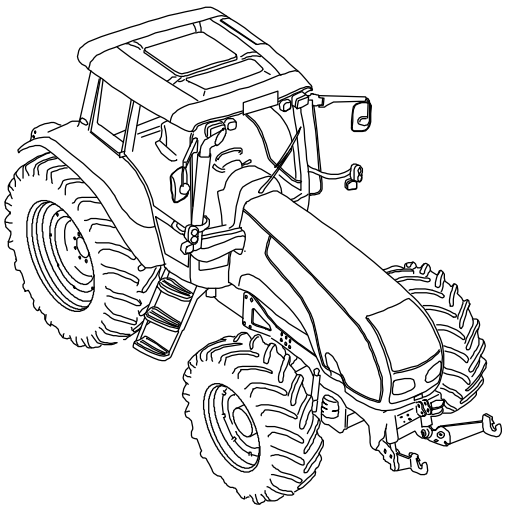
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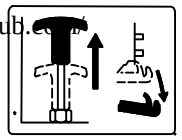
T121c–T171c
T121h–T191h
T151eLS–T191LS

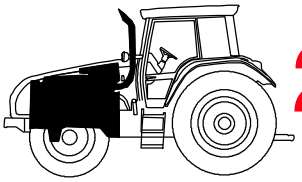


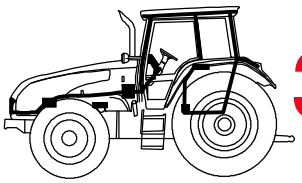
Service Manual

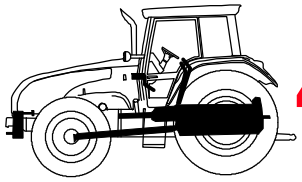
Tractors

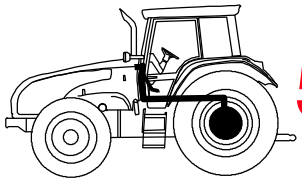
Valtra Inc.
FIN–44200 Suolahti, FINLAND
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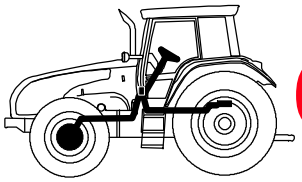

10 General

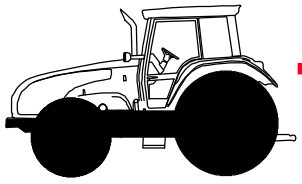

20 Engine

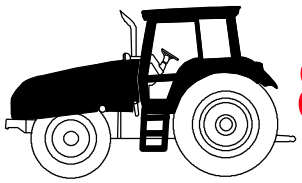

30 Electrical system

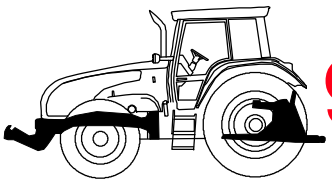

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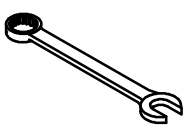

50 Brakes


60 Front axle and steering system


70 Frame and wheels


80 Cab and shields


90 Hydraulics


100 Tools

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10. General

11. General

12. Layout

13. Repair

14. Maintenance

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To the reader

The Service Manual is intended to be a practical reference source to be used in workshop. The repair instructions in the manual are based on methods which have been worked out in practice during normal workshop conditions and which are based on the use of special tools from the manufacturer when stated in the instructions. The manual also contains descriptions of the design and function of the components.

Detailed maintenance instructions can be found in Operator's Manual.

The Service Manual will be continually updated with new revised pages which should be inserted in the manual. Alterations and additions will first appear as service bulletins.

Only genuine Valtra spare parts should be used to ensure the best possible function of the machine. Certain operations should be carried out with the aid of special tools designed by Valtra.

Valtra Inc.
Tractor Service

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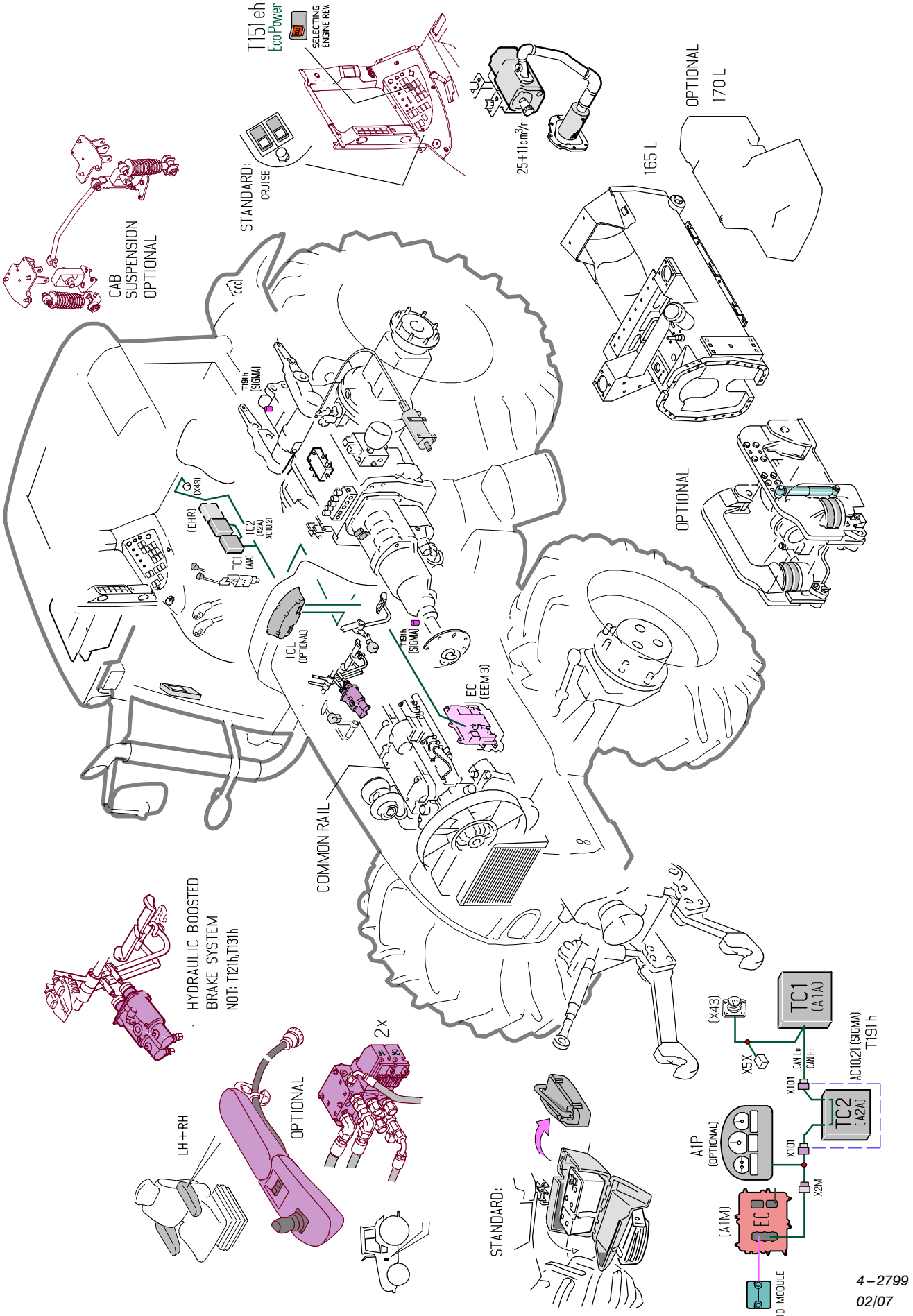
T1 series tractor (c models)



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05/07

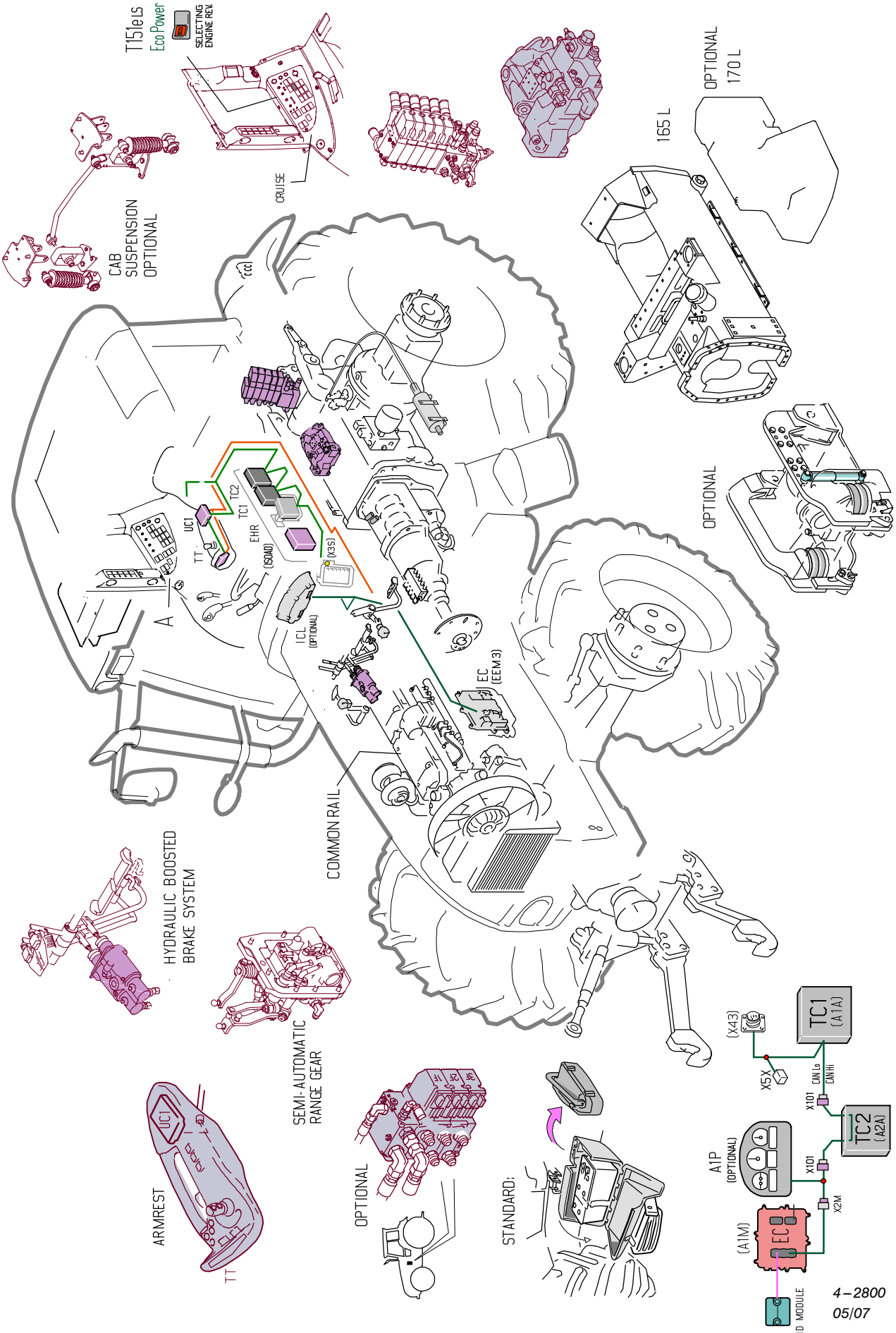
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T1 series tractor (h models)



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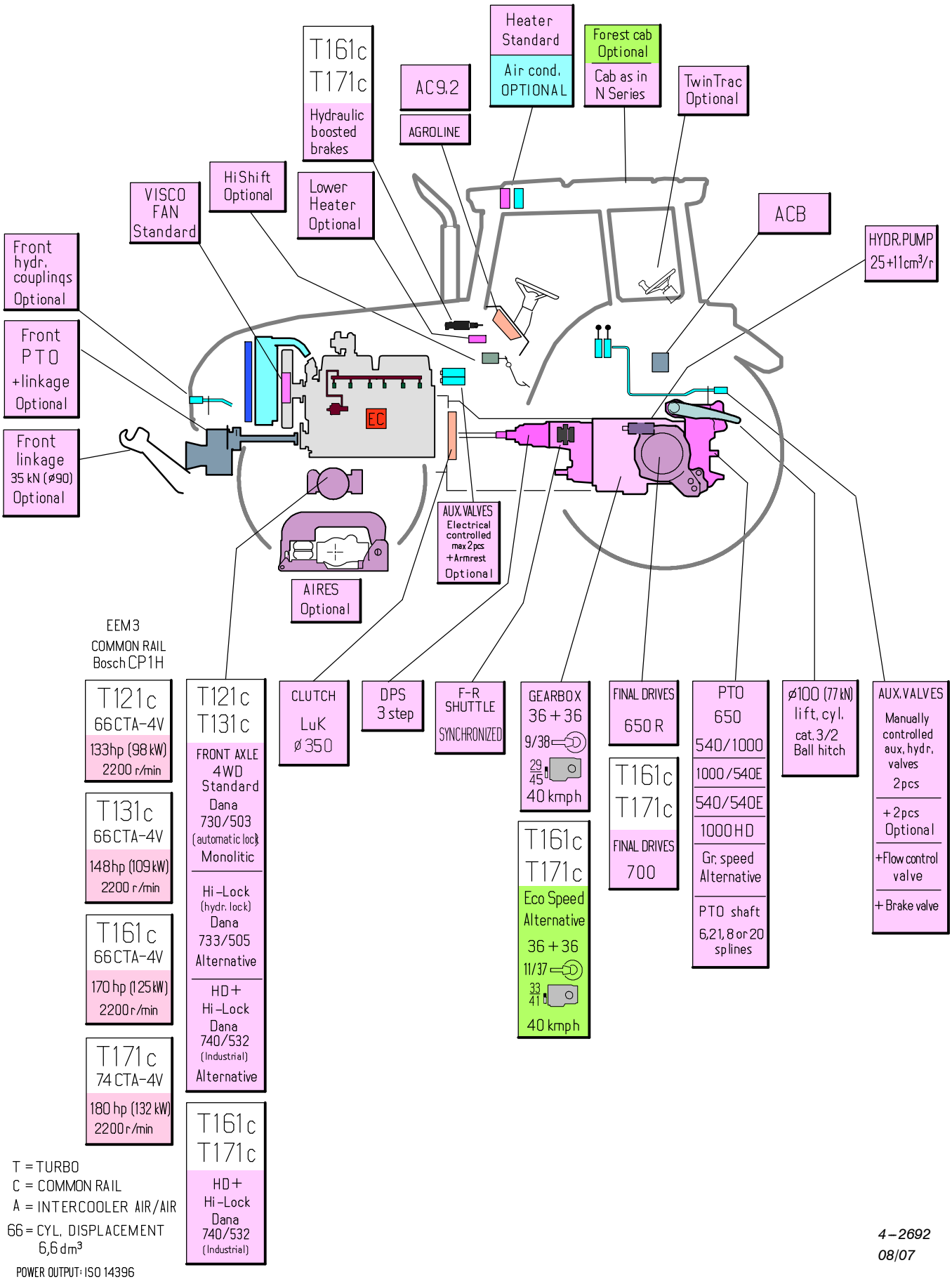
T1 series tractor (LS models)



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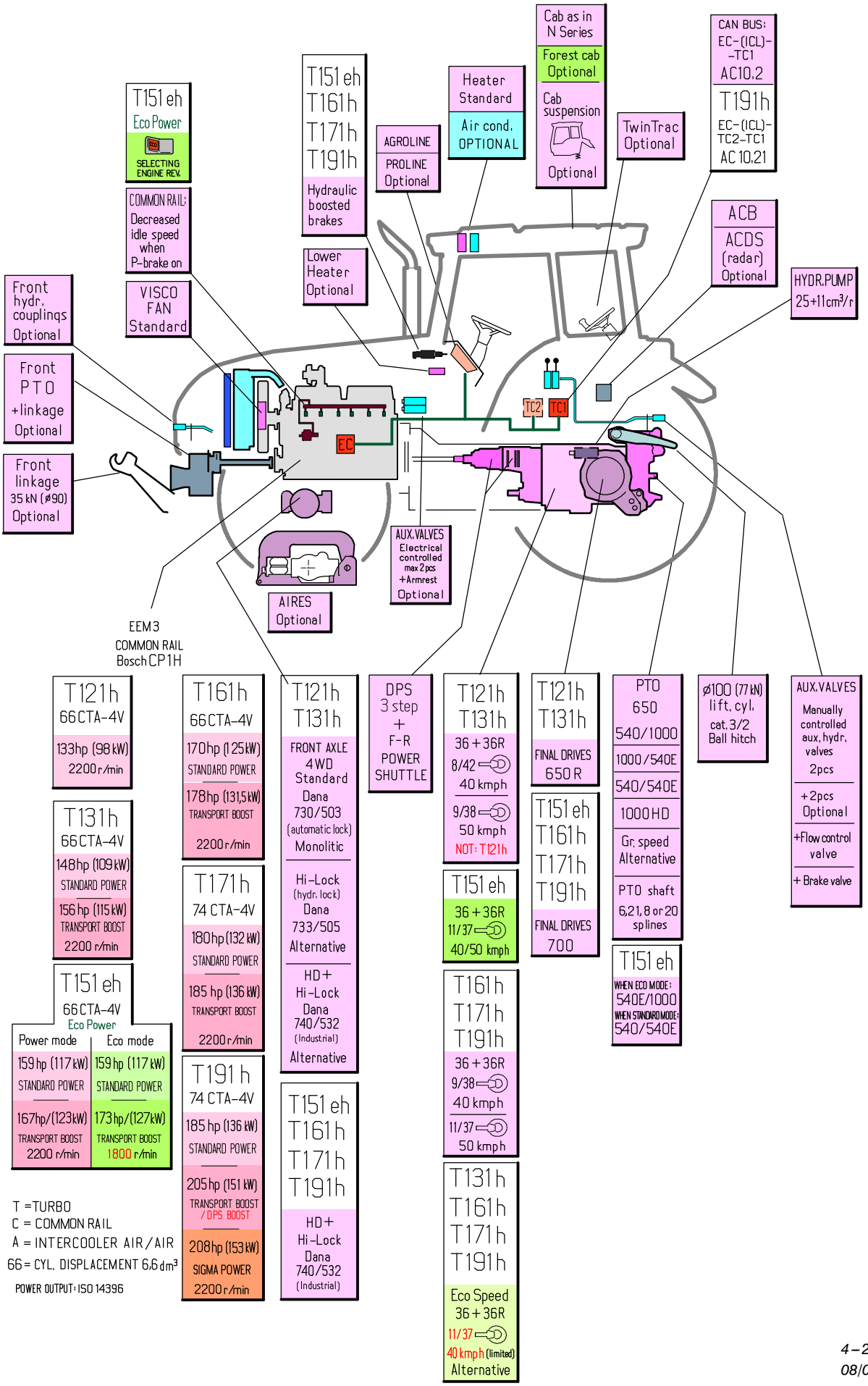
Tc models, construction



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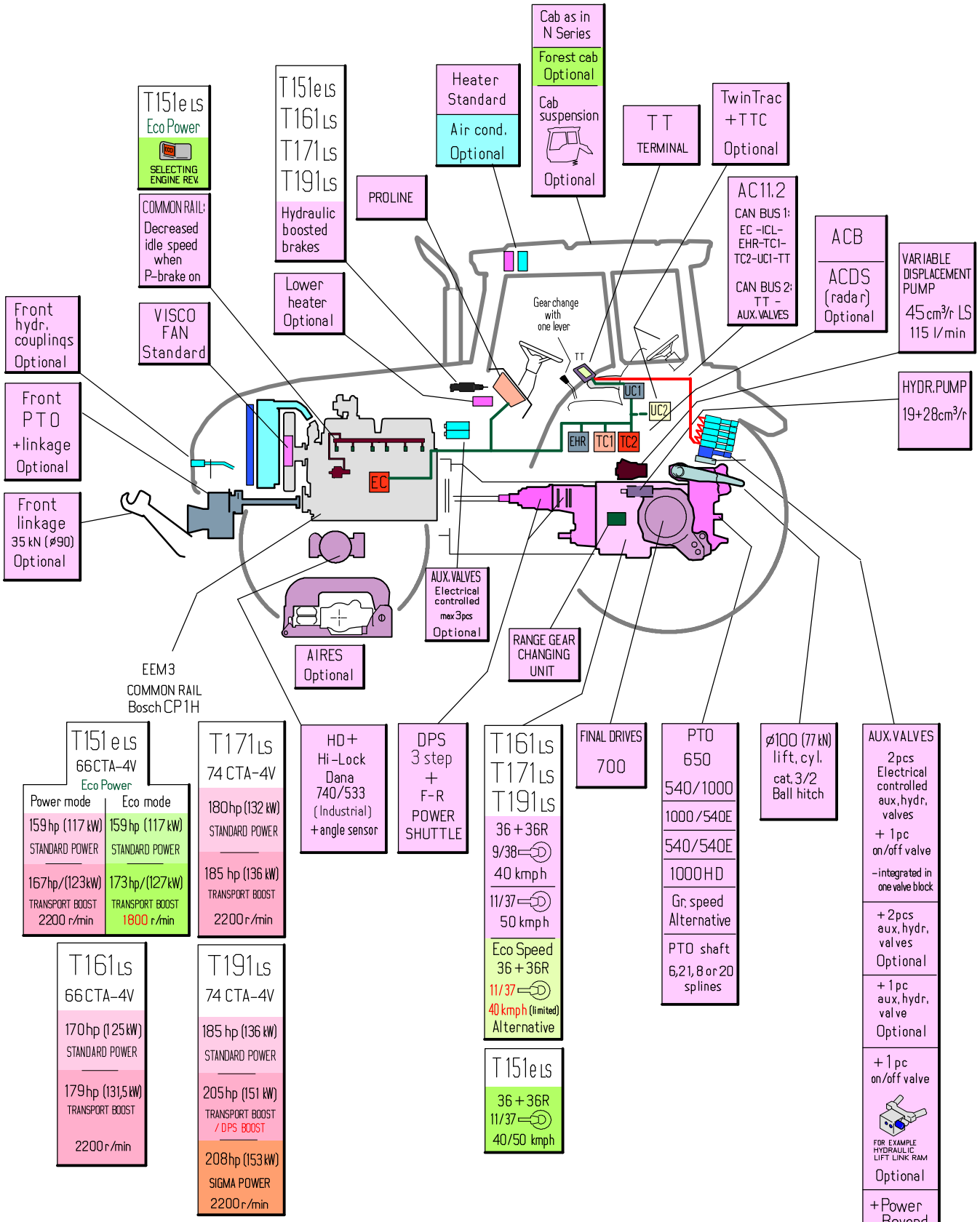
Th models, construction



4–2693
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TLS models, construction

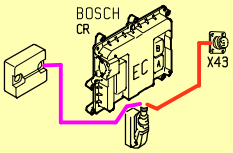
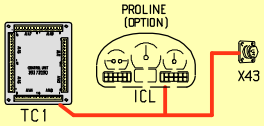
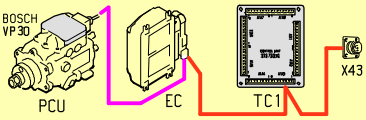
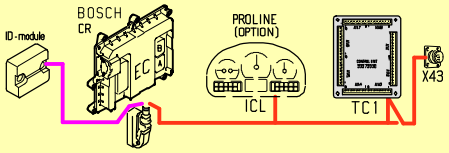
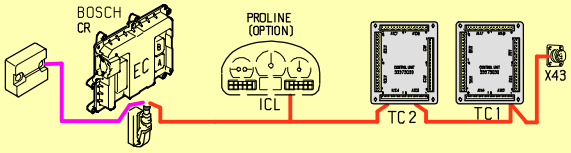
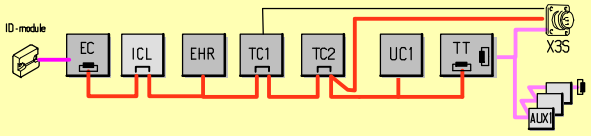
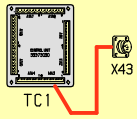


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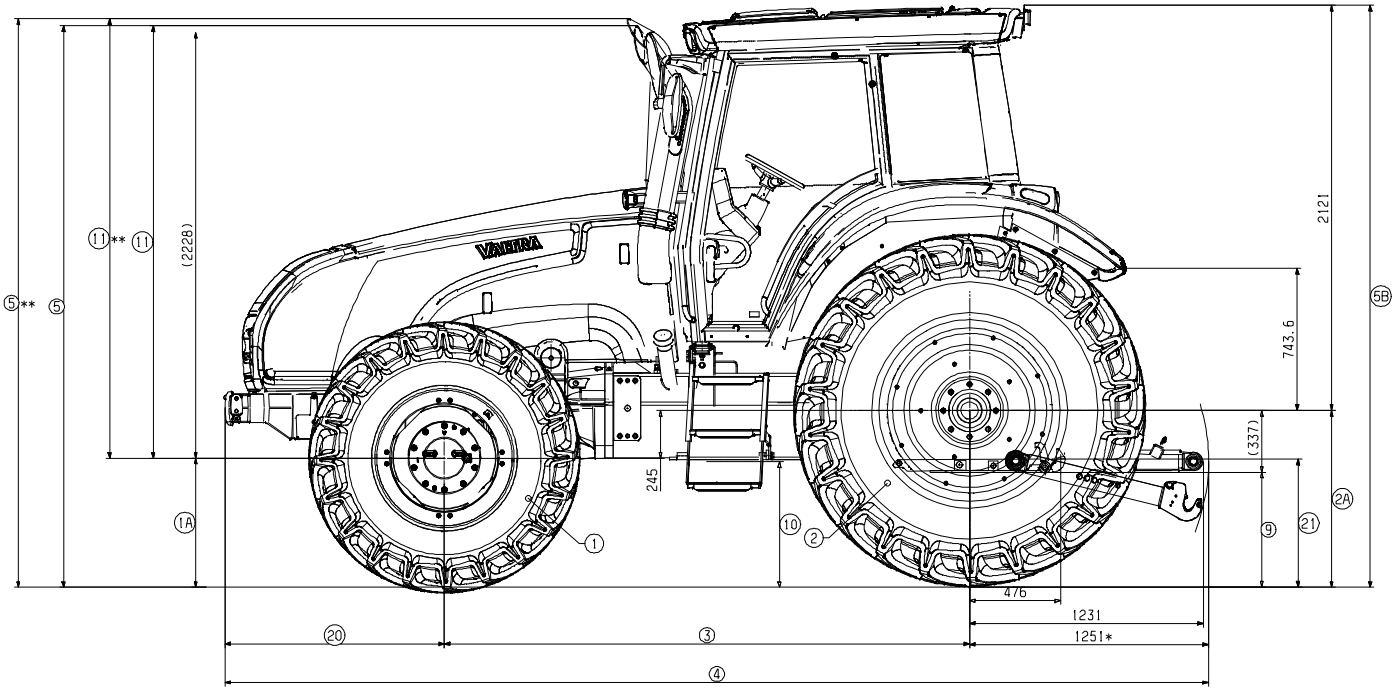
Autocontrol systems

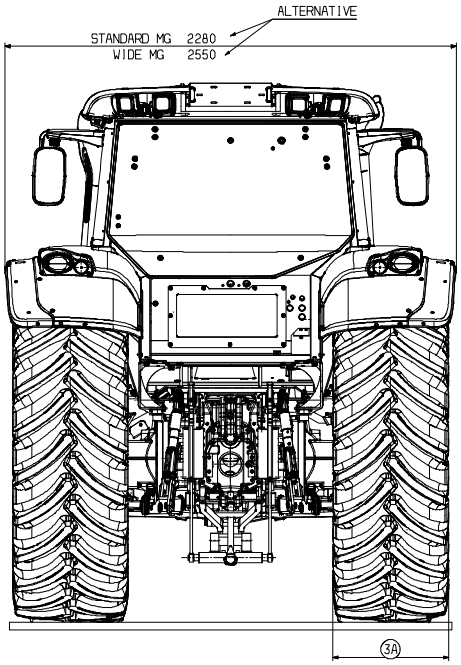
MODEL	AC SYSTEM	CONTROL UNITS	CAN ID
N91c (N101c, N111c)	~~AC9.0~~	—	—
N101c CR T121c, T131c T161c, T171c	AC9.2		EC=0
N91h (N101h, N111h)	~~AC10.0~~		TC1=3
(N111eh)	~~AC10.1~~		TC1=3 EC=0
N101h CR N111eh CR N121h, N141h T121h, T131h, T151eh T161h, T171h	AC10.2		TC1=3 EC=0 ICL=23
T191h	AC10.21		EC = 0 ICL = 23 TC1 = 3 TC2 = 4
N121LS, N141LS T151eLS, T161LS T171LS, T191LS	AC11.2		EC = 0 ICL = 23 EHR = 35 TC1 = 3 TC2 = 4 UC1 = 5 TT = 40 AUX1 = 129 AUX2 = 130 AUX3 = 131 AUX4 = 132 AUX5 = 133 AUX1F = 135 AUX2F = 136 AUX3F = 137
N82h, N92h	AC13.0		TC1=3

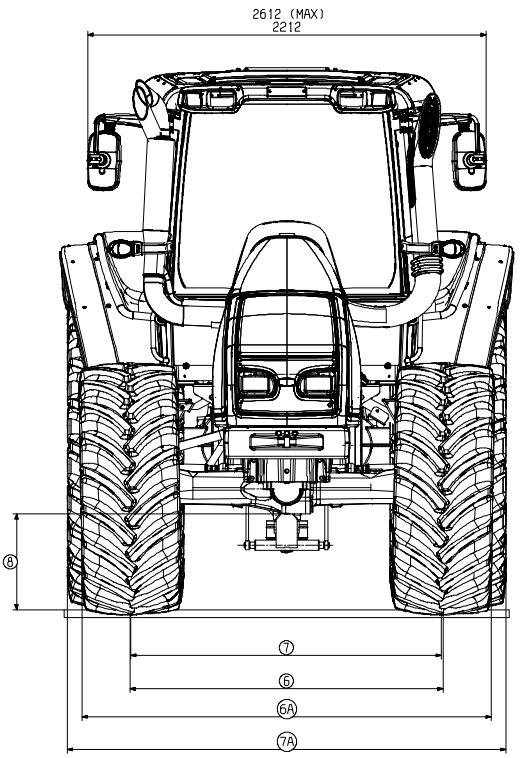
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T1 series, dimensions







	1	1A	2	2A	3	4	5	5B	9	10	11	20	21
MODEL	FRONT WHEELS		REAR WHEELS		WHEEL BASE	MAX. LENGTH	HEIGHT	HEIGHT OF CAB	CLEARANCE R.	GR. CLEARENCE MID.			
T121	16.9R28	675	20.8R38	875	2748	5128/5148*	2900	2996	550	617	2225	1149	632
T131	16.9R28	675	20.8R38	875	2748	5128/5148*	2900	2996	550	617	2225	1149	632
T151	460/85R30	725	20.8R42	925	2748	5128/5148*	2900	3046	600	667	2175	1149	682
T161	460/85R30	725	20.8R42	925	2748	5128/5148*	2900	3046	600	667	2175	1149	682
T171	460/85R30	725	20.8R42	925	2748	5128/5148*	3003	3046	600	667	2278	1149	682
T191	460/85R30	725	20.8R42	925	2748	5128/5148*	3003	3046	600	667	2278	1149	682

	6	6A	7	7A	8	3A
MODEL	TRACK W. FRONT TYRE. MIN/MAX	MIN/MAX	TRACK W. REAR TYRE. MIN/MAX	MIN/MAX	CLEARANCE FR.	
T121	16.9R28, 1740/2035	2169/2464	20.8R38, 1710/2010	2238/2538	545	528
T131	16.9R28, 1740/2035	2169/2464	20.8R38, 1710/2010	2238/2538	545	528
T151	460/85R30, 1730/2025	2185/2480	20.8R42, 1710/2010	2238/2538	595	528
T161	460/85R30, 1730/2025	2185/2480	20.8R42, 1710/2010	2238/2538	595	528
T171	460/85R30, 1730/2025	2185/2480	20.8R42, 1710/2010	2238/2538	595	528
T191	460/85R30, 1730/2025	2185/2480	20.8R42, 1710/2010	2238/2538	595	528

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02/07

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Dimensions (mm)	T121c	T131c	T161c	T171c
With front tyres	16.9R28	16.9R28	460/85R30	460/85R30
With rear tyres	20.8R38	20.8R38	20.8R42	20.8R42
Length	5148	5148	5148	5148
Width	2338	2338	2338	2338
Height to the roof	2996	2996	3046	3046
Height to the exhaust pipe	2900	2900	2900	3003
Wheel base	2748	2748	2748	2748
Ground clearance (front axle)	545/505[1)]	545/505[1)]	595/555[1)]	595/555[1)]
Ground clearance (rear axle)	550	550	600	600

Dimensions (mm)	T121h	T131h	T151eh	T161h	T171h	T191h
With front tyres	16.9R28	16.9R28	460/85R30	460/85R30	460/85R30	460/85R30
With rear tyres	20.8R38	20.8R38	20.8R42	20.8R42	20.8R42	20.8R42
Length	5148	5148	5148	5148	5148	5148
Width	2338	2338	2338	2338	2338	2338
Height to the roof	2996	2996	3046	3046	3046	3046
Height to the exhaust pipe	2900	2900	2900	2900	3003	3003
Wheel base	2748	2748	2748	2748	2748	2748
Ground clearance (front axle)	545/505[1)]	545/505[1)]	595/555[1)]	6595/555[1)]	595/555[1)]	595/555[1)]
Ground clearance (rear axle)	550	550	600	600	600	600

Dimensions (mm)	T151eLS	T161LS	T171LS	T191LS
With front tyres	460/85R30	460/85R30	460/85R30	460/85R30
With rear tyres	20.8R42	20.8R42	20.8R42	20.8R42
Length	5148	5148	5148	5148
Width	2338	2338	2338	2338
Height to the roof	3046	3046	3046	3046
Height to the exhaust pipe	2900	2900	3003	3003
Wheel base	2748	2748	2748	2748
Ground clearance (front axle)	595/555[1)]	595/555[1)]	595/555[1)]	595/555[1)]
Ground clearance (rear axle)	600	600	600	600

[1)] With front axle suspension.
Dimension from the rear axle mid point to the cab roof part is 2113 mm.

Weights

Weights kg	T121c, T121h	T131c, T131h
With tyres	16.9R28, 20.8R38	16.9R28, 20.8R38
Total weight (with full fuel tank and without ballast weights)	5530[1)]	5530[1)]
Front axle weight (%)	2480[1)] (45)	2480[1)] (45)
Rear axle weight (%)	3050 (55)	3050 (55)

Weights kg	T151eh	T161c, T161h	T171c, T171h	T191h
With tyres	540/65R30, 650/65R42	540/65R30, 650/65R42	540/65R30, 650/65R42	540/65R30, 650/65R42
Total weight (with full fuel tank and without ballast weights)	5970	5970	5970	5990
Front axle weight (%)	2720 (45)	2720 (45)	2720 (45)	2740 (46)
Rear axle weight (%)	3250 (55)	3250 (55)	3250 (55)	3250 (54)

[1)] With industrial front axle 140 kg heavier, standard on models T161c–T171c, T151eh–T191h.

Weights kg	T151LS	T161LS	T171LS	T191LS
With tyres	540/65R30, 650/65R42	540/65R30, 650/65R42	540/65R30, 650/65R42	650/65R42, 540/65R30
Total weight (with full fuel tank and without ballast weights)	5970	5970	5970	5990
Front axle weight (%)	2720 (45)	2720 (45)	2720 (45)	2740 (46)
Rear axle weight (%)	3250 (55)	3250 (55)	3250 (55)	3250 (54)

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Maximum permissible front-- and rear axle loadings

Regardless of any limitations due to the tyres, with standard track widths max. speed.

Tractor			T121c–T131c, T121h–T131h	T161c–T171c, T151eh–T191h T151eLS–T191LS
Front 4WD	max 40 km/h		4000	
	max 8 km/h		5500	
	industrial front axle	max 40 km/h	5000	5500
	industrial front axle	max 8 km/h	6200	6200
Rear, max 40 km/h			8000	9000
Total weight, max 40 km/h			9000	11000

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Track widths

Rear	Track width
460/85R38, 18.4R38	1612, 1714, 1808, 1910, 2012
520/70R38, 520/85R38, 20.8R38, 480/80R42	1714, 1808, 1910, 2012
540/65R38	1714, 1808, 1910
580/70R38, 600/65R38	1808, 1910
650/60R38, 650/75R38, 620/70R42, 650/65R42, 710/70R38	1811
20.8R42	1714, 1808
270/95R48	1500, 1522, 1600, 1622, 1900, 1922, 2000, 2022
680/75R32	1810
520/85R38, 540/80R38 IND ,20.8R38, 20.8–38 FOR, 650/75R38, 650/65R42 IND	1676 ,1850
600/65R38 FOR, 650/65R38, 650/65R38 FOR, 650/75R38, 650/65R42 IND	1850
18.4R38, 18.4–38 FOR, 480/80R38 IND	1650, 1876
600/65–34 FOR	1900

Front	Track width
14.9R28, 380/85R28	1440, 1530, 1645, 1735, 1840, 1930, 2045, 2135
420/70R28, 420/85R28, 16.9R28, 440/65R28, 480/65R28, 480/70R28	1440, 1530, 1645, 1735, 1840, 1930, 2045
520/60R28	1435, 1530, 1640, 1735, 1835, 1930
540/65R28	1440, 1530, 1645, 1735, 1840, 1930
230/95R36	1504, 1580, 1602, 1702, 1880, 1980, 2002, 2102
14.9R28, 420/85R28, 16.9R28, 400/80R28 IND, 440/80R28 IND,14.9–28 FOR, 500/65R28 FOR	1745, 1840
Industrial front axle	**Track width**
14.9R28, 420/70R28	1530, 1626, 1732, 1830, 1928, 2026, 2130
16.9R28, 420/85R28, 480/65R28, 480/70R28	1530, 1626, 1732, 1830, 1928, 2026
540/65R28	1530, 1626, 1732, 1830, 1928
520/60R28	1535, 1630, 1740, 1835, 1935, 2030
600/60R28	1535, 1630, 1740, 1835, 1935
460/85R30	1540, 1630, 1745, 1835, 1940, 2030
230/95R36	1500, 1544, 1812, 1856, 1898, 1942, 2210, 2254
14.9R28, 400/80R28 IND, 14.9–28 FOR, 540/70R30 FOR	1875,1900
16.9R28, 540/65R28, 540/65R28 FOR, 440/80R28, 440/80R28 IND, 16.9–28 FOR, 500/65R28 FOR	1865,1890
500/60–26,5 FOR	1895, 1885

Measured between middle of tyres.

With air suspension front axle track widths are 40 mm narrower.

The standard track widths are underlined. **When track widths are adjusted or larger tyres fitted, the turning angles have to be checked/adjusted with max turning angle of front axle on both sides. When adjusting the rear axle track widths, check that the wheels rotate freely. Check also when using chains that the distance from the cab to the tyres does not go below 80 mm. Check further that the distance from parking lights to the outer sides of the tyres does not exceed 400 mm.**

IMPORTANT: The maximum allowed width of the tractor is 2550 mm.

Fixed rims

At the rear, the distance between the mudguards is 1090 mm.

When using the narrow track widths for the rear axle, check that the lower links do not touch the tyres. When required lock the side regulators.

IMPORTANT: According to EU–directive the smallest allowed distance between the tyre and the cab is 50 mm.

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General information about T1 series tractors

	T121c	T131c	T161c	T171c
Engine type	66 CTA–4V	66 CTA–4V	66 CTA–4V	66 CTA–4V
Engine power (kW/hp/rpm)	98/133/2200	109/148/2200	125/170/2200	132/180/2200
Compression pressure (MPa)	16,5:1	16,5:1	16,5:1	16,5:1
Oil pressure, normal (kPa)	250–400	250–400	250–400	250–400
Oil pressure, min. (kPa)	100	100	100	100
Engine speed, idle (rpm)	850	850	850	850
Engine max. speed (rpm)	2400	2400	2400	2400
Battery voltage (V)	12	12	12	12
Battery capacity (Ah)	174	174	174	174
PTO output at 1000 rpm (kW/engine rpm)	77/2000	88/2000	103/2000	110/2000
Ratio, front axle/rear axle, 40km/h)	1,323	1,323	1,33	1,33
Ratio, front axle/rear axle, 50km/h)	1,329	1,329	1,323	1,323
Max. working pressure (steering, MPa)	14	14	14	14
Low pressure circuit max. pressure (MPa)	1,8	1,8	1,8	1,8
Low pressure circuit pump capacity at max. engine speed (l/min.)	30	30	30	30
High pressure circuit max. pressure (MPa)	19,6	19,6	19,6	19,6
Shock valve opening pressure of pump (MPa)	23	23	23	23
High pressure circuit pump capacity at max. engine speed (l/min.)	73 [1]	73 [1]	73 [1]	73 [1]
Hydraulic linkage max. lifting force (kN)	77 [2]	77 [2]	77 [2]	77 [2]

[1]) Double pump **25**+**11** cm^3/r , i=1,32, 2200 r/min engine revs with free flow pressure

[2]) Lifting cylinder Ø 100mm

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	T121h	T131h	T151eh	ECO
Engine type	66 CTA – 4V	66 CTA – 4V	66 CTA – 4V	
Engine power (kW/hp/rpm)	98/133/2200	109/148/2200	123/167/2200 [1] 117/159/2200	127/173/1800 [1] 117/159/1800
Compression pressure (MPa)	16,5:1	16,5:1	16,5:1	
Oil pressure, normal (kPa)	250 – 400	250 – 400	250 – 400	
Oil pressure, min. (kPa)	100	100	100	
Engine speed, idle (rpm)	850 650 [2]	850 650 [2]	850 650 [2]	
Engine max. speed (rpm)	2400	2400	2400	2000
Battery voltage (V)	12	12	12	
Capacity (Ah)	174	174	174	
PTO output at 1000 rpm (kW/engine rpm)	77/2000	88/2000 94/2000 [2]	95/2000 102/2000 [2]	95,3/1750 104,3/1750 [2]
Ratio, front axle/rear axle, 40km/h)	1,323	1,323	1,33	
Ratio, front axle/rear axle, 50km/h)	1,329	1,329	1,323	
Max. working pressure (steering, MPa)	14	14	14	
Low pressure circuit max. pressure (MPa)	1,8	1,8	1,8	
Low pressure circuit pump capacity at max. engine speed (l/min.)	30	30	30	
High pressure circuit max. pressure (MPa)	19,6	19,6	19,6	
Shock valve opening pressure of pump (MPa)	23	23	23	
High pressure circuit pump capacity at max. engine speed (l/min.)	73 [3]	73 [3]	73 [3]	60 [4]
Hydraulic linkage max. lifting force (kN)	77 [5]	77 [5]	77 [5]	

1) Higher transport boost power area, when the main gear is H2 or higher and PS boost area, when quick–shift is 2 or 3. The transport boost and PS boost power areas are equal.

2) Parking brake is on

3) Double pump **25**+**11** cm^3/r , i=1,32, 2200 r/min engine revs with free flow pressure

4) Double pump **25**+**11** cm^3/r , i=1,32, 1800 r/min engine revs with free flow pressure

5) Lifting cylinder Ø 100mm

https://truckmanualshub.com/

	T161h	T171h	T191h
Engine type	66 CTA – 4V	74 CTA – 4V	74 CTA – 4V
Engine power (kW/hp/rpm)	131,5/179/2200 [2] 125/170/2200	138/185/2200 [2] 132/180/2200	153/208/2200 [3] 151/205/2200 [2] 136/185/2200
Compression pressure (MPa)	16,5:1	17,5:1	17,5:1
Oil pressure, normal (kPa)	250 – 400	250 – 400	250 – 400
Oil pressure, min. (kPa)	100	100	100
Engine speed, idle (rpm)	850 650 [4]	850 650 [4]	850 650 [4]
Engine max. speed (rpm)	2400	2400	2400
Battery voltage (V)	12	12	12
Capacity (Ah)	174	174	174
PTO output at 1000 rpm (kW/engine rpm)	103/2000 110/2000 [2]	110/2000 117/2000 [2]	114/2000 130/2000 [3] 130/2000 [4]
Ratio, front axle/rear axle, 40km/h)	1,33	1,33	1,33
Ratio, front axle/rear axle, 50km/h)	1,323	1,323	1,323
Max. working pressure (steering, MPa)	14	14	14
Low pressure circuit max. pressure (MPa)	1,8	1,8	1,8
Low pressure circuit pump capacity at max. engine speed (l/min.)	30	30	30
High pressure circuit max. pressure (MPa)	19,6	19,6	19,6
Shock valve opening pressure of pump (MPa)	23	23	23
High pressure circuit pump capacity at max. engine speed (l/min.)	73 [5]	73 [5]	73 [5]
Hydraulic linkage max. lifting force (kN)	77 [6]	77 [6]	77 [6]

[1]) Transport boost power area, when the main gear is H2 or higher

[2]) Transport boost power area, when the main gear is H2 or higher and PS boost area, when quick – shift is 2 or 3. The transport boost and PS boost power areas are equal.

[3]) Sigma power area, the largest output/torque area, when the power transferred through the power – take – off is large enough.

The symbol  is illuminated in the instrument panel.

[4]) Parking brake is on

[5]) Double pump **25**+**11** cm^3/r , i=1,32, 2200 r/min engine revs with free flow pressure

[6]) Lifting cylinder Ø 100mm

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	T151eLS	ECO	T161LS	T171LS	T191LS
Engine type	66 CTA – 4V		66 CTA – 4V	74 CTA – 4V	74 CTA – 4V
Engine power (kW/hp/rpm)	123/167/2200 [2] 117/159/2200	127/173/1800 [2] 117/159/1800	131,5/179/2200 [2] 125/170/2200	138/185/2200 [2] 132/180/2200	153/208/2200 [3] 151/205/2200 [2] 136/185/2200
Compression pressure (MPa)	16,5:1		16,5:1	17,5:1	17,5:1
Oil pressure, normal (kPa)	250 – 400		250 – 400	250 – 400	250 – 400
Oil pressure, min. (kPa)	100		100	100	100
Engine speed, idle (rpm)	850 650 [4]		850 650 [4]	850 650 [4]	850 650 [4]
Engine max. speed (rpm)	2400	2000	2400	2400	2400
Battery voltage (V)	12		12	12	12
Capacity (Ah)	174		174	174	174
PTO output at 1000 rpm (kW/engine rpm)	95/2000 102/2000 [2]	95,3/1750 104,3/1750 [2]	103/2000 110/2000 [2]	110/2000 117/2000 [2]	114/2000 130/2000 [3] 130/2000 [4]
Ratio, front axle/rear axle, 40km/h)	1,323		1,33	1,33	1,33
Ratio, front axle/rear axle, 50km/h)	1,323		1,323	1,323	1,323
Max. working pressure (steering, MPa)	14		14	14	14
Low pressure circuit max. pressure (MPa)	1,8		1,8	1,8	1,8
Low pressure circuit pump capacity at max. engine speed (l/min.)	55	45	55	55	55
High pressure circuit max. pressure (MPa)	20,5		20,5	20,5	20,5
Shock valve opening pressure (MPa)	25		25	25	25
High pressure circuit pump capacity at max. engine speed (l/min.)	115 [5]	94 [6]	115 [5]	115 [5]	115 [5]
Hydraulic linkage max. lifting force (kN)	81 [7]		81 [7]	81 [7]	81 [7]

1) Transport boost power area, when the main gear is H2 or higher

2) Transport boost power area, when the main gear is H2 or higher and PS boost area, when quick – shift is 2 or 3. The transport boost and PS boost power areas are equal.

3) Sigma power area, the largest output/torque area, when the power transferred through the power – take – off is large enough.
The symbol  is illuminated in the instrument panel.

4) Parking brake is on

5) Variable displacement pump, 2200 r/min engine revs, load sensing system

6) Variable displacement pump, 1800 r/min engine revs, load sensing system

7) Lifting cylinder Ø 100mm

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	T121c–T131c, T121h–T131h	T161c, T151eh–T161h, T151eLS–T161LS	T171c, T171h, T171LS	T191h, T191LS
Capacities				
Engine (l)	6,6	6,6	7,4	7,4
Cooling system (l)	29	30	30	31
Air conditioning (kg)	1,6	1,6	1,6	1,6
Transmission (l)	55–65	55–65	55–65	55–65
Fillings (l)				
Differential	8	8	8	8
Hub reduction gears, agricultural front axle	2x1	–	–	–
Hub reduction gears, industrial front axle	2x1,5	2x1,5	2x1,5	2x1,5
Fuel tank	165	165	165	165
Extra fuel tank	170	170	170	170
Filters service (change) intervals (h)				
Oil filter	500	500	500	500
Pressure filters	500	500	500	500
Return oil filter	500	500	500	500
Fuel filter	1000	1000	1000	1000
Air filter	1000	1000	1000	1000
Safety filter	1000	1000	1000	1000
Prefilter	1000	1000	1000	1000
Recirculation filter	1000	1000	1000	1000
Transmission housing breather	1000	1000	1000	1000

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Contents

Layout

121.1 ... Supplements for Service Manual 1
121.2 ... Layout of Service Manual 3
121.3 ... Code designations 5
121.4 ... How to find electrical components in the Service Manual 7

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The following editions and supplements have been published for the Valtra T1 series Service Manual:

	Ordering number	Date	Content
Service Manual	39 235 211	04/2007	First edition
Service Manual supplement	39 266 211	08/2008	– Added page 15 to AC9.2 diagrams (code 323.1) – Added semi–automatic range gear wiring (code 421.5) – Added wiring diagrams for Powershift, shuttle, 4WD and differential lock control (code 443.2) – Gearbox work instructions updated (code 425.1) – Powershift gear reconditioning instructions updated (code 445.1) – Shuttle gear reconditioning instructions updated (code 445.2) – 4WD clutch work instructions updated (code 445.3) – Added section on PTO shaft (code 461.7) – Added section on brake cooling (code 511.6) – Added section on semi–active cab suspension (code 811.3) and the related fault finding and work instructions (codes 813.1 and 815.1) Updates in sections 10, 20, 30, 40, 50, 60, 70, 80 and 90

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Layout of Service Manual

Division into groups

The manual is divided into groups (10–100) which are based on the make–up of the tractor. The groups are listed on the first index leaf.

Example. 10. General
20. Engine, fuel and cooling systems
30. Electrical system
40. Power transmission
a.s.o.

The number designation for each group is given in the top left box of the respective pages (and the first figure in the code designation).

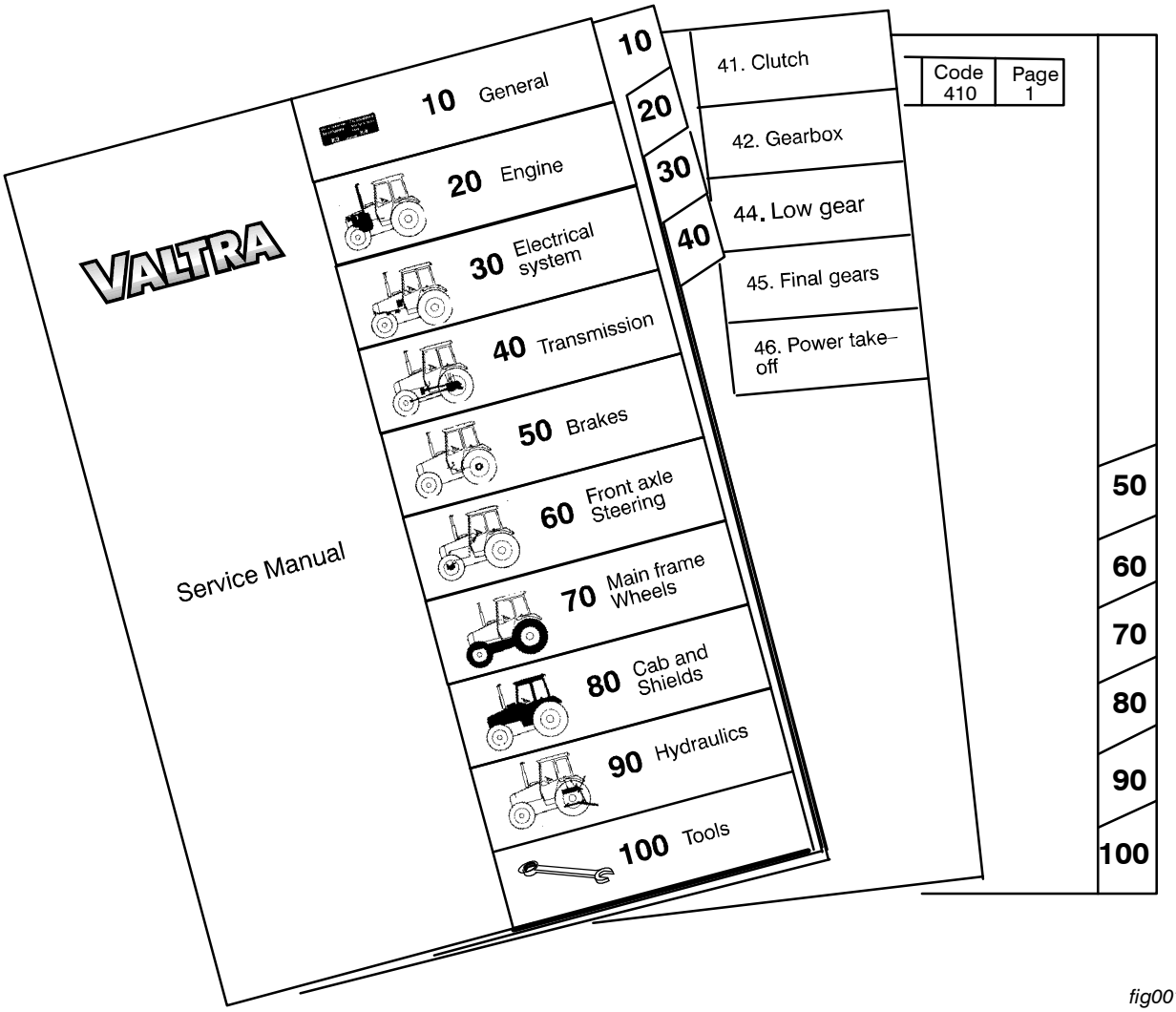


fig001c

Division into components or sub–groups

Each group is further divided into components or sub–groups. The number and the name of each component is given in the top left box on each page (and comprise the two first figures in the code designation).

Example. 41. Clutch
42. Gearbox
44. Low gear
45. Final drives etc.

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10. General

11. General
12. Layout
13. Repairs
14. Maintenance

20 Engine

21. Engine
22. Fuel system
23. Cooling system

30 Electrical system

31. General
32. Autocontrol AC9.2
33. Autocontrol AC10.2&AC10.21
34. Autocontrol AC11.2
38. CAN bus
39. Safety instructions

40 Power transmission

41. Clutch
42. Gearbox
44. Quick shift gear, power shuttle and 4WD clutch
45. Final drives
46. Power take–off

50 Brake system

51. Brake system
52. Parking brake
53. Trailer braking system

60. Steering system and front axle

61. Steering system
63. Aires
64. Powered front axle (Dana 733/503&733/505)
65. Powered front axle (Dana 740/532&740/533)
68. TwinTrac

70 Frame and wheels

71. Frame
72. Wheels

80 Cab and shields

81. Cab
82. Instruments
83. Air conditioner

90 Hydraulics

91. Hydraulics
92. Working hydraulics
93. Electro–hydraulic power lift

100 Special tools

101 Special tools ETV
102 Locally prepared tools ET

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Header

Tractor model

At the top of each page it is indicated for which tractor the page is valid.

Code designation

Three–digit code designations are used to separate the different document groups for the respective components. The same code is also used in the Time list as a reference to the text in this manual. The code designation numbers appear in the box at the top of the page and also in the headings.

More detailed information about code designation in the next page.

Page numbers

The instructions for all components are numbered in consecutive order in the right–hand box at the top of the page. The page numbers begin with page 1 for each component.

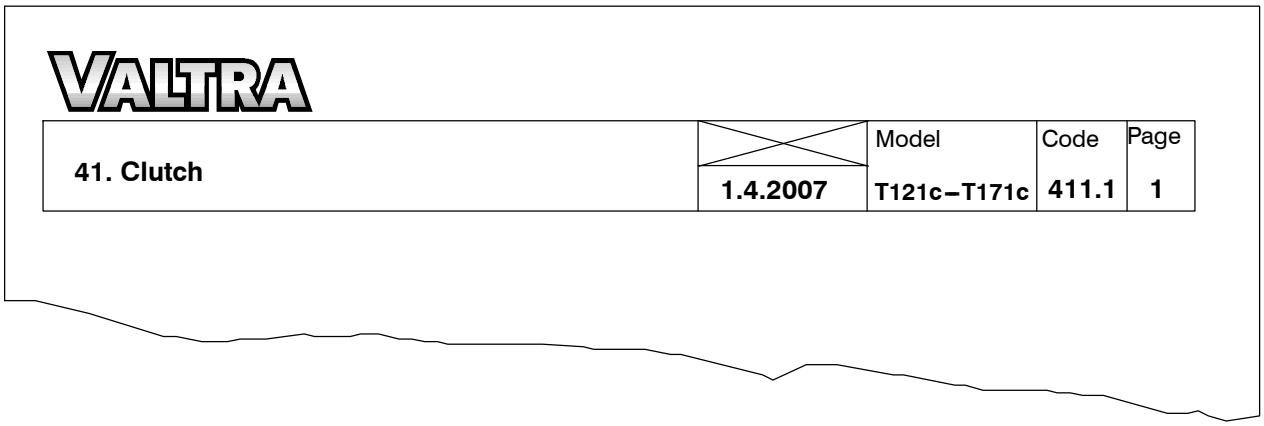


fig003c

Date

At the top of each page there are two boxes for dates. In a case of revised issue, the date of the earlier issue is printed in the crossed–over box and and the date of the current issue is printed in the proper date box.

Additions and amendments of the service manual

New and up–dated pages will be continuously added to the service manual. The new pages should be inserted as indicated by the code:
– the first digit (also the first digit on the index leaf) indicates the group:
– the two first digits indicate the component or sub–group.
– the third digit indicates the document group for the respective components
– the page number indicates the definite position of the page within the service manual.

If there are two pages with the same code and page number, it is the page with the later date in the date box and the old date in the crossed–over box which is valid or which is the current page.

When an entirely new set of repair instructions is issued, it will be accompanied by instructions on where the pages should be inserted in the file.

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Code designition in the service manual

The basic structure for the subgroups is divided according to subject matter.

XX1	Technical data, technical specifications, training material
XX2	Maintenance
XX3	Fault finding
XX4	Special tools
XX5	Work instructions

Every subject matter contain sub components (max. quontity 99)

XXX.1
XXX.2
...
XXX.99

Example (Engine, fuel system)

22 Fuel system
- 221. Technical data, , technical specifications, training material
  - 221.1 Technical data
  - 221.2 Bosch VE pump
  - 221.3 Bosch VP30 pump
  - 221.4 Injector
  - 221.5 EC
- 222. Maintenance
- 223. Fault finding
  - 223.1 Bosch VE pump
  - 223.2 Bosch VP30 pump
  - 223.3 Measuring the fuel feed pressure
  - 223.4 Engine control unit sensors
  - 223.5 Starter motor
  - 223.6 Starting control
- 224. Special tools
- 225. Work instructions
  - 225.1 Bosch VE pump
  - 225.2 Bosch VP30 pump
  - 225.3 Injector
  - 225.4 Delivery pipes
  - 225.5 Changing the EC unit

Pictures include index numbers (for example *fig001*). Numbering helps to find certain picture. All groups has an own index numbering and pictures are indexed starting at 001. Index numbers may not go in order.

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How to find electrical components in the service manual

Because the structure of service manual has been changed the electrical components has been divided to their function based.

See code **323.1** fo T121c and code **333.1** T121h a.s.o. Code is for equipment list of the wiring diagram. Equipment list includes symbol, description, page and position, locations and code.

Symbol

Drawing symbol in the wiring diagram.

Description

Description of the component.

Page and position

Wiring diagram page and position on the page.

Location

Location of the component in tractor.

Code

The service manual code where the component can be found.

Symbol	Description	Page and position	Location	Code
–A1M	EC unit	/1.B4	Engine	221.5
–B1Q	Temperature sensor, outside	/13.A7	Roof	831.2
–S1Da1	Switch, 1 valve block, lowering	/11.B5	Cab	921.2

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Contents

131.1 . . . General instructions for repair 1
131.2 . . . Tightening torques 5

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General instructions for repairs

Outer oil seals
The Service Manual contains instructions for changing all outer oil seals, (e.g. oil seals on the PTO shaft end, on the output shaft to the front wheel drive and on the pinion shaft on the powered front axle, and so on).

Sealing compound and glue
If sealing compounds or glue are required for the repair work, the instructions will specify a sealing compound or glue which is readily available through specialist dealers. Some seals should be greased before fitting and the space between the lips of the seal should be filled with universal grease. If the seal is to be pushed over splines or sharp edges the seal should be protected with for example a thin plastic foil. Avoid using too much sealing glue to prevent blocking of lubricating oil borings for instace.

Tightening torques and setting values
All necessary tightening torques and setting values for each repair operation are given at the beginning of each repair section under the heading Technical Data. The most important values can also be found in the repair instructions.

Table on code **131.2** gives the tightening torques in order of dimension, quality and surface treatment. The values given in the table should be used if the tightening torque is not given in the repair instructions.

Safety

Always bear safety in mind when repairing or servicing the tractor. Use tools and lifting devices in the correct way . When you are removing tractor components or splitting the tractor, every tractor part must be supported in such a way, that no risk of accident exists. Avoid working under the supported tractor part if it is not absolutely necessary. When supporting the tractor the centre of gravity of the frame part must always be checked. For instance the wedges must always be fitted between front axle and engine to prevent axle oscillation when splitting the front frame of the tractor.

There is various different chemicals (fuel, oil, grease, fluids) in the tractor. The harmfullness to skin and eyes must be noted when handling these chemicals. Also must be noted that there is pressurized circuits in the tractor. Opening these circuits can be dangerous if the pressure is not released carefully.

Trouble–shooting

The following procedure, combined with the information contained in the workshop manual will be helpful in tracing faults accurately. It consists of following a number of logical steps to locate and correct the problem.

a) Determine the problem
b) List possible causes
c) Differentiate the causes
d) Conduct checks in logical order to determine the exact cause
e) Consider approximate remaining service life against cost of parts and labour.
f) Make any necessary repairs.
g) Recheck the parts and functions for correct operation

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Handling of heavy components

Unless otherwise specified, all removals should be accomplished using adjustable lifting equipment. All supporting slings must be parallel to each other and as near vertical as possible in relation to the object being lifted. However, where slings are of a far greater capacity than the weight of the load to be fitted, a triangular lifting arrangement may be used. When removing a component at an angle, remember that the capacity of an eyebolt is reduced when the angle between the supporting members and the object becomes less than 90˚.

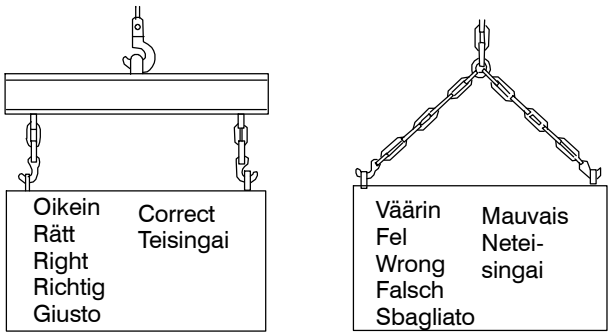


fig001c

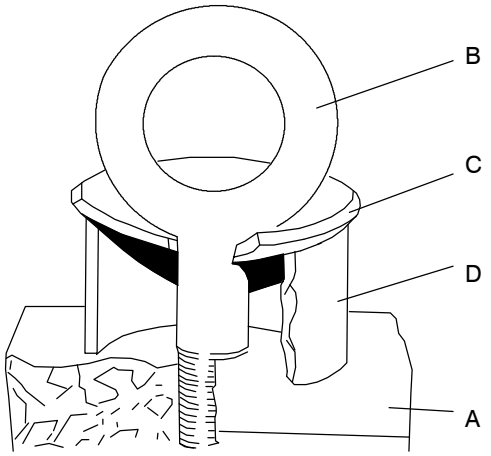


fig002c

Forged eyebolt support

A. Load
B. Lifting shackle
C. Shackle retaining plate (3 mm thick)
D. Sleeve

When necessary the forged eyebolt can be supported in the way shown in figure above. Sleeve D may or may not be welded to plate.

Warning! If a part resists removal, check that all nuts and bolts have been removed and that there is no interference from adjacent parts.

Cleanliness

To ensure long life of a machine, it is important to keep dirt and foreign material out of its vital working components. Precautions must be taken to safeguard against this. Enclosed compartments, seals and filters have been provided to keep the supply of air, fuel and lubricant clean. These protective devices must not be removed.

Whenever hydraulic, fuel, lubricating oil or lines are disconnected, clean the point of disconnection and the surrounding area. As soon as a line has been disconnected, cap, plug or tape the line or opening to prevent the ingress of foreign material.

The same cleaning and covering precautions should be taken when access covers or inspection plates are removed.

Clean and inspect all parts. Make sure that all passages and holes are clear. Cover all parts to keep them clean. Make sure parts are clean when they are reassembled. LEAVE NEW PARTS IN THEIR WRAPPING UNTIL THEY ARE ACTUALLY NEEDED FOR REASSEMBLY.

Assembly

When reassembling a machine, complete each step in sequence. never partially assemble one part then start to assemble another. Make all recommended adjustments. Always check the job on completion to ensure that nothing has been overlooked. Recheck the various adjustments before putting the machine back into service.

Note! Before fitting new parts, remove rust preventative compound from all machined surfaces (usually ”peel–off substances).

Lubrication

Where applicable, fill the compartments of repaired or renewed components with the quantity, type and grade of clean lubricant recommended.

Shims

When shims are removed, tie them together and identify their location. Keep shims clean and take care not to bend them before refitting them.

Gaskets

Make sure that the holes in gaskets line up with lubricating oil passages in the mating parts. If gaskets have to be made, use material of the correct type and thickness. Make sure that holes are punched in the right places. Incorrectly punched gaskets can cause serious damage.

Lip type rubber seals

Lubricate the lips of lip–type rubber seals with oil before fitment. Do not use grease on seals, except for grease seals.

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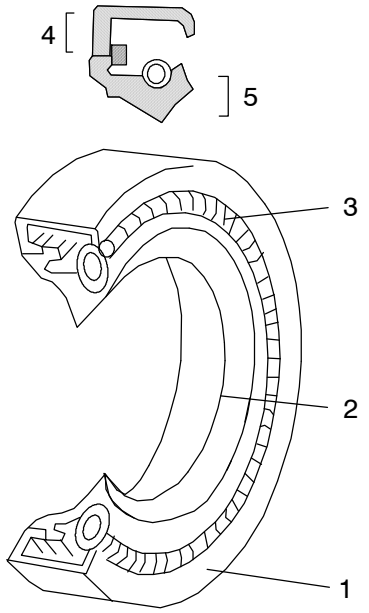


fig003c

The main parts of lip–type seal:
1. Case
2. Sealing element
3. Ring spring

The figure above shows the construction of a simple lip–type seal. The cross section shows the heel (4) and the toe (5), used to identify the sides of a single element seal. With a few exceptions, the toe of a single–lip is located on the lubricant side. Some seals have a second auxiliary lip which has no spring.

Cables and wires

When removing or disconnecting a group of cables or wires, label each one to ensure correct refitment.

Locking devices

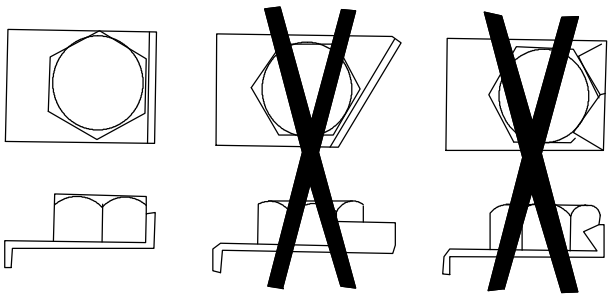


fig004c

Correct and incorrect use of retainers

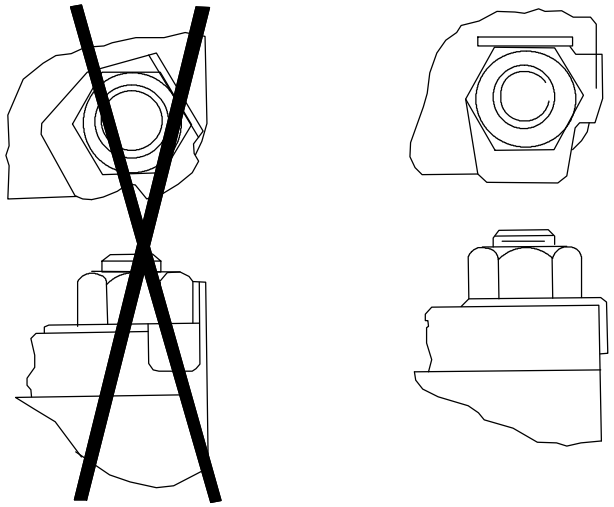


fig005c

Correct and incorrect method of fitting and bending locking tabs.

Slackening of nuts and bolts is prevented by mechanical means such as lockwashers, tab washers and cotter pins, or by locking agents (Loctite for example).

Flat retainers must be installed properly to be effective. Bend one end of the retainer against the edge of the part. Bend the other end against one of the nut or bolt head.Always fit new retainers in compartments which house moving parts. When fitting lockwashers on aluminium housings, place a flat washer between the lockwasher and the housing.

Note!
1) Never fit a lockwasher under a nut or bolt to which a specified torque has to be applied.
2) Always thoroughly degrease components before applying locking agents.

Bushes and press fits

Do not fit bushes with a hammer alone. Use a suitable fitting tool and a hammer or, better still, a press if possible.

When using a press, ensure that pressure is applied directly in line with the bore. If the ring has an oil hole, take care to align it with the oil hole in the mating part. When press fitting a part into another part, lubricate the mating surfaces. Tapered parts should be assembled dry. Before assembly, check that the tapers are dry and free from burrs.

Fitting bolts in blind holes

Use bolts of the correct length. A bolt which is too long may ”bottom” before the head comes into contact with the part it is to hold: this will cause damage to the threads. If a bolt is too short, there may not be enough threads engaged to hold the part securely.

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Tightening torques

Tightening torques, metric standard thread (ISO).

Dim.	Tightening torques Nm[1])									
	Quality, surface treatment, material									
	8.8 lubr.	tol.±	8.8 Zne[2])	tol±	8.8 Znk[3])	tol±	10.9 lubr.	tol±	12.9 lubr.	tol±
M4	–		–		–		–		–	
M5	6,4	0,6	5,7	0,5	–		9	1	11	1
M6	11	1	10	1	12	1,2	15	1,5	18	2
M8	25	2	23	2	30	3	35	4	45	5
M10	50	5	45	5	60	5	70	7	90	10
M12	90	10	80	8	100	10	125	10	151	15
M14	140	15	125	10	160	15	200	20	240	20
M16	220	20	195	20	250	25	300	30	370	40
M18	300	30	270	30	350	35	430	40	510	50
M20	430	40	380	40	480	50	600	60	720	70
M22	570	60	500	50	650	65	800	80	970	100
M24	740	70	660	70	830	80	1030	100	1250	120
M27	1100	100	950	100	1200	120	1500	150	1800	180
M30	1500	150	1300	130	1600	160	2040	200	2500	250

If the bolts differs from the standard range the values in the table must not be used.

[1]) 1 Nm=0,102 kpm
[2]) Zne=zinc electroplating
[3]) Znk=hot galvanized

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Valtra service

Maintenance

Correct maintenance at the right time is essential for reliable operation of the tractor. Maintenance costs are small compared with repair costs resulting from lack of maintenance. The most important measures are those which you carry out yourself which include lubrication and various checks and adjustments. The service intervals shown apply for normal operating conditions but in more severe conditions servicing should be carried out more frequently.

Carrying out the maintenance

- Always stop the engine before starting work.
- Apply the parking brake to ensure the tractor cannot move. If the ground is uneven the wheels should be blocked.
- Wash down the tractor first so that the work can be done easily and quicker. **NOTE: Do not let the water get to the electrical equipment when washing the machine.**
- Thoroughly wipe off filler caps and plugs as well as surrounding parts of the tractor before filling up with fuel or oil.
- Inspect the oil and filters when changing.

  Large amounts of dirt (e.g. heavily clogged filters) can point to a fault which could cause extensive and costly repairs if not corrected in time.
- When carrying out level checks the tractor should stand on level ground.
- Levels should be checked in the morning when the oil is cold and has had time to run down to the bottom of the unit concerned.
- When changing the oil, bear in mind that the oil can be very hot when it drains from the tractor.
- Avoid touching the exhaust manifold, turbocharger and other hot parts of the engine.
- Keep the engine surfaces clean in order to avoid the risk of fire.
- The fuel, lubricating oil and coolant cause irritation to skin if in contact for long periods.
- After completion of service work replace all safety covers.
- Waste oil and oil filters should be handled carefully and disposed of properly.

Greasing lubricating points fitted with grease nipples

- Always clean the grease nipples before applying the grease gun.
- Apply grease through the nipples until clean grease oozes out (unless otherwise instructed).
- Wipe away superfluous grease which has been pressed out at the lubricating point.
- Preferably carry out lubrication with bearing points and joints unloaded and with the bearings in different positions.

Scheduled maintenance

The maintenance schedule begins with the running hour meter reading 0. This means that maintenance scheduled at 500 h intervals is performed at meter readings 500 h, 1000 h etc., even if the same procedures were carried out at the 50 h maintenance. At the 1000 h maintenance, for example, the daily, weekly and 500 hour maintenance procedures must also be undertaken.

Service inspection (after 100 hours)

Service inspection have to be carried out to all new tractors after 100 hours running.

The service procedure is as follows:

20 Engine:
- Change engine oil and filter
- Change prefilter, fuel system
- Change fuel filter

40 Power transmission:
- Change pressure filters and hydraulic return filter

60 Front axle and steering system:
- Change oil in differential
- Change oil in hub

Other targets:
- Lubricate according to charts
- Road test tractor. Check during the road test all the functions of the controls and instruments. After the road test, check for oil leaks, check the coolant and fuel system.

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Filling table

All volumes are with filters.

Part of machine	Valtra–grade	SAE–grade	API–grade	Volume, when changing (liter)
Engine	Valtra Engine CR	10W–40: –25˚C...+40˚C	CI–4 (ACEA E7)	19
Hydraulic system and transmission	Valtra Transmission	HT 60: –30˚C...+30˚C HT 100: –10˚C...+40˚C	GL–4	min 55 max 65
Powered front axle – differential	Valtra Axle LS (Limited Slip)	80W–90	GL–5	8
– hub reduction gears, agricultural front axle	Valtra Axle			2x1
– hub reduction gears, industral-front axle				2x1,5
Front PTO (extra equipment)	Shell Donax TX			2,2
Fueltank	Diesel fuel which conforms to EN 590 norm			165
– extra tank				170
Cooling system – T121c–T131c, T121h–T131h	water + anti freeze agent (standard ASTM D3306–86a or BS 6580:1985)			29
– T161c–T171c, T151eh–T171h, T151eLS–T171LS				30
– T191h, T191LS				31
Brake fluid reservoir T121c–T131c, T121h–T131h	Brake fluid SAE J1703			0,5
Clutch fluid reservoir, c models				0,2
Clutch fluid reservoir (HiShift), c models (extra equipment)				0,25
Windscreen washer	Washer fluid			11
Windscreen washer (forest equipment, extra equipment)				17,5

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Oil recommendations according to outdoor temperature

When starting the tractor in a warm garage, oil meant for warmer areas may be used.

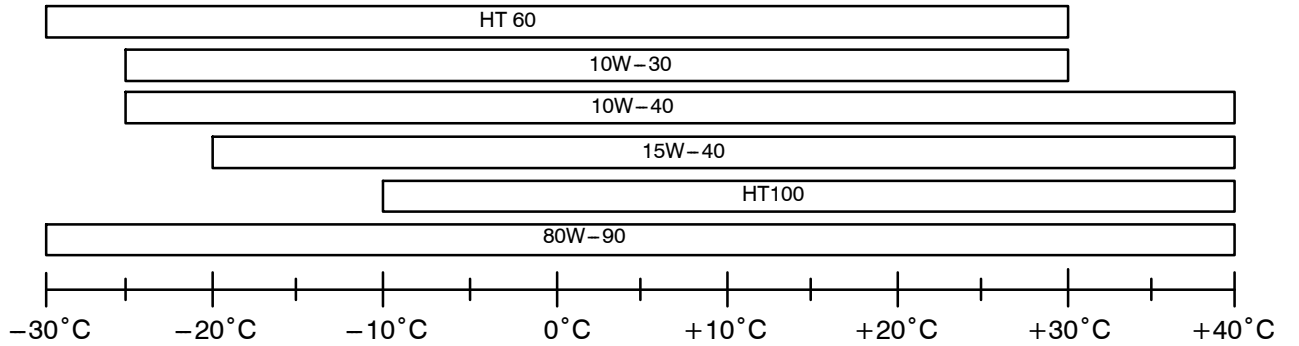


fig001c

ISO 15380 class HEES (synthetic esters) bio oils can be used as transmission and hydraulic oil. The oil must fulfil the technical requirements of tractor transmission oil. The bio oil cannot be mixed with mineral oil.

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Grease

Always use the following greases in Valtra tractors. Each point requires it own type of grease.

Valtra Grease, NLGI2 Universal grease

Lithium–based universal grease. Is suitable for greasing all heavy machines.
–25˚ ... +130˚C

Universal grease of high quality, lithium based grease for vehicle use. It is recommended for greasing wheel bearings, chassis water pumps, catepillar rollers etc. The grease is adhesive, protects against corrosion and resists water and varying temperatures.
Temperature range is –25˚ ... +130˚C.

Valtra Calsium LF, NLGI2 Calsium Grease LF

Is suitable for greasing all heavy machines. Long fibre grease. Colour red. Especially good for greasing points exposed to water.
–25˚ ... +80˚C

Calsium LF is of long fibre, high quality and calsium based universal grease for vehicle use. It is recommended for greasing chassis, water pumps, pins etc.The grease is adhesive, protects against corrosion and resists water and varying temperatures.
Temperature range is –25˚ ... +80˚C.

Valtra Grease Moly, NLGI2 Moly Grease

Is suitable for greasing all heavy machines. Lithium–based universal grease. Molybdenum sulphide as an additive (1–3%) improves greasing in places exposed to shock loads.
–25˚ ... +130˚C

Universal grease of high quality, lithium based grease for vehicle use. It is recommended for greasing wheel bearings, chassis water pumps, catepillar rollers etc. The grease is adhesive, protects against corrosion and resists water and varying temperatures.
Temperature range is –25˚ ... +130˚C.

Avoid repeating skin contact.

Protect nature and take care of empty packages.

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Maintenance schedule (c and h models)

Daily / every 10 hours

1. Check engine oil level.
2. Check coolant level, radiator fins.
3. Check for leaks.

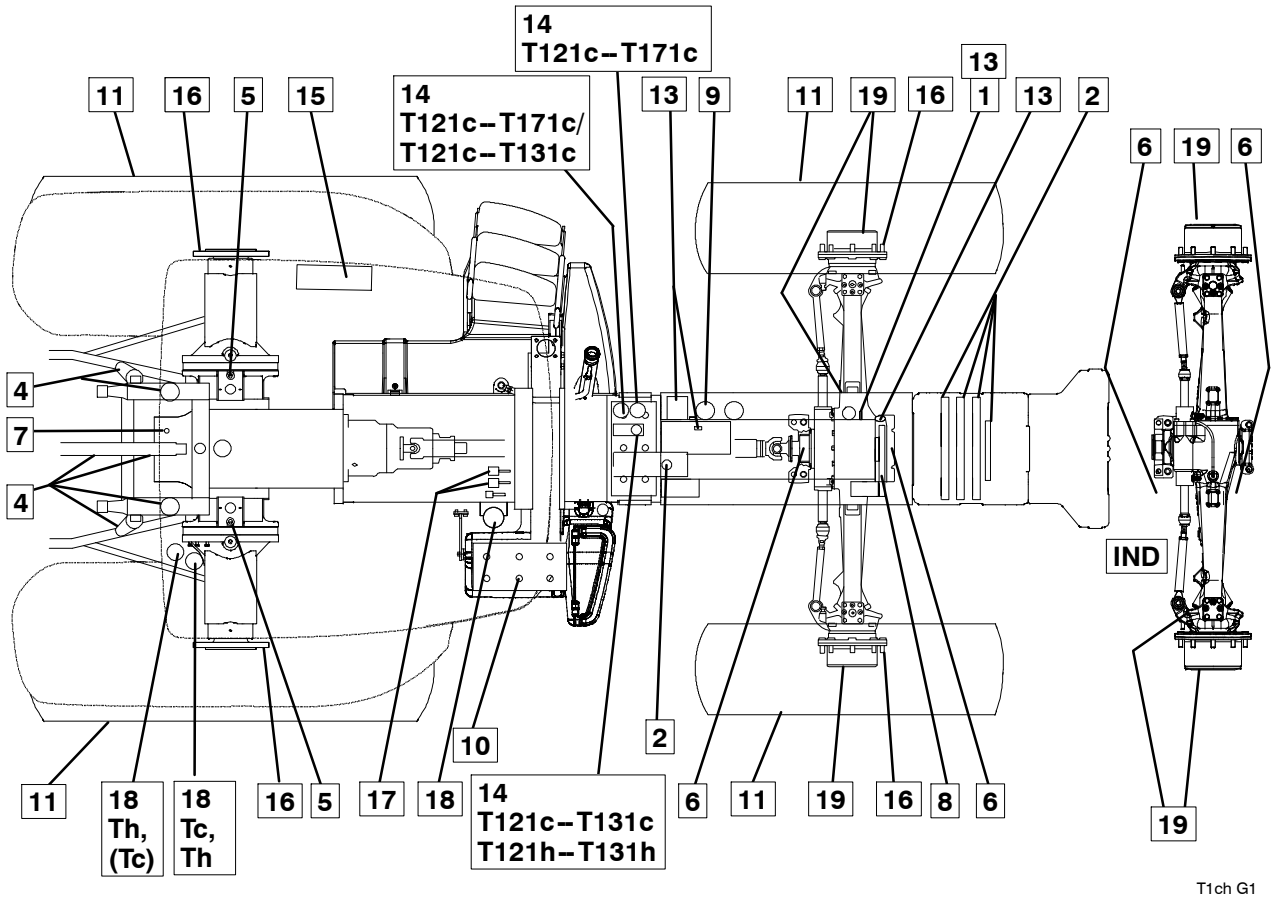
Weekly / every 50 hours

4. Grease three–point linkage.
5. Grease brake mechanism (high pressure grease).
6. Grease front axle mounting bearings.
7. Check oil level in transmission and hydraulics.
8. Check belt/belts tightness.
9. Check fuel system prefilter and sediment bowl.
10. Check electrolyte level in battery.
11. Check tyre/tire pressures.

Every 500 hours

12. Grease door hinges.
13. Change engine oil and filter (or yearly), in extremely dusty conditions or when using over 5 % Biodiesel fuel at 250–hour.
14. Check brake fluid level and clutch fluid level
15. Clean cab ventilation air filter (more often if needed).
16. Check wheel nuts tightness.
17. Check brake pedal free travel.
18. Change pressure filters of the transmission and hydraulics and also auxiliary hydraulic return oil filter (h models, on c models as extra equipment) or if the filter indicator lamp illuminates.
19. Check oil level in front axle differential and hubs.

Note! When carrying out servicing you must follow the service intervals, you must also do all previously mentioned items. For example, when doing 500 hours service you must also do the servicing required at weekly and daily.



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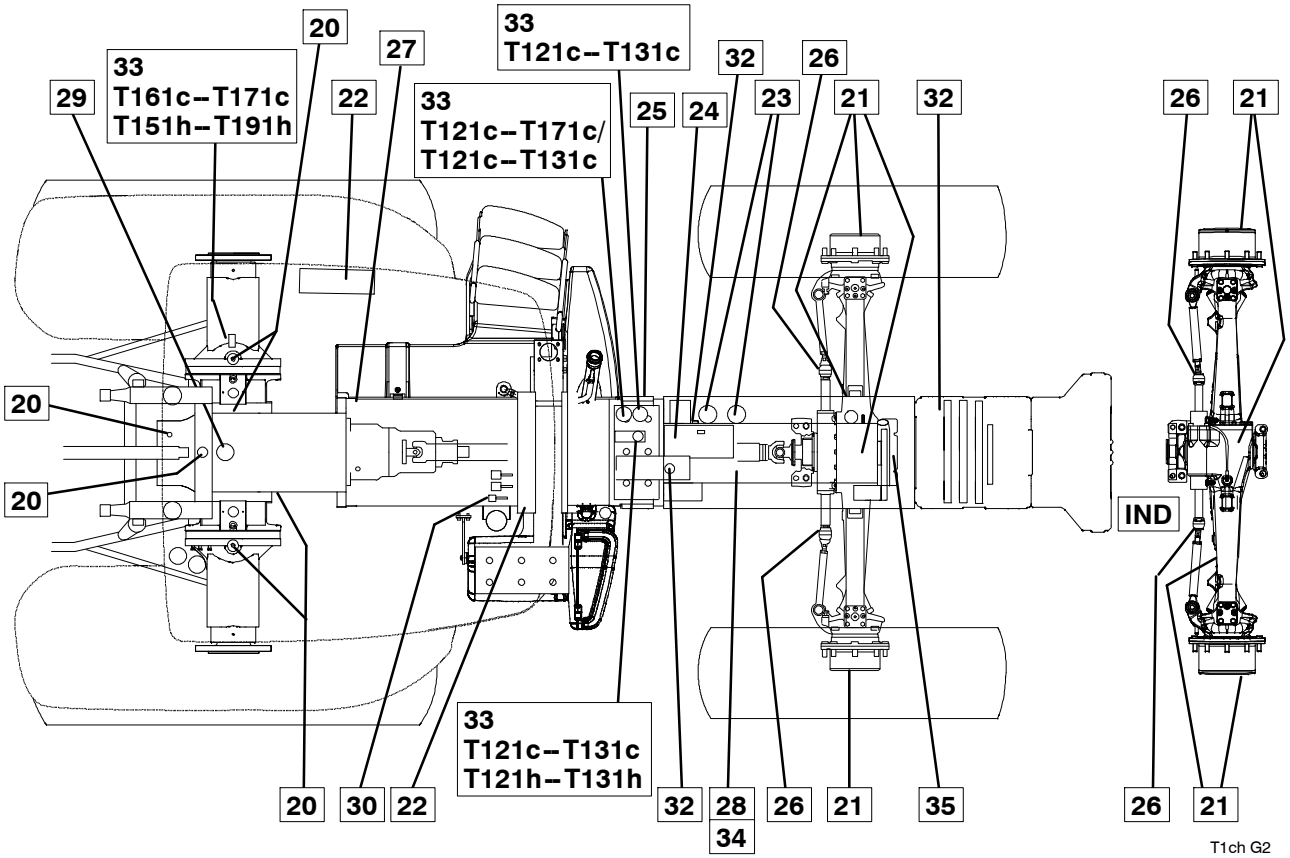
Every 1000 hours / yearly

20. Change oil in transmission/hydraulics and clean suction strainer.
21. Change oil in front axle differential and hubs.
22. Change cab ventilation air filter and recirculation filter.
23. Change fuel filter and prefilter, when using over 5 % Biodiesel fuel at 500–hour.
24. Change air filter and safety filter.
25. Grease flywheel ring gear.
26. Check/adjust front wheel toe–in.
27. Clean fuel tank.
28. Adjust valves.
29. Change transmission housing breather.
30. Accelerator pedal calibration and checking of power shuttle operation.
31. Tighten frame nuts and bolts.

Every 2000 hours / every other year

32. Change radiator coolant.
33. Change brake fluid.
34. Check and clean injectors.
35. Check/change engine vibration damper, the models T121c–T161c and T121h–T161h.

Note! When carrying out servicing you must follow the service intervals, i.e., you must also do all previously mentioned items. For example, when doing 2000 hours service you must also do the servicing required at 1000, 500 hours, weekly and daily.



T1ch G2

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Maintenance schedule (LS models)

Daily / every 10 hours

1. Check engine oil level.
2. Check coolant level, radiator fins and front grilles of the engine cover.
3. Check for oil and fuel leaks.

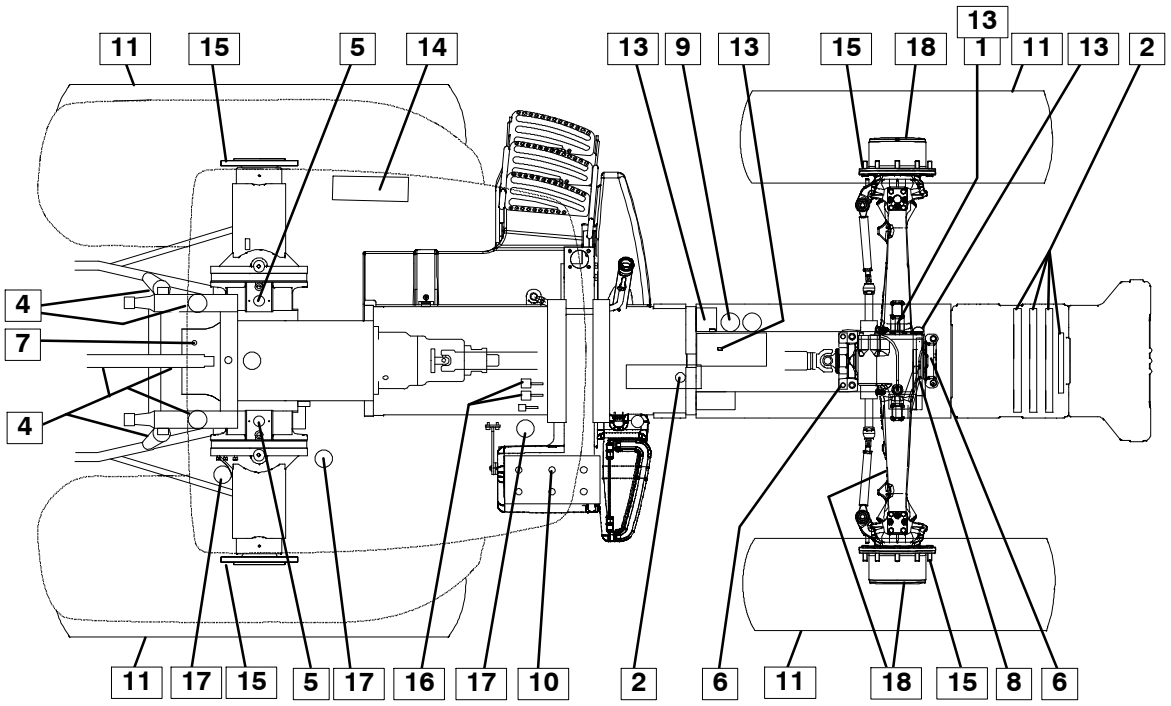
Weekly / every 50 hours

4. Grease three – point linkage.
5. Grease brake mechanism (high pressure grease).
6. Grease front axle mounting bearings.
7. Check oil level in transmission and hydraulics.
8. Check belt/belts tightness.
9. Check fuel system prefilter and sediment bowl.
10. Check electrolyte level in battery.
11. Check tyre/tire pressures.

Every 500 hours

12. Grease door hinges.
13. Change engine oil and filter (or yearly), in extremely dusty conditions or when using over 5 % Biodiesel fuel at 250 – hour.
14. Clean cab ventilation air filter (more often if needed).
15. Check wheel nuts tightness.
16. Check brake pedal free travel.
17. Change pressure filters of the hydraulics and also return oil filter or if the filter indicator lamp illuminates.
18. Check oil level in front axle differential and hubs.

Note! When carrying out servicing you must follow the service intervals, you must also do all previously mentioned items. For example, when doing 500 hours service you must also do the servicing required at weekly and daily.



T1LS G1

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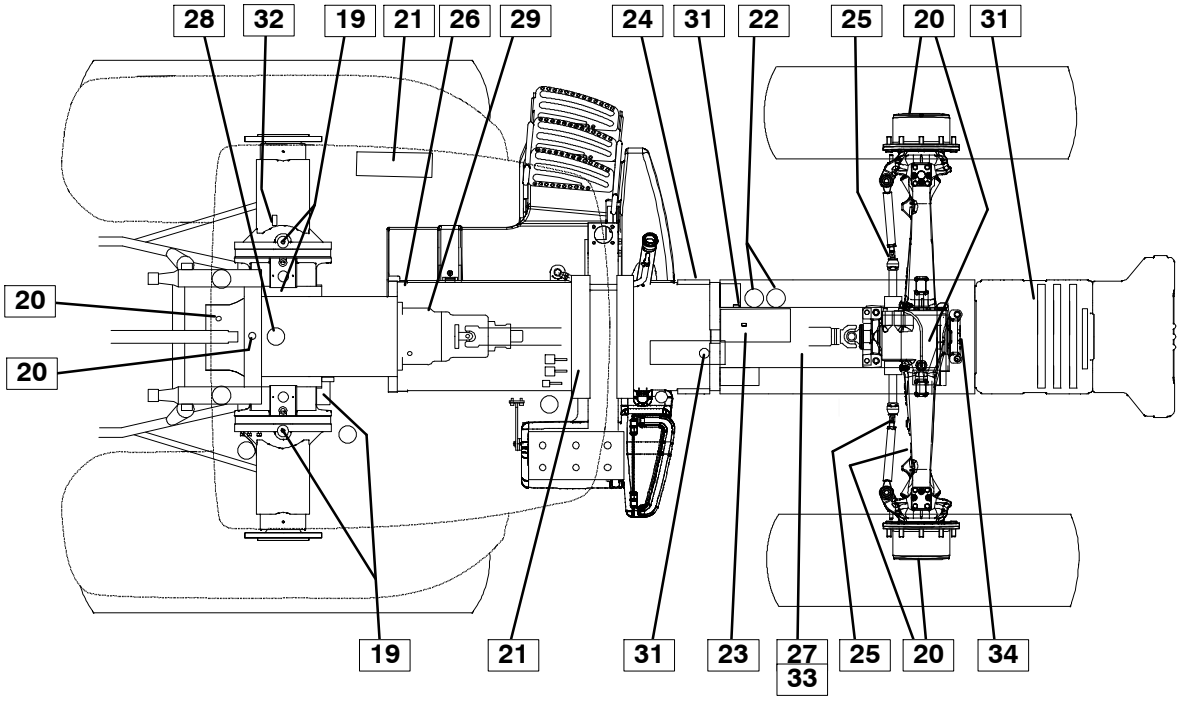
Every 1000 hours / yearly

19. Change oil in transmission/hydraulics and clean suction strainer.
20. Change oil in front axle differential and hubs.
21. Change cab ventilation air filter and recirculation filter.
22. Change fuel filter and prefilter, when using over 5 % Bio-diesel fuel at 500–hour.
23. Change air filter and safety filter.
24. Grease flywheel ring gear.
25. Check/adjust front wheel toe–in.
26. Clean fuel tank.
27. Adjust valves.
28. Change transmission housing breather.
29. Accelerator pedal calibration and checking of power shuttle operation.
30. Tighten frame nuts and bolts.

Every 2000 hours / every other year

31. Change radiator coolant.
32. Change brake fluid.
33. Check and clean injectors.
34. Check/change engine vibration damper, the models T151eLS and T161LS

Note! When carrying out servicing you must follow the service intervals, i.e., you must also do all previously mentioned items. For example, when doing 2000 hours service you must also do the servicing required at 1000, 500 hours, weekly and daily.



T1LS G2

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20. Engine

21. Engine

22. Fuel system

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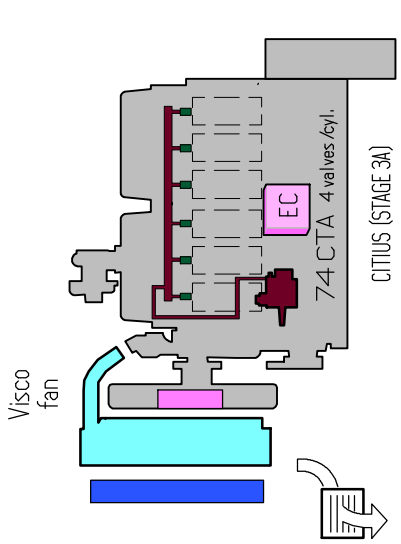
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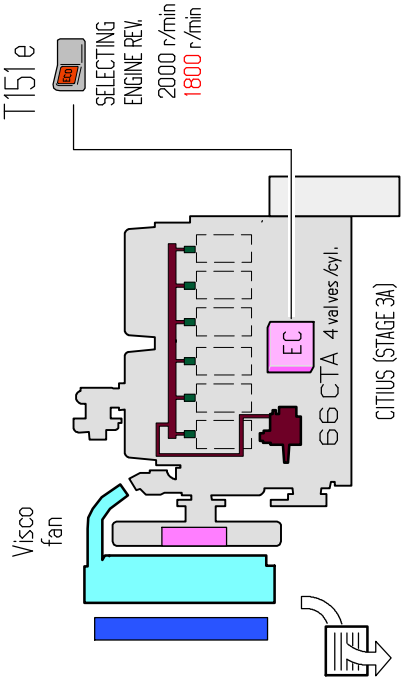
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Engines



T191h T191LS	74 CTA-4V	185 hp (136 kW)	STANDARD POWER	205 hp (151 kW)	TRANSPORT BOOST / DPS BOOST
				208 hp (153 kW)	SIGMA POWER
				2200 r/min	
T171LS T171h	74 CTA-4V	180 hp (132 kW)	STANDARD POWER	185 hp (136 kW)	TRANSPORT BOOST
				2200 r/min	
T171c	74 CTA-4V	180 hp (132 kW)	2200 r/min		



T161h T161LS	66CTA-4V	170hp (125 kW)	STANDARD POWER	178hp (131,5 kW)	TRANSPORT BOOST
				2200 r/min	
T161c	66CTA-4V	170hp (125kW)	2200 r/min		
T151eh T151e LS	66CTA-4V	159 hp (117 kW)	STANDARD POWER	173hp/(127kW)	TRANSPORT BOOST
		167hp/(123kW)	TRANSPORT BOOST	1800 r/min	
		159 hp (117 kW)	STANDARD POWER	2200 r/min	
	ECO				
T131h	66CTA-4V	156 hp (115 kW)	TRANSPORT BOOST	2200 r/min	
		148hp (109kW)	STANDARD POWER		
T131c	66CTA-4V	148hp (109kW)	2200 r/min		
T121c T121h	66CTA-4V	133hp (98 kW)	2200 r/min		

T = TURBO
C = COMMON RAIL
A = INTERCOOLER AIR/AIR
66 = CYL. DISPLACEMENT 6,6 dm^3
POWER OUTPUT: ISO 14396

4–2739
02/07

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Engines

– **T121c**–**T171c** and **T121h**
The tractors have 4–stroke, six–cylinder, turbocharged and intercoolered multi power common rail direct injection diesel engines.

– **T131h**–**T191h** and **T151LS** –**T171LS**
The tractors have 4–stroke, six–cylinder, turbocharged and intercoolered multi power common rail direct injection diesel engines.

Two power ranges

The models **T131h, T151eh, T161h, T171h, T151eLS, T161LS ja T171LS** have also a larger transport boost power area, when the main gear is H2 or higher.

Two engine running speed ranges

On the models **T151eh** / **T151eLS** it is possible to choose either standard engine range (maximum 2200 r/min) or low engine range (maximum 1800 r/min) with the “ECO” switch.

On the low engine range the fuel consumption, and the emissions are lower and the noise will be reduced. On the low engine range there are also Transport boost and PS boost power ranges in use.

Three power ranges

The models **T191h** / **T191LS** have a larger transport boost power area, when the main gear is H2 or higher and PS boost area, when quick–shift is 2 or 3.
The transport boost and PS boost power areas are equal.
The largest Sigma Power area with all gears is in use, when the power transferred through the power–take–off is large enough. The symbol  is illuminated in the instrument panel.

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Engine output standards

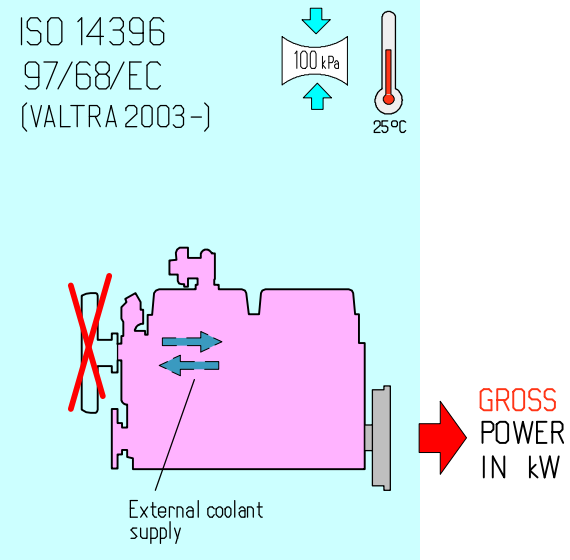


fig002

ISO 14396 (Valtra 2003– >):

Gross power (in kW) without fan. Testing temperature is 25 degrees C, pressure 100 kPa.
No engine ancillaries fitted. If water pump drive requires a fan belt, alternator etc, these are present but not under load. Coolant is supplied externally. Produces high power values from given engine. Becomes practically more common in tractor world.

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Technical specifications

Model	T121c	T131c	T61c	T171c
Designation	66 CTA–4V	66 CTA–4V	66 CTA–4V	74 CTA–4V
Type	Four stroke direct injection diesel engine with Common Rail			
Turbocharged, intercooler	yes	yes	yes	yes
Number of cylinders	6	6	6	6
Numbering of cylinders (fr. front)	1–2–3–4–5–6	1–2–3–4–5–6	1–2–3–4–5–6	1–2–3–4–5–6
Cylinder bore, mm	108	108	108	108
Stroke, mm	120	120	120	134
Cylinder displacement, dm^3	6,6	6,6	6,6	7,4
Compression ratio	16,5:1			17,5:1
Max. output, kW/(hp)/r/min (ISO 14396)	102/(139)/2000	113/(154)/2000	128/(174)/2000	135/(184)/2000
Nominal output, kW/(hp)/r/min (ISO 14396)	98/(133)/2200	109/(148)/2200	125/(170)/2200	132/(180)/2200
Max Torque, Nm/r/min	550/1500	580/1500	660/1500	670/1500
Max. no load speed, r/min	2400	2400	2400	2400
Low idling speed, r/min	850	850	850	850

Model	T121h	T31h	T151eh	
Designation	66 CTA–4V	66 CTA–4V	66 CTA–4V	
Type	Four stroke direct injection diesel engine with Common Rail			
Turbocharged, intercooler	yes	yes	yes	
Number of cylinders	6	6	6	
Numbering of cylinders (fr. front)	1–2–3–4–5–6	1–2–3–4–5–6	1–2–3–4–5–6	
Cylinder bore, mm	108	108	108	
Stroke, mm	120	120	120	
Cylinder displacement, dm^3	6,6	6,6	6,6	
Compression ratio				
Max. output, kW/(hp)/r/min (ISO 14396)	102/(139)/2000	119/(162)/2000[1)] 113/(154)/2000	127/(173)/2000[1)] 120/(163)/2000	**ECO** 127/(173)/1800[1)] 117/(159)/1800
Nominal output, kW/(hp)/r/min (ISO 14396)	98/(133)/2200	115/(156)/2200[1)] 109/(148)/2200	123/(167)/2200[1)] 117/(159)/2200	**ECO** 127/(173)/1800[1)] 117/(159)/1800
Max Torque, Nm/r/min	550/1500	650/1500[1)] 580/1500	680/1500[1)] 620/1500	730/1100[1)] 680/1100
Max. no load speed, r/min	2400	2400	2400	2000
Low idling speed, r/min	850 650[2)]	850 650[2)]	850 650[2)]	850 650[2)]

[1)] Higher transport boost power area, when the main gear is H2 or higher.
[2)] Parking brake is on

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Model	T161h	T171h	T191h
Designation	66 CTA–4V	74 CTA–4V	74CTA–4
Type	Four stroke direct injection diesel engine with Common Rail		
Turbocharged, intercooler	turbo, intercooler	turbo, intercooler	turbo, intercooler
Number of cylinders	6	6	6
Numbering of cylinders (fr. front)	1–2–3–4–5–6	1–2–3–4–5–6	1–2–3–4–5–6
Cylinder bore, mm	108	108	108
Stroke, mm	120	134	134
Cylinder displacement, dm^3	6,6	7,4	7,4
Compression ratio			
Max. output, kW/(hp)/r/min (ISO 14396)	135(184)2000[1)] 128(174)2000	142(193)2000[1)] 135(184)2000	155/(211)/2000[3)] 155/(211)/2000[2)] 139/(189)/2000
Nominal output, kW/(hp)/r/min (ISO 14396)	131,5/(179)/2200[1)] 125/(170)/2200	136/(185)/2200[1)] 132/(180)/2200	153/(208)/2200[3)] 151/(205)/2200[2)] 136/(185)/2200
Max Torque, Nm/r/min	710/1500[1)] 660/1500	730/1500[1)] 670/1500	830/1500[3)] 750/1500[2)] 680/1400
Max. no load speed, r/min	2400	2400	2400
Low idling speed, r/min	850650[4)]	850 650[4)]	850 650[4)]

[1)] Higher transport boost power area, when the main gear is H2 or higher.

[2)] Higher transport boost power area, when the main gear is H2 or higher and PS boost area, when quick–shift is 2 or 3. The trans boost and PS boost power areas are equal.

[3)] Sigma power area, the largest output/torque area, when the power transferred through the power–take–off is large enough. The symbol Σ is illuminated in the instrument panel.

[4)] Parking brake is on

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Model	T151eLS		T161LS	T171LS	T191LS
Designation	66 CTA–4V		66 CTA–4V	74 CTA–4V	74 CTA–4V
Type	Four–stroke common rail direct injection diesel engine with Common Rail				
Turbocharged and intercooling	turbo, intercooler				
Number of cylinders	6	6	6	6	6
Numbering of cylinders (from front)	1–2–3–4–5–6				
Cylinder bore, mm	108		108	108	108
Stroke, mm	120		120	134	134
Cylinder displacement, dm^3	6,6		6,6	7,4	7,4
Compression ratio					
Max. output, kW/(hv)/r/min (ISO 14396)	127(173)/2000[1] 120(163)/2000	**ECO** 127(173)/1800[1] 117(159(/1800	135(184)/2000[1] 128/(174)/2000	142(193)/2000[1] 135(184)/2000	155/(211)/2000[3] 155/(211)/2000[2] 139(189)/2000
Nominal output kW/(hv)/r/min (ISO 14396)	123(167)2200[1] 117(159)/2200	**ECO** 127(173)1800[1] 117(159)/1800	131,5(179)/2200[1] 125(170)/2200	136(185)/2200[1] 132(180)2200	153(208)/2200[3] 151(205)/2200[2] 136(185)/2200
Max. Torque, Nm/r/min (ISO 14396)	680/1500[1] 620/1500	730/1100[1] 680/1100	710/1500[1] 660/1500	730/1500[1] 670/1500	830/1500[2] 750/1500[1] 680/1400
Max. no load speed, r/min	2400	2000	2400	2400	2400
Low idling speed, r/min	850 650[4]	850 650[4]	850 650[4]	850 650[4]	850 650[4]

[1] Transport boost power area, when the main gear is H2 or higher.

[2] Transport boost power area, when the main gear is H2 or higher and PS boost area, when quick–shift is 2 or 3. The trans boost and PS boost power areas are equal.

[3] Sigma power area, the largest output/torque area, when the power transferred through the power–take–off is large enough. The symbol Σ is illuminated in the instrument panel.

[4] Parking brake is on

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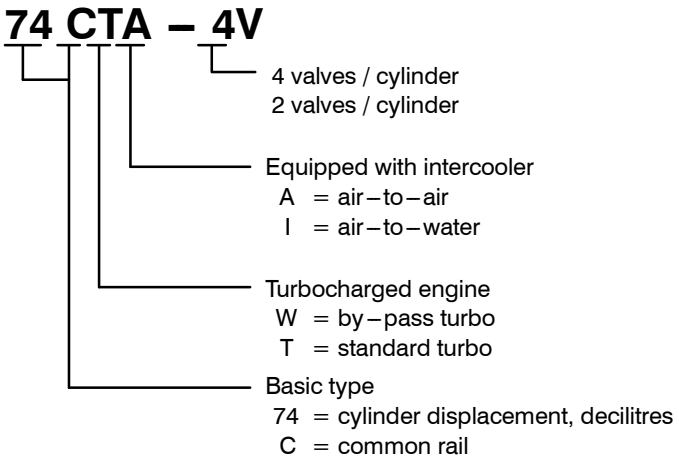


fig003en

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Technical data

Cylinder block

Holes for guide pins	13.250...13.320 mm
Main bearing housing diameter (66–engines)	91.000...91.025 mm
Main bearing housing diameter (74–engines)	96.000...96.025 mm
Main bearing housing diameter (with bearing 8361 40950), (66–engine)	92.000...92.025 mm
Cylinder liner location, diameter:	
- upper end	124.514...124.554 mm
- lower end	123.000...123.040 mm
Inside diameter of camshaft bushing no. 1 (fitted)	50.040...50.060 mm
Inside diameter of camshaft bearing bushings nos. 2–5 (fitted, 66– and 74–engines).	50.010...50.070 mm
Height of cylinder block	428.170...428.430 mm

Cylinder liners

Protrusion of cylinder liner above cylinder block top face	0.030...0.080 mm
Max. permissible height difference between liners (under same head)	0.02 mm
Height of cylinder liner flange, std	9.03...9.05 mm
Height of cylinder liner flange, 1st oversize.	9.08...9.10 mm
Height of cylinder liner flange, 2nd oversize	9.13...9.15 mm
Height of cylinder liner flange, 3rd oversize	9.23...9.25 mm
Outer diameter of cylinder liner flange	131.700...131.800 mm
Outer diameter of cylinder liner guide:	
– at upper end of liner	124.475...124.500 mm
– at lower end of liner	122.961...122.986 mm
Liner bore	108.010...108.032 mm

Cylinder head

Height of cylinder head	109.900...110.000 mm
Height of cylinder head after repair grinding (minimum)	109.500 mm
Length of cylinder head bolts	145 ± 0.08 mm (max. 147 mm)
Length of cylinder head studs (overall length)	186 + 1 mm (max. 188.5 mm)
Inside diameter of valve guide	8.000...8.015 mm
Outside diameter of valve guide	16.028...16.039 mm
Diameter of valve guide bore in cylinder head	16.000...16.018 mm
Position of valve guide top above cylinder head surface	13 mm
Depth of valve head face below cylinder head surface:	
– inlet valve	0.65...0.85 mm (max. 2.20 mm)
– exhaust valve	0.45...0.65 mm (max. 2.20 mm)
Angle of valve seat:	
– inlet valve	35°+20'
– exhaust valve	45°+20'
Width of valve seat:	
– inlet valve	2.2 mm
– exhaust valve	2.0 mm
Diameter of exhaust valve seat ring	36.060...36.122 mm
Diameter of exhaust valve seat rings recess	36.000...36.025 mm
Diameter of exhaust valve seat ring (overhaul part 8370 70187)	36.260...36.322 mm
Diameter of exhaust valve seal ring recess (overhaul part 8370 70187)	36.200...36.225 mm
Diameter of inlet valve seat ring	41.070...41.132 mm
Diameter of inlet valve seat ring recess	41.000...41.025 mm
Diameter of inlet valve seat ring (overhaul part 8370 70188)	41.270...41.332 mm
Diameter of inlet valve seat ring recess (overhaul part 8370 70188)	41.200...41.225 mm

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Valves and rockers,

With a valve clearance of 1.0 mm:
– inlet valve opens ..... 2° ± 2° B.T.D.C
– inlet valve closes ..... 18° ± 2° A.B.D.C
– exhaust valve opens ..... 36° ± 2° B.B.D.C
– exhaust valve closes ..... 2° ± 2° A.T.D.C
Valve clearance hot and cold:
– inlet valve ..... 0.35 mm
– exhaust valve ..... 0.35 mm
Angle of valve face:
– inlet valve ..... 35° – 20'
– exhaust valve ..... 45° – 20'
Outside diameter of valve head:
– inlet valve ..... 39 mm
– exhaust valve ..... 35 mm
Max. valve movement with a valve clearance of 0.35 mm:
– inlet valve ..... 9.5 mm
– exhaust valve ..... 9.0 mm
Inlet valve stem diameter ..... 7.960...7.975 mm
Exhaust valve stem diameter ..... 7.925...7.940 mm
Inlet valve stem clearance ..... 0.025...0.055 mm
– Reject limit ..... 0.30 mm
Exhaust valve stem clearance ..... 0.060...0.090 mm
– Reject limit ..... 0.35 mm
Depth of valve head face below cylinder head surface:
– inlet valve ..... 0.65...0.85 mm (max. 2.20mm)
– exhaust valve ..... 0.45...0.65 mm (max. 2.20mm)
Valve spring free length ..... 75.1 mm
Spring pressure when spring compressed to a length of:
– 41.0 mm ..... 300 ± 10 N
– 31.0 mm ..... 420 ± 15 N
Rocker arm shaft diameter ..... 24.970...24.990 mm
Diameter of rocker arm bore ..... 25.000...25.021 mm
Free length of rocker arm spring ..... 88 mm
Spring pressure when spring compressed to a length of 66 mm ..... 75...95 N

Tappets and Push Rods

Outside diameter of tappet ..... 29.939...29.960 mm
Diameter of tappet bore in cylinder block ..... 30.000...30.043 mm
Max. permissible push rod deflection (when free) ..... 0.4 mm
Overall length of push rod (66– and 74– 4V engines) ..... 245...246.3 mm

Camshaft

Diameter of camshaft bearing journal no. 1 ..... 49.875...49.900 mm
Diameter of camshaft bearing journals nos. 2–4 (66– and 74–engines) ..... 49.865...49.890 mm
Diameter of camshaft bearing journal no. 5 (66– and 74–engines) ..... 49.885...49.910 mm
Camshaft clearance in bearing bush no. 1 ..... 0.140...0.185 mm
Camshaft clearance in bearing bush nos. 2–4 (66– and 74–engines) ..... 0.110...0.160 mm
Camshaft clearance in bearing bush no. 5 (66– and 74–engines). ..... 0.100...0.185 mm
Camshaft end play ..... 0.5...1.0 mm
Cam height (distance between back of cam and tip of cam):
4V engines:
– inlet valve ..... 43.180...43.680 mm
– exhaust valve ..... 41.700...42.200 mm
Cam lift:
4V engines:
– inlet valve ..... 6.18 mm
– exhaust valve ..... 7.70 mm
Width of cam, 4V engines ..... 19.70...20.30 mm
Camshaft max. permissible deflection (total indicator reading) ..... 0.03 mm

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Crankshaft

Crankpin diameter:	
– standard	67.981...68.000 mm
– 1st undersize 0.25 mm	67.731...67.750 mm
– 2nd undersize 0.50 mm	67.481...67.500 mm
– 3rd undersize 1.00 mm	66.981...67.000 mm
– 4th undersize 1.50 mm	66.481...66.500 mm
Crankpin length	40.000...40.160 mm
Main bearing journal diameter (66–engines):	
– standard	84.985...85.020 mm
– 1st undersize 0.25 mm	84.735...84.770 mm
– 2nd undersize 0.50mm	84.485...84.520 mm
– 3rd undersize 1.00 mm	83.985...84.020 mm
– 4th undersize 1.50 mm	83.485...83.520 mm
Main bearing housing diameter (in cylinder block)	91.000...91.025 mm
Main bearing journal diameter (74–engines):	
– standard	89.985...90.020 mm
– 1st undersize 0.25 mm	89.735...89.770 mm
– 2nd undersize 0.50 mm	89.485...89.520 mm
– 3rd undersize 1.00 mm	88.985...89.020 mm
– 4th undersize 1.50 mm	88.485...88.520 mm
Main bearing housing diameter (in cylinder block)	96.000...96.025 mm
Main bearing shell thickness:	
– standard	2.955...2.965 mm
– 1st undersize 0.25 mm	3.080...3.090 mm
– 2nd undersize 0.50 mm	3.205...3.215 mm
– 3rd undersize 1.00 mm	3.455...3.465 mm
– 4th undersize 1.50 mm	3.705...3.715 mm
– bearing 8361 40950 (see instruction 5 B)	3.705...3.715 mm
Main bearing clearance	0.050...0.127 mm
Length of thrust bearing journal (journal nearest to flywheel):	
– standard (2 standard thrust plates)	45.000...45.080 mm
– 1st oversize (one std and one 0.1 mm overthick thrust plate)	45.100...45.180 mm
– 2nd oversize (one std and one 0.2 mm overthick thrust plate)	45.200...45.280 mm
– 3rd oversize (one 0.1 mm and one 0.2 mm overthick thrust plate)	45.300...45.380 mm
– 4th oversize (two 0.2 mm overthick thrust plates)	45.400...45.480 mm
Other crankshaft journals cannot be ground longer.	
Crankshaft end float	0.100...0.380 mm
Max. permissible ovality and other deformity of crankpins or journals	0.03 mm
Crankshaft unbalance	1.0 Ncm max
Number of teeth on trigger wheel	60–2

Flywheel

Interference fit between ring gear–flywheel	0.425...0.600 mm
Before fitting the ring gear, heat up to a temperature of	150...200˚C
Flywheel unbalance	1.0 Ncm max.
Max. permissible axial wobble of flywheel clutch face, measured at inner edge of clutch face on diameter 200	0.06:ø200

Timing gears

Tooth backlash	0.05...0.25 mm
Max. permissible side wobble of gears	0.05 mm
Idle gear (slide bearing, 50.7 mm length shaft)	
– Idler gear shaft, diameter	55.151...55.170 mm
– Inner diameter of idler gear bushing (fitted)	55.200...55.230 mm
Inner diameter of idler gear hole	60.000...60.030 mm
Timing marks:	
Timing marks on gears are in alignment when the 1st cylinder piston is at its top, dead centre between compression and power strokes.	
On crankshaft gear	2 dots on tooth
On idler gear:	
– against crankshaft gear mark	1 dot on tooth
– against camshaft gear mark	1 dot on tooth
On camshaft gear	1 dot on notch

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Connecting rod

Big–end bearing shell thickness:	
– standard	1.835...1.842 mm
– 1st undersize 0.25 mm	1.960...1.967 mm
– 2nd undersize 0.50 mm	2.085...2.092 mm
– 3rd undersize 1.00 mm	2.335...2.342 mm
– 4th undersize 1.50 mm	2.585...2.592 mm
Big–end bearing clearance	0.046...0.098 mm
End float (side clearance) at big–end on crankshaft	0.200...0.410 mm
Piston pin bushing location perpendicular to longitudinal axis of connecting rod to be within	0.15:100
Piston pin bushing location and big–end bearing location to be parallel to within	0.05:100
Max. permissible weight difference between connecting rods in the same engine	20 g
Weight marking (letter) at lower end.	

66– and 74–Engines

Inside diameter of piston pin bush (with bush pressed into connecting rod)	40.025...40.040 mm
Outside diameter of piston pin bush (std)	44.080...44.120 mm
Outside diameter of piston pin bush (oversize 8353 28326)	44.580...44.620 mm
Interference fit: connecting rod small end bushing–connecting rod	0.057...0.120 mm
Connecting rod small end bore	44.000...44.025 mm
Connecting rod small end bore (oversize bush)	44.500...44.525 mm
Connecting rod big–end bore	71.730...71.749 mm

Piston, rings and pin

Piston diameter:	
– 17 mm from lower edge (66– engines)	107.883...107.897 mm
– 19 mm from lower edge (74– engines)	107.893...107.907 mm
Pin bore in piston	40.003...40.009 mm
Piston pin diameter	39.991...40.000 mm
Width of ring grooves:	
– 1st groove	wedge shaped ring
– 2nd groove	2.520...2.540 mm
– 3rd groove	4.040...4.060 mm
Side clearance of piston rings in their grooves:	
– 1st ring	wedge shaped ring
– 2nd ring	0.03...0.062 mm
– 3rd ring	0.05...0.082 mm
– Reject limit	0.15 mm
Piston ring height (in direction of cylinder):	
– 1st ring	wedge shaped ring
– 2nd ring	2.478...2.490 mm
– 3rd ring	3.975...3.990 mm
Piston ring gap (with piston fitted in cylinder):	
– 1st ring	0.40...0.55 mm
– 2nd ring	0.60...0.80 mm
– 3rd ring	0.30...0.60
– Reject limit 1st and 3rd ring	1.0 mm
– Reject limit 2nd ring	1.5 mm
Max. permissible weight difference between pistons in same engine	25 g
Piston must be heated up to 100˚C before fitting gudgeon pin.	

Lubricating system

Engine lubrication	Gear type pump – strainer on suction side and replaceable filter on pressure side
Oil filter	disposable type filter element
Oil volumes and qualities	See code 130
Oil pressure at normal running temperature:	
– at idling speed (min.)	1.0 bar
– at running speed	2.5...5.0 bar
Oil pressure regulating valve (66– and 74–engines):	
Free length of oil pressure valve spring (identification = yellow dot)	49.3...50.8 mm
Assembly length / load of oil pressure valve spring	28.5 mm / 127 N
Oil filter by–pass valve opens at a pressure difference of	2 ± 0.5 bar

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Oil pump, 66– and 74–engines

Backlash between gears when crankshaft lies firmly against the lower side of the main bearings:
– crankshaft gear–lubricating oil pump gear ..... 0.05...0.25 mm
– between the pump gears ..... 0.16...0.26 mm
Diameter of drive shaft at bearings for body and cover ..... 17.966...17.984 mm
Diameter of drive shaft bearing hole on body and cover ..... 18.000...18.018 mm
Inner diameter of bearing for gear wheel which rotates on fixed shaft ..... 18.000...18.018 mm
Diameter of fixed shaft at gear wheel ..... 17.966...17.984 mm
Fixed shaft in pump body, diameter ..... 20.035...20.048 mm
Protrusion of fixed shaft end below pump body face ..... 0.5 mm
Thickness of cover gasket ..... 0.06...0.08 mm
Outer diameter of gear wheels ..... 55.824...55.870 mm
Housing diameter ..... 56.000...56.120 mm
Thickness of gears ..... 32.000...32.027 mm
End play of gears ..... 0.03...0.11 mm
Depth of housing ..... 32.000...32.043 mm

Coolant pump, 66– and 74–engines

Outside diameter of bearing ..... 72 mm
Diameter of bearing housing ..... 71.961...71.991 mm
Diameter of the water seal recess in the pump body ..... 39.981...40.019 mm
Shaft diameter at bearing ..... 30.002...30.015 mm
Shaft diameter at impeller ..... 15.907...15.920 mm
Impeller hole diameter ..... 15.876...15.894 mm
Distance between impeller blade and housing ..... 0.7 mm
Balancing precision of fan ..... 0.3 Ncm max

Pump Equipped with Reinforced Bearing

Outer diameter of the front bearing 95 mm:
Bearing up diameter in water pump wheel ..... 94.965...95.000 mm
Outer diameter of bearings position in pump frame ..... 60.002...60.021 mm
Outer diameter of the front bearing 120 mm:
Bearing up diameter in water pump wheel ..... 119.965...120.000 mm
Outer diameter of bearings position in pump frame ..... 65.002...65.021 mm
Outside diameter of rear bearing ..... 52 mm
Diameter of bearing housing ..... 51.979...52.009 mm
Diameter of the water seal recess in the pump body ..... 36.450...36.489 mm
Shaft diameter at rear bearing ..... 20.002...20.015 mm
Shaft diameter at impeller ..... 15.907...15.920 mm

Turbocharger

Schwitzer

	S100	S200	S300
Axial clearance max.	0,10 mm	0,10 mm	0,12 mm
Radial clearance (compressor end) max.	0,82 mm	0,88 mm	0,88 mm
Compressor wheel locknut torque	6,8 Nm	13,6 Nm	20,3 Nm
Compressor housing screws torque	13,6 Nm	13,6 Nm	13,6 Nm
Turbine housing screws torque	21,0 Nm	21,0 Nm	21,0 Nm

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Tightening torques

Object	Nm
Cylinder head bolts and nuts	80 Nm + 90° + 90°
Cylinder head studs to cylinder block	30
Main bearing screws	200
Connecting rod screws	40 Nm + 90°
Crankshaft nut, 66/74	1000
Crankshaft pulley screws	30
Flywheel housing screws:	
– M12	150
– M10	80
Flywheel screws	150
Idler gear screws, 66:	
– M10	60
– M14	200
Idler gear screws (with ball bearing), 66/74:	
– M14	180
– M8	32
Double idler gear:	
– M12 screw	120
– M14 nut	140
Camshaft gear nut	200
Rocker arm shaft bracket screw and nuts	45
Valve cover and frame screws	25
Piston cooling valve	30
Oil pump retaining screws	60
Oil sump drain plug M18	80
Oil cooler connecting piece	60
Coolant pump pulley nut	120
Belt tightener screw	48
Exhaust manifold screws	50

Always use the torque values listed in the following tables when specific torque values are not available.
Use a washer with the aluminium parts.

Thread	Strength class	
	8.8	10.9
M8	25 Nm	35 Nm
M10	50 Nm	75 Nm

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General

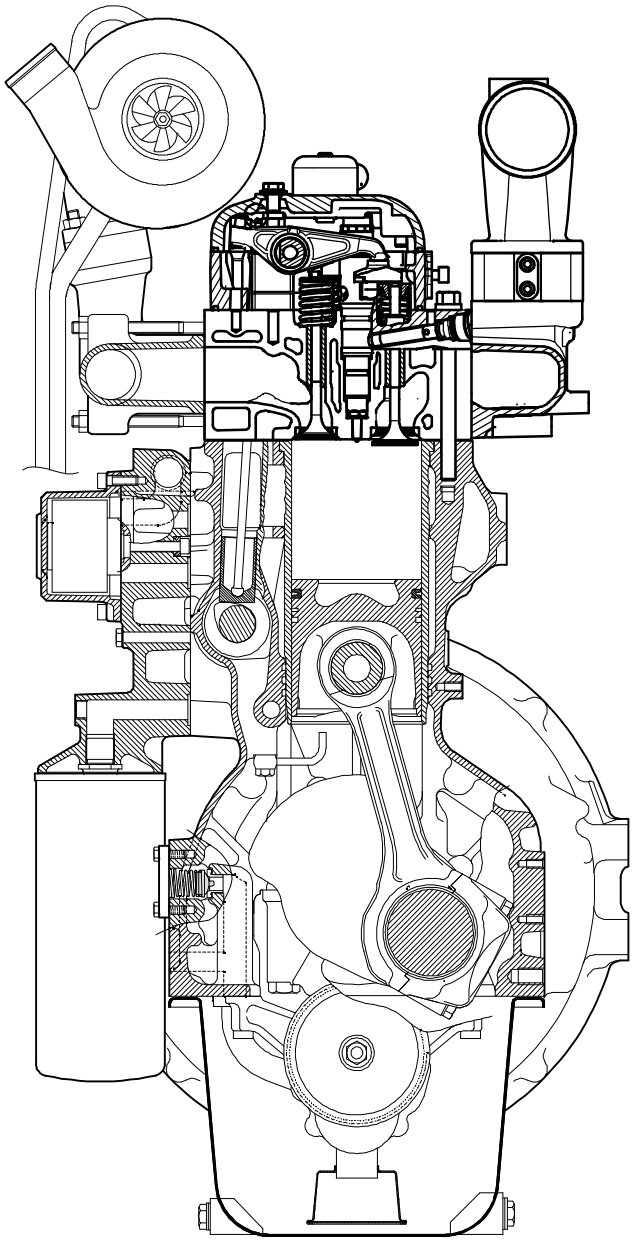


fig004

The engines consists of water–cooled in–line diesel engines with four and six cylinders. The turbocharged engines are equipped with wet, changeable cylinder liners.

All the engine types have a rigid and ribbed cylinder block. The crank mechanism is designed for supercharging. The cylinder liners are wet and supported at the middle. The cylinder head bolts are high tensile bolts.

Cylinder block

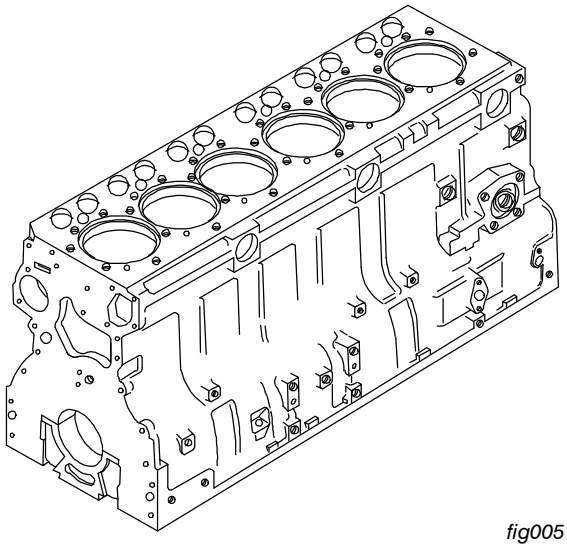


fig005

The cylinder block is the main body of the engine, to which other engine parts are attached. Wet and replaceable cylinder liners are supported at the middle, which reduces vibrations and directs coolant circulation mainly to the upper part of the liners.

In 66– and 74–engines, the seal between the lower part of the cylinder liner and the cylinder block is achieved by three O–rings, which are fitted in grooves in the liner. The upper part is sealed by the cylinder head gasket.

The camshaft is located in the cylinder block. The 66– and 74–engines have separate bearing sleeves in all camshaft bearing locations. The drilling for the camshaft rear end is covered with a plug.

There are spaces on both sides of the rear main bearing for guide bearing shims (the crankshaft thrust bearings).

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Flywheel housing

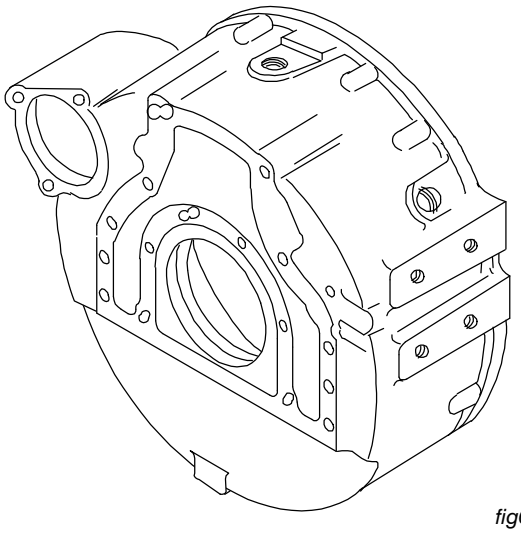


fig006

The flywheel housing is fitted at the rear end of the cylinder block. The seal for the crankshaft rear end is placed in a bore in the housing. The starter motor fixing point is fitted in the flywheel housing.

The lower face of the flywheel housing functions as a sealing surface for the oil sump gasket. This means that the lower face of the cylinder block must be level with the flywheel housing. When fitting the flywheel housing, its position is determined by tension pins.

The flywheel housing is delivered according to the requirements set by the engine model and different flywheel housings can be mounted on all engine types.

Cylinder head

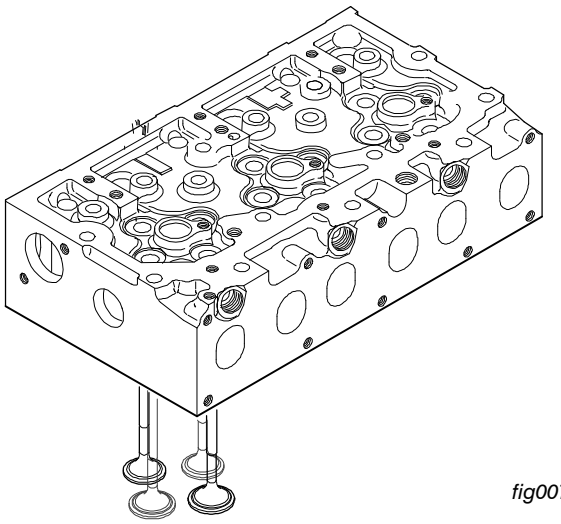


fig007

66–and 74–engines have two cylinder heads. Every cylinder has four valves. There is a place for the injector in the middle of four valves. The injector is located vertically in the centre of the cylinder and in the middle of the combustion chamber. This ensures accurate and homogenous mixing of fuel and air and leads to clean and low emission combustion with good efficiency.

Each cylinder has its own inlet and exhaust ports located on either side of the head. Every inlet valve has its own inlet port but there is only one exhaust port for every two of the cylinder's exhaust valves. There are no water holes on the inlet side of the cylinder head. This eliminates the possibility of water entering the inlet air.

Cylinder head bolts are high tensile bolts, which are tightened up to yield limit using the angle tightening method. Due to the large stretch, the tightening forces are kept constant during the whole lifetime and retightening is unnecessary.

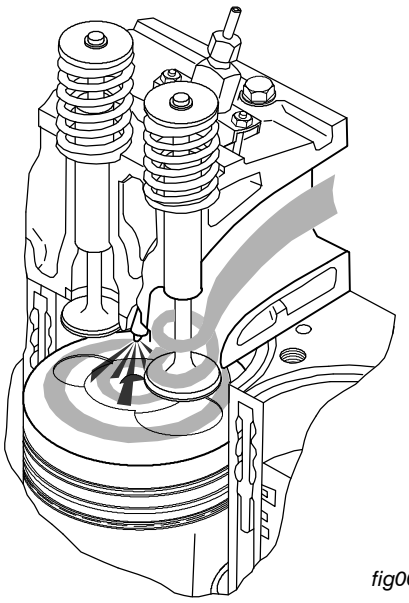


fig008

The injector and its side feeding pipe locations are machined directly into the cylinder head. The port for the side feeding pipe is located between the inlet ports. The inlet and exhaust valve guides are identical and can be interchanged. Exhaust valves are fitted with separate valve seat rings. The engines with high output are also equipped with separate inlet valve seats.

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Valve mechanism

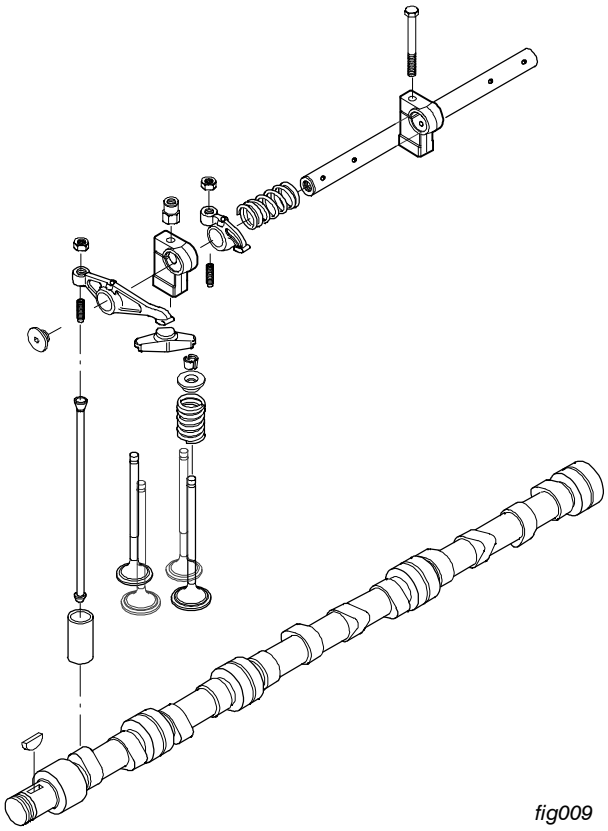


fig009

The valve mechanism is operated by the camshaft which is located in the cylinder block. The drive is transferred with the help of tappets and push rods. The camshaft gear wheel is fitted with a nut and guided with a key. Each bearing is lubricated by the force feed lubrication system through drilled oilways in the cylinder block.

Crank mechanism

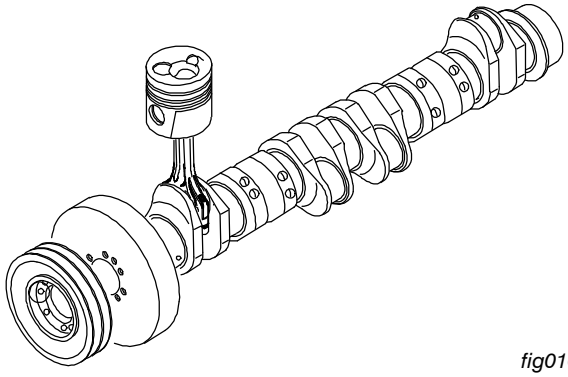


fig010

The crankshaft is forged from chrome alloy special steel and is induction hardened at the bearing and sealing surfaces. This makes it possible to grind bearings four times without a new heat treatment. Gear wheels are located at the front end of the crankshaft. They are a press fit, and drive the idler wheel and oil pump. In addition, the front end of the crankshaft has splines for the hub of the V–belt pulley. The hub of 74–engines is fastened to the crankshaft with a cone joint. An oil deflector ring is fitted between the hub and gear wheel.

The crankshaft is supported on the cylinder block by main bearings, which are placed on both sides of each cylinder. There is therefore one main bearing more than there are cylinders. The crankshaft thrust washers are placed in both sides of the rearmost main bearing.

A flywheel, on which there is a press–fit starter ring gear, is fitted at the rear end of the crankshaft.
The forged connecting rod has an I–cross–section. The bearing location at the bottom end of the connecting rod is fracture–split, and the bearing cup is secured by two special elongated screws.

The upper part has a wedge–shaped bearing location, in which the piston pin bearing bushing is fitted with a press fit. The piston is made of a eutectic aluminium alloy. In the upper face of the piston there is a combustion chamber. The shape of the chamber is intended to maximise the mixture of air and fuel. The upper ring location is formed in a cast iron ring, which is cast in the piston. In addition, the piston is graphite–coated to ensure correct running–in.

The piston has three rings. The upper molybdenum–coated ring has a wedge–shaped cross–section. On some slightly supercharged engines the upper ring is right–angled. The middle ring is tapered and it fits into its groove. The taper takes up the clearance. The oil control ring is spring–loaded and it has a twostage, chromed scraping edge.

Some four–cylinder engines are equipped with a balancer unit. The eccentric weights, which rotate at twice the engine speed, even out the vibration forces exerted by the movement of the pistons and the crank mechanism.

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Timing gears

The timing gear drives the camshaft, high–pressure pump and oil pump. The timing gear train consists of hardened, helically cut gear wheels. The gear of the high–pressure pump is spur–geared and it is driven by a double idler gear. The gears are encased by the timing gear casing, which is fitted to the front of the engine.

If the engine is equipped with a hydraulic pump, it is driven via a gear or a separate drive unit.

The idler gear is supported with a bearing sleeve / ball bearing (66– and 74–engines) on the shaft on the front face of the cylinder block. Two different dimensions of gear and shaft are used.

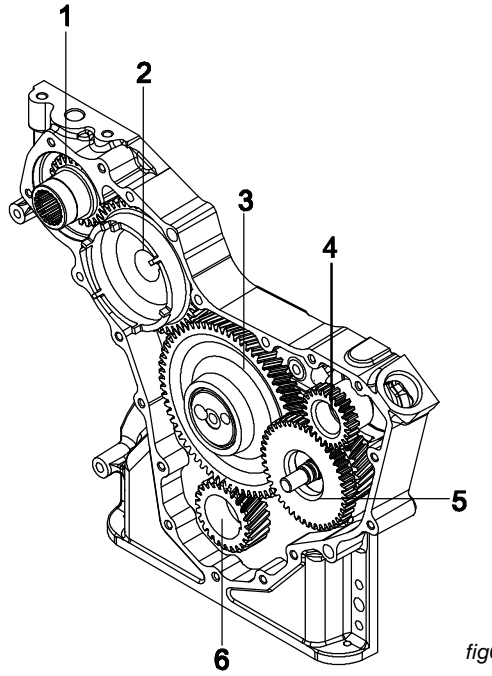


fig011

1. P.T.O. gear
2. Camshaft gear
3. Idler gear
4. High–pressure pump gear
5. Double idler gear
6. Crankshaft gear

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Lubricating system

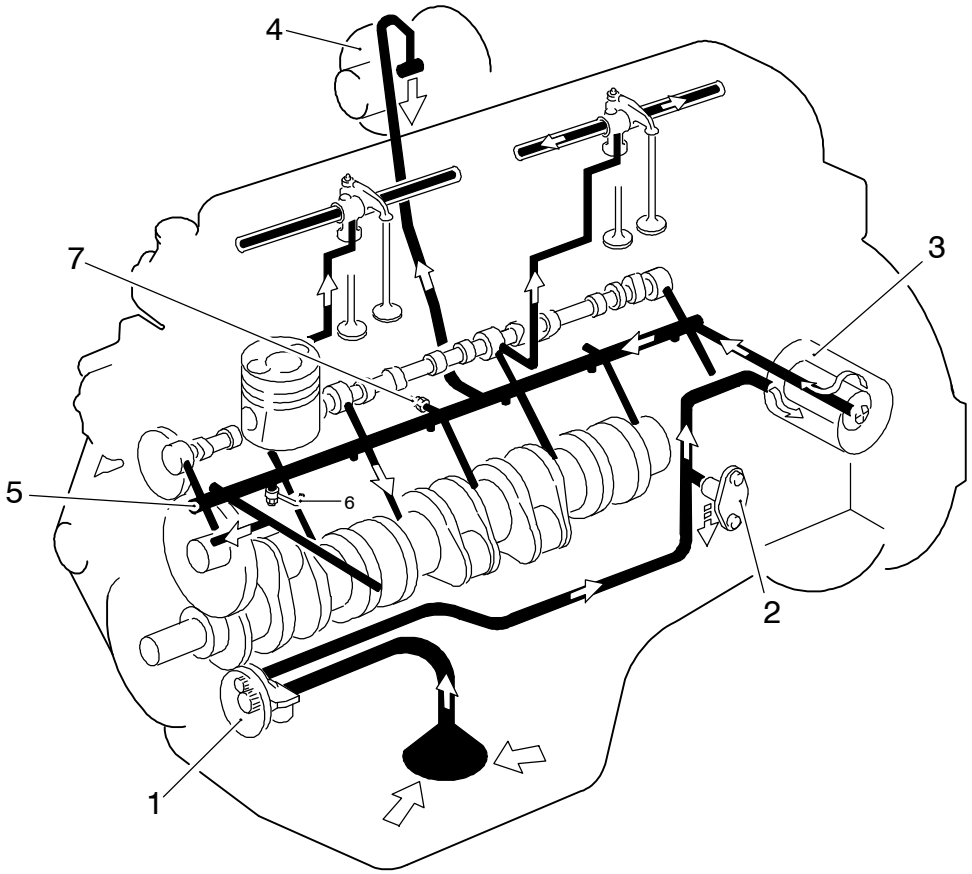


fig012

Lubricating system (66– and 74-engines)
1. Oil pump
2. Oil pressure regulating valve
3. Oil filter
4. Turbocharger
5. Main oil gallery
6. Piston cooling nozzle
7. Oil pressure sensor

The engine has a pressure lubricating system in which the oil pump (gear pump) is attached to the lower face of the cylinder block. The oil is sucked up by the pump through a suction strainer. After the pump, the oil is led through an oilway to the oil pressure regulating valve and via the oil cooler to the oil filter. After the filter, the oil is led through the main oil gallery from which oilways branch out. The oil is led through the oilways in the main bearings and through the crankshaft to the bigend bearings.

The oil is further directed from the main gallery to accessory equipment, turbocharger and, if applicable, to a compressor. In addition, the camshaft bearing points and the valve mechanism get their lubrication oil via the main oil gallery.

The undersides of the pistons of the engines with high output are always cooled by the oil spray when the oil pressure is more than 3 bar.

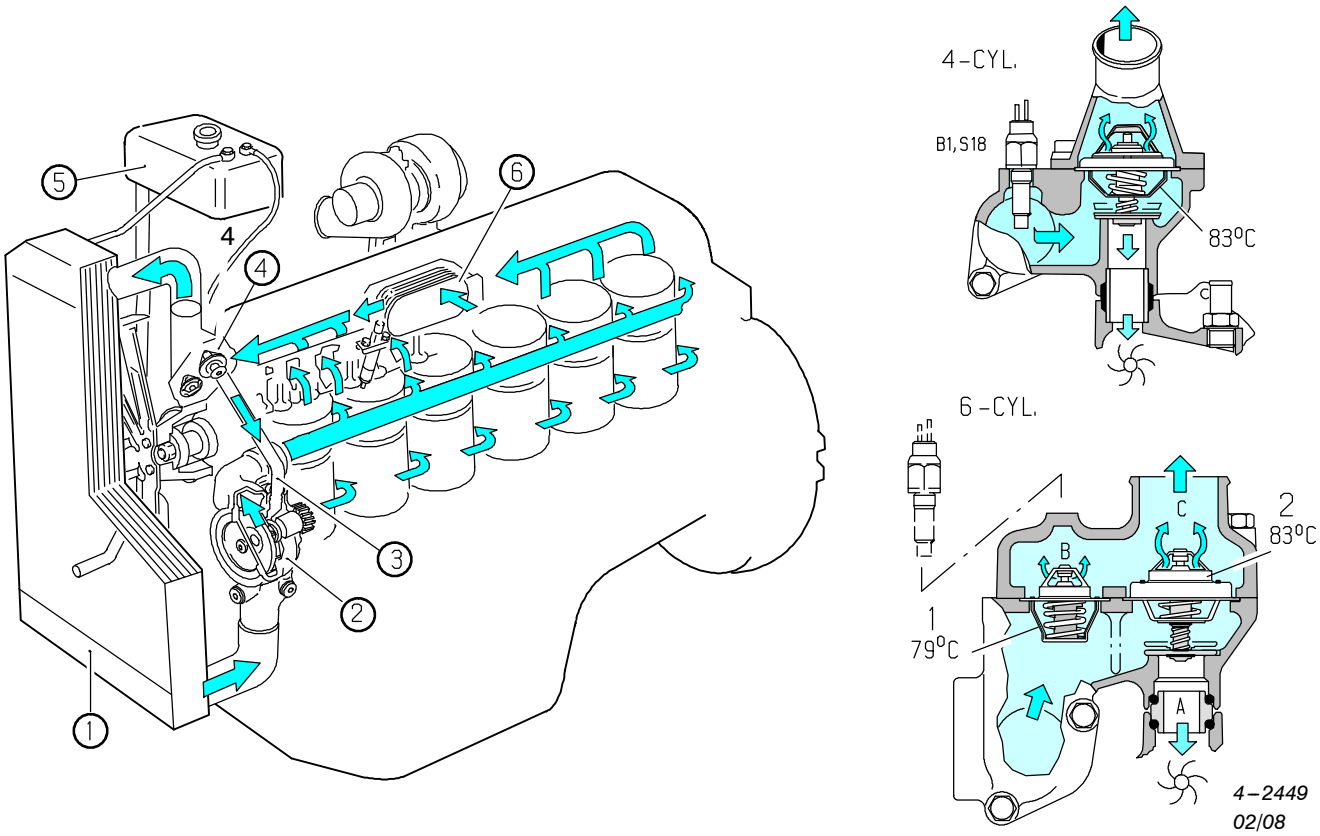
The oil pressure regulating valve is located under the oil filter on the left side of the engine. The regulating valve keeps the oil pressure constant, independent of the engine speed. At working speed, the oil pressure is 2.5 to 5 bar depending on the temperature and the quality of the lubricating oil. At idling speed, the pressure is 1.0 bar minimum.

The oil filter is of main flow type. It has a replaceable cartridge mounted on the left side of the engine. At the bottom of the oil filter cartridge there is a by–pass valve for cold start or clogging of the filter.

Some engine types are equipped with an oil cooler located between the cylinder block and the oil filter. All the oil that circulates through the filter also goes through the cooler and is cooled by the engine coolant circulating in the oil cooler.

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Cooling system



1. Radiator
2. Coolant pump
3. Bypass pipe
4. Thermostats
5. Expansion tank
6. Oil cooler

Operation ..... Centrifugal pump, pressurized radiator with expansion tank, regulated by pressure cap
Thermostat ..... 2 thermostats: 79˚C and 83˚C
Fan, belt driven: ..... The Visco fan automatically switches on and off according the cooling temperature (55˚C)

The coolant pump is attached to the front face of the cylinder block and the thermostat housing is mounted above it.

In 6–cylinder engines there are two separate thermostats. One of them is steering the bypass flow of the coolant. This arrangement ensures a steady warming-up of the engine under all conditions. The thermostats differ in types and opening temperatures.

When the coolant temperature is below the thermostat opening temperature the coolant (A) circulates through the bypass hole into the coolant pump. The smaller, single–acting thermostat (1) opens first (at 79°C) letting some of the coolant (B) into the radiator.

Following the load increase, the other thermostat (2) opens (at 83°C). This thermostat is of a double-acting type and it closes the bypass hole when it opens and directs the coolant (C) into the radiator. These engine models do not have any separate winter-type thermostats.

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Inlet and exhaust system

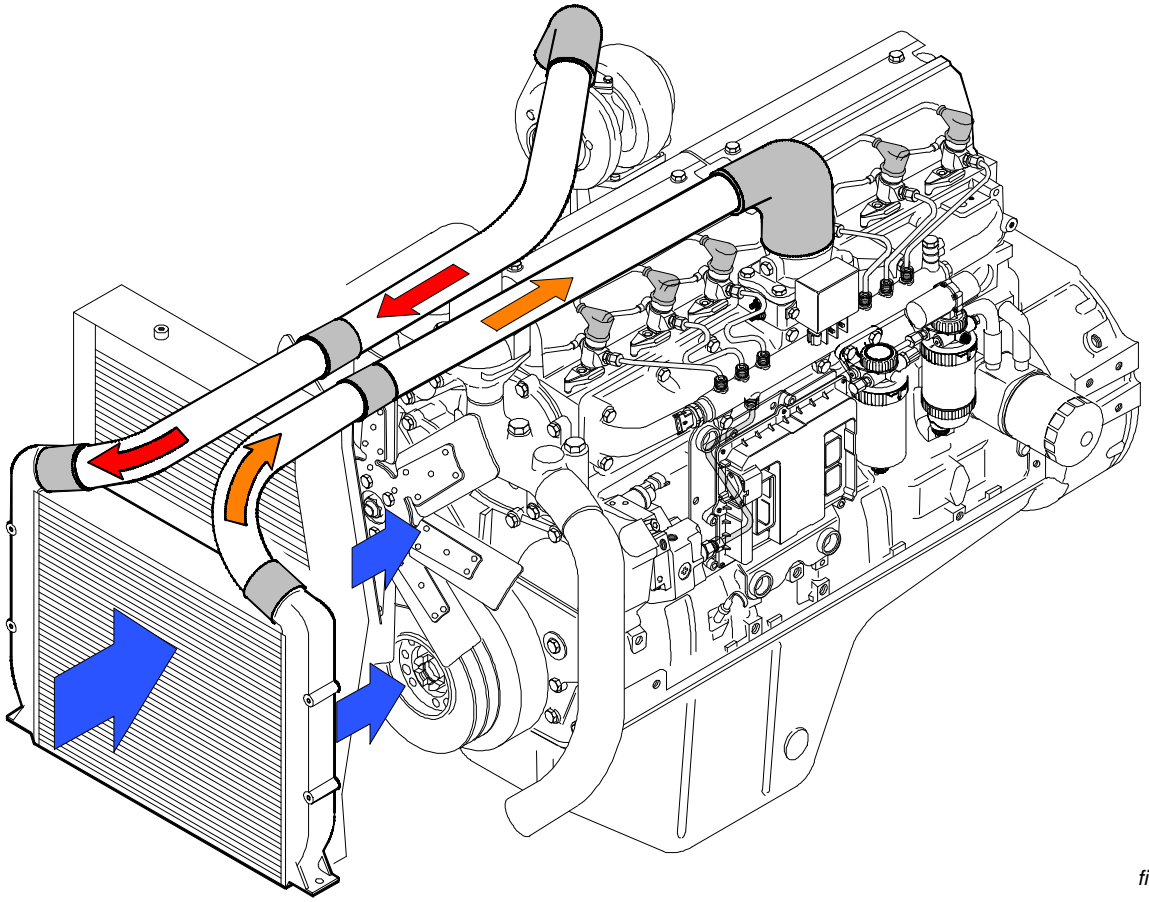


fig015

The filter system for the engine inlet air comprises a cyclone type pre–cleaner, and a paper filter which acts as the main filter. The incoming air is made to rotate in the cyclone pre–cleaner. This causes most of the impurities to settle out and collect in the cyclone pre–cleaner dust collector. The paper filter comprises one or two replaceable filter elements. The paper is corrugated and surrounded by a metal support.

The impurities in the air collect at the larger filter element, which can be cleaned when necessary.
The inner safety filter prevents impurities form entering the engine should the main filter element break, or be fitted incorrectly.

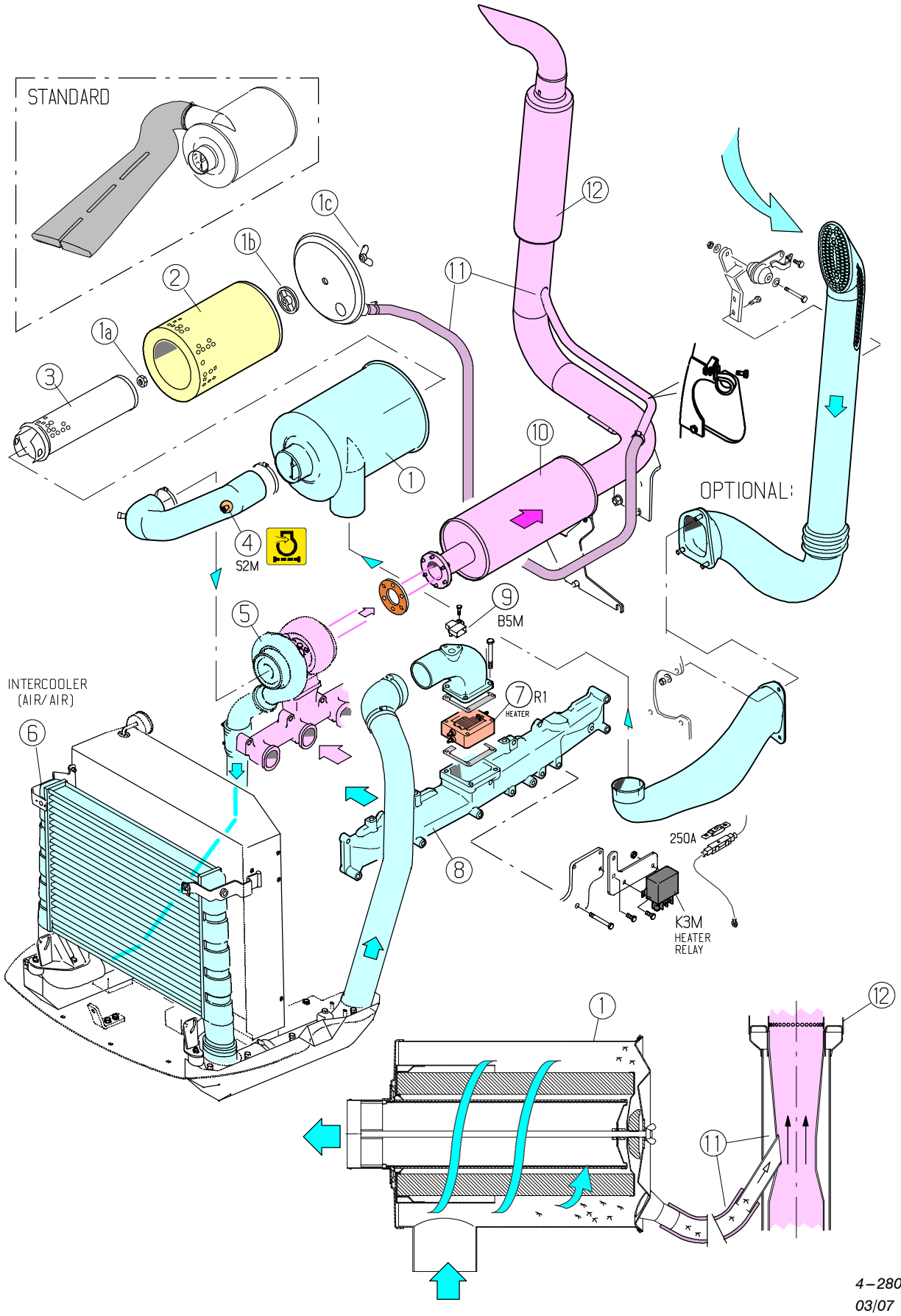
A mechanical or electrical service indicator can be mounted on the filter housing or on the inlet pipe to show when the filter cartridge is clogged. The inlet system also includes the hoses between the air cleaner and the turbocharger and between the turbocharger and the intake manifold.

The exhaust manifold is attached to the cylinder head with high tensile bolts without a separate gasket.
Retightening of the manifold bolts is unnecessary.

The turbocharger is a turbo–compressor driven by exhaust gas. The compact design of the turbocharger is fast to react even during low revolutions. The turbocharger is lubricated and cooled by the lubrication system of the engine. The CWA–engine is equipped with a by–pass turbocharger in which excessive air pressure is adjusted by a ”by–pass channel”. The boost pressure is adjusted correctly by the manufacturer, and must not be changed afterwards.

The compressed air is cooled on an air–to–air basis. The air coming from the turbocharger has a temperature of about 150˚C and is cooled by the cooling air of the engine. The intercooler’s cell is ideally installed in front of the radiator or side–by–side with the radiator. The cooling of the compressed air stabilises the combustion, irrespective of the temperature, and minimises the thermal and mechanical load of the engine thus lowering nitric oxides (NOx) and particles (PT). Certain engine versions can also be equipped with an air–to–water intercooler. In that case, the engine specification is CTI.

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1. Air filter housing
   1a) nut
   1b) fastener
   1c) nut
2. Main air filter
   Change:
   – At least once a year
   – Every 1000 hours
   – After 5 cleanings, when the indicator light for the air cleaner has illuminated 5 times
3. Safety filter
   The safety filter protects the engine if the main filter should become damaged. The safety filter must not be cleaned, it should always be replaced. Take the greatest possible care when removing the safety filter so that no dirt enters the induction pipe.
   Change:
   – At least once a year
   – After every 1000 hours
4. Low–pressure indicator (S21)
   When the lamp lights up on the instrument panel, the filter must be cleaned. If the warning light illuminates quickly in dusty conditions, check the ejector pipe is fitted properly.
5. Turbo
6. Intercooler
7. Engine intake air heater
8. Intake manifold
9. Boost pressure sensor (B3M)
10. Silencer
11. Ejector + hose
12. Exhaust pipe

Cleaning:
Always stop the engine before cleaning. A blockage of the air filter is indicated by a change of the engine beat, smoky exhaust and reduction of engine power.

– Check the inside of the air cleaner housing and the inlet pipe. Dirt on these parts indicates that the filter element is defective or has not been fitted properly.
– Clean the filter element with compressed air, max. pressure 500 kPa (5 bar = 73 lbf/in^2), or with an effective vacuum cleaner.

Important: Hold the filter element up against the light (or shine a flashlight through the centre hole) and inspect the element. If any holes are noticed the filter element must be changed.

Filter fitting:

– Check that seals are in good condition and the sealing surfaces are clean.
– Fit the safety filter (**3**) and make sure that it is correctly positioned in the housing. Tighten the nut (**1a**) to hold it in place.
– Fit the main filter and make sure that it is correctly positioned in the housing. Tighten the fastener (**1b**) of the filter until the filter comes into contact with the end of filter housing.

Do not over tighten the nut (**1c**) on the air cleaner housing (approx 1–1.5 turns after the flange seal has come into contact with the surface of the housing). The cover of the housing must be mounted so that the ejector pipe (**11**) is in the lower position.

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Special tools

Cylinder block and cylinder liners (code 215.1)

	Order no	Description
1.	9051 73100	Puller for cylinder liner
2.	9025 87400	Drift for fitting camshaft cup plug
3.	9101 65600	Milling cutter for cylinder liner seat
	9045 87600	Spare cutting blade for milling cutter
4.	9101 66300	Press tool for cylinder liner
5.	9025 79200	Holder for dial gauge
6.	9052 46620	Drift for 40 mm cup plug
7.	9052 46650	Drift for 16 mm cup plug

Timing gears and flywheel housing (codes 215.2 and 215.8)

8.	9052 46400	Centring tool for flywheel housing
9.	9025 98700	Drift for tension pins in timing gear- and flywheel housing
10.	9052 46300	Drift for fitting rear crankshaft seal
11.	9201 30270	Centring tool for idler gear, narrow timing gear housing
12.	9025 98800	Drift for tension pins in timing gear housing
13.	9030 15200	Drift for fitting front crankshaft seal

Cylinder head and valve mechanism (codes 215.3 and 215.4)

14.	9052 47200	Counter nut for lever above
15.	9101 66200	Lever for compressing valve spring
16.	9120 85400	Milling tool for injector seat, 4V engines
17.	9120 85300	Drift for removing valve guide, 4V engines
18.	9120 85000	Drift for fitting valve guide, 4V engines
19.	9103 94800	Drift for 45 mm cup plug
20.	8370 62635	Milling cutter kit for valve seat, 4V engines
21.	9101 66100	T-handle for valve seat milling cutter
22.	9101 71100	Milling cutter for facing exhaust valve seat
23.	9101 65502	Milling cutter for exhaust valve seat
24.	9101 65503	Inner milling cutter for exhaust valve seat
25.	9101 75800	Milling cutter for facing inlet valve seat
26.	9101 65505	Milling cutter for inlet valve seat
27.	9101 65506	Inner milling cutter for inlet valve seat
28.	9052 46660	Drift for 36 mm cup plug

Crankshaft (code 215.5)

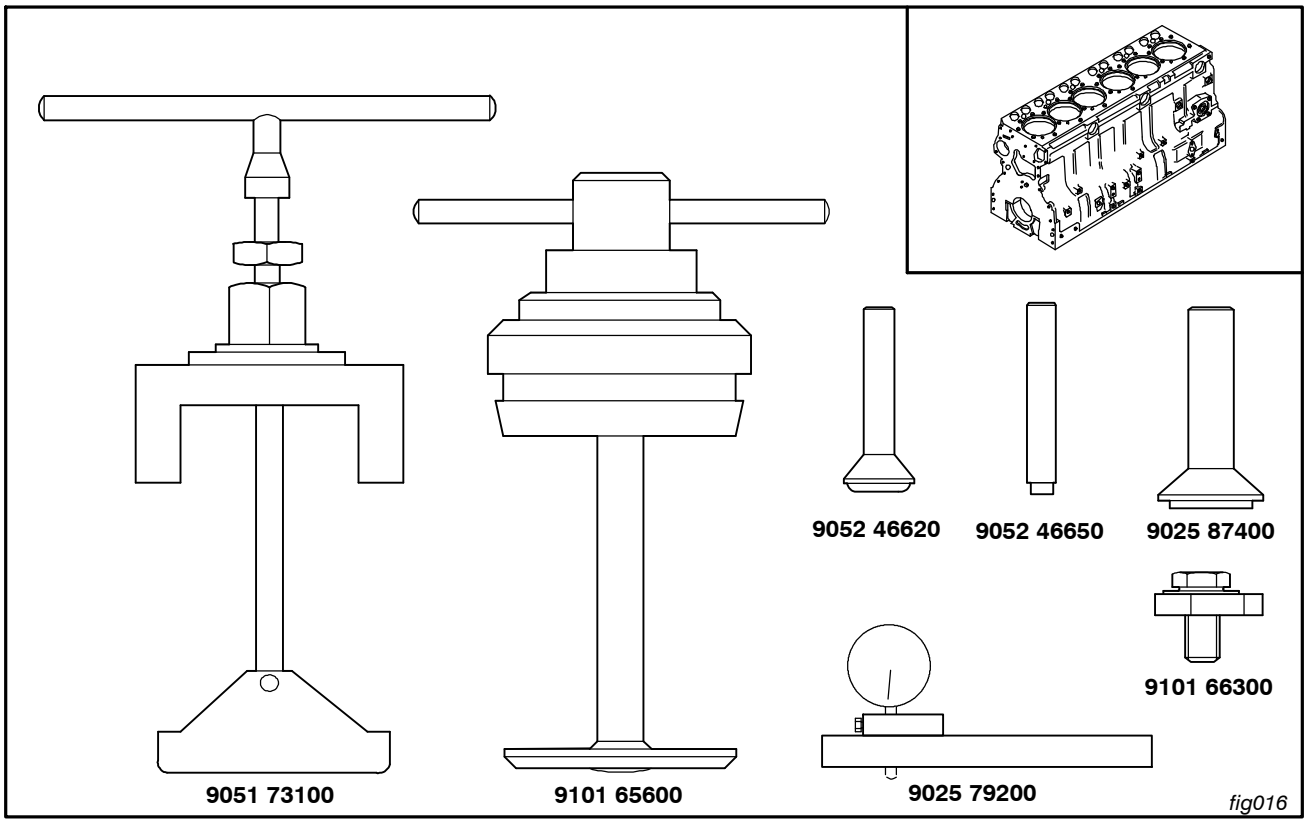
29.	9052 48800	Puller for crankshaft gears
30.	9103 94700	Drift for fitting crankshaft gears
31.	9101 65700	Spanner for crankshaft nut
32.	9024 55800	Spanner for crankshaft nut
33.	9104 53300	Puller for crankshaft hub

Connecting rods and pistons (code 215.6)

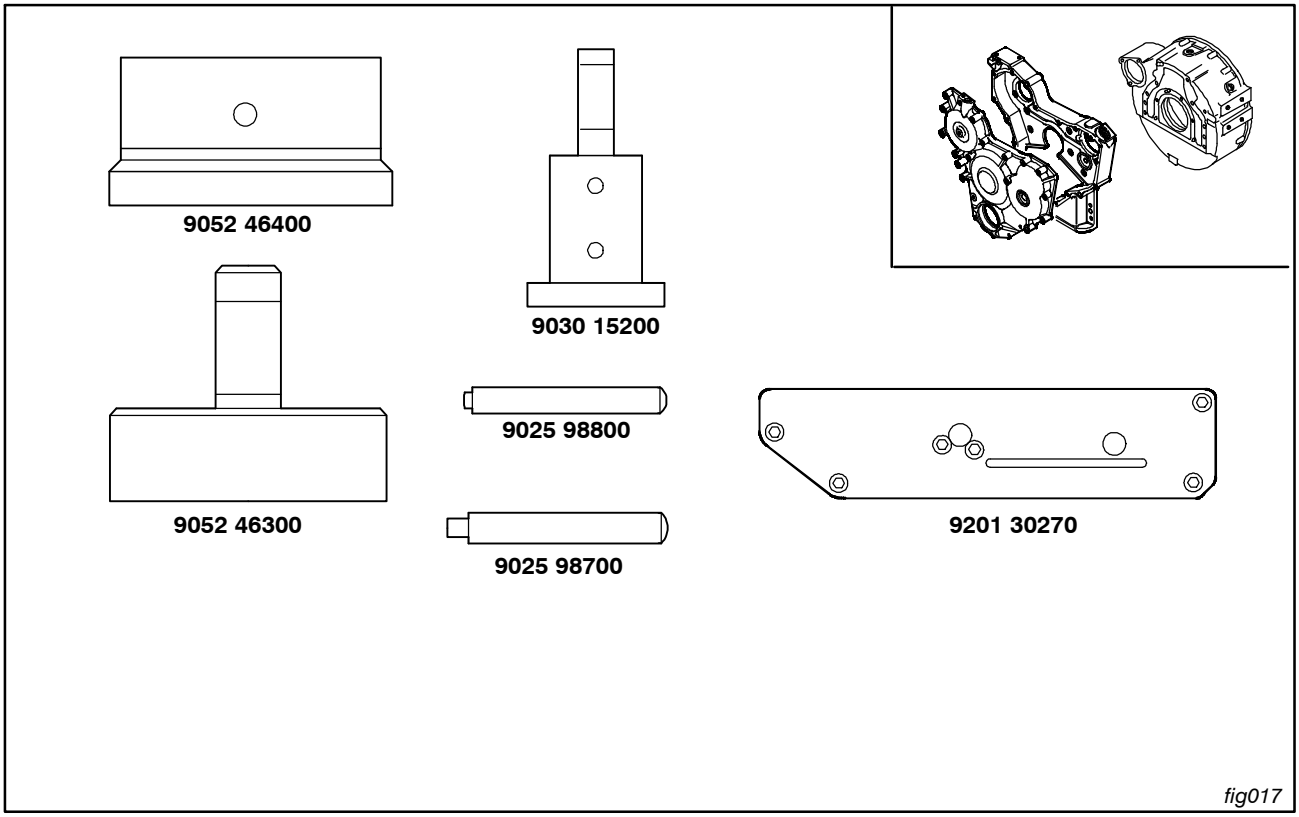
34.	9020 01100	Conical sleeve for fitting pistons
35.	9052 46900	Piston ring pliers

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Cylinder block and cylinder liners

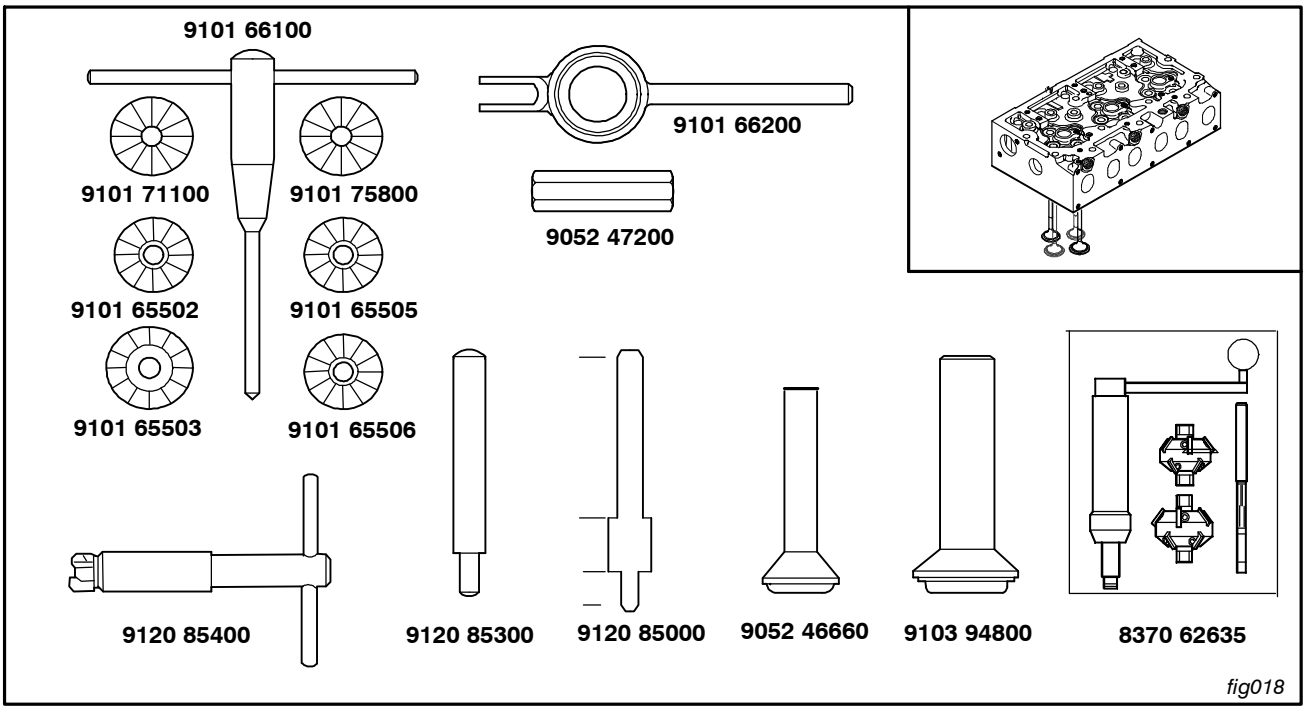


Timing gears and flywheel housing

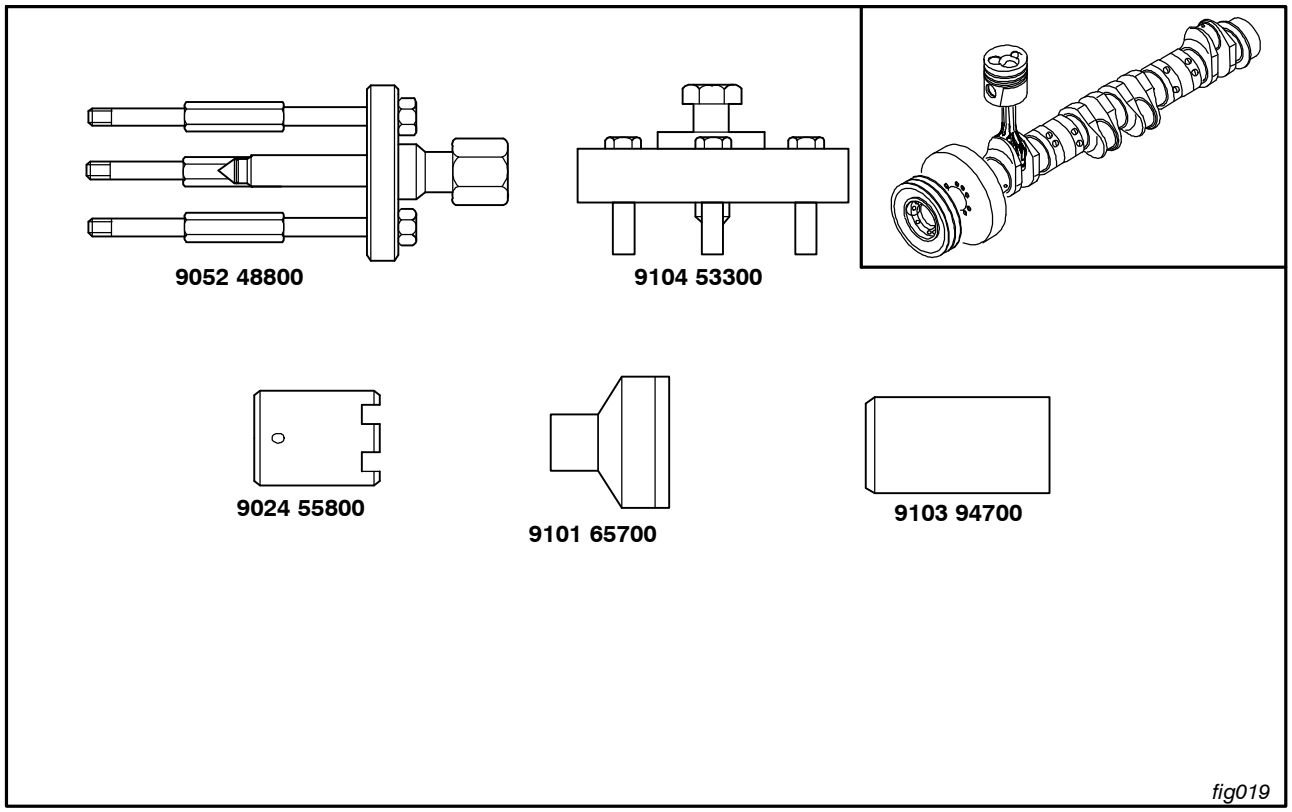


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Cylinder head and valve mechanism

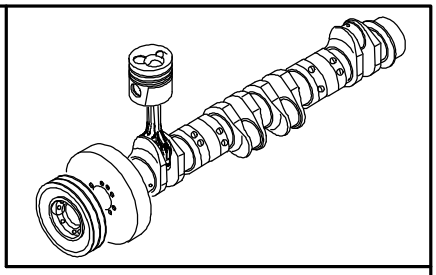


Crankshaft



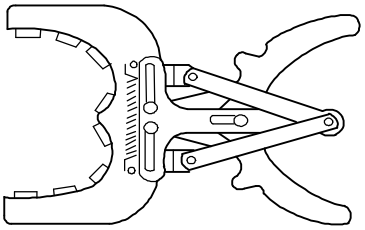
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Connecting rods and pistons





9020 01100



9052 46900

fig020

Cylinder block and cylinder liners

Measuring cylinder liner wear

1. Using a micrometer, set the dial gauge to zero using a new cylinder liner indicating the initial dimension of the bore. See **code 211.1 "Technical data"**, point **"Cylinder liners"**.
2. Clean the inner surface of the cylinder liner thoroughly before measurement.

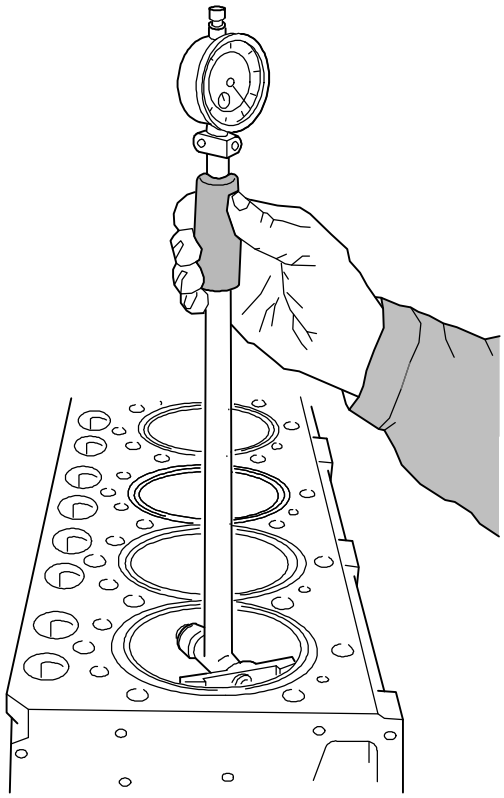


fig021

3. Perform the measurement crosswise at the top end, lower end and middle of the liner.
4. Check the gauge reading for maximum wear and ovalness (compare with rated).

Removing cylinder liner

1. If the cylinder liners are to be used again they should be marked so that they can be fitted in the same position.

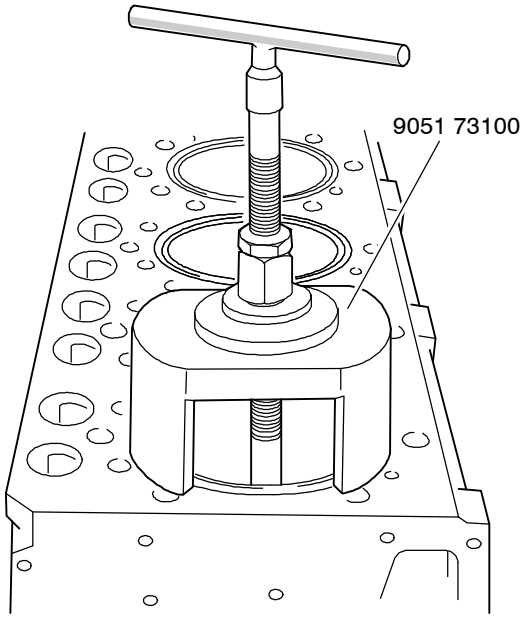


fig022

2. Remove the cylinder liners using cylinder liner puller 9051 73100.

Checking cylinder block

1. Clean the cylinder block and all oilways.
2. Check the cooling channels and remove the scale and sediment to ensure engine cooling.
3. Check the tightness of the cup plugs and threaded plugs in the cylinder block as well as the condition of the cylinder block and sealing faces.
4. Measure the wear of the camshaft bearing points (compare with rated).

Note! If it is necessary to machine the upper face of the cylinder block, the pistons must be shortened by the same dimension. Observe the valve disc spaces on the piston upper face.

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Changing camshaft bushing

All camshaft bearing points are provided with a separate bearing bushing.

1. Remove the camshaft rear end plug and tap the bushings out with a long drift. Observe the different outer diameters when removing.
2. Clean the bushing locations carefully.

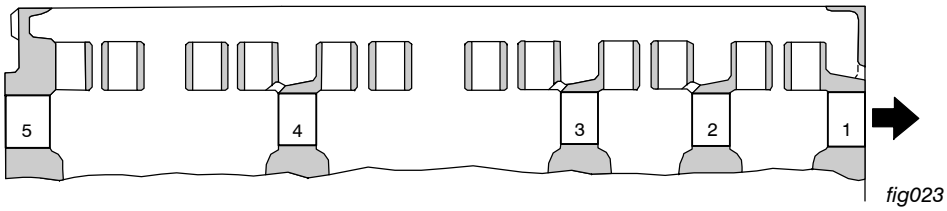


fig023

Hole diameters for the bushings. Numbering begins from the front end of the engine.

Hole diameter

1. 55,62...55,65 mm
2. 55,42...55,45 mm
3. 55,22...55,25 mm
4. 55,42...55,45 mm
5. 55,64...55,67 mm

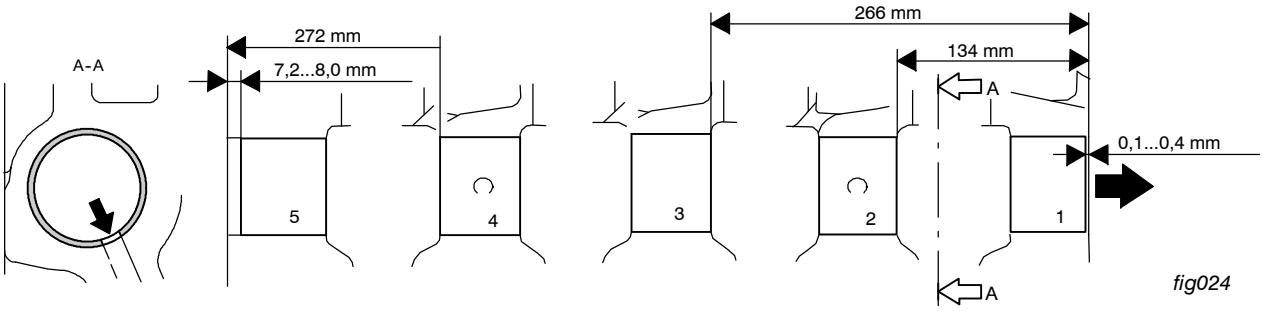


fig024

3. Press in new bushings (2 – 5). Observe the different outer diameters. Note the position of the oil hole. It is unnecessary to ream the bushing because it has a correct inner diameter when it is fitted in place.

Note! The camshaft front end bushing (1) is equipped with the oil groove on the outside. Fit the oil hole of the bushing at a **30°** angle from horizontal level (see picture at the top of the page). The bushing has the correct measurements after assembly (no need for machining).

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Fitting plug at camshaft rear end

1. Clean the seat for the plug.
2. Apply sealing compound to the contact surface of the plug.

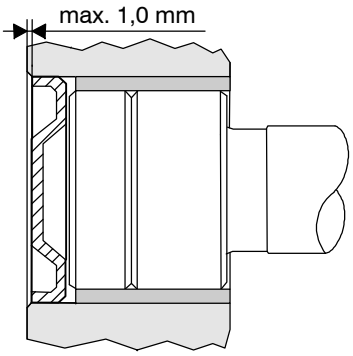


fig025

3. Drive in the plug with fitting drift 9025 87400.

Note! Do not drive in the plug too far because it will affect the camshaft end float.

Oversize bushings for camshaft

Order numbers of the oversize camshaft bushings and hole diameters for the bushings. Numbering begins from the front end of the engine. Installing places are the same as with the standard bushings.

	Order no.	Hole diameter
1.	8368 66036	56,02...56,05 mm
2.	8368 52466	55,62...55,65 mm
3.	8368 52460	55,42...55,45 mm
4.	8368 52466	55,62...55,65 mm
5.	8368 52467	55,84…55,87 mm

Fitting plug at camshaft rear end
(oversize bushings)

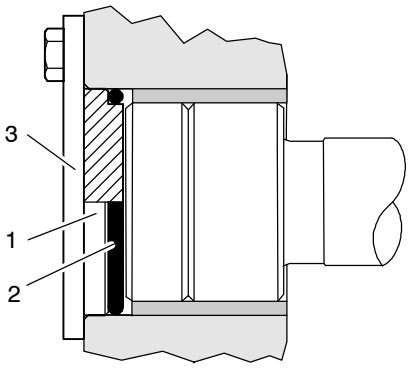


fig026

The camshaft rear end plug is replaced with plug 8363 24391 (1) and O–ring 6146 05125 (2) after machining. Use plate 8361 24210 (3) in those engines where the flywheel housing is not covering the blocking plug.

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Fitting cylinder liner

1. Clean the cylinder liner and its recess in the cylinder block. Without O–rings, the liner should rotate easily in its recess.
2. Apply a thin layer of marking paint on the underside of the cylinder liner flange. Fit the cylinder liner without O–rings and turn it forwards and backwards. Lift out the liner and check that paint has been deposited on the whole contact surface.

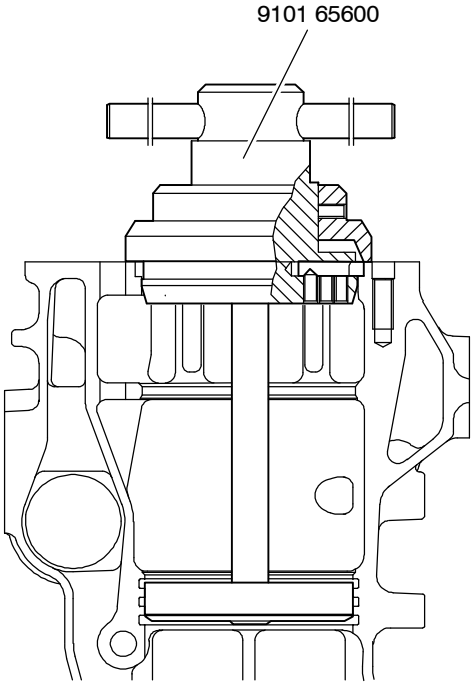


fig027

3. If the recess is damaged, or the cylinder liner height (see point 5) needs to be adjusted, use milling cutter 9101 65600. If necessary, a light lapping can be executed after milling with the help of the cylinder liner. Apply lapping paste to the underside of the cylinder liner flange, and twist the liner with twisting tool. Lapping is not suitable for adjusting the cylinder liner height.
4. Clean the contact surfaces.

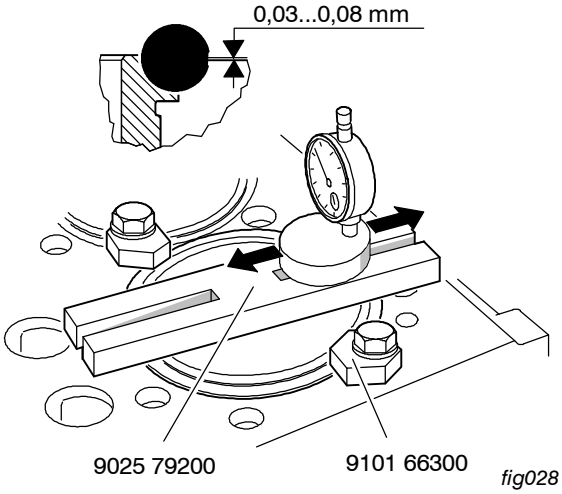


fig028

5. Fit the cylinder liners and fix each liner with two press tools 9101 66300. Measure the cylinder liner height with a dial gauge and holder 9025 79200. Zero the dial gauge against a flat surface, for example, the cylinder block face. Measure each liner in four places. The height of the liner above the cylinder block face should be **0.03...0.08 mm**. The height difference between cylinder liners under the same cylinder head must not exceed **0.02 mm**, nor must an intermediate cylinder liner lie lower than an outer one.
6. If the cylinder liner height is too low, a liner with a higher flange should be fitted.

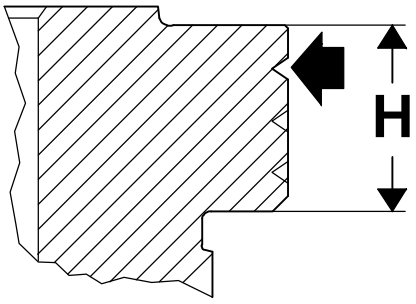


fig029

Order no.	H	Marking grooves pcs
8366 47420	$9{,}03^{+0{,}02}$	- (std.)
8366 47933	$9{,}08^{+0{,}02}$	1
8366 47934	$9{,}13^{+0{,}02}$	2
8366 47935	$9{,}23^{+0{,}02}$	3

Cylinder liners with oversize flanges (higher flanges) are marked with grooves on the outer circumference as follows:

1st oversize, 0,05 mm = 1 marking groove
2nd oversize, 0,10 mm = 2 marking grooves
3rd oversize, 0,20 mm = 3 marking grooves

Note! Recess depth is adjusted with a cylinder liner recess cutter 9101 65600.

7. If the liner height of a cylinder liner is not the same all the way round, the cylinder liner flange and the cylinder block recess depth should be checked. Cylinder liners with warped flanges should be discarded.

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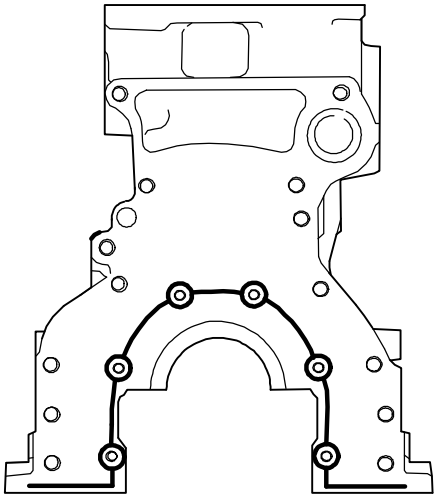


fig030

8. Fit the O–rings into the grooves in the cylinder liner. Fit the green O–ring (A) into the lowest groove. Lubricate the O–rings with a liquid soap (not with engine oil).

Note! Stretch the O–rings as little as possible when fitting them. Max. permissible stretch is 6%.



fig031

9. Press the cylinder liners into the cylinder block. It should be easy to press them fully home. Make sure that the liners do not rise up after fitting.

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Flywheel housing

Fitting flywheel housing

The flywheel housing is centred on the cylinder block by two tension pins. Even the flywheel housings which are delivered as spare parts have ready–made holes for the pins.

1. Clean the sealing surfaces between the cylinder block and the flywheel housing.

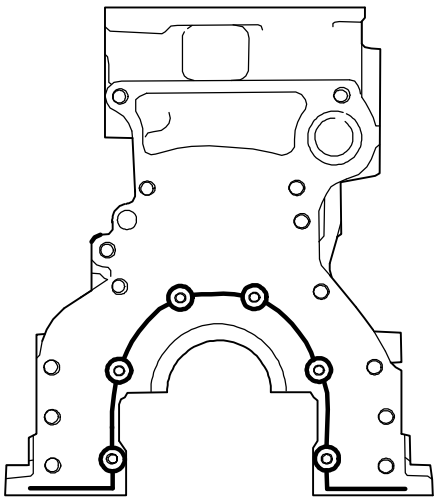


fig032

2. Apply silicone sealant as shown in the picture.
3. Lift the flywheel housing into place and fit all the bolts.
4. Centre the housing with centring tool 9052 46400. **Note!** This is important for engines with a turbine clutch. Fit the tension pins with drift 9025 98700.
5. Tighten the fixing bolts: the inner ring socket head bolts to **80 Nm** and the outer ring hexagonal bolts to **150 Nm**.

Changing crankshaft rear oil seal

1. Split the tractor at clutch. Remove the clutch assembly (and if applicable the turbine clutch).
2. Remove the flywheel.
3. Remove the oil seal. Do not damage the crankshaft.
4. Clean the seal location and grind off any burrs.

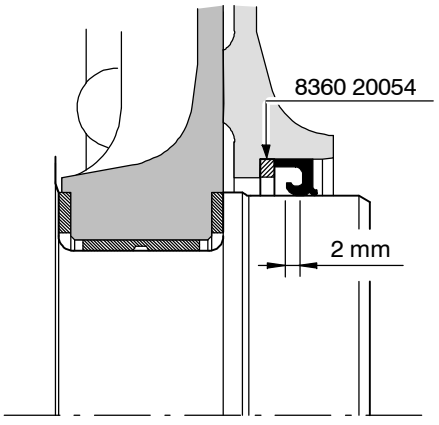


fig033

Note! If the crankshaft is worn at the sealing location, a 2 mm spacer ring, order no. 8360 20054, can be fitted in front of the crankshaft rear oil seal.

5. Fit the seal as follows:
   – Do not remove the plastic sleeve before installing.
   – Fit the seal dry, **not oiled**.

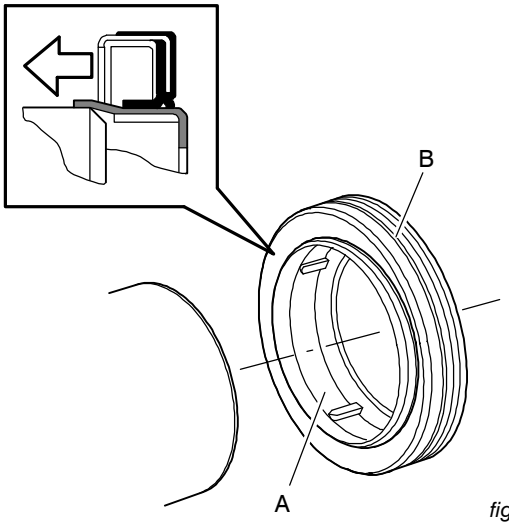


fig034

– Put the sleeve (A) against the crankshaft rear end so that the sleeve is on the shaft bevelling.

– Push the seal (B) over the sleeve on the shaft and further against the flywheel housing.

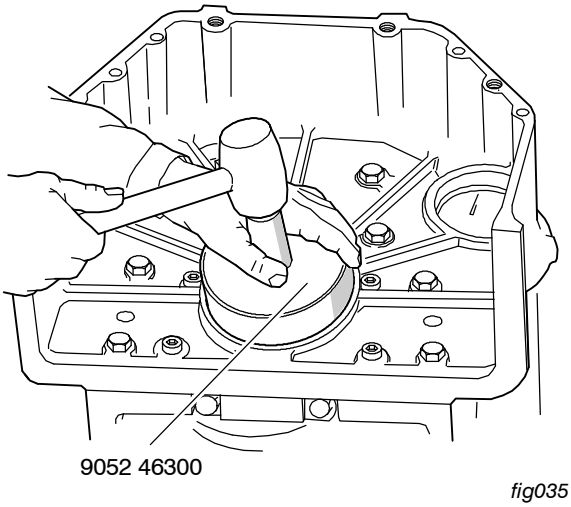


fig035

– Remove the sleeve and hit the seal into position with the fitting tool 9052 46300.

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Cylinder head

Removing cylinder head

1. Clean the engine externally and drain the coolant. Disconnect the coolant hoses from the cylinder head and the thermostat housing.
2. Remove the suction hoses between the turbocharger and the air filter and between the turbocharger and the inlet manifold.
3. Disconnect the turbocharger pressure and return oil pipes.
4. Disconnect the current from the main switch. Disconnect wires from the intake air heater.
5. Remove the injector leak-off fuel pipes and the delivery pipes. Remove the injectors. Fit blanking-off caps on all open connections.
6. Remove the inlet and exhaust manifolds and the thermostat housing.

Note! It is possible to remove the cylinder head even thought these parts are attached to the head.

7. Remove the valve cover.
8. Remove the rocker arm mechanism and the push rods.
9. Loosen all the cylinder head bolts first by a 1/4 turn and then remove them. Remove the cylinder head.

Removing valves

Ensure that valves which are to be re-used are marked, so that they are fitted in their original locations.

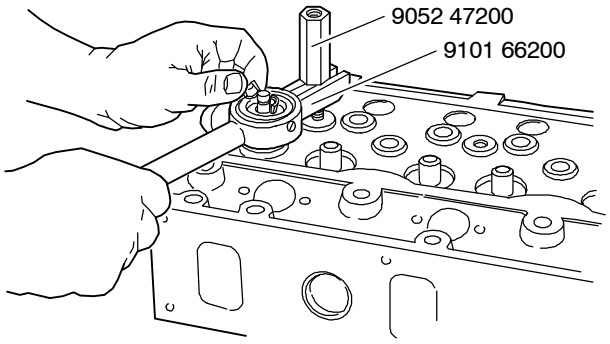


fig036

1. Install the counter screw 9052 47200 for the valve spring installing tool in the rocker arm cover bolt. On the 66– and 74-engines there is not a screw stud at the valves for the centre cylinder. A bolt of suitable length should be used instead.
2. Compress the valve springs using lever 9101 66200. Remove the valve cotters, spring guide and spring. Remove the valves. If you are re–fitting the old valves, ensure that they are re–fitted in the exact same locations.

Checking cylinder head

1. Remove the soot from the exhaust ports, clean the sealing surfaces and wash the cylinder head.
2. Check for cracks and other damage.

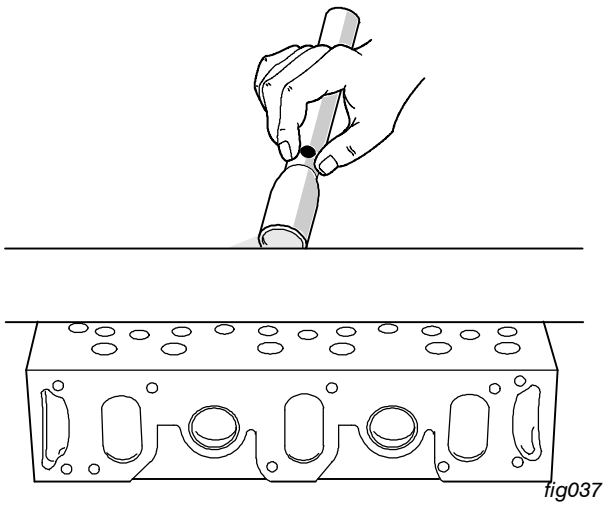


fig037

3. Check the flatness of the cylinder head by using a straight edge. An uneven or warped surface should be surface ground. The height of the cylinder head, after grinding, should not be less than **109.50 mm**. The valve disc depth from the cylinder head surface should be **0.60 mm** for the exhaust valves and **0.80 mm** for the inlet valves.

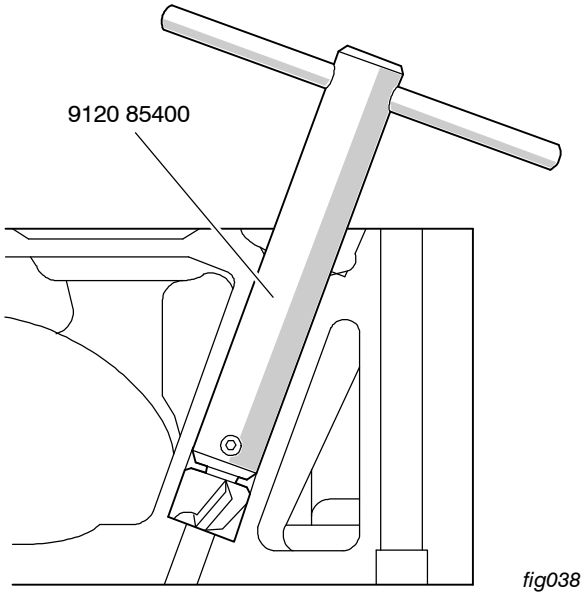


fig038

4. Straighten and clean the injector location seat in the cylinder head with cutter 9120 85400.

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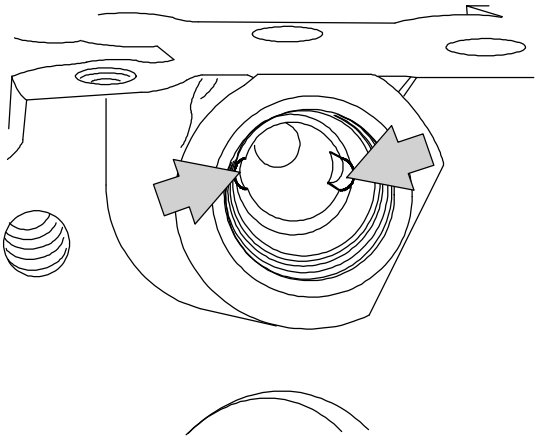


fig039

5. Also check that the location for the side feed pipe is clean – especially the grooves for the guide balls.

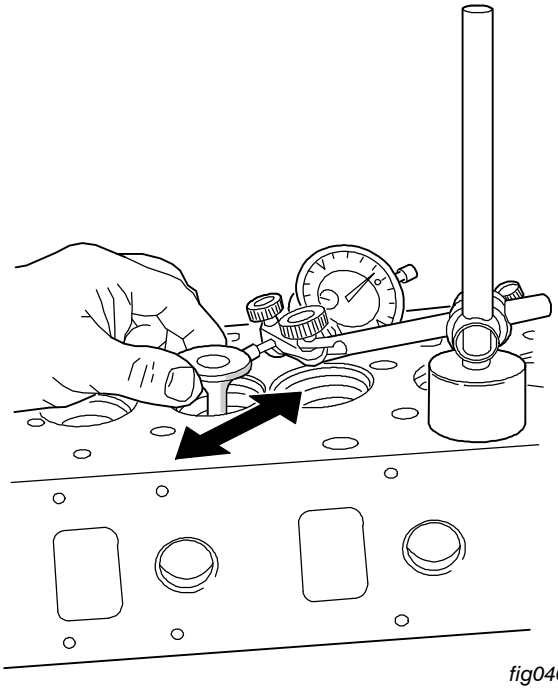


fig040

6. Measure the clearance between the valve stem and the valve guide with a dial gauge. Lift the valve so that the valve head is **15 mm** from the face of the cylinder head, and measure the clearance. It must not be greater than **0,30 mm** for the inlet valves and **0,35 mm** for the exhaust valves. In order to establish the valve guide wear, a new valve should be used when measuring.

Changing valve guides

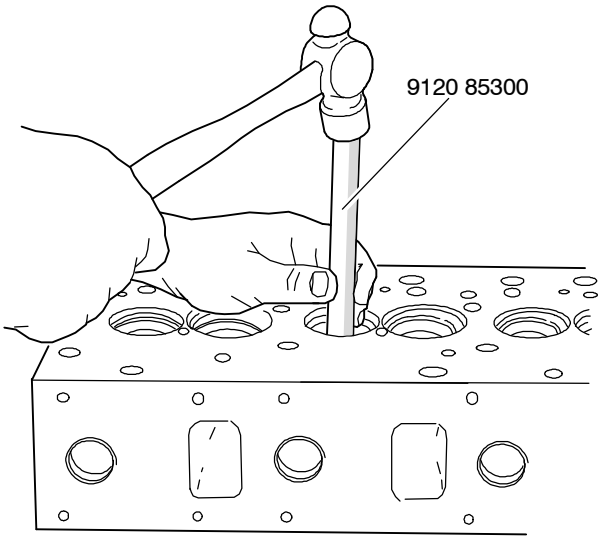


fig041

1. Press or knock off the old guides using drift **9120 85300**. Clean the valve guide locations.

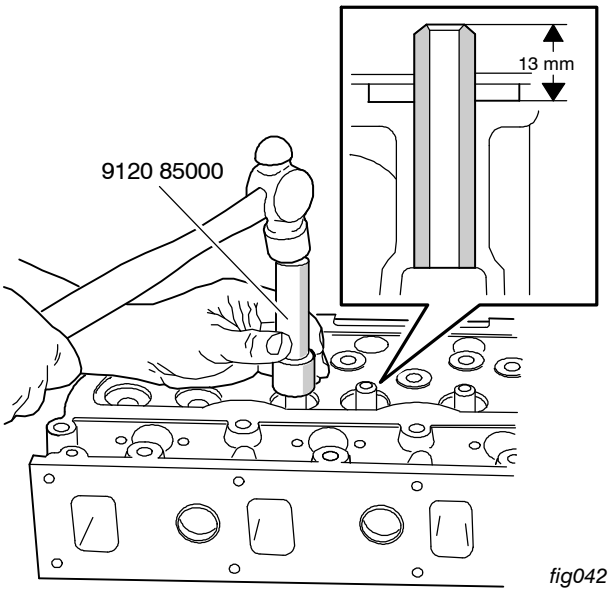


fig042

2. Lubricate the outside of the new guides and fit them using drift **9120 85000**, which ensures the correct fitting height (**13 mm** over the spring face).

3. The guides are the same for the inlet and exhaust valves. Ensure that the steepest chamfer on the guide, faces the valve head. Check that the valves do not bind in the guides.

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Machining valve seat

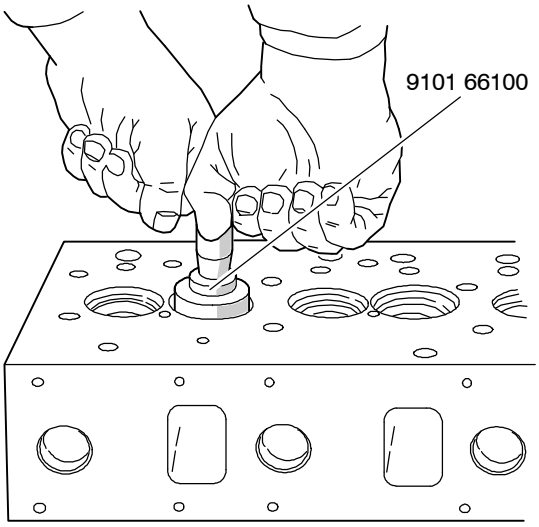


fig043

Machine the damaged valve seat with milling cutter kit **8370 62635** or 9101 66100 (T-handle). If the width of the seat exceeds **2.0 mm** in the exhaust and **2.2 mm** in the intake, it should be reduced primarily at the outer edge.

The valve seat angle is **45° +20'** for the exhaust valve and **35°+20'** for the inlet valve.

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Changing valve seat rings

Exhaust valves are fitted with separate valve seat rings. Also the engines with high output are equipped with separate inlet valve seats. If the sealing surface is damaged so badly that it cannot be repaired with machining, the seat ring should be changed.

1. Grind the valve head on a discarded valve so that it sits down in the valve seat. Fit the valve and weld it in place in the seat. Cool with water.
2. Turn the cylinder head over and knock out the valve and seat.

Exhaust

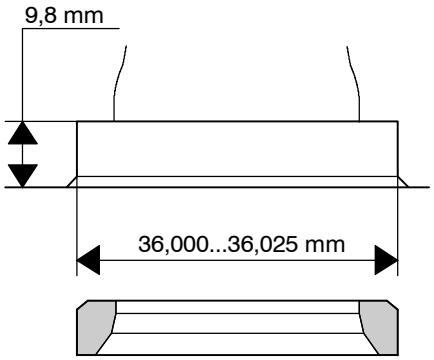


fig044

Inlet

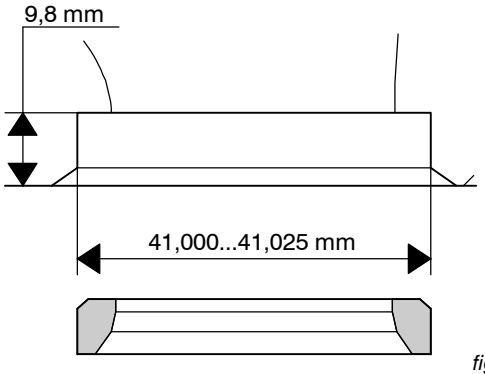


fig045

3. Clean the valve seat location. Cool the new seat ring in liquid nitrogen until it stops bubbling, or alternatively place it in dry ice.
4. Fit the seat with a suitable drift. Machine the seat.

Note! Where necessary, standard size seats can be replaced by inserts with a larger outer diameter. See **code 211.1,** "**Technical data**", point "**Cylinder head**".

The inlet valve seat machined direct on the cylinder head, can be provided with a separate valve seat ring, order no. **8366 47936**. Machine the seat insert location on the cylinder.

Grinding valves

In order to ensure that there is a proper seal around the valves, there is a difference in the sealing surface angles. Thus there is a very narrow sealing surface which seals effectively even after prolonged running.

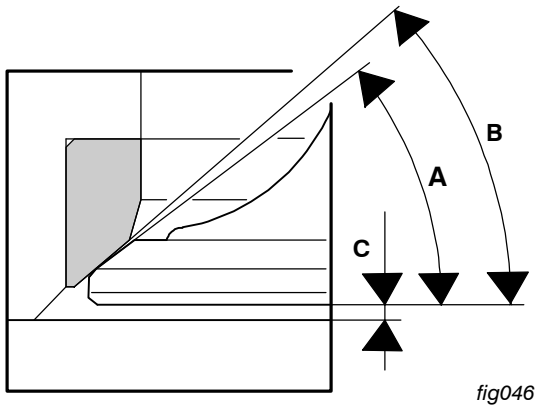


fig046

	A	B	C (mm)
Inlet	$35^{\circ}{}_{-20'}$	$35^{\circ}{}_{+20'}$	$0{,}8\pm^{0{,}05}$ (max. 2,20)
Exhaust	$45^{\circ}{}_{-20'}$	$45^{\circ}{}_{+20'}$	$0{,}6\pm^{0{,}05}$ (max. 2,20)

1. Grind the damaged valve disc with a valve refacer. Adjust angles to **45°-20'** for exhaust valves and **35°-20'** for inlet valves.
2. If the edge of the valve head is less than **1,5 mm** after it has been ground, or if the valve stem is bent, the valve should be discarded.
3. If necessary, grind the end of the valve stem.
4. Lap the valves with lapping paste and check the contact surface with marking paint.
5. Clean the cylinder head and valves of any remaining lapping paste.

Fitting valves

1. Check the valve springs for straightness, length and tension using a spring tester. See "**Technical data**", point "**Valves, rockers and tappets**".
2. Lubricate the valve stems and fit the valves in the correct order in the cylinder.
3. Fit the springs, spring guides and valve keepers with the aid of a lever for compressing valve springs, 9101 66200.
4. Tap the end of the valve stems lightly after fitting the valve in order to ensure that they are secure.

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Fitting cylinder head

1. Measure the length of the cylinder head bolts. Compare with the dimensions shown in the figure below. Change any bolts that are too long.

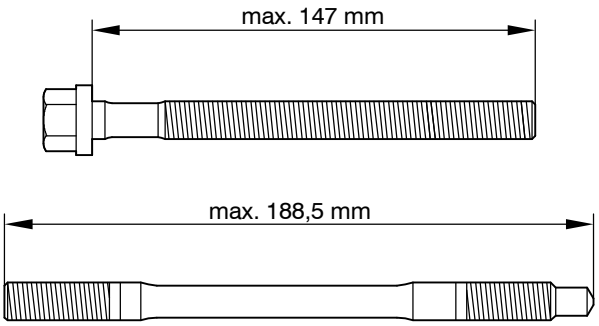


fig047

2. Screw the cylinder head stud bolts into the cylinder block to a torque of **30 Nm**. Fit the valve tappets if removed.

3. Check that the sealing surfaces are clean and fit the cylinder head gasket(s) and the cylinder head(s). Ensure that on the six cylinder engines both cylinder heads are parallel by lightly fastening the exhaust manifold before tightening the cylinder head bolts (the exhaust manifold can become damaged if the heads are not parallel). Clean, lubricate and fit the bolts.

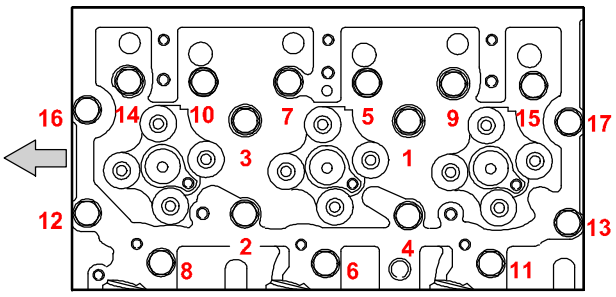


fig048

4. The picture above shows the correct tightening order of the cylinder head bolts. The order has not been marked on the cylinder heads.

5. Tighten the cylinder head bolts progressively as follows:
   - First tighten to **80 Nm**
   - Tighten by **90°**
   - Tighten again by **90°**

6. Adjust the valve clearances (see code **215.4**, “Adjusting valves”).

Note! After this the cylinder head does not need retightening.

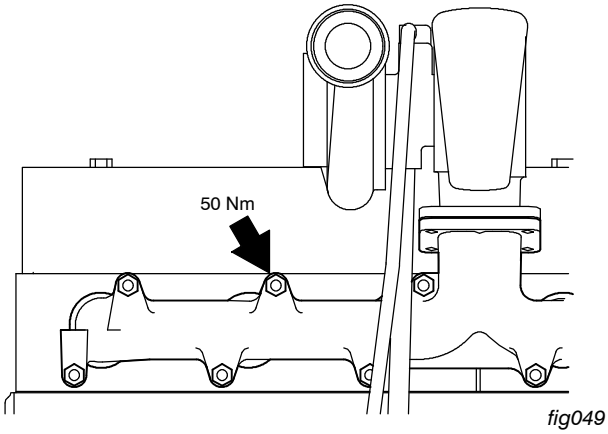


fig049

Tighten the exhaust manifold nuts to **50 Nm. Do not overtighten!**

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Valve mechanism

Reconditioning valve mechanism

1. Check the valve tappets, especially the contact surface against the camshaft. Worn or damaged tappets should be discarded.

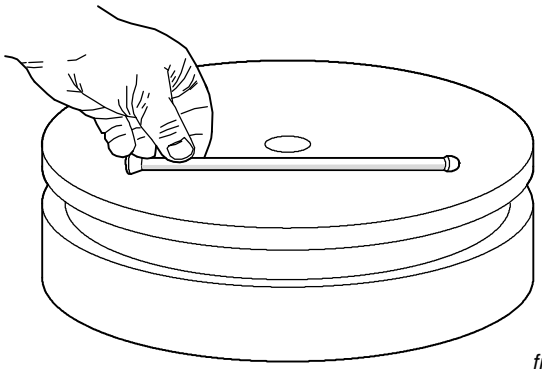


fig050

2. Check the straightness of the push rods by rolling them on a surface table. Also check the spherical surfaces at the ends.

Engine	Total Length of Push Rod, mm	Order Number of Push Rod
66– and 74– engines	245...246.3	8370 70119

3. Dismantle and clean the rocker arm mechanism. Check the shaft for wear and check that the oilways are clean.

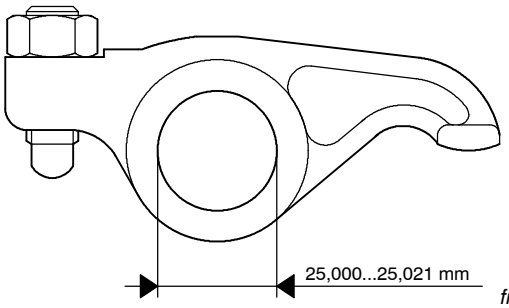


fig051

4. Check the diameter of the rocker arm bore, **25.000...25.021 mm**. Change the worn or damaged rocker arm. Where necessary, grind the rocker arm valve contact surface to the correct shape. Do not grind more than necessary, as the hardened layer is thin.

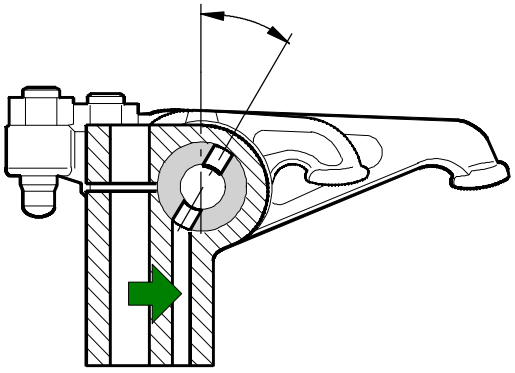


fig052

5. Fit the plug to the other end of the rocker arm shaft. Lubricate the shaft and fit various parts in the correct order. Notice the correct position of the brackets and the shaft. Fit the other end plug and tighten the plugs to **25 Nm**.

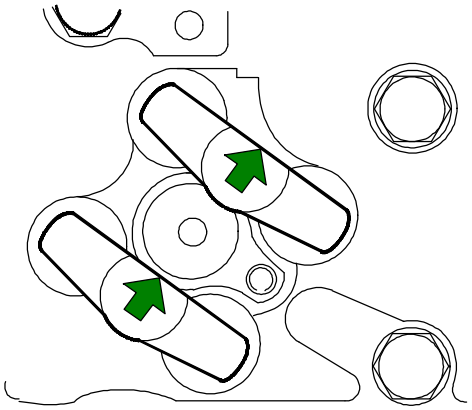


fig053b

6. Fit the connecting parts onto the valves in position as shown in the pictures.

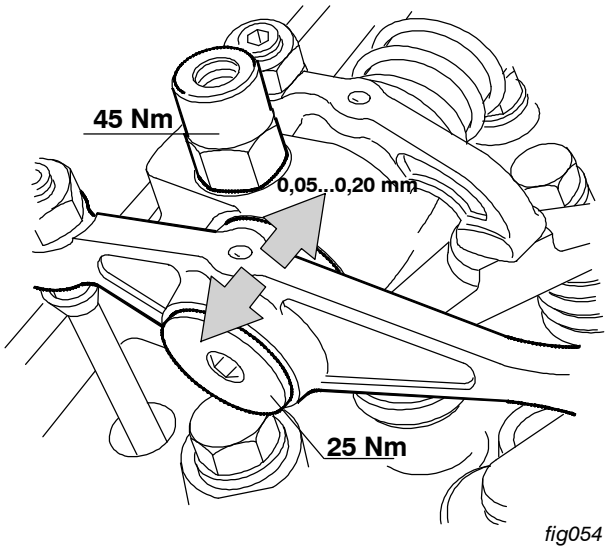


fig054

7. Fix the valve mechanism and ensure the right end clearance, **0.05...0.20 mm**, for the levers at the end. Tighten the mechanism screw and nuts to a torque of **45 Nm**.

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Changing camshaft / camshaft gear

1. Remove the valve cover. Remove the rocker arm mechanism.
2. Remove the radiator, cooling fan, alternator and the V-belt.
3. Remove the V-belt pulley, the crankshaft nut and the hub (with damper).
4. Remove the timing gear casing cover (engine front cover).

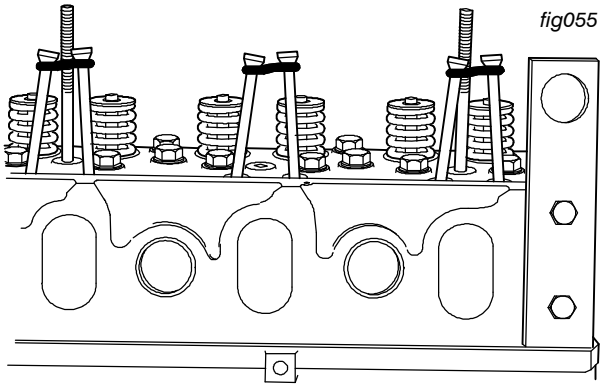


fig055

5. Connect the push rods in pairs, using o-rings or elastic bands to prevent them from falling through.

Note! Do not connect the push rods too tightly as this might cause them to bend or snap.

6. Crank the engine until the aligning marks on the idler gear and camshaft gear are facing each other. Extract the camshaft.
7. Separate the camshaft from the gear wheel using a press or suitable drift.
8. Clean the parts which are to be refitted.
9. Fit the key in its groove. Heat the camshaft gear to **200˚C** in an oven and fit it on the shaft.
10. Lubricate bearing surfaces and lobes and insert the shaft in the cylinder block. Ensure that the aligning marks on the gears agree.
11. Fit the timing gear casing cover, the hub, damper and crankshaft V-belt pulley.
12. Free the push rods and fit the rocker arm mechanism. Adjust the valves. Fit the valve cover.
13. Fit the other removed parts.

Checking and adjusting valve clearances

The valve clearance, which can be adjusted on a hot or cold engine, is **0.35 mm** for both inlet and exhaust valves. The clearance is adjusted when the respective piston is at T.D.C. in the compression stroke. The valves for the different cylinders are adjusted in the same sequence as the order of injection.

Adjusting

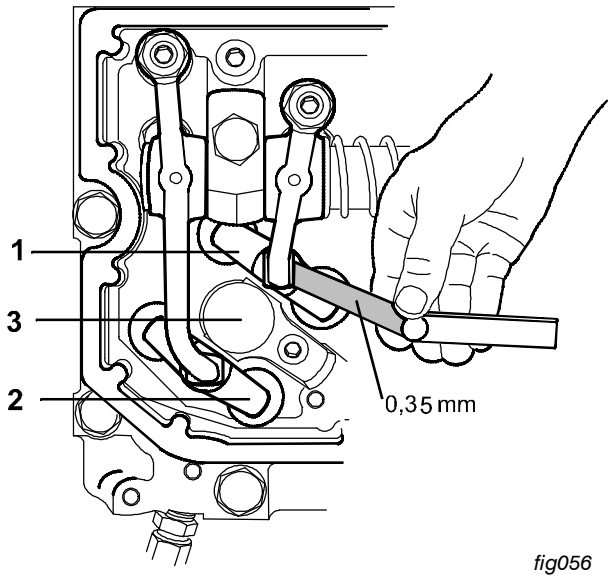


fig056

1. Intake valves
2. Exhaust valves
3. Injector

– Loosen the locknut on the adjusting screw.

– Check the clearance with a feeler gauge and adjust to the correct clearance by turning the adjusting screw.

– Tighten the locknut and check again that the clearance is correct.

66– and 74-engines

– Rotate the crankshaft in the running direction until the valves in the 6th cylinder are rocking (exhaust closes, inlet opens). Check the valve clearance of the 1st cylinder.

– Rotate the crankshaft by 1/3 of a turn in the running direction so that valves in the 2nd cylinder are rocking. Check the valves in the 5th cylinder.

– Continue according to the order of injection:

Injection order		1 – 5 – 3 – 6 – 2 – 4
Valves rock in cyl. no.		6 – 2 – 4 – 1 – 5 – 3

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Crankshaft

Removing crankshaft

1. Remove the oil sump.

3. Unscrew the lubricating oil pump pressure pipe fixing screws from the cylinder block. Remove the oil pump and the suction and pressure pipes.

4. Remove the flywheel and the flywheel housing.

5. Detach the belt pulley and the hub from the crankshaft front end. Remove timing gear housing. (see code **215.8**, "Removing timing gear casing").

6. Remove the connecting rod bearing caps and push the connecting rods out of the way of the crankshaft.

7. Remove the main bearing caps and lift out the crankshaft.

Checking crankshaft

1. Clean the crankshaft. Do not forget the oilways.

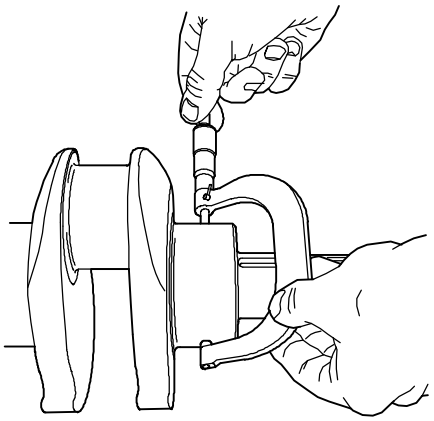


fig057

2. Measure the journal wear in several points. Out–of–round, taper or other wear must not exceed **0.03 mm**.

3. Refit the bearing caps with new bearing shells and tighten them to the correct torque. Measure the I.D. with a dial gauge which has been zeroed to the dimensions given in point 2. With this method the indicator shows the actual bearing clearance. Measure at several points in case the worn bearing housing is not round.

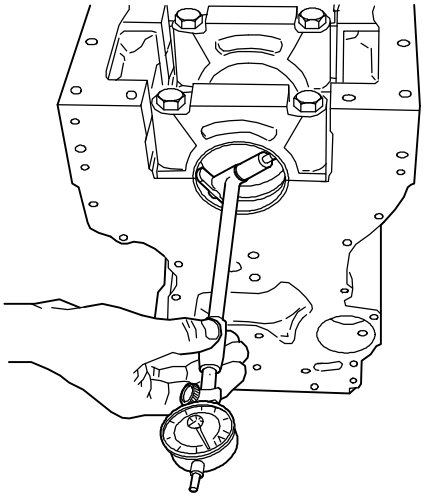


fig058

4. If the bearing clearance exceeds **0.18 mm** for main bearings or **0.14 mm** for connecting rod big–end bearings with new bearing shells, the bearing journals on the crankshaft should be ground. Refer to the specifications for the relevant correct undersize and the corresponding bearings, see **code 211.1, "Technical data"**, point **"Crankshaft"**.

Note! When grinding, note that the journal edges must remain round.

Note! If necessary, the main bearing can also be fitted with outer diameter 1.0 mm oversize and inner diameter 0.5 mm undersize. Order no. is 8361 40950. The main bearing housing is machined to 92.000...92.025 mm and the crankshaft to 84.485...84.520 mm. (Special bearings not available for 74–engines.)

Changing crankshaft gears

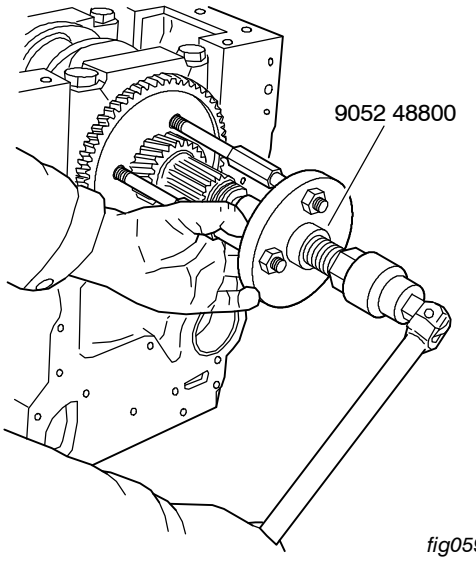


fig059

1. Apply puller 9052 48800 to the crankshaft gears and pull off both gears.

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2. Clean the seat on the crankshaft, for example, with a wire brush.

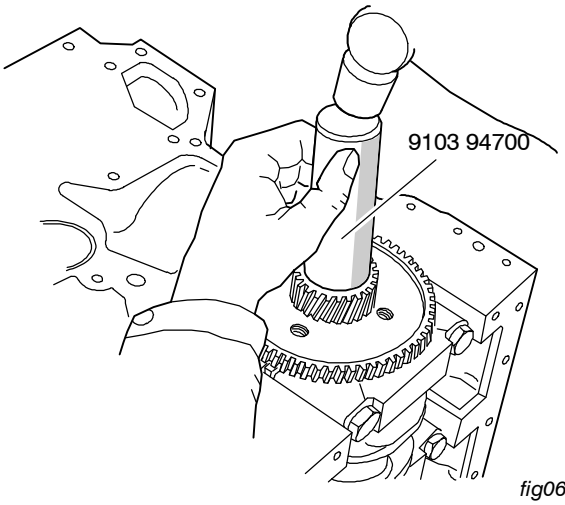


fig060

3. Heat the new gears to **220...250˚C**. Tap them onto the shaft with drift 9103 94700. Note the position of the key and ensure that the aligning marks on the front gear are visible. Leave it to cool.

Fitting crankshaft

1. Clean the oilways, bearing shells and bearing locations. Check that the crankshaft is clean.

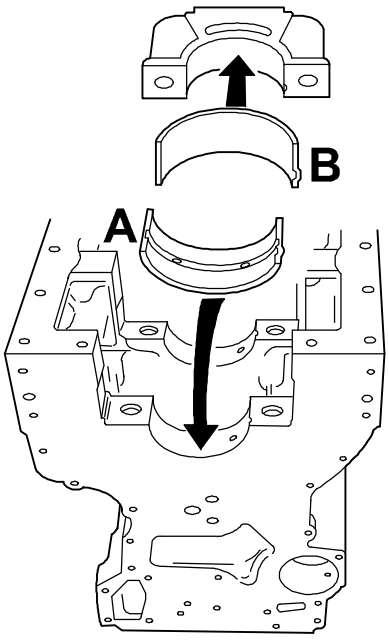


fig061

2. Assemble the bearing with oilholes/groove (**A**) to the cylinder block and the bearing with no hole (**B**) to the bearing cap. Ensure that the bearing shell clamping claws fit into their notches and that the shells to be fitted in the cylinder block have a hole coinciding with the oil port.

3. Lubricate the bearing surfaces and fit the crankshaft. Fit the crankshaft thrust bearings with the lubricating grooves facing the crankshaft.

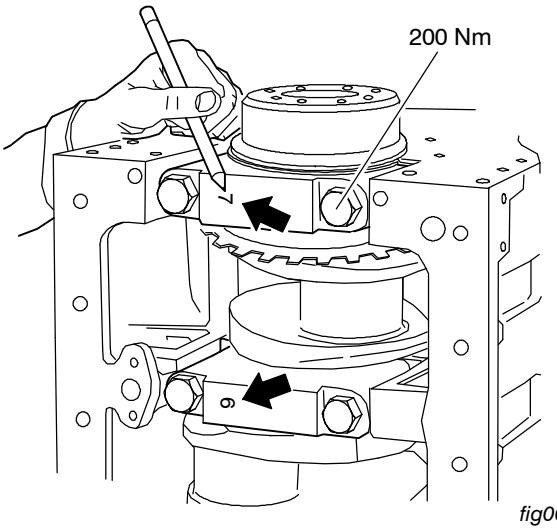


fig062

4. Fit the main bearing caps according to their numbering (bearing lock in the block and in the cap are on the same side); the rear thrust bearings are provided with guide lugs. Lubricate the bolts and tighten them to **200 Nm**.

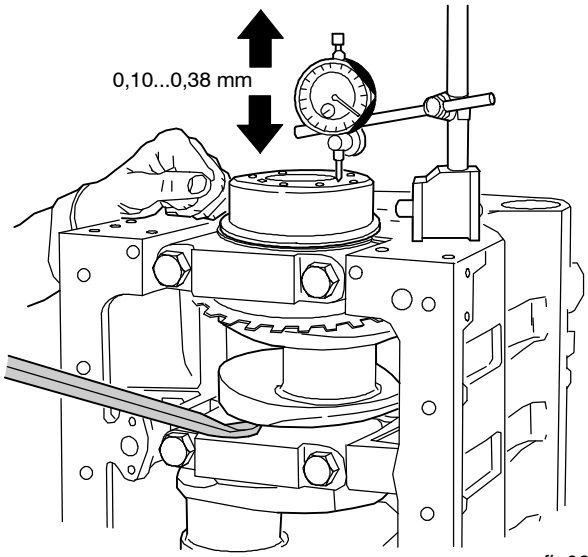


fig063

5. Check that the crankshaft can rotate without binding. Check the end float using a dial gauge. The correct end float is **0.10...0.38 mm**. If the end float is too large, oversize thrust bearings should be fitted.

Note! Bearing shells should never be reamed or machined in any other way, nor should the sides of the bearing caps be filed.

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Crankshaft hub piece

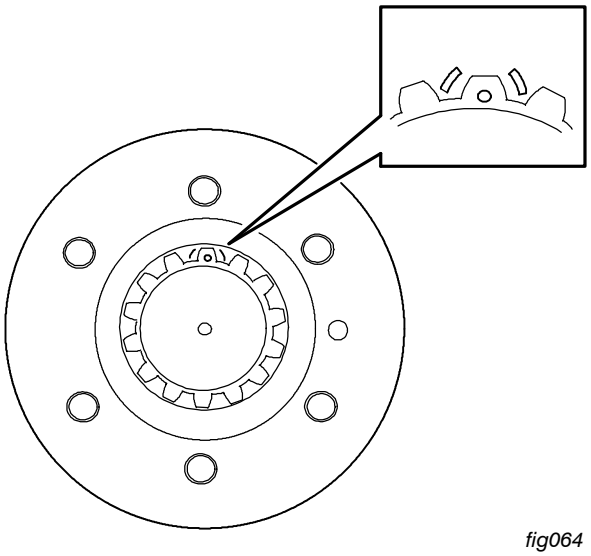


fig064

When fitting the hub piece to the crankshaft front end, note the correct position of the hub (engines with the installation mark of the injection pump on the crankshaft pulley/vibration damper). The hub piece has an installation mark on two teeth and the corresponding installation mark **o** of the crankshaft is on one tooth.

Checking element of the rubber damper

66-engines

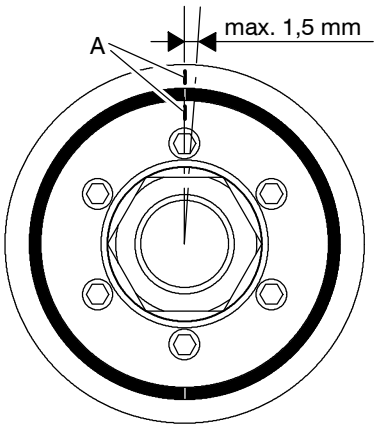


fig065

1. Check the alignment marks (A) on both sides of the rubber element. If the difference is more than **1.5 mm**, change the damper for a new one.

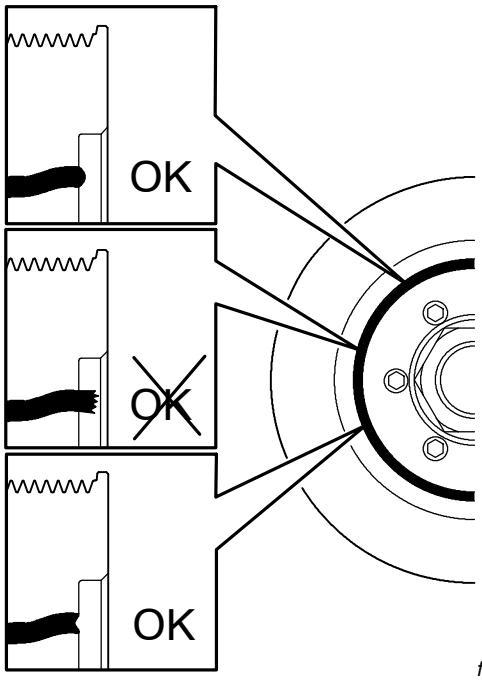


fig066

2. Also check the condition of the rubber element. If rubber pieces have been loosened from the element, rubber has been pressed to a depth of more than **3.5 mm** or the outer circumference is slack or it moves in the direction of the shaft, change the damper.

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Viscose type vibration damper

66– and 74-engines

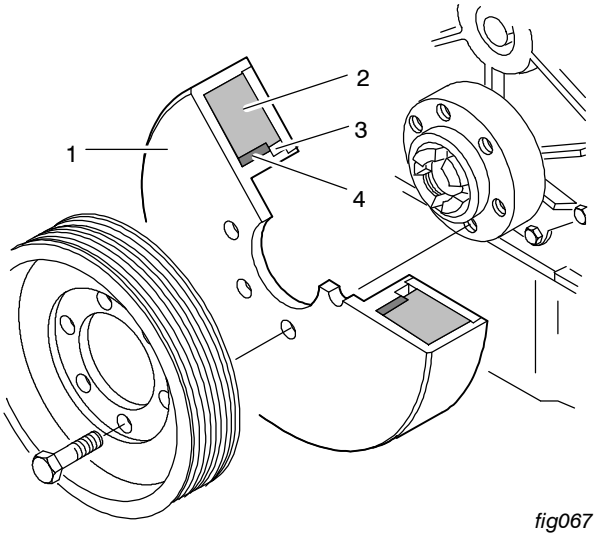


fig067

1. Housing
2. Damper mass
3. Liquid cavity
4. Bushing

In 74–engines and some 66–engine versions, there is a vibration damper of ”viscose type”. Inside the damper there is a housing filled with stiff silicone oil, in which the damping substance has very small tolerances.

Note! Even a small dent makes the vibration damper inoperative. Do not remove it by turning forcibly and be careful not to damage it when it is loose. If you detect a dent on the outer surface, do not re–install the damper in the engine.

Note! Make the installation mark of the injection pump on the vibration damper with an electric pen (do not tap).

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Connecting rods and pistons

Removing pistons together with connecting rods

1. Remove the oil sump and the oil inlet and pressure pipes.
2. Remove the cylinder head.
3. Scrape off any soot in the cylinder liner. If the turning edge is clearly marked, smooth it down carefully with a scraper.
4. Remove the big–end bearing caps and bearing shells. Place the shells in order if they are to be reused.
5. Push up the piston and connecting rod with the shaft of a hammer or similar wooden tool.
6. Remove the piston pin snap rings. Push out the pin.

Note! If the piston pin does not move under thumb pressure, the piston should be heated to **100˚C**.

Changing connecting rod bearings

Piston pin bushing

1. Clean the connecting rod and bearing shells.

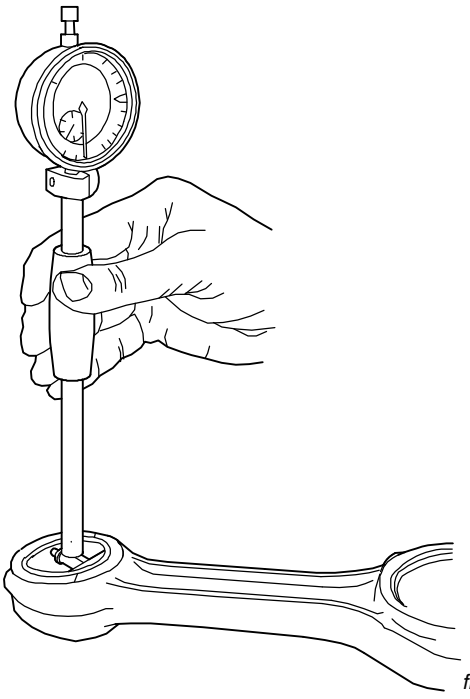


fig068

2. Measure the I.D. of the piston pin bushing using a cylinder gauge.
3. If the piston pin bushing is worn, it should be driven out using a suitable drift.

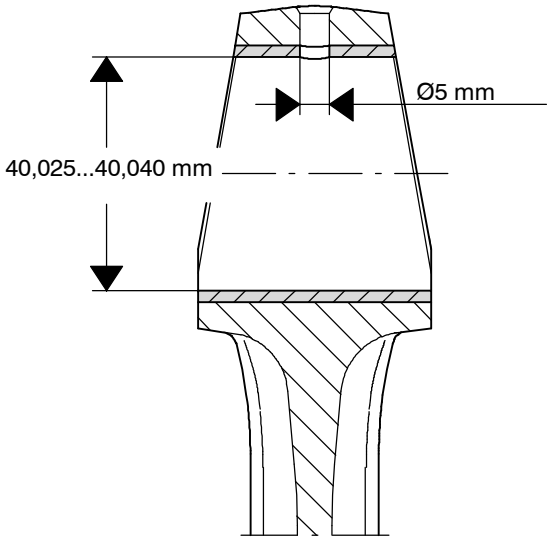


fig069

4. Press the new bush in its place. Ensure that the oil hole in the bush coincides with the respective hole in the connecting rod. After fitting drill oil hole, ream the bush to obtain its correct diameter.

Note! The connecting rod can, if needed, be fitted with a 0.5 mm oversize bushing. See **code 211.1, "Technical data"**, point **"Connecting rod"**.

Big end bearing

1. Fit the bearing shells together and tighten the screws.
2. Measure the I.D. using a cylinder gauge which has been zeroed to the diameter of the respective bearing journal. If the clearance exceeds **0.14 mm** with new bearing shells, the big–end journals require grinding. Refer to the specifications for the correct undersize and the corresponding bearing.

Note! Ensure that the radii at the end of the bearing journals are not altered when grinding.

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Checking connecting rod

The connecting rod is checked in a special fixture, intended for the purpose. See **(211.1),** "**Technical data** ", point "**Connecting rod**".

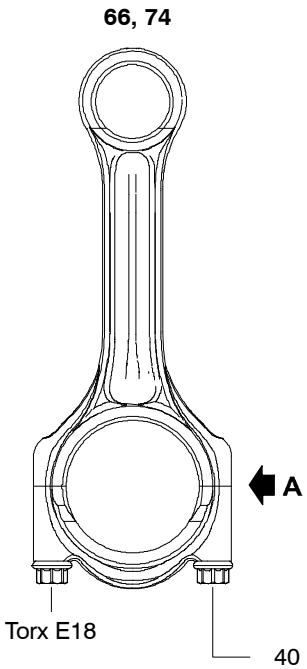


fig070

Note! Always change screws when opened.

The connecting rods are divided into weight classes with intervals of **20 g**. The weight class (a letter) is stamped on the side face of the connecting rod. All the connecting rods in one engine should be of the same weight class, that is to say the greatest permissible weight difference is **20 g**.

The letters show the weight classes as follows:

66– and 74-engines

Letter (A)	Weight
F	1935 - 1954 g
V	1955 - 1974 g
X	1975 - 1994 g
Y	1995 - 2014 g
W	2015 - 2034 g
Z	2035 - 2054 g
G	2055 - 2074 g

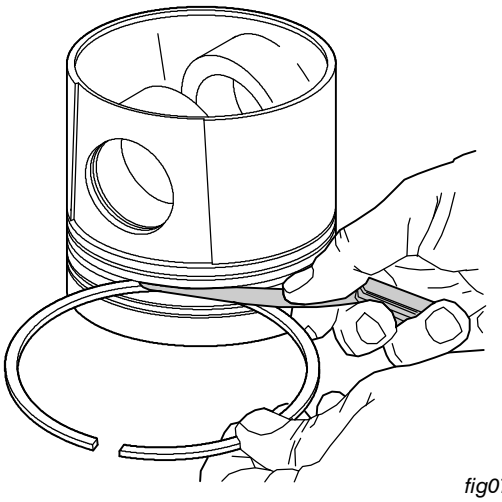
The order numbers of the connecting rod kits as spare parts are as follows:

Engine type	Number of cyl.	Order no.
66, 74	6	8368 40928

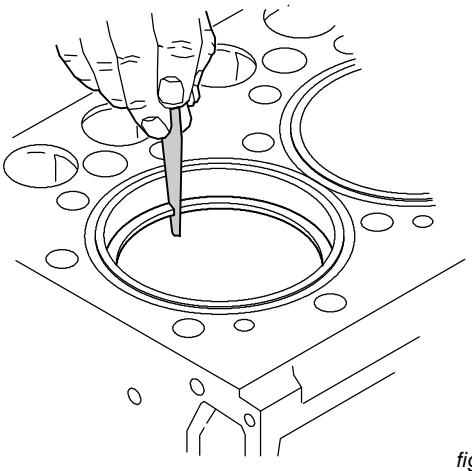
All connecting rods in the kit are same weight class.

Changing piston rings

1. Remove the piston rings with piston ring pliers 9052 46900. Do not open the rings more than is necessary. If the rings are to be used again ensure that they are fitted in the same groove.


fig071

2. Clean the piston ring grooves and measure the piston ring clearance, which must not exceed **0.15 mm**. Determine whether too large a clearance is due to worn rings or a worn groove. Change worn parts.


fig072

3. Measure the piston ring gap by pushing one piston ring at a time into the cylinder bore. The piston ring gap must not exceed **1 mm** on the 1st and 3rd piston rings and **1.5 mm** on the 2nd piston ring.

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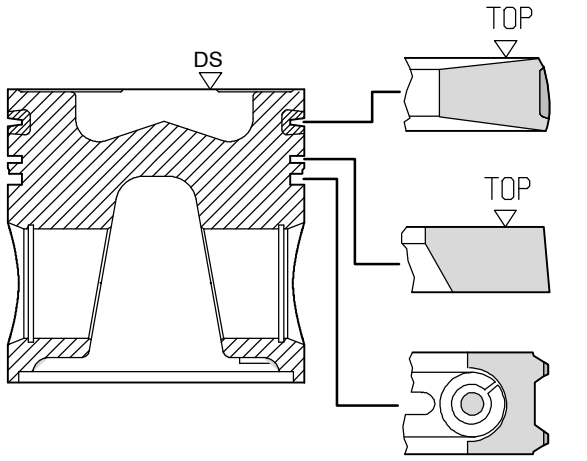


fig073

4. Fit the piston rings on the piston using the piston ring pliers. Ensure that the rings are fitted in the correct groove and that "TOP", or the manufacturer's designation, faces upwards.

Checking pistons

Check the condition of the pistons and piston pins. Pay special attention to any cracks on the edge of the combustion chamber and on the upper edge of the piston pin hole. Measure the diameter of the piston at the point shown in the figure below. Replace the piston if needed.

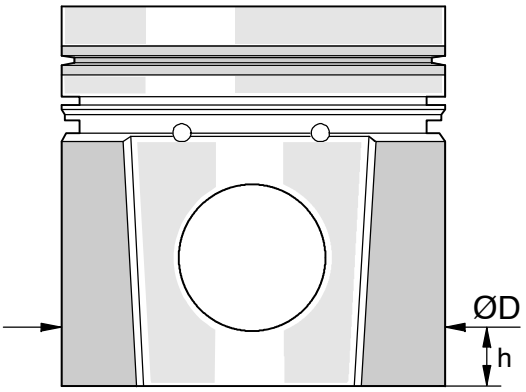


fig074

Engine	**D** (mm)	**h** (mm)
66	107,883...107,897	17,0
74	107,893...107,907	19,0

Fitting piston pin

1. Place the connecting rod inside the piston and push the piston pin into place.

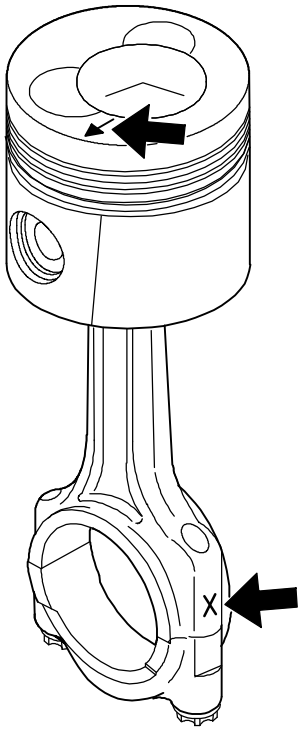


fig075

The combustion chamber and the weight class letter should be on the same side.

2. Fit the piston pin circlips. Ensure the circlips are pressed correctly into the grooves. The circlip ends must point upwards.

Fitting piston together with connecting rod

1. Check that the bearing locations are clean and place the bearing shells in the connecting rod and bearing cap. Note the position of the bearing shells.

2. Lubricate piston, rings and cylinder bore. Ensure that the piston ring gaps are spread around the piston.

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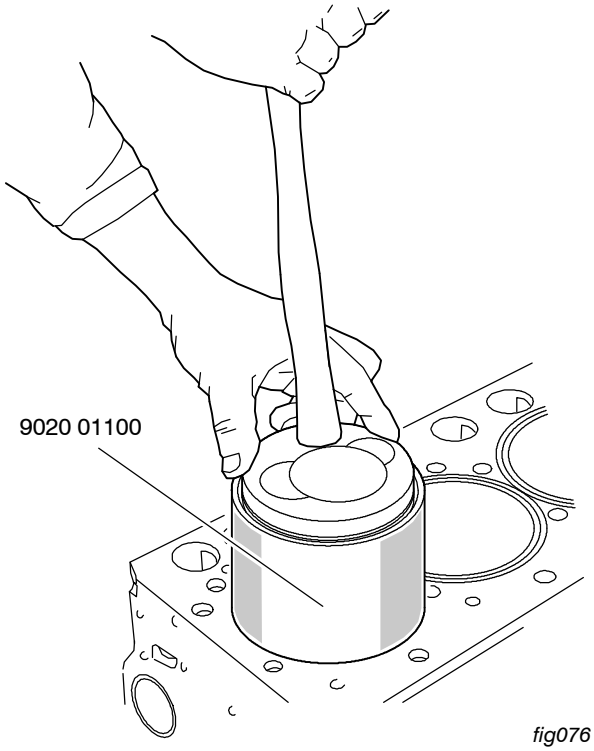


fig076

3. Use a piston ring strap or preferably fitting tool 9020 01100. Fit the piston with the connecting rod so that the combustion chamber and the fuel injector are on the same side (the arrow on the piston must point forward).

4. Lubricate the big–end bearing journal and bearing shells, and push the piston down. Fit the bearing cap so that the notches for the guide lugs are in the same side. Tighten the connecting rod screws to **40 Nm + 90°**.

5. Check that the connecting rod has sufficient end float on the big–end bearing journal.

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Flywheel

Changing starter ring gear on flywheel

If the ring gear is worn, replace it with a new one. The ring gear cannot be turned around because its teeth are chamfered and hardened on the starter motor side.

1. Remove the old starter ring by tapping it at various points with a drift. Clean the flywheel contact face with a steel–wire brush.

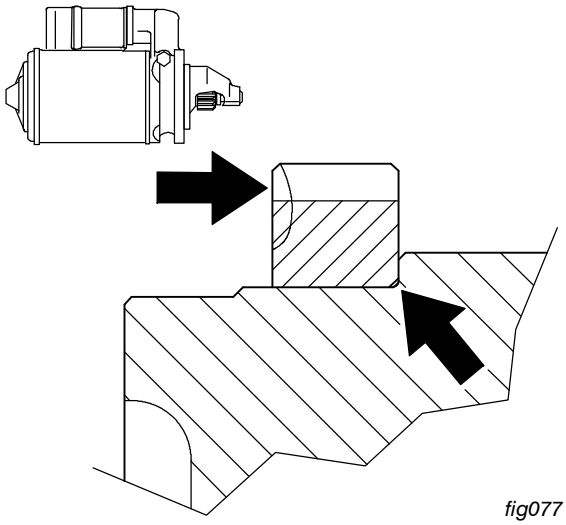


fig077

2. Warm the ring gear to a temperature of **150...200˚C**. Fit the ring gear with the inner diameter chamfering turned against the flywheel and the teeth chamfering against the starter motor.
3. Allow the ring gear to cool freely without using any coolant.

Fitting flywheel

1. Clean the contact surfaces on the crankshaft rear flange and on the flywheel.
2. Fasten the flywheel to the crankshaft rear end. Suitable studs (2 pcs) can be used as guide pins, and screwed into the flywheel fixing bolt holes.

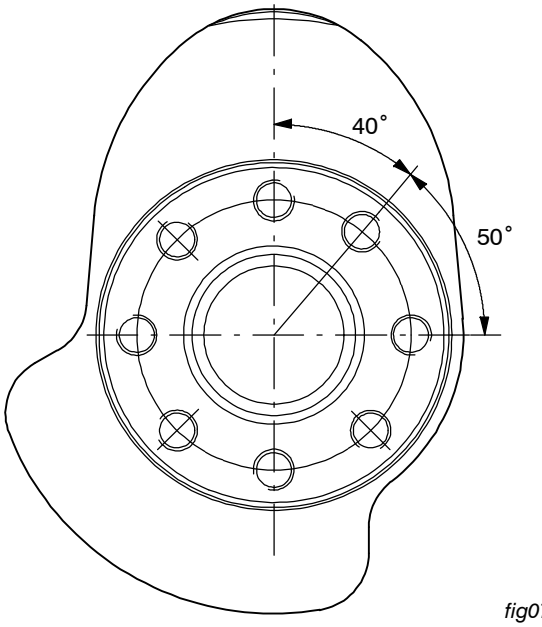


fig078

3. Tighten the flywheel retaining screws evenly to a torque of **150 Nm**.

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Timing gears, 66– engines

Removing timing gear casing

Since the bottom face of the timing gear casing forms a part of the mating face of the oil sump gasket, the casing cannot be removed without first removing the oil sump.

1. Drain the engine oil and remove the oil sump.
2. Remove the radiator, fan, alternator, belt tensioning and belt (if not previously removed). If the engine is equipped with an air compressor or air conditioner, it must be removed.

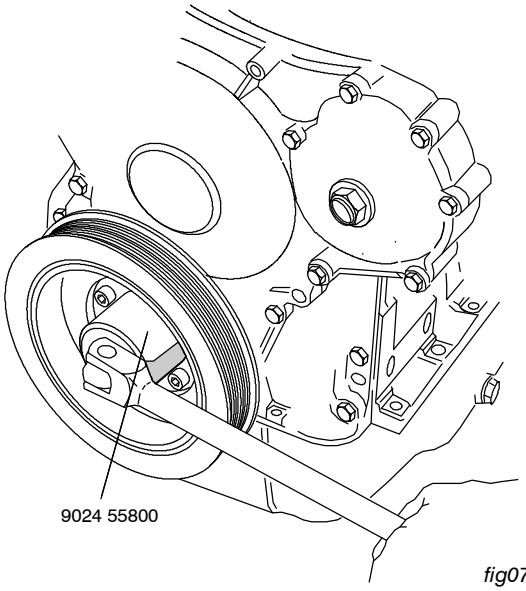


fig079

3. Loosen the crankshaft nut (special tool 9024 55800 for 66–engines). Remove the hub (with belt pulley and viscose damper).
4. Remove the drive unit and hydraulic pump (if installed).
5. Open the double idler gear nut and remove the timing gear casing cover and the oil deflector ring at the front end of the crankshaft.
6. Remove the high–pressure pump.

Note! If the timing gear casing does not need changing, the double idler gear shaft can remain in place.

7. Remove the double idler gear.
8. Unscrew the idler gear bolts (17 and 22 mm). Remove the flange, gear wheel and bearing journal.
9. Extract the camshaft.

Note! If the cylinder head and valve mechanism have not been removed, the tappets must be prevented from falling down. (see code **215.4**, “Changing camshaft / camshaft gear”).

10. Remove the timing gear casing. Ensure that none of the sealing surfaces are damaged.
11. Remove the crankshaft front sealing ring from the front casing and clean all the parts that have been removed.

Reconditioning idler gear

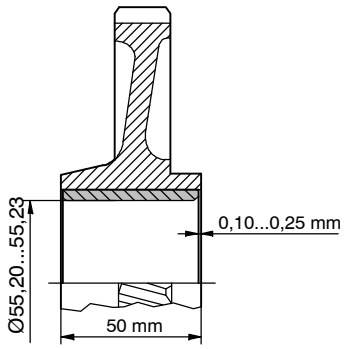


fig080

If the idler gear bushing has been changed, press in a new bushing so that its rear edge is **0.1...0.25 mm** inside the gear wheel rear edge.

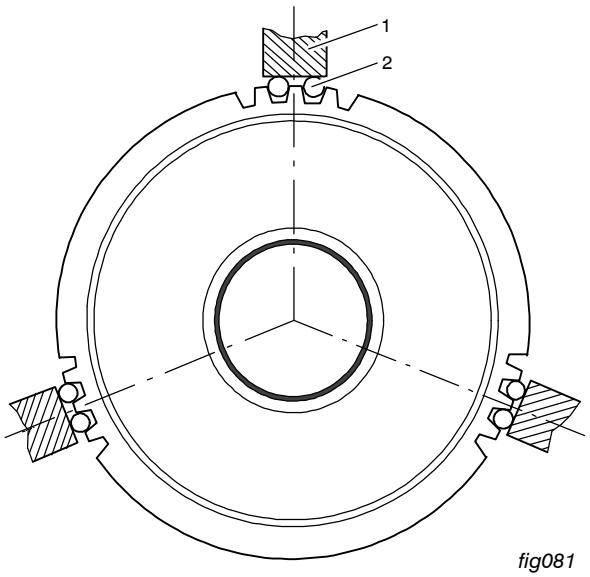


fig081

1. Chuck of lathe
2. Roller 5 mm

Machine the idler gear bushing inner diameter to a correct dimension after fitting. Centre the idler gear according to the figure above so that the tooth backlash is kept the same.

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Fitting timing gear casing

The position of the timing gear casing and cover is determined by two tension pins. Centring should therefore not be undertaken in connection with fitting. However, the tooth backlash between the different gears should be checked. Casing and covers that are delivered as spare parts also have holes for the tension pins already machined.

1. Apply sealant to a sealing surface and fit the casing against the cylinder block. Drive in the tension pins with drift 9025 98700. Tighten nuts and bolts.
2. Lubricate the camshaft bearings and insert the shaft into the cylinder block. Release the push rods and tappets if they have been suspended.
3. Fit the idler gear with a shaft stud and ensure that the markings are in the correct position. Fit the washer and tighten the bolts to the correct torque.
4. Fit the double idler gear bearings as shown in the picture. Fit the double idler gear using a new O–ring. Tighten the shaft fastening screw to 120 Nm.

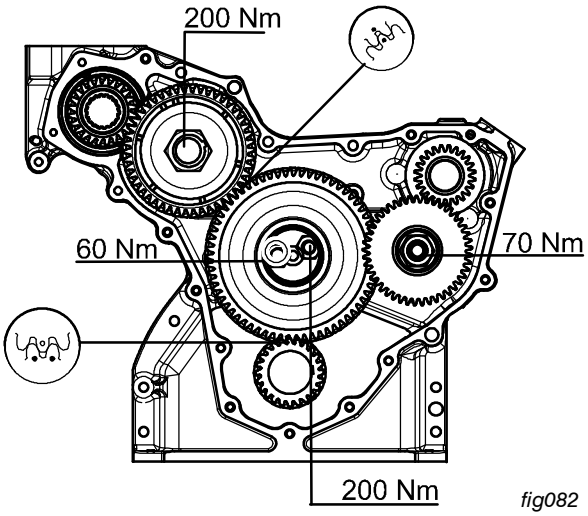


fig082

Note! Fit the double idler gear shaft before fitting the high-pressure pump. Otherwise the shaft screw is impossible to tighten.

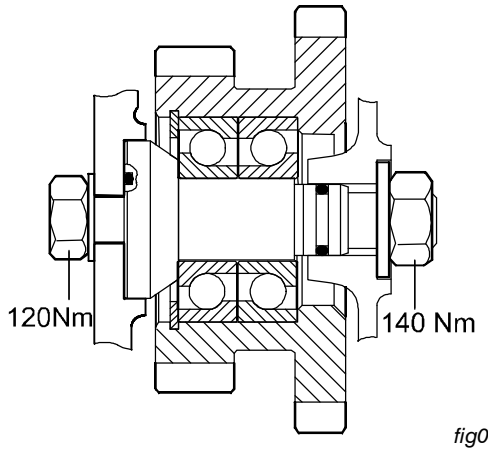
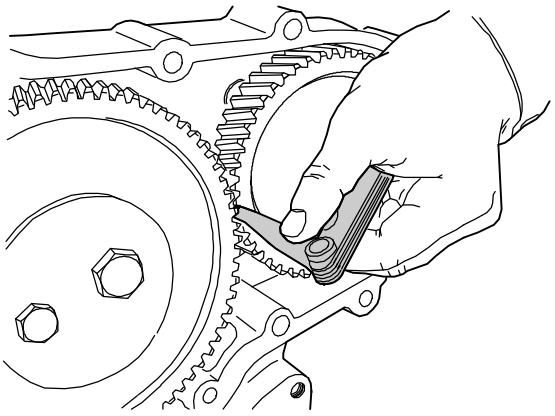


fig083

5. Fit the high–pressure pump and gear wheel.
6. Tighten the camshaft and high–pressure pump gear nuts to the correct torque.


fig084

7. Check the tooth backlash, which should be **0.05...0.25 mm**.

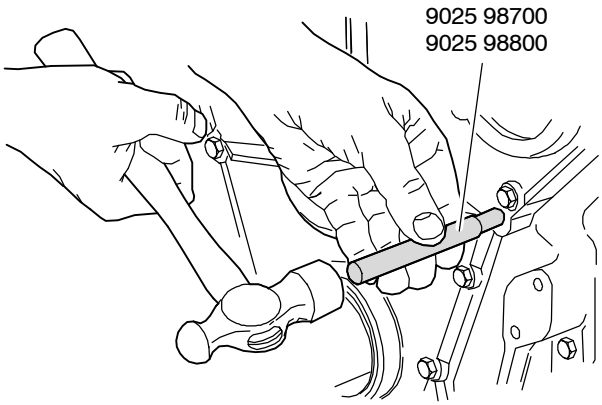


fig085

8. Fit the oil deflector ring on the crankshaft and fit the timing gear casing cover using a sealant. Drive in the tension pins with drifts 9025 98700 and 9025 98800 respectively (the tubular pin round the screw stud). Tighten nuts and bolts.

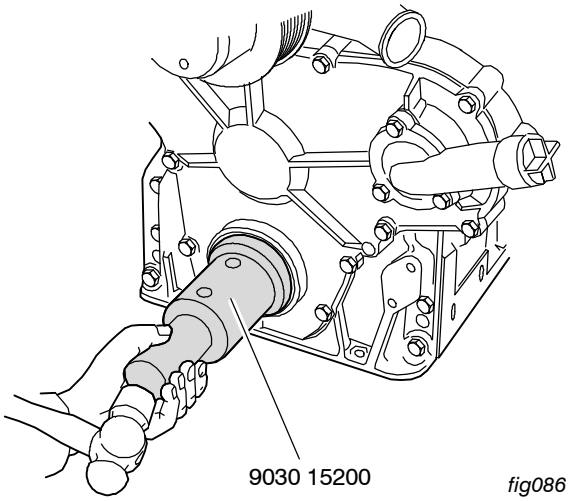


fig086

9. Fit the protective plate into the seal location and fit the crankshaft front seal with special tool 9030 15200.

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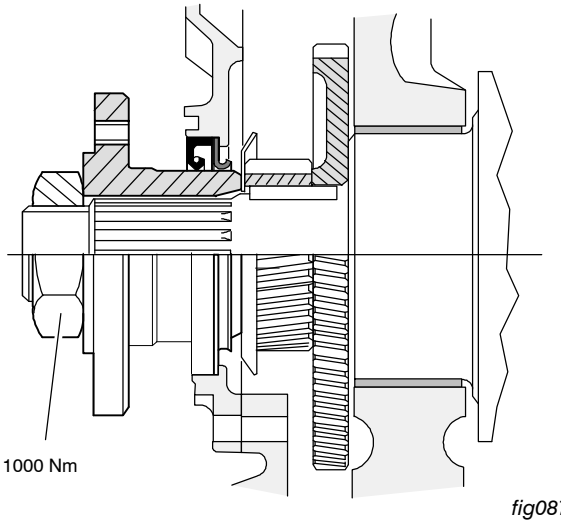


fig087

10. Lubricate both the seal and sealing surfaces and fit the crankshaft hub (with belt pulley).

11. Lubricate the crankshaft nut threads. Tighten the nut to **1000 Nm** on 66–engines.

12. Fit the other removed parts.

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Timing gear assembly, 74– engines

This timing gear is equipped with the idler gear, which is fitted with a ball bearing.

Removing timing gear casing

Since the bottom face of the timing gear casing forms a part of the mating face of the oil sump gasket, the casing cannot be removed without first removing the oil sump.

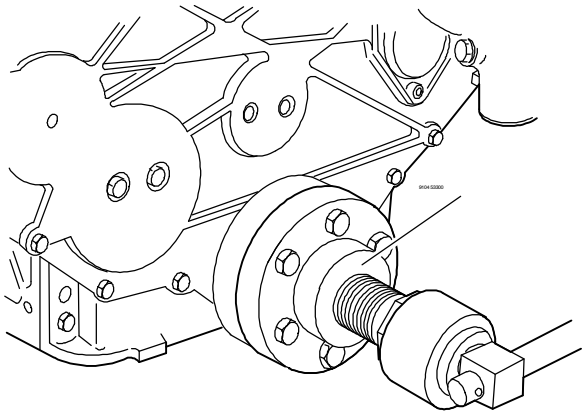


fig088

1. Drain the engine oil and remove the oil sump.
2. Remove the radiator, fan, alternator, belt tensioning and belt (if not previously removed). If the engine is equipped with an air compressor, it must be removed.
3. Remove the crankshaft belt pulley and the vibration damper.
4. Loosen the crankshaft nut about two turns (special tool 9024 55800). Fit extractor 9104 53300 and extract the crankshaft hub. Take off the extractor, open the nut and remove the hub.

Note! Do not remove the nut completely at first. The hub can be thrown dangerously when the nut is loosened.

5. Remove the high–pressure pump.

Note! If the timing gear casing does not need changing, the high–pressure pump can remain in place. In this case, disconnect all leads and pipes from the pump.

6. Unscrew the idler gear screw and remove the idler gear. Also remove the double idler gear and small idler gear (broad timing gear casing).
7. Extract the camshaft.

Note! If the cylinder head and valve mechanism have not been removed, the tappets must be prevented from falling down.

8. Remove the timing gear casing. Ensure that none of the sealing surfaces are damaged.
9. Remove the crankshaft front seal ring from the front casing cover and clean all the parts removed.

Fitting timing gear casing

The position of the narrow timing gear casing and cover is determined by two tension pins. Centring should therefore not be undertaken in connection with fitting. However, the backlash between the different gears should be checked. Casing and covers that are delivered as spare parts also have holes for the tension pins already machined.

Note! The front cover of the broad timing gear has been centred with the idler gear shafts. The separate guide pins are not used.

1. Apply sealant to a sealing surface and fit the casing against the cylinder block. Drive in the tension pins with drift 9025 98700. Tighten the screws and nuts.
2. Lubricate the camshaft bearings and insert the shaft into the cylinder block. Release the push rods and tappets if they have been suspended.

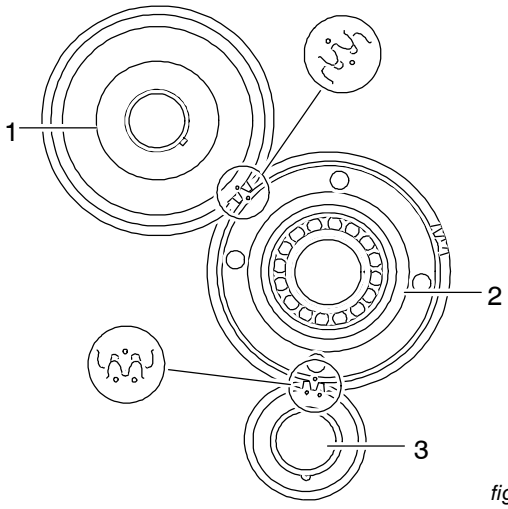


fig089

3. Assemble the idler gears as shown in the picture. Fix the big idler gear in position. Note the position of the timing marks. Screw the fastening screw with seal element in the higher position.

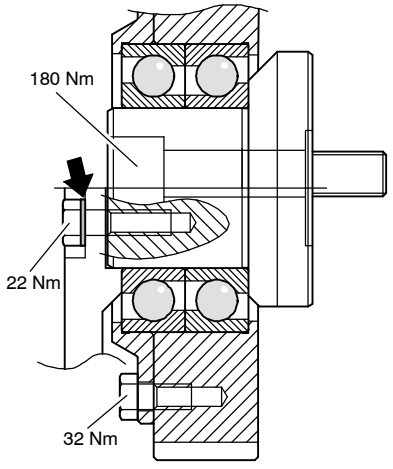


fig090

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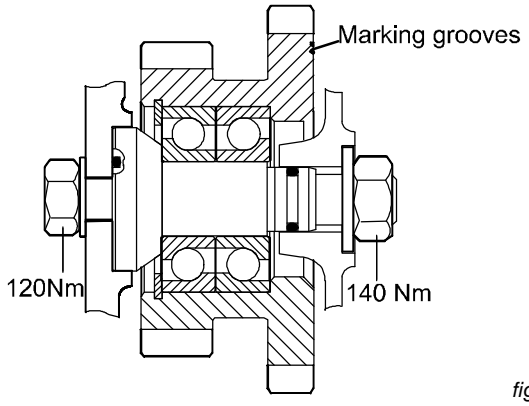


fig091

4. Fit the double idler gear bearings as shown in the picture. Fit them using new O–rings. Tighten the shaft fastening screw to **120 Nm**.

In the 74–engines, the double idler gear differs from the high–pressure pump gear in the number of teeth. Gears are marked with marking grooves on the face as follows:

Engine	Marking grooves	Double idler gear	High–pressure pump gear
74	1	8370 70086 / z = 45	8370 70087 / z = 30

Note! Fit the double idler gear shaft before fitting the high–pressure pump. Otherwise the shaft screw is impossible to tighten.

5. Fit the high–pressure pump and gear wheel.

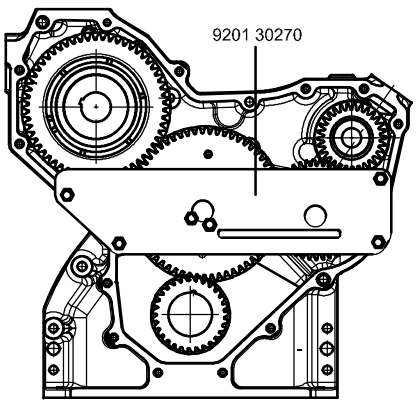


fig092

Centring tool	Engine	Timing gear casing
9201 30270	74	8370 70062 narrow 8370 70157 narrow/drive unit

6. Tighten the guide bolts in the centring tool frame and position the unit on the idler gears as shown in the picture (guide bolts in the idler gear shaft holes and housing holes). Tighten the idler gear bolts through the centring tool holes. Tighten the idler gear bolt (M14) to 180 Nm and small idler gear bolts (M8) to 45 Nm. Remove the centring tool.

7. Tighten the camshaft and high–pressure pump gear nuts to the correct torque.

8. Check the tooth clearance, which should be **0.05...0.25 mm**.

9. Fit the drive unit shaft onto the front cover (engines with a drive unit). Fit the cover and knock the tension pins into place (narrow timing gear casing). Note the seal rings for the screws of idler gear shaft. Fit the rear bearing of the drive unit and the cover.

Note! If the oil throwing ring is removed from the crankshaft, fit it with the drift 9103 94900 before fitting the cover.

10. Tighten the double idler gear nut to 140 Nm.

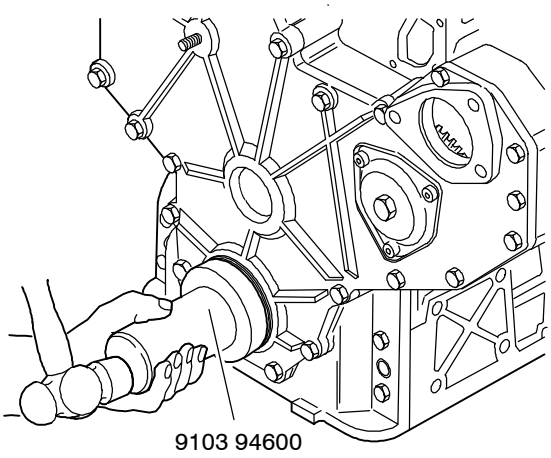


fig093

11. Fit the protecting plate in position at the bottom of the seal and fit the front seal of the crankshaft with special tool 9103 94600.

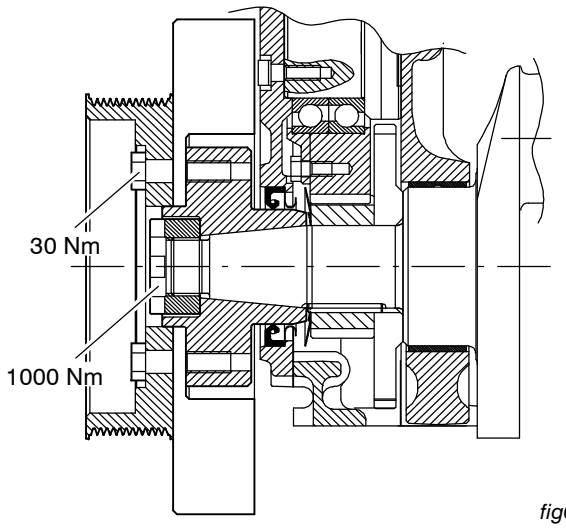


fig094

12. Lubricate both the seal and the sealing surface and fit the crankshaft hub. Lubricate the crankshaft nut threads slightly and tighten the nut to **1000 Nm**.

13. Fit the other removed parts.

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Fan Drive Device

1. Assemble the drive device as shown in the picture. Fit the inner bearing and the lock ring. Fill the bearing housing partially with heat–resistant ball bearing grease (NLGI 2). Fit the spacer sleeve, the outer bearing and the lock ring. Note the position of the outer bearing during assembly.
2. Press the shaft into place so that the ball bearings do not transmit the pressure.
3. Tap the blocking plug (if removed) into place with fitting drift 9025 87400.

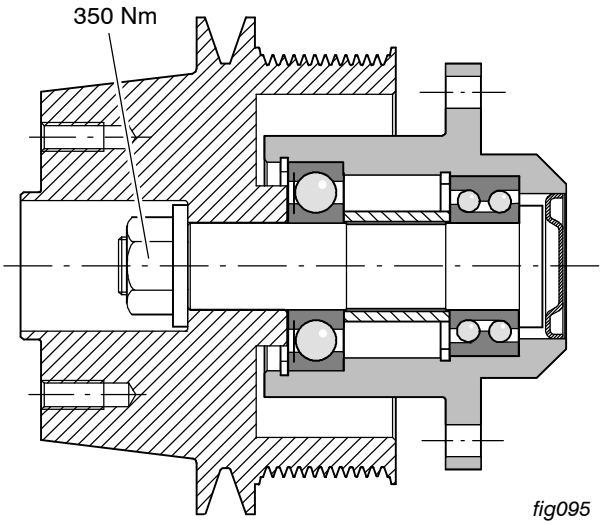


fig095

4. Fit the belt pulley, washer and nut. Tighten the nut to **350 Nm**.

Power take-off

The engines use a transmission that can be equipped with a PTO run from the camshaft gear. The PTO can run e.g. a hydraulic pump.

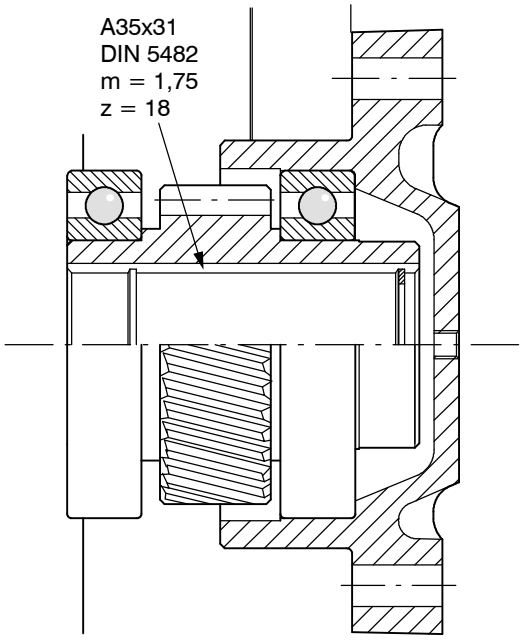


fig096

Note! Use molybdenite–sulphide (MoS2) ball bearing grease (NLGI 2) for the grooves of the hydraulic pump shaft and the coupling sleeve.

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Changing crankshaft gear rim

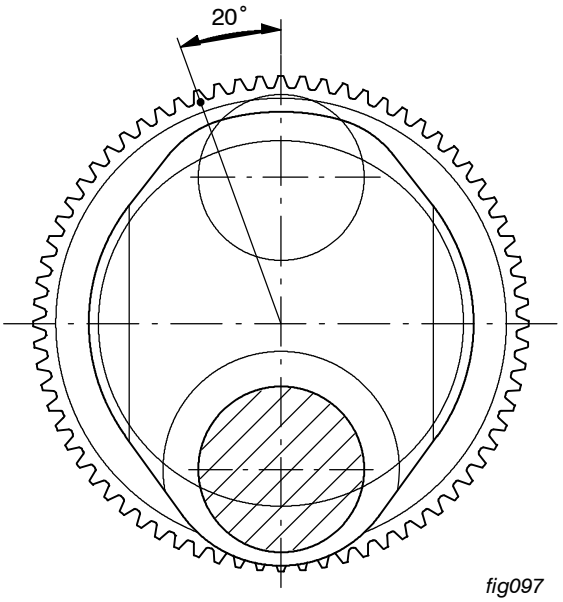


fig097

1. Mark the position of the gear rim on the shaft.
2. Heat the gear rim with a welding torch and drive it off using a suitable drift.
3. Heat the new gear rim to max. **250°C.** Fit the gear rim with the chamfer facing the crankshaft flange, and with the teeth according to markings or according to figure above. Tap the gear rim down and leave it to cool.

Note! The picture above shows a rear view of the crankshaft and no. 2 cylinder big end bearing journal.

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Lubrication system

Oil pressure regulating valve

If the pressure of the engine lubricating oil is insufficient or varies, the oil level then the regulating valve should be checked.

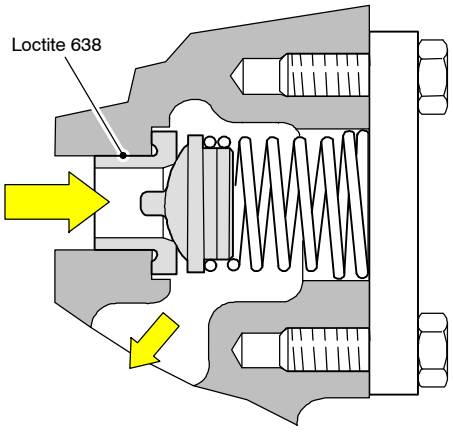


fig098

1. Remove the cover and the spring with the valve plate.
2. Clean the parts and check that the sealing surfaces are undamaged. Damaged parts should be changed. Scrape off any remains of the gasket.

Note! There are two types of spring.

3. Apply locking fluid (e.g. Loctite 638) onto the outside of the valve seat. Tap the new valve seat into the cylinder block using a suitable drift. Place the spring with valve plate into the cylinder block and fit the cover with a new gasket.

Removing and dismantling lubricating oil pump

1. Drain the engine oil and remove the oil sump.
2. Remove the oil pump suction and pressure pipe.
3. Remove the oil pump together with any shims between the pump and the cylinder block.
4. Remove the pump cover and the gasket. Remove the gear on the dead axle.
5. Clamp the pump gear across the teeth in a vice fitted with soft jaws, and loosen the drive gear nut. Knock the gear wheel off by hitting the end of the shaft with a soft hammer. Pull out the drive shaft gear wheel.
6. Clean the parts and check for wear and other damage. See **code 211.1,** "**Technical data**", point "**Oil pump**". Change damaged parts and all seals.

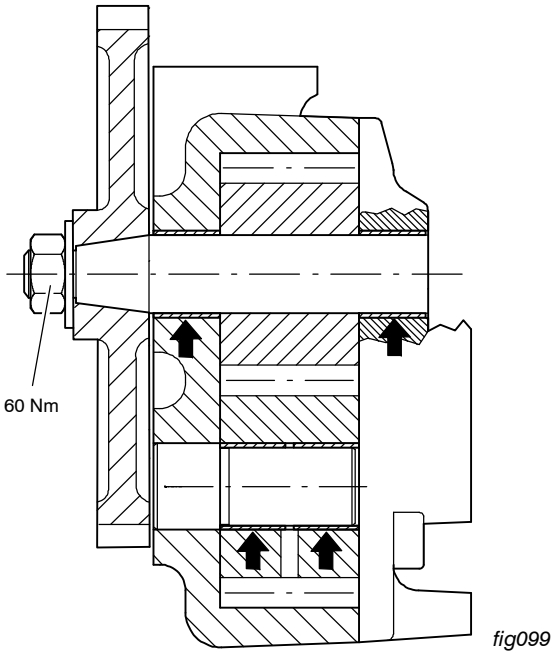


fig099

7. On the 66– and 74 –engines, the bearing points are provided with separate bearing bushings. If you change the bushings, machine them to a size of **18.000...18.018** mm after fitting.

Assembling and fitting lubricating oil pump

1. Fit the gear wheels to the pump body. Fit the cover using a new gasket. Partly tighten the screws. Rotate the pump shaft and tap the side of the cover gently until it reaches the position in which the shaft rotates most freely. Tighten the screws and check that the shaft still rotates freely.
2. Fit the drive gear onto the shaft. Apply locking fluid (e.g. Loctite 242) onto the nut threads and tighten the nut to **60 Nm**. Remember the washer under the nut.

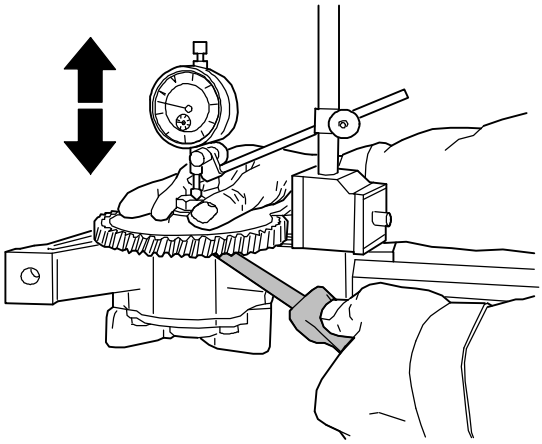


fig100

3. Fasten the oil pump in a vice and check the end float between gear and pump housing. The clearance, which should be **0.03...0.11 mm**, is adjusted by the number of gaskets between the cover and the body.

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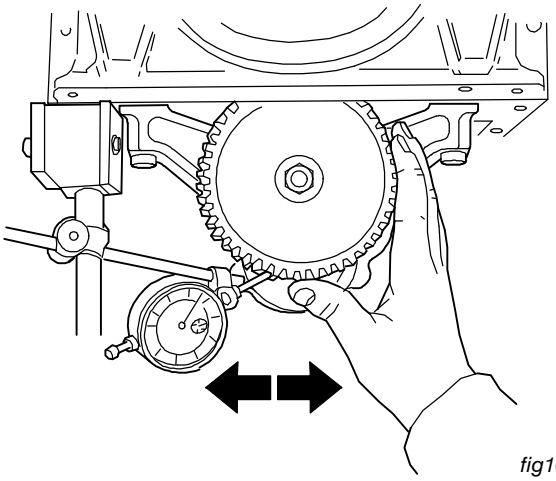


fig101

4. Fit the pump and check the tooth backlash against the crankshaft gear. The clearance, which should be **0.05...0.25 mm**, is adjusted with shims between the pump body and the cylinder block (shim 0.2 mm, order no. 8360 07871). One shim increases/decreases the backlash by about 0.07 mm.

Note! When measuring the tooth backlash, the engine should be the correct way up as the crankshaft bearing clearance affects the tooth backlash.

5. Connect the suction and pressure pipes together with new seals.

6. Fit the oil sump and fill in the lubrication oil.

Piston cooling nozzles

The engines with high output are fitted with piston cooling nozzles. The cooling nozzles can be removed after the oil sump is removed. The nozzles have a ball valve with an opening pressure of **3±0.25 bar**.

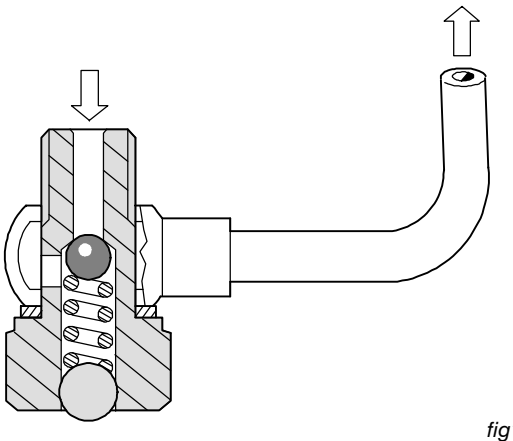


fig102

1. Change the valve if necessary. Detach the valve from the engine and remove the nozzle pipe. Fit a new valve.

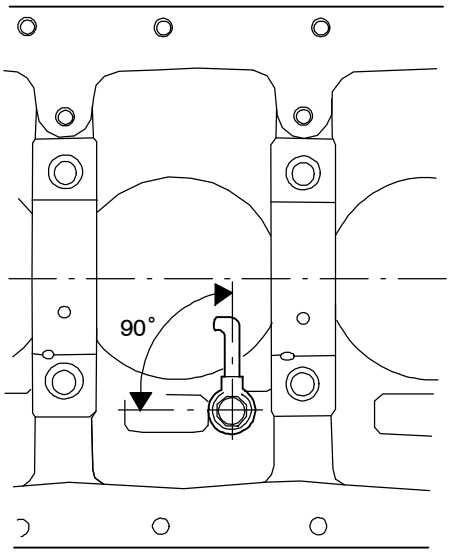


fig103

2. Fit the nozzle pipe at a **90˚** angle to the centre line of the crankshaft as shown in the picture above. Tighten the valve to **30 Nm**. Ensure that the pipe does not touch the pistons or connecting rods when the engine is running.

Fitting oil sump gasket

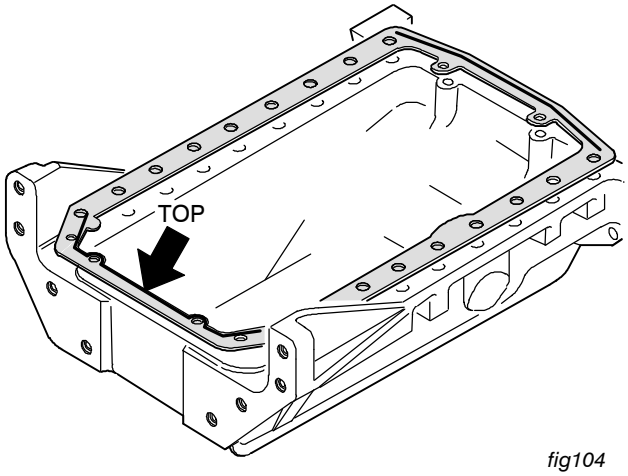


fig104

Fit the oil sump gasket with the silicone stripes against the cylinder block (self–carrying and casted oil sumps).

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Lubricating oil cooler

Some engines are fitted with an oil cooler, which is positioned in between the oil filter and the cylinder block.

1. The engine coolant should be drained before removing the lubricating oil cooler.

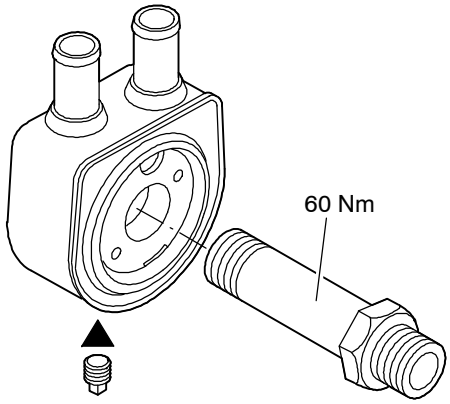


fig105

2. Fit new sealing rings. Fit the cooler with the draining plug turned downwards. Connect the coolant pipes in the correct way.
3. Apply the locking fluid (e.g. Loctite 242) to the nipple (the thread that attaches to the cylinder block) and tighten it to a torque of **60 Nm**.

Lubricating oil quality requirements

Use lubricating oils of the following quality grades.

API-grade	ACEA-grade
CI-4	E7

Select the viscosity grade from table below depending on the temperature outside.

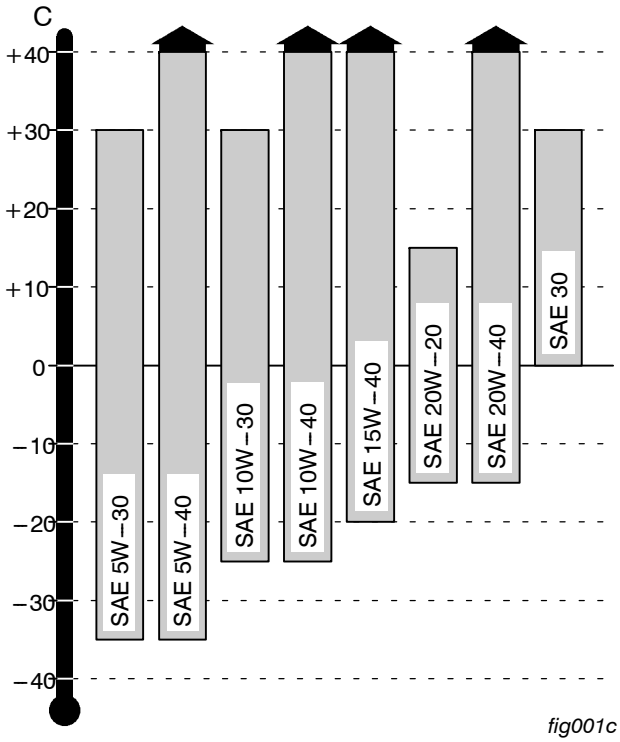


fig001c

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Inlet and exhaust system

An engine that is fitted with a turbocharger is a lot more sensitive to disturbances and impurities in the inlet and exhaust systems than a naturally aspirated engine. Therefore, special attention should be paid to the whole inlet and exhaust system.

Checking air cleaner

The engine performance and length of service life depend to a great extent on the state of the air cleaner. A defective air cleaner allows impurities to pass through, which in time damage the turbocharger and the engine. A blocked air cleaner reduces the engine output and also causes oil leakage through the sealing ring on the turbocharger shaft.

Note! The safety filter inside the main filter should not be removed unnecessarily for checking or cleaning. The safety filter must not be cleaned, but should be changed when necessary.

Checking inlet and exhaust pipes

Important! Leaks in the inlet or exhaust system drastically reduce the effect of the turbocharger. Because of the pressure, even small leaks in the manifold or the turbine inlet contact flange quickly increase in size. For this reason, all leaks must be dealt with immediately.

1. Inspect the pipes and sealing surfaces between the air cleaner and the turbocharger, as well as between the turbocharger and the intake manifold. If the intake manifold is dusty inside, there is a leak in either the air cleaner or the inlet pipes. Fix the leak.
2. Clean the intake manifold sealing surface. Check that the sealing surface is flat using a straight ruler. If the surface is not flat or has scratches on it, machine or renew the intake manifold. On 66– and 74–engines, ensure that the cylinder heads are parallel.
3. Fit a new gasket and fasten the intake manifold. Tighten the manifold fixing screws to a torque of **30 Nm**. Fasten the air pipes carefully.
4. Check that the exhaust manifold is airtight. Tighten the nuts to **50 Nm** and inspect for any damage (cracks, deformation, corrosion etc.). Also check the connection between the turbocharger and the exhaust manifold.
5. Remove the manifold if necessary. Clean the sealing surfaces and remove any carbon deposits. Check that the sealing surfaces are flat. If the fastening flanges are twisted or there are scratches on the sealing surfaces, machine the flanges or renew the exhaust manifold.
6. Ensure that no loose objects or impurities have entered the exhaust pipe or the silencer. Any such loose objects or impurities can increase the back pressure for the exhaust gases from the turbine wheel.

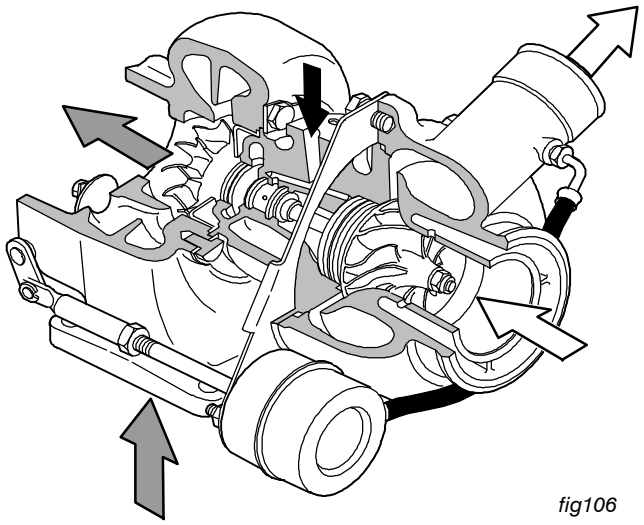


fig106

Inlet air

Exhaust gases

Lubrication oil

Checking turbocharger

If a fault is suspected in the turbocharger, it can be located in the following way:

1. Visually inspect the turbine and compressor wheels. The vanes must not show any signs of damage, deformation or wear caused by foreign objects.
2. Investigate any oil leaks through the sealing rings on the shaft in the turbine and compressor housing.

Note! At low idling speed there is always a certain amount of oil leakage on the compressor side. However, this should not cause too much concern unless the oil consumption is too great.

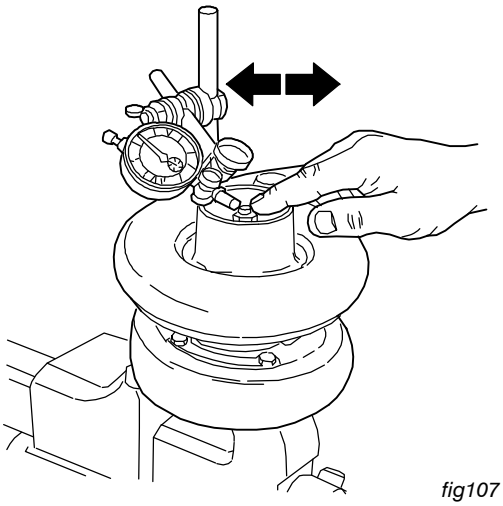


fig107

3. Check the turbine shaft running clearance. Place the stylus of a dial gauge against the shaft and move the shaft sideways. Refer to the clearance given in the specifications. See **code 211.1,** "**Technical data**" point "**Turbocharger**".

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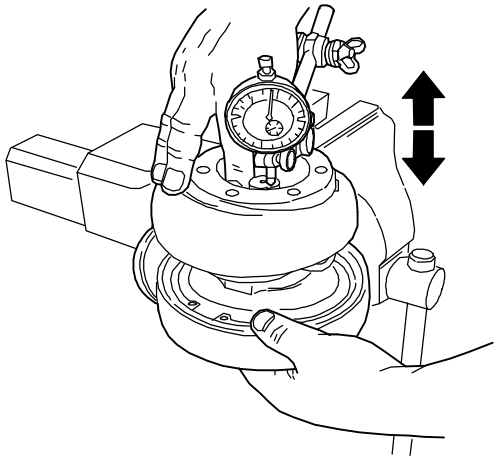


fig108

4. Check the shaft end float. Place the stylus of the dial gauge against the end of the shaft and move the shaft axially. Refer to the clearance given in the specifications. See **code 211.1,** "**Technical data**" point "**Turbocharger**".

If any defects or wear are detected, the turbocharger should be reconditioned.

If the engine does not work correctly and the turbocharger is not defective or too worn, the fault could be traced to one of the following items:

- Blocked air filter.
- Leakage in the inlet or exhaust systems. Leaking flange seal.
- Defective injection pump or EEM 3 control unit.
- Defective or wrongly adjusted injectors.
- Low fuel pressure (e.g. blocked fuel filter).
- Low compression, wrong valve clearance.

Fitting turbocharger

Locate the cause of the defects on the turbocharger. Remedy the fault before fitting the new turbocharger.

In order for the turbocharger to work satisfactorily, it is important that the engine oil is in good condition. Likewise, the oil should be to the correct quality specification. The air filter and oil filter should be serviced according to the Instruction Manual specification.

The setting of the injection system seriously affects the function of the turbocharger. The injection system should be adjusted according to the manufacturer's instructions.

1. Check the tightness of the intake and exhaust manifolds, and that they are securely fastened. Ensure that there are no loose carbon or rust particles, or other foreign objects in the manifolds.
2. Connect the turbocharger to the exhaust manifold and tighten down using a new gasket.
3. Connect the inlet pipe and the exhaust pipe to the turbo.

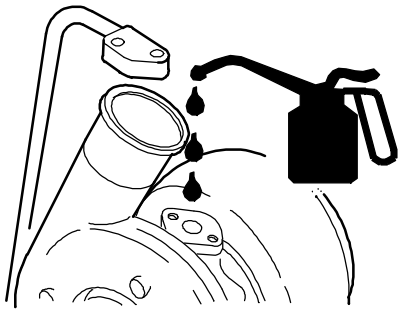


fig109

4. Pour about 0.1 litres of pure engine oil into the bearing housing before attaching the pressure oil pipe. This is very important in order to ensure that the turbocharger is lubricated when starting.
5. Connect the pressure and return oil pipes. Use a new seal. Check that there is no tension in the pipes when tightening.
6. Start the engine and check that there are no leaks.

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Technical data

High pressure pump

Type CP1H . . . . . 3 cylinder / radial plungers
– max. injection pressure . . . . . 1100 bar
– gear ratio . . . . . 4 : 3

Injection order 1–5–3–6–2–4

Injectors

Type CRIN2–2V/CRIN2–4V
– nozzle 8–hole

Fuel System

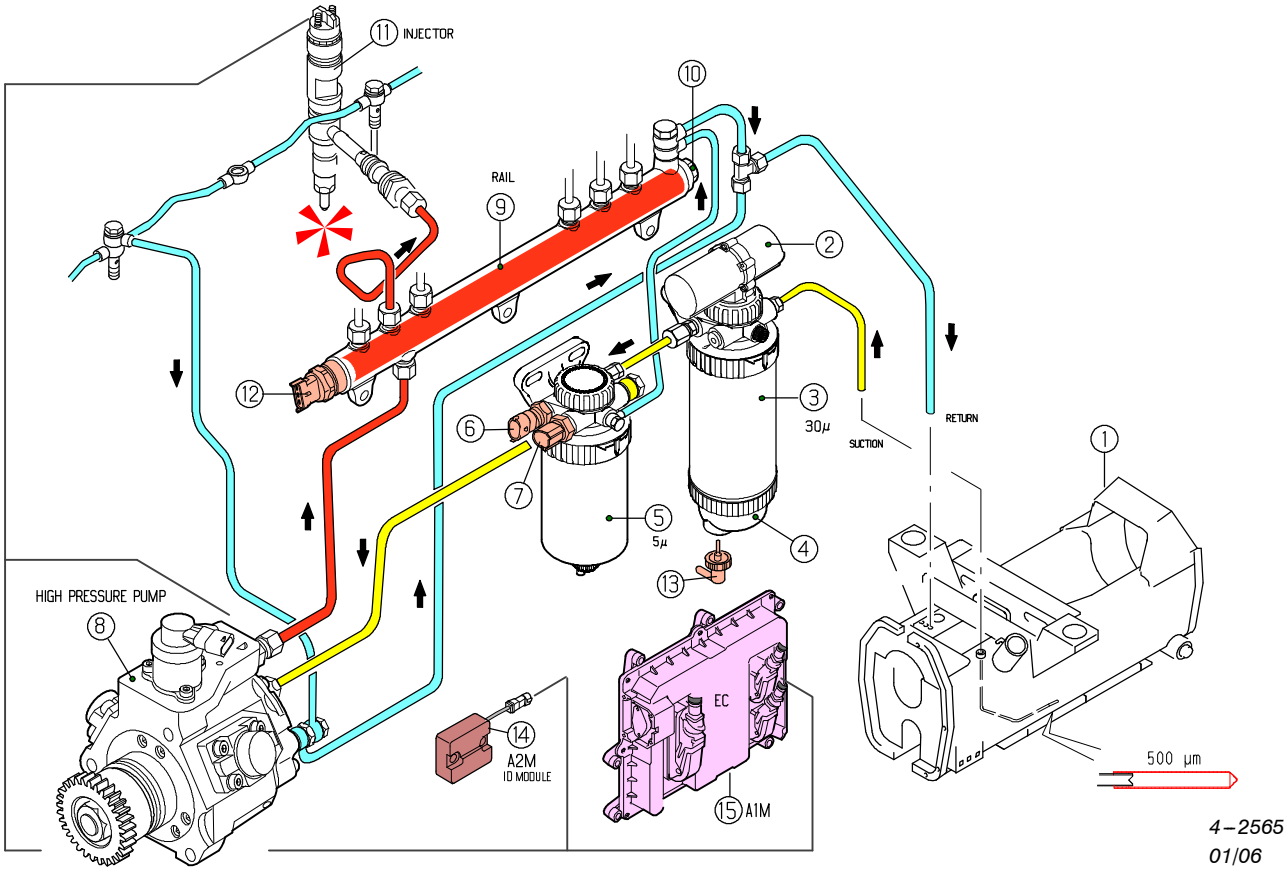
Fuel . . . . . The fuel must be according to norm EN 590
Max. continuous fuel inlet temperature . . . . . 70˚ C
Fuel filters:
– prefilter . . . . . Stanadyne 30 µ, element no 8368 67591
– main filter . . . . . Stanadyne 5 µ, element no 8368 67595
Feed pump . . . . . Electric type, with prefilter
Supply voltage . . . . . 12 V
Current drain . . . . . max. 6 A
Feed pressure at idle speed . . . . . 0.75 bar

Tightening Torques

Injector retaining screw . . . . . 40 Nm
Injector wire nuts (M4) . . . . . 1.5 Nm
High pressure pump gear nut (M14) . . . . . 70 Nm
High pressure pump retaining screws . . . . . 30 Nm
High pressure fuel pipes to high pressure pump and rail . . . . . 30 Nm
Low pressure fuel pipes to high pressure pump . . . . . 25 Nm
High pressure fuel pipes to injector . . . . . 25 Nm

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Fuel system, description

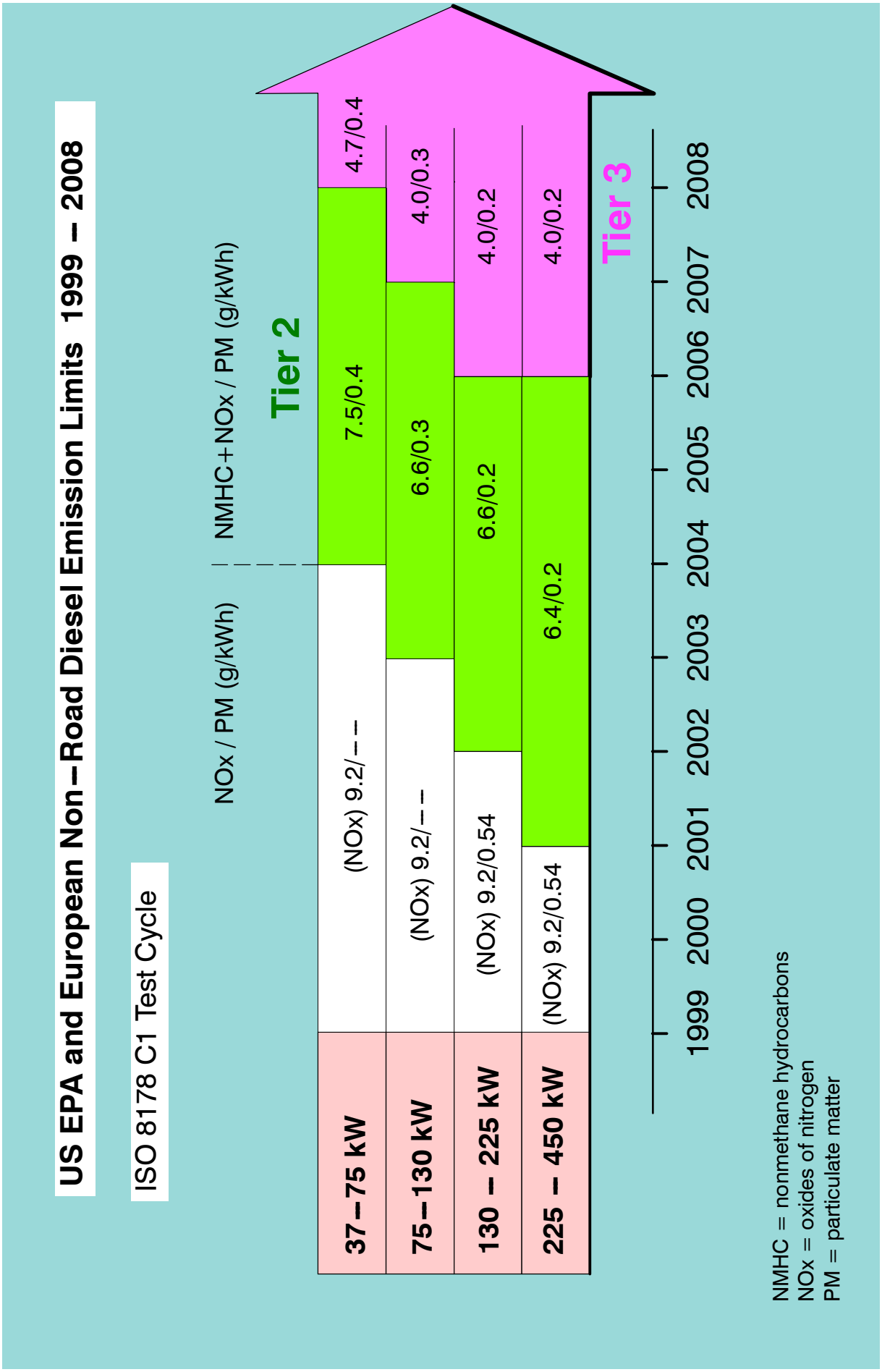


Engines are fitted with a common rail system that is controlled by the EEM3 electronic control unit.

1. Fuel reservoir
2. Feed pump
3. Prefilter (30 microns)
4. Water separator
5. Fuel filter (5 microns)
6. Temperature sensor
7. Feed pressure sensor
8. High–pressure pump
9. High–pressure accumulator (rail)
10. Rail pressure limiting valve
11. Fuel injector
12. Rail pressure sensor
13. Water detector
14. ID module
15. Control unit

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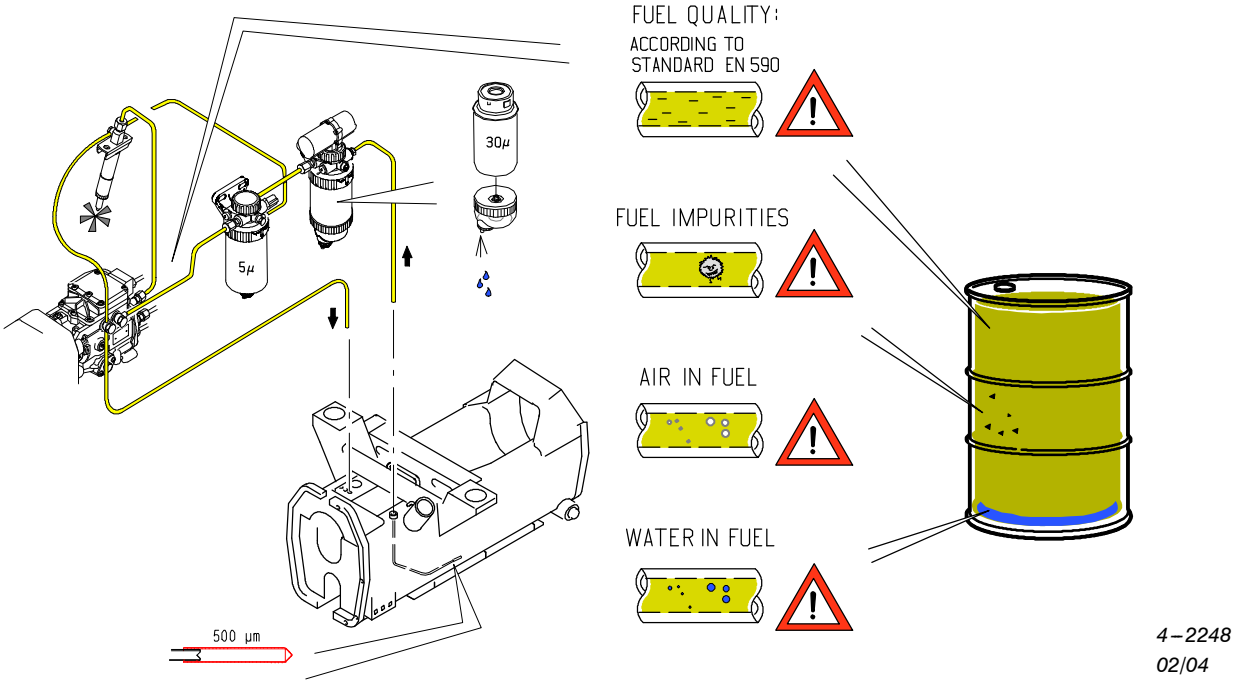
Timetable of the EU emission directives in the picture



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Fuel quality and storage requirements



Quality requirements of engine fuel :

Property	Requirement	Test standard
Specific weight +15°C	0.82...0.84 kg/dm^3	EN ISO 3675:1998, EN ISO 12185
Viscosity +40°C, 445,	1.2...4.5 mm^2/s	ISO 3104
Sulphur content	max. 350 mg/kg	EN ISO14596:1998
Cetane number	min. 51	EN ISO 5165:1998
Water content	max. 200 mg/kg	prEN ISO 12937:1996
Lubricity/HFFR	max. 460 µm	ISO 12156–1

Fuel

- The fuel must conform to the **EN 590** standard.
- The properties of light fuel oil that is only intended for warming use do not meet the requirements of modern diesel engines and cannot be used as fuel.
- In particular, distributor–type injector pumps require the fuel to have sufficient lubricity, because they do not have oil lubrication in the same way as typical multi–element pumps. Adding oil to diesel fuel is not recommended, because it causes carbon build–up, and if oil is mixed with even a small amount of water it will clog the filter.
- Additionally, various fuel quality requirements imposed by taxation and seasonal changes have to be taken into consideration.

Fuel storage

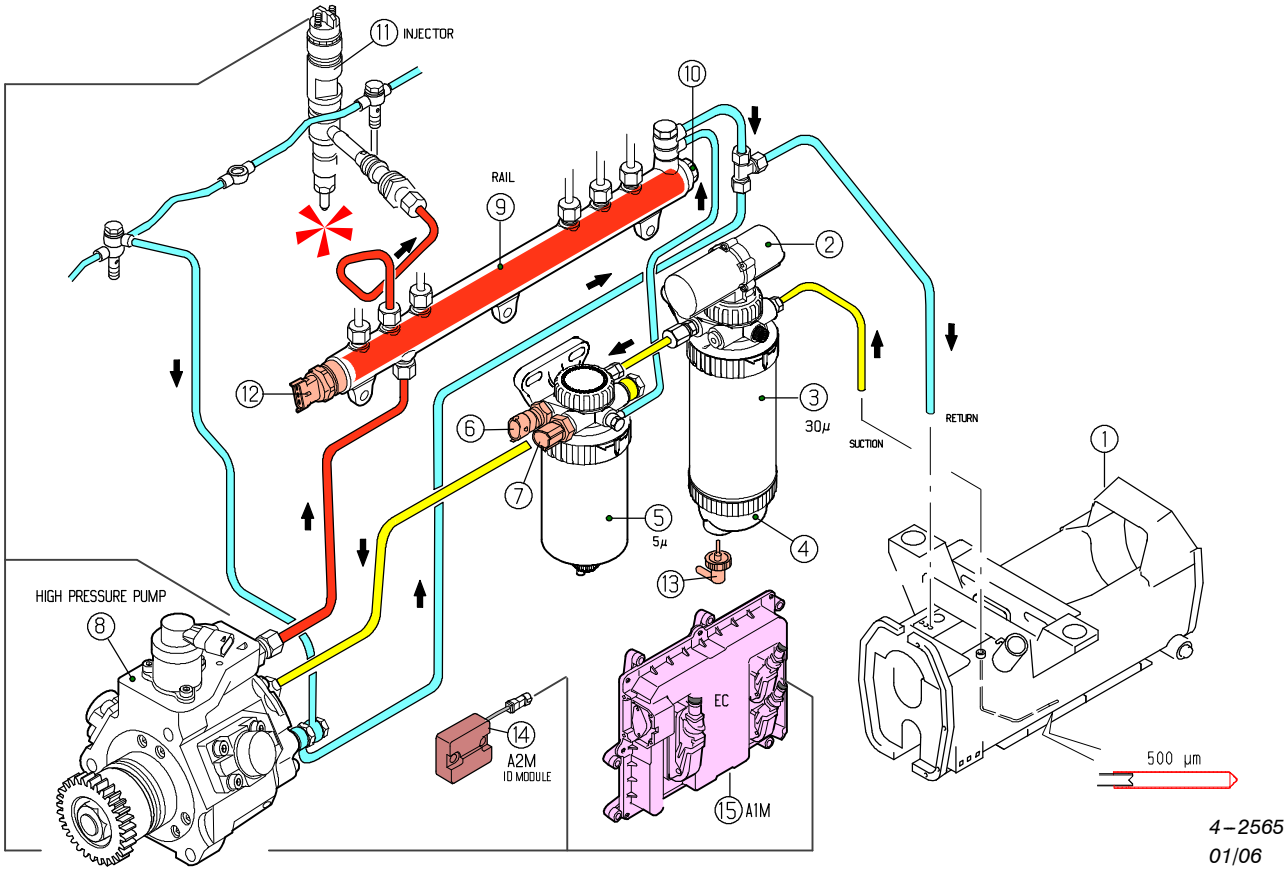
- Storing and distributing fuel must be arranged in conditions where no water or impurities can enter the storage tanks. The storage tanks must be installed in a slanted position, so that water and impurities are collected at the opposite end from the suction pipe of the pump. The suction pipe of the pump should not reach the bottom of the tank.
- Water must be periodically drained from the tank in order to prevent problems. Refueling at the same time the tank is being refilled must be avoided without exception.
- When the tank is filled with winter–quality fuel in good time, the engine is guaranteed to run flawlessly during the cold season.

Filter system

- The engine's standard filter system gives sufficient protection for the injection system from impurities that can be present in well–tended distribution systems.
- The control of distributor–type injection pumps is based on internal pressure, which will drop if the fuel system is clogged. If the pilot pressure drops too low, engine power is reduced, smoke increased and starting becomes more difficult. Additionally, water in the injection system will destroy it in a very short time. **For this reason, the water trap and the filters must always be serviced according to the specified amount of running hours**.
- It is also important always to use original Valtra (or Sisu Diesel) fuel filters. They guarantee sufficient filtration, preventing impurities from damaging the fuel system. There are many cheap filter kits (so–called pirates) on the market, with lower quality and performance in order to minimise the cost. Among other things, the quality and amount of filter paper are often insufficient. There are also often dangerous defects in the basic structure that may cause expensive damage even in a short period of time.

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High pressure pump Bosch CP1



Engines are fitted with a common rail system that is controlled by the EEM3 electronic control unit.

1. Fuel reservoir
2. Feed pump
3. Prefilter (30 microns)
4. Water separator
5. Fuel filter (5 microns)
6. Temperature sensor
7. Feed pressure sensor
8. High–pressure pump
9. High–pressure accumulator (rail)
10. Rail pressure limiting valve
11. Fuel injector
12. Rail pressure sensor
13. Water detector
14. ID module
15. Control unit

The electric feed pump draws fuel from the tank through the pre–filter, then the main fuel filter to the high–pressure pump. From the high–pressure pump, fuel is pumped up into the rail. This highly pressurised fuel is stored in a high–pressure pipe, where it is controlled and injected through electronic injectors that are controlled by EEM3. The injection is optimised in terms of emissions, efficiency and operation noise and takes place in four steps (maximum). Excess fuel returns from the injectors and the pressure–regulating valves of the high–pressure pump and rail and is fed back into the fuel tank.The overflow pipe from the filter helps with the automatic bleeding of the system.

Bleeding fuel system

– Low pressure circuit:

The fuel system bleeds air automatically due to the electric feed pump. If the engine is not restarted, air is bled from the fuel system by holding the ignition switch in position **1** when the fuel pump is rotating for one minute at a time. If the engine fails to start, move the ignition switch back to the **STOP** position, bleed again in the position **1** and start the engine.

– High pressure circuit:

In Common Rail engines let the pump run for 30 seconds and the start for 10 seconds in turn (the high pressure circuit bleeds only when the high pressure pump is rotating).

WARNING: The fuel system connectors are not allowed to be opened when the engine is running and not in 30 seconds after switching off the engine. The pressure in injection type of engines (CR models) is over 1000 bar.

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Bosch CP1

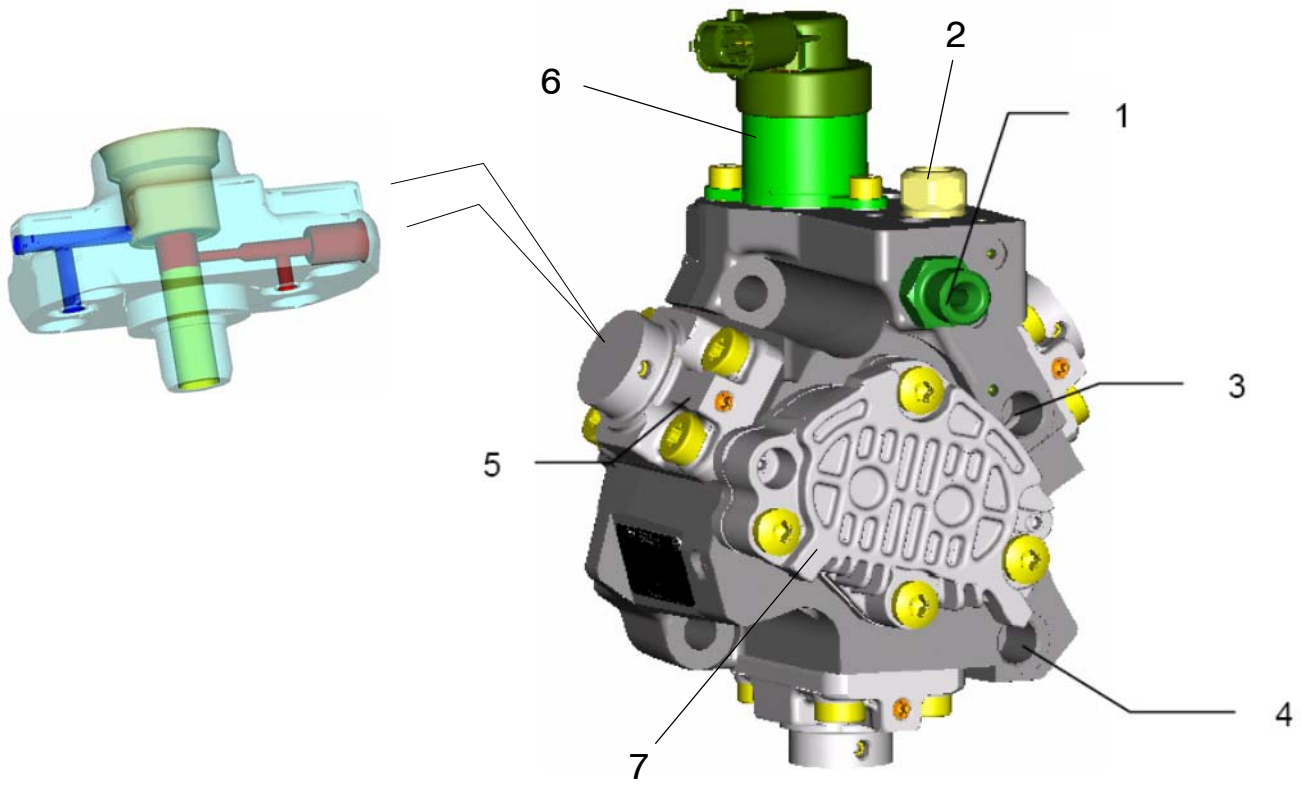


fig004

1. High pressure connection
2. Pressure regulator valve
3. Inlet connection
4. Return connection
5. Pump element
6. Charging regulating valve
7. Gear feed pump

– Pump element is machined to the cover
– Suction and pressure valves are located also in the cover

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High pressure pump (Bosch CP1), operation principle

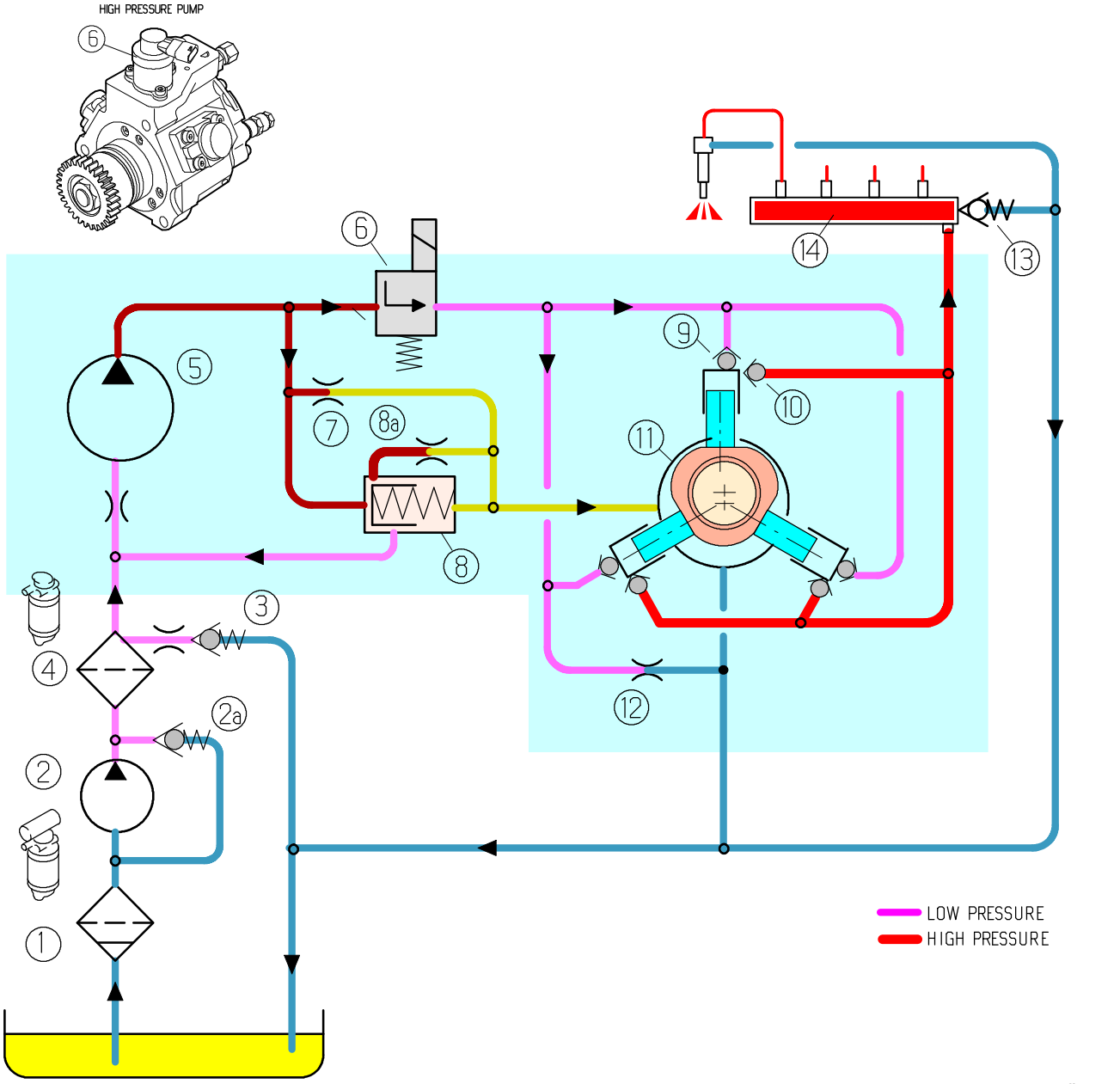


fig005

1. Prefilter
2. Electrical feed pump

2a. Pressure relief valve (0,75 bar)

3. Valve for bleeding
4. Main filter
5. Gear feed pump
6. Charging regulating valve
   – regulates a charge of the high pressure pump
7. Lubricating throttle
8. Overflow valve
   – keeps a pressure before charging regulating valve (6) steady (3...7 ±1 bar depending on pump type)

8a. Throttle (hole in piston)

9. Suction valve
10. Pressure valve
11. High pressure pump
12. Discharging throttle
13. Pressure relief valve (50–100 bar over max. press.)
14. Rail
    – In normal driving conditions a pressure of the rail varies between 300...900 bars

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Charging regulating valve

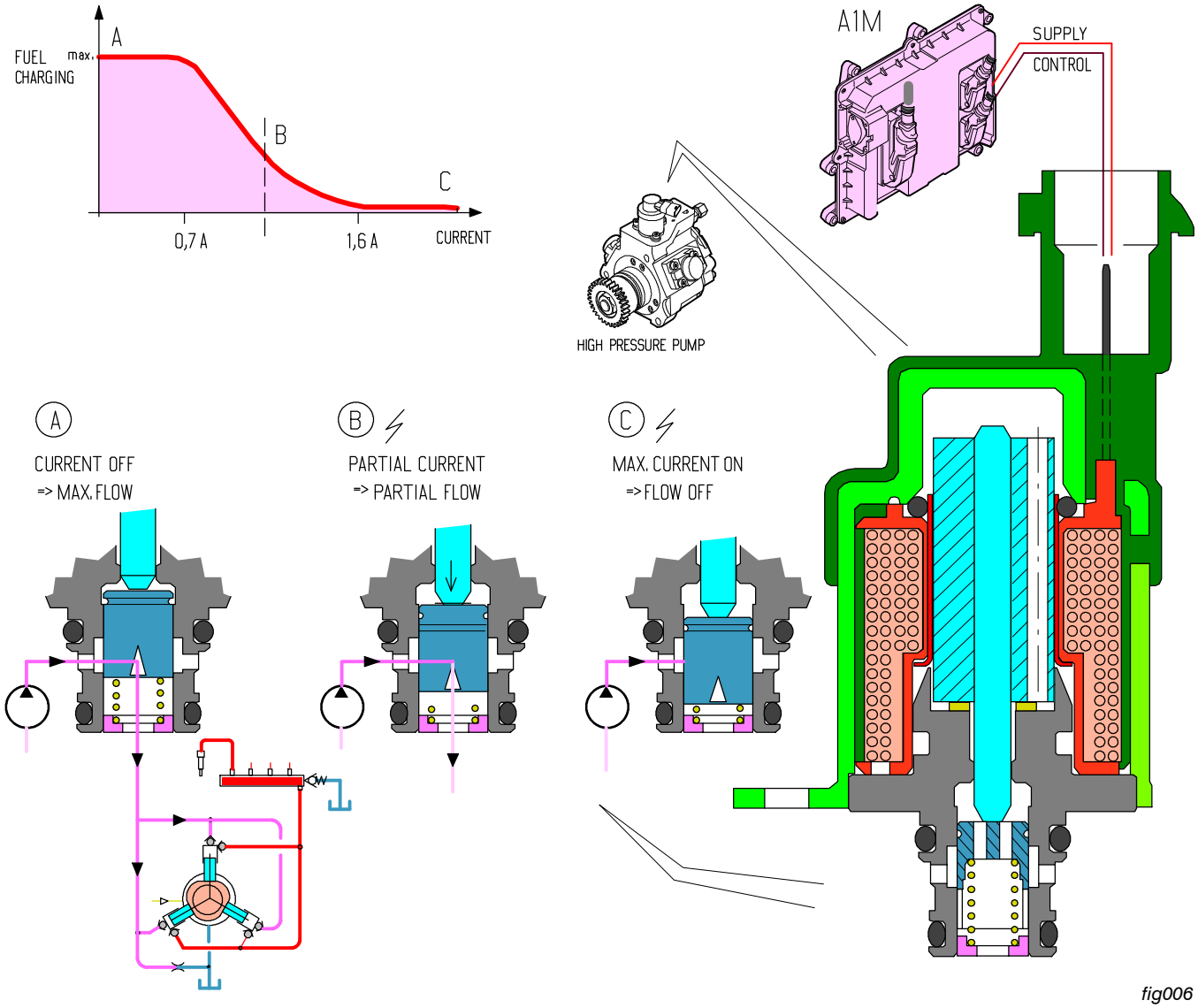


fig006

Charging regulating valve adjusts the charging of the high pressure pump and in this way the output of the pump.

The control unit controls the valve steplessly with pulse modulated current.

A) Solenoid valve unenergized –> maximum flow (max. charging for high pressure pump)

B) Solenoid energized with partial current –> partial flow

C) Solenoid valve energized –> flow stopped (min. charging for high pressure pump)

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Rail

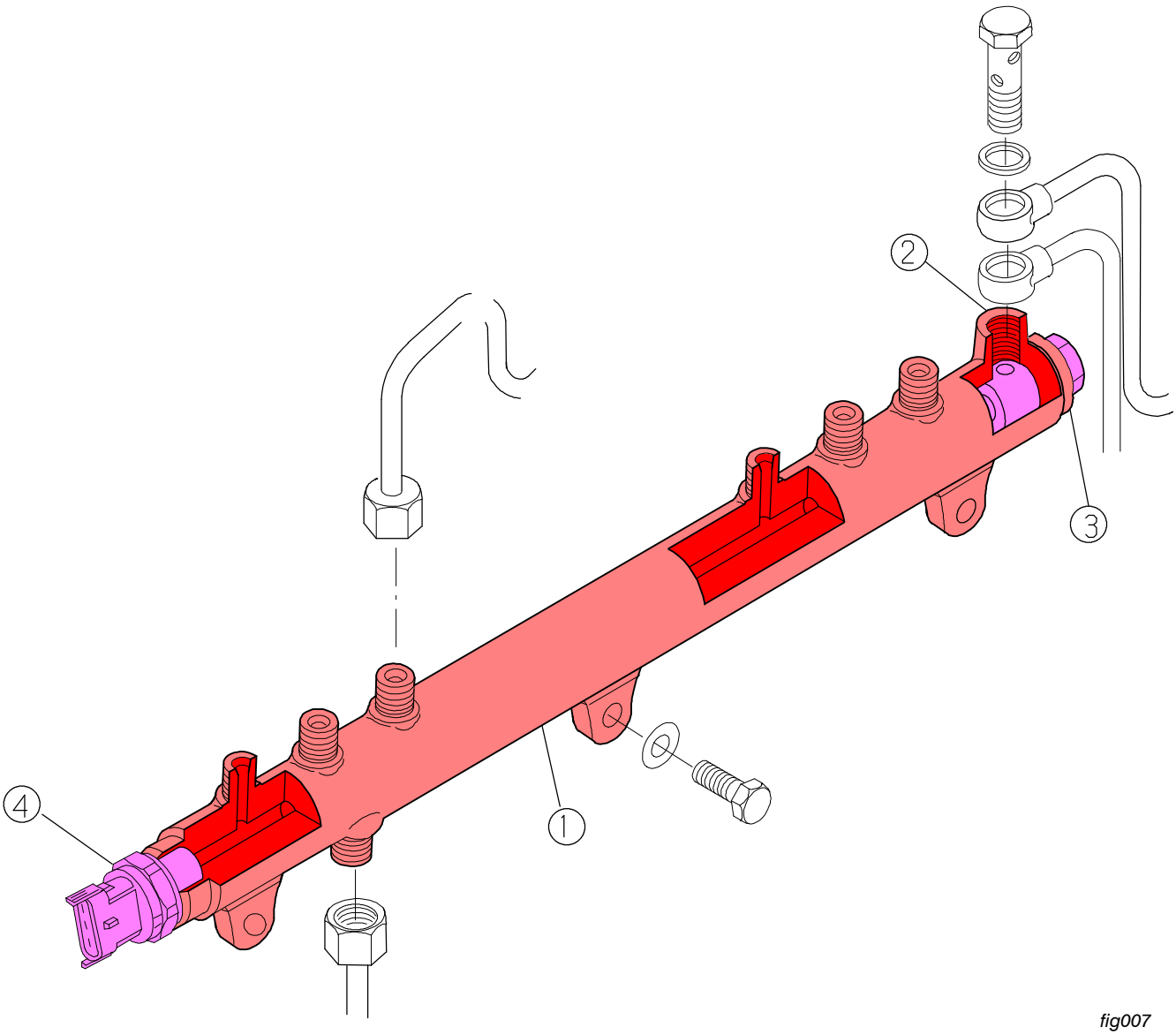


fig007

1) Rail (pressure accumulator)
2) Return flow connection
3) Pressure relief valve
   – opens 50–200 bar over max. pressure (1100 bar)
4) Pressure sensor
   – supply: 5V
   – the signal voltage produced by the sensor varies between about 0.3...4.5 V
   – cannot be measured with resistance meter (reults damage in signal circuit)

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Delivery pipes

Delivery pipe inner diameter

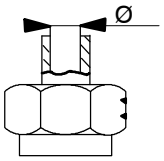


fig008

Without notch –> Ø 1.5 mm
1 notch –> Ø 1.75 mm
2 notches –> Ø 2,.0 mm

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Injector, engines with 4 valves

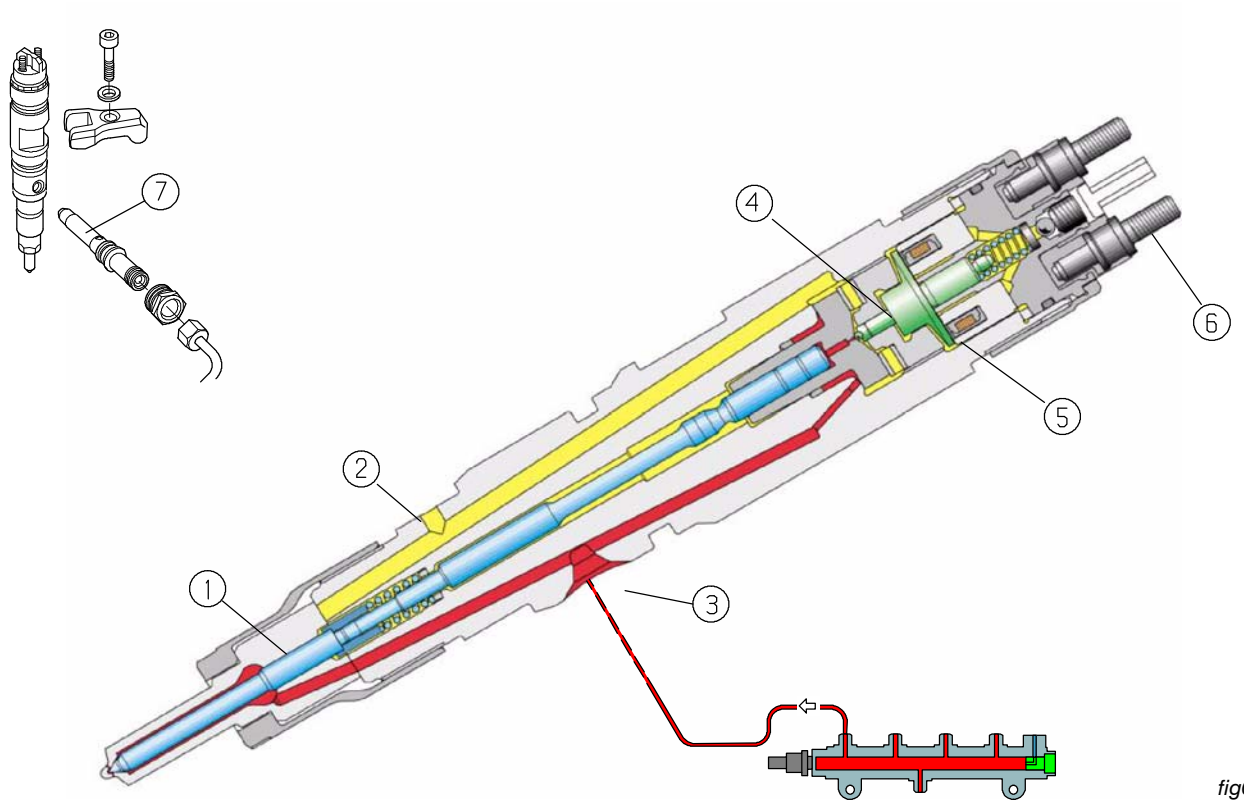


fig009

1. Nozzle
2. Return flow connection
3. Conical high pressure connection
4. Anchor
5. Coil
6. Electrical connections
7. Side charging pipe
   – Injector and side charging pipe are delivered always together

– The start of injection and the injected fuel quantity are adjusted by electrically triggered injectors.

  These injectors replace the nozzle and nozzle–holder assembly.

– The injectors in four valve engines are different type. The fuel from the rail (pressure accumulator) are led in these injectors via cylinder head to the injector body.

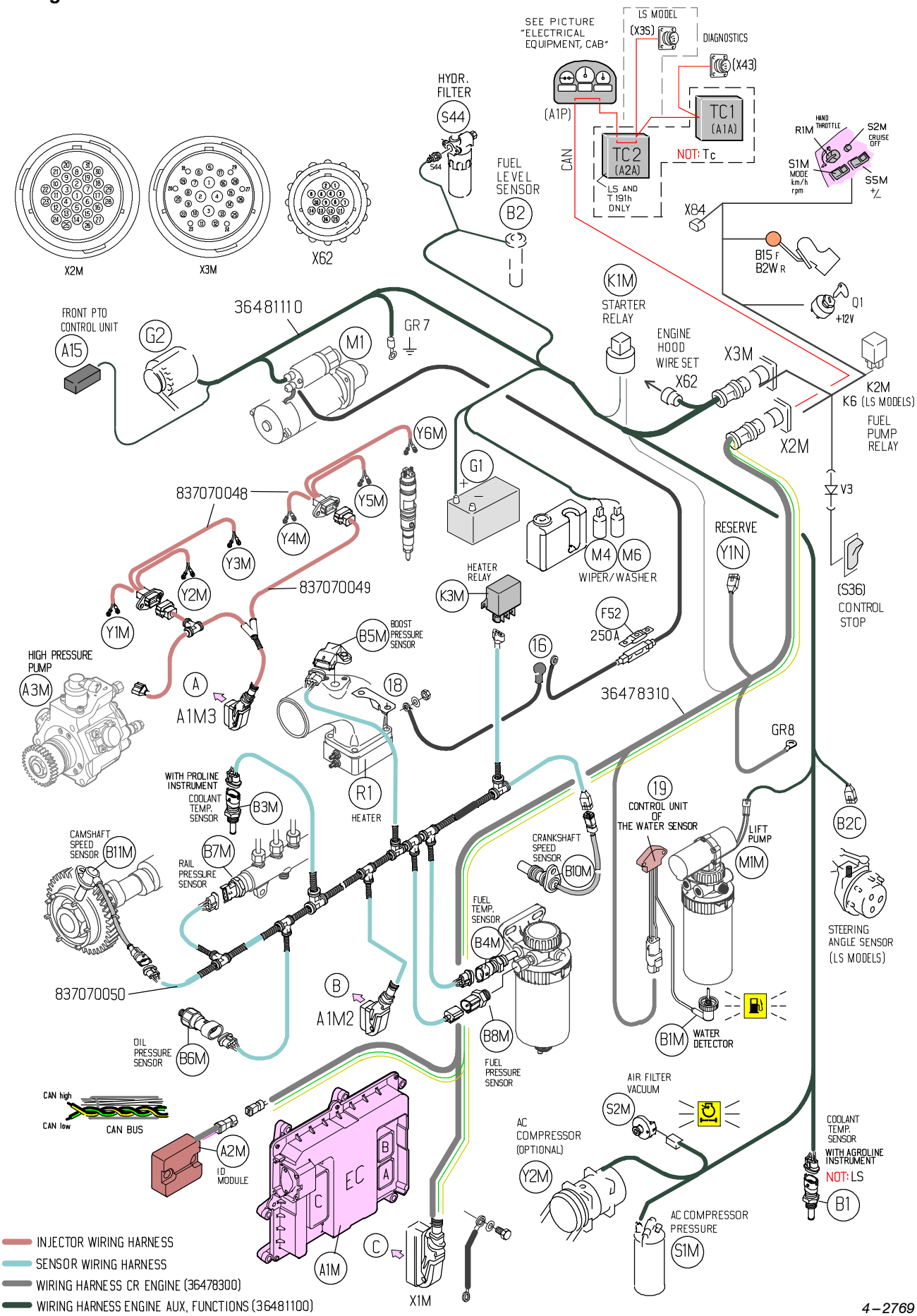
  This construction enables the placement of the injector in the middle of the cylinder and in vertical position. In this case the combustion space on the piston can be located exactly in the middle of the piston. So the control of the fuel combustion is more precise.

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Electrical equipment

Wiring



4–2769
05/07

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Sensors wiring harness 837070050

–B3M Coolant temperature sensor
–B4M Fuel temperature sensor
–B5M Boost pressure sensor
–B6M Oil pressure sensor
–B7M Fuel pressure sensor (rail)
–B8M Fuel pressure sensor
–B10M Speed sensor (crankshaft)
–B11M Speed sensor (camshaft)
–K3M Inlet air heater relay

Injectors wiring harness 837070049

–A1M1 Electronic control unit (ECU)
–A3M High–pressure pump

Injectors wiring harness 837070048

–Y1M Fuel injector cyl. 1
–Y2M Fuel injector cyl. 2
–Y3M Fuel injector cyl. 3
–Y4M Fuel injector cyl. 4
–Y5M Fuel injector cyl. 5
–Y6M Fuel injector cyl. 6

Inlet air heater

–16) Heater wiring
–18) Earthing plate
–F52 Fuse
–R1 Inlet air heater

CR Engine wiring harness 36478310

–A2M ID module
–B1M Water detector sensor (fuel)
–19) Sensor's electronics
–K1M Relay, starter motor
–Y1N Exhaust brake (not used)

Wiring harness of the engine aux. functions 36481110

–A15 Control unit, front PTO
–B1 Temperature sensor, engine coolant
–B2 Level sensor, fuel
–B2C Steering angle sensor (LS models)
–G1 Battery
–G2 Alternator
–M4 Windscreen washer
–M6 Rear window washer
–M1 Starter motor
–M1M Fuel feed pump
–S44 Indicator light switch, pressure filter (high pressure circuit)
–S1M Pressure switch, compressor pressure
–S2M Pressure sensor, engine air filter
–Y2M Magnetic clutch, compressor, air conditioner

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Electronic engine management, components

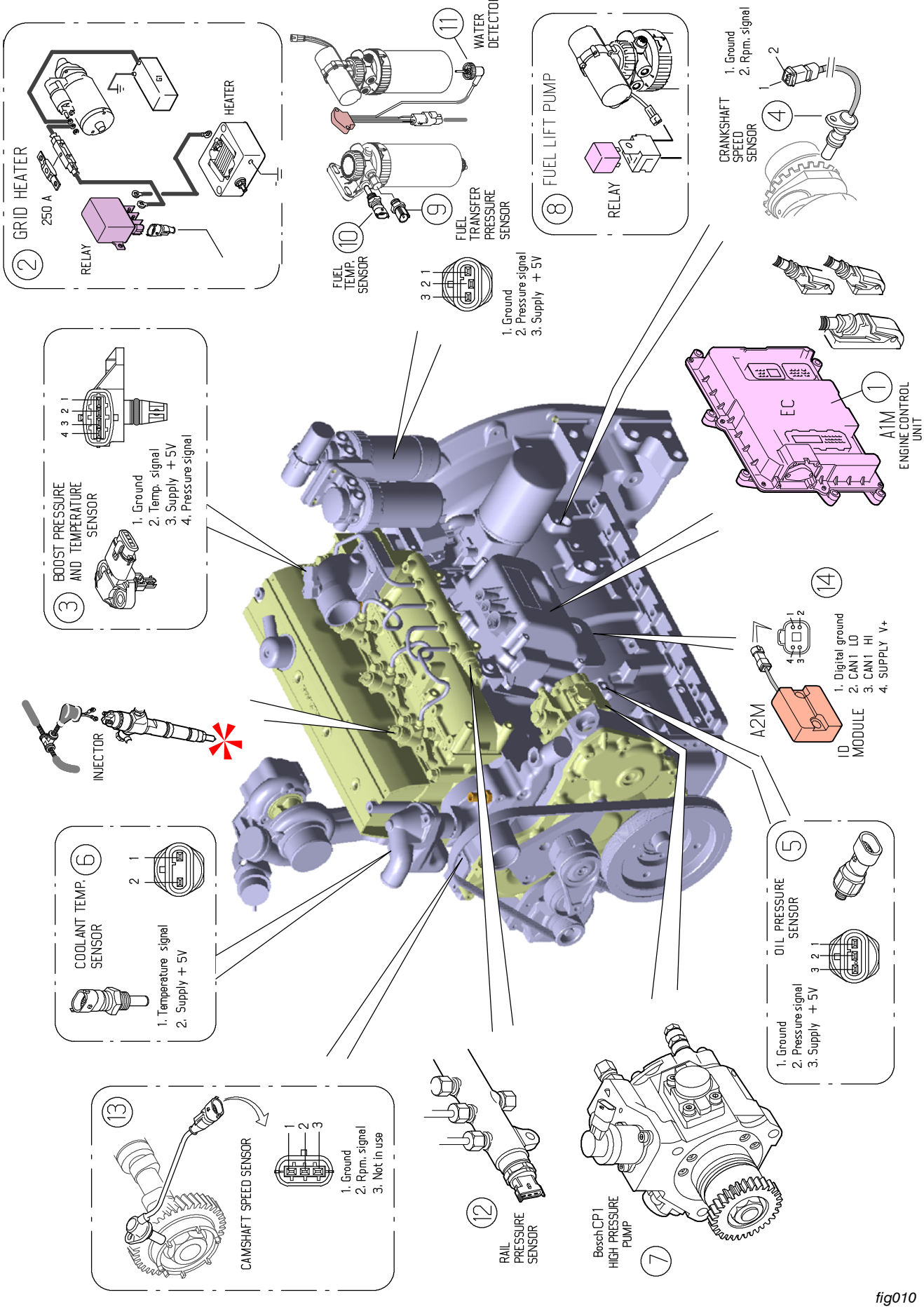


fig010

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Citius series engine fulfils the emission requirements set by authorities (EU97/68/EC Stage 3 and EPA 40 CFR 89 Tier 3).

The manufacturer guarantees that all engines of this type are equivalent to the engine that is officially approved. This must be noticed especially when performing periodical maintenance, follow carefully the service schedule. Any adjusting and repair work for the injection system or the engine control unit can only be made by a representative authorized by Sisu Diesel Inc.

When performing any service or repair work use only original SisuDiesel spare parts. Inadequate or delayed service and the use of other than original SisuDiesel spare parts invalidates the responsibility of Sisu Diesel Inc. on the fulfilment of the emission requirements.

Parts of engine control system EEM3:

1) Electronic control unit (ECU)
2) Electric intake air heater
3) Boost pressure sensor
   – 1. Ground
   – 2. Temperature signal
   – 3. +5V
   – 4. Pressure signal
4) Crankshaft speed sensor
   – 1. Ground
   – 2. Rpm signal
5) Oil pressure sensor
   – 1. Ground
   – 2. Pressure signal
   – 3. +5V
6) Coolant temperature sensor
   – 1. Temperature signal
   – 2. +5V
7) High pressure pump
8) Elecric fuel lift pump
   – with the pump will be secured, that there is no air in the fuel suction line.
9) Fuel transfer pressure sensor (0,05–0,2 bar)
   Informs about the the lowering of the fuel pressure before there are problems in engine running
   – 1. Ground
   – 2. Pressure signal
   – 3. +5V
10) Fuel temperature sensor
   – 1. Temperature signal
   – 2. +5V
11) Water detector
12) Rail pressure sensor
13) Camshaft speed sensor
   – 1. Ground
   – 2. Rpm signal
   – 3. Not in use
14) ID module
   – 1. Digital ground
   – 2. CAN1 LO
   – 3. CAN1 HI
   – 4. Supply

EEM 3 – Engine Control System, description

The basic function of the electric control of the engine is continuous adjustment and measuring of the load, quantity of fuel and rotating speed.

Other additional function are for example cold start automatics and engine protecting automatics. The central unit of the electric control receives continuously signals from sensors that measure different functions in the engine like rotating speed, oil pressure, boost pressure, fuel and coolant temperature.

The control unit receives the relevant information about the engine load need from the transmission or cabin through the CAN–bus. The identifier and operation information is received from ID–module. The EC unit makes it also possible to have a wide diagnostics through code numbers or a diagnostic light.

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EC unit

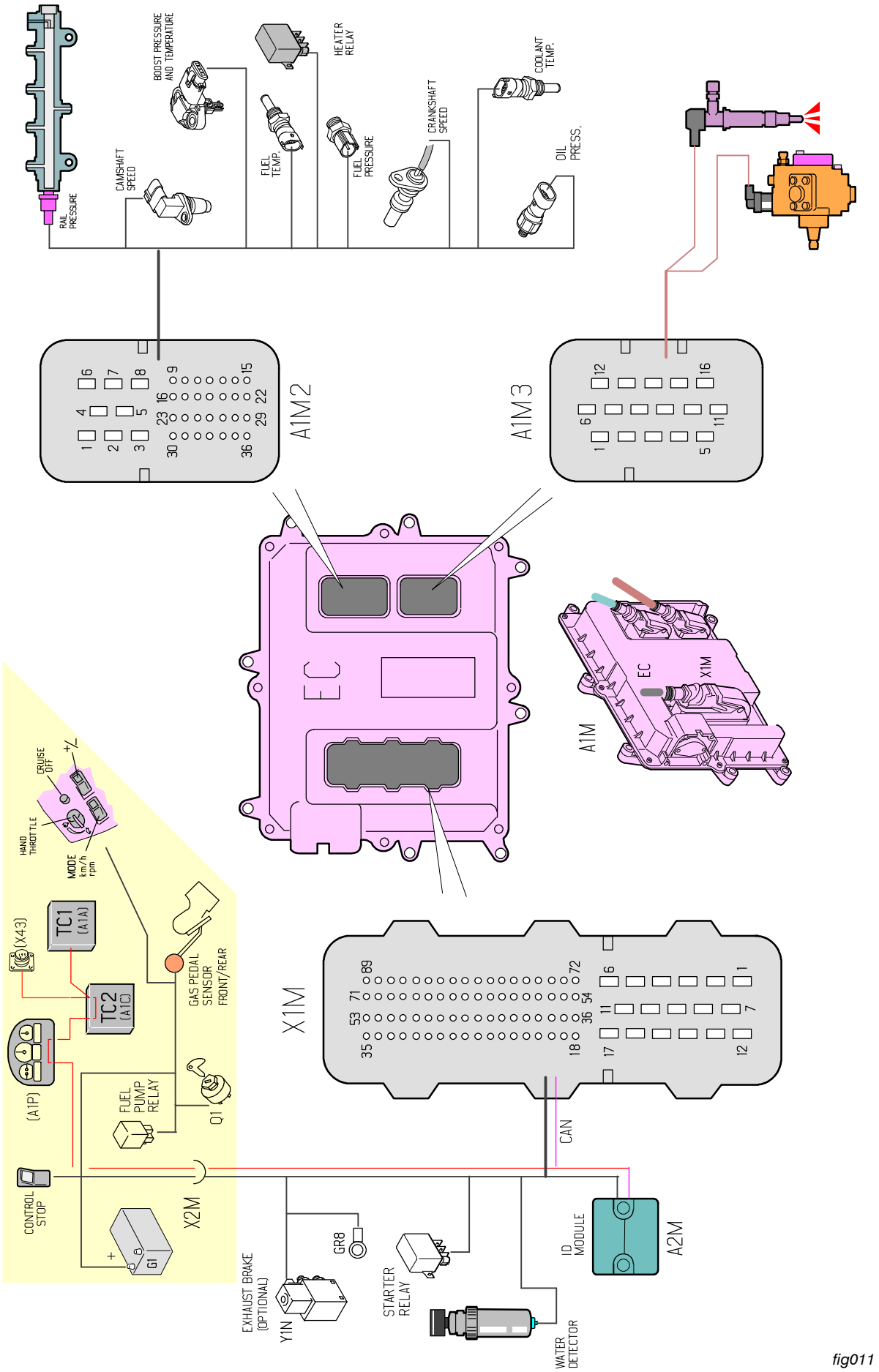
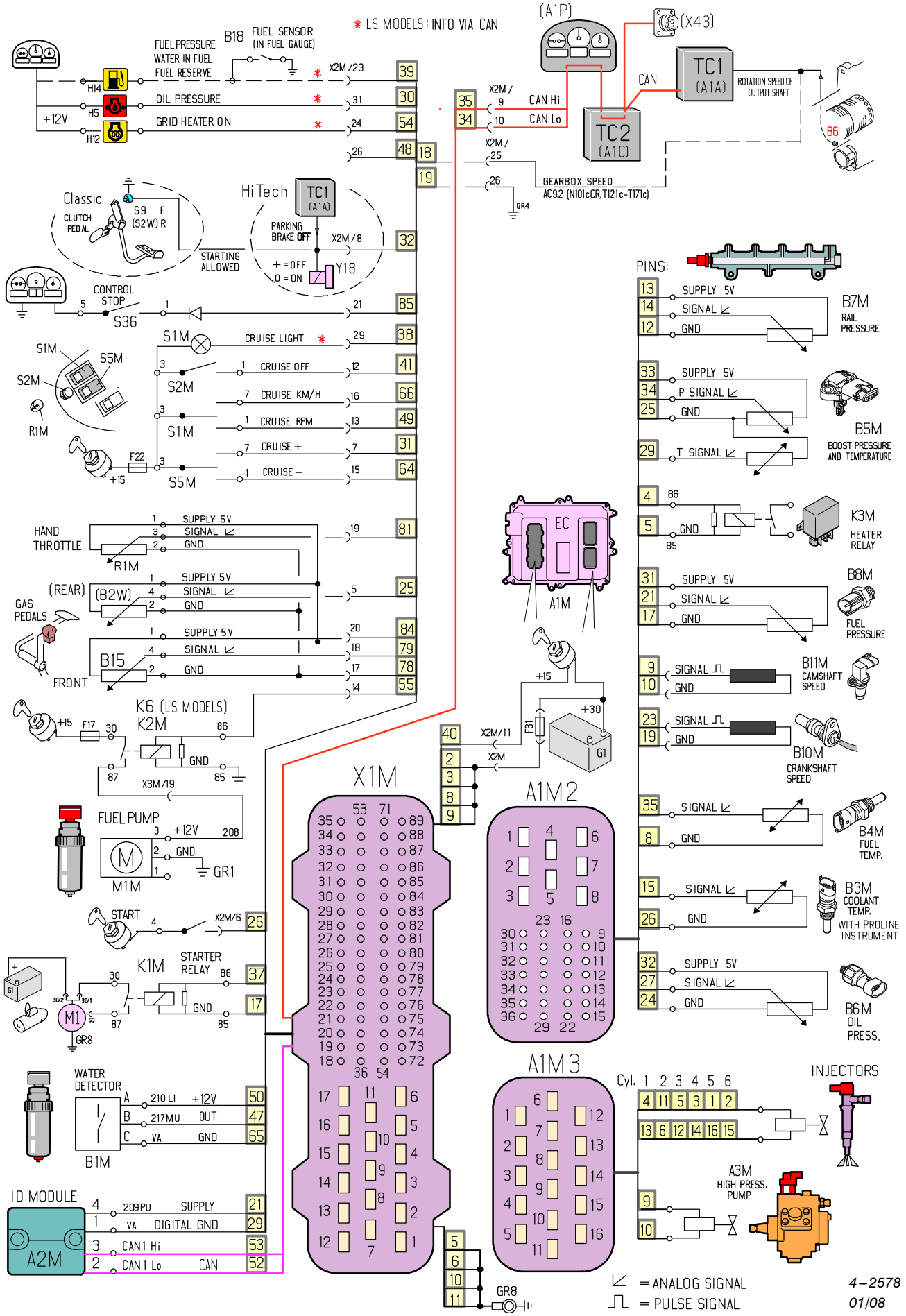


fig011

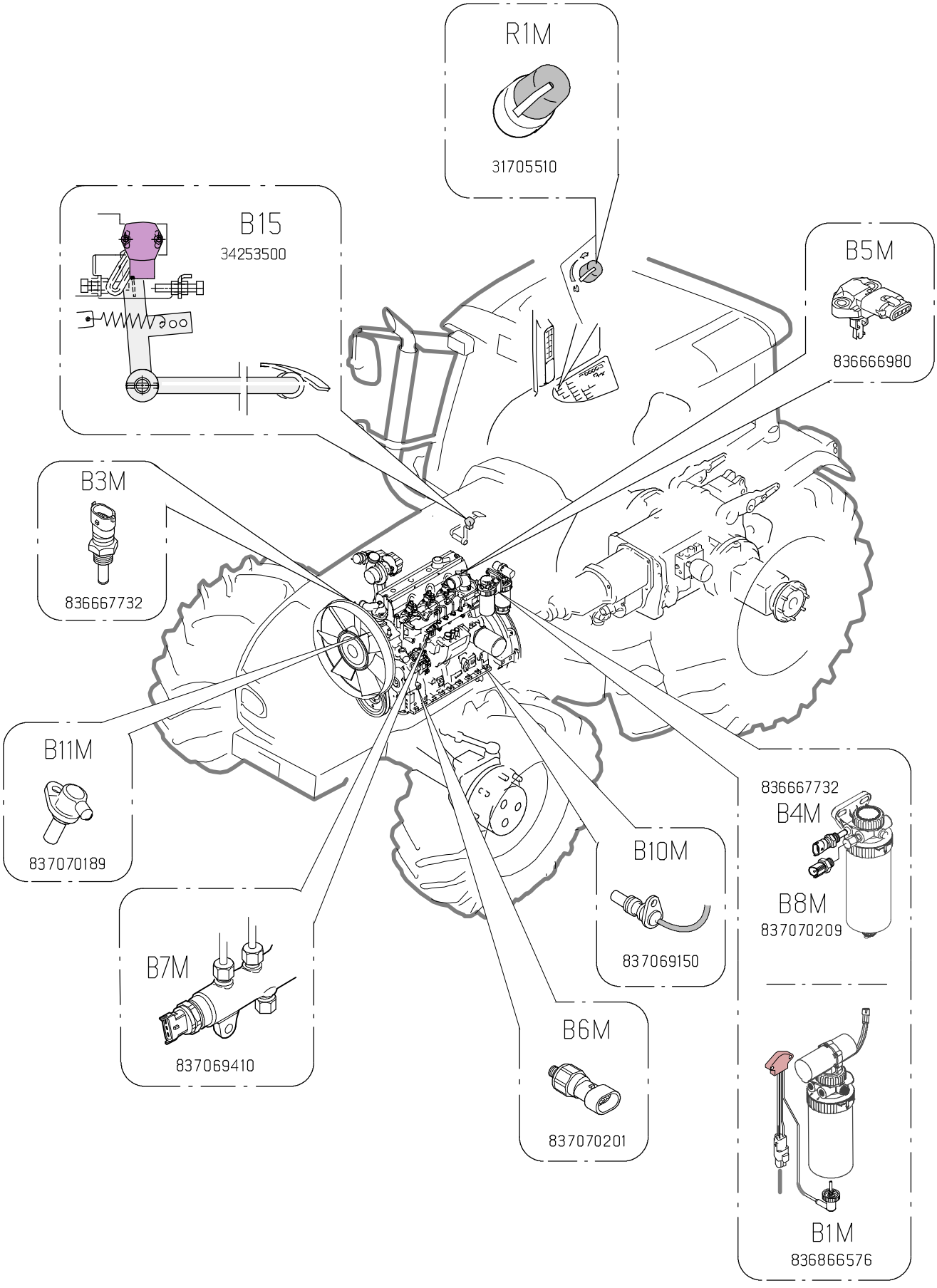
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EEM3 control unit pins



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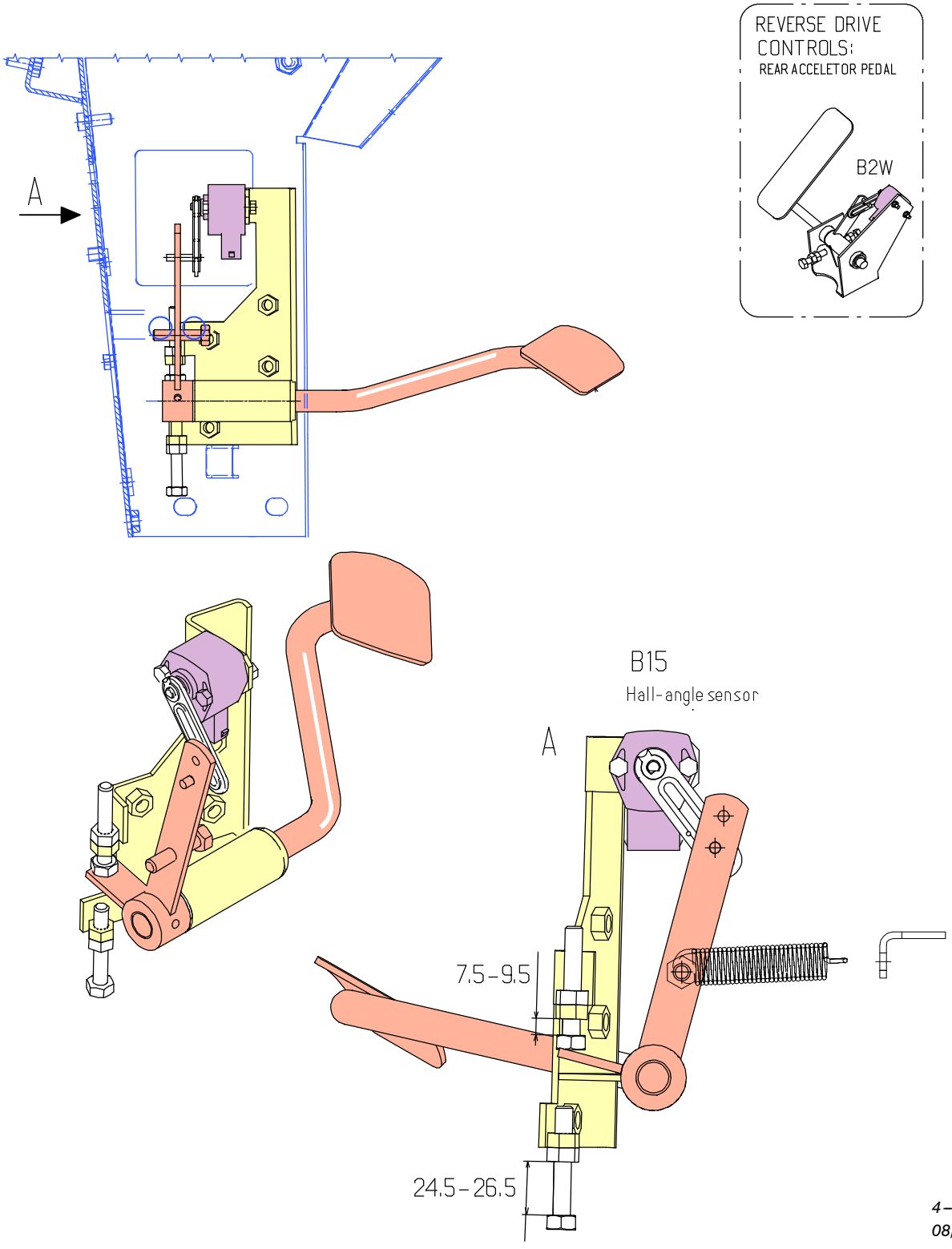
Sensors of the EC unit



4–2911
02/08

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Angle sensor, accelerator pedal



The angle sensor B15 is located in the gas pedal mechanism.

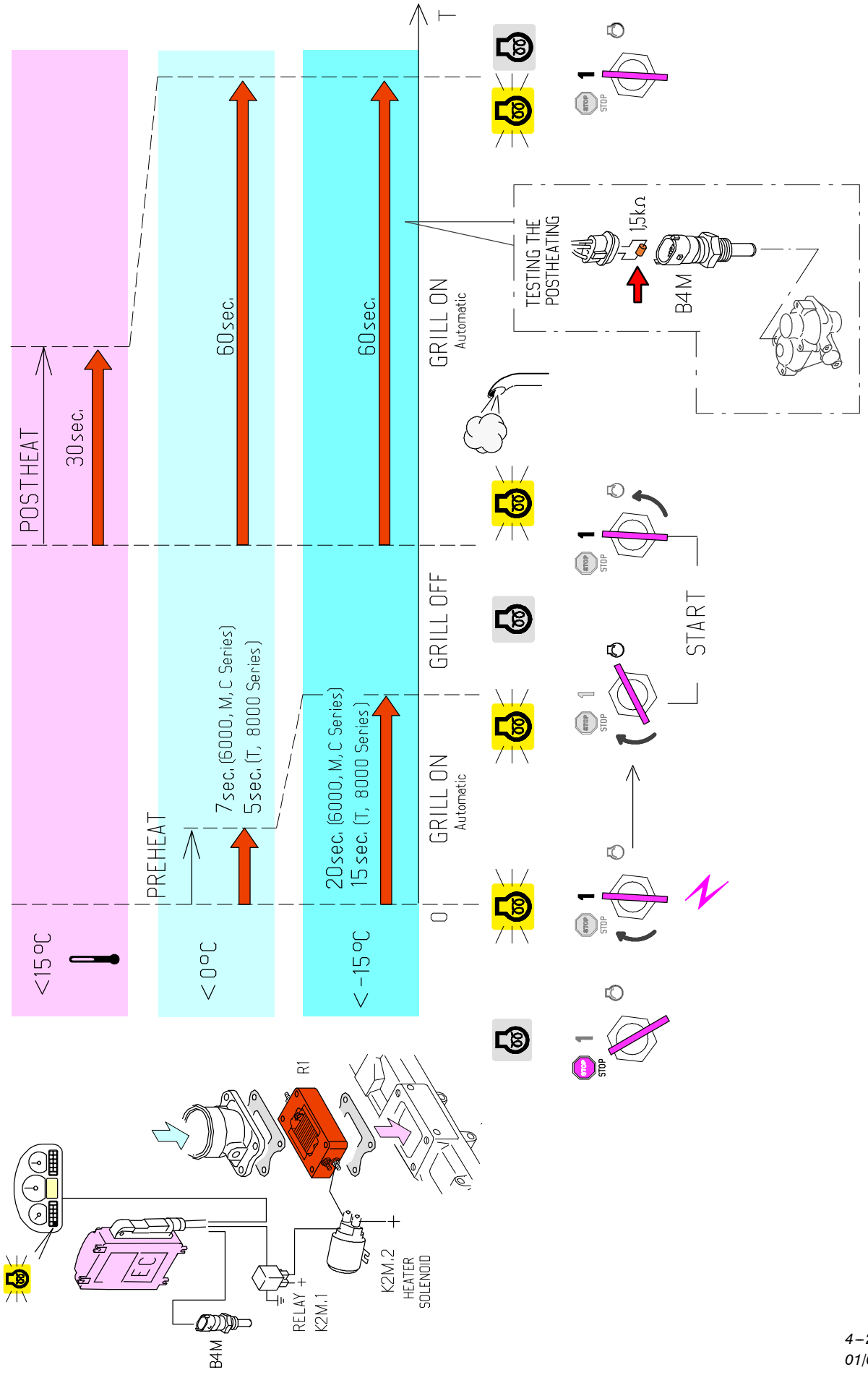
Sensor adjusting instructions:

When the pedal is at upper position the output voltage is **0.5**...**1.0 V**.
When the pedal is at lower position the output voltage is **4.0**...**4.5 V**

1) Hall– angle sensor (B15)
2) Limiting screw
   – limits the movement of the sensor, so that the movement area will not be exceeded, eg. when the instrument panel housing bends.
3) Limiting screws (2 pcs) for pedal travel

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Grid heater control



4–2333
01/06

https://truckmanualshub.com/

The use of a grid heater is necessary to start the engine in cold conditions. The purpose of this device is to warm up the air in the inlet manifold to improve the diesel combustion in cold conditions.

The EEM3 system has an automatic grid heater control sequence. Temperature for pre heat control is defined with lower temperature between fuel temperature by PCU (injection pump) or EC (engine control unit) temperature.

If temperature is below a defined temperature limit, the control unit output DO2 (digital output) is activated , and controls with help of the relay K2M.1 and solenoid K2M.2 the grid heater R1 for a temperature dependent time after the ignition is switched on.

The grid postheating is based on the engine coolant temperature if the signal is ok; if the signal is not ok, then either the EC unit temperature or the fuel temperature is used, whichever the lower.

After starting has been started the control output is switched off during start period until the engine will run. When the engine is running the control output (DO2 / A1M:pin 3) is again switched on for the postheat time depending on the temperature.

Inputs :
- Fuel temperature
- Coolant temperature
- EC unit temperature
- Ignition key, Digital in
- Engine speed, RPM1 (redundant speed by the PSG1 message when needed)

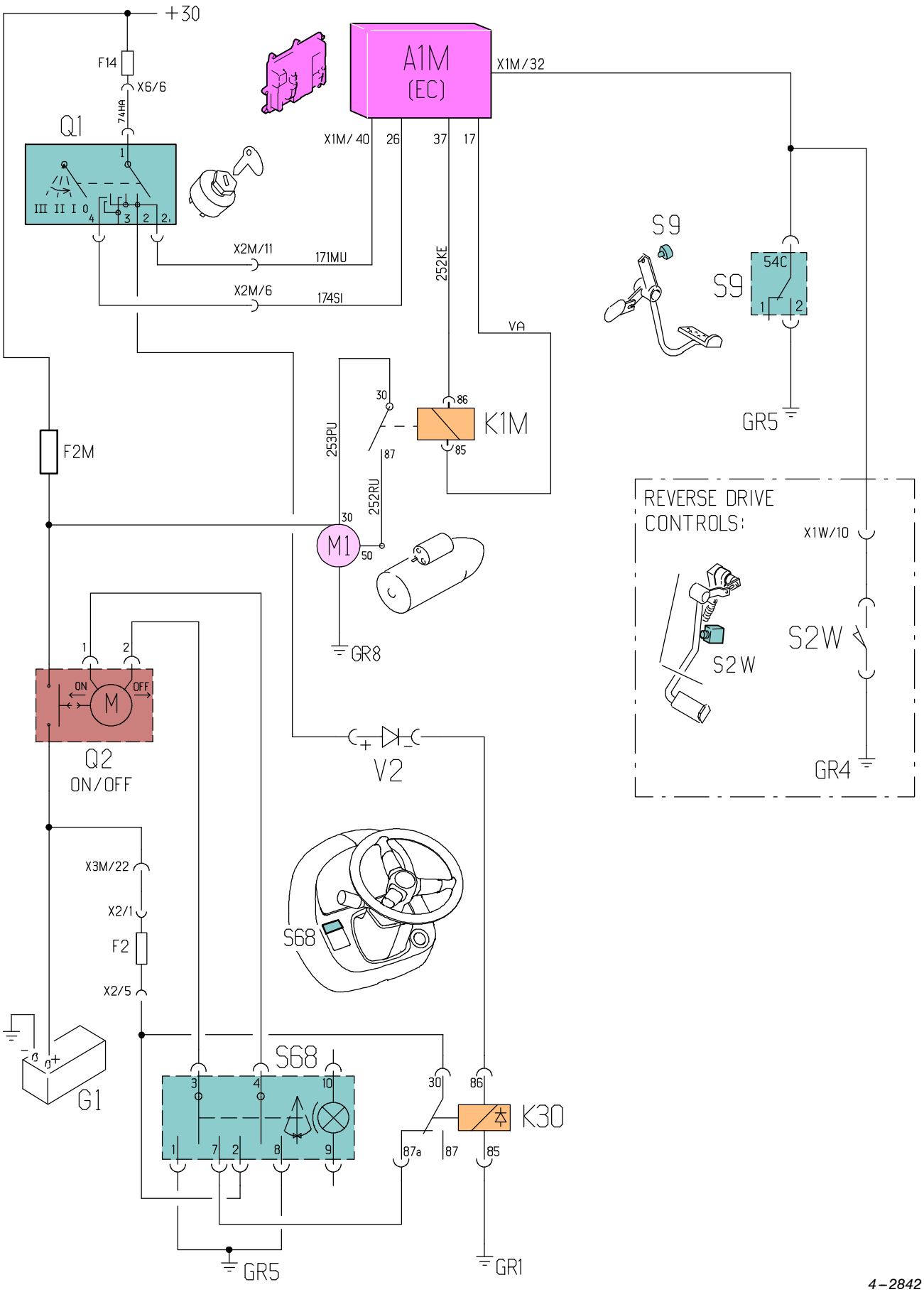
Outputs :
- Output for control relay, digital out (DO2 / A1M:pin 3)

Preheat time (**7** s):
- if temperature > 0°C –> **no preheating**
- if temperature lower than –15°C –> preheat time =**20 s**

Postheat time (**30** s) :
- if temperature > +15°C –> **no postheating**
- if temperature lower than 0°C –> postheat time =**60 s**

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Starting control, T121c–T171c



4–2842
06/07

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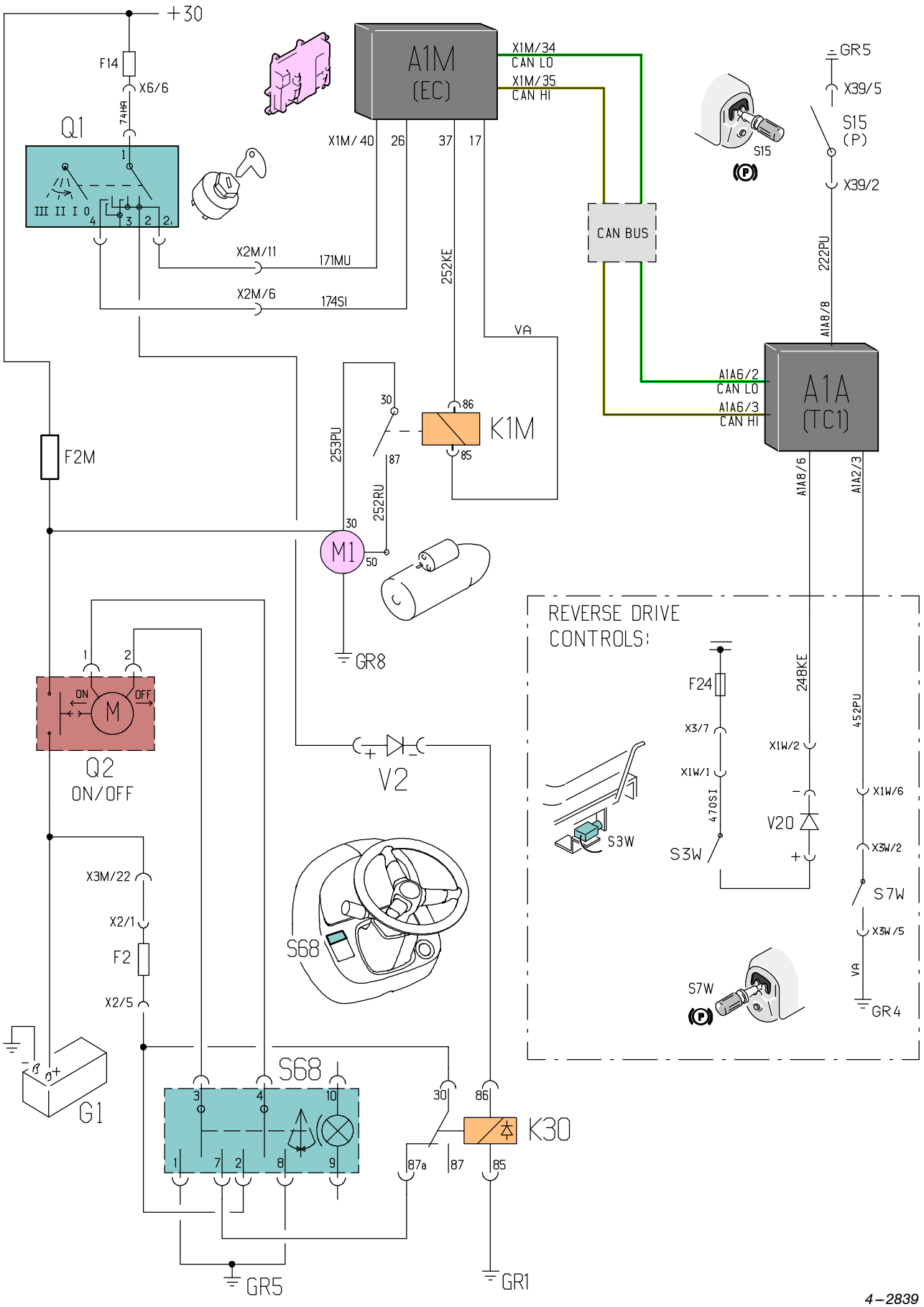
– Start prevention:
  The engine control unit (**A1M**) controls the relay **K1M**.
  This function allows the starting of the engine only when the clutch pedal is pressed down (**S9** / **S2W**)

– The engine control unit controls the relay (K1M) with ON/OFF system. The control unit uses following information for the controlling:
  – clutch pedal, front (S9)
  – clutch pedal, rear (S2W)

– If the clutch pedal is pressed down (pin X1M/32 earthed), the engine control unit earths the relay **K1M**.
  The current to the relay is on as long as the condition is in effect.

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Starting control (T121h–T191h)



4–2839
06/07

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– Start prevention:
The engine control unit (**A1M**) controls the relay **K1M**.
This function allows the starting of the engine only when the parking brake is on (**S15** / **S7W**)

– The engine control unit controls the relay (K1M) with ON/OFF system. The control unit uses following information for the controlling:
  – seat direction (S3W)
  – parking brake, front (S15)
  – parking brake, rear (S7W)

– The direction of the seat (**S3W**) affects to starting process. Transmission control unit (**A1A**) transfers the information about the seat direction to CAN bus:

  pin A1A8/6
  dead circuit = seat front
  live circuit = seat back

– If the seat is forwards, the engine control unit earths the relay **K1M** if the front shuttle lever is in position **P** (pin A1A8/8 earthed)

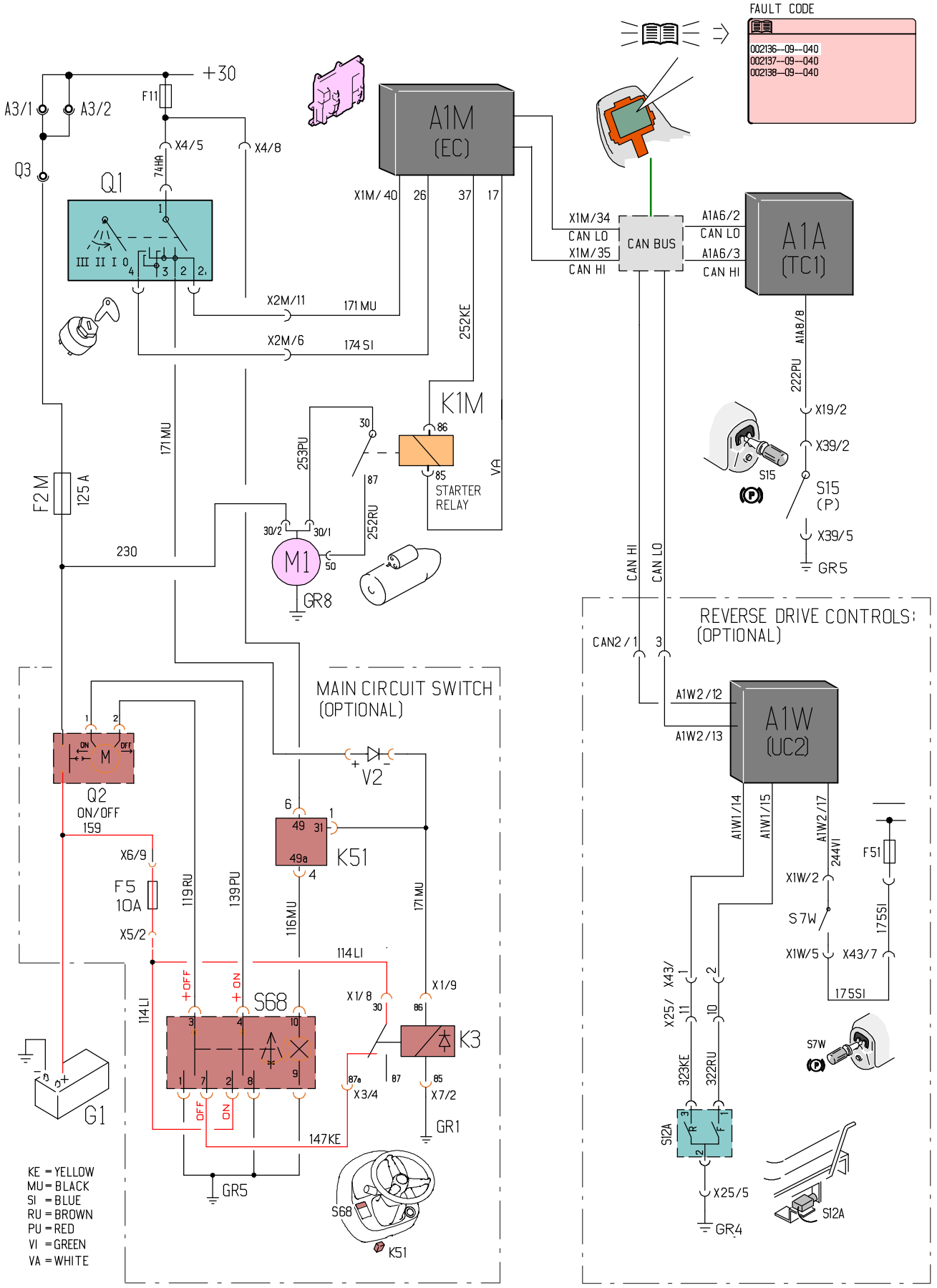
  The current to the relay is on as long as the condition is in effect.

– If the seat is backwards, the engine control unit earths the relay **K1M** if the rear shuttle lever is in position **P** (pin A1A2/3 earthed)

  The current to the relay is on as long as the condition is in effect.

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Starting control (T151eLS–T191LS)



4–2742
08/07

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– Start prevention:
  The engine control unit (**A1M**) controls the relay **K1M**.
  This function allows the starting of the engine only when the parking brake is on (**S15** / **S7W**)

– The engine control unit controls the relay (K1M) with ON/OFF system. The control unit uses following information for the controlling:
  – seat direction (S12A)
  – parking brake, front (S15)
  – parking brake, rear (S7W)

– The direction of the seat (**S12A**) affects to starting process. TwinTrac control unit (**A1W**) transfers the information about the seat direction to CAN bus.
  A1W1/15 earthed = seat front
  A1W1/14 earthed = seat back

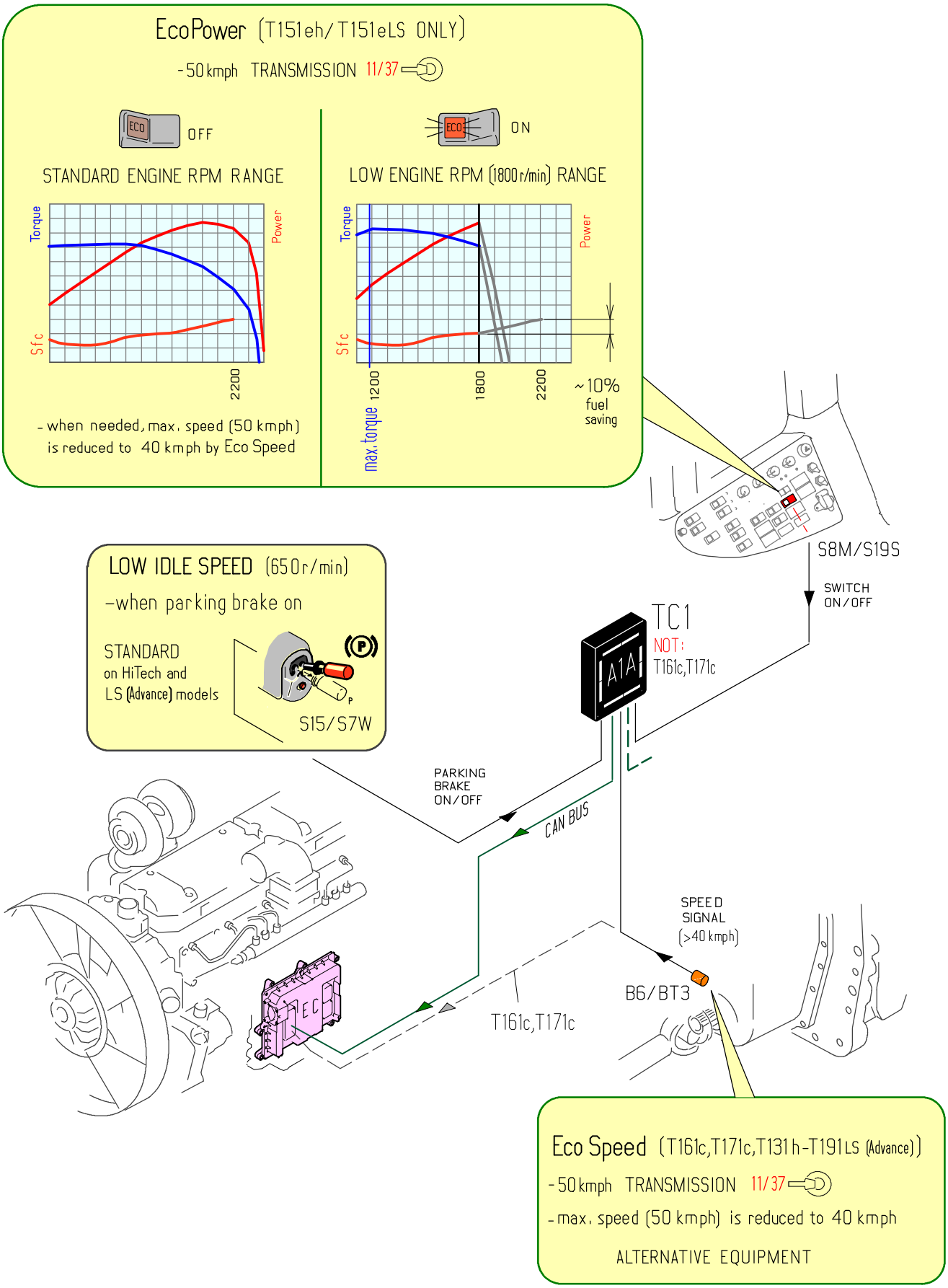
– If the seat is forwards, the engine control unit earths the relay **K1M** if the front shuttle lever is in position **P** (pin A1A8/8 earthed)
  The current to the relay is on as long as the condition is in effect.

– If the seat is backwards, the engine control unit earths the relay **K1M** if the rear shuttle lever is in position **P** (pin A1W2/17 is powered)
  The current to the relay is on as long as the condition is in effect.

– Main circuit switch (S68), extra equipment.
  The rocker switch has three positions and is spring returned to the midpoint.
  The symbol side pressed down = electric main circuit switch is on.
  The opposite side to the symbol pressed down = electric main circuit is off. The main circuit is not allowed to be switched off, before the ignition key is turned into the STOP position.
  When the main circuit is switched off, all the other circuits are dead, except for the ones to the radio and the clock.
  When the engine is switched off/stopped, the indicator light of the main current switch flashes (relay K51) to sign, that the main current has to be switched off.

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Low idle speed, EcoSpeed and ECO mode



4–2834
05/07

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Low idle speed (T121h–T191h, T151LS–T191LS)

– When parking brake (**S15**/**S7W**) is engaged, the idle speed is 650 r/min

Electric speed limiter, EcoSpeed (T161c, T171c, T131h–T191h, T151LS–T191LS)

– When using 50 km/h transmission the maximum speed is limited to 40 km/h. This gives lower fuel consumption, reduced emissions and lower noise level.

– Engine control unit (**A1M**) limits the speed according to the signal of gearbox speed sensor (**B6**). When using the highest gear the maximum speed is 40km/h.

Engine speed range selector, ECO (T151eh, T151eLS)

– The switch (**S8M**) has two positions.

– The **symbol side pressed down:**
Low engine range (**ECO**, maximum **1800 r**/**min**) selected. When the ECO mode is engaged the engine revs are limited to 1800r/min. This gives lower fuel consumption, reduced emissions and lower noise level. In addition, when using the highest gear the maximum speed is 40km/h. When using the 1000 r/min power take–off output the maximum revs are 900 r/min.

– The **opposite side to the symbol pressed down:**
The standard engine range (maximum **2200 r**/**min**) selected.
When using the highest gear the maximum speed is 50 km/h (in marketing areas where the maximum speed is 40 km/h the tractors are equipped with the electric speed limiter EcoSpeed).

– Eco mode :

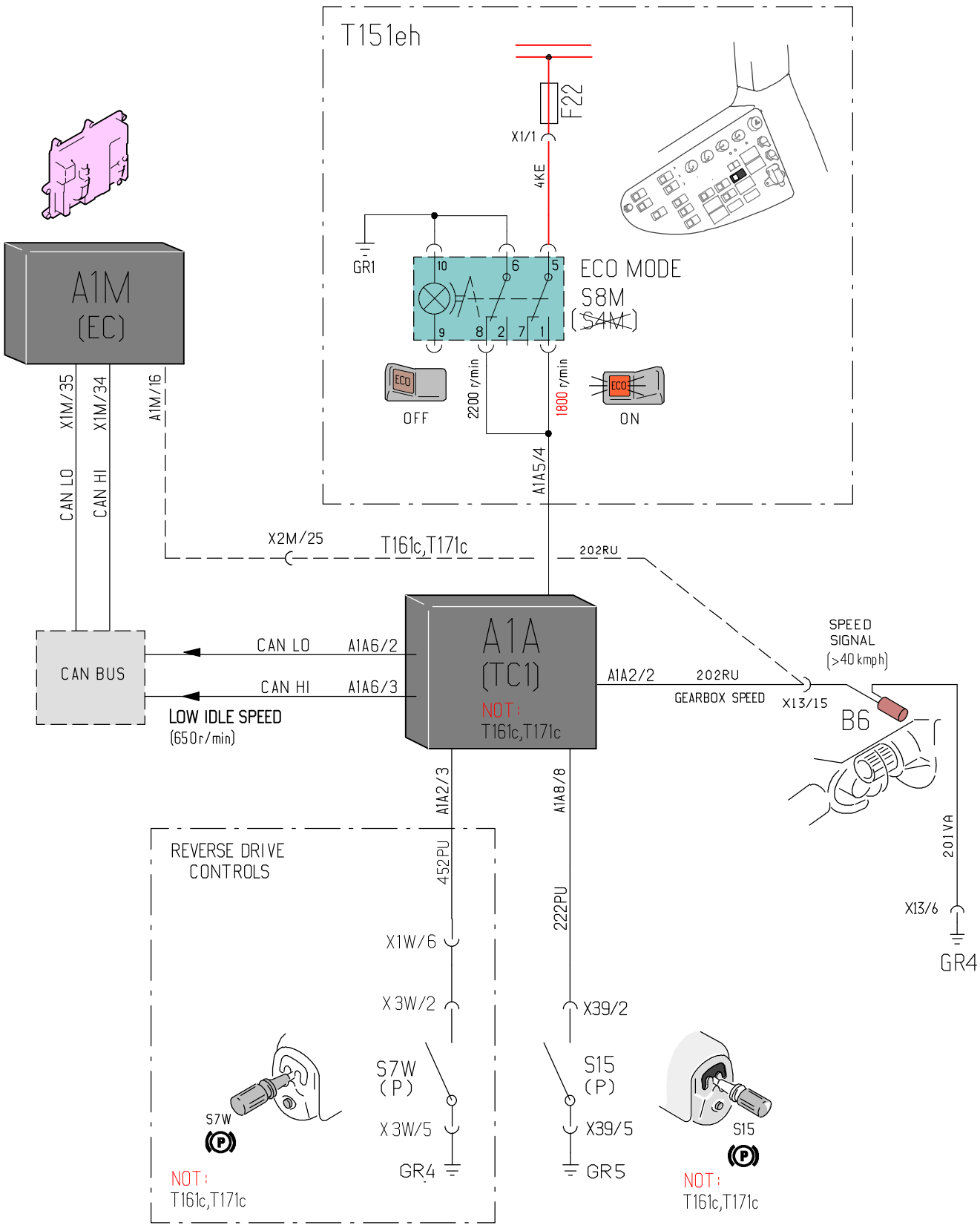
  – Rated speed 1800 rpm
  – Fuel savings up to 10 %
  – Lower noise level
  – Lower piston speed (about 20%), increased engine life
  – Very high torque, even at 1000 rpm
  – Wide, constant torque range

– Eco mode is recommended:

  – For maximising fuel efficiency
  – For soil preparation

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Wiring (T161c, T171c, T121h–T191h)



4–2823
05/07

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– Low idle speed (T121h–T191h)
When the parking brake (**S15**/**S7W**) is engaged, the idle speed is 650 r/min.

– Electric speed limiter, EcoSpeed (T161c, T171c, T131h–T191h)

When using 50 km/h transmission the maximum speed is limited to 40 km/h.

Engine control unit (**A1M**) limits the speed according to the signal of gearbox speed sensor (**B6**). When using the highest gear the maximum speed is 40km/h.

– Engine speed range selector, ECO (T151eh)
The switch (**S8M**) has two positions.

– The **symbol side pressed down:**
Low engine range (**ECO**, maximum **1800 r**/**min**) selected. When the ECO mode is engaged the engine revs are limited to 1800 r/min.

– The **opposite side to the symbol pressed down:**
The standard engine range (maximum **2200 r**/**min**) selected.
When using the highest gear the maximum speed is 50 km/h (in marketing areas where the maximum speed is 40 km/h the tractors are equipped with the electric speed limiter EcoSpeed).

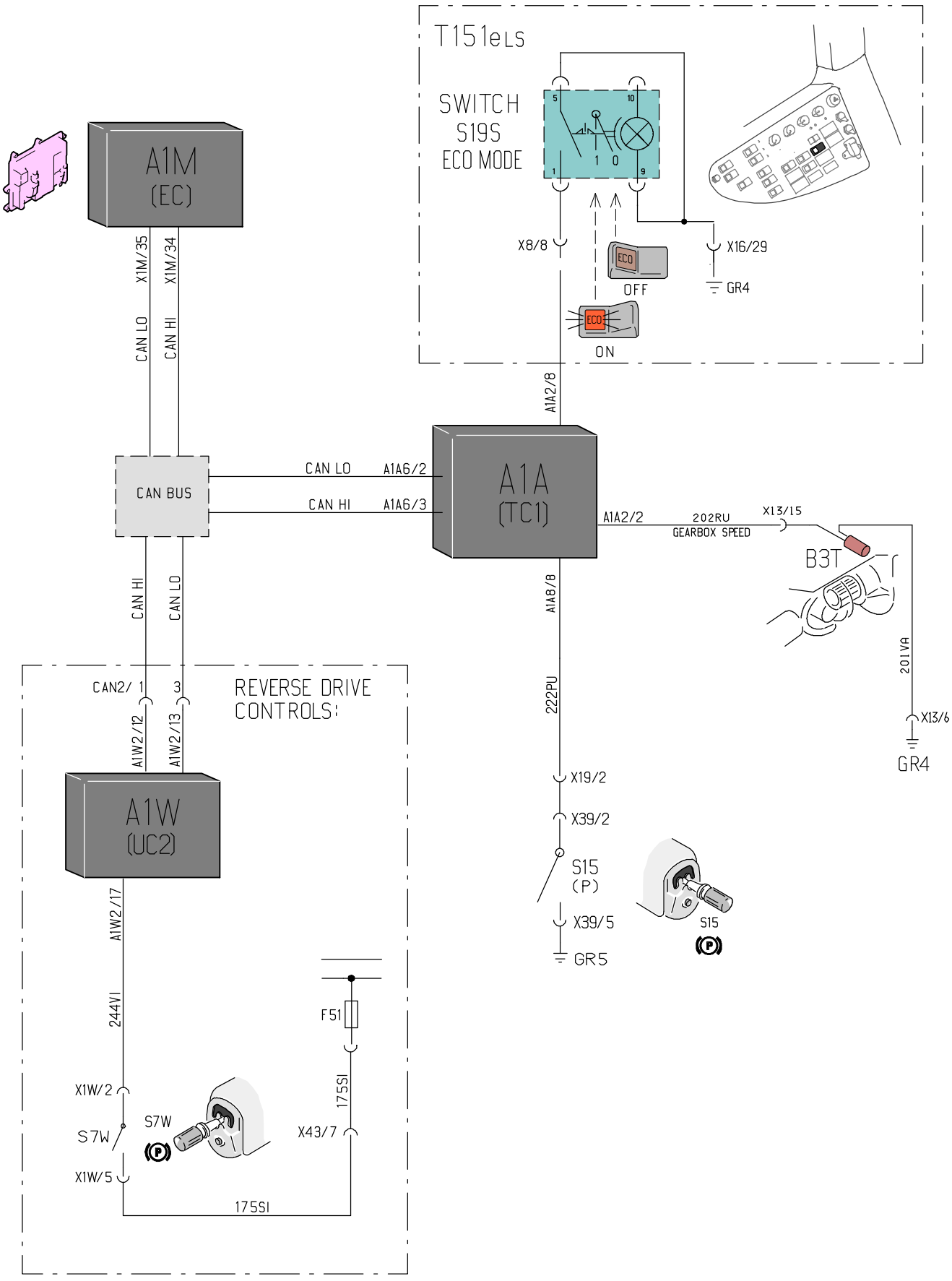
– HiTech: The parking brake information for the two–stage idling speed is taken also (except via the switch **S15**) from the parking brake control (when the control unit switches the solenoid valve of the parking brake on), and the engine rpm request goes via the CAN BUS to the engine control unit.

When the control unit TC1 switches the parking brake on, at the same time it sends a message, in which a lower engine rpm is requested.

The F–R lever can be in parking brake position without lowering the engine rpm. E.g. when the driving speed is too high, the parking brake will not be switched on.

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Wiring (T151eLS–T191LS)



4–2826
05/07

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– Low idle speed
When parking brake (**S15**/**S7W**) is engaged, the idle speed is 650 r/min.

– Electric speed limiter, EcoSpeed

When using 50 km/h transmission the maximum speed is limited to 40 km/h.

Engine control unit (**A1M**) limits the speed according to the signal of gearbox speed sensor (**B3T**). When using the highest gear the maximum speed is 40km/h.

– Engine speed range selector, ECO (T151eLS)
The switch (**S19S**) has two positions.

– The **symbol side pressed down:**
Low engine range (ECO, maximum **1800 r**/**min**) selected. When the ECO mode is engaged the engine revs are limited to 1800r/min.

– The **opposite side to the symbol pressed down:**
The standard engine range (maximum **2200 r**/**min**) selected.
When using the highest gear the maximum speed is 50 km/h (in marketing areas where the maximum speed is 40 km/h the tractors are equipped with the electric speed limiter EcoSpeed).

– HiTech: The parking brake information for the two–stage idling speed is taken also (except via the switch **S15**) from the parking brake control (when the control unit switches the solenoid valve of the parking brake on), and the engine rpm request goes via the CAN BUS to the engine control unit.

When the control unit TC1 switches the parking brake on, at the same time it sends a message, in which a lower engine rpm is requested.

The F–R lever can be in parking brake position without lowering the engine rpm. E.g. when the driving speed is too high, the parking brake will not be switched on.

Measuring the fuel feed pressure

1. Clean the pre–filter, the fuel filter and the related fuel pipes from the outside.

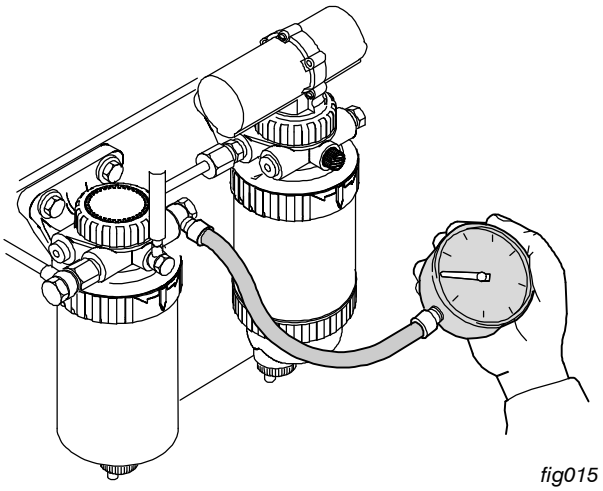


fig015

2. Disconnect the pressure switch from the fuel filter and connect the gauge instead (the thread is M14x1.5).

3. Run the engine at low idling speed for a while and compare the gauge reading with the prescribed value (0.75 bar with CP1H high–pressure pump)

Note! If the pressure is below the prescribed value, this may be caused by:

•	Clogged fuel filters.
•	Malfunction of the feed pump.
•	Suction piping clogged or leaking air.
•	Empty fuel tank or unsuitable fuel (e.g. summer fuel in the winter).

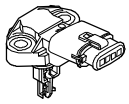
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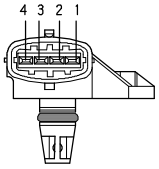
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Measuring EC unit sensors

Sensors

B5M BOOST PRESSURE





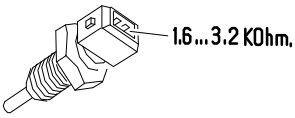
1. Ground
2. Temp. signal
3. Supply + 5V
4. Pressure signal

Resistance values in different intake air temperatures:
- **0** Celsius –> approx **5,8** kOhm
- **20** Celsius –> approx **2,5** kOhm
- **50** Celsius –> approx **2,4** kOhm
- **100** Celsius –> approx **0,1** kOhm

Voltage values when different boost pressures:
- **0** bar –> approx **0,3** V
- **0,5** bar –> approx **0,5** V
- **1,5** bar –> approx **2,0** V

Screw M5 / 3,3 Nm

B3M

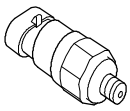


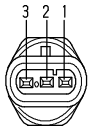
Check the resistance between sensor pins **2** and **1** (–)

Resistance values in different temperatures:
- **0** Celsius –> approx **1,6** kOhm
- **25** Celsius –> approx **2,0** kOhm
- **50** Celsius –> approx **2,4** kOhm
- **100** Celsius –> approx **3,2** kOhm

Thread M12x1,5 / 25Nm

B6M OIL PRESSURE SENSOR





1. Ground
2. Pressure signal
3. Supply + 5V

Voltage values when different oil pressures:
0,5 V –> 0 bar
0,9 V –> 1 bar
1,3 V –> 2 bar
1,7 V –> 3 bar
2,1 V –> 4 bar
2,5 V –> 5 bar
2,9 V –> 6 bar
3,3 V –> 7 bar
3,7 V –> 8 bar
4,1 V –> 9 bar

Thread M10x1 / 25Nm

fig016en

Location of the sensors in wiring diagram:

Symbol	Description	Page+position (in wiring diagram)	Location
AC9.2			
–B3M	Sensor, engine coolant temperature	/1.D8	Engine
–B5M	Sensor, boost pressure	/1.D9	Engine
–B6M	Sensor, engine oil pressure	/1.D10	Engine
AC10.2&AC10.21			
–B3M	Sensor, engine coolant temperature	/1.D8	Engine
–B5M	Sensor, boost pressure	/1.D9	Engine
–B6M	Sensor, engine oil pressure	/1.D10	Engine
AC11.2			
–B3M	Sensor, engine coolant temperature	/1.C11	Engine
–B5M	Sensor, boost pressure	/1.C12	Engine
–B6M	Sensor, engine oil pressure	/1.C13	Engine

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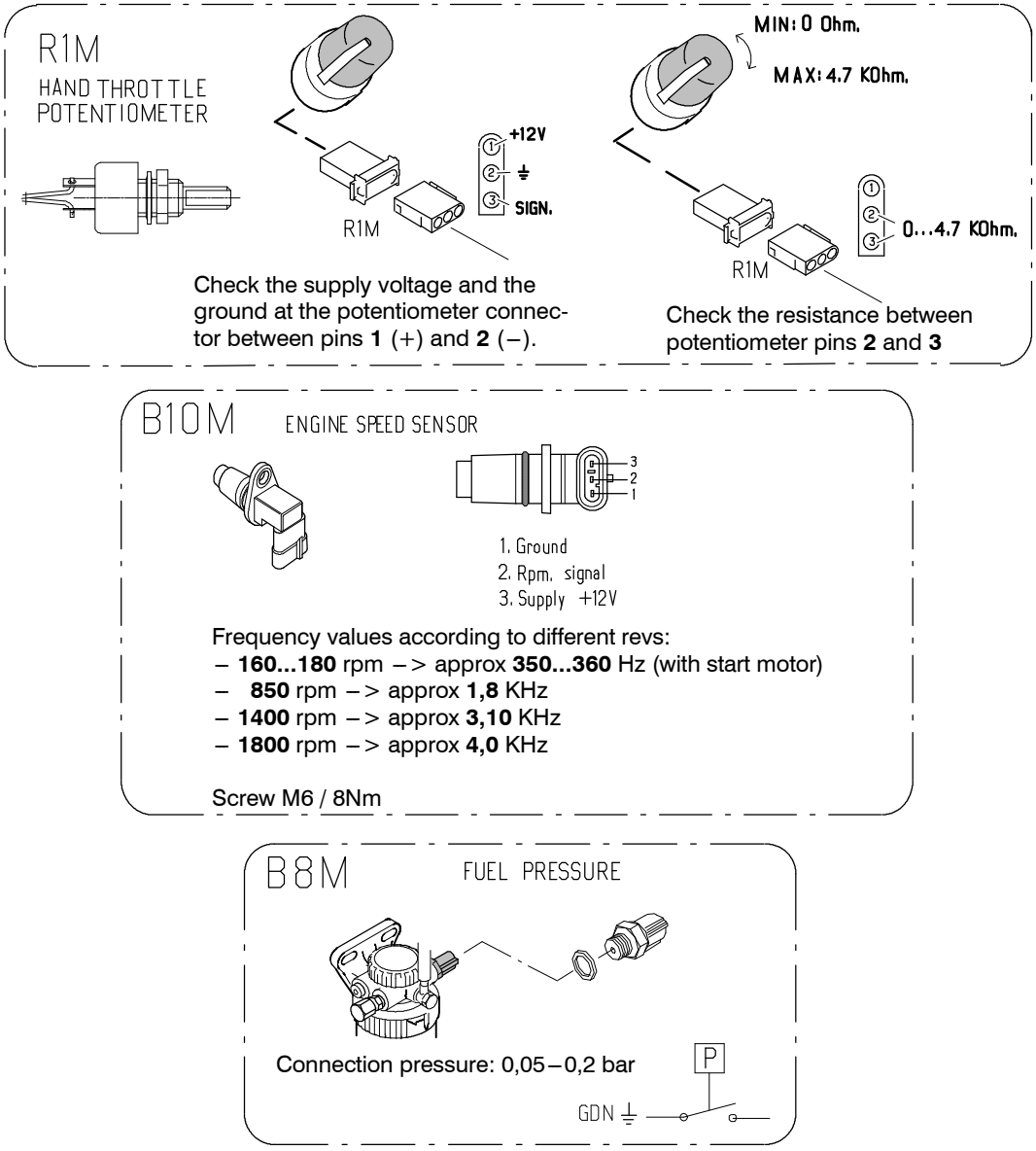


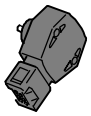
fig017en

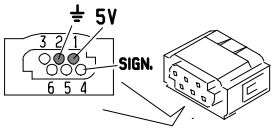
Location of the sensors in wiring diagram:

Symbol	Description	Page+position (in wiring diagram)	Location
AC9.2			
–B8M	Sensor, fuel pressure	/1.D11	Engine
–B10M	Speed sensor, engine	/1.D12	Engine
–R1M	Potentiometer, hand throttle	/2.D3	Cab
AC10.2&AC10.21			
–B8M	Sensor, fuel pressure	/1.D11	Engine
–B10M	Speed sensor, engine	/1.D12	Engine
–R1M	Potentiometer, hand throttle	/2.D2	Cab
AC11.2			
–B8M	Sensor, fuel pressure	/1.C15	Engine
–B10M	Speed sensor, engine	/1.C15	Engine
–R1S	Potentiometer, hand throttle	/2.D8	Cab

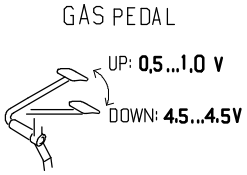
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B15 HALL-SENSORS





Check the supply voltage and the ground at the sensor connector between pins **1** (+) and **2** (–).



Check the signal voltage using **ETV 894 510** measuring cable.

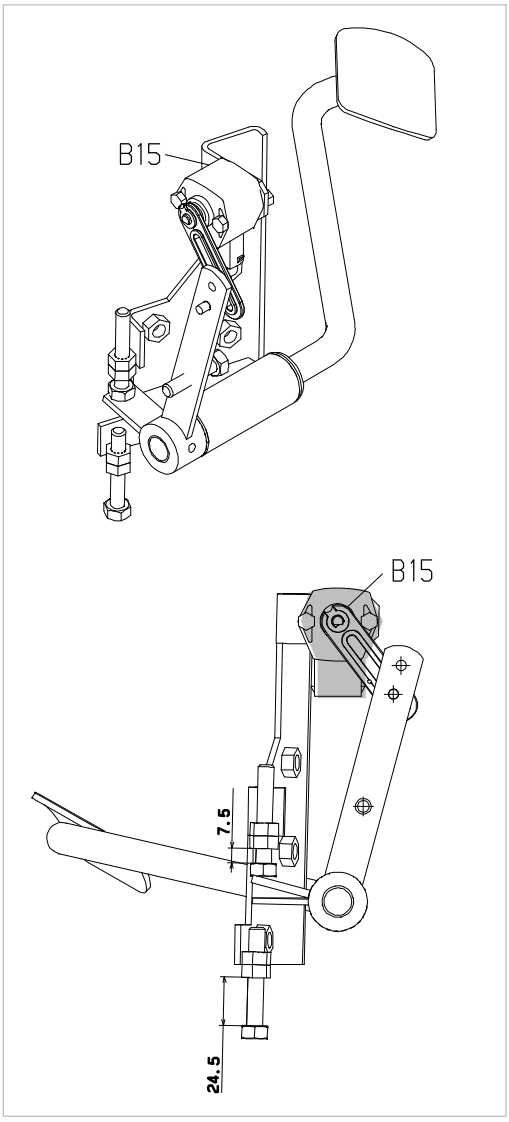


fig018en

Location of the sensors in wiring diagram:

Symbol	Description	Page+position (in wiring diagram)	Location
AC9.2			
–B15	Position sensor, front accelerator pedal	/2.D1	Cab
AC10.2&AC10.21			
–B15	Position sensor, front accelerator pedal	/2.D1	Cab
AC11.2			
–B15	Position sensor, front accelerator pedal	/2.D6	Cab

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Battery and starter motor

Function of starter motor is affected greatly by battery, wires and their point of contact.
Charge of battery must be over 50 % especially in cold weather condition.

Charge of battery can be tested without specific weight meter.

– Try to start engine about 10 seconds.
– After 5 minutes measure terminal voltage from battery.

These results are valid for 12 V battery when temperature is +20 degrees in Celsius.

Specific weight of battery acid *	Terminal voltage (after 5 minutes)	Charge of battery
1,280	12,6	100 %
1,250	12,4	75 %
1,220	12,2	50 %
1,190	12,0	25 %
1,130	11,7	0 %

*) kg/dm^3

In case that charge of battery is good enough, next thing is to measure voltage drop between battery and starter motor according to picture.

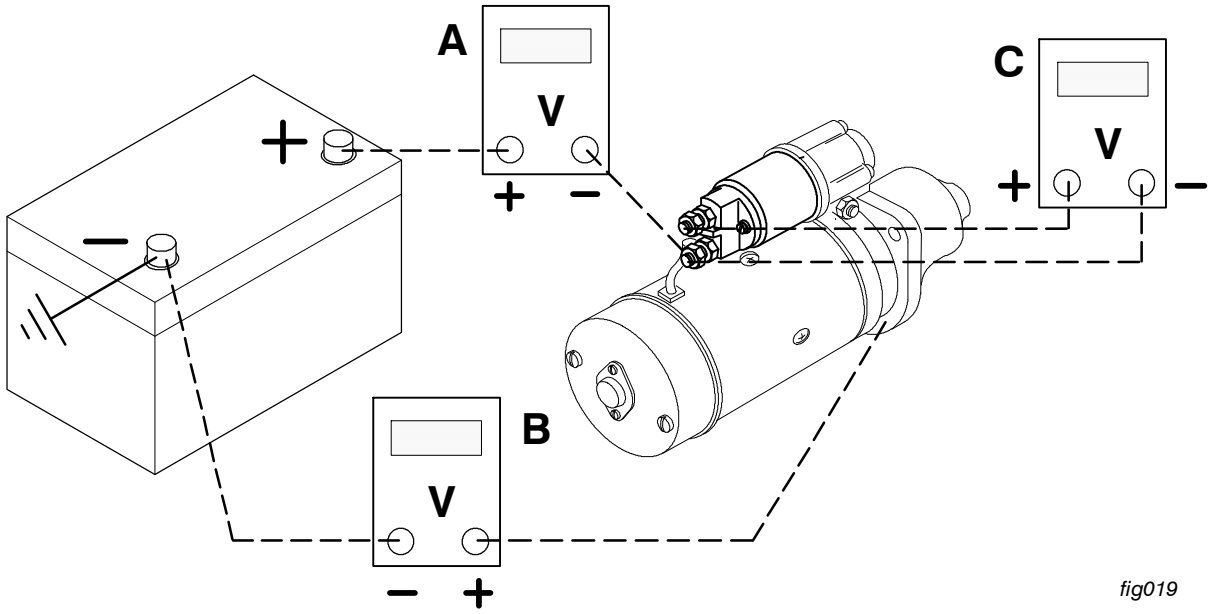


fig019

If voltage drop is greater than attached table shows, is the reason probably oxidized connector or wires and their point of contact.

Measurement	Pole	Voltage drop
A	Battery plus pole – starter motors solenoids output	**max 0,5 V**
B	Battery minus pole – starter motors gound	**max 0,1 V**
C	Startermotors solenoids input – output	**max 0,3 V**

Voltage drop in 12 V system is measured according to picture between poles when trying to start the engine.

Make sure that impulse comes to starter motors solenoid after the ignition.

In case that everything is in order nevertheless starter motor doen't run it could be damaged.

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Special tools

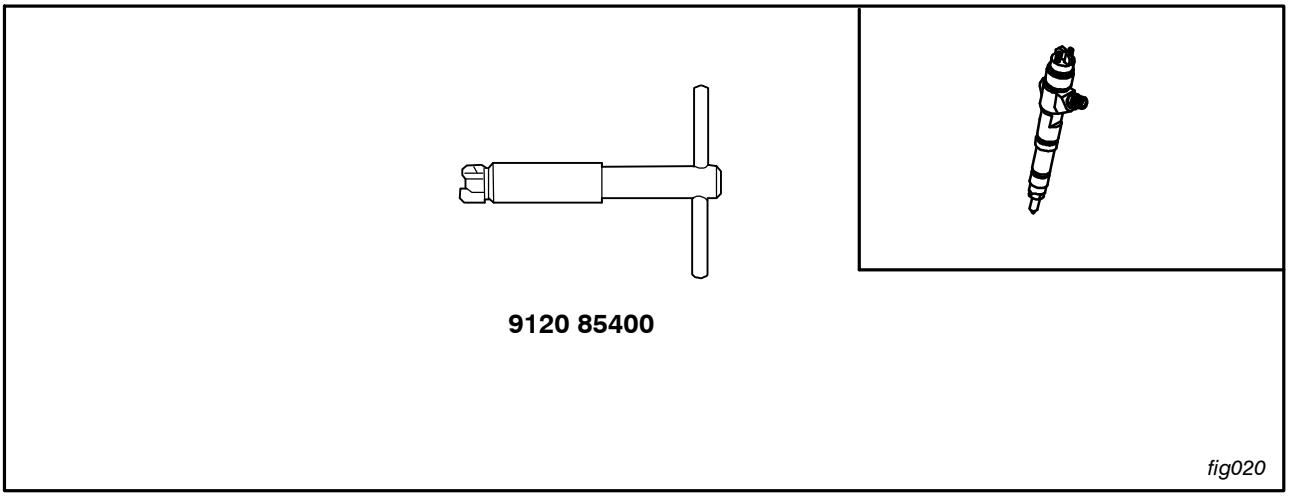
Injectors (code 225.3)

9120 85400 . . . . . Milling tool for injector seat

High pressure pump, Injectors and Control Unit (code 225.2, 225.3, 225.5)

36 000 400 . . . . . MultiTool and necessary equipment, with protection case

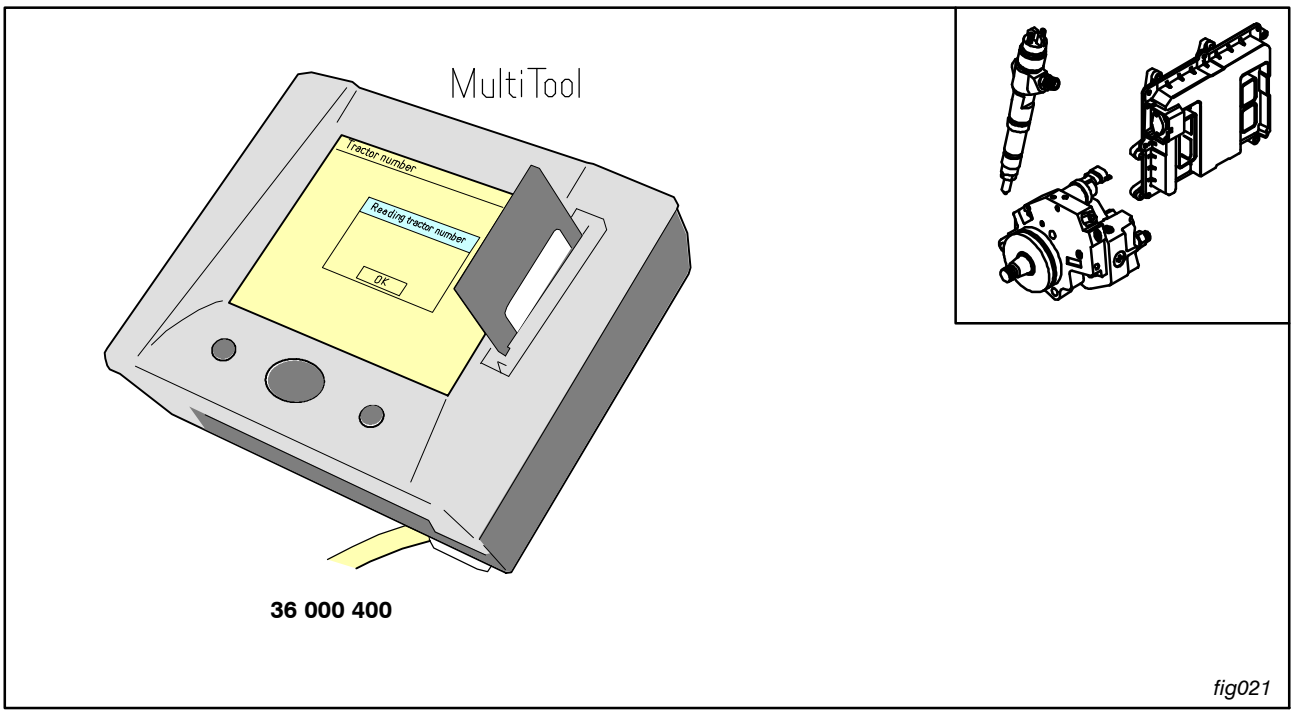
Injector



9120 85400

fig020

High pressure pump, Injectors and Control Unit



36 000 400

fig021

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Bleeding the fuel system

Bosch CP1



WARNING: Do not open high–pressure pipe connectors on the fuel system when the engine is running. Wait at least 30 sec. after the engine has stopped. If the jet of high–pressure fuel comes into contact with your skin, the fuel will penetrate the skin causing severe injuries. Contact your doctor immediately.

Citius series engines have an automatic fuel–bleeding system. Separate bleeding is not required for changing the fuel filters or in the event of insufficient fuel. It is sufficient to switch on the current and let the electric feed pump work for about 30 seconds before you start. Crank the engine for about 10 seconds. If the engine does not start, continue pumping and cranking alternately until it starts.

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High pressure pump (Bosch CP1)

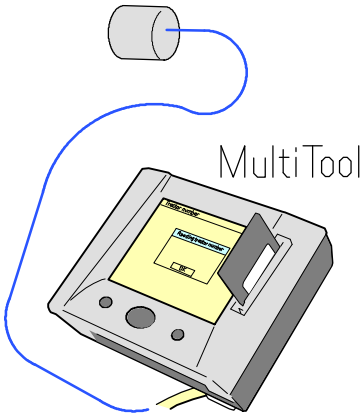


fig022

Function of the high pressure pump can be tested with the MultiTool. See more specifically in Diagnostic and Programming Manual.

Removing high pressure pump

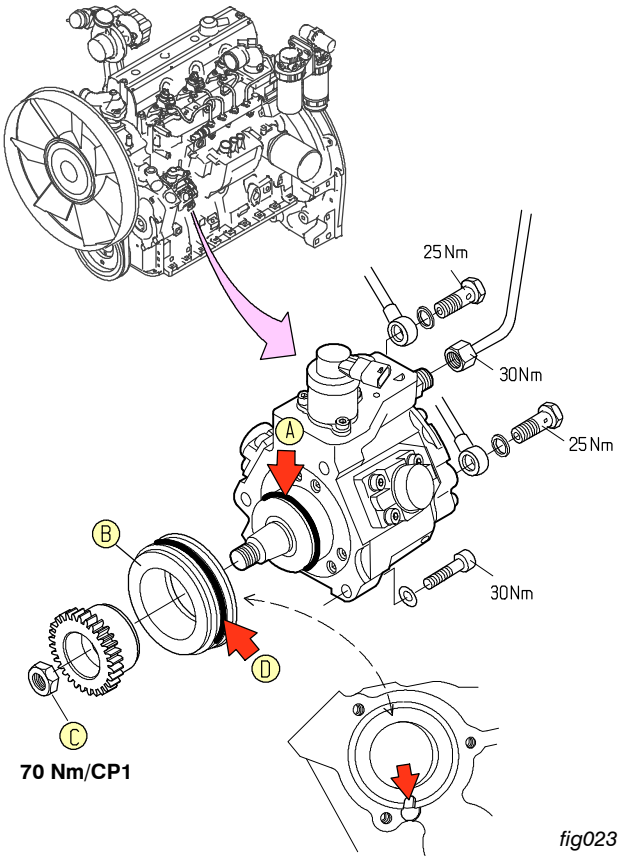


fig023

WARNING: Do not open high–pressure pipe connectors on the fuel system when the engine is running. Wait at least 30 seconds after the engine has stopped. If the jet of high–pressure fuel comes into contact with your skin, the fuel will penetrate the skin causing severe injuries. Seek medical attention immediately.

1. Disconnect the electric main switch. Clean the high–pressure pump and surroundings. Detach the wire connector.
2. Disconnect the fuel delivery pipes and insert protective plugs in the connections.
3. Unscrew the retaining screws and remove the high–pressure pump. Notice the guide ring used in the high–pressure pump of 66–engines. Remove the gear with the appropriate tool. Take the high–pressure pump to the Bosch Diesel agent or the service department of Sisu Diesel Oy to be reconditioned.

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Fitting high pressure pump

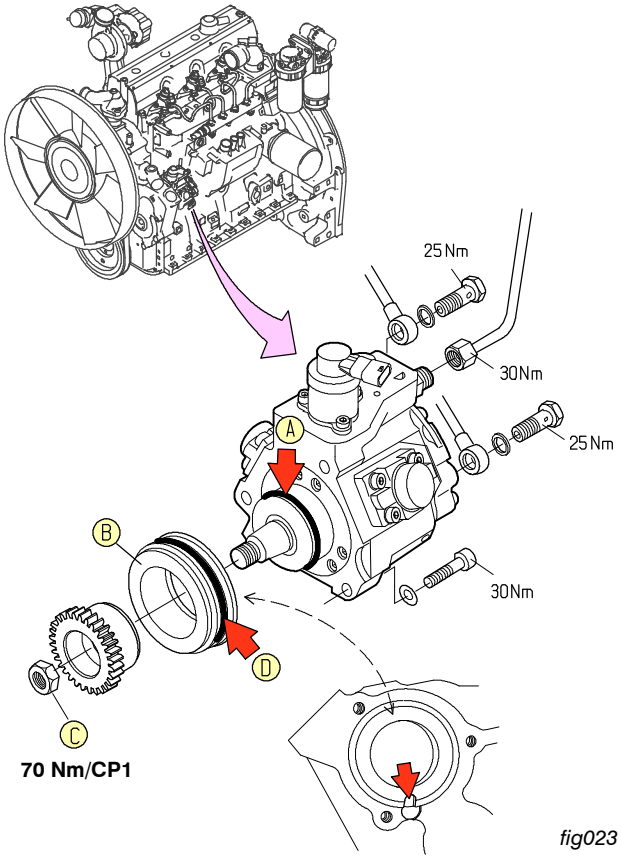


fig023

1. Attach the new O–ring to the sealing groove of the high–pressure pump. If the front cover of the gear housing has not been removed, fix the gear to the shaft of the pump. Please note that the guide ring of the CP1H high–pressure pump has to be fixed to the pump flange before the gear is fixed.
2. Tighten the nut of the gear to **70 Nm**.
3. Lubricate the O–ring, place the high–pressure pump in position in the gear housing and tighten the fixing screws to 30 Nm. There are no specific instructions on the alignment of the high–pressure pump gear and the double gear.

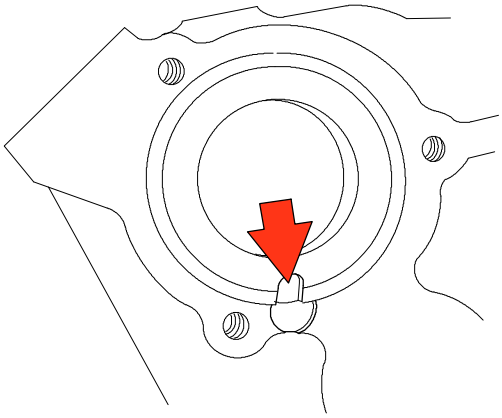


fig024

4. Turn the borehole in the CP1H pump guide ring so that it lines up with a similar borehole the gear housing.
5. Fix the fuel feeding pipes. Tighten the connectors of the low–pressure pipes to a torque of **25 Nm** and the connectors of the high–pressure pipes to **30 Nm**. Then attach the wiring connector.

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Injectors (Bosch CP1)

Removing injectors

WARNING: Do not open high–pressure pipe connectors on the fuel system when the engine is running. Wait at least 30 sec. after the engine has stopped. If the jet of high–pressure fuel comes into contact with your skin, the fuel will penetrate the skin causing severe injuries. Contact your doctor immediately.

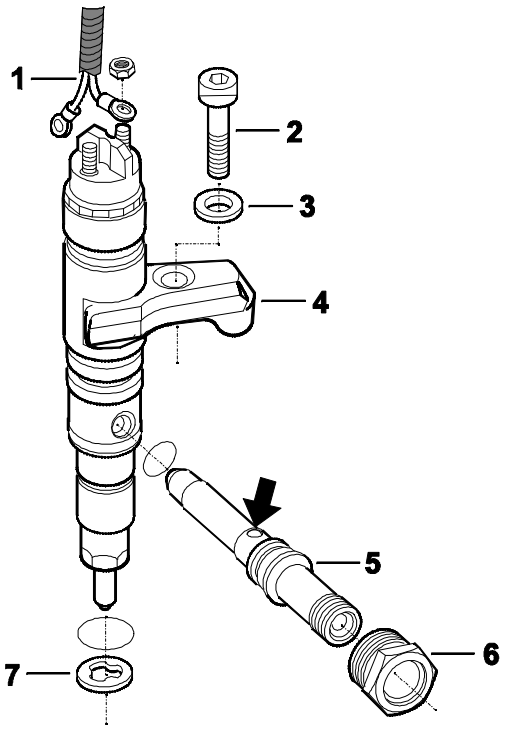


fig025

1. Clean high–pressure pipes and surroundings.
2. Remove the valve cover.
3. Detach the high–pressure pipe and injector wires.

Note! Prevent fuel circulation to the engine via the overflow pipe located in the cylinder head (if the fuel tank is above the engine).

4. Loosen the fastening screw holding the injector in place and the fastening nut holding the feeding pipe in place. Unscrew and remove them. Plug plastic covers into all the connection points.

Note! The injector and feeding pipe are calibrated to couple. Do not mix them up.

5. Also remove the injector seal ring from the cylinder head if it has not been removed with the injector.

Inspecting injectors

Function of the injectors can be tested with MultiTool. See more specifically in the Diagnostic and Programming Manual.

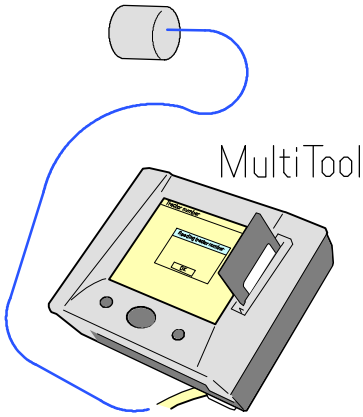


fig026

Note! The nozzle on the injector cannot be changed. Instead a spare injector is available.

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Fitting injector in engine

1. Ensure the injector seat on the cylinder head is clean. Replace the old seal ring and the O–rings with new ones.
2. Install the injector and feeding pipe on the cylinder head. Pay attention to the position of the feeding pipe. Adjust the feeding pipe's control balls (shown with an arrow on the picture) so that they line up with the grooves in the cylinder head.
3. Tighten the fastening screw and nut progressively as follows:
   1. Pre–tighten the fastening screw (2) to 15 Nm
   2. Undo the fastening screw
   3. Pre–tighten the fastening nut (6) to 15 Nm
   4. Tighten the fastening screw to 40 Nm
   5. Tighten the fastening nut to 50 Nm
4. Install the high–pressure pipe (tightening torque 30 Nm) and injector wires (nuts M4, torque 1.5 Nm). Replace the valve cover seals and attach the cover (torque for the screws 25 Nm).

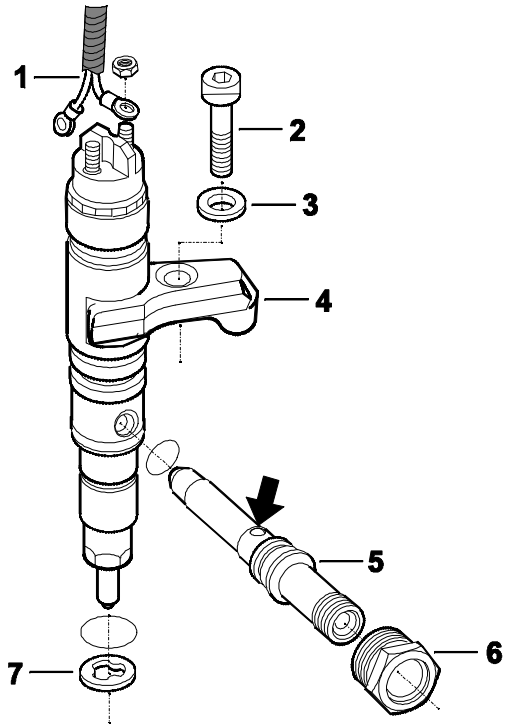


fig025

1. Injector wiring
2. Fastening screw
3. Washer
4. Fastener
5. Feeding pipe
6. Fastening nut
7. Seal ring

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Delivery pipes

Fitting delivery pipes

1. Check the state of the pipes. If there are kinks, damage by chafing, or if the tapered sealing end is damaged, the pipes should be changed.
2. Fit the pipes without tension and check that they are at right angles to the union. Tighten the delivery pipe attaching nuts to **30 Nm**. **Do not overtighten!**
3. Fit the clamps for the pipes.

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Changing of Control Unit (ECU)

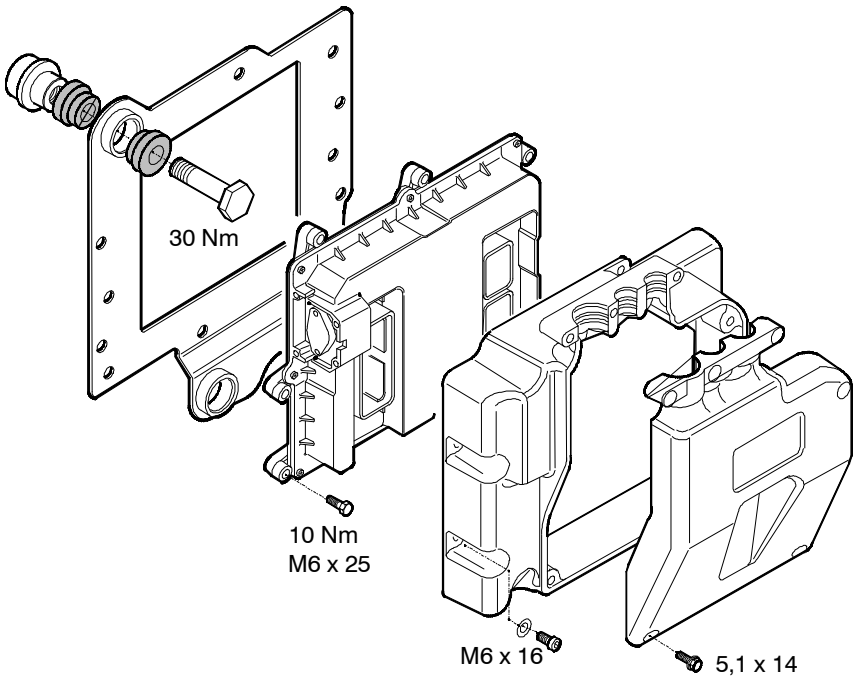


fig027

EEM 3 control unit

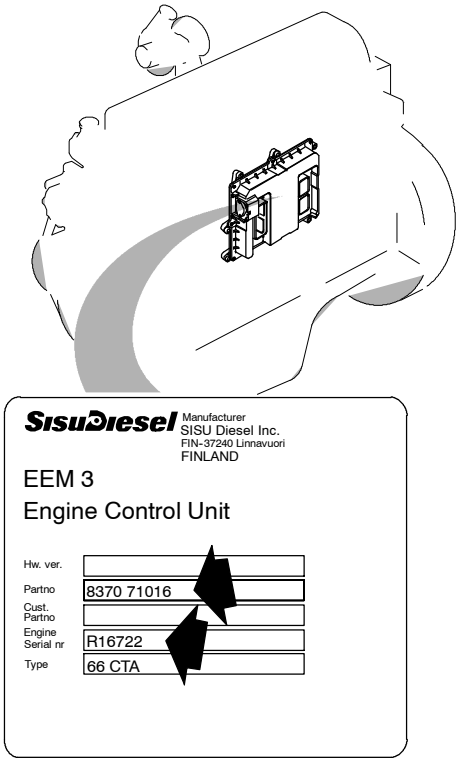


fig028

Note! The specification of the model and the engine serial number are indicated on the type plate of the EEM3 control unit. These numbers must always be stated when ordering a control unit.

1. The control unit (ECU) is fixed to the bracket on the left side of the engine.
2. Remove the outer plastic cover and disconnect the multipole connectors. Do not touch to the poles of the connectors. Remove the inner plastic cover.
3. Remove the control unit from the bracket. Check that the bracket's rubber damper works. Change this if necessary. Torque for the fixing screws is **30 Nm**.

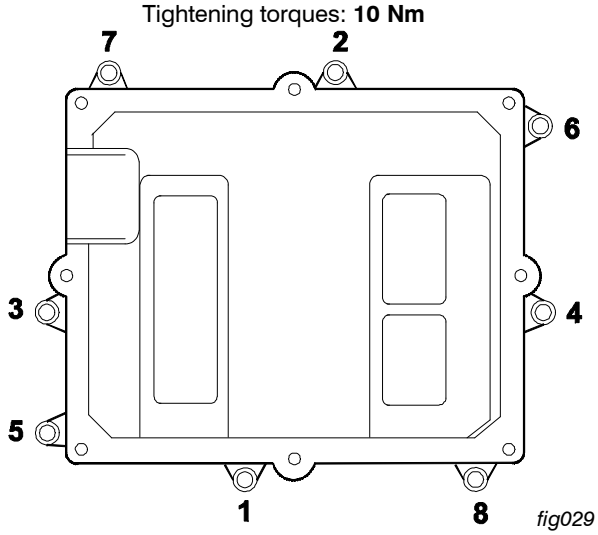


fig029

4. Attach the new control unit. Tighten the screws to **10 Nm** in the order shown in the picture.
5. Attach the inner plastic cover, connect the multipole connectors and attach the outer plastic cover.
6. Enter the program of the control unit (ECU) with the MultiTool. See more specifically in the Diagnostic and Programming Manual.

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Contents

Technical data, technical specifications, training material

231.1 ... Technical specifications 1
231.2 ... Quality requirements of coolant 3
231.3 ... Thermostat 5

Special tools

234.1 ... Special tools 1

Work instructions

235.1 ... Reconditioning of coolant pump 1

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Technical data

Coolant pump

Outside diameter of bearing . . . . . 72 mm
Diameter of bearing housing . . . . . 71.961...71.991 mm
Diameter of the water seal recess in the pump body . . . . . 39.981...40.019 mm
Shaft diameter at bearing . . . . . 30.002...30.015 mm
Shaft diameter at impeller . . . . . 15.907...15.920 mm
Impeller hole diameter . . . . . 15.876...15.894 mm
Distance between impeller blade and housing . . . . . 0.7 mm
Balancing precision of fan . . . . . 0.3 Ncm max

Thermostat

Order no.	Type	Opening begins at	Fully open at	Max. stroke
8366 66334	ø67 mm / 83°C	83°±2°C	95°C	8,0 mm
8366 59685	ø67 mm / 86°C	86°±2°C	99°C	8,0 mm
8360 15156	ø54 mm / 79°C	79°±2°C	94°C	7,5 mm
8363 31590	ø67 mm / 83°C	83°±2°C	95°C	8,0 mm

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Quality requirements of coolant

The coolant used must meet the requirements of standard ASTM D 3306 or BS 6580:1992.

- The cooling mixture must consist 40...60% of ethylene/propylene–glycol based antifreeze and water. The ideal proportions are 50% antifreeze liquid to 50% water.
- The water used must be mechanically clean and not too acidic (e.g. swamp water) or too hard (calciferous well water).
- The proportion (the frost proof quality) of the coolant should be checked periodically. Change the coolant every two years.

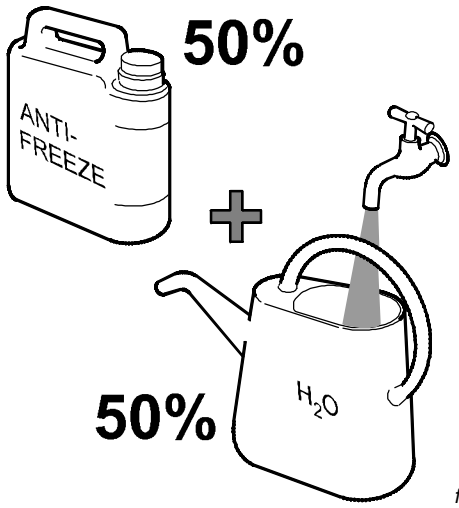


fig001c

Note! Water alone should never be used as a coolant!

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Thermostat

Check the function of the thermostat as follows:

- Lower the thermostat into a vessel of boiling water so that it does not touch the sides or bottom.
- Opening must begin after less than 20 seconds.
- The thermostat must be fully open in less than 50 seconds. See ”**Technical data (231.1)**”.

66-engines

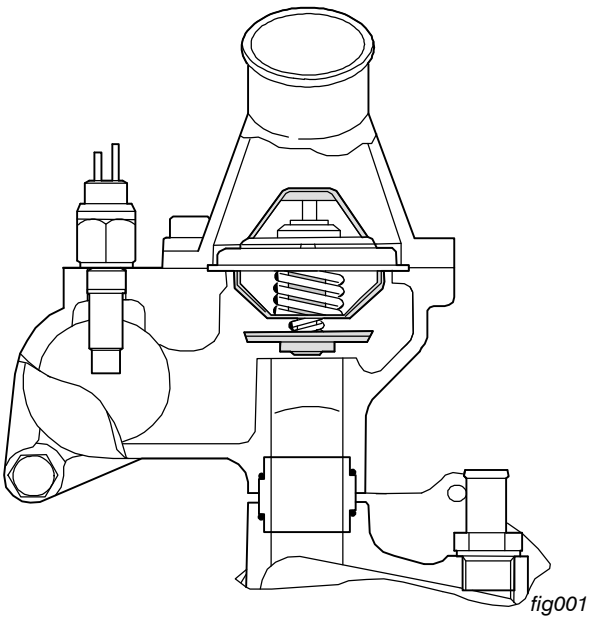


fig001

It is a 2–way thermostat. Its opening temperature is 83˚C.

66- and 74-engines

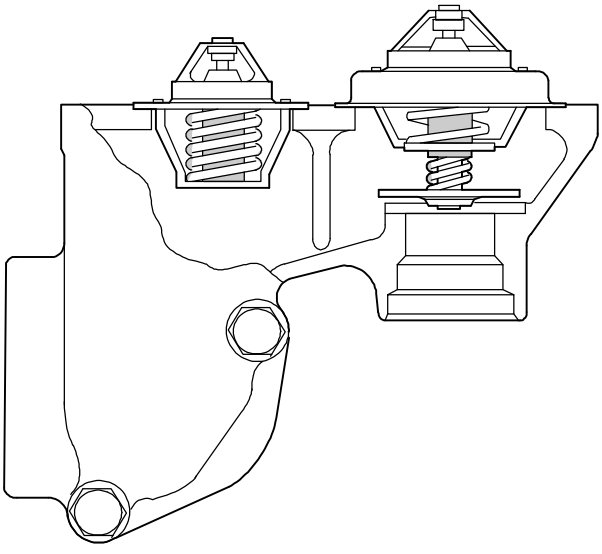


fig002

Some 66– and 74–engines have two separate thermostats. These are different from the type used as single thermostats and the two are not interchangeable. For these engines there are no separate winter thermostats.

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Special tools

Coolant pump (code 235.1)

9101 93200 . . . . . Puller for coolant pump impeller
9051 79300 . . . . . Drift for fitting coolant pump water seal

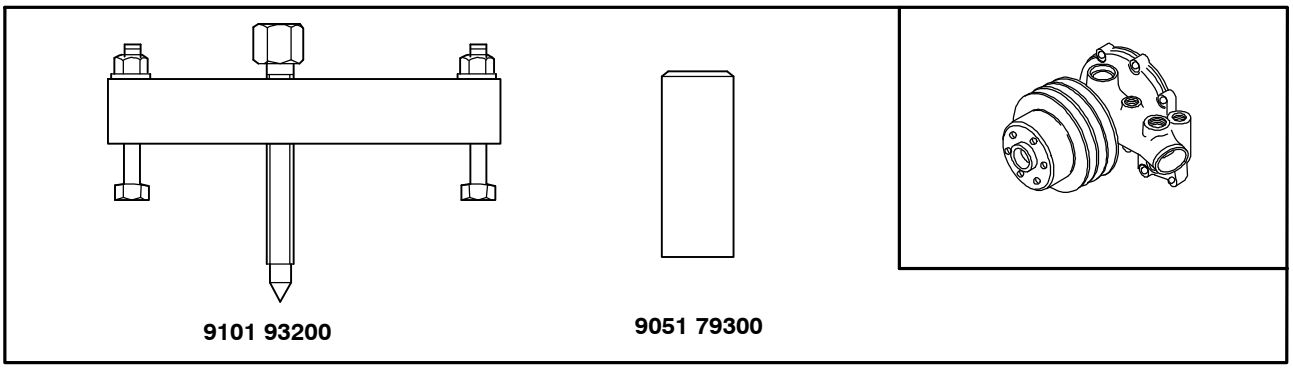


fig003

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Reconditioning of coolant pump

66- and 74-engines

1. Drain the coolant. Remove the thermostat housing, fan and v–belt.
2. Remove the coolant pump. Detach the pump rear plate and clean the sealing surfaces.
3. Unscrew the belt pulley fixing nut/screw and remove the belt pulley

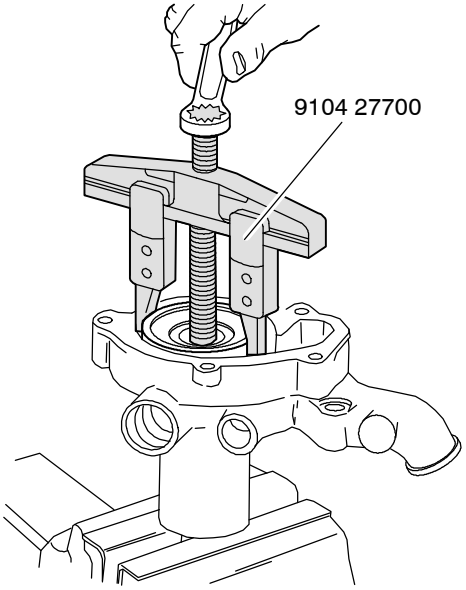


fig004

4. Remove the impeller on the shaft with puller 9101 93200 (66– and 74–engines).
5. Remove the circlip from the pump body. Press the shaft together with the bearings pointing in the direction of the fan. Use a hydraulic press, for example. Support the pump body so that the bearings have enough space to release.
6. Tap out the water seal and shaft seal using a drift. Clean the parts and inspect their condition. Replace faulty or worn parts with new ones.

Note! If the pump bearings have to be changed, use a reconditioning kit. This kit also contains all the seals (see Parts Catalogue).

7. Drive the new shaft seal into the housing using a suitable drift. Put the bearings and the intermediate sleeve onto the shaft. Grease the bearings with heat–resistant ball bearing grease (NLGI 2). Fit the shaft and the bearings in such a way that the ball bearings do not transmit the pressure. Fit the circlip on the bearing.

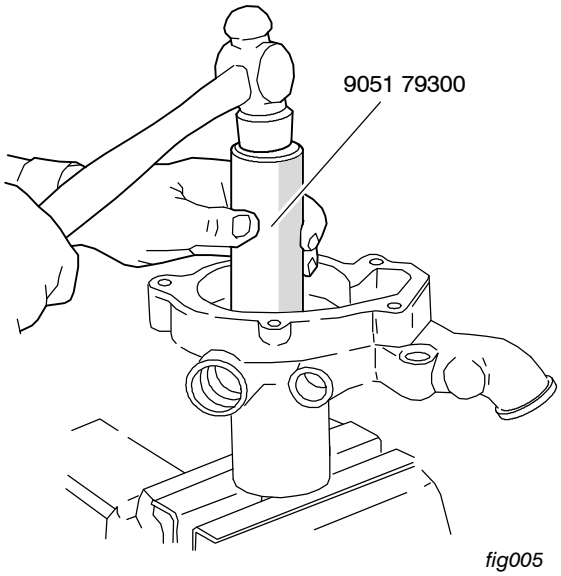


fig005

8. Fit the water seal with drift 9051 79300. Use as a "lubricating liquid" coolant between the shaft and the seal.

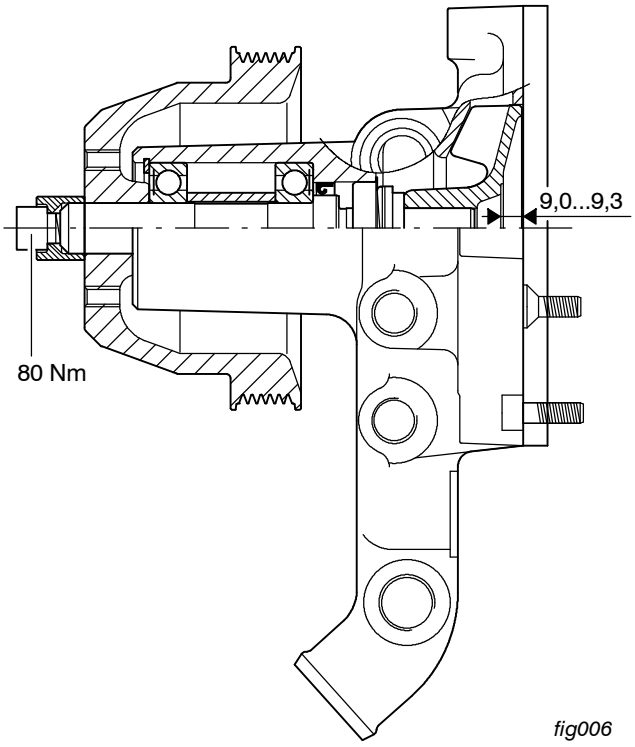


fig006

9. Press the impeller into position while, at the same time, supporting the shaft at the other end. The mounting depth of the impeller is **9.0...9.3 mm** in 33– and 44–engines (see picture above). Make sure that the shaft can rotate freely. Fit the belt pulley and tighten its attaching screw to a torque of **80 Nm**. **Note** in particular the left–hand thread of the belt pulley attaching screw.

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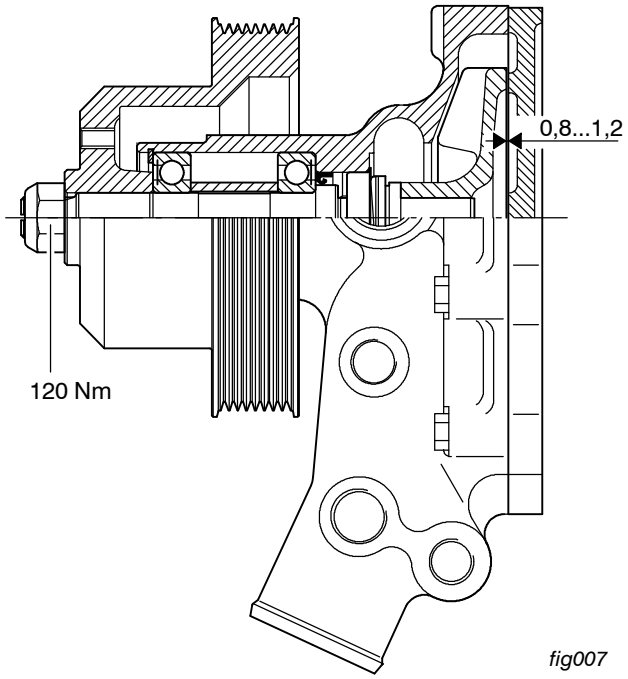


fig007

10. The mounting depth of the impeller is **0.8...1.2 mm** in 66– and 74– engines (see picture above). Make sure that the shaft can rotate freely. Fit the belt pulley and tighten its attaching nut to a torque of **120 Nm**.

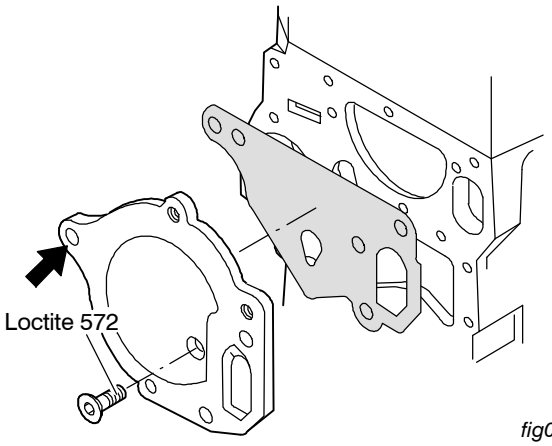


fig008

10. Fit the rear plate to the cylinder block using a new seal. Use guide pin (Ø8 mm) in the hole shown with an arrow in the picture above. Apply sealing compound to the thread of the screw

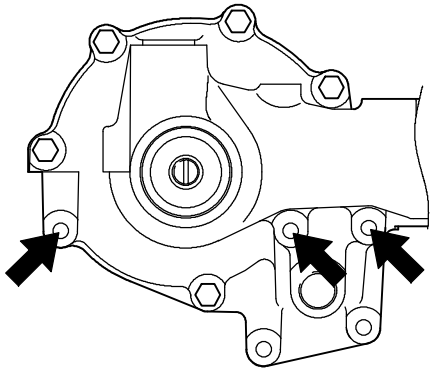


fig009

On 66– and 74–engines, fit the rear plate to the pump using a new seal. Use guide pins (Ø8.5 mm) in the holes shown with arrows in the picture above.

Coolant pumps with heavy duty bearings

66- and 74-engines

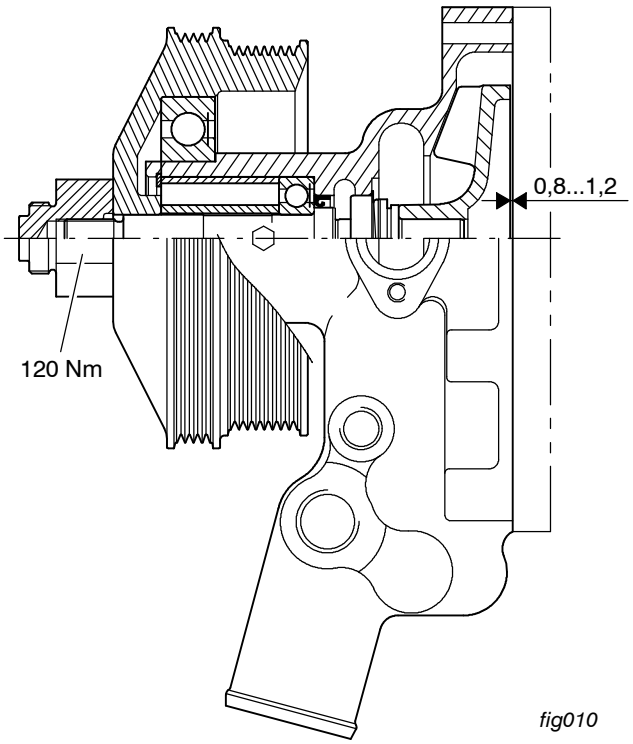


fig010

Some versions of 66– and 74–engines have heavy duty bearings in the coolant pump. The reconditioning of this pump is done according to instruction 271 / 1. **Note** in particular the position of the front bearing during assembly.

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30. Electrical system

31. General

32. Autocontrol AC9.2

33. Autocontrol AC10.2
Autocontrol AC10.21

34. Autocontrol AC11.2

38. CAN bus

39. Safety instructions

Contents

Technical data, technical specifications, training material

311.1 ... Technical data 1
311.2 ... Fuses and relays 3
311.3 ... Trailer socket 7

Work instructions

315.1 ... Headlight adjustment 1

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Technical data

Voltage	12 V, negative ground
Battery	174 Ah
Alternator	120A
Starter motor	4,2 kW
Safety start:	
–T121c–T171c	Operated by the clutch pedal
–T121h–T191h, T151eLS–T191LS	Operated by the parking brake
Electric resistor (engine induction air)	2,1 kW
Bulbs:	
Headlights	60/55 W– H4
Sidelights	5 W
Rear/brake lights	5/21 W
Direction indicators	21 W
Working lights	55 W – H3
Instrument panel lights and warning lights	2 W – 1,2 W
Cabin lights (T121c–T171c, T121h–T191h)	2 x 10 W
Cabin lights (T151eLS–T191LS)	2 x 5 W
Fuses and relays	see code 311.2

Autocontrol systems	
T121c–T171c	AC9.2
T121h–T171h	AC10.2
T191h	AC10.21
T151eLS–T191LS	AC11.2

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Electric center of front housing

Fuses (T121c–T171c, T121h–T191h)

F1 15A HAZARD, WATERPUMP
F2 5A RADIO, INSTRUMENTATION, TEL., EL. MAIN CIRCUIT SWITCH, TACHOGRAPH
F3 15A MAIN BEAMS
F4 15A DIPPED BEAMS
F5 10A PARKING LIGHTS, LEFT
F6 10A PARKING LIGHTS, RIGHT
F7 25A FRONT WORKING LIGHTS
F8 25A LIGHT SWITCH
F9 15A TRAILER SOCKET/REAR FOG LIGHT,EL. MAIN CIRCUIT SWITCH
F10 25A 3 PIN CURRENT SOCKET
F11 5A AUTOCONTROL (+BAT), BUZZER[1)]
F12 10A ROTATING WARNING LIGHT, CAB LIGHT
F13 10A RESERVE
F14 15A IGNITION SWITCH
F14 15A PREHEATING OF INDUCTION AIR, FUEL PUMP[3)]
F15 25A FAN, AIR CONDITIONING
F16 10A REAR WORKING LIGHTS, INNER
F17 10A DIRECTION INDICATORS, FIELDMASTER, ISOADAPTER
F18 5A INSTRUMENTATION, WARNING LIGHTS, AUTOCONTROL
F19 10A WINDSCREEN WIPER/WASHER, HORN
F20 10A REAR WINDOW WIPER/WASHER, RADIO, (TRAILER HITCH LIGHT)
F21 15A AIR CONDITIONING, CONTROL, FLOOR FAN, FUEL FEED PUMP [4)]
F22 10A 4WD, PTO, POWER SHIFT, (FRONT SUSPENSION) [1)]
F22 10A HITECH SENSORS, 4WD, (FRONT SUSPENSION) [2)]
F23 10A REAR WORKING LIGHTS, OUTER
F24 10A RESERVE [1)]
F24 10A AC–5, SEAT DIRECTION [2)]
F25 15A AIR SPRING SEAT/SEAT HEATING, REVERSE DRIVE LOCKOUT, EL FRONT LOADER VALVES
F26 10A BACK BUZZER, (SIGMA), HISHIFT
F27 10A BRAKE LIGHTS, DIFFERENTIAL LOCK, EXHAUST BRAKE
F28 10A RESERVE
F29 10A CIGARETTE LIGHTER, 2 PIN CURRENT SOCKET
F30 10A 1A IF HF*
F31 30A CR–CONTROLLER SUPPLY

*IF HANDS FREE IS FITTED
[1)] 6000–series, Nc, [2)]HiTech, Nh, [3)] Motor control , Bosch VE,[4)] Common Rail motor

Relays (T121c–T171c, T121h–T191h)

K1 FRONT WORKING LIGHTS
K2 REAR WORKING LIGHTS
K3 REAR FOG LIGHT
K4 RELAY, STARTER SWITCH
K5 RELAY, STARTER SWITCH
K6 AIR CONDITIONING, FAN, CONTROL
K7 4–WHEEL BRAKING, CONTROL

The fuse box, which is positioned under the instrument panel should always be kept clean and dry. It contains 31 fuses. The nominal current rating of the fuses is between 5–25 A. If any of the fuses blow, the fault must be traced and remedied. **Fuses must not be replaced with ones of a higher rating**, as this may cause damage to the electrical equipment. The fuse diagram is placed under the fuse box (it is shown in the figure above). There is space for reserve fuses between the fuses.

When you need a continuous electrical supply e.g. to the implement, illumination etc. power can be taken from the trailer connection. With the implement control system (optional equipment) electrical power to the optional equipment can be switched on and off from the driver's cab.

Power for optional equipment can also be taken from the spare fuses or unused optional equipment fuses. A continuous current source can be connected from the main current pole of the starter motor (on the models with main circuit breaker, current is switched off with main switch) through the new fuse.

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Fuses (T151eLS–T191LS)

F1 15A HAZARD BLINKERS
F2 5A INDICATOR LIGHT FOR MAIN BEAM
F3 15A HIGH BEAM
F4 15A LOW BEAM
F5 10A ELECTRIC MAIN SWITCH, TACHOGRAPH
F6 5A RADIO, CABIN LIGHT, INSTRUMENTATION (BUZZER)
F7 25A AIR CONDITIONING COMPRESSOR
F8 25A LIGHT SWITCH
F9 15A TRAILER SOCKET/FOG LIGHT, REAR
F10 20A ENGINE CONTROL UNIT
F11 10A STARTER SWITCH
F12 10A CABIN LIGHT
F13 10A SHORT WAVE–TELEPHONE
F14 20A ENGINE CONTROL UNIT
F15 10A FUEL FEED PUMP
F16 10A RESERVE FOR EXTRA WORKING LIGHTS
F17 10A DIRECTION INDICATORS
F18 5A INSTRUMENTS, WARNING LIGHTS
F19 10A WINDSCREEN WIPER/WASHER, HORN
F20 10A REAR WINDOW WIPER/WASHER
F21 15A RESERVE
F22 10A TC2 CONTROL UNIT [1)]
F23 15A EXTRA FRONT WORKING LIGHTS (LIFTING HANDLE)
F24 10A TC 1–CONTROL UNIT [2)]
F25 15A AIR SUSPENSION SEAT/SEAT HEATING, REAR STEERING PREVENTION
F26 10A FRONT PTO
F27 10A RESERVE
F28 2A HANDSFREE
F29 10A CIGARETTE LIGHTER, 2–PIN CURRENT SOCKET
F30 1A HANDSFREE

[1)] U–PILOT, 4WD, DIFFERENTIAL LOCK
[2)] POWER SHIFT, POWER SHUTTLE, PTO, PARKING BRAKE, SEMI–AUTOMATIC RANGE GEAR

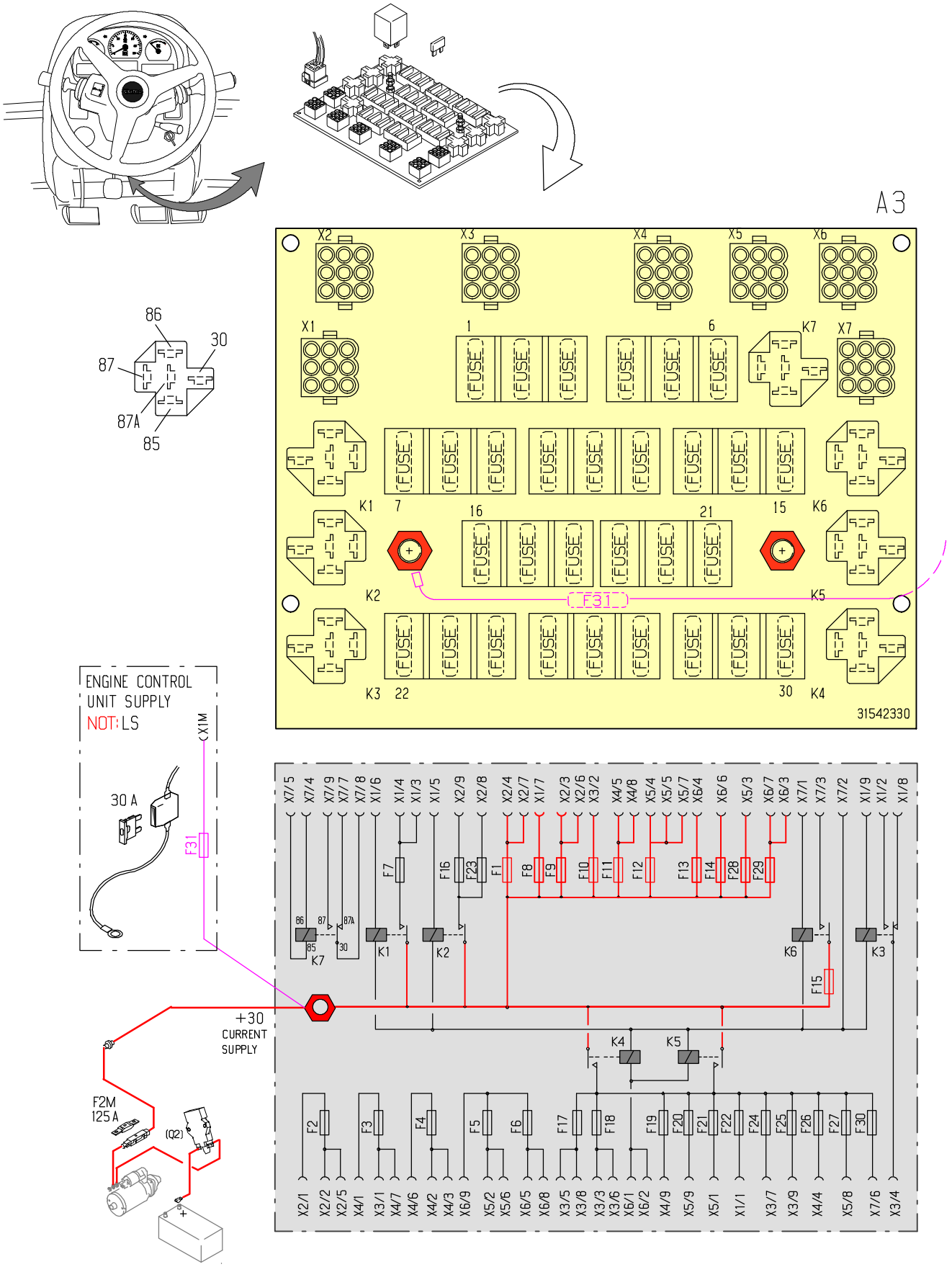
Relays (T151eLS–T191LS)

K1 AIR CONDITIONING COMPRESSOR. CONTROL
K2 EXTRA FRONT WORKING LIGHTS (LIFTING HANDLE)
K3 RELAY, MAIN SWITCH
K4 RELAY, STARTER SWITCH
K5 RELAY, STARTER SWITCH,
K6 FUEL FEED PUMP, CONTROL
K7 HAND BRAKE SAFETY CONNECTION FROM FORWARD–DIRECTION

The fuse diagram is placed under the fuse box (it is shown in the figure above). There is space for reserve fuses between the fuses. It contains 30 fuses. The nominal current rating of the fuses is between 1–25 A.

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Wiring



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Electric center of side panel (T151eLS–T191LS)

Fuses

F31 10A FRONT WORKING LIGHTS
F32 10A REAR WORKING LIGHTS, OUTER
F33 10A REAR WORKING LIGHTS, INNER
F34 10A PARKING LIGHTS, LIGHTNING
F35 10A PARKING LIGHTS, LEFT
F36 10A PARKING LIGHTS, RIGHT
F37 20A MAIN BEAM AUTOMATIC
F38 5A AUTOCONTROL
F39 10A ROT. WARNING LIGHT
F40 30A FAN, SPEED–III
F41 10A BRAKING LIGHTS
F42 25A 3–PIN CURRENT SOCKET
F43 5A CRUISE–SWITCHES
F44 5A AUTOCONTROL
F45 15A FAN(I,II), AIR CONDITIONING, FLOOR FAN
F46 10A ELECTRICAL MIRROR
F47 10A ARM REST
F48 10A CAN–VALVES
F49 10A TRAILER HITCH LIGHT
F50 5A POWER SHIFT–, LL–, PTO–SWITCHES, ACTIV SENSORS OF THE TC1 (TRANSMISSION CONTROL UNIT) , RADAR
F51 10A TWINTRAC, FRONT AXLE SUSPENSION
F52 5A 3–PIN CURRENT SOCKET
F53 10A ISOADAPTER
F54 10A ON/OFF–,VALVES OF THE FRONT LOADER/–FRONT LINKAGE
F55 15A ISOBUS, ECU–PWR
F56 30A ISOBUS, PWR

Relays

K8 FRONT WORKING LIGHTS
K9 REAR WORKING LIGHTS
K10 PARKING LIGHTS (AUTOMATIC/MANUL)
K11 RELAY, STARTER SWITCH 1
K12 RELAY, STARTER SWITCH 2
K13 ISOBUS ECU–PWR
K14 ISOBUS–PWR
K15 MAIN BEAMS (AUTOMATIC)
K16 U–PILOT CURRENT SOCKET
K17 FAN, SPEED–III
K18 JBRAKING LIGHTS
K19 LS–SOLENOID ON/OFF
K20 JOYSTICK BUSH BUTTON 1
K21 CAN–VALVES
K22 JOYSTICK BUSH BUTTON 2

The tractor has two electric centers. One (A3) is located under the instrument panel and the other one (A5) is under in front part of the RH side panel.

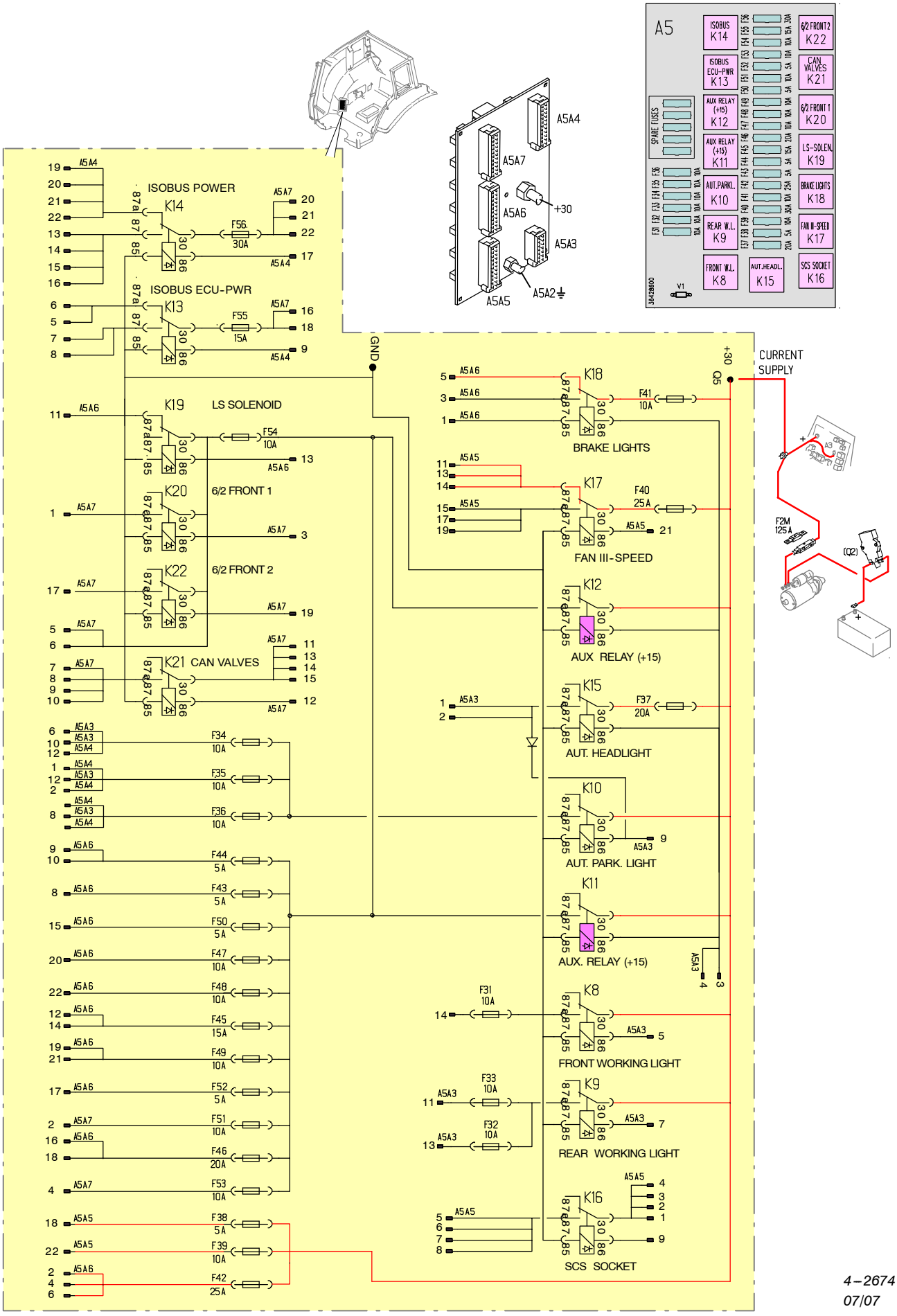
If any of the fuses blow, the fault must be traced and remedied. **Fuses must not be replaced with ones of a higher rating**, as this may cause damage to the electrical equipment.

When a continuous electrical supply is needed the cab has three connections for power output (see electrical equipment of the cab: X5S, X4S, X2S). In addition, power can be taken from the trailer connection and from the front of the tractor.

Power for optional equipment can also be taken from the spare fuses or unused optional equipment fuses. A current source can be connected from the main current pole of the starter motor (current is switched off with main switch) through the new fuse.

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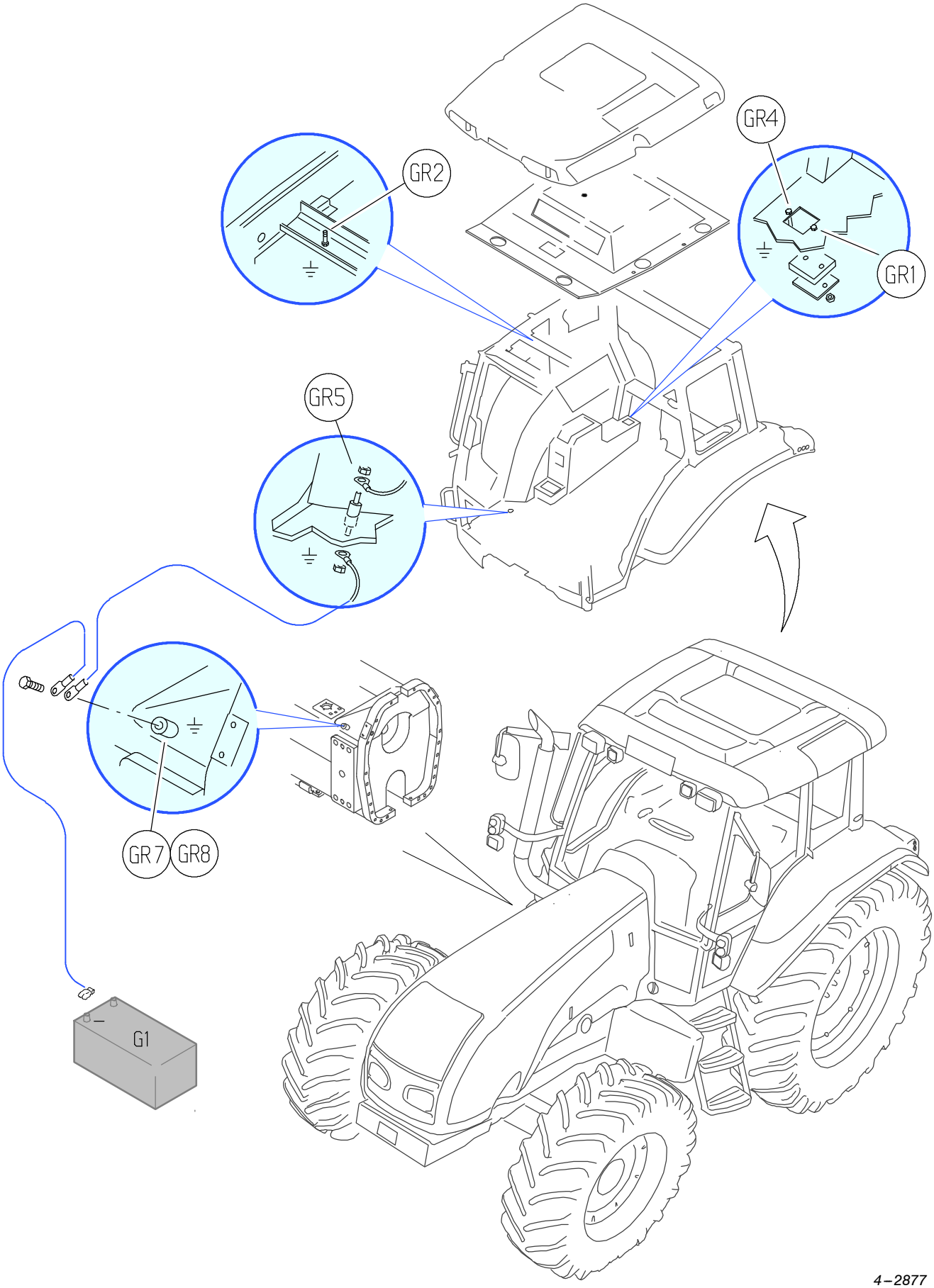
Wiring



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Earthing points



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Electric preheating of engine induction air

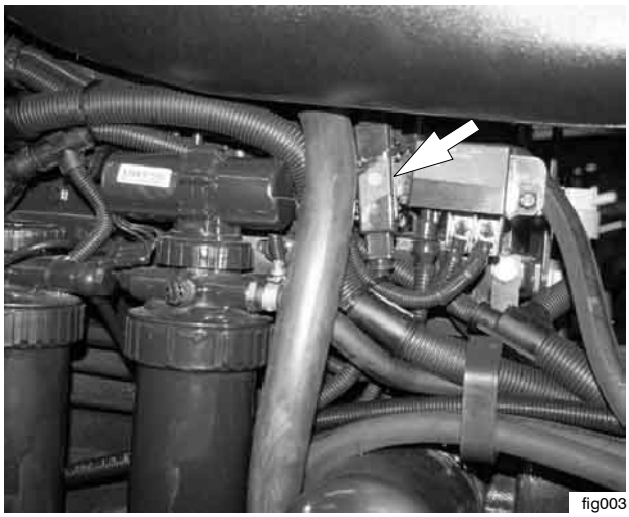


fig003

T121c–T171c, T121h–T191h F52
T151eLS–T191LS F1M

250A Fuse for electric preheating of engine induction air

Cabin power supply



fig004

T121c–T171c, T121h–T191h F100
T151eLS–T191LS F2M

125A Cabin power supply

The fuse is situated immediately in front of the cab in the RH corner in the power supply cable from the starter motor.

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Standard trailer socket

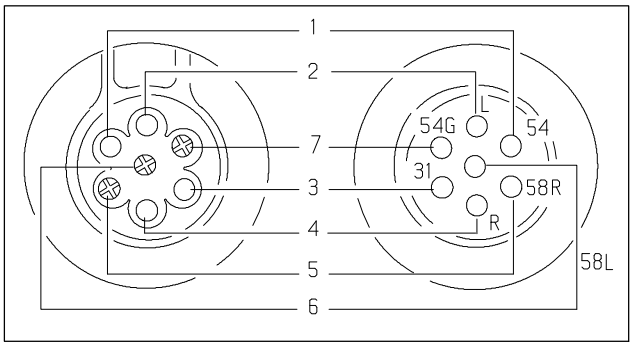
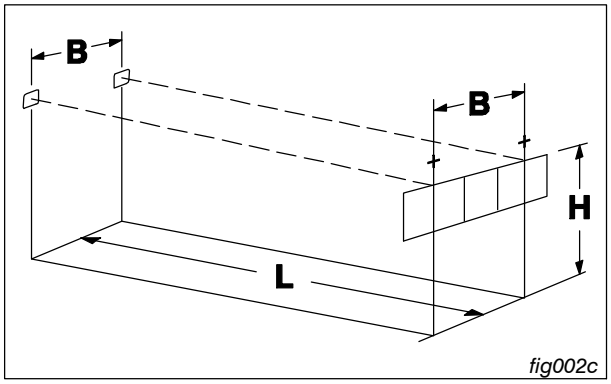


fig001c

1. Brake light (red)
2. LH side direction indicator (yellow)
3. Earthing (white)
4. RH side direction indicator (violet)
5. RH side parking light (brown)
6. LH side parking light (black)
7. Permanent current, max. 15 A.
   The possibility to switch off the current supply is only available in the tractors with a main switch or a rear fog light.

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Headlight adjustment



Correct adjustment of the headlights is very important when running on the public highway.Headlight adjustment can be carried out quickly and accurately by using an optical headlight adjusting unit. If no optical instrument is available, adjustment can be done as follows: Check before adjusting the headlight that the tractor loading is normal and tyre pressures are correct.With dipped–beam switched on, the cutoff edge of the light pattern should come at height H when the tractor is at distance L. With full–beam switched on, the distance between the light points should be B. Any necessary adjustment is done with the headlamp adjusting screws.

Measurements:

L = 5 m
B = Distance between headlight centres
H = Height of headlights above ground minus 50 mm

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Contents

Training material

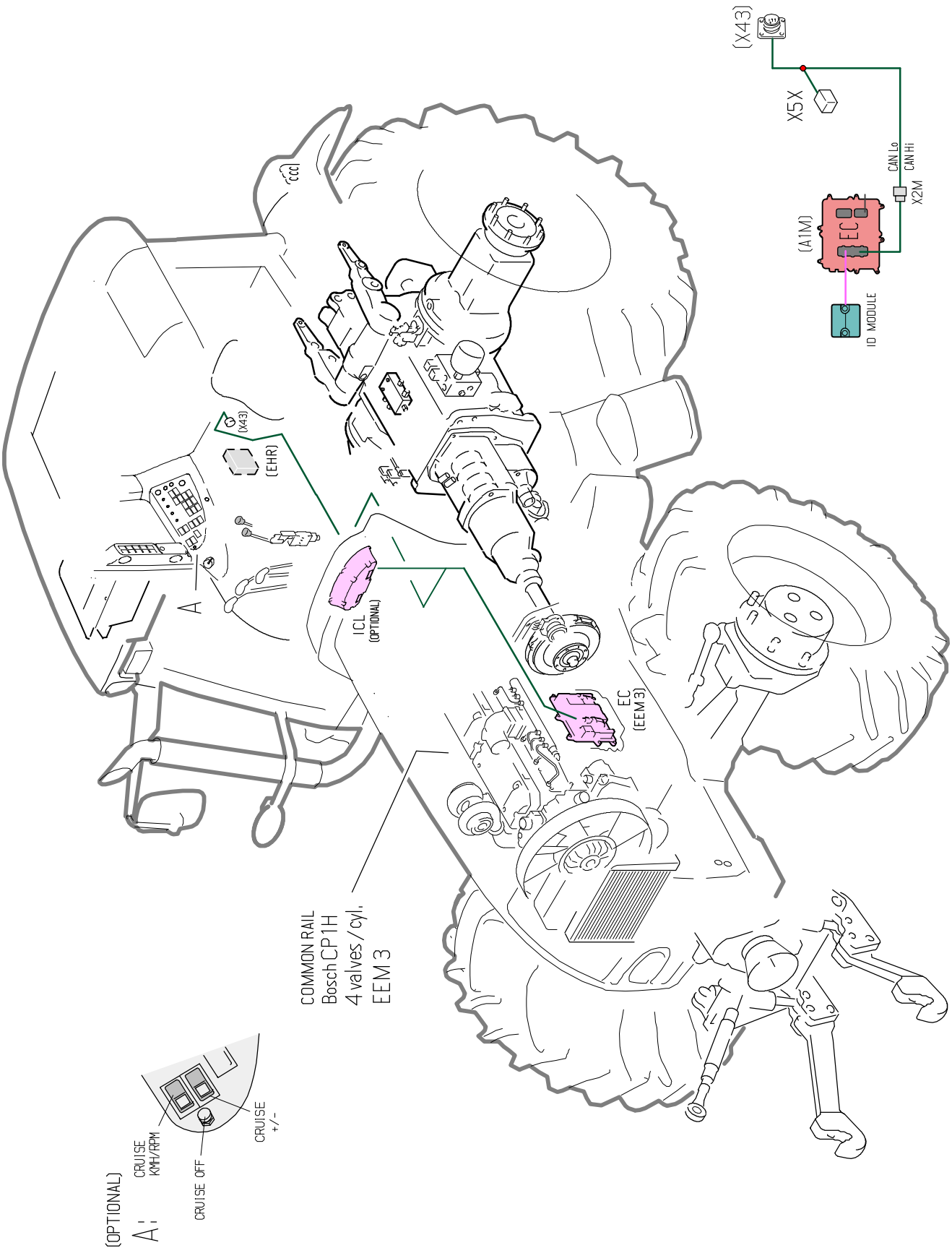
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Electrical equipment, cab 2
Electrical equipment, front housing 4
Electrical equipment, frame 6
Electrical equipment, engine 8
CAN bus 10

Fault finding

323.1 ... Wiring diagram 1

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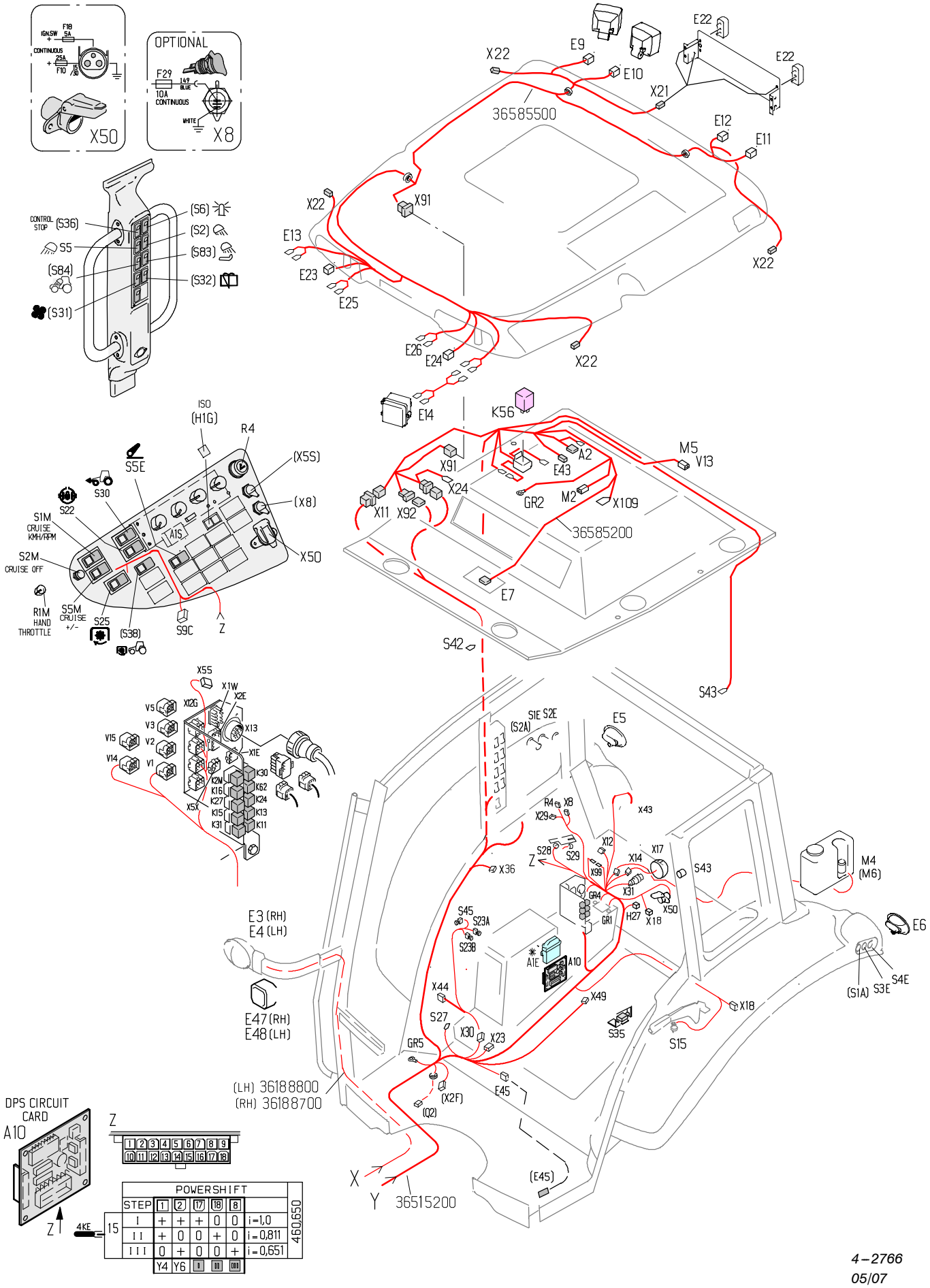
Autocontrol AC9.2



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Electrical equipment, cab



4–2766
05/07

*** SEE PICTURE "ELECTRICAL EQUIPMENT, ENGINE"

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Cab wiring harness 36515200

–A10 Control unit, DPS
–A1E Control unit EH power lift
–E45 Step light
–H27 Buzzer, reversing
–K11 Relay, brake light
–K13 Relay, differential lock
–K15 Relay, 4WD
–K16 Relay, PTO emergency stop
–K24 Control relay, HiShift
–K27 Control relay 4WD, on/off
–K62 Relay, rear PTO
–K2M Relay, fuel pump
–M6 Rear window washer
–R4 Cigarette lighter
–R1M Potentiometer, hand throttle
–S2 Rocker switch, 2–pos. rear working lights
–S4 Combined switch
–S5 Rocker switch, 2–pos. extra front working lights
–S6 Rocker switch, 2–pos. rot. warning light
–S9 Safety switch, starter (clutch pedal)
–S15 Indicator light switch, parking brake
–S22 Rocker switch, 3–pos. differential lock
–S25 Rocker switch, 3–pos. PTO
–S27 Switch, back buzzer
–S28 Limit switch, PTO 540
–S29 Limit switch, PTO 1000/540E
–S30 Rocker switch, 3–pos. 4WD
–S31 Rocker switch, 3–pos. floor fan
–S32 Rocker switch, 3–pos. rear window wiper and washer
–S36 Rocker switch 2–pos. control stop
–S38 Rocker switch, 2–pos., front–PTO
–S45 Push buttons, HiShift
–S83 Rocker switch, 2–pos. drawhook light
–S84 Rocker switch, 2–pos. extra front working lights
–S9C Rocker switch, 2–pos. rear PTO automatic stop, man./auto
–S1M Rocker switch 3–pos. cruise kmh/rpm
–S2M Switch, cruise on/off
–S4M Clutch pedal information
–S5M Rocker switch 3–pos. cruise +/–

Top roof wiring harness 36585500

–E9 Rear working light, right outer
–E10 Rear working light, right, middle
–E11 Rear working light, left, outer
–E12 Rear working light, left, middle
–E13 Front working light, right
–E14 Front working light, left
–E23 Upper head light, right
–E24 Upper head light, left
–E25 Parking light, upper, right
–E26 Parking light, upper, left

Inner roof wiring harness 36585200

–A2 Radio
–E7 Cab light
–K56 Time–delay relay, cabin light and door step
–M2 Heating fan
–M5 Rear window wiper
–S42 Door switch, cab light, right
–S43 Door switch, cab light, left

RH front direction indicator wiring harness 36188700

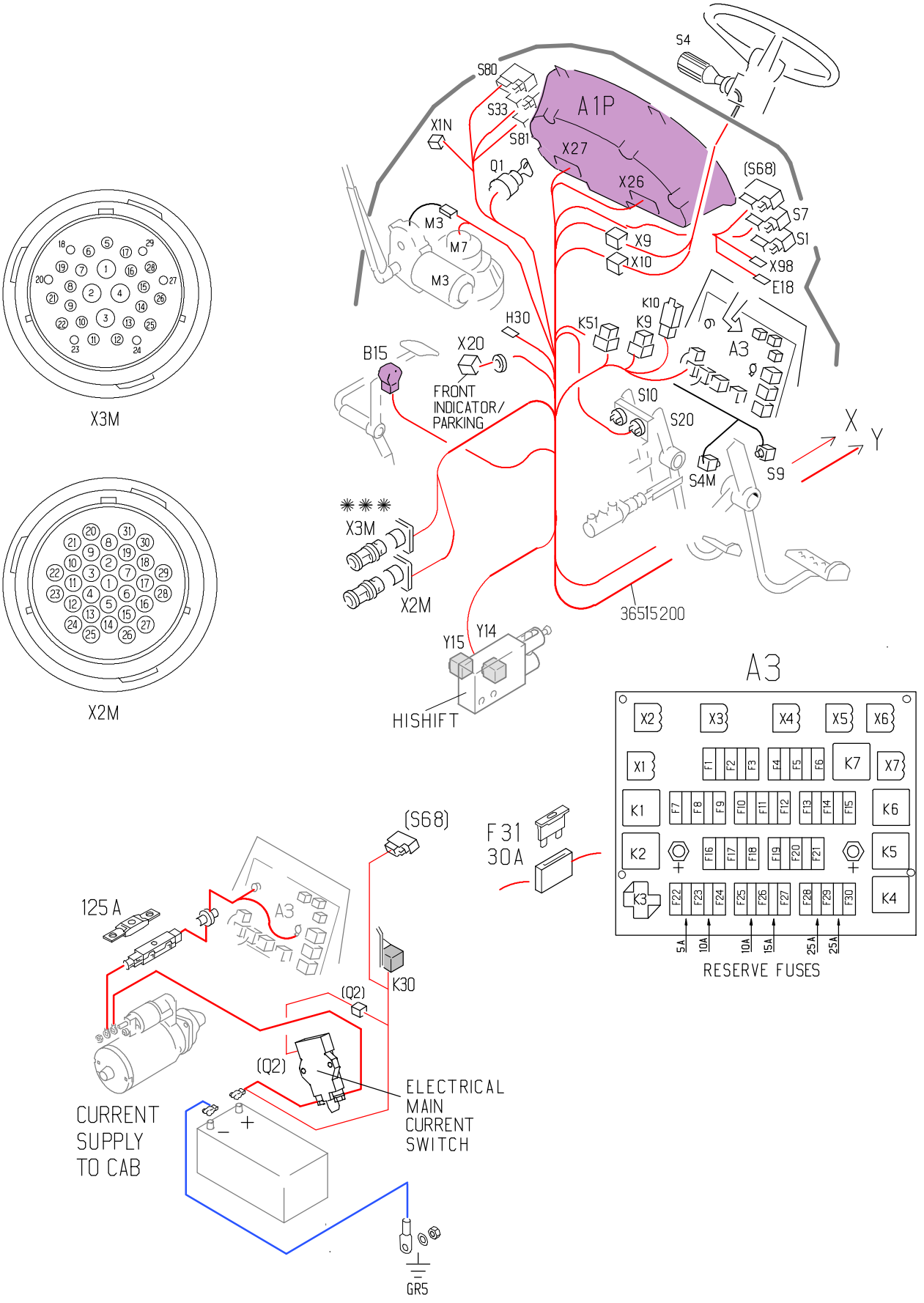
–E3 Front direction indicator, right
–E47 Extra front working light, right

LH front direction indicator wiring harness 36188800

–E4 Front direction indicator, left
–E48 Extra front working light, left

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Electrical equipment, front housing



✳✳✳ SEE PICTURE "ELECTRICAL EQUIPMENT, ENGINE "

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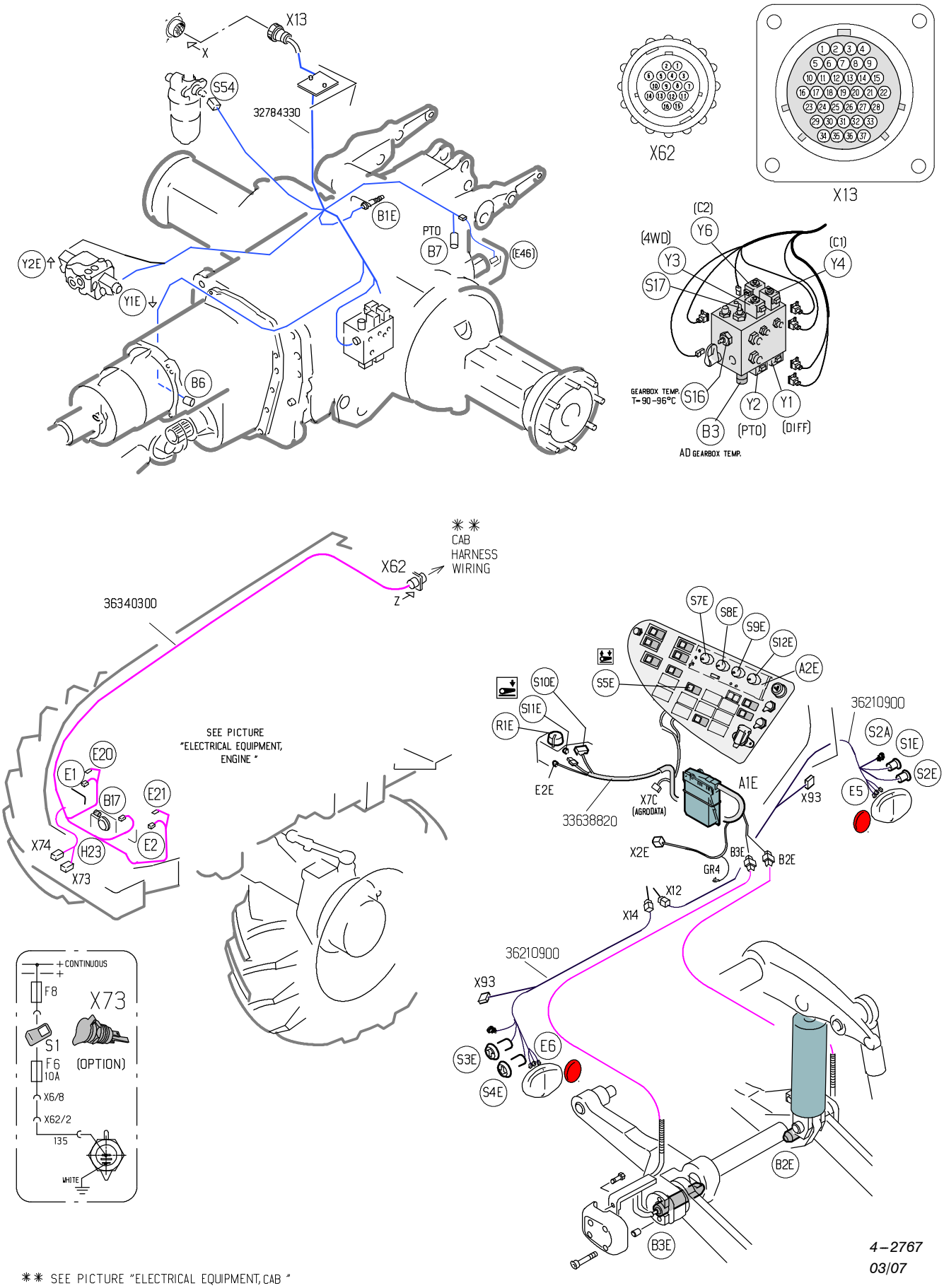
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Cab wiring harness 36515200

– A3 Electric centre
– A1P Instrument
– B15 Position sensor, front accelerator pedal
– E18 Pressure air gauge lighting
– F31 30A, EC–control unit supply
– H30 Buzzer, instrumentation
– K1 Front working lights
– K2 Rear working lights
– (K3) Rear fog light
– K4 Relay, starter switch
– K5 Relay, starter switch
– K6 Relay, fan III speed
–K9 Relay, interval wiper
–K10 Relay, flasher unit
–K30 Relay, main switch stop preventing
–K51 Relay, main switch
–M3 Windscreen wiper
–M7 Floor fan
–Q1 Ignition switch
–Q2 Main switch
–S1 Rocker switch, 3–pos. head lights
–S4 Combined switch
–S7 Rocker switch, 2–pos. hazard warning flashers
–S9 Safety switch, starter (clutch pedal)
–S10 Limit switch, right brake light
–S20 Limit switch, left brake light
–S33 Rocker switch 2–pos. upper head light
–(S68) Rocker switch, mainswitch control
–S80 Rocker switch, 3–pos. instrumentation, display size setting
–S81 Rocker switch, 3–pos. instrument, setting switch for LCD–display
–Y14 Solenoid valve, HiShift
–Y15 Solenoid valve, HiShift, retardation

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Electrical equipment, frame



✳✳ SEE PICTURE "ELECTRICAL EQUIPMENT, CAB "

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Solenoids wiring harness 32784330

– B3 Sensor, gearbox temperature
– B6 Speed sensor, gearbox
– B7 Speed sensor, rear PTO
– B1E Position sensor, rear power lift
– E46 Trailer hitch light
– S16 Temperature sensor, gearbox oil
– S17 Pressure sensor, gearbox oil pressure
– S54 Indicator light switch, pressure filter (low pressure circuit)
– Y1 Solenoid valve, differential lock
– Y2 Solenoid valve, rear PTO
– Y3 Solenoid valve, 4WD
– Y4 Solenoid valve, DPS C1–clutch
– Y6 Solenoid valve, DPS C2–clutch
– Y1E Solenoid valve, power lift, lowering
– Y2E Solenoid valve, power lift, lifting

Engine hood wiring harness 34595300

– B17 Temperature sensor, outdoors temperature
– E1 Head light,right
– E2 Head light, left
– H23 Horn

Power lift wiring harness 33638820

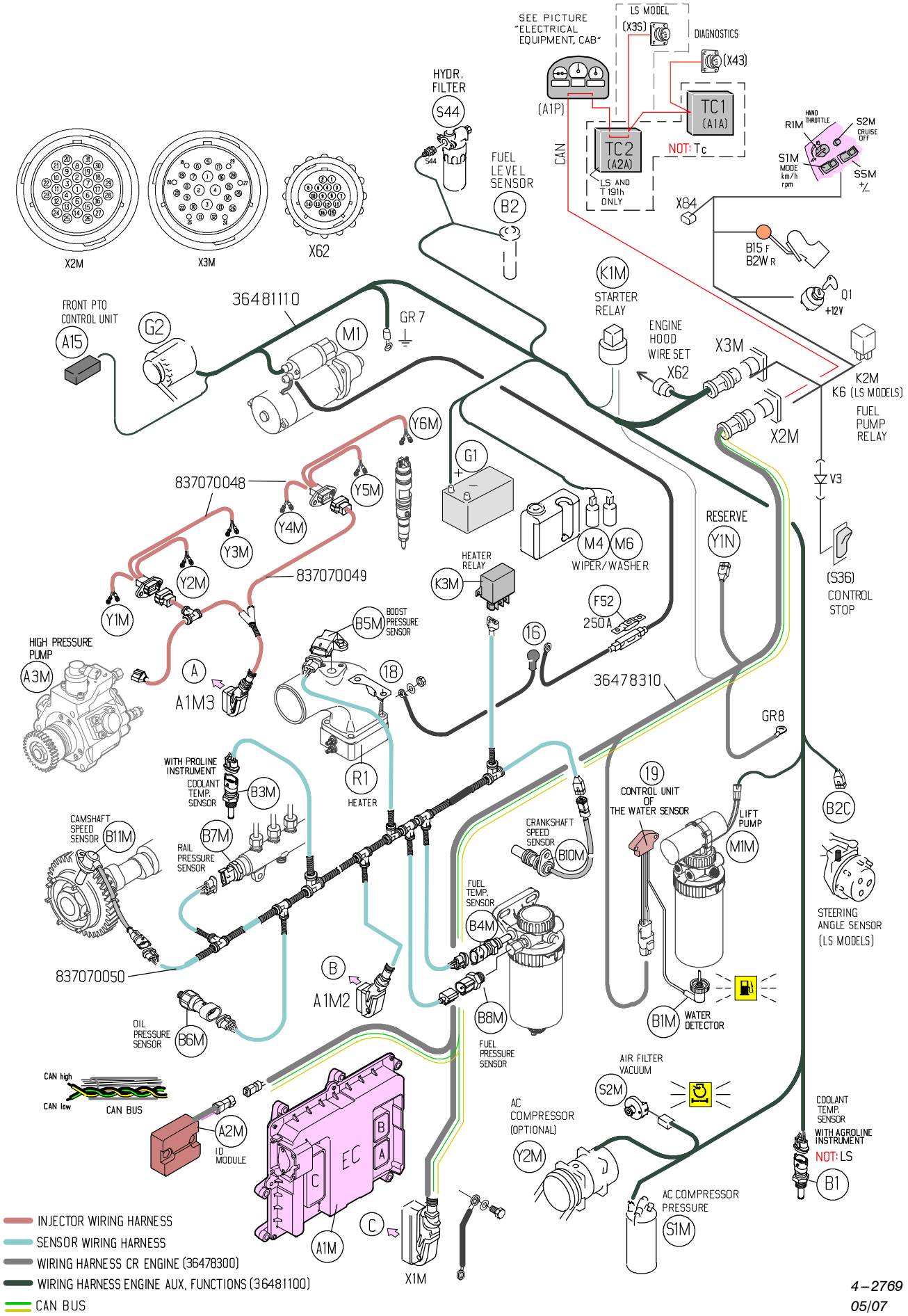
– A1E Control unit, power lift
– A2E Switch panel, power lift
– B2E Draft sensor, power lift, r.h
– B3E Draft sensor, power lift, l.h
– E2E Lightning, position potentiometer
– R1E Potentiometer, power lift, position control
– S5E Rocker switch 3–pos. inside operation, lifting/ lowering
– S7E Lowering speed selector, hydraulic lift
– S8E Transport height selector, hydraulic lift
– S9E Draft control selector, hydraulic lift
– S10E Rocker switch, 3–pos. power lift lifting/lowering
– S11E Rocker switch, power lift, forced lowering
– S12E Drive balance control

Mudguard wiring harness 36210900

– E5 Rear light, right (indicator/parking/braking)
– E6 Rear light, left (indicator/parking/braking)
– S1E Push button, rear operation, lifting, r.h.
– S2E Push button, rear operation, lowering, r.h.
– S3E Push button, rear operation, lifting, l.h.
– S4E Push button, rear operation, lowering, l.h.

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Electrical equipment, engine



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Sensors wiring harness 837070050

– B3M Coolant temperature sensor
– B4M Fuel temperature sensor
– B5M Boost pressure sensor
– B6M Oil pressure sensor
– B7M Fuel pressure sensor (rail)
– B8M Fuel pressure sensor
– B10M Speed sensor (crankshaft)
– B11M Speed sensor (camshaft)
– K3M Inlet air heater relay

Injectors wiring harness 837070049

– A1M1 Electronic control unit (ECU)
– A3M High–pressure pump

Injectors wiring harness 837070048

– Y1M Fuel injector cyl. 1
– Y2M Fuel injector cyl. 2
– Y3M Fuel injector cyl. 3
– Y4M Fuel injector cyl. 4
– Y5M Fuel injector cyl. 5
– Y6M Fuel injector cyl. 6

Inlet air heater

– 16) Heater wiring
– 18) Earthing plate
– F52 Fuse
– R1 Inlet air heater

CR Engine wiring harness 36478310

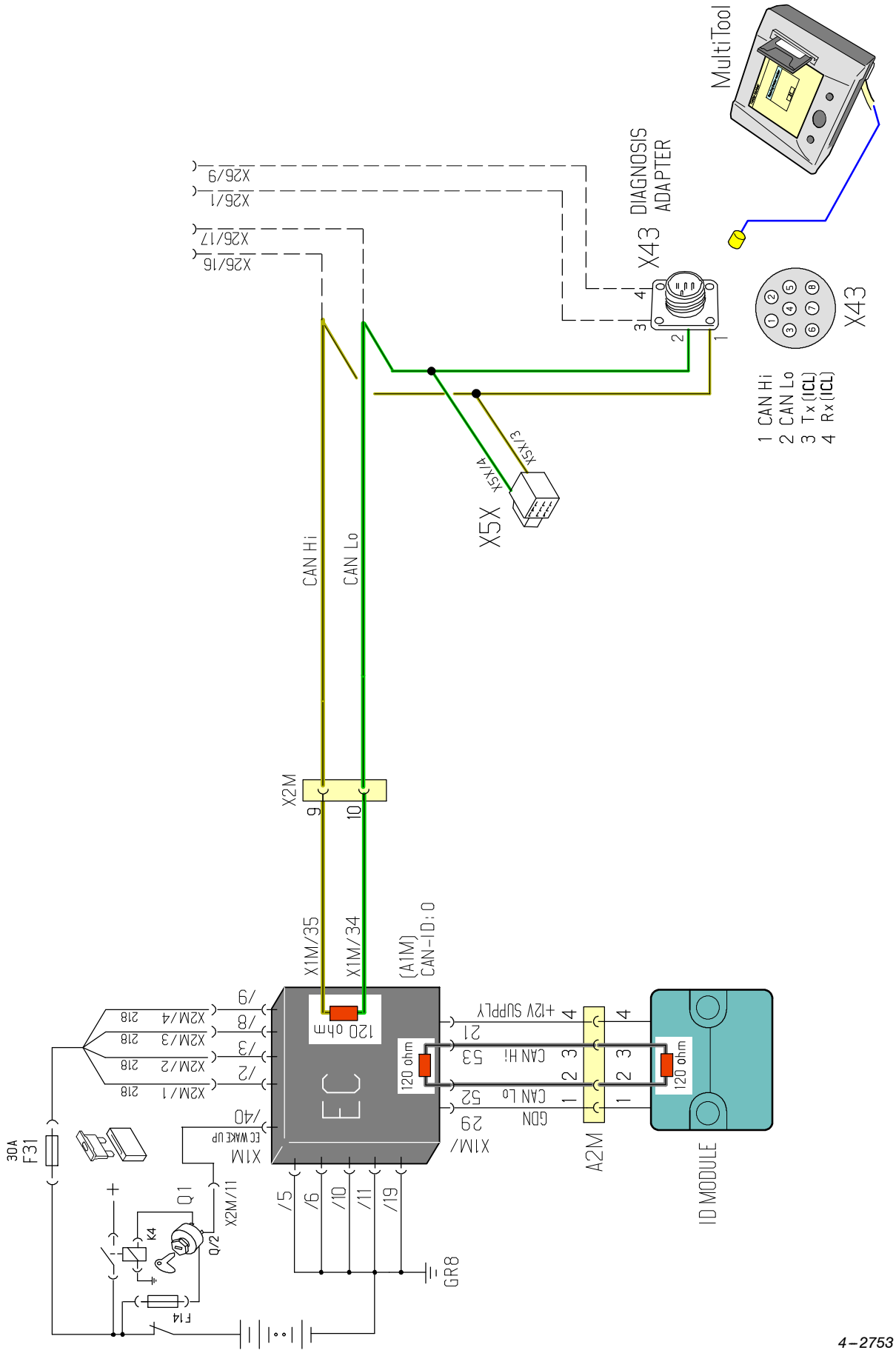
– A2M ID module
– B1M Water detector sensor (fuel)
– 19) Sensor's electronics
– K1M Relay, starter motor
– Y1N Exhaust brake (not used)

Wiring harness of the engine aux. functions 36481110

– A15 Control unit, front PTO
– B1 Temperature sensor, engine coolant
– B2 Level sensor, fuel
– B2C Steering angle sensor (LS models)
– G1 Battery
– G2 Alternator
– M4 Windscreen washer
– M6 Rear window washer
– M1 Starter motor
– M1M Fuel feed pump
– S44 Indicator light switch, pressure filter (high pressure circuit)
– S1M Pressure switch, compressor pressure
– S2M Pressure sensor, engine air filter
– Y2M Magnetic clutch, compressor, air conditioner

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CAN bus



4–2753
05/07

Wiring diagram

Symbol	Description	Page and position	Location
–A1E	Control unit, power lift, EHRB	/10.C7	Cab
–A1E	Control unit, power lift, EHRD	/11.B6	Cab
–A1F	Control unit, front suspension	/13.B5	Cab
–A1M1	Control unit, EC	/1.C8	Engine
–A1M1	Control unit, EC	/2.B1	Engine
–A1M1	Control unit, EC	/6.C1	Engine
–A1M2	Connector, 36–pole	/1.C7	Engine
–A1M3	Connector, 16–pole	/1.C14	Engine
–A1P	Instrument	/1.A14	Cab
–A1P	Instrument	/2.C13	Cab
–A1P	Instrument	/4.C15	Cab
–A1P	Instrument	/6.C5	Cab
–A1P	Instrument	/7.C6,C13	Cab
–A1P	Instrument	/9.B2	Cab
–A2	Radio	/1.D5	Cab
–A2E	Switch panel, power lift, EHRB	/10.C12	Cab
–A2E	Switch panel, power lift, EHRD	/11.B12	Cab
–A2M	ID–module	/1.B10	Engine
–A2M1	Connector, 4–pole	/1.B10	Engine
–A3M	High pressure pump	/1.D13	Engine
–A5	Air suspension seat	/7.C7	Cab
–A10	Control unit, DPS	/7.B2	Cab
–A15	Control unit, front–PTO	/6.D13	Engine
–A18	Recirculation actuator	/14.A7	Roof
–A19	Water mixing actuator	/14.A9	Roof
–A20	Fan speed regulator	/14.A11	Roof
–B1	Temperature sensor, engine coolant	/9.C10	Engine
–B1E	Position sensor, rear power lift (EHRB)	/10.C1	Transmission
–B1E	Position sensor, power lift (EHRD)	/11.B1	Transmission
–B1F	Angle sensor	/13.C5	Front axle
–B1M	Sensor, water detector	/1.B11	Engine
–B2	Level sensor, fuel	/9.C11	Transmission
–B2E	Draft sensor, power lift (EHRB), r.h	/10.C1	Transmission
–B2E	Draft sensor, power lift (EHRD), r.h	/11.C1	Transmission
–B2Q	Temperature sensor, internal	/14.D6	Roof
–B2W1	Position sensor, rear accelerator pedal	/2.D4	Cab
–B3	Temperature sensor, gearbox oil	/9.C3	Transmission
–B3E	Draft sensor, power lift (EHRB), l.h	/10.C1	Transmission
–B3E	Draft sensor, power lift (EHRD), l.h	/11.C1	Transmission
–B3M	Sensor, coolant temperature	/1.D8	Engine
–B4E	Position sensor, power lift (EHRD), implement (ACD)	/11.C1	Transmission
–B4M	Sensor, Fuel temperature	/1.D8	Engine
–B5M	Sensor, boost pressure	/1.D9	Engine
–B5Q	Solar sensor	/14.D7	Roof
–B6	Speed sensor, gearbox	/2.D9	Transmission
–B6M	Sensor, oil pressure	/1.D10	Engine
–B7	Speed sensor, PTO	/2.D11	Transmission
–B7M	Sensor, rail pressure	/1.D10	Engine
–B8M	Sensor, fuel pressure	/1.D11	Engine
–B10	Speed radar	/11.D1	Transmission
–B10M	Sensor, crankshaft speed	/1.D12	Engine
–B11M	Sensor, camshaft speed	/1.D12	Engine
–B16	Position sensor, accelerator pedal	/2.D1	Cab
–B19	Temperature sensor	/14.D10	Roof
–B20	Temperature sensor	/14.D10	Roof
–B21	Temperature sensor, evaporator	/14.D11	Roof
–Denso	Air conditioner	/14.B2	Roof
–Denso_aut	Air conditioning control unit	/14.B6	Roof

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Symbol	Description	Page and position	Location
–E1	Head light, right	/4.D5	Engine
–E1E	Lightning, switch panel	/10.C12	Cab
–E1E	Lightning, switch panel	/11.B11	Cab
–E2	Head light, left	/4.D4	Engine
–E2E	Lightning, position potentiometer	/10.C15	Cab
–E2E	Lightning, position potentiometer	/11.A11	Cab
–E3	Front direction indicator, right	/12.D8	Cab
–E3	Front direction indicator, right	/4.D6	Cab
–E4	Front direction indicator, left	/12.D3	Cab
–E4	Front direction indicator, left	/4.D8	Cab
–E5	Rear light, right (indicator/parking/braking)	/12.D11	Cab
–E5	Rear light, right (indicator/parking/braking)	/4.D12	Cab
–E6	Rear light, left (indicator/parking/braking)	/12.D7	Cab
–E6	Rear light, left (indicator/parking/braking)	/4.D10	Cab
–E7	Cab light	/5.B11	Cab
–E9	Rear working light, right, outer	/3.C1	Roof
–E9X	Rear working light (Xenon), right, outer	/3.C5	Roof
–E10	Rear working light, right, middle	/3.C3	Roof
–E11	Rear working light, left, outer	/3.C2	Roof
–E11X	Rear working light (Xenon), left, outer	/3.C2	Roof
–E12	Rear working light, left, middle	/3.C4	Roof
–E13	Front working light, right, inner	/3.C5	Roof
–E14	Front working light, left, inner	/3.C6	Roof
–E16/1	Upper panel light	/5.B8	Roof
–E16/2	Upper panel light	/5.B8	Roof
–E16/3	Upper panel light	/5.B8	Roof
–E16/4	Upper panel light	/5.B8	Roof
–E17	Seat heater	/7.C8	Cab
–E18	Pressure gauge light	/5.C2	Cab
–E20	Parking light, right, Norway	/5.C3	Engine
–E21	Parking light,left, Norway	/5.C4	Engine
–E22L	Register plate light	/5.C8	Roof
–E22R	Register plate light	/5.C7	Roof
–E23	Upper head light, right	/4.D2	Cab
–E24	Upper head light, left	/4.D3	Cab
–E25	Parking light, upper, right	/5.C5	Cab
–E26	Parking light, upper, left	/5.C6	Cab
–E43	control panel light	/5.B9	Cab
–E45	Step light	/5.C11	Cab
–E46	Trailer hitch light	/5.C15	Transmission
–E47	Extra front working light, right	/3.C7	Cab
–E48	Extra front working light, left	/3.C8	Cab
–E51	Warning light, rear right	/12.D9	Mudguard, right
–E52	Warning light, rear left	/12.D5	Mudguard, left
–E53	Extremity warning light, rear right	/12.D10	Mudguard, right
–E54	Extremity warning light, rear left	/12.D6	Mudguard, left

–F1	15A, hazard blinkers, water pump	/4.A7	Cab
–F2	5A, radio, instrumentation, tel., main switch, tachograph	/1.C3	Cab
–F3	15A, main beams	/4.B3	Cab
–F4	15A, dipped beams	/4.B4	Cab
–F5	10A, parking lights, left	/12.B11	Cab
–F5	10A, parking lights, left	/5.A3	Cab
–F6	10A, parking lights, right	/12.B11	Cab
–F6	10A, parking lights, right	/5.A4	Cab
–F7	25A, front working lights	/3.A6	Cab
–F8	25A, light switch	/12.A11	Cab
–F8	25A, light switch	/4.A6	Cab
–F9	15A, trailer socket/fog light, rear	/4.A9	Cab
–F10	25A, 3–pole current socket	/9.A14	Cab
–F11	5A, power lift control unit, buzzer	/10.A7	Cab
–F11	5A, power lift control unit, buzzer	/11.A4	Cab
–F12	10A, rot. warning light, cabin light	/3.A10	Cab
–F14	10A, starter switch	/1.A6	Cab
–F15	25A, fan, air conditioning	/14.A3	Cab

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Symbol	Description	Page and position	Location
–F16	10A, rear working lights, inner	/3.A2	Cab
–F17	10A Direction indicators, Fieldmaster, isoadapter	/4.A8	Cab
–F18	5A, instruments, indicatorlights, Autocontrol	/9.A13	Cab
–F19	10A, windscreen wiper/washer, horn	/8.A8	Cab
–F20	10A, rear window wiper/washer, radio, trailer hitch light	/8.A3	Cab
–F21	15A, Air conditioning, control, floor fan, fuel feed pump	/14.A4	Cab
–F22	10A, sensors HiTech, 4WD, front suspension	/6.A7	Cab
–F23	10A, rear working lights, outer	/3.A2	Cab
–F25	15A, air spring seat/seat heating, reverse drive lockout, el front loader valves	/7.A7	Cab
–F26	10A, back buzzer, HiShift	/7.A15	Cab
–F27	10A, braking lights, differential lock, exhaust brake	/6.A3	Cab
–F29	10A, cigarette lighter, 2–pin current socket	/9.A15	Cab
–F31	30A, Engine control unit (EEM supply)	/1.A8	Cab
–F52	250A, Inlet air heater	/1.C7	Engine
–FAN	Fan, heater, air conditioner	/14.A7	Roof
–G1	Battery	/1.C1	Engine
–G2	Alternator	/1.B5	Engine
–GR1	Ground	/1.D4	Cab
–GR1	Ground	/12.D7,D10	Cab
–GR1	Ground	/13.D2	Cab
–GR1	Ground	/14.D2,D5	Cab
–GR1	Ground	/5.D11,D15	Cab
–GR1	Ground	/6.D14,D16	Cab
–GR1	Ground	/6.D2,D7,D11	Cab
–GR1	Ground	/7.D7–D15	Cab
–GR1	Ground	/9.D13,D15	Cab
–GR2	Ground	/1.D5	Engine
–GR2	Ground	/13.D16	Roof
–GR2	Ground	/14.D12	Roof
–GR2	Ground	/3.D6	Roof
–GR2	Ground	/5.D9,D11,D12	Roof
–GR2	Ground	/8.D3,D5	Roof
–GR4	Ground	/10.D8,D15	Cab
–GR4	Ground	/11.D5–D14	Cab
–GR4	Ground	/14.D8	Cab
–GR4	Ground	/2.D7, D10	Cab
–GR4	Ground	/6.D11	Cab
–GR5	Ground	/1.A2	Cab
–GR5	Ground	/12.D3,D7,D8	Cab
–GR5	Ground	/14.D4	Cab
–GR5	Ground	/2.D6	Cab
–GR5	Ground	/4.B6,D15	Cab
–GR5	Ground	/5.D15	Cab
–GR5	Ground	/6.D9	Cab
–GR5	Ground	/8.D9,D10	Cab
–GR5	Ground	/9.D2,D15	Cab
–GR8	Ground	/1.D6	Engine
–GR8	Ground	/2.D5	Engine
–GR8	Ground	/9.D8,D11	Engine
–GR9	Ground	/2.D5	Cab
–GR10	Ground	/12.D14	Cab
–H23	Horn	/8.D7	Engine hood
–H24.1	Rotating roof light, rear right	/3.C12	Roof
–H24.2	Rotating roof light, rear left	/3.C13	Roof
–H24.3	Rotating roof light, front right	/3.C9	Roof
–H24.4	Rotating roof light, front left	/3.C11	Roof
–H27	Reverse Buzzer	/7.C15	Cab
–H28	Indicator light, stop, rear	/9.C7	Cab
–H30	Buzzer, instrumentation	/9.A10	Cab

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Symbol	Description	Page and position	Location
–K1	Relay, front working lights	/3.C14	Cab
–K1M	Starter auxiliary relay	/1.B6	Engine
–K2	Relay, rear working lights	/3.C16	Cab
–K2M	Relay, fuel pump	/2.C4	Cab
–K3M	Relay, intake air heater	/1.D7	Engine
–K4	Auxiliary relay, starter switch	/1.A3	Cab
–K5	Auxiliary relay, starter switch	/1.A3	Cab
–K6	Relay, air conditioning, fan, control	/14.A3,C3	Cab
–K7	Relay, 4–wheel brake	/6.A9	Cab
–K9	Relay, interval wiper	/8.C9	Cab
–K10	Relay, flasher unit (NA)	/12.B7	Cab
–K10	Relay, flasher unit	/4.A14	Cab
–K11	Relay, brake lights	/6.A3	Cab
–K13	Relay, differential lock	/6.B3	Cab
–K15	Relay, 4WD	/6.B8	Cab
–K16	Relay, PTO emergency stop	/6.C15	Cab
–K24	Relay, HiShift	/7.C14	Cab
–K27	Relay 4WD, on/off	/6.B7	Cab
–K30	Relay, main switch	/1.D4	Cab
–K31	Relay, air conditioner compressor	/14.C5	Cab
–K32	Relay, air conditioner	/14.B5	Cab
–K51	Relay, main switch	/1.B3	Cab
–K56	Time–delay relay, cabin light and door step	/5.B12	Roof
–K60	Relay, hitch release	/13.B2	Cab
–K62	PTO on/off relay	/6.A16	Cab
–K73	Relay, PTO prevention	/12.C13	Cab
–K74	Relay, air conditioner compressor	/14.C2	Cab
–K76	Relay, ON/OFF latch	/15.C2	Cab
–K77	Relay, floating 1, 100 mA	/15.A14	Cab
–K78	Relay, floating 2, 100 mA	/15.A15	Cab
–K80	Relay, floating on	/15.C4	Cab
–K81	Relay, floating off	/15.C4	Cab
–K82	Relay, buttons for floating	/15.C7	Cab
–K83	Upper button relay, floating off, 2 A	/15.B10	Cab
–K84	Lower button relay, floating on, 2 A	/15.C12	Cab
–K85	Lower button relay, floating off, 2 A	/15.B10	Cab
–K86	Lower button relay, floating on, 2 A	/15.C11	Cab
–K87	Relay, float starting allowed	/15.A5	Cab
–M1	Starter motor	/1.B5	Engine
–M1M	Fuel pump	/2.D5	Engine
–M2	Fan, heater, air conditioner	/14.A5,B2,B5	Roof
–M3	Windscreen wiper	/8.D10	Cab
–M4	Windscreen washer	/8.D8	Engine
–M5	Rear window wiper	/8.D3	Roof
–M6	Rear window washer	/8.D2	Cab
–M7	Floor fan	/14.C4	Cab
–M9	Roof window wiper	/8.D5	Roof
–Q1	Heat/starter switch	/1.A5	Cab
–Q2	Main switch	/1.B1	Transmission
–R1	Intake air heater	/1.D7	Engine
–R11D1	Joystick	/15.B12	Arm rest
–R1E	Potentiometer, power lift (EHRB) position control	/10.B10	Cab
–R1E	Potentiometer, power lift (EHRD), position control	/11.A10	Cab
–R1M	Potentiometer, hand throttle	/2.D3	Cab
–R2	Resistor, power lift (EHRB), for position control	/10.B10	Cab
–R3	Resistor, power lift (EHRB), for forced lowering	/10.A10	Cab
–R4	Cigarette lighter	/9.C15	Cab

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Symbol	Description	Page and position	Location
–S1	Rocker switch 3–pos. head lights	/12.A10	Cab
–S1	Rocker switch 3–pos. head lights	/4.A6	Cab
–S1E	Push button, rear operation, r.h., lifting	/10.B2	Mudguard, right
–S1E	Push button, rear operation, lifting, r.h.	/11.B1	Mudguard, right
–S1M	Pressure switch, air cond. compr.	/14.D3,D6	Engine
–S1M	Switch, cruise kmh / rpm	/2.A1	Cab
–S2	Rocker switch, 2–pos. rear working lights	/3.B15	Cab
–S2 AUTO	Rocker switch, 3–pos. rear working lights, man./auto	/3.B12	Cab
–S2E	Push button, rear operation, r.h., lowering	/10.B3	Mudguard, right
–S2E	Push button, rear operation, lowering, r.h.	/11.B2	Mudguard, right
–S2F	Switch, suspension off/on/calibr.	/13.C8	Cab
–S2M	Switch, cruise on/off	/2.A5	Cab
–S2W	Switch, rear clutch pedal	/2.D7	Cab
–S3E	Push button, rear operation, lifting, l.h.	/10.B3	Mudguard, left
–S3E	Push button, rear operation, lifting, l.h.	/11.B2	Mudguard, left
–S4	Combined switch	/12.A3	Cab
–S4	Combined switch	/4.A3,B14	Cab
–S4	Combined switch	/8.B8	Cab
–S4E	Push button, rear operation, lowering, l.h	/10.B4	Mudguard, left
–S4E	Push button, rear operation, lowering, l.h.	/11.B3	Mudguard, left
–S4M	Switch, clutch pedal, movement started	/6.A1	Cab
–S5	Rocker switch 2–pos. front working lights	/3.B6	Cab
–S5E	Rocker switch 3–pos. inside operation, lifting/lowering	/10.B6	Cab
–S5E	Rocker switch 3–pos. inside operation, lifting/lowering	/11.A6	Cab
–S5E	Rocker switch 3–pos. inside operation, lifting/lowering	/13.A2	Cab
–S5M	Switch, 3–pos., cruise +/–	/2.A3	Cab
–S6	Rocker switch 2–pos. rot. warning lights	/3.B10	Cab
–S7	Rocker switch 2–pos. hazard warning flashers	/12.A7	Cab
–S7	Rocker switch 2–pos. hazard warning flashers	/4.A11	Cab
–S7E	Lowering speed selector, power lift	/10.C12	Cab
–S7E	Lowering speed selector, power lift	/11.C11	Cab
–S8E	Transport height selector, power lift	/10.C12	Cab
–S8E	Transport height selector, power lift	/11.B11	Cab
–S9	Switch, clutch pedal	/2.D6	Cab
–S9C	Switch, Auto PTO	/6.B15	Cab
–S9E	Draft control selector, power lift	/10.C12	Cab
–S9E	Draft control selector, power lift	/11.B11	Cab
–S9W	Switch, brake pedal, rear	/6.D11	Cab
–S10	Limit switch, brake light, right	/6.D9	Cab
–S10E	Rocker switch, 3–pos. power lift (EHRB) lifting/lowering	/10.B13	Cab
–S10E	Rocker switch, 3–pos. power lift (EHRD), lifting/lowering	/11.A14	Cab
–S11E	Rocker switch, power lift (EHRB), forced lowering	/10.B9	Cab
–S11E	Rocker switch, power lift (EHRD), forced lowering	/11.A8	Cab
–S12	Pressure switch, engine air filter	/9.C8	Engine
–S12E	Drive balance control, power lift	/10.B12	Cab
–S12E	Drive balance control, power lift	/11.C11	Cab
–S15	Switch, parking brake	/6.D11	Cab
–S16	Temperature switch, gearbox oil	/9.C2	Transmission
–S17	Pressure switch, gearbox oil	/9.C4	Transmission
–S20	Limit switch, brake light, left	/6.D10	Cab
–S22	Rocker switch 3–pos. differential lock	/6.B2	Cab
–S23/1–	DPS–	/7.A5	Cab
–S23/1+	DPS+	/7.A4	Cab
–S23/2–	DPS–	/7.A3	Cab
–S23/2+	DPS+	/7.A3	Cab
–S25	Rocker switch 3–pos. rear PTO	/6.B14	Cab
–S27	Switch, back buzzer	/7.B15	Cab
–S28	Push button, PTO 540	/6.A14	Cab
–S29	Push button, PTO 1000/540E	/12.C13	Cab
–S29	Push button, PTO 1000/540E	/6.A15	Cab
–S30	Rocker switch 3–pos. 4WD	/6.B5	Cab
–S31	Switch, 3–pos., floor fan	/14.B4	Cab
–S32	Rocker switch, 3–pos. rear window wiper and washer	/8.A2	Cab
–S33	Rocker switch 2–pos. change over switch, head lights up	/4.B1	Cab
–S35	Rear steering prevention	/7.B9	Cab
–S36	Switch, 2–pos., control stop	/9.C9	Cab
–S38	Rocker switch 2–pos. front–PTO	/6.A13	Cab

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Symbol	Description	Page and position	Location
–S42	Door switch, cab light, RH	/5.C13	Roof
–S43	Door switch, cab light, LH	/5.C14	Roof
–S44	Pressure switch, pressure filter (high pressure circuit)	/9.C6	Engine
–S45	Push buttons, HiShift, F/R	/7.D12	Cab
–S45/2	Push buttons, HiShift, 1 – 4	/7.D13	Cab
–S45/3	Push buttons, HiShift, LL – H	/7.D14	Cab
–S54	Pressure switch, pressure filter (low pressure circuit)	/9.C4	Transmission
–S59	Rocker switch, 2–pos. wiper. roof wind.	/8.A5	Cab
–S63	Bucket release	/15.C10	Sidepanel
–S68	Switch, mainswitch control	/1.C2	Cab
–S75	Switch, power on/off	/15.B2	Sidepanel
–S80	Switch, 3–pos., instrument, display size	/9.A2	Cab
–S81	Switch, 3–pos., instrument, display mode	/9.A4	Cab
–S83	Switch, 2–pos., drawhook	/5.B15	Cab
–S84	Rocker switch 2–pos. extra front working lights	/3.B7	Cab
–S86	Switch, hitch release	/13.C1	Cab
–S88	Soft drive	/15.C8	Sidepanel
–S90	Firm floating	/15.B4	Arm rest
–S92	Switch, side mirror heating	/13.B15	Roof
–S102	Switch, PTO prevention	/12.B15	Transmission
–S115	Button floating	/15.B6	Arm rest
–V1 (1)	Diode, 4WD auto	/6.C5	Cab
–V1 (2)	Diode, differential lock	/6.D3	Cab
–V1 (3)	Diode, 4WD solenoid	/6.D8	Cab
–V1 (4)	Diode, brake pedal, right	/6.C9	Cab
–V1 (5)	Diode, brake pedal, left	/6.C9	Cab
–V2 (1)	Diode, 4WD	/6.C9	Cab
–V2 (2)	Diode, rear PTO	/6.D16	Cab
–V2 (3)	Diode, rear PTO	/6.C16	Cab
–V2 (4)	Diode, DPS C2–clutch solenoid	/7.D4	Cab
–V2 (5)	Diode, DPS C1–clutch solenoid	/7.D4	Cab
–V3 (1)	Diode, 4–wheel brake	/6.C11	Cab
–V3 (2)	Diode, 4–wheel brake	/6.C11	Cab
–V3 (3)	Diode, 4–wheel brake	/6.C10	Cab
–V3 (4)	Diode	/6.B2	Cab
–V3 (5)	Diode	/6.B2	Cab
–V5 (1)	Diode, HiShift	/7.B12	Cab
–V5 (2)	Diode, HiShift	/7.B12	Cab
–V5 (3)	Diode, HiShift	/7.B13	Cab
–V5 (4)	Diode, HiShift	/7.C12	Cab
–V5 (5)	Diode, HiShift	/7.C12	Cab
–V6	Diode, floating	/15.B4	Cab
–V13	Diode, main switch, heat / starter switch	/1.B4	Cab
–V13	Diode, rear window washer motor	/8.D3	Roof
–V14 (1)	Diode, parking brake	/6.C7	Cab
–V14 (2)	Diode, rear working lights	/3.B14	Cab
–V14 (3)	Diode, rear working lights	/3.B13	Cab
–V14 (4)	Diode, control stop	/9.D9	Cab
–V14 (5)	Diode, control stop	/9.D9	Cab
–V15 (1)	Diode, rear stop–indicator light	/9.D7	Cab
–V15 (2)	Diode, differential lock solenoid	/6.B5	Cab
–V16	Diode, direction	/15.B6,B7,C8	Cab

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Symbol	Description	Page and position	Location
–X1	Connector, 9–pole	/12.A11	Cab
–X1	Connector, 9–pole	/3.A6,C14,C16	Cab
–X1	Connector, 9–pole	/4.A6	Cab
–X1	Connector, 9–pole	/6.A7	Cab
–X1E	Connector 9–pole	/11.C3,D3	Cab
–X1E	Connector, 9–pole	/2.C12	Cab
–X1M	Connector, 89–pole	/1.B7	Engine
–X1M	Connector, 89–pole	/2.B1–B6	Engine
–X1M	Connector, 89–pole	/2.C1–C7	Engine
–X1M	Connector, 89–pole	/6.C1	Engine
–X1N	Connector, 9–pole	/4.B12	Cab
–X1W	Connector,12–pole	/2.C4, C7	Cab
–X1W	Connector,12–pole	/2.D3	Cab
–X2	Connector, 9–pole	/1.C3	Cab
–X2	Connector, 9–pole	/3.A2	Cab
–X2	Connector, 9–pole	/4.A7,A9	Cab
–X2E	Connector, 15–pole	/10.A4–A14	Cab
–X2E	Connector, 15–pole	/10.B3,D6–D13	Cab
–X2E	Connector, 15–pole	/11.A3,A4,A15	Cab
–X2E	Connector, 15–pole	/11.B3,B15	Cab
–X2E	Connector, 15–pole	/11.C3,C7,C10	Cab
–X2E	Connector, 15–pole	/9.A12	Cab
–X2F	Connector, 3–pole	/13.A5,D5	Cab
–X2F	Connector, 3–pole	/4.D15	Cab
–X2M	Connector, 31–pole	/1.A7,A14	Engine
–X2M	Connector, 31–pole	/1.B8,B14	Engine
–X2M	Connector, 31–pole	/2.B1–B6	Engine
–X2M	Connector, 31–pole	/2.C1–C7	Engine
–X2M	Connector, 31–pole	/4.B13	Engine
–X2M	Connector, 31–pole	/6.B1	Engine
–X3	Connector, 9–pole	/4.A8,B4	Cab
–X3	Connector, 9–pole	/7.A7	Cab
–X3	Connector, 9–pole	/9.A13,A14	Cab
–X3M	Connector, 29–pole	/1.B1,B3,B5	Engine
–X3M	Connector, 29–pole	/14.C3,C6	Engine
–X3M	Connector, 29–pole	/2.D5	Engine
–X3M	Connector, 29–pole	/4.C4	Engine
–X3M	Connector, 29–pole	/5.C3	Engine
–X3M	Connector, 29–pole	/6.C13	Engine
–X3M	Connector, 29–pole	/8.B3,B7	Engine
–X3M	Connector, 29–pole	/8.B5,C1,C8,C11	Engine
–X4	Connector, 9–pole	/10.A7	Cab
–X4	Connector 9–pole	/11.A4	Cab
–X4	Connector, 9–pole	/4.B3	Cab
–X4	Connector, 9–pole	/7.A15	Cab
–X4	Connector, 9–pole	/8.A8	Cab
–X5	Connector, 9–pole	/12.B11	Cab
–X5	Connector, 9–pole	/14.A4	Cab
–X5	Connector, 9–pole	/3.A10	Cab
–X5	Connector, 9–pole	/5.A3	Cab
–X5	Connector, 9–pole	/6.A3	Cab
–X5	Connector, 9–pole	/8.A3	Cab
–X.5	Connector, 9–pole	/15.C13,D13,D14	Cab
–X.5D	Connector, 9–pole	/15.C13,C14,D13, D14	Cab
–X5X	Connector, 9–pole	/14.C8	Cab
–X6	Connector, 9–pole	/1.A4,A6	Cab
–X6	Connector, 9–pole	/12.B11	Cab
–X6	Connector, 9–pole	/5.A3	Cab
–X6	Connector, 9–pole	/9.A15	Cab
–X6D	Connector, 9–pole	/15.A4,A5,A7,B2,B5, ,B6,B7,B12,B14,C13, C14,C16	Cab
–X.6D	Connector, 9–pole	/15.A5,A7,B5,B6,B7, B14	Cab
–X7	Connector, 9–pole	/1.A3	Cab
–X7	Connector, 9–pole	/14.A2,C3	Cab
–X7	Connector, 9–pole	/6.A10	Cab

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Symbol	Description	Page and position	Location
–X7C	Connector, 3–pole	/10.A14	Cab
–X7C	Connector, 3–pole	/11.A15,C3	Cab
–X8	Connector, 2–pole current socket	/9.C16	Cab
–X9	Connector, 9–pole	/8.A8,B9	Cab
–X10	Connector, 9–pole, combined switch	/12.B1	Cab
–X10	Connector, 9–pole, combined switch	/4.A4,B14	Cab
–X10	Connector, 9–pole	/8.B8	Cab
–X11	Connector, 9–pole	/14.C2,C5	Roof
–X11	Connector, 9–pole	/3.B2,B3,B6,B10	Roof
–X11	Connector, 9–pole	/5.A7,A11	Roof
–X11	Connector, 9–pole	/8.B3	Roof
–X12	Connector, 9–pole	/10.A2,B2	Cab
–X12	Connector, 9–pole	/11.A1,A2,B1	Cab
–X12	Connector, 9–pole	/12.C6,C7,D7	Cab
–X12	Connector, 9–pole	/4.C12,D12	Cab
–X12G	Connector, 9–pole, ISOBUS	/13.A8	Cab
–X13	Connector, 37–pole	/10.B2,D6,D7	Cab
–X13	Connector, 37–pole	/11.B2,D7,D9	Cab
–X13	Connector, 37–pole	/2.D9–D11	Cab
–X13	Connector, 37–pole	/5.B15,D15	Cab
–X13	Connector, 37–pole	/6.C3,C8,C15	Cab
–X13	Connector, 37–pole	/7.C3,C4	Cab
–X13	Connector, 37–pole	/9.C2–C5	Cab
–X14	Connector, 9–pole	/10.A3,B4	Cab
–X14	Connector, 9–pole	/11.A3,B3	Cab
–X14	Connector, 9–pole	/12.C9,C11,D10	Cab
–X14	Connector, 9–pole	/4.C10,D10	Cab
–X17	Connector, 7–pole, trailer socket	/4.B7	Cab
–X20	Connector, 9–pole	/12.C3,C8,D3,D8	Cab
–X20	Connector, 9–pole	/3.C7,D7	Cab
–X20	Connector, 9–pole	/4.C6,C8	Cab
–X21	Connector, 2–pole, register plate light	/5.C7	Roof
–X22	Connector, 2–pole	/3.C9–C13	Roof
–X23	Connector, 9–pole, DPS and HiShift extra switches	/7.A3,B3,D12,D14	Cab
–X23D	Connector, 3–pole	/15.A3	Cab
–X24	Connector, 9–pole	/1.D5	Roof
–X24	Connector, 9–pole	/14.A2,A3	Roof
–X24	Connector, 9–pole	/5.B11	Roof
–X24	Connector, 9–pole	/8.B4	Roof
–X26	Connector, 28–pole, instrument	/2.C13	Cab
–X26	Connector, 28–pole, instrument	/6.C6	Cab
–X26	Connector, 28–pole, instrument	/7.C12	Cab
–X26	Connector, 28–pole, instrument	/9.B1–B11	Cab
–X27	Connector, 36–pole, instrument	/1.A14	Cab
–X27	Connector, 36–pole, instrument	/4.C14,B15	Cab
–X27	Connector, 36–pole, instrument	/6.C4,C6	Cab
–X27	Connector, 36–pole, instrument	/7.C5	Cab
–X27	Connector, 36–pole, instrument	/9.B2–B12	Cab
–X29	Connector, 2–pole socket, stop–alarm	/9.C10	Cab
–X30	Connector, 9–pole	/1.B13	Cab
–X30	Connector, 9–pole, DPS and HiShift switches	/7.A4,B4,D13	Cab
–X31	Connector, 2–pole.socket, PTO–emerg. stop	/6.A14	Cab
–X43	Connector, 8–pole, diagnostics	/2.A6	Cab
–X49	Connector, 2–pole	/7.B7,D7	Cab
–X49.1	Connector, 2–pole	/15.A2	Cab
–X.49.1	Connector, 2–pole	/15.A2,D13	Cab
–X50	Connector, 3–pole current socket	/9.C13	Cab
–X.50	Connector, 3–pole current socket	/15.D14	Cab
–X55	Connector, 1–pole	/13.A3	Cab
–X62	Connector, 16–pole	/4.C4,D4	Engine
–X62	Connector, 16–pole	/5.C3	Engine
–X62	Connector, 16–pole	/8.C7	Engine
–X65	Connector, 3–pole	/13.A15	Roof
–X73	Connector, 2–pole, current socket	/9.C15	Engine
–X75L	Connector, 5–pole	/13.D12	Roof
–X75R	Connector, 5–pole	/13.D14	Roof
–X80	Connector, 4–pole, front loader	15.D1,D8,D10,D11	Cab
–X81	Connector, pin socket	/15.D1,D8,D10,D11	Transmission

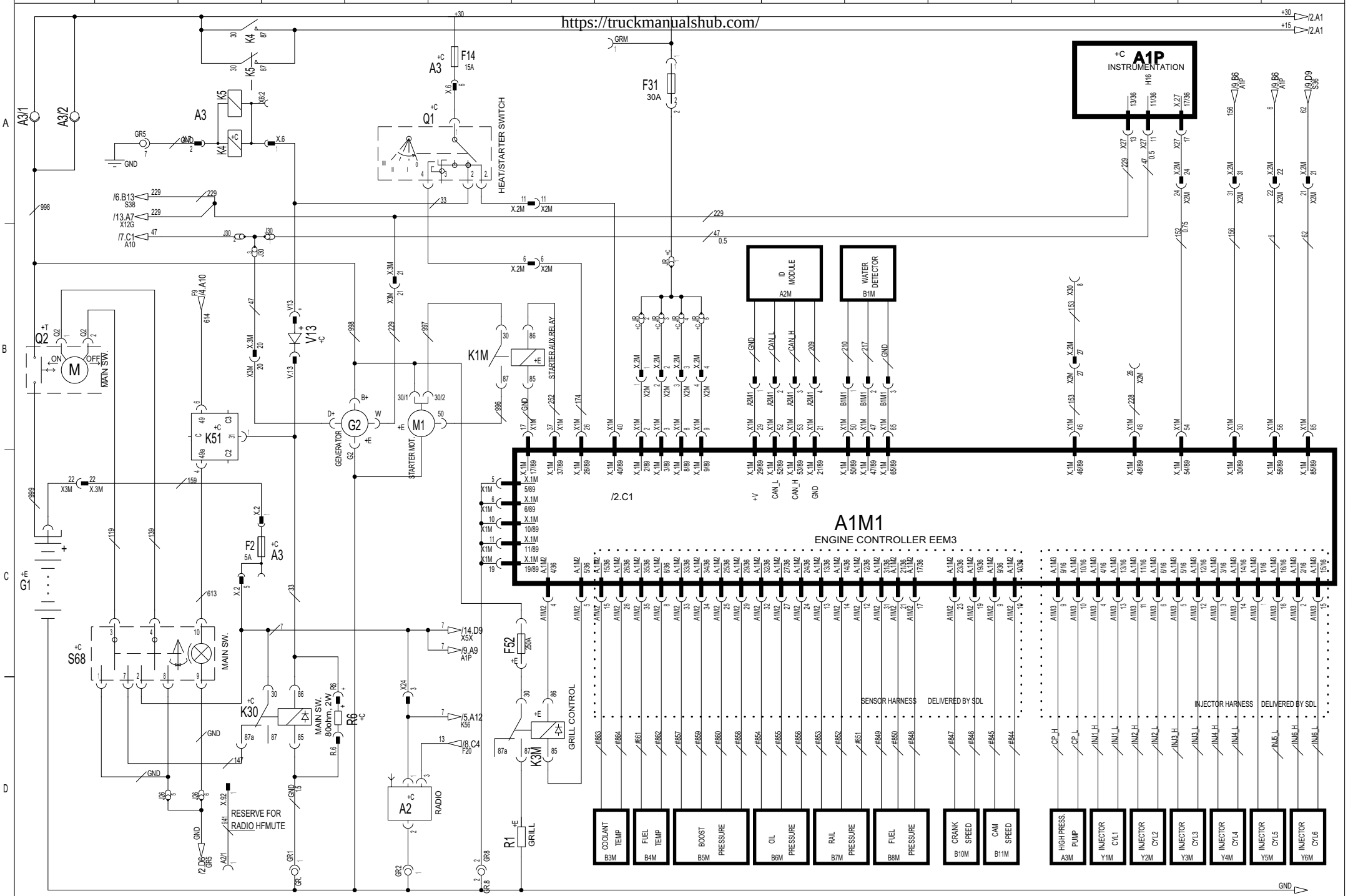
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Symbol	Description	Page and position	Location
–X91	Connector, 9–pole	/3.B2,B3,B10	Roof
–X91	Connector, 9–pole	/3.C6,D6	Roof
–X91	Connector, 9–pole	/4.C2	Roof
–X91	Connector, 9–pole	/5.A7,D9	Roof
–X92	Connector, 3–pole	/1.D3	Roof
–X92	Connector, 3–pole	/4.C2	Roof
–X93	Connector, 3–pole	/12.D10	Mudguard, right
–X93	Control joystick, electrical mirrors	/13.A10	Roof
–X93	Connector, 3–pole	/4.C14	Mudguard, right
–X94	Connector, 3–pole	/12.D6,D8	Mudguard, left
–X94	Connector, 3–pole	/4.C9	Mudguard, left
–X.97	Connector	/15.A2	Cab
–X98	Connector, 2–pole	/12.A3,A6	Cab
–X99	Connector, 2–pole	/12.C7,C11	Cab
–X99	Connector, 2–pole	/4.C10,C12	Cab
–X102	Connector, 4–pole	/14.C6	Roof
–X103	Connector, 2–pole	/14.C7	Roof
–X105	Connector, 26–pole	/14.B6–B8	Roof
–X107	Connector, 9–pole	/13.B11,C15	Roof
–X110	Connector, 9–pole	/13.A13,B11	Roof
–X112	Connector, 6–pole	/14.A9	Roof
–X113	Connector, 6–pole	/14.A11	Roof
–X114	Connector, 2–pole	/14.D10	Roof
–X115	Connector, 2–pole	/14.D11	Roof
–X116	Connector, 2–pole	/14.D10	Roof
–X117	Connector, 1–pole	/14.A5	Roof
–X118	Connector, 6–pole	/14.A8	Roof
–X119	Connector, 26–pole	/14.B7–B12	Roof
–XR3	Connector, 3–pole, flintstone resistor	/15.B15,B16	Cab
–Y1	Solenoid valve, differential lock	/6.D4	Transmission
–Y1E	Solenoid valve, power lift (EHRB), lowering	/10.D5	Transmission
–Y1E	Solenoid valve, power lift (EHRD), lowering	/11.D7	Transmission
–Y1M	Injector, cylinder 1	/1.D14	Engine
–Y2	Solenoid valve, PTO	/6.D15	Transmission
–Y2E	Solenoid valve, power lift (EHRB), lifting	/10.D6	Transmission
–Y2E	Solenoid valve, power lift (EHRD), lifting	/11.D8	Transmission
–Y2F	Solenoid valve, 3/2	/13.C6	Cab
–Y2M	Injector, cylinder 2	/1.D14	Engine
–Y2M	Air conditioner compressor	/14.D3,D6	Engine
–Y3	Solenoid valve, 4WD	/6.D8	Transmission
–Y3M	Injector, cylinder 3	/1.D15	Engine
–Y4	Solenoid valve, DPS C1–clutch	/7.D3	Transmission
–Y44	Solenoid valve, differential lock	/6.B5	Transmission
–Y4F	Solenoid valve, 2/2	/13.C7	Cab
–Y4M	Injector, cylinder 4	/1.D15	Engine
–Y5D	Bucket turn, X axle	/15.D14	Transmission
–Y5M	Injector, cylinder 5	/1.D16	Engine
–Y6D	Arm move, Y axle	/15.D13	Transmission
–Y6	Solenoid valve, DPS C2–clutch	/7.D4	Transmission
–Y6M	Injector, cylinder 6	/1.D16	Engine
–Y7	Solenoid valve, rear steering prevention	/7.C9	Transmission
–Y9	Magnetic clutch, front–PTO	/6.D13	Engine
–Y14	Solenoid valve, HiShift	/7.B11	Transmission
–Y15	Solenoid valve, HiShift, delay	/7.B14	Transmission
–Y19	Solenoid valve, trailer hitch release	/13.C3	Transmission

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Symbol	Description	Page and position	Location
–A1M1	Control unit, EC	/1.C8	Engine
–A1M2	Connector, 36–pole	/1.C7	Engine
–A1M3	Connector, 16–pole	/1.C14	Engine
–A1P	Instrument	/1.A14	Cab
–A2	Radio	/1.D5	Cab
–A2M	ID–module	/1.B10	Engine
–A2M1	Connector, 4–pole	/1.B10	Engine
–A3M	High pressure pump	/1.D13	Engine
–B1M	Sensor, water detector	/1.B11	Engine
–B3M	Sensor, coolant temperature	/1.D8	Engine
–B4M	Sensor, Fuel temperature	/1.D8	Engine
–B5M	Sensor, boost pressure	/1.D9	Engine
–B6M	Sensor, oil pressure	/1.D10	Engine
–B7M	Sensor, rail pressure	/1.D10	Engine
–B8M	Sensor, fuel pressure	/1.D11	Engine
–B10M	Sensor, crankshaft speed	/1.D12	Engine
–B11M	Sensor, camshaft speed	/1.D12	Engine
–F2	5A, Radio, instrumentation, tel., main switch, tachograph	/1.C3	Cab
–F14	10A, starter switch	/1.A6	Cab
–F31	30A, Engine control unit (EEM supply)	/1.A8	Cab
–F52	250A, Inlet air heater	/1.C7	Engine
–G1	Battery	/1.C1	Engine
–G2	Alternator	/1.B5	Engine
–GR1	Ground	/1.D4	Cab
–GR2	Ground	/1.D5	Engine
–GR5	Ground	/1.A2	Cab
–GR8	Ground	/1.D6	Engine
–K1M	Starter auxiliary relay	/1.B6	Engine
–K3M	Relay, intake air heater	/1.D7	Engine
–K4	Auxiliary relay, starter switch	/1.A3	Cab
–K5	Auxiliary relay, starter switch	/1.A3	Cab
–K30	Relay, main switch	/1.D4	Cab
–K51	Relay, main switch	/1.B3	Cab
–M1	Starter motor	/1.B5	Engine
–Q1	Heat/starter switch	/1.A5	Cab
–Q2	Main switch	/1.B1	Transmission
–R1	Intake air heater	/1.D7	Engine
–S68	Switch, mainswitch control	/1.C2	Cab
–V13	Diode, main switch, heat / starter switch	/1.B4	Cab
–X1M	Connector, 89–pole	/1.B7	Engine
–X2M	Connector, 31–pole	/1.A7,A14	Engine
–X2M	Connector, 31–pole	/1.B8,B14	Engine
–X2	Connector, 9–pole	/1.C3	Cab
–X3M	Connector, 29–pole	/1.B1,B3,B5	Engine
–X6	Connector, 9–pole	/1.A4,A6	Cab
–X7	Connector, 9–pole	/1.A3	Cab
–X24	Connector, 9–pole	/1.D5	Roof
–X27	Connector, 36–pole, instrument	/1.A14	Cab
–X30	Connector, 9–pole	/1.B13	Cab
–X92	Connector, 3–pole	/1.D3	Roof
–Y1M	Injector, cylinder 1	/1.D14	Engine
–Y2M	Injector, cylinder 2	/1.D14	Engine
–Y3M	Injector, cylinder 3	/1.D15	Engine
–Y4M	Injector, cylinder 4	/1.D15	Engine
–Y5M	Injector, cylinder 5	/1.D16	Engine
–Y6M	Injector, cylinder 6	/1.D16	Engine

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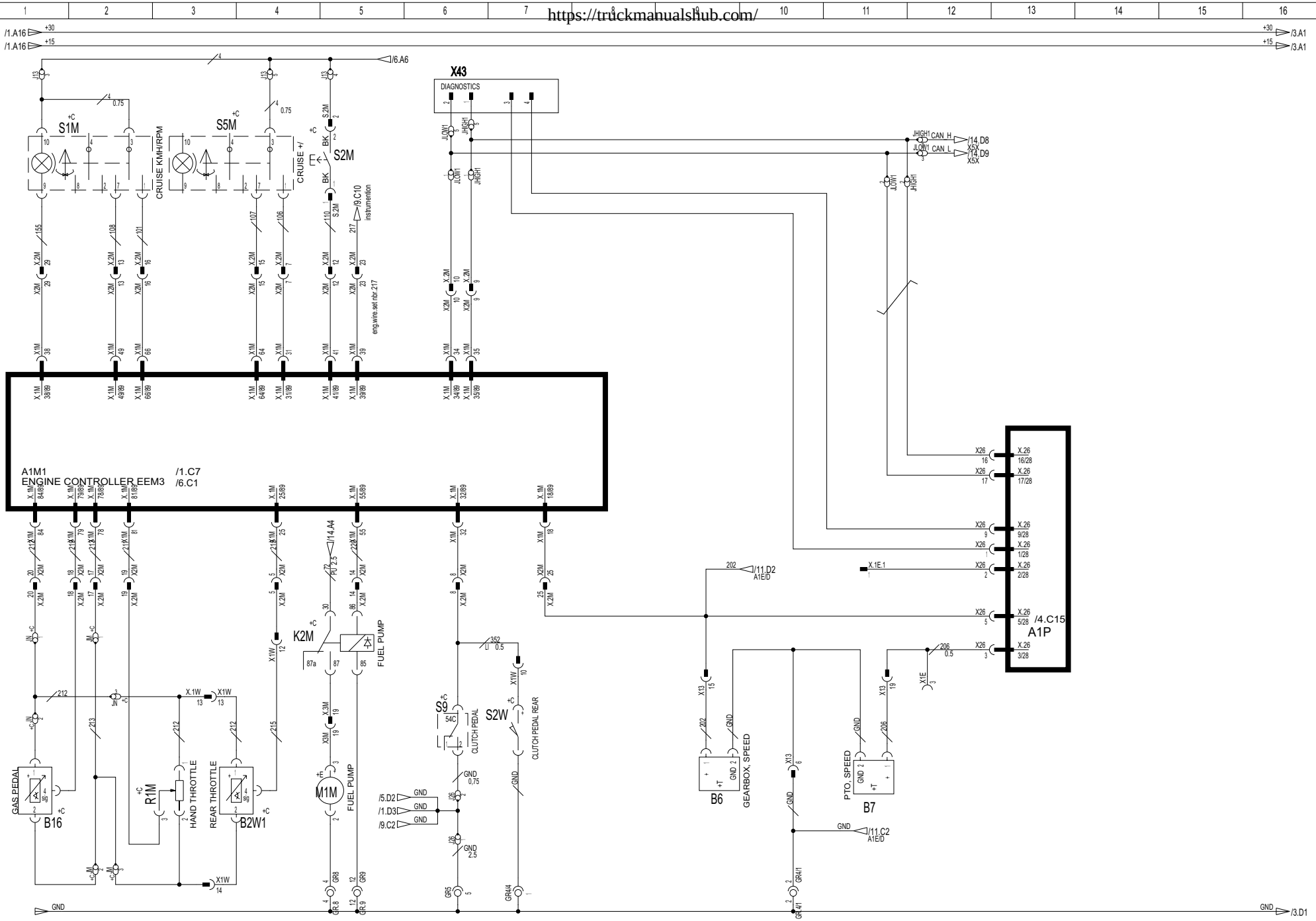
VALTRA

EEM1
WIRING DIAGRAM AC9.2

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Symbol	Description	Page and position	Location
–A1M1	Control unit, EC	/2.B1	Engine
–A1P	Instrument	/2.C13	Cab
–B2W1	Position sensor, rear accelerator pedal	/2.D4	Cab
–B6	Speed sensor, gearbox	/2.D9	Transmission
–B7	Speed sensor, PTO	/2.D11	Transmission
–B16	Position sensor, accelerator pedal	/2.D1	Cab
–GR4	Ground	/2.D7, D10	Cab
–GR5	Ground	/2.D6	Cab
–GR8	Ground	/2.D5	Engine
–GR9	Ground	/2.D5	Cab
–K2M	Relay, fuel pump	/2.C4	Cab
–M1M	Fuel pump	/2.D5	Engine
–R1M	Potentiometer, hand throttle	/2.D3	Cab
–S1M	Switch, cruise kmh / rpm	/2.A1	Cab
–S2M	Switch, cruise on/off	/2.A5	Cab
–S2W	Switch, rear clutch pedal	/2.D7	Cab
–S5M	Switch, 3–pos., cruise +/–	/2.A3	Cab
–S9	Switch, clutch pedal	/2.D6	Cab
–X1E	Connector, 9–pole	/2.C12	Cab
–X1M	Connector, 89–pole	/2.B1–B6	Engine
–X1M	Connector, 89–pole	/2.C1–C7	Engine
–X1W	Connector,12–pole	/2.C4, C7	Cab
–X1W	Connector,12–pole	/2.D3	Cab
–X2M	Connector, 31–pole	/2.B1–B6	Engine
–X2M	Connector, 31–pole	/2.C1–C7	Engine
–X3M	Connector, 29–pole	/2.D5	Engine
–X13	Connector, 37–pole	/2.D9–D11	Cab
–X26	Connector, 28–pole, instrument	/2.C13	Cab
–X43	Connector, 8–pole, diagnostics	/2.A6	Cab

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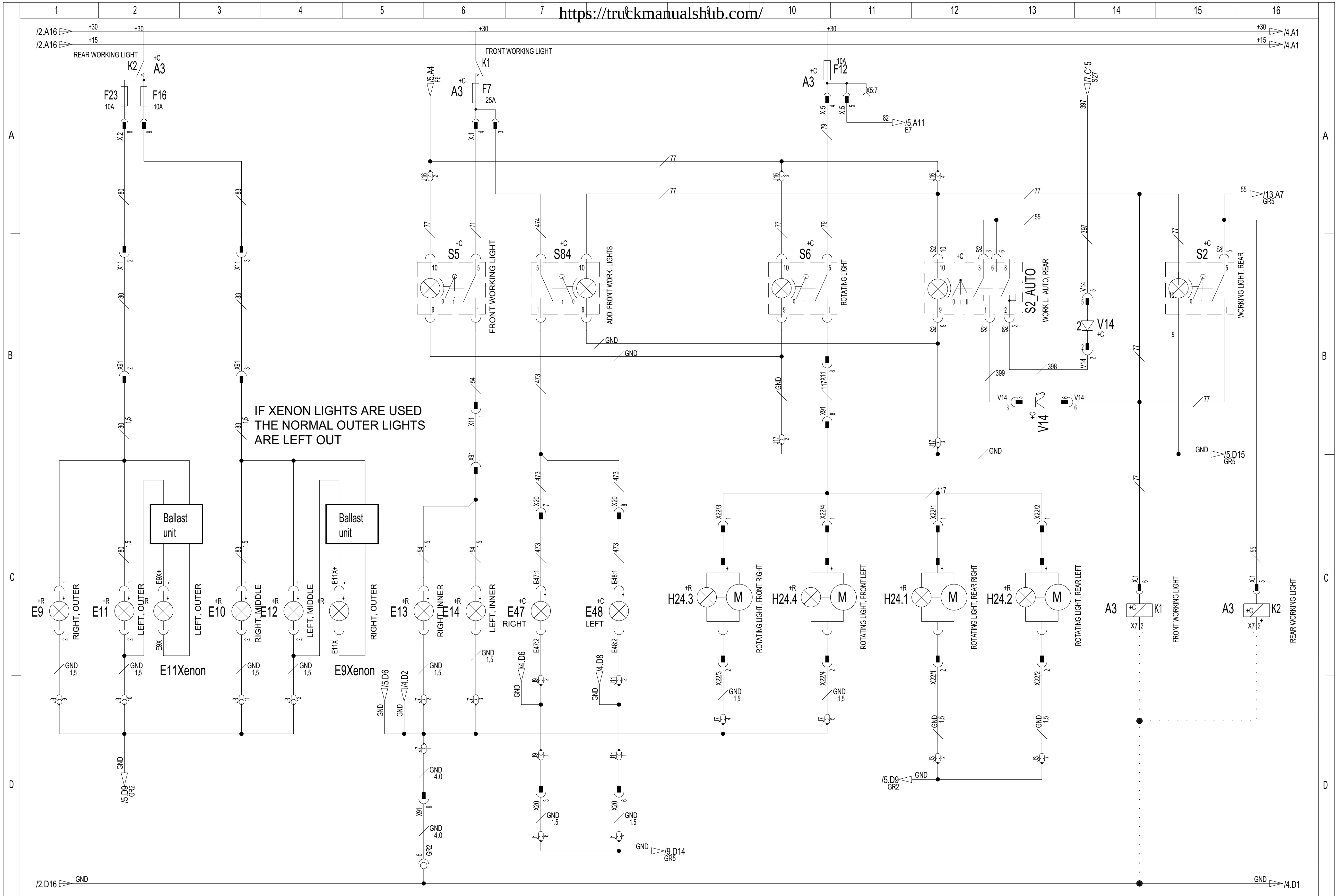
VALTRA

EEM
WIRING DIAGRAM AC9.2

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Symbol	Description	Page and position	Location
–E9	Rear working light, right, outer	/3.C1	Roof
–E9X	Rear working light (Xenon), right, outer	/3.C5	Roof
–E10	Rear working light, right, middle	/3.C3	Roof
–E11	Rear working light, left, outer	/3.C2	Roof
–E11X	Rear working light (Xenon), left, outer	/3.C2	Roof
–E12	Rear working light, left, middle	/3.C4	Roof
–E13	Front working light, right, inner	/3.C5	Roof
–E14	Front working light, left, inner	/3.C6	Roof
–E47	Extra front working light, right	/3.C7	Cab
–E48	Extra front working light, left	/3.C8	Cab
–F7	25A, front working lights	/3.A6	Cab
–F12	10A, rot. warning light, cabin light	/3.A10	Cab
–F16	10A, rear working lights, inner	/3.A2	Cab
–F23	10A, rear working lights, outer	/3.A2	Cab
–GR2	Ground	/3.D6	Roof
–H24.1	Rotating roof light, rear right	/3.C12	Roof
–H24.2	Rotating roof light, rear left	/3.C13	Roof
–H24.3	Rotating roof light, front right	/3.C9	Roof
–H24.4	Rotating roof light, front left	/3.C11	Roof
–K1	Relay, front working lights	/3.C14	Cab
–K2	Relay, rear working lights	/3.C16	Cab
–S2	Rocker switch, 2–pos. rear working lights	/3.B15	Cab
–S2 AUTO	Rocker switch, 3–pos. rear working lights, man./auto	/3.B12	Cab
–S5	Rocker switch 2–pos. front working lights	/3.B6	Cab
–S6	Rocker switch 2–pos. rot. warning lights	/3.B10	Cab
–S84	Rocker switch 2–pos. extra front working lights	/3.B7	Cab
–V14 (2)	Diode, rear working lights	/3.B14	Cab
–V14 (3)	Diode, rear working lights	/3.B13	Cab
–X1	Connector, 9–pole	/3.A6,C14,C16	Cab
–X2	Connector, 9–pole	/3.A2	Cab
–X5	Connector, 9–pole	/3.A10	Cab
–X11	Connector, 9–pole	/3.B2,B3,B6,B10	Roof
–X20	Connector, 9–pole	/3.C7,D7	Cab
–X22	Connector, 2–pole	/3.C9–C13	Roof
–X91	Connector, 9–pole	/3.B2,B3,B10	Roof
–X91	Connector, 9–pole	/3.C6,D6	Roof

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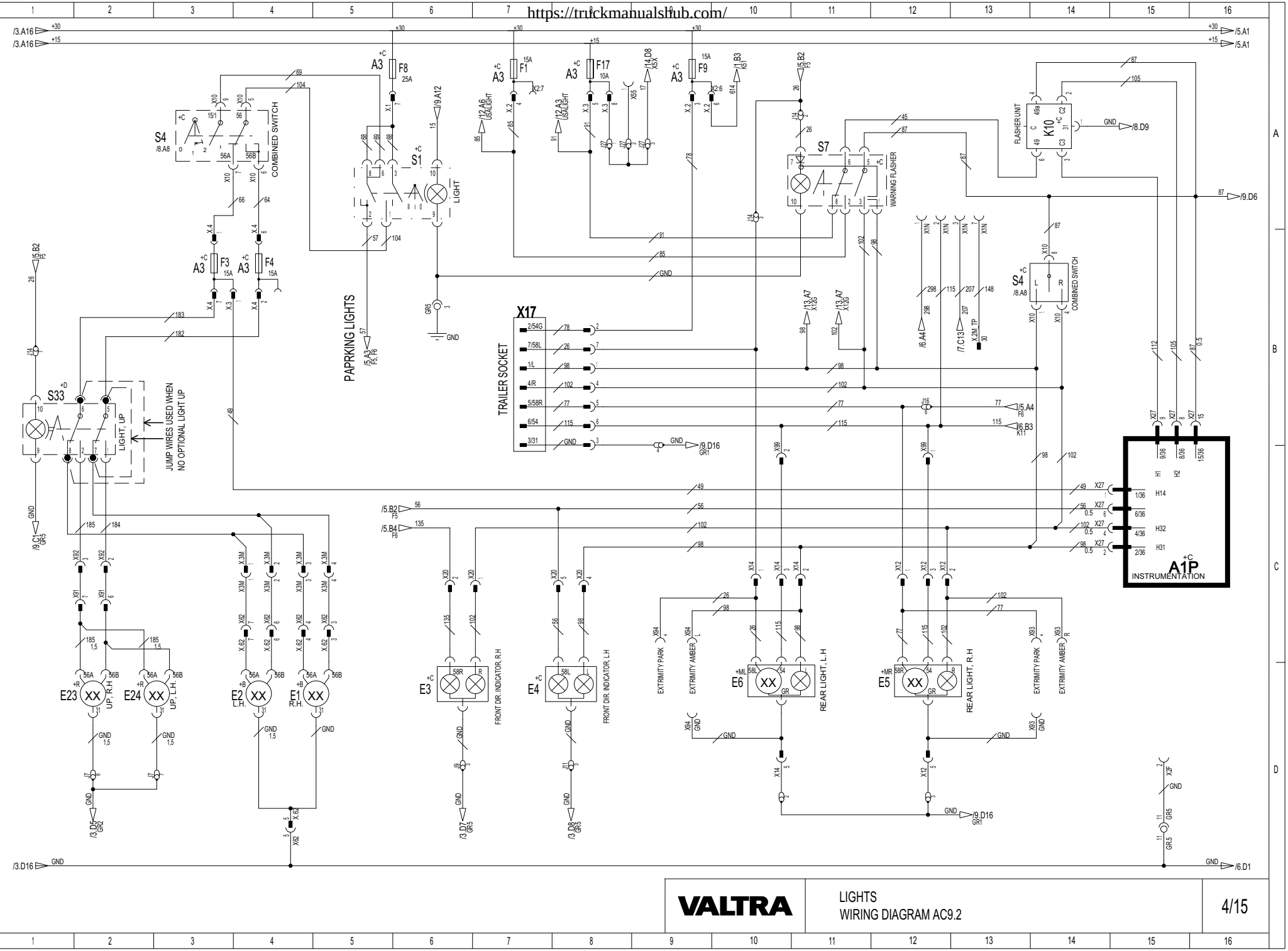
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LIGHTS
WIRING DIAGRAM AC9.2

https://truckmanualshub.com/

Symbol	Description	Page and position	Location
–A1P	Instrument	/4.C15	Cab
–E1	Head light, right	/4.D5	Engine
–E2	Head light, left	/4.D4	Engine
–E3	Front direction indicator, right	/4.D6	Cab
–E4	Front direction indicator, left	/4.D8	Cab
–E5	Rear light, right (indicator/parking/braking)	/4.D12	Cab
–E6	Rear light, left (indicator/parking/braking)	/4.D10	Cab
–E23	Upper head light, right	/4.D2	Cab
–E24	Upper head light, left	/4.D3	Cab
–F1	15A, hazard blinkers, water pump	/4.A7	Cab
–F3	15A, main beams	/4.B3	Cab
–F4	15A, dipped beams	/4.B4	Cab
–F8	25A, light switch	/4.A6	Cab
–F9	15A, trailer socket/fog light, rear	/4.A9	Cab
–F17	10A, direction indicators, Fieldmaster, isoadapter	/4.A8	Cab
–GR5	Ground	/4.B6,D15	Cab
–K10	Relay, flasher unit	/4.A14	Cab
–S1	Rocker switch 3–pos. head lights	/4.A6	Cab
–S4	Combined switch	/4.A3,B14	Cab
–S7	Rocker switch 2–pos. hazard warning flashers	/4.A11	Cab
–S33	Rocker switch 2–pos. change over switch, head lights up	/4.B1	Cab
–X1	Connector, 9–pole	/4.A6	Cab
–X1N	Connector, 9–pole	/4.B12	Cab
–X2	Connector, 9–pole	/4.A7,A9	Cab
–X2F	Connector, 3–pole	/4.D15	Cab
–X2M	Connector, 31–pole	/4.B13	Engine
–X3	Connector, 9–pole	/4.A8,B4	Cab
–X3M	Connector, 29–pole	/4.C4	Engine
–X4	Connector, 9–pole	/4.B3	Cab
–X10	Connector, 9–pole, combined switch	/4.A4,B14	Cab
–X12	Connector, 9–pole	/4.C12,D12	Cab
–X14	Connector, 9–pole	/4.C10,D10	Cab
–X17	Connector, 7–pole, trailer socket	/4.B7	Cab
–X20	Connector, 9–pole	/4.C6,C8	Cab
–X27	Connector, 36–pole, instrument	/4.C14,B15	Cab
–X62	Connector, 16–pole	/4.C4,D4	Engine
–X91	Connector, 9–pole	/4.C2	Roof
–X92	Connector, 3–pole	/4.C2	Roof
–X93	Connector, 3–pole	/4.C14	Mudguard, right
–X94	Connector, 3–pole	/4.C9	Mudguard, left
–X99	Connector, 2–pole	/4.C10,C12	Cab

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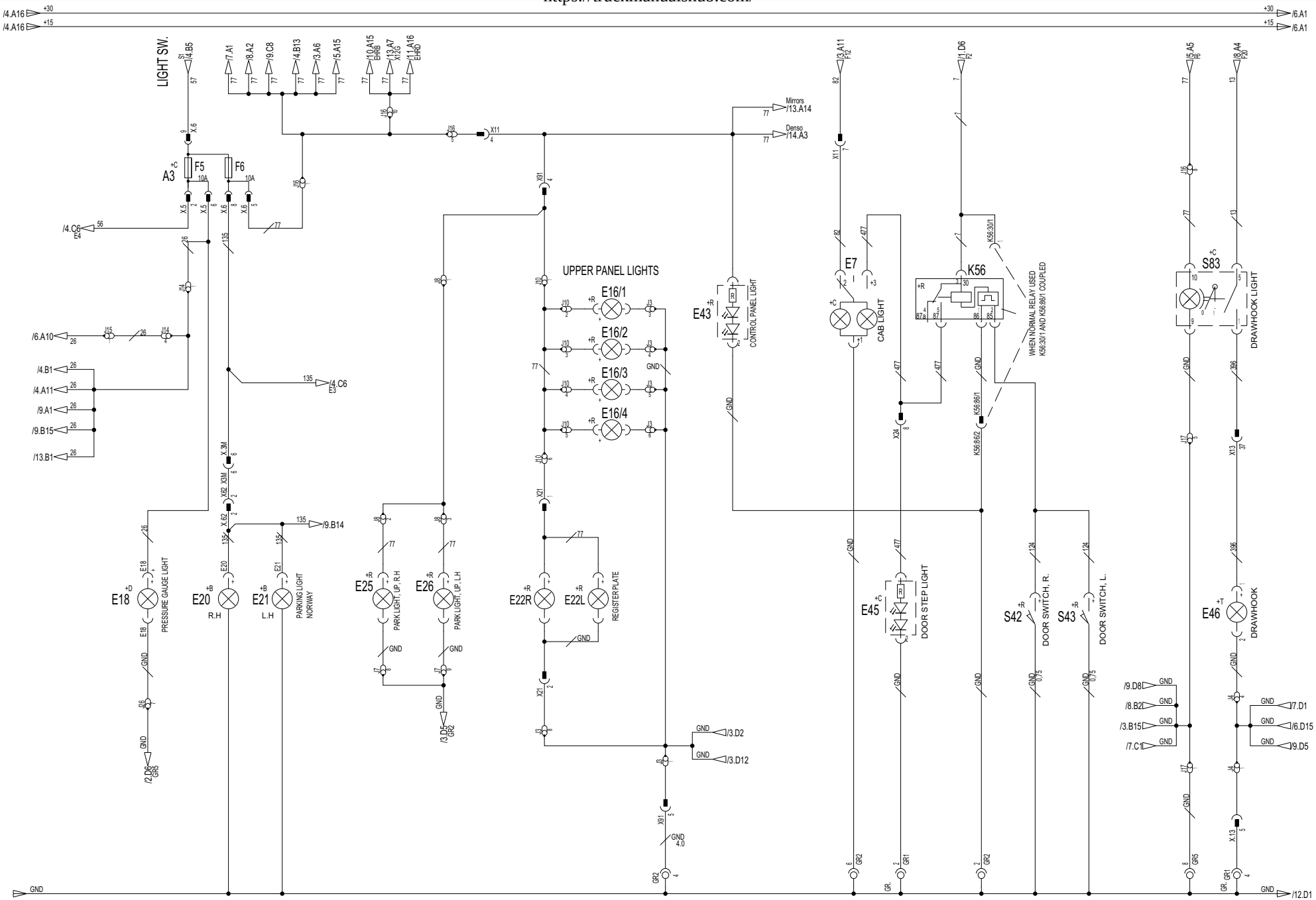
LIGHTS
WIRING DIAGRAM AC9.2

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https://truckmanualshub.com/

Symbol	Description	Page and position	Location
–E7	Cab light	/5.B11	Cab
–E16/1	Upper panel light	/5.B8	Roof
–E16/2	Upper panel light	/5.B8	Roof
–E16/3	Upper panel light	/5.B8	Roof
–E16/4	Upper panel light	/5.B8	Roof
–E18	Pressure gauge light	/5.C2	Cab
–E20	Parking light, right, Norway	/5.C3	Engine
–E21	Parking light,left, Norway	/5.C4	Engine
–E22L	Register plate light	/5.C8	Roof
–E22R	Register plate light	/5.C7	Roof
–E25	Parking light, upper, right	/5.C5	Cab
–E26	Parking light, upper, left	/5.C6	Cab
–E43	control panel light	/5.B9	Cab
–E45	Step light	/5.C11	Cab
–E46	Trailer hitch light	/5.C15	Transmission
–F5	10A, parking lights, left	/5.A3	Cab
–F6	10A, parking lights, right	/5.A4	Cab
–GR1	Ground	/5.D11,D15	Cab
–GR2	Ground	/5.D9,D11,D12	Roof
–GR5	Ground	/5.D15	Cab
–K56	Time–delay relay, cabin light and door step	/5.B12	Roof
–S42	Door switch, cab light, RH	/5.C13	Roof
–S43	Door switch, cab light, LH	/5.C14	Roof
–S83	Switch, 2–pos., drawhook	/5.B15	Cab
–X3M	Connector, 29–pole	/5.C3	Engine
–X5	Connector, 9–pole	/5.A3	Cab
–X6	Connector, 9–pole	/5.A3	Cab
–X11	Connector, 9–pole	/5.A7,A11	Roof
–X13	Connector, 37–pole	/5.B15,D15	Cab
–X21	Connector, 2–pole, register plate light	/5.C7	Roof
–X24	Connector, 9–pole	/5.B11	Roof
–X62	Connector, 16–pole	/5.C3	Engine
–X91	Connector, 9–pole	/5.A7,D9	Roof

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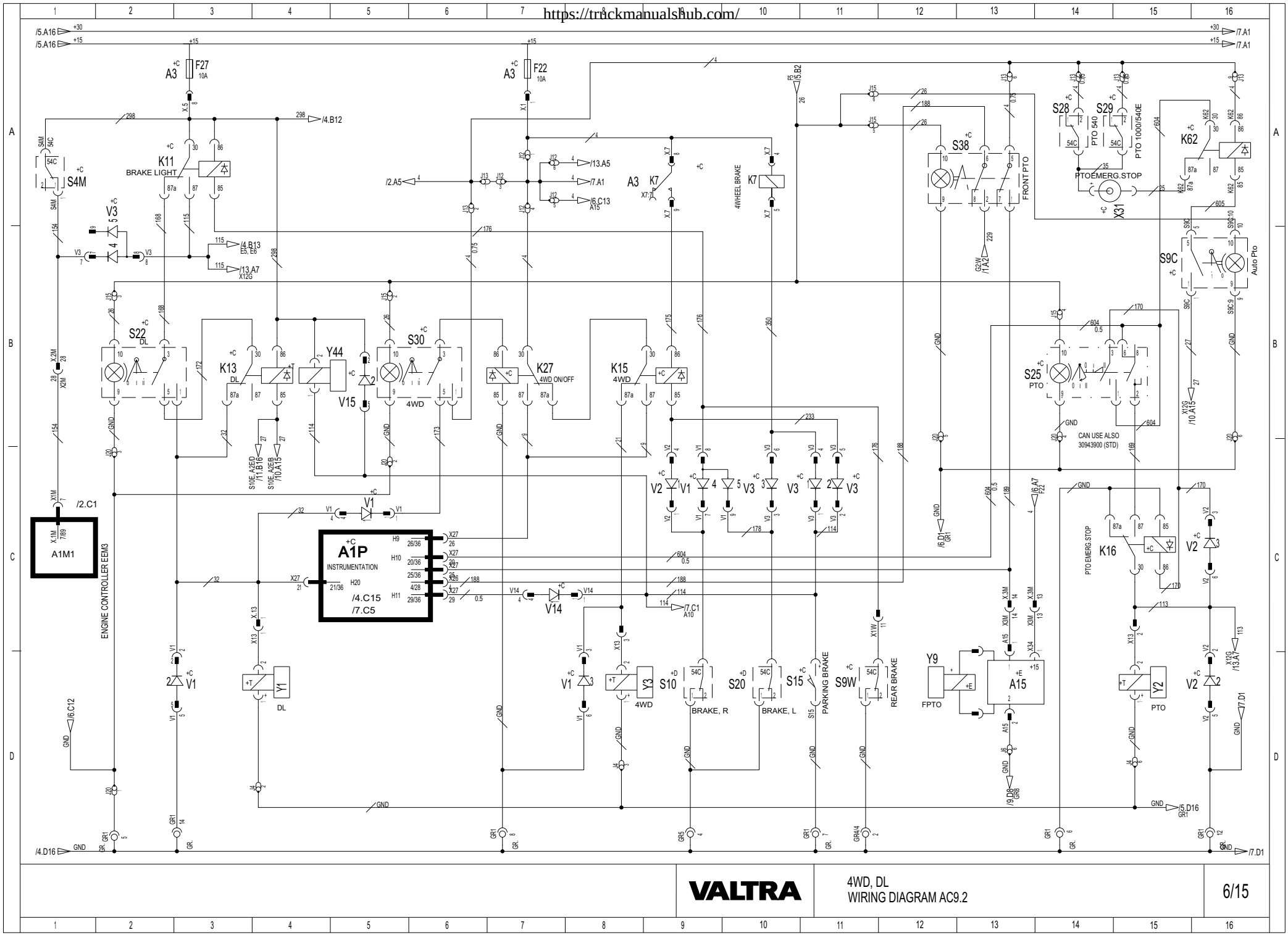
LIGHTS
WIRING DIAGRAM AC9.2

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Symbol	Description	Page and position	Location
–A1M1	Control unit, EC	/6.C1	Engine
–A1P	Instrument	/6.C5	Cab
–A15	Control unit, front–PTO	/6.D13	Engine
–F22	10A, sensors HiTech, 4WD, front suspension	/6.A7	Cab
–F27	10A, braking lights, differential lock, exhaust brake	/6.A3	Cab
–GR1	Ground	/6.D2,D7,D11	Cab
–GR1	Ground	/6.D14,D16	Cab
–GR4	Ground	/6.D11	Cab
–GR5	Ground	/6.D9	Cab
–K7	Relay, 4–wheel brake	/6.A9	Cab
–K11	Relay, brake lights	/6.A3	Cab
–K13	Relay, differential lock	/6.B3	Cab
–K15	Relay, 4WD	/6.B8	Cab
–K16	Relay, PTO emergency stop	/6.C15	Cab
–K27	Relay 4WD, on/off	/6.B7	Cab
–K62	PTO on/off relay	/6.A16	Cab
–S4M	Switch, clutch pedal, movement started	/6.A1	Cab
–S9C	Switch, Auto PTO	/6.B15	Cab
–S9W	Switch, brake pedal, rear	/6.D11	Cab
–S10	Limit switch, brake light, right	/6.D9	Cab
–S15	Switch, parking brake	/6.D11	Cab
–S20	Limit switch, brake light, left	/6.D10	Cab
–S22	Rocker switch 3–pos. differential lock	/6.B2	Cab
–S25	Rocker switch 3–pos. rear PTO	/6.B14	Cab
–S28	Push button, PTO 540	/6.A14	Cab
–S29	Push button, PTO 1000/540E	/6.A15	Cab
–S30	Rocker switch 3–pos. 4WD	/6.B5	Cab
–S38	Rocker switch 2–pos. front–PTO	/6.A13	Cab
–V1 (1)	Diode, 4–WD auto	/6.C5	Cab
–V1 (2)	Diode, differential lock	/6.D3	Cab
–V1 (3)	Diode, 4WD solenoid	/6.D8	Cab
–V1 (4)	Diode, brake pedal, right	/6.C9	Cab
–V1 (5)	Diode, brake pedal, left	/6.C9	Cab
–V2 (1)	Diode, 4WD	/6.C9	Cab
–V2 (2)	Diode, rear PTO	/6.D16	Cab
–V2 (3)	Diode, rear PTO	/6.C16	Cab
–V3 (1)	Diode, 4–wheel brake	/6.C11	Cab
–V3 (2)	Diode, 4–wheel brake	/6.C11	Cab
–V3 (3)	Diode, 4–wheel brake	/6.C10	Cab
–V3 (4)	Diode	/6.B2	Cab
–V3 (5)	Diode	/6.B2	Cab
–V14 (1)	Diode, parking brake	/6.C7	Cab
–V15 (2)	Diode, differential lock solenoid	/6.B5	Cab
–X1	Connector, 9–pole	/6.A7	Cab
–X1M	Connector, 89–pole	/6.C1	Engine
–X2M	Connector, 31–pole	/6.B1	Engine
–X3M	Connector, 29–pole	/6.C13	Engine
–X5	Connector, 9–pole	/6.A3	Cab
–X7	Connector, 9–pole	/6.A10	Cab
–X13	Connector, 37–pole	/6.C3,C8,C15	Cab
–X26	Connector, 28–pole, instrument	/6.C6	Cab
–X27	Connector, 36–pole, instrument	/6.C4,C6	Cab
–X31	Connector, 2–pole.socket, PTO–emerg. stop	/6.A14	Cab
–Y1	Solenoid valve, differential lock	/6.D4	Transmission
–Y2	Solenoid valve, PTO	/6.D15	Transmission
–Y3	Solenoid valve, 4WD	/6.D8	Transmission
–Y9	Magnetic clutch, front–PTO	/6.D13	Engine
–Y44	Solenoid valve, differential lock	/6.B5	Transmission

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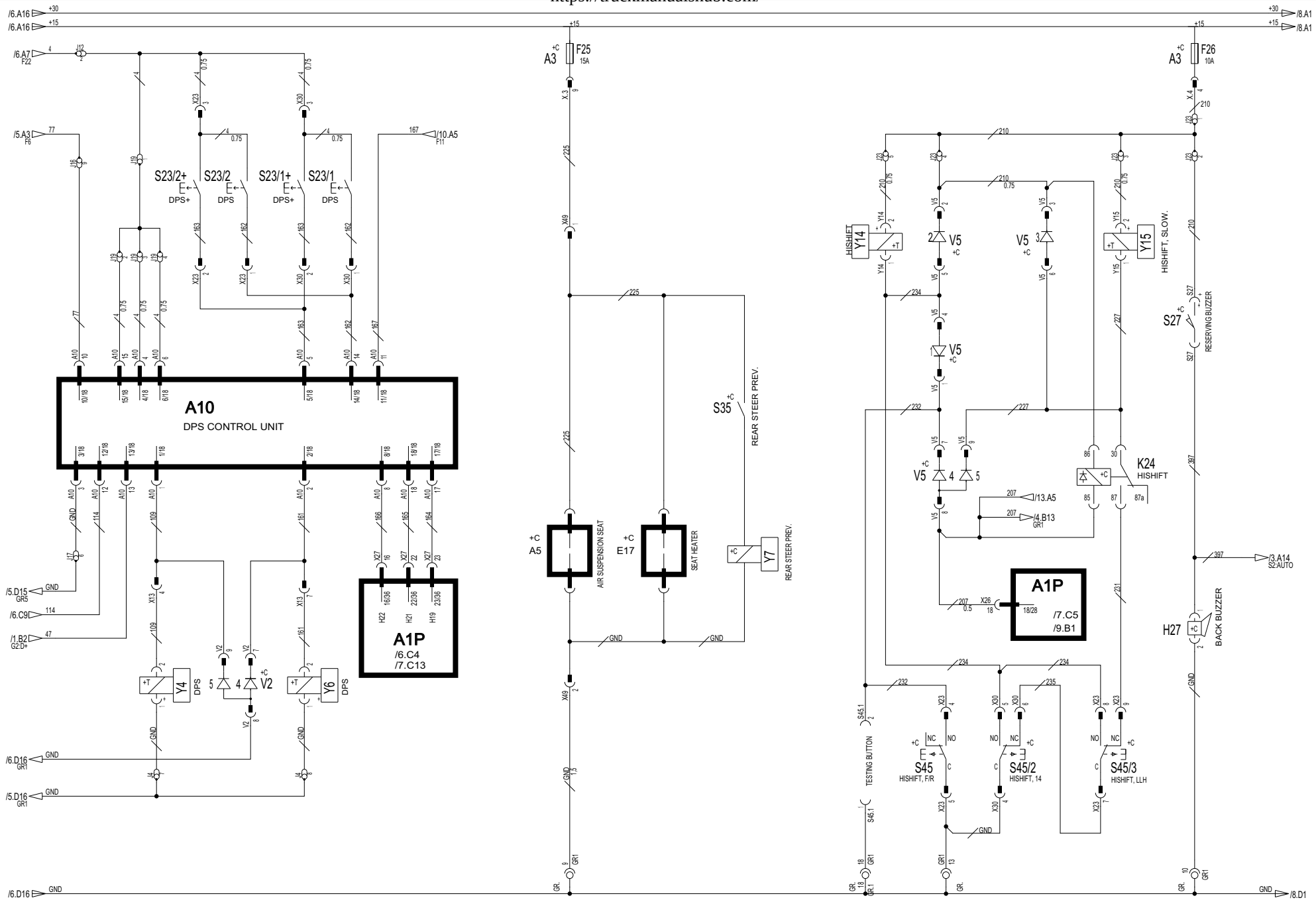
4WD, DL
WIRING DIAGRAM AC9.2

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Symbol	Description	Page and position	Location
–A1P	Instrument	/7.C6,C13	Cab
–A5	Air suspension seat	/7.C7	Cab
–A10	Control unit, DPS	/7.B2	Cab
–E17	Seat heater	/7.C8	Cab
–F25	15A, air spring seat/seat heating, reverse drive lockout, el front loader valves	/7.A7	Cab
–F26	10A, back buzzer, HiShift	/7.A15	Cab
–GR1	Ground	/7.D7–D15	Cab
–H27	Reverse Buzzer	/7.C15	Cab
–K24	Relay, Hi–Shift	/7.C14	Cab
–S23/1–	DPS–	/7.A5	Cab
–S23/1+	DPS+	/7.A4	Cab
–S23/2–	DPS–	/7.A3	Cab
–S23/2+	DPS+	/7.A3	Cab
–S27	Switch, back buzzer	/7.B15	Cab
–S35	Rear steering prevention	/7.B9	Cab
–S45	Push buttons, Hi–shift, F/R	/7.D12	Cab
–S45/2	Push buttons, Hi–shift, 1 – 4	/7.D13	Cab
–S45/3	Push buttons, Hi–shift, LL – H	/7.D14	Cab
–V2 (4)	Diode, DPS C2–clutch solenoid	/7.D4	Cab
–V2 (5)	Diode, DPS C1–clutch solenoid	/7.D4	Cab
–V5 (1)	Diode, Hi–shift	/7.B12	Cab
–V5 (2)	Diode, Hi–shift	/7.B12	Cab
–V5 (3)	Diode, Hi–shift	/7.B13	Cab
–V5 (4)	Diode, Hi–shift	/7.C12	Cab
–V5 (5)	Diode, Hi–shift	/7.C12	Cab
–X3	Connector, 9–pole	/7.A7	Cab
–X4	Connector, 9–pole	/7.A15	Cab
–X13	Connector, 37–pole	/7.C3,C4	Cab
–X23	Connector, 9–pole, DPS and Hi–Shift extra switches	/7.A3,B3,D12,D14	Cab
–X26	Connector, 28–pole, instrument	/7.C12	Cab
–X27	Connector, 36–pole, instrument	/7.C5	Cab
–X30	Connector, 9–pole, DPS and Hi–Shift switches	/7.A4,B4,D13	Cab
–X49	Connector, 2–pole	/7.B7,D7	Cab
–Y4	Solenoid valve, DPS C1–clutch	/7.D3	Transmission
–Y6	Solenoid valve, DPS C2–clutch	/7.D4	Transmission
–Y7	Solenoid valve, rear steering prevention	/7.C9	Transmission
–Y14	Solenoid valve, Hi–Shift	/7.B11	Transmission
–Y15	Solenoid valve, Hi–Shift, delay	/7.B14	Transmission

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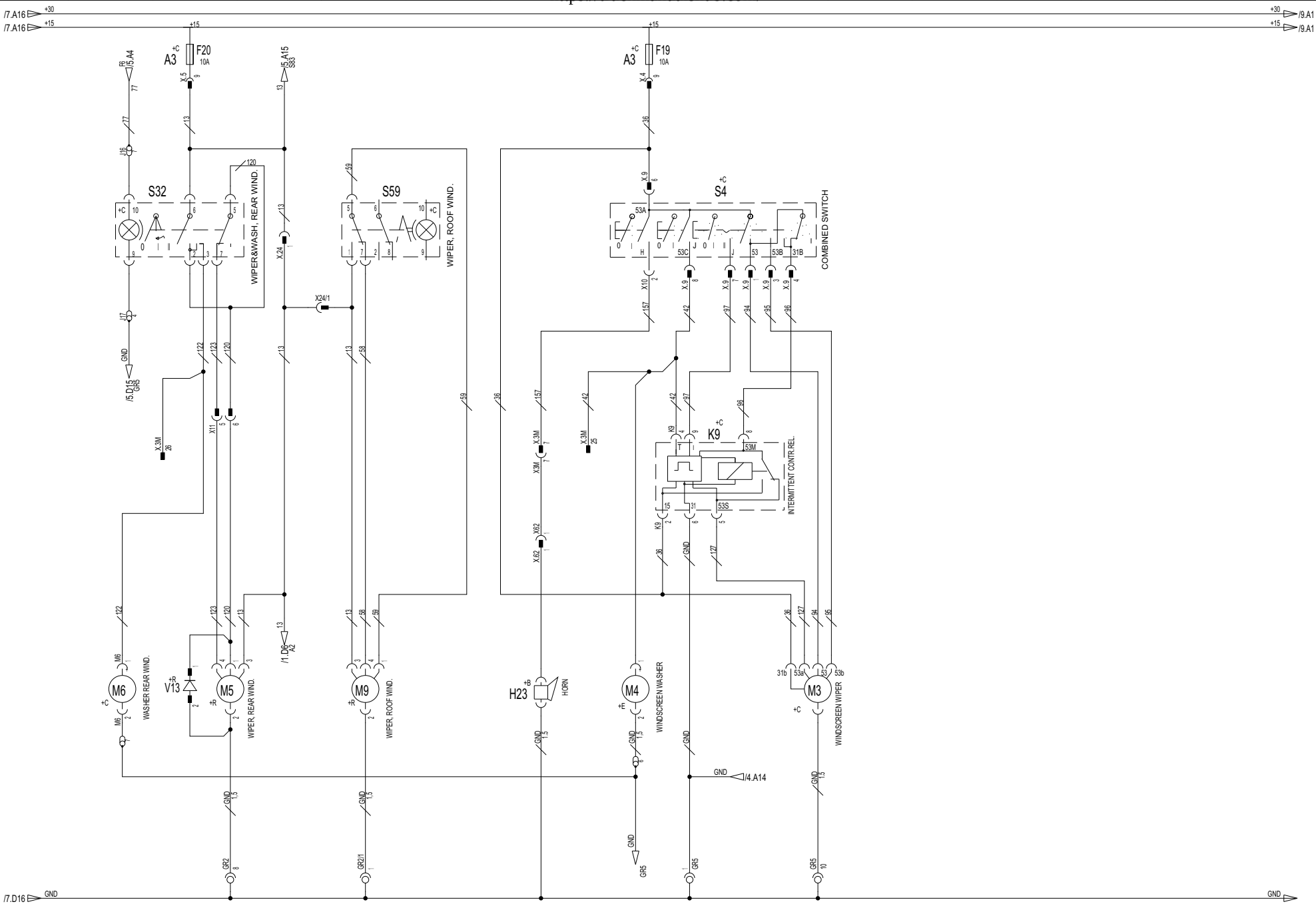
DPS, HI-SHIFT
WIRING DIAGRAM AC9.2

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Symbol	Description	Page and position	Location
–F19	10A, windscreen wiper/washer, horn	/8.A8	Cab
–F20	10A, rear window wiper/washer, radio, trailer hitch light	/8.A3	Cab
–GR2	Ground	/8.D3,D5	Roof
–GR5	Ground	/8.D9,D10	Cab
–H23	Horn	/8.D7	Engine hood
–K9	Relay, interval wiper	/8.C9	Cab
–M3	Windscreen wiper	/8.D10	Cab
–M4	Windscreen washer	/8.D8	Engine
–M5	Rear window wiper	/8.D3	Roof
–M6	Rear window washer	/8.D2	Cab
–M9	Roof window wiper	/8.D5	Roof
–S4	Combined switch	/8.B8	Cab
–S32	Rocker switch, 3–pos. rear window wiper and washer	/8.A2	Cab
–S59	Rocker switch, 2–pos. wiper. roof wind.	/8.A5	Cab
–V13	Diode, rear window washer motor	/8.D3	Roof
–X3M	Connector, 29–pole	/8.B3,B7	Engine
–X4	Connector, 9–pole	/8.A8	Cab
–X5	Connector, 9–pole	/8.A3	Cab
–X9	Connector, 9–pole	/8.A8,B9	Cab
–X10	Connector, 9–pole	/8.B8	Cab
–X11	Connector, 9–pole	/8.B3	Roof
–X24	Connector, 9–pole	/8.B4	Roof
–X62	Connector, 16–pole	/8.C7	Engine

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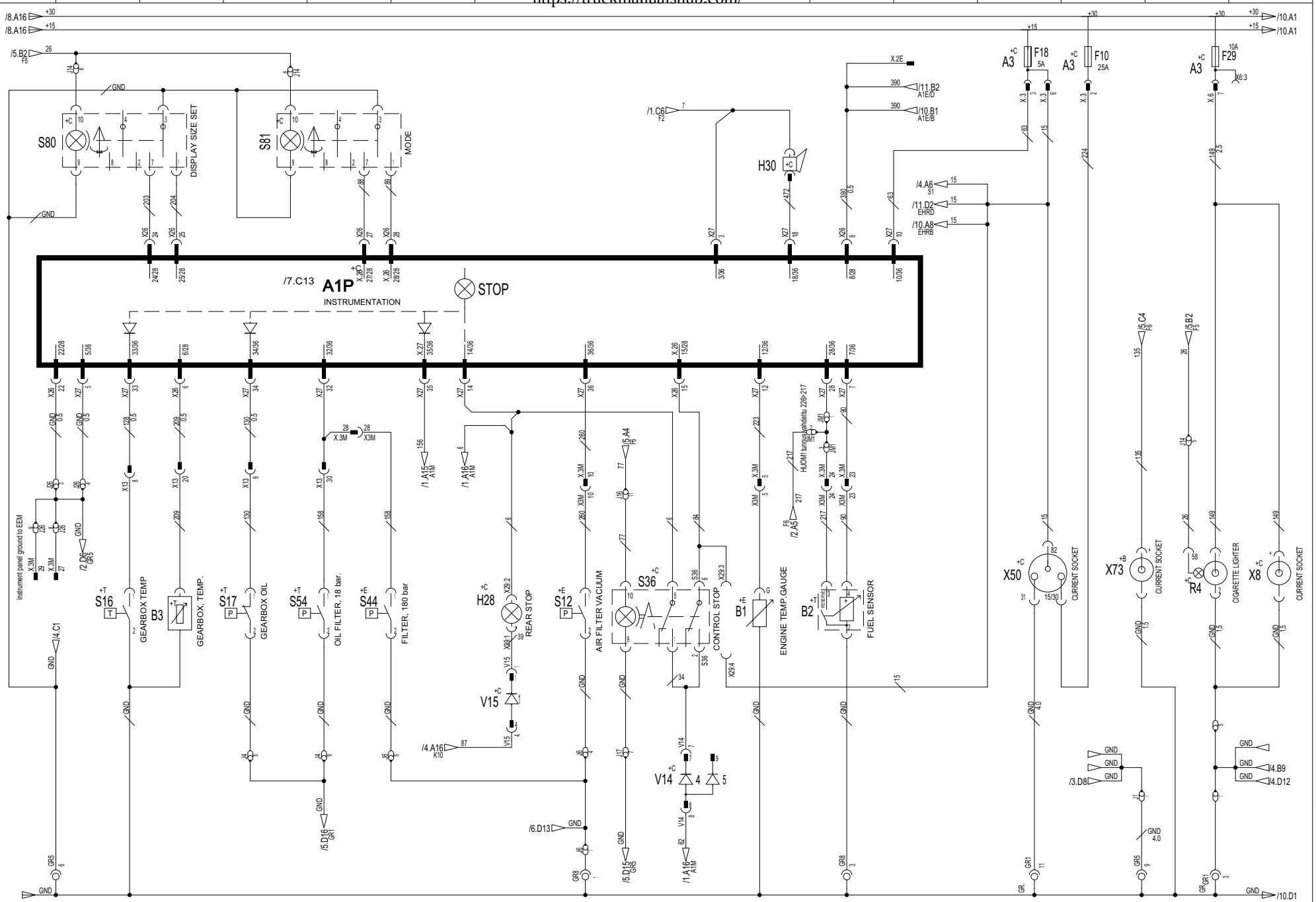
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BLINKERS, WASHERS
WIRING DIAGRAM AC9.2

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Symbol	Description	Page and position	Location
–A1P	Instrument	/9.B2	Cab
–B1	Temperature sensor, engine coolant	/9.C10	Engine
–B2	Level sensor, fuel	/9.C11	Transmission
–B3	Temperature sensor, gearbox oil	/9.C3	Transmission
–F10	25A, 3–pole current socket	/9.A14	Cab
–F18	5A, instruments, indicatorlights, Autocontrol	/9.A13	Cab
–F29	10A, cigarette lighter, 2–pin current socket	/9.A15	Cab
–GR1	Ground	/9.D13,D15	Cab
–GR5	Ground	/9.D2,D15	Cab
–GR8	Ground	/9.D8,D11	Engine
–H28	Indicator light, stop, rear	/9.C7	Cab
–H30	Buzzer, instrumentation	/9.A10	Cab
–R4	Cigarette lighter	/9.C15	Cab
–S12	Pressure switch, engine air filter	/9.C8	Engine
–S16	Temperature switch, gearbox oil	/9.C2	Transmission
–S17	Pressure switch, gearbox oil	/9.C4	Transmission
–S36	Switch, 2–pos., control stop	/9.C9	Cab
–S44	Pressure switch, pressure filter (high pressure circuit)	/9.C6	Engine
–S54	Pressure switch, pressure filter (low pressure circuit)	/9.C4	Transmission
–S80	Switch, 3–pos., instrument, display size	/9.A2	Cab
–S81	Switch, 3–pos., instrument, display mode	/9.A4	Cab
–V14 (4)	Diode, control stop	/9.D9	Cab
–V14 (5)	Diode, control stop	/9.D9	Cab
–V15 (1)	Diode, rear stop–indicator light	/9.D7	Cab
–X2E	Connector, 15–pole	/9.A12	Cab
–X3	Connector, 9–pole	/9.A13,A14	Cab
–X3M	Connector, 29–pole	/8.B5,C1,C8,C11	Engine
–X6	Connector, 9–pole	/9.A15	Cab
–X8	Connector, 2–pole current socket	/9.C16	Cab
–X13	Connector, 37–pole	/9.C2–C5	Cab
–X26	Connector, 28–pole, instrument	/9.B1–B11	Cab
–X27	Connector, 36–pole, instrument	/9.B2–B12	Cab
–X29	Connector, 2–pole.socket, stop–alarm	/9.C10	Cab
–X50	Connector, 3–pole current socket	/9.C13	Cab
–X73	Connector, 2–pole, current socket	/9.C15	Engine

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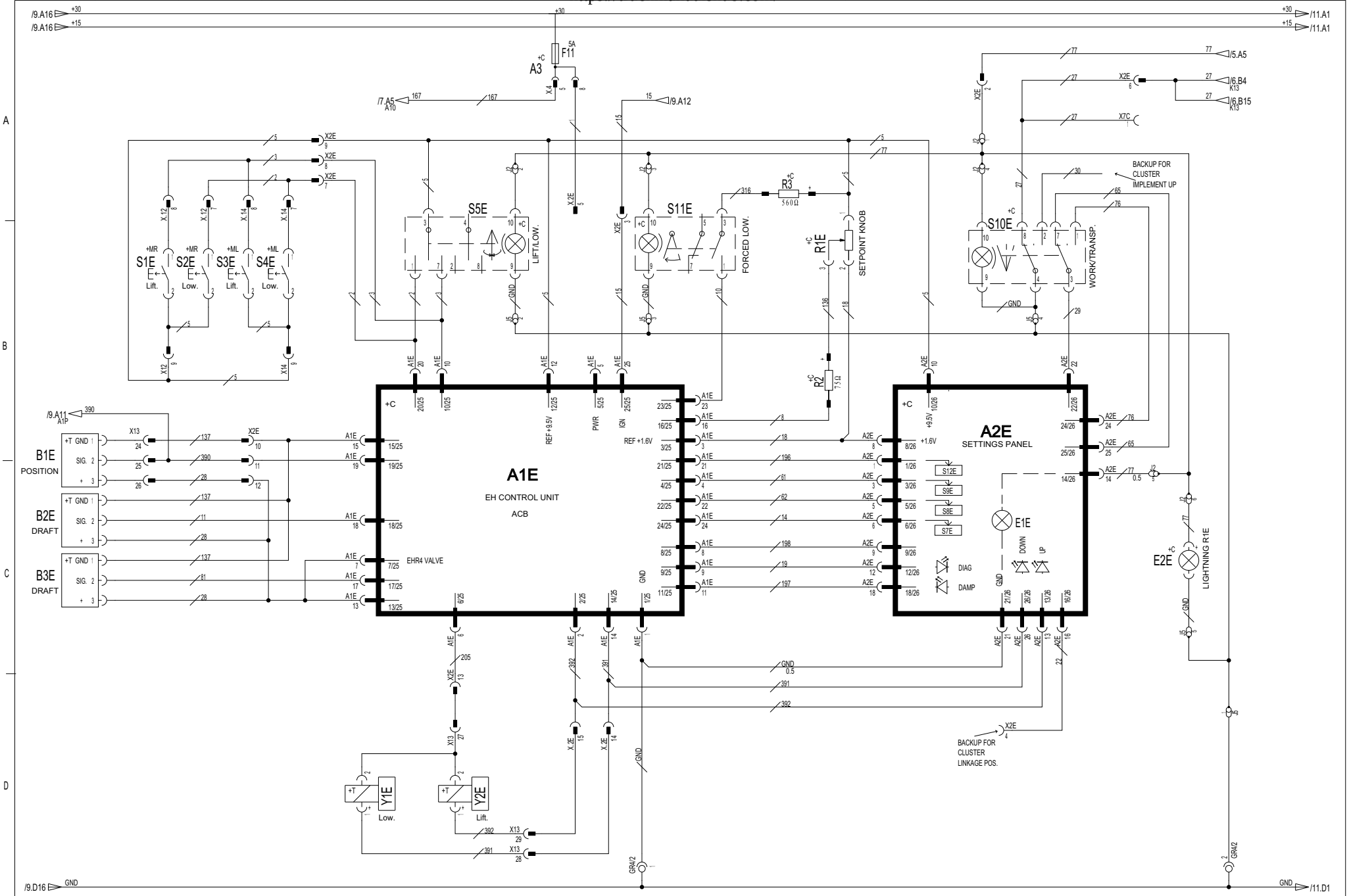
INSTRUMENT PANEL, WARNING LIGHTS
WIRING DIAGRAM AC9.2

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Symbol	Description	Page and position	Location
–A1E	Control unit, power lift, EHRB	/10.C7	Cab
–A2E	Switch panel, power lift, EHRB	/10.C12	Cab
–B1E	Position sensor, rear power lift (EHRB)	/10.C1	Transmission
–B2E	Draft sensor, power lift (EHRB), r.h	/10.C1	Transmission
–B3E	Draft sensor, power lift (EHRB), l.h	/10.C1	Transmission
–E1E	Lightning, switch panel	/10.C12	Cab
–E2E	Lightning, position potentiometer	/10.C15	Cab
–F11	5A, power lift control unit, buzzer	/10.A7	Cab
–GR4	Ground	/10.D8,D15	Cab
–R1E	Potentiometer, power lift (EHRB) position control	/10.B10	Cab
–R2	Resistor, power lift (EHRB), for position control	/10.B10	Cab
–R3	Resistor, power lift (EHRB), for forced lowering	/10.A10	Cab
–S1E	Push button, rear operation, r.h., lifting	/10.B2	Mudguard, right
–S2E	Push button, rear operation, r.h., lowering	/10.B3	Mudguard, right
–S3E	Push button, rear operation, lifting, l.h.	/10.B3	Mudguard, left
–S4E	Push button, rear operation, lowering, l.h	/10.B4	Mudguard, left
–S5E	Rocker switch 3–pos. inside operation, lifting/lowering	/10.B6	Cab
–S7E	Lowering speed selector, power lift	/10.C12	Cab
–S8E	Transport height selector, power lift	/10.C12	Cab
–S9E	Draft control selector, power lift	/10.C12	Cab
–S10E	Rocker switch, 3–pos. power lift (EHRB) lifting/lowering	/10.B13	Cab
–S11E	Rocker switch, power lift (EHRB), forced lowering	/10.B9	Cab
–S12E	Drive balance control, power lift	/10.B12	Cab
–X2E	Connector, 15–pole	/10.A4–A14	Cab
–X2E	Connector, 15–pole	/10.B3,D6–D13	Cab
–X4	Connector, 9–pole	/10.A7	Cab
–X7C	Connector, 3–pole	/10.A14	Cab
–X12	Connector, 9–pole	/10.A2,B2	Cab
–X13	Connector, 37–pole	/10.B2,D6,D7	Cab
–X14	Connector, 9–pole	/10.A3,B4	Cab
–Y1E	Solenoid valve, power lift (EHRB), lowering	/10.D5	Transmission
–Y2E	Solenoid valve, power lift (EHRB), lifting	/10.D6	Transmission

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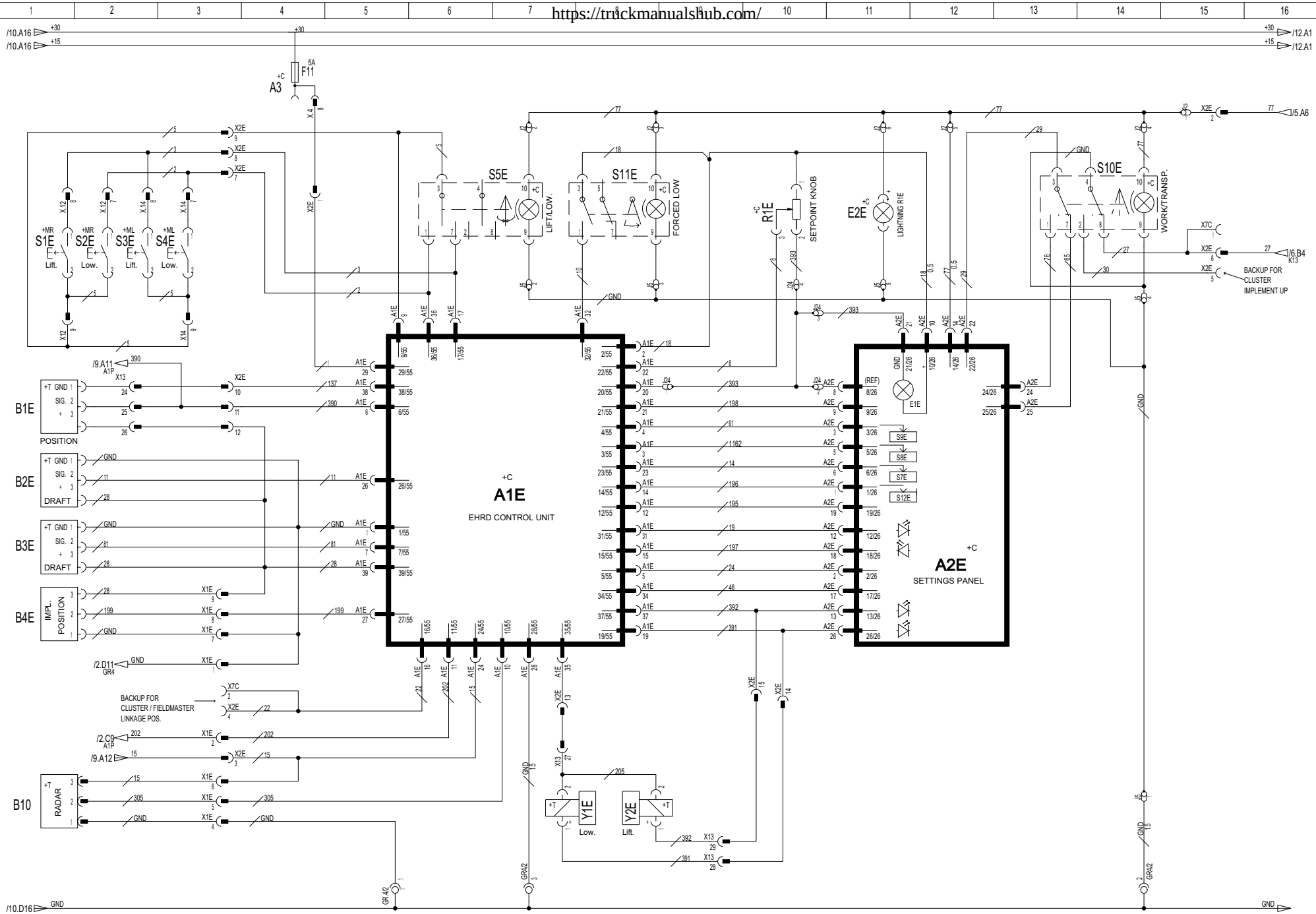
EHRB
WIRING DIAGRAM AC9.2

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Symbol	Description	Page and position	Location
–A1E	Control unit, power lift, EHRD	/11.B6	Cab
–A2E	Switch panel, power lift, EHRD	/11.B12	Cab
–B1E	Position sensor, power lift (EHRD)	/11.B1	Transmission
–B2E	Draft sensor, power lift (EHRD), r.h	/11.C1	Transmission
–B3E	Draft sensor, power lift (EHRD), l.h	/11.C1	Transmission
–B4E	Position sensor, power lift (EHRD), implement (ACD)	/11.C1	Transmission
–B10	Speed radar	/11.D1	Transmission
–E1E	Lightning, switch panel	/11.B11	Cab
–E2E	Lightning, position potentiometer	/11.A11	Cab
–F11	5A, power lift control unit, buzzer	/11.A4	Cab
–GR4	Ground	/11.D5–D14	Cab
–R1E	Potentiometer, power lift (EHRD), position control	/11.A10	Cab
–S1E	Push button, rear operation, lifting, r.h.	/11.B1	Mudguard, right
–S2E	Push button, rear operation, lowering, r.h.	/11.B2	Mudguard, right
–S3E	Push button, rear operation, lifting, l.h.	/11.B2	Mudguard, left
–S4E	Push button, rear operation, lowering, l.h.	/11.B3	Mudguard, left
–S5E	Rocker switch 3–pos. inside operation, lifting/lowering	/11.A6	Cab
–S7E	Lowering speed selector, power lift	/11.C11	Cab
–S8E	Transport height selector, power lift	/11.B11	Cab
–S9E	Draft control selector, power lift	/11.B11	Cab
–S10E	Rocker switch, 3–pos. power lift (EHRD), lifting/lowering	/11.A14	Cab
–S11E	Rocker switch, power lift (EHRD), forced lowering	/11.A8	Cab
–S12E	Drive balance control, power lift	/11.C11	Cab
–X1E	Connector 9–pole	/11.C3,D3	Cab
–X2E	Connector, 15–pole	/11.A3,A4,A15	Cab
–X2E	Connector, 15–pole	/11.B3,B15	Cab
–X2E	Connector, 15–pole	/11.C3,C7,C10	Cab
–X4	Connector 9–pole	/11.A4	Cab
–X7C	Connector, 3–pole	/11.A15,C3	Cab
–X12	Connector, 9–pole	/11.A1,A2,B1	Cab
–X13	Connector, 37–pole	/11.B2,D7,D9	Cab
–X14	Connector, 9–pole	/11.A3,B3	Cab
–Y1E	Solenoid valve, power lift (EHRD), lowering	/11.D7	Transmission
–Y2E	Solenoid valve, power lift (EHRD), lifting	/11.D8	Transmission

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EHRD
WIRING DIAGRAM AC9.2

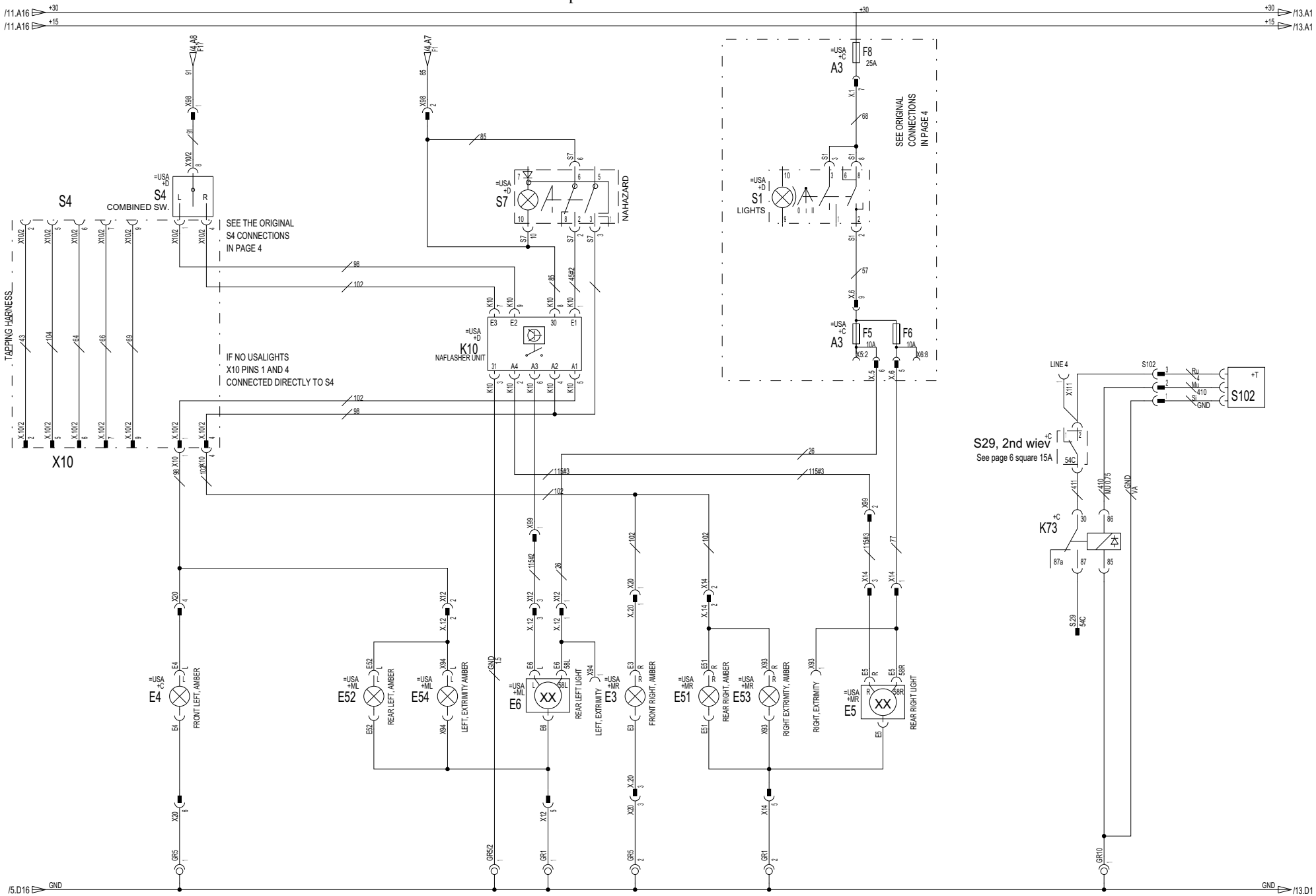
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Symbol	Description	Page and position	Location
–E3	Front direction indicator, right	/12.D8	Cab
–E4	Front direction indicator, left	/12.D3	Cab
–E5	Rear light, right (indicator/parking /braking)	/12.D11	Cab
–E6	Rear light, left (indicator/parking/braking)	/12.D7	Cab
–E51	Warning light, rear right	/12.D9	Mudguard, right
–E52	Warning light, rear left	/12.D5	Mudguard, left
–E53	Extremity warning light, rear right	/12.D10	Mudguard, right
–E54	Extremity warning light, rear left	/12.D6	Mudguard, left
–F5	10A, parking lights, left	/12.B11	Cab
–F6	10A, parking lights, right	/12.B11	Cab
–F8	25A, light switch	/12.A11	Cab
–GR1	Ground	/12.D7,D10	Cab
–GR5	Ground	/12.D3,D7,D8	Cab
–GR10	Ground	/12.D14	Cab
–K10	Relay, flasher unit (NA)	/12.B7	Cab
–K73	Relay, PTO prevention	/12.C13	Cab

Symbol	Description	Page and position	Location
–S1	Rocker switch 3–pos. head lights	/12.A10	Cab
–S4	Combined switch	/12.A3	Cab
–S7	Rocker switch 2–pos. hazard warning flashers	/12.A7	Cab
–S29	Push button, PTO 1000/540E	/12.C13	Cab
–S102	Switch, PTO prevention	/12.B15	Transmission
–X1	Connector, 9–pole	/12.A11	Cab
–X5	Connector, 9–pole	/12.B11	Cab
–X6	Connector, 9–pole	/12.B11	Cab
–X10	Connector, 9–pole, combined switch	/12.B1	Cab
–X12	Connector, 9–pole	/12.C6,C7,D7	Cab
–X14	Connector, 9–pole	/12.C9,C11,D10	Cab
–X20	Connector, 9–pole	/12.C3,C8,D3,D8	Cab
–X93	Connector, 3–pole	/12.D10	Mudguard, right
–X94	Connector, 3–pole	/12.D6,D8	Mudguard, left
–X98	Connector, 2–pole	/12.A3,A6	Cab
–X99	Connector, 2–pole	/12.C7,C11	Cab

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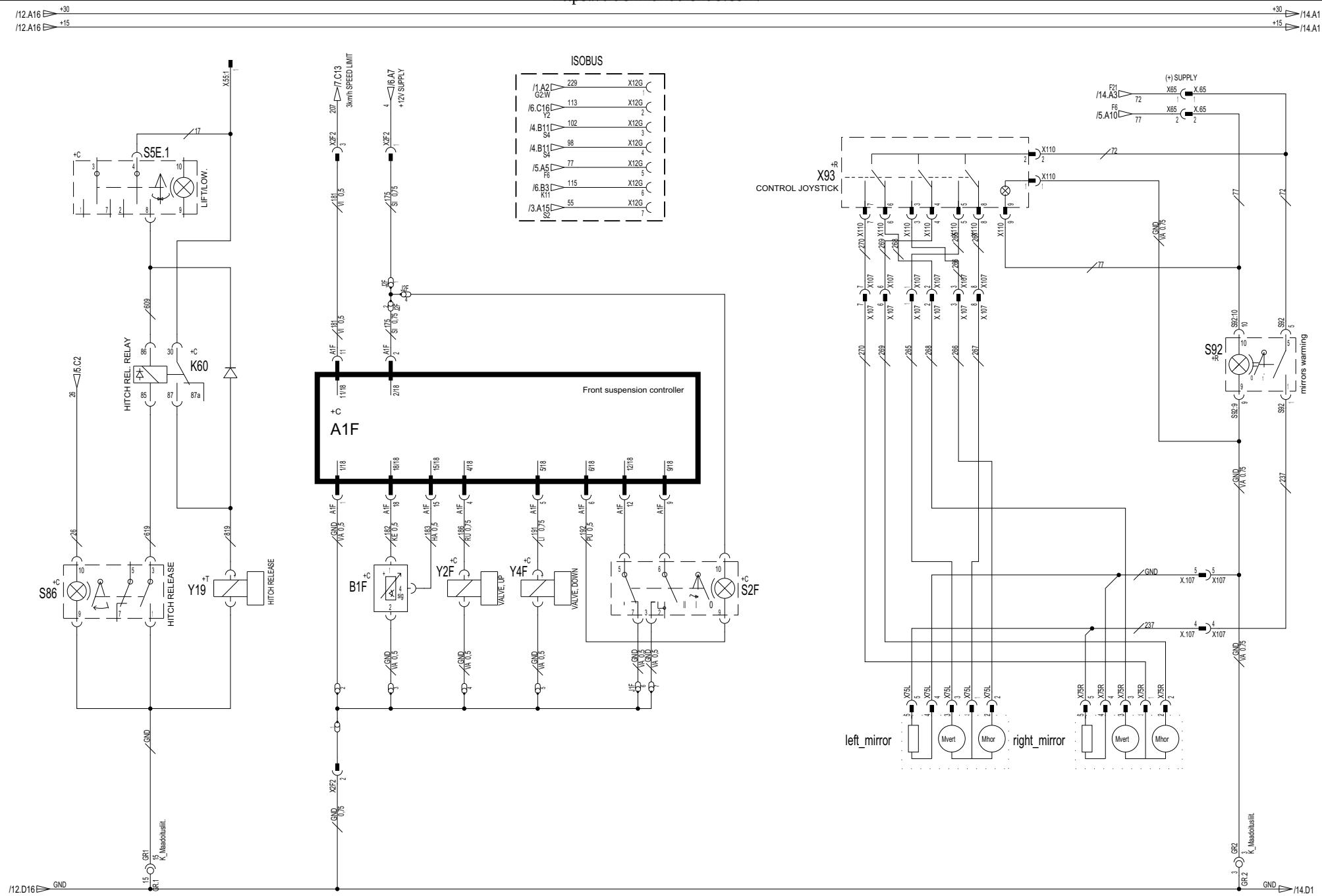
NA LIGHTS, PTO
WIRING DIAGRAM AC9.2

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Symbol	Description	Page and position	Location
–A1F	Control unit, front suspension	/13.B5	Cab
–B1F	Angle sensor	/13.C5	Front axle
–GR1	Ground	/13.D2	Cab
–GR2	Ground	/13.D16	Roof
–K60	Relay, hitch release	/13.B2	Cab
–S2F	Switch, suspension off/on/calibr.	/13.C8	Cab
–S5E	Rocker switch 3–pos. inside operation, lifting/lowering	/13.A2	Cab
–S86	Switch, hitch release	/13.C1	Cab
–S92	Switch, side mirror heating	/13.B15	Roof
–X2F	Connector, 3–pole	/13.A5,D5	Cab
–X12G	Connector, 9–pole, ISOBUS	/13.A8	Cab
–X55	Connector, 1–pole	/13.A3	Cab
–X65	Connector, 3–pole	/13.A15	Roof
–X75L	Connector, 5–pole	/13.D12	Roof
–X75R	Connector, 5–pole	/13.D14	Roof
–X93	Control joystick, electrical mirrors	/13.A10	Roof
–X107	Connector, 9–pole	/13.B11,C15	Roof
–X110	Connector, 9–pole	/13.A13,B11	Roof
–Y2F	Solenoid valve, 3/2	/13.C6	Cab
–Y4F	Solenoid valve, 2/2	/13.C7	Cab
–Y19	Solenoid valve, trailer hitch release	/13.C3	Transmission

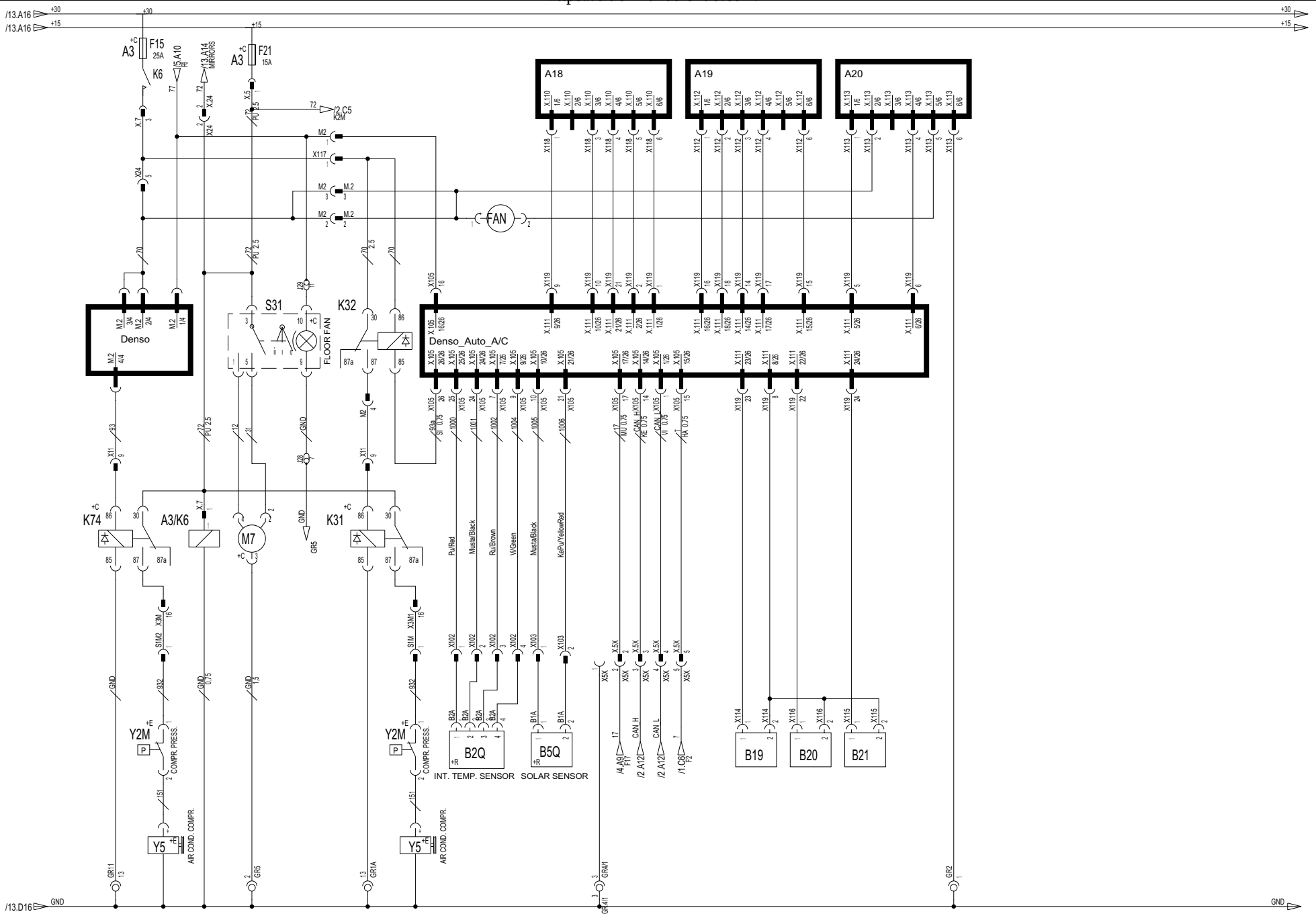
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Symbol	Description	Page and position	Location
–A18	Recirculation actuator	/14.A7	Roof
–A19	Water mixing actuator	/14.A9	Roof
–A20	Fan speed regulator	/14.A11	Roof
–B2Q	Temperature sensor, internal	/14.D6	Roof
–B5Q	Solar sensor	/14.D7	Roof
–B19	Temperature sensor	/14.D10	Roof
–B20	Temperature sensor	/14.D10	Roof
–B21	Temperature sensor, evaporator	/14.D11	Roof
–Denso	Air conditioner	/14.B2	Roof
–Denso_aut	Air conditioning control unit	/14.B6	Roof
–F15	25A, fan, air conditioning	/14.A3	Cab
–F21	15A, Air conditioning, control, floor fan, fuel feed pump	/14.A4	Cab
–FAN	Fan, heater, air conditioner	/14.A7	Roof
–GR1	Ground	/14.D2,D5	Cab
–GR2	Ground	/14.D12	Roof
–GR4	Ground	/14.D8	Cab
–GR5	Ground	/14.D4	Cab
–K6	Relay, air conditioning, fan, control	/14.A3,C3	Cab
–K31	Relay, air conditioner compressor	/14.C5	Cab
–K32	Relay, air conditioner	/14.B5	Cab
–K74	Relay, air conditioner compressor	/14.C2	Cab
–M2	Fan, heater, air conditioner	/14.A5,B2,B5	Roof
–M7	Floor fan	/14.C4	Cab
–S1M	Pressure switch, air cond. compr.	/14.D3,D6	Engine
–S31	Switch, 3–pos., floor fan	/14.B4	Cab
–X3M	Connector, 29–pole	/14.C3,C6	Engine
–X5	Connector, 9–pole	/14.A4	Cab
–X5X	Connector, 9–pole	/14.C8	Cab
–X7	Connector, 9–pole	/14.A2,C3	Cab
–X11	Connector, 9–pole	/14.C2,C5	Roof
–X24	Connector, 9–pole	/14.A2,A3	Roof
–X102	Connector, 4–pole	/14.C6	Roof
–X103	Connector, 2–pole	/14.C7	Roof
–X105	Connector, 26–pole	/14.B6–B8	Roof
–X112	Connector, 6–pole	/14.A9	Roof
–X113	Connector, 6–pole	/14.A11	Roof
–X114	Connector, 2–pole	/14.D10	Roof
–X115	Connector, 2–pole	/14.D11	Roof
–X116	Connector, 2–pole	/14.D10	Roof
–X117	Connector, 1–pole	/14.A5	Roof
–X118	Connector, 6–pole	/14.A8	Roof
–X119	Connector, 26–pole	/14.B7–B12	Roof
–Y2M	Air conditioner compressor	/14.D3,D6	Engine

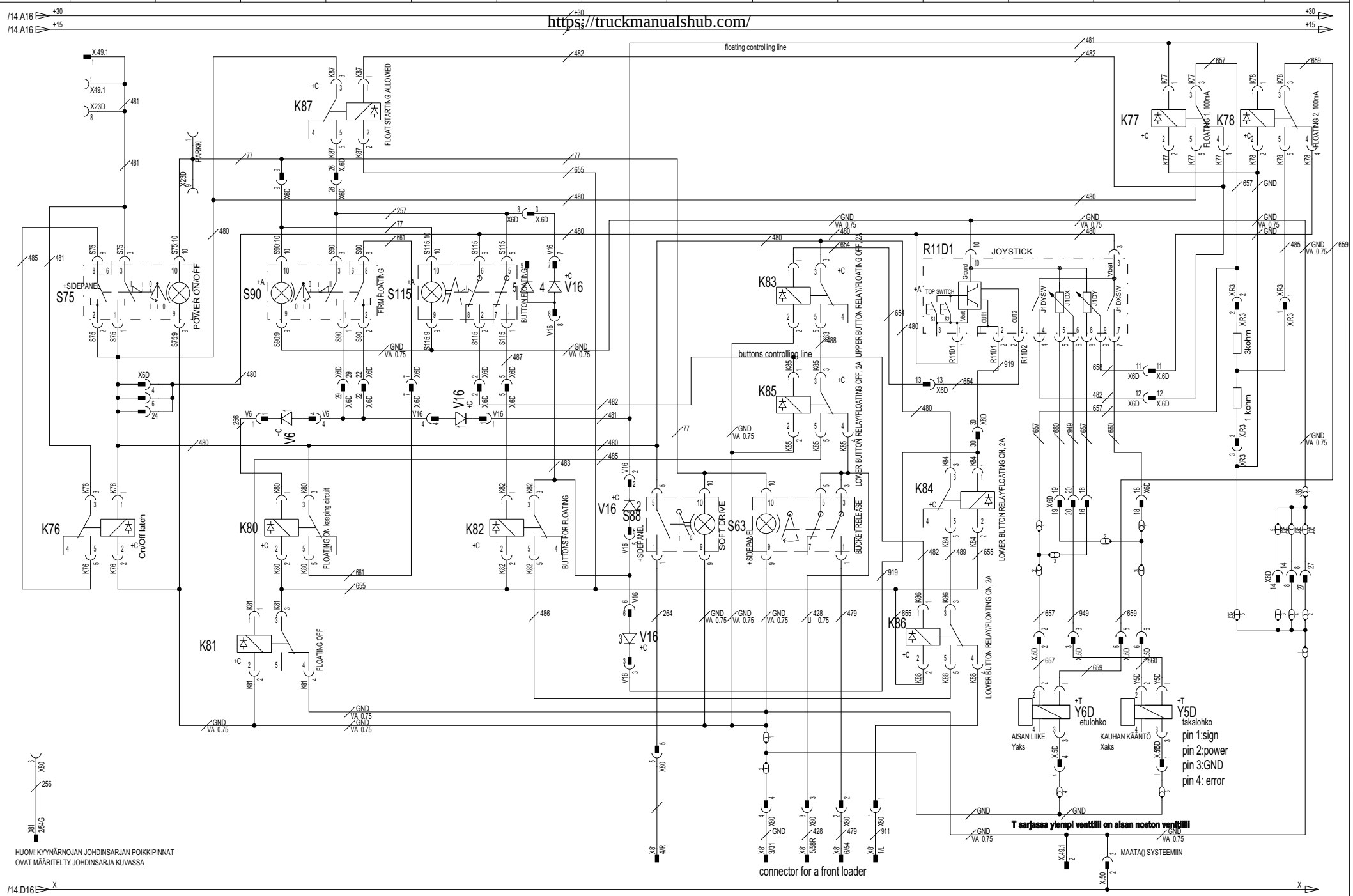
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Symbol	Description	Page and position	Location
–K76	Relay, ON/OFF latch	/15.C2	Cab
–K77	Relay, floating 1, 100 mA	/15.A14	Cab
–K78	Relay, floating 2, 100 mA	/15.A15	Cab
–K80	Relay, floating on	/15.C4	Cab
–K81	Relay, floating off	/15.C4	Cab
–K82	Relay, buttons for floating	/15.C7	Cab
–K83	Upper button relay, floating off, 2 A	/15.B10	Cab
–K84	Lower button relay, floating on, 2 A	/15.C12	Cab
–K85	Lower button relay, floating off, 2 A	/15.B10	Cab
–K86	Lower button relay, floating on, 2 A	/15.C11	Cab
–K87	Relay, float starting allowed	/15.A5	Cab
–R11D1	Joystick	/15.B12	Arm rest
–S63	Bucket release	/15.C10	Sidepanel
–S75	Switch, power on/off	/15.B2	Sidepanel
–S88	Soft drive	/15.C8	Sidepanel
–S90	Firm floating	/15.B4	Arm rest
–S115	Button floating	/15.B6	Arm rest
–V6	Diode, floating	/15.B4	Cab
–V16	Diode, direction	/15.B6,B7,C8	Cab
–X.5	Connector, 9–pole	/15.C13,D13, D14	Cab
–X.5D	Connector, 9–pole	/15.C13,C14, D13,D14	Cab
–X6D	Connector, 9–pole	/15.A4,A5,A7, B2,B5,B6,B7, B12,B14,C13, C14,C16	Cab
–X.6D	Connector, 9–pole	/15.A5,A7,B5, B6,B7,B14	Cab
–X23D	Connector, 3–pole	/15.A3	Cab
–X49.1	Connector, 2–pole	/15.A2	Cab
–X.49.1	Connector, 2–pole	/15.A2,D13	Cab
–X.50	Connector, 3–pole current socket	/15.D14	Cab
–X80	Connector, 4–pole, front loader	15.D1,D8,D10, D11	Cab
–X81	Connector, pin socket	/15.D1,D8,D10, D11	Transmission
–X.97	Connector	/15.A2	Cab
–XR3	Connector, 3–pole, flintstone resistor	/15.B15,B16	Cab
–Y5D	Bucket turn, X axle	/15.D14	Transmission
–Y6D	Arm move, Y axle	/15.D13	Transmission

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VALTRA	FLINTSTONE WIRING DIAGRAM AC9.2	15/15

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Contents

Training material

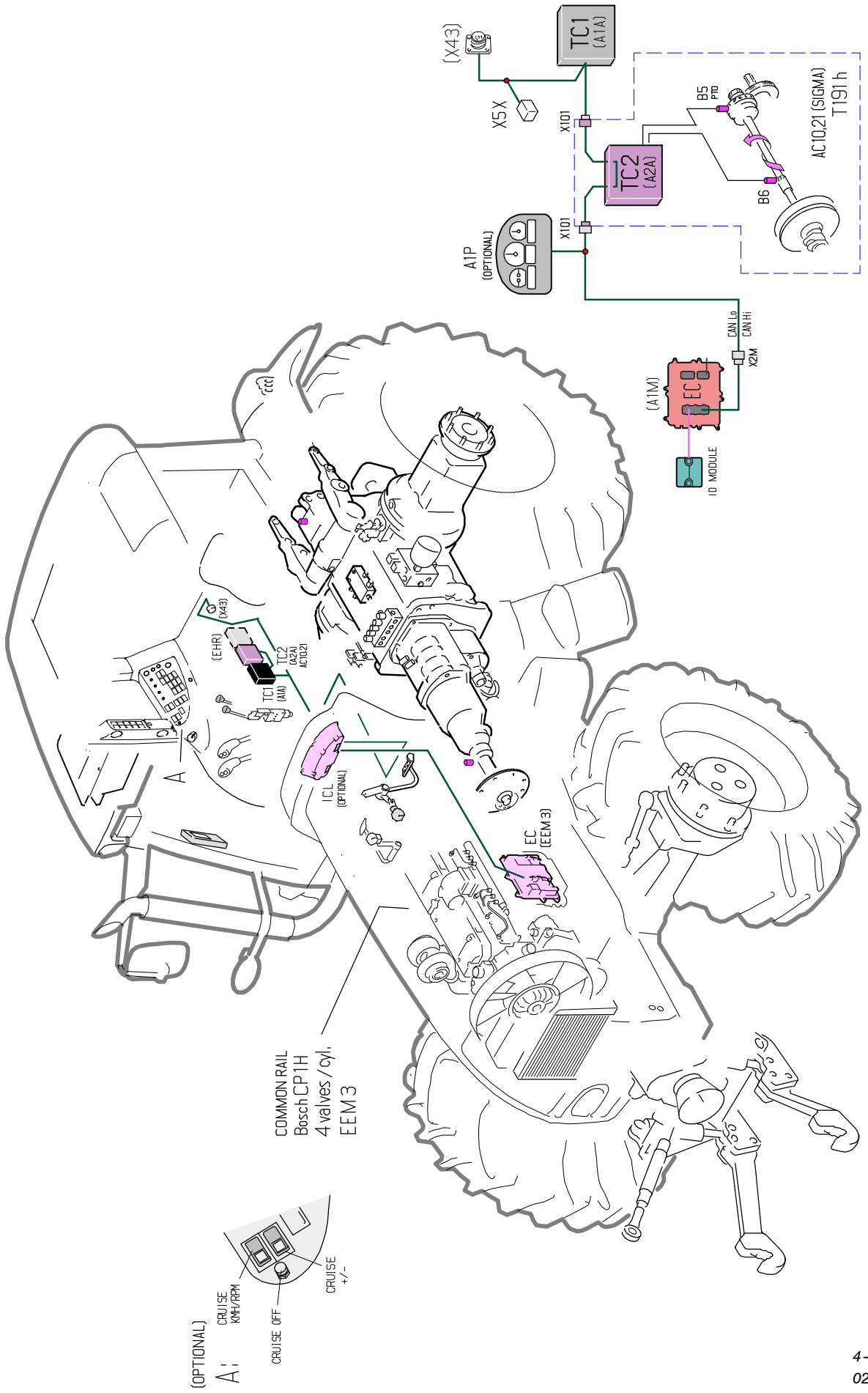
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Electrical equipment, engine 8
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Fault finding

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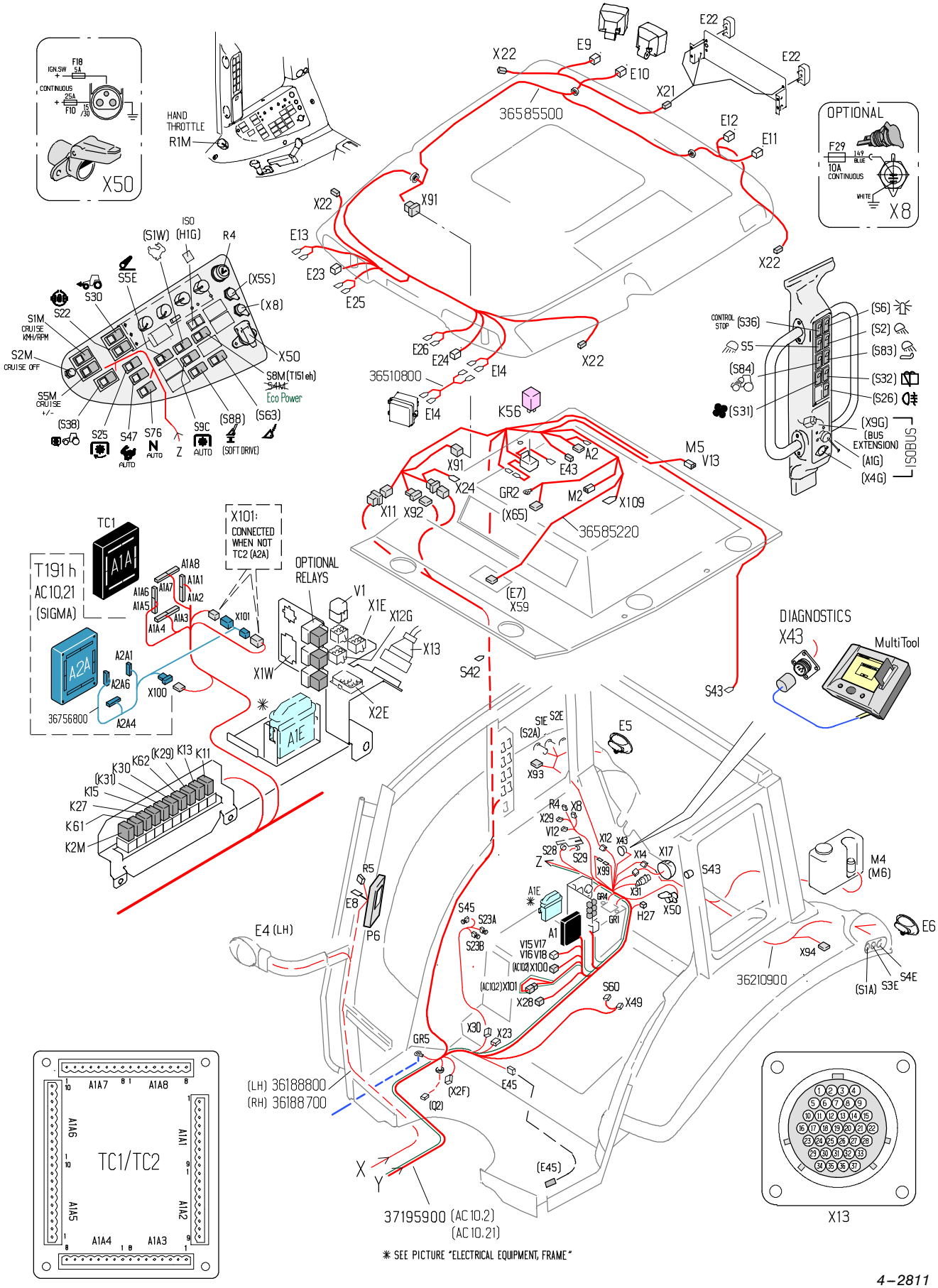
Autocontrol AC10.2 and AC10.21



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Electrical equipment, cab



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Cab wiring harness 37195900

–A1E Control unit EH power lift
–E45 Step light
–H27 Buzzer, reversing
–K11 Relay, brake light
–K13 Relay, differential lock
–K15 Relay, 4WD
–K27 Control relay 4WD, on/off
–(K29) Relay back buzzer
–K30 Relay, main switch stop preventing
–K31 Relay, AC compressor control
–K61 Hand brake safety relay (F–position)
–K62 Relay, rear PTO
–K2M Relay, fuel pump
–(M5) Rear window wiper
–M6 Rear window washer
–R4 Cigarette lighter
–R1M Potentiometer, hand throttle
–S2 Rocker switch, 2–pos. rear work.lights
–S5 Rocker switch, 2–pos. extra front working lights
–S6 Rocker switch, 2–pos. rot. warning light
–S22 Rocker switch, 3–pos. differential lock
–S25 Rocker switch, 3–pos. PTO
–(S26) Rocker switch, rear fog light
–S27 Switch, back buzzer
–S28 Limit switch, PTO 540
–S29 Limit switch, PTO 1000/540E
–S30 Rocker switch, 3–pos. 4WD
–S31 Rocker switch, 3–pos. floor fan
–S32 Rocker switch, 3–pos. rear window wiper and washer
–S36 Rocker switch 2–pos. control stop
–S38 Rocker switch, 2–pos., front PTO
–S45 Push buttons, Hi–shift
–S47 Rocker switch DPS auto / man.
–S63 Rocker switch, bucket release
–S76 Rocker switch, autom. traction control
–S83 Rocker switch, 2–pos. drawhook light
–S84 Rocker switch, 2–pos. extra front working lights
–S88 Soft drive on
–S9C Rocker switch, 2–pos. rear PTO automatic stop, man./auto
–S1M Rocker switch 3–pos. cruise kmh/rpm
–S2M Switch, cruise on/off
–S5M Rocker switch 3–pos. cruise +/–
–S8M Rocker switch, ECO

Top roof wiring harness 36585500

–E9 Rear working light, right outer
–E10 Rear working light, right, middle
–E11 Rear working light, left, outer
–E12 Rear working light, left, middle
–E13 Front working light, right
–E14 Front working light, left
–E23 Upper head light, right
–E24 Upper head light, left
–E25 Parking light, upper, right
–E26 Parking light, upper, left

Inner roof wiring harness 36585200

–A2 Radio
–E7 Cab light
–K56 Time–delay r., cabin light and door step
–M2 Heating fan
–M5 Rear window wiper
–S42 Door switch, cab light, right
–S43 Door switch, cab light, left

RH front direction indicator wiring harness 36188700

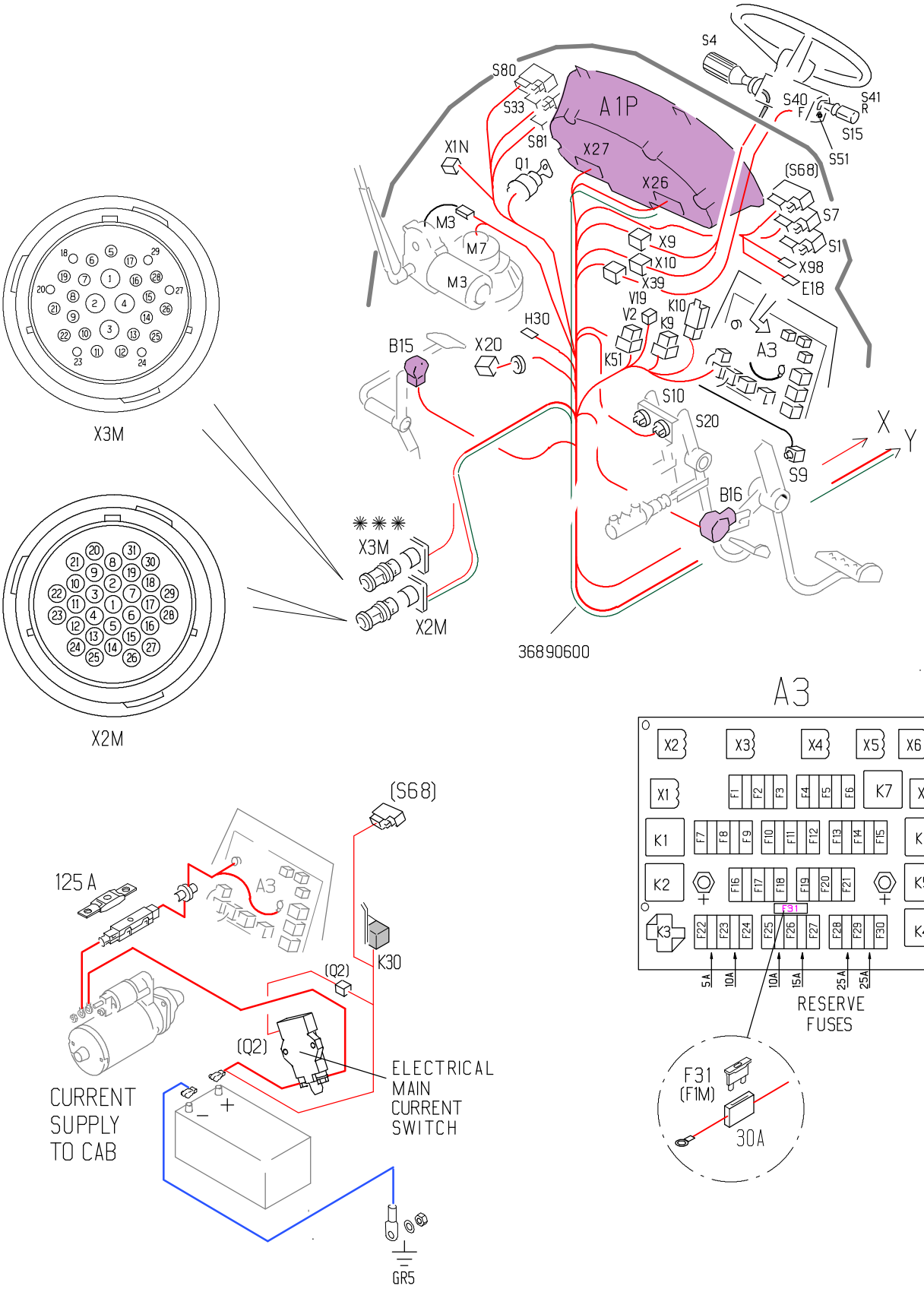
–E3 Front direction indicator, right
–E47 Extra front working light, right

LH front direction indicator wiring harness 36188800

–E4 Front direction indicator, left
–E48 Extra front working light, left

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Electrical equipment, front housing



✱✱✱ SEE PICTURE "ELECTRICAL EQUIPMENT, ENGINE"

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Cab wiring harness 36890600

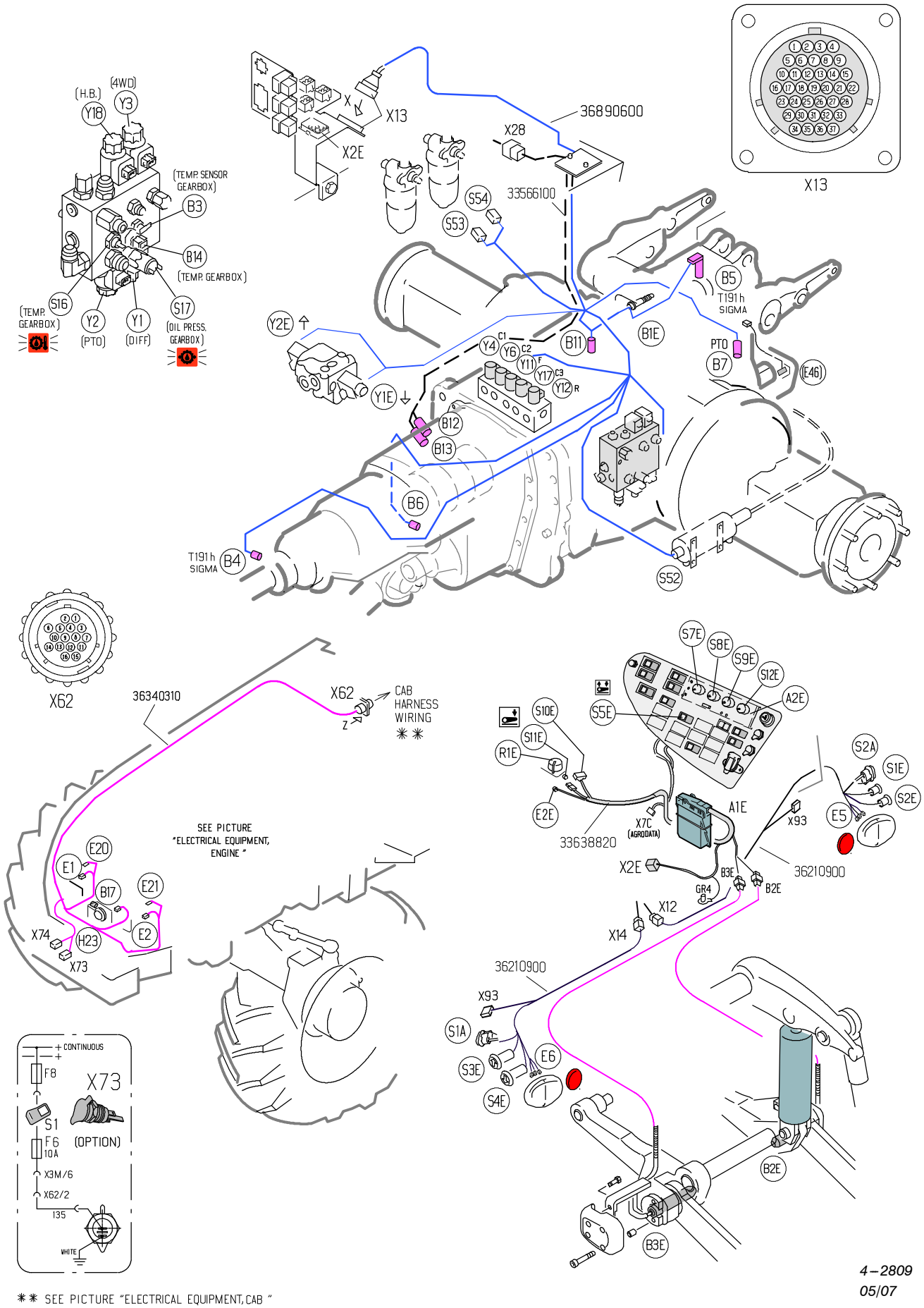
–A3 Electric centre
–A1P Instrument
–B15 Position sensor, front accelerator pedal
–B16 Angle sensor , clutch pedal
–E18 Pressure air gauge lighting
–F31 30A, EC–control unit supply
–H30 Buzzer, instrumentation
–K1 Front working lights
–K2 Rear working lights
–(K3) Rear fog light
–K4 Relay, starter switch
–K5 Relay, starter switch
–K6 Relay, fan III speed
–K7 4–wheel braking, control
–K9 Relay, interval wiper
–K10 Relay, flasher unit
–K30 Relay, main switch stop preventing
–K51 Relay, main switch
–M3 Windscreen wiper
–M7 Floor fan
–Q1 Ignition switch
–Q2 Main switch
–S1 Rocker switch, 3–pos. head lights
–S4 Combined switch
–S7 Rocker switch, 2–pos. hazard warning flashers
–S9 Safety switch, starter (clutch pedal)
–S10 Limit switch, right brake light
–S20 Limit switch, left brake light
–S33 Rocker switch 2–pos. upper head light
–S68 Rocker switch, mainswitch control
–S80 Rocker switch, 3–pos. instrumentation, display size setting
–S81 Rocker switch, 3–pos. instrument, setting switch for LCD–display

Power shuttle lever wiring harness 34643700

–S15 Reed relay, parking brake (P)
–S40 Reed relay, direction forward (F)
–S41 Reed relay, direction reverse (R)
–S51 Push button, DPS–preselection

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Electrical equipment, frame



✳✳ SEE PICTURE "ELECTRICAL EQUIPMENT, CAB"

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Solenoids wiring harness 36890600

–B3 Sensor, gearbox temperature
–B4 Speed sensor, Sigma, engine
–B5 Speed sensor, Sigma, PTO
–B6 Speed sensor, gearbox
–B7 Speed sensor, rear PTO
–B11 Speed sensor, engine
–B14 Temperature sensor, gearbox
–B1E Position sensor, rear power lift
–E46 Trailer hitch light
–S16 Temperature sensor, gearbox oil
–S17 Pressure sensor, gearbox oil pressure
–S52 Limit switch, parking brake cable
–S53 Indicator light switch pressure, filter, return
–S54 Indicator light switch, pressure filter (low pressure circuit)
–Y1 Solenoid valve, differential lock
–Y2 Solenoid valve, rear PTO
–Y3 Solenoid valve, 4WD
–Y4 Solenoid valve, DPS C1–clutch
–Y6 Solenoid valve, DPS C2–clutch
–Y11 Solenoid, forward
–Y12 Solenoid, reverse
–Y17 Solenoid valve, DPS C3–clutch
–Y18 Solenoid, parking brake
–Y1E Solenoid valve, power lift, lowering
–Y2E Solenoid valve, power lift, lifting

Wiring harness, gear tooth sensors 33566100

–B12 Sensor, F/R shuttle
–B13 Sensor, F/R shuttle

Engine hood wiring harness 36340310

–B17 Temperature sensor, outdoors temperature
–E1 Head light,right
–E2 Head light, left
–E20 Parking light, right, Norway
–E21 Parking light, left, Norway
–H23 Horn

Power lift wiring harness 33638820

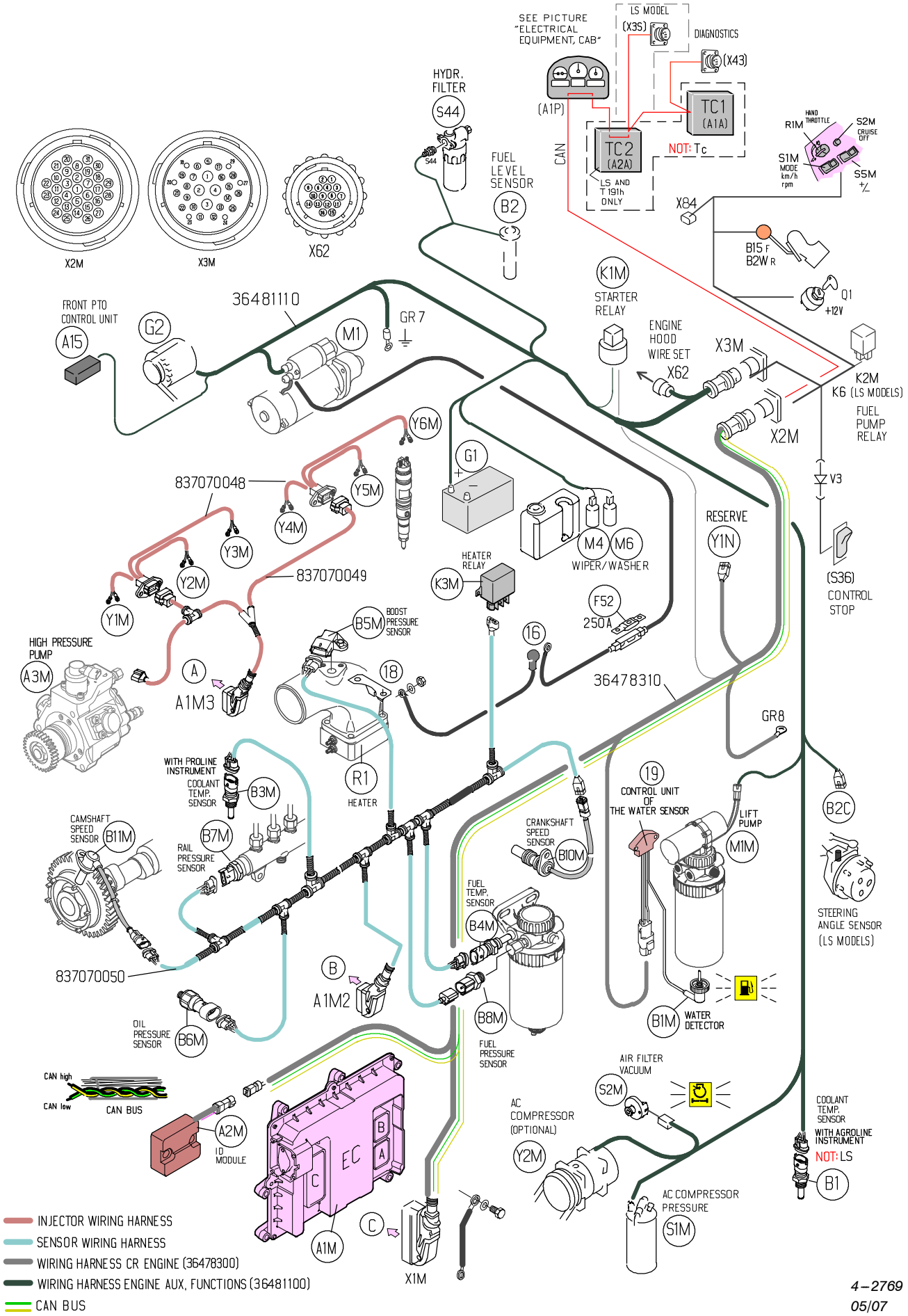
–A1E Control unit, power lift
–A2E Switch panel, power lift
–B2E Draft sensor, power lift, r.h
–B3E Draft sensor, power lift, l.h
–E2E Lightning, position potentiometer
–R1E Potentiometer, power lift, position control
–S5E Rocker switch 3–pos. inside operation, lifting/lowering
–S7E Lowering speed selector, hydraulic lift
–S8E Transport height selector, hydraulic lift
–S9E Draft control selector, hydraulic lift
–S10E Rocker switch, 3–pos. power lift lifting/lowering
–S11E Rocker switch, power lift, forced lowering
–S12E Drive balance control

Mudguard wiring harness 36210900

–E5 Rear light, right (indicator/parking/braking)
–E6 Rear light, left (indicator/parking/braking)
–S1A Push button, PTO rear start, left
–S1E Push button, rear operation, lifting, r.h.
–S2A Push button, PTO rear start, right
–S2E Push button, rear operation, lowering, r.h.
–S3E Push button, rear operation, lifting, l.h.
–S4E Push button, rear operation, lowering, l.h.

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Electrical equipment, engine



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Sensors wiring harness 837070050

– B3M Coolant temperature sensor
– B4M Fuel temperature sensor
– B5M Boost pressure sensor
– B6M Oil pressure sensor
– B7M Fuel pressure sensor (rail)
– B8M Fuel pressure sensor
– B10M Speed sensor (crankshaft)
– B11M Speed sensor (camshaft)
– K3M Inlet air heater relay

Injectors wiring harness 837070049

– A1M1 Electronic control unit (ECU)
– A3M High–pressure pump

Injectors wiring harness 837070048

– Y1M Fuel injector cyl. 1
– Y2M Fuel injector cyl. 2
– Y3M Fuel injector cyl. 3
– Y4M Fuel injector cyl. 4
– Y5M Fuel injector cyl. 5
– Y6M Fuel injector cyl. 6

Inlet air heater

– 16) Heater wiring
– 18) Earthing plate
– F52 Fuse
– R1 Inlet air heater

CR Engine wiring harness 36478310

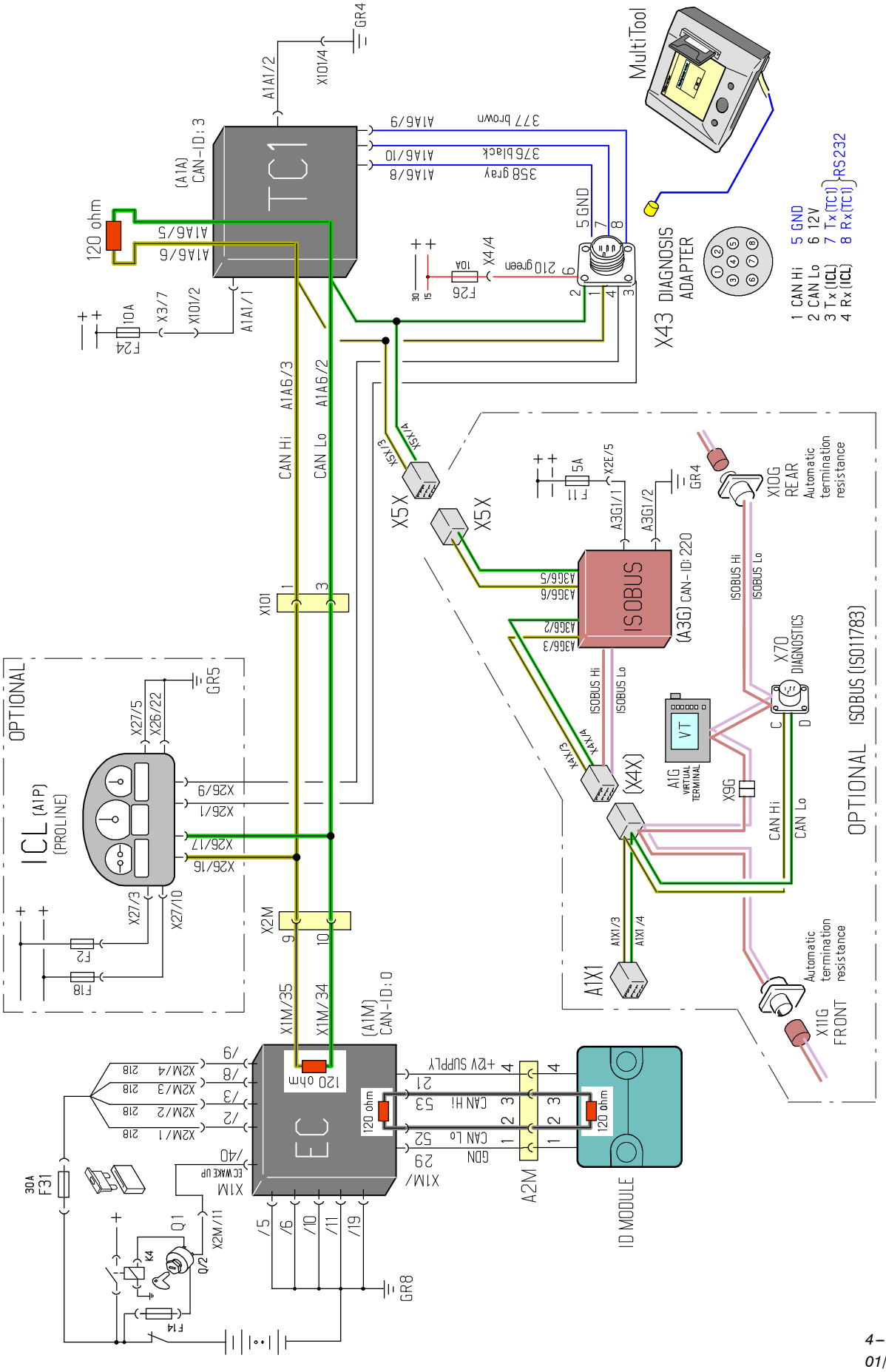
– A2M ID module
– B1M Water detector sensor (fuel)
– 19) Sensor's electronics
– K1M Relay, starter motor
– Y1N Exhaust brake (not used)

Wiring harness of the engine aux. functions 36481110

– A15 Control unit, front PTO
– B1 Temperature sensor, engine coolant
– B2 Level sensor, fuel
– B2C Steering angle sensor (LS models)
– G1 Battery
– G2 Alternator
– M4 Windscreen washer
– M6 Rear window washer
– M1 Starter motor
– M1M Fuel feed pump
– S44 Indicator light switch, pressure filter (high pressure circuit)
– S1M Pressure switch, compressor pressure
– S2M Pressure sensor, engine air filter
– Y2M Magnetic clutch, compressor, air conditioner

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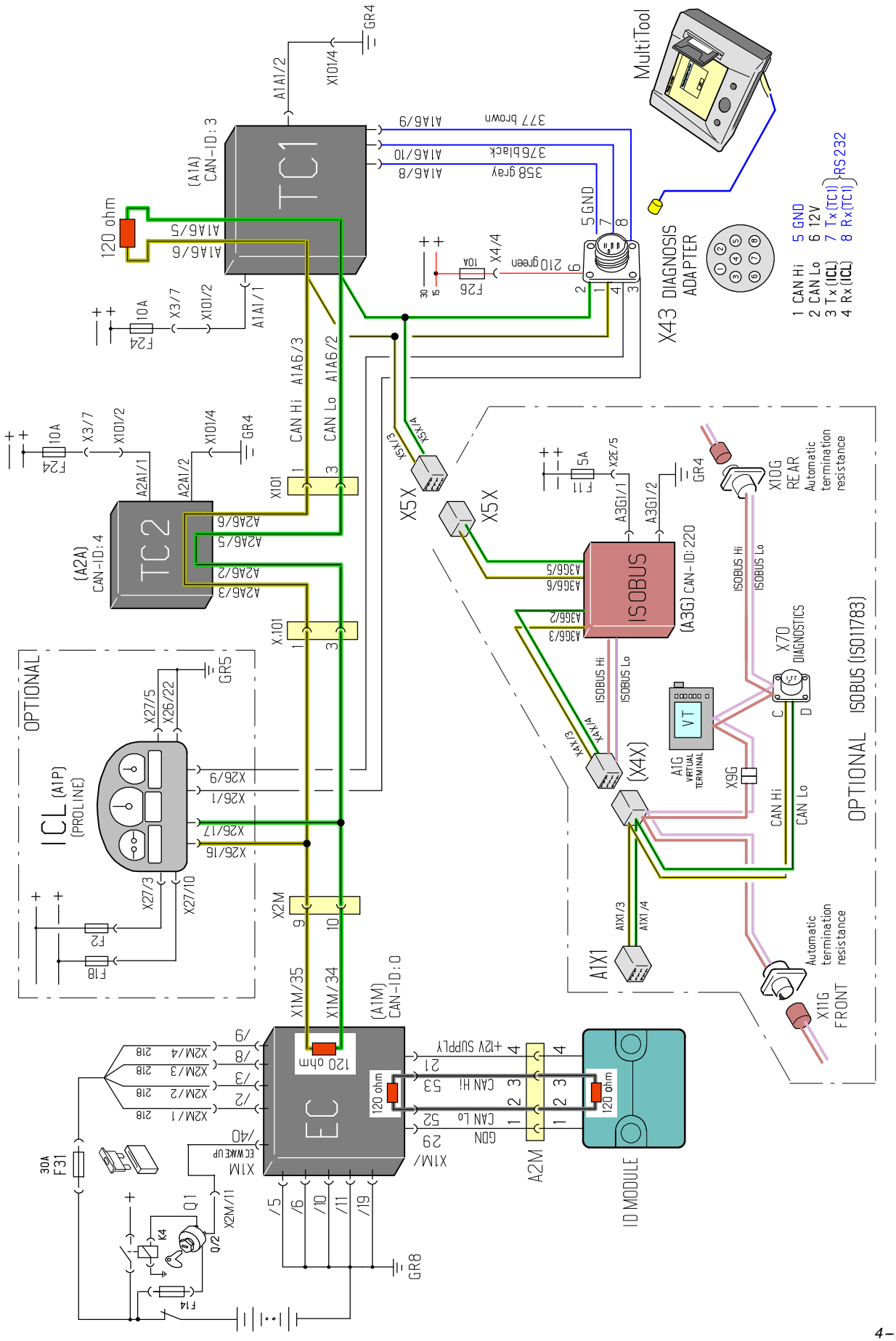
CAN bus, AC10.2



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CAN bus, AC10.21



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Wiring diagram

Symbol	Description	Page and position	Location
–A1A	Control unit, transmission, TC1	/2.B11	Cab
–A1A	Control unit, transmission, TC1	/3.B5	Cab
–A1A	Control unit, transmission, TC1	/4.B5	Cab
–A1A	Control unit, transmission, TC1	/5.C14	Cab
–A1A1	Connector, 9–pole	/3.B3–B16	Cab
–A1A1	Connector, 9–pole	/4.C9	Cab
–A1A2	Connector, 9–pole	/2.B10	Cab
–A1A2	Connector, 9–pole	/3.B4,B5	Cab
–A1A2	Connector, 9–pole	/4.C4–C7	Cab
–A1A2	Connector, 9–pole	/5.C14	Cab
–A1A3	Connector, 8–pole	/3.B3–B12	Cab
–A1A3	Connector, 8–pole	/4.B8	Cab
–A1A3	Connector, 8–pole	/5.C11,C14	Cab
–A1A4	Connector, 8–pole	/3.B13–B15	Cab
–A1A4	Connector, 8–pole	/4.B8	Cab
–A1A5	Connector, 10–pole	/2.C8	Cab
–A1A5	Connector, 10–pole	/3.B5–B7	Cab
–A1A5	Connector, 10–pole	/4.B3	Cab
–A1A6	Connector, 10–pole	/2.B7–B9	Cab
–A1A7	Connector, 8–pole	/2.A11,A13	Cab
–A1A7	Connector, 8–pole	/2.C9,C11	Cab
–A1A7	Connector, 8–pole	/4.B8,C10	Cab
–A1A7	Connector, 8–pole	/5.C16	Cab
–A1A8	Connector, 8–pole	/2.C12,C13	Cab
–A1A8	Connector, 8–pole	/4.B13	Cab
–A1A8	Connector, 8–pole	/5.C12–C16	Cab
–A1E	Control unit, power lift, EHRB	/12.C6	Cab
–A1E	Control unit, power lift, EHRD	/13.C7	Cab
–A1F	Control unit, front suspension	/16.C8	Cab
–A1M	Control unit, EC	/1.C8	Engine
–A1M	Control unit, EC	/2.B3	Engine
–A1M2	Connector, 36–pole	/1.C7	Engine
–A1M3	Connector, 16–pole	/1.C14	Engine
–A1P	Instrument	/1.A14	Cab
–A1P	Instrument	/11.B2	Cab
–A1P	Instrument	/3.C1	Cab
–A1P	Instrument	/5.C3	Cab
–A1P	Instrument	/7.C15	Cab
–A2	Radio	/10.C15	Cab
–A2A	Control unit, transmission, TC2	/16.C13	Cab
–A2A1	Connector, 9–pole	/16.B15,C14,C15	Cab
–A2A4	Connector, 8–pole	/16.B13	Cab
–A2A6	Connector, 10–pole	/16.B14	Cab
–A2E	Switch panel, power lift, EHRB	/12.B12	Cab
–A2E	Switch panel, power lift, EHRD	/13.C12	Cab
–A2M	ID–module	/1.A10	Engine
–A2M1	Connector, 4–pole	/1.B10	Engine
–A3M	High pressure pump	/1.D13	Engine
–A5	Air suspension seat	/10.C14	Cab
–A15	Control unit, front–PTO	/11.C15	Engine
–A16	Fieldmaster	/15.B13	Cab
–A17	Adapter, Fieldmaster sensor signals	/15.C10	Cab
–A18	Recirculation actuator	/10.A7	Roof
–A19	Water mixing actuator	/10.A9	Roof
–A20	Fan speed regulator	/10.A11	Roof
–B1	Temperature sensor, engine coolant	/11.C13	Engine
–B1A	Solar sensor	/10.D7	Roof
–B1A	Angle sensor, wheel	/18.D12	Front axle
–B1E	Position sensor, rear power lift, EHRB	/12.C1	Transmission
–B1E	Position sensor, rear power lift, EHRD	/13.B1	Transmission
–B1F	Angle sensor	/16.C8	Front axle
–B1M	Sensor, water detector	/1.A11	Engine

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Symbol	Description	Page and position	Location
–B1W	Angle sensor, rear clutch pedal	/4.D10	Cab
–B2A	Temperature sensor, internal	/10.D6	Roof
–B2A	Sensor, steering angle and steering speed	/18.C14	Cab
–B2E	Draft sensor, r.h	/12.C1	Transmission
–B2E	Draft sensor, r.h	/13.C1	Transmission
–B2M	Fan control	/1.A12	Engine
–B2W	Position sensor, rear accel. pedal	/2.D3	Cab
–B3	Temperature sensor, gearbox oil	/11.C3	Transmission
–B3E	Draft sensor, l.h	/12.C1	Transmission
–B3E	Draft sensor, l.h	/13.C1	Transmission
–B3M	Sensor, coolant temperature	/1.D8	Engine
–B4	Sensor, Sigma engine	/16.D15	Transmission
–B4E	Sensor, implement position (ACD)	/13.C1	Transmission
–B4M	Sensor, Fuel temperature	/1.D8	Engine
–B5	Sensor, Sigma PTO	/16.D14	Transmission
–B5M	Sensor, boost pressure	/1.D9	Engine
–B6	Speed sensor, gearbox	/15.D10	Transmission
–B6	Speed sensor, gearbox	/3.D4	Transmission
–B6M	Sensor, oil pressure	/1.D10	Engine
–B7	Speed sensor, PTO	/15.D11	Transmission
–B7	Speed sensor, PTO	/3.D3	Transmission
–B7M	Sensor, rail pressure	/1.D10	Engine
–B8M	Sensor, fuel pressure	/1.D11	Engine
–B10	Speed radar	/13.D2	Transmission
–B10	Speed radar	/15.D14	Transmission
–B10M	Sensor, crankshaft speed	/1.D12	Engine
–B11	Speed sensor, engine	/3.D5	Transmission
–B11M	Sensor, camshaft speed	/1.D12	Engine
–B12	Sensor, F/R shuttle	/3.D8	Transmission
–B13	Sensor, F/R shuttle	/3.D9	Transmission
–B14	Sensor, gearbox temperature	/3.D6	Transmission
–B15	Position sensor, accelerator pedal	/2.D1	Cab
–B16	Position sensor, clutch pedal	/2.D8	Cab
–B17	Temperature sensor, outdoors	/3.A7	Engine hood
–B18	Level sensor, fuel	/11.C14	Transmission
–B19	Temperature sensor	/10.D10	Roof
–B20	Temperature sensor	/10.D10	Roof
–B21	Temperature sensor, evaporator	/10.D11	Roof
–Denso	Air conditioner	/10.B2	Roof
–Denso_aut	Air conditioning control unit	/10.B6	Roof
–E1	Head light, right	/7.D6	Engine
–E1E	Lightning, switch panel	/12.C12	Cab
–E1E	Lightning, switch panel	/13.B11	Cab
–E2	Head light, left	/7.D5	Engine
–E2E	Lightning, position potentiometer	/12.C14	Cab
–E2E	Lightning, position potentiometer	/13.A11	Cab
–E3	Front direction indicator, right	/14.D9	Cab
–E3	Front direction indicator, right	/7.D7	Cab
–E4	Front direction indicator, left	/14.D8	Cab
–E4	Front direction indicator, left	/7.D8	Cab
–E5	Rear light, right (indicator/parking/braking)	/14.D12	Mudguard, right
–E5	Rear light, right (indicator/parking/braking)	/7.D12	Cab
–E6	Rear light, left (indicator/parking/braking)	/14.D7	Mudguard, left
–E6	Rear light, left (indicator/parking/braking)	/7.D10	Cab
–E7	Cab light	/8.B11	Cab
–E8	Lighting for pillar display	/4.A10	Cab
–E8W	Lighting for rear pillar display	/4.A13	Cab
–E9	Rear working light, right, outer	/6.C1	Roof
–E9X	Rear working light (Xenon), right, outer	/6.C5	Roof
–E10	Rear working light, right, middle	/6.C3	Roof
–E11	Rear working light, left, outer	/6.C2	Roof
–E11X	Rear working light (Xenon), left, outer	/6.C2	Roof
–E12	Rear working light, left, middle	/6.C4	Roof

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Symbol	Description	Page and position	Location
–E13	Front working light, right, inner	/6.C5	Roof
–E14	Front working light, left, inner	/6.C6	Roof
–E16/1	Upper panel light	/8.B8	Roof
–E16/2	Upper panel light	/8.B8	Roof
–E16/3	Upper panel light	/8.B8	Roof
–E16/4	Upper panel light	/8.B8	Roof
–E17	Seat heater	/10.C14	Cab
–E18	Pressure gauge light	/8.C2	Cab
–E20	Parking light, right, Norway	/8.C3	Engine
–E21	Parking light,left, Norway	/8.C4	Engine
–E22L	Register plate light	/8.C8	Roof
–E22R	Register plate light	/8.C7	Roof
–E23	Upper head light, right	/7.D3	Cab
–E24	Upper head light, left	/7.D4	Cab
–E25	Parking light, upper, right	/8.C5	Cab
–E26	Parking light, upper, left	/8.C6	Cab
–E43	control panel light	/8.B10	Cab
–E45	Step light	/8.C11	Cab
–E46	Trailer hitch light	/8.C15	Transmission
–E47	Extra front working light, right	/6.C7	Cab
–E48	Extra front working light, left	/6.C8	Cab
–E51	Warning light, rear right	/14.D10	Mudguard, right
–E52	Warning light, rear left	/14.D5	Mudguard, left
–E53	Extremity warning light, rear right	/14.D11	Mudguard, right
–E54	Extremity warning light, rear left	/14.D6	Mudguard, left
–F1	5A, Auto–Guide	/18.A5	Cab
–F1	15A, hazard blinkers, water pump	/7.A7	Cab
–F2	5A, Radio, instrumentation, tel., main switch, tachograph	/1.C3	Cab
–F3	15A, main beams	/7.B3	Cab
–F4	15A, dipped beams	/7.B4	Cab
–F5	10A, Parking lights, left	/14.B11	Cab
–F5	10A, parking lights, left	/8.A3	Cab
–F6	10A, Parking lights, right	/14.B12	Cab
–F6	10A, parking lights, right	/8.A4	Cab
–F7	25A, front working lights	/6.A6	Cab
–F8	25A, Light switch	/14.A11	Cab
–F8	25A, light switch	/7.A6	Cab
–F9	15A, trailer socket/fog light, rear	/7.A9	Cab
–F10	25A, 3–pole current socket	/9.A13	Cab
–F11	5A, power lift control unit, buzzer	/12.A7	Cab
–F11	5A, power lift control unit, buzzer	/13.A4	Cab
–F12	10A, rot. warning light, cabin light	/6.A10	Cab
–F14	10A, starter switch	/1.A6	Cab
–F15	25A, fan, air conditioning	/10.A2	Cab
–F16	10A, rear working lights, inner	/6.A2	Cab
–F17	10A, direction indicators, Fieldmaster, isoadapter	/7.A8	Cab
–F18	5A, instruments, indicatorlights, Autocontrol	/9.A12	Cab
–F19	10A, windscreen wiper/washer, horn	/9.A6	Cab
–F20	10A, rear window wiper/washer, radio, trailer hitch light	/9.A2	Cab
–F21	15A, Air conditioning, control, floor fan, fuel feed pump	/10.A4	Cab
–F22	10A, 4WD, PTO, Delta Power Shift, front suspension	/5.A9	Cab
–F23	10A, rear working lights, outer	/6.A2	Cab
–F24	10A, AC–5, seat direction	/3.A15	Cab
–F25	15A, suspension seat, seat heater, rear steering prevention, electric front loader valves	/10.A14	Cab
–F26	10A, Back buzzer	/2.A15	Cab
–F27	10A, Braking lights	/5.A2	Cab
–F29	10A, cigarette lighter, 2–pin current socket	/9.A9	Cab
–F31	30A, Engine control unit (EEM supply)	/1.A8	Cab
–F52	250A, Inlet air heater	/1.C7	Engine
–FAN	Fan, heater, air conditioner	/10.A7	Roof
–G1	Battery	/1.C1	Engine
–G2	Alternator	/1.D5	Engine

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Symbol	Description	Page and position	Location
–GR1	Ground	/1.D4	Cab
–GR1	Ground	/10.D2,D5,D14	Cab
–GR1	Ground	/14.D6,D11	Cab
–GR1	Ground	/15.D7	Cab
–GR1	Ground	/2.D5,D15	Cab
–GR1	Ground	/3.D10	Cab
–GR1	Ground	/5.D2–D6	Cab
–GR1	Ground	/8.D11,D15	Cab
–GR1	Ground	/9.D9,D12	Cab
–GR2	Ground	/10.D12,D15	Roof
–GR2	Ground	/16.D6	Roof
–GR2	Ground	/6.D6	Roof
–GR2	Ground	/8.D9,D11,D12	Roof
–GR2	Ground	/9.D2,D4	Roof
–GR4	Ground	/10.D8	Cab
–GR4	Ground	/12.D8,D15	Cab
–GR4	Ground	/13.D2–D14	Cab
–GR4	Ground	/15.D11	Cab
–GR4	Ground	/3.D15	Cab
–GR4	Ground	/4.D4	Cab
–GR5	Ground	/1.A2,D6	Cab
–GR5	Ground	/10.D4	Cab
–GR5	Ground	/11.D1	Cab
–GR5	Ground	/14.D7,D9	Cab
–GR5	Ground	/2.D10	Cab
–GR5	Ground	/5.D9	Cab
–GR5	Ground	/7.D2	Cab
–GR5	Ground	/8.D15	Cab
–GR5	Ground	/9.D7,D8,D11	Cab
–GR7	Ground	/11.D2,D4,D5	Engine
–GR8	Ground	/11.D14	Engine
–GR8	Ground	/2.D4	Cab
–H23	Horn	/9.C6	Engine hood
–H24.1	Rotating roof light, rear right	/6.C12	Roof
–H24.2	Rotating roof light, rear left	/6.C13	Roof
–H24.3	Rotating roof light, front right	/6.C9	Roof
–H24.4	Rotating roof light, front left	/6.C11	Roof
–H27	Reverse Buzzer	/2.D15	Cab
–H28	Indicator light, stop, rear	/11.C8	Cab
–H30	Buzzer, instrumentation	/11.A10	Cab
–K1	Relay, front working lights	/6.C14	Cab
–K1M	Starter auxiliary relay	/1.B5	Engine
–K2	Relay, rear working lights	/6.C16	Cab
–K2M	Relay, fuel pump	/2.D4	Engine
–K3M	Relay, intake air heater	/1.D7	Engine
–K4	Auxiliary relay, starter switch	/1.A3	Cab
–K5	Auxiliary relay, starter switch	/1.A3	Cab
–K6	Relay, air conditioning, fan, control	/10.A2,C3	Cab
–K7	Control relay, 4WD–brake	/5.B9,B10	Cab
–K9	Relay, interval wiper	/9.C7	Cab
–K10	Relay, NA flasher unit	/14.B7	Cab
–K10	Relay, flasher unit	/7.A14	Cab
–K11	Relay, brake light	/5.B2	Cab
–K13	Relay, differential lock	/5.B3	Cab
–K15	Relay, 4WD	/5.B8	Cab
–K27	4WD on/off relay	/5.B7	Cab
–K29	Relay, reverse buzzer	/2.B15	Cab
–K30	Relay, main switch	/1.D4	Cab
–K31	Relay, air conditioner compressor	/10.C2,C5	Cab
–K32	Relay, air conditioner	/10.B5	Cab
–K51	Relay, main switch	/1.B3	Cab
–K56	Time–delay relay, cabin light and door step	/8.B12	Roof
–K60	Relay, trailer hitch release	/15.B8	Cab
–K61	Safety relay, parking brake	/2.B16	Cab

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Symbol	Description	Page and position	Location
–K62	PTO on/off relay	/5.B11	Cab
–K69	Relay, joystick button, lower	/17.B10	Cab
–K70	Relay, joystick button, upper	/17.B11	Cab
–K73	Relay, PTO prevention	/5.B13	Cab
–K75	Relay, rear steering prevention	/4.B15	Cab
–K76	Relay, hydraulics on/off	/17.B6	Cab
–K87	Relay, Auto–Guide	/18.C6	Cab
–M1	Starter motor	/1.D4	Engine
–M1M	Fuel pump	/2.D4	Engine
–M2	Fan, heater, air conditioner	/10.A5,B2,B5	Roof
–M3	Windscreen wiper	/9.C8	Cab
–M4	Windscreen washer	/9.C6	Engine
–M5	Rear window wiper	/9.C13	Roof
–M6	Rear window washer	/9.C1	Cab
–M7	Floor fan	/10.C4	Cab
–M9	Roof window wiper	/9.C3	Roof
–P1A	Terminal, Auto–Guide	/18.B2	Cab
–P1W	Rear display	/4.A11	Cab
–P6	Front display (pillar)	/4.A8	Cab
–Q1	Heat/starter switch	/1.A7	Cab
–Q2	Main switch	/1.B1	Transmission
–R1	Intake air heater	/1.D7	Engine
–R1E	Potentiometer, power lift (EHRB) position control	/12.B10	Cab
–R1E	Potentiometer, power lift pos. control	/13.A10	Cab
–R1M	Potentiometer, hand throttle	/2.D2	Cab
–R2	Resistor, power lift (EHRB) (for position control)	/12.B10	Cab
–R3	Resistor, power lift (EHRB) (for forced lowering)	/12.A10	Cab
–R4	Cigarette lighter	/9.C9	Cab
–R5	Resistor, lighting for pillar display	/4.A9	Cab
–R5W	Resistor, lighting for rear pillar display	/4.A12	Cab
–R11D1	Joystick, front valves	/17.A13	Armrest
–S1	Switch, 3–pos., head lights	/14.A10	Cab
–S1	Rocker switch 3–pos. head lights	/7.A6	Cab
–S1A	Push button, PTO rear start, left	/5.B14	Left mudguard
–S1E	Push button, rear operation, r.h., lifting	/12.B2	Right mudguard
–S1E	Push button, rear operation, r.h., lifting	/13.B1	Right mudguard
–S1M	Pressure switch, air cond. compressor	/10.D3,D6	Engine
–S1M	Push button, cruise kmh / rpm	/2.A1	Cab
–S1W	Switch, DPS +/–	/4.A2	Cab
–S2	Rocker switch, 2–pos. rear working lights	/6.B15	Cab
–S2 AUTO	Rocker switch, 3–pos. rear working lights, man./auto	/6.B12	Cab
–S2A	Push button, PTO rear start, right	/5.B15	Right mudguard
–S2E	Push button, rear operation, r.h., lowering	/12.B3	Right mudguard
–S2E	Push button, rear operation, r.h., lowering	/13.B2	Right mudguard
–S2F	Switch, suspension off/on/calibr.	/16.C12	Cab
–S2M	Pressure switch, engine air filter	/11.C4	Engine
–S2M	Switch, cruise on/off	/2.A4	Cab
–S2W	Limit switch, clutch pedal	/4.D4	Cab
–S3E	Push button, rear operation, l.h., lifting	/12.B3	Left mudguard
–S3E	Push button, rear operation, l.h., lifting	/13.B2	Left mudguard
–S3W	Limit switch, seat direction	/4.A13	Cab
–S4	Combined switch	/14.A5	Cab
–S4	Combined switch	/7.A3,B14	Cab
–S4	Combined switch	/9.B6	Cab
–S4E	Push button, rear drive, l.h., lowering	/12.B4	Left mudguard
–S4E	Push button, rear drive, l.h., lowering	/13.B3	Left mudguard
–S4W	Programming switch	/4.D4	Cab
–S5	Rocker switch, 2–pos., front working lights	/6.B6	Cab

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Symbol	Description	Page and position	Location
–S5E	Switch, 3–pos., cabin, lifting/lowering	/12.B6	Cab
–S5E	Switch, 3–pos., cabin, lifting/lowering	/13.A6	Cab
–S5E	Switch, 3–pos., cabin, lifting/lowering	/15.B8	Cab
–S5M	Switch, 3–pos., cruise +/–	/2.A3	Cab
–S5W	Reed relay, direction forward (F), rear	/4.D6	Cab
–S6	Rocker switch, 2–pos., rot. warning lights	/6.B10	Cab
–S6W	Reed relay direction reverse (R), rear	/4.D6	Cab
–S7	Switch, 2–pos., hazard warning flashers	/14.A7	Cab
–S7	Rocker switch 2–pos. hazard warning flashers	/7.A11	Cab
–S7E	Lowering speed selector, power lift	/12.C12	Cab
–S7E	Lowering speed selector, power lift	/13.B11	Cab
–S7W	Reed relay, parking brake, rear	/4.D7	Cab
–S8E	Transport height selector, power lift	/12.C12	Cab
–S8E	Transport height selector, power lift	/13.B11	Cab
–S8M	Switch, ECO mode	/3.A4	Cab
–S9	Switch, clutch pedal	/2.D10	Cab
–S9C	Switch, PTO aut./man.	/5.B10	Cab
–S9E	Draft control selector, power lift	/12.C12	Cab
–S9E	Draft control selector, power lift	/13.B11	Cab
–S9W	Switch, brake pedal, rear	/4.D8	Cab
–S10	Switch, right brake light	/5.C9	Cab
–S10E	Switch, 3–pos., lifting/lowering	/12.B12	Cab
–S10E	Switch, 3–pos., lifting/lowering	/13.A14	Cab
–S116	Switch, Auto–Guide	/18.A5	Cab
–S11E	Switch, forced lowering	/12.B8	Cab
–S11E	Switch, forced lowering	/13.A8	Cab
–S12E	Drive balance control, power lift	/12.B12	Cab
–S12E	Drive balance control, power lift	/13.C11	Cab
–S15	Reed relay, front parking brake (P)	/2.D13	Cab
–S16	Temperature switch, gearbox oil	/11.C3	Transmission
–S17	Pressure switch, gearbox oil	/11.C7	Transmission
–S20	Switch, left brake light	/5.C10	Cab
–S22	Switch, differential lock	/5.B1	Cab
–S23/1–	DPS–	/4.A5	Cab
–S23/1+	DPS+	/4.A4	Cab
–S23/2–	DPS–	/4.A4	Cab
–S23/2+	DPS+	/4.A3	Cab
–S25	Switch, 3–pos., PTO	/5.B15	Cab
–S28	Push button, PTO 540	/2.A12	Cab
–S29	Push button, PTO 1000/540E	/2.A13	Cab
–S30	Switch, 4WD	/5.B5	Cab
–S31	Switch, 3–pos., floor fan	/10.B4	Cab
–S32	Rocker switch, 3–pos., rear window wiper and washer	/9.B1	Cab
–S33	Rocker switch 2–pos. change over switch, head lights up	/7.B3	Cab
–S36	Switch, 2–pos., control stop	/11.C10	Cab
–S38	Rocker switch 2–pos. front–PTO	/11.B15	Cab
–S40	Reed relay, direction forward (F), front	/2.D12	Cab
–S41	Reed relay, direction reverse (R), front	/2.D13	Cab
–S42	Door switch, cab light, RH	/8.C13	Roof
–S43	Door switch, cab light, LH	/8.C14	Roof
–S44	Pressure switch, pressure filter (high pressure circuit)	/11.C5	Engine
–S45/1	Push button, Hi–shift	/4.A5	Cab
–S45/2	Push button, Hi–shift	/4.A6	Cab
–S47	Switch, 3–pos., DPS Man./Auto	/2.A11	Cab
–S51	Push button, DPS–preselection (D), front	/2.D11	Cab
–S52	Switch, parking brake cable	/11.C8	Transmission
–S53	Pressure switch, pressure filter, return	/11.C7	Transmission
–S54	Pressure switch, pressure filter (low pressure circuit)	/11.C6	Transmission
–S59	Rocker switch, 2–pos. wiper. roof wind.	/9.B4	Cab
–S60	Switch, seat safety	/2.D9	Cab
–S63	Switch, implement locking release	/17.C10	Cab
–S68	Switch, mainswitch control	/1.D2	Cab
–S75	Switch, hydraulics on/off	/17.B8	Cab
–S76	Switch, 2–pos., traction control on/off	/2.A10	Cab
–S80	Switch, 3–pos., instrument, display size	/11.A2	Cab
–S81	Switch, 3–pos., instrument, display mode	/11.A4	Cab
–S83	Switch, 2–pos., drawhook	/8.B15	Cab
–S84	Rocker switch, 2–pos., extra front working lights	/6.B7	Cab

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Symbol	Description	Page and position	Location
–S86	Switch, trailer hitch release	/15.D7	Cab
–S88	Switch, Soft drive	/17.C9	Cab
–S90	Switch, floating	/17.B13	Cab
–S92	Switch, side mirror heating	/16.B6	Roof
–S93	Control joystick, electrical side mirrors	/16.A3	Roof
–S102	Switch, PTO prevention	/5.B16	Transmission
–V1 (1)	Diode, 4–WD auto	/5.C4	Cab
–V1 (2)	Diode, differential lock solenoid	/5.D2	Cab
–V1 (3)	Diode, 4WD solenoid	/5.D8	Cab
–V1 (4)	Diode, brake pedal, right	/5.B8	Cab
–V1 (5)	Diode, brake pedal, left	/5.B8	Cab
–V2	Diode, main switch, heat / starter switch	/1.B4	Cab
–V9	Diode, rear working lights	/6.B14	Cab
–V10	Diode, rear working lights	/6.B13	Cab
–V11	Diode, control stop	/11.D10	Cab
–V12	Diode, rear stop–indicator light	/11.D9	Cab
–V13	Diode, rear window washer motor	/9.C2	Roof
–V14	Diode, parking brake safety relay	/2.D16	Cab
–V15	Diode, parking brake solenoid control	/3.C10	Cab
–V16	Diode, direction forward (F)	/2.C12	Cab
–V17	Diode, direction reverse (R)	/2.C13	Cab
–V18	Diode, 4–WD	/5.C10	Cab
–V19	Diode, fuel pump	/5.A10	Cab
–V20	Diode, seat direction	/4.B14	Cab
–X1	Connector, 9–pole	/14.A11	Cab
–X1	Connector, 9–pole	/5.A9	Cab
–X1	Connector, 9–pole	/6.A6,C14,C16	Cab
–X1	Connector, 9–pole	/7.A6	Cab
–X1A	Connector, 12–pole	/18.B13	Cab
–X1E	Connector, 9–pole	/13.C3,D4	Cab
–X1E	Connector, 9–pole	/15.D10–D14	Cab
–X1E	Connector, 9–pole	/3.C3	Cab
–X1L	Connector, 9–pole	/15.B12	Cab
–X1M	Connector, 89–pole	/1.B7	Engine
–X1M	Connector, 89–pole	/2.B1–B6	Engine
–X1N	Connector, 9–pole	/11.D11	Cab
–X1W	Connector,12–pole	/2.C3,D3	Cab
–X1W	Connector, 12–pole	/4.B12,B13	Cab
–X1W	Connector, 12–pole	/4.C4–C11	Cab
–X2	Connector, 9–pole	/1.C1	Cab
–X2	Connector, 9–pole	/6.A2	Cab
–X2	Connector, 9–pole	/7.A7,A9	Cab
–X2A	Connector, 12–pole	/18.B12	Cab
–X2E	Connector, 15–pole	/12.A4–A14	Cab
–X2E	Connector, 15–pole	/12.B4	Cab
–X2E	Connector, 15–pole	/12.D6,D7,D12	Cab
–X2E	Connector, 15–pole	/13.A3,A4,A15	Cab
–X2E	Connector, 15–pole	/13.B3,B15	Cab
–X2E	Connector, 15–pole	/13.D4,D7,D10	Cab
–X2F	Connector, 3–pole	/16.A8,D8	Cab
–X2M	Connector, 31–pole	/1.A7,A14	Engine
–X2M	Connector, 31–pole	/1.B8,B14	Engine
–X2M	Connector, 31–pole	/11.C12,D10	Engine
–X2M	Connector, 31–pole	/2.B1–B6	Engine
–X2M	Connector, 31–pole	/2.C1–C6	Engine
–X2M	Connector, 31–pole	/3.C5,C7	Engine
–X3	Connector, 9–pole	/3.A15	Cab
–X3	Connector, 9–pole	/10.A14	Cab
–X3	Connector, 9–pole	/7.A8,B3	Cab
–X3	Connector, 9–pole	/9.A12,A13	Cab
–X3A	Connector, 4–pole	/18.C10	Cab

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Symbol	Description	Page and position	Location
–X3M	Connector, 29–pole	/1.B1,B3,B5	Engine
–X3M	Connector, 29–pole	/10.C3,C6	Engine
–X3M	Connector, 29–pole	/11.C4–C15,D2	Engine
–X3M	Connector, 29–pole	/2.D4	Engine
–X3M	Connector, 29–pole	/3.A7	Engine
–X3M	Connector, 29–pole	/7.C5	Engine
–X3M	Connector, 29–pole	/8.B3	Engine
–X3M	Connector, 29–pole	/9.B2,B5	Engine
–X3W	Connector, 9–pole	/4.C4–C7	Cab
–X3W	Connector, 9–pole	/4.D4–D7	Cab
–X4	Connector, 9–pole	/2.A15	Cab
–X4	Connector, 9–pole	/12.A7	Cab
–X4	Connector, 9–pole	/13.A4	Cab
–X4	Connector, 9–pole	/7.B3	Cab
–X4	Connector, 9–pole	/9.A5	Cab
–X4A	Connector, 2–pole	/18.A6,D5	Cab
–X5	Connector, 9–pole	/10.A4	Cab
–X5	Connector, 9–pole	/14.B11	Cab
–X5	Connector, 9–pole	/5.A2	Cab
–X5	Connector, 9–pole	/6.A10	Cab
–X5	Connector, 9–pole	/8.A3	Cab
–X5	Connector, 9–pole	/9.A2	Cab
–X5D	Connector, 6–pole	/17.C13,C15	Cab
–X5D	Connector, 6–pole	/17.D13,D15	Cab
–X5X	Connector, 9–pole	/10.C8	Cab
–X6	Connector, 9–pole	/1.A4,A7	Cab
–X6	Connector, 9–pole	/14.B12	Cab
–X6	Connector, 9–pole	/8.A3	Cab
–X6	Connector, 9–pole	/9.A9	Cab
–X6A	Connector, 16–pole	/18.A9	Cab
–X6D	Connector, 37–pole	/17.A9	Cab
–X6D	Connector, 37–pole	/17.B8–B12	Cab
–X6D	Connector, 37–pole	/17.C7,C12–C15	Cab
–X7	Connector, 9–pole	/1.A3	Cab
–X7	Connector, 9–pole	/10.A2,C3	Cab
–X7	Connector, 9–pole	/5.B9	Cab
–X7A	Connector, 9–pole	/18.A11	Cab
–X7C	Connector, 3–pole	/12.A14	Cab
–X7C	Connector, 3–pole	/13.A15,D4	Cab
–X8	Connector, 2–pole current socket	/9.C10	Cab
–X8A	Connector, 4–pole	/18.C8	Cab
–X8A*	Connector, 4–pole	/18.C8	Cab
–X9	Connector, 9–pole	/9.B6,B7	Cab
–X10	Connector, combined switch	/14.B3,C8,C9	Cab
–X10	Connector, 9–pole, combined switch	/7.A3,B14	Cab
–X10	Connector, 9–pole	/9.B6	Cab
–X11	Connector, 9–pole	/10.B2,B5	Roof
–X11	Connector, 9–pole	/6.B2,B3,B6,B10	Roof
–X11	Connector, 9–pole	/8.A7,A11	Roof
–X11	Connector, 9–pole	/9.C3	Roof
–X12	Connector, 9–pole	/12.A2,B2	Cab
–X12	Connector, 9–pole	/13.A1,B1	Cab
–X12	Connector, 9–pole	/14.C6,C7,D6	Cab
–X12	Connector, 9–pole	/5.B15,C15	Cab
–X12	Connector, 9–pole	/7.C12,D12	Cab
–X12G	Connector, 9–pole, ISOBUS	/16.A12	Cab
–X13	Connector, 37–pole	/11.C3–C8	Cab
–X13	Connector, 37–pole	/12.B2,D6,D7	Cab
–X13	Connector, 37–pole	/13.B2,D7,D9	Cab
–X13	Connector, 37–pole	/15.D10,D11	Cab
–X13	Connector, 37–pole	/16.C14	Cab
–X13	Connector, 37–pole	/3.C4–C10	Cab
–X13	Connector, 37–pole	/5.C1,C8,D14	Cab
–X13	Connector, 37–pole	/8.B15,D15	Cab

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Symbol	Description	Page and position	Location
–X14	Connector, 9–pole	/12.A4,B4	Cab
–X14	Connector, 9–pole	/13.A3,B3	Cab
–X14	Connector, 9–pole	/14.C10,C12,D10	Cab
–X14	Connector, 9–pole	/5.A14,C14	Cab
–X14	Connector, 9–pole	/7.C10,D10	Cab
–X15	Connector, 1–pole	/18.D5	Engine
–X16	Connector, 1–pole	/18.A4	Engine
–X17	Connector, 7–pole, trailer socket	/7.B7	Cab
–X20	Connector, 9–pole	/14.C9,D9	Cab
–X20	Connector, 9–pole	/6.C7,D7	Cab
–X20	Connector, 9–pole	/7.C7,C8	Cab
–X21	Connector, 2–pole, register plate light	/8.C7,D7	Roof
–X21D	Connector, 9–pole	/17.A10,A11	Cab
–X21D	Connector, 9–pole	/17.B10,B12	Cab
–X21D	Connector, 9–pole	/17.C12	Cab
–X22	Connector, 2–pole	/6.C9–C13	Roof
–X23	Connector, 3–pole	/4.A3,B3	Cab
–X23D	Connector, 9–pole	/17.B7,B9	Cab
–X23D	Connector, 9–pole	/17.C7,C9	Cab
–X23D	Connector, 9–pole	/17.D7–D9	Cab
–X24	Connector, 9–pole	/10.A2,A3,A15	Roof
–X24	Connector, 9–pole	/8.B11	Roof
–X24	Connector, 9–pole	/9.B3	Roof
–X26	Connector, 28–pole, instrument	/11.B1–B13	Cab
–X26	Connector, 28–pole, instrument	/3.C2	Cab
–X27	Connector, 36–pole, instrument	/1.A14	Cab
–X27	Connector, 36–pole, instrument	/11.B2–B14	Cab
–X27	Connector, 36–pole, instrument	/3.C2	Cab
–X27	Connector, 36–pole, instrument	/5.C3	Cab
–X27	Connector, 36–pole, instrument	/7.C14,B15	Cab
–X28	Connector, 9–pole	/3.D8,D9	Cab
–X29	Connector, 2–pole.socket, stop–alarm	/11.C9	Cab
–X30	Connector, 9–pole	/4.A5,A6,B5,B6	Cab
–X31	Connector, 2–pole socket, PTO–emerg. stop	/5.B12	Cab
–X39	Connector, 9–pole	/2.C12,D12	Cab
–X43	Connector, 8–pole, diagnostics	/2.A8	Cab
–X45	Connector, 9–pole, fieldmaster	/15.B15	Cab
–X46	Connector, 7–pole rear socket	/15.B16	Cab
–X47	Connector, 2–pole, fieldmaster	/15.B12	Cab
–X49	Connector, 2–pole	/10.A14,B14,D14	Cab
–X49	Connector, 2–pole	/17.B7,D7	Cab
–X50	Connector, 3–pole current socket	/9.C11	Cab
–X55	Connector, 1–pole	/15.A9	Cab
–X58	Connector, 9–pole	/17.C7	Cab
–X61	Connector, 9–pole	/11.D15	Cab
–X62	Connector, 16–pole	/16.A9	Engine
–X62	Connector, 16–pole	/3.A7	Engine
–X62	Connector, 16–pole	/7.C5,D5	Engine
–X62	Connector, 16–pole	/8.C3	Engine
–X62	Connector, 16–pole	/9.C6,D11	Engine
–X65	Connector, 3–pole	/16.A6	Roof
–X73	Connector, 2–pole, current socket	/9.C12	Engine
–X74	Connector, 9–pole	/16.A10	Engine hood
–X75L	Connector, 5–pole	/16.C3	Roof
–X75R	Connector, 5–pole	/16.C5	Roof
–X80	Connector, 6–pole	/17.D8–D13	Cab
–X81	Connector, 7–pole	/17.D8–D13	Cab
–X91	Connector, 9–pole	/6.B2,B3,B10	Roof
–X91	Connector, 9–pole	/6.C6,D6	Roof
–X91	Connector, 9–pole	/7.C3	Roof
–X91	Connector, 9–pole	/8.A8,D9	Roof
–X92	Connector, 3–pole	/10.C16	Roof
–X92	Connector, 3–pole	/7.C3	Roof
–X93	Connector, 1–pole	/14.D11,D12	Cab
–X93	Connector, 3–pole	/7.C14	Mudguard, right
–X94	Connector, 1–pole	/14.D6,D8	Cab
–X94	Connector, 3–pole	/7.C9	Mudguard, left
–X98	Connector, 2–pole	/14.A5,A7	Cab

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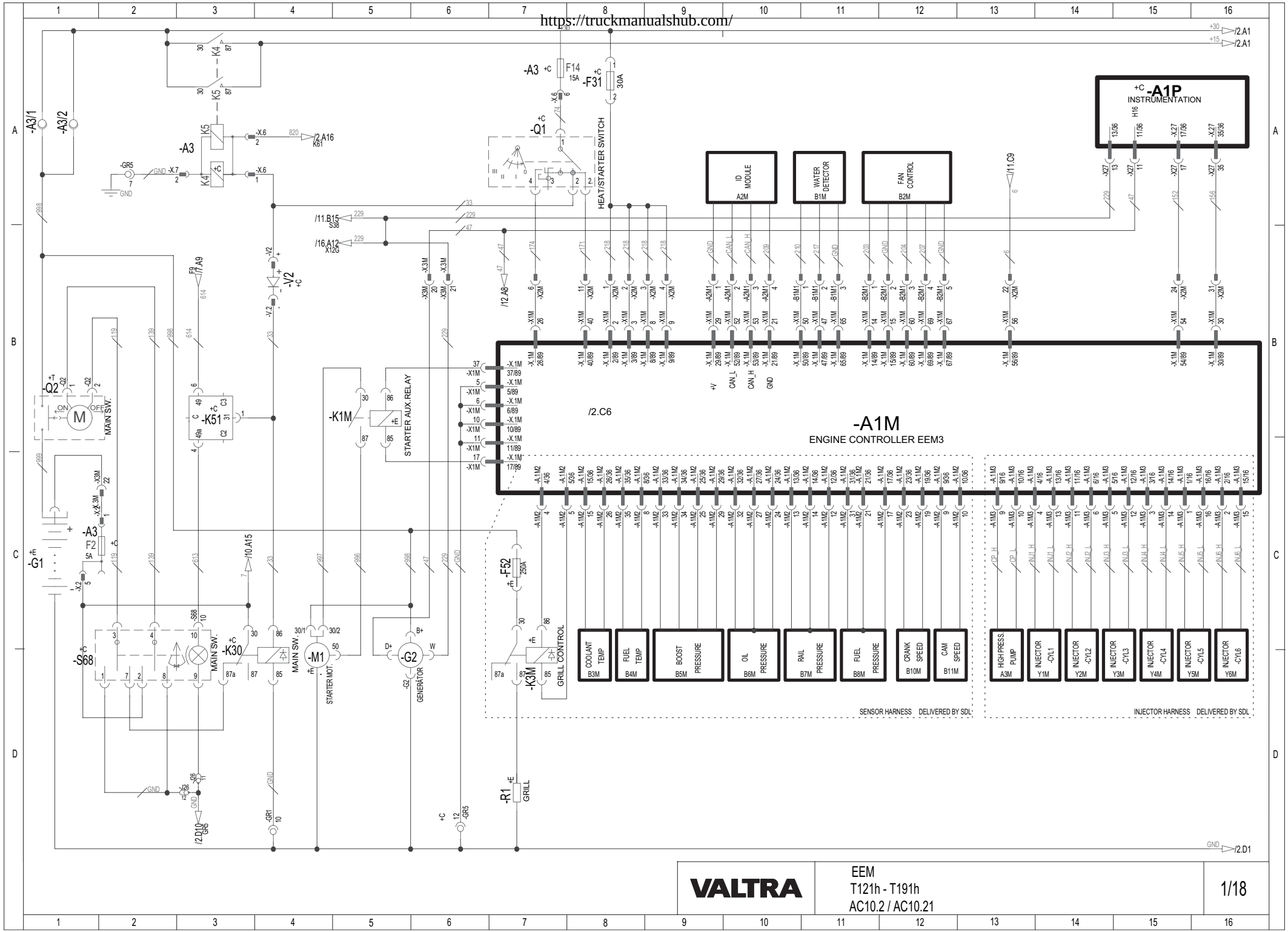
Symbol	Description	Page and position	Location
–X99	Connector, 2–pole	/14.C7,C11	Cab
–X99	Connector, 2–pole	/7.C10,C12	Cab
–X100	Connector, 3–pole	/16.B13,C14	Cab
–X101	Connector, 4–pole	/16.B14,B15	Cab
–X101	Connector, 4–pole	/3.C15,D15	Cab
–X102	Connector, 4–pole	/10.C6	Roof
–X103	Connector, 2–pole	/10.C7	Roof
–X105	Connector, 26–pole	/10.B6–B8	Roof
–X107	Connector, 9–pole	/16.B2,C6	Roof
–X109	Connector, 1–pole	/10.A5	Roof
–X110	Connector, 6–pole	/10.A8	Roof
–X111	Connector, 26–pole	/10.B7–B12	Roof
–X112	Connector, 6–pole	/10.A9	Roof
–X113	Connector, 6–pole	/10.A11	Roof
–X114	Connector, 2–pole	/10.D10	Roof
–X115	Connector, 2–pole	/10.D11	Roof
–X116	Connector, 2–pole	/10.D10	Roof
–X117	Connector, 1–pole	/18.C6	Cab
–X118	Connector, 6–pole	/18.A5	Cab
–Y1	Solenoid valve, differential lock	/5.D1	Transmission
–Y1A	Solenoid valve, wheel turning	/18.D14	Cab
–Y1E	Solenoid valve, power lift, lowering	/12.D5	Transmission
–Y1E	Solenoid valve, power lift, lowering	/13.D7	Transmission
–Y1M	Injector, cylinder 1	/1.D14	Engine
–Y2	Solenoid valve, PTO	/5.D14	Transmission
–Y2E	Solenoid valve, power lift, lifting	/12.D6	Transmission
–Y2E	Solenoid valve, power lift, lifting	/13.D8	Transmission
–Y2F	Solenoid valve, 3/2	/16.C9	Cab
–Y2M	Injector, cylinder 2	/1.D14	Engine
–Y2M	Air conditioner compressor	/10.D3,D6	Engine
–Y3	Solenoid valve, 4WD	/5.D8	Transmission
–Y3M	Injector, cylinder 3	/1.D15	Engine
–Y4	Solenoid valve, DPS C1–clutch	/3.D13	Transmission
–Y4F	Solenoid valve, 2/2	/16.C10	Cab
–Y4M	Injector, cylinder 4	/1.D15	Engine
–Y5D	Solenoid valve, bucket tilt	/17.D15	Transmission
–Y5M	Injector, cylinder 5	/1.D16	Engine
–Y6	Solenoid valve, DPS C2–clutch	/3.D14	Transmission
–Y6D	Solenoid valve, arms up/down	/17.D13	Transmission
–Y6M	Injector, cylinder 6	/1.D16	Engine
–Y7	Solenoid valve, rear steering prevention	/4.C15	Transmission
–Y9	Magnetic clutch, front–PTO	/11.C16	Engine
–Y11	Solenoid, forward	/3.D11	Transmission
–Y12	Solenoid, reverse	/3.D12	Transmission
–Y17	Solenoid valve, DPS C3–clutch	/3.D15	Transmission
–Y18	Solenoid, parking brake	/3.D10	Transmission
–Y19	Solenoid valve, trailer hitch release	/15.D9	Transmission

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Symbol	Description	Page and position	Location
–A1M	Control unit, EC	/1.C8	Engine
–A1M2	Connector, 36–pole	/1.C7	Engine
–A1M3	Connector, 16–pole	/1.C14	Engine
–A1P	Instrument	/1.A14	Cab
–A2M	ID–module	/1.A10	Engine
–A2M1	Connector, 4–pole	/1.B10	Engine
–A3M	High pressure pump	/1.D13	Engine
–B1M	Sensor, water detector	/1.A11	Engine
–B2M	Fan control	/1.A12	Engine
–B3M	Sensor, coolant temperature	/1.D8	Engine
–B4M	Sensor, Fuel temperature	/1.D8	Engine
–B5M	Sensor, boost pressure	/1.D9	Engine
–B6M	Sensor, oil pressure	/1.D10	Engine
–B7M	Sensor, rail pressure	/1.D10	Engine
–B8M	Sensor, fuel pressure	/1.D11	Engine
–B10M	Sensor, crankshaft speed	/1.D12	Engine
–B11M	Sensor, camshaft speed	/1.D12	Engine
–F2	5A, Radio, instrumentation, tel., main switch, tachograph	/1.C3	Cab
–F14	10A, starter switch	/1.A6	Cab
–F31	30A, Engine control unit (EEM supply)	/1.A8	Cab
–F52	250A, Inlet air heater	/1.C7	Engine
–G1	Battery	/1.C1	Engine
–G2	Alternator	/1.D5	Engine
–GR1	Ground	/1.D4	Cab
–GR5	Ground	/1.A2,D6	Cab
–K1M	Starter auxiliary relay	/1.B5	Engine
–K3M	Relay, intake air heater	/1.D7	Engine
–K4	Auxiliary relay, starter switch	/1.A3	Cab
–K5	Auxiliary relay, starter switch	/1.A3	Cab
–K30	Relay, main switch	/1.D4	Cab
–K51	Relay, main switch	/1.B3	Cab
–M1	Starter motor	/1.D4	Engine
–Q1	Heat/starter switch	/1.A7	Cab
–Q2	Main switch	/1.B1	Transmission
–R1	Intake air heater	/1.D7	Engine
–S68	Switch, mainswitch control	/1.D2	Cab
–V2	Diode, main switch, heat / starter switch	/1.B4	Cab
–X1M	Connector, 89–pole	/1.B7	Engine
–X2M	Connector, 31–pole	/1.A7,A14	Engine
–X2M	Connector, 31–pole	/1.B8,B14	Engine
–X2	Connector, 9–pole	/1.C1	Cab
–X3M	Connector, 29–pole	/1.B1,B3,B5	Engine
–X6	Connector, 9–pole	/1.A4,A7	Cab
–X7	Connector, 9–pole	/1.A3	Cab
–X27	Connector, 36–pole, instrument	/1.A14	Cab
–Y1M	Injector, cylinder 1	/1.D14	Engine
–Y2M	Injector, cylinder 2	/1.D14	Engine
–Y3M	Injector, cylinder 3	/1.D15	Engine
–Y4M	Injector, cylinder 4	/1.D15	Engine
–Y5M	Injector, cylinder 5	/1.D16	Engine
–Y6M	Injector, cylinder 6	/1.D16	Engine

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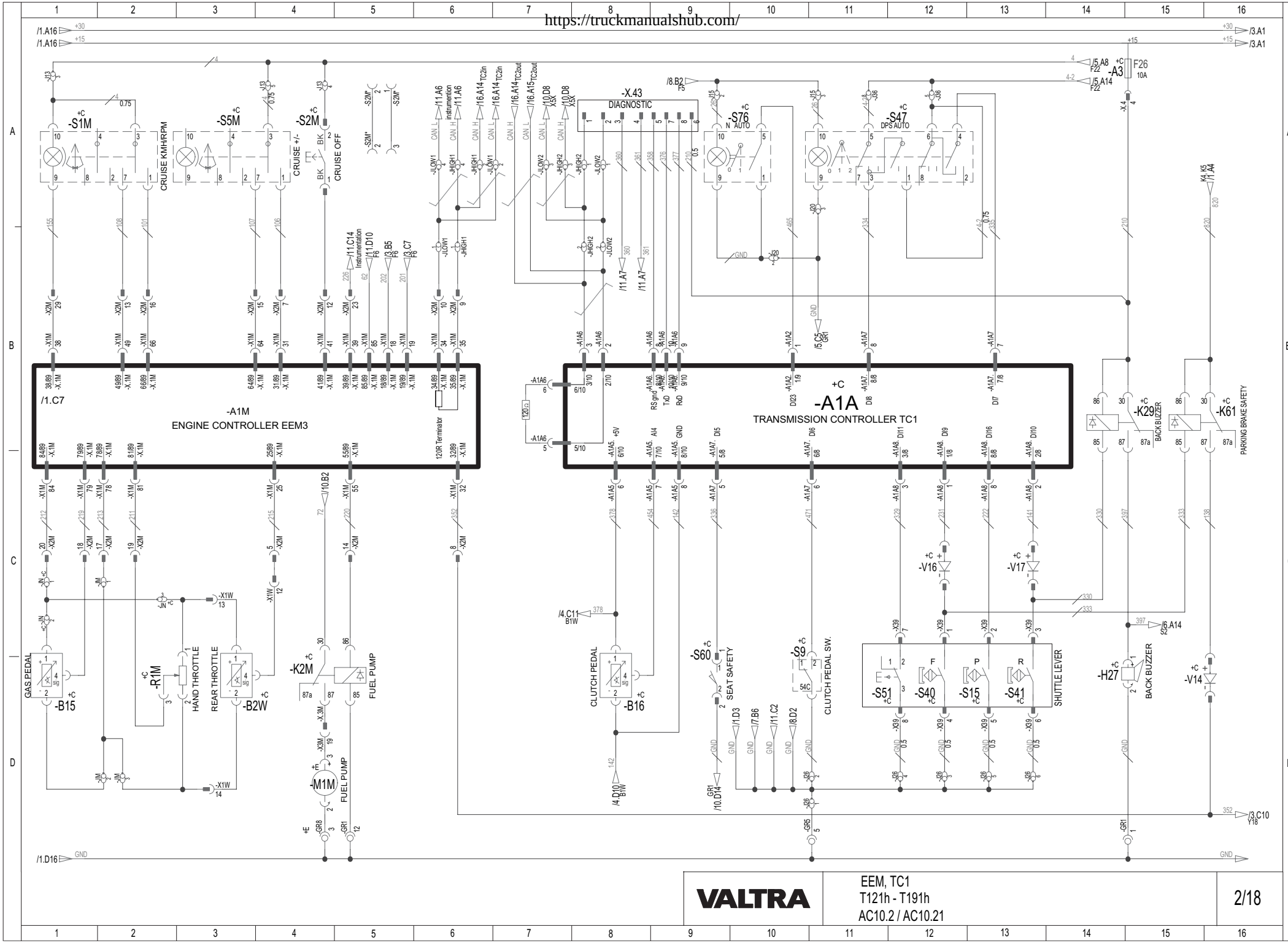
VALTRA	EEM T121h - T191h AC10.2 / AC10.21	1/18

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Symbol	Description	Page and position	Location
–A1A	Control unit, transmission, TC1	/2.B11	Cab
–A1A2	Connector, 9–pole	/2.B10	Cab
–A1A5	Connector, 10–pole	/2.C8	Cab
–A1A6	Connector, 10–pole	/2.B7–B9	Cab
–A1A7	Connector, 8–pole	/2.A11,A13	Cab
–A1A7	Connector, 8–pole	/2.C9,C11	Cab
–A1A8	Connector, 8–pole	/2.C12,C13	Cab
–A1M	Control unit, EC	/2.B3	Engine
–B2W	Position sensor, rear accel. pedal	/2.D3	Cab
–B15	Position sensor, accelerator pedal	/2.D1	Cab
–B16	Position sensor, clutch pedal	/2.D8	Cab
–F26	10A, Back buzzer	/2.A15	Cab
–GR1	Ground	/2.D5,D15	Cab
–GR5	Ground	/2.D10	Cab
–GR8	Ground	/2.D4	Cab
–H27	Reverse Buzzer	/2.D15	Cab
–K2M	Relay, fuel pump	/2.D4	Engine
–K29	Relay, reverse buzzer	/2.B15	Cab
–K61	Safety relay, parking brake	/2.B16	Cab
–M1M	Fuel pump	/2.D4	Engine
–R1M	Potentiometer, hand throttle	/2.D2	Cab

Symbol	Description	Page and position	Location
–S1M	Push button, cruise kmh / rpm	/2.A1	Cab
–S2M	Switch, cruise on/off	/2.A4	Cab
–S5M	Switch, 3–pos., cruise +/–	/2.A3	Cab
–S9	Switch, clutch pedal	/2.D10	Cab
–S15	Reed relay, front parking brake (P)	/2.D13	Cab
–S40	Reed relay, direction forward (F), front	/2.D12	Cab
–S41	Reed relay, direction reverse (R), front	/2.D13	Cab
–S47	Switch, 3–pos., DPS Man./Auto	/2.A11	Cab
–S51	Push button, DPS–preselection (D), front	/2.D11	Cab
–S60	Switch, seat safety	/2.D9	Cab
–S76	Switch, 2–pos., traction control on/off	/2.A10	Cab
–V14	Diode, parking brake safety relay	/2.D16	Cab
–V16	Diode, direction forward (F)	/2.C12	Cab
–V17	Diode, direction reverse (R)	/2.C13	Cab
–X1M	Connector, 89–pole	/2.B1–B6	Engine
–X1W	Connector,12–pole	/2.C3,D3	Cab
–X2M	Connector, 31–pole	/2.B1–B6	Engine
–X2M	Connector, 31–pole	/2.C1–C6	Engine
–X3M	Connector, 29–pole	/2.D4	Engine
–X4	Connector, 9–pole	/2.A15	Cab
–X43	Connector, 8–pole, diagnostics	/2.A8	Cab
–X39	Connector, 9–pole	/2.C12,D12	Cab

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VALTRA

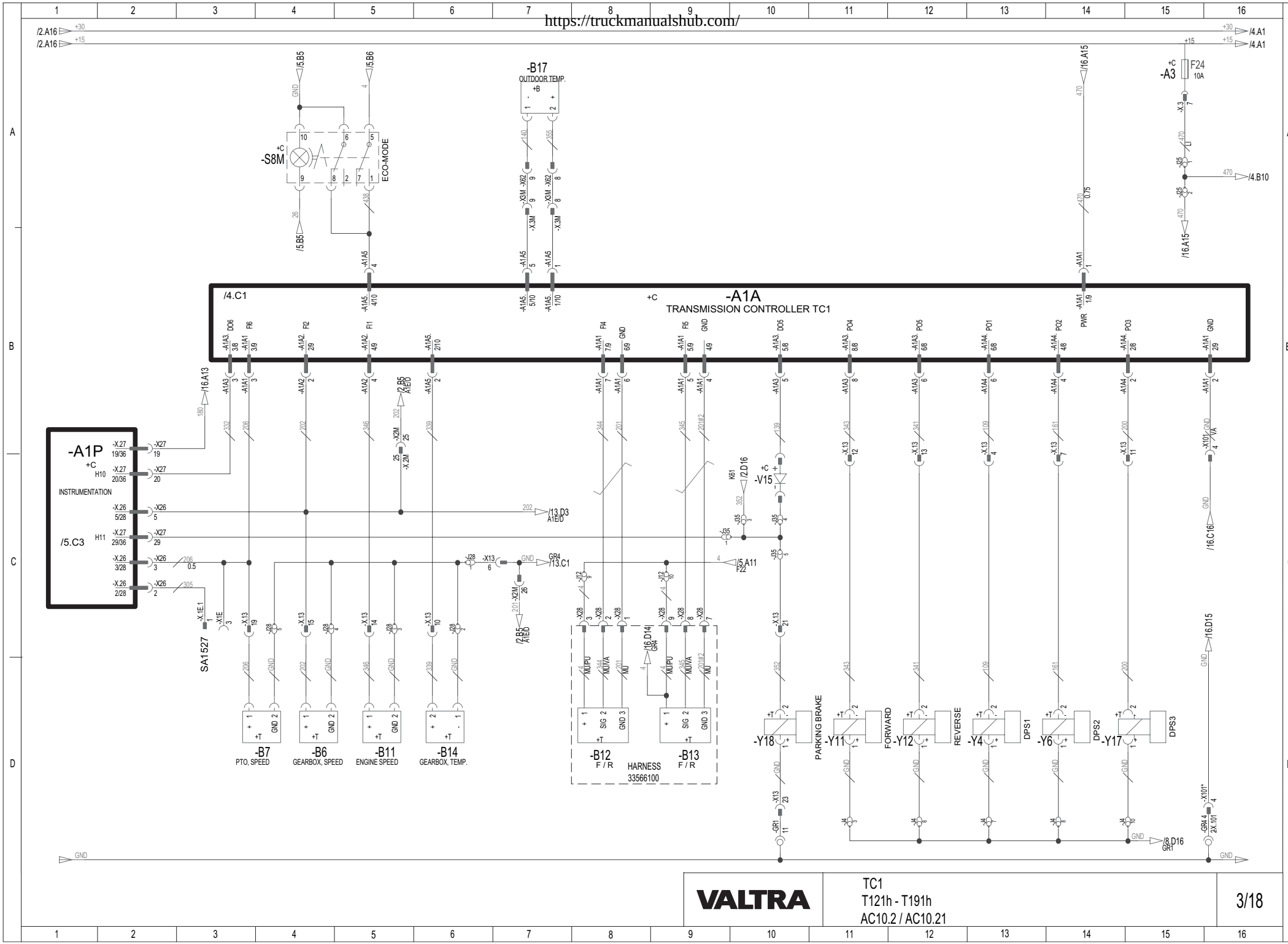
EEM, TC1
T121h - T191h
AC10.2 / AC10.21

2/18

https://truckmanualshub.com/

Symbol	Description	Page and position	Location
–A1A	Control unit, transmission, TC1	/3.B5	Cab
–A1A1	Connector, 9–pole	/3.B3–B16	Cab
–A1A2	Connector, 9–pole	/3.B4,B5	Cab
–A1A3	Connector, 8–pole	/3.B3–B12	Cab
–A1A4	Connector, 8–pole	/3.B13–B15	Cab
–A1A5	Connector, 10–pole	/3.B5–B7	Cab
–A1P	Instrument	/3.C1	Cab
–B6	Speed sensor, gearbox	/3.D4	Transmission
–B7	Speed sensor, PTO	/3.D3	Transmission
–B11	Speed sensor, engine	/3.D5	Transmission
–B12	Sensor, F/R shuttle	/3.D8	Transmission
–B13	Sensor, F/R shuttle	/3.D9	Transmission
–B14	Sensor, gearbox temperature	/3.D6	Transmission
–B17	Temperature sensor, outdoors	/3.A7	Engine hood
–F24	10A, AC–5, seat direction	/3.A15	Cab
–GR1	Ground	/3.D10	Cab
–GR4	Ground	/3.D15	Cab
–S8M	Switch, ECO mode	/3.A4	Cab
–V15	Diode, parking brake solenoid control	/3.C10	Cab
–X1E	Connector, 9–pole	/3.C3	Cab
–X2M	Connector, 31–pole	/3.C5,C7	Engine
–X3	Connector, 9–pole	/3.A15	Cab
–X3M	Connector, 29–pole	/3.A7	Engine
–X13	Connector, 37–pole	/3.C4–C10	Cab
–X26	Connector, 28–pole, instrument	/3.C2	Cab
–X27	Connector, 36–pole, instrument	/3.C2	Cab
–X28	Connector, 9–pole	/3.D8,D9	Cab
–X62	Connector, 16–pole	/3.A7	Engine
–X101	Connector, 4–pole	/3.C15,D15	Cab
–Y4	Solenoid valve, DPS C1–clutch	/3.D13	Transmission
–Y6	Solenoid valve, DPS C2–clutch	/3.D14	Transmission
–Y11	Solenoid, forward	/3.D11	Transmission
–Y12	Solenoid, reverse	/3.D12	Transmission
–Y17	Solenoid valve, DPS C3–clutch	/3.D15	Transmission
–Y18	Solenoid, parking brake	/3.D10	Transmission

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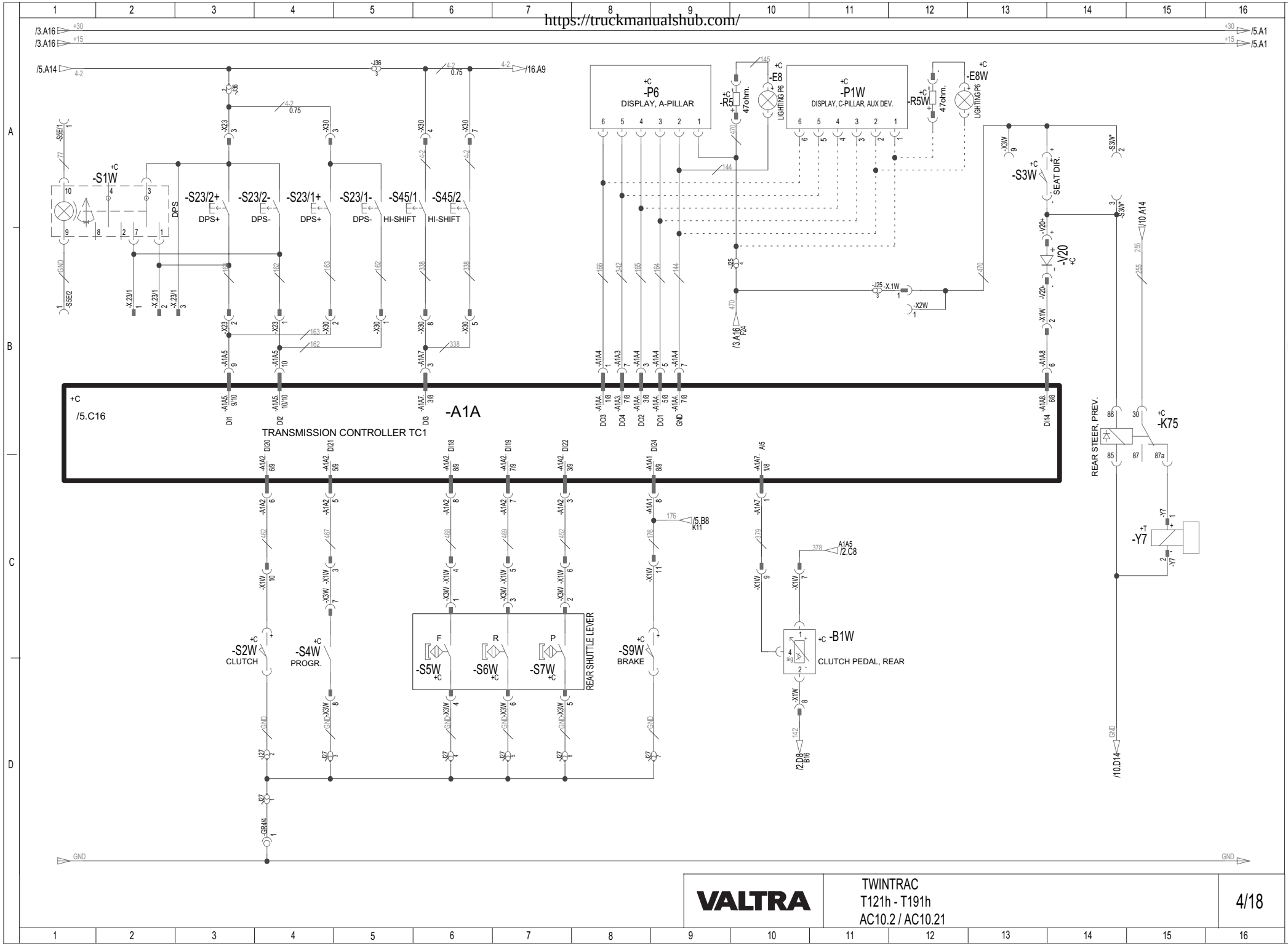


VALTRA	TC1 T121h - T191h AC10.2 / AC10.21	3/18

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Symbol	Description	Page and position	Location
–A1A	Control unit, transmission, TC1	/4.B5	Cab
–A1A1	Connector, 9–pole	/4.C9	Cab
–A1A2	Connector, 9–pole	/4.C4–C7	Cab
–A1A3	Connector, 8–pole	/4.B8	Cab
–A1A4	Connector, 8–pole	/4.B8	Cab
–A1A5	Connector, 10–pole	/4.B3	Cab
–A1A7	Connector, 8–pole	/4.B8,C10	Cab
–A1A8	Connector, 8–pole	/4.B13	Cab
–B1W	Angle sensor, rear clutch pedal	/4.D10	Cab
–E8	Lighting for pillar display	/4.A10	Cab
–E8W	Lighting for rear pillar display	/4.A13	Cab
–GR4	Ground	/4.D4	Cab
–K75	Relay, rear steering prevention	/4.B15	Cab
–P1W	Rear display	/4.A11	Cab
–P6	Front display (pillar)	/4.A8	Cab
–R5	Resistor, lighting for pillar display	/4.A9	Cab
–R5W	Resistor, lighting for rear pillar display	/4.A12	Cab
–S1W	Switch, DPS +/–	/4.A2	Cab
–S2W	Limit switch, clutch pedal	/4.D4	Cab
–S3W	Limit switch, seat direction	/4.A13	Cab
–S4W	Programming switch	/4.D4	Cab
–S5W	Reed relay, direction forward (F), rear	/4.D6	Cab
–S6W	Reed relay direction reverse (R), rear	/4.D6	Cab
–S7W	Reed relay, parking brake, rear	/4.D7	Cab
–S9W	Switch, brake pedal, rear	/4.D8	Cab
–S23/1–	DPS–	/4.A5	Cab
–S23/1+	DPS+	/4.A4	Cab
–S23/2–	DPS–	/4.A4	Cab
–S23/2+	DPS+	/4.A3	Cab
–S45/1	Push button, Hi–shift	/4.A5	Cab
–S45/2	Push button, Hi–shift	/4.A6	Cab
–V20	Diode, seat direction	/4.B14	Cab
–X1W	Connector, 12–pole	/4.B12,B13	Cab
–X1W	Connector, 12–pole	/4.C4–C11	Cab
–X3W	Connector, 9–pole	/4.C4–C7	Cab
–X3W	Connector, 9–pole	/4.D4–D7	Cab
–X23	Connector, 3–pole	/4.A3,B3	Cab
–X30	Connector, 9–pole	/4.A5,A6,B5,B6	Cab
–Y7	Solenoid valve, rear steering prevention	/4.C15	Transmission

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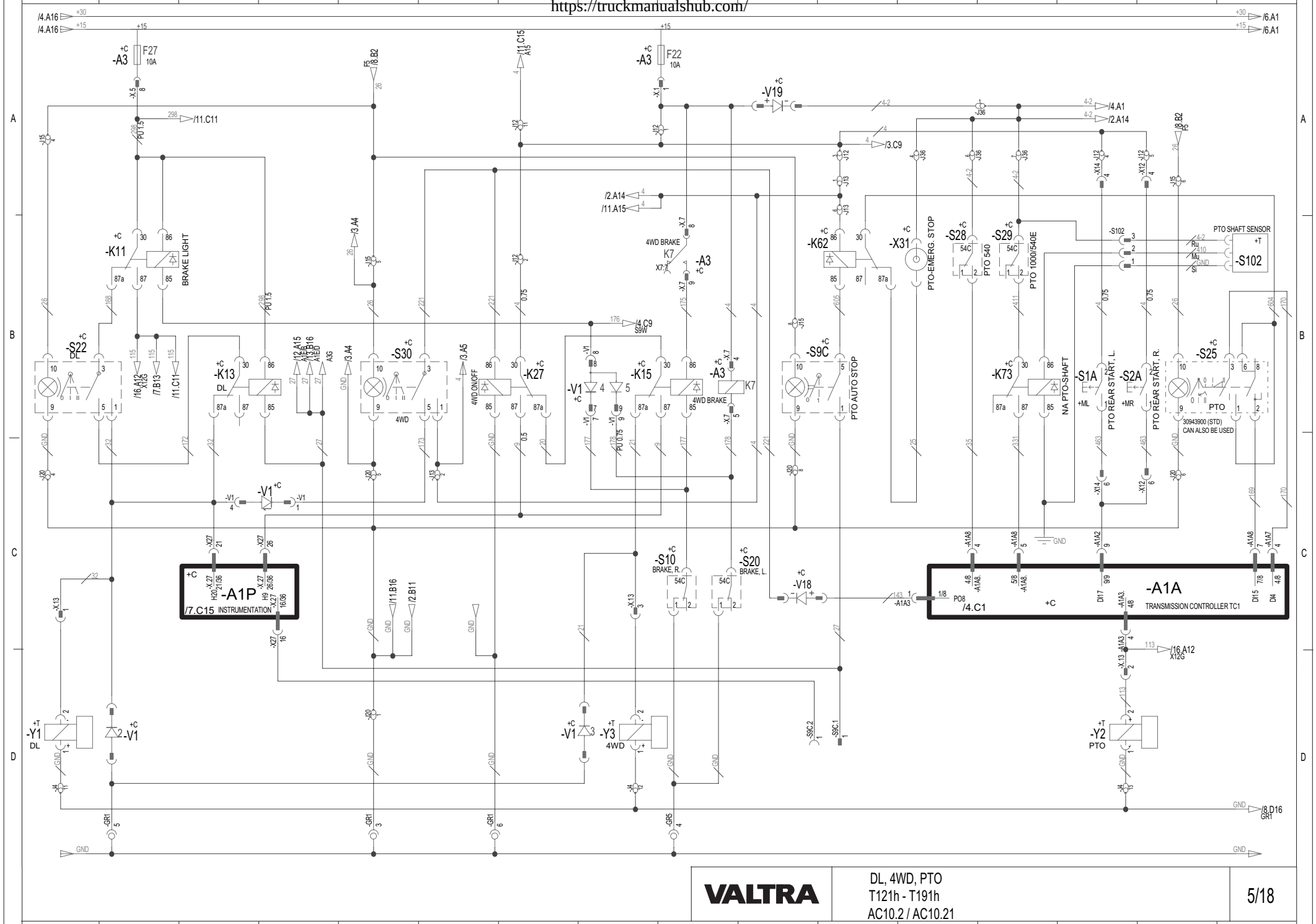
VALTRA	TWINTRAC T121h - T191h AC10.2 / AC10.21	4/18

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Symbol	Description	Page and position	Location
–A1A	Control unit, transmission, TC1	/5.C14	Cab
–A1A2	Connector, 9–pole	/5.C14	Cab
–A1A3	Connector, 8–pole	/5.C11,C14	Cab
–A1A7	Connector, 8–pole	/5.C16	Cab
–A1A8	Connector, 8–pole	/5.C12–C16	Cab
–A1P	Instrument	/5.C3	Cab
–F22	10A, 4WD, PTO, Delta Power Shift, front suspension	/5.A9	Cab
–F27	10A, Braking lights	/5.A2	Cab
–GR1	Ground	/5.D2–D6	Cab
–GR5	Ground	/5.D9	Cab
–K7	Control relay, 4WD–brake	/5.B9,B10	Cab
–K11	Relay, brake light	/5.B2	Cab
–K13	Relay, differential lock	/5.B3	Cab
–K15	Relay, 4WD	/5.B8	Cab
–K27	4WD on/off relay	/5.B7	Cab
–K62	PTO on/off relay	/5.B11	Cab
–K73	Relay, PTO prevention	/5.B13	Cab
–S1A	Push button, PTO rear start, left	/5.B14	Left mudguard
–S2A	Push button, PTO rear start, right	/5.B15	Right mudguard
–S9C	Switch, PTO aut./man.	/5.B10	Cab
–S10	Switch, right brake light	/5.C9	Cab
–S20	Switch, left brake light	/5.C10	Cab
–S22	Switch, differential lock	/5.B1	Cab
–S25	Switch, 3–pos., PTO	/5.B15	Cab
–S28	Push button, PTO 540	/2.A12	Cab
–S29	Push button, PTO 1000/540E	/2.A13	Cab
–S30	Switch, 4WD	/5.B5	Cab
–S102	Switch, PTO prevention	/5.B16	Transmission

Symbol	Description	Page and position	Location
–V1 (1)	Diode, 4–WD auto	/5.C4	Cab
–V1 (2)	Diode, differential lock solenoid	/5.D2	Cab
–V1 (3)	Diode, 4WD solenoid	/5.D8	Cab
–V1 (4)	Diode, brake pedal, right	/5.B8	Cab
–V1 (5)	Diode, brake pedal, left	/5.B8	Cab
–V18	Diode, 4–WD	/5.C10	Cab
–V19	Diode, fuel pump	/5.A10	Cab
–X1	Connector, 9–pole	/5.A9	Cab
–X5	Connector, 9–pole	/5.A2	Cab
–X7	Connector, 9–pole	/5.B9	Cab
–X12	Connector, 9–pole	/5.B15,C15	Cab
–X13	Connector, 37–pole	/5.C1,C8,D14	Cab
–X14	Connector, 9–pole	/5.A14,C14	Cab
–X27	Connector, 36–pole, instrument	/5.C3	Cab
–X31	Connector, 2–pole socket, PTO–emerg. stop	/5.B12	Cab
–Y1	Solenoid valve, differential lock	/5.D1	Transmission
–Y2	Solenoid valve, PTO	/5.D14	Transmission
–Y3	Solenoid valve, 4WD	/5.D8	Transmission

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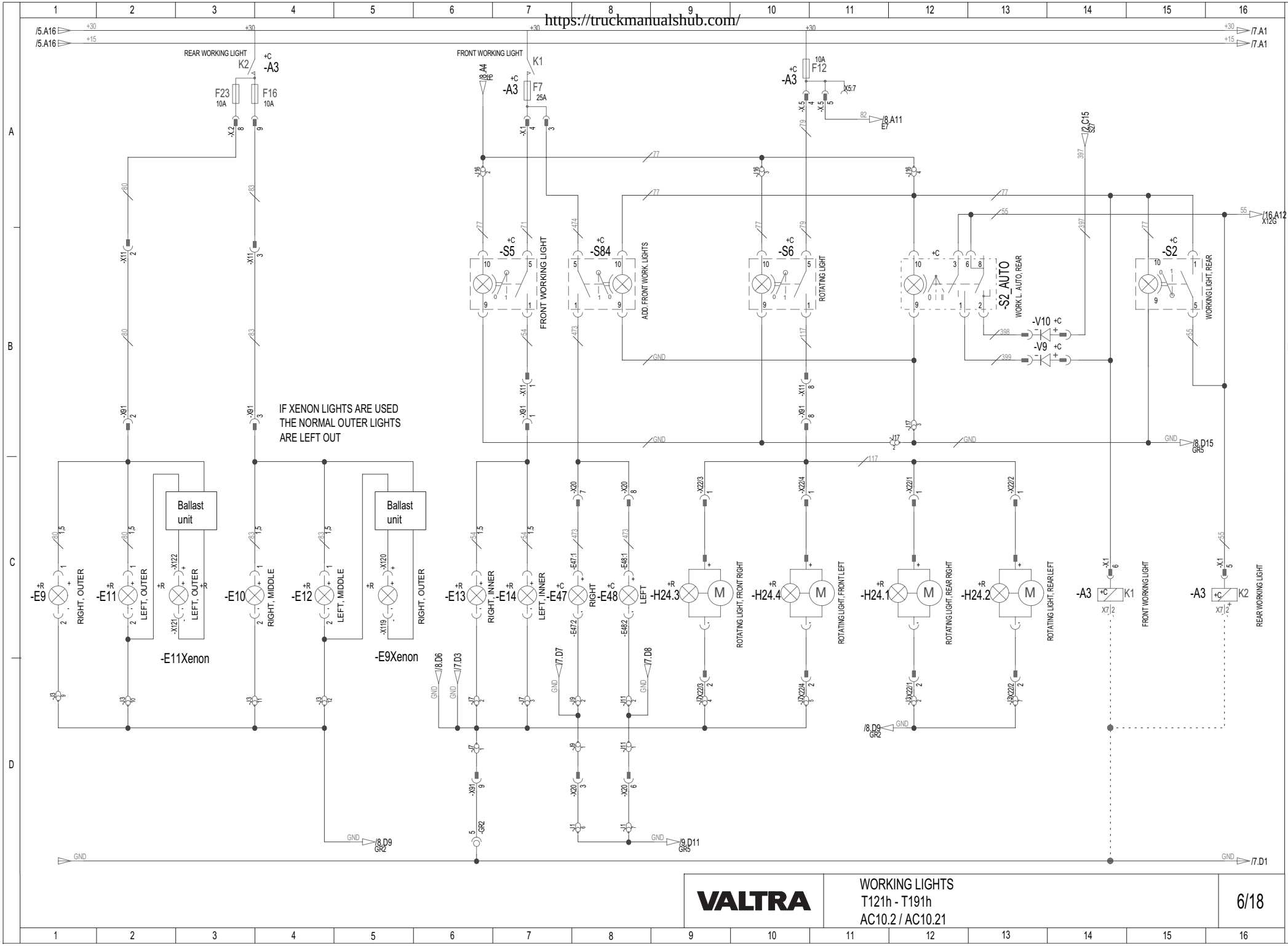


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Symbol	Description	Page and position	Location
–E9	Rear working light, right, outer	/6.C1	Roof
–E9X	Rear working light (Xenon), right, outer	/6.C5	Roof
–E10	Rear working light, right, middle	/6.C3	Roof
–E11	Rear working light, left, outer	/6.C2	Roof
–E11X	Rear working light (Xenon), left, outer	/6.C2	Roof
–E12	Rear working light, left, middle	/6.C4	Roof
–E13	Front working light, right, inner	/6.C5	Roof
–E14	Front working light, left, inner	/6.C6	Roof
–E47	Extra front working light, right	/6.C7	Cab
–E48	Extra front working light, left	/6.C8	Cab
–F7	25A, front working lights	/6.A6	Cab
–F12	10A, rot. warning light, cabin light	/6.A10	Cab
–F16	10A, rear working lights, inner	/6.A2	Cab
–F23	10A, rear working lights, outer	/6.A2	Cab
–GR2	Ground	/6.D6	Roof
–H24.1	Rotating roof light, rear right	/6.C12	Roof
–H24.2	Rotating roof light, rear left	/6.C13	Roof
–H24.3	Rotating roof light, front right	/6.C9	Roof
–H24.4	Rotating roof light, front left	/6.C11	Roof
–K1	Relay, front working lights	/6.C14	Cab
–K2	Relay, rear working lights	/6.C16	Cab

Symbol	Description	Page and position	Location
–S2	Rocker switch, 2–pos. rear working lights	/6.B15	Cab
–S2 AUTO	Rocker switch, 3–pos. rear working lights, man./auto	/6.B12	Cab
–S5	Rocker switch, 2–pos., front working lights	/6.B6	Cab
–S6	Rocker switch, 2–pos., rot. warning lights	/6.B10	Cab
–S84	Rocker switch, 2–pos., extra front working lights	/6.B7	Cab
–V9	Diode, rear working lights	/6.B14	Cab
–V10	Diode, rear working lights	/6.B13	Cab
–X1	Connector, 9–pole	/6.A6,C14,C16	Cab
–X2	Connector, 9–pole	/6.A2	Cab
–X5	Connector, 9–pole	/6.A10	Cab
–X11	Connector, 9–pole	/6.B2,B3,B6,B10	Roof
–X20	Connector, 9–pole	/6.C7,D7	Cab
–X22	Connector, 2–pole	/6.C9–C13	Roof
–X91	Connector, 9–pole	/6.B2,B3,B10	Roof
–X91	Connector, 9–pole	/6.C6,D6	Roof

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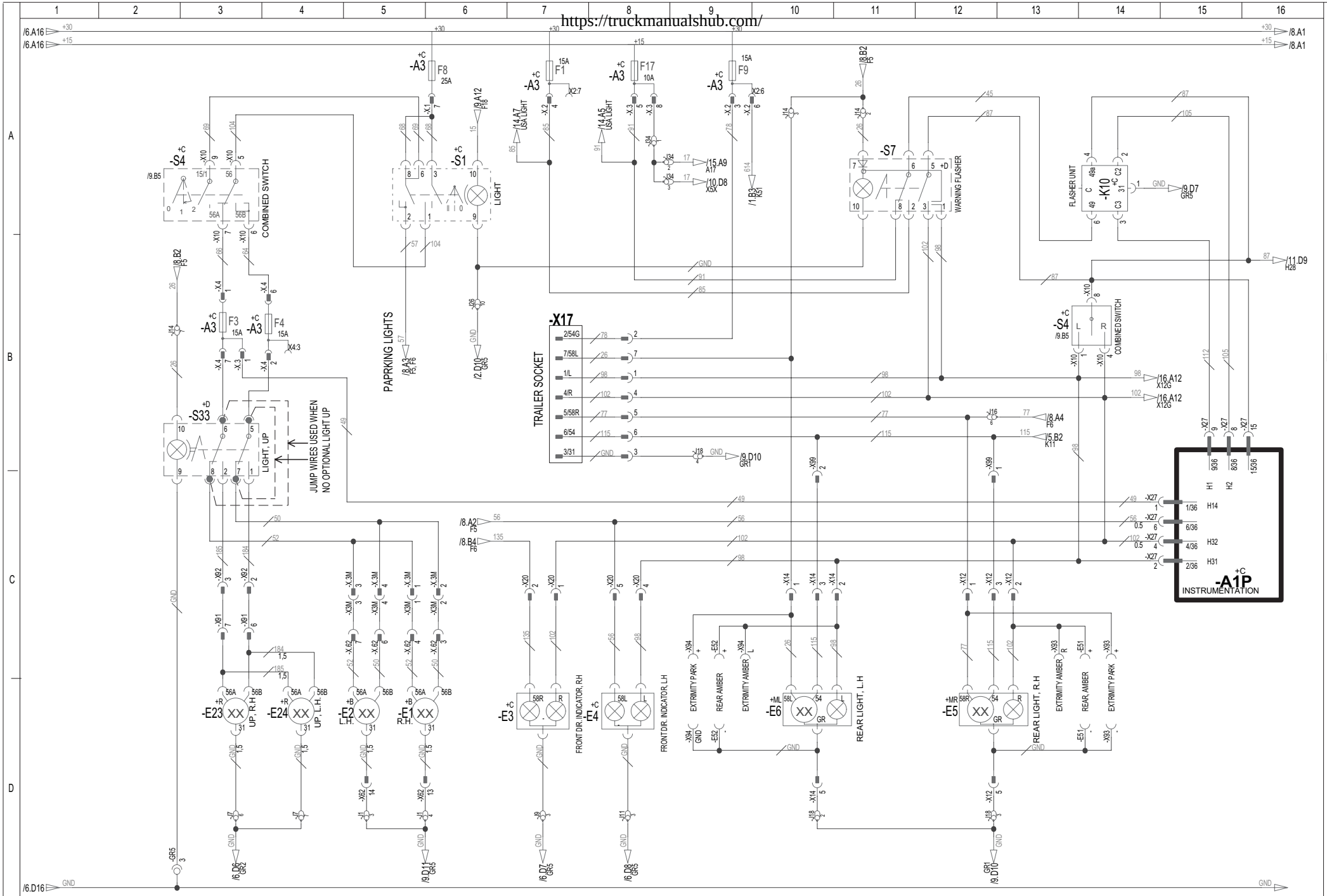


VALTRA	WORKING LIGHTS T121h - T191h AC10.2 / AC10.21	6/18

https://truckmanualshub.com/

Symbol	Description	Page and position	Location
–A1P	Instrument	/7.C15	Cab
–E1	Head light, right	/7.D6	Engine
–E2	Head light, left	/7.D5	Engine
–E3	Front direction indicator, right	/7.D7	Cab
–E4	Front direction indicator, left	/7.D8	Cab
–E5	Rear light, right (indicator/parking/braking)	/7.D12	Cab
–E6	Rear light, left (indicator/parking/braking)	/7.D10	Cab
–E23	Upper head light, right	/7.D3	Cab
–E24	Upper head light, left	/7.D4	Cab
–F1	15A, hazard blinkers, water pump	/7.A7	Cab
–F3	15A, main beams	/7.B3	Cab
–F4	15A, dipped beams	/7.B4	Cab
–F8	25A, light switch	/7.A6	Cab
–F9	15A, trailer socket/fog light, rear	/7.A9	Cab
–F17	10A, direction indicators, Fieldmaster, isoadapter	/7.A8	Cab
–GR5	Ground	/7.D2	Cab
–K10	Relay, flasher unit	/7.A14	Cab
–S1	Rocker switch 3–pos. head lights	/7.A6	Cab
–S4	Combined switch	/7.A3,B14	Cab
–S7	Rocker switch 2–pos. hazard warning flashers	/7.A11	Cab
–S33	Rocker switch 2–pos. change over switch, head lights up	/7.B3	Cab
–X1	Connector, 9–pole	/7.A6	Cab
–X2	Connector, 9–pole	/7.A7,A9	Cab
–X3	Connector, 9–pole	/7.A8,B3	Cab
–X3M	Connector, 29–pole	/7.C5	Engine
–X4	Connector, 9–pole	/7.B3	Cab
–X10	Connector, 9–pole, combined switch	/7.A3,B14	Cab
–X12	Connector, 9–pole	/7.C12,D12	Cab
–X14	Connector, 9–pole	/7.C10,D10	Cab
–X17	Connector, 7–pole, trailer socket	/7.B7	Cab
–X20	Connector, 9–pole	/7.C7,C8	Cab
–X27	Connector, 36–pole, instrument	/7.C14,B15	Cab
–X62	Connector, 16–pole	/7.C5,D5	Engine
–X91	Connector, 9–pole	/7.C3	Roof
–X92	Connector, 3–pole	/7.C3	Roof
–X93	Connector, 3–pole	/7.C14	Mudguard, right
–X94	Connector, 3–pole	/7.C9	Mudguard, left
–X99	Connector, 2–pole	/7.C10,C12	Cab

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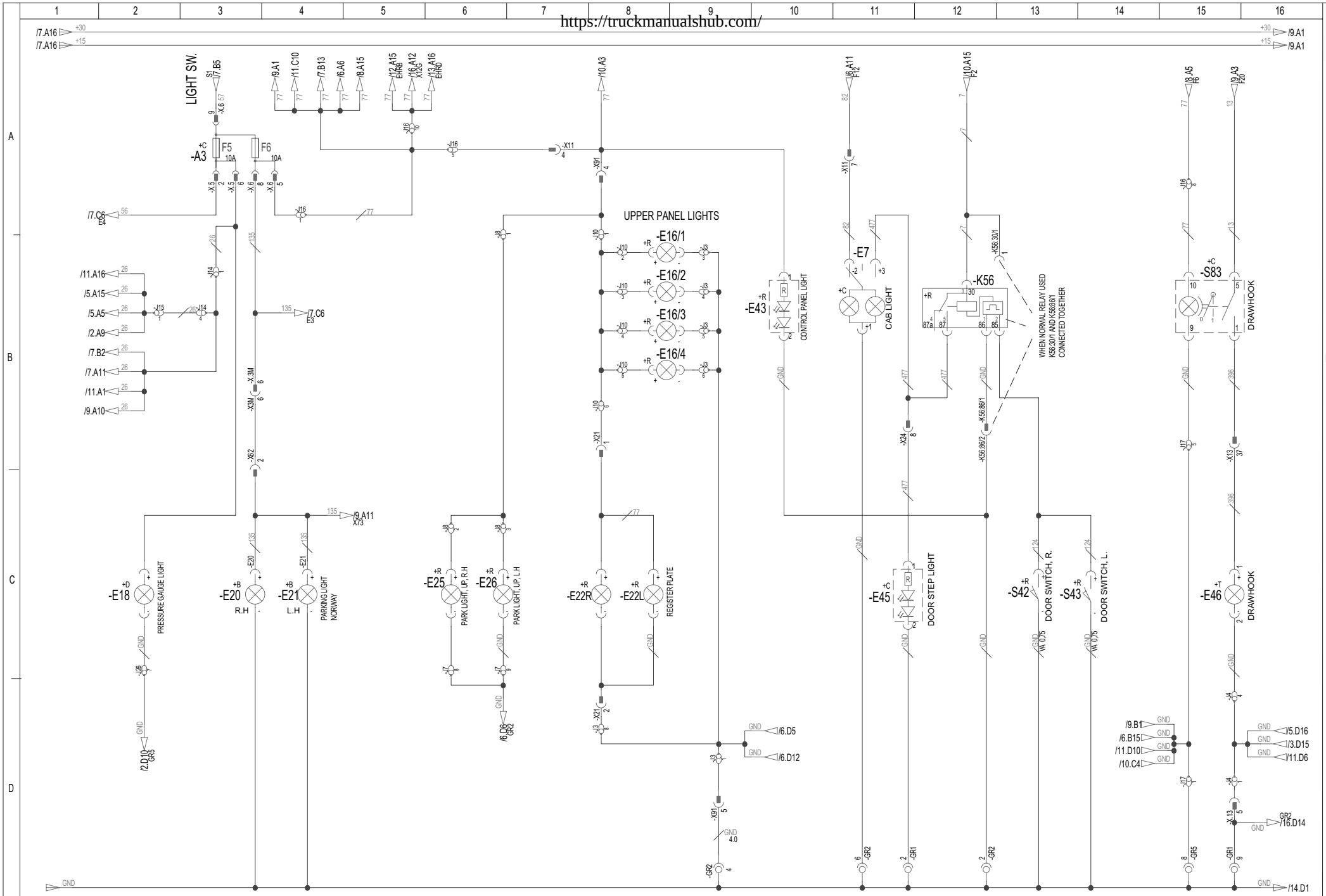


VALTRA	LIGHTNING T121h - T191h AC10.2 / AC10.21	7/18

https://truckmanualshub.com/

Symbol	Description	Page and position	Location
–E7	Cab light	/8.B11	Cab
–E16/1	Upper panel light	/8.B8	Roof
–E16/2	Upper panel light	/8.B8	Roof
–E16/3	Upper panel light	/8.B8	Roof
–E16/4	Upper panel light	/8.B8	Roof
–E18	Pressure gauge light	/8.C2	Cab
–E20	Parking light, right, Norway	/8.C3	Engine
–E21	Parking light,left, Norway	/8.C4	Engine
–E22L	Register plate light	/8.C8	Roof
–E22R	Register plate light	/8.C7	Roof
–E25	Parking light, upper, right	/8.C5	Cab
–E26	Parking light, upper, left	/8.C6	Cab
–E43	control panel light	/8.B10	Cab
–E45	Step light	/8.C11	Cab
–E46	Trailer hitch light	/8.C15	Transmission
–F5	10A, parking lights, left	/8.A3	Cab
–F6	10A, parking lights, right	/8.A4	Cab
–GR1	Ground	/8.D11,D15	Cab
–GR2	Ground	/8.D9,D11,D12	Roof
–GR5	Ground	/8.D15	Cab
–K56	Time–delay relay, cabin light and door step	/8.B12	Roof
–S42	Door switch, cab light, RH	/8.C13	Roof
–S43	Door switch, cab light, LH	/8.C14	Roof
–S83	Switch, 2–pos., drawhook	/8.B15	Cab
–X3M	Connector, 29–pole	/8.B3	Engine
–X5	Connector, 9–pole	/8.A3	Cab
–X6	Connector, 9–pole	/8.A3	Cab
–X11	Connector, 9–pole	/8.A7,A11	Roof
–X13	Connector, 37–pole	/8.B15,D15	Cab
–X21	Connector, 2–pole, register plate light	/8.C7,D7	Roof
–X24	Connector, 9–pole	/8.B11	Roof
–X62	Connector, 16–pole	/8.C3	Engine
–X91	Connector, 9–pole	/8.A8,D9	Roof

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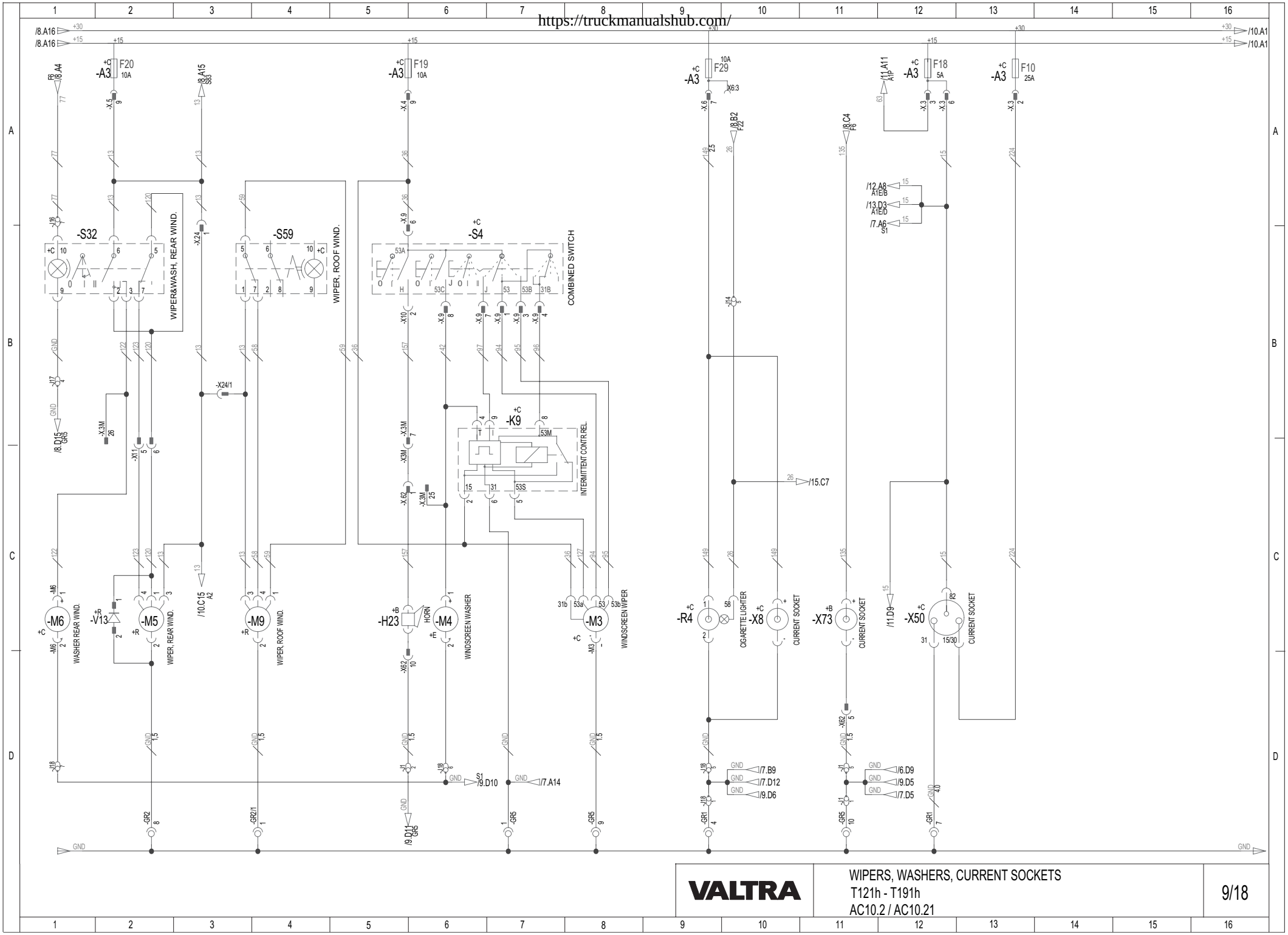
VALTRA

LIGHTNING
T121h - T191h
AC10.2 / AC10.21

https://truckmanualshub.com/

Symbol	Description	Page and position	Location
–F10	25A, 3–pole current socket	/9.A13	Cab
–F18	5A, instruments, indicatorlights, Autocontrol	/9.A12	Cab
–F19	10A, windscreen wiper/washer, horn	/9.A6	Cab
–F20	10A, rear window wiper/washer, radio, trailer hitch light	/9.A2	Cab
–F29	10A, cigarette lighter, 2–pin current socket	/9.A9	Cab
–GR1	Ground	/9.D9,D12	Cab
–GR2	Ground	/9.D2,D4	Roof
–GR5	Ground	/9.D7,D8,D11	Cab
–H23	Horn	/9.C6	Engine hood
–K9	Relay, interval wiper	/9.C7	Cab
–M3	Windscreen wiper	/9.C8	Cab
–M4	Windscreen washer	/9.C6	Engine
–M5	Rear window wiper	/9.C13	Roof
–M6	Rear window washer	/9.C1	Cab
–M9	Roof window wiper	/9.C3	Roof
–R4	Cigarette lighter	/9.C9	Cab
–S4	Combined switch	/9.B6	Cab
–S32	Rocker switch, 3–pos. rear window wiper and washer	/9.B1	Cab
–S59	Rocker switch, 2–pos. wiper. roof wind.	/9.B4	Cab
–V13	Diode, rear window washer motor	/9.C2	Roof
–X3M	Connector, 29–pole	/9.B2,B5	Engine
–X3	Connector, 9–pole	/9.A12,A13	Cab
–X4	Connector, 9–pole	/9.A5	Cab
–X5	Connector, 9–pole	/9.A2	Cab
–X6	Connector, 9–pole	/9.A9	Cab
–X8	Connector, 2–pole current socket	/9.C10	Cab
–X9	Connector, 9–pole	/9.B6,B7	Cab
–X10	Connector, 9–pole	/9.B6	Cab
–X11	Connector, 9–pole	/9.C3	Roof
–X24	Connector, 9–pole	/9.B3	Roof
–X50	Connector, 3–pole current socket	/9.C11	Cab
–X62	Connector, 16–pole	/9.C6,D11	Engine
–X73	Connector, 2–pole, current socket	/9.C12	Engine

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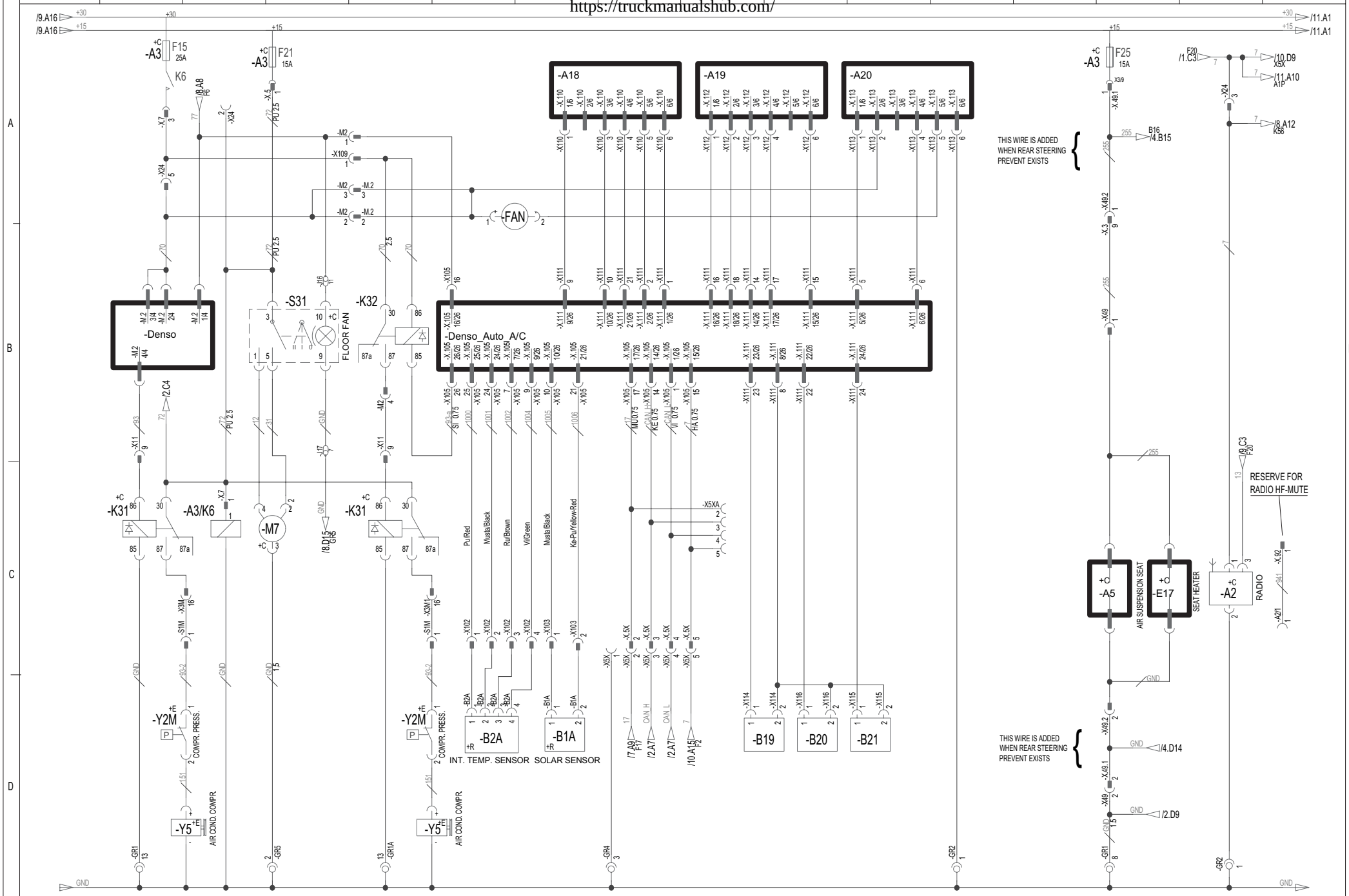
VALTRA

WIPERS, WASHERS, CURRENT SOCKETS
T121h - T191h
AC10.2 / AC10.21

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Symbol	Description	Page and position	Location
–A2	Radio	/10.C15	Cab
–A5	Air suspension seat	/10.C14	Cab
–A18	Recirculation actuator	/10.A7	Roof
–A19	Water mixing actuator	/10.A9	Roof
–A20	Fan speed regulator	/10.A11	Roof
–B1A	Solar sensor	/10.D7	Roof
–B2A	Temperature sensor, internal	/10.D6	Roof
–B19	Temperature sensor	/10.D10	Roof
–B20	Temperature sensor	/10.D10	Roof
–B21	Temperature sensor, evaporator	/10.D11	Roof
–Denso	Air conditioner	/10.B2	Roof
–Denso_aut	Air conditioning control unit	/10.B6	Roof
–E17	Seat heater	/10.C14	Cab
–F15	25A, fan, air conditioning	/10.A2	Cab
–F21	15A, Air conditioning, control, floor fan, fuel feed pump	/10.A4	Cab
–F25	15A, suspension seat, seat heater, rear steering prevention, electric front loader valves	/10.A14	Cab
–FAN	Fan, heater, air conditioner	/10.A7	Roof
–GR1	Ground	/10.D2,D5,D14	Cab
–GR2	Ground	/10.D12,D15	Roof
–GR4	Ground	/10.D8	Cab
–GR5	Ground	/10.D4	Cab
–K6	Relay, air conditioning, fan, control	/10.A2,C3	Cab
–K31	Relay, air conditioner compressor	/10.C2,C5	Cab
–K32	Relay, air conditioner	/10.B5	Cab
–M2	Fan, heater, air conditioner	/10.A5,B2,B5	Roof
–M7	Floor fan	/10.C4	Cab
–S1M	Pressure switch, air cond. compressor	/10.D3,D6	Engine
–S31	Switch, 3–pos., floor fan	/10.B4	Cab
–X3	Connector, 9–pole	/10.A14	Cab
–X3M	Connector, 29–pole	/10.C3,C6	Engine
–X5	Connector, 9–pole	/10.A4	Cab
–X5X	Connector, 9–pole	/10.C8	Cab
–X7	Connector, 9–pole	/10.A2,C3	Cab
–X11	Connector, 9–pole	/10.B2,B5	Roof
–X24	Connector, 9–pole	/10.A2,A3,A15	Roof
–X49	Connector, 2–pole	/10.A14,B14,D14	Cab
–X92	Connector, 3–pole	/10.C16	Roof
–X102	Connector, 4–pole	/10.C6	Roof
–X103	Connector, 2–pole	/10.C7	Roof
–X105	Connector, 26–pole	/10.B6–B8	Roof
–X109	Connector, 1–pole	/10.A5	Roof
–X110	Connector, 6–pole	/10.A8	Roof
–X111	Connector, 26–pole	/10.B7–B12	Roof
–X112	Connector, 6–pole	/10.A9	Roof
–X113	Connector, 6–pole	/10.A11	Roof
–X114	Connector, 2–pole	/10.D10	Roof
–X115	Connector, 2–pole	/10.D11	Roof
–X116	Connector, 2–pole	/10.D10	Roof
–Y2M	Air conditioner compressor	/10.D3,D6	Engine

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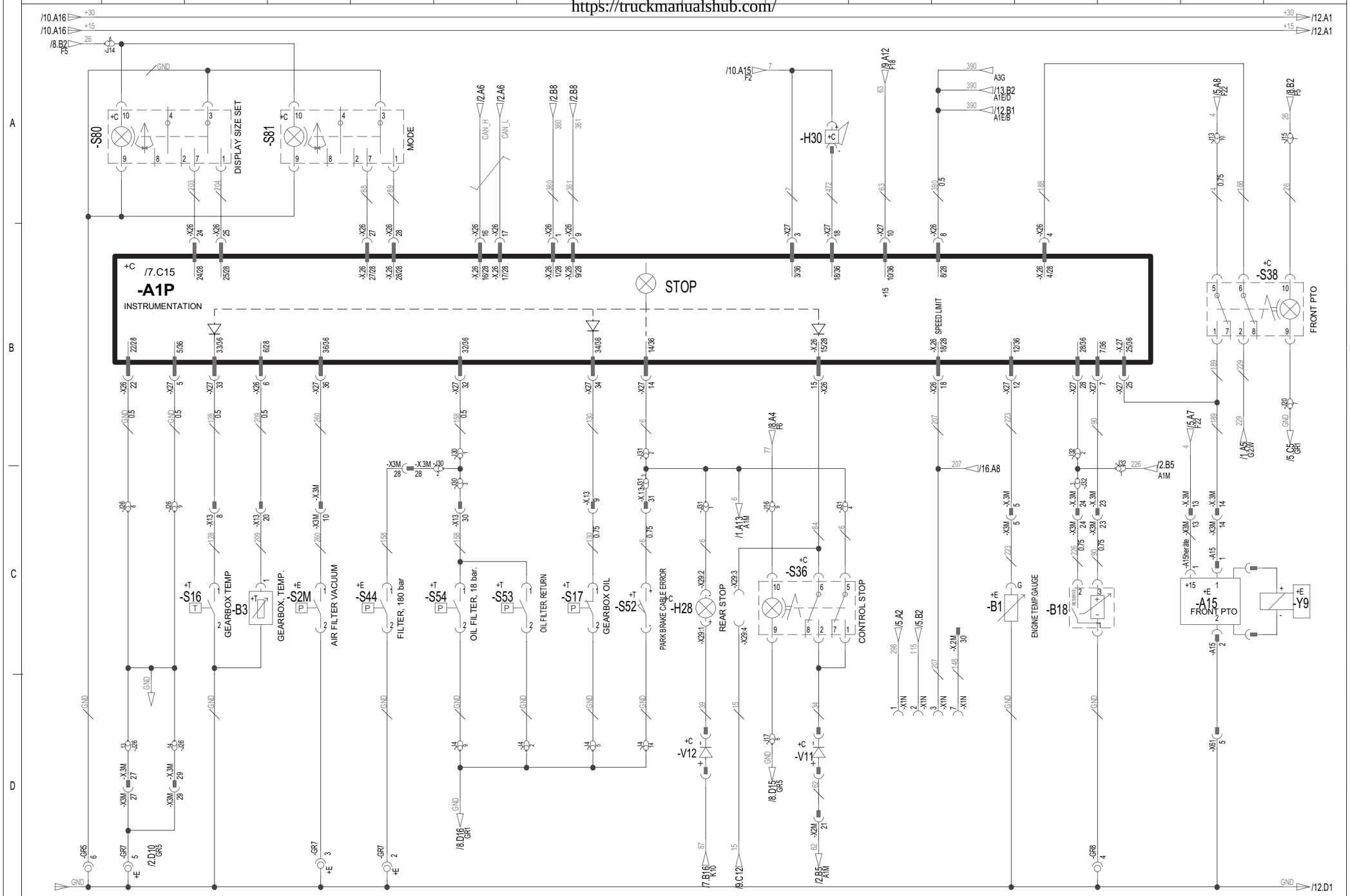
VALTRA	A/C, SEAT, RADIO T121h - T191h AC10.2 / AC10.21	10/18

https://truckmanualshub.com/

Symbol	Description	Page and position	Location
–A1P	Instrument	/11.B2	Cab
–A15	Control unit, front–PTO	/11.C15	Engine
–B1	Temperature sensor, engine coolant	/11.C13	Engine
–B3	Temperature sensor, gearbox oil	/11.C3	Transmission
–B18	Level sensor, fuel	/11.C14	Transmission
–GR5	Ground	/11.D1	Cab
–GR7	Ground	/11.D2,D4,D5	Engine
–GR8	Ground	/11.D14	Engine
–H28	Indicator light, stop, rear	/11.C8	Cab
–H30	Buzzer, instrumentation	/11.A10	Cab
–S2M	Pressure switch, engine air filter	/11.C4	Engine
–S16	Temperature switch, gearbox oil	/11.C3	Transmission
–S17	Pressure switch, gearbox oil	/11.C7	Transmission
–S36	Switch, 2–pos., control stop	/11.C10	Cab
–S38	Rocker switch 2–pos. front–PTO	/11.B15	Cab
–S44	Pressure switch, pressure filter (high pressure circuit)	/11.C5	Engine
–S52	Switch, parking brake cable	/11.C8	Transmission
–S53	Pressure switch, pressure filter, return	/11.C7	Transmission
–S54	Pressure switch, pressure filter (low pressure circuit)	/11.C6	Transmission
–S80	Switch, 3–pos., instrument, display size	/11.A2	Cab
–S81	Switch, 3–pos., instrument, display mode	/11.A4	Cab

Symbol	Description	Page and position	Location
–V11	Diode, control stop	/11.D10	Cab
–V12	Diode, rear stop–indicator light	/11.D9	Cab
–X1N	Connector, 9–pole	/11.D11	Cab
–X2M	Connector, 31–pole	/11.C12,D10	Engine
–X3M	Connector, 29–pole	/11.C4–C15,D2	Engine
–X13	Connector, 37–pole	/11.C3–C8	Cab
–X26	Connector, 28–pole, instrument	/11.B1–B13	Cab
–X27	Connector, 36–pole, instrument	/11.B2–B14	Cab
–X29	Connector, 2–pole.socket, stop–alarm	/11.C9	Cab
–X61	Connector, 9–pole	/11.D15	Cab
–Y9	Magnetic clutch, front–PTO	/11.C16	Engine

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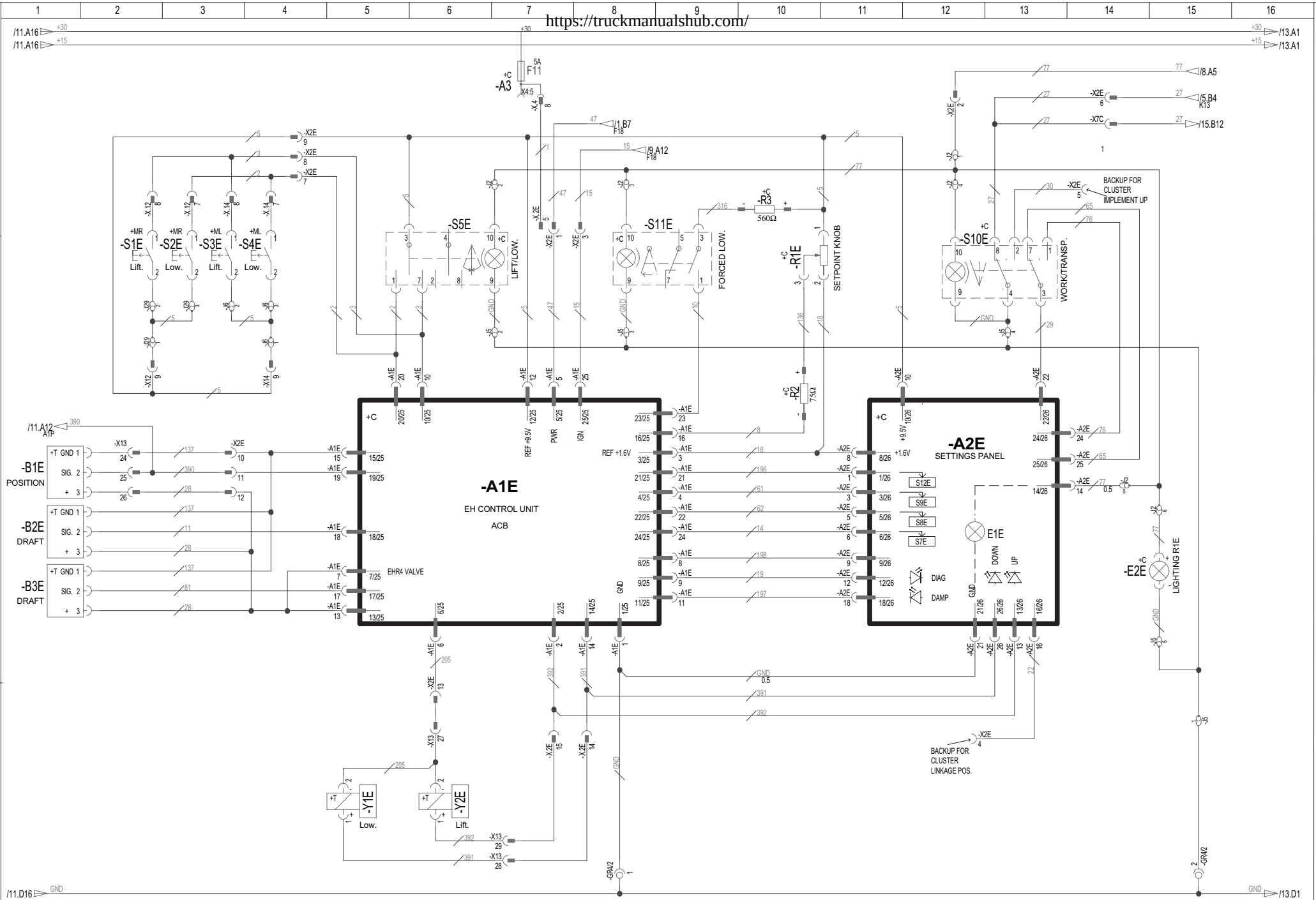
VALTRA

INSTRUMENTATION, FRONT PTO
T121h - T191h
AC10.2 / AC10.21

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Symbol	Description	Page and position	Location
–A1E	Control unit, power lift, EHRB	/12.C6	Cab
–A2E	Switch panel, power lift, EHRB	/12.B12	Cab
–B1E	Position sensor, rear power lift, EHRB	/12.C1	Transmission
–B2E	Draft sensor, r.h	/12.C1	Transmission
–B3E	Draft sensor, l.h	/12.C1	Transmission
–E1E	Lightning, switch panel	/12.C12	Cab
–E2E	Lightning, position potentiometer	/12.C14	Cab
–F11	5A, power lift control unit, buzzer	/12.A7	Cab
–GR4	Ground	/12.D8,D15	Cab
–R1E	Potentiometer, power lift (EHRB) position control	/12.B10	Cab
–R2	Resistor, power lift (EHRB) (for position control)	/12.B10	Cab
–R3	Resistor, power lift (EHRB) (for forced lowering)	/12.A10	Cab
–S1E	Push button, rear operation, r.h., lifting	/12.B2	Right mudguard
–S2E	Push button, rear operation, r.h., lowering	/12.B3	Right mudguard
–S3E	Push button, rear operation, l.h., lifting	/12.B3	Left mudguard
–S4E	Push button, rear drive, l.h., lowering	/12.B4	Left mudguard
–S5E	Switch, 3–pos., cabin, lifting/lowering	/12.B6	Cab
–S7E	Lowering speed selector, power lift	/12.C12	Cab
–S8E	Transport height selector, power lift	/12.C12	Cab
–S9E	Draft control selector, power lift	/12.C12	Cab
–S10E	Switch, 3–pos., lifting/lowering	/12.B12	Cab
–S11E	Switch, forced lowering	/12.B8	Cab
–S12E	Drive balance control, power lift	/12.B12	Cab
–X2E	Connector, 15–pole	/12.A4–A14	Cab
–X2E	Connector, 15–pole	/12.B4	Cab
–X2E	Connector, 15–pole	/12.D6,D7,D12	Cab
–X4	Connector, 9–pole	/12.A7	Cab
–X7C	Connector, 3–pole	/12.A14	Cab
–X12	Connector, 9–pole	/12.A2,B2	Cab
–X13	Connector, 37–pole	/12.B2,D6,D7	Cab
–X14	Connector, 9–pole	/12.A4,B4	Cab
–Y1E	Solenoid valve, power lift, lowering	/12.D5	Transmission
–Y2E	Solenoid valve, power lift, lifting	/12.D6	Transmission

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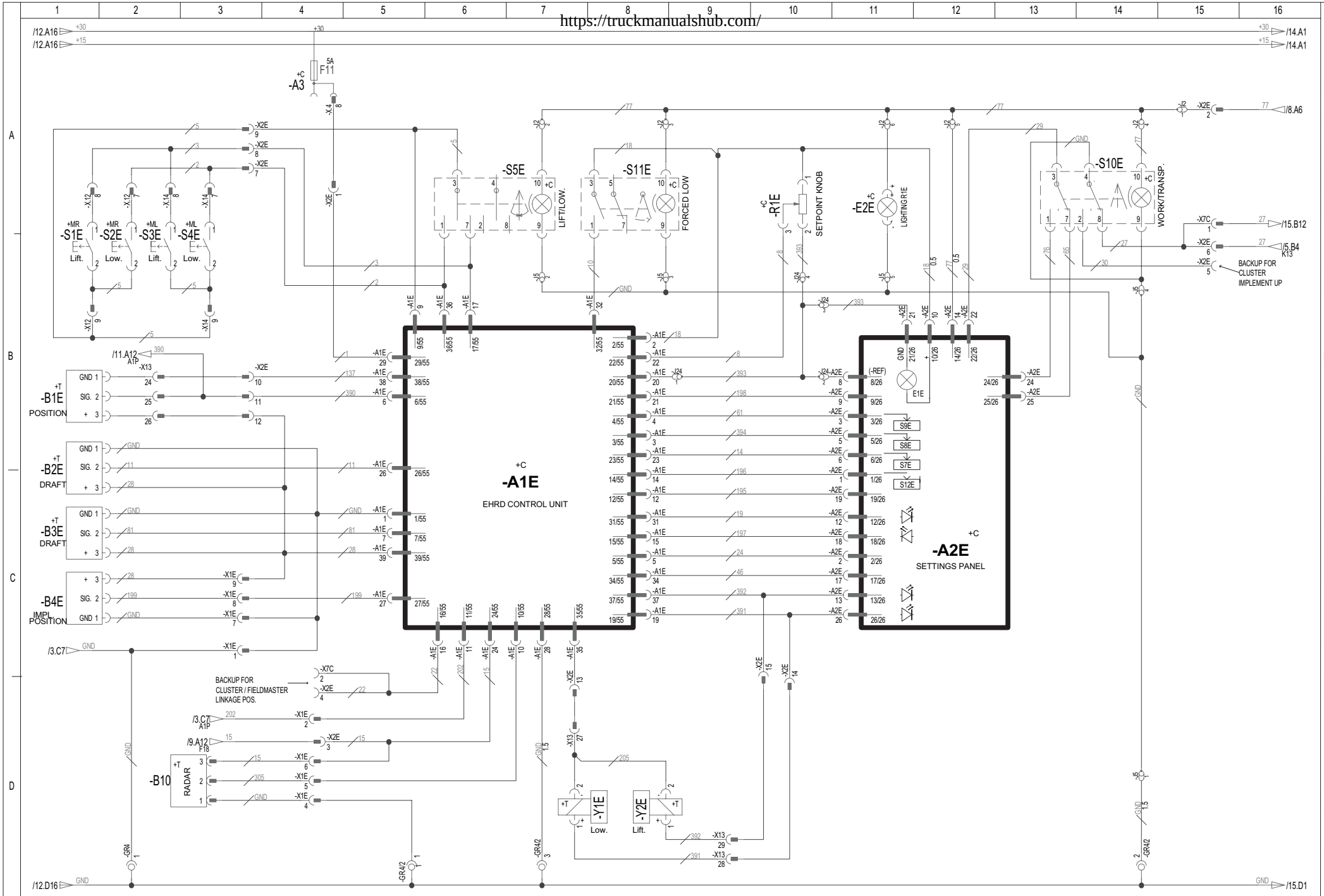


VALTRA	EHRB T121h - T191h AC10.2 / AC10.21	12/18

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Symbol	Description	Page and position	Location
–A1E	Control unit, power lift, EHRD	/13.C7	Cab
–A2E	Switch panel, power lift, EHRD	/13.C12	Cab
–B1E	Position sensor, rear power lift, EHRD	/13.B1	Transmission
–B2E	Draft sensor, r.h	/13.C1	Transmission
–B3E	Draft sensor, l.h	/13.C1	Transmission
–B4E	Sensor, implement position (ACD)	/13.C1	Transmission
–B10	Speed radar	/13.D2	Transmission
–E1E	Lightning, switch panel	/13.B11	Cab
–E2E	Lightning, position potentiometer	/13.A11	Cab
–F11	5A, power lift control unit, buzzer	/13.A4	Cab
–GR4	Ground	/13.D2–D14	Cab
–R1E	Potentiometer, power lift pos. control	/13.A10	Cab
–S1E	Push button, rear operation, r.h., lifting	/13.B1	Right mudguard
–S2E	Push button, rear operation, r.h., lowering	/13.B2	Right mudguard
–S3E	Push button, rear operation, l.h., lifting	/13.B2	Left mudguard
–S4E	Push button, rear drive, l.h., lowering	/13.B3	Left mudguard
–S5E	Switch, 3–pos., cabin, lifting/lowering	/13.A6	Cab
–S7E	Lowering speed selector, power lift	/13.B11	Cab
–S8E	Transport height selector, power lift	/13.B11	Cab
–S9E	Draft control selector, power lift	/13.B11	Cab
–S10E	Switch, 3–pos., lifting/lowering	/13.A14	Cab
–S11E	Switch, forced lowering	/13.A8	Cab
–S12E	Drive balance control, power lift	/13.C11	Cab
–X1E	Connector, 9–pole	/13.C3,D4	Cab
–X2E	Connector, 15–pole	/13.A3,A4,A15	Cab
–X2E	Connector, 15–pole	/13.B3,B15	Cab
–X2E	Connector, 15–pole	/13.D4,D7,D10	Cab
–X4	Connector, 9–pole	/13.A4	Cab
–X7C	Connector, 3–pole	/13.A15,D4	Cab
–X12	Connector, 9–pole	/13.A1,B1	Cab
–X13	Connector, 37–pole	/13.B2,D7,D9	Cab
–X14	Connector, 9–pole	/13.A3,B3	Cab
–Y1E	Solenoid valve, power lift, lowering	/13.D7	Transmission
–Y2E	Solenoid valve, power lift, lifting	/13.D8	Transmission

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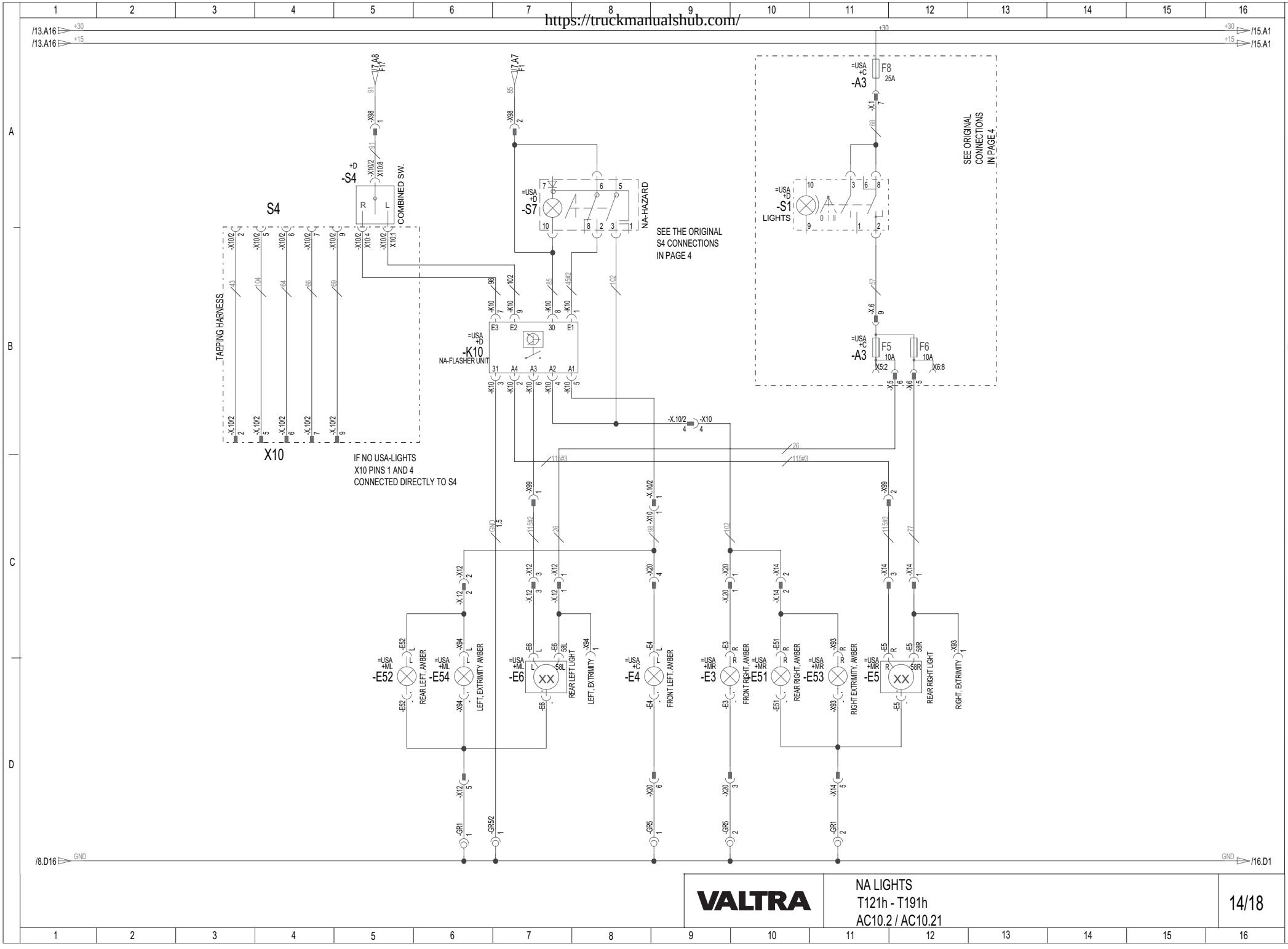


VALTRA	EHRD T121h - T191h AC10.2 / AC10.21	13/18

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Symbol	Description	Page and position	Location
–E3	Front direction indicator, right	/14.D9	Cab
–E4	Front direction indicator, left	/14.D8	Cab
–E5	Rear light, right (indicator/parking/braking)	/14.D12	Mudguard, right
–E6	Rear light, left (indicator/parking/braking)	/14.D7	Mudguard, left
–E51	Warning light, rear right	/14.D10	Mudguard, right
–E52	Warning light, rear left	/14.D5	Mudguard, left
–E53	Extremity warning light, rear right	/14.D11	Mudguard, right
–E54	Extremity warning light, rear left	/14.D6	Mudguard, left
–F5	10A, Parking lights, left	/14.B11	Cab
–F6	10A, Parking lights, right	/14.B12	Cab
–F8	25A, Light switch	/14.A11	Cab
–GR1	Ground	/14.D6,D11	Cab
–GR5	Ground	/14.D7,D9	Cab
–K10	Relay, NA flasher unit	/14.B7	Cab
–S1	Switch, 3–pos., head lights	/14.A10	Cab
–S4	Combined switch	/14.A5	Cab
–S7	Switch, 2–pos., hazard warning flashers	/14.A7	Cab
–X1	Connector, 9–pole	/14.A11	Cab
–X5	Connector, 9–pole	/14.B11	Cab
–X6	Connector, 9–pole	/14.B12	Cab
–X10	Connector, combined switch	/14.B3,C8,C9	Cab
–X12	Connector, 9–pole	/14.C6,C7,D6	Cab
–X14	Connector, 9–pole	/14.C10,C12,D10	Cab
–X20	Connector, 9–pole	/14.C9,D9	Cab
–X93	Connector, 1–pole	/14.D11,D12	Cab
–X94	Connector, 1–pole	/14.D6,D8	Cab
–X98	Connector, 2–pole	/14.A5,A7	Cab
–X99	Connector, 2–pole	/14.C7,C11	Cab

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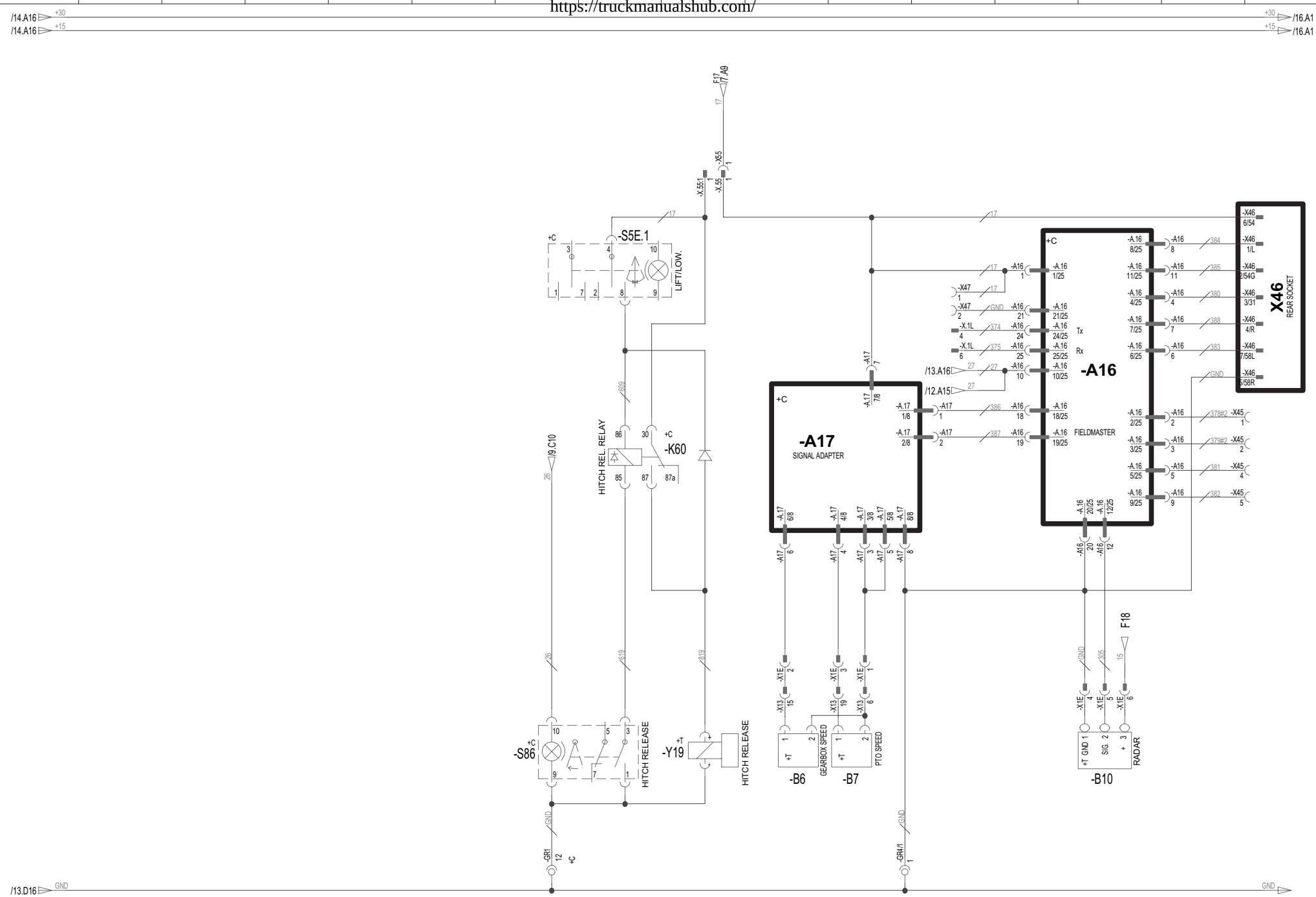


VALTRA	NA LIGHTS T121h - T191h AC10.2 / AC10.21	14/18

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Symbol	Description	Page and position	Location
–A16	Fieldmaster	/15.B13	Cab
–A17	Adapter, Fieldmaster sensor signals	/15.C10	Cab
–B6	Speed sensor, gearbox	/15.D10	Transmission
–B7	Speed sensor, PTO	/15.D11	Transmission
–B10	Speed radar	/15.D14	Transmission
–GR1	Ground	/15.D7	Cab
–GR4	Ground	/15.D11	Cab
–K60	Relay, trailer hitch release	/15.B8	Cab
–S5E	Switch, 3–pos., cabin, lifting/lowering	/15.B8	Cab
–S86	Switch, trailer hitch release	/15.D7	Cab
–X1L	Connector, 9–pole	/15.B12	Cab
–X1E	Connector, 9–pole	/15.D10–D14	Cab
–X13	Connector, 37–pole	/15.D10,D11	Cab
–X45	Connector, 9–pole, fieldmaster	/15.B15	Cab
–X46	Connector, 7–pole rear socket	/15.B16	Cab
–X47	Connector, 2–pole, fieldmaster	/15.B12	Cab
–X55	Connector, 1–pole	/15.A9	Cab
–Y19	Solenoid valve, trailer hitch release	/15.D9	Transmission

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VALTRA

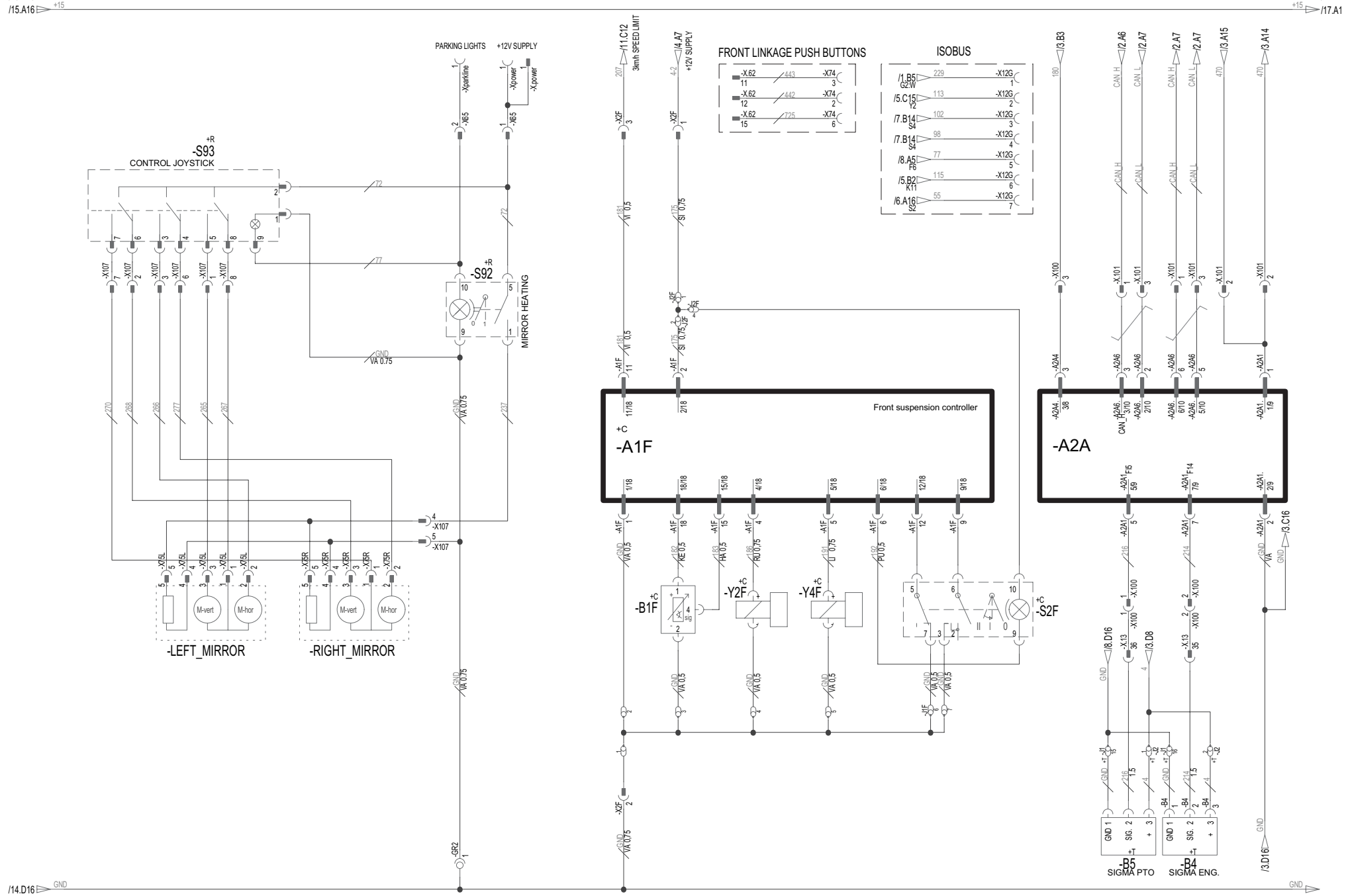
HITCH RELEASE, FIELDMASTER
T121h - T191h
AC10.2 / AC10.21

15/18

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Symbol	Description	Page and position	Location
–A1F	Control unit, front suspension	/16.C8	Cab
–A2A	Control unit, transmission, TC2	/16.C13	Cab
–A2A1	Connector, 9–pole	/16.B15,C14,C15	Cab
–A2A4	Connector, 8–pole	/16.B13	Cab
–A2A6	Connector, 10–pole	/16.B14	Cab
–B1F	Angle sensor	/16.C8	Front axle
–B4	Sensor, Sigma engine	/16.D15	Transmission
–B5	Sensor, Sigma PTO	/16.D14	Transmission
–GR2	Ground	/16.D6	Roof
–S2F	Switch, suspension off/on/calibr.	/16.C12	Cab
–S92	Switch, side mirror heating	/16.B6	Roof
–S93	Control joystick, electrical side mirrors	/16.A3	Roof
–X2F	Connector, 3–pole	/16.A8,D8	Cab
–X12G	Connector, 9–pole, ISOBUS	/16.A12	Cab
–X13	Connector, 37–pole	/16.C14	Cab
–X62	Connector, 16–pole	/16.A9	Engine
–X65	Connector, 3–pole	/16.A6	Roof
–X74	Connector, 9–pole	/16.A10	Engine hood
–X75L	Connector, 5–pole	/16.C3	Roof
–X75R	Connector, 5–pole	/16.C5	Roof
–X100	Connector, 3–pole	/16.B13,C14	Cab
–X101	Connector, 4–pole	/16.B14,B15	Cab
–X107	Connector, 9–pole	/16.B2,C6	Roof
–Y2F	Solenoid valve, 3/2	/16.C9	Cab
–Y4F	Solenoid valve, 2/2	/16.C10	Cab

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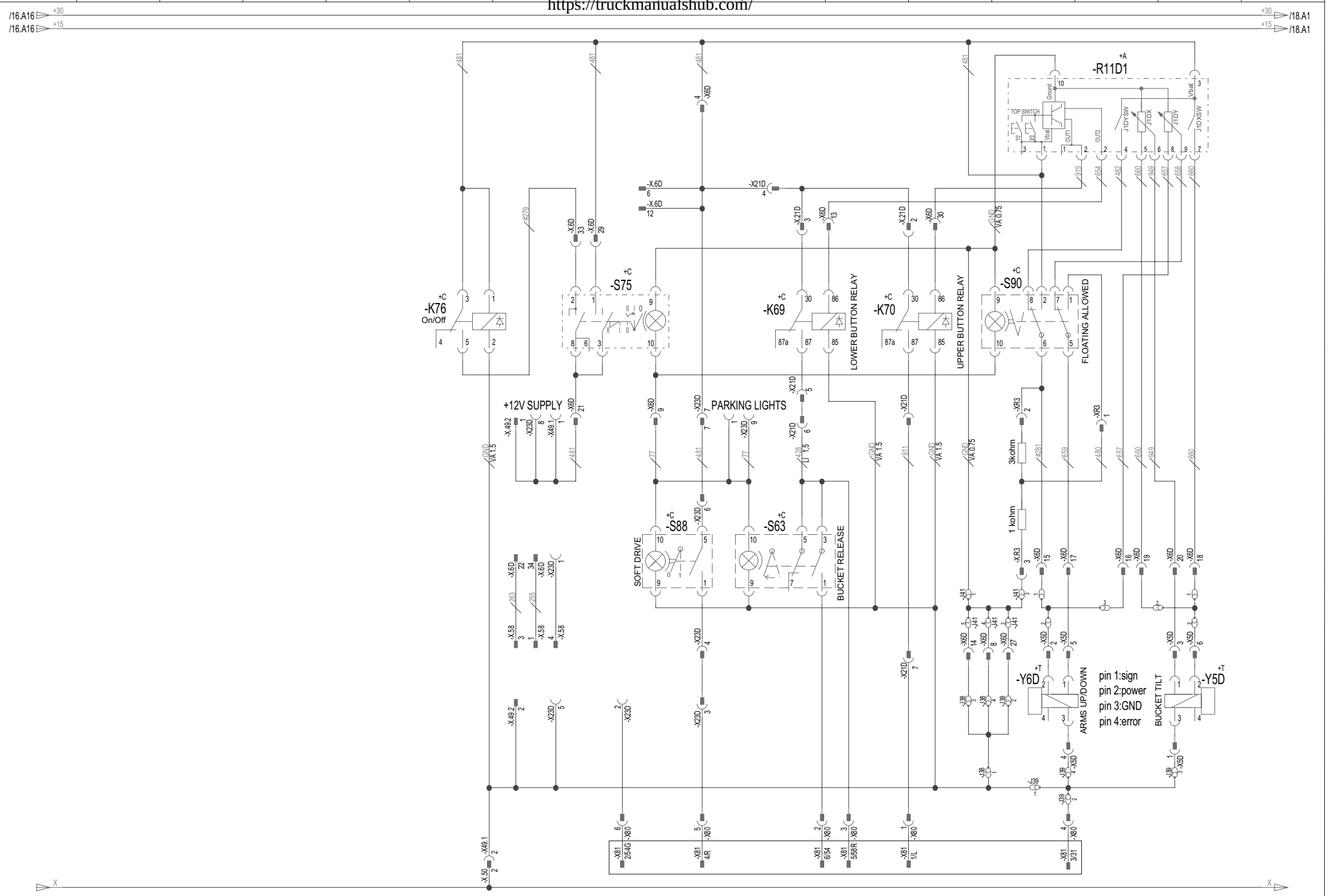
EL. MIRRORS, FRONT SUSPENSION, TC2
T121h - T191h
AC10.2 / AC10.21

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Symbol	Description	Page and position	Location
–K69	Relay, joystick button, lower	/17.B10	Cab
–K70	Relay, joystick button, upper	/17.B11	Cab
–K76	Relay, hydraulics on/off	/17.B6	Cab
–R11D1	Joystick, front valves	/17.A13	Armrest
–S63	Switch, implement locking release	/17.C10	Cab
–S75	Switch, hydraulics on/off	/17.B8	Cab
–S88	Switch, Soft drive	/17.C9	Cab
–S90	Switch, floating	/17.B13	Cab
–X5D	Connector, 6–pole	/17.C13,C15	Cab
–X5D	Connector, 6–pole	/17.D13,D15	Cab
–X6D	Connector, 37–pole	/17.A9	Cab
–X6D	Connector, 37–pole	/17.B8–B12	Cab
–X6D	Connector, 37–pole	/17.C7,C12–C15	Cab
–X21D	Connector, 9–pole	/17.A10,A11	Cab
–X21D	Connector, 9–pole	/17.B10,B12	Cab
–X21D	Connector, 9–pole	/17.C12	Cab
–X23D	Connector, 9–pole	/17.B7,B9	Cab
–X23D	Connector, 9–pole	/17.C7,C9	Cab
–X23D	Connector, 9–pole	/17.D7–D9	Cab
–X49	Connector, 2–pole	/17.B7,D7	Cab
–X58	Connector, 9–pole	/17.C7	Cab
–X80	Connector, 6–pole	/17.D8–D13	Cab
–X81	Connector, 7–pole	/17.D8–D13	Cab
–Y5D	Solenoid valve, bucket tilt	/17.D15	Transmission
–Y6D	Solenoid valve, arms up/down	/17.D13	Transmission

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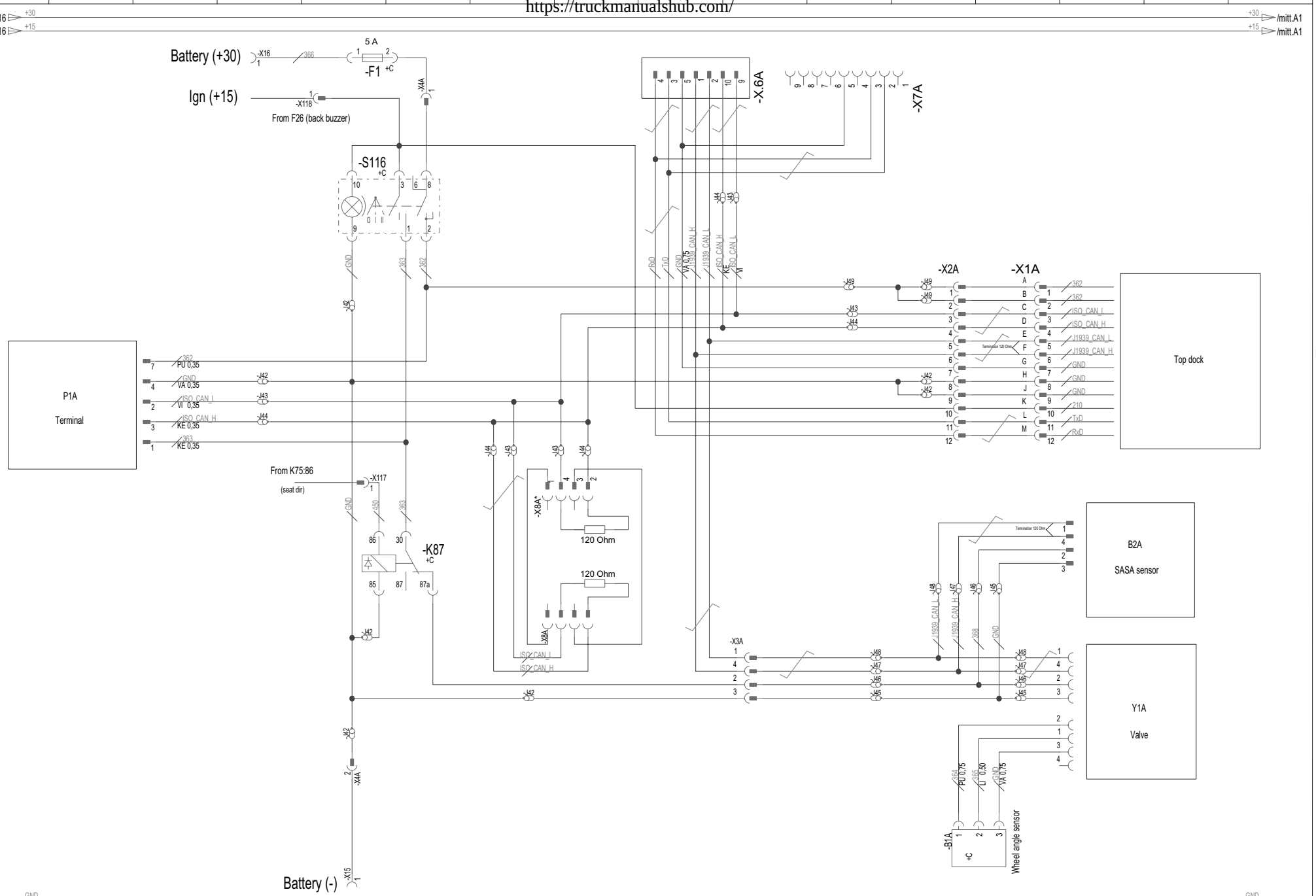
VALTRA

ARMREST, HYDRAULICS CONTROL
T121h - T191h
AC10.2 / AC10.21

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Symbol	Description	Page and position	Location
–B1A	Angle sensor, wheel	/18.D12	Front axle
–B2A	Sensor, steering angle and steering speed	/18.C14	Cab
–F1	5A, Auto–Guide	/18.A5	Cab
–K87	Relay, Auto–Guide	/18.C6	Cab
–P1A	Terminal, Auto–Guide	/18.B2	Cab
–S116	Switch, Auto–Guide	/18.A5	Cab
–X1A	Connector, 12–pole	/18.B13	Cab
–X2A	Connector, 12–pole	/18.B12	Cab
–X3A	Connector, 4–pole	/18.C10	Cab
–X4A	Connector, 2–pole	/18.A6,D5	Cab
–X6A	Connector, 16–pole	/18.A9	Cab
–X7A	Connector, 9–pole	/18.A11	Cab
–X8A	Connector, 4–pole	/18.C8	Cab
–X8A*	Connector, 4–pole	/18.C8	Cab
–X15	Connector, 1–pole	/18.D5	Engine
–X16	Connector, 1–pole	/18.A4	Engine
–X117	Connector, 1–pole	/18.C6	Cab
–X118	Connector, 6–pole	/18.A5	Cab
–Y1A	Solenoid valve, wheel turning	/18.D14	Cab

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VALTRA	AUTO-GUIDE T121h - T191h AC10.2 / AC10.21	18/18

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Fault finding

343.1 ... Wiring diagram 1

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Autocontrol AC11.2

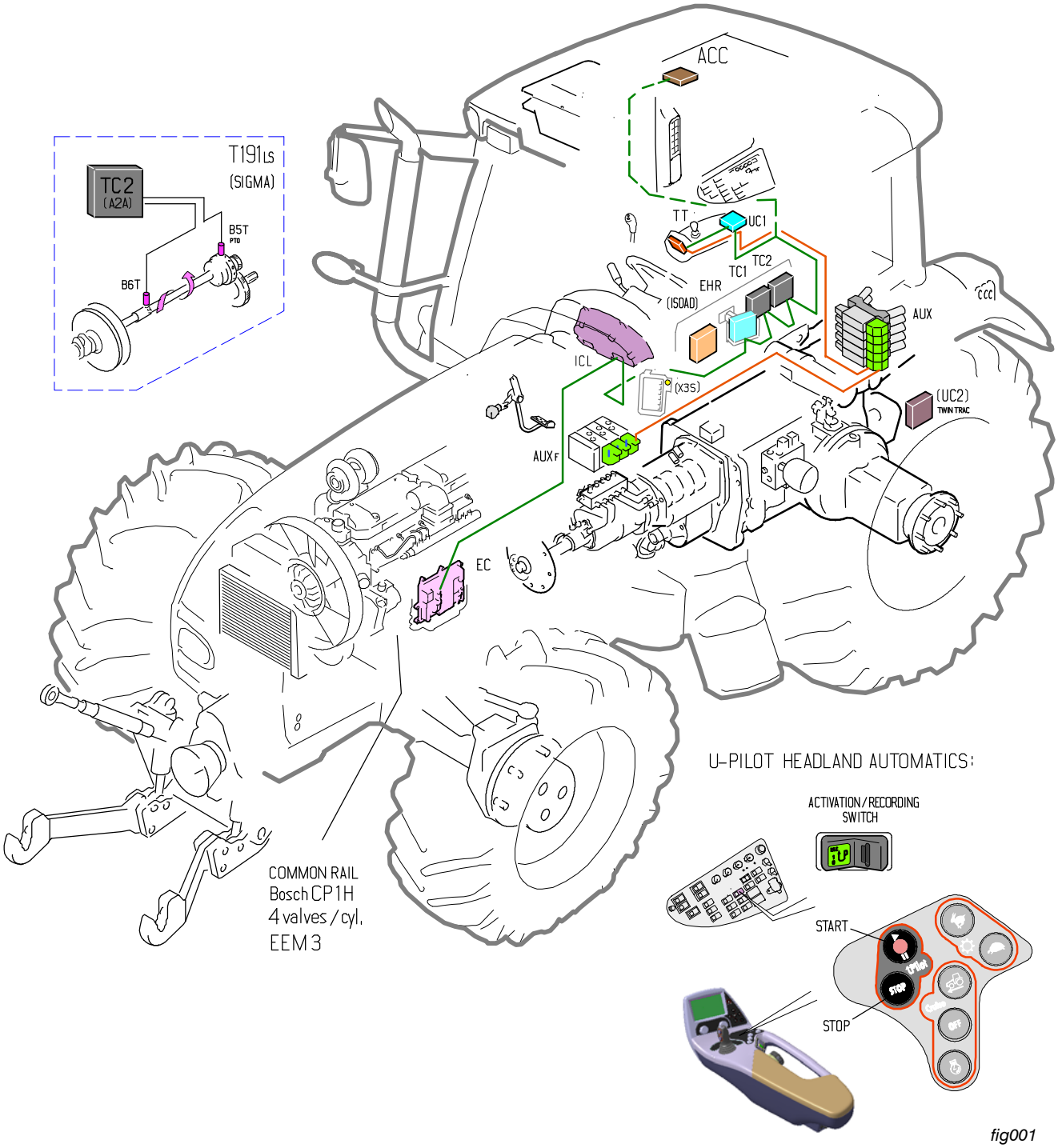


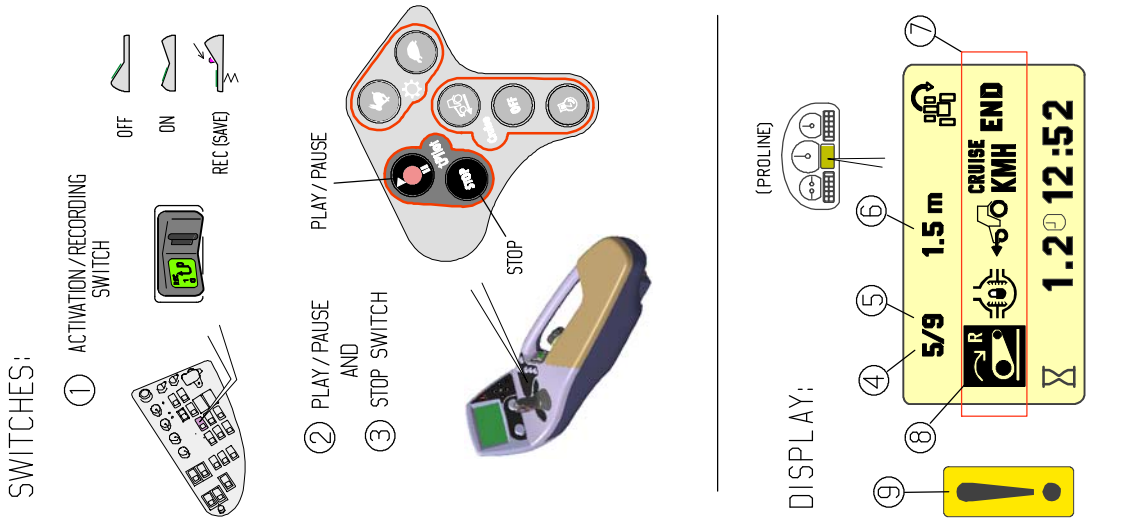
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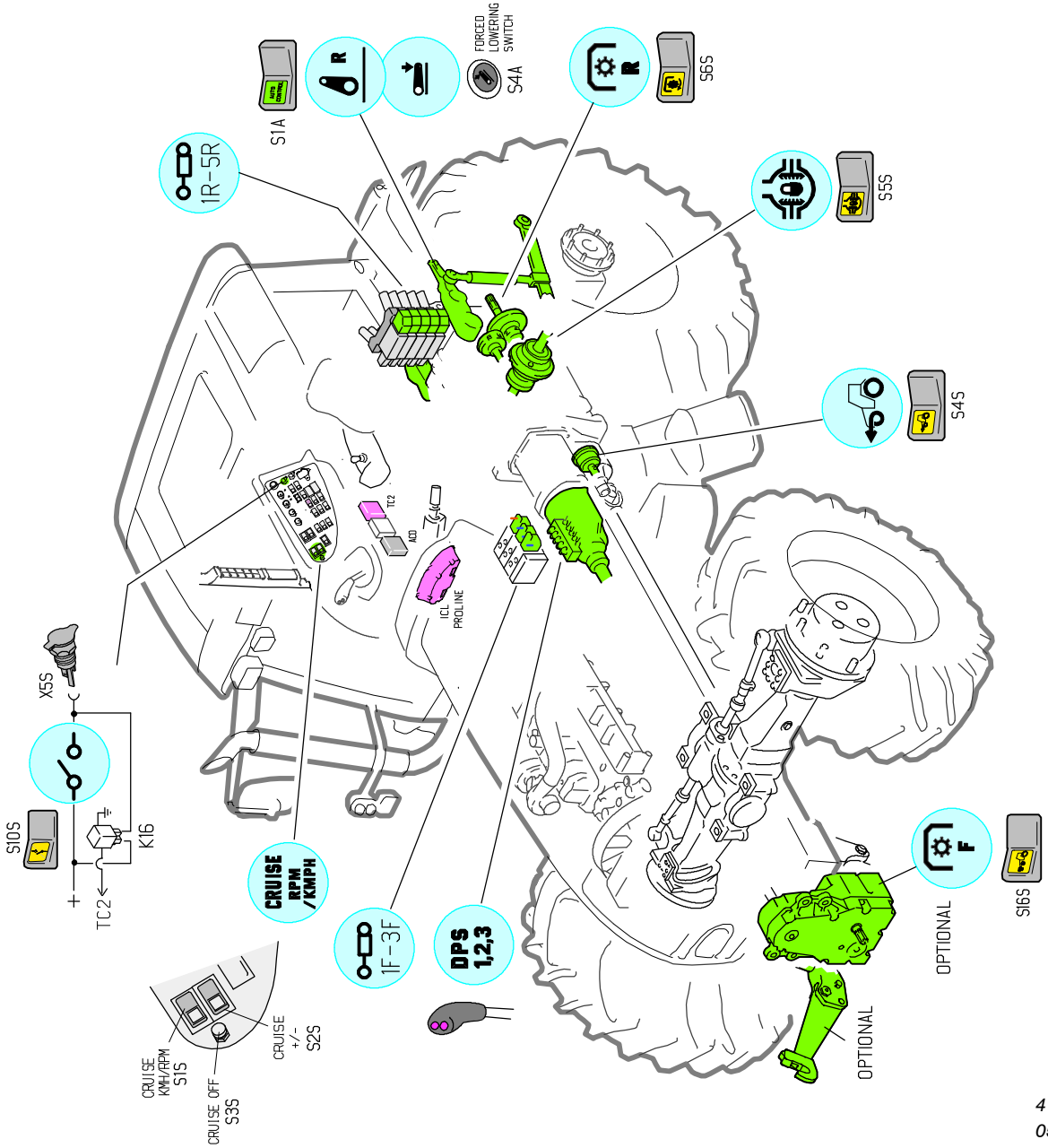
Features of the Autocontrol AC11.2:

- Common Rail engine
- Control of hydraulics (TT + armrest)
- UC1 in armrest (+ UC2 TwinTrac controller optional)
- Semi–automatic range gear
- CAN bus structure
- U Pilot as standard
- Sigma Power (T191LS only)

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U–Pilot headland automatics





4–2828
05/07

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1) Activation / recording switch
2) Play / pause switch
3) Stop switch
4) Number of operation
5) Total number of operations
6) Distance to the next operation
7) Symbols of the recorded operations (in the display max 5 pcs)
8) Symbol of the next/ongoing operation
9) Warning light

The aim of the U–Pilot system is to automate a group of often used functions. A typical example is the turn on the headland.

The idea of the system is that the operator runs the whole operational cycle and presses the desired switches and the cycle is recorded to the memory of the system. The operational cycle can then be started with one press of a switch. The system has also an on–line/programmable PAUSE function with the activation switch (**2**) in the arm rest that stops the operation for a while and restarts it with a new press.

The recorded items are the pressed functions and the travelled distance between functions. The programming and the run can be done with different speeds, the distances remain constant while the time intervals are changed.



DANGER: When using U–Pilot the operations start automatically. Ensure that nobody is in the danger area.



CAUTION: The switches on the side panel do not show the status of equipment when using U–Pilot.

Operating Range
- Tractor speed must be between 0.5 km/h and 20 km/h
- Max. 30 operations
- Total operating range under 100 m without pause
- Travel distance between consecutive operations under 63.5 m
- Distances are measured with 0.5 m accuracy, minimum distance between operations is 0.5 m even if the switches are pressed within smaller distances
- Maximum length of a pause is 5 minutes

The system has two switches, an U–Pilot activation/recording switch (**1**) in the side panel and in the arm rest the activation (**2**) and stop switches (**3**).

The activation/recording (OFF/ON/REC) switch (1) has three positions:

1. **The opposite side to the symbol pressed down:** U–Pilot not in use.
2. **Middle position:** U–Pilot in standby mode.
3. **The symbol side pressed down** (spring–return, push–down locking device to the middle position of the switch)**:** U–Pilot starts recording or saving.

When pressing **the activation switch (2) (PLAY/PAUSE)** the recorded programme starts. Pressing the switch during operation causes a pause. When the programme is in pause mode the recorded programme can be resumed by pressing the switch. When recording, using the switch causes a pause in the programme.

When pressing the stop switch (**3**) **(STOP)** the recorded programme stops and the U–Pilot has to be re–activated by pressing the switch (**1**) in the side panel (first to the OFF position and then to the ON position).

The display of the system is the Proline instrument panel.
- The top row of Proline display has the number of operation (**4**) / total number of operations (**5**) and the distance to next operation (**6**).
- The centre row displays the symbols of the recorded operations (in the display max 5 pcs) (**7**).
- The symbol of the next/ongoing operation has a dark background (**8**).
- The U–Pilot display will automatically appear on the screen when the activation/recording switch (**1**) is set to the middle or record position. At the same time, the warning light (**9**) lights up. The display can be changed to any other display.

The symbol of the U–Pilot  is displayed in the large drive display (in the left lower diagnostics sector) of the arm rest tractor terminal when U–Pilot is active.

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Symbol	Operation	Switch positions	Limitation
	Rear linkage up	Stop or down	2),3)
	Rear linkage up	Stop or down	2),3)
	Rear linkage forced lowering		
	Rear linkage forced lowering release		
	Hydraulic block 1R +	Hydr. ON, joystick rear, M3	2), 3)
	Hydraulic block 1R –	Hydr. ON, joystick rear, M3	2), 3)
	Hydraulic block 2R +	Hydr. ON, joystick rear, M3	2), 3)
	Hydraulic block 2R –	Hydr. ON, joystick rear, M3	2), 3)
	Hydraulic block 3R +	Hydr. ON	2), 3)
	Hydraulic block 3R –	Hydr. ON	2), 3)
	Hydraulic block 4R +	Hydr. ON	2), 3)
	Hydraulic block 4R –	Hydr. ON	2), 3)
	Hydraulic block 5R +	Hydr. ON	2), 3)
	Hydraulic block 5R –	Hydr. ON	2), 3)
	Hydraulic block 1F +	Hydr. ON, joystick front, M3, (6/2)	2), 3)
	Hydraulic block 1F –	Hydr. ON, joystick front, M3, (6/2)	2), 3)
	Hydraulic block 2F +	Hydr. ON, joystick front, M3, (6/2)	2), 3)
	Hydraulic block 2F –	Hydr. ON, joystick front, M3, (6/2)	2), 3)

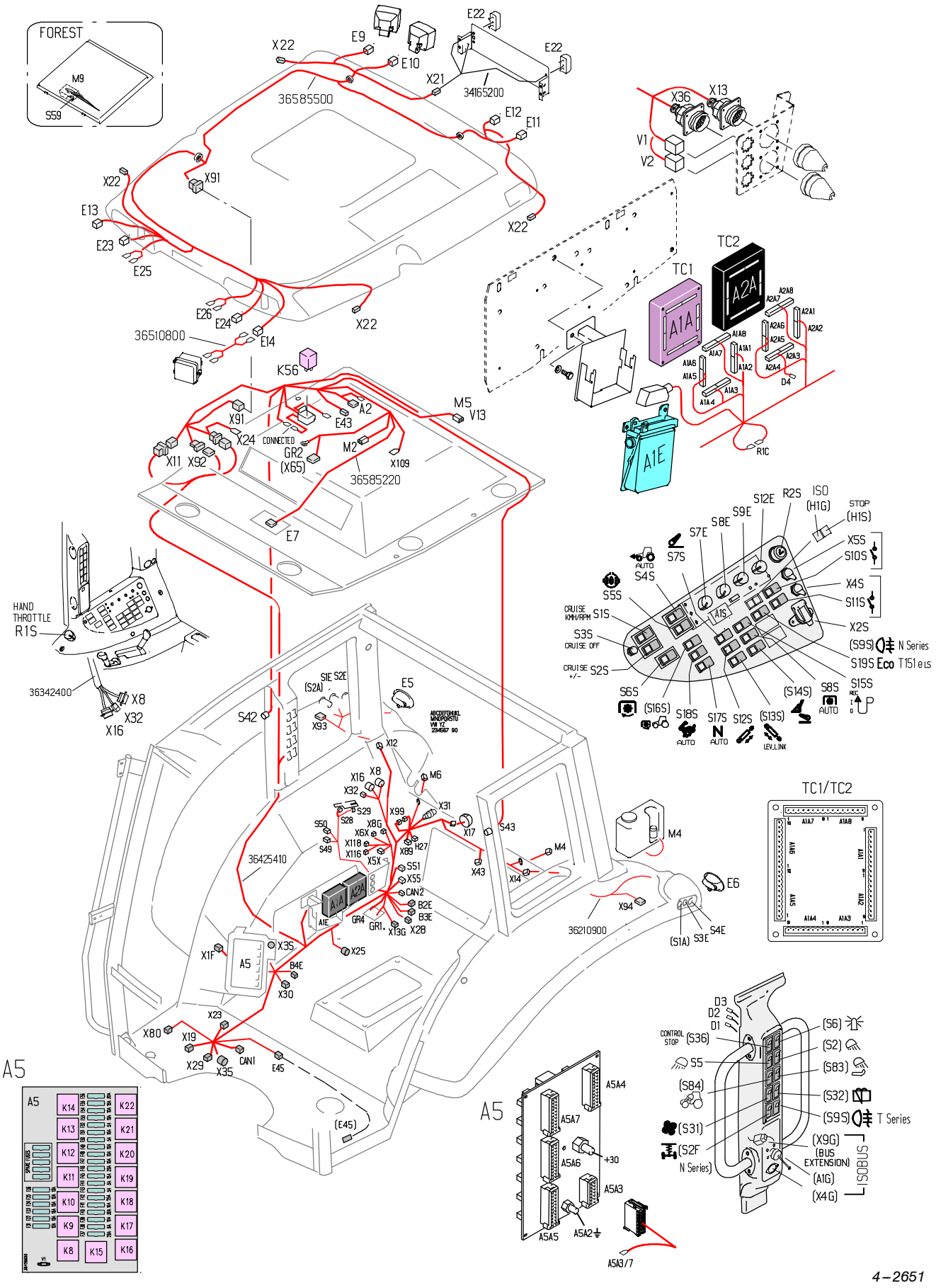
Symbol	Operation	Switch positions	Limitation
	Hydraulic block 3F +	Hydr. ON	2), 3)
	Hydraulic block 3F –	Hydr. ON	2), 3)
	Front PTO on	OFF	
	Front PTO off	OFF	
	Rear PTO on	Standby position	2)
	Rear PTO off	Standby position	2)
cruise KMH	Cruise control (constant speed) on		3)
cruise RPM	Cruise control on		3)
cruise OFF	Cruise control (constant RPM) off		3)
DPS 1	Powershift speed range 1		1)
DPS 2	Powershift speed range 2		1)
DPS 3	Powershift speed range 3		1)
	4WD on		1)
	4WD off		1)
	Differential lock on		1)
	Differential lock off		1)
	Power socket on	OFF position	2)
	Power socket off	OFF position	2)
Pause	Pause in the recorded programme		
END	End of the recorded programme		

The U–Pilot controls the upper current socket in the side panel.

1) If these functions are in the AUTO mode when recording, no operation is recorded. If the operation has been recorded before, but the switch is turned to the AUTO position before running the programme, the switch overrides the programme. In this case the recorded operations of the switch do not occur.
   The rear PTO makes an exception. If it is in the AUTO mode, a PTO stop is recorded even if it is triggered by the raising of the rear linkage. In use the rear PTO is stopped by a programmed stop or the raising of the rear linkage (whichever happens first).
2) The system checks the positions of these switches before recording or running a programme. If the position is incorrect the symbol of the function blinks on the display.
3) The system does not check the adjustments of the equipment. Thus, they must be checked and adjusted by the operator.

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Electrical equipment, cab



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Wiring harness, outer roof (36585500)

–E9 Rear working light, right outer
–E10 Rear working light, right inner
–E11 Rear working light, left outer
–E12 Rear working light, left inner
–E13 Front working light, right inner
–E14 Front working light, left inner
–E23 Upper head light, right
–E24 Upper head light. left
–E25 Parking light, up right
–E26 Parking light, up left

Wiring harness, register plate (34165200)

–E22 Register plate light

Wiring harness, inner roof (36585200)

–E7 Cab light
–E43 Control panel light
–K56 Time–delay relay, cabin light and door step
–M2 Air conditioner
–M5 Rear window wiper
–M9 Roof window wiper
–S42 Door switch, cab light, RH
–S43 Door switch, cab light, LH
–S59 Switch, 2–pos., roof window wiper

Wiring harness, lever housing (36425420)

–A1A Control unit, TC1
–A1E Control unit, power lift
–A2A Control unit, TC2
–A5 Electric center
–E45 Step light
–M4 Windscreen washer
–M6 Rear window washer
–S2 Switch, 2–pos., rear working lights
–S2F Switch, suspension off/on/calibr.
–S5 Switch, 2–pos., front working lights
–S6 Switch, 2–pos., rot. warning light
–S28 Limit switch, PTO 540
–S29 Limit switch, PTO 1000/540E
–S31 Switch, 3–pos., floor fan
–S32 Switch 3–pos., rear window wiper& washer
–S36 Switch, 2–pos., control stop
–S49 Switch, creeper off
–S50 Switch, creeper on
–S83 Switch, 2–pos., drawhook light
–S84 Switch, 2–pos., add. front working lights

Wiring harness, switch panel (36342400)

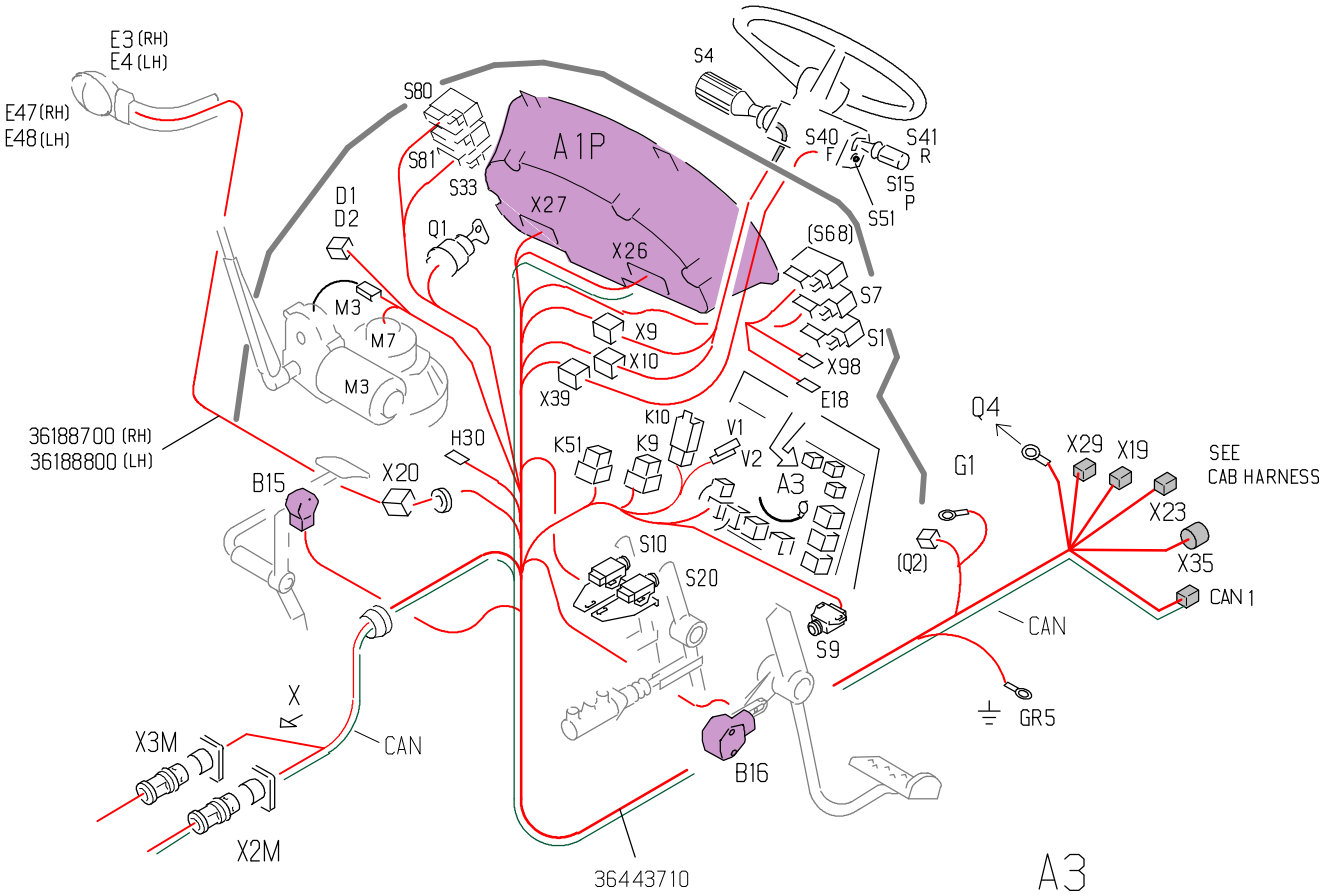
–A1S Powerlift control panel
–H1G Indicator light, ISOBUS
–H1S Indicator light, stop, rear
–R1S Potentiometer, hand throttle
–R2S Cigarette lighter
–S1S Switch, cruise kmh / rpm
–S2S Switch, cruise +/–
–S3S Switch, cruise off
–S4S Switch, 4WD auto
–S5S Switch, differential lock, auto
–S6S Combined switch, PTO
–S7E Switch, lowering speed
–S7S Combined switch, lift / low
–S8E Switch, top limit
–S8S Switch, PTO auto stop
–S9E Switch, mixing
–S9S Switch, rear fog light
–S10S Switch, 2–pole current socket
–S11S Switch, 2–pole current socket
–S12E Switch, drive balance system / slip
–S12S Switch, lifting / lowering
–S13S Switch, lifting / lowering
–S14S Switch, front loader / linkage
–S15S Combined switch, U–pilot
–S16S Combined switch, front PTO
–S17S Switch, autotraction
–S18S Switch, DPS auto

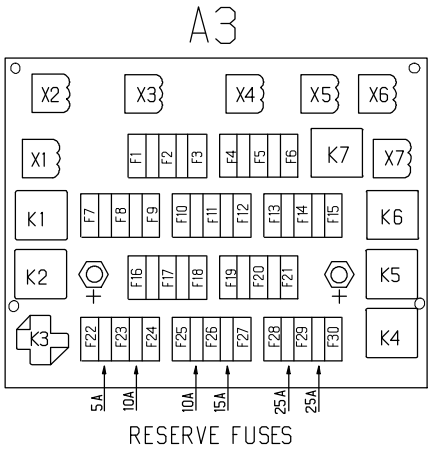
Wiring harness, mud guard (36210900)

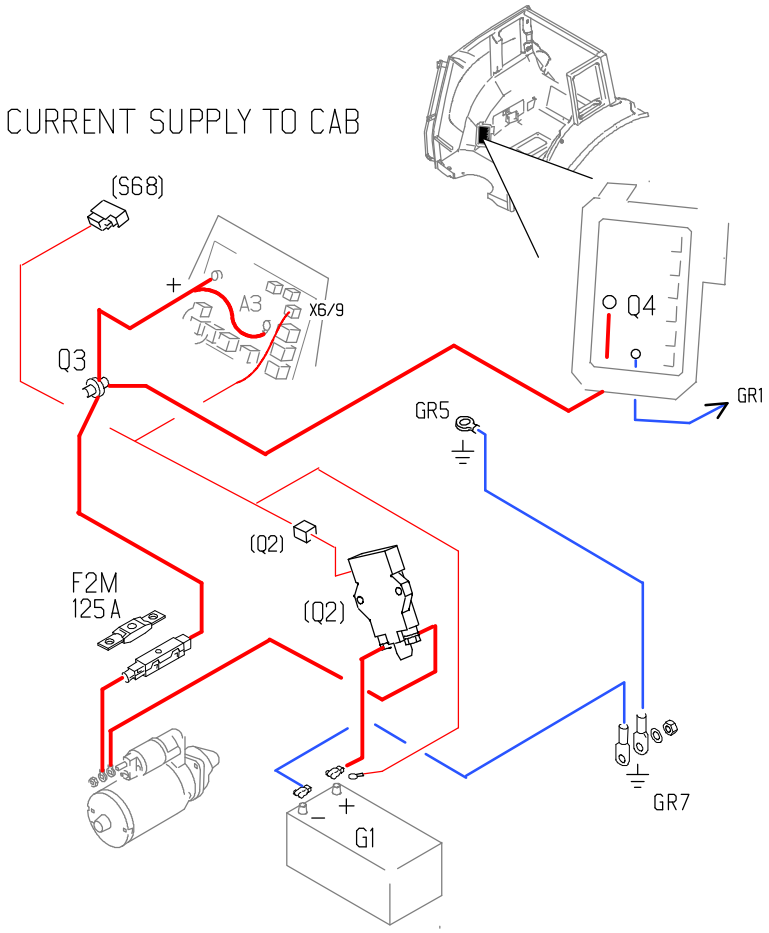
–E5 Rear light (indicator/parking/braking)
–E6 Rear light (indicator/parking/braking)
–S1A Push button, PTO rear start, left
–S1E Push button, rear operation, r.h., lifting
–S2A Push button, PTO rear start, right
–S2E Push button, rear operation, r.h., lowering
–S3E Push button, rear operation, l.h., lifting
–S4E Push button, rear operation, l.h., lowering

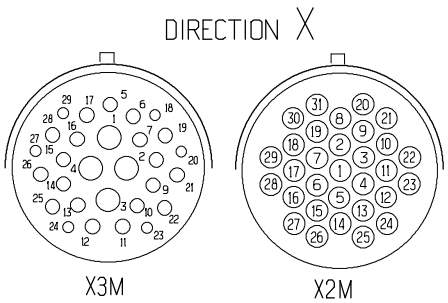
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Electrical equipment, front housing









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Wiring harness, front housing (36443710)

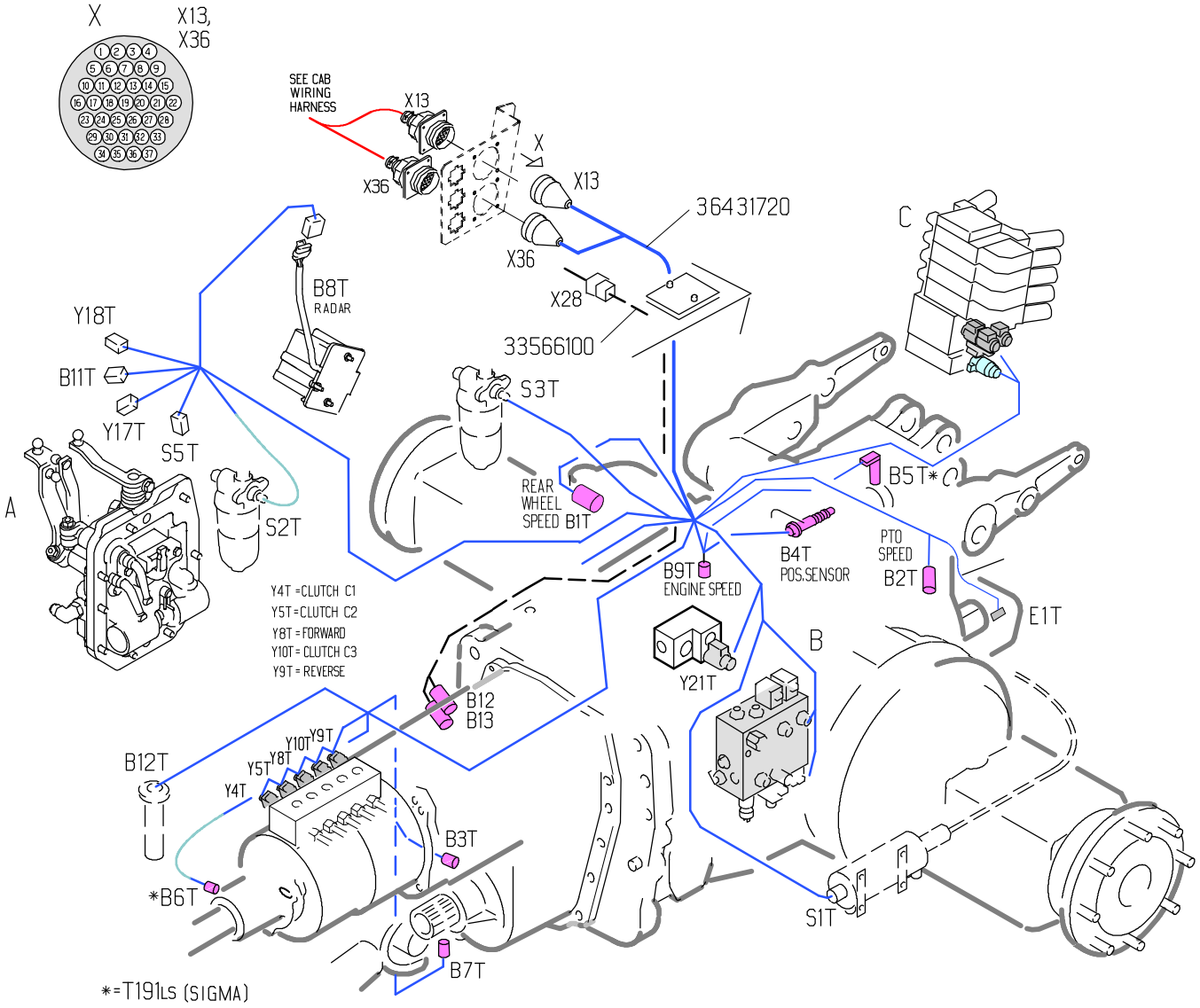
–B15 Position sensor, accelerator pedal
–B16 Position sensor, clutch pedal
–E18 Lightning, pressure meter
–H30 Buzzer, instrumentation
–K9 Intermittent control relay, wiper
–K10 Relay, parking lights
–K51 Relay, main switch
–M3 Windscreen wiper
–M7 Floor fan
–Q1 Heat/starter switch
–Q2 Main switch
–S1 Switch, 3–pos., head lights
–S4 Combined switch
–S7 Switch, 2–pos., warning flashers
–S9 Switch, starter safety
–S10 Switch, right brake light
–S15 Reed relay, front parking brake (P)
–S20 Switch, left brake light
–S33 Switch, upper head lights
–S40 Reed relay, direction forward, front
–S41 Reed relay, direction reverse, front
–S51 Push button, DPS–preselection, front
–S68 Switch, main switch control
–S80 Switch, 3–pos., instrument, display size
–S81 Switch, 3–pos., instrument, display mode

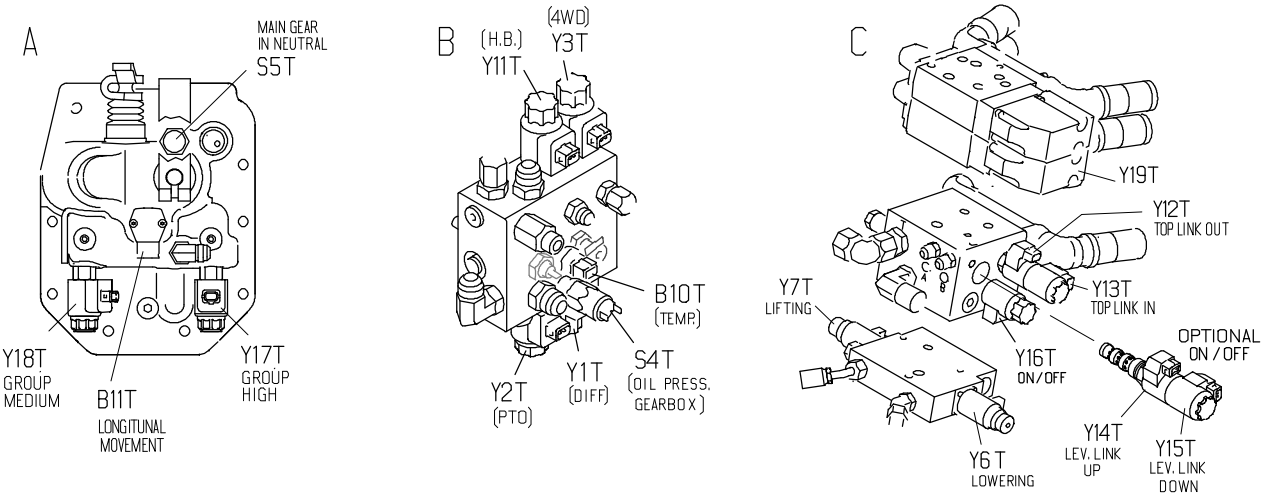
Wiring harnesses, blinkers (36188700 and 36188800)

–E3 Front direction indicator, right
–E4 Front direction indicator, left
–E47 Additional front working light, right
–E48 Additional front working light, left

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Electrical equipment, frame





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Wiring harness, frame (36431720)

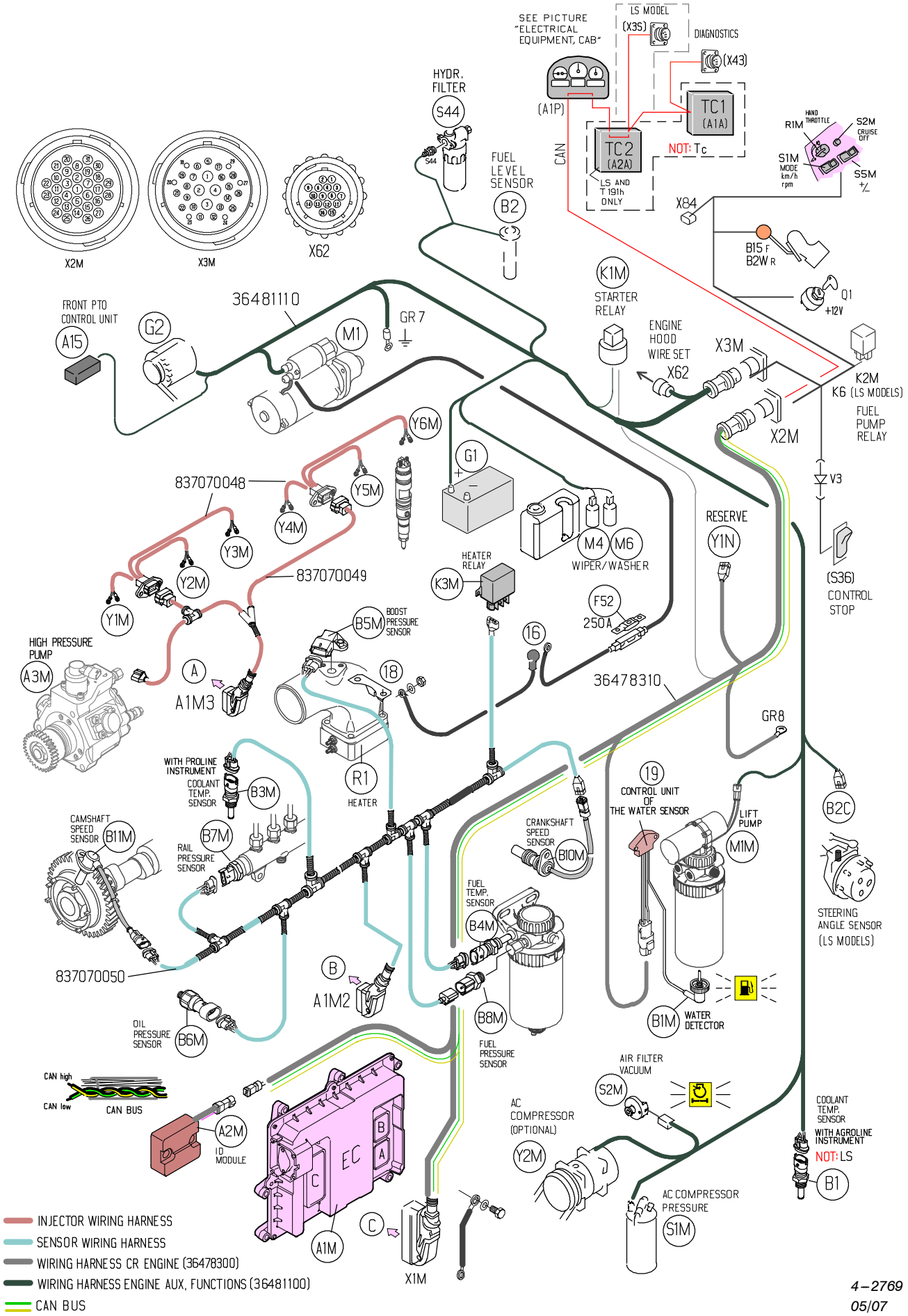
–B1T Sensor, rear wheel speed
–B2T Sensor, PTO–speed
–B3T Sensor, gearbox speed
–B4T Position sensor, rear power lift
–B5T Sensor, Sigma PTO
–B6T Sensor, Sigma engine
–B7T Sensor, front axle speed
–B8T Radar
–B9T Sensor, engine rpm speed
–B10T Gearbox temperature sensor
–B11T Sensor, longitudinal movement
–B12T Sensor, fuel gauge
–E1T Drawing hook light
–S1T Limit switch, parking brake cable
–S2T Limit switch, oil filter ind. light
–S3T Limit switch, oil filter ind. light
–S4T Limit switch, gearbox oil ind. light
–S5T Limit switch, main gear free
–Y1T Solenoid valve, differential lock
–Y2T Solenoid valve, PTO
–Y3T Solenoid valve, 4WD
–Y4T Solenoid valve, DPS1
–Y5T Solenoid valve, DPS2
–Y6T Solenoid valve, power lift lowering
–Y7T Solenoid valve, power lift lifting
–Y8T Solenoid, Forward direction
–Y9T Solenoid, reverse direction
–Y10T Solenoid valve, DPS3
–Y11T Solenoid, parking brake
–Y12T Solenoid valve,lifting
–Y13T Solenoid valve, lowering
–Y14T Solenoid valve, lifting
–Y15T Solenoid valve, lowering
–Y16T Solenoid valve, auxiliary valves on/off
–Y17T Solenoid valve, H–speed
–Y18T Solenoid valve, M–speed
–Y19T Solenoid valve, auxiliary valves
–Y21T Solenoid valve, brake cooling

Wiring harness, gear tooth sensors (33566100)

–B12 Sensor, F/R shuttle
–B13 Sensor, F/R shuttle

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Electrical equipment, engine



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Solenoids wiring harness 32784330

–B3 Sensor, gearbox temperature
–B4 Speed sensor, Sigma, engine
–B5 Speed sensor, Sigma, PTO
–B6 Speed sensor, gearbox
–B7 Speed sensor, rear PTO
–B11 Speed sensor, engine
–B14 Temperature sensor, gearbox
–B1E Position sensor, rear power lift
–E46 Trailer hitch light
–S16 Temperature sensor, gearbox oil
–S17 Pressure sensor, gearbox oil pressure
–S52 Limit switch, parking brake cable
–S53 Indicator light switch pressure, filter, return
–S54 Indicator light switch, pressure filter (low pressure circuit)
–Y1 Solenoid valve, differential lock
–Y2 Solenoid valve, rear PTO
–Y3 Solenoid valve, 4WD
–Y4 Solenoid valve, DPS C1–clutch
–Y6 Solenoid valve, DPS C2–clutch
–Y11 Solenoid, forward
–Y12 Solenoid, reverse
–Y17 Solenoid valve, DPS C3–clutch
–Y18 Solenoid, parking brake
–Y1E Solenoid valve, power lift, lowering
–Y2E Solenoid valve, power lift, lifting

Wiring harness, gear tooth sensors 33566100

–B12 Sensor, F/R shuttle
–B13 Sensor, F/R shuttle

Engine hood wiring harness 34595300

–B17 Temperature sensor, outdoors temperature
–E1 Head light,right
–E2 Head light, left
–E20 Parking light, right, Norway
–E21 Parking light, left, Norway
–H23 Horn

Power lift wiring harness 33638820

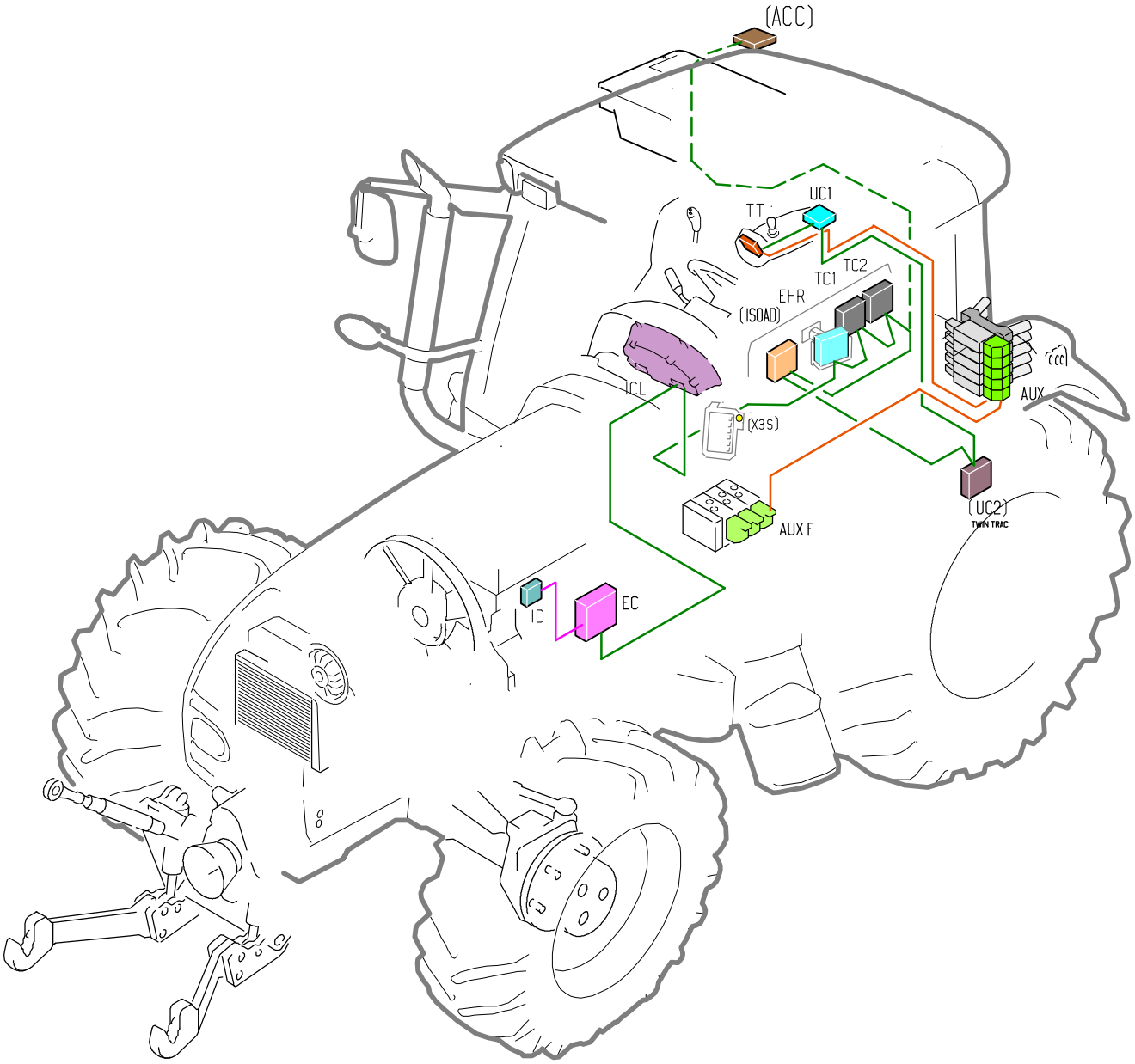
–A1E Control unit, power lift
–A2E Switch panel, power lift
–B2E Draft sensor, power lift, r.h
–B3E Draft sensor, power lift, l.h
–E2E Lightning, position potentiometer
–R1E Potentiometer, power lift, position control
–S5E Rocker switch 3–pos. inside operation, lifting/lowering
–S7E Lowering speed selector, hydraulic lift
–S8E Transport height selector, hydraulic lift
–S9E Draft control selector, hydraulic lift
–S10E Rocker switch, 3–pos. power lift lifting/lowering
–S11E Rocker switch, power lift, forced lowering
–S12E Drive balance control

Mudguard wiring harness 36210900

–E5 Rear light, right (indicator/parking/braking)
–E6 Rear light, left (indicator/parking/braking)
–S1A Push button, PTO rear start, left
–S1E Push button, rear operation, lifting, r.h.
–S2A Push button, PTO rear start, right
–S2E Push button, rear operation, lowering, r.h.
–S3E Push button, rear operation, lifting, l.h.
–S4E Push button, rear operation, lowering, l.h.

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CAN bus

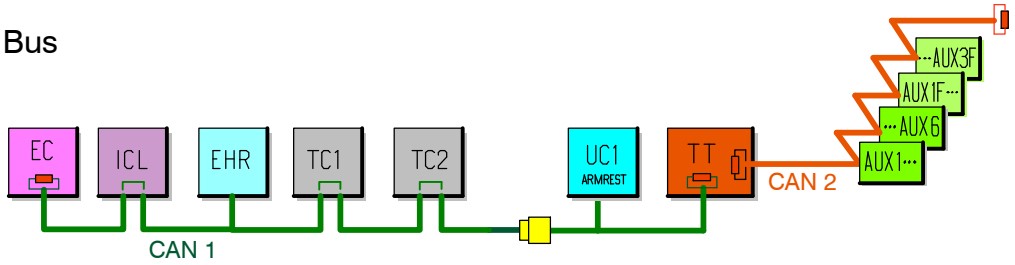


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12/06

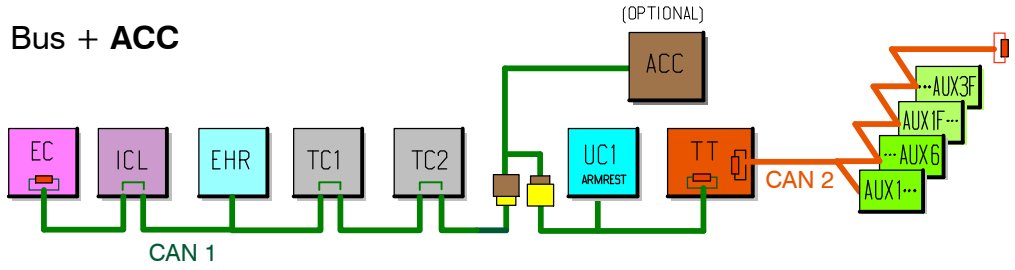
EC = Engine Controller (CAN–ID= 0)
ICL = Instrument panel (CAN–ID= 23)
EHR = Power lift Controller (CAN–ID= 35)
TC1 = Transmission Controller 1 (CAN–ID= 3)
TC2 = Transmission Controller 2 (CAN–ID= 4)
UC1 = Input Output Extension Module (CAN–ID= 5)
(UC2) = Input Output Extension Module, TwinTrac (CAN–ID= 6)
TT = Tractor Terminal (CAN–ID= 40)
AUX = Auxiliary hydraulic valves, F=front, (CAN–ID= 129–137)
ACC = Automatic Air Conditioner (CAN–ID= –)
(ISOAD) = ISOBUS control unit (incl. Implement signal connection ISO11788) (CAN–ID= 220)
CAN = Controller Area Network
(X3S) = Diagnostics / Programming connector

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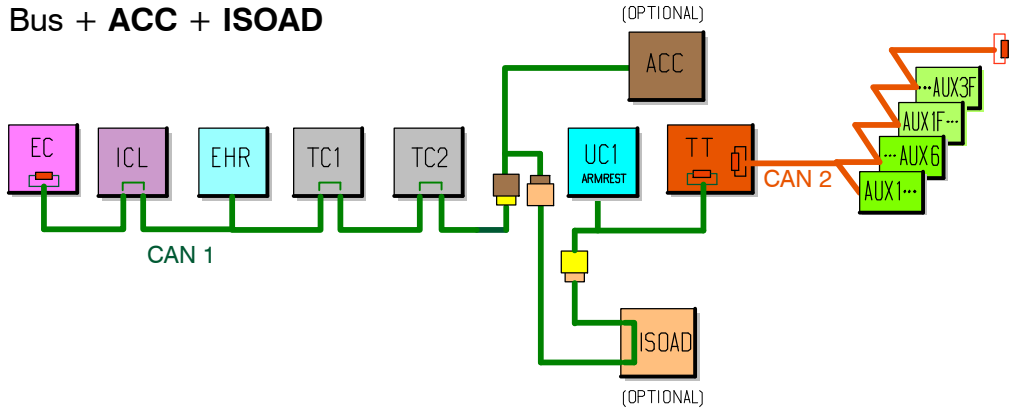
Basic CAN Bus



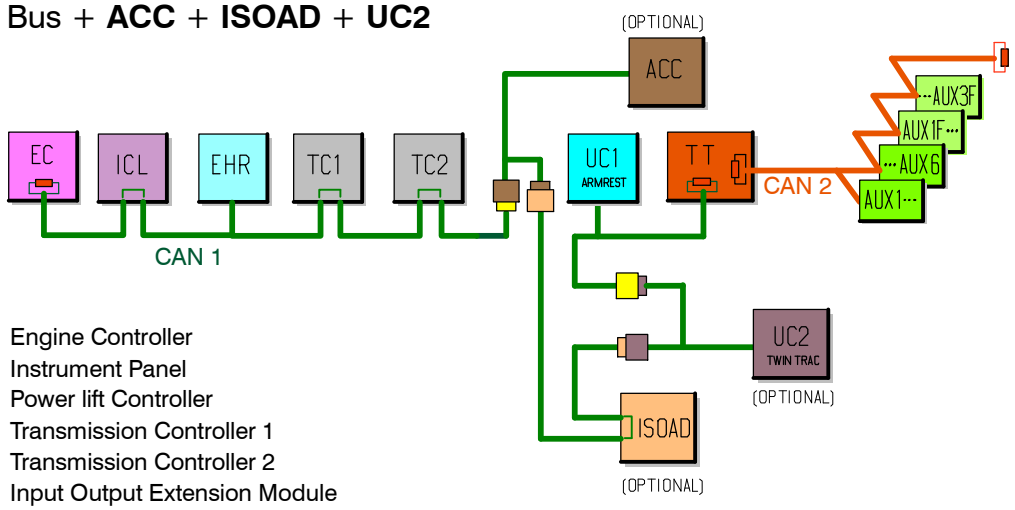
Basic CAN Bus + **ACC**



Basic CAN Bus + **ACC** + **ISOAD**



Basic CAN Bus + **ACC** + **ISOAD** + **UC2**

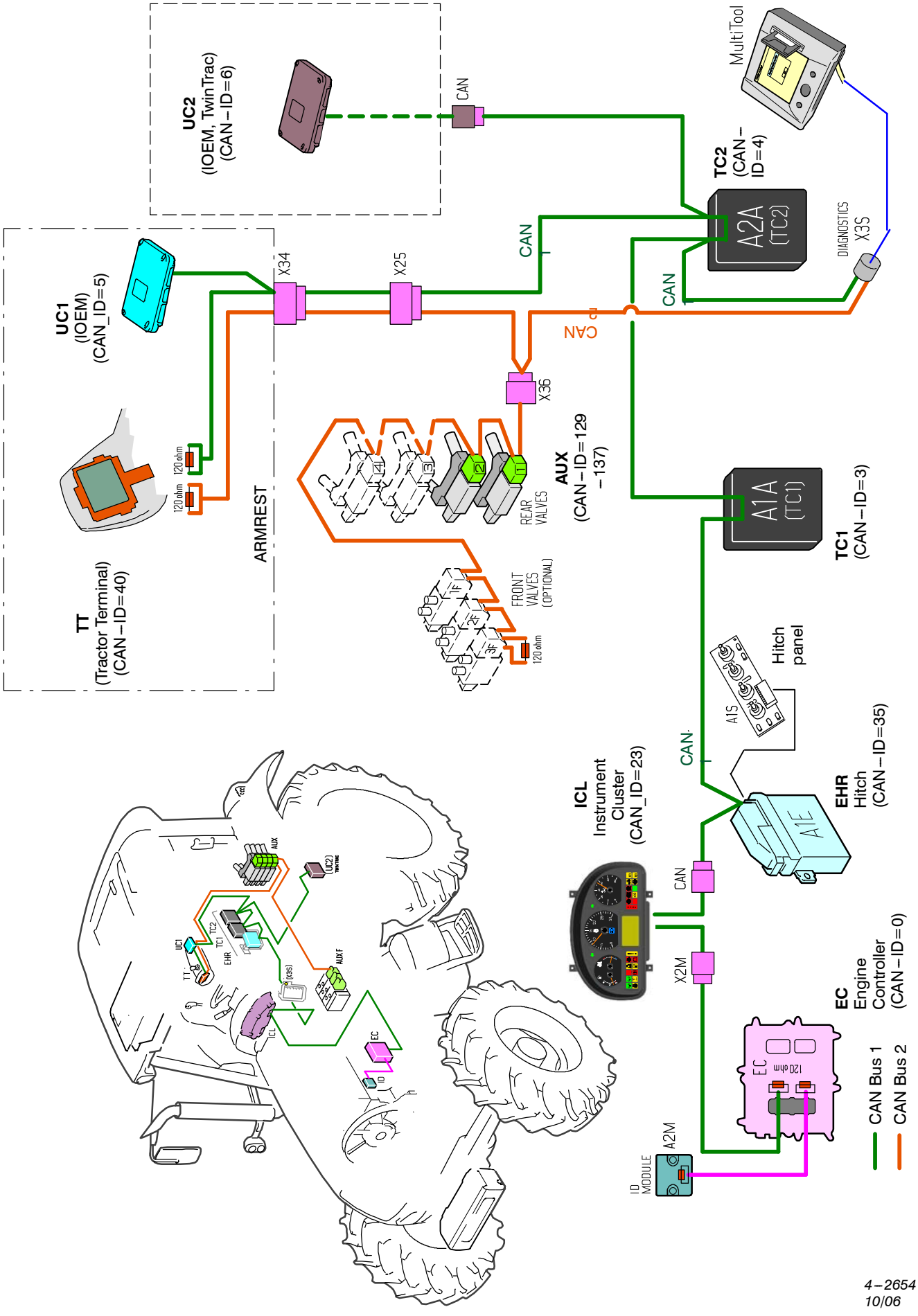


EC	=	Engine Controller
ICL	=	Instrument Panel
EHR	=	Power lift Controller
TC1	=	Transmission Controller 1
TC2	=	Transmission Controller 2
UC1	=	Input Output Extension Module
(UC2)	=	Input Output Extension Module (TwinTrac)
TT	=	Tractor Terminal
AUX	=	Auxiliary hydraulic valves (F=front)
(ACC)	=	Automatic Air Conditioner
(ISOAD)	=	ISOBUS control unit (incl. Implement signal connection ISO11788)
CAN	=	Control Area Network

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CAN buses and control units



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EC Engine Controller (CAN–ID=0)
Controls the engine:
– fuel injection control
– rpm / torque control
– cruise control
– preheater

ICL Instrument panel (CAN–ID=23)
Instrument cluster functions:
– indicator lights
– indicator gauges
– LCD (for driving information)

EHR Hitch (CAN–ID=35)
EHR functions:
– rear power lift valve
– position control
– slip control
– drive balance control
– draft control

TC1 (CAN–ID=3)
TC1 functions:
– user interface
– TwinTrac functions
– Auto traction
– Power shift control
– Power shuttle control
– range gear change (H–M) control
– PTO control

TC2 (CAN–ID=4)
TC2 functions:
– DL automatic
– 4WD automatic

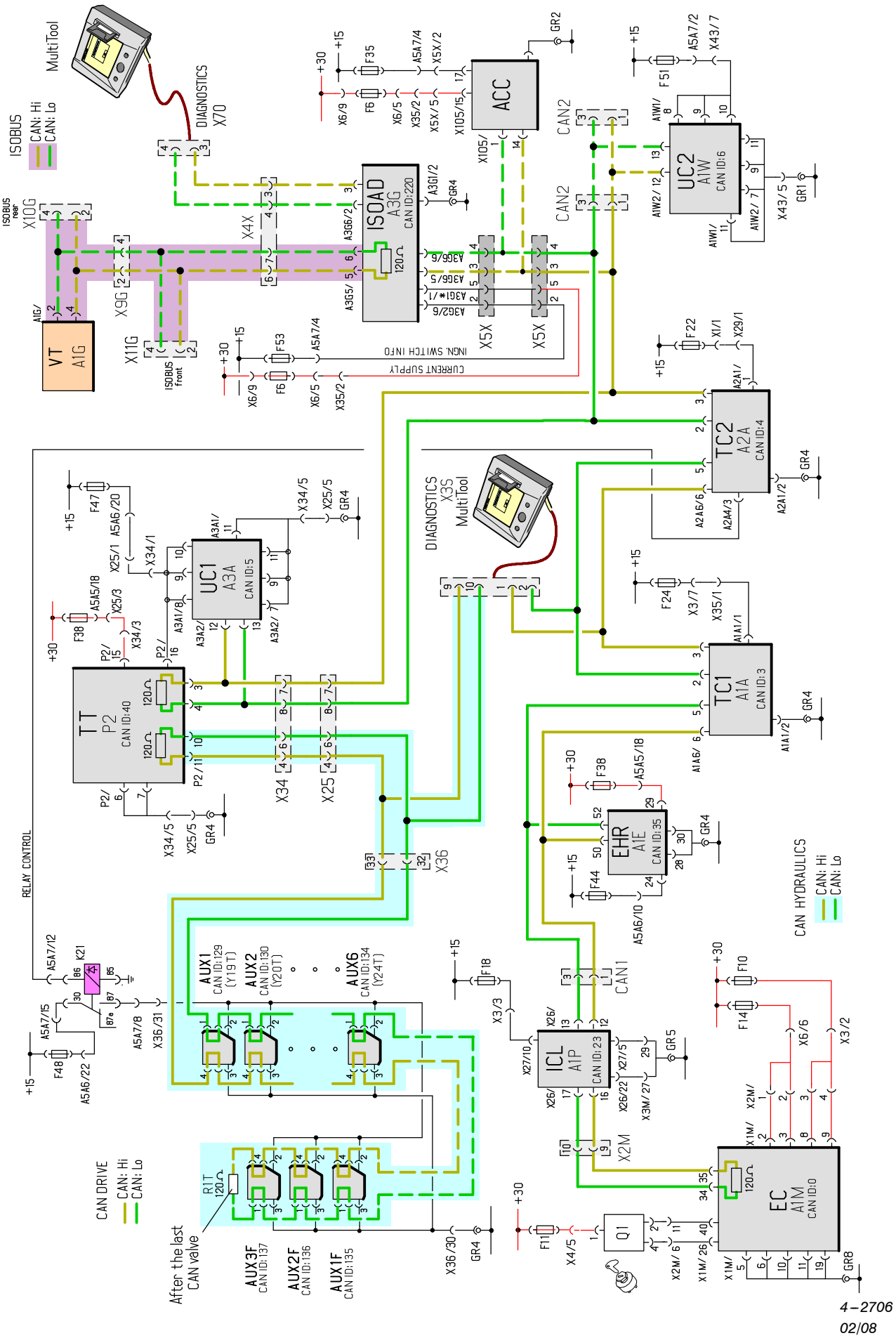
TT (Hydraulics Terminal) (CAN–ID=40)
TT functions:
– drive display
– hydraulics settings
– calibration display
– service code
– I / O test

UC1 Module (CAN–ID=5)
IOEM functions:
– transforms inputs to CAN messages

AUX (CAN–ID=129–137)
AUX functions
– controls the oil flow
– spool position

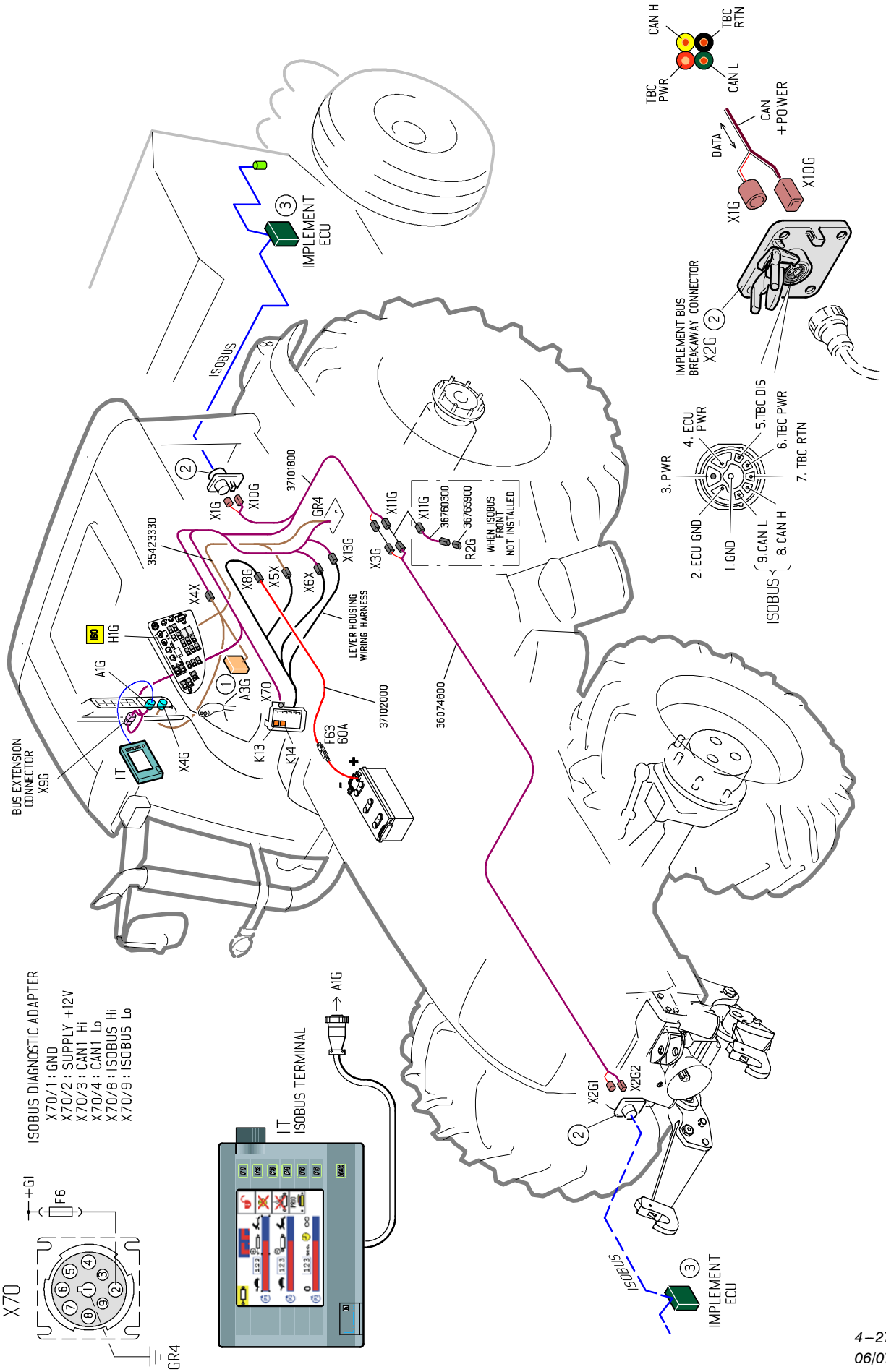
UC2 TwinTrac Module (IOEM) (CAN–ID=6)
TTM functions:
– transforms TwinTrac input / output signals to CAN bus information

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ISOBUS (ISO 11783)



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06/07

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The ISOBUS system, which is based on the ISO 11783 standard, allows Electronic Control Units (ECU) of the tractor and the implement to communicate and share information via a CAN bus. For example, the implement can access the actual speed that is being measured by the tractor, which reduces the need for additional sensors on the implement itself.

Traditionally, complex implements have required their own specific control boxes to allow the operator to control their functions This system works when only one implement and control box is needed. In all other cases, there is a possibility that the operator must have a cabin full of different control boxes.

With the ISOBUS system the role of a specific control box is handed over to the ISOBUS Terminal (IT) which is capable of controlling all ISOBUS compatible implements regardless of their manufacturers. Only one ISOBUS terminal is needed in the tractor. This terminal can control several implements at the same time.

Only one cable needs to be connected to the tractor's Implement Bus Breakaway Connector (2). The ISOBUS terminal can be in the cabin at all times, and it will automatically recognize the implement and download the control software from the Implement ECU (3).

1) Tractor Electronic Control Unit (A3G)

2) Implement Bus Breakaway Connector
– Provides power and data to implement
– Automatic termination:
  Connection opens when implement is connected.

3) Implement Electronic Control Unit

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Wiring diagram

Symbol	Description	Page and position	Location
–A1A	Control unit, TC1	/10.B2	Cab
–A1A	Control unit, TC1	/5.B10	Cab
–A1A	Control unit, TC1	/7.B6	Cab
–A1A1	Connector, 9–pole	/5.B6	Cab
–A1A2	Connector, 9–pole	/10.B2	Cab
–A1A2	Connector, 9–pole	/5.B8	Cab
–A1A3	Connector, 8–pole	/5.B10	Cab
–A1A3	Connector, 8–pole	/7.B2	Cab
–A1A4	Connector, 8–pole	/5.B14	Cab
–A1A4	Connector, 8–pole	/7.B8	Cab
–A1A5	Connector, 10–pole	/10.B2	Cab
–A1A5	Connector, 10–pole	/7.B6	Cab
–A1A6	Connector, 10–pole	/10.B9	Cab
–A1A6	Connector, 10–pole	/7.B4	Cab
–A1A7	Connector, 8–pole	/10.B3	Cab
–A1A7	Connector, 8–pole	/5.B9	Cab
–A1A7	Connector, 8–pole	/7.B5	Cab
–A1A8	Connector, 8–pole	/10.B7	Cab
–A1A8	Connector, 8–pole	/5.B9	Cab
–A1C	Control unit, TC2	/12.B10	Cab
–A1C	Control unit, TC2	/19.B2	Cab
–A1E	Control unit, power lift	/9.B7	Cab
–A1F	Front suspension	/17.A4	Cab
–A1M	Control unit, EC	/1.B14	Engine
–A1M	Control unit, EC	/2.B3	Engine
–A1M2	Connector, 36–pole	/1.C11	Engine
–A1P	Instrument	/4.B7	Cab
–A1P	Instrument	/8.B11	Cab
–A1S	Powerlift control panel	/9.B2	Cab
–A1W	Control unit, TwinTrac	/18.C6	Cab
–A1W1	Connector, 16–pole	/18.C6	Cab
–A1W2	Connector, 30–pole	/18.B6	Cab
–A2	Radio	/3.C11	Cab
–A2A1	Connector, 9–pole	/12.C4	Cab
–A2A2	Connector, 9–pole	/12.C6	Cab
–A2A3	Connector, 8–pole	/12.C3	Cab
–A2A3	Connector, 8–pole	/19.B2	Cab
–A2A4	Connector, 8–pole	/12.C5	Cab
–A2A4	Connector, 8–pole	/19.B3	Cab
–A2A5	Connector,10–pole	/12.C7	Cab
–A2A6	Connector, 10–pole	/12.B3	Cab
–A2A7	Connector, 8–pole	/12.C4	Cab
–A2A8	Connector, 8–pole	/12.B3	Cab
–A2E	Switch panel, power lift	/9.C13	Cab
–A2M	ID–module	/1.A13	Engine
–A3A	Control unit, UC1	/11.B5	Cab
–A3A1	Connector, 16–pole	/11.B4	Cab
–A3A2	Connector, 30–pole	/11.B6	Cab
–A3G	Control unit, ISOBUS	/14.C9	Cab
–A3G1	Connector, 6–pole	/14.B9	Cab
–A3G2	Connector, 6–pole	/14.B8	Cab
–A.3G3	Connector, 6–pole	/14.C7	Cab
–A.3G7	Connector, 8–pole	/14.D7	Cab
–A.3G8	Connector, 6–pole	/14.D7	Cab
–A3G4	Connector, 8–pole	/14.B8	Cab
–A3G5	Connector, 8–pole	/14.B10	Cab
–A3G6	Connector, 9–pole	/14.B7	Cab
–A3M	High pressure pump	/2.C2	Engine
–A5	Air suspension seat	/5.B2	Cab
–A15	Control unit, front PTO	/12.C1	Cab
–A16	Fieldmaster	/13.B12	Cab
–A17	Adapter, Fieldmaster sensor signals	/13.C8	Cab
–A18	Denso	/6.B11	Cab

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Symbol	Description	Page and position	Location
–B1E	Position sensor, rear power lift (B4T)	/9.B1	Transmission
–B1F	Angle sensor	/17.C4	Front axle
–B1M	Sensor, water detector	/1.A14	Engine
–B1T	Sensor, rear wheel speed	/12.D9	Transmission
–B1W1	Sensor, clutch pedal	/18.D9	Cab
–B2	Sensor, fuel gauge	/8.C9	Engine
–B2C	Sensor, steering angle (only T series)	/12.D7	Transmission
–B2E	Draft sensor, r.h	/9.B1	Transmission
–B2T	Sensor, PTO–speed	/5.D9	Transmission
–B2W	Sensor, gas pedal	/18.D12	Cab
–B2W	Position sensor, rear accel. pedal	/2.D9	Cab
–B3E	Draft sensor, l.h	/9.C1	Transmission
–B3M	Sensor, coolant temperature	/1.C11	Engine
–B3T	Sensor, gearbox speed	/5.D9	Transmission
–B4E	Sensor, implement position (ACD)	/9.C1	Transmission
–B4M	Sensor, Fuel temperature	/1.C12	Engine
–B5M	Sensor, boost pressure	/1.C12	Engine
–B5T	Sensor, Sigma PTO (only T series)	/12.D9	Transmission
–B6	Speed sensor, gearbox	/13.C2	Transmission
–B6	Speed sensor, gearbox	/14.C2	Transmission
–B6M	Sensor, oil pressure	/1.C13	Engine
–B6T	Sensor, Sigma engine (only T series)	/12.D10	Transmission
–B7	Speed sensor, PTO	/13.C2	Transmission
–B7	Speed sensor, PTO	/14.C2	Transmission
–B7M	Sensor, rail pressure	/1.C14	Engine
–B7T	Sensor, front axle speed	/12.D8	Transmission
–B8M	Sensor, fuel pressure	/1.C15	Engine
–B8T	Radar	/9.C1	Transmission
–B9T	Sensor, engine rpm speed	/5.D8	Transmission
–B10	Speed radar	/13.D12	Transmission
–B10	Speed radar	/14.C2	Transmission
–B10M	Sensor, crankshaft speed	/1.C15	Engine
–B10T	Gearbox temperature sensor	/10.D5	Transmission
–B11M	Sensor, camshaft speed	/1.C16	Engine
–B11T	Sensor, longitudinal movement	/7.C8	Transmission
–B12	Sensor, F/R shuttle	/5.D6	Transmission
–B13	Sensor, F/R shuttle	/5.D7	Transmission
–B15	Position sensor, accelerator pedal	/2.D6	Cab
–B16	Position sensor, clutch pedal	/10.D2	Cab
–B17	Temperature sensor, outdoors	/10.D7	Bonnet
–D1	Diode	/6.C14	Cab
–D2	Diode	/6.C15	Cab
–E1	Head light,right	/4.D5	Bonnet
–E1T	Drawing hook light	/3.C16	Transmission
–E2	Head light,left	/4.D4	Bonnet
–E3	Front direction indicator, right	/16.C12	Cab
–E3	Front direction indicator, right	/4.D11	Cab
–E4	Front direction indicator, left	/16.C4	Cab
–E4	Front direction indicator, left	/4.D7	Cab
–E5	Rear light, right (indicator/parking/braking)	/16.C11	Right mudguard
–E5	Rear light (indicator/parking/braking)	/4.D13	Right mudguard
–E6	Rear light, left (indicator/parking/braking)	/16.C6	Left mudguard
–E6	Rear light (indicator/parking/braking)	/4.D12	Left mudguard
–E7	Cab light	/3.C12	Cab
–E9	Rear working light, right outer	/3.C1	Roof
–E10	Rear working light, right inner	/3.C2	Roof
–E11	Rear working light, left outer	/3.C2	Roof
–E12	Rear working light, left inner	/3.C3	Roof
–E13	Front working light, right inner	/3.C5	Roof
–E14	Front working light, left inner	/3.C6	Roof
–E17	Seat heater	/5.B2	Cab
–E23	Upper head light, right	/4.D2	Roof
–E24	Upper head light. left	/4.D2	Roof
–E45	Step light	/3.C12	Cab
–E47	Additional front working light, right	/3.C11	Cab
–E48	Additional front working light, left	/3.C10	Cab
–E51	Cab roof warning light, rear right	/16.C12	Right mudguard

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Symbol	Description	Page and position	Location
–E52	Cab roof warning light, rear left	/16.C5	Left mudguard
–E53	Extremity warning light, right	/16.C10	Cab
–E54	Extremity warning light, left	/16.C7	Cab
–F1	15A, hazard blinkers	/4.A14	Cab
–F1M	250A, Inlet air heater	/1.C10	Engine
–F2	5A, long beam indicator light	/4.A5	Cab
–F2M	125A, Cab supply	/1.A1	Cab
–F3	15A, high beam	/4.B4	Cab
–F4	15A, low beam	/4.B3	Cab
–F5	10A, main switch, tachograph	/16.B10	Cab
–F6	5A, radio, inner light, instrument (buzzer)	/16.B11	Cab
–F7	25A, air condition compressor	/6.A13	Cab
–F8	25A, light switch	/16.A10	Cab
–F8	25A, light switch	/4.A2	Cab
–F9	15A, trailer socket/fog light, rear	/4.A15	Cab
–F11	10A, starter switch	/1.A11	Cab
–F11	10A, starter switch	/14.A8	Cab
–F12	10A, cabin light	/3.A12	Cab
–F14	20A, engine control unit (EEM supply2)	/1.A12	Cab
–F15	15A, fuel feed pump	/2.A13	Cab
–F16	10A, reserve for working lights	/3.A10	Cab
–F17	10A, direction indicators	/4.A13	Cab
–F18	5A, instrumentation, warning lights	/14.A4	Cab
–F18	5A, instrumentation, indicator lights	/8.A8	Cab
–F19	10A, windscreen wiper/washer, horn	/6.A8	Cab
–F20	10A, rear window wiper/washer, radio	/6.A3	Cab
–F22	10A, TC2, semi–automatic range gear	/12.A13	Cab
–F23	15A, additional working lights (lifting handle)	/3.A10	Cab
–F24	10A, TC1 control unit	/5.A12	Cab
–F25	15A, suspension seat / seat heater / rear steering prevention	/11.A3	Cab
–F26	10A, front PTO	/12.A1	Cab
–F27	10A, reserve	/5.A4	Cab
–F29	10A, cigarette lighter, 2pin current socket	/8.A4	Cab
–F31	10A, front working lights	/3.A6	Cab
–F32	10A, rear work lights (outer)	/3.A2	Cab
–F33	10A, rear work lights (inner)	/3.A2	Cab
–F34	10A, parking lights, instrument	/4.A8	Cab
–F35	10A, parking light, left	/4.A8	Cab
–F36	10A, parking light, right	/4.A9	Cab
–F37	20A, driving beam automatic	/4.A4	Cab
–F38	5A, autocontrol	/9.A4	Cab
–F39	10A, rotation warning light, ISO adapter	/3.A8	Cab
–F40	30A, fan III–speed	/6.A11	Cab
–F41	10A, braking lights	/4.A15	Cab
–F42	25A, 3pin current socket	/8.A6	Cab
–F43	5A, cruise switches	/2.A10	Cab
–F44	5A, autocontrol	/10.A13	Cab
–F45	15A, fan I,II–speeds air cond., floor fan	/6.A14	Cab
–F46	10A, electrical mirrors	/3.A11	Cab
–F47	10A, arm rest	/11.A4	Cab
–F48	10A, auxiliary valves	/19.A5	Cab
–F49	10A, towing hook light	/3.A16	Cab
–F50	5A, TC1, sensors, radar	/7.A9	Cab
–F51	10A, TwinTrack, front axle suspension	/17.A5	Cab
–F52	5A, 3pin current socket	/8.A7	Cab
–F53	10A, ISO adapter	/12.A14	Cab
–F54	10A, rear power lift (on/off), front loader / linkage	/19.A8	Cab
–F55	15A, ISOBUS ECU power	/15.B8	Cab
–F56	30A, ISOBUS power	/15.B7	Cab
–G1	Battery	/1.D1	Engine
–G2	Alternator	/1.D6	Engine
–GR1	Ground, rear light, solenoid valves	/1.D7	Cab
–GR1	Ground	/12.D12	Cab
–GR1	Ground	/15.D6	Cab
–GR1	Ground	/16.D5	Cab
–GR1	Ground	/17.D4	Cab
–GR1	Ground	/18.D2	Cab

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Symbol	Description	Page and position	Location
–GR1	Ground	/19.D11	Cab
–GR1	Ground	/3.D13	Cab
–GR1	Ground	/4.D12	Cab
–GR1	Ground	/6.D3	Cab
–GR1	Ground	/8.D3	Cab
–GR2	Ground	/3.D2	Roof
–GR2	Ground	/4.D2	Roof
–GR2	Ground	/6.D5	Roof
–GR4	Ground	/10.D13	Cab
–GR4	Ground	/11.D14	Cab
–GR4	Ground	/12.D2	Cab
–GR4	Ground	/14.D4	Cab
–GR4	Ground	/15.D7	Cab
–GR4	Ground	/19.D4	Cab
–GR4	Ground,	/5.D1	Cab
–GR4	Ground	/8.D2	Cab
–GR4	Ground	/9.D6	Cab
–GR5	Ground	/10.D5	Cab
–GR5	Ground	/12.D14	Cab
–GR5	Ground	/16.D4	Cab
–GR5	Ground	/6.D15	Cab
–GR5	Ground	/7.D2	Cab
–GR5	Ground	/8.D12	Cab
–GR6	Ground	/13.D8	Cab
–GR7	Ground, battery	/12.D1	Engine
–GR7	Ground	/8.D13	Engine
–GR.7	Ground, battery	/1.D6	Engine
–GR.7	Ground, battery	/4.D4	Engine
–GR8	Ground, head lights	/1.D10	Engine
–GR8	Ground	/8.D12	Engine
–H1G	Indicator light, ISOBUS	/14.C11	Cab
–H1S	Indicator light, stop, rear	/8.C8	Cab
–H23	Horn	/6.D6	Bonnet
–H24	Rotating roof light	/3.C8	Roof
–H27	Reverse Buzzer	/12.C13	Cab
–H30	Buzzer, instrumentation	/8.C14	Cab
–K1	Relay, air condition compressor control	/6.C13	Cab
–K1M	Starter auxiliary relay	/1.B9	Engine
–K2	Relay, additional working lights (lifting handle)	/3.A10	Cab
–K3	Relay, main switch	/1.C4	Cab
–K3M	Relay, intake air heater	/1.C10	Engine
–K4	Auxiliary relay, starter switch	/1.A2	Cab
–K5	Auxiliary relay, starter switch	/1.A2	Cab
–K6	Relay, fuel feed pump control	/2.C11	Cab
–K7	Control relay, 4WD–brake	/2.C14	Cab
–K8	Control relay, front working lights	/3.C6	Cab
–K9	Control relay, rear working lights	/3.C4	Cab
–K9	Intermittent control relay, wiper	/6.C9	Cab
–K10	Relay,parking ligts automatic/manual	/16.B8	Cab
–K10	Relay, parking lights	/4.A7	Cab
–K11	Auxiliary relay, starter switch 1	/1.A6	Cab
–K12	Auxiliary relay, starter switch 2	/1.A6	Cab
–K13	Relay, ISOBUS ECU–power	/15.B9	Cab
–K14	Relay, ISOBUS power	/15.B5	Cab
–K15	Relay, driving beam automatic	/4.A4	Cab
–K16	Relay, U–pilot current socket control	/8.B4	Cab
–K17	Relay, fan III–speed	/6.B14	Cab
–K18	Relay, braking lights	/5.A6	Cab
–K19	Relay, auxiliary valves on / off solenoid	/19.C14	Cab
–K20	Relay, hydraulics1 (joystick button 1.)	/19.C2	Cab
–K21	Relay, auxiliary valves	/19.C3	Cab
–K22	Relay, hydraulics2 (joystick button 2.)	/19.C2	Cab
–K51	Relay, main switch	/1.B4	Cab
–K56	Time–delay relay, cabin light and door step	/3.B13	Cab

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Symbol	Description	Page and position	Location
–M1	Starter motor	/1.D8	Engine
–M1	Starter motor	/11.B3	Engine
–M1M	Fuel pump	/2.C13	Engine
–M3	Windscreen wiper	/6.D10	Cab
–M4	Windscreen washer	/6.D7	Engine
–M5	Rear window wiper	/6.D3	Roof
–M6	Rear window washer	/6.D2	Cab
–M7	Floor fan	/6.D14	Cab
–M9	Roof window wiper	/6.D5	Roof
–P2	Tractor terminal display	/11.D1	Cab
–Q1	Heat/starter switch	/1.A11	Cab
–Q2	Main switch	/1.B1	Transmission
–R1	Intake air heater	/1.D10	Engine
–R1A	Joystick	/11.A9	Cab
–R1C	Potentiometer	/7.C4	Cab
–R1S	Potentiometer, hand throttle	/2.D8	Cab
–R2A	Lever 1	/11.A11	Cab
–R2S	Cigarette lighter	/8.C1	Cab
–R3A	Lever 2	/11.A12	Cab
–R3S	Potentiometer, droop control	/5.A13	Cab
–R4A	Lever 3	/11.A13	Cab
–R5A	Lever 4	/11.A14	Cab
–R6A	Potentiometer, rear lift postion control	/11.A4	Cab
–R7A	Draw hook lever	/11.A15	Cab
–S1	Switch, 3–pos., head lights	/16.A10	Cab
–S1	Switch, 3–pos., head lights	/4.A2	Cab
–S1A	Switch, autocontrol	/11.A6	Cab
–S1A	Push button, PTO rear start, left	/5.A7	Left mudguard
–S1E	Push button, rear operation, r.h., lifting	/9.A1	Right mudguard
–S1M	Push button, compressor pressure	/6.C13	Cab
–S1S	Switch, cruise kmh / rpm	/2.A5	Cab
–S1T	Limit switch, parking brake indicator light	/8.C11	Cab
–S1W1	Switch, clutch pedal	/18.B9	Cab
–S2	Switch, 2–pos., rear working lights	/3.B3	Cab
–S2A	Push button, Power shift up	/11.C7	Cab
–S2A	Push button, PTO rear start, right	/5.A7	Right mudguard
–S2E	Push button, rear operation, r.h., lowering	/9.A2	Right mudguard
–S2F	Switch, suspension off/on/calibr.	/17.C8	Cab
–S2M	Switch, air filter vacuum	/8.C13	Engine
–S2S	Switch, cruise +/–	/2.A7	Cab
–S2W	Switch, brake pedal	/18.D13	Cab
–S3A	Push button, Power shift down	/11.C8	Cab
–S3E	Push button, rear operation, l.h., lifting	/9.A2	Left mudguard
–S3M	Push button	/5.B4	Cab
–S3S	Switch, cruise off	/2.A8	Cab
–S3T	Limit switch, oil filter ind. light	/8.C10	Transmission
–S4	Combined switch	/16.A3	Cab
–S4	Combined switch	/4.A4	Cab
–S4	Combined switch	/6.B9	Cab
–S4A	Push button, forced lowering	/11.C11	Cab
–S4E	Push button, rear operation, l.h., lowering	/9.A3	Left mudguard
–S4M	Push button	/5.B5	Cab
–S4S	Switch, 4WD auto	/12.A12	Cab
–S4T	Limit switch, gearbox oil ind. light	/8.C10	Transmission
–S4W	Push button, programming switch	/18.B11	Cab
–S5	Switch, 2–pos., front working lights	/3.B6	Cab
–S5A	Push button,U pilot start	/11.C12	Cab
–S5S	Switch, differential lock auto	/12.A10	Cab
–S5T	Limit switch, main gear free	/7.C6	Transmission
–S5W	Reed relay, direction forward (F), rear	/18.B11	Cab
–S6	Switch, 2–pos., rot. warning light	/3.A8	Cab
–S6A	Push button,U pilot stop	/11.C13	Cab
–S6S	Combined switch, PTO	/5.A9	Cab
–S6W	Reed relay, direction reverse (R), rear	/18.B12	Cab
–S7	Switch, 2–pos., warning flashers	/16.C9	Cab
–S7	Switch, 2–pos., warning flashers	/4.B12	Cab

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Symbol	Description	Page and position	Location
–S7A	Push button,constant engine speed	/11.C13	Cab
–S7E	Switch, lowering speed	/9.B12	Cab
–S7S	Combined switch, lift / low	/9.A5	Cab
–S7W	Reed relay, parking brake, rear	/18.B12	Cab
–S8A	Push button,constant driving speed	/11.C14	Cab
–S8E	Switch, top limit	/9.B12	Cab
–S8S	Switch, PTO auto stop	/12.A8	Cab
–S9	Switch, starter safety	/10.D4	Cab
–S9A	Push button, cruise off	/11.C14	Cab
–S9E	Switch, mixing	/9.C12	Cab
–S9S	Switch, rear fog light	/5.A16	Cab
–S10	Switch, right brake light	/12.D14	Cab
–S10S	Switch, 2–pole current socket	/8.A2	Cab
–S11A	Switch, seat	/11.B2	Cab
–S11S	Switch, 2–pole current socket	/8.B5	Cab
–S12A	Switch, seat front/rear	/11.A2	Cab
–S12E	Switch, drive balance system / slip	/9.C12	Cab
–S12S	Switch, lifting / lowering	/19.B12	Cab
–S13S	Switch, lifting / lowering	/19.B14	Cab
–S14S	Switch, front loader/linkage	/19.B10	Cab
–S15	Reed relay, front parking brake (P)	/10.C11	Cab
–S15S	Combined switch, U–pilot	/12.A6	Cab
–S16S	Combined switch, front PTO	/12.A2	Cab
–S17S	Switch, front PTO	/10.A2	Cab
–S18S	Switch, DPS auto	/10.A4	Cab
–S19S	Switch, ECO	/5.A14	Cab
–S20	Switch, left brake light	/12.D15	Cab
–S23/1–	Push button, DPS–	/7.A9	Cab
–S23/1+	Push button, DPS+	/7.A8	Cab
–S28	Push button, PTO 540	/10.A7	Cab
–S29	Push button, PTO 1000/540E	/10.A7	Cab
–S31	Switch, 3–pos., floor fan	/6.B15	Cab
–S32	Switch 3–pos., rear window wiper& washer	/6.B3	Cab
–S33	Switch, upper head lights	/4.B4	Cab
–S35	Rear steering prevention	/5.B3	Cab
–S36	Switch, 2–pos., control stop	/2.A4	Cab
–S40	Reed relay, direction forward (F), front	/10.C11	Cab
–S41	Reed relay, direction reverse (R), front	/10.C12	Cab
–S42	Door switch, cab light, RH	/3.C14	Roof
–S43	Door switch, cab light, LH	/3.C14	Roof
–S44	Limit switch, indicator light pressure filter 180 bar	/8.C12	Engine
–S45/1	Push button, Hi–shift	/7.A10	Cab
–S49	Switch, creeper off	/10.A8	Cab
–S50	Switch, creeper on	/10.A9	Cab
–S51	Push button, DPS–preselection (D), front	/10.C10	Cab
–S53	Limit switch, indicator light pressure filter, return	/8.C12	Transmission
–S59	Switch, 2–pos., wiper: roof window	/6.B5	Cab
–S63	Switch, hydraulic locking	/19.B6	Cab
–S68	Switch, mainswitch control	/1.C2	Cab
–S80	Switch, 3–pos., instrument, display size	/8.A14	Cab
–S81	Switch, 3–pos., instrument, display mode	/8.A12	Cab
–S83	Switch, 2–pos., drawhook light	/3.B15	Cab
–S84	Switch, 2–pos., add. front working lights	/3.A9	Cab
–S88	Switch, soft drive	/19.B7	Cab
–V1	Diode, parking lights (automatic)	/10.B13	Cab
–V1	Diode, parking lights (automatic)	/12.C2	Cab
–V1 (1)	Diode, parking lights (automatic)	/5.C10	Cab
–V2	Diode, main switch, heat / starter switch	/1.B5	Cab
–V2.1	Diode, brake pedal, right	/12.C14	Cab
–V2.2	Diode, brake pedal, left	/12.C13	Cab
–V2.3	Diode, brake pedal, right	/12.C16	Cab
–V2.7	Diode, brake pedal, right	/12.C14	Cab
–V2.9	Diode, brake pedal, left	/12.C15	Cab
–V3	Diode, control stop	/2.A4	Cab
–V3	Diode, control stop	/3.B5	Cab
–V11	Diode, control stop	/2.D15	Cab

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Symbol	Description	Page and position	Location
–X.1	Connector, 9–pole	/1.C4	Cab
–X.1	Connector, 9–pole	/16.A10	Cab
–X.1	Connector, 9–pole	/3.C9	Cab
–X.1	Connector, 9–pole	/4.A2	Cab
–X.1	Connector, 9–pole	/6.A13	Cab
–X.1L	Connector, 9–pole	/13.B9	
–X1E	Connector, 9–pole	/13.C5	Cab
–X1E	Connector, 9–pole	/14.C3	Cab
–X1F	Connector, 3–pole	/17.D4	Cab
–X1M	Connector, 89–pole	/1.B10	Engine
–X1M	Connector,89–pole	/2.B2	Engine
–X1W1	Connector, 8–pole	/18.B11	Cab
–X.2	Connector, 9–pole	/3.A10	Cab
–X.2	Connector, 9–pole	/4.A5	Cab
–X.28	Connector, 9–pole	/5.D5	Cab
–X2E	Connector	/14.A4	Cab
–X2M	Connector, 31–pole	/1.B10	Engine
–X2M	Connector, 31–pole	/2.B2	Engine
–X2S	Connector, current socket (ISO)	/8.C7	Cab
–X.2M	Connector, 31–pole	/1.B10	Engine
–X.3	Connector, 9–pole	/1.C4	Cab
–X.3	Connector, 9–pole	/10.A10	Cab
–X.3	Connector, 9–pole	/4.B3	Cab
–X.3	Connector, 9–pole	/8.A8	Cab
–X3G	Connector	/15.C6	Cab
–X3M	Connector, 31–pole	/1.D6	Engine
–X3M	Connector, 31–pole	/12.C1	Engine
–X3M	Connector, 31–pole	/2.C13	Engine
–X3M	Connector, 31–pole	/4.C3	Engine
–X3M	Connector, 31–pole	/5.A4	Engine
–X3M	Connector, 31–pole	/6.C2	Engine
–X3M	Connector, 31–pole	/8.C9	Engine
–X.3S	Connector,diagnostics	/8.A11	Cab
–X.4	Connector, 9–pole	/1.A11	Cab
–X.4	Connector, 9–pole	/12.A1	Cab
–X.4	Connector, 9–pole	/4.B3	Cab
–X.4	Connector, 9–pole	/6.A8	Cab
–X4G	Connector	/14.B15	Cab
–X4S	Connector, current socket	/8.C5	Cab
–X4X	Connector	/14.C15	Cab
–X4X	Connector	/15.A5	Cab
–X.5	Connector, 9–pole	/1.B3	Cab
–X.5	Connector, 9–pole	/16.B10	Cab
–X.5	Connector, 9–pole	/3.A12	Cab
–X.5	Connector, 9–pole	/6.A3	Cab
–X5S	Connector, current socket	/8.C3	Cab
–X5X	Connector, 9–pole	/12.A5	Cab
–X5X	Connector, 9–pole	/14.D15	Cab
–X.6	Connector, 9–pole	/1.B3	Cab
–X.6	Connector, 9–pole	/16.A10	Cab
–X.6	Connector, 9–pole	/8.A4	Cab
–X6G	RS–232 connector	/14.B5	Cab
–X.7	Connector, 9–pole	/1.B7	Cab
–X.7	Connector, 9–pole	/2.A13	Cab
–X8	Connector,37–pole	/12.A1	Cab
–X8	Connector, 37–pole	/19.A10	Cab
–X8	Connector, 37–pole	/2.A10	Cab
–X8	Connector, 37–pole	/5.A10	Cab
–X8	Connector,37–pole	/8.A3	Cab
–X8	Connector,37–pole	/9.A6	Cab
–X.8G	Connector	/15.A7	Cab
–X10	Connector, 9–pole	/16.A7	Cab
–X11	Connector, 9–pole	/3.C2	Roof
–X11	Connector, 9–pole	/4.A9	Roof
–X11	Connector, 9–pole	/6.C3,	Roof
–X12	Connector, 9–pole	/16.D6	Right mudguard
–X12	Connector, 9–pole	/4.C13	Right mudguard
–X12	Connector, 9–pole	/5.A8	Right mudguard
–X12	Connector, 9–pole	/9.B1	Right mudguard

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Symbol	Description	Page and position	Location
–X13	Connector, 37–pole	/13.C4	Cab
–X13	Connector, 37–pole	/14.C3	Cab
–X13	Connector, 37–pole	/3.C15	Cab
–X13	Connector, 37–pole	/5.A12	Transmission
–X13	Connector, 37–pole	/9.B2	Cab
–X13	Connector, 37–pole	/8.C9	Cab
–X.13	Connector, 37–pole	/12.C8	Cab
–X14	Connector, 9–pole	/13.B3	Cab
–X14	Connector, 9–pole	/16.D11	Cab
–X14	Connector, 9–pole	/4.C12	Left mudguard
–X14	Connector, 9–pole	/5.A7	Left mudguard
–X14	Connector, 9–pole	/9.A3	Left mudguard
–X16	Connector, 37–pole	/10.A5	Cab
–X16	Connector, 37–pole	/12.B9	Cab
–X16	Connector, 37–pole	/19.C6	Cab
–X16	Connector, 37–pole	/2.A6	Cab
–X16	Connector, 37–pole	/8.C2	Cab
–X17	Connector, 7–pole, trailer socket	/4.C16	Cab
–X19	Connector	/10.C2	Cab
–X.91	Connector, 9–pole	/4.C2	Roof
–X.92	Connector, 3–pole	/3.C12	Roof
–X.92	Connector, 3–pole	/4.C2	Roof
–X110	Connector, 4–pole	/2.C14	Cab
–X20	Connector, 9–pole	/16.C4	Cab
–X20	Connector, 9–pole, front flashers	/3.C10	Cab
–X20	Connector, 9–pole	/4.C7	Cab
–X22	Connector, 2–pole, rotation light	/3.C8	Roof
–X23	Connector, 3–pole	/12.C1	Cab
–X23	Connector, 3–pole	/4.A15	Cab
–X23	Connector, 3–pole	/6.B13	Cab
–X24	Connector, 9–pole	/3.C11	Roof
–X24	Connector, 9–pole	/6.B4	Roof
–X25	Connectori, 16–pole	/11.A1	Cab
–X25	Connectori, 16–pole	/4.C7	Cab
–X26	Connector, 28–pole, instrument	/8.B8	Cab
–X27	Connector, 36–pole, instrument	/4.B5	Cab
–X27	Connector, 36–pole, instrument	/8.B8	Cab
–X29	Connector, 9–pole	/11.A3	Cab
–X29	Connector, 9–pole	/12.A13	Cab
–X29	Connector, 9–pole.socket, stop–alarm	/2.B4	Cab
–X29	Connector, 9–pole	/3.A12	Cab
–X29	Connector, 9–pole	/4.B1	Cab
–X29	Connector, 9–pole	/6.C7	Cab
–X29	Connector, 9–pole	/8.A4	Cab
–X30	Connector, 9–pole (gear change lever)	/7.A9	Cab
–X31	Connector, 2–pole socket, PTO–emerg. stop	/5.A9	Cab
–X32	Connector, 4–pole	/8.A3	Cab
–X34	Connector, 9–pole	/11.B1	Cab
–X35	Connector, 37–pole	/1.B3	Cab
–X35	Connector, 37–pole	/10.C4	Cab
–X35	Connector, 37–pole	/12.A1	Cab
–X35	Connector, 37–pole	/2.B6	Cab
–X35	Connector, 37–pole	/4.A7	Cab
–X35	Connector, 37–pole	/5.D4	Cab
–X35	Connector, 37–pole	/6.A3	Cab
–X35	Connector, 37–pole	/8.B9	Cab
–X36	Connector, 37–pole, auxiliary valves	/19.C4	Cab
–X36	Connector, 37–pole	/7.C4	Cab
–X37	Connector, 3pole (seat turning angle switch)	/11.B3	Cab
–X38	Connector	/11.B3	Cab
–X39	Connector	/10.D10	Cab
–X43	Connector, 3–pole, seat direction	/18.A2	Cab
–X43	Connector, 3–pole, seat direction	/2.C9	Cab
–X45	Connector, 9–pole, fieldmaster	/13.B14	Cab
–X46	Connector, 7–pole, rear socket	/13.B15	Cab
–X47	Connector, 2–pole, fieldmaster	/13.B9	Cab
–X49	Connector, 2–pole	/5.A1	Cab
–X55	Connector, 1–pole, fieldmaster	/3.A15	Cab

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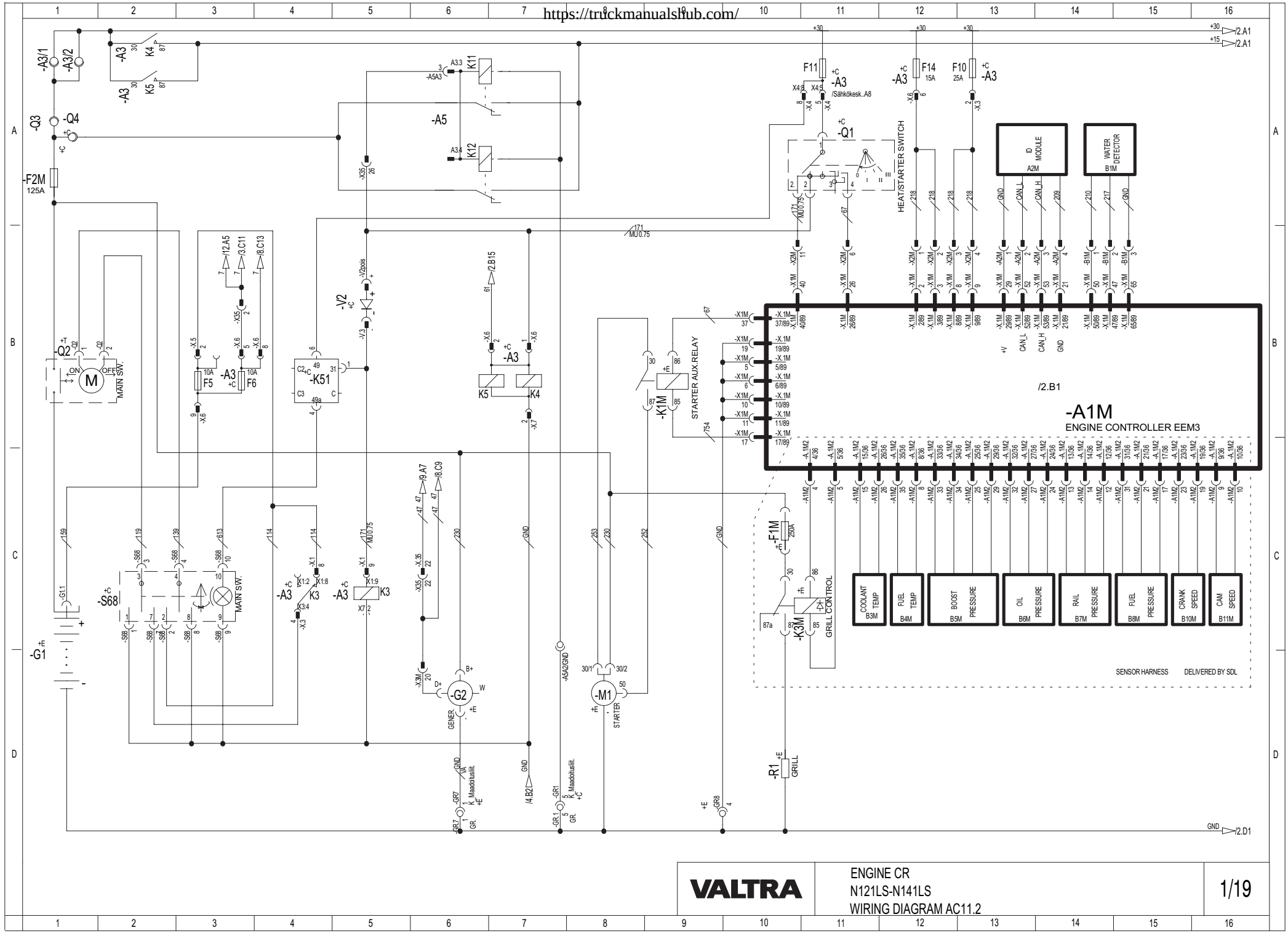
Symbol	Description	Page and position	Location
–X62	Connector, 6–pole	/10.C7	Bonnet
–X62	Connector, 16–pole	/4.C3	Bonnet
–X62	Connector, 16–pole	/5.B4	Bonnet
–X62	Connector, 16–pole	/6.C6	Bonnet
–X73	Connector, 2–pole current socket	/4.D9	Bonnet
–X74	Connector	/5.B4	Cab
–X80	Connector, 4–pole, front loader	/19.A9	Cab
–X81	Connector, pin socket	/19.D9	Transmission
–X89	Connector, implement	/12.D13	Cab
–X91	Connector, 9–pole	/3.C2	Roof
–X93	Connector, 1–pole	/16.C10	Cab
–X98	Connector, 2–pole	/16.A6	Cab
–X99	Connector, 2–pole	/16.C6	Cab
–X99	Connector, 2–pole	/4.C12	Cab
–Y1M	Injector, cylinder 1	/2.C2	Engine
–Y1T	Solenoid valve, differential lock	/12.C11	Transmission
–Y1W	Solenoid valve, rear steering	/18.D6	Transmission
–Y2F	Solenoid valve, 3/2	/17.C5	Engine
–Y2M	Injector, cylinder 2	/2.C3	Engine
–Y2M	Pressure switch, compressor pressure	/6.D13	Cab
–Y2T	Solenoid valve, PTO	/5.D13	Transmission
–Y3M	Injector, cylinder 3	/2.C4	Engine
–Y3T	Solenoid valve, 4WD	/12.C12	Transmission
–Y4F	Solenoid valve, 2/2	/17.C6	Engine
–Y4M	Injector, cylinder 4	/2.C4	Engine
–Y4T	Solenoid valve, DPS1	/5.D14	Transmission
–Y5T	Solenoid valve, DPS2	/5.D15	Transmission
–Y6T	Solenoid valve, power lift lowering	/9.D8	Transmission
–Y7	Solenoid valve, rear starter prevention	/5.D3	Cab
–Y7T	Solenoid valve, power lift lifting	/9.D9	Transmission
–Y8T	Solenoid, Forward direction	/5.D11	Transmission
–Y9	Magnetic clutch, front–PTO	/12.C2	Engine
–Y9T	Solenoid, reverse direction	/5.D12	Transmission
–Y10T	Solenoid valve,DPS3	/5.D16	Transmission
–Y11T	Solenoid, parking brake	/5.D10	Transmission
–Y12T	Solenoid valve,lifting	/19.C12	Transmission
–Y13T	Solenoid valve, lowering	/19.C13	Transmission
–Y14T	Solenoid valve, lifting (optional)	/19.C15	Transmission
–Y15T	Solenoid valve, lowering (optional)	/19.C16	Transmission
–Y16T	Solenoid valve, auxiliary valves on/off	/19.C8	Transmssion
–Y17T	Solenoid valve, H–speed	/7.C3	Transmission
–Y18T	Solenoid valve, M–speed	/7.C2	Transmission
–Y19T	Solenoid valve, auxiliary valves	/19.D4	Transmission
–Y21T	Solenoid valve, brake cooling	/7.C9	Transmission
–Y43	Solenoid valve, front loader / lift	/19.C11	Transmission

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Symbol	Description	Page and position	Location
–A1M	Control unit, EC	/1.B14	Engine
–A1M2	Connector, 36–pole	/1.C11	Engine
–A2M	ID–module	/1.A13	Engine
–B1M	Sensor, water detector	/1.A14	Engine
–B3M	Sensor, coolant temperature	/1.C11	Engine
–B4M	Sensor, Fuel temperature	/1.C12	Engine
–B5M	Sensor, boost pressure	/1.C12	Engine
–B6M	Sensor, oil pressure	/1.C13	Engine
–B7M	Sensor, rail pressure	/1.C14	Engine
–B8M	Sensor, fuel pressure	/1.C15	Engine
–B10M	Sensor, crankshaft speed	/1.C15	Engine
–B11M	Sensor, camshaft speed	/1.C16	Engine
–F1M	250A, Inlet air heater	/1.C10	Engine
–F2M	125A, Cab supply	/1.A1	Cab
–F10	20A, Engine control unit (EEM supply)	/1.A13	Cab
–F11	10A, starter switch	/1.A11	Cab
–F14	20A, engine control unit (EEM supply2)	/1.A12	Cab
–G1	Battery	/1.D1	Engine
–G2	Alternator	/1.D6	Engine
–GR1	Ground, rear light, solenoid valves	/1.D7	Cab
–GR.7	Ground, battery	/1.D6	Engine
–GR8	Ground, head lights	/1.D10	Engine

Symbol	Description	Page and position	Location
–K1M	Starter auxiliary relay	/1.B9	Engine
–K3M	Relay, intake air heater	/1.C10	Engine
–K3	Relay, main switch	/1.C4	Cab
–K4	Auxiliary relay, starter switch	/1.A2	Cab
–K5	Auxiliary relay, starter switch	/1.A2	Cab
–K11	Auxiliary relay, starter switch 1	/1.A6	Cab
–K12	Auxiliary relay, starter switch 2	/1.A6	Cab
–K51	Relay, main switch	/1.B4	Cab
–M1	Starter motor	/1.D8	Engine
–Q1	Heat/starter switch	/1.A11	Cab
–Q2	Main switch	/1.B1	Transmission
–R1	Intake air heater	/1.D10	Engine
–S68	Switch, mainswitch control	/1.C2	Cab
–V2	Diode, main switch, heat / starter switch	/1.B5	Cab
–X.1	Connector, 9–pole	/1.C4	Cab
–X1M	Connector, 89–pole	/1.B10	Engine
–X.2M	Connector, 31–pole	/1.B10	Engine
–X2M	Connector, 31–pole	/1.B10	Engine
–X3M	Connector, 31–pole	/1.D6	Engine
–X.3	Connector, 9–pole	/1.C4	Cab
–X.4	Connector, 9–pole	/1.A11	Cab
–X.5	Connector, 9–pole	/1.B3	Cab
–X.6	Connector, 9–pole	/1.B3	Cab
–X.7	Connector, 9–pole	/1.B7	Cab
–X35	Connector, 37–pole	/1.B3	Cab

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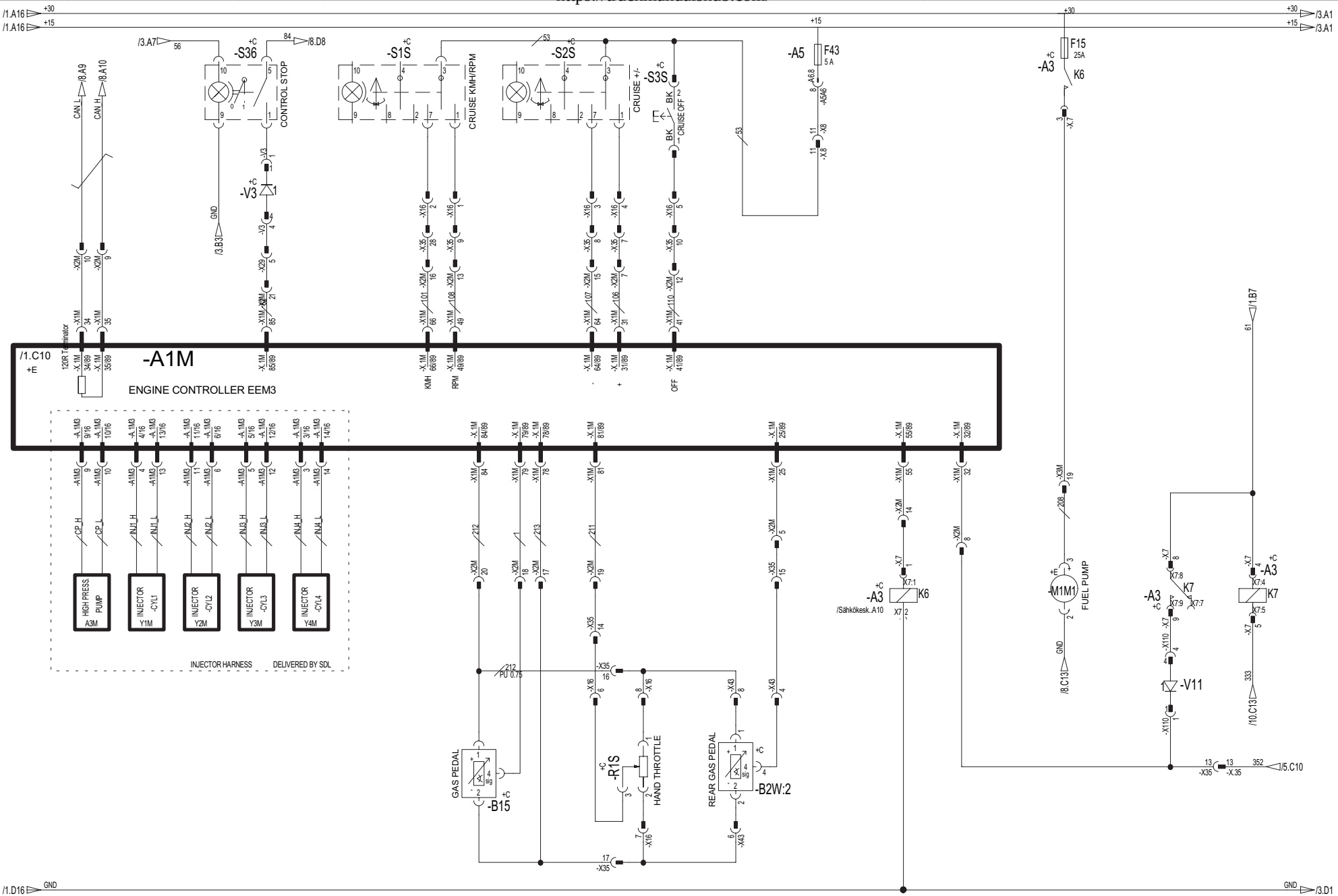
VALTRA	ENGINE CR N121LS-N141LS WIRING DIAGRAM AC11.2	1/19

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Symbol	Description	Page and position	Location
–A1M	Control unit, EC	/2.B3	Engine
–A3M	High pressure pump	/2.C2	Engine
–B2W	Position sensor, rear accel. pedal	/2.D9	Cab
–B15	Position sensor, accelerator pedal	/2.D6	Cab
–F15	15A, fuel feed pump	/2.A13	Cab
–F43	5A, cruise switches	/2.A10	Cab
–K6	Relay, fuel feed pump control	/2.C11	Cab
–K7	Control relay, 4WD–brake	/2.C14	Cab
–M1M	Fuel pump	/2.C13	Engine
–R1S	Potentiometer, hand throttle	/2.D8	Cab
–S1S	Switch, cruise kmh / rpm	/2.A5	Cab
–S2S	Switch, cruise +/–	/2.A7	Cab
–S3S	Switch, cruise off	/2.A8	Cab
–S36	Switch, 2–pos., control stop	/2.A4	Cab
–V3	Diode, control stop	/2.A4	Cab
–V11	Diode, control stop	/2.D15	Cab

Symbol	Description	Page and position	Location
–X1M	Connector,89–pole	/2.B2	Engine
–X2M	Connector, 31–pole	/2.B2	Engine
–X3M	Connector, 31–pole	/2.C13	Engine
–X.7	Connector, 9–pole	/2.A13	Cab
–X8	Connector, 37–pole	/2.A10	Cab
–X16	Connector, 37–pole	/2.A6	Cab
–X29	Connector, 9–pole.socket, stop–alarm	/2.B4	Cab
–X35	Connector, 37–pole	/2.B6	Cab
–X43	Connector, 3–pole, seat direction	/2.C9	Cab
–X110	Connector, 4–pole	/2.C14	Cab
–Y1M	Injector, cylinder 1	/2.C2	Engine
–Y2M	Injector, cylinder 2	/2.C3	Engine
–Y3M	Injector, cylinder 3	/2.C4	Engine
–Y4M	Injector, cylinder 4	/2.C4	Engine

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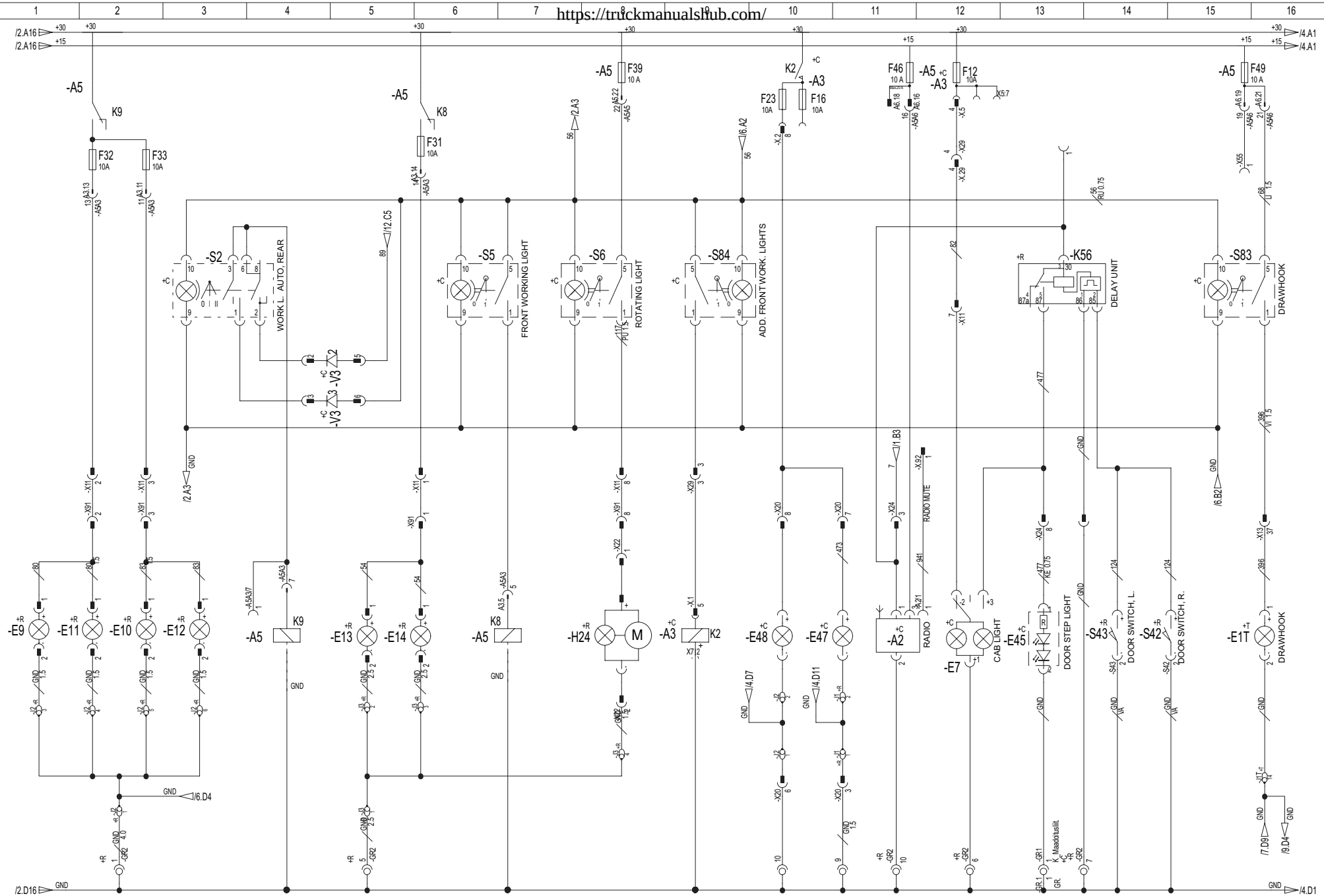
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ENGINE cont., EXTH. BRAKE
N121LS-N141LS
WIRING DIAGRAM AC11.2

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Symbol	Description	Page and position	Location
–A2	Radio	/3.C11	Cab
–E1T	Drawing hook light	/3.C16	Transmission
–E7	Cab light	/3.C12	Cab
–E9	Rear working light, right outer	/3.C1	Roof
–E10	Rear working light, right inner	/3.C2	Roof
–E11	Rear working light, left outer	/3.C2	Roof
–E12	Rear working light, left inner	/3.C3	Roof
–E13	Front working light, right inner	/3.C5	Roof
–E14	Front working light, left inner	/3.C6	Roof
–E45	Step light	/3.C12	Cab
–E47	Additional front working light, right	/3.C11	Cab
–E48	Additional front working light, left	/3.C10	Cab
–F12	10A, cabin light	/3.A12	Cab
–F16	10A, reserve for working lights	/3.A10	Cab
–F23	15A, additional working lights (lifting handle)	/3.A10	Cab
–F31	10A, front working lights	/3.A6	Cab
–F32	10A, rear work lights (outer)	/3.A2	Cab
–F33	10A, rear work lights (inner)	/3.A2	Cab
–F39	10A, rotation warning light, ISO adapter	/3.A8	Cab
–F46	10A, electrical mirrors	/3.A11	Cab
–F49	10A, towing hook light	/3.A16	Cab
–GR1	Ground	/3.D13	Cab
–GR2	Ground	/3.D2	Roof
–H24	Rotating roof light	/3.C8	Roof
–K2	Relay, additional working lights (lifting handle)	/3.A10	Cab
–K8	Control relay, front working lights	/3.C6	Cab
–K9	Control relay, rear working lights	/3.C4	Cab
–K56	Time–delay relay, cabin light and door step	/3.B13	Cab
–S2	Switch, 2–pos., rear working lights	/3.B3	Cab
–S5	Switch, 2–pos., front working lights	/3.B6	Cab
–S6	Switch, 2–pos., rot. warning light	/3.A8	Cab
–S42	Door switch, cab light, RH	/3.C14	Roof
–S43	Door switch, cab light, LH	/3.C14	Roof
–S83	Switch, 2–pos., drawhook light	/3.B15	Cab
–S84	Switch, 2–pos., add. front working lights	/3.A9	Cab
–V3	Diode, control stop	/3.B5	Cab
–X.1	Connector, 9–pole	/3.C9	Cab
–X.2	Connector, 9–pole	/3.A10	Cab
–X.5	Connector, 9–pole	/3.A12	Cab
–X11	Connector, 9–pole	/3.C2	Roof
–X13	Connector, 37–pole	/3.C15	Cab
–X20	Connector, 9–pole, front flashers	/3.C10	Cab
–X22	Connector, 2–pole, rotation light	/3.C8	Roof
–X24	Connector, 9–pole	/3.C11	Roof
–X29	Connector, 9–pole	/3.A12	Cab
–X55	Connector, 1–pole, fieldmaster	/3.A15	Cab
–X91	Connector, 9–pole	/3.C2	Roof
–X.92	Connector, 3–pole	/3.C12	Roof

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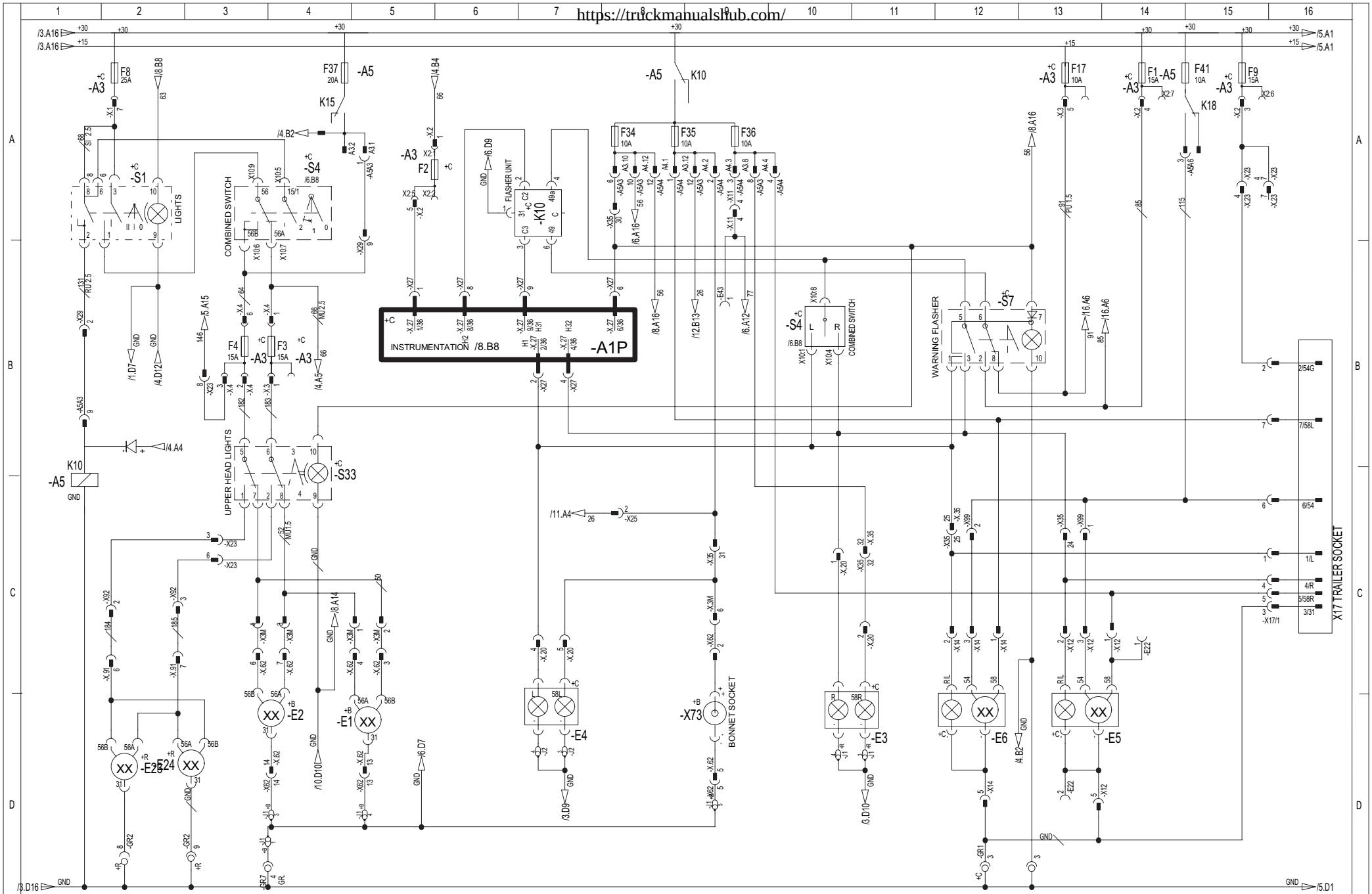
WORKING LIGHTS
N121LS-N141LS
WIRING DIAGRAM AC11.2

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Symbol	Description	Page and position	Location
–A1P	Instrument	/4.B7	Cab
–E1	Head light,right	/4.D5	Bonnet
–E2	Head light,left	/4.D4	Bonnet
–E3	Front direction indicator, right	/4.D11	Cab
–E4	Front direction indicator, left	/4.D7	Cab
–E5	Rear light (indicator/parking/braking)	/4.D13	Right mudguard
–E6	Rear light (indicator/parking/braking)	/4.D12	Left mudguard
–E23	Upper head light, right	/4.D2	Roof
–E24	Upper head light. left	/4.D2	Roof
–F1	15A, hazard blinkers	/4.A14	Cab
–F2	5A, long beam indicator light	/4.A5	Cab
–F3	15A, high beam	/4.B4	Cab
–F4	15A, low beam	/4.B3	Cab
–F8	25A, light switch	/4.A2	Cab
–F9	15A, trailer socket/fog light, rear	/4.A15	Cab
–F17	10A, direction indicators	/4.A13	Cab
–F34	10A, parking lights, instrument	/4.A8	Cab
–F35	10A, parking light, left	/4.A8	Cab
–F36	10A, parking light, right	/4.A9	Cab
–F37	20A, driving beam automatic	/4.A4	Cab
–F41	10A, braking lights	/4.A15	Cab
–GR1	Ground	/4.D12	Cab
–GR2	Ground	/4.D2	Roof
–GR.7	Ground, battery	/4.D4	Engine
–K10	Relay, parking lights	/4.A7	Cab
–K15	Relay, driving beam automatic	/4.A4	Cab

Symbol	Description	Page and position	Location
–S1	Switch, 3–pos., head lights	/4.A2	Cab
–S4	Combined switch	/4.A4	Cab
–S7	Switch, 2–pos., warning flashers	/4.B12	Cab
–S33	Switch, upper head lights	/4.B4	Cab
–X.1	Connector, 9–pole	/4.A2	Cab
–X.2	Connector, 9–pole	/4.A5	Cab
–X3M	Connector, 31–pole	/4.C3	Engine
–X.3	Connector, 9–pole	/4.B3	Cab
–X.4	Connector, 9–pole	/4.B3	Cab
–X11	Connector, 9–pole	/4.A9	Roof
–X12	Connector, 9–pole	/4.C13	Right mudguard
–X14	Connector, 9–pole	/4.C12	Left mudguard
–X17	Connector, 7–pole, trailer socket	/4.C16	Cab
–X20	Connector, 9–pole	/4.C7	Cab
–X23	Connector, 3–pole	/4.A15	Cab
–X25	Connectori, 16–pole	/4.C7	Cab
–X27	Connector, 36–pole, instrument	/4.B5	Cab
–X29	Connector, 9–pole	/4.B1	Cab
–X35	Connector, 37–pole	/4.A7	Cab
–X62	Connector, 16–pole	/4.C3	Bonnet
–X73	Connector, 2–pole current socket	/4.D9	Bonnet
–X.91	Connector, 9–pole	/4.C2	Roof
–X.92	Connector, 3–pole	/4.C2	Roof
–X99	Connector, 2–pole	/4.C12	Cab

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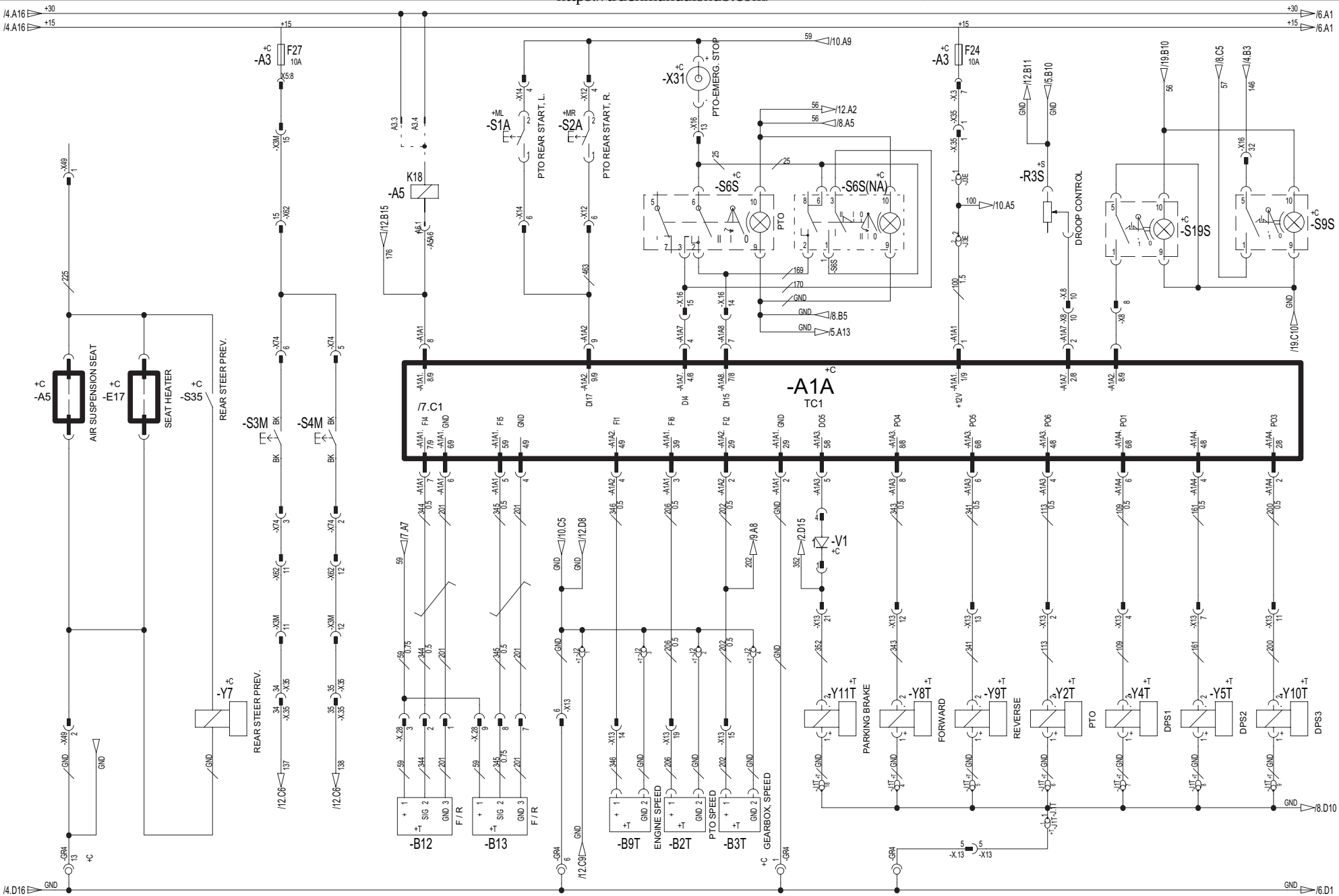


VALTRA	LIGHTS N121LS-N141LS WIRING DIAGRAM AC11.2	4/19

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Symbol	Description	Page and position	Location
–A1A	Control unit, TC1	/5.B10	Cab
–A1A1	Connector, 9–pole	/5.B6	Cab
–A1A2	Connector, 9–pole	/5.B8	Cab
–A1A3	Connector, 8–pole	/5.B10	Cab
–A1A4	Connector, 8–pole	/5.B14	Cab
–A1A7	Connector, 8–pole	/5.B9	Cab
–A1A8	Connector, 8–pole	/5.B9	Cab
–A5	Air suspension seat	/5.B2	Cab
–B2T	Sensor, PTO–speed	/5.D9	Transmission
–B3T	Sensor, gearbox speed	/5.D9	Transmission
–B9T	Sensor, engine rpm speed	/5.D8	Transmission
–B12	Sensor, F/R shuttle	/5.D6	Transmission
–B13	Sensor, F/R shuttle	/5.D7	Transmission
–E17	Seat heater	/5.B2	Cab
–F24	10A, TC1 control unit	/5.A12	Cab
–F27	10A, reserve	/5.A4	Cab
–GR4	Ground,	/5.D1	Cab
–K18	Relay, braking lights	/5.A6	Cab
–R3S	Potentiometer, droop control	/5.A13	Cab
–S1A	Push button, PTO rear start, left	/5.A7	Left mudguard
–S2A	Push button, PTO rear start, right	/5.A7	Right mudguard
–S3M	Push button	/5.B4	Cab
–S4M	Push button	/5.B5	Cab
–S6S	Combined switch, PTO	/5.A9	Cab
–S9S	Switch, rear fog light	/5.A16	Cab
–S19S	Switch, ECO	/5.A14	Cab
–S35	Rear steering prevention	/5.B3	Cab
–V1 (1)	Diode, parking lights (automatic)	/5.C10	Cab
–X3M	Connector, 31–pole	/5.A4	Engine
–X8	Connector, 37–pole	/5.A10	Cab
–X12	Connector, 9–pole	/5.A8	Right mudguard
–X13	Connector, 37–pole	/5.A12	Transmission
–X14	Connector, 9–pole	/5.A7	Left mudguard
–X.28	Connector, 9–pole	/5.D5	Cab
–X31	Connector, 2–pole socket, PTO–emerg. stop	/5.A9	Cab
–X35	Connector, 37–pole	/5.D4	Cab
–X49	Connector, 2–pole	/5.A1	Cab
–X62	Connector, 16–pole	/5.B4	Bonnet
–X74	Connector	/5.B4	Cab
–Y2T	Solenoid valve, PTO	/5.D13	Transmission
–Y4T	Solenoid valve, DPS1	/5.D14	Transmission
–Y5T	Solenoid valve, DPS2	/5.D15	Transmission
–Y7	Solenoid valve, rear starter prevention	/5.D3	Cab
–Y8T	Solenoid, Forward direction	/5.D11	Transmission
–Y9T	Solenoid, reverse direction	/5.D12	Transmission
–Y10T	Solenoid velve, DPS3	/5.D16	Transmission
–Y11T	Solenoid, parking brake	/5.D10	Transmission

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TC1
N121LS-N141LS
WIRING DIAGRAM AC11.2

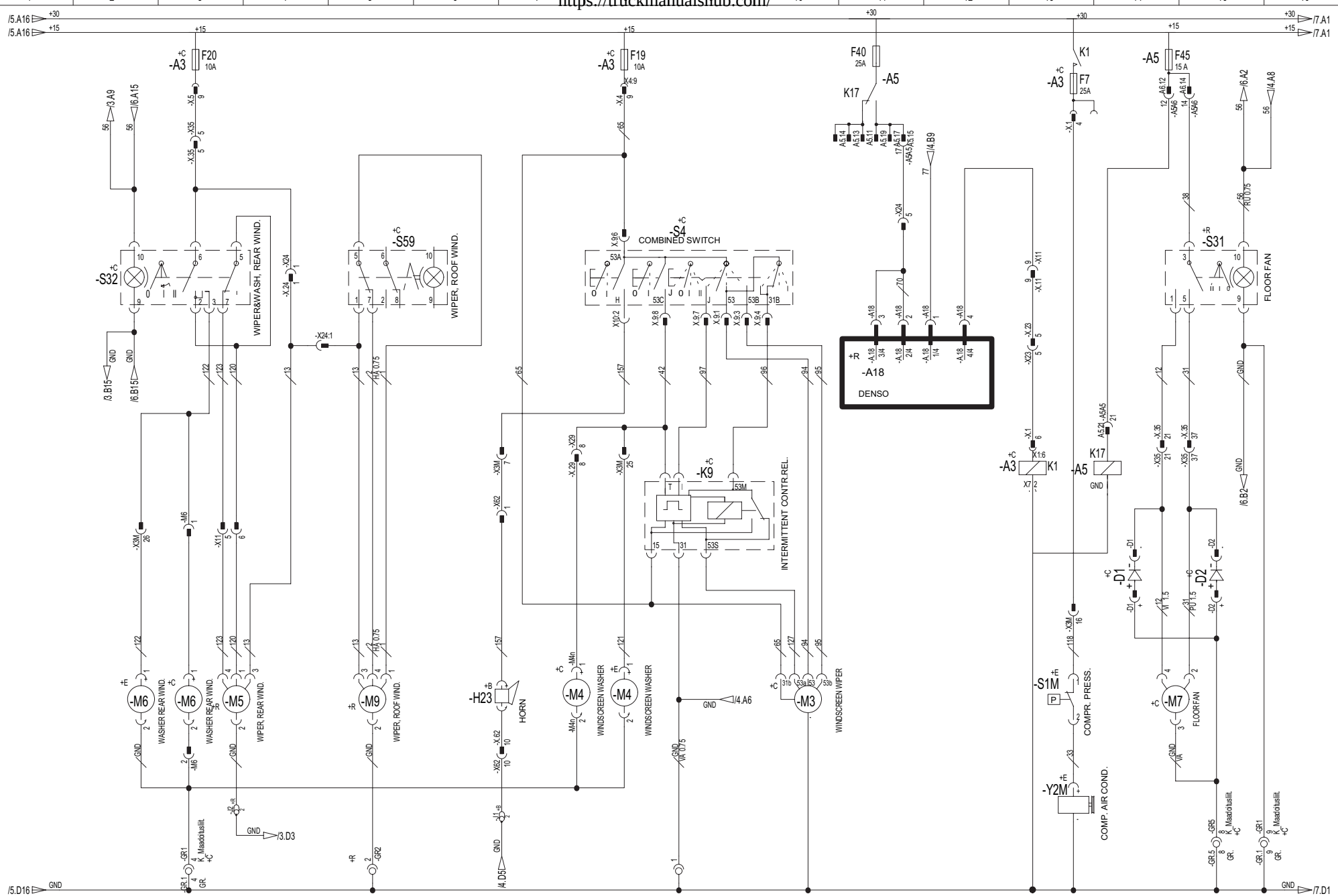
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Symbol	Description	Page and position	Location
–A18	Denso	/6.B11	Cab
–D1	Diode	/6.C14	Cab
–D2	Diode	/6.C15	Cab
–F7	25A, air condition compressor	/6.A13	Cab
–F19	10A, windscreen wiper/washer, horn	/6.A8	Cab
–F20	10A, rear window wiper/washer, radio	/6.A3	Cab
–F40	30A, fan III–speed	/6.A11	Cab
–F45	15A, fan I,II–speeds air cond., floor fan	/6.A14	Cab
–GR1	Ground	/6.D3	Cab
–GR2	Ground	/6.D5	Roof
–GR5	Ground	/6.D15	Cab
–H23	Horn	/6.D6	Bonnet
–K1	Relay, air condition compressor control	/6.C13	Cab
–K9	Intermitent control relay, wiper	/6.C9	Cab
–K17	Relay, fan III–speed	/6.B14	Cab
–M3	Windscreen wiper	/6.D10	Cab
–M4	Windscreen washer	/6.D7	Engine
–M5	Rear window wiper	/6.D3	Roof
–M6	Rear window washer	/6.D2	Cab
–M7	Floor fan	/6.D14	Cab
–M9	Roof window wiper	/6.D5	Roof

Symbol	Description	Page and position	Location
–S1M	Push button, compressor pressure	/6.C13	Cab
–S4	Combined switch	/6.B9	Cab
–S31	Switch, 3–pos., floor fan	/6.B15	Cab
–S32	Switch 3–pos., rear window wiper& washer	/6.B3	Cab
–S59	Switch, 2–pos., wiper: roof window	/6.B5	Cab
–X3M	Connector, 31–pole	/6.C2	Engine
–X.1	Connector, 9–pole	/6.A13	Cab
–X.4	Connector, 9–pole	/6.A8	Cab
–X.5	Connector, 9–pole	/6.A3	Cab
–X11	Connector, 9–pole	/6.C3,	Roof
–X23	Connector, 3–pole	/6.B13	Cab
–X24	Connector, 9–pole	/6.B4	Roof
–X29	Connector, 9–pole	/6.C7	Cab
–X35	Connector, 37–pole	/6.A3	Cab
–X62	Connector, 16–pole	/6.C6	Bonnet
–Y2M	Pressure switch, compressor pressure	/6.D13	Cab

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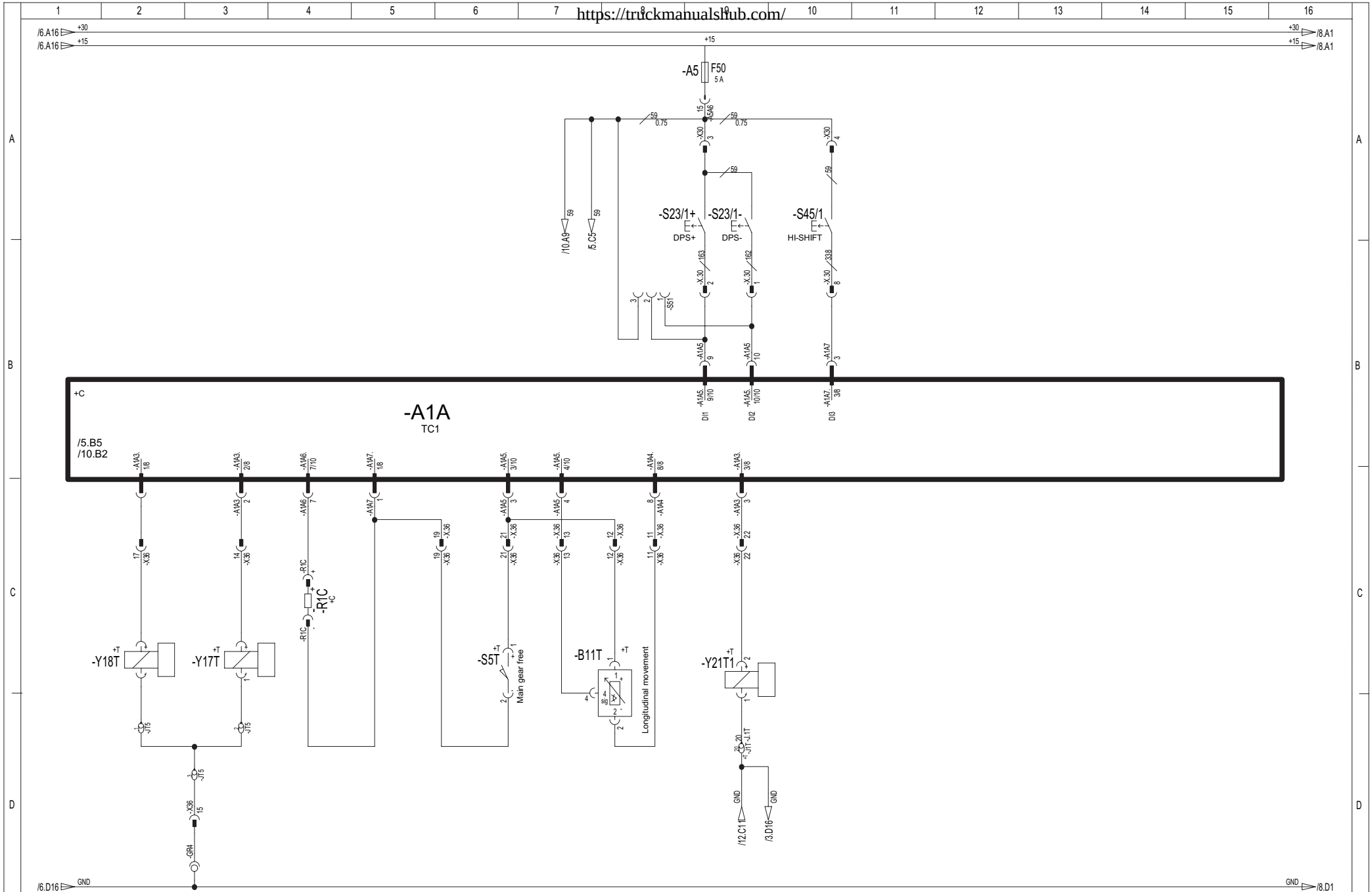
WIPERS, FANS, AC
N121LS-N141LS
WIRING DIAGRAM AC11.2

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https://truckmanualshub.com/

Symbol	Description	Page and position	Location
–A1A	Control unit, TC1	/7.B6	Cab
–A1A3	Connector, 8–pole	/7.B2	Cab
–A1A4	Connector, 8–pole	/7.B8	Cab
–A1A5	Connector, 10–pole	/7.B6	Cab
–A1A6	Connector, 10–pole	/7.B4	Cab
–A1A7	Connector, 8–pole	/7.B5	Cab
–B11T	Sensor, longitudinal movement	/7.C8	Transmission
–F50	5A, TC1, sensors, radar	/7.A9	Cab
–GR5	Ground	/7.D2	Cab
–R1C	Potentiometer	/7.C4	Cab
–S5T	Limit switch, main gear free	/7.C6	Transmission
–S23/1–	Push button, DPS–	/7.A9	Cab
–S23/1+	Push button, DPS+	/7.A8	Cab
–S45/1	Push button, Hi–shift	/7.A10	Cab
–X30	Connector, 9–pole (gear change lever)	/7.A9	Cab
–X36	Connector, 37–pole	/7.C4	Cab
–Y17T	Solenoid valve, H–speed	/7.C3	Transmission
–Y18T	Solenoid valve, M–speed	/7.C2	Transmission
–Y21T	Solenoid valve, brake cooling	/7.C9	Transmission

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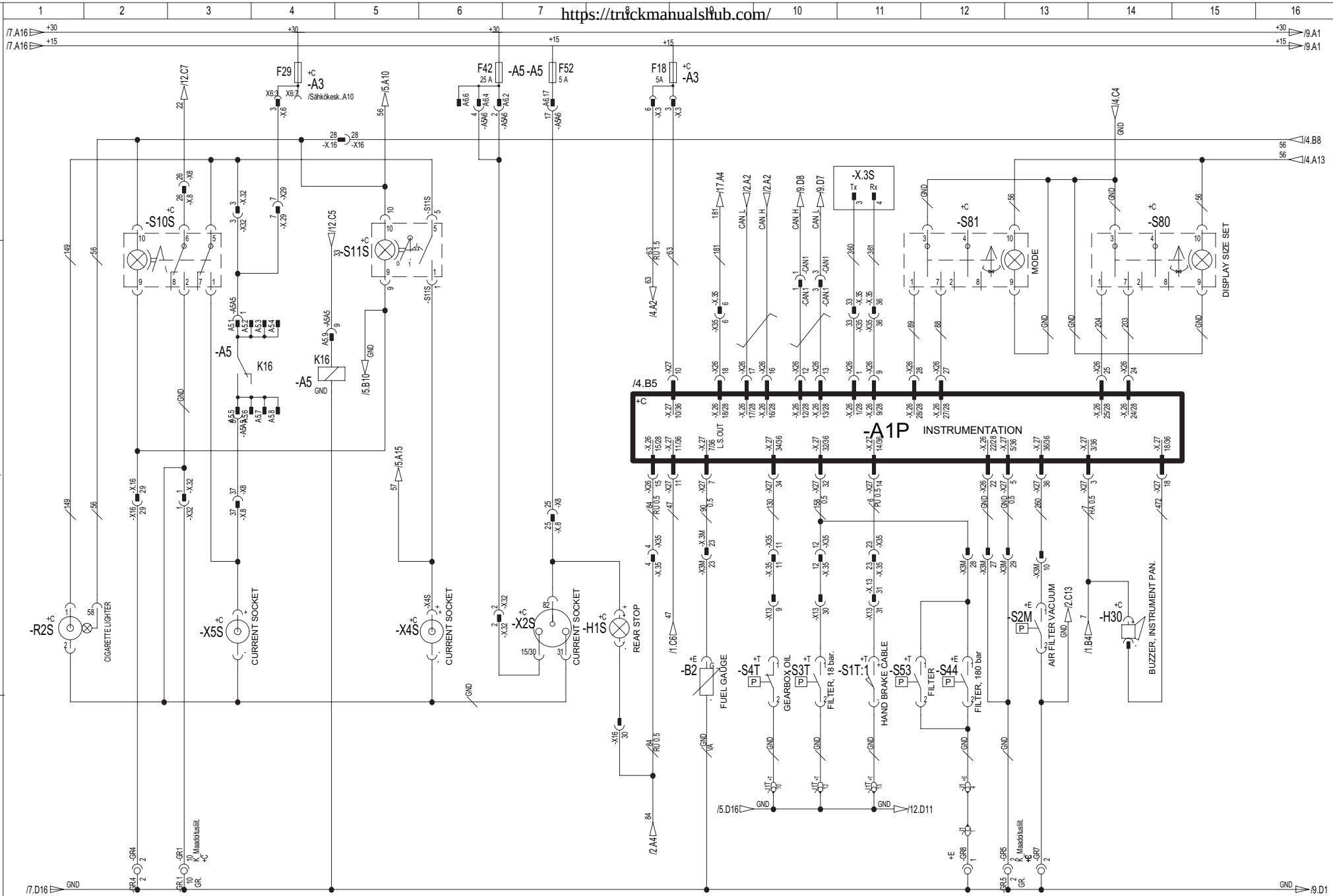
TC1
N121LS-N141LS
WIRING DIAGRAM AC11.2

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Symbol	Description	Page and position	Location
–A1P	Instrument	/8.B11	Cab
–B2	Sensor, fuel gauge	/8.C9	Engine
–F18	5A, instrumentation, indicator lights	/8.A8	Cab
–F29	10A, cigarette lighter, 2pin current socket	/8.A4	Cab
–F42	25A, 3pin current socket	/8.A6	Cab
–F52	5A, 3pin current socket	/8.A7	Cab
–GR1	Ground	/8.D3	Cab
–GR4	Ground	/8.D2	Cab
–GR5	Ground	/8.D12	Cab
–GR7	Ground	/8.D13	Engine
–GR8	Ground	/8.D12	Engine
–H1S	Rear stop indicator light	/8.C8	Cab
–H30	Buzzer, instrumentation	/8.C14	Cab
–K16	Relay, U–pilot current socket control	/8.B4	Cab
–R2S	Potentiometer, cigarette lighter	/8.C1	Cab
–S1T	Limit switch, parking brake indicator light	/8.C11	Cab
–S2M	Switch, air filter vacuum	/8.C13	Engine
–S3T	Limit switch, oil filter ind. light	/8.C10	Transmission
–S4T	Limit switch, gearbox oil ind. light	/8.C10	Transmission
–S10S	Switch	/8.A2	Cab
–S11S	Switch	/8.B5	Cab
–S44	Limit switch, indicator light pressure filter 180 bar	/8.C12	Engine
–S53	Limit switch, indicator light pressure filter, return	/8.C12	Transmission
–S80	Switch, 3–pos., instrument, display size	/8.A14	Cab
–S81	Switch, 3–pos., instrument, display mode	/8.A12	Cab
–X2S	Connector, current socket (ISO)	/8.C7	Cab
–X3M	Connector, 31–pole	/8.C9	Engine
–X.3S	Connector,diagnostics	/8.A11	Cab
–X4S	Connector, current socket	/8.C5	Cab
–X5S	Connector, current socket	/8.C3	Cab
–X.3	Connector, 9–pole	/8.A8	Cab
–X.6	Connector, 9–pole	/8.A4	Cab
–X8	Connector,37–pole	/8.A3	Cab
–X13	Connector, 37–pole	/8.C9	Cab
–X16	Connector, 37–pole	/8.C2	Cab
–X26	Connector, 28–pole, instrument	/8.B8	Cab
–X27	Connector, 36–pole, instrument	/8.B8	Cab
–X29	Connector, 9–pole	/8.A4	Cab
–X32	Connector, 4–pole	/8.A3	Cab
–X35	Connector, 37–pole	/8.B9	Cab

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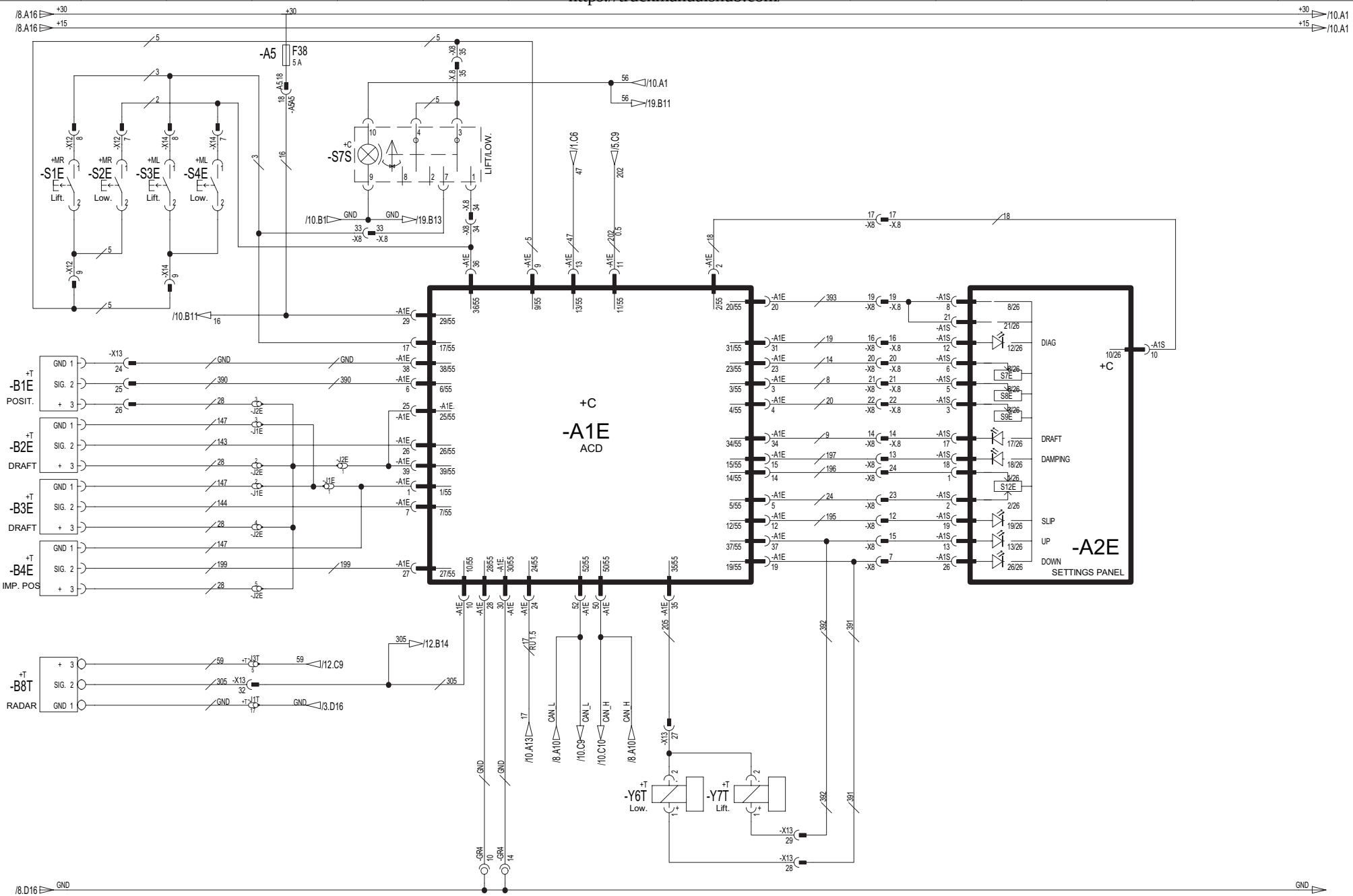


VALTRA	OUTLETS, ICL, HITCH REL. N121LS-N141LS WIRING DIAGRAM AC11.2	8/19

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Symbol	Description	Page and position	Location
–A1E	Control unit, power lift (ACD)	/9.B7	Cab
–A1S	Powerlift control panel	/9.B2	Cab
–A2E	Switch panel, power lift	/9.C13	Cab
–B1E	Position sensor, rear power lift (B4T)	/9.B1	Transmission
–B2E	Draft sensor, r.h	/9.B1	Transmission
–B3E	Draft sensor, l.h	/9.C1	Transmission
–B4E	Sensor, implement position (ACD)	/9.C1	Transmission
–B8T	Radar	/9.C1	Transmission
–F38	5A, autocontrol	/9.A4	Cab
–GR4	Ground	/9.D6	Cab
–S1E	Push button, rear operation, r.h., lifting	/9.A1	Right mudguard
–S2E	Push button, rear operation, r.h., lowering	/9.A2	Right mudguard
–S3E	Push button, rear operation, l.h., lifting	/9.A2	Left mudguard
–S4E	Push button, rear operation, l.h., lowering	/9.A3	Left mudguard
–S7E	Switch, lowering speed	/9.B12	Cab
–S7S	Combined switch, lift / low	/9.A5	Cab
–S8E	Switch, top limit	/9.B12	Cab
–S9E	Switch, mixing	/9.C12	Cab
–S12E	Switch, drive balance system / slip	/9.C12	Cab
–Y6T	Solenoid valve, power lift lowering	/9.D8	Transmission
–Y7T	Solenoid valve, power lift lifting	/9.D9	Transmission
–X8	Connector,37–pole	/9.A6	Cab
–X12	Connector, 9–pole	/9.B1	Right mudguard
–X13	Connector, 37–pole	/9.B2	Cab
–X14	Connector, 9–pole	/9.A3	Left mudguard

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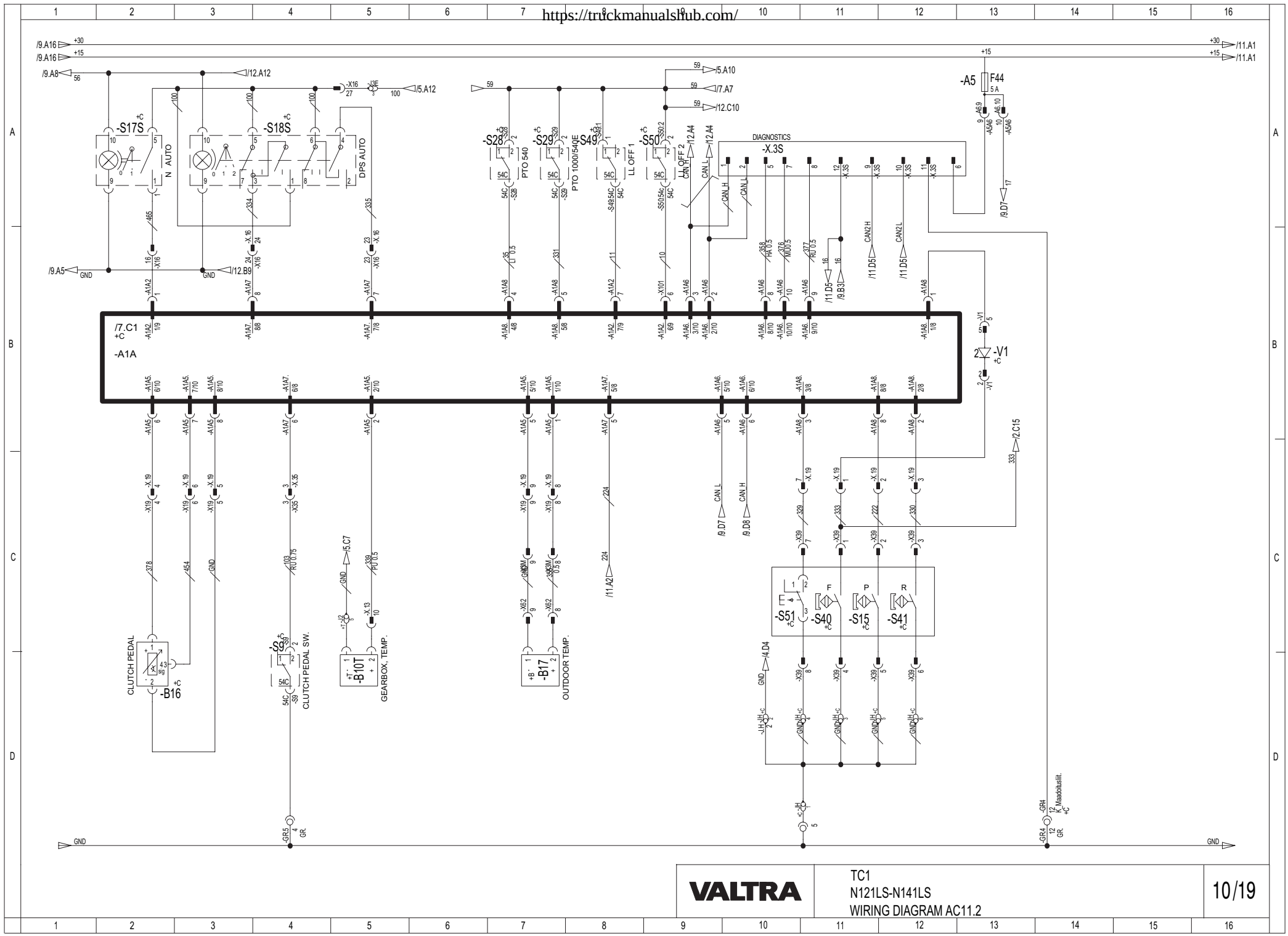


VALTRA	EHRD N121LS-N141LS WIRING DIAGRAM AC11.2	9/19

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Symbol	Description	Page and position	Location
–A1A	Control unit, TC1	/10.B2	Cab
–A1A2	Connector, 9–pole	/10.B2	Cab
–A1A5	Connector, 10–pole	/10.B2	Cab
–A1A6	Connector, 10–pole	/10.B9	Cab
–A1A7	Connector, 8–pole	/10.B3	Cab
–A1A8	Connector, 8–pole	/10.B7	Cab
–B10T	Gearbox temperature sensor	/10.D5	Transmission
–B16	Position sensor, clutch pedal	/10.D2	Cab
–B17	Temperature sensor, outdoors	/10.D7	Bonnet
–F44	5A, autocontrol	/10.A13	Cab
–GR4	Ground	/10.D13	Cab
–GR5	Ground	/10.D5	Cab
–S9	Switch, starter safety	/10.D4	Cab
–S15	Reed relay, front parking brake (P)	/10.C11	Cab
–S17S	Switch, front PTO	/10.A2	Cab
–S18S	Switch, DPS auto	/10.A4	Cab
–S28	Push button, PTO 540	/10.A7	Cab
–S29	Push button, PTO 1000/540E	/10.A7	Cab
–S40	Reed relay, direction forward (F), front	/10.C11	Cab
–S41	Reed relay, direction reverse (R), front	/10.C12	Cab
–S49	Switch, creeper off	/10.A8	Cab
–S50	Switch, creeper on	/10.A9	Cab
–S51	Push button, DPS–preselection (D), front	/10.C10	Cab
–V1	Diode, parking lights (automatic)	/10.B13	Cab
–X.3	Connector, 9–pole	/10.A10	Cab
–X16	Connector, 37–pole	/10.A5	Cab
–X19	Connector	/10.C2	Cab
–X35	Connector, 37–pole	/10.C4	Cab
–X39	Connector	/10.D10	Cab
–X62	Connector, 6–pole	/10.C7	Bonnet

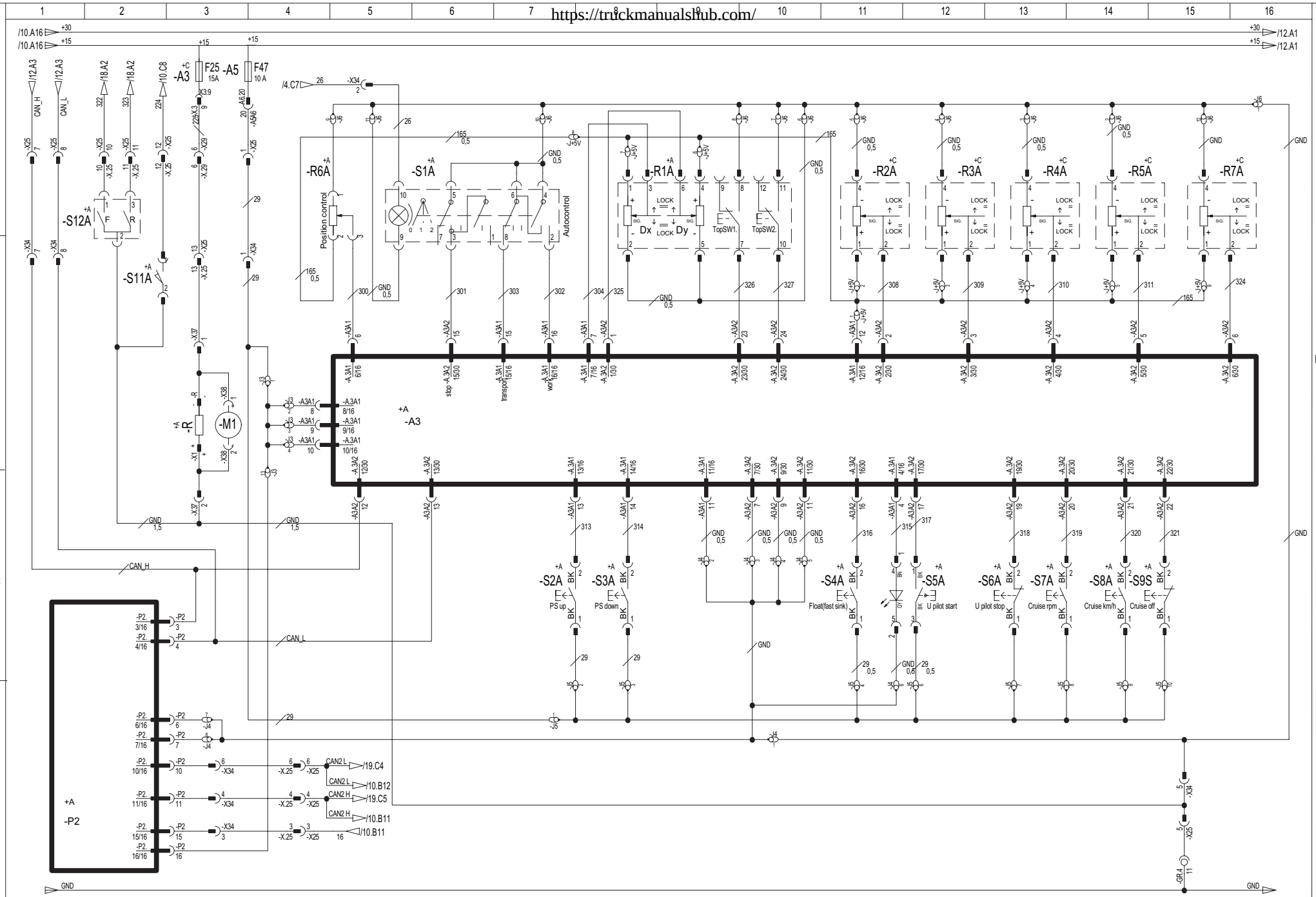
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Symbol	Description	Page and position	Location
–A3A	Control unit, UC1	/11.B5	Cab
–A3A1	Connector, 16–pole	/11.B4	Cab
–A3A2	Connector, 30–pole	/11.B6	Cab
–F25	15A, suspension seat / seat heater / rear steering prevention	/11.A3	Cab
–F47	10A, arm rest	/11.A4	Cab
–GR4	Ground	/11.D14	Cab
–M1	Starter motor	/11.B3	Engine
–P2	Tractor terminal display	/11.D1	Cab
–R1A	Joystick	/11.A9	Cab
–R2A	Lever 1	/11.A11	Cab
–R3A	Lever 2	/11.A12	Cab
–R4A	Lever 3	/11.A13	Cab
–R5A	Lever 4	/11.A14	Cab
–R7A	Draw hook lever	/11.A15	Cab
–R6A	Potentiometer, rear lift postion contron.	/11.A4	Cab
–S1A	Switch, autocontrol	/11.A6	Cab
–S2A	Push button, Power shift up	/11.C7	Cab
–S3A	Push button, Power shift down	/11.C8	Cab
–S4A	Push button, forced lowering	/11.C11	Cab
–S5A	Push button,U pilot start	/11.C12	Cab
–S6A	Push button,U pilot stop	/11.C13	Cab
–S7A	Push button,constant engine speed	/11.C13	Cab
–S8A	Push button,constant driving speed	/11.C14	Cab
–S9A	Push button, cruise off	/11.C14	Cab
–S11A	Switch, seat	/11.B2	Cab
–S12A	Switch, seat front/rear	/11.A2	Cab
–X25	Connectori, 16–pole	/11.A1	Cab
–X29	Connector, 9–pole	/11.A3	Cab
–X34	Connector, 9–pole	/11.B1	Cab
–X37	Connector, 3pole (seat turning angle switch)	/11.B3	Cab
–X38	Connector	/11.B3	Cab

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ARMREST
N121LS-N141LS
WIRING DIAGRAM AC11.2

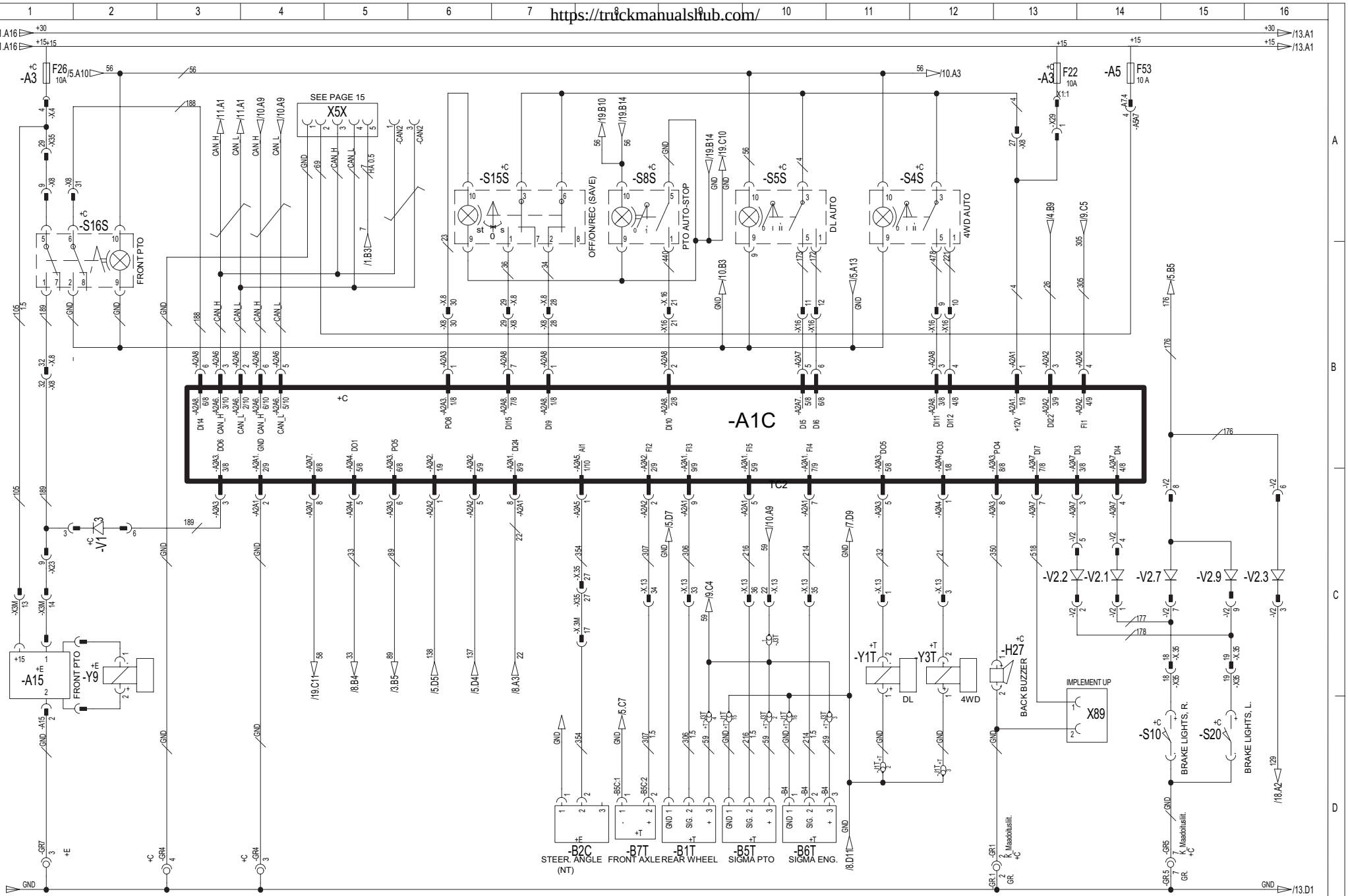
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Symbol	Description	Page and position	Location
–A1C	Control unit, TC2	/12.B10	Cab
–A2A1	Connector, 9–pole	/12.C4	Cab
–A2A2	Connector, 9–pole	/12.C6	Cab
–A2A3	Connector, 8–pole	/12.C3	Cab
–A2A4	Connector, 8–pole	/12.C5	Cab
–A2A5	Connector,10–pole	/12.C7	Cab
–A2A6	Connector, 10–pole	/12.B3	Cab
–A2A7	Connector, 8–pole	/12.C4	Cab
–A2A8	Connector, 8–pole	/12.B3	Cab
–A15	Control unit, front PTO	/12.C1	Cab
–B1T	Sensor, rear wheel speed	/12.D9	Transmission
–B2C	Sensor, steering angle (only T series)	/12.D7	Transmission
–B5T	Sensor, Sigma PTO (only T series)	/12.D9	Transmission
–B6T	Sensor, Sigma engine (only T series)	/12.D10	Transmission
–B7T	Sensor, front axle speed	/12.D8	Transmission
–F22	10A, TC2, semi–automatic range gear	/12.A13	Cab
–F26	10A, front PTO	/12.A1	Cab
–F53	10A, ISO adapter	/12.A14	Cab
–GR1	Ground	/12.D12	Cab
–GR4	Ground	/12.D2	Cab
–GR5	Ground	/12.D14	Cab
–GR7	Ground, battery	/12.D1	Engine
–H27	Reverse Buzzer	/12.C13	Cab

Symbol	Description	Page and position	Location
–S4S	Switch, 4WD auto	/12.A12	Cab
–S5S	Switch, differential lock auto	/12.A10	Cab
–S8S	Switch, PTO auto stop	/12.A8	Cab
–S10	Switch, right brake light	/12.D14	Cab
–S15S	Combined switch, U–pilot	/12.A6	Cab
–S16S	Combined switch, front PTO	/12.A2	Cab
–S20	Switch, left brake light	/12.D15	Cab
–V1	Diode, parking lights (automatic)	/12.C2	Cab
–V2.1	Diode, brake pedal, right	/12.C14	Cab
–V2.2	Diode, brake pedal, left	/12.C13	Cab
–V2.3	Diode, brake pedal, right	/12.C16	Cab
–V2.7	Diode, brake pedal, right	/12.C14	Cab
–V2.9	Diode, brake pedal, left	/12.C15	Cab
–X3M	Connector, 31–pole	/12.C1	Engine
–X.4	Connector, 9–pole	/12.A1	Cab
–X5X	Connector, 9–pole	/12.A5	Cab
–X8	Connector,37–pole	/12.A1	Cab
–X.13	Connector, 37–pole	/12.C8	Cab
–X16	Connector, 37–pole	/12.B9	Cab
–X23	Connector, 3–pole	/12.C1	Cab
–X29	Connector, 9–pole	/12.A13	Cab
–X35	Connector, 37–pole	/12.A1	Cab
–X89	Connector, implement	/12.D13	Cab
–Y1T	Solenoid valve, differential lock	/12.C11	Transmission
–Y3T	Solenoid valve, 4WD	/12.C12	Transmission
–Y9	Magnetic clutch, front–PTO	/12.C2	Engine

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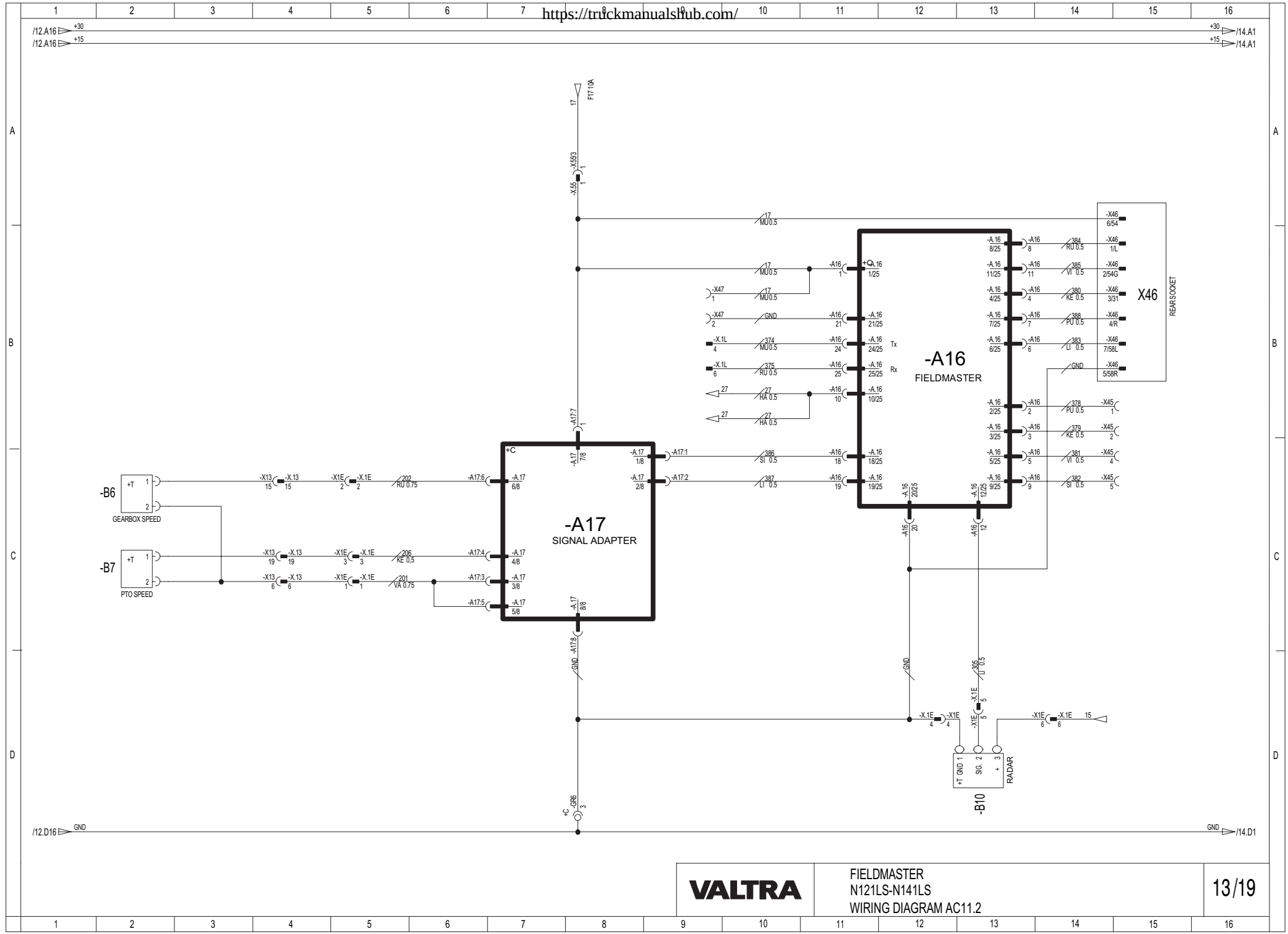


VALTRA	TC2, FRONT PTO N121LS-N141LS WIRING DIAGRAM AC11.2	12/19

https://truckmanualshub.com/

Symbol	Description	Page and position	Location
–A16	Fieldmaster	/13.B12	Cab
–A17	Adapter, Fieldmaster sensor signals	/13.C8	Cab
–B6	Speed sensor, gearbox	/13.C2	Transmission
–B7	Speed sensor, PTO	/13.C2	Transmission
–B10	Speed radar	/13.D12	Transmission
–GR6	Ground	/13.D8	Cab
–X1E	Connector, 9–pole	/13.C5	Cab
–X.1L	Connector, 9–pole	/13.B9	
–X13	Connector, 37–pole	/13.C4	Cab
–X14	Connector, 9–pole	/13.B3	Cab
–X45	Connector, 9–pole, fieldmaster	/13.B14	Cab
–X46	Connector, 7–pole, rear socket	/13.B15	Cab
–X47	Connector, 2–pole, fieldmaster	/13.B9	Cab

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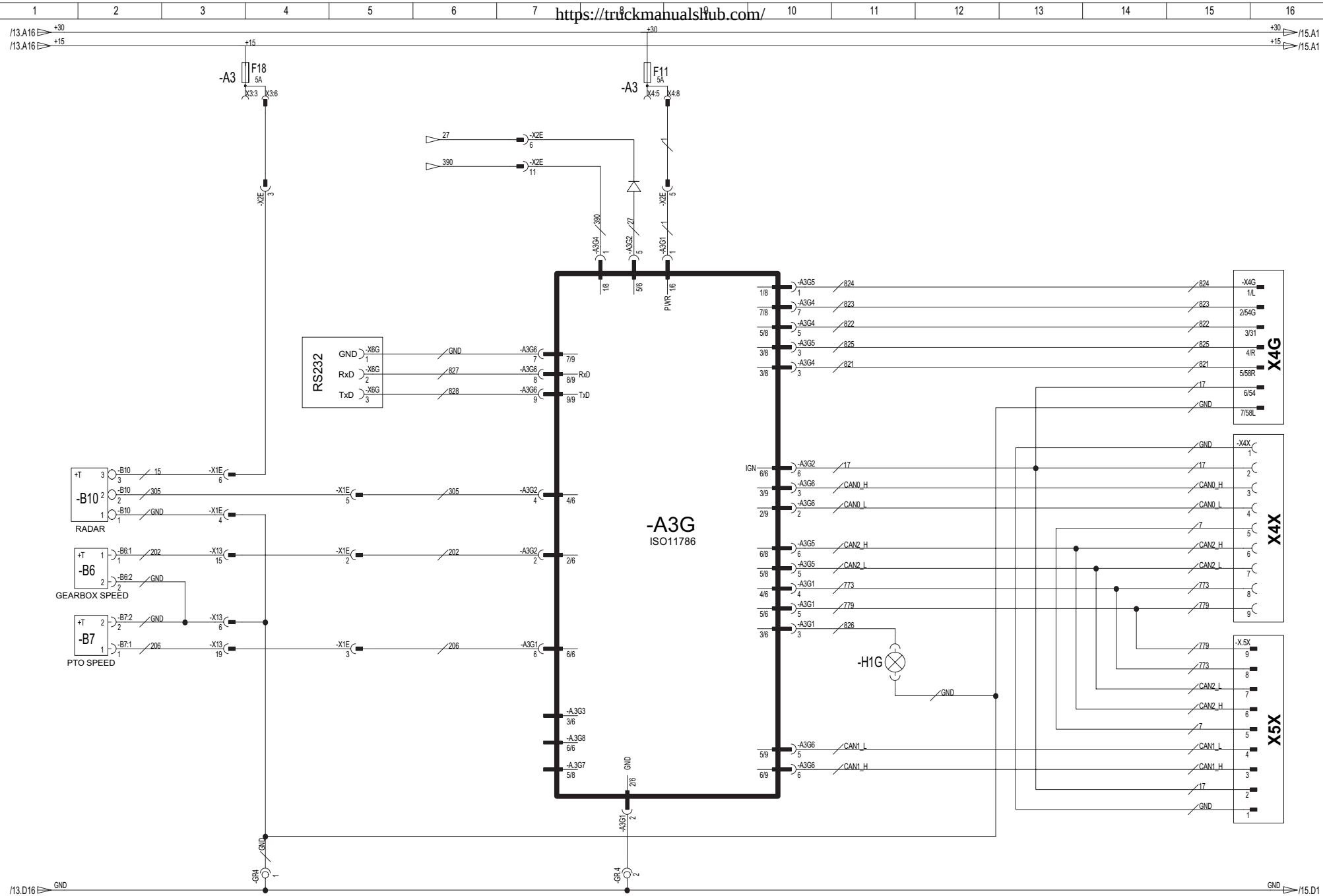


VALTRA	FIELDMASTER N121LS-N141LS WIRING DIAGRAM AC11.2	13/19

https://truckmanualshub.com/

Symbol	Description	Page and position	Location
–A3G	Control unit, ISOBUS	/14.C9	Cab
–A3G1	Connector, 6–pole	/14.B9	Cab
–A3G2	Connector, 6–pole	/14.B8	Cab
–A.3G3	Connector,6–pole	/14.C7	Cab
–A3G4	Connector, 8–pole	/14.B8	Cab
–A3G5	Connector,8–pole	/14.B10	Cab
–A3G6	Connector, 9–pole	/14.B7	Cab
–A.3G7	Connector, 8–pole	/14.D7	Cab
–A.3G8	Connector, 6–pole	/14.D7	Cab
–B6	Speed sensor, gearbox	/14.C2	Transmission
–B7	Speed sensor, PTO	/14.C2	Transmission
–B10	Speed radar	/14.C2	Transmission
–F11	10A, starter switch	/14.A8	Cab
–F18	5A, instrumentation, warning lights	/14.A4	Cab
–H1G	Light	/14.C11	Cab
–GR4	Ground	/14.D4	Cab
–X1E	Connector, 9–pole	/14.C3	Cab
–X2E	Connector	/14.A4	Cab
–X4G	Connector	/14.B15	Cab
–X4X	Connector	/14.C15	Cab
–X5X	Connector, 9–pole	/14.D15	Cab
–X6G	RS–232 connector	/14.B5	Cab
–X13	Connector, 37–pole	/14.C3	Cab

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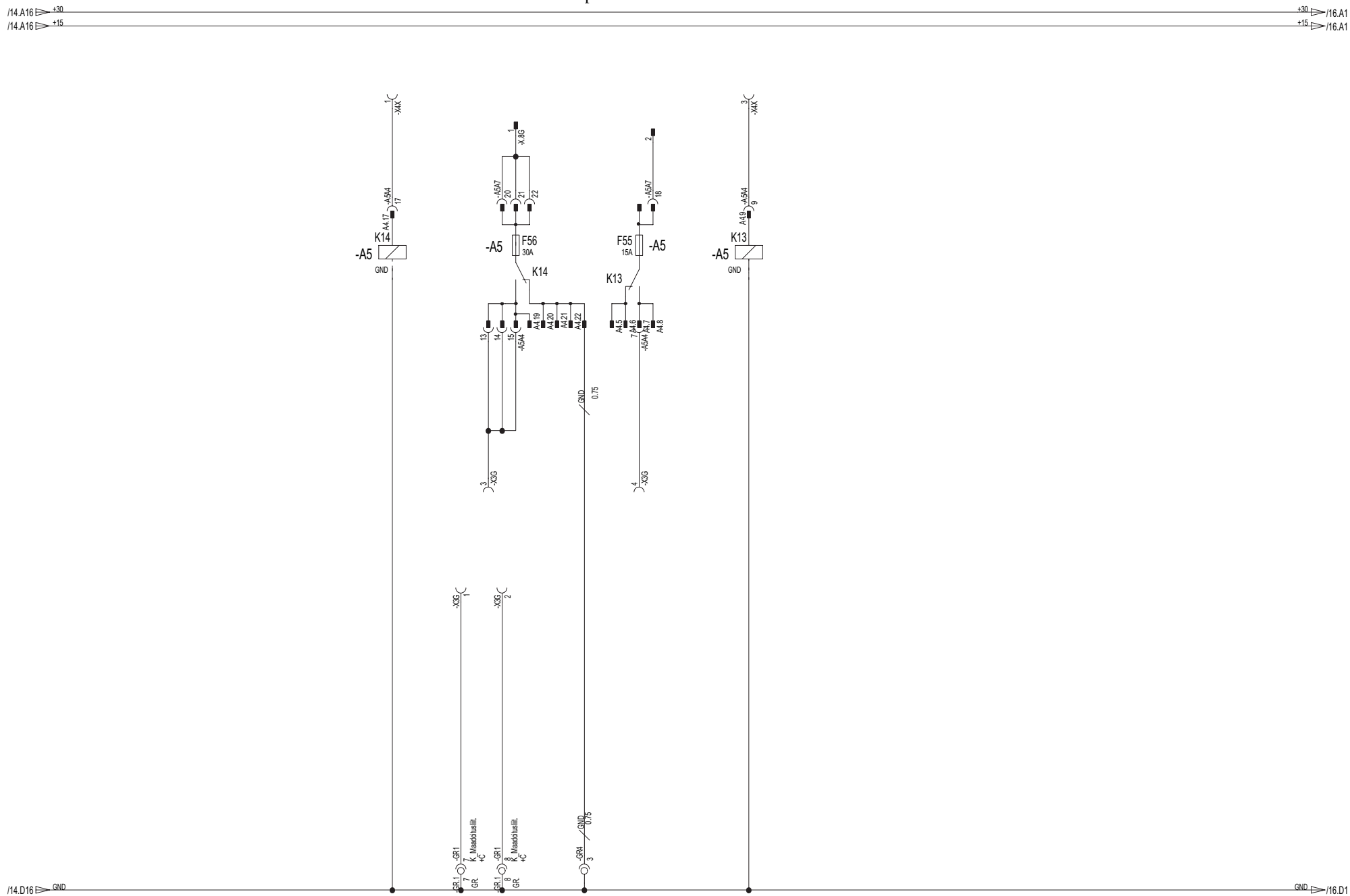


VALTRA	ISO 11786 SENSOR INTERFACE N121LS-N141LS WIRING DIAGRAM AC11.2	14/19

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Symbol	Description	Page and position	Location
–K13	Relay, ISOBUS ECU–power	/15.B9	Cab
–K14	Relay, ISOBUS power	/15.B5	Cab
–F55	15A, ISOBUS ECU power	/15.B8	Cab
–F56	30A, ISOBUS power	/15.B7	Cab
–GR1	Ground	/15.D6	Cab
–GR4	Ground	/15.D7	Cab
–X3G	Connector	/15.C6	Cab
–X4X	Connector	/15.A5	Cab
–X.8G	Connector	/15.A7	Cab

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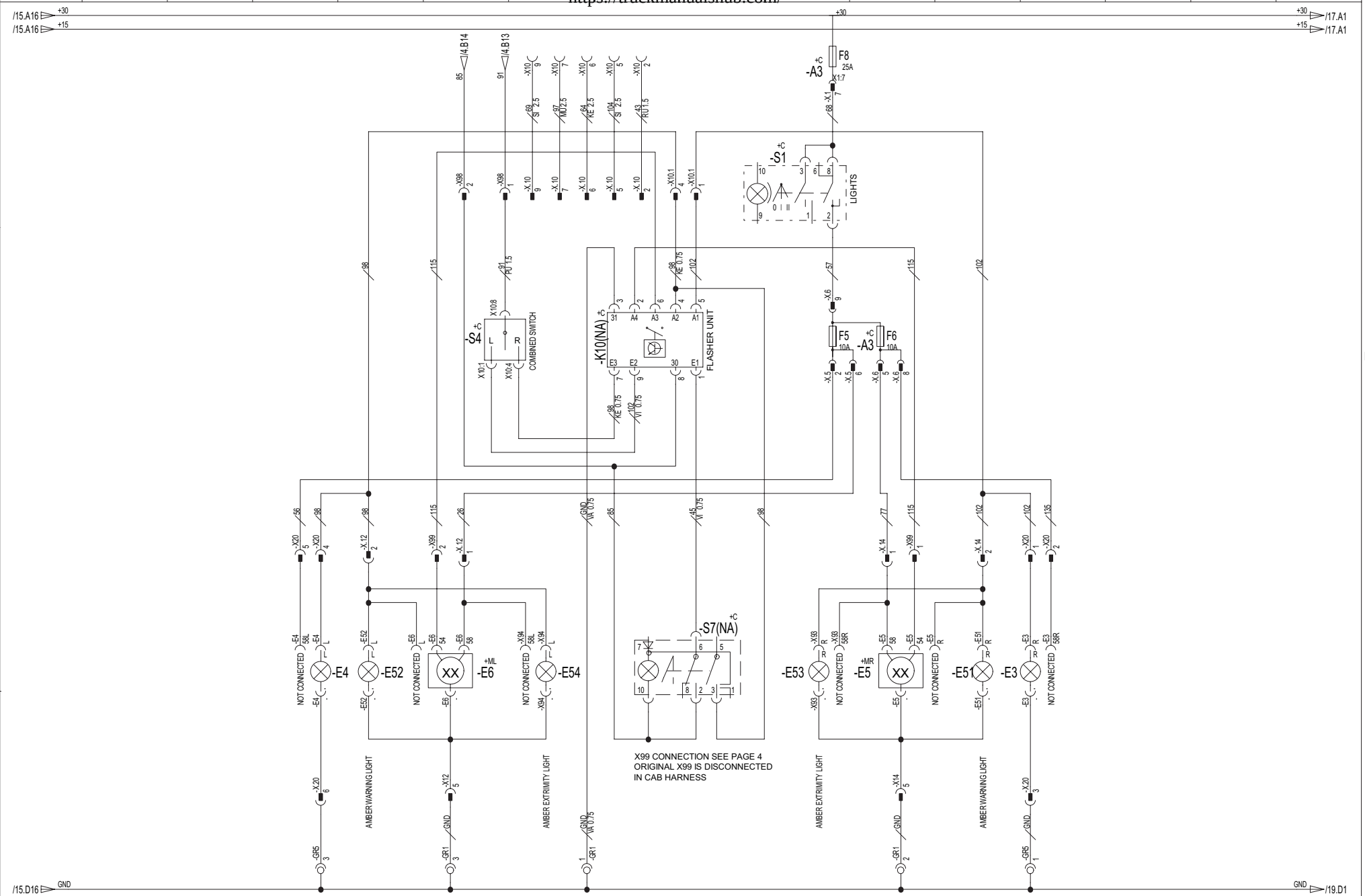
VALTRA

ISOBUS ISO-11783
N121LS-N141LS
WIRING DIAGRAM AC11.2

https://truckmanualshub.com/

Symbol	Description	Page and position	Location
–E3	Front direction indicator, right	/16.C12	Cab
–E4	Front direction indicator, left	/16.C4	Cab
–E5	Rear light, right (indicator/parking/braking)	/16.C11	Right mudguard
–E6	Rear light, left (indicator/parking/braking)	/16.C6	Left mudguard
–E51	Cab roof warning light, rear right	/16.C12	Right mudguard
–E52	Cab roof warning light, rear left	/16.C5	Left mudguard
–E53	Extremity warning light, right	/16.C10	Cab
–E54	Extremity warning light, left	/16.C7	Cab
–F5	10A, main switch, tachograph	/16.B10	Cab
–F6	5A, radio, inner light, instrument (buzzer)	/16.B11	Cab
–F8	25A, light switch	/16.A10	Cab
–GR1	Ground	/16.D5	Cab
–GR5	Ground	/16.D4	Cab
–K10	Relay,parking ligts automatic/manual	/16.B8	Cab
–S1	Switch, 3–pos., head lights	/16.A10	Cab
–S4	Combined switch	/16.A3	Cab
–S7	Switch, 2–pos., warning flashers	/16.C9	Cab
–X.1	Connector, 9–pole	/16.A10	Cab
–X.5	Connector, 9–pole	/16.B10	Cab
–X.6	Connector, 9–pole	/16.A10	Cab
–X10	Connector, 9–pole	/16.A7	Cab
–X12	Connector, 9–pole	/16.D6	Right mudguard
–X14	Connector, 9–pole	/16.D11	Cab
–X20	Connector, 9–pole	/16.C4	Cab
–X93	Connector, 1–pole	/16.C10	Cab
–X98	Connector, 2–pole	/16.A6	Cab
–X99	Connector, 2–pole	/16.C6	Cab

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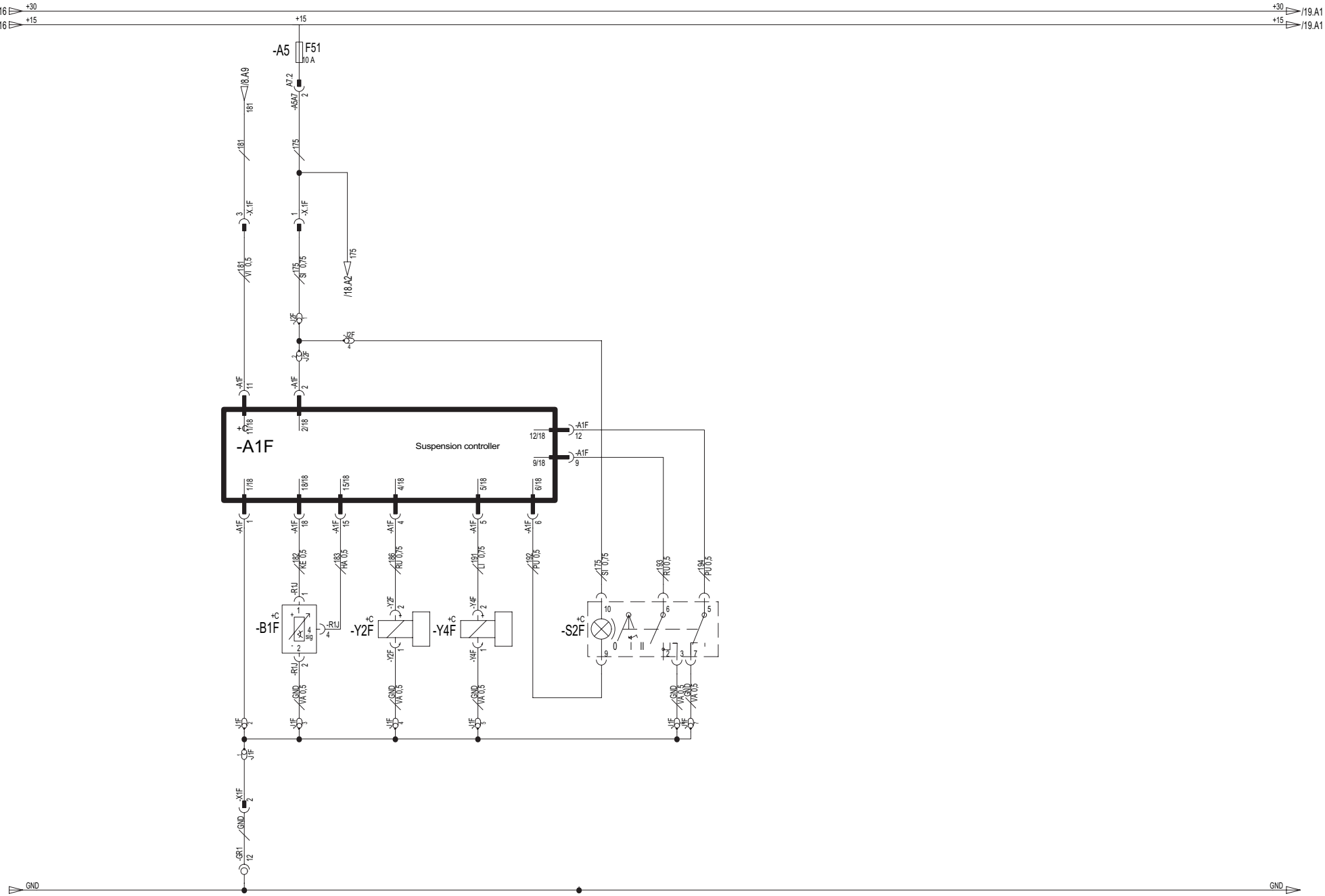


VALTRA	NA-LIGHTS N121LS-N141LS WIRING DIAGRAM AC11.2	16/19

https://truckmanualshub.com/

Symbol	Description	Page and position	Location
–A1F	Front suspension	/17.A4	Cab
–B1F	Angle sensor	/17.C4	Front axle
–F51	10A, TwinTrack, front axle suspension	/17.A5	Cab
–GR1	Ground	/17.D4	Cab
–S2F	Switch, suspension off/on/calibr.	/17.C8	Cab
–Y2F	Solenoid valve, 3/2	/17.C5	Engine
–Y4F	Solenoid valve, 2/2	/17.C6	Engine
–X1F	Connector, 3–pole	/17.D4	Cab

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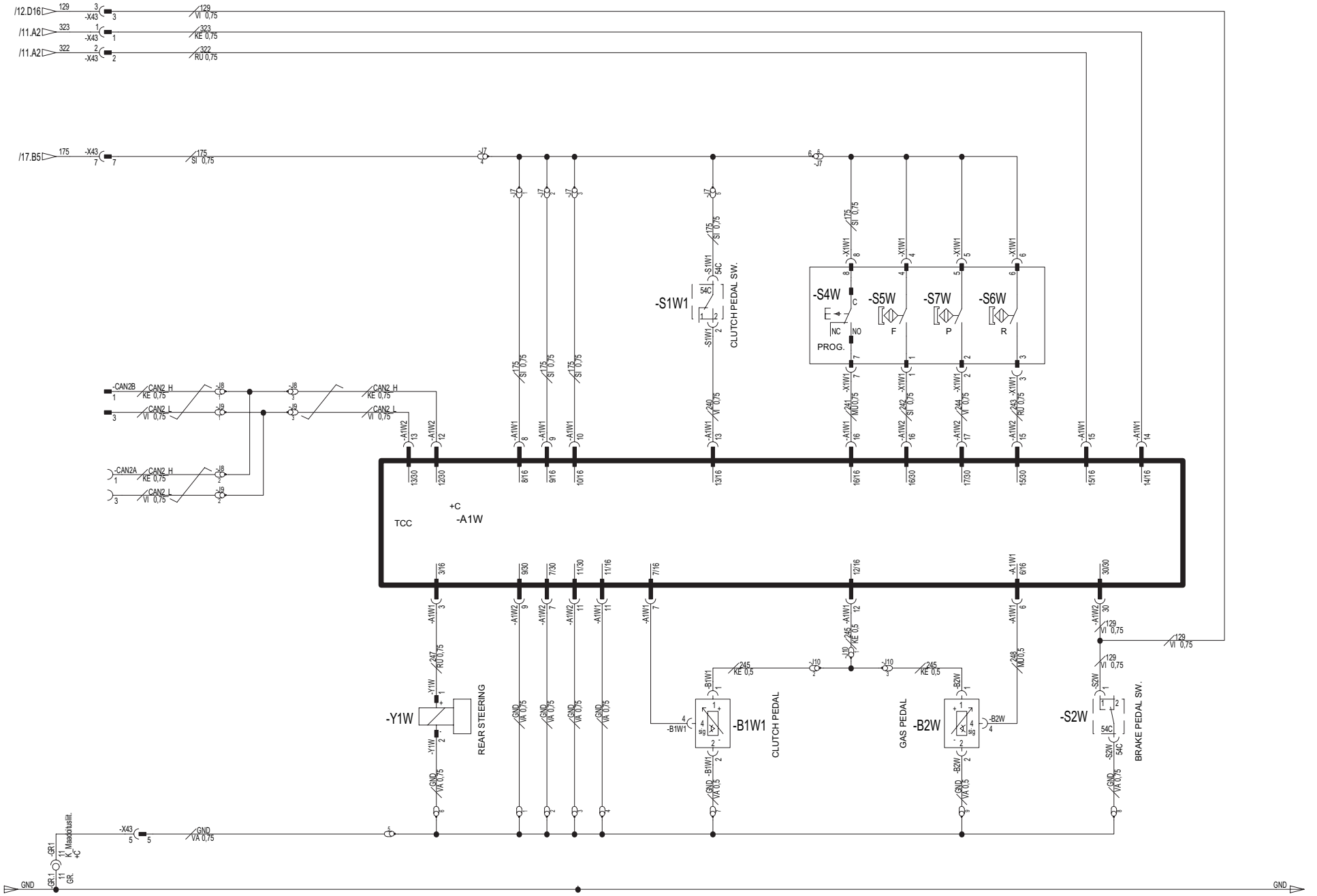
VALTRA

FRONT SUSPENSION
N121LS-N141LS
WIRING DIAGRAM AC11.2

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Symbol	Description	Page and position	Location
–A1W	Control unit, TwinTrac	/18.C6	Cab
–A1W1	Connector, 16–pole	/18.C6	Cab
–A1W2	Connector, 30–pole	/18.B6	Cab
–B1W1	Sensor, clutch pedal	/18.D9	Cab
–B2W	Sensor, gas pedal	/18.D12	Cab
–GR1	Ground	/18.D2	Cab
–S1W1	Switch, clutch pedal	/18.B9	Cab
–S2W	Switch, brake pedal	/18.D13	Cab
–S4W	Push button, programming switch	/18.B11	Cab
–S5W	Reed relay, direction forward (F), rear	/18.B11	Cab
–S6W	Reed relay, direction reverse (R), rear	/18.B12	Cab
–S7W	Reed relay, parking brake, rear	/18.B12	Cab
–X1W1	Connector, 8–pole	/18.B11	Cab
–X43	Connector, 3–pole, seat direction	/18.A2	Cab
–Y1W	Solenoid valve, rear steering	/18.D6	Transmission

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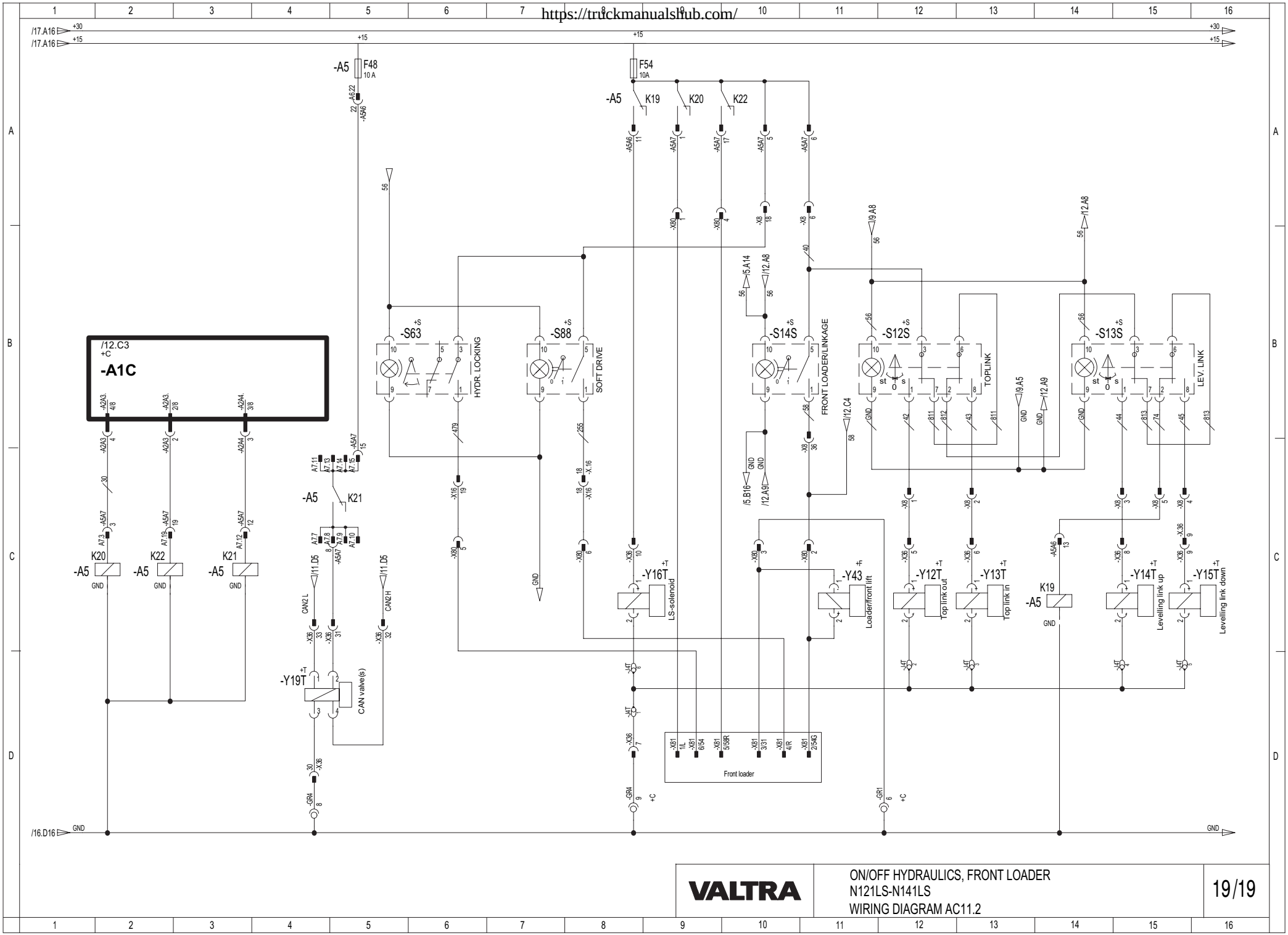
VALTRA

TWIN TRAC
N121LS-N141LS
WIRING DIAGRAM AC11.2

https://truckmanualshub.com/

Symbol	Description	Page and position	Location
–A1C	Control unit, TC2	/19.B2	Cab
–A2A3	Connector, 8–pole	/19.B2	Cab
–A2A4	Connector, 8–pole	/19.B3	Cab
–F48	10A, auxiliary valves	/19.A5	Cab
–F54	10A, rear power lift (on/off), front loader / linkage	/19.A8	Cab
–GR1	Ground	/19.D11	Cab
–GR4	Ground	/19.D4	Cab
–K19	Relay, auxiliary valves on / off solenoid	/19.C14	Cab
–K20	Relay, hydraulics1 (joystick button 1.)	/19.C2	Cab
–K21	Relay, auxiliary valves	/19.C3	Cab
–K22	Relay, hydraulics2 (joystick button 2.)	/19.C2	Cab
–S12S	Switch, lifting / lowering	/19.B12	Cab
–S13S	Switch, lifting / lowering	/19.B14	Cab
–S14S	Switch, front loader/linkage	/19.B10	Cab
–S63	Switch, hydraulic locking	/19.B6	Cab
–S88	Switch, sorft drive	/19.B7	Cab
–X8	Connector, 37–pole	/19.A10	Cab
–X16	Connector, 37–pole	/19.C6	Cab
–X36	Connector, 37–pole, auxiliary valves	/19.C4	Cab
–X80	Connector, 4–pole, front loader	/19.A9	Cab
–X81	Connector, pin socket	/19.D9	Transmission
–Y12T	Solenoid valve,lifting	/19.C12	Transmission
–Y13T	Solenoid valve, lowering	/19.C13	Transmission
–Y14T	Solenoid valve, lifting (optional)	/19.C15	Transmission
–Y15T	Solenoid valve, lowering (optional)	/19.C16	Transmission
–Y16T	Solenoid valve, auxiliary valves on/off	/19.C8	Transmssion
–Y19T	Solenoid valve, auxiliary valves	/19.D4	Transmission
–Y43	Solenoid valve, front loader / lift	/19.C11	Transmission

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VALTRA

ON/OFF HYDRAULICS, FRONT LOADER
N121LS-N141LS
WIRING DIAGRAM AC11.2

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Contents

Technical data, technical specifications, training material

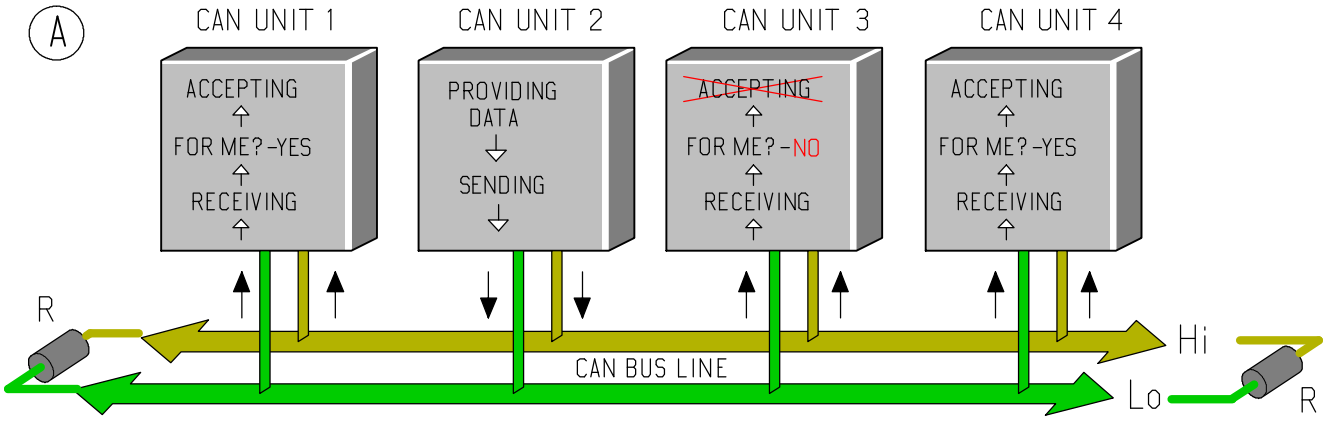
381.1 ... CAN bus in general 1

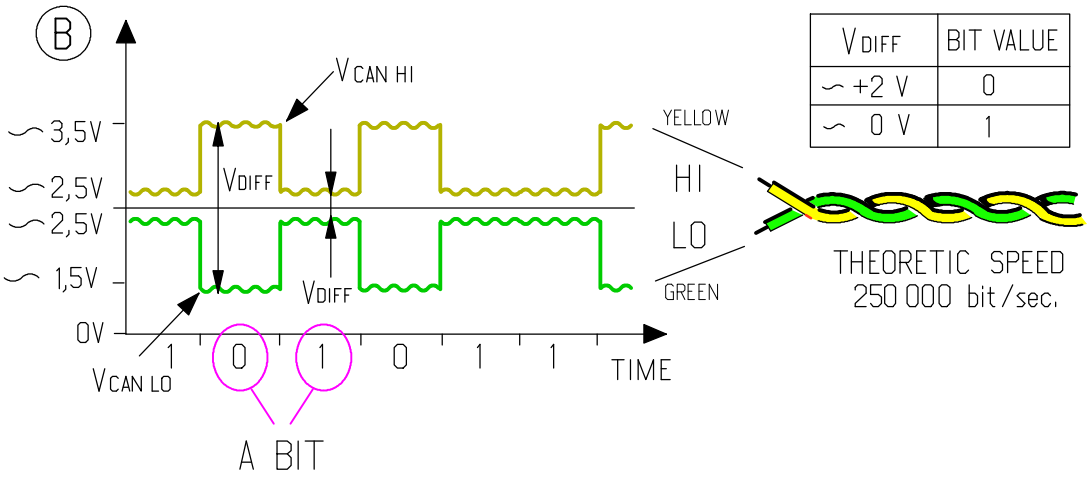
Fault finding

383.1 ... CAN bus fault finding 1

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CAN data transfer in general





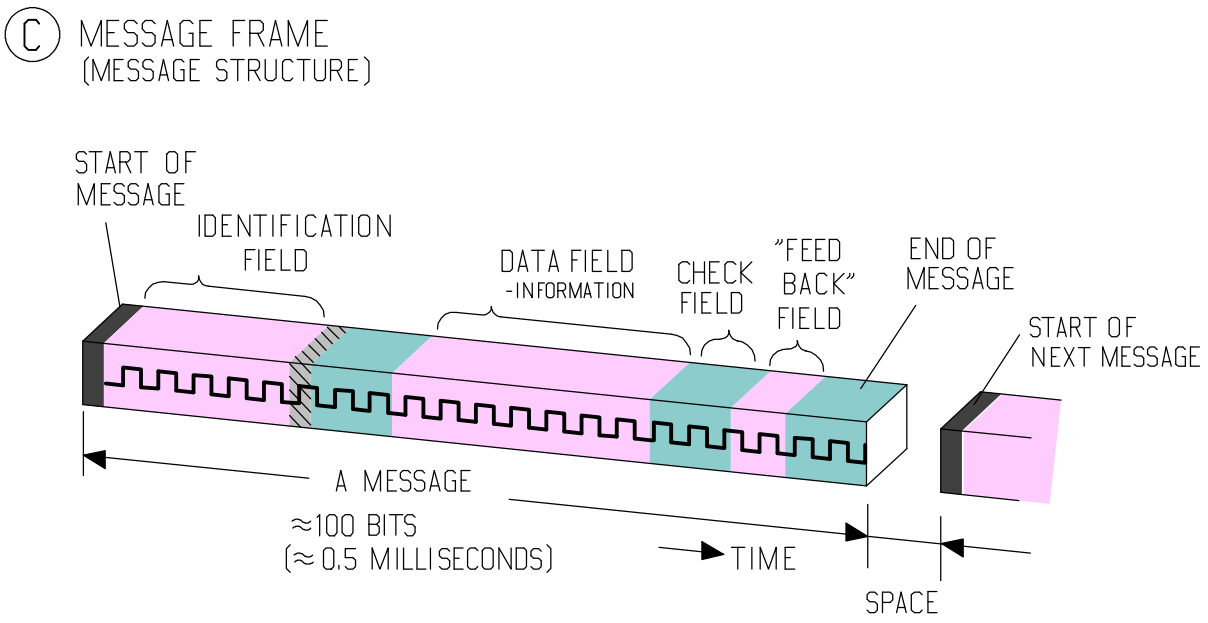


fig001c

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CAN (Controller Area Network) is a network that is designed specially for data transfer between control units in vehicles.

A. CAN bus line consists of two conductor wires. Data transfer is very fast which means that CAN is a ”real time” system. The CAN principle has been designed by Bosch and it has been standardised by ISO and SAE standardisation organisations.

Many CAN units can be connected to the same bus line. All stations use the same wires when transferring data. When one of the stations is sending a message to the line all the other stations are ”listening” (receiving) the message.

The receiving station checks if the message is important to it. The messages have no destination but every station knows which kind of messages it must accept. Every message has also a priority level that determines which message has a right to be sent first.

B. Data transfer in CAN bus is digital. It means that a message consists of bits that can have two different values: “1” or “0” (zero). Bits are sent one bit after the other until the message has been sent totally. In CAN system a message can be sent with speed of 250 000 bits per second.

Every CAN units measures differential voltage between Hi and Lo. V_{diff} about 2 V means “0“ bit and V_{diff} about 0 V means “1” bit..

C. Message frame

The electronics send bit packages called message frames to the bus. A message frame consist of fields. The most important fields are clarified below.

Always the first is a start field that synchronises all stations. Secondly an identification field is sent which also defines the priority of the message frame.

Data field contains the information itself e.g. an order to a hydraulic valve. After receiving the message every station sends feed back bits that means it has received the message correctly. End of message field informs that the message has been sent totally. Before next message there is some space.

A message contains about 100 bits and sending a message takes about 0.5 milliseconds. So, about 2000 messages can be sent in a second (theoretically).

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CAN bus principle

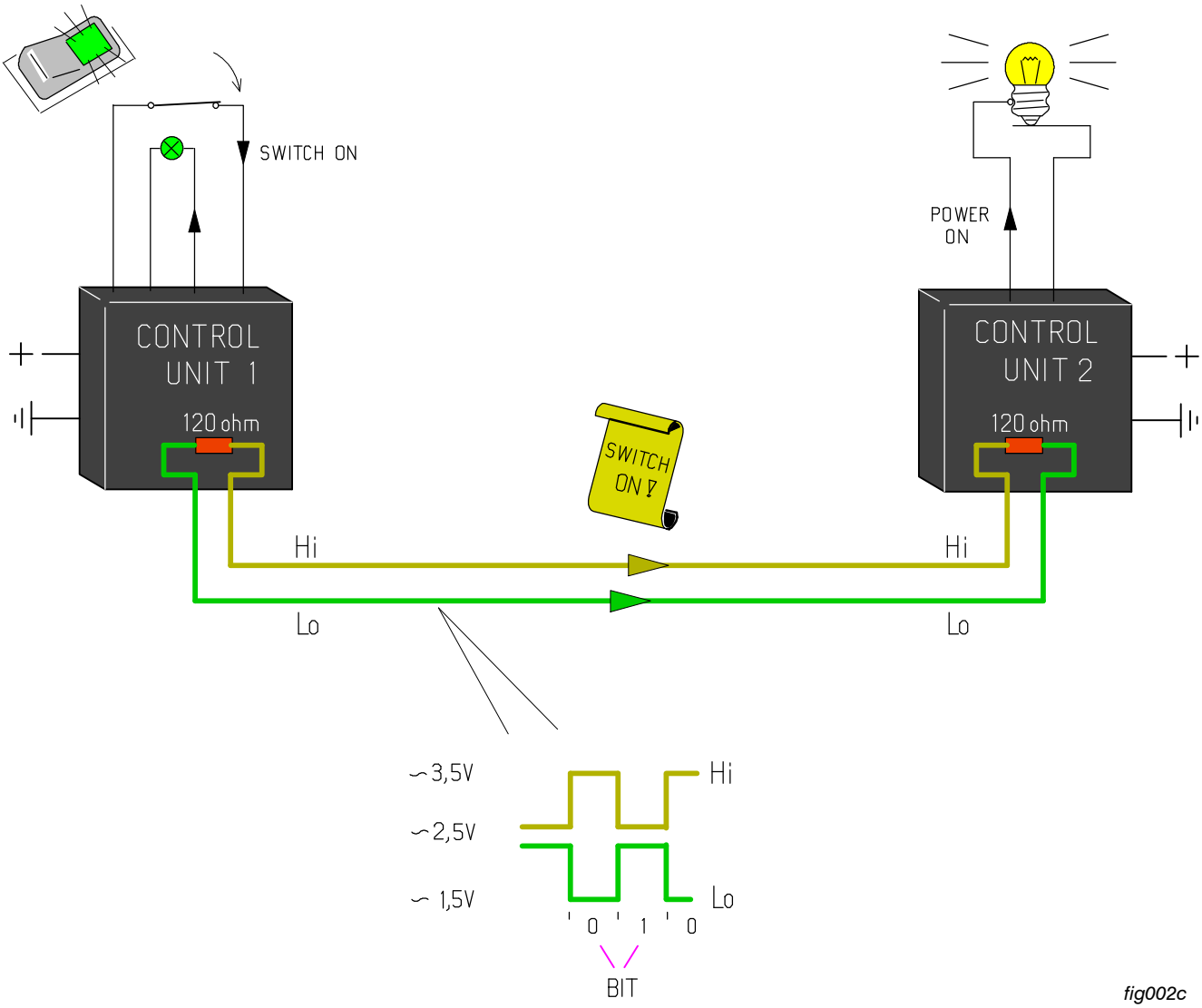


fig002c

A simple CAN bus consists of two control units, which have been connected with two copper wires (twisted paired cable) to each other.

When the switch **1** of the control unit is off, the control unit makes a message, in which it tells to the control unit **2** that the switch is in off position. This kind of message goes between control units a few tens times per second.

When the switch is actuated, the contents of the message will be changed : the switch is on. The control unit **2** gets this message and switches the light on.

The control unit 2 can send a message to the unit 1, that the light is on and the control unit 1 can switch on the indication light of the switch.

The message goes between the control units digitally.

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CAN bus fault finding

The CAN bus of a tractor consists of two or more control units (e.g. EC, ICL and TC1). Terminal resistors (120 Ohm) are located at both ends of the CAN bus.

If a fault code concerning CAN bus appears in the display (ICL), there is a fault in CAN wires or in a control unit.
The system can automatically tell which control unit can't receive any messages (the control units monitor each others).

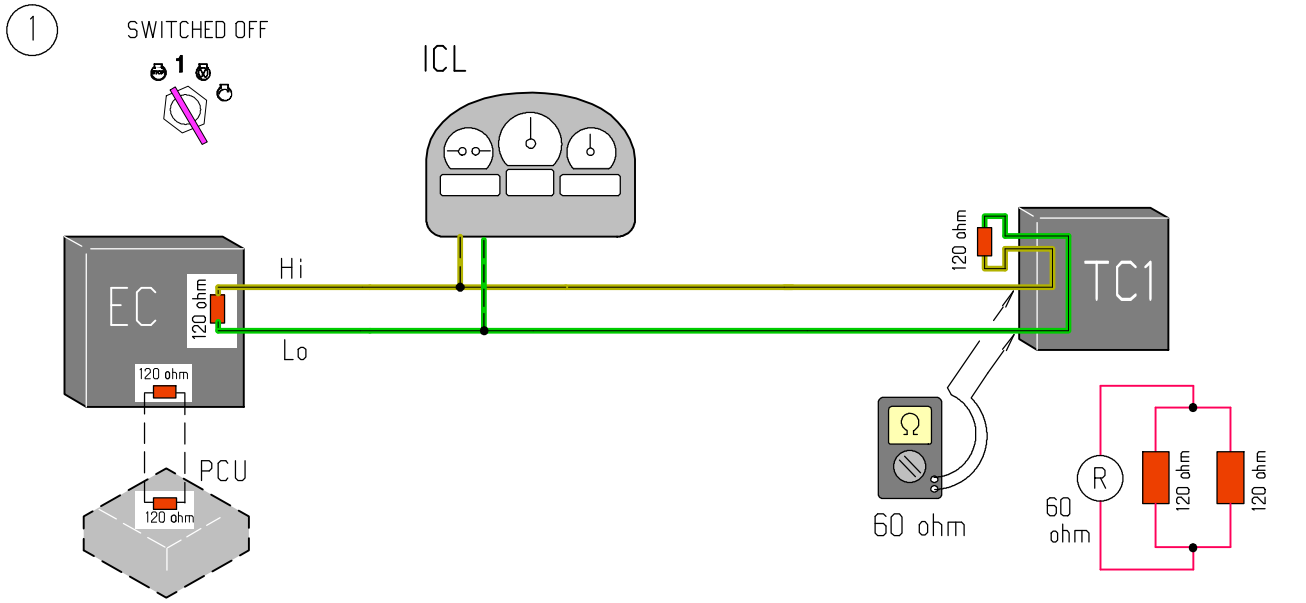


fig003c

1) If resictace between CAN Hi and CAN Lo wires (at any point) is about 60 Ohm, CAN bus is physically OK.
The control units EC and TC1 are also OK, since terminal resistors (120 Ohm) are situated in EC and close to TC1.
The ICL insturment panel is also OK, because the CAN bus goes through it.

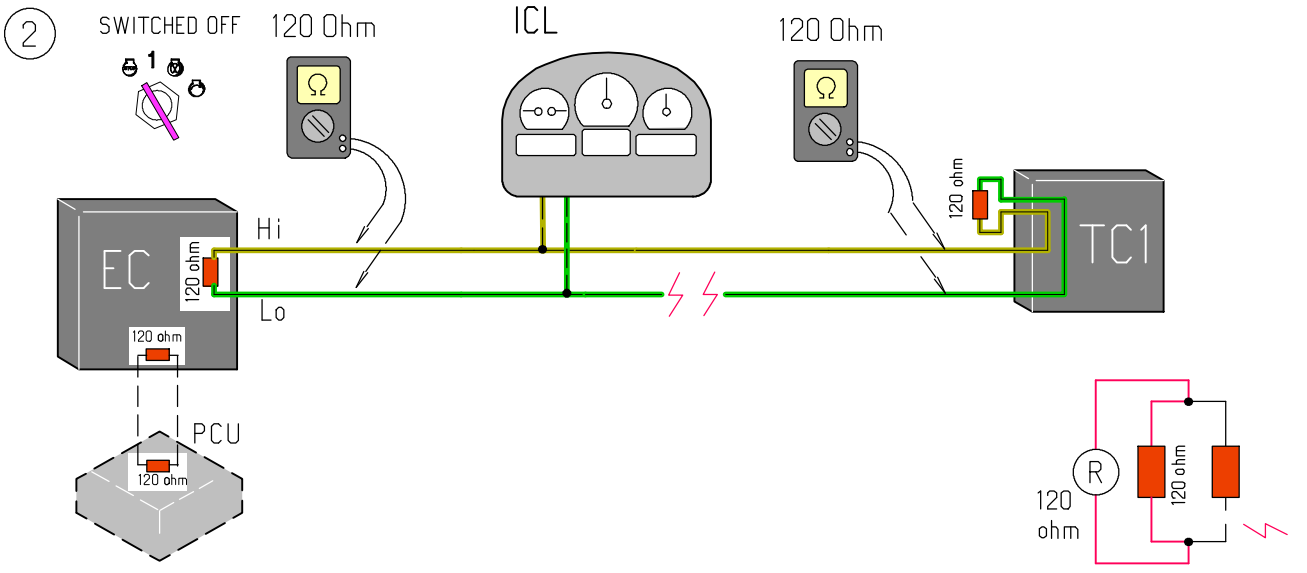


fig004c

2) If resistance between CAN Hi and CAN Lo wires (at any point) is about 120 Ohm, a Can bus wire is broken (one or both wires).

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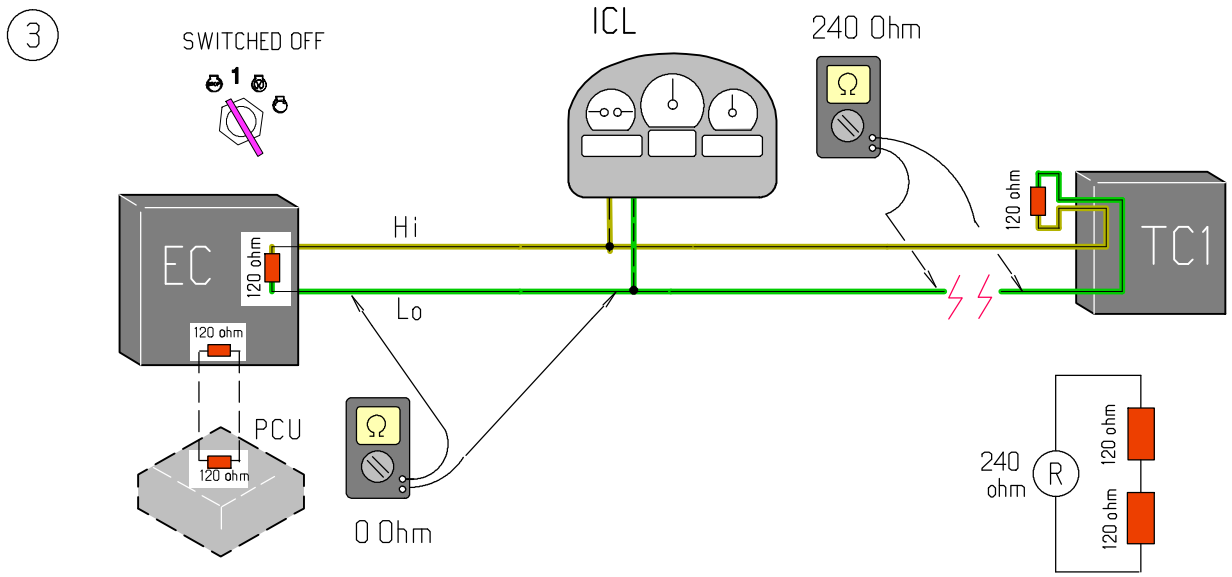


fig005c

3) If the CAN bus is physically broken, start to determine where the faulty point is situated. At first measure resistance of CAN Lo wire between e.g. EC and TC1 control units.
The measurement should be done between connectors Lo–Lo or Hi–Hi. If the resistance is about 0 Ohm, the wire is OK between measured points.
If the resistance is about 240 Ohm, the bus wire is broken between measured points. In the figure the CAN Lo wire is broken between contol unit TC1 and instrument panel ICL.

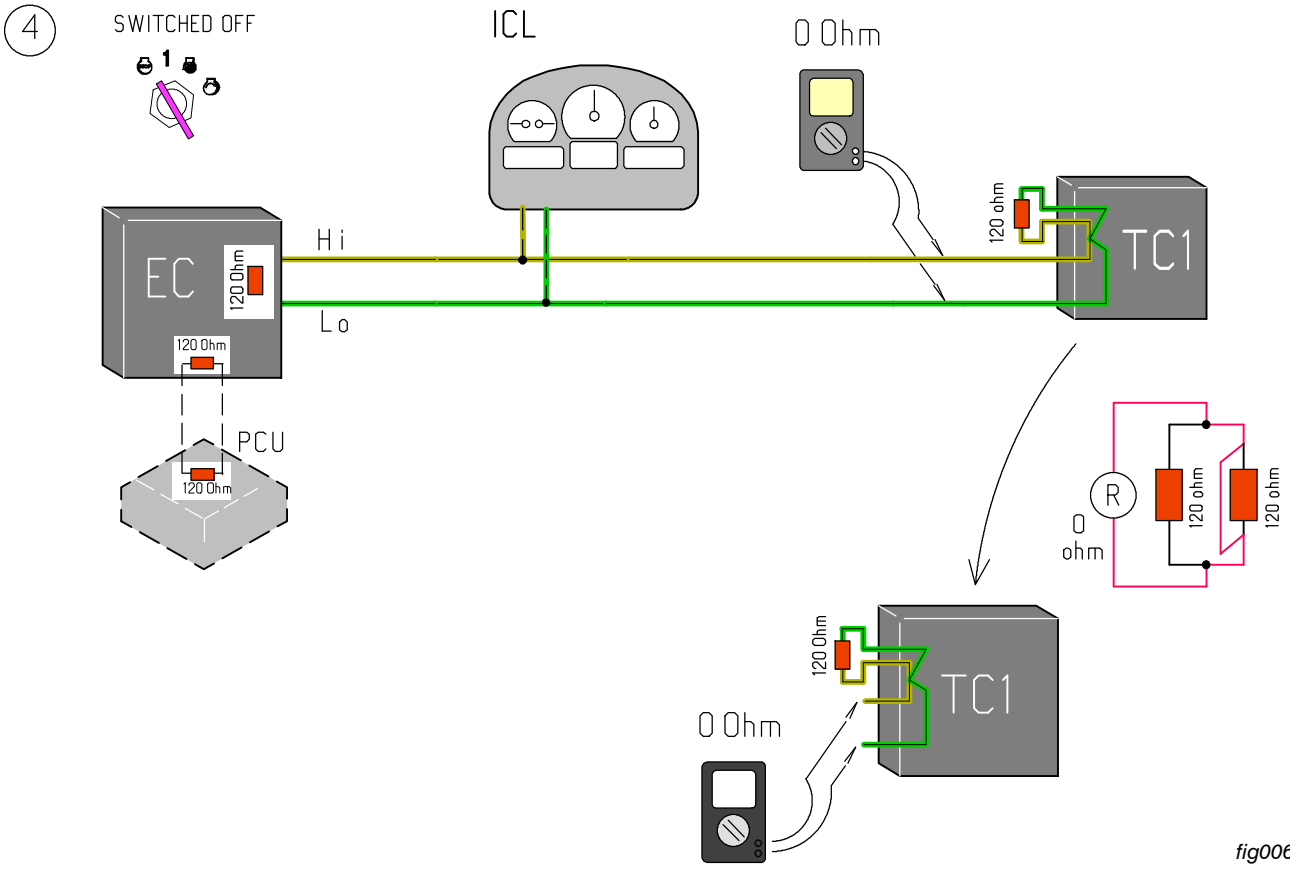


fig006c

4) If resistance between CAN Hi and CAN Lo is about 0 Ohm, there is a short–circuit in the CAN bus.
Detach one of control units and measure the resistance between CAN Hi and Can Lo connector pins on the control unit. Fix the unit back if it is OK.
Then detach the next unit and measure it, and so on until the faulty unit has been found. If resistance is about 0 Ohm the unit is faulty. When all the units have been checked and still there is a short–circuit, the CAN bus wires must be faulty. To find the point where the fault is situated the wires must be checked visually.

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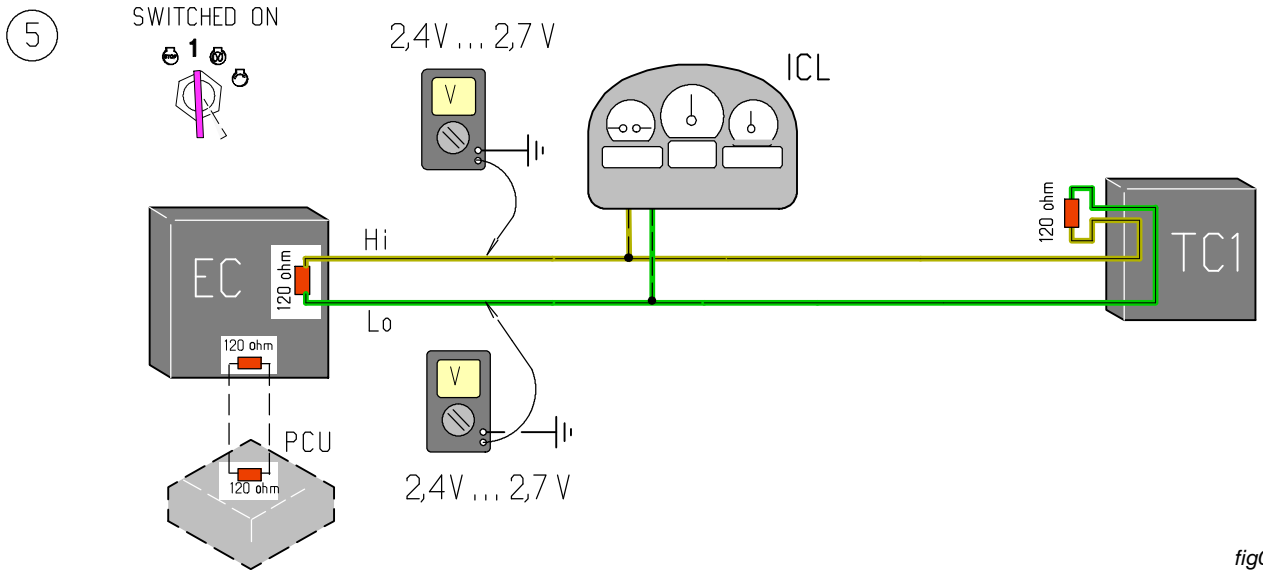


fig007c

5) Switch the power on and measure the voltage between CAN Hi and CAN Lo wires and the earth. The voltage should be between 2,4V...2,7V.

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Contents

391.1 . . . Safety precautions for the electrical system 1
ESD (Static electricity) 2

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Safety precautions for the electrical system

– Always connect the battery with the correct polarity

– Disconnect the negative lead of the battery first and connect it last

– Disconnect the battery leads before removing the alternator

– Remove the battery caps during charging to prevent the build up of explosive gases in the battery

Alternator

The tractor has a negative – earthed alternator which can easily be damaged if incorrect connections are made in the electrical system. For example, connection of the battery with wrong polarity can burn the alternator or rectifier.

Battery checks and maintenance

– Check the charge in the battery using a hydrometer (acid tester). The density of the electrolyte should be at least 1,23.

– Make sure that the fan belt (belts) are always correctly tensioned.

– Keep the battery clean. It can be washed with lukewarm water after removal from the tractor.

– Also clean the pole studs, the cable terminals and the battery retainer thoroughly. Wash off oxidized spots with water. Wipe the outside of the battery when it is clean, and coat the pole studs and the cable terminals with petroleum jelly.

– Refit the battery.



WARNING

It is forbidden to smoke or have a naked flame near the battery. The battery gives off explosive hydrogen gas!
Battery electrolyte is corrosive.



CAUTION

Always when the electric welding is done to the tractor, disconnect both battery cables (+ and –) and alternator wires. Otherwise the tractor electric system can be damaged.

Auxiliary equipment must be fitted according to the instructions. Fuse nominal current rating must be checked before fitting. Any auxiliary components must not be fitted to the electric circuit (safety risk).

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ESD (Static electricity)

Static electricity (= frictional electricity)

Static electricity is generated everywhere we move and work. When we are electrically charged and touch a conductive object, the charge is discharged from our body to the object, causing an 'electric shock'. This phenomenon is known as ESD (= Electro Static Discharge).

A static charge means that a substance is in a state of electric disequilibrium, which means that the charged object has a deficit or excess of electrons. Static charges are generated in objects when they touch or rub against other objects.

A static charge may cause problems if it is allowed to discharge uncontrollably. Static charge discharges may damage the sensitive instruments of the circuit board. The likelihood of the discharge depends on the voltage that exists between the objects involved in the discharge, and the force of the discharge depends on the amount of discharge energy. With the help of earthing, the static charge can be discharged in a controlled fashion.

An electrostatic discharge does not necessarily destroy the entire device. Its functionality may be disrupted only partially, or the device may even seem to function properly, but its lifetime reduces dramatically. Sometimes, damage like this is impossible to detect even in testing, which affects product reliability. In complex devices and systems, finding and replacing a single defective component may be difficult and expensive.

Regarding the electric functionality of components, ESD defects can be divided into two main types:

1) Immediate defects, which lead to an obvious deterioration or complete failure of the component right away. The defect is usually easy to detect, by functional testing, for example.

2) Latent defects, which do not cause drastic changes in immediate component functionality, but rather erode component reliability and lead to changes in functionality only after weeks or months have passed.

Detecting slight ESD damage is often very difficult. The emergence of latent defects is especially problematic for the user, as the defect is usually detected only when the component or device breaks down completely. Latent defects amount to up to 90% of all static electricity–induced component failures.

Depending on its voltage, a static electricity discharge can be felt, heard, or seen.

- feeling requires a voltage of appr. 3000V
- hearing requires a voltage of 4000V
- seeing requires a voltage of over 5000V.

Circuit boards can withstand static electricity discharges of appr. 100V.

Special requirements for handling uncased circuit boards

Uncased circuit boards include for example the T/M/C work hydraulics circuit board (34832900, 34628000), the LCD panel (34921400), the power lift control unit (33497800), the DPS control unit (32845300) and the S series working lights control unit (34406300).

When circuit boards are handled, the requirements of the circuit board unit manufacturer and the ESD standard (SFS–EN–61340–5–1/2) must be complied with.

Protection from static electricity and observance of ESD requirements

ESD requirements concerning circuit board handling

Using charge–absorbing materials

- storage of circuit boards in their delivery packaging

Using material that protects from static discharges

- transfer of circuit boards from delivery packaging to installation
- handling, storage, and dispatch of circuit boards that are to be returned

Use of ESD bracelet

- when installing circuit boards
- **always** when the circuit board is not in its packaging

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Circuit board handling instructions concerning maintenance

– Handling and storage of circuit boards separately from other components.

– Keep the circuit boards in their packaging prior to installation.

– Always use the bracelet when taking a circuit board from its packaging and when the circuit board is not in its packaging.

– Maintain general cleanness during installation.

– Return circuit boards in their delivery packaging.

Package markings



fig001c

ESD bracelet



fig002c

Use of ESD bracelet during maintenance tasks (Connect the bracelet to ground pin)



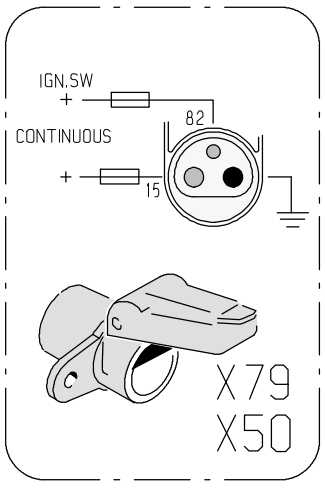


fig003c

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40. Power transmission

41. Clutch
HiShift

42. Gearbox

44. Quick−shift gear, DPS
Reverse shuttle
4WD clutch

45. Final drives

46. Power take−off

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Technical specification

T121c–T171c

Hydraulically controlled, dry, single–disc clutch with disc spring

Type ..... LuK
Disc linings ..... Organic material (asbestos–free)
Disc diameter ..... 350 mm

The free travel can not be felt because the thrust bearing is in continuous contact. The free pedal travel is 10–15 mm measured at the piston rod. As extra equipment it is available to have the push buttons for HiShift, so there is no need to use the foot clutch pedal.

T121h–T191h and T151eLS–T191LS

The shuttle unit operates as the clutch and the drive plate is fitted to the flywheel.

Tightening torques

Engine – frame screws ..... 80 Nm
4–WD cardan axle flange screws ..... 35 Nm
Clutch–flywheel (Mechanical Clutch) ..... 23 Nm
Clutch–flywheel (Torsional damper) ..... 45 Nm
Pump shaft drive flange–flywheel (Mechanical Clutch) ..... 45 Nm
The slave cylinder screws (Mechanical Clutch) ..... 45 Nm

Clutch, description

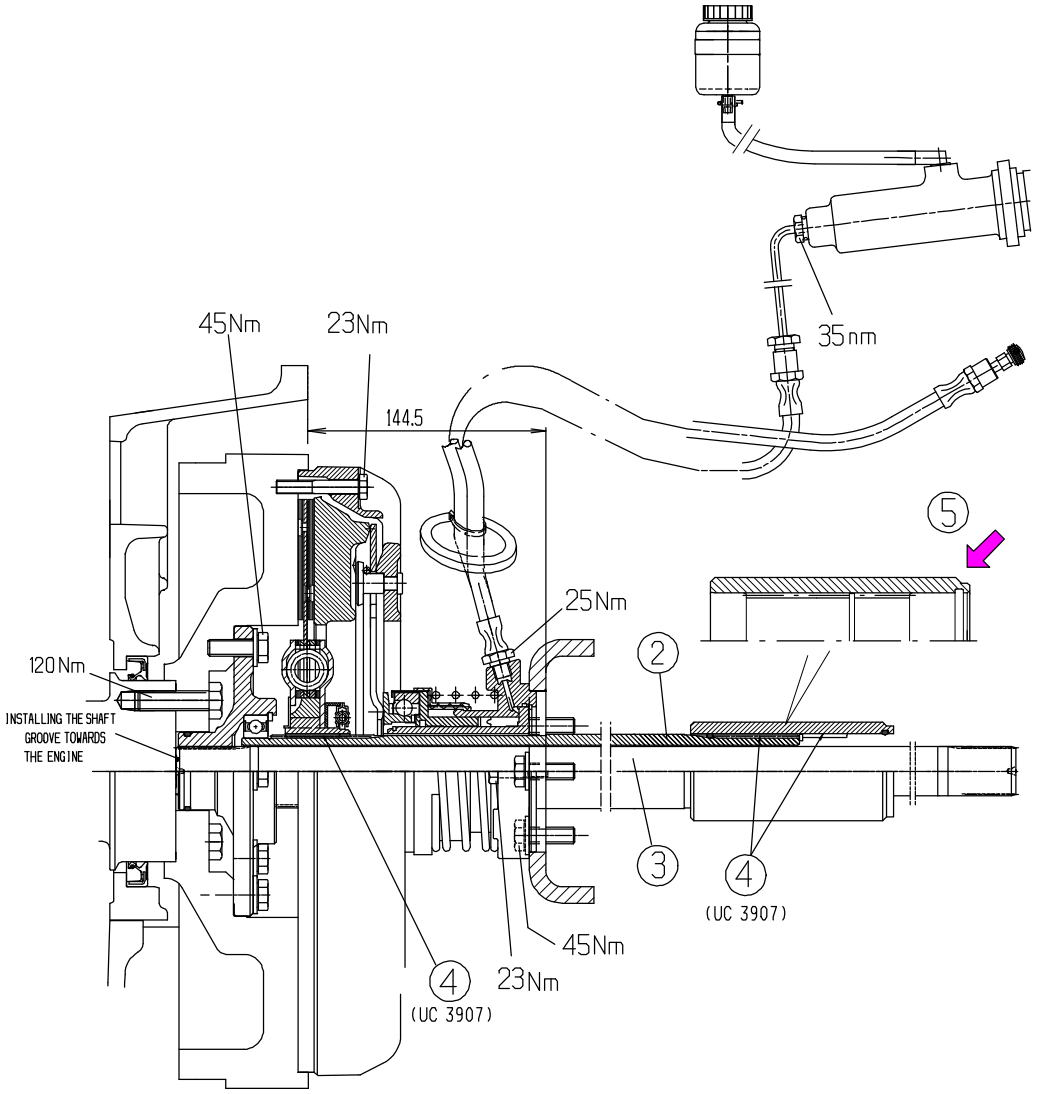


fig001

– Clutch is hydraulically controlled, dry, single–disc clutch with disc spring
– Disc linings: organic material (asbestos–free)
– Disc diameter 330 mm

The free travel can not be felt because the thrust bearing is in continuous contact. The free pedal travel is 10–15 mm measured at the piston rod. As extra equipment it is available to have the push buttons for HiShift, so there is no need to use the foot clutch pedal.

1) Vibration pre–damper (damps out the vibrations coming from gears in the gearbox)
2) Clutch shaft
3) Pump drive shaft
4) EP– grease evenly on splines
5) Installing groove backwards

Checking clutch disc and clutch assembly

Checking axial throw of clutch disc

Mount the disc between the chuck and tailstock on a lathe. Rotate the disc and measure the axial throw at its outer edge. Also measure the taper (”dishing”) of the disc. If the throw or taper is greater than **0,5 mm**, change the disc.

Checking thickness of clutch disc

Thickness, new disc (unloaded) **10,0–11,1 mm**. Axial resilience **0,4–0,8 mm.**

The centre of the clutch disc

Coat the splines in the centre of the clutch disc with pressure–resistant grease to safeguard the axial movement of the disc on the clutch shaft.

Checking movement of pressure plate

Place the clutch in fixture ETV 892 570 with 10 mm spacers. Secure with at least four bolts. Apply the clutch 3–4 times so that the cup spring ”beds down”.

1. Check the height difference between the fingers of the cup spring: this must not exceed **0,8 mm**. If it is greater, the clutch must be changed.
2. Press the cup spring fingers down by 10 mm and measure the distance between the spacers and pressure plate. The clearance must be at least **1, 9 mm**. Check at several points.

A new pressure plate is flat to slightly concave, max. 0,01/10 mm: convexity, i.e. the reverse state, must not occur.

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Hydraulic clutch pedal

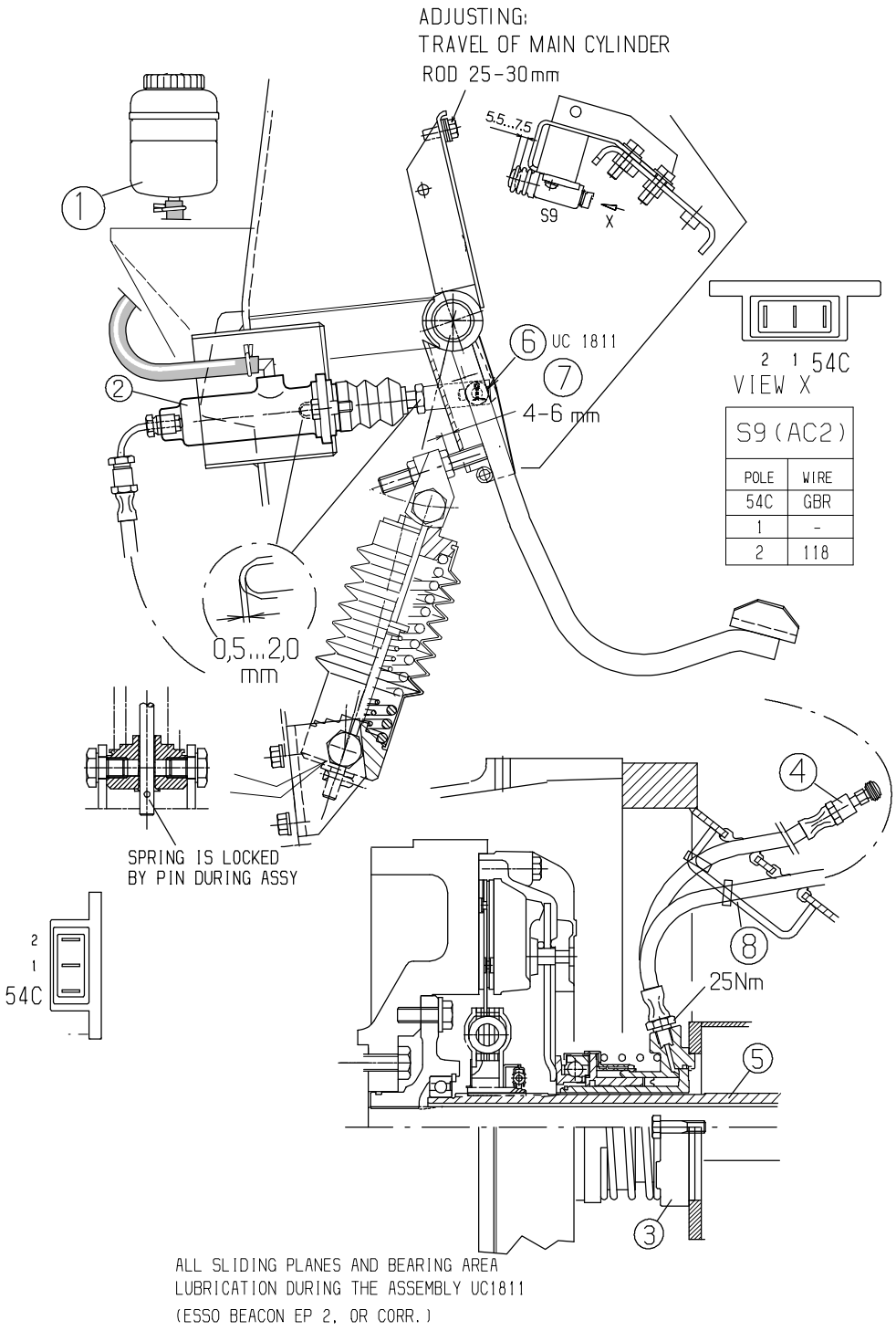


fig002

– Normally the clutch pedal needs no adjustment. In connection with reparations, ensure that there is a clearance of **0,5–2** mm between the piston and the push rod (it is difficult to check the clearance since the release bearing is always in contact with the clutch).

1) Reservoir (volume 2 dm^3)
2) Master cylinder
3) Release bearing – slave cylinder (Luk)
4) Bleeding nipple
5) Clutch shaft
6) Universal grease (all bearing surfaces)
7) Adjusting value of clutch pedal power assistance
8) In connection with repairs: fasten the hoses into the support rod, in order to avoid contact with the clutch.

HiShift (optional)

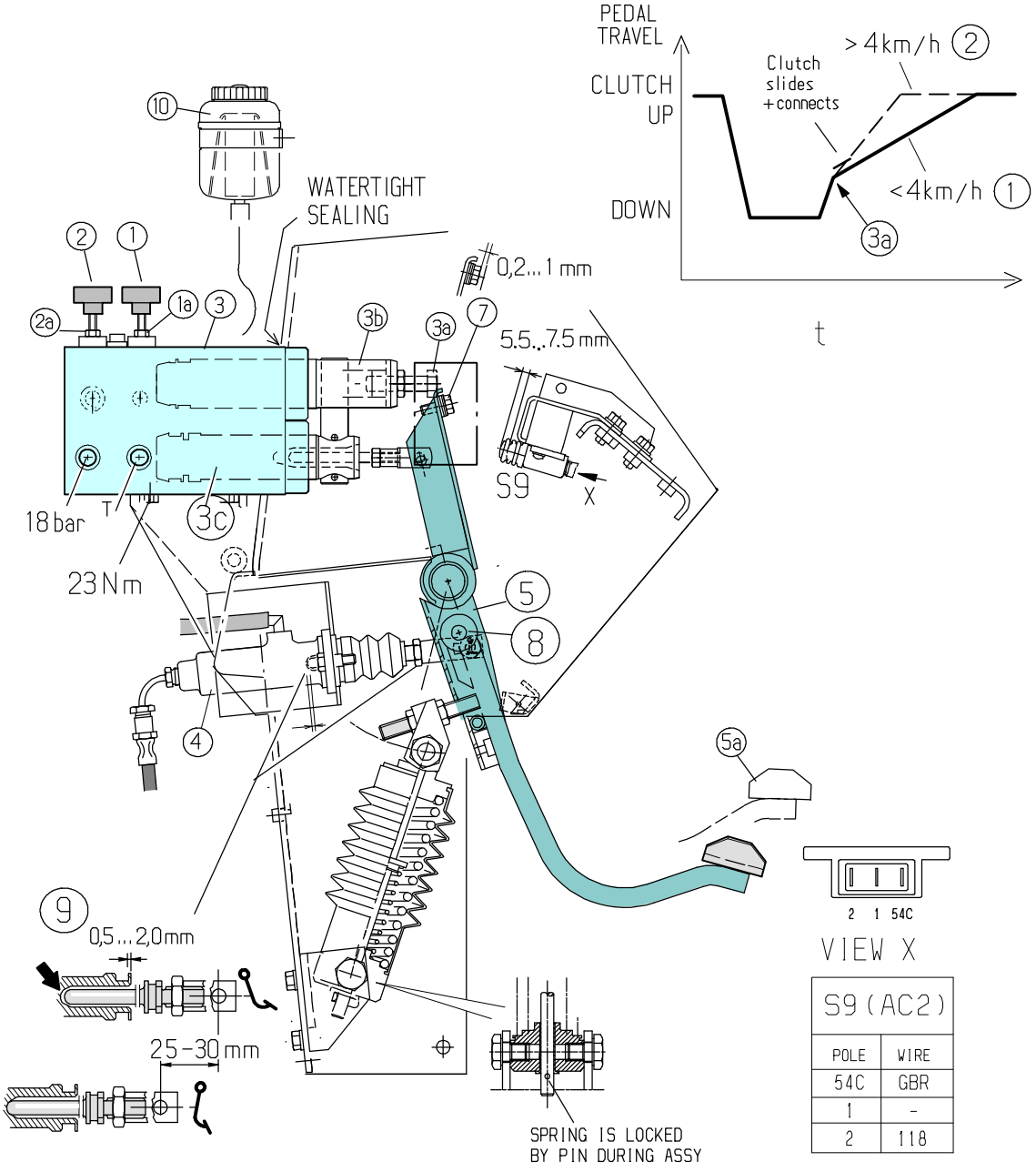


fig003

HiShift includes a hydraulic block **3** attached to the cab front wall with aid of the bracket, a new clutch pedal **5**, a new clutch fluid reservoir and electric parts. In the same block there are separate pistons, damping piston **3b** and working piston **3c**. The pistons are mechanically coupled to each other.

Inside the damping cylinder there is clutch fluid, therefore the changing of the fluid viscosity is as small as possible. In addition, the constant flow of the low pressure hydraulic oil warms up the hydraulic valve block.

When the speed is more than 4 km/h, the clutch pedal rises automatically quicker. When using the forward/reverse gear lever the clutch rises always slower.

HiShift clutch adjusting (by operator):
The adjustment of the HiShift has been made by the manufacturer. If needed, the clutch pedal rising speed after the "knee point" (point, where the damping begins) can be adjusted.

Speed under **4 km/h** (lower curve):

– By rotating the adjusting knob **1** in the closed direction (clockwise) (the lock 1a nut has to be slackened), the clutch rises slower (the curve is gentler) and vice versa.

  The factory adjustment is 1 $^{1}/_{4}$ turns open. Open 1 turn is the minimum value, because of clutch slip.

N.B! Always adjust Knob 1 first.

Speed over **4 km/h** (the upper curve):

– By rotating the adjusting knob **2** in the closed direction (clockwise) (the lock nut 2a has to be slackened), the clutch rises slower (the curve is gentler) and vice versa. The factory adjustment is 2 turns.

Note! The clutch pedal rising speed can not be adjusted too slow, in order that the clutch does not slip and wear unnecessarily.

1) Adjustable restriction for clutch pedal rising speed (speed under 4 km/h).
1a) Locking nut
2) Adjustable restriction for clutch pedal rising speed (speed over 4 km/h)
2a) Lock nut
3) Hydraulic block
3a) Adjusting screw. When needed, the ”knee point” can be adjusted by this screw to the right place. For the adjustment there is an opening in the console.
3b) Damping piston
3c) Hydraulic part piston
4) Clutch master cylinder
5) Clutch pedal
5a) The clutch pedal has a safety hinge which eliminates an accidental damage to the foot.
7) When piston **3c** is fully pushed out, clearance to the stopper should be **0,2...1mm.**
8) All sliding and bearing surfaces should be greased with universal grease (UC1811) in connection with repair works.
9) The piston stroke should be **25–30 mm**. The must be a gap of **0,5...2,0 mm** between the master cylinder and the push rod.
10) Fluid reservoir (2 dm^3). The reservoir has a splash plate.



If you have to leave tractor runnig alone, make sure that children has no access on the cab. Tractor moves easily!

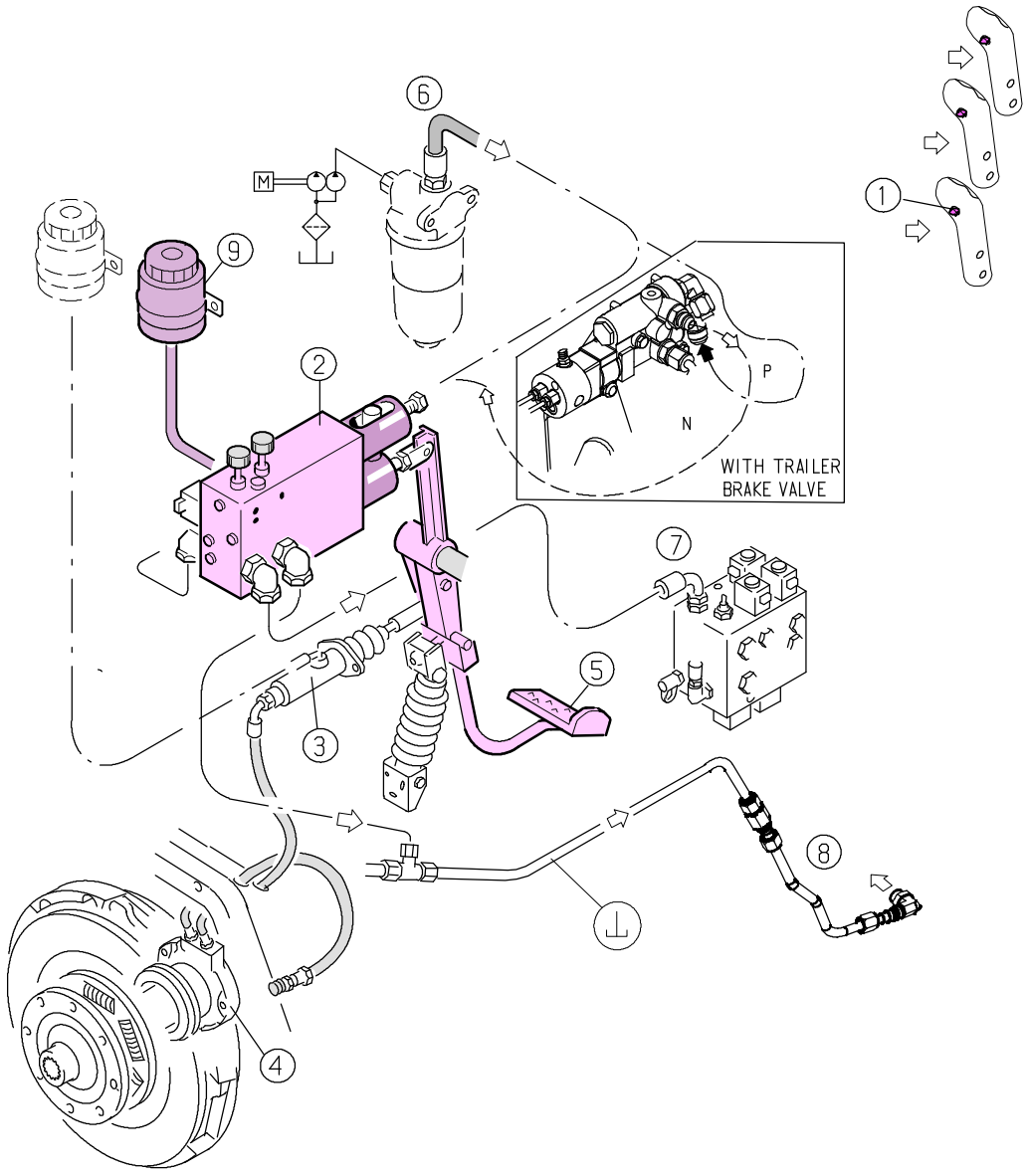


fig004

HiShift (option) controls the clutch pedal electro–hydraulically and it is unnecessary to depress the clutch pedal with foot. The clutch can always be operated normally using the foot pedal.

There is a button (1) on the speed gear lever, range gear lever and forward/reverse gear lever, by pressing this button the clutch pedal is depressed. When the button is released, the clutch pedal rises according to the preset adjustment.

When the speed is below 4 km/h or when using the HiShift button, the clutch is engaged slower (the pedal rises slower) than when the speed is greater than 4 km/h.

When using the HiShift, first press the button and then move the lever to the desired position. The button can then be released and the clutch will be engaged.

<u>When coupling implements or other operations where precise movements are needed the foot pedal must always be used!</u>

If the clutch pedal has been pressed down by the button and the clutch is to be engaged by foot operation, wait for a few seconds after releasing the button before starting to engage the clutch by the foot.

1) Push buttons in the gear lever knobs.
2) Hydraulic block
3) Main cylinder (same as on standard model).
4) Release bearing–slave cylinder (same as on standard model).
5) Clutch pedal
6) The oil from the low pressure circuit is conducted to the valve block 2 and further to the valve block for low pressure circuit 7 (warming up the valve block 2).
7) Valve block for low pressure circuit 7.
8) Steering hydraulics return oil.
9) Extra reservoir for the valve block

Note! Always be able to operate the clutch pedal by foot if needed.

Cylinder, HiShift

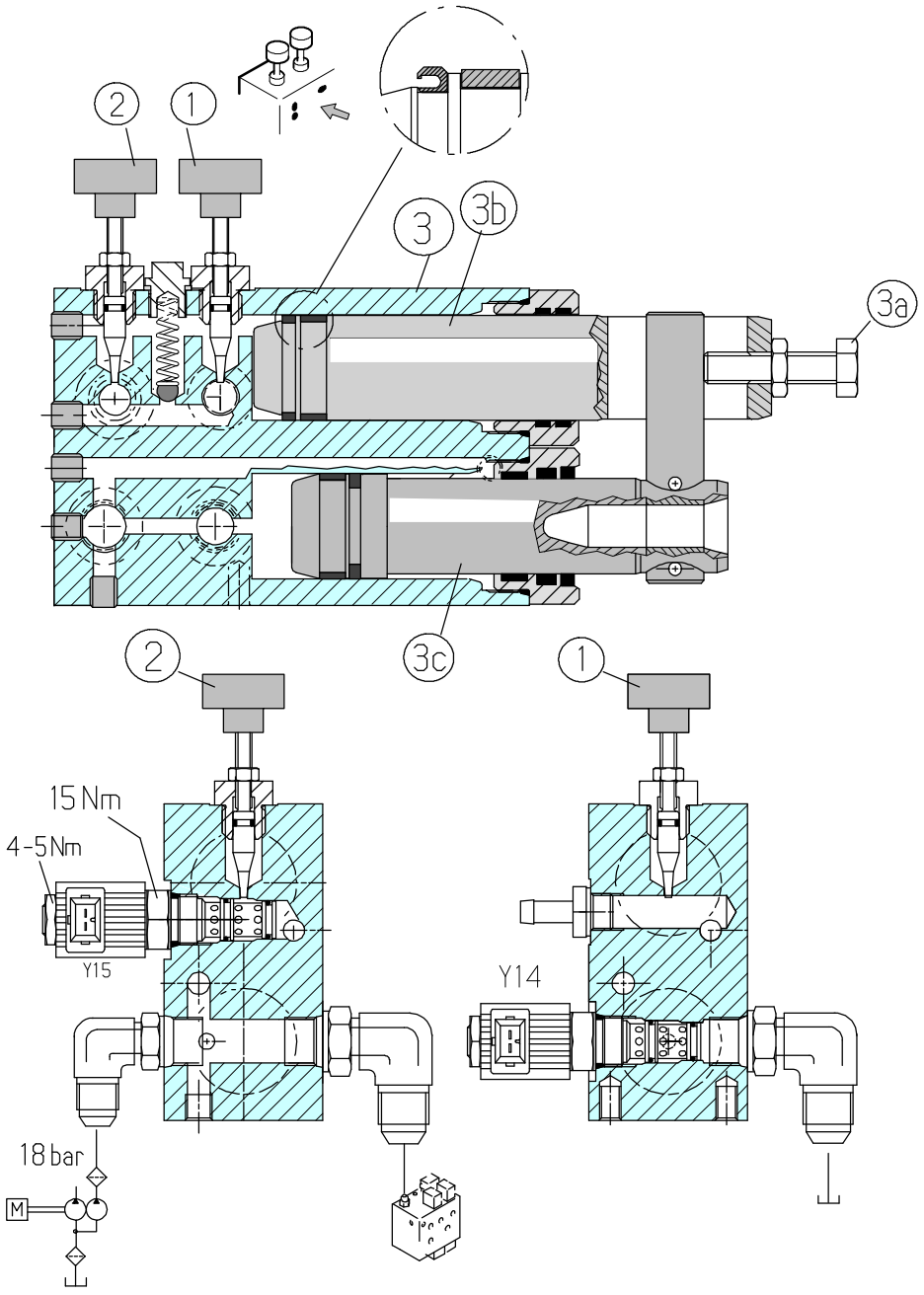


fig005

The pistons in the hydraulic block have hard chrome plating. Solenoid valves are same as on the low pressure valve block. However, the solenoid valve Y15 and damping piston **3b** have special brake fluid resistant seals (violet of the colour), which should be noted when repaired.

The restrictions 1 and 2 has been marked by drilled holes.

1) Adjustable restriction for clutch pedal rising speed (speed under 4 km/h).
2) Adjustable restriction for clutch pedal rising speed (speed over 4 km/h).
3) Hydraulic valve block

3a) Adjusting screw. When needed, the ”knee point” can be adjusted by this screw to the right place. Open –> the point rises. For the adjustment there is an opening in the console.

3b) Damping piston

3c) Hydraulic part piston

HiShift, function 1

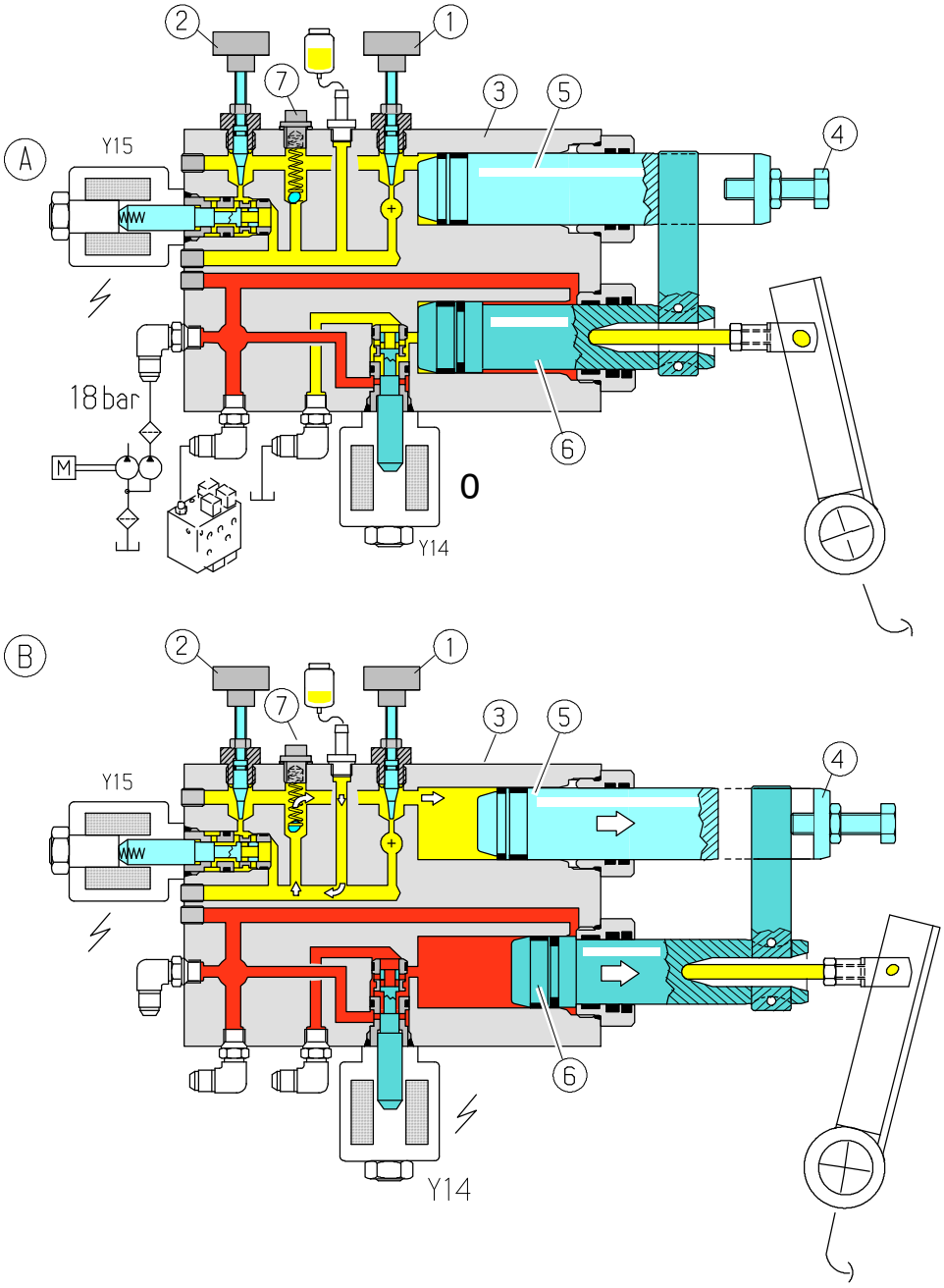


fig006

The constant flow of the low pressure hydraulic oil warms up the hydraulic valve block. Function

A: HiShift button is not pressed (speed < 4km/h; solenoid Y15 energised). Pressure behind the piston **6** keeps the piston in the start position.

B: HiShift button is pressed (speed < 4km/h; solenoid Y15 energised). Solenoid valve (Y14) is energised and opens the connection from the pressure side to the working cylinder.

Hydraulic pressure (18 bar) pushes by the working cylinder piston **6** the clutch pedal down. The working cylinder piston withdraws by the assistance of a pin the damping piston **5**, and the damping cylinder is filled with fluid through filling valve **7**. Solenoid valve (Y14) is energised as long as the button is pushed.

1) Adjustable restriction for clutch pedal rising speed (speed under 4 km/h).
2) Adjustable restriction for clutch pedal rising speed (speed over 4 km/h).
   The basic adjustment of the restriction has been made by the manufacturer.
3) Hydraulic block
4) Adjusting screw. When needed, the ”knee point” can be adjusted by this screw to the right place. Open –> the point rises.
5) Damping piston
6) Hydraulic piston
7) Filling valve

HiShift, function 2

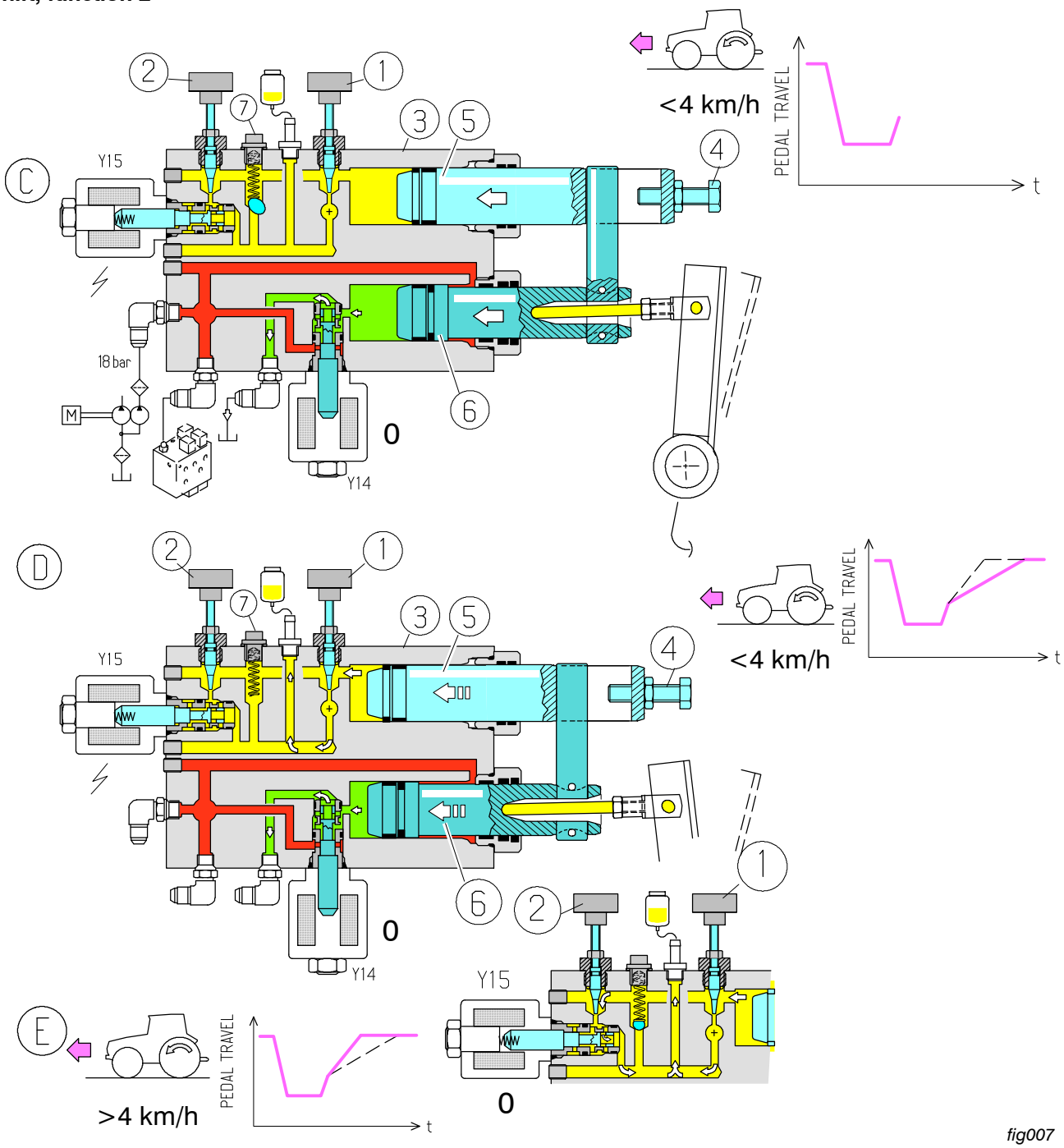


fig007

C: HiShift button is released (speed < 4km/h; solenoid Y15 energised). The solenoid (Y14) is unenergised, and the connection from the working cylinder to the tank opens. The constant hydraulic pressure on the piston rod side begins to push the working cylinder piston **6** back to the start position. The piston moves first fast (allowed by the groove in the damping piston **5**). In the picture the pin attached to the piston **6** touches just the damping piston **5** (so called knee point)

D: Damping phase (speed < 4km/h; solenoid Y15 energised). The pin forces also the damping piston **5** to move to the start point. The piston **6** moves now slower, because the return flow of the damping fluid is restricted with restriction **1**.

E: Damping phase (speed > 4km/h; solenoid Y15 not energised). The steering current of the relay **K24** is not earthed, and an extra connection from the fluid space in the damping cylinder to the reservoir opens. Restrictions **1** and **2** determines the amount of the flow. Adjusting is done only by the restriction **2**. In this way the pedal raising can be made quicker by the speed over 4 km/h.

1) Adjustable restriction for clutch pedal rising speed (speed under 4 km/h).
2) Adjustable restriction for clutch pedal rising speed (speed over 4 km/h). The basic adjustment of the restriction has been made by the manufacturer.
3) Hydraulic block
4) Adjusting screw. When needed, the ”knee point” can be adjusted by this screw to the right place. Open –> the point rises.
5) Damping piston
6) Hydraulic piston

Drive plate

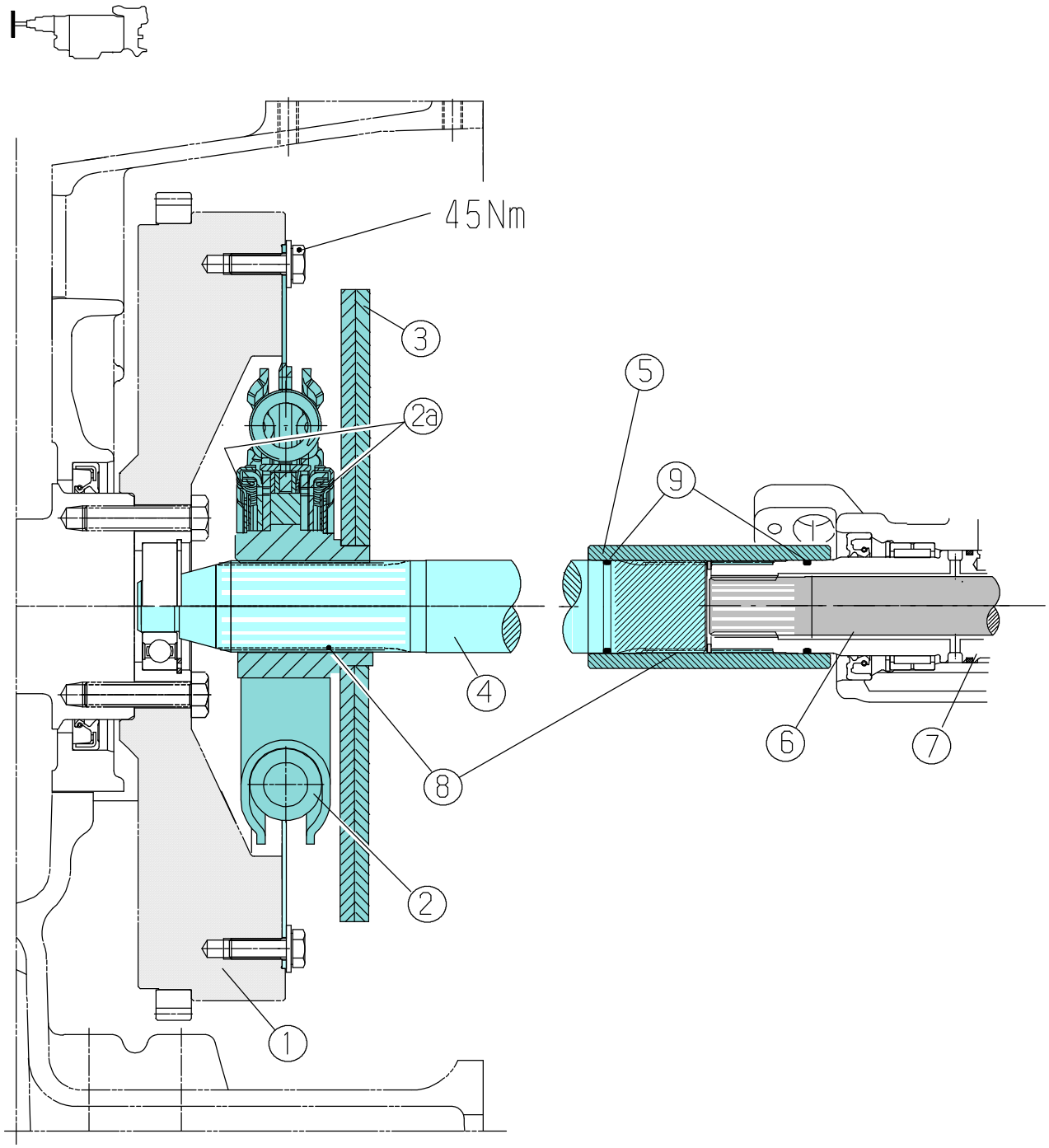


fig009

1. Flywheel
2. Damper springs
   These springs damper the shock between the engine and the transmission.

2a Small damper springs
   Damper so–called idle running vibrations in the transmission

3. Drive plate
   Plates increase the mass, and damp the vibrations
4. Drive shaft
5. Coupling sleeve
6. PTO / hydr. pump shaft
   The PTO drive shaft can be removed from the front end without taking away first the DPS.
7. Input shaft for DP
8. Pressure–proof grease to the splines of the shafts
9. O–ring (2x)
   Function as oil seals (the space of the DPS input shafts is under lubrication pressure)

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Checking clutch disc and clutch assembly

This section includes clutch disc and clutch assembly checking instructions. These checks must be carried out, when the clutch doesn't work correctly.

Checking axial throw of clutch disc

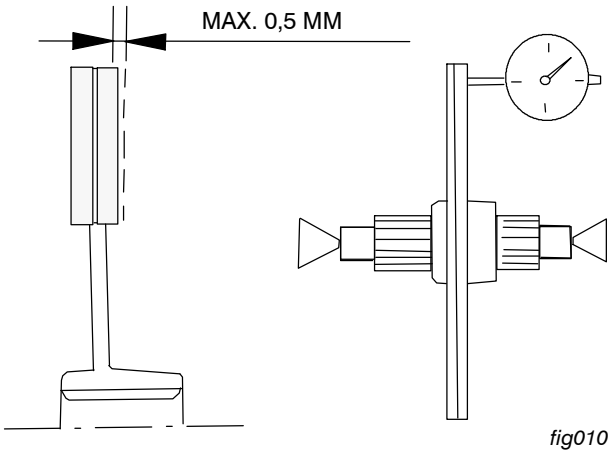


fig010

Mount the disc between the chuck and tailstock on a lathe. Rotate the disc and measure the axial throw at its outer edge. Also measure the taper ("dishing") of the disc. If the throw or taper is greater than 0,5 mm, change the disc.

Note! Light concavity of the disc does not take affect!

Checking thickness of clutch disc

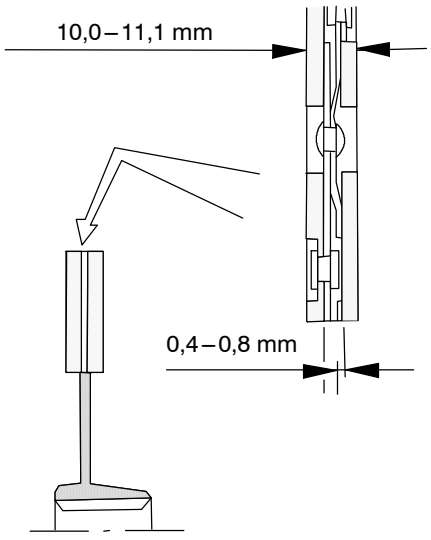


fig011

Thickness, new disc (unloaded) 10,0–11,1 mm. Axial resilience 0,4–0,8 mm

Clutch disc splines

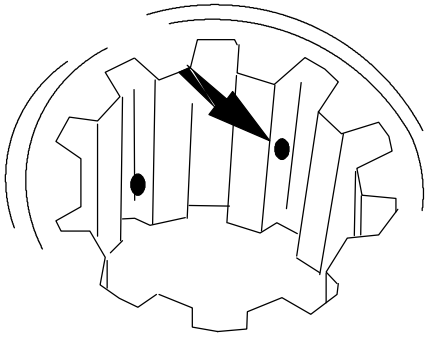


fig012

Coat the splines in the centre of the clutch disc with pressure–resistant grease to safeguard the axial movement of the disc on the clutch shaft.

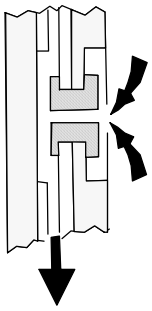


fig013

Clutch disc rivets

Rivets have a small hole for free air flow. If these holes become clogged (e.g. dust), it can cause sticking of the disc.

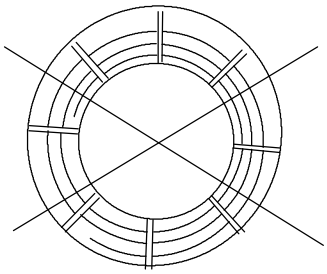


fig014

Organic linings are made by winding asbestos–free band. For that reason radial grooves must not be made on the linings because thus bands can cut off. This can cause the linings to loosen.

Friction surfaces must be clean. A small amount of grease on the linings can cause vibrations and the disc can stick.

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Checking movement of pressure plate

Place the clutch in fixture ETV 892 570 with 10 mm spacers. Secure with at least four bolts (23Nm torque).

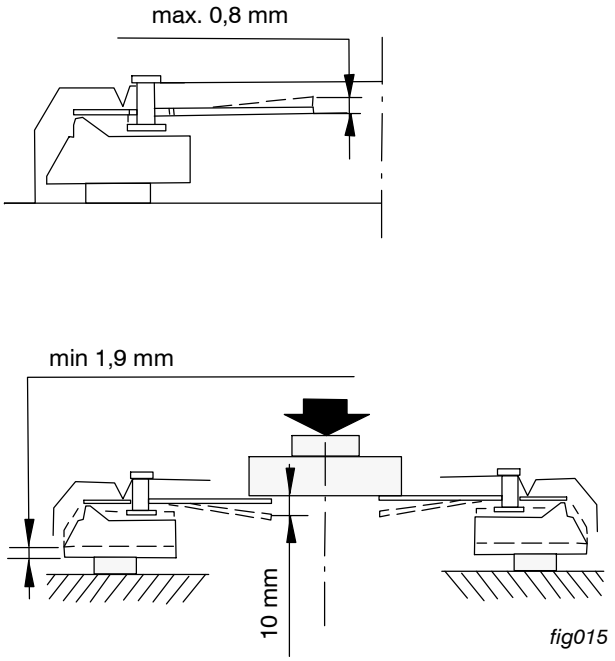


fig015

1. Check the height difference between the fingers of the cup spring: this must not exceed 0,8 mm. If it is greater, the clutch must be changed.

2. Press the cup spring fingers down by 10 mm and measure the distance between the spacers and pressure plate. The clearance must be at least 1, 90 mm. Check at several points. If the clearance is lower the clutch must be changed.

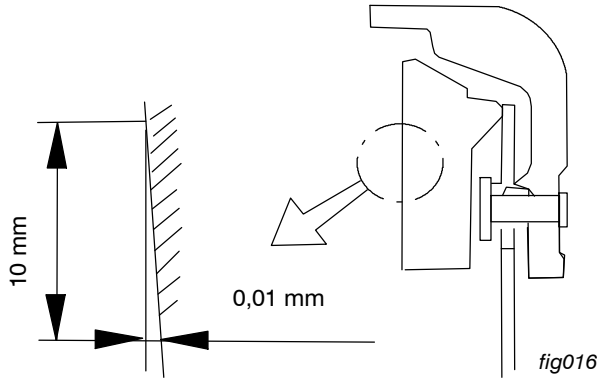


fig016

Checking concavity of pressure plate

A new pressure plate is flat to slightly concave, max. 0,01/10 mm: convexity, i.e. the reverse state, must not occur. The reason for the concave surface is to allow engagement to start at the outer edge of the lining where the disc is least sensitive to slipping. A grooved or otherwise deformed clutch must be changed. Do not machine pressure plate!

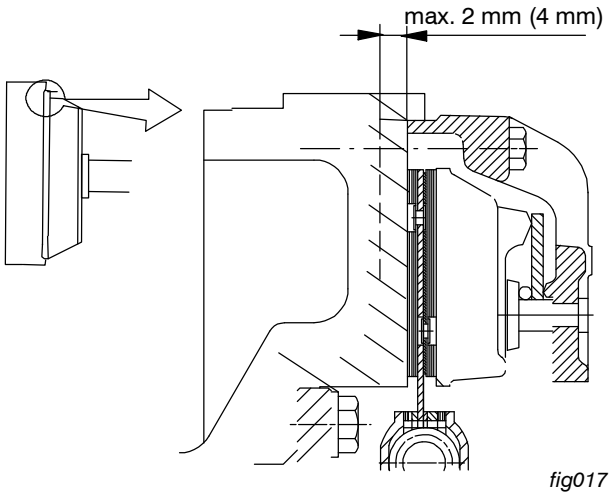


fig017

Machining flywheel

Flywheel should be machined, when assembling a new clutch. The flywheel can be machined 2 mm without any further action. For additional machining the holes for the clutch attaching bolts must also be deepened. The maximum machining of the flywheel is 4 mm.

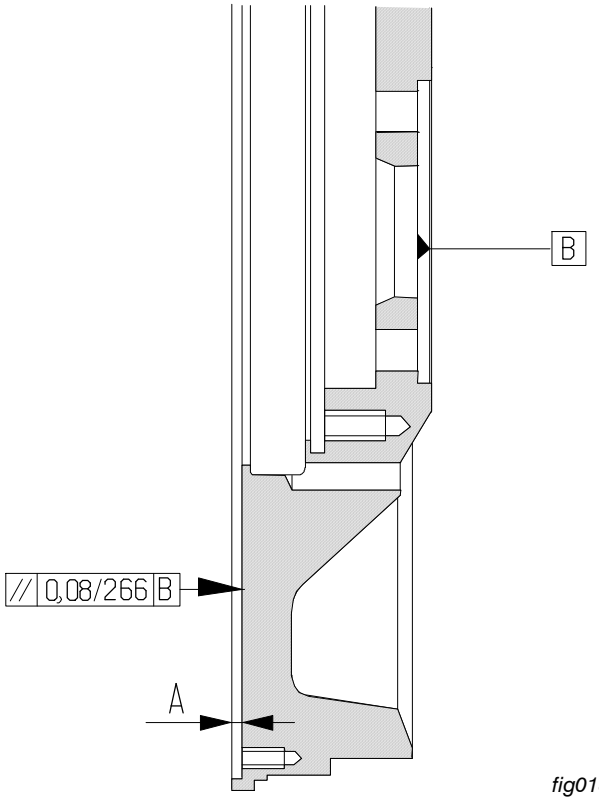


fig018

Note! When machining the flywheel, it is important to observe that the clutch surface and the flywheel fixing surface are parallel.

Measurement A on a new flywheel is 6±0,3 mm, and max allowable value is 10±0,3 mm.

Special tools

Clutch disc and assembly check (code 413.1)

ETV 892 570 ..... Kit for checking clutch
– 1. ETV 892 571 ..... Adjusting fixture
– 2. ETV 892 592 ..... Centring sleeve for propulsion clutch disc
– 3. ETV 892 575 ..... Press drift D = 150 mm, L = 50 mm
ETV 892 578 ..... Press drift D = 90 mm, L = 40 mm
– 4. ETV 892 570 ..... Pressure and turning lever, complete
– 7. ETV 893 710* ..... Spacer block 6,5 mm (4 pcs)
– 8. Std. ..... Bolt M8X60, at least 4 pcs
– 10. ETV 892 582 ..... Guide pin
– 12. ETV 893 711* ..... Spacer sleeve 72 mm, propulsion clutch
ETV 893 712* ..... Spacer sleeve 96 mm, PTO clutch
– 13. ETV 892 584 ..... Indicator sleeve, L = 30 mm
– 14. ETV 892 585 ..... Long indicator, PTO clutch
ETV 892 586 ..... Short indicator, propulsion clutch
– 15. ETV 892 58 ..... Indicator nut

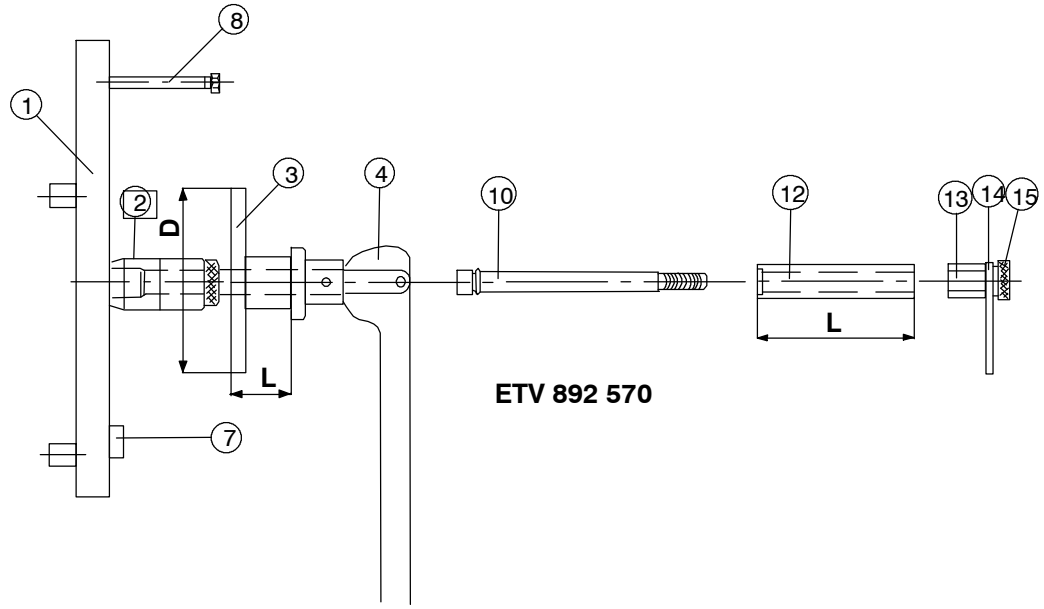


fig019

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Hydraulic clutch release mechanism

Bleeding the clutch circuit

Note! The bleeding hose/nipple is placed on the LH side of the tractor frame.

This release mechansim does not normally require any adjustments. The clutch pedal free travel cannot be felt, since the release bearing is in the continuous contact with the clutch. If the clutch does not release, the system must be bled.

Note! Check that the reservoir is full of brake fluid before bleeding. Pump with the clutch pedal a few times, so that the system is under pressure.

- Depress the clutch pedal and at the same time open the bleeding nipple.
- When the pedal is down, close the nipple and allow the pedal to rise up.
- Continue in this way until no air bubbles come out of the nipple.
- Check again liquid level in the reservoir and top up if necessary.

Note! Do not allow the liquid to contact the tractor frame, since the brake fluid can damage the paint.

Adjusting the pedal free travel

The free travel cannot be felt, since the release bearing touches the clutch release fingers all the time. Normally the pedal does not need any adjustment.

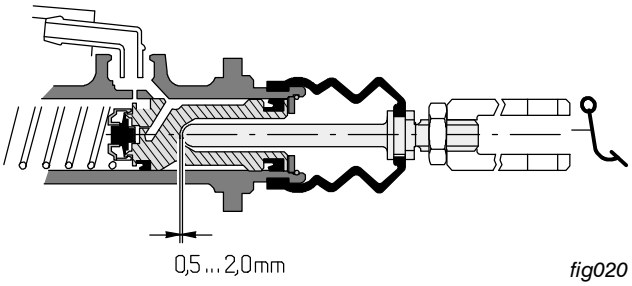


fig020

Adjust the distance between the master cylinder piston and the pedal push rod to **0,5–2,0 mm**, when the pedal is in the upper position.

This clearance can be adjusted by slackening the clevis lock nut and by rotating the clevis.

Master cylinder

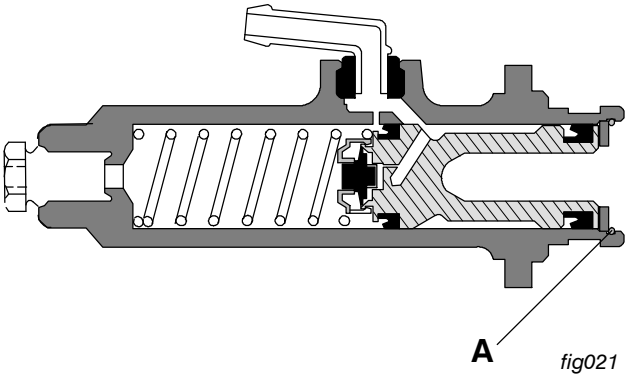


fig021

The master cylinder is attached with two bolts onto the cab front wall. A seal kit is available for the cylinder. The seals, piston and the spring can be removed from the cylinder by removing the circlip A and the intermediate ring behind the circlip. Lubricate new seals with brake fluid. The seals must not be lubricated with oil, because oil damages them.

Slave cylinder/release bearing

Note! The tractor frame is split / assembled at the clutch.

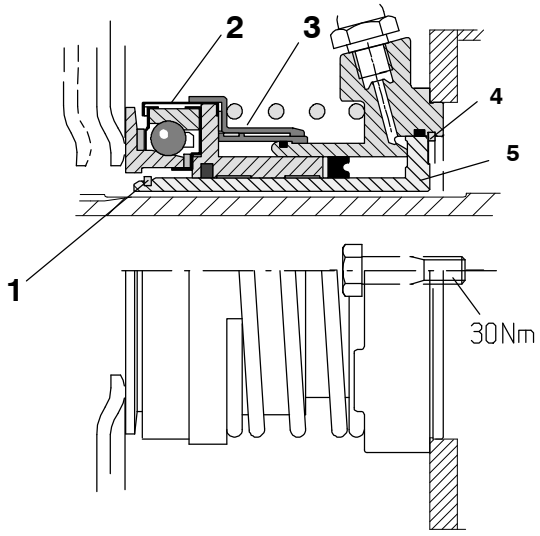


fig022

1. The slave cylinder unit is attached with three bolts onto the tractor frame. The pressure hose and the bleeding hose have different threads.
2. The release bearing can be removed by releasing circlip 1. Before removing the bearing, the locking sleeve 2 claws should be released from the flange.
3. The plastic covering 3 cannot be removed separately. The guide sleeve 5 loosens, when you remove the circlip 4.

Important! The slave cylinder seals must not be lubricated with mineral oil. The seals are lubricated with brake fluid.

Note! When the clutch disc linings are worn, the slave cylinder shrinks correspondingly and the stroke of the cylinder remains the same (about 10 mm).

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Technical data

Number of gears	All models	Optional equipment
– forwards	24	36
– reverse	24	36

Oil

(common to transmission and hydraulics).
– Viscosity and quality grade: see page **141.2**
– Oil volume: see page **141.2**

Warning lights for gearbox oil pressure and temperature. Oil cooler as standard.

Pressure lubrication for input shaft and bevel pinion shaft. Other shafts are lubricated through splash lubrication.

Lubricating oil pressure–relief valve, opening pressure	0,2 MPa
Suction strainer, degree of separation	125 μm
Pressure filter, filtration capacity	β10=75

Number of teeth	**T121c–T131c**	**T161c–T171c**
– bevel pinion shaft/crown wheel 40km/h	Z8/Z42	Z9/Z38
– bevel pinion shaft/crown wheel 50km/h	–	Z11/37
Gears for 4WD:		
– in front end of bevel pinion shaft 40km/h	Z29	Z29
– in front end of bevel pinion shaft 50km/h	–	Z33
– in front end of transmission shaft 40km/h	Z45	Z45
– in front end of transmission shaft 50km/h	–	Z41

Differential

– number of differential pinions	4 pcs	4 pcs

Tractors with ground speed PTO; there is a coupling, selector fork and shaft for PTO in the gearbox.

Number of teeth	**T121h**	**T131h**	**T151eh**	**T161h–T191h**
– bevel pinion shaft/crown wheel 40km/h	Z8/Z42	Z8/Z42	Z11/Z37	Z9/Z38
– bevel pinion shaft/crown wheel 50km/h	–	Z9/Z38	Z11/Z37	Z11/Z37
Gears for 4WD:				
– in front end of bevel pinion shaft 40km/h	Z29	Z29	Z33	Z29
– in front end of bevel pinion shaft 50km/h	–	Z33	Z33	Z33
– in front end of transmission shaft 40km/h	Z45	Z45	Z41	Z45
– in front end of transmission shaft 50km/h	–	Z41	Z41	Z41

Differential

– number of differential pinions	4 pcs	4 pcs	4 pcs	4 pcs

Tractors with ground speed PTO; there is a coupling, selector fork and shaft for PTO in the gearbox.

Number of teeth	**T151eLS**	**T161LS–T191LS**
– bevel pinion shaft/crown wheel 40km/h	Z11/Z37	Z9/Z38
– bevel pinion shaft/crown wheel 50km/h	Z11/Z37	Z11/Z37
Gears for 4WD:		
– in front end of bevel pinion shaft 40km/h	Z33	Z29
– in front end of bevel pinion shaft 50km/h	Z33	Z33
– in front end of transmission shaft 40km/h	Z41	Z45
– in front end of transmission shaft 50km/h	Z41	Z41

Differential

number of differential pinions	4 pcs	4 pcs

Tractors with ground speed PTO; there is a coupling, selector fork and shaft for PTO in the gearbox.

Tightening torques

Gearbox

Bevel pinion shaft ring nuts (+transmission shaft ring nut)	270 Nm
Input shaft front end cover	21–25 Nm
Layshaft front end cover	21–25 Nm
Gearbox side cover screws	50 Nm

Differential

Crown wheel fxing bolts	110 Nm
Differential bearing cover screws	40–50 Nm

Frame joints

Gearbox–fuel tank:	
– upper studs	270–330 Nm
– lover hexaconal socket–head screws	125 Nm
Gearbox–reverse shuttle	21–25 Nm
Gearbox–power take–off:	
– upper studs (8 pcs)	270–330 Nm
– lower studs (6 pcs)	72–88 Nm
Gearbox–brake housing	270–330 Nm
Propeller shaft flange joints	35 Nm

Settings

Gearbox

Pinion shaft rolling resistance measured with torsion meter at front end of shaft (without differential)	1,7–2,3 Nm
Input shaft end float	0,025–0,075 mm
Layshaft end float	0,025–0,075 mm

Differential

Differential bearing preload measured with torsion meter at front end of bevel pinion shaft (=pinion shaft rolling resistance+)	+0,6–1,7 Nm (Z8/42) +0,8–2,2 Nm (Z9/38)
Tooth backlash, pinion/crown wheel	0,175–0,325 mm

Sealing compounds and locking fluids used

Reverse shuttle–gearbox, sealing Hylosil RTV Grade 102 Black
Power take–off–gearbox, sealing Hylosil RTV Grade 102 Black
Brake housings–gearbox, sealing Hylosil RTV Grade 102 Black
Side cover–gearbox, sealing Hylosil RTV Grade 102 Black
Threads on selector fork rails (+transmission shaft ring nut), Loctite 242
Crown wheel fixing bolts, Loctite 273

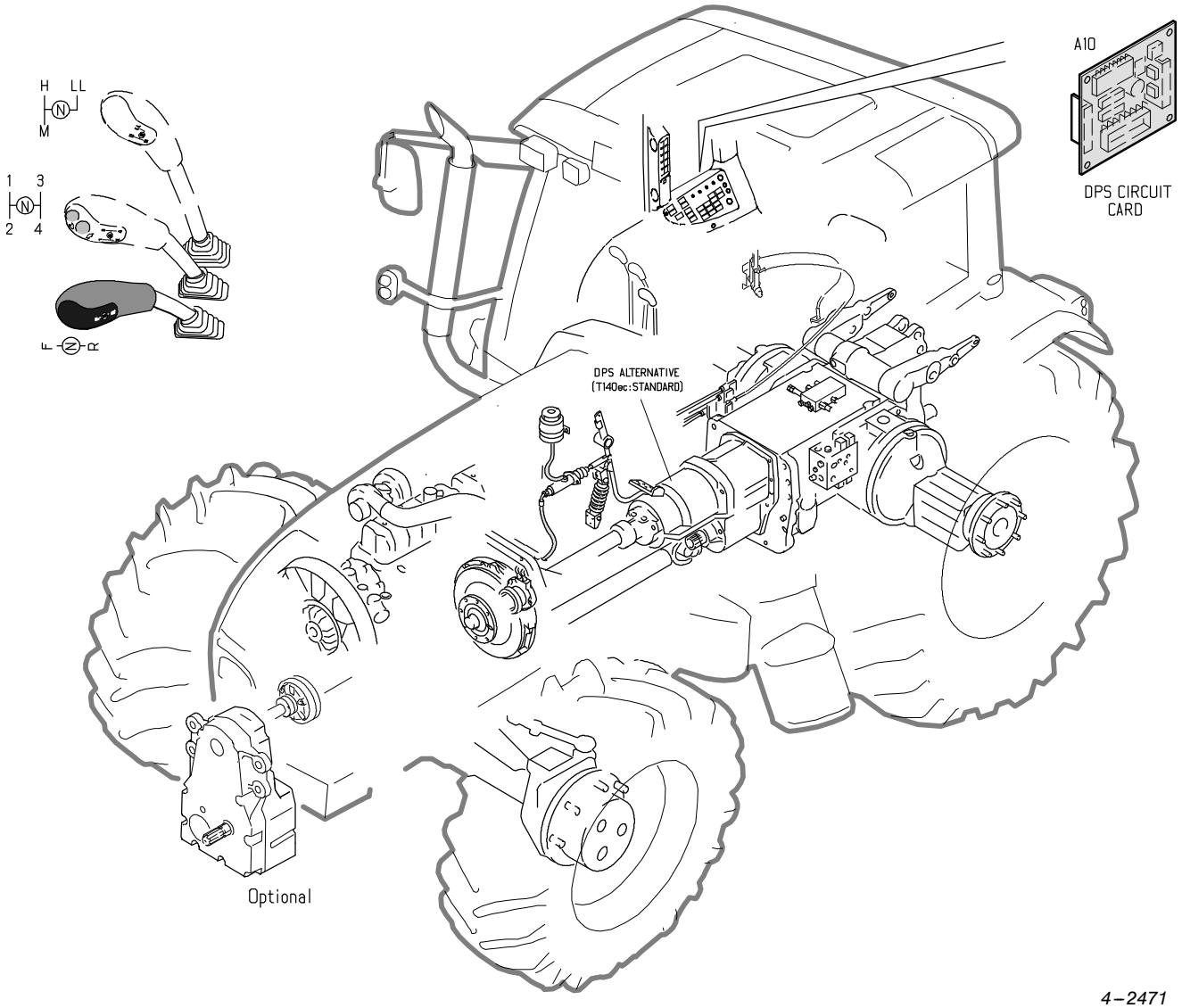
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Gearbox construction and function (Classic)

Position of the gearbox is shown in the figure below. Reverse shuttle and quick–shift gear are attached to the front of the gearbox. Power take–off is attached to the rear end. Rear axles are attached to the both sides of the gearbox. Differential is fitted in the rear part of the gearbox housing.

The gearbox is operated mechanically with a speed gear lever and range gear lever. Gearbox has three ranges (LL–M–H), of which the LL range is optional equipment. Gearbox has four speed gears. The reverse shuttle is operated with a separate lever. The Delta Powershift (optional equipment) gear triples the number of speeds.

The gearbox is fully synchronized (except LL range). Helical gearing. Pressure lubrication.



4–2471
02/08

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Gearbox construction and function (Hi-Tech)

Position of the gearbox is shown in the figure below. Reverse shuttle and quick–shift gear are attached to the front of the gearbox. Power take–off is attached to the rear end. Rear axles are attached to the both sides of the gearbox. Differential is fitted in the rear part of the gearbox housing.

The gearbox is operated mechanically with a speed gear lever and range gear lever. Gearbox has three ranges (LL–M–H) and four speed gears. The reverse shuttle is operated with a separate lever. The Delta Powershift (optional equipment) gear triples the number of speeds.

The gearbox is fully synchronized (except LL range). Helican gearing. Pressure lubrication. Separate reverse shuttle.

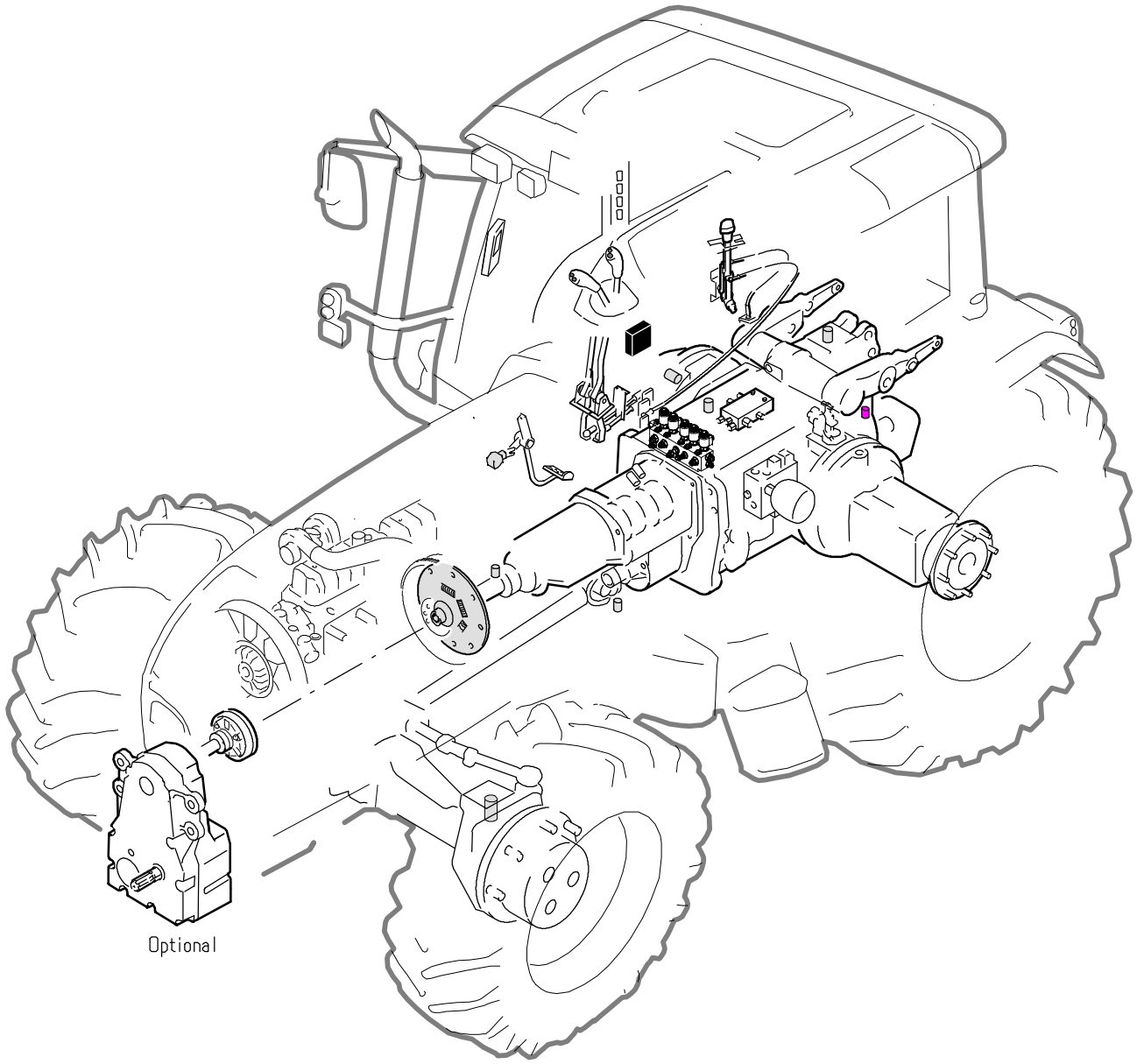


fig002

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Gearbox construction and function (LS)

Position of the gearbox is shown in the figure below. Reverse shuttle and quick–shift gear are attached to the front of the gearbox. Power take–off is attached to the rear end. Rear axles are attached to the both sides of the gearbox. Differential is fitted in the rear part of the gearbox housing.

The gearbox is controlled electronically with a common speed gear and range gear lever. Gearbox has three ranges (LL–M–H), of which the LL range is optional equipment (separate lever). The gearbox has four speed gears. The change of the speed range H/M will be done in the neutral position of the speed gear lever, moving the lever shortly right. The reverse shuttle is operated with a separate lever. The Delta Powershift gear triples the number of speeds.

The gearbox is fully synchronized (except LL range). Helical gearing. Pressure lubrication.

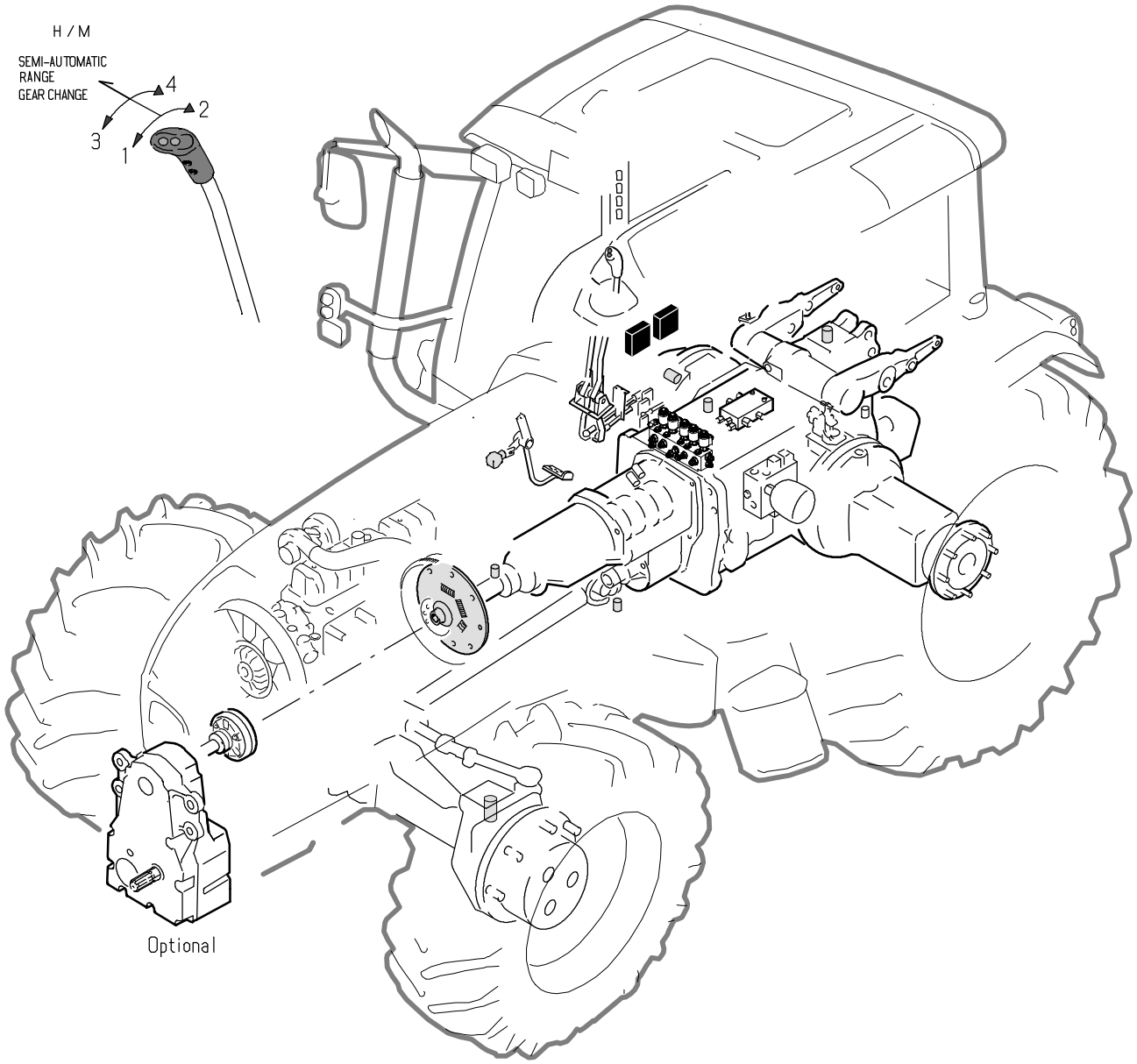
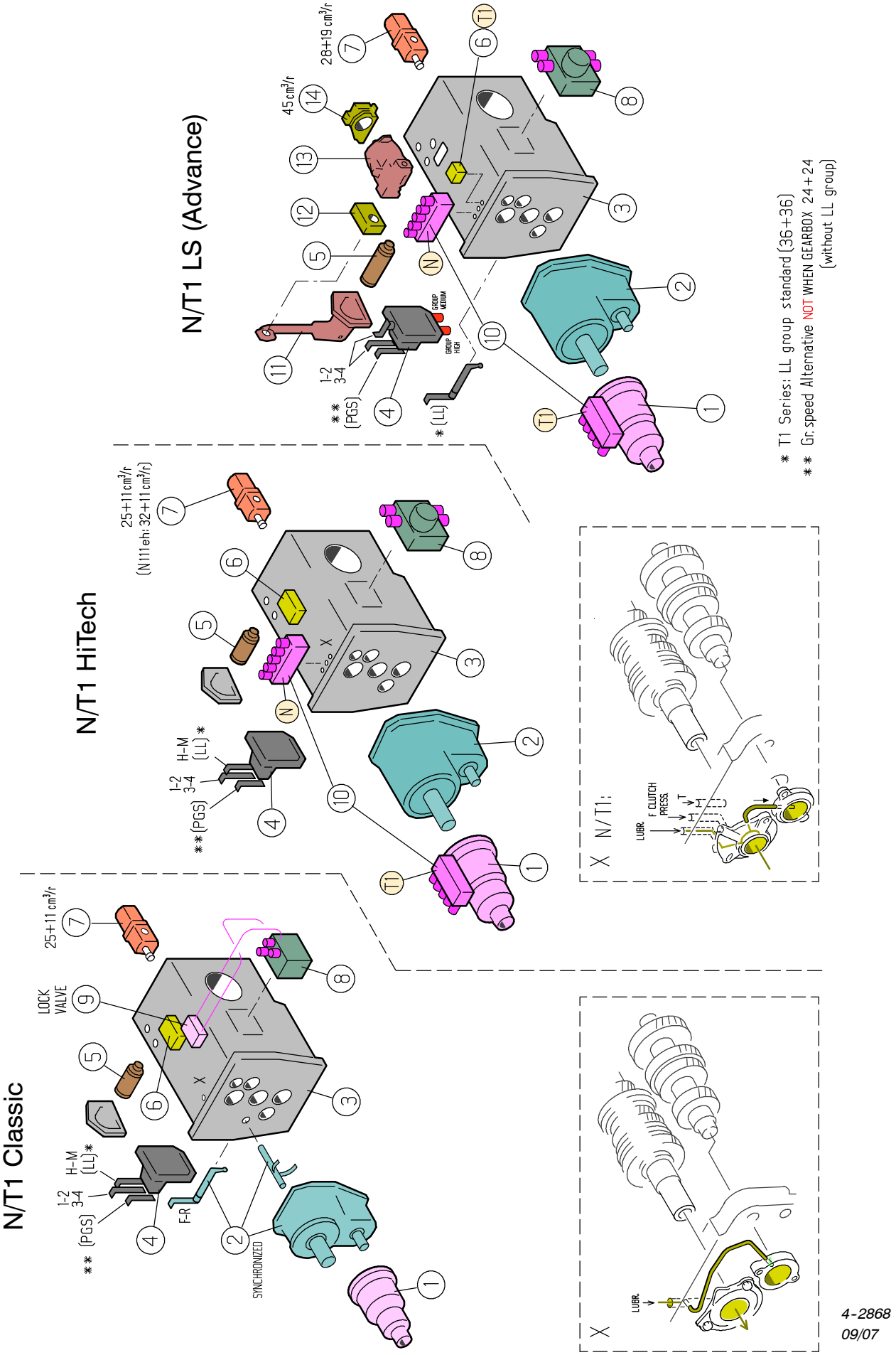


fig089

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Gearbox differences



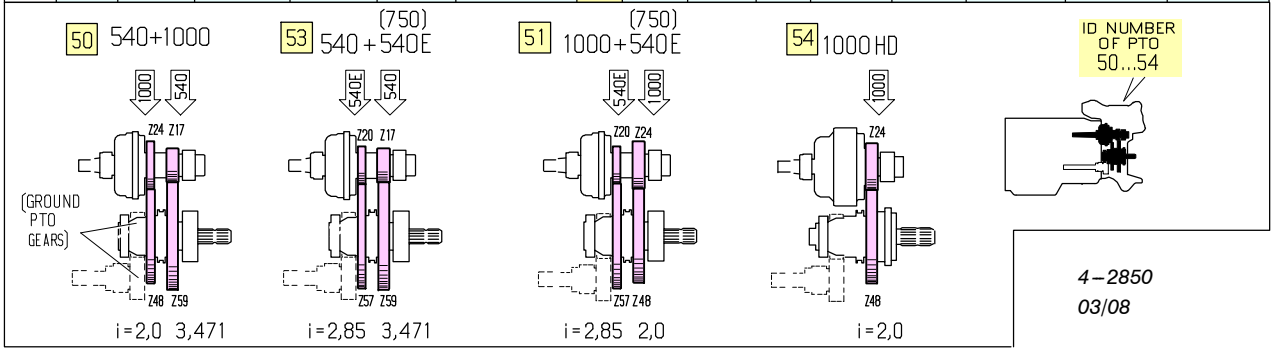
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1) Powershift gear
2) Shuttle unit
   Classic: . . . . . synchronized
   HiTech, LS: . . . . . multi disc clutches forward/reverse
3) Gearbox
4) Selector forks
5) Suction strainer
6) Lubricating block
7) Double pump
8) Block for the low pressure hydraulics
9) Lock valve (Classic–models)
10) Block for the DPS and shuttle unit
11) Ejector (LS models)
12) Valve block, supply pressure (LS models)
13) Variable displacement pump 115/min /2200 r/min (LS–models)
14) Valve block, lubrication

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Gear ratios

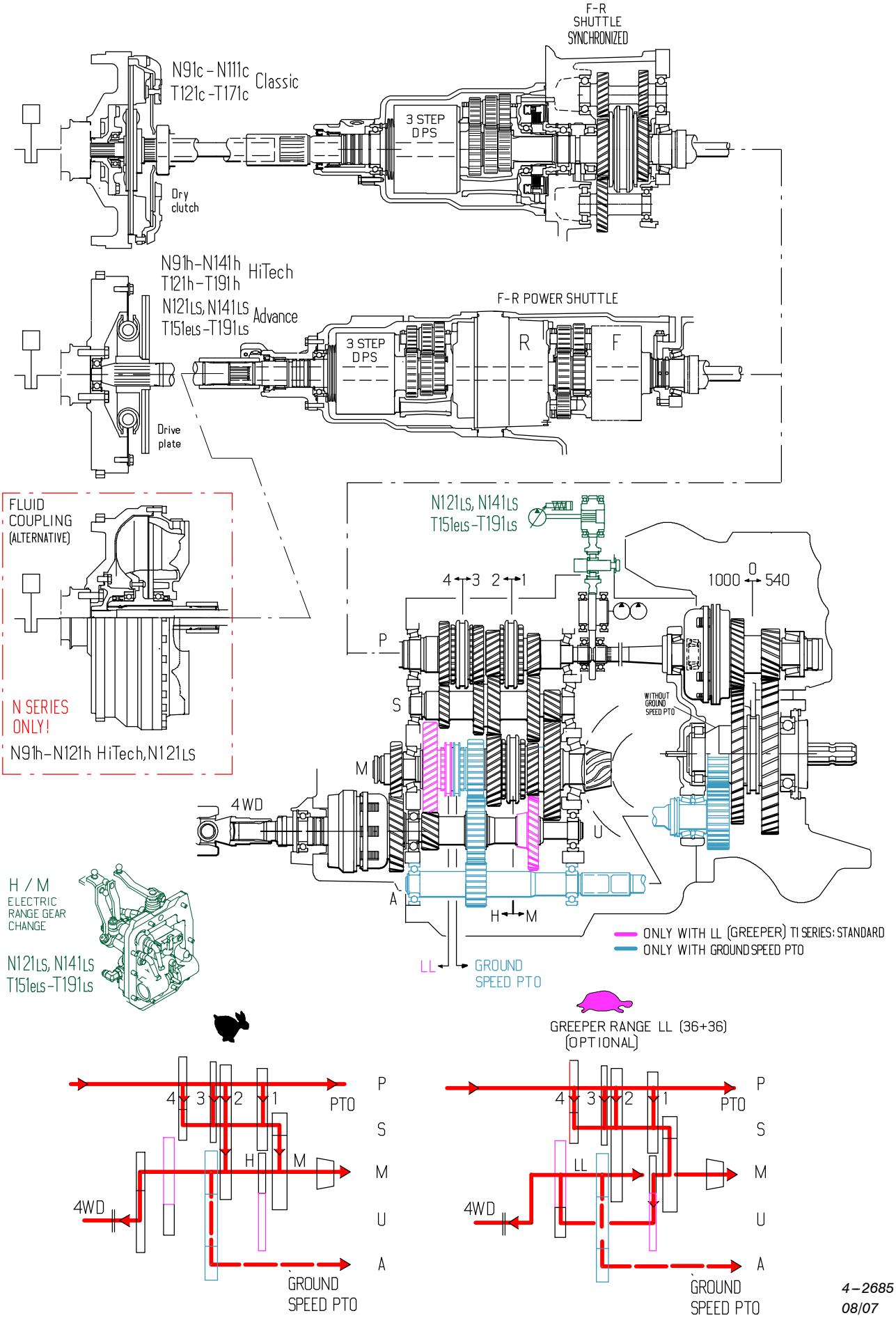
		GEAR QTY	DPS 3 step	FORWARD REVERSE SHUTTLE	ID LETTER			GROUND PTO GEARS	GROUND PTO PTO AXLE REVS/ 1 REAR WHEEL REV	PUMP GEAR RATIO (DISPLACEMENT) cm^3/r	FINAL DRIVES	FRONT AXLE DANA 730/503 733/505 740/532 740/533	RATIO FRONT/REAR
Nh	N91h-N111h 40KM/H	36+36R CREEPER	1,0/0,811/0,651	F = 1:1 R = ~5% FASTER	MA	29/44	8/42	26/20	i=40,81	i=1,32 (25+11)	650 R (i=6,857)	i=17,538	i=1,353
					MB			—					
	N111eh ~~50KM/H~~ 40KM/H				ME	33/41	9/38	25/24	i=40,96	i=1,32 (32+11)			i=1,329
					MF			—					
	N121h-N141h 40KM/H				MG	29/45	8/42	26/20	i=40,81				i=1,323
					MH			—					
	N121h-N141h 50KM/H				ML	33/41	9/38	25/24	i=40,96	i=1,32 (25+11)			i=1,329
					MN			—					
	N91h-N111h 40KM/H	24+24			—	29/44	8/42	—	—				i=1,353
					MD			—					
	N121h-N141h 40KM/H				—	29/45	8/42	—	—				i=1,323
					MK			—					
NLs	N121LS-N141LS 40KM/H	36+36R CREEPER			LO	29/45	8/42	26/20	i=40,81	i=1,32 (28+19) i=1,2 (45)			i=1,323
					LP			—					
	N121LS-N141LS 50KM/H				LR	33/41	9/38	25/24	i=40,96				i=1,329
					LS			—					
	N121LS-N141LS 40KM/H	24+24			—	29/45	8/42	—	—				i=1,323
					LN			—					
Nc	N91c-N111c 40KM/H	36+36R CREEPER		F = 1:1 R=~2,5% FASTER SYNCHRONIZED	LT	29/44	8/42	26/20	i=40,81	i=1,32 (25+11)			i=1,353
					LU			—					
	N91c-N111c 40KM/H	24+24			—	29/44	8/42	—	—				i=1,353
					LX			—					
T1h	T121h, T131h 40KM/H	36+36R	1,0/0,811/0,651	F = 1:1 R = ~5% FASTER	HE	29/45	8/42	26/20	i=40,81	i=1,32 (25+11)	650 R (i=6,857)	i=17,538	i=1,323
					HF			—					
	T131h 50KM/H / T131h Eco Speed 40KM/H ~~50KM/H~~				HG	33/41	9/38	25/24	i=40,96				i=1,329
					HH			—					
	T161h,T171h,T191h 40KM/H				HC	29/45	9/38	26/20	i=41,03				i=1,33
					HD			—					
	T161h-T191h 50KM/H / T151eh [Eco Speed 40KM/H] 50KM/H / T161h-T191h Eco Speed 40KM/H ~~50KM/H~~				HL	33/41	11/37	25/24	i=40,79		700 (i=8,571)		i=1,323
					HB			—					
T1c	T121c, T131c 40KM/H			F = 1:1 R=~2,5% FASTER SYNCHRONIZED	CE	29/45	8/42	26/20	i=40,81		650 R (i=6,857)	i=17,538	i=1,323
					CF			—					
	T161c, T171c 40KM/H				CC	29/45	9/38	26/20	i=41,03		700 (i=8,571)		i=1,33
					CD			—					
	T161c, T171c 50KM/H / T161c,T171c Eco Speed 40KM/H ~~50KM/H~~				CA	33/41	11/37	25/24	i=40,79				i=1,323
					CB			—					
TLs	T161LS,T171c,T191LS 40KM/H			F = 1:1 R = ~5% FASTER	TO	29/45	9/38	26/20	i=41,03	i=1,32 (28+19) i=1,2 (45)			i=1,33
					TP			—					
	T161LS-T191LS 50KM/H / T151e LS [Eco Speed 40KM/H] 50KM/H / T161LS-T191LS Eco Speed 40KM/H ~~50KM/H~~				TR	33/41	11/37	25/24	i=40,79				i=1,323
					TS			—					



4–2850
03/08

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Transmission structure



4–2685
08/07

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Layshaft

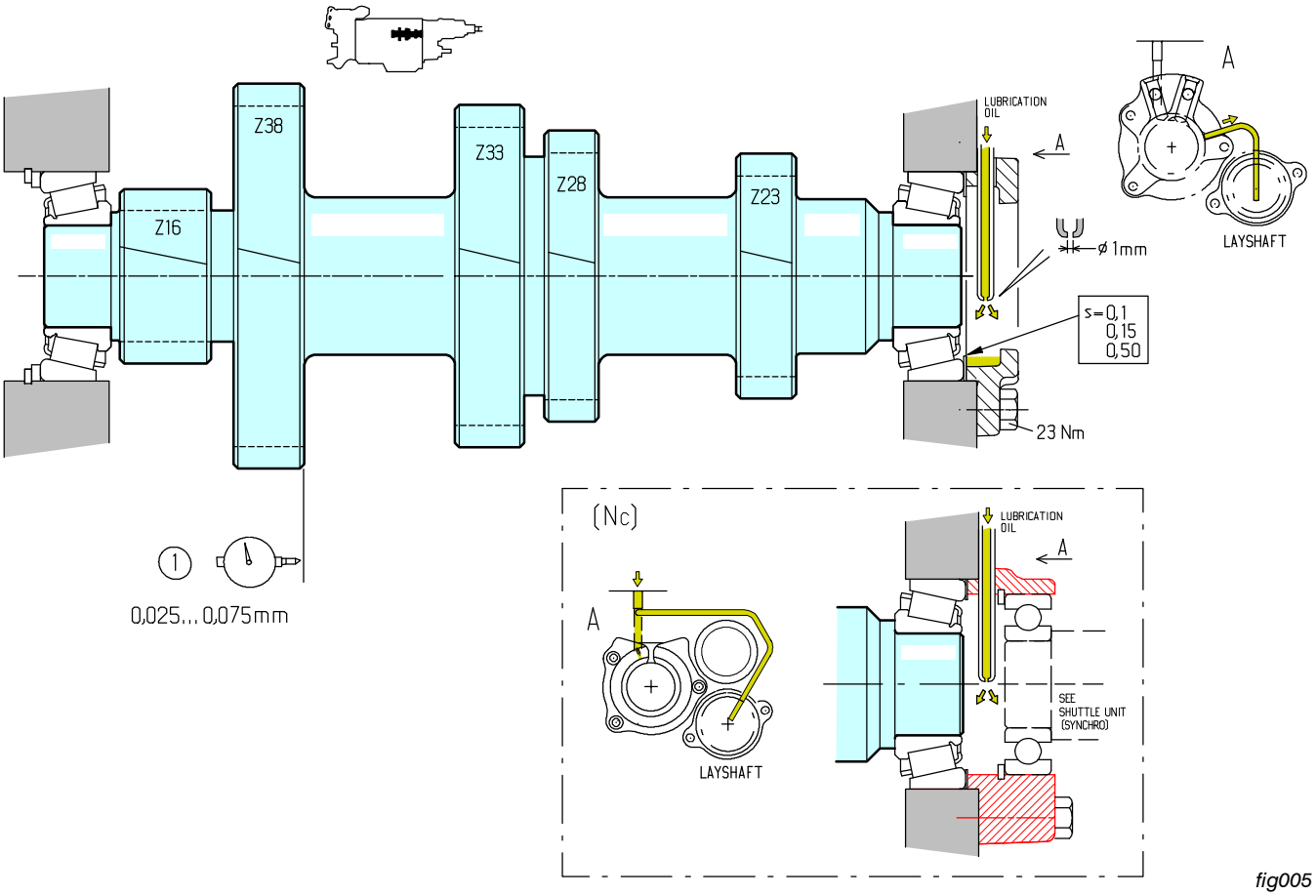


fig005

The countershaft gears are machined to the shaft. All gears are helical.

– Adjustment of new tapered roller bearings: select the shims so, that after fastening the bearing cup axial play is **0.025...0.075 mm**.

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Input shaft

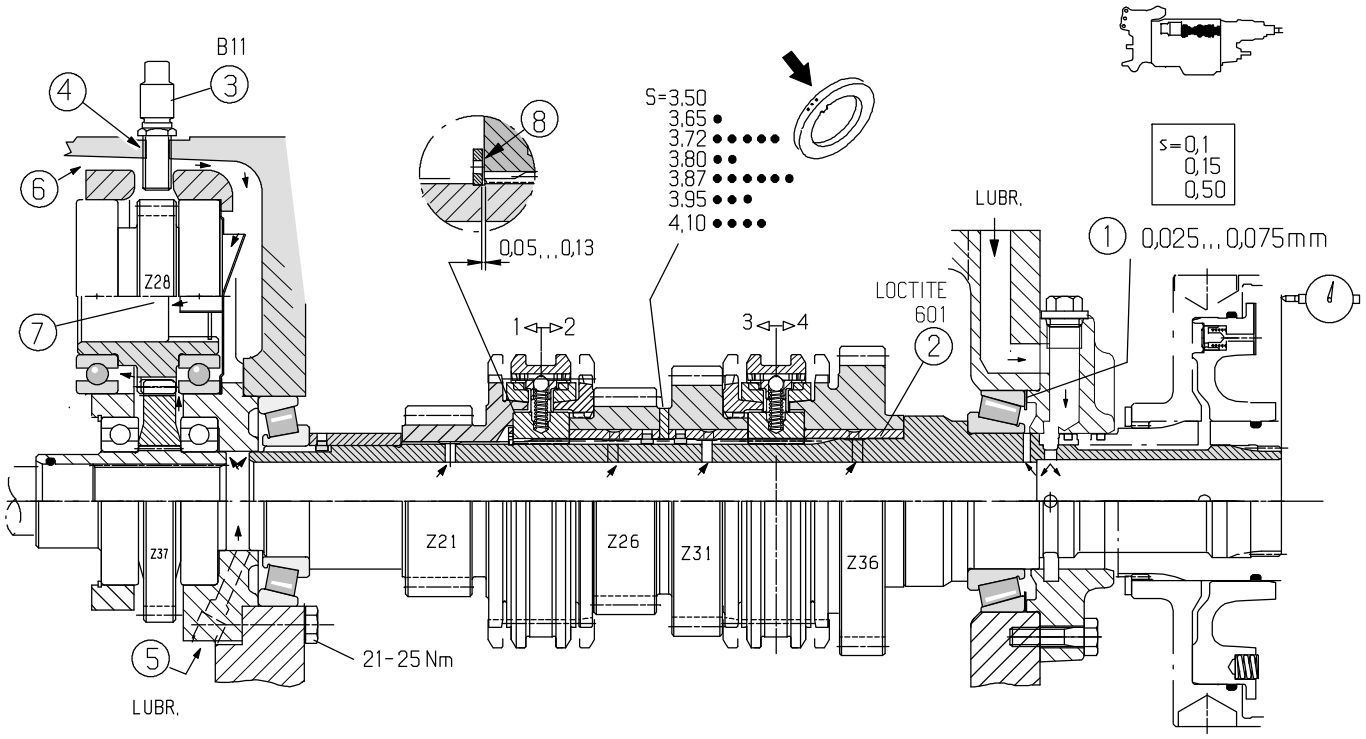


fig007

1) Adjustment of new tapered roller bearings: select the shims so, that after fastening the bearing cup axial play is 0.025...0.075 mm.
2) Loctite 601 (UK 0086) for locking the bearing sleeve.
3) Inductive sensor, engine rev. (wiring diagram: B11). Adjustment of the sensor: turn the sensor carefully by hand until it reaches the gear, then turn back 1/3 rev. Lock the sensor with the locking nut.
4) Loctite 572 (UK 0174) on the threads of the sensor .
5) Lubrication oil to the main shaft (see also the gearbox lubrication)
5a) The lubrication oil supply into the front end of the input shaft.
6) Splash lubrication from the crown wheel. Oil comes also via the drive gears of the pump.
7) Lubrication oil to the splines of hydraulic pump drive shaft.
8) With this ring the gap between the hub of the synchromesh unit and retaining ring must be adjusted to 0,05–0,13 mm. The fitting ring has markings according to the thickness.

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Bevel pinion shaft

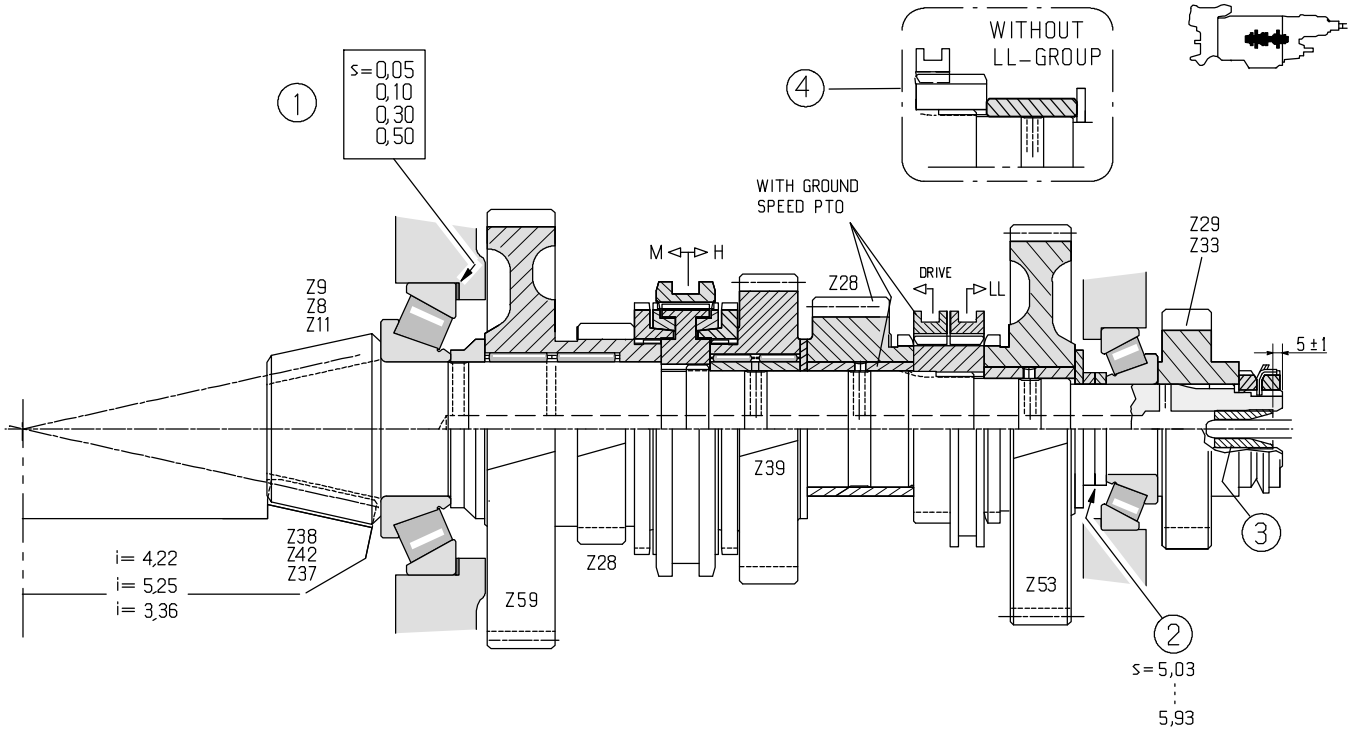


fig008

1. The position of the pinion shaft is adjusted by shims.
2. Space rings for adjusting pretightening of taper roller bearings.
3. A teflon sleeve supports the lubrication pipe. The sleeve is pressed 5 mm into the shaft bore.
4. Tractors without creeping speeds: synchr. ring LL and gear Z53 has been removed, instead of the bearing there is a bushing.

Transmission shaft

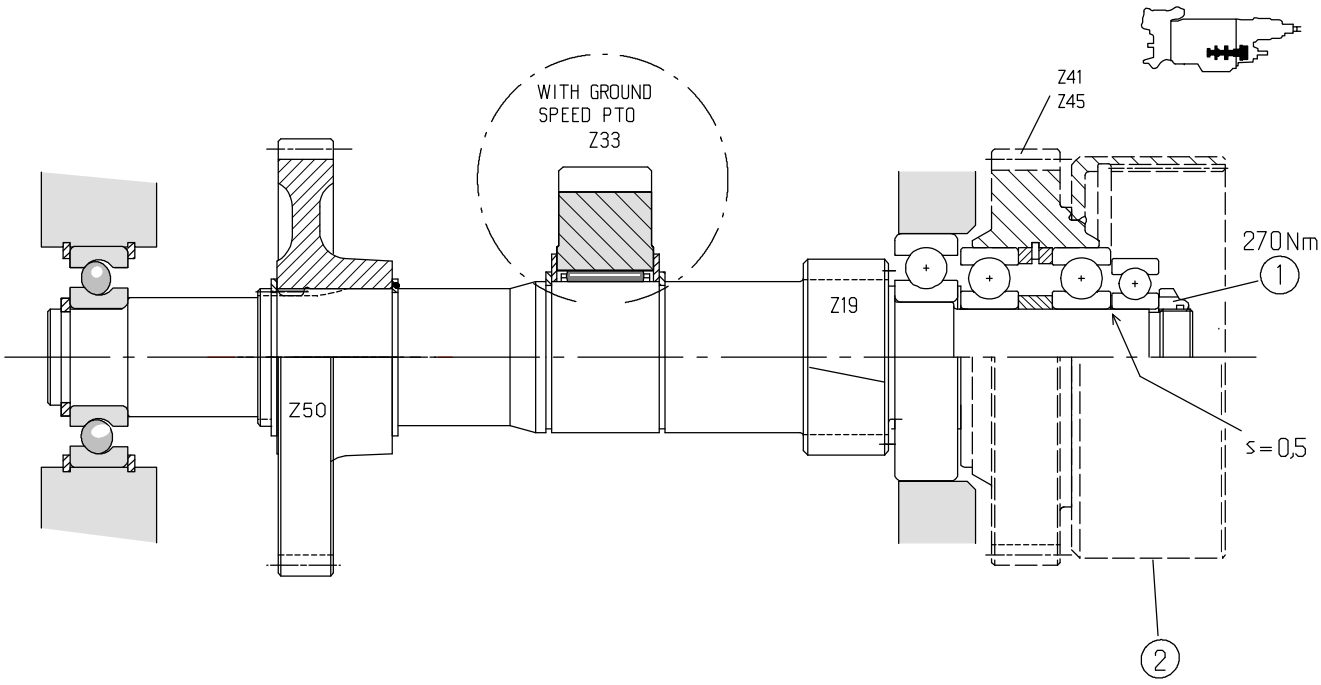


fig009

1. Shaft nut (270 Nm).
2. 4WD clutch drum.

Note! Gear Z33 only on tractors with ground speed PTO (36+36 transmission)

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Ground speed PTO shaft

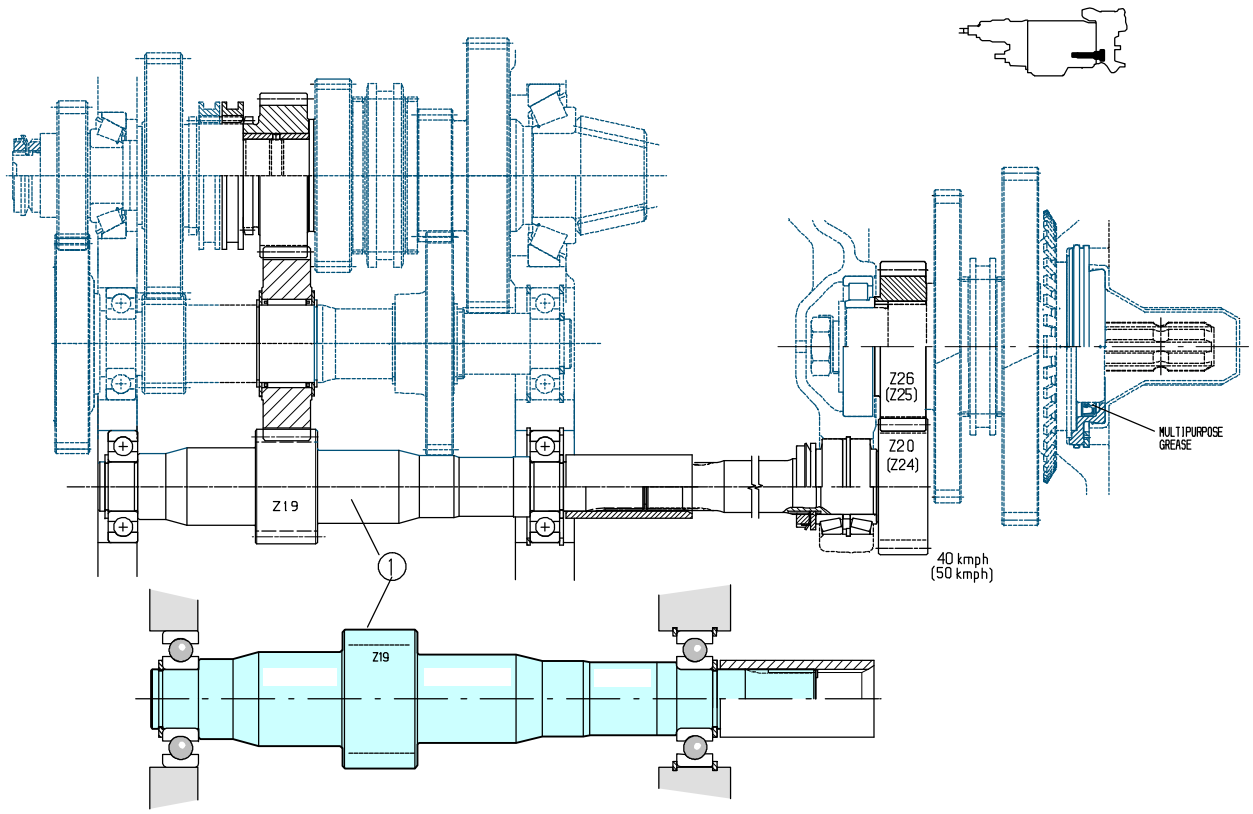


fig010

Ground speed is optional equipment.

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Gear levers, Classic

The gear selectors are grouped on the right–hand side of the operator. The levers have a common support shaft, where the levers are fastened with journal bearings.

1) Forward/reverse gear lever
   Lever in **front position** = forward speeds
   Lever in **rear position** = reverse speedsGear change between Forwards & Reverse is synchronized.When changing driving direction, the tractor must be stopped and clutch pedal depressed.
2) Speed gear lever
   This lever (2) selects four synchronized speed gears, the middle position is neutral. The speed gears can be used in all three speed ranges (lever 3, speed ranges LL, M and H) and also in the forward and reverse gears (lever 1).
3) Range gear lever
   The range lever selects three different ranges.

Front position on right (in the driving direction)**:** creeper speed range **LL**

Rear position on left (in the driving direction)**:** low range **M**

Front position on left (in the driving direction)**:** high range **H**. Low (M) and High (H) ranges are synchronized. When changing ranges the clutch pedal must be depressed.

4) Tighten the support shaft until the forward/reverse gear lever (1) operation force is 6–10 N (measured at the knob 1).
5) Tightening the screw, adjust the clearance to 0,3...0,7 mm. The clearance allows the axial movement (there are cup springs at the end of the support shaft).
6) Multi–purpose grease (UC1811) when assembled.
8) Plate prevents the twisting of the gear selector
9) HiShift (extra equipment)
10) Push buttons for Power Shift (alternative equipment) Adjust shifter rods and cable wires to dimensions shown in figure. Adjustment can be done through a access hole on the RH side mudguard.

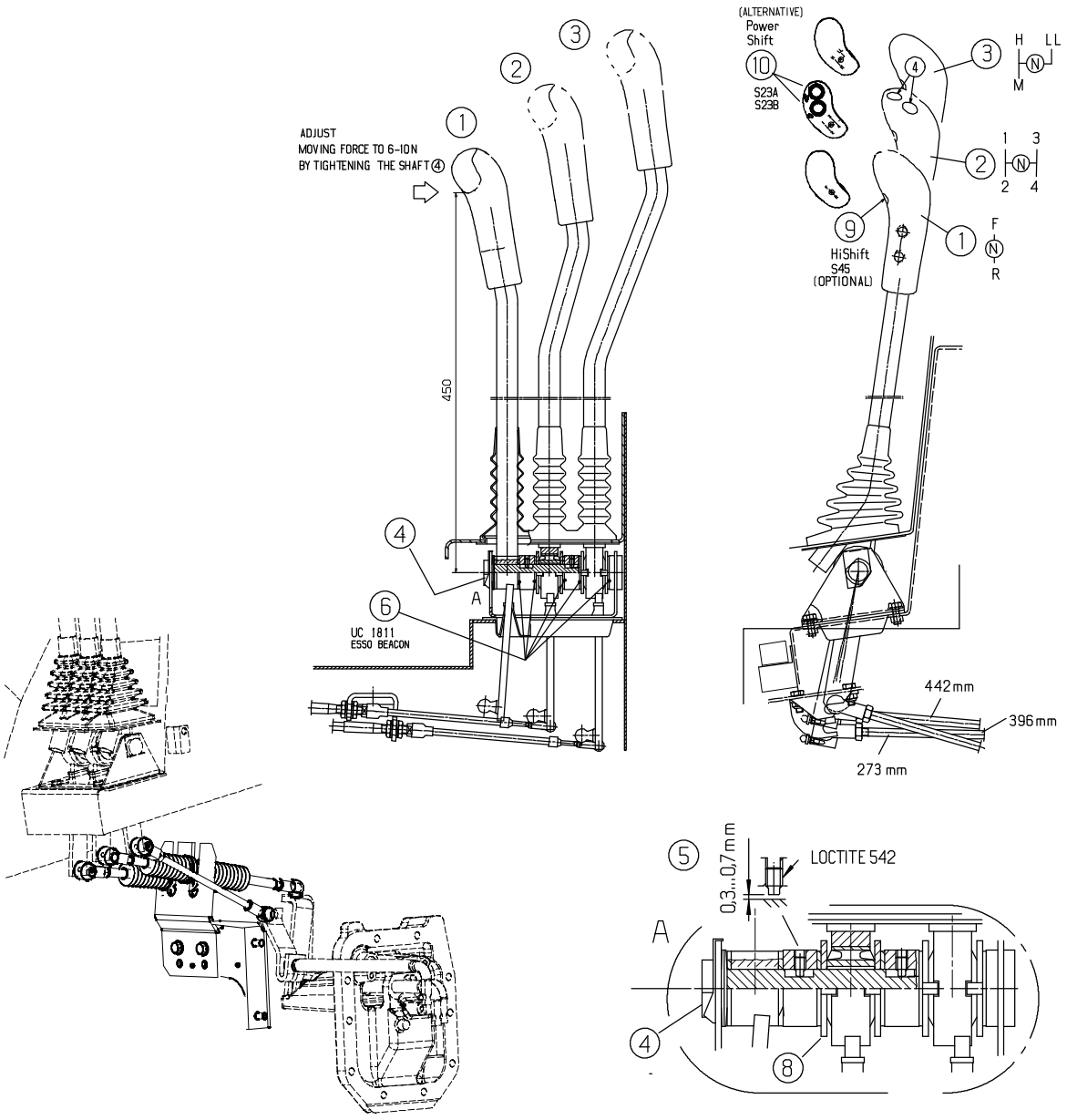


fig011

Gear levers, HiTech

The range gear lever (2) selects ranges LL, M or H. When selecting e.g. LL, the lever is moved first outwards and then forwards. The lever lower end first moves inwards and pushes via a cable the selector lever on the side cover outwards and it engages with a groove on the LL–range selector fork. When the range gear lever is then moved forwards, the lower part moves backwards and via shifter rods it turns the selector lever so that the LL–range engages.

1. Speed gear lever
2. Range gear lever
3. Plate with slots
4. Tightening the screw, adjust the clearance to 0,3...0,7 mm. The clearance allows the axial movement (there are cup springs at the end of the support shaft).
5. Shaft
6. Shifter rods

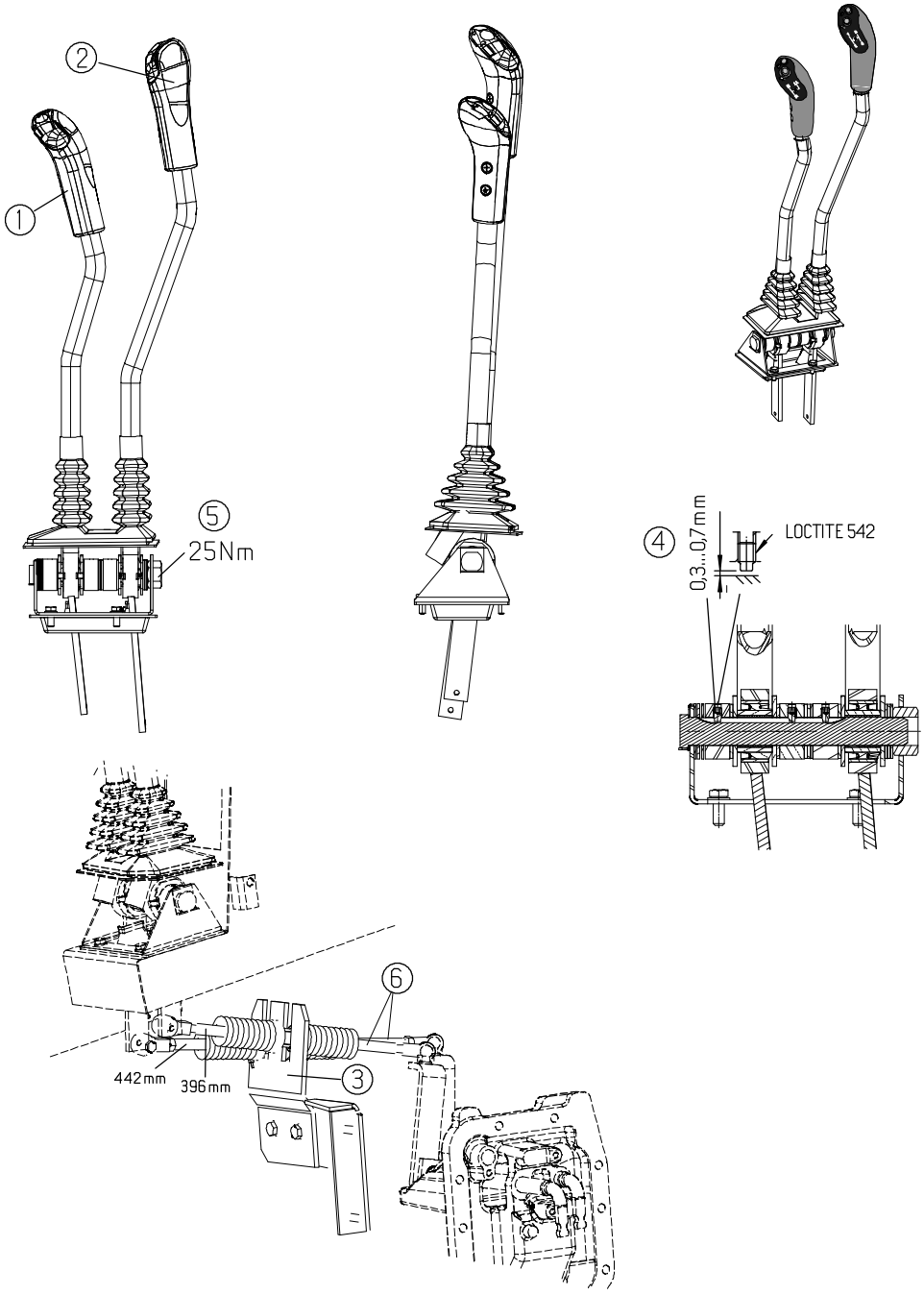


fig012

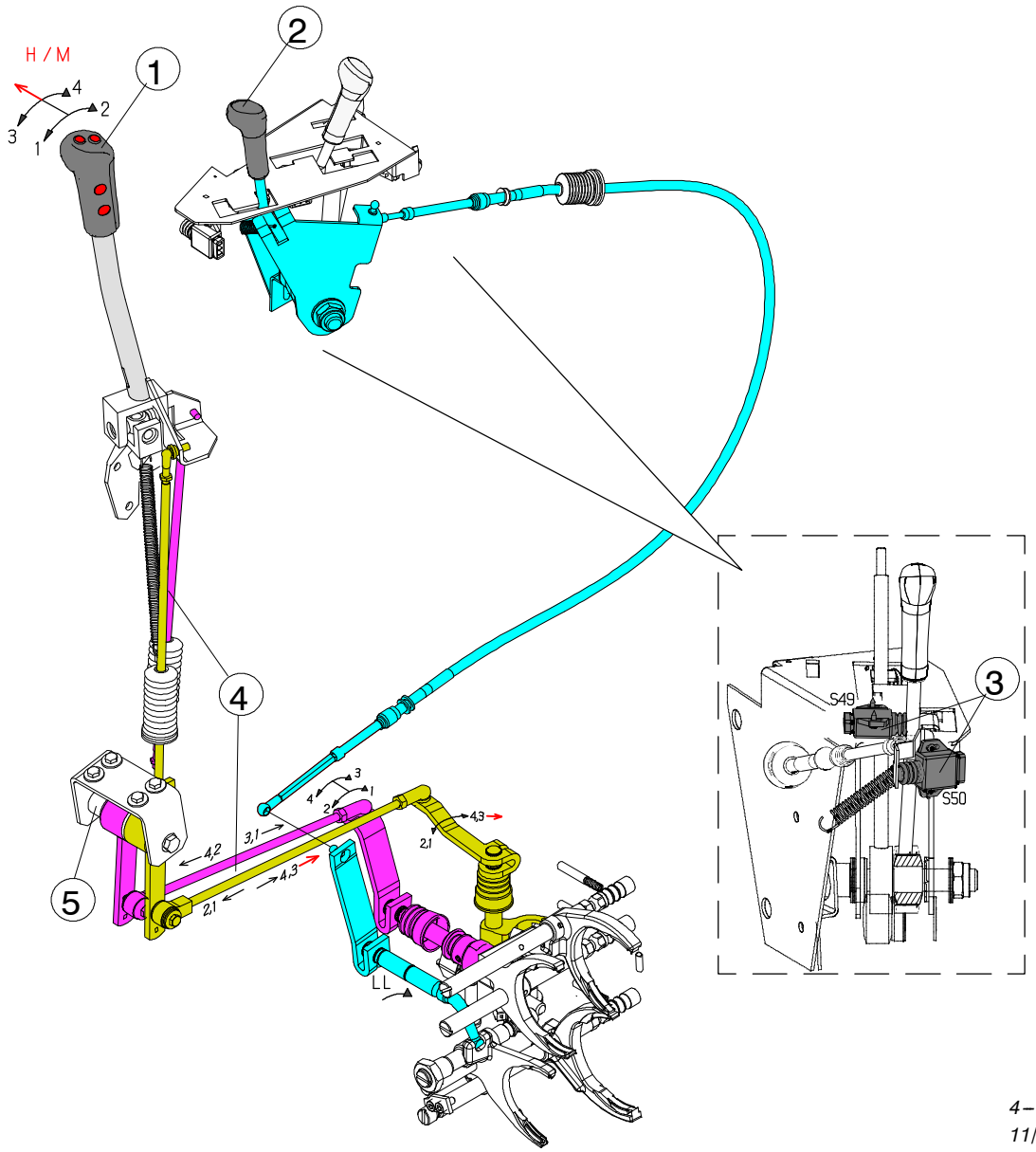
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Gear levers, LS

The range gear lever (1) is used to select the **four synchronized speed gears** and **speed ranges H and M**. The centre position is neutral. The speed gears can be used in all speed ranges: LL, M and H. (The LL speed range is an extra equipment actuated with a separate lever (2) when driving forward or in reverse.) The speed range (H/M) must be changed with the speed gear lever in the neutral position, pushing the lever to the right momentarily with the clutch pedal depressed. (The range gear function does not work with the HiShift switch.) The M range will engage only when the speed is **under 12** km/h. The driving can also be started with the H1 gear.

The LL gear lever (2) selects the LL range (driving speed below 2 km/h). When selecting e.g. LL, the lever is moved (with the clutch pedal depressed) first outwards and then forwards. The lower end of the lever first moves inwards and a cable pulls the selector lever on the side cover outwards whereby the selector lever connects with a groove on the LL range selector fork. Thus, when the range gear lever is moved forwards, the lower end of the lever moves backwards and, via shifter rods, turns the selector lever so that the LL range is engaged. Two switches (3) indicate the position of the lever, which is then displayed in the tractor terminal.

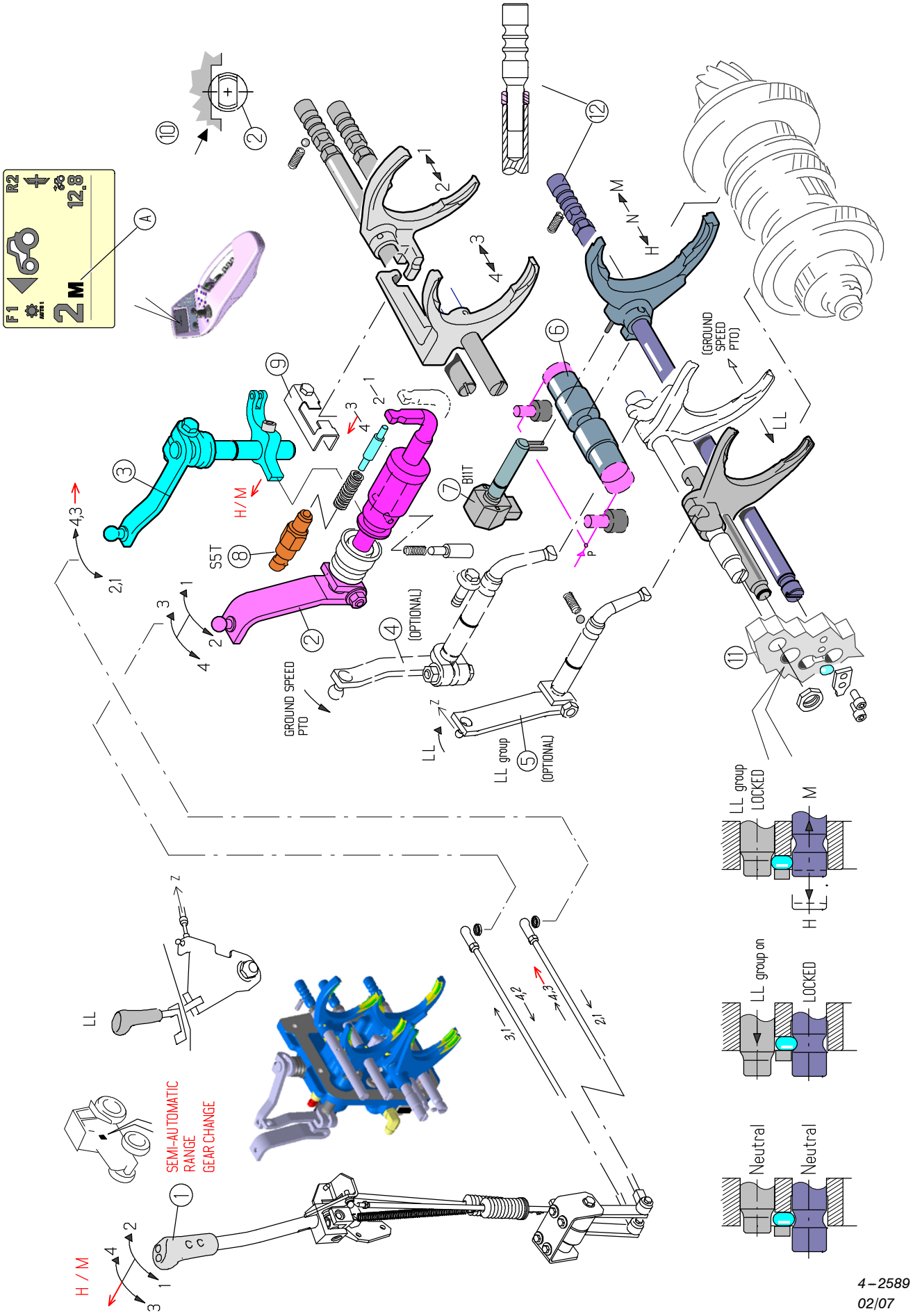
1. Semi–automatic range gear lever (main gear H & M)
2. LL gear lever
3. Switch
3. Switch
4. Shifter rods
5. Shaft



4–2740
11/06

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Gear shifting system (LS)



4–2589
02/07

This lever (1) selects **four synchronized speed gears** and **the speed ranges H and M**, the centre position is neutral. The speed gears can be used in all speed ranges LL, M and H (LL speed range is an extra equipment actuated with separate lever when driving forward/reverse). The change of the speed range H/M is done in the neutral position of the speed gear lever, moving the lever shortly right. At the same time the clutch pedal must be pressed (with HiShift switch the changing of the ranges doesn't function). The range M will engage only when the speed is **under 12** km/h.

The letter (**A**) H, M or LL on the display unit shows which speed range is engaged. Letter flashes as long as range is engaging.
NOTE: Too high driving speed or too quick engaging of the main gear may prevent the speed range engagement. Then range gear goes in neutral and the display shows in the point **A** the symbol **N**. Move the gear lever to neutral, and the speed range will engage and the main gear can be engaged.

When changing the main gears, the clutch pedal is not necessarily needed because of the HiShift switch in the lever. Due to the HiShift automatic selection the engaging is smooth. Use of clutch pedal is still possible if needed.

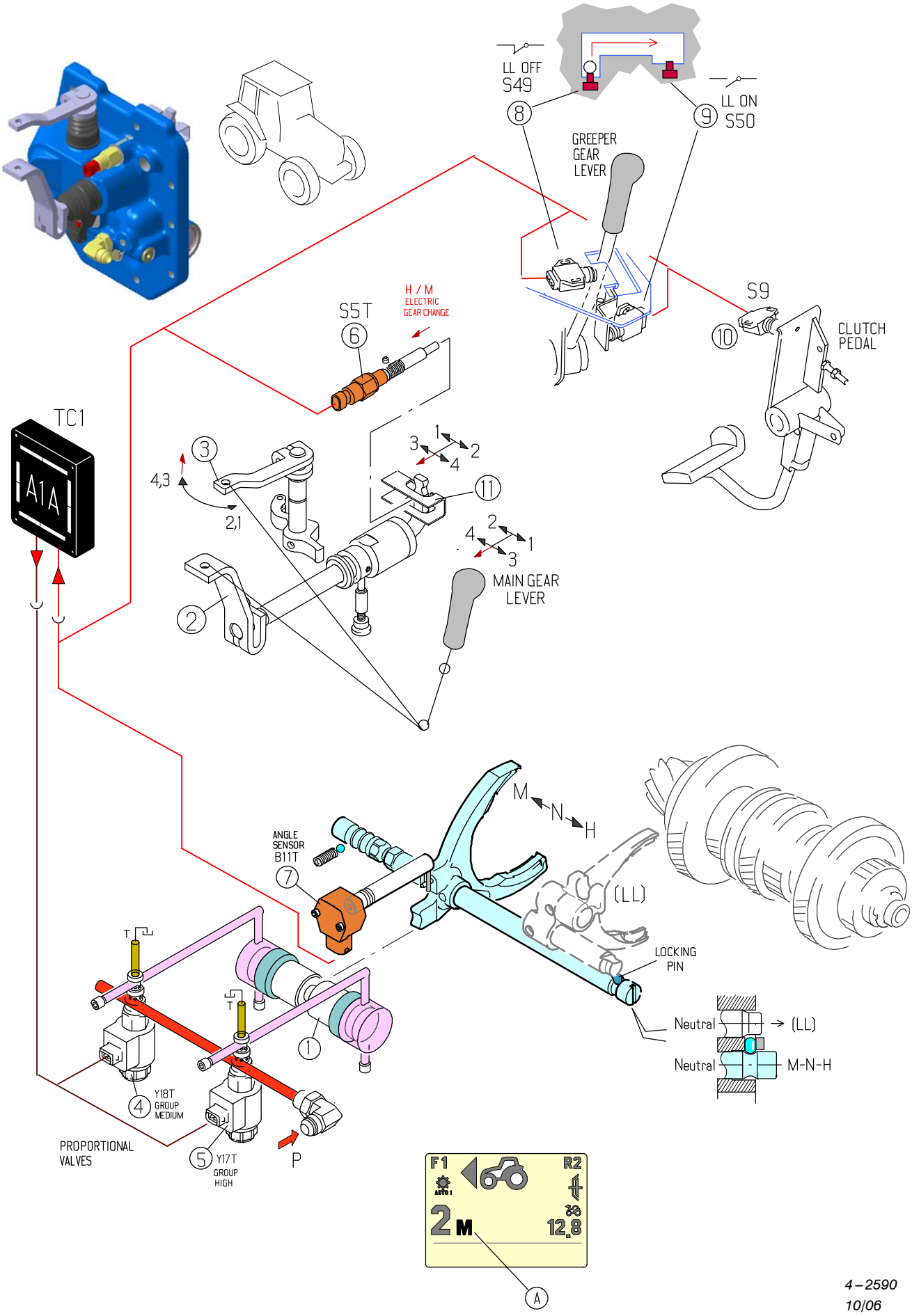
When after starting the display shows in the point A the symbol **N** and the change of the range takes (the symbol flashes and the range gear must be changed, always after **N** first go to the range **M**) about 3 seconds, the automatics have error function (see service codes). The driving can be continued temporarily by depressing the clutch pedal down until the range gear is engaged.

The range gear shifting system takes care of the shifting of the H and M range gears when needed by the driver. When shifting the LL group on, the system couples the H–M selector fork to the neutral position. The coupling of two gear ranges at the same time has been prevented with a mechanical block.

1) Gear lever
2) Lever (movements in tractor direction)
3) Lever (movements in transverse direction)
4) PTO lever (optional)
5) LL (creeper) group lever (option)
6) Piston
7) Angle sensor. Finds out the selector fork position (M and N)
8) Range change switch (S5T).
   When pushing the main gear lever to side direction, the change switch will be activated, and the range gear shifting system begins to shift the group.
9) Limit plate (same as earlier).
10) Groove in the housing.
    Ensures mechanically that the limit switch (S5T) activates only when the main gear is in the neutral position.
11) Locking block.
    Prevents the coupling of two gear ranges at the same time
12) Adjusting screw for the selector shaft
    new construction (screw is in the selector shaft)
    new thread M14x1,25 (pitch as earlier; makes the adjusting easier)

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Semi–automatic range gear



4–2590
10/06

The semi–automatic range gear system takes care of coupling the range gears **H** and **M** when needed by the driver. A side movement has been added to the gear change scheme in the neutral position between the 3th and 4th gears. When the lever is moved to this position, the switch **S5T** in the gearbox side cover will be activated and the electro–hydraulic range change system begins to change the range.

Range change process will be started, if all following conditions are fulfilled:

1. Clutch pedal fully depressed (switch S9)
2. Main gear in neutral (secured mechanically with plate **11**)
3. Speed under speed limit **12km/h** (change H–>M, the change M–>H has no limit)
4. Creeper gear **not** coupled (this has also a mechanical prevention: locking ball)
5. Range gear changing switch (S5T) activated.

The change of the speed range H/M will be done in the neutral position of the speed gear lever, moving the lever shortly right. At the same time the clutch pedal must be pressed (with HiShift switch the changing of the ranges not doesn't function). The letter (**A**) H, M or LL on the display unit shows which speed range is engaged. When the range is engaging the letter flashes as long as the automatic is engaged.

NOTE: Too high driving speed or too quick engaging of the main gear may prevent the speed range engagement. Then range gear goes in neutral and the display shows in the point **A** the symbol **N**. Move the gear lever to neutral, and the speed range will engage and the main gear can be engaged.

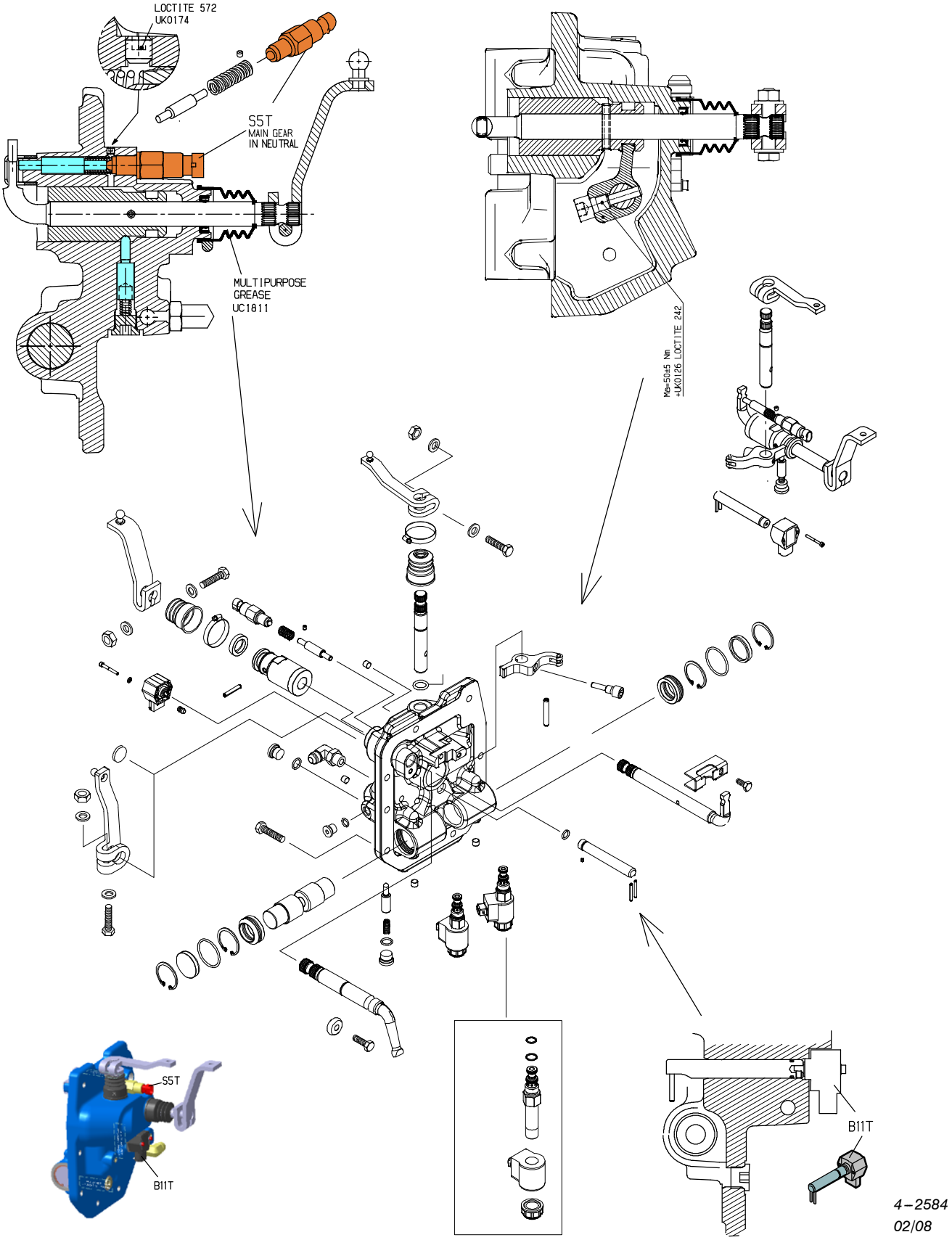
The semi–automatic range gear system takes also care of the coupling H/M range off when the creeper gear lever is moved to the on or off position. The creeper speed range is engaged by moving the lever to the front position. When engaging the creeper speed range, the tractor must be stopped (speed below 2 km/h / 1,2 mph).

– Depress the clutch pedal
– Move the creeper speed range lever to the on position. The automatics engage the H/M range to the neutral position. When engaging the LL flashes in the display point **A** (at the same time the symbol  in the instrument panel). After engaging the LL shows continuously (at the same time the symbol  in the instrument panel).
– Release the clutch pedal.

When the LL–range is disengaged the gearbox is in the neutral position and the display shows in the point **A** the symbol N. After selecting the range gear first time the range M engages.

1) Piston
2) Lever (longitudinal movements)
3) Lever (transversal movements + actuating the sensor B11)
4) Proportional valve (Y18T)
5) Proportional valve (Y17T)
6) Change switch S5T
7) Analog angle sensor (B11T)
8) Limit switch (S49, LL off)
9) Limit switch (S50, LL on)
10) Limit switch (S9, clutch pedal down)
11) Limit plate + groove (H/M group coupling movement only in neutral)

Limit switch and sensors



4–2584
02/08

When pushing the main gear lever to the side (away from driver), the limit switch (S5T) in the cover block activates and the range gear shifting system begins to shift the group.

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Synchronization

Synchronizing cones

On input shaft (couplers for gears 1–2 and 3–4): ø82 mm, steel.
On bevel pinion shaft (coupler for ranges M and H): ø90 mm, steel.
The synchromesh units on the input shaft are interchangeable and can be fitted either way. Measuring synchronizing cone wear and assembling the unit.

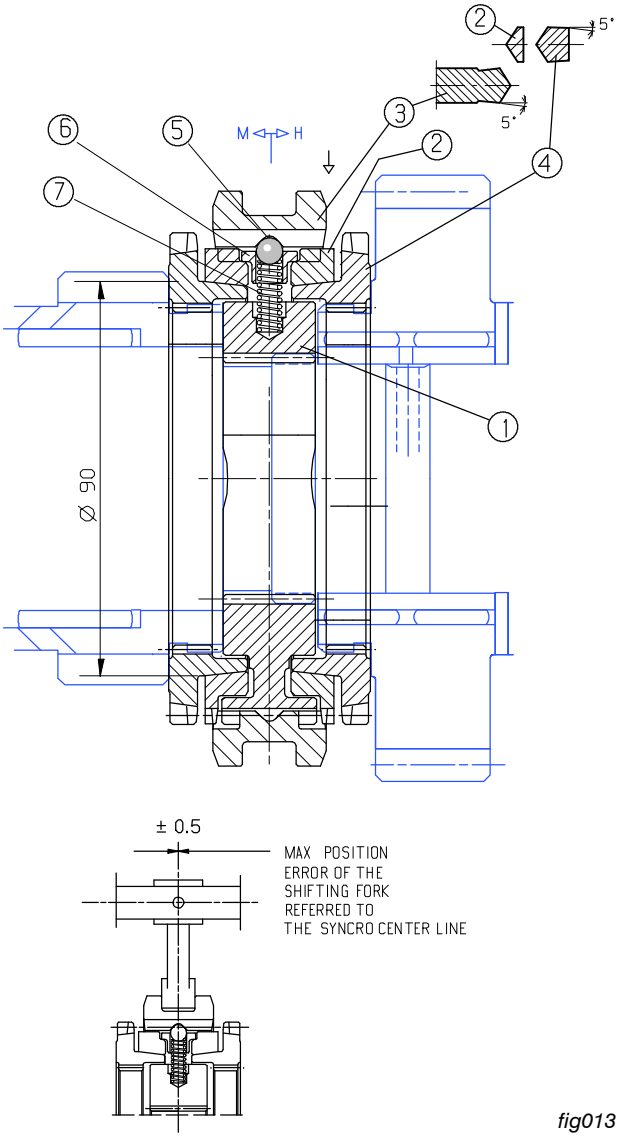


fig013

1. Synchro hub
2. Synchronizing cone (2pcs.)
3. Slidind sleeve
4. Coupler (2pcs.)
5. Ball (3pcs.)
6. Shoe (3pcs.)
7. Spring (3pcs.)

The gearbox is fully synchronized (except LL–range).

Engagement

The axial movement of the sliding coupler (3) presses the synchronizing cone (2) against the male taper on the coupler (4) by means of the balls (5) and shoes (6). The different speeds of the components to be coupled together produces staggering of their relative positions, limited by stops, which in turn causes the chamfered teeth on the synchronizing cone (2) to press against the sliding coupler (3), thereby preventing any relative movement of this coupler. The pressure exerted by the sliding coupler (3) and the staggered position of the synchronizing cone (2) creates axial pressure between the tapered friction surfaces on the synchronizing cone (2) and the coupler (4) by means of the chamfers on the teeth. This axial pressure gradually reduces the difference in speeds in order to achieve synchronization.

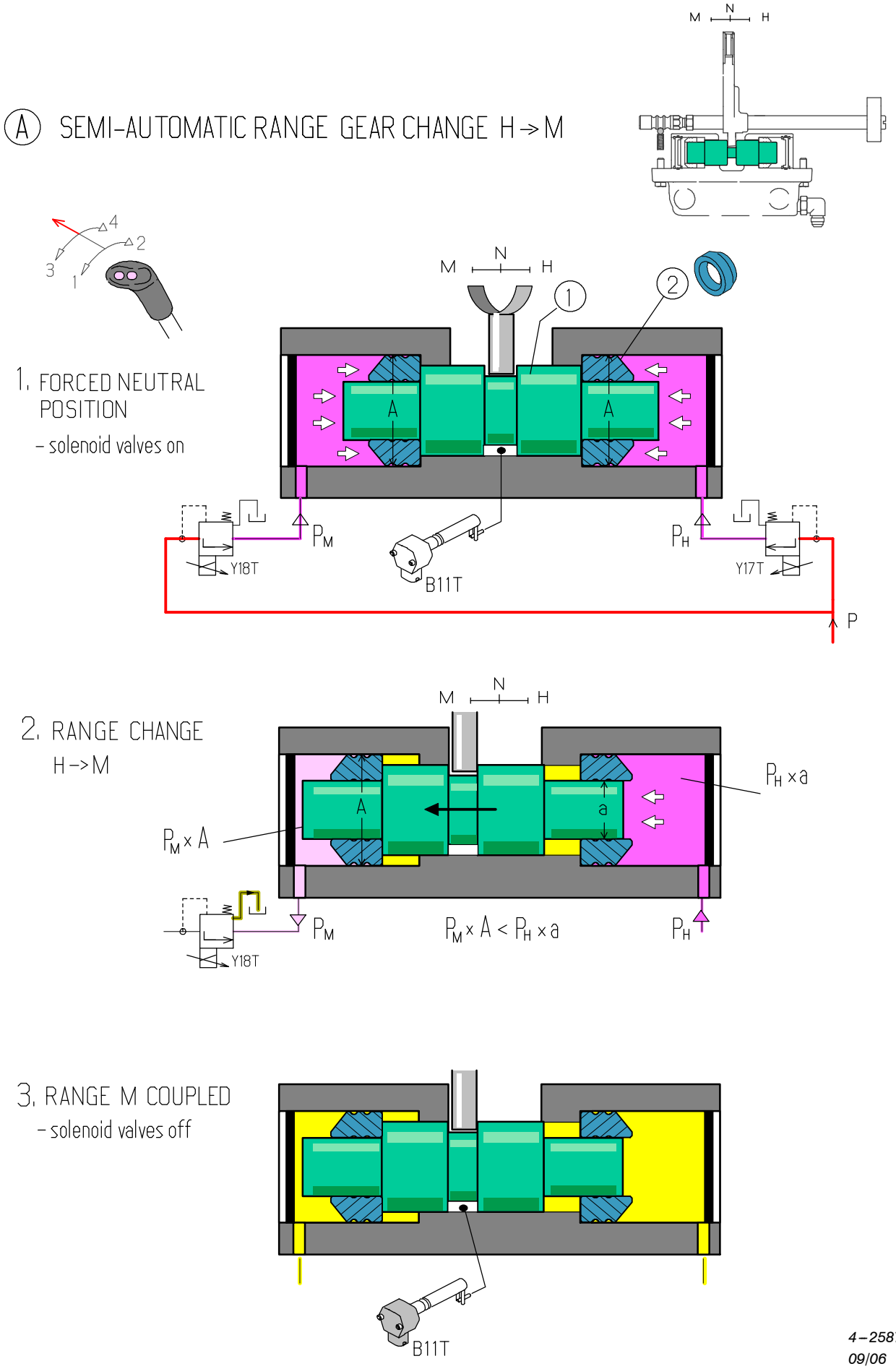
Once, the speeds have been synchronized, the sliding coupler (5) continues to exert pressure against the synchronizing cone (2) and pushes it backwards until the teeth in coupler (4) are opposite gaps between the teeth on the synchronizing cone (2). At this point the resistance, which had so far prevented the sliding coupler (4) from moving, is overcome and the sliding coupler (4) engages silently with the teeth in the coupler (4).

Neutral position

The sliding coupler (3) is in the middle position. Balls (5) are pushed into the V shaped groove in the sliding coupler (3) by springs (7). The gears can turn freely on the shaft. The sliding coupler (4) is locked in this position by three balls (5) held by springs (7).

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Function of the range gear shifting (LS)



4–2587
09/06

https://truckmanualshub.com/

The range gear shifting system takes care of the shifting of the H and M range gears when needed by the driver. When shifting the LL group on, the system couples the H–M selector fork to the neutral position (point B). The coupling of two gear ranges at the same time has been prevented with a mechanical block.

Function:

The selector fork M/H is moved with help of a hydraulic piston, which can be set into three positions **M**–**N**–**H**. The moving of the piston happens with help of two proportional valves.

By pressurizing both piston ends, the piston can be moved to **N** (middle position) and the **M** and **H** positions can be achieved by pressurizing one piston end and releasing the other.
After the desired gear has been shifted, both cylinder ends are made pressureless.

The positions of the selector fork are found out with an analog angle sensor. When changing the group, the position of the main gear is secured mechanically, so that the limit switch (S5T) of the group can be activated only when the main gear is in neutral position.

A) Semi–automatic gear change H–> M

1. Shifting to the neutral position
   When pushing the main gear lever to side direction (outwards from the driver), the limit switch (S5T) in the cover block will be activated, and the control unit (TC1) allows with help of the proportional (solenoid) valves the pressure to affect on both ends of piston. The piston moves to the neutral position.

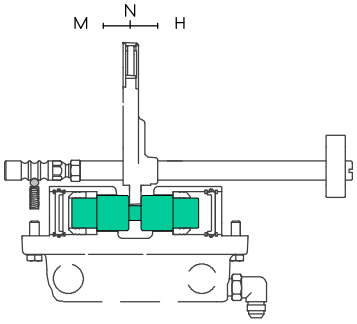
2. Immediately when the angle sensor (B11T) finds out that the piston is in neutral position, the pressure is reduced in the M– group side (P_M x A < P_H x a). The piston + selector fork begin to move to the M group direction with a controlled power (and speed).

3. The M group engages
   The angle sensor (B11T) notices that the shifting has been done and gives information about it to the control unit. Proportional (solenoid) valves couple both piston ends pressureless (to the tank).

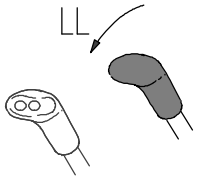
1) Piston
   the selector fork M–H (and the angle sensor B11T) are coupled to the piston

2) Ring piston

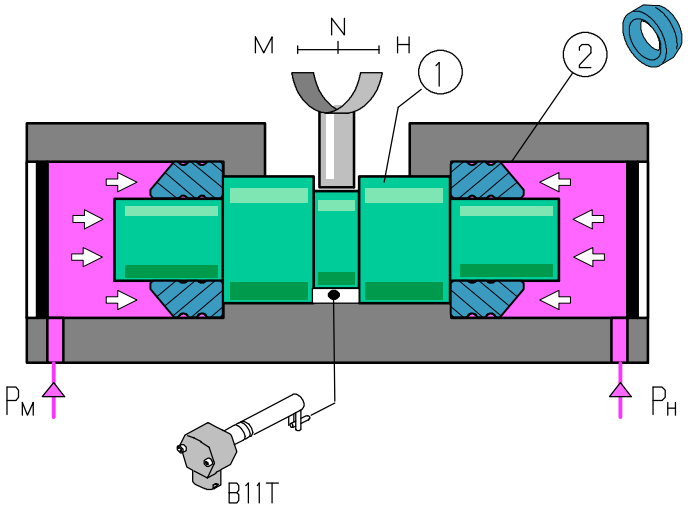
https://truckmanualshub.com/



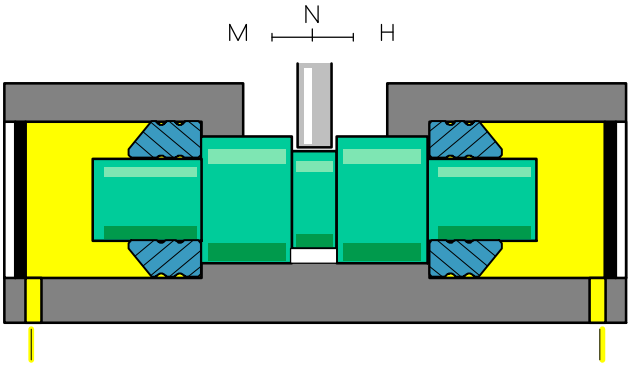
Ⓑ SECURING NEUTRAL POSITION WHEN CHANGING LL GROUP ON



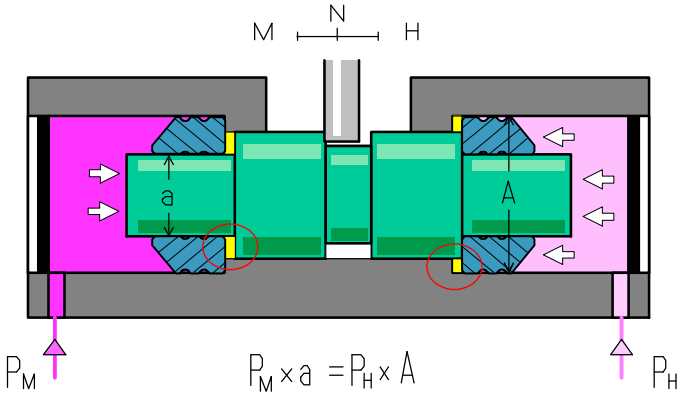
1. FORCED NEUTRAL POSITION
   - solenoid valves on



2. OFF
   - solenoid valves off



Ⓒ IF $P_M > P_H$



4–2588
09/06

B) Creeper group (LL) will be engaged.

At the same time the neutral position of the H–M group is secured.

1. When the creeper group lever is moved from OFF position to the LL position, a switch in the lever will be activated, and the control unit couples the H–M group gear to the neutral position. Equal pressure is led to both piston ends, and the piston (**1**) is hold in middle position.

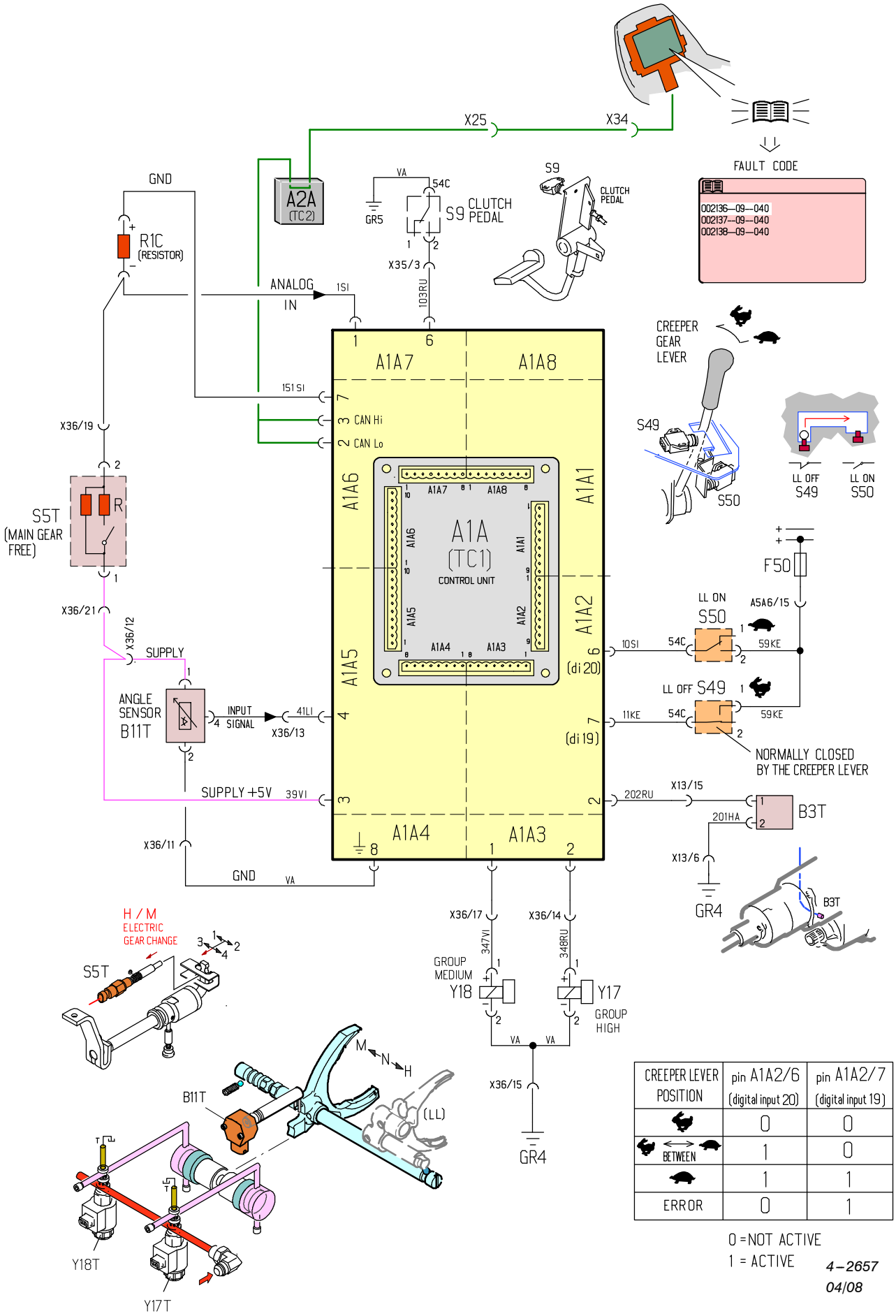
2. When the angle sensor (B11T) finds out that the piston is in neutral position, both proportional valves are switched off. Both piston ends become pressureless.

C) If there is pressure difference

If there for some reason a small pressure difference between the piston ends, the piston moves from the middle position to the direction of smaller pressure. At the same time the piston pushes the ring piston (**2**) to the direction of smaller pressure. In this case the area (**A**) becomes larger (counter force increases), and due to this, the piston movement stops. The piston remains in the neutral position as long as the forces against the piston ends are equal (P_M x a = P_H x A).

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Semi–automatic range gear wiring (LS)



CREEPER LEVER POSITION	pin A1A2/6 (digital input 20)	pin A1A2/7 (digital input 19)
🐓	0	0
🐓 ⟷ 🐢 BETWEEN	1	0
🐢	1	1
ERROR	0	1

0 = NOT ACTIVE
1 = ACTIVE

4–2657
04/08

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Differential

The crown wheel and differential case are mounted in the gearbox housing on taper roller bearings. Bearing preload and tooth backlash between the pinion and the crown wheel are adjusted with threaded flanges.

Four differential pinions on the differential. The side bevel gears and pinions in the differential case have plain bearings.

Differential lock

The differential lock is an electro–hydraulically controlled multi–disc clutch. The solenoid valve for the lock is placed on the servo valve block on the left hand side of the gearbox.

The low pressure pump supplies oil to the servo valve block via an external oil hose. A pressure–limiting valve on the servo valve block limits the diff. lock oil pressure to 1,8 MPa. Pressurised oil from the servo valve block to the diff. lock is conducted through a pipe inside the gearbox housing.

In the differential case cover there is a piston which presses the clutch discs together, thus connecting the differential bevel side gear to the differential casing.

The diff. lock can be engaged while driving. The differential lock disengages automatically, if the brake pedals (or one pedal) are pressed.

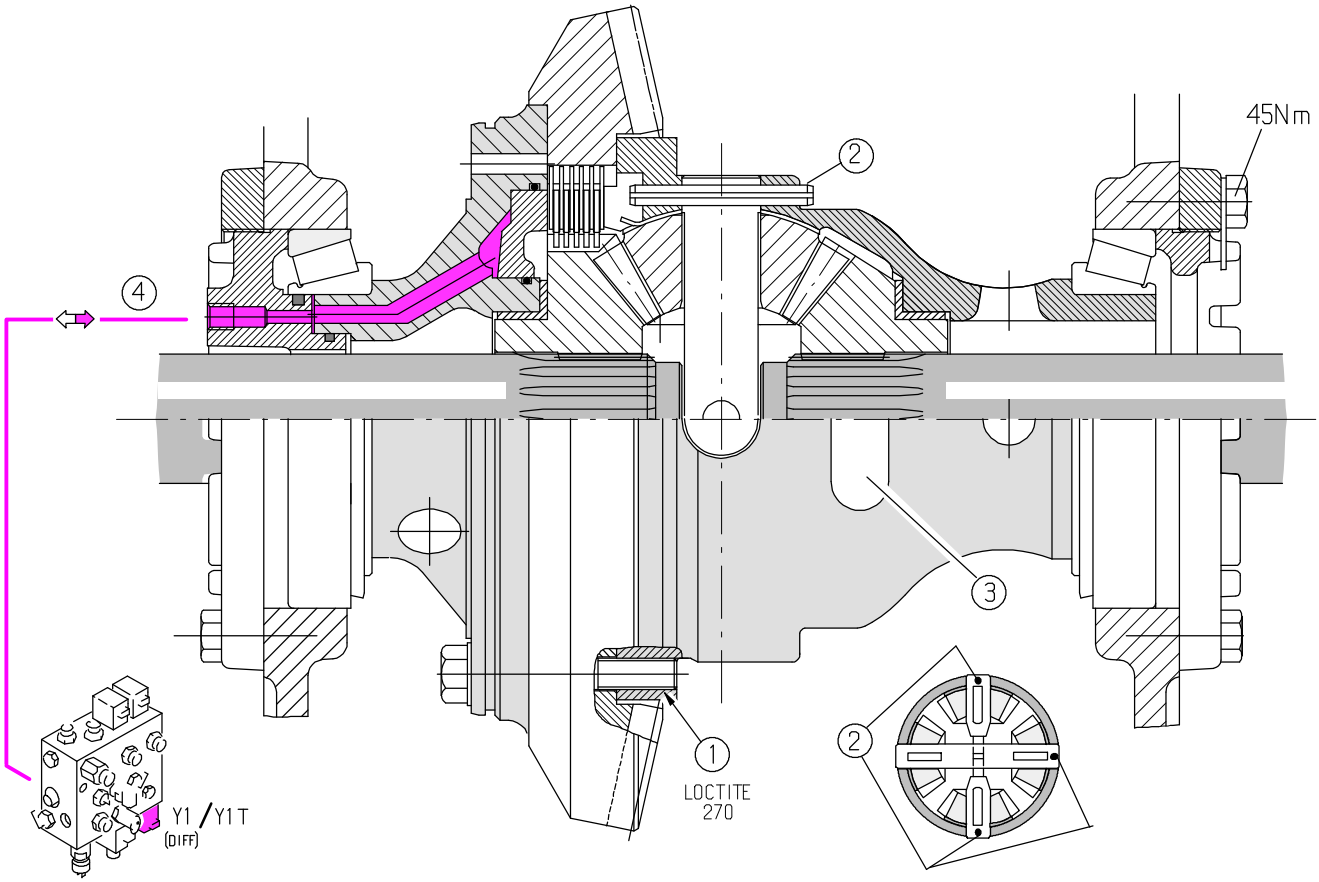


fig014

1. Loctite 270 on the crown wheel bolt threads
2. Note the position of the tension pin
3. Oil hole for lubricating oil from the PTO unit lubricating oil pipe hole.
4. Pressurised oil to the differential lock.

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Selector levers

Selector levers, which move the selector forks, are led into the gearbox through the side cover on the right side of the gearbox. Selector levers for speed and range gears can move also in– and outwards on the cover.

On the side cover there are fitted blocking pieces which prevent simultaneous engagement of two gears. At the outer end of the selector levers there are fitted shifter levers. Shifter rods and cable are attached to the shifter levers.

Also the selector lever for the ground speed PTO (optional) is led into the gearbox through the side cover (see section 46 Power take–off).

Note! Reverse shuttle selector lever is placed in front of the side cover (see section 44).

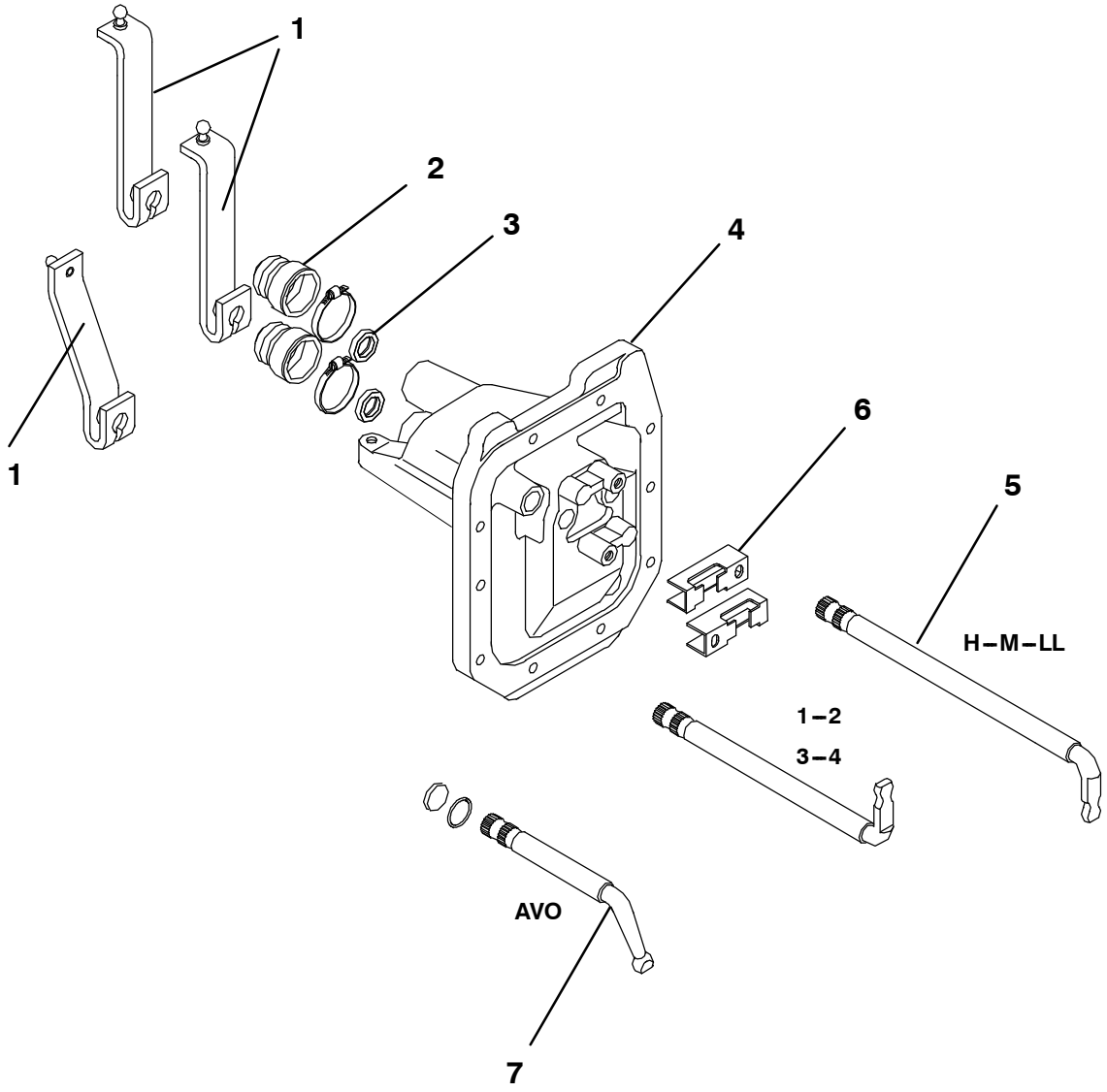


fig015

1. Shift levers
2. Lead–in rubber
3. Seal rings
4. Side cover (on the RH side of the gearbox)
5. Selector levers
6. Blocking pieces
7. Shift lever with PTO ground speed (if assembled)

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Selector forks and selector fork rails

The ball–headed selector shafts that move the selector forks have been taken into the gearbox through the lever cover that is situated on the right–hand side of the gearbox. The selector shafts of the range gears and the speed gears move also in– and outwards in the lever cover. In addition, the selector rod of the ground speed power take–off (if as option) is taken into the gearbox through the same cover.

The outer ends of the selector shafts are joined with the selector rods, that are in turn joined with the connecting rods that come from the lower ends of the gear levers (see illustration of the gear lever system. The inlets of the selector shafts are sealed.

The selector forks of the synchromesh units for ranges M – H and speeds 1 – 2 and 3 –4 are all mounted on their own selector shafts. The forks are fixed with pins on the shafts (note the position of the pins).

The rail for fork LL (and for the ground speed PTO fork) is attached to the gearbox housing with threads.

1) Push the synchromesh unit of the gear to its free (middle) position. Turn the selector shaft either into the adjustment piece or out, until the selector ring of the synchromesh unit is in the middle. In the disengaged position of the gearbox clutches the dents of the M–H and LL forks (as well as the dents of the forks for speeds 1–2 and 3–4) must cover each other completely.
2) The long pins into the two uppermost holes, and the shortest pin into the lowermost hole.
3) Universal grease (UC 1811) onto the selector shaft axles.
4) Hylosil packing compound (UK 0067) onto the joint surface of the cover.
5) Locking compound Loctite 242 (UK 0126) onto the screw.
6) Locked with ball
7) Because of the different moving distance, the sleeve on the (M–H, LL) selector rod end differs from the others sleeves. The sleeve has been marked with an identification groove.

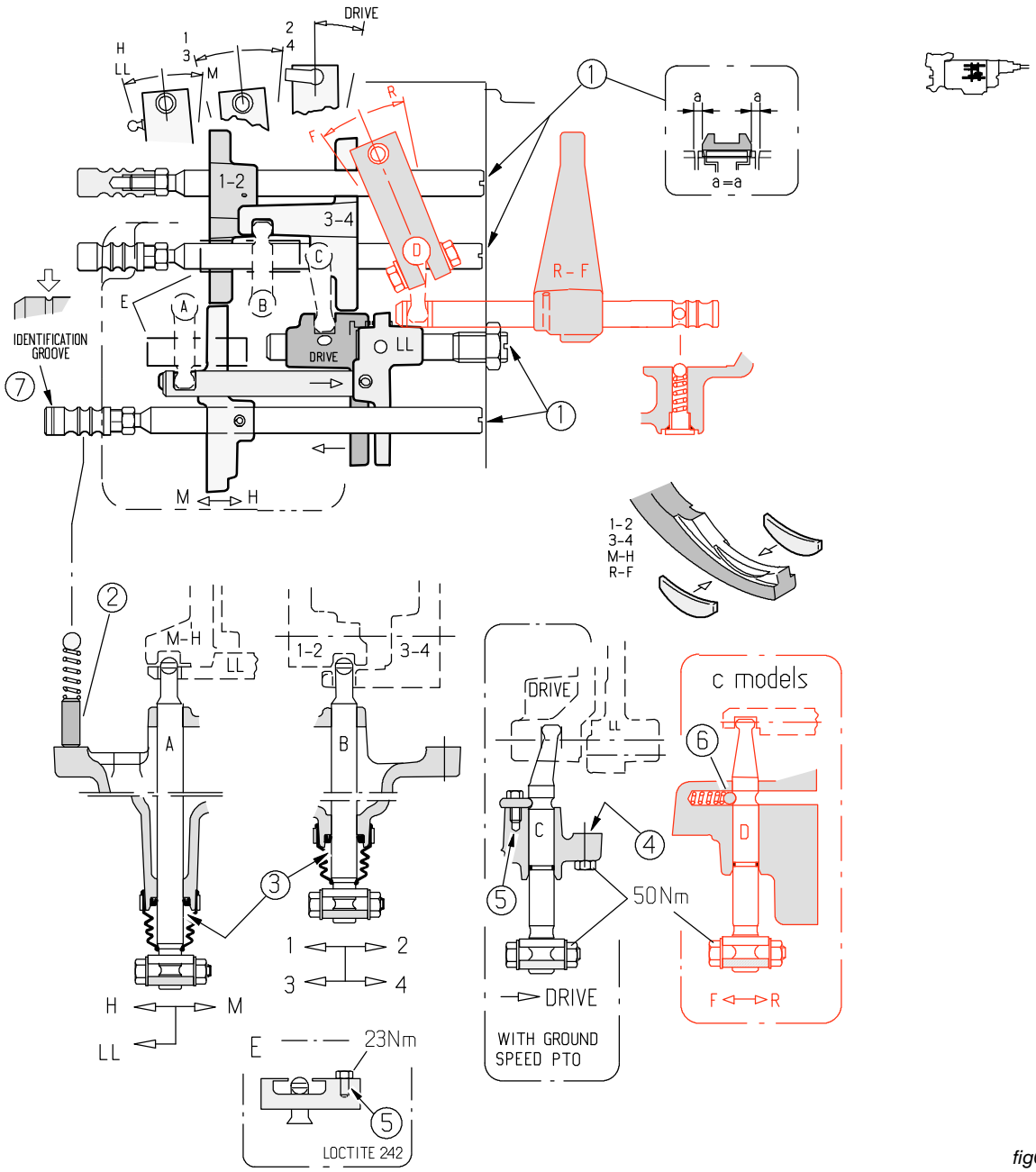


fig016

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Sensors

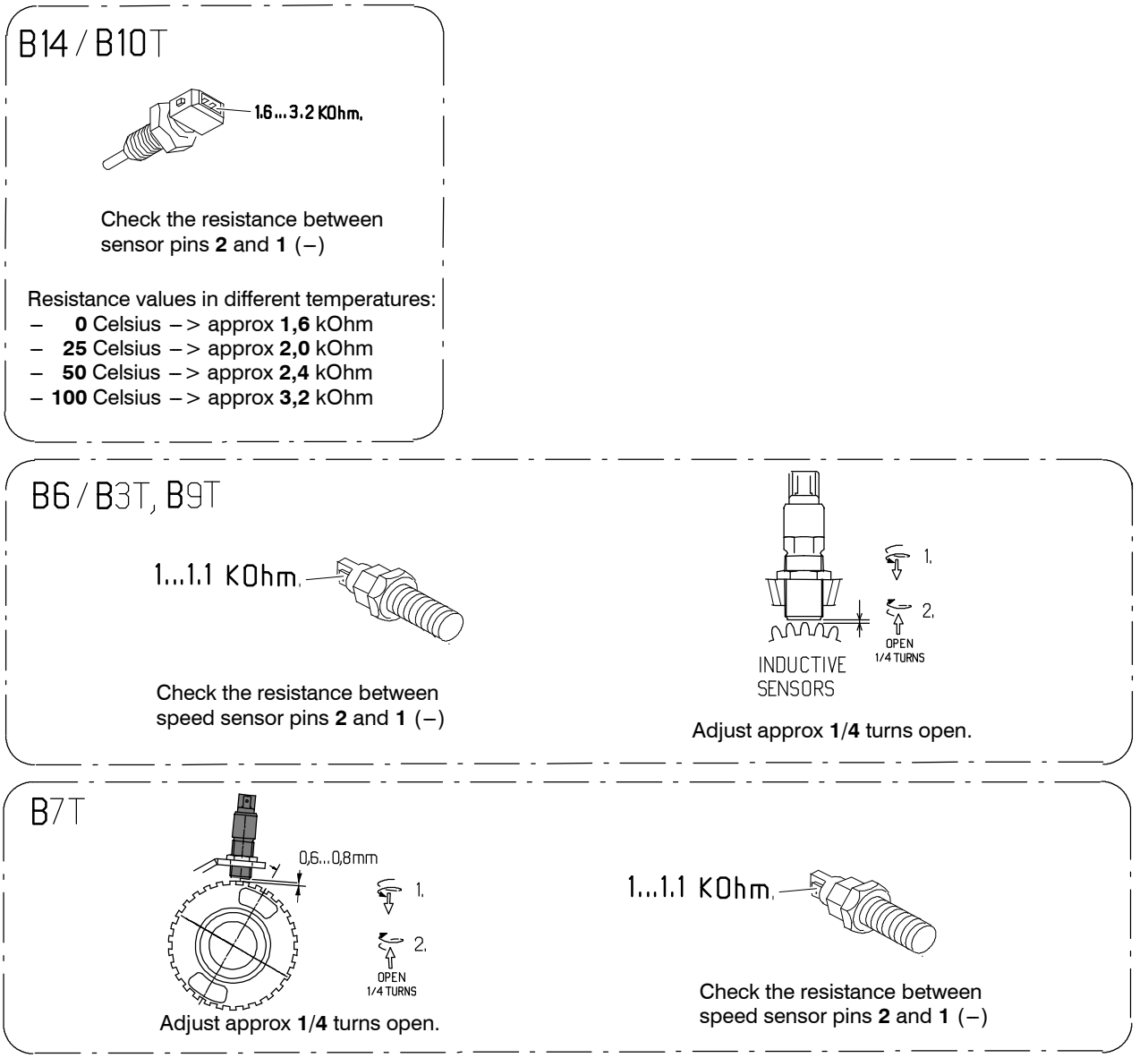


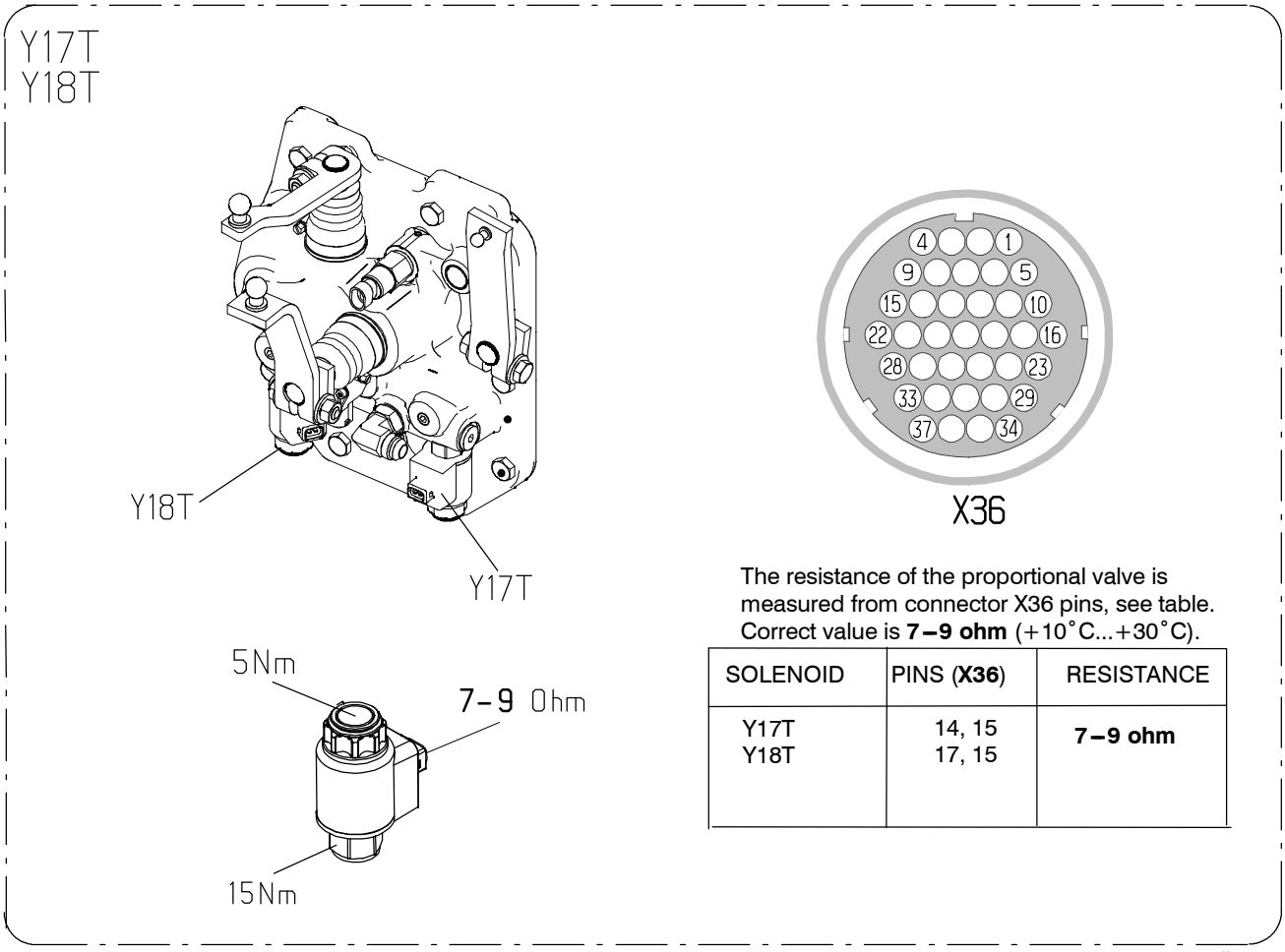
fig094

Location of the sensors in wiring diagram:

Symbol	Description	Page+position (in wiring diagram)	Location
AC9.2			
–B6	Speed sensor, gearbox	/2.D9	Transmission
AC10.2&AC10.21			
–B6	Speed sensor, gearbox	/3.D4, /15.D10	Transmission
–B6	Speed sensor, gearbox	/15.D10	Transmission
–B14	Temperature sensor, gearbox oil	/3.D6	Transmission
AC11.2			
–B3T	Speed sensor, gearbox	/5.D9	Transmission
–B7T	Speed sensor, 4WD axle	/12.D8	Transmission
–B10T	Temperature sensor, transmission oil	/10.D5	Transmission

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Solenoid valves (LS models)



The resistance of the proportional valve is measured from connector X36 pins, see table. Correct value is **7–9 ohm** (+10˚C...+30˚C).

SOLENOID	PINS (**X36**)	RESISTANCE
Y17T Y18T	14, 15 17, 15	**7–9 ohm**

fig096

Location of the sensors in wiring diagram:

Symbol	Description	Page+position (in wiring diagram)	Location
–Y17T	Solenoid valve, group: high	/7.C3	Transmission
–Y18T	Solenoid valve, group: medium	/7.C2	Transmission

Special tools

Gear shift lever mechanism (code 425.1)

ETV 894 080 . . . . . Drift for fitting selector fork rail for LL–range

Gearbox service (code 425.2)

ETV 893 300 . . . . . Puller for differential bearings
ETV 894 120 . . . . . Counter hold for puller ETV 893 300.
ETV 893 302 . . . . . Claws for puller ETV 893 300
ETV 892 230 . . . . . Socket spanner for bevel pinion shaft ring nut
ETV 893 340 . . . . . Plate for fitting bearing race, pinion shaft rear bearing
ETV 892 370 . . . . . Sleeve for fitting input shaft front end bearing
Sleeve for fitting bevel pinion shaft front end bearing
ETV 894 080 . . . . . Drift for fitting selector fork rail for LL–range
ET 894 060 . . . . . Press tool adjusting selector forks

Differential (code 425.3)

ETV 893 400 . . . . . Plate for fitting differential bearings
ETV 891 870 . . . . . Plate for fitting thrust bearing for differential side of gear

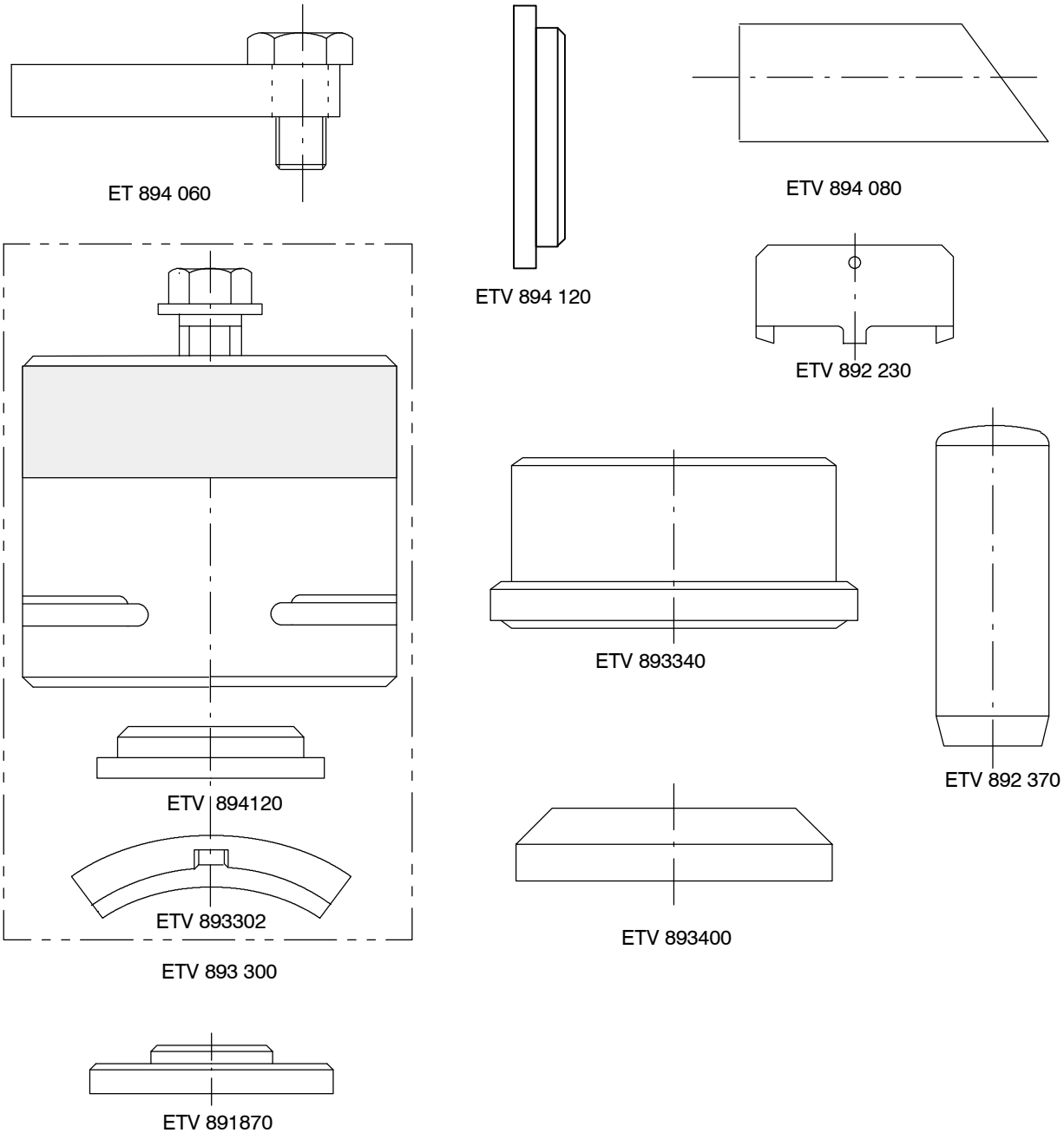


fig018

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Gear shift lever mechanism

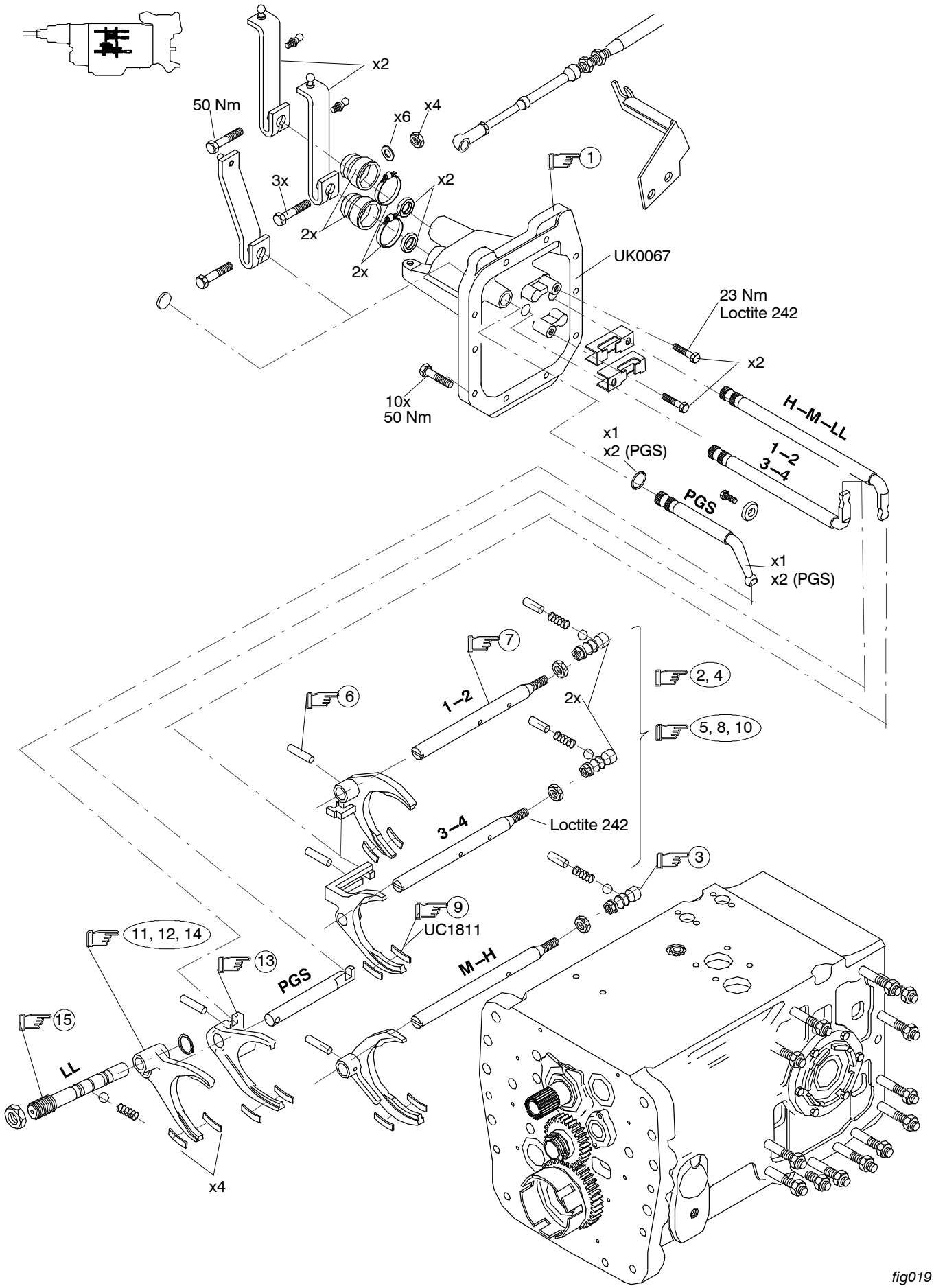


fig019

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Reconditioning the gear shift mechanism

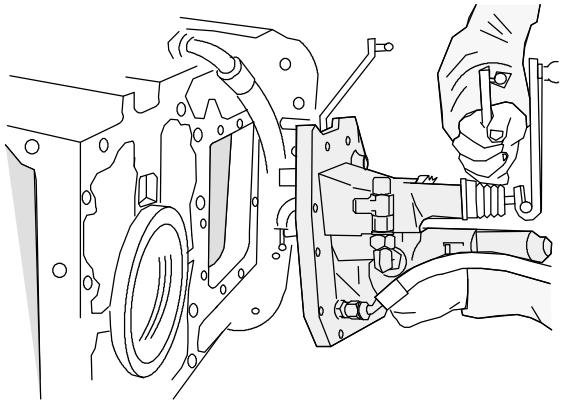


fig020

1. Before removing/fitting the side cover, move all gears to the neutral position.

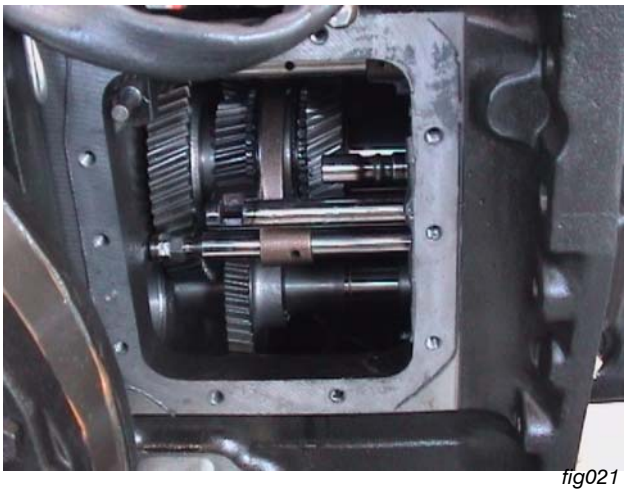


fig021

2. Check that, the locking balls, springs and pins of the selector rails are in holes.

Note! The longer pins into the two upper holes and the shortest pin into the lowest the hole.

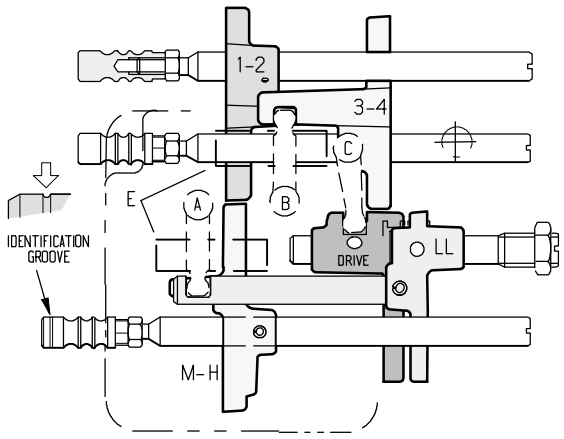


fig022

3. Because of the different moving distance, the adjusting piece on the (M–H, LL) rail end differs from the other adjusting pieces. The adjusting pieces has been marked with groove.

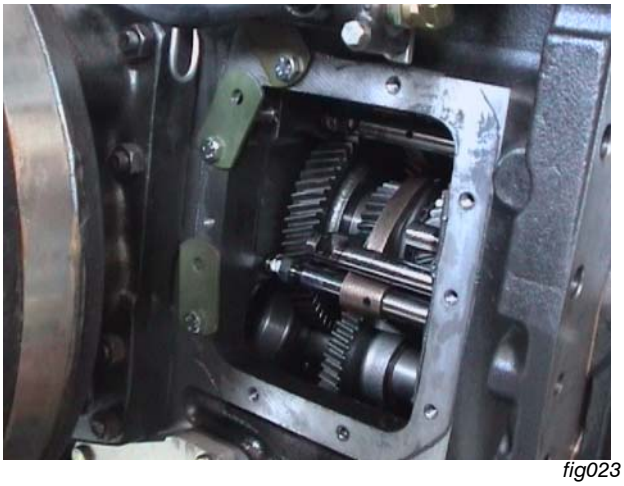


fig023

4. Before fitting the plates the selector rails must be in neutral position. With help of the plates the locking balls and the adjusting pieces stay in place.

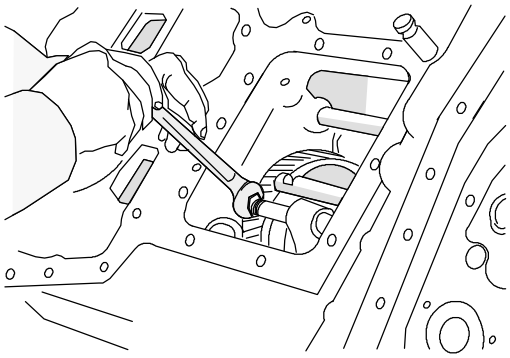




fig024

5. Move the selector fork and the sliding coupling to the middle position. Preadjust the position of the locking pin holes by turning the selector rail.

   After fitting the locking pin, finely adjust the selector fork position by screwing the adjusting piece at the rear end of the selector rail. Check the adjustment again by moving the selector fork to front and rear position Adjust in the same way all the selector forks.

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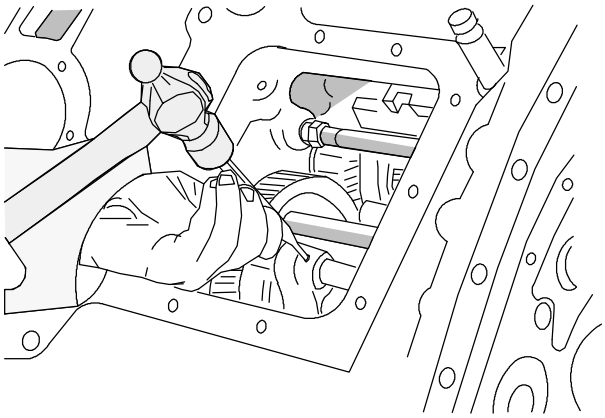




fig025

6. Engage gear 1. Tap the locking pins (3pcs, 1 – 2, 3 – 4 and M – H) of the selector forks and leave the pins in the selector forks (pins can disappear inside the gearbox). When the selector rail turns round, then the locking pin is clear of the rail.

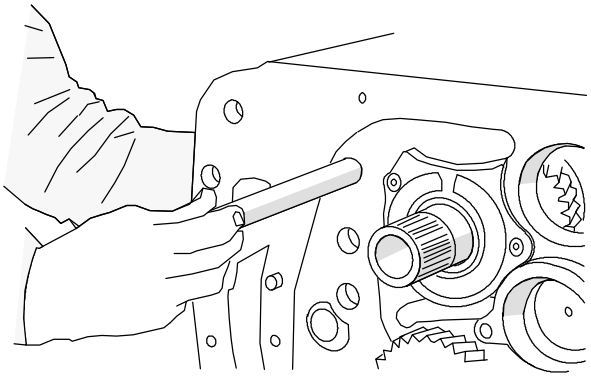


fig026

7. Unscrew the selector rails from adjusting pieces and pull out the selector rails forwards.

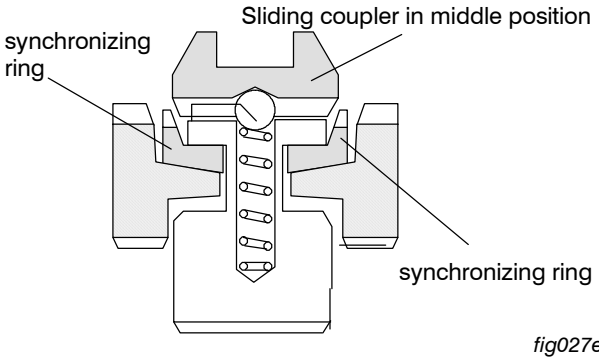


fig027en



fig028

8. Check that the sliding coupler is in middle position and the synchronizing rings move loosely (must not be against to the gear wheel). If the synchronizing ring is against to the gear wheel then torque rises up (the bevel pinion shaft and the transmission shaft rotate badly).



fig029

9. Use grease in fitting the sliding pieces.

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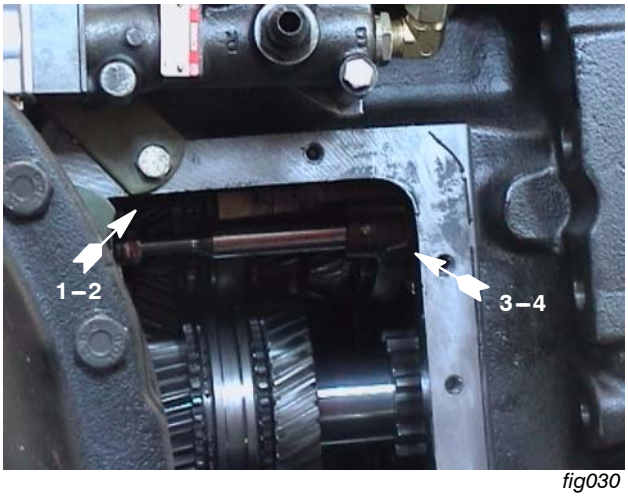


fig030

10. Installation order for the selector forks:
    – first fit the 1–2 selector fork.
    – the 3–4 selector fork.
    – the 3–4 selector rail.
    – the 1–2 selector rail.



fig031

– fit the M–H selector fork.

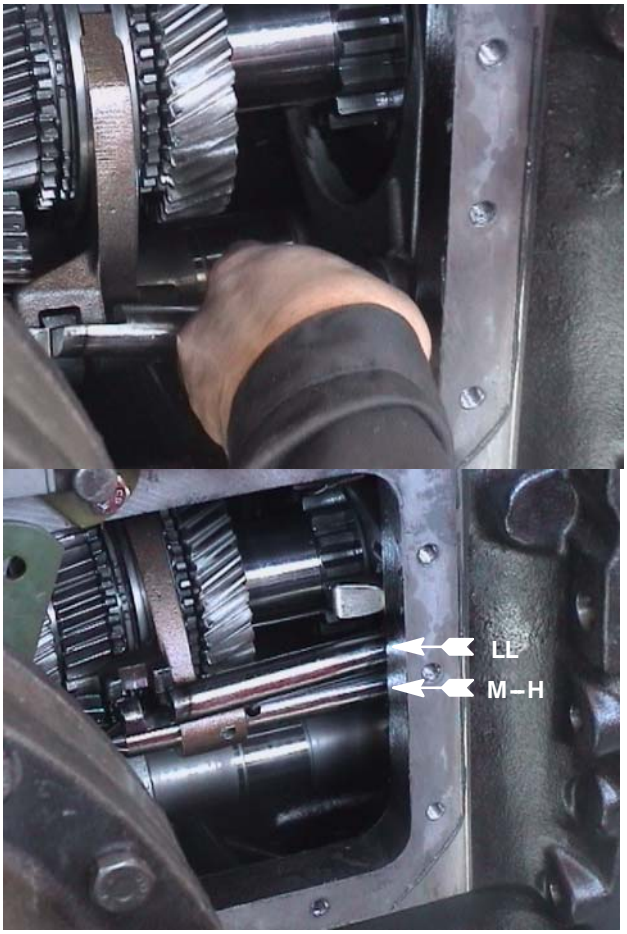


fig032

– fit / pass the LL selector fork and rail **assy** past the sliding coupler and then move it first down a bit and finally move up to the sliding coupler.
– fit the M–H selector rail.

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fig033

11. Special tool ETV (ETV 894 080).



fig034

12. Fit the spring, ball and the special tool (ETV 894080) into the LL selector fork. The special tool holds the ball and spring in place, when pushing the LL–selector rail through the selector fork.



fig035

13. Special tool ETV is a straight end pin Ø **20** x **15**mm (only the **ground speed PTO** for transmission). Because of the lack of space, use shorter special tool (the selector fork of the ground speed PTO makes the installation complicated).

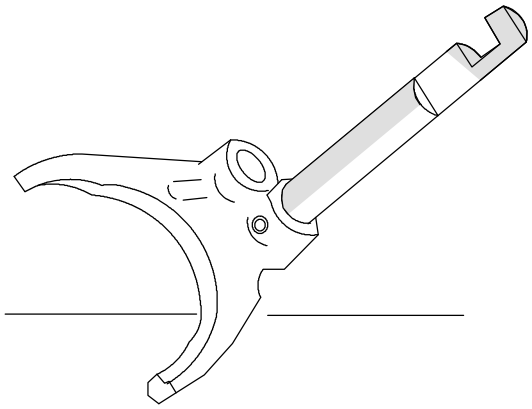


fig036

14. Fit/remove the LL–selector fork and the rail assy. **Note!** The groove on the shaft upwards.

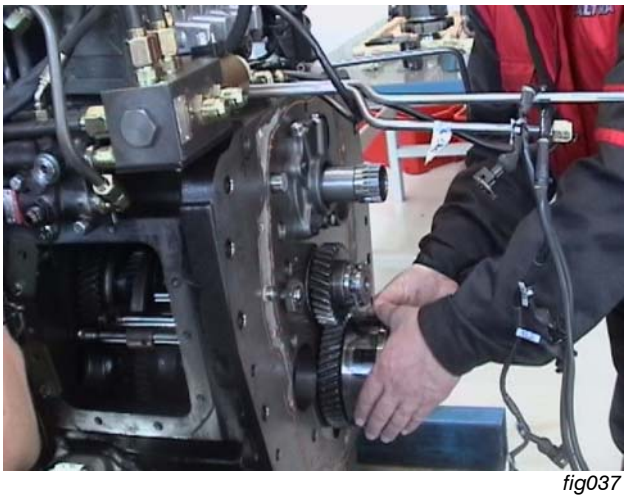


fig037

15. Adjust the LL–selector rail in both directions and find the middle point for the selector fork. If the sliding coupler is too much in extreme position against to the coupler then a knocking is heard (rotate the transmission shaft).

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Disassembling gearbox

In this instruction the gearbox has been removed from the tractor. In addition to the external oil piping, the following components have also been removed:

– final drives together with brake housings
– power shift gear
– reverse shuttle.

Removing differential

Place the gearbox in the fitting stand. Instruction below is shown in the correct working order. In addition, the gearbox below has been equipped with parts for optional ground speed PTO.

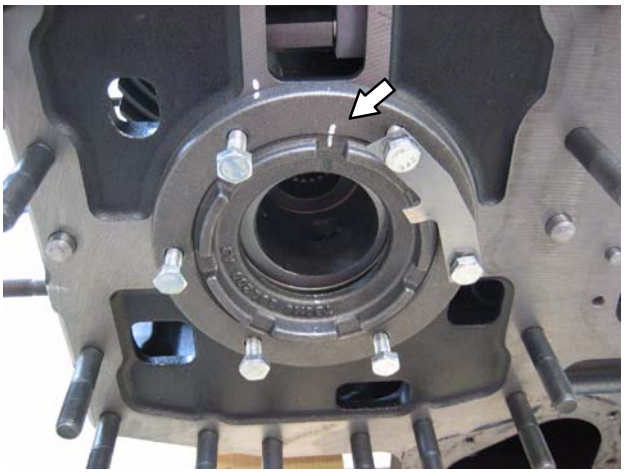


fig128

1. **Note!** Before removing, mark the position of the differential bearing flanges for easier assembling.

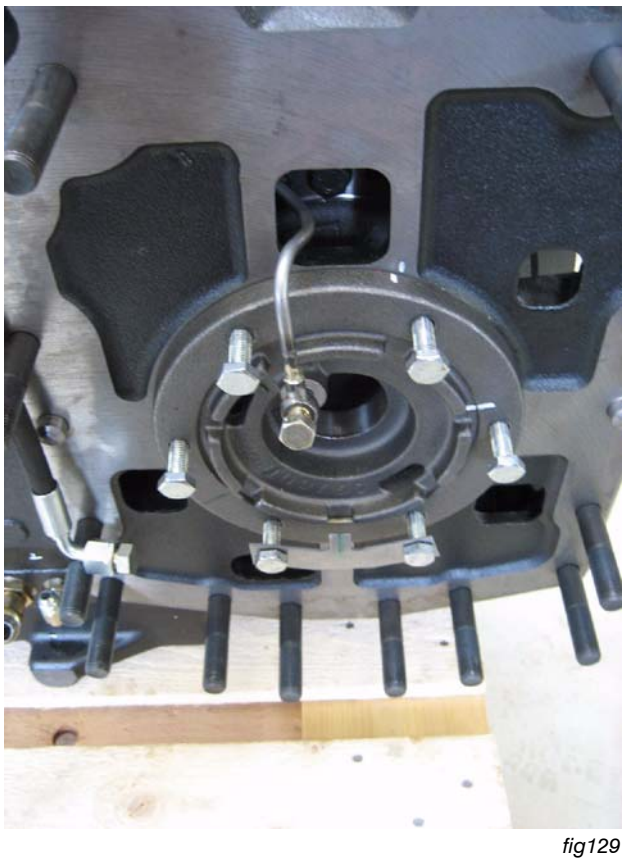


fig129

2. Detach the differential lock pressure oil pipe from the LH side bearing flange and bend the pipe to one side.

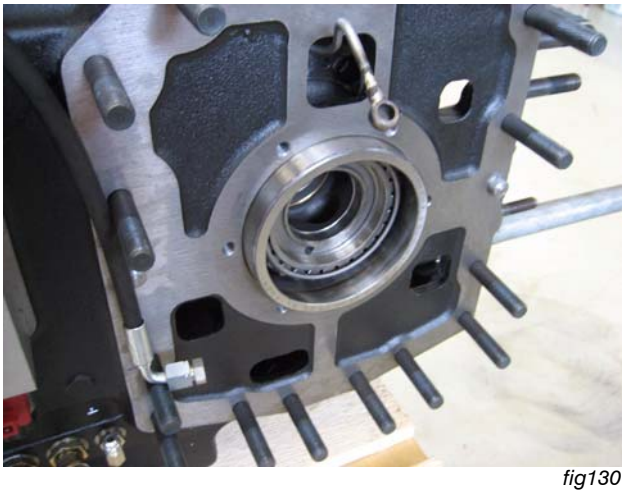


fig130

3. Remove the LH side bearing flange and push the differential to the left until the outer track of the LH side bearing is pushed out from its housing.

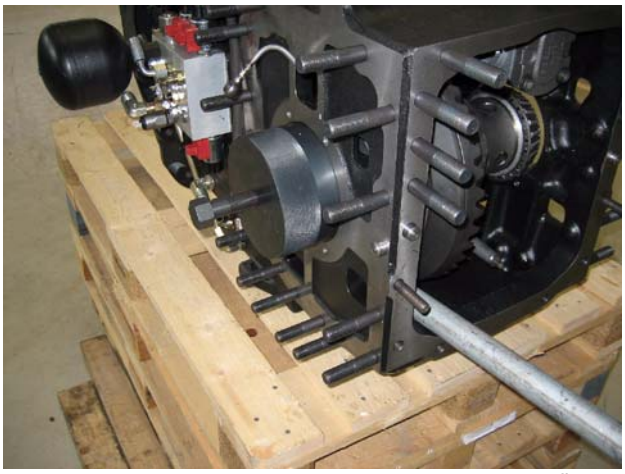


fig131

4. Use puller ETV 893300 with a counter hold tool ETV 894120 and claws ETV 893302 to remove the LH side bearing.

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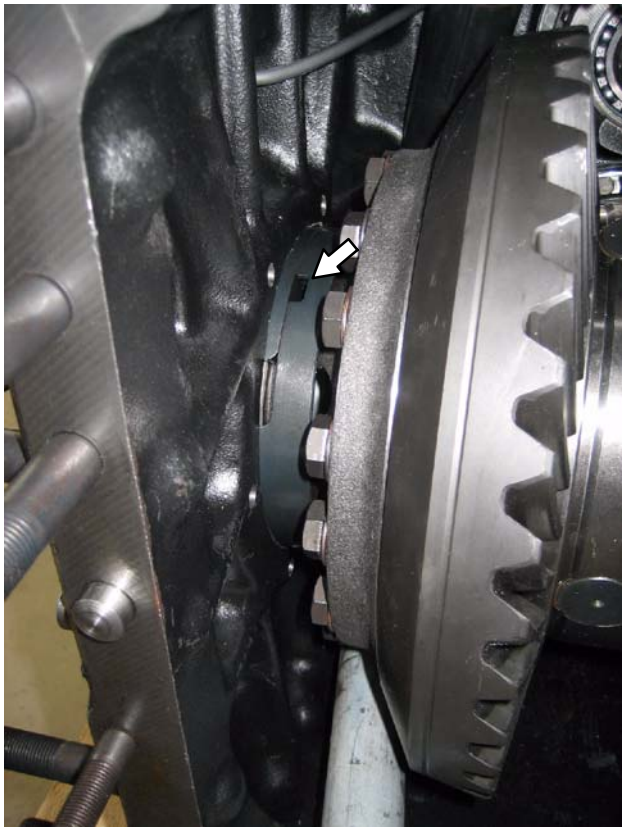


fig132

5. **Note!** Do not tighten the grip of the puller until the claws are inside the bearing opening as shown in the picture.

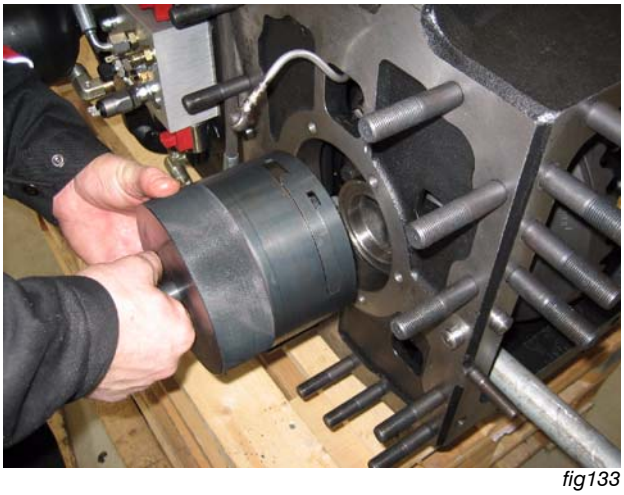


fig133

6. Remove the bearing.

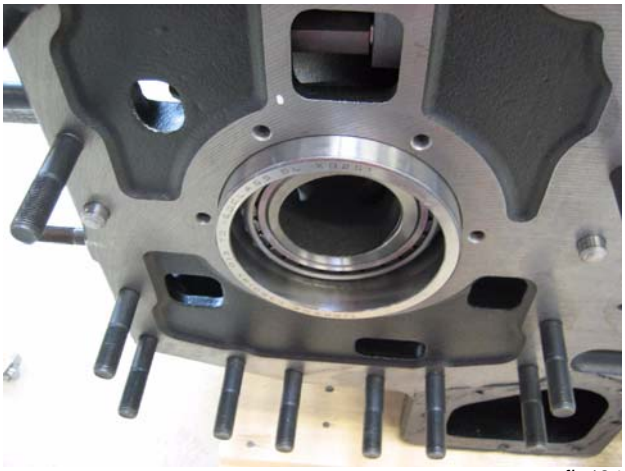


fig134

7. Remove the RH side bearing flange and the bearing outer race.



fig135

8. Lift out the differential from the gearbox. There is no need to detach the RH side bearing.

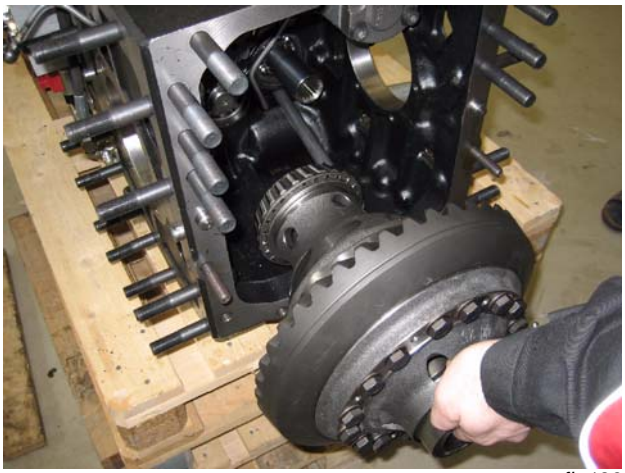


fig136

9. For the reconditioning of the differential see section **425.3**.

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Removing side cover

Note! The side cover can also be detached from the tractor without removing the gearbox. Only the oil need to be drained from the gearbox.

1. Set the range gear to neutral position before removing the side cover.

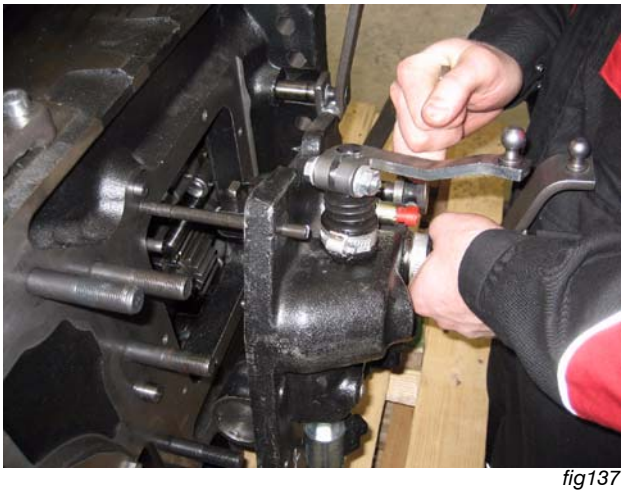


fig137

2. Unscrew the side cover bolts and pull out the cover holding it straight. **Note!** Use guide pins, if necessary.

Removing pump

Note! The pump and suction pipes can also be installed with the differential in place, if necessary.



fig138

1. Open the two pump suction pipe clips and make sure that the suction pipe is disconnected. Do not disconnect the bottom end of the pipe.

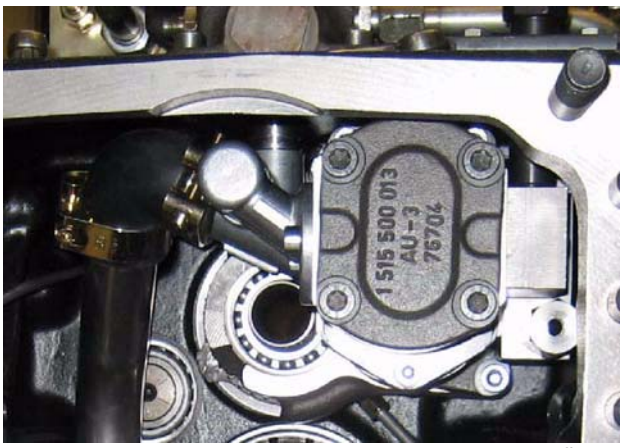


fig139

2. Open the plug on the rear side of the lubrication plate and press the lubrication pressure valve with a screwdriver until you can lift up the connecting tube of the suction tube.

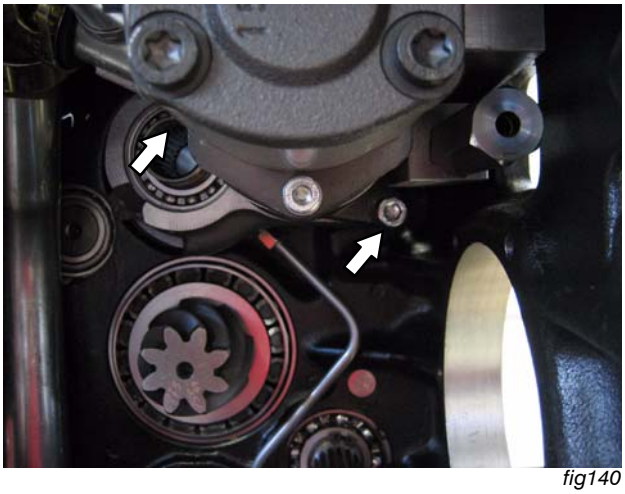


fig140

3. Unscrew the fixing bolts of the pump (two M8 hex bolts).

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fig141



fig142

4. Unfasten delivery couplings the on the top of the gearbox.



fig143

5. Remove the pump.

Removing selector forks



fig144

1. Unscrew the nut at the front end of the LL gear rail.



fig145

2. Remove the mechanical coupling lock.

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fig146

3. Store the blocking pin in a safe place.

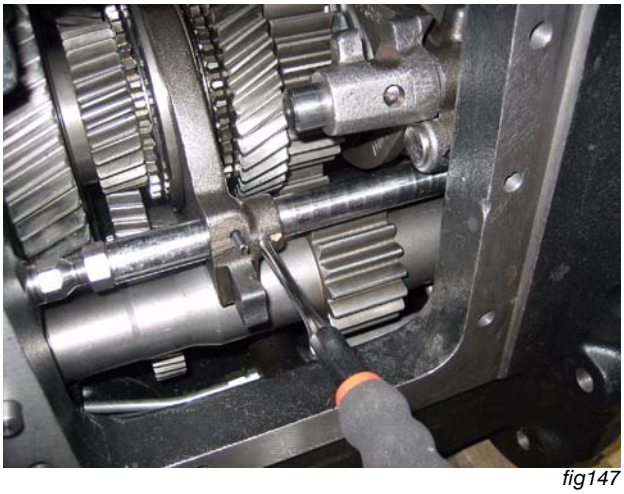


fig147

4. Tap out the locking pin of the shifter rail for gears M and H.



fig148

5. If only the shifters are to be serviced, the adjusting pieces can be locked into place using metal sheets.

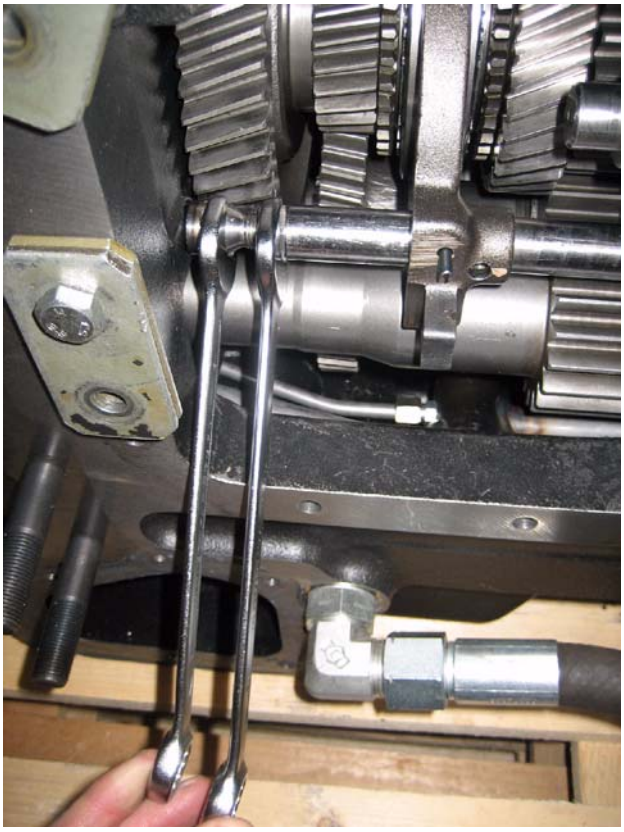


fig149

6. Unscrew the locking nut of the adjusting pieces.

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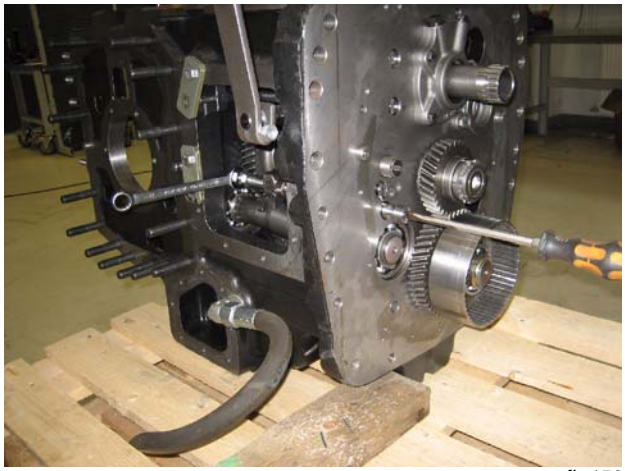


fig150

7. Remove the shifter rail from the gearbox by inserting a screwdriver in the groove at the front end of the rail and turning it.

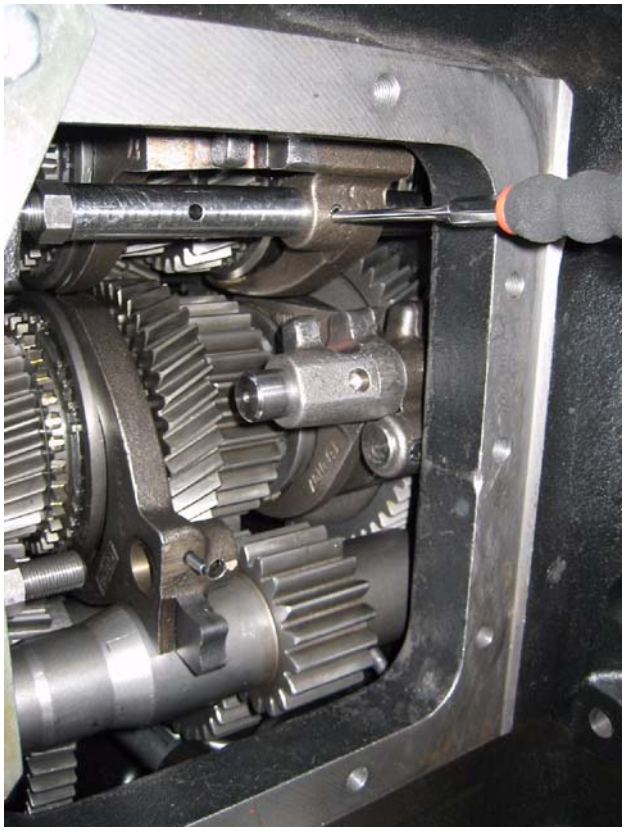


fig151

8. Tap out the locking pin of the shifter rail for gears 3 and 4.

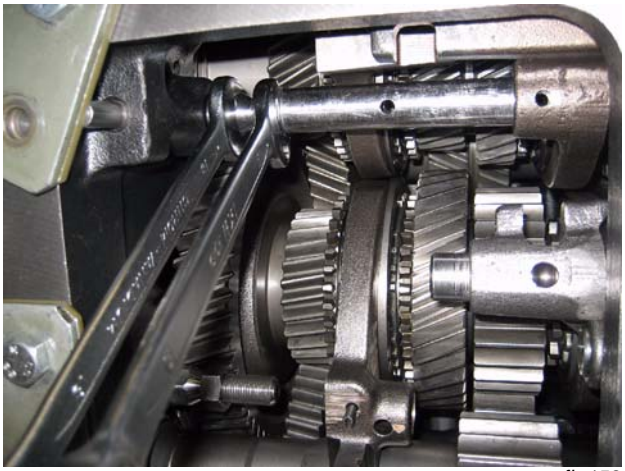


fig152

9. Unscrew the locking nut of the adjusting pieces.

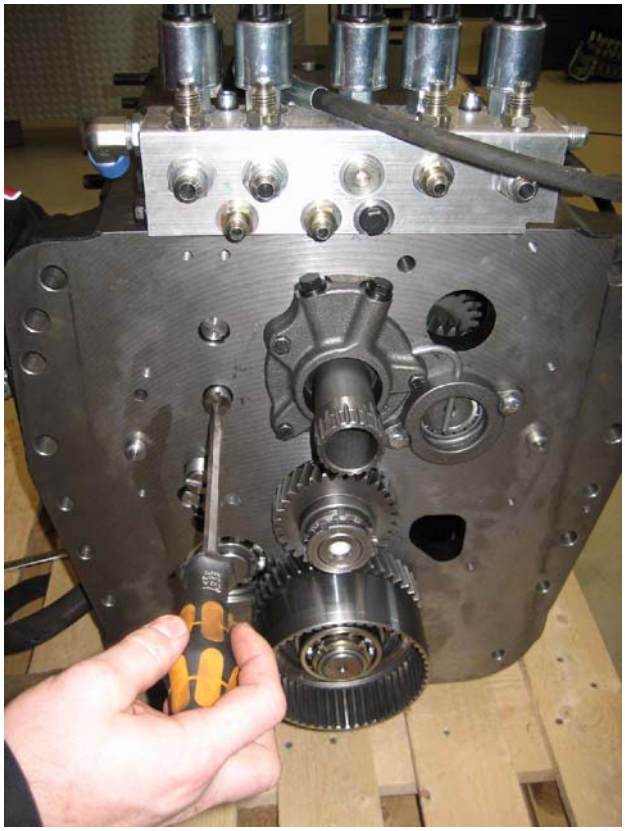


fig153

10. Remove the shaft from the gearbox by inserting a screwdriver in the groove at the front end of the shaft and rotating it.

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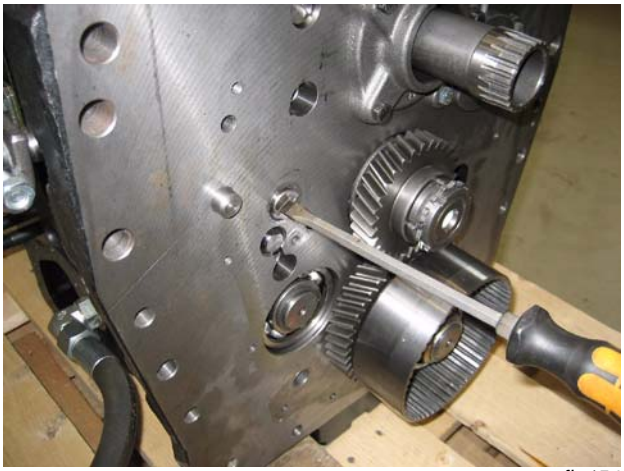


fig154

11. Rotate the (optional) ground speed PTO shaft to move the ground speed PTO and LL shifter rails backwards inside the gearbox.



fig155

12. Tap out the locking pin of the shifter rail for gear LL.



fig156

13. Remove the circlip from the ground speed PTO / LL shifter rail.



fig157

14. Remove the ground speed PTO shifter rail.



fig158

15. Fit the installation tool ETV 894080 into the selector fork. The tool holds the ball and spring inside the fork in place.



fig159

16. Remove the ground speed PTO selector fork from the gearbox.

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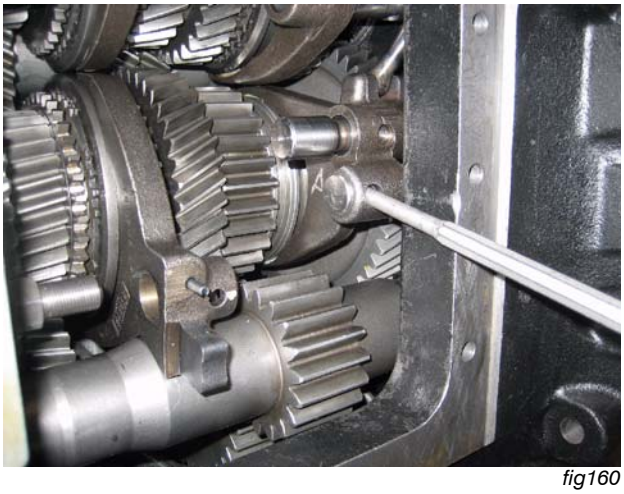


fig160

17. Tap out the locking pin of the shifter rail for gear LL.

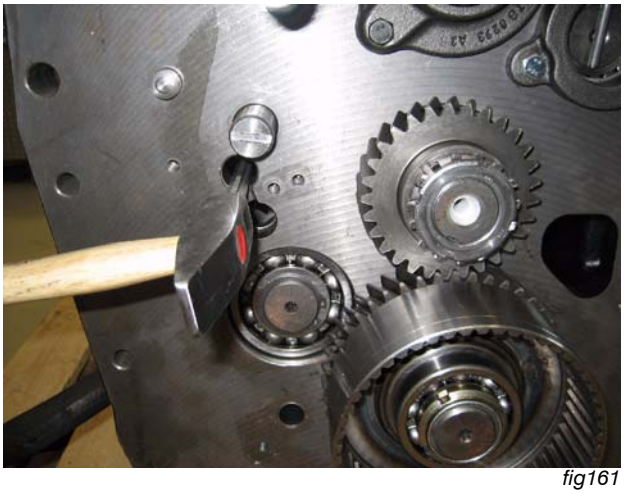


fig161

18. Tap the shifter rail for gear LL to move it backwards.



fig162

19. Remove the shifter rail for gear LL.



fig163

20. Remove the selector fork for gears 3 and 4.

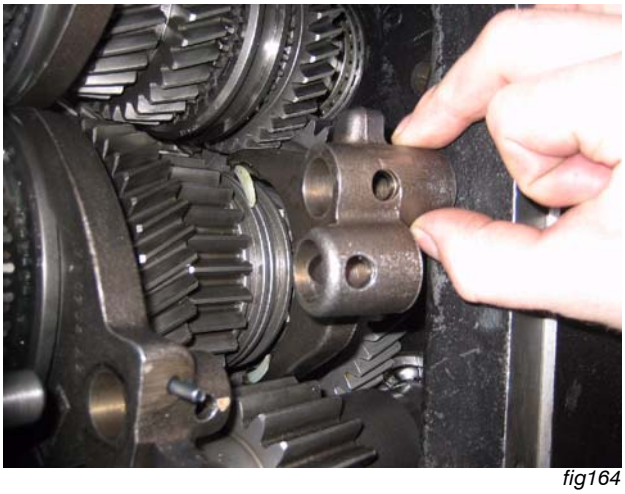


fig164

21. Remove the selector fork for gear LL.

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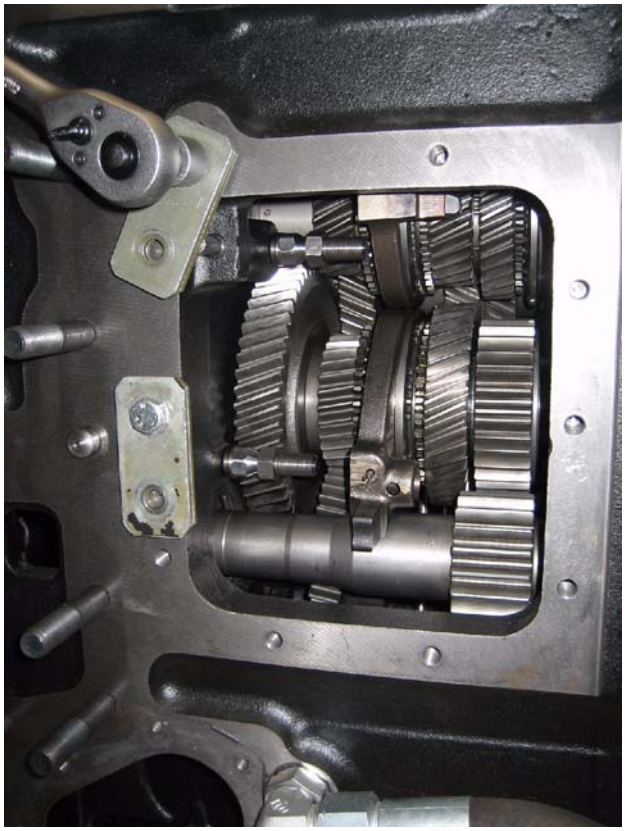


fig165

22. Remove the metal sheets.



fig166

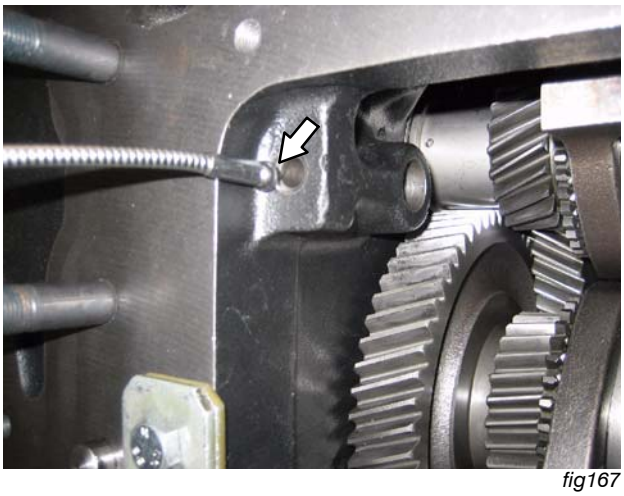


fig167

23. Collect the pins, springs and balls used for locking the adjusting pieces into position. Then remove the adjusting pieces.



fig168

24. Tap out the locking pin of the shifter rail for gears 1 and 2.



fig169

25. Unscrew the locking nut of the adjusting pieces.

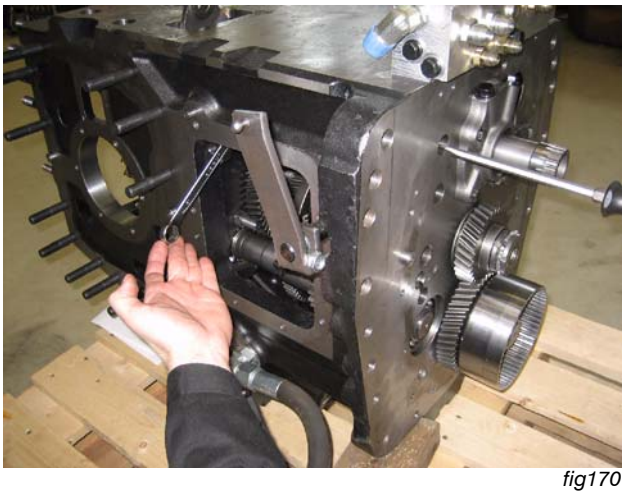


fig170

26. Remove the shifter rail from the gearbox by inserting a screwdriver in the groove at the front end of the rail and turning it.

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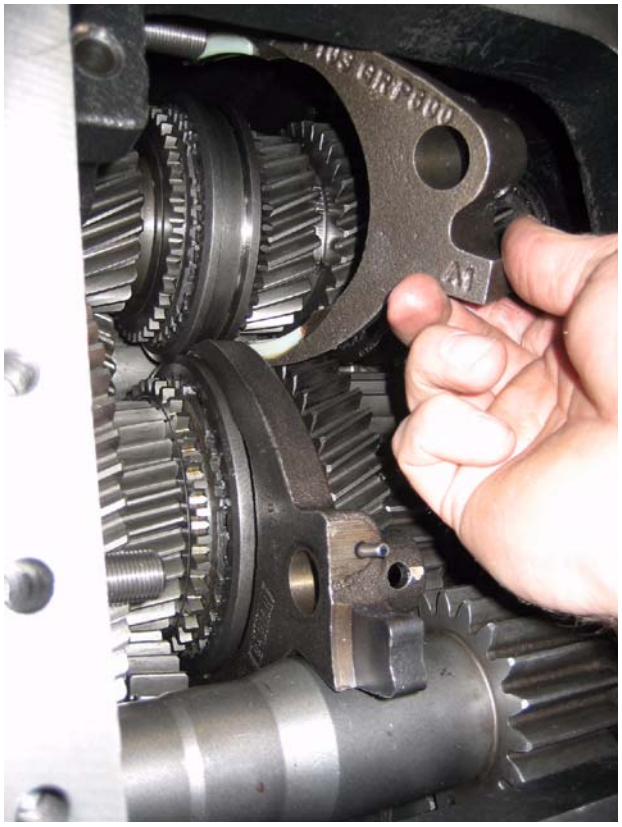


fig171

27. Remove the selector fork for gears 1 and 2.



fig172

28. Remove the selector fork for gears M and H. **Note!** The fork will be easier to remove if gear H1 is engaged.

Removing shafts

Removing ground speed PTO shaft, bevel pinion shaft, layshaft, transmission shaft and input shaft.

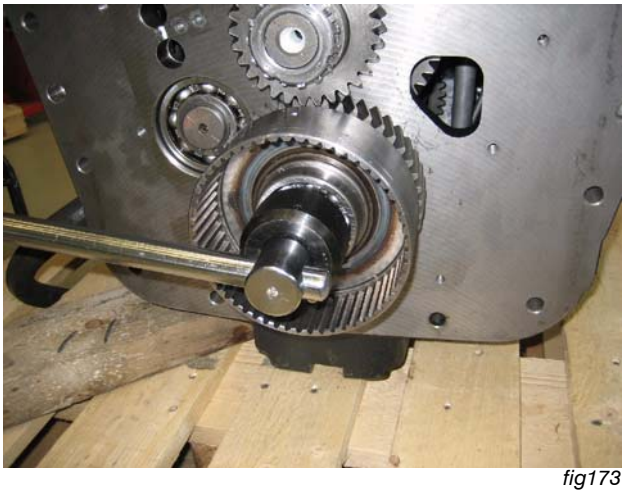


fig173

1. Unscrew the clutch drum nut at the front end of the transmission shaft.

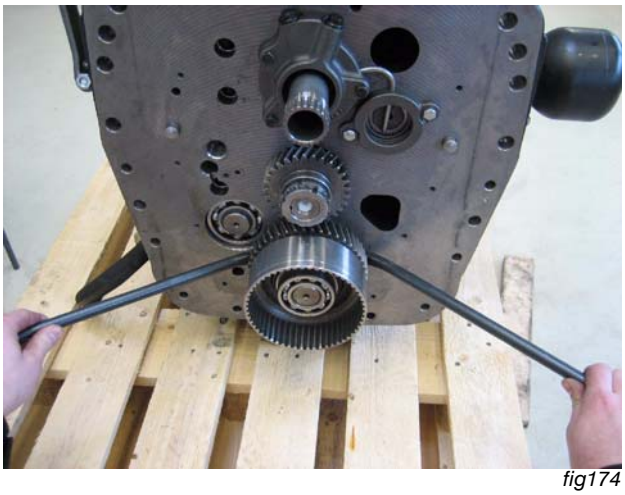


fig174

2. Remove the 4WD clutch drum nut and the associated bearings, sleeves, and spacing rings.



fig175

3. Unscrew the nuts at the front end of the bevel pinion shaft (ETV 892230) and the lock washer.

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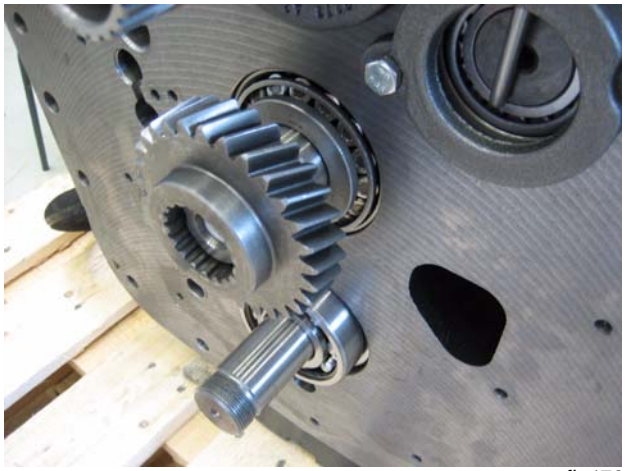


fig176

4. Remove the gearwheel, the outer race of the bearing, spacers, and stop plate.



fig177

5. Remove the circlips from the ground speed PTO shaft (front and rear end).



fig178

6. Tap the shaft to move it forward.

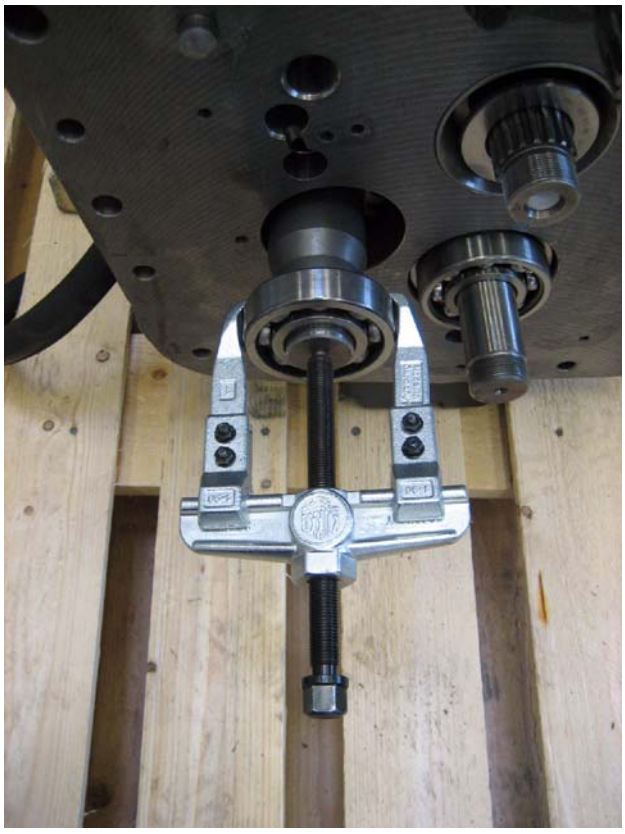


fig179

7. Remove the front bearing with a puller.

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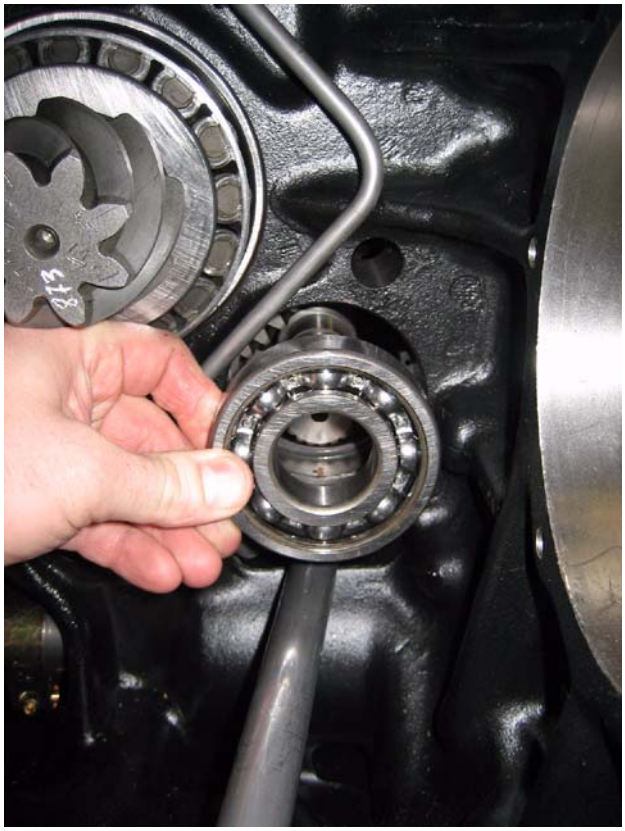


fig180

8. Remove the rear bearing friom the gearbox.



fig181

9. Remove the ground speed PTO shaft through the side opening.

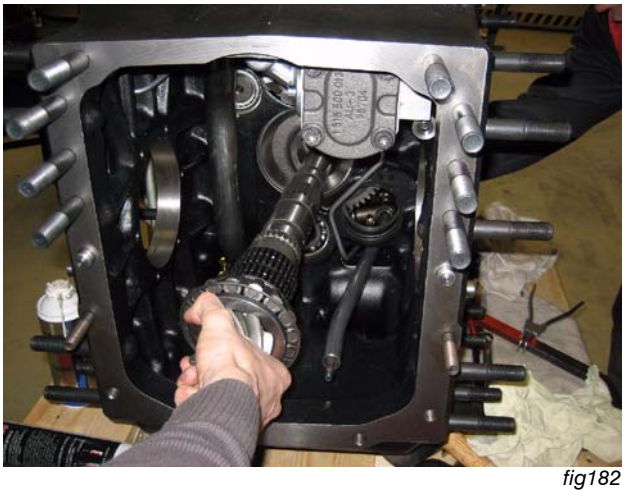


fig182

10. Remove the bevel pinion shaft through the back of the gearbox.



fig183

11. Remove the gearwheels and synchronizing units of the bevel pinion shaft through the side opening.



fig184

12. Remove the transmission shaft by first removing the circlip of the rear bearing from the shaft.

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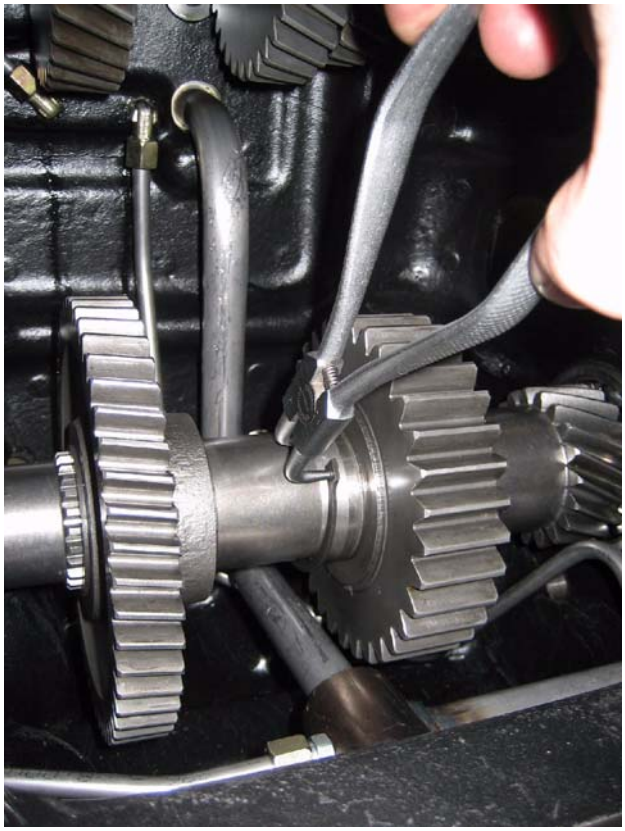


fig185

13. Remove all circlips from the transmission shaft.



fig186

14. Tap the rear end of the shaft until it comes off the bearings.

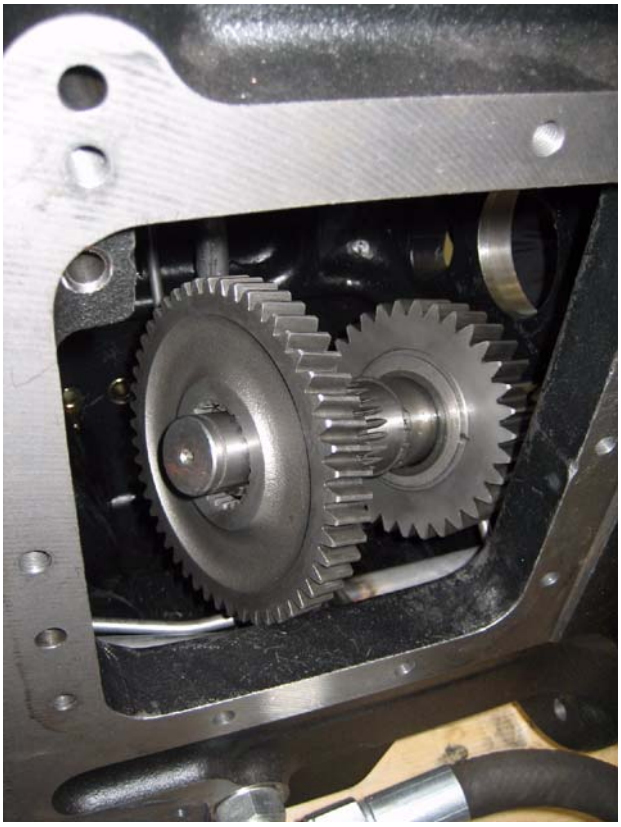


fig187

15. Move the transmission shaft to the front. Then remove the gearwheels, circlips, bearing, and spacer rings.



fig188

16. Remove the transmission shaft through the front.

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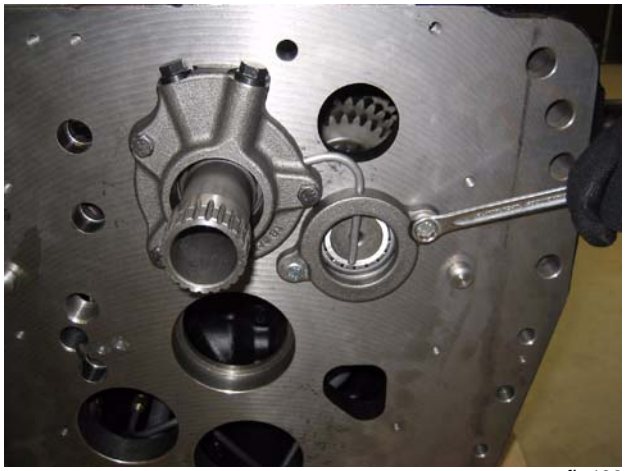


fig189

17. Remove the bearing covers at the front ends of the input shaft and layshaft. Also remove the outer races of the bearings.



fig190

18. Before removing the layshaft and the input shaft, unscrew the lowest bolt for the pump drive mechanism inside the gearbox housing.



fig191

19. Pull the input shaft from the front of the gearbox. The bearing races of the input shaft and layshaft come loose.



fig192

20. Move the layshaft forward. This enables the shaft to be removed from the gearbox with the rear end first. Support the rear end of the shaft while removing it.

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fig193

21. Remove the front end bearing of the input shaft using a puller.

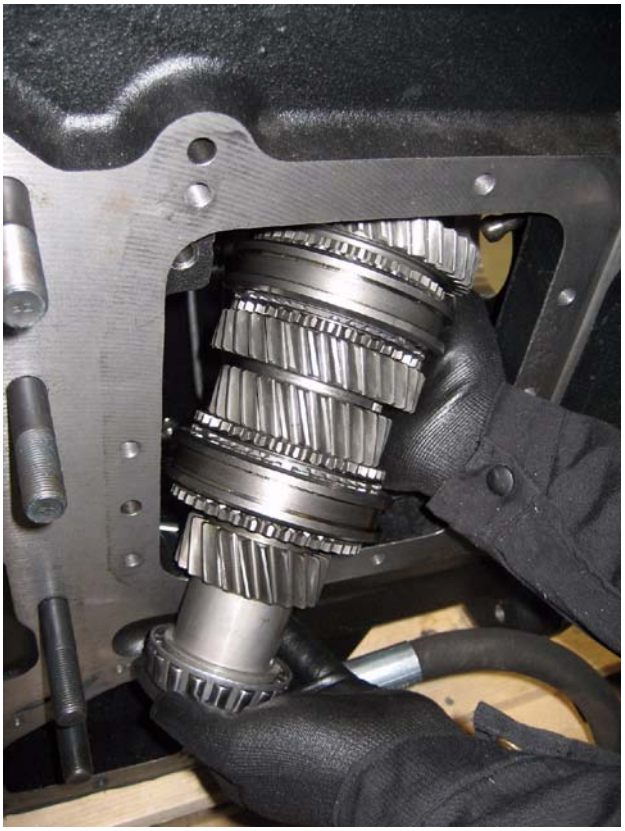


fig194

22. Remove the input shaft in one piece through the side opening. Take out the rear end first.

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Assembling gearbox

Note! In this instruction, assembling work is done in the correct working order. Before assembling, the lubricating oil pipes must be fitted.

Fitting layshaft, input shaft, transmission shaft, bevel pinion shaft and ground speed PTO shaft

Note! Lubricate all parts with oil before fitting.

1. If the layshaft bearings are changed, warm up new bearings before fitting them onto the shaft or use a suitable fitting sleeve.
2. Fit the pump drive mechanism, if detached. Do not fit the lowest fixing screw yet. Fit the input shaft lubricating oil pipe.
3. Fit the outer race of the layshaft rear bearing into the bearing housing from the rear. Then fit the spacer ring (3 mm) and the circlip behind the bearing race.

Adjusting position of bevel pinion shaft (40 km/h models)

The purpose of this adjustment is to determine the number of shims under the rear bearing outer race.

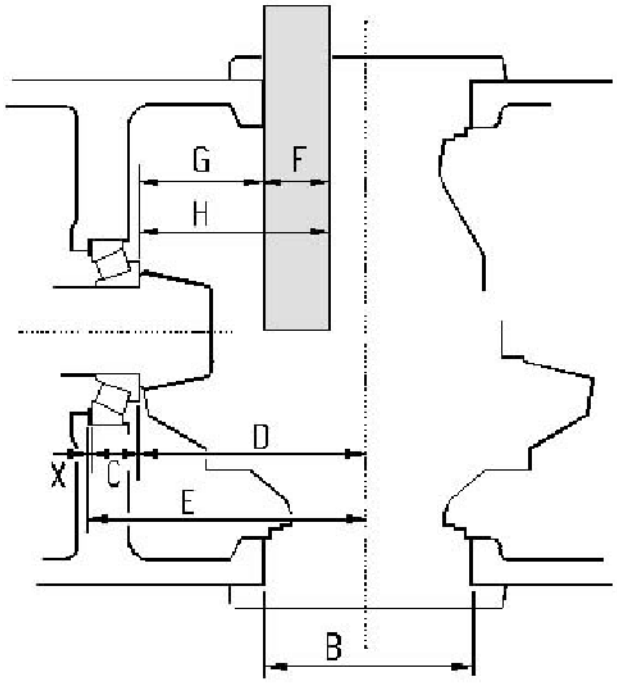


fig195

X = required shim thickness
C = thickness of rear bearing
D = measurement stamped into the end surface of the pinion shaft (the distance from the rear surface of the bearing to the centre of the differential bearing locations)
B = diameter of the bearing opening for differential
E = the distance from the bottom of the rear pinion bearing location to the centre of the differential bearing locations.
F = width of the measurement instrument
G = distance from the rear level surface of the bevel pinion shaft to the front edge of the bearing opening of the differential

Note! E = **193 mm** + decimals stamped on the RH side of the gearbox housing (e.g. 95). However, if this decimals is between 0.00–0.20, then **E=194 mm.**

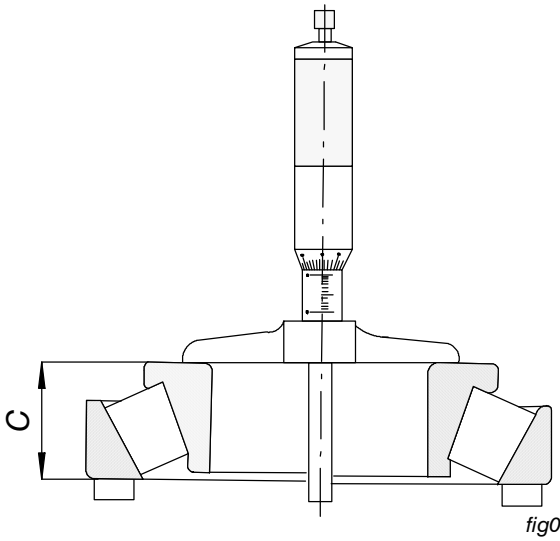


fig060

1. Measure the thickness (**C**) of the rear bearing (e.g. 33.75) (rotate the bearing at least 20 times before measuring).

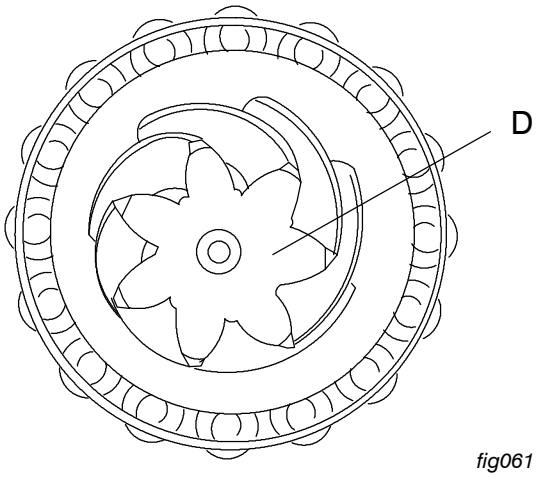
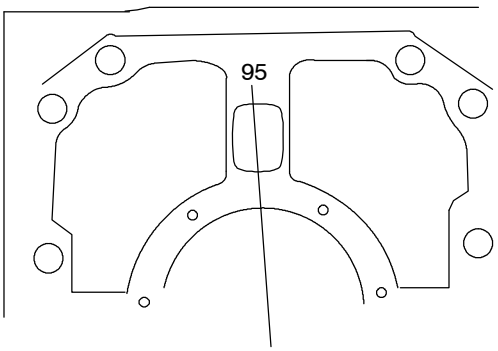


fig061

2. Read value **D** stamped into the rear end of the pinion shaft (e.g. 159.70)



Decimal for value E

fig062en

3. Read decimals stamped on the RH side of the gearbox. The shims thickness can be determined by using the following formula:

X=E–(C+D)

E.g. X=193.95–(33.75+159.70)=0.5 mm

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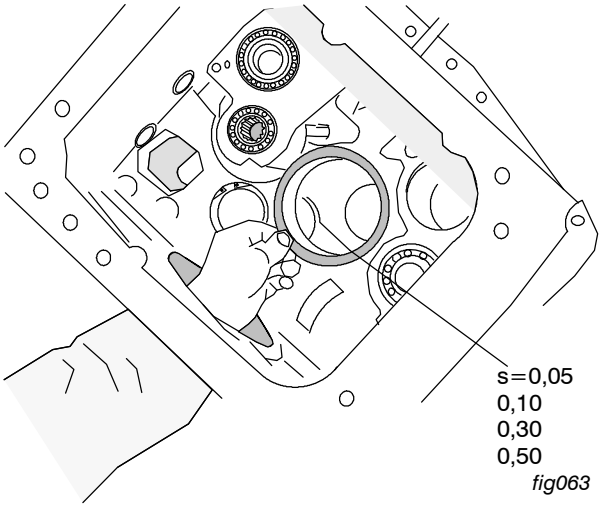


fig063

4. Set the required thickness (X) of shims into the bearing location.

Note! First fit the shim with three lugs (0.30 mm, order no 30486400). The thickness of this shim must be included in the calculated thickness (**X**).

5. Drive in the outer bearing race against the shims using ETV 893340.

It is recommended that the position of the bevel pinion shaft be checked as follows:

The position should be checked using only the bevel pinion shaft (with no gear parts installed onto the shaft). Place the shaft on the front and rear end bearings and tighten the front end nut of the bevel pinion shaft to a rolling resistance of 1.7–2.3 Nm.


fig196

6. Measure the diameter of the bearing opening for the differential (**B**).


fig197

7. Measure the distance (**H**) between the level surface of the inner race of the bearing at the rear end of the bevel pinion shaft and the rear edge of the measuring instrument. The width of the measuring instrument = **F**.

You can now calculate the distance between the level surface at the rear end of the bevel pinion shaft and the front edge of the bearing opening for the differential.

G=H–F

Note! Measurement **D** marked at the end of the bevel pinion shaft must match the measured value **G+B/2**.

D=G+B/2

Should the measured value not match the marked value, the difference must be corrected by adding or removing shims.

8. Remove the bevel pinion shaft from the gearbox.

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Adjusting position of bevel pinion shaft (50 km/h models)

The purpose of this adjustment is to determine the number of shims under the rear bearing outer race.

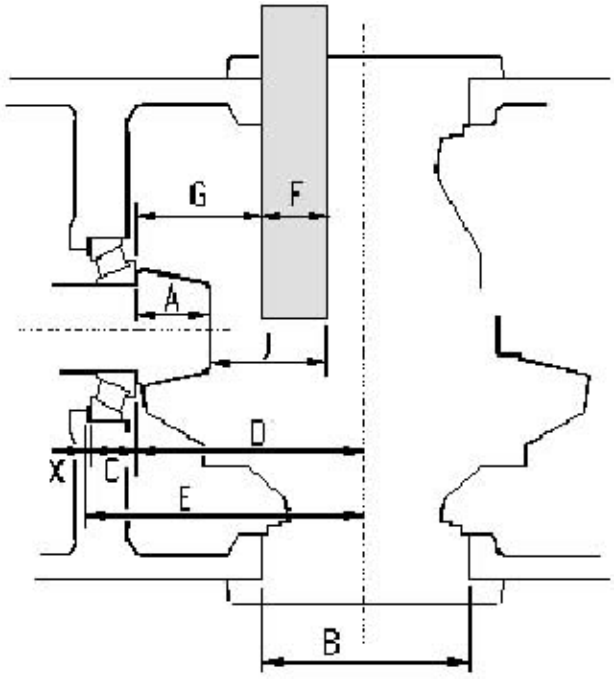


fig198

X = required shim thickness
C = thickness of rear bearing
D = measurement stamped into the end surface of the pinion shaft (the distance from the rear surface of the bearing to the centre of the differential bearing locations)
B = diameter of the bearing opening for differential
E = the distance from the bottom of the rear pinion bearing location to the centre of the differential bearing locations.
F = width of the measurement instrument
G = distance from the rear level surface of the bevel pinion shaft to the front edge of the bearing opening of the differential

Note! E = 193 mm + decimals stamped on the RH side of the gearbox housing (e.g. 95). However, if this decimals is between 0.00–0.20, then **E=194 mm.**

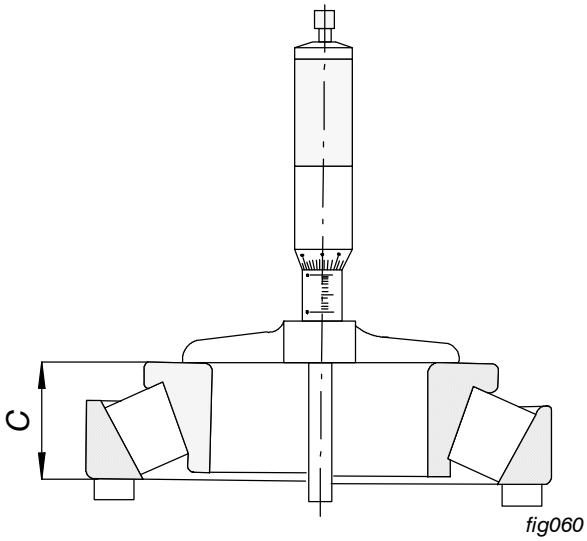


fig060

1. Measure the thickness (**C**) of the rear bearing (e.g. 33.75) (rotate the bearing at least 20 times before measuring).

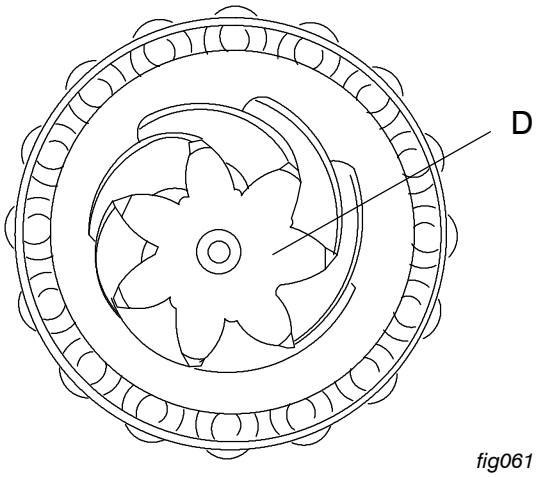
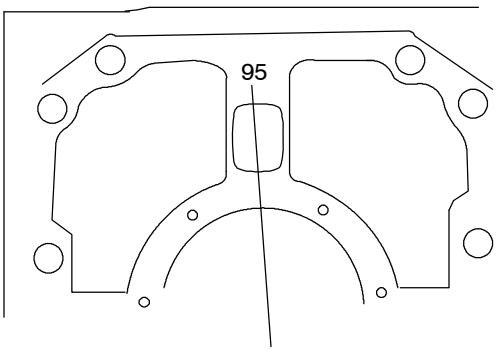


fig061

2. Read value **D** stamped into the rear end of the pinion shaft (e.g. 159.70)



Decimal for value E

fig062en

3. Read decimals stamped on the RH side of the gearbox. The shims thickness can be determined by using the following formula:

X=E–(C+D)

E.g. X=193.95–(33.75+159.70)=0.5 mm

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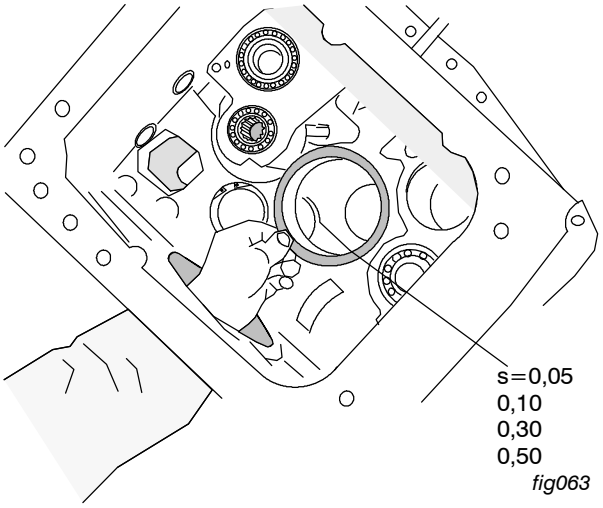


fig063

4. Set the required thickness (X) of shims into the bearing location.

Note! First fit the shim with three lugs (0.30 mm, order no 30486400). The thickness of this shim must be included in the calculated thickness (**X**).

5. Drive in the outer bearing race against the shims using ETV 893340.

It is recommended that the position of the bevel pinion shaft be checked as follows:

The position should be checked using only the bevel pinion shaft (with no gear parts installed onto the shaft). Place the shaft on the front and rear end bearings and tighten the front end nut of the bevel pinion shaft to a rolling resistance of 1.7–2.3 Nm.


fig199

6. Measure the diameter of the bearing opening for the differential (**B**).



fig200

7. Measure the length (**A**) of the bevel gear on the bevel pinion shaft (e.g. 51.45).


fig201

8. Measure the distance (**J**) between the level surface at the rear end of the bevel gear and the rear edge of the measuring instrument. The width of the measuring instrument = **F**.

G=A+J–F

Note! Measurement **D** marked at the end of the bevel pinion shaft must match the measured value **G+B/2**.

D=G+B/2

Should the measured value not match the marked value, the difference must be corrected by adding or removing shims.

9. Remove the bevel pinion shaft from the gearbox.

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Installing shafts

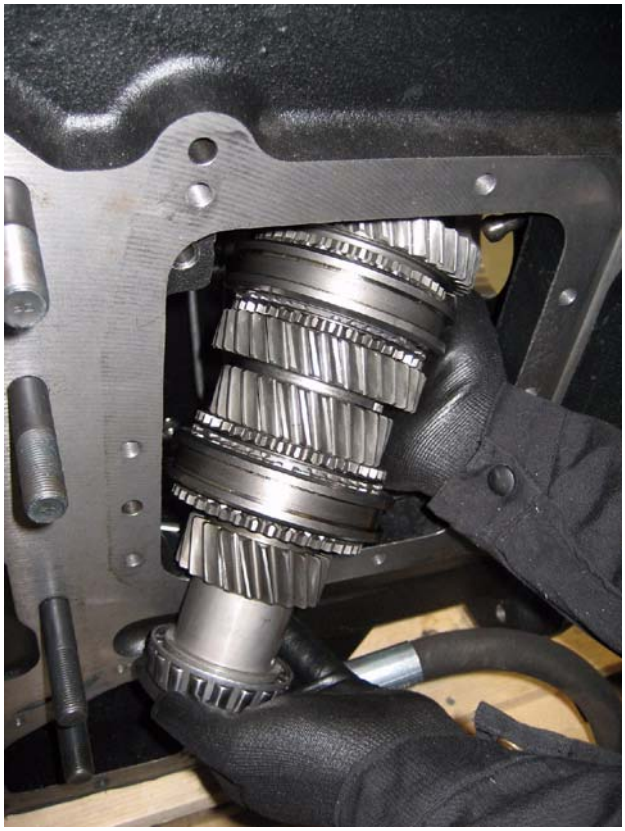


fig202

1. Place the assembled input shaft into the gearbox through the side opening.



fig203

2. Fit the layshaft into the gearbox through the side opening. Lift up the rear end of the input shft while fitting the layshaft.



fig204

3. Fit the bearing cover of the layshaft and the front bearing of the input shaft (ETV 892370).



fig205

4. Fit the outer race and bearing cover of the input shaft front bearing.

5. Rotate the input shaft 20–30 revolutions, in order to bed in the bearings.

6. Measure the input shaft end float using a dial gauge. The end float should be **0.025–0.075 mm**. Pull and lift the shaft while rotating it. Add or remove shims as necessary.



fig206

7. In the same way adjust the end float of the layshaft. The end float should be **0.025–0.075 mm**.

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fig207

8. **Note!** Remember to install the lowest bolt for the pump drive mechanism.



fig208

9. Fit the layshaft lubricating oil pipe.



fig209

10. Fit the front circlip and spacer ring of the transmission shaft.



fig210

11. Fit the transmission shaft into the gearbox through the front bearing hole. Fit the needle bearing, gear wheel and spacer ring onto the shaft.

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fig211

12. Fit the rear circlip of the front gear wheel onto the shaft. **Note!** The circlip must not be fit to its groove at this stage.

13. Fit the circlip of the rear gear wheel into its groove.



fig212

14. Fit the rear gear wheel and rear circlip.



fig213

15. Tap the front end of the shaft until it is in its place.



fig214

16. Fit a circlip to the rear end of the shaft.

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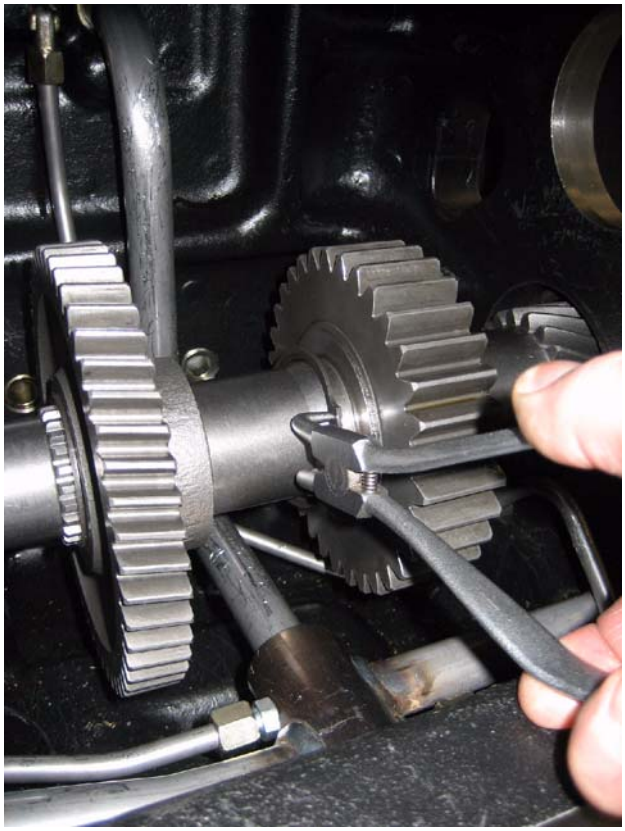


fig215

17. Fit the circlip of the ground speed PTO shaft.



fig216

18. Fit the pinion shaft gear wheels and synchronizing units into the gearbox as follows:



fig217

19. Fit the gear wheel and needle bearings (2 pieces) of the M speed range. The bevel pinion shaft can be used to support the components that are being fitted.



fig218

20. Fit the synchronizing unit for M and H speed ranges.



fig219

21. Fit the gear wheel, bushing, and bearing for the H speed range.

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fig220

22. Fit the gear wheel and bushing for the LL speed range.



fig221

23. Fit the spacer ring, bushing, and ground speed PTO gear wheel.



fig222

24. Fit the ground speed PTO / LL coupling rings. **Note!** The inside gearing of the gear wheel must face forward. Note also that the bevel surfaces of the gearing of the coupling rings must face outwards.

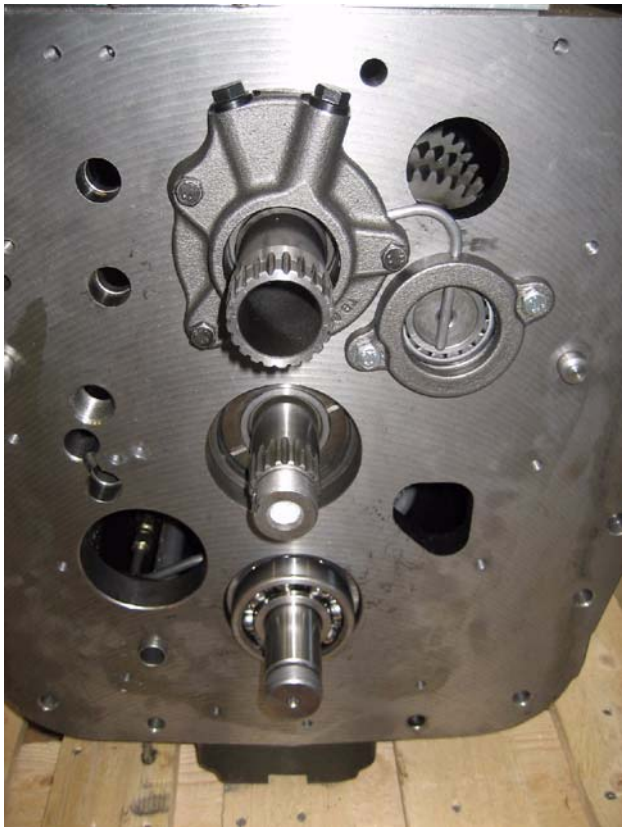


fig223

25. The shaft is inserted into the gearbox through back. **Note!** Make sure that all gear wheels sit in their splines. Do not use force. Instead, rotate the shaft while pushing it.

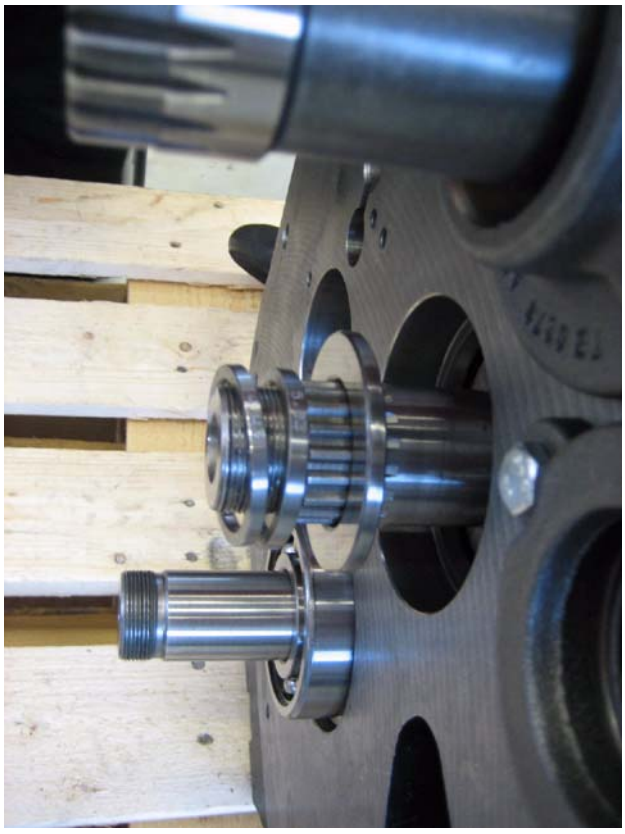


fig224

26. Fit the stop plate and spacer rings.

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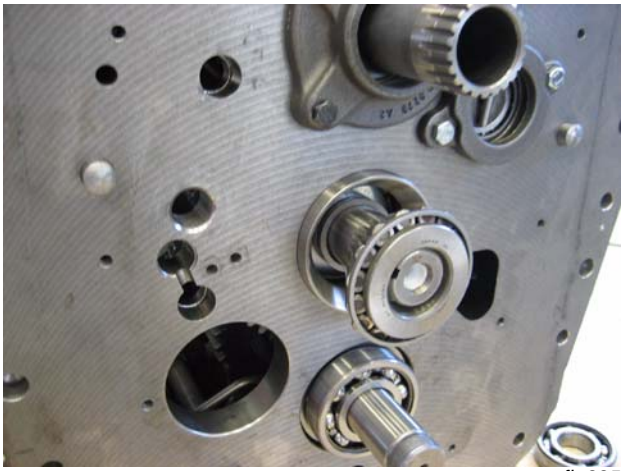


fig225

27. Fit the outer race of the bearing. Then fit the bearing.



fig226

28. Fit the gear wheel and the inner locking nut.

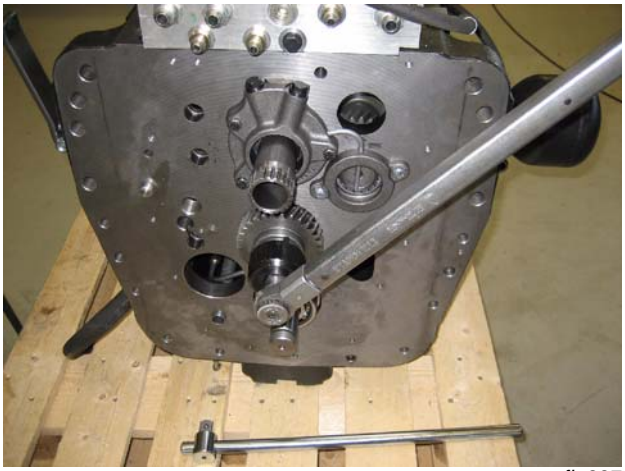


fig227

29. Rotate the shaft 20–30 full revolutions. Then tighten the locking nut to a torque of 270 Nm (ETV 892230). **Note!** Tightening the locking nut will be easier if, for example, the M speed range and two gears are engaged at the same time.

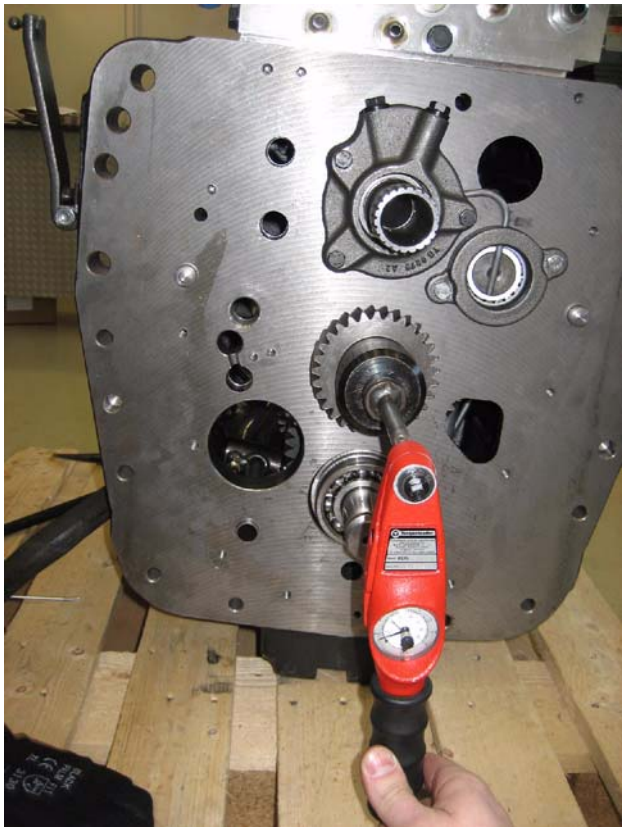


fig228

30. Measure the rolling resistance of the bevel pinion shaft using a torsion meter. The value must be between **1.7 and 2.3 Nm**.

    If the rolling resistance is smaller than the minimum allowed value:

    – decrease the spacer ring thickness.

    If the rolling resistance is greater than the maximum allowed value:

    – increase the spacer ring thickness.

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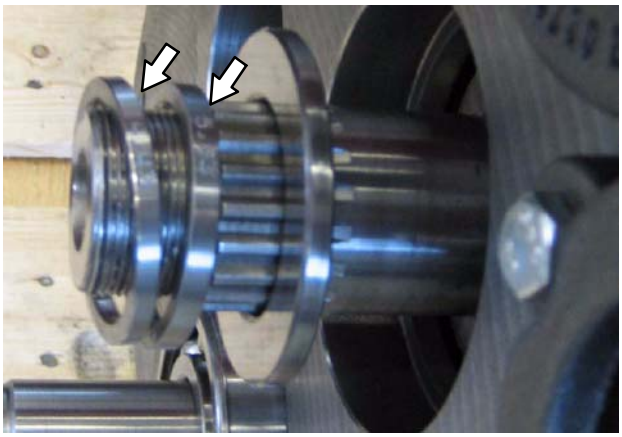


fig229

31. Rotate the shaft 20–30 full revolutions. Then tighten the locking nut to a torque of 270 Nm (ETV 892230). **Note!** Tightening the locking nut will be easier if, for example, the M speed range and two gears are engaged at the same time.

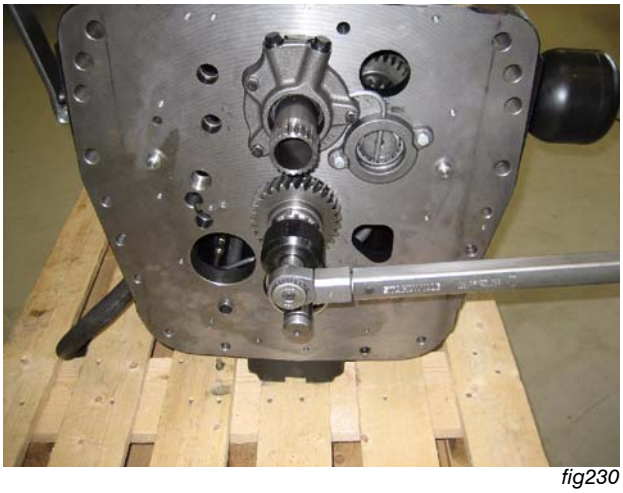


fig230

32. When the adjustment is correct, tighten the shaft nuts to their correct torque (270 Nm).

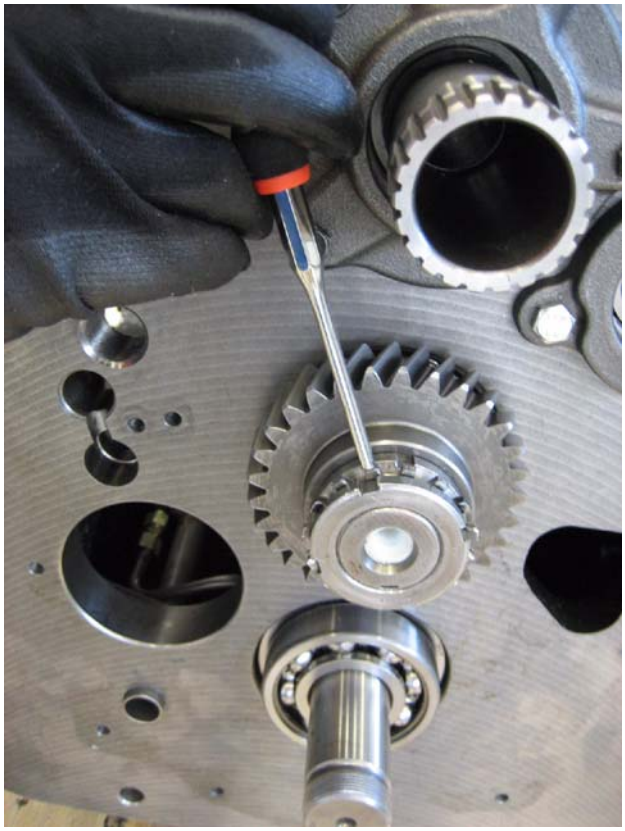


fig231

33. Lock the shaft nuts with locking washer tabs.



fig232

34. Fit the ground speed PTO shaft into the gearbox through the side opening.

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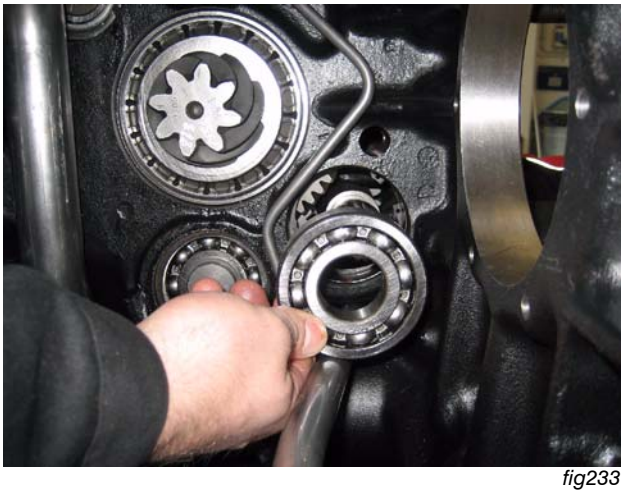


fig233

35. Fit the rear bearing into place through the back and tap it against the circlip.

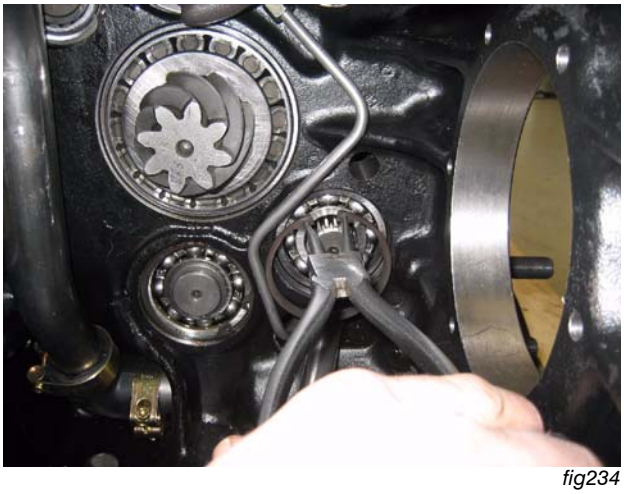


fig234

36. Fit the rear circlip of the rear bearing.
37. Tap the front end of the shaft until the shaft is in place inside the bearing.

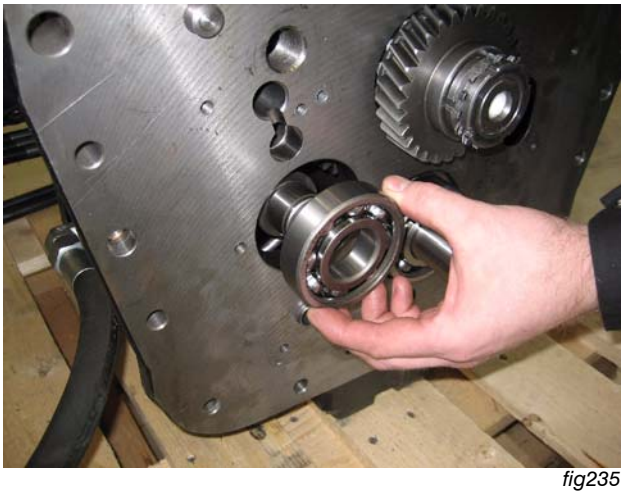


fig235

38. Fit the front bearing.



fig236

39. Fit the rear bearing circlip into the grooves on the shaft.



fig237

40. Fit the front bearing circlip into the grooves on the shaft.

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Fitting differential

1. Fit the differential RH side bearing into the differential housing (if removed). Use tool ETV 893400.

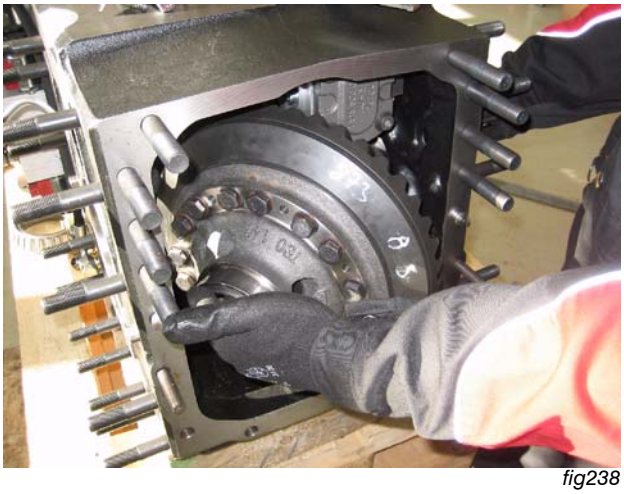


fig238



fig239

2. Place the differential case into the gearbox housing right side first.



fig240

3. Fit the RH side bearing outer race.



fig241

4. Fit the RH bearing cover according to the markings made during the disassembly.

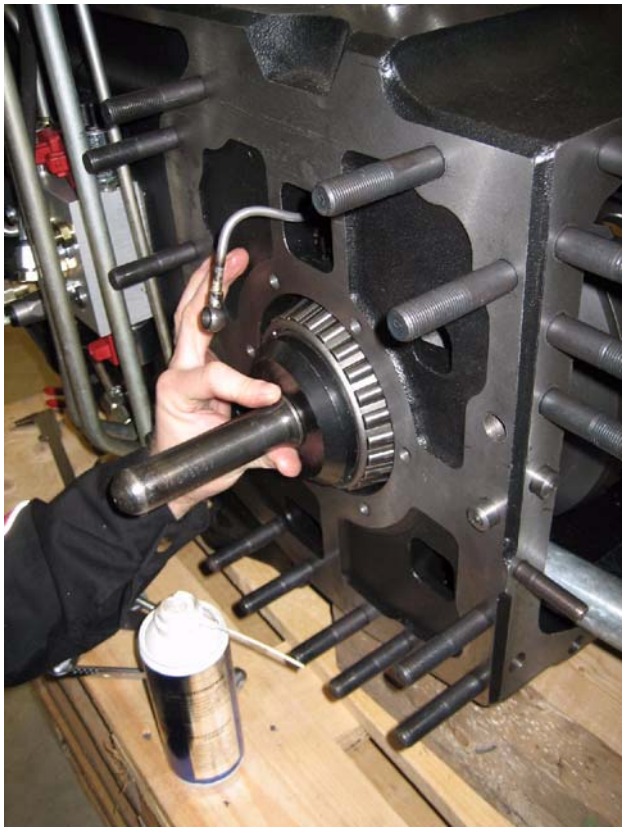


fig242

5. Fit the LH bearing race with tool ETV 893400.

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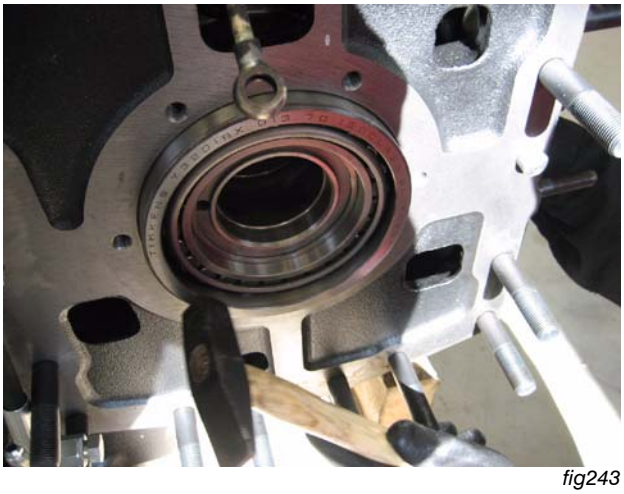


fig243

6. Fit the outer race of the bearing

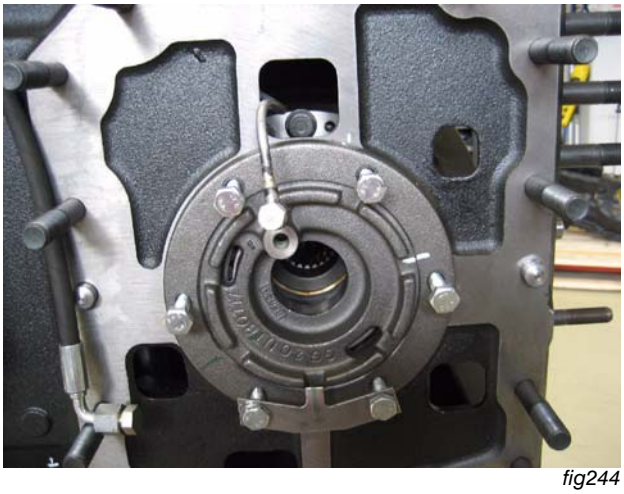


fig244

7. Fit the RH bearing cover according to the markings made during the disassembly.

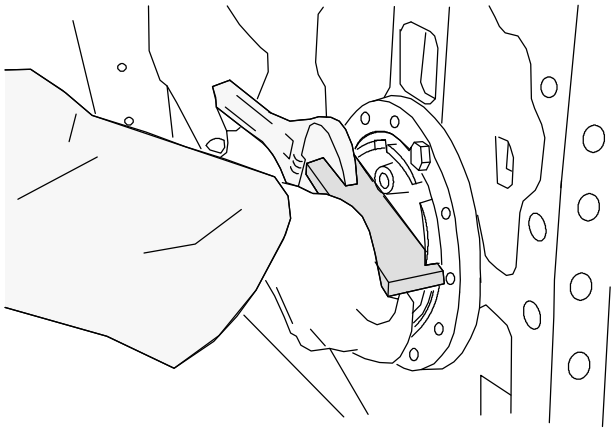


fig078

8. Adjust the backlash between the crown wheel and the pinion by moving the differential sideways by means of the adjusting flanges. Ensure that there is no play in the bearings during the adjustment by turning both nuts equally in the same direction.

Note! The adjusting flange can be tightened with a piece of flat iron and an adjustable spanner as shown in the figure above.

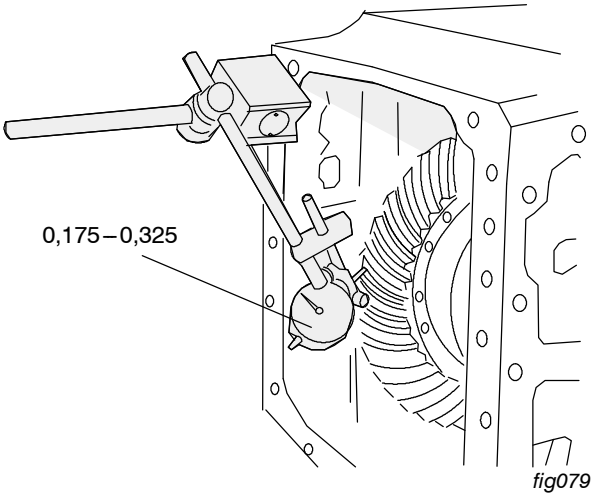


fig079

9. Measure the tooth backlash with a dial gauge with the stylus at right angles to the side of the tooth. The backlash should be **0.175–0.325 mm**.

Note! Try to adjust the backlash to the middle of the tolerance range or preferably near the minimum value.

If the tooth backlash is too great:
– tighten the left side and loosen the right side simultaneously.

If the tooth backlash is too small:
– loosen the left side and tighten the right side simultaneously.

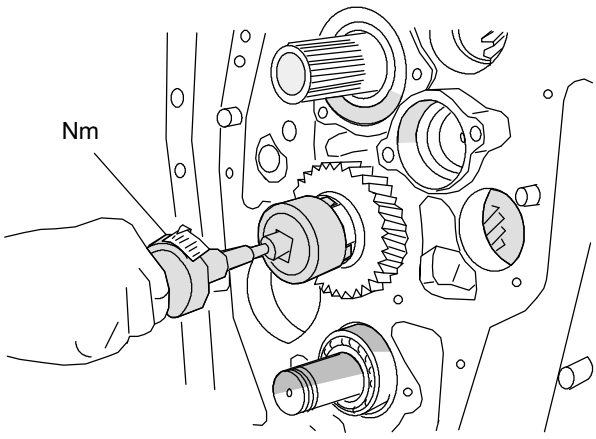


fig080

10. When the backlash is correct, tighten the RH side adjusting flange carefully until the differential bearing rolling resistance is correct. The rolling resistance is measured at the front end of the bevel pinion shaft. Thus the correct value is the bevel pinion shaft rolling resistance (which was measured earlier):

+0.6–1.7 Nm (Z8/42) or
+0.8–2.2 Nm (Z9/38)

The number of teeth of the pinion/crown wheel is given in parentheses.

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Adjust the rolling resistance by rotating only the RH side adjusting flange.

If the rolling resistance is too great:
– loosen the RH side adjusting flange.

If the rolling resistance is too small:
– tighten the RH side adjusting flange.

Check the tooth backlash of the pinion/crown wheel after adjusting the rolling resistance.

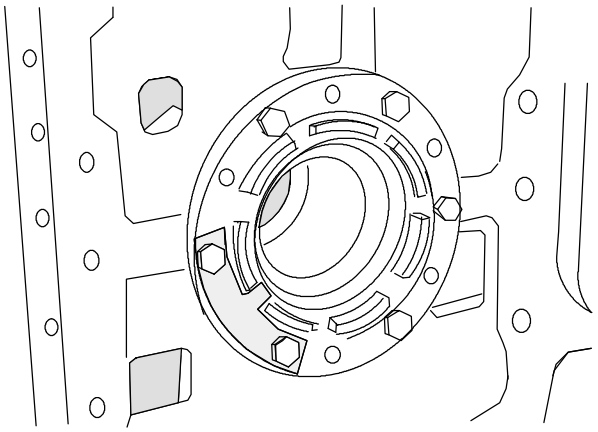


fig081

11. When the bearing preload is correct, lock the adjusting flanges with locking plates. Tighten the bearing cover screws.

12. Bend and connect the differential lock pipe on the LH side.

Note! The LH side adjusting flange can be in such a position that the differential lock pipe connection is not in the correct position in relation to the pressure pipe. If this is the case, remove the bearing cover screws and turn the bearing and adjusting flange together until the connection is on the top. Retain the relative position of the bearing cover and the adjusting flange to ensure that the preload does not change.

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Fitting 4WD clutch drum

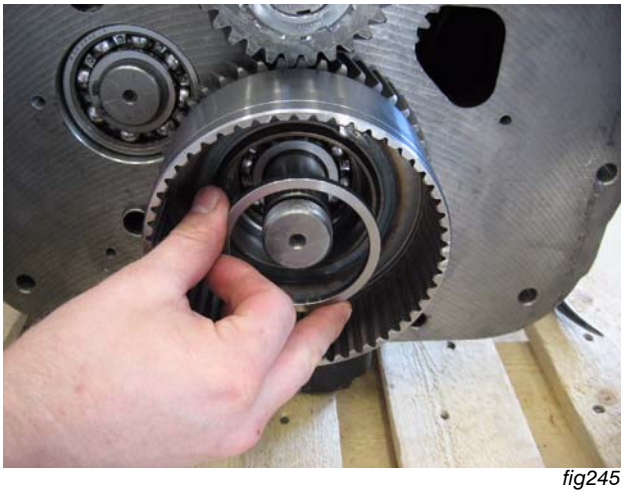


fig245

1. Fit the spacing ring and circlip into the clutch drum. Fit the clutch drum into position and fit the front spacer ring.



fig246

2. Fit the bushing onto the transmission shaft.



fig247

3. Fit the bearing onto the transmission shaft.

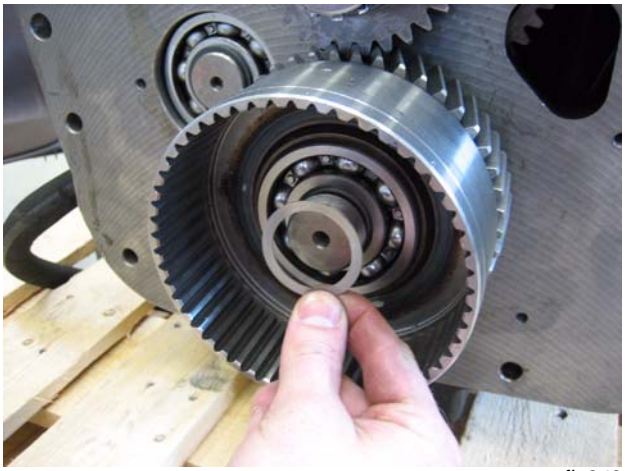


fig248

4. Fit the spacing washer (0.5 mm)

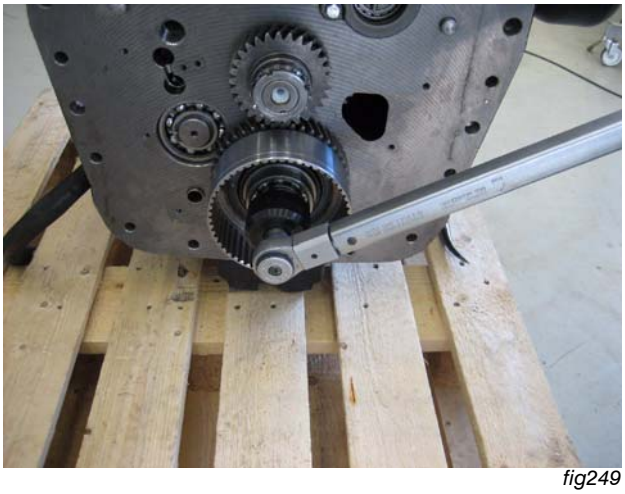


fig249

5. Fit the shaft nut in place. Apply Loctite 242 to the threads. Use the tool ETV 894190 to tighten the nut to a torque of 270 Nm.

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Fitting and adjusting selector forks



fig250

1. Fasten the sliding pieces on the forks with a little grease to facilitate the assembly.



fig251

2. Fit the selector fork for speed ranges M and H into place. **Note!** Fitting the selector forks will be easier if the gear H1 is engaged.



fig252

3. Fit the selector fork for gears 1 and 2 into place.



fig253

4. Fit the selector fork for gears 3 and 4 into place.

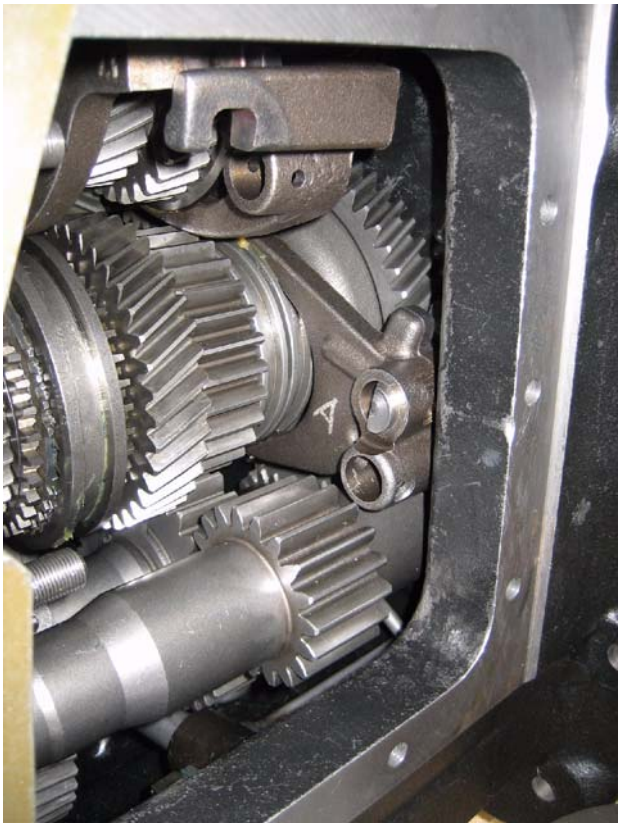


fig254

5. Fit the selector fork for speed range LL into place. Fitting the selector fork will be easier if the sliding coupling for the ground speed PTO on the bevel pinion shaft is moved to its rearmost position and the LL range sliding coupler (together with the fork) is moved to the front.

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fig255

6. Fit the selector fork of the (optional) ground speed PTO into place.



fig256

7. Fit the adjusting pieces.

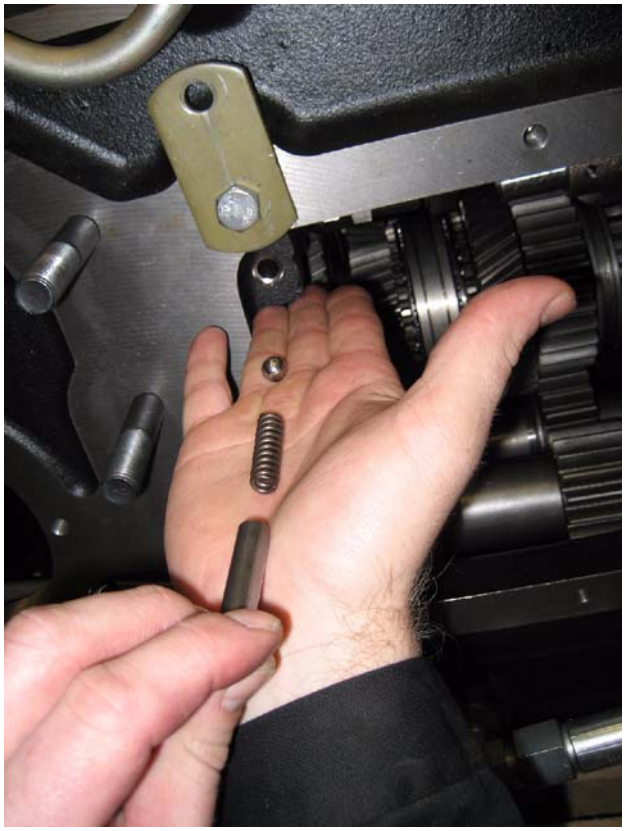


fig257

8. Fit the balls and springs.

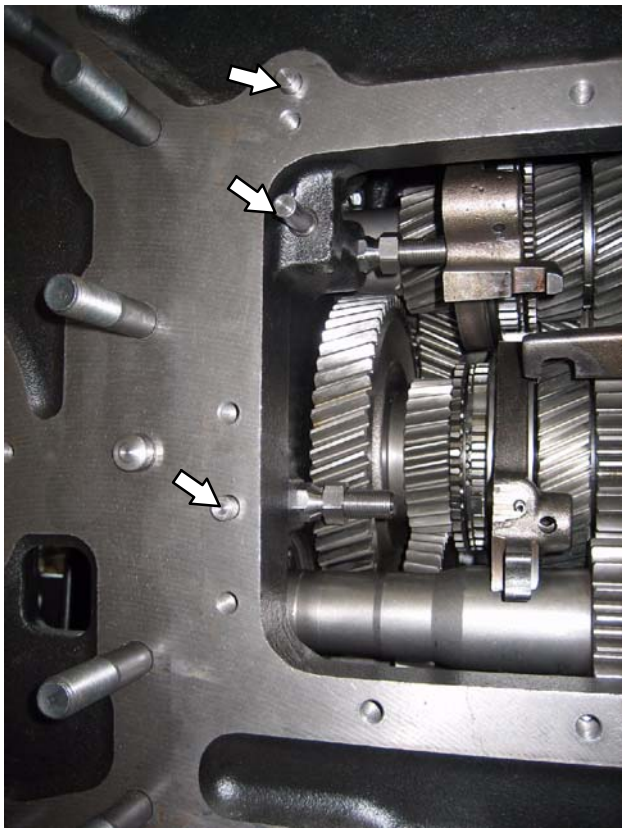


fig258

9. Fit the pins.

https://truckmanualshub.com/

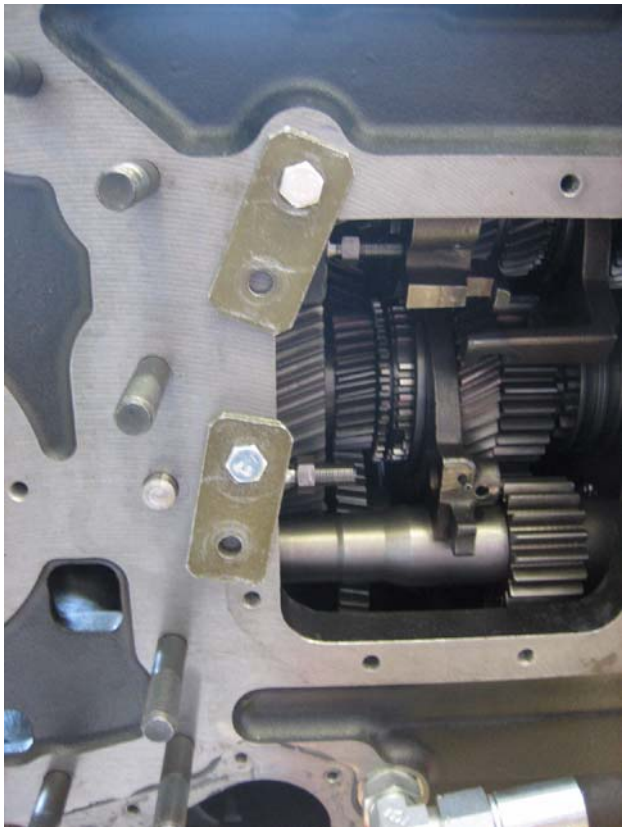


fig259

10. Lock the adjusting pieces into their middle grooves using stop plates.

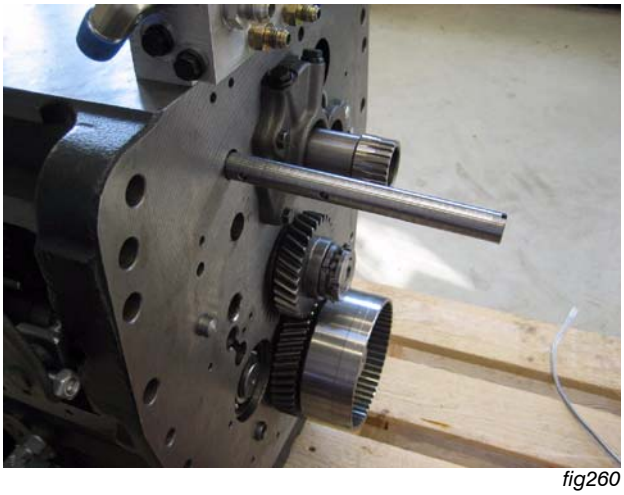


fig260

11. Fit the shifter rail for gears 1 and 2.

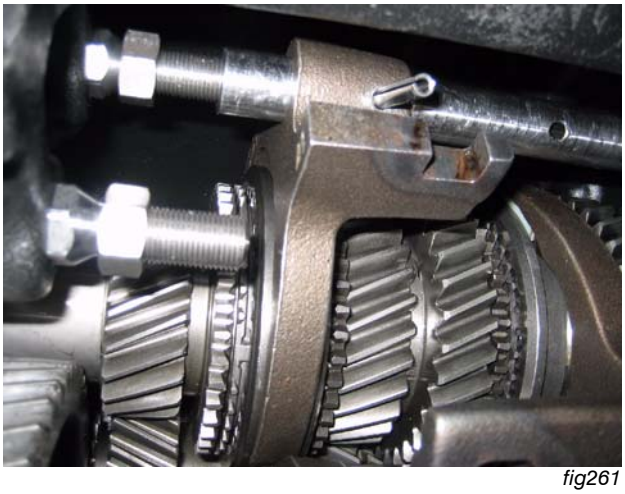


fig261

12. Shift the synchronizing unit for gears 1 and 2 to the neutral position. Screw the shifter rail into the adjusting piece until you see the locking pin hole of the rail through the corresponding hole in the selector fork. Tap the locking pin into place. The groove must be parallel with the shifter rail.

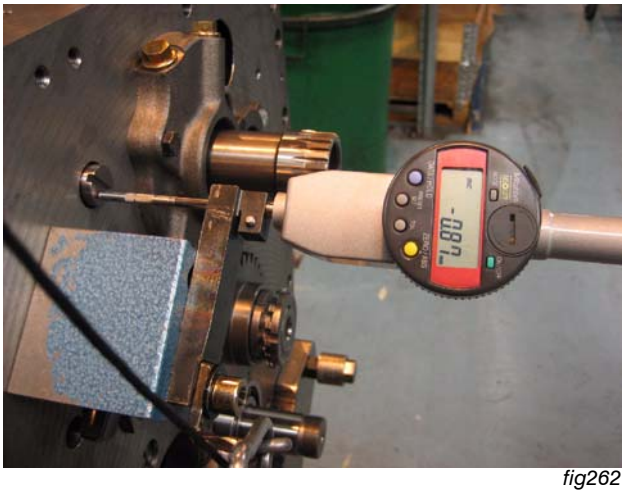


fig262

13. Check the free play. The free play must be equal in both directions when a gear is engaged. Lock the adjustment using a lock nut.

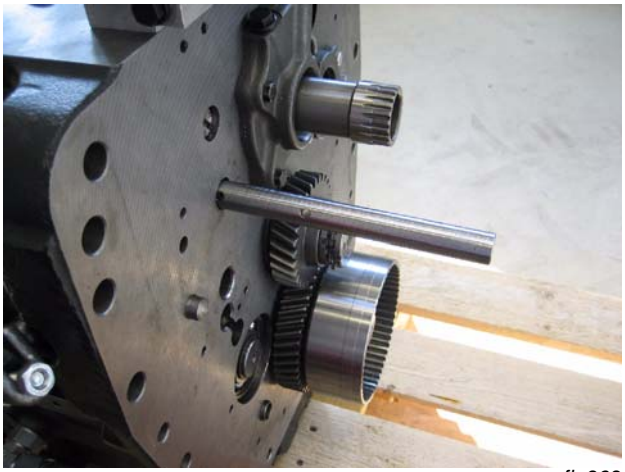


fig263

14. Fit the shifter rail for gears 3 and 4.

15. Adjust the selector fork for gears 3 and 4 by repeating steps 12 and 13.

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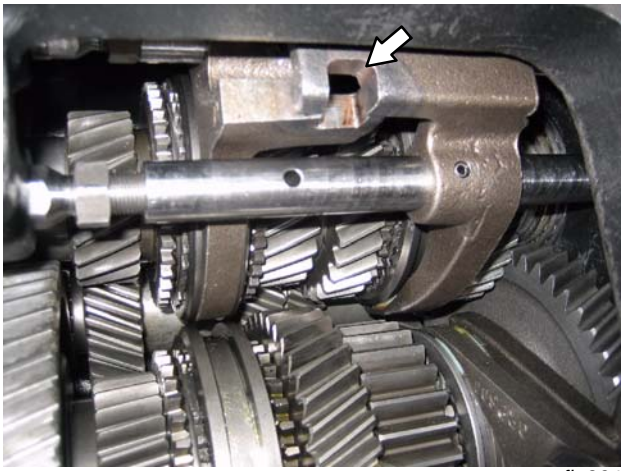


fig264

16. **Note!** The groove of the selector fork for gears 1 and 2 must be aligned with the groove of the selector fork for gears 3 and 4.

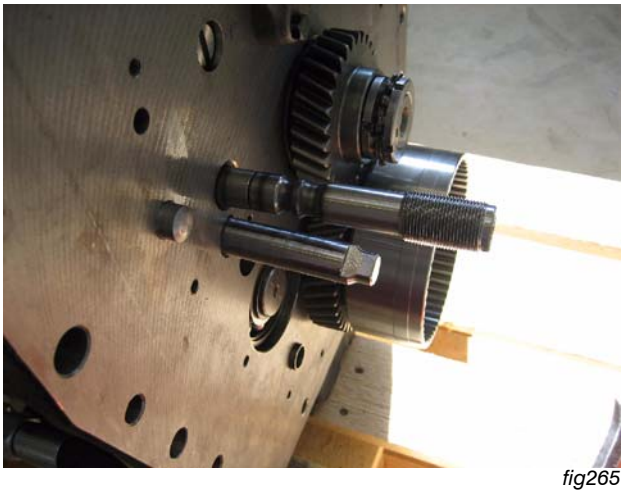


fig265

17. Push the PTO/LL rail into the gearbox thorugh the front. First push the rail through the LL fork.



fig266

18. The rail pushes out the tool ETV 894080.

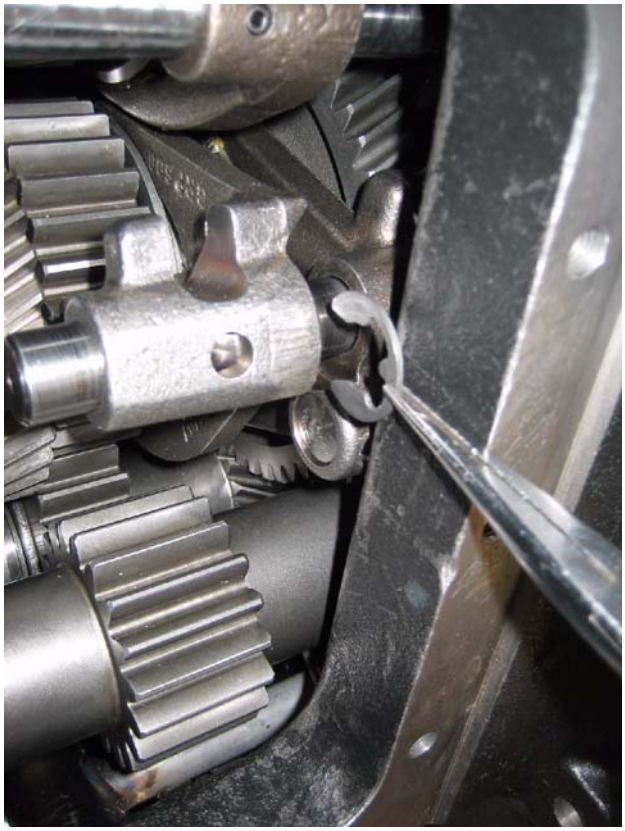


fig267

19. Fit the circlip into its groove.

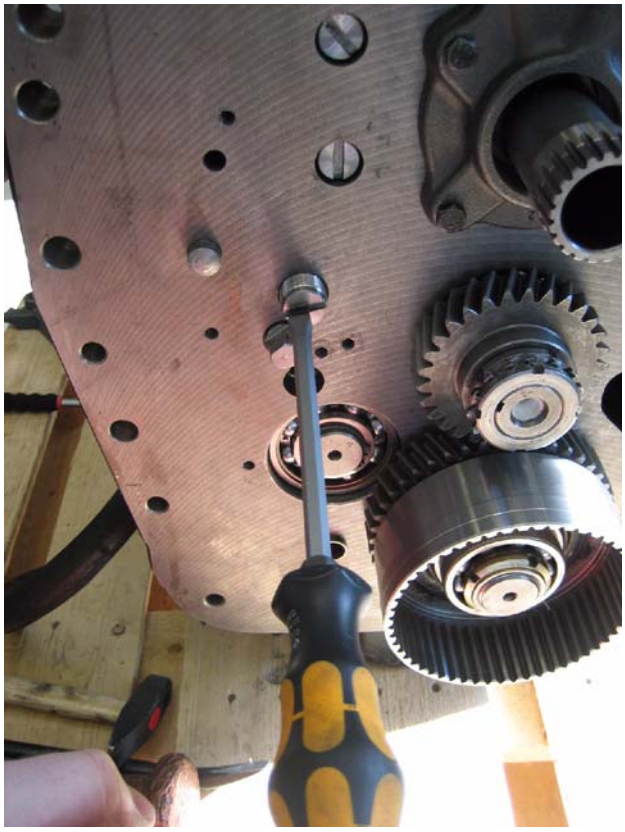


fig268

20. Move the LL and PTO sliding couplers to the neutral position. Make sure that the gears engage in extreme positions.

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fig269

21. Fit the locking pin. Make sure that the groove is parallel with the shifter rail. **Note!** Ensure that the shifter railis fitted correctly: the lightened section must face the LL/PTO shaft. (See figure in step 22.)



fig270

22. Lock the shifter rail into position using a nut.

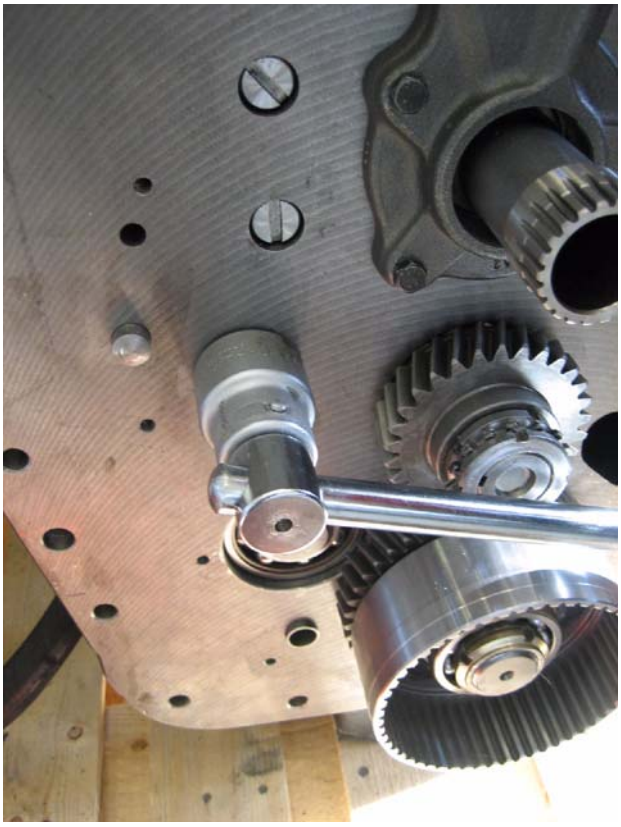


fig271

23. Tighten the nut to a torque of 28 Nm.

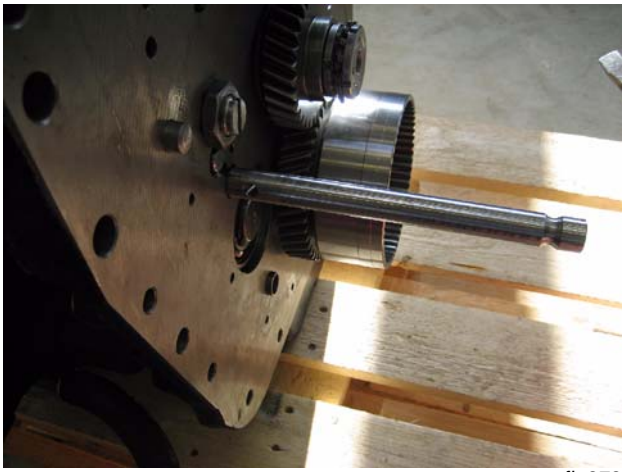


fig272

24. Fit the shifter rail for gears M and H.

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fig273

25. Shift the synchronizing unit for gears M and H to the neutral position. Screw the shifter rail into the adjusting piece until you see the locking pin hole of the rail through the corresponding hole in the selector fork. Tap the locking pin into place. The groove must be parallel with the shifter rail.



fig274

26. Check the free play. The free play must be equal in both directions when a gear is engaged. Lock the adjustment using a lock nut.

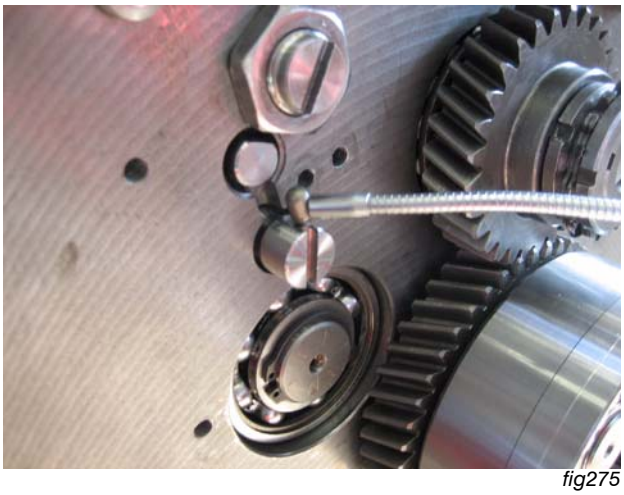


fig275

27. Fit the mechanical coupling lock.

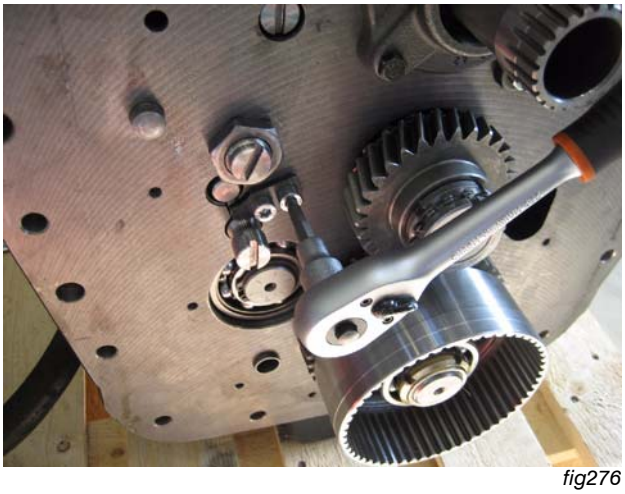


fig276

28. Tighten the socket screws to a torque of 23 Nm.

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Fitting side cover

1. Begin by moving all the gears (forks) to the neutral position. Apply sealing compound (e.g. Silastic) to the contact surface between the cover and the gearbox. Clean the contact surfaces, if necessary.



fig277

2. Fit the range gear piston and position sensor to the middle position.

3. Hold the cover vertically and fit it into its place. **Note!** Use guide pins, if necessary. **Note!** Make sure that the range gear piston stays in the middle position.
   LS models: Also ensure that the locking pins of the position sensor are on both sides of the the locking pin in the selector fork for gears M and H.



fig278

4. Tighten the side cover bolts to a torque of 50 Nm.

Fitting pump, suction pipes and suction strainer housing

Note! The oil pump and suction pipes can be fitted without removing the differential.

Note! The input shaft lubricating pipe must be fitted before fitting the differential.

1. Fit the hose clip to the curved suction pipe with the tightening screw pointing up. Then fasten the pump connector to the drive mechanism.

2. Fit the pump. Tighten the bolts with fingers.

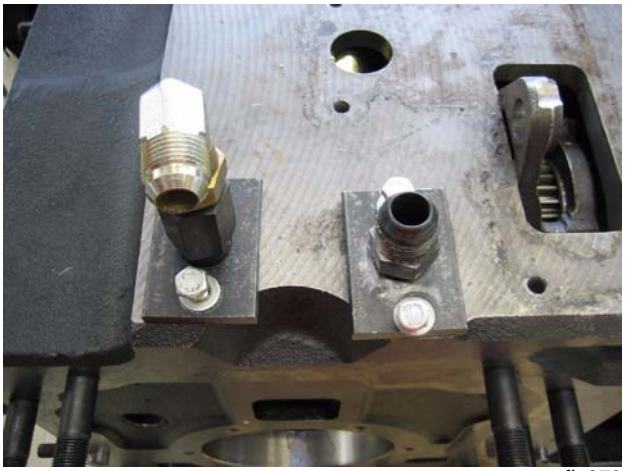


fig279

3. Fit the delivery couplings to the pump through the gearbox. Then tighten the bolts to a torque of 23 Nm.

4. Tighten the fixing bolts of the pump to a torque of 45 Nm.

5. Finally, tighten the hose clips of the curved suction pipe while the system is still dry.

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Reconditioning differential

Note! If reconditioning the differential only, then remove:

– PTO unit
– final drives/brake housings
– differential

Note! For detaching the brake housings, raise the cab or split the tractor between the gearbox and fuel tank according.

Changing the differential side bevel gear bearings and the differential lock discs

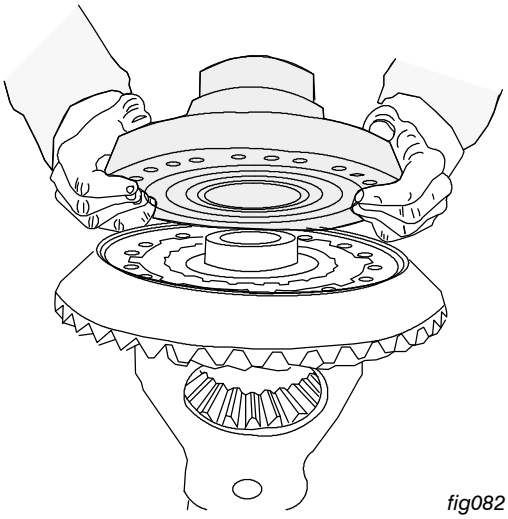


fig082

1. Remove the crown wheel attaching screws (9 mm) and remove the differential cover.

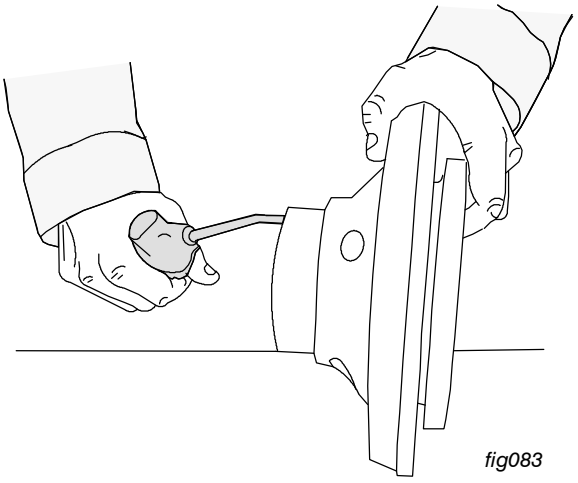


fig083

2. Press the piston for the differential lock out of the casing half using compressed air **but be careful**. Change the o–rings on the piston.

3. Change the bearing for the differential side gear. Remove the bearing using a drift and fit the new bearing using ETV 891870.

4. Lubricate the o–rings on the piston and push the piston into place.

5. Lift off the crown wheel. Remove the friction and steel discs and lift out the differential side gear.



fig084

6. Drive out the tubular pin (8 mm) locking the differential pinion shaft and tap out the shaft. Lift out the differential pinion and the right differential side gear.

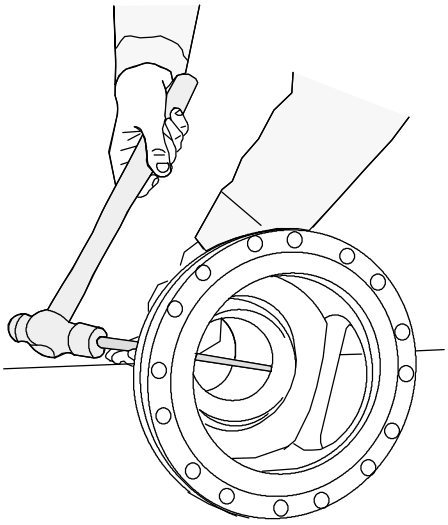


fig085

7. Remove the right side differential side gear using a hammer and a drift. Fit a new bearing using ETV 891870.

8. Lubricate the bearing and fit the right–hand side differential side gear in position. Lubricate the differential pinions and place them in the differential casing. Drive the shaft for the differential pinions into place.

9. Fix the shaft in position with the tubular pin.

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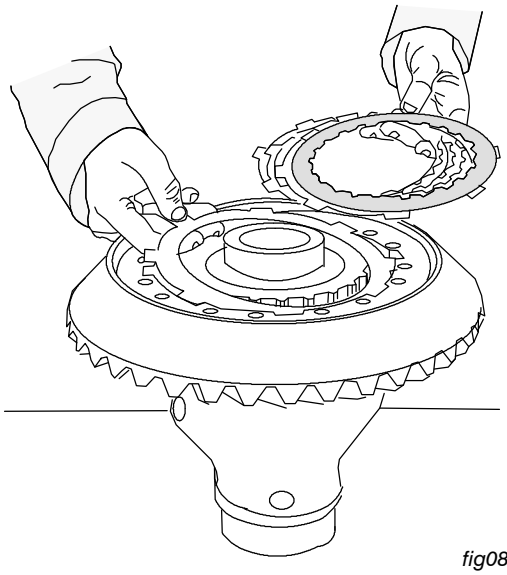


fig086

10. Position the crown wheel and the left hand side differential side gear. Position the friction and steel discs, the first and the last disc of the disc pack is a steel disc).

Note! There are five friction discs (internal splines) and six steel discs (lugs on outer circumference). When changing the discs, change simultaneously the whole disc pack.

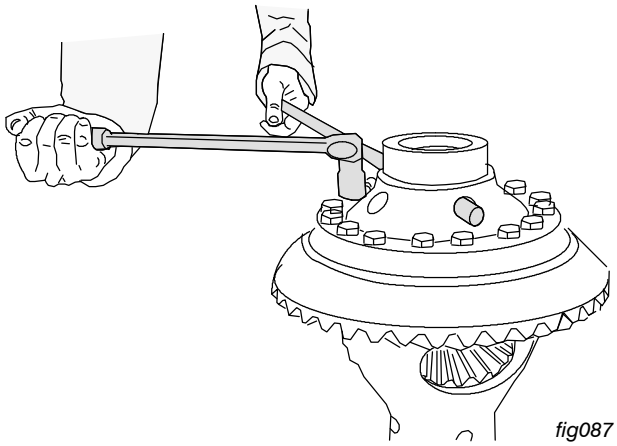


fig087

11. Position the left differential casing half. Apply locking fluid to the threads of the crown wheel attaching bolts and tighten the screws to a torque of **110 Nm**.

12. Fit the differential.

13. Fit final drives/brake housings.

14. Fit the PTO unit.

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Removal/installation of the gear lever cover

Quick instruction: removal of the gear lever cover

1. Put the supports under the tractor and if needed, put the planks on both sides of the front tyres.
2. Remove the rear wheels.
3. Drain the transmission oil.
4. Remove the gear lever rods and the cable bracket.
5. Remove the suction pipe.
6. Disconnect the necessary the pipes and the wires.
7. Remove the cover of the gear lever.
8. If needed remove the piston of the range gear.

Quick instruction: installation of the gear lever cover

1. Carry out the refitting in the reverse order.
2. If you remove the piston of the range gear, so fit the piston of the range gear.
3. Ensure that groove of the range gear piston is in the middle position. The selector fork and the groove of the range gear piston must be against each other when the cover of the gear lever is fitted into place.
4. Fit the gear lever cover into place.
5. Push the shaft fully home and ensure e.g. with help of the screw wrench that the pin of the selector fork is between the pins of shaft end. **Note!** Check that shaft pin is between the fork pins by rotating the shaft.
6. Fit the sensor and fast the locking screw of the position sensor shaft. Check the gear levers function.
7. Fit the pipes and the electric connectors into place.
8. Fit the suction pipe.
9. Fit the gear lever rods and the cable bracket.
10. Fit the rear wheels into place.
11. Fill the transmission oil.
12. Carry out the test run and check the connections and possible leaks.

Support points of the tractor

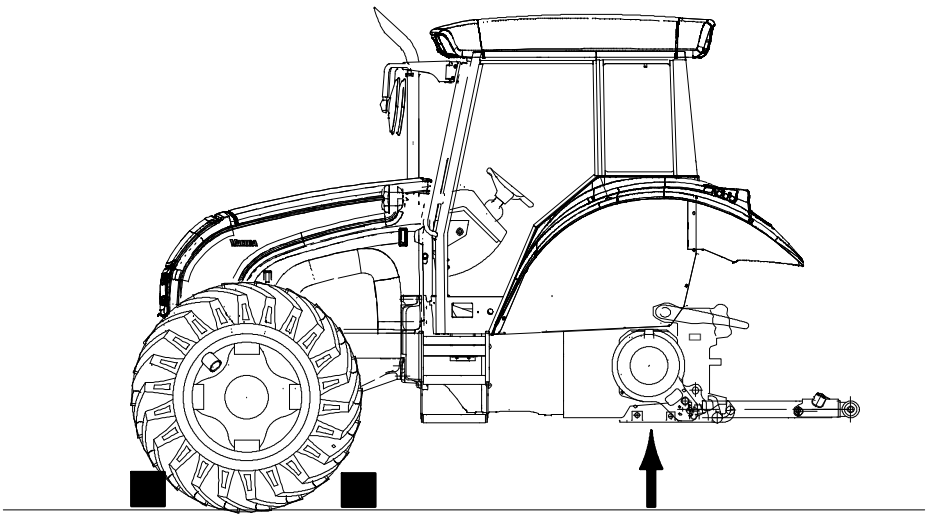
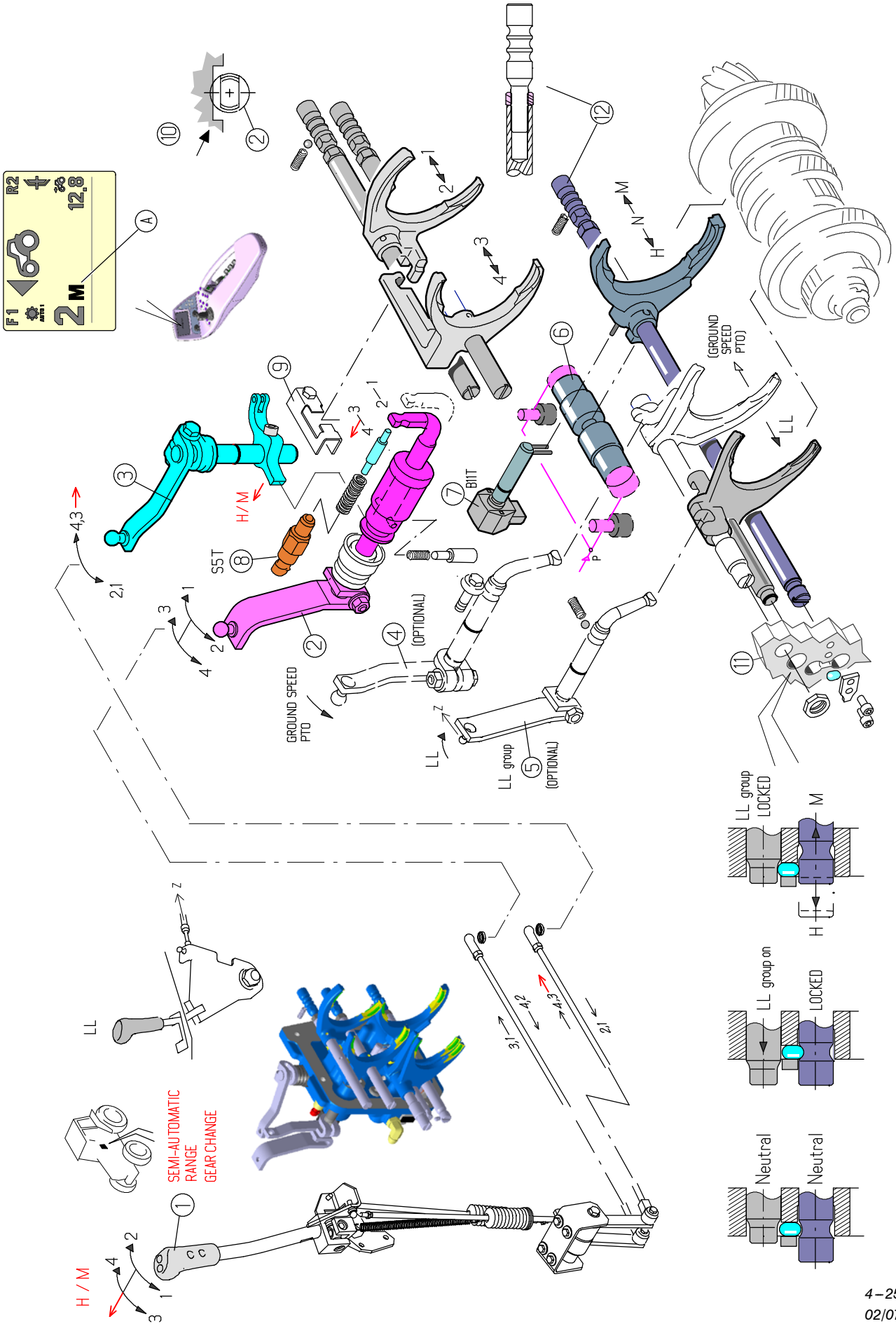


fig097

Support point

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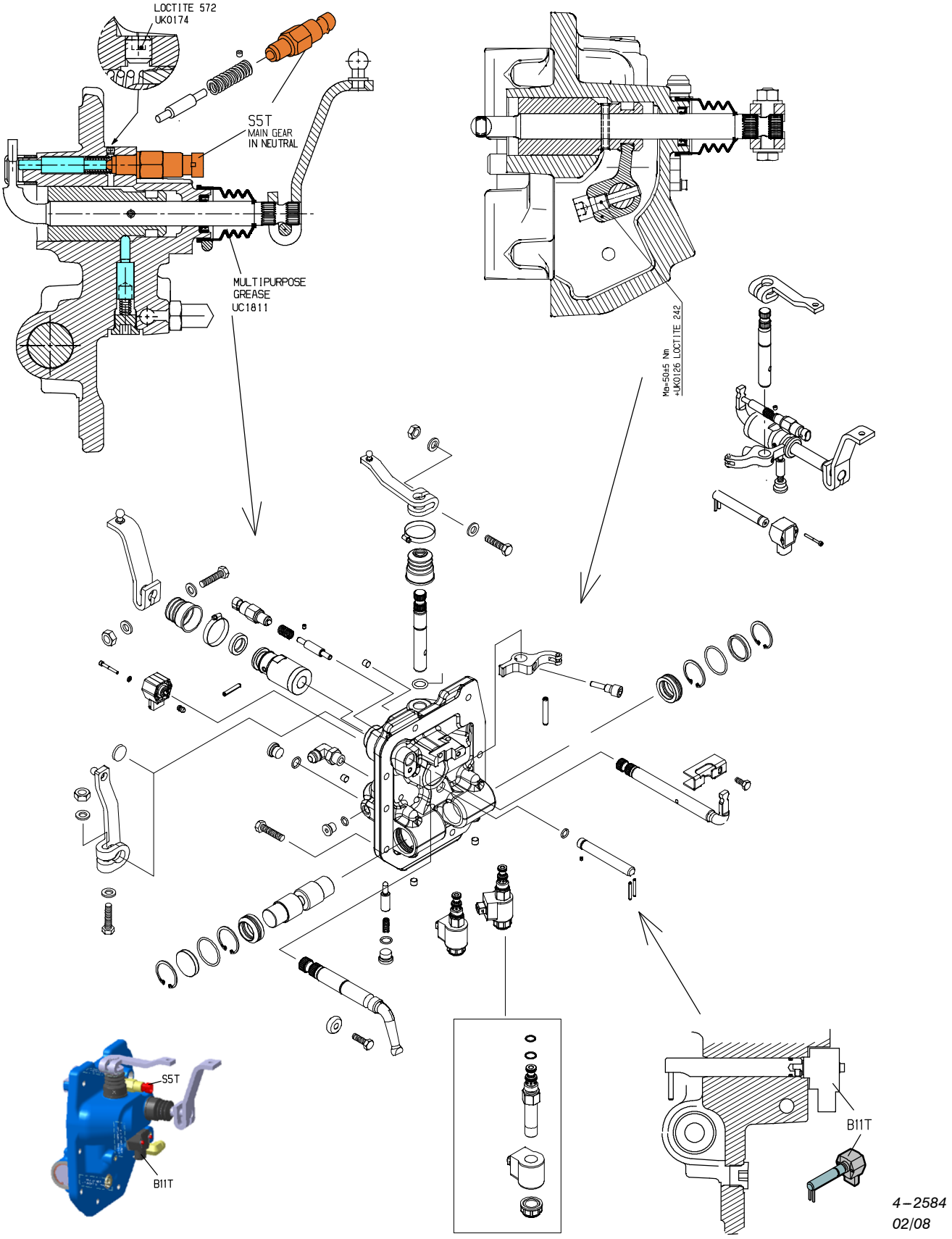
Gear change mechanism



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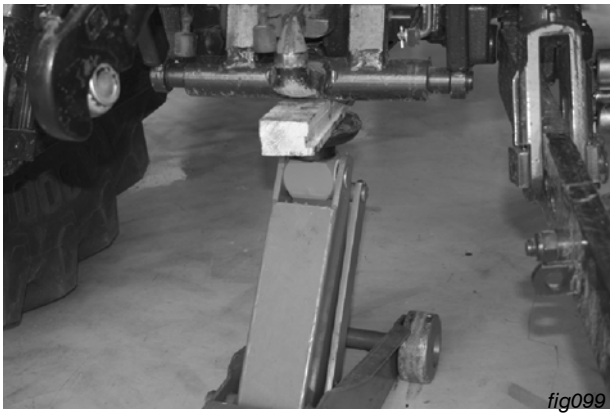
https://truckmanualshub.com/

Gear lever cover



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Removal of the gear lever cover


fig099

1. Lift the tractor rear end up.

Note! Be careful when working under tractor!


fig100

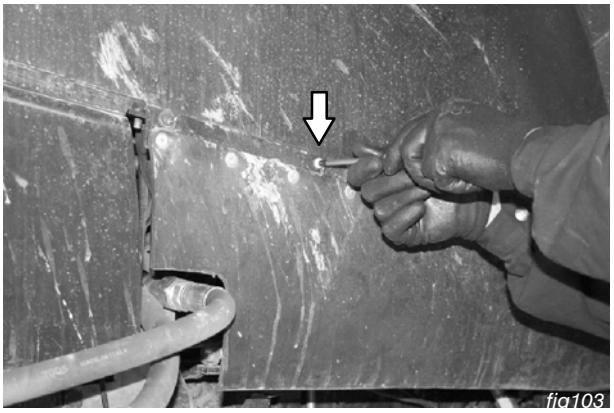
2. Remove the rear wheels.


fig101

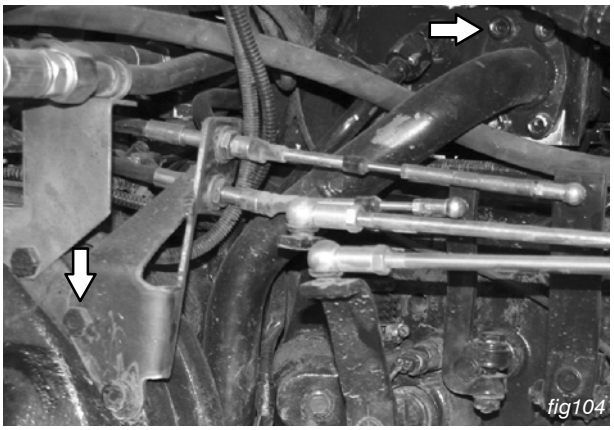
3. Put the supports under the tractor and if needed, put the planks on both sides of the front tyres.


fig102

4. Drain the transmission oil (about 65 litres).

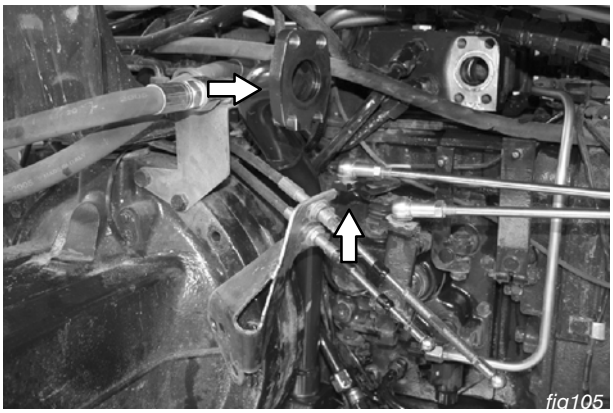

fig103

5. Remove the protective rubber.

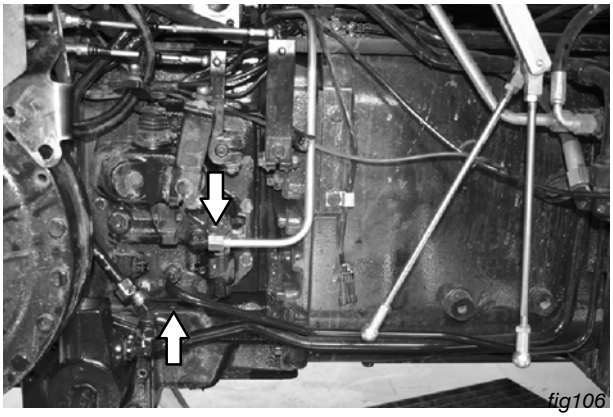

fig104

6. Remove the fastening screws of the suction pipe and the cable bracket.

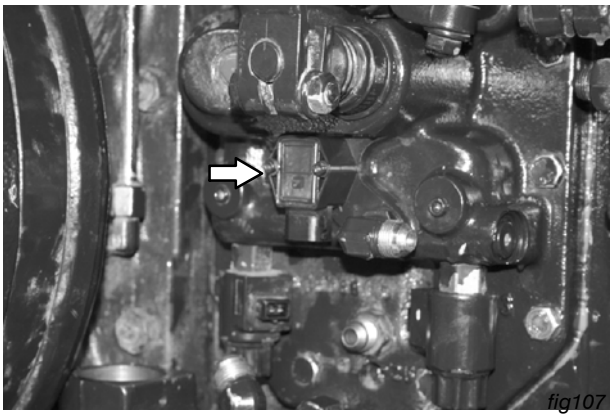
https://truckmanualshub.com/


fig105

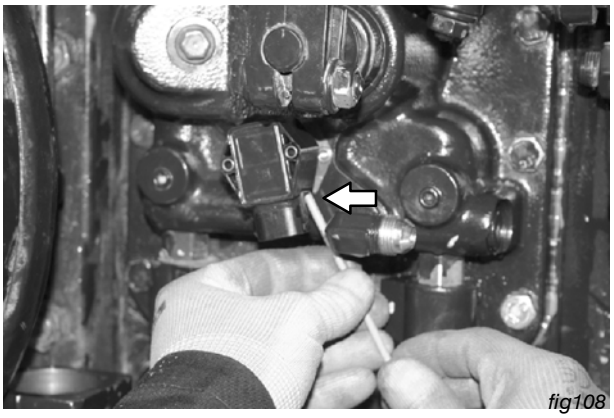
7. Turn the suction pipe according to picture and lift the suction pipe away. Remove the gear lever rods.

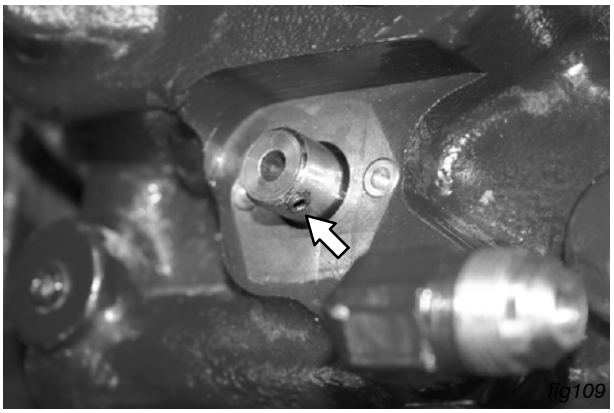

fig106

8. Open the oil pipes connection.

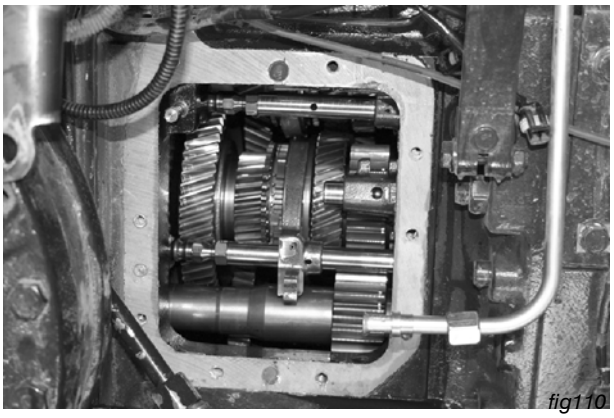

fig107

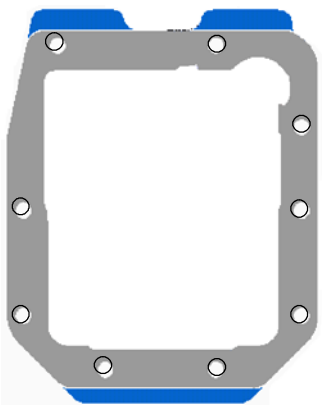
9. Remove the sensor screws.


fig108


fig109

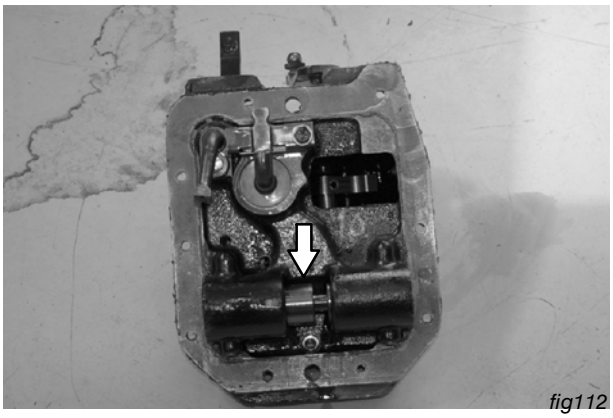
10. Open the shaft screws of the sensor and remove the sensor.


fig110

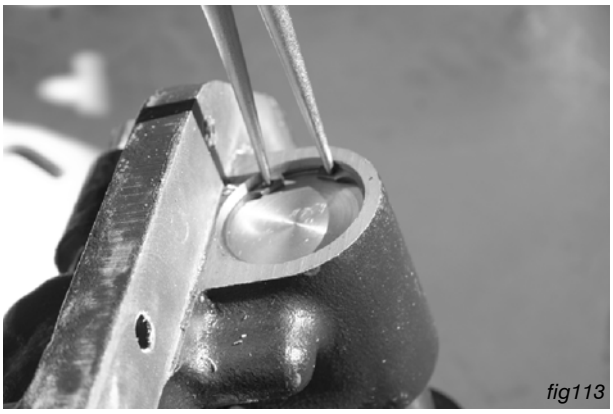

fig111

11. Move all gears to the neutral position. Remove the fastening screws of the cover. Remove the cover of the gear lever.

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fig112

12. If needed remove the piston of the range gear.


fig113

13. Remove the snap ring from both ends.


fig114

14. Remove the plug from both ends.


fig115

15. Remove the second snap ring from both ends.


fig116

16. Remove the O–ring from both ends.


fig117

17. Remove the sleeve from both ends.


fig118

18. Remove the piston of the range gear.

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Installation of the gear lever cover

1. Carry out the refitting in reverse order.

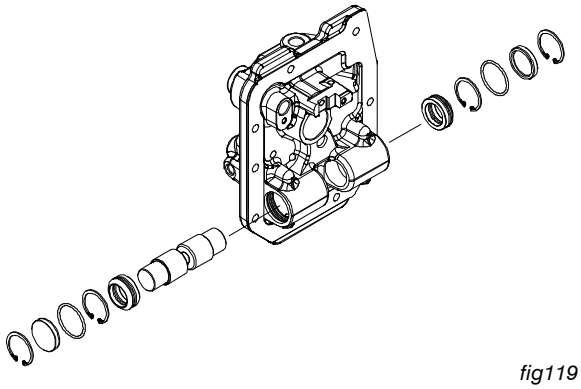


fig119

2. If you remove the piston of the range gear,fit parts of the range gear according to the picture.

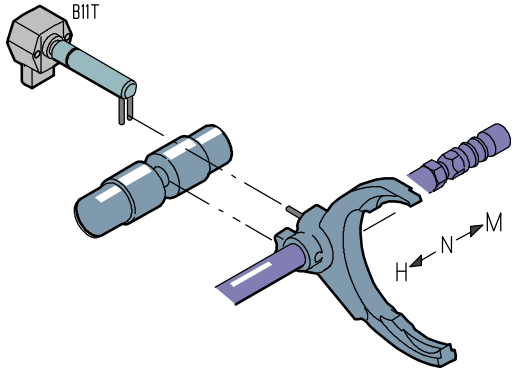


fig120

3. **Notice!** During installation that the parts are fitted according to the picture.

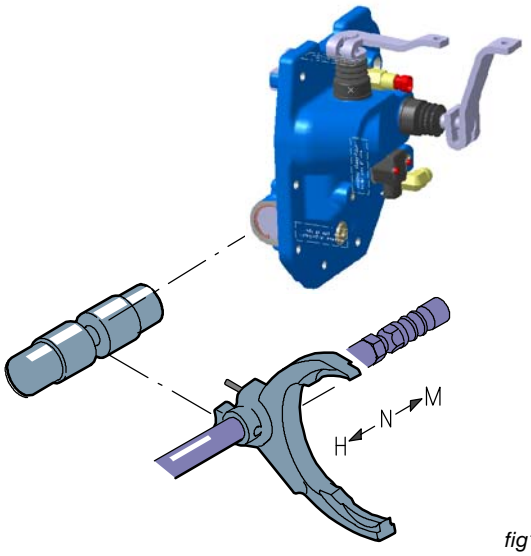


fig121

4. Ensure that groove of the range gear piston is in the middle position.
   The selector fork and the groove of the range gear piston must be against each other when the cover of the gear lever is fitted into place.

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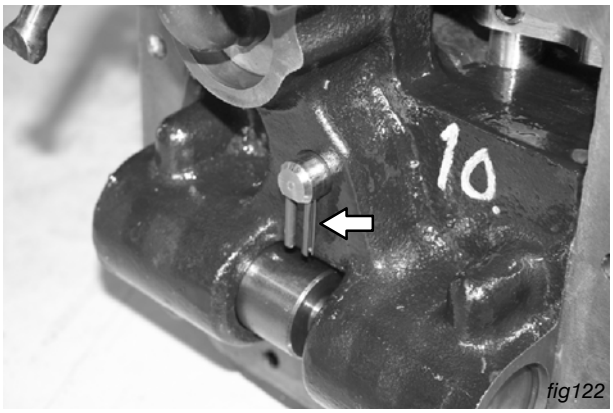
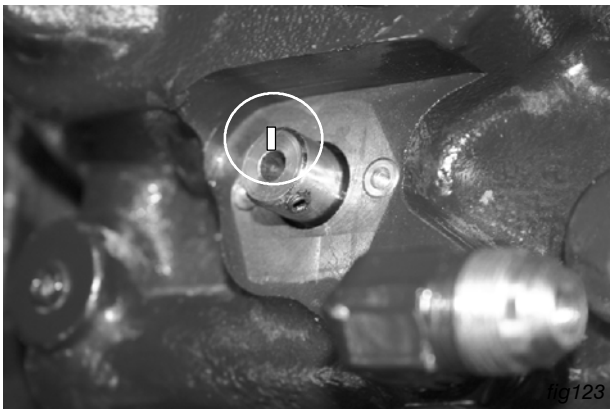
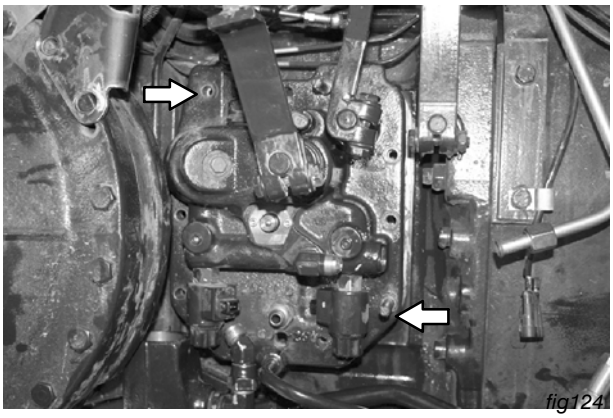


fig122

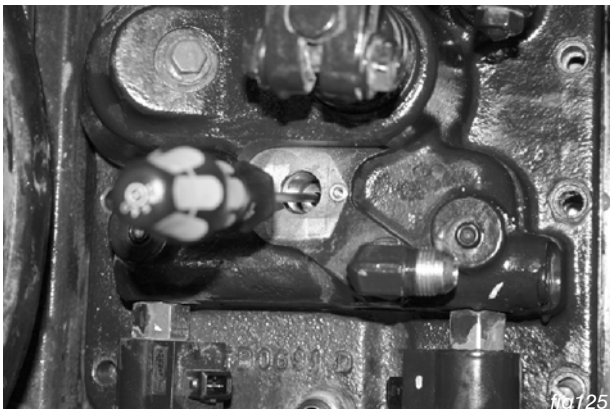
5. Rotate the pins of the shaft downwards (see picture).


fig123

6. Mark the shaft position for checking.


fig124

7. Check that all gears are in the neutral position and fit the gear lever cover into place. Use of guiding pins helps when installing the cover.


fig125

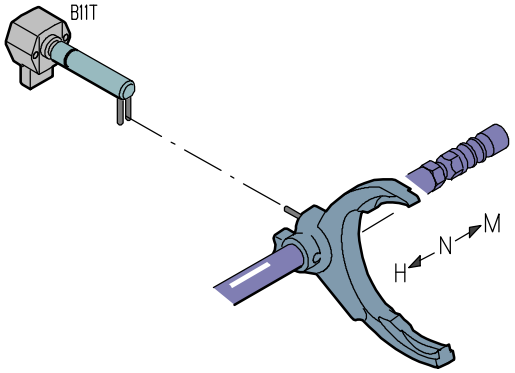
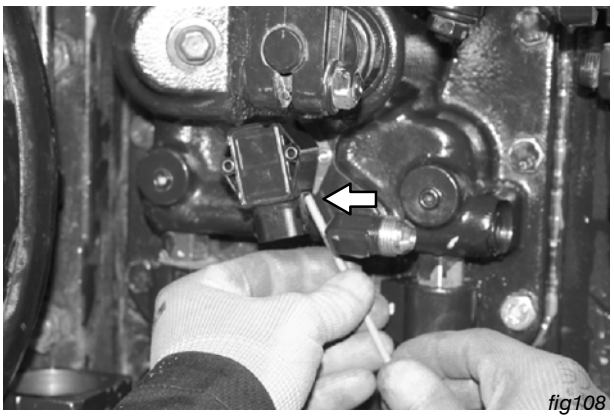
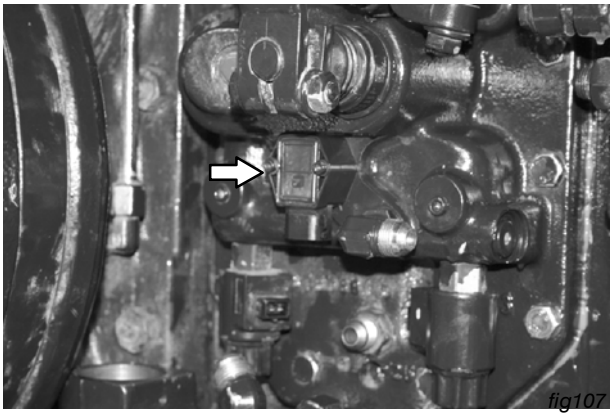


fig126

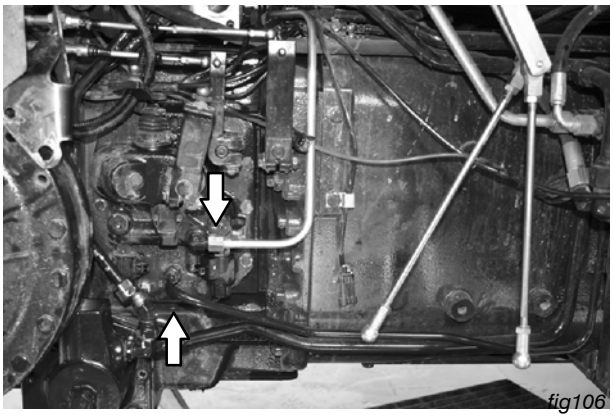
8. Push the shaft fully home and ensure e.g. with help of the screw wrench that the pin of the selector fork is between the pins of shaft end.
Note! Check that shaft pin is between the fork pins by rotating the shaft.

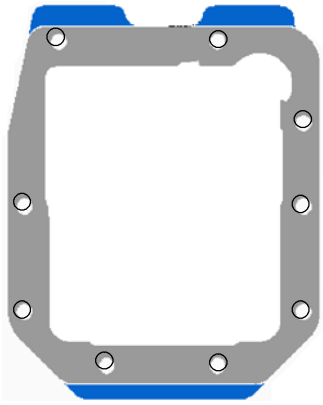

fig108


fig107

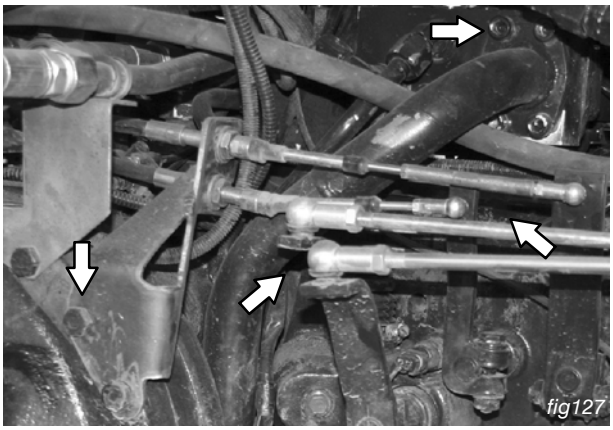
9. Fit the sensor and fasten the locking screws of the position sensor shaft. Check the gear levers function.

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fig106


fig111

10. Fit all the fastening screws of the cover. Fit the connections of the oil pipes.


fig127

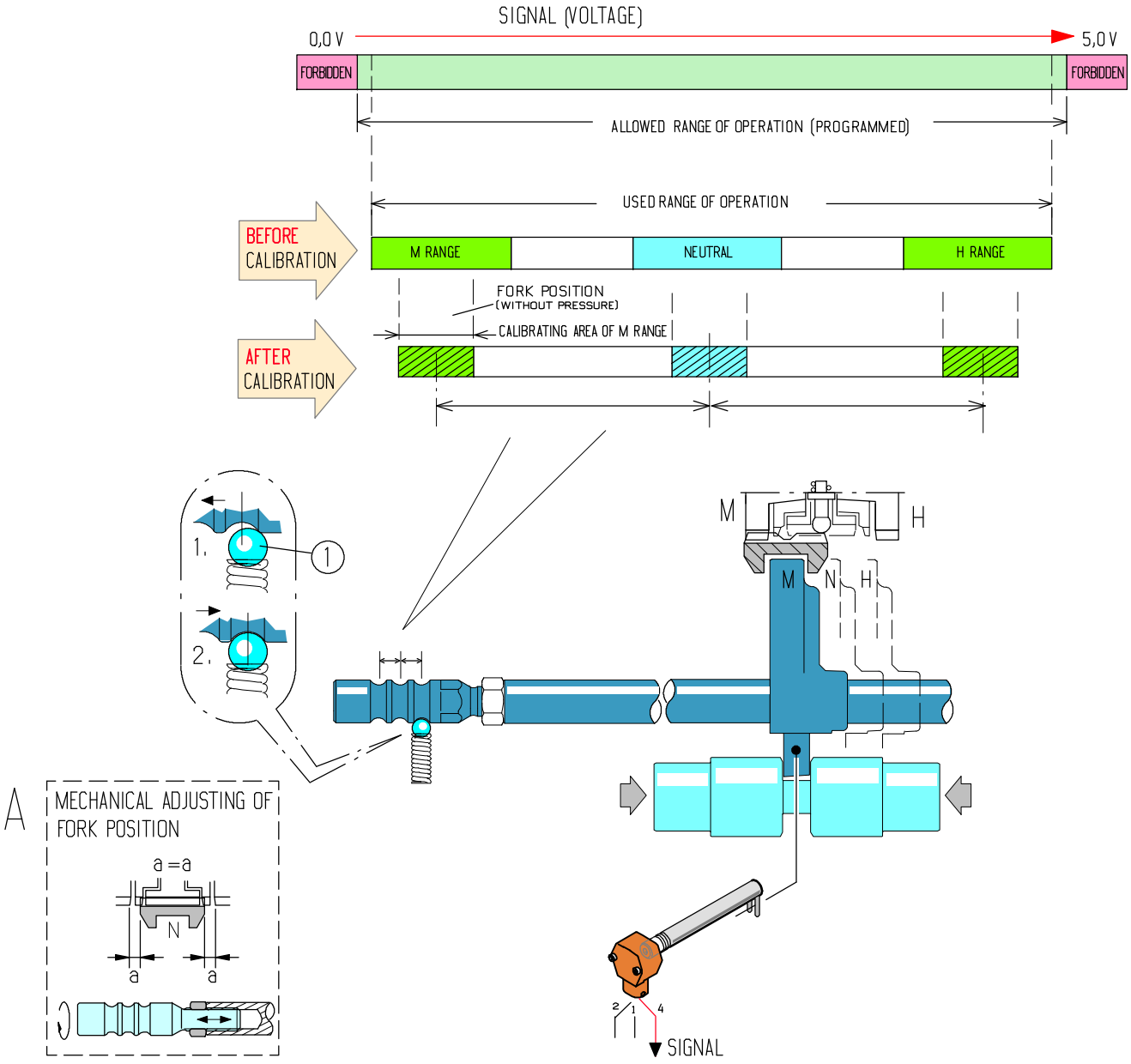
11. Fit the fastening screws of the suction pipe, the cable bracket and the gear lever rods.

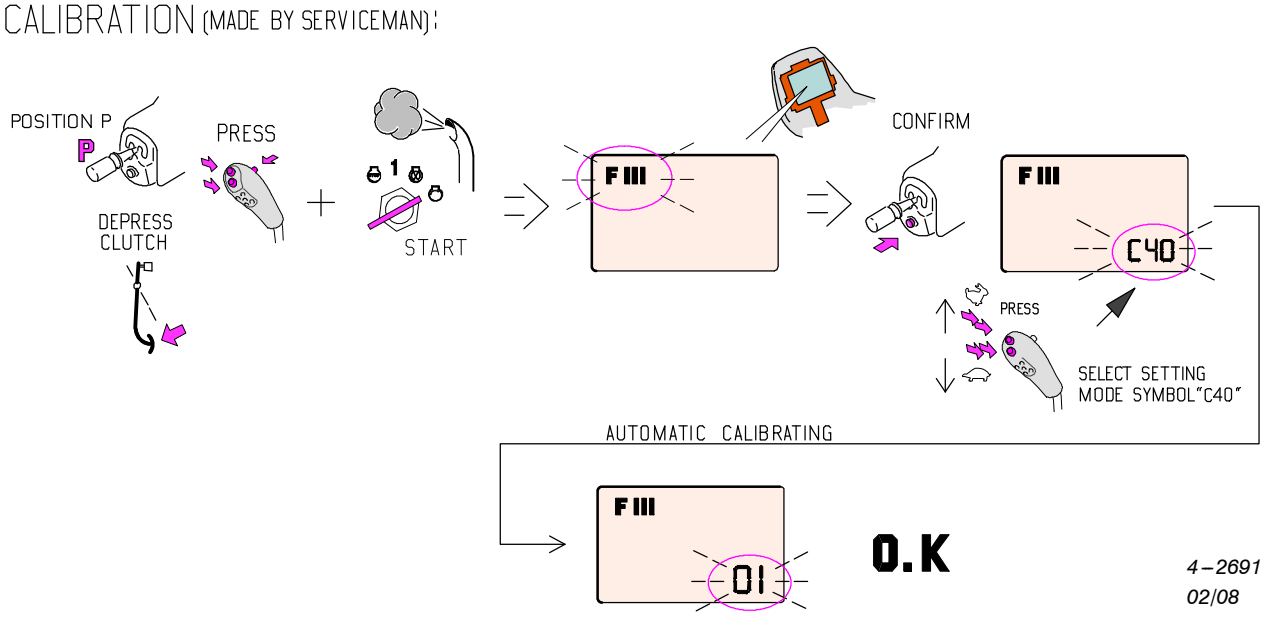

fig100

12. Fit the rear wheels into place.
13. Fill the transmission oil.
14. Carry out the test run and check the connections and possible leaks.

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Calibration principle of semi–automatic range gear (LS)





4–2691
02/08

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The right mechanical position of the selector forks has been adjusted (A).

The positions M – N – H and undefined intermediate positions are notified with the analog angle sensor (B11T). Signal ranges for every position have been defined in the program.

When e.g. the M range has been electrohydraulically coupled on, the selector moves a little bit over the locking position and when the pressure against the shifting piston is discharged, the selector moves slightly rearwards and is locked with the ball (1).

Calibration:

The calibration of the angle sensor is made with the calibration mode C40 of the TC1 control unit.
The calibration is made by going to the calibration mode –> the control unit couples the M group on, notifies the signal of the extreme position and observes when the selector has been returned backwards and notifies this value as a calibration signal for M position.

From this position the control unit calculates the “limiting values” of the N and H ranges.

If the limiting values do not fit inside the allowed range (e.g. if the fork pin doesn’t be inside the the pins of the angle sensor), the calibration is ended with the error notification.

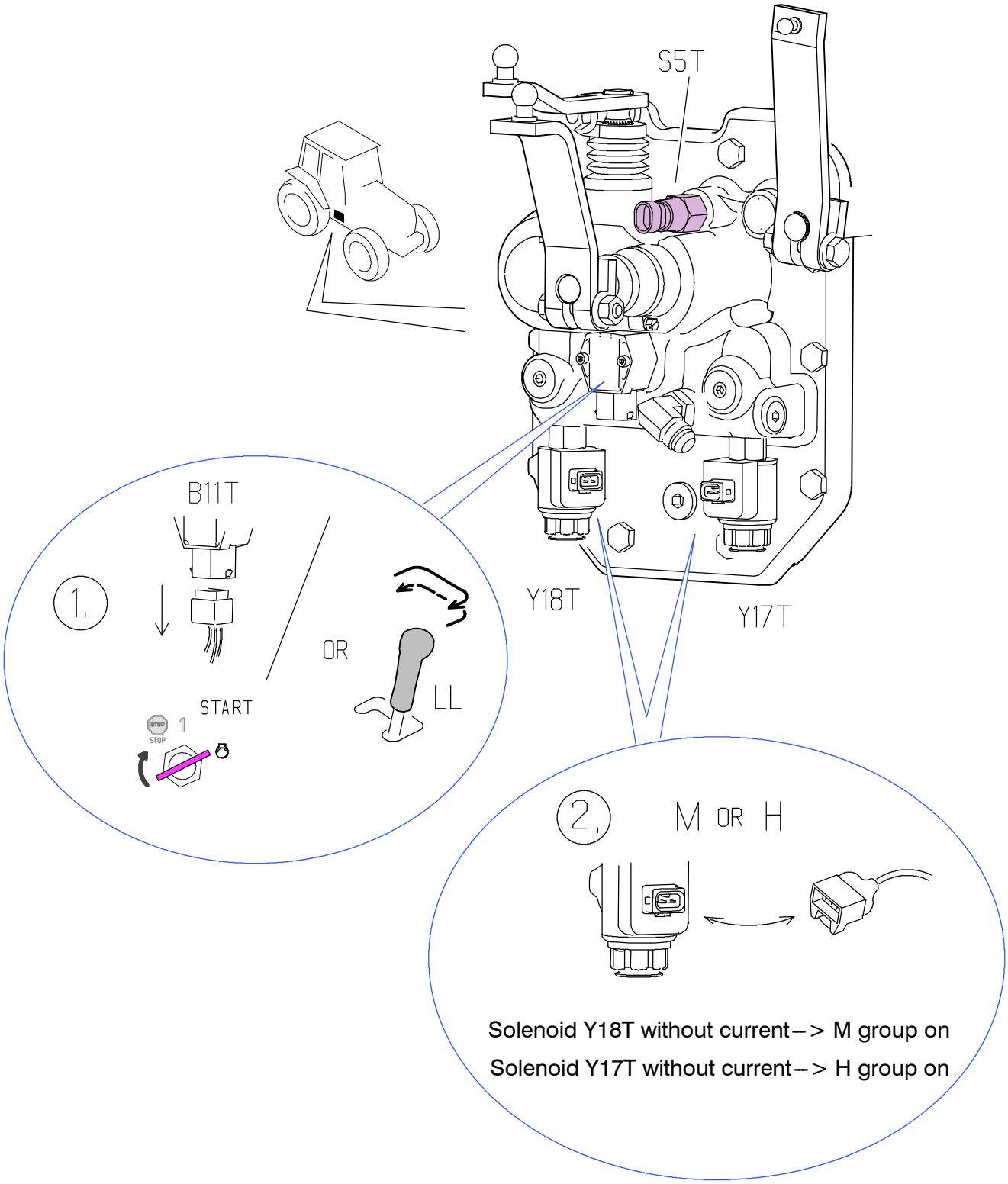
Calibrating the semi–automatic range gear (serviceman):

The gear must be set to neutral and the parking brake must be on.

1. Engine is running (1000 rpm) stationary.
2. Choose the index C40.
   - Press the both DPS push buttons and the HiShift button on the lever knob at the same time.
   - Depress the clutch pedal to the bottom and start the engine.
   - After this select the suitable F mode with the DPS push buttons and confirm the selection with the DPS pre–programming knob.
3. Press the pre–programming button.
4. Wait until **“01**” appears in the TT (Tractor Terminal) display.
5. If a fault or interruption code is displayed, check the reason in the service code list.

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Forcing the semi–automatic range gear on (LS)



4–2841
06/07

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The semi–automatic range gears can be forced on for example in situations, where the change switch **S5T** is damaged, and the gear range remains in neutral (and only the creeper gear LL, if available, can be shifted on).

1) Moving the semi–automatic range gear to the neutral (if the range is not already in neutral):

1. Ensure that the parking brake lever is in the parking brake position and the current is off.
2. Remove the connector from the angle sensor **B11T** and start the engine. Because the solenoids are energized and there is pressure on both sides of the piston, the piston moves to the middle position and the gear will be in neutral.

Another way is to put the creeper (LL) gear lever (if available) on and then off.

2) "Tricking" the semi–automatic range gear, in order to get the H or M gear range on (in neutral position):

1. Ensure that the current is off.
2. Remove the connector from either solenoid (**Y18T** or **Y17T**), depending on the desired range gear (with the connector of the angle sensor still removed).
3. Start the engine. The pressure will increase in the other side of cylinder and the range changes.

Wait for about half a minute before driving the tractor. (The control unit TC1 gives the voltage to the solenoid within about 23 seconds. So the range will be coupled, but the pressure will be kept behind the piston end during this time. When driving then, it can cause the wearing of the selector).

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Technical specifications

3–step Powershift

Gear ratios
– direct ratio ..... i=1
– overdrive ..... i=0.811
– overdrive ..... i=0.651
Powershift clutch pressures (from low pressure pump) ..... 1.8 MPa

Multi–disc clutches

Foremost clutch C1

– number of friction discs ..... 9 pcs
– number of steel discs ..... 9 pcs

Intermediate clutch C2:

– number of friction discs ..... 7 pcs
– number of steel discs ..... 7 pcs

Clutch C3 for planetary when shuttle:

– number of friction discs/steel discs ..... 6/6 kpl
Cup springs (2 pcs.) in planetary gear clutch, convexity ..... 7±0.15 mm
Cup springs (6 pcs.) in clutch for reduction ratio, convexity ..... 3 mm
Cup springs (4 pcs.) in clutch for overdrive, convexity ..... 3.5 mm

4WD clutch

Number of friction discs ..... 12 spc
Number of steel discs ..... 11 spc
Cup springs (4 pcs), convexity ..... 8.5 mm
Clutch pressure (from low pressure circuit) ..... 1.8 MPa

Tightening torques

Gear housing–shuttle ..... 45 Nm
Gear housing–fuell tank:
– hex socket–head screw ..... 125 Nm
– nuts with studs ..... 270–330 Nm
Flange joint, propeller shaft ..... 35 Nm
Cab attaching bolts ..... 200 Nm
Seal retainer on quick–shift gear input shaft ..... 23 Nm
Quick–shift gear cover bolts ..... 23 Nm
Planet carrier screws ..... 23 Nm
Solenoid valve fixing screws ..... 2.5–3.5 Nm
Oil hoses to the steering valve ..... 50 Nm
Front axle attaching bolts ..... 380 Nm

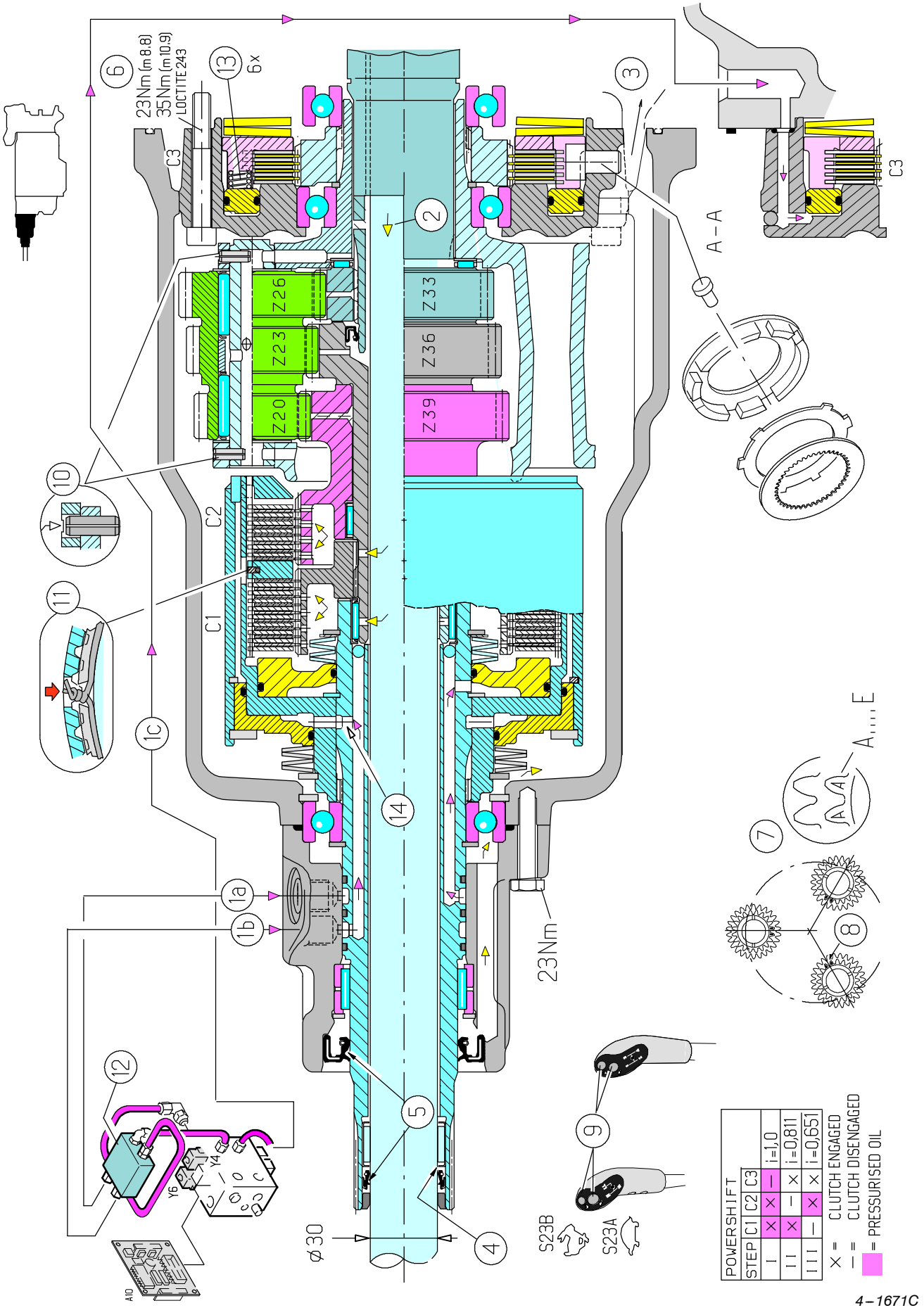
Settings

4WD clutch pack clearance is adjusted by first tightening the output shaft nut and then unscrewing it **one and a half turn**.

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Powershift gear (Syncro)



4–1671C
06/08

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– In the the clutch drum and on the outer race of the intermediate plates (concerns the clutches C1 and C2) there are teeth (splines), Z=54.
– The numbers of the friction and intermediate discs:

DPS type	Clutch C1		Clutch C2		Clutch C3	
	Friction discs	Intermediate discs	Friction discs	Intermediate discs	Friction discs	Intermediate discs
650	9	9[1)]	7	7[1)]	4	5

[1)] Intermediate disc with involute gear teeth (32773200). Other friction discs are with each other and intermediate discs with each other of the same type.

1a) Pressure oil (1.8 MPa) to DPS multi–disc clutch C1.
1b) Pressure oil (1.8 MPa) to DPS multi–disc clutch C2.
1c) Pressure oil (1.8 MPa) to DPS multi–disc clutch C3.
2) Lubrication oil.
3) Lubrication and leak–off oil return to gearbox through the countershaft front end cover.
4) The markings on the needle bearings (hardened sides) to face outwards.
5) To be packed with universal grease when fitting.
6) When removing the screws of the clutch housing, the planetary gears may be in such a position, that the screws cannot be opened. In this case, pressurize with e.g. hydraulical hand pump the clutch C3. Then you can rotate the clutch to another position. The fastening screws must be tightened gradual and evenly, and be sure that no one of the screws remain loose.
7) The planetary gears are sorted in groups (A–E). The class designation has been located on two teeth. All three planetary gears must have the same class designation/ side (both ends have been marked separately). A planetary gear set (3pcs) is delivered as a spare part.
8) **Note!** Arrows to point to the centre of the sun wheel when fitting.
9) The switch for the powershift is located in the gear lever handle
10) When the planetary carrier is stationary, the lubrication (splash) oil can flow along the grooves and through the pins to lubricate the planetary gears.

N.B.! The pin has to be assembled a little lower than the surface of the planetary carrier (lubrication oil can get in the hole).

11) Steel wire for securing has been added. After removing the wire, the locking ring can be taken off by pressing it through the holes (6 pcs, ø 9 mm) in the clutch drum.
12) Lock valve
13) The multi–disc clutch C3 has springs (6 pcs). The springs return the piston to the end position.
14) **Note!** The holes must align each other.
15) Power shuttle housing

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Function of the DPS (syncro)

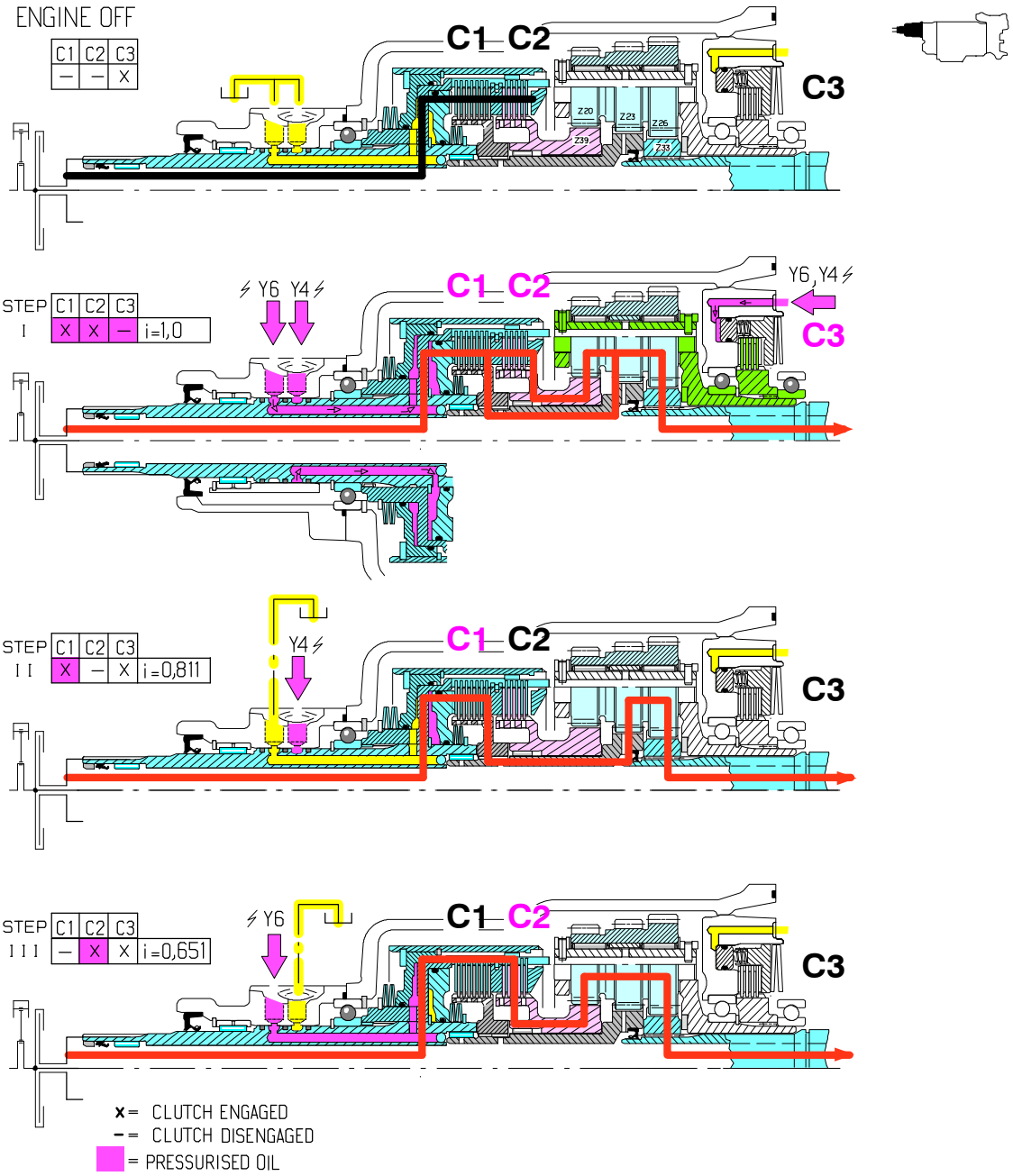


fig002

– The engine has been stopped: all the clutches are without pressure and the DPS is in neutral position. **N.B. When parking tractors always apply the parking brake. The engine does not brake** on models with DPS (alarm buzzer sounds).

Step I:
All the clutches C1, C2, C3 are pressurised (the solenoids Y4 and Y6 are energised). The clutch C3 is open and allows the free rotation of the planet carrier.

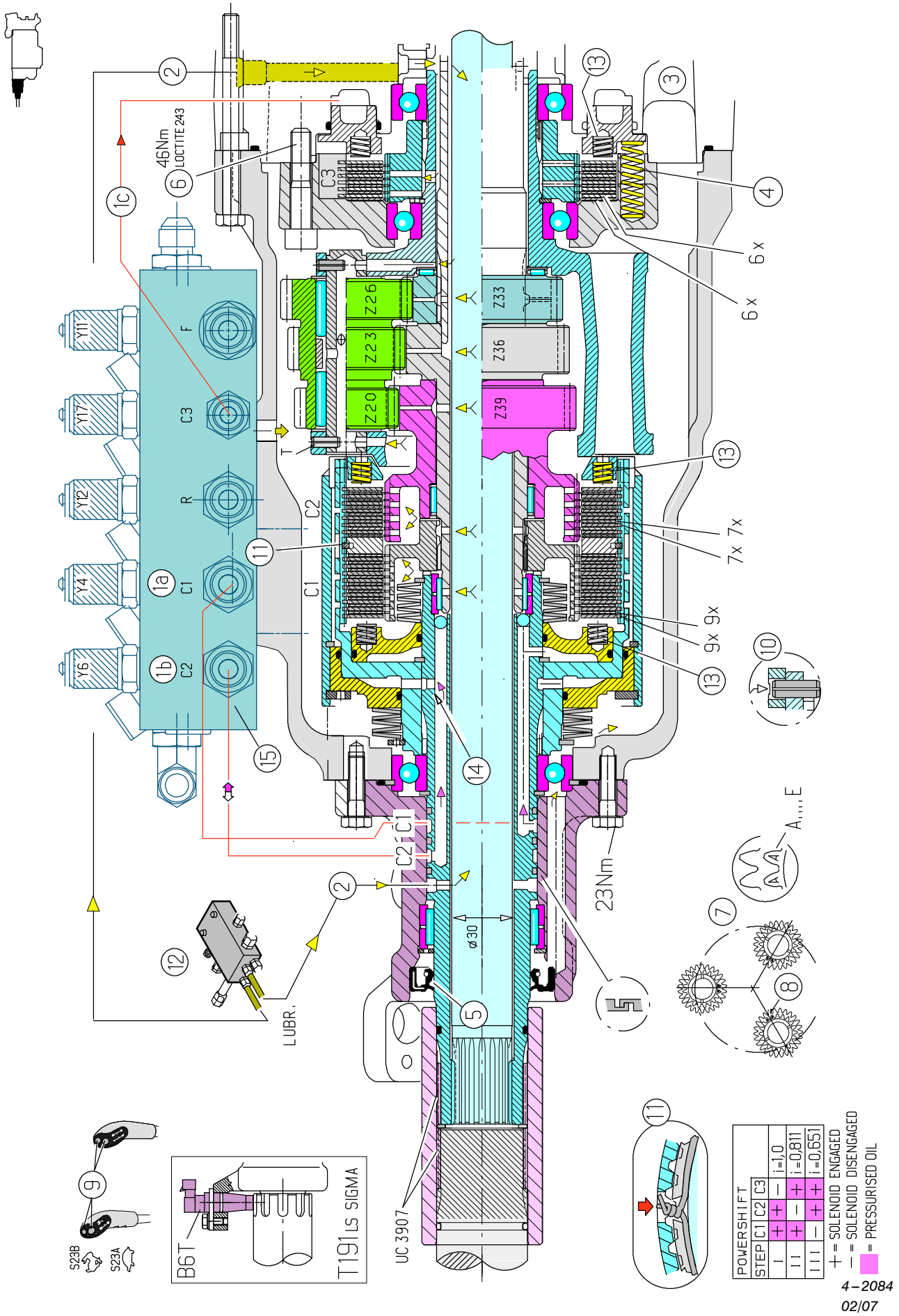
The input shaft and both the middle shafts and the planet carrier are coupled together, and they rotate as a whole unit. The planet gears don't rotate separate. The gear ratio is i = 1.0.

Step II:
The multi–disc clutch C1 is pressurised (solenoid Y4 energised). The clutches C2 and C3 are without pressure. The clutch C3 is closed by the cup springs and connects the planet carrier with the frame. The clutch has been connected the input shaft and the next gear shaft with each other. The power goes further via the planetary gears to the gear located on the main shaft. Gear ratio is i = 0.811.

Step III:
The multi–disc clutch C2 is pressurised (solenoid Y6 energised). The clutches C1 and C3 are without pressure. The clutch C3 is closed by the cup springs and connects the planet carrier with the frame. The clutch C2 has coupled the input shaft and the middle shaft with each other . The power goes via the planet gears to the gear located on the main shaft. The gear ratio is i = 0.651.

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Powershift gear (Hitech, LS)



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– In connection with the new power shuttle also the DPS has been changed. Proportional solenoid valves control the oil flow to the DPS, and thus the function of the DPS is smooth. The DPS has three multi–disc clutches, which close by means of proportional valves, and open by the spring force. Each clutch has its own proportional valve. Always two pressurised clutches are required (at the same time) in order to shift the gear.

1a) Pressure oil (0...1.8 MPa) to DPS multi–disc clutch C1.

1b) Pressure oil (0...1.8 MPa) to DPS multi–disc clutch C2

1c) Pressure oil (0...1.8 MPa) to DPS multi–disc clutch C3

2) Lubrication oil

3) Lubrication and leak–off oil return to shuttle unit / gearbox.

4) Return spring of the clutch C3 (9 pcs)

5) Front shaft seal: To be packed with universal grease when fitting.

6) Clutch housing fastening screw (46 Nm). Loctite 243 on threads.

7) The planetary gears are sorted in groups (A–E). The class designation has been located on two teeth. All three planetary gears must have the same class designation/ side (both ends have been marked separately). A planetary gear set (3pcs) is delivered as a spare part.

8) **Note!** Markings must point to the centre of the sun wheel when fitting.

9) The DPS switches are located in the gear lever handles.

10) When the planetary carrier is stationary, the lubrication (splash) oil can flow along the grooves and through the pins to lubricate the planetary gears.

N.B.! Fit the locking pins so that the split sides come at the carrier groove and tap the pins a little deeper that the planetary carrier surface to facilitate free flow of lubricating oil. The hindmost pin is for manufacturing reasons tight only with the shaft.

11) Steel wire for securing. After removing the wire, the locking ring can be taken off by pressing it through the holes (6 pcs, ø 9 mm) in the clutch drum.

12) Distribution block.

13) The clutches have springs (18 pcs/ piston). The springs damper the coupling of the clutch.

14) When mounting, check that the holes align each other (pressure line of the clutch C2).

15) Valve block for DPS and shuttle unit.

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Function of the DPS (Hitech)

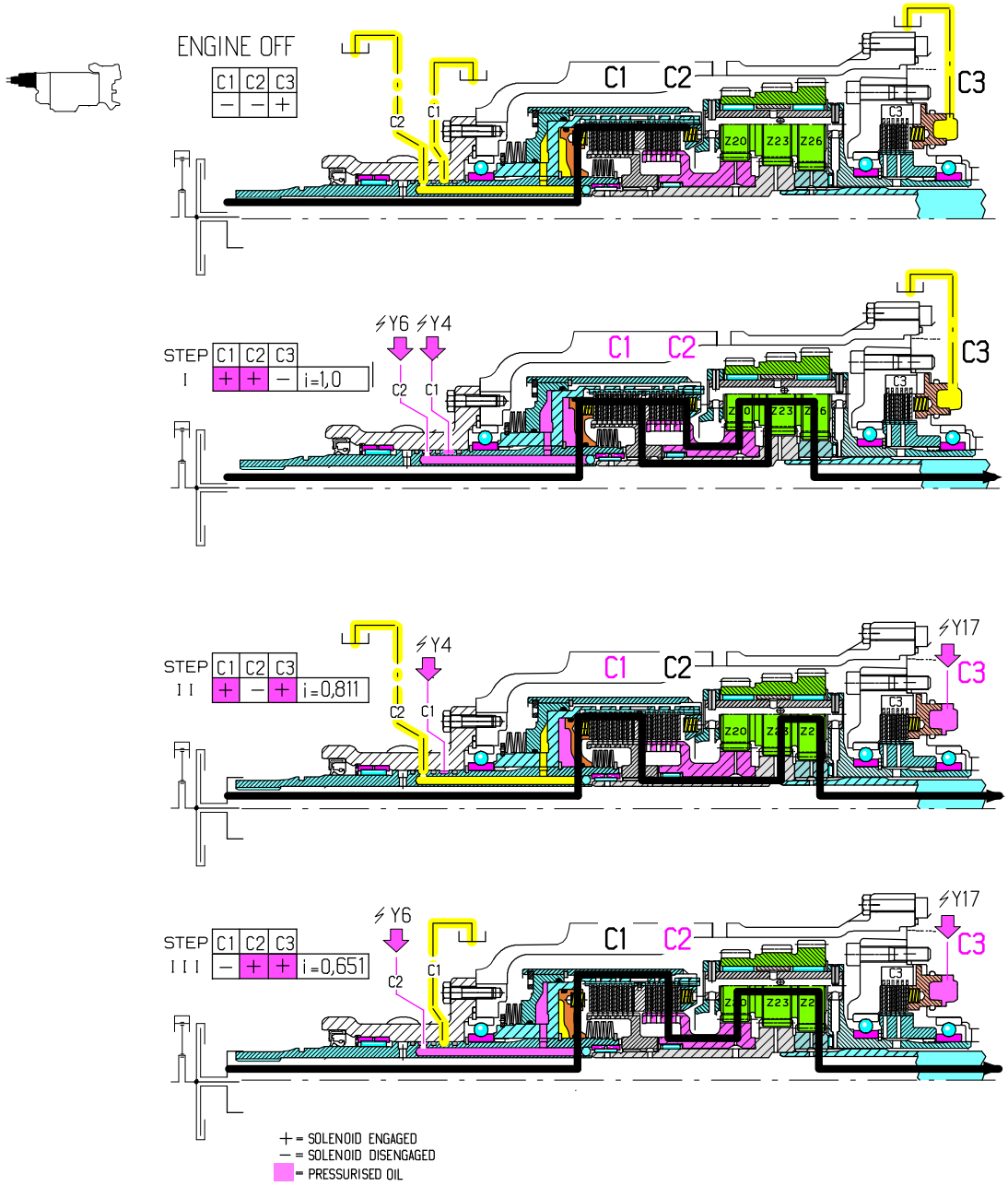


fig004

The engine has been stopped: all the clutches are without pressure and the DPS is in neutral position. The parking brake applies automatically when stopping the engine.

Step I:
All the clutches C1, C2 are pressurised (the solenoids Y4 and Y6 are energised. The clutch C3 is open and allows the free rotation of the planet carrier.

The input shaft and both the middle shafts and the planet carrier are coupled together, and they rotate as a whole unit. The planet gears don't rotate separate. The gear ratio is i= 1.0.

Step II:
The multi–disc clutches C1 and C3 are pressurised (solenoids Y4 and Y17 are energised). The clutch C2 is without pressure. The clutch C3 connects the planet carrier with the frame.

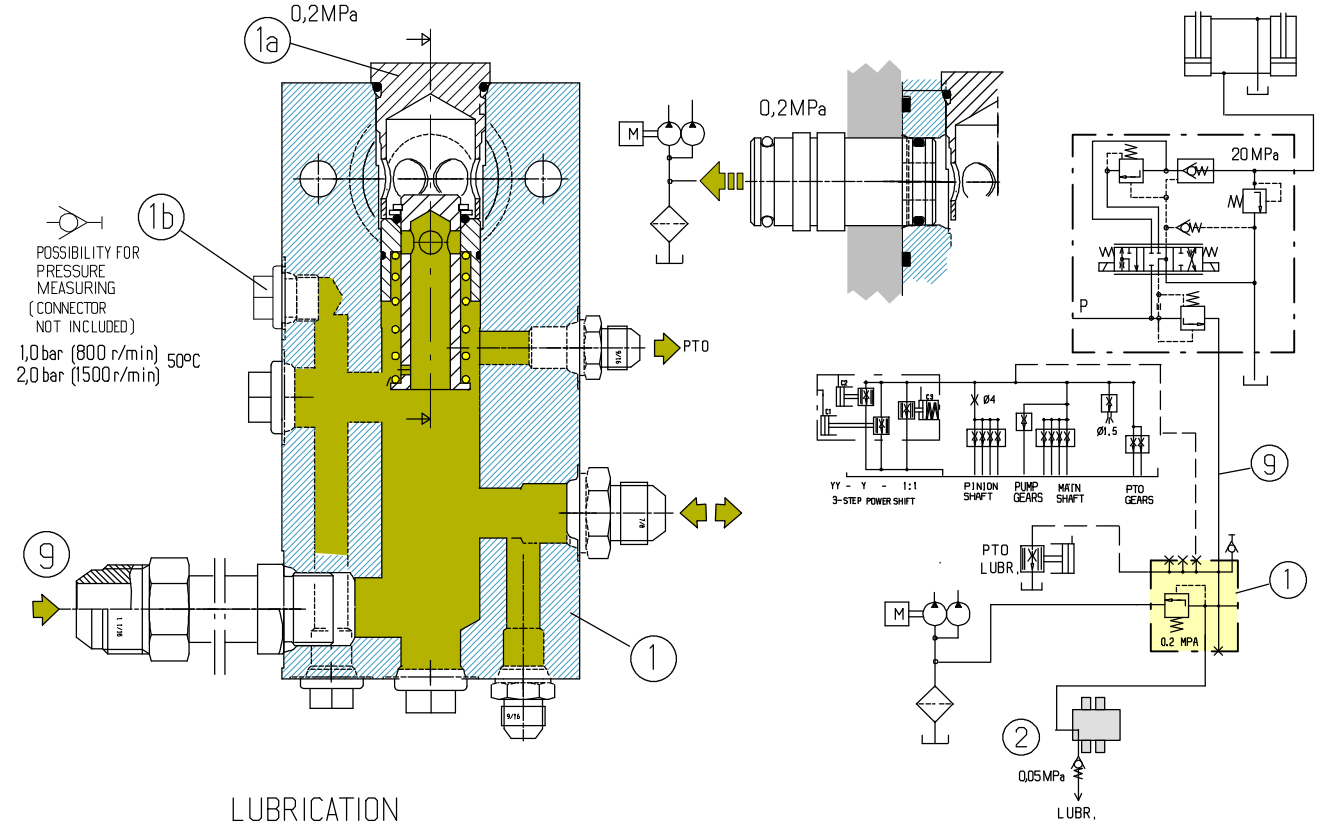
The clutch has been connected the input shaft and the next gear shaft with each other. The power goes further via the planetary gears to the gear located on the main shaft. Gear ratio is i= 0,811

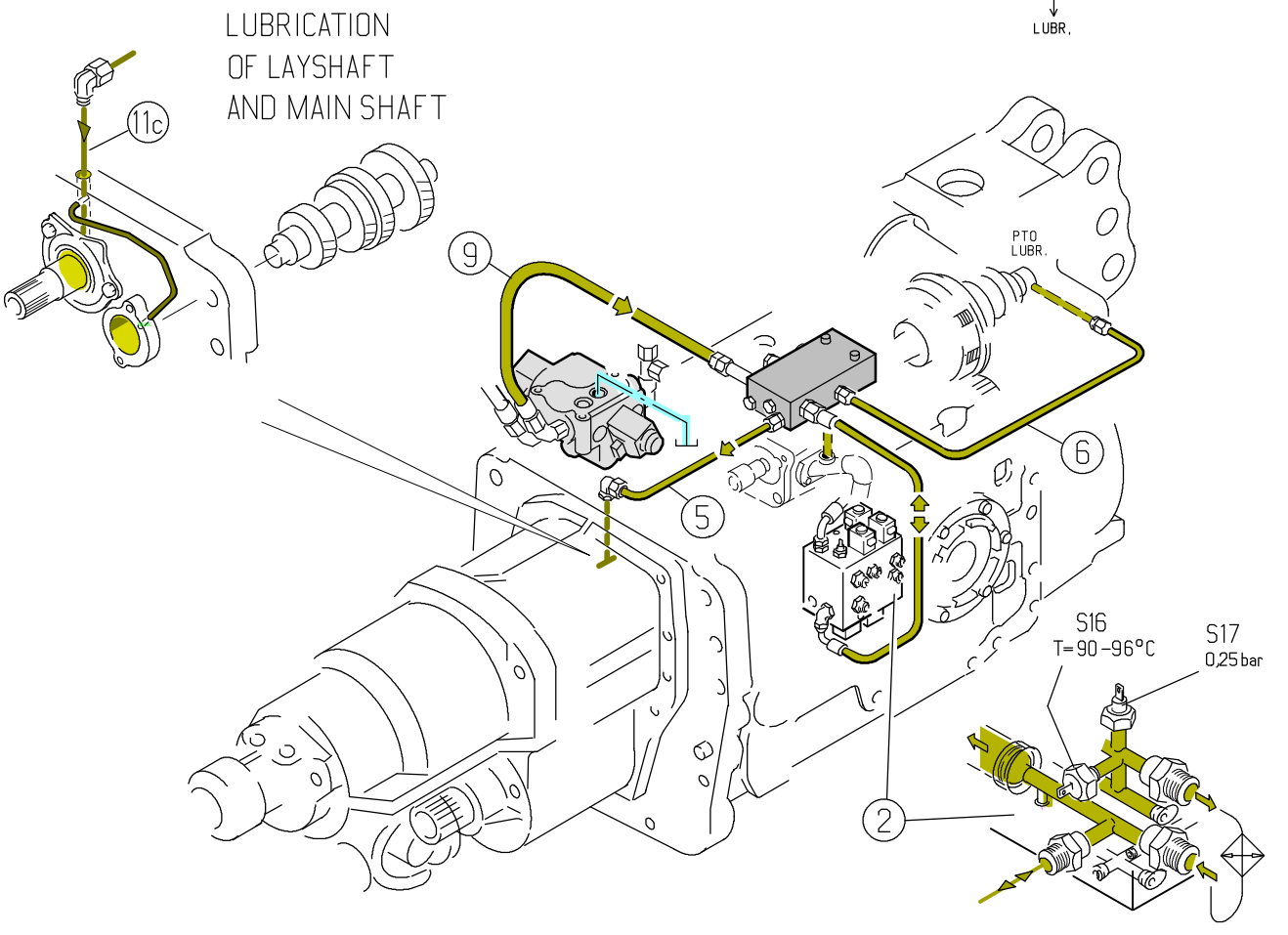
Step III:
The multi–disc clutches C2 and C3 are pressurised (solenoids Y6 and Y17 are energised). The clutch C1 is without pressure. The clutch C3 connects the planet carrier with the frame.

The clutch C2 has coupled the input shaft and the middle shaft with each other . The power goes via the planet gears to the gear located on the main shaft.The gear ratio is i= 0.651.

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Lubrication oil supply (Syncro)





4–2717
06/07

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In addition to the oil from the low pressure circuit (see picture of the valve block), the return oil from the power lift is used to lubricate the front bearing of the main shaft (extra lubrication) and the PTO. The lubricating oil for above–mentioned components is taken through the lubrication block **1**.

When the lubricating pressure rises over 0.25 MPa (2.5 bar), the oil flows through the valve **1a** to the suction pipe of the pump. When the oil is very cold, the great part of the return oil circulates through this valve and thus helping the suction of the pump.

The oil flows to the lubrication block:
- From the free circulation of the power lift control valve **9**, when the auxiliary hydraulic valves and the power lift are not operated.
- From the valve block of low pressure circuit, if the oil is taken much via auxiliary hydraulic valves to the external use, e.g. when tipper is used.

1) Lubrication block

1a) Valve 0.2 MPa (20 l/min) determines the max. lubrication pressure. The excess lubricating oil gets to the pump suction side. Especially in cold conditions this is advantage.

1b) The measuring connector of the lubricating pressure. The pressure should be (oil temp. 50 C):
- 1.0 bar (800 r/min)
- 2.0 bar (1500 r/min)

2) Valve block of the the low pressure circuit

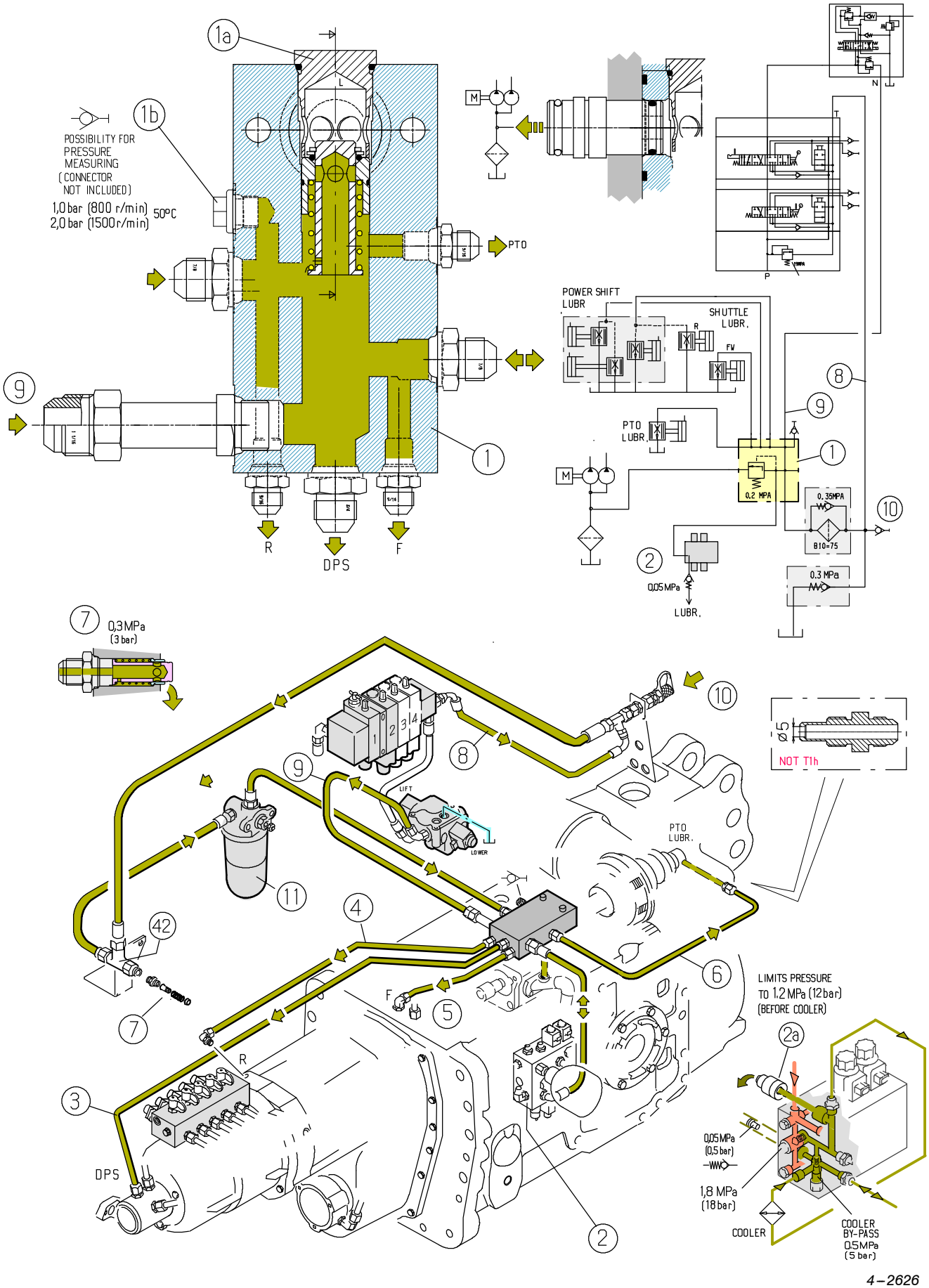
5) Lubricating oil to main shaft

6) Lubricating oil to the PTO multi–disc clutch (+PTO gears)

9) Free circulation oil from the power lift control valve

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Lubrication oil supply (Hitech)



4–2626
06/07

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In addition to the oil from the low pressure circuit, the return flow of the greater pump section lubricates the DPS / shuttle unit.The lubricating oil for above–mentioned components is taken through the lubrication block **1**.

When the lubricating pressure rises over 0.25 MPa (2.5 bar), the oil flows through the valve **1a** to the suction pipe of the pump. When the oil is very cold, the great part of the return oil circulates through this valve and thus helping the suction of the pump.

The oil flows to the lubrication block:
- From the free circulation of the working hydraulics **9**, when the auxiliary hydraulic valves and the power lift are not operated.
- Through the filter **11 ,** when the auxiliary hydraulic valves are operated.
- From the auxiliary return oil coupling **10** (when connected) through the filter **11**.
- From the valve block of low pressure circuit. If the pressure drops below 0.05 MPa (0.5 bar) for some reason, the valve **2a** cuts the lubricating flow to the gearbox, in order to secure the lubrication of the DPS and shuttle clutches.

1) Lubrication block

1a) Valve 0.2 MPa (20 l/min) determines the max. lubrication pressure. The excess lubricating oil gets to the pump suction side. Especially in cold conditions this is advantage.

1b) The measuring connector of the lubricating pressure. The pressure should be (oil temp. 50 C):
- 1.0 bar (800 r/min)
- 2.0 bar (1500 r/min)

2) Valve block of the the low pressure circuit.

2a) In the lubricating tube of the low pressure hydraulics there has been mounted a 0.05 Mpa (0.5 bar) valve, which secures the lubricating oil to the DPS and the shuttle unit, when the pressure drops under 0.05 MPa.

3) Lubricating oil to the DPS.

4) Lubricating oil to the shuttle (reverse clutch).

5) Lubricating oil to the shuttle (forward clutch).

6) Lubricating oil to the PTO multi–disc clutch (+PTO gears).

7) Pressure relief valve 0.3 MPa (3 bar) determines the max. pressure in the **return oil system**.
- If the hydraulic return pressure rises (e.g. because of cold oil, or heavy use of a tipping device) over 0.3 MPa (3 bar), the oil can flow (without filtering) to the tank through this valve.

8) Return oil from the auxiliary hydraulic valves.

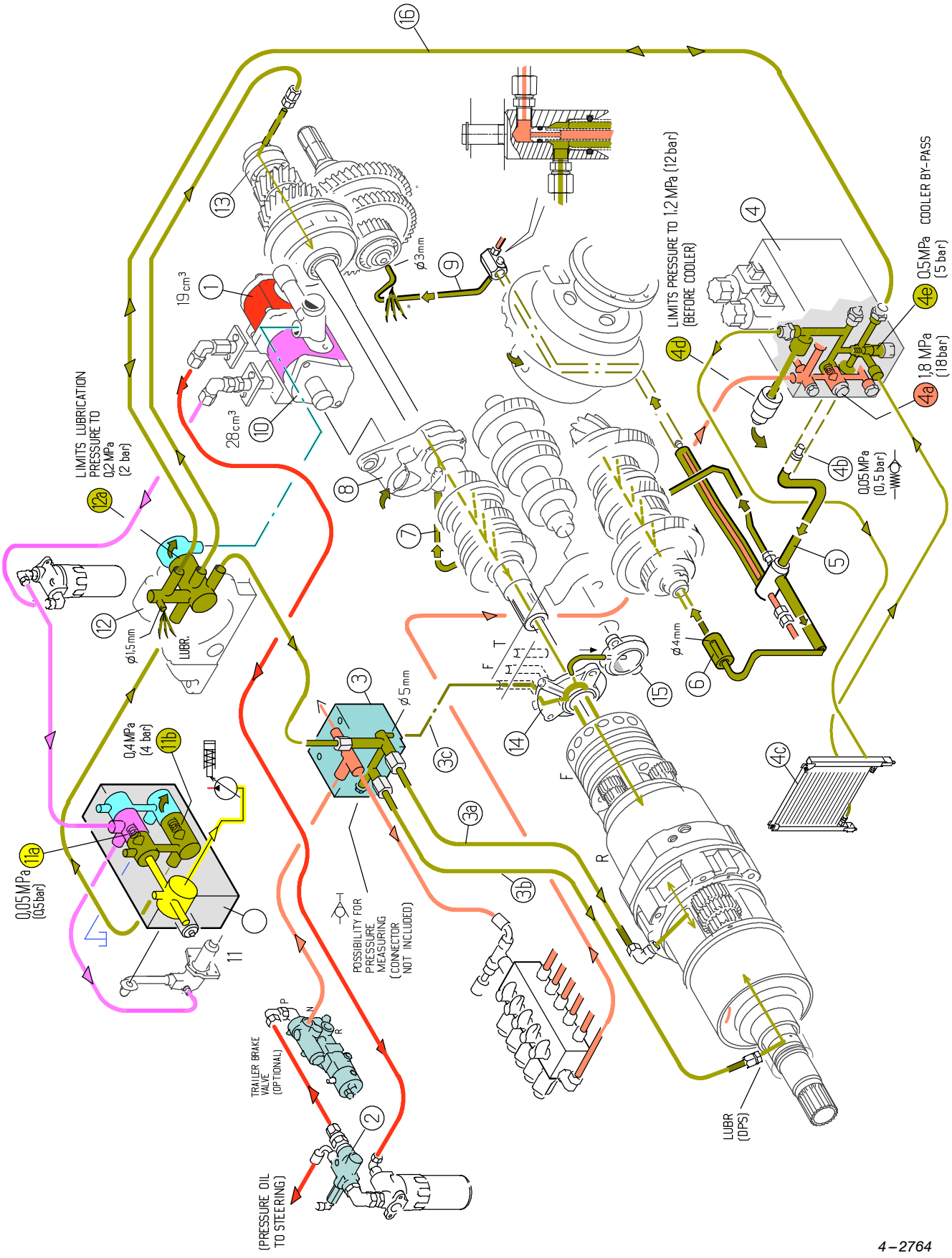
9) Free circulation oil from the pump side flange of the auxiliary hydraulic valves. Lubricating oil to the PTO multi–disc clutch (+PTO gears).

10) Auxiliary return oil connector.
When changing oil it is recommended to refill by pump through the return coupling, then the oil goes through the return filter.

11) Return oil filter.

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Lubrication oil supply (LS)



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1) Double pump 2nd section (19cm3/r).
Steering/ brake valve/ low press. circuit additional output for gearbox and PTO lubrication.

2) Priority valve
directs the pressure when needed to steering or trailer brake valve (optional) + low pressure circuit.

3) Dividing block

3a) Lubrication oil to the multi–disc clutch (reverse) of the shuttle unit.

3b) Lubrication oil to the DPS multi–disc clutches.

3c) Lubrication oil to the multi–disc clutch (forward) of the shuttle unit.

4) Valve block.

4a) Pressure relief valve 1.8 MPa (18 bar).
Limits the pressure of the low pressure circuit to 1.8 MPa (18 bar). The oil which discharges through the pressure relief valve flows further via oil cooler **10** to gearbox lubrication.

4b) Non–return valve (0.05 MPa). Located in the gearbox lubrication pipe.

4c) Oil cooler.

4d) Safety valve for the oil cooler.
Opens to the tank, and limits the pressure before the cooler to max. 1.2 MPa (12 bar).

4e) By–pass valve for the oil cooler 0.5 MPa (5bar). Secures the oil for lubricating, e.g. in wintertime.

5) Lubricating oil to the gearbox.

6) Sleeve.
The oil for bevel pinion shaft flows through the sleeve The tube has a ø 2mm throttle for limiting the bevel pinion shaft lubrication.

7) Lubricating oil for the main shaft.

8) Lubricating splash oil to the hydraulic pump drive gears and the shaft splines.

9) Lubricating oil to the PTO shaft.
Lubricating pipe has a ø 1.5 mm hole for lubricating of the differential.

10) Double pump 1st section (28cm3/r).
Produces, when needed, oil to variable displacement pump (via ejector), excess oil to gearbox and PTO lubrication.

11) Valve block.

11a) Valve 0.05 MPa (0.5bar). Discharges the overflow oil to the lubrication (via valve block **12**) when there is sufficient pressure (over 0.05 MPa (0.5 bar) in the suction line).

11b) Pressure relief valve:
assists the valve **12a** in the housing.
opens, if the lubrication pressure for some reason increases over 0.4MPa (4 bar).

12) Lubrication block, housing for pump drive gears.

12a) Pressure relief valve 0.2 MPa (2 bar). Limits the pressure of the lubrication circuit to **0.2 MPa**.

13) Lubricating oil to the PTO multi–disc clutch (+PTO gears).

14) Bearing cover of the main shaft.

15) Bearing cover of the counter shaft. Directs the oil to the foremost bearing.

16) Connection pipe
balances the lubrication oil between extra gear (upper valve block) and gearbox (side valve block).

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Power shuttle unit (Syncro)

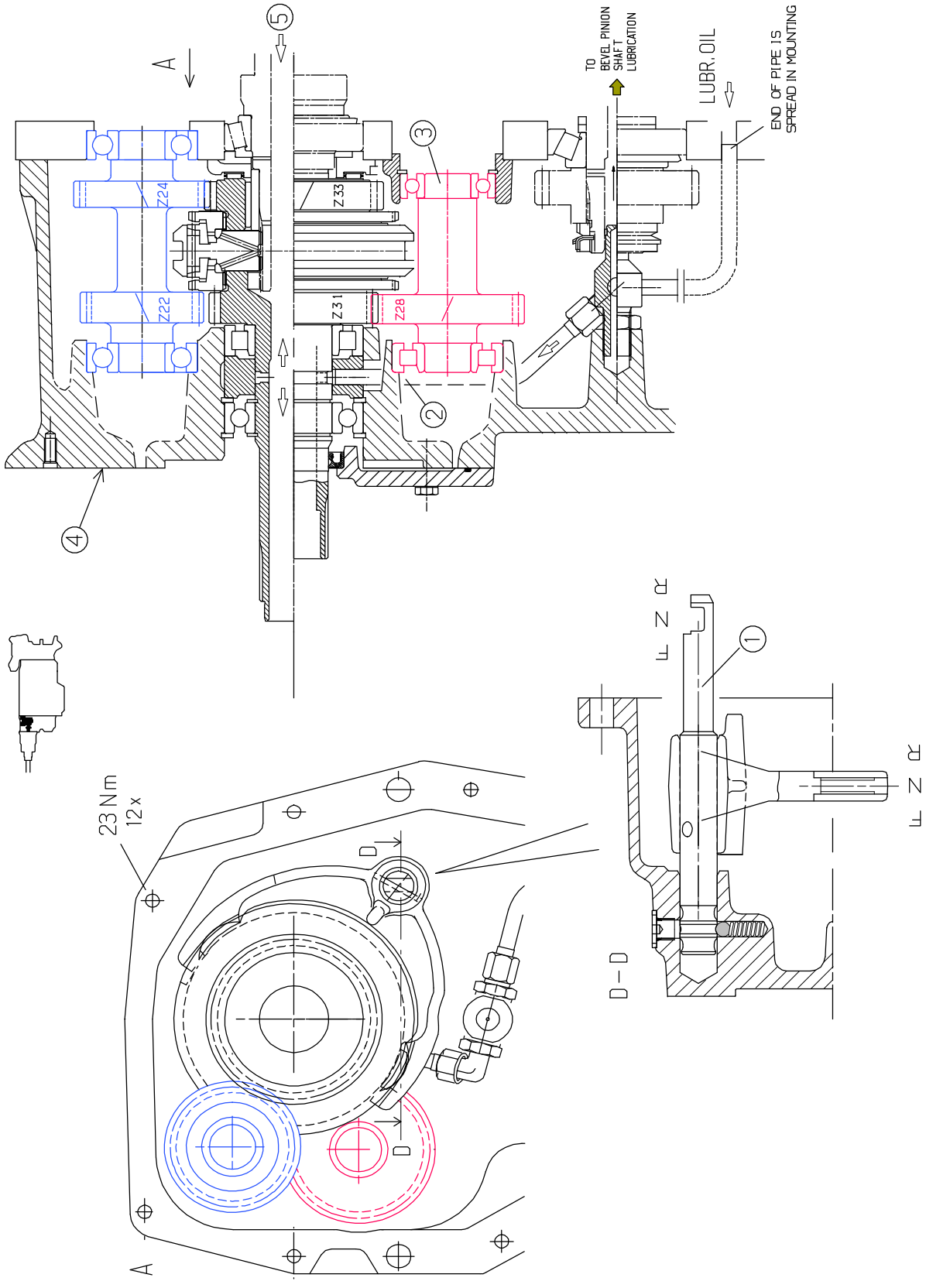


fig007

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The shuttle gear is situated in front of the main gearbox. The forward/reverse shuttle is controlled with a separate lever. The shuttle is synchronized. When changing the driving direction, the tractor must be stopped and clutch pedal depressed.

On forward gear, power is transmitted directly through the shuttle, while on reverse it is taken to a countershaft over a reverse gear. The reverse speeds are 2.5 per cent higher than forward speeds.

The selector shaft of the synchromesh unit goes through the front wall of the gearbox (see the picture of selectors).

The shuttle gear is lubricated with pressure oil max. 0.2 MPa (see gearbox lubrication picture).

Lubrication oil for the pinion shaft and synchromesh unit + quick–shift gear has been conducted via pipes inside the forward–reverse shuttle housing. Distributing piece has a ø 2 mm throttle for the oil to the pinion shaft. Lubrication oil (for synchromesh unit + quick–shift gear) is conducted via a sleeve to the gear shaft, Z=31. A smaller diameter (towards shuttle unit) guides the main oil flow to the quick–shift gear.

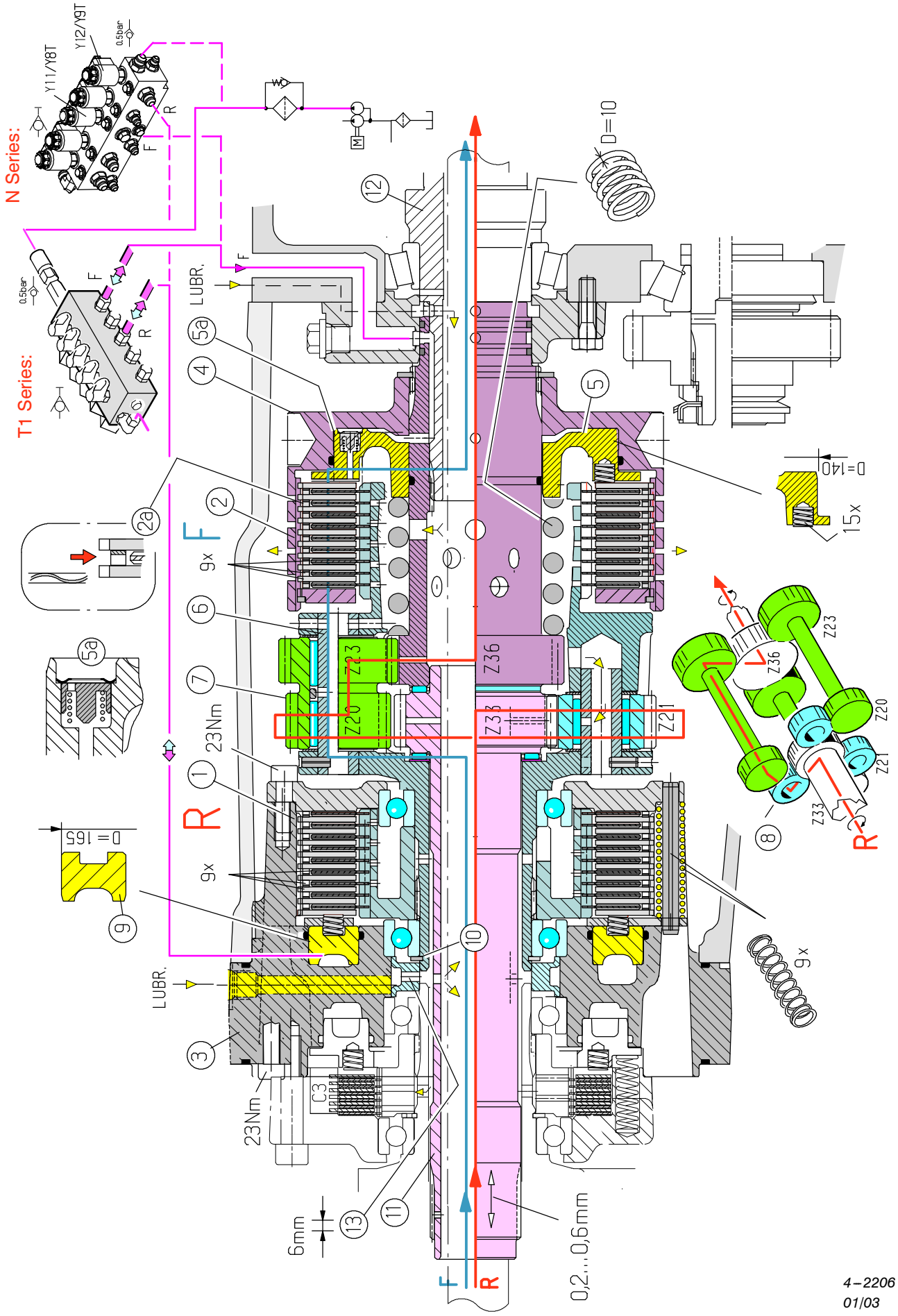
1) The selector shaft can be removed by pulling out the selector lever from locked position (see picture of the selector forks).
2) Lubrication oil to the forward–reverse shuttle.
3) Reverse gear shaft
4) Sealing compound LOCTITE 574/250 ML (UK 0182) to the face of the joint.
5) Lubrication oil from the main shaft.

Working order for repair works:

	Drain transmission oil	Split tractor between fuel tank–gearbox	Remove quick–shift gear	Remove F–R shuttle	Disassemble gearbox
Repairing reverse shuttle synchromesh unit	1	2	3	4	
Changing reverse shuttle selector fork	1	2	3	4	
Changing reverse shuttle selector lever	1	2	3	4	5

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Power shuttle unit (Hitech, LS)



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The Power shuttle is placed between the gearbox and the DPS. It has planetary–type gear drives which are operated by two wet multi–disc clutches, one for forward driving and one for reverse driving. Multi disc clutches operate at the same time as the driving clutch due this the tractor not having a traditional dry clutch disc. The function of the Power Shuttle system is controlled by the electric control unit of the gearbox. This means that the electronics are adjusting steplessly the disengaging and engaging pressures of the hydraulic multi–discs according to adjusted program. In this way it is possible to get a gentle start of forward and reverse shuttle driving.

Function (selector lever in neutral position):

Both multi–disc clutches **1** and **2** are pressureless. The engine drives the shaft **11** (+ the planetary carrier **6**). The gears **8** and the planet gears **7** rotates with the planetary carrier. The clutch housing **4** and the shaft (Z36) don't rotate.

Function (selector lever in forward driving position):

The multi–disc clutch **1** is pressureless and the clutch **2** is pressurised. The clutch **2** has connected the clutch housing **4** and the planetary carrier **6** with each other and at the same time has locked the planet gears **7**. The whole planetary gear rotates with the shaft **11** (the gear ratio 1:1).

Function (selector lever in reverse driving position):

The multi–disc clutch **2** is pressureless and the clutch **1** pressurised. The clutch **1** has connected the planetary carrier **6** with the housing. The shaft **11** rotates by means of the idler gears **8** the planet gears 7, which rotate by the shaft (Z36) the main shaft **12** of the gearbox.The gear ratio is now about 5% faster.

Function (disengagement):

The pressure of the multi–disc clutch 1 or 2 will be reduced quickly, in the beginning through the proportional valve. Almost immediately the release valve **5a** or **9a** opens, which allows the pressure to discharge through the piston **5** or **9**. The return movement of the piston would otherwise be e.g. for centrifugal force too slow. Clutches, which are coupled free, have a small pressure (<1 bar, from proportional valve) all the time in order to secure that the pressure channels are filled with oil.

1) Multi–disc clutch, reverse driving (friction discs 9 pcs, intermediate discs 9 pcs)
2) Multi–disc clutch, forward driving (friction discs 9 pcs, intermediate discs 9 pcs)
2a) Plate springs (9+9 pcs). The spring prevent the contact of the clutch discs when the clutch is pressureless.
3) Intermediate piece, connects the DPS and the shuttle unit.
4) Clutch housing.
5) Piston, forward drive clutch.
5a) Discharge valve, forward clutch. When the clutch is pressureless, the oil can rapidly flow out through the valve.
6) Planetary carrier.
7) Planet gear set (3 pcs)
8) Idle gears (3 pcs)
9) Piston, reverse drive clutch
10) Retainer ring. The ring must be removed from front (after removing the oil distribution ring) in order to take away the planetary carrier. When the planetary carrier has been removed, the R clutch can be disassembled.
11) Input shaft
12) Gearbox main shaft
13) Oil guide ring

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FNR–lever (Hitech and LS)

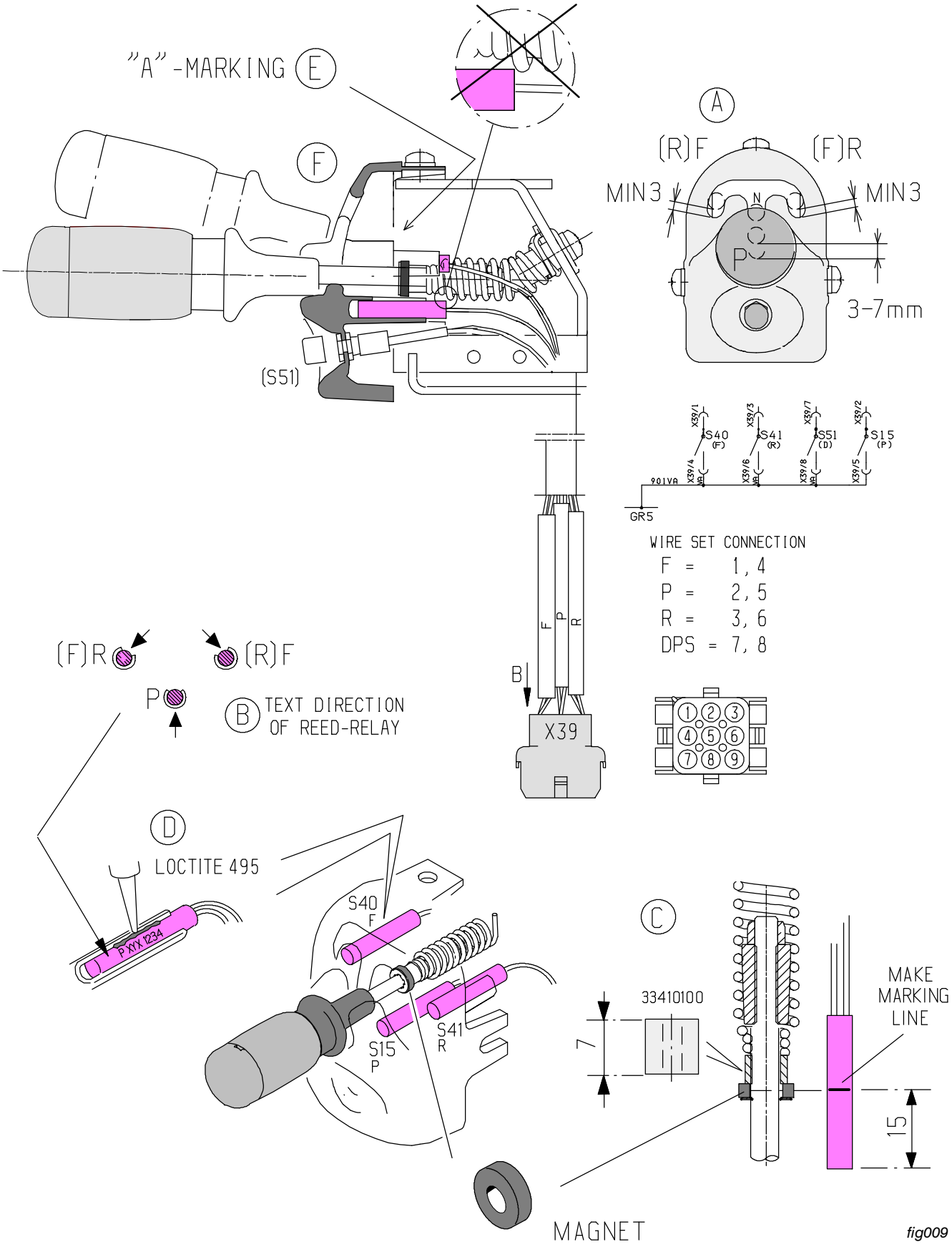


fig009

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– If there are malfunctions in the lever functions, make the following checks and adjustments (see Service Bulletin 32–25).
Loosen the steering wheel and the lever cover. Loosen the power shuttle lever complete from the rack.

A: Check the connection points of the reed –relays. Use a multimeter in the resistance mode, or connect the power shuttle lever into the wiring harness of the tractor and check it in the test mode FII.
Please, note that you can drive also in the test mode, and at the same time control the function of the reed –relays in the different driving conditions.

B: Check the correct direction of the reed –relays: in F– and R– positions the text side of the reed –relay has to face the magnet, and in the P –position the text has to be turned away from the magnet.

C: Check according to the drawing C the correct place of the reed –relays with regard to the magnet. To make adjustment easy make a marking line on the reed –relay surface at the distance of 15 mm from the wireless end. The marking line has to be situated in the midline of the magnet. If it is impossible to loosen the reed –relays from the cover, you have to fit both a new cover 33410810, and the new reed –relay 33566500.

D: If the lever works correctly, fix the reed –relays with Loctite 495 (UK0069) or Loctite 406.

E: Check, that the cover 33410810 is intact and the inner surface is marked with ”A”.

F: Move the lever in P –position (parking brake), and check that the spiral spring does not touch the reed–relay in the P –position.If needed, push the reed –relay deeper. In that case the magnet has also to be moved in the same direction by changing the sleeve 33410100 into a longer (7 mm) one.

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Power shuttle engagement

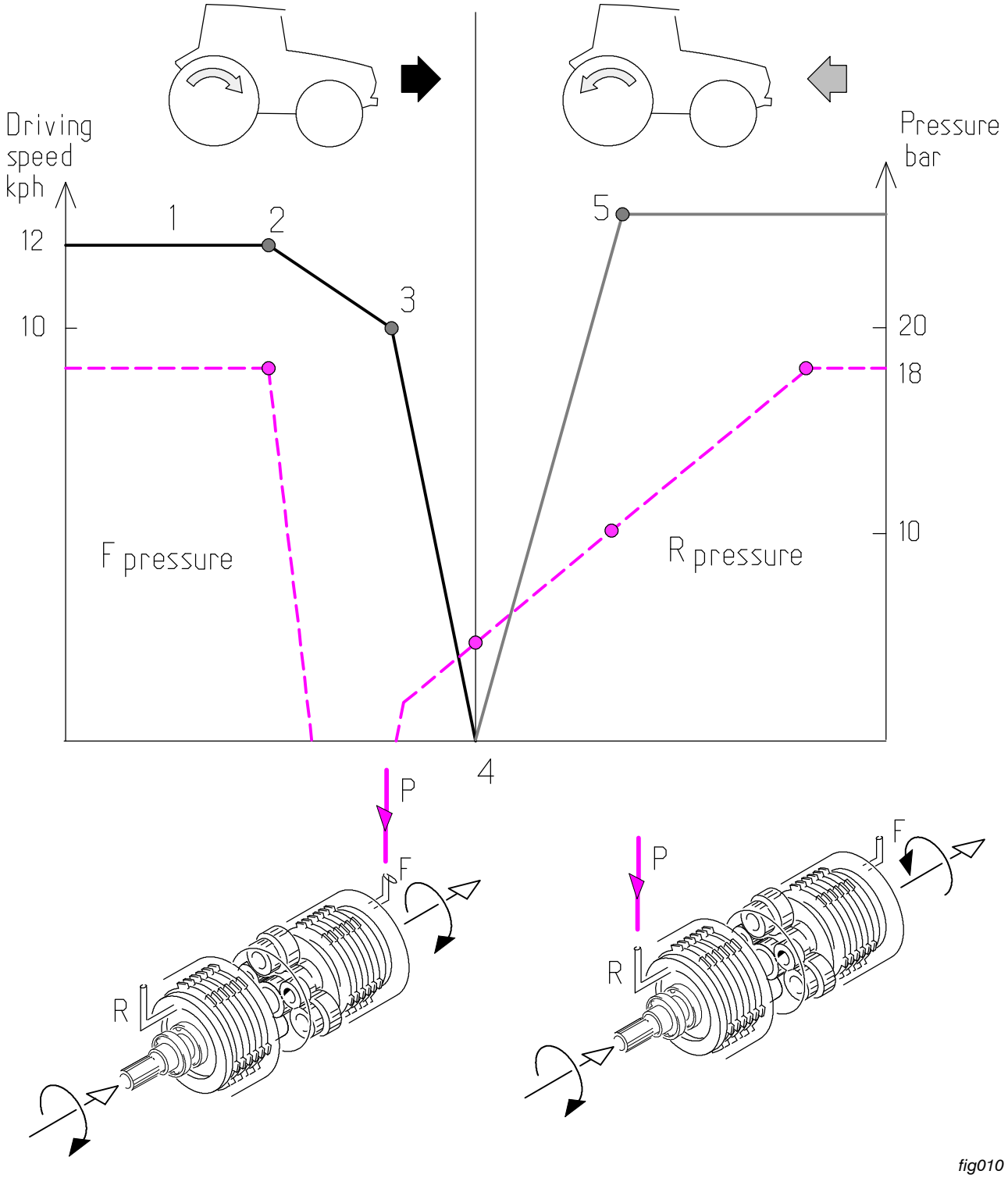


fig010

1) Driving speed 12 km/h.
– 18 bar in the F–clutch.

2) Gear change F –> R.
– Pressure disappears immediately from the F–clutch, and the tractror is rolling on neutral (brakes can be used).

3) Driving speed is lowered to 10 km/h.
– A rapid pre–filling into R–clutch, after which the pressure begins to rise. R–clutch brakes (connects the planetary carrier with the housing).

4) Acceleration of the tractor starts. The pressure of the multi–disc clutch rises still linearly to 18 bar (the driving situation determines the rising speed).

5) Max. reverse driving speed (+5 %, if DPS has not been preprogrammed) is reached at a pressure of about 10 bar.

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Engaging pressure of the shuttle clutches F and R

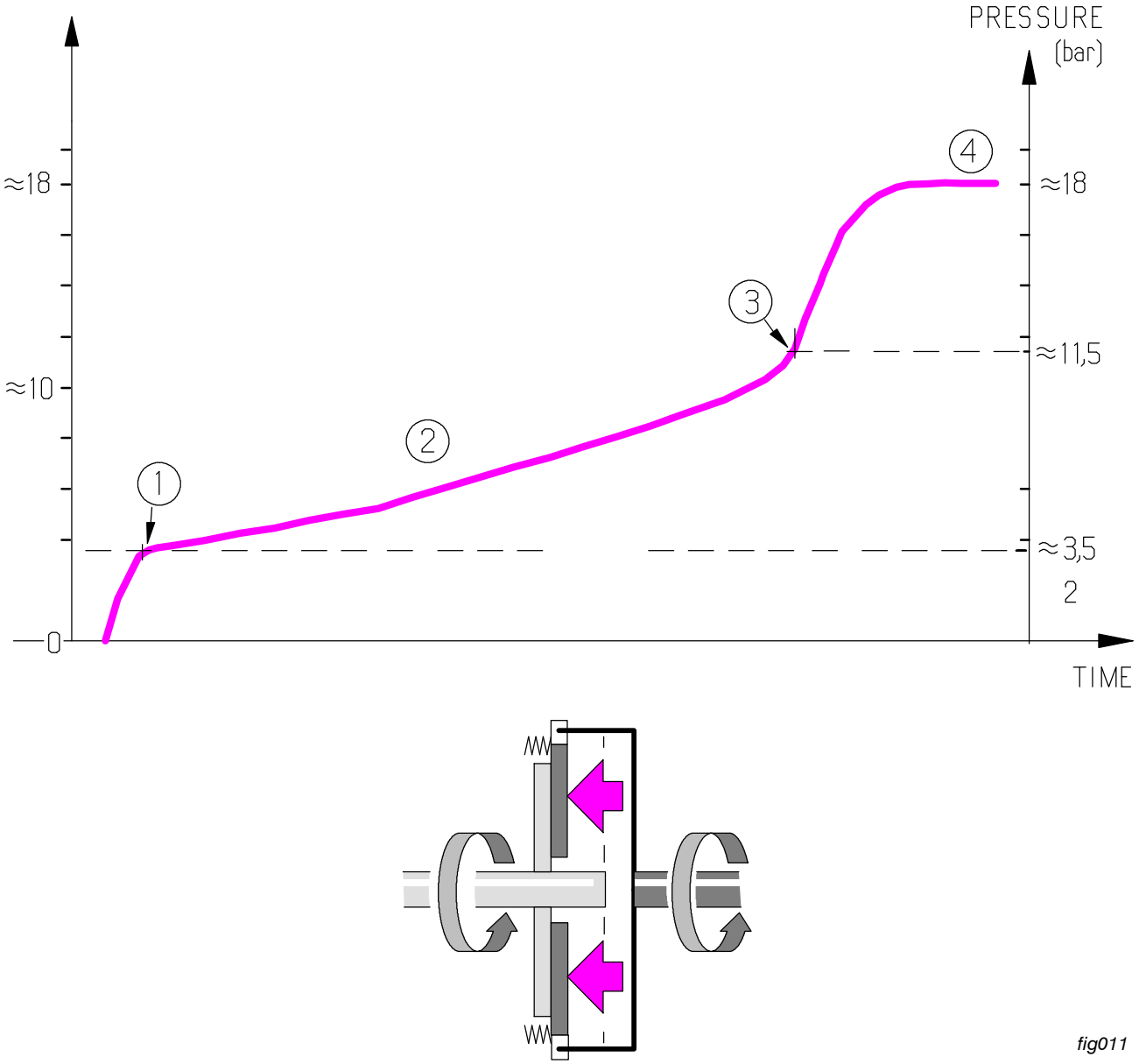


fig011

The picture shows the pressure, which affects on the piston of the power shuttle.

1. The start pressure has been set to about 3,5 bar. In the pressure area of 3...18 bar the hysteresis of the valve is considerably smaller (=better) than in the area of 0...3 bar. Hysteresis means the difference in the function curves, when the raising and lowering directions are compared. Thus the valve gives a bit different pressure depending on that, if the pressure is raised or lowered.

   With higher pressure level the control of the clutches can be made more accurate, which makes easier among other things the use of the clutch pedal in exact works or e.g. when holding the tractor stationary on the ascent with help of the engine.

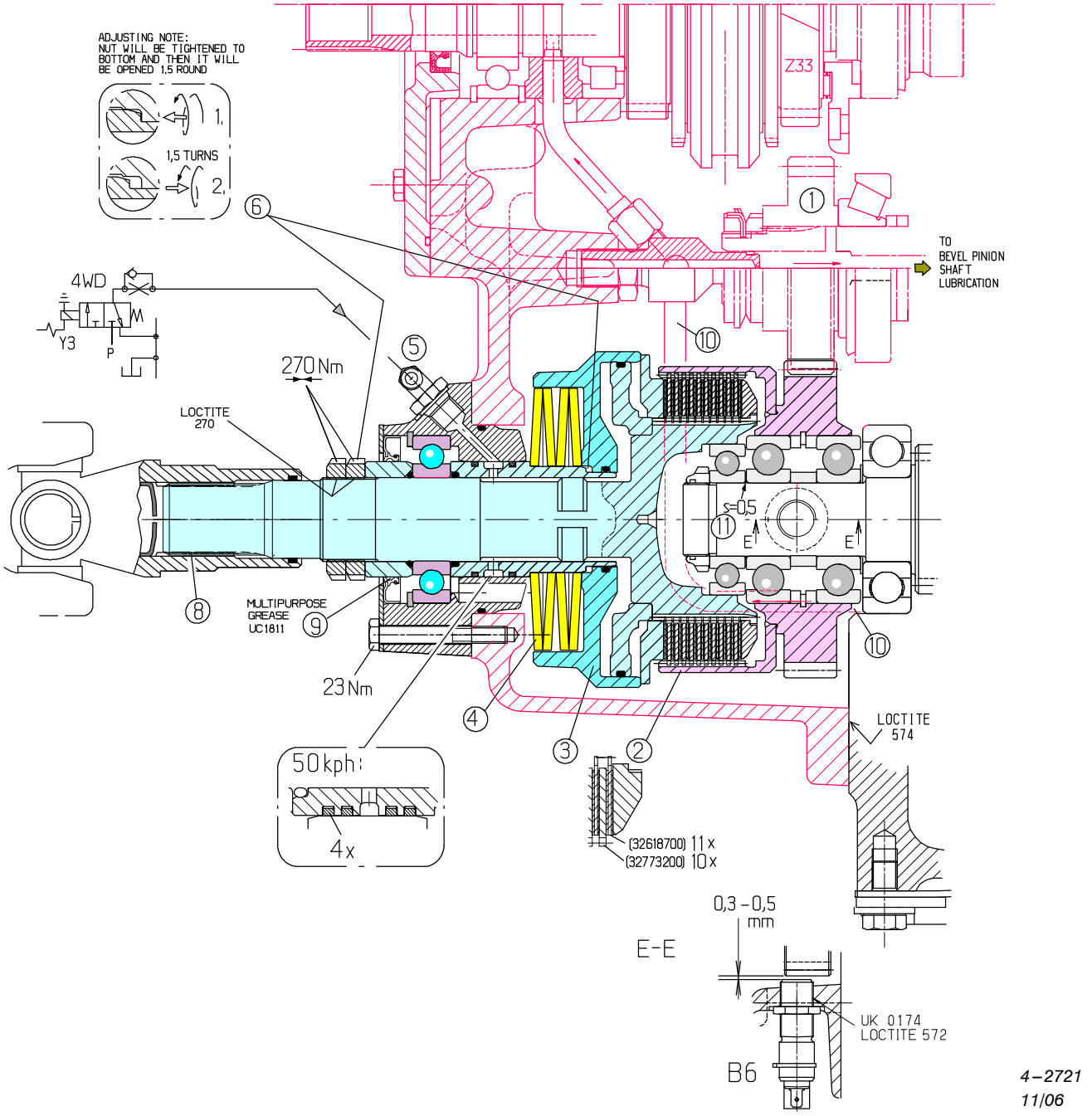
2. The pressure rises in the slip area of the clutch.

3. When the pressure has raised to 11,5 bar, the clutch has already a full torque transmitting capability (650 Nm). The raising of this point by about 1,5 bar don't affect on transmitting capability, because there is confidence coefficient enough. Additionally, the clutches of the power shuttle has been planned according to the heat transfer ability.

4. The end pressure is about 18 bar.

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4WD clutch (Syncro)



1) Gear located on the front end of the pinion shaft
2) The casing of the multi–disc clutch rotates always when the tractor moves. The lugs of the steel discs are connected with the grooves in the casing.
3) Press cylinder
4) Cup springs
5) Pressure oil inlet
6) Tighten the shaft nut first completely home and the open it up by **1.5 rounds**. So the necessary clearance for the clutch discs is achieved.

Note! Before tightening the shaft nut be sure that the lugs of the discs are exactly on the same line. The shaft nuts (2 pcs) are to be tightened toward each other with torque 270 Nm; the nut on the clutch side must be hold in its place. Loctite 270 on threads.

7a) Gearbox sensor
– When repaired, the splitting of the tractor is necessary.
8) EP– grease on splines
9) Multipurpose grease to the shaft seal.
10) Lubrication pipe for bevel pinion shaft and forward–reverse synchro unit
11) Spacer ring prevents the contact of the bearing outer races with each other

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4WD clutch (Hitech, LS)

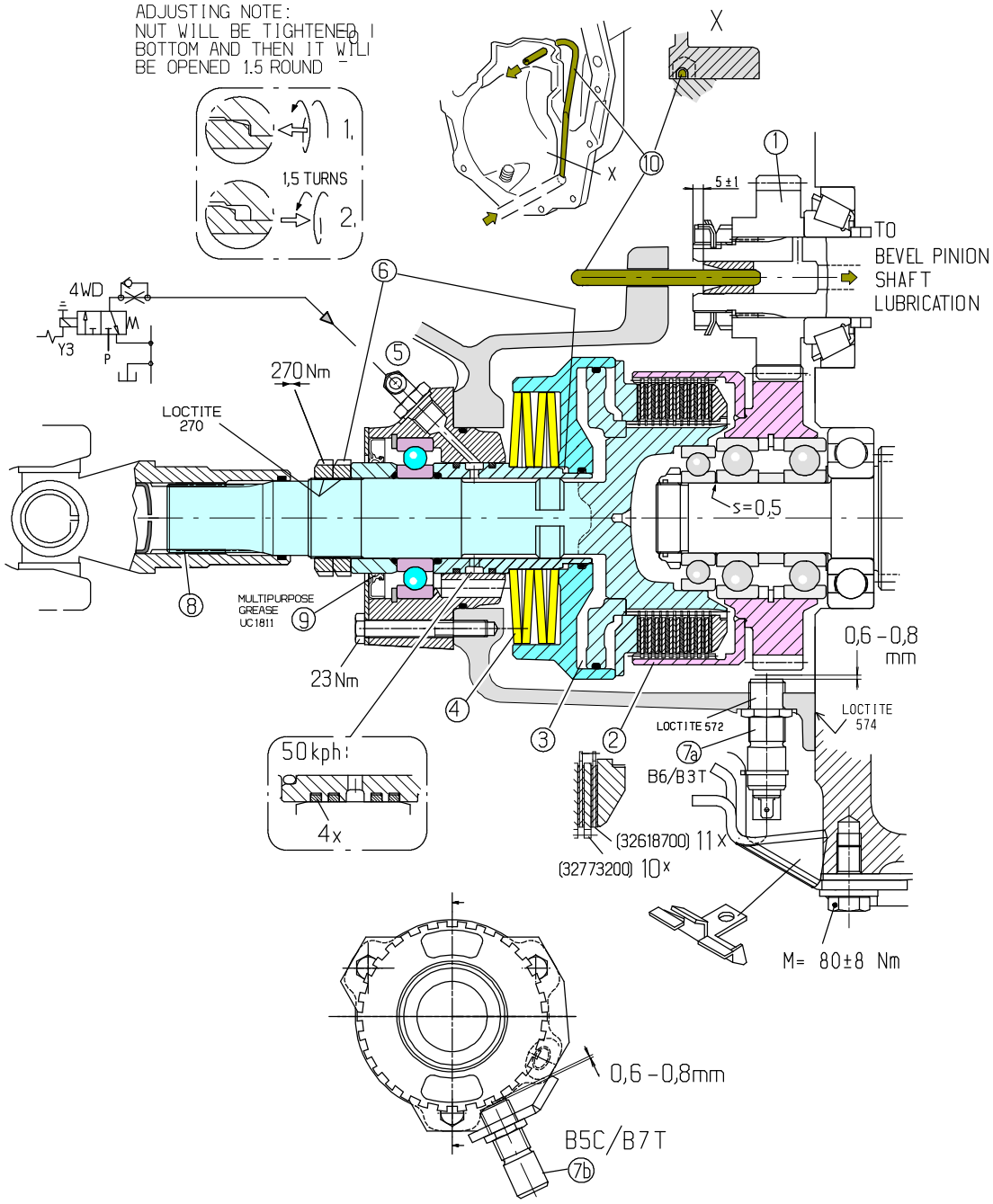


fig013

The housing has a shield casting above the 4WD clutch. Thus there is no more extra oil in the 4WD clutch space (less oil foaming).

1) Gear located on the front end of the pinion shaft.
2) The casing of the multi–disc clutch rotates always when the tractor moves. The lugs of the steel discs are connected with the grooves in the casing.
3) Press cylinder.
4) Cup springs
5) Pressure oil inlet.
6) Tighten the shaft nut first completely home and the open it up by **1.5 rounds**. So the necessary clearance for the clutch discs is achieved. Note! Before tightening the shaft nut be sure that the lugs of the discs are exactly on the same line. The shaft nuts (2 pcs) are to be tightened toward each other with torque 270 Nm; the nut on the clutch side must be hold in its place. Loctite 270 on threads.

7a) Gearbox sensor
– The sensor has a new location under the housing. When repaired, the splitting of the tractor is no more necessary. **NB!** the shield of the sensor.

7b) Front axle speed sensors
8) EP– grease
9) Multipurpose grease to the shaft seal.
10) Lubrication pipe to bevel pinion shaft.
– A teflon sleeve has been pressed into the bevel pinion shaft end. **NB!** mounting measure 5mm.

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Valve block (Syncro)

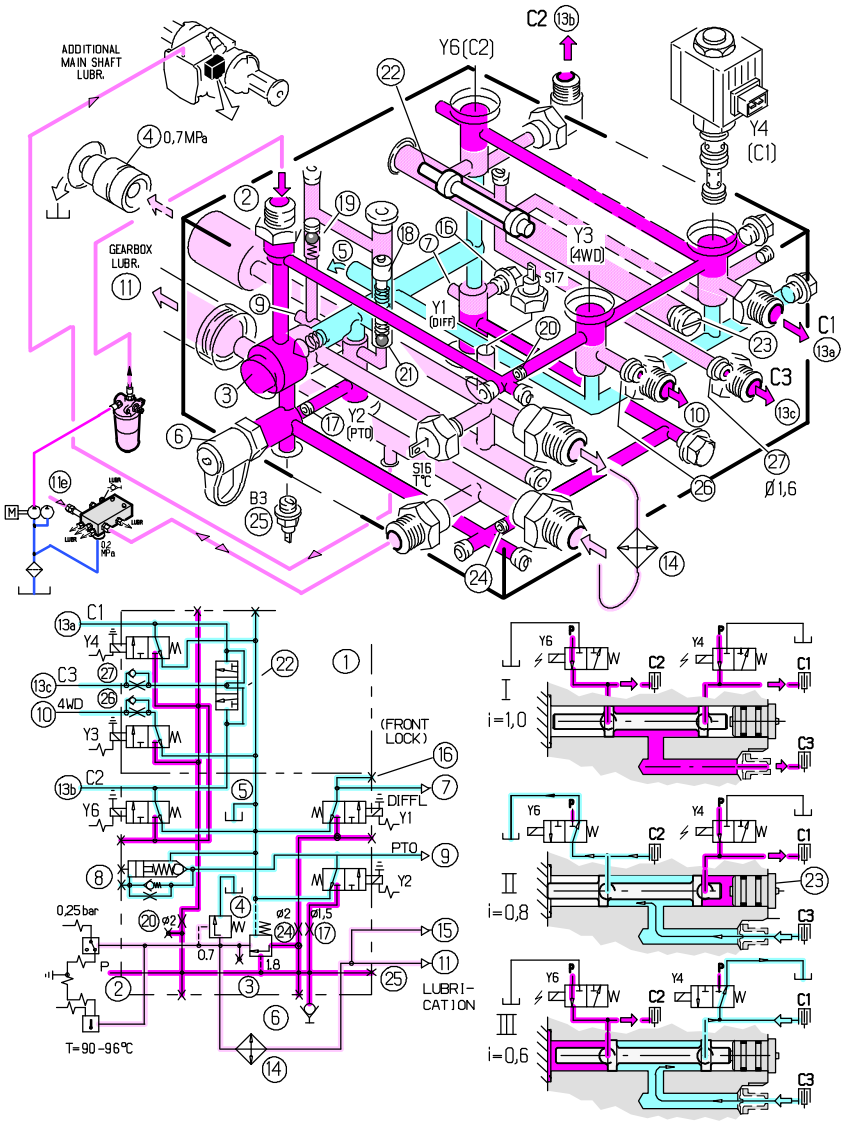


fig014

The pressure oil from the pump is conducted to the connector **2**. The drilled passage directs the oil flow via the pressure relief valve (1.8 MPa) **3** to the measuring connector **6**. Oil flows to the PTO solenoid (Y2) through a restriction hole **17** (ø 1.5 mm).
Oil to the differential lock solenoid (Y1) is conducted through the drillings via a restriction hole **24** (ø 2 mm).

1) Valve block
2) Oil from the pump
3) Pressure relief valve, 1.8–1.9 MPa (18–19 bar)
4) Safety valve 0.7 MPa (7 bar) . Protects the system, when oil is is stiff in the oil cooler.
5) Tank passage for the solenoid valves
6) Measurement point (Valmet HPR, connecting thread M16)
7) Pressure oil to the differential lock
8) Damping valve, includes parts 18, 19, 21 (see PTO).
9) Pressure oil to PTO multi–disc clutch.
10) Pressure oil to 4WD multi–disc clutch.
11) To the gearbox lubrication, see lubrication picture
11e) Free circulation oil from the control valve of the power lift
13a) Pressure oil (1.8 MPa) to quick–shift gear clutch C1, see DPS.
13b) Pressure oil (1.8 MPa) to quick–shift gear clutch C2, see DPS.
13c) Pressure oil (1.8 MPa) to quick–shift gear clutch C3, see DPS.
14) Oil cooler (**Note!** In case the oil cooler is damaged, do not plug the hoses, but use a by–pass hose).
15) Connection to DPS lubrication.
16) Plug (for the front axle differential lock).
17) Restriction hole (ø 1.5 mm) eliminates the pressure drop, when engaging PTO solenoid.
18) Piston, damping valve for PTO
19) Ball, damping valve for PTO.
20) Ø 2mm restriction hole eliminates the press. drop, when engaging 4WD, PS1, PS2 – valves.
21) Ball valve, PTO damping system.
22) Valve slide for the powershift multi–disc clutch C3.
23) The adjustment screw of the valve slide (done in the factory, the position has been marked).
24) Ø 2mm restriction hole eliminates the press. drop, when engaging the differential lock.
25) Temperature sender unit for Agroline– display (optional equipment)
26) Restriction/counter valve (Ø 1.6 mm restriction hole) prevents the pressure drop in the DPS multi–disc clutches, when the 4WD has been disengaged, e.g. when braking.
27) DPS 650: Restriction/counter valve (Ø 1.6 mm restriction hole) makes the pressure increasing slower in the multi–disc clutch C3 (in other words, the opening of the planetary carrier) , and in this way prevents the momentary neutral position of the DPS.

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Lock valve (Syncro)

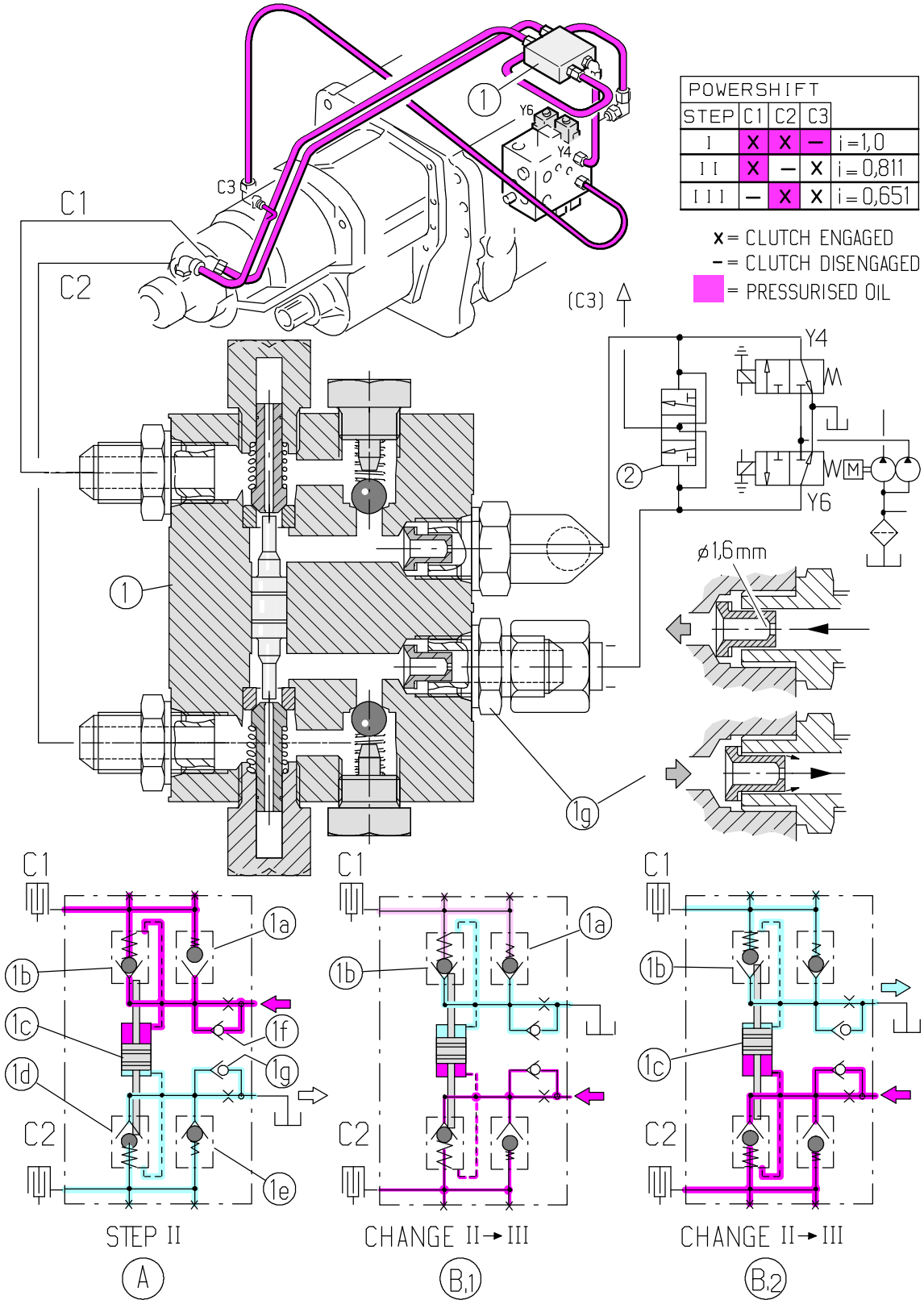


fig015

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Tractor with Delta Powershift (i=1,0/0,811/0,651): when switching the different speed ranges, the clutches are pressurized :

Range	Clutch C1	Clutch C2	Clutch C3
I	Pressurised	Pressurised	Pressurised
II	Pressurised	–	–
III	–	Pressurised	–

When changing from range II to range III, clutch C2 becomes pressurised and at the same time clutch C1 becomes unpressurised (and vice versa when changing from range III to range II).In order to ensure the correct pressurising and unpressurising of the clutches C1 and C2 (engagement without jerks), a lock valve has been fitted between the pipes to the clutches in question. Checking the function of the lock valve.

A) Function of the lock valve (range II engaged):
Pressure oil affects via solenoid valve Y4 through the restriction valve **1f** and non–return valve **1a** (0,7 bar) on the clutch C1. The pressure keeps the ball valve piston **1c** in the lower position, and valve **1d** is open.Since the solenoid valve Y6 is unenergised (free connection to the tank), the clutch C2 is unpressurised.

B.1) Function (change from II to III):
The solenoid valve Y6 becomes energised, and pressure oil can flow to the clutch C2 (through the throttle ø 1,6 mm). At the same time solenoid valve Y4 becomes unenergised, and connection from clutch C1 to the tank opens. The non–return valves **1a** and **1b** close and pressure remains in the clutch C1 (the pressure lowers slowly due to the DPS seal leaks). Pressure in the clutch C2 begins to rise when the clutch clearances have disappeared.

B.2) When pressure in the clutch C2 has risen enough high (about 7 bar), and the clutch functions, the lock valve piston **1c** moves (in picture) upwards and opens the valve **1b.** (**NB.** the opening of the valve depends only from the spring force). Now pressure in the clutch C1 releases and range III engages.

– The clutch C3 has been all the time unpressurised. The spindle valve **2** in the servo valve block changes its side immediately when the gear change starts.

1) Lock valve

1a,e) Non–return valves, (0,7 bar)

1b,d) Non–return valves
(**NB!** Opening the valves can result a malfunction).

1f,g) Restriction valves (ø 1.6 mm restriction – in). The valves calm the function of the piston 1c.

1c) Lock valve piston

2) Spindle valve

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Valve block (Hitech / LS)

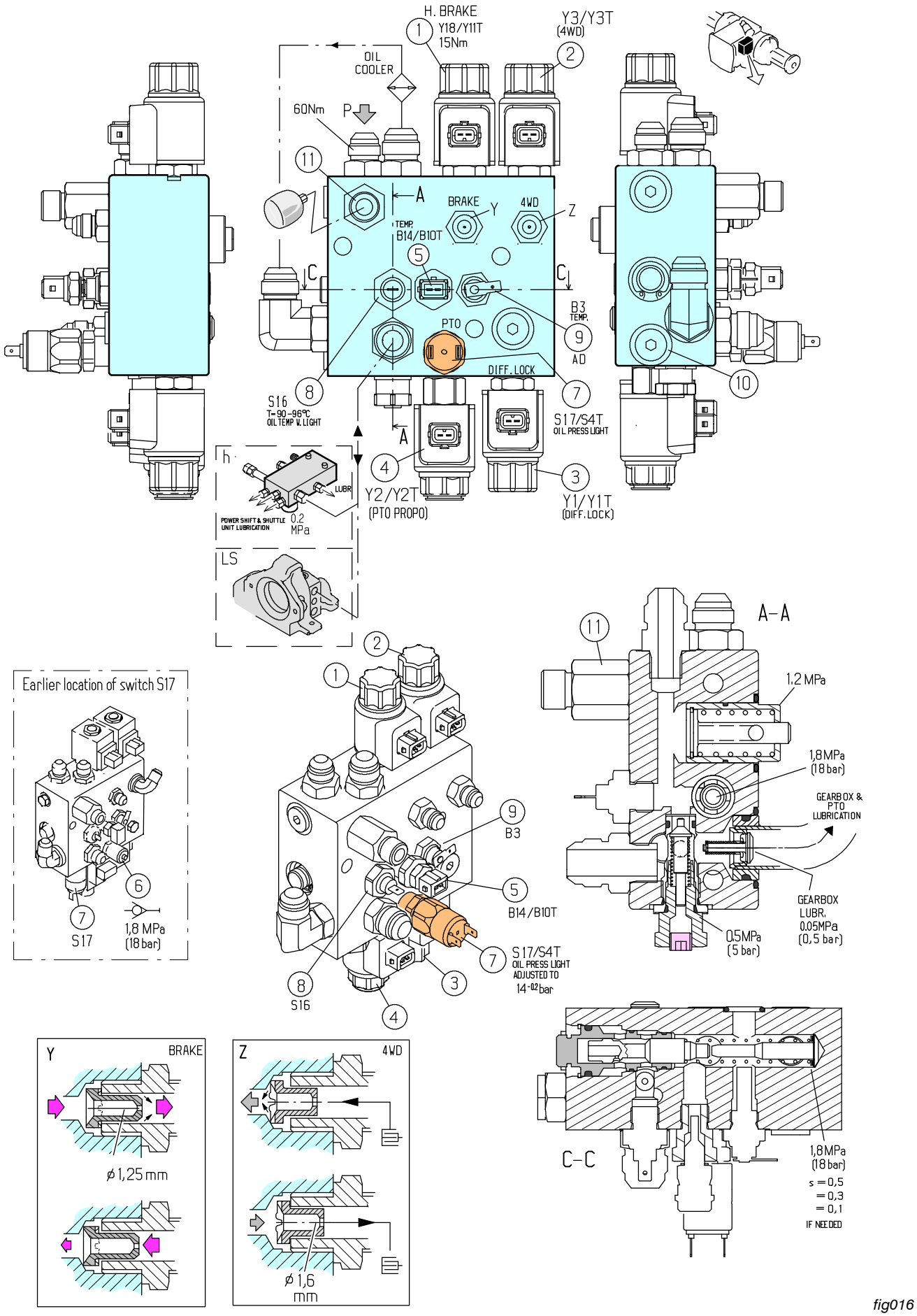


fig016

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1) Solenoid valve of hand brake (energised, when the hand brake is disengaged).

2) 4WD solenoid valve.

3) Solenoid valve of differential lock.

4) Proportional valve of PTO Y2 / Y2T (P6).

5) Temperature sensor of Autocontrol.

6) Earlier location: pressure test point. low pressure circuit (1.8–1.9 MPa)
The test connector has been removed in the new construction (S17 / S4T is at it's place). When the pressure is measured, a test connector must be fitted instead of the sensor S17 / S4T (see warning above) or instead of the plug 10.

7) Indicator light sensor (S17 / S4T), gearbox oil pressure
The pressure switch for the oil pressure warning light has been removed from the lubrication circuit to the low pressure circuit. In this way the blinking of the light is prevented at decreased idling speed (CR engines+Hitech transmission). It gives a warning when the pressure drops under 14 bar (1.4 MPa).

   WARNING! Tractors with multi–disc clutch:
   When the new pressure switch (14bar) will be detached, the pressure accumulator must be discharged by waiting 5 min after turning the engine off, or by engaging the parking brake on/off 5 times.

   Do not turn the screw on the end of the switch (affects on pressure adjusting). The right pressure limit (14^{-2} bar) has been adjusted by the manufacturer.

8) Indicator light sensor (S16), gearbox oil temperature.

9) Oil temperature sensor (B3), AD–instrument.

11) Connection for pressure accumulator.

Detail Y:
Restriction valve of the parking brake (oil **from the cylinder** has a restriction, diam. 1.25 mm). With help of the counter/ restriction valve the parking brake do not activate too quickly

Detail Z:
4WD restriction valve (oil **to the cylinder** has a restriction, diam. 1.6 mm). The restriction enables that the pressure in the valve block is as equal as possible, when engaging the 4WD. The returning of oil from the 4WD clutch happens so quickly, that e.g. the braking of front axle happens with as little delay as possible.

NB! Do not intermix these spools, when repairing the block

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Valve block function (Hitech / LS)

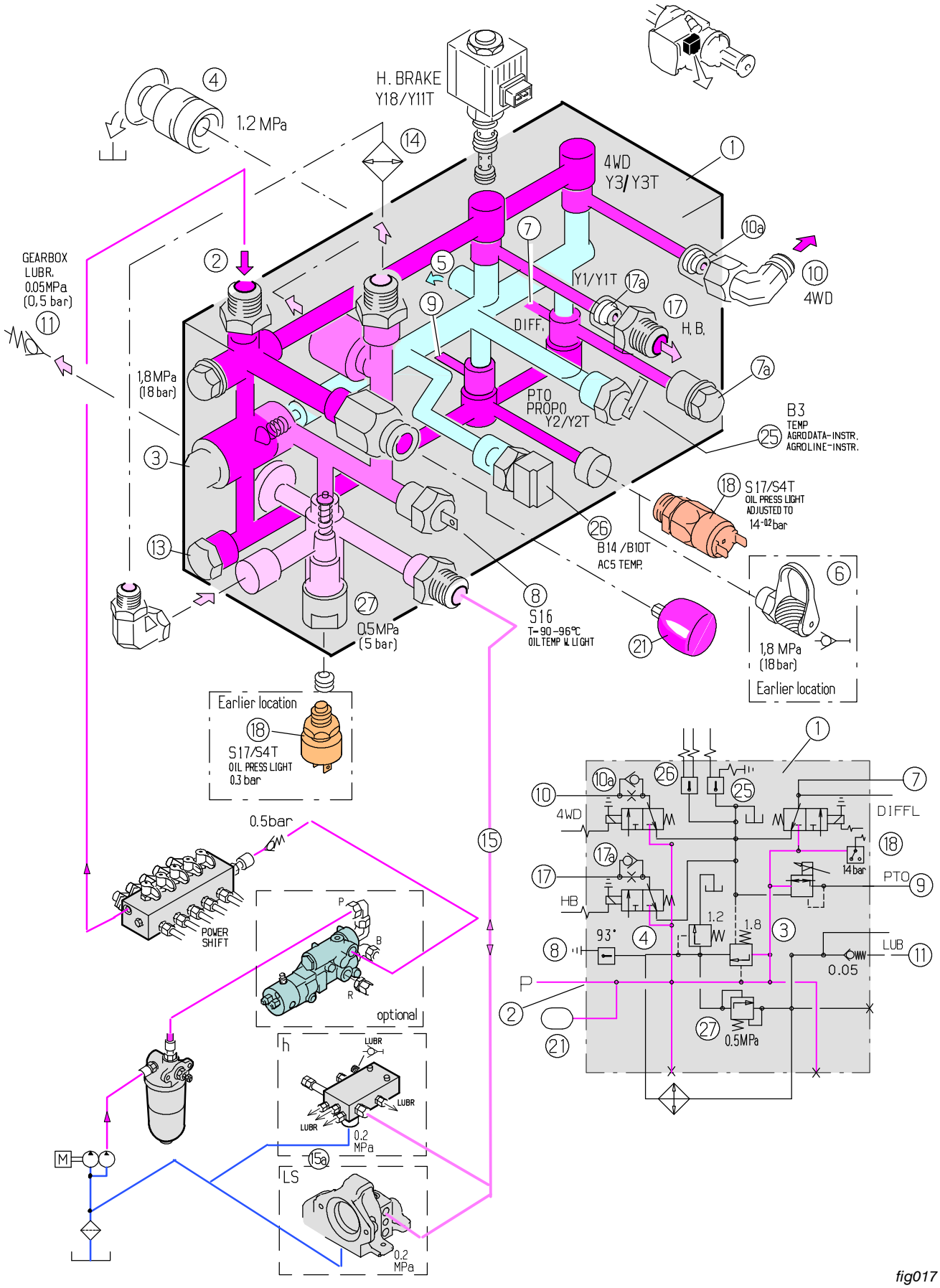


fig017

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Pressure oil enters through the connector **2** into the valve block. Oil (1,8 MPa, 18 bar) flows to the solenoid valves Y18/Y11T, Y3/Y3T and Y2/Y2T, Y1/Y1T. Oil gets through the pressure relief valve **3** further via the oil cooler **14** to the lubrication **11**.
In the lubrication pipe, which goes to the gearbox lubrication, there is a built–in non–return valve (0.05 MPa). The valve ensures the sufficient lubrication of the multi–disc clutches, when the pressure drops below 0.05 MPa for some reason. The oil pressure in the low–pressure (lubrication) hydraulics has been limited by a pressure relief valve **15a** in the lubrication block.

1) Valve block
2) Oil from the pump.
3) Pressure relief valve 1.8–1.9 MPa (18–19 bar).
4) Safety valve for the oil cooler. Opens to the tank, and determines the pressure before the cooler to max. **1.2** MPa (12 bar)
5) Tank passage for the solenoid valves
6) Earlier location: Measurement point for low–pressure hydraulics.The test connector has been removed in the new construction (S17/S4T is at it's place). When the pressure is measured, a test connector must be fitted instead of the sensor S17/S4T (see warning, ref 18) or instead of the plug 13.
7) Pressure oil to the differential lock.

7a) Plug for the front axle differential lock.
8) Indicator light switch, gearbox temperature
9) Pressure oil to PTO multi–disc clutch.
10) Pressure oil to 4WD multi–disc clutch.

10a) Restriction/counter valve prevents the pressure drop in the supply circuit when the 4WD has been disengaged (multi–disc clutch pressurized), e.g. when braking.

11) To the gearbox lubrication
13) Plug
14) Oil cooler
15) Connection to the return line from the working hydraulics, and to lubrication of the DPS and shuttle unit.

15a) The 0.2 MPa valve (20 l/min) in the filter housing determines the max. pressure in the lubrication circuit.

17) Oil to the parking brake.

17a) Restriction / counter valve delays the coupling of the handbrake.

18) Indicator light sensor (S17/S4T), gearbox oil pressure
WARNING! Tractors with multi–disc clutch:
When the new pressure switch (14bar) will be detached, the pressure accumulator must be discharged by waiting 5 min after turning the engine off, or by engaging the parking brake on/off 5 times.

21) Pressure accumulator.
25) Temperature sensor, Agrodata instrumentation (B3)
26) Temperature sensor, gearbox
27) By–pass valve for the oil cooler (0.5 MPa) secures oil for lubricating, e.g. in wintertime.

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Valve block for Powershift and shuttle unit (Hitech)

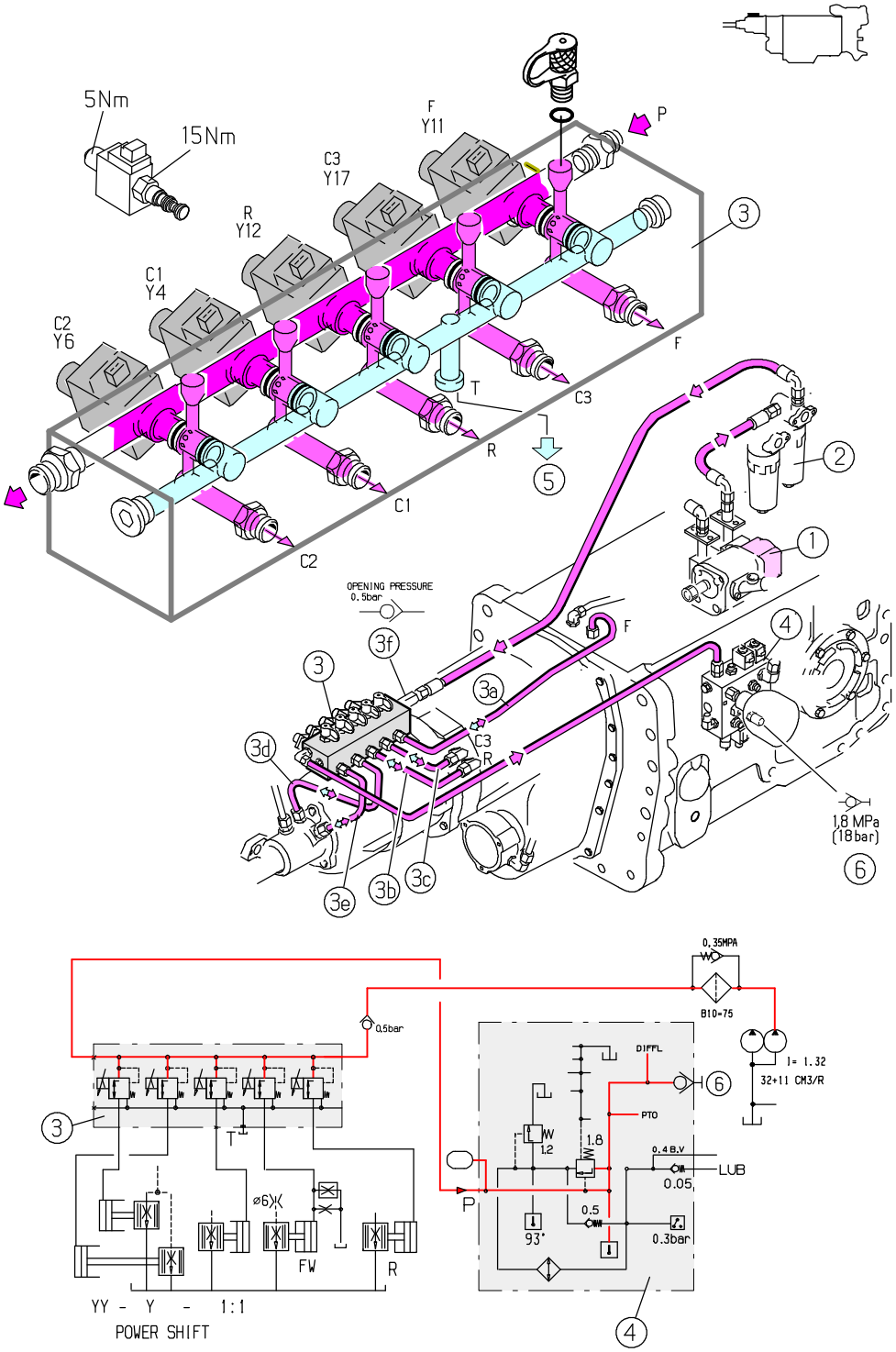


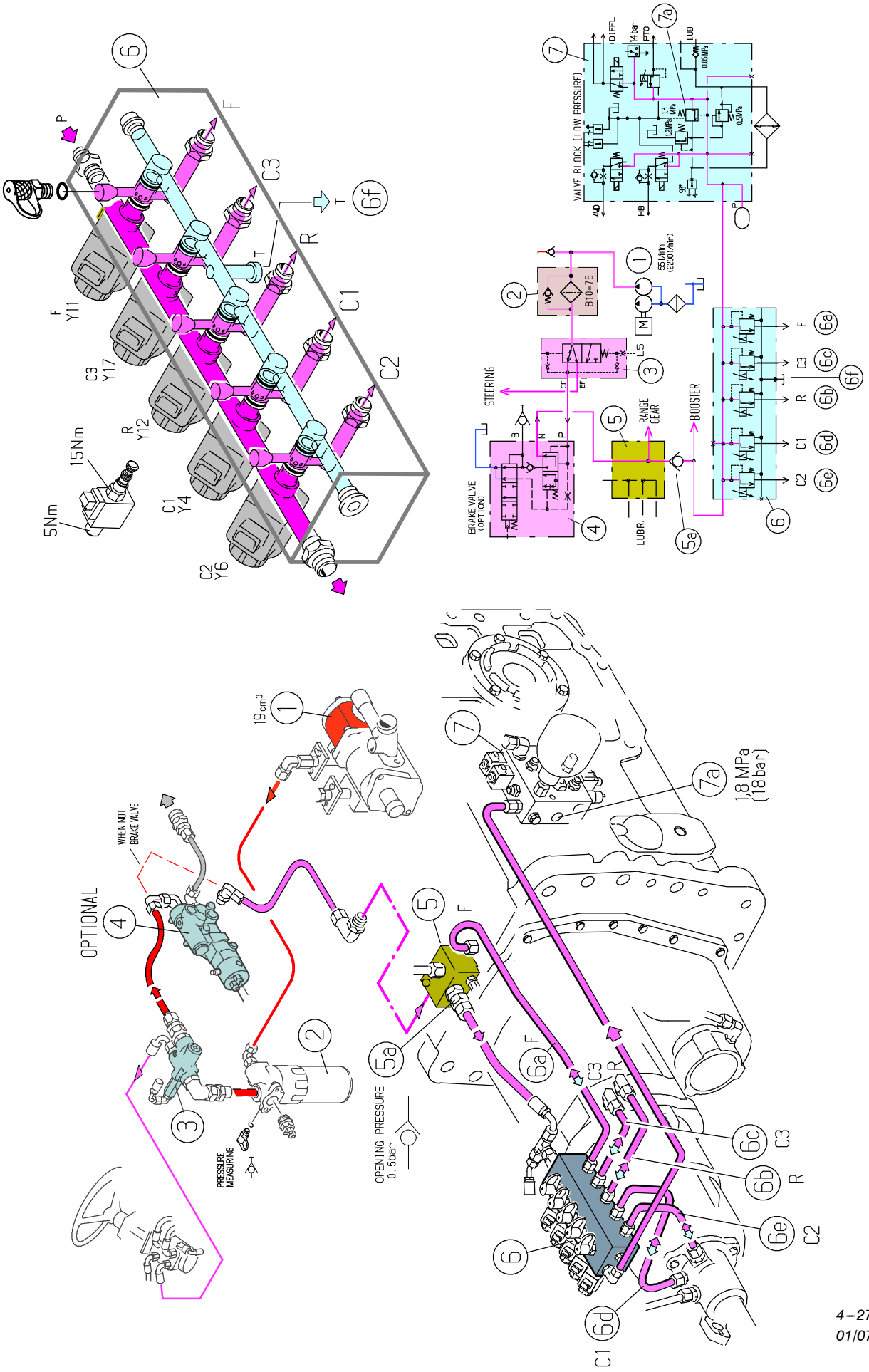
fig018

The pump circulates the oil through the DPS and shuttle unit valve block **3** to the gearbox valve block **4**. So the valve block **3** keeps warm in cold weather conditions. All solenoid valves are proportional valves.

1) Low–pressure circuit of the pump
2) Pressure filter for low–pressure hydraulics
3) Valve block
3a) Pressure oil (0...1.8 MPa) to the shuttle unit (forward)
3b) Pressure oil (0...1.8 MPa) to the shuttle unit (reverse)
3c) Pressure oil (0...1.8 MPa) to DPS multi–disc clutch C3
3d) Pressure oil (0...1.8 MPa) to DPS multi–disc clutch C1
3e) Pressure oil (0...1.8 MPa) to DPS multi–disc clutch C2
3f) Non–return valve 0.05 MPa (0.5 bar). Prevents the pressure accumulator to discharge through the pump.
4) Gearbox valve block
5) In the DPS housing there is an opening for the tank channel. In this way the tank channel is as short as possible (no resistances)
6) Pressure test point for low–pressure circuit (1.8 Mpa–1.9 MPa)
7) The shuttle unit lubrication

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Valve block for Powershift and shuttle unit (LS)



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The pump circulates the oil through the filter **2**, priority valve **3**, trailer brake valve **4**, block **5** and through the DPS and shuttle unit valve block **6** to the gearbox valve block **7**. So the valve block **6** keeps warm in cold weather conditions. All solenoid valves are proportional valves.

1) Low–pressure circuit of the pump
2) Pressure filter for low–pressure hydraulics
3) Priority valve
4) Brake valve (optional)
5) Valve block (see page XXX)

5a) Non–return valve 0.05 MPa (0.5 bar). Prevents the pressure accumulator to discharge through the pump.

6a) Pressure oil (0...1.8 MPa) to the shuttle unit (forward)

6b) Pressure oil (0...1.8 MPa) to the shuttle unit (reverse)

6c) Pressure oil (0...1.8 MPa) to DPS multi–disc clutch C3

6d) Pressure oil (0...1.8 MPa) to DPS multi–disc clutch C1

6e) Pressure oil (0...1.8 MPa) to DPS multi–disc clutch C2

6f) In the DPS housing there is an opening for the tank channel.
In this way the tank channel is as short as possible (no resistances)

7) Gearbox valve block

7a) Pressure test point for low–pressure circuit (1.8 Mpa–1.9 MPa)

Sensors

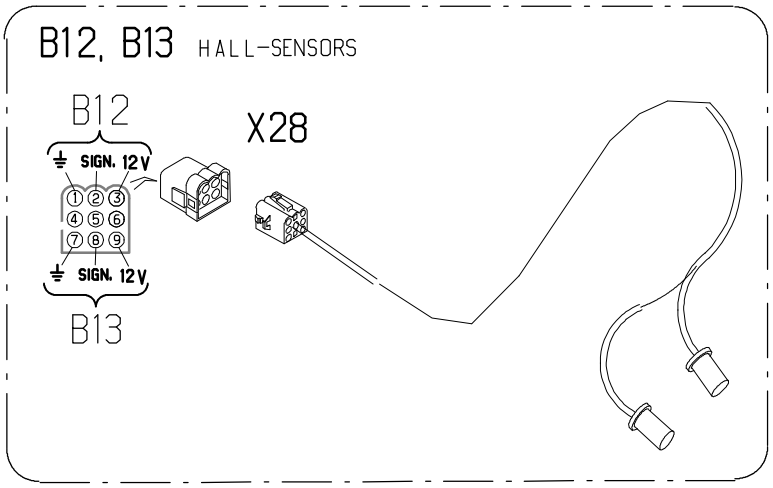


fig063

Shuttle sensor B13 (lower sensor):
1000 r/min –> 180–210 Hz (F)
1500 r/min –> 280–310 Hz (F)
1800 r/min –> 340–380 Hz (F)

Shuttle sensor B12 (upper sensor)
1000 r/min –> 190–220 Hz (R)
1500 r/min –> 300–330 Hz (R)
1800 r/min –> 360–400 Hz (R)

Location of the components in wiring diagram

Symbol	Description	Page + postion (in wiring diagram)	Location
AC10.2&AC10.21			
–B12	Sensor, F/R power shuttle	3.D8	Transmission
–B13	Sensor, F/R power shuttle	3.D9	Transmission
AC11.2			
–B12	Sensor, F/R power shuttle	5.D6	Transmission
–B13	Sensor, F/R power shuttle	5.D7	Transmission

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FNR–lever

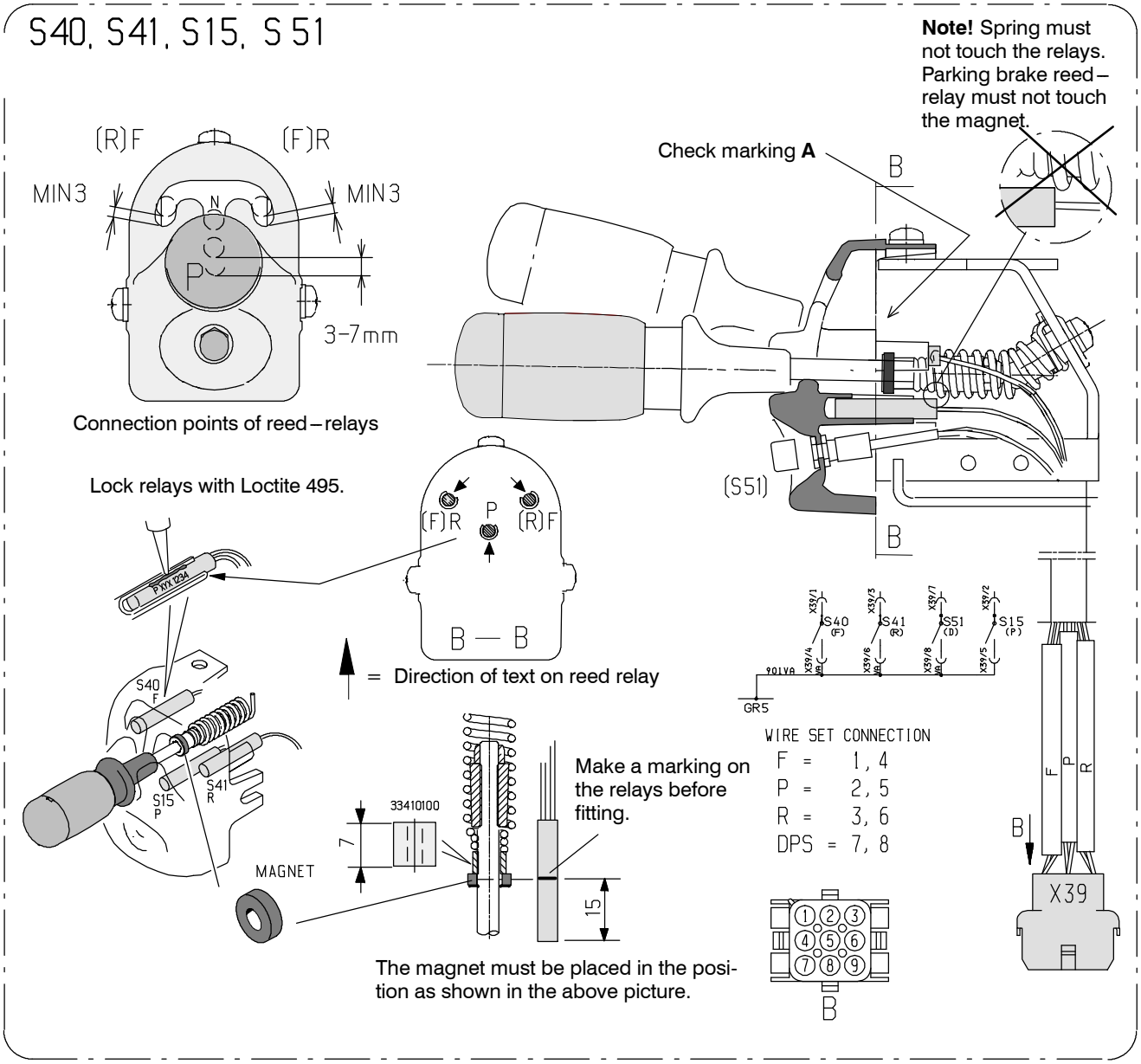


fig057en

Location of the components in wiring diagram

Symbol	Description	Page + postion (in wiring diagram)	Location
AC10.2&AC10.21			
–S15	Reed relay, parking brake (P)	2.D13	Cab
–S40	Reed relay, direction forward (F)	2.D12	Cab
–S41	Reed relay, direction reverse (R)	2.D13	Cab
–S51	Push button, front DPS–preselection	2.D11	Cab
AC11.2			
–S15	Reed relay, parking brake (P)	10.C11	Cab
–S40	Reed relay, direction forward (F)	10.C11	Cab
–S41	Reed relay, direction reverse (R)	10.C12	Cab
–S51	Push button, front DPS–preselection	10.C10	Cab

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Proportional valves

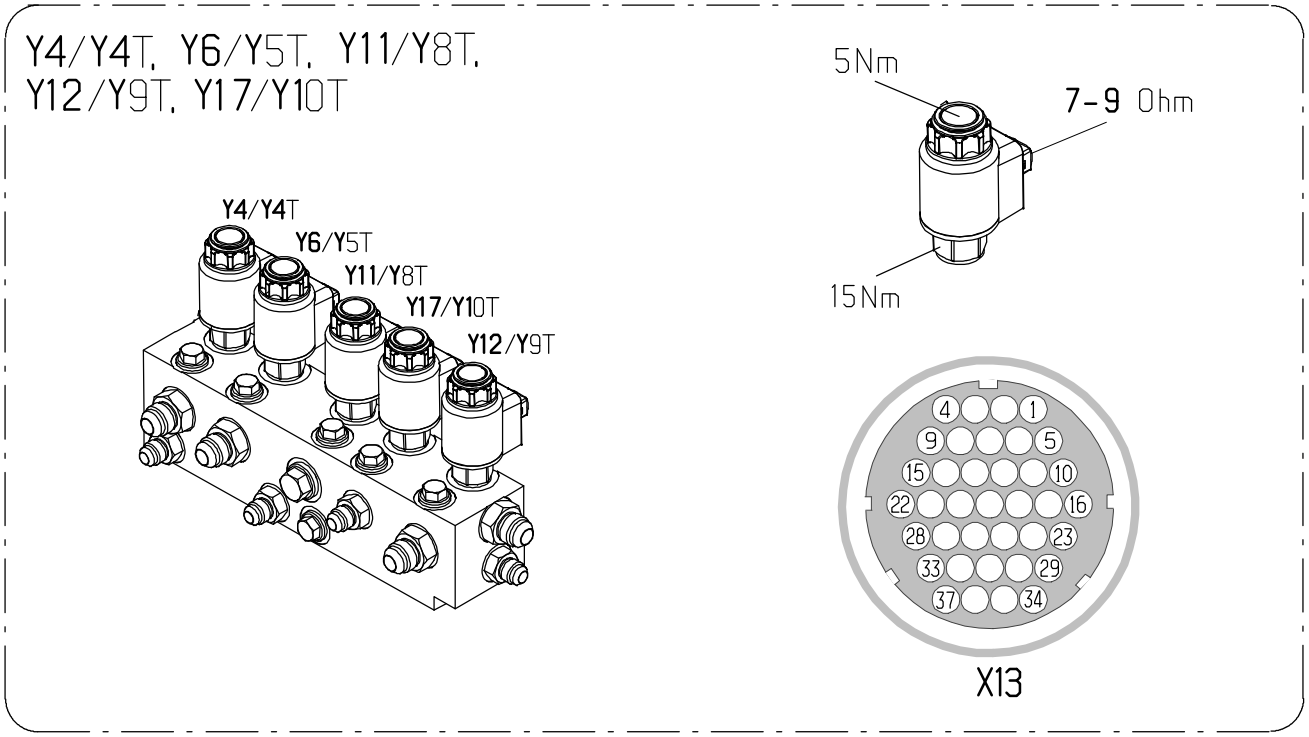


fig058

The resistance of the proportional valve is measured from connector X13 pins, see table. Correct value is **7–9 ohm** (+10˚C...+30˚C).

Solenoid	Pins (**X13**)	Resistance
Y4/Y4T (C1)	4, 5	**7–9 ohm**
Y6/Y5T (C2)	7, 5	
Y11/Y8T (F)	12, 5	
Y12/Y9T (R)	13, 5	
Y17/Y10T (C3)	11, 5	

Location of the components in wiring diagram

Symbol	Description	Page + postion (in wiring diagram)	Location
AC9.2			
–Y4	Valve, DPS 1	/7.D3	Transmission
–Y6	Valve, DPS 2	/7.D4	Transmission
AC10.2&AC10.21			
–Y4	Valve, DPS 1	/3.D13	Transmission
–Y6	Valve, DPS 2	/3.D14	Transmission
–Y11	Valve, direction forward	/3.D11	Transmission
–Y12	Valve, direction reverse	/3.D12	Transmission
–Y17	Valve, DPS 3	/3.D15	Transmission
AC11.2			
–Y4T	Valve, DPS 1	/5.D14	Transmission
–Y5T	Valve, DPS 2	/5.D15	Transmission
–Y8T	Valve, direction forward	/5.D11	Transmission
–Y9T	Valve, direction reverse	/5.D12	Transmission
–Y10T	Valve, DPS 3	/5.D16	Transmission

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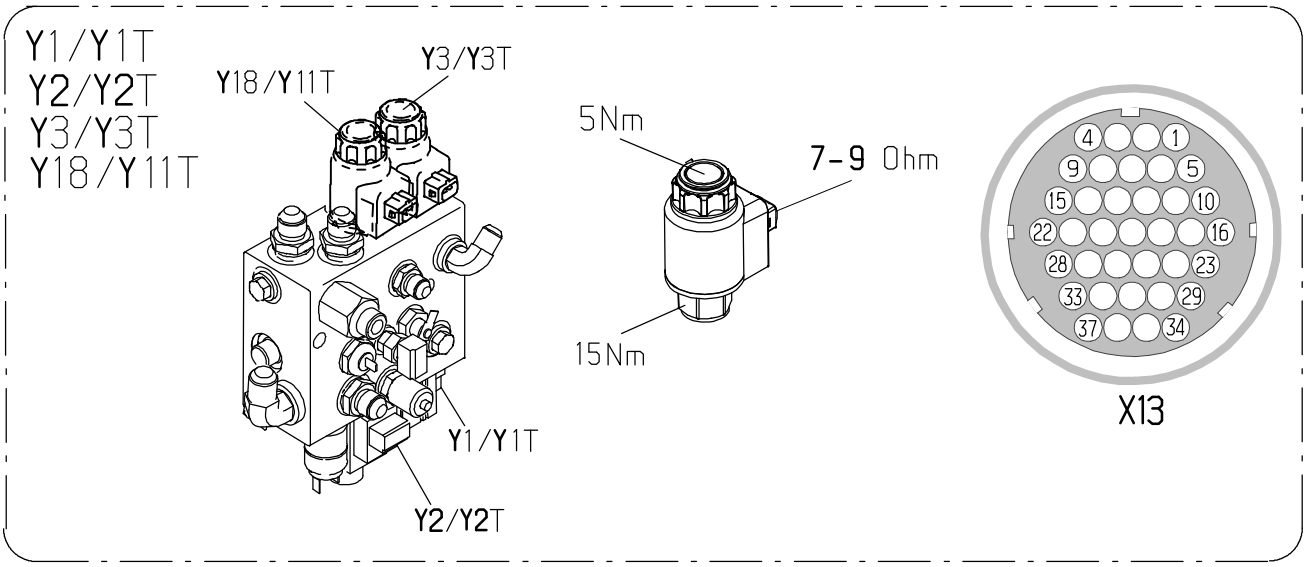


fig062

The resistance of the proportional valve is measured from connector X13 pins, see table. Correct value is **7–9 ohm** (+10˚C...+30˚C).

Solenoid	Pins (**X13**)	Resistance
Y1/Y1T (DIFF)	1, 5	**7–9 ohm**
Y2/Y2T (PTO)	2, 5	
Y3/Y3T (4WD)	3, 5	
Y18/Y11T (H.B.)	21, 5	

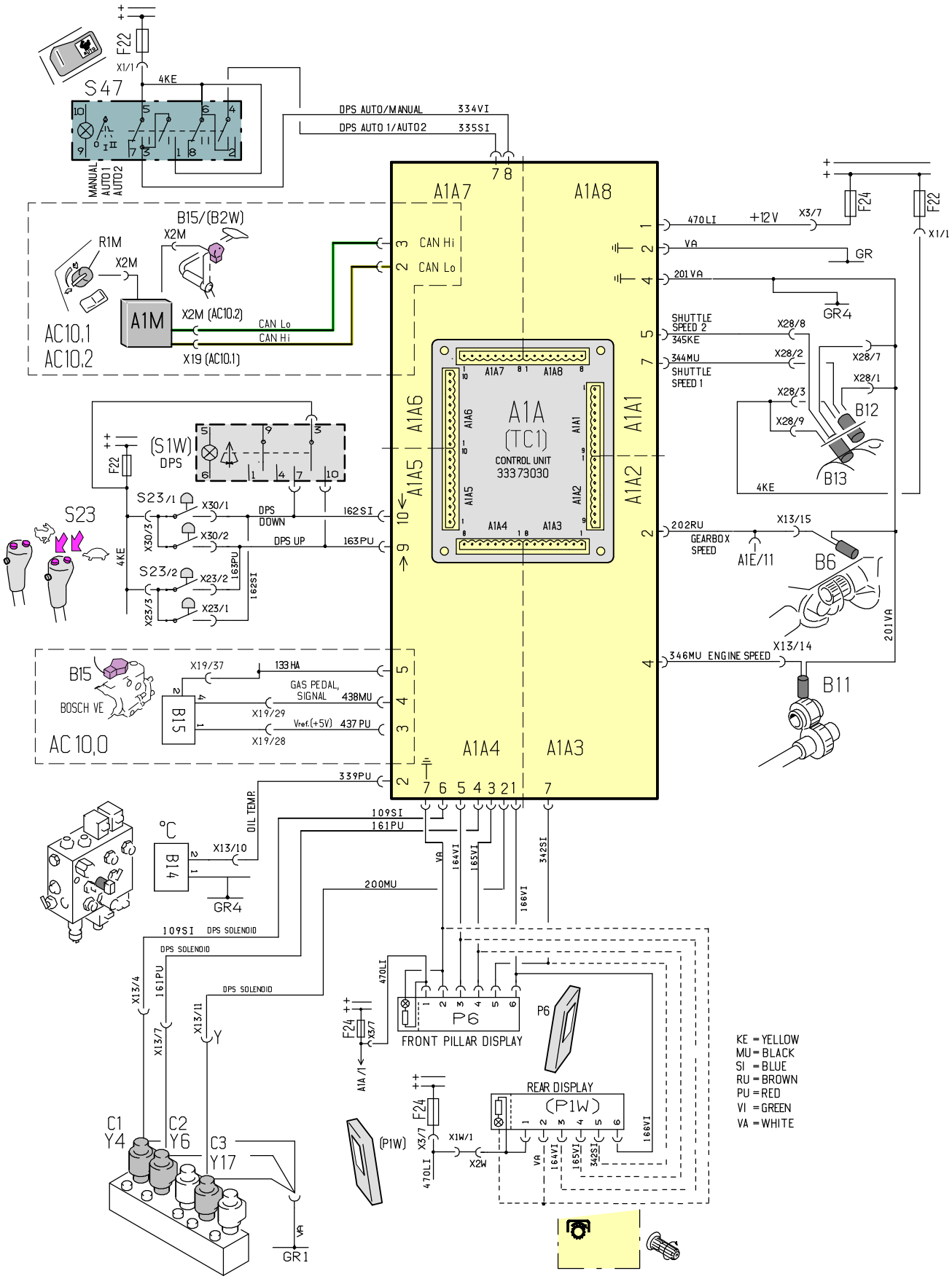
Location of the components in wiring diagram

Symbol	Description	Page + postion (in wiring diagram)	Location
AC9.2			
–Y1	Solenoid valve, differential lock	/6.D4	Transmission
–Y3	Solenoid valve, 4WD	/6.D8	Transmission
AC10.2&AC10.21			
–Y1	Solenoid valve, differential lock	/5.D1	Transmission
–Y3	Solenoid valve, 4WD	/5.D8	Transmission
AC11.2			
–Y1T	Solenoid valve, differential lock	/12.C11	Transmission
–Y3T	Solenoid valve, 4WD	/12.C12	Transmission

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Wiring

Powershift control (HiTech)



4–2684
09/06

https://truckmanualshub.com/

– Switch **S47**: DPS, man./auto
  – pins (A1A7; 8 ja 7) currentless; manual function
  – pins 8 and 7 current–carrying: AUTO 1
  – pin 8 current–carrying, pin 7 currentless: AUTO 2

– Switches **S23 (S1W)**, DPS, selector
  – Switches are placed in range gear and speed gear lever knobs.
  – When pushing the switch, an impulse (12V) goes either to pin A1A5;10 (change down) or to pin A1A5;9 (change up).
  – The number of DPS usage can be checked in the display.

– Angle sensor **B15**, accelerator pedal / hand throttle **R1M**:
  – Has an effect on the choosing of the changing program (together with the sensor **B11**: man: down, AUTO1 / AUTO2: up / down.

– Temperature sensor **B14**, gearbox (compensating of the oil viscosity):
  – The control unit supplies a 12V voltage to the sensor. The current, which goes through the sensor, changes according to the temperature. Earthing to the pin A1A1; 4.
  – Activates the fault diagnostics, if the resistance (wire + sensor) value corresponds to the temperature value over +150° (great resistance) or under –50° (little resistance).

– DPS solenoid valves **Y4** (P1/C1), **Y6** (P2/C2) and **Y17** (P3/C3).
  – During the gear coupling the control unit supplies pulse like voltage (12V) from the pins (A1A4; 2,4,6) to the proportional solenoid valves.
  – The diodes of the solenoid have been built in to the control unit A1 (preventing high voltage pulses when switching off).

– Display **P6 (P1W)**
  – The data lines go through the pins (A1A4;1,3,5,A1A3;7) to the display.
  – **NB!** The current supply for the display comes direct via the fuse F24.

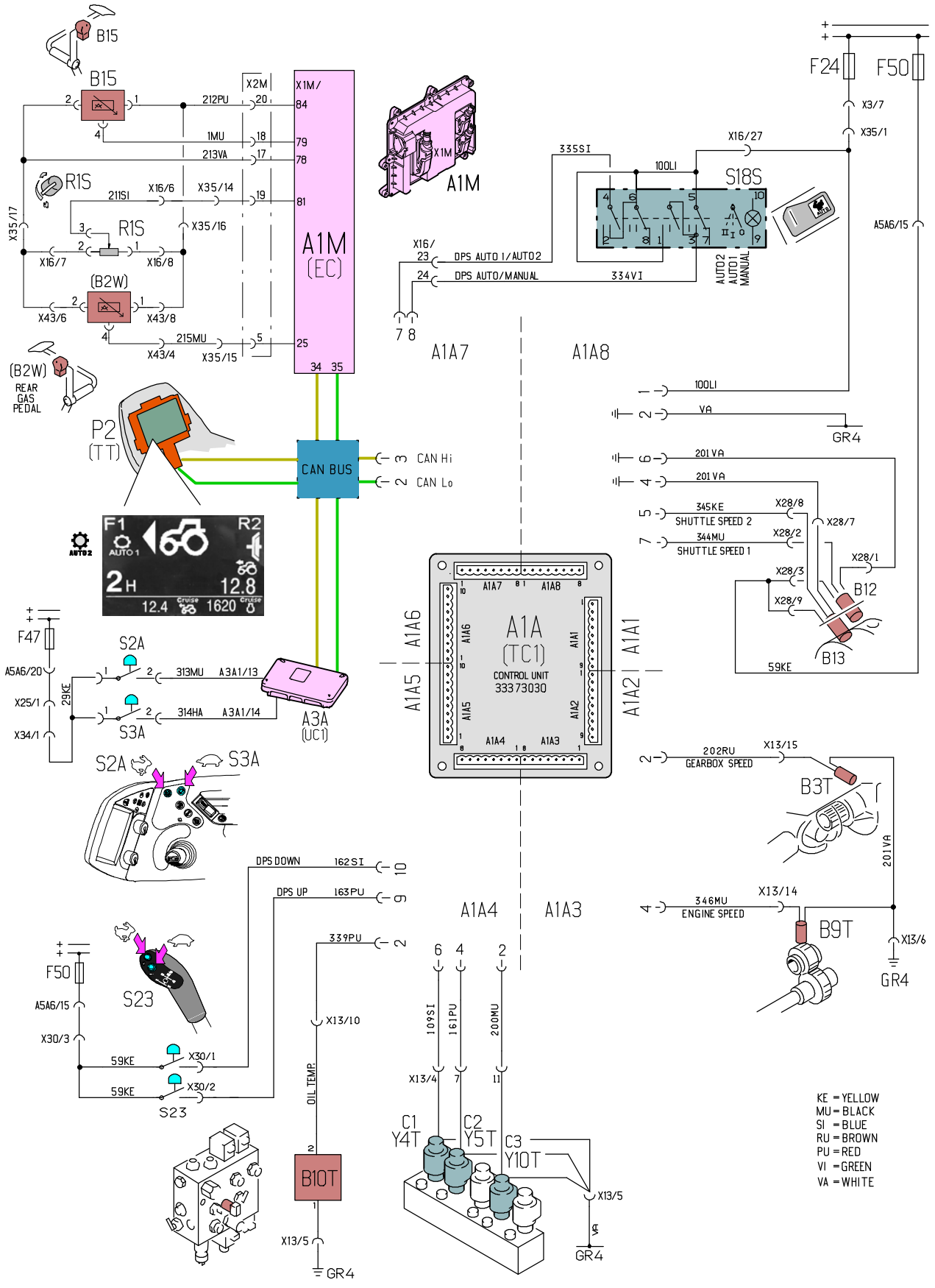
– Speed sensor **B6** (F2), gearbox
  – Inductive sensor (no supply), gives pulses according to the revolution speed of the gearbox (driving speed) to the pin A1A2;2.
  – When moving, the DPS changes according to the program, when stationary, the DPS changes at once.

– Speed sensor **B11** (F1), engine speed
  – Inductive sensor (no supply), gives pulses according to the revolution speed of the engine to the pin A1A2;4.
  – Gives information about engine load to the control unit together with sensor B15 (AUTO1 / AUTO2).

– F/R sensors **B13** (F5), **B12** (F4)
  – Active sensors, supply voltage 12V (fuse F22). The sensors report the revolution speed and direction of the gearbox input shaft to pins A1A1;5 and 7.
  – Feed back: the control unit observes the development of the DPS output revolution speed, which should be according to the programmed curve.

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Powershift control (LS)



4–2750
01/07

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– Switch **S18S**: Powershift, man./auto
  – pins (A1A7; 8 ja 7) currentless; manual function
  – pins 8 and 7 current–carrying: AUTO 1
  – pin 8 current–carrying, pin 7 currentless: AUTO 2

– Switches **S23**, **S2A** and **S3A,** Powershift selectors
  – Switches are placed in gear lever knob (S23) and in arm rest (S2A, S3A).
  – When pushing the switches S23, an impulse (12V) goes either to the pin A1A5;10 (change down) or to pin A1A5;9 (change up).
  – When using arm rest switches (S2A, S3A) signals are transmitted via CAN bus.
  – The number of PS usage can be checked in the display.

– Angle sensor **B15** (/**S2W**), accelerator pedal / hand throttle **R1S**:
  – Has an effect on the choosing of the changing program (together with the sensor **B9T**:
  man = down, AUTO1 / AUTO2 = up / down.

– Temperature sensor **B10T** , gearbox (compensating of the oil viscosity):
  – The control unit supplies a 12V voltage to the sensor. The current, which goes through the sensor changes according to the temperature.
  – Activates the fault diagnostics, if the resistance (wire + sensor) value corresponds to the temperature value over +150° (great resistance) or under –50° (little resistance).

– Powershift solenoid valves **Y4T** (P1/C1), **Y5T** (P2/C2) and **Y10T** (P3/C3)
  – During the gear coupling the control unit supplies a pulse like voltage (12V) from the pins (A1A4; 2,4,6) to the proportional solenoid valves.
  – The diodes of the solenoid are built in to the control unit A1 (preventing high voltage pulses when switching off).

– Display **P2**
  – Information shown in the display is transmitted via CAN bus.

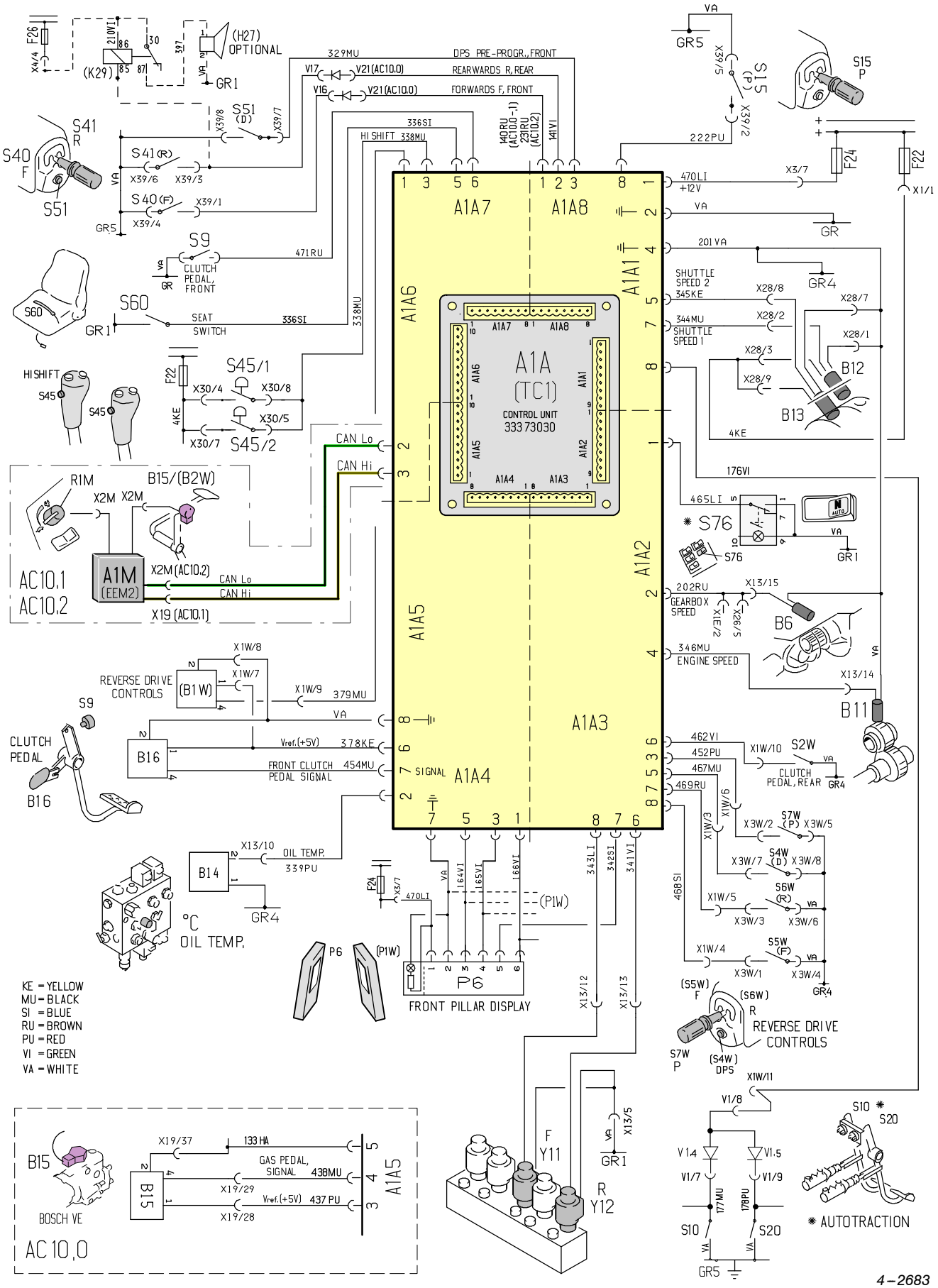
– Speed sensor **B3T** (F2), gearbox
  – Inductive sensor (no supply), sends pulses according to the revolution speed of the gearbox (driving speed) to the pin A1A2;2.
  – When moving, the PS changes according to the program, when stationary, the PS changes at once.

– Speed sensor **B9T** (F1), engine speed
  – Inductive sensor (no supply), sends pulses according to the revolution speed of the engine to the pin A1A2;4.
  – Gives information about engine load to the control unit together with sensor B15 (AUTO1 / AUTO2).

– F/R sensors **B13** (F5), **B12** (F4)
  – Active sensors, supply voltage 12V (fuse F50). The sensors report the revolution speed and direction of the gearbox input shaft to pins A1A1;5 and 7.
  – Feedback: the control unit observes the development of the PS output revolution speed, which should be according to the programmed curve.

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Shuttle control (HiTech)



4–2683
09/06

https://truckmanualshub.com/

– Switches **S40** / **S5W**: reed relay, forward (F),
S41 / **S6W**: reed relay, reverse (R)
– The switches are so–called reed relays, which are activated by a magnet on the shuttle lever.
When activated, the relays earth either the pin A1A8;1 (F) or A1A8;2 (R).
– The number of the shuttle usage can be checked from the display.

– Switch **S51**:DPS preprogramming (in connection with forward/reverse driving)
– The pin A1A3;3 is earthed by pressing down the clutch pedal.
– The pedal should be pressed at least 2 seconds for the preprogramming to be successful.

– Safety switch **S60**, seat
– Gives the driver information by earthing pin A1A7;5.

– Safety switch **S9** / **S2W** starting:
– 1. **Functions as a safety switch.**
When the clutch pedal is pressed down, S9 closes. **The control unit** allows the engine starting if the parking brake (S15/ S7W) is engaged and the speed is under 2 km/h.
– 2. When closing, the switch **always releases the shuttle switches**.
When the clutch pedal is pressed, S9 closes, and the control unit A1 (digital input A1A7/6) will be earthed. The upper position of the pedal does not have a limit switch, but the position is recognized using the calibration value.

– Angle sensor **B16** / **B1W**, clutch pedal:
– With the clutch pedal the driver “tells” the control unit how the clutch (shuttle unit) has to be controlled.
– The control unit supplies a 5V voltage from the pin A1A5;6. To the pin A1A5;7 comes a signal, which corresponds to the swing angle. Calibrating and the fault codes: see Service Manual.

– Temperature sensor **B14** , gearbox (compensating of the oil viscosity):
– The control unit supplies a 12V voltage to the sensor. The current, which goes through the sensor changes according to the temperature. Earthing to the pin A1A1;4.
– Activates the fault diagnostics, if the resistance (wire + sensor) value corresponds to the temperature value over +150° (great resistance) or under –50° (little resistance).

– Display **P6**/ **P1W**
– the data lines go through the pins (A1A4;1,3,5,A1A3;7) to the display.

– The F/R solenoid valves **Y11** (P4) and **Y12** (P5):
– During the coupling of the direction, the control unit supplies pulse like voltage (12V) from the pins (A1A3;6, 8) to proportional solenoid valves. The diodes for the solenoids (preventing the high voltage pulses when switching off) are located in the control unit.
Although the direction is off, these connectors have a low control current. When the another direction has been selected, the other coupling and the pressure lines have a small pressure (under 1 bar). This function ensures, when the direction is on, a small overpressure in the hydraulic pipes. With help of this, the developing of the disturbing air bubbles will be prohibited.

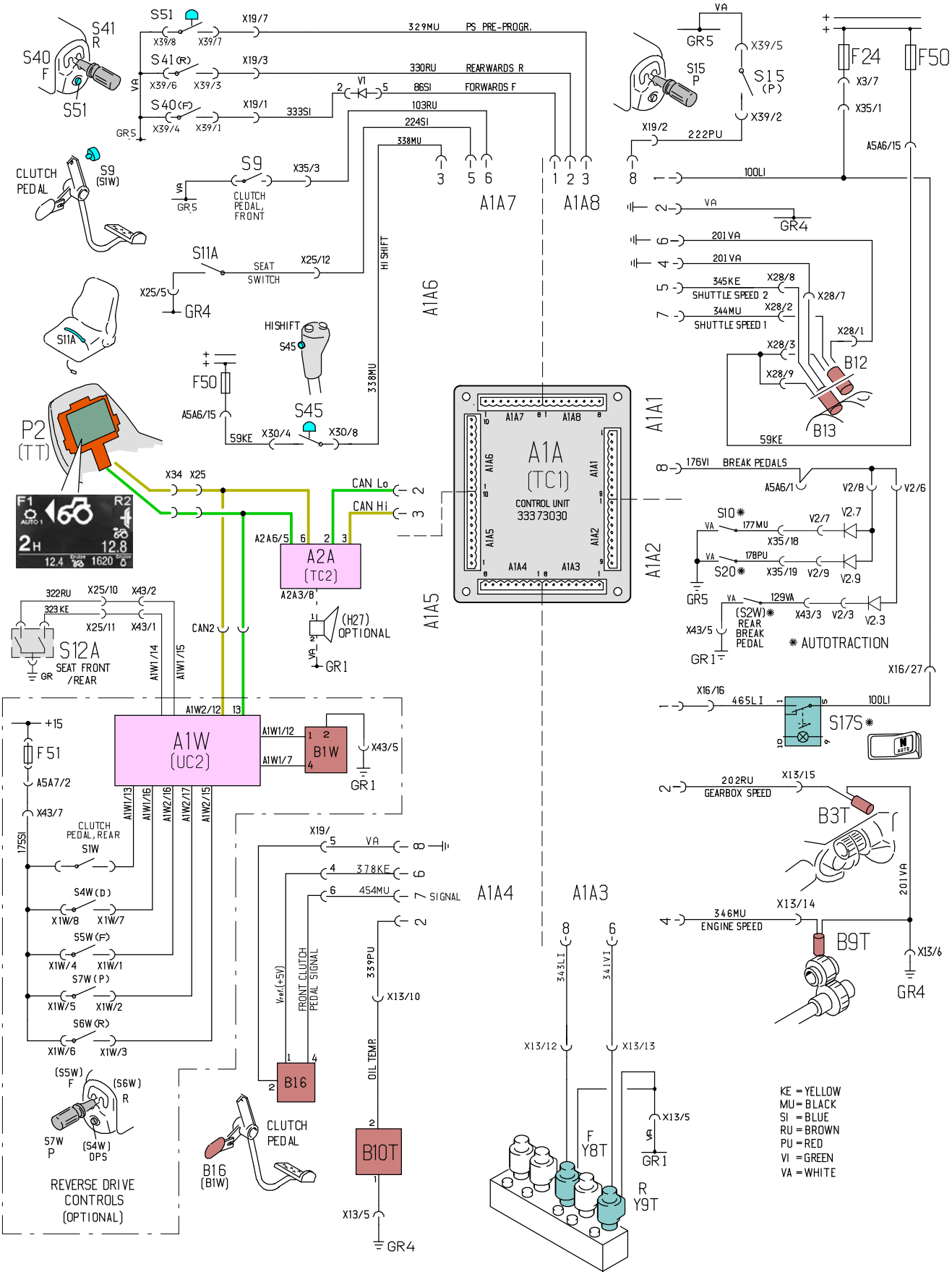
– F/R sensors **B13** (F5), **B12** (F4)

– Velocity sensor **B11** (F1), engine

– Velocity sensor **B6** (F2), gearbox

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Shuttle control (LS)



4–2751
04/08

https://truckmanualshub.com/

– Switches **S40** / **S5W**: reed relay, forward (F),
S41 / **S6W**: reed relay, reverse (R)
– The switches are so–called reed relays, which are activated by a magnet on the shuttle lever. When activated, the relays earth either the pin A1A8;1 (F) or A1A8;2 (R).
– The number of the shuttle usage can be checked from the display.

– Switch **S51**: DPS preprogramming (in connection with the forward/reverse driving).
–The pin A1A3; 3 is earthed by pressing down the clutch pedal
– The pedal should be pressed at least 2 seconds for the preprogramming to be successful.

– Safety switch **S11A**, seat
– Gives the driver information by earthing the pin A1A7;5.

– Safety switch **S9** / **S1W** starting:
– 1. **Functions as a safety switch.**
When the clutch pedal is pressed down, S9 closes. **The control unit** allows the engine starting if the parking brake (S15/ S7W) is engaged and the speed is under 2 km/h.
– 2. When closing, the switch **always releases the shuttle switches**.
When the clutch pedal is pressed, S9 closes, and the control unit A1 (digital input A1A7/6) will be earthed. The upper position of the pedaldoes not have a limit switch, but the position is recognized using the calibration value.

– Angle sensor **B16** / **B1W**, clutch pedal:
– With the clutch pedal the driver “tells” the control unit how the clutch (shuttle unit) has to be controlled.
– The control unit supplies a 5V voltage from the pin A1A5;6. To the pin A1A5;7 comes a signal, which corresponds to the swing angle. Calibrating and the fault codes: see Service Manual.

– Temperature sensor **B10T** , gearbox (compensating of the oil viscosity):
– The control unit supplies a 12V voltage to the sensor. The current, which goes through the sensor, changes according to the temperature. Earthing to the pin A1A1;4.
– Activates the fault diagnostics, if the resistance (wire + sensor) value corresponds to the temperature value over +150° (great resistance) or under –50° (little resistance).

– Display **P2**
– Information shown in the display is transmitted via CAN bus.

– The F/R solenoid valves **Y8T** (P4) and **Y9T** (P5):
– During the coupling of the direction, the control unit supplies a pulse like voltage (12V) from the pins (A1A3;6, 8) to proportional solenoid valves. The diodes for the solenoids (preventing the high voltage pulses when switching off) are located in the control unit.
Although the direction is off, these connectors have a low control current. When the another direction has been selected, the other coupling and the pressure lines have a small pressure (under 1 bar). This function ensures, when the direction is on, a small overpressure in the hydraulic pipes. With help of this, the formation of the disturbing air bubbles will be prohibited.

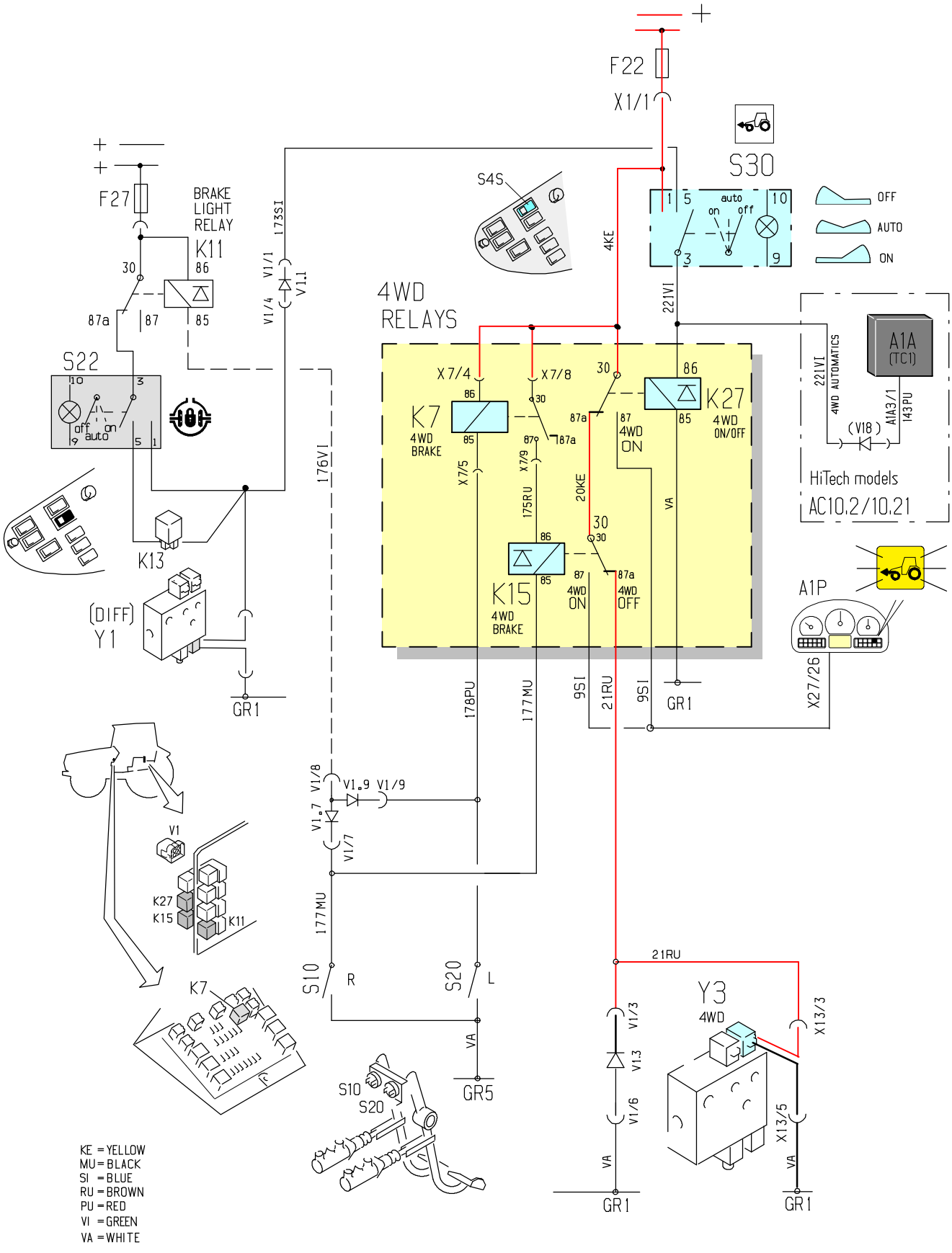
– F/R sensors **B13** (F5), **B12** (F4)

– Velocity sensor **B9T** (F1), engine

– Velocity sensor **B3T** (F2), gearbox

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4WD control (Classic / HiTech)



4–2807
03/07

https://truckmanualshub.com/

4WD automatics (not in Tc models):

Driving start and shuttle automation (control unit output A1A1/8) engages the 4WD automatically when starting to drive and/or shuttling. 4WD is also engaged when using the HiShift switch and if the driving speed is under 10 km/h. The automatic function also engages the 4WD regardless of the position of 4WD switch (the wire 221Vi from the control unit has been connected direct to the pole 86 of the relay K27). The automatic function disengages the 4WD after starting to drive or shuttling after the adjusted delay. Driving start automatics is set with FIII/10 setting.

With this function it is possible to get the maximum traction. This reduces wheel slip by the rear wheels when working on slippery surfaces. The function is activated on as the factory setting (4.0 s). The 4WD disengaging time can be adjusted 0.5–20 s or disengaged totally with the display settings.

The positions of the switch (S30) (N.B! The 4WD multi–disc clutch is under pressure when switched off):

Opposite side to the symbol pressed down: 4WD off.
The solenoid Y3 is energized via the contact of relay **K15**, and oil pressure disengages the 4WD multi–disc clutch.

The switch in the centre position = Automatic position.
When the differential lock is engaged, 4WD is also engaged. The current supply to the switch **S30** has been taken from the same line as to the differential lock solenoid. Otherwise the function is similar to the previous description.

When the differential lock is disengaged, 4WD is also disengaged unless the driver is braking with both brake pedals at the same time. When the differential lock is switched off, the current supply to the switch S30 stops. The relay **K27** opens and the current gets via the contact 87a to the relay **K15**. The solenoid **Y3** is now energized via contact 87a of the relay K15 (unless both brake pedals or the parking brake is being used), and oil pressure disengages the 4WD multi–disc clutch.

Symbol side pressed down: 4WD is continuously on (light on the instrument panel).
The switch S30 has energized the coil of the relay K27. The relay connects the current (via contact 87) to the indicator light. Solenoid Y3 is not energized and the cup springs hold the 4WD clutch on.

Four wheel drive is always engaged when braking with both brake pedals.

When depressing one of the brake pedals 4WD does not engage. When braking with both pedals, the coil of the relay is energized as relay K7 activates. The coil is thus earthed via the switch S10. Relay K15 activates making solenoid Y3 unenergized (4WD engage, indicator light lights up).

When using the parking brake the control unit switches 4WD on (with help of relay K27).

Front wheel drive can be engaged and disengaged while driving without using the clutch pedal.

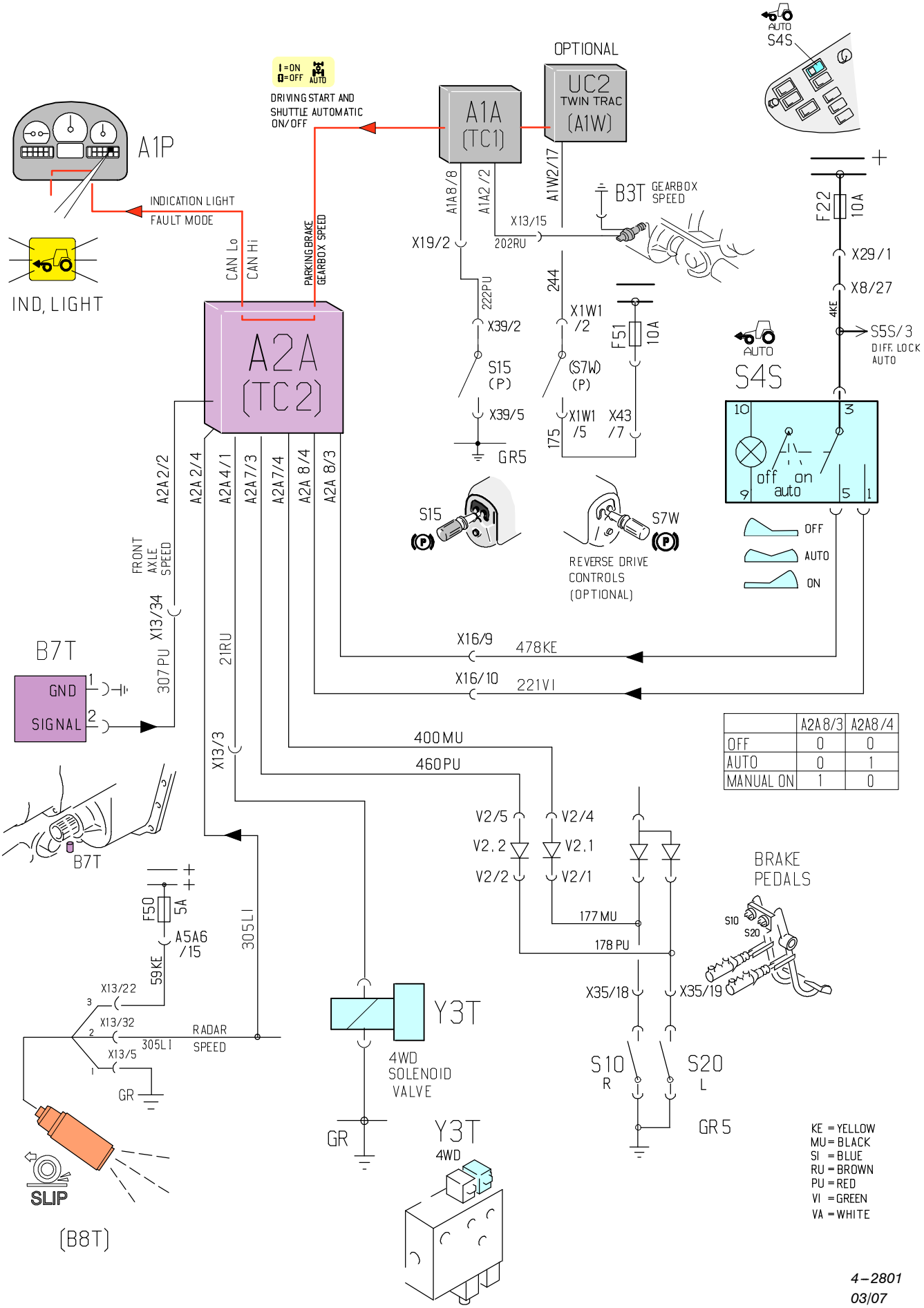
4WD is always on, when the engine is not running.

Wire colours:

Ru = brown	Mu = black
Pu = red	Vi = green
Ke = yellow	Va = white
Si = blue	

https://truckmanualshub.com/

4WD control (LS)



4–2801
03/07

https://truckmanualshub.com/

The automatic 4WD is controlled by the 3 position switch (OFF – AUTO – ON). When 4WD is engaged the indicator light in the instrument panel is illuminated.

The opposite side to the symbol pressed down: 4WD is disengaged except in the following cases:
– The (latched together) brake pedals are pressed.

OR
– The parking brake is engaged.

OR
– The 4WD engagement function is activated in a driving start automation or shuttle automation situation. (The factory setting default is that the function is activated.)
–The driving start and shuttle automation engages 4WD automatically when starting to drive or using shuttling. 4WD is also engaged when using the HiShift switch if driving speed is under **10 km/h**. The automatic function disengages 4WD after starting to drive or shuttling, after a delay of few seconds.

OR
– The 4WD control is in fault mode.

Middle position (Auto) – the automatic position:

4WD control (automatic position)

4WD engages, when:

– the gearbox speed is greater than the engaging limit (0.3 km/h)

AND

– the speed difference between front and rear wheels exceeds the speed difference limit (10%) for more than 0.35 seconds.

The slip percentage is different from the one selected in the instrument panel display. The slip percentage in the instrument panel shows the true slip of wheels (ground speed).

4WD disengages, when:
(disengaging delay is 5 seconds)

– when the slip percentage of the gearbox / radar is below 4% (= slip percentage which can be selected to the instrument panel display).

The symbol side pressed down (On): Manual on position, 4WD is always engaged.

Front wheel drive can be engaged and disengaged while driving without using the clutch pedal.

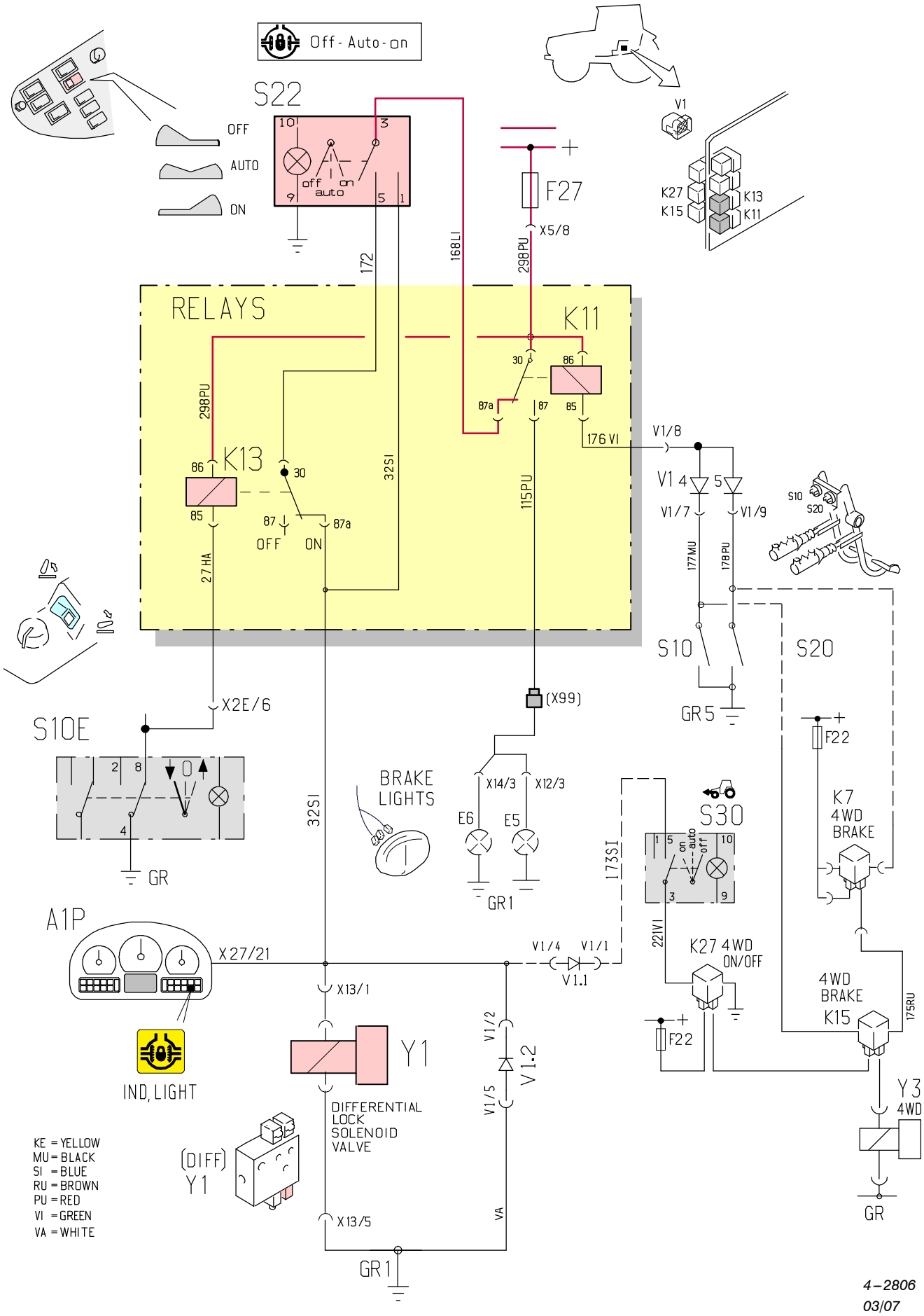
With this function it is always possible to get the maximum traction. This reduces wheel slip by the rear wheels when working on slippery surfaces, for example.

If the indicator light in the instrument panel flashes in the automatic position, the automation system is in error mode and the system engages 4WD for safety reasons.
Resons for the error mode:
– The speed sensors are not calibrated.
– There is a fault in the switch (the service function code is also displayed).

NOTE! 4WD automation is active once the speed sensors have been calibrated. If these sensors are not calibrated, 4WD will be engaged in the AUTO position.

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Differential lock control (Classic / HiTech)



4–2806
03/07

https://truckmanualshub.com/

The differential lock for the rear axle operates electro–hydraulically (also available as alternative equipment for the front axle). The switch for the differential lock has three positions. When the lock is engaged the indicator light on the instrument panel is illuminated.

Function:

The opposite side to the symbol pressed down (in the picture): the lock is disengaged (solenoid Y1 cannot be energized).

The switch in the centre position (automatic position): the lock is always engaged except when:
– One or both brake pedals are pressed.
During the pedal press the lock is disengaged (relay **K11** switches off current to solenoid valve **Y1** and connects current to the brake lights), but lock engages again when the pedals are released.
– The linkage lifting/stop/lowering switch is in the lifting position (relay **K13** switches off the current to solenoid **Y1** and to the indicator light).

With the aid of this function the lock is disengaged when the implement is raised up and is re–engaged when the implement is lowered. If the lock is needed while the implement is in the working position, the implement is raised by means of the position control potentiometer (not with the lifting/lowering switch).

The lock re–engages when lifting/stop/lowering switch is switched to the centre or lower position.

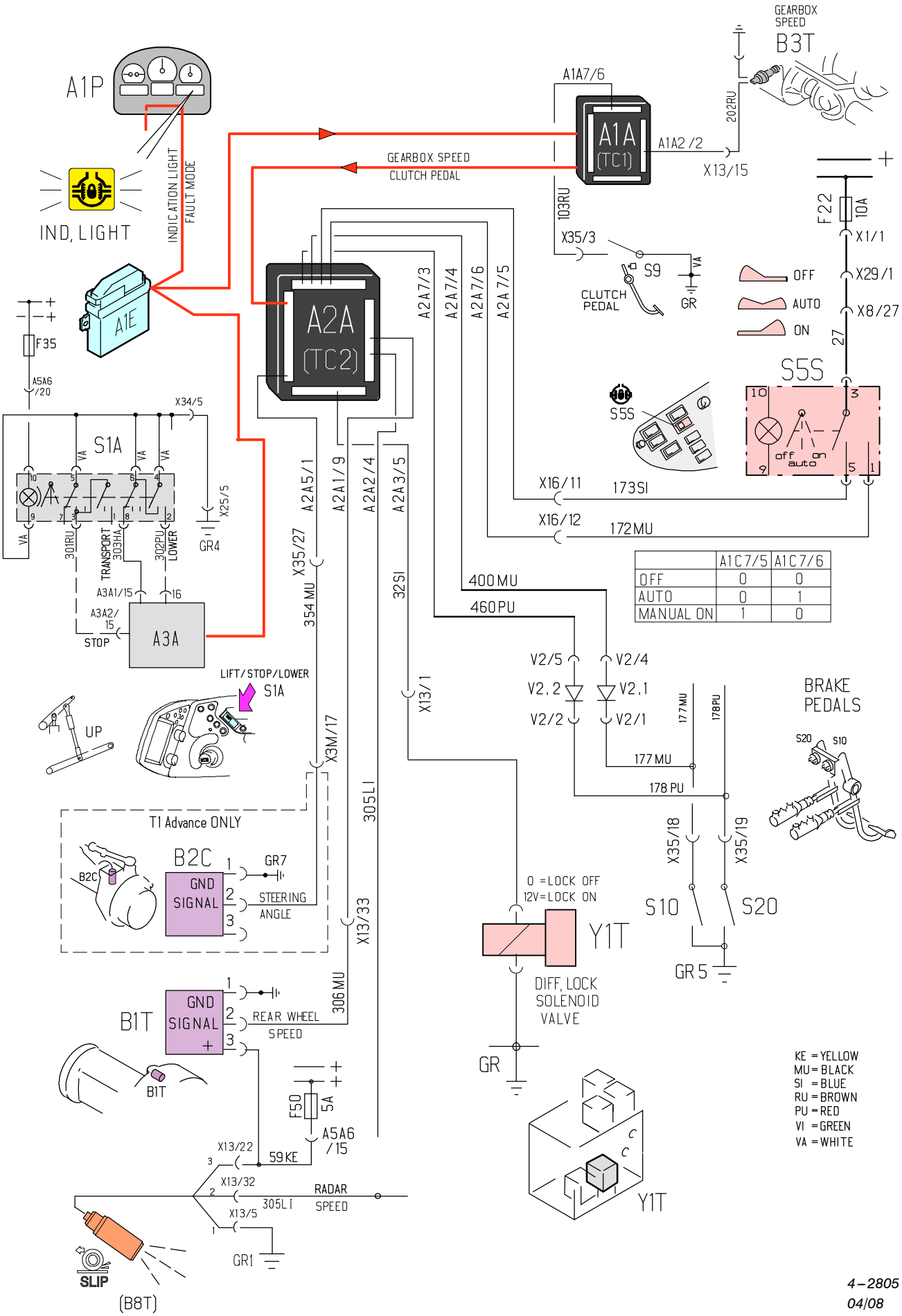
The rear edge of the switch is pressed down (no spring return): pressed down the lock is always engaged except when one or both brake pedals are pressed. The lock re–engages when one or both pedals are released.

The differential lock can be switched on and off while driving. Use the differential lock only when even drive on both wheels is required. The lock should be disengaged when driving on the road.

Wire colours:
Ru = brown
Pu = red
Ke = yellow
Si = blue
Mu = black
Vi = green
Va = white

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Differential lock control (LS)



4–2805
04/08

https://truckmanualshub.com/

The differential lock for the rear axle operates electro hydraulically (also available as alternative equipment for the front axle). The switch for the differential lock has 3 positions (OFF – AUTO – ON). When the lock is engaged the indicator light on the instrument panel is illuminated.

Function:

Opposite side to the symbol pressed down (OFF): The lock is always disengaged (the solenoid Y1 is not energized).

Middle position (Auto): Automatic position
In the automatic position the lock engages when needed and disengages at once when it is not needed. The function is based on the measurement of the wheel slip.

Previous tractor models:

Differential lock control (switch in auto – position)

Differential lock engages:

– When the speed difference between the right and left rear wheel exceed approximately **14 %** (no attention is paid to front wheel slip)[1)]

– In addition, the speed difference between the radar speed (= ground speed) and the transmission has to be over **10 %** (the slip percentage is displayed in the instrument panel).

1) This slip percentage is different to the one selected in the instrument panel display, which shows the true slip of the driving wheels (= ground speed).

Differential lock disengages:

– When the speed difference between the radar speed (= ground speed) and transmission is below **6 %.** The slip percentage is the same slip as the one selected in the instrument panel display.
The disengaging delay is **5** seconds.

– The lock disengages when driving speed rises over **15 km/h** (or the wheels are turned more than **±10°** from the middle position).
– When pressing the clutch pedal.
– When pressing one of the brake pedals.

– When pressing the lifting/stop/lowering switch to the lifting position (**S7S**) If the switch is already in the lifting position or its position does not change, it does not disengage the lock.

Current tractor models:

Differential lock control (switch in auto – position)

The lock is engaged unless:

– at least one of the brake pedals is pressed down (the lock engages upon releasing the brake pedal/pedals)

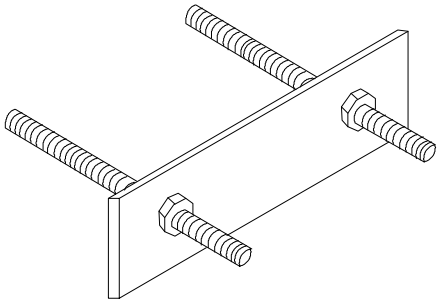
– the linkage lifting/stop/lowering switch is in the lifting position (or controlled by the U – Pilot function) and the links have risen high enough. (The lock engages when the linkage is lowered.)

The symbol side pressed down (On): The lock is always engaged except in the following cases:
– One or both brake pedals are depressed (the lock re – engages when one or both pedals are released).
– The differential lock can be engaged and disengaged during driving.
– If the indicator light in the instrument panel flashes in the automatic position, the automatic system is in an error mode and it disengages the differential lock for safety reasons. The error mode may result from the following reasons:
  – The speed sensors are not calibrated
  – The turning angle sensor is not calibrated (please contact an authorized workshop).
  – There is a malfunction in the switch (the service function code also comes on).
– The lift linkage position (switch S7S), gearbox speed (sensor B3T) and pedal information (S9) are relayed to the control unit A2A as a CAN signal.

Special tools

Reconditioning shuttle (code 445.2)

ETV 894 350 . . . . . Compressing tool for F–clutch large coil spring



ETV 894 350

fig019

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Reconditioning the Powershift gear

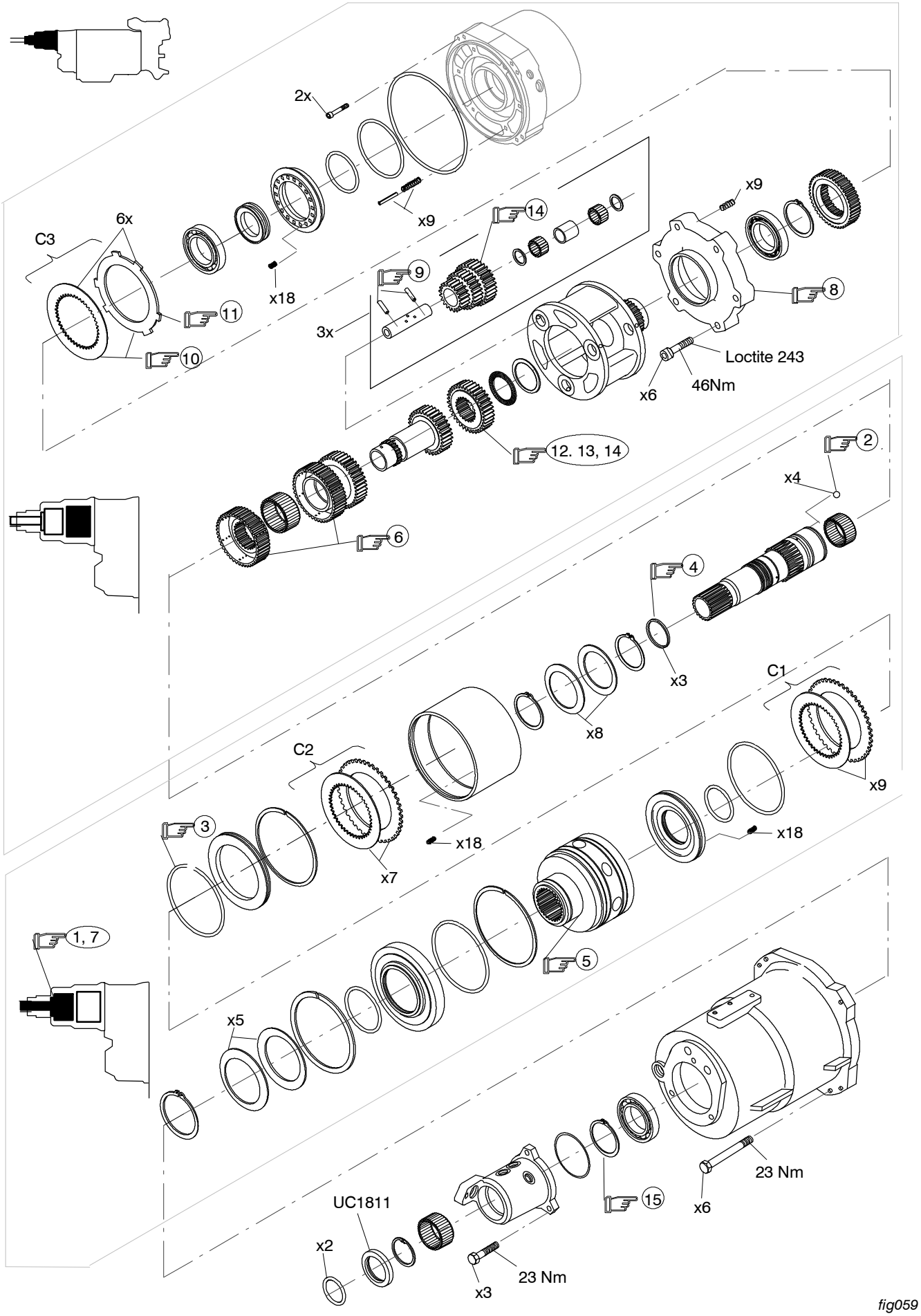


fig059

https://truckmanualshub.com/

Removing the Powershift gear



fig280

1. Remove the front end piece of the Powershift gear.



fig281

2. Remove the circlip from the outer ring of the bearing.



fig282

3. Mark the position of the Powershift gear housing in relation to the housing of the shuttle unit.



fig283

4. Remove the Powershift unit housing.



fig284

5. Remove the clutch drum for Powershift gears C1 and C2 with the shaft.

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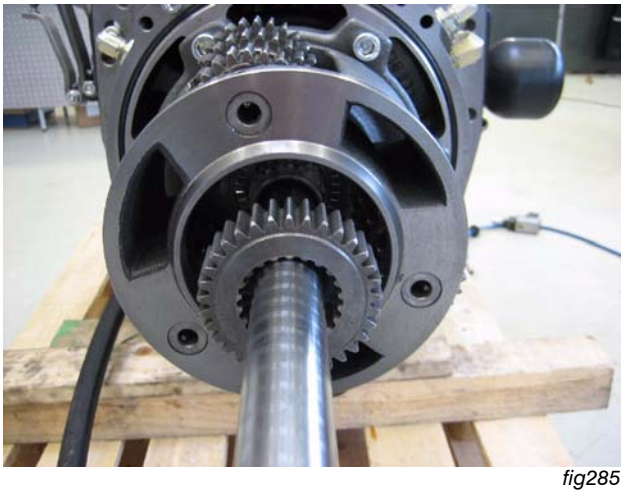


fig285

6. Remove the gear wheel from inside the planetary gear.

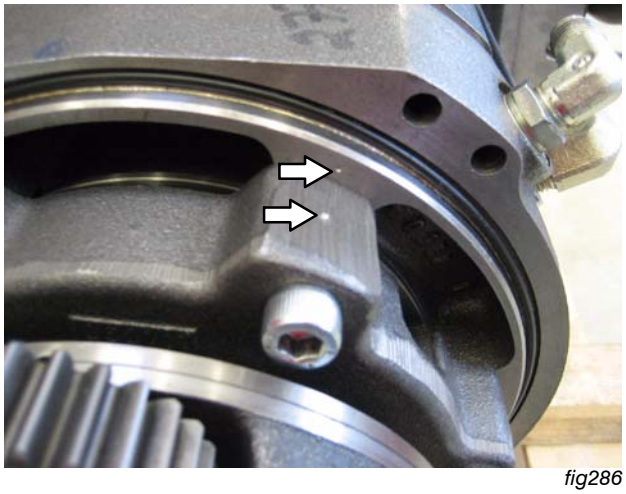


fig286

7. Mark the position of the planetary gear flange in relation to the housing of the shuttle unit.

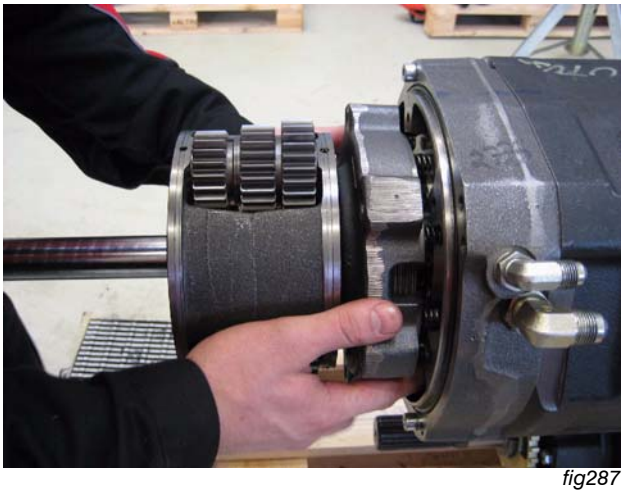


fig287

8. Remove the planetary gear flange. Recover and store the O–ring that comes loose and the springs of the clutch.



fig288

9. **Note!** Recover and store the bushing.

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Reconditioning the multi–disc clutches C1 and C2 for the Powershift gear

Disassembling



fig289



fig290

1. Remove the large circlip. Then remove the clutch drum from its housing by lifting it up.



fig291

2. Remove the C2 clutch discs from the drum. Pull out the piano wire from under the circlip.



fig292

3. Remove the circlip inside the drum by pressing it through the holes in the drum. Remove the C1 clutch discs.

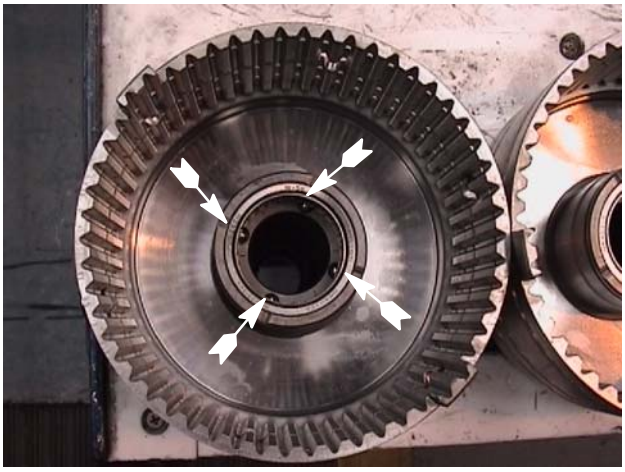


fig021

4. Check that the four balls are in place.



fig293

5. The pistons of C1 and C2 clutches can be removed by applying compressed air to the oil holes in the shaft. The circlips and belleville springs must be removed before removing the pistons. Check the seal rings of the pistons and change them if necessary.

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Assembling

1. Fit the pistons, belleville springs, and circlips (if they have been removed).
2. Fit the friction discs, spacer rings and circlip of the C1 clutch.



fig022b

3. Push a piano wire (thickness ø1 mm and length about 450 mm) under the circlip.

Note! Tap the side of the clutch drum to make the piano wire slide better.

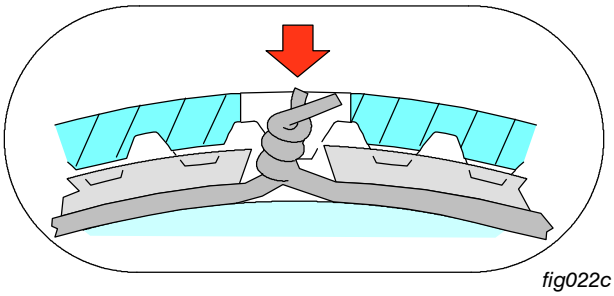


fig022c

4. Bend the wire ends outwards about 5 mm to prevent the rotation of the wire

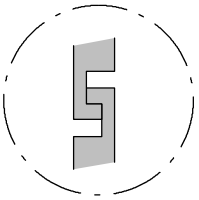


fig023

5. Fit the metallic seal rings into the grooves. Ensure that the ring ends are locked together. **Note**! Apply grease to the metallic seal rings.

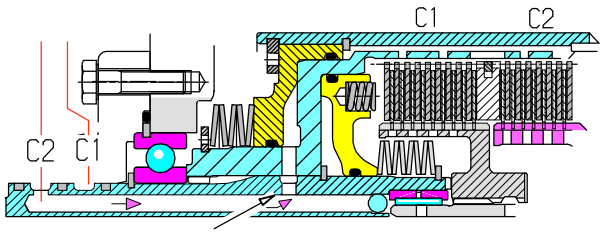


fig024

6. When assembling the unit make sure that the holes align with each other (pressure line of the clutch C2).

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fig025

7. After the installation of the friction discs (clutch C1 and C2) fit the C1 and C2 hubs fully home. **Ensure** that all the friction discs are in the grooves of the hub (rotate the hub).

   Do not loosen the assembly during fitting. Othwerwise the friction discs can move out from grooves of the hub.



fig026

8. **Note!** During the fitting the multi–disc clutch can only be pushed. Do not pull the clutch, because the friction discs can slip out from grooves of the hub. If this happens, the C1 and C2 hubs must be fitted again.

   Push and rotate the multi–disc clutch and simultaneously rotate the planetary gear until the multi–disc clutch slips fully home.

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Reconditioning and fitting the multi–disc clutch C3 and the planetary gear for the Powershift gear

Disassemble/assemble the multi–disc clutch using the exploded picture.

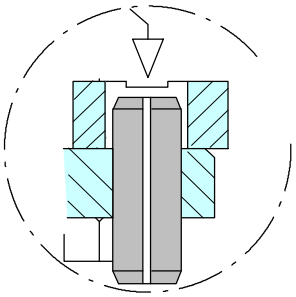


fig028

If you remove the planet wheel shaft, during reassembly make sure that the split sides of the locking pins align with the carrier grooves. In addition, tap in the pins so that they are a little below the surface of the the planetary gear flange. This ensures free flow of lubricating oil.



fig294

1. Before fitting the friction discs of the C3 clutch push a screwdriver between the planetary gear and the planetary gear attachment flange. Otherwise the lowest friction disc can remain behind the groove of the hub. Do not remove the screwdriver until the flange of the planetary gear has been attached to the housing of the shuttle unit.



fig029

Open notch



fig295

2. Do not fit the cams of the steel disc into the open notches in the planetary gear flange as this would decrease the support surface area of the steel discs.

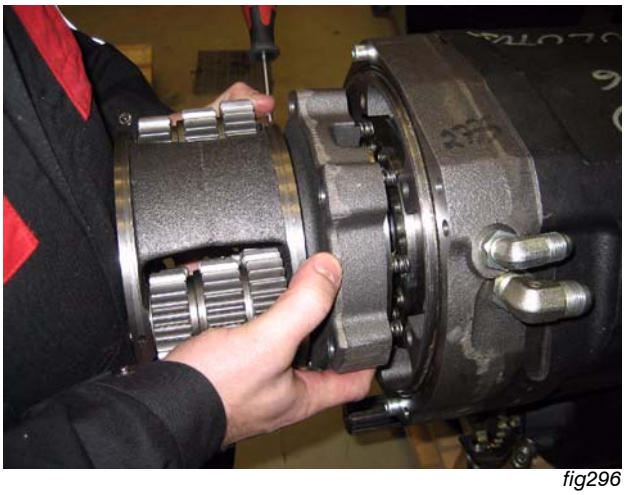


fig296

3. Do not remove the screwdriver until the planetary gear flange has been attahced to the to the shuttle unit. Apply Loctite 243 to the threads of the flange bolts. Tighten the bolts to atorque of 43 Nm.

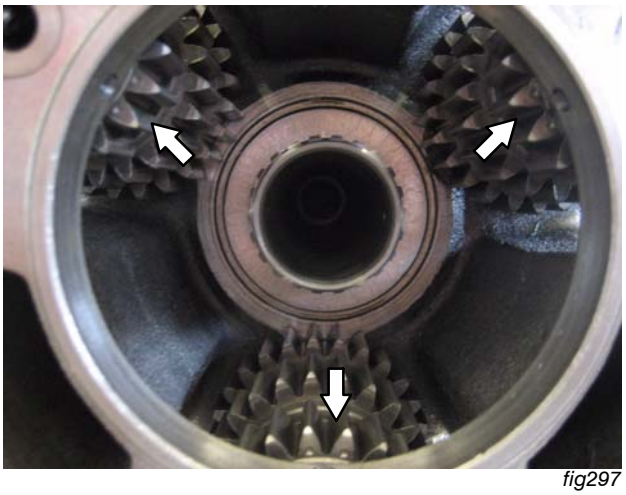


fig297

4. Rotate the planet wheels until all the marking spots point to the middle of the sun gear.

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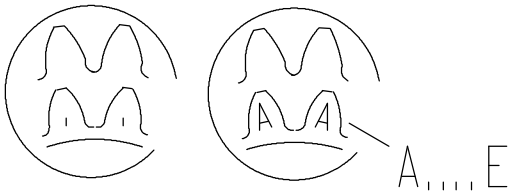


fig033c

Note! If there are markings on the planet wheels, all the markings must match each other. In other words, all the planet wheels must have either spot or letter (A, B, C, D, or E) markings.



fig298

5. Fit/pass an O – ring around the planetary gear. This keeps the markings of the planet wheels in place.



fig299

6. Fit the rear gear wheel and needle bearing. Make sure that the location of the markings stays the same.



fig300

7. Fit the clutch drum of Powershift gears C1 and C2. The clutch unit can only be pushed, not pulled!



fig301

8. Fit the housing of the Powershift gear unit.



fig302

9. Tighten the bolts to a torque of 23 Nm.

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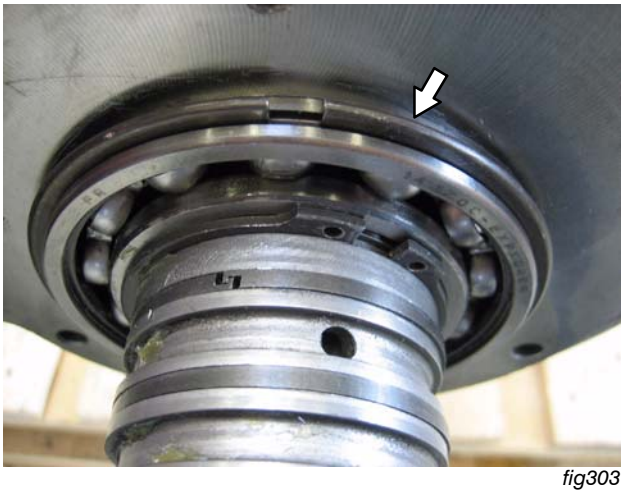


fig303

10. Fit the circlip. If there is a gap between the circlip and housing after the fitting is completed, one of the clutch friction discs has slipped out of the groove of the hub.



fig304

11. Fit the front end piece. **Note!** Be careful not to damage the metallic seal rings.



fig305

12. Tighten the bolts of the front end piece to a torque of 23 Nm.

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Reconditioning shuttle

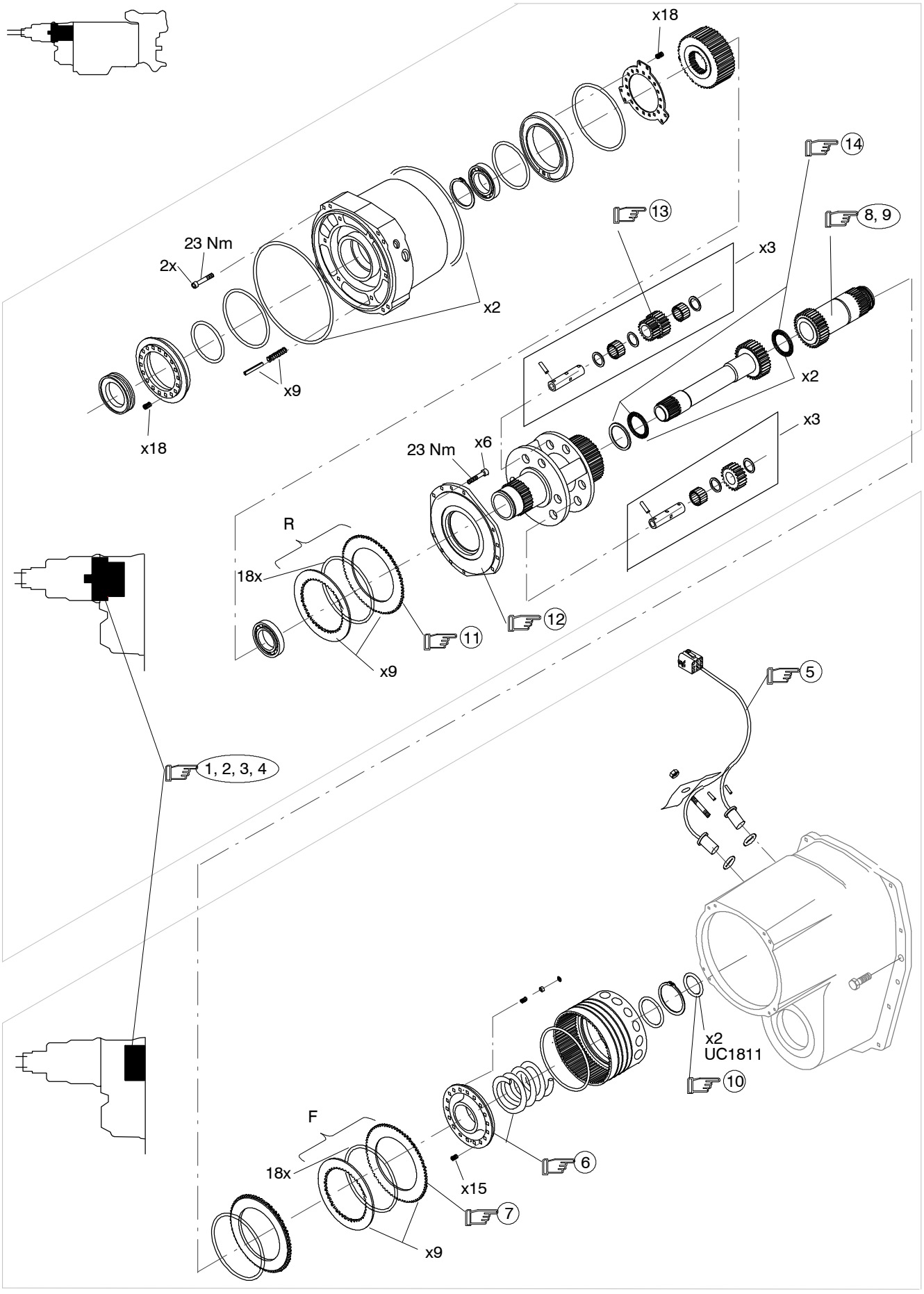


fig035

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Removing shuttle

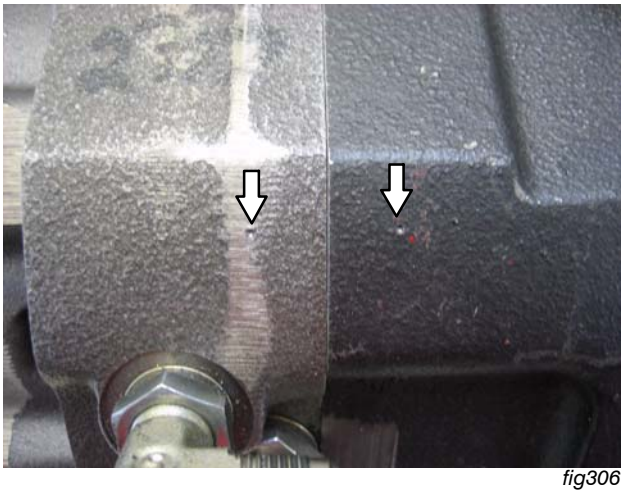


fig306

1. Mark the position of the shuttle flange in relation to the housing of the shuttle.



fig307

2. Fit the PTO shaft into place. Use the shaft as an aid to remove and disassemble the shuttle unit. Detach the shuttle flange.

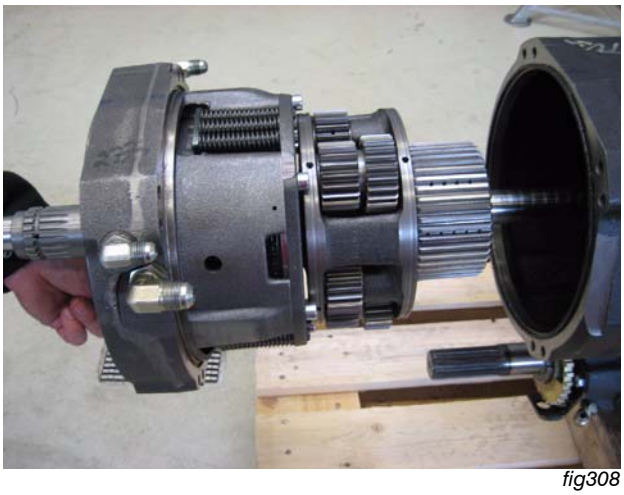


fig308

3. Hold the reverse drive unit straight and pull it out.

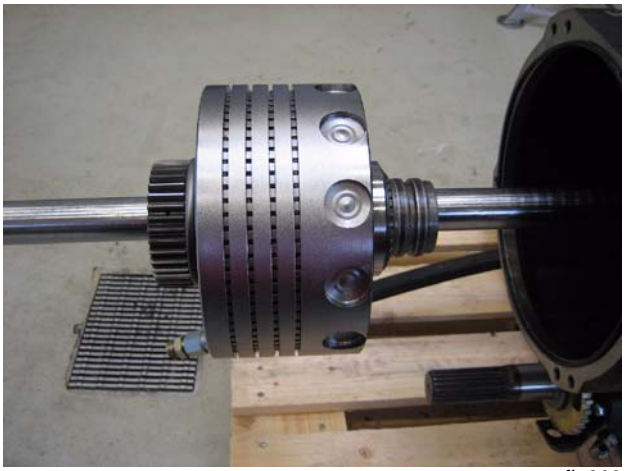


fig309

4. Hold the forward driving unit straight and pull it out.

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Reconditioning clutch for forward driving

1. Take care of the thrust bearing between the sun gears.

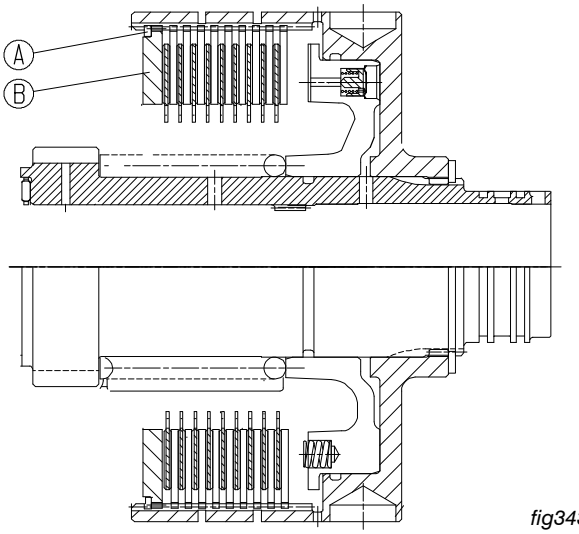


fig343

2. Compress the clutch disc pack and release the snap ring A and remove the support ring B.

3. Take the friction and steel discs and the spring rings out of the drum. Remove the small spiral springs in the piston housing.

Note! Dip the friction discs in oil before fitting and keep them in oil for a while. Change all small coil springs of the piston in connection with reparations.

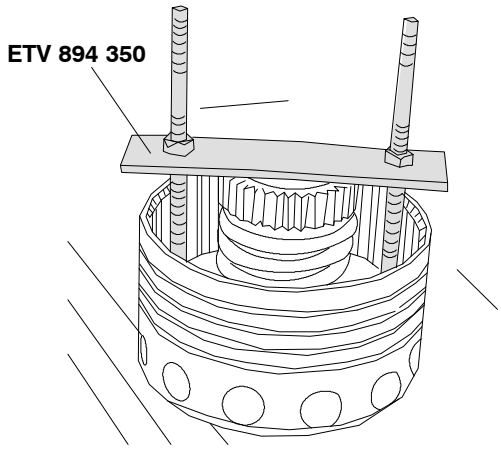


fig041

4. If you change the piston seals or the large spiral spring, screw ETV 894 350 into the threaded holes in the piston. Tighten the nuts of the ETV at which time the spring is shrunk (and the piston is pulled out of its location).

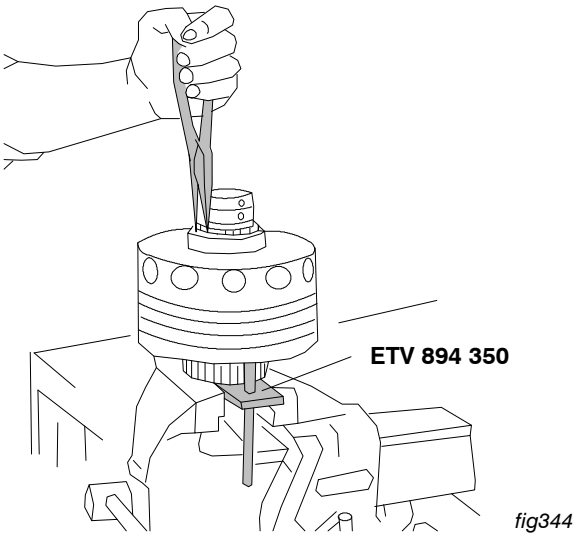


fig344

5. Remove the clutch drum snap ring.

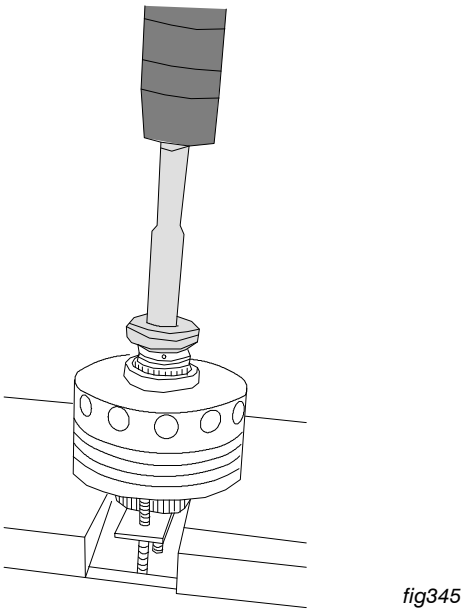


fig345

6. Remove the drum (press fit) by pressing it carefully with a hydraulic press.

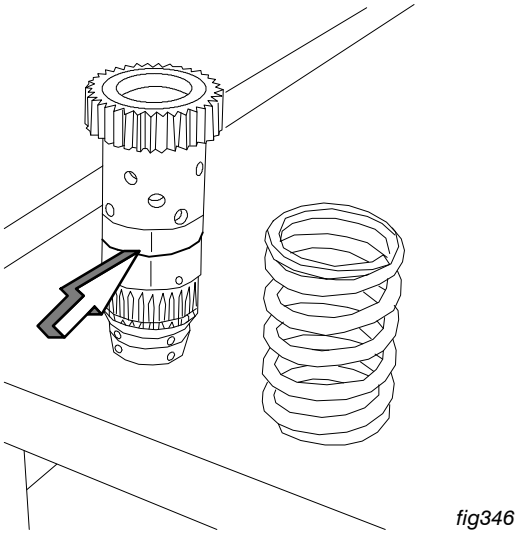


fig346

7. Unscrew ETV 894 350, at which time the piston loosens. Check/change the piston small O–ring around the sun gear shaft (arrow) and lubricate the O–ring with oil or grease.

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8. Check that the large spring is OK. Ensure, that its length is within permissible dimensions.

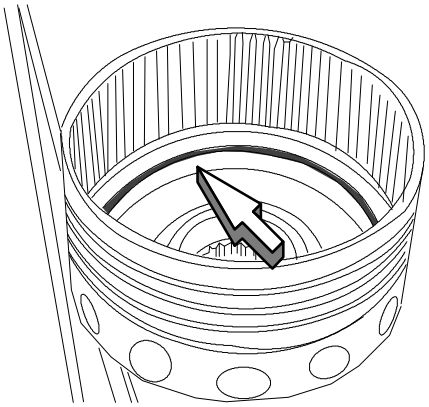
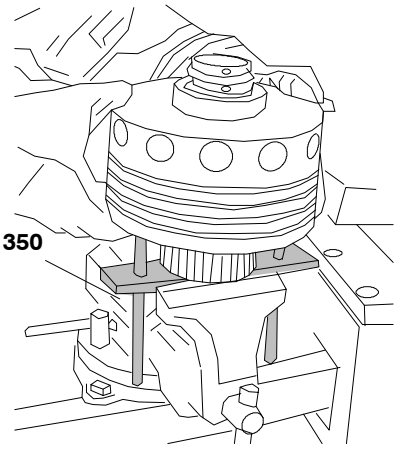


fig347

9. If necessary, change the large O–ring of the piston (see arrow) and lubricate it with oil or grease.

Note! Check the function of the emptying valve. If the valve is disassembled, the valve circlip will be damaged.



ETV 894 350

fig348

10. Place the large spring onto the sun gear shaft. Fit the piston and fasten ETV 894 350 and tighten it until the spring is compressed. Warm the drum a little (+80˚C) and press it into place and fit the snap ring of the drum.

11. Remove ETV 894 350.

12. Position the small spiral springs into the borings in the piston.

Note! Change all the small coil springs in connection with repair work. Dip all friction discs in oil a little while before fitting them.

13. Fit by turns new friction and steel discs and the spring rings. Fit a steel disc first against the piston springs. The top disc must be a friction disc (9 steel discs, 9 friction discs, and 9 spring rings). The spring rings are placed onto the outer circumference of the friction discs.

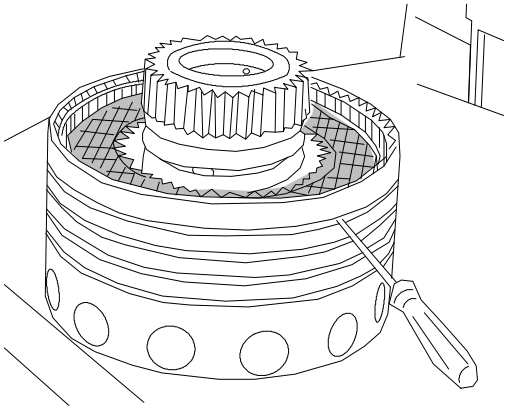


fig042

Note! Before fitting the two last friction discs and a steel disc, push for instance small screwdrivers through holes in the side of the drum. Compress the disc pack and push the screwdrivers so that they hold the disc pack compressed. Then fit the last three discs.

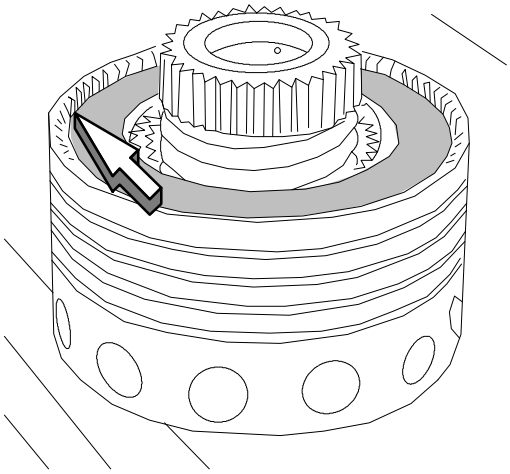


fig349

14. Place the support ring on the disc pack, press down the disc pack and fit the snap ring (arrow). Remove the screwdrivers.

15. Check/change the metallic seal rings in the rear end of the sun gear shaft. Ensure that the ring ends are locked together.

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Reconditioning reverse drive clutch

Disassembling

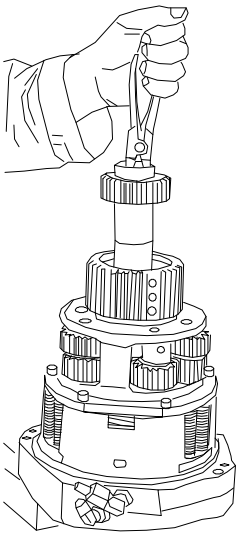


fig350

1. Remove the shuttle input shaft (foremost sun gear shaft). Take care of the shaft thrust bearing.

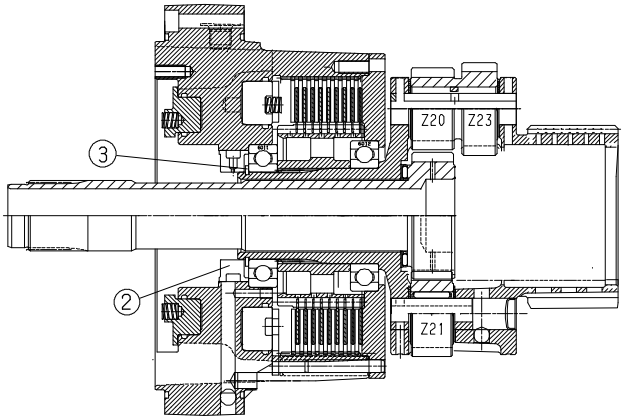


fig351

2. Remove the DPS planetary carrier rearmost ball bearing in front of the oil ring (2) (if not released earlier). Remove the oil ring (2) and the shuttle planetary carrier snap ring (3).

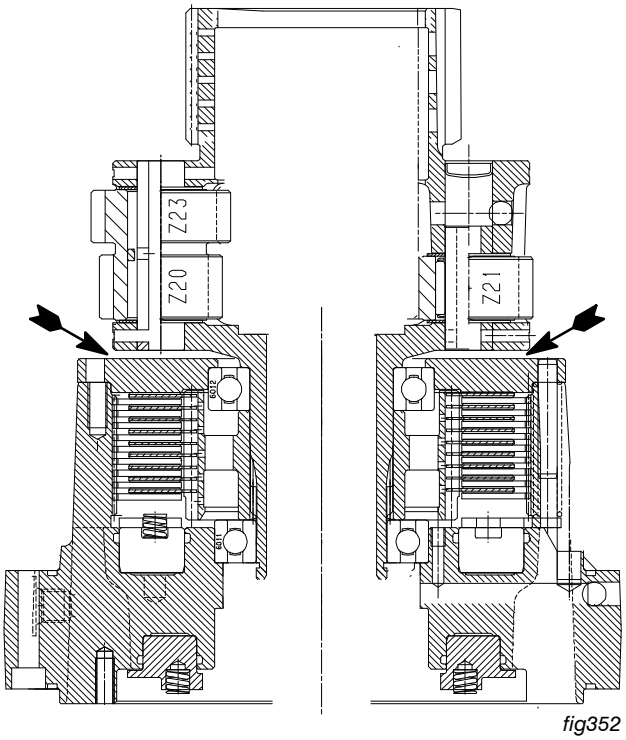


fig352

3. Pry loose the planetary carrier of the shuttle with two fitting levers placed at the positions indicated by the arrows.

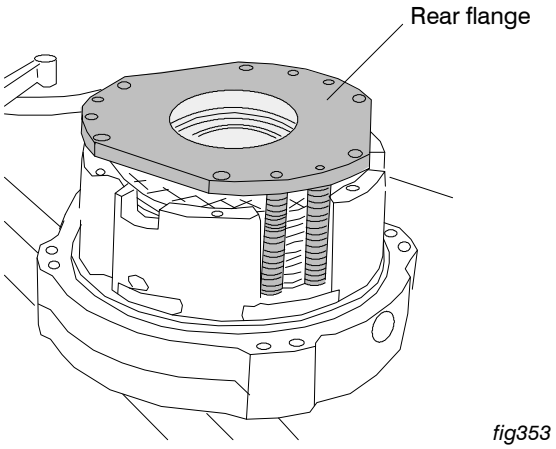


fig353

4. Unscrew the disc pack rear flange bolts after which the flange rises upwards with the aid of the springs. Remove the flange+springs+ball bearing.

5. Take the friction and steel discs and the spring rings out of the drum. Remove the disc pack hub.

6. Remove the support ring for the piston small spiral springs. Remove the springs. Remove the ball bearing.

7. If you change the piston seals, the piston can be forced out by carefully blowing compressed air through the pressure pipe connection.

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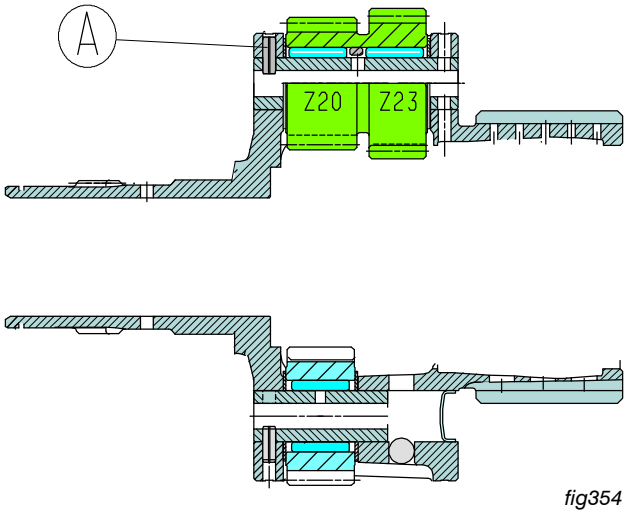


fig354

8. The planetary wheels can be detached by tapping out the tension pin (A) and by pushing the gear axle to the left (as indicated in the picture). If you must change the planetary wheels, change all three wheels. The new wheels gears must be of the same series as indicated by the markings (e.g. A) on the gear teeth.

Assembling

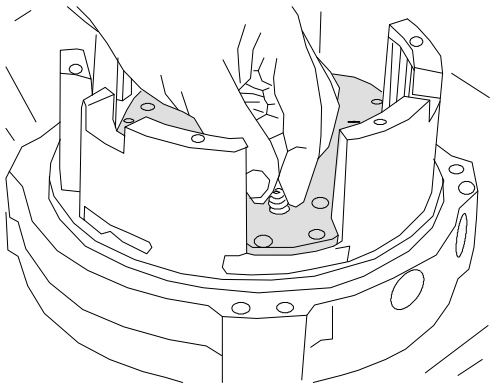


fig355

9. If you have removed the piston, push it down into its location. Place the spiral spring support plate onto the piston and fit the small spiral springs into their borings (picture).

Note! Change all springs in connection with repair work.

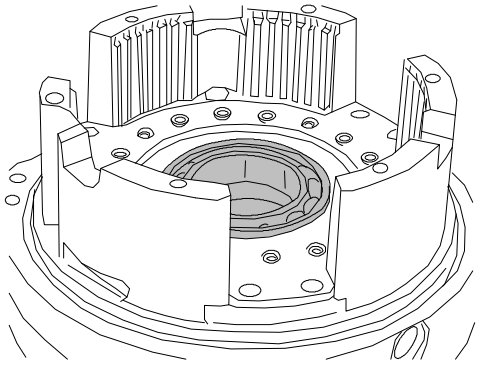


fig356

10. Fit the ball bearing (picture).

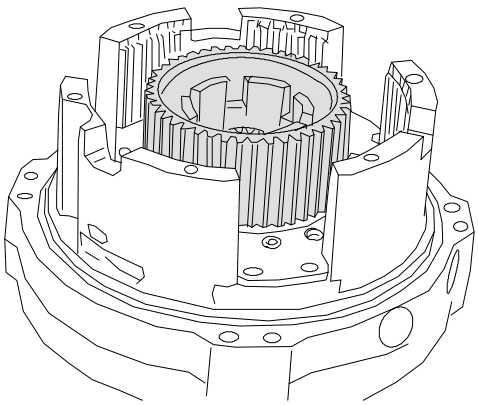


fig357

11. Fit the hub (picture). Dip the friction discs in oil a little while before fitting.

12. Fit by turns new friction and steel discs and the spring rings. Fit a steel disc first against the piston springs. The top disc must be a friction disc (9 steel discs, 9 friction discs, and 9 spring rings). The spring rings are placed onto the outer circumference of the friction discs.

Note! The discs and the spring rings are the same as in the clutch for forward driving and a number of the discs is also the same.

Note! Dip all friction discs in oil before fitting.

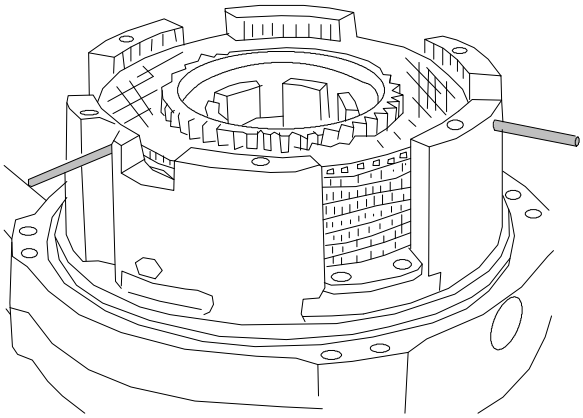


fig045

13. After the last steel disc has been fitted, press down the disc pack and push pins with a diameter of 3 mm (e.g. drill bits) through the holes in the sides of the clutch drum to keep the disc pack compressed.

Note! Push the pins over the steel disc, not the top friction disc. Otherwise the friction disc can be twisted.

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fig310

14. Tighten the planetary gear attaching bolts to the reverse drive clutch evenly (23 Nm). While tightening the nuts monitor the progression of the hub between the friction discs. If needed, rotate the planetary gear. Finally, remove the pins.



fig311

15. Fit the thrust plate and the needle bearing.

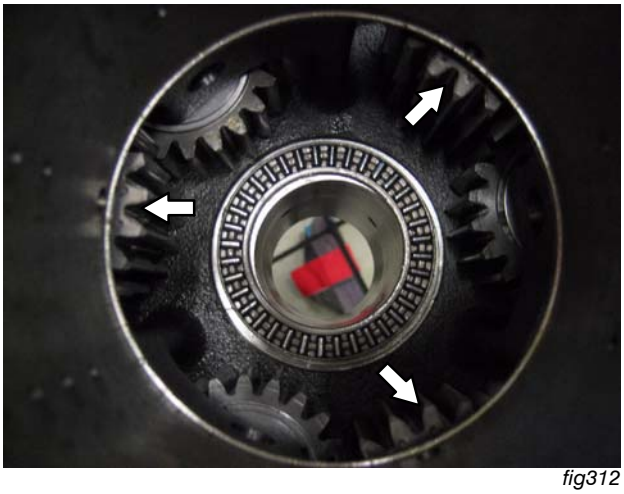


fig312

16. Rotate the planet wheels until all the point markings on them point to the centre of the sun gear.

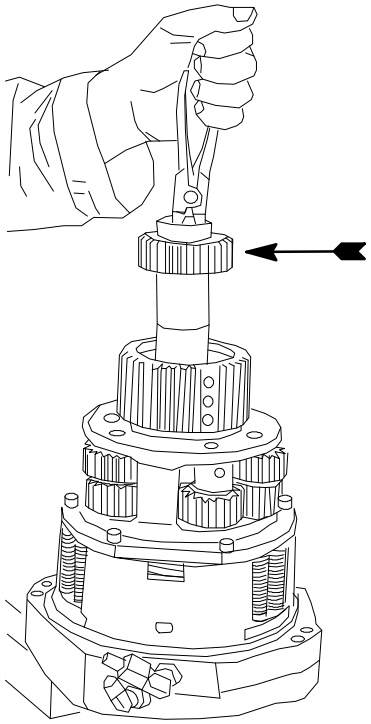


fig048b

17. Fit the input shaft of the shuttle. Make sure that the positions of the markings stay the same.



fig313

18. Fit the needle bearing.

19. Fit the forward driving unit to the grooves of the planetary gear. Rotate the unit until it falls into place. **Mind your fingers!** Make sure that all the friction discs align with the grooves.

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Fitting shuttle



fig315

1. **Do not loosen** the assembly during fitting, because the friction discs can move out from the grooves of the hub.

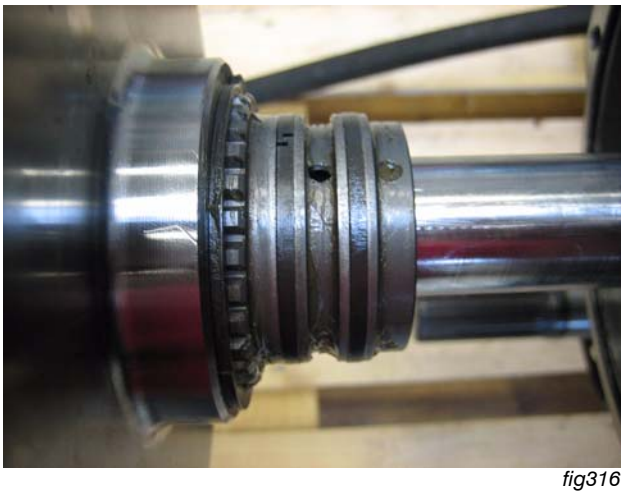


fig316

2. Use grease to center the metallic seal rings to the hub of the forwad driving unit.

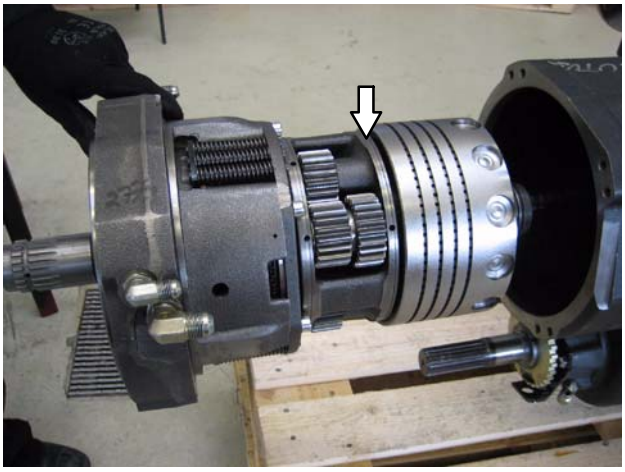


fig317

3. Fit the PTO shaft and use it as an aid during the fitting. **Note!** Observe the gap between the planetary gear and and forward driving clutch during fitting and make sure that it stays the same.



fig318

4. During fitting, the assembly must not be pulled outwards, because that might remove the friction discs from the grooves of the hub.

The final stage of the fitting must be performed carefully so that the metallic seal rings in the rear end of the shuttle are guided into the oil flange. The fit is close.



fig319

5. If necessary, rotate the gear wheel of the forward driving clutch through the shuttle sensor hole using, for example, a screwdriver. Engage gear 4 and speed range H to ensure that the splines of the input shaft stay in place.

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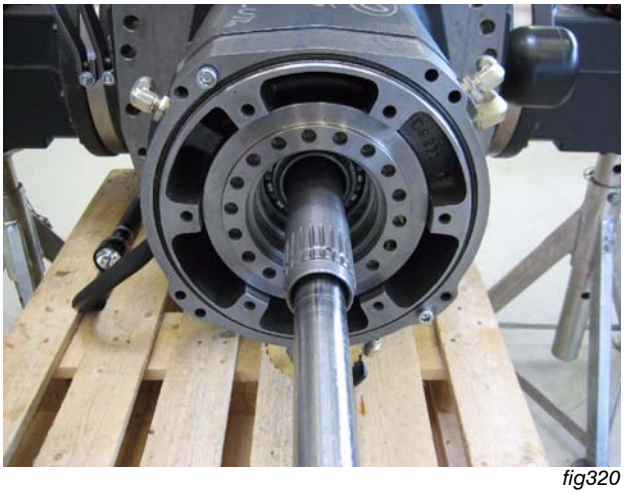


fig320

6. Tighten the bolts of the shuttle flange to a torque of 23 Nm.



fig321

7. Fit the bushing.

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4WD clutch

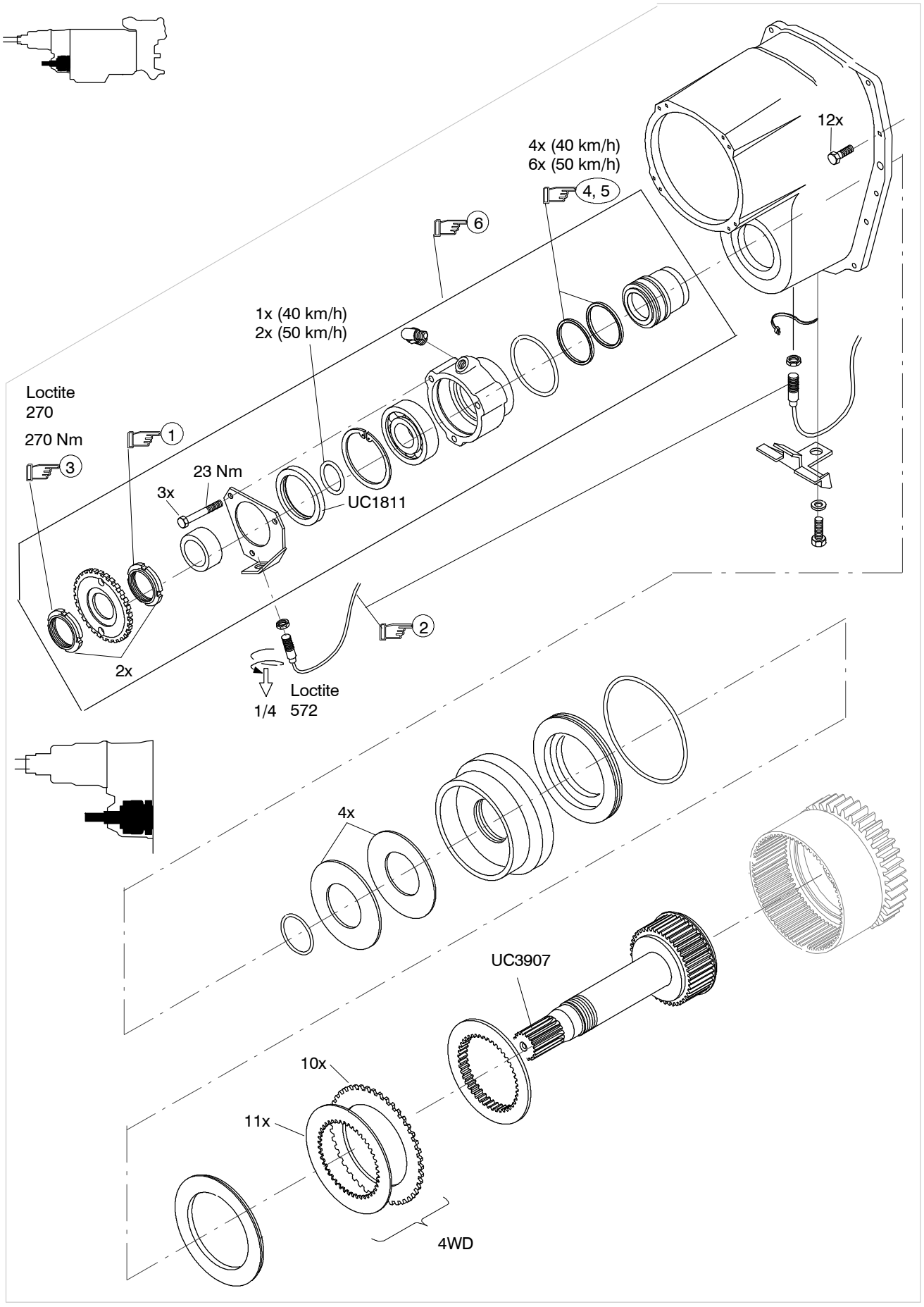


fig049

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Disassembling 4WD multi–disc clutch



fig322

1. Unscrew the shaft nut. (Tool ETV 894170 can also be used for this purpose.)

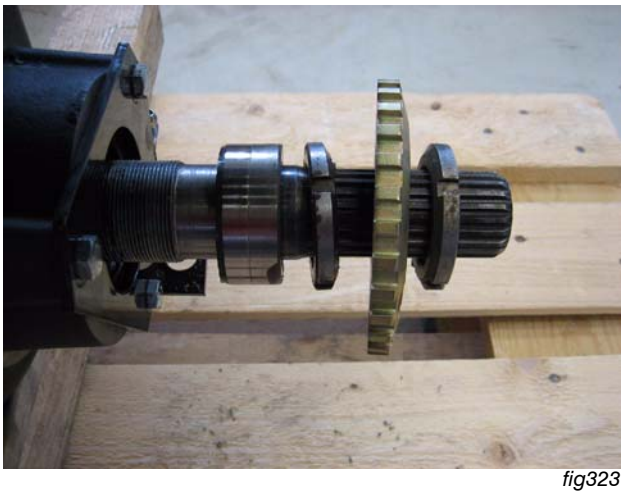


fig323

2. Remove the calculator disc, unscrew the rear shaft nut and remove the bushing.

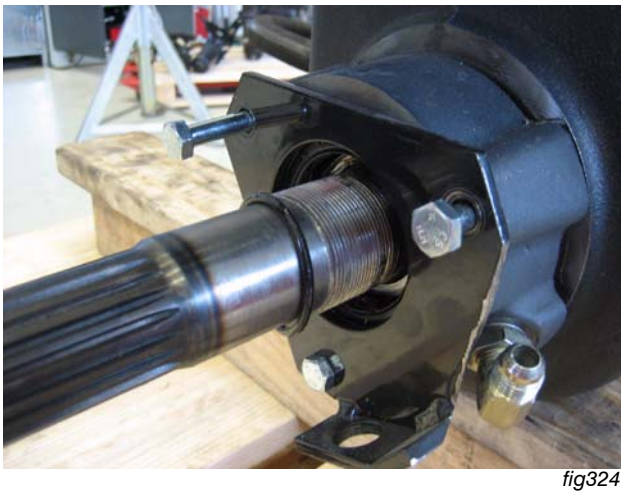


fig324

3. Remove the O–ring and then remove the bearing housing.

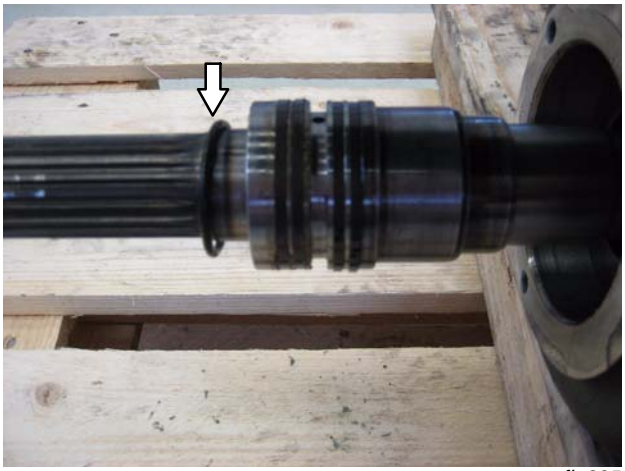


fig325

4. Remove the O–ring and then remove the bushing.



fig326

5. Unscrew the shuttle housing bolts. Then pull the housing forward to remove it from the gearbox housing.

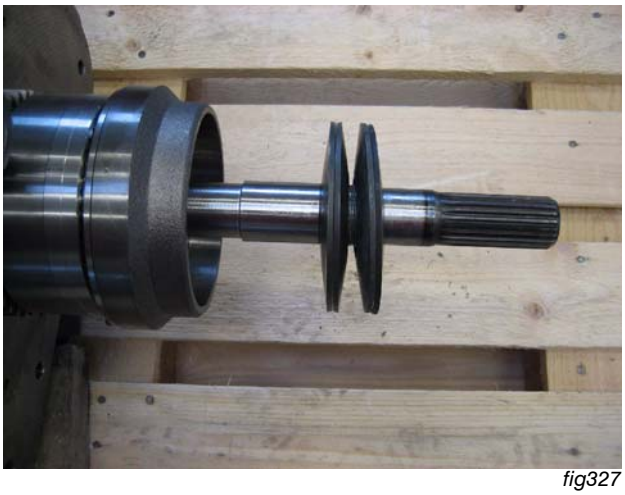


fig327

6. Remove the belleville springs from the piston.

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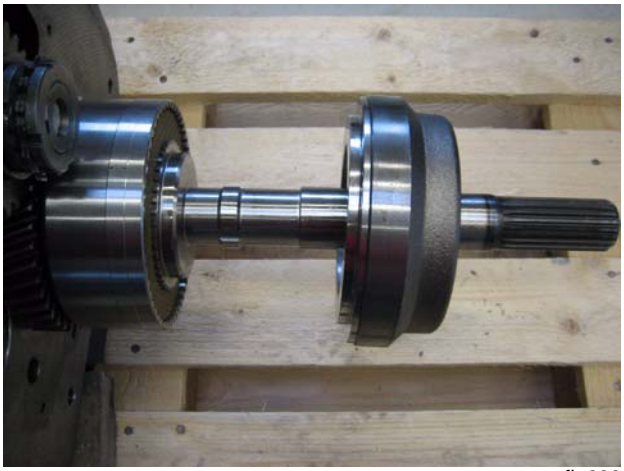


fig328

7. Pull the piston off the 4WD clutch.

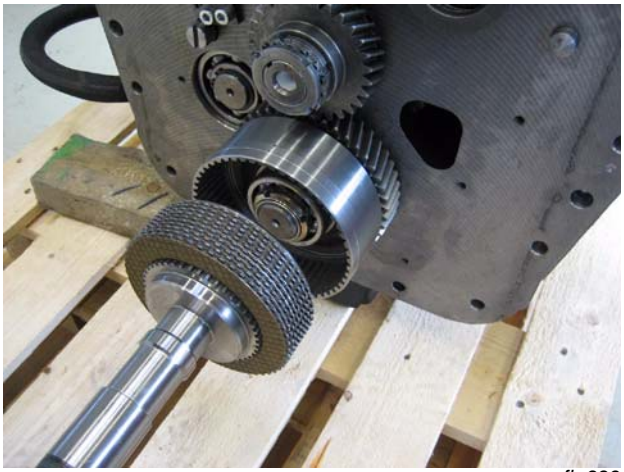


fig329

8. Pull off the 4WD shaft and the attached clutch pack from the 4WD drum.

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Assembling 4WD multi–disc clutch



fig330

1. .Fit the 4WD shaft and counter plate into the 4WD drum.

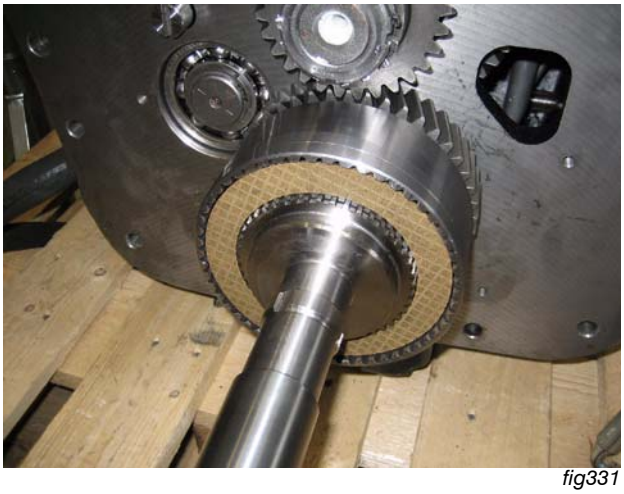


fig331

2. Fit the clutch and spacer discs.

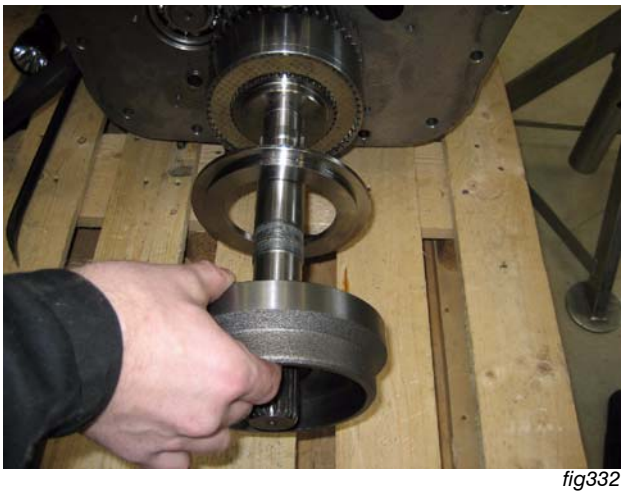


fig332

3. Fit the piston and the cylinder.

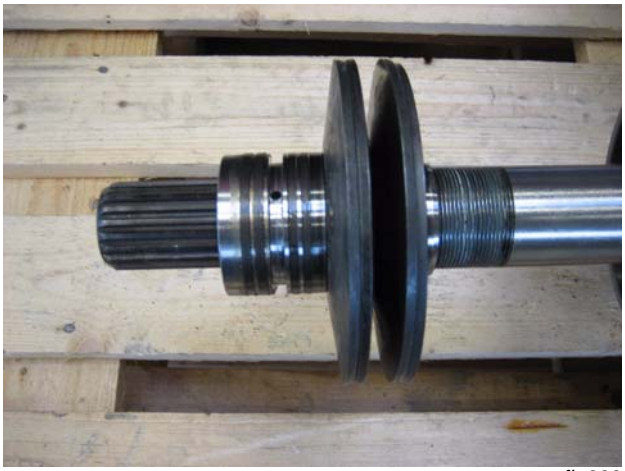


fig333

4. Fit the belleville springs over the bushing and slide them in place using the 4WD shaft.

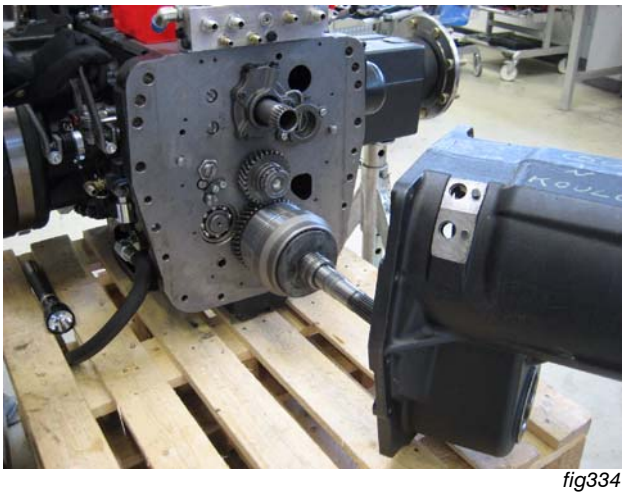


fig334

5. Fit the shuttle housing and tighten the bolts (12 pcs) to a torque of 23 Nm. Use Loctite 574 in the bolts.



fig335

6. Fit the O–ring onto the 4WD shaft.

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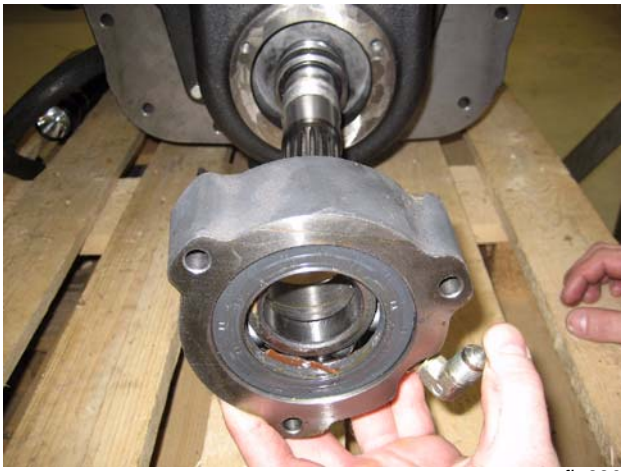


fig336

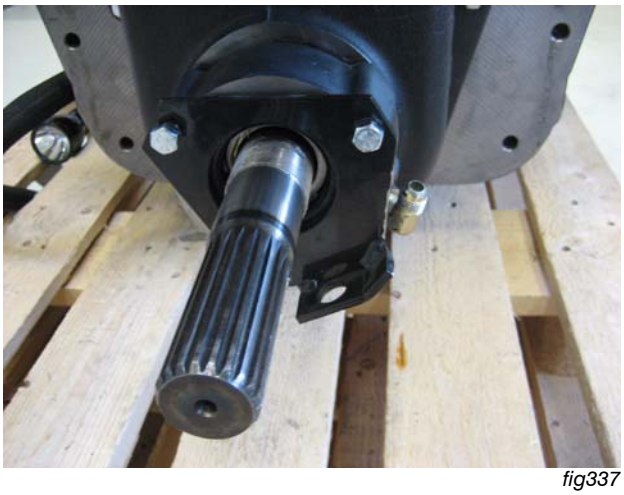


fig337

7. Fit the bearing housing and the holder for the sensor.



fig338

8. Fit the O–ring onto the 4WD shaft.



fig339

9. Fit the bushing onto the 4WD shaft.

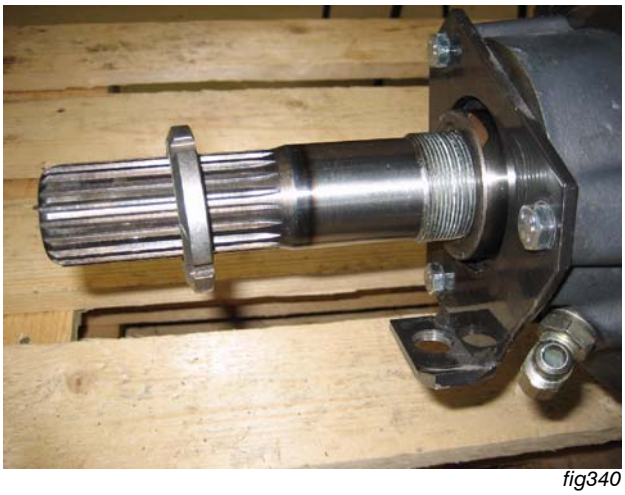


fig340

10. Fit the shaft nut.

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fig341

11. Tighten the shaft nut fully and then open it by 1.5 turns. This creates a sufficient free play for the clutch pack. Use Loctite 270.

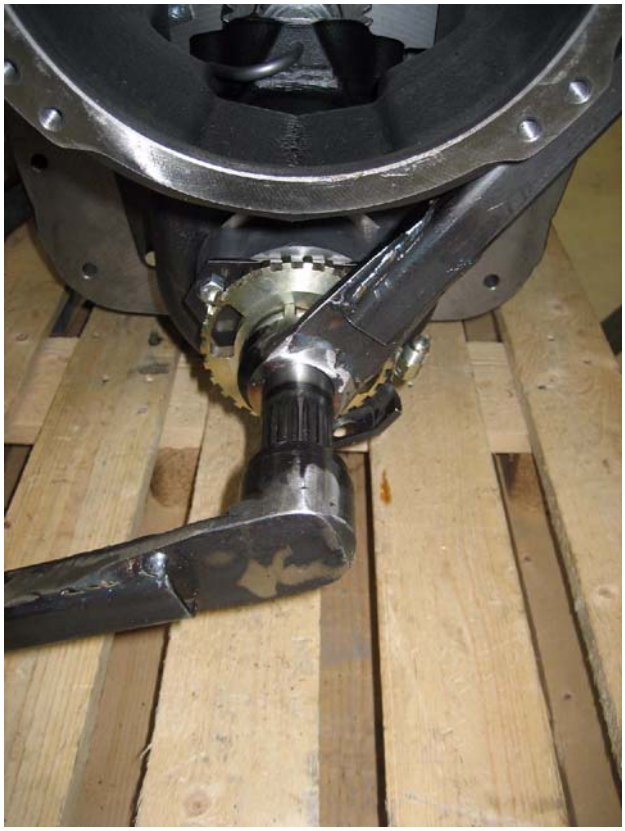


fig342

12. Fit the calculator disc and front shaft nut (bevel facing backwards). Tighten the shaft nut to a torque of 270 Nm. Use Loctite 270.

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Changing seals of the 4WD shaft

The changing of the shaft seal and the metallic seal rings can be carried out from the underside without removing the gearbox.



fig054

– Tractors without the **B5C** sensor.

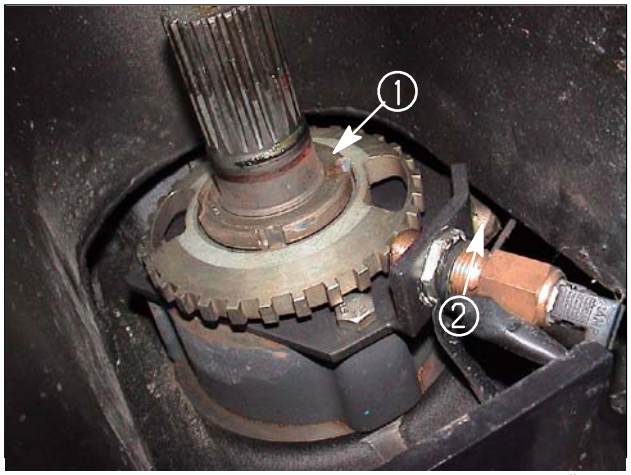


fig055

– Tractors with the **B5C** sensor.

– Open the 4WD shaft nuts (**1**) using special tool ETV 894 170

– Disconnect the pressure oil pipe (**2**) from the seal housing.



fig056

– Unscrew the seal / bearing housing bolts and pull out the housing from the shaft.



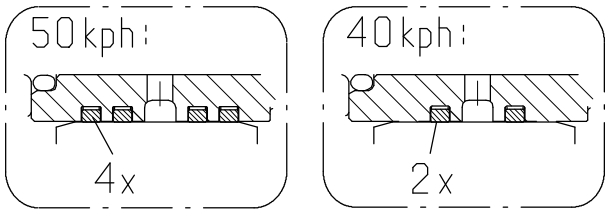


fig053

– Pull out the oil sleeve from the shaft. On the oil sleeve there are metallic seal rings.

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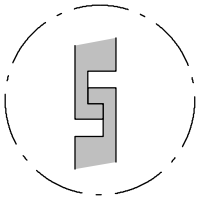
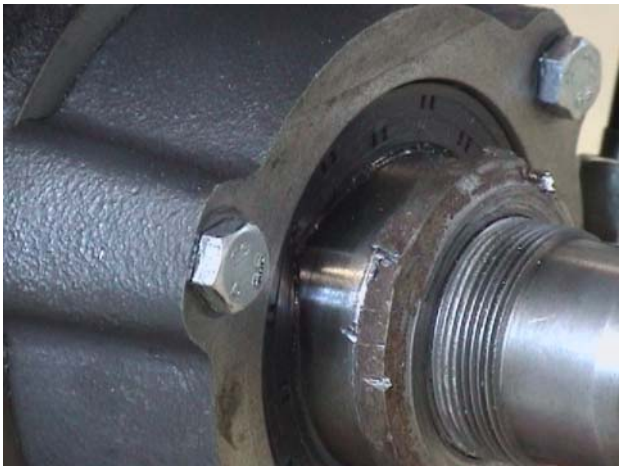


fig023

– Fit the metallic seal rings into the grooves. Ensure, that the ring ends are locked together.

Note! Use grease in the metallic seal rings.



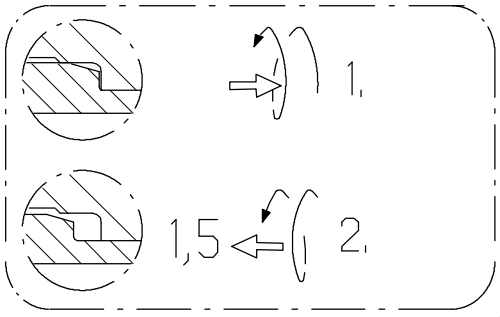


fig050

– Replace the old shaft nut with a new one (old nut stretches when used again)

– Tighten the new shaft nut first fully home and then open it by **1.5 turns**. So the necessary clearance for the clutch discs is achieved. Use **Loctite 270** on threads.

Note! Stop tightening, until the movement of the oil sleeve stops (check the sleeve between the nut and the shaft seal).

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Technical data

Final drives type 650
Gear ratio 6,86
Flange distance . . . . . 1750 mm
5 brake discs per side, friction surface . . . . . 3850 cm^2

Power transmission/**hydraulics** (oil volume / changing volume):
Min . . . . . 55 / 30 l
Max . . . . . 65 / 40 l

Final drives type 700
Gear ratio 8,571
Flange distance . . . . . 1750 mm
5 brake discs per side, friction surface . . . . . 4272 cm^2

Tightening torques

Drive shaft centre screw . . . . . 10–20 Nm
Final drives attaching bolts
10.9 . . . . . 120 Nm
Rear wheel . . . . . 550 Nm
Cab attaching bolts . . . . . 200 Nm

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Final drives, description

The final drives are of the planetary gear type working in conjunction with hydraulically controlled multi–disc brakes which run in oil. Final drives have been attached to the brake housings with 14 bolts. Construction is the same on all N models

The power is transmitted from the differential, via the inner drive shaft, to the planetary gears, and then though the outer drive shafts to the rear wheels. Planetary gear ratio; 1=6,86

The ring gear is fitted between the rear axle housing and the brake housing and is easy to remove.

The planetary sun gear is machined integral with the inner drive shaft. When the inner shaft rotates, it drives the planetary gears and the planetary gear retainer, which is connected to the outer drive shaft, through splines.

The outer drive shaft is journalled in the drive axle housing in taper roller bearings. The planetary gears are carried in needle bearings on the shaft studs which are fixed to the planetary retainer. The final drive bearings is lubricatted by the transmission oil.

The final drives do not have a separate oil space but they do have common oil with transmission and hydraulic system.

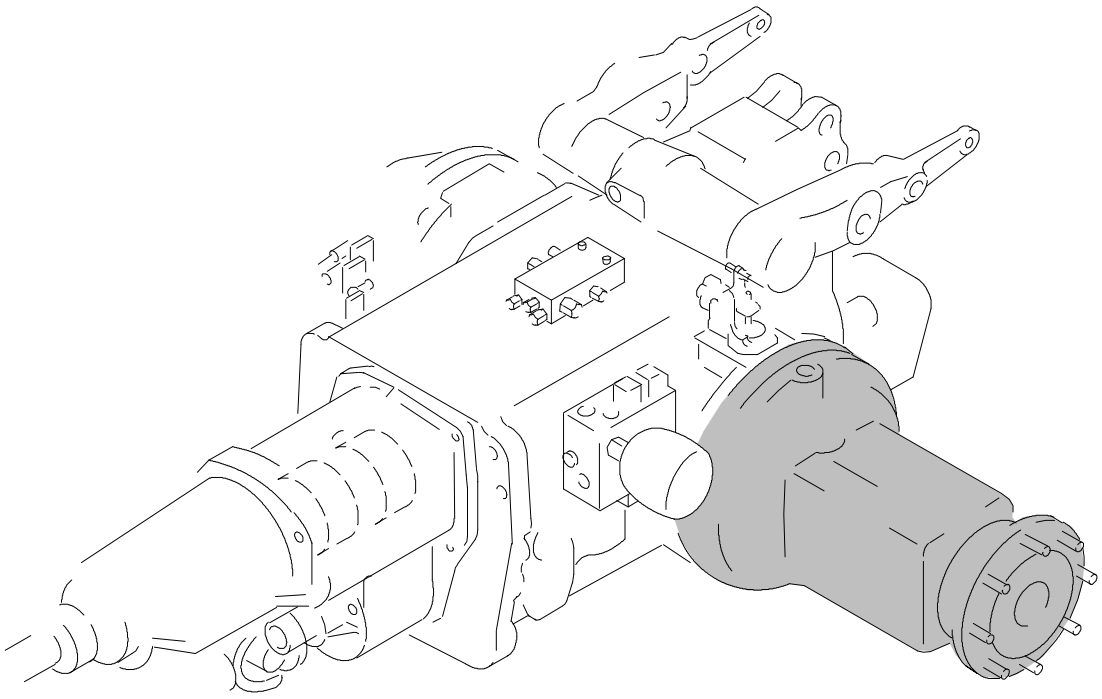


fig001

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Final drives 650

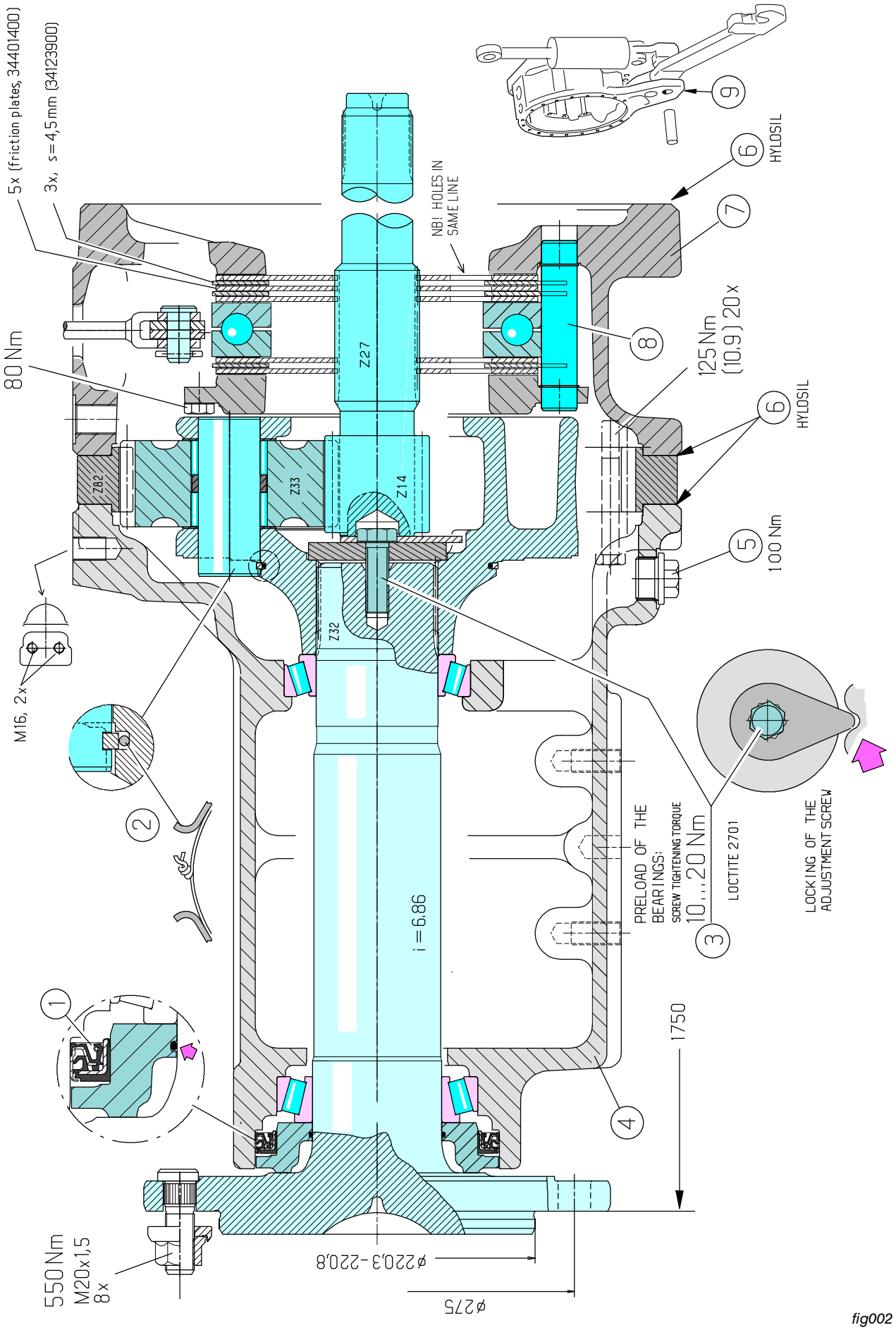


fig002

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– Final drives 650:
– Gear ratio 6,86
– Flange distance . . . . . 1750 mm
– 5 brake discs per side, friction surface . . . 3850 cm^2

The brake housing are no more the same; the left hand housing and the right hand housing are different.

The final drive housing (34846100) has two threaded holes for cab support

Note! Fit the holes in friction discs in the same line.

Power transmission/hydraulics (oil volume / changin volume):
Min . . . . . 55 / 30 l
Max . . . . . 65 / 40 l

1) The seal is a cassette type
NB! O–ring between wearing ring of the seal and hub shaft.

2) Wire ends are turned 1...1.5 rev. around each other and bent to one side.

3) Adjusting outer drive shaft bearing clearance**:**
– Place the drive shaft with the wheel flange on the floor. Bed in the bearings by rotating the axle housing 20–30 turn. Tighten the centre screw (3) to a torque of **10–20 Nm**. Again rotate the axle housing and check the torque.
– Turn the lock washer for the centre screw so that the notch on the washer locates in the recess in the planetary retainer. Loctite 2701 on threads.

5) Oil draining plug
Change the oil in the power transmission/hydraulic system and clean the suction strainer every 1000 hours.

6) Sealing compound Hylosil RTV Grade A (UK 0067) to the faces of the joints.

7) Brake housing.

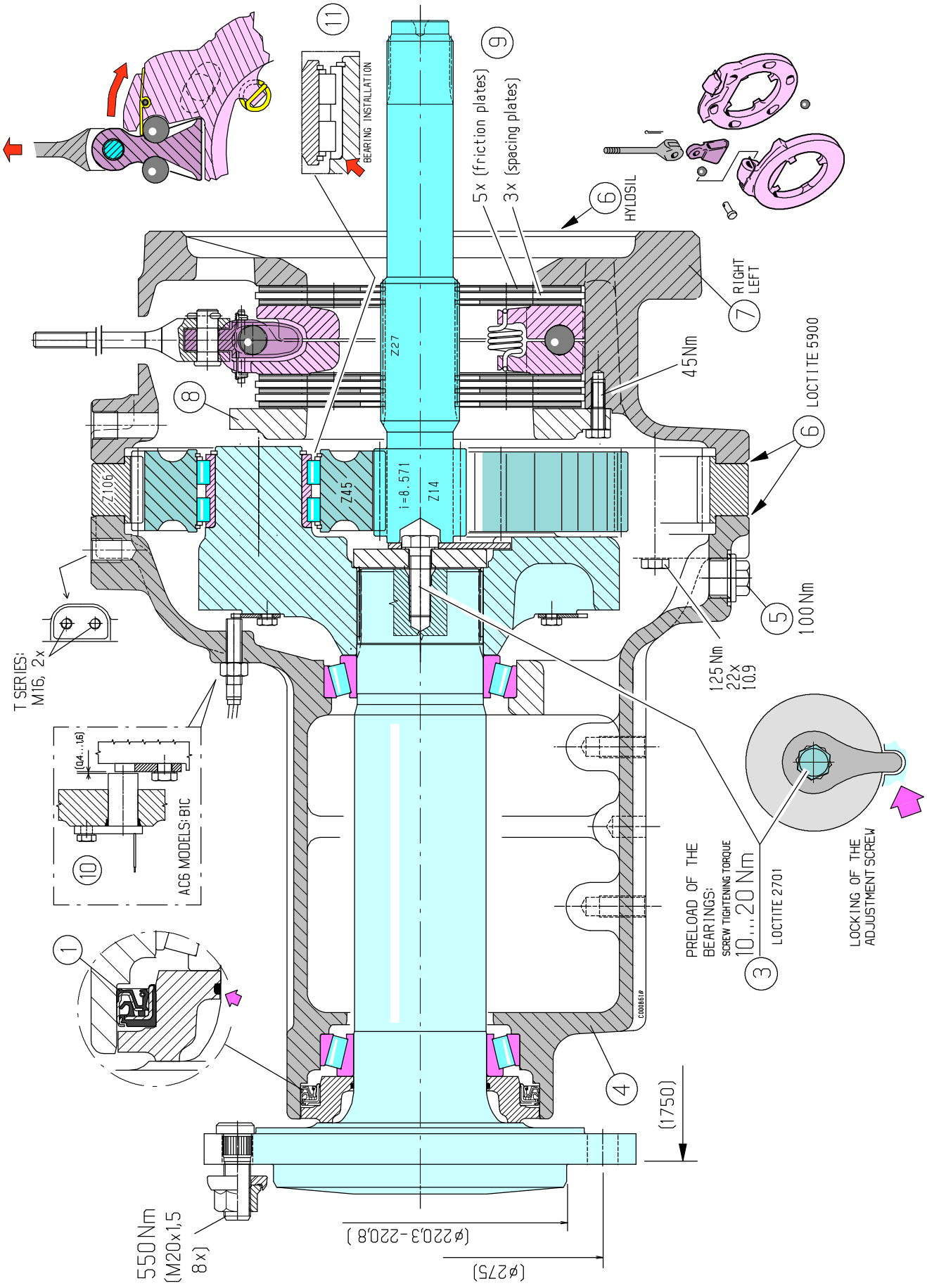
8) Brake pin.

9) The brake housing has one lug for lower link.

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Final drives 700



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– Final drives 700:
– Gear ratio 8.571
– Flange distance . . . . . 1750 mm

The planetary gears **2** (3 pcs) have been fitted with cylinder roller bearings to shafts in planetary carrier casting.– The final drive housing (34846100) has two threaded holes for cab support.

Note! O– ring between wearing ring of the seal and the hub shaft.

Transmission oil volume:
Type **700**
min. . . . . **45 L**
max. . . . . **55 L**
extra max. . . . . **65 L**

1) Cassette type seal (10 mm greater outside and inner diameter as on type 650).

2) Planetary gear

3) Adjusting outer drive shaft bearing clearance**:**

– Place the drive shaft with the wheel flange on the floor. Bed in the bearings by rotating the axle housing 20–30 turn. Tighten the centre screw (3) to a torque of **10–20 Nm**. Again rotate the axle housing and check the torque.
– Turn the lock washer for the centre screw so that the notch on the washer locates in the recess in the planetary retainer.Loctite 2701 on threads. Change the oil in the power transmission/hydraulic system and clean the suction strainer every 1000 hours.

4) The thinner part of the axle housing (fixing point for the implements) has same measures (230 x 270) and holes as in final drive type 650R.

5) Oil draining plug.

6) Sealing compound Hylosil RTV Grade A (UK 0067) to the faces of the joints.

7) Brake housing (left and right sides are different).

8) Brake support plate
– the cams on the intermediate discs and the corresponding holes in the brake housing keeps the brake parts in place.

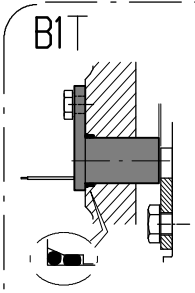
9) Brake disc set.
– friction plates 9,5” (242,5 mm) x 7” (178 mm), 5 pcs, friction area 4272 cm^2 / disc.
– intermediate discs (s= 5mm), 3 pcs

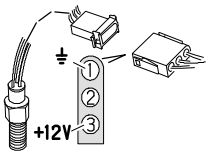
Note! mount the holes in the friction discs in the same line.

10) Speed sensor of rear axle (B1C)

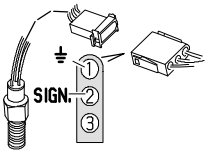
11) **Note!** Bearing installation: rounded edge against the shoulder. Otherwise the bearing does not lie deep enough

Sensors





Check the supply voltage and the ground at the sensor **B1T** connector between pins **3** (+) and **1** (–).



Check the signal voltage at the sensor **B1T** connector between pins **2** and **1** (–).

Frequency values according to different speeds:
- **3** km/h –> approx **14** Hz
- **6** km/h –> approx **28** Hz
- **9** km/h –> approx **41** Hz

fig017

Location of the sensors in wiring diagram:

Symbol	Description	Page+position (in wiring diagram)	Location
–B1T	Speed sensor (Hall), rear wheel	12.D9	Transmission

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Special tools

Reconditioning final drives (code 455.1)

ETV 893 320 . . . . . Plate for fitting outer drive shaft bearing race
ETV 890 220 . . . . . Universal handle
ETV 893 310 . . . . . Plate for fitting outer drive shaft inner oil seal
ETV 893 690 . . . . . Plate for fitting outer drive shaft inner oil seal

Locally prepared tools

Reconditioning final drives (code 455.1)

ET 893 410 . . . . . Support for removing outer drive shaft bearing race

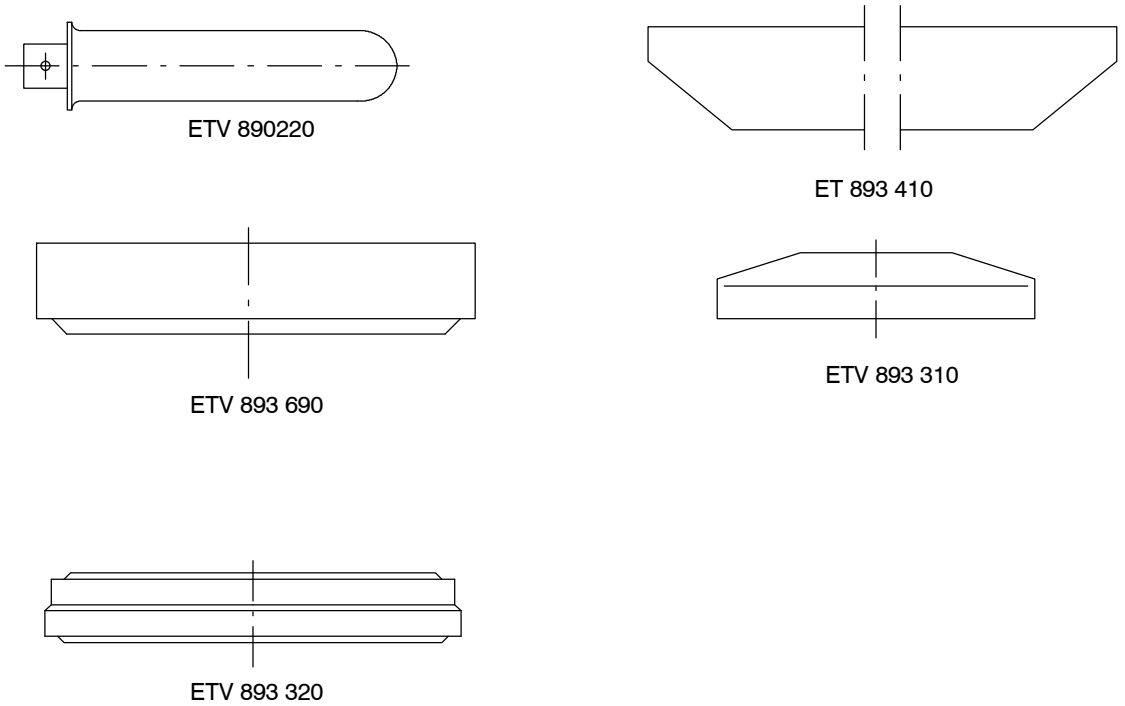


fig003

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Reconditioning final drives

Removing final drives

Note! The brake housing is not removed from the tractor. e/LS– models have a rotation speed sensor on the RH side final drive.

1. Drain the transmission oil (22 mm, 3 plugs). Disconnect the check links from the rear axle housings.
2. Slacken the rear wheel nuts. Raise the rear wheel and remove it. Block up the tractor with an axle stand placed under the front edge of the brake housing.
3. Unscrew the cab rear attaching bolts. Disconnect the PTO control cable, pick–up hitch release control and the joint at the lower end of the lewelling screw control rod. Remove all engine hood plates.
4. Raise the cab rear end about 6 cm and support it.

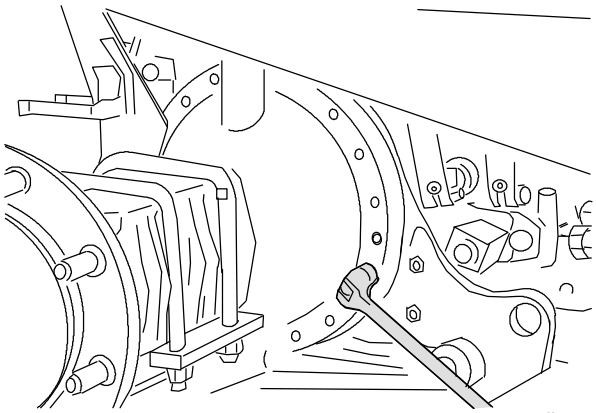


fig004

5. Connect a suitable hoist to the rear axle housing. Unscrew the final drive attaching bolts.

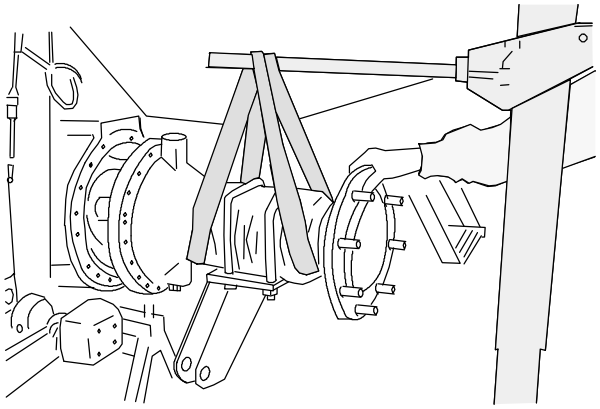


fig005

6. Pull the housing straight outwards so that it clears the brake housing.

Changing needle bearings in planetary gears

1. Remove the lock washer from the centre screw securing the outer drive shaft to the planetary gear and unscrew the screw. The attaching plate remains inside the planetary retainer.

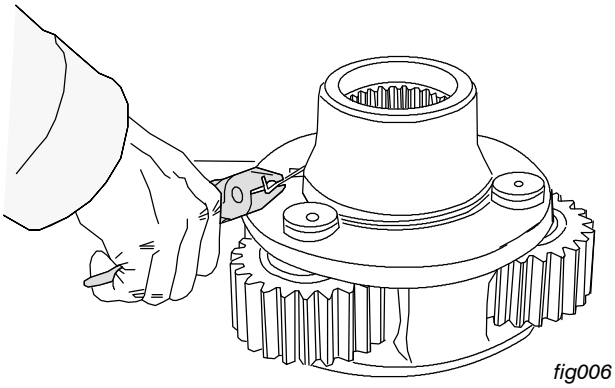


fig006

2. Pull the planetary gear off the drive shaft. Cut the locking wire under the locking spring for the planetary gear shaft studs. Remove the locking wire.
3. Compress the locking spring with a pair of pliers and pull the shaft studs out of the planetary retainer.

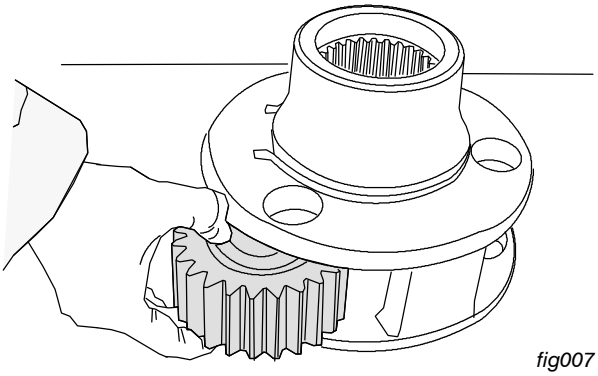


fig007

4. Remove the planetary gears from the retainer. Push at the wear washers in order to prevent the 2x25 needles in each bearing from falling out. Change the needles. When assembling, fix the needles in position with a little grease.

Note! Note the spacers between the two rows of needles.

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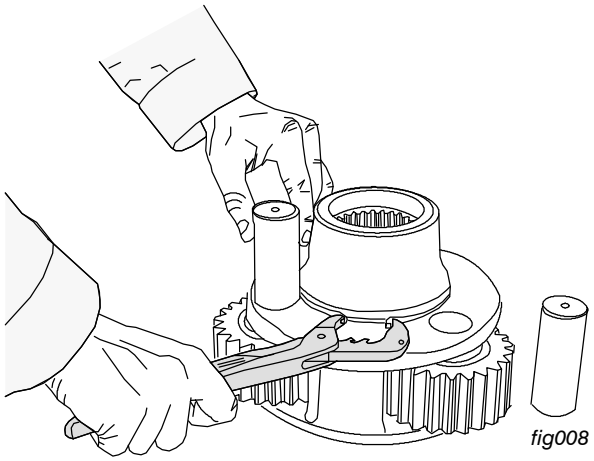


fig008

5. Press the bearing wear washers against the sides of the planetary gears and press them into the retainer. Compress the locking spring and push the shaft studs into position and make sure the locking spring engages the groove in the studs. Fit the attaching plate for the planetary gears retainer before fitting the third planetary gear.
6. Push in 1,5 mm wire under the locking spring when the planetary shaft studs have been fitted and wind the wire ends one to one and a half turns and bend them.
7. The ring gear can be loosened with a drift. Before fitting the ring gear apply sealing compound on the sides of the ring gear.

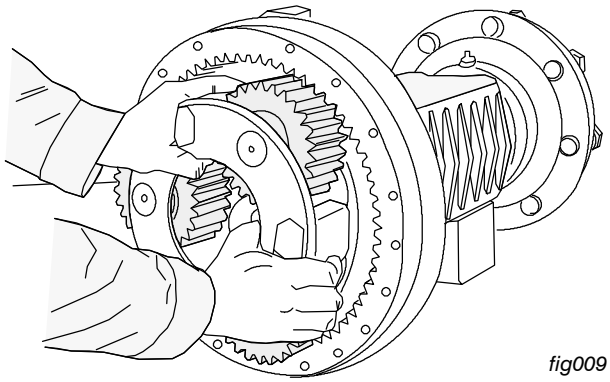


fig009

8. Push the planetary gear onto the splines on the outer drive shaft. Secure the planetary gear by tightening the centre screw (24 mm).
9. Adjust the bearing clearance of the outer drive shaft and fit the assembly to the tractor.

Changing bearings and seals for outer drive shaft

1. Remove the final drives and detach the planetary gear.

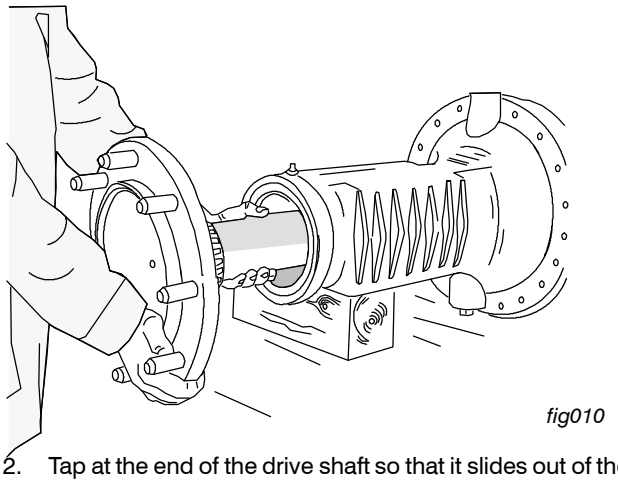


fig010

2. Tap at the end of the drive shaft so that it slides out of the bearings. Pull the shaft out of the axle housing.

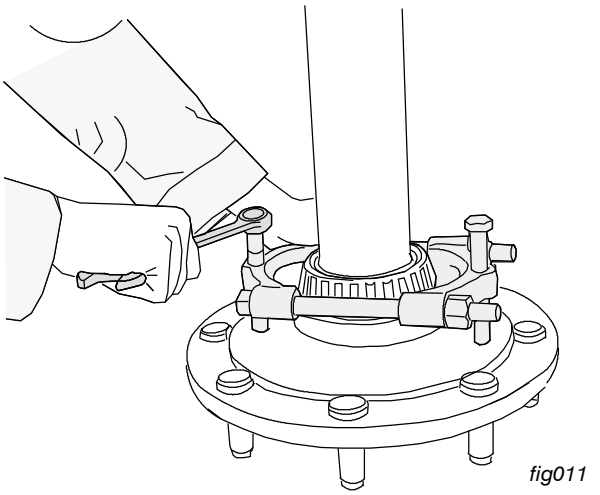


fig011

3. Remove the outer drive shaft bearing using a puller. Warm up a new bearing and fit it onto the shaft fully home.

Note! If the wear ring on the shaft has damaged, change it before fitting the bearing.

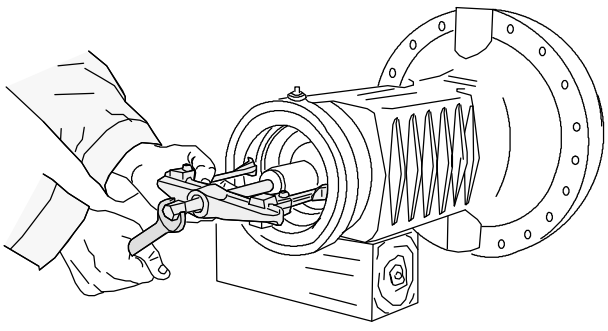


fig012

4. Remove the outer seal for the shaft using a puller (fit a suitable counter hold inside the rear axle housing).

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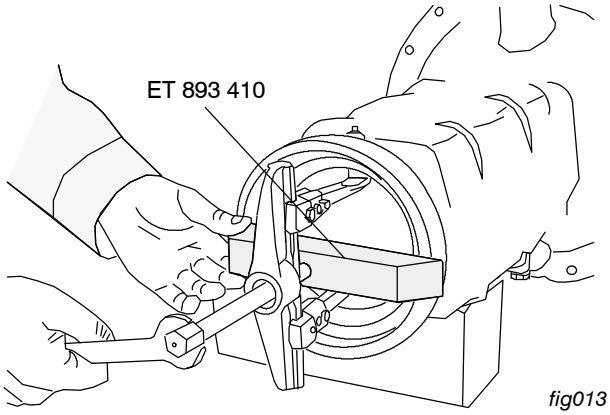


fig013

5. Position counter hold ET 893 410 against the rear axle housing and pull out the outer bearing race.
6. Remove the plastic ring in front of the inner seal. Lever out the seal, if damaged. Grease lips of a new seal and fit it. Fit the plastic ring in front of the seal.
7. Fit the race of the outer bearing (ETV 893 320 and universal handle ETV 890 220). Tap it fully home.
8. Lubricate the outer oil seal and fit it. Use a sturdy plate for fitting.
9. Remove the inner bearing race using a puller and support. Fit a new bearing race using plate.

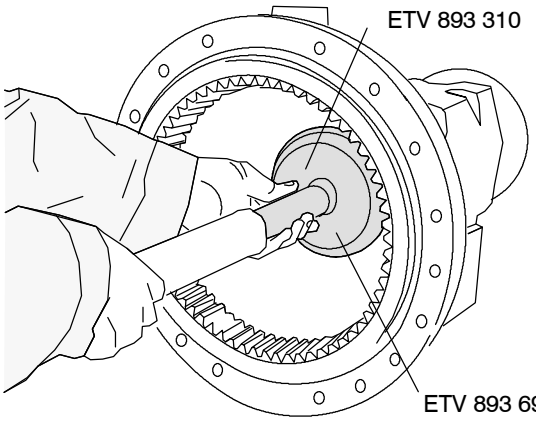


fig014

10. Change the inner oil seal of the outer drive shaft. Fit a new seal**.**
11. Put the drive shaft upright with the wheel flange on the floor. Grease the bearings and seals before fitting them.
12. Fit the inner bearing on the drive shaft. Fit the planetary gear on the splines on the drive shaft and press the planetary gear home. Fix the planetary gear to the end of the drive shaft with the attaching plate and the screw.
13. Adjust the drive shaft bearing clearance and fit the final drives.

Adjusting outer drive shaft bearing clearance

1. Place the drive shaft with the wheel flange on the floor. Bed in the bearings by rotating the axle housing 20–30 turn.

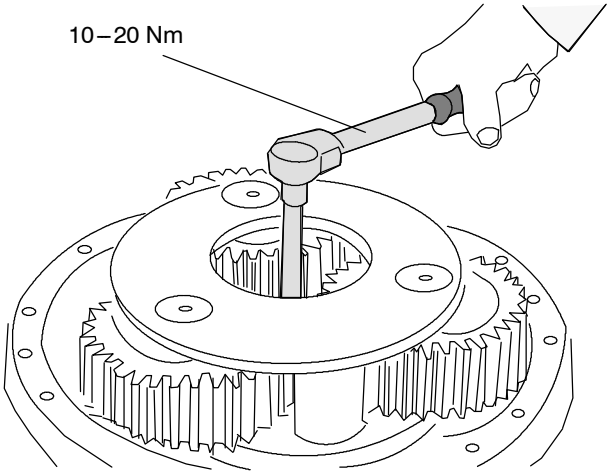


fig015

2. Tighten the centre screw to a torque of **3–5 Nm**. Again rotate the axle housing and check the torque.

Note! After some time of operation the correct bearing clearance will be established.

3. Turn the lock washer for the centre screw so that the notch on the washer locates in the recess in the planetary retainer.

Note! The lock washer can be fixed with a small amount of grease before fitting the final drives.

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Fitting final drive

Note! Push the inner drive shaft fully home into the brake housing so that it is pushed through brake discs and its splines engage the differential.

1. Apply sealing compound Hylosil RTV silicone Grade 102 Black (UK 0067) to the ring gear sides and place the ring gear against the rear axle housing.

Note! Make sure that the bolt holes align.

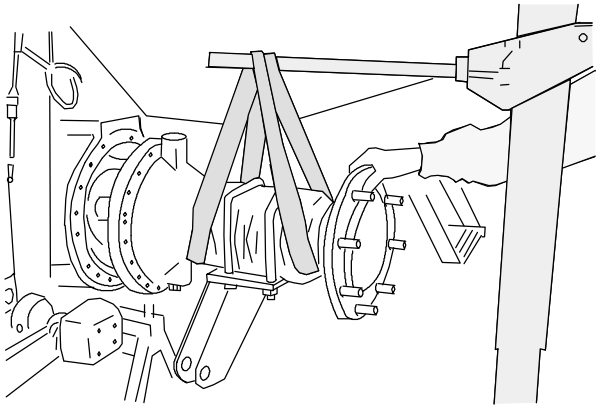


fig005

2. Lift up the rear axle housing and move it inwards at right angles so that the inner drive shaft locates between the planetary gears.

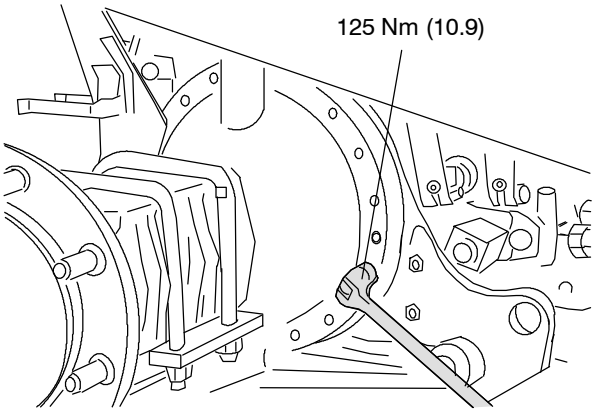


fig016

3. Tighten the bolts to **125 Nm** (10.9).
4. Press grease through the nipple to the drive shaft outer bearing (about 30 g).
5. Connect the check link to its bracket on the rear axle housing. Fit the rear wheel and tighten the nuts to **550 Nm**. Fill the transmission with oil.
6. Lower the cab rear end and tighten the attaching bolts to **200 Nm**.
7. Connect the PTO control cable, pick–up hitch release control and the joint at the lower end of the lewelling screw control rod. Fit the engine hood plates.
8. Test–drive the tractor and check for leaks.

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Technical data

PTO is controlled with a control lever:
– engine PTO is engaged at low engine revs.
– ground speed PTO is engaged while the tractor is stationary
PTO shafts (changeable):
– ø 35 mm (1 3/8”), standard ISO 500, as standard 6–splines
– ø 35 mm (1 3/8”), standard ISO 500, option 21–splines
– ø 45 mm (1 3/4”), standard ISO 500, option 20–splines
– ø 45 mm (1 3/4”), standard ISO 500, option 6–splines
– ø 38 mm, standard GOST 3480–58, option 8–splines

At outputs over 50 kW, use 21–splines shaft. In heavy ground speed PTO use is recommended the 20–splines shaft. Use, if necessary, a torque limiting clutch (1000 Nm)

Engine PTO, ratios:
– PTO speed 540 r/min at engine speed . . . . . 1874 r/min
– PTO speed 540E r/min at engine speed (option) . . . . . 1539 r/min
– PTO speed 1000 r/min at engine speed . . . . . 2000 r/min

Engine front PTO, rations:
– PTO speed 1000 r/min at engine speed . . . . . 1920 r/min

Ground speed PTO, ratios
– 1 rear wheel rev. corresponds (T121c–T131c, T121h–T131h) . . . . . 40,81 shaft rev.
– 1 rear wheel rev. corresponds (T161c–T171c, T161h–T191h, T161LS) . . . . . 41,03 shaft rev.
– 1 rear wheel rev. corresponds
(T161c–T171c, T151eh–T191h, T161LS–T191LS 50 km/h, T151eLS) . . . . . 40,79 shaft rev.

PTO multi–disc clutch
– clutch pressure 1,8 MPa (from low pressure circuit of hydraulic system).
– PTO clutch solenoid valve is fitted on the servo valve block. In the PTO clutch there is fitted a PTO brake. In addition, the system has a cushioning valve for engagement.
– friction discs 8 kpl
– steel discs 7 kp

Max. power take–off output at nominal revs of 1000 r/min, kW (hp):

T121c, T121h	T131c	T131h	T151eh	T160c
77 (105)	88 (120)	88 (120) 94 (128)[2)]	95,3 (130)[1)] / 95 (129) 104,3 (142)[1, 2)] / 102 (139)[2)]	103 (140)
T161h, T161LS	**T171c**	**T171h, T171LS**	**T191h, T191LS**	
103 (140) 110 (150)[2)]	110 (150)	110 (150) 117 (159)[2)]	114 (155) 130 (177)[3)] 130 (177)[4)]	

[1)] At engine speed 1750 r/min.
[2)] Transport boost power area, when the main gear is H2 or higher.
[3)] Transport boost power area, when the main gear is H2 or higher and PS boost area, when quick–shift is 2 or 3. The transport boost and PS boost power areas are equal.
[4)] Sigma power area, the largest output/torque area, when the power transferred through the power–take–off is large enough. The symbol  is illuminated in the instrument panel.

Settings

Clearance of the ground speed PTO shaft bearings . . . . . 0,025–0,075 mm
Clearance of the PTO clutch shaft bearings . . . . . 0,025–0,075 mm
Clearance between PTO shaft rear bearing and PTO shaft oil seal is adjusted to zero with shims.

Tightening torques

Frame joint between gearbox–PTO housing:
– upper stud nuts (8 pcs) . . . . . 270–330 Nm
– lower stud nuts (6 pcs) . . . . . 72–88 Nm
Front cover of the PTO unit . . . . . 72–88 Nm
Shaft nut on the ground speed PTO shaft . . . . . 260–280 Nm
Locking plate for the cluch shaft adjusting nut . . . . . 21–25 Nm
Locking bolt at the front end of the PTO shaft . . . . . 225 Nm

Locking fluids and sealing compounds used

Sealing compound Hylosil RTV Grade 102 black between gearbox–PTO unit
Sealing compound Loctite 542 on PTO speed sensor threads.

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Markings on the PTO units

The number code is stambed on the PTO housing.

Note! If tractor's PTO speeds are changed, then AC control unit must be reprogrammed.

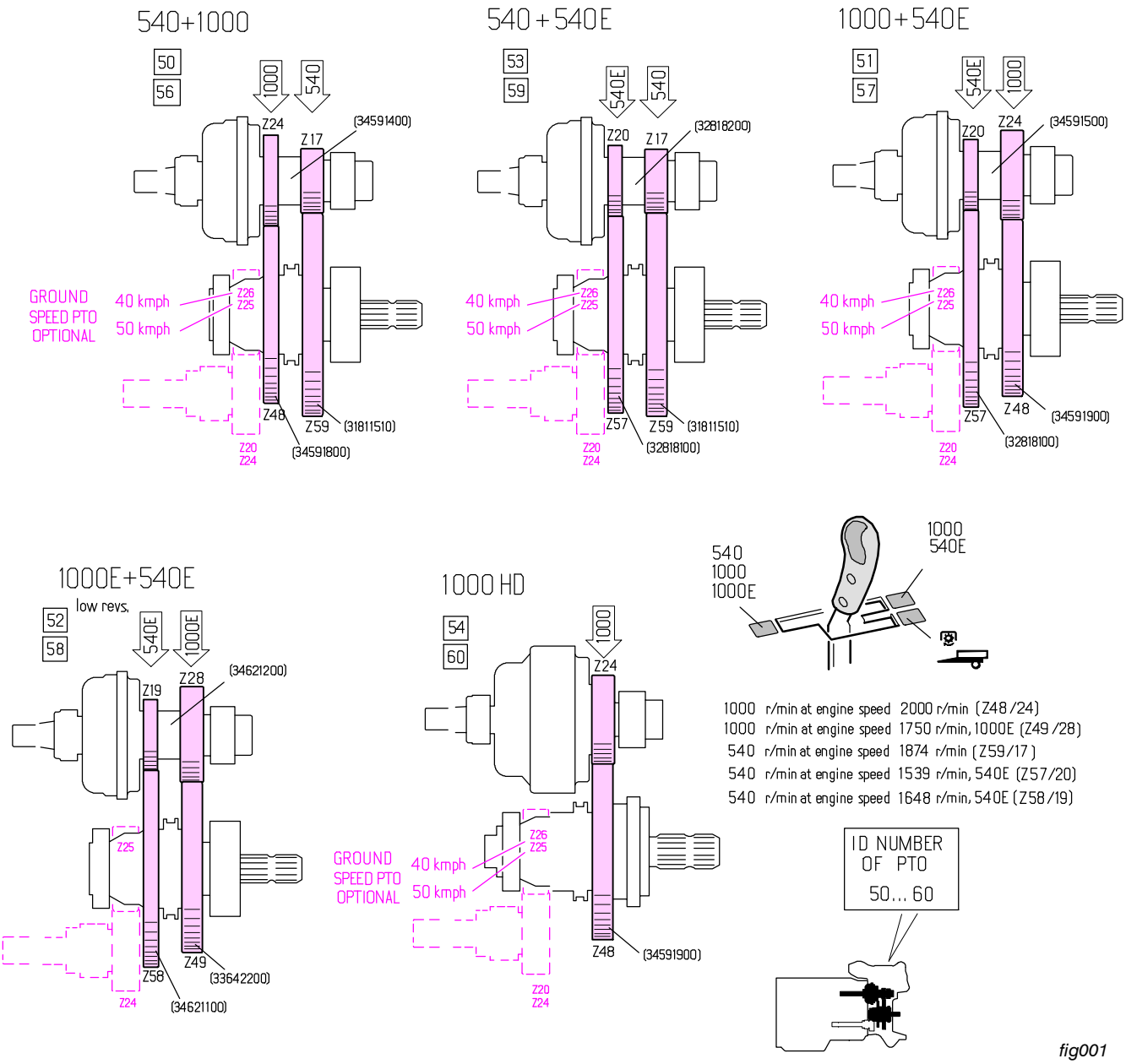


fig001

PTO alternatives	T121c–T171c, T121h–131h, T161LS–T171LS	T151eh, T151eLS	T191h, T191LS
540 + 1000	x		
540 + 1000 + PGS PTO	x		
1000 EHD	x		x
1000 EHD + PGS PTO	x		x
540+ 540 E (540+750)	x		
540 + 540 E + PGS PTO	x		
1000 + 540E / (750+540)[1)]	x	x	x
1000 + 540E + PGS / (750+540 +PGS)[1)]	x	x	x

PGS = proportional gr. speed, EHD = heavy duty

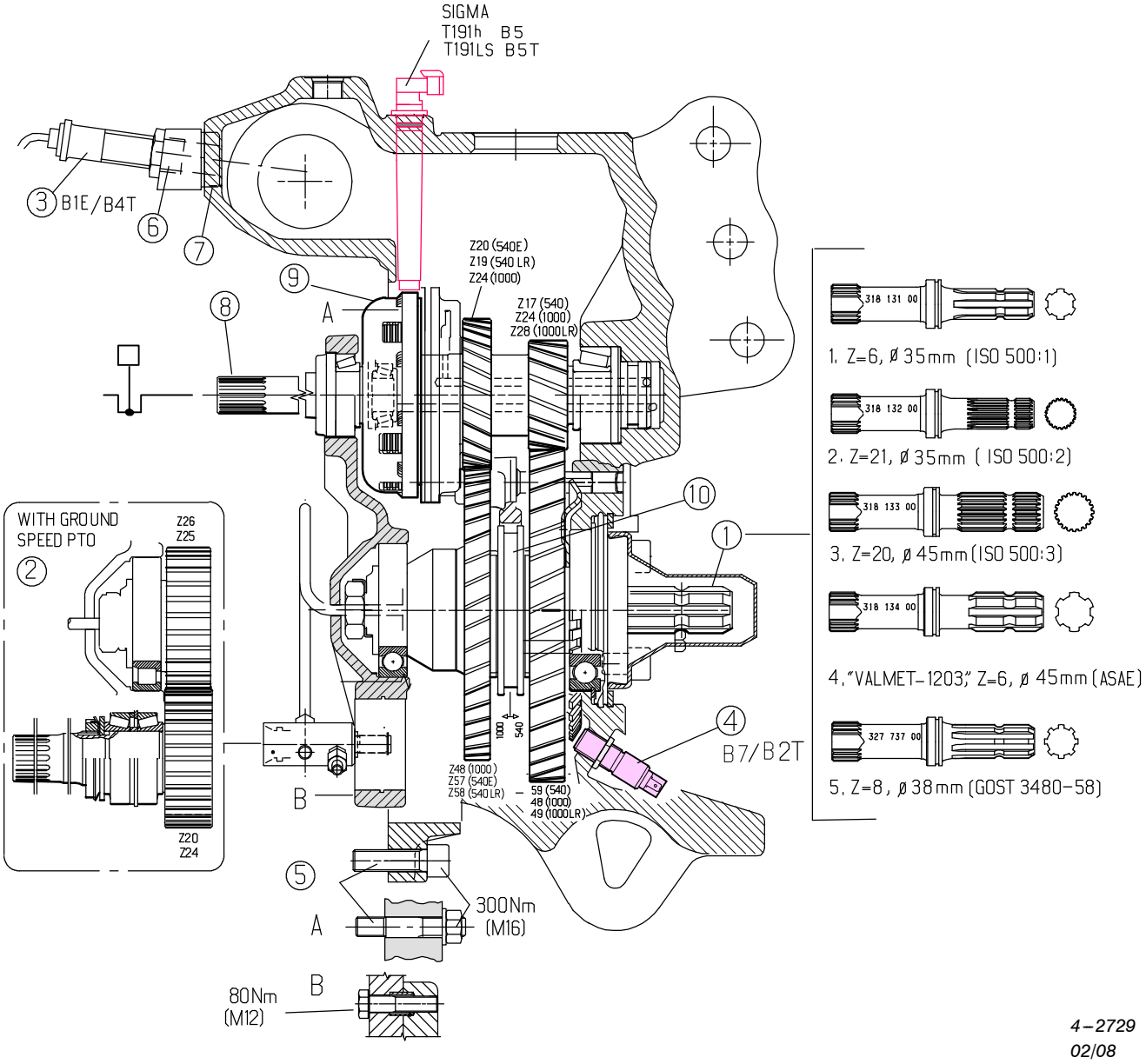
[1)] Model T151eh with low engine range "ECO"

PTO ratio ..... **540 r/min** at engine speed 1874 r/min
1000 r/min at engine speed 2000 r/min
540E = 540 r/min at engine revs 1539 r/min

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Power take–off, description



4–2729
02/08

The PTO system is equipped with an electro–hydraulically controlled multi–disc clutch and a mechanical dog clutch. PTO is controlled with a control lever:
– Engine PTO is engaged at low engine rews.
– Ground speed PTO is engaged while the tractor is stationary. PTO shafts can be changed.

Front end of shaft (8) is connected to the coupling sleeve in the pump drive mechanism at the rear end of the gearbox input shaft. Shaft (1) is rotated by the pump drive shaft from the engine flywheel. Shaft (8) front end together with the PTO clutch drum (9) always rotate when the engine is running.

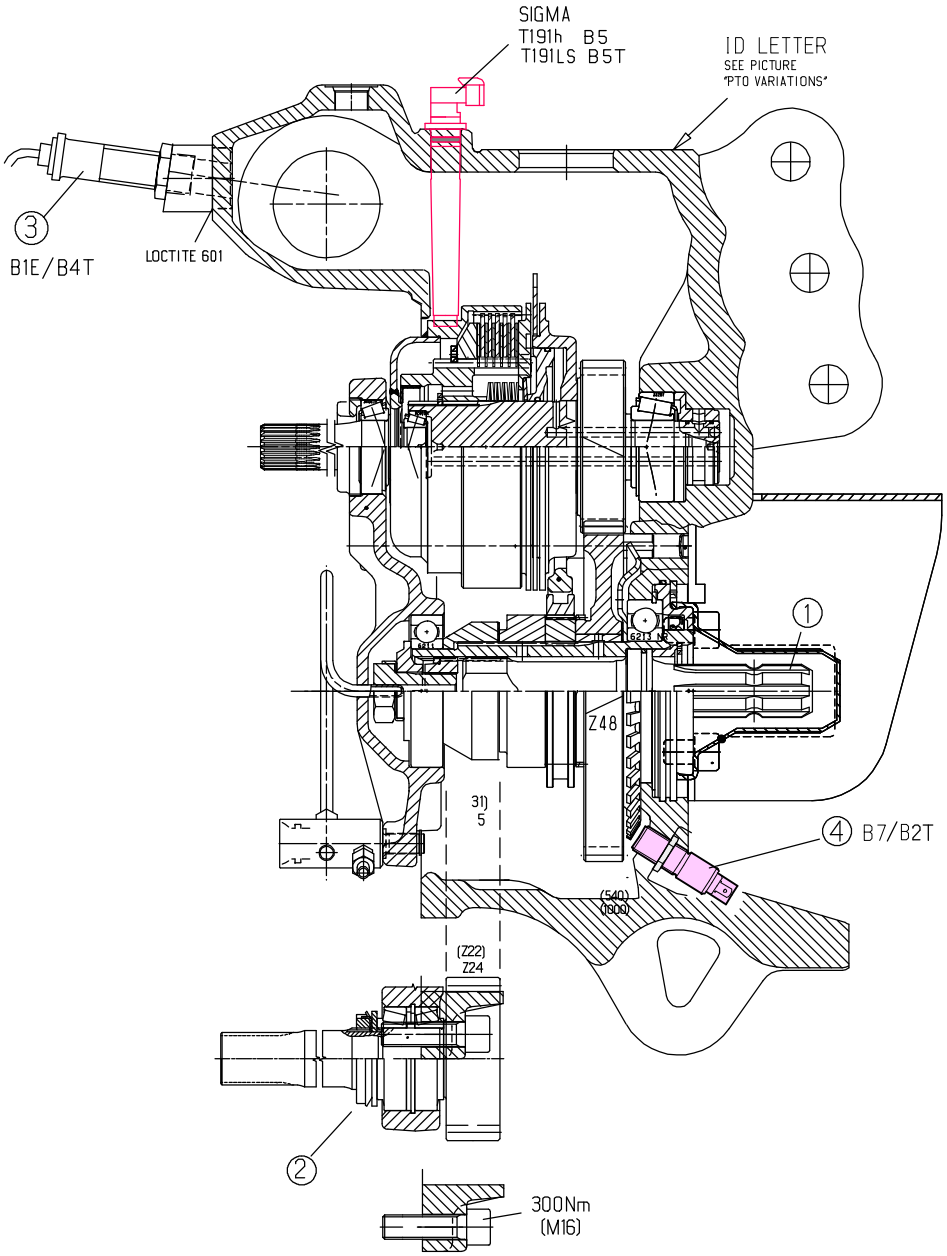
When there is no oil pressure in the PTO clutch, power is not transmitted to the PTO shaft. Now the PTO brake cup springs engage the brake which prevents upper shaft gearwheels from rotating.

When pressurised oil acts in the PTO clutch, the clutch is engaged (and the brake is released) and power is transmitted to the PTO shaft gearwheels. When sliding coupler (3) is in the front position, 1000 r/min PTO or 750 PTO has been engaged. When the coupler is in the rear position, 540 r/min PTO has been engaged.

1) For each PTO speed there is an interchangeable shaft, which can be changed easily.
2) Gears with ground speed PTO.
3) Position sensor (B1E/B4T).
4) Inductive sensor located beside the PTO output shaft. The sensor measures the rotation speed of the PTO shaft.
5) Locking with Loctite 270 (UK 0062)
6) Permatex Super 300 (UK 0157)
7) Loctite 601 (UK 0086)
8) Front end of shaft
9) PTO clutch drum
10) PTO sliding coupler

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Heavy Duty PTO



4–2211
02/08

In extra heavy use, when extreme load peaks are frequent, it is possible that a normal PTO clutch slips. To prevent this, an extra heavy PTO mechanism has been designed.

While the disc diameter of the normal multi–disc clutch is 133 mm, the disc diameter of the EHD PTO is 162 mm. Also the gears of the EHD are thicker.

The large clutch takes so much space, that the 540 r/min rotating speed is not possible in the same PTO.

1) For each PTO speed there is an interchangeable shaft, which can be changed easily.
2) Gears with ground speed PTO.
3) Position sensor (B1E/B4T).
4) Inductive sensor located beside the PTO output shaft. The sensor measures the rotation speed of the PTO shaft.

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PTO clutch and brake

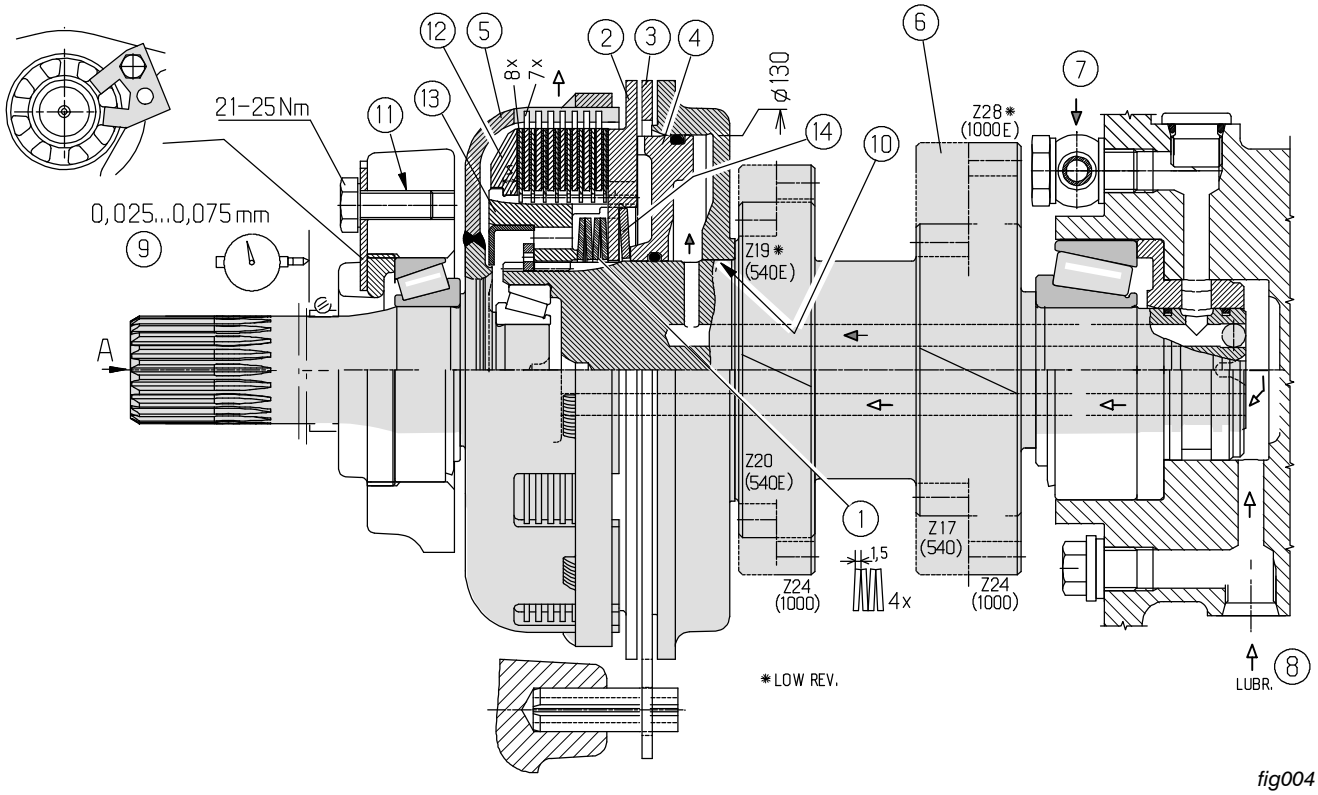


fig004

The PTO multi–disc clutch gets the coupling pressure from the low pressure circuit of the hydraulic system. The solenoid valve Y2 on the valve block connects and disconnects the pressure. When there is no pressure in the clutch (solenoid valve not energized), the cup springs (1) press the pressure plate (2) against brake disc (3), and the shaft (6) brakes.

When the pressure is on (behind the piston (4), it moves the piston forward releasing the brake and coupling the housing (5) with clutch discs to the shaft (6). Power is transmitted to the PTO output shaft.

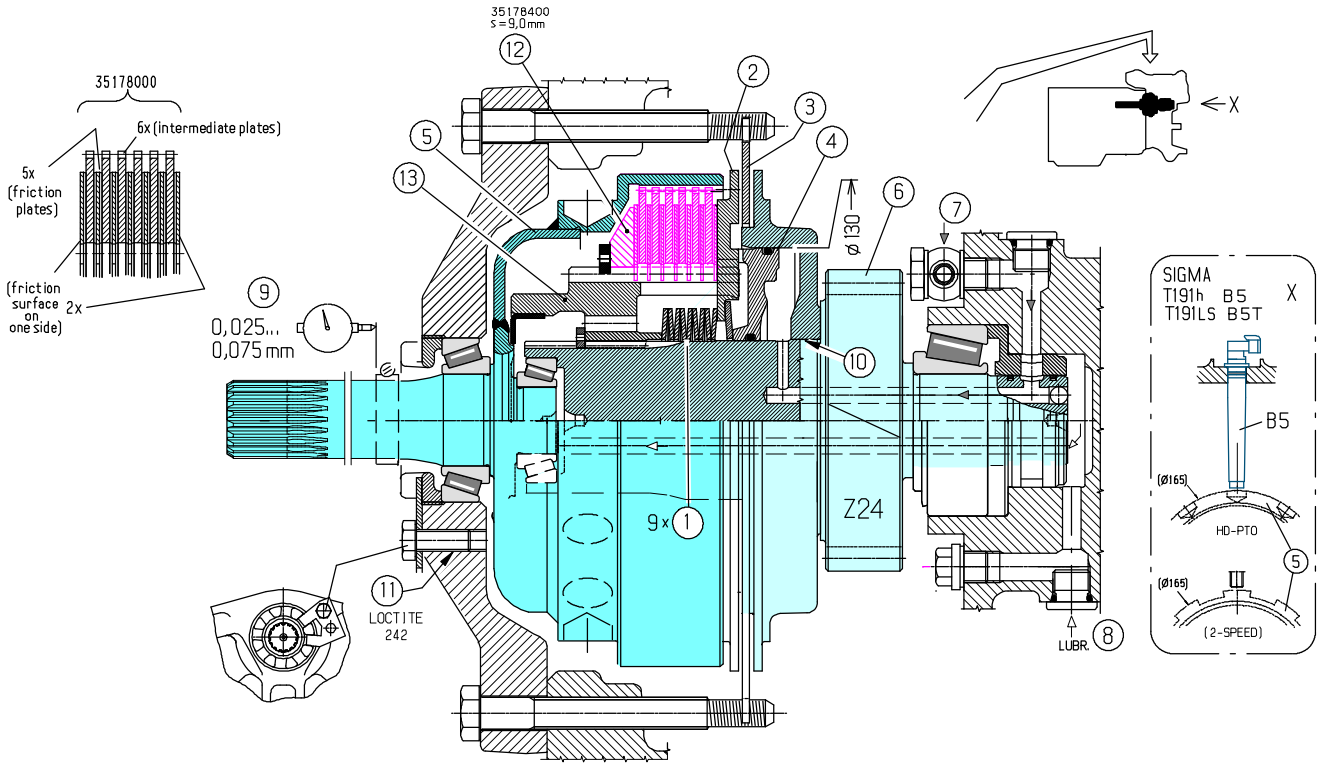
Note! Discs are to be replaced as a set. The friction discs are worn out when the grooves are no more visible.

– friction plates 8 pcs
– intermediate (steel discs) 7 pcs

1) Cup springs 4 pcs, note the order sequence.
2) Pressure plate
3) Brake disc
4) Piston
5) Front shaft + clutch drum
6) Gear shaft
7) Pressure oil to the cluth
8) Lubrication oil
9) Adjusting the bearing clearance of the PTO clutch shaft:
   – Remove the locking piece and turn the adjusting nut (in front of the front bearing) so, that there are no clearances in the tapered roller bearings. Put the dial indicator e.g. against a hose clip, which is fitted on the shaft in front of the adjusting nut. Open the the adjusting nut until there is a clearance of **0.025–0.075** mm between the bearings. When measuring the clearance, push the shaft to its extreme positions. Lock the nut with a locking plate. The locking plate can be fitted in four ways (plate can be turned).
10) Fastening with Loctite 601 (UK0086).
11) Loctite 242 (UK0126) on the threads.
12) Counter ring
13) Hub
14) Cup spring (the spring makes the coupling of the multi–disc clutch softer)

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PTO clutch and brake (Heavy Duty PTO)



4–2220
02/08

	Standard PTO	Heavy Duty PTO
– Disc. diameter	133 mm	162 mm
– Number of friction discs	6 / 8 pcs	5+2 pcs
– Friction area in clutch	778/1090 cm^2	1161 cm^2
– Piston outer diameter	126 mm	130 mm

1) Cup springs 9 pcs, note the order sequence
2) Pressure plate
3) Brake disc
4) Piston
5) Shaft/clutch drum
7) Pressure oil
8) Lubrication oil
9) Adjustment of PTO clutch shaft's bearing clearance
10) Press–on fit between the parts
11) Loctite 242 (UK 0126) on the threads
12) Counter ring (s= 9.0 mm)
13) Hub

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Proportional ground speed PTO

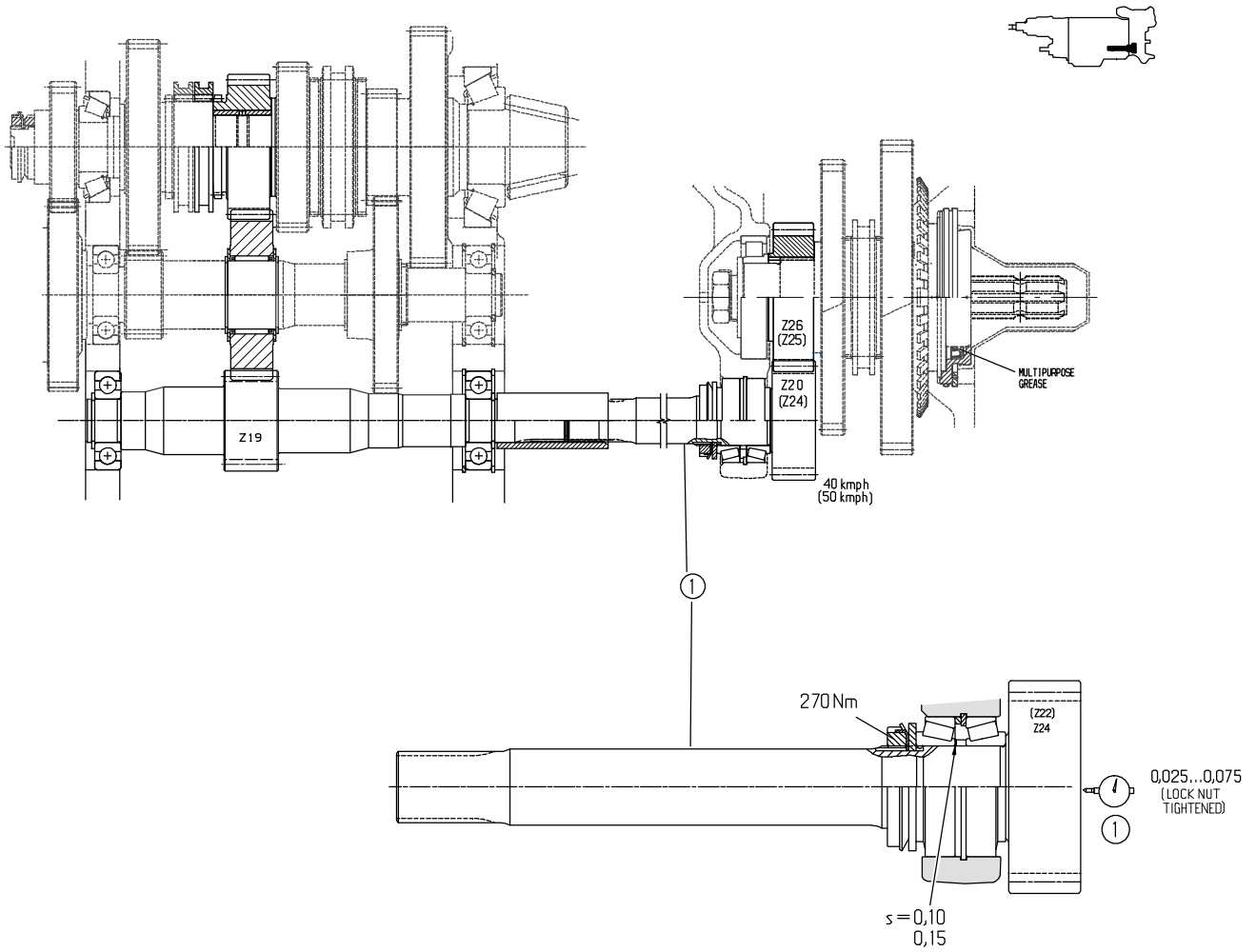


fig006

1) Adjusting the clearing of the ground speed PTO shaft bearing:

– If you have changed the bearings of the ground speed PTO shaft (shaft is attached to the front cover), adjust the taper roller bearing clearance as follows:
– Fasten the cover firmly e.g. to a bench vice.
– Put first the previous shims between the bearings.
– Fit the spacer ring and tighten the shaft nut to a torque of **260–280 Nm**.
– Put a dial indicator at the rear end against the center of the gear.
– Measure the clearance: it should be **0.025–0.075 mm**. Rotate the shaft and push it to its extreme positions during measuring.
– When needed, add or reduce shims between the bearings.

Note! Tighten the shaft nut finally (**260–280 Nm**) when you have mounted the cover (easier assembling of the cover).

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Engagement of the PTO (Syncro)

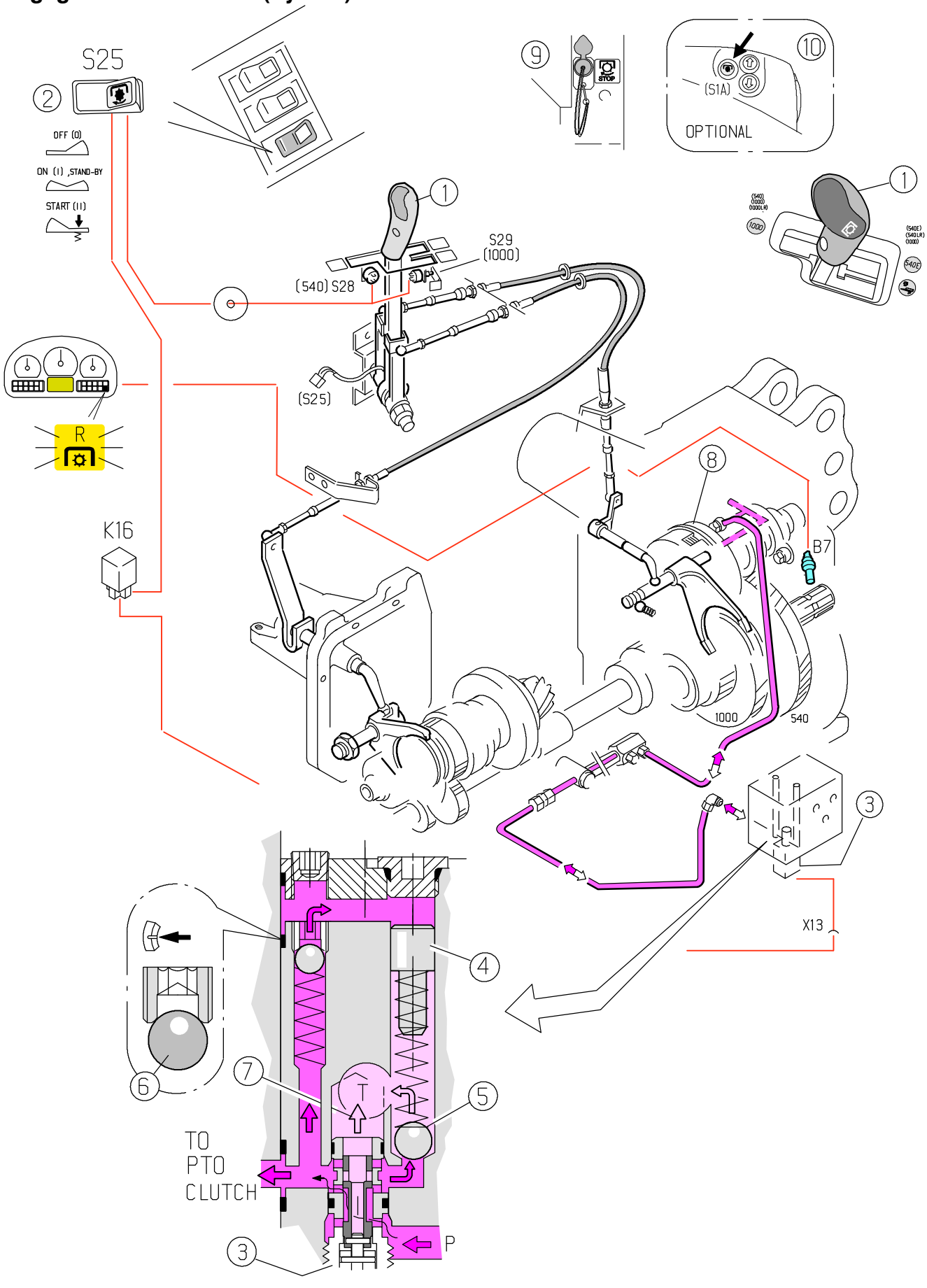


fig007

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The damping valve has been built in the valve block.

Function

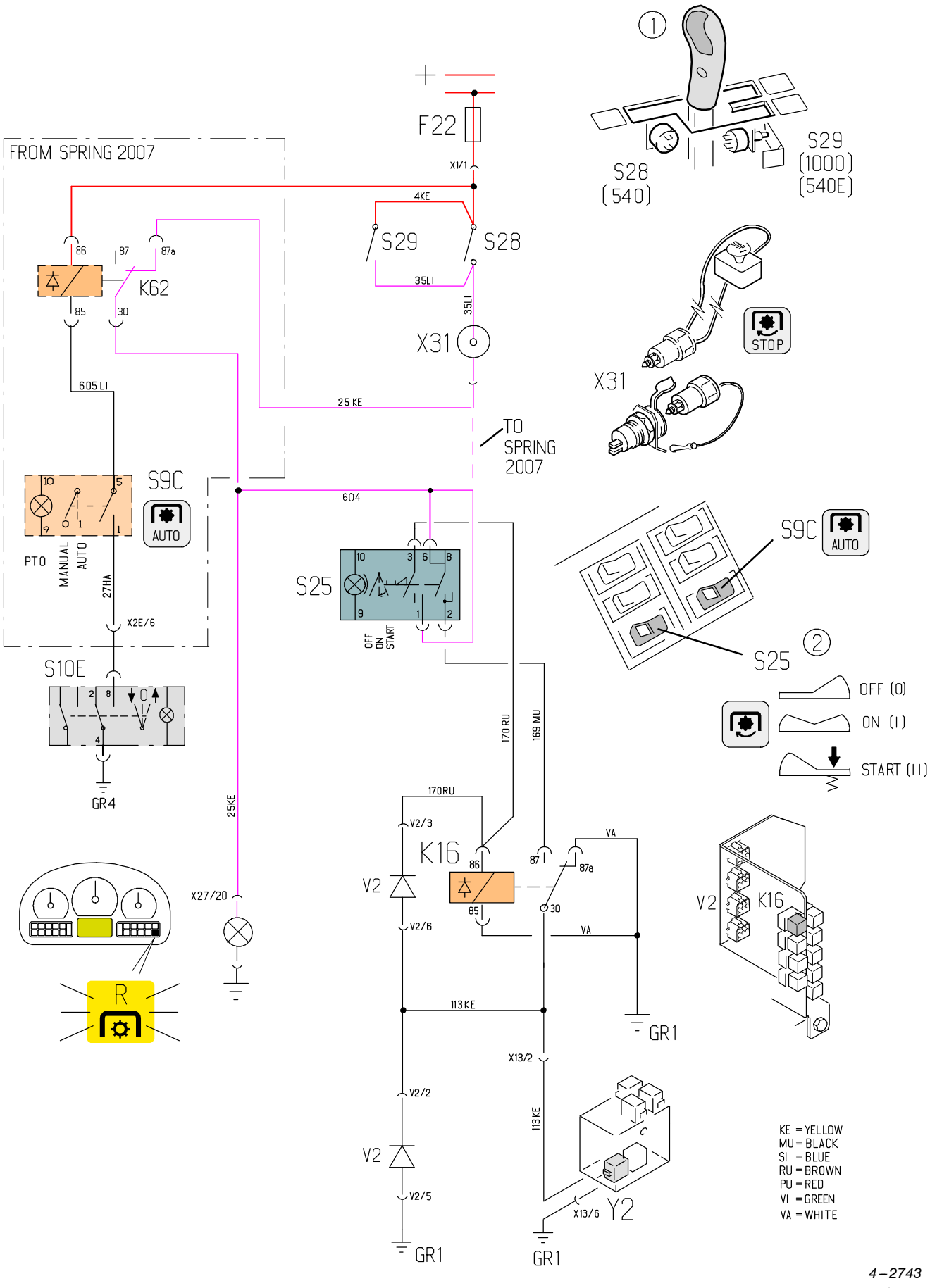
When the PTO is engaged, the solenoid valve conducts the oil to the PTO clutch and to the damping valve. The spring of the damping valve (under piston **4**) has maximum lenght. The pressure encreases in the lowest channel, and opens a ball valve **5** and the oil discharges to the tank. At the same time oil flows in the smaller bore past a ball **6** through a small slot on the valve seat to the upper channel. The oil pressure pushes the piston **4** downwards and the spring load which acts to ball valve **5** increases. The oil flow to the tank decreases, and the pressure acting to the PTO multi–disc clutch rises slowly to the maximum (18 bar).

When the PTO disengaged, oil retuns via solenoid valve to the tank channel **7**. The pressure in the lowest channel decreases, and oil in the upper channel can flow past the ball **6**. The piston **4** returns rapidly to the original position. This construction enables the damping function when the PTO is engaged quickly again.

1) PTO control lever.
2) Sliding switch
3) PTO solenoid valve
4) Piston of the modulating valve
5) Ball valve (tank channel)
6) Upper ball valve
7) Return oil via solenoid valve to the tank
8) Multi–disc clutch
9) Emergency stop
10) Rear PTO starting push buttons (optional)

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Rear PTO control (Syncro)



4–2743
12/06

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The PTO rocker switch (**2**) has been placed on the power lift selector panel below the differential lock switch. The switch has three positions.

Starting the PTO:
1. Select first the PTO speed range with the lever (the indicator lights comes on).
2. Switch on the PTO with the rocker switch.

Selector lever (1) in the engaged position, **the front edge of the switch** (2) **pressed down:** OFF position. The PTO indicator light is on (if the emergency stop plug is fitted in the socket). This switch only temporarily disengages the PTO.

NOTE: Always disengage the PTO by moving the lever to the centre position (e.g. when leaving the tractor cab) by moving the lever to the centre position.

The PTO can be temporarily disengaged (emergency stop) by pushing the lever outwards. (Switch **S29** or **S28** opens and relay K16 disengages.) PTO should be restarted with switch (2).

Selector lever (1) in the engaged position, **the switch in the middle position:** ON position. PTO does not start, if the switch is not in the START position.

Selector lever (1) in the engaged position, **the switch rear edge is pressed down** (spring return)**:** START position. Relay **K16** functions and switches on current to the solenoid **Y2**. The relay is energized (via diode) all the time the switch is in the middle position (ON position) and the lever and the emergency plug are in the ON position.

When switching the lift/stop/lower switch **S10E** to the lifting position (switch **S9C** in Auto position) the relay **K62** will be earthed and cuts off the current supply to the switch **S25** (and relay **K16**).

There is an emergency socket at the rear of the tractor. A plug is fitted in the socket. When the plug is removed, PTO stops and restarting can be done only by using the switch in the cab.

The plug can be replaced with a remote control switch. When the circuit is cut with the remote control switch, PTO disengages.

After the emergency stop or switching off, PTO can be started only by switching the switch in the cab to the START position (spring return).

Switch **S9C**: rear PTO automatic stop. The switch has two positions.

– **Left side pressed down (Off):** automatic stop of PTO is Off.

– **Right side pressed down (On):** AUTO position (PTO automatic stop).

  PTO disengages when the linkage is raised to the transport position

  PTO does not re–engage even if the linkage is lowered. PTO has to be started with the rocker switch in the Start position (right side depressed).

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Engagement of the PTO (HiTech)

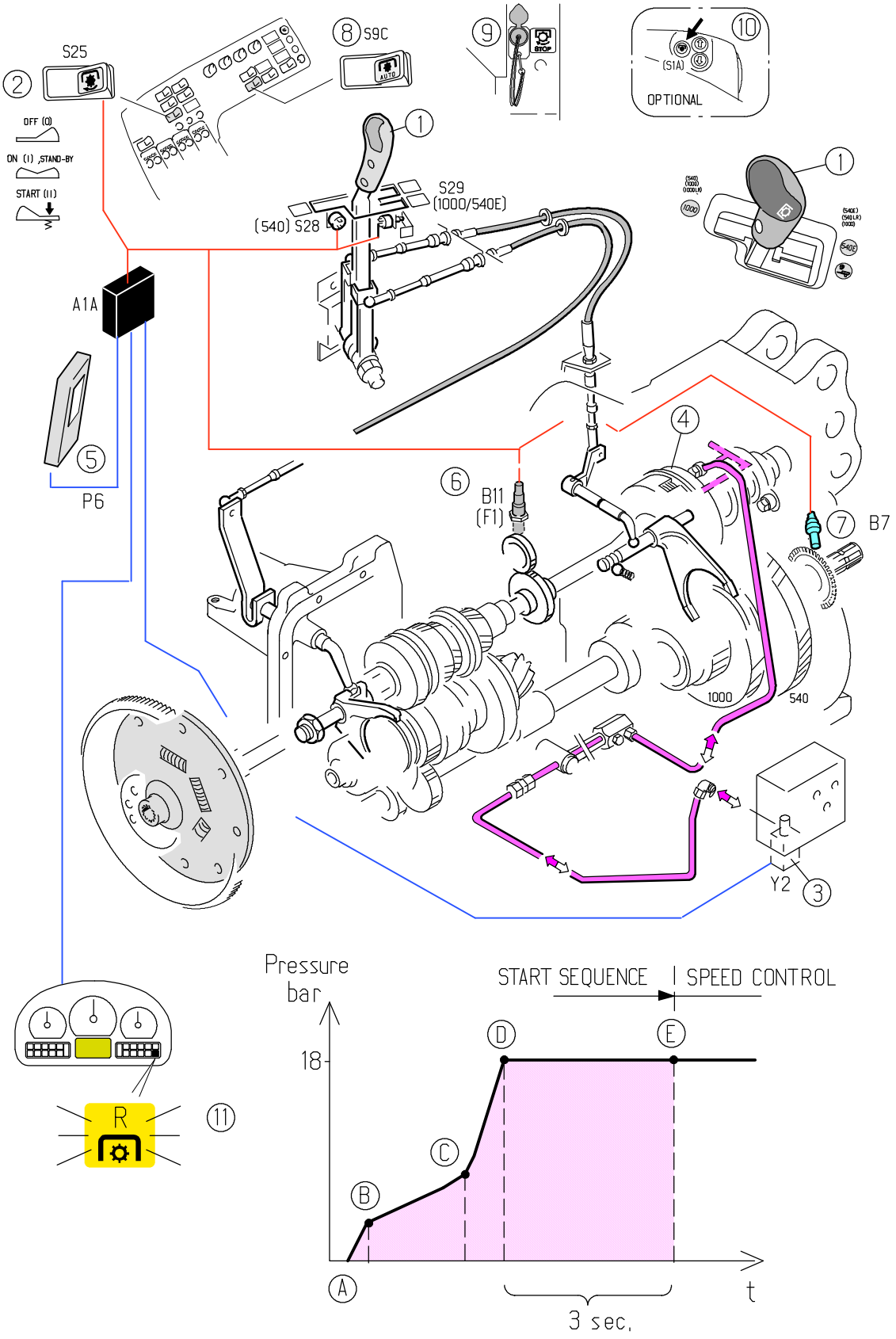


fig008

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The PTO is operated with a proportional solenoid valve.

The the required PTO speed is selected with the lever **1.** The movement of the control lever is transmitted to the PTO gear selector and to the selector (ground speed PTO) in the gearbox by cable wires.

When the control lever is moved to e.g. front position (540 r/min), the mechanical dog clutch of PTO moves to rear position, and when the lever is released, its shaft presses the limit switch (S28). The indicator light flashes. When the PTO is switched on with the rocker switch **2**, the electronic unit A1 finds out which one of the speeds (540, 540E or 1000) is switched on. The indicator light is on.

Starting: The electronic unit **A1** controls the coupling according to a certain program (the same program for both rotation speeds). The start of the PTO is thus independent from the load and smooth.

On the curve points A–B the cylinder of the multi–disc clutch **4** is filled rapidly.

Between the points B and C the clutch pressure is raised up slowly, the small–sized implements start.

After point C the clutch pressure is raised up rapidly, when also more heavy implements start.

When the PTO shaft starts to rotate, the PTO symbol comes into view in the display.

3 seconds after the full pressure engagement (D), the clutch “grip control” starts (after the point E). The electronic unit compares the rotation speeds of the engine sensor (B11) and the PTO sensor (B7), and notices also the gear ratio. If the multi–disc clutch begins (e.g. resulting from a high load) to slip, a fault code lights up in the display, and the clutch will be disengaged.

When the PTO is switched off, the limit switch disengages the PTO multi–disc clutch (indicator light goes out), and simultaneously the brake will be engaged in order to prevent the PTO shaft rotation.

When the control lever is moved to neutral position, the mechanical dog clutch is also transferred to its middle position. The PTO output shaft is completely disengaged from the gearbox and can be rotated freely e.g. by hand.

When operating with PTO driven implements there is a rocker switch **2** on the side panel to operate the multi–disc clutch on–off.

There are no technical limitations to keeping the clutch disengaged by this electric switch. However, for safety reasons, when going out of the cab, move the PTO speed selector lever to neutral position.

There are no technical limitations to keeping the clutch disengaged by this electric switch. However, for safety reasons, when going out of the cab, move the PTO speed selector lever to neutral position.

The ground speed is engaged by moving the lever from the middle position to the left + back, and then the dog clutch in the gearbox engages the ground speed PTO mechanically. Then the PTO multi–disc clutch is disengaged (no pressure). The switch **2** does not function and the control light on the instrument panel does not illuminate.

Ground speed PTO must not be engaged when the tractor is moving.

1) PTO control lever
2) PTO rocker switch (Off–on–start)
3) PTO proportional valve
4) Multi–disc clutch
5) Display unit
6) Engine speed sensor
7) Pto speed sensor
8) Rear PTO automatic stop
9) Emergency stop
10) Rear starting push buttons
11) PTO indicator light

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Rear PTO control (HiTech)

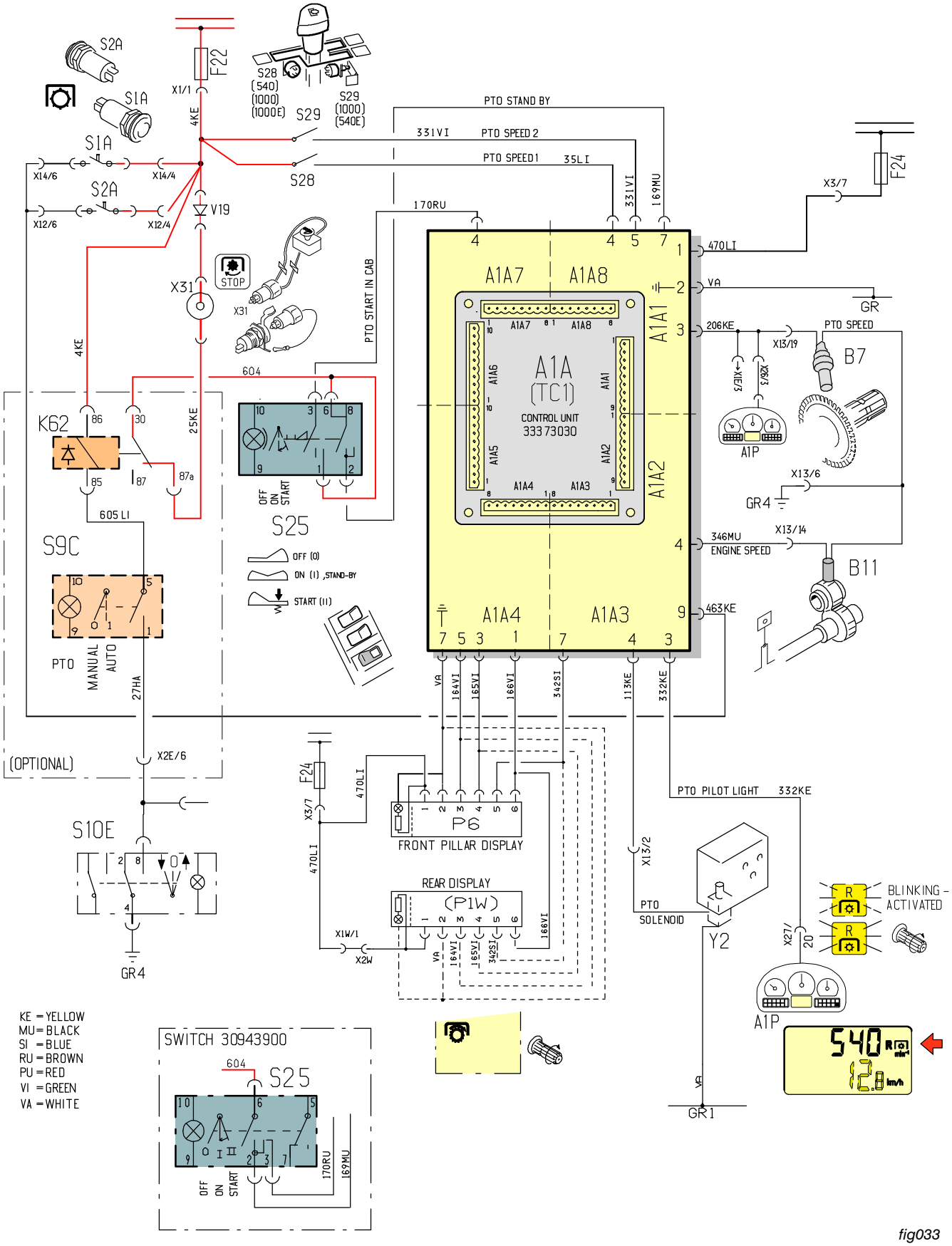


fig033

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– Switch **S28**: PTO 540 (or 1000 or 1000E)
Switch **S29**: PTO 1000 (or 540E)
Depending on the selection of the PTO speed, a voltage (12V) goes to the pins A1A8; 4 or 5.

– Switch **S9C**: Rear PTO automatic stop. The switch has two positions.
Left side pressed down (Off): automatic stop of PTO is **Off**.
Right side pressed down (On): **AUTO**–position (PTO automatic stop).

PTO disengages
– when the linkage is raised into the transport position
– **and**
– the three seconds delay time has passed.

The PTO does not re–engage though the linkage is lowered. The PTO has to be started with the rocker switch start position (**right side** depressed).

– The power take off switch **S25** has 3 positions:
The **left side** pressed down is the **off** position.
The switch in the **centre** is the **on** position or **standby** position.
The **right side** pressed down (spring–return) is the **starting** position or **off** position.

Activated in the middle position, voltage goes to the pin A1A8/7 (stand–by). When starting, the pin A1A8;7 is energized, but furthermore the pin A1A7/4 receives battery voltage. If the pin A1A8;7 is not energized, the PTO will not start.

– PTO push buttons **S1A** / **S2A** (optional) have separate digital inputs in the control unit (A1A2; 9).

– **Starting with the rear push–buttons**. The power take–off can also be started by using the rear starting push–buttons on the rear mudguards. The switch has to be pressed to the centre position before you leave the tractor. The power take–off starts, when one or the other rear starting push–button is pressed continuously for at least 3 seconds (starting begins after 0.5 seconds). If the pressing is interrupted during 3 seconds, the power take–off stops.

– **Stopping with the rear push–buttons** .The PTO can also be stopped by pressing once the rear starting push–button. After this the push–button operates as starting button, when it is pressed for more than 3 seconds.Using switch the PTO is engaged electro–hydraulically, the indicator lamp on the instrument panel illuminates. Disengagement occurs electro–
hydraulically. The indicator light on the instrument panel flashes and shows that the lever is engaged. Using switch disengagement is only temporarily.

– **Note!** When you do not need PTO, always keep the left side of the switch pressed down = on off position. The actual disengagement and engagement of the PTO must be done by PTO control lever . E.g. when leaving the cab, the lever has to be moved to the centre position, except when using the push buttons on the mudguards (extra equipment).

– PTO solenoid valve **Y2**. During the coupling of the PTO, the control unit supplies pulse like voltage (12V) from the pin A1A3; 4 to proportional solenoid valves.

– Indicator light, PTO. Flashes, when the switch S28 or S29 has been activated (= speed selected), but the switch S25 is not yet on. Is continuously on, when the PTO is activated additionally with the switch S25.

– Speed sensor **B11** (F1)**,** engine rotation speed. Inductive sensor (no supply), gives pulses to the pin A1A2;4 according to the revolution speed of the engine.

– Speed sensor **B7** (F6), PTO rotation speed
Inductive sensor (no supply), gives pulses to the pin A1A1;3 according to the revolution speed of the PTO. The control unit **A1A** observes the difference of the rotation speeds between the engine sensor (B11) and the PTO sensor (B7), when there is a full control over than 3 sec. If the multi–disc clutch begins (e.g. resulting from a high load) to slip, a fault code lights up in the display, and the clutch will be disengaged by the control unit.

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Engagement of the PTO (LS)

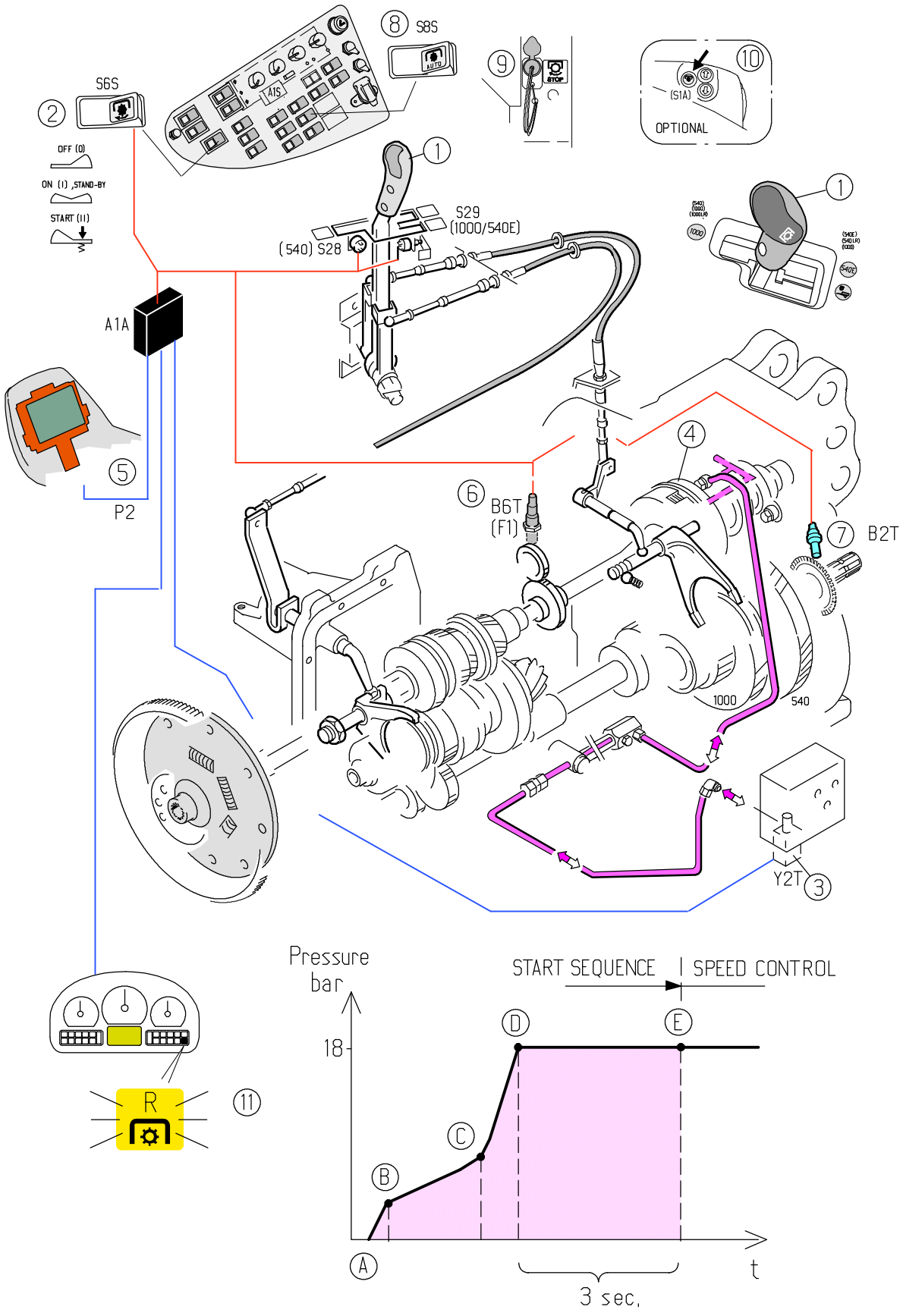


fig032

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The PTO is operated with a proportional solenoid valve.

The the required PTO speed is selected with the lever **1.** The movement of the control lever is transmitted to the PTO gear selector and to the selector (ground speed PTO) in the gearbox by cable wires.

When the control lever is moved to e.g. front position (540 r/min), the mechanical dog clutch of PTO moves to rear position, and when the lever is released, its shaft presses the limit switch (S28). The indicator light flashes. When the PTO is switched on with the rocker switch **2**, the electronic unit A1 finds out which one of the speeds (540, 540E or 1000) is switched on. The indicator light is on.

Starting: The electronic unit **A1A** controls the coupling according to a certain program (the same program for both rotation speeds). The start of the PTO is thus independent from the load and smooth.

On the curve points A–B the cylinder of the multi–disc clutch **4** is filled rapidly.

Between the points B and C the clutch pressure is raised up slowly, the small–sized implements start.

After point C the clutch pressure is raised up rapidly, when also more heavy implements start.

When the PTO shaft starts to rotate, the PTO symbol comes into view in the display.

3 seconds after the full pressure engagement (D), the clutch “grip control” starts (after the point E). The electronic unit compares the rotation speeds of the engine sensor (B6T) and the PTO sensor (B2T), and notices also the gear ratio. If the multi–disc clutch begins (e.g. resulting from a high load) to slip, a fault code lights up in the display, and the clutch will be disengaged.

When the PTO is switched off, the limit switch disengages the PTO multi–disc clutch (indicator light goes out), and simultaneously the brake will be engaged in order to prevent the PTO shaft rotation.

When the control lever is moved to neutral position, the mechanical dog clutch is also transferred to its middle position. The PTO output shaft is completely disengaged from the gearbox and can be rotated freely e.g. by hand.

When operating with PTO driven implements there is a rocker switch **2** on the side panel to operate the multi–disc clutch on–off.

There are no technical limitations to keeping the clutch disengaged by this electric switch. However, for safety reasons, when going out of the cab, move the PTO speed selector lever to neutral position.

There are no technical limitations to keeping the clutch disengaged by this electric switch. However, for safety reasons, when going out of the cab, move the PTO speed selector lever to neutral position.

The ground speed is engaged by moving the lever from the middle position to the left + back, and then the dog clutch in the gearbox engages the ground speed PTO mechanically. Then the PTO multi–disc clutch is disengaged (no pressure). The switch **2** does not function and the control light on the instrument panel does not illuminate.

Ground speed PTO must not be engaged when the tractor is moving.

1) PTO control lever
2) PTO rocker switch (Off–on–start)
3) PTO proportional valve
4) Multi–disc clutch
5) Display unit
6) Engine speed sensor
7) Pto speed sensor
8) Rear PTO automatic stop
9) Emergency stop
10) Rear starting push buttons
11) PTO indicator light

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Rear PTO control (LS)

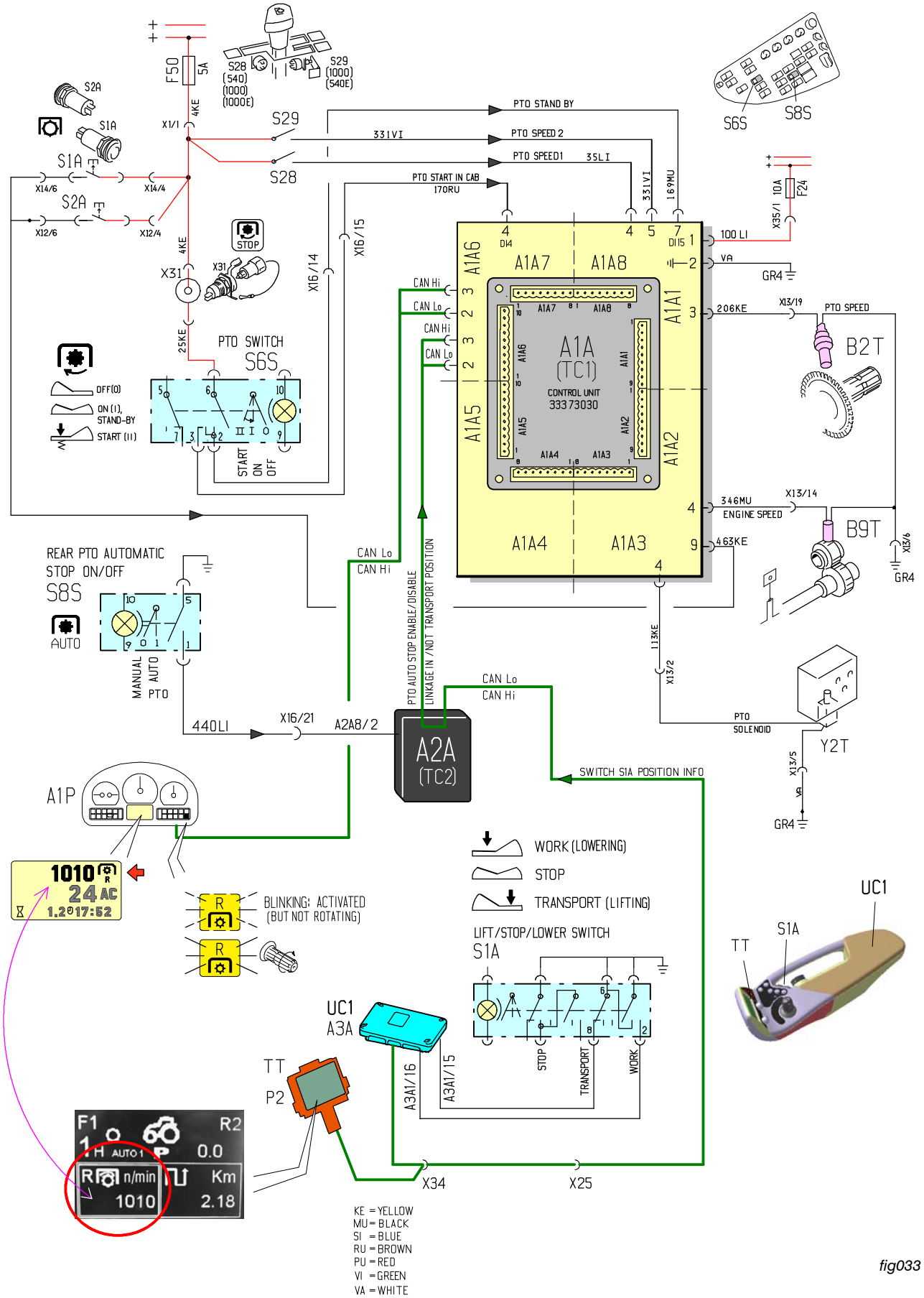


fig033

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– Switch **S28**: PTO 540 (or 1000 or 1000E)
Switch **S29**: PTO 1000 (or 540E)
Depending on the selection of the PTO speed, a voltage (12V) goes to the pins A1A8; 4 or 5.

– Switch **S8S**: Rear PTO automatic stop. The switch has two positions.
Symbol side pressed down (On): **AUTO**–position (PTO automatic stop).
The opposite side to the symbol pressed down (Off): automatic stop of PTO is **Off**.
PTO disengages:
when the linkage is raised into the transport position
and
the three seconds delay time has passed

Note!: Start the PTO after automatic stop. The PTO does not re–engage though the linkage is lowered. The PTO has to be started with the rocker switch (**S6S**) start position (**symbol side** depressed).

– The power take off switch **S6S** has 3 positions:
The **symbol side** pressed down (spring–return) is the STARTING position or OFF position. The desired rotating speed has to be selected through the PTO selector lever (**S6S**) always before starting.
The switch in the **centre** is the ON position or STANDBY position.
The **opposite side to the symbol** pressed down is the **OFF** position.

– PTO push buttons **S1A** / **S2A** (optional) have separate digital inputs in the control unit (A1A2; 9).

– **Starting with the rear push–buttons**. The power take–off can also be started by using the rear starting push–buttons on the rear mudguards. The switch (**S6S**) has to be pressed to the **centre position** before you leave the tractor. The power take–off starts, when one or the other rear starting push–button is pressed continuously for **at least 3 seconds** (starting begins after 0.5 seconds). If the pressing is interrupted during 3 seconds, the power take–off stops.

– **Stopping with the rear push–buttons** .The PTO can also be stopped by pressing once the rear starting push–button. After this the push–button operates as starting button, when it is pressed for more than 3 seconds. Using switch the PTO is engaged electro–hydraulically, the indicator lamp on the instrument panel illuminates. Disengagement occurs electro–hydraulically. The indicator light on the instrument panel flashes and shows that the lever is engaged. Using switch disengagement is only temporarily.

– **Warning**: When you do not need PTO, always keep the opposite side to the symbol of the switch (**S6S**) pressed down = on off position. The actual disengagement and engagement of the PTO must be done by PTO control lever. E.g. when leaving the cab, the lever has to be moved to the centre position, except when using the push buttons on the mudguards (extra equipment).

– PTO solenoid valve **Y2T**. During the coupling of the PTO, the control unit supplies pulse like voltage (12V) from the pin A1A3; 4 to proportional solenoid valves.

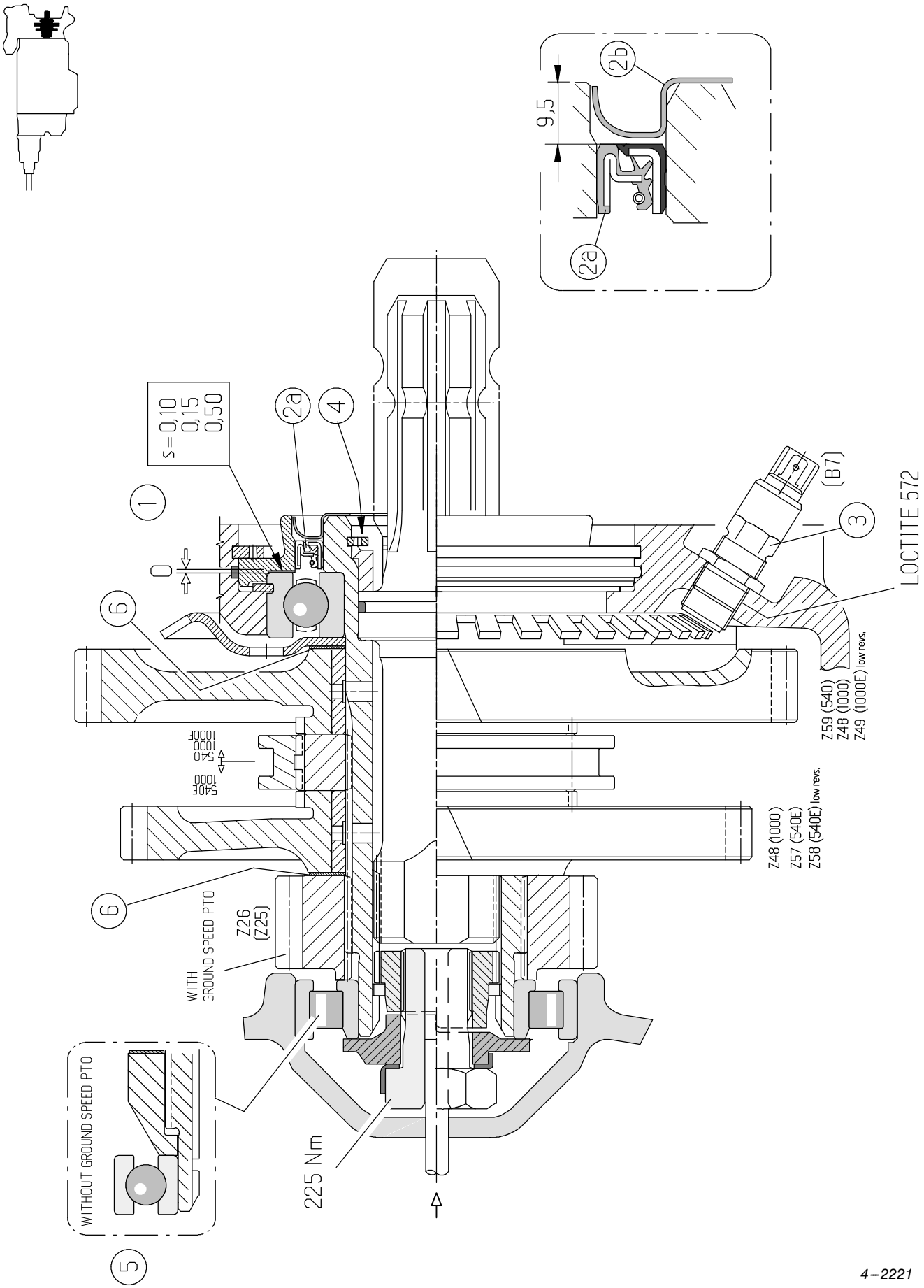
– Indicator light, PTO. Flashes, when the switch S28 or S29 has been activated (= speed selected), but the switch S25 is not yet on. Is continuously on, when the PTO is activated additionally with the switch S25.

– Speed sensor **B9T** (F1)**,** engine rotation speed. Inductive sensor (no supply), gives pulses to the pin A1A2;4 according to the revolution speed of the engine.

– Speed sensor **B12T** (F6), PTO rotation speed
Inductive sensor (no supply), gives pulses to the pin A1A1;3 according to the revolution speed of the PTO. The control unit **A1A** observes the difference of the rotation speeds between the engine sensor (B9T) and the PTO sensor (B2T), when there is a full control over than 3 sec. If the multi–disc clutch begins (e.g. resulting from a high load) to slip, a fault code lights up in the display, and the clutch will be disengaged by the control unit.

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PTO shaft



4–2221
03/03

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1) Between the ball bearing and the seal housing there is a shim. The clearance between the parts is to be adjusted (as required) to 0.

   The clearance can be measured by locating a dial indicator against the seal housing and moving the housing (shim thicknesses: 0.10, 0.15 and 0.50 mm).

2) Multi–purpose grease (UC 1811) into the seal

2a) Cassette seal

2b) Protective cup

3) Inductive sensor

   Adjustment of the the sensor: turn the sensor carefully by hand until it reaches the measuring plate, then turn back 1/3 revolutions. Lock the sensor with the locking nut. Apply sealing compound Loctite 572 (UK 0174) to the threads.

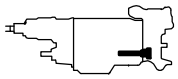
4) Change the shaft by removing the circlip.

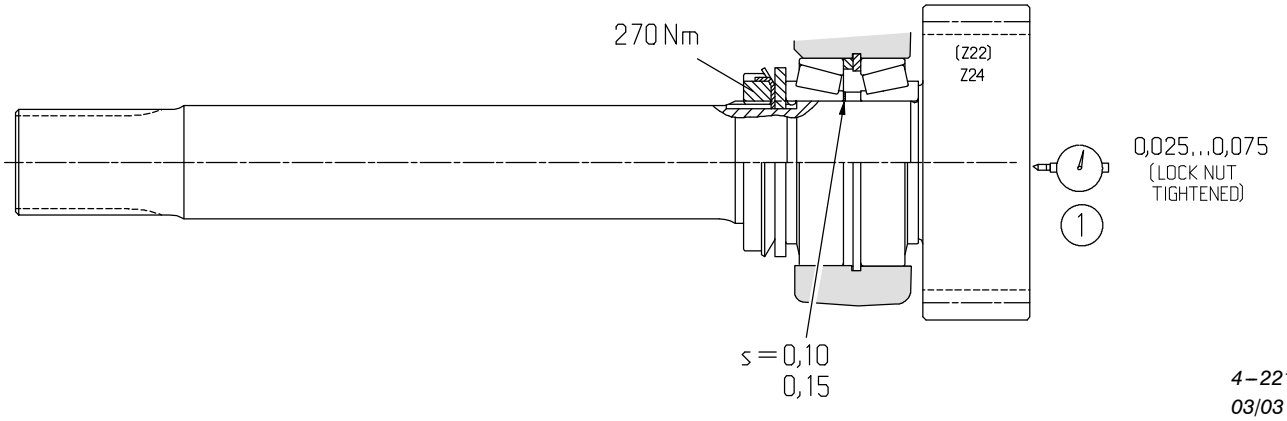
5) Models without ground speed PTO: Instead of the gear there is a spacer sleeve and ring. The bearing is a ball bearing.

6) Axial thrust plate (2 pcs)

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Ground speed PTO shaft





4–2218
03/03

Adjusting the clearing of the ground speed PTO shaft bearing:

If you have changed the bearings of the ground speed PTO shaft (shaft is attached to the front cover), adjust the taper roller bearing clearance as follows:

- If you have changed the bearings of the ground speed PTO shaft (shaft is attached to the front cover), adjust the taper roller bearing clearance as follows:
- Fasten the cover firmly e.g. to a bench vice.
- Put first the previous shims between the bearings.
- Fit the spacer ring and tighten the shaft nut to a torque of **260–280 Nm**.
- Put a dial indicator at the rear end against the center of the gear.
- Measure the clearance: it should be **0.025–0.075 mm**. Rotate the shaft and push it to its extreme positions during measuring.
- When needed, add or reduce shims between the bearings.

Note! Tighten the shaft nut finally (**260–280 Nm**) when you have mounted the cover (easier assembling of the cover).

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Sensors

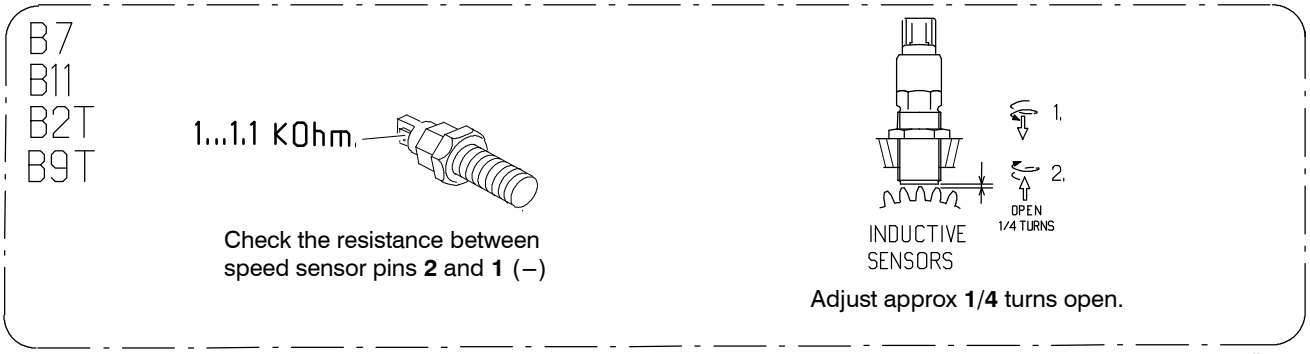
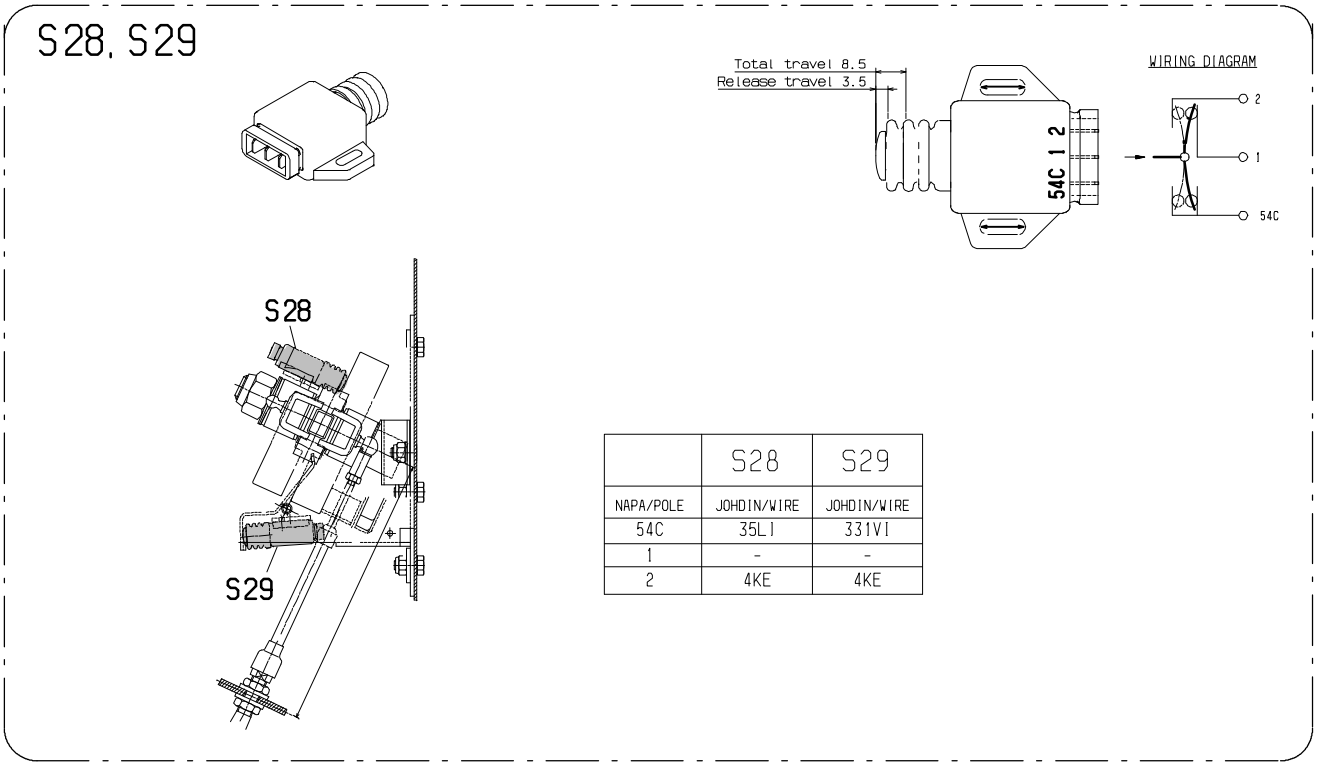


fig009

Switches



	S28	S29
NAPA/POLE	JOHDIN/WIRE	JOHDIN/WIRE
54C	35L1	331V1
1	-	-
2	4KE	4KE

fig010

Location of the components in wiring diagram

Symbol	Description	Page + postion (in wiring diagram)	Location
AC9.2			
–B7	Speed sensor, PTO	/2.D11	Transmission
–S28	Limit switch, rear PTO 540	/6.A14	Cab
–S29	Limit switch, rear PTO 1000/540E	/6.A15	Cab
–S29	Limit switch, rear PTO 1000/540E	/12.C13	Cab
AC10.2&AC10.21			
–B7	Speed sensor, PTO	/3.D3	Transmission
–B7	Speed sensor, PTO	/15.D11	Transmission
–S28	Limit switch, rear PTO 540	/2.A12	Cab
–S29	Limit switch, rear PTO 1000/540E	/2.A13	Cab
AC11.2			
–B2T	Speed sensor, PTO	/5.D9	Transmission
–S28	Limit switch, rear PTO 540	/10.A7	Cab
–S29	Limit switch, rear PTO 1000/540E	/10.A7	Cab

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Magnetic valves (Hitech, LS)

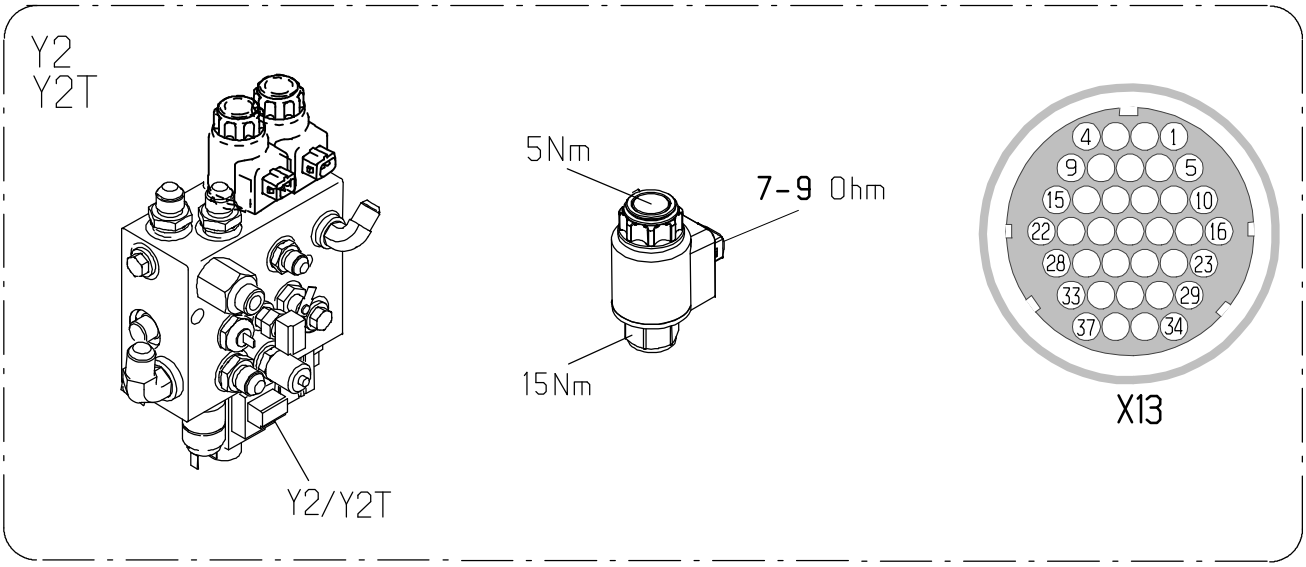


fig011

The resistance of the proportional valve is measured from connector X13 pins, see table. Correct value is **7–9 ohm** (+10˚C...+30˚C).

Solenoid	Pins (**X13**)	Resistance
Y2/Y2T (PTO)	2, 5	**7–9 ohm**

Location of the components in wiring diagram

Symbol	Description	Page + postion (in wiring diagram)	Location
AC9.2 –Y2	Magnetic valve, power take–off rear	/6.D15	Transmission
AC10.2&AC10.21 –Y2	Magnetic valve, power take–off rear	/5.D14	Transmission
AC11.2 –Y2T	Magnetic valve, power take–off rear	/5.D13	Transmission

Special tools

Reconditioning PTO (code 465.1)

ETV 890 220 . . . . . Universal handle
ETV 891 870 . . . . . Plate for fitting PTO shaft seal
ETV 894 080 . . . . . Drift for fitting selector fork rail locking ball
ETV 894 420 . . . . . Ring for fitting PTO shaft cassette seal (to be used with below listed sleeves)
ETV 894 430 . . . . . Sleeve (ø 35) for fitting PTO shaft cassette seal (to be used with above mentioned ring)
ETV 894 440 . . . . . Sleeve (ø 44,6) for fitting PTO shaft cassette seal (to be used with above mentioned ring)

Locally prepared tools

Reconditioning PTO (code 465.1)

ET 894 000 . . . . . Tool for unscrewing locking flange at front end of PTO shaft
ET 894 090 . . . . . Sleeve for fitting PTO clutch circlip

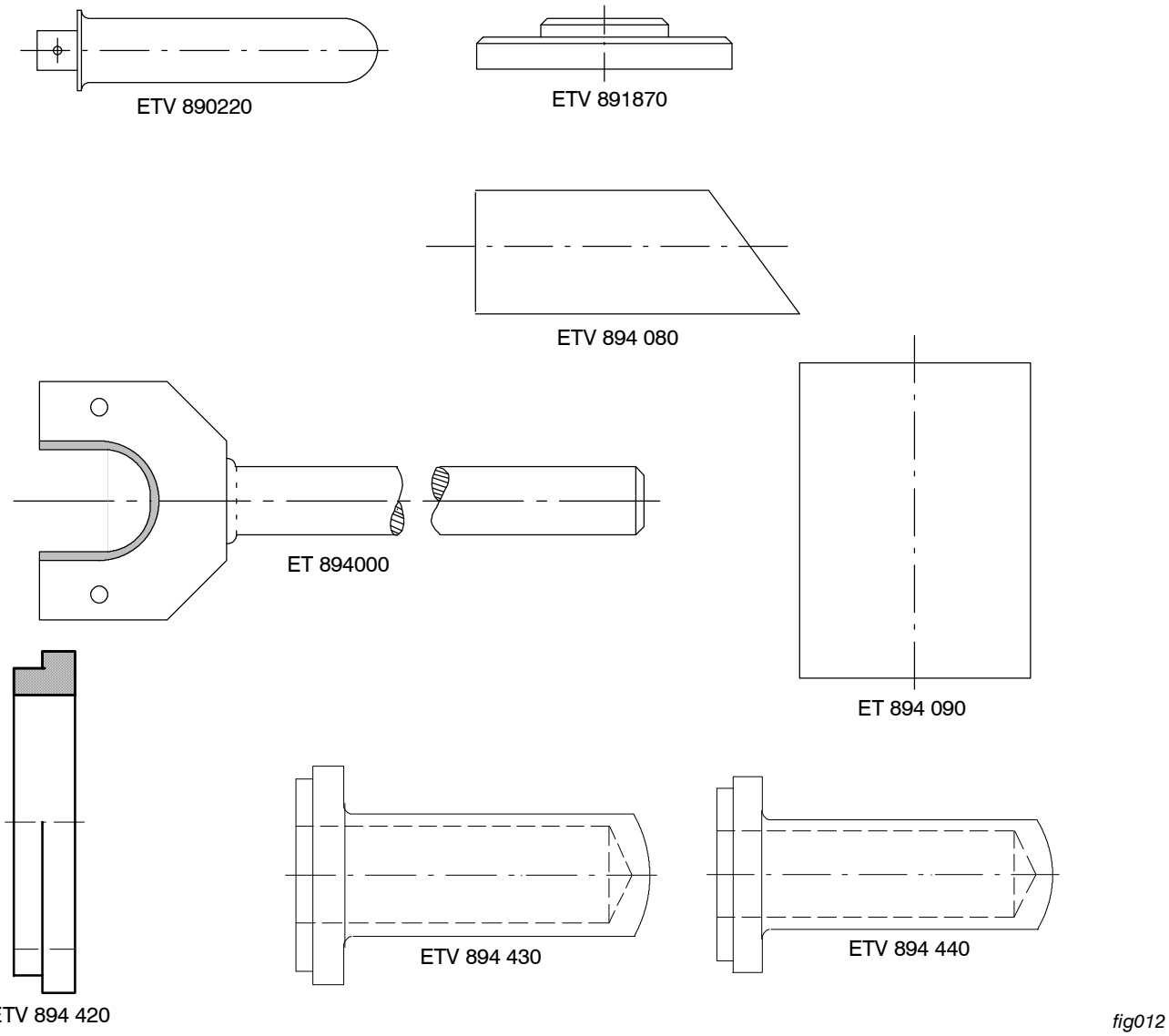


fig012

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Reconditioning PTO

Note! In the instructions below has been used a PTO unit which is equipped with parts for ground speed PTO. The instructions are good also for PTO units without the ground speed PTO.

Removing PTO unit

1. Drain the oil from the transmission. Disconnect the PTO speed sensor wire. Remove the position sensor of the hydraulic power lift.
2. Disconnect the auxiliary hydraulic pipes from the quick–action couplings (in front of the bracket for couplings).
3. Disconnect the PTO control cable, pick–up hitch release control and the locking pin for the levelling screw control rod joint.

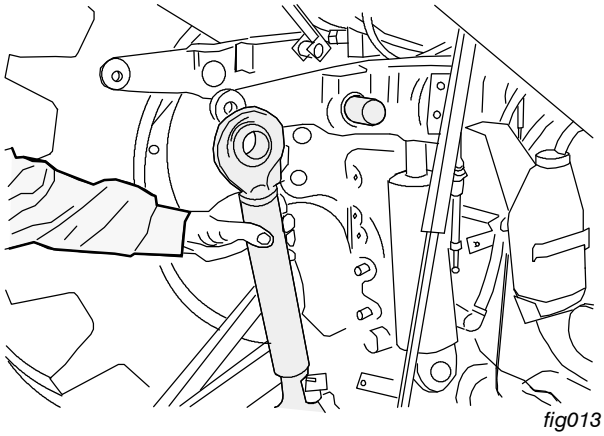


fig013

4. Lower the towing hook. Disconnect the lifting links from the lifting arms.
5. Disconnect the lifting cylinder upper ends from the lifting arms. Disconnect the oil hoses from the lifting cylinder and lower them.

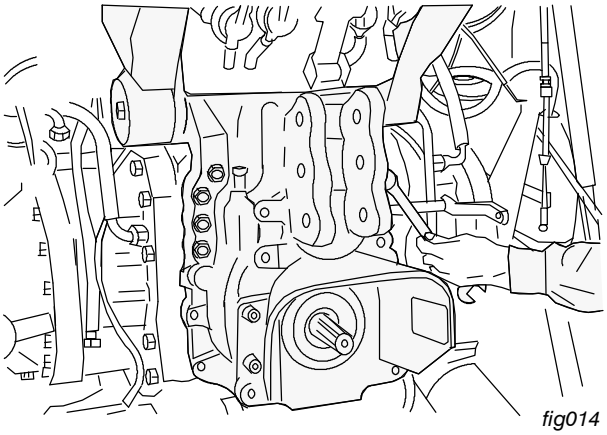


fig014

Note! Support the lifting arms by pushing an iron bar through the hole for lifting cylinder pin and further under the return oil connection for auxiliary hydraulic (the cam on the lifting shaft can damage if the lifting arms can rotate freely).

6. Unscrew the PTO housing fixing bolts. Disconnect the draft sensor connectors. Open the leak oil reservoir cap and release its hoses.
7. Wrap a lifting rope round the PTO housing. Push a tube onto the PTO shaft end. The unit can be kept in balance with the tube.

Note! As a suitable tube can be used tool ET 893 550 (tool for Carraro front axle on Valmet 05–series).

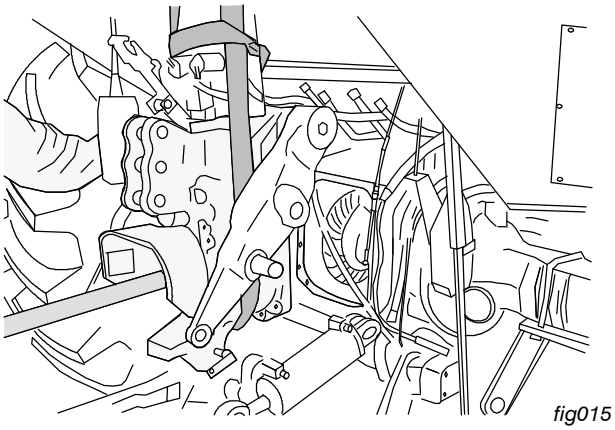


fig015

8. Raise the towing hook with a garage jack about 40 cm and pull the PTO unit straight out from place.

Note! Towing hook prevents PTO unit disengagement, if the hook position is not right.

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Removing PTO clutch

1. Remove the PTO unit.
2. Remove the external lubricating oil pipes and the oil distributor piece.

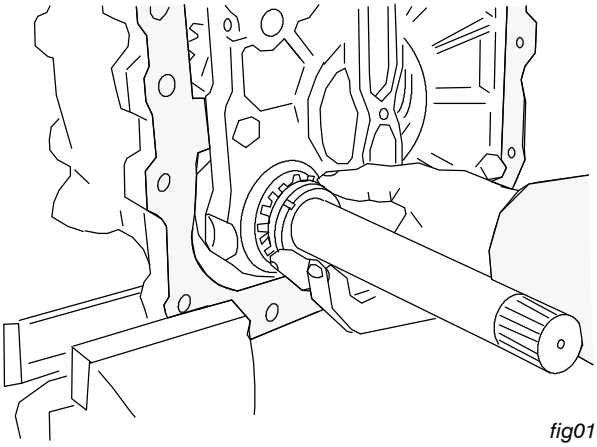


fig016

3. Set the PTO selector lever to the neutral position (middle position). Slacken the ground speed PTO shaft nut for easier removing of the front cover.

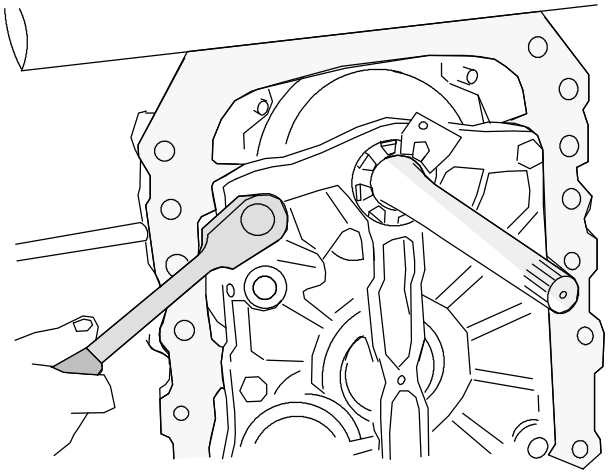


fig017

4. Unscrew the front cover bolts. Pry out the cover with a fitting lever and prevent the selector fork locking ball and spring from springing from their place.

Note! Easiest way to remove the cover is to pry at the PTO shaft front end. There is a guide sleeve on two fixing bolts on upper and lower corner of the cover.

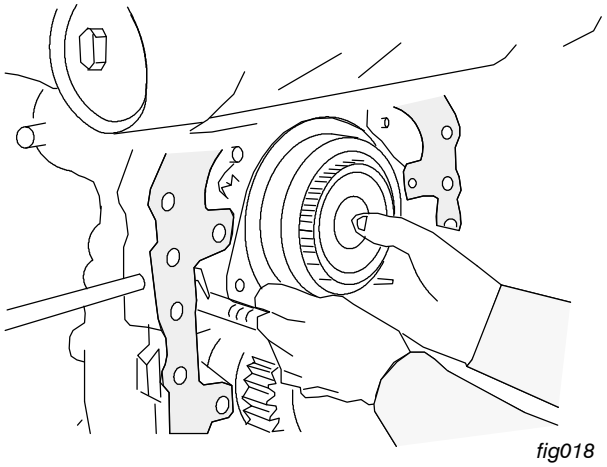


fig018

5. Remove the PTO clutch and shaft from the housing.

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Reconditioning PTO clutch

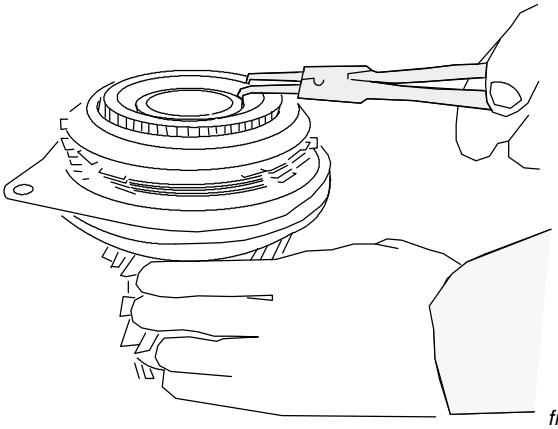


fig019

1. Remove the oil deflector plate from the PTO clutch hub and remove the circlip under the plate and the clutch cup springs release.
2. Remove the clutch discs. Check the condition of the friction and steel discs and the PTO brake plate. Replace damaged parts.

Note! The friction discs and steel discs must be renewed as a complete set. The friction disc must be changed if the grooves on it have disappeared.

3. Remove the piston, if necessary, with compressed air or knock the shaft end against the table. Change the piston seals. Push in the piston.

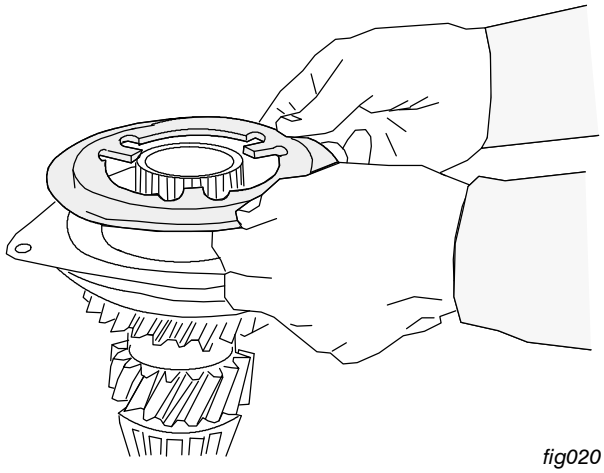


fig020

4. Assemble the clutch by fitting the brake plate on the piston. Then place on the brake plate a plate which has internal lugs.
5. Place the cup springs (5 pcs) on the internal lugs. The first spring concave side against the lugs and then other springs in pairs the concave sides against each other.

Note! The cup spring convexity is 3 mm.

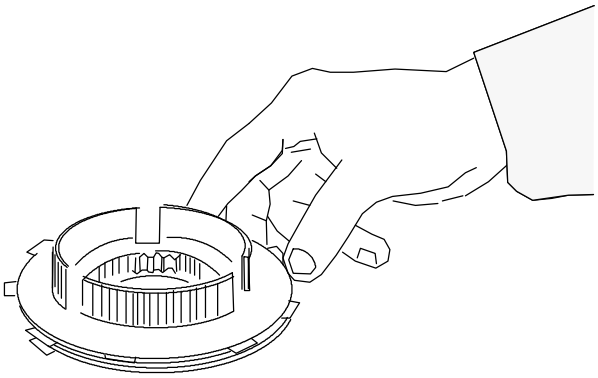


fig021

6. Place the friction and steel discs by turns onto the hub (first friction disc).
7. Fit then the hub/disc pack onto the plate which has internal lugs (and on the cup springs) so that the grooves on the hub engages with the lugs on the plate.
8. Fit the circlip into the hub and force the circlip into its groove by striking with sleeve ET 894 090. Fit the oil deflector plate onto the hub.

Note! Place the clutch shaft on a table and assure that the clutch drum grooves are enough deep. The discs (steel disc) must not be against the groove bottoms when the shaft is in the working position.

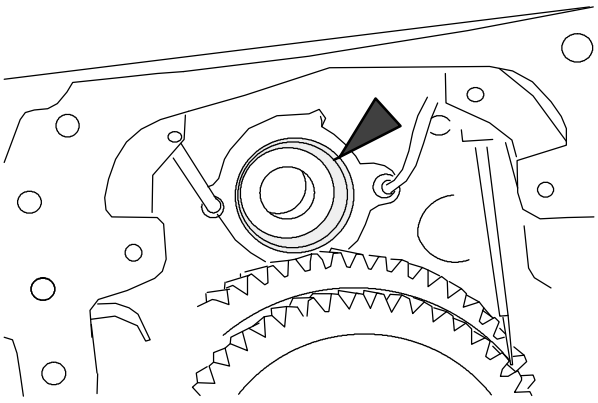


fig022

9. Check the clutch shaft rear taper roller bearing and its race in its location on the housing. Change the parts if necessary.
10. Check also condition of the piston ring type seals at the rear end of the clutch shaft.
11. Check and change, if necessary, the taper roller bearings at the front end of the shaft. Fit all bearings fully home.

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Fitting PTO clutch shaft and adjusting bearing clearance

Note! Adjusting bearing clearance of ground speed PTO shaft (adjustment is done before fitting the front cover).

1. If you have changed the bearings of the ground speed PTO shaft (shaft is attached to the front cover), adjust the taper roller bearing clearance as follows:
– Fasten the front cover to a vice.
– Fit the old shims between the bearings.
– Fit the spacer ring and tighten the shaft nut to **260–280 Nm.**
– Place a dial gauge stylus against the shaft rear end (middle of the gear).

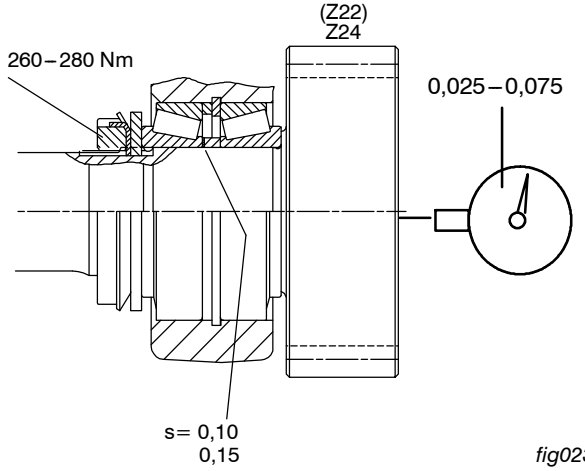
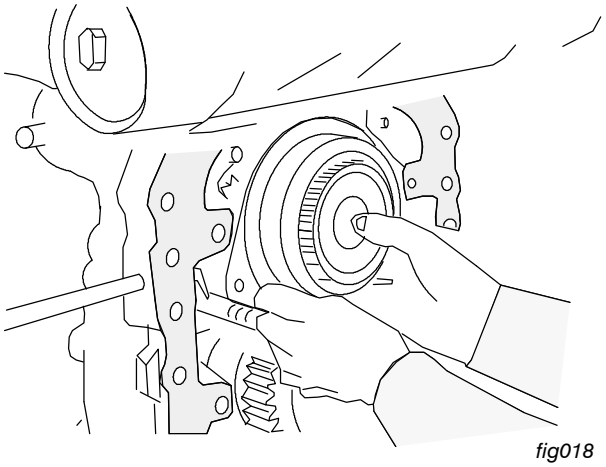


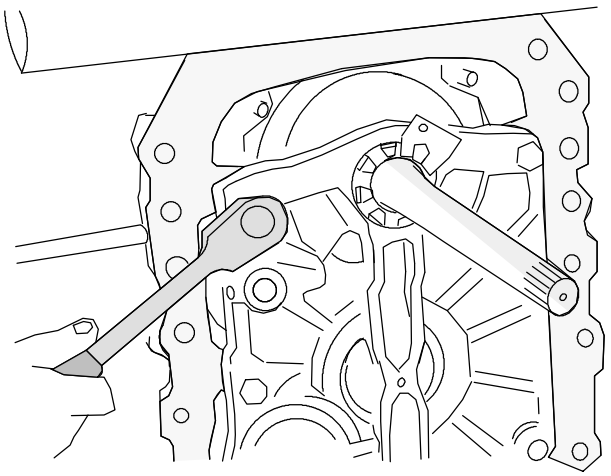
fig023

– Measure the clearance which should be **0,025–0,075 mm.** Rotate the shaft and press it to its extreme positions.
– Increase or decrease shims thickness between bearings.

Note! Shim thickness of 0,10mm and 0,15 mm are available. Tighten the shaft nut after the front cover has been fitted.


fig018

2. Fit the PTO clutch shaft into the housing. Do not damage the piston ring type seals at the rear end of the shaft.
3. Place the clutch drum/shaft onto the clutch disc pack.
4. Fit drift ETV 894 080 into the hole for selector fork rail for holding the locking spring and ball in place.
5. Fit the front cover and make sure that:
– The selector fork rail is pushed through the hole on the cover and that the rail pushes out the drift.
– The PTO shaft front end bearing is pushed into its location on the cover.
– The brake plate holes engage with the pins on the cover.


fig017

6. Tighten the cover bolts to a correct torque. Ensure that the selector fork rail locking ball and spring are in place.

Note! Two bolts on the upper and lower corner of the cover have a guide sleeve.

7. When the cover is in place, tighten the ground speed PTO shaft nut to **260–280 Nm** and lock it with a locking washer.

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Adjusting clutch shaft bearing clearance

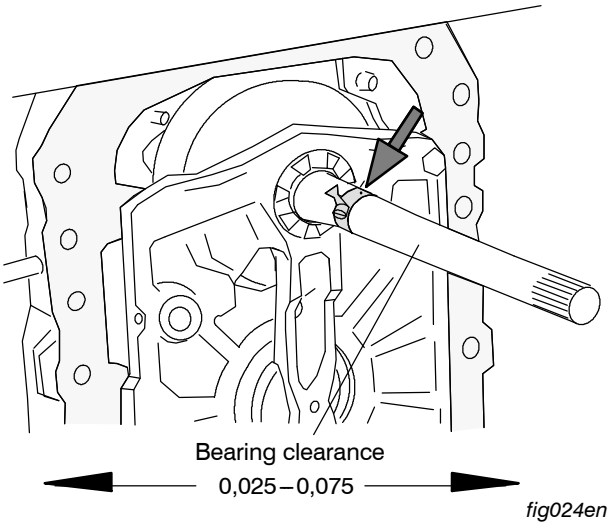


fig024en

– Remove the locking plate and turn the adjusting nut on the shaft until there is no clearance in the clutch shaft taper roller bearings.
– Place a dial gauge stylus against a hose clip pressed on the clutch shaft.
– Unscrew the adjusting nut so that the clearance of **0,025–0,075 mm** is obtained for the bearings. Rotate the shaft and press it to its extreme positions when measuring the clearance.

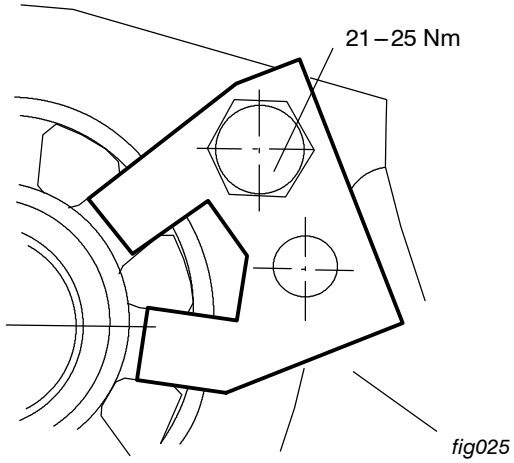


fig025

– Lock the adjusting nut with a locking plate and tighten its fixing screw to **21–25 Nm**. Apply Loctite 242 to threads.

Note! One step of the adjusting nut corresponds to about 0,09 mm alteration on the clearance value. Note that the locking plate can be fitted in two different way which doubles the number of steps.

8. Fit the oil pipes and the oil distributor piece.
9. Fit the PTO unit.

Removing selector fork and PTO shaft gears

1. Remove the PTO unit.
2. Carry out procedures **2–5** on page **2** in this code.

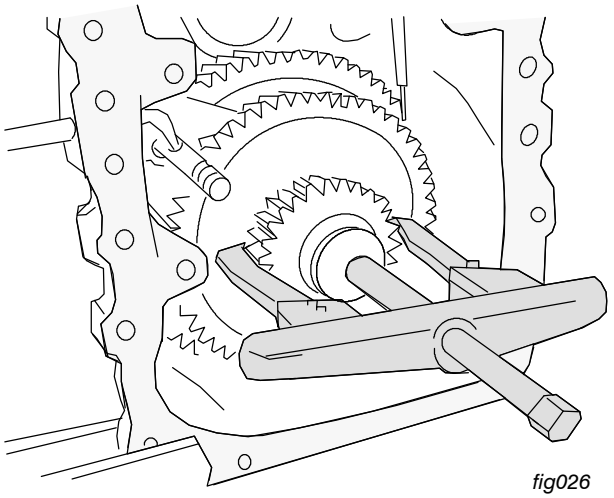


fig026

3. Release the locking washer and unscrew the locking bolt. Remove the flange and pull out the roller bearing inner race as above.

Note! Tractors without ground speed PTO: Pull out the ball bearing and remove the spacer sleeve and ring in front of the gearwheel.

4. Remove the small ground speed PTO gearwheel (if fitted) and the middle gearwheel for engine PTO 1000r/min.

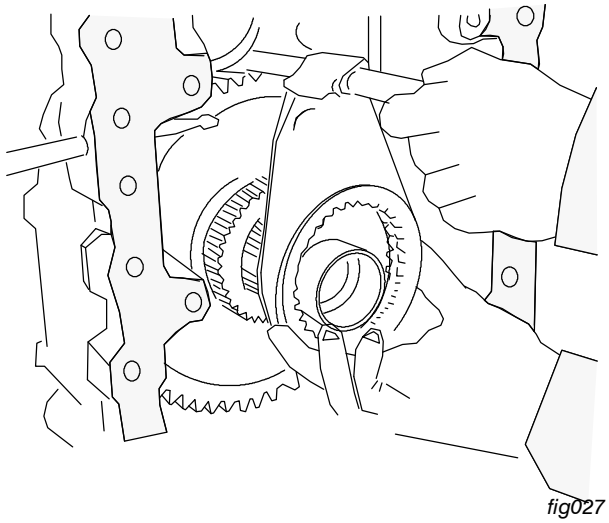


fig027

5. Pull the selector fork and its rail out from the housing. Change, if necessary, the inner selector lever which has a round–shaped end. Fit a new fork onto the rail and secure it with a locking pin.

Note! Fit the locking pin of the outer selector lever so that its split side points forwards.

6. Remove the larger circlip for the oil seal retainer at the PTO shaft rear end. Knock at the front end of the hollow shaft round the PTO shaft and remove the PTO shaft/hollow shaft. Remove the big gearwheel from the PTO housing.
7. Check the PTO shaft seal and o–rings and change them if necessary. Check also the PTO shaft rear ball bearing.

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Fitting gears and selector fork

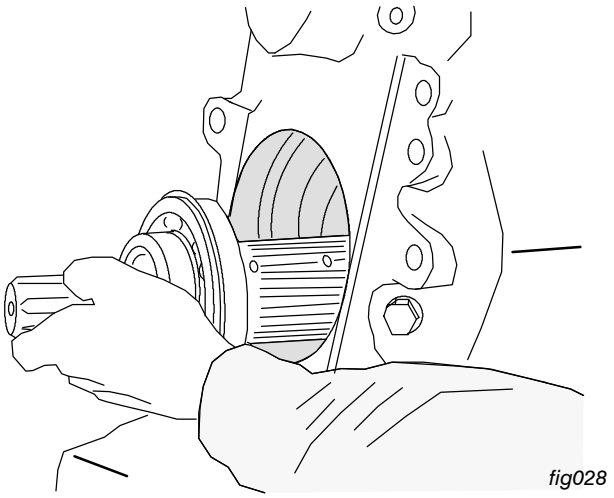


fig028

1. Push the PTO shaft/hollow shaft/ball bearing as a complete unit into the housing. Place the impulse disc onto the hollow shaft splines and fit the spacer ring in front of the disc.

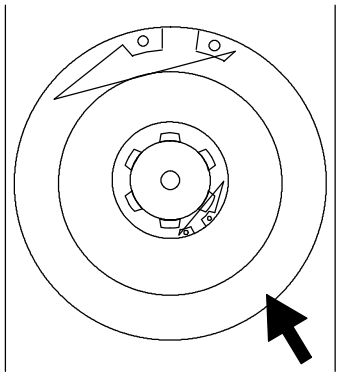


fig029

2. Fit the big gearwheel onto the shaft before the shaft is fully home. Tap at the PTO shaft rear end until the rear ball bearing is in its location fully home. Fit the seal retainer and the larger circlip.

Note! There are shims between the seal retainer and the ball bearing. The clearance between these parts is adjusted to zero. Use old shims. If necessary, the clearance can be measured by placing a dial gauge stylus against the seal retainer. Available thickness of shims; 0,10 0,15 and 0,50 mm.

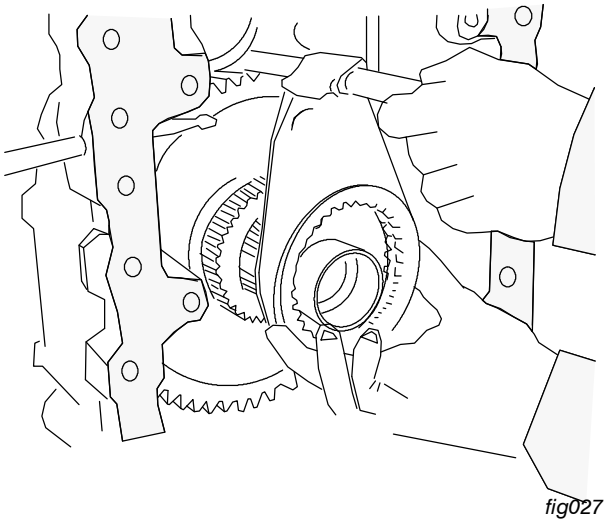


fig027

3. Fit the sliding coupler onto the fork and place the fork/rail into the housing so that the sliding coupler engages onto the teeth on the big gearwheel.

Note! Fit the selector lever round–shaped end into the hole on the rail.

4. Fit the middle gearwheel and then the small gearwheel and the roller bearing.

Note! Tractors without the ground speed PTO: fit the roller bearing, the spacer ring and the sleeve in front of the small gearwheel.

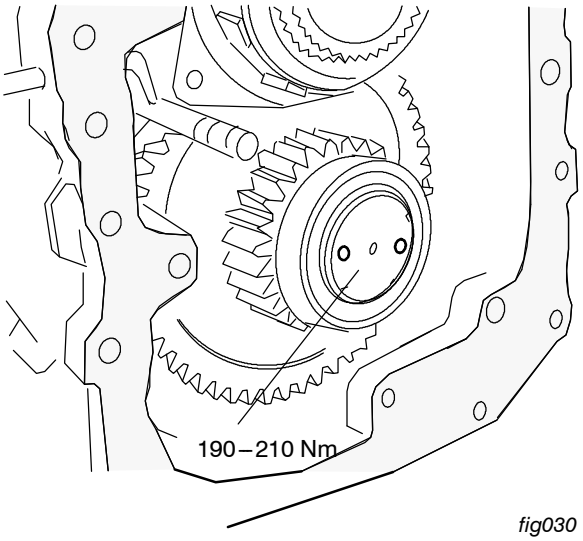


fig030

5. Fit the flange and tighten the locking bolt to **225 Nm** and lock it with the locking washer.

Note! Tractors without the ground speed PTO: Fit the ball bearing and then locking flange or locking bolt.

6. Carry out procedures **1–7** on page **4** in this code.
7. Fit the PTO unit.

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Fitting PTO unit

1. Clean contact surfaces between the PTO housing and the gearbox and apply sealing compound to the surfaces.

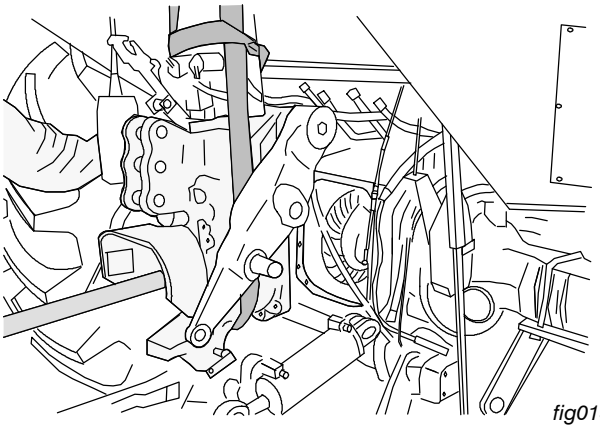


fig015

2. Push the PTO unit straight into place so that the PTO clutch shaft front end (and ground speed PTO shaft front end) engages with their splines.

Note! Before fitting the PTO unit, put the ground speed PTO shaft coupling sleeve onto the rear end of the ground speed PTO output shaft in the gearbox.

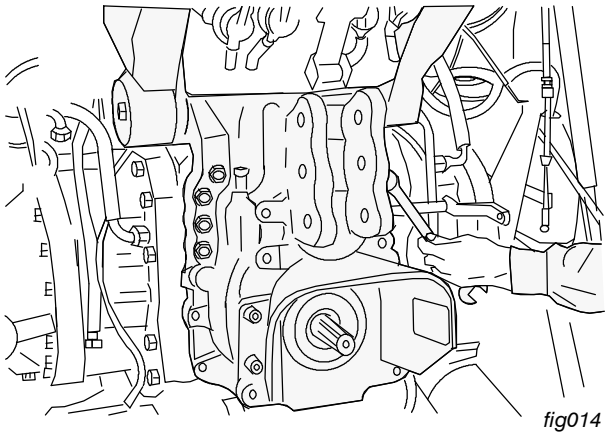


fig014

3. Tighten the PTO housing bolts to a correct torque. Connect the hoses to the lifting cylinders. Connect the lifting cylinder upper ends with pins to the lifting arms.
4. Connect the draft sensor connectors. Fit the leak oil reservoir hoses and the reservoir cap.
5. Connect the pipes to the quick–action couplings. Slacken, if necessary, the quick–action couplings in their bracket for easier work.
6. Fit the PTO control cable. Connect the pick–up hitch release control. Connect the lower joint of the levelling screw control rod.

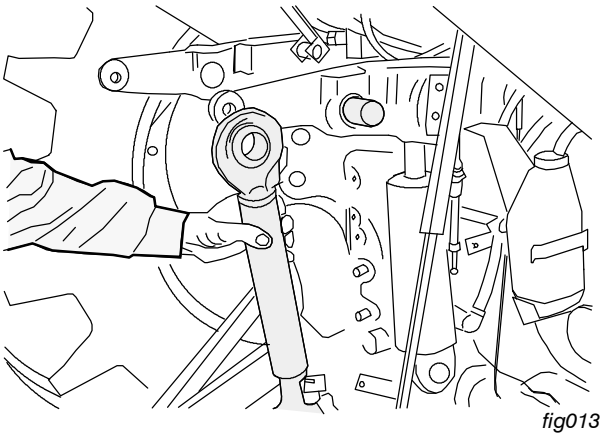


fig013

7. Connect the lifting link upper ends to the lifting arms. Fit the top link. Connect the pick–up hitch lifting links.
8. Fill the transmission with oil.
9. Fit the position sensor and adjust it.

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Changing cassette seal of PTO shaft

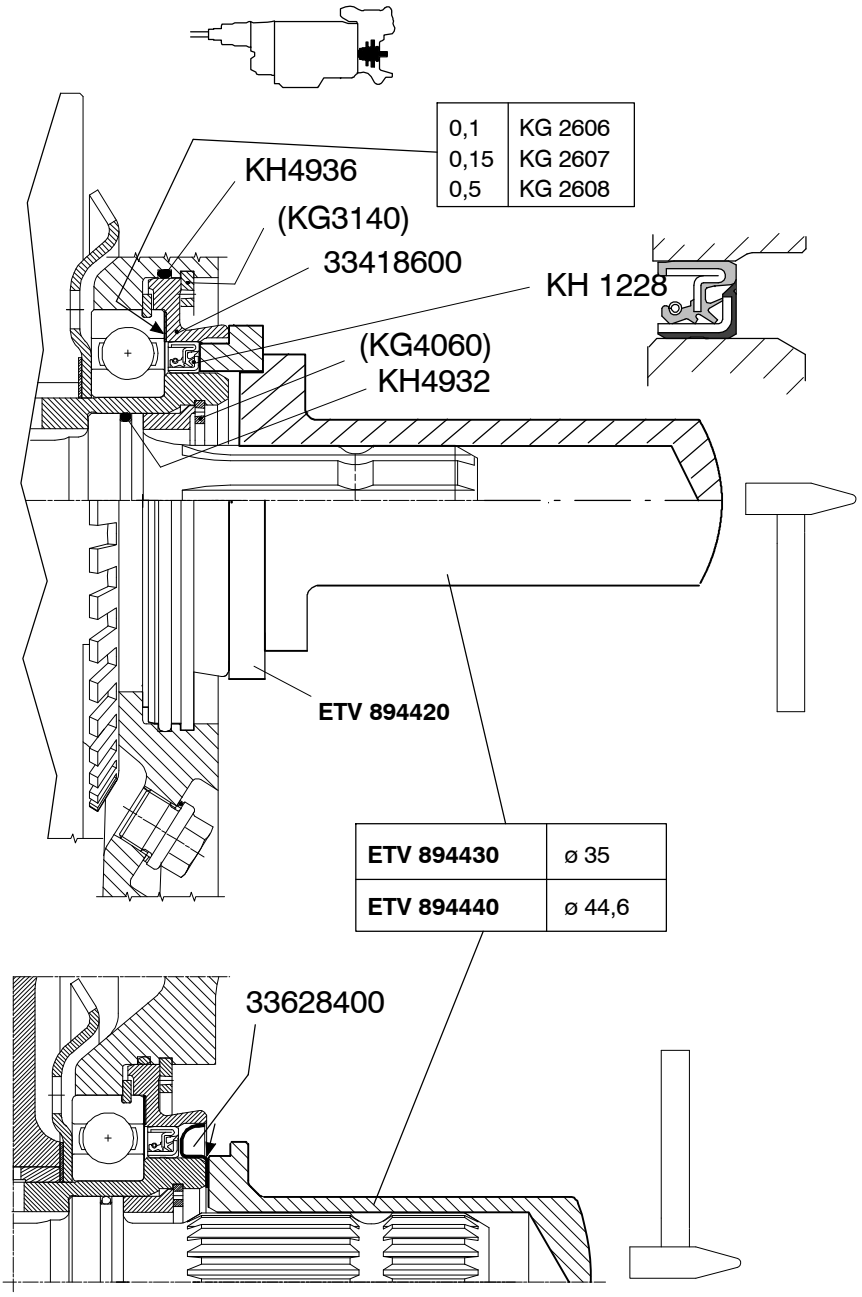


fig031

1. Drain the oil from the transmission. Remove the PTO shaft protective tube . Remove the PTO shaft seal retainer (33418600) large circlip (KG3140) and pry out the retainer (33418600) with two large screwdrivers. Also the protective (33628400) cup and the cassette seal (KH1228) are removed.
2. Clean the parts and the housing bore. Change, if necessary, the seal retainer o–ring and oil it.
3. Fit the seal retainer (use same shims between the retainer and the bearing. When necessary, the play can be measured with a dial gauge and new shims can be fitted). Fit the seal retainer large circlip.
4. When the seal retainer is in place, fit the cassette seal as follows:
   – lubricate the seal inner and outer surfaces with oil.
   – tap the seal into place by using ring ETV 894420 and sleeve ETV 894430 (PTO shaft ø 35 mm) or sleeve ETV 894 440 (PTO shaft ø 44,6 mm).
   – fit the seal protective cup by using one of the above mentioned sleeves.

Note! It is very important, that the seal is pushed straight into its location. That is why the fitting sleeves and the ring must be used.

5. Fill the transmission housing with oil. Start the PTO and check for leaks.

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50. Brake system

51. Brake system

52. Parking brake

53. Trailer brake system

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Technical data

Service brakes are hydraulically controlled disc brakes running in oil.

Models with final drives 700 (T161c–T171c, T151eh–T191h, T151eLS–T191LS) have hydraulically boosted service brakes.

Number of friction discs per brake	5 pcs
Friction disc diameter	
– final drives 650	224 mm
– final drives 700	242,5 mm
Friction surface per brake	
– final drives 650	3690 cm^2 / org.
– final drives 700	4272 cm^2 / org.
Function	Hydraulic, with two master cylinders
Parking brake	
– T121c–T171c	Mechanically controlled, acting on the foot brakes
– T121h–T191h, T151eLS–T191LS	Driving brakes engaging with spring, disengaging with hydraulic pressure. Controlled with shuttle lever. When engine is not running, the parking brake is applied.

Tightening torques

Brake disc attaching flange	
– final drives 650	80 Nm
– final drives 700	45 Nm
Brake housing–final gear housing:	
– 10.9 (M12)	125 Nm
Brake housing–gearbox	270–330 Nm
Brake pipes–master cylinder	20 Nm
Master cylinder bolts	23 Nm
Rear wheel nuts	550 Nm
Cab attaching bolts	see code 811.1

Settings

Brake pedal free travel (latched together)	
– final drives 650	70–80 mm
– final drives 700	35–45 mm
Parking brake cable adjusting value	1–2 mm

Final drives 650:	
Brake fluid	SAE J1703
Brake fluid reservoir	0,5 l

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Brake system, construction

Unboosted brake system (with final drives 650)

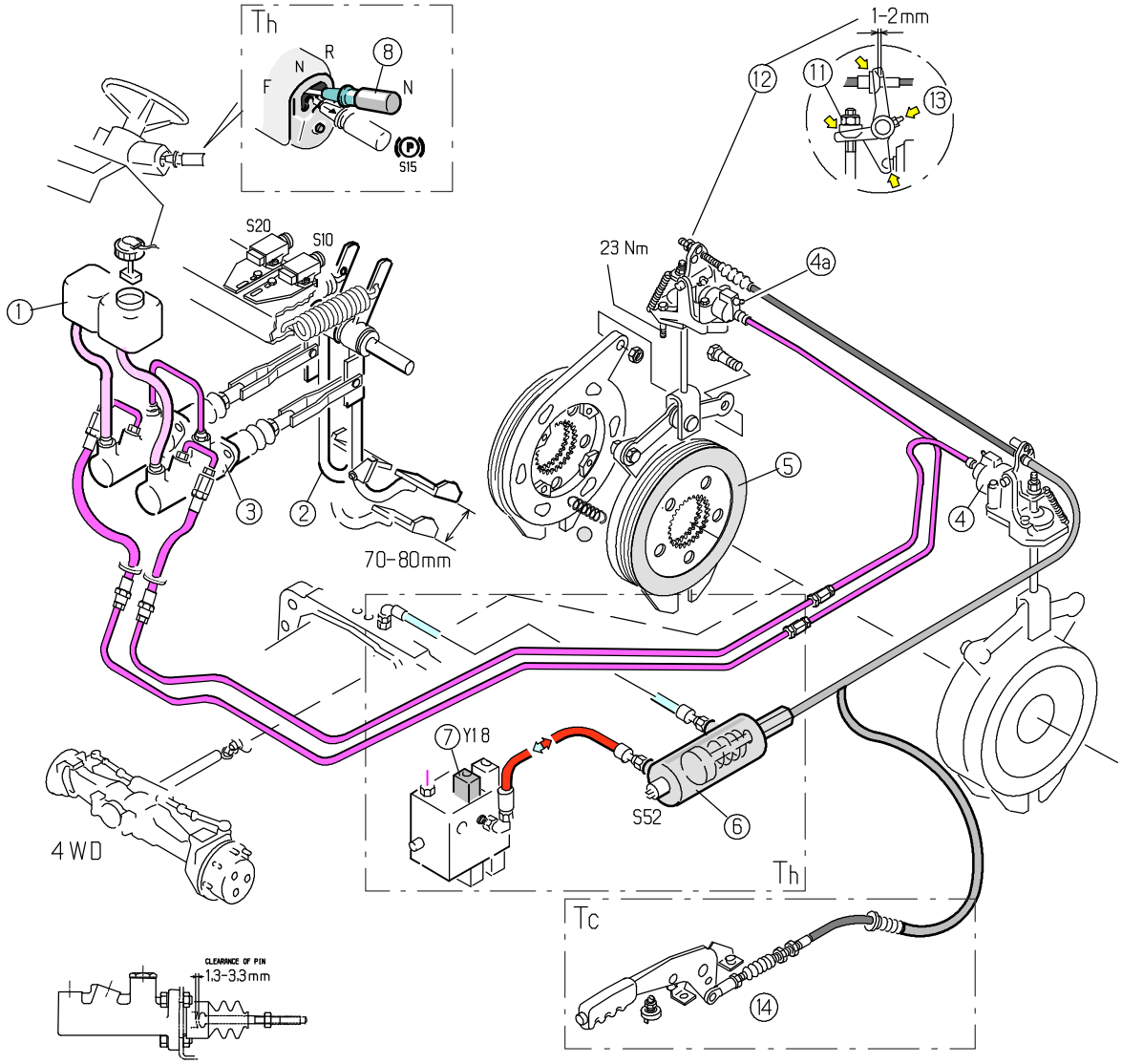


fig001

The oil bath multi–disc brakes are located on the rear axle between the differential and final drives. The brakes operate hydraulically from the brake pedals. When both brake pedals are depressed the front wheel drive is engaged automatically in order to provide braking function at the front wheels. The pedals can be connected together and used as running brakes or separated and used individually as steering brakes. The brakes can be adjusted by means of adjusting nuts which are fitted on the rear axle.

Parking brake

T121h–T131h

The parking brake is electro–hydraulic and is controlled with a shuttle lever. When engaging the parking brake, the pressure exhausts from the cylinder operate the parking brake and a strong spring engages the tractor brakes. At the same time the control unit disengages the transmission. With this system the tractor brakes are always on when the engine is not running.

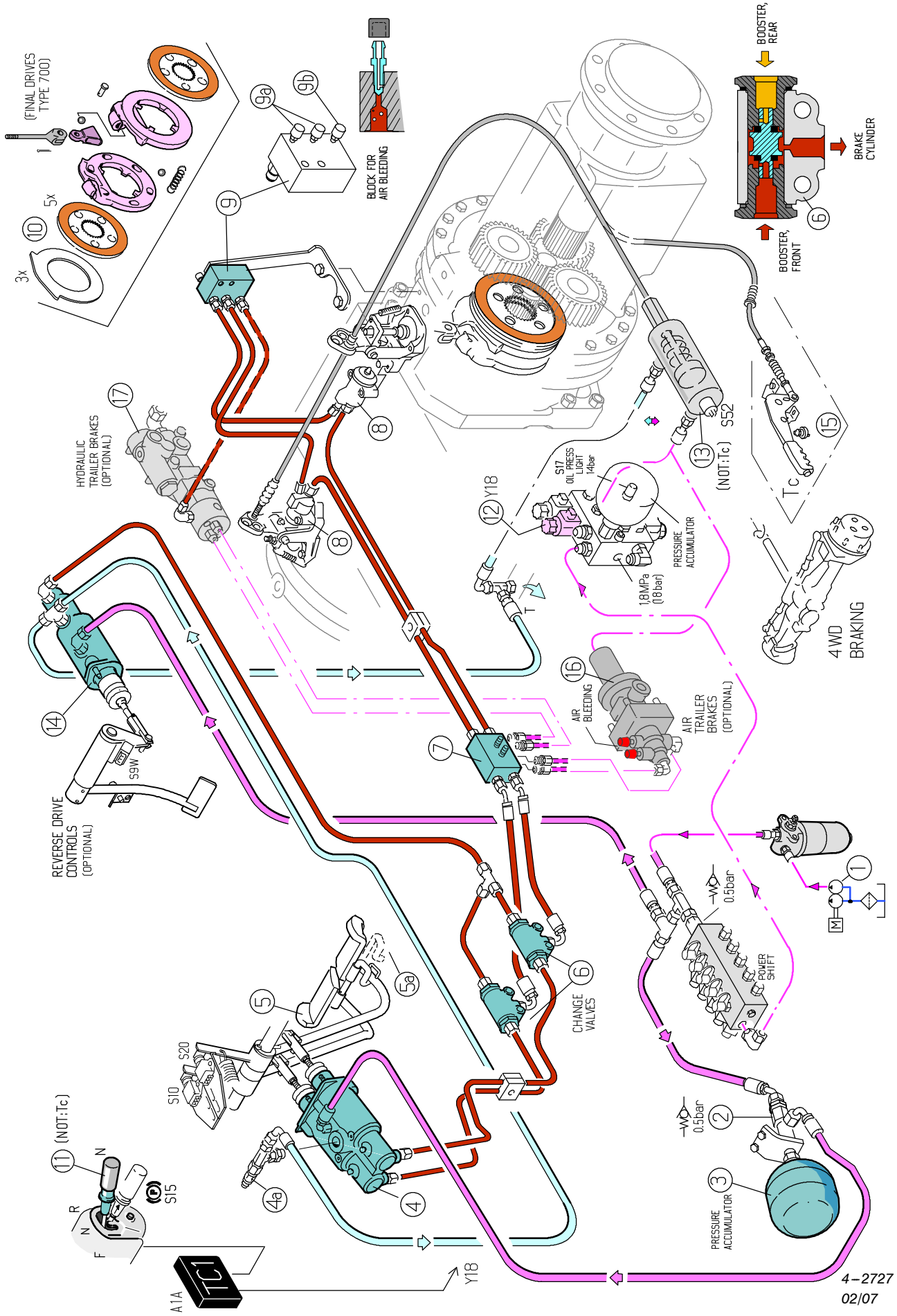
T121c–T131c

The parking brake is mechanically operated and it acts on the foot brakes.

1) Brake fluid container (with electrical oil level indicator)
2) Pedal
3) Main cylinder
4) Brake cylinder
4a) Bleeding screws on both cylinders
5) Brake discs
6) Parking brake cylinder
7) Solenoid valve
8) F/R shuttle and parking lever
11) Adjusting nut (drive brakes)
12) Adjusting nut (parking brake)
13) Grease nipple. One grease nipple on both sides
14. Parking brake in Tc–tractors
– Brake valve for trailer brakes is optional equipment.

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Boosted brake system (with final drives 700)



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– Boosted brake system is in T1 Series tractors with final drives 700.
Brake booster uses the pressure (18 bar) of low pressure hydraulics. The boost pressure is used to produce needed brake pressure in addition to pedal force. Use of steering brake is also possible in this system.

The brake system uses the **transmission oil** as brake fluid. There is no need for separate brake fluid container because the tank line capacity works as a container when brake pedals are up.
Brake cylinders (8) are of a new type because the need of different connections and gaskets that are suitable for mineral oil.

– Change the brake circuit oil when changing transmission/ hydraulic oil.
The oil in the brake circuits will not be changed when changing the transmission/hydraulic oil. Because of this after every other oil change the brake circuit oil has to be changed by bleeding. Also when repairing, the system has to be filled and bled in the same way.

– If the engine stops and the ignition key is NOT TURNED, the parking brake solenoid remains charged and parking brake remains disengaged. Parking brake engages slowly when the pressure of low pressure hydraulics drops low enough (hydraulic pump is not rotating). This takes 10...30 seconds depending on the situation.

If the engine is stopped by TURNING the ignition key, parking brake solenoid discharges immediately and parking brake engages. This is how the emergency braking can be done if the service brakes are not working for some reason.

– A hydraulic and air pressure valve is available as extra equipment for the trailer brake operation.

– The bleeding of the brake system have to be carried out in the given order (see code 512.1)

1) Pump of low pressure hydraulics (1,8 MPa / 18 bar)
2) Non–return valve
Ensures the needed pressure for efficient braking, even if pressure in other part of low pressure circuit drops temporarily due the use of multi–disc clutches or permanently due the breakage of pipe / hose.
3) Pressure accumulator
– With help of pressure accumulator it is possible to brake few times even if engine is stopped.
– Pressure switch (S17) of low pressure hydraulics warns about low pressure.
4) Brake booster (two–piece)
4a) Quick–action coupling. Quick–action coupling is only for bleeding carried out in assembly plant.
5) Brake pedals. Brake light switches S10 and S20 in the pedals.
5a) Latch for brake pedals
6) Shuttle valve
7) Distribution block
8) Brake cylinders
9) Bleeding block
9a) Bleed nipples (2pcs) of work cylinders
9b) Bleed nipple of trailer fluid brake valve (extra equipment)
10) Brake disks (5 friction disks and 3 intermediate disks per side)
11) Lever of shuttle and parking brake
12) Solenoid valve of parking brake
13) Cylinder of parking brake
14) Brake booster (one–piece)
15) Mechanical parking brake (Tc models)
16) Control valve of trailer air pressure brakes
17) Hydraulic brake valve of trailer

Parking brake

T161c–T171c

The parking brake is mechanically operated and it acts on the foot brakes.

T151eh–T191h, T151eLS–T191LS

The parking brake is electro–hydraulic and is controlled with the shuttle lever. When engaging the parking brake (parking brake and 4WD indicator lamps light on instrument panel), the pressure exhausts from the cylinder operating the parking brake and a strong spring engages the tractor brakes. At the same time the control unit disengages the transmission. With this system the tractor brakes are always on when the engine is not running.

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Brake cylinders

Unboosted brake system (with final drives 650)

Master cylinder

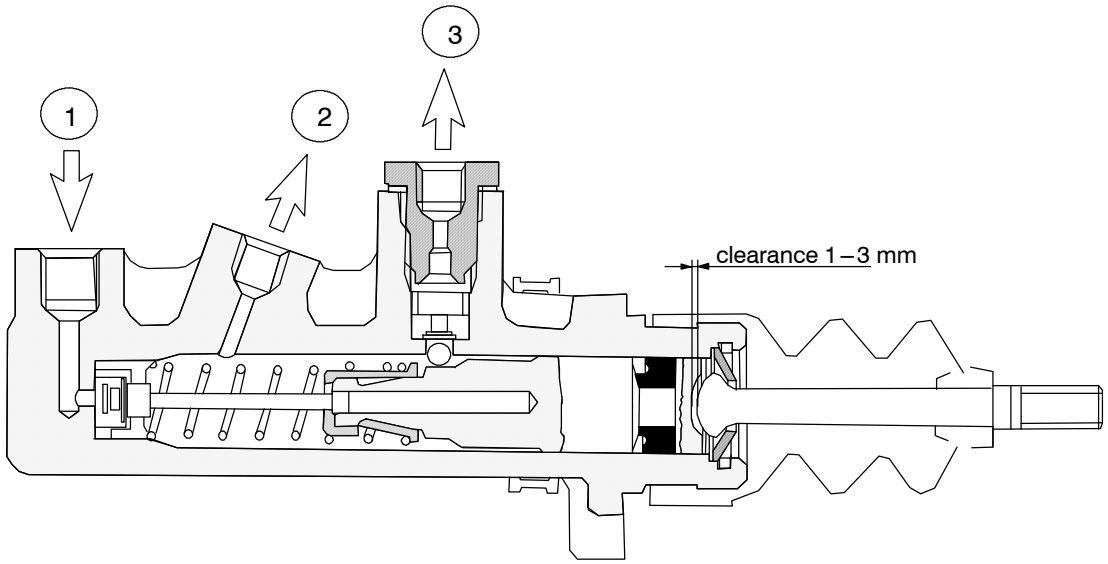


fig002

Brake cylinder

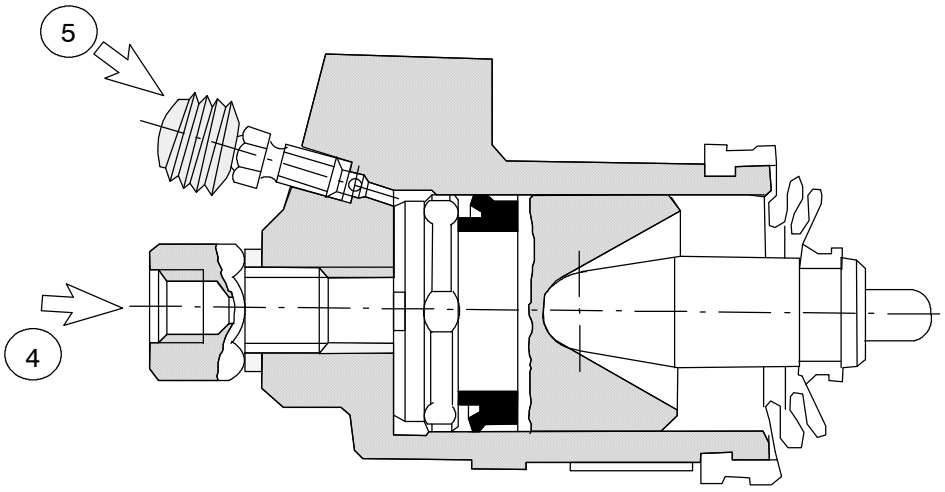


fig017

The brake fluid flows from the reservoir through pipe (1) into the master cylinder. When the pedals are depressed, the non–return valve at the front end of the master cylinder closes preventing oil from returning to the reservoir. The fluid, now under pressure in the cylinder, flows through pipe (2) to hole (4) at the front end of the brake cylinder behind the piston and forces out the thrust rod.

The valves and the intermediate pipe (3) in the master cylinders serve as an equalising mechanism, if the mechanical setting of the two brakes differs. When the pedals are depressed, the pistons actuate the valves so that they open and any pressure differences in the brake circuits are equalised through the intermediate pipe (3).

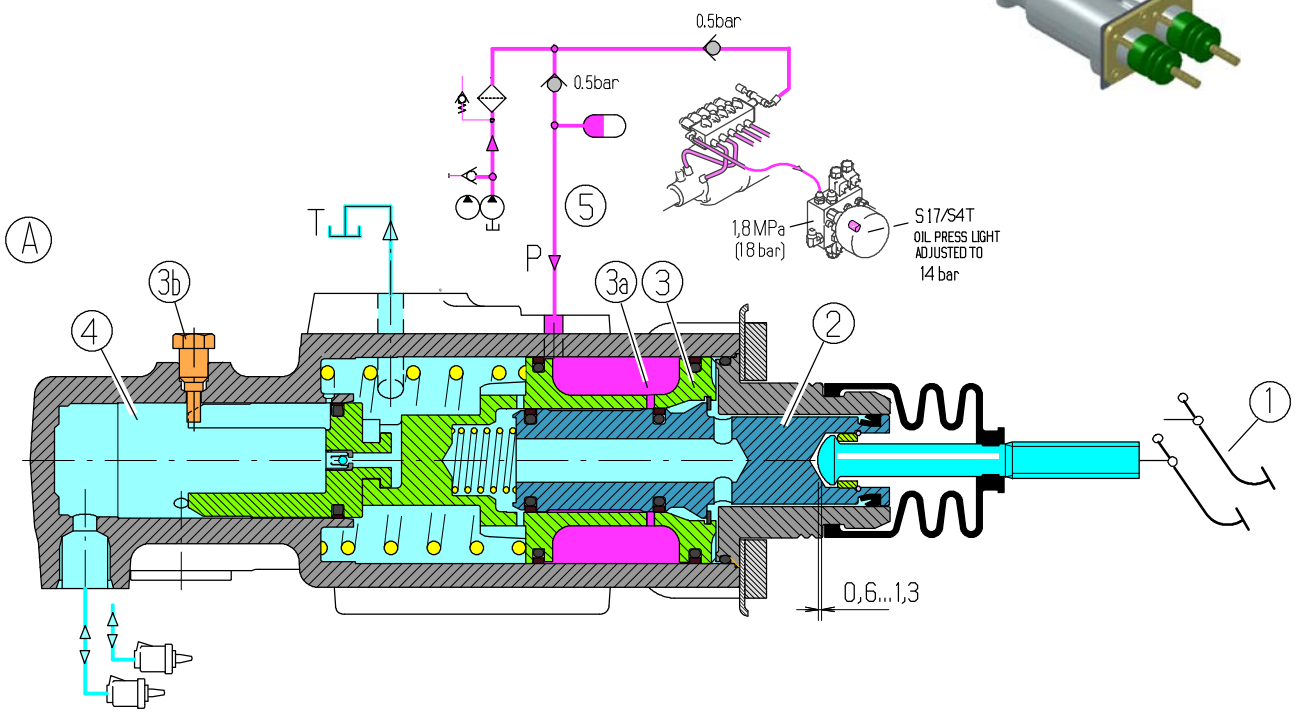
If only one of the brakes is applied, the valve is opened by the piston, thus pressurising the intermediate pipe (3). This causes the valve in the other (not actuated) master cylinder to close. Oil under pressure now flows from the master cylinder which is being applied to the corresponding brake cylinder.

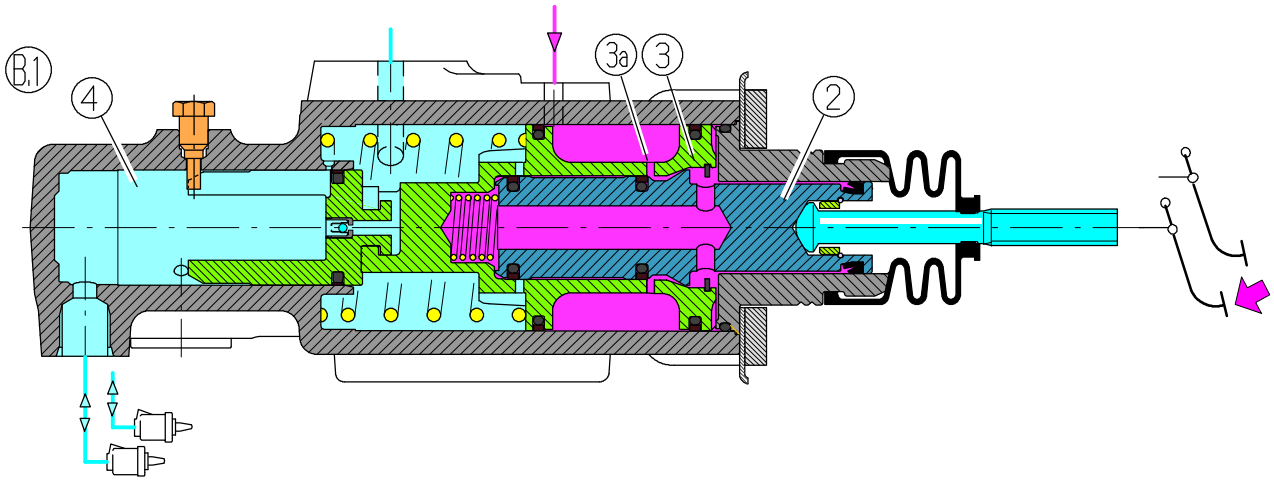
The brake system bleeder nipples (5) are placed on top of the respective brake cylinders.

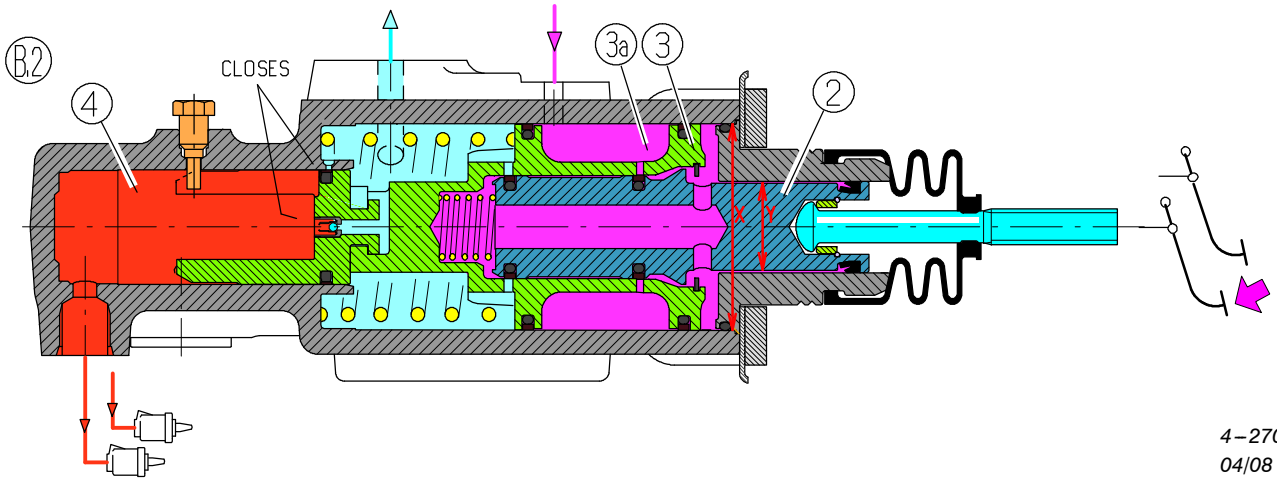
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Hydraulically boosted brake system (with final drives 700)









4–2705
04/08

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Brake booster uses the pressure (18 bar) of low pressure hydraulics. Full pressure is not used in normal braking.

A) Brake pedal (1) is not depressed.

Pressure of low pressure hydraulics affects to the pressure space of the piston **3**. The spool **2** keeps the drilling **3a** on the piston closed.

The space **4** of main cylinder is unpressurized and is connected to tank line T that is kept open by piston **3**. Booster tank line **T** works as a reservoir for main cylinder when pedals are up.

B1) Brake pedal is depressed

The spool **2** has been moved to left and connection **3a** to space on the right side of the piston **3** is opened. The spring in front of the spool **2** compresses.

B2) As above

Pressure gets to the right side of the piston **3** and moves the piston left. At the same time the pressure in the space **4** of the main cylinder and in the brake cylinder increases. Braking starts.
Connection through the drilling **3a** disconnects soon after the piston have started moving.

Boosting effect is developed when the effective area of the pressure to left is larger (helps pressure developing of the main cylinder) than to right (**X**>**Y**).

The springs keep the balance so the boost pressure that is proportioned with pedal pressure affects on the right side of the piston **3**.

The spool **2** touches the piston **3** only when the “knee point” of boosting is passed. Same happens if braking is carried out without boost pressure.

– There is a pressure accumulator **5** in the pressure line of the system. The accumulator makes it possible to brake few times even if the pressure of low pressure hydraulics has been dropped for example due the dying–out of engine. In low pressure hydraulic circuit there is a pressure switch (**S17**/**S4T**), which warns about decreasing of the pressure in tractor’s low pressure system.

– Use of steering brake is possible. If only the other pedal is depressed, non–return valve closes connection to the opposite main cylinder. If both pedals are depressed, main cylinders are connected and the pressure in both is same.

1) Brake pedals (can be unlatched to work separately)
2) Spool
3) Piston
   3a) Drilling
   3b) Guide. The guide prevents the piston from rotating around its own axis (air grooves are located only on the certain part of periphery of circle and they must be up).
4) Main cylinder
5) Pressure accumulator

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Brake mechanism (with final drives 650)

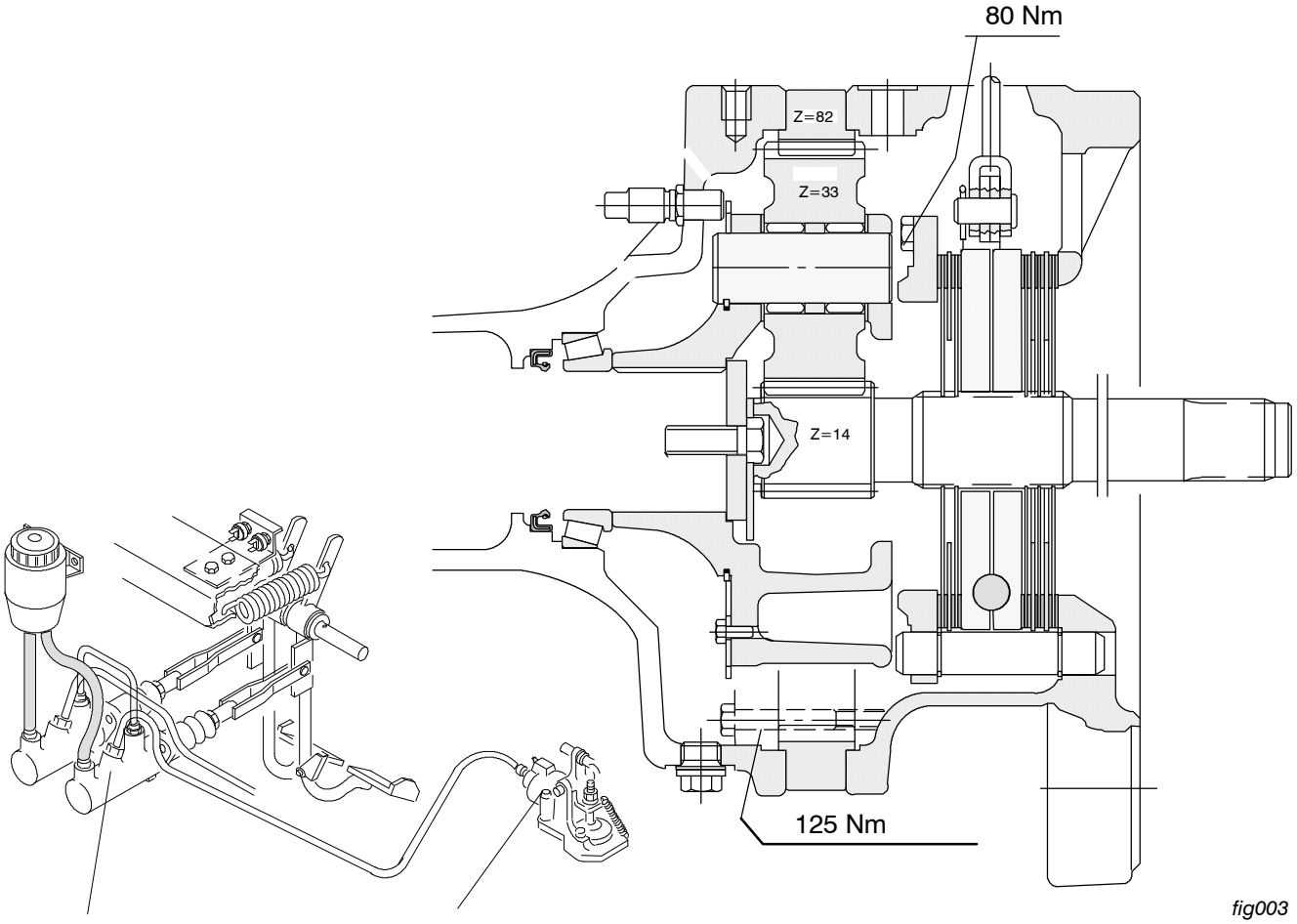


fig003

Master cylinder

Brake cylinder

The brake master cylinders and the brake fluid reservoir are positioned to the right on the cab front wall. The brake system has two brake cylinder with in–built equalising valves, which ensure even braking action when the brake pedals are latched together.

The brake discs are fitted on splines on the inner drive shaft in the brake housing. The brake system and the gearbox use the same oil.

The bleeder nipples are positioned on top of the brake cylinders

During brake application the force from the brake cylinders is transferred, via levers, to the brake discs. The thrust plates turn in opposite direction and the balls between the plates force them against the brake discs and brake action is obtained.

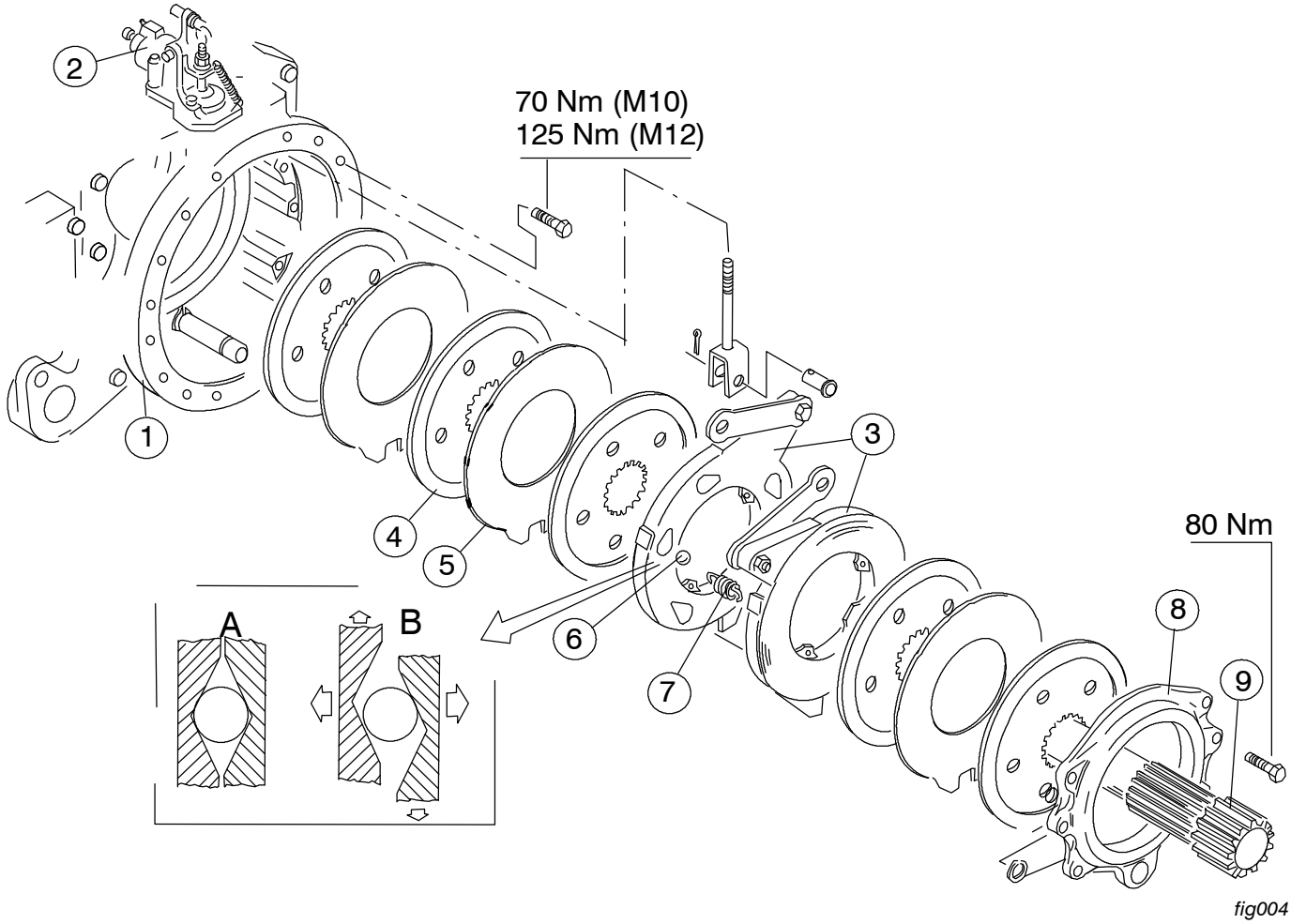


fig004

1. Brake housing
2. Brake cylinder
3. Application plates
4. Brake discs
5. Intermediate discs
6. Brake balls
7. Return spring (4 pcs per brake)
8. Support brake
9. Inner drive shaft

A) Application plates and balls in neutral position
B) Movement of application plates when braking

Brake mechanism (with final drives 700)

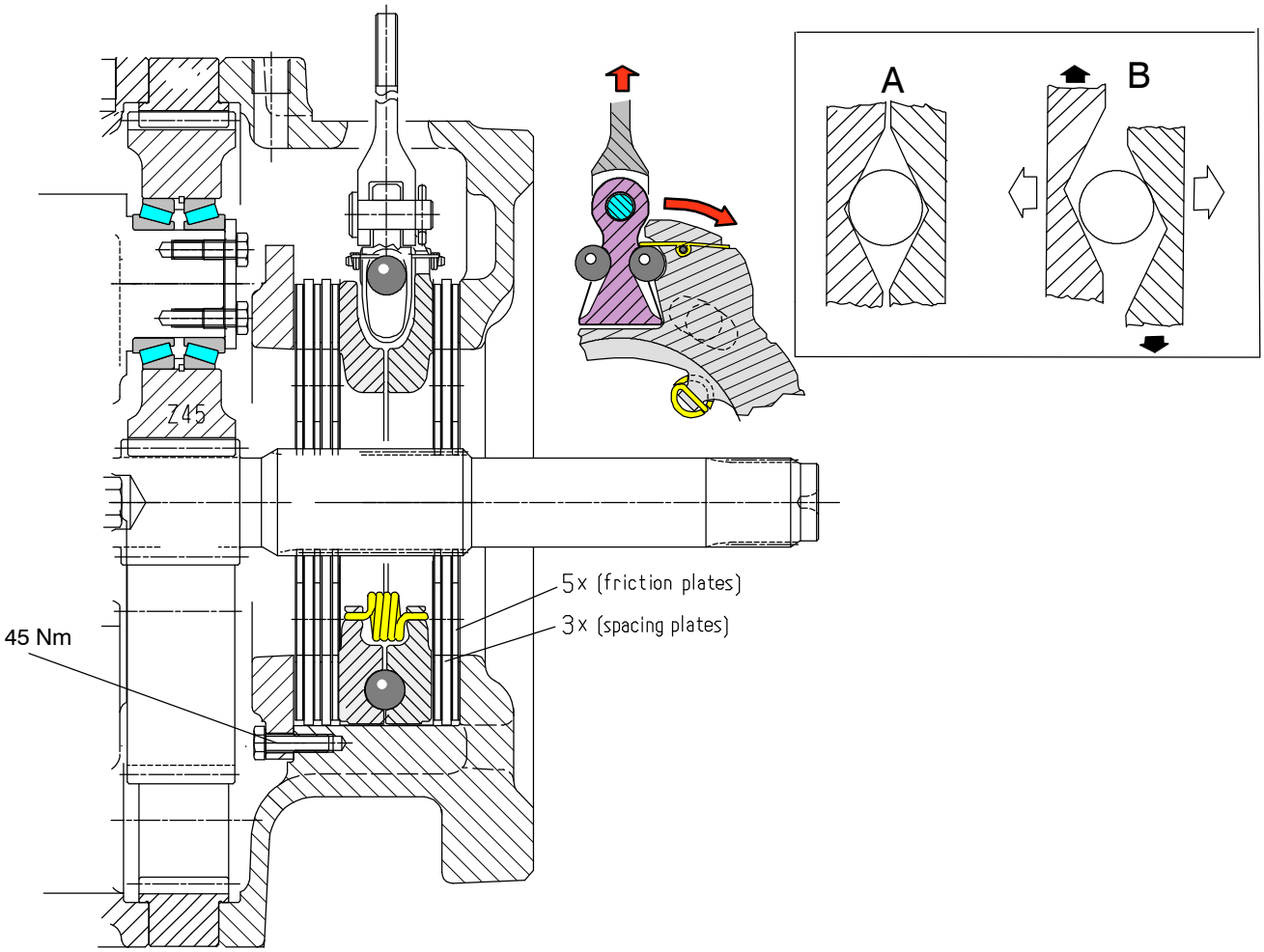


fig018

In connection with final drives 700 the brake mechanism is different. In this system the application plate pressing force agains the brake discs is obtained by the tapered part, sides of which press the steel balls which turns the application plates causing the brake force.

There is not an anchor bolt in the lower part of the brakes, as in connection with final drives 300–650. In final drives 700 there are sholders in the intermediate discs and in the application plates which engage in the notches casted in the rear axle housing.

The brake discs are fitted on the drive shaft splines so that the holes in the discs are tried to place in the same line in order to facilitate free oil flow.

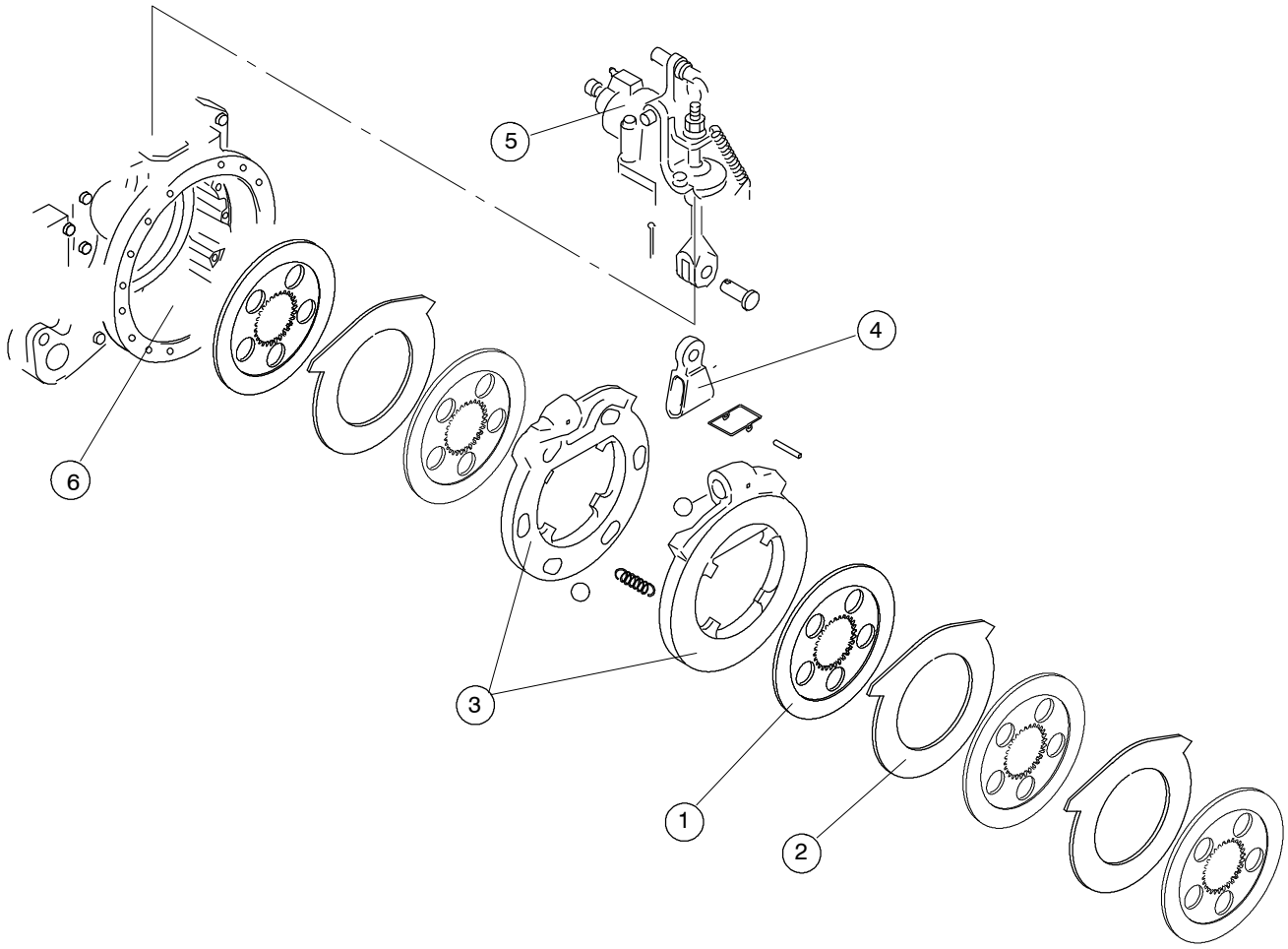
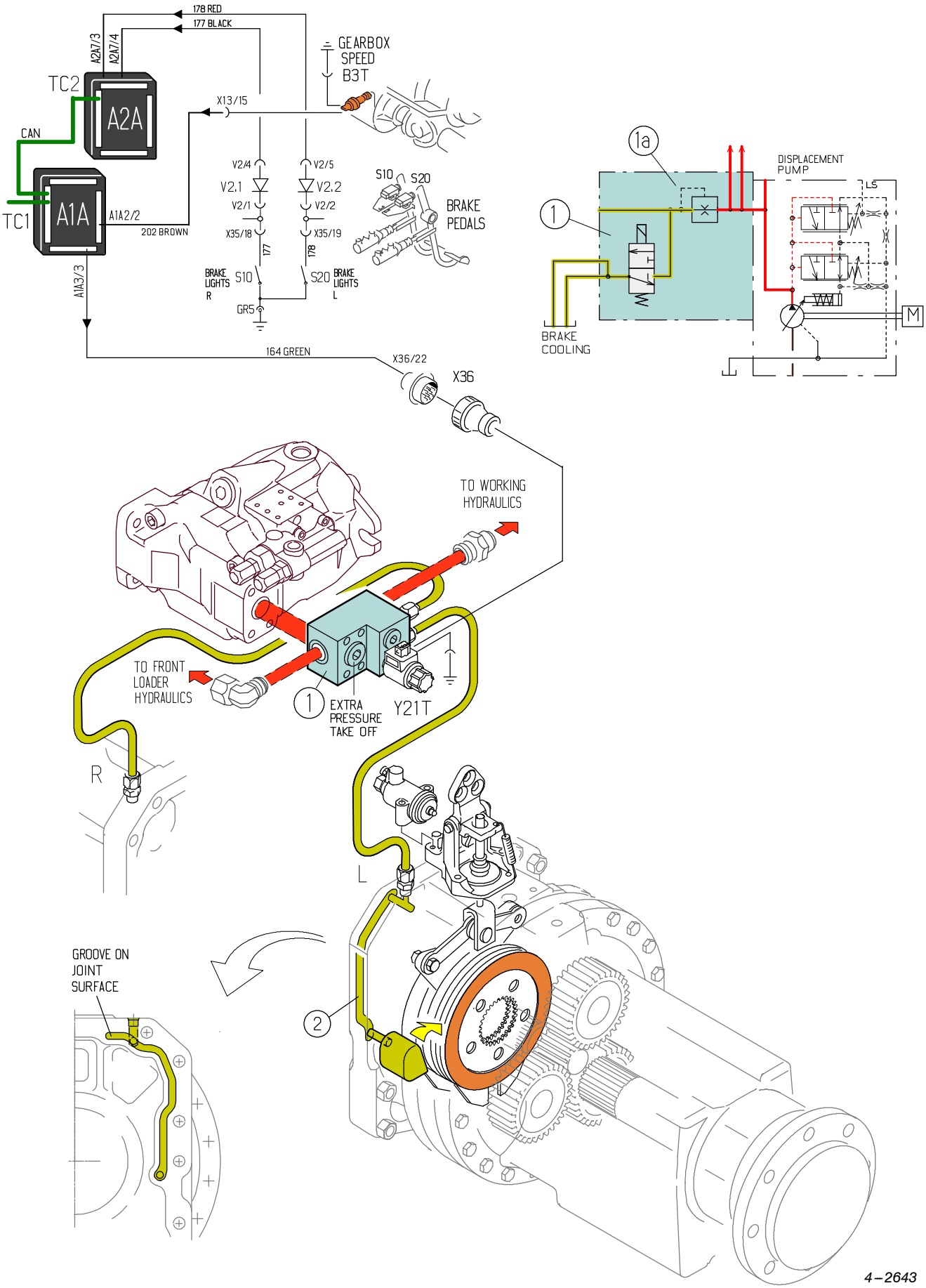


fig019

1. Brake discs (5 pcs). Holes in the same line.
2. Intermediate discs (3 pcs).
3. Application plates (6 pcs balls between the plates).
4. Taperd part to expand the application plates.
5. Brake working cylinder.
6. Brake housing.

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Brake cooling system (LS)



4–2643
10/06

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All the LS (Advance) tractors have a brake cooling system as standard.

When starting the braking at a driving speed of over **15 km**/**h**, cooling oil is injected to the brake housing.

The system is controlled by a program, and in certain situations there is a delay in the cooling time after braking.

Function:

When braking at a driving speed of **over 15 km**/**h** the cooling is switched on.

Cooling is on as long as the brake pedal is depressed (even if the speed decreases below 15 km/h).

If braking (+ cooling) lasts over **5 seconds**, the cooling will continue for an additional **15 seconds** (delay) even if the braking has already ended.

Control unit gets the braking information from the brake pedal switches (**S20**, **S10**) and the speed information from the gearbox speed sensor (**B3T**).

The program has following parameters:
– brake cooling speed limit (setting: 15 km/h)
– brake cooling breaktime (5s)
– brake cooling aftercooling delay (15s).

These values are preprogrammed and cannot be changed by a serviceman.

1) Distribution piece + cooling valve

1a) Pressure compensated throttle
– Changes in the oil pressure upstream of the throttle have no effect on the cooling flow through the throttle.

2) In the brake housings there is a groove for directing the oil to the right place.

Bleeding brake system (with final drives 650)

Maintenance

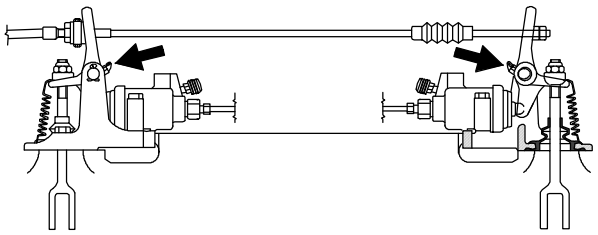


fig005

Note! Grease brake lever nipples (see arrows) weekly (or every 50 running hours). It is recommended, that the brake fluid is changed every two years.

Bleeding brake system

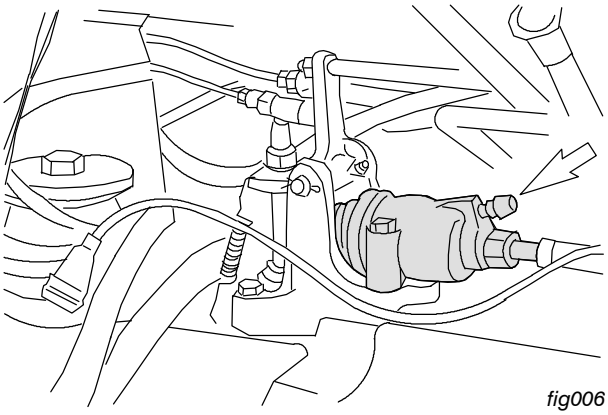


fig006

Note! Both brake cylinders have a bleeding nipple (see arrow). Bleed both brakes individually (pedals not latched together).

1. Check that the brake fluid reservoir is full.
2. Pump several times with the pedal in order to built up the pressure in the system.
3. Depress one of the brake pedals and at the same time open the bleed nipple on the brake which is actuaded by the pedal. Close the nipple and slowly let the brake pedal up again.
4. Repeat the pumping action with brake pedal until the brake fluid which runs out at the bleeding nipple is completely free of air.
5. The procedure for bleeding the brakes is the same on both sides.

Fluid brake valve of the trailer

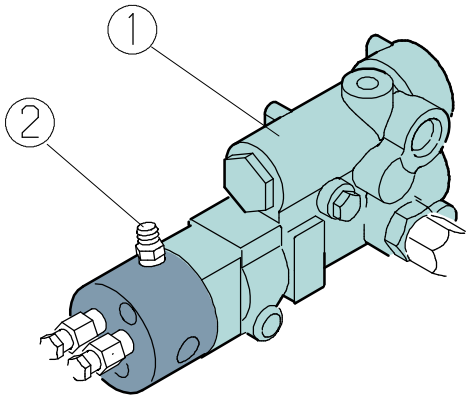


fig023

When changing the tractor brake fluid, to drain the hoses open also the bleed nipple (**2**) of the trailer brake valve. The brake valve (**1**) is located behind, on the right side of the gearbox.

Bleeding the trailer brake valve is done in the same way from the bleeding nipple (**2**) as bleeding the brake cylinders. The pedals must be locked together.

Trailer air pressure brakes

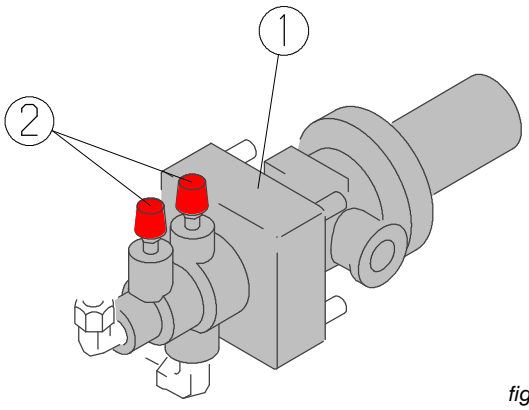


fig022

When changing the tractor brake fluid, to drain the hoses, open the bleed nipple (**2**) of the control valve (**1**). The control valve (**1**) is situated on the right side under the cab on the air reservoir.

The control valve is situated lower than the tractor brake cylinders. Therefore it has to be bled before bleeding the tractor brake cylinders. Bleeding is done in the same way from the bleed nipples (**2**) as bleeding the tractor brake cylinders, pressing the pedals.

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Bleeding brake system (with final drives 700)

Maintenance

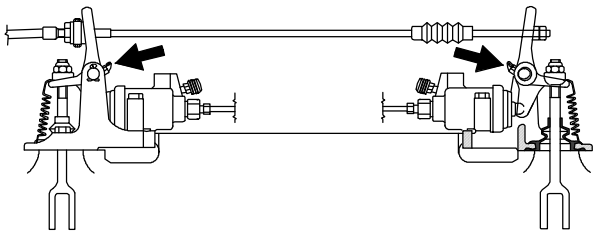


fig005

Note! Grease brake lever nipples (see arrows) weekly (or every 50 running hours).

Bleeding brake system

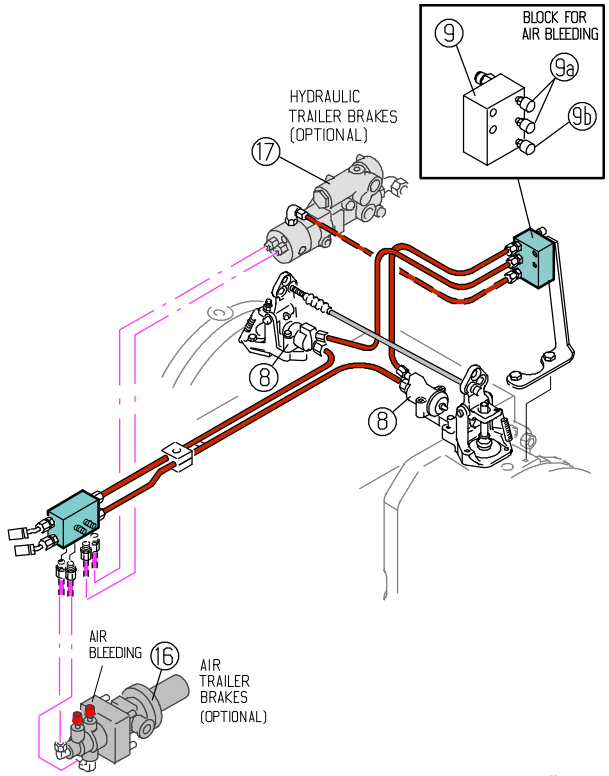


fig020

The brake system has to be bled every two years when changing the oil of the brake circuits or if the connections have been opened when repairing.

When bleeding the brakes, the latches must be locked together. Do not let the oil run on the ground.

Bleed the brake system in the following way:

- Start the tractor and let run about 3 minutes. Then the oil from pump is completely free of air.
- Open the bleeding nipples, it is recommended running hoses from the bleeder nipples to a suitable container.
- Pump the pedals until there are no air bubbles in the oil.
- Close the bleed nipples.

The bleeding must be carried out in the following order:

1. The bleeding nipples for the control valve (**16**) of the trailer air pressure brakes (extra equipment). Both brake pedal circuits, right and left, have their own bleed nipple. The control valve is situated on the right side under the cab on the air pressure reservoir.
2. The bleed nipples (**9a**) of the tractor brake working cylinder. Both brake pedal circuits, right and left, have their own bleed nipple. The nipples are placed in the bleeding block (**9**) on the top of the left axle housing, two highest nipples.
3. The bleed nipple (**9b**) of the tractor fluid brake valve (**17**) in the trailer (extra equipment). The nipple is placed in the lowest location of the bleeding block.
4. Check that the pedal free travel is the same on both wheels while driving with the pedals latched together. The pedal free travel should be about **35–45 mm**.
5. The bleeding of the brake circuit for reverse drive control (extra equipment) is carried out from the bleed nipples (**9a**) of the working cylinder by pressing the rear brake pedal.
6. Check the free play of the rear brake pedal. The pedal free travel should be about **60–70 mm**.

Switches

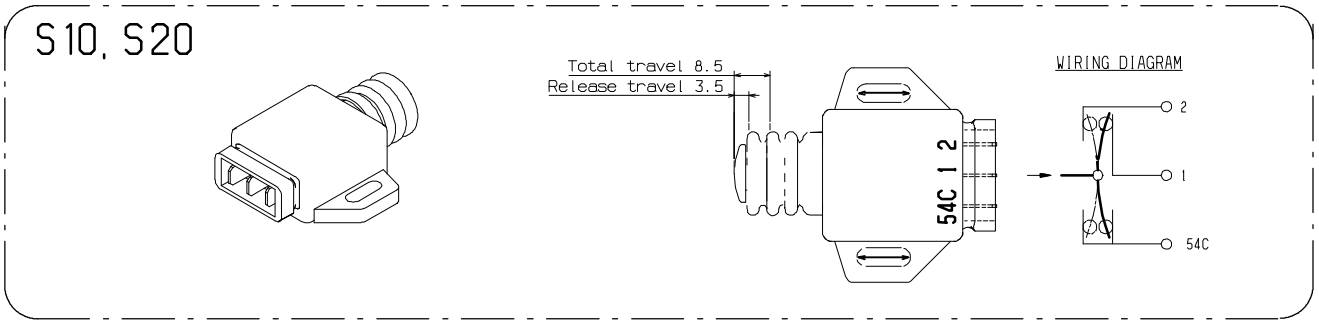


fig016

S20 left		S10 right	
Pole	Wire	Pole	Wire
54C	GRB	54C	GRB
1	178MU	1	177PU
2	–	2	–

Location of the components in wiring diagram

Symbol	Description	Page + postion (in wiring diagram)	Location
AC9.2			
–S10	Limit switch, front brake pedal (right light)	/6.D9	Cab
–S20	Limit switch, front brake pedal (left light)	/6.D10	Cab
AC10.2&AC10.21			
–S10	Limit switch, front brake pedal (right light)	/5.C9	Cab
–S20	Limit switch, front brake pedal (left light)	/5.C10	Cab
AC11.2			
–S10	Limit switch, front brake pedal (right light)	/12.D14	Cab
–S20	Limit switch, front brake pedal (left light)	/12.D15	Cab

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Solenoid valve (T121h–T191h, T151eLS–T191LS)

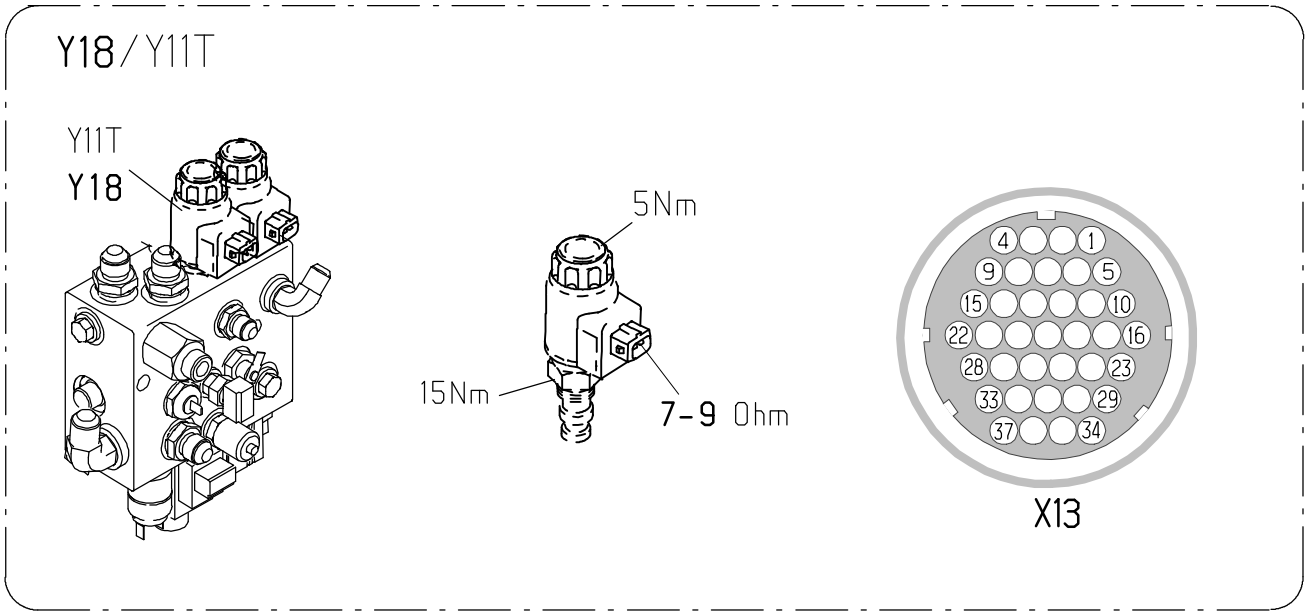


fig007

The resistance of the solenoid valve (On / off–valve) is measured from connector X13 pins, see table.

Solenoid	Pins (X13)	Resistance (+10˚C...+30˚C)
Y18	21,5	7–9 ohm

Location of the components in wiring diagram

Symbol	Description	Page + postion (in wiring diagram)	Location
AC10.2&AC10.21 –Y18	Solenoid valve, parking brake	/3.D10	Transmission
AC11.2 –Y11T	Solenoid valve, parking brake	/5.D10	Transmission

Changing brake discs

Note! There are oil grooves on the friction surface of the brake discs. On new discs the grooves are 0,3 mm deep. If the grooves are worn away, the braking efficiency will be impaired and the discs should be replaced.

1. Remove the final drives.
2. Pull out the inner drive shaft. Remove the outer support plate in front of the discs.
3. Remove the outer brake discs.

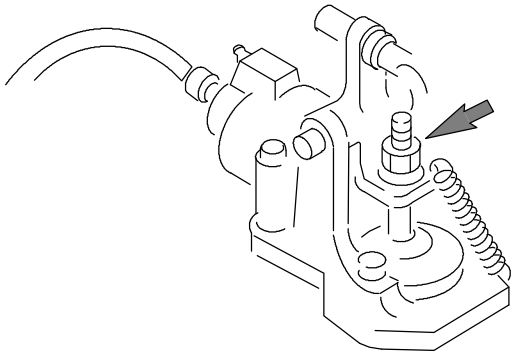


fig008

4. Slacken the adjusting nut (see arrow) until the brake mechanism is loose.
5. Take out the cotter pin and the link pin at the lower end of the stay. Pull the stay up until it is free from the application plate.

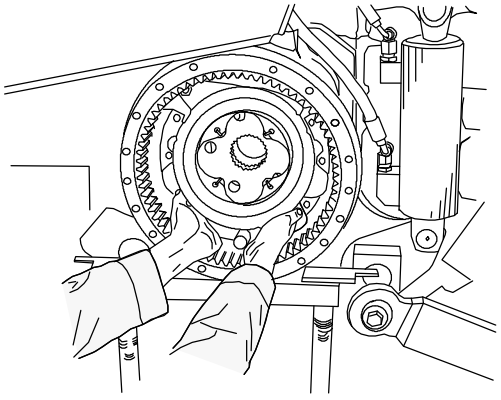


fig009

5a. Final drives 650: Remove the application plates by simultaneously pulling out the anchor bolt, fitted under the plate, and loosening the lower end of the plate from its position.

Note! The removal of the application plates is easier if the outermost circlip is removed from the anchor bolt.

5b. Final drives 700 has not an anchor bolt. Pull the application rings out of the housing.

6. Remove the inner brake discs.
7. Check the friction surfaces in the brake housing and polish with an emery cloth.

8a. Push the anchor bolt in through the hole in the brake housing, but do not press it right home. Fit the inner brake discs on the anchor bolt. Check that the discs remain located in front of the inner circlip.

8b. Final drives 700: There is no anchor bolt. Place the inner brake discs and the intermediate discs in position so that the lugs engage into the grooves on the brake housing.

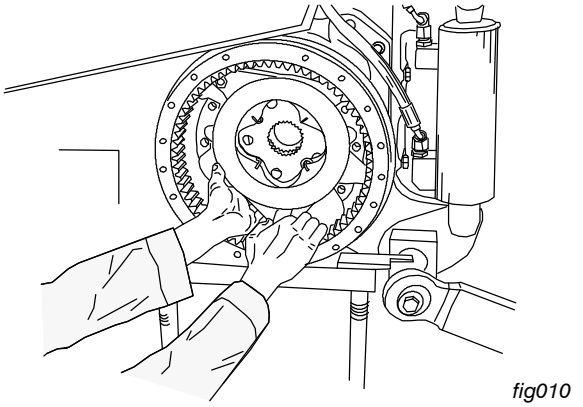


fig010

9a. Final drives 650: Insert the application plate into the housing with the upper edge first locating the lower edge of the plate on the pulled–out anchor bolt. Press the bolt and the application plate into position. Fit the outer circlip on the anchor bolt.

9b. Final drives 700: Pass the application plate into place so that lugs on it engage into the grooves in the housing.

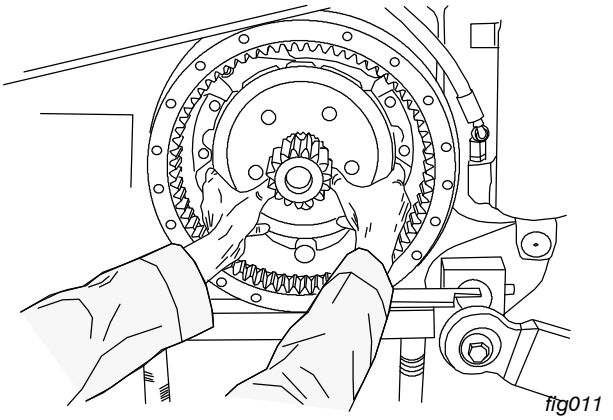


fig011

10. Fit the outer brake discs and press the inner drive shaft into the outermost brake discs. Grip with your fingers behind the inner brake discs and move them up on to splines on the inner drive shaft. Then press the inner drive shaft into position in the differential.

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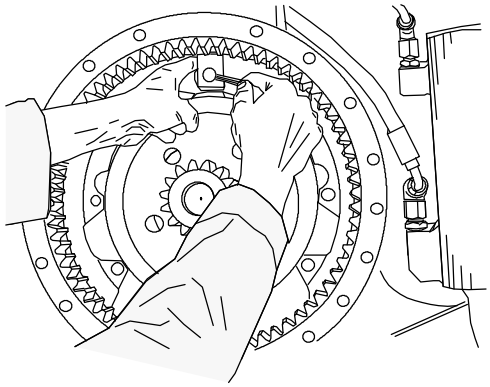


fig012

11. Using the link pin connect the brake stay to the link arms of the application plate and secure with the cotter pin. Tighten the adjusting nut at the upper end of the stay.

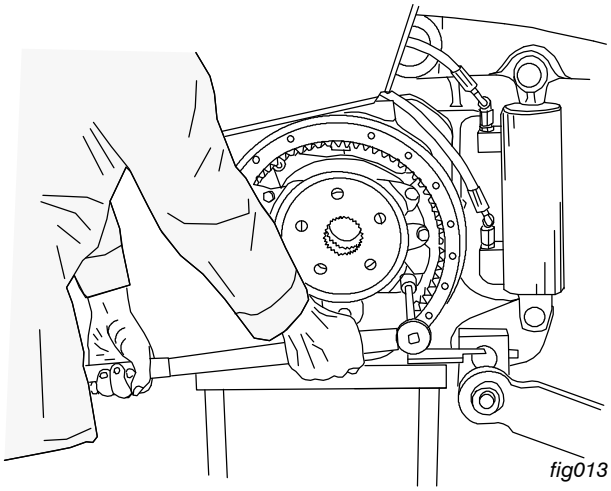


fig013

12. Fit the support and tighten it to
    80 Nm (final drives 650)
    45 Nm (final drives 700)

13. Fit the final drives and adjust brakes.

Changing brake housing

The brake housing fixing bolts are difficult to open if the cabin is fitted in place. For that reason, the cabin must be lifted up before removing the brake housings.

When fitting the brake housing, apply sealing compound Hylosil RTV Grade 102 black or Loctite 5900 to the contact surfaces between gearbox – brake housing.

Brake housing fixing bolts are tightened to **270–330 Nm**.

Adjusting foot brakes

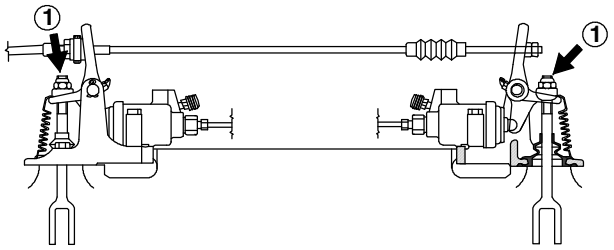


fig014

Final drives 650

The pedal free travel should be **70–80 mm** with the pedals latched together. The free play on the rear brake pedal is (extra equipment) **60–70 mm**.

Adjust as follows:

1. Fit blocks in front of the front wheels to prevent the tractor from moving. When adjusting the service brakes, the parking brake must not be engaged.
2. Raise the rear wheels off the ground so that they can be turned by hand.
3. Tighten the adjusting nut (**1**) until the wheels cannot be turned by hand any further.
4. Slacken the adjusting screw 1.5 – 2 turns and check that the wheel can rotate freely.
5. Check that the brake action is the same on both wheels while driving with the pedals latched together.
6. Check the pedal free travel.

Note! Tractors equipped with the reverse drive controls: Adjust first the front pedals according to the instruction above.

Final drives 700

1. Make sure that the tractor cannot move by itself, engage the range gear to neutral, start the tractor and engage the shuttle – and parking brake lever to the N – position.
2. Tighten the adjusting nuts (**1**) to **20 Nm**.
3. Slacken the screws 2,3 turns.
4. Check when driving the function of both brakes individually.
5. Check that the brake action is the same on both wheels while driving with the pedals latched together.
6. Check that the pedal free travel is the same on both wheels while driving with the pedals latched together. The pedal free travel is **35–45 mm**.

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Adjusting master cylinder pushrod clearance

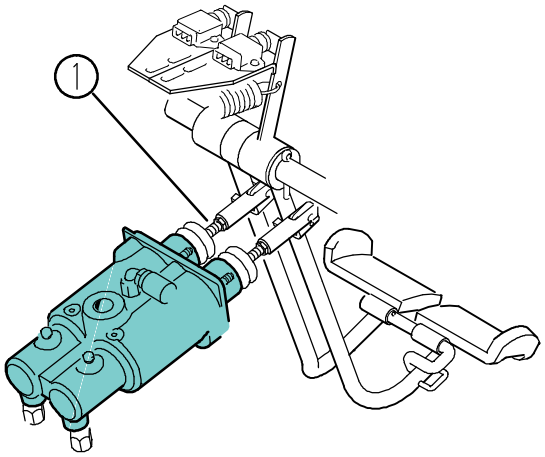


fig015

The clearance should be **1–3 mm** with final drives 650 and **0,6–1,3 mm** with final drives 700. This adjustment is done by slackening screw (**1**) and removing the cotter pin and the pivot pin and turning the clevis.

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Fault finding

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Parking brake

T121c–T171c

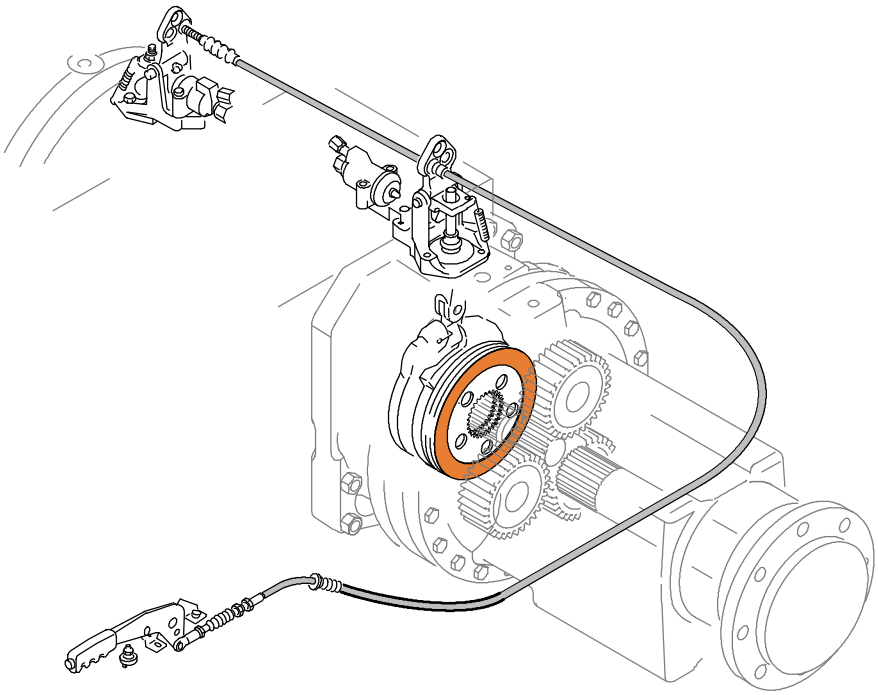
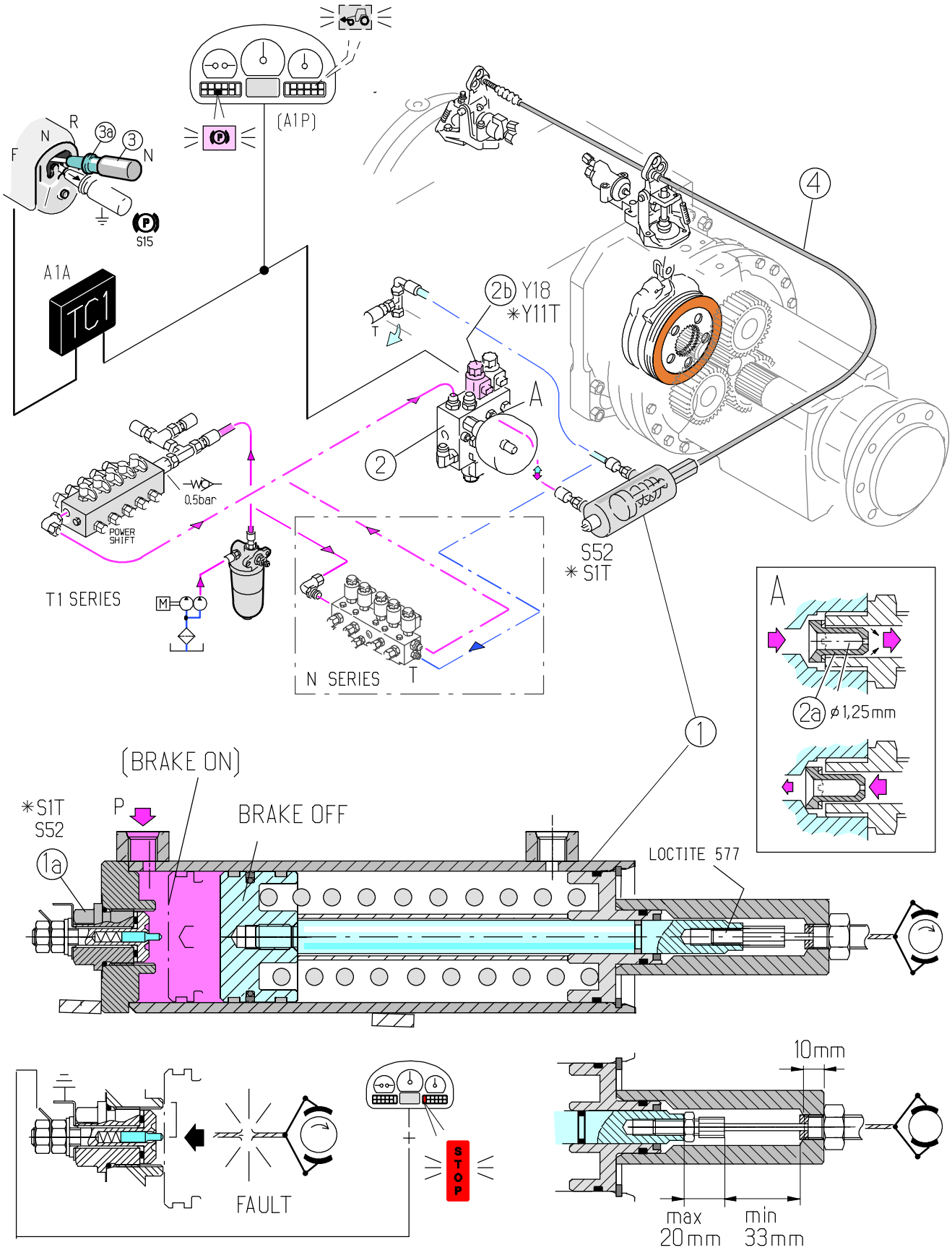


fig005

The parking brake is mechanically operated and it acts on the foot brakes.

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T121h–T191h, T151eLS–T191LS



* = LS MODELS

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02/08

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The parking brake is electro – hydraulic and is controlled with the shuttle lever. When engaging the parking brake (parking brake and 4WD indicator lamps light on instrument panel), the pressure exhausts from the cylinder operating the parking brake and a strong spring engages the tractor brakes. At the same time the control unit disengages the transmission. With this system the tractor brakes are always on when the engine is not running.

Function (parking brake off)

When the engine is running (current is on), the solenoid valve **2b** is energized (open) and lets the oil flow to the cylinder **1**. The piston is at the hindmost position (”brake off”) and the parking brake is off.

Function (parking brake engaged)

Parking brake is applied when reverse shuttle is in the middle position by pulling the collar **3a** round the lever and moving the lever to the down position. The control unit **A1** engages the parking brake by switching the solenoid valve **Y18**/**Y11T** off. The solenoid valve is no more energised, and the connection to the pressure side closes in the valve block **2**. At the same time the connection to the tank opens, and the oil can escape from the cylinder through a restriction valve **2a**. The spring around the piston rod tightens the wire cable and the brake discs. At the same time the 4WD relays are activated, and the 4WD engages.

When the F – R lever has been moved from the position F or R, the shuttle unit is in neutral.

DANGER! Always apply the parking brake when parking the tractor. The engine does not brake the transmission. If the engine is on, the parking brake and 4WD are always engaged.

If the parking brake cable **4** breaks or the adjustment is wrong, the piston touches the switch **1a**., the STOP light will be earthed and the light begins to flash.

1) Brake cylinder
   1a) Safety switch (when e.g. the cable wire breaks off, the switch connects the STOP light on).
2) Valve block
   2a) Restriction valve (oil flows from the cylinder with restriction)
   2b) Solenoid valve
3) Shuttle and parking brake lever.
   3a) Collar
4) Wire cable. **Note!** When repairing, adjusting dimension of the cable end is max 20 mm (see picture). Mount the end of the cable mantle 10 mm into the end piece of the cylinder.

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Adjusting parking brake

The parking brake is controlled with a spring return pressure cylinder and it is connected to the foot brake mechanism by a cable. The parking brake is adjusted in the factory and re–adjustment is not necessary unless parts of the brake mechanism have been changed (the parking brake is affected when the foot brakes are adjusted).

IMPORTANT: Always adjust the driving brakes before adjusting the parking brake.

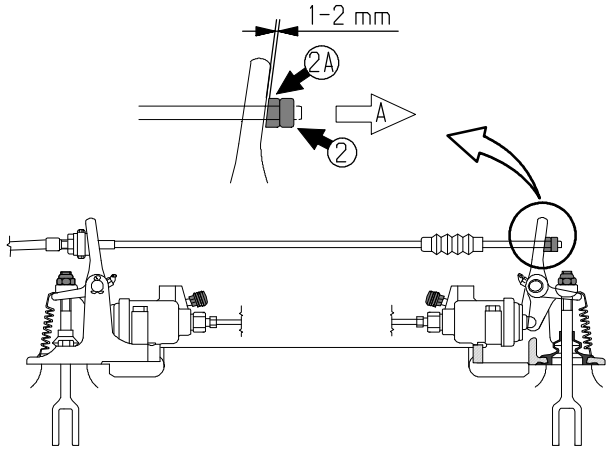


fig004

1. When adjusting, the parking brake has to be off. The tractor engine must be running. In addition, shuttle, main gear, and range levers have to be in the neutral position. Fit blocks in front of the front wheels to prevent the tractor from moving.
2. Pull the cable clearance to the end of the cable (to direction of arrow **A**).

3a. Open the locking nut (**2**) and adjust using the adjusting nut (**2A**). The tolerance is **1–2 mm**.

3b. T161c–T171c: Open the locking nut (**2**) and adjust the parking brake lever free travel to about **50 mm** (at lever end) by turning the adjusting nut (**2A**) at the rear end of the cable.

4. Tighten the locking nut.

T121h–T191h, T151eLS–T191LS:
IMPORTANT: When mounting the parking brake cable, the cylinder side end has to be mounted according to the tolerances.

Fault finding from parking brake system

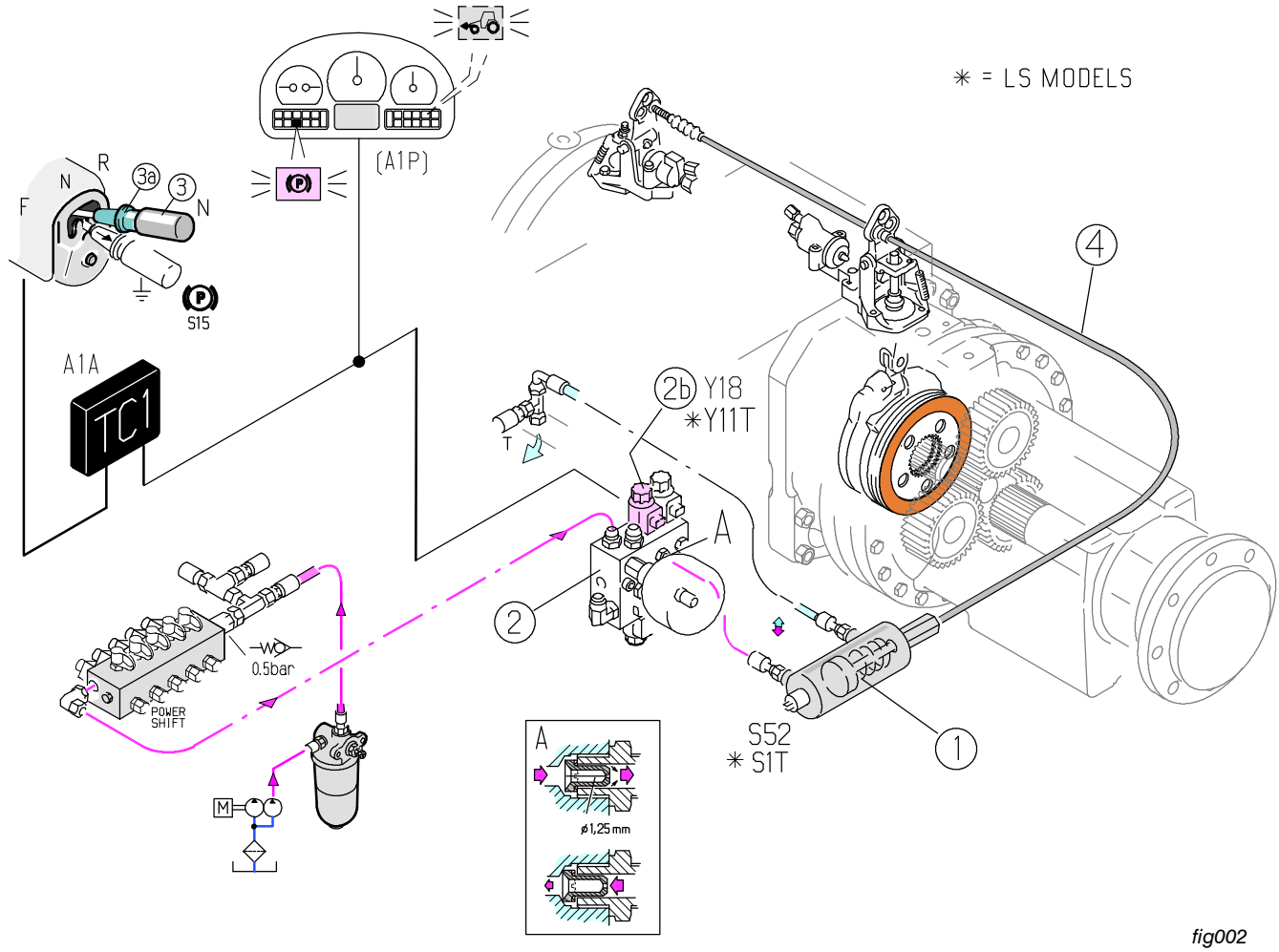


fig002

If the hand brake does not disengage (engine running) although the shuttle lever is moved to the N, R or F position so:

– Check whether the solenoid valve (2a) is energised (magnetic), when the hand brake is disengaged. If not, measure the solenoid resistance, which should be **11–12 ohms**.

– If the solenoid is faulty, it should be replaced.

– If the solenoid is OK, measure whether current comes up to the solenoid connector. If not, check the solenoid wires and connectors.

– If the solenoid and its wiring and the hand brake switch are OK, the fault can lie in the hand brake relay or in the AC control unit.

– If these are Ok, the fault can lie in the hydraulic system.

Note! If the hand brake engages itself during driving, the solenoid valve (2b) has become unenergised or low pressure circuit has malfunctions.

1. Parking brake cylinder
2. Valve block on which there is a hand brake solenoid valve
   2b Parking brake solenoid valve Y18/Y11T
3. Shuttle lever (position P)
4. Hand brake cable
5. Sensor

A Valve allows oil to flow out of ram with a little counter pressure

Note! If the driving speed exceeds 3 km/h, the hand brake engagement is prevented by relay K61.

– A non–return valve has been fitted in the system which together with the AC program modification, retards the pressure drop in the low pressure circuit in cases that e.g. engine stops during driving (e.g. fuel runs out). Program disengages all transmission multi–disc clutches, if the engine stops and the driving speed exceeds 5 km/h. In this case the parking brake cylinder starts to brake after 15...30 seconds.

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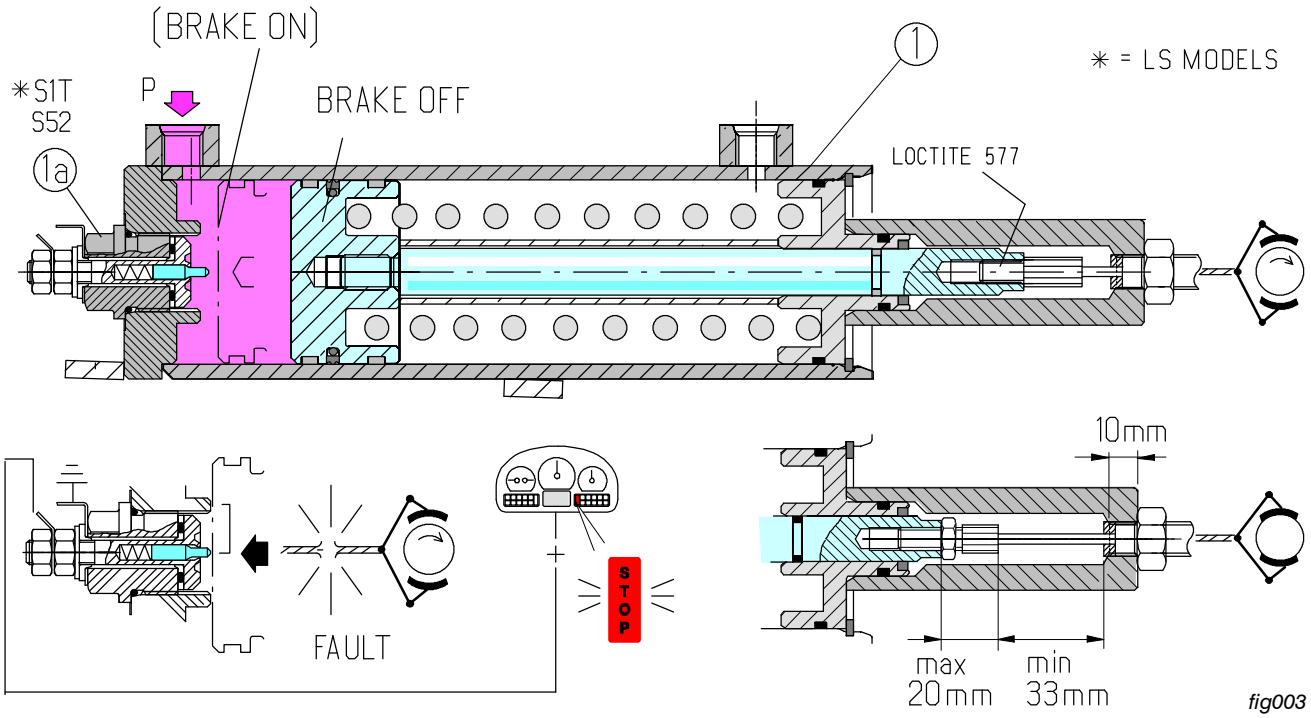


fig003

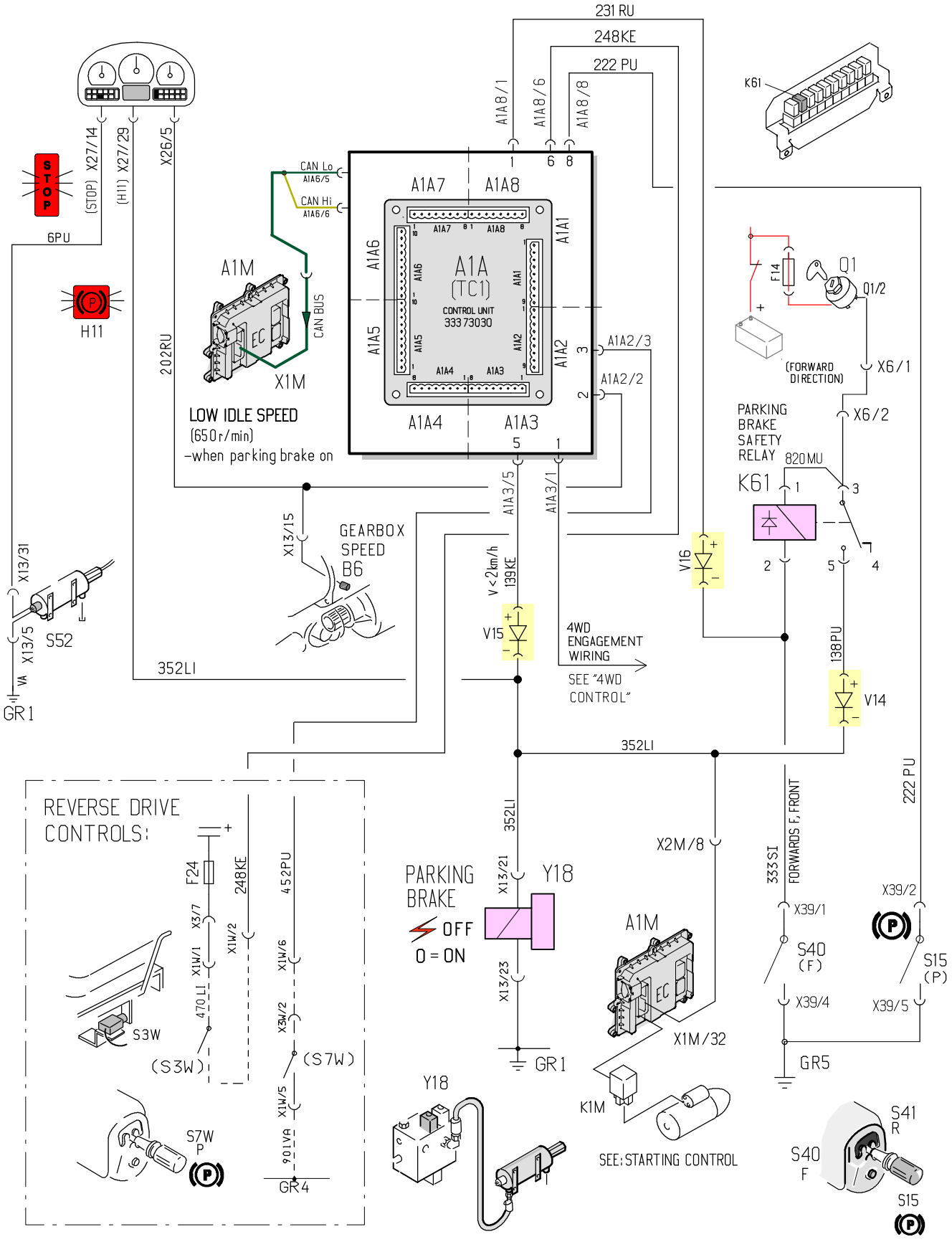
Hand brake ram

1a) Safety switch lights up the STOP light in the dasboard, if e.g. the hand brake cable breaks.

Note! Adjusting dimensions MAX 20 and 10 mm must come true when fitting a new cable.

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Wiring (T121h–T191h)



KE = YELLOW
MU = BLACK
SI = BLUE
RU = BROWN
PU = RED
VI = GREEN
VA = WHITE

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05/07

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– The control unit **A1** switches the parking brake on by switching the solenoid valve **Y18** off.

– The control unit switches the relay (K52) on (control unit output A1A3/2)

– The control unit engages the 4WD (control unit output A1A3/1).

– For safety reasons the parking brake will engage only when the speed is 2–6 km/h, factory setting is **3 km/h**.
When needed, the parking brake engaging speed can be adjusted (see “resetting parameters”, section 30.
NOTE! When adjusting the limited speed over **3 km/h** observe, that when engaging the parking brake while driving, the tractor can stop very quickly.
This adjustment can only be used in those tractors, in which the parking brake is used when the lower speed is needed, e.g. in forest work.

– **Function** (the parking brake switch **S15** / **S7W** is off, engine is running):

When the current is on, the solenoid valve **Y18** becomes current through the control unit **A1**.
The solenoid valve is open and the pressure holds the parking brake spring open (see parking brake picture) and the parking brake is not on.

– **Function**, the switch **S15** / **S7W** is applied (engine is running):

A signal about the coupling goes to the control unit (the connector A1A8/8 is earthed).
The control unit switches in turn the solenoid valve **Y18** off (presumed, that the speed is 2–6 km/h). The control unit receives the speed information via the sensor **B6**. The valve lets the pressure escape from the parking brake cylinder, and the spring engages the parking brake on.

The parking brake ind. light lights up, when the current supply for the solenoid **Y18** stops.

The control unit switches the 4WD on.

The control unit switches the starter motor relay K52 (see “starting control”) on, and the coil of the starter motor relay **K14** will be earthed if parking brake is on. The engine can be stated.

– If the piston of the cylinder touches the switch (S52) due to e.g. the cable breaking off, or wrong adjustment of the cable, the STOP– light in the instrument panel will be earthed, and it lights up.

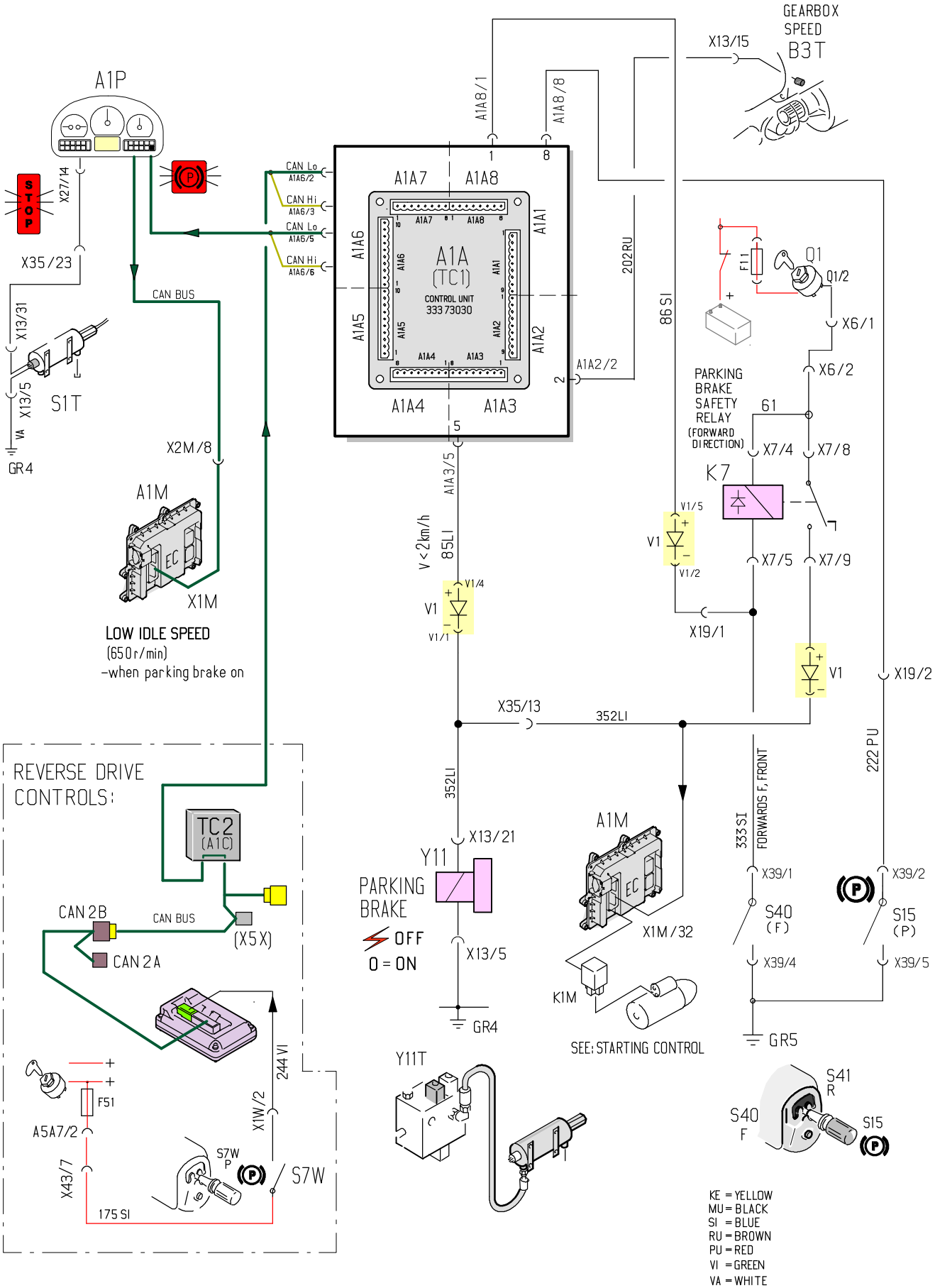
– When the engine is stopped, (ignition switch in STOP–position), the parking brake and 4WD will be automatically applied (all wheels locked). The control unit do not supply current, and the hydraulic pressure disappears.
The STOP position of the starter switch can be used as an **emergency brake** (all wheels will lock), if the brakes disappears while driving for some reason.

– If the direction switch **S3W** of the reverse drive controls has been closed (the driver’s seat has been turned for reverse driving), the switch **S7W** directs the function (not S15).

– The safety wiring of the parking brake (relay **K61**):
When the shuttle lever is in forward driving position, the relay K61 switches on (besides the control unit) the solenoid valve of the parking brake (= parking brake off). If the current supply from the control unit to the valve will be broken for some reason, the parking brake doesn’t engage before the shuttle lever has been moved to some other position.

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Wiring (T151eLS–T191LS)



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– The control unit **A1A** switches the parking brake on by switching the solenoid valve **Y11** off.

– The EC control unit **A1M** switches the starter aux. relay K1M on (see picture 4–2742)

– The TC2 control unit **A2A** engages the 4WD.

– For safety reasons the parking brake will engage only when the speed is 2–6 km/h, factory setting is **3 km/h**.
When needed, the parking brake engaging speed can be adjusted (see “resetting parameters”, section 30.
NOTE! When adjusting the limited speed over **3 km/h** observe, that when engaging the parking brake while driving, the tractor can stop very quickly.
This adjustment can only be used in those tractors, in which the parking brake is used when the lower speed is needed, e.g. in forest work.

– **Function** (the parking brake switch **S15** / **S7W** is off, engine is running):

  When the current is on, the solenoid valve **Y11** becomes current through the control unit **A1A**.
  The solenoid valve is open and the pressure holds the parking brake spring open (see parking brake picture) and the parking brake is not on.

– **Function**, the switch **S15** / **S7W** is applied (engine is running):

  A signal about the coupling goes to the control unit (the connector A1A8/8 is earthed).
  The control unit switches in turn the solenoid valve **Y11** off (presumed, that the speed is 2–6 km/h). The control unit receives the speed information via the sensor **B6**. The valve lets the pressure escape from the parking brake cylinder, and the spring engages the parking brake on.

  The parking brake ind. light lights up, when the current supply for the solenoid **Y11** stops.

  The TC2 control unit **A1C** switches the 4WD on.

  The control unit **A1M** switches the starter motor relay **K1M** (see “starting control”) on, if parking brake is on. The engine can be stated.

– If the piston of the cylinder touches the switch (S52) due to e.g. the cable breaking off, or wrong adjustment of the cable, the STOP– light in the instrument panel will be earthed, and it lights up.

– When the engine is stopped, (ignition switch in STOP–position), the parking brake and 4WD will be automatically applied (all wheels locked). The control unit do not supply current (and not the relay K7), and the hydraulic pressure disappears.
The STOP position of the starter switch can be used as an **emergency brake** (all wheels will lock), if the brakes disappears while driving for some reason.

– If the direction switch **S3W** of the reverse drive controls has been closed (the driver’s seat has been turned for reverse driving), the switch **S7W** directs the function (not S15).

– The safety wiring of the parking brake (relay **K61**):
When the shuttle lever is in forward driving position, the relay K61 switches on (besides the control unit) the solenoid valve of the parking brake (= parking brake off). If the current supply from the control unit to the valve will be broken for some reason, the parking brake doesn’t engage before the shuttle lever has been moved to some other position.

– Starting prevention: the information of the parking brake state goes to the pin X1M/32 of the engine control unit.

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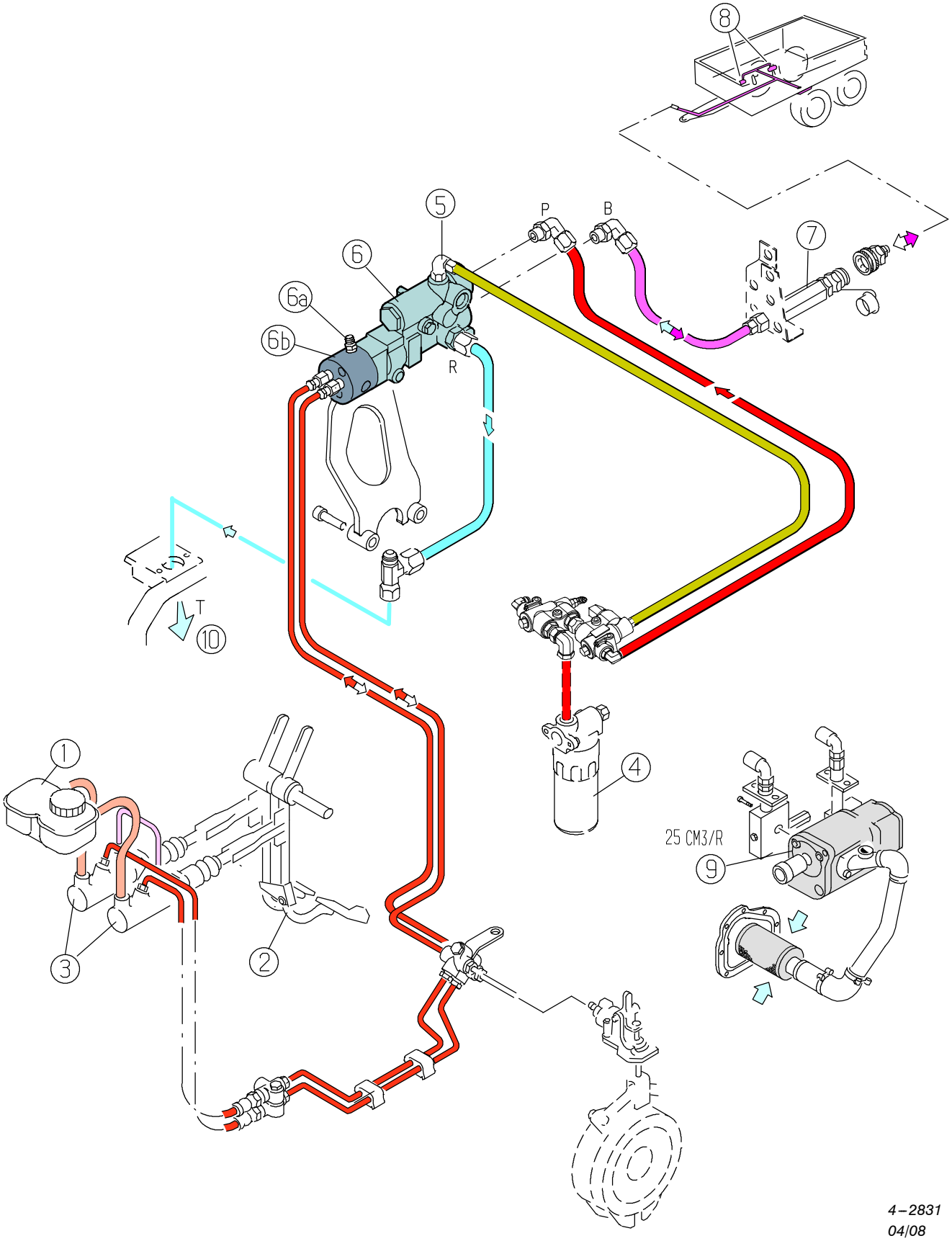
Maintenance

532.1 . . . Maintenance, trailer air pressure brakes 1

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Fluid brake valve of the trailer (extra equipment)

T121c–T131c, T121h–T131h (final drives 650)



4–2831
04/08

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Trailer brake valve is an optional equipment. The trailer brake valve system makes use of the pressure of the tractors hydraulic system.

Max. operating pressure of the brake valve is 15 MPa and pressure ratio of the control
block is 1:13.

Control block (**6b**) allows the pressure to the brake valve only when **both** pedals are depressed.

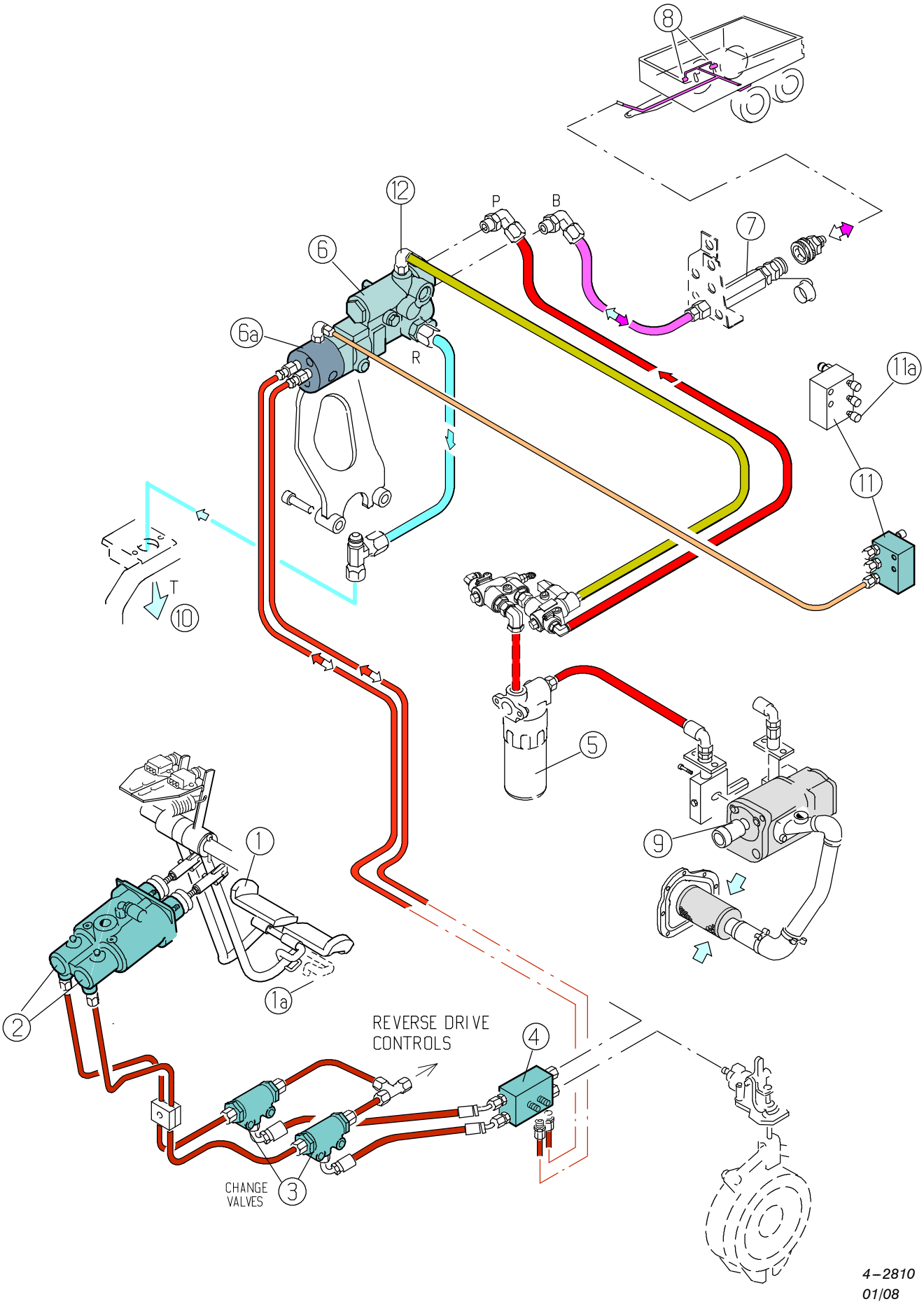
1) Brake fluid reservoir
2) Brake pedals
3) Main brake cylinders
4) Pressure filter for low pressure circuit
5) LS line
6) Trailer brake valve
   6a) Bleed nipple of the trailer brake valve
   6b) Control block
7) Quick–action coupling for the trailer brake
8) Brake cylinders for the trailer
9) Hydraulic pump
10) Return oil to the tank

– When using the trailer brakes the brake pedals must always be locked together (the trailer brakes do not operate if only one of the brake pedals is pressed).
– The trailer brakes do not work when using the parking brake.
– When the engine is not running, the power brake of the trailer does not work.
– When changing the tractor brake fluid, to drain the hoses, open the bleed nipples (**6a**) of the control valve.

  Bleeding is done from the bleed nipples (**6a**) as bleeding the tractor brake cylinders, but the brake pedals should be latched together.

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T161c–T171c, T151eh–T191h (final drives 700)



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01/08

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Trailer brake valve is an optional equipment. The trailer brake valve system makes use of the pressure of the tractors hydraulic system.

Max. operating pressure of the brake valve is 15 MPa and pressure ratio of the control block is 1:11.

Control block (**6a**) allows the pressure to the brake valve only when **both** pedals are depressed.

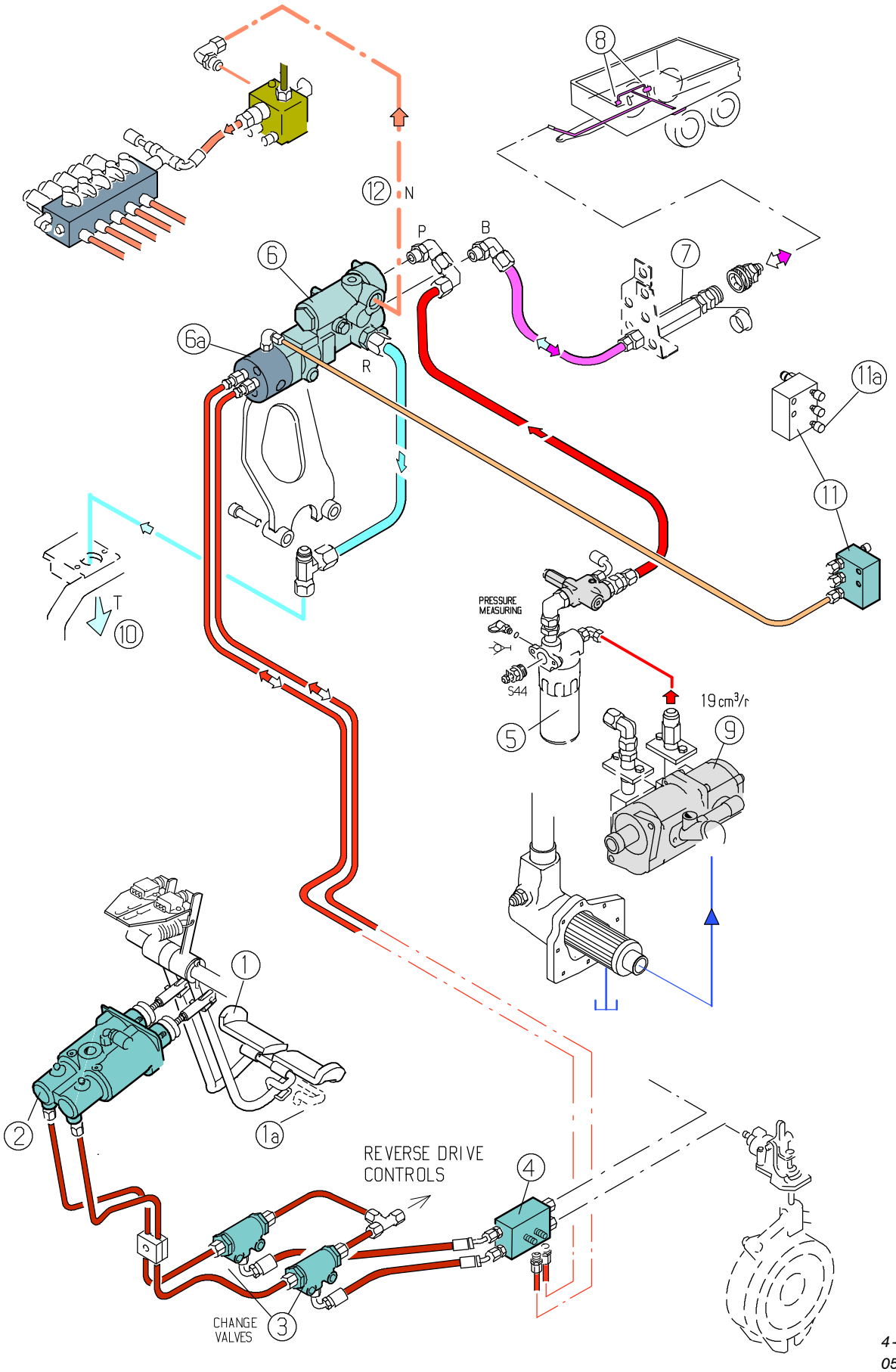
1) Brake pedals
   1a) Latch for brake pedals
2) Main brake cylinders
3) Shuttle valve (between front and rear pedals)
4) Distribution block
5) Pressure filter for low pressure circuit
6) Trailer brake valve
   6a) Control block
7) Quick–action coupling for the trailer brake
8) Brake cylinders for the trailer
9) Hydraulic pump
10) Return oil to the tank
11) Bleeding block
   11a) Bleed nipple of the brake valve
12) LS line

– When using the trailer brakes the brake pedals must always be locked together (the trailer brakes do not operate if only one of the brake pedals is pressed).
– The trailer brakes do not work when using the parking brake.
– When the engine is not running, the power brake of the trailer does not work.
– When changing the tractor brake fluid, to drain the hoses, open the bleed nipple (**11a**) of the control valve.

  Bleeding is done from the bleed nipple (**11a**) as bleeding the tractor brake cylinders, but the brake pedals should be latched together.

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T151eLS–T191LS (final drives 700)



4–2833
05/07

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Trailer brake valve is an optional equipment. The trailer brake valve system makes use of the pressure of the tractors hydraulic system.

Max. operating pressure of the brake valve is 15 MPa and pressure ratio of the control block is 1:11.

Control block (**6a**) allows the pressure to the brake valve only when **both** pedals are depressed.

1) Brake pedals
   1a) Latch for brake pedals
2) Main brake cylinders
3) Shuttle valve (between front and rear pedals)
4) Distribution block
5) Pressure filter for low pressure circuit
6) Trailer brake valve
   6a) Control block
7) Quick–action coupling for the trailer brake
8) Brake cylinders for the trailer
9) Hydraulic pump
10) Return oil to the tank
11) Bleeding block
   11a) Bleed nipple of the brake valve
12) Oil to the valve block

– When using the trailer brakes the brake pedals must always be locked together (the trailer brakes do not operate if only one of the brake pedals is pressed).
– The trailer brakes do not work when using the parking brake.
– When the engine is not running, the power brake of the trailer does not work.
– When changing the tractor brake fluid, to drain the hoses, open the bleed nipples (**6a**) of the control valve.

  Bleeding is done from the bleed nipples (**6a**) as bleeding the tractor brake cylinders, but the brake pedals should be latched together.

Trailer air pressure brakes (extra equipment)

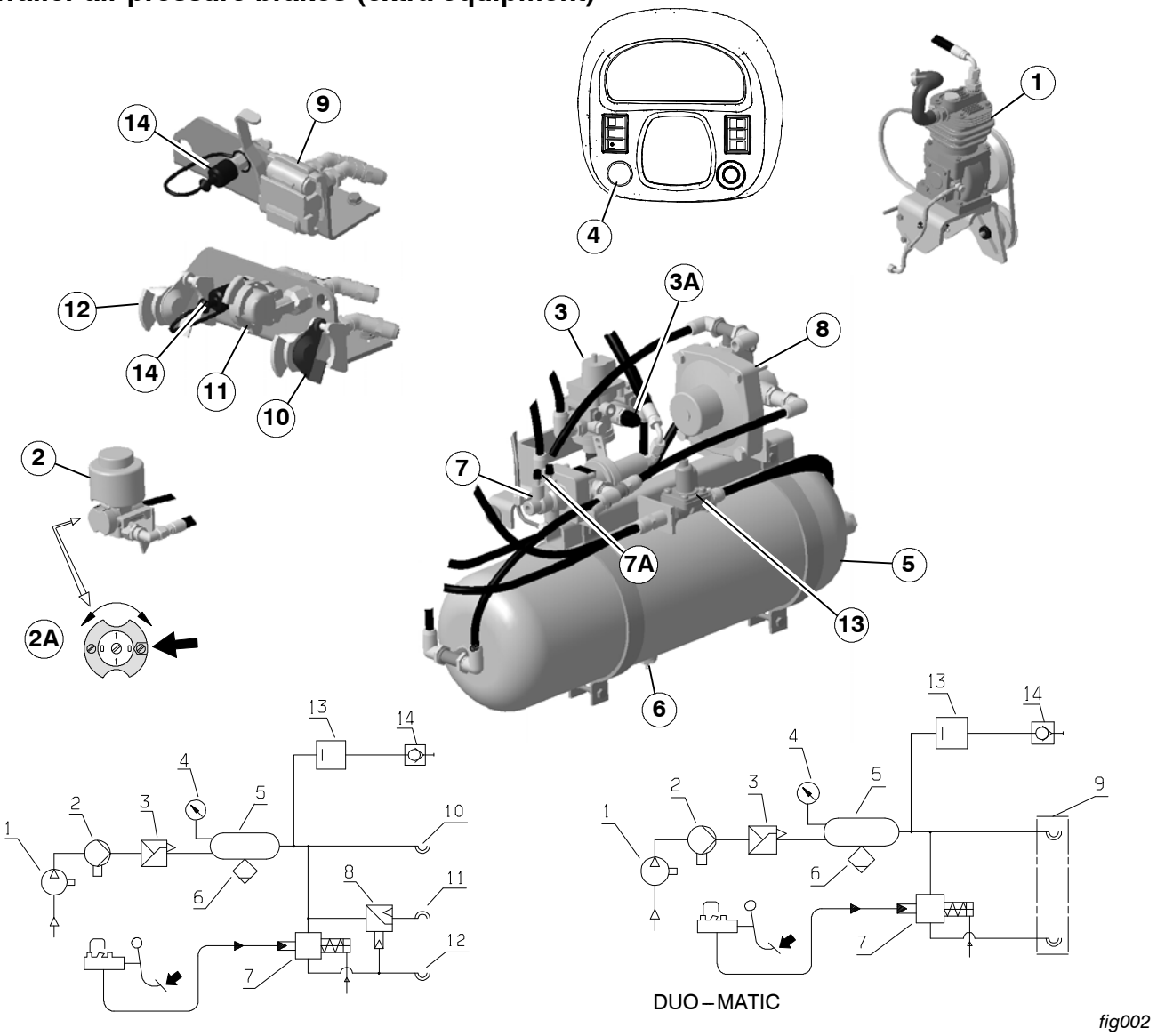


fig002

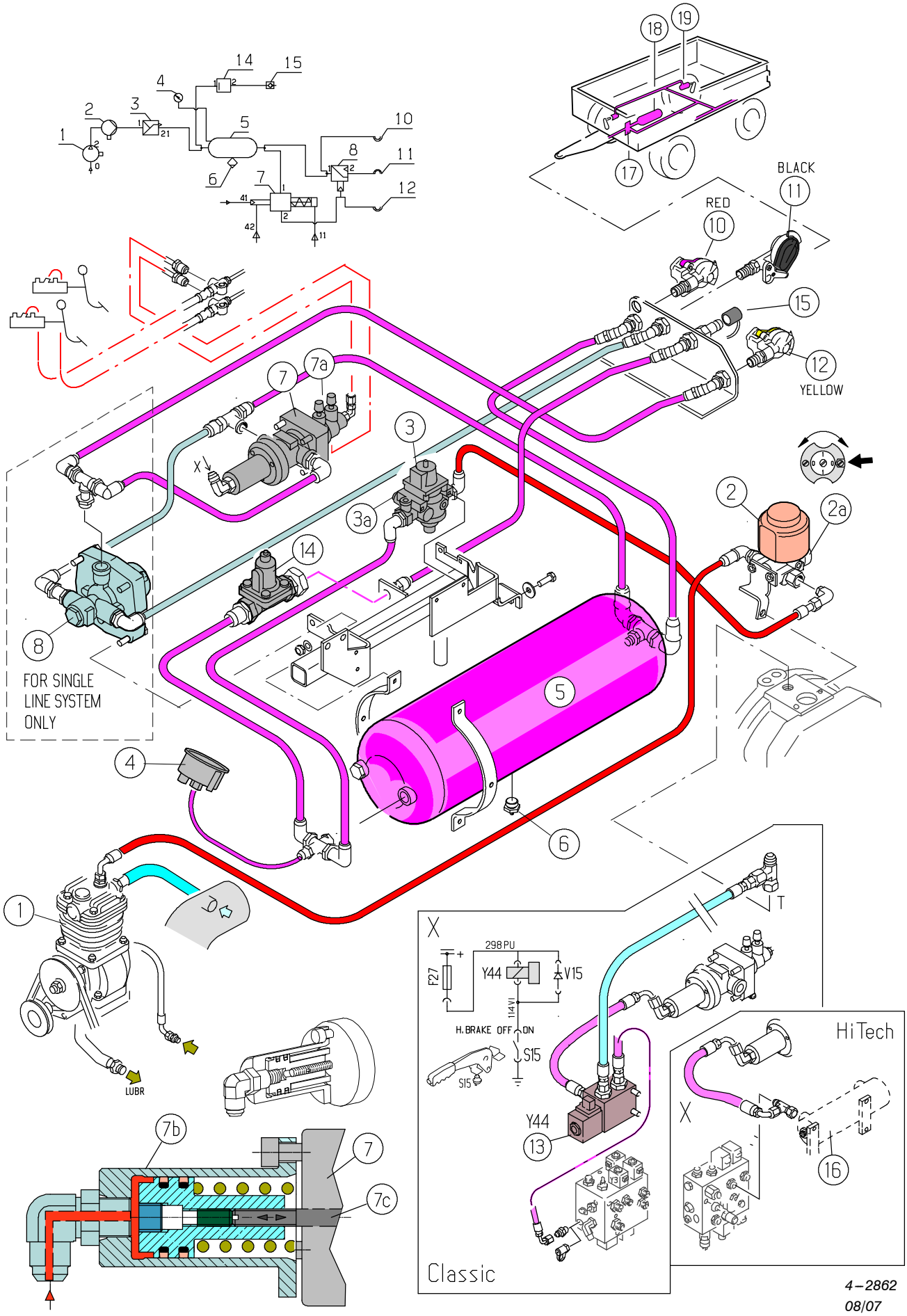
1 Compressor
2 Anti freeze pump
2A Anti freeze device flow valve
3 Pressure adjuster
3A Air pressure coupling
4 Pressure meter
5 Air pressure container
6 Water draining valve
7 Steering valve for trailer
7A Bleed nipples
8 Steering valve for trailer, one pipe system, not in Duo–Matic system
9 Trailer coupling Duo–Matic
10 Trailer coupling two pipe system; container line (red)
11 Trailer coupling one pipe system; connector (black)
12 Trailer coupling two pipe system; brake line (yellow)
13 Overflow valve
14 Quick coupling for output of compressed air

On models T121c–T131c and T121h–T131h the brake system uses the same brake fluid as in the tractor drive brakes.

On models T161c–T171c, T151eh–T191h and T151eLS–T191LS the brake system uses the same transmission/hydraulic oil as in the tractor drive brakes.

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One and two pipe system



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At the front end of the control valve **7** there is a single–action cylinder **7b**.

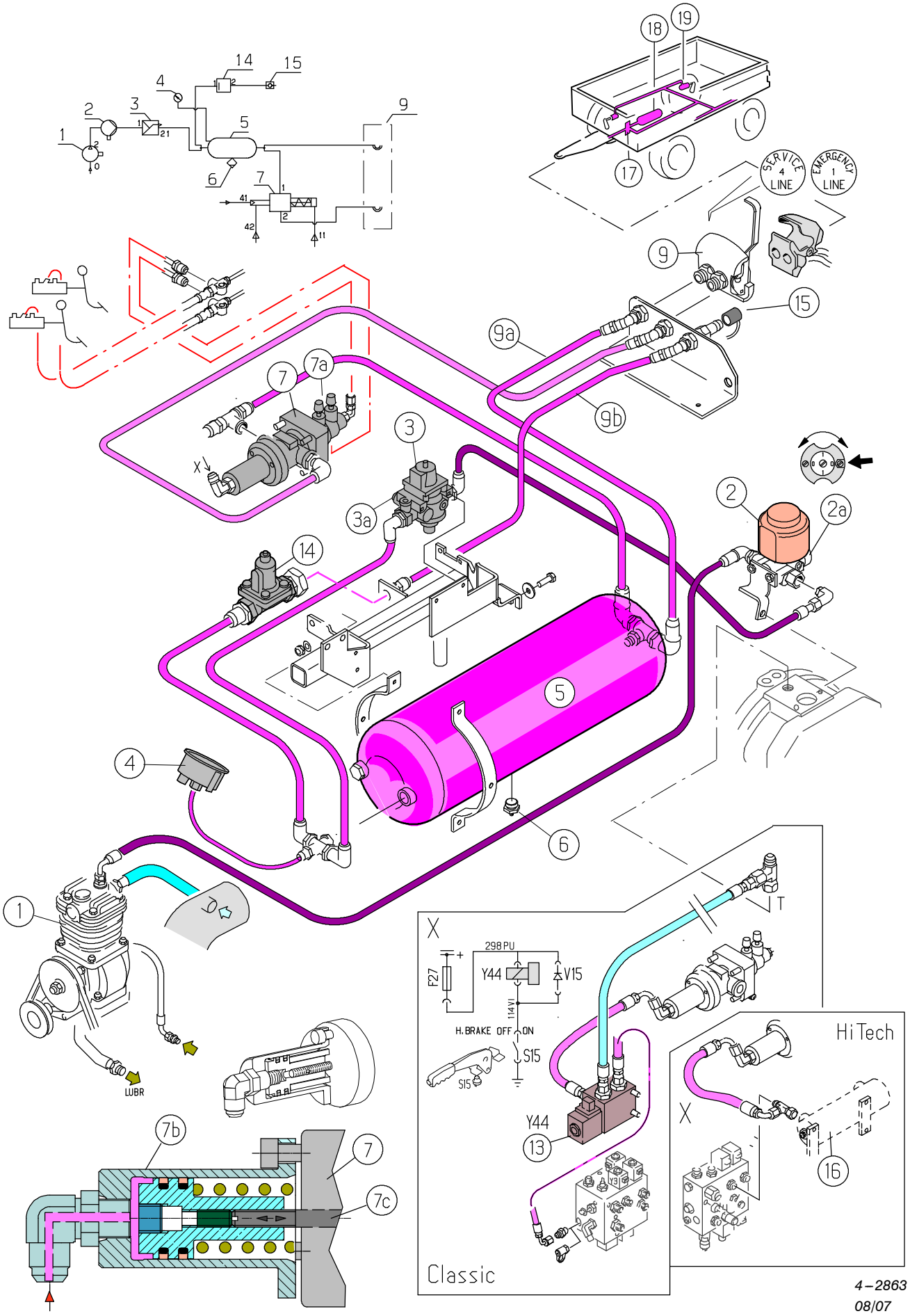
HiTech models: The cylinder has been connected parallel with the parking brake cylinder **16**. When the engine is running (current is on), the parking brake cylinder is pressurized (parking brake off), and the piston of the cylinder presses the spindle **7c** of the control valve. When the current has been cut off from the parking brake solenoid valve, the connection to the tank opens, and the parking brake is on. At the same time the spring pushes the piston and the spindle out of the control valve (brakes are on).

Classic models: The pressure to the cylinder comes via a solenoid valve **13** (Y44) controlled by the hand brake.

1) Compressor. The compressor has been connected to the engine pressure lubrication system. Air to the compressor is taken from the engine induction system (connected after the engine air filter). The compressor runs always when the engine is running.
2) Anti–freeze pump. The device injects anti–freeze agent into the brake system so that moisture in the induction air (condenses into water) would not freeze and would not cause malfunctions in the brake system.
   2a) Anti freeze device flow valve
3) The pressure regulator regulates the reservoir pressure, which should be between the higher (ca 8,1 bar) and the lower (ca 7,5 bar) connecting pressure of the regulator. When the regulator stops the filling of the reservoir (connecting limit reached), the air produced by the compressor can flow freely outdoors through the hose which has been drawn downwards from the pressure regulator. Except the connector **15**, compressed air can be also got from coupling **3a** which is situated above the pressure container by turning the coupling as far as it will go. Through this coupling the system can be filled, when needed, by outside compressed air e.g. when the compressor of the tractor is broken. By doing this, the coupling cannot be turned to bottom. The regulator relief valve opening pressure is 12–14 bar.
   3a) Air pressure coupling
4) The pressure gauge is placed in the instrument panel. The gauge shows the reservoir pressure.
5) The air reservoir (20 litres).
6) There is a drain cock in the bottom of the reservoir. The drain cock opens by pressing or by pulling the drain cock pin. The water draining should be done daily.
7) Control valve. The valve controls the combined single and double line braking system according to the control pressure taken from the tractor brake system.
   7a) Bleed nipples
   7b) Cylinder. The function is controlled via the hand brake.
   7c) Spindle of the control valve
8) Control valve. This valve is intended to control the single line system. It gets control signals from the control valve (**7**).The valve limits also pressure to the trailer brakes (5,2 bar). During braking the valve lowers (single line system) the trailer brake pressure and the trailer wheels brake. When finishing the braking, the air can flow via the control valve to the trailer air reservoir.
10) –12) Brake couplings. For the single line system there is a black–cover coupling, the couplings with red and yellow covers are for the double line system. The couplings have been made so that wrong connections are impossible. Grease with silicon grease the rubber surfaces of the trailer quick couplings every 500 hours.
13) Solenoid valve (Classic models). It is electrically controlled by the limit switch (S15) of the hand brake
14) Overflow valve (see air suspension of front axle). Prevents the pressure drop in the reservoir below the adjusting pressure of the overflow valve (6,2–6,5 bar).
15) Quick coupling for output of compressed air
16) Tractor parking brake cylinder
17) Trailer brake valve + brake force regulator (not included)
18) Compressed–air reservoir , trailer (not included)
19) Brake cylinders, trailer (not included)

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Duo–Matic



4–2863
08/07

https://truckmanualshub.com/

The trailer air brake system with ”Duo–Matic” –couplings is an alternative equipment for these customers, which have trailers (with above–mentioned couplings) based on truck frames.

The ”Duo–Matic” trailer air braking system has only two line system. The function (pressures, etc.) corresponds the function of two line system, shown on previous pages. The ”Duo–Matic”– couplings does not have any colour codes, because there is no risk for confusing the couplings.

1) Compressor
2) Anti–freeze pump
   2a) Anti freeze device flow valve
3) Pressure regulator
   3a) Air pressure coupling
4) Pressure gauge
5) Compressed–air reservoir
6) Water draining valve
7) Trailer brake control valve
   7a) Bleed nipples
   7b) Cylinder
   7c) Spindle of the control valve
9) Trailer brake coupling ”Duo–Matic”
   9a) Double line system ; reservoir line
   9b) Double line system ; brake line
13) Solenoid valve (Classic models).
14) Overflow valve, (see air suspension of front axle). Prevents the pressure drop in the reservoir below the adjusting pressure of the overflow valve (6,2–6,5 bar).
15) Quick coupling for output of compressed air
16) Tractor parking brake cylinder
17) Trailer brake valve + brake force regulator (not included)
18) Compressed–air reservoir , trailer (not included)
19) Brake cylinders, trailer (not included)

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Maintenance, trailer air pressure brakes (extra equipment)

See picture on code **531.2**

Common points

The pressure container can not be welded and drilled.

The pressure regulator is provided with an inbuilt pressure regulator, which operates, if the pressure rises to 12–14 bar. This can be caused by a broken pressure regulator valve, frozen or blocked filter.

To prevent the jaming of the anti freeze device flow valve (**2A**), use antifreeze fluid for a while at least once per a month in warm season.

Service daily

The water has to be drained **daily** from the press air system by pressing and pulling the spindle (**6**) of the water draining valve at the bottom of the container.

Service weekly or after every 50 operating hours

Check the fixing bolts of the compressor. Check and adjust the compressor (**1**) belt tension by adjusting the adjusting wheel.

Service after every 500 operating hours

Grease the rubber surfaces of the trailer quick couplings (**9–12**) with Valtra Calsium LF Grease.

Check the integrity of the system. The system has to be air tight, so that after stopping the engine the pressure does not decrease more than **0,15 bar during 10 minutes** (2%). When needed repair the leaks.

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60. Steering system and front axle

61. Steering system

63. Air suspension

64. Powered front axle
Dana 730/503 Monolitic
Dana 733/505 HiLock

65. Powered front axle
Dana 740/532
Dana 740/533

68. TwinTrac (HiTech, LS)

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Technical data

Hydrostatic, oil supply from main pump via priority valve. Adjustable, telescopic steering column. One double action central steering cylinder.

Steering valve	Orbitrol OSPC 125 LS (agricultural axle) Orbitrol OSPC 160 LSN (industrial axle)
Pump capacity per revolution	0.125 l (agricultural axle) 0.160 l (industrial axle)
Working pressure (at pressure–test point, 1500 r/min / 50–65°C)	14–15.5 MPa
Pressure–limiting valve opening pressure	14 MPa
Shock valve opening pressure	19.5–21.5 MPa
Priority valve:	OLS 120 (LS models: OLS 80)
Steering speed	over 2 round/sec. at idling speed
Steering wheel rotates	4.5 turn

Steering capacity ±30° with front axle load of 5000 kg on dry asphalt

Turning radius (m) with standard track width:

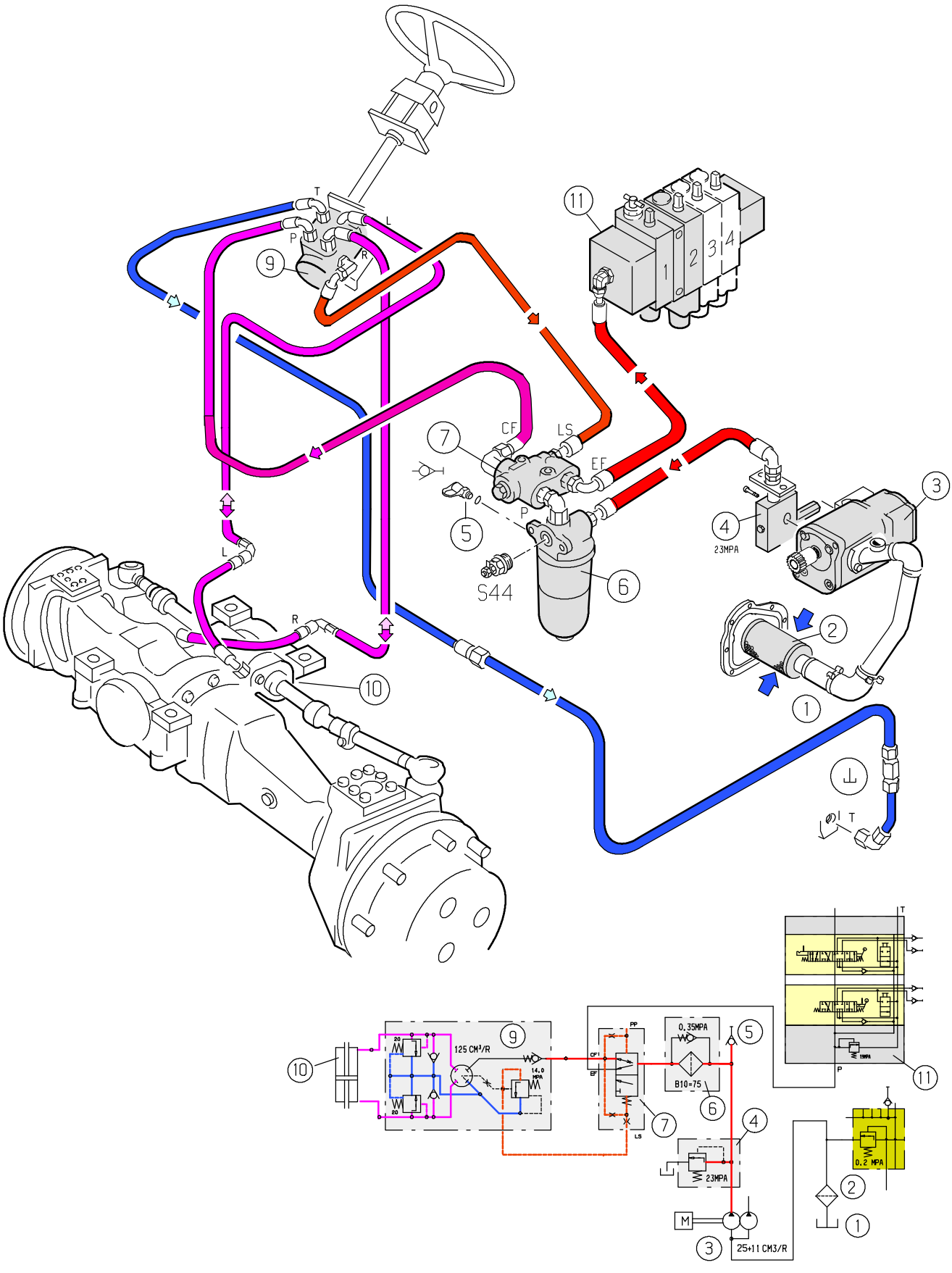
Tyres, with standard track width	16.9R28
Minium turning circle radius	5.6 m

Toe–in	0–2 mm
Suction strainer filtering properties	125 μm
Pressure filter, degree of separation	β10=75

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Steering hydraulics (T121c–T171c, T121h–T191h)



4–2907
02/08

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Pressurized oil to the steering system is supplied by the high–pressure pump which also feeds the the working hydraulics. The system has a priority valve, which ensures that there is always enough hydraulic oil for steering.

Pressure–limiting valve (14 MPa) and shock valves (20 MPa) are fitted in the steering valve.

The steering valve is of a load–sensing type. The LS port is either open to the return line when the steering is in neutral, or open to the pressure feed line (P) as soon as the steering wheel is turned.

1) Oil reservoir

2) Inlet strainer

3) Double pump **25**+**11** cm^3/r, i=1.32

4) Pressure relief valve, 23 MPa (next to the pump)

5) Measurement point (Valmet HPR)

6) Pressure filter (filtering grade: β10=75)

7) Priority valve

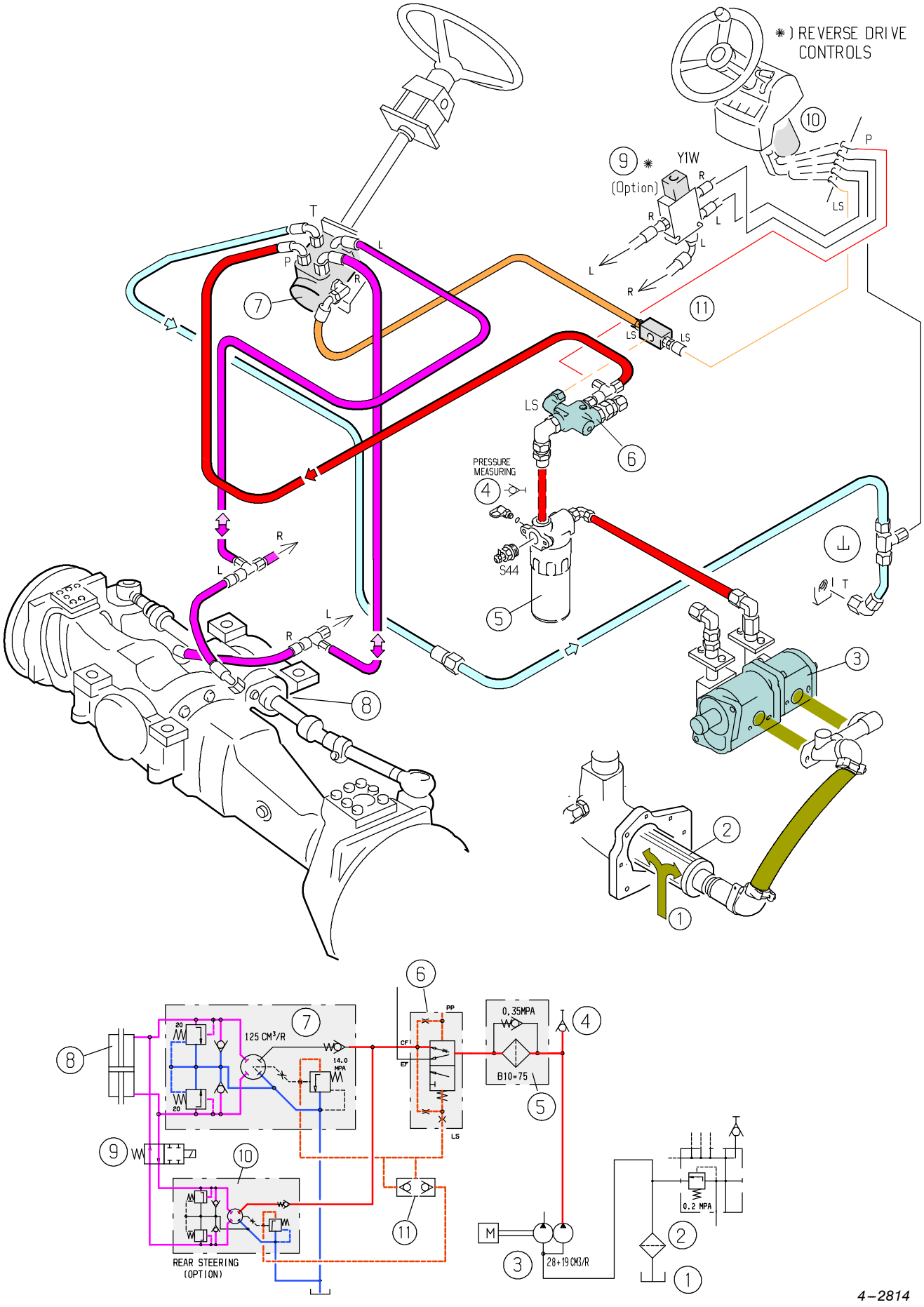
9) Steering valve (OSPC 125LS, 125 cm^3/r)
– pressure relief valve, steering 14 MPa
– Shock valve 20 MPa

10) Steering cylinder

11) Inlet flange (pump side)

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Steering hydraulics (T151eLS–T191LS)



4–2814
04/07

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Pressurized oil to the steering system is supplied by the high–pressure pump. The system has a priority valve, which ensures that there is always enough hydraulic oil for steering.

Pressure–limiting valve (14 MPa) is fitted in the steering valve.

The steering valve is a load sensing type. The LS port is either open to the return line when the steering is in neutral, or open to the pressure feed line (P) as soon as the steering wheel is turned.

1) Oil reservoir
2) Inlet strainer
3) Double pump (**28**+**19** cm^3/r)
4) Measurement point (Valmet HPR)
5) Pressure filter (filtering grade: β10=75)
6) Priority valve
7) Steering valve (OSPC 125LS, 125 cm^3/r)
   – pressure relief valve 14 MPa
   – shock valves 20 MPa
8) Steering cylinder
9) Directional control valve (reverse drive control)
10) Steering valve (reverse drive control)
11) Shuttle valve (reverse drive control)

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Priority valve

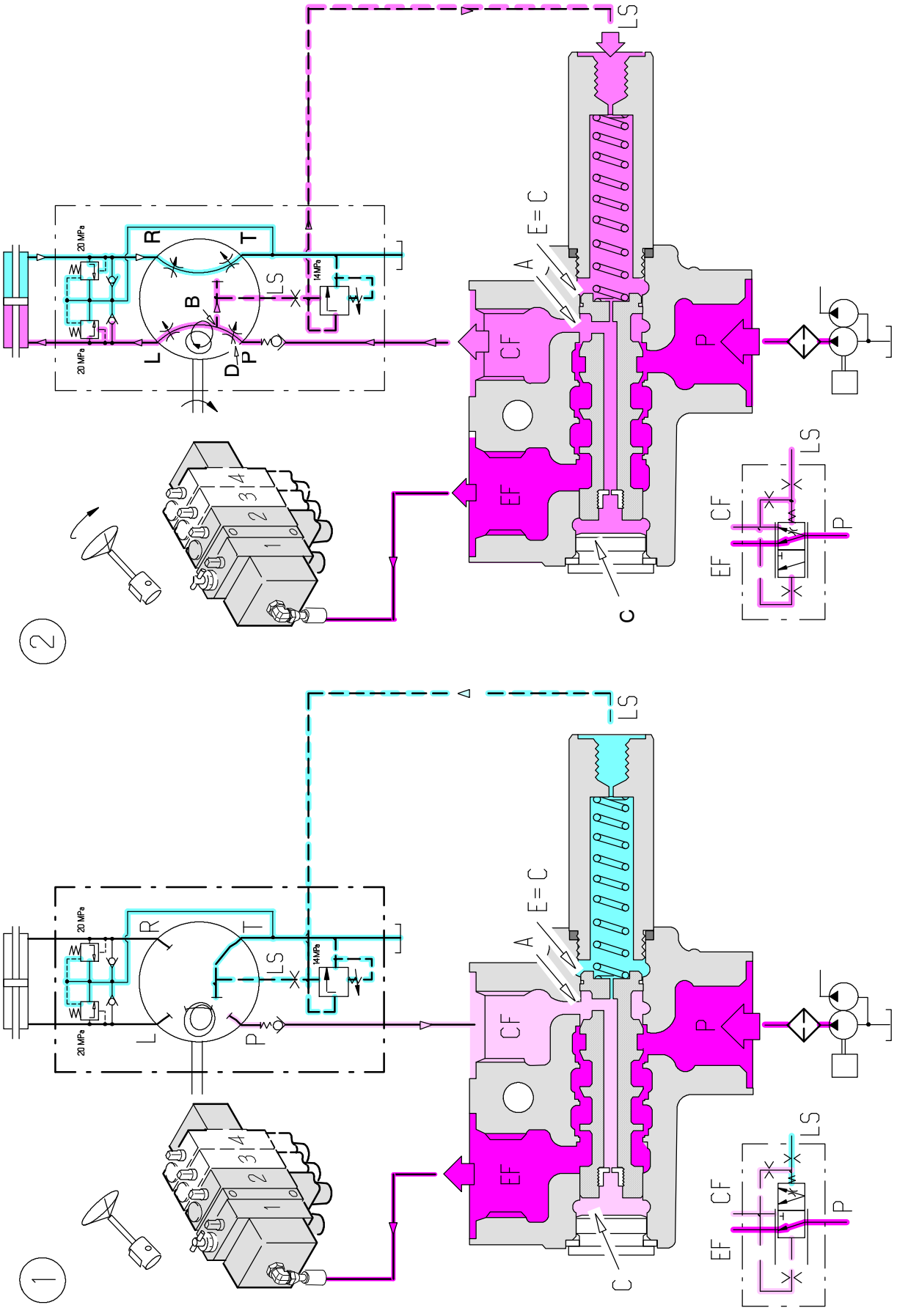


fig002

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The priority valve is placed on the right side of the tractor, connected with the pressure filter.

The priority valve directs the oil flow both to the working hydraulics EF and to the steering hydraulics CF.
Steering hydraulics have priority. This means that in every situation there is sufficient oil flow for steering of the tractor, independently of the load of steering hydraulics and working hydraulics. The rest of the oil flow is available for the working hydraulics.

Function of the priority valve

1) The pump delivers oil – steering is not used.

The **P** connection of the steering valve is closed
The **LS** (Load Sensing) line is connected to the **T** connection

All the pump delivery is driven over the three–stepped throttling to the **EF** connection with a pressure loss determined by the LS spring (of the working hydraulic circuit), which is ca. 7 bar (area C x pressure in point A = spring force LS).

2) The steering wheel is turned.

The throttle **D** of the steering valve opens up. The pressure upon the steering cylinder L/R is conducted from point **B** along the LS line to the side of the spring of the priority valve.

The pressure which acts at the left end of the slide is area **C** x pressure **B** on the steering valve (this pressure is conducted via port CF and through the drilling on the slide). At the right end of the slide acts pressure **B** + spring pressure. Now the slide moves to the left and oil flow between ports **P–EF** is throttled and oil starts to flow between ports **P–CF**.

The state of balance is achieved when the pressure loss **A** – **B** = 7 bar, which corresponds to the value of the LS spring.
D is the throttling that varies according to the steering speed in the space **A** – **B**.

Steering at maximum speed:

When the steering speed is the maximum, the flow area **D** of the throttle is maximal.
The priority valve increases the oil flow from the **CF** connection to the steering valve so much, that the pressure loss **A** – **B** = 7 bar. This situation represents the maximum steering speed.
When the steering movement is finished, port D on the steering valve is closed and the pressure in line LS discharges to the tank.

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Steering valve

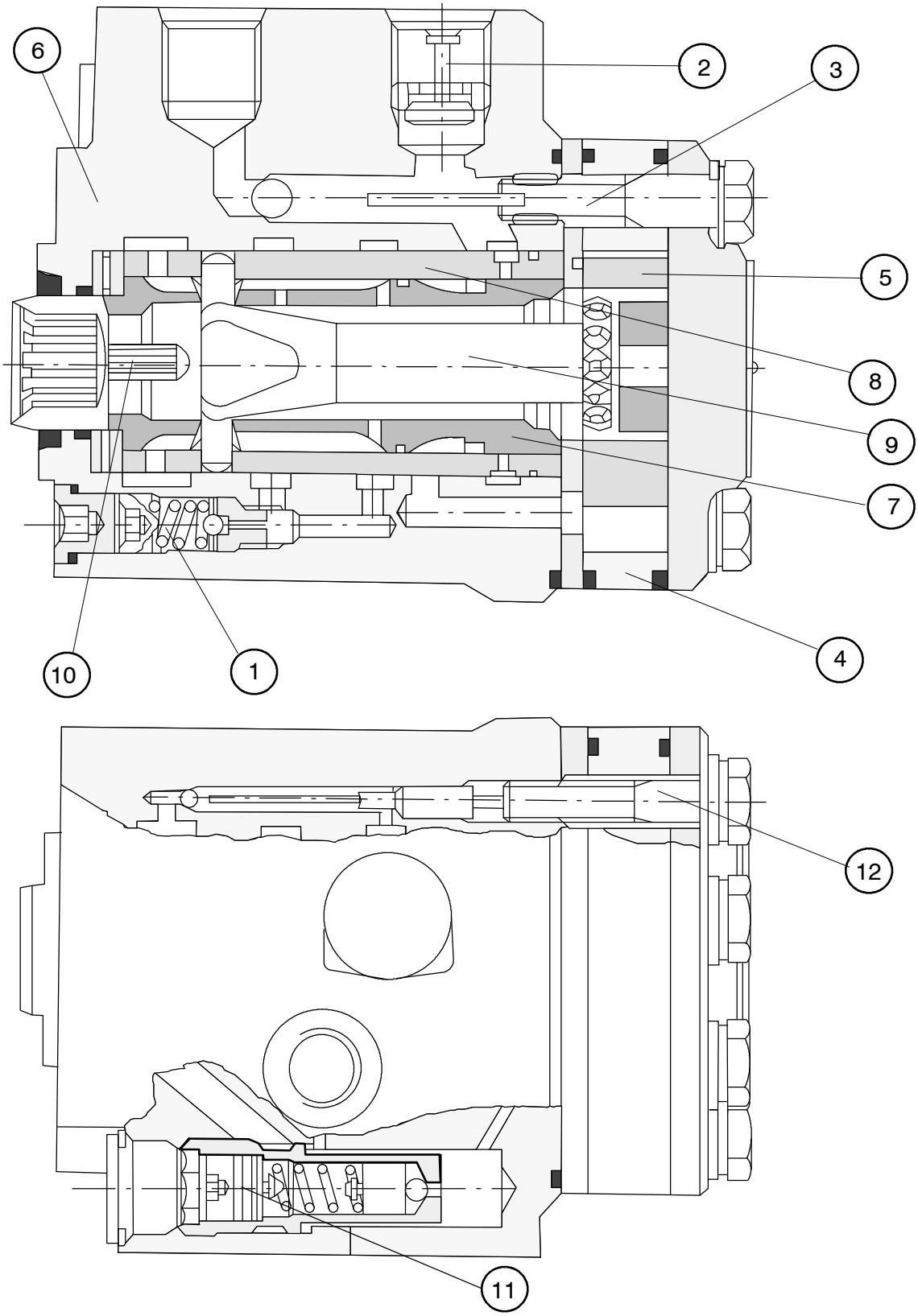


fig003

1. Shock valve (2 pcs, 19,5 MPa)
2. Non–return valve
3. Non–return valve for emergency steering
4. Rotor ring
5. Rotor
6. Valve housing
7. Inner valve spool
8. Outer valve spool
9. Rotor shaft
10. Centring springs
11. Pressure–limiting valve (14 MPa)
12. Anti–cavitation valves (2 pcs)

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See figure on previous page.

The steering valve consists of a metering unit (rotor set) and a valve unit. The rotor set consists of a rotor ring (4) with seven internal teeth and a rotor (5) with six external teeth. The valve unit consists of a valve housing (6), outer valve slide (8) and inner valve slide (7).

The inner slide (7) is directly actuated by the steering wheel. The outer valve slide (8) is mechanically connected to the rotor (5) by a cross pin and rotor shaft (9). The cross pin which runs through both valve slides permits the inner valve slide to move 8° in both directions independent of the outer valve slide.

When the steering wheel is in the rest position, centring springs keep the inner and the outer valve slides in neutral (in relation to each other) and the oil flows freely through the steering valve. The passages to the steering cylinder are kept closed and the steering cylinder cannot move.

When the steering wheel is turned, the inner valve slide is turned in relation to the outer valve slide. The neutral–position passages become restricted at the same time the passages down to the measuring unit and on to the steering cylinder gradually open. Simultaneously the return oil from the other side of the steering cylinder flows back via the steering valve.

The oil flow from the pump through the valve makes the rotor and the outer valve slide turn in the same direction as the steering wheel and the inner valve slide.

When the steering wheel is not turned any further and kept still, the centring springs bring the outer and the inner valve slide back into the neutral position The passages to the steering cylinder close and the oil flows freely again through the steering valve.

When the hydraulic pump does not supply any oil, the metering unit of the steering valve acts as a manually powered pump. The oil which is drawn from the steering cylinder and the return line via the non–return valve (3) is delivered to the other side of the steering cylinder when the steering wheel (and inner valve slide 7) is turned 8°. The cross pin then also makes the following parts turn: the outer valve slide (8), rotor shaft (9) and rotor (5). Shocks and knocks against the steering wheel are dampened by the two shock valves (1) which are fitted in the steering valve.

The shock valves are combined with anti–cavitation valves (point A) in order to keep the cylinder fully supplied with oil at all times.

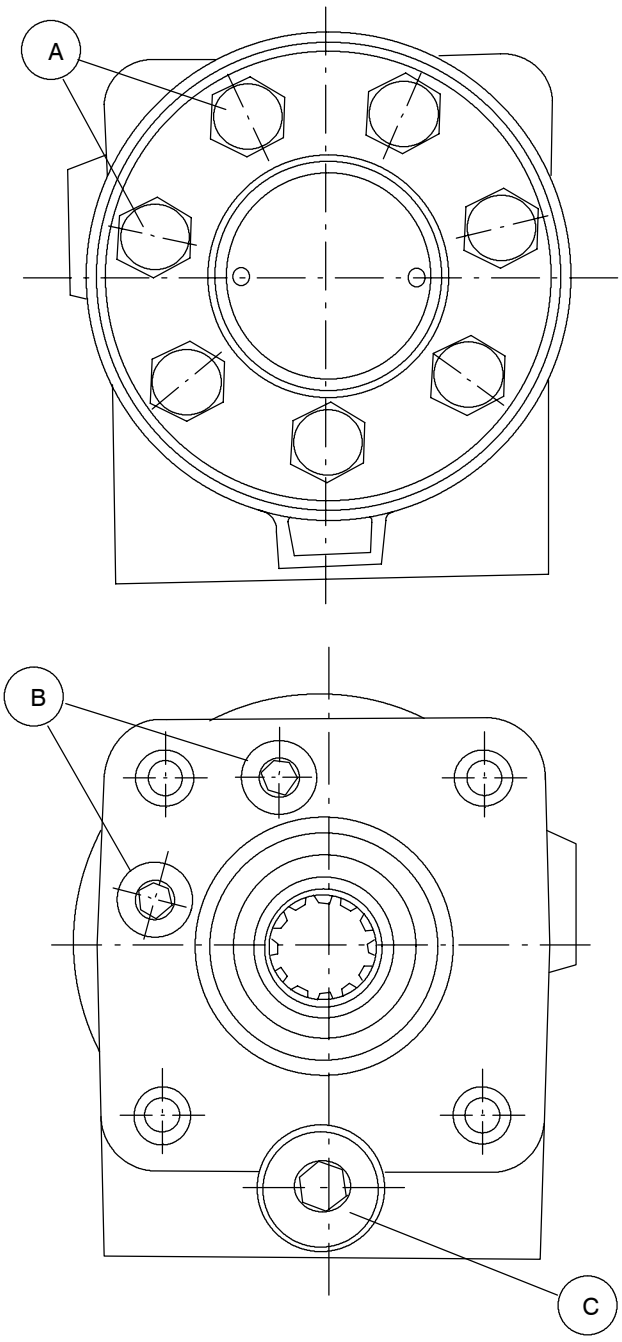


fig004

A. Anti–cavitation valves
B. Shock valves
C. Pressure–limiting valve

Fault tracing chart

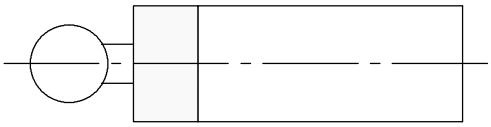
Fault	Probable cause	Remedy
The steering wheel is hard to turn, but the steering is otherwise normal	1. No hydraulic pressure. The pump or the pump drive faulty	Repair the fault
	2. Non–return valve (3 fig. 5) leaking or ball in wrong position.	Replace the ball or check its position
	3. Pressure–limiting valve jammed in open position	Repair the pressure–limiting valve (or clean it)
	4. Considerable friction in the mechanical parts of the steering system.	Lubricate the steering system bearings and joints, repair if necessary. Check the steering column clearance
Continual correction of the steering wheel is necessary. The steering wheel will not assume a neutral position.	1. Leaf springs have no force or are broken	Change the leaf springs
	2. Steering column and steering valve are not in line.	Line up the steering column with the centre line of the steering valve
	3. Too little play or no play at all between the steering column and the connecting piece.	Adjust the clearance
The steering wheel will not assume the neutral position, tends to turn itself=motor effect)	1. Dirt, burrs or swarf between the inner and outer slides.	If possible clean the slides, otherwise change the complete housing or the whole steering valve
	2. Jamming between the inner and outer slides caused by too high fluid pressure	Clean the whole steering system
	3. Leaf springs broken or have no spring pressure.	Adjust the pressure–limiting valve to the prescribed pressure
		Change the leaf springs
Road wheels turn in the wrong direction	1. Hoses to steering cylinder are reversed	Change the hoses round
	2. Wrong setting of rotor shaft or rotor set, see figure	Correct the setting
Steering force too low (or only to one side)	1. Steering pressure too low	Correct the pump pressure of the pressure–limiting valve
	2. Worn seal on steering cylinder piston	Change the piston seal
	3. Too large internal leakage in steering valve	Change or recondition the steering valve
	4. Shock valve faulty	Recondition shock valve
	5. Abnormal superstructure for use of machine	Compare with machine of standard version
Abnormally large ”play” in steering wheel	1. Groove for cross pin worn or broken	Change rotor shaft
	2. Play in universal joint on steering column	Change the universal joint
	3. Leaf springs broken or have no spring force	Change the leaf spring
Road wheels vibrate	1. Air in the steering cylinder	Bleed the steering system
	2. Wear in the mechanical connections or wheel bearings	Change worn parts
The steering wheel is subject to severe shocks when steering wheel is turned or the steering wheel tries to move the opposite way (=tends to twist out of the hands)	1. Faulty setting of rotor shaft and rotor set	
Shocks from road wheels while driving	1. Non–return valve (2 fig. 5) faulty	Change steering valve
Steering too slow	1. Too little oil in the system	Check oil level and oil pressure flow from the pump
	2. Pipe lines partly clogged	Clean or repair
	3. worn steering valve	Change or recondition the steering valve
	4. Abnormal superstructure or use of machine	Compare with machine of standard version

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Special tools

Steering valve (code 615.1)

ETV 894 330 . . . . . Fitting tool for steering valve seal



ETV 894 330

fig005

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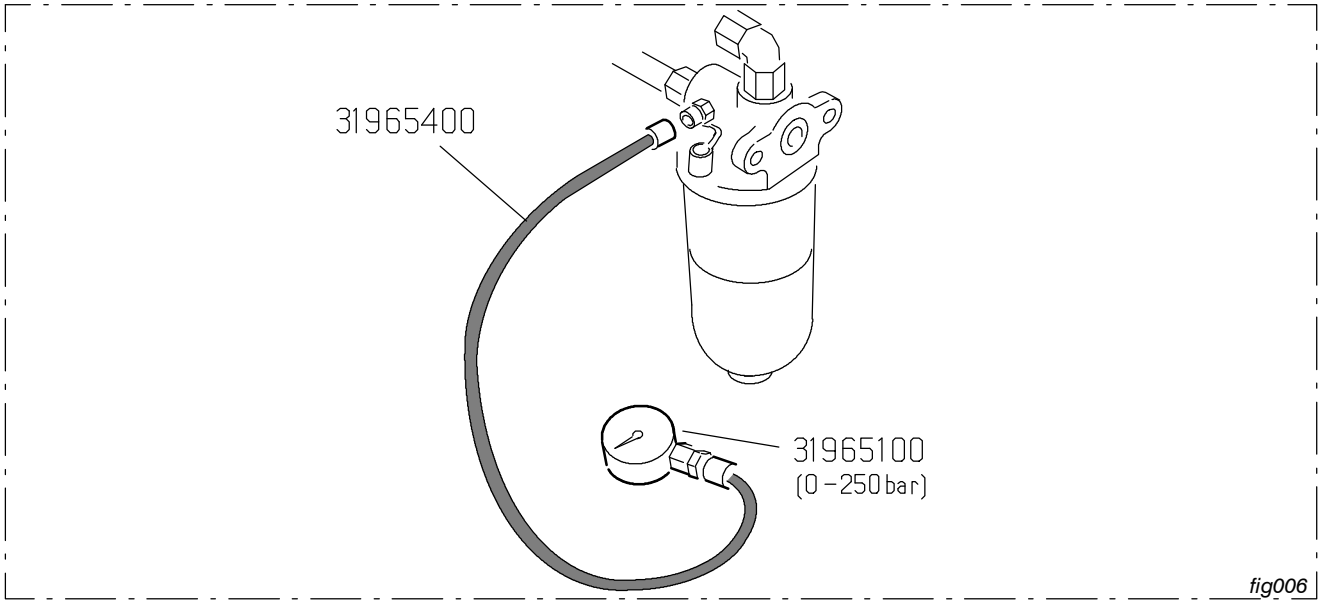


fig006

1. Equipment for measuring steering system working pressure (**pressure at test point 14,0–15,5 MPa**)
Pressure measuring kit 31965000 includes the above shown hose and pressure gauge. These parts can also be ordered separately.

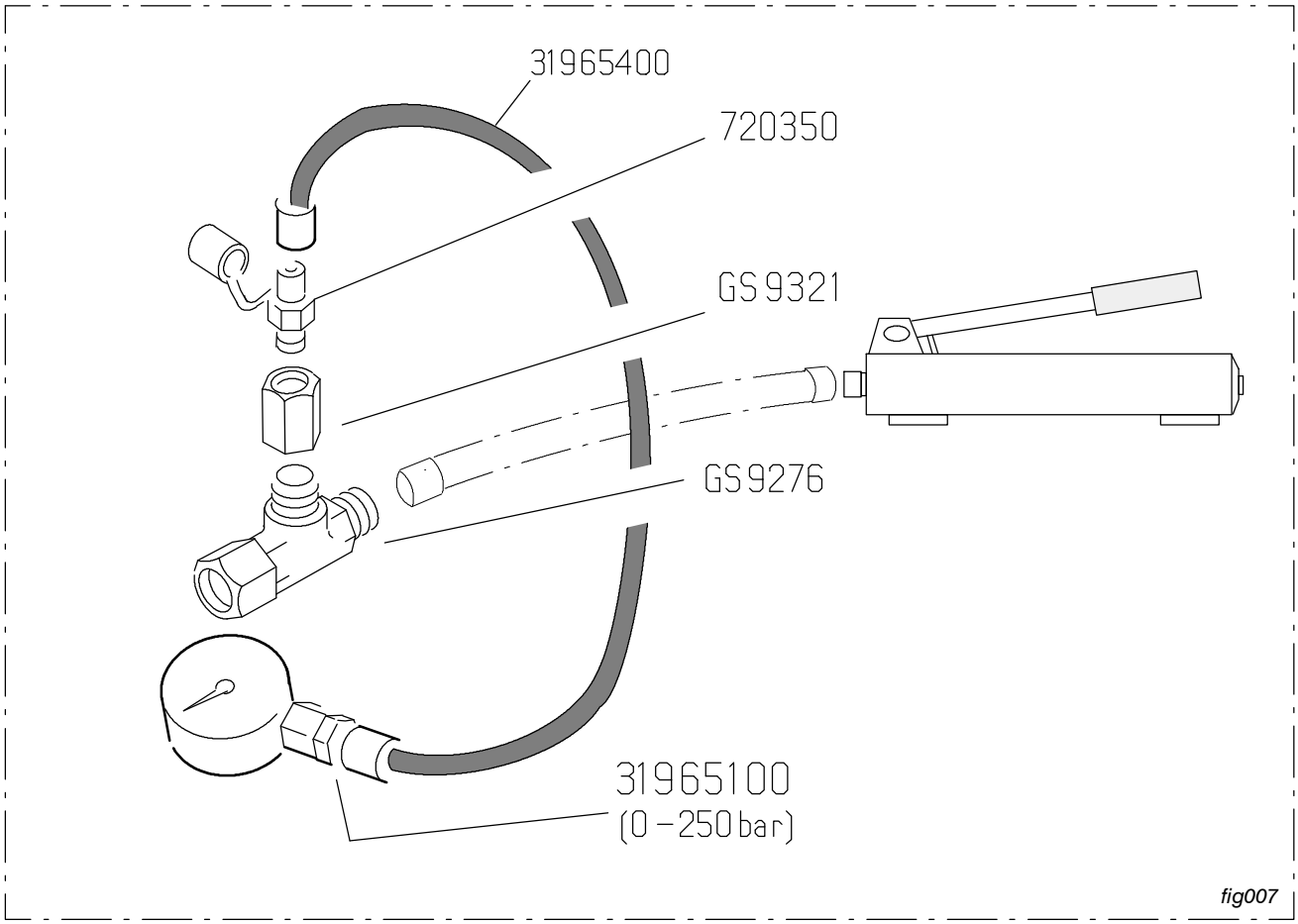


fig007

2. Equipment for measuring shock valve opening pressure **(opening pressure 19,0–21,5 MPa)**.
Note! T–connector GS9276 has thread 3/4–16 for connecting hand pump hose. The pressure measuring kit 31965000 does not include the hand pump

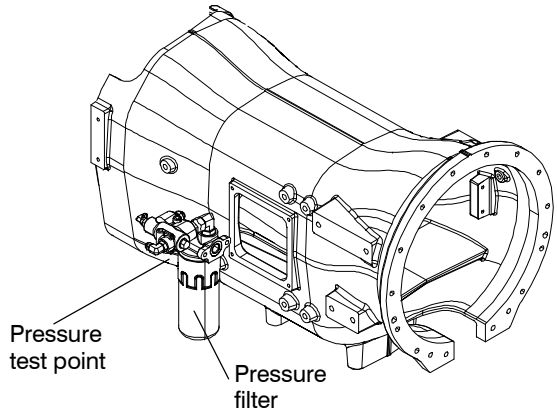
Reconditioning steering system

Measuring steering system

(pressure–limiting valve opening pressure)

1. Start the engine and allow it run until the oil temperature in the transmission is **50–65 °C**.

Note! Oil warms up faster if the steering wheel is held against lock.



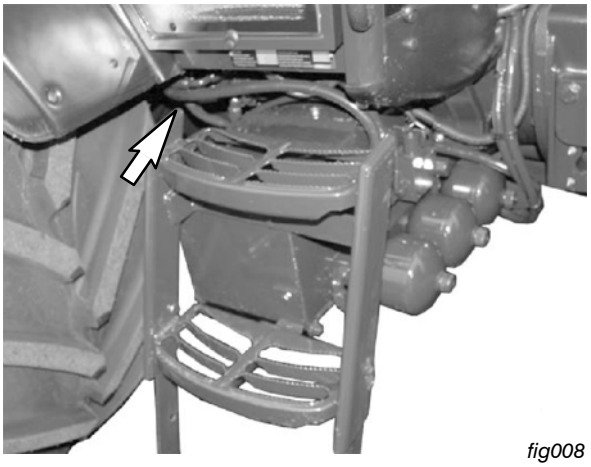


fig008

2. Connect a pressure gauge (measuring equipment, see code **614.1**) to the pressure test point (Valmet HPR) on the pressure filter bracket.

3. Run engine at **1500 r/min**.

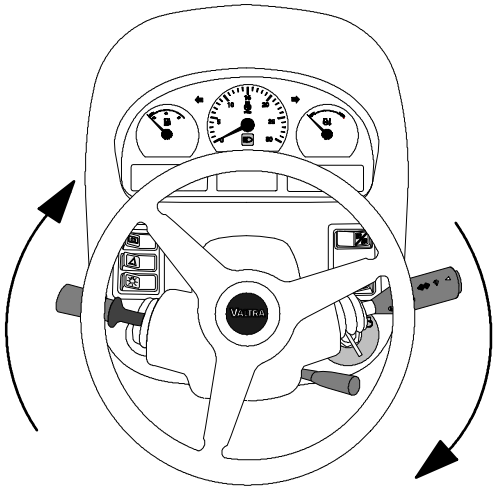


fig009

4. Turn the steering wheel to full lock and hold. The correct pressure gauge reading is **14,0–15,5 MPa** (140–155 bar).

Note! If the pressure value is not correct, remove the steering valve and inspect the pressure limiting valve.

Checking shock valve opening pressure

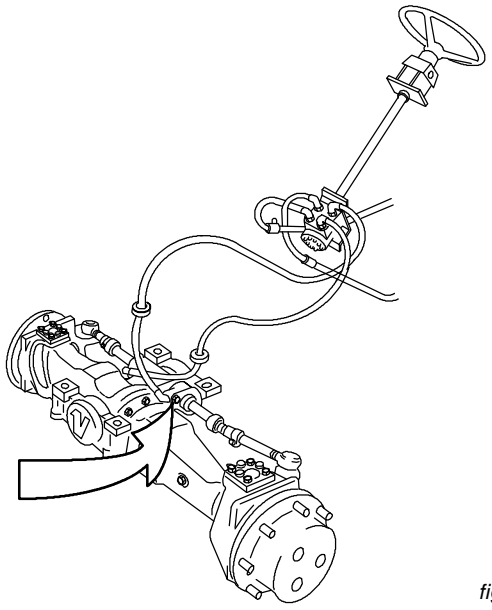


fig010

1. Disconnect one of the oil lines to the steering cylinder and connect a hand pump and a pressure gauge to the disconnected hose.

Note! It is easier to disconnect the hose if the tractor is driven so that one front wheel is upper that the other (axle oscillation).

2. Pump up pressure and read off the shock valve opening pressure. The correct value is **19,5–21,5 MPa** (195–215 bar).

3. Completely re–assemble the system and check the opening pressure in the other line to the steering cylinder.

Note! If opening pressure is not correct, remove the steering valve (see next page) and check and clean the shock valves and adjust them (see page 3).

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Steering circuit leakage check

1. Start the engine and allow it run until the oil temperature in transmission is **55–65 °C**.
2. Run the engine at **1500 r/min**.

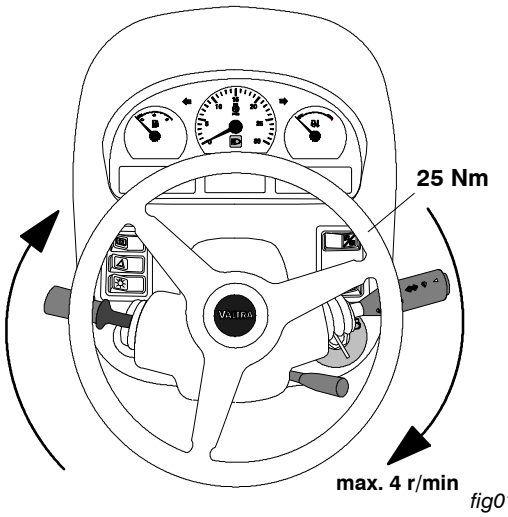
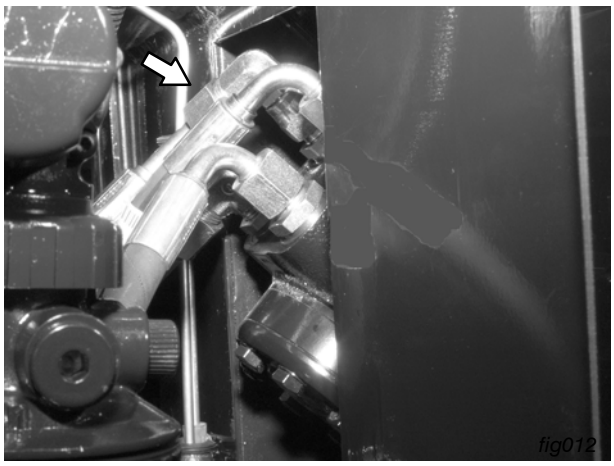


fig011

3. Turn the steering wheel to full lock and apply **25 Nm** torque to the steering wheel.
4. If the steering wheel turns more that **4 rev/min**, there is too much internal leakage in the steering valve and it must be changed.
5. Check the internal leakage also with a new steering valve. If the steering wheel still turns too much, the steering cylinder seals must be checked.

Removing steering valve

1. Remove the engine side shields.


fig012

2. Disconnect the oil hoses from the steering valve.

Note! Mark the hoses for easier fitting.

3. Unscrew the steering valve bracket screws from the cab front wall.
4. Attach the steering valve to a vice and remove the bracket.

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Cleaning shock valves and pressure–limiting valves

1. Remove the steering valve. Secure the valve in a vice with soft jaws.

Note! There are two shock valves in the steering unit. Both valves are similar.

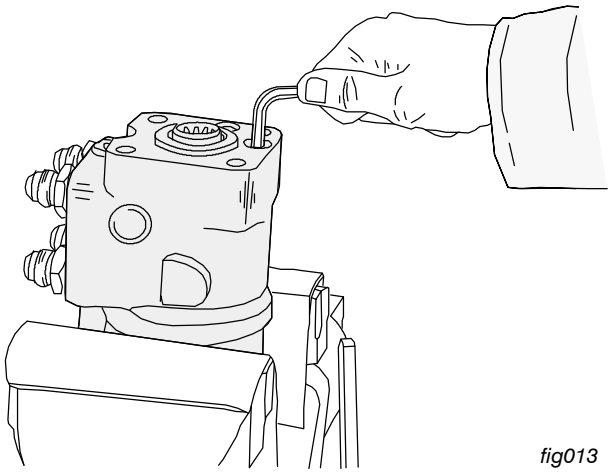


fig013

2. Remove the plug on the shock valve (6 mm socket head) and remove the sealing ring of the plug.

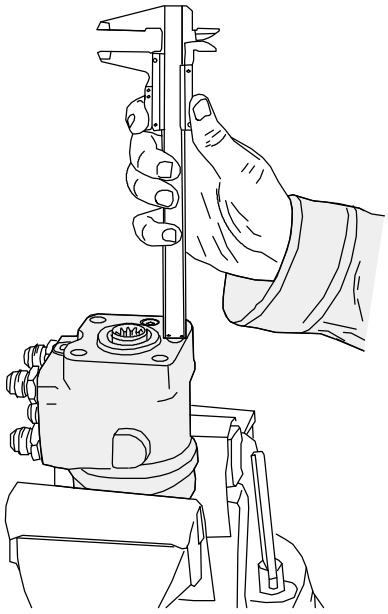


fig014

3. Measure and make a note of the distance between the adjusting screw and the upper face of the steering valve to faciliate the setting of the opening pressure of the shock valve.

4. Remove the adjusting screw (6 mm socket head). Shake out a spring, washer and a ball.

5. Clean and check the parts and change faulty ones. Lubricate all parts with oil before assembling. Minor damage to the seat can be polished with a ball and fine grinding paste.

6. Fit the valve ball, washer and the spring.

7. Apply a little locking fluid to the threads on the adjusting screw. Screw in the screw to the depth as measured in paragraph 3.

8. Fit the sealing ring and the valve plug and tighten to a torque of **40–60 Nm**.

9. Unscrew the pressure–limiting valve plug (8 mm socket head).

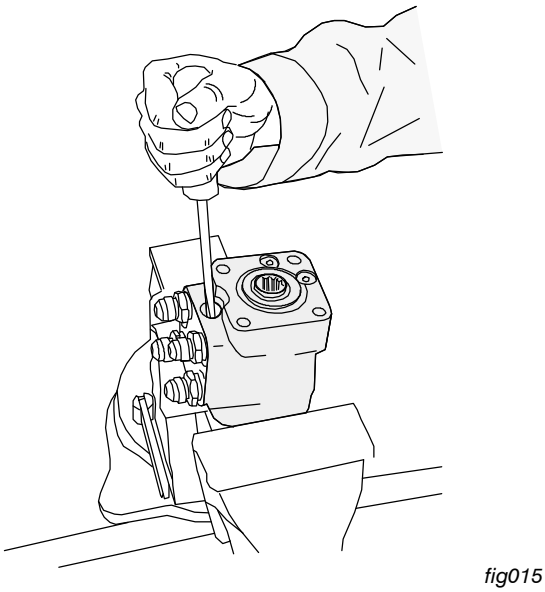


fig015

10. Remove the pressure–limiting valve insert by unscrewing it with a 12 mm Allen key.

11. The pressure–limiting valve insert can be disassembled by unscrewing the plug with a 4 mm Allen key. After that the valve spring, seat and the ball can be removed.

Note! When assembling the valve, screw the plug to the same depth as it was before disassembling.

12. Clean all parts and the valve bore and lubricate the parts with oil.

13. Make sure that there is a sealing ring on the pressure–limiting valve insert. Fit the valve insert and tighten it to **40–60 Nm**.

14. Fit the plug sealing ring and tighten the plug to **40–60 Nm**.

15. Fit the steering valve (see page 8) and check the steering system pressures (see page 1).

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Changing seals in steering valve

1. Remove the steering valve.
2. Secure the steering valve in a vice with the cover upwards. Mark the position of the cover, distributor plate and rotor ring for easier fitting.

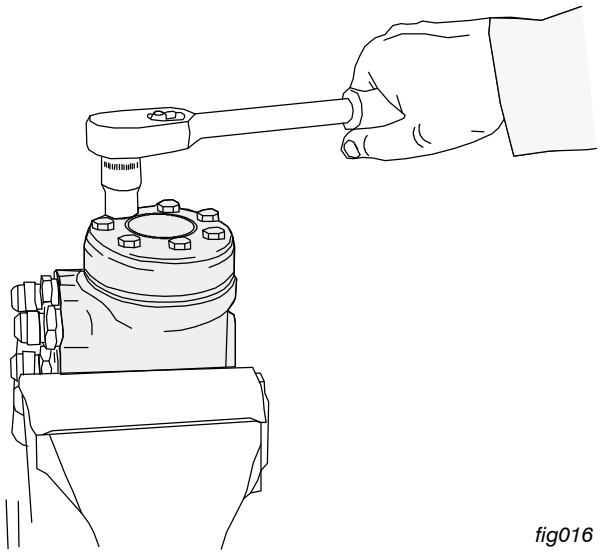


fig016

3. Unscrew the cover fixing bolts.

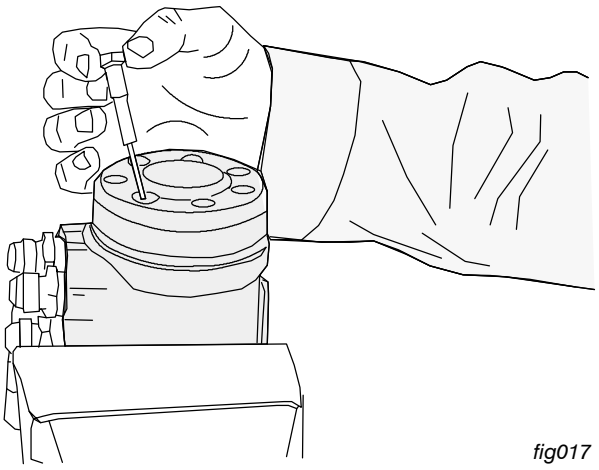


fig017

Note! Remember where the bolt with the locating pin was fitted. If the valve is turned upside down, three valve balls and two pins will fall out.

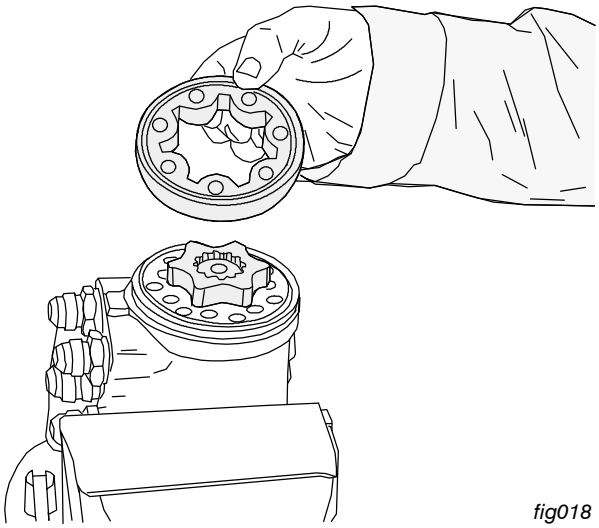


fig018

4. Remove the cover, rotor ring and the rotor and the washer inside the rotor.

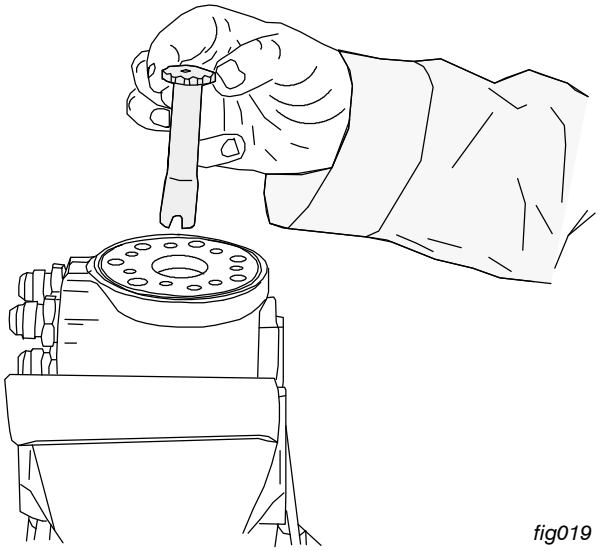


fig019

5. Remove the rotor shaft and the distributor plate. Check/change o–rings between the parts.
6. Push up the valve slide and pull them out of the valve housing. Remove the thrust bearing from the slide bore.

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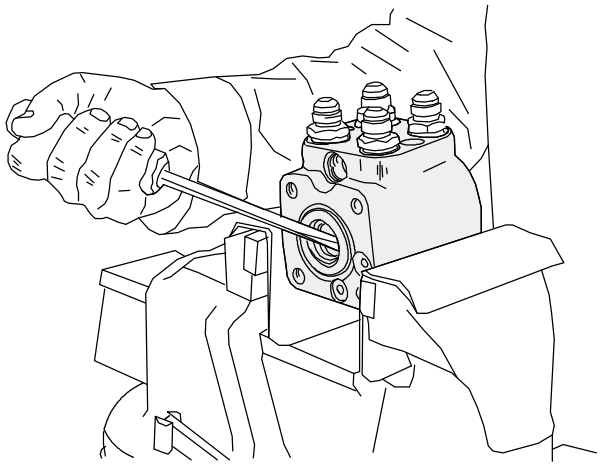


fig020

7. Turn the steering valve to a horizontal position and prize out the seal from the valve housing. Remove the inner oil seal. Fit a new outer seal. Apply some grease to the seal and turn the valve back to the vertical position.

8. Fit the inner seal (and the support ring) using tool ETV 894 330 as follows:

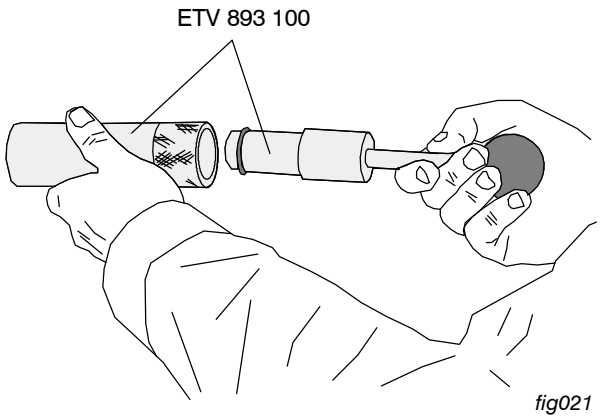


fig021

– Lubricate the o–ring. Fit the support ring on the stud of the tool and fit the o–ring on the support ring. Push the stud into the guide sleeve.

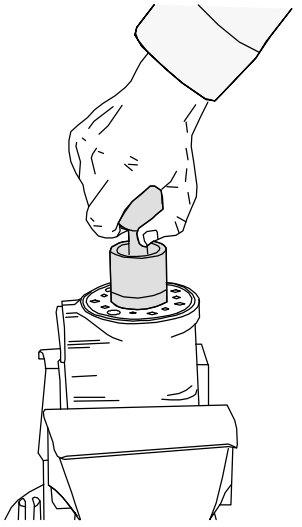


fig022

– Push the guide sleeve into the valve housing and push the seal together with the support ring in place using the stud on the tool. Remove the tool and check that the seal is property positioned.

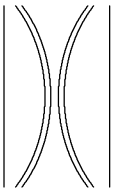


fig023

Note! If the centring springs are changed, they must be fitted as shown in figure above.

Note! Before removing the springs, mark position of the valve spindles in ralation to each others e.g. with tusche. Rinse the spindles with gas oil (also lubricating properties) so that they can move easily and the centring springs can center them.

9. Fit the ring over the centring springs. Place the thrust bearing assembly onto the valve slide.

Note! Thick thrust washer first, then bearing and then the thin thrust washer. Chamfered side of the thick washer towards the slide.

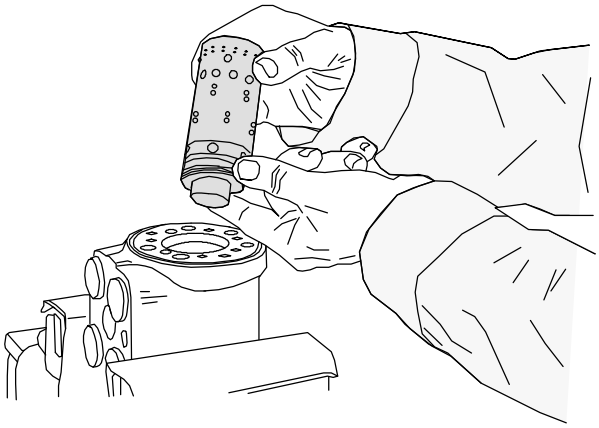


fig024

10. Push the valve slide into the housing fully home

Note! The valve slide together with the thrust bearing is easier to fit into the housing when the steering valve is horizontally. Turn the slides until the cross pin is parallel to the flat side of the valve housing.

11. Fit a new o–ring and the distributor plate onto the housing according to the mark. Fit the rotor shaft so that grooves on it engage the cross pin.

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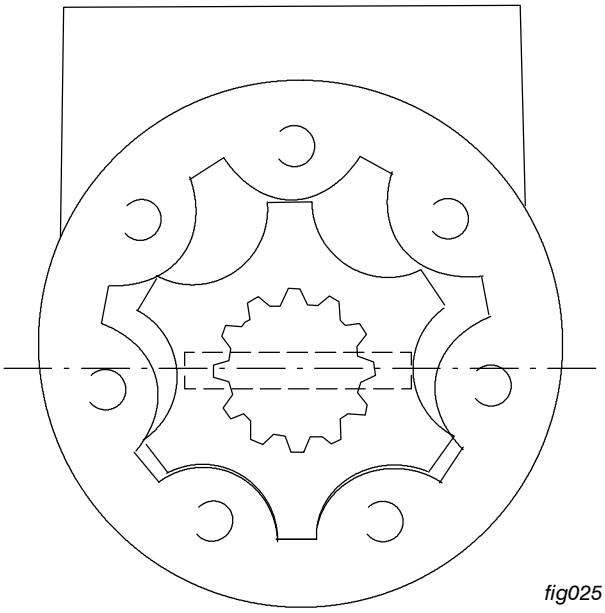


fig025

13. Then fit a new o–ring and the rotor ring according to the marks. Fit the rotor according to the figure above.

14 Fit the washer inside the rotor.

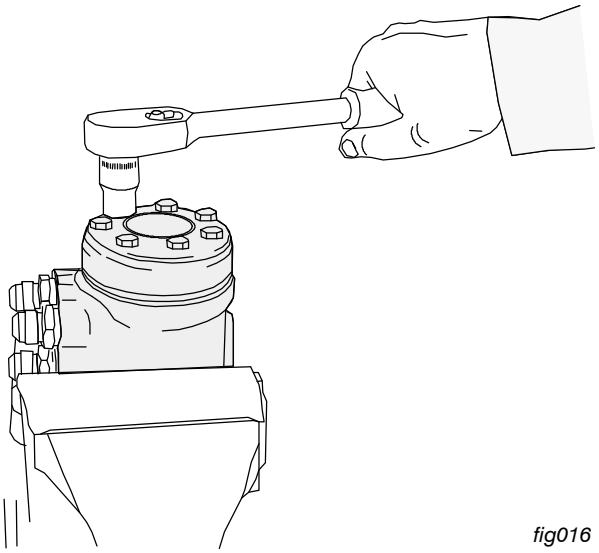


fig016

15. Fit the cover according to the marks and tighten the bolts to a torque of **30–35 Nm**.

16. Fit the steering valve.

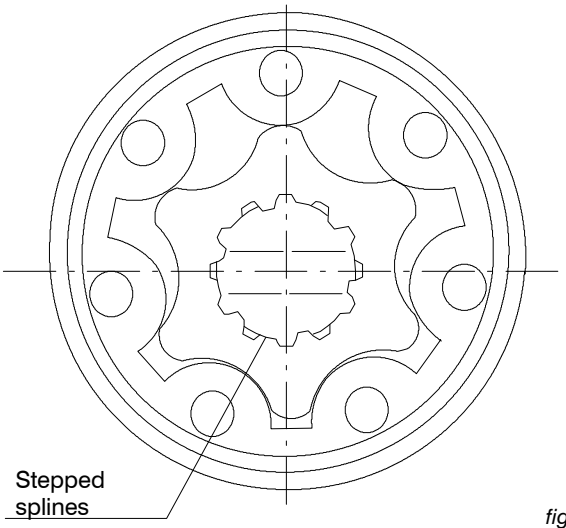


fig026

Note! In the latest steering valves the rotor shaft and the rotor have stepped splines at which time the mutual position of the parts is determined automatically.

Note! The stepped splines also prevent the rotor shaft from releasing from the cross pin inside the valve. With regard to possible repair works it is recommended, that a spacer is fitted at the end of the rotor shaft to ensure the position of the shaft. The spacers are still available as spare parts.

Fitting steering valve

1. Attach the bracket to the steering valve (17 mm) and secure the screws with locking washers.

2. Place the valve into its place and guide the steering wheel column lower end into the valve splines.

3. Fasten the bracket to the cab front wall. Connect the oil hoses according to the marks.

4. Test–run the tractor and check for leaks.

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Priority valve OLS 120

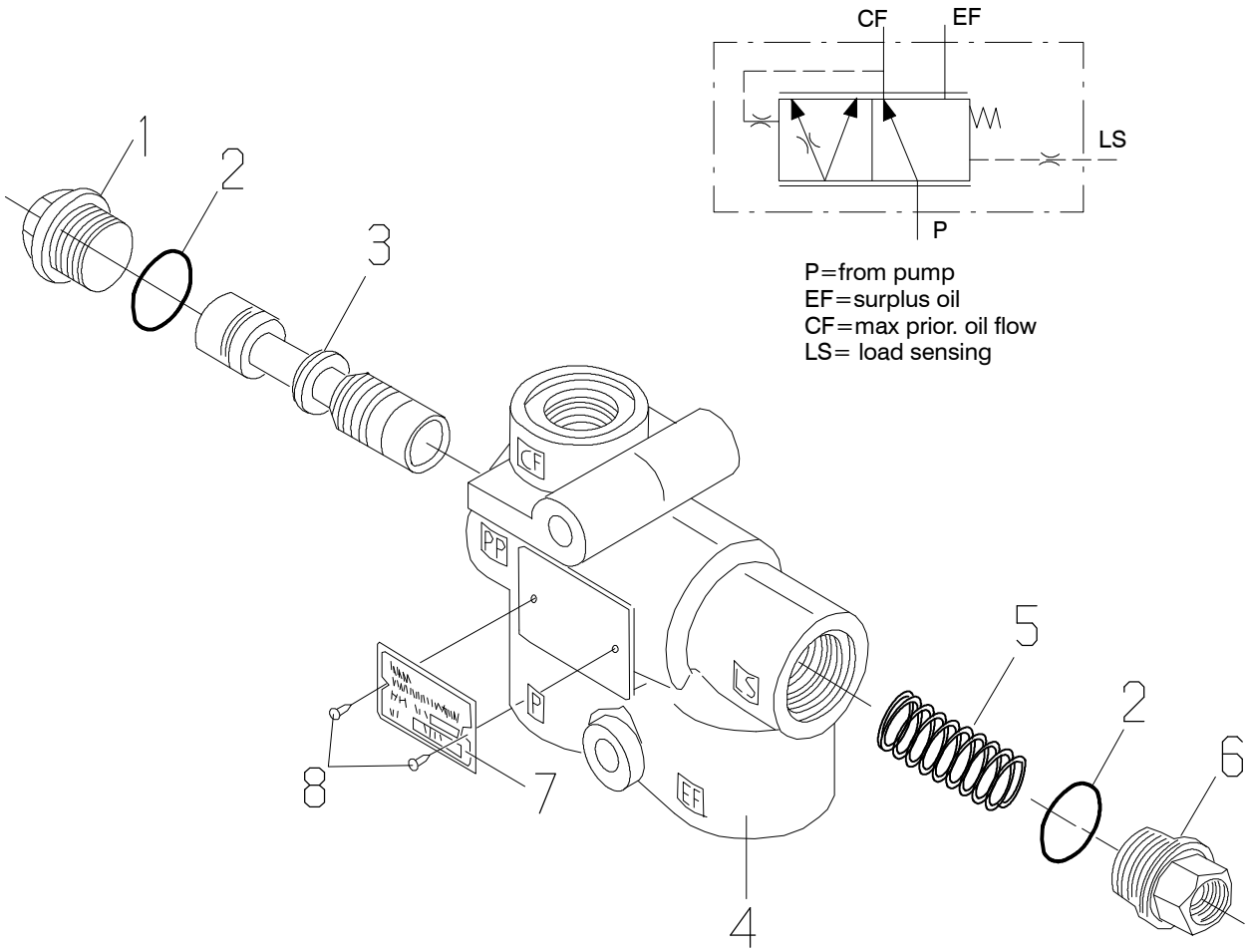


fig027

Disassemling

1. Detach the priority valve which is fitted beside the pressure filter under the cab floor on the RH side.
2. Open plug (1) and remove the sealing ring (2).
3. Unscrew the connection (6) and remove the sealing ring (2) and the spring (5).
4. Push out the valve slide (3) by using e.g. a pencil. Do not damage contact surfaces on the slide and the housing.
5. Check and clean the parts. Replace the sealing rings with new ones. Lubricate the parts with oil before fitting.

Assemling

1. Push the slide (3) into the housing. Fit a new sealing ring on the plug (1).
2. Place the spring (5) into the housing. Fit a new sealing ring and the connection (6). Tighten the connection to **40–60 Nm**.
3. Tighten the plug (1) to **40–60 Nm**.
4. Fit the priority valve.

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Steering cylinder adjustments

Adjusting front wheel toe–in

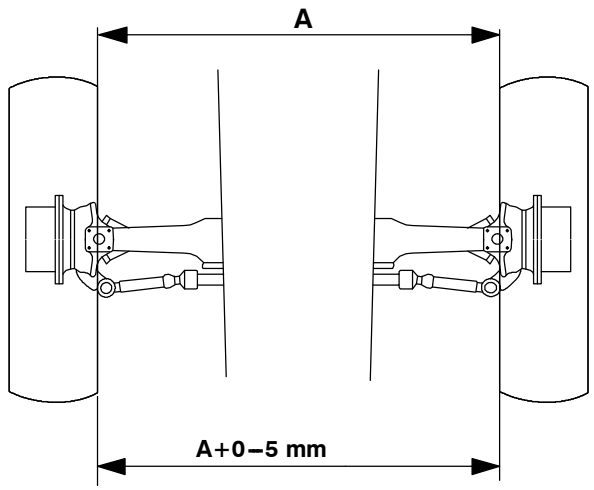


fig028

First check that there is no play on the ball joints of the steering arms and tie rods. Set the wheels for running straight ahead.

Checking

Make a vertical mark on the front tyres on the middle of the tread level with hubs. Measure the distance between the marks. Roll the tractor forwards so that the marks again come level with hubs, this time at the rear edge. Measure the distance between the marks again. The distance of the marks should be **0–5 mm** larger at the rear edge.

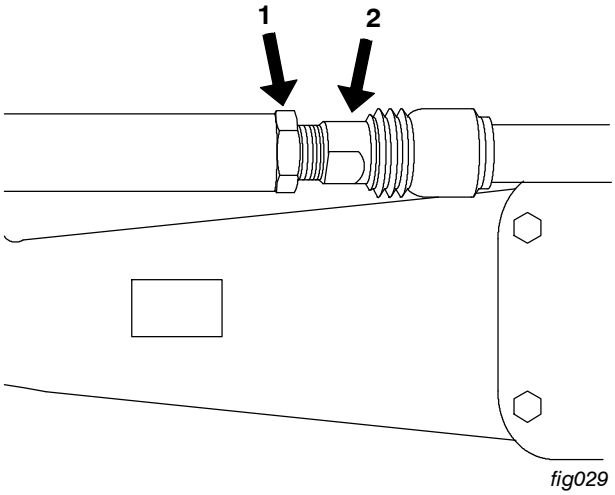


fig029

Adjustment

Slacken the locking screws (1) of the tie rod and turn the adjusting screw (2) in the desired direction.

Check the measurements again as above and tighten the locking screws when the correct measurement has been obtained. Both tie rods must be adjusted so that there is no limitation of the steering lock.

Adjusting steering lock

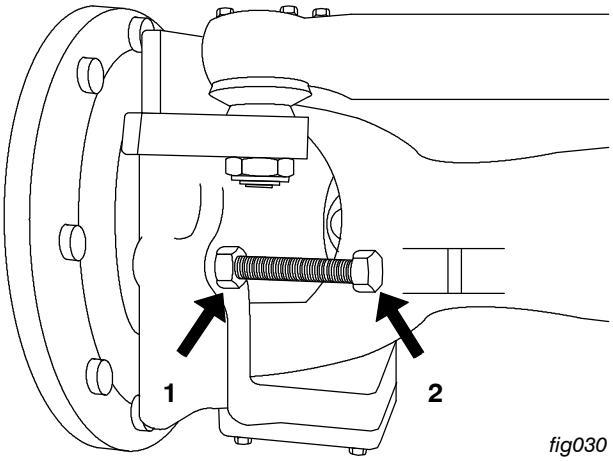


fig030

Adjustment of steering angle may be necessary when changing tyres or if the track width of the front wheels has been adjusted.

The front axle is fitted with limiter screws which limit the steering lock. Carry out adjustment by slackening the locking nuts (1) and adjust the adjusting screws (2). After adjusting tighten the nuts.

Adjust the adjusting screws of both sides to the same length, so that the turning angle would be same on both sides.

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General of air suspension of front axle

The air suspension of front axle is option. The foremost components of the system (compressor, deicer with reservoir, pressure regulator, pressure gauge and pressure air reservoir) are the same as for the optional pressure air brakes for the trailer . In addition, the air suspension has an overflow valve and a levelling valve, which keeps the height of the suspension system (rubber bellows height) the same regardless of the loading on the front axle. In addition, the system incl. two shock absorbers, air pipes and necessary frame parts. The upper parts of the frame are bolted onto the side of the tractor frame (front loader mounting is possible).

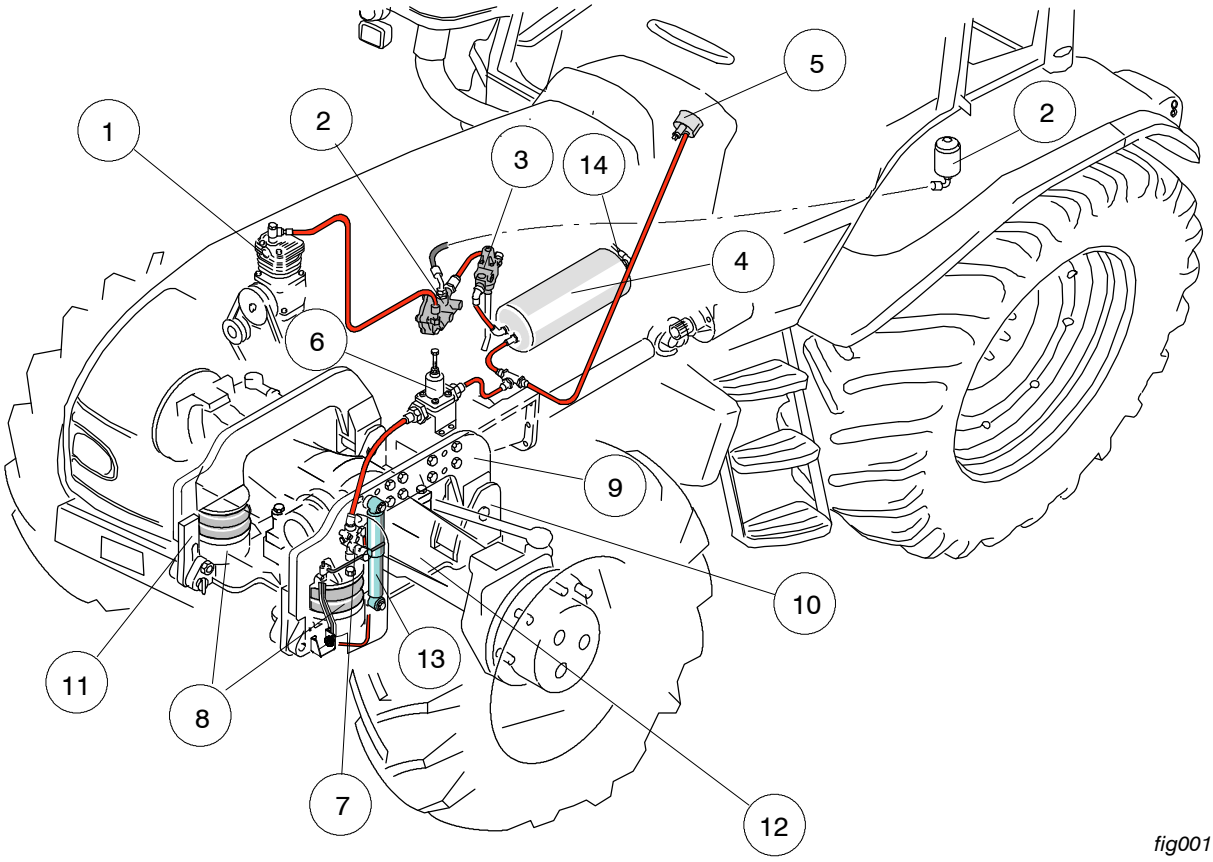


fig001

Mounting of the air suspension system

1. Compressor (same as for pressure air brakes)
2. Deicer and reservoir (same as for pressure air brakes)
3. Pressure regulator (same as for pressure air brakes)
4. Pressure reservoir (same as for pressure air brakes)
5. Pressure gauge (same as for pressure air brakes)
6. Overflow valve
7. Levelling valve
8. Rubber bellows
9. Fixed support plates (on both sides)
10. Hinge pins in the rear end
11. Oval attaching holes in the front end (suspension can be locked by using round holes)
12. Bottom plate, on which there is attached the front axle
13. Shock absorber (on both sides)
14. Pressure take–off for trailer brakes.

Note! The same suspension system can be fitted both on the standard front axle and on the industrial front axle.

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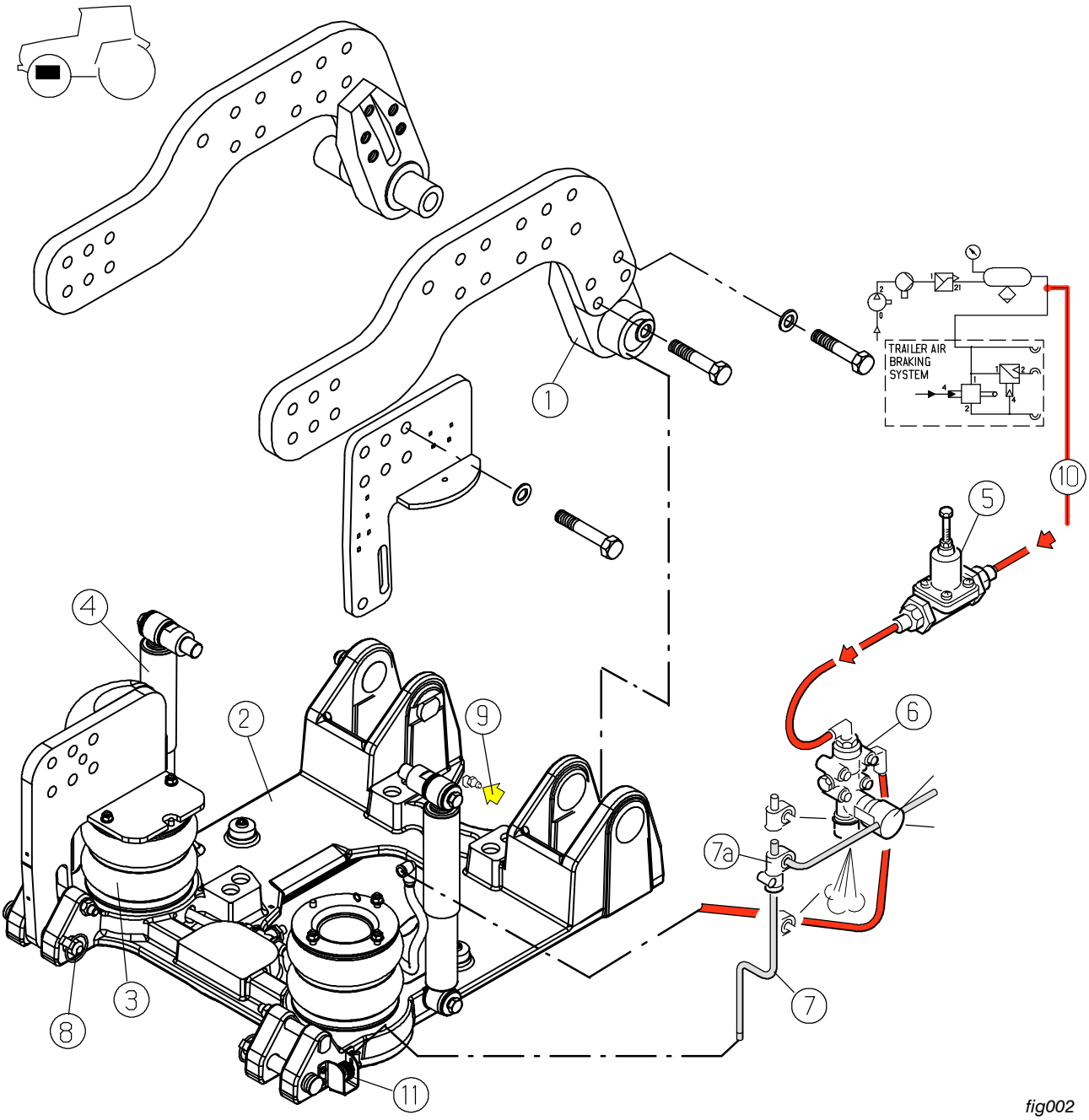


fig002

Air suspension system for front axle

1. Joint pin bracket
2. Bottom plate
3. Rubber bellows
4. Shock absorber
5. Overflow valve (if the tractor has the trailer air brakes, the overflow valve ensures enough high pressure in the brakes even though there is a leakage in the suspension system).
6. Levelling valve
7. Feeler linkage of the levelling valve

7a. Adjusting piece of linkage

8. Locking pin (the suspension can be locked by fitting the lock pin into the round holes. If the holes do not align, turn the levelling valve linkage to align the holes).
9. Grease nipples of axle brackets. The nipple of the foremost bracket is placed under the bracket (greasing at **every 250** running hours)
10. Pressure air intake from reservoir.
11. Lock wheel for the levelling valve linkage.

Note! The front axle loading is **350 kg** greater than on the tractor without the air suspension. The max. permissible axle loadings are the same as for the industrial front axle and standard front axle.

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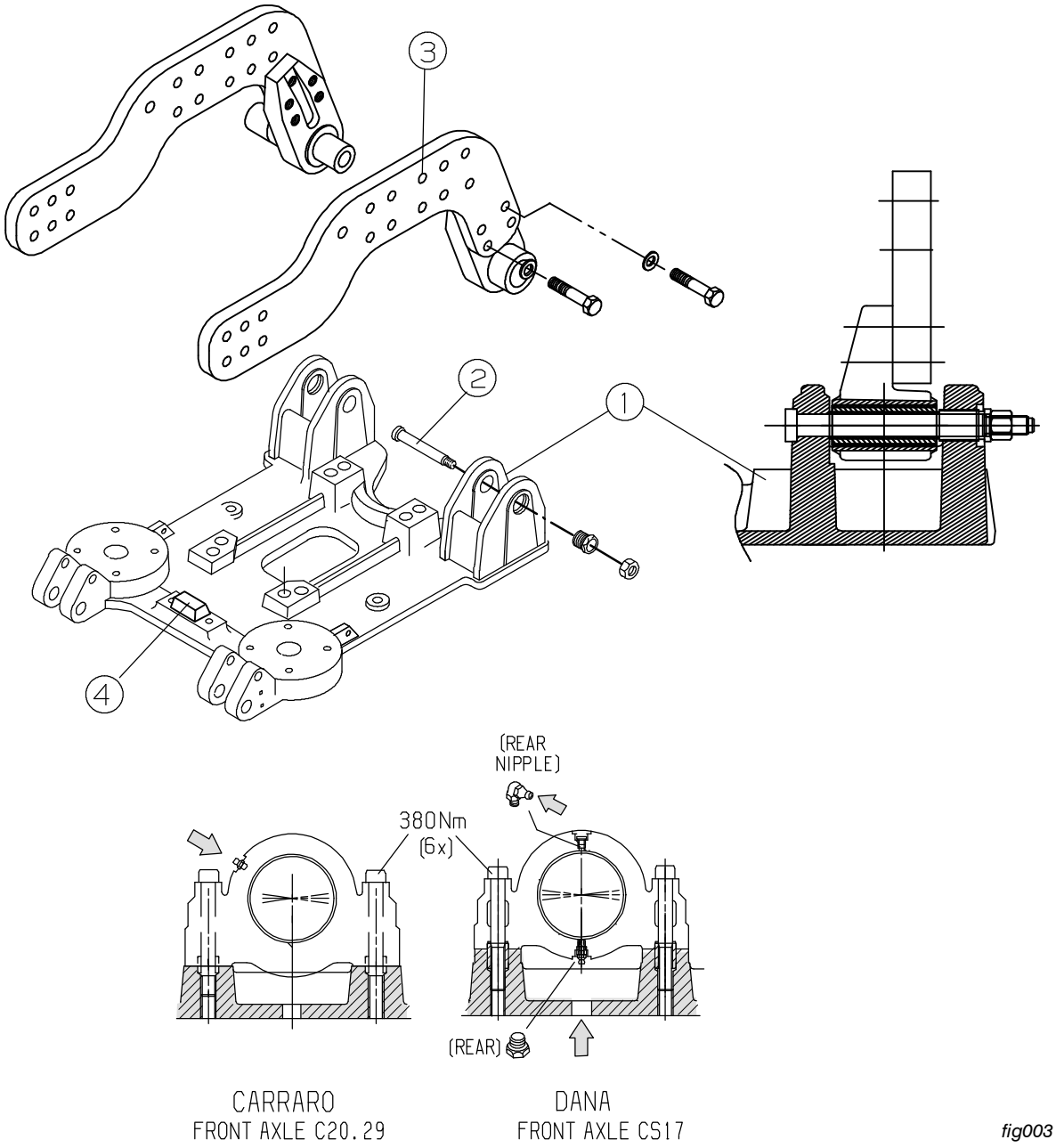


fig003

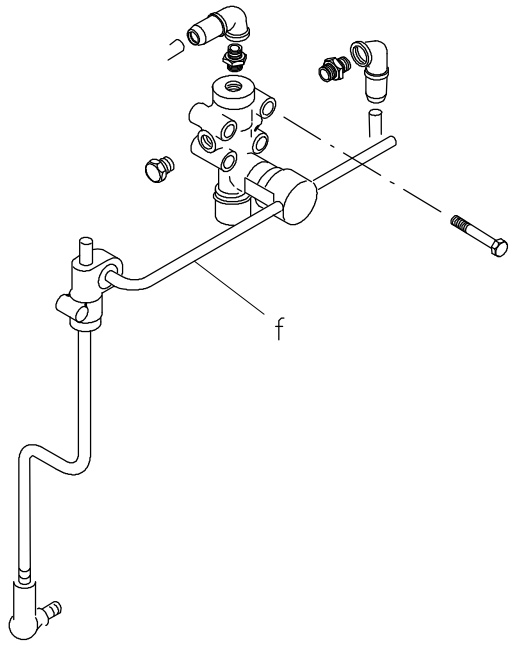
Front axle air suspension

1. Pivot mounting
2. Joint pin
3. Mounting screws (M20x75 8+8 kpl, torque 380 Nm)
4. Bumber soften the hit on tractors frame, if suspension goes instantaneous at extreme position

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Levelling valve



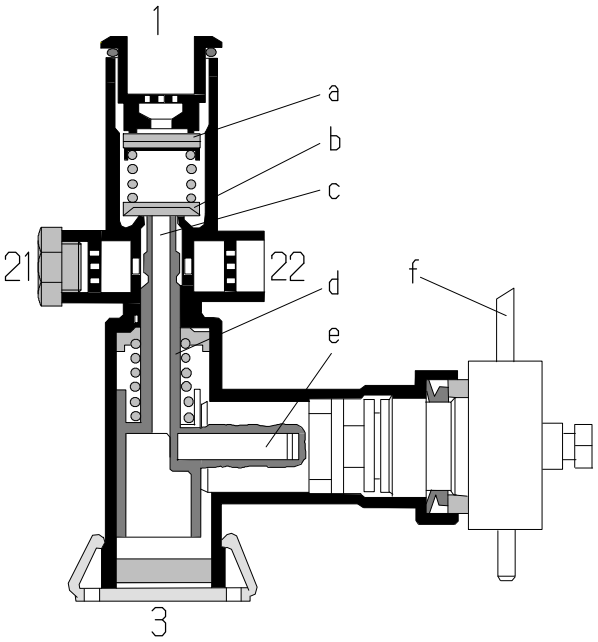


fig004

Function

When the loading on the front axle increases, the tractor frame/levelling valve moves downwards. Linkage lifts up the link (f) and sleeve (d) with the aid of the cam pin (e). When the sleeve (d) moves upwards, it opens the valve (b), and compressed air flows from the reservoir through port (1) and valve (a) into the suspension rubber bellows, which are connected to port 22 (port 21 is plugged).

When pressure increases in the bellows, the frame moves upwards, and link (f), when moving downwards, closes the valve (b).

When pressure increases in the bellows and link (f) together with the cam pin (e) move downwards, excess air from the bellows can flow through passage (c) and hole (3) to atmosphere. Now the tractor frame moves downwards and link (f) returns into the normal horizontal position. When passage (c) is closed, the levelling valve is again in the balanced position.

Adjustment

- lower the tractor frame into the lowest position against the limiter
- fill the bellows slowly. The valve must stop the lifting movement, when the locking pin holes align in the front part of the suspension frame. If the tractor rises more, lower the tractor frame and make the vertical link longer.
- check the adjustment again and change the vertical link length until the lifting height is correct (locking pins holes align).
- if the closing angle (link near horizontal) is reached before the correct height, shorten the vertical link.

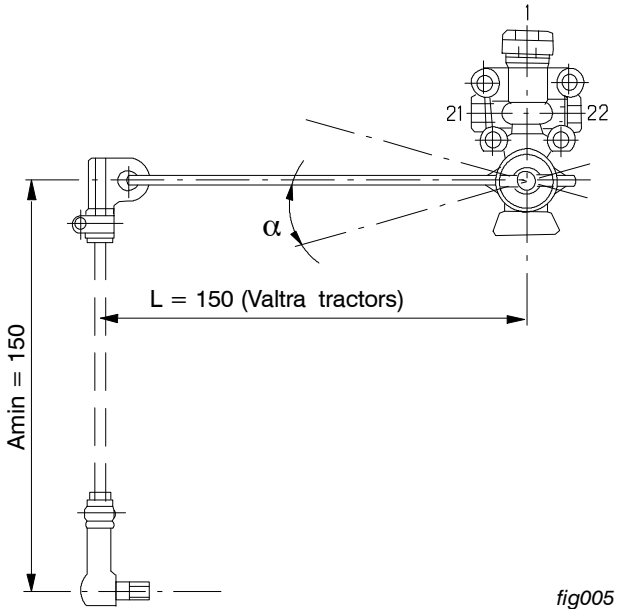


fig005

Note! The total stroke of the bellows on Valtra–tractors is ± 72 mm i.e. H= 144 mm (front wheel suspension is then ±40 mm).

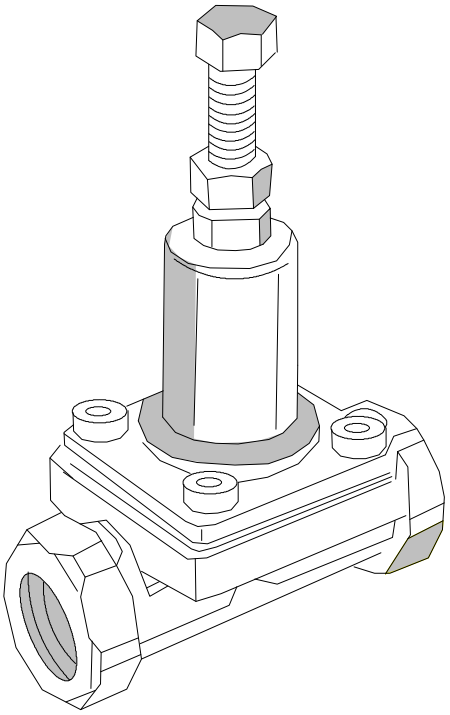
Note! Separate spare parts are not available for the valve. In case of a damage a new valve must be fitted. When fitting a new valve, the adjusting values can be set into the same values as for the old valve (however, the adjustment must be checked).

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Overflow valve

(only on tractors equipped with pressure air brakes)



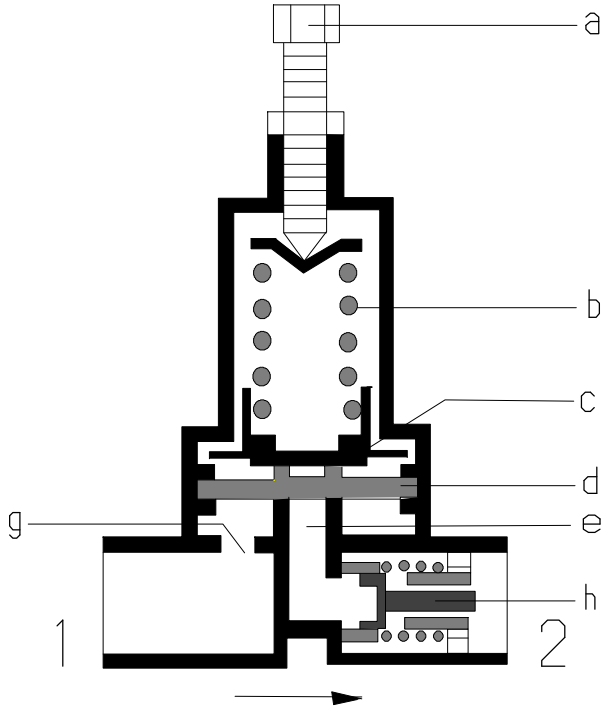


fig006

Function

This valve ensures that the pressure air flow into the suspension occurs just when the correct pressure affects the air brake system (although the suspension air bellows are leaking). Non–return valve (h) prevents return of the air form port 2 (suspension) to port 1 (reservoir). If the pressure drops in port 1, the pressure in the second side 2 remains the same.

Compressed air flows in the direction of the arrow through valve and through port (g) to the underside of membrane (d). Spring (b) presses the membrane against the seat. When enough high pressure has reached (6,2–6,5 bar), spring force (b) is overcome so that the membrane (d) rises up from its seat and passage (e) opens. Air flows through the non–return valve (h) into the suspension. Return flow is impossible since the non–return valve closes, if the pressure in the suspension is higher.

Adjustment

The valve opening pressure can be adjusted by turning screw (a). When turning clockwise the opening pressure increases and vice versa.

The valve does not need any maintenance. Opening pressure (1 –> 2) factory setting is **6,2–6,5 bar** (closing pressure – 10 %).

Note! In case of damage the whole valve is changed.

Other components

Compressor, deicer, pressure regulator, pressure reservoir and pressure gauge are the same as for the air brakes of the trailer (option).

Note! The pressure air pipes of the suspension system have been made of nylon pipes and quick couplings.

IMPORTANT! Although the engine is stopped, the suspension system remains under pressure. Always before maintenance works, make the system unpressurised e.g. by turning the level valve linkage.

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Shock absorbers

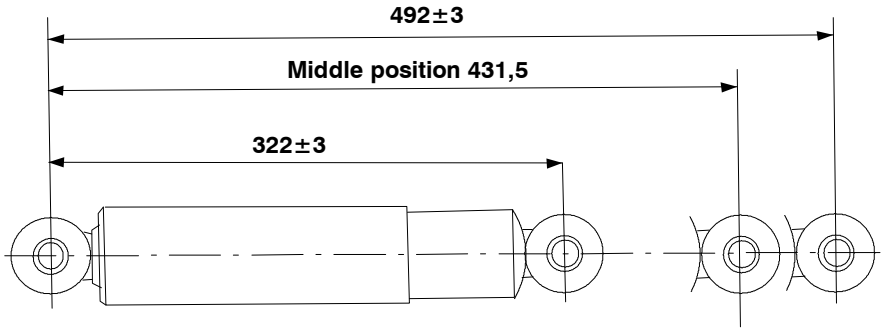


fig007

The shock absorbers (2 pcs) are of a liquid type. If the shock absorbers are damaged, the oscillations will take longer to stabilize after driving over pot holes or an rough terrain: giving uncomfortable driving. The shock absorbers are attached with the aid of bushings which have rubber damping.

Note! The shock absorbers cannot be repaired, but a new one is fitted in place of the damaged one.

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Rubber bellows

Type: Dunlop 8”x2.
Pressure values:

	Pressure	Limit value
Max. axle loading, static	3,5 bar	15 bar
Max. axle loading, bottom reaching	14 bar	15 bar
Norm. axle loading, outwards	1,8 bar	not vacuum

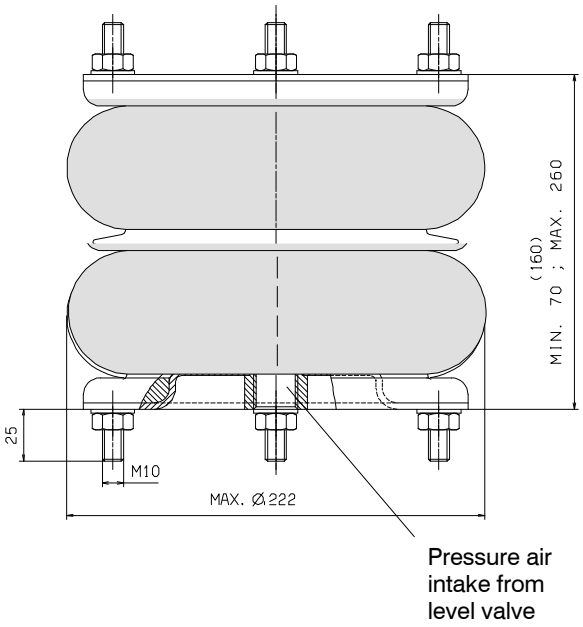


fig008

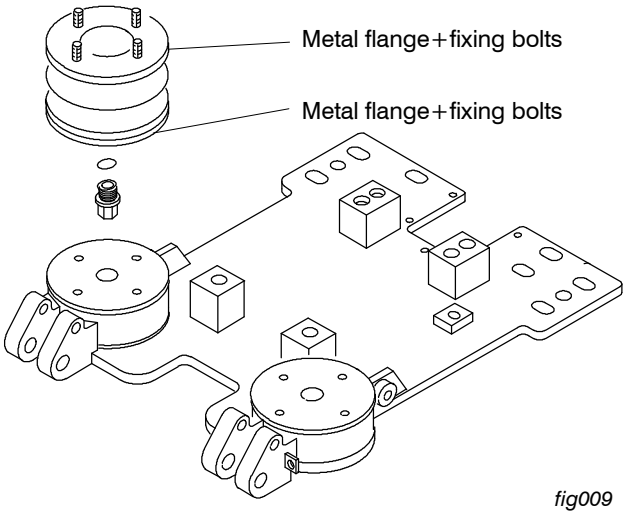


fig009

Note! In case of damages the rubber bellows are changed as a complete unit.

The bellows can be removed as follows:

– stop the engine, exhaust the system
– remove the rubber bellows protective coverings
– unscrew the bellows upper nuts (4 pcs)
– disconnect the pressure pipes under the bellows
– unscrew the lower nuts (4 pcs)
– remove the front end joint pins of the suspension
– raise the tractor front frame, until the bellows can be removed.
– fitting in the reverse order

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Technical data

4WD is engaged electro–hydraulically by means of a multi–disc clutch.

Axle type	Dana 730/503 Monolitic
Axle type	Dana 733/505 HiLock
Dana 730/503 Monolitic	automatic differential lock
Dana 733/505, HiLlock	Differential lock, electrohy–draulic controlled multidisc differential brake, simultaneously controlled with rear axle differential lock
Gear ratios:	
–Differential	2,923
–Hub reduction gears	6,000
–Total gear ratio	17,54
Number of the teeth (crown wheel/pinion)	Z32/10
Steering lock (adjustable)	max. 55˚
Front axle oscillation	±8˚
Caster	0°
King pin inclination (KPI)	5°
Camber	1°
Toe–in	0–2 mm
Flange distance	1800 mm
Oils:	
–differential	8 litres
–hub	2x1 litres
–degree	80W/90 GL–5 (LS)

Tightening torque

Front axle attaching bolts	380 Nm
Front wheel nuts	550 Nm
Propeller shaft flange joint	35 Nm
Tie rod–steering arm	160 Nm
king pin attaching bolts	120 Nm
Ring gear attaching bolts	75 Nm
Crown wheel attaching bolts	120 Nm
Pinion shaft nut	250 Nm
Housing of the differential attaching bolts	165 Nm
Planetary gear housing attaching bolts	50 Nm
Bearing cap of the differential attaching bolts (with an automatic differential lock)	90 Nm
Bearing cap of the differential attaching bolts (without automatic differential lock)	155 Nm

Setting values

Thickness of diff.brake disc set	14,51–14,69 mm
Press fit of the king pin standard value (not loose)	0,5–0,6 mm
Tightening of the differential bearings	open 1/4–1/2 turn
Tooth clearance, crown wheel/pinion shaft	0,15–0,25 mm (measured at the crown wheel tooth)
Rolling resistance for pinion shaft bearings, measured using spring balance:	
– bevel pinion shaft bearings	0,9–1,5 Nm
– bevel pinion shaft bearings+seal	1,4–2 Nm
– bevel pinion shaft bearings+seal+differential bearings	2–3 Nm
Axial clearance (between axle housing–pivot bearing brackets)	0,1–1,1 mm

Sealing compounds and locking fluids used:

Sealing compound Loctite 290
– on outer sides of oil seals
– on wear ring inner surfaces
– on hub seal dust cover
Medium strength locking fluid Loctite 242
– ring gear attaching bolts
Heavy strength locking fluid Loctite 586
– tie rod–piston rod

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Powered front axle, description

The powered front axle is attached to the front end of the tractor by two bearing brackets. There is a small clearance between the axle housing and central pivot bearing brackets. This clearance can be adjusted with shims.

The power is transmitted from the gearbox to the pinion shaft by the propeller shaft. From the pinion shaft, power is transmitted through the differential to the drive shafts and through the double universal joints to the hub reduction gears and the front wheels

The drive shafts are carried in bearing bushings in the axle housing and in ball bearing in the swivel housings.

In each hub gear the planetary pinions (3 off) are carried in roller bearings in the retainer. The ring gear is bolted to the steering knuckle.

The steering knuckle is attached to the front axle housing by the king pins which are carried in taper roller bearings. The bearing preload of the king pins is adjusted with shims at the upper pin.

The differential is provided with an automatic differential brake. The friction discs are fitted between the differential side gears and the differential casing.

Position of pinion shaft, tooth backlash and differential and pinion bearing preload are adjusted with shims.

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Front axle (Dana 730/503, 733/505)

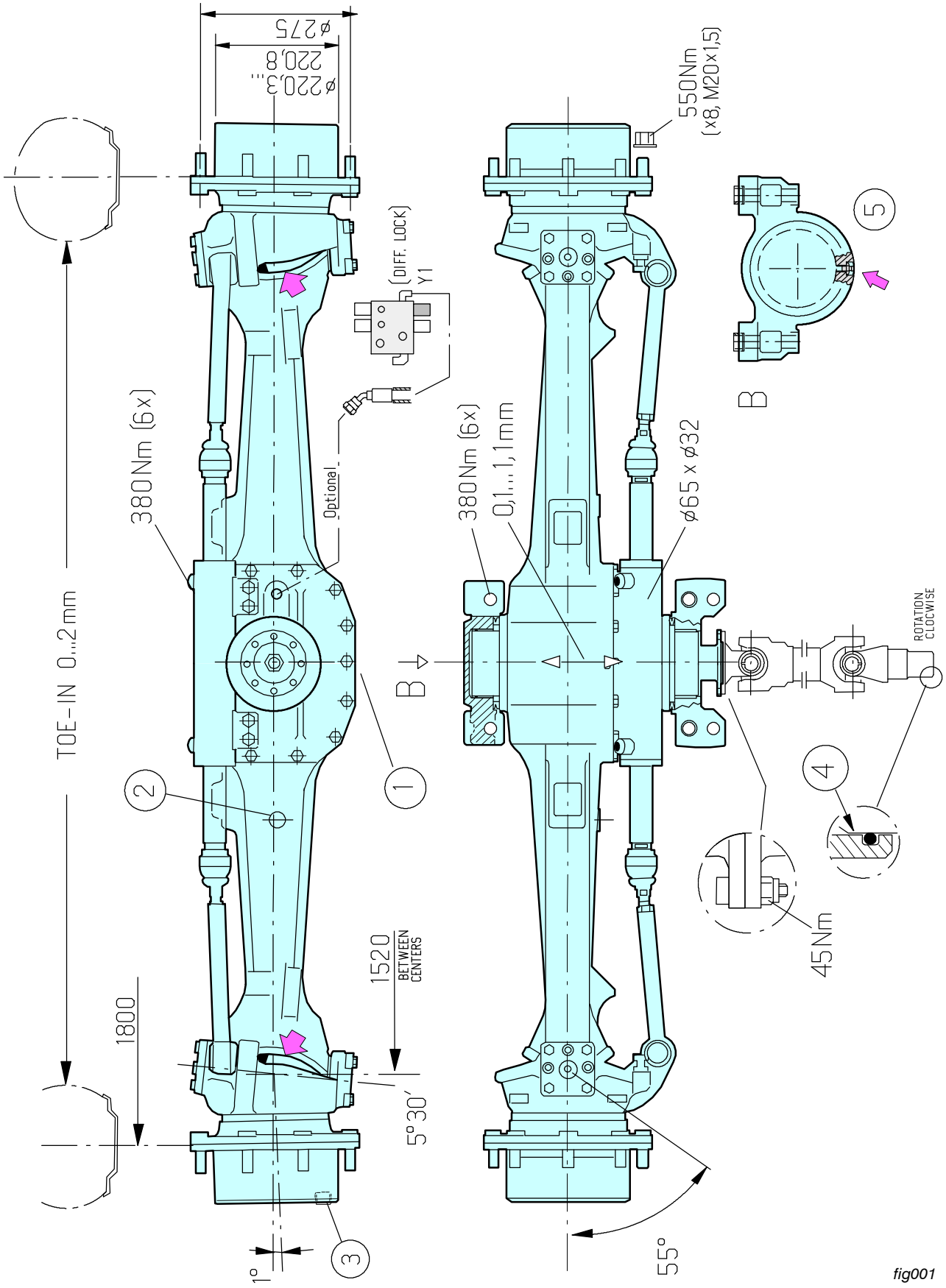


fig001

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Axle type	Dana 730/503	Dana 733/505
Control, on/off	Electro–hydraulically controlled multi–disc clutch	
Ratio, differential	2.923	2.923
Ratio, planetary gears	6.000	6.000
Total ratio	17.54	17.54
Ratio, front axle/rear axle	1.323	1.323
Ratio, front axle/rear axle 50 km/h, and T131h Eco Speed models	1.329	1.329
Differential lock, automatic differential brake	yes	–
Differential lock, electrohydraulic controlled multidisc differential brake, simultaneously controlled with rear axle differential lock	–	yes
Front axle suspension, control on/off	–	–
Steering arc, adjustable	max 55°	max 55°
Axle turning	12°	12°
Caster	0°	0°
King pin inclination KPI	5°	5°
Camber	1°	1°
Toe–in, mm	0–2	0–2
Flange distance,mm	1800	1800

Recommended fuel and lubricants :

Part of machine	Valtra–grade	SAE–grade	API–grade	Volume, when changing (liter)
Powered front axle				
– differential	Valtra Axle	80W–90	GL–5 (LS)	8
– hub reduction gears				2x1

1) Plug for checking and draining oil

2) Oil checking / filling plug for differential housing

3) Oil filling / draining plug for hub

4) EP–grease (UC3907) when assembled

5) The grease nipple quantity (on one bearing) was 2 pcs / is 1 pc

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Planetary gear (Dana 730/503, 733/505)

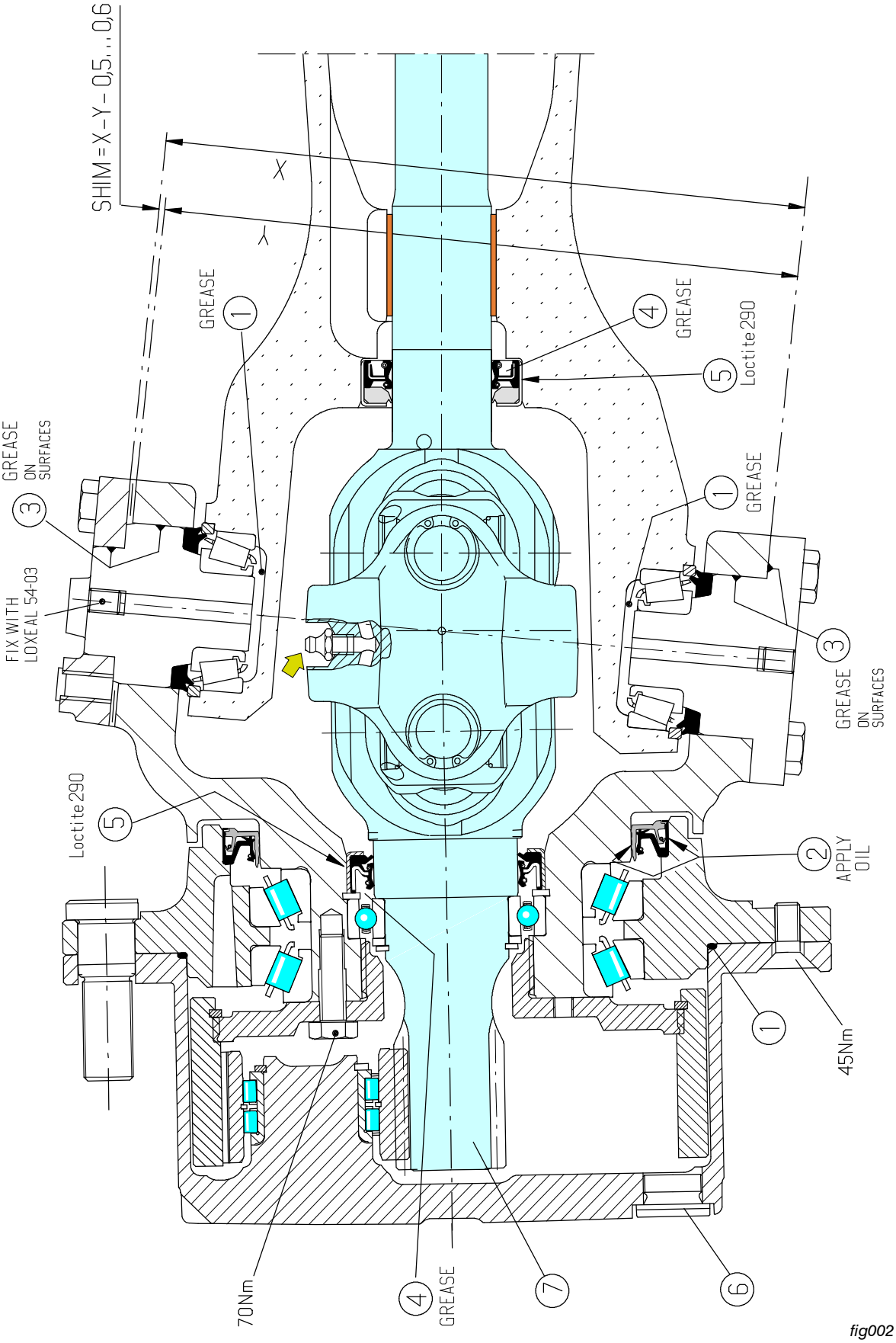


fig002

https://truckmanualshub.com/

1) Fill the space with grease when assembled

2) When assembled, smear places shown in the picture with oil.

3) Smear the surfaces with grease

4) Fill the space between the dust and seal lips with grease

5) Loctite 290 to the outer surface of the seal ring

6) Oil filling and draining plug.
Turn the wheel until the oil surface indicator line is horizontal. The oil surface should be level with the inspection hole. Check oil level every **500** hours.

Change oil (1 litre / hub) every **1000** hours.

7) Double u– joint shaft
Bond the shaft splines with some tape, to preserve the swivel housing seal from damage.

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Differential (Dana 730/503)

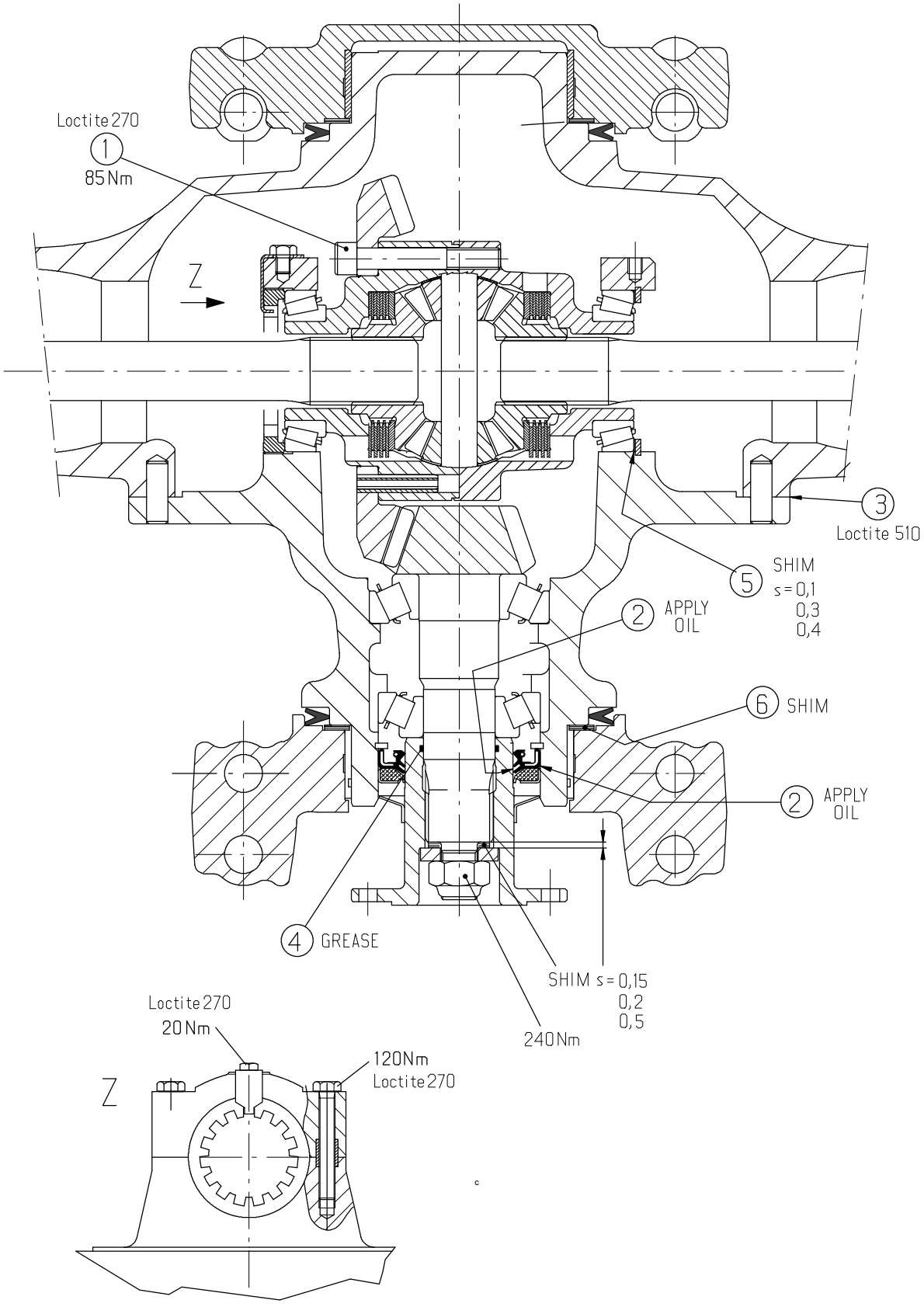


fig003

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1) Smear Loctite 270 on the screw
2) When assembled, smear places shown in the picture with oil.
3) Fix with Loctite 510
4) Fill the space with grease when assembled
5) Shims (0,1mm, 0,3mm, 0,4mm)
6) Shim
7) Dip the discs in oil before assembly

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Differential (Dana 733/505)

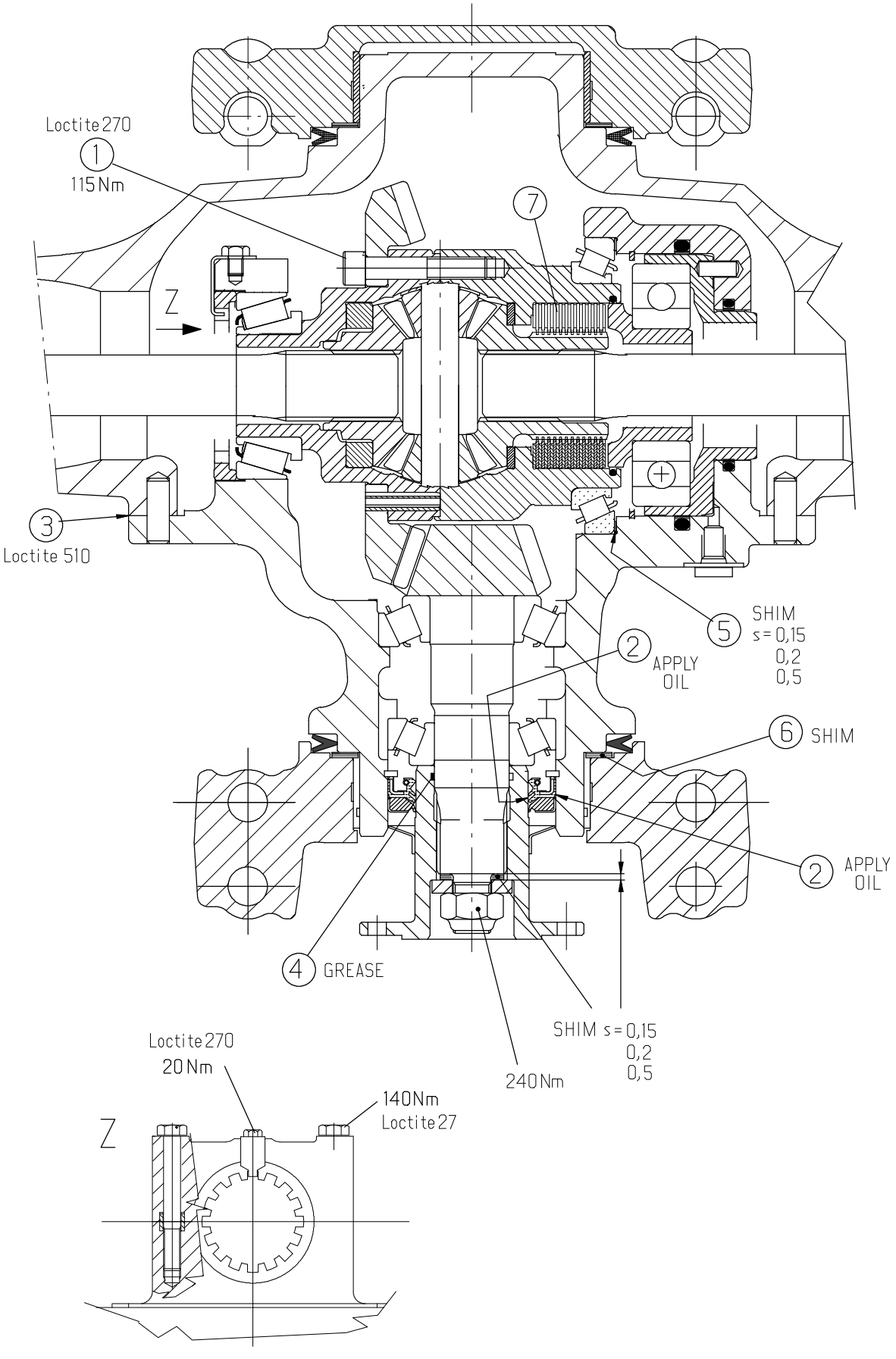


fig004

https://truckmanualshub.com/

1) Smear Loctite 270 on the screw
2) When assembled, smear places shown in the picture with oil.
3) Fix with Loctite 510
4) Fill the space with grease when assembled
5) Shims (0,1mm, 0,3mm, 0,4mm)
6) Shim

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Differential adjustments

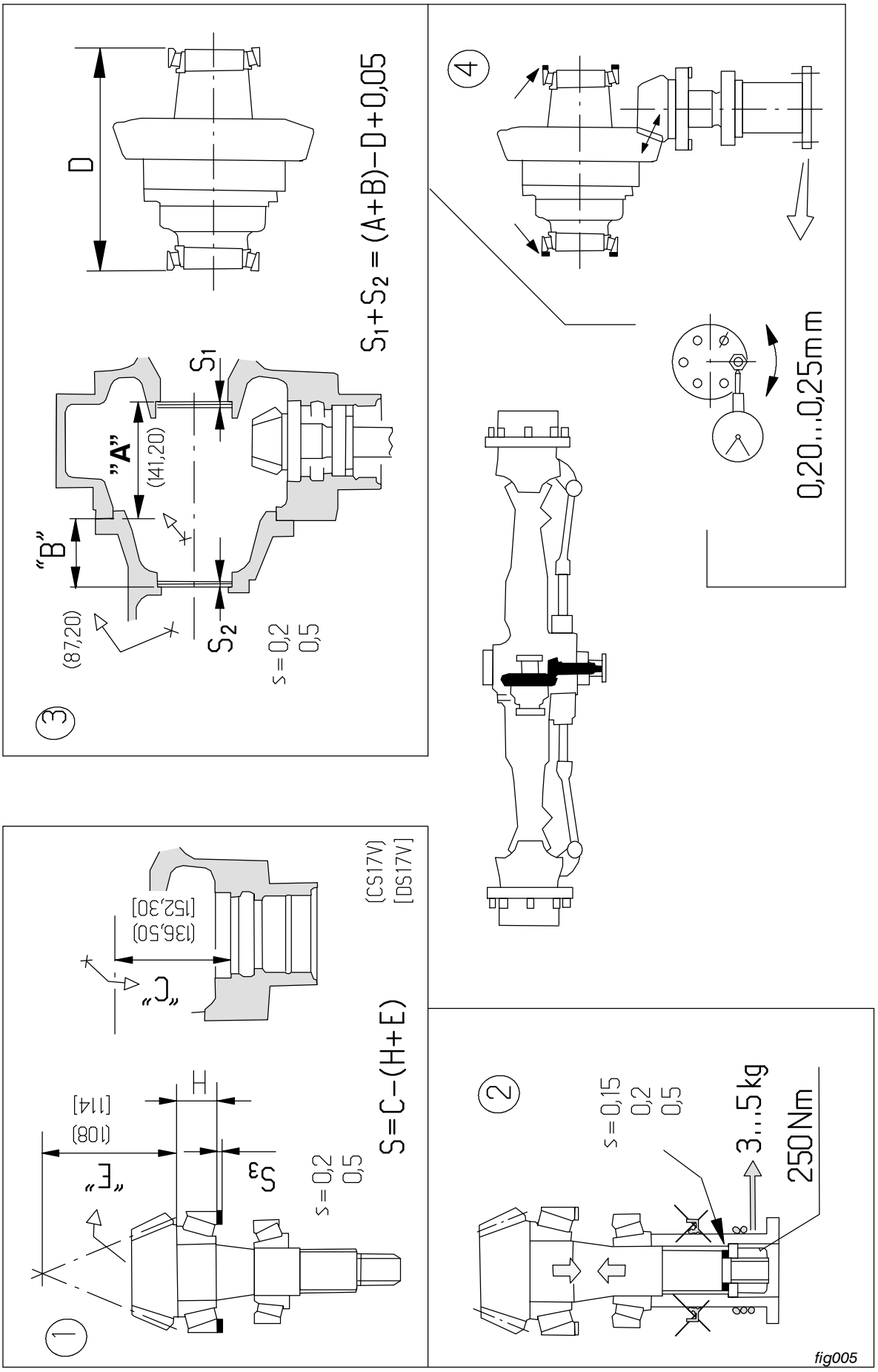


fig005

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1) Adjusting position of pinion shaft:

See the figure written on the pinion end, e.g. E= 108 mm, and the figure written in the housing e.g. C= 136,50 mm.
Measure the height H of the front bearing, e.g. 25,20 mm.

Thickness of the shims: $S_3 = C - (E + H) = 136,50 - (108,00 + 28,00) =$ 0,5 mm

Position the shims calculated and fit the outer bearing ring (front).
Heat inner ring of conical bearing to temperature of 80° and fit flush on pinion. Fit rear inner ring.

2) Adjusting pinion shaft bearing:

Mount the flange (without oil seal) so that the shims fit inside the splines of the flange.
Mount the thrust–washer on the shaft and tighten with nut the flange to the end (Do not push by hands, because the shims can fall behind the shoulder).
Tighten the nut with torque of 250 Nm.

Measure with a spring balance the force required to make the flange turn (without oil seal).
The value of F should be between 3–5 kg (corresponds to a rotating torque of 0,9–1,5 Nm with a diameter of 60 mm).

3) Adjusting differential bearings:

Measure distance D between two bearings in the differential carrier (e.g. D= 226,50 mm).

Note number A painted on long housing, showing distance between the bearing recess and the flance surface (e.g. A= 141,20 mm).

Note figure B painted inside short housing section, showing distance between recess of bearing and flange surface (e.g. B= 87,20 mm).

Thickness of the shims : $S_1 + S_2 = (A + B) - D + 0,05$
$= (141,20 + 87,20) - 226,50 + 0,05$
$= 1,95$ mm

0,05 mm is the bearing preloading value. Distribute the shims beneath the two bearings.

4) Adjusting tooth backlash pinion/crown wheel:

Assemble the differential and the housings . Measure the play pinion/crown wheel on the transmission attachment flange, using a comparator. Normal values are between 0,20 – 0,25 mm.

Locally prepared tools

Planetary gear (code 645.2)

ET 894 020 . . . . . Fitting tool for the cassette seal

Knuckle housing (code 645.3)

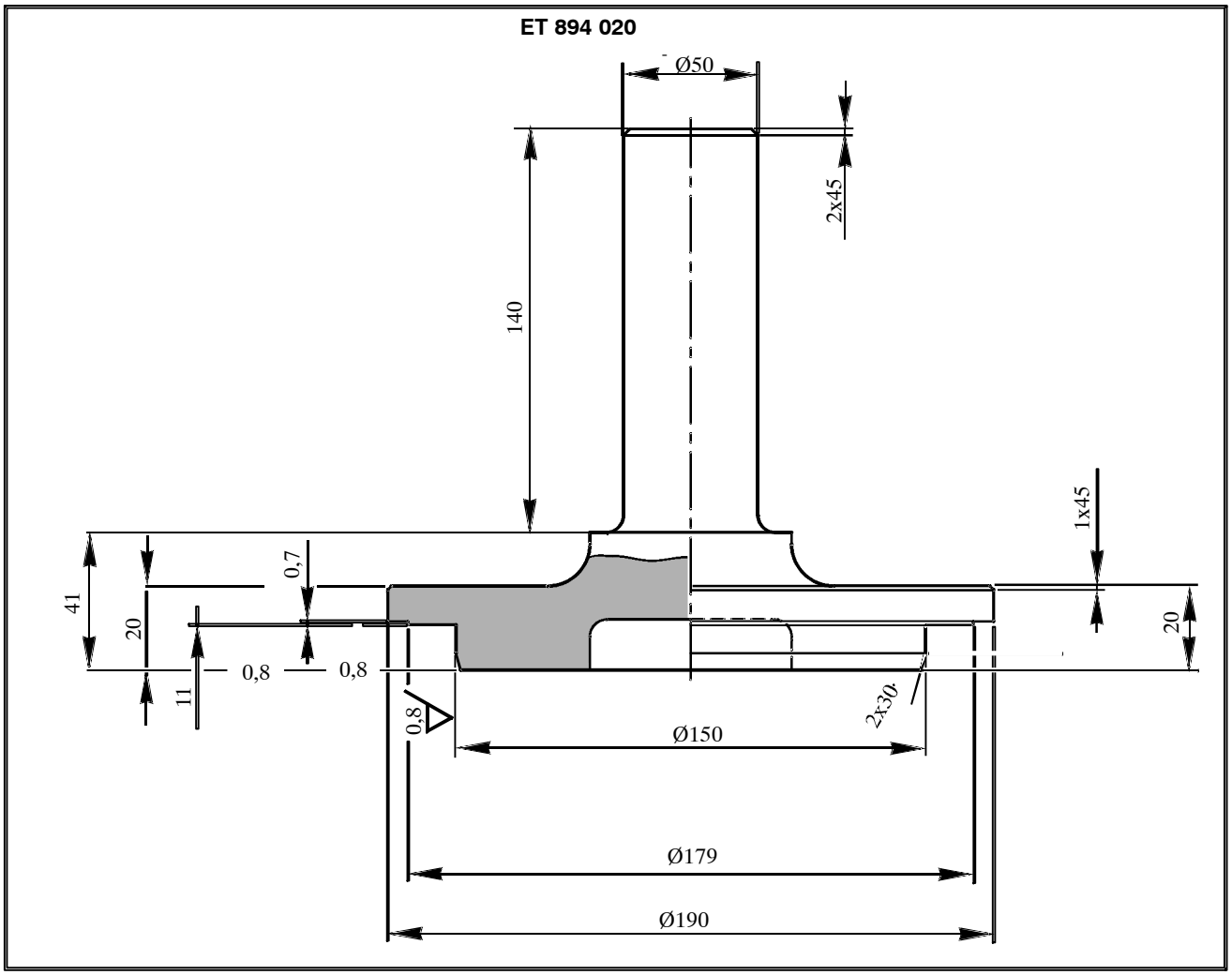
ET 894 030 . . . . . Fitting tool for the outer oil seal of the drive shaft
ET 894 040 . . . . . Fitting tool for the bushing of the drive shaft
ET 894 050 . . . . . Fitting tool for the inner oil seal of the drive shaft

Differential (code 645.4)

ET 894 070 . . . . . Fitting tool for the seal of the bevel pinion shaft

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ET 894 020



ET 894 030

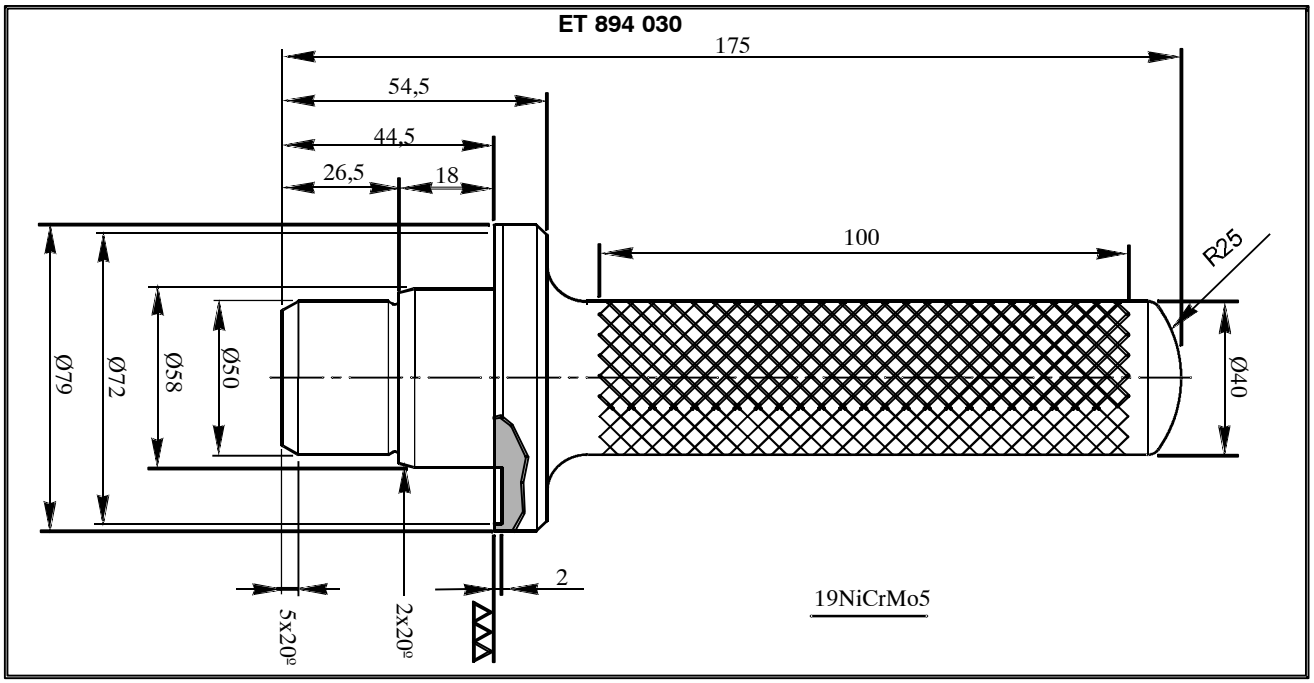
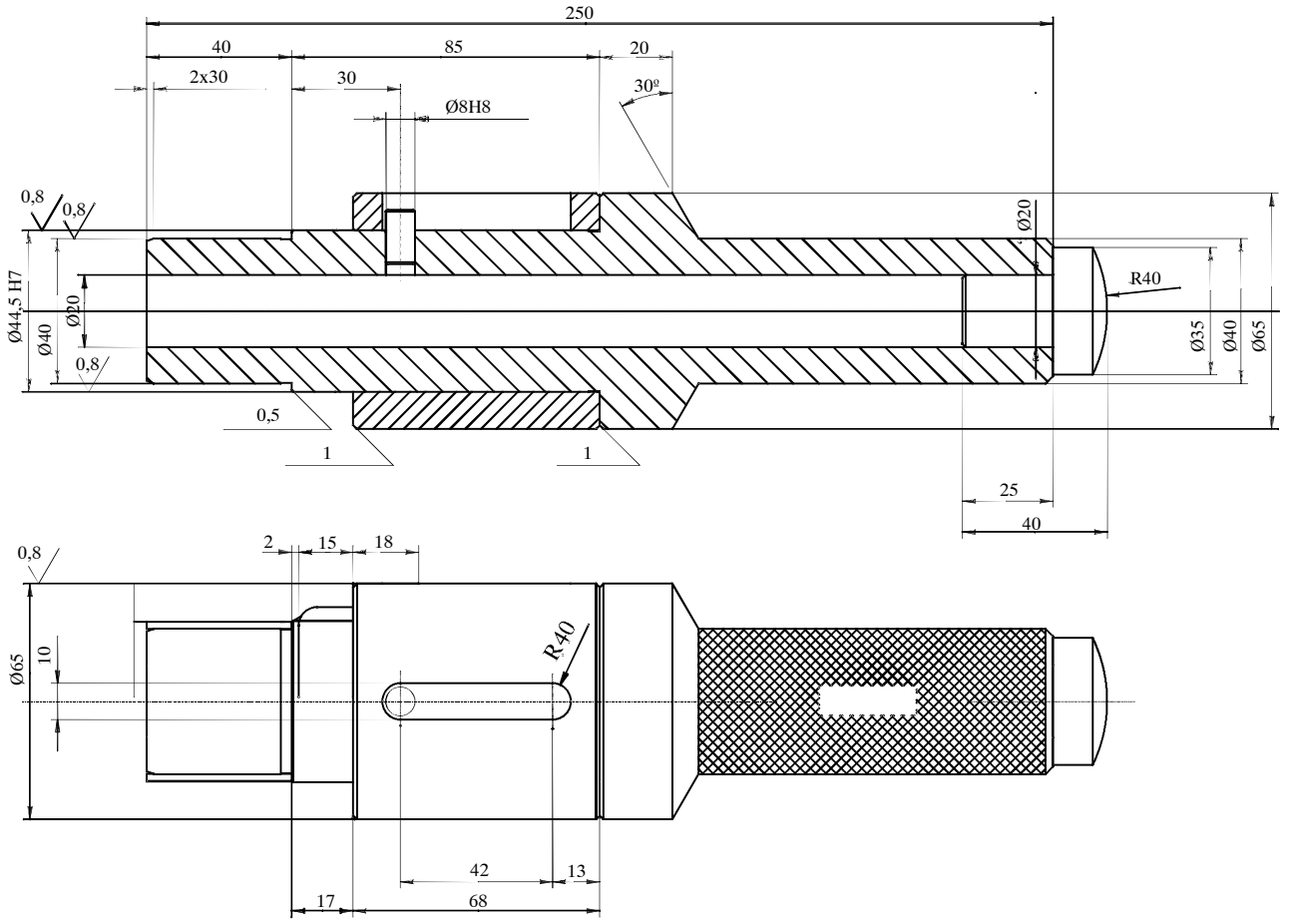


fig006

https://truckmanualshub.com/

ET 894 040



ET 894 050

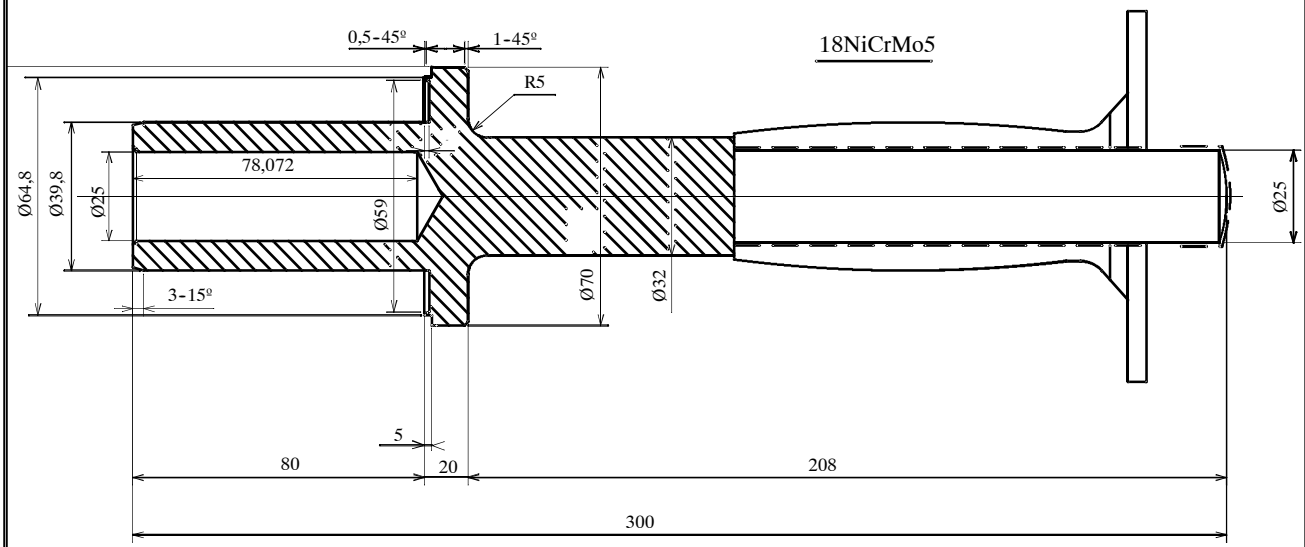
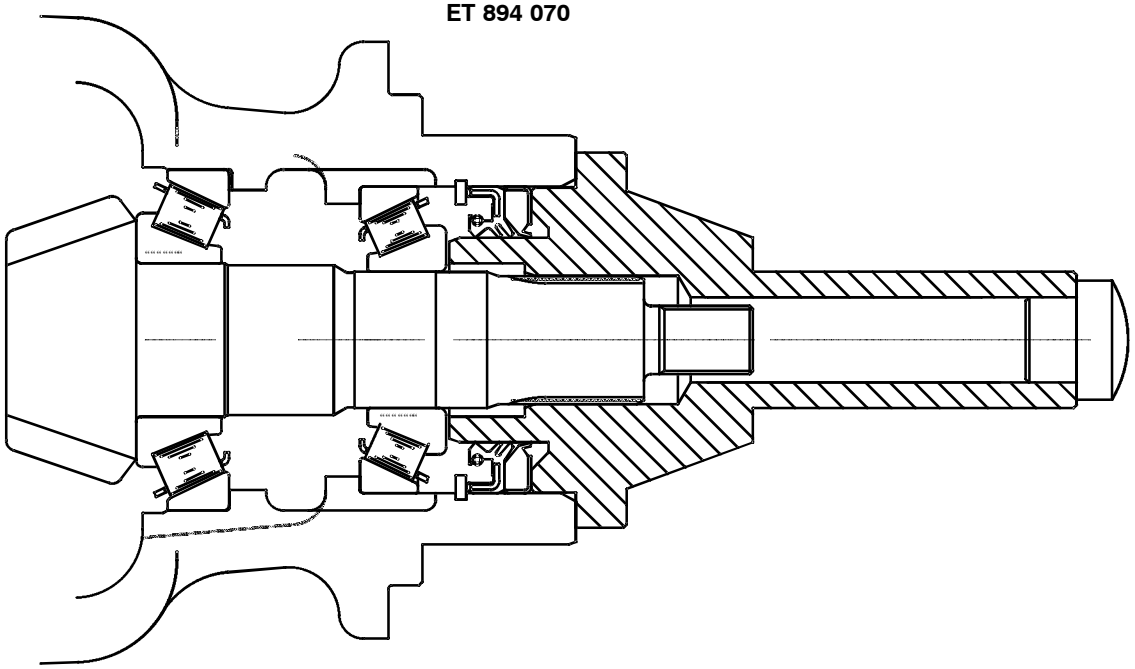


fig007

https://truckmanualshub.com/

ET 894 070



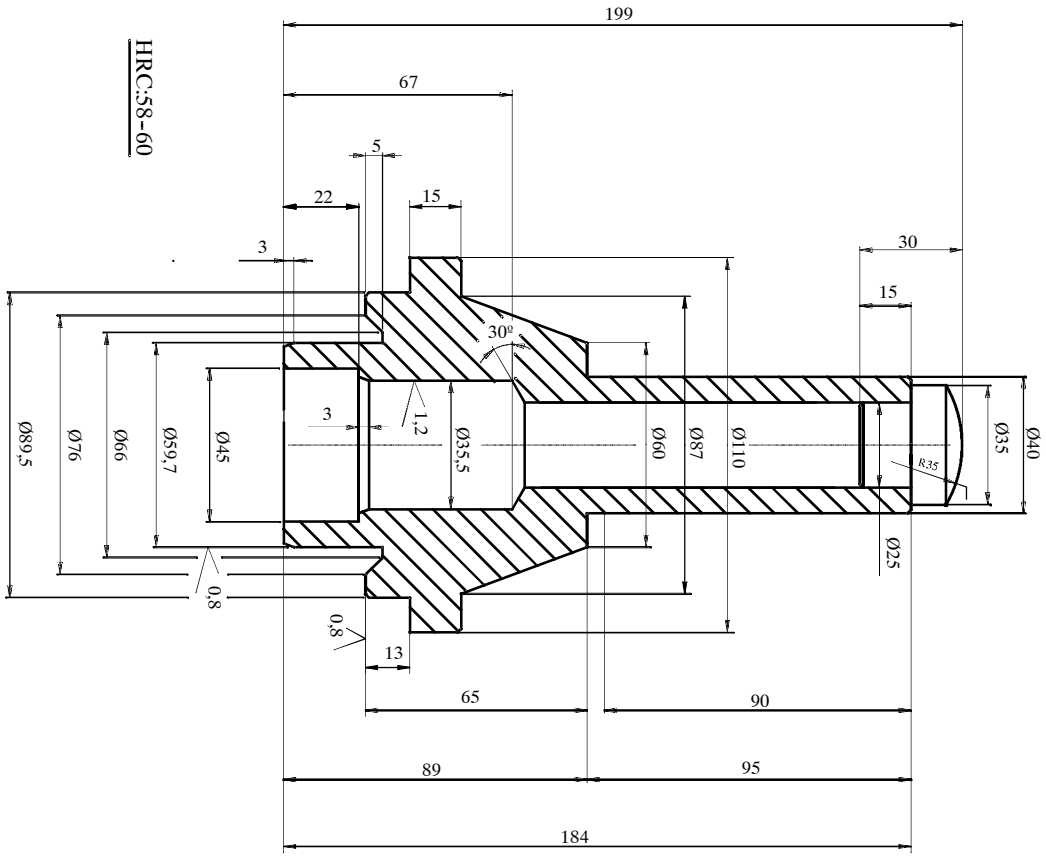


fig008

Axle housing and central pivot bearing brackets

Removing front axle

1. Drain the oil from the hub gears and from the differential (if necessitated by the repair job in hand).
2. Remove the propeller shaft guard. Disconnect the propeller shaft front flange joint from the pinion shaft.
3. Disconnect oil hoses from the steering cylinder. Raise the tractor front end and place axle stands under the front frame. Remove front wheels if needed.
4. Connect the hoist to the front axle and remove axle bearing brackets from tractor frame. Remove the axle from the tractor.

Changing central pivot bearing brackets sleeves

1. Remove front axle

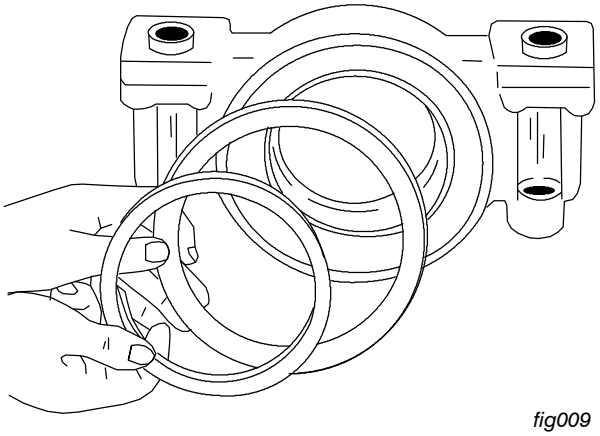


fig009

2. Remove bearing brackets from axle. Check condition of bearing sleeves

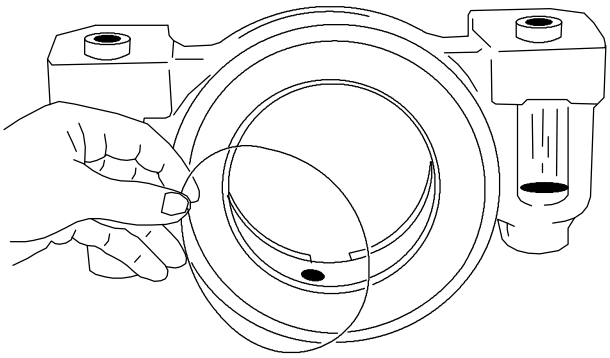


fig010

3. Check condition of v–ring and intermediate ring. Grease all parts with universal grease. Also grease the o–rings for the sleeves.
4. Fit bearing brackets onto the axle and fit the axle.

N.B. Central pivot bearing brackets should have a small axial clearance (0,1–1,1 mm). Adjust this if necessary using shims.

Fitting front axle

1. Check that bearing brackets are in right position on the axle.
2. Lift up the front axle and tighten the bearing bracket attaching bolts to **380 Nm**. **Note!** Propeller shaft guard front end must be fitted under the rear attaching bolts.
3. Connect the steering cylinder oil hoses. Connect the propeller shaft flange joint (**35 Nm**).
4. Fit the front wheels if removed (**550 Nm**). Remove supports from under the tractor.
5. If the oil was drained refill the differential (**8 l**) and both hubs (**2x1 l**).
6. Grease the front axle central pivot bearings.
7. Test run the tractor and check that the steering system function properly.

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Disassembling the planetary reduction

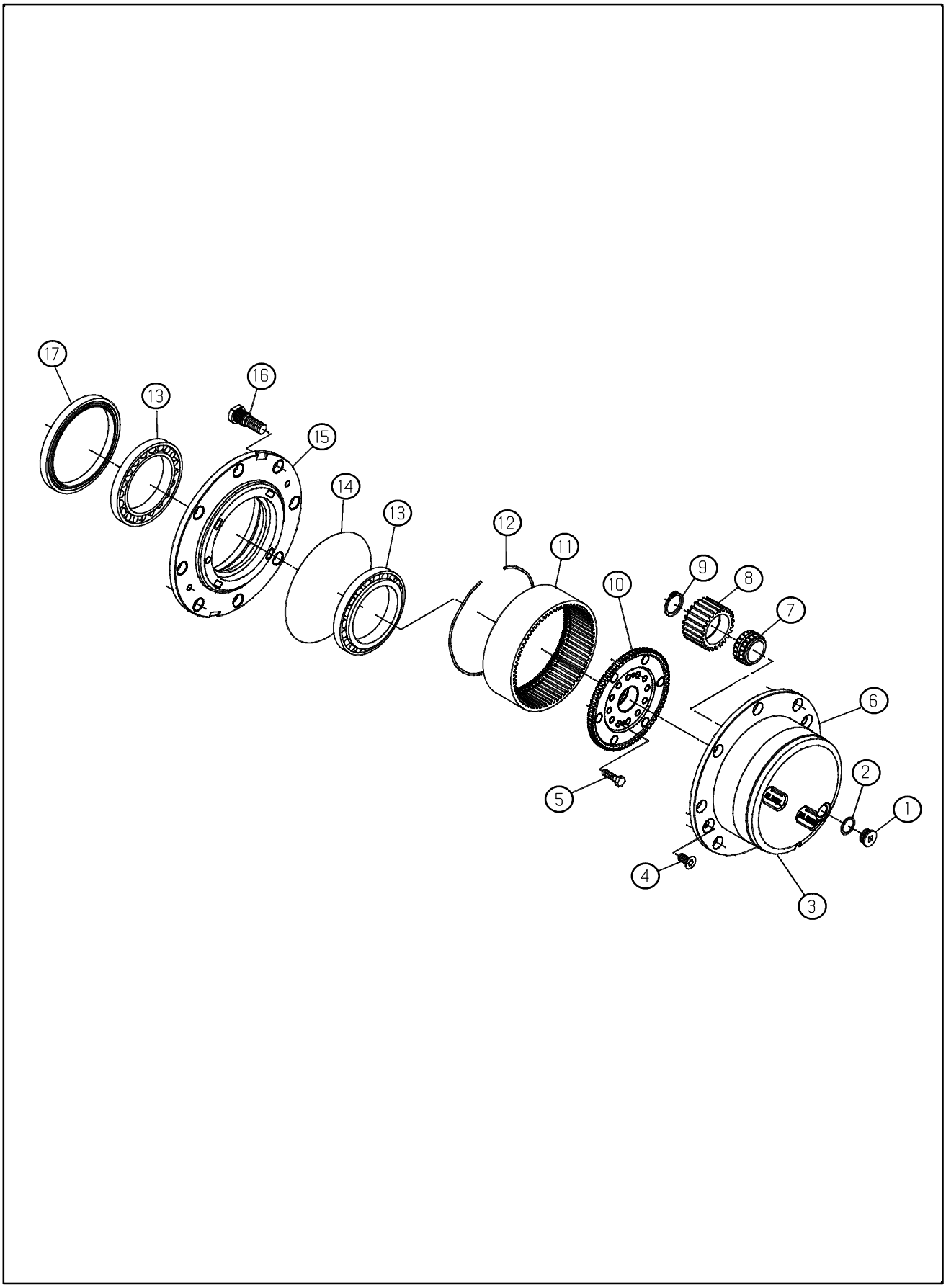
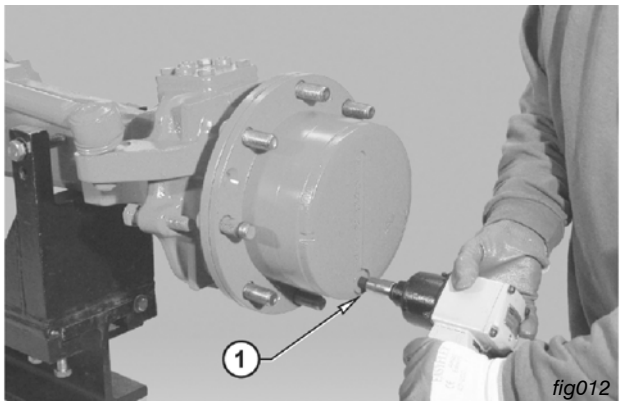
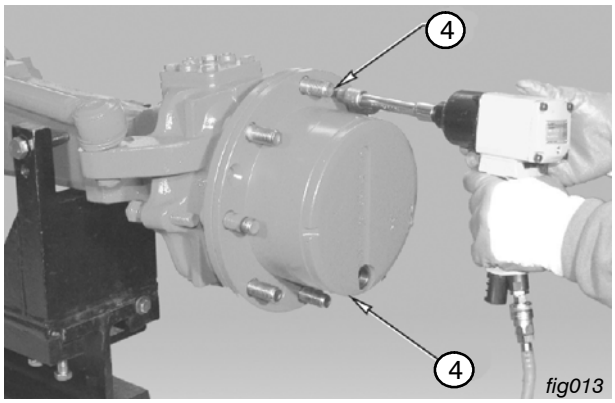


fig011

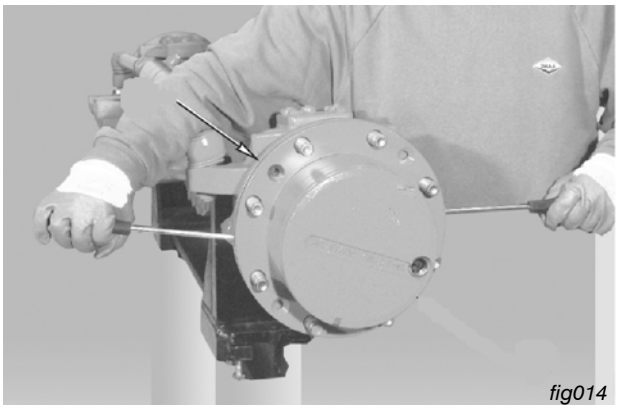
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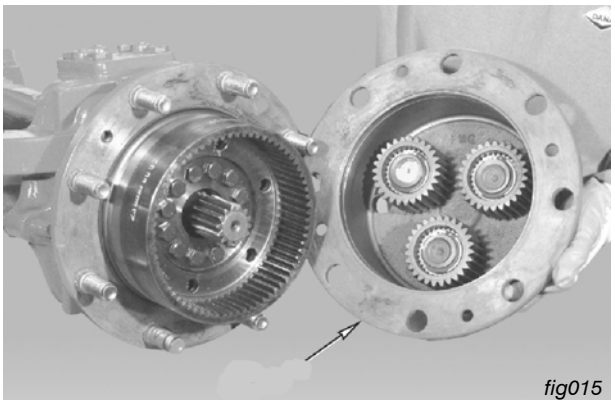


Turn the hub so that the oil draining/filling plug (1) is in the rear position. Remove the oil–level plug (1).

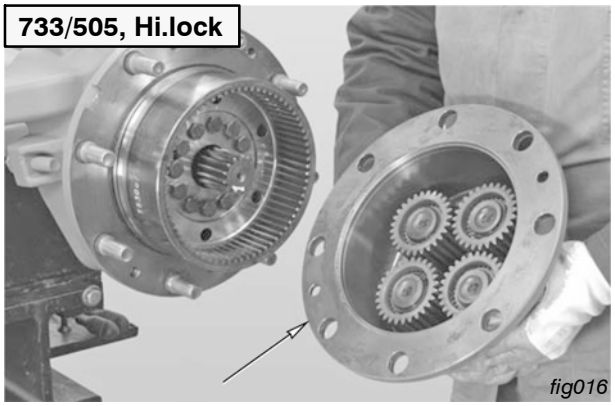


Unscrew two hexagonal socket head bolts (4) in recesses.



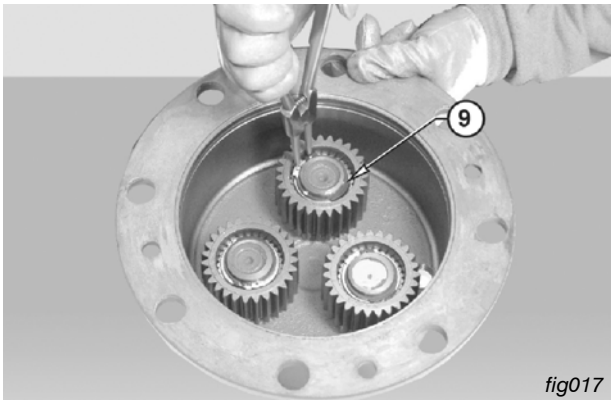


733/505, Hi.lock

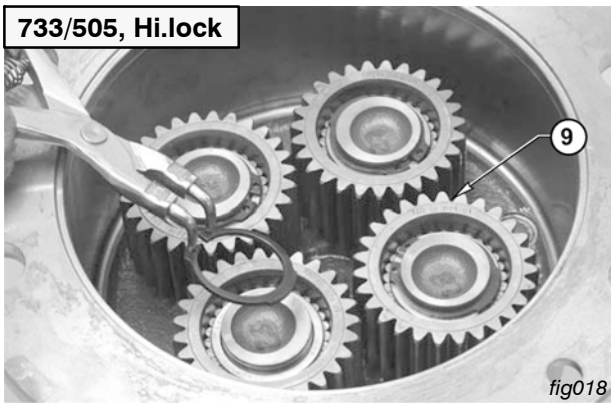


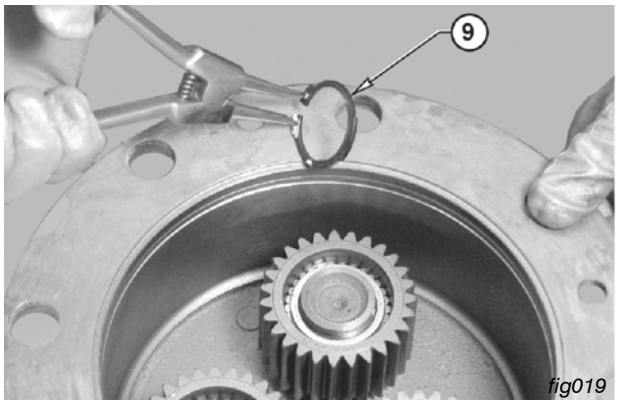
Tap with a soft mallet the planetary carrier/hub cover out and pry it out with two fitting levers.

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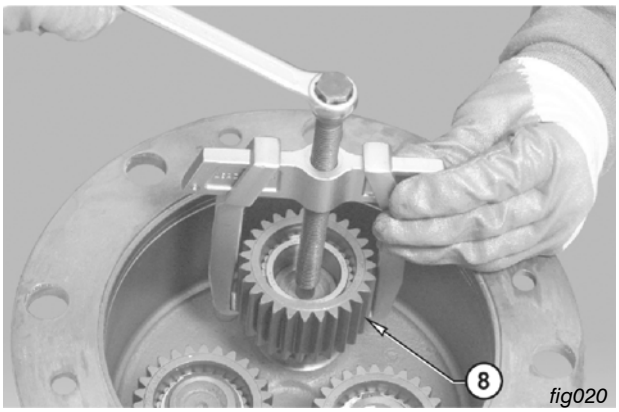


733/505, Hi.lock

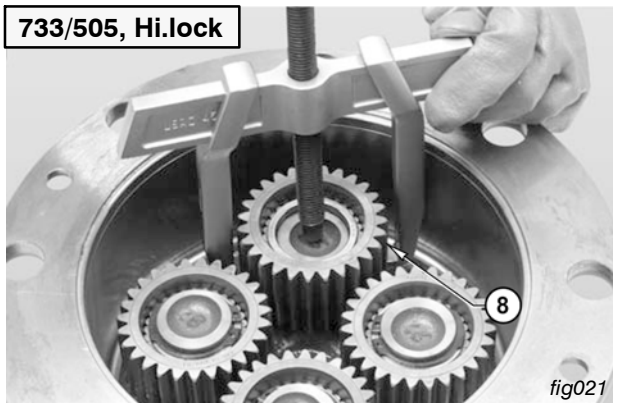


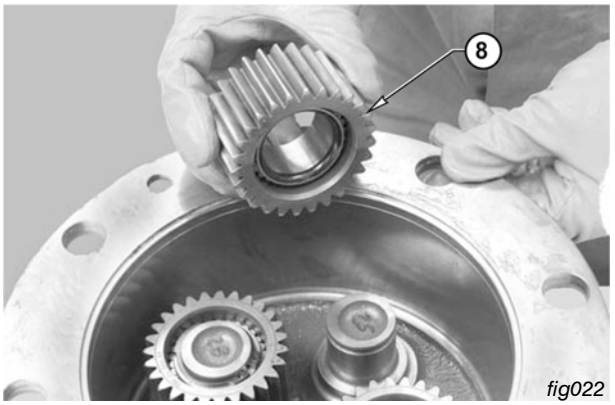


Remove the snap rings (9).



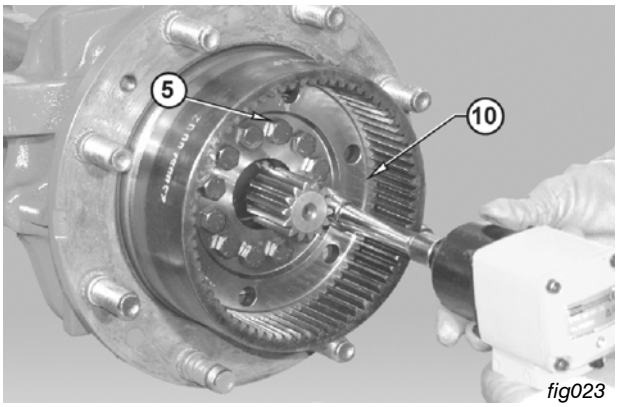
733/505, Hi.lock



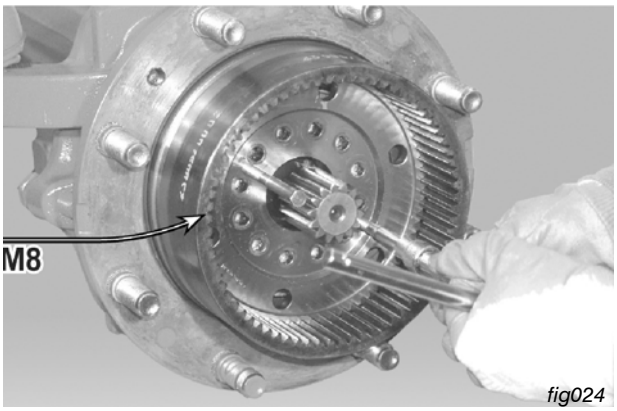


With the help of a puller, remove the planet gears (8).

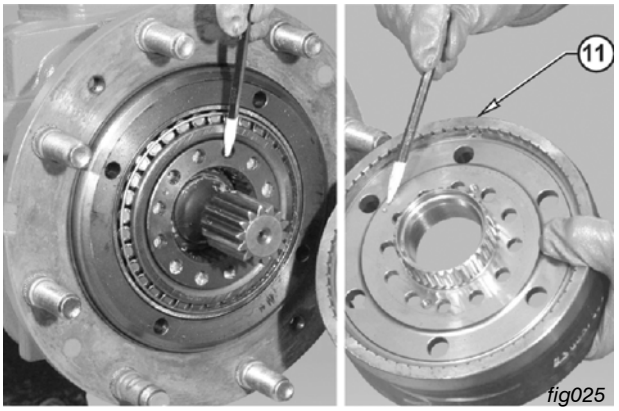
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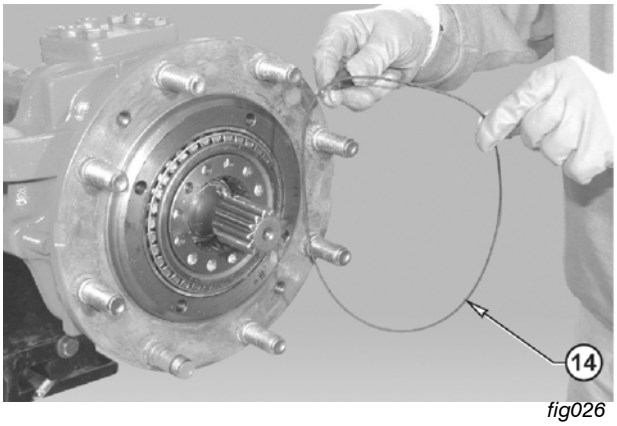
Remove the bolts (5) from the ring gear (10).



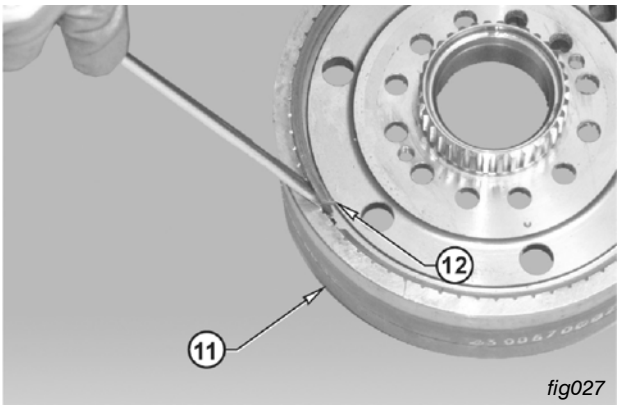
Use 2 screws **M8** to remove the ring gear.

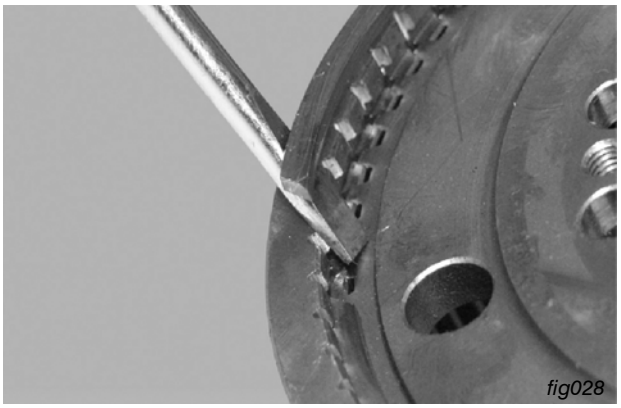


Remove the ring gear (11).

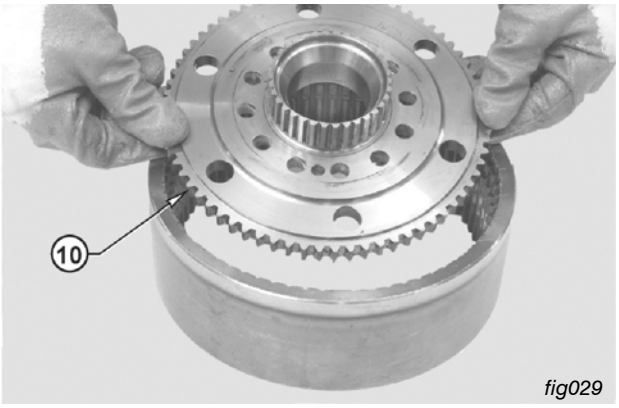


Remove the O – ring (14).

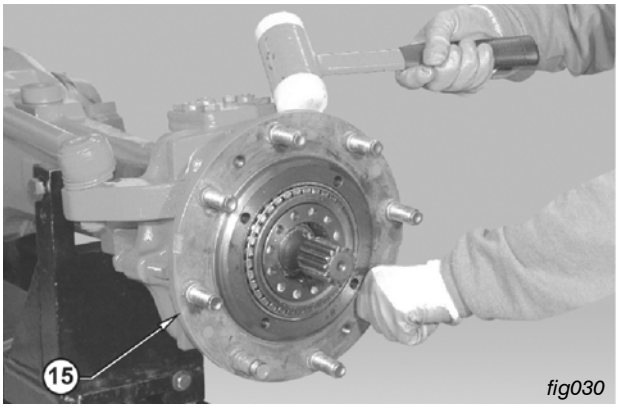




Remove the snap ring (12) from the ring gear (11).

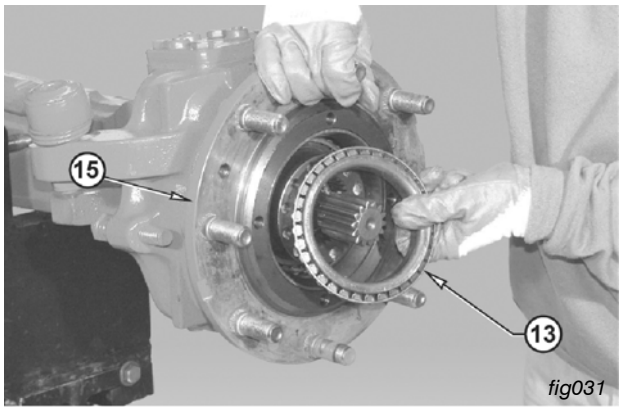


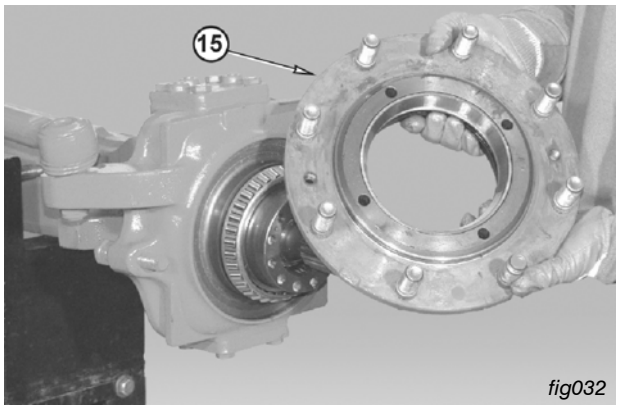
Remove the flange from the ring gear (10).



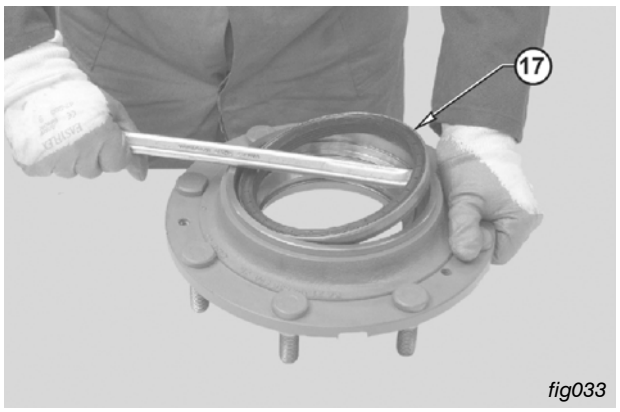
Remove the hub flange (15) with help of a plastic hammer.

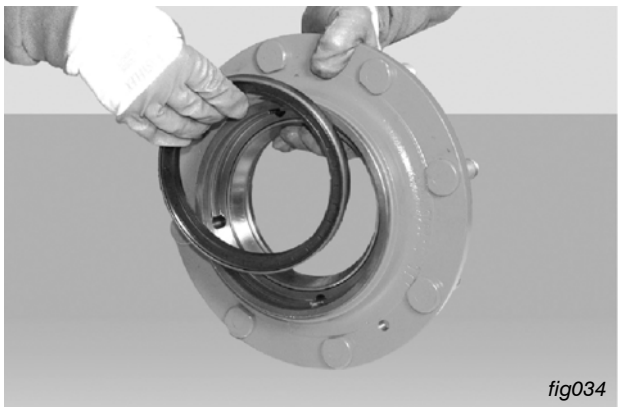
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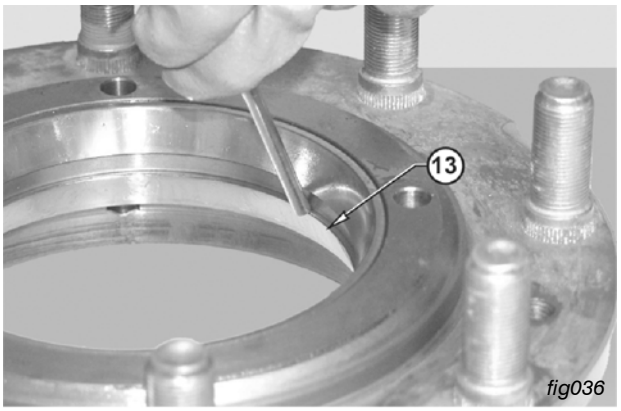
Remove the outer bearing (13) and the hub flange (15).



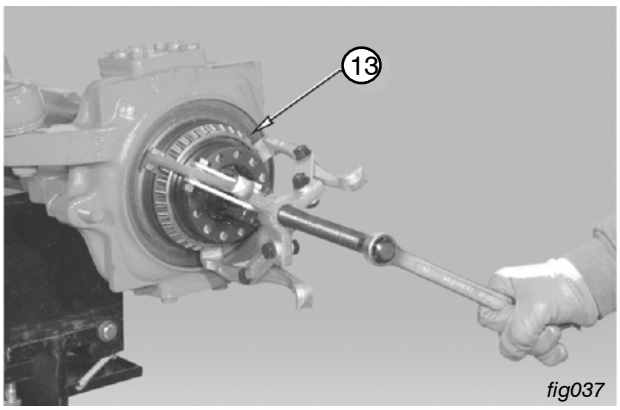


Remove the cassette seal (17).





Remove the wheel bearing outer races (13).



Remove the bearing (13).

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Assembling the planetary reduction

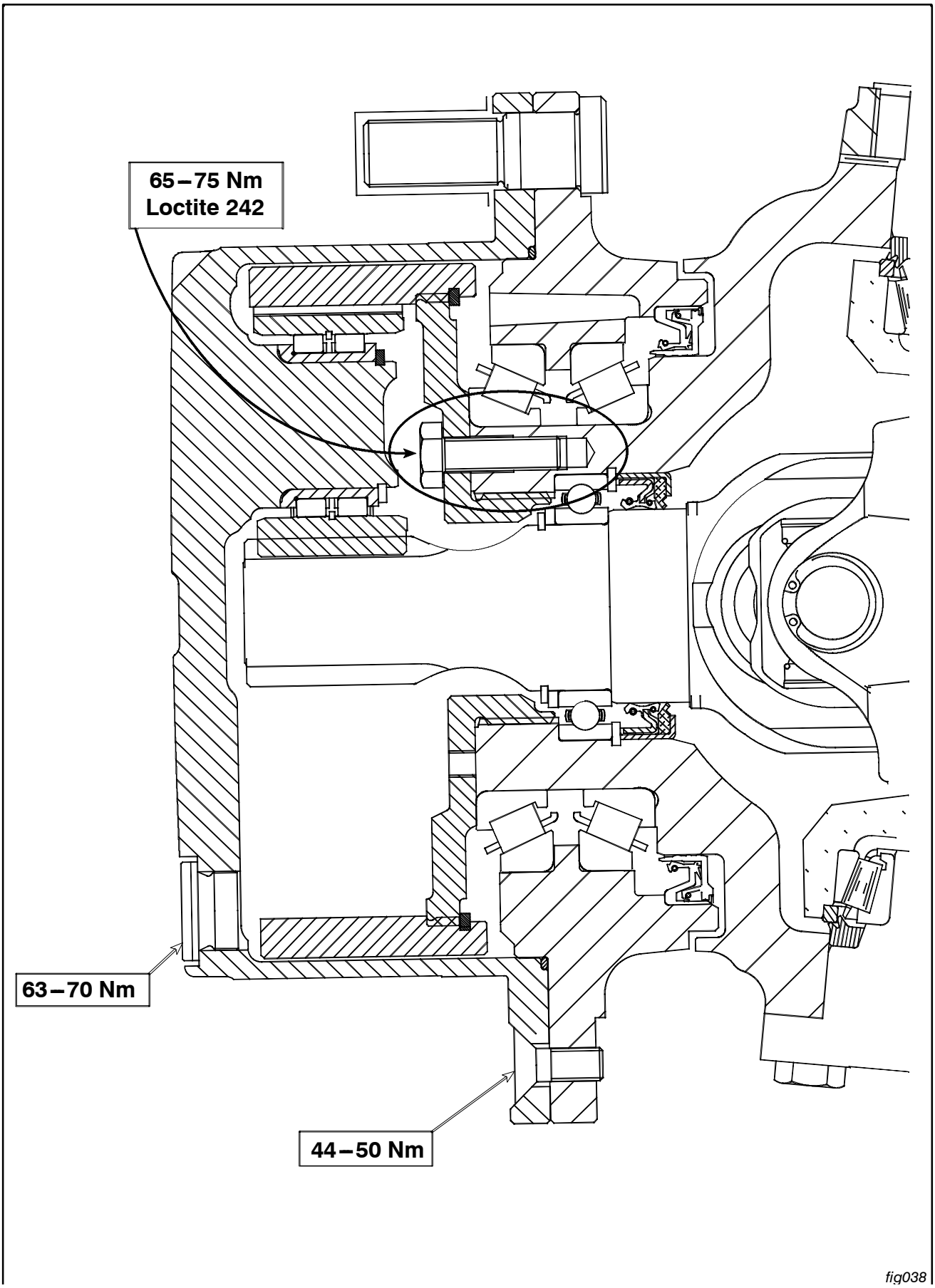
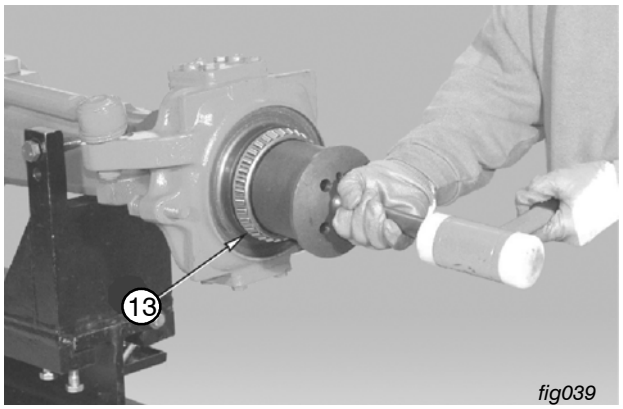
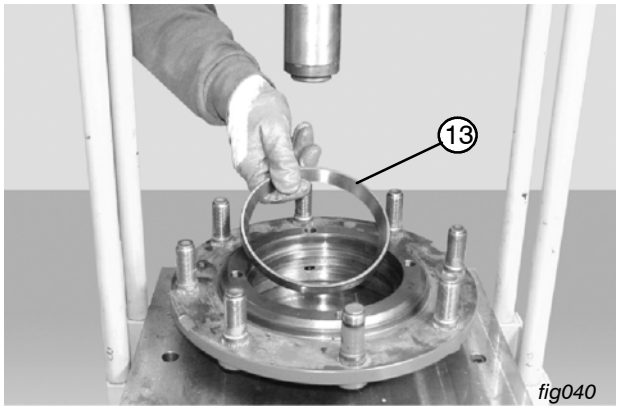


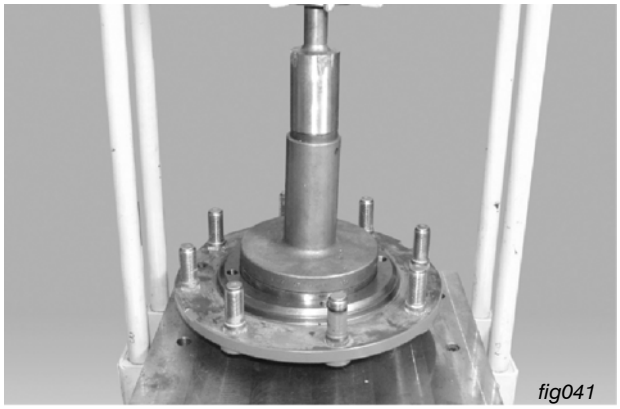
fig038

https://truckmanualshub.com/

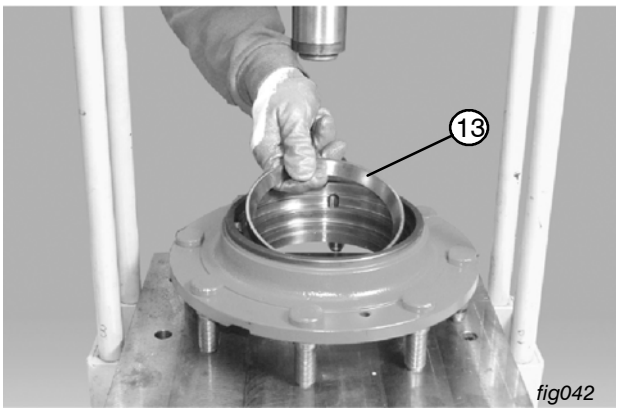


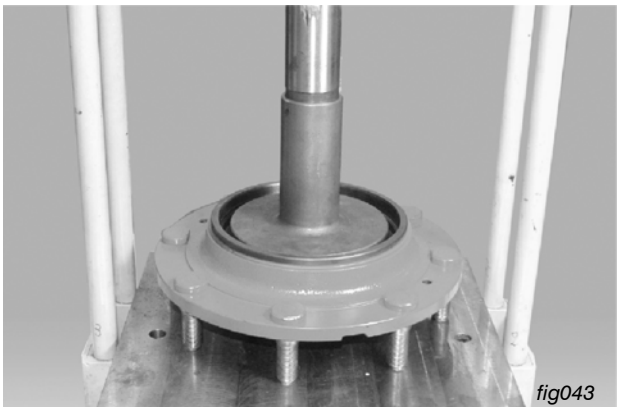
Grease the inner wheel bearing (13) and fit it into place.





Fit the bearing outer race (13) into place with tool.





Fit the bearing outer race (13) into place with tool.

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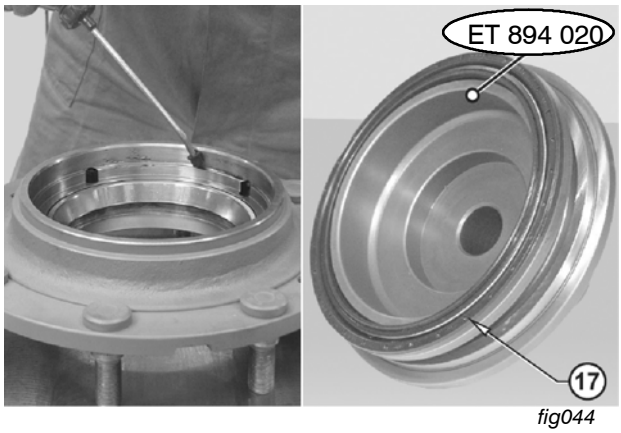


fig044

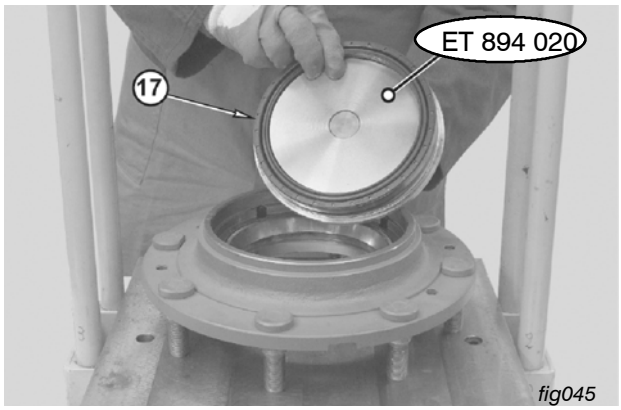


fig045

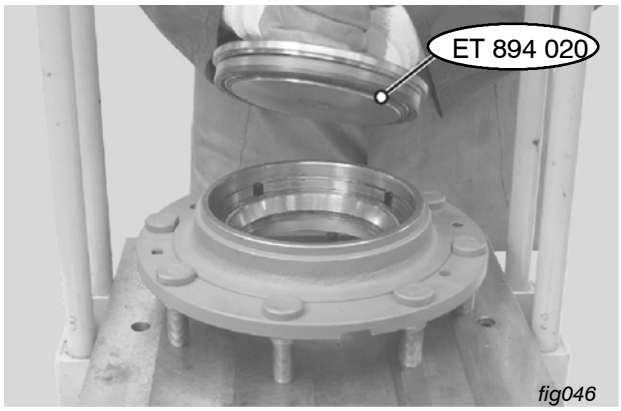


fig046

Fit a new cassette seal (17) with plate **ET 894 020**. Grease the seal lips.

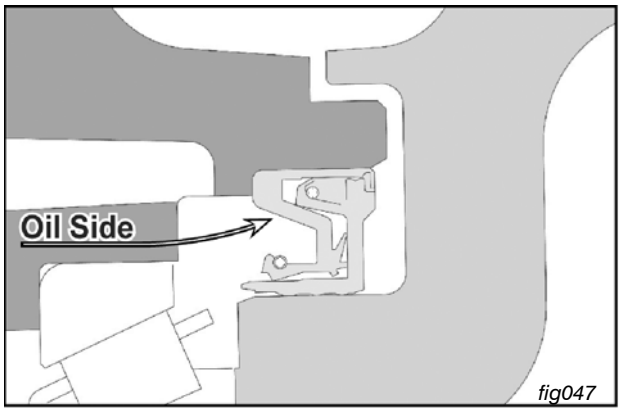


fig047

Ensure, that the cassette seal (17) is fitted according to picture.

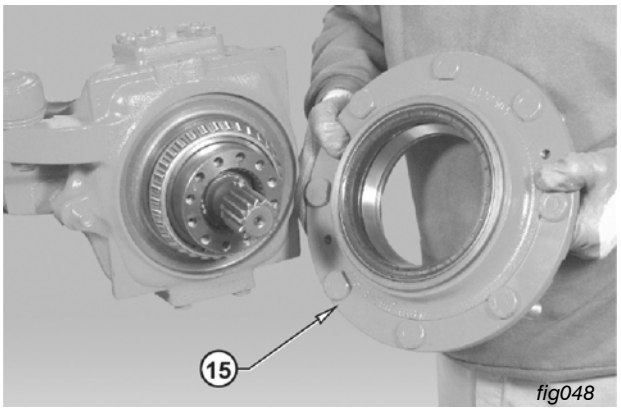
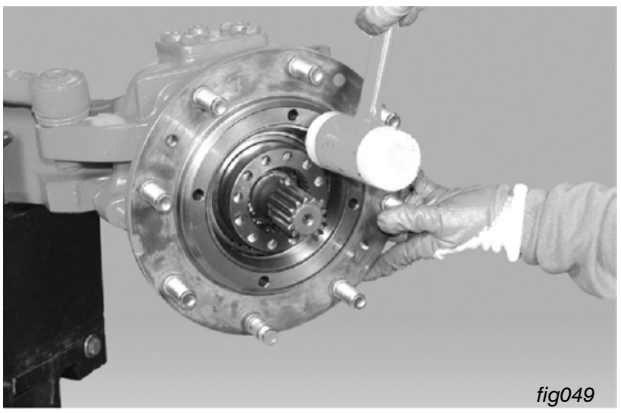


fig048

Fitt the hub flange into place (15).


fig049

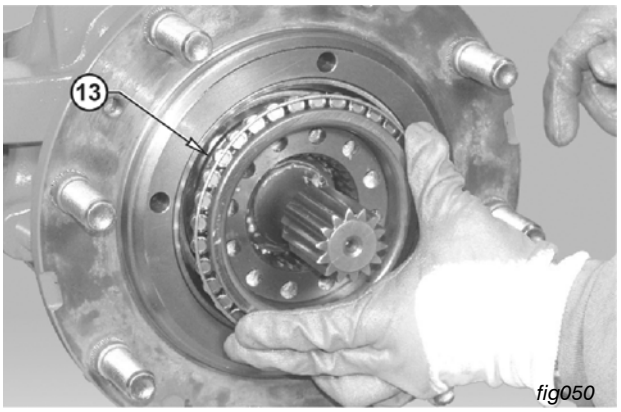
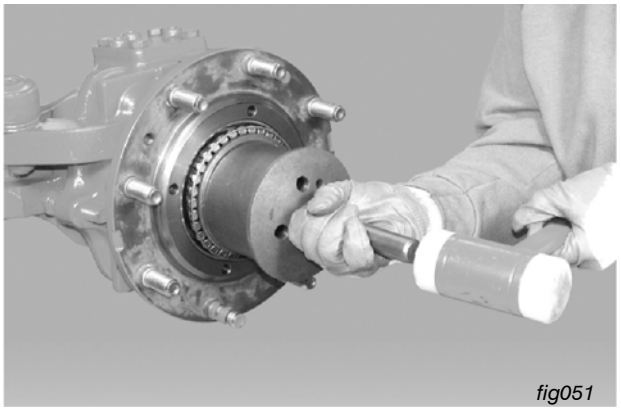
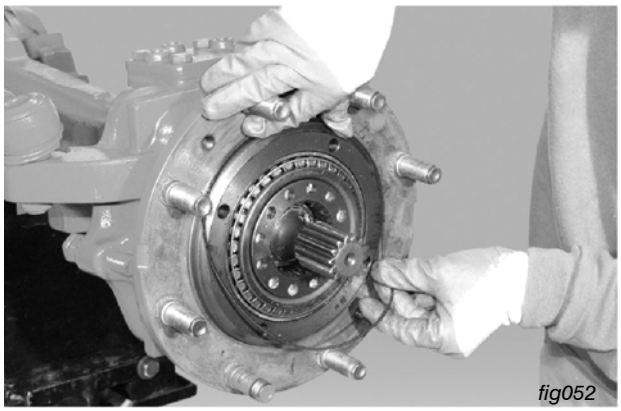


fig050


fig051

Grease the outer wheel bearing (13) and fit it into place.

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fig052

Fit new O–ring.

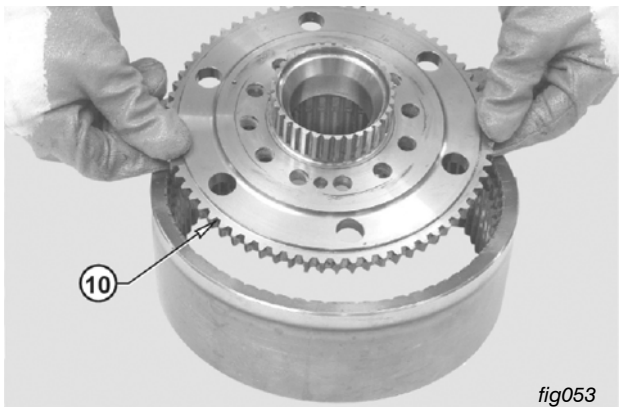


fig053


fig054

Fit the flange (10) into place.



fig055

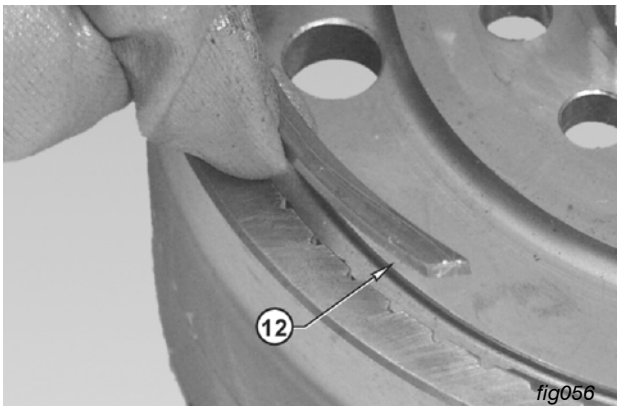
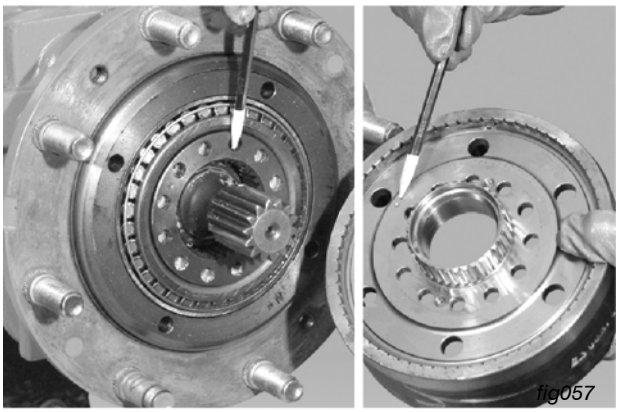
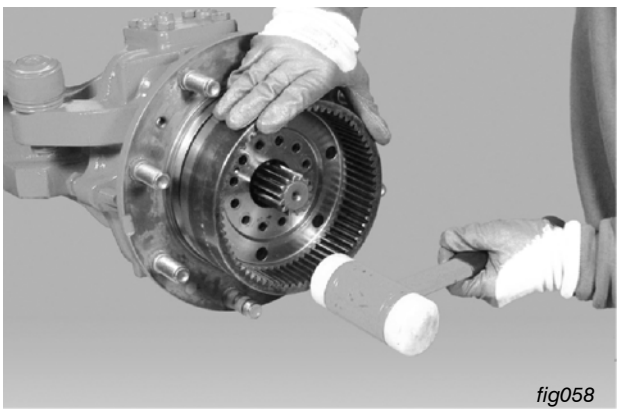


fig056

Fit the snap ring (12). Ensure, that the snap ring is in groove.


fig057

Fit the assembled ring gear into place.


fig058

Fit the ring gear into place. When fitting use plastic hammer.

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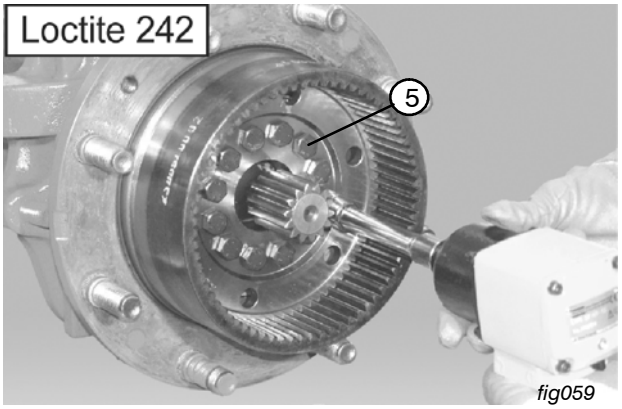


fig059

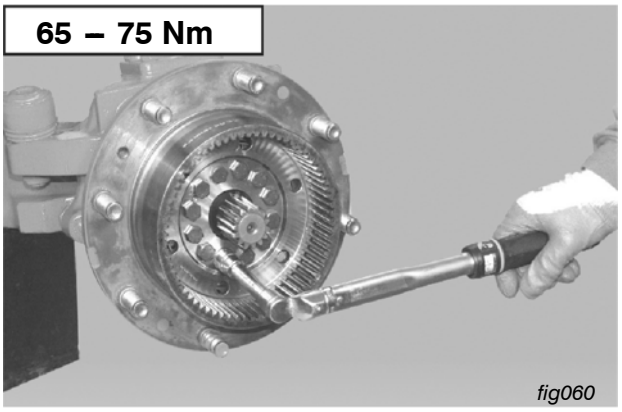


fig060

Apply **Loctite 242** on the bolts (5) and tighten the bolts.
Tightening torques: **65 – 75 Nm**.

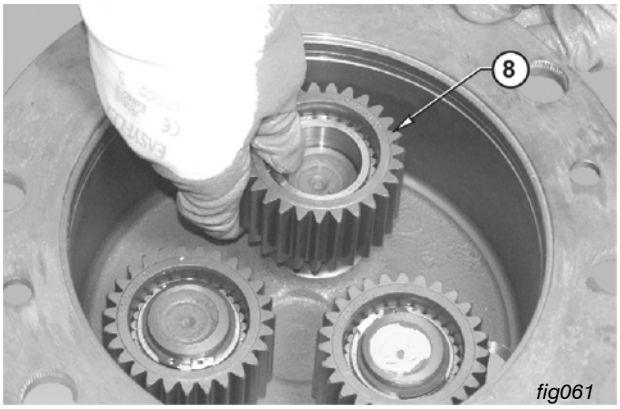


fig061

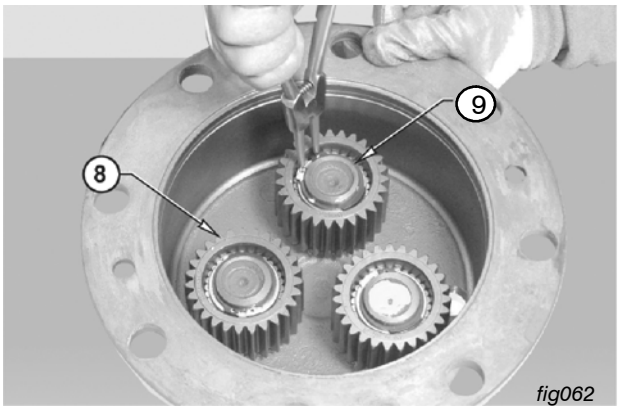


fig062

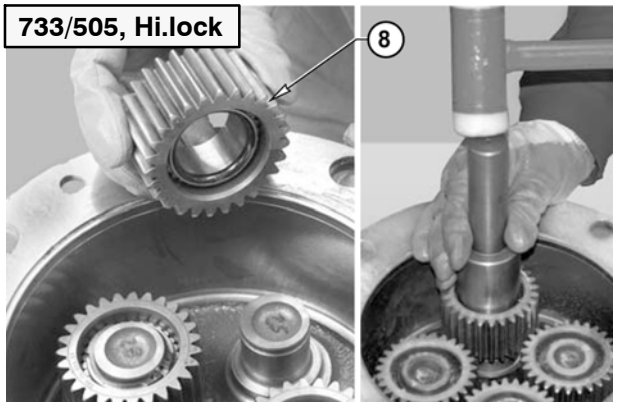


fig063

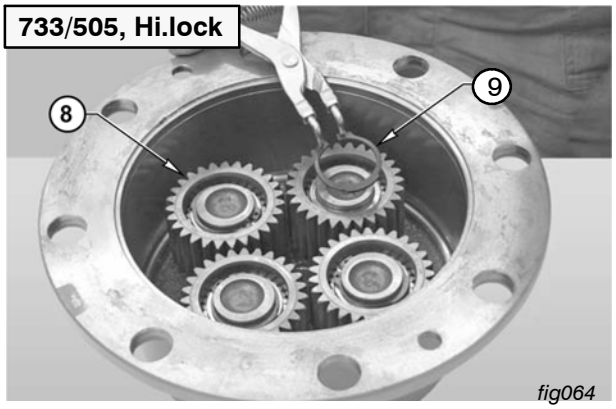


fig064

Fit the planet gears (8) onto the planetary carrier. Fit the snap rings (9).

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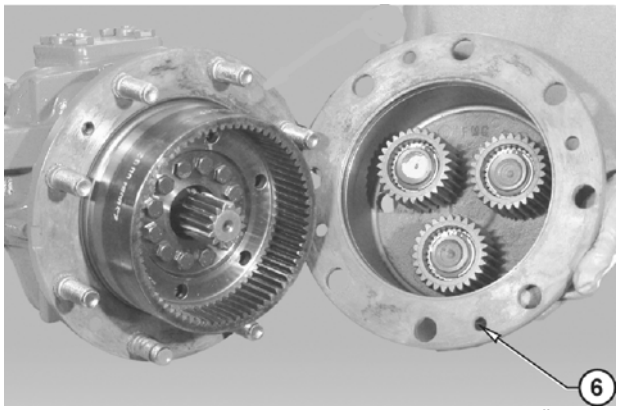


fig065

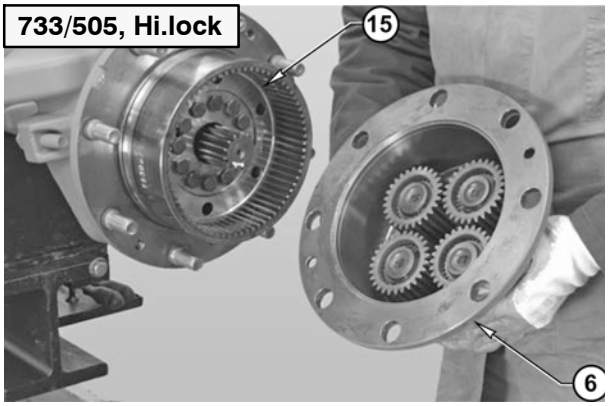


fig066

Fit the planetary carrier (6) into place.

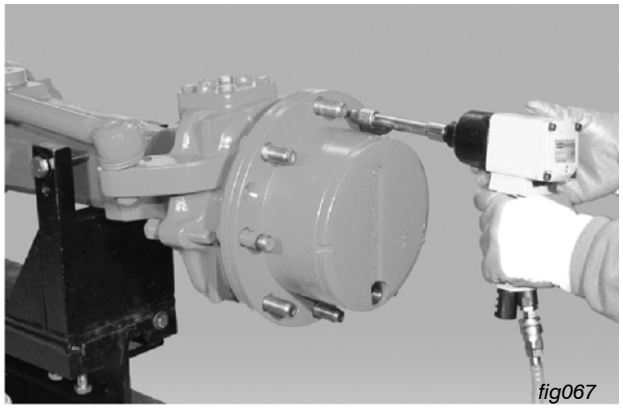


fig067

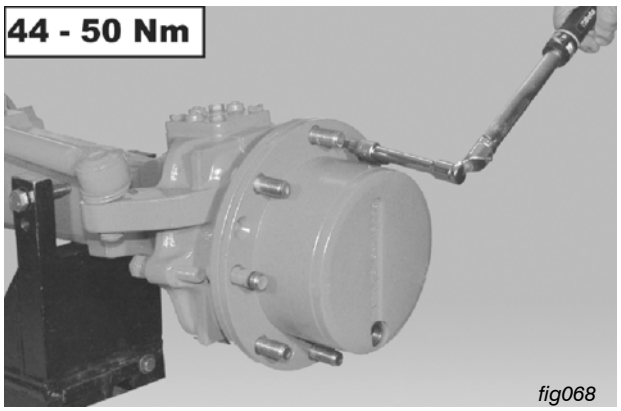
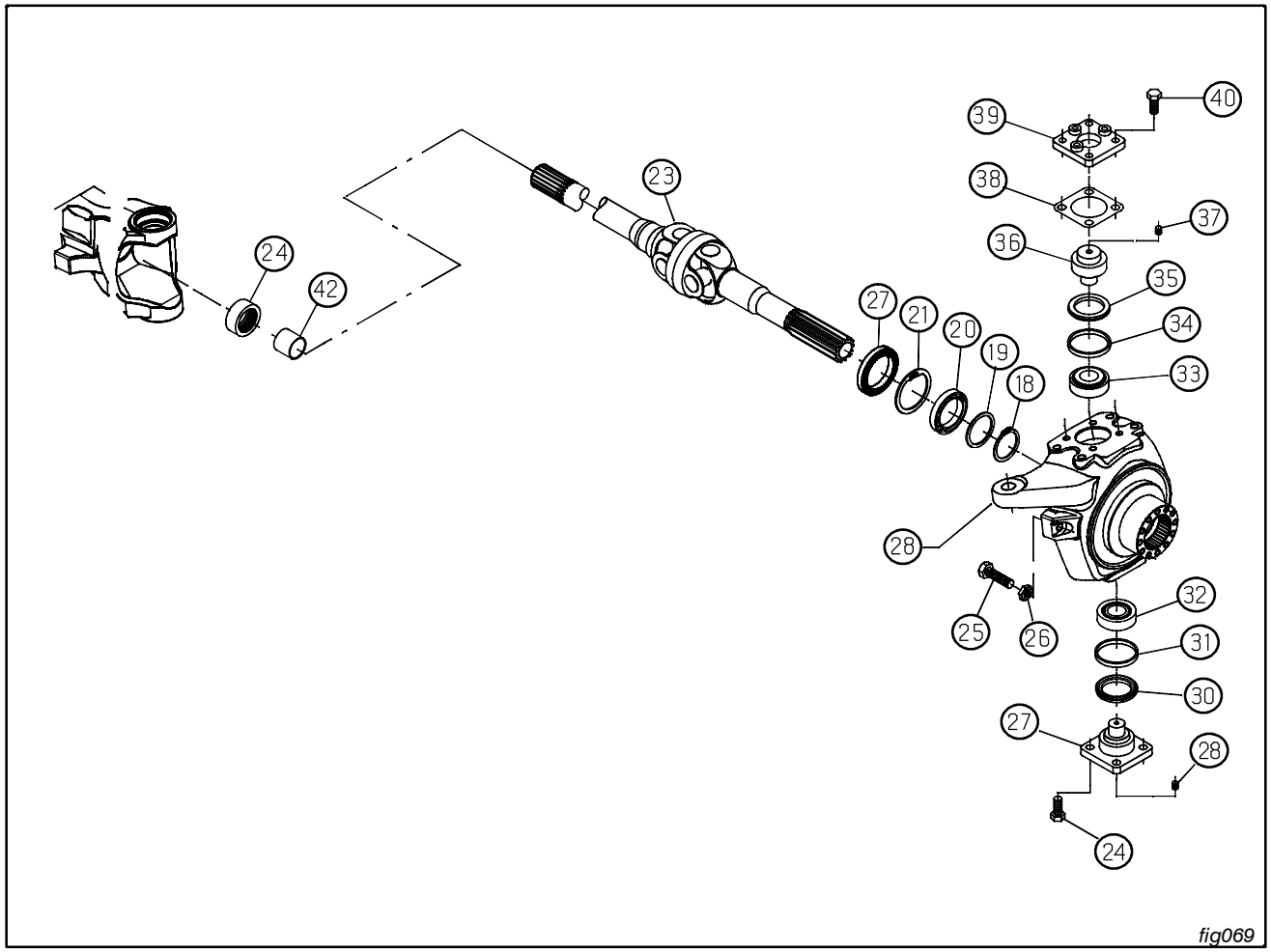


fig068

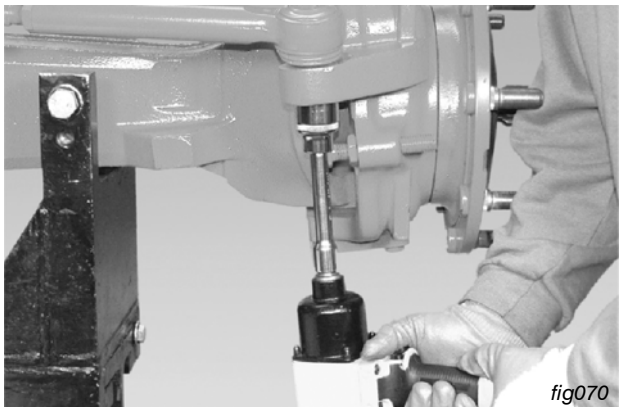
Tighten the bolts. Tightening torques: **44±50 Nm**.

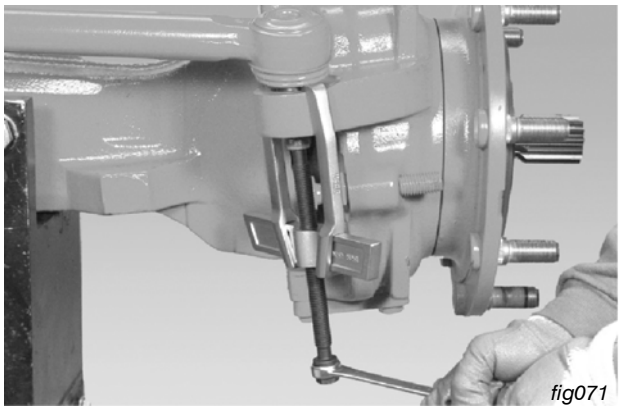
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Removing of the knuckle housing



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fig070


fig071

Disconnect the tie rod from the steering arm.

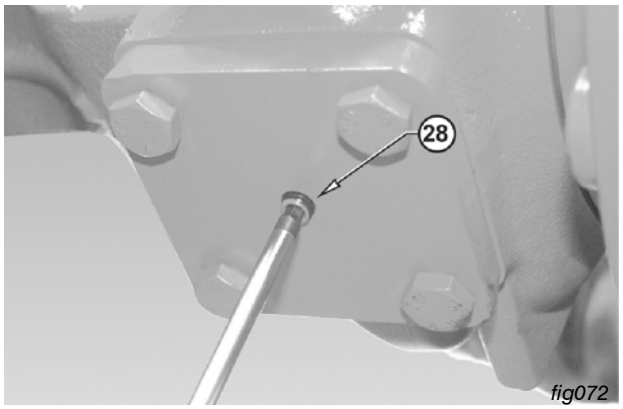


fig072

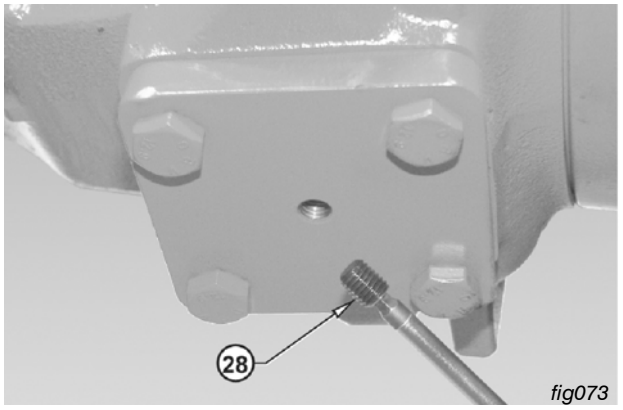


fig073

Remove the lower plug (28).

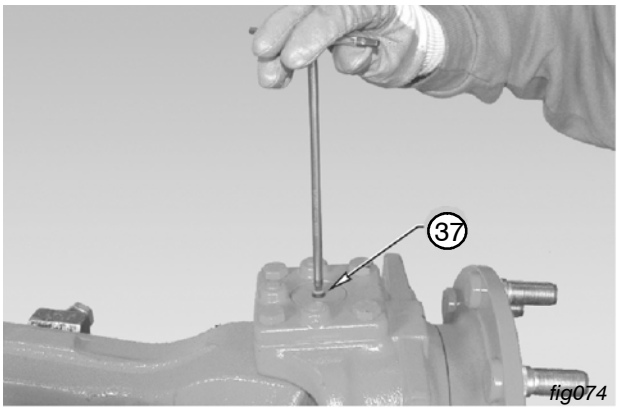


fig074

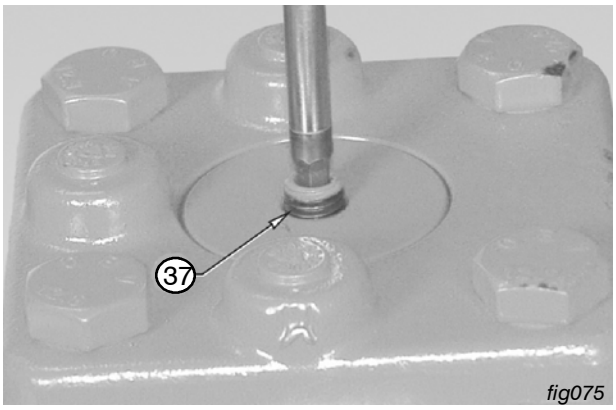


fig075

Remove the upper plug (37).

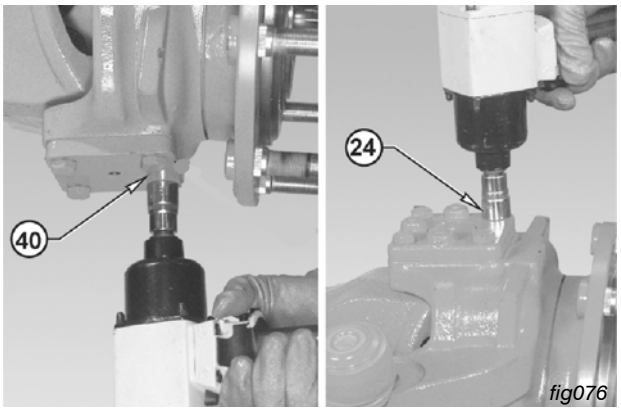
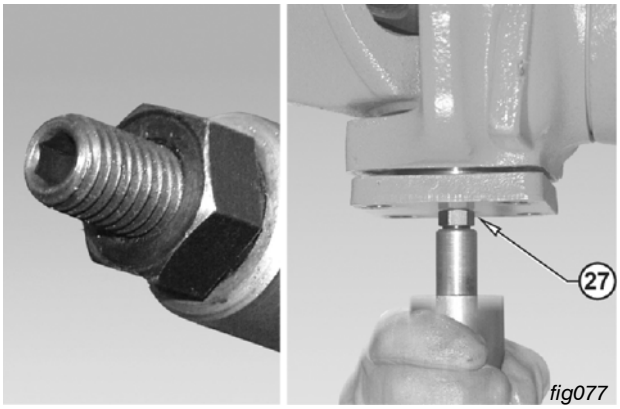
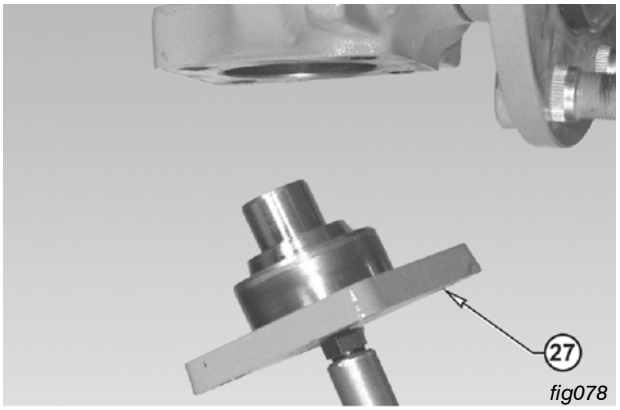


fig076

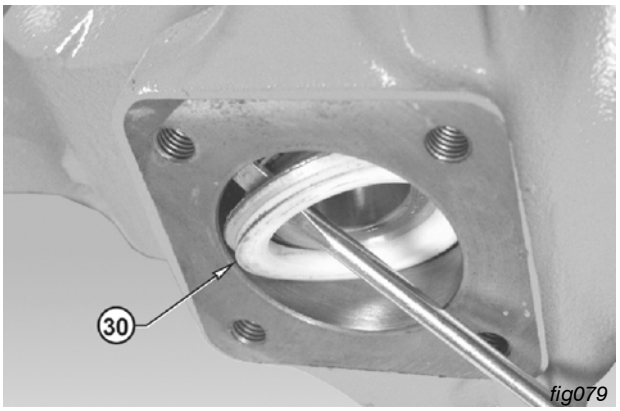
Remove fastening bolts of the king pins (40) and (24).

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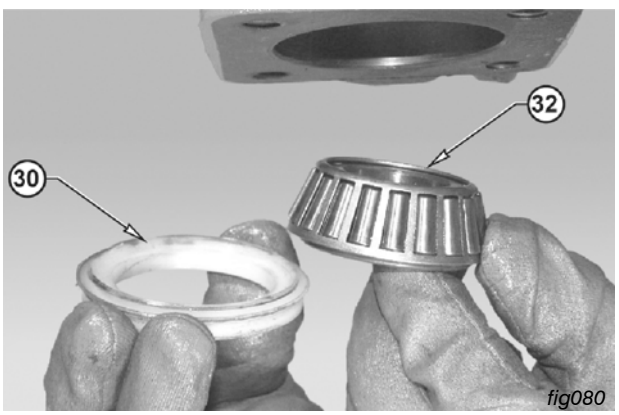




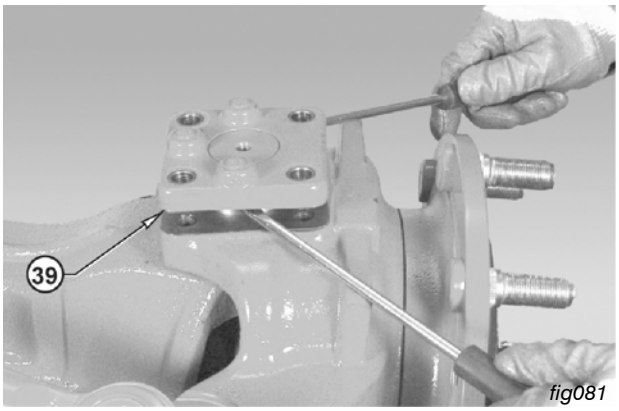
Remove the lower king pin (27) with a puller.

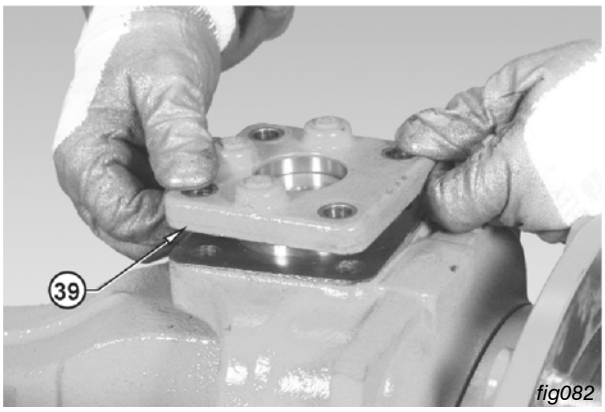


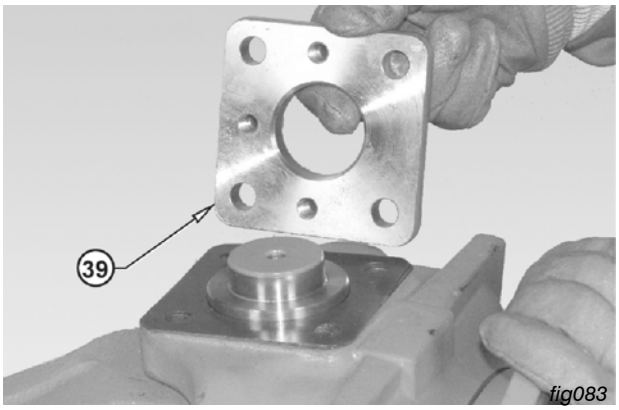
Remove the ring sealing (30).



Remove the bearing (32).

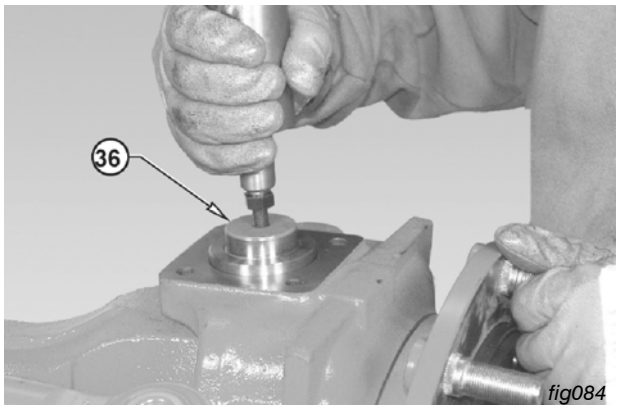






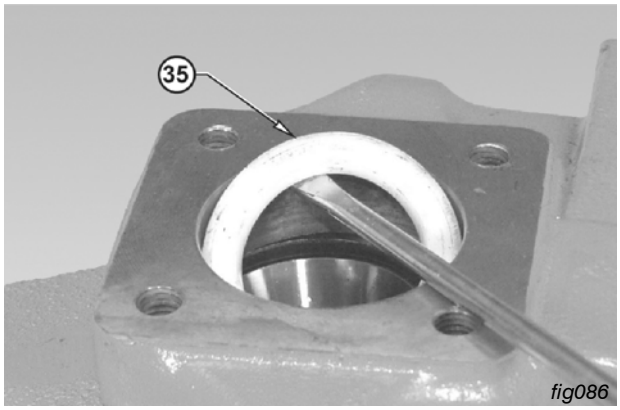
Remove the upper plate of the king pin (39).

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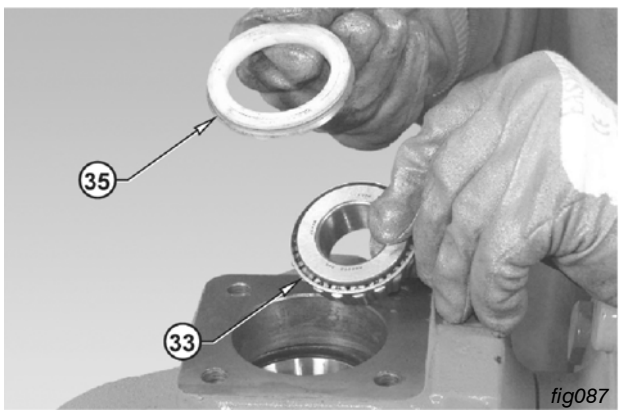




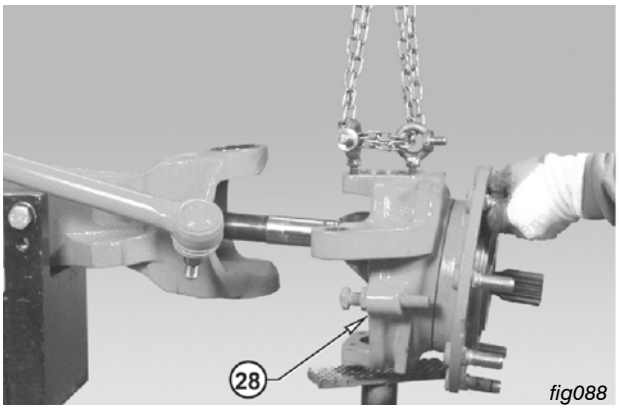
Remove the upper king pin (36) with a puller.



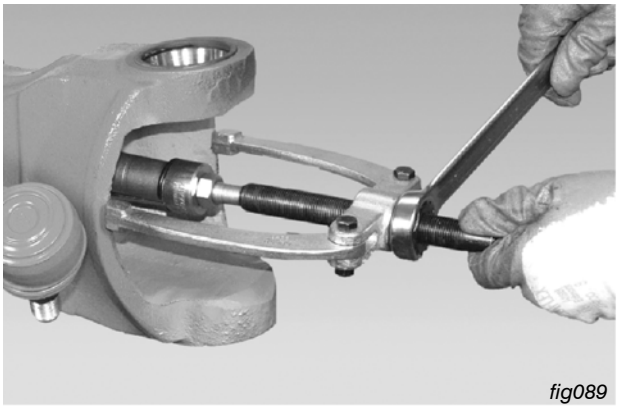
Remove the ring sealing (35).

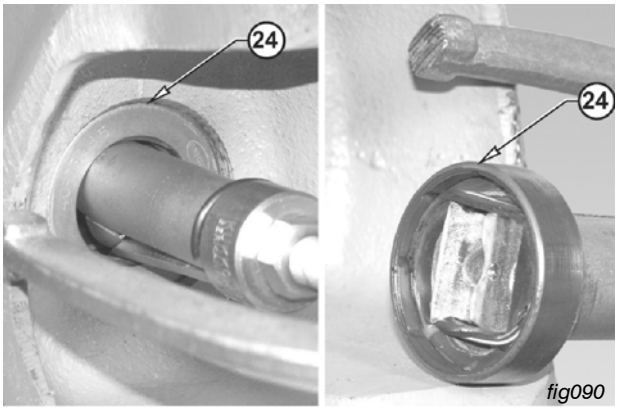


Remove the bearing (33).



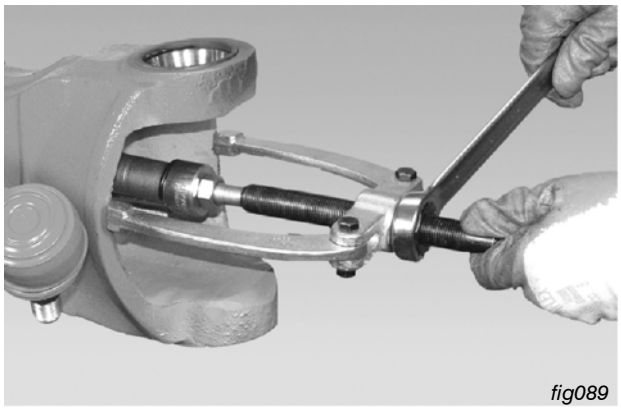
Remove the hub flange (28).





Remove the oil seal (24) with a puller.

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fig089

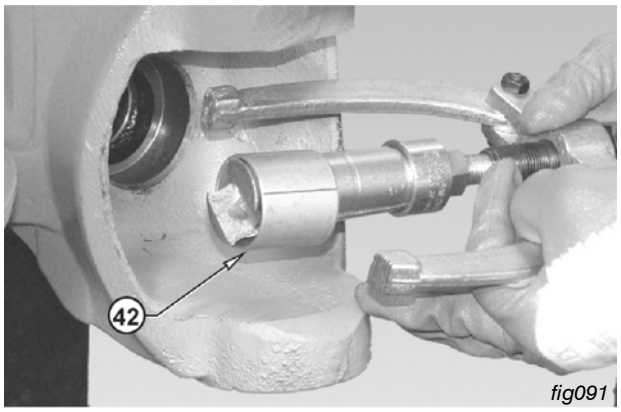
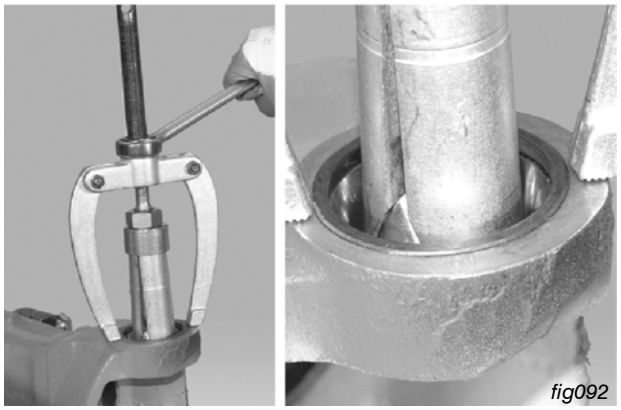


fig091

Remove the bushing (42) with a puller.


fig092

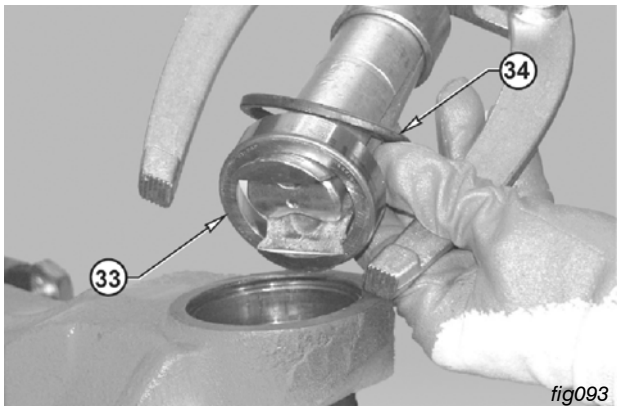
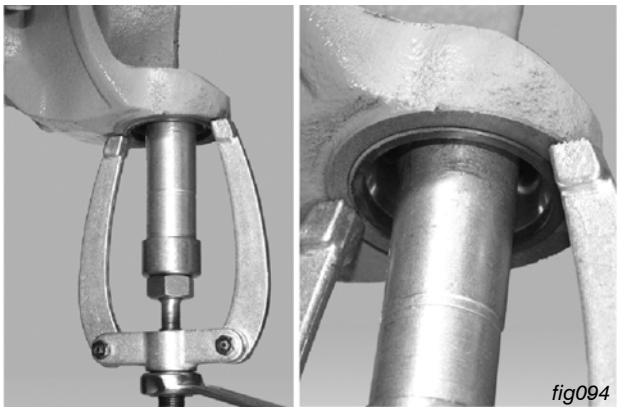


fig093

Remove the upper spacer ring (34) and the bearing outer race (33) with a puller.


fig094

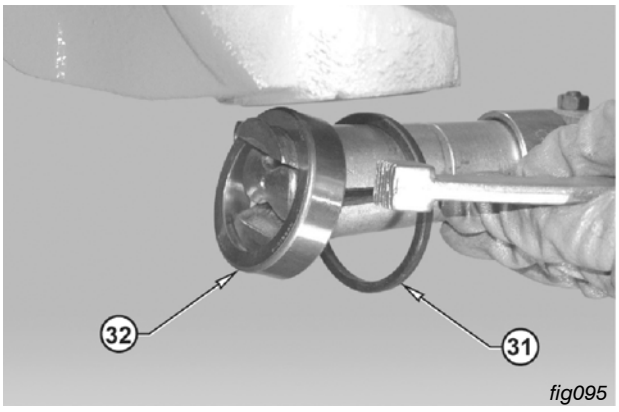
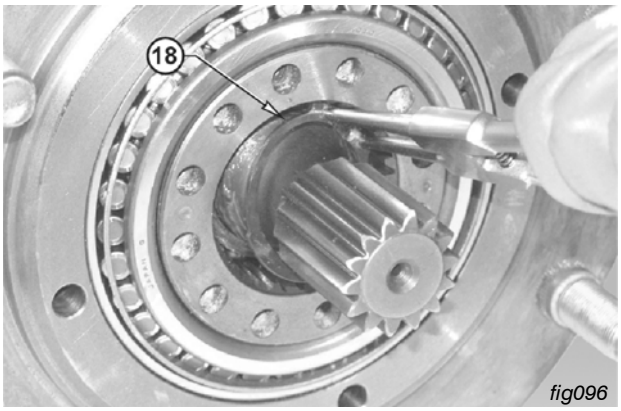
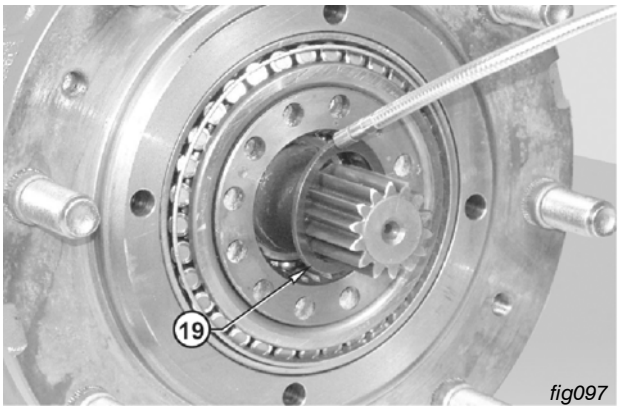


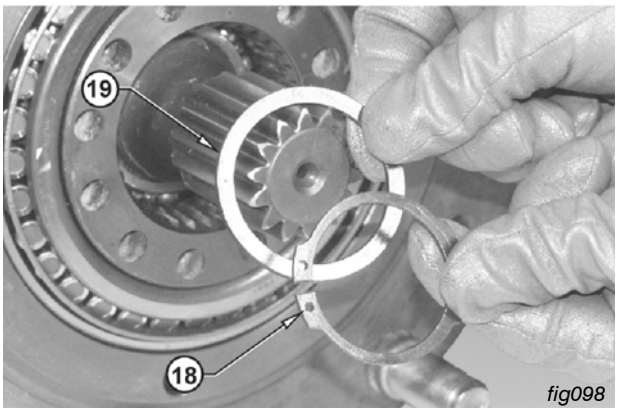
fig095

Remove the lower spacer ring (31) and the bearing outer race (32) with a puller.

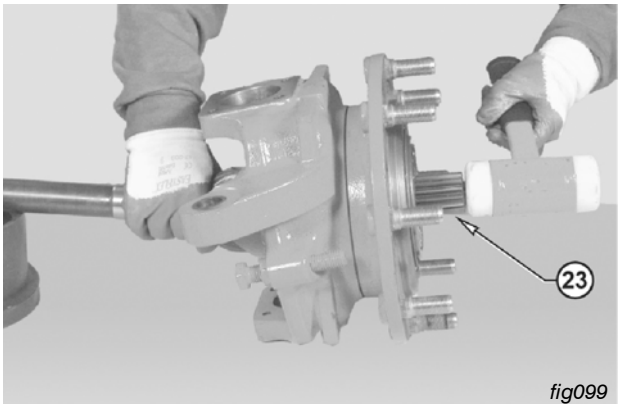
https://truckmanualshub.com/

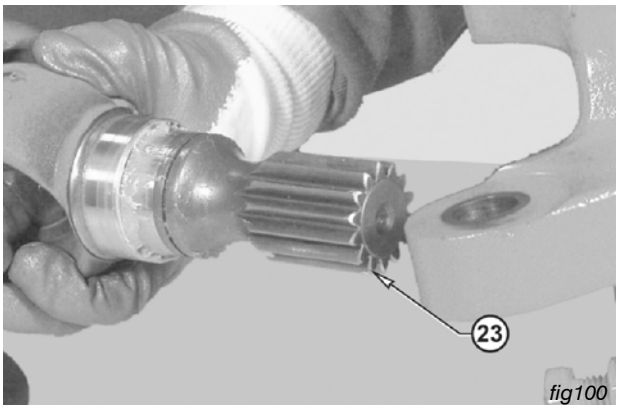




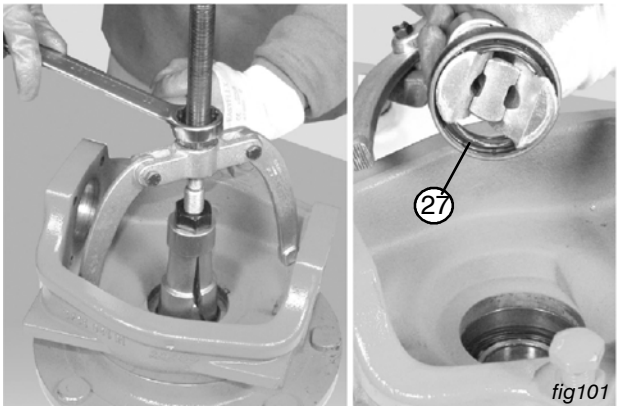


Remove the snap ring (18) and the shim (19).

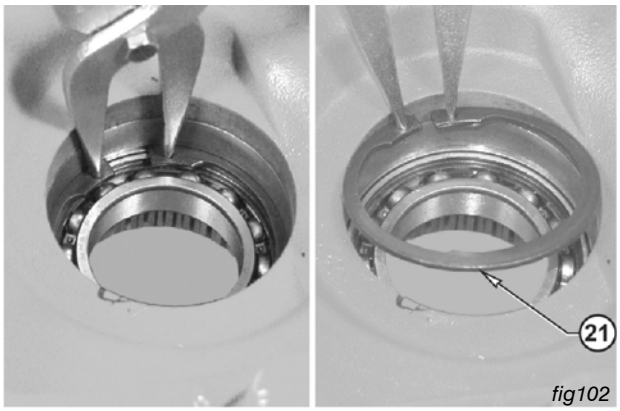




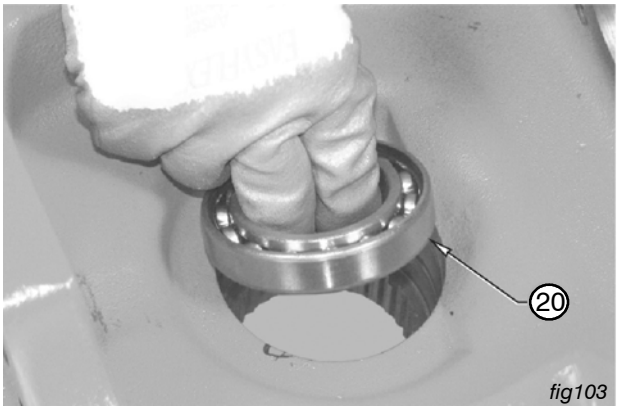
Remove the drive shaft (23). When fitting use plastic hammer.



Remove the oil seal (27) with a puller.



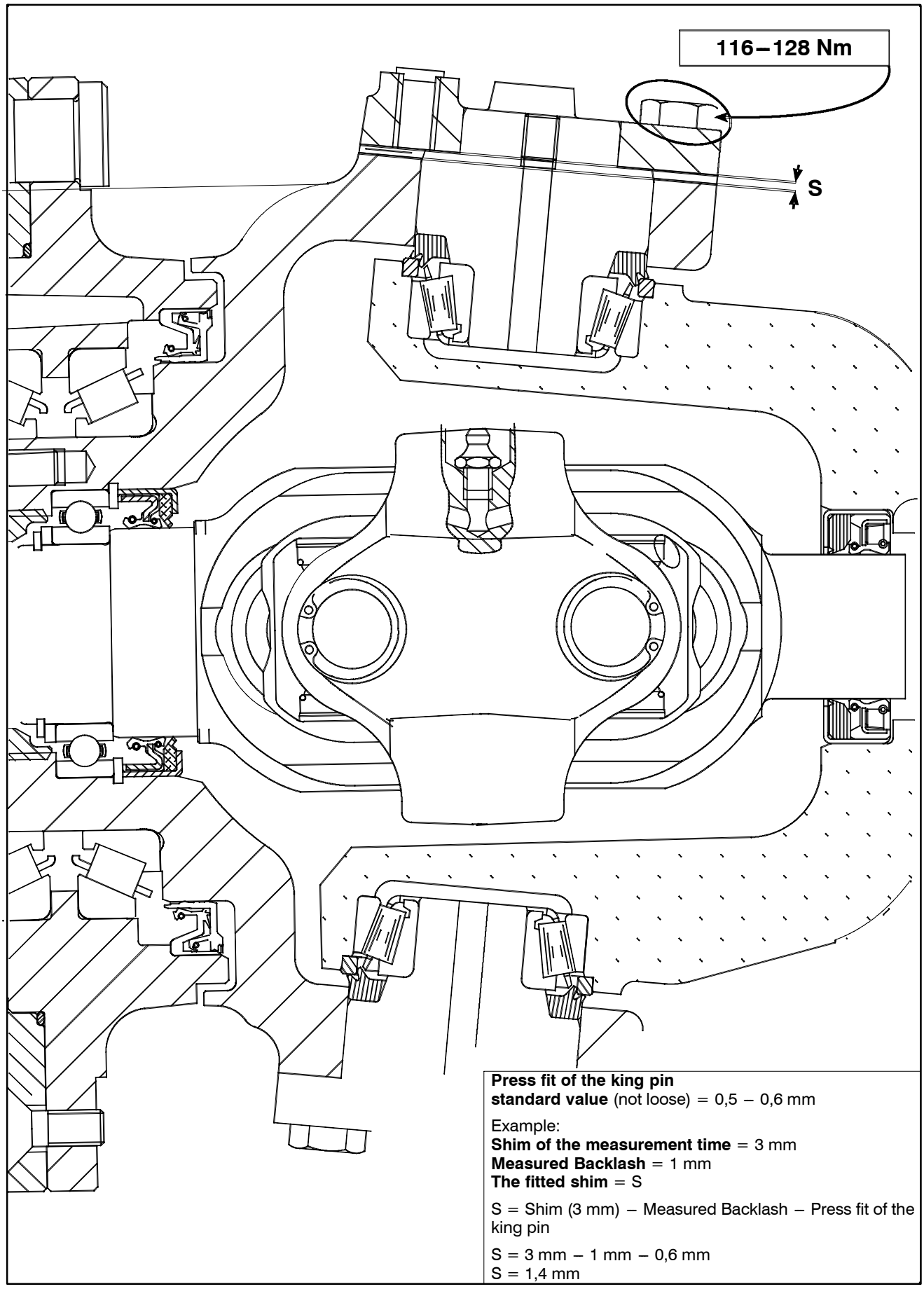
Remove the snap ring (21).



Remove the bearing (20).

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Assembling the knuckle housing



Press fit of the king pin
standard value (not loose) = 0,5 – 0,6 mm

Example:
Shim of the measurement time = 3 mm
Measured Backlash = 1 mm
The fitted shim = S

S = Shim (3 mm) – Measured Backlash – Press fit of the king pin

S = 3 mm – 1 mm – 0,6 mm
S = 1,4 mm

fig104en

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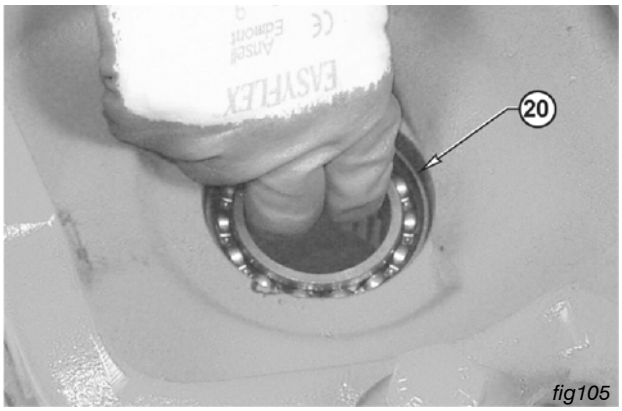


fig105

Fit the bearing (20).

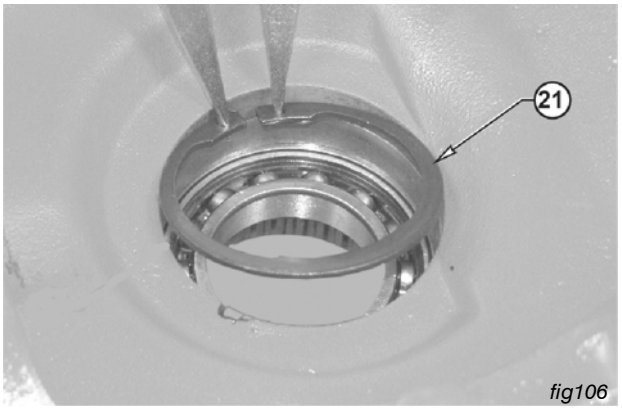


fig106



fig107

Fit the snap ring (21). Ensure, that the snap ring is in groove.

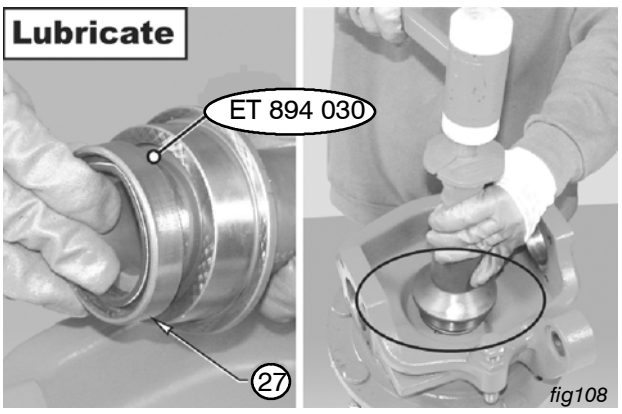


fig108

Fit a new seal (27) with plate **ET 894 030**. Grease the seal lips.

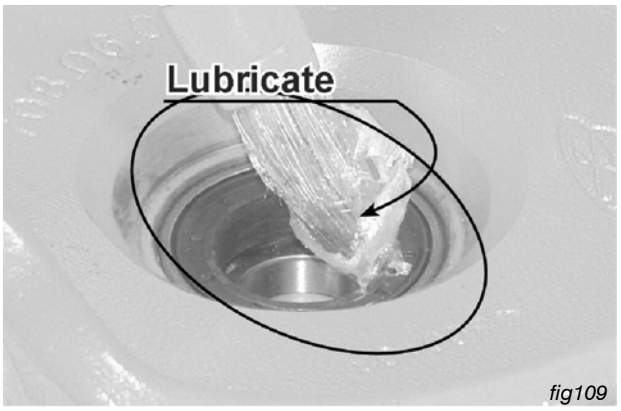


fig109

Grease the seal lips before installation of the drive shaft.

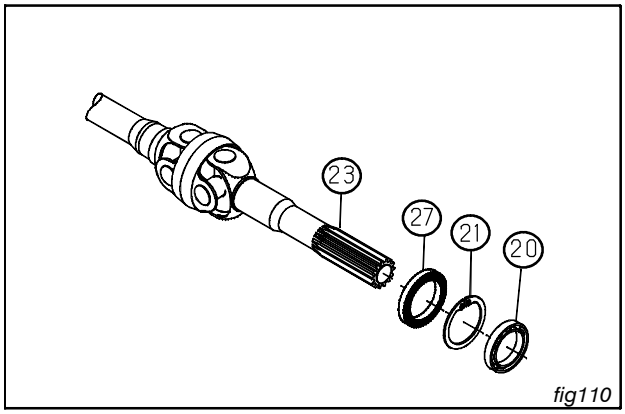


fig110

Ensure, that the parts are fitted according to picture.

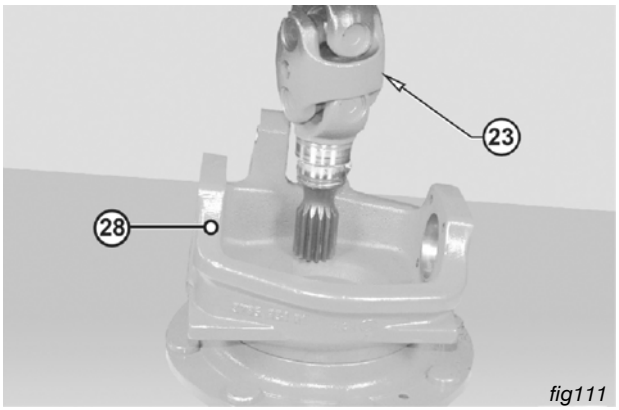
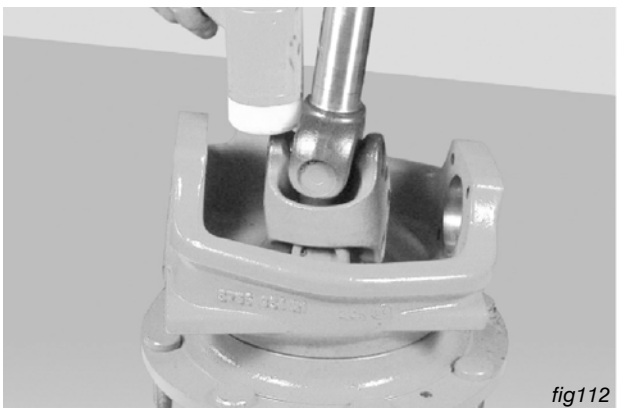


fig111


fig112

Fit the drive shaft (23) into place.

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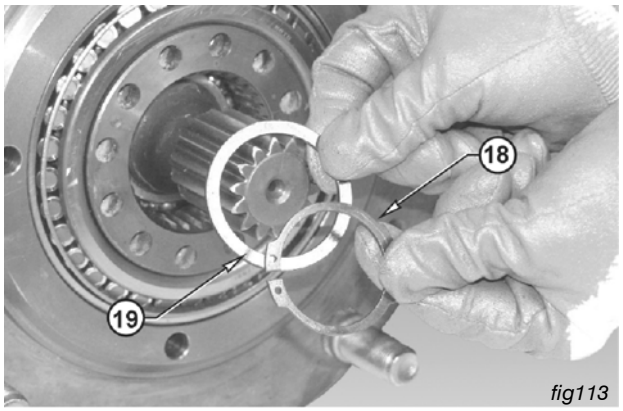


fig113

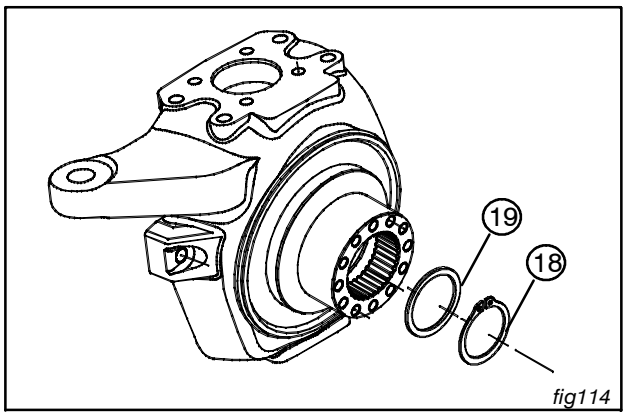


fig114

Install the shim (19) and the snap ring (18).

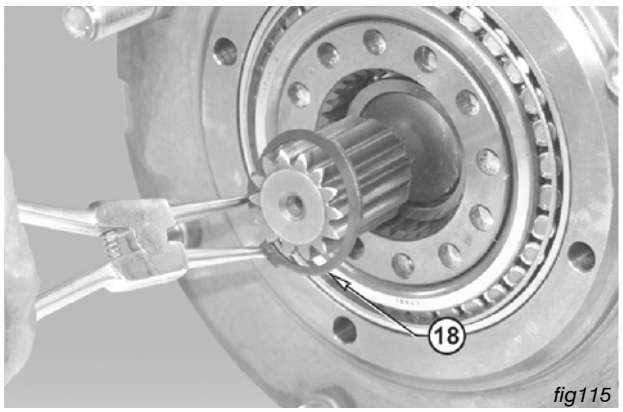


fig115

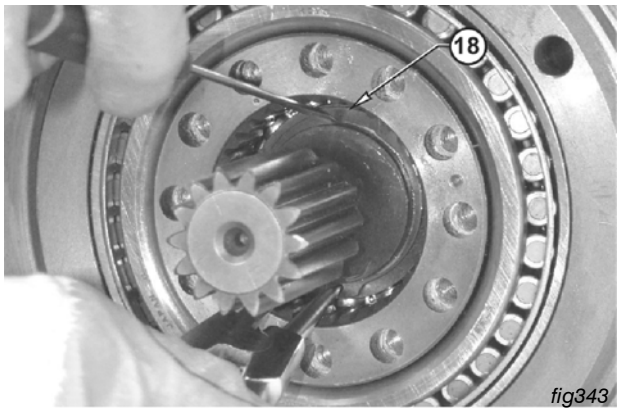


fig343

Fit the snap ring (18). Ensure, that the snap ring is in groove.

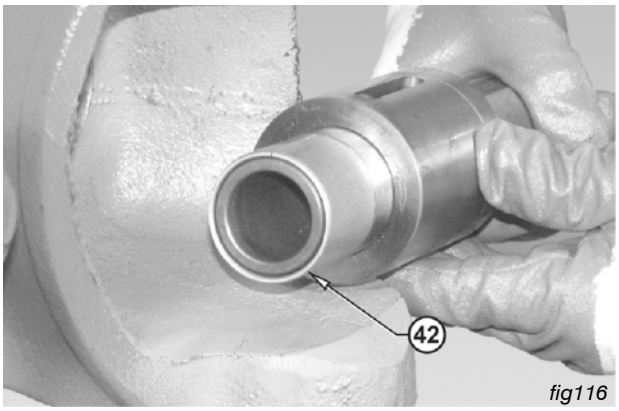


fig116

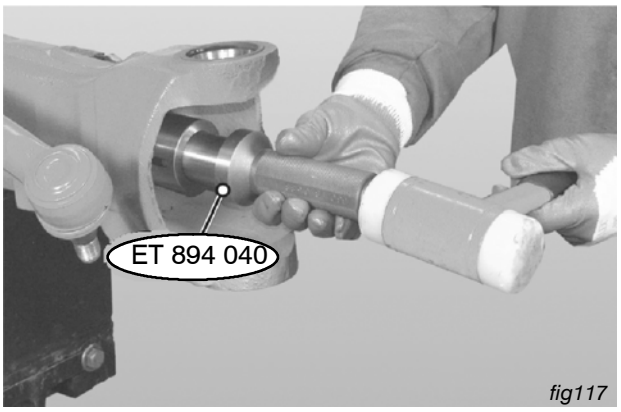


fig117

Lubricate the bushing (42) and fit the bushing into place with tool **ET 894 040**.

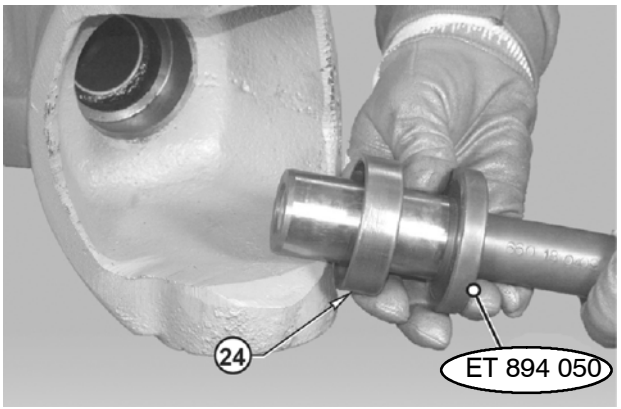
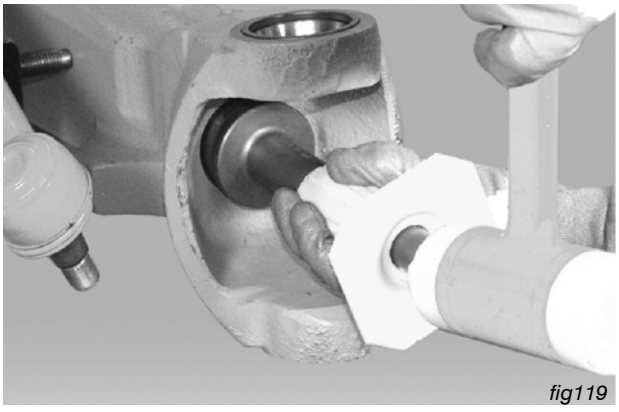


fig118


fig119

Fit a new seal (24) with plate **ET 894 050**. Grease the seal lips.

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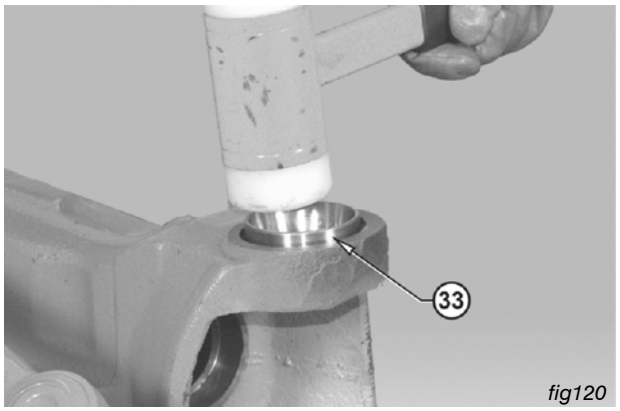
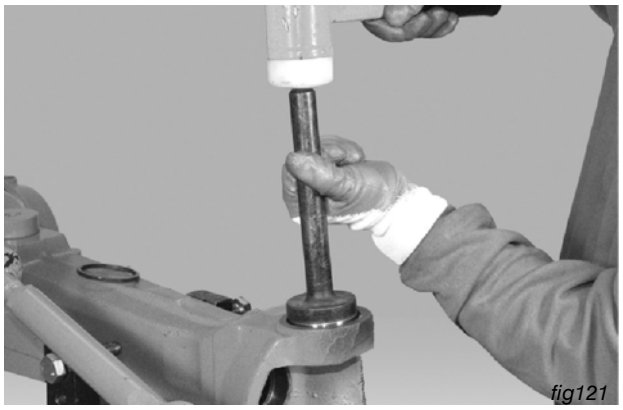


fig120


fig121

Fit the upper bearing outer race (33) into place.

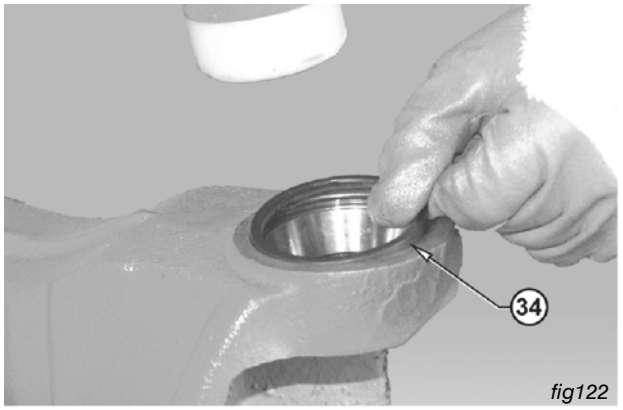


fig122

Fit the upper spacer ring (34) into place.

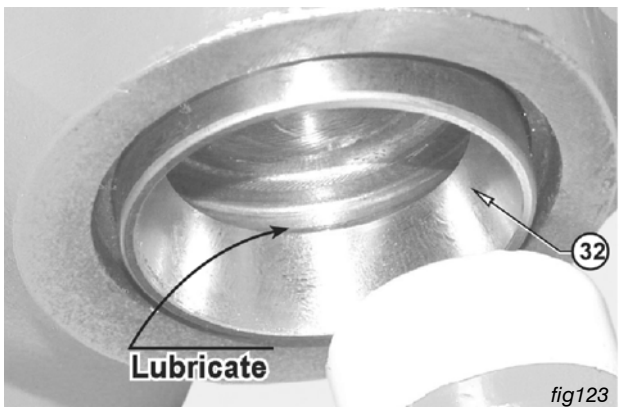


fig123

Fit the lower bearing outer race (32) into place.

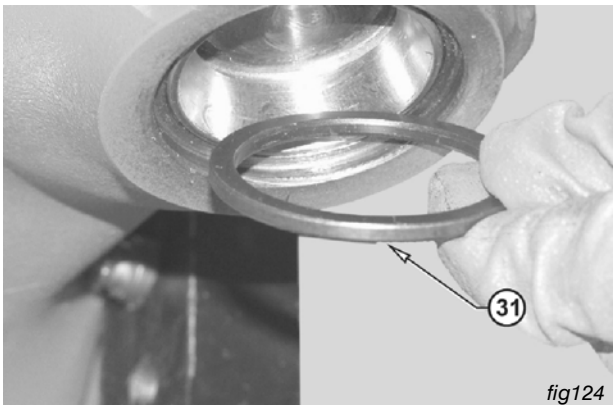
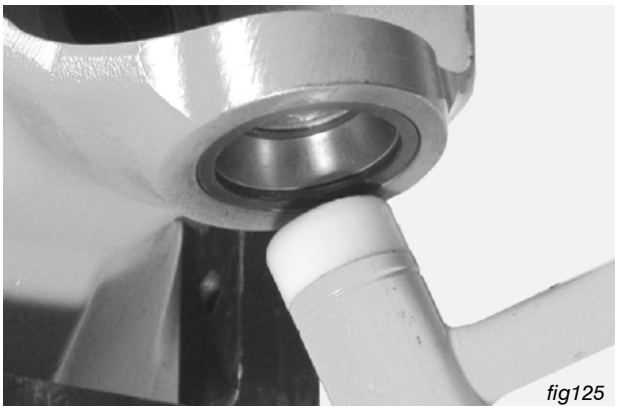


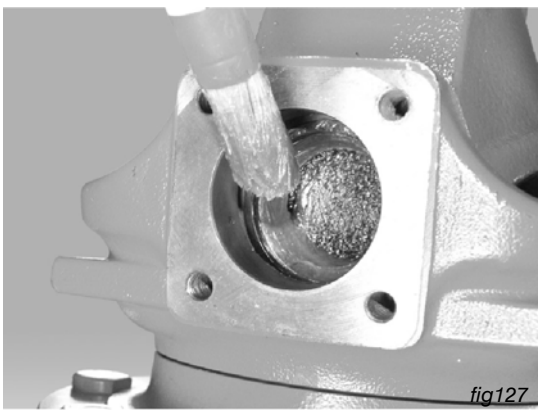
fig124


fig125

Fit the lower spacer ring (31) into place.


fig126

Fit the hub flange into place. Do not damage the seal on the drive shaft.


fig127

Grease the bearing housing.

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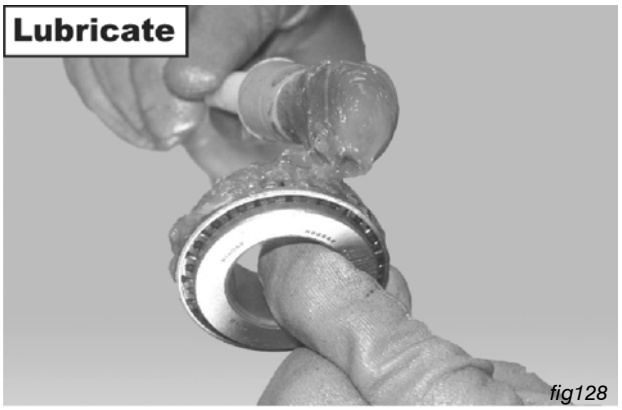


fig128

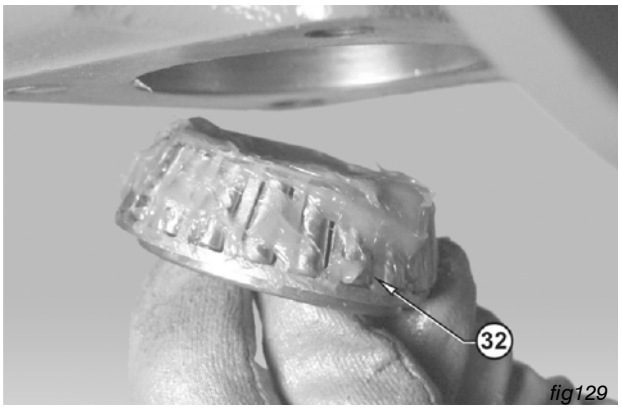


fig129

Grease the bearing (32) and fit it into place.

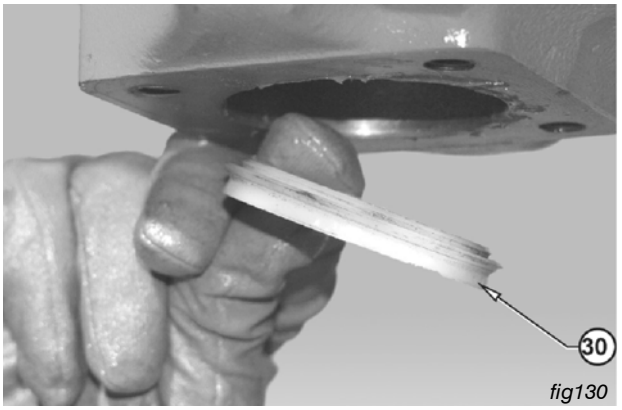


fig130

Fit the ring sealing (30) into place.

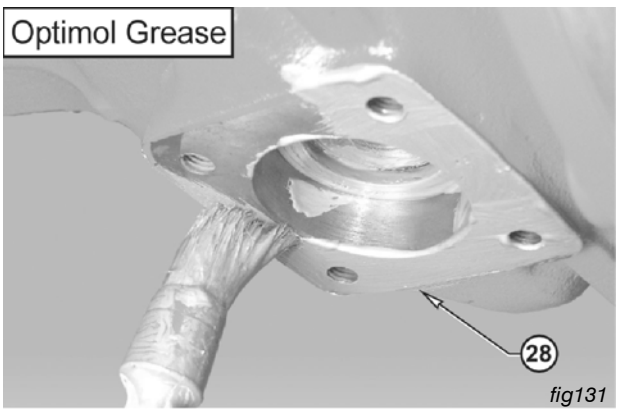


fig131

Grease the surface (28) of the king pin cover.

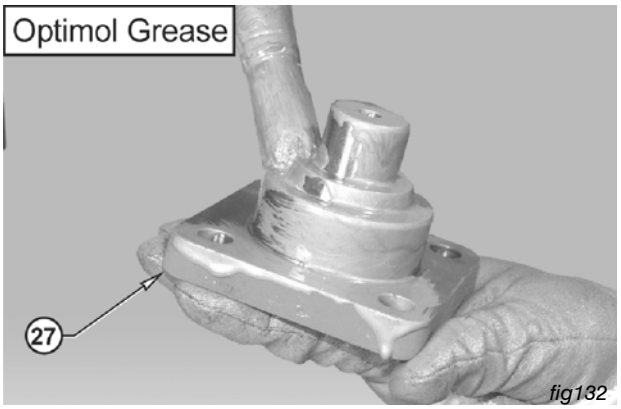


fig132

Grease the lower king pin (27).

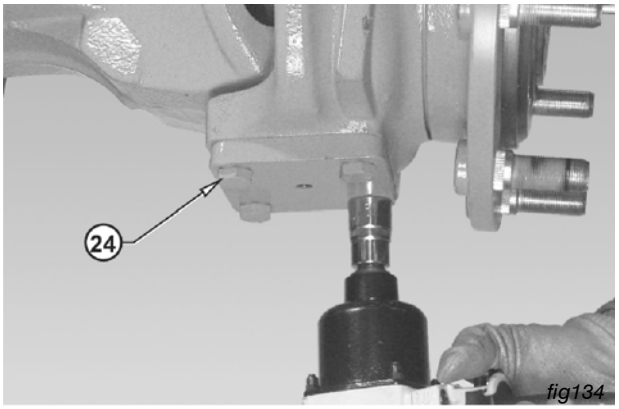


fig134

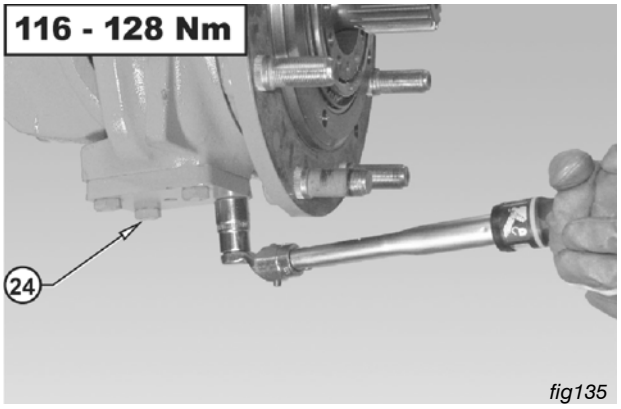


fig135

Tighten fastening bolts of the king pins (24). Tightening torques: **116 – 128 Nm**.

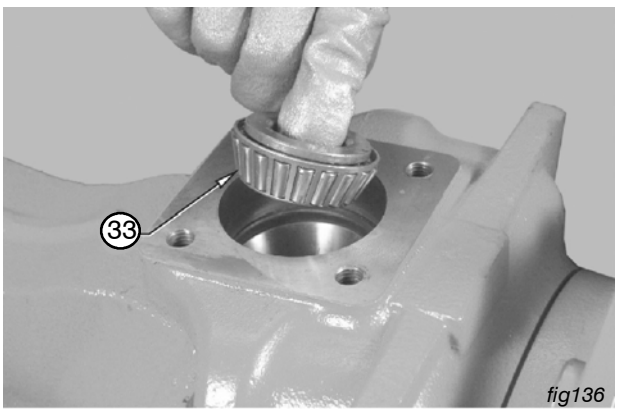


fig136

Fit the upper bearing (33).

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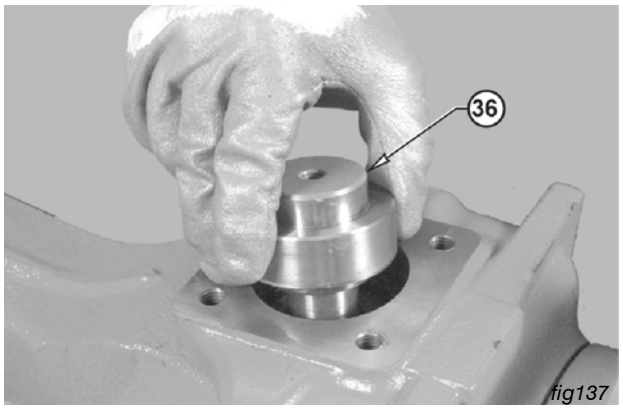
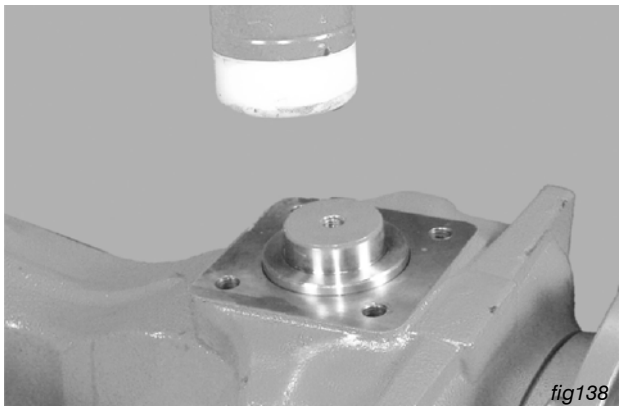


fig137


fig138

Fit the upper king pin (36) into place. Next carry out the measurement of the king pin shim.

The measurement of the king pin shim

During the measurement must be use an extra shim of the **3 mm**.
Calculate the number of shims required (**measurement S**), taking into account the fact that the bearings are press fit by **0,5–0,6 mm**.

Press fit of the king pin
standard value (not loose) = 0,5 – 0,6 mm

Example:
Shim of the measurement = 3 mm
Measured Backlash = 1 mm
The fitted shim = S

S = Shim (3 mm) – Measured Backlash – Press fit of the king pin

S = 3 mm – 1 mm – 0,6 mm
S = 1,4 mm

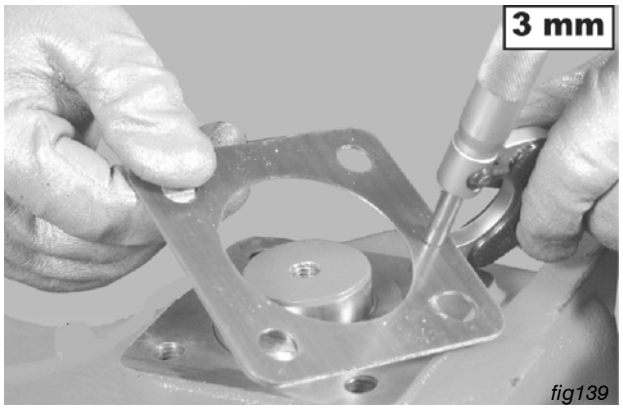


fig139

Fit the shim of the measurement time (**3mm**) into place.

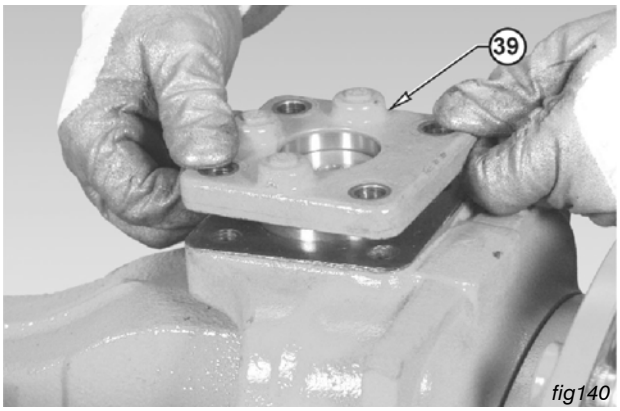
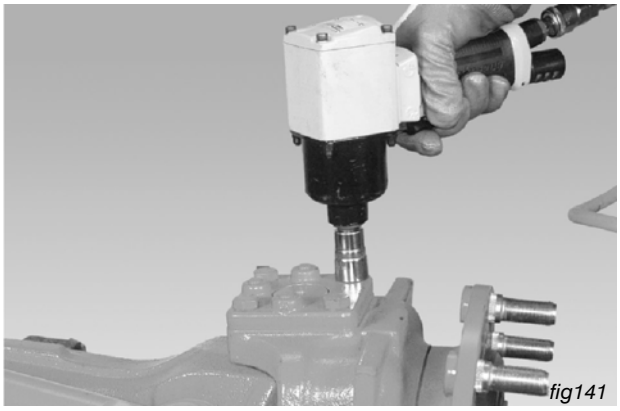
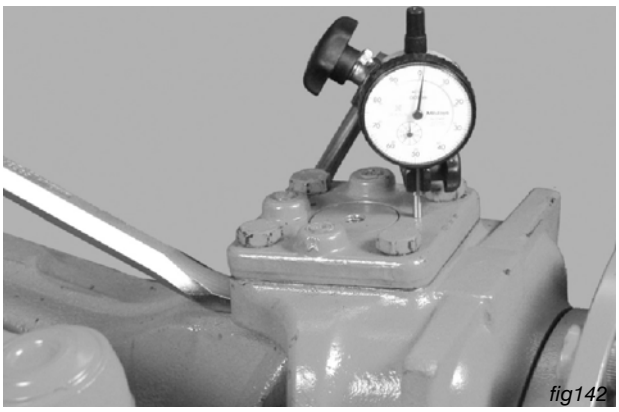


fig140

Fit the upper plate of the king pin (39) into place.


fig141

Tighten fastening bolts of the plate.


fig142

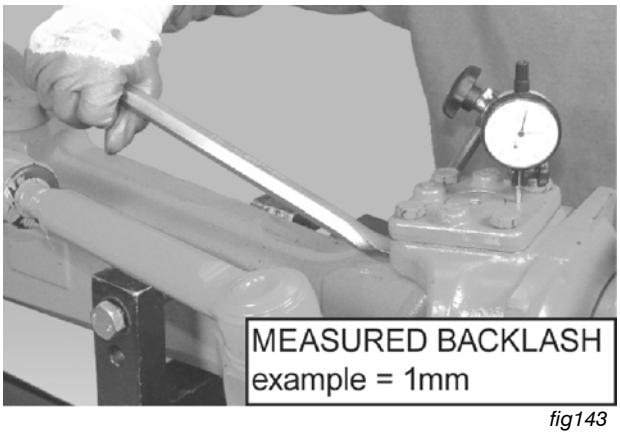
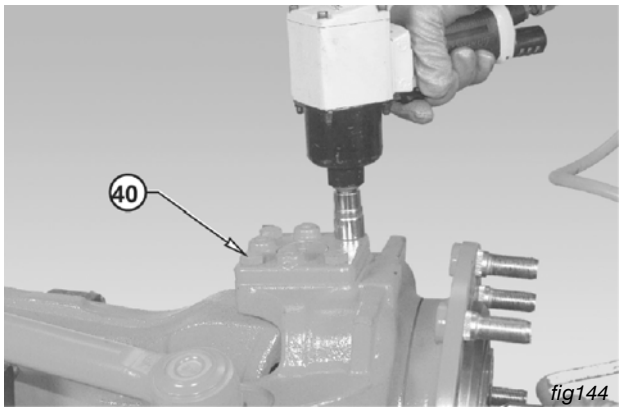


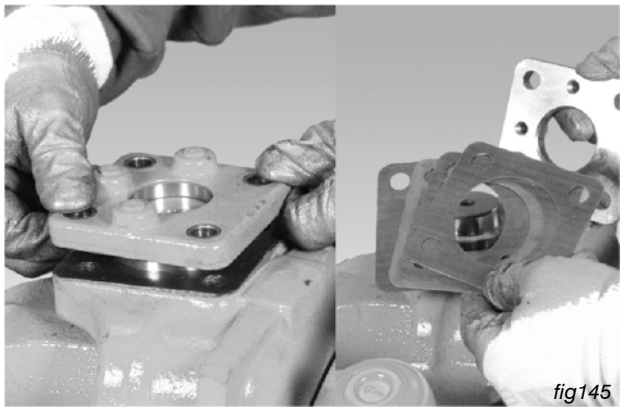
fig143

Measure the end float (measured Backlash).

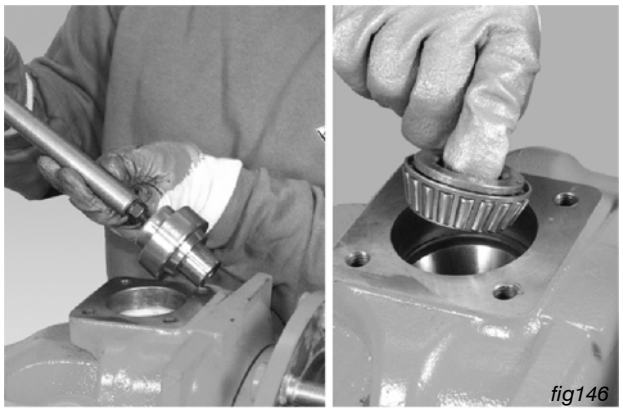
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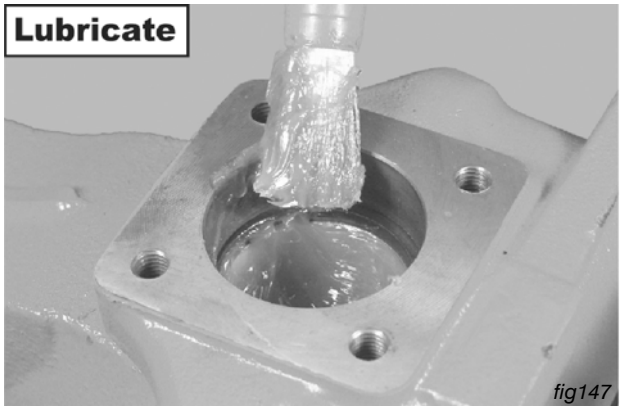
Remove fastening bolts (40) of the plate.



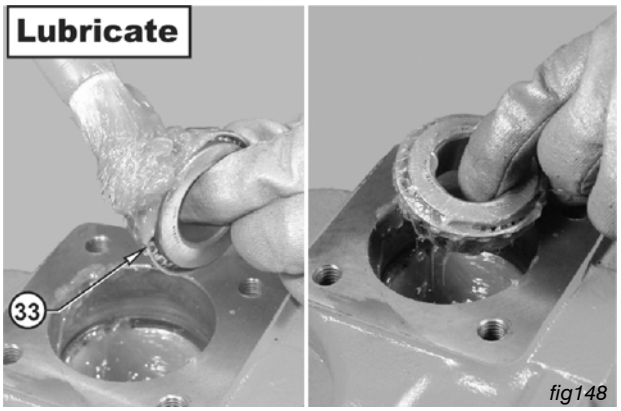
Remove the plate of the king pin and shims of the measurement time (**3 mm**).



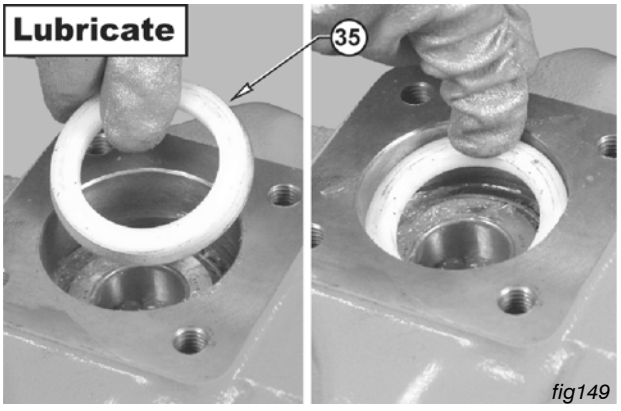
Remove the king pin and the bearing.



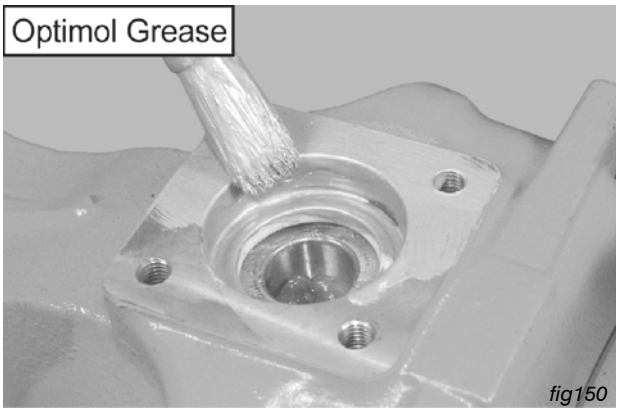
Grease the bearing housing.

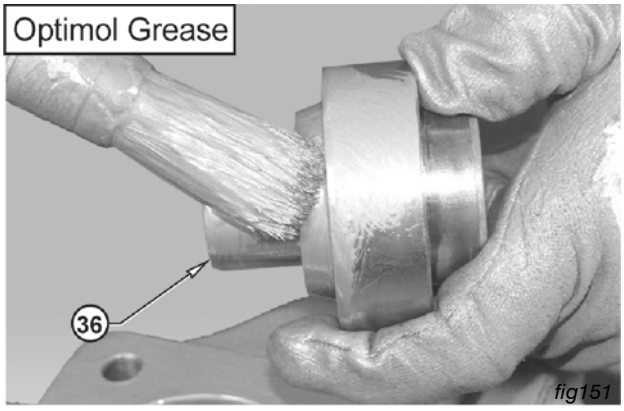


Grease the bearing (33) and fit it into place.



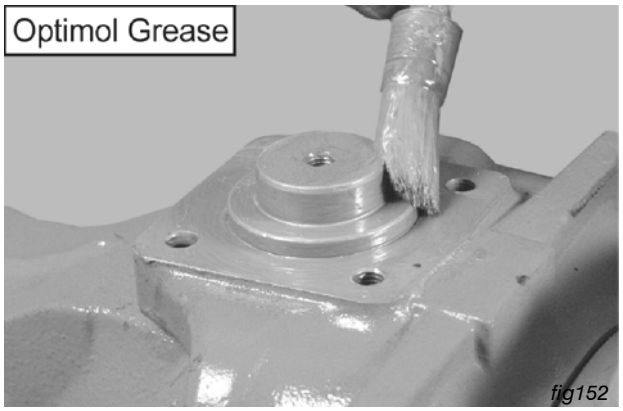
Fit the ring sealing (35) into place.





Grease the king pin (36).

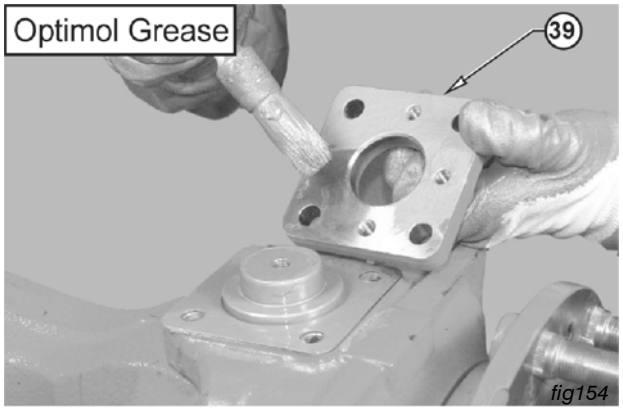
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Grease the surface of the king pin cover.

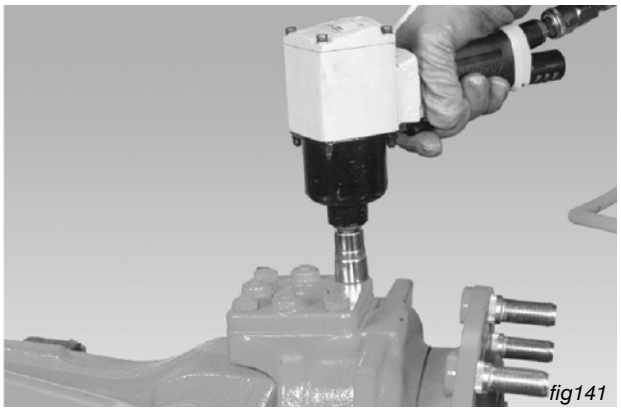


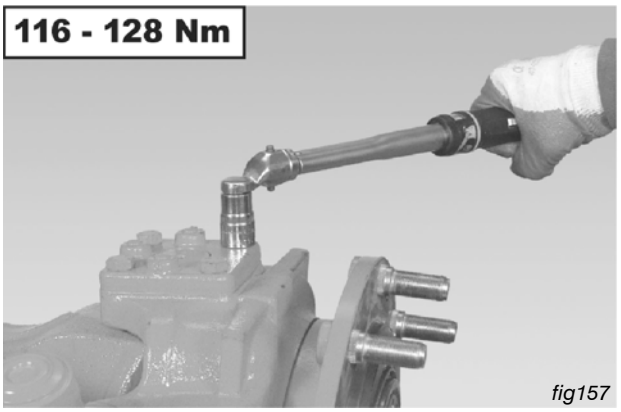
Fit the measured shim **S** (38) under the upper king pin.



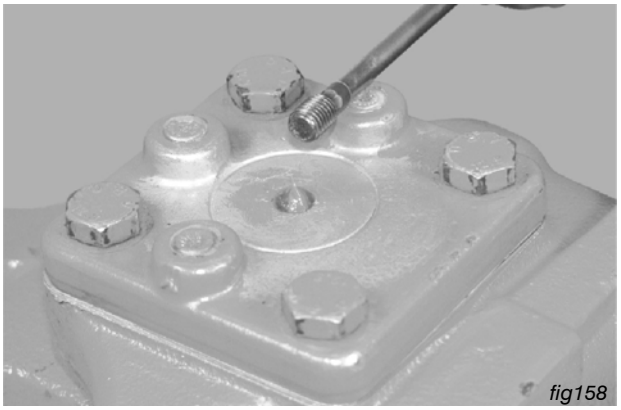


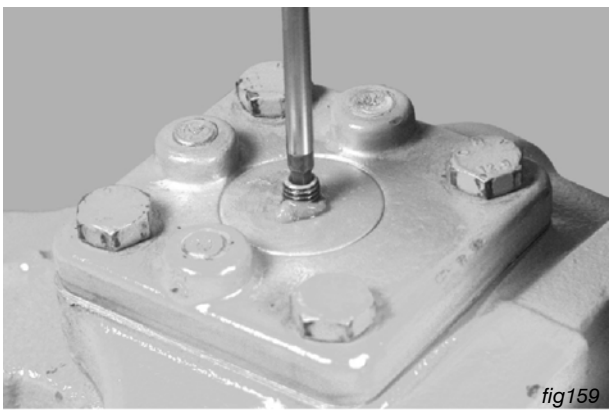
Fit the plate of the king pin (39) into place.





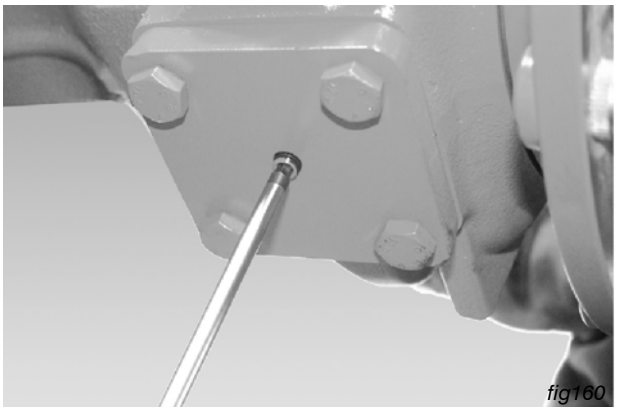
Tighten fastening bolts of the king pin. Tightening torques: **116 – 128 Nm**.

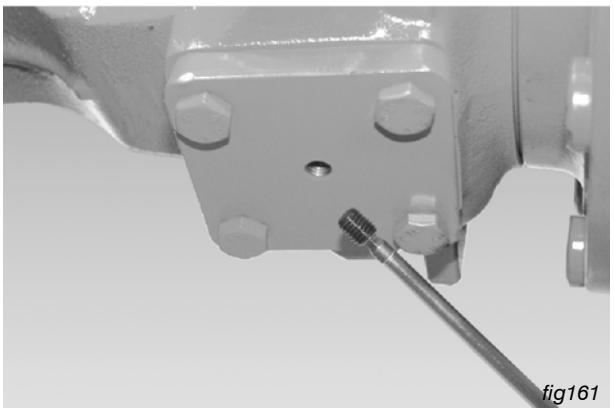




Fit the upper plug into place. The additional grease exits throught this hole.

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fig160


fig161

Fit the lower plug into place. The additional grease exits throught this hole.

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Disassembling the differential (HiLock)

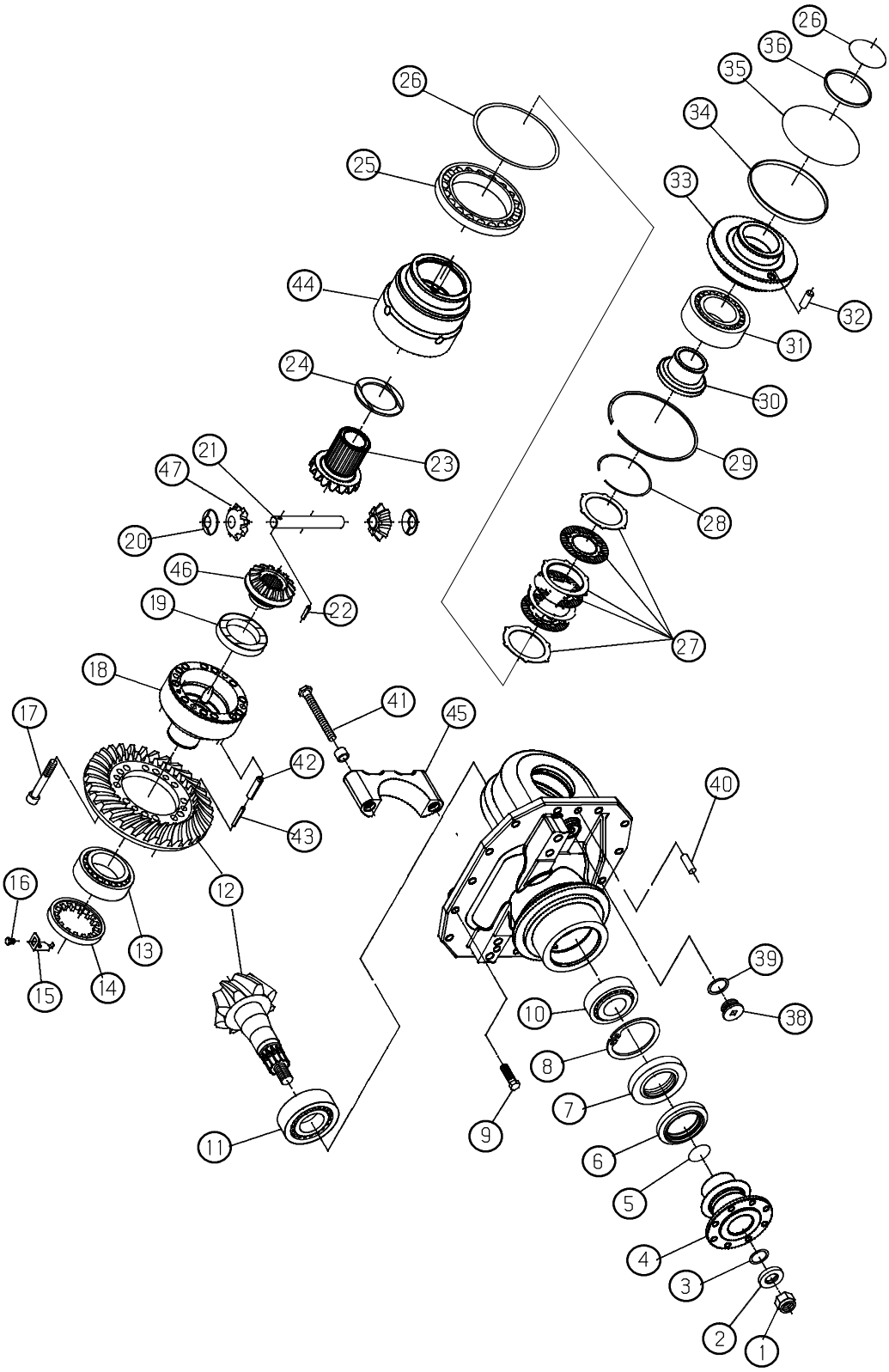
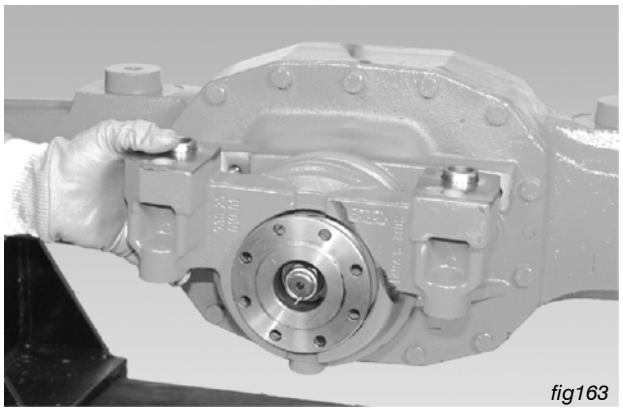


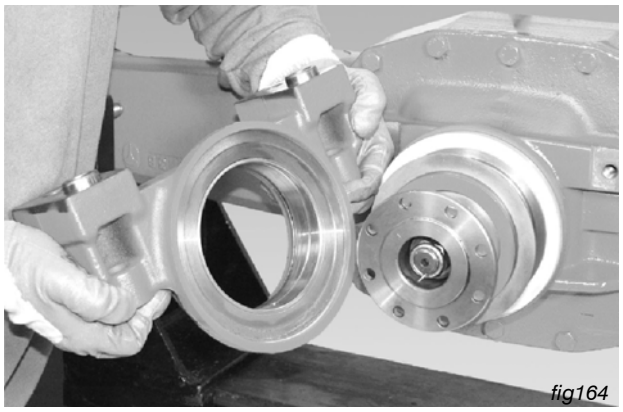
fig162

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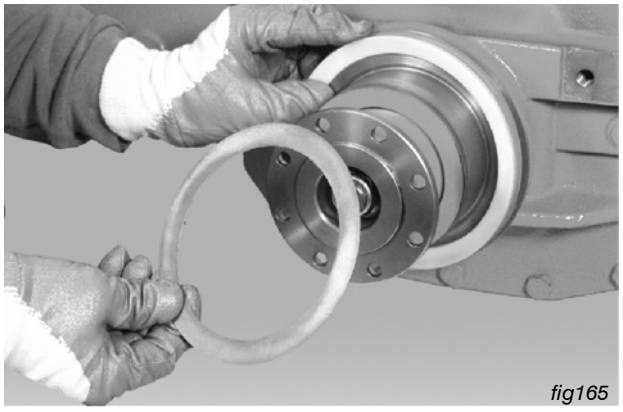
Before disassembling the differential

– drain the oil from the axle housing.
– remove the steering cylinder.
– disconnect the oil hose of the differential lock.
– remove the hubs and the drive shafts.

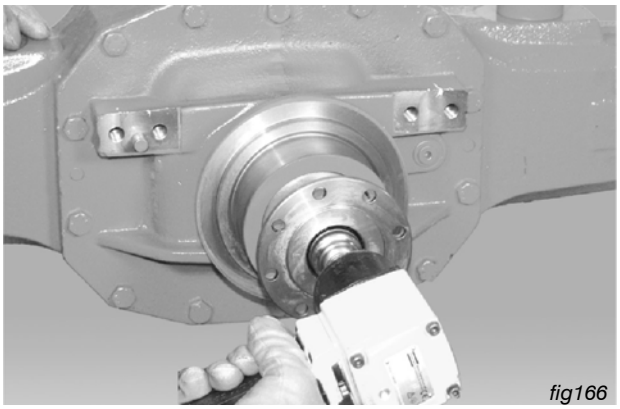

fig163


fig164

Remove the bearing bracket on the axle.


fig165

Remove the v–ring and spacer ring.


fig166

Prevent rotation of the bevel pinion shaft and unscrew the nut.

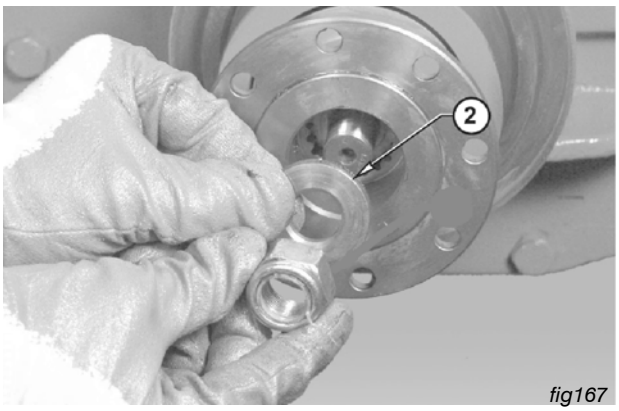


fig167

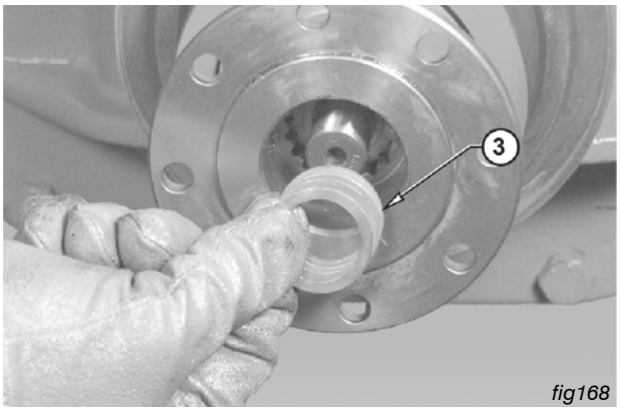


fig168

Remove the nut, washer (2) and shims (3).

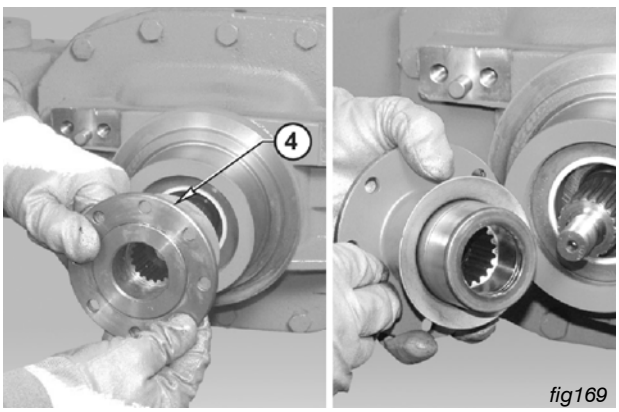
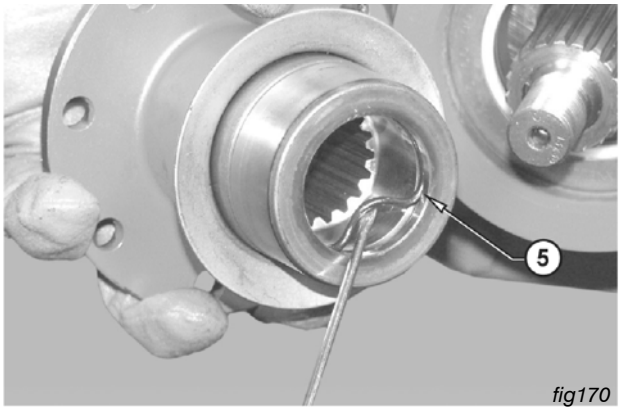


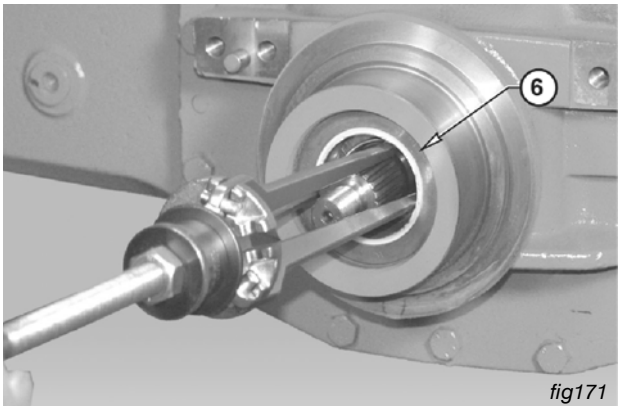
fig169

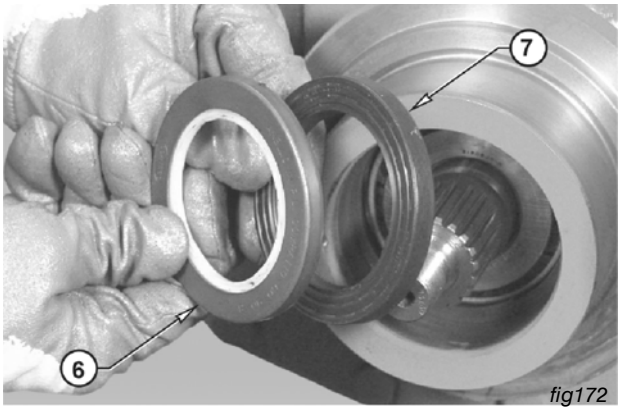
Remove the flange (4).

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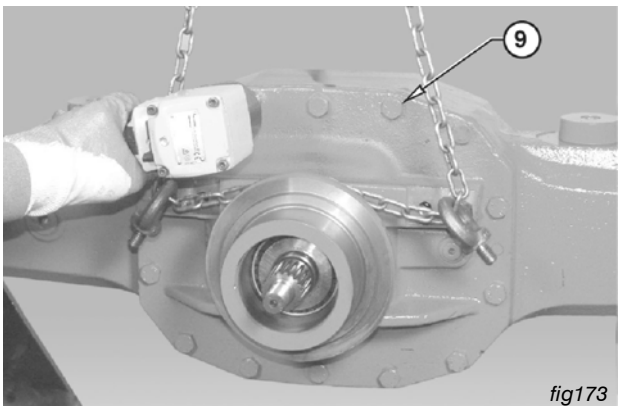


Remove the O–ring (5).

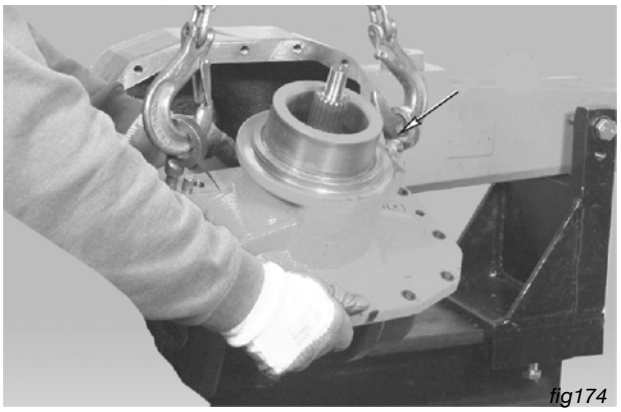




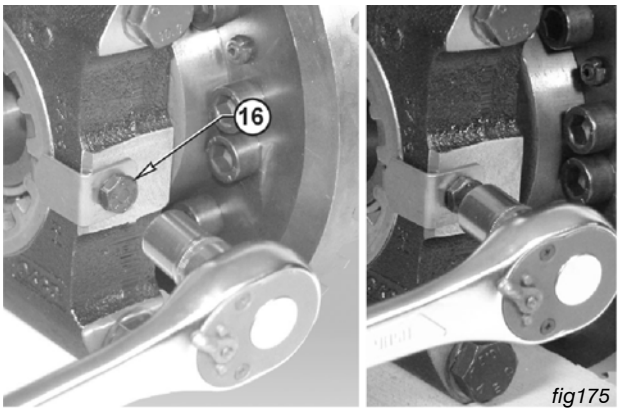
Remove the sealing ring (6 and 7).



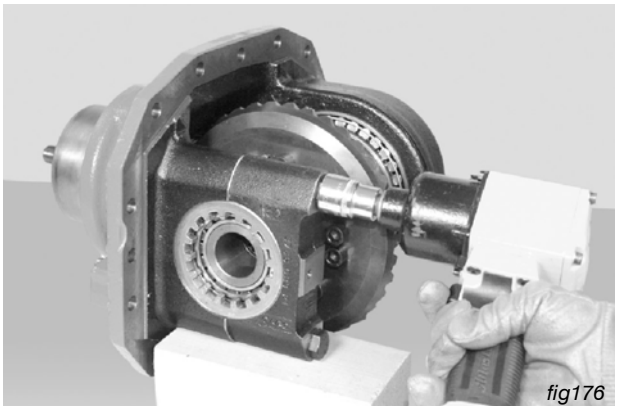
Remove the screws (9).



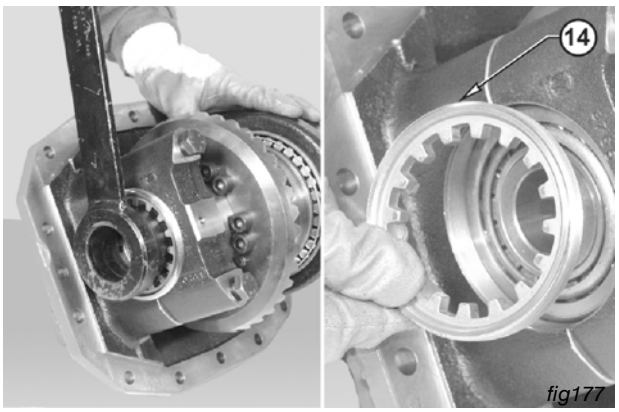
Take out the differential from the axle housing.



Remove the screw (16).

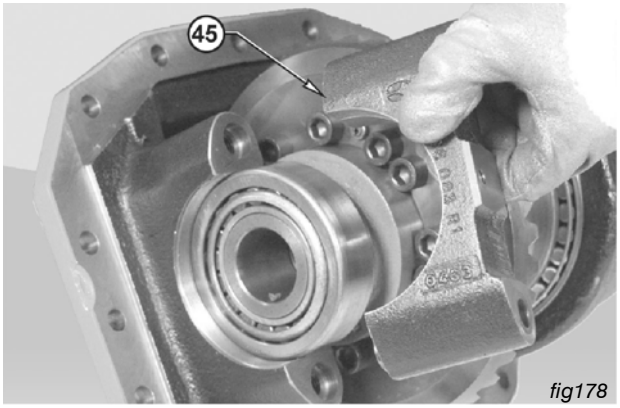


Loosen the bearing cap bolts.

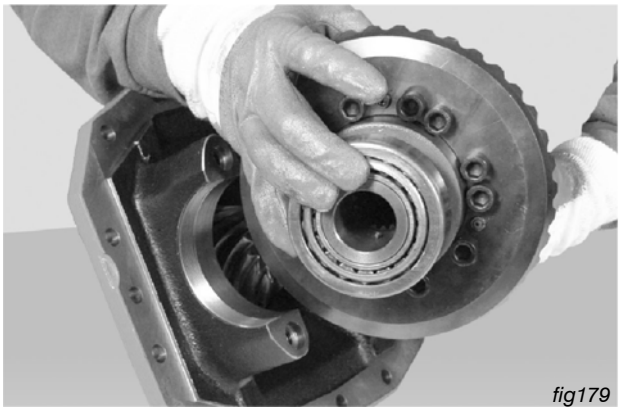


Remove the ring nuts (14). **Note!** Clean the threads of the ring nut.

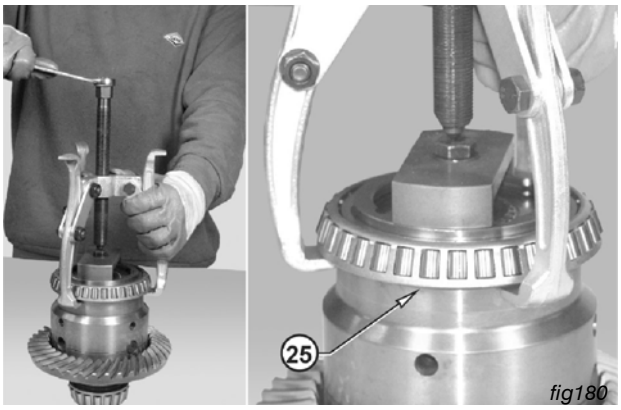
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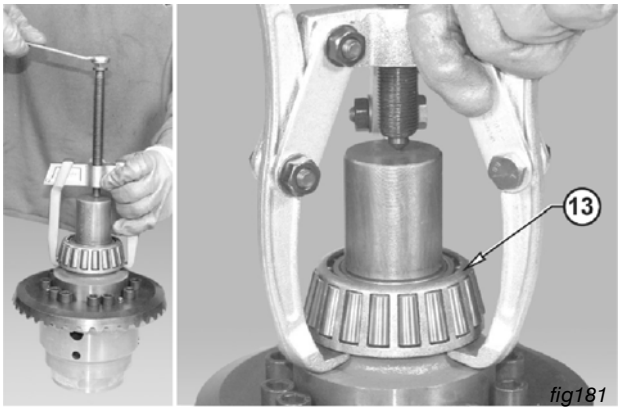
Remove the bearing cap (45).



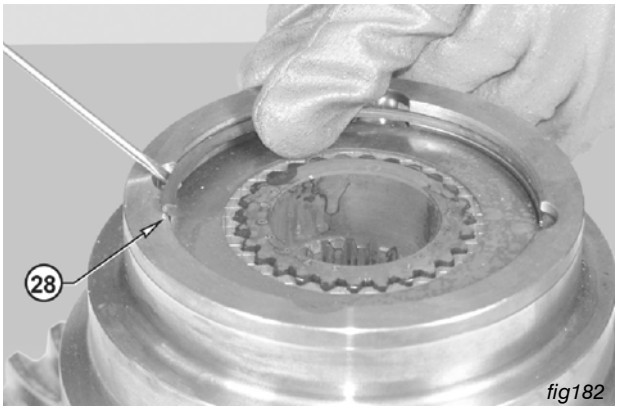
Remove the differential.



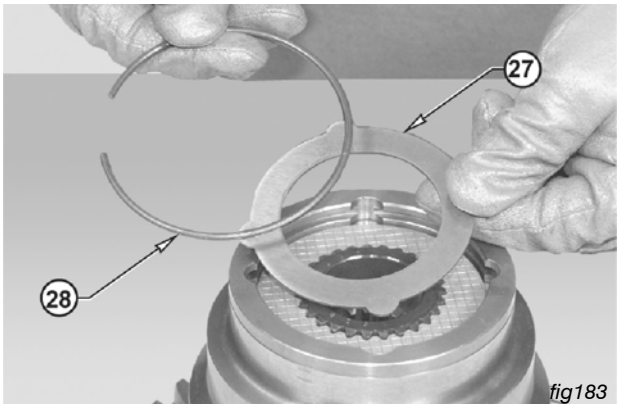
Remove the differential bearing (25), when necessary.

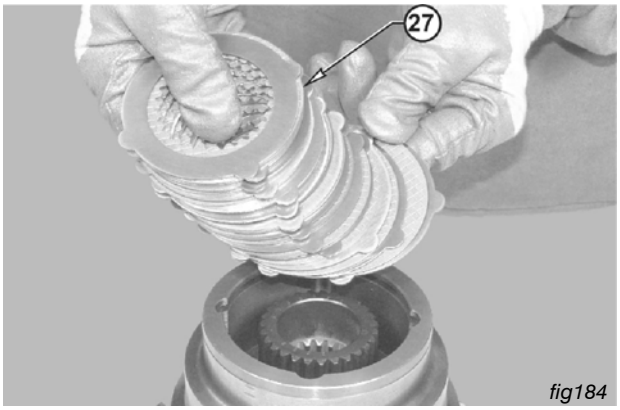


Remove the differential bearing (13), when necessary.

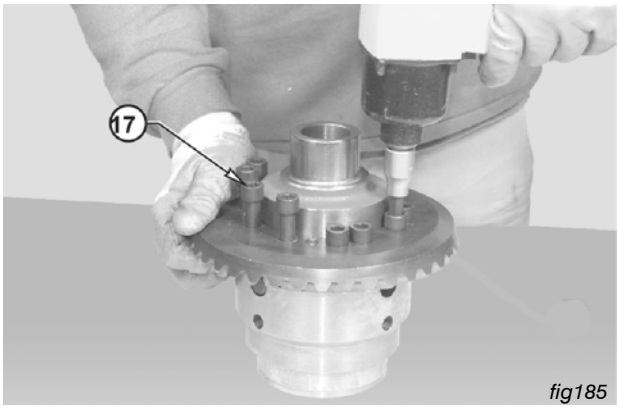


Remove the snap ring (28).



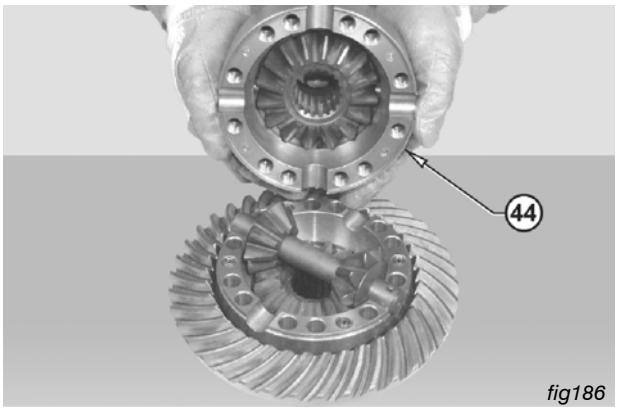


Remove the friction discs (27).

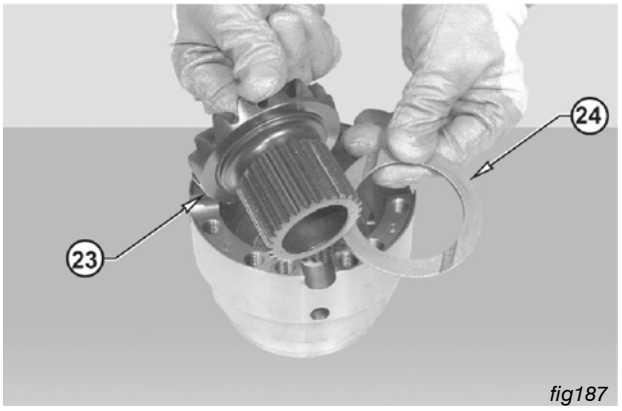


Unscrew the attach screws of the crown wheel (17).

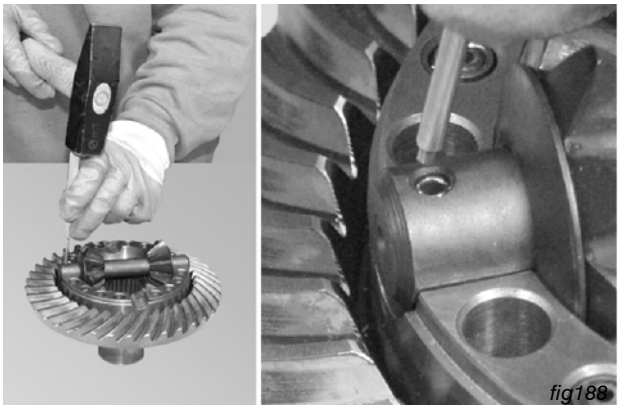
https://truckmanualshub.com/



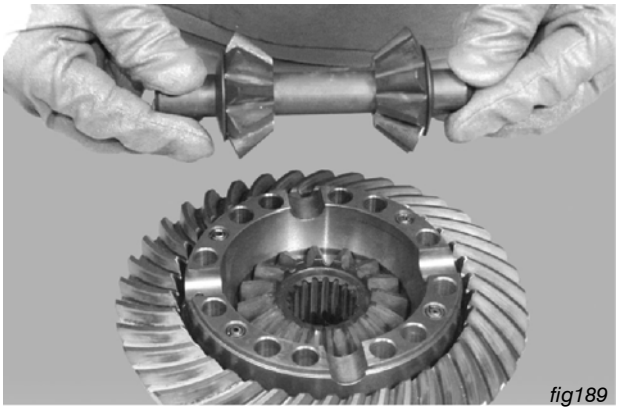
Mark the halves of the differential location. Open the differential (44).



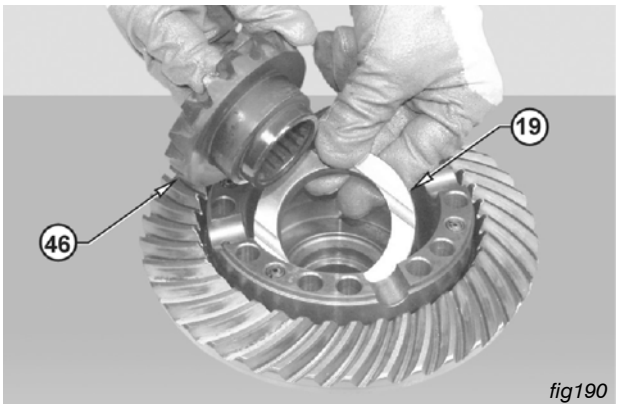
Remove the thrust bearing (24) and the differential wheel (23).



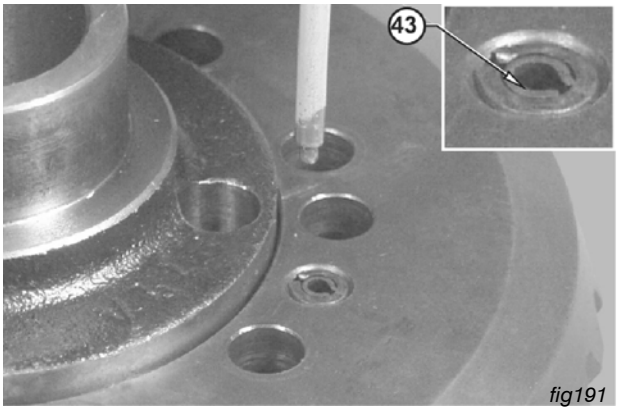
Remove the locking cones of the axle.



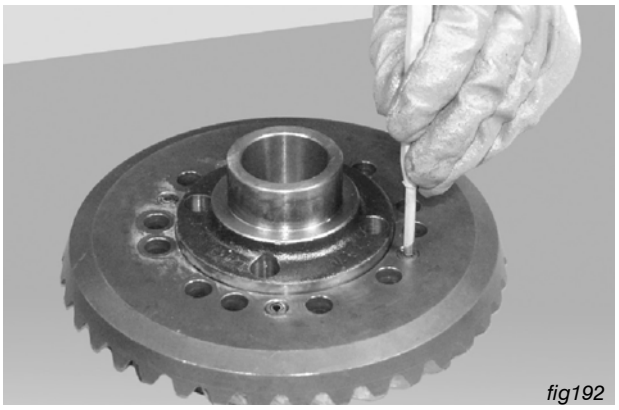
Remove the differential pinions.

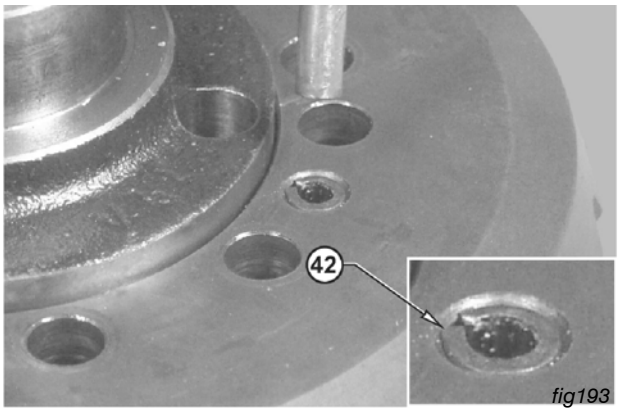


Remove the thrust bearing (19) and the differential wheel (46).



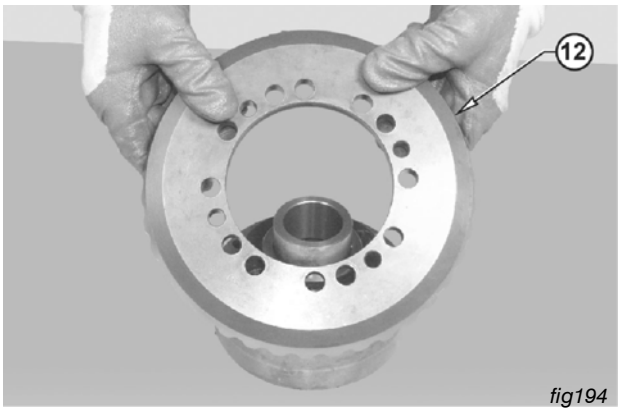
Remove the inner locking cones (43) of the crown wheel.



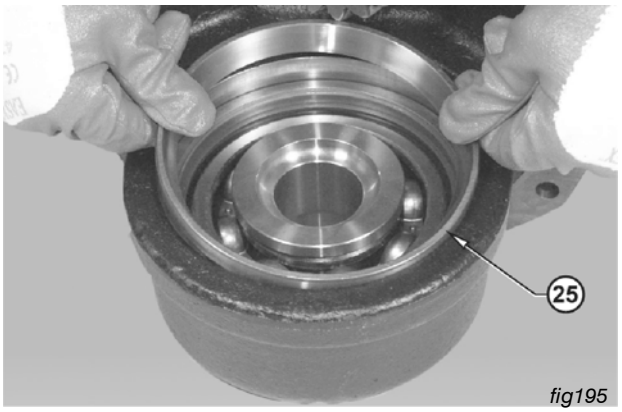


Remove the outer locking cones (42) of the crown wheel.

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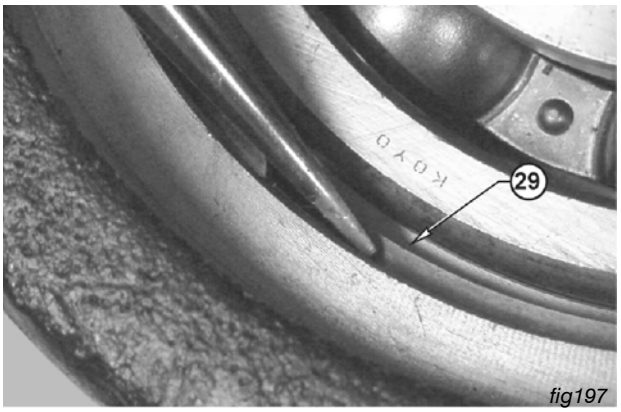
Remove the crown wheel (12).

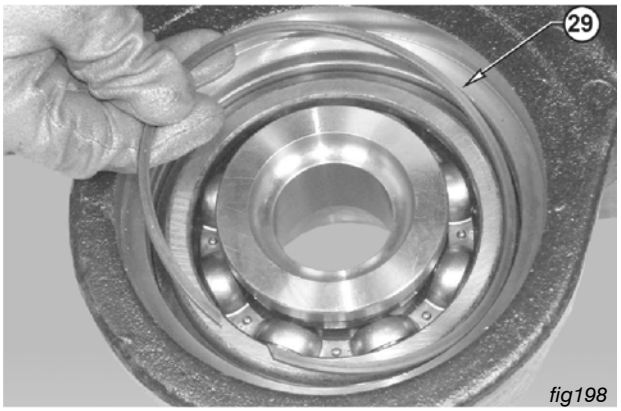


Remove the bearing outer race (25).

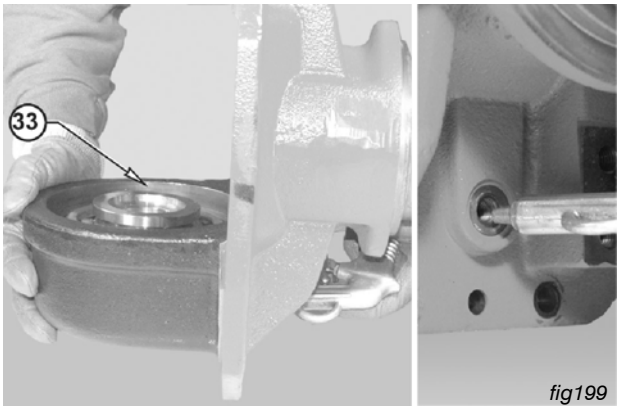


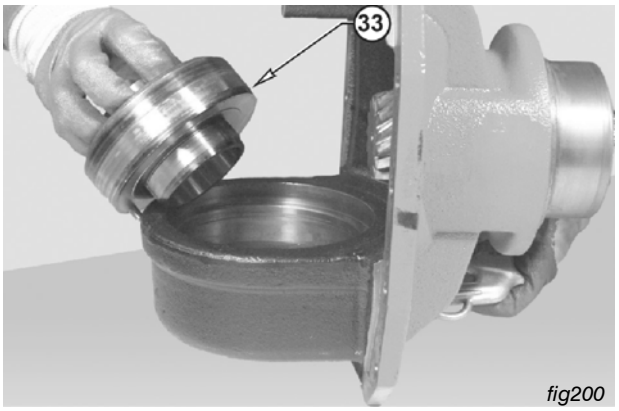
Remove the shim (26).





Remove the snap ring (29).





Remove the piston (33) of the differential lock e.g. with help of the compressed air.

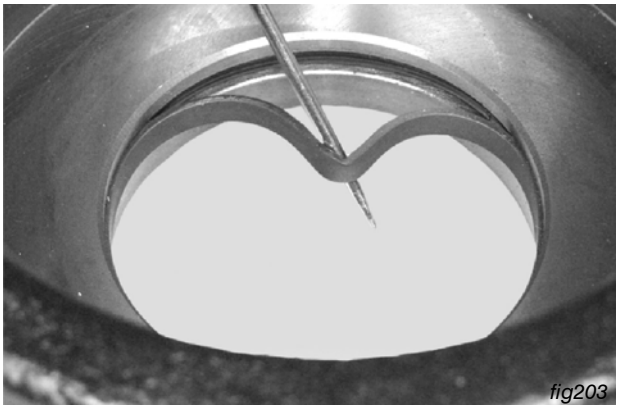
https://truckmanualshub.com/



Remove seal (34).

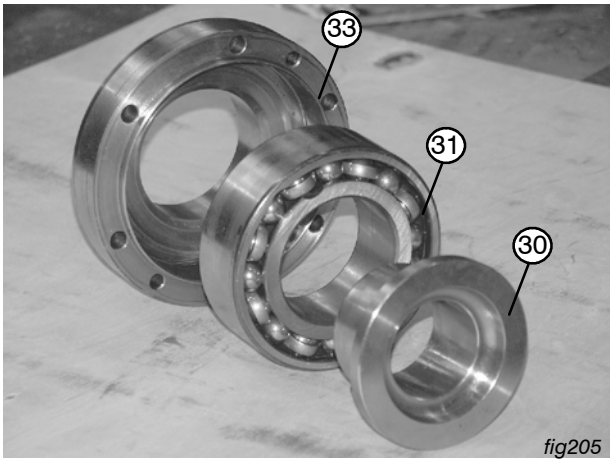


Remove the O–ring.

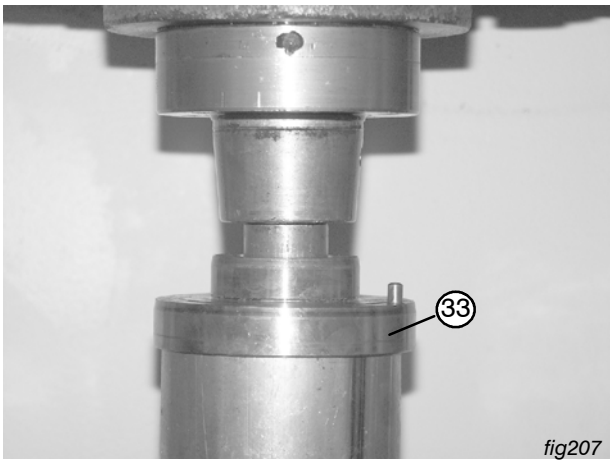




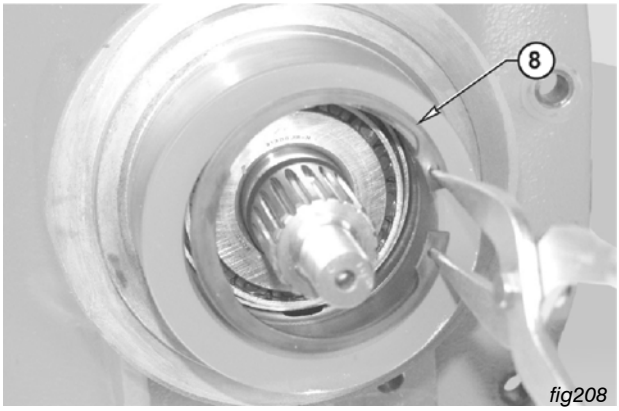
Remove seal (34) and O–ring (35).







Disassemble the flange, bearing and piston of the differential bearing by pressing with a hydraulic press.



Remove the snap ring (8).

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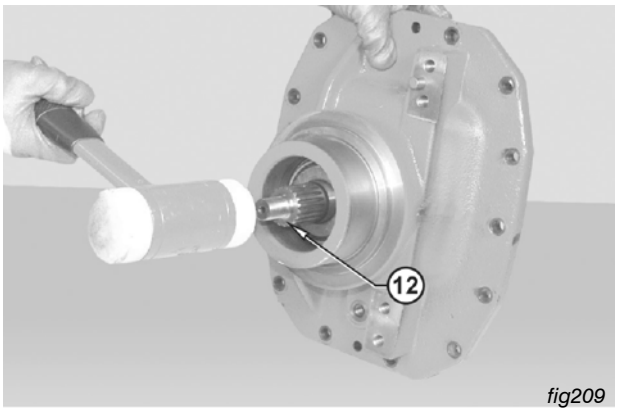


fig209

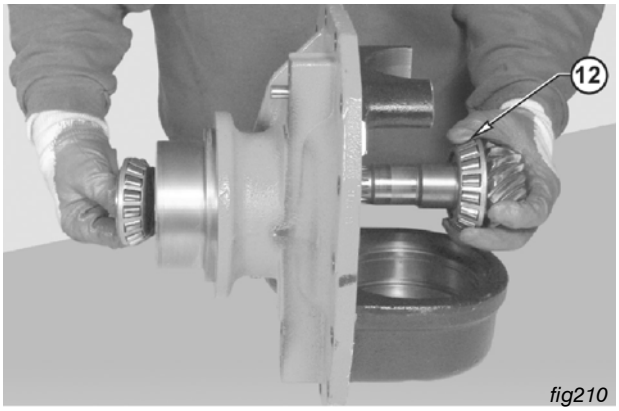


fig210

Remove the bevel pinion shaft (12).

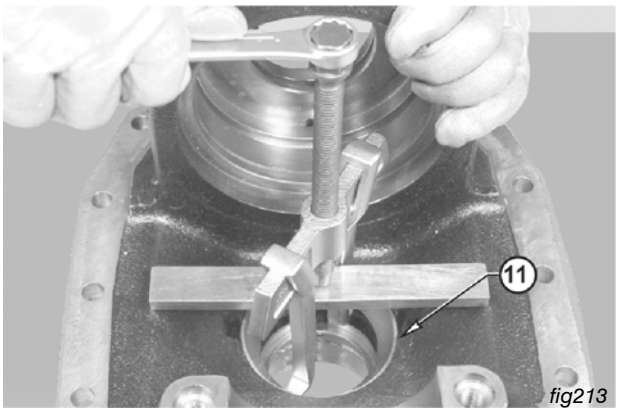
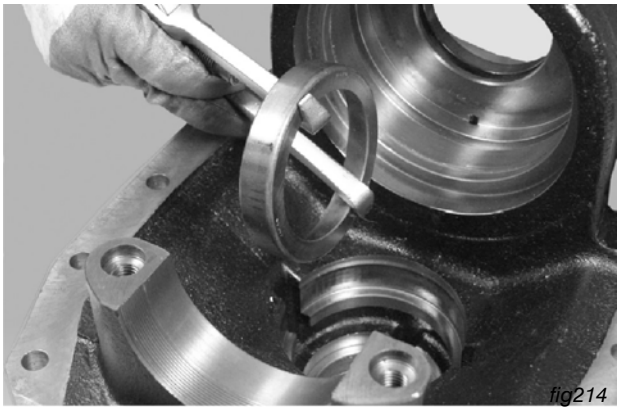


fig213


fig214

Remove the bearing outer race (11).

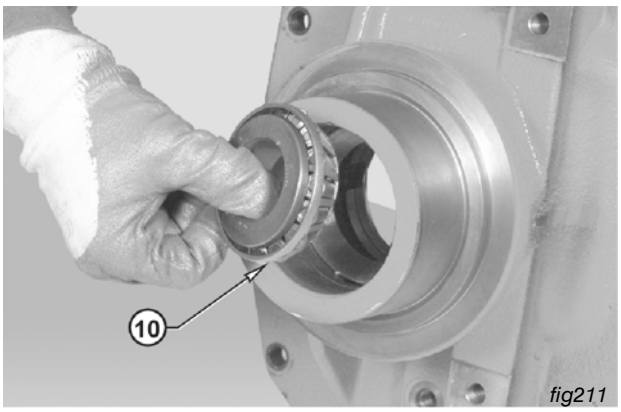


fig211

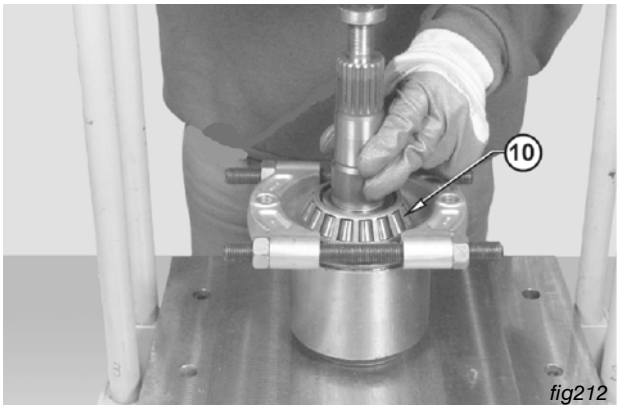
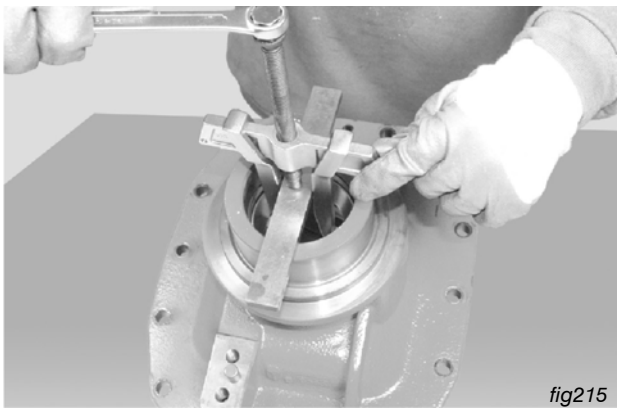


fig212

Remove the bearings (10) with help of a puller.


fig215

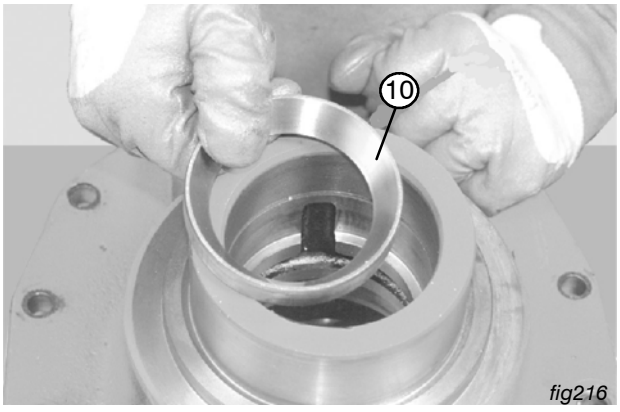


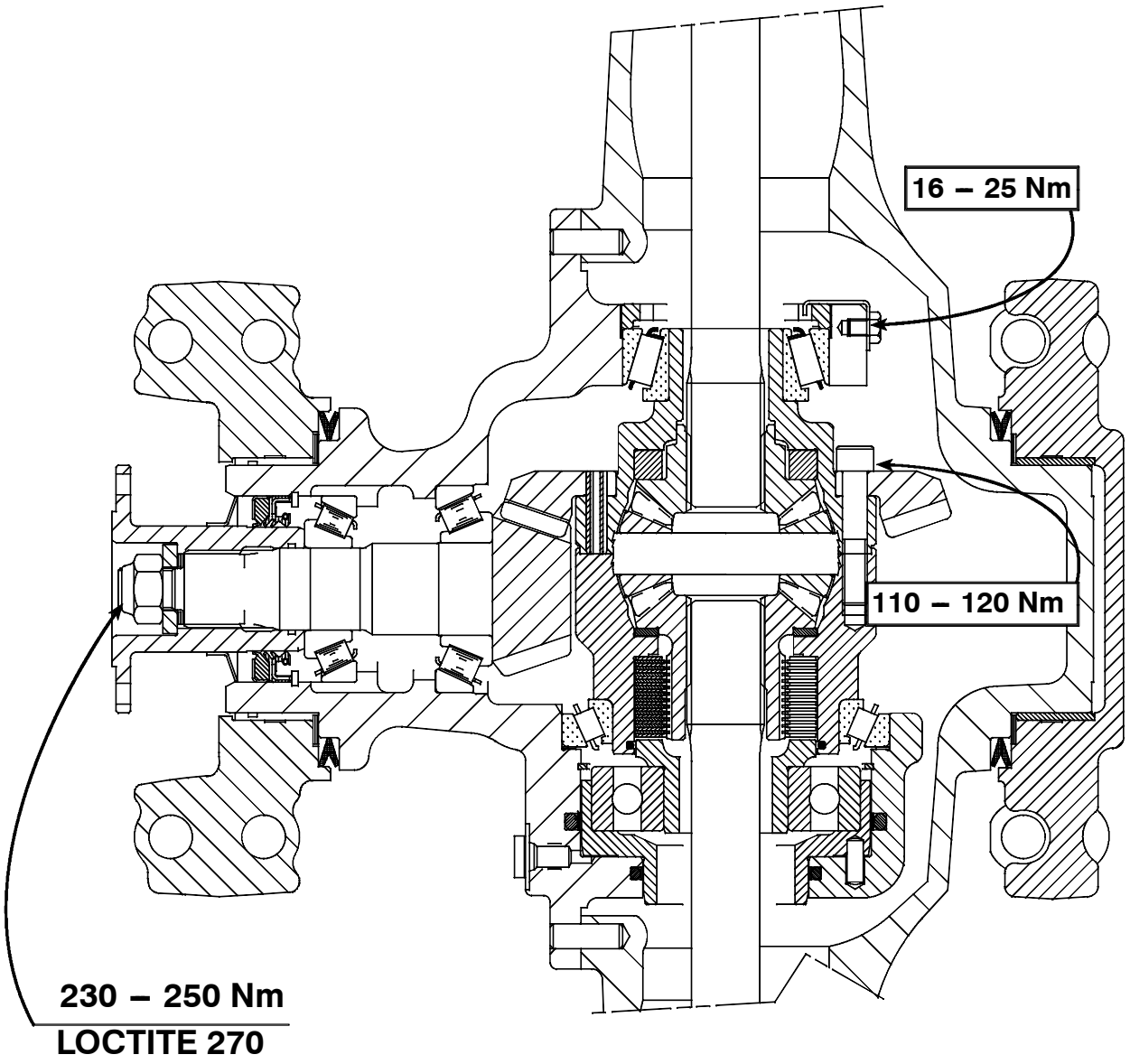
fig216

Remove the bearing outer race (10).

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Assembling the differential (HiLock)

ROLLING RESISTANCE (bevel pinion shaft bearings) = **0,9 – 1,5 Nm**
ROLLING RESISTANCE (bevel pinion shaft bearings+seal) = **1,4 – 2 Nm**
ROLLING RESISTANCE (bevel pinion shaft bearings+seal+differential bearings) = **2 – 3 Nm**



D = **I** on old pinion – **I** on new pinion =
S = **S** old + (**D**)
I = centre distance
S = **S** old + (**D**):
D = difference from new/old pinion
S old = first time installation shims

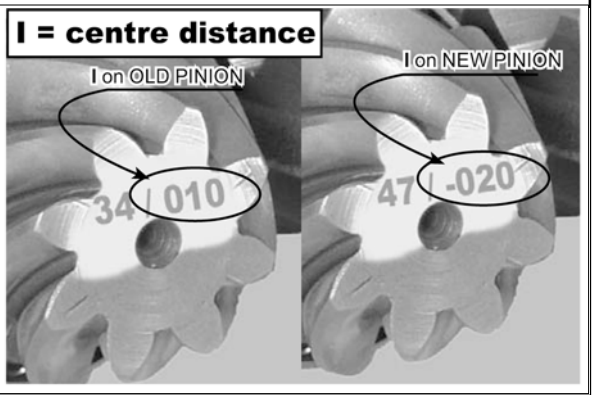


fig217en

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Fitting the bevel pinion shaft and adjusting position of the new shaft

Adjusting the new pinion shaft position

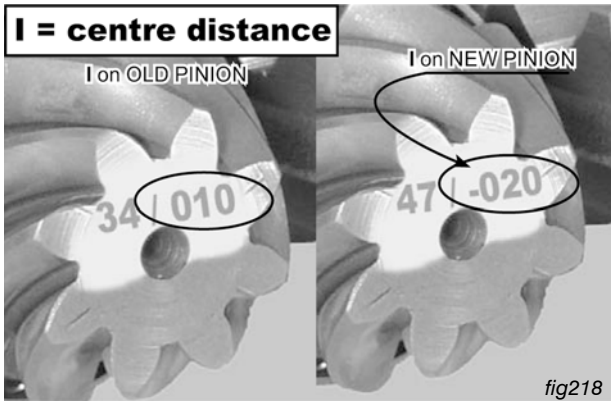


fig218

Read the **measure I** of the old pinion shaft (e.g. 0,10 mm). and the **measure I** of the new pinion shaft (e.g. 0,20 mm) Calculate with help of these measures the difference value **D** between the bevel pinion shafts.

Example:
I old pinion − I new pinion = D
0,10 mm – (–0,20 mm) = 0,30 mm

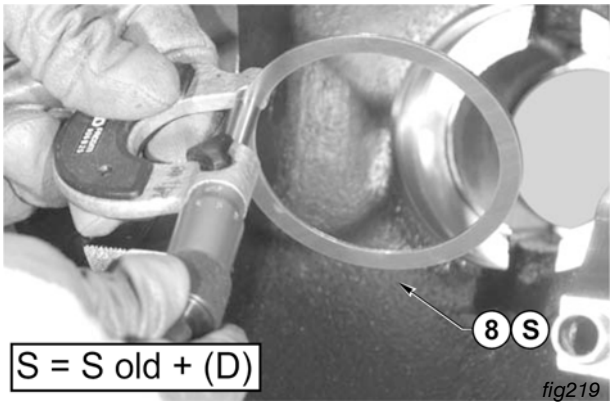


fig219

Calculate with help of these measures the new shim **S** of the bevel pinion shafts.
Example:
S old = old shims.
D = difference value of the bevel pinion shafts.

S old + (D) = S
0,80 + (0,30) = 1,10 mm

Put the shim **S** under the inner bearing outer race and fit the bearing outer race against the shims.

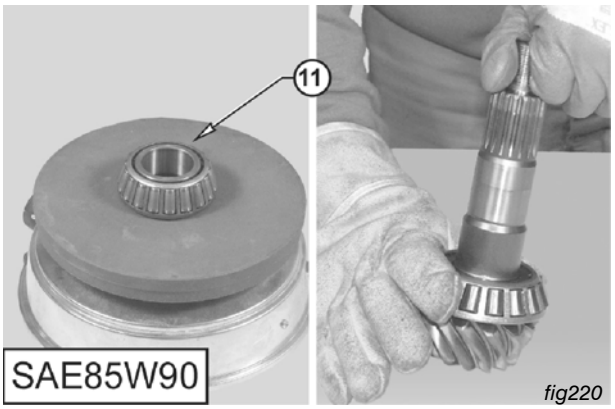


fig220

Heat the bearing (11) to about 100 C° and fit it to the bevel pinion shaft. When the bearing has cooled down, lubricate it with oil.


fig221

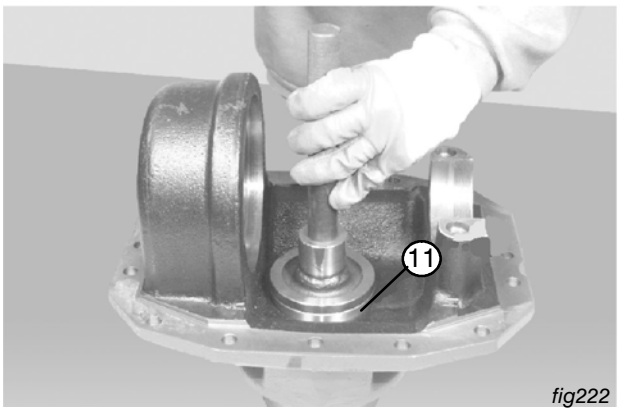
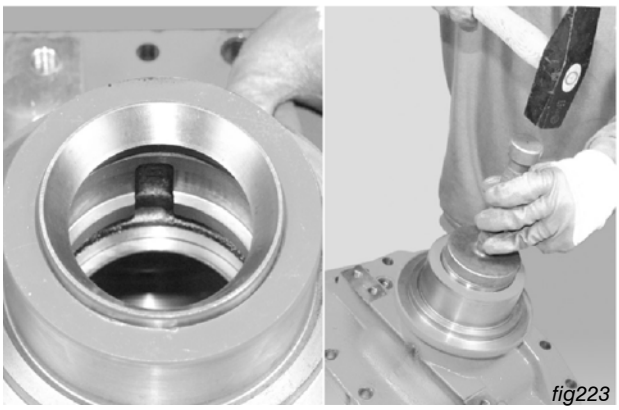


fig222

Fit the bearing outer race (11).


fig223

Fit the bearing outer race.

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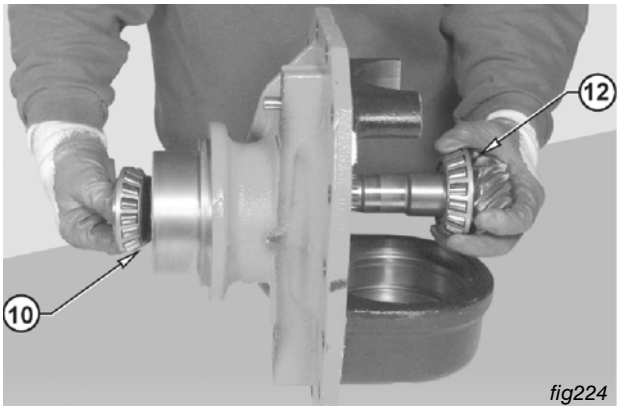


fig224

Heat the bearing (10) to about 100 C° and fit it into place. Fit the bevel pinion shaft (12) into place. When the bearing has cooled down, lubricate it with oil.

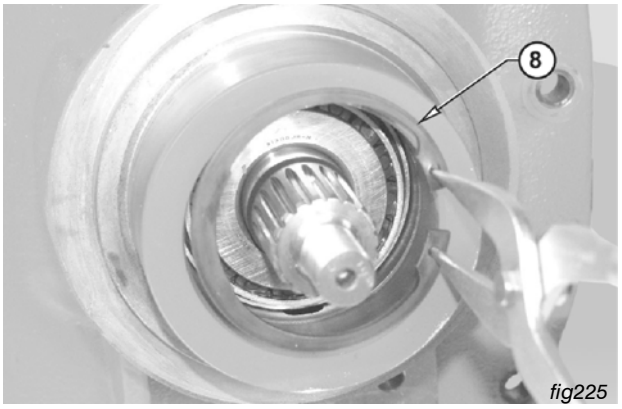


fig225

Fit the snap ring (8). Ensure, that the snap ring is in groove.

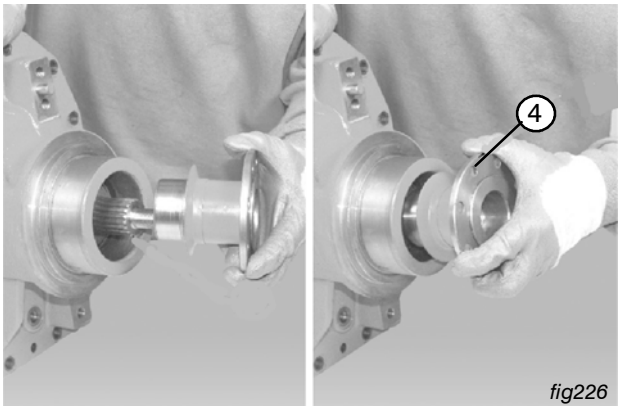


fig226

Fit the flange (4) onto the bevel pinion shaft without the sealing ring.

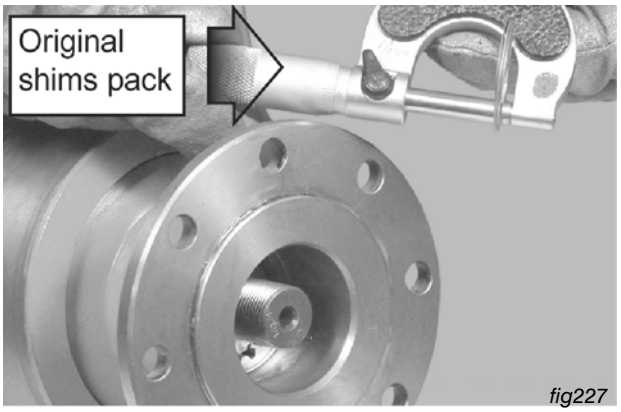


fig227

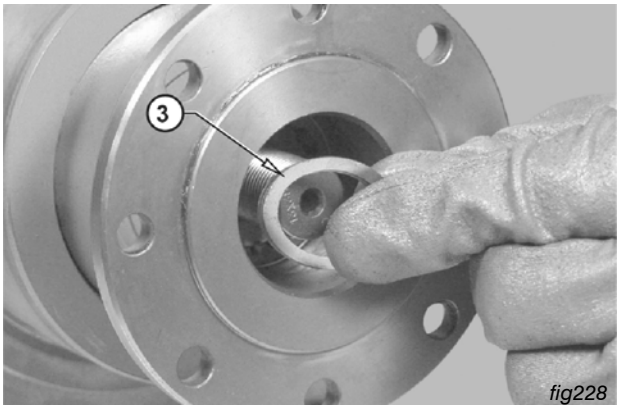
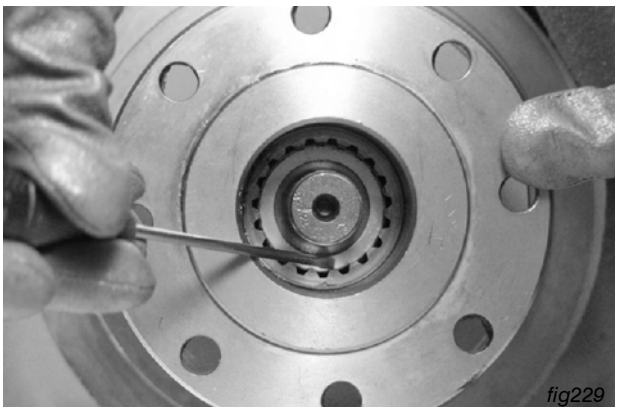


fig228


fig229

Fit the **2 mm** shim (3) thick into place.

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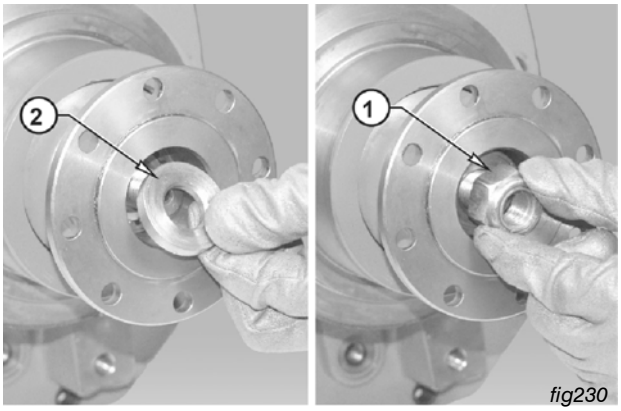
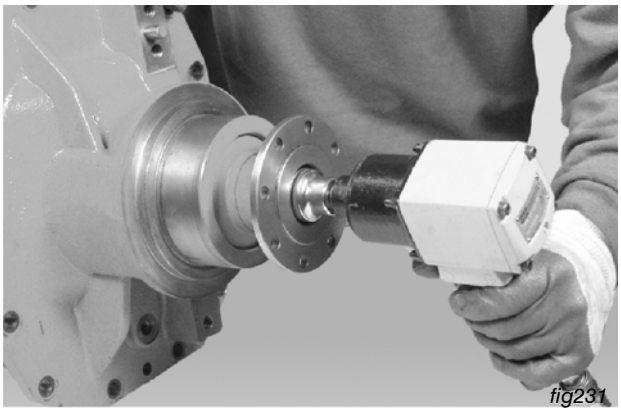


fig230

Assemble washer (2) and nut (1).


fig231

Tighten the nut.

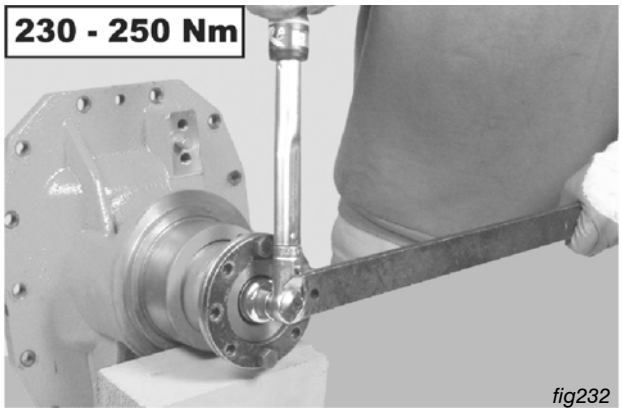


fig232

Tighten the nut of the shaft and lock the flange of the cardan with support tool. Tighten the nut of the shaft (1) to **230 – 250** Nm.

Measurement of rolling resistance for the bevel pinion shaft bearing

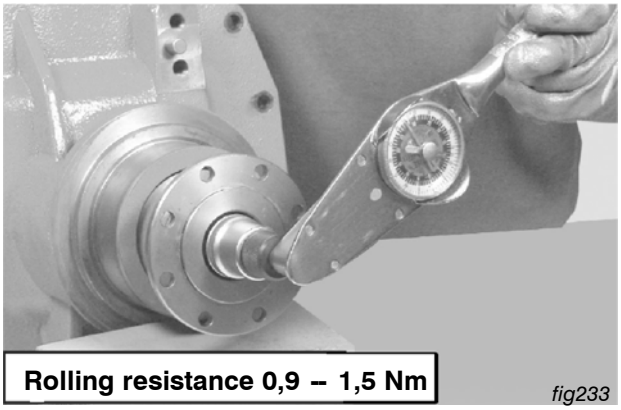
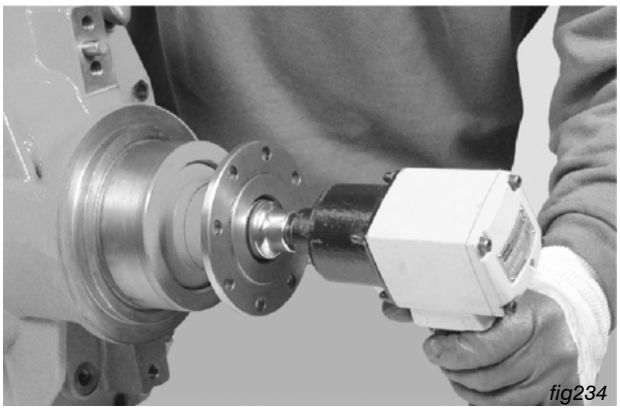


fig233

Use a spring balance to measure the force needed (rolling resistance) to rotate the bevel pinion shaft.

Measure the rolling resistance two, three times. Read off the value, while the shaft is rotating. In the beginning of rotation more power is needed.

The rolling resistance should be **0,9 – 1,5 Nm.** If the rolling resistance is not correct, the number of shims under the nut must be adjusted.
Note! If the rolling resistance is too great more shims are required and vice versa.


fig234

Unscrew the nut.

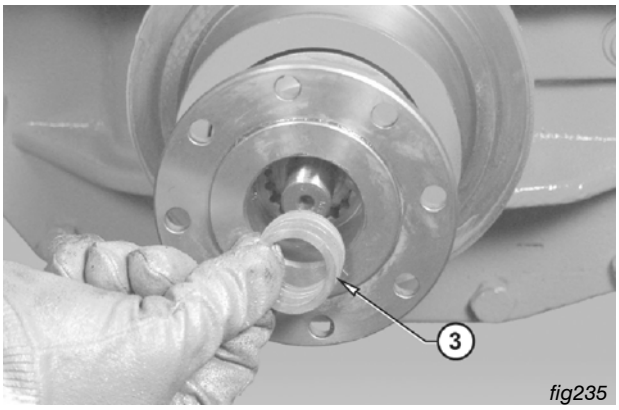


fig235

Remove the washer and shims (3).

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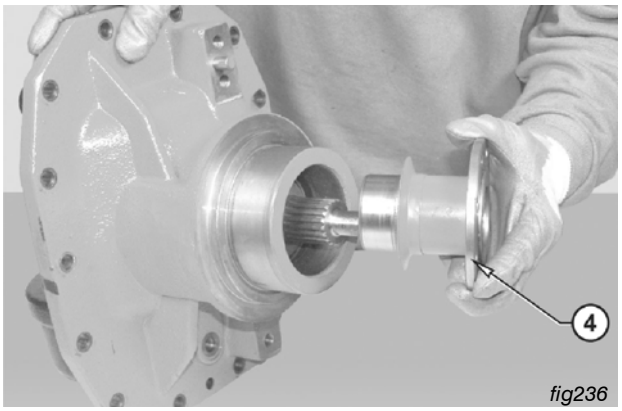


fig236

Remove the flange (4).

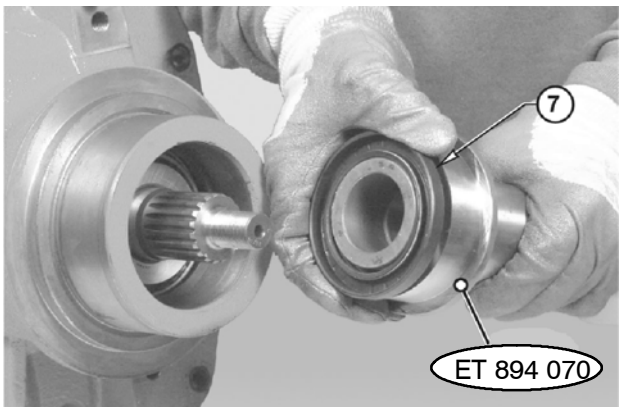


fig237

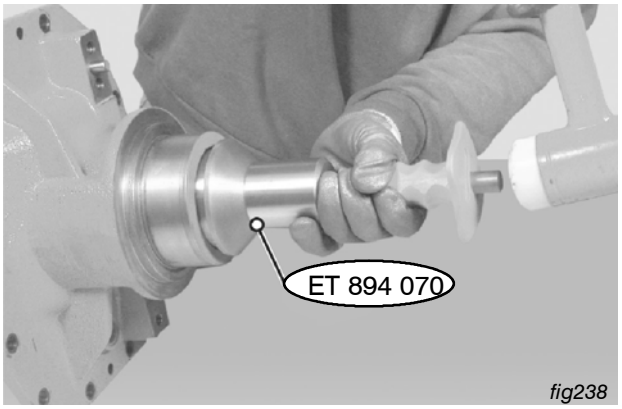


fig238

Lubricate the sealing ring (7) and fit it into place with tool **ET 894 070**.

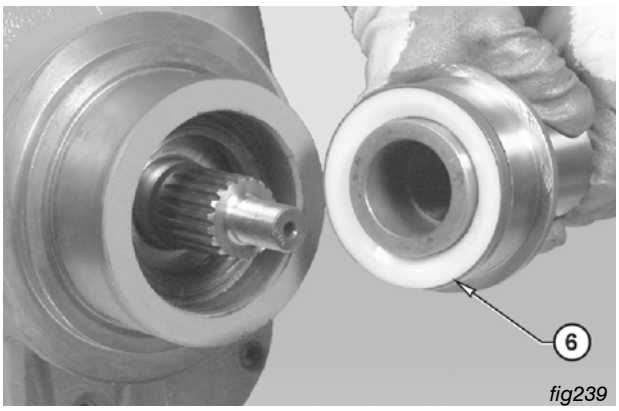


fig239

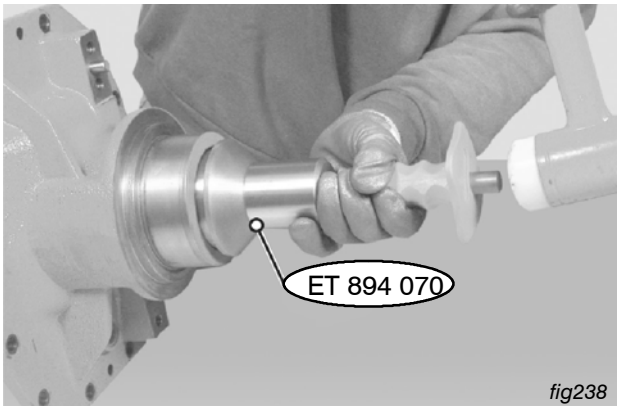


fig238

Lubricate the sealing ring (6) and fit it into place with tool **ET 894 070**.

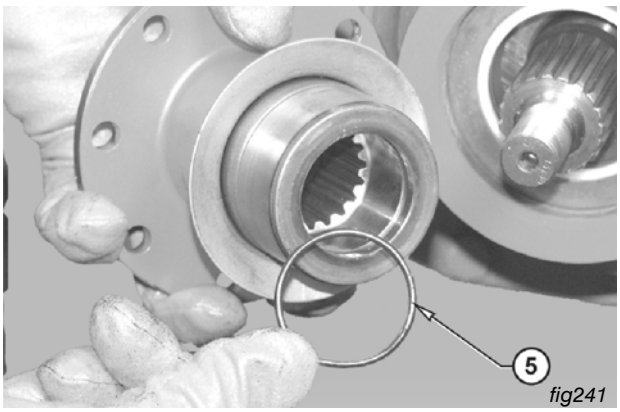
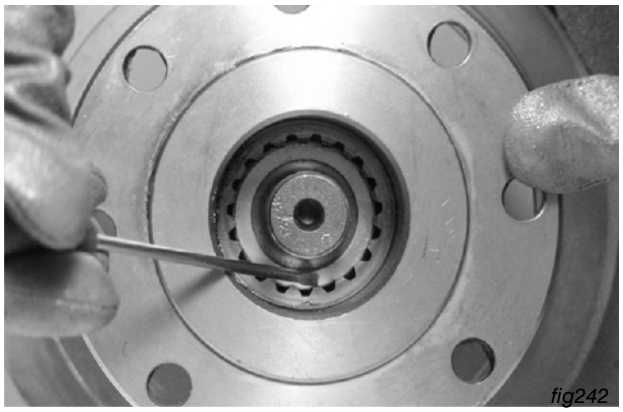


fig241

Fit the O–ring (5).

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fig242

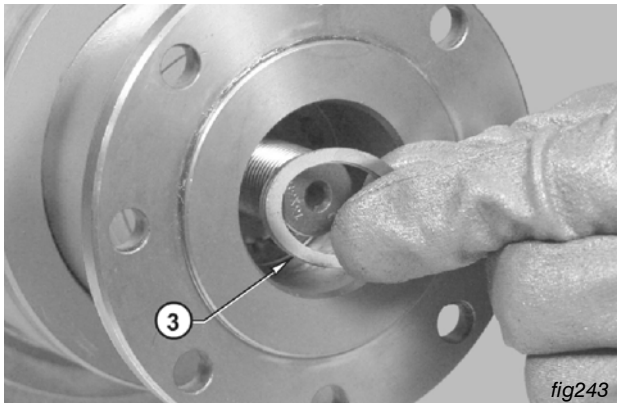


fig243

Fit the shims (3).

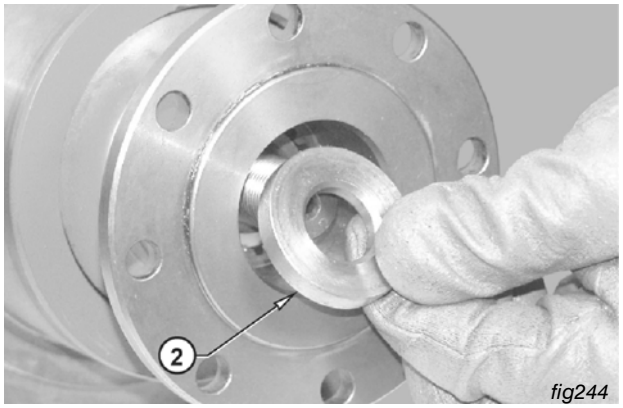


fig244

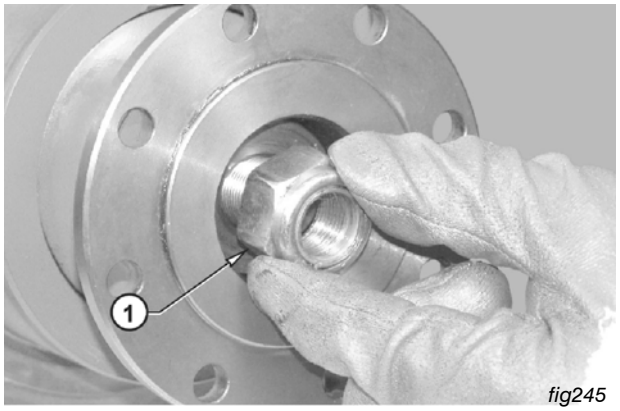
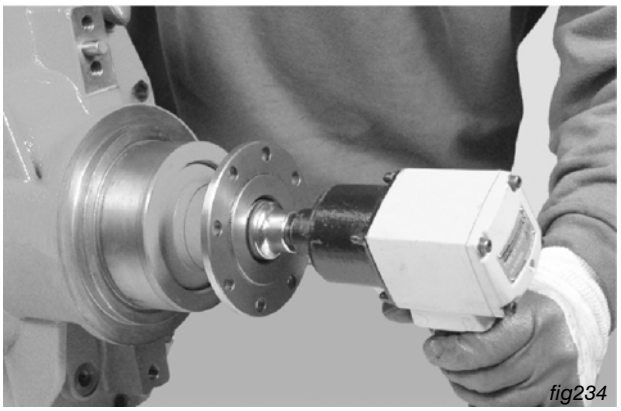


fig245

Fit the washer (2) and nut (1).


fig234

Tighten the nut.

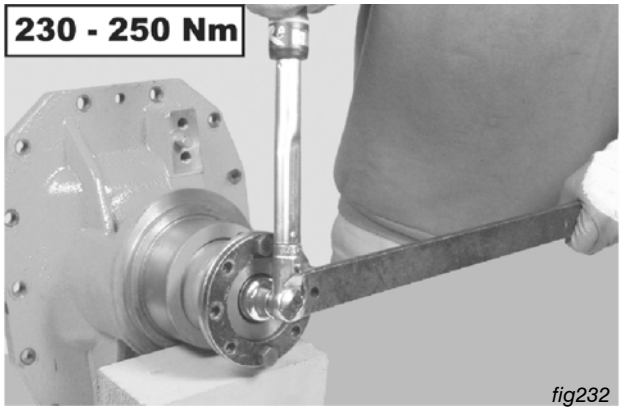


fig232

Tighten the nut of the shaft and lock the flange of the cardan with support tool. Tighten the nut of the shaft (1) to **230 – 250 Nm**.

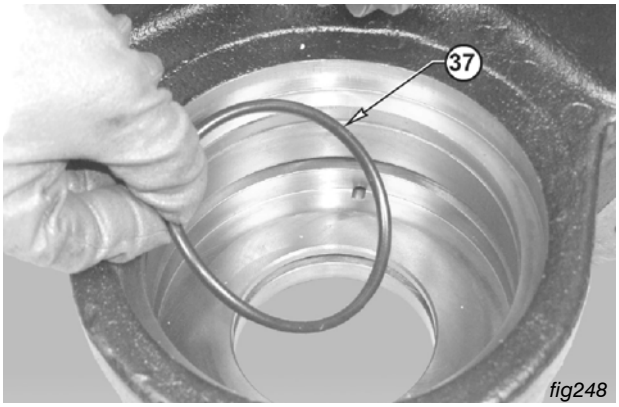


fig248

Fit the O–ring (37).

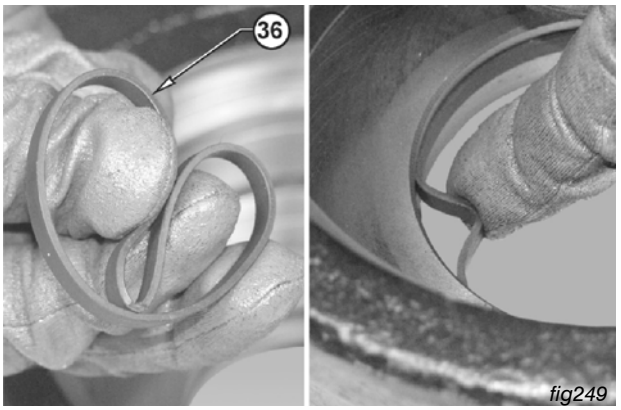


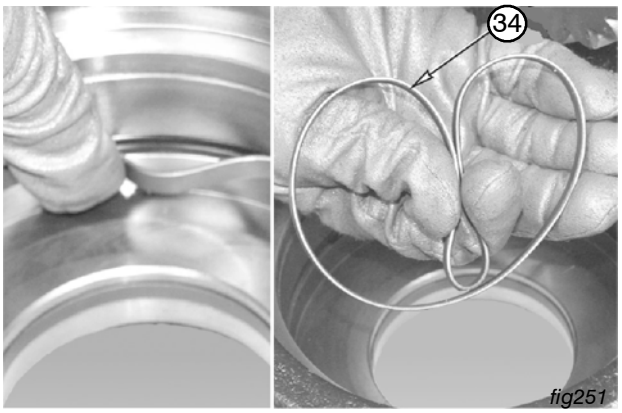
fig249

Fit the seal (36).

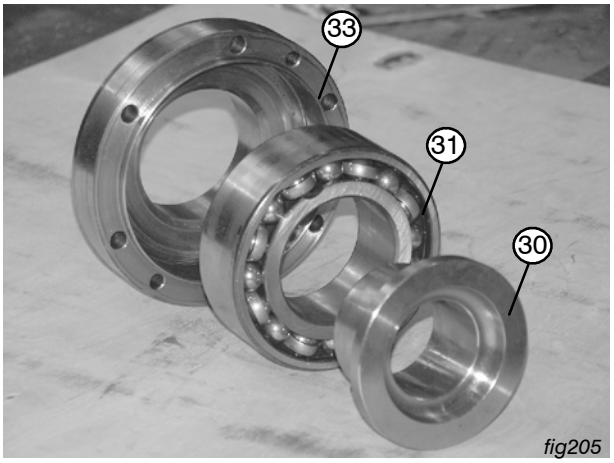
https://truckmanualshub.com/

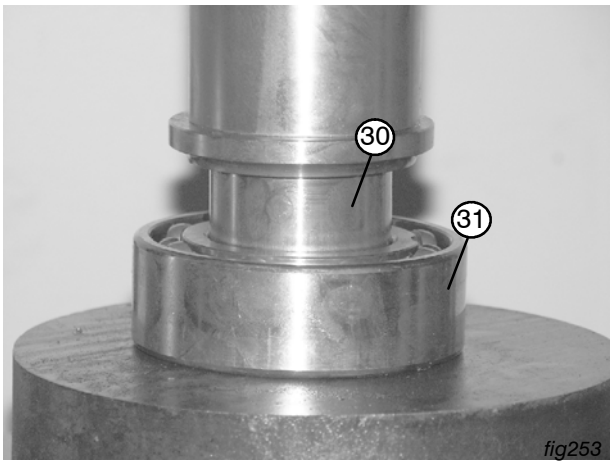


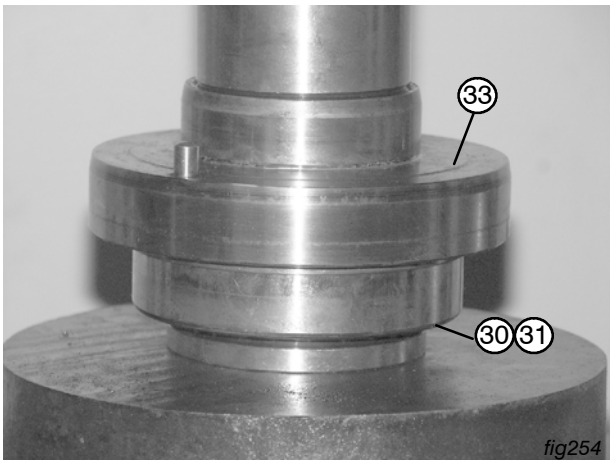
Fit O–ring (35).



Fit the seal (34).







Fit the sleeve (30) to the bearing (31) with help of the tool.

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fig255

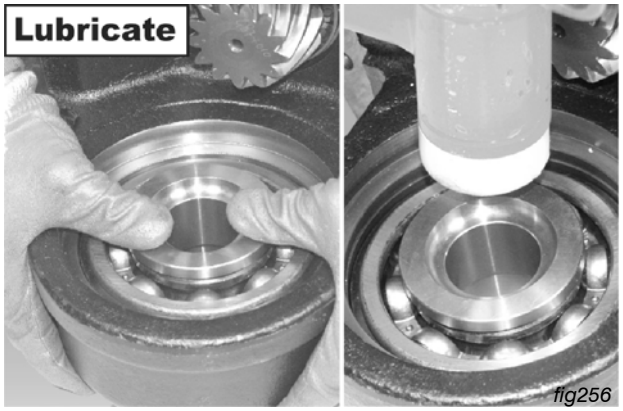


fig256

Fit the piston assy and notice the position of the pin.


fig257


fig258

Fit the snap ring. Ensure, that the snap ring is in groove.

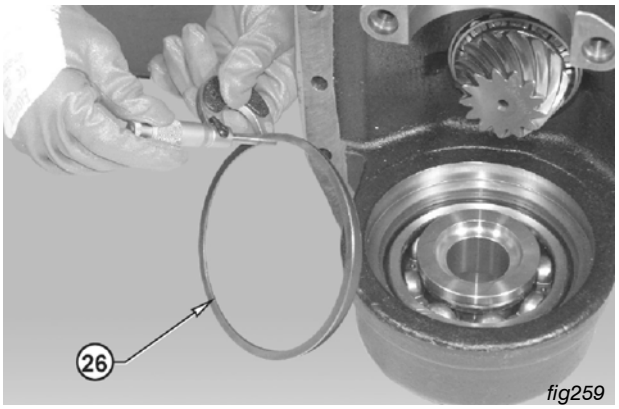


fig259

Fit the shims **1,2 mm** (26) fully home into bearing housing of the differential.

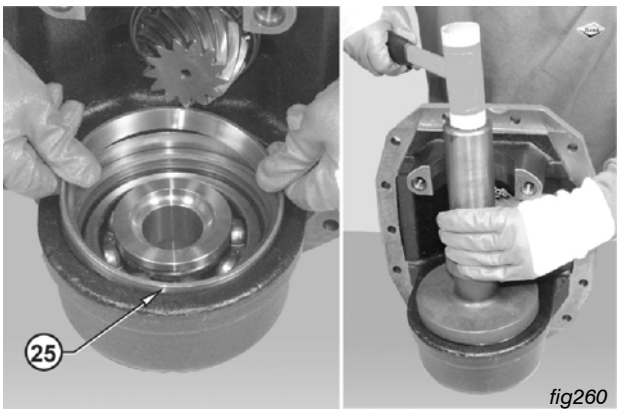


fig260

Fit the bearing outer race (25) into place.

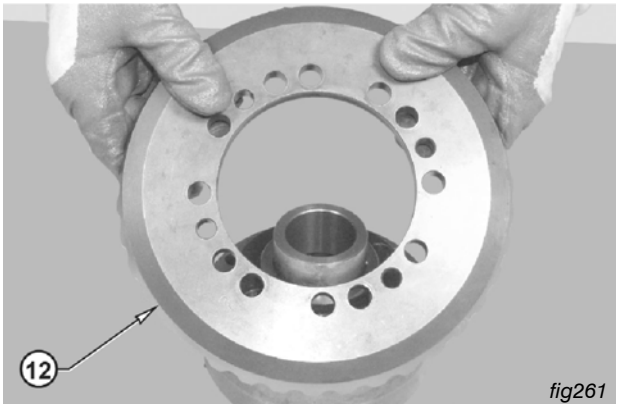


fig261

Fit the crown wheel (12).

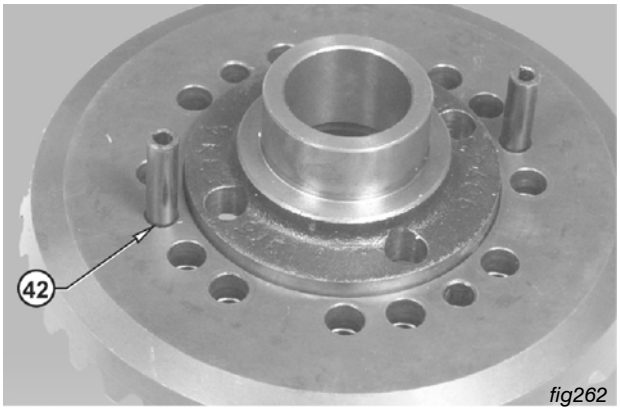
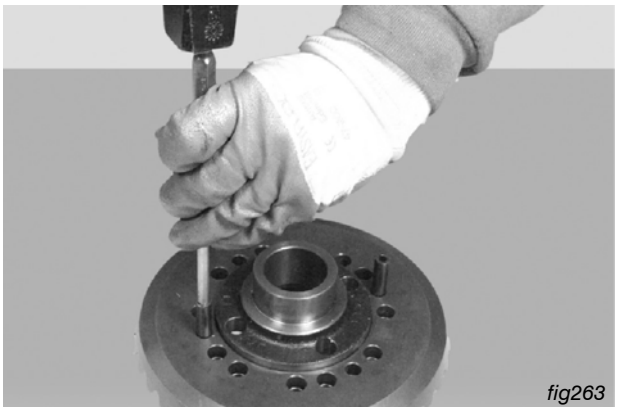
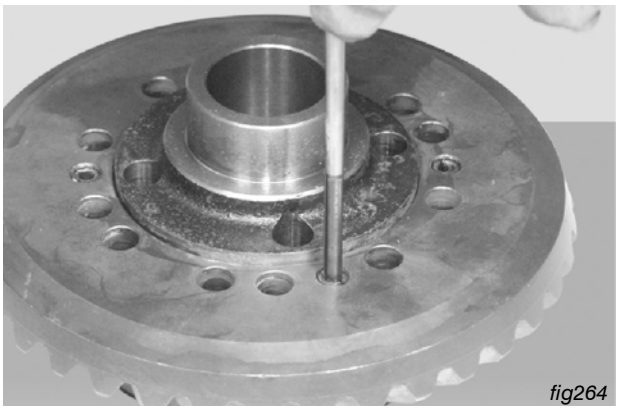


fig262

Fit the outer locking cones (42) into place.

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fig263


fig264

Fit the inner locking cones into place.

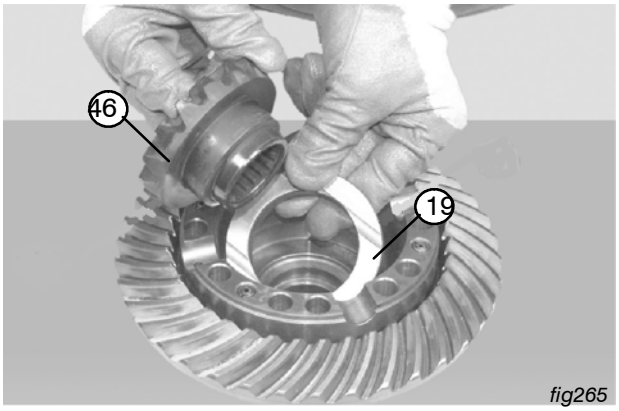


fig265

Fit the thrust bearing (19) and the differential wheel (46) into place.

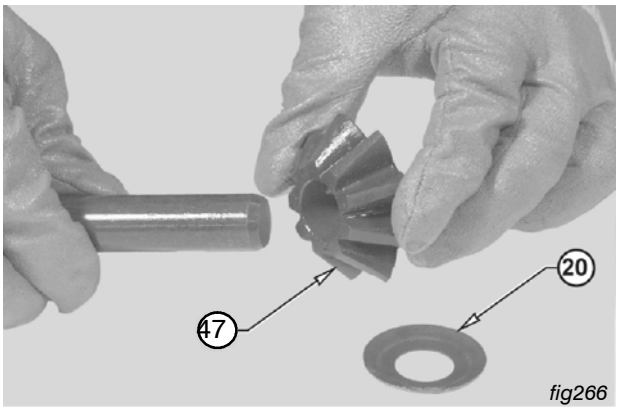
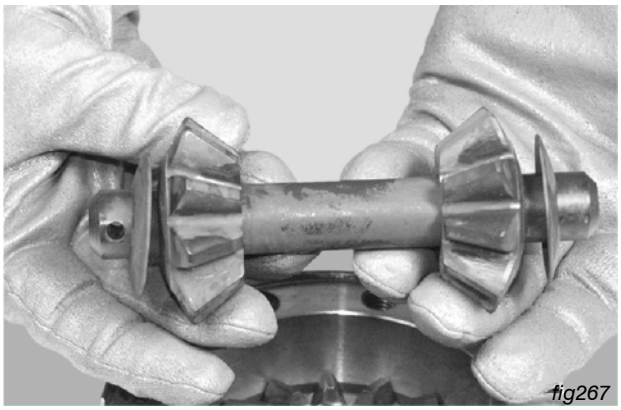


fig266


fig267

Fit the differential pinion (47) and the bearings (20) onto the axle. Fit the axle assy into place.



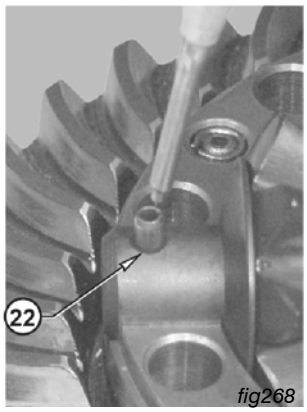


fig268

Fit the locking cones (22) into place. **Note!** Check that the differential pinions rotate freely.

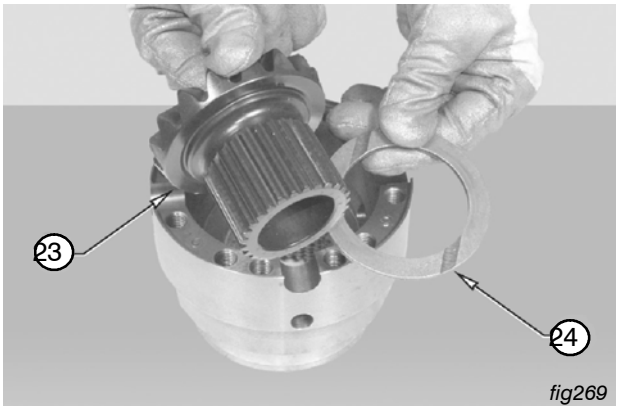
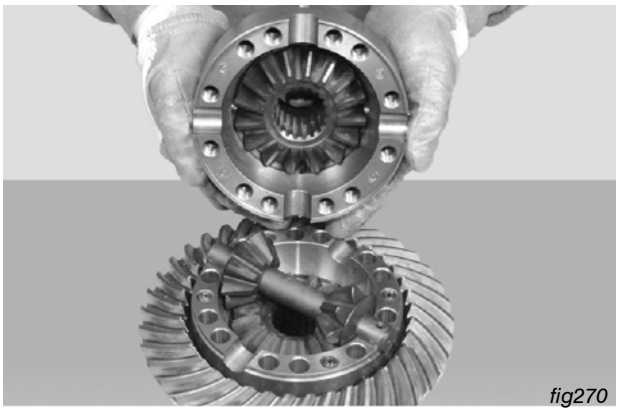
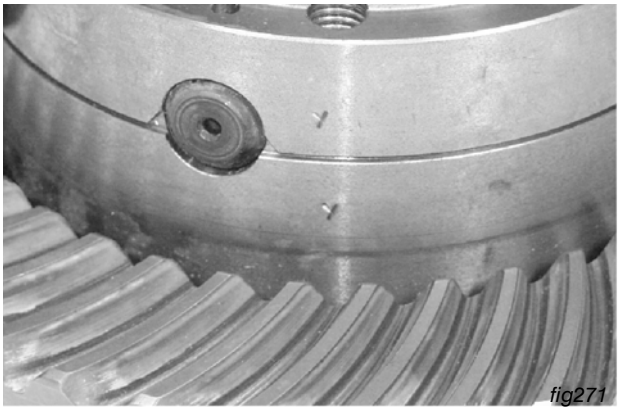


fig269

Fit the thrust bearing (24) and the differential wheel (23) into place.

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fig270


fig271

Fit the halves of the differential together. **Notice** that the marks align.



fig272

Tighten the attach screws of the crown wheel. Tightening torques: **116 – 128 Nm**.

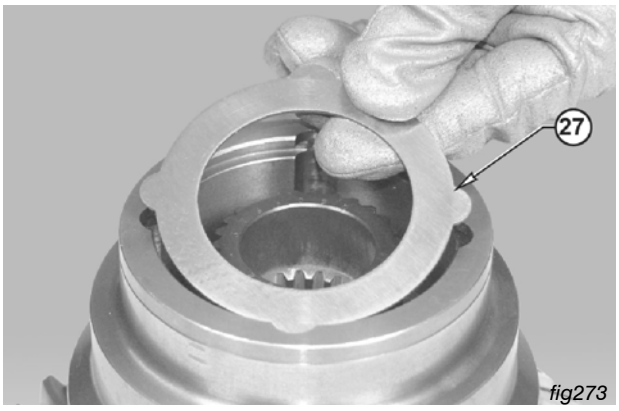


fig273

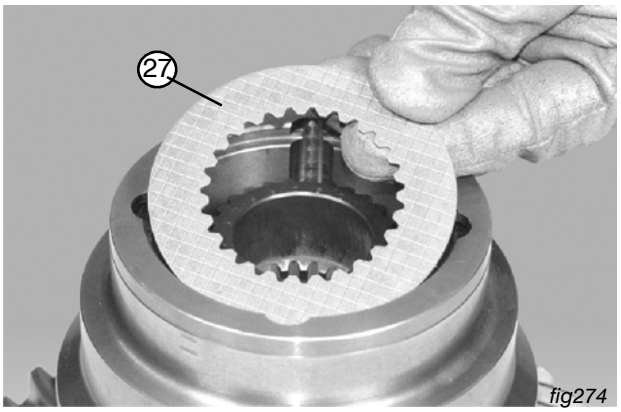
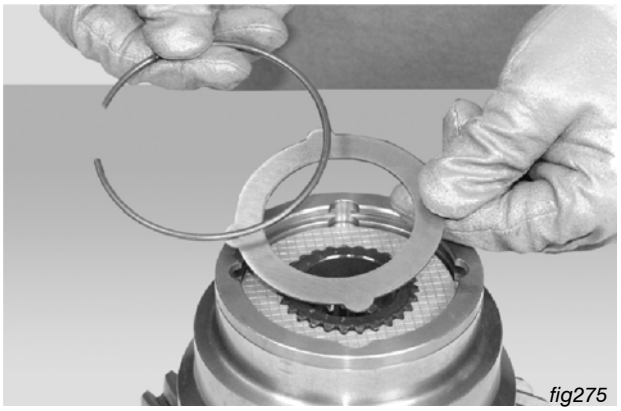


fig274

Fit by turns the steel disc and the friction disc (27) into the differential housing. **Note!** the first and the last disc of the disc pack is a steel disc.


fig275

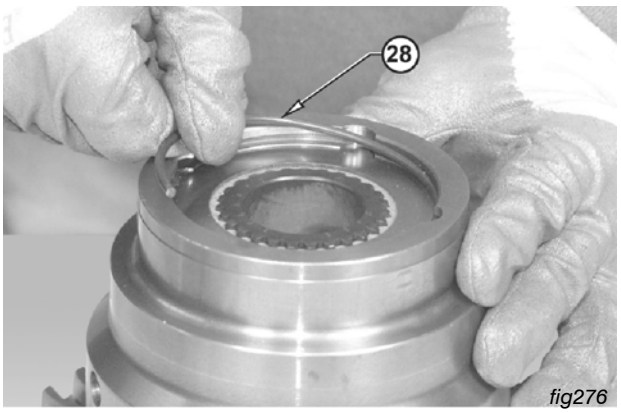


fig276

Fit the snap ring (28).

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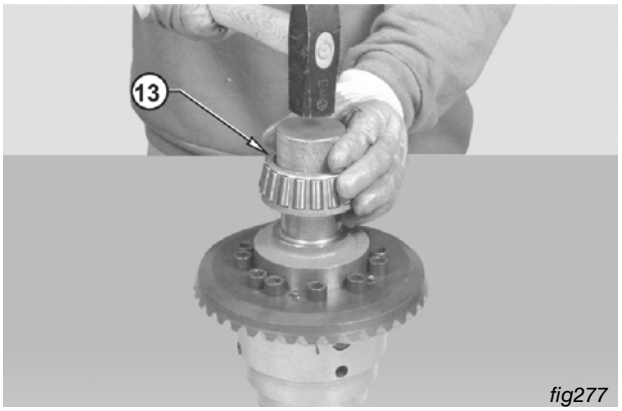


fig277

Fit the differential bearing (13).

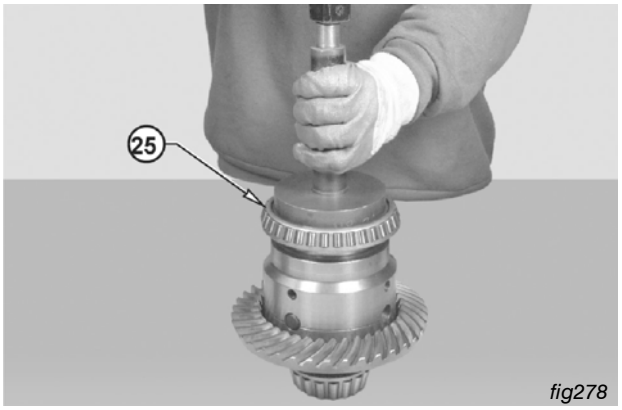
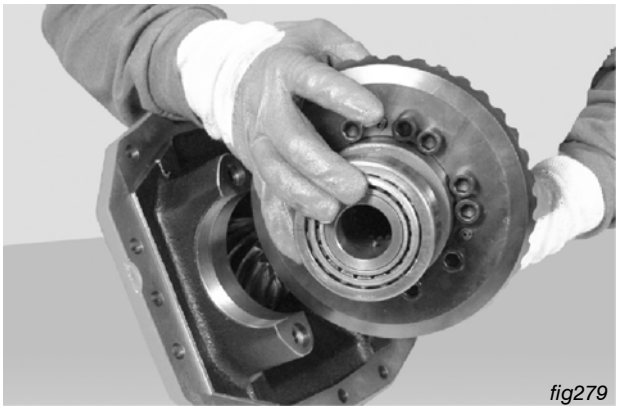


fig278

Turn the unit upside down and fit the differential bearing (25). **Note!** Hit carefully the bearing into place so that the inner race will not damage.


fig279

Fit the differential into place.

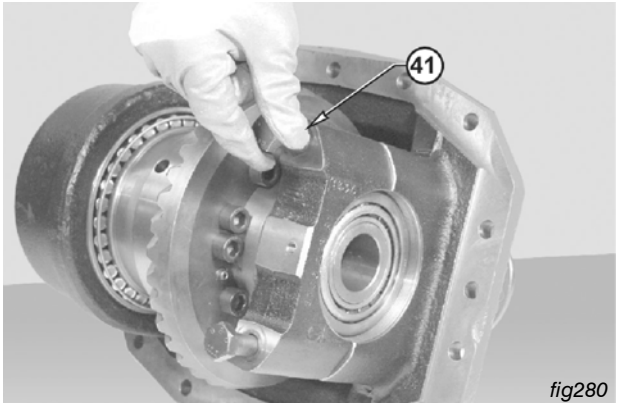


fig280

Fit the bearing cap into place and tighten the bolts (41).

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Tightening of the differential bearings



fig281

Tighten the bolts of the bearing cap. Tightening torques: **130 – 155 Nm**.

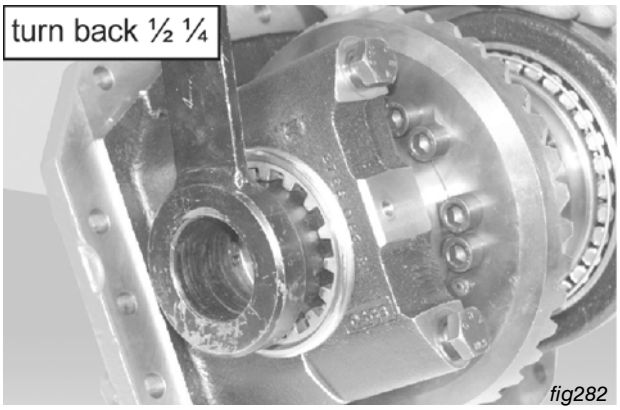


fig282

Tighten the ring nut until backlash is zero and after this loosen the ring nut **1/4 – 1/2 turn**.

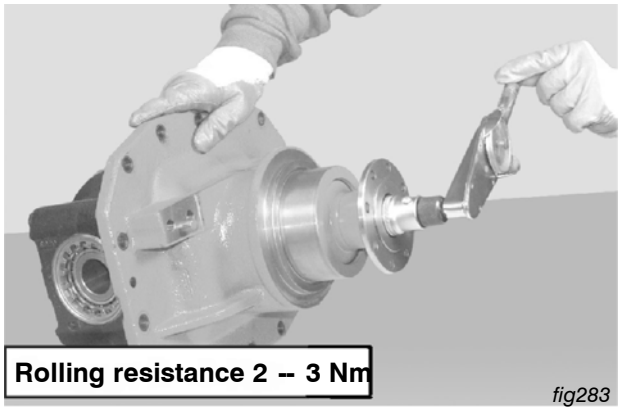
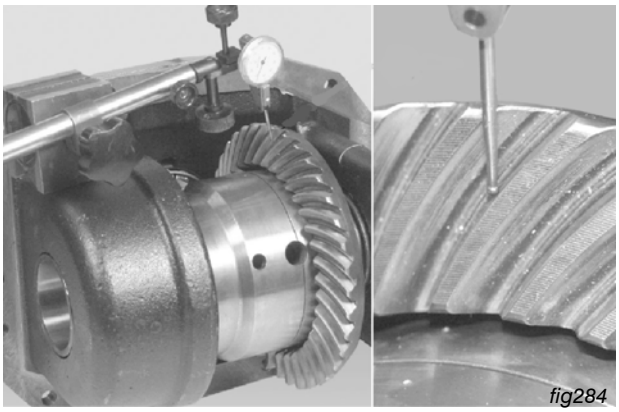


fig283

Check the rolling resistance of the bevel pinion shaft: **2 – 3 Nm**.

Measurement of the bevel pinion and the crown wheel tooth clearance


fig284

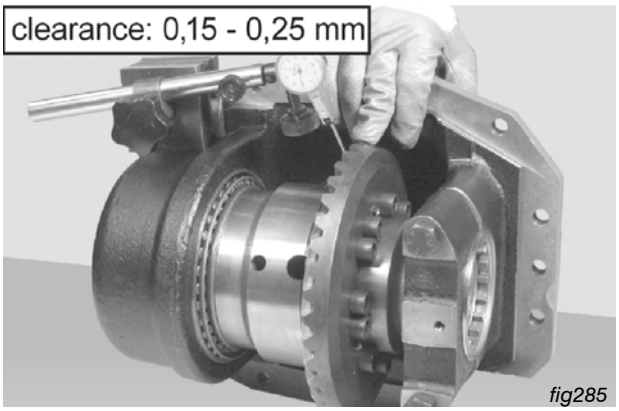


fig285

Place the dial gauge stylus against the crown wheel tooth. Move the crown wheel to both directions. The backlash must be between **0,15–0,25 mm**.
If clearance is small –> put thicker shim.
If clearance is big –> put thinner shim.

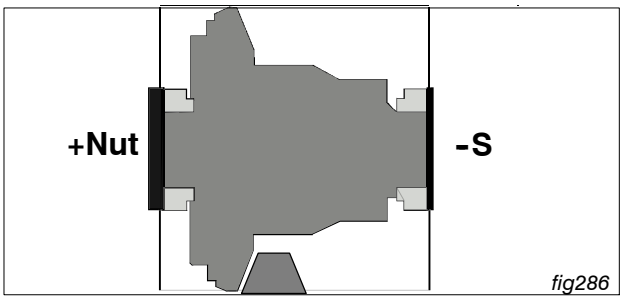


fig286

–S: thinner shim.
+Nut: more adjustment with the nut.
–S +Nut = reduction clearance crown and pinion

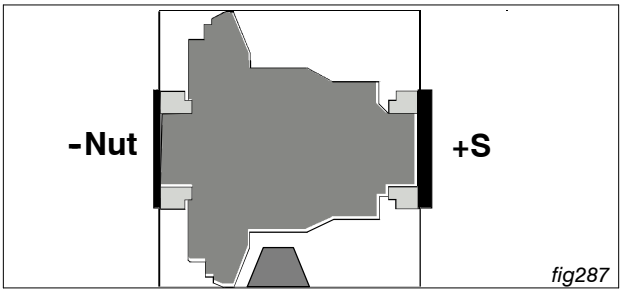


fig287

+S: thicker shim.
–Nut: less adjustment with the nut.
+S –Nut = increase clearance crown and pinion

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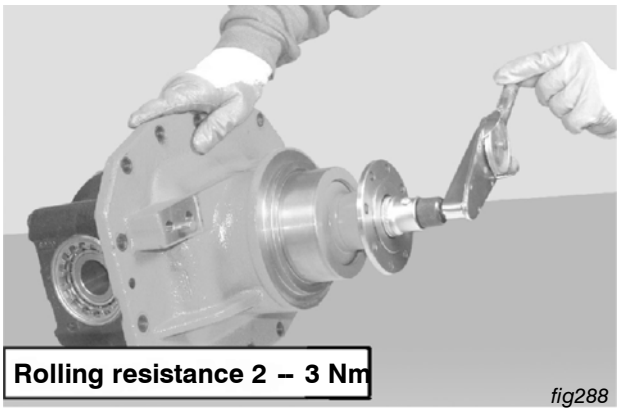


fig288

Check the rolling resistance of the bevel pinion shaft: **2 – 3 Nm** (rolling resistance include bevel pinion shaft bearings+seal+differential bearings).

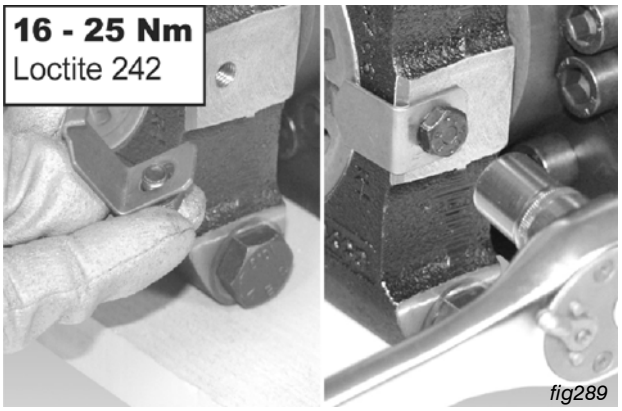


fig289

Refit the locking tabs. Turn the nuts, if necessary, so that the tabs fit into the notches on the nuts. Apply Loctite **242** on the bolts and tighten the bolts. Tightening torques: **16 – 25 Nm**.

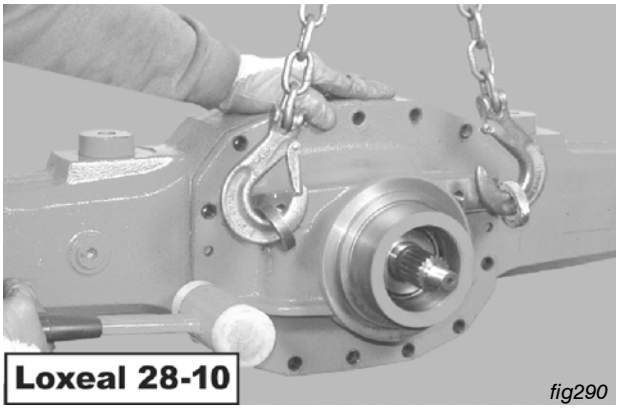


fig290

Clean the mating surfaces of the axle housing and the differential. Apply Loctite **510** or Loctite **518** to mating surface. Fit/push the differential into the axle housing.

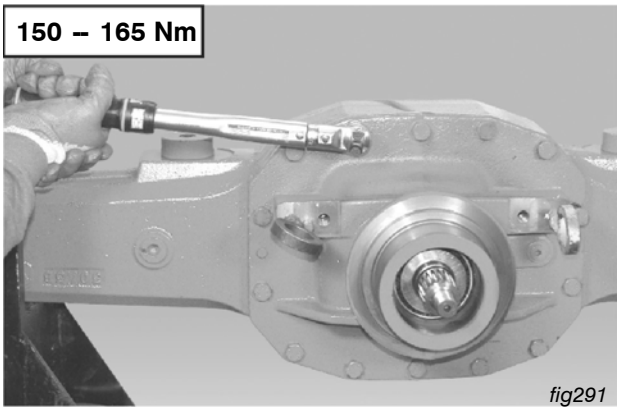


fig291

Tighten the bolts. Tightening torques: **150 – 165 Nm**.

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Removing the steering cylinder

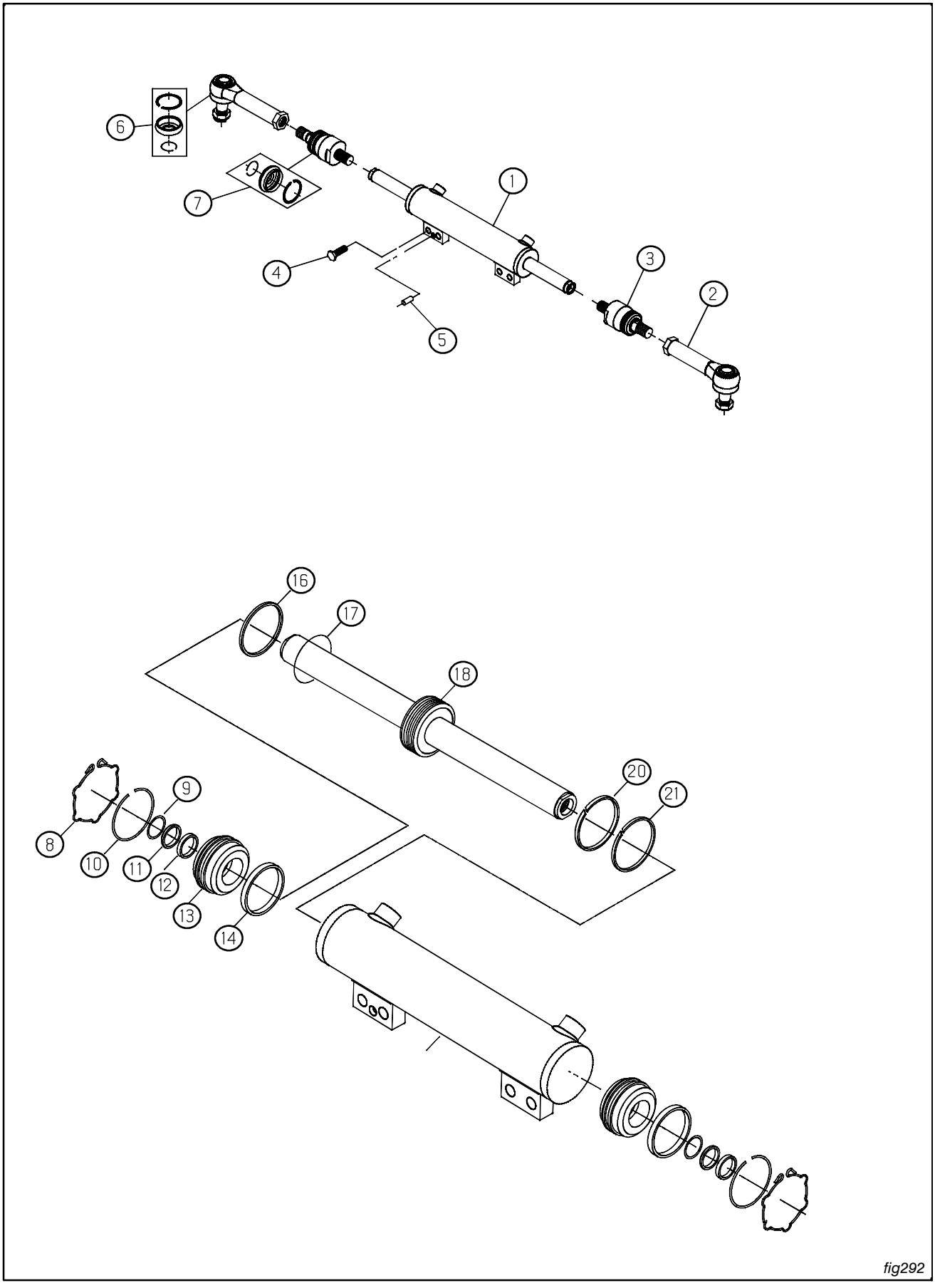
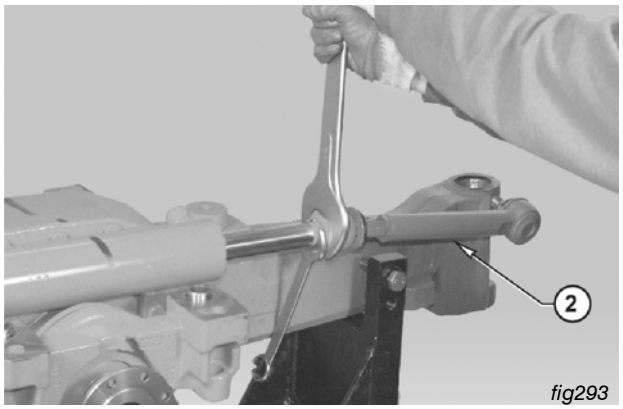
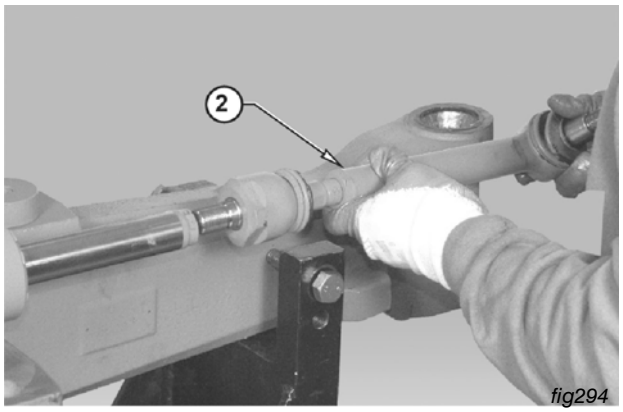


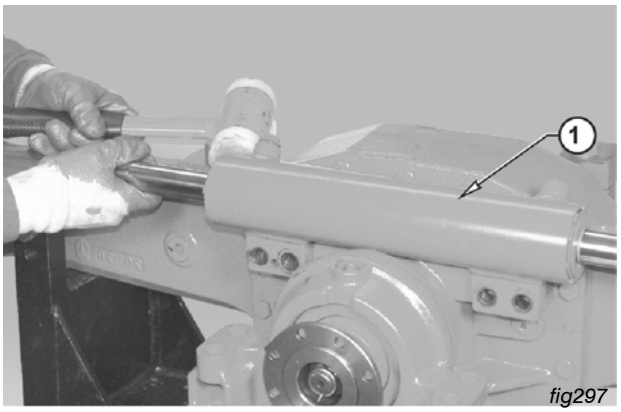
fig292

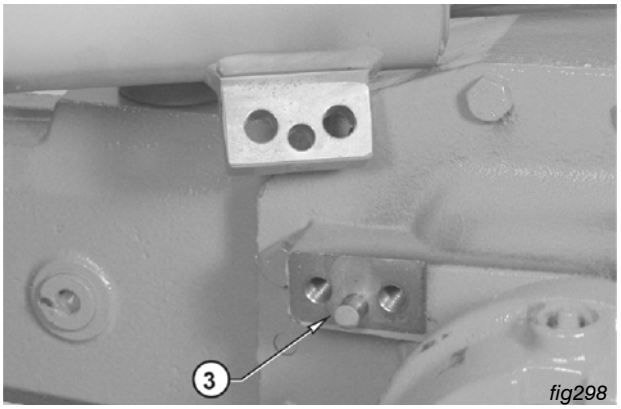
https://truckmanualshub.com/



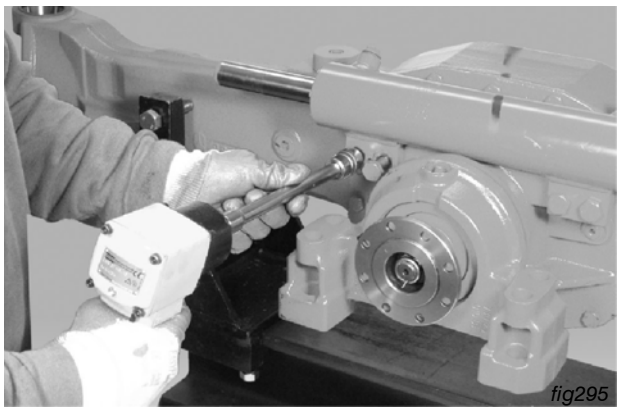


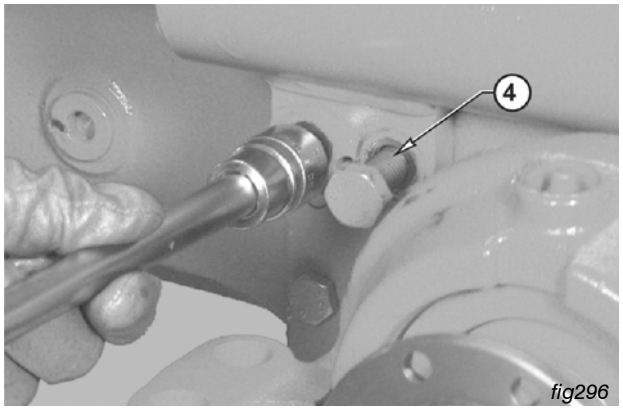
Disconnect the tie rods (2) from the piston rod end.



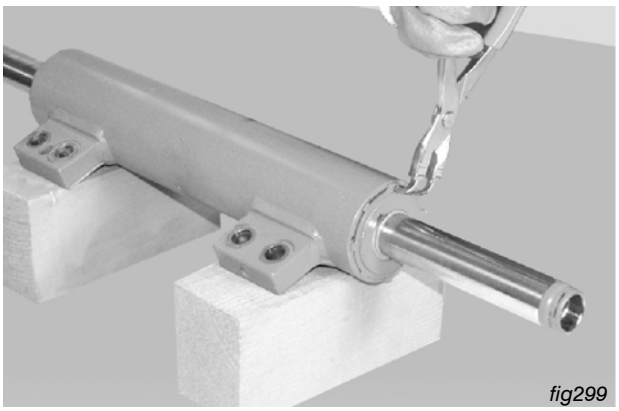


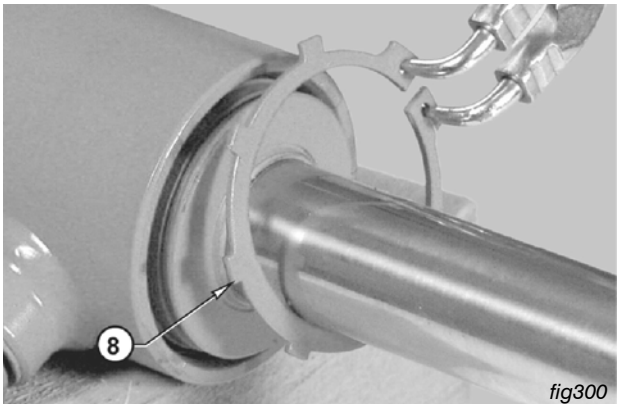
Remove the cylinder (1).





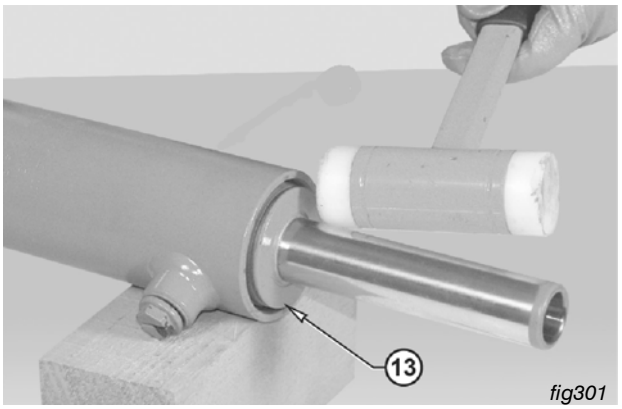
Remove fastening bolts (4) of the steering cylinder.



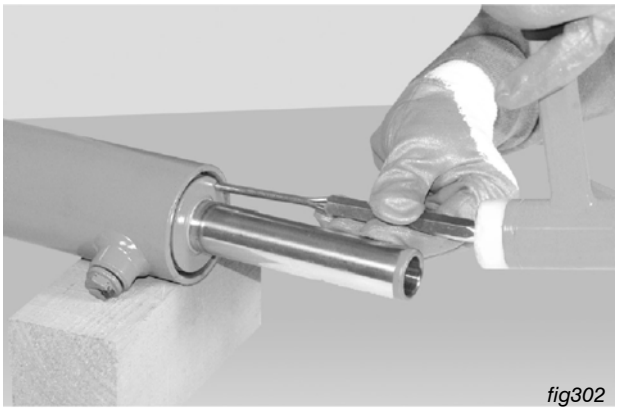


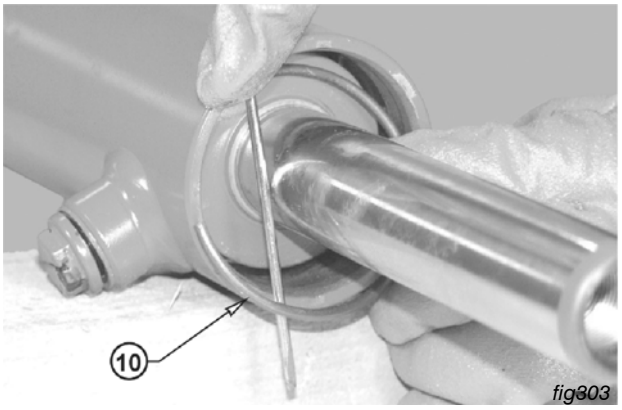
Before disassembling the cylinder, drain out the oil. Remove the snap ring (8) of the cylinder cover.

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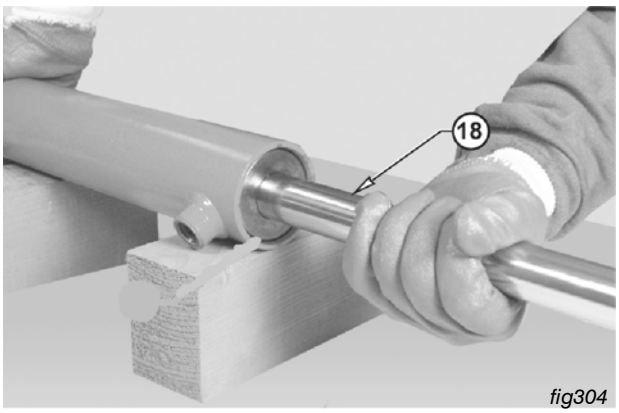


Carefully tap the cylinder cover (13) inwards.

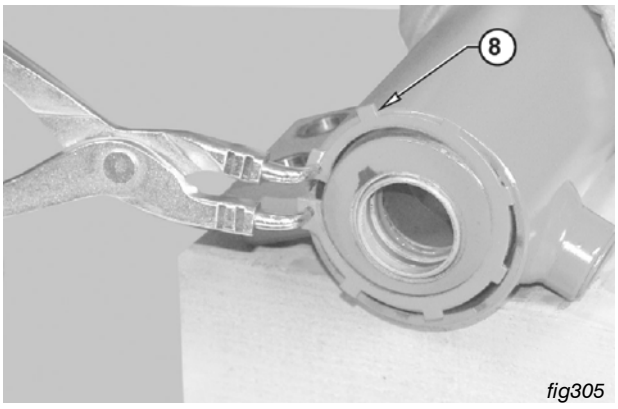




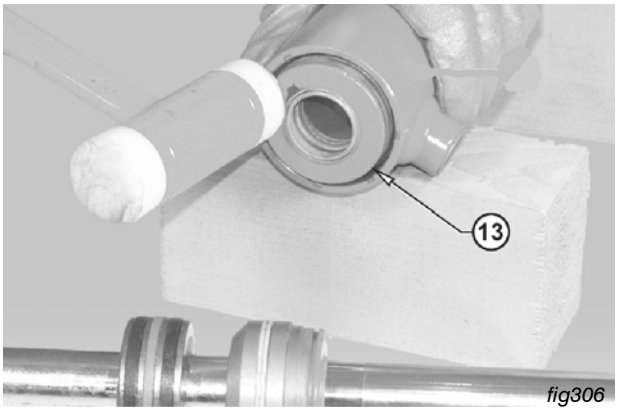
Remove the snap ring (10) from inside the cylinder.

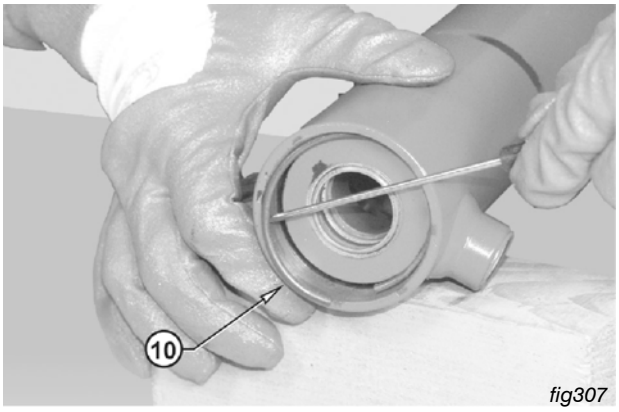


Pull out the piston rod (18).

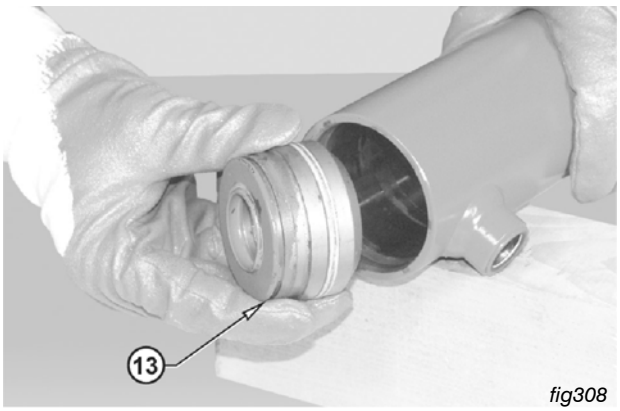


Remove the snap ring (8) of the cylinder cover.





Carefully tap the cylinder cover inwards and remove the snap ring (10).



Pull out the cylinder cover.

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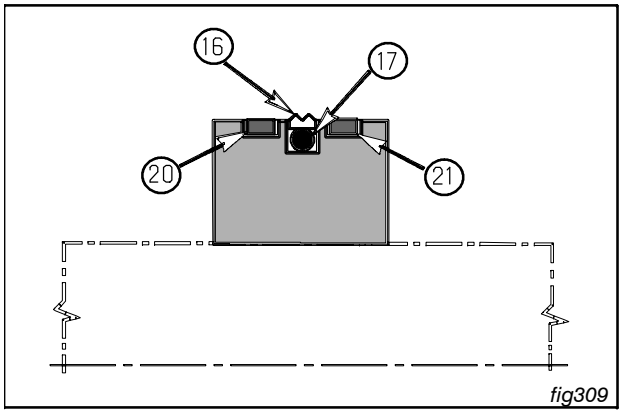
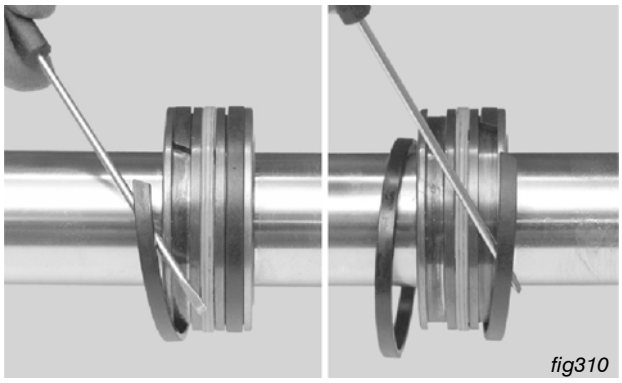
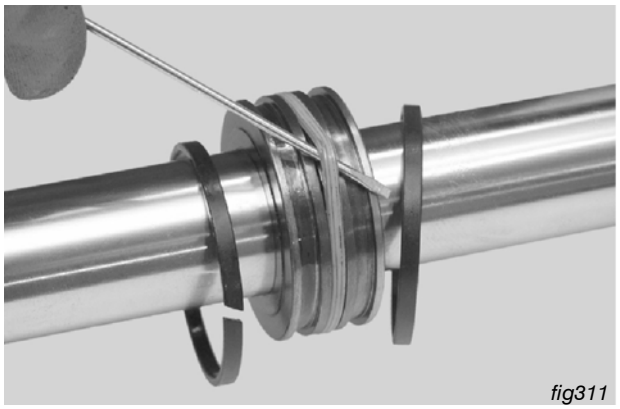


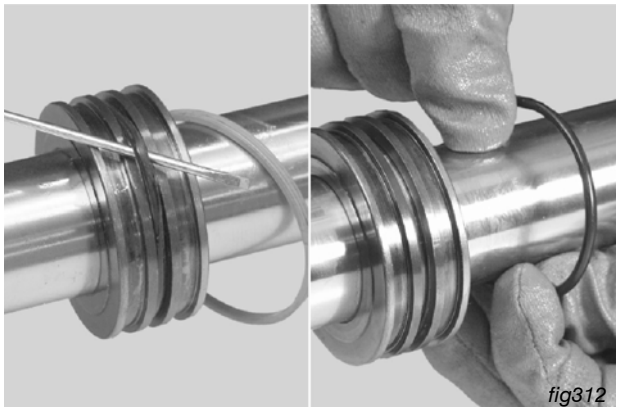
fig309


fig310

Remove the guiding rings (20 and 21) from the piston.


fig311

Remove the piston seal (16).


fig312

Remove the O–rings (17).

https://truckmanualshub.com/

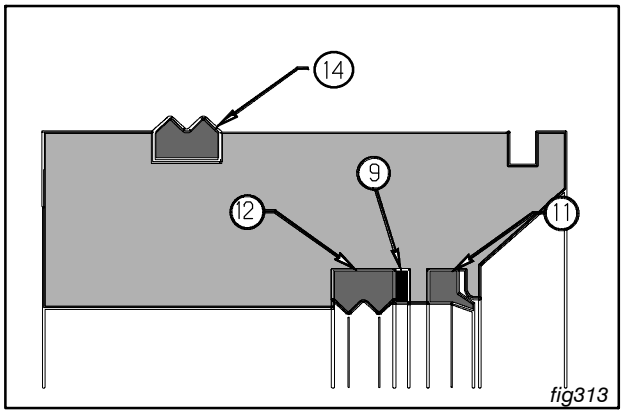
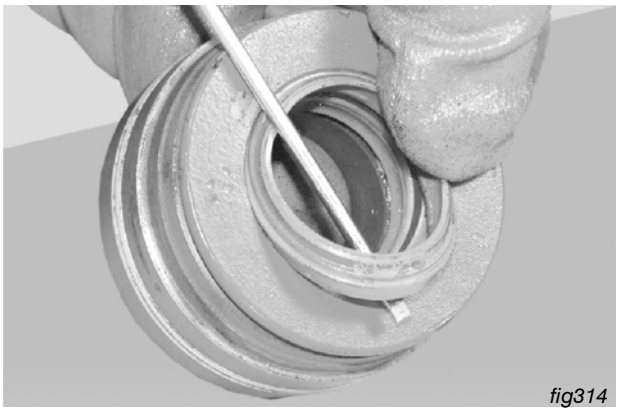


fig313


fig314

Remove the wiper of the piston rod (11).

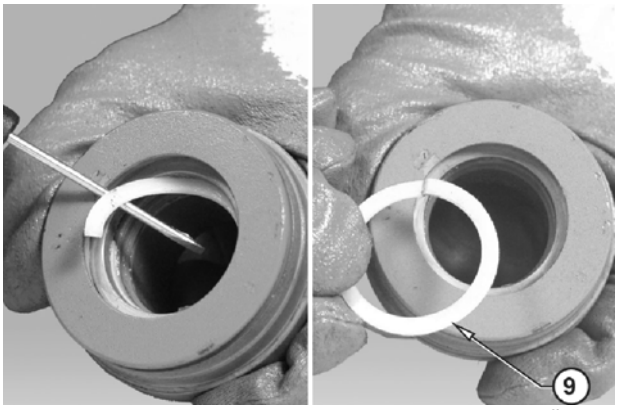
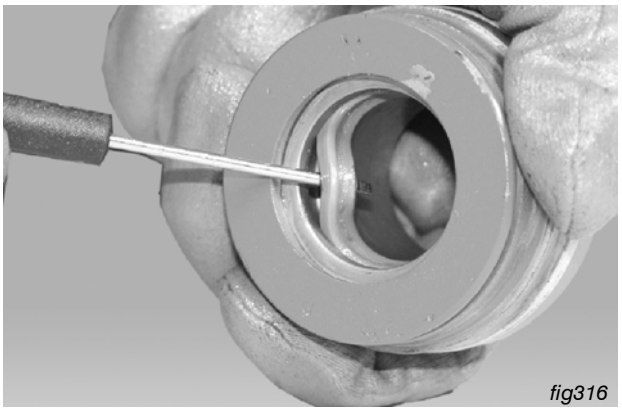


fig315

Remove the backing ring (9).


fig316

Remove the rod seal (12).


fig317

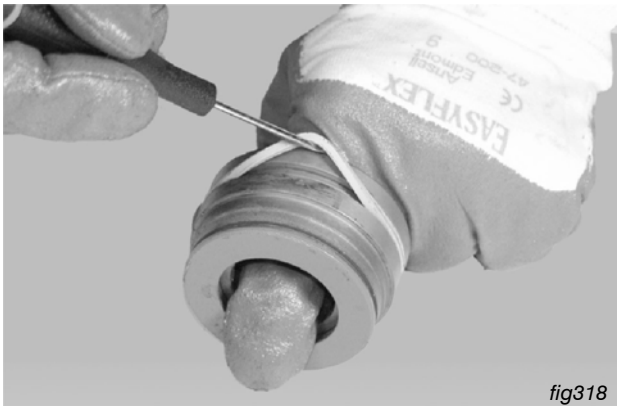


fig318

Remove the seal (14).

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https://truckmanualshub.com/

Fitting the steering cylinder

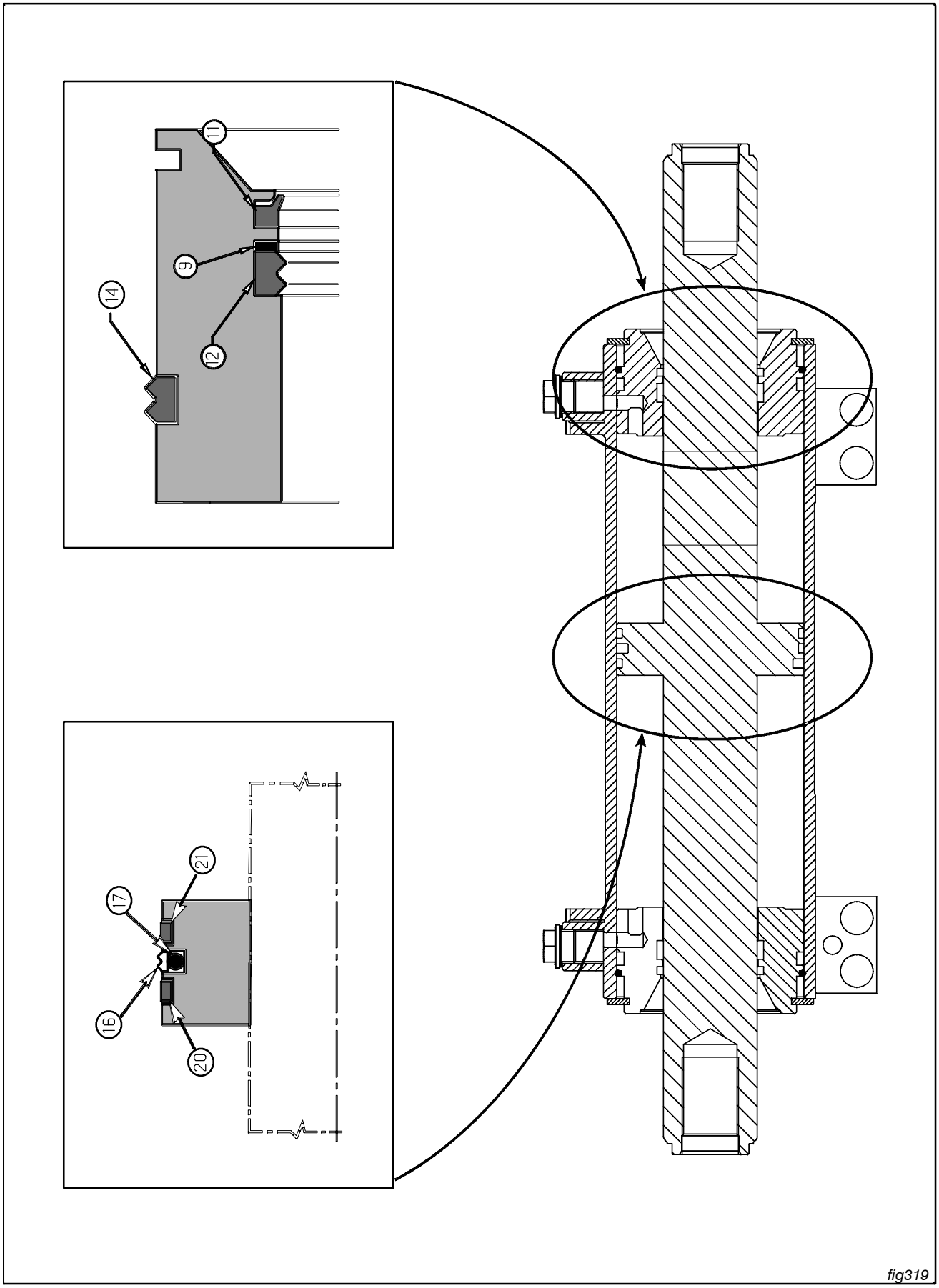


fig319

https://truckmanualshub.com/


fig317

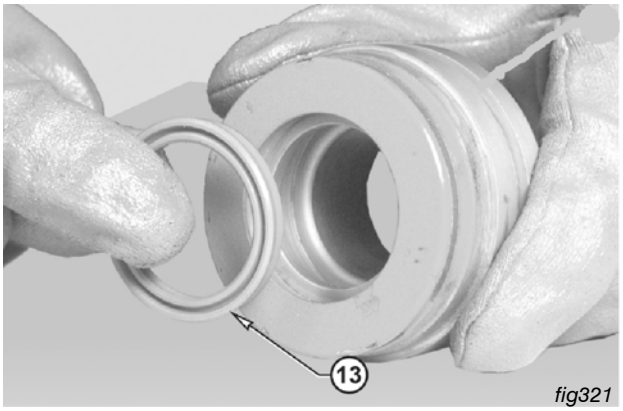


fig321

Lubricate the rod seal (13) and fit it into the cylinder cover.

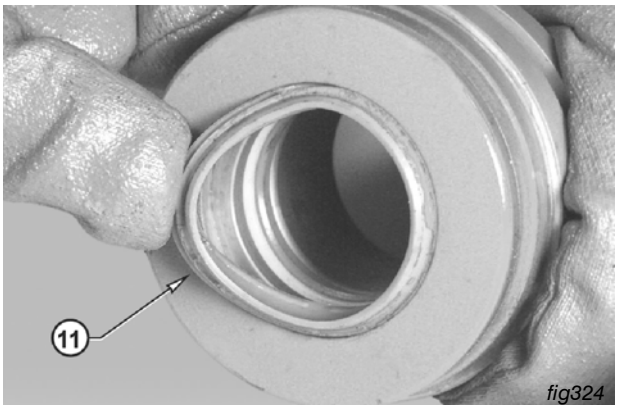
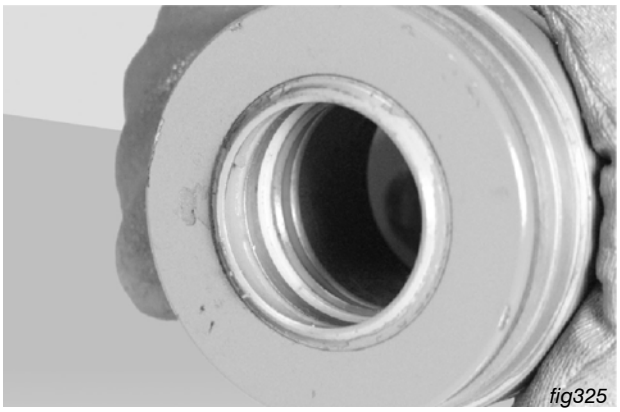


fig324


fig325

Fit the the wiper of the piston rod (11) into place.

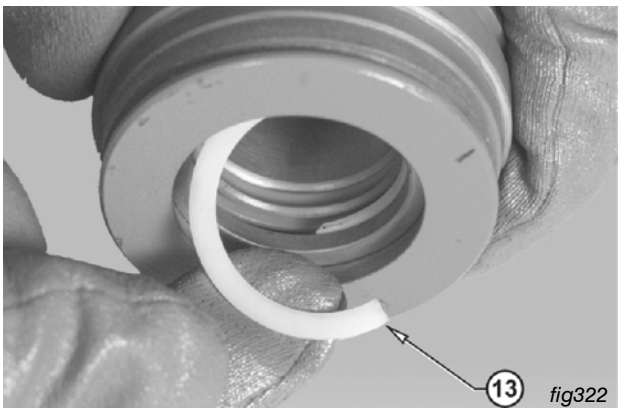
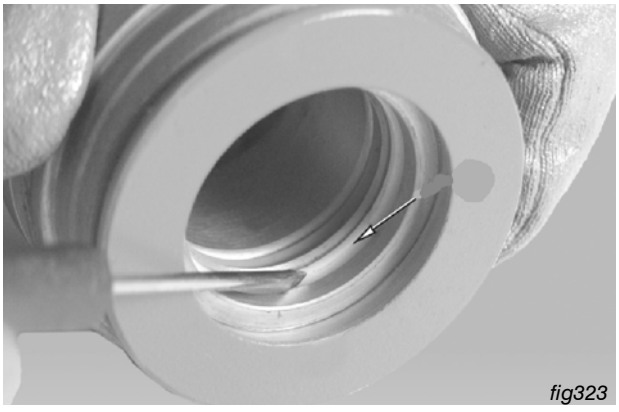


fig322


fig323

Fit the backing ring (13). Check, that ends of the backing ring is together.

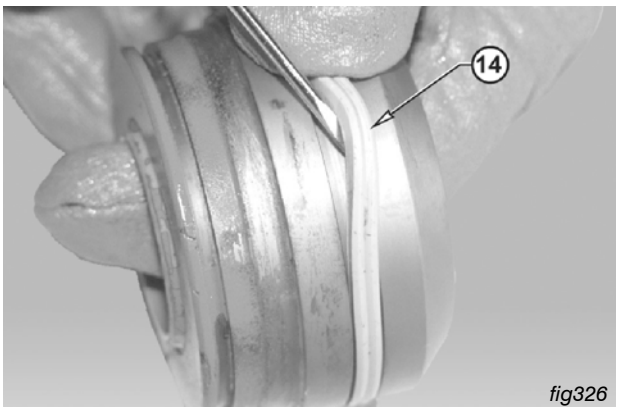
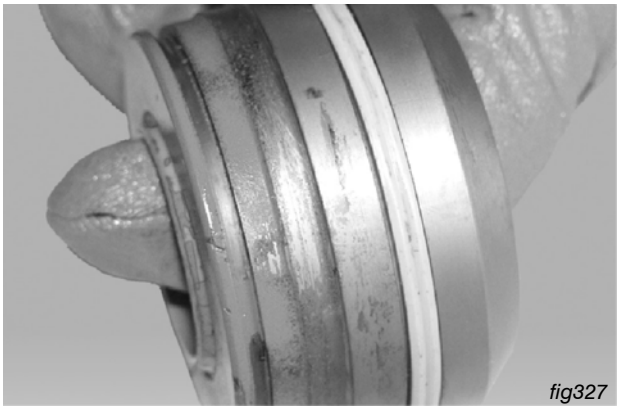
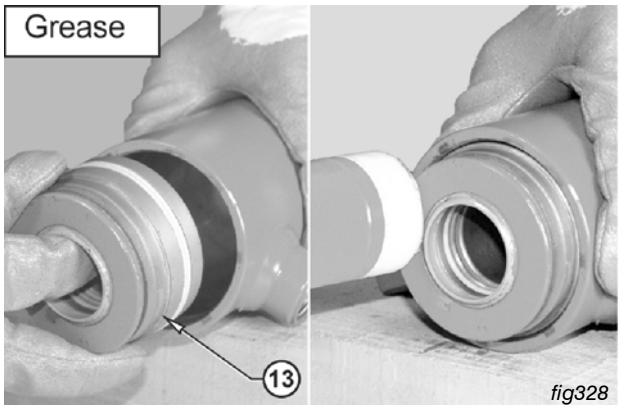


fig326

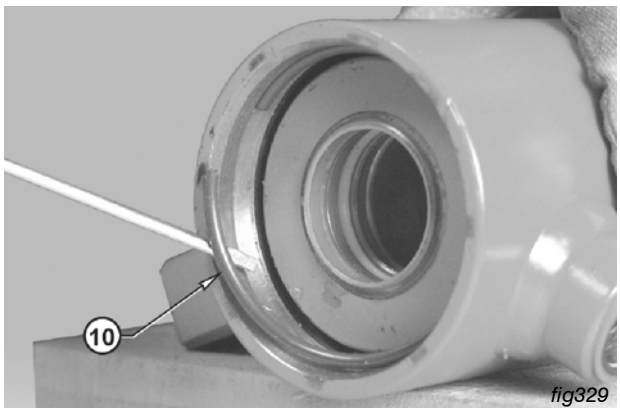

fig327

Lubricate the seal and fit it into the cylinder cover. Don‘t let roll the seal during fitting.

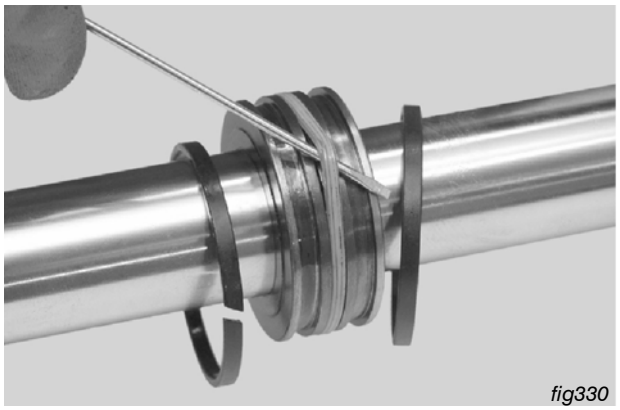
https://truckmanualshub.com/



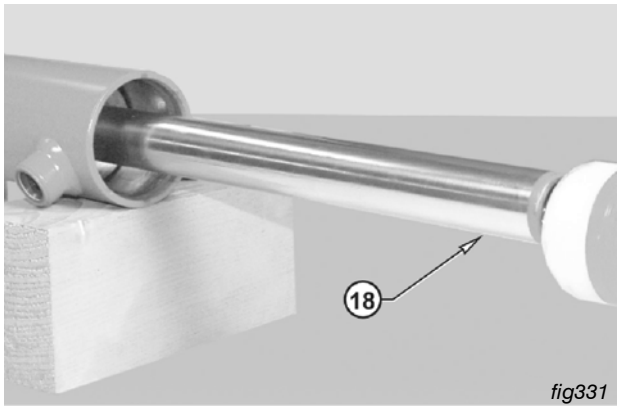
Lubricate the seals and fit the cylinder cover (13) over the groove of the snap ring.



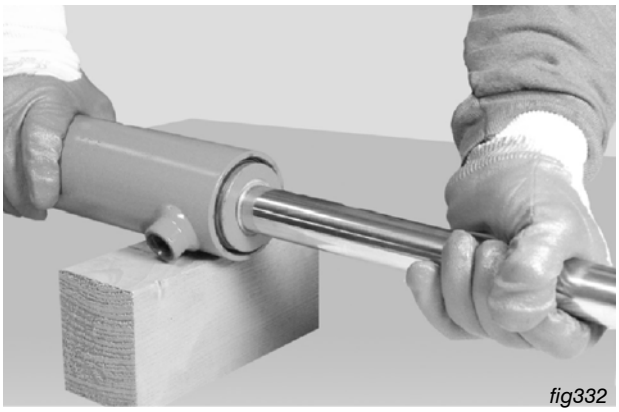
Fit the snap ring (10) into place.



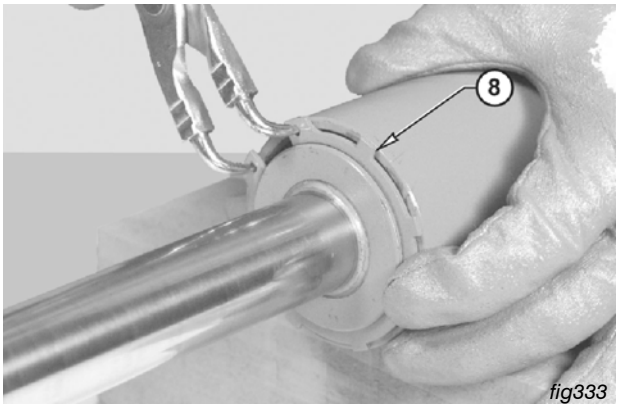
Fit the piston seals/the guiding rings into place.



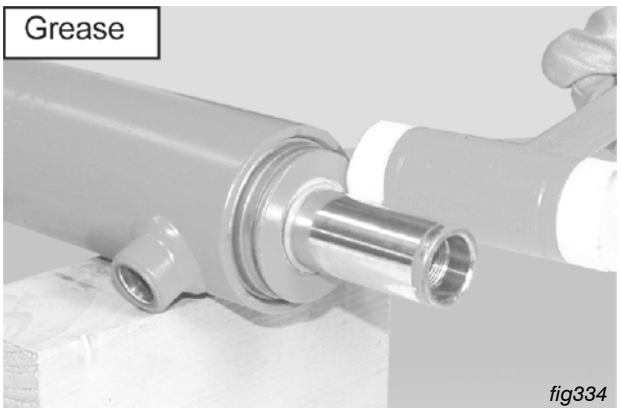
Fit the piston rod (18) through another end of the cylinder tube into place.



Pull the piston rod so that the cylinder cover is against the snap ring.

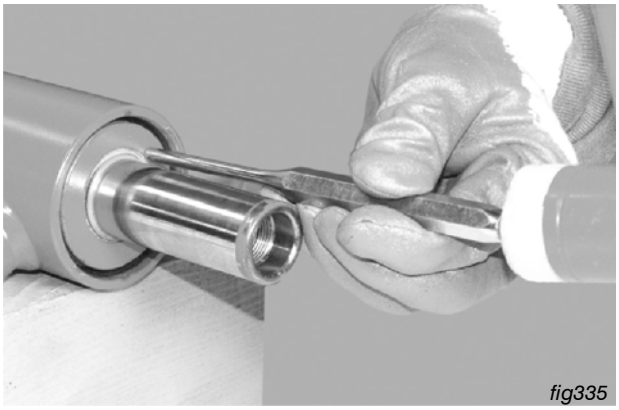


Fit the snap ring (8). Ensure, that the snap ring is in groove.



Lubricate the seals and fit the cylinder cover over the groove of the snap ring.

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fig335

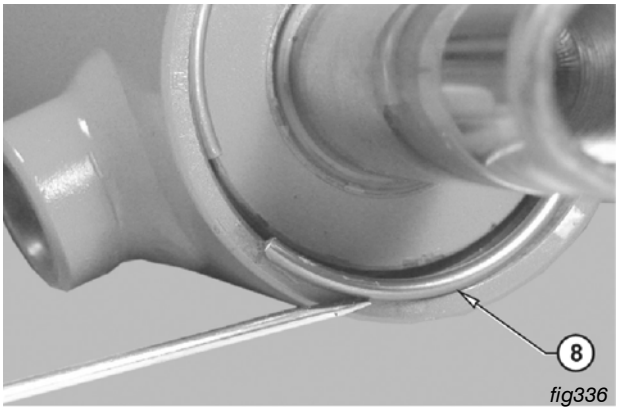


fig336

Fit the snap ring (8). Ensure, that the snap ring is in groove.

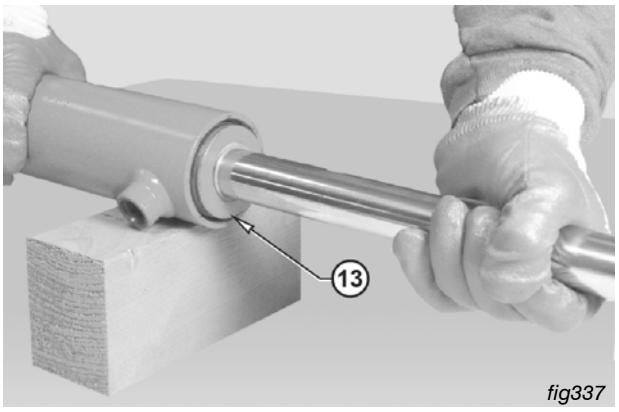


fig337

Pull out the piston rod so that the cylinder cover (13) is against the snap ring.

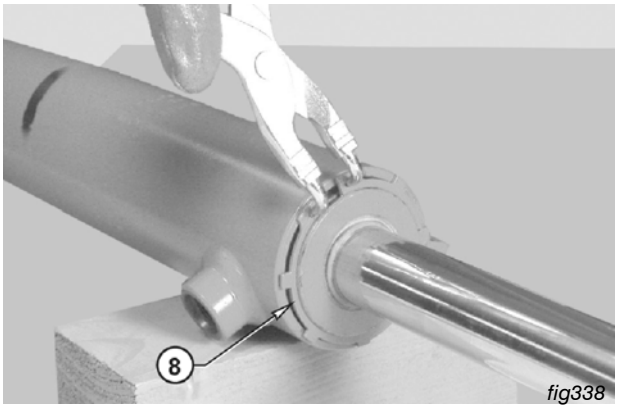


fig338

Fit the snap ring (8). Ensure, that the snap ring is in groove.

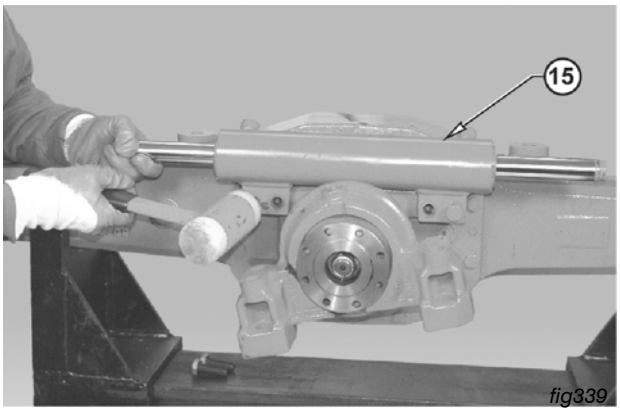
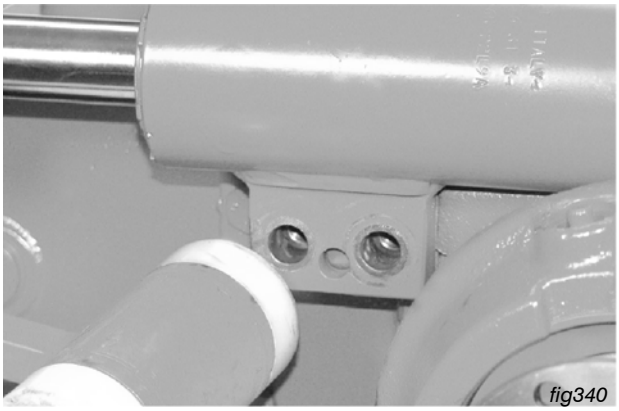


fig339


fig340

Fit the steering cylinder (15) into place.

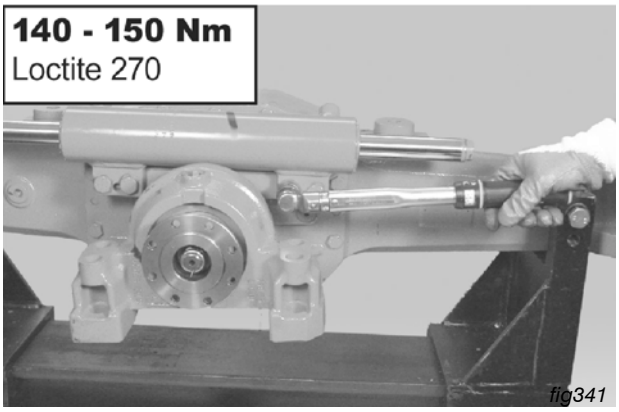


fig341

Tighten fastening bolts of the steering cylinder. Tightening torques: **140 – 150 Nm**.

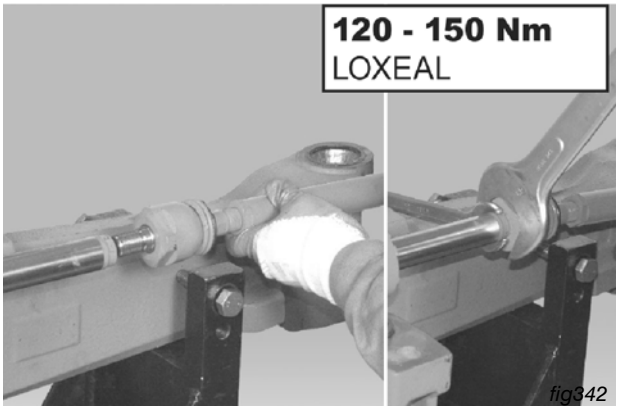


fig342

Fit the tie rods to the piston rod. Use grease on threads. Tightening torques: **120 – 150 Nm**.

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Technical data

Axle type	**Hi–lock[1)] Industrial axle**	
Control, on/off	Electro–hydraulically controlled multi–disc clutch	
Ratio, differential	2.923	
Ratio, planetary gears	6.000	
Total ratio	17.54	
Ratio, front axle/rear axle 40 km/h	**T121c, T131c T121h, T131h** 1.323	**T161c–T171c T151eh–T191c T151eLS–T191LS** 1.33
Ratio, front axle/rear axle 50 km/h	**T131h** 1.329	**T161c–T171c T151eh–T191h T151eLS–T191LS** 1.323
Differential lock, electrohydraulic controlled multidisc differential brake, simultaneously controlled with rear axle differential lock	yes	
Steering arc, adjustable	max. 55°	
Axle turning	8°	
Caster	0°	
King pin inclination KPI	5°	
Camber	1°	
Toe–in, mm	0–2	
Flange distance, mm	1900	

[1)] Standard on models T161c–T171c and T151eh–T191h.

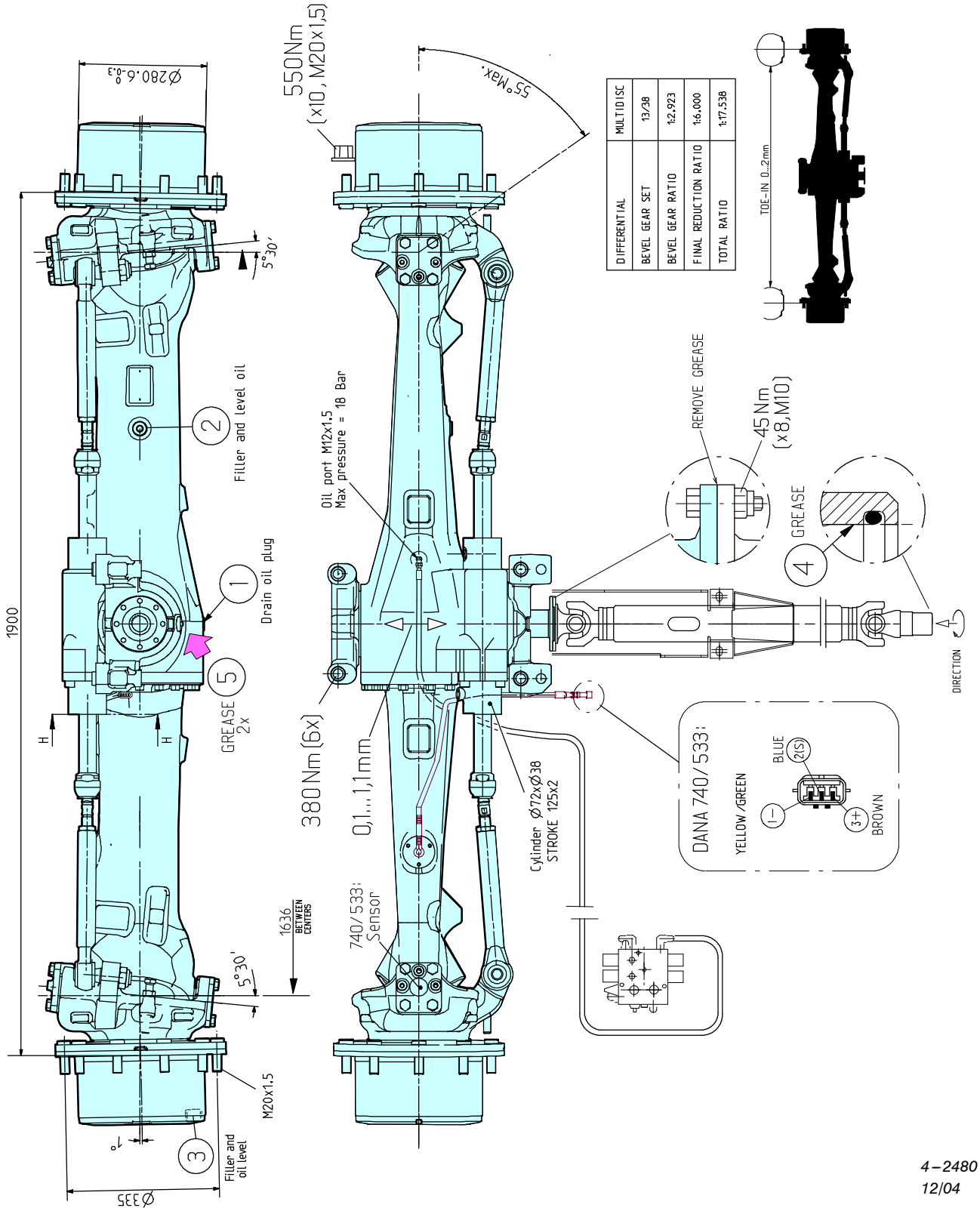
Recommended fuel and lubricants :

Part of machine	**Valtra–grade**	**SAE–grade**	**API–grade**	**Volume, when changing** (liter)
Powered front axle – differential	Valtra Axle	80W–90	GL–5 (LS)	8
– hub reduction gears				2x2.0

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Maintenance points



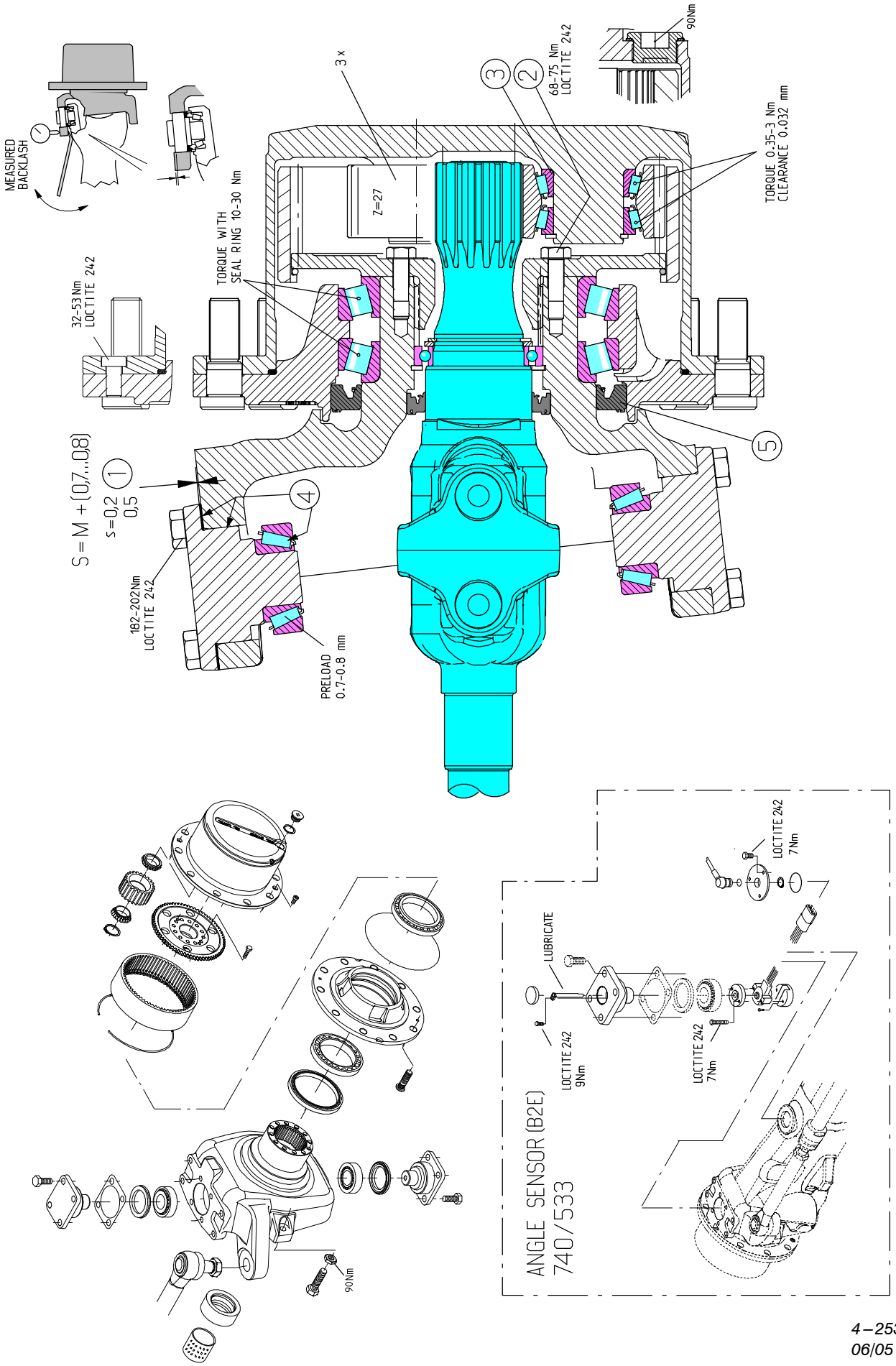
4–2480
12/04

1. Plug for checking and draining oil
2. Oil checking / filling plug for differential housing
3. Oil filling / draining plug for hub
4. EP–grease (UC3907) when assembled
5. The grease nipple quantity (on one bearing) 1 pc

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Planetary gear (Dana 740/532, 740/533)



4 – 2530
06/05

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– The measurement of the king pin shim.

Use an extra shim of **1,5 mm** must be use during the measurement.
Calculate the number of shims required (**measurement S**), taking into account the fact that the bearings have press fit by **0,7–0,8 mm**.

1) Press fit of the king pin standard value (not loose) = 0,7 – 0,8 mm

Example:
Shim of the measurement = 1,5 mm
Measured backlash = 0,5 mm
The fitted shim = S

– fit the shim of the measurement (**1,5 mm**) into place

– tighten fastening bolts of the plate

– measure the end float (example = 0,5 mm).

S = Shim (1,5 mm) – Measured backlash – Press fit of the king pin
S = 1,5 mm – 0,5 mm – 0,7 mm
S = 0,3 mm

2) Loctite 242 on the screw.

3) Note that the planet gear + bearings will be placed in right direction

4) Grease (Optimoil) the surface of the king pin cover and the bearing

5) Ensure, that the cassette seal is fitted according to the picture

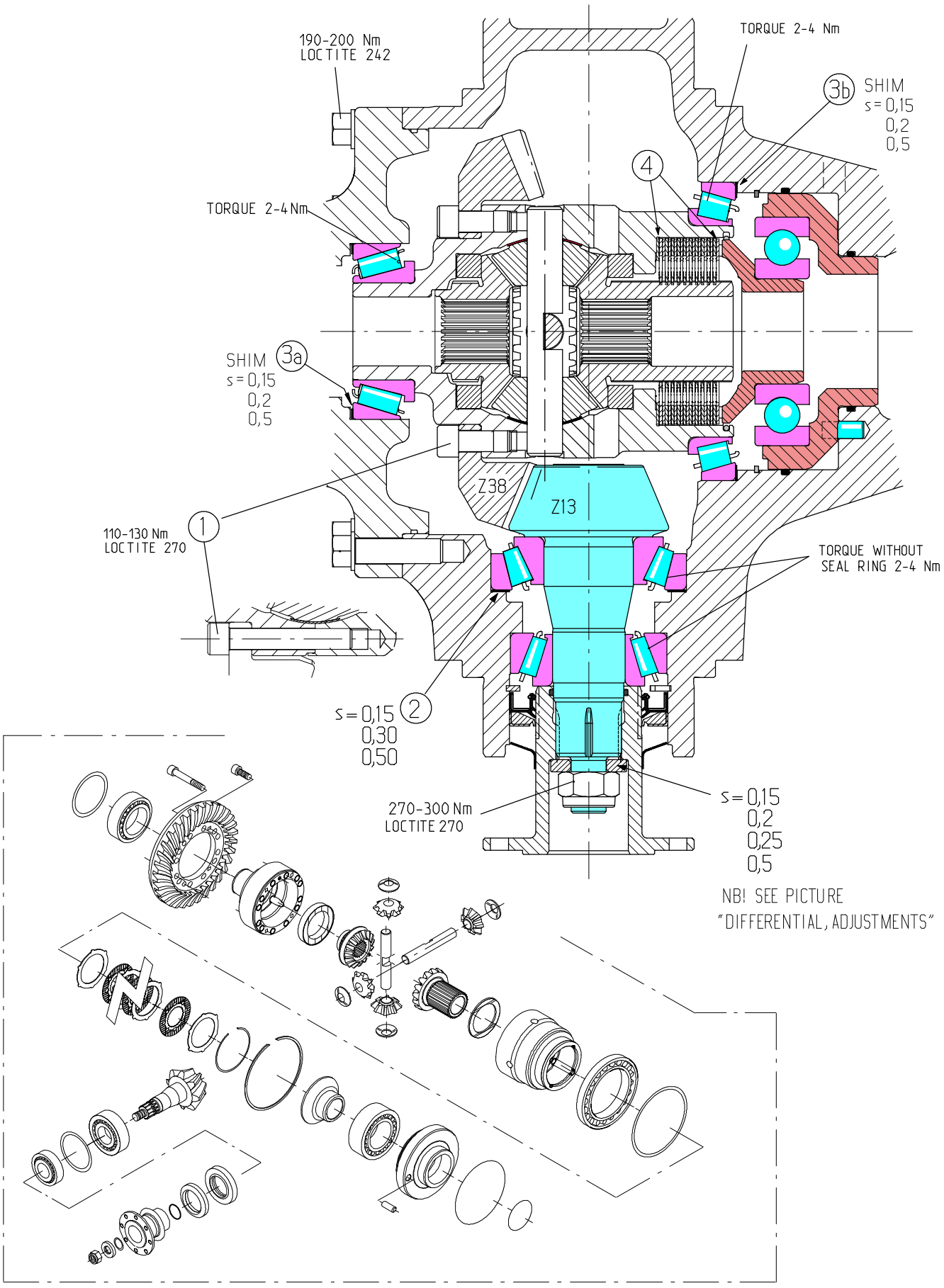
– Check oil level in planetary gears every **500** hours:

Turn the wheel until the oil surface indicator line is horizontal. The oil surface should be level with the hole.

– Change oil in planetary gears every **1000** hours.

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Differential (Dana 740/532, 740/533)



4–2531
06/05

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1) Smear Loctite 270 on the screw

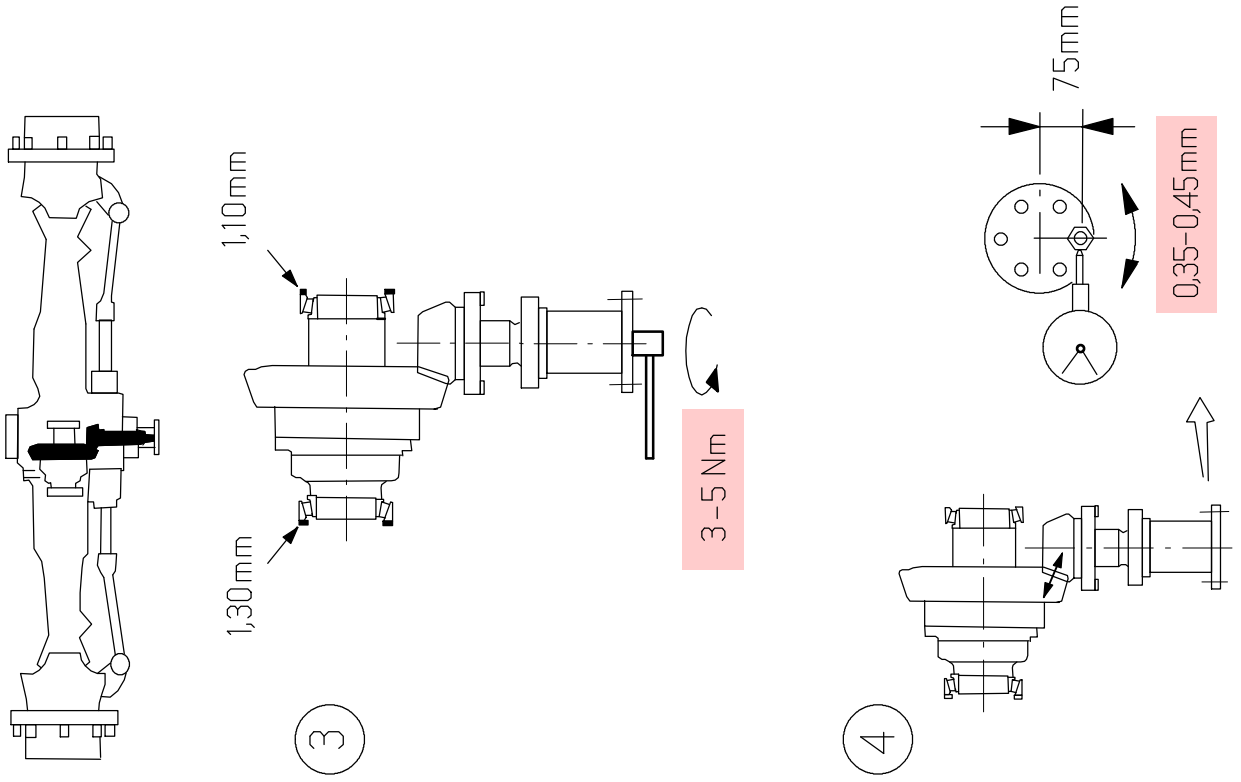
2) Shims (0,15 mm, 0,30 mm, 0,50 mm)

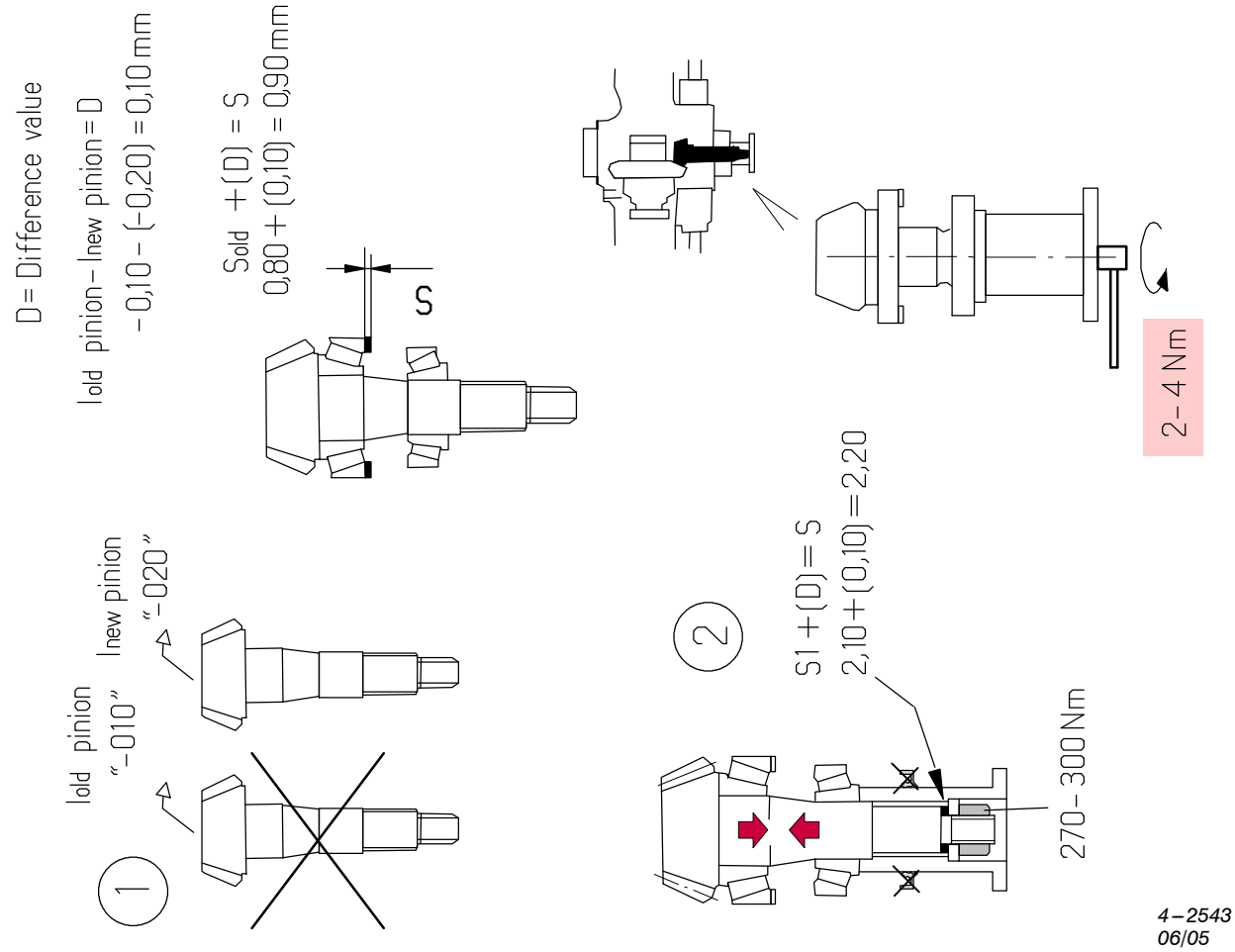
3a, 3b) Shims (0,15 mm, 0,2 mm, 0,5 mm)

4) Note! the first and the last disc of the disc pack is a steel disc

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Differential adjustments





4 – 2543
06/05

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1) Adjusting the new pinion shaft position:

Read the **measure l** of the old pinion shaft (e.g. **0,10** mm). and the **measure l** of the new pinion shaft (e.g. **0,20** mm). Calculate with help of these measures the difference value **D** between the bevel pinion shafts.
Example:
l old pinion – **l new pinion** = **D**
–0,10 mm – (–0,20 mm) = 0,10 mm

Calculate with help of these measures the new shim **S** of the bevel pinion shafts
Example:
S old = old shims
D = difference value of the bevel pinion shafts

S old + (D) = S
0,80 + (0,10) = 0,90 mm

Note! Put the shim **S** under the inner bearing outer race

2) Fit the bevel pinion shaft (flange without the sealing ring!).

Calculation of the new shim under the nut:
When installing the new bevel pinion shaft then measure difference of the bevel pinion shafts also under the nut to come the shim **S**.
Example:
S1 = old shims
D = difference value of the bevel pinion shafts

l old pinion – **l new pinion** = **D**
–0,10 mm – (–0,20 mm) = 0,10 mm

S1 + (D) = S
2,10 + (0,10) = 2,20 mm

Note! Put the shim **S** under the nut

Tighten the nut of the shaft (lock the flange of the cardan with support tool). Tighten the nut of the shaft to **270 – 300** Nm.
Use a spring balance to measure the force needed (rolling resistance) to rotate the bevel pinion shaft.
Measure the rolling resistance two, three times. Read off the value, while the shaft is rotating. In the beginning of rotation more power is needed.

The rolling resistance should be **2 –4 Nm**. If the rolling resistance is not correct, the number of shims under the nut must be adjusted.
Note! If the rolling resistance is too great more shims are required and vice versa.

3) Fit the **1,10 mm** shim under the bearing outer race (piston side in the axle housing). Fit the differential.

Fit the **1,30 mm** shim under the bearing outer race (crown wheel side)
Fit the differential into the axle housing and connect the axle sections with several screws (**190 Nm**).

Check the rolling resistance of the bevel pinion shaft: **3 – 5 Nm** (rolling resistance included bevel pinion shaft bearings+differential bearings).

If the rolling resistance is too low then add the shims of the differential. If the rolling resistance is too high then remove the shims of the differential.

4) Measure the pinion/crown wheel tooth backlash on the drive flange according to picture.
The backlash should be in the range **0,35 – 0,45 mm**.

If the backlash is too small so transfer the shims of the differential from the shorter axle section side to the longer side.

If the backlash is too big so transfer the differential of the shims from the longer axle section side to the shorter side.

Locally prepared tools

Planetary gear (code 655.2)

ET 894 080 . . . . . Fitting tool for the outer oil seal of the drive shaft
ET 894 150 . . . . . Fitting tool for the cassette seal

Knuckle housing (code 655.4)

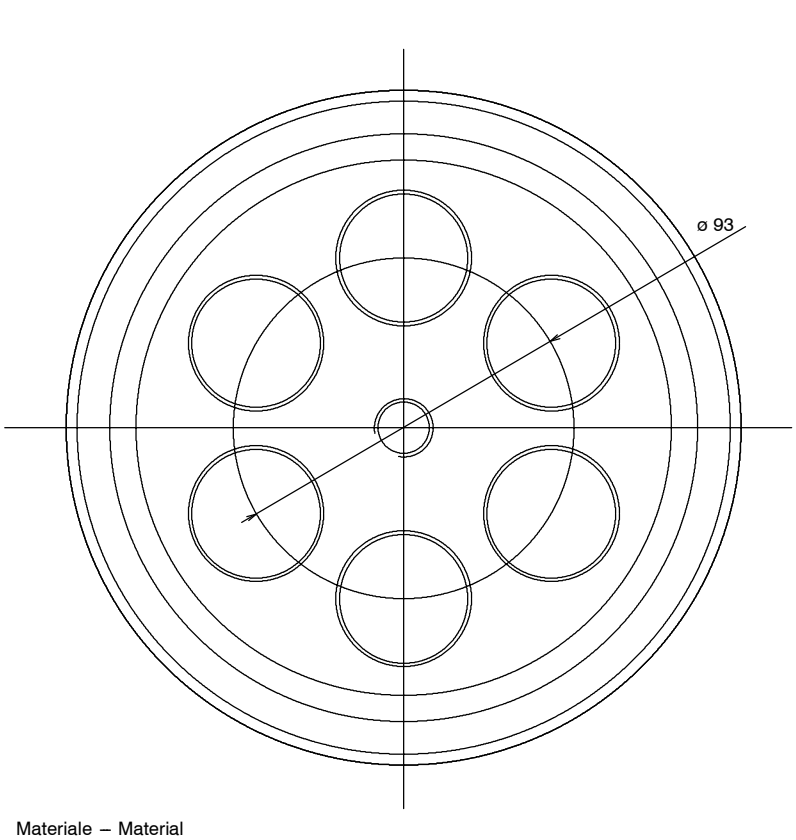
ET 894 040 . . . . . Fitting tool for the bushing of the drive shaft
ET 894 100 . . . . . Fitting tool for the inner oil seal of the drive shaft
ET 894 160 . . . . . Fitting tool for the inner oil seal of the drive shaft

Differential (code 655.5)

ET 894 120 . . . . . Fitting tool for the seal of the bevel pinion shaft
ET 894 140 . . . . . Tool for pinion/crown wheel tooth backlash measurement
ET 894 160 . . . . . Fitting tool for the inner oil seal of the drive shaft

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ET 894 080



Materiale – Material
39 NiCrMo3 EN 10083–1
Brunito – Burnished

fig001

https://truckmanualshub.com/

ET 894 150

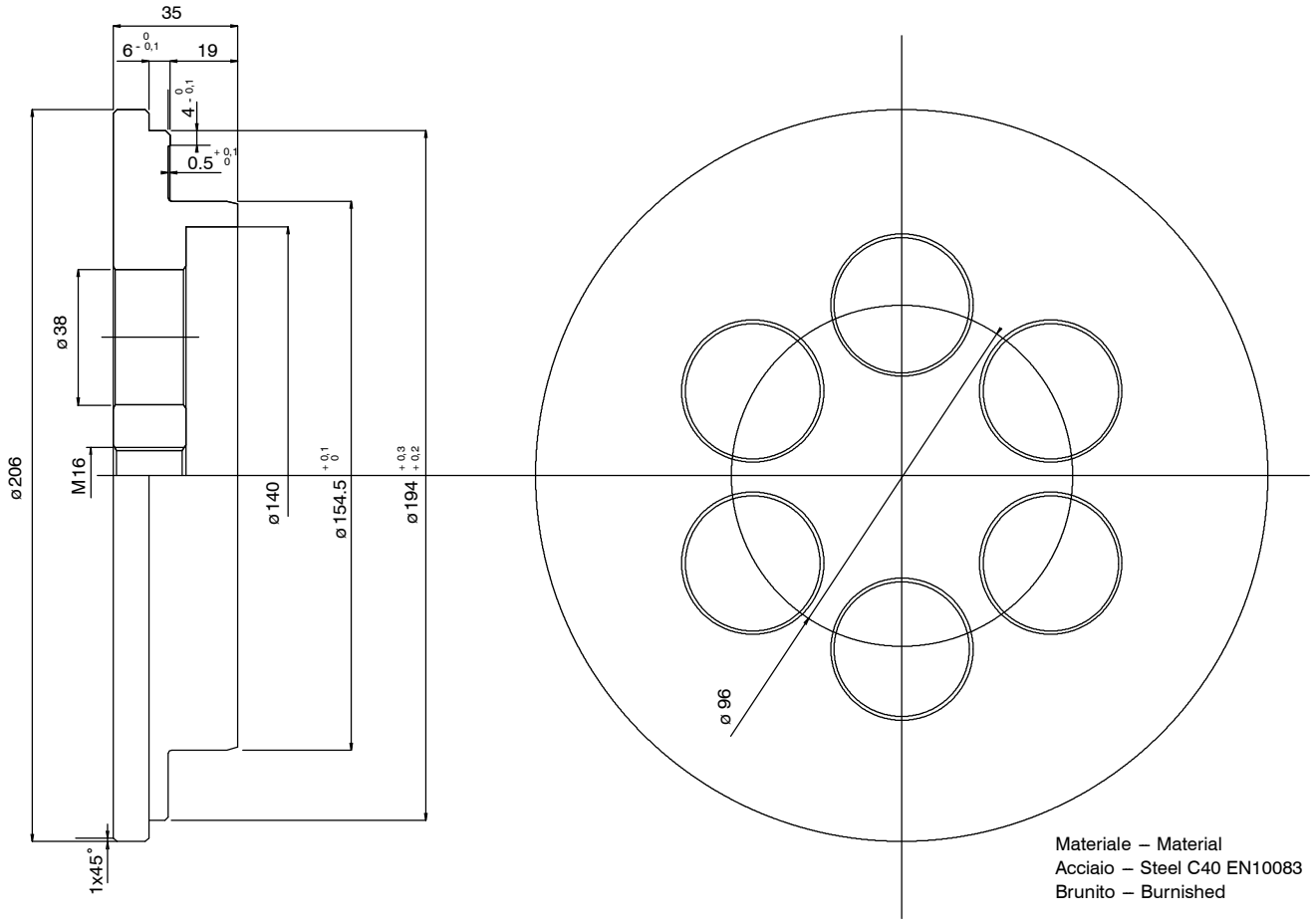


fig002

https://truckmanualshub.com/

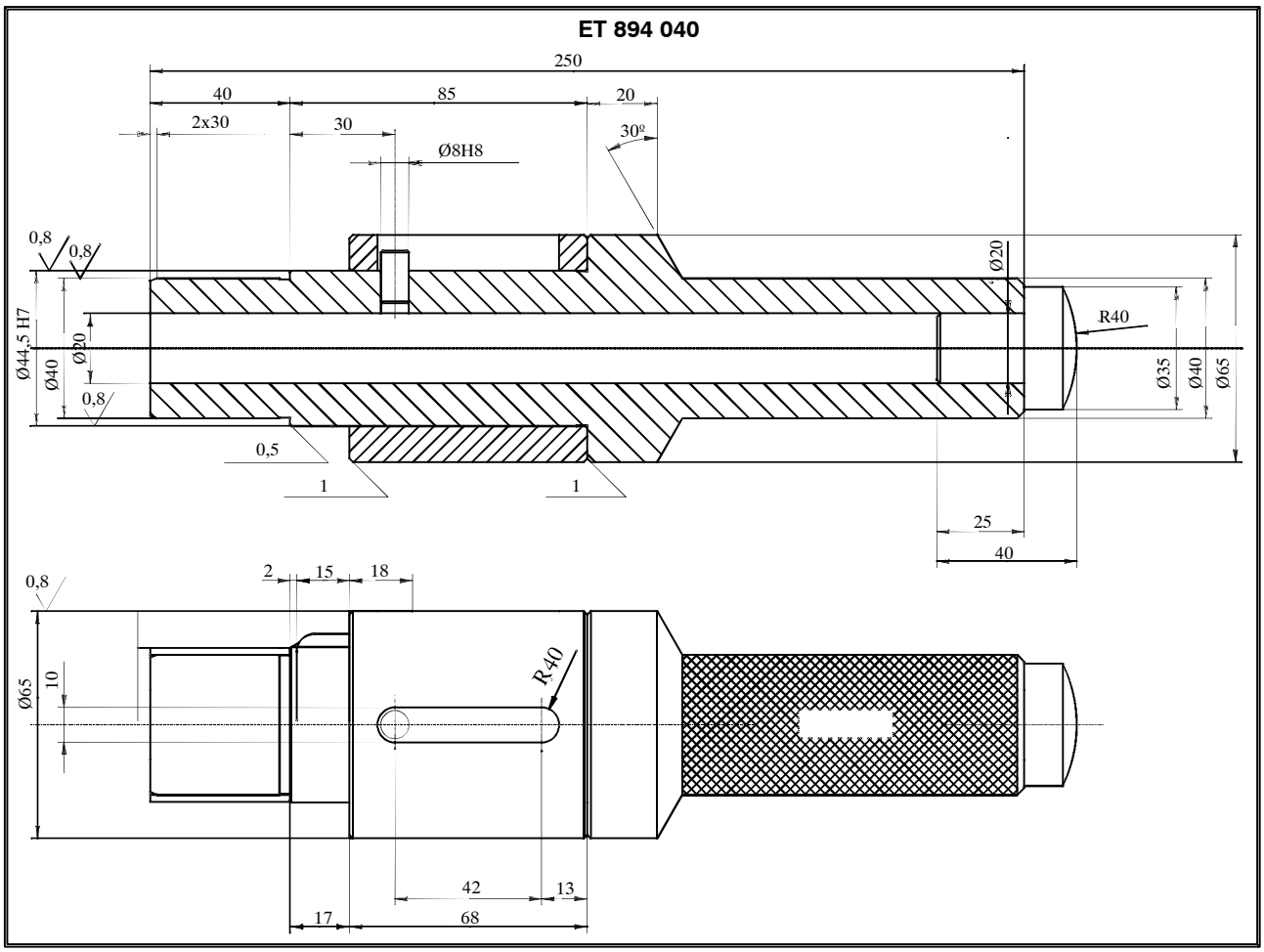


fig003

https://truckmanualshub.com/

ET 894 100

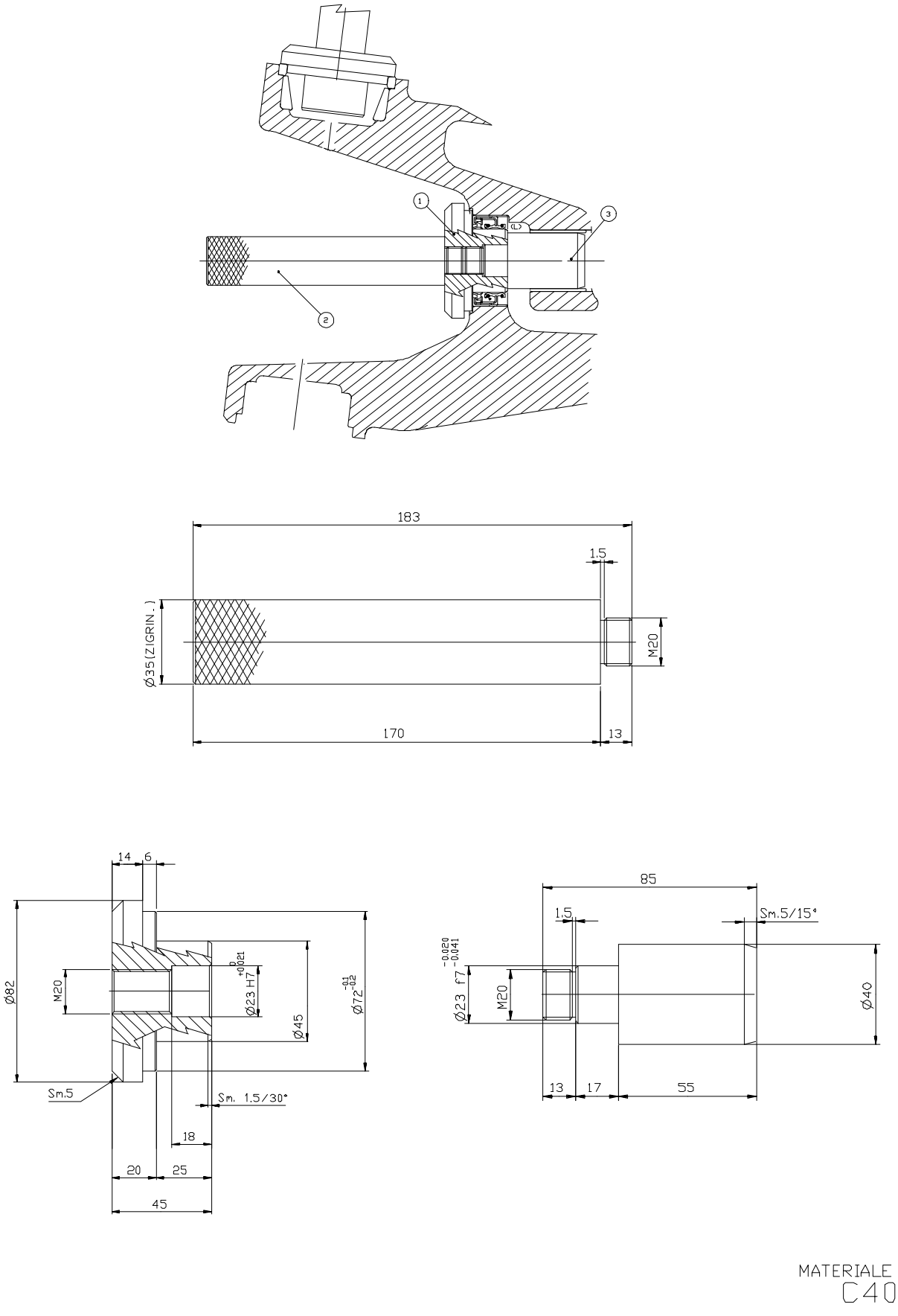
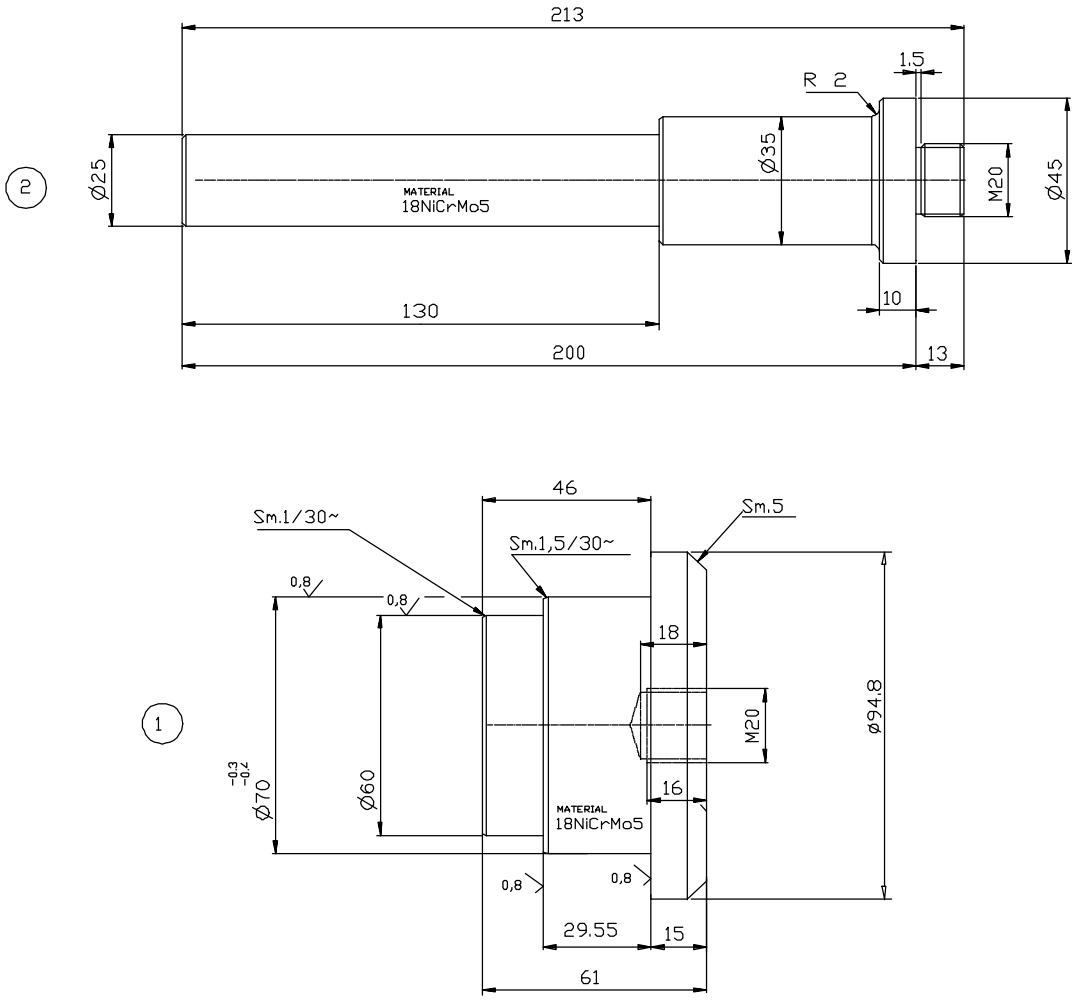


fig004

https://truckmanualshub.com/

ET 894 160



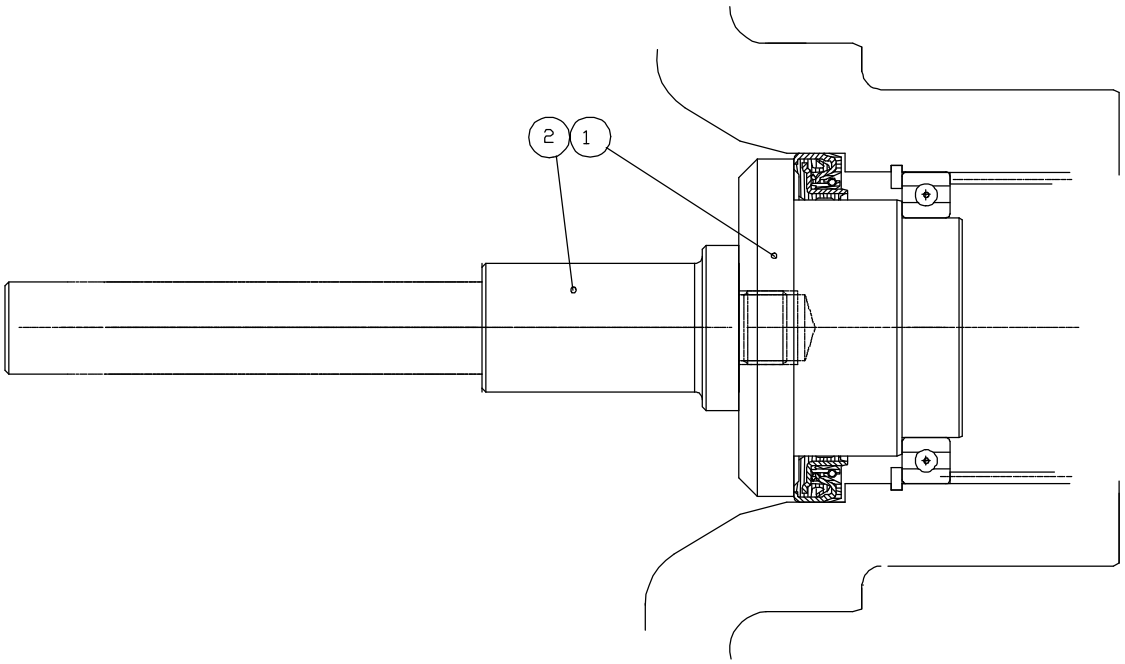
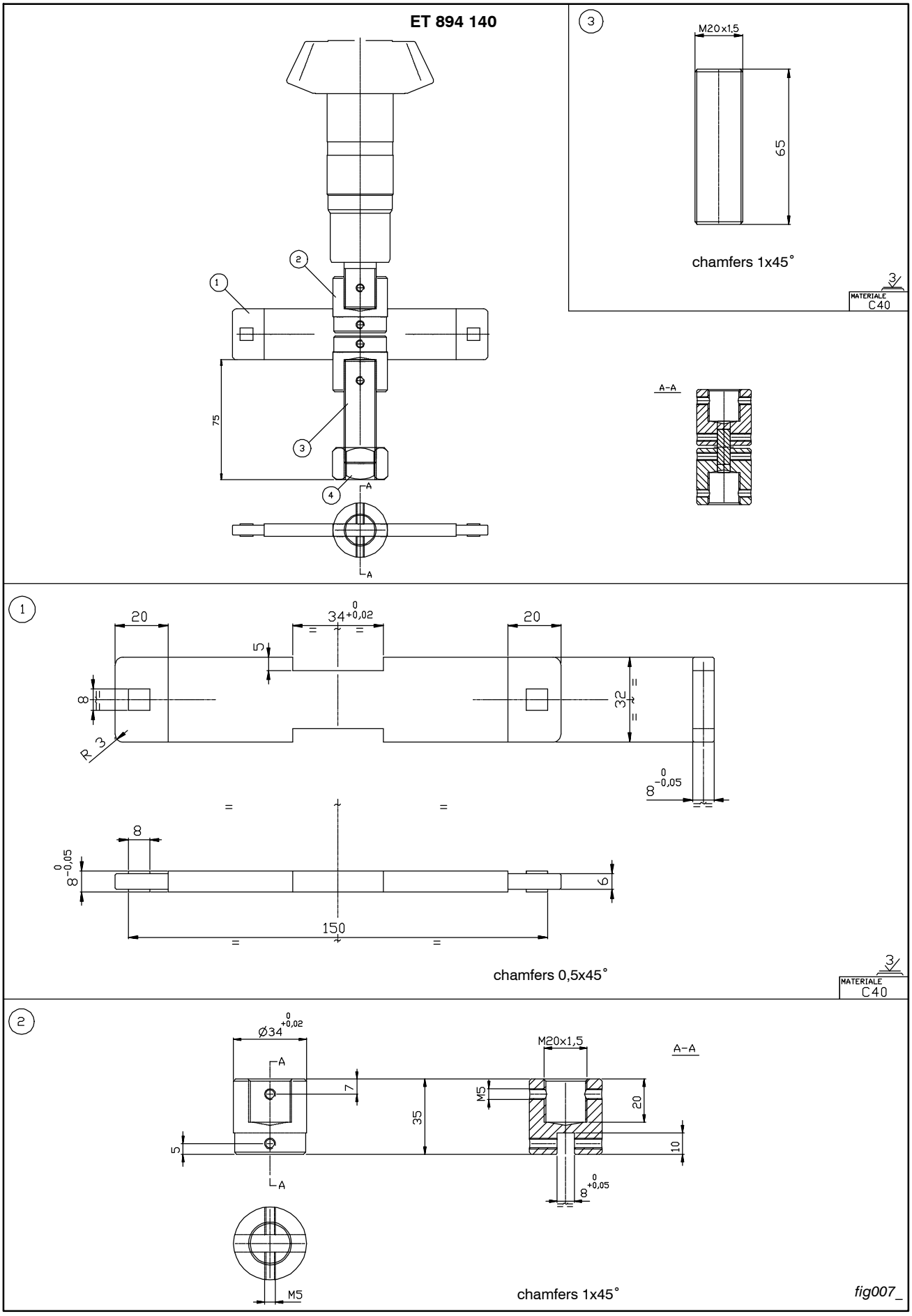


fig005

https://truckmanualshub.com/



https://truckmanualshub.com/

ET 894 120

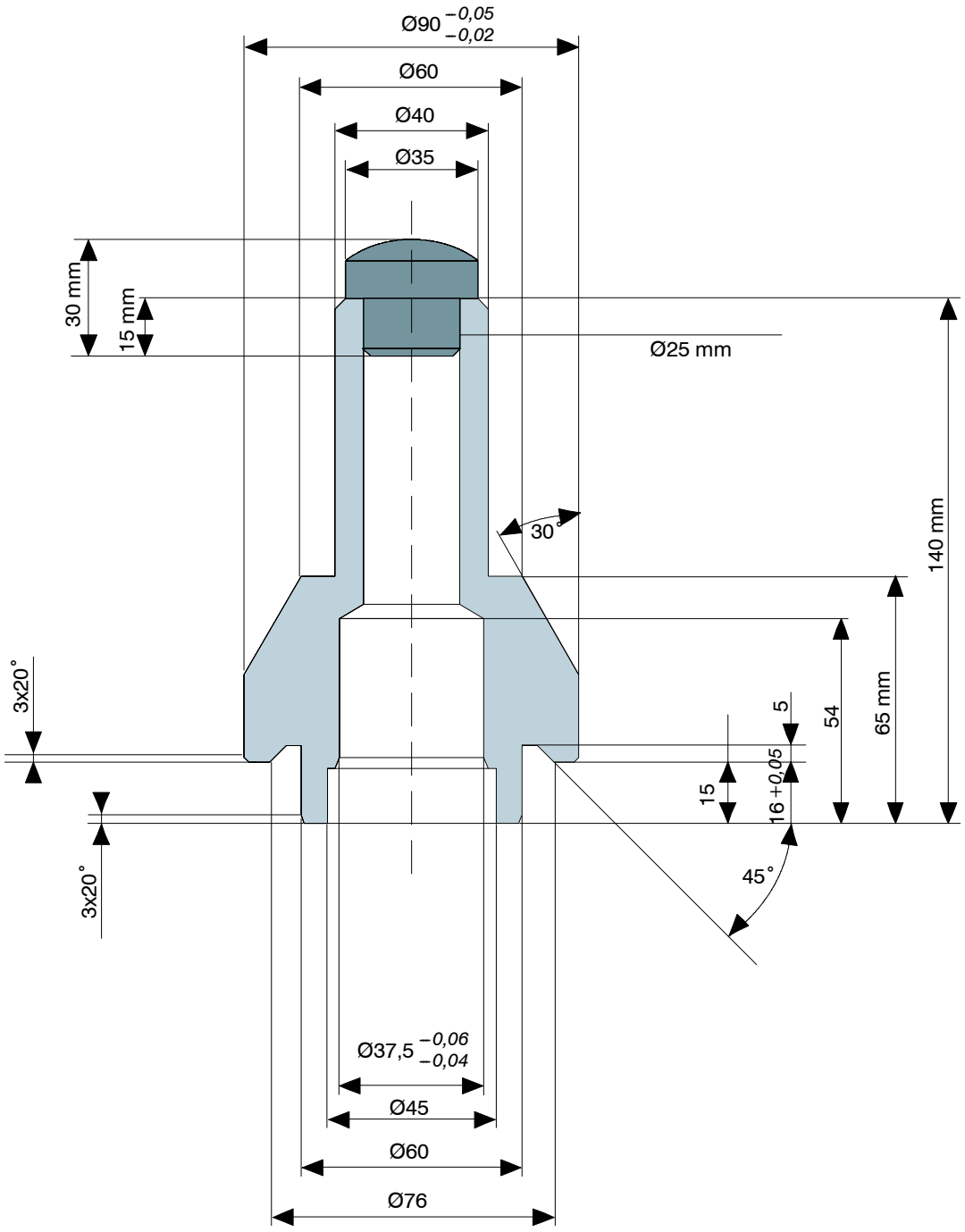


fig006

Disassembling the bearing brackets

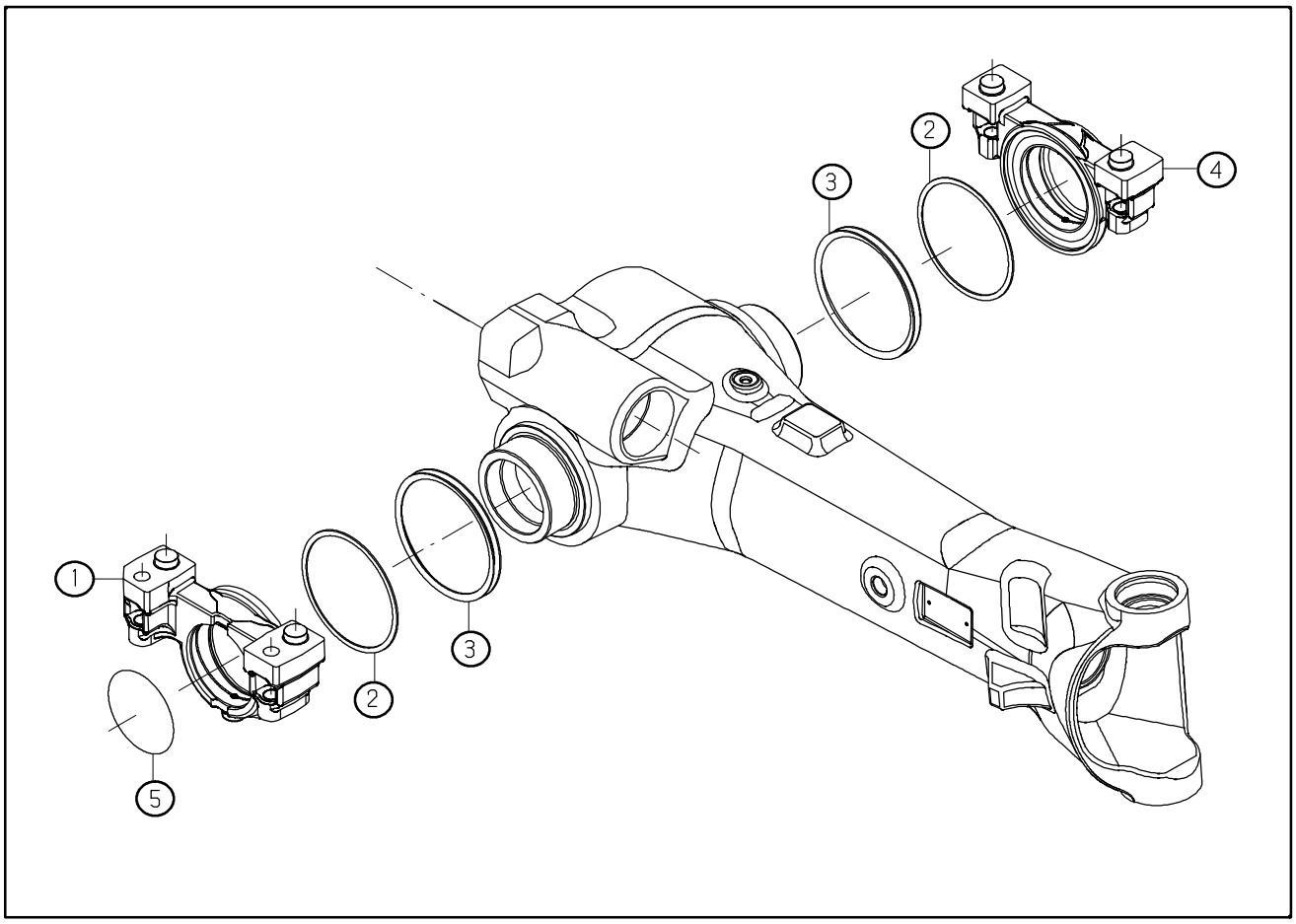
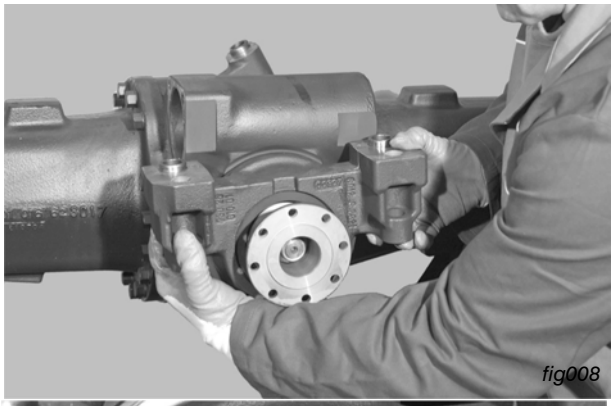
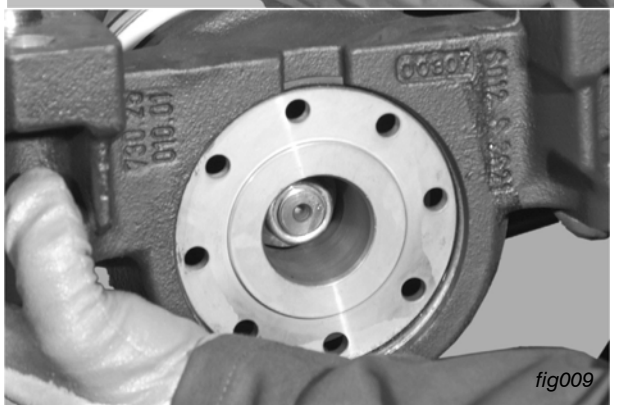


fig007

https://truckmanualshub.com/


fig008


fig009

Remove the rear bearing bracket (1).

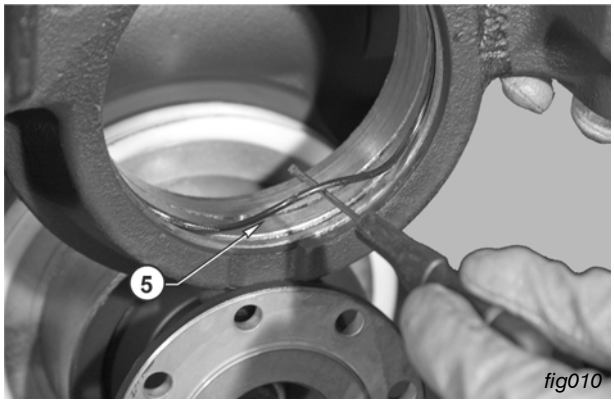
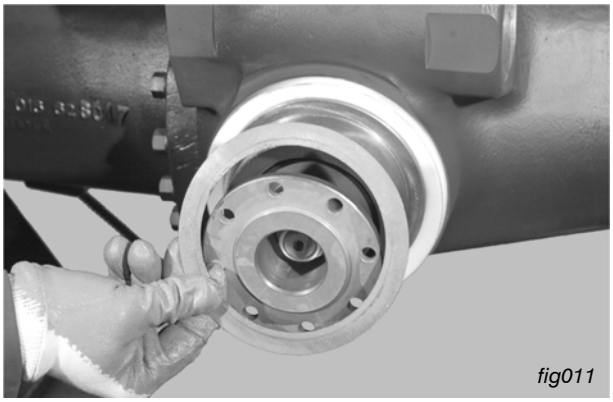


fig010

Remove the O–ring (5).

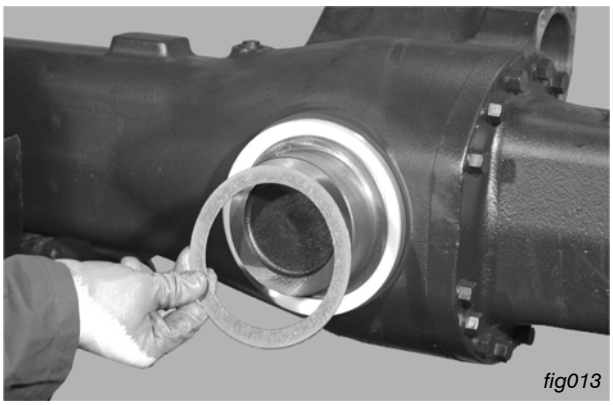

fig011

Remove the V– ring (3) and spacer ring (2).



fig012

Remove the front bearing bracket (4).

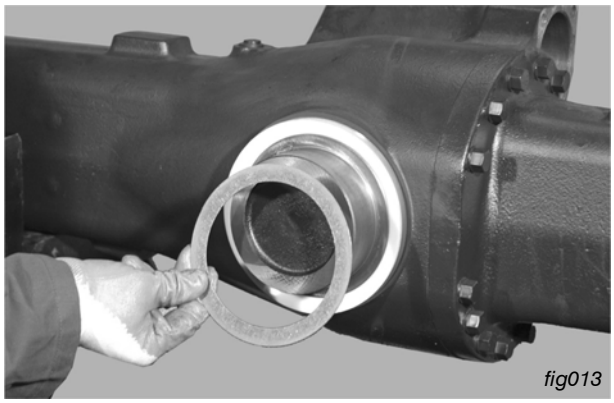

fig013

Remove the V– ring (3) and spacer ring (2).

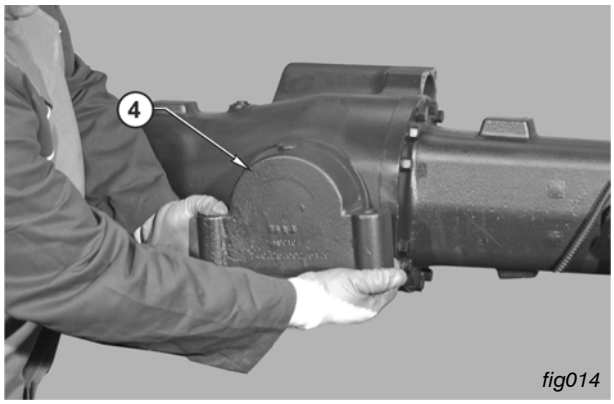
https://truckmanualshub.com/

Assembling the bearing brackets

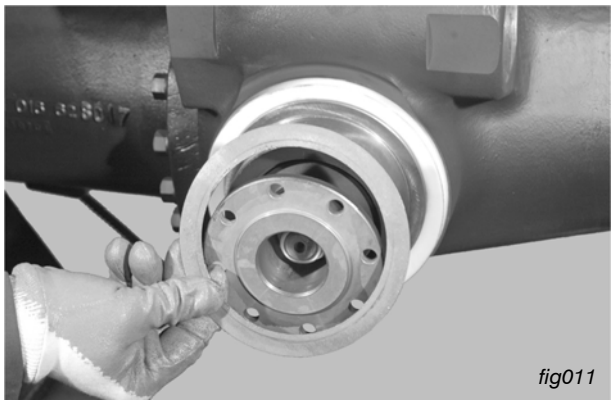
N.B. Central pivot bearing brackets should have a small axial clearance **0,1–1,1 mm**. Adjust this if necessary using shims.



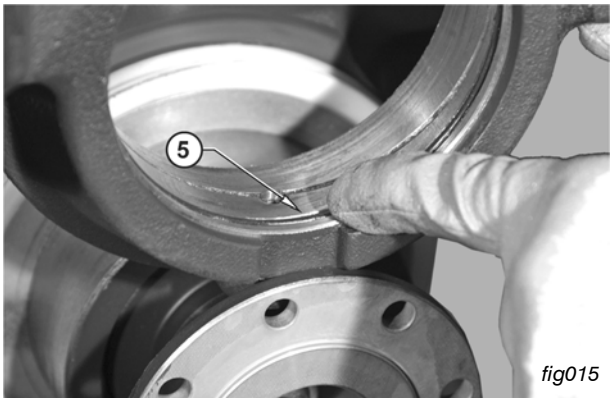
Fit the V–ring (3) and spacer ring (2).



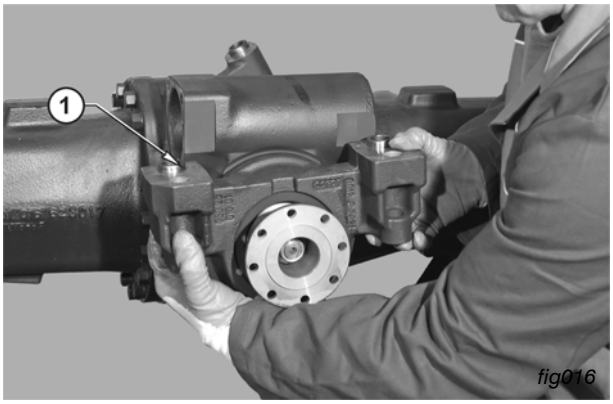
Fit the front bearing bracket (4).



Fit the V–ring (3) and spacer ring (2).



Fit the O–ring (5).



Fit the rear bearing bracket (1).

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Disassembling the planetary reduction

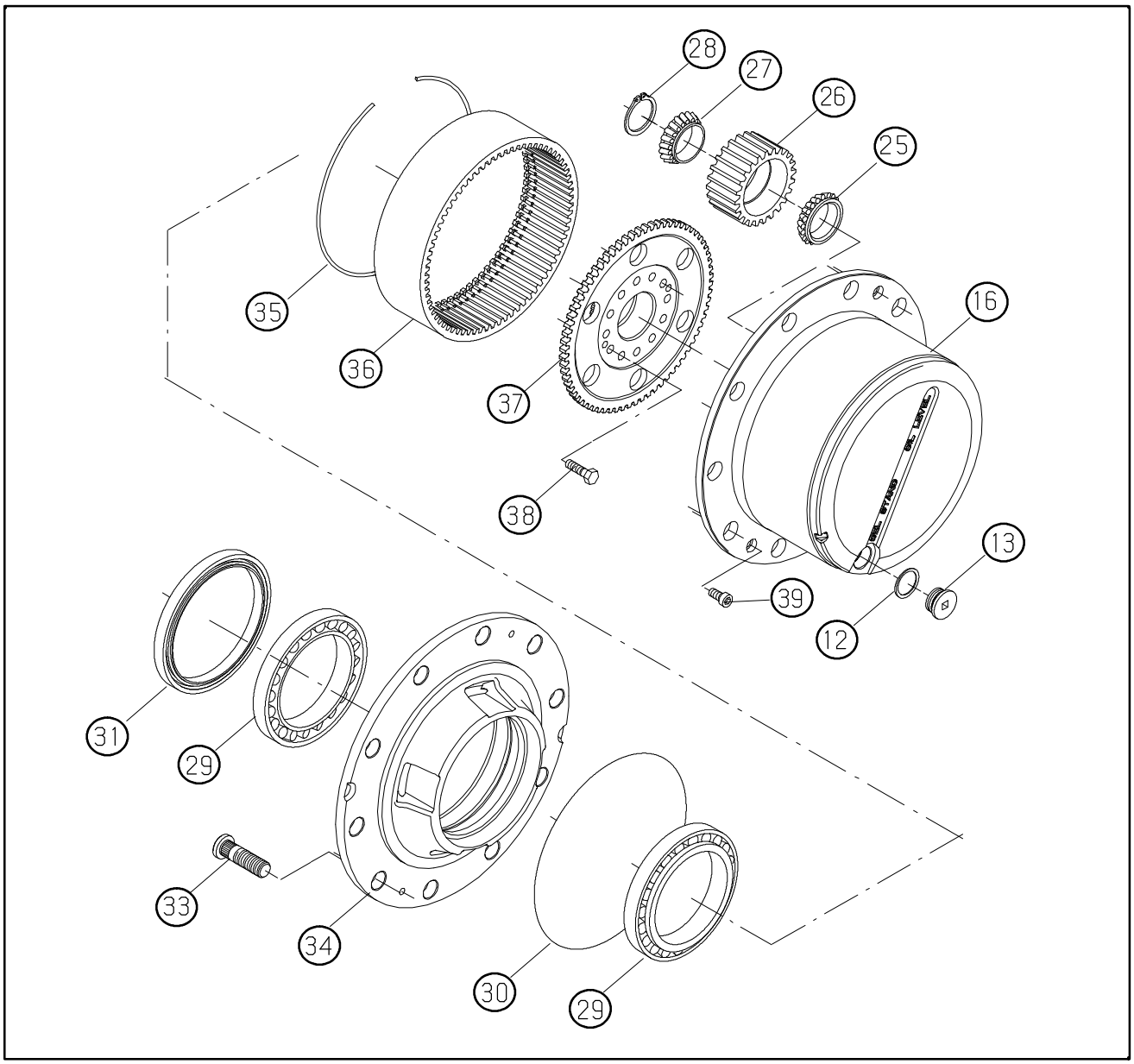
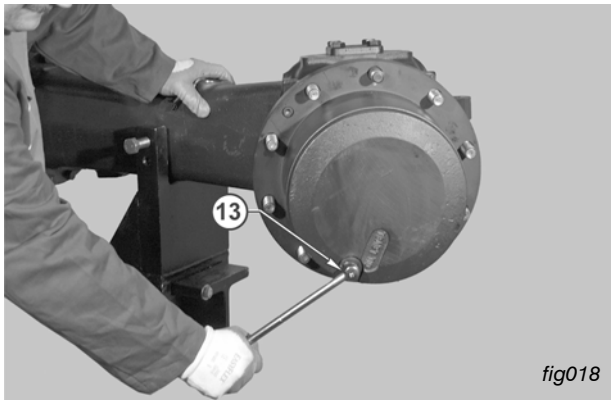
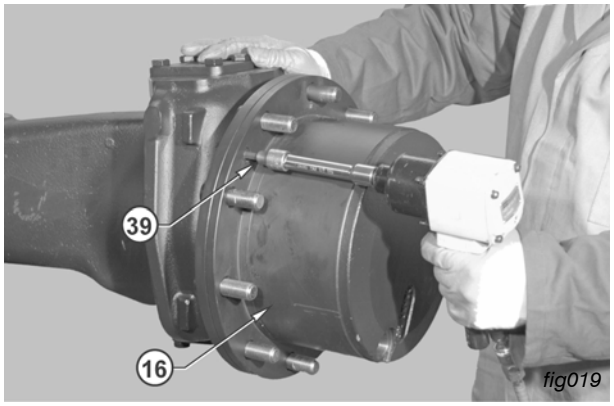


fig017

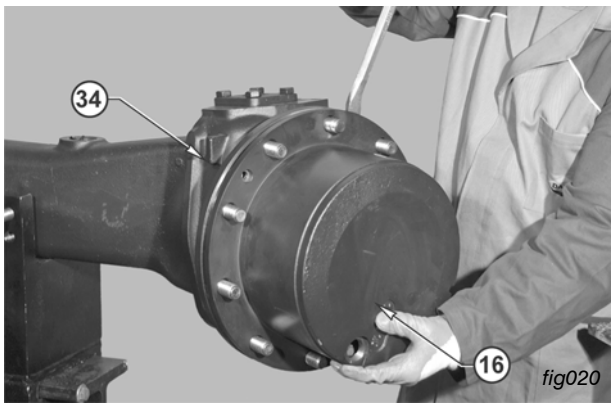
https://truckmanualshub.com/

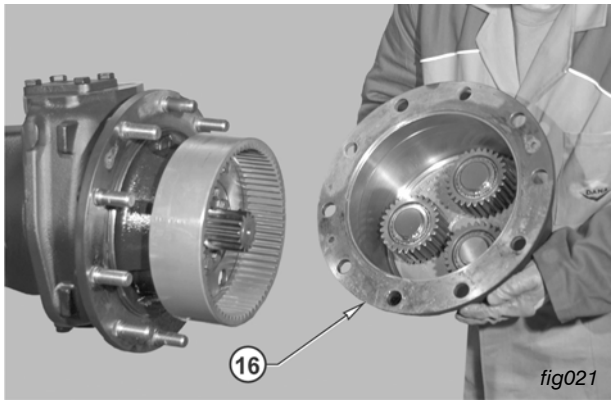


Turn the hub so that the oil draining/filling plug (1) is in the rear position. Remove the oil–level plug (13).



Unscrew two hexagonal socket head bolts (39) in recesses.

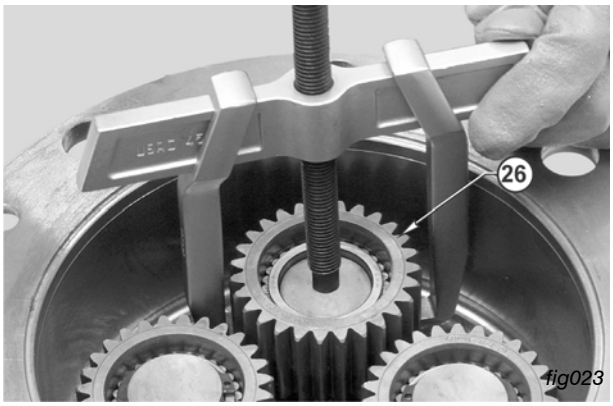




Tap with a soft mallet the planetary carrier/hub cover out and pry it out with two fitting levers.



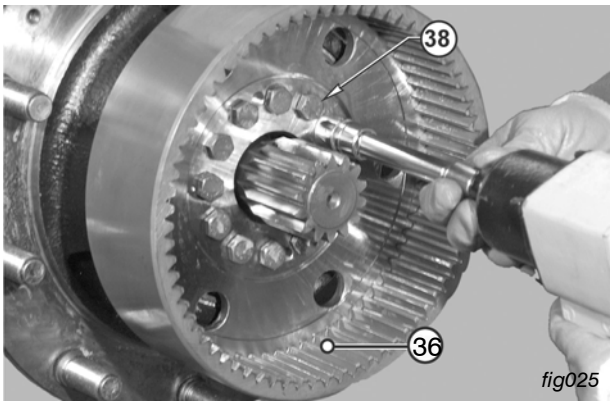
Remove the snap rings (28).



With the help of a puller, remove the planet gears (26).

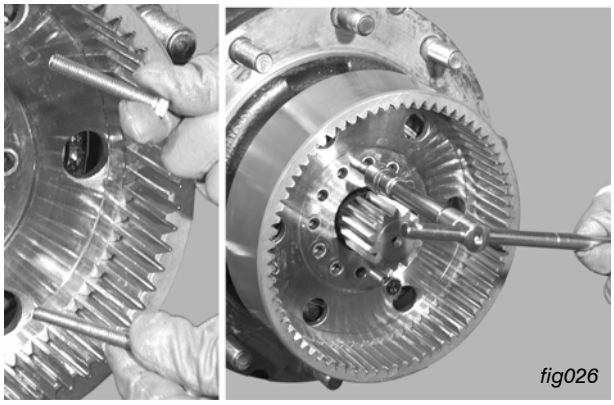


Remove the O–ring (30).

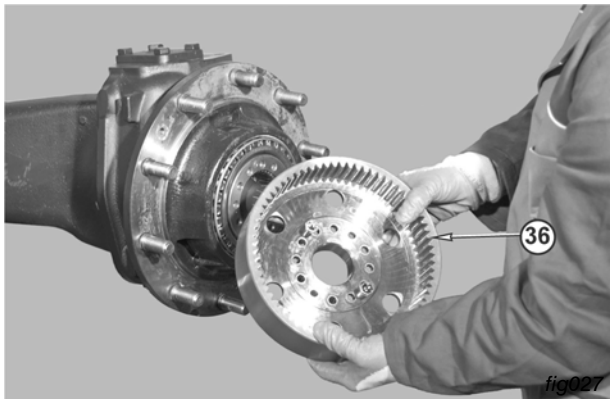


Remove the bolts (38) from the ring gear (36).

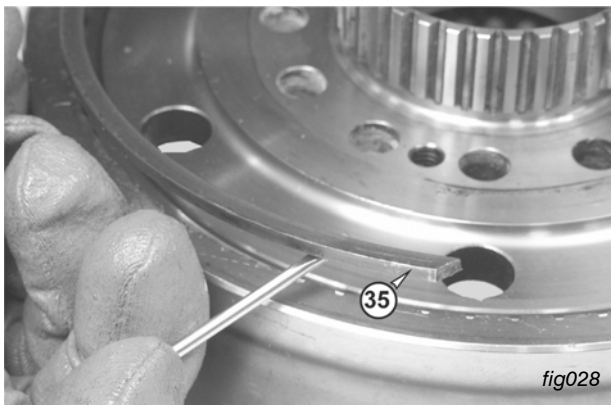
https://truckmanualshub.com/



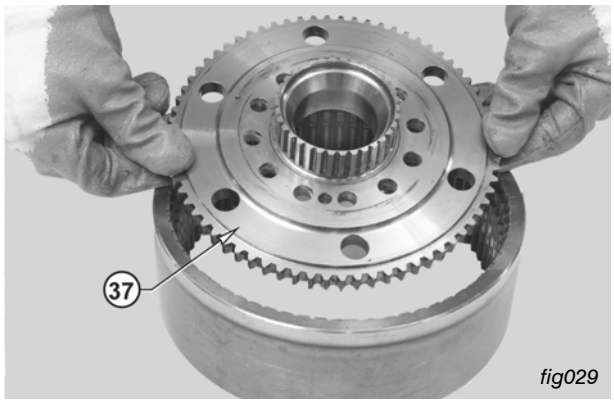
Use 2 screws **M8** to remove the ring gear.



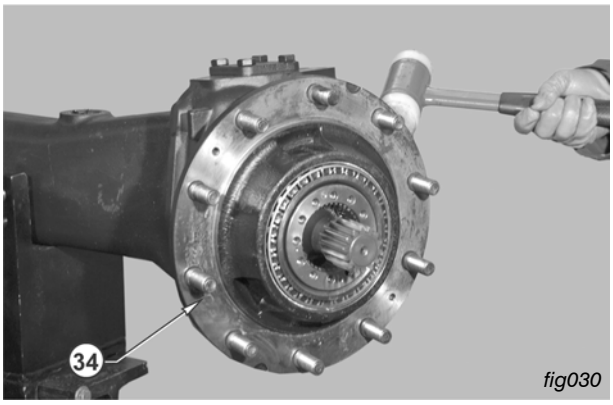
Remove the ring gear (36).



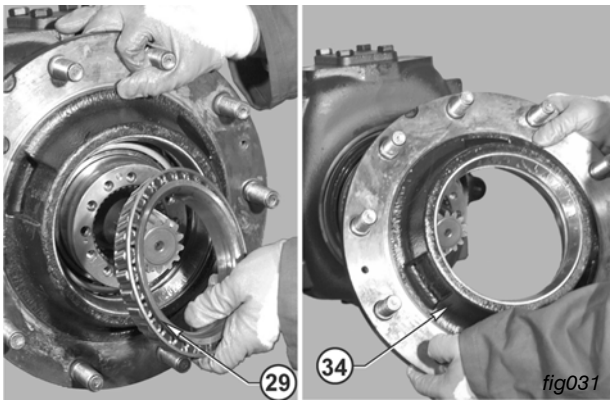
Remove the snap ring (35) from the ring gear (36).



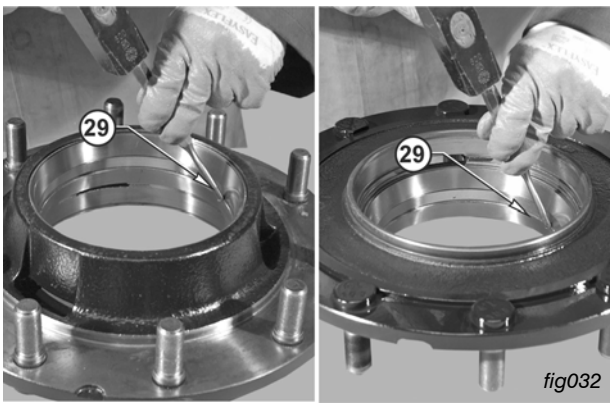
Remove the flange from the ring gear (37).



Remove the hub flange (34) with help of a plastic hammer.

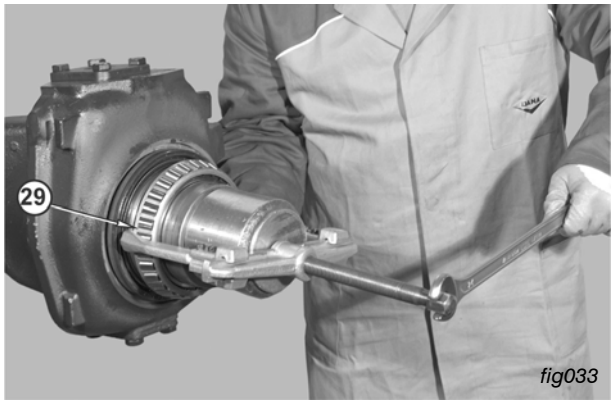


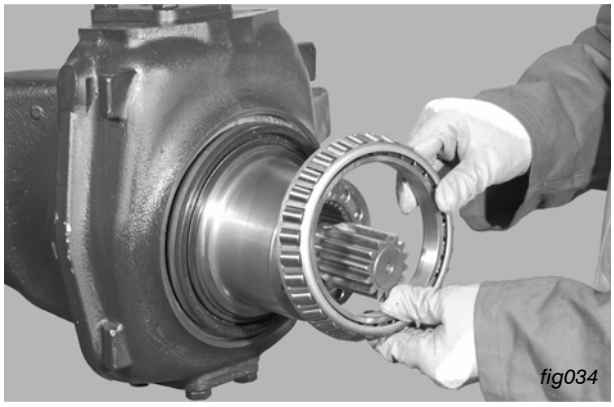
Remove the outer bearing (29) and the hub flange (34).



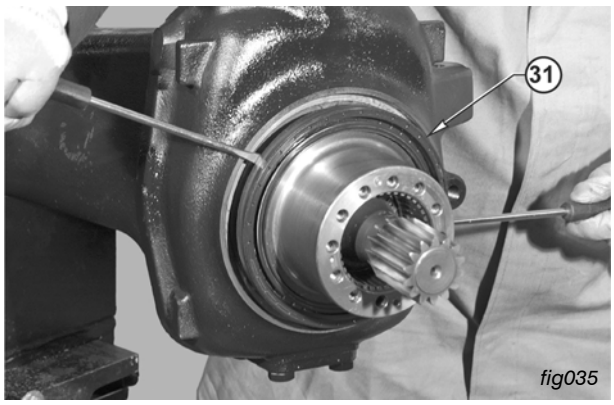
Remove the wheel bearing outer races (29).

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Remove the bearing (29).



Remove the cassette seal (31).

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Assembling the planetary reduction

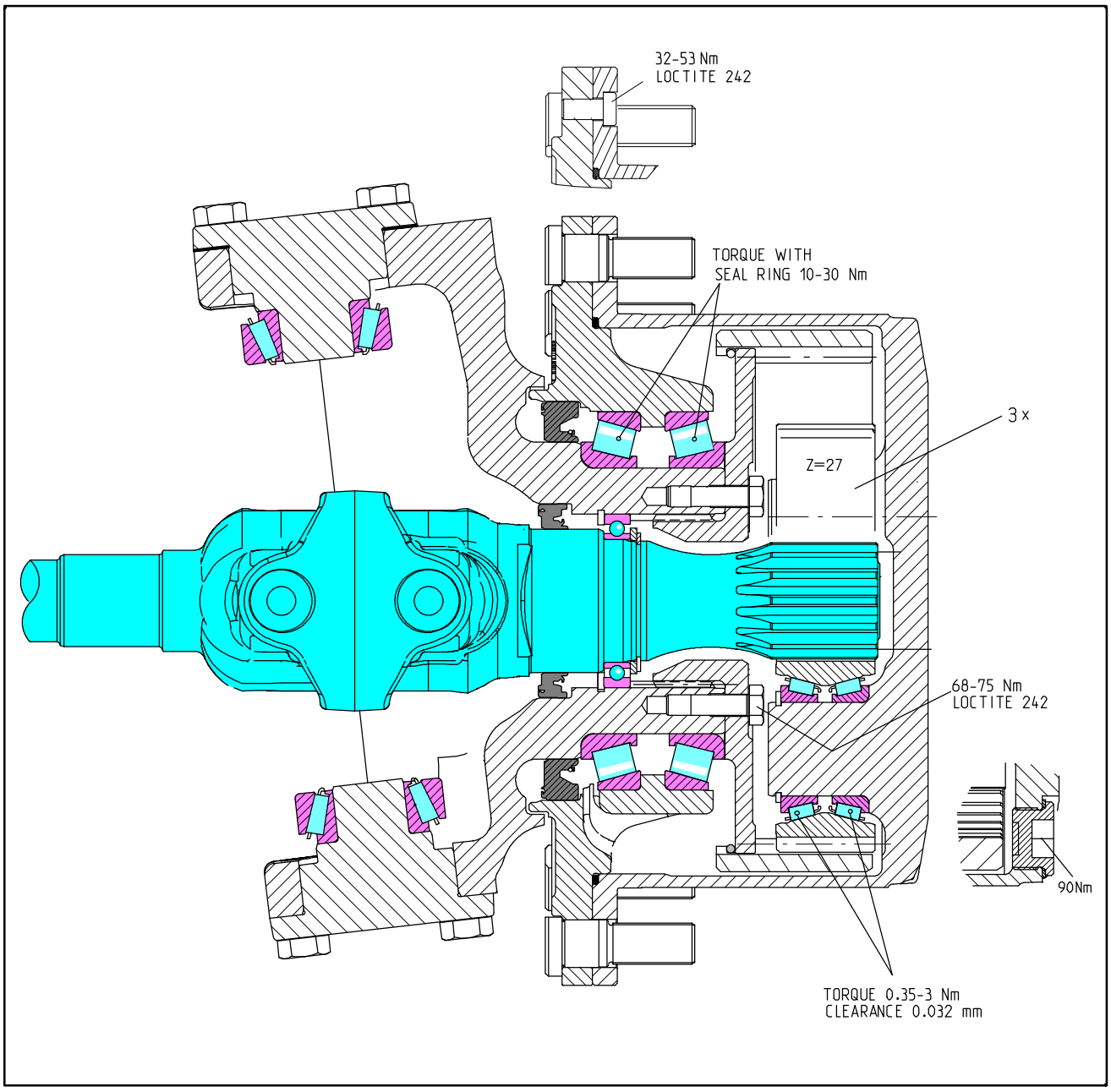


fig036

https://truckmanualshub.com/

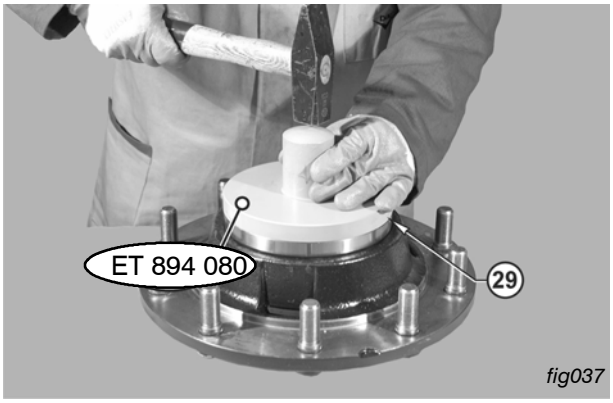


fig037

Fit the bearing outer race (29) with plate **ET 894 080**.

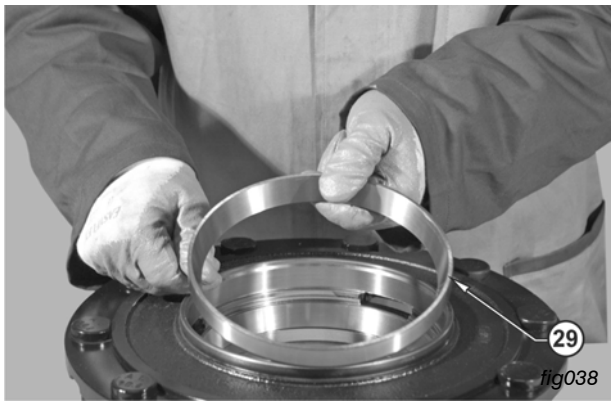


fig038



fig039

Fit the bearing outer race (29) with plate **ET 894 080**.



fig040

Grease the inner wheel bearing (29) and fit it into place.

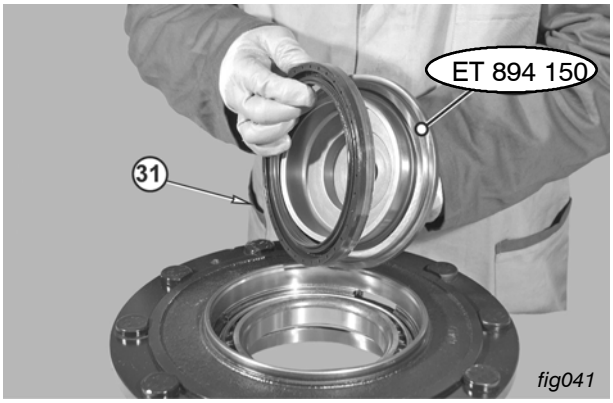


fig041



fig042

Fit a new cassette seal (31) with plate **ET 894 150**. Grease the seal lips.

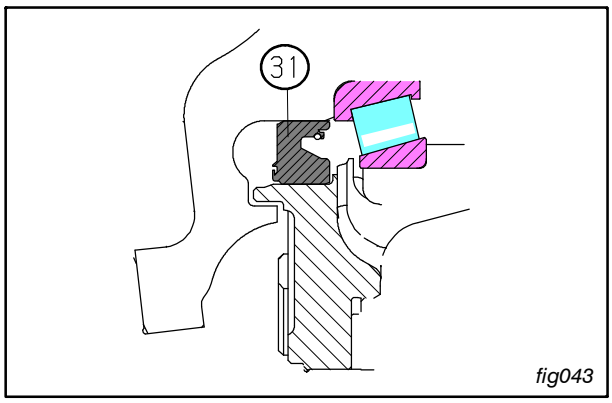
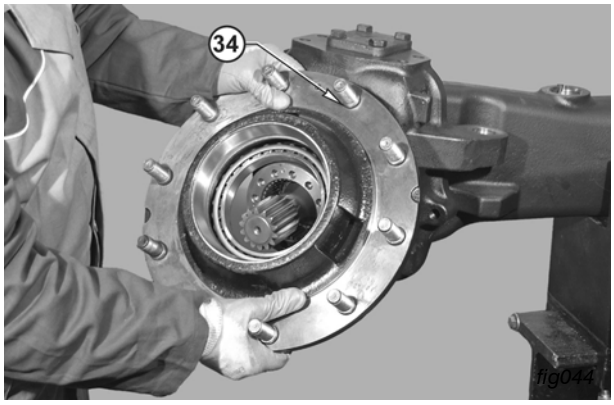
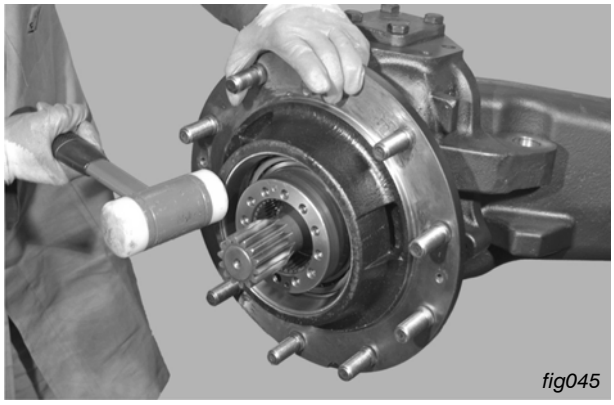


fig043

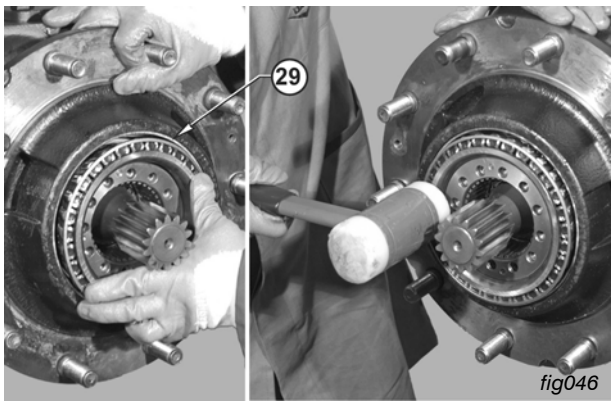
Ensure, that the cassette seal (31) is fitted according to picture.

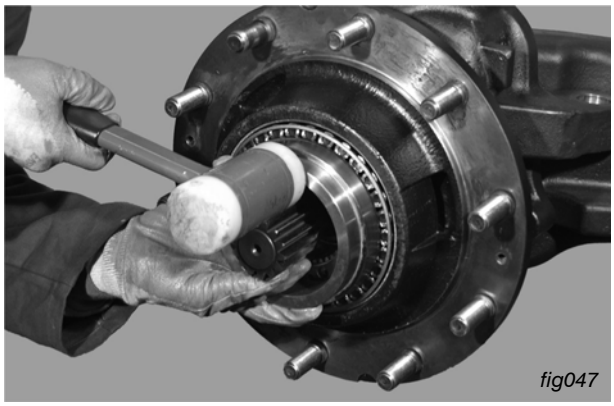
https://truckmanualshub.com/



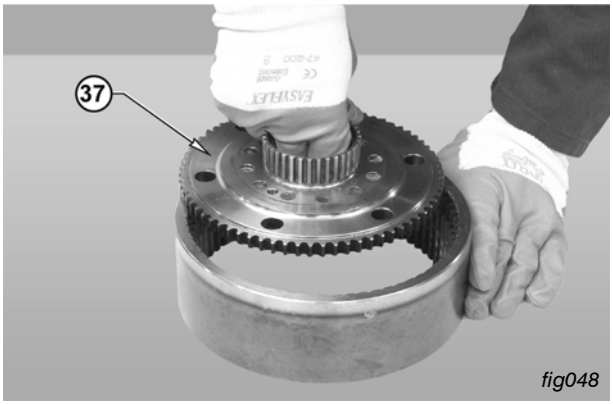


Fitt the hub flange into place (34).

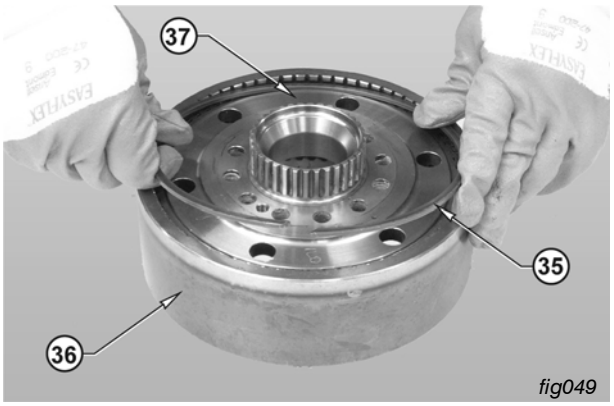


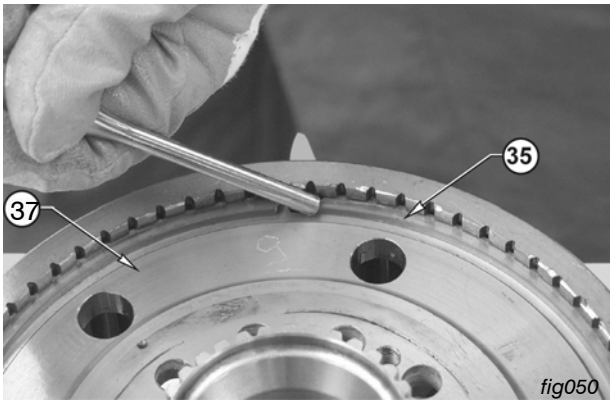


Grease the outer wheel bearing (29) and fit it into place.

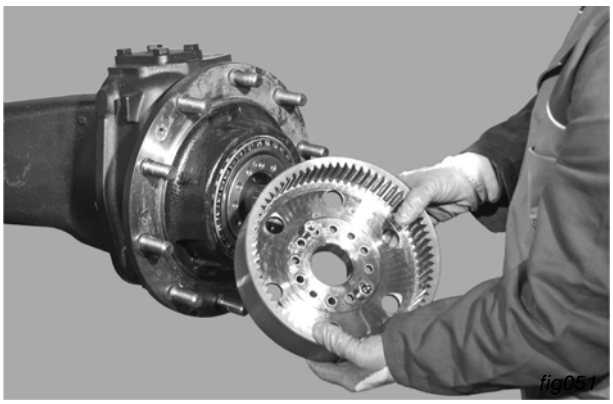


Fit the flange (37) into place.





Fit the snap ring (35). Ensure, that the snap ring is in groove.



Fit the assembled ring gear into place.

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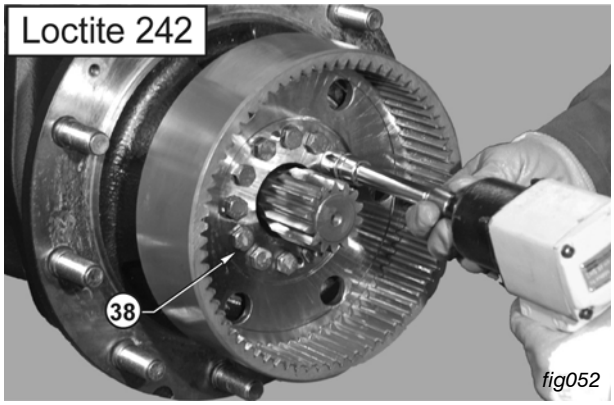


fig052

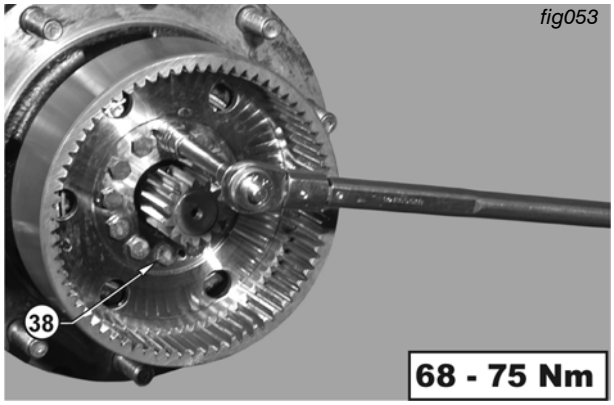


fig053

Apply **Loctite 242** on the bolts (38) and tighten the bolts. Tightening torques: **65 – 75 Nm**.

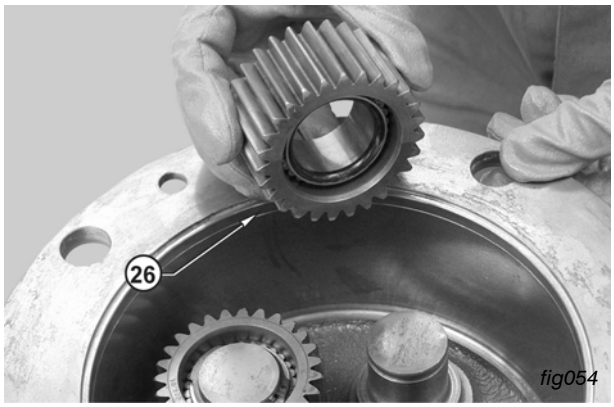


fig054



fig055

Fit the planet gears (26) onto the planetary carrier. Fit the snap rings (28).

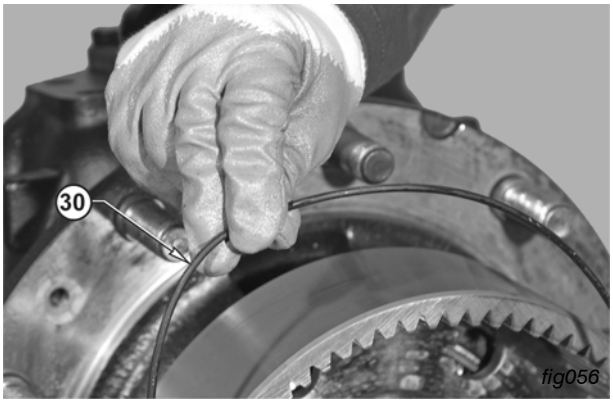


fig056

Fit new O–ring.

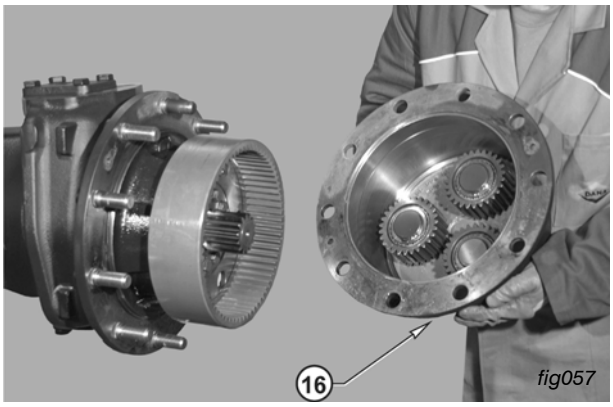


fig057

Fit the planetary carrier (16) into place.

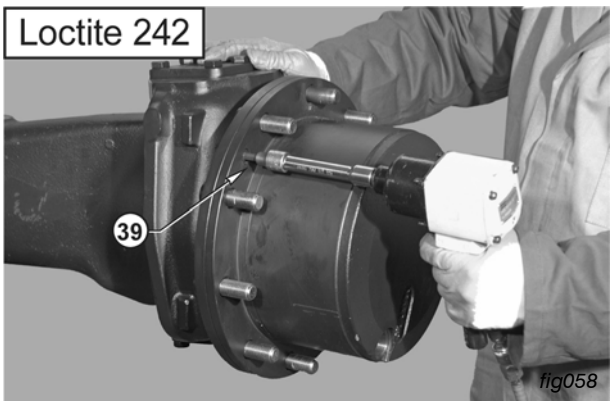


fig058

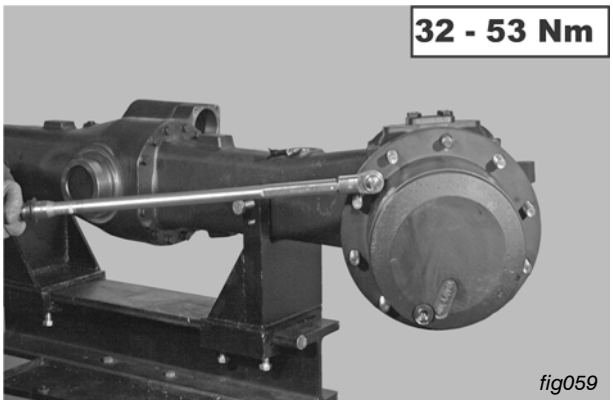


fig059

Apply **Loctite 242** on the bolts (39) and tighten the bolts. Tightening torques: **32 – 53 Nm**.

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Disassembling the sensor

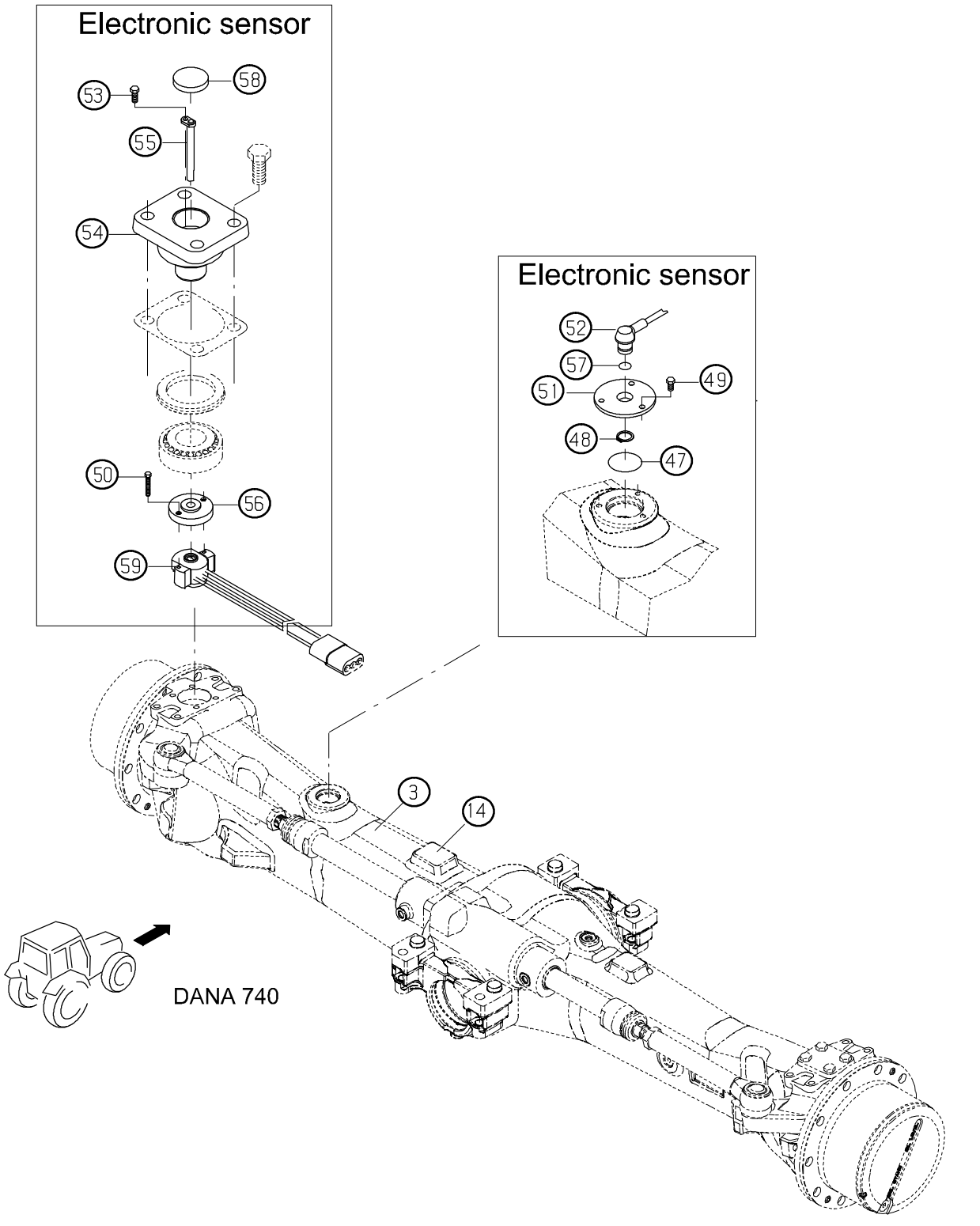
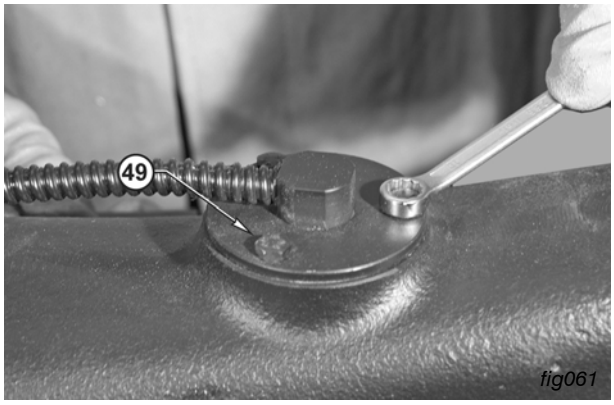


fig060

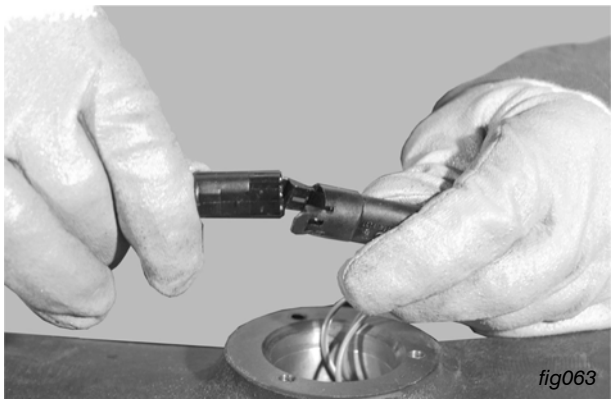
https://truckmanualshub.com/



Remove the screws (49).

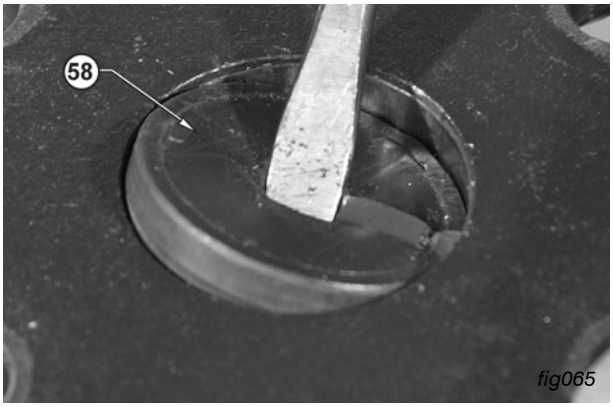


Remove the sensor (51).

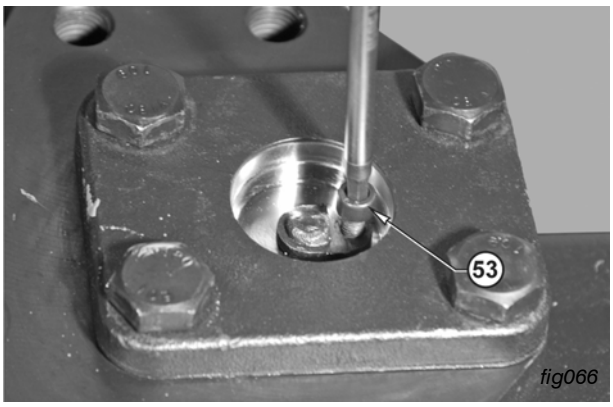


Disconnect the connector of the sensor.

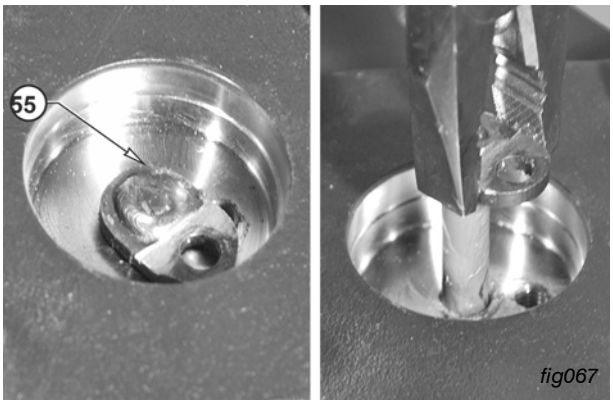




Remove the plug (58).

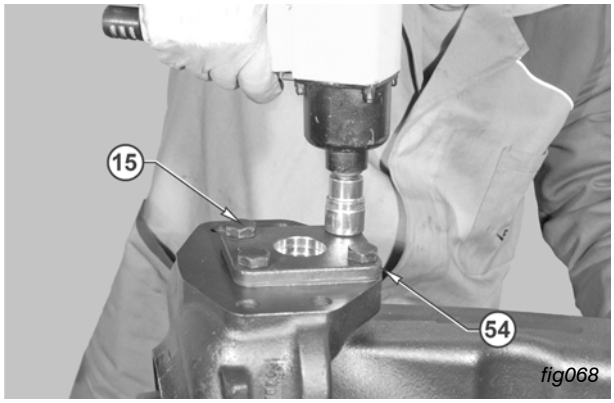


Remove the screw (53).

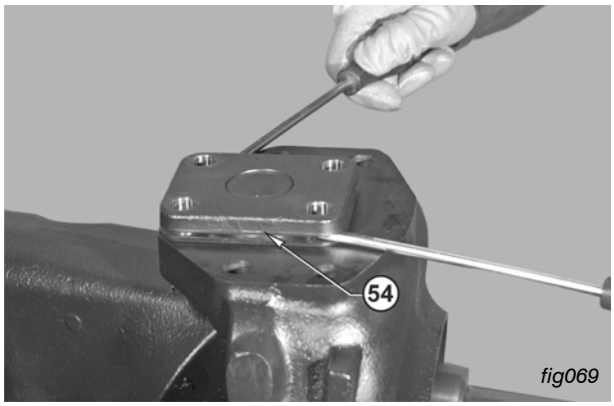


Remove the sensor pin (55).

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Remove fastening bolts of the king pins (15).



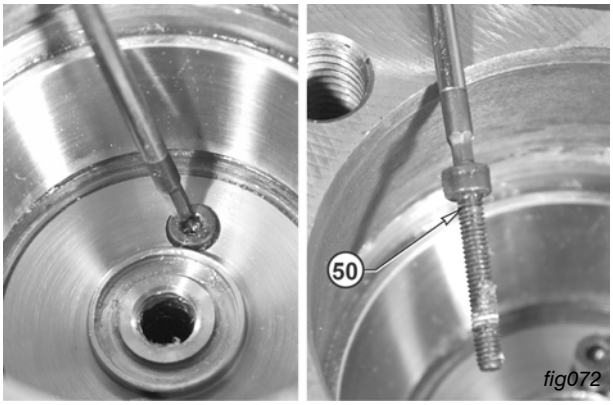
Remove the upper king pin (54).



Remove the upper king pin (17).



Remove the O–ring.

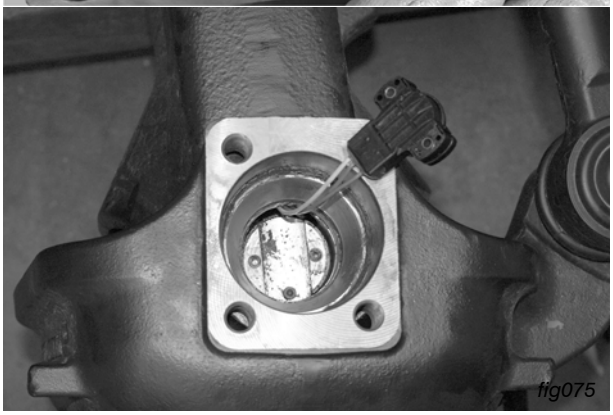


Remove the screws (50).



Remove the plate of the sensor.

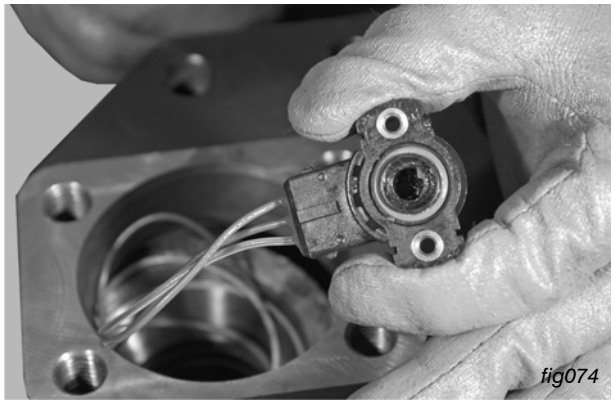


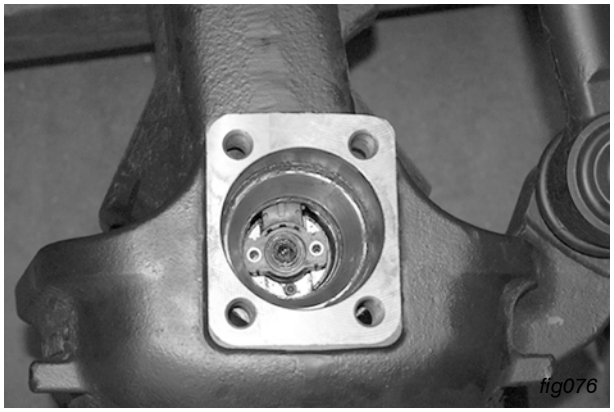


Remove the sensor (59).

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Assembling the sensor

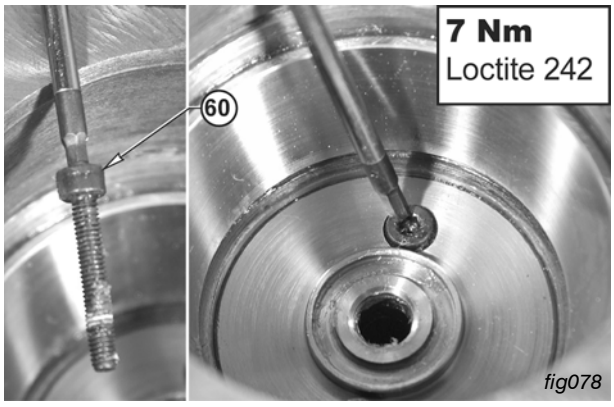




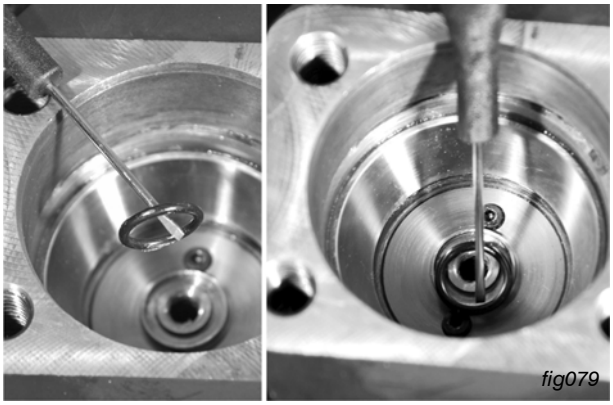
Fit the sensor (59).



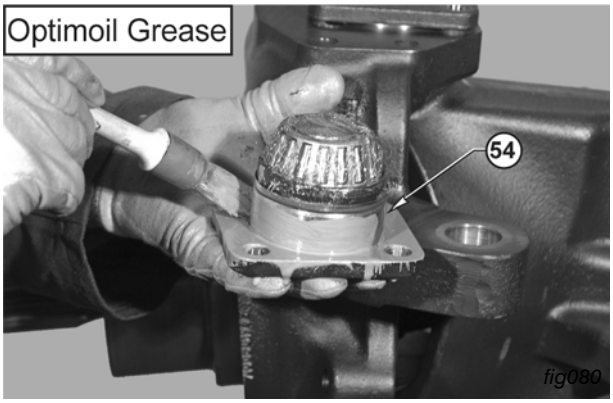
Fit the plate onto the sensor.



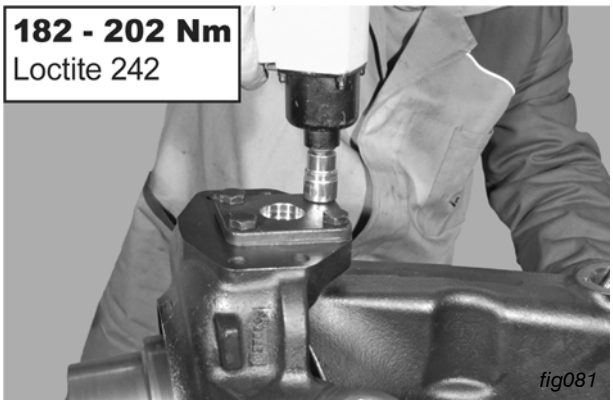
Apply Loctite **242** on the screws (50) and tighten the screws. Tightening torque: **7 Nm**.
Ensure that the plate and the sensor are straight during installation.



Fit the new O–ring

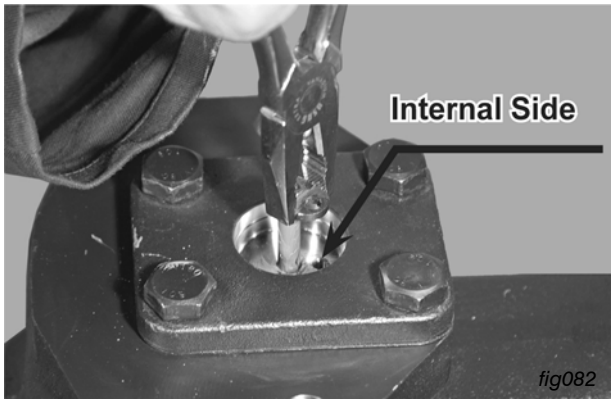


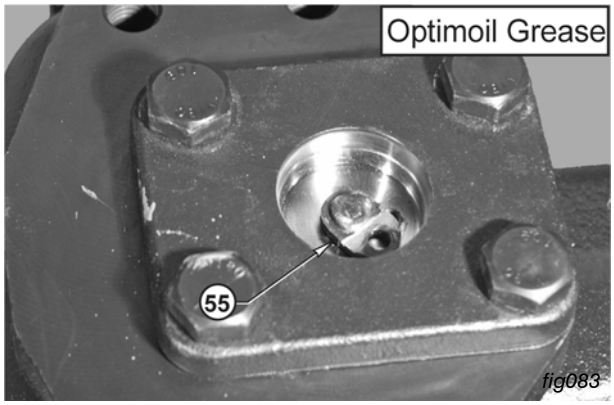
Grease the surface of the king pin (54) and the bearing.



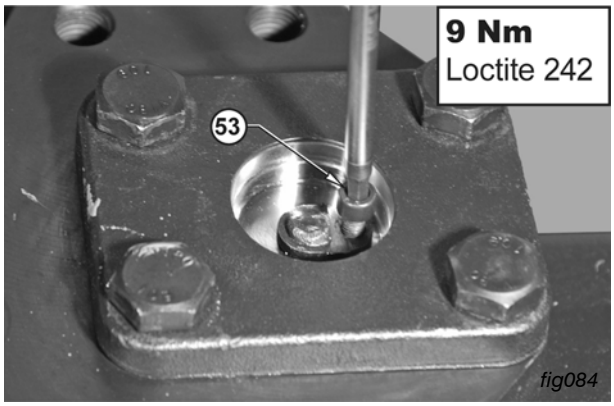
Tighten fastening bolts of the king pin. Tightening torques: **182 – 202 Nm**.

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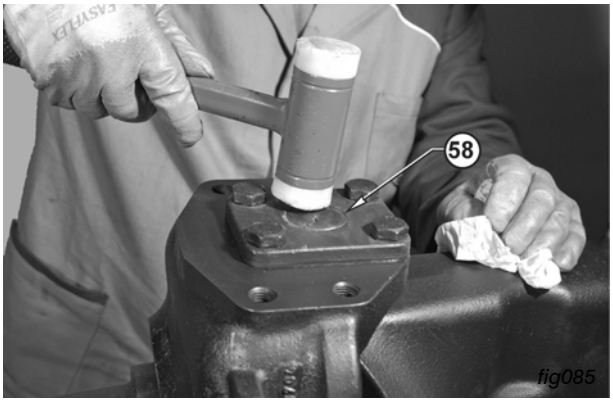




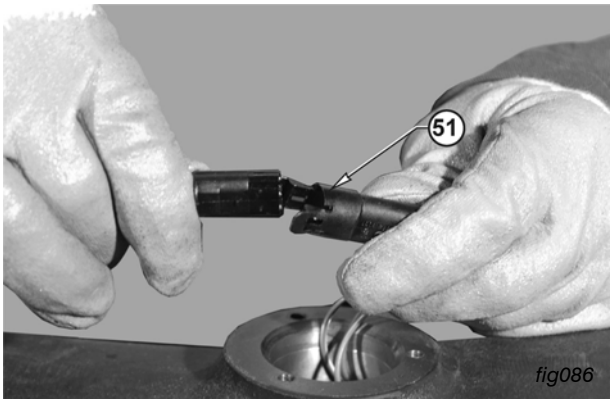
Grease and fit the sensor pin (55).



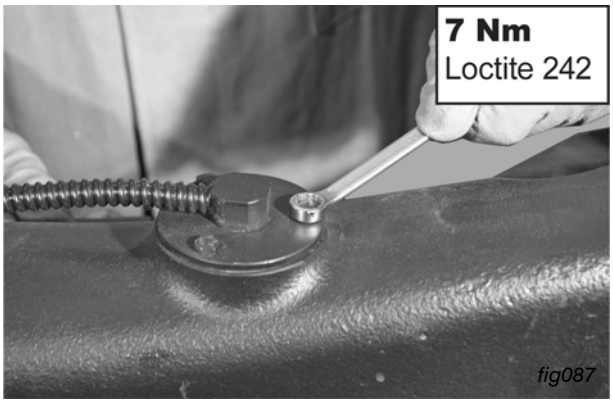
Apply Loctite **242** on the screw (53) and tighten the screw. Tightening torque: **9 Nm**.



Fit the plug (58) into place.



Connect the connector of the sensor (51).



Apply Loctite **242** on the screws (49) and tighten the screws. Tightening torque: **7 Nm**.

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Removing of the knuckle housing

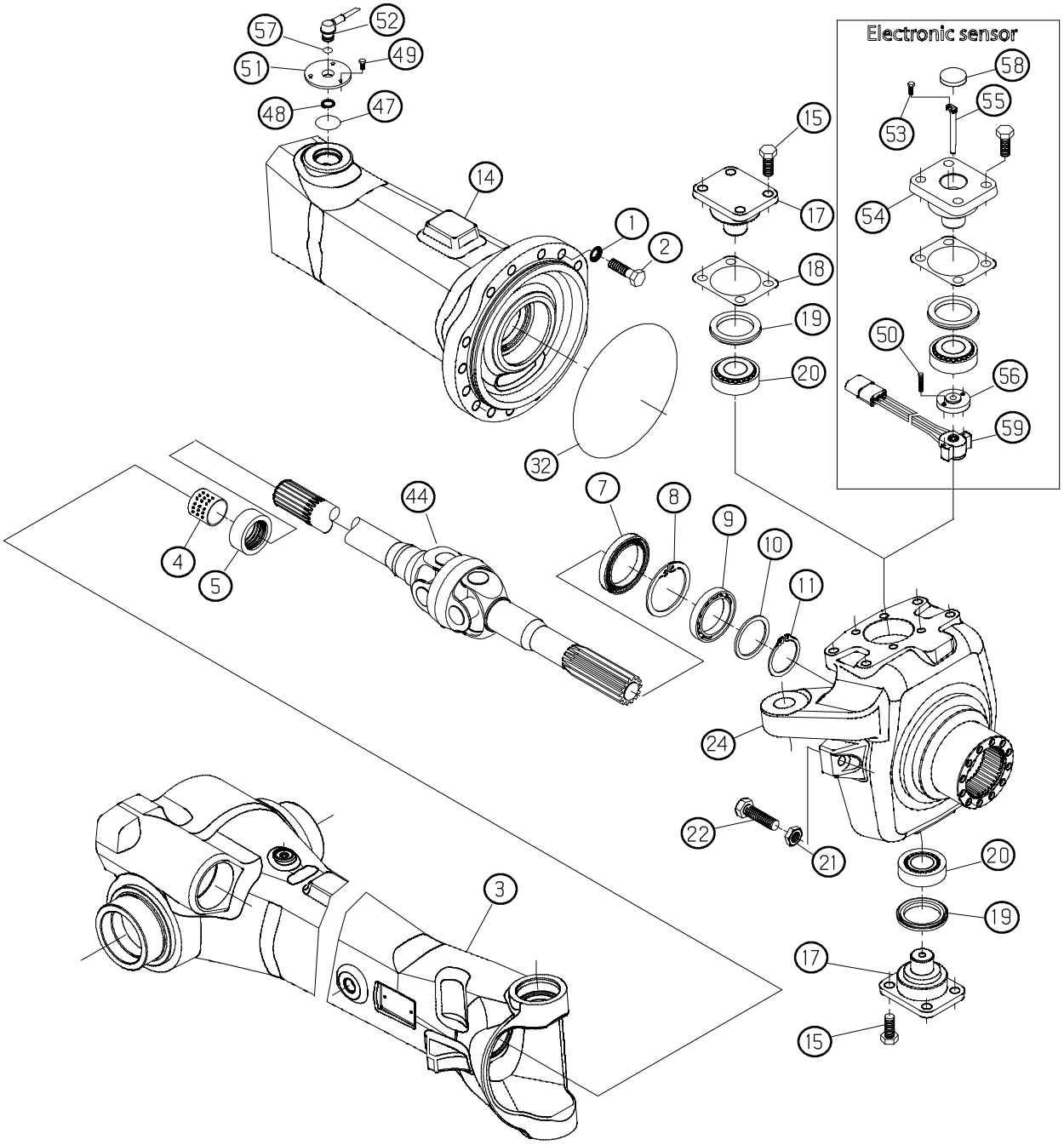
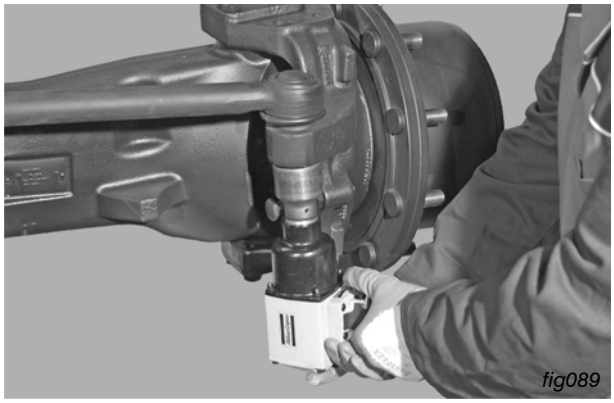
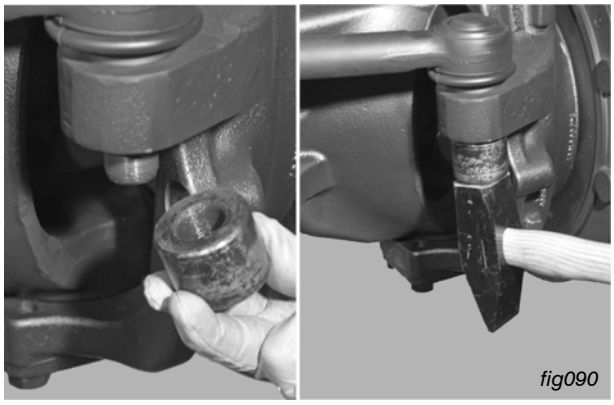


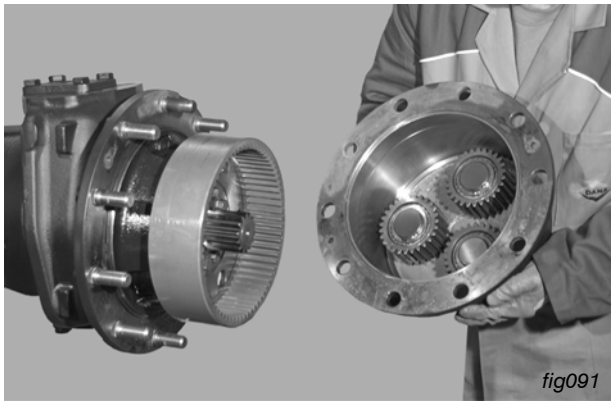
fig088

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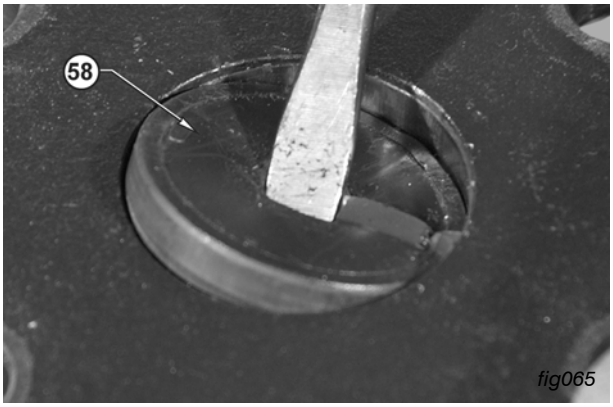


Disconnect the cone joint of the tie rod.

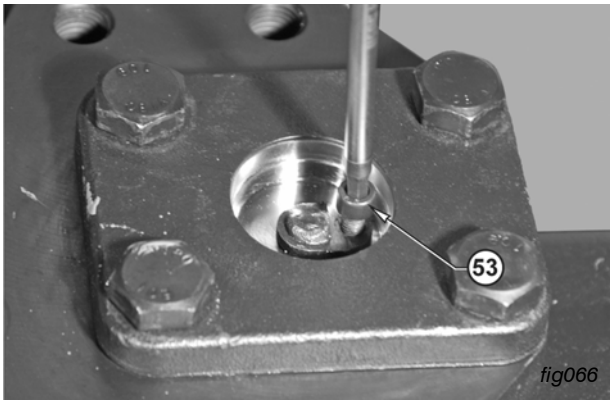


Disassemble the planetary carrier/hub cover.

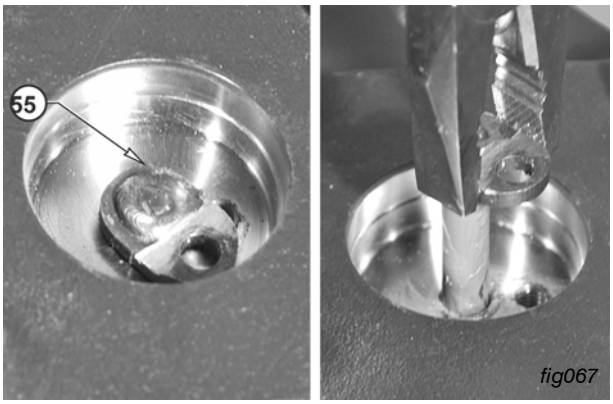




Remove the plug (58).

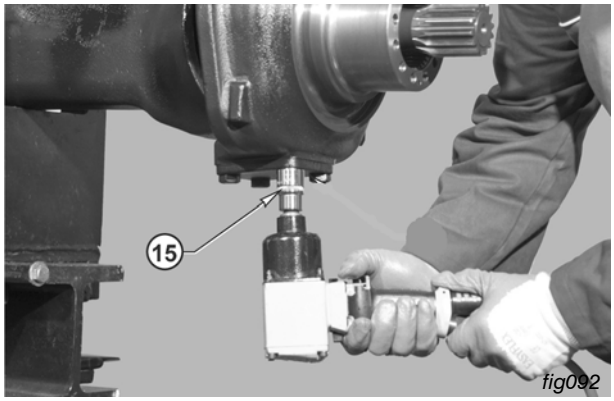


Remove the screw (53).



Remove the sensor pin (55).

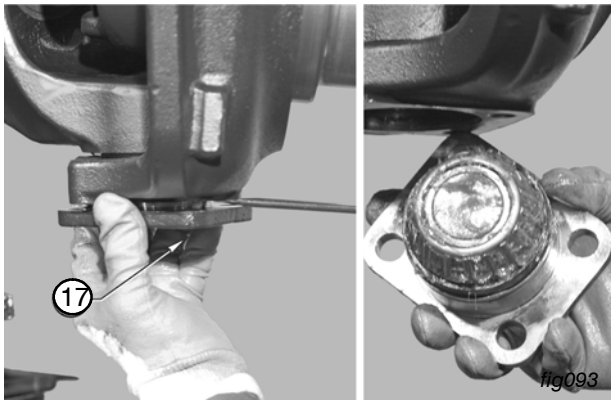
https://truckmanualshub.com/



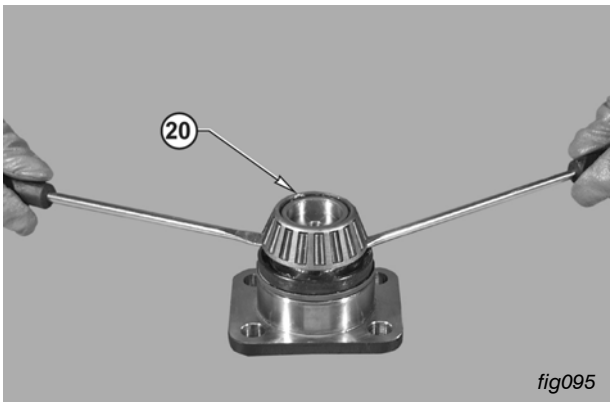
Remove fastening bolts of the king pins (15).



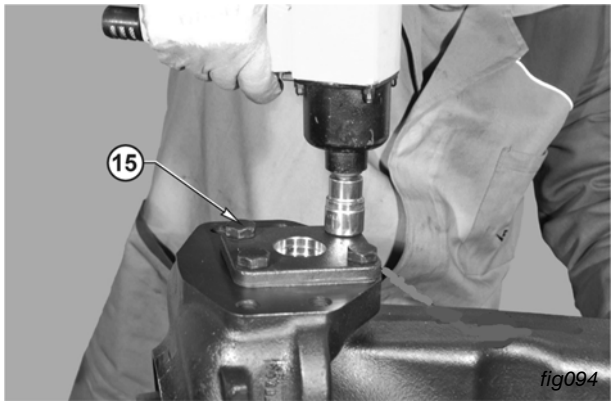
Remove the upper king pin (54).



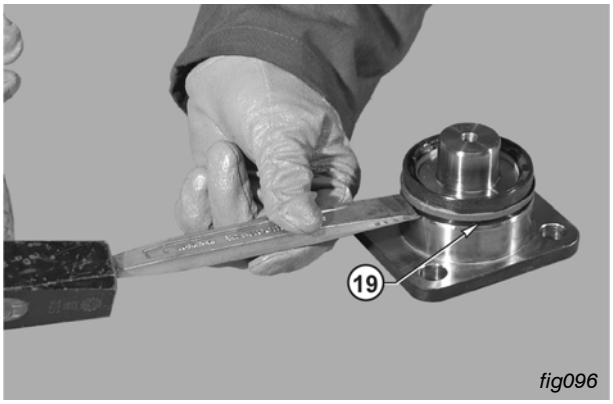
Remove the lower king pin (17).



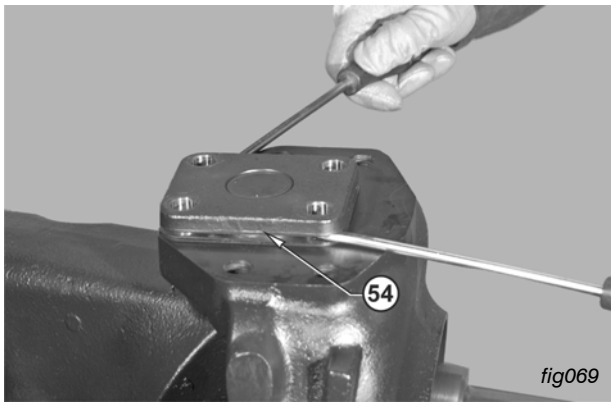
Remove the bearing (20).

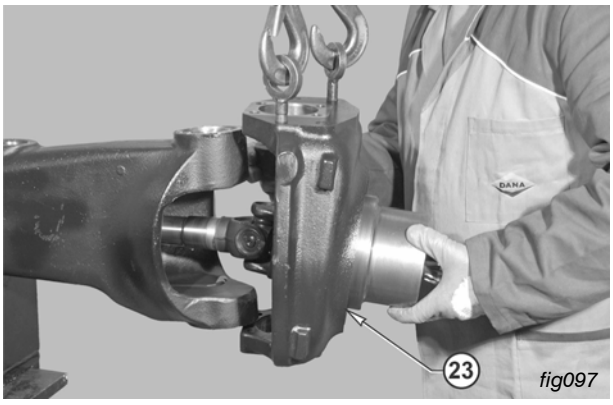


Remove fastening bolts of the king pins (15).



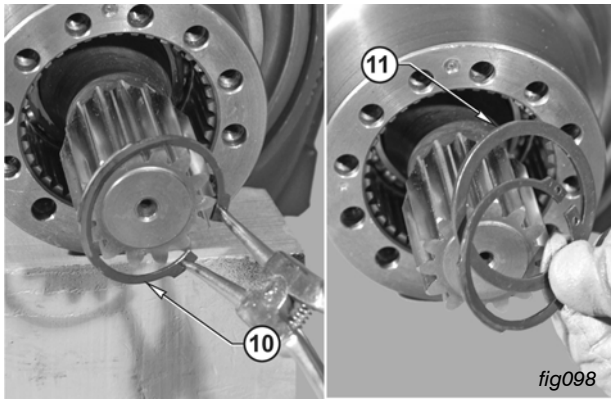
Remove the ring sealing (19).



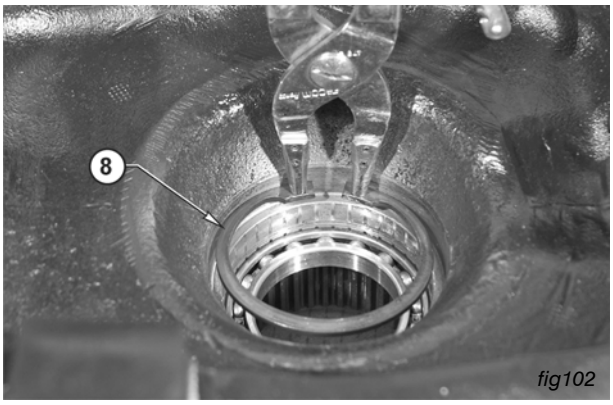


Remove the hub flange (23).

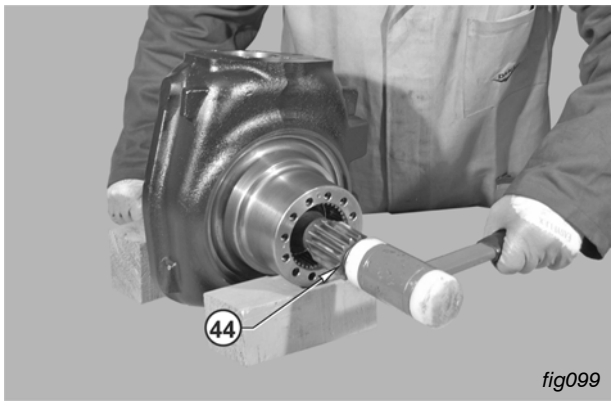
https://truckmanualshub.com/



Remove the snap ring (10) and the shim (11).



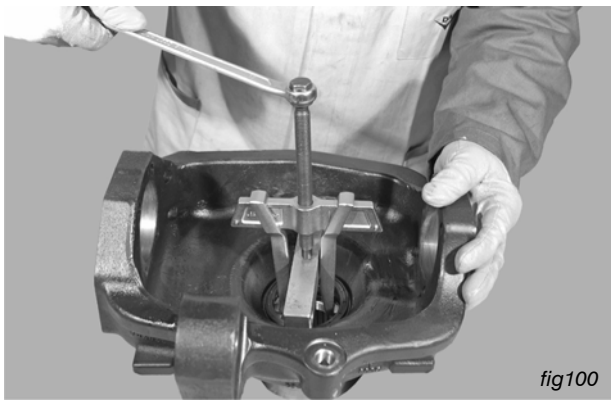
Remove the snap ring (8).

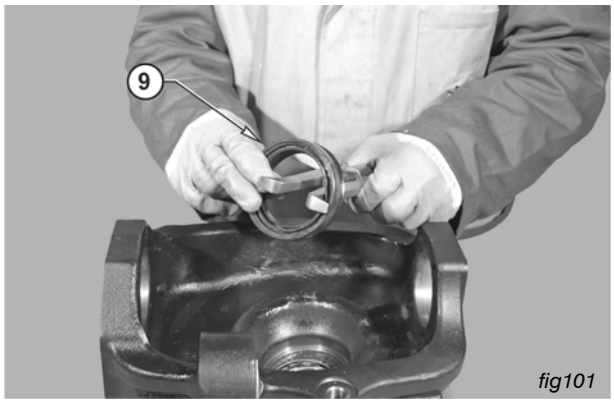


Remove the drive shaft (44). When fitting use plastic hammer.

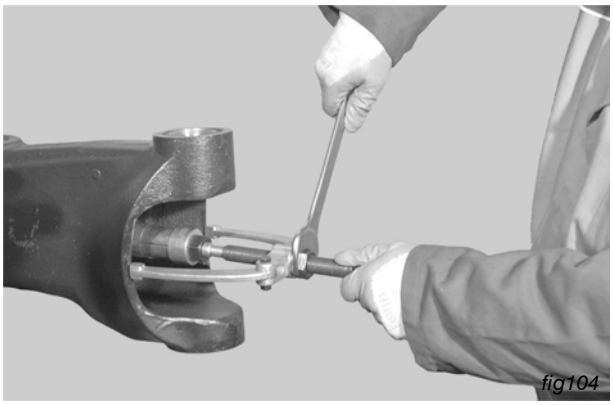


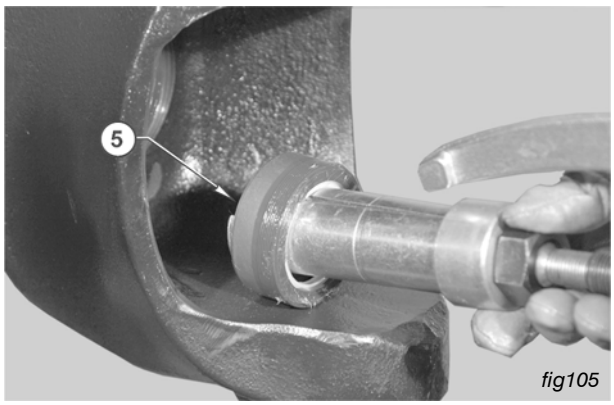
Remove the bearing (9).





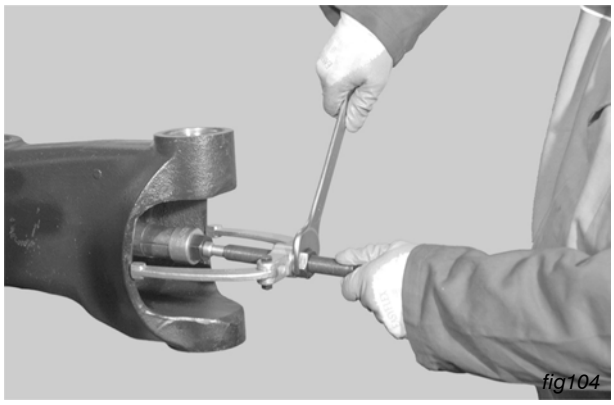
Remove the oil seal (9) with a puller.





Remove the oil seal (5) with a puller.

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fig104

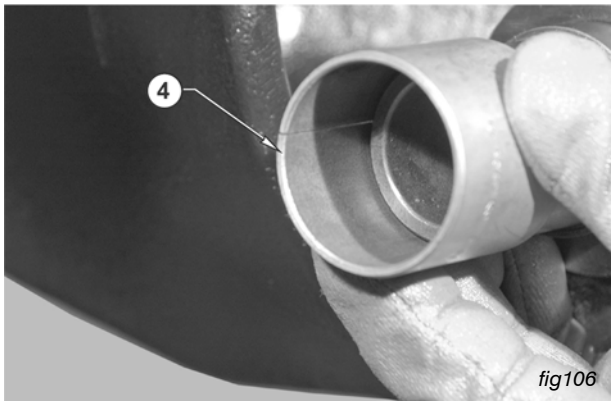


fig106

Remove the bushing (4) with a puller.

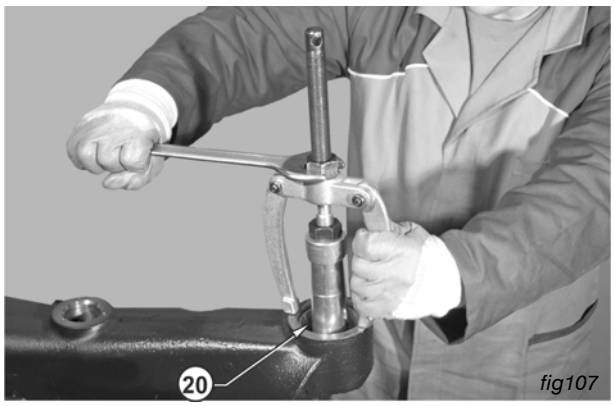


fig107

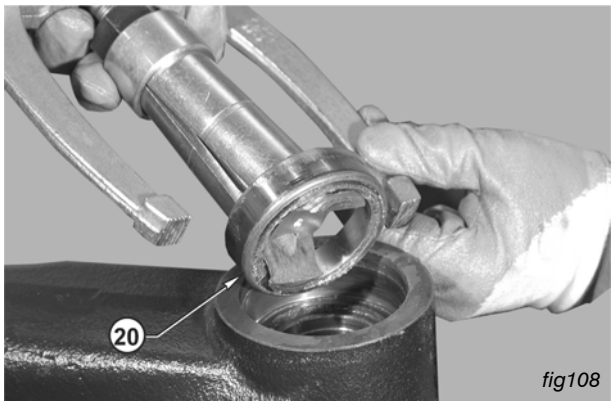


fig108

Remove the bearing outer race (20) with a puller.

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Assembling the knuckle housing

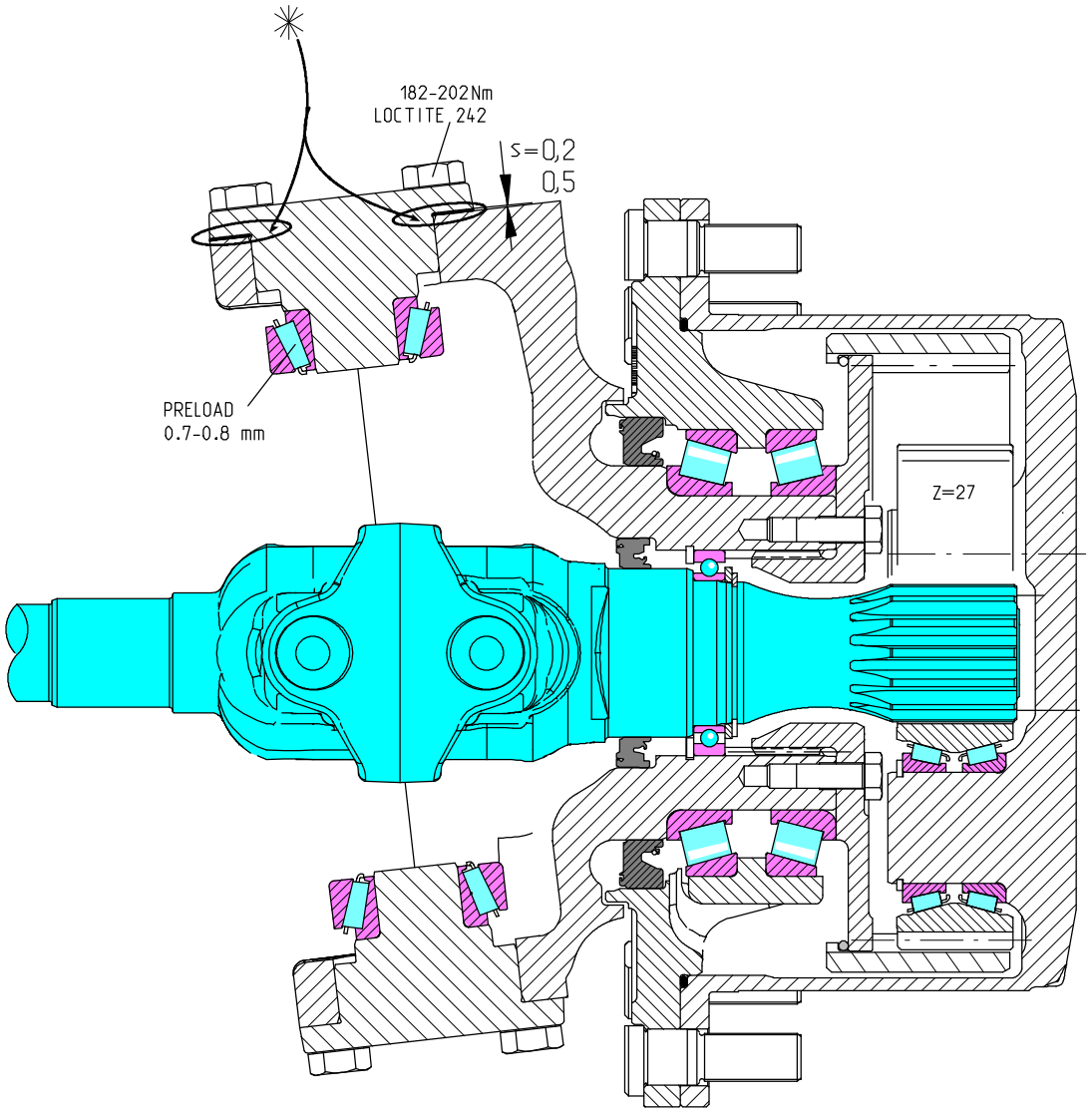


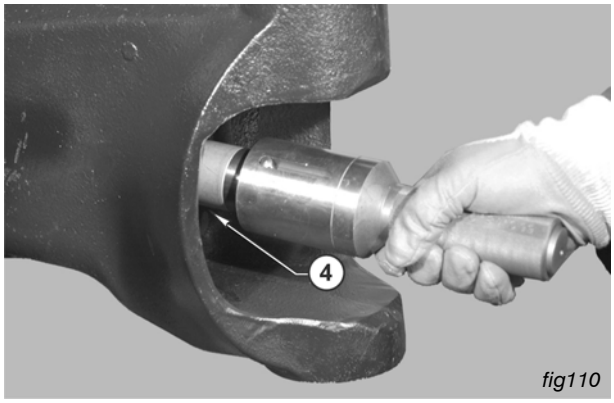
fig109

✳ **Press fit of the king pin**
standard value (not loose) = 0,7 – 0,8 mm

Example:
Shim of the measurement = 1,5 mm
Measured Backlash = 0,5 mm
The fitted shim = S

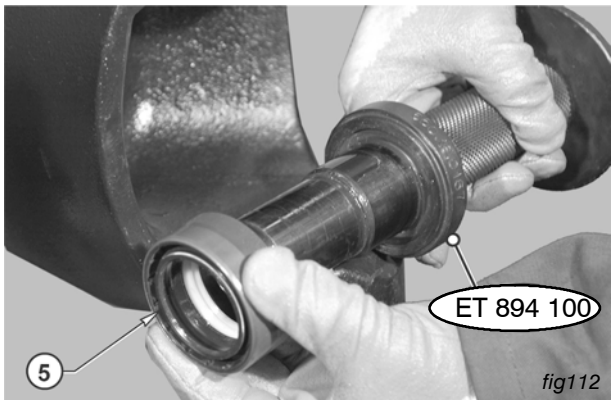
S = Shim (1,5 mm) – Measured Backlash – Press fit of the king pin
S = 1,5 mm – 0,5 mm – 0,7 mm
S = 0,3 mm

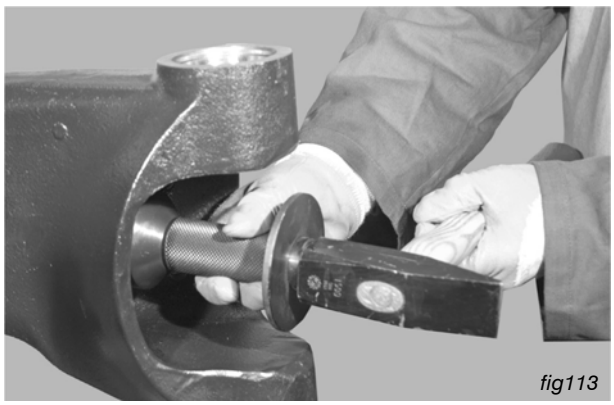
https://truckmanualshub.com/



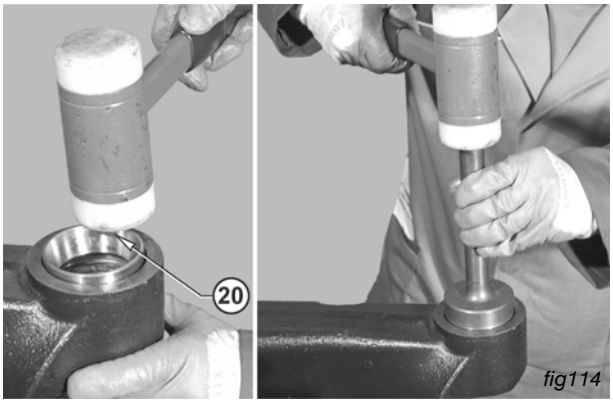


Lubricate the bushing (4) and fit the bushing into place with tool **ET 894 040**.

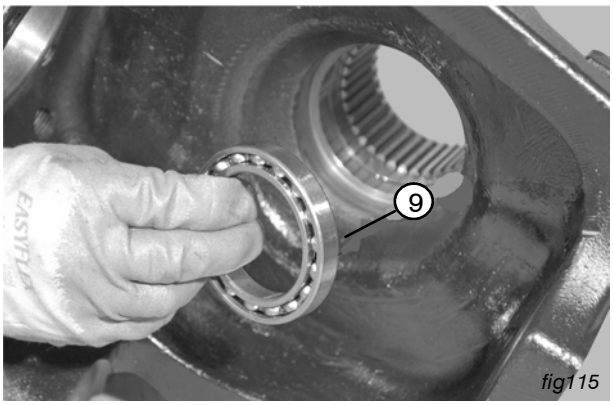




Fit a new seal (5) with plate **ET 894 100**. Grease the seal lips.



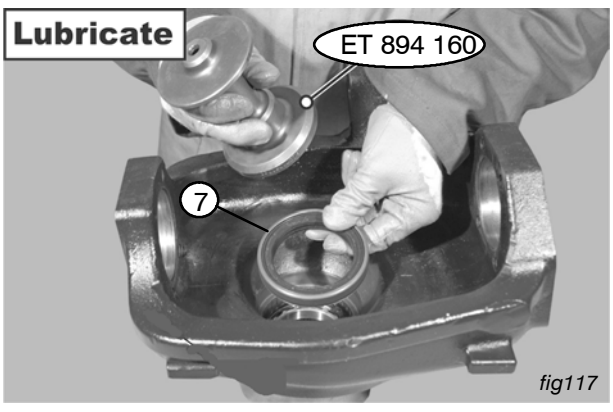
Fit the upper bearing outer race (20) into place.



Fit the bearing (9).

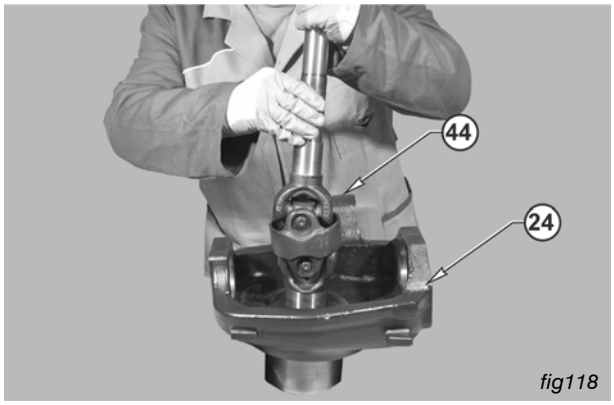


Fit the snap ring (8). Ensure, that the snap ring is in groove.

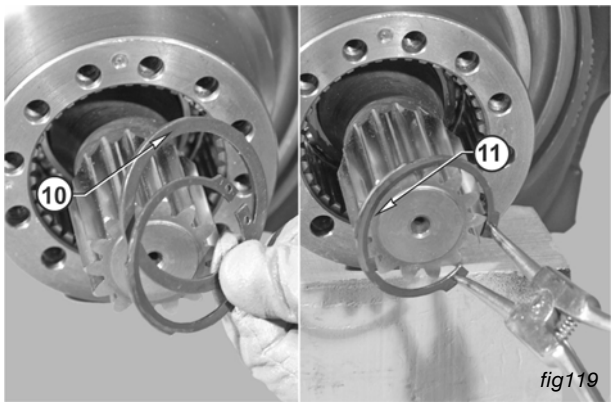


Fit a new seal (7) with plate **ET 894 160**. Grease the seal lips.

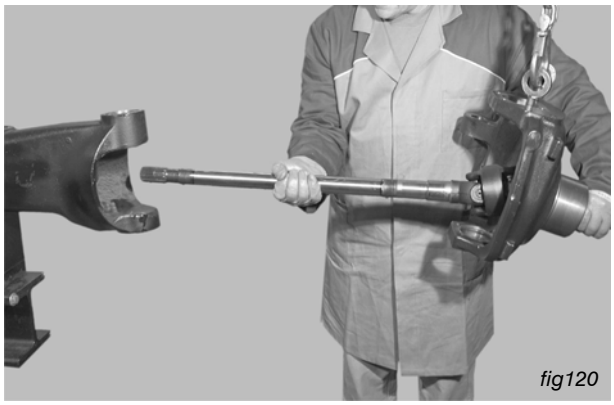
https://truckmanualshub.com/



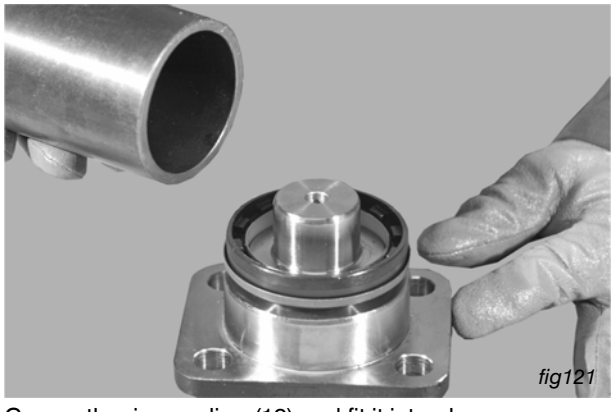
Fit the drive shaft (44) into place.



Install the shim (10) and the snap ring (11).



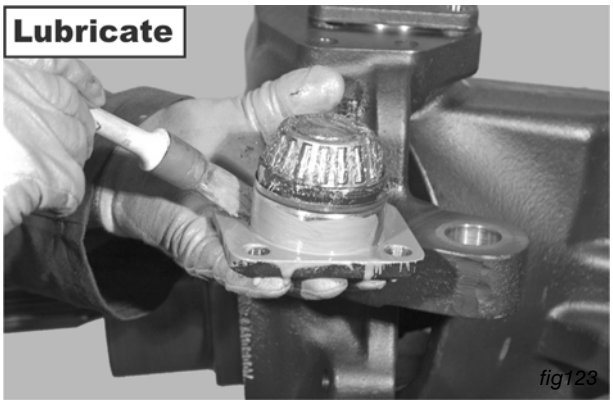
Fit the hub flange into place. Do not damage the seal on the drive shaft.



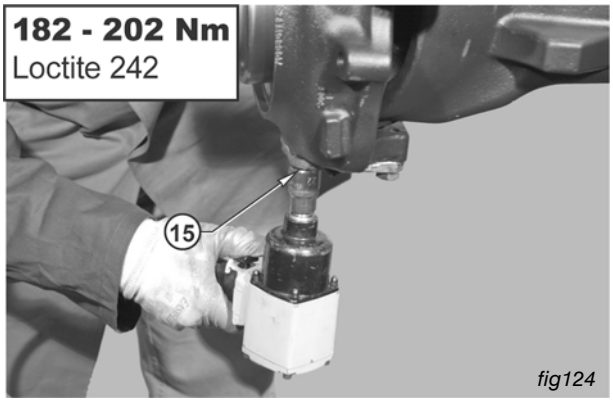
Grease the ring sealing (19) and fit it into place.



Fit the bearing (20).



Grease the surface of the lower king pin and the bearing (20).



Tighten fastening bolts of the king pins (15). Tightening torques: **182 – 202 Nm**.

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The measurement of the king pin shim

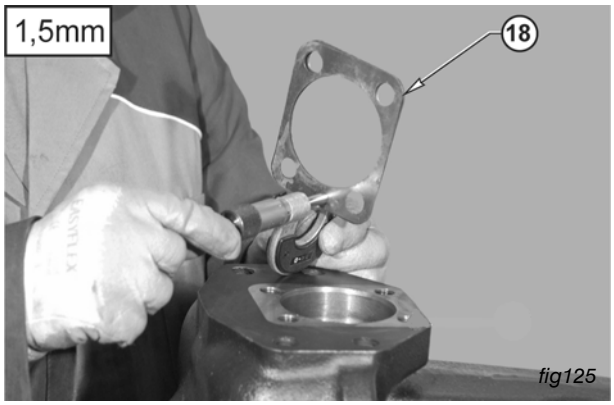
Use an extra shim of **3 mm** must be use during the measurement.

Calculate the number of shims required (**measurement S**), taking into account the fact that the bearings are press fit by **0,7–0,8 mm**.

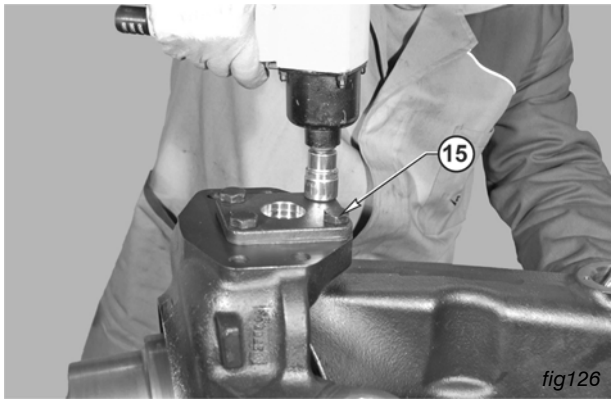
Press fit of the king pin
standard value (not loose) = 0,7 – 0,8 mm

Example:
Shim of the measurement = 1,5 mm
Measured Backlash = 0,5 mm
The fitted shim = S

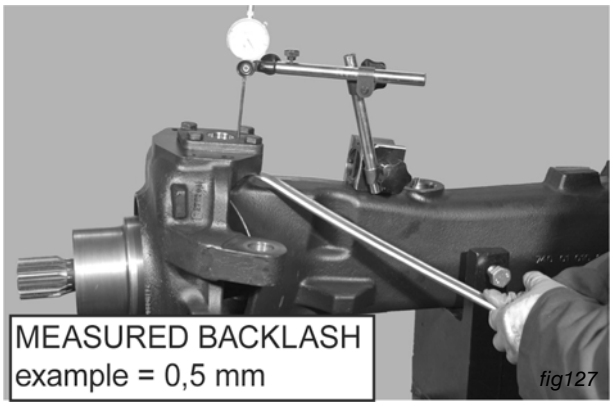
S = Shim (1,5 mm) – Measured Backlash – Press fit of the king pin
S = 1,5 mm – 0,5 mm – 0,7 mm
S = 0,3 mm



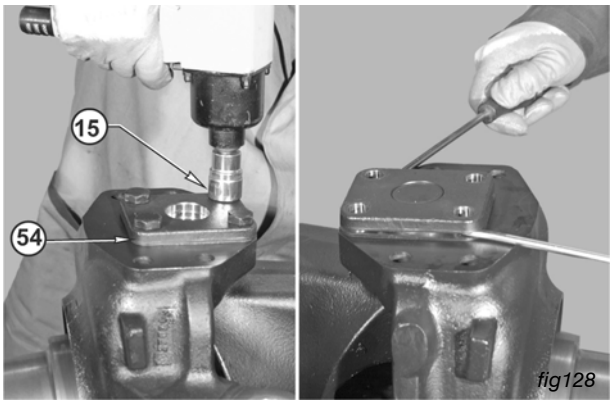
Fit the shim of the measurement (**1,5 mm**) into place.



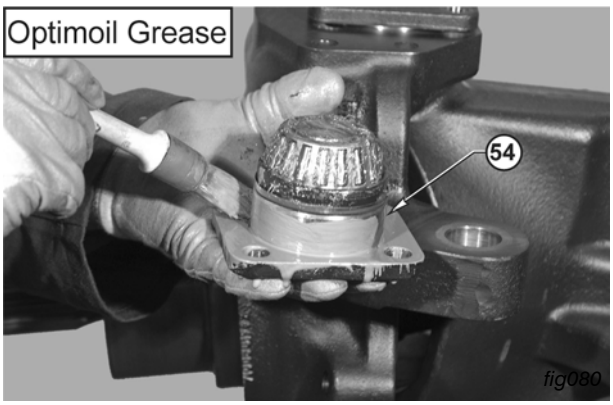
Tighten fastening bolts of the king pin (15).



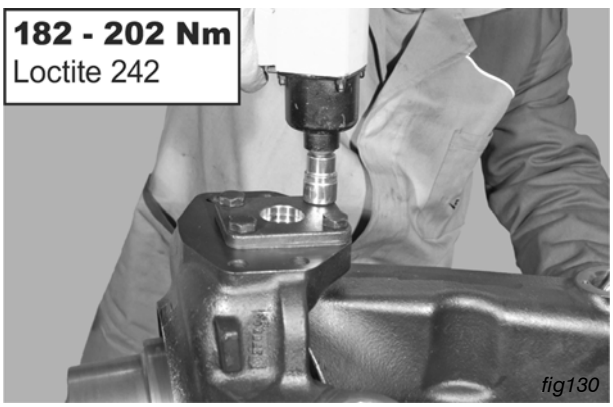
Measure the end float (measured Backlash).



Remove fastening bolts (15).

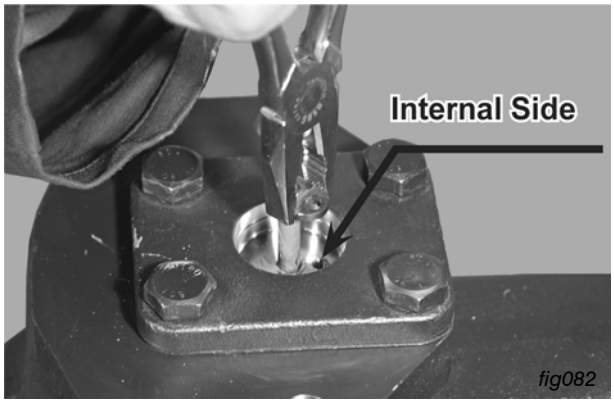


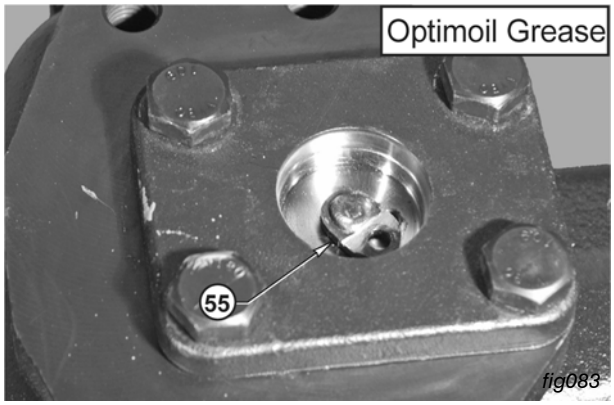
Grease the surface of the upper king pin (54) and the bearing.



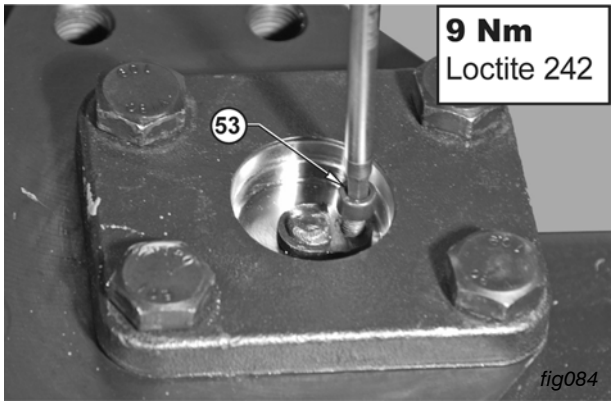
Tighten fastening bolts of the king pin. Tightening torques: **182 – 202 Nm**.

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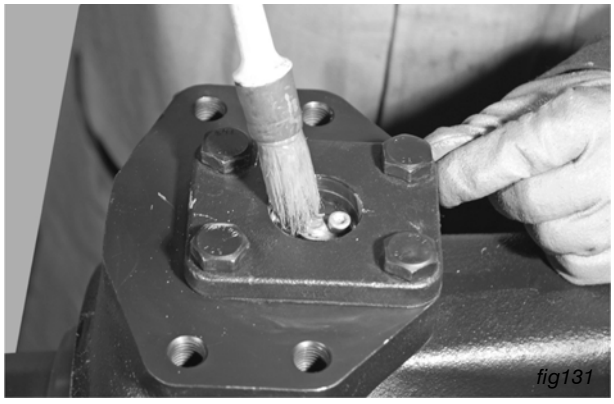




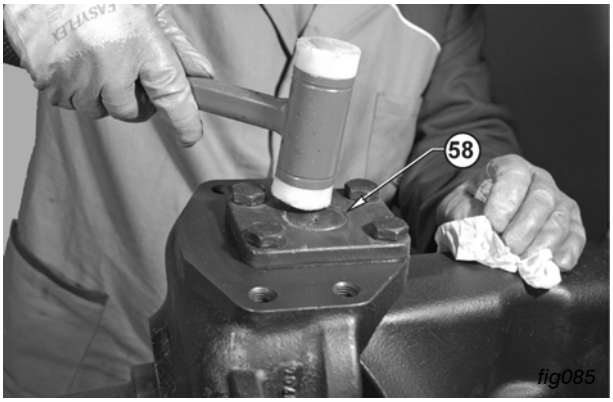
Grease and fit the sensor pin (55).



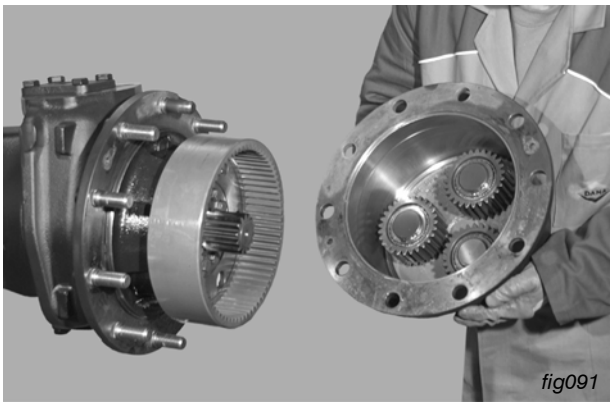
Apply Loctite **242** on the screw (53) and tighten the screw.
Tightening torque: **9 Nm**.



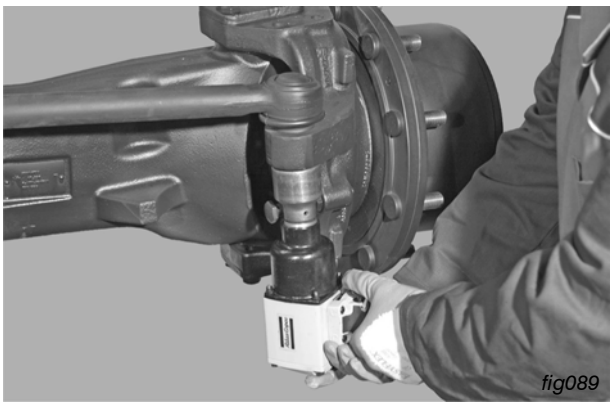
Grease the inside of the housing.

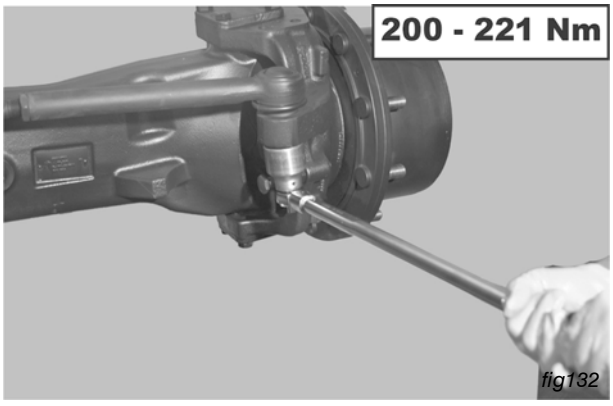


Fit the upper plug (58) into place.



Assemble the planetary carrier/hub cover.





Connect the cone joint of the tie rod. Use grease on threads.
Tightening torques: **200 – 221 Nm**.

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Disassembling the differential

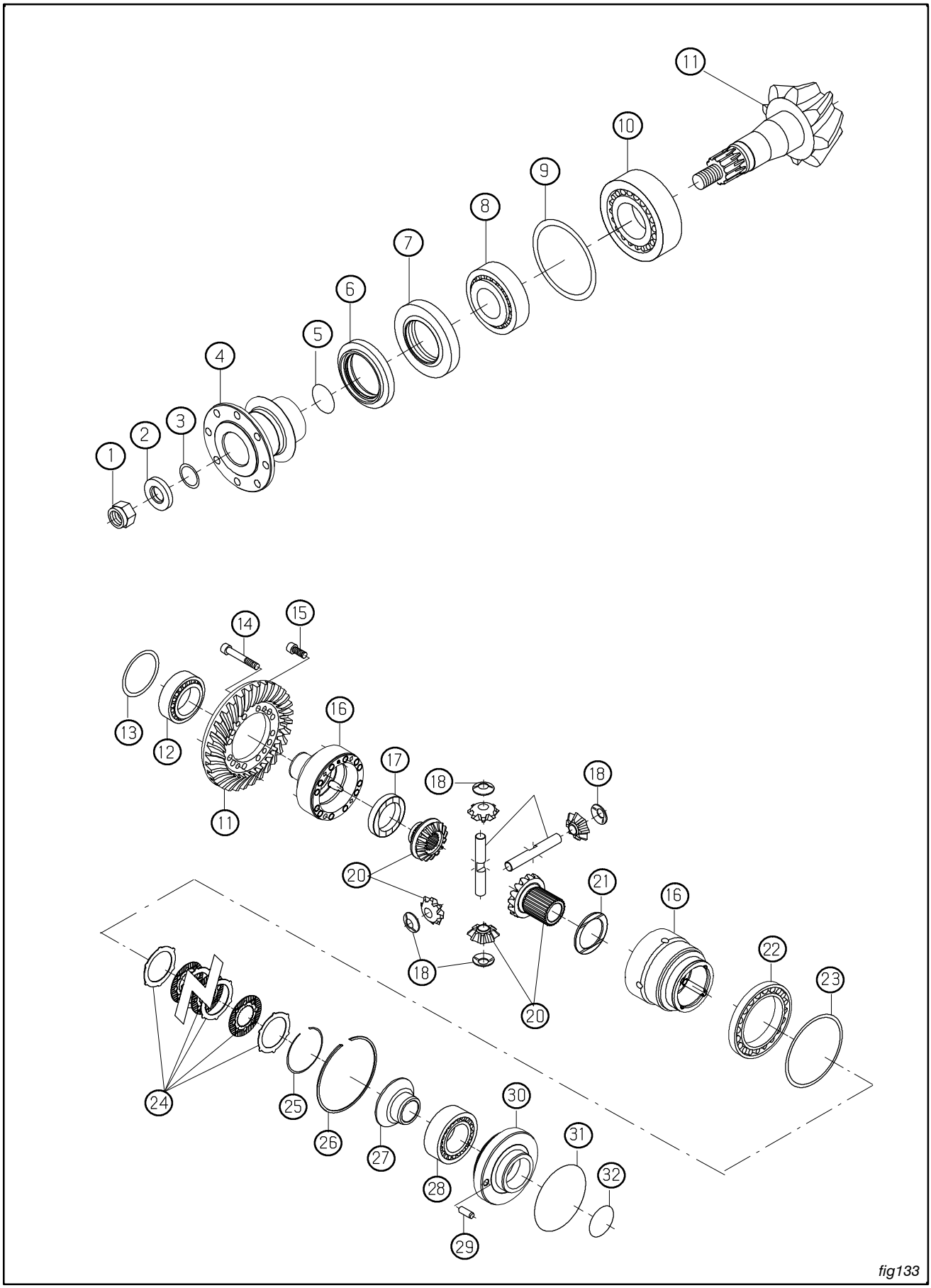
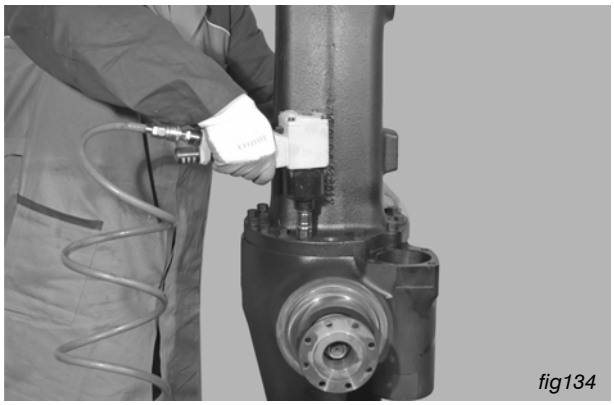


fig133

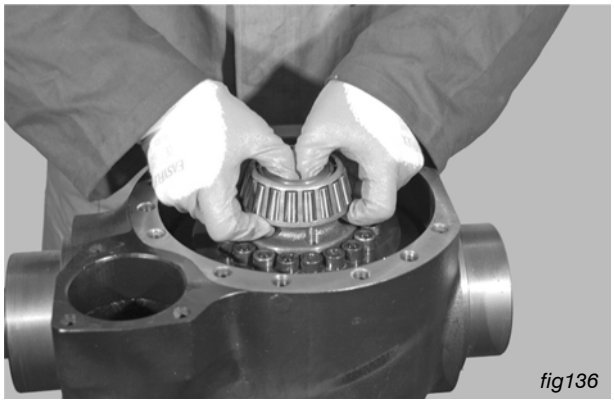
https://truckmanualshub.com/


fig134

Unscrew the attach screws of the axle housing.


fig135

Remove the axle housing.


fig136

Remove the differential.



fig137

Remove the differential bearing (12), when necessary.

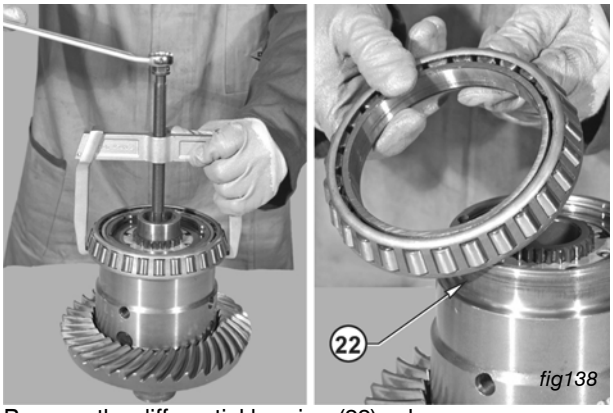


fig138

Remove the differential bearing (22), when necessary.



fig139

Unscrew the attach screws of the crown wheel.



fig140

Remove the crown wheel (11).

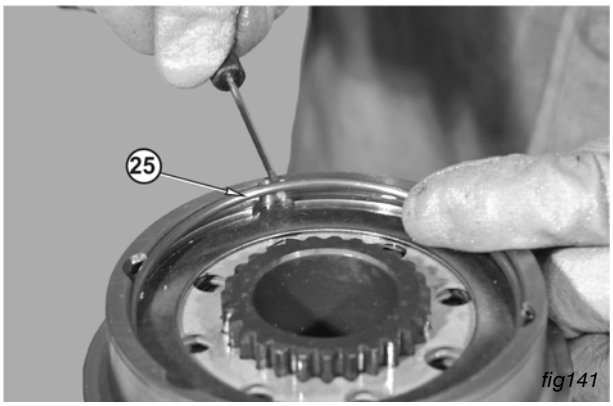
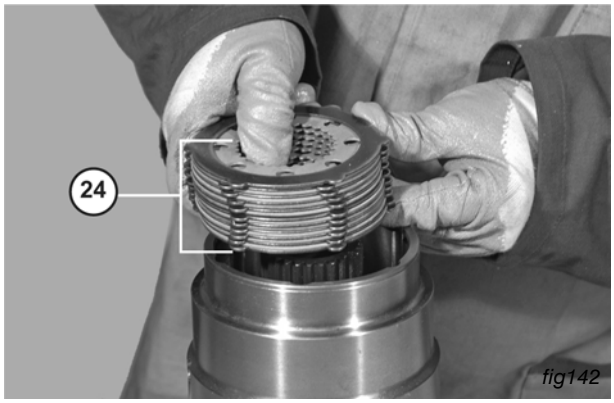


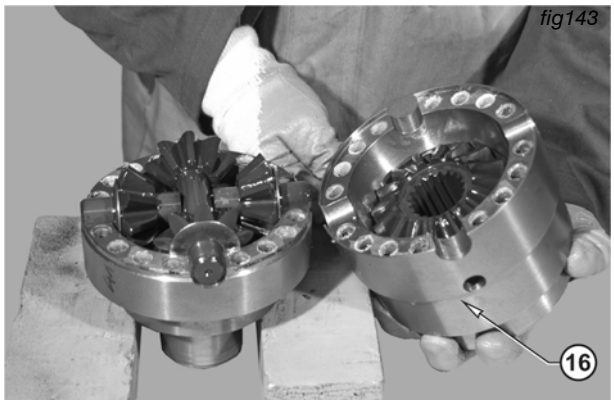
fig141

Remove the snap ring (25).

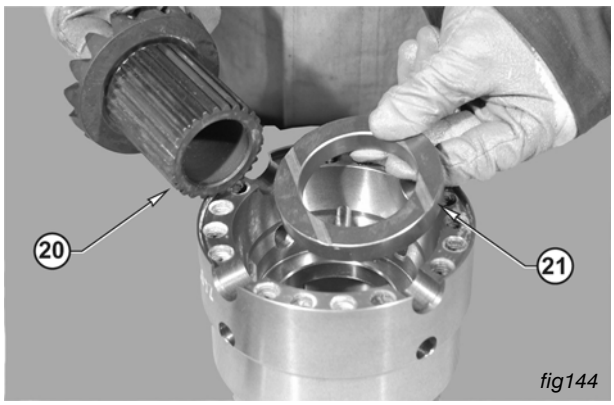
https://truckmanualshub.com/



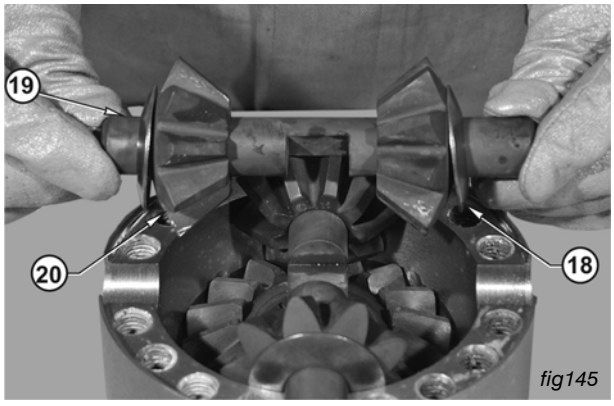
Remove the friction discs (24).



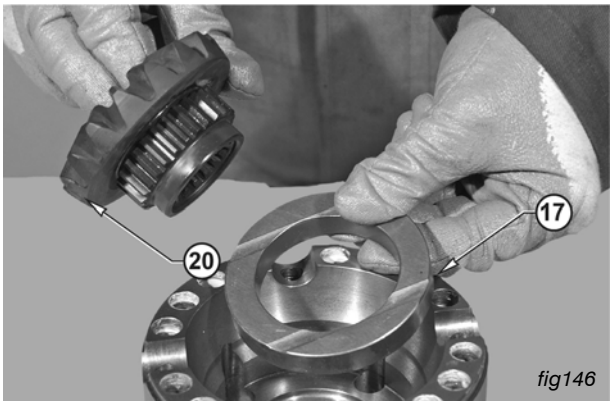
Mark the halves of the differential location. Open the differential (16).



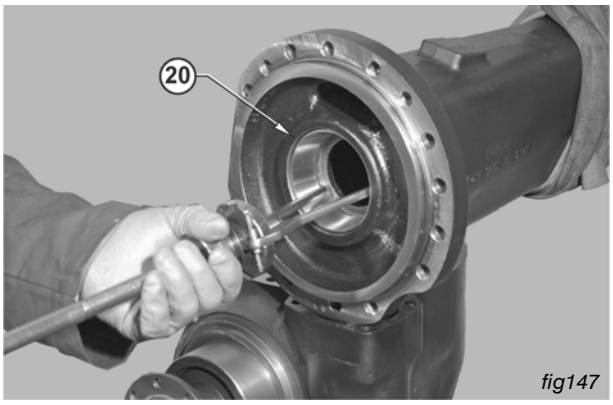
Remove the thrust bearing (21) and the differential wheel (20).

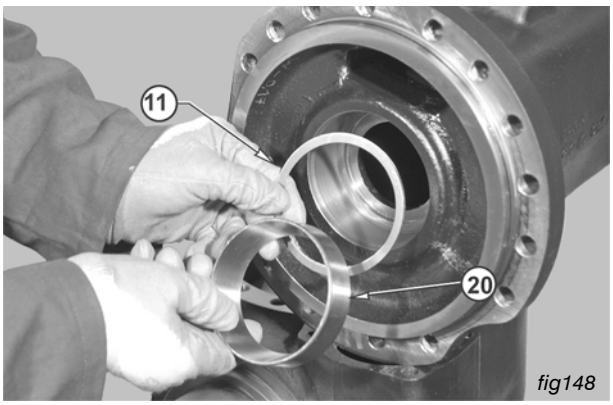


Remove the differential pinions and the bearings.



Remove the thrust bearing (17) and the differential wheel (20).





Remove the bearing outer race (20) with help of a puller. Remove the shims (11).

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fig149



fig150

Remove the bearing outer race (22) with help of a puller.
Remove the shims (23).

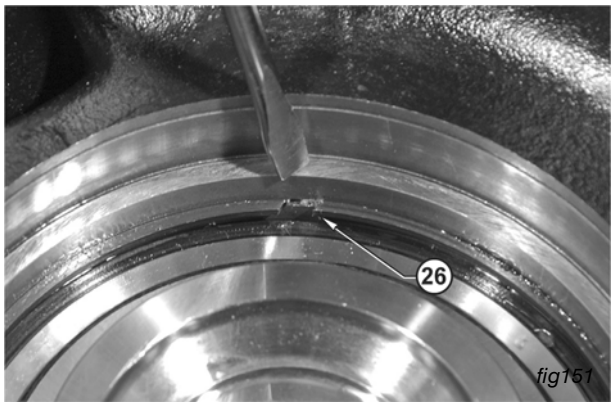


fig151

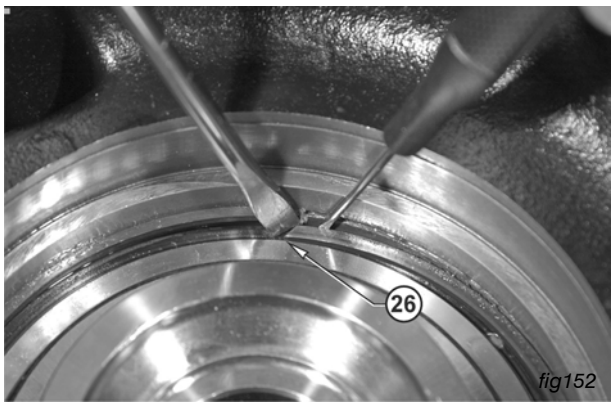


fig152

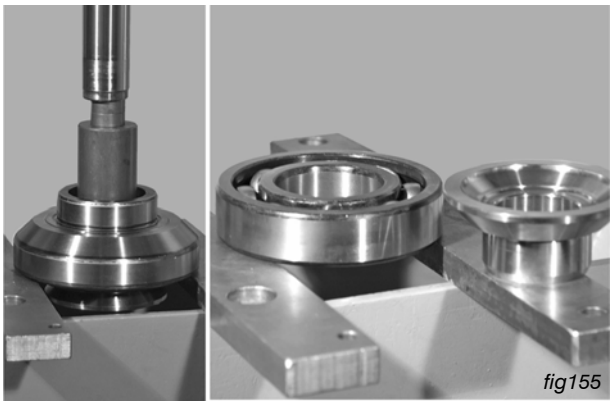
Remove the snap ring (26).


fig153



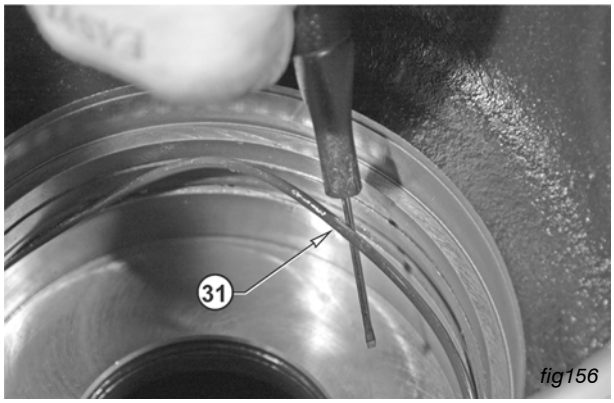
fig154

Remove the piston (30) of the differential lock e.g. with help of the compressed air.

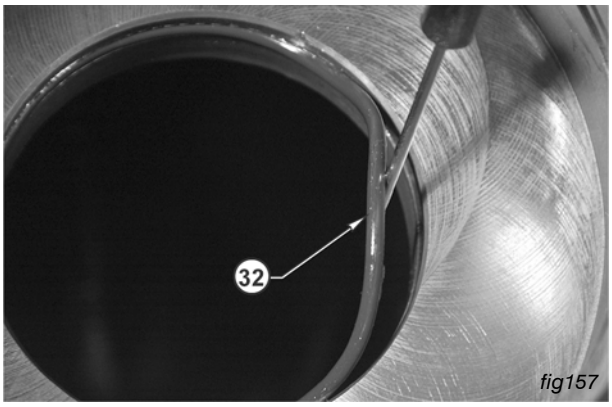

fig155

Disassemble the piston (30), the bearing (28) and the bushing (27) by pressing with a hydraulic press.

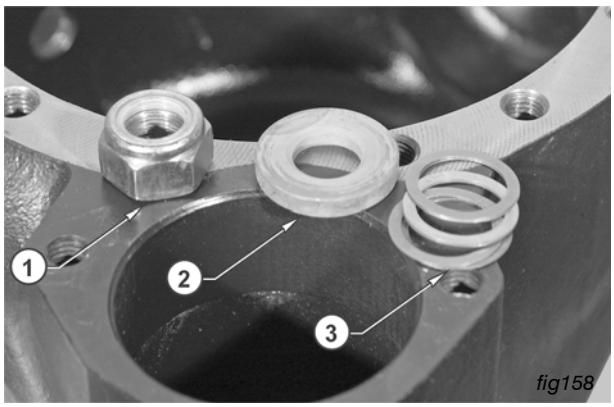
https://truckmanualshub.com/



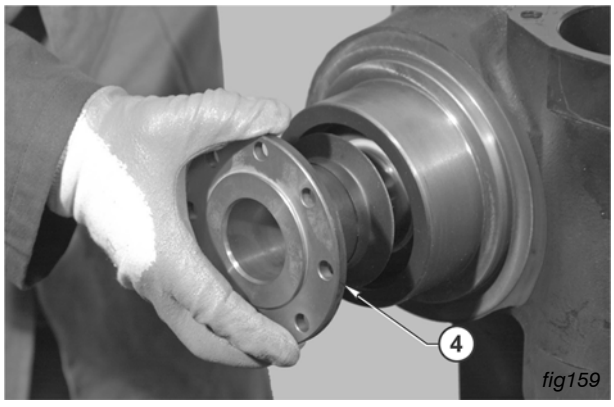
Remove the O–ring (31).



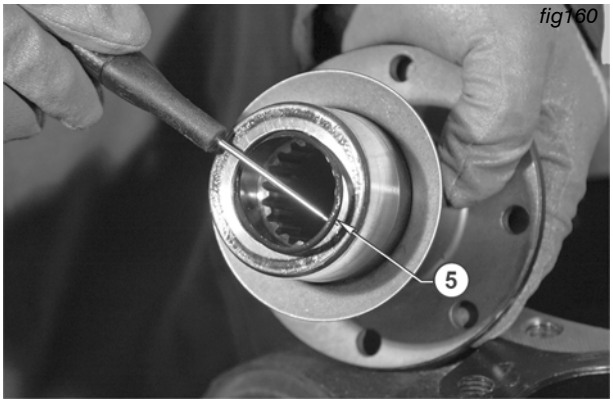
Remove the O–ring (32).



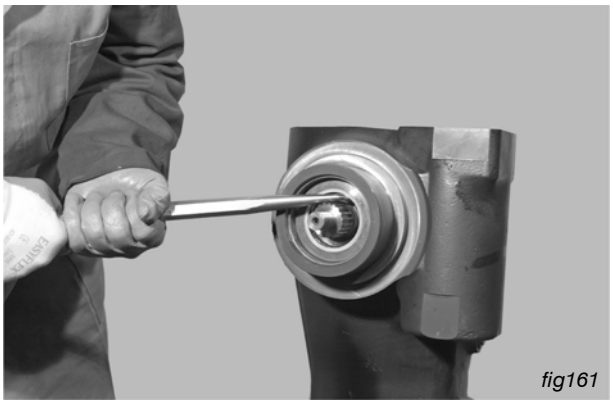
Remove the nut (1), washer (2) and shims (3).

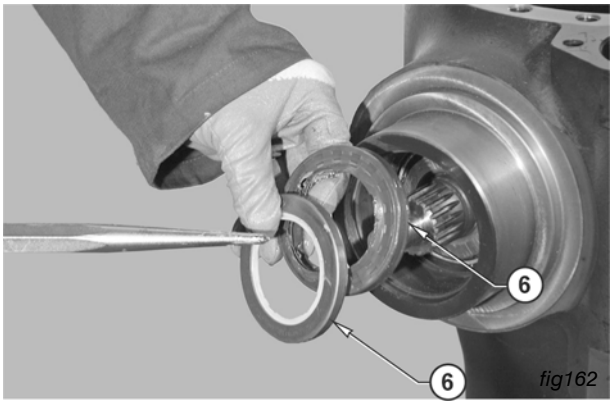


Remove the flange (4).

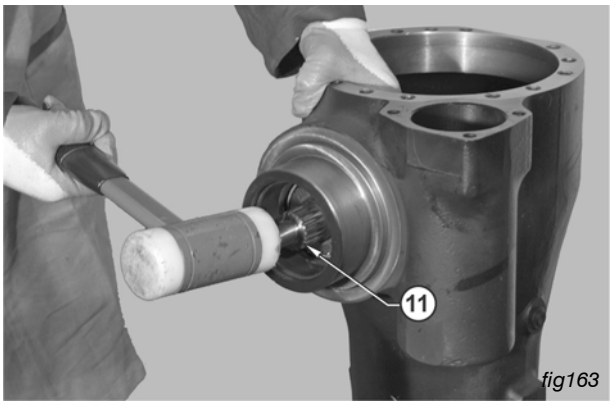


Remove the O–ring (5).





Remove the sealing ring (6 and 7).

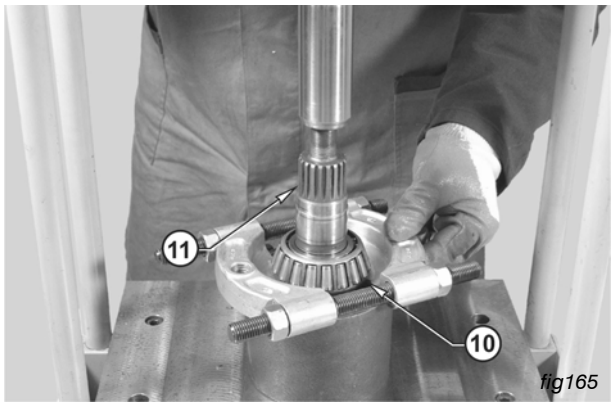


Remove the bevel pinion shaft (11).

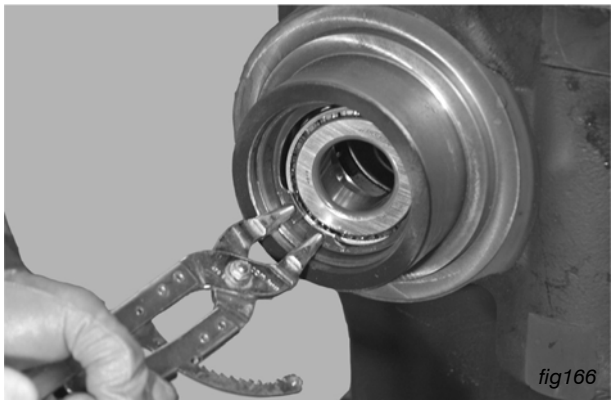
https://truckmanualshub.com/



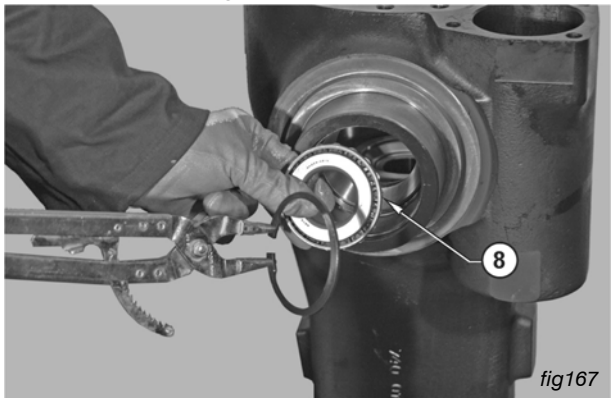
Remove the bevel pinion shaft.



Remove the bearing (10) with help of a puller.

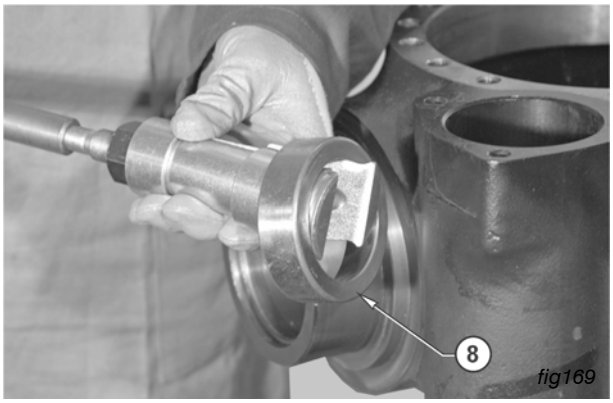


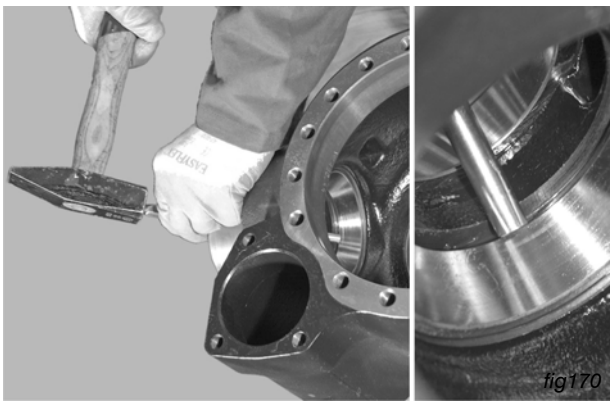
Remove the snap ring.



Remove the bearing (8).







Remove the bearing outer races.



Remove the shims (5).

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Assembling the differential

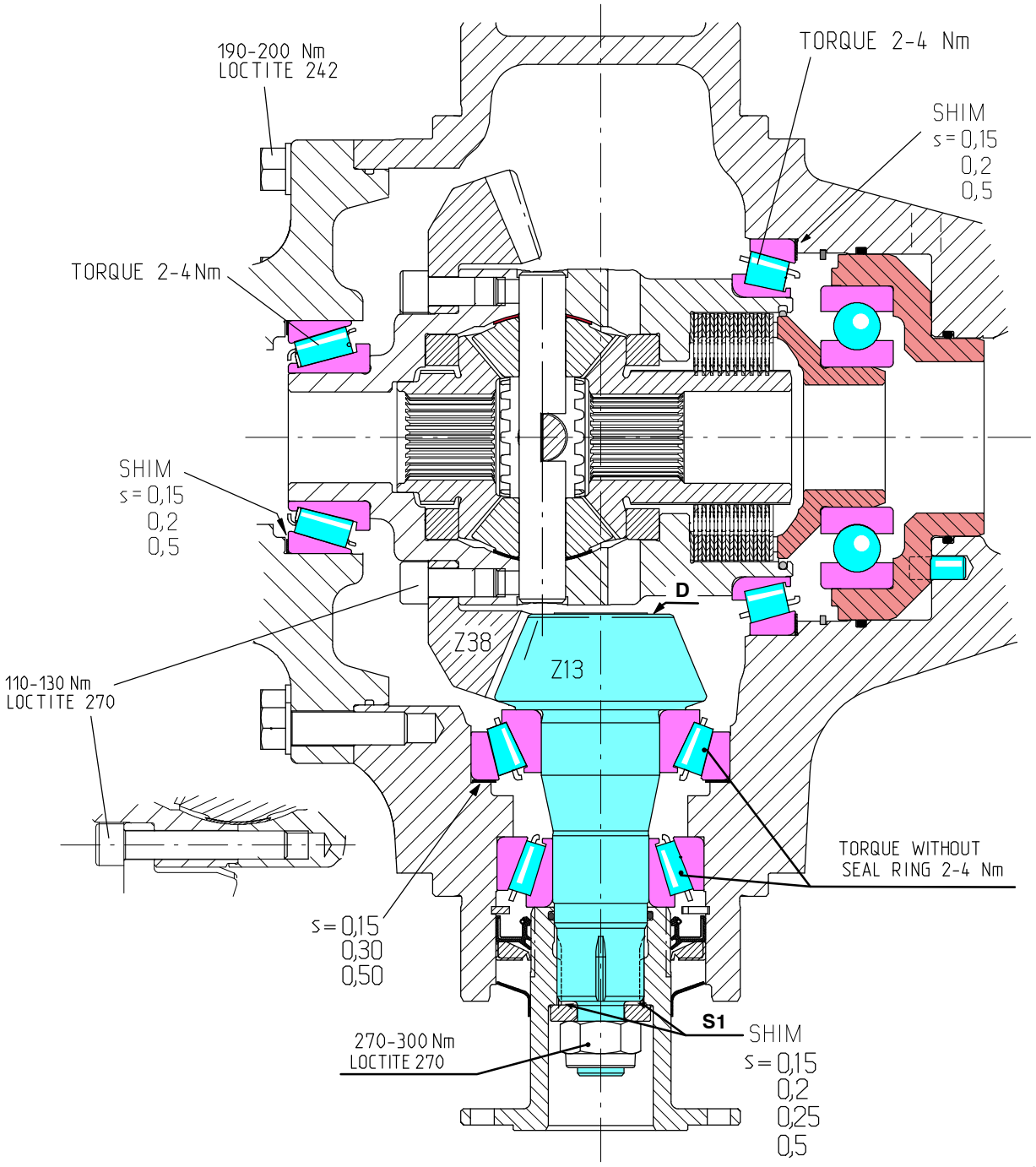


fig172

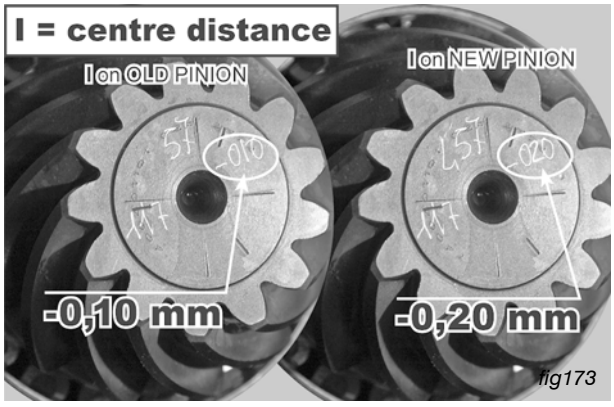
D = I on old pinion – I on new pinion =
S = S old + (D)**I** = centre distance

S1 = S1 old + (D)
D = difference value of the bevel pinion shafts
S old = old shims

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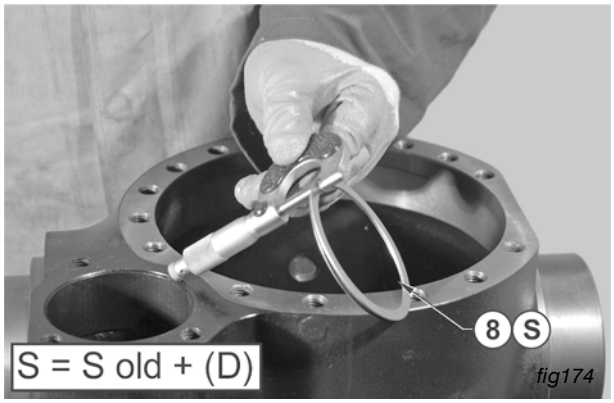
Fitting the bevel pinion shaft and adjusting position of the new shaft

Adjusting the new pinion shaft position



Read the **measure I** of the old pinion shaft (e.g. 0,10 mm). and the **measure I** of the new pinion shaft (e.g. 0,20 mm)
Calculate with help of these measures the difference value **D** between the bevel pinion shafts.

Example:
I old pinion – **I new pinion** = **D**
–0,10 mm – (–0,20 mm) = 0,10 mm



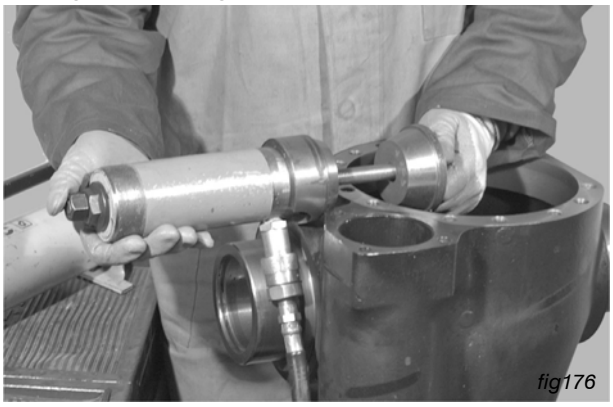
Calculate with help of these measures the new shim **S** of the bevel pinion shafts.
Example:
S old = old shims.
D = difference value of the bevel pinion shafts.

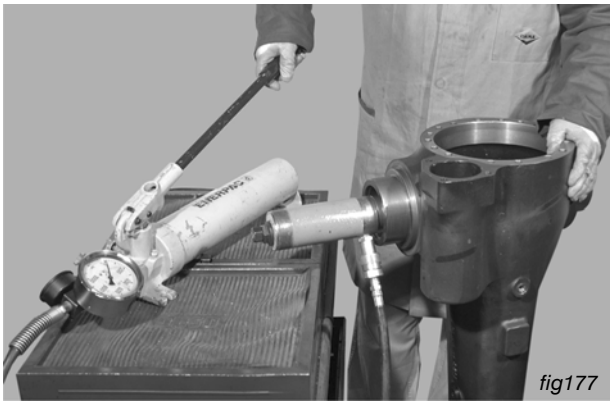
S old + (D) = S
0,80 + (0,10) = 90 mm

Note! Put the shim **S** under the inner bearing outer race.

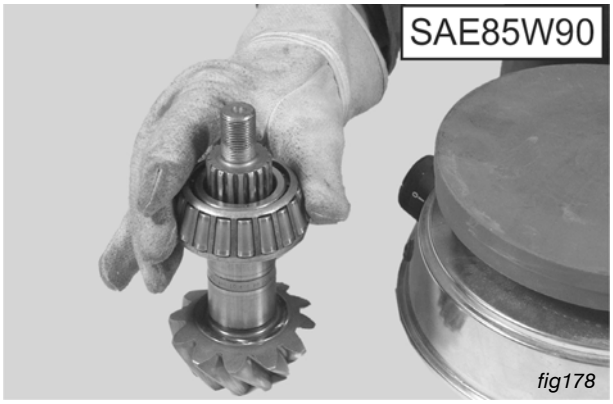


Put the shim **S** under the inner bearing outer race and fit the bearing outer race against the shims into place.



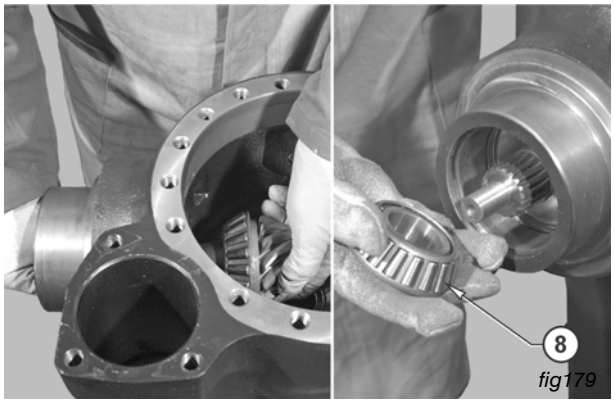


Fit the bearing outer races (8 and 10) e.g. with help of the hydraulic press.

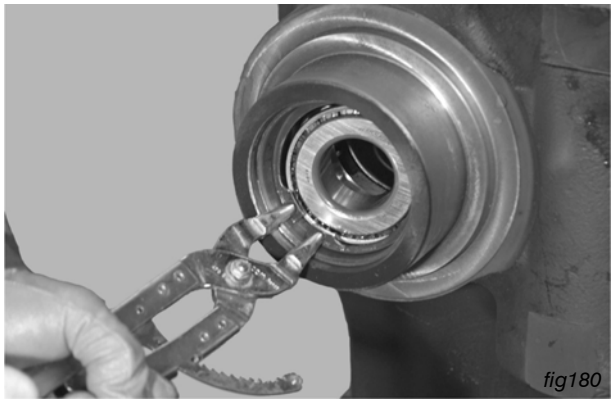


Heat the bearing (11) to about 100 C° and fit it to the bevel pinion shaft. When the bearing has cooled down, lubricate it with oil.

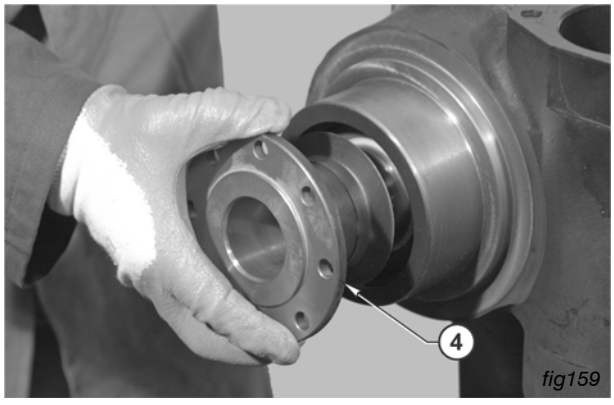
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Heat the inner bearing to 80˚C and push it onto the bevel pinion shaft fully home.
Push the bevel pinion shaft into the housing. Heat the outer bearing to 80˚C and push it onto the shaft against the outer race.
When the bearing has cooled down, lubricate it with oil.

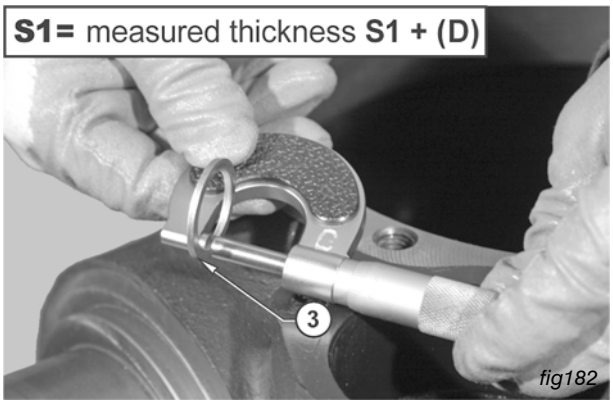


Fit the snap ring. Ensure, that the snap ring is in groove.



Fit the flange (4) onto the bevel pinion shaft without the sealing ring.

Calculation of the new shim under the nut



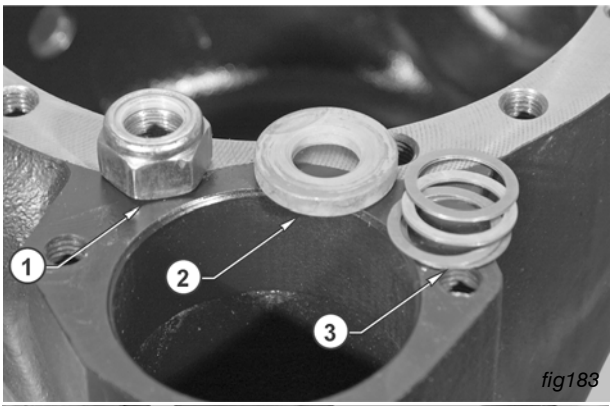
When installing the new bevel pinion shaft then measure difference of the bevel pinion shafts also under the nut to come the shim **S**.

Calculate with help of these measures the new shim **S** of the bevel pinion shaft (under the nut).
Example:
S1 = old shims.
D = difference value of the bevel pinion shafts.

l old pinion – l new pinion = D
–0,10 mm – (–0,20 mm) = 0,10 mm

S1 + (D) = S
2,10 + (0,10) = 2,20 mm

Note! Put the shim **S** under the nut





Assemble shim (3), washer (2) and nut (1).

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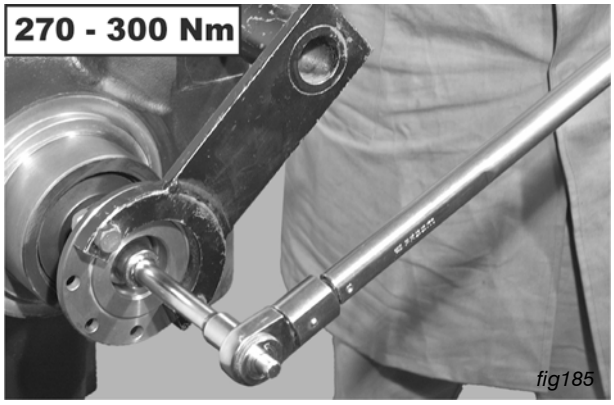


fig185

Tighten the nut of the shaft and lock the flange of the cardan with support tool. Tighten the nut of the shaft (1) to **270 – 300** Nm.

Measurement of rolling resistance for the bevel pinion shaft bearing



fig186

Use a spring balance to measure the force needed (rolling resistance) to rotate the bevel pinion shaft.

Measure the rolling resistance two, three times. Read off the value, while the shaft is rotating. In the beginning of rotation more power is needed.

The rolling resistance should be **2 – 4 Nm.** If the rolling resistance is not correct, the number of shims under the nut must be adjusted.
Note! If the rolling resistance is too great more shims are required and vice versa.

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Fitting the differential unit



fig187

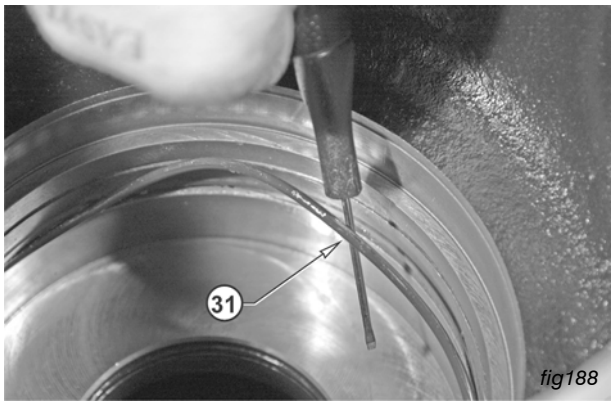


fig188

Fit the O–rings (31) and (32).

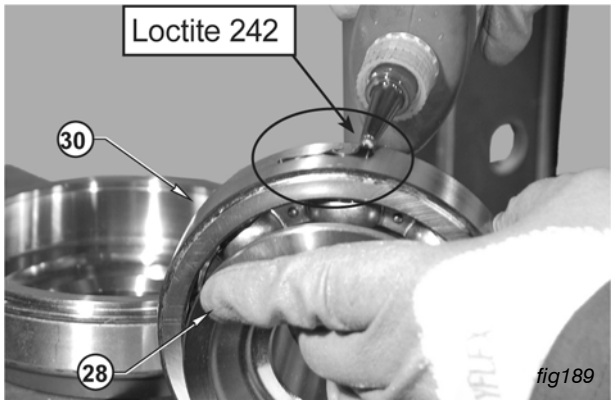


fig189

Apply Loctite **242** on the bearing outer race (28).

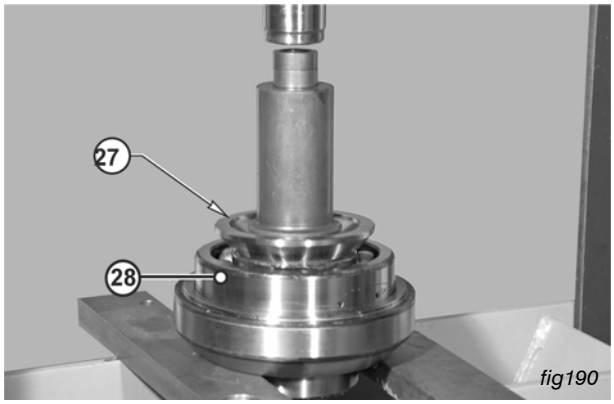


fig190

Fit the sleeve (27) to the bearing (28) with help of the hydraulic press.


fig191

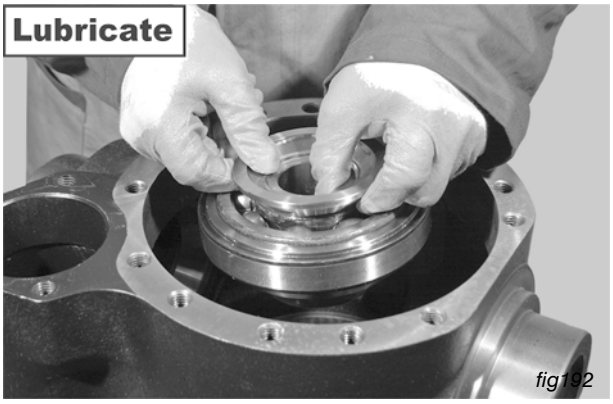


fig192

Fit the piston assy and notice the position of the pin.

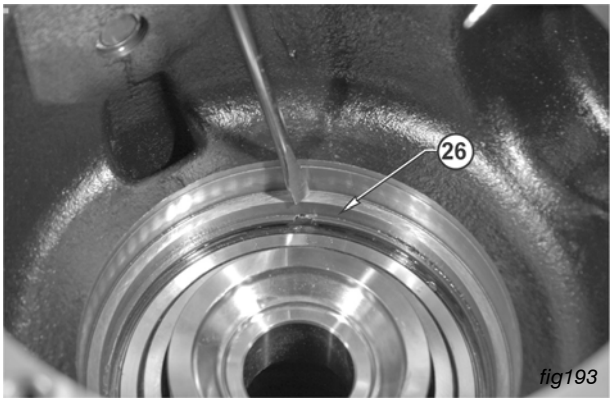
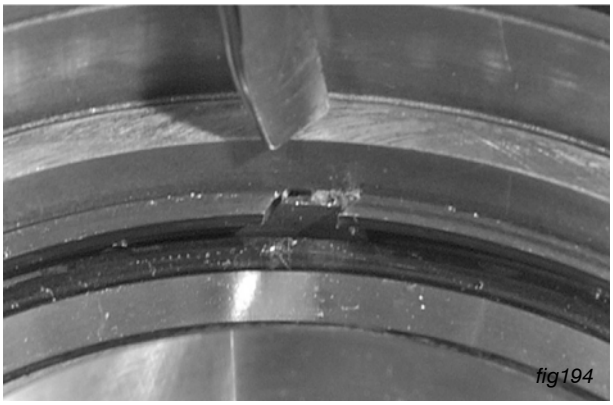


fig193


fig194

Fit the snap ring (26). Ensure, that the snap ring is in groove.

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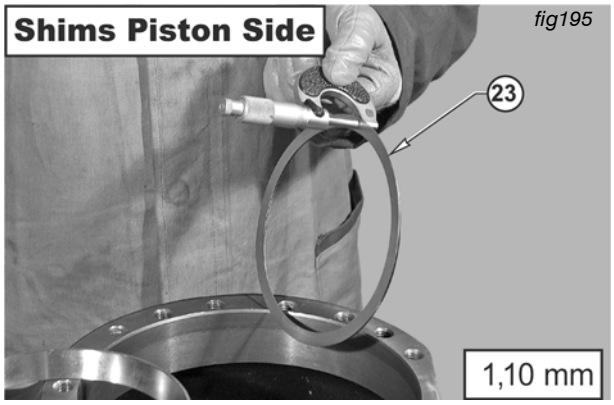


fig195

Check thickness of the shim (23). The shim thickness: **1,10 mm**.

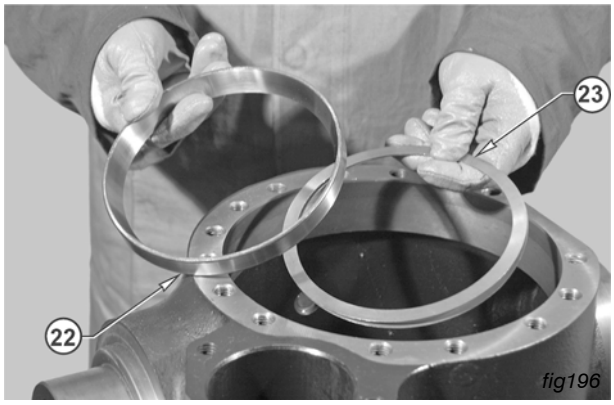


fig196

Fit the bearing outer race (22) into place against the shims.

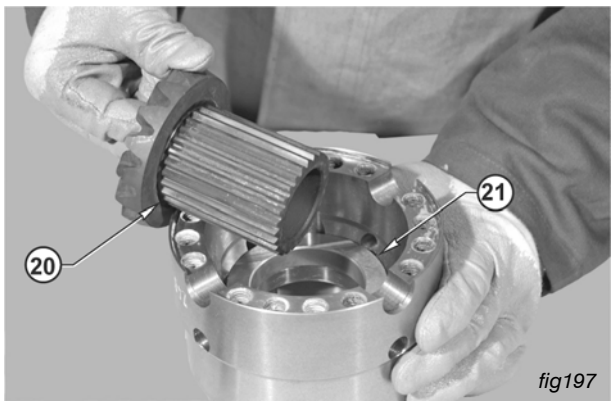


fig197

Fit the thrust bearing (21) and the differential wheel (20) into place.

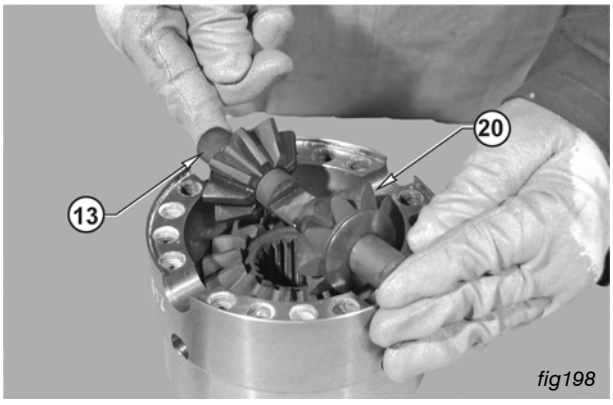


fig198

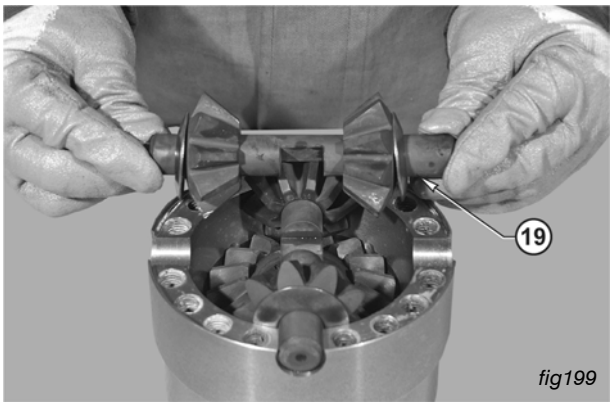


fig199

Fit the differential pinions (20) and the bearings onto the axle. Lubricate the bearings of the differential pinions and fit the axle assy into place.

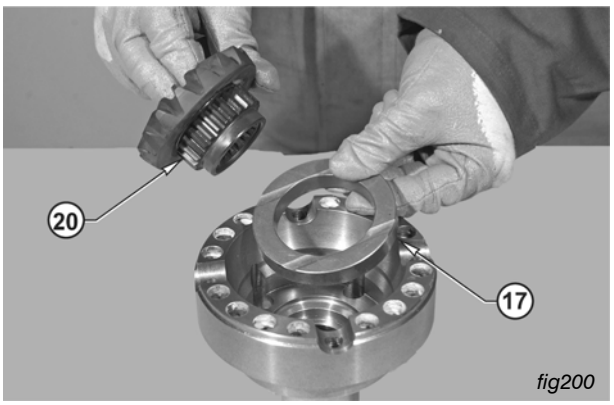


fig200

Fit the thrust bearing (17) and the differential wheel (20) into place.

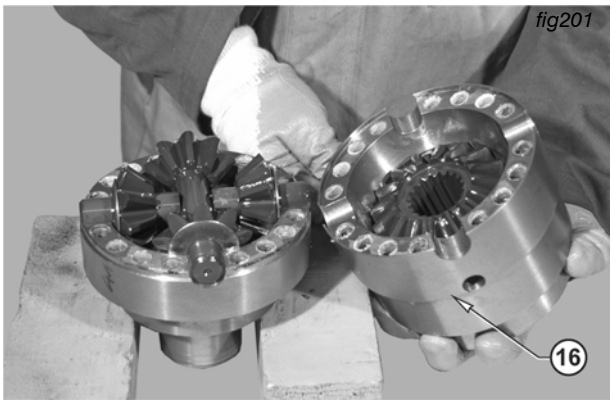


fig201

Fit the halves of the differential together. **Notice** that the marks are align.

https://truckmanualshub.com/

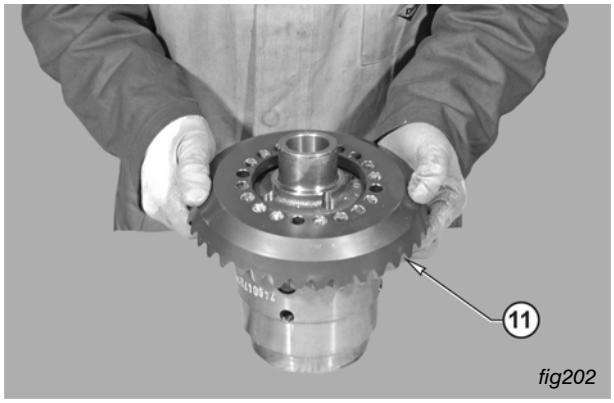


fig202

Fit the crown wheel (11).

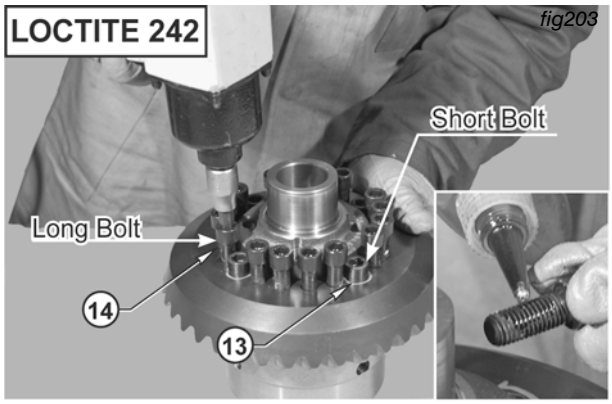


fig203

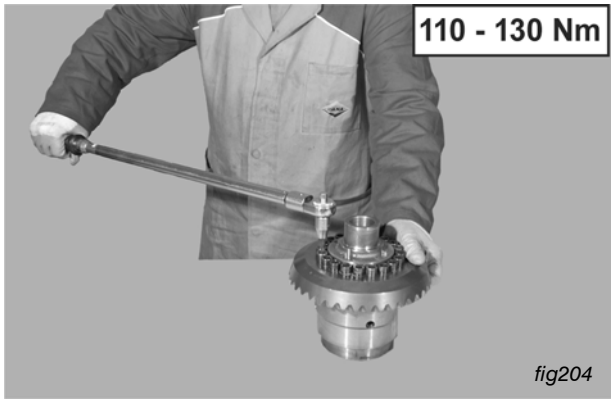


fig204

Apply **Loctite 242** on the bolts and tighten the bolts (27). Tightening torques: **110 – 130 Nm.**



fig205

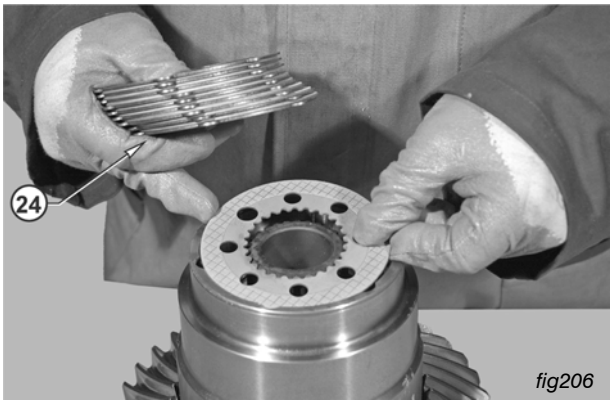
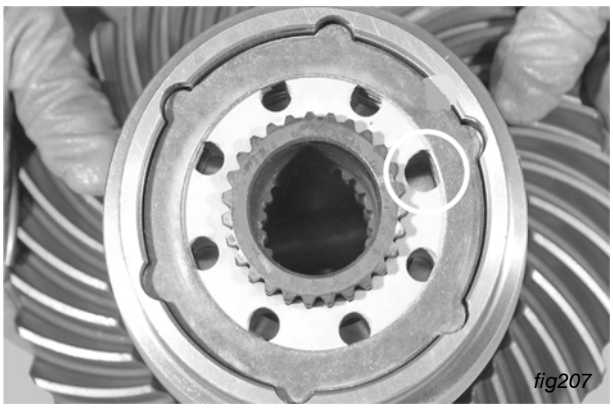


fig206

Fit by turns the steel disc and the friction disc (24) into the differential housing. **Note!** the first and the last disc of the disc pack is a steel disc.


fig207

Align the discs so that all oil circulation holes are in the same line.

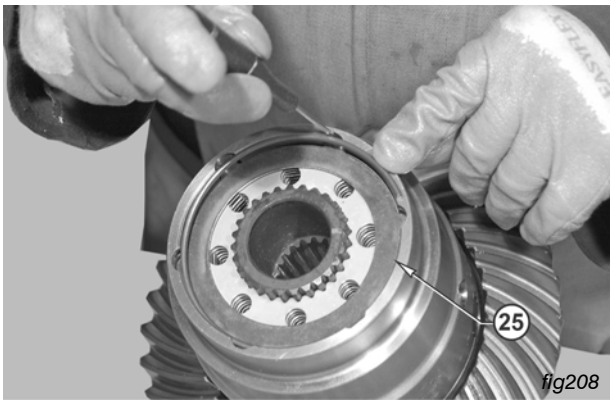


fig208

Fit the snap ring (25).

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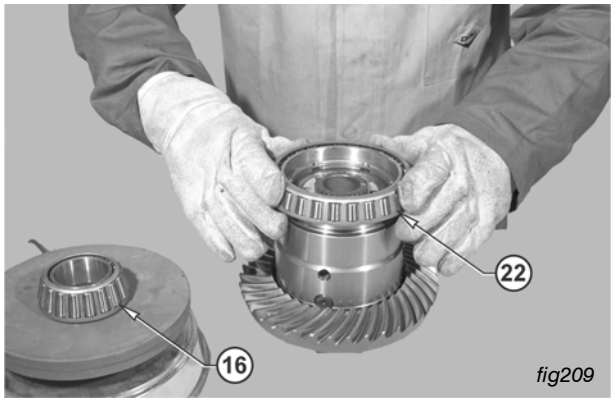
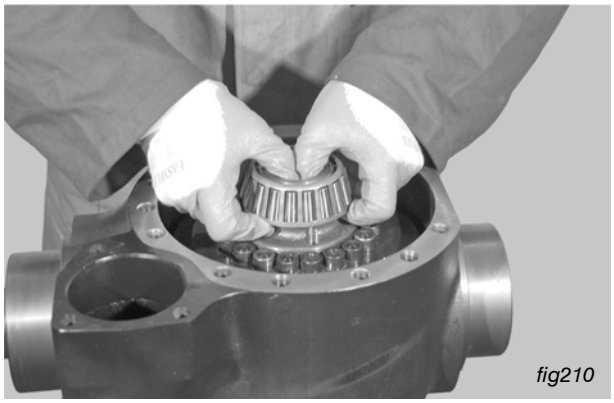


fig209

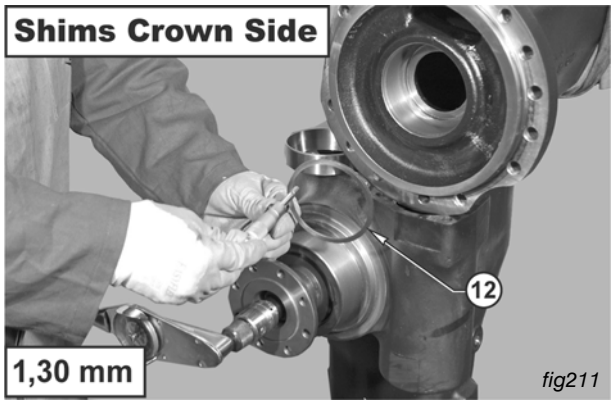
Heat the differential bearings (16 and 22) to 80˚C.
Fit the differential bearing (22).
Turn the unit upside down and fit the differential bearing (16).


fig210

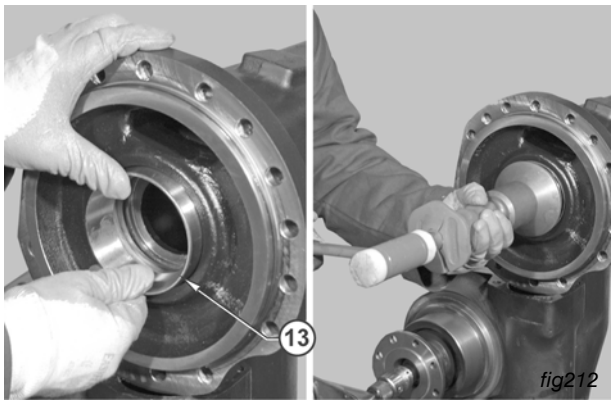
Fit the differential into place.

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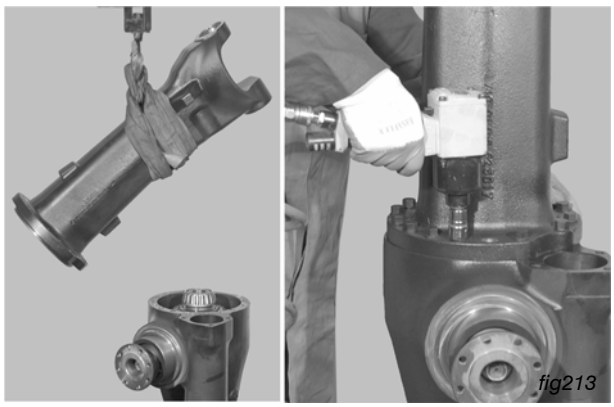
Adjusting differential bearing preload and pinion/crown wheel tooth backlash



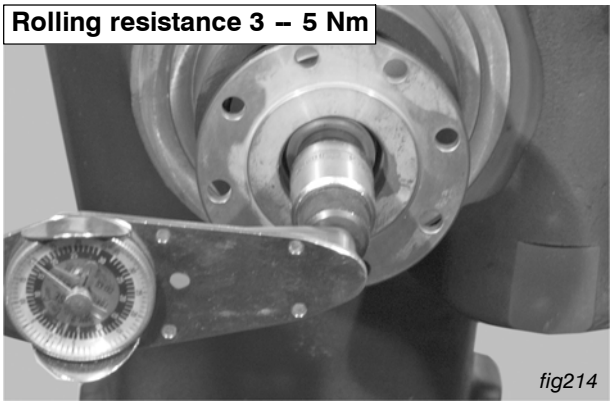
Fit the **1,30 mm** thick shim (12) under the bearing outer race.



Fit the bearing outer race (12) into place against the shims.



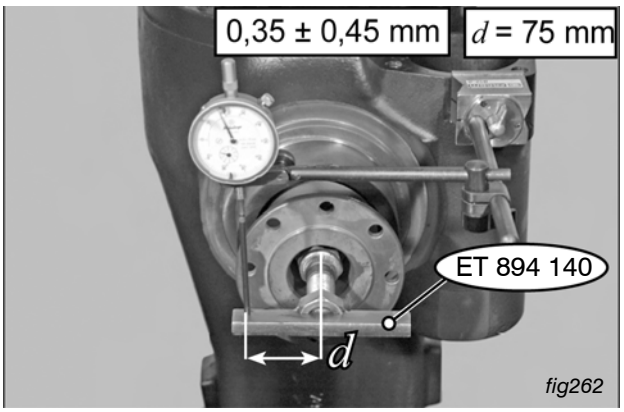
Fit the differential into the housing. Fit the axle housing into place and tighten the screws to **190 – 200 Nm**.



Check the rolling resistance of the bevel pinion shaft: **3 – 5 Nm** (rolling resistance include bevel pinion shaft bearings+differential bearings).

If the rolling resistance is too low then add the shims of the differential.

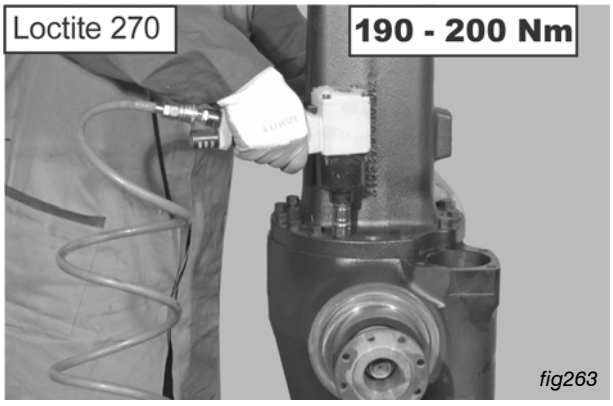
If the rolling resistance is too high then remove the shims of the differential.



Measure the pinion/crown wheel tooth backlash on the drive flange according to picture.
The backlash should be in the range **0,35 – 0,45 mm.**

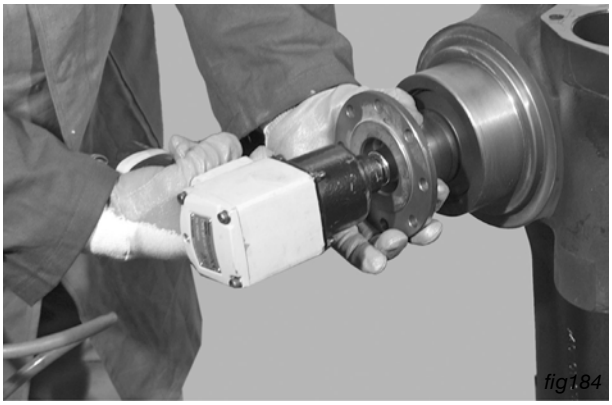
If the backlash is too small so transfer the differential of the shims from the shorter axle section side to the longer side.

If the backlash is too big so transfer the differential of the shims from the longer axle section side to the shorter side.

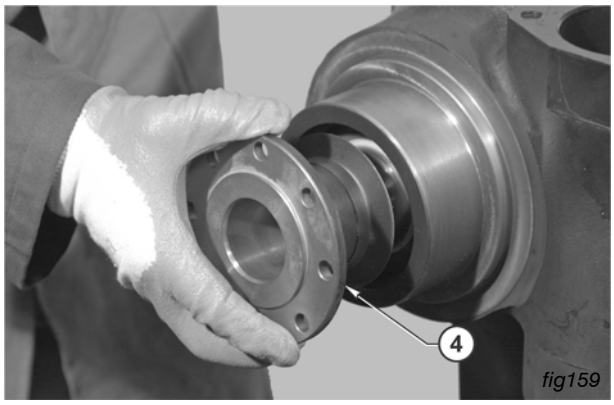


When adjustment is carried out, open/apply Loctite **242** on the screws and tighten the screws. Tightening torques: **190 – 200 Nm**.

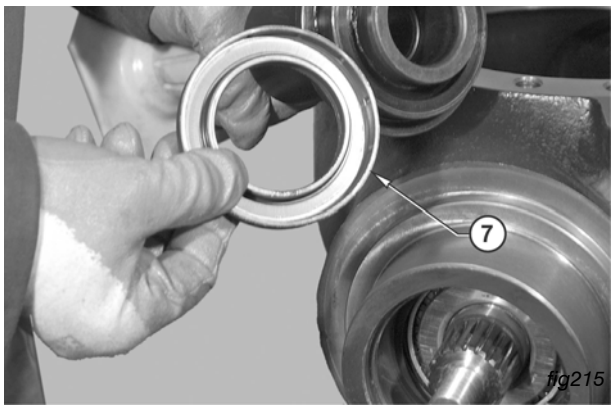
https://truckmanualshub.com/

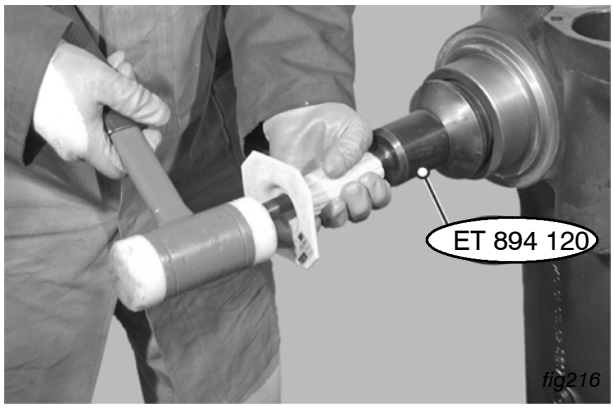


Unscrew the nut. Remove the washer (2) and shims (3).

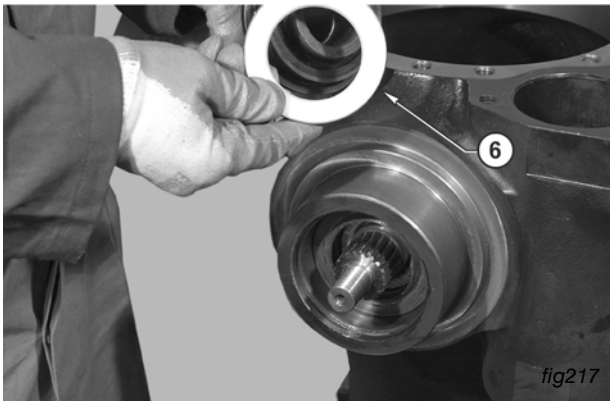


Remove the flange (4).

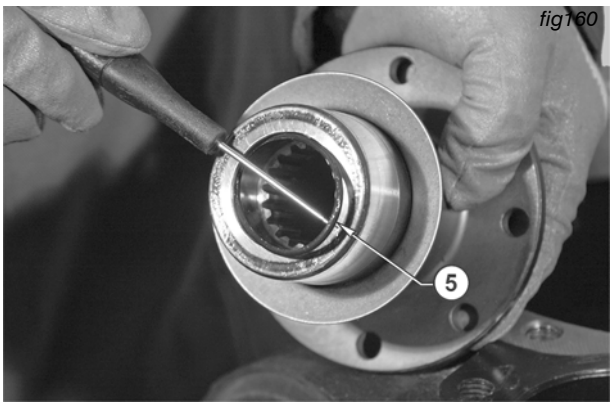




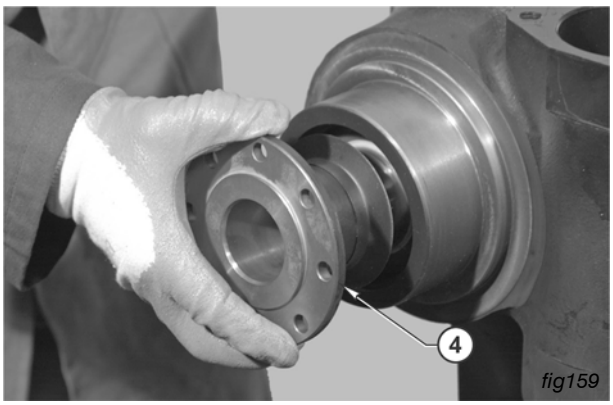
Lubricate the sealing ring (7) and fit it into place with tool **ET 894 120**.



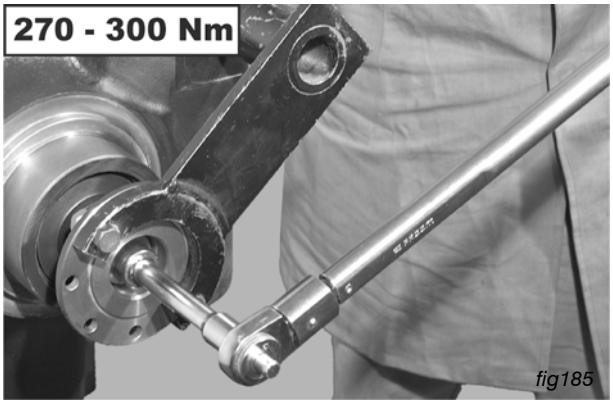
Lubricate the sealing ring (6) and fit it into place with tool **ET 894 160**.



Fit the O–ring (5).



Fit the flange (4).



Fit the washer (2) and nut (1).
Tighten the nut of the shaft and lock the flange of the cardan with support tool. Tighten the nut of the shaft (1) to **270 – 300 Nm**.

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Removing the steering cylinder

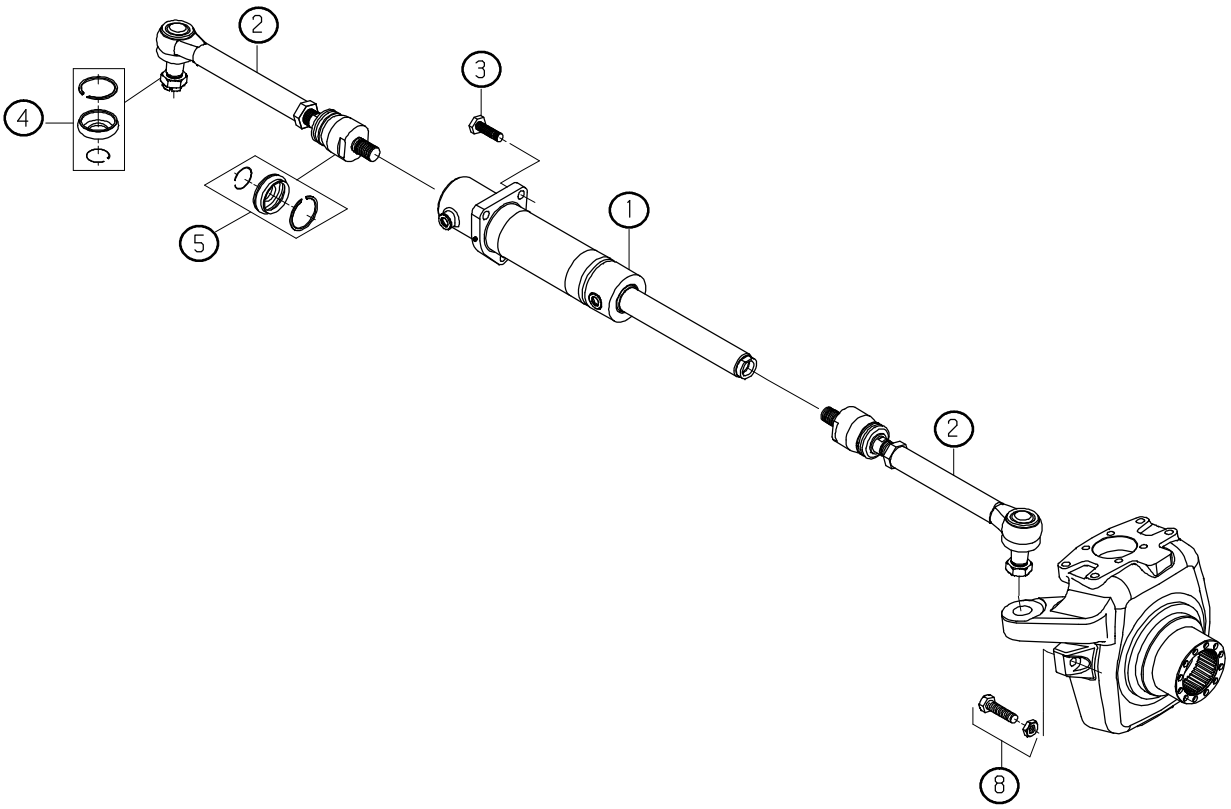
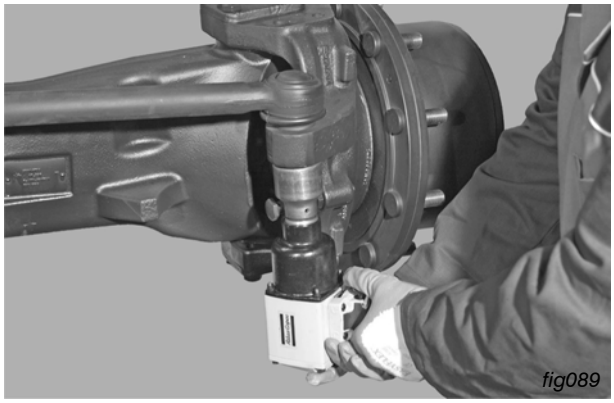
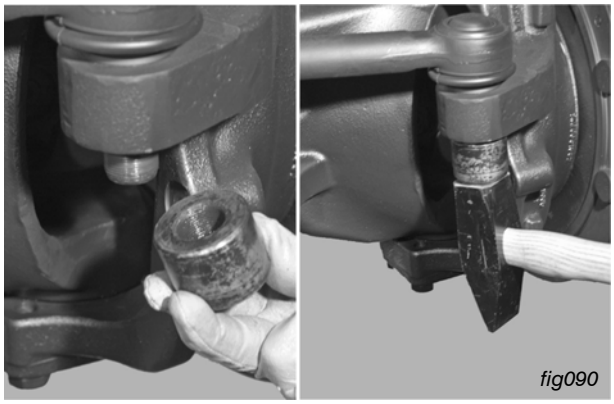


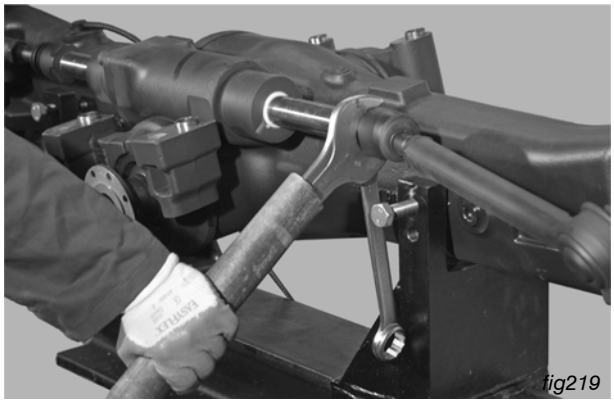
fig218

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fig089


fig090

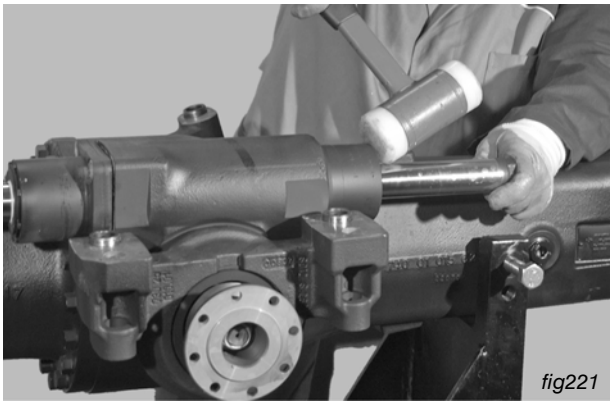
Disconnect the cone joint of the tie rod.


fig219

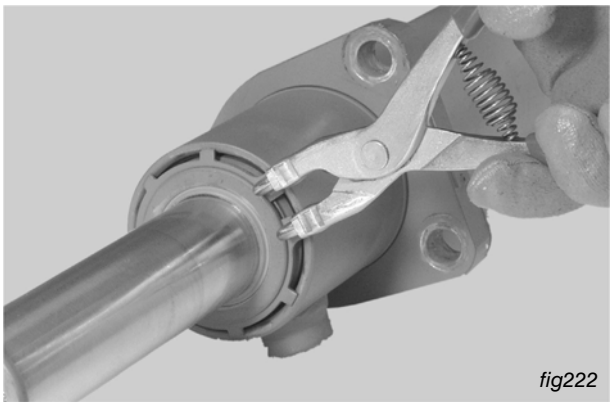
Disconnect the tie rods (2) from the piston rod end.


fig220

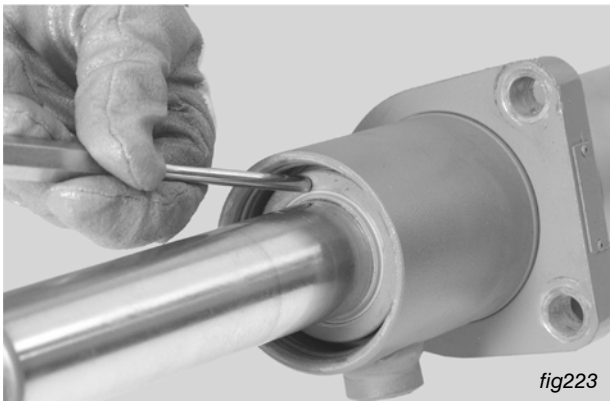
Remove fastening bolts (3) of the steering cylinder.


fig221

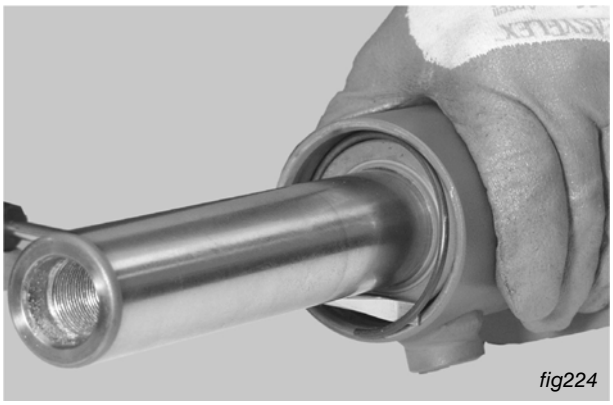
Remove the cylinder (1).


fig222

Before disassembling the cylinder, drain out the oil. Remove the snap ring of the cylinder cover.

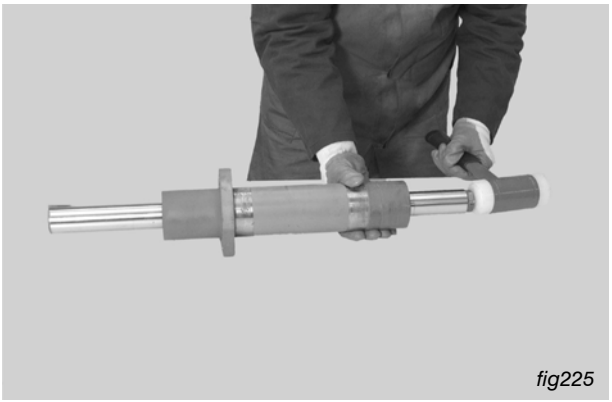

fig223

Carefully tap the cylinder cover inwards.

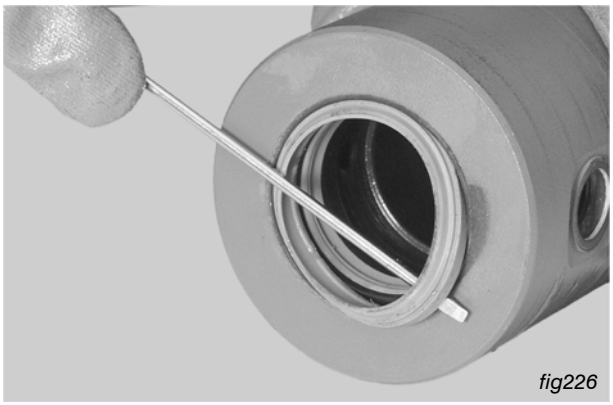

fig224

Remove the snap ring from inside the cylinder.

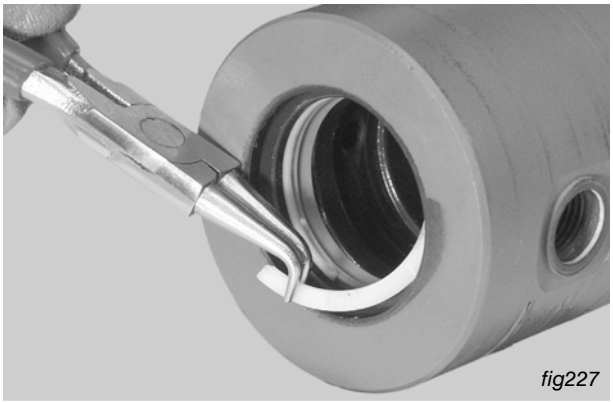
https://truckmanualshub.com/


fig225

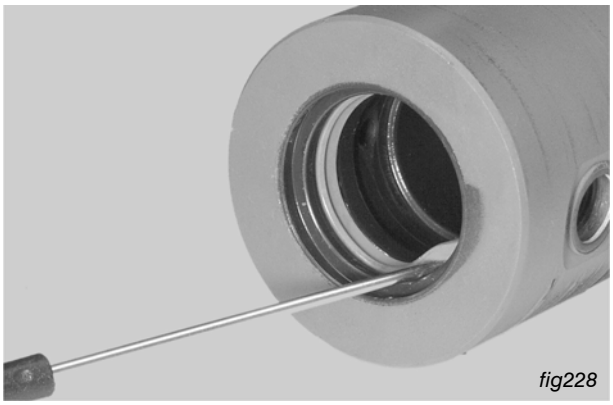
Remove out the piston rod.


fig226

Remove the wiper of the piston rod.


fig227

Remove the backing ring.


fig228

Remove the rod seal.

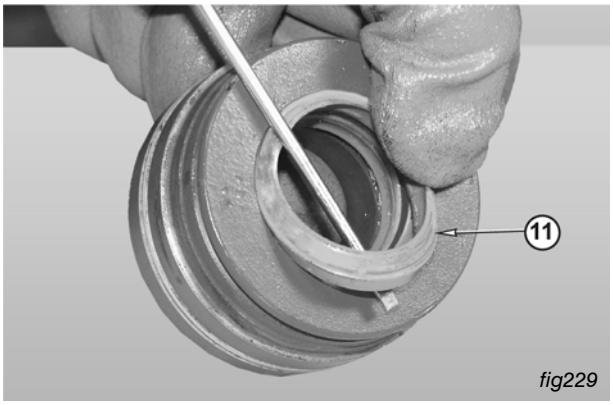


fig229

Remove the wiper of the piston rod.

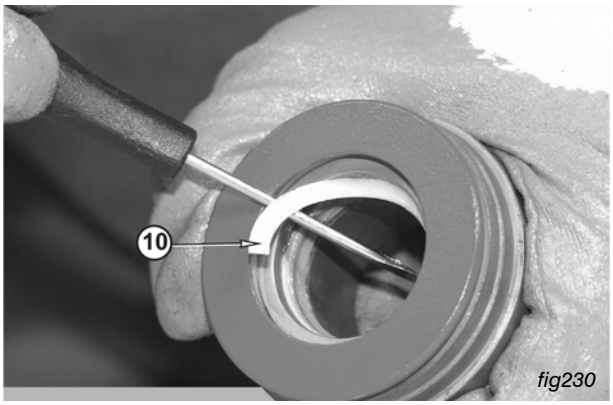
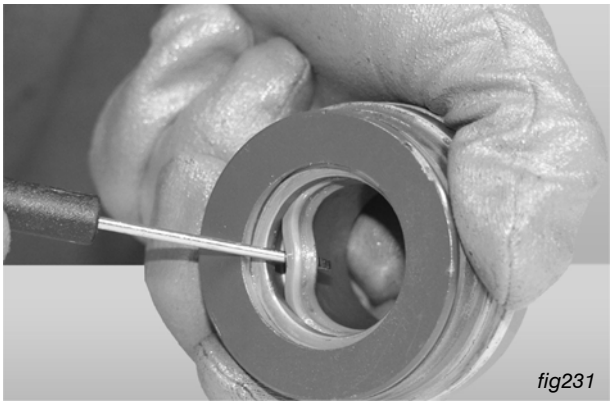


fig230

Remove the backing ring.


fig231

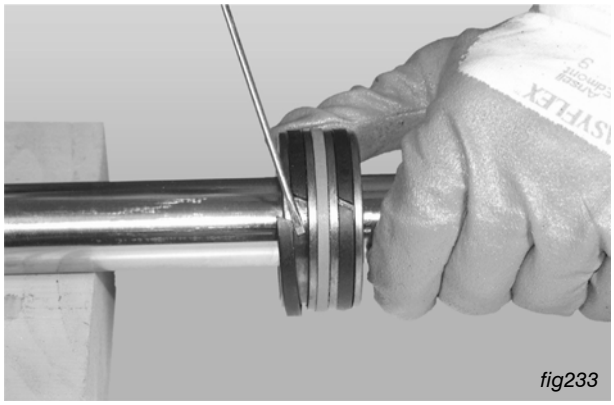
Remove the rod seal.

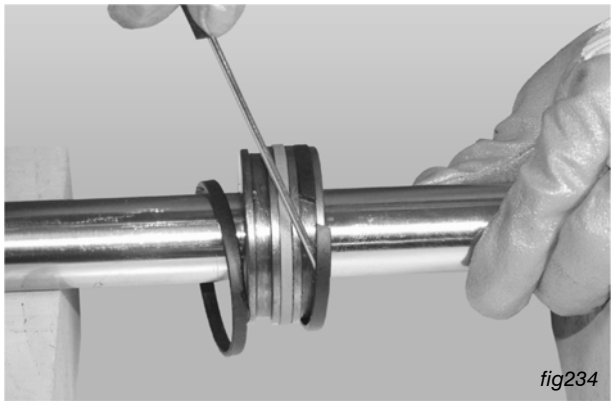


fig232

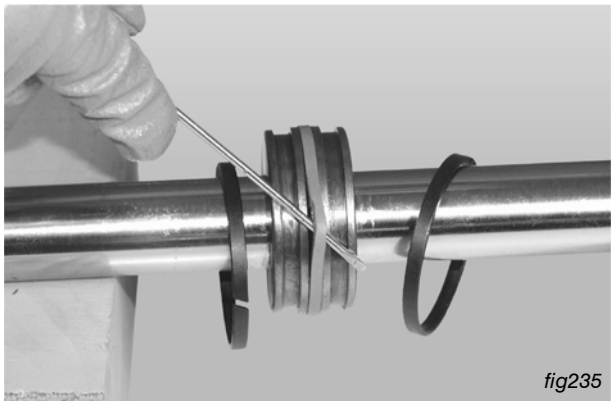
Remove the seal.

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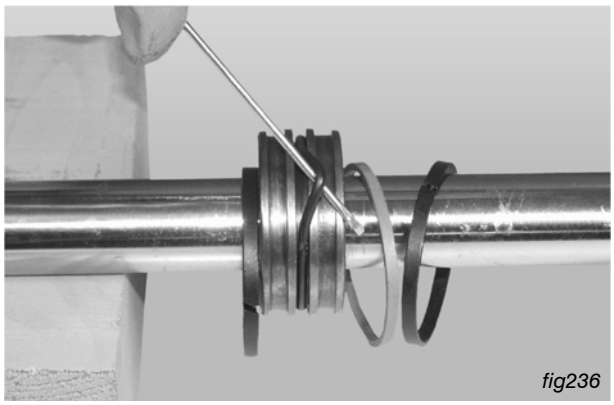

fig233


fig234

Remove the guiding rings from the piston.


fig235

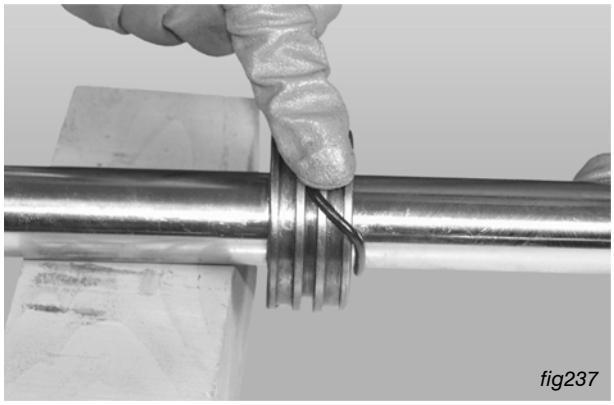
Remove the piston seal.


fig236

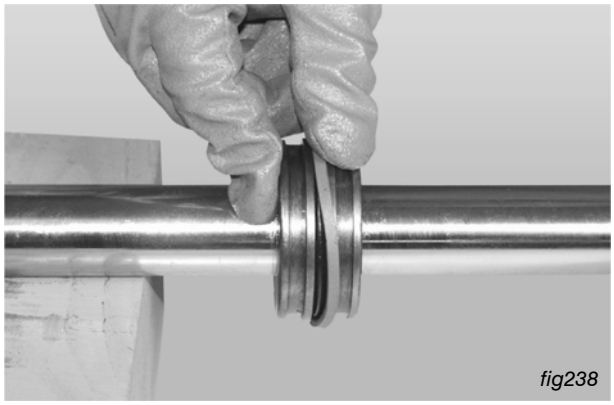
Remove the O–ring.

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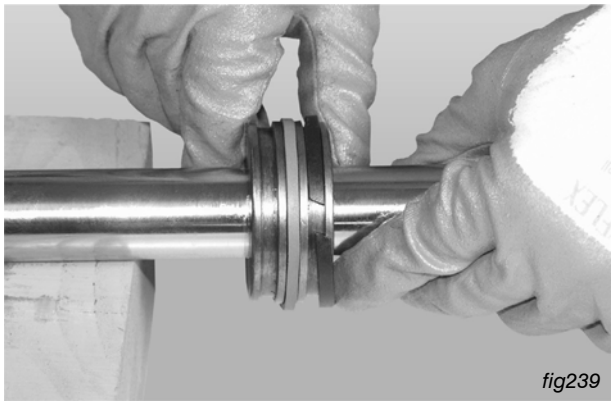
Fitting the steering cylinder

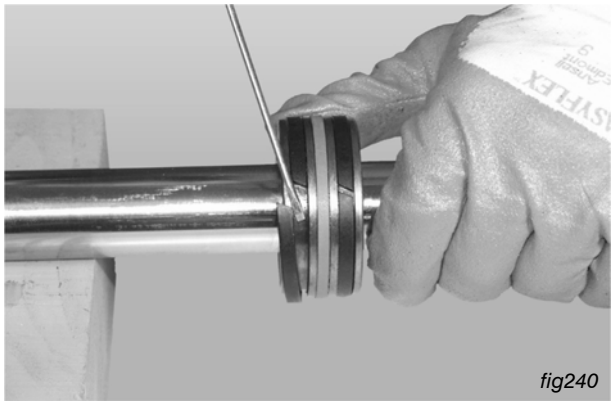

fig237

Fit the O–ring.

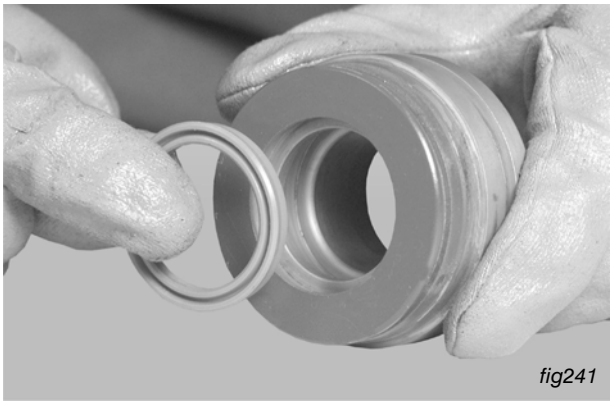

fig238

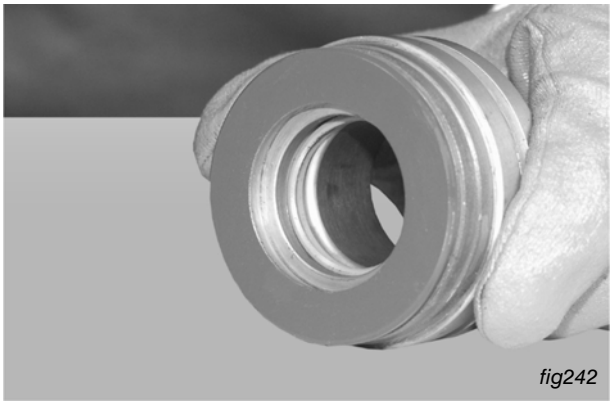
Fit the piston seal.


fig239

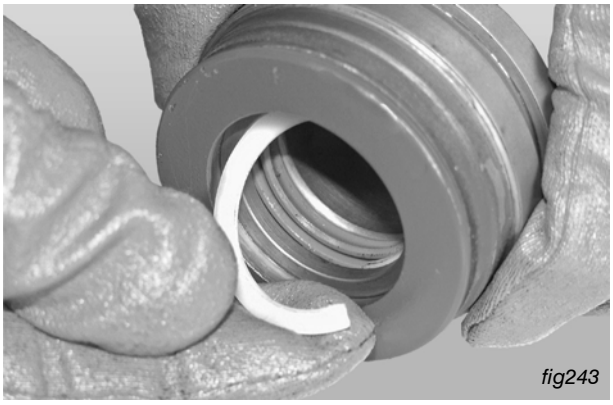

fig240

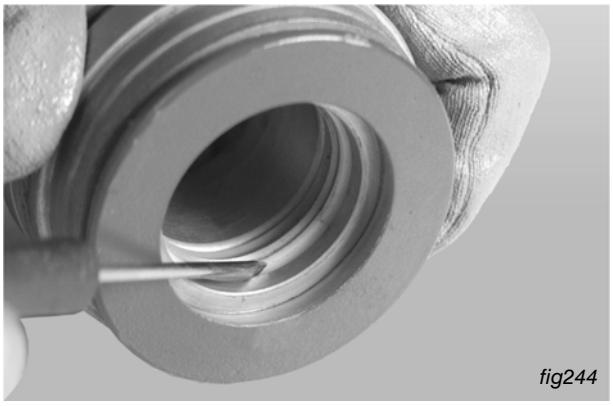
Fit the guiding rings.


fig241


fig242

Lubricate the rod seal and fit it into the cylinder cover.


fig243


fig244

Fit the backing ring. Check, that ends of the backing ring is together.

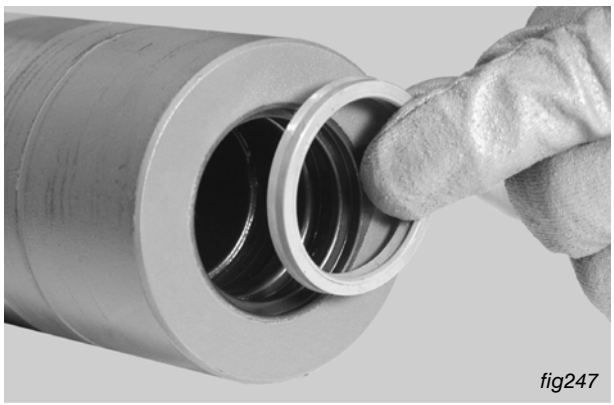
https://truckmanualshub.com/

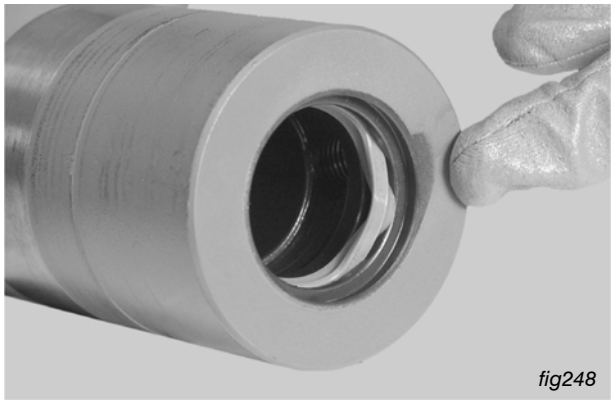

fig245

Fit the the wiper of the piston rod into place.

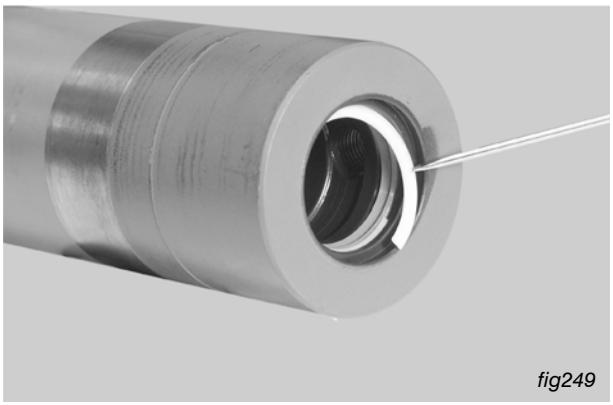

fig246

Lubricate the seal and fit it into the cylinder cover. Don‘t let roll the seal during fitting.

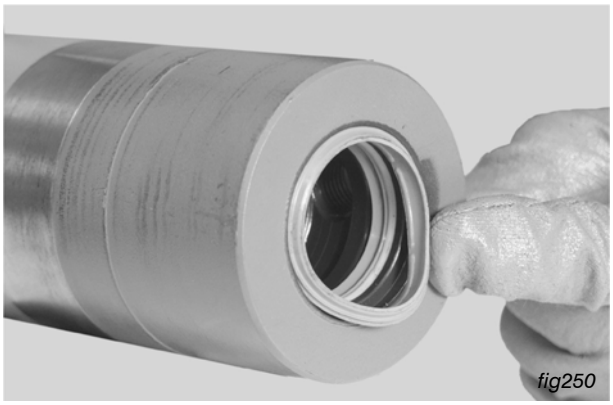

fig247


fig248

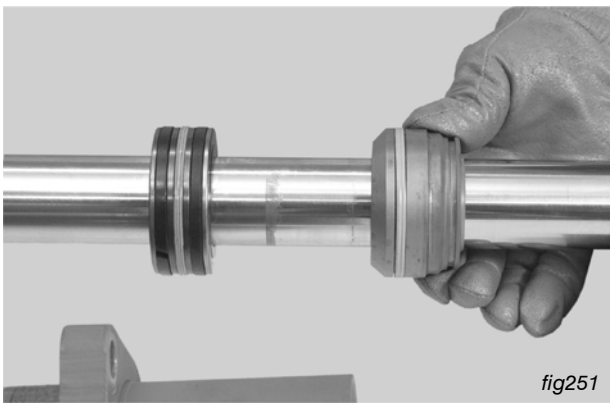
Lubricate the rod seal and fit it into the cylinder cover.


fig249

Fit the backing ring. Check, that ends of the backing ring is together.


fig250

Fit the the wiper of the piston rod into place.

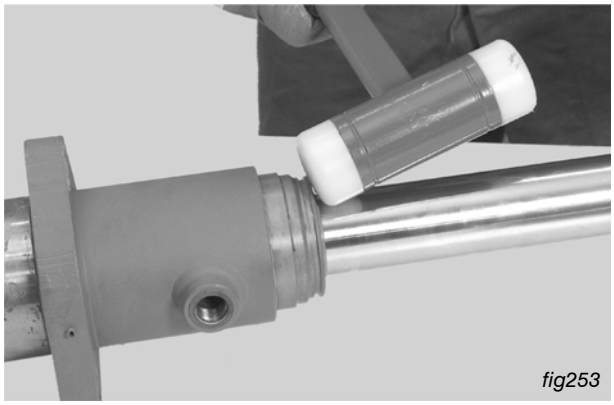

fig251

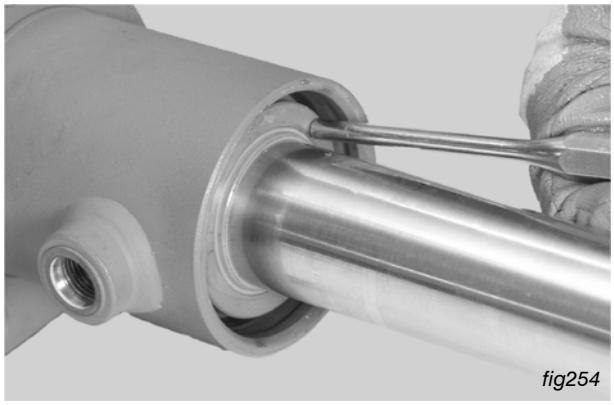
Push the cylinder cover on the piston.


fig252

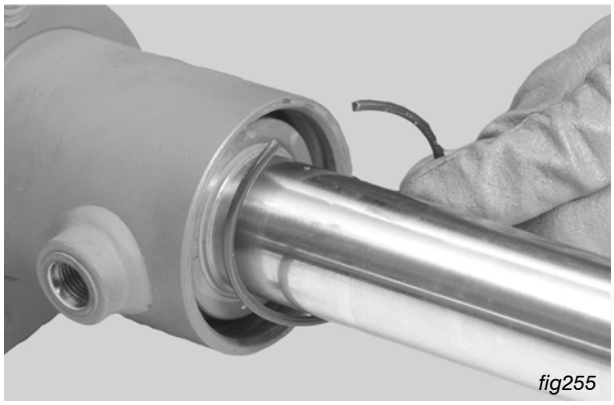
Push the piston into the cylinder.

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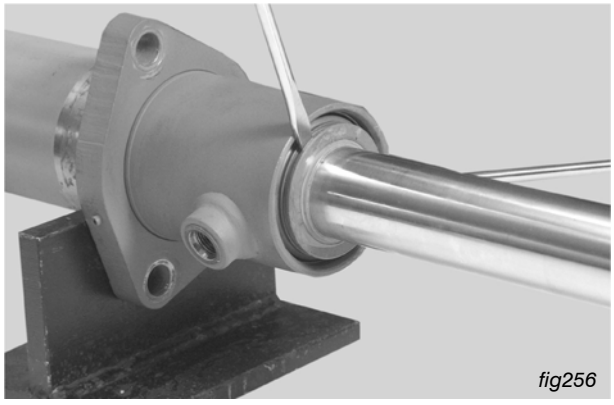

fig253


fig254

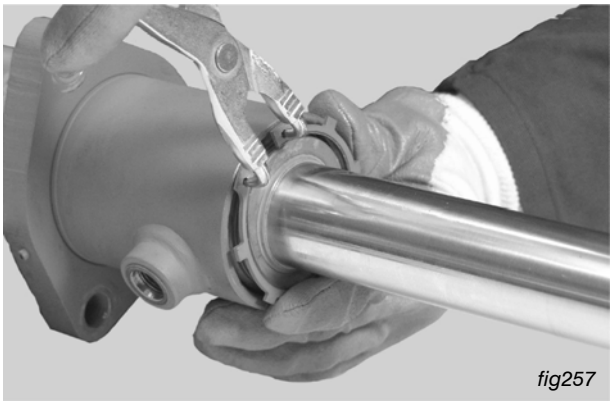
Lubricate the seals and fit the cylinder cover over the groove of the snap ring.


fig255

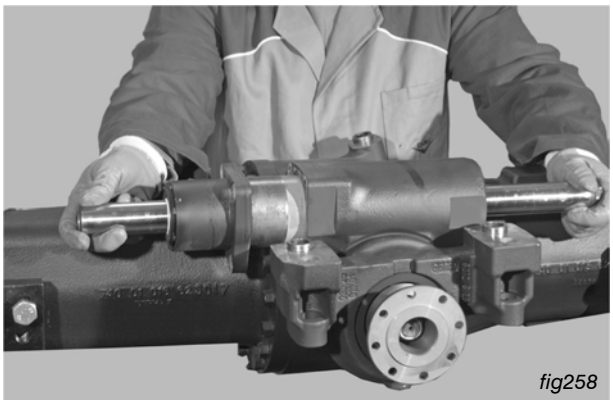
Fit the snap ring. Ensure, that the snap ring is in groove.


fig256

Pull out the piston rod so that the cylinder cover is against the snap ring.


fig257

Fit the snap ring. Ensure, that the snap ring is in groove.


fig258

Fit the steering cylinder into place.


fig220

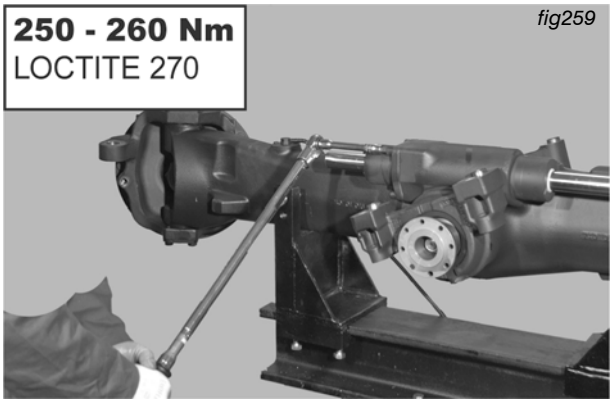


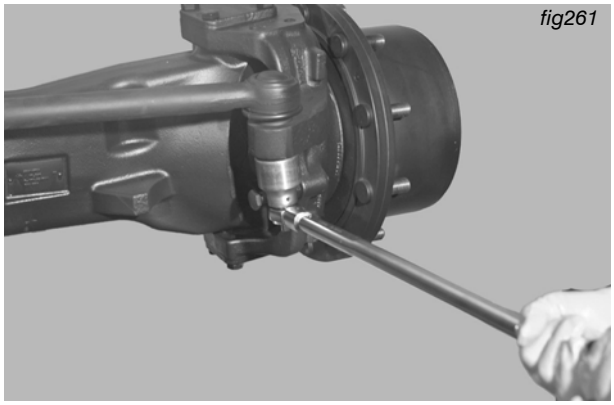
fig259

Tighten fastening bolts of the steering cylinder. Tightening torques: **250 – 260 Nm**.

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Fit the tie rods to the piston rod. Use Loctite 270 on threads.
Tightening torques: **120 – 150 Nm**.



Connect the cone joint of the tie rod. Use grease on threads.
Tightening torques: **200 – 221 Nm**.

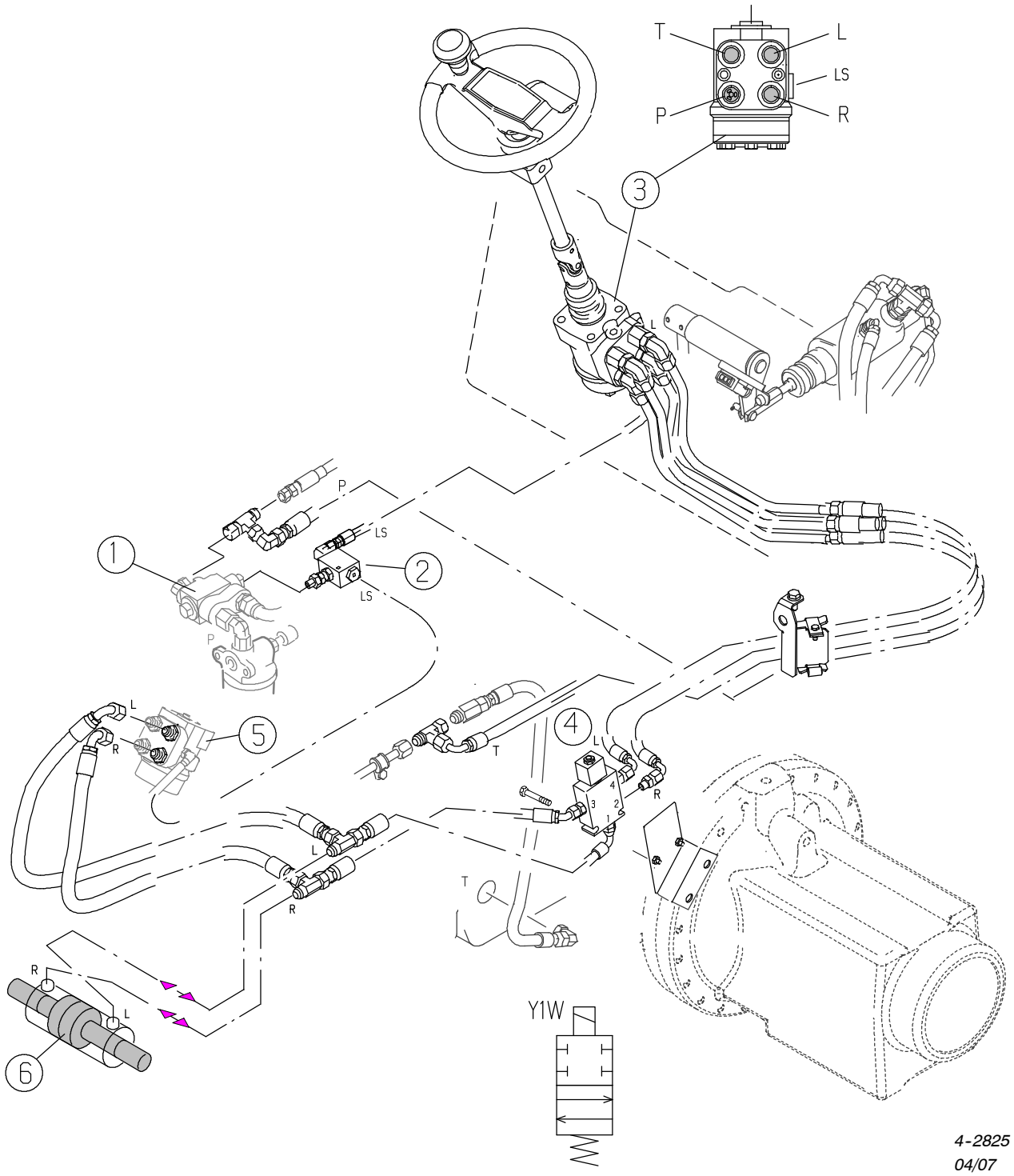
Contents

Technical data, technical specifications, training material

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681.2 ... Steering column 3
681.3 ... Electrical system 5

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Hydraulic components

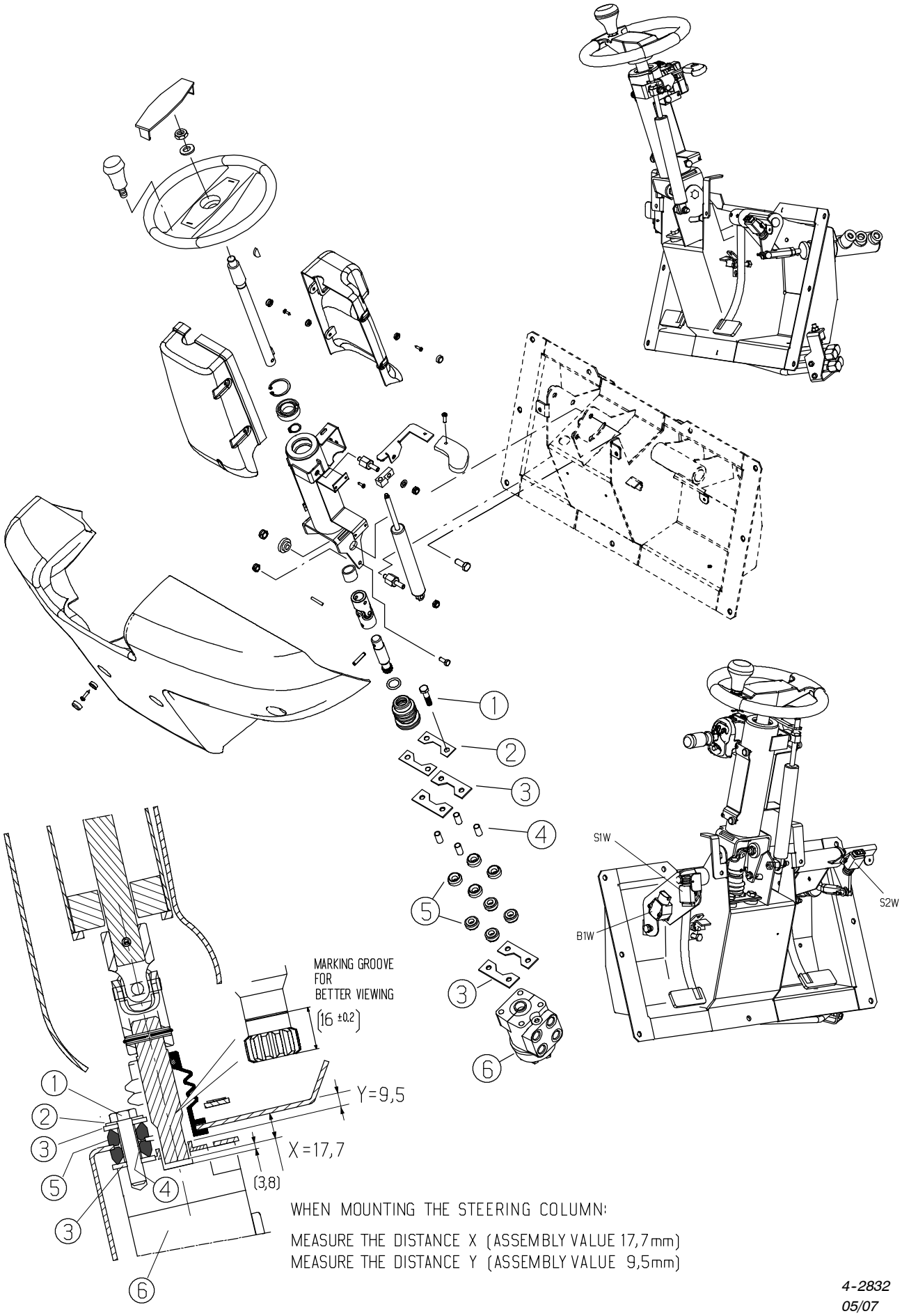


1) Priority valve
2) Shuttle valve
3) Steering valve (OSPC 125LS, 125 cm^3/r)
   – pressure relief valve 14 MPa
   – shock valves 20 MPa
4) Directional control valve
5) Steering valve
6) Steering cylinder

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Steering column



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When fitting the steering column, measure the distance between the end of the lower steering shaft and the housing (measure X ; assembly value = 17,7 mm), furthermore measure the distance between the collar of the steering valve and the upper surface of the housing (measure Y ; assembly value = 9,5 mm).

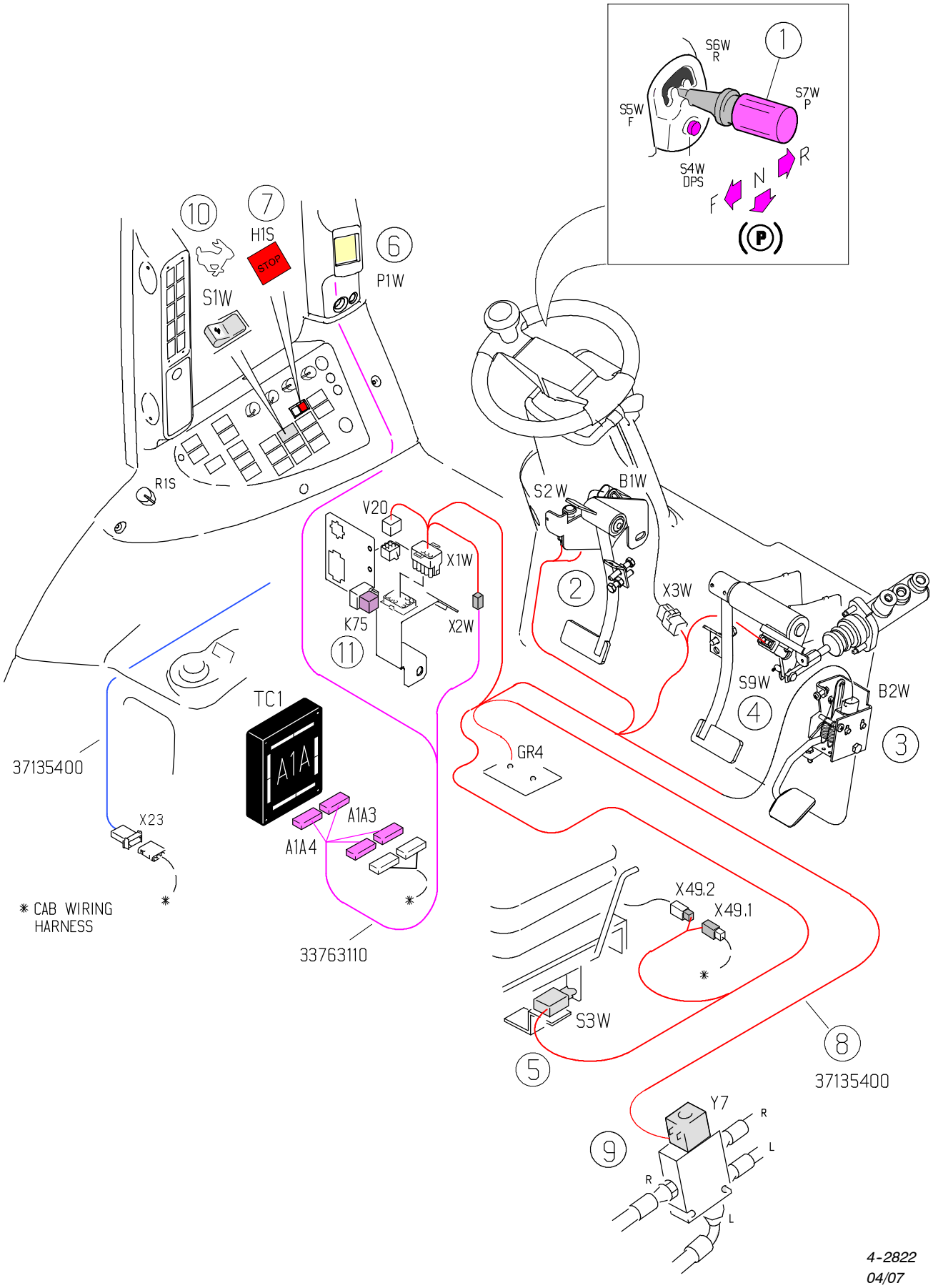
In this way the right depth of the steering shaft end in the steering valve will be secured.
(In every reverse control system, the shaft depth in the steering valve will be notified and marked in the cab check card by the cab manufacturer).

There are no adjusting shims but the plates (3) on both ends. The tolerances of the housing are precise.

1) Screw
2) Locking plate
3) Plate
4) Sleeve
5) Vibration damper
6) Steering valve (OSPC 100LS)
   - Pressure relief valve, steering 14 MPa (=working pressure)
   - Shock valves 20 MPa
   - The steering valve for reverse drive controls has minor displacement (100 cm^3/r) as front valve (125/160 cm^3/r), because the steering movements must be smaller when driving backwards.

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Electrical system (T121h–T191h)

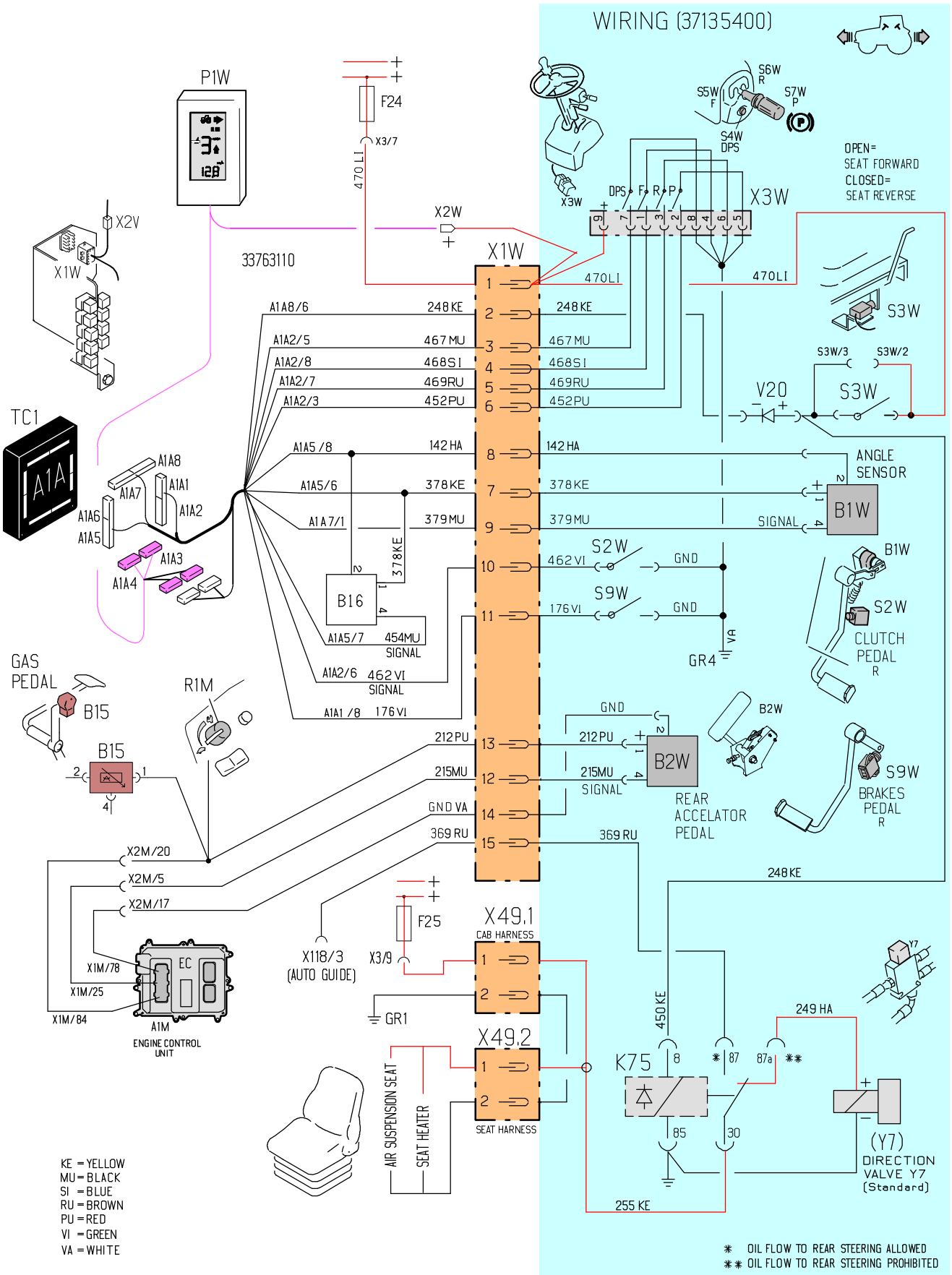


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04/07

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1) There is a similar reverse shuttle / parking brake lever as in the front steering column.
   NB! Driving directions!
   DPS pre–programming button functions as in the standard model.
2) The clutch pedal has an angle sensor (B1W) and safety switch (S2W).
3) Rear accelerator pedal sensor (B2W)
4) Brake pedal switch (S9W)
5) F/R switch (S3W) of the driver's seat
6) Rear display (P1W)
7) Rear stop light
8) Cable harness, reverse drive controls (37135400)
9) The reverse drive preventing system (control valve Y7 + switch S3W)
10) Extra switch for Powershift, (S1W, 3–position)
11) K75 relay, rear steering prevented
    – switches the function to the reverse (seat forward–> oil flow to rear steering valve prevented)
    – protects the F/R switch (5) from overload

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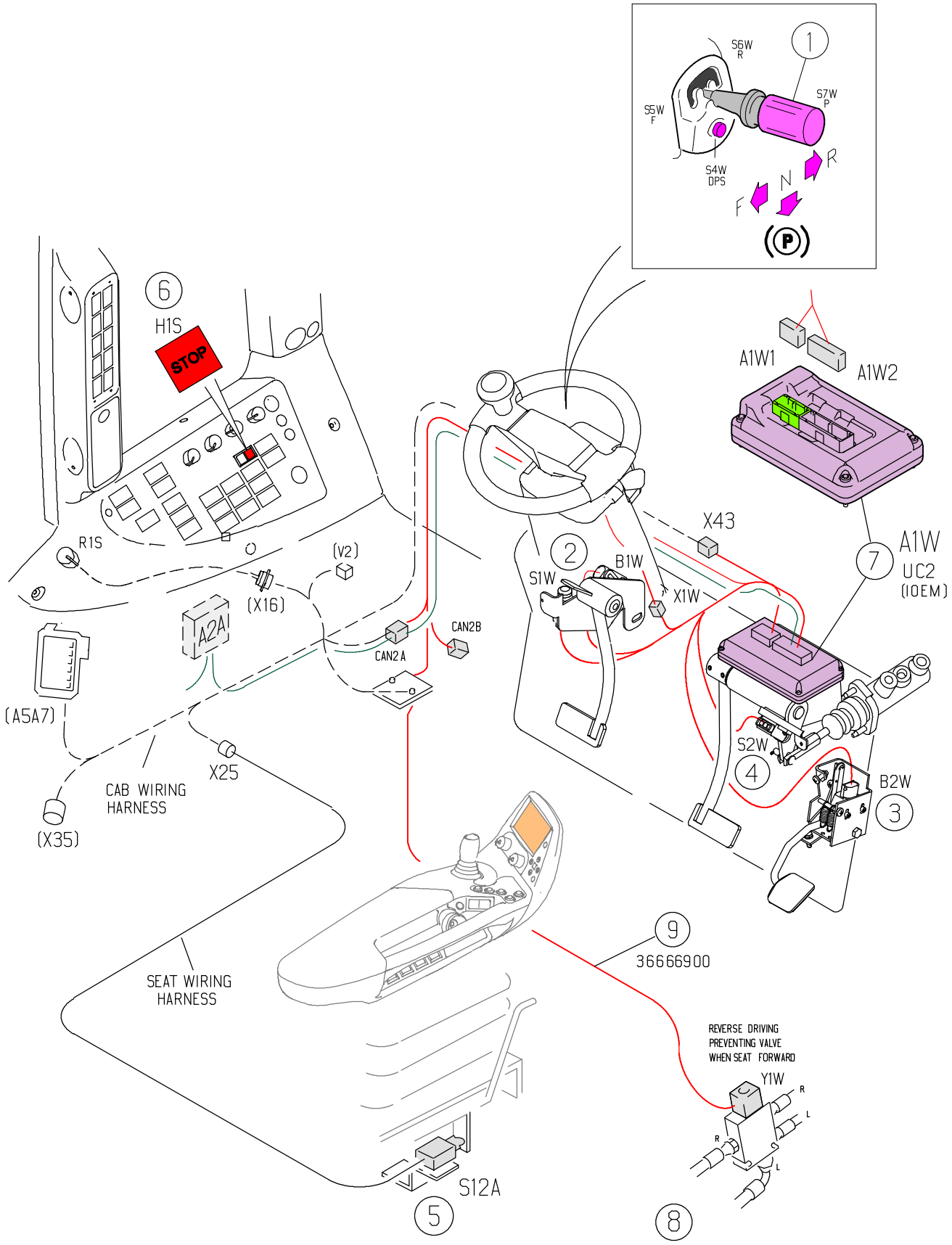


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Electrical system (T151eLS–T191LS)

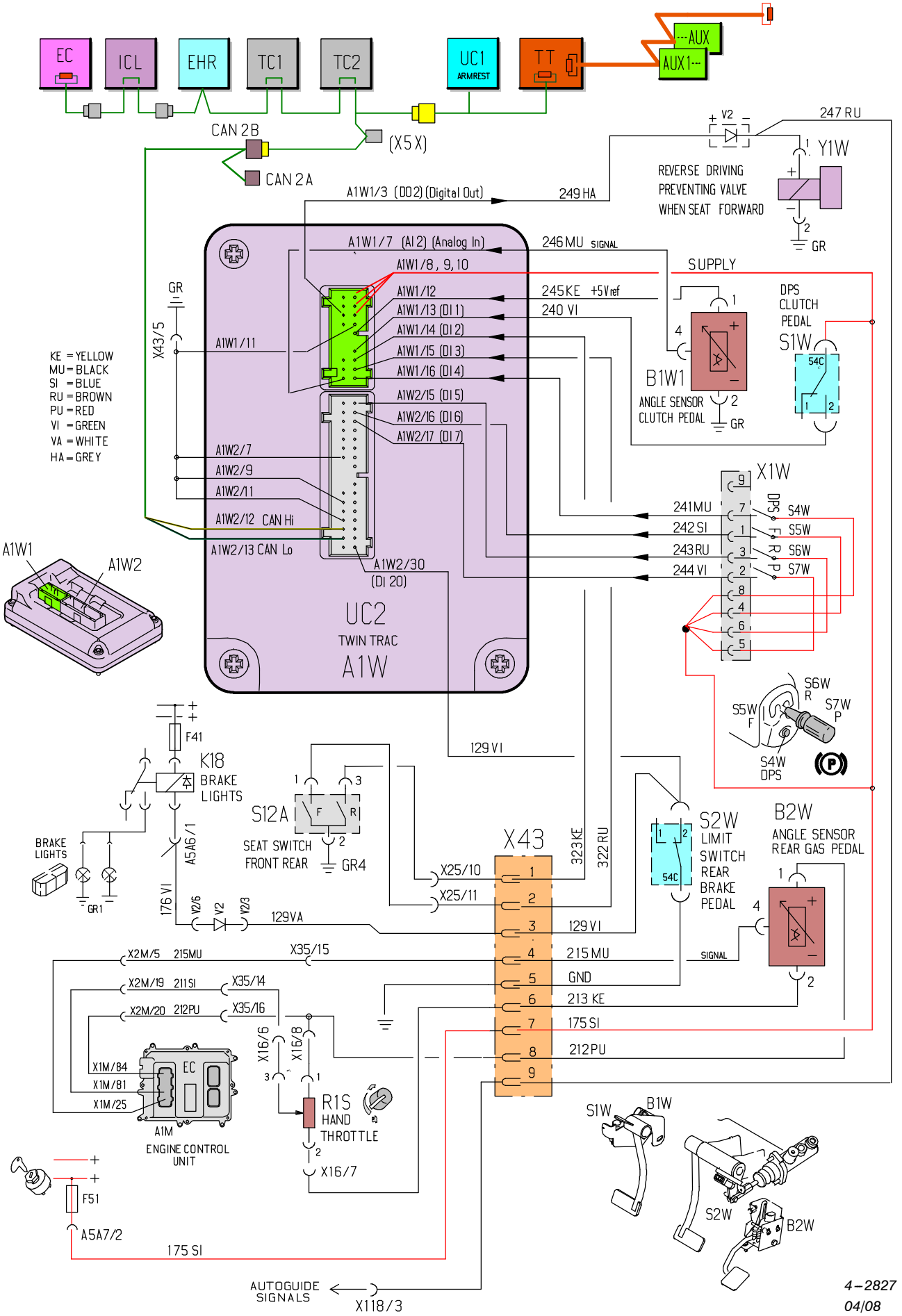


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1) There is a similar reverse shuttle / parking brake lever as in the front steering column.
   DPS pre–programming button functions as in the standard model. NB! Driving directions!
2) The clutch pedal has an angle sensor (B1W) and safety switch (S1W).
3) Rear accelerator pedal angle sensor (B2W)
4) Brake pedal switch (S2W)
5) F/R switch (S12A) of the driver seat.
6) Rear stop–light (H1S)
7) TwinTrac control unit (A1W)
8) The reverse drive preventing system (control valve + switch S12A)
9) Cable harness, TwinTrac (36666900)

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I/O	Signal	Logic	Connection
DI1	Clutch pedal, rear (S1W)	”0” = pedal not depressed ”1” = pedal depressed	”0” = floating ”1” = + 12V
DI2	Seat backwards (S12A)	”0” = seat not backwards ”1” = seat backwards	”0” = floating ”1” = GND
DI4	Preprogramming, rear (S4W)	”0” = ”1”+ t (+clutch pedal)	”0” = floating, button released ”1” = + 12 V, button depressed
DI5	F–R change, rear –R (S6W)	”0” = driving not backwards ”1” = driving backwards	”0” = floating ”1” = + 12 V
DI6	F–R change, rear –F (S5W)	”0” = driving not forwards ”1” = driving forwards	0” = floating ”1” = + 12 V
DI7	Parking brake, rear (S7W)	”0” = parking brake off ”1” = parking brake on	”0” = floating ”1” = + 12 V
DI20 (–)	Rear brake (S2W)		”0” = floating ”1” = GND
AI2	Clutch pedal, rear (B1W)	”0V” = 0V ”5V” = 5V	Voltage increases when pedal is de-pressed
DO2	Rear wheel in use, solenoid (Y1W)	”0” = not steered ”1” = steered	”0” = 0 V ”1” = + 12 V

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70. Frame and wheel

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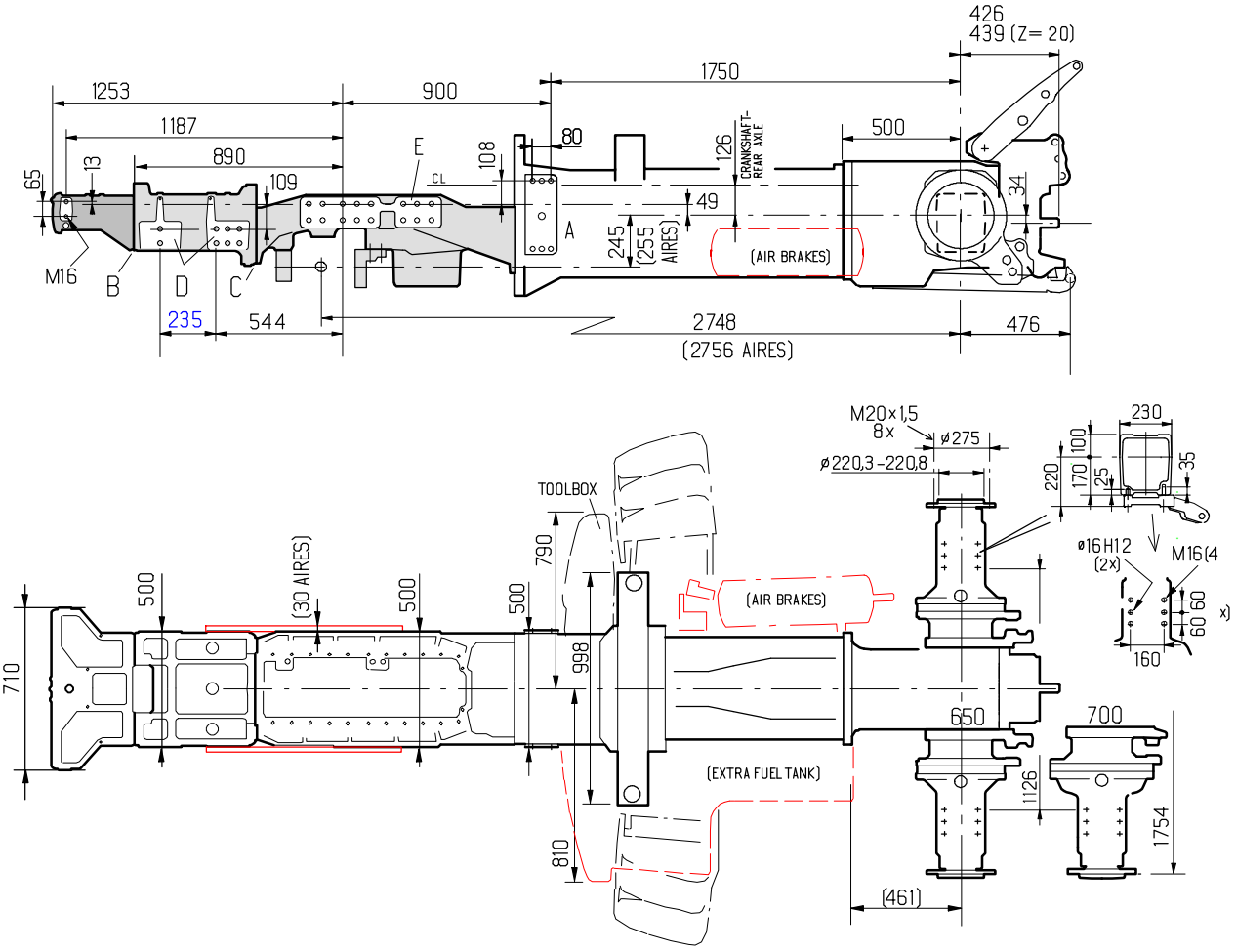
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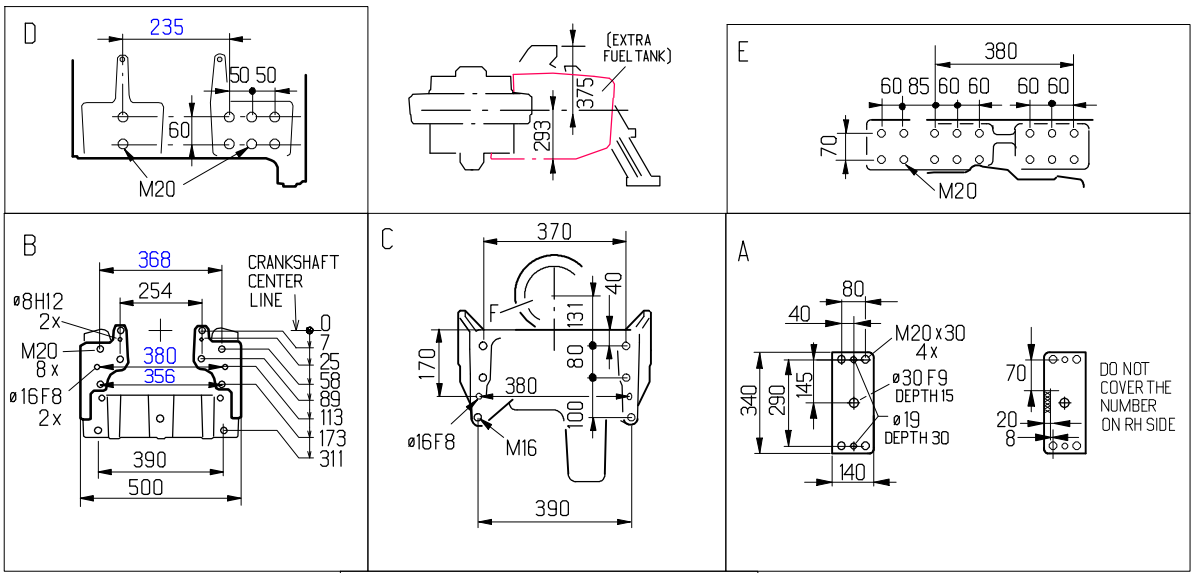
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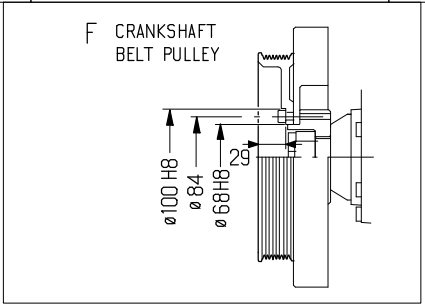
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Fixing points for implements







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Front weight support and frame

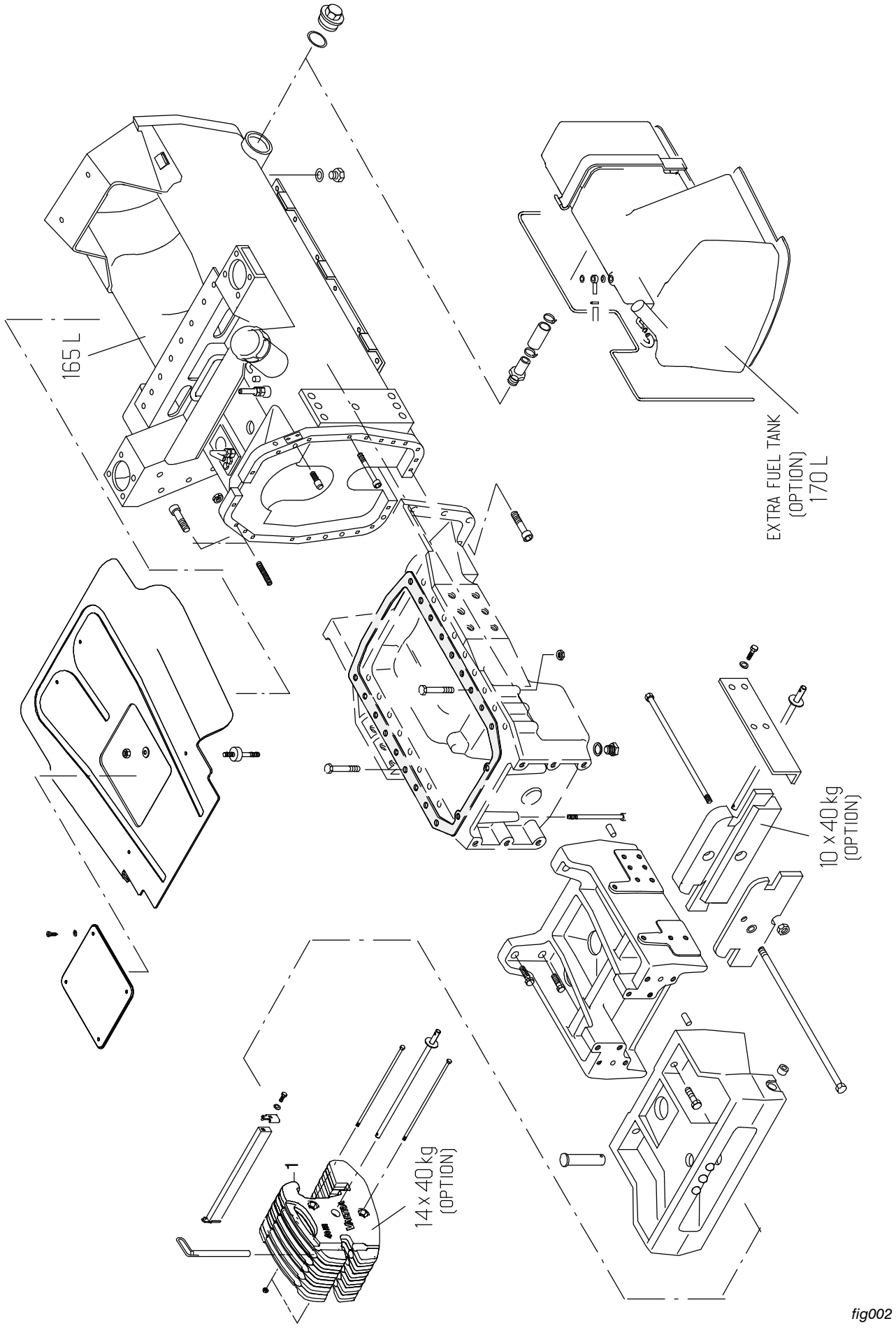


fig002

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80. Cab

81. Cab

82. Instruments

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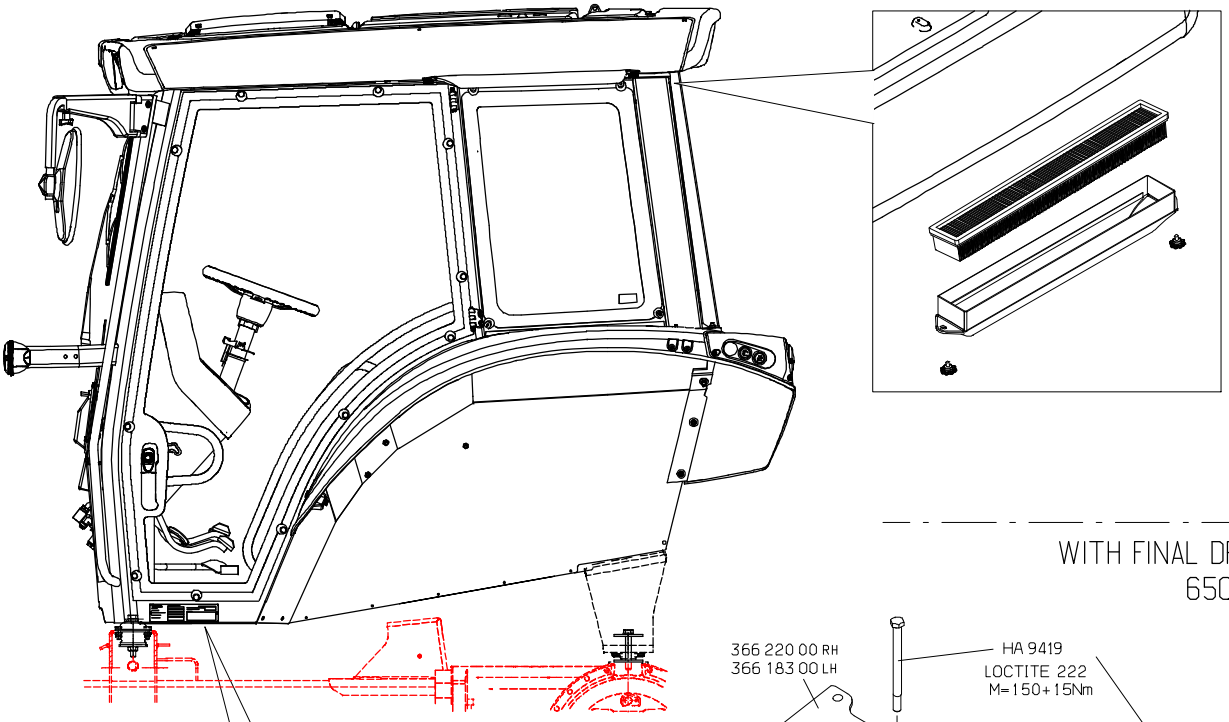
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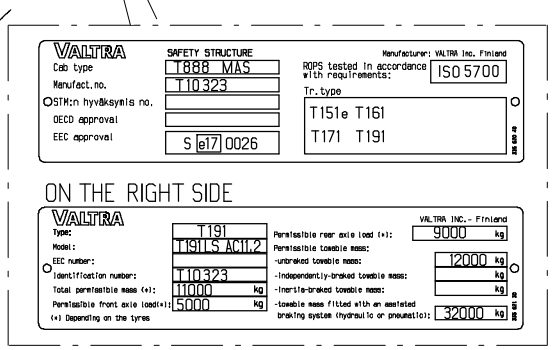
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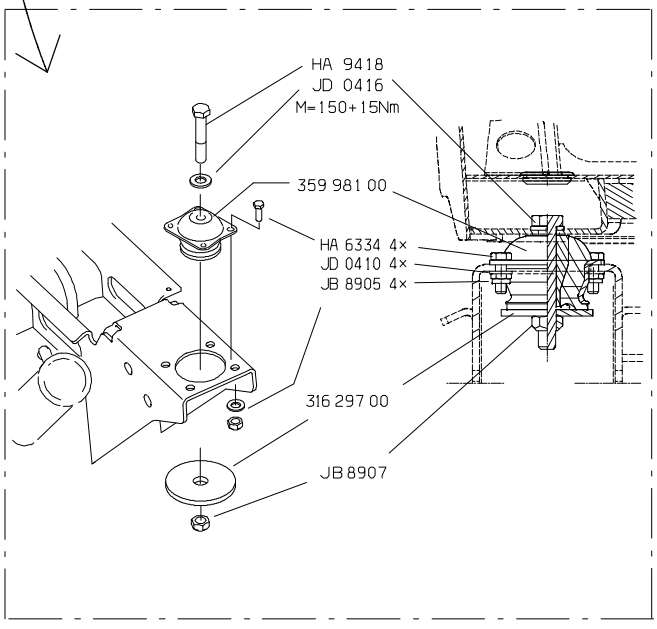
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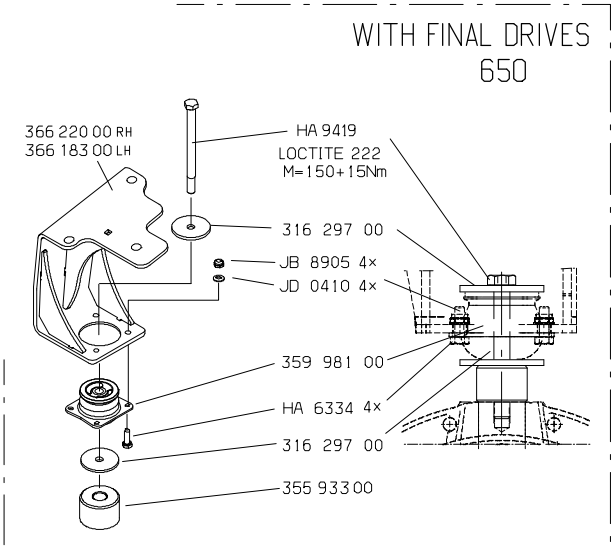
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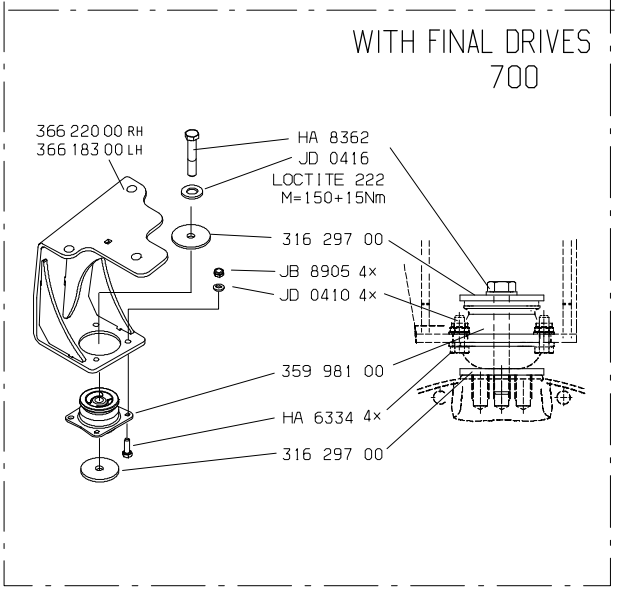
Cab







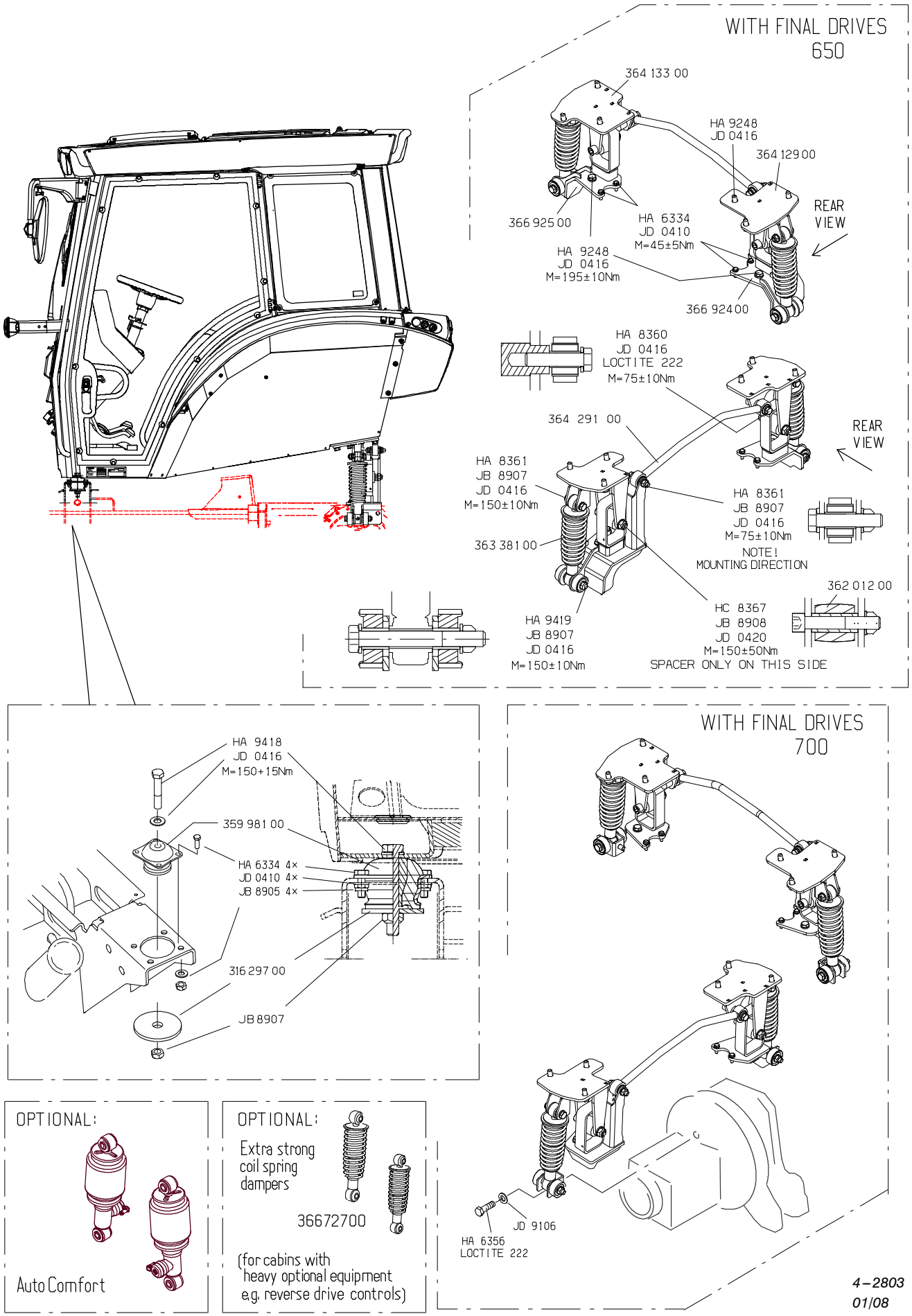




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Cab suspension



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Cab heater

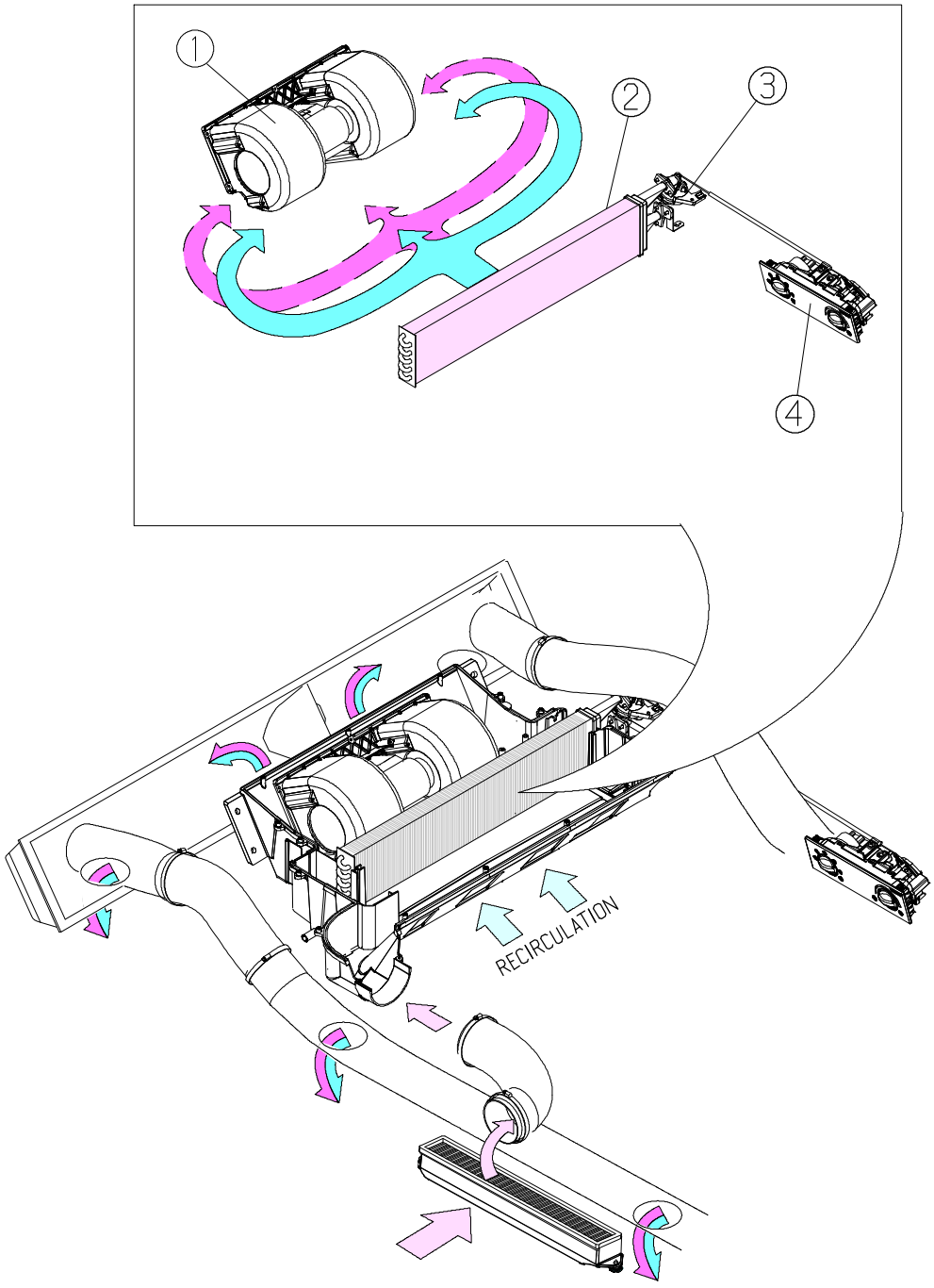


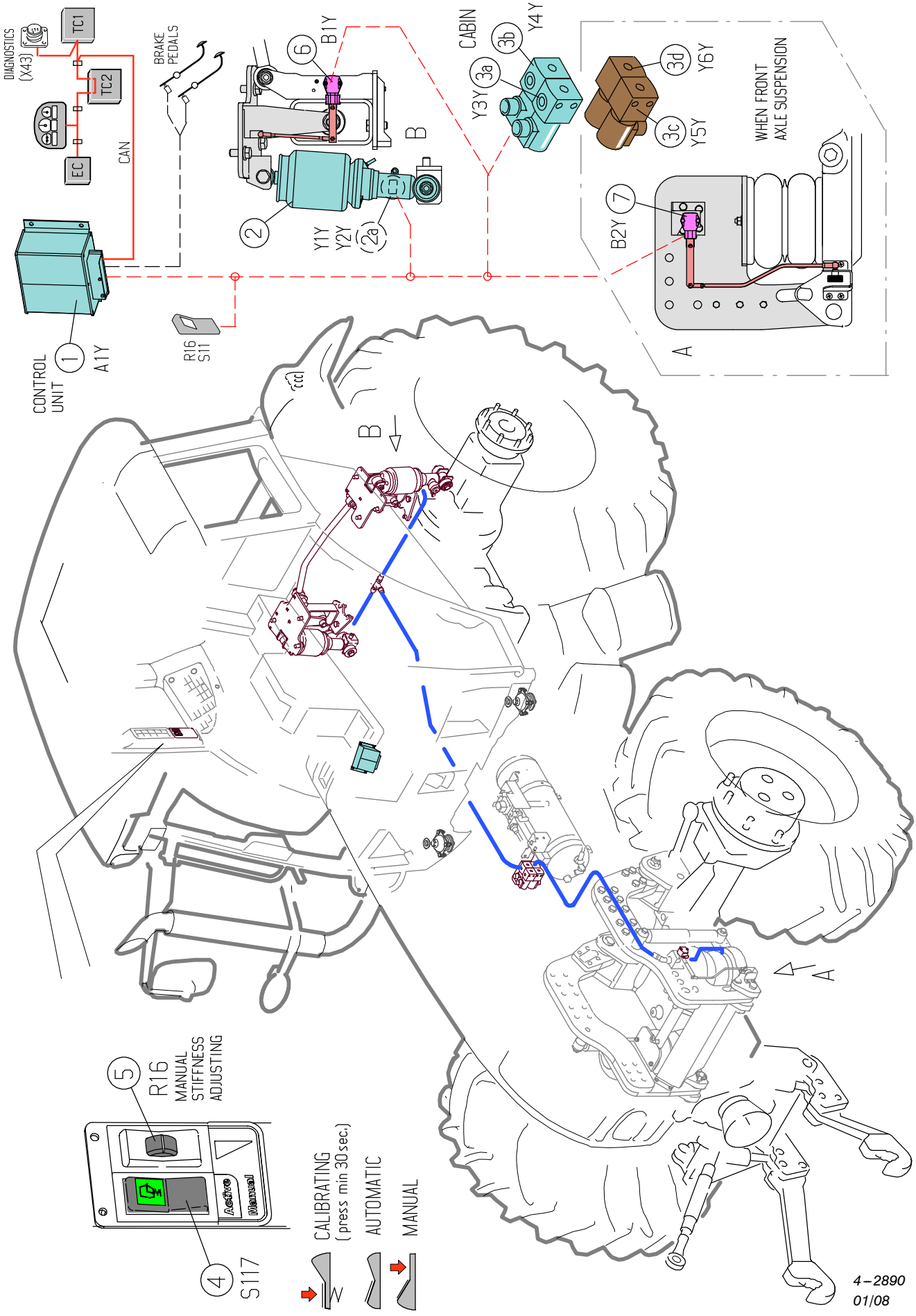
fig002

1) Blower
2) Heater coil
3) Water valve
4) Heater control unit

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Semi–active cab suspension (AutoComfort)



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AutoComfort cab suspension is a semi–active cab suspension system that automatically adjusts to different driving conditions.

Level control:

– Electronic level control for cabin and front axle (if fitted). Both level controls have two 2/2 solenoid valves, one valve for raising and one for lowering.
– The middle position is determined using calibration.
– Control based on longer time position average. The valve is continuously open if the distance to the middle position is great. The valve periodically adjusts the level closer to the middle position.
– Front axle level control is disabled when braking or when the parking brake is engaged.

The system reacts to cab movements by adjusting the stiffness of the shock absorption every two milliseconds. The adjustment is based on the following:
– movement data from the position sensor
– driving speed (CAN)
– DPS changing (CAN)
– position of F–R shuttle (CAN)
– braking.

1) Electronic control unit

2) Air spring/CDC (Continuous Damping Control) damper modules

2a) Damper proportional valve
– built–in in the damper

3a–3b) two 2/2 solenoid valves (on/off) for cab level control

3c–3d) two 2/2 solenoid valves (on/off) for level control of the front axle suspension

4) Selector switch:
– **Symbol side (spring return) pressed down:** Calibration of level control (must be pressed for 30 seconds). Switch indicator light blinks.
– **Middle position:** Active (automatic damping control).
– **The lower side pressed down:** Manual damping adjustment by turning wheel 5).

Fault codes are shown by blinking switch light (only one fault at a time).

5) Manual stiffness adjusting
– when the symbol side of the switch (4) is pressed down

6) Position sensor (cabin)

7) Position sensor (front axle suspension)

Fault finding

Sensors

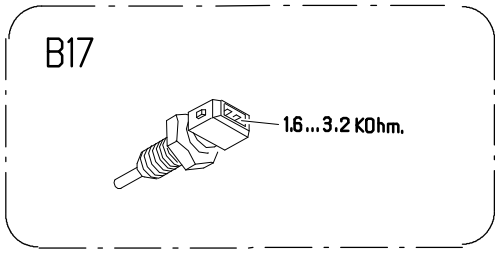


fig003

Check the resistance between sensor pins **2** and **1** (–)

Resistance values in different temperatures:
– **0** Celsius –> approx **1.6** kOhm
– **25** Celsius –> approx **2.0** kOhm
– **50** Celsius –> approx **2.4** kOhm
– **100** Celsius –> approx **3.2** kOhm

Location of the sensors in wiring diagram:

Symbol	Description	Page+position	Location
AC10.2&AC10.21			
–B17	Sensor, outdoor temperature	/3.A7	Engine hood
AC11.2			
–B17	Sensor, outdoor temperature	/10.D7	Engine hood

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Fault diagnostics of the AutoComfort system

The fault diagnostics shows the faults in the system by blinking the switch indicator light. The diagnostics shows only one fault at a time. If there are several faults at the same time, the first fault in the list is shown. When the fault has been corrected, the second fault will be shown after the following start.

The control unit does not remember the faults after a current break. Acknowledging a fault after repairing it always requires the control unit to be restarted (by switching the current off from the tractor). Therefore the blinking of the indicator light will continue although the fault is no longer active.

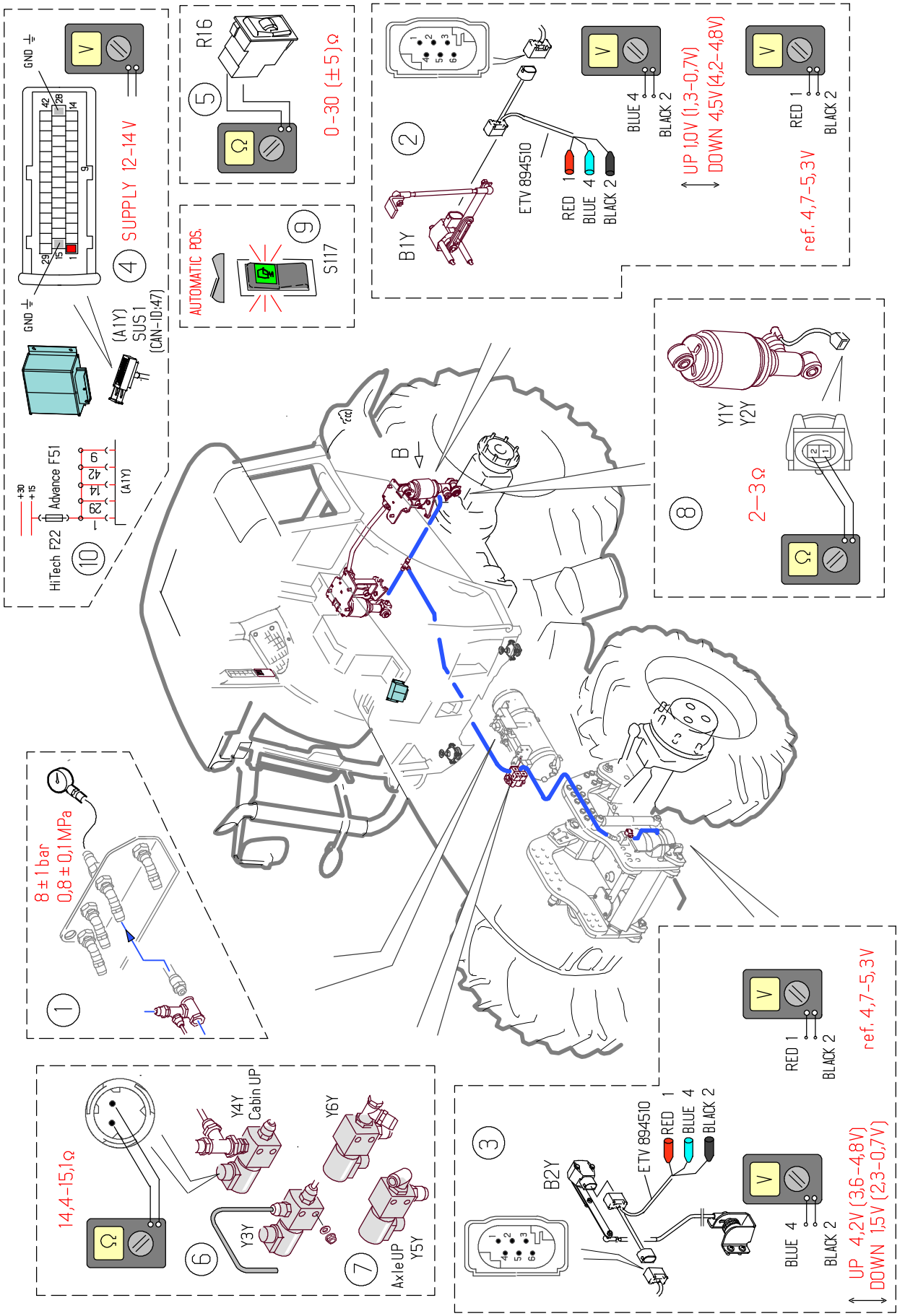
Note! Fault diagnostics does not start until the current has been switched on for a few minutes! **Note!** The function of the switch light can be notified when the switch is in “active” position (in the middle). In the normal situation, when the system is OK, the switch indicator light is continuously on in the active position. In the manual position (opposite side of the symbol down) the light is off. When calibrating, the light blinks steadily without breaks.

The fault codes are indicated by the blinking indicator light of the switch. For example, number 4 means four quick flashes of the indicator light. Between the periods the indicator light is off for about three seconds. The cycle of four flashes and three seconds will repeat until the control unit is switched off.

The control unit recognizes automatically whether the level control of the front axle is connected to the system. The identification happens with the help of the compressed air valves. If the control unit does not find either of the valves (neither lifting nor lowering valve), it assumes that the level control of the front axle has not been installed and will interrupt the diagnostics for the front axle.

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AutoComfort system, testing



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06/08

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Testing the AutoComfort cab suspension

If there is a malfunction, the values which can be measured with a multimeter, for example, are the following:

1. The pressure of the pneumatic system 8bar +/– 1bar

2. Position sensor of the cab: down 4.5 V (4.2–4.8V), up 1.0V (1.3–0.7V).
Free signal line 0.6V (MultiTool: AI04)

3. Position sensor of the front axle: down 1.5V (2.3–0.7V), up 4.2V (3.6–4.8V).
Free signal line 0.6V (MultiTool: AI06).

4. Supply voltage of the control unit: 12–14V, reference voltage: 4.7–5.3V.

5. Potentiometer of the manual adjustment: resistance i 0–30 +/– 5 Ohms.
(MultiTool: AI05).

6. The solenoid of the the cab control valve : resistance 14.4–15.1 Ohms.
Free voltage line 1.8V.

7. The solenoid of the the axle control valve : resistance 14.4–15.1 Ohms.
Free voltage line 1.8V.

8. The proportional valve of the damper module : resistance i 2–3 Ohms.

9. The diagnostic light must be on when the Auto/man switch is in the Auto position.
(pin 24: 0 or 12V).

10. The fuse for AutoComfort is in HiTech tractors F22 and in Advance tractors F51

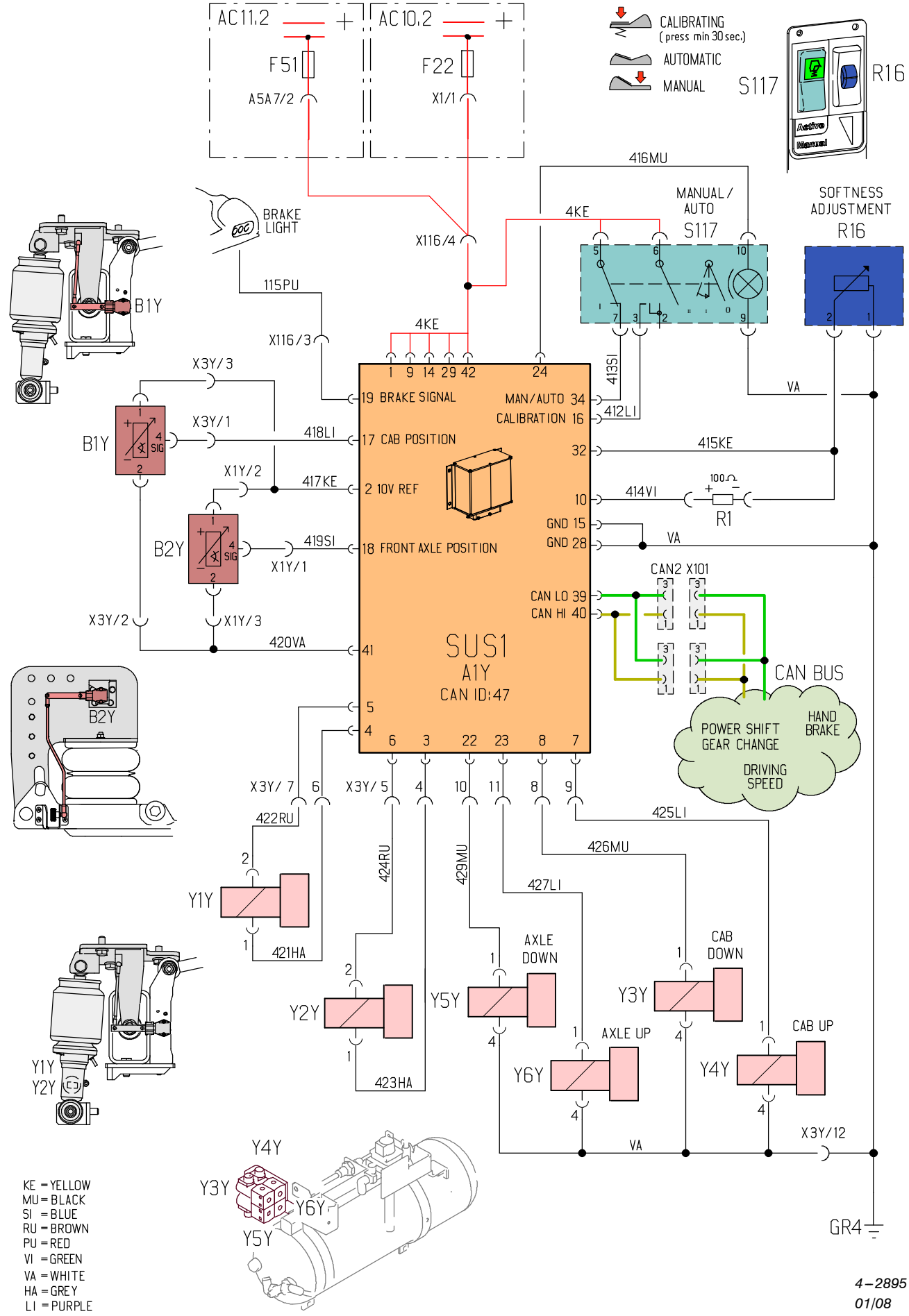
The inputs / outputs can be tested with the MultiTool.

The pins of the control unit (SUS1, CAN ID= 47):

17	cab position sensor (B1Y)	MT AI04 0–10V
18	front axle position sensor (B2Y)	MT AI06 0–10V
32	manual potentiometer (R16)	MT AI05 0–10V
19	brake light switch	MT AI08 0–10V
16	calibration switch	MT AI08 0–10V
34	auto/manual switch (S117)	MT AI09 0–10V
4–5	proportional valve, right (Y1Y)	MT AO01 0–2A (Letter V on display), PO01 0–35%
6–3	proportional valve, left (Y2Y)	MT AO02 0–2A (Letter V on display) PO02 0–35%
7	cab control valve, raising (Y4Y)	MT AO03 0–12V
8	cab control valve, lowering (Y3Y)	MT AO04 0–12V
22	axle control valve, raising (Y5Y)	MT AO05 0–12V
23	axle control valve, lowering (Y6Y)	MT AO06 0–12V

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AutoComfort system, wiring



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Control	Active						
	Handbrake on	Handbrake off					
		Speed < 4 km/h			Speed > 4 km/h		
		Normal operation	Braking	Powershift gear change	Normal operation	Braking	Powershift gear change
2000 mA		X	X	X			
1500 mA						X[1)]	X[1)]
1400 mA							
0 mA	X						
Automatic control 650...2000 mA					X		

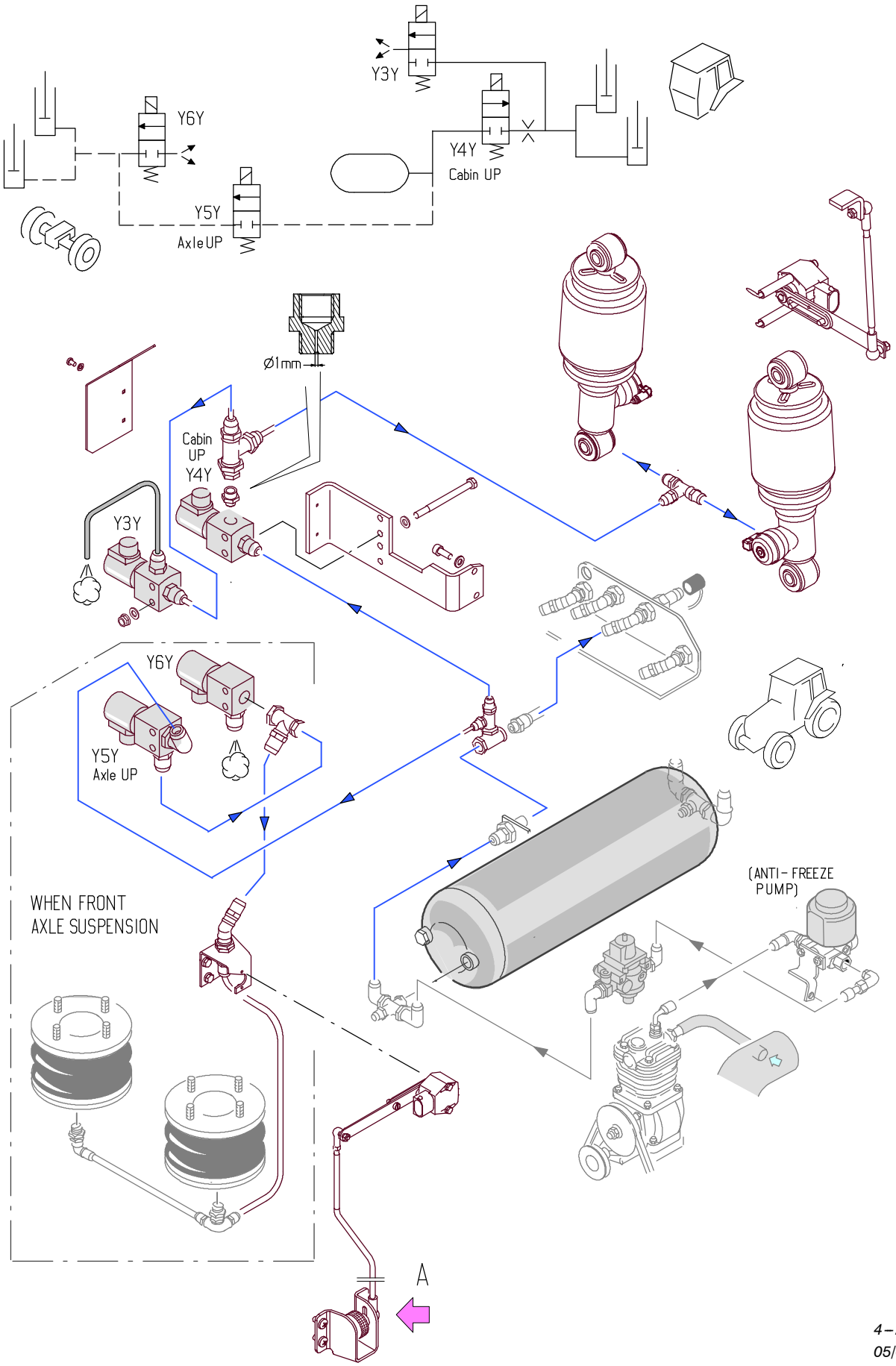
1) If automatic control is requests for more than 1500 mA, the requested current will be applied.

Control	Manual			
	Handbrake on	Handbrake off		
		Normal operation	Braking	Powershift gear change
1500 mA			X[2)]	
0 mA	X			
Manual adjustment 650...2000 mA		X		X

2) If manual control requests for more than 1500 mA, the requested current will be applied.

AutoComfort system work instructions

AutoComfort system components



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05/08

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Calibrating the AutoComfort suspension

The calibration is carried out on even surface. The control unit calibrates the middle position of the cab and the front axle at the same time. **Note!** Be careful with the moving cab and front axle suspension. During the calibration, the engine must be running, the F – R lever in N position and 4WD off. If the tractor has a front loader, it must lie on the ground in floating position during calibration.

The calibration is started by pressing the upper side (symbol side) of the AutoComfort rocker switch over 30 seconds.

When calibrating, the suspension first goes to the lowest position (discharging valves are open for 40 seconds). The suspension rises up (lifting valves remain open for 80 seconds). After the calibration the suspension seeks the middle position. During calibration, the indicator light of the switch blinks steadily (50% ON 50 % OFF).

If the tractor has many front weights etc., the front axle suspension will not calibrate itself properly but remains too low. In this case the front axle suspension has to be adjusted to the middle position by moving the fastening point of the position sensor rod (arrow in the picture). Calibration is necessary, for example, when the position sensor has been changed.

Fitting/removing the locking pins for the front axle

– Switch off the engine.
– With the current switched on, move the F – R lever to the N position. (The parking brake is automatically on when the engine is not running).
– Adjust the axle height by moving the rod of the position sensor (arrow in the component picture).

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Instrument panel AGROLINE



fig001

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1) Revolution counter
2) Fuel gauge
4) Engine temperature gauge
5) Direction indicator flasher
6) Engine air filter warning light
7) Not used
8) Direction indicator warning light for first trailer
9) Direction indicator warning light for second trailer
10) Cold start glow (the starter switch is in the position 1 and automatic glowing is in operation).
11) Not in use
12) Parking brake.
    c models:
    Parking brake is on.
    h models:
    The light is on when the shuttle lever is in the parking brake position. If the indicator light is on and the STOP light is flashing, the parking brake cable is broken or incorrectly adjusted.
13) Low fuel level. Comes on when about 50 l fuel is left. Also, in models N91c – N111c, N91h – N111h, the light comes on when the fuel feed pressure is low.
    Additionally the cyclical flashing of the indicator light indicates the following things:
    – The fuel feed pressure is low ☼–☼———☼–☼———
    (on 0,3 s, pause 0,3 s, on 0,3 s, pause 1 s, on 0,3 s, pause 0,3 s, on 0,3 s, pause 1 s, ...)
    –Water in fuel (extra equipment) ☼–☼–.
    (on 0,5 s, pause 0,5 s, on 0,5 s, pause 0,5 s, ...)
14) Battery charging. Comes on when charging does not operate. NOTE: The charging failure must be fixed at once. When the voltage is reduced, the electric valves may reduce the oil pressure for the multi–disc clutches and cause clutch slippage which may damage the clutch discs.
15) Not in use
16) Engine oil pressure
17) LCD–display (Agroline)
18) Gearbox oil pressure
19) Stop– warning light. The Stop–light is controlled by the following functions, i.e. if one of the following warning lights come on, the STOP–light starts to flash:
    – engine oil pressure (16) too low
    – gearbox oil pressure (18) too low
    – gearbox oil temperature (28) too high
    – Parking brake (12) cable is broken or incorrectly adjusted (flashes).
    If only the central warning (STOP) lamp starts to flash, the engine temperature is too high (can be seen also on the temperature gauge). If the stop–lamp starts to flash when the parking brake is applied, the parking brake cable is broken or the adjustment is wrong.
20) Power Shift speed range I is engaged
21) Power Shift speed range II is engaged
22) Power Shift speed range III is engaged
23) Differential lock
24) Rear PTO. Is on when PTO shaft is rotating. Flashes when the shaft does not rotate, but the selection lever is engaged.
25) Front PTO (optional)
26) 4WD
27) Hydraulic pressure filter blocked
28) Gearbox oil temperature
29) High beams
30) Switch (S80) to select functions in LCD–display upper row

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LCD display

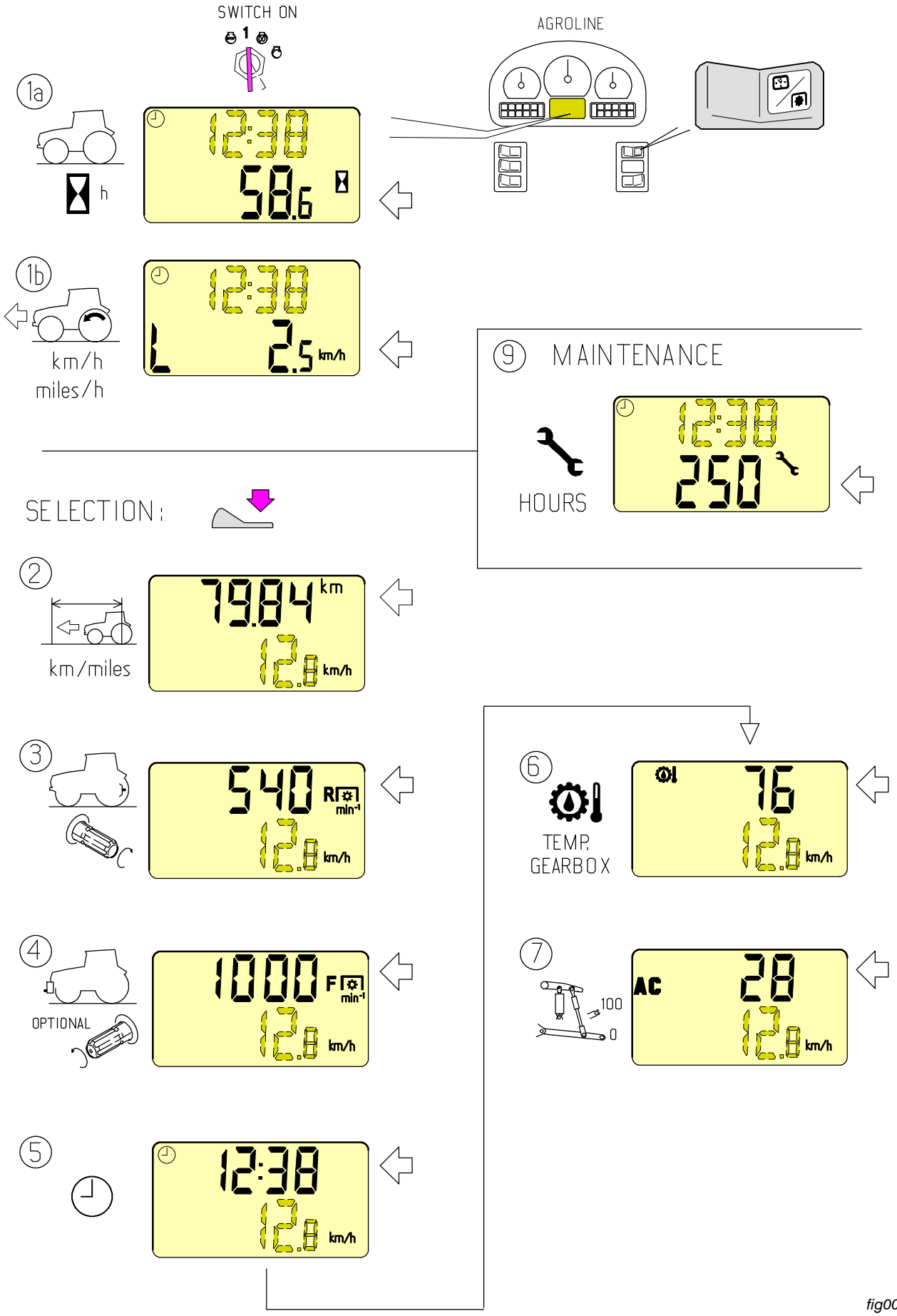


fig002

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– Continuously shows a display that cannot be chosen with a switch (two functions on the bottom line):

1a) Operating hours
The display shows the operating hours to tenths of decimal accuracy. The operating hours are shown on the bottom line, when the power is on and the tractor is not moving.

1b) Driving speed km/h / miles/h.
When the driving speed is under 3 km/h, the symbol **L** is shown in the display. The display shows up to 15 km/h to one decimal place.
The driving speed unit (km/h / miles/h) can be changed by an authorized workshop. When switching the power on the operating hours are shown first on the bottom line. When the tractor starts to move the bottom line display changes to show the driving speed.

– Functions on the top line. By pressing the right side of the change over switch for LCD–display unit the display changes.

2) Driving trip m, km/miles.
The driving trip display shows the trip up to 1 km with an accuracy of one meter. The display shows symbol **m**. After one kilometre the symbol in display changes to **km** and the driving trip shows up to 100 km, to two decimals places. After 100 km only one decimal place is shown. The maximum display is 999.9 km.
If the driving trip unit (km / miles) needs to be changed, please contact an authorized workshop.

3) Rear PTO rotating speed.
When the rear power take–off is engaged the symbol is on and the PTO rotating speed shows beside it on the top line.

4) Front PTO rotating speed (extra equipment).
When the front power take–off is engaged, as extra equipment, the symbol is on and the PTO rotating speed shows beside it on the top line.

5) Clock

6) Transmission temperature
When the temperature is under 40°C the display shows –LO– and when over 40°C it shows the temperature. If the temperature rises over 90°C, clean the radiator and check the gearbox oil level.

7) Position of lower links %, 0–100 AC
The display shows symbol AC and the position of the lower links as a percentage scale 0 – 100. 0 = the lower links are in the lowest position and 100 = the lower links are in the top position. When the lower links are in the middle position, the display shows the number 50.

9) Maintenance schedule.
When the tool symbol and periodic maintenance hour number are illuminated in the display, the appropriate service work has to be carried out by an authorized workshop. If this work is not carried out, the tool symbol and periodic maintenance hour number are shown for 10 seconds whenever the ignition is switched on. When the service has carried out this warning will be deleted by simultaneously pressing the left side of the change over switch and switching the ignition on. The tool symbol will illuminate again when the next service interval has been reached.
When the power is switched on, the last display is shown in the display unit.

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Setting mode

The parameter values of the Agroline–instrument panel will be changed in the setting mode.

If the setting mode is not altered for over 10 seconds), the display changes into the “normal” mode.

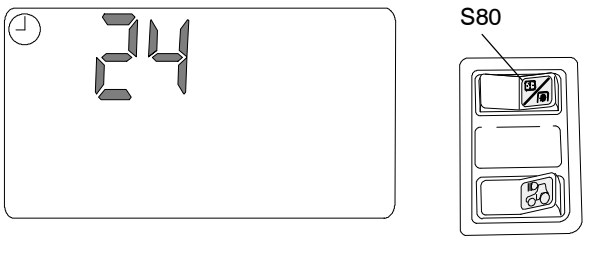


fig003

– With the power switched on press and hold the right side of the change over switch for LCD–unit (**S80**) for over 3 seconds, until the display changes to the setting mode (the display can be changed for 12 or 24 hours).

The rest of the settings can be displayed by pressing the right side of change over switch (**S80**).

Clock mode setting 12/24 hours

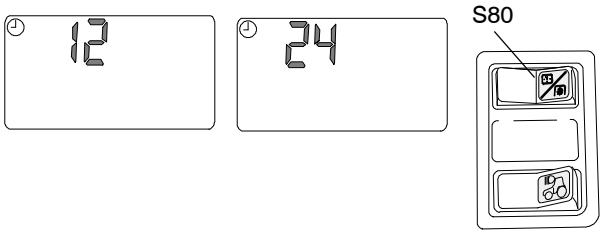


fig004

– Activate the clock display in the setting mode (12/24).
– Set the desired hour display by pressing the left side of the change over switch (**S80**).

The setting of the clock display is complete when the display changes into “normal” mode after about 10 seconds or by pressing the right side of the change over switch (**S80**) for over 3 seconds.

Setting the clock

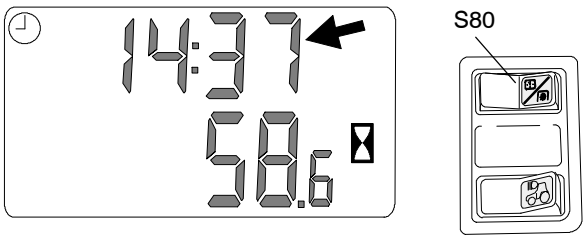


fig005

– Activate the clock in the setting mode, (the minutes start to flash).
– Set the minutes by pressing the left side of the change over switch (**S80**). By keeping the left side pressed down the numbers change continuously.
– To change the hours press the right side of the change over switch (**S80**).
– Set the hours by pressing the left side of the change over switch (**S80**).

The new time is set and the display goes into “normal” mode after about 10 seconds without making any changes or by pressing the right side of the change over switch (**S80**) for over 3 seconds.

Changing the Agroline tyre/tire parameters for different tyres/tires

If the tyres/tires are changed to a different rolling diameter, the instrument must be calibrated on the following way:

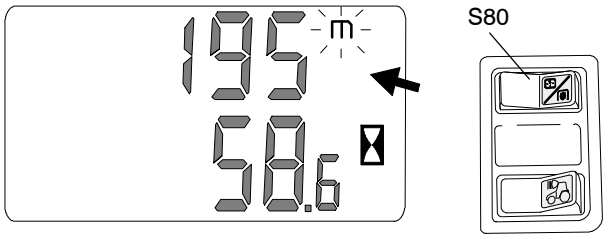


fig006

– Activate the tyres/tires parameter in the setting mode The letter **m** will start to flash.
– Select the right code number by pressing the left side of change over switch (**S80**). By keeping the left side pressed down the numbers change continuously.

Changing the parameters is complete when the display goes into “normal” mode after about 10 seconds or by pressing the right side of the change over switch (**S80**) for over 3 seconds.

Note: The code number value can vary between 100–400. When pressing the switch rear edge, the code value changes from a smaller value to greater one. The code numbers and corresponding tyres/tires are listed in the Diagnostics and programming manual.

Settings made by service

Generator pulse number

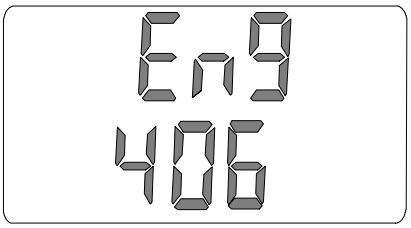


fig007

All models 406

Front PTO pulse number

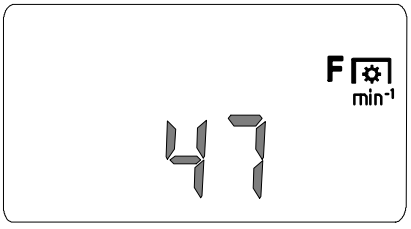


fig008

All models 47

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Choice the units km/miles

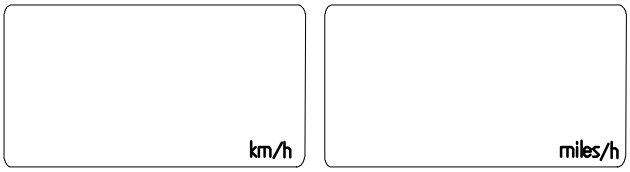


fig009

AC100, linkage upper position, voltage

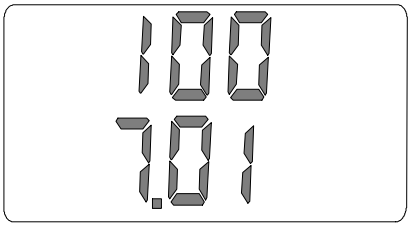


fig010

AC0, linkage lower position, voltage

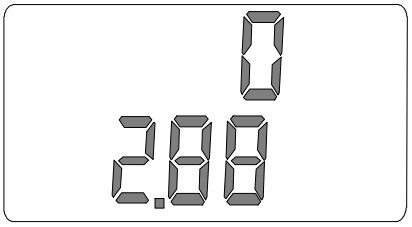


fig011

Rear PTO speed display on/off

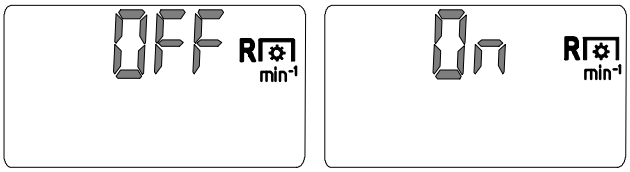


fig012

All the models, On

Front PTO speed display on/off

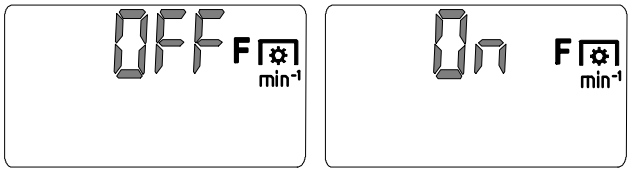


fig013

Sigma display on/off

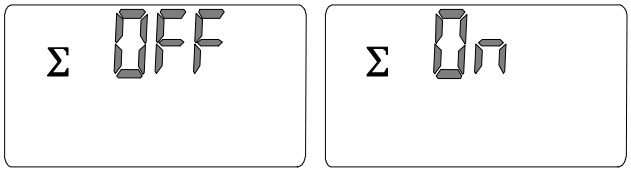


fig014

T191h, On
Other models, OFF

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Instrument panel PROLINE

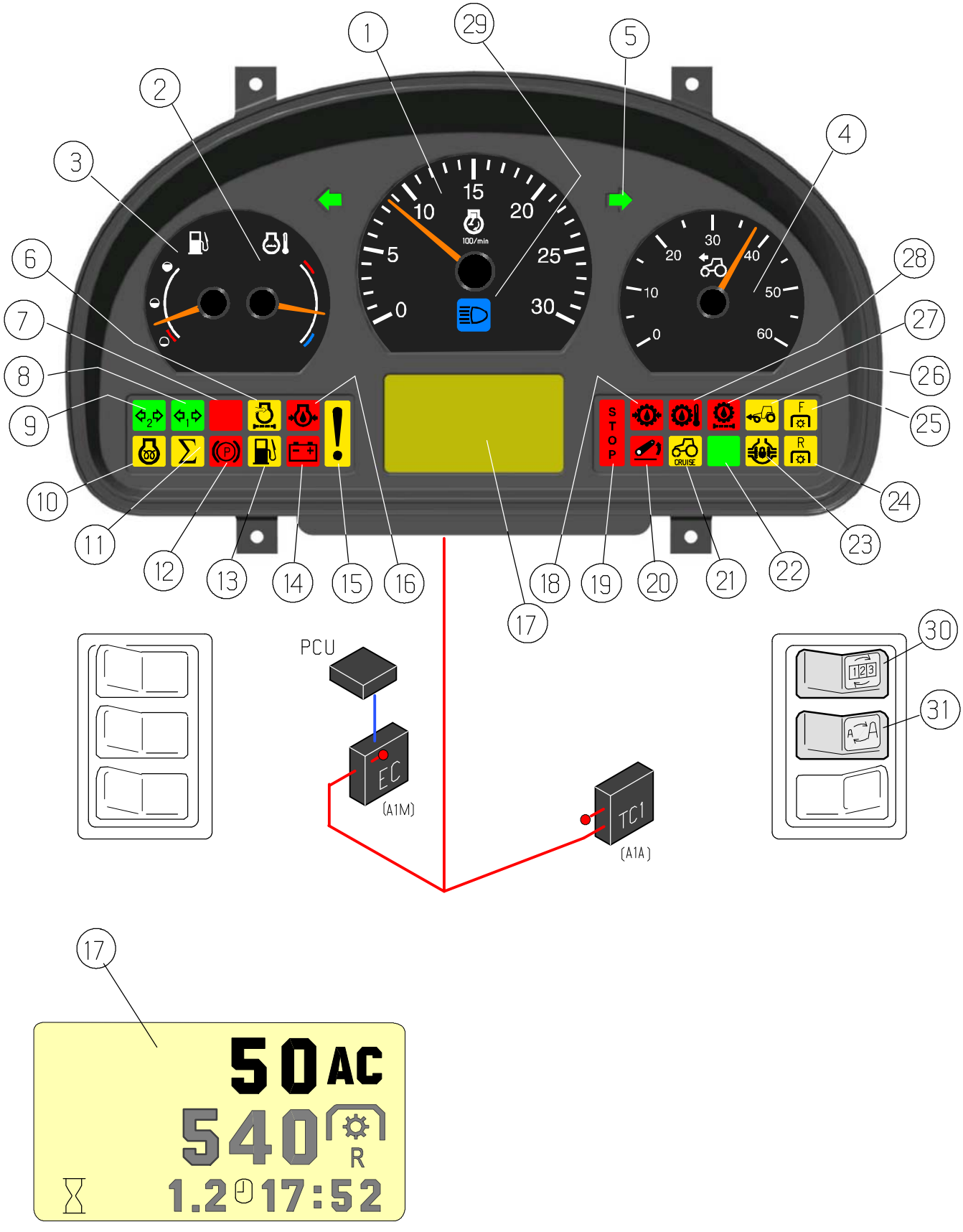


fig015

https://truckmanualshub.com/

LCD– display is in Proline of a graphic type.
The Proline– instrument is connected to CAN bus and gets the main information from there.

For the control of the instrument there are two switches under the instrument With help of the rocker switches **30**, and **31** the desired information is chosen to the display, and also the settings of the clock etc. can be done.
The instrument gets the engine revs and temperature information direct from the engine through the CAN bus. The driving speed information comes direct from the gearbox through the CAN bus and equally the speed given by the radar, which is used for determining the slip. The instrument sends also some information to the CAN bus.

1) Revolution counter
2) Engine temperature gauge
3) Fuel gauge
4) Speed gauge
5) Direction indicator flasher
6) Engine air filter warning light. Warning light is on when the engine is running and the buzzer is sounding (once)
7) Not in use
8) Direction indicator warning light for first trailer
9) Direction indicator warning light for second trailer
10) Thermostart–glow on
11) On Sigma Power models the –indicator light is illuminated when the tractor is operating in the high power range (the light is continuously on, yellow).
12) Parking brake. If the indicator light is on and the STOP light is flashing, the parking brake cable is broken or incorrectly adjusted.
13) Low fuel level (yellow). Comes on when about 15 l fuel is left and the buzzer is sounding (once). If the tractor is fitted with the extra tank the level will be about 30 l.
14) Battery charging. Indicator light is on, when battery charging is not operating and the buzzer is sounding (once)
15) General warning. Lights on in connection with warnings
16) Engine oil pressure. Warning light is on when the engine is running and the buzzer is sounding continuously and the stop–indicator light flashes
17) LCD–display
18) Gearbox oil pressure. Warning light is on, the buzzer is sounding (once) and the stop–indicator light flashes
19) Stop– warning light, controlled by following functions:
    – engine oil pressure (16) too low
    – gearbox oil pressure (18) too low
    – gearbox oil temperature (28) too high
    – parking brake (12) cable is broken or incorrectly adjusted (flashes).
20) Rear linkage in transport position = lift/stop/lower switch is in the lift position
21) Constant speed in action (constant speed / constant revs chosen)
22) Not in use
23) Differential lock
24) Rear PTO. Flashes when the shaft does not rotate, but the selection lever is engaged. Is on when rear PTO shaft is rotating.
25) Front PTO (optional). Light is on continuously, when front power take–off is on.
26) 4WD on
27) Hydraulic pressure filter blocked
28) Gearbox oil temperature. Warning light is on, the buzzer is sounding (once) and the stop–indicator light flashes. Temperature will be shown on the LCD display
29) High beams
30) Change switch for graphic display
31) Zoom switch for graphic display

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LCD DISPLAY

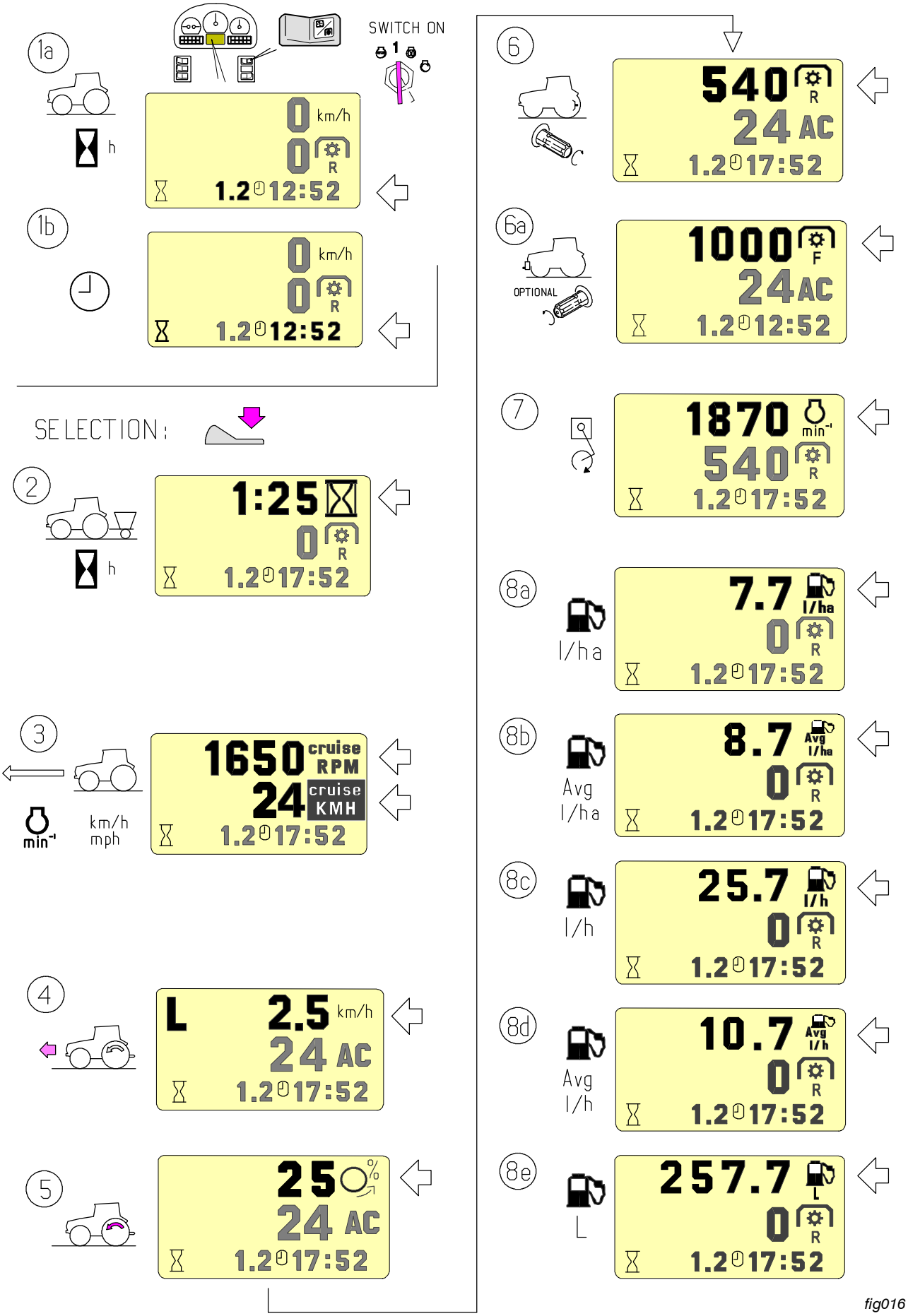


fig016

https://truckmanualshub.com/

Continuously shows (= shows which cannot be selected by the switch)

1a) **Operating hours**
– Displayed with an accuracy of plus or minus one decimal point when the power is on.

1b) **Clock**
The display shows the clock on the bottom line, as 12/24 hour display.

Displays which may be chosen with change over switch:
When the power is switched on, the display that was selected last is put on the screen.

2) **Working time**
Working time is, for example, the time that has been devoted to ploughing/plowing a certain area. Working time is stored in the memory when the power is switched off from the meter.

3) **Cruise–control**
RPM = constant engine running speed
KMH = constant driving speed
The numerical value displays the value of programmed/programed constant engine revs/driving speed. When the constant engine running speed or driving speed is engaged the corresponding text shows with white on dark background (constant driving speed in picture) and also the cruise indicator light comes on in the instrument panel.

4) **Driving speed km/h, mph.** The driving speed is shown as follows:
– When the driving speed is under 3 km/h (2 miles/h), the symbol **L** is shown in the display.
– The driving speed 0–10 km/h (0–10 miles/h) is shown up to one decimal place.
– The driving speed 10–15 km/h (10–15 miles/h) is shown up to one decimal place at 0,2.
– The driving speed over 15 km/h (15 miles/h), decimals cannot be seen. The speed unit can be changed (km/h / miles/h) when changing the unit of length.

5) **Wheel slip** (0–100).
This display mode shows the percentage wheel slip. The wheel slip percentage is attained by comparing the speed information from the radar (ground speed) to the rotation speed of the wheels. The radar starts to operate at a speed 0.3 km/h (0.2 miles/h). Before that the display shows only a zero.

6) **Rear PTO speed**
The PTO rotation speed shows beside the symbol (at the accuracy of 10 rpm).

6a) **Front PTO rotation speed** (extra equipment)
The PTO rotation speed shows beside the symbol (at the accuracy of 10 rpm).

7) **Engine running speed**
This display mode shows the engine RPMs in 10 of revolutions per minute (the gauge with a needle displays the RPMs in hundreds of RPMs).

8a) **Immediate fuel consumption** (l/ha, gal/acre)

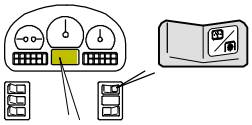
8b) **Average fuel consumption** (l/ha, gal/acre)

8c) **Immediate fuel consumption** (l/h, gal/h)

8d) **Average fuel consumption in an hour**

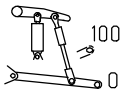
8e) **Fuel consumption** (l, gal)

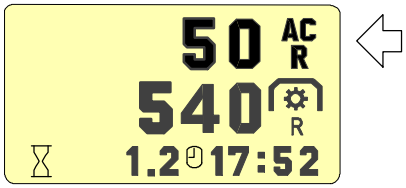
https://truckmanualshub.com/



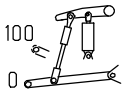
SELECTION (CONTINUED):

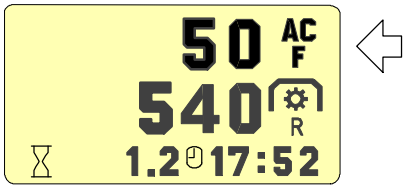
9





9a

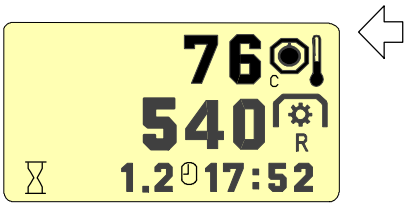




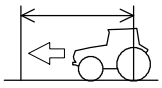
10



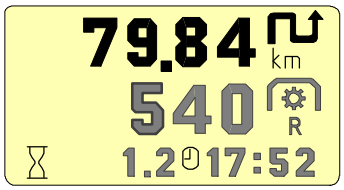
TEMP. GEARBOX



11



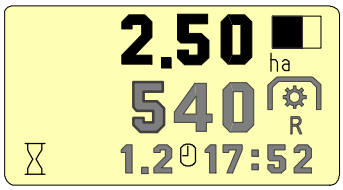
km/miles



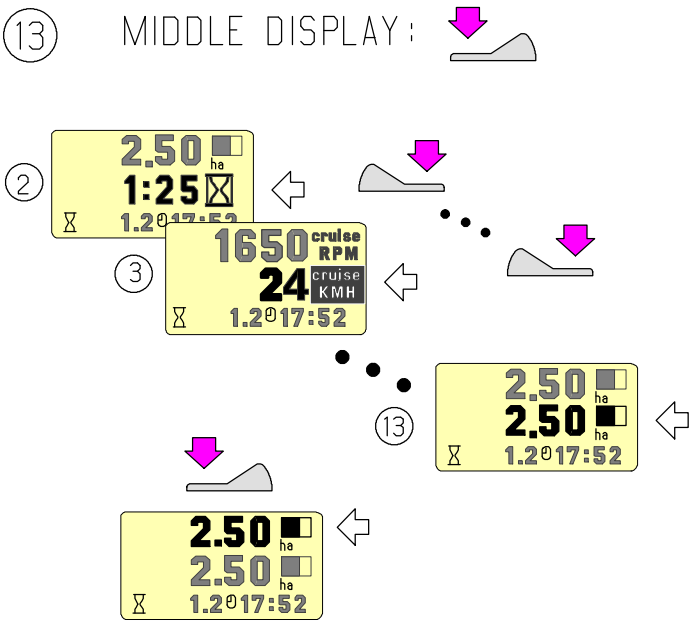
12

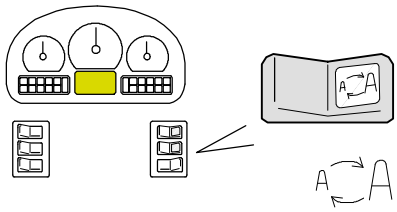


ha

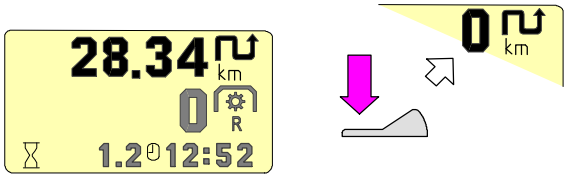


13 MIDDLE DISPLAY:





14 SETTING AT ZERO:



15 DISPLAY GHANGE:

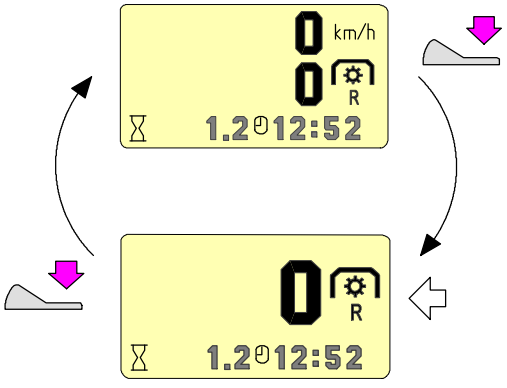


fig017

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9) **Position of lower links %, 0–100 AC**
The display shows symbol AC and the position of the lower links as a percentage scale 0 – 100. 0 = the lower links are in the lowest position and 100 = the lower links are in the top position. When the lower links are in the middle position, the display shows the number 50.

9a) **Lifting link position of front linkage %, 0–100**

10) **Transmission temperature**
The display shows the temperature as follows:
– When the temperature is under 40˚C (104˚F) the display shows **lo**
– When the temperature is over+40˚C (104˚F) the display shows the temperature.
– When the temperature is over 119˚C (246˚F) the display shows **high**.
If the temperature rises above 90˚C (194˚F), clean the radiator and check the gearbox oil level.

11) **Driving trip m, km, yard, miles**
The display shows the driving trip as follows:
– up to1 km (1 mile) with an accuracy of one meter (yard), the display shows symbol **m** (**yard**).
– after one kilometre (miles) the symbol in the display changes to **km** (**miles**) and the driving trip shows up to 100 km (miles), to two decimals places.
– after **100 km** (**100 miles**) only one decimal place is shown.
– The maximum display is **999.9 km** (**999.9 miles**).The trip unit (km, miles) can be changed when changing the unit of length. The driver can set the display to zero.

12) **Area ha, acre**
The display shows the cultivated area / ha,acre. The counter increases only when the implement is in work (the lower links in lower position). The working area will be saved in the memory, when the gauge is switched off.The area unit can be changed (ha, acre) when changing the length unit.

13) **Functions on the middle line**
Moving the function of the change over switch to the middle–line is done by pressing the left side of the switch. Return to the top line by pressing the left side of the switch again.
The middle line functions are like the ones on the top line. The various functions for the top and middle line can be selected for the display at the same time.

14) **Resetting the driving trip–,working hours–and working area to zero**
– Select working hours, driving trip or area on the display by pressing the right side of the change over switch for the LCD–display unit (in driving trip picture)
– Then press and hold down the left side of the setting switch until the display is zero. Working time, area and driving trip will always be zeroed at the same time.

15) **Setting the switch for the LCD–display in Proline–instrument panel**
By pressing the left side of the switch (11.10) any of the mid–line displays can be enlarged into two lines high. The top line display disappears. By pressing again the left side of the switch the display goes into ”normal” mode (two–line display).

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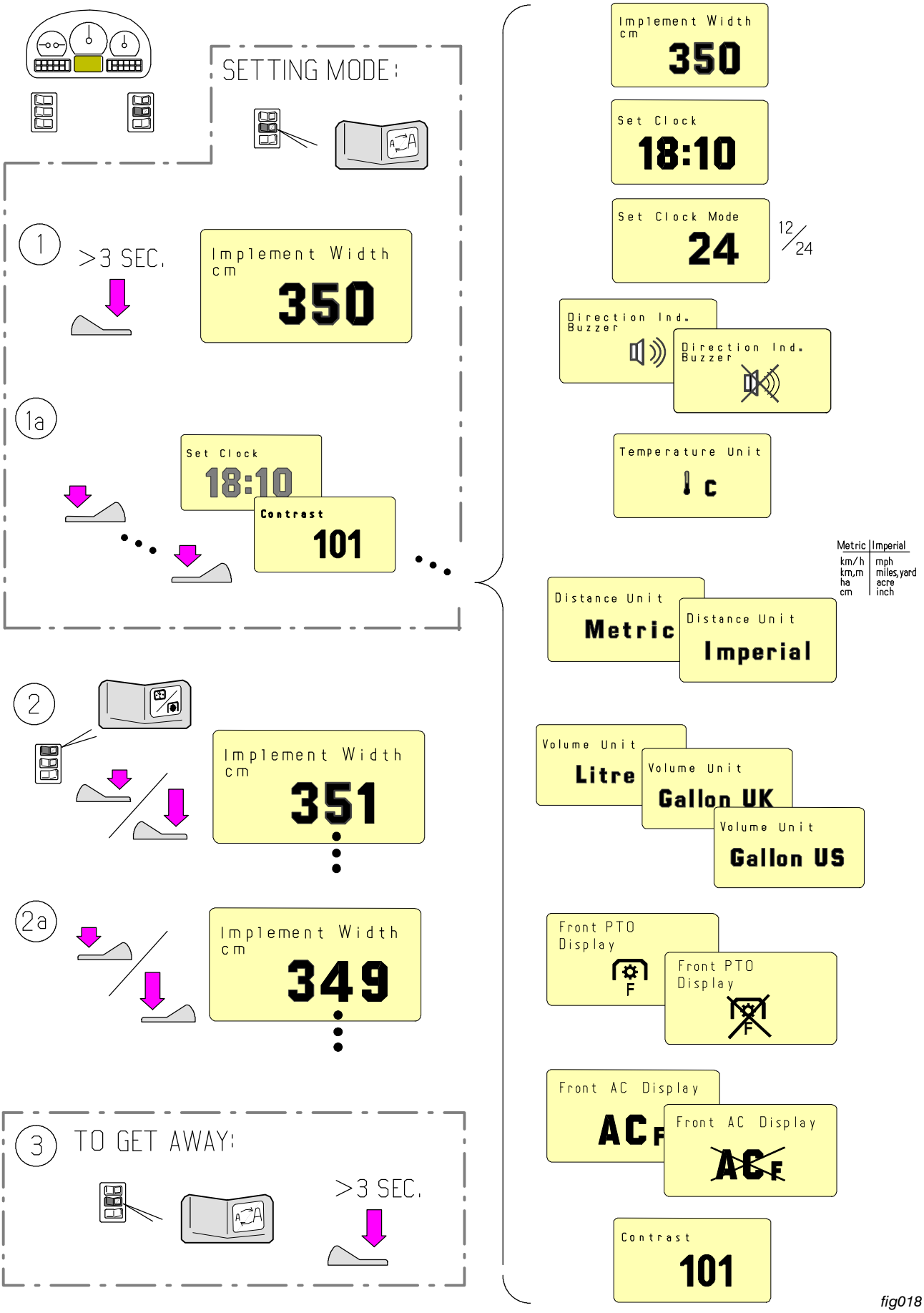


fig018

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1) Activate the display to the setting mode by pressing the right side of the setting switch for more than 3 seconds. The display shows the first parameter which can be changed; implement width.

1a) By pressing the left side of the setting switch the other parameters can be shown in the display.

- Width of the implement cm, inch
- Resetting time
- Clock mode 12/24
- Direction indicator buzzer
- Unit of temperature C, F
- Unit of length m, yard
- Unit of volume l, gal (UK, US)
- Front PTO speed display
- Display for lifting link position of the front linkage
- Adjusting display contrast

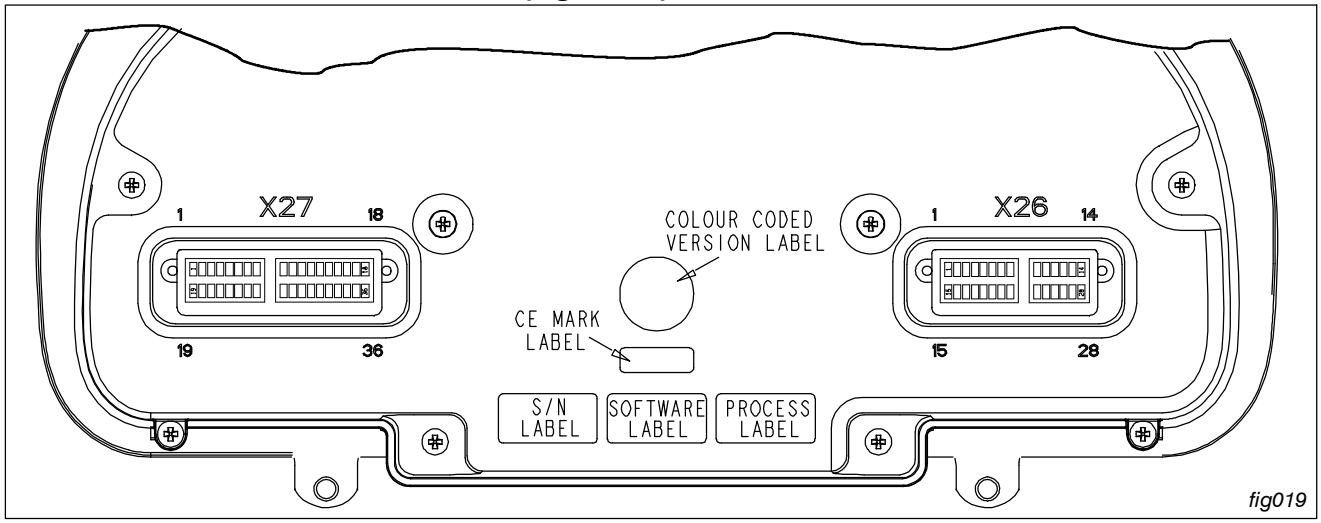
2) **Increasing the parameter value**
- press the right side of the change over switch, the parameter value will increase step by step
- **or**
- by keeping the right side of the change over switch pressed down, the parameter value will increase continuously

2a) **Decrease the parameter value**
- press the left side of the change over switch , the parameter value will decrease step by step
- **or**
- by keeping the left side of the change over switch pressed down, the parameter value will decrease continuously

3) **Escaping from the setting mode**
- Escape from the setting mode by pressing the right side of the switch for over 3 seconds.

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Connectors of the ICL instrument (Agroline)



Pin nr.	Connector X27:	Pin nr.	Connector X26:
1	Main beam	1	Not in use
2	The left indicator light of the flashing indicators	2	Not in use
3	The supply voltage of the instrument (fuse **F2** 5A)	3	Rear PTO speed
4	The right indicator light of the flashing indicators	4	Front PTO speed
5	Ground (GR7)	5	Gearbox speed
6	Lights switch, parking light	6	Gearbox temperature, analog signal
7	Fuel sensor signal (B2).	7	Not in use
8	Direction indicator relay (K10), flashers on first trailer	8	Power lift position sensor signal (B1E)
9	Direction indicator relay (K10), flashers on second trailer	9	Not in use
10	Starter switch relay (K4), starter switch on/off signal	10	Not in use
11	Alternator (G2), charging light.	11	Not in use
12	Engine temperature	12	Not in use
13	Engine speed	13	Not in use
14	Parking brake cable indicator (S52), Stop–warning light.	14	Not in use
15	Direction indiacator relay (K10)	15	Not in use
16	Not in use	16	Not in use
17	Not in use	17	Not in use
18	Buzzer control (H30).	18	Low speed output
19	Not in use	19	Not in use
20	PTO rear	20	Not in use
21	Differential lock	21	Not in use
22	Not in use	22	Ground (GR7)
23	Not in use	23	Not in use
24	Pre–heater	24	Signal of the set switch for LCD–display (S80).
25	Front PTO indicator light.	25	Signal of the mode switch for LCD–display (S80).
26	4WD	26	Not in use
27	Not in use	27	Not in use
28	Fuel reserve	28	Not in use
29	Parking brake		
30	Not in use		
31	Not in use		
32	Transmission/hydraulic filters indicator (S53, S54 and S44), warning light		
33	Gearbox oil temperature		
34	Transmission/hydraulic oil pressure indicator (S17), warning light		
35	Engine oil pressure		
36	Engine air filter indicator (S12), warning light		

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Connectors of the ICL instrument (Proline)

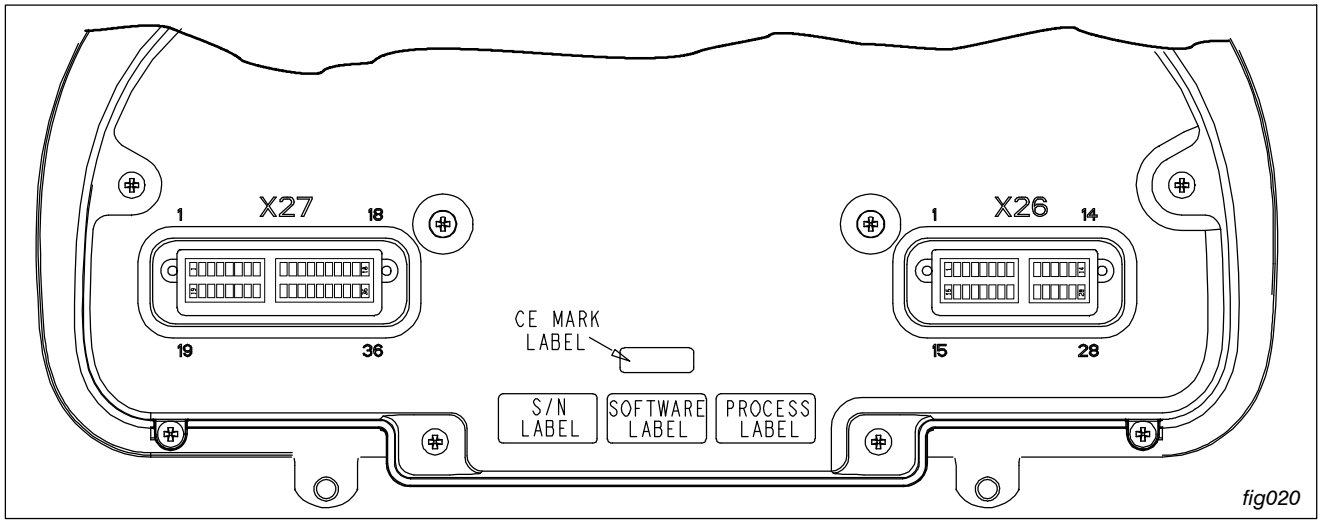


fig020

Pin nr.	Connector X27:	Pin nr.	Connector X26:
1	Main beam	1	RS232 programming connector (X43)
2	The left indicator light of the flashing indicators	2	Radar
3	The supply voltage of the instrument (fuse **F2** 5A)	3	Rear PTO speed
4	The right indicator light of the flashing indicators	4	Front PTO speed
5	Ground (GR7)	5	Gearbox speed
6	Light switch, parking light	6	Gearbox temperature, analog signal
7	Fuel sensor signal (B2).	7	SigmaPower input
8	Direction indicator relay (K10), flashers on first trailer	8	Power lift position sensor signal (B1E)
9	Direction indicator relay (K10), flashers on second trailer	9	RS232 programming connector (X43)
10	Starter switch relay (K4), starter switch on/off signal	10	Not in use
11	Alternator (G2), charging light.	11	Not in use
12	Engine temperature	12	CAN Hi
13	Engine speed	13	CAN Lo
14	Parking brake cable indicator (S52), Stop–warning light.	14	Can shield
15	Direction indiacator relay (K10)	15	Engine stopping signal control and rear stop warning light (H28) control
16	Transmission, creeper gear	16	CAN Hi
17	Engine coolant level	17	CAN Lo
18	Buzzer control (H30).	18	Low speed output
19	Warning +	19	Program line
20	PTO rear	20	Can shield
21	Differential lock	21	Not in use
22	Cruise	22	Ground (GR7)
23	Rear power lift in transport position	23	Not in use
24	Pre–heater	24	Signal of the set switch for LCD–display (S80).
25	Front PTO indicator light.	25	Signal of the mode switch for LCD–display (S81).
26	4WD +	26	Not in use
27	Warning –	27	Not in use
28	Fuel reserve	28	Not in use
29	Parking brake		
30	Sigma power		
31	4WD –		
32	Transmission/hydraulic filters indicator (S53, S54 and S44), warning light		
33	Gearbox oil temperature, warning light		
34	Transmission/hydraulic oil pressure indicator (S17), warning light		
35	Engine oil pressure, warning light		
36	Engine air filter indicator (S12), warning light		

Fault codes

Agroline instrument can show fault codes, at which time the spanner symbol is visible in the display.
The fault code can be seen by scanning with the change over switch for LCD (S80). The fault code is shown in the upper row of display, if one of the following sensors have malfunctions:

– Fuel level sensor. **First digit** of three–number code.
– Engine temperature sensor. **Middle digit** of fault code.
– Gearbox temperature sensor. **Last digit** of fault code.

0 = OK
1 = poor contacts
2 = short circuit

E.g: **200**: fuel sensor short circuit
E.g: **010**: engine temperature sensor does not send signal (wire broken, sensor damage etc.).
E.g: **001:** gearbox temperature sensor does not send signal (wire broken, sensor damage etc.).

Fault tracing

If the Agroline instrument have malfunctions, check that the instrument rear face connectors X26 and X27 are correctly connected. If the instrument is totally black although the current is switched on, check the fuse, supply wires (X27/10) and earth points (X27/5).

When necessary, check various sensors and switches. If wires, switches and sensors are OK, but the problem still exists, change the instrument. When ordering a spare instrument, tractor chassis no., tractor model, actual running hours and possible front PTO must be notified.

If the change over switch for LCD (S80) has malfunctions, check the wire connections inside the switch and the connectors on the rear face of the instrument. When edges of the switch are pressed, certain pins (X26/24, 25)in connector X26 is earthed.

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Sensors of the Agroline instrument

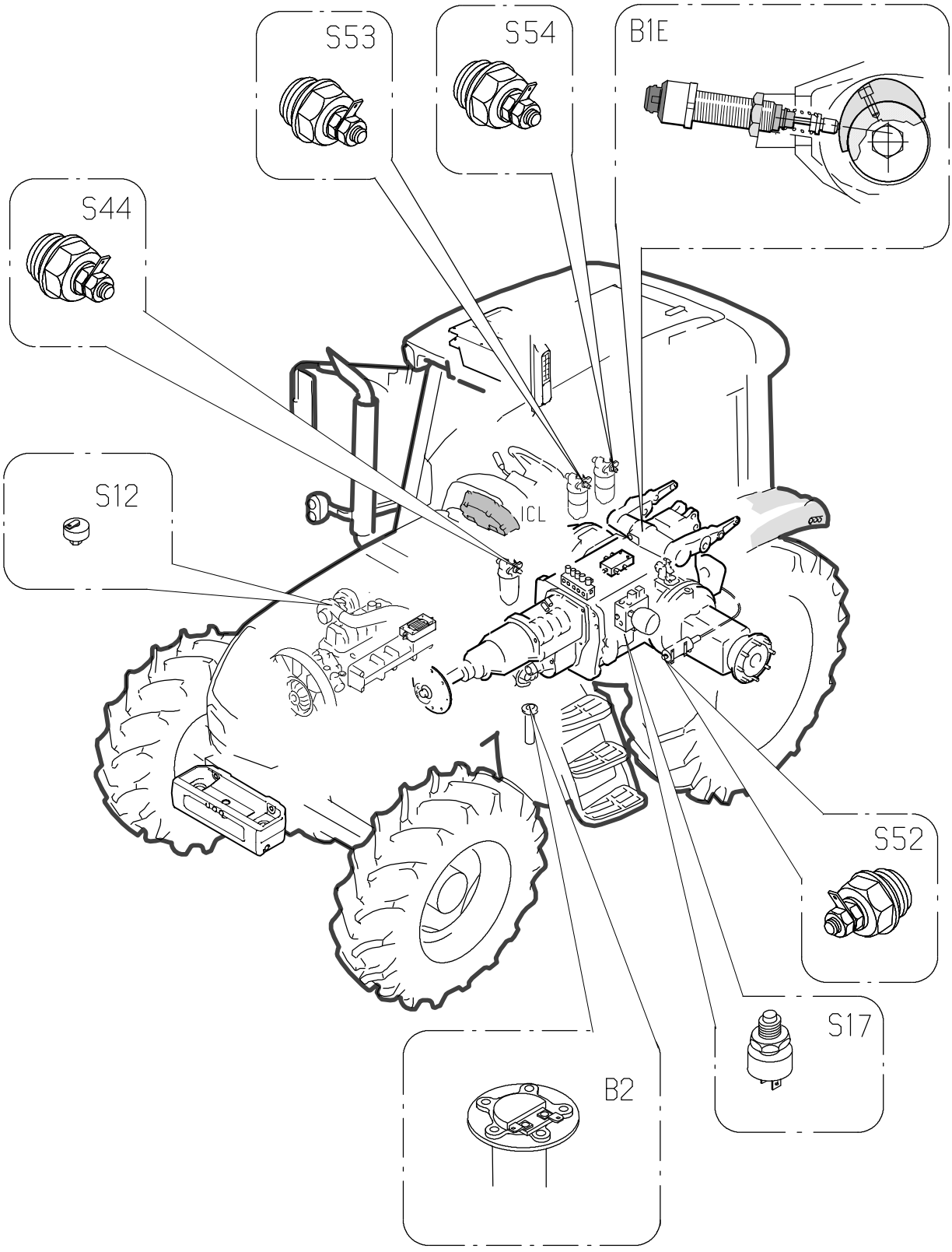


fig021

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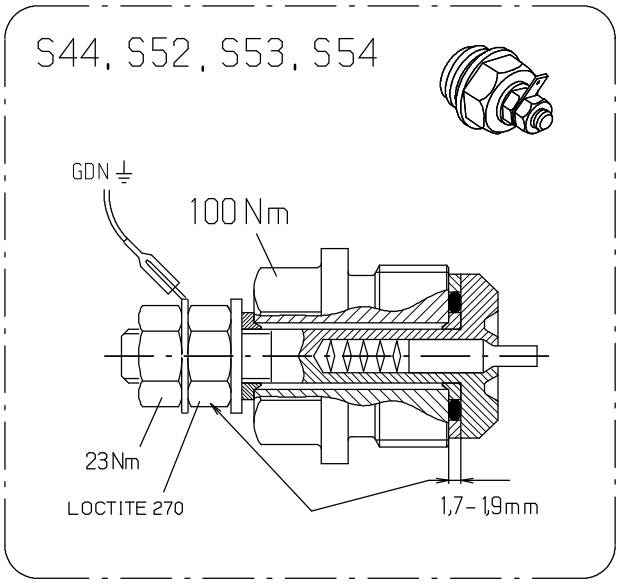


fig022

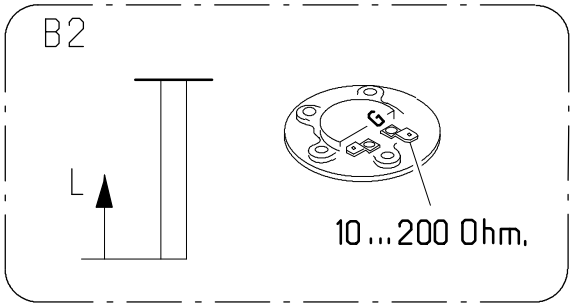


fig023

B2: Check the resistance of the fuel sensor pin.
Resistance values with different fuel levels:

L (mm)	Resistance (Ohm)
0 26	~ 200
128 145	~ 150
261 294	~ 80
377 423	~ 10

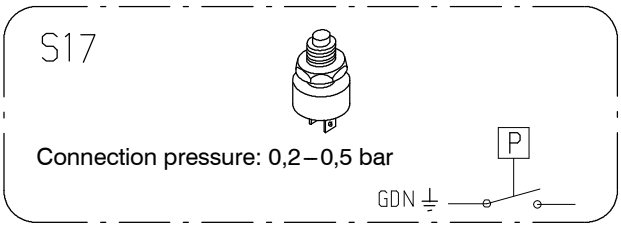


fig024

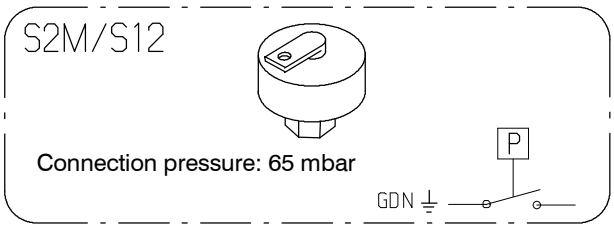


fig025

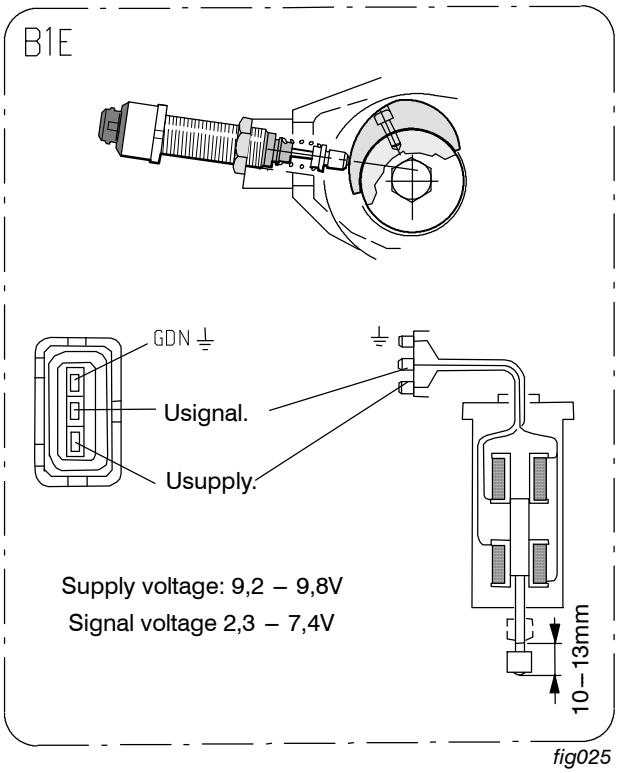


fig025

Location of the sensors in wiring diagram:

Symbol	Description	Page+position	Location
AC9.2:			
–B1E	Position sensor, power lift	/11.B1 and /10.C1	Transmission
–B2	Sensor, fuel level	/9.C11	Fuel tank
–S12	Pressure switch drop indicator, air filter	/9.C8	Engine
–S17	Gearbox oil pressure switch	/9.C4	Transmission
–S44	Indicator light switch, pressure filter 180 bar	/9.C6	Transmission
–S54	Indicator light switch, pressure filter 18 bar	/9.C4	Transmission
AC10.2&AC10.21:			
–B1E	Position sensor, power lift	/13.B1 and /12.C1	Transmission
–B2	Sensor, fuel level	/11.C13	Fuel tank
–S2M	Switch, air filter vacuum	/11.C4	Engine
–S17	Gearbox oil pressure switch	/11.C7	Transmission
–S44	Indicator light switch pressure filter 180 bar	/11.C5	Transmission
–S52	Indicator light limit switch, parking brake cable	/11.C8	Transmission
–S53	Indicator light switch, pressure filter, return	/11.C7	Transmission
–S54	Indicator light switch, pressure filter 18 bar	/11.C6	Transmission

Contents

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Technical data

Refrigerant:
Refrigerant R134a
– refrigerant filling in system . . . . . 1,6 kg

Compressor SANDEN SD7H15KH8241:
– Number of cylinders . . . . . 7 pcs
– Cyl diam x stroke . . . . . ø 29,5 mm x 32 mm
– Max revs . . . . . 7000 r/min
– Lubricating oil when refrigerant R134a (Valtra UC 1300) . . . . . ZXL 100 PG (DH–PS)
– Lubricating oil volume . . . . . 207 cm^3 (2,07 dl)
Electro–magnetic clutch:
– voltage . . . . . 12 V (DC)
– starting torque . . . . . 35 Nm
– power consumption . . . . . 43 W (max)
– clutch clearance . . . . . 0,3–0,6 mm

High and low pressures at engine revs 1500 r/min between temperatures +20...+25 °C:
– low pressure . . . . . 50–300 kPa
– high pressure . . . . . 700–1400 kPa

Dryer:
– pressure switch switches off at max pressure . . . . . 3,2–3,4 MPa
– pressure switch switches off at min pressure . . . . . 0,1–0,2 MPa

Hoses:
– hose type . . . . . A
– the requirements of the hose . . . . . SAE J 51 B
– barrier type . . . . . R–134A refrigerant
– lubricating oil volume to hose (only new hoses) . . . . . 0,1 dl oil per 1 meter

Air conditioning unit:
– control unit switch off when inside temperature is . . . . . below 2 °C (below set point)
– control unit switch on when inside temperature is . . . . . over 2 °C (above set point)

– control unit switch off when deicing sensor temperature is . . . . . below –2 °C
– control unit switch on when deicing sensor temperature is . . . . . over 0 °C

– control unit switch off when outside temperature is . . . . . below +8 °C
– control unit switch on when outside temperature is . . . . . over +10 °C

– In–cab sensor . . . . . Thermistor 10kOhm 25°C
– After–coil sensor . . . . . Thermistor 10kOhm 25°C
– Deicing sensor . . . . . Thermistor 10kOhm 25°C
– Outside sensor . . . . . Thermistor 10kOhm 25°C
– Valve feedback . . . . . Potentiometer 10kOhm
– Controller + ... 12VDC
– Controller – . . . . . Ground

Outputs:
– Blower Speed . . . . . PWM signal
– A/C Clutch 12VDC/5A
– Inside Air Circulation . . . . . 12VDC/signal to relay
– Valve Motor + ... 12VDC/Ground
– Valve Motor – . . . . . 12 VDC/Ground

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Safety precautions

The refrigerant circuit of the air conditioner must be serviced and repaired by authorized personnel. The cooling system is pressurized. incorrect procedures may result in personal injury.

– The pressure of the refrigerant is always greater than its normal boiling point. If piping is split, the refrigerant will evaporate or boil very rapidly.

– Uncontrolled escape of refrigerant must be avoided. The refrigerant is non–flammable, non–toxic (except when in contact with a flame) and non–corrosive (except in contact with water).

– Never attempt to empty the system by loosening a connection. Slow emptying without danger can only be carried out using a manifold gauge set.

– You should be very careful when handling refrigerant. It can freeze the skin or the eyes on direct contact. Never handle refrigerant without wearing safety goggles, as well as gloves.

– Do not empty the system in a room where there is a flame. Refrigerant R134a and open flame form poisonous and stimulating compounds (e.g. hydrofluoric acid)

– Never weld or clean with steam near a filled system: excess pressure may be created with possible leakage.

– If it is necessary to retighten a connection, use two spanners for tightening, so as to prevent distortion which may give rise to leakage.

– Do not store refrigerant in the sun or close to a source of heat.

– Avoid subjecting the bottle to impact. Do not carry the bottle in the passenger compartment of a vehicle.

In the event of an accident, proceed as follows:

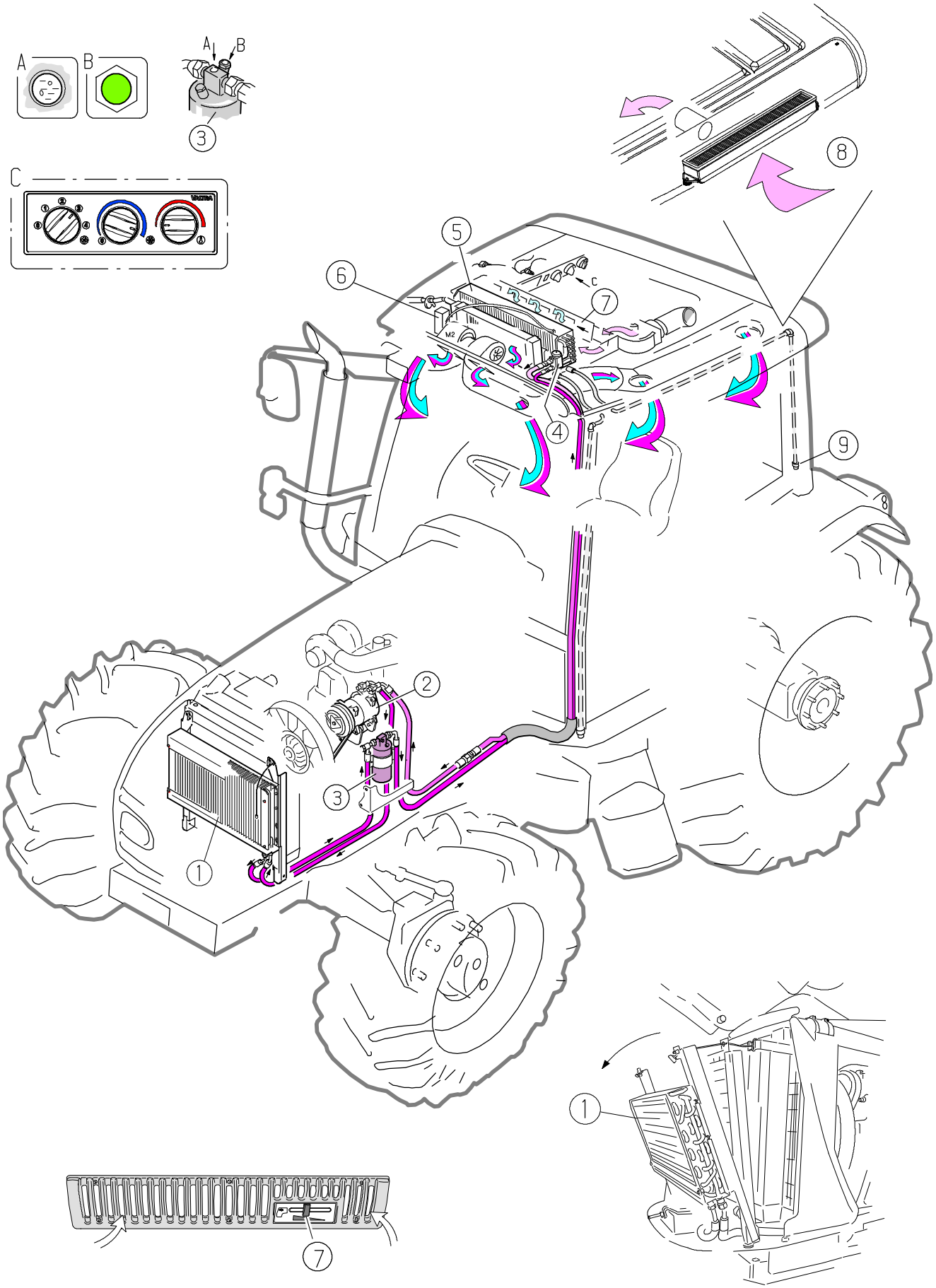
– If you get refrigerant in your eyes, wash them carefully with a solution of mineral oil, and continue to wash them carefully, with a solution of boric acid and water (1 teaspoonful of acid, diluted in a quarter of a cup of water). **Contact a doctor immediately.**

Never wash you eyes with pure water because refrigerant+water causes corrosive acid.

– Freezing caused by liquid refrigerant can be treated by progressively thawing the injured area with cold water and then applying a dry skin cream. **Contact a doctor immediately**.

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Air conditioner construction



4–2662
09/07

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Air conditioner reduces the temperature of the air which is blown to the cab to the desired value.

1) In the condenser the hot gaseous refrigerant loses part of its heat so that it begins to condense and is transformed to a liquid state. N.B! The condenser must be cleaned at regular intervals to remove dust etc. Hinge for easier cleaning.

2) The swash plate compressor is driven by the supplementary belt pulley (on the crankshaft end). The compressor belt pulley has an in–built electromagnetic clutch, which couples the pulley to the compr. drive shaft. The compressor sucks the refrigerant in, compresses and then delivers it onwards to the condenser.

3) Drier/receiver serves both as an expansion vessel/reservoir and drier (absorbs chemically the possible humidity). In the receiver there is solid filter which takes the contaminating particles.
On the receiver there is a sight glass **A** and moisture indicator **B**.
Sight glass **A** (run the engine at 1500 rpm, air conditioner at max. cooling for a few minutes):

Sight-glass	Description	Conclusion and remarks
	No bubbles appear at all. (Reduction by bleeding is necessary).	POSSIBLE EXCESSIVE REFRIGERANT The high–pressure side will be abnormally hot. REMEDY: Contact authorized workshop for releasing the excess refrigerant
	The fluid inside is almost transparent. A few bubbles may appear as the engine speeds up and down.	SUFFICIENT REFRIGERANT. The high–pressure side will be hot and the low–pressure side cold.
	A few bubbles appear intermittenly, at intervals of 1 to 2 seconds. (Refilling is necessary)	INSUFFICIENT REFRIGERANT. The high–pressure side will be warm, and the low–pressure side fairly cold. REMEDY: Check for refrigerant leakage. Contact authorized workshop.
	When bubbles flow continuously, or the flow has changed to a ”mist” flow, the refrigerant is almost exhausted . (Refilling is necessary)	VERY LITTLE REFRIGERANT. There will be almost no difference in temperature between the high–pressure side and the low–pressure side. REMEDY: Stop the compressor and inspect the entire system. When necessary, contact authorized workshop.

NB! The refrigerant must be clear. If the refrigerant has brown/yellowish colour, it must be changed.
If the colour of the moisture Indicator **B** is green (earlier driers: blue), drier is O.K., if pink or gray, replace receiver drier.

N.B! Never leave a receiver unplugged! The receiver must be replaced if the system is opened.
On the receiver there is a pressure guard, which breaks the current circuit of the magnetic clutch if the pressure the system is too high or low. The receiver has also a thermal fuse, which melts if the temperature of the refrigerant rises above 107–118˚C.

4) Thermostatic expansion valve allows precisely the amount of refrigerant required to be injected to the evaporator (**5**), so that the evaporation process goes in the best way. This action is dependent on the suction pressure after the evaporator and on the temperature at the evaporator outlet. The expansion valve separates the low and high pressures from each other.

5) The heat required for evaporating the refrigerant is taken from the passing air, which thereby cools down. When the air cools, the moisture in the air condenses on the surface of the evaporator fins. The condensed water is then channelled to the outside through hoses (9).

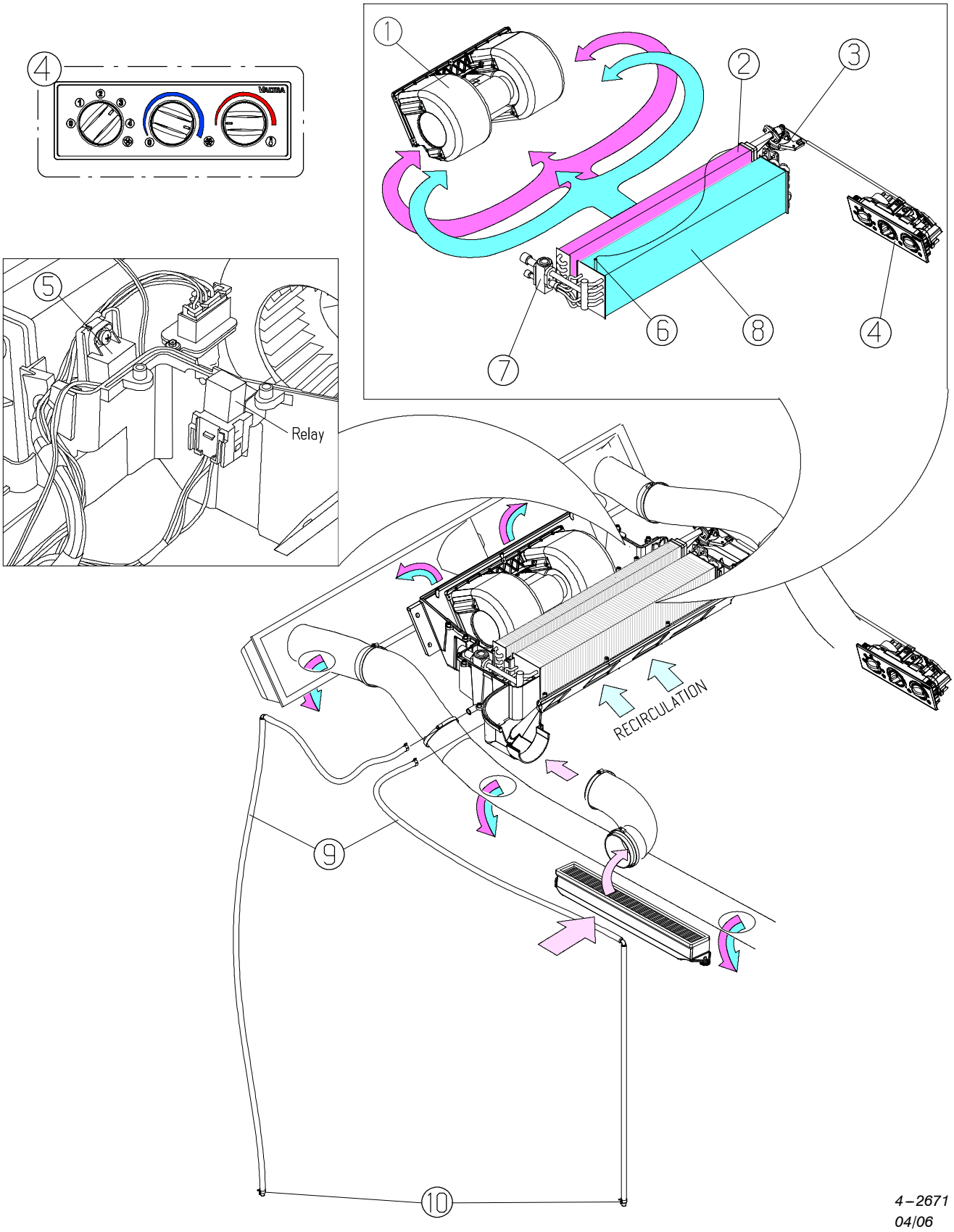
6) Adjustable temperature control. The sensor (capillary tube) of the temperature control is inserted between the evaporator fins and senses the temperature at the coldest point in the evaporator. Temperature control switches the electromagnetic clutch off at a sensor temperature below +2..3˚C (prevents the evaporator from freezing up) and again, when the temperature of the fins rises, at about 6...7˚C (or about at 19˚C, in the minimum position).

7) Openings for air recirculation. Through this can the air in the cabin be steered again to the suction channel for cooling.

8) Air intake for the cab

9) The hoses for the elimination of the condense water have valves, which prevent the air coming through the hoses into the system.

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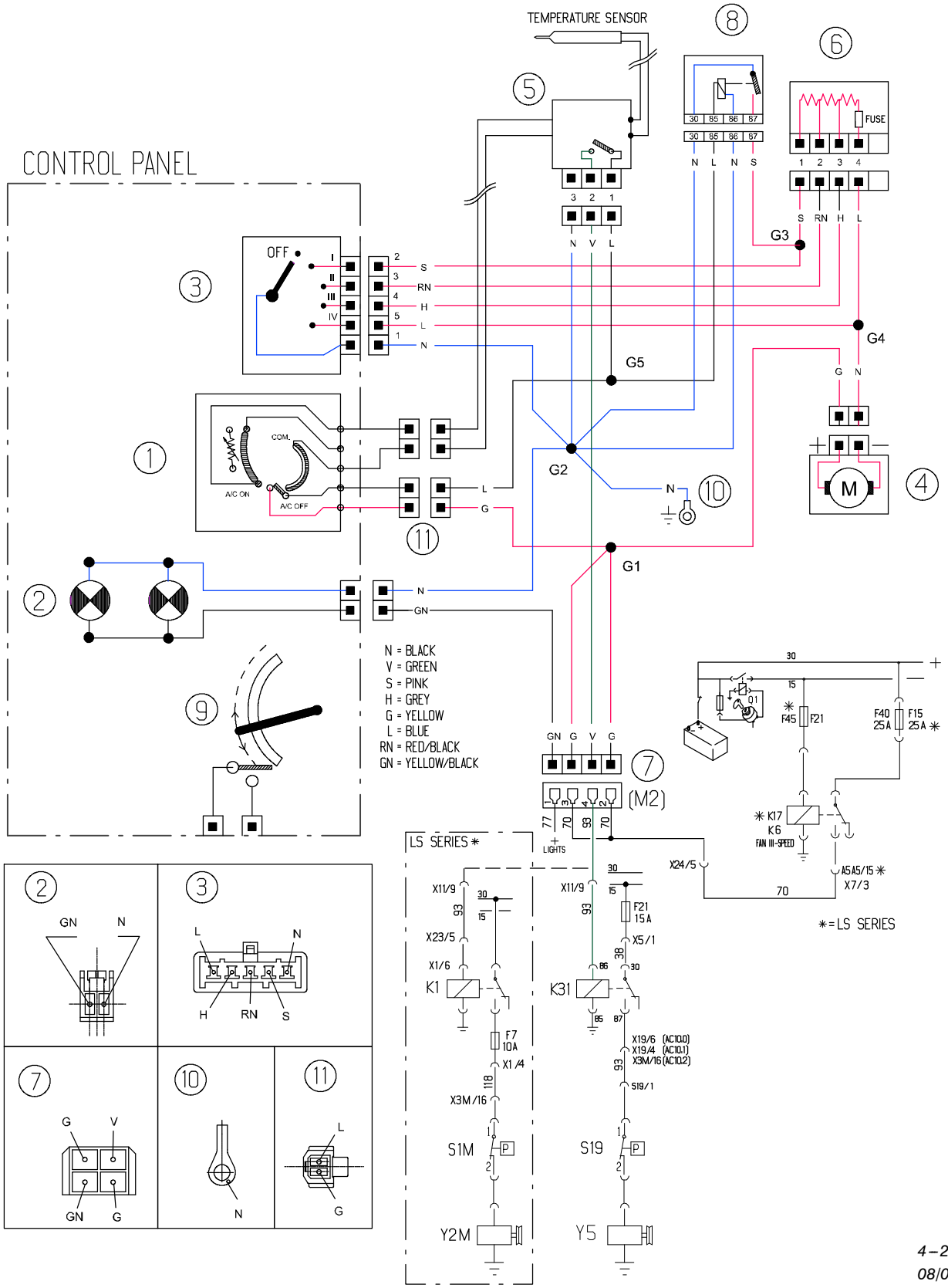


4 – 2671
04/06

1 Blower motor
2) Heater coil
3) Water valve
4) Control panel for air conditioner and heater
5) Thermostat
6) Temperature sensor
7) Expansion valve
8) Evaporator
9) Condense water hoses
10) Valves
Prevent the air coming through the hoses into the system.

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Wiring (manually operated)

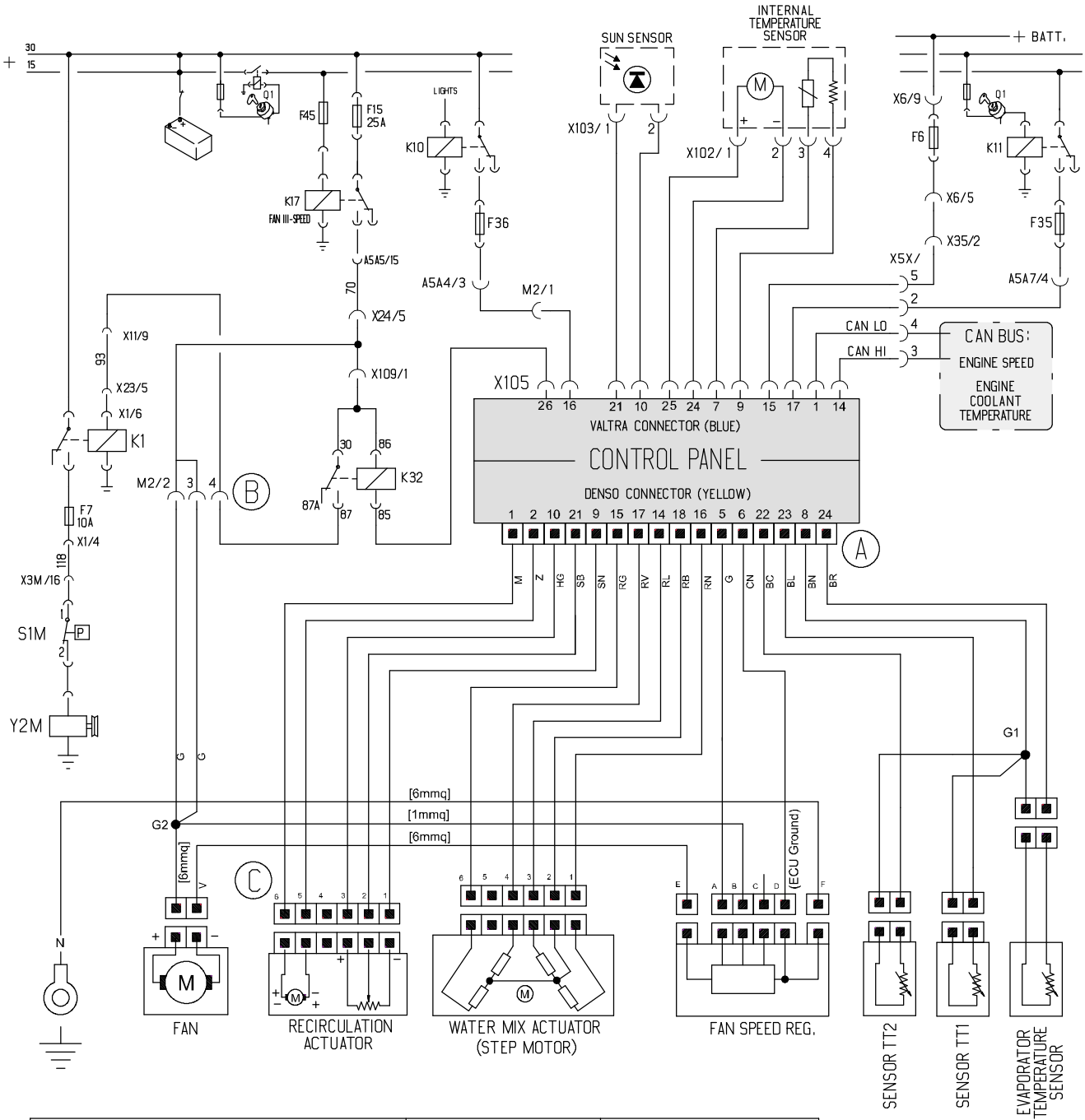


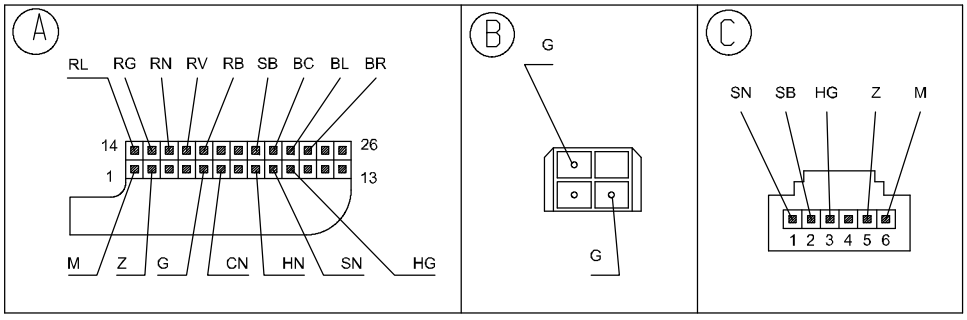
4–2680
08/06

1. Air conditioning control
2. Control panel lightning
3. Fan speed control
4. Fan
5. Thermostat
6. Resistor
7. Connector to roof wiring harness
8. Relay
9. Temperature control
   - When the air conditioner is switched on, the blower is in speed range 1 (if the fan speed control switch (**3**) is in position 0).
   - If the fan speed control switch is in another position, the fan rotates at corresponding speed.
10. Ground
11. Air conditioning control connector M2 (to the inner roof wiring harness)

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Wiring (automatic control)





G = YELLOW
M = BROWN
N = BLACK
V = GREEN
Z = VIOLET

BC = WHITE/ORANGE
BL = WHITE/BLUE
BN = WHITE/BLACK
BR = WHITE/RED
CN = ORANGE/BLACK
HG = GREY/YELLOW
HN = GREY/BLACK

RB = RED/WHITE
RG = RED/YELLOW
RL = RED/BLUE
RN = RED/BLACK
RV = RED/GREEN
SB = PINK/WHITE
SN = PINK/BLACK

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04/07

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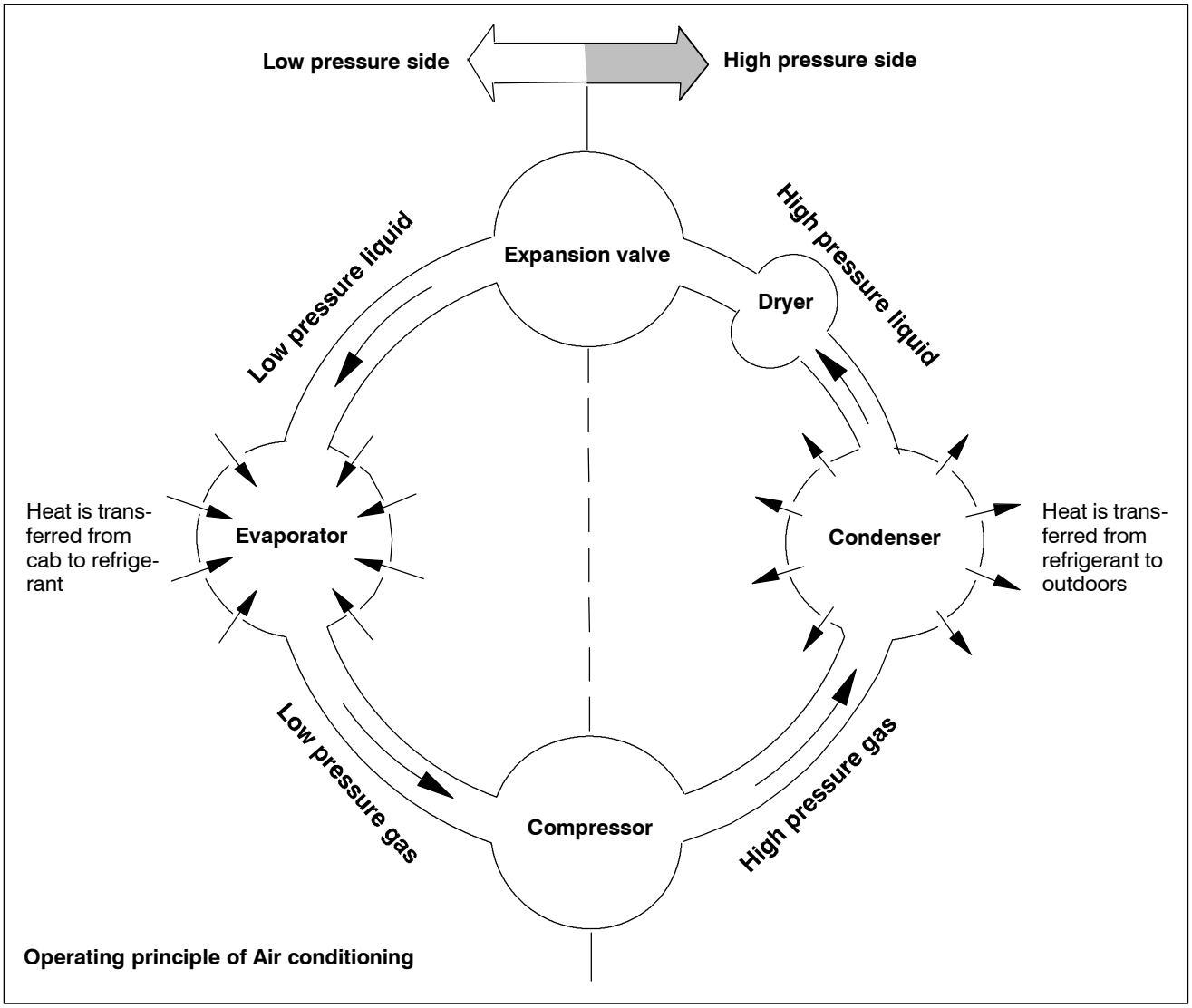
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Operating principle

An Air conditioning takes heat from the cab air when outdoor temperature is high. Refrigerant in the system is exposed under different pressures and temperatures and this causes a cooling effect. Refrigerant vaporizes in the evaporator and evaporation absorbs heat which is taken from the warm cab air which is blown through the evaporator.

The Air conditioning functions so that the refrigerant is continuously circulated in the system at which time it changes from liquid form into gaseous form. This process absorbs heat from the cab when the refrigerant vaporises in the evaporator and emits heat to outdoors when refrigerant becomes condensed in the condenser.

Although the process has four parts, it can be divided into two main parts: high pressure side and low pressure side according to the figure below.



Operating principle of Air conditioning

fig003c_en

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Circulation of the refrigerant

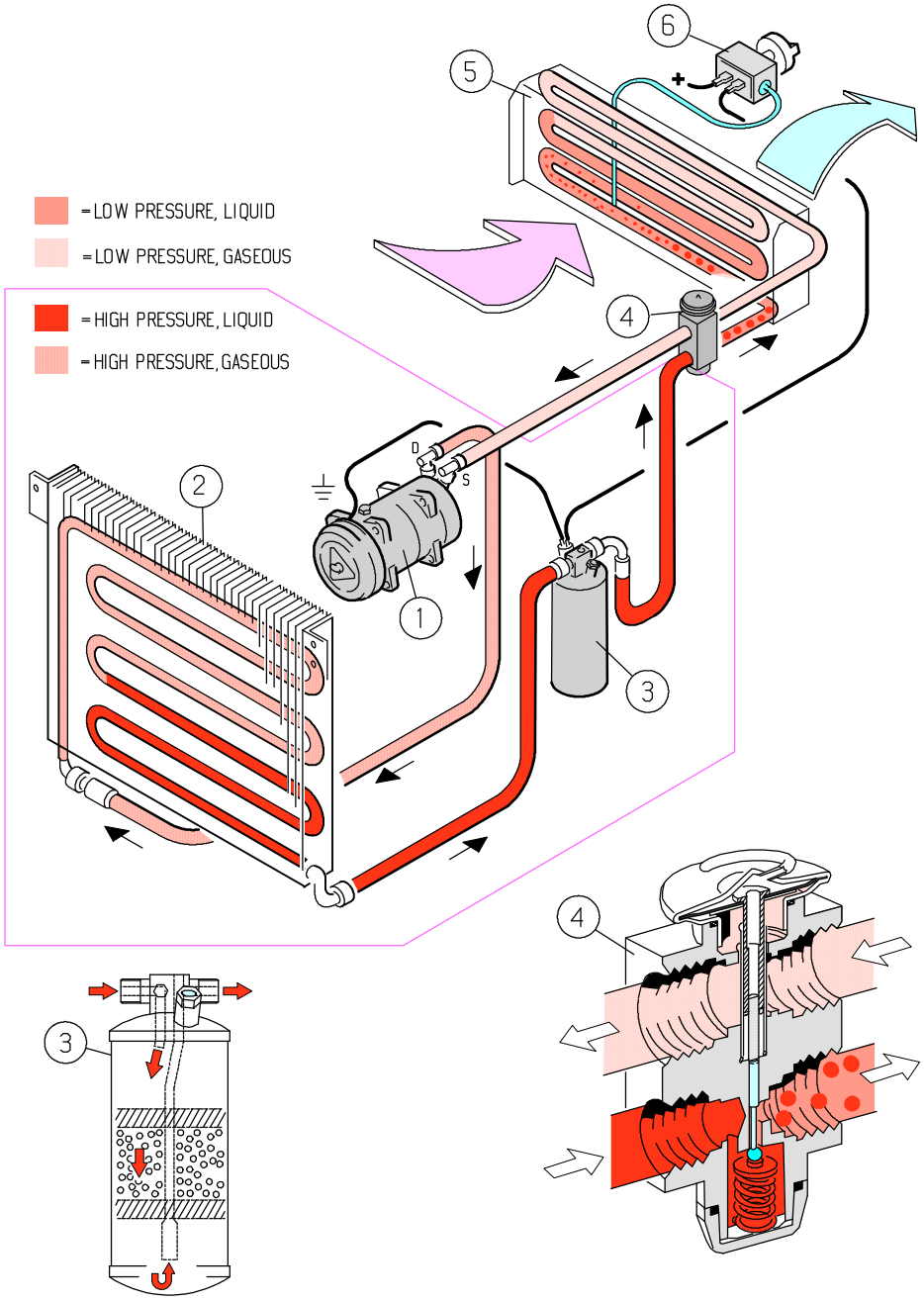


fig003

Circulation of the refrigerant begins from the compressor. The compressor sucks low pressure gas from the evaporator and compresses high pressure gas into the condenser. In the condenser gaseous refrigerant becomes condensed and emits heat to outdoors.

From the condenser high pressure liquid flows via a dryer to the expansion valve in which a part of the liquid vaporizes and the refrigerant cools and its pressure drops. Liquid flows from the expansion valve into the evaporator where cab heat changes liquid into gas. This low pressure gas then flows into the compressor suction side from where a new circulation begins.

Max. cooling effect corresponds to the situation when the compressor works all the time. In order to achieve a certain cooling effect, the compressor has to keep a certain pressure in the evaporator outlet side.

An evaporation temperature of R134 is **–26**°C. When pressure increases the evaporation temperature rises and vice versa. When the Air conditioning is operating the low pressure hoses are cold and high pressure hoses are warm.

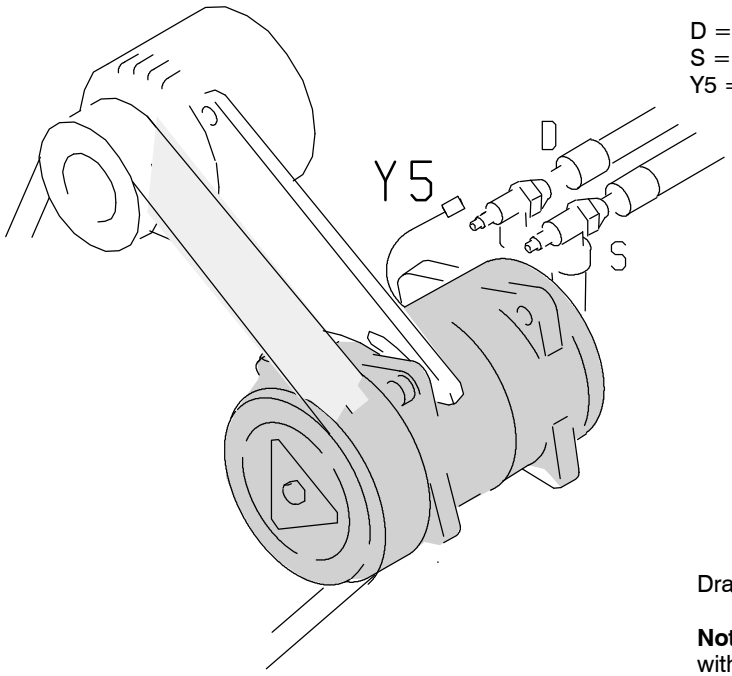
Liquid refrigerant from the condenser is filtered and dried in the dryer container. The dryer also prevents gaseous freon from entering into the expansion valve. In the dryer container there is a pressure switch which switches off current to the compressor if pressure in the high pressure circuit rises too high or becomes too low. The dryer has two inspection glasses through which can be checked the refrigerant filling and moisture in the system.

1. Compressor
2. Condenser
3. Dryer
4. Expansion valve
5. Evaporator
6. Control unit

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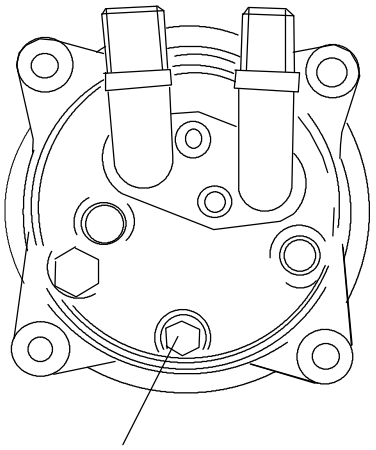
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Compressor



D = Discharge
S = Suction
Y5 = magnetic clutch

Note! The service valves are on the pipe connectors.(D and S)



Draining/filling plug for lubricating oil.

Note! Do not open the plug, if the system is filled with refrigerant. Compressor oil should be stored in a closed container.

fig004en

Compressor is driven by an extra belt pulley at the front end of the crankshaft. The compressor belt pulley is fitted with an electromagnetic clutch, which switches the compressor off and on according to the required cooling effect.

Compressor oil: see code 832.2.

When the compressor is functioning properly, it starts and stops regularly. With maximum cooling effect the compressor runs often but not as long as in minimum cooling. The compressor must not make unusual sounda. Check the compressor belts regularly.

Tightening torques:
– 3/4” connection on pressure side **24.5–29.5 Nm.**
– 7/8” connection on suction side **29.5–33.5 Nm.**

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Condenser

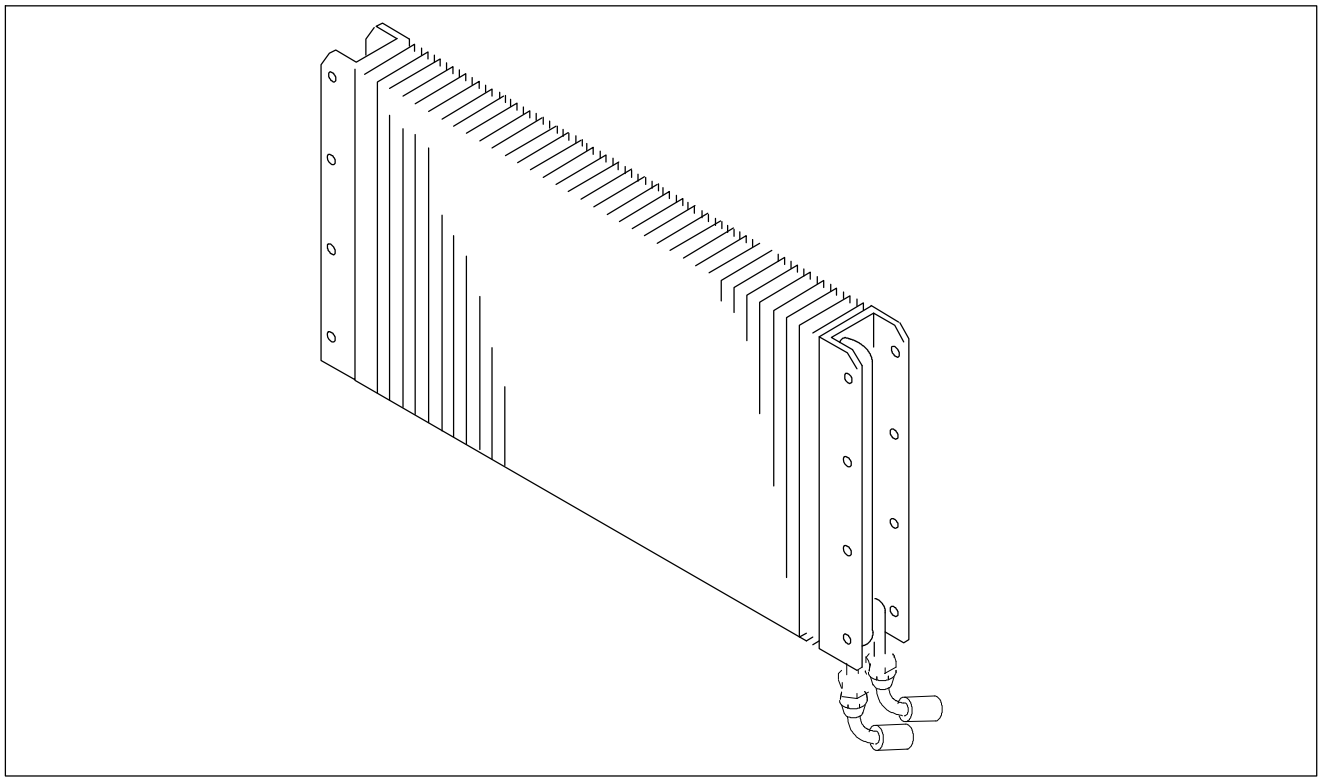


fig005

If malfunctions occur, always check and clean the outside of the condenser of impurities.

Cleaning can be carried out with compressed air.

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Evaporator

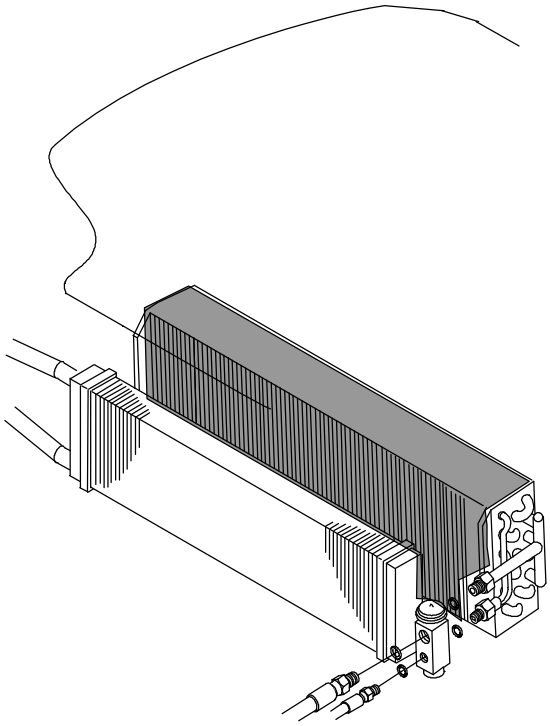


fig006

Deicing sensor is installed to the evaporator and it senses the lowest temperature of the evaporator. The control unit switches off the compressor when the temperature of the evaporator output pipe drops below **–2** °C (prevents icing on the evaporator), and switches on again when the temperature of the evaporator output pipe has risen above **0**°C.

Make sure that the drain pipes for the condensing water are open i.e. water can flow away from the evaporator housing bottom. Otherwise icing can appear on the evaporator. If there is water on the evaporator housing bottom, the drain pipes should be checked e.g. with compressed air.

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Dryer

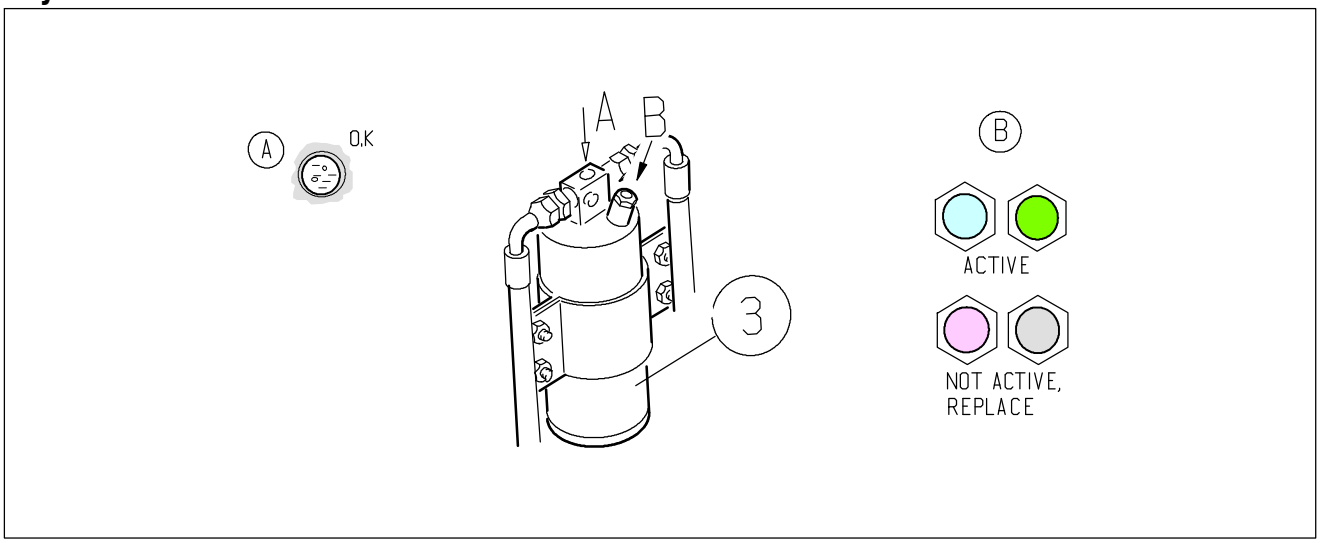


fig007b

The dryer reservoir (**3**) is a combined expansion/liquid reservoir and a drying filter for moisture. The dryer also includes a filter which filters for impurities in the system. There are two inspection glasses on the dryer: **A**=inspection of refrigerant and its filling, **B**=moisture indicator.

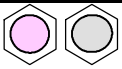
The dryer reservoir must not be stored with pipe connections open.

N.B! Never leave a receiver unplugged! The receiver must be replaced if the system is opened. On the receiver there is a pressure guard, which breaks the current circuit of the magnetic clutch if the pressure in the system is too high or low. The receiver has also a thermal fuse, which melts if the temperature of the refrigerant rises above 107–118˚C.

Inspection glass A (1500 r/min and max cooling effect)

Sightglass	Description	Conclusion and remarks
	No bubbles appear at all. (Reduction by bleeding is necessary). (This can also mean that there is no refrigerant at all in the system).	POSSIBLE EXCESSIVE REFRIGERANT The high–pressure side will be abnormally hot. REMEDY: Contact an authorized workshop for releasing the excess refrigerant.
	The fluid inside is almost transparent. A few bubbles may appear as the engine speeds up and down.	SUFFICIENT REFRIGERANT. The high–pressure side will be hot and the low–pressure side cold.
	A few bubbles appear intermittenly, at intervals of 1 to 2 seconds. (Refilling is necessary)	INSUFFICIENT REFRIGERANT. The high–pressure side will be warm, and the low–pressure side fairly cold. REMEDY: Check for refrigerant leakage. Contact an authorized workshop.
	When bubbles flow continuously, or the flow has changed to a ”misty” flow, the refrigerant is almost exhausted. (Refilling is necessary)	VERY LITTLE REFRIGERANT. There will be almost no difference in temperature between the high–pressure side and the low–pressure side. REMEDY: Stop the compressor and inspect the entire system. If necessary, contact an authorized workshop.

Inspection glass B

Sightglass	Description
	The moisture indicator colour is **green** or **blue** (earlier models): the system is in order.
	The moisture indicator colour is **pink** or **grey**: the dryer and the refrigerant should be changed.

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Expansion valve

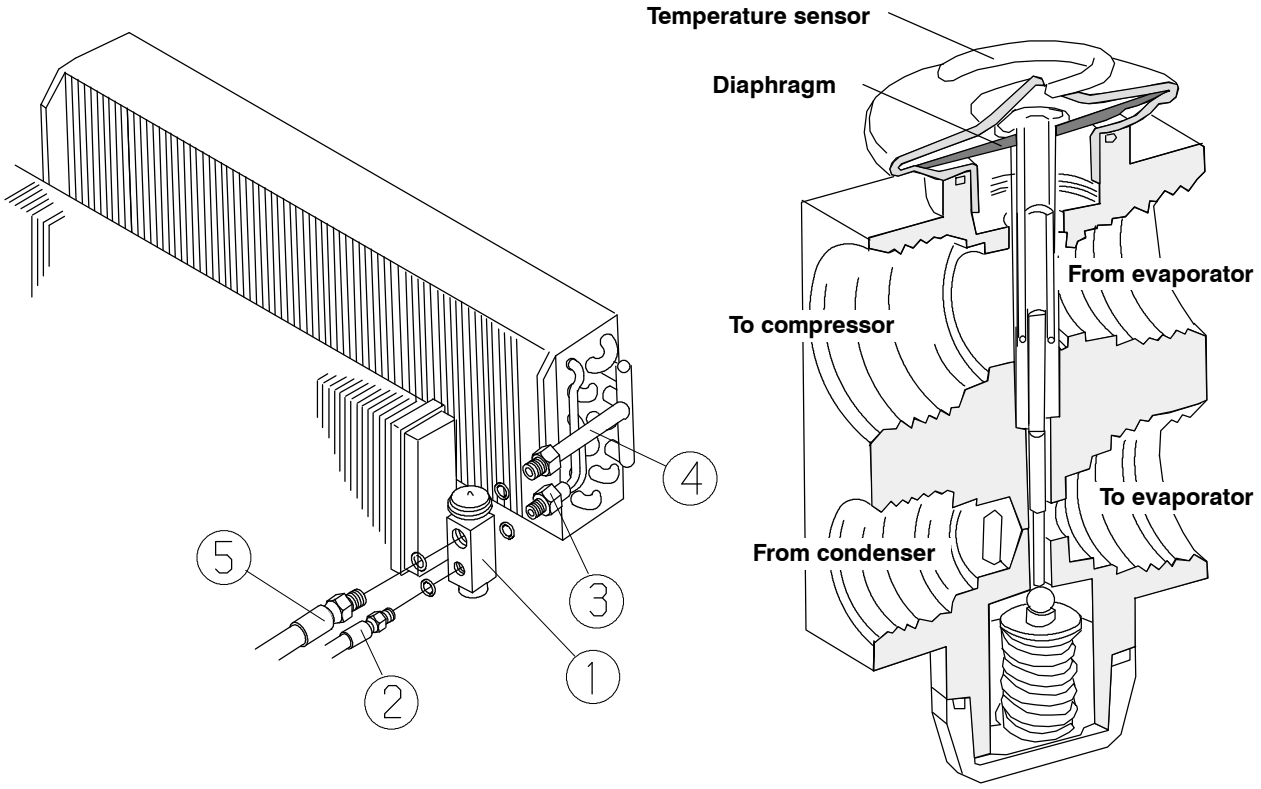


fig008en

1. Expansion valve
2. Hose from condenser
3. Inlet pipe to evaporator
4. Outlet pipe from evaporator
5. Hose to compressor suction side

The expansion valve regulates the amount of refrigerant in the evaporator so that the refrigerant vaporizes in the best possible way. The expansion valve lets only as much refrigerant flow into the evaporator as the evaporator can vaporize.

When the compressor starts pressure drops in the evaporator and the diaphragm pushes the pin downwards and the ball opens. Refrigerant can now flow via the spring housing into the evaporator

When the temperature in the evaporator outlet pipe lowers, the temperature sensor pulls the diaphragm upwards and the valve ball closes preventing refrigerant from flowing into the evaporator. In this way the expansion valve regulates all the time the amount of refrigerant in the evaporator.

The expansion valve is accessible after removing the cover on the cab roof. In addition, the expansion valve is covered by insulating mass.

The expansion valve and the metal pipes have been covered with insulating mass **30794000**.

– A faulty expansion valve causes a poor cooling effect.

– If the expansion valve is noisy (continuing whistle), there is too little refrigerant in the system which causes bubbles to appear in the inspection glass of the drier.

– If the expansion valve does not function (stuck fast or frozen in open or closed position), the cooling effect is weak.

– If the air conditioning system blows first cool air, then warm air and then cool air again, there is ice in the expansion valve which prevents refrigerant from flowing into the evaporator.

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Service table for Air condition system

Daily

1. Clean the condenser
2. Clean fresh air and cabin air filters

Monthly or every 250h

1. Check from the service detector of dryer that it's ok
2. Check the air condition compressors t–belt
3. Run the air condition system for a while. **Note!** Cooling and heating modes!

Yearly or every 1000h

1. Check the attachment of the air condition compressor
2. Check that the magnetic clutch of compressor is clean and the tolerance is ok
3. Check evaporator for leaks and/or abrasion
4. Check cleanness of output holes for condense water
5. Check all hoses and connectors for leaks and/or abrasion
6. Change fresh and cabin air filters
7. Run air condition system for a while. **Note!** Cooling and heating!
8. A/C system leak test.

Every other years, 2000h or when changing any hose of air condition system

1. Recover, vacuum and leak test, recharge the A/C system, replenish A/C system oil and add colorant.
2. Change the dryer (in case of need)

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Amount of oil in the A/C system

Compressor oil loops in the system soluted into refrigerant. When air conditioning is stopped, oil will stays on that place.

When changing the main components oil must be added to system according to table below.

NOTE! Every time when A/C system is open, the vacuum and leak test must be done to the system.

Total amount	207 cm^3 (207 ml)
Compressor oil	ZXL 100 PG
Oil loss	
Change of conderser	40 cm^3 (40 ml)
Change of dryer	40 cm^3 (40 ml)
Change of compressor	See instruction
Change of evaporator	40 cm^3 (40 ml)
Change of expansion valve	20 cm^3 (20 ml)
Change of hose	20 cm^3 (20 ml)
Broken A/C hose	40 cm^3 (40 ml)

Changing the compressor

– The new compressor includes the total amount of oil 207 cm^3 (207ml) which is total amount of oil in A/C system.

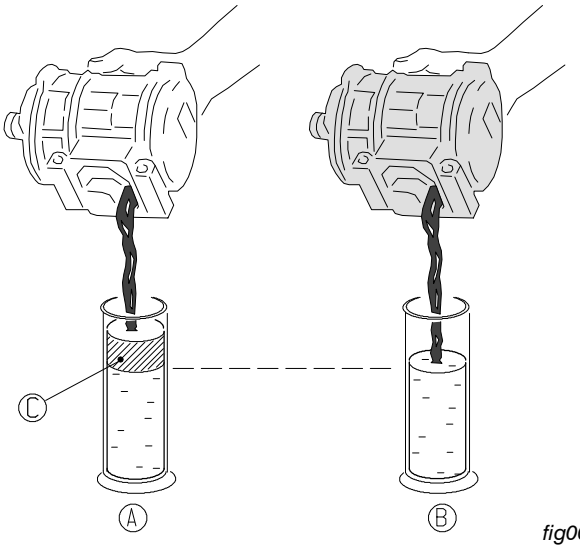


fig009

A) The new compresssor, the compressor oil poured to graduated glass.

B) The old compressor, the compressor oil poured to graduated glass.

C) Excess amount of oil.

After changing the new compressor, compressor oil must be added according to B.

If there is too much compressor oil in the system, refrigerating capacity will reduce.

If compressor oil level in the system is low, compressor will wear.

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Recovery, recycling and rechanging of refrigerant

– Must be done with fully automatic equipment. Fully automatic equipment does recover, vacuum, leak test and charge.

Working phases

1) Connecting to A/C system
   – Connect hoses (hi– and lo–side) to the tractor A/C system.
   – Open the coupler valves on the hoses. Pressure can be seen in diameter gauges.
2) Recover

– recovery of refrigerant and oil
– check the oil drain bottle, and note the amount of oil that was removed from A/C system. This is the amount of oil that must be charged into the A/C system after recharging is complete (see step 6).

3) Vacuum and leak test
   – removes air and moisture from A/C system
   – vacuum the system for at least 1 hour to ensure sufficient moisture and contaminant removal.
   – leak test shows if there are any leaks in the system
4) Recharge the A/C system
   – Valid weight of refrigerant, see code 831.1
5) Disconnect from A/C system
6) Replenish A/C system oil
   – Do this manually, add the same amount oil that was removed from system in recover state (see step 2).
7) Add colorant.

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Air conditioning system test

Testing must be done at shady location.
Ambient temperature must be between +20˚C and +28˚C and the engine temperature on normal.

In general:

1. Start the tractors engine
2. Set engine RPM to 1500
3. Turn the temperature knob towards cold and turn off floor fan.
4. Set blower speed to 3.
5. Open all roof louvers
6. Shut recirculation grille.
7. Set air conditioner 50% cooling.
8. Run engine 30 minutes. Then set air conditioner to maximum.
9. When air conditioner has been cooled at maximum 10 minutes, measure louver temperature at front LH louver. Cabin doors, windows and roof hatch must be shut during measurement.
10. Lowest louver temp. must be between +2˚ C and +6˚ C
11. If temperatures differ from the normal values, use pressure gauges to find out the problem. (See code **833.3**). Suction pressure (low side) should be from 0.2 to 0.9 bar and discharge pressure (high side) should be from 8.0 to 10.5 bar.

If the magnetic clutch of the compressor doesn't connect properly, there might be a broken wire between thermostat and compressor, faulty thermostat or faulty potentiometer.

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Air conditioning system temperature test

– Before doing any measurement, make sure that engine is warm and air conditioner is ON

– Measurement will be done with hand touch or infrared surface temperature meter

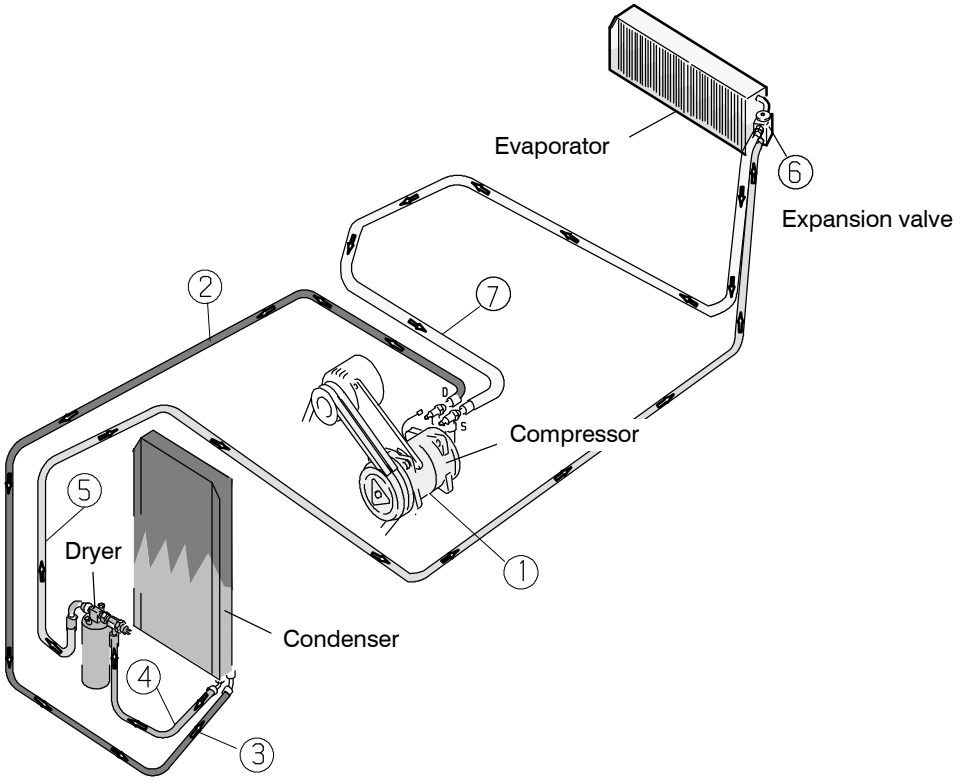


fig010en

1. Compressor (hot)
2. High pressure line from compressor to conderser (hot)
3. Conderser feed side (hot)
4. Conderser exhaustion side (warm)
5. Liquid line from dryer to expansion valve (warm)
6. Expander exhaustion line (cold)
7. Low pressure line compressor feed side (cold)

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Trouble shooting with pressure gauges

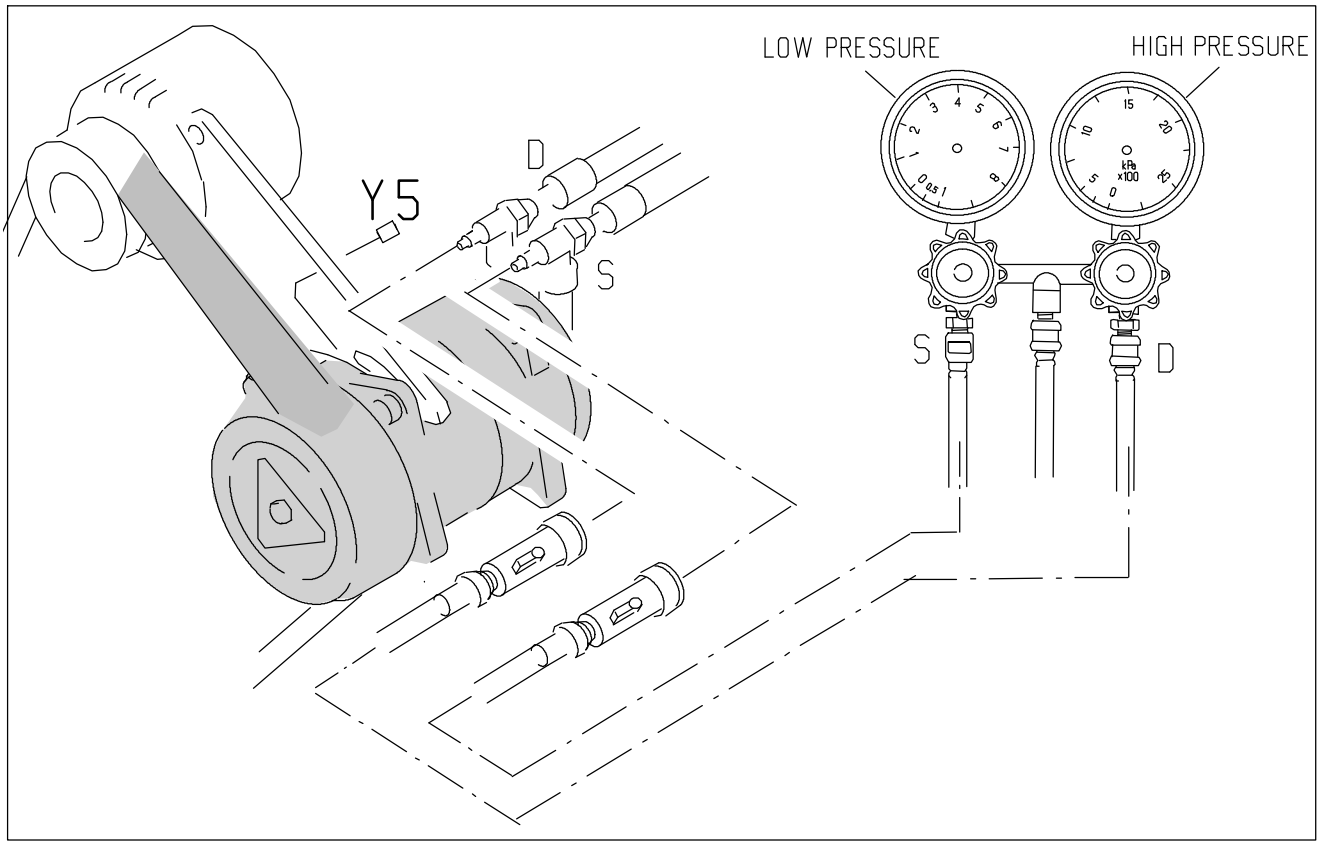


fig011

System pressures depend directly on air pressure and temperature. At outdoor temperature **20˚–25˚C** and at engine revs **1500 r/min** the low pressure varies between **50–300 kPa** and the high pressure between **700–1400 kPa**. The pressure gauges are connected to the compressor service valves: low pressure gauge to (**S**) and high pressure gauge to (**D**).
Make the connecting and disconnecting when the engine is stoped.

Low pressure too low **High pressure normal**

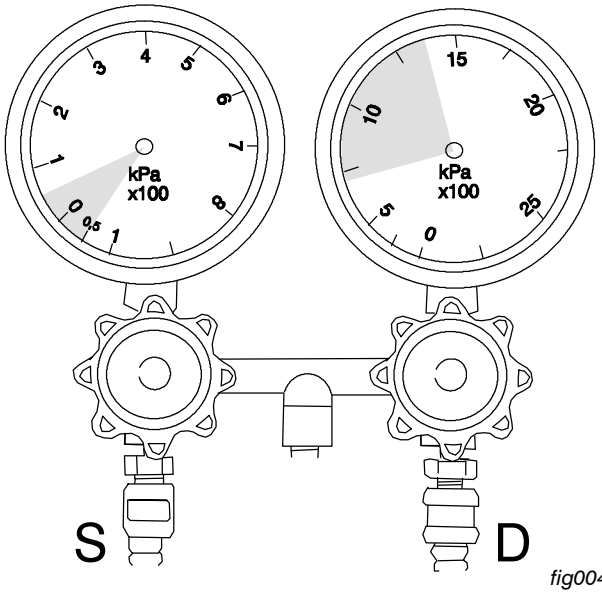


fig004c

Note! Refrigerant in the gauge hoses blows off. Use gloves and goggles when connecting and disconnecting gauges. Recap valves.

Overcharge
In a correctly charged system, refrigerant discharged from the compressor in the form of gas looses its excess heat, resulting from compression in the first coil of the condenser and condenses to a liquid in the subsequent coils. Before flowing to the reservoir, this liquid is held in the last condenser coil. If the system is over–charged, the liquid level builds up in the condenser, leaving fewer coils available to condense the gas. Both temperature and pressure then build up, causing hoses to burst in some cases.

Possible fault	Remedy
1. Expansion valve faulty.	1. Change expansion valve.
2. Moisture in system causing icing in expansion valve	2. Empty and flush the system. Change the dryer and the expansion valve if necessary.
3. Expansion valve is clogged or evaporator dirty, if low pressure gauge shows underpressure.	3. Empty system and change the expansion valve and also the evaporator and dryer if necessary.
4. Dryer blocked (temperature difference on different sides of blockage causes icing in the dryer when Air conditioning is functioning).	4. Empty system and change the dryer.

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Low pressure high **High pressure normal**

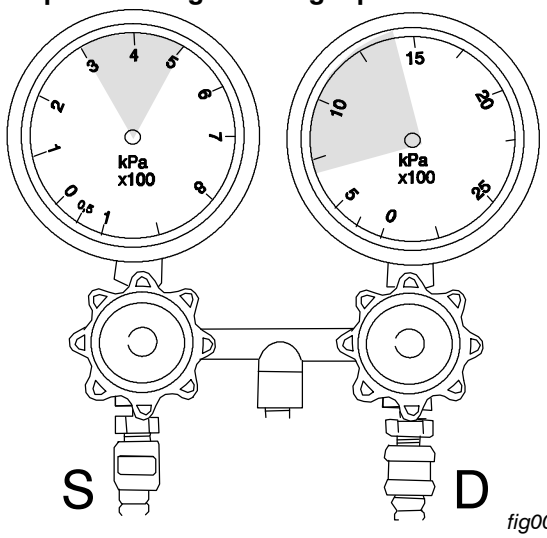


fig005c

Possible fault	Remedy
1. Expansion valve faulty. Valve stuck fast in open position.	1. Empty system and change expansion valve.
2. Compressor faulty or its belt slackened.	2. Check compressor belt. Change damaged compressor.
3. Too little refrigerant in system.	3. Empty and refill the system with refrigerant (1,6 kg).

Low pressure high **High pressure low**

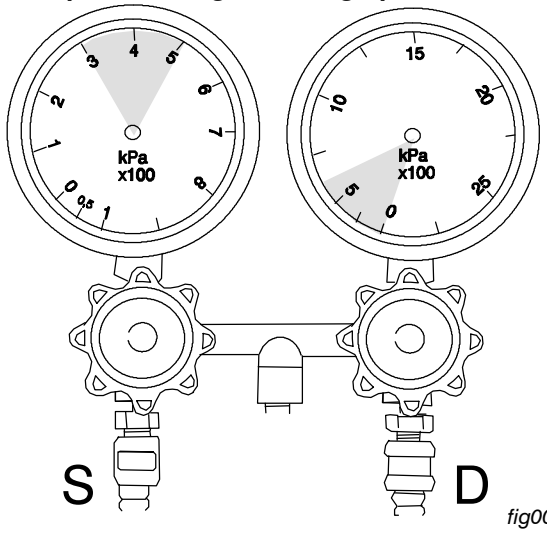


fig006c

Possible fault	Remedy
1. Valves or seals in compressor faulty.	1. Change compressor.
2. Too little refrigerant causes the high pressure reading to be too low.	2. Empty and refill the system with correct amount of refrigerant (1,6 kg).

Low pressure normal **High pressure high**

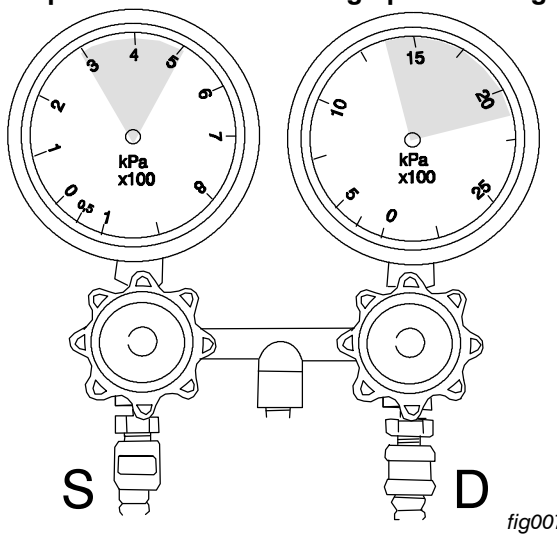


fig007c

Possible fault	Remedy
1. Air in system or too much refrigerant in system.	1. Empty system and refill with refrigerant (1,6 kg).
2. Condenser dirty (insects etc)	2. Clean the condenser.
3. If bubbles appear in inspection glass fast filling is OK, the dryer hose connections have been connected faulty and refrigerant flows in reverse direction.	3. Empty system and change hose connections. Change the dryer. Refill system (1,6 kg).
4. If there is bubbles and icing in the dryer, there is restriction in the dryer inlet side.	4. Empty system and remove blockage and fit a new dryer. Refill system (1,6 kg).

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Low pressure high **High pressure high**

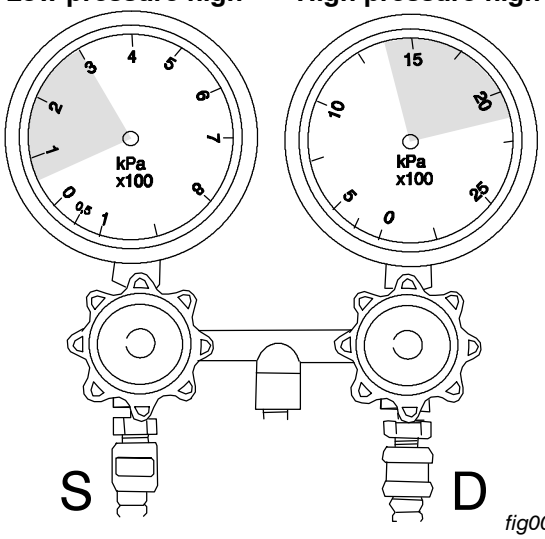


fig008c

Possible fault	Remedy
1. Condenser is dirty (insects etc.)	1. Clean condenser
2. Too much refrigerant in system.	2. Empty and refill system with refrigerant (1,6 kg).

Both gauges show same pressure

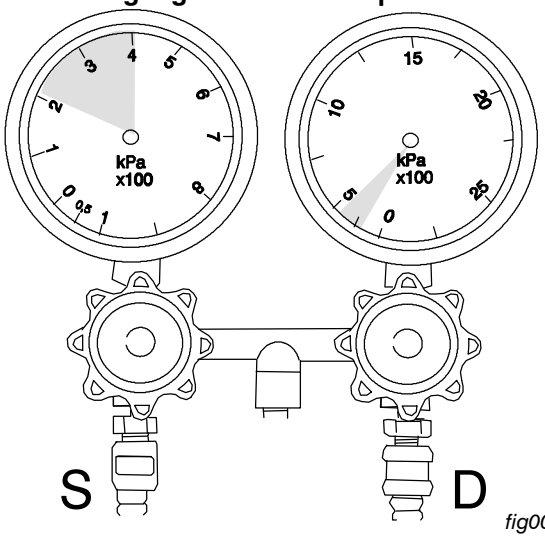


fig009c

Possible fault	Remedy
1. Compressor magnetic clutch does not function.	1. Change compressor
2. Compressor is faulty	2. Change compressor
3. Electric system faulty (temperature switch, pressure switch, fuse etc.)	3. Check electrical system.

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90. Hydraulic system

91. Hydraulics

92. Working hydraulics

93. Power lift

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Technical data

Hydraulic system is independent of engine and PTO clutches.

Separate pumps for working hydraulics and low pressure circuit hydraulics which have a common suction strainer. Both circuits are equipped with a pressure filter.

Electro–hydraulic linkage

Operations	Autocontrol B (ACB)	Autocontrol D (ACD)
With electro–hydraulic lower link draft sensing	X	X
Draft control mixing (position control/draft control mixing)	X	X
Lowering speed, independent of load	X	X
Transport height	X	X
Drive balance control	X	X
Slip control		X

Hydraulic lift control valve
– manufacturer ..... Bosch
– shock valve opening pressure ..... 20 MPa (200 bar)

	Lifting cylinder ø	Lower link type	The length of the lower links
T121c–T171c T121h–T191h T151eLS–T191LS	100 mm	Category 3, quick coupling grabs	940 mm

Low pressure circuit

Pump capacity:
–T121c–T171c, T121h–T191h (**11** cm^3/r , i=1,32) .... 30 l/min at 2200 r/min engine revs
–T151eh (ECO mode) ..... 25 l/min at 1800r/min engine revs
–T151eLS–T191LS (**19** cm^3/r , i=1,32) ..... 55 l/min at 2200r/min engine revs
–T151eLS (ECO mode) ..... 45 l/min at 1800r/min engine revs
Max. pressure ..... 1,8 MPa (18 bar)

Supplies oil for the following functions
T121c–T171c, T121h–T191h ..... Power Shift
Powered front axle
Power take–off
Differential lock
Gearbox and PTO lubrication
Power shuttle
Parking brake
Boosted brake system

T151eLS–T191LS ..... Steering (prioritized), max. pressure 14 MPa, decompression for low pressure circuit 1,8 MPa after the priority valve.
Power Shift
Powered front axle, unlocking
Power take–off
Differential lock
Gearbox and PTO lubrication
Power shuttle
Boosted brake system
Parking brake
Range gear movement
Trailer brake valve (extra equipment)

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High pressure circuit

Pump capacity:

–T121c–T171c, T121h–T191h (**25** cm^3/r , i=1,32)	73 l/min at 2200 r/min engine revs with free low pressure
–T151eh (ECO mode)	60 l/min at 1800 r/min engine revs with free low pressure
–T151eLS–T191LS (variable displacement pump)	115 l/min at 2200 r/min engine revs, load sensing system, supplies oil if needed.
–T151eLS (ECO mode)	94 l/min, at 1800 r/min engine revs

Max. pressure (at 1500 r/min):

–T121c–T171c, T121h–T191h	19,6 MPa (196 bar)
–T151eLS–T191LS	20,5 MPa (205 bar)

Shock valve opening pressure of pump:

–T121c–T171c, T121h–T191h	23 MPa (230 bar)

Pressure relief valve opening pressure of working hydraulic circuit:

–T121c–T171c, T121h–T191h	20 MPa (200 bar)
–T151eLS–T191LS	25 MPa (250 bar)

Supplies oil for the following functions:

–T121c–T171c, T121h–T191h	Steering, which is prioritized, Hydraulic lift, Auxiliary hydraulics Trailer brake valve (extra equipment)
–T151eLS–T191LS	Hydraulic lift, Auxiliary hydraulics

Available volume of oil for auxiliary hydraulics with different filling quantities:

min.	30 l
max.	40 l

Additional pump (T151eLS–T191LS)

Pump capacity (**28** cm^3/r , i=1,32):	81 l/min 2200r/min
Supplies oil for following functions	Ejector of the variable displacement pump

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Valves for auxiliary hydraulics

T121c–T171c, T121h–T191h

Two 1/2–action valves, separate levers. First valve has a mechanical position locking function. Second valve has a floating position. As extra equipment, two valves and one oil flow control valve+brake valve can be fitted.

T151eLS–T191LS

Rear:

– As standard, one on/off valve. Controling e.g. hydraulic top link (assume the lock valve as well).
– As extra equipment, one on/off valve. Solid connection for the hydraulic lift link ram (assume the lock valve as well), for the hydraulic trailer hitch with the hydraulic extension etc.
– As standard, two double acting valve blocks with adjustable electric control.
– As extra equipment, three double acting valve blocks with adjustable electric control.

Front, as extra equipment, following variations:

Assuming four valves in the rear.

– Two valve blocks with adjustable electric control, plus the front loader or the front linkage, as extra equipment.
– Three valve blocks with adjustable electric control, plus the front loader and/or the front linkage, as extra equipment.

All valves are electric adjusted CAN bus valves, except the on/off valves

All adjustable electric control valves are pressure compensated. Therefore, while using different valves with different pressures at the same time, the oil flow outputs still remains the same as it has been adjusted for each valve and port.
In addition, all adjustable electric control valves are Zero–leak valves (not on/off valves controlled with rocker switch on the RH side panel. If necessary the implements has to equipped with lock valves).

The max. capacity of the adjustable valves is 80–90 l/min. If needed a larger capacity, the capacity of the two valves can be combined.

The adjustable valves functions can be adjusted with switches and display of the RH arm rest support:

– activated = on function/not activated = not on function
– max oil flow output regulation for + and – ports
– timer regulation for the activation time of the oil flow = position locking, 0–60 seconds and continuously flow for + and – ports
– floating position for the port (lower)
– three different outputs, regulated in the factory, selecting with the rotation switch
– three memory places for the regulating values

With the joystick, guided by the controlling switch can be controlled, either two valves in the rear or two valves in the front (e.g the front loader or the front linkage). Other valves are controlled with the linear control levers and the on/off valves with the rocker switches.

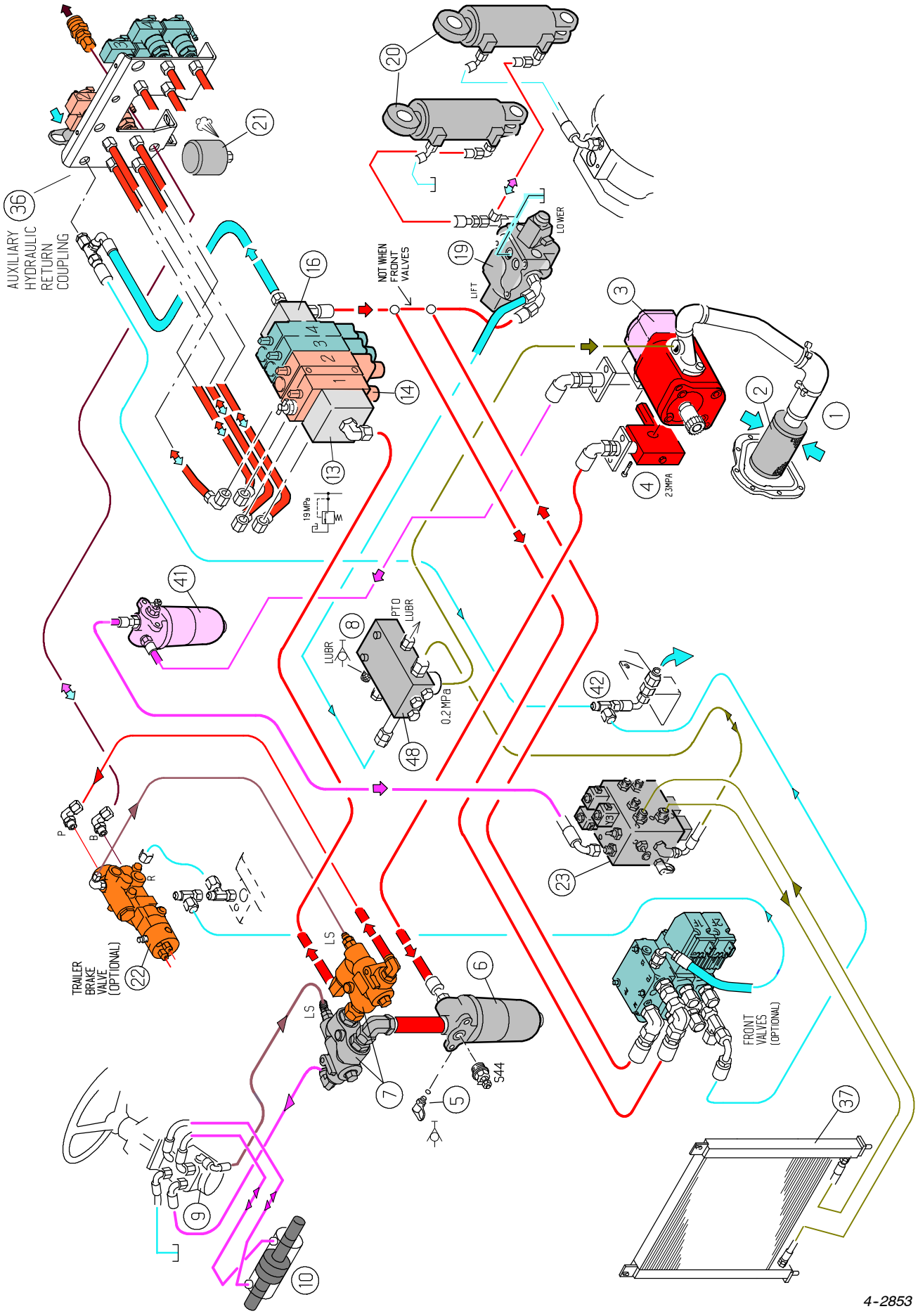
In the models with the front loader and the front linkage the push buttons of the joystick can be used for other implements extra functions.

Brake valve can be fitted, as extra equipment, independently other valves.

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Hydraulic system, T121c–T171c



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Pump capacity
– **73 l/min** at 2200 r/min engine revs with free low pressure

Max. pressure
– 19,6 MPa (196 bar)

Shock valve opening pressure of pump
– 23 MPa (230 bar)

Pressure relief valve opening pressure of working hydraulic circuit
– 19,6 MPa (196 bar)

Supplies oil for following functions:
– Steering (prioritized), Hydraulic lift, Auxiliary hydraulics

Available volume of oil for auxiliary hydraulics with different filling quantities:
min. . . . . 30 l
max. . . . . 40 l

1. Oil reservoir
2. Inlet strainer
3. Double pump (**25**+**11** cm^3/r)
4. Press. relief valve, 23 MPa, besides the pump
5. Measurement point (Valmet HPR).
6. Pressure filter (filtering grade: $\beta 10=75$)
   – By–pass valve 0,35 MPa
7. Priority valve (2 pcs when trailer brake valve installed)
8. Pressure checking point (lubrication)
9. Steering valve (OSPC 125LS, 125 cm^3/r)
   – pressure relief valve, steering 14 MPa
10. Steering cylinder
13. Inlet flange (pump side)
   – pressure relief valve 196 MPa
14. Directional control valve
16. End flange (tank side)
19. Control valve (Bosch)
   – shock valve (for cylinder), 20 MPa
20. Lift cylinders
21. Ventilation for lift cylinders + transmission (filtering grade: $\beta 10=75$)
22. Trailer brake valve
23. Valve block (safety valve 0.4 MPa + pressure relief valve 1.8 MPa)
36. Auxiliary hydraulic system return coupling
37. Oil cooler
41. Filter, low–pressure hydraulics
42. Connection to the tank
48. Valve block (0,2 MPa)

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Hydraulic diagram

1. Oil reservoir
2. Inlet strainer
3. Double pump (**25+11** cm^3/r, i=1.32)
4. Press. relief valve, 23 MPa (besides the pump)
5. Measurement point (Valmet HPR)
6. Pressure filter (filtering grade: β10=75)
   – By–pass valve 0.35 MPa
   – warning light (blocking up)
7. Priority valve
8. Pressure checking point (lubrication)
9. Steering valve (OSPC 125LS, 125 cm^3/r)
   – pressure relief valve, steering 14 MPa
   – shock valve 20 MPa
10. Steering cylinder
13. Inlet flange (pump side)

13a Pressure relief valve 19,6 ±0,4 MPa / 1500 rpm

14. Directional control valve
15. Directional control valve
16. End flange (tank side)
17. Directional control valve, optional
18. Directional control valve, optional
19. Control valve (Bosch)
    – Shock valve (for cylinder), 20 MPa
20. Lift cylinders
21. Ventilation for lift cylinders + transmission (filtering grade: β10=75).
22. Brake valve (optional)
23. Valve block (with DPS)
    – Pressure relief valve 1.8 MPa
    – Safety valve 0,7 MPa
24. Differential lock
26. Rear PTO
27. Multi–disc clutch, 4WD
28. 3– step powershift
30. Lubrication of pinion shaft
31. Lubrication of pump drive gear
32. Lubrication of main shaft
33. Lubrication of differential
34. Lubrication of PTO shafts
35. Lubrication of PTO gears
36. Auxiliary hydraulic system return coupling
37. Oil cooler
38. Flow control valve (optional equipment)
40. Differntial lock, front axle (optional equipment)
41. Filter, low–pressure hydraulics
43. Pump side

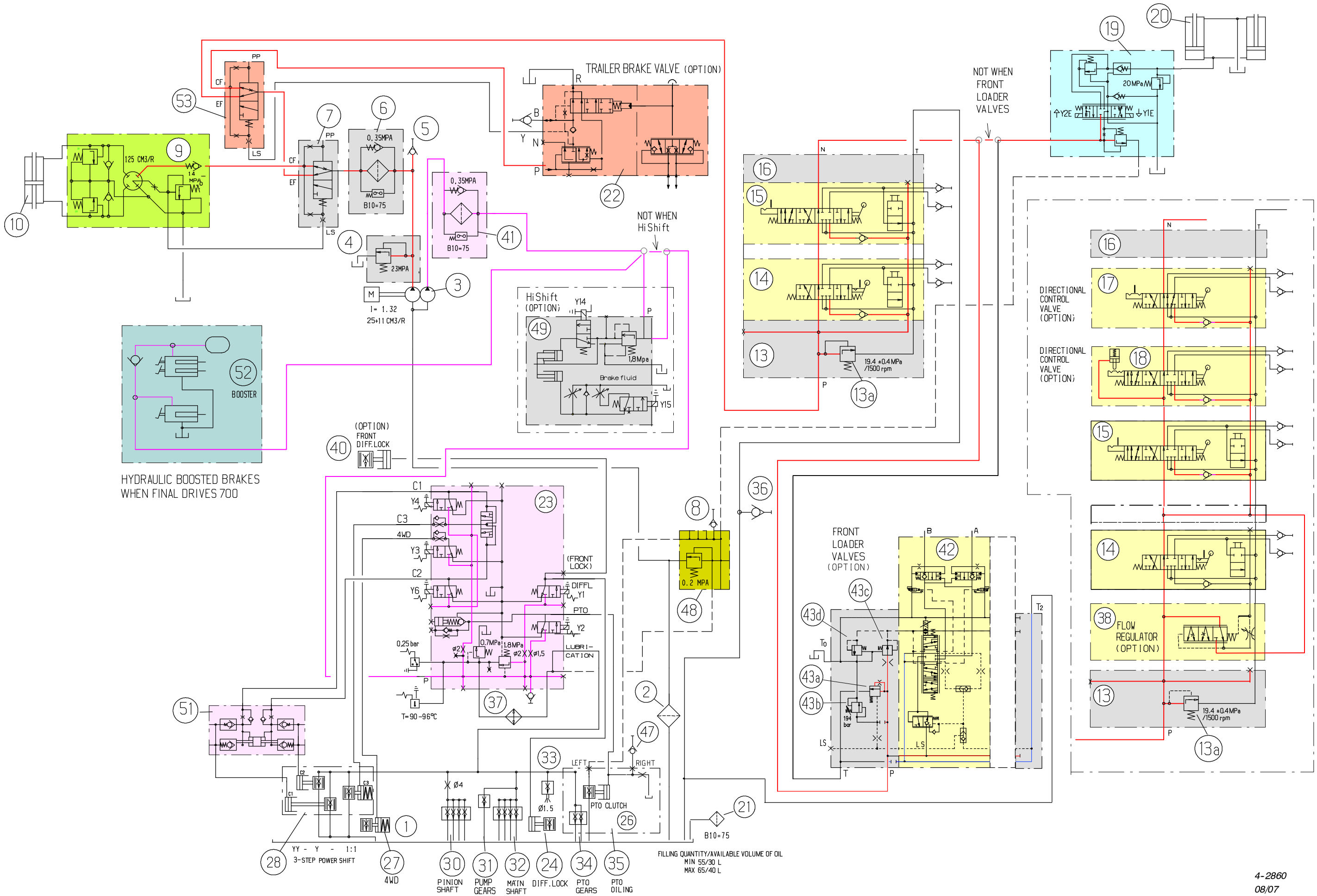
43a. Free circulation valve

43b. LS pressure limiting valve (adjustable)

43c. Pilot pressure relief valve

43d. Pilot pressure limiting valve

47. PTO pressure checking point
48. Valve block (0,2 MPa)
49. Hi Shift (optional equipment)
50. Valve block (without DPS)
51. Lock valve
52. Hydraulic boosted brake system
53. Priority valve (for brake valve)

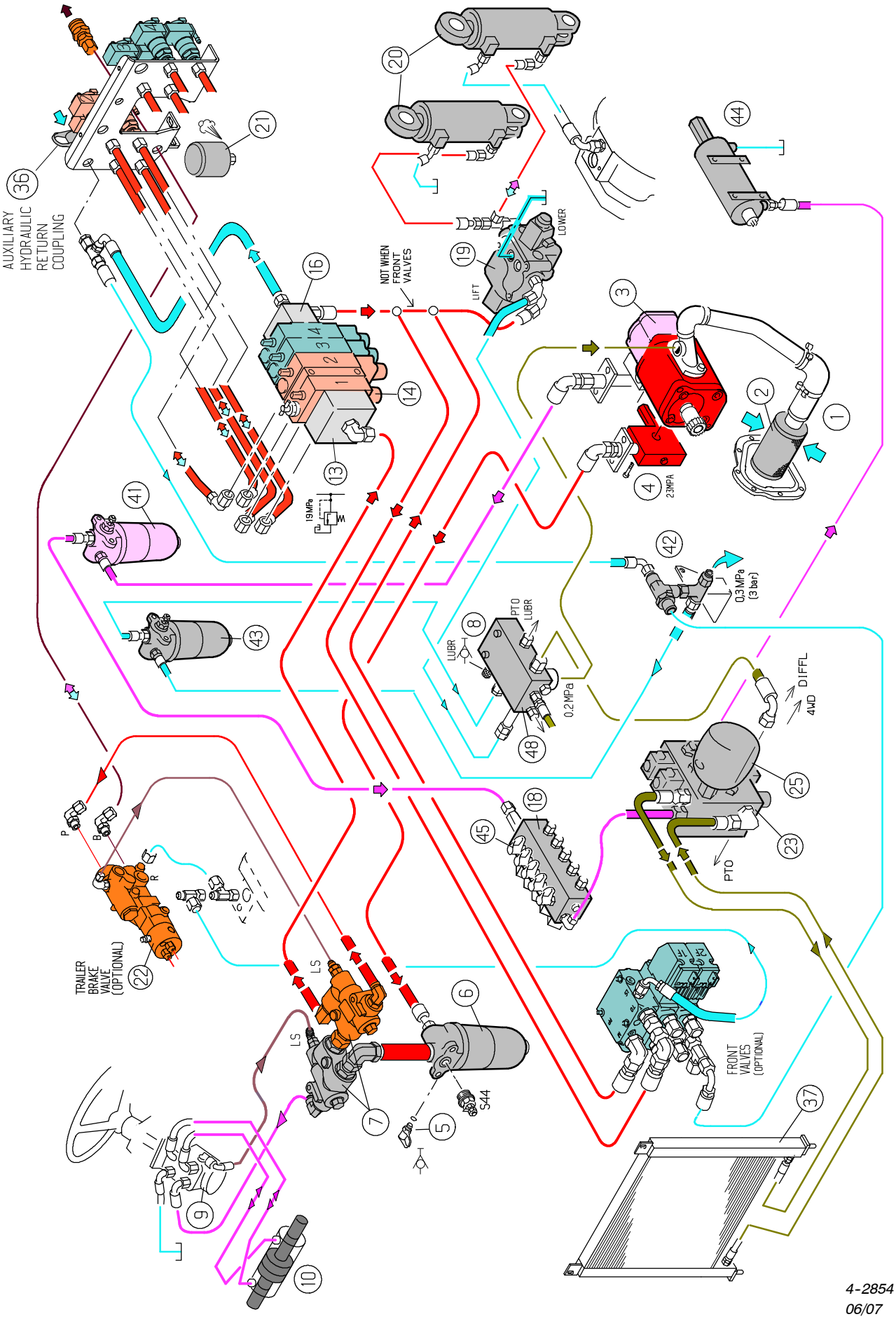


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Hydraulic system, T121h–T191h



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Pump capacity
– **73 l/min** at 2200 r/min engine revs
or
– **60 l/min** at 1800 r/min engine revs (T151eh ECO mode)

Max. pressure
– 19.6 MPa (196 bar)

Shock valve opening pressure of pump
– 23 MPa (230 bar)

Pressure relief valve opening pressure of working hydraulic circuit
– 19.6 MPa (196 bar)

Supplies oil for following functions:
– steering (prioritized), hydraulic lift, auxiliary hydraulics, trailer brake valve

Available volume of oil for auxiliary hydraulics with different filling quantities:
min. . . . . 30 l
max. . . . . 40 l

1. Oil reservoir
2. Inlet strainer
3. Double pump (**25**+**11** cm^3/r)
4. Press. relief valve, 23 MPa (besides the pump)
5. Measurement point (Valmet HPR).
6. Pressure filter (filtering grade: $\beta 10=75$)
   – By–pass valve 0.35 MPa
7. Priority valve (2 pcs when trailer brake valve installed)
8. Pressure checking point (lubrication)
9. Steering valve (OSPC 125LS, 125 cm^3/r)
   – pressure relief valve, steering 14 MPa
10. Steering cylinder
13. Inlet flange (pump side)
   – pressure relief valve 196 MPa
14. Directional control valve
16. End flange (tank side)
19. Control valve (Bosch)
   – shock valve (for cylinder), 20 MPa
20. Lift cylinders
21. Ventilation for lift cylinders + transmission (filtering grade: $\beta 10=75$).
22. Trailer brake valve
23. Valve block (safety valve 0.4 MPa + pressure relief valve 1.8 MPa)
25. Hydraulic accumulator
36. Auxiliary hydraulic system return coupling
37. Oil cooler
41. Filter, low–pressure hydraulics
42. Valve, 0.3 MPa (3 bar)
43. Filter, aux. return oil
44. Hand brake cylinder
45. Valve block (power shift + power shuttle)
48. Valve block (0.2 MPa)

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Hydraulic diagram

1. Oil reservoir
2. Inlet strainer
3. Double pump (25+11 cm^3/r, i= 1.32)
4. Press. relief valve, 23 MPa (besides the pump)
5. Measurement point (Valmet HPR)
6. Pressure filter (filtering grade: β10=75)
   – Bypass valve 0.35 MPa
   – Warning light (blocking up)
7. Priority valve
8. Pressure checking point (lubrication)
9. Steering valve (OSPC 125LS, 125 cm^3/r)
   – Pressure relief valve, steering 14 MPa
   – Shock valve 20 MPa
10. Steering cylinder
11. Steering valve, reverse drive (option) valve as in point 9).
12. Shuttle valve (reverse drive)
13. Inlet flange (pump side)

13a Pressure relief valve 19 MPa

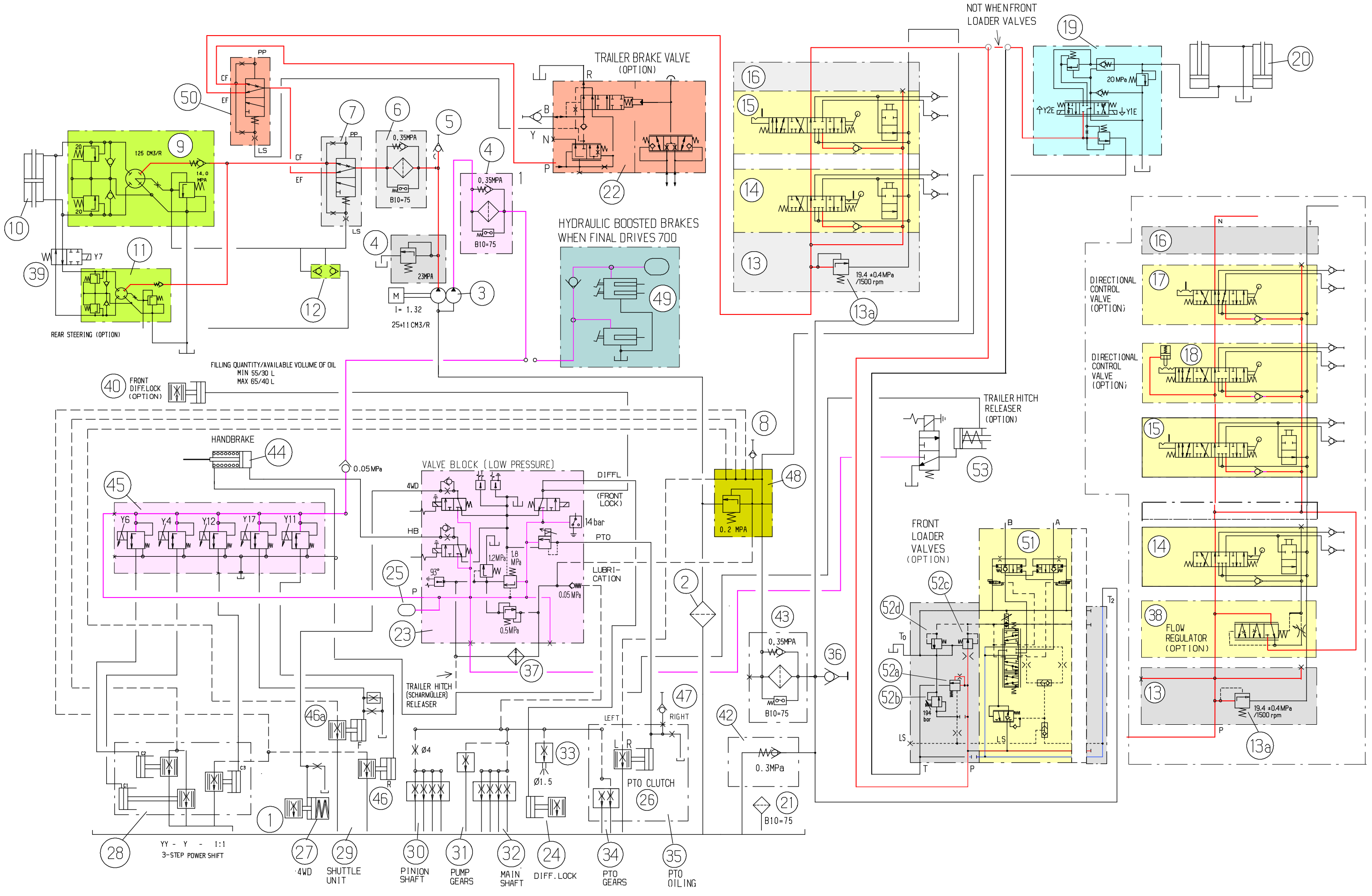
14. Directional control valve
15. Directional control valve
16. End flange (tank side)
17. Directional control valve, optional
18. Directional control valve, optional
19. Control valve (Bosch)
    – Shock valve (for cylinder), 20 MPa
20. Lift cylinders
21. Ventilation for lift cylinders + transmission (filtering grade: β10=75).
22. Brake valve (optional)
23. Valve block (with DPS)
    – Pressure relief valve 1.8 MPa
    – Safety valve 1.2 MPa
24. Differential lock
25. Hydraulic accumulator
26. Rear PTO
27. Multi–disc clutch, 4WD
28. 3–step Powershift
29. Lubrication of power shuttle
30. Lubrication of pinion shaft
31. Lubrication of pump drive gear
32. Lubrication of main shaft
33. Lubrication of differential
34. Lubrication of PTO shafts
35. Lubrication of PTO gears
36. Auxiliary hydraulic system return coupling
37. Oil cooler
38. Flow control valve (optional)
39. Directional control valve (for blocking the reverse drive control)
40. Differential lock, front axle (optional equipment)
41. Filter, low–pressure hydraulics
42. Valve 0.3 Mpa (3 bar)
43. Filter, aux. return oil
44. Hand brake cylinder
45. Valve block (DPS + power shuttle)
46. Multi disc clutch, reverse

46a Multi–disc clutch, forward

47. PTO pressure checking point
48. Valve block (0.2 MPa)
49. Hydraulic boosted brake system
50. Priority valve (for brake valve)
51. Front loader valves (optional)
52. Pump side

52a. Free circulation valve
52b. LS pressure limiting valve (adjustable)
52c. Pilot pressure relief valve
52d. Pilot pressure limiting valve

53. Trailer hitch releaser (optional equipment)

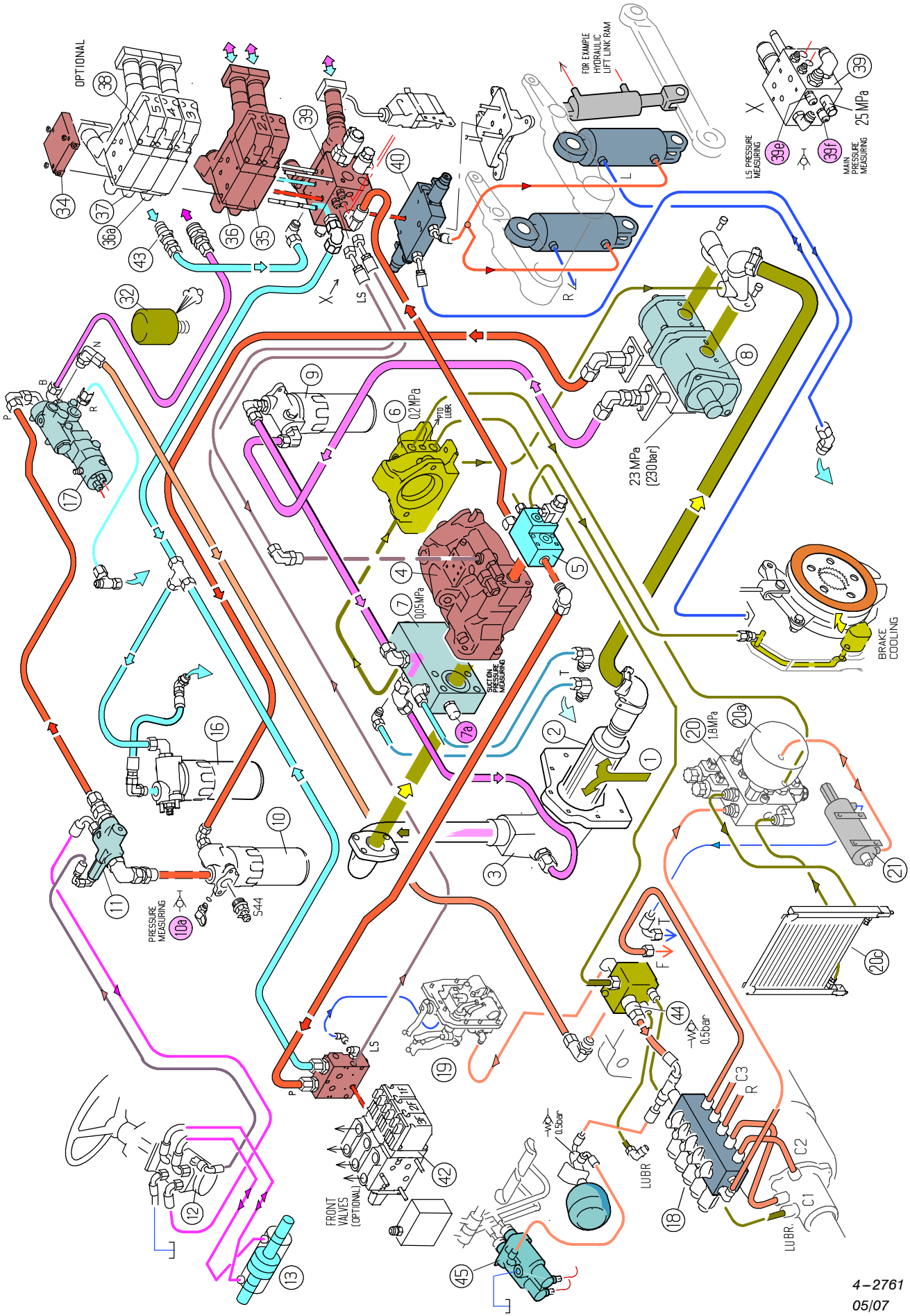


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Hydraulic system, T151eLS–T191LS



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1) Oil reservoir (gearbox)

2) Inlet strainer

3) Ejector
   – increases the output quantity of the supply pump (8)

4) Variable displacement pump

5) Valve block (brake cooling valve)

6) Valve block, lubricating
   – limits the lubrication pressure to 0.2 MPa

7) Valve block
   – **Valve 0.05 MPa**
   – Suction line pressure controls the valve
   – Releases the overflow oil to the lubrication when there is sufficient pressure in the suction line
   – **Pressure relief valve**
   – Assists the valve (6)
   – Opens, if the lubrication pressure for some reason increases over 0.4MPa (4 bar)

7a) Pressure measuring point (suction press.)

8) Double pump (28+19 cm3/r, i=1.32)
   – 19cm3/r: steering/ brake valve/ low press. circuit additional output for gearbox and PTO lubrication
   – 28cm3/r: to variable displacement pump

9) Pressure filter
   – filtering grade: ß10=75)
   – by–pass valve 0,35 MPa

10) Pressure filter

10a) Pressure measuring point

11) Priority valve
   – directs the pressure when needed to steering or low pressure circuit + trailer brake valve (optional)

12) Steering valve (125 cm3/r)
   – pressure relief valve, steering 14 MPa
   – shock valves 20 MPa

13) Steering cylinder

16) Return oil filter
   – filtering grade: ß10=75)
   – by–pass valve 0.35 MPa

17) Brake valve (optional)

18) Valve block (DPS+ shuttle unit)

19) Gear range change system (M–H)

20) Valve block

20a) Hydraulic accumulator
   – low pressure relief valve 1.8 MPa

20c) Oil cooler

21) Parking brake cylinder

32) Ventilation for lift cylinders + transmission
   – filtering grade: ß10=75

34) End flange
   Pilot pressure relief valve
   – Not adjustable
   – Regulates the pilot pressure to 12 bar
   – Continuous small flow keeps the valve warm
   Pilot pressure limiting valve
   – Not adjustable
   – Limits the pilot pressure to max. 13 bar

35–38) Directional control valve (incl. zero leak valve)

39) On/off valve block
   – shock valve (limits the system pressure to 25 MPa (250bar)

39e) Pressure measuring point (LS press.)

39f) Pressure measuring point (main press.)

40) Control valve, power lift

41) End flange

42) Front loader valves (optional)

43) Free return coupling

44) Block + check valve

45) Hydraulic boosted brakes

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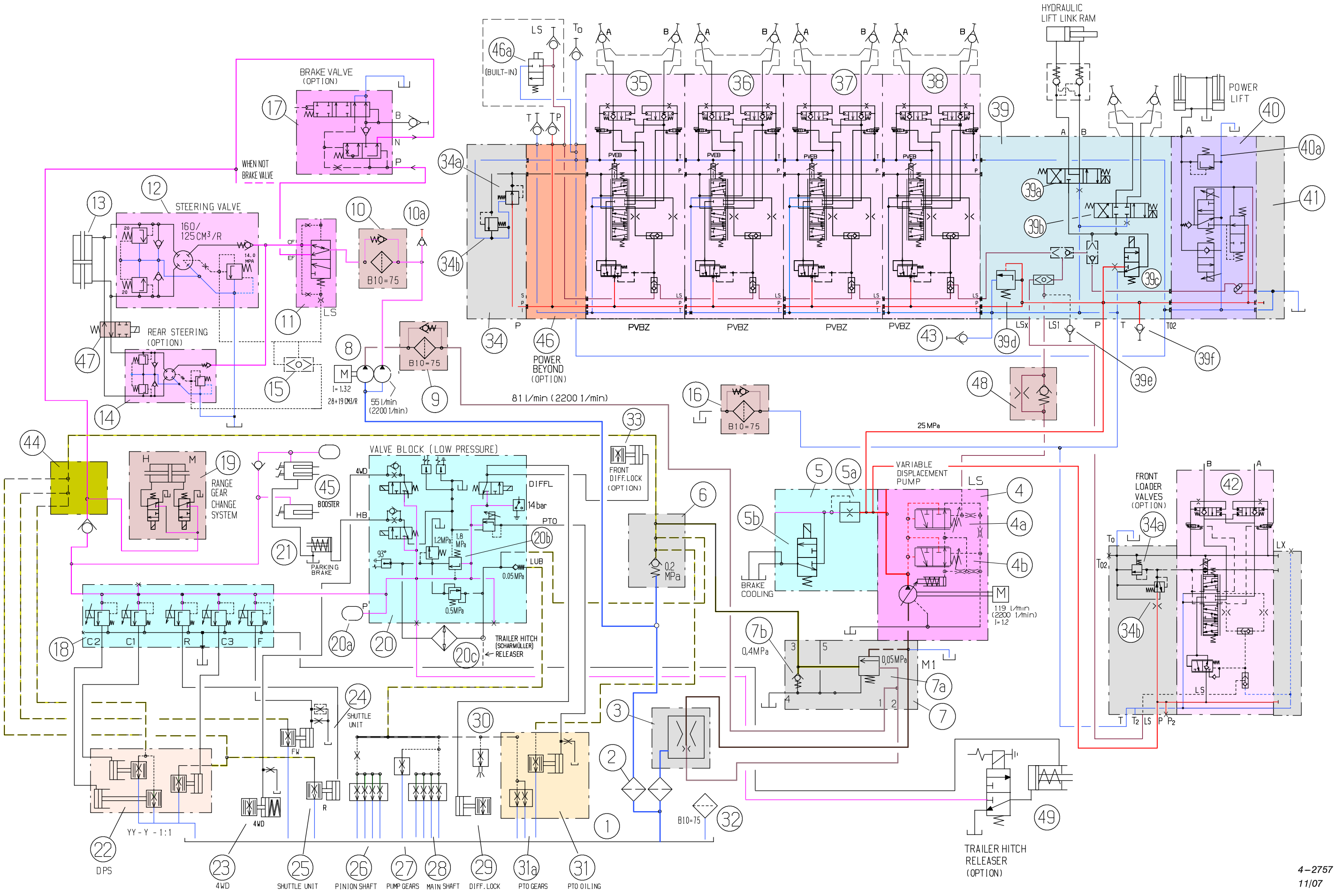
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Hydraulic diagram

1) Oil reservoir (gearbox)
2) Inlet strainer
3) Ejector
   – incr. the output quantity of the supply pump (8)
4) Variable displacement pump (115l/min/2200l/min)
   4a) Upper spool for flow control
   – stand–by pressure 2–2.5 MPa
   4b) Lower spool for pressure control
   – max. press. adjustment of the system 20.5+0.5 MPa
5) Valve block
   5a) Flow valve
   5b) Brake cooling valve (on/off)
   – throttle restricts the flow
6) Valve block, lubricating
   – limits the lubrication pressure to 0.2 MPa
7) Valve block
   7a) Valve
   – suction line pressure controls the valve
   – releases the overflow oil to the lubrication when there is sufficient pressure in the suction line
   7b) Pressure relief valve
   – assists the valve (6)
   – opens, if the lubrication pressure for some reason increases over 0.4MPa (4 bar)
8) Double pump (28+19 cm3/r, i=1.32)
   – 19cm3/r: steering/ brake valve/ low press. circuit additional output for gearbox and PTO lubrication
   – 28cm3/r: to variable displacement pump
9) Pressure filter
   – filtering grade: ß10=75)
   – bypass valve 0.35 MPa
10) Pressure filter
   – filtering grade: ß10=75
   – by–pass valve 0.35 MPa
   10a) Pressure measuring point, steering pressure
11) Priority valve
   – directs the pressure when needed to steering or brake valve (option)
12) Steering valve (125/160 cm^3/r)
   – pressure relief valve, steering 14 MPa
   – shock valves 20 MPa
13) Steering cylinder
14) Steering cylinder, reverse drive controls
15) Shuttle valve, reverse drive
16) Return oil filter
   – filtering grade: ß10=75)
   – bypass valve 0.35 MPa
17) Brake valve (optional)
18) Valve block (DPS+ shuttle unit)
19) Semi–automatic range gear (M–H)
20) Valve block
   20a) Hydraulic accumulator
   20b) Low pressure relief valve 1.8 MPa
   20c) Oil cooler
21) Parking brake cylinder
22) 3–step Powershift
23) Multi–disc clutch, 4WD
24) Multi–disc clutch, forward
25) Multi–disc clutch, reverse
26) Lubrication of bevel pinion shaft
27) Lubrication of pump drive gears
28) Lubrication of main shaft
29) Differential lock
30) Lubrication of differential
31) Lubrication of PTO gears
   31a) Lubrication of PTO shafts
32) Ventilation for lift cylinders + transmission
   –filtering grade: ß10=75
33) Differential lock, front axle (optional)
34) End flange
   34a) Pilot pressure relief valve
   – not adjustable
   – regulates the pilot pressure to 12 bar
   – continuous small flow keeps the valve warm
   34b) Pilot pressure limiting valve
   – not adjustable
   – limits the pilot pressure to max. 13 bar

35–38) Directional control valve (incl. zero leak valve)

39) On/off valve block
   – N.B! valves are not proportional
   39a) Valve for hydraulic lift link ram
   39b) Valve for hydraulic top link
   39c) Valve
   – connects the pressure to valves 39a and 39b
   – connects abobe mentioned valves to LS line
   39d) Safety valve
   –limits the system pressure to 25MPa (250 bar)
40) Control valve, power lift
   40a) Shock valve
41) End flange
42) Front loader valves (optional)
43) Free return coupling
44) Block + counter valve
45) Hydraulic boosted brakes
46) Power Beyond block (option)
   46a) Automatic discharging of the LS pressure to the tank
47) Valve, rear steering off
48) Throttle check valve (damps vibration)
49) Trailer hitch releaser (optional equipment)



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Hydraulic pump and suction strainer (T121c–T171c, T121h–T191h)

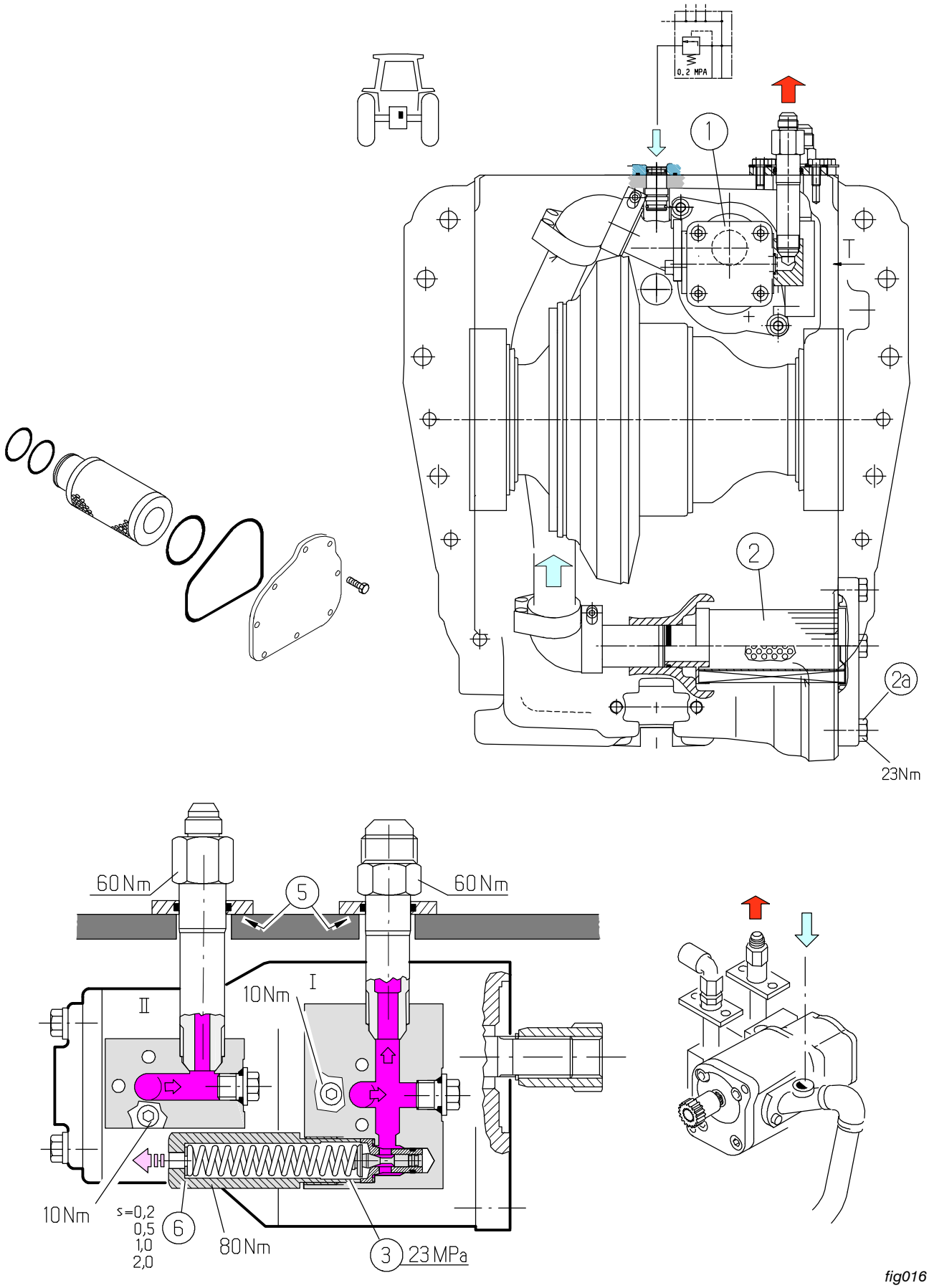


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Function of pump

The pump drive shaft front end is connected to the engine flywheel by means of the drive flange. The drive shaft goes through the gearbox input shaft to the rear end where it is fitted to the pump drive mechanism.

The twin gear pump is placed in the gearbox housing and is attached to the rear side of the wall between the gearbox and differential housings.

The twin pump capacity per revolution and the drive mechanism gear ratio:
– See code 911.1

1. Hydraulic pump
2. Suction strainer
3. Protection valve of the high pressure circuit pump
   – Opening pressure 23 MPa
5. Sealing plates of pressure pipe lead–throughs
6. Shims for adjusting of the opening pressure

Cleaning suction strainer

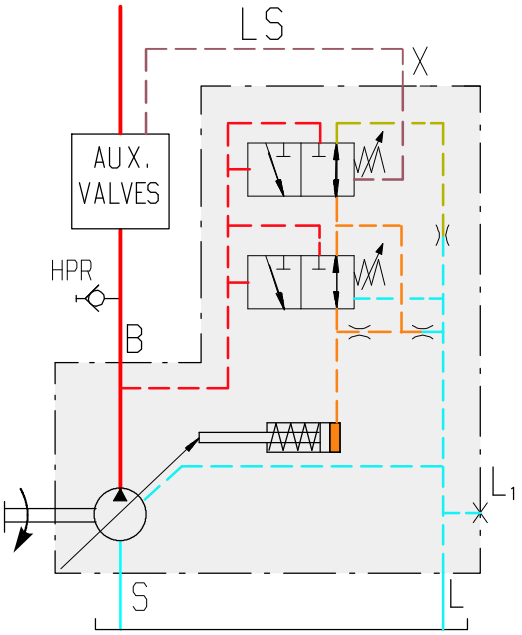
Change oil in power transmission/hydraulics system and clean the suction strainer every 1000 hours or yearly.

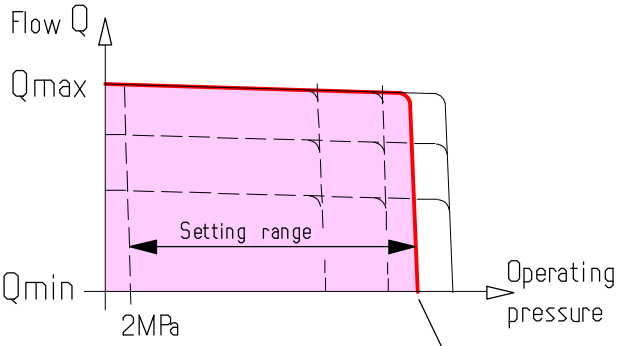
Cleaning suction strainer:

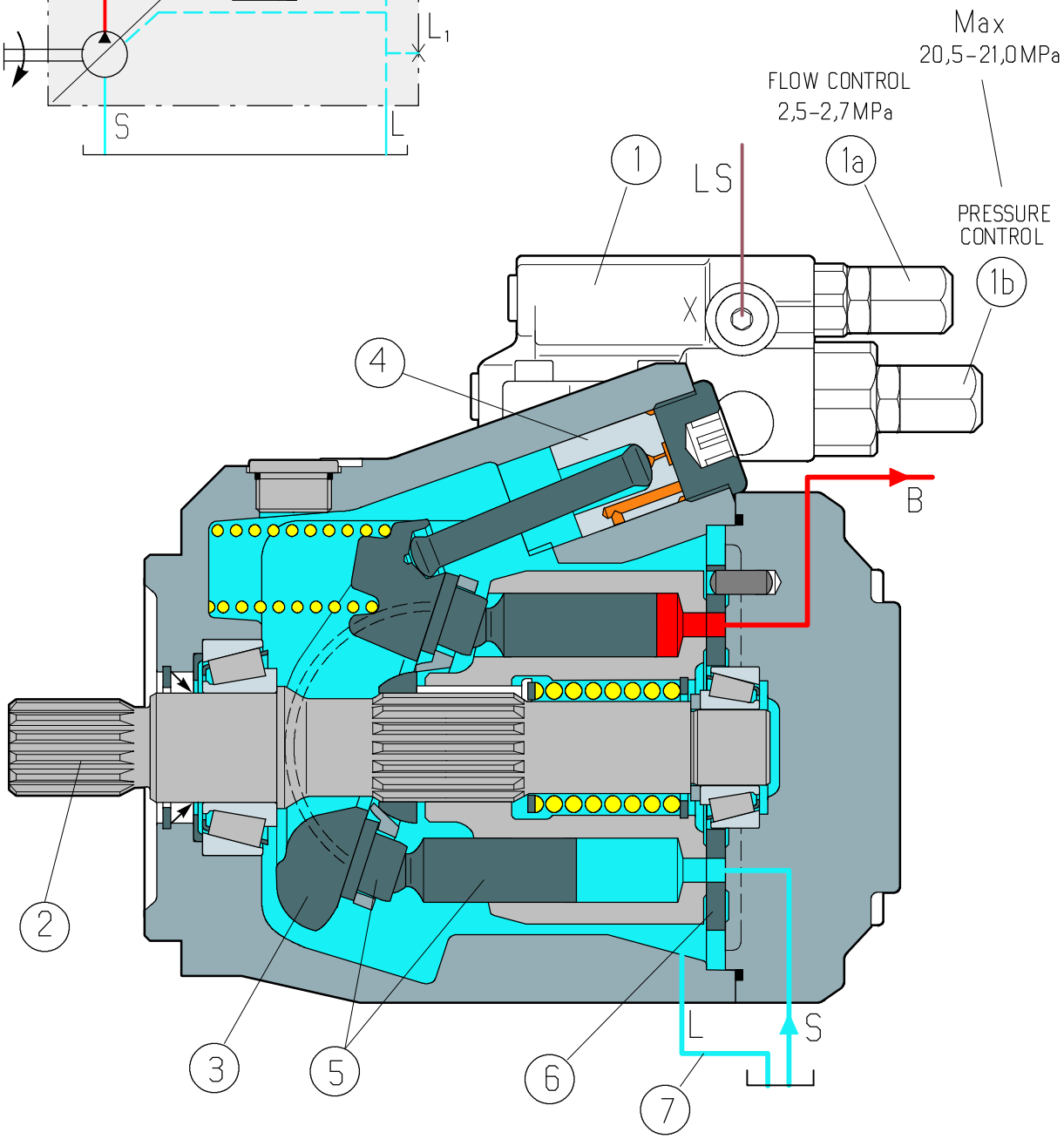
– Drain the oil
– Remove the cover fixing nuts (2a).
– Remove the strainer.
– Clean the insert in diesel fuel and dry it with compressed air. Change the insert if damaged.
– In conditions where the hydraulic system becomes dirty quickly, the suction strainer has to be cleaned more frequently. If the operating sound of the pump changes to a shrieking noise, the suction strainer cleaned and the oil checked to ensure that its viscosity corresponds to the manufacturer's recommendation.

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Variable displacement pump, Bosch A10VO DFR1 (T151eLS–T191LS)







4–2845
06/07

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The high pressure circuit is of a Load Sensing type, function of which is based on the variable displacement pump equipped with the LS–regulator.

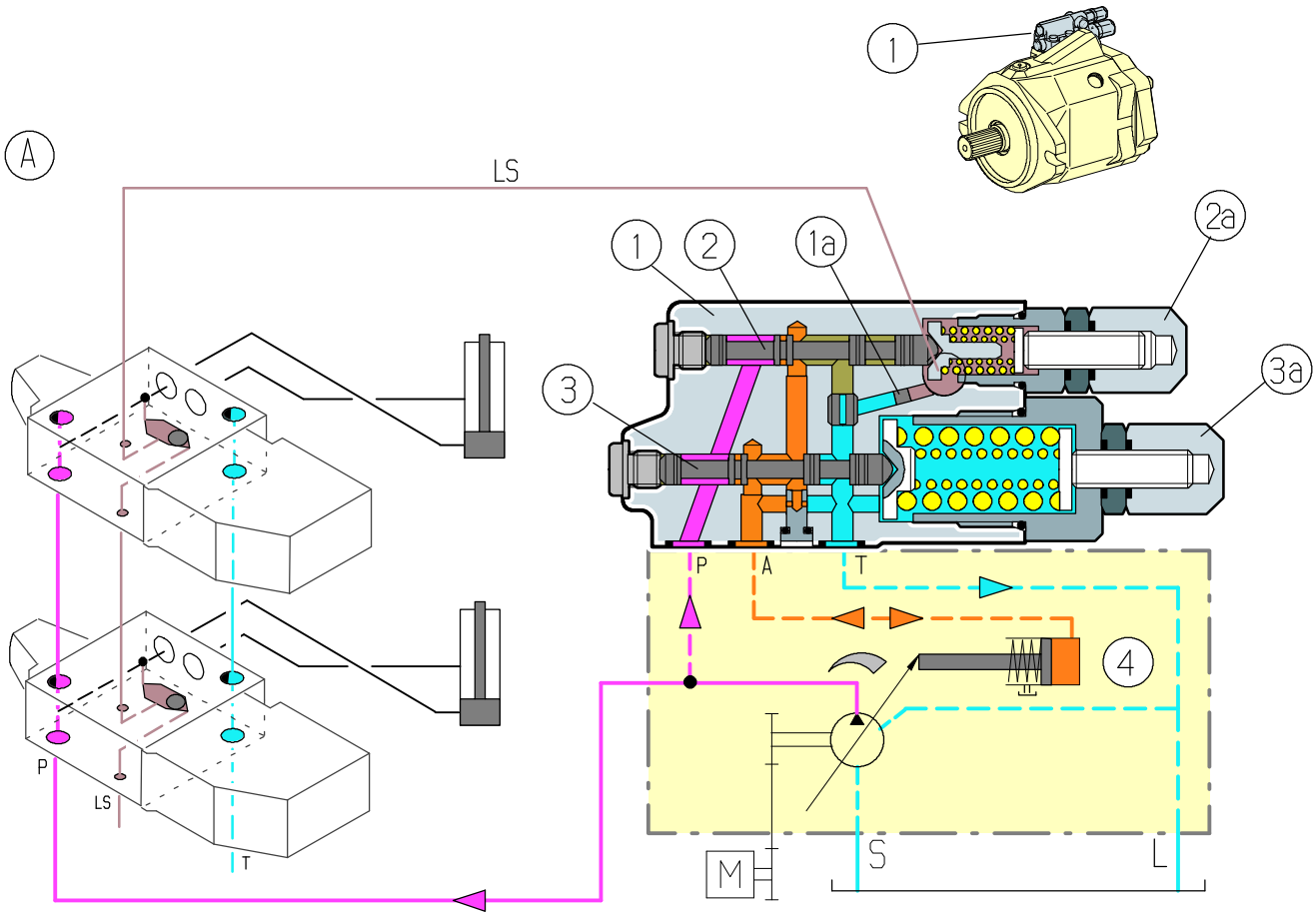
The pump has a regulator, which adjusts the pump output regarding of the loading so, that a desired, constant pressure difference is created over an auxiliary valve spool. The load pressure (LS) in the upper part of the spool is conducted into the LS–port of the regulator and thus the pump “knows” the load pressure in various working cylinders.

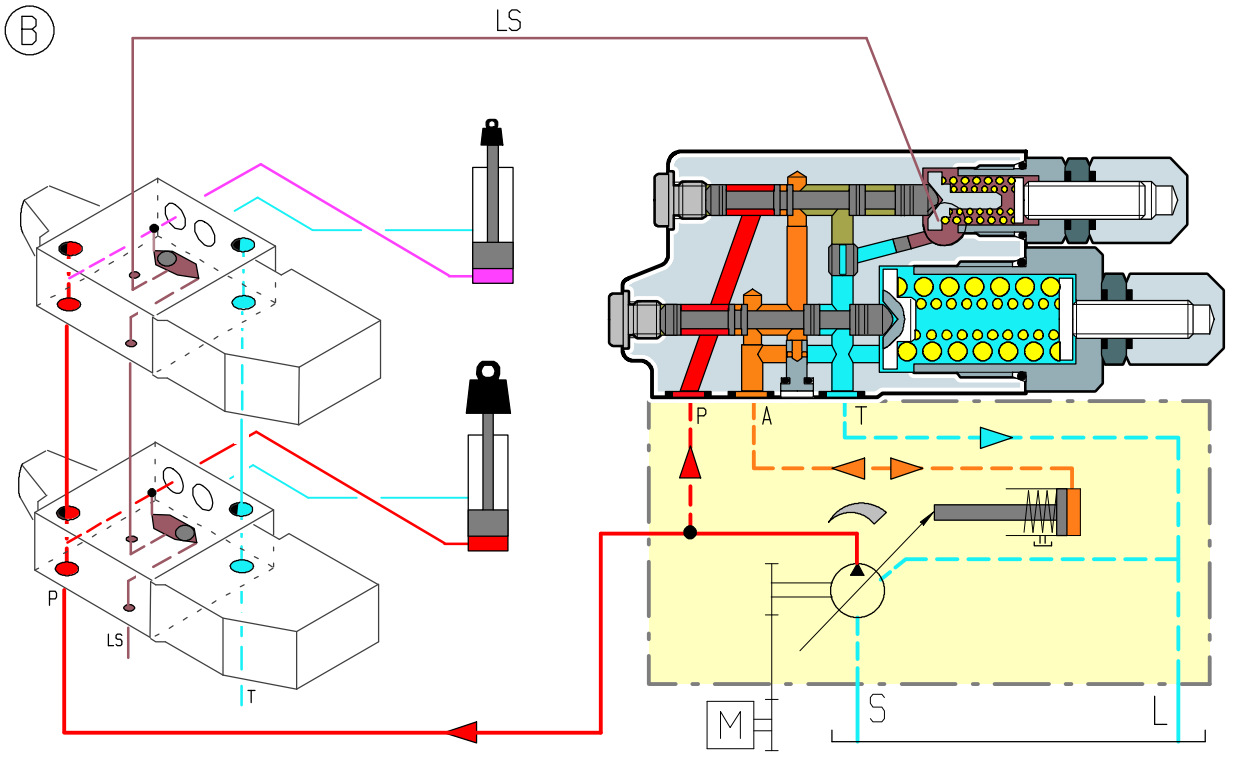
When the LS–pressure varies, at the same time is varied the pump feed pressure, which is kept all the time above the LS–pressure by the amount of the constant pressure difference. The pump volume flow and the cylinder moving speed is kept constant regardless of the variable load pressure.

1) Regulator
   1a) Upper spool for flow control
   1b) Lower spool for pressure control
2) Driveshaft
3) Swashplate
4) Swahplate turning piston
5) Pistons (9x) + shoe pieces (note! also tensile load)
6) Divider plate
7) Leak oil from housing

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LS–pressure





4–2846
06/07

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The pressure line pressure affects the passage P of the regulator. This pressure is conducted via the boring in the piston to the left side of the spool.
Line A is connected to the piston, which adjust the position of the pump adjusting plate.
Line T is connected to the pump housing and it is also connected to the tank via the leakage oil boring.

Function of the regulator:

A) The engine has been started (but not hydraulic load):

The oil flow produced by the pump gets through the regulator port **P**, adjusting spool **2** and port **A** to the adjusting cylinder of the pump **4** against the spring).

The pressure pushes the swash plate to the 0–angle position and the pump produces only the oil for leagages (2,0–2,2 MPa =Stand–by pressure).

LS–line (and spring space) is almost unpressurised. Stand–by pressure affects everywhere in the pressure side.

B) The engine is running and hydraulic power is needed (e.g. power lift cylinders):

An external auxiliary valve has conducted oil to implement / implements. The pressure rises in pressure line (and also in LS line)

The highest LS pressure in implements gets via the LS connection (X) of the regulator to the right side of the flow regulating spool **2**. Becouse there affects also the spring force, the spool moves to the left and reduces the flow **P** –> **A**.

The pressure behing the adjusting piston **4** decreases, the angle of the pump (output) increases, and as result of the higher pressure the spool **2** makes the flow **P** –> **A** greater , until a balance on the both ends of the spool has been achieved.

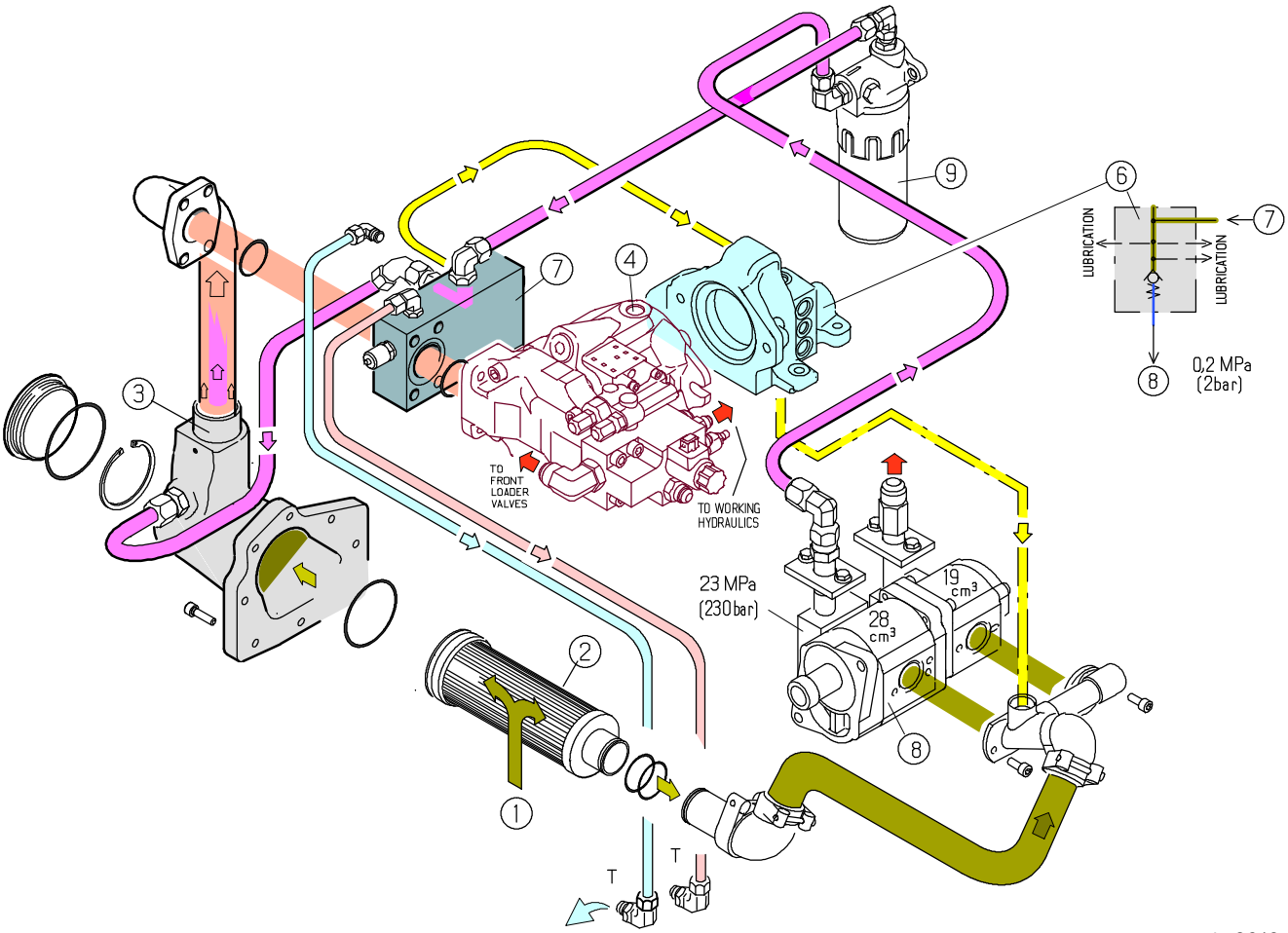
Between the pressure line and the LS pressure of the load there is a pressure difference, which keeps constant regardless of the load changes, in other words the pressure in the pressure line is always with a constant pressure difference (2,5–2,7 MPa, adjusting screw **2a**) higher than the LS pressure.

Pressure regulator:
When pressure increases, the lower spool is pushed to the right against the spring force. When the adjusted max. pressure (pressure cutter pressure, 20,5–21,0 MPa) is reached, passage between ports P and A opens and the pump plate is adjusted to the smaller angle (=smaller output).

1) Regulator
   1a) The LS –> tank leak line has been plugged
2) Flow regulating spool
   2a) Flow regulating screw
3) Pressure adjustment spool
   3a) Max. pressure adjusting screw
   – max. pressure 20,5 –21,0 MPa)
4) Adjusting cylinder of the pump

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Suction system (T151eLS–T191LS)



4–2619
01/07

1) Oil reservoir (gearbox)

2) Inlet strainer

3) Ejector
   – increases the output quantity of the supply pump **8**

4) Variable displacement pump (115/min /2200 r/min)

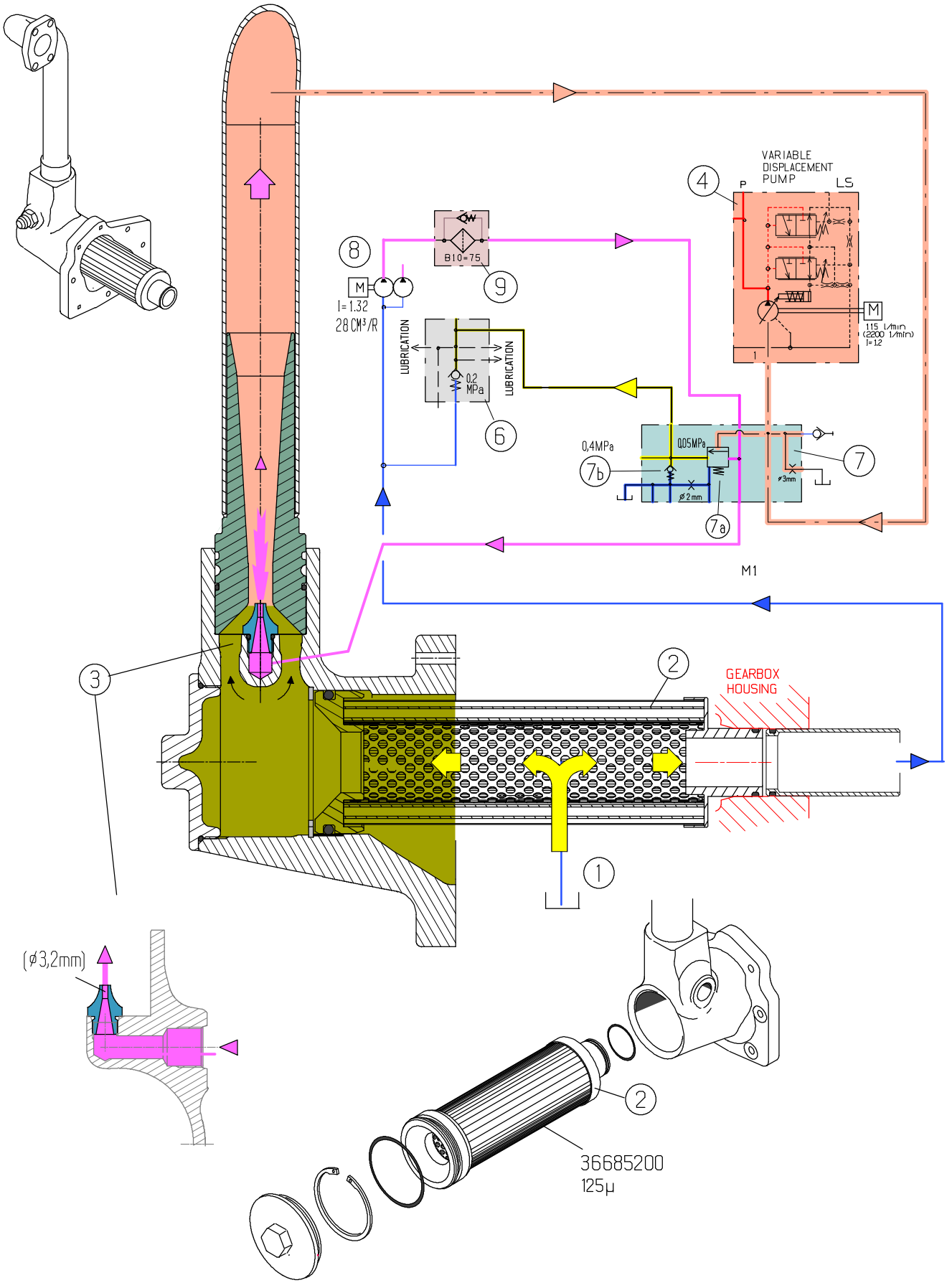
6) Valve block, lubricating
   – limits the lubrication pressure to 0,2 MPa

7) Valve

8) Double pump (28+19 cm3/r, i=1.32)
   – 19cm3/r: steering/ brake valve/ low press. circuit
   – 28cm3/r: to variable displacement pump. Additional output for gearbox and PTO lubrication

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Suction strainer and ejector



4–2618
08/06

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When needed (pressure drops in the suction line), the ejector makes the suction flow to the variable displacement pump more effective.

1) Oil reservoir (gearbox)

2) Inlet strainer

3) Ejector
   – increases the output quantity of the supply pump **8**

4) Variable displacement pump (115 l/min /2200 1/min)

6) Valve block, lubricating
   – limits the lubrication pressure to 0,2 MPa

7) Valve block

   7a) Valve (0,05 MPa)
   – suction line pressure controls the valve
   – releases the overflow oil to the lubrication (to valve block **6**) when there is sufficient pressure (over 0,05 MPa (0,5bar)) in the suction line (**3** –> **4**).

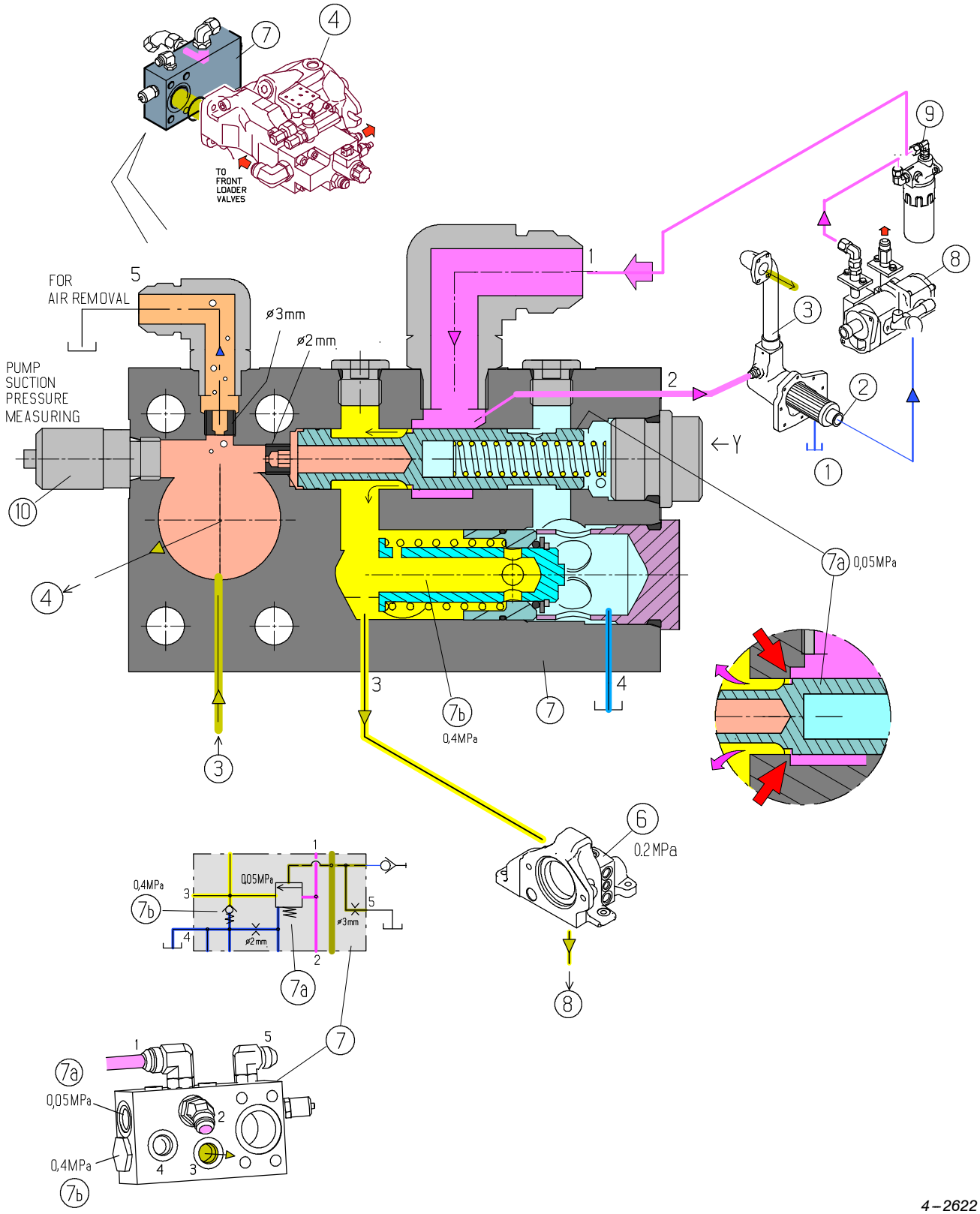
   7b) Pressure relief valve
   – assists the valve 6
   – opens, if the lubrication pressure for some reason increases over 0,4MPa (4 bar)

8) Double pump (28+19 cm3/r, i=1.32)
   – 19cm3/r: steering/ brake valve/ low press. circuit, lubrication
   – 28cm3/r: when needed, to variable displacement pump (via ejector). Excess oil to gearbox and PTO lubrication.

9) Pressure filter
   – filtering grade: ß10=75
   – by–pass valve 0,35 MPa

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Suction system valve block



4–2622
09/06

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1) Oil reservoir (gearbox)

2) Inlet strainer

3) Ejector
   – increases the output quantity of the supply pump **8**

4) Variable displacement pump (115 l/min /2200 1/min)

6) Valve block, lubricating
   – limits the lubrication pressure to 0,2 MPa

7) Valve block

   7a) Valve
   – suction line pressure controls the valve
   – releases the overflow oil to the lubrication (to valve block **6**) when there is sufficient pressure (over 0,05 MPa (0,5bar)) in the suction line (**3** –> **4**).
   – Throttle (diam. 2 mm) damps the function of the valve **7a**

   7b) Pressure relief valve
   – assists the valve in the housing **6**
   – opens, if the lubrication pressure for some reason increases over 0,4MPa (4 bar)

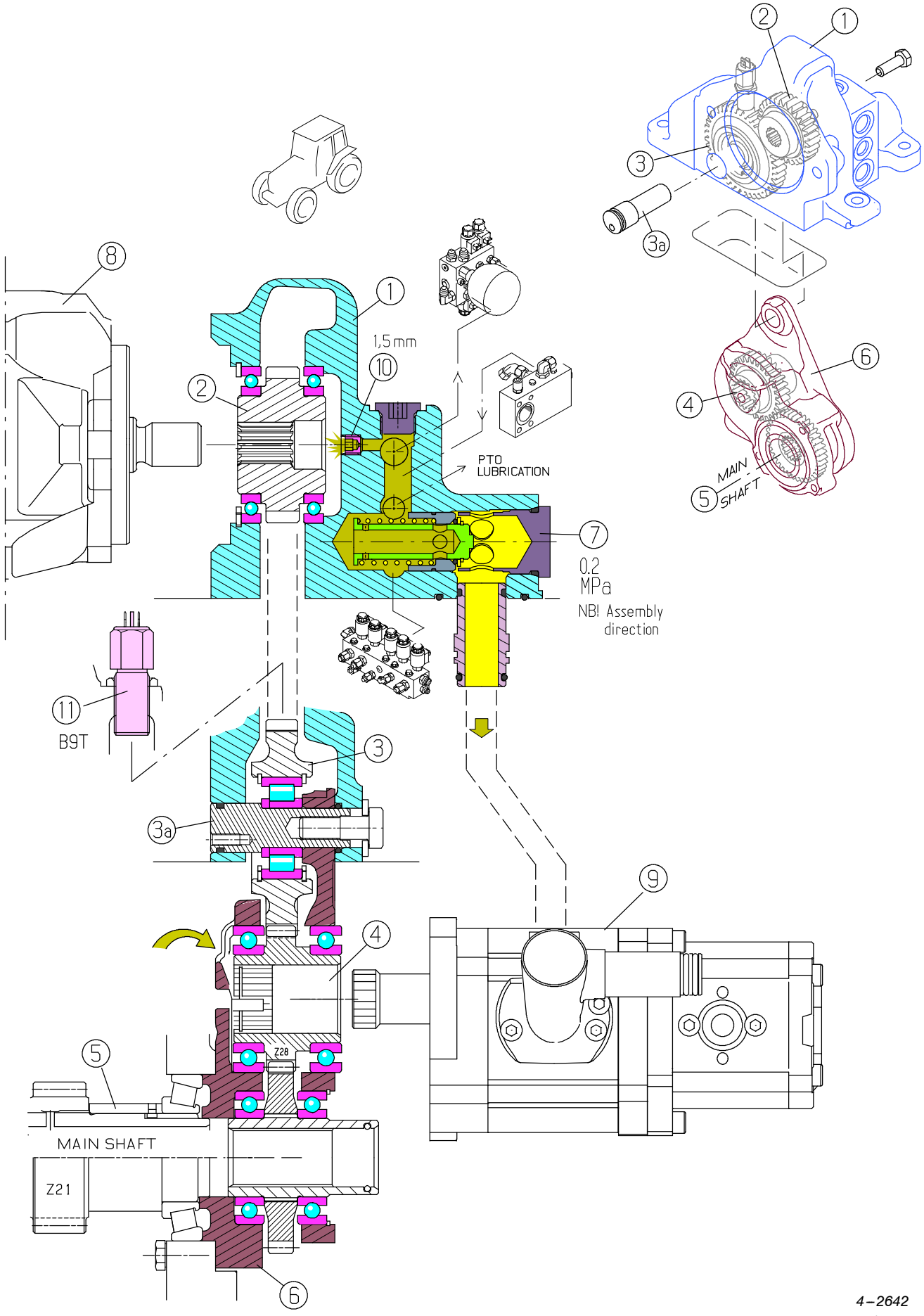
8) Double pump (28+19 cm3/r, i=1.32)
   – 19cm3/r: steering/ brake valve/ low press. circuit, lubrication
   – 28cm3/r: when needed, to variable displacement pump (via ejector). Excess oil to gearbox and PTO lubrication.

9) Pressure filter
   – filtering grade: ß10=75)
   – by–pass valve 0,35 MPa

10) Pressure measuring point (suction pressure)
    NB! In some cases, (e.g. when the pump turns to the 0– angle) it can happen that the pressure rises momentarily up to 20 bar

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Hydraulic pump drive gears and lubrication



4–2642
01/07

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1) Housing
2) Drive gear for variable displacement pump
3) Intermediate gear
   3a) Shaft
   – connects also housings **1** and **6** together
4) Drive gear for double pump
5) Main shaft
6) Housing
7) Pressure relief valve
   – limits the lubrication pressure to 0,2 MPa
8) Variable displacement pump
9) Double pump
10) Throttle (1,5 mm)
11) Inductive sensor (B9T), engine rpm

    Adjustment of the sensor:
    turn the sensor carefully by hand until it reaches the gear, then turn back 1/4 rev. Lock the sensor with the locking nut.

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Maintenance

1. Check the hydraulic oil weekly/at every 50 running hours. Oil quality: 10W/30, 5W/30 or 5W/20, API GL–4 (STOU) according to the outdoor temperature.
2. The pressure filter is changed the first time at 100 hours warranty service. The second change is done at 500 running hours. After that the filter is changed at every 500 running hours.
3. Hydraulic oil should be changed at intervals of 1000 running hours or yearly which ever is reached first. The suction strained should be cleaned always when the oil is changed. The suction strainer should be changed more often when necessary.

Note! If the hydraulic valves are used continuously, the hydraulic oil and the pressure filter should be changed more often.

4. The high pressure circuit and the low pressure circuit can be measured according to instructions. Also different clutch pressures can be checked. The pressure limiting valve and the shock valve can be opened and cleaned. These valves can also be adjusted by changing shims.

Important! If the hydraulic power lift or the Powershift have malfunctions, the pressure filter insert should be changed immediately.

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Measuring pressures (T121c–T171c, T121h–T191h)

Measuring of the low pressure circuit

1. Start the engine and set the revs to **1500 r/min**.

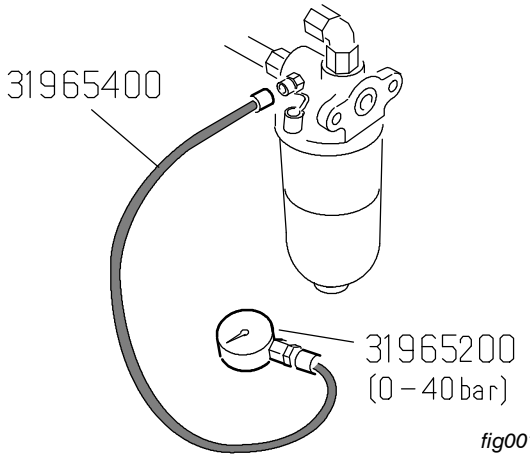


fig001c

2. Connect a pressure gauge to the test point on the pressure filter and read the pressure value.
   The pressure should be **1,8–1,9 MPa.**

During the pressure measuring:

– the steering wheel must not be turned.
– the auxiliary hydraulic valve levers should be in the neutral positions.
– the power lift position control potentiometer must not be in the lowest position.

Measuring of the high pressure circuit

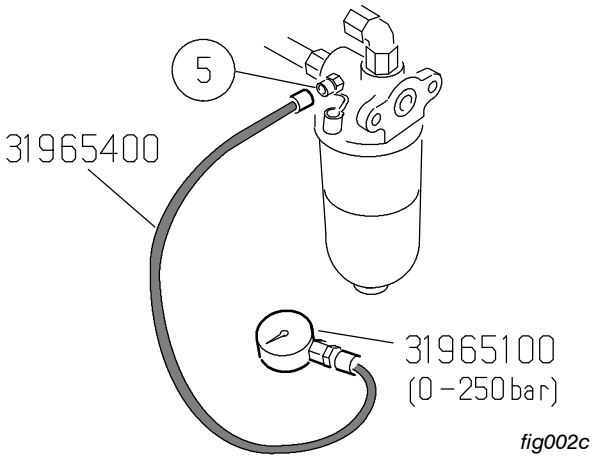


fig002c

1. Connect a pressure gauge (0...25 MPa) to the measuring point of the pressure filter (5).
2. Adjust engine revs to **1500 r/min**. Warm the transmission/ hydraulic oil to the temperature **+50** ± 10˚C.

Note! The oil warms up faster if the steering wheel is held against the extreme position.

3. Move an auxiliary hydraulic valve lever to the pressure position (ensure that the revs are 1500 **r/min**.) and read the pressure value.
   The pressure should be **19,6** ± 0,4 MPa

Note! The pressure of the system is maintained by the pressure relief valve on the underside of the front plate of the auxiliary hydraulic valve set.

Measuring of the free circulation pressure

Pressure values at engine revs of 1500 r/min:
– ~**1,5 MPa** (+50˚...+65˚C)
– ~**1,7 MPa** (+30˚...+32˚C)
– ~**2,0 MPa** (+20˚...+25˚C)

Note! Possible extra hydraulic equipment increases the free circulation pressure value. For instance, on a tractor that has three valve blocks and a front loader, the free circulation pressure value is **about 2,1 MPa** (+50...+65˚ C).

Note! Order no. for pressure measuring kit is **31965000**. It includes all pressure measurement equipment.

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Measuring pressures (T151eLS–T191LS)

Measuring of the low pressure circuit

1. Start the engine and set the revs to **1500 r/min**.

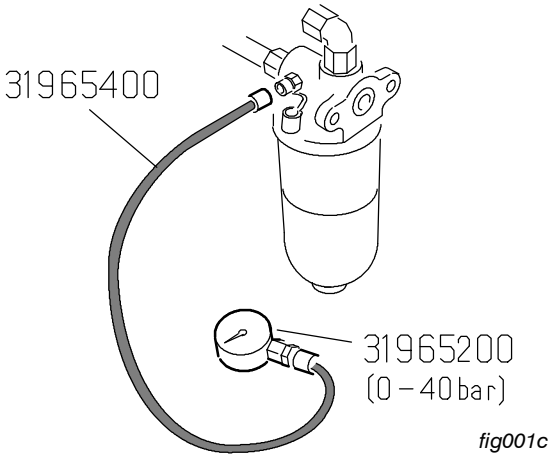


fig001c

2. Connect a pressure gauge to the test point on the pressure filter and read the pressure value.
   The free circulation pressure should be **1,8–1,9 MPa**.

During the pressure measuring:
– the steering wheel must not be turned.
– the auxiliary hydraulic valves should be in the neutral position.
– the power lift position control potentiometer must not be in the lowest position.

Measuring of the high pressure circuit

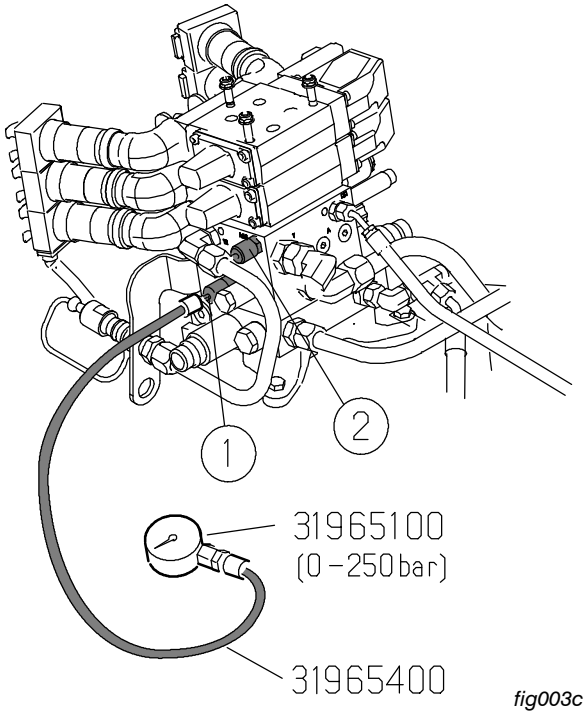


fig003c

Measuring standby pressure

1. Start the engine and set the revs to **1500 r/min**.
2. Connect a pressure gauge (4 MPa) to the measuring point (**1**) of the valve block and read the pressure value.
   The standby pressure should be **1,95–2,3 MPa**.

If the standby pressure is too high, there can be pressure in the LS line. The LS pressure can be measured from the LS pressure measuring point (**2**) of the valve block. **LS pressure** should be **0–0,2 MPa**.

Note! By connecting one pressure gauge to the pressure line and another gauge to the LS line and by loading the hydraulics e.g. with the first auxiliary hydraulic valve block, the LS pressure must be 2,5–2,7 MPa lower than the pressure in the pressure line.

Measuring high pressure

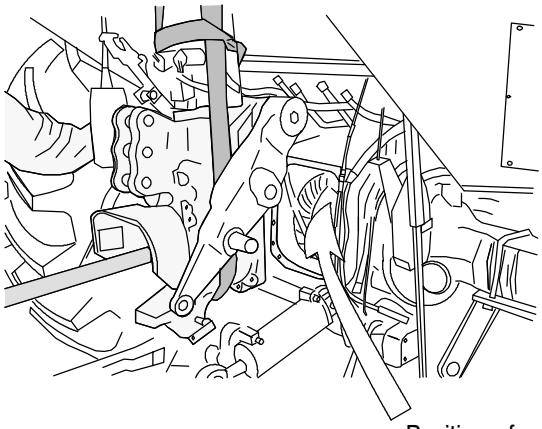
1. Connect a pressure gauge (25 MPa) to the measuring point (1) of the valve block.
2. Adjust engine revs to **1500 r/min**. Warm the transmission/ hydraulic oil to the temperature **+50** ± 10°C.

Note! The oil warms up faster if the steering wheel is held against the extreme position.

3. Move an auxiliary hydraulic valve lever to the pressure position (ensure that the revs are **1500 r/min**) and read the pressure value.
   The high pressure should be **20,5** ± **0,5 MPa**

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Pump and pipes, fault tracing



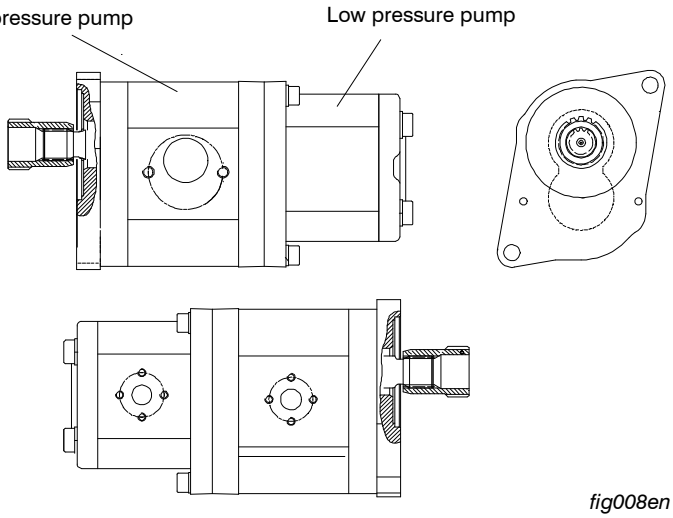


fig008en

General

The condition of the pump can be checked e.g. by measuring pump output at different counter pressures. A worn pump has a lowered output and it cannot maintain enough high pressure. In this case the hydraulic circuit does not function as it should.

The lowered output causes the hydraulic cylinder movements to be slower than normal.
The lowered pressure means that the hydraulic cylinder cannot raise heavy loads. E.g. the lifting cylinder cannot raise the load even thought its weight is below the max permissible load.

A possible reason can also be a faulty pressure – limiting valve or shock valve. In addition, oil leaks in various components and seals can also cause corresponding malfunctions.

The pump can be tested e.g. by measuring the pump output with a flow meter. Use of a separate loading valve makes it possible to measure the output at different pressures. The pump output must not vary much at different counter pressures. The working hydraulic pump output can be measured from the quick–action couplings. The low pressure pump output can be measured by connecting the flow meter on the pressure hose between the pump and the servo valve block.

It is difficult to determine a certain reject limit to the pump. In a light agricultural use even a worn pump can function satisfactorily. Just when a tractor has extra hydraulic equipment (front loader, timber loader etc.), a worn pump cannot maintain the hydraulic circuit and it should be changed.

Fault tracing by inspecting oil

1. Air in oil – If there is too much air in the oil, the result is that oil foams in the tank. In this case, check all seals and connectors in the suction side. Also the suction strainer cover seal can be faulty. Check the condition of the pump drive shaft oil seal. Change oil if necessary.

2. Water in oil – Water in oil causes the oil to be milky. The system must be emptied and filled with new oil. In addition, prevent water from entering into the hydraulic system. Water causes corrosion to the various parts in the hydraulic circuit.

3. Impurities in oil – Impurities can be verified by taking a sample of oil and by pouring it through a filter paper. The suction strainer and the pressure filter should be serviced according to the maintenance schedule. Impurities can enter into the system from the auxiliary hydraulic cylinders. The hydraulic oil and the pressure filter must be changed according to the instructions.

4. Impaired properties of oil – Mineral oil loses some lubricating properties in prolonged use. This can appear in a change of colour, change of smell or a change of viscosity. For these reasons, it is necessary to change the oil according to the maintenance program. Also oil level should be checked regularly.

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Fault tracing without removing pump

If the hydraulic system functions when the oil is cold, but in the operating temperature different functions are slow or powerless, this indicates that the oil pump is worn–out.

The high pressure pump can be tested by connecting a pressure gauge to the circuit and by pulling one auxiliary hydraulic valve lever to the pressure position. Now if the pressure gauge reading follows clearly the change in engine revs, this indicates that the pump is worn.

The faulty pump can be noisy which indicates damage in the pump. Note that a blocked suction strainer causes a shrieking sound to the pump.

A worn pump ”whips” oil and due to the fluid friction the whole hydraulic system overheats. This can be verified by feeling the temperatures of the pipes and the oil reservoir. In this case, for instance, the pump pressure pipe can be essentially warmer that other pipes and the oil reservoir.

Internal inspection of pump

Note! Never dismantle the pump if the warranty is valid, but in this case change for a new spare pump.

1. Detach the damaged pump from the tractor. Make sure that the pump and a fitting table are clean before dismantling the pump.
2. Do not clean parts of the pump before inspection
3. Mark all removed parts in relation to each other for easier assembling.
4. Fit always new seals. A seal kit no. 32664100 is available for the pump.

Note! When the hydraulic system is in a perfect condition, the pump housing surfaces are smooth and shiny as well as the bearing surfaces. Text below presents how faults in the hydraulic system affect the oil pump.

1. Impurities in oil – Impurities cause clear dragging grooves on the pump housing and bearing surfaces in the direction of rotation. The most evident damage caused by impurities are deep grooves on the gearwheel side surfaces. Impurities wear the pump fast resulting in lowered output value.

2. Cavitation damages – Mineral oils contain 10 percent of air. In the pump suction side if suction is too high, air bubbles are formed, which fasten onto the pump housing. When pressure in the pressure side rises rapidly, the bubbles ”explode” causing deep pits on the pump housing. In certain cases the cavitation generates sound, which can be heard from the pump.

Possible reasons:
1. Suction pipe or suction strainer blocked.
2. Wrong oil viscosity.
3. Air enters into system.

3. Air in oil – If air enters into the system via the suction side or via the pump drive shaft seal, this causes the same damages as cavitation. If there is too much air in the oil, the oil in the reservoir foams.

4. Pump drive shaft loading – If the pump drive shaft has a strong radial loading caused by the pump drive mechanism, this causes damage to the shaft seal and air and oil leaks by the seal and after a prolonged use, the drive shaft bearings are worn unevenly. For the same reason, the pump gears cut the pump housing on one side resulting internal leakages in the pump.

Observe the following when assembling the pump

Assemble the low pressure pump and tighten the end cover bolts to a correct torque. Assemble the high pressure pump and tighten the end cover bolts only finger tight. Blow compressed air (~ 5 bar) through the pressure side hole (suction side hole open) at which time the shafts and gear wheels are centered and at the same time tighten the end cover bolts to a correct torque of **61–68 Nm**.

Note! Without this centering the pump will probably be damaged after a very short operating time.

Service of the the pump

Removing the pump

1. Drain the oil from the transmission

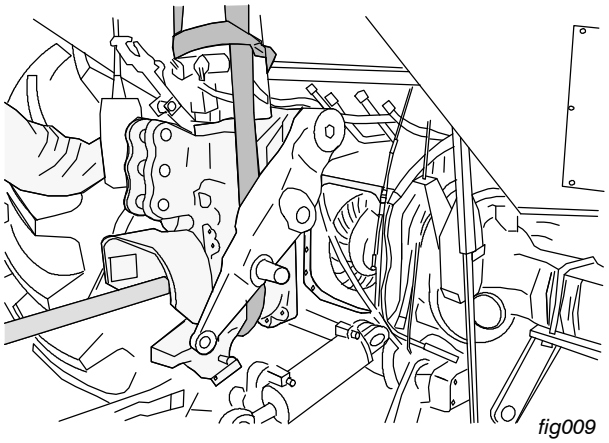


fig009

2. Remove the PTO housing.

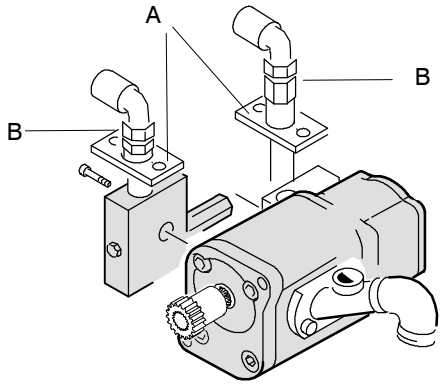


fig010

3. Remove the RH side brake cylinder. Disconnect the connectors from the pressure pipes (B). Slacken the sealing pieces (A) and unscrew the pressure pipes from the pump.

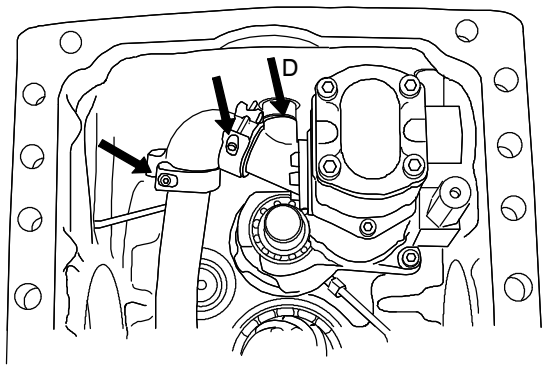


fig011

4. Open the two pump suction pipe clip and make sure that suction is disconnected.

5. Open the plug on the rearside of the lubrication plate and push with a screwdriver the lubrication pressure valve (C) so that the connecting tube can be lifted in the inlet tube.

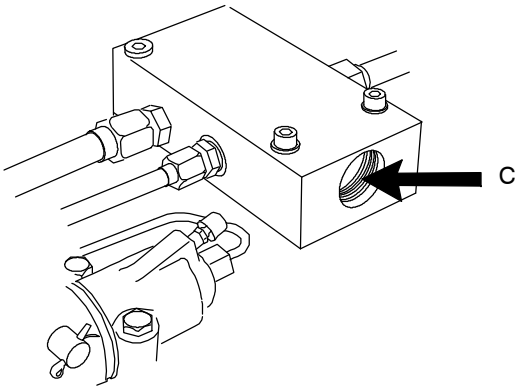


fig012

Note! The differential can be in place because it does not prevent removal of the pump.

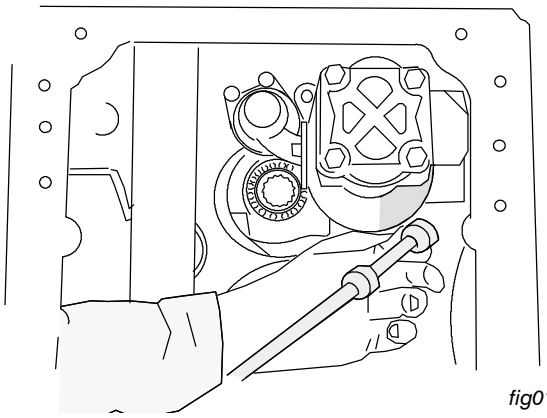


fig013

6. Unscrew the pump fixing bolts and remove the pump from the gearbox housing.

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Fitting the pump

1. Fit the pipe clip (screw upwards) onto the suction pipe. Fit the pump coupling sleeve into the pump drive mechanism (if removed).
2. Fit a new pump. Turn the pump clockwise and tighten the fixing bolts to **40–50 Nm**.
3. Make sure that the pump inlet tube is holding still and push the connecting tube down.

Check, that the pump goes fully home by hand and the main axle of the pump is not pressed axially. There should not be a gap between flange of the pump and frame of the gearbox.

4. Push the pressure pipes through the sealing pieces and screw the pipes into the pump thread to a torque of **60 Nm**. Be sure that the pressure pipes don't touch the transmission frame.
5. Apply sealing compound Hylosil RTV Grade 102 Black between the gearbox and sealing pieces. Apply Loctite 542 to the sealing piece screws and tighten.
6. Connect the pressure hoses to the pressure pipes. Fit the brake cylinder.
7. Tighten the suction pipe clip to a torque of **2 Nm**. Fit the PTO unit.
8. Fill the transmission with oil and test–drive the tractor. Make sure that the new pump is functioning by measuring hydraulic pressures (see code **913.1**).

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Adjusting the pump

High pressure

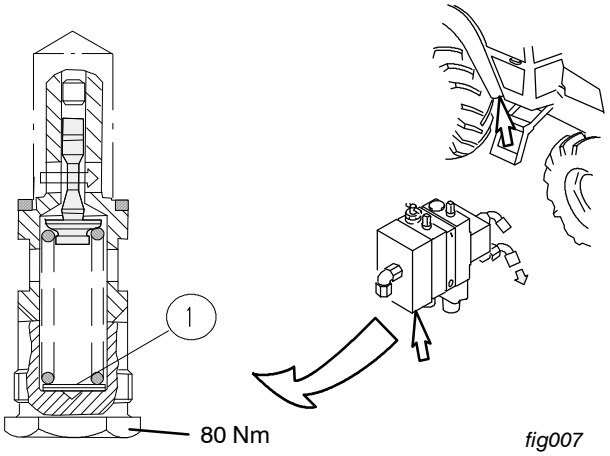


fig007

If the high pressure deviates from the correct value, change the spring of the pressure relief valve or fit the adjusting shims (1) under the spring. Thickness of **0,2 mm** the shims raises the pressure value about **0,4 MPa**.

Note! If adjusting is not successful, the problem can be a faulty component, for instance impurities in the valve spindle or the hydraulic pump can be worn out.

Low pressure

If the low pressure deviates from the correct value, change the spring of the pressure relief valve or fit the adjusting shims (1) under the spring. Thickness of **0,2 mm** the shims raises the pressure value about **0,4 MPa**.

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Adjusting the variable displacement pump

If the pressures deviate from the correct values, the pump can be adjusted as described below.

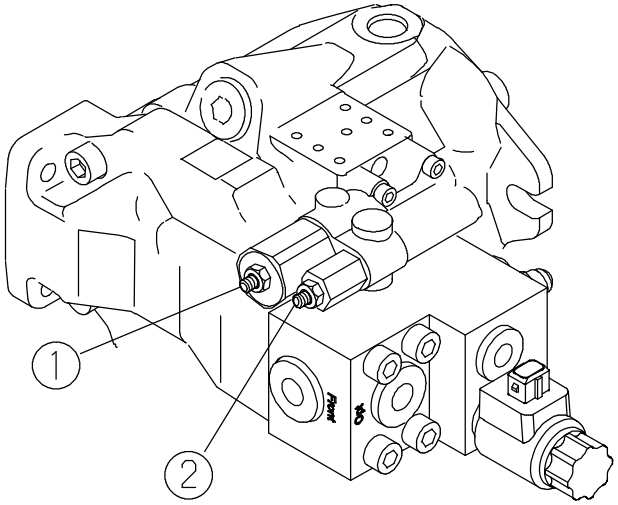


fig004c

1. Fill the pump housing with oil (if the pump is refitted or replaced)
2. Ensure, that all auxiliary hydraulic valve blocks are in neutral position. Connect a pressure gauge (25 MPa) to the pressure test point located on the rear valve block.
3. Unscrew the covers of the adjusting screws.
4. Unscrew both pump adjusting screws (**1** and **2**) fully out (flow regulator and pressure regulator).
5. Start the engine, adjust engine revs to **1500 rpm**. Warm the hydraulic oil up to **+50...+65 °C**.
6. Screw the flow regulator screw (**2**) fully in. The pressure line pressure must not rise.
7. Turn the pressure control screw (**1**) to the closed position (clockwise) until reading of the pressure gauge shows **20,5 MPa ± 0,3 MPa**.
8. Lock the pressure control screw by locking nut (tightening torque: **25 Nm**).
9. Open the flow control screw (counter clockwise) until reading of the pressure gauge shows under 40 bar.
10. Change a pressure gauge (4 MPa).
11. Open the flow control screw (**2**) until pressure gauge shows **2,2 MPa ± 0,1 MPa**.
12. Lock the flow control screw by locking nut (tightening torque: **25 Nm**).
13. Install the covers of the setting screws (tightening torque: **21 Nm**).

Note! The main pressure relief valve opening pressure is a little above the pressure cutter value (about 3–4 MPa). The main pressure relief valve opening pressure can be checked by increasing the pressure cutter value temporarily above the opening pressure of the main pressure relief valve, in which situation the pump is functioning as a constant displacement pump.

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Contents

Technical data, technical specifications, training material

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Description (T121c–T171c, T121h–T191h)

Valtra Tc and Th tractors have as standard two valves for auxiliary hydraulics, which are controlled separately with two levers. The valves are fitted on the RH side of the tractor with the control levers inside the cab.

Both of these valves are adjustable for either single–acting or double–acting function. One of the valves can be locked mechanically in different positions and the other valve has a "floating position".

Available extra equipment at the rear:

– two valves
– oil flow distribution valve
– trailer brake valve.

Available extra equipment in the front:

– two electric controlled adjustable valves for front loader use
– a quick–action coupling.

When repairing or changing the valves, they are accessible through the hole in the cab RH side mudguard.

Intermediate plate A and the pump side end plate B have been attached to the valve bracket (3 pcs bolts). Tightening torque for the bolts is **45 Nm.**

Bolts C (4 pcs) through the valve block set must be tightened evenly and crosswise to a torque of **23 Nm**. Otherwise the valve spools can get trapped. When fitting extra valves, bolts C should be changed for longer ones.

Note! When fitting valve blocks, ensure that the O–rings between the blocks are correctly positioned in their grooves.

Quick couplings

All the quick–action couplings are of push–pull type. A leakage oil reservoir is standard equipment.

There is a breather hole under the rubber seal ring in the quick couplings, which hole should point downwards.

If the breather hole does not point downwards, a small amount of oil can leak inside the coupling or water can condense to the coupling, which makes it difficult to connect the couplings.

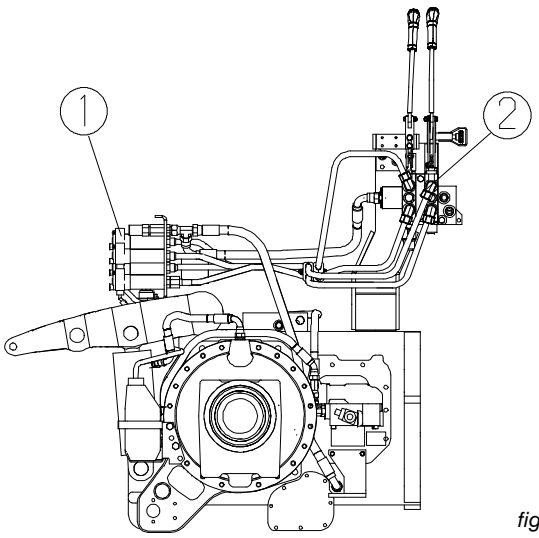


fig001

1. Valves for auxiliary hydraulics
2. Quick–action couplings

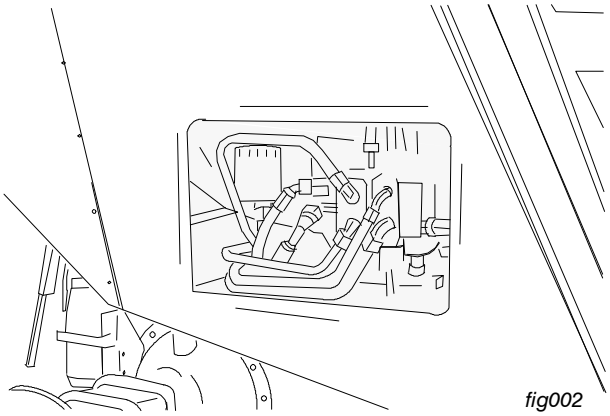


fig002

Access hole

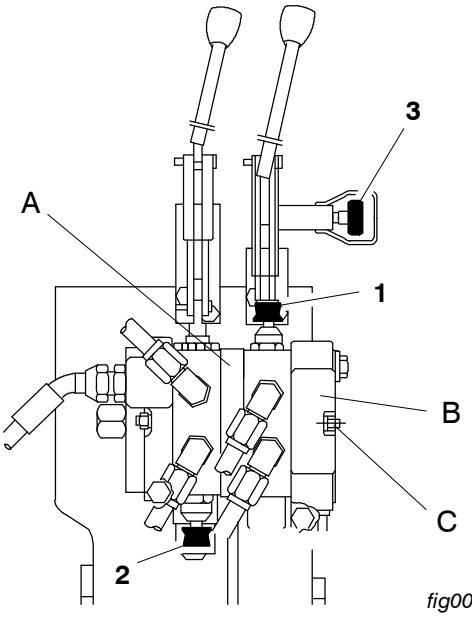
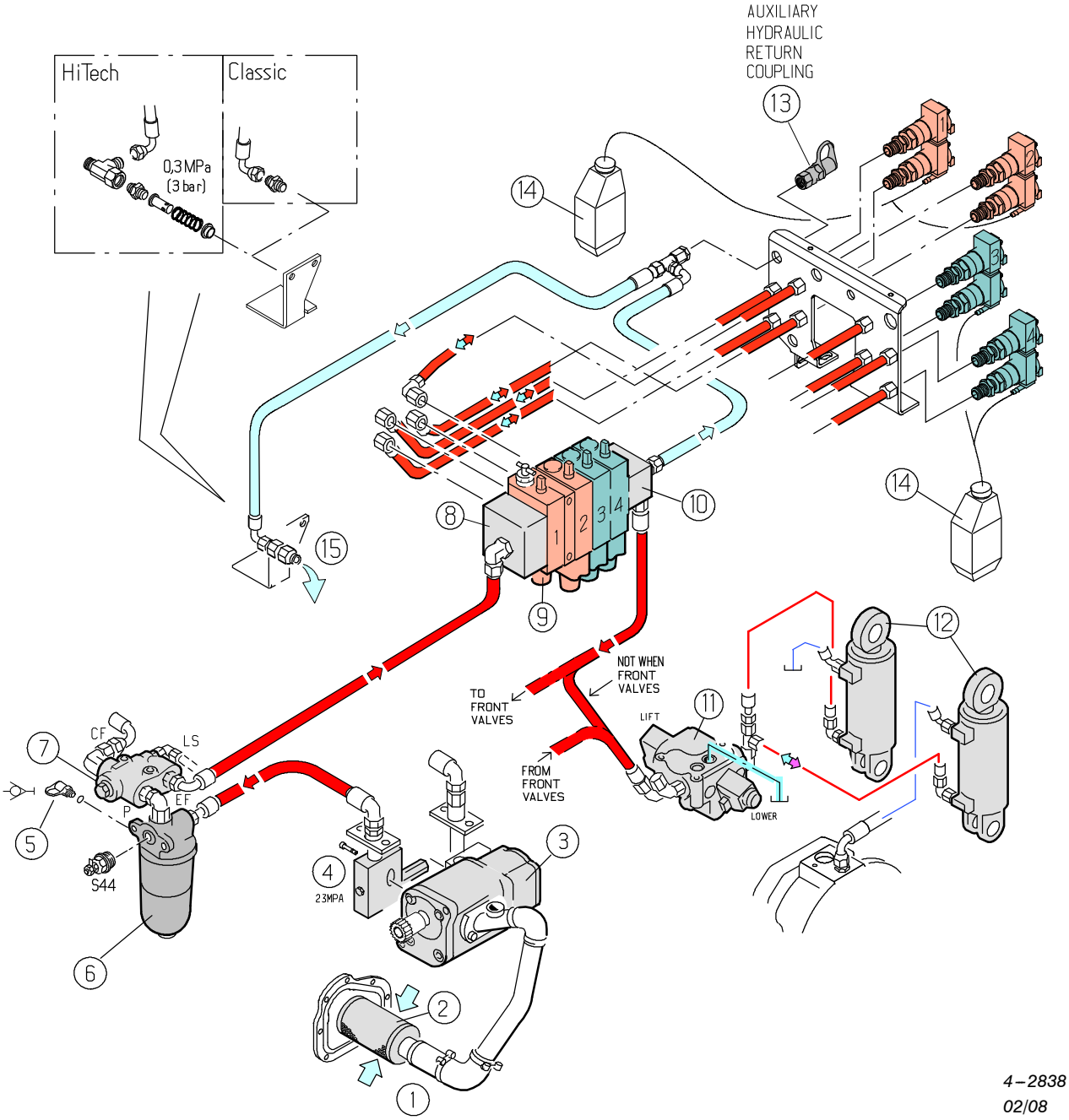


fig003

Control levers for standard valves
1. Adjustment between single/double–action
2. Adjustment between single/double–action
3. Position locking

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4–2838
02/08

Pump capacity
- **73 l/min** at 2200 r/min engine revs with free low pressure
- T151eh (ECO mode): **60** l/min at 1800 r/min engine revs with free low pressure

Max. pressure
- 19.6 MPa (196 bar)

Shock valve opening pressure of pump
- 23 MPa (230 bar)

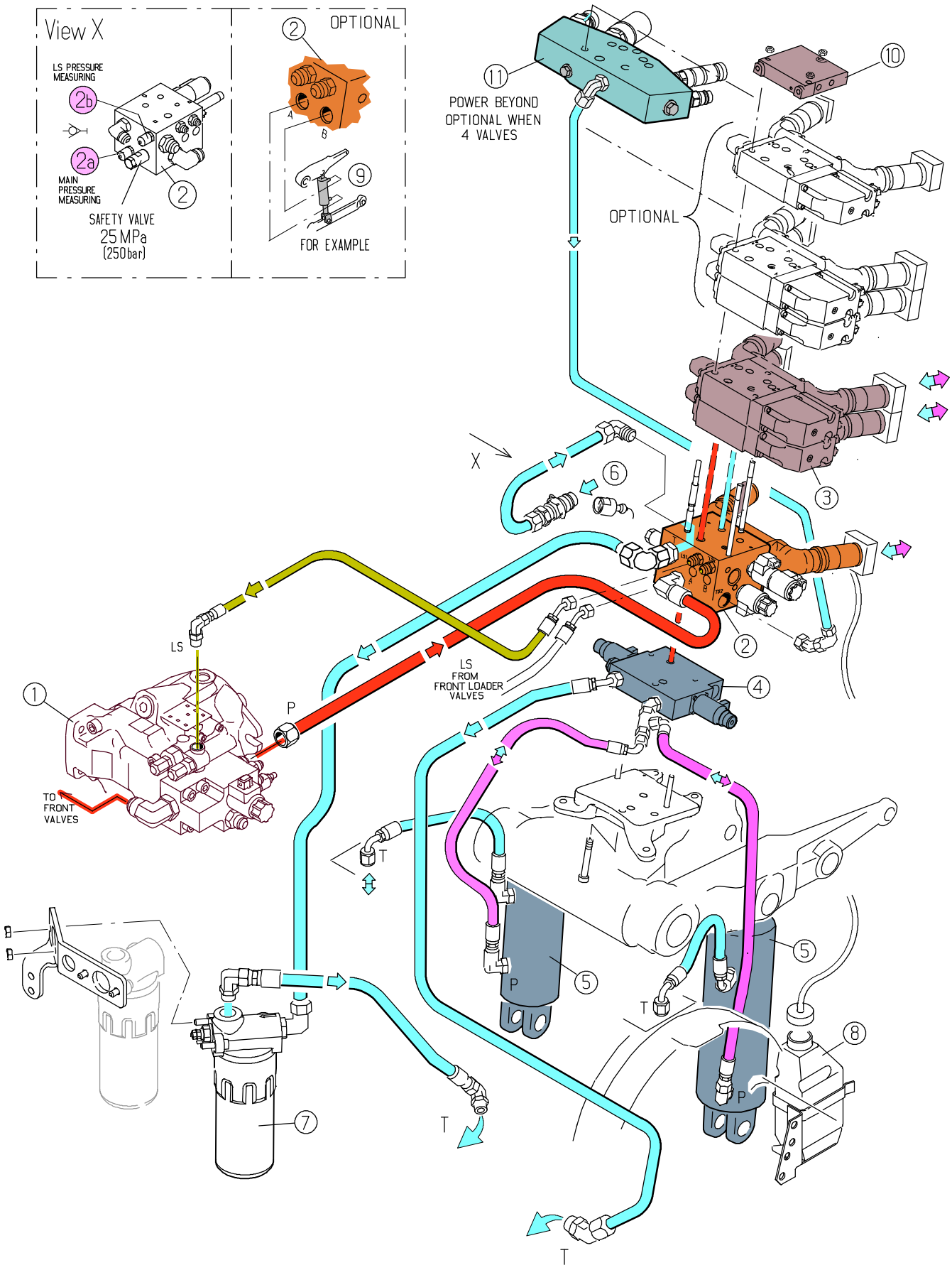
Pressure relief valve opening pressure of working hydraulic circuit
- 20 MPa (200 bar)

Supplies oil for following functions:
- steering (prioritized), hydraulic lift, auxiliary hydraulics, trailer brake valve (extra equipment)

Available volume of oil for auxiliary hydraulics with different filling quantities:
min. . . . . 30 l
max. . . . . 40 l

1) Oil reservoir
2) Inlet strainer
3) Double pump (**25**+**11** cm^3/r)
4) Press. relief valve, 23 MPa, next to the pump
5) Measurement point (Valmet HPR)
6) Pressure filter (filtering grade: β10=75)
   – Bypass valve 0.35 MPa
7) Priority valve
8) Inlet flange (pump side)
   – pressure relief valve 19 MPa
9) Directional control valve
10) End flange (tank side)
11) Power lift control valve
   – shock valve (for cylinder), 20 MPa
12) Lift cylinders
13) Auxiliary hydraulic system return coupling
14) Leak oil reservoir
15) Connection to the tank

Description (T151eLS–T191LS)



4–2835
05/07

Working hydraulic circuit supplies oil for following functions:
– Hydraulic lift
– Auxiliary hydraulics

Due to the LS–system of the displacement pump only the necessary volume of the oil is supplied for the working hydraulics corresponding to the pressure load.
The system has also a separate pump (81 l/min), which supplies oil for the ejector of the high pressure circuit boosting the suction of the displacement pump

The max. capacity of the high pressure circuit pump
– 115 l/min, at 2200 r/min.

1) Variable displacement pump
   – with hydraulic control
   – Max. continuous working pressure is 205 bar.
2) On/off valve block
   – N.B! valves are not proportional
   2a) Measuring connector for LS pressure
   2b) Measuring connector for pump pressure
3) Directional control valves (incl. Zero leak valves)
4) Power lift control valve
5) Lift cylinders
6) Free return coupling
7) Return filter
8) Leak oil reservoir
9) Hydraulic lift link ram
10) End flange
11) Power beyond valve

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Valves for auxiliary hydraulics (T121c–T171c, T121h–T191h)

Foremost standard valve

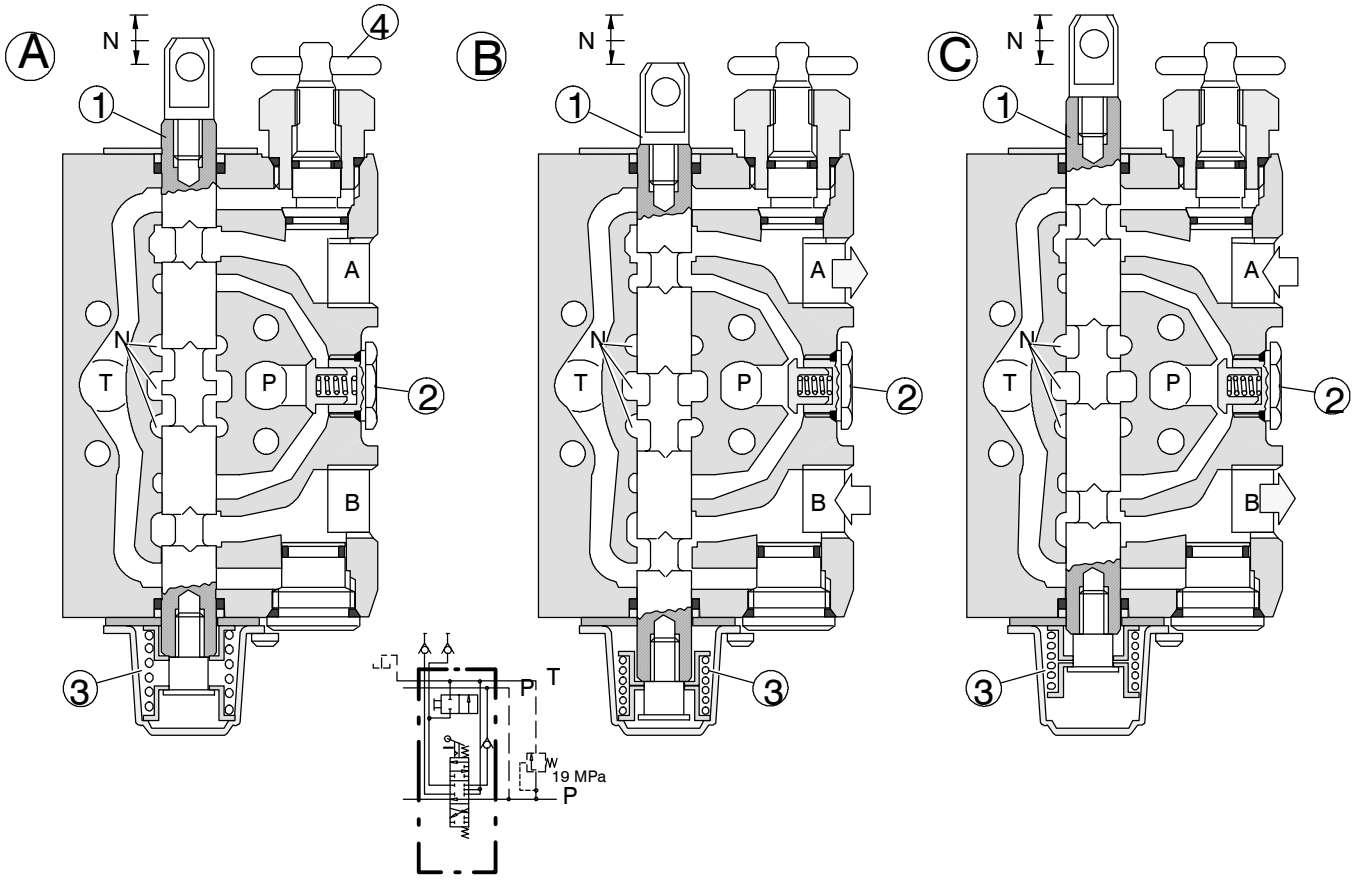


fig005

The foremost standard valve (order no 32536400): 1/2 –action, 3 positions (out–hold–in), spring–return. Out position can be locked mechanically.

Function

A: Neutral position. Oil flows from the priority valve through the flow–through channels **N** to the control valve of the hydraulic lift. The channels to the auxiliary hydraulics (**A**, **B**) and the non–return valve **2** are closed.

B: Pressure position: When the slide **1** has been moved downwards, the middle part of the slide closes the channels **N**, and its upper part opens the line to the port **A**. Pressure in the channel **N** and in channel **P** increases (these channels unite in the front end flange). The non–return valve **2** opens and oil flows to the auxiliary hydraulics via port **A**. At the same time the slide opens the return line from port **B** to tank channel **T**.

C: Pressure position: Slide **1** has been moved upwards. Flow–through channels **N** are closed and oil flows via port **B** to the auxiliary hydraulics. Return oil flows from port **A** to tank channel **T.**

– The change–over valve **4** is used to give a double–acting valve a single–action function. When single–acting, the equipment hose must be connected to the lower connector **B**.

1) Slide
2) Non–return valve
3) Centring springs
4) Change–over valve

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Rearmost standard valve

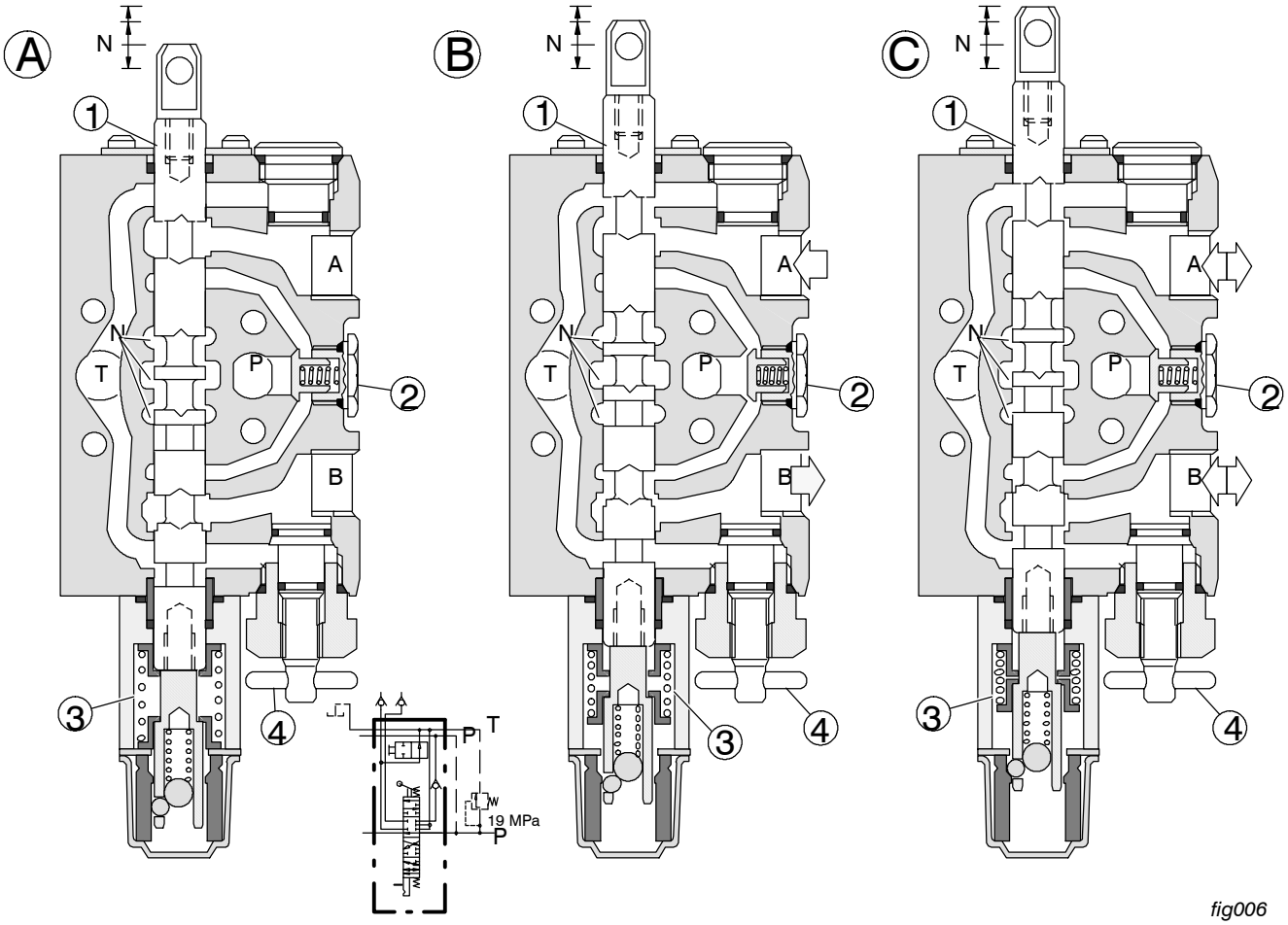


fig006

The rearmost standard valve (order no. 32536500): 1/2 –action, 4 positions (out–hold–in–float), spring–return. Floating position can be locked.

Function

A: Neutral position. Oil flows from the priority valve (and valve no 1) through the flow–through channels **N** to the control valve of the hydraulic lift. The channels to the auxiliary hydraulics (**A**, **B**) and the non–return valve **2** are closed.

B: Pressure position: When the slide **1** has been moved upwards, the middle part of the slide closes the channels **N**, and its lower part opens the line to the port **B**. Pressure in the channel **N** and in channel **P** increases (these channels unite in the front end flange). The non–return valve **2** opens and oil flows to the auxiliary hydraulics via port **B**. At the same time the slide opens the return line from port **A** to tank channel **T**. When the slide has been moved downwards, the port **A** is pressurised and return oil flows via port **B**.

C: Floating position: The slide **1** has been moved further upwards. The detent balls lock the sleeve. The sleeve opens the middle channels **N** and oil flows to the hydraulic lift. The lines from the pressure channel **P** to ports **A** and **B** are closed. Both ports **A**, **B** are connected to tank channel (and to each other).

– The change–over valve **4** is used to give a double–acting valve a single–action function. When single–acting, the equipment hose must be connected to the upper connector **A**.

1) Slide
2) Non–return valve
3) Centring springs
4) Change–over valve

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Oil flow control valve

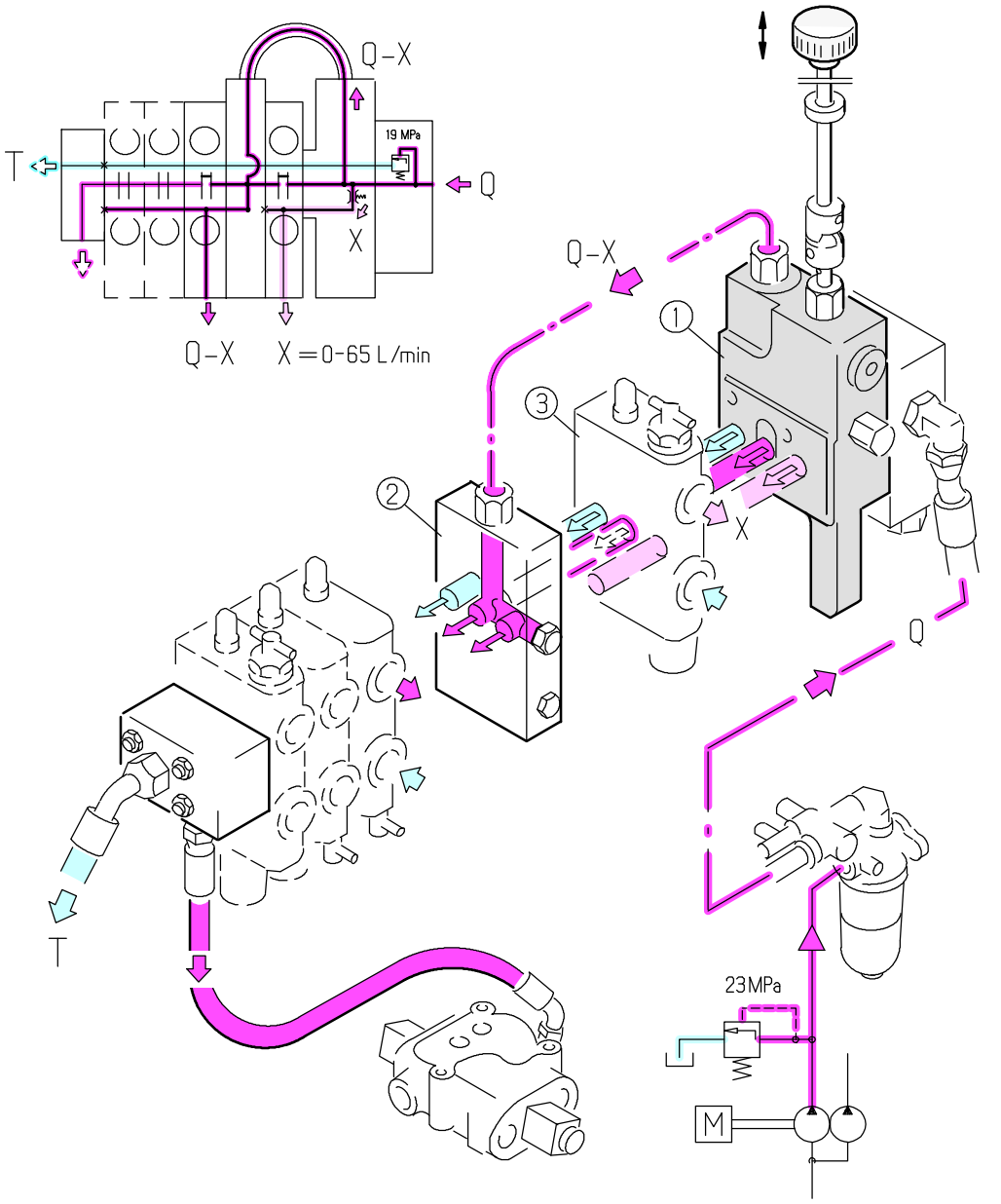


fig007

The oil flow control valve makes it possible to use simultaneously two hydraulic cylinders or simultaneous use of power lift and one auxiliary cylinder.

With the oil flow control valve the oil flow can be adjusted so that it suits the implement, when maximal flow is not needed for e.g. speed control of hydraulic motors (together with a special valve of the motor).

The oil flow control valve is situated between the pump end plate and the valve block. The oil flow is adjusted with a knob on the side panel in the cab.

Functions

- The valve directs the required priority flow (that can be steplessly adjusted from 0 to 40 litres per minute) to the spool valve that is mounted between the oil flow control valve and the intermediate plate.
- The rest of the flow is directed through an external pipe to the next, downstream spool valves.

X = pressure channel for the regulated oil flow
Q–X= the surplus flow to other spool valves

1) Oil flow control valve
2) Intermediate plate
3) The spool valve supplied by the regulated flow

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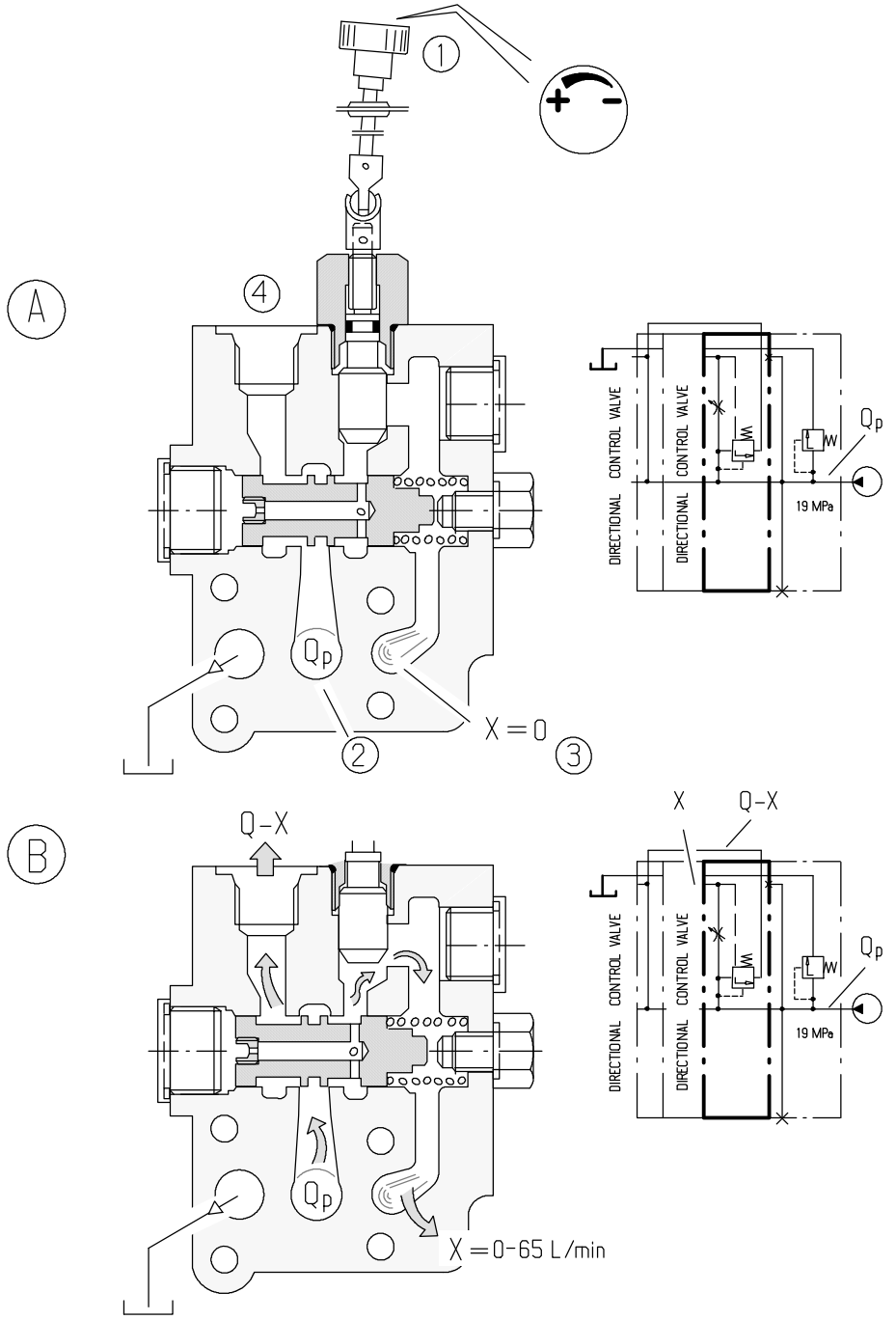


fig010

A) The oil flow is not adjusted.

The first spool valve can not be used when the throttle is closed. The pump flow goes through the channel Qp to the spool valves after the intermediate plate, and further through the power lift control valve into the tank.

B) The oil flow is adjusted (and the manual control valve is in the active position).

The pump flow is divided in proportion to the throttle between 0 and 65 litres per minute among the channels Q–X and X and can simultaneously be used for controlling the spool valve X (between the pump end plate and the intermediate plate) and one of the next spool valves, or the spool valve X and the power lift.

When the throttle spindle 1 is opened, the flow X grows and the flow Q–X decreases.

If the pressure in channel X varies, the same pressure change is transmitted through the throttle and the balance piston bore also to the opposite head of the piston, and this means in practice that the spindle keeps its position and the flow does not change.

The throttle in the piston bore prevents vibration.

– When the oil flow is adjusted, the pressure of the flow X is the pump pressure minus the spring load. The pressure of the flow Q–P varies from free flow pressure to maximum pressure, depending on the use of the other manual control valves / of the power lift.

1) Adjusting knob
2) Pressure channel that goes through the valve blocks
3) Adjusted flow to the X spool valve
4) Surplus flow to other spool valves

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Kick–out valve (extra equipment)

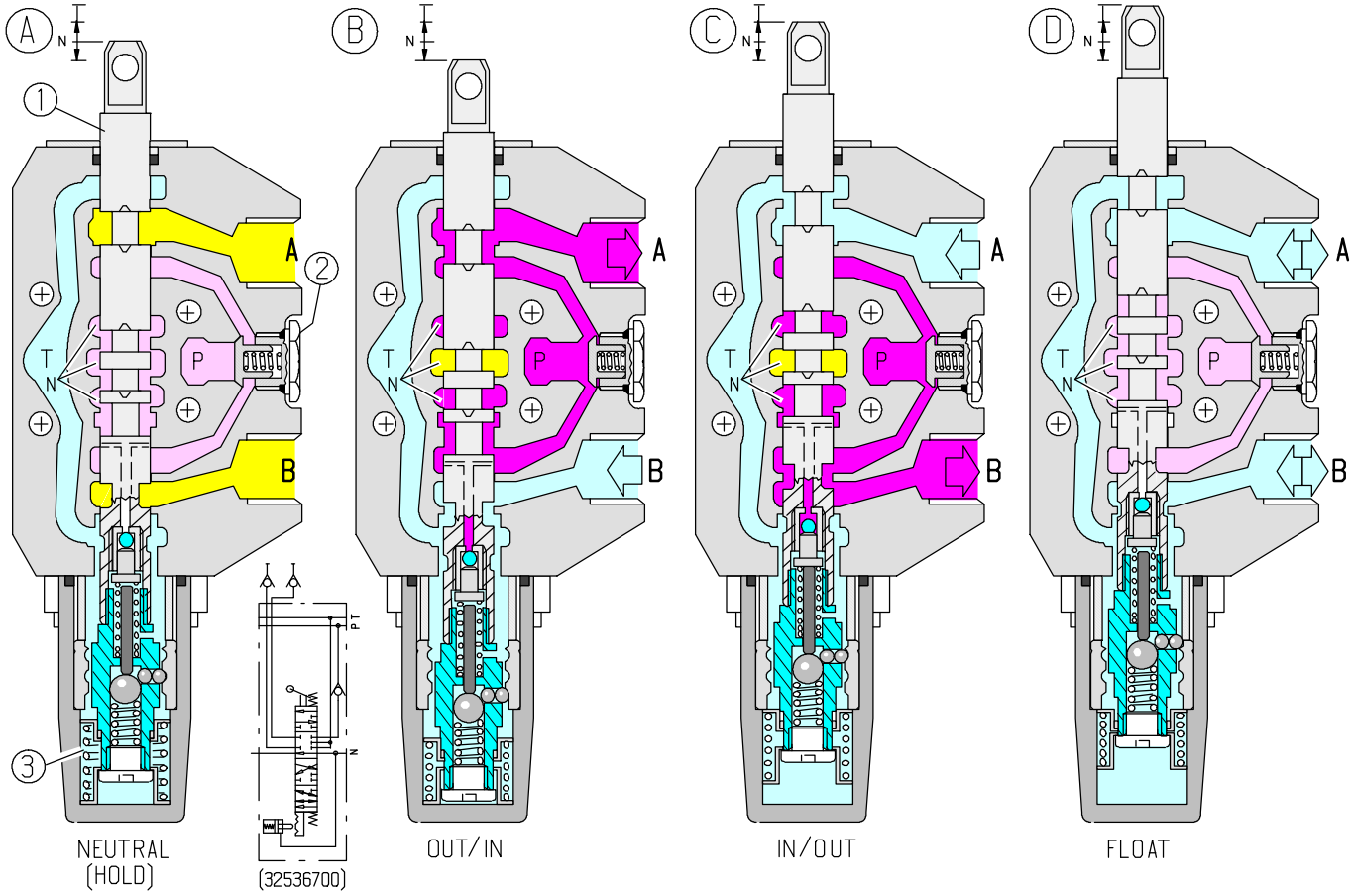


fig009

Extra equipment (32536700): 2–action, 4 positions (float–out–hold–in) kick out. Float, out and in–positions can be locked.

Function:

A: Neutral position: Oil flows from the priority valve (via valve blocks) through passages **N** and further to the power lift control valve. Passages to auxiliary hydraulics (**A**, **B**) and the non–return valve **2** are closed.

B: Pressure position: When the spool **1** is moved downwards, the spool middle part closes the passages **N** and the spool upper part opens an oil way to port **A**. Pressure in passage **N** increases as in passage **P** (passages joint together in the front end plate). Non–return valve **2** opens and oil flows via port **A** to the auxiliary hydraulics. At the same time the spool has opened a return passage from port **B** to tank passage **T**. Locking balls lock the spool.

C: When the spool is moved upwards, port **B** is pressurised and oil returns via port **A**.

Pressure return (kick–out) to the neutral position happens when oil pressure pushes ball+needle at the spool lower end and releases the locking balls (at a pressure of 14–16 MPa). The spring space is open and allows oil to be returned to passage **T**. Rest of pressure in the oil space (if greater than 0,2 MPa) can cause returning of the spool to the neutral position.

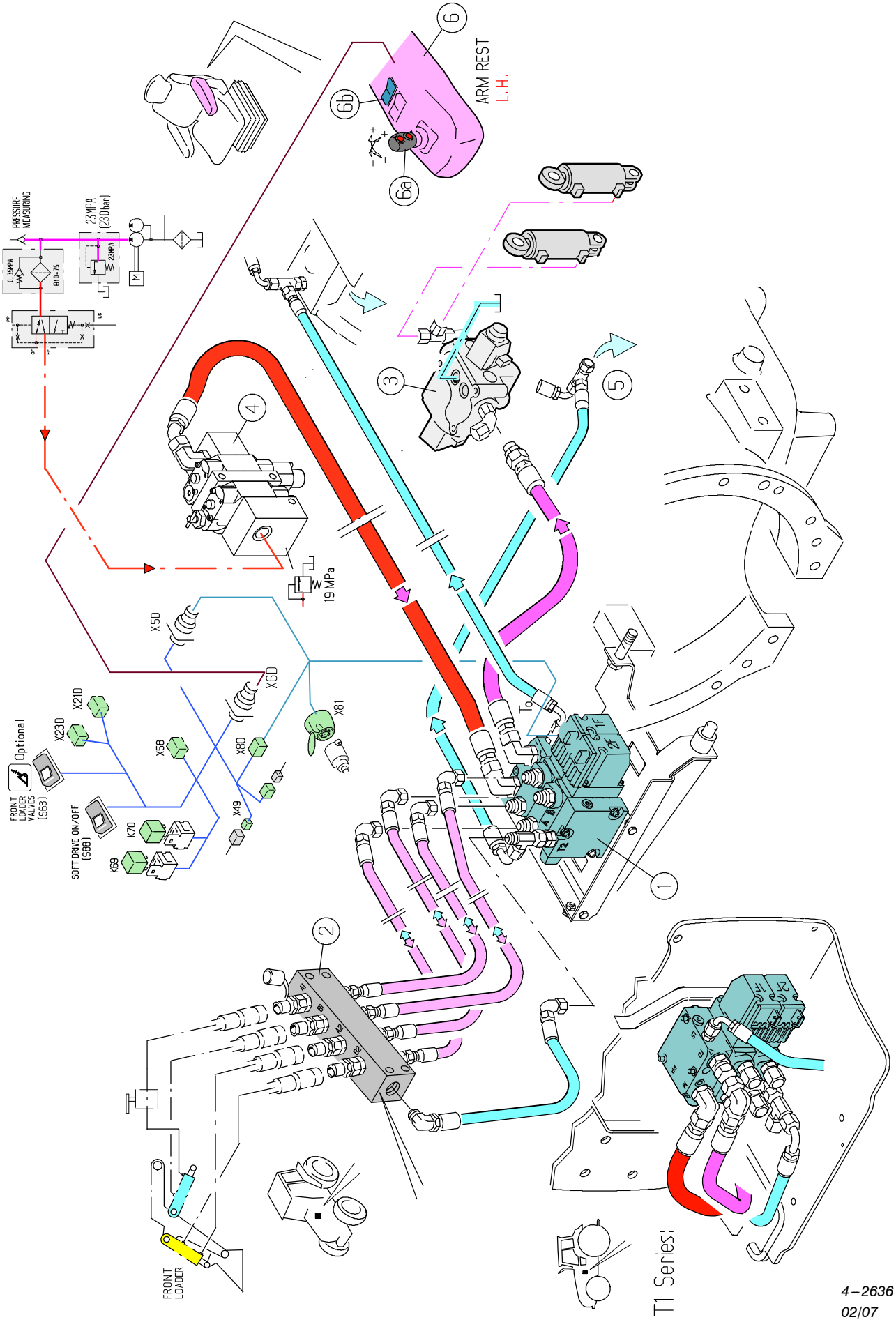
D: Floating position: Spool **1** has been moved further upwards. The locking balls lock the spool in position. The middle passages **N** open and oil flows through them to the power lift control valve. Connection between pressure passage **P** to ports **A** and **B** is closed. Both ports **A** and **B** are connected with tank passage **T**.

– When the valve is used as a single–acting valve, an implement hose should be connected to the upper coupling **A**. The return oil flow can be created by moving the spool to the floating position (upwards).

1) Spool
2) Non–return valve
3) Centring springs

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Front valves (extra equipment)



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1) Front valves

2) Valve block (front loader)

3) Control valve for power lift

4) Auxiliary hydraulic valves (mechanical use)
   In the end flange of the auxiliary hydraulic valves there is a pressure relief valve 19 MPa.

5) Tank connection (on the side of the gearbox housing)

6) Armrest (NB! has been located on the left side of the driver's seat)

   6a) Joystick (for auxiliary valves 1F, 2F)

   Raise/lower the loader:
   Move the lever backwards to lift the loader arm. Move the lever forwards to lower the loader arm.

   Empty/angle tool upwards
   Move the lever sideways towards you, to angle the tool upwards. Move the lever sideways away from you to empty the tool.

   Push buttons:
   The joystick has two push buttons which with the switches of equipment locking and Softdrive affects the front loader power socket (max 10 A).

   By pressing the lowest contact button and simultaneously turning the control lever sideways towards you e.g. the bale grap can be closed and correspondingly opened by turning away from you.

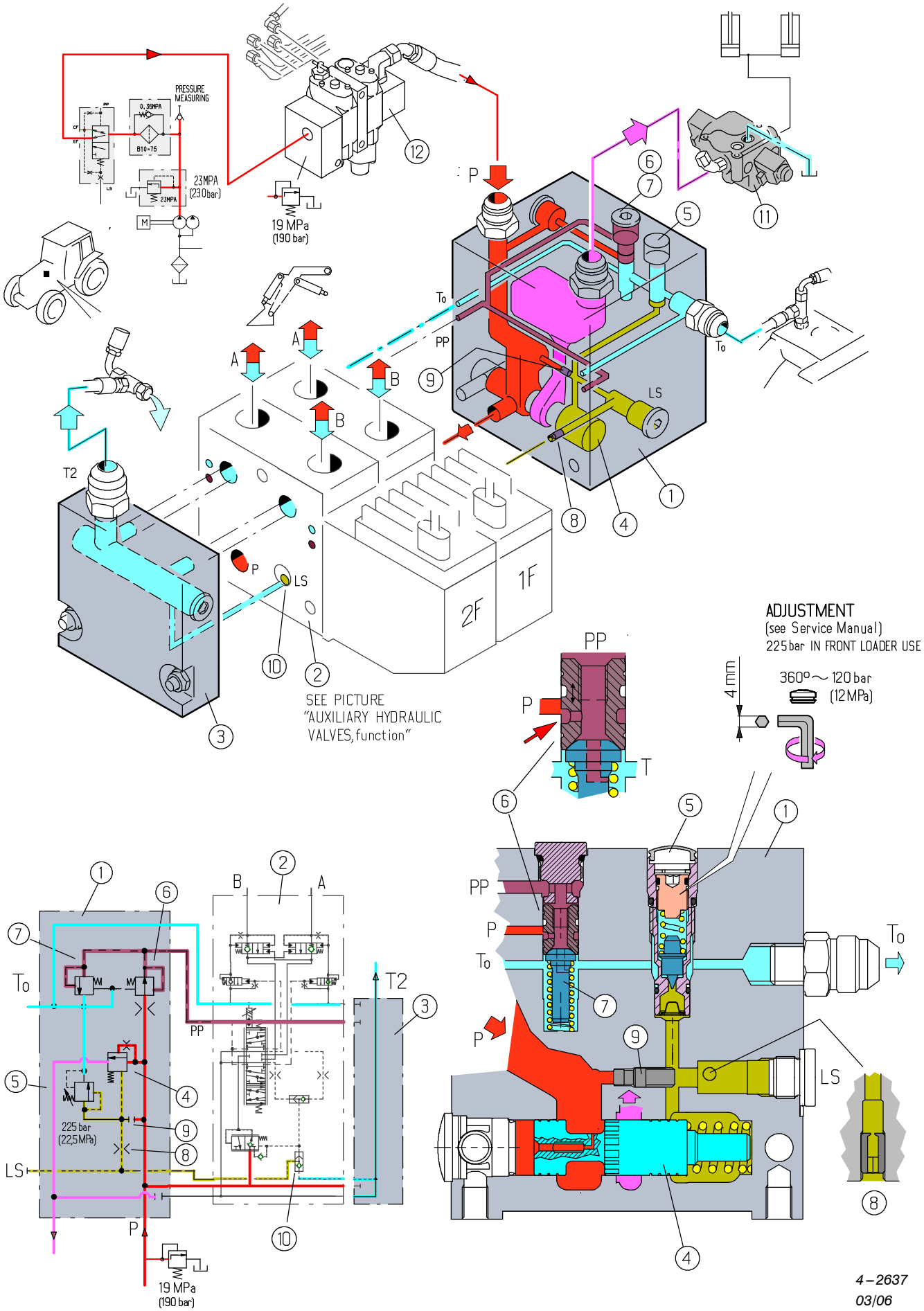
   6b) Main switch of front loader hydraulics

   The switch has two positions:
   The symbol side pressed down = Front loader hydraulics ON
   The opposite side to the symbol pressed down = Front loader hydraulics OFF

T0 = tank connection without counter pressure. If there is a counter pressure, it would rise the pilot pressure of the valves.

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Oil supply for front valves



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1) Pumpside

2) Front valves

3) End flange

4) Free circulation valve.

   Adjusts the oil flow to the control valve (11) with help of the LS pressure. The working pressure of the front loader valves has been set to 225 bar. When working with front loader, this secures that there is pressure enough also for power lift.

   If front loader is used, there develops a pressure in the LS line (=load pressure), which affects on the right end of the free circulation spool (**4**). Additionally on the right side there is a spring which also tries to prevent the opening of the valve. Working pressure **P** affects on the left end of the spool through a bore in the spool. When the LS pressure increases, the spool (**4**) moves to the left, and the flow to the control valve (**11**) decreases.

   If the front loader is not used, there is any LS pressure and the oil can get to the power lift control valve. However, the free circulation spring causes a little counter pressure to the pump.

5) LS pressure limiting valve (adjustable).

   The LS pressure affects on the right end of the free circulation spool and secures that there is pressure enough also for power lift control valve (**11**).
   The pump has a safety valve 23 MPa.

6) Pilot pressure relief valve for the aux. valves (not adjustable).

   Adjusts the pressure to **12 bar**.

   The pressure oil can get through a bore to the inside of the sleeve. When the pressure has increased enough, it pushes the sleeve downwards against the spring under the spool (7), and it limits the increasing of the pressure. In this way there develops the pilot **PP** pressure of the valves.

7) Pilot pressure limiting valve (not adjustable).

   Limits the pilot pressure to max. **13 bar**.

   A small oil amount can flow continuously through a hole in the pin to the tank.

8) Throttle

9) Plug

   Closes the connection from pressure channel to the LS channel.

10) Change–over counter valves.

    Make possible that the highest LS pressure affects on the free circulation valve **4**.

11) Power lift control valve

12) Auxiliary hydraulic valves

    In the end flange there is pressure 19 MPa relief valve, as earlier

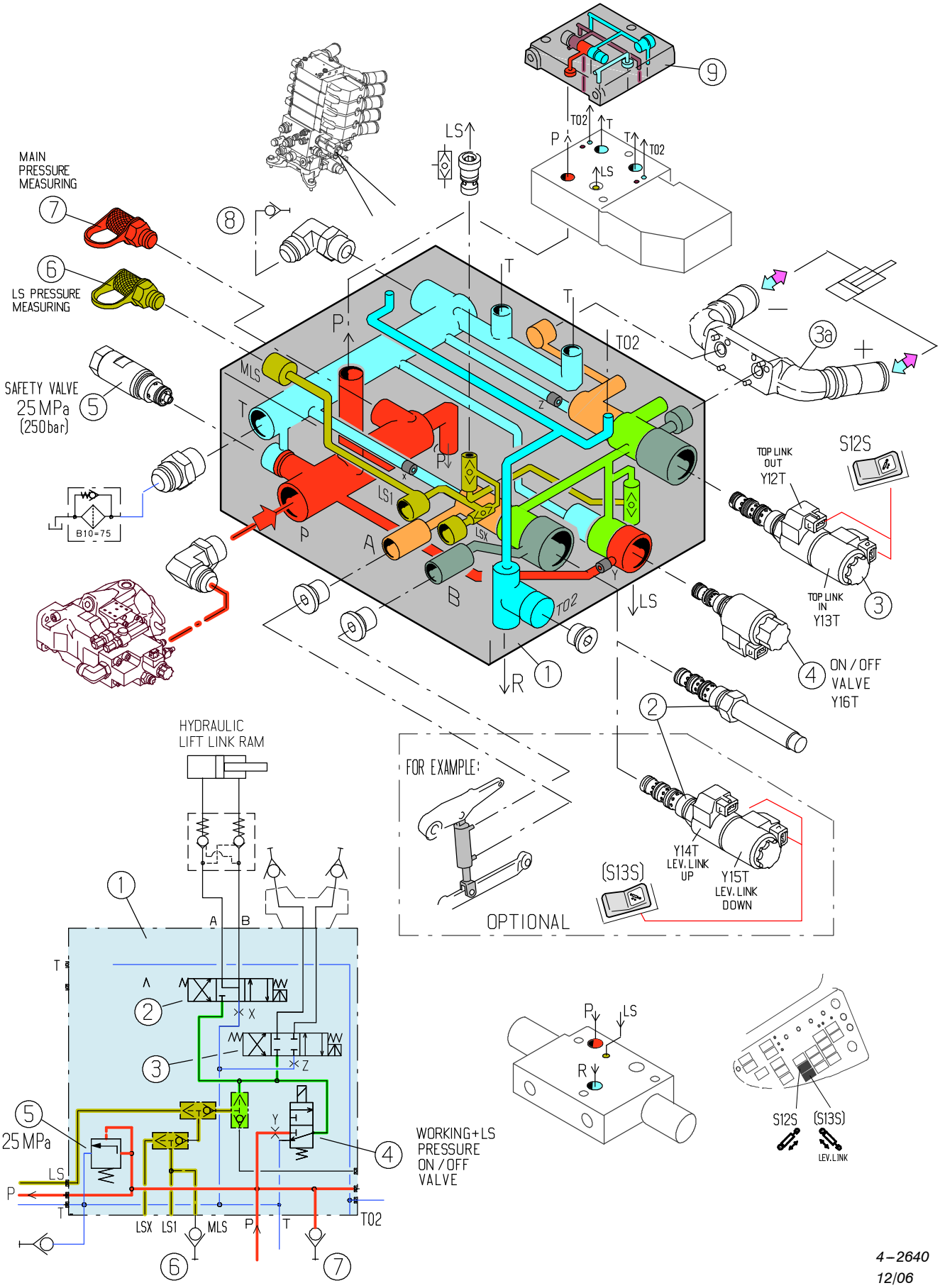
T0 = tank connection without counter pressure. If there is a counter pressure, it would rise the plot pressure of the valves.

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Valves for auxiliary hydraulics (T151eLS–T191LS)

Valve block (pump end)



4–2640
12/06

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1) Valve block (pump end)
Divides the output of the variable displacement pump to the lift control valve, to the proportional auxiliary valves (Danfoss) and to the on/off valves.
In the block there are change–over counter valves, which direct the highest signal pressure via the LS1 connection to the regulator of the pump.
The LS pressure of the e.g front valves can be coupled to the LSX bore. When the bore is used, the change–over valve (366 561 00) must be mounted to the bore.

2) Rear valve block (optional)

The body of this valve is ready fitted to the block (**1**) (functions as a plug). When fitting the optional equipment the valve will be activated by assembling the solenoids Y14T and Y15T.

With switch **S13S** is controlled the rear valve block, where the implement is attached permanently e.g. levelling ram, hydraulic towing hook extension etc.
This switch is active even if the auxiliary hydraulic is not activated.

The rocker switch has two positions and is spring–centred:
The symbol side pressed down = lifting function (+)
The opposite side to the symbol pressed down = lowering function (–)

CAUTION: In the spring–centred position both the ports are connected direct to the tank. This has to be noticed when connecting other implements to the valve block.

3) Rear valve block

With switch **S12S** is controlled the rear valve block equipped with quick–couplings (the lowest quick–action coupling at the rear). With this switch can for example, the hydraulic top link be controlled.
This switch is active even if the auxiliary hydraulic is not activated.
The rocker switch has two positions and is spring–centred:
The symbol side pressed down = lifting function (+)
The opposite side to the symbol pressed down = lowering function (–)

3a) Connection for the top link

4) On/off–valve (is activated always with valves 2 and 3)
- connects the pressure to valves 2 and 3
- connects above mentioned valves to LS line

5) Safety valve
- limits the system pressure to 25MPa (250 bar)
- the actual adjuster of the max. pressure is in the regulator of the pump

6) Pressure measuring connector (LS pressure)

7) Pressure measuring connector (main pressure)

8) Free return coupling

9) End flange
- in the flange there has been built–in the pilot pressure control valves for the Danfoss auxiliary valves.

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End flange and pilot pressure

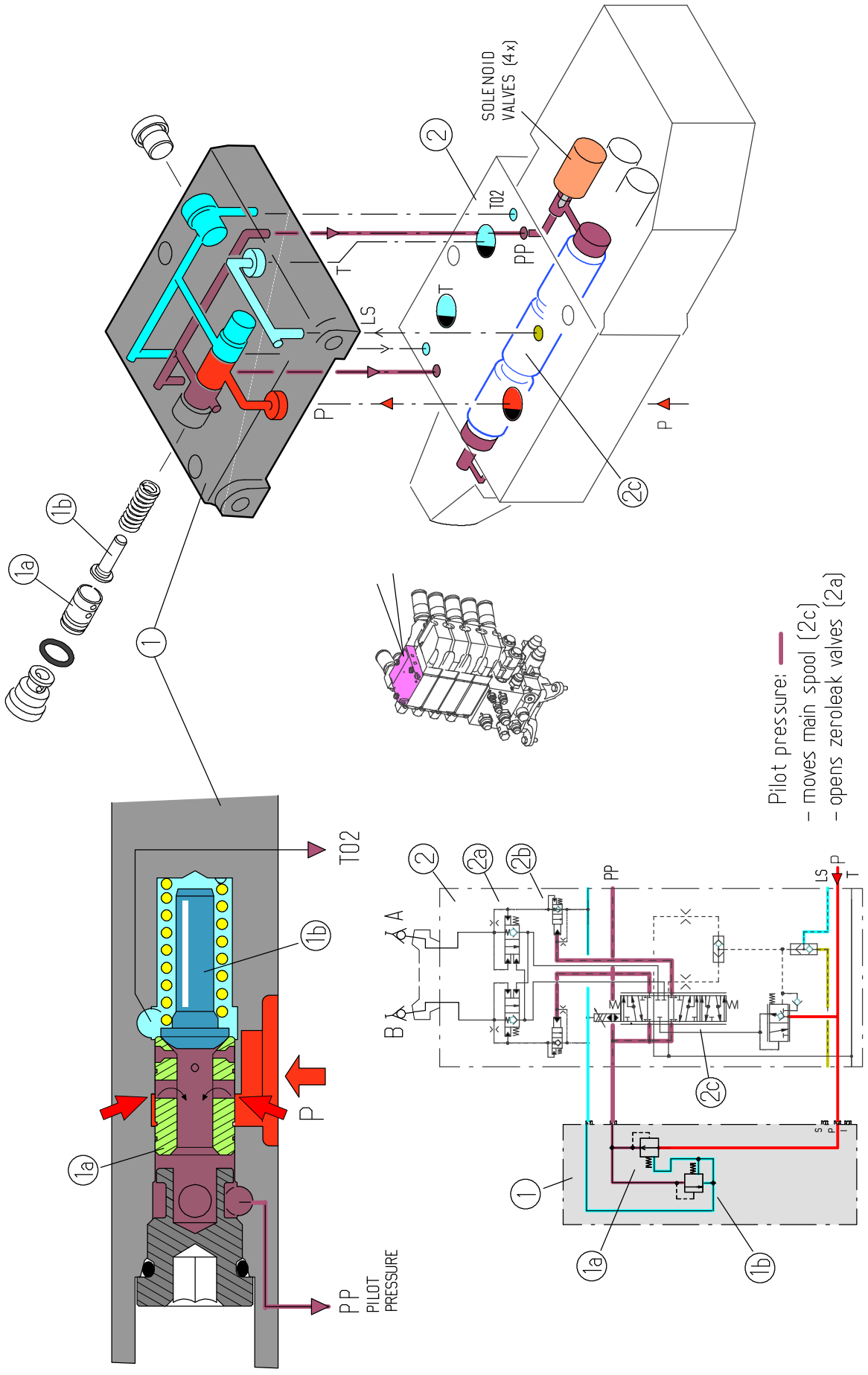


fig013

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The pilot pressure **PP** is used to move the main spool (**2c**) and to open with help of the pilot valves (**2b**) the zeroleak valves (**2a**), so that the connection from the port **A**/**B** to the tank **T** opens.

1) End flange

1a) Pilot pressure relief valve for the aux. valves **12 bar** (1,2 MPa) (not adjustable).

Adjusts the pilot pressure. The pressure oil can flow through a bore to the inside of the sleeve (**1a**) . When the pressure has increased enough, it pushes the sleeve to the right against the spring under the spool (**1b**). At the
same time the inlet opening becomes smaller and the increasing of the pressure stops. In this way there develops the pilot **PP** pressure of the valves.

1b) Pilot pressure limiting valve (not adjustable).

If the pressure increases too much , the spool (**1b**) looses from the valve sleeve (**1a**) and discharges the overpressure to the tank.
The valve limits the pilot pressure to max. **13 bar** (1,3 MPa).

2) Auxiliary hydraulic valve

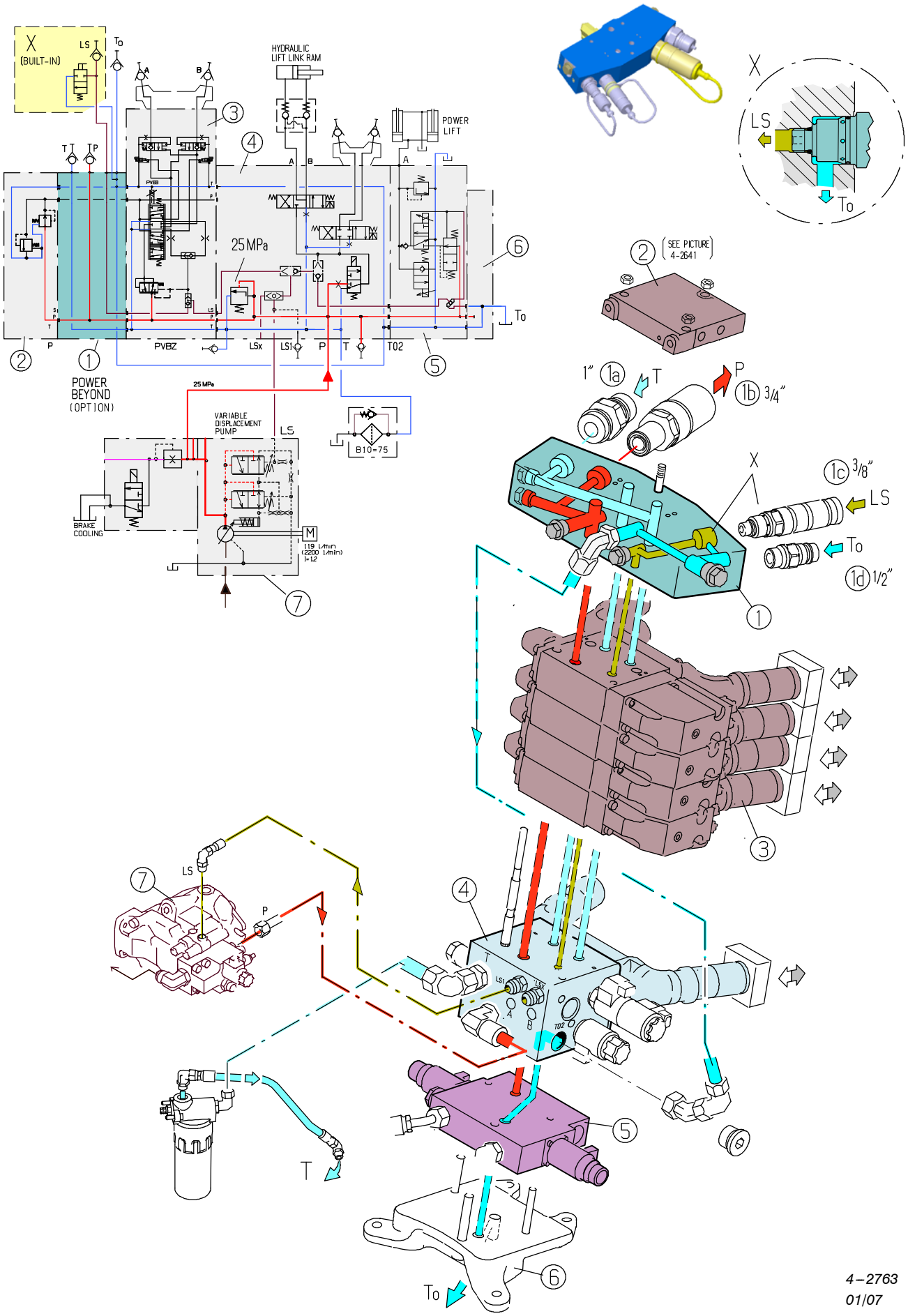
2a) Locking valves (zeroleak valves)

2b) Pilot valves for the zeroleak

2c) Main spool

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Power beyond (extra equipment)



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The greatest possible hydraulic output can be achieved with the smallest dissipation with the help of the Power Beyond couplings. This is suitable for implements which have LS–line for the tractor.

The system includes an LS coupling (**1c**), in which the extra device load sensing system has to be connected.

When the LS–line hose of the implement is connected to the LS line (**1c**) the pressure settles to a level determined by the implement LS pressure. The pressure in the tractor is determined by a device, which has the highest LS pressure.

If the external implement (and any other devices) is not used, the pump line has only a pressure caused by the free circulation. In this way the pump is not overloaded unnecessarily, the hydraulic oil does not over heat and fuel consumption decreases.

Connect the tank hoses (**1a** and **1d**) always first and take them away until last in order to avoid damage in the hydraulics.

All the quick couplings are the serie ISO 7241/1 “A”.Quick couplings types and sizes are according to the standard. If the implement couplings do not match to the tractor couplings, the implement couplings have to be changed to match the tractor ones.

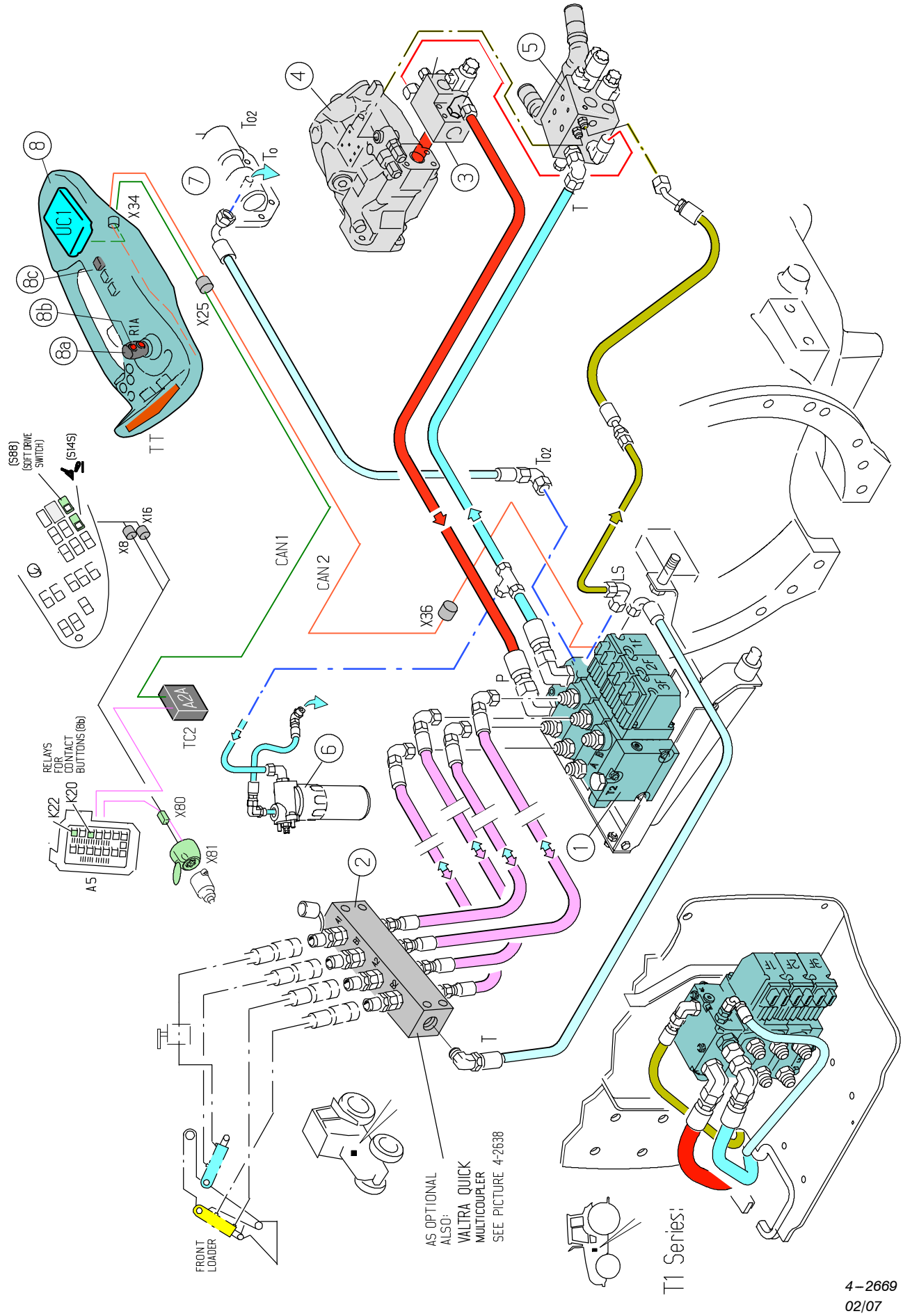
1) Power Beyond block
   1a) Free return coupling, male quick coupling, 25 (1”)
   1b) Pressure coupling, female quick coupling 20 (3/4”)
   1c) LS coupling (load sensing), female quick coupling 10 (3/8”).

   Point X: The connector has an built–in valve which connects the LS –line to the tank always when the quick coupling has not been coupled. So the pressure can be discharged in the LS line.

   LS –hose connector counterpart (male quick coupling 10 (3/8”)) part number is 36159800 (male thread JIC 3/4”–16).
   1d) E.g. leakage connector for the hydraulic motor housing, male quick coupling 12,5 (1/2”)
2) End flange
3) Directional control valve (incl. Zero leak valves)
4) On/off valve block
   –N.B! valves are not proportional
5) Control valve (power lift)
6) Fastening plate
7) Variable displacement pump

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Front valves (extra equipment)



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Working pressure for the front valves has been taken direct from the variable displacement pump. The 25 MPa (250 bar) safety valve is common with rear auxiliary hydraulic valves and is located in the on/off valve block (5).

The LS pressure can affect on the control system of the pump through hoses and via on/off valve block.

1) Front valves
2) Valve block
3) Valve block
4) Variable displacement pump
5) On/off valve block
6) Return filter
7) Tank connection (in the cover of the electro hydraulic gear change system)
8) Arm rest

8a) Joystick (valves 1F, 2F)

The valve blocks either at the rear or at the front are controlled with the Joystick. The choice will be made with the selection switch on the armrest (see variations of auxiliary hydraulic valves).

Forward and backward movements parallel to the seat for controlling the valve blocks 1 behind and **1F** front and transverse movements control valve block 2 behind and **2F** front.

Position locks, floating – position:
The position lock or the floating – position can be set to on by pushing the joystick in the direction in question to the extreme position (by the max flow point, when the force required increases) for under 1 sec. and releasing the joystick. If the joystick is held in its extreme position for over 1 sec, the output starts to follow the movement of the joystick.

IMPORTANT: Do not unnecessarily hold the programmed position locks for the valve blocks used by the joysticks. Then there will be no danger of engaging the position lock by accident.

The joystick control lever has two contact buttons, which can be used e.g. with front loader. By pressing the contact buttons of the control lever you can get power outputs from the pin socket (**X81**). By pressing the lowest switch of the control lever, the position of the switch (**S14S**) effects on the function.

8b) Auxiliary hydraulics, control lever for front valve block (3F)

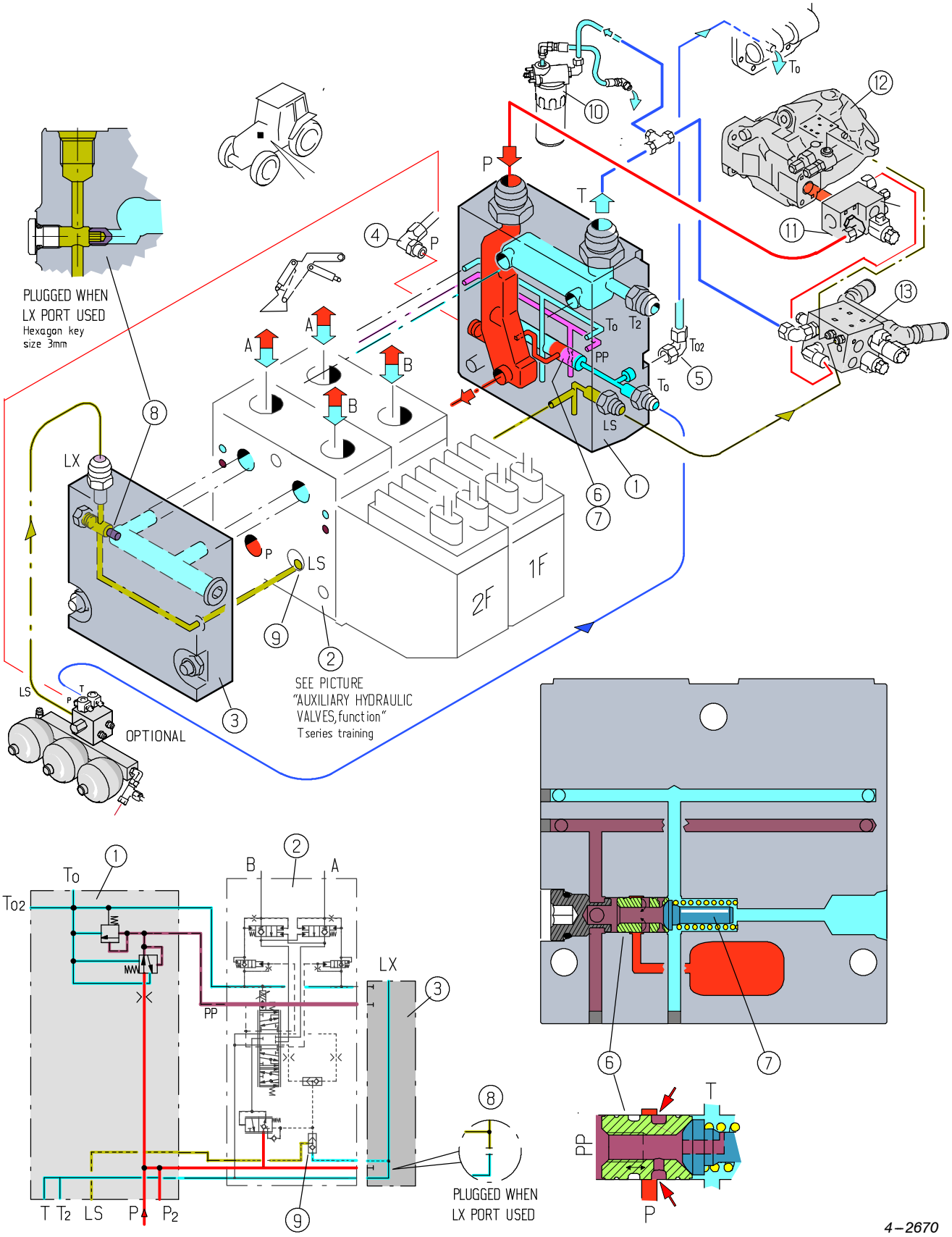
The front valve block 3F is always active, when the hydraulic is activated with the ON/OFF switch.

Use this lever to direct the outputs to the coupling at the front.
– when pulling the lever towards the driver = lifting function (+)
– when pushing the lever away from the driver = lowering function (–)

T0 = tank connection without counter pressure. If there is a counter pressure, it would rise the plot pressure of the valves.

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Oil supply for front valves



4–2670
08/06

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1) Pump side

2) Valves for front loader

3) End flange

4) Pressure oil to the suspended front axle (optional)

5) Tank connection without counter pressure (on the cover of the M–H range gear selector).

6) Pilot pressure relief valve for the aux. valves (not adjustable).

   Adjusts the pressure to **12 bar**.

   The pressure oil can get through a bore to the inside of the sleeve. When the pressure has increased enough, it pushes the sleeve downwards against the spring under the spool (**7**), and it limits the increasing of the pressure. In this way there develops the pilot **PP** pressure of the valves.

7) Pilot pressure limiting valve (not adjustable).

   Limits the pilot pressure to max. 13 bar.

   A small oil amount can flow continuously through a hole in the pin to the tank.

8) Plug

   Closes the connection from pressure channel to the LS channel (LX).

   The plug is needed only when there is an further LS–connection for e.g. front axle suspension.

9) Change–over counter valves.

   Make possible that the highest LS pressure affects on the variable displacement pump.

10) Pressure filter for return oil

11) Dividing block

12) Variable displacement pump

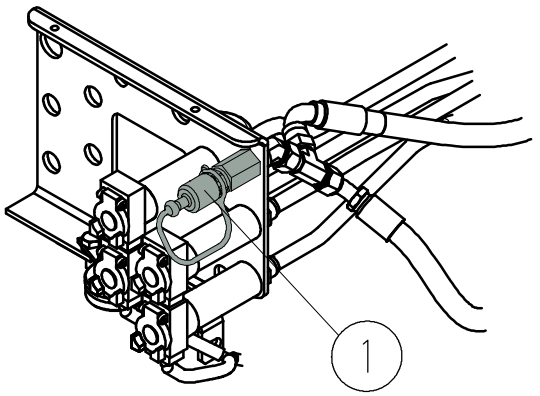
13) On/off valve block

T0 = tank connection without counter pressure. If there is a counter pressure, it would rise the plot pressure of the valves.

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Return oil connection for auxiliary hydraulics

T121c - T171c
T121h - T191h



T151eLS - T191LS

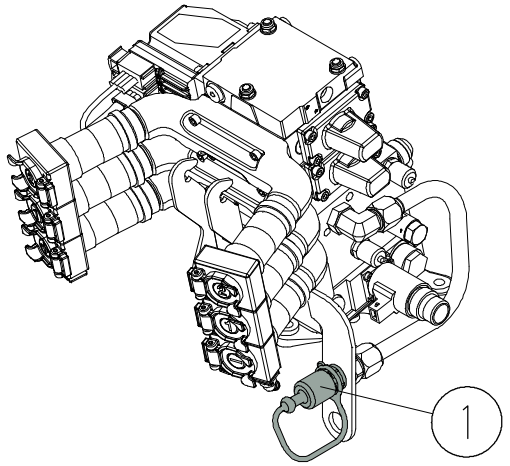


fig008

T1 Series tractors have as standard a return oil connection (1), which can be used when low return pressure is needed.

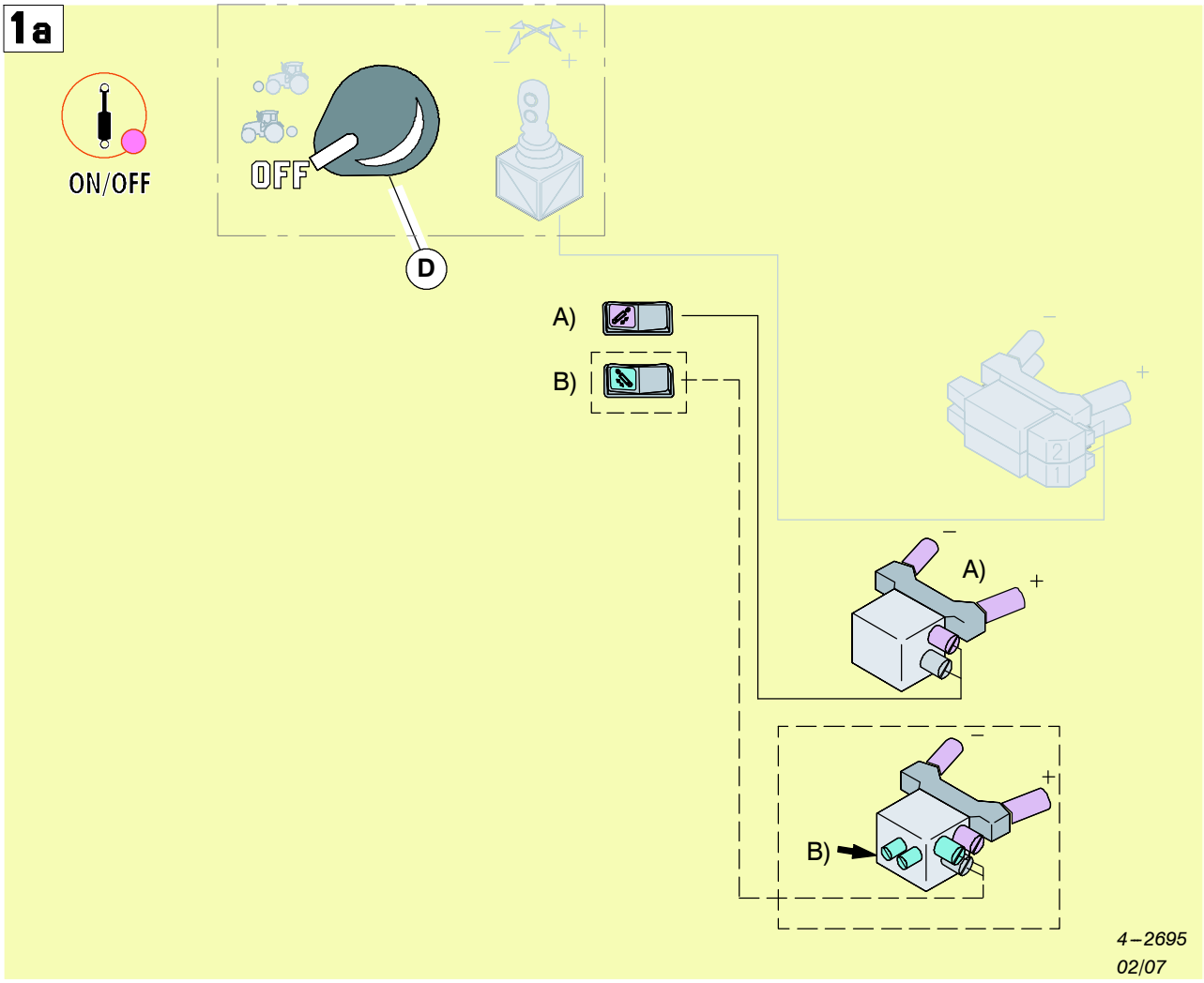
Counter pressures

1/2 inch connection, flow 50 l/min, 10˚C	max. 9 bar
1/2 inch connection, flow 50 l/min, 50˚C	max. 4 bar
3/4 inch connection, flow 50 l/min, 10˚C	max. 7 bar
3/4 inch connection, flow 50 l/min, 50˚C	max. 3,5 bar
1 inch connection, flow 50 l/min, 10˚C	max. 5 bar
1 inch connection, flow 50 l/min, 50˚C	max. 3 bar

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Combinations of auxiliary hydraulics valves (T151eLS–T191LS)



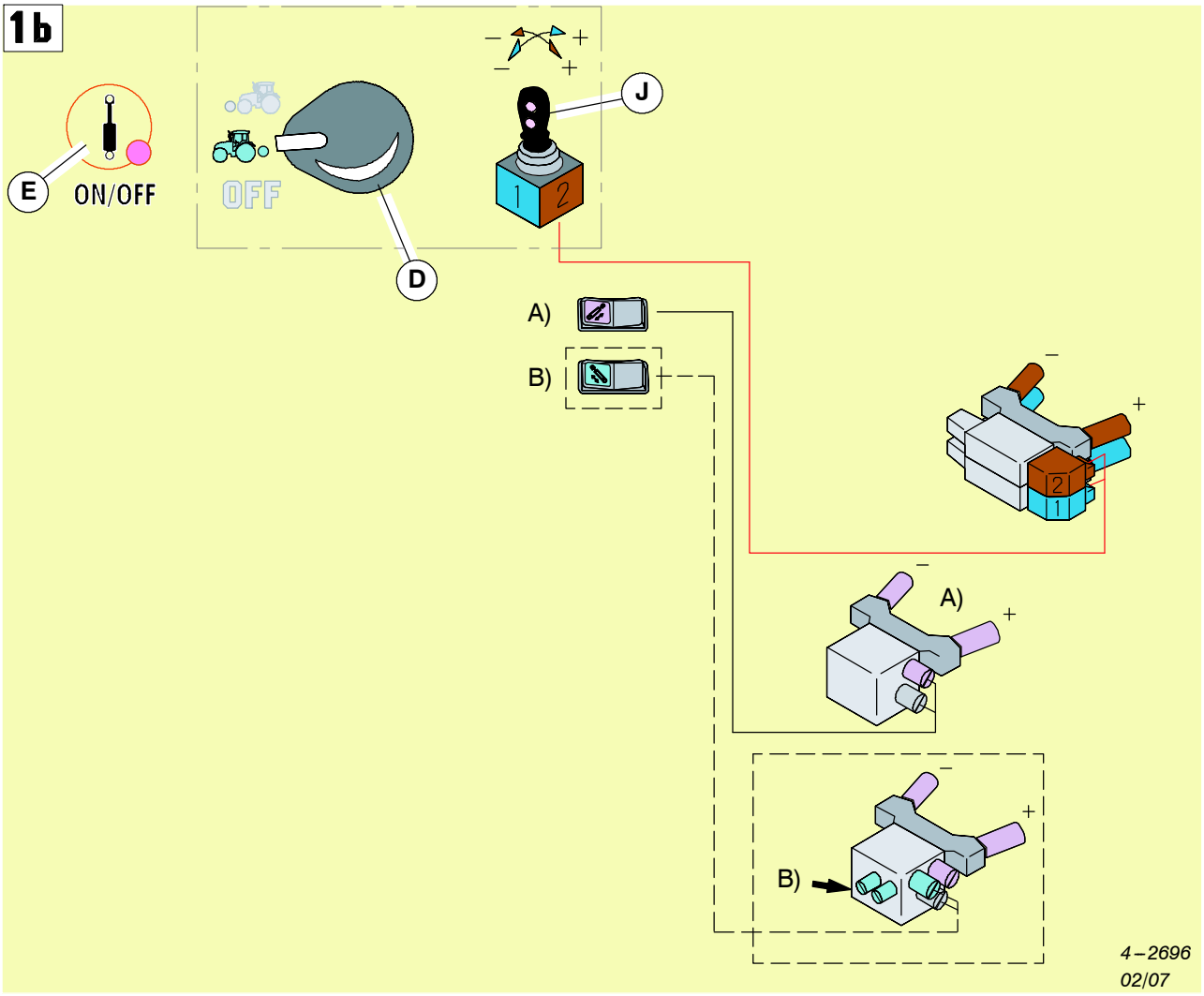
Variation 1 (2 + 2 valves at the rear)

1a: The joystick functions are not activated = the switch **D** is in OFF–position.

– With the upper on/off rocker switch (**A**) of the RH side panel (not adjustable) controlling the rear valve blocks, quick couplings at the rear (**A+**, **A–**) e.g. for the hydraulic top link.

– With the lower on/off rocker switch (**B**) of the RH side panel, extra equipment (not adjustable), controlling the solid mounted implement e.g. the levelling gear, hydraulic extension of the trailer hitch etc.

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Variation 1 (2 + 2 valves at the rear)

1b: The joystick functions to the rear = the switch **D** is in position ○.

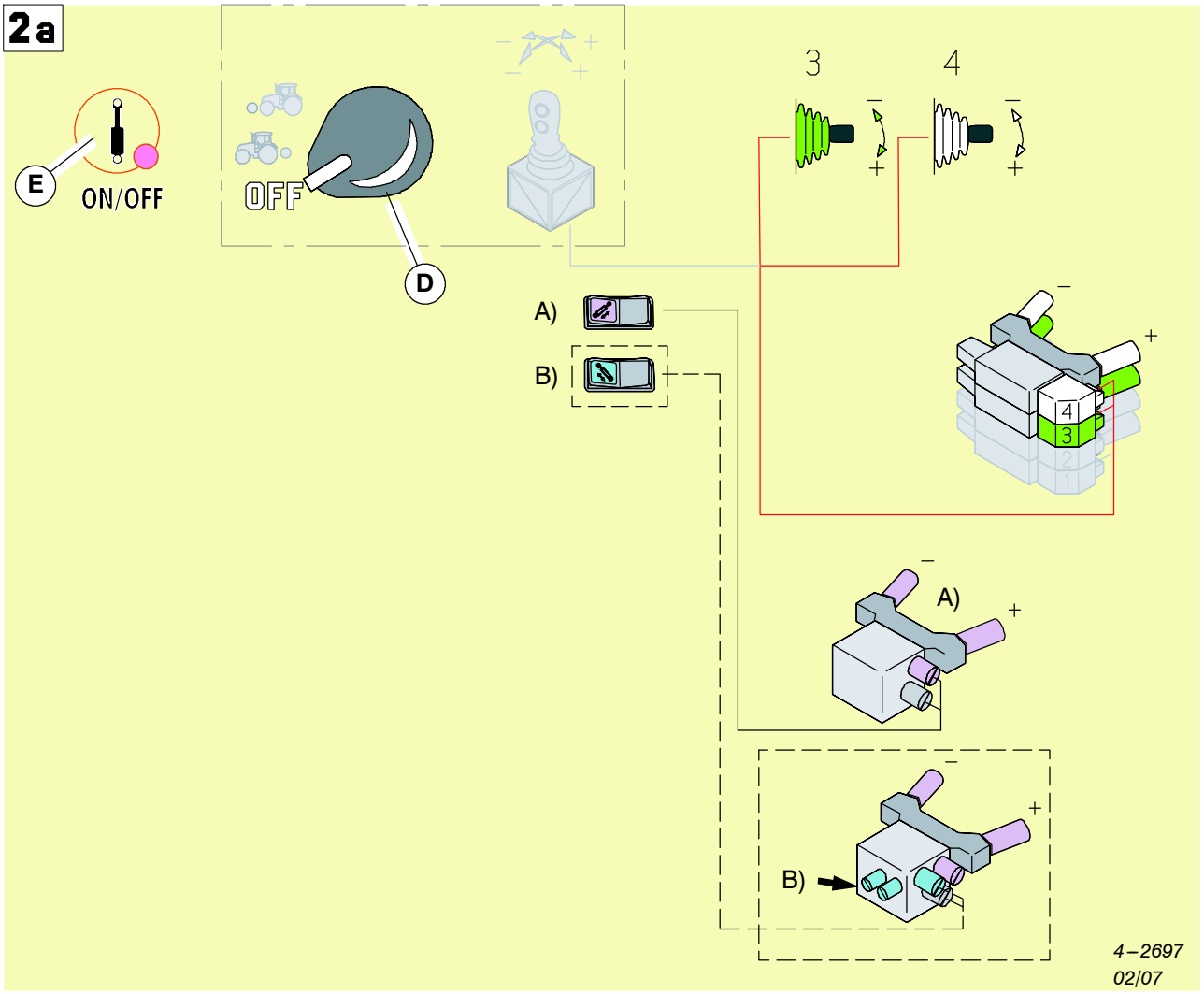
Addition position **1a** functions operate also the following functions:

The hydraulics has to be activated with the switch **E**, so that the joystick **J** functions.

– Longitudinal movements of the joystick **J** controls the valve block **1**
= quick couplings at the rear (**1–**, **1+**).

– Transverse movements (**2**) of the joystic **J** controls the valve block **2**
= quick couplings at the rear (**2–**, **2+**).

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Variation 2 (4 + 2 valves at the rear)

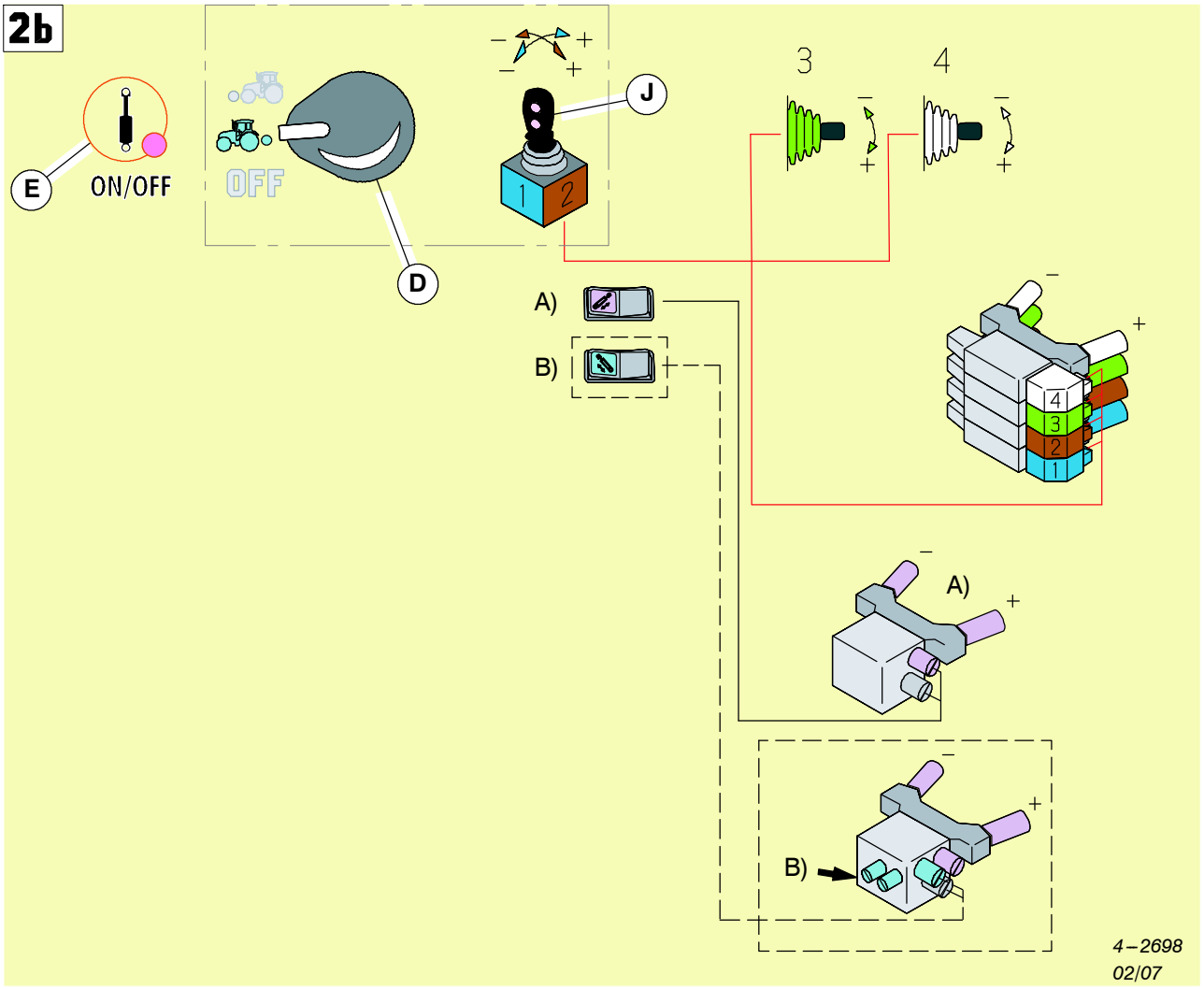
2a: The joystick functions are not activated = the switch **D** is in the OFF–position

- The upper on/off rocker switch (**A**) of the RH side panel (not adjustable) controls the rear valve blocks, quick couplings at the rear (**A+**, **A–**) e.g for the hydraulic top link.
- The lower on/off rocker switch (**B**) of the RH side panel, extra equipment (not adjustable), controls the solid mounted implement e.g the levelling gear, hydraulic extension of the trailer hitch etc.

The hydraulic has to be activated with the switch **E**, so that the controlling levers function.

- The lever **3** controls the valve block **3** = quick couplings at the rear (**3–**, **3+**).
- The lever **4** controls the valve block **4** = quick couplings at the rear (**4–**, **4+**).

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Variation 2 (4 + 2 valves at the rear)

2b: The joystick functions to the rear = the switch **D** is in position ○.

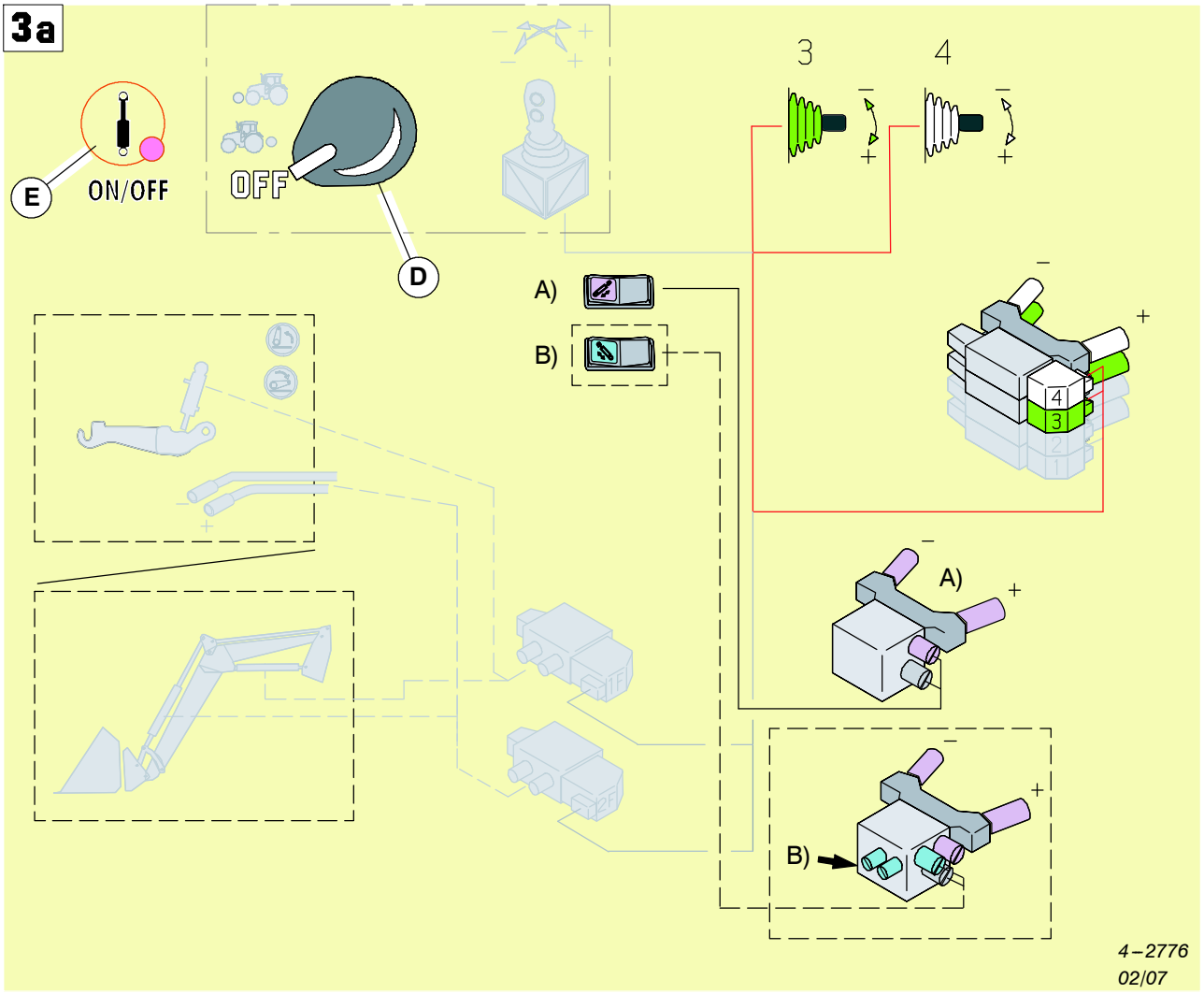
Addition position **2a** functions operate also the following functions:

The hydraulics have to be activated with the switch **E**, so that the controlling levers function.

– Longitudinal movements of the joystick **J** controls the valve block **1**
= quick couplings at the rear (**1–**, **1+**).

– The transverse movements of the joystick **J** controls the valve block **2**
= quick couplings at the rear (**2–**, **2+**).

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Variation 3 (4 + 2 valves at the rear, 2 valves at the front, front loader or front linkage)

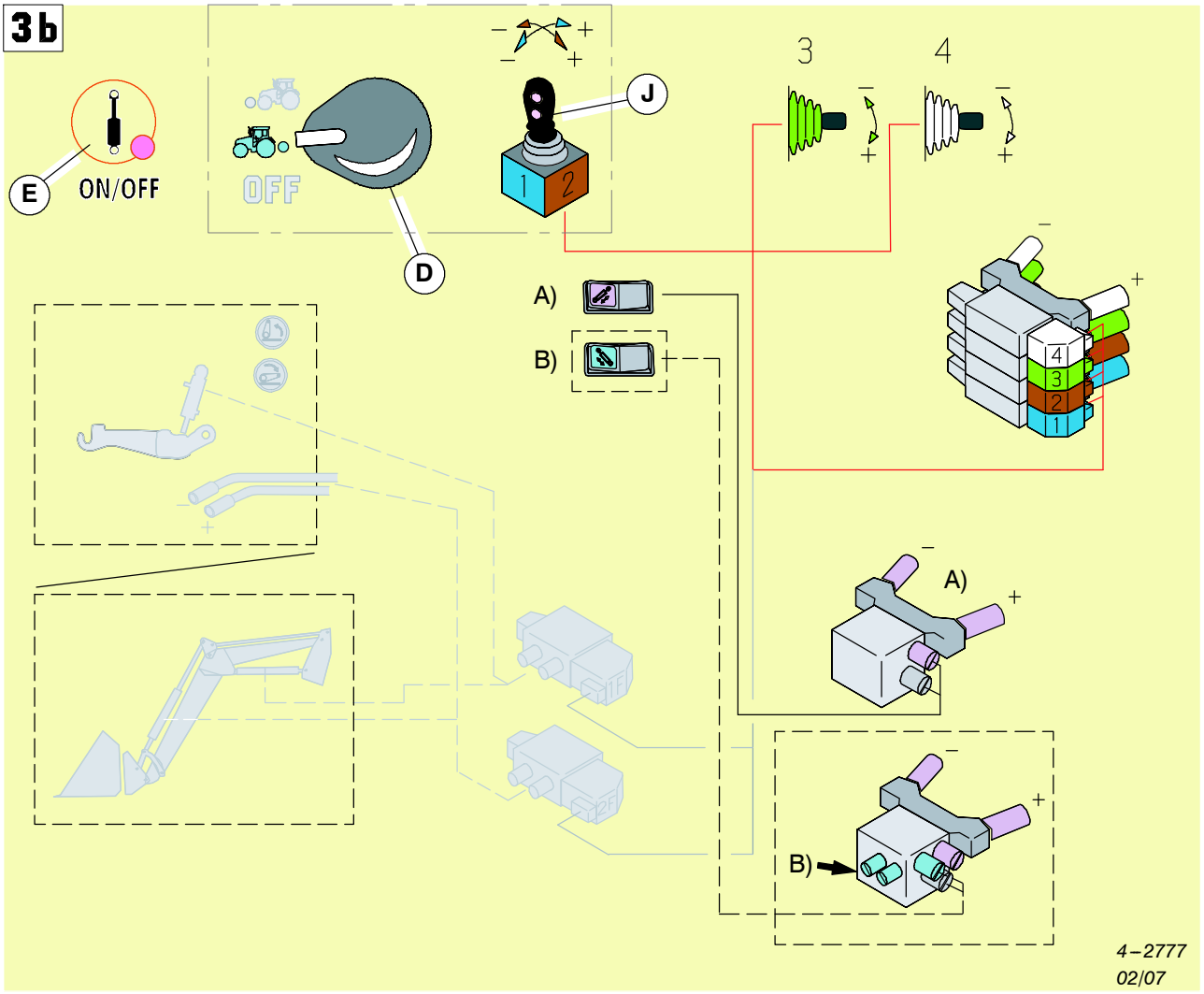
3a: The joystick functions are not activated = the switch **D** is in OFF–position.

- The upper on/off rocker switch (**A**) of the RH side panel (not adjustable), controls the rear valve blocks, quick couplings at the rear (**A+**, **A–**) e.g for the hydraulic top link.
- The lower on/off rocker switch (**B**) of the RH side panel, extra equipment (not adjustable), controls the solid mounted implement e.g the levelling gear, hydraulic extension of the trailer hitch etc.

The hydraulics have to be activated with the switch **E**, so that the controlling levers function.

- The lever **3** controls the valve block **3** = quick couplings at the rear (**3–**, **3+**).
- The lever **4** controls the valve block **4** = quick couplings at the rear (**4–**, **4+**).

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Variation 3 (4 + 2 valves at the rear, 2 valves at the front, front loader or front linkage)

3b: The joystick functions to the rear = the switch **D** is in position ○.

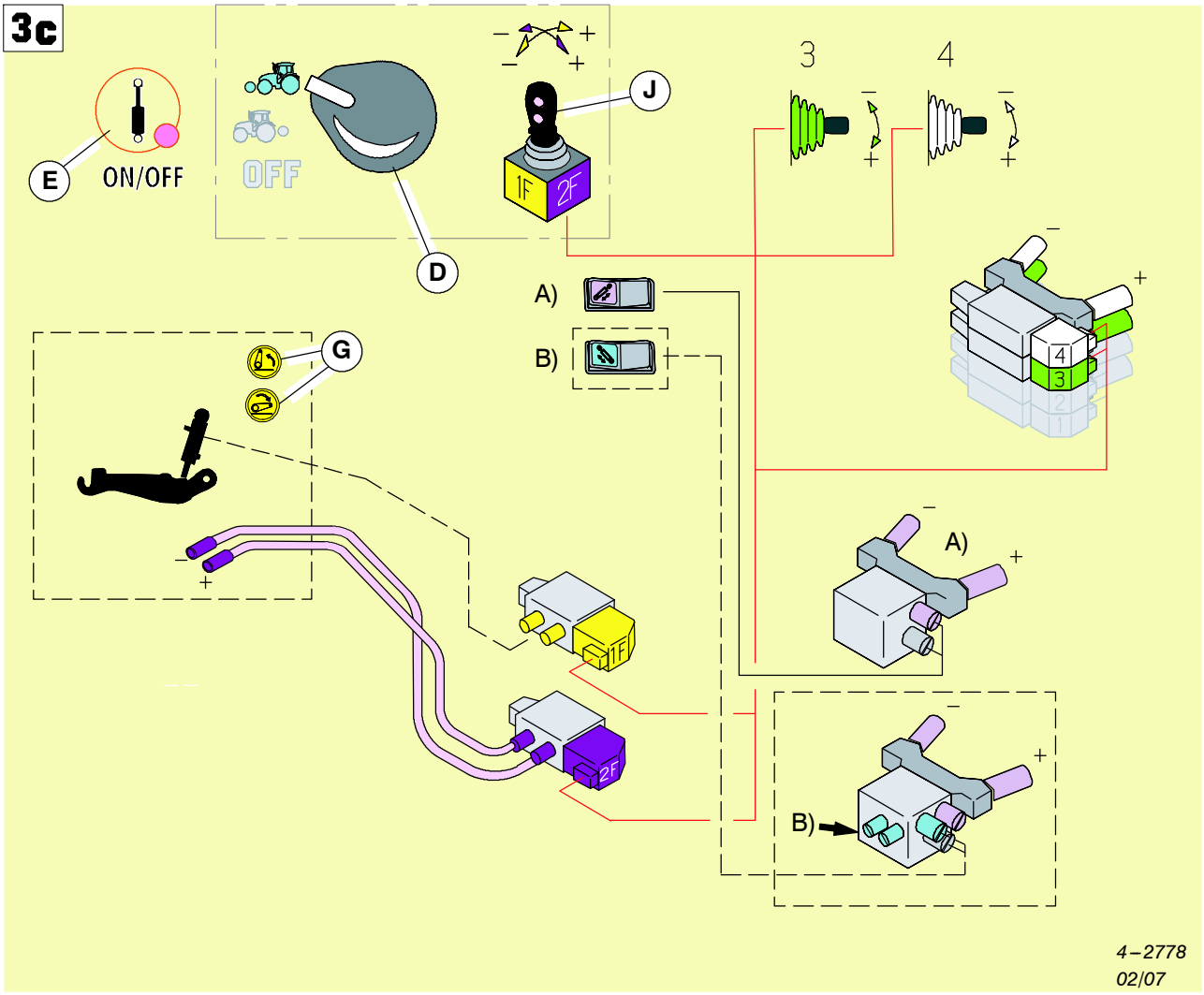
Addition position **3a** functions operate also the following functions:

The hydraulics have to be activated with the switch **E**, so that the controlling levers function.

– The longitudinal movements of the joystick **J** controls the valve block **1**
= quick couplings at the rear (**1–**, **1+**).

– The transverse movements of the joystick **J** controls the valve block **2**
= quick couplings at the rear (**2–**, **2+**).

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Variation 3 (4 + 2 valves at the rear, 2 valves at the front, front linkage)

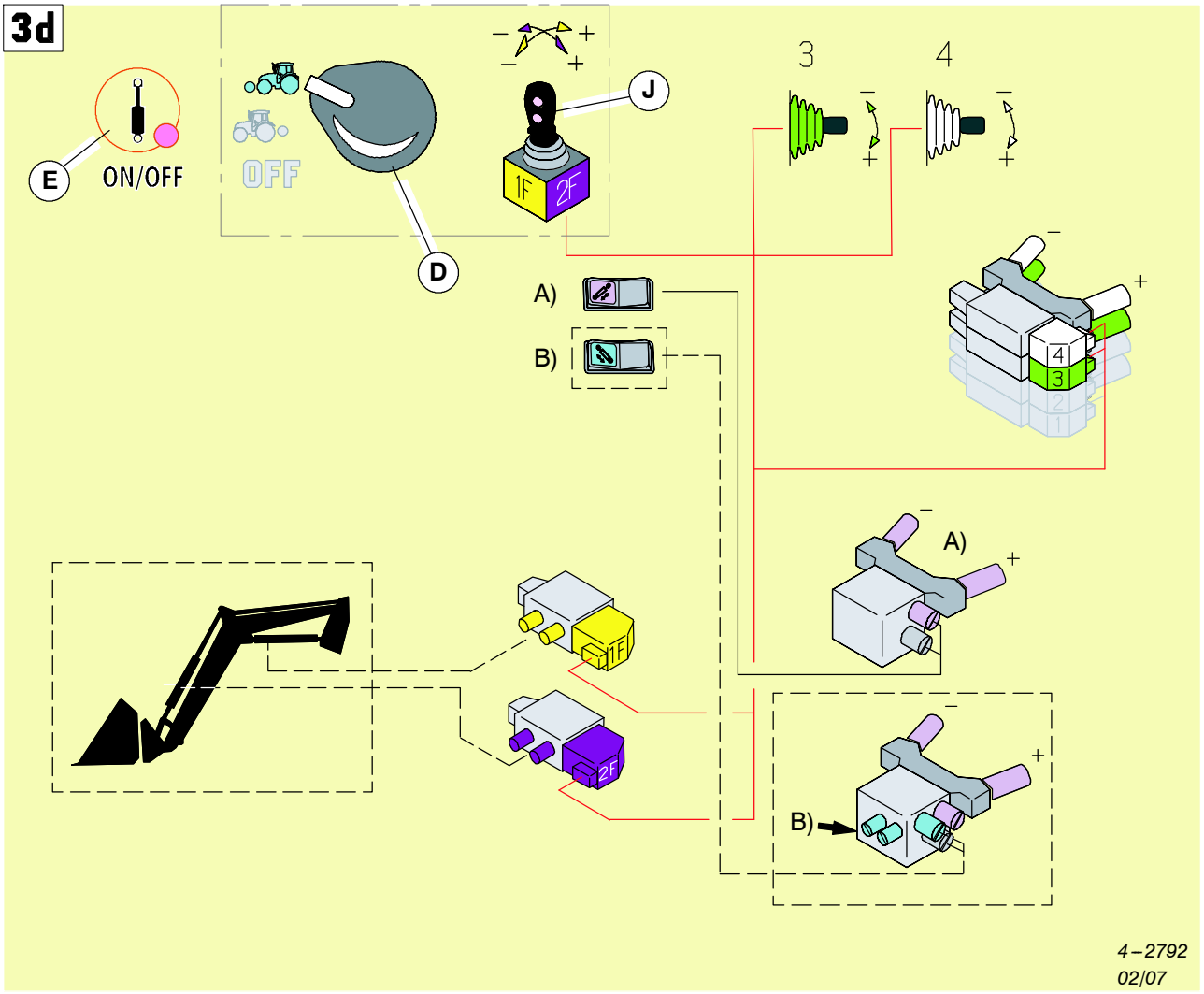
3c: The joystick functions to the front = the switch **D** is in position .

Addition position **3a** functions operate also the following functions:

The hydraulics have to be activated with the switch **E**, so that the controlling levers function.

- The longitudinal movementsof the joystick **J** controls the valve block **1F**
  = the front linkage, extra equipment.
- The transverse movementsof the joystick **J** controls the valve block **2F**
  = Quick couplings at the front (**2F–, 2F+**).
- The front linkage can also be controlled by the front switch (**G**)

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Variation 3 (4 + 2 valves at the rear, 2 valves at the front, front loader)

3d: The joystick functions to the front = the switch D is in position ☼.

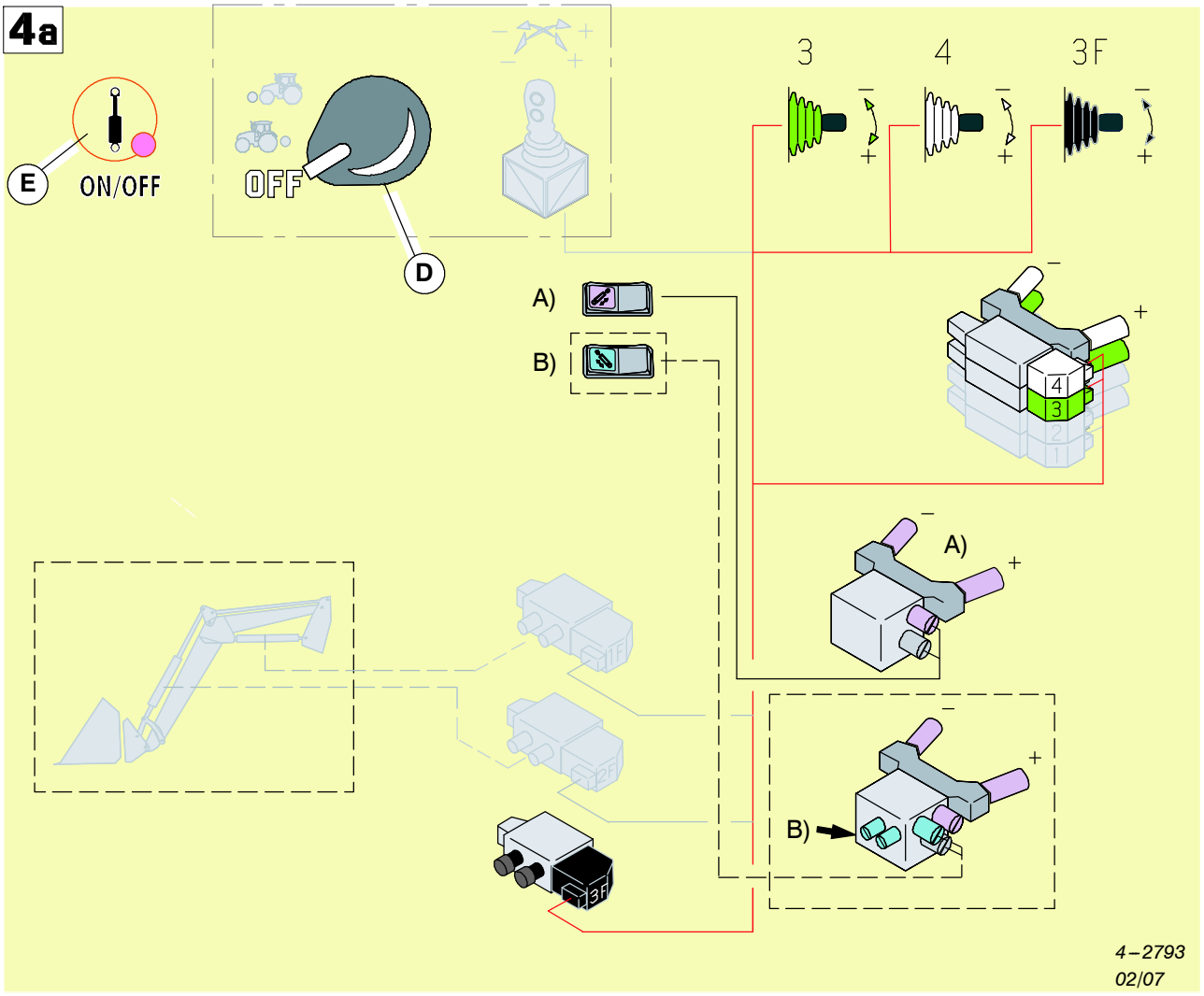
Addition position **3a** functions operate also the following functions.

The hydraulics have to be activated with the switch **E**, so that the controlling levers function.

– The longitudinal movements of the joystick **J** controls the valve block **1F**
= the boom of the front loader (extra equipment).

– The transverse movements of the joystic **J** controls the valve block **2F**
= bucket of the front loader (extra equipment).

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Variation 4 (4 + 2 valves at the rear, 3 valves at the front, front loader)

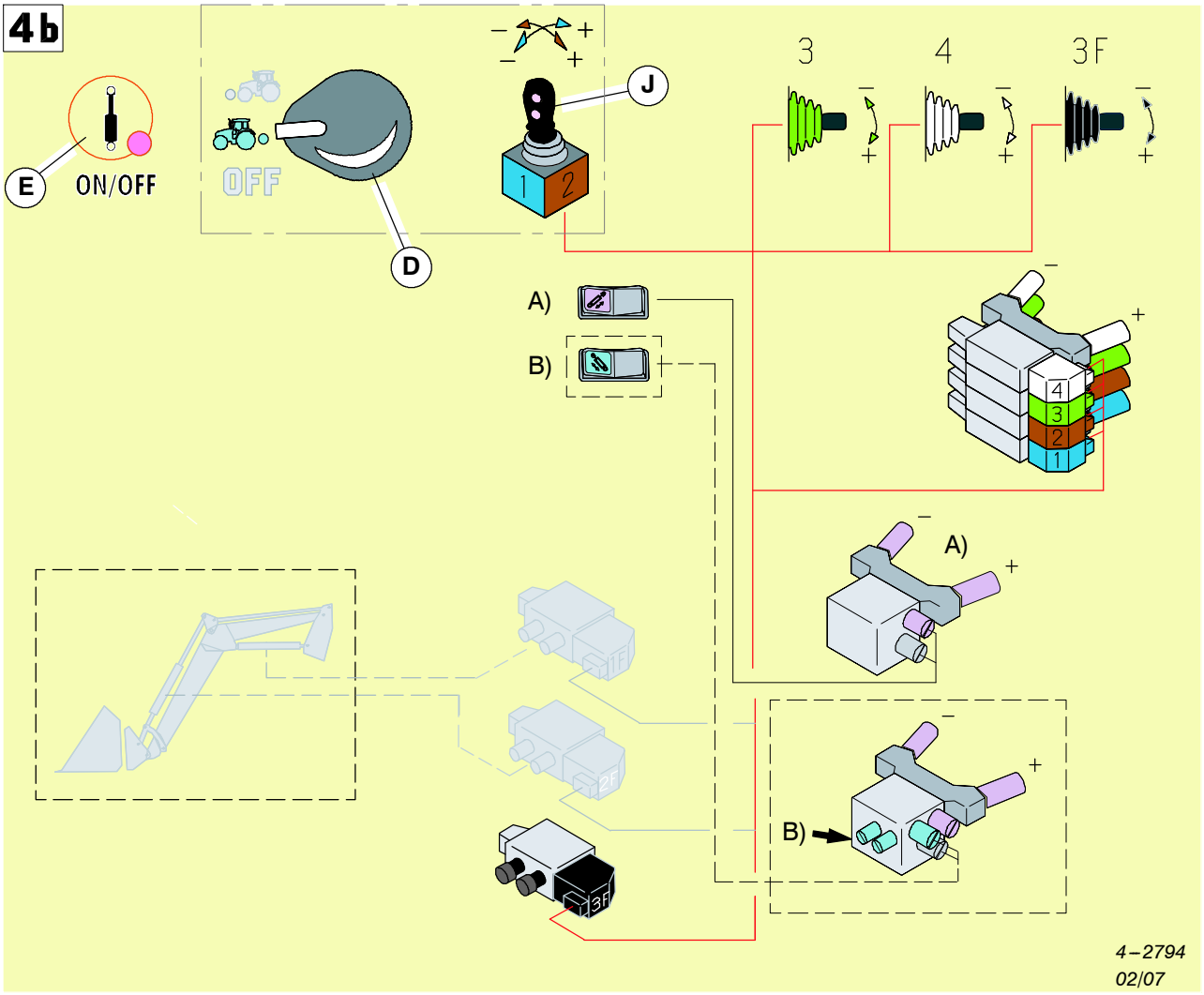
4a: The joystick functions are not activated = the switch **D** is in OFF–position.

- The upper on/off rocker switch (**A**) of the RH side panel (not adjustable), controls the rear valve, quick couplings at the rear (**A+, A–**) e.g. for the hydraulic top link.
- The lower on/off rocker switch (**B**) of the RH side panel, extra equipment (not adjustable), controls the solid mounted implement e.g. the levelling gear, hydraulic extension of the trailer hitch etc.

The hydraulics have to be activated with the switch **E**, so that the controlling levers function.

- The lever **3** controls the valve block 3 = quick couplings at the rear (**3–, 3+**).
- The lever **4** controls the valve block 4 = quick couplings at the rear (**4–, 4+**).
- The lever **3F** controls the valve block 3F = quick couplings at the front (**3F–, 3F+**)

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Variation 4 (4 + 2 valves at the rear, 3 valves at the front, front loader)

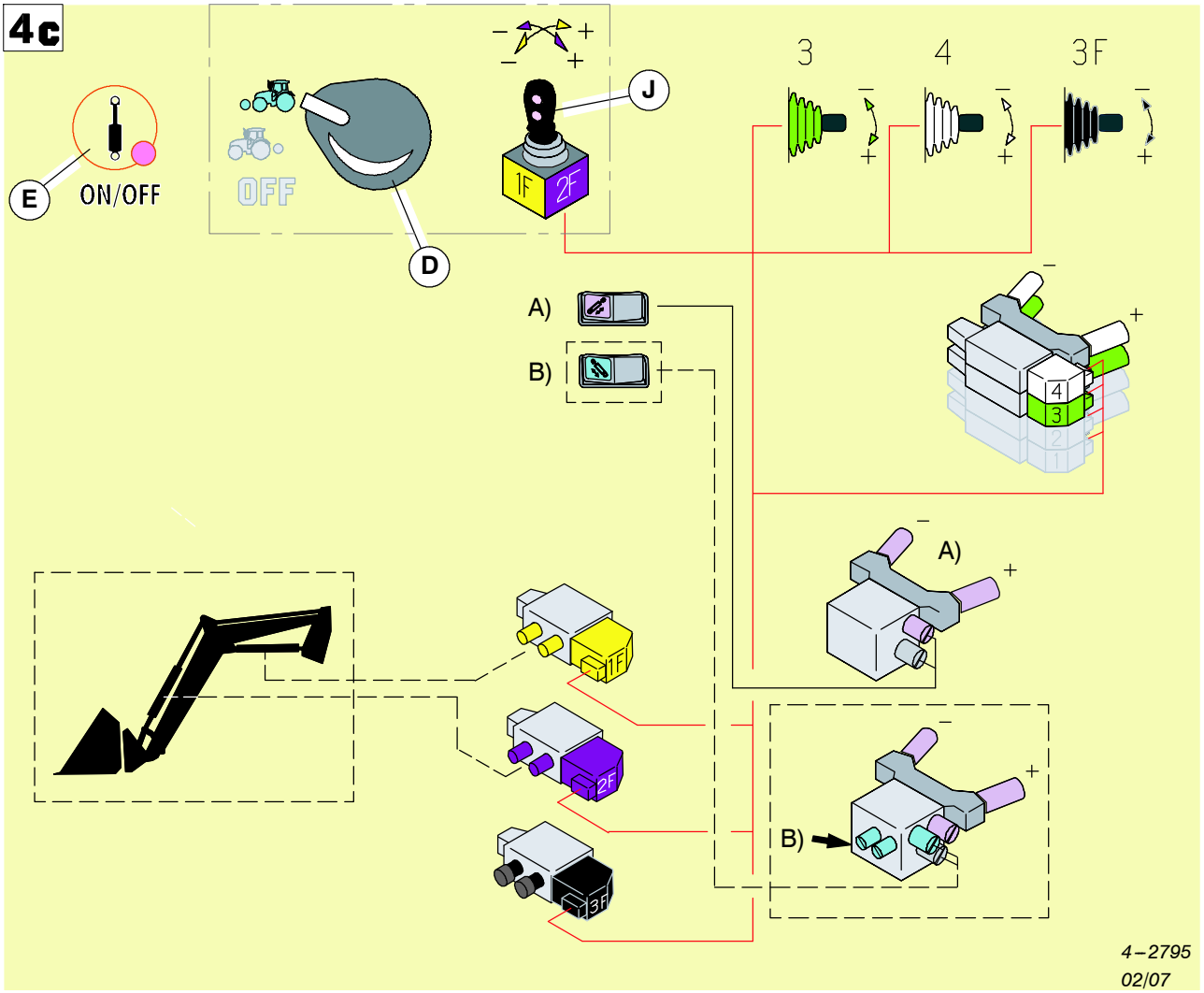
4b: The joystick functions to the rear = the switch **D** is in position ○.

Addition position **4a** functions operate also the following functions:

The hydraulics have to be activated with the switch **E**, so that the controlling levers function.

- The longitudinal movements of the joystick **J** controls the valve block **1**
  = quick couplings at the rear (**1–, 1+**).
- The transverse movements of the joystick **J** controls the valve block **2**
  = quick couplings at the rear (**2–, 2+**).

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Variation 4 (4 + 2 valves at the rear, 3 valves at the front, front loader)

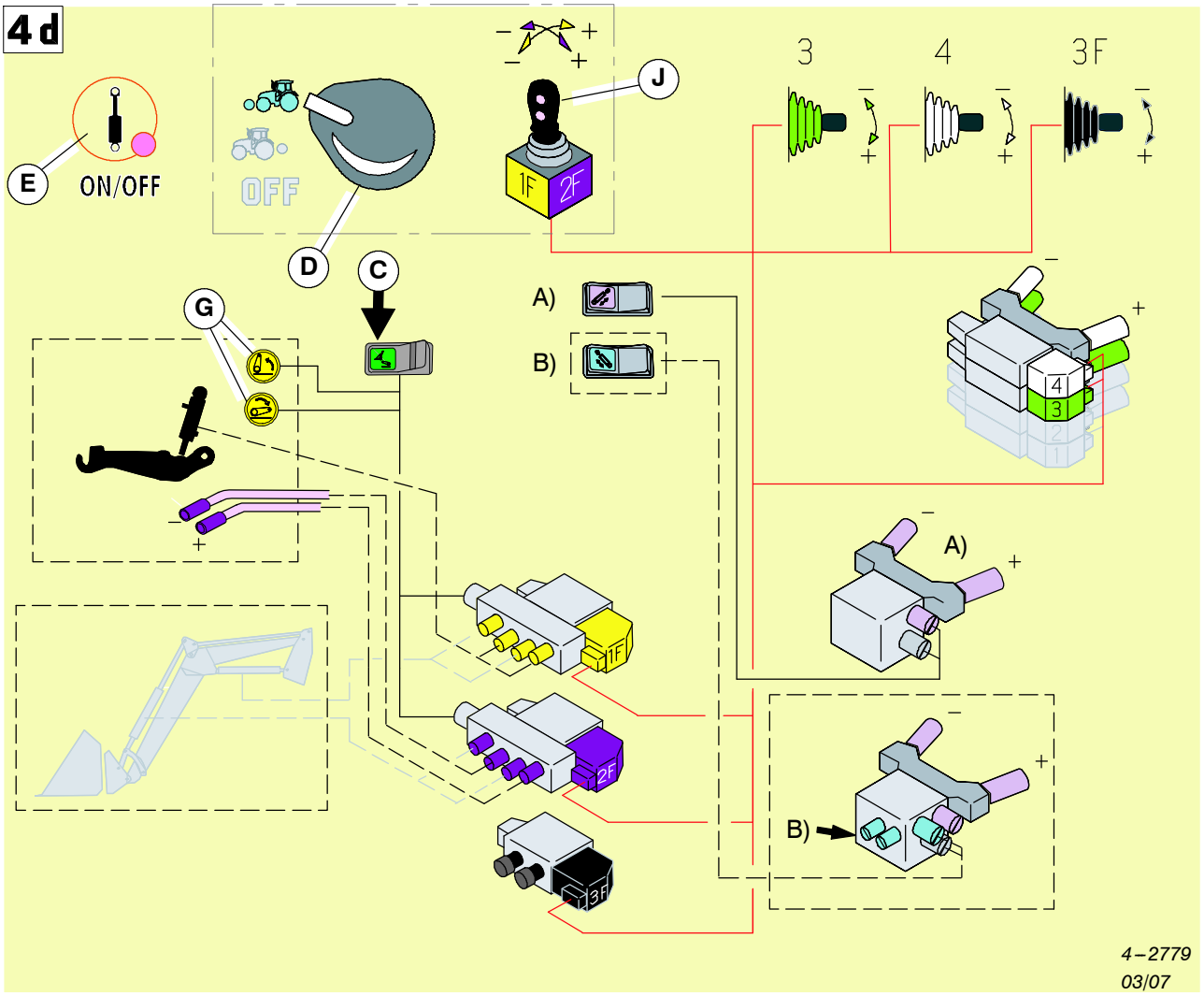
4c: The joystick functions to the front = the switch **D** is in position .

Addition position **4a** functions operate also the following functions:

The hydraulics have to be activated with the switch **E**, so that the controlling levers function.

- The longitudinal movements of the joystick **J** controls the valve block **1F**
  = the boom of the front loader, extra equipment.
- The transverse movements of the joystick **J** controls the valve block **2F**
  = bucket of the front loader (extra equipment) (**2F–, 2F+**).

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Variarion 4: (4 + 2 valves at the rear, 3 valves at the front, from which 2 x 6/2, front loader + front linkage)

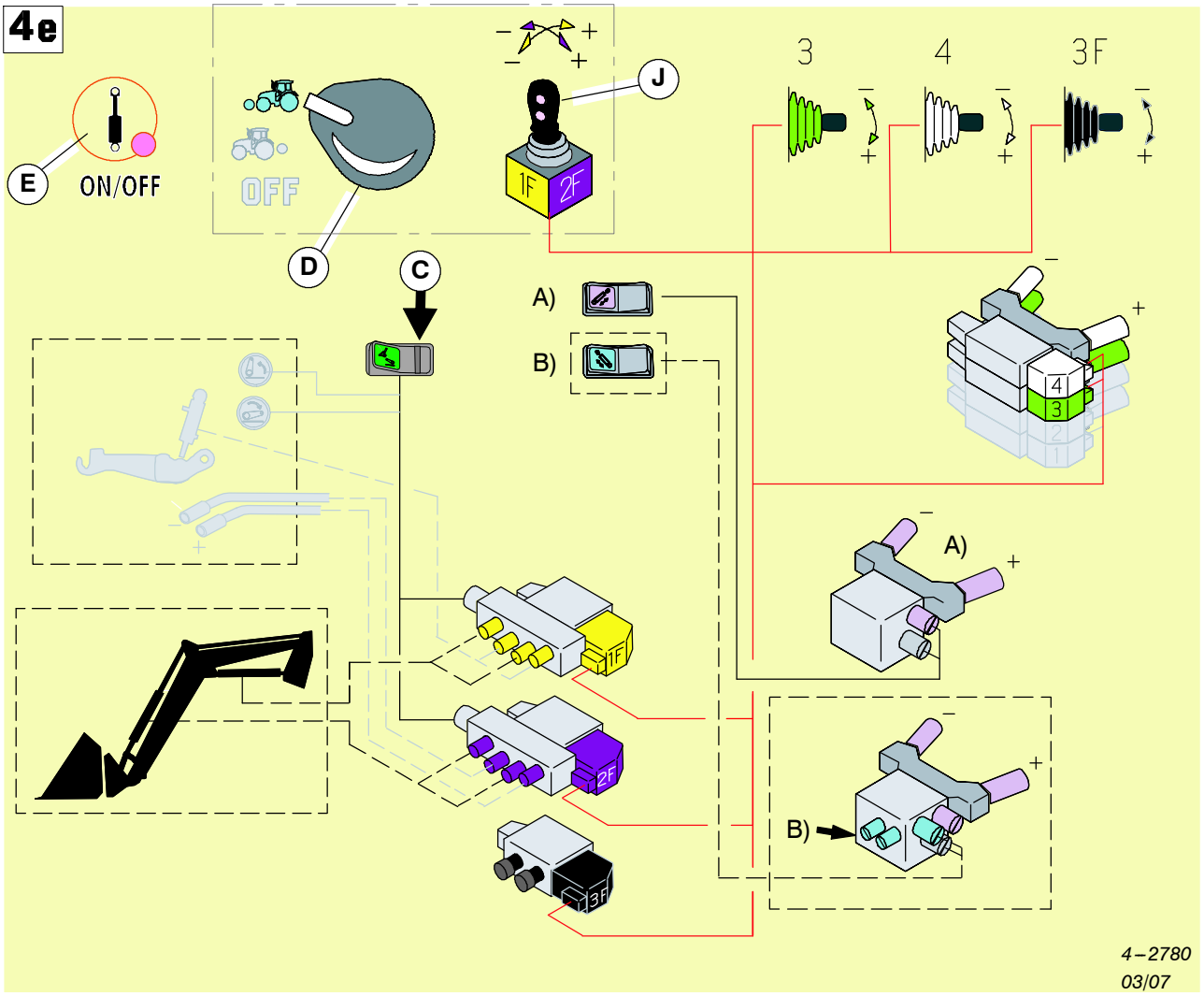
4d:The joystick functions to the front = the switch D is in the position

Addition position **4a** functions operate also the following functions:

The hydraulics have to be activated with the switch **E**, so that the controlling levers function.

- The symbolside of the change–over switch **C** pressed down:
- The longitudinal movements of the joystick **J** controls the valve block **1F**
  = the front linkage, extra equipment.
- The transverse movements of the joystick **J** controls the valve block **2F**
  = quick couplings at the front (**2F–, 2F+**).
- The front linkage can also be controlled by the front switch (**G**).

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Variation 4: (4 + 2 valves at the rear, 3 valves at the front, from which 2 x 6/2, front loader + front linkage)

4e: The joystick functions to the front = the switch D is in the position .

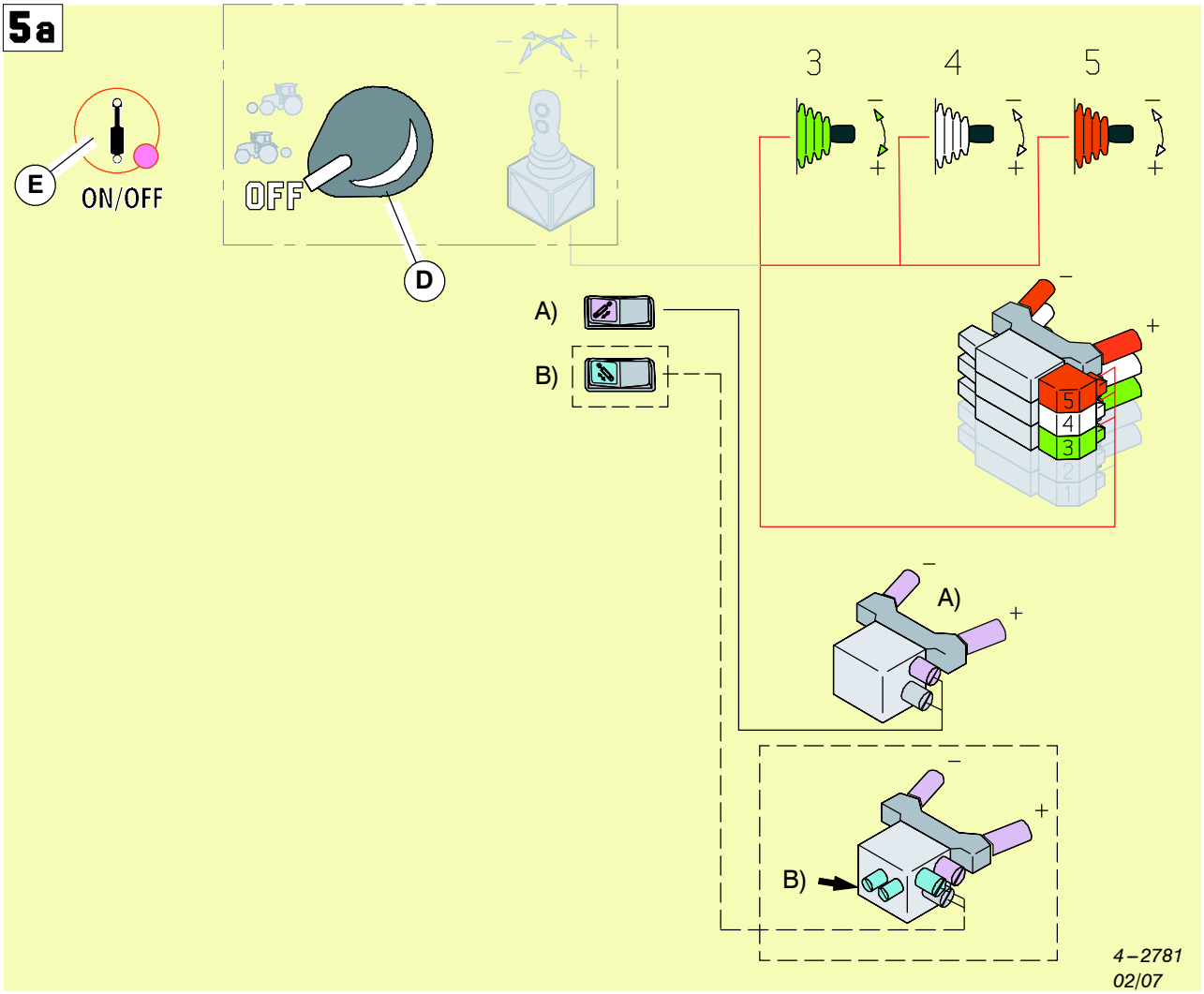
Addition position **4a** functions operate also the following functions:

The hydraulics have to be activated with the switch **E**, so that the controlling levers function.

The opposite side to the symbol of the change–over switch **C** pressed down:

- The longitudinal movements of the joystick **J** controls the valve blocks **1F**
  = the boom of the front loader, extra equipment.
- The transverse movements of the joystick **J** controls the valve blocks **2F**
  = bucket of the front loader, extra equipment.

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Variation 5 (5 + 2 valves at the rear)

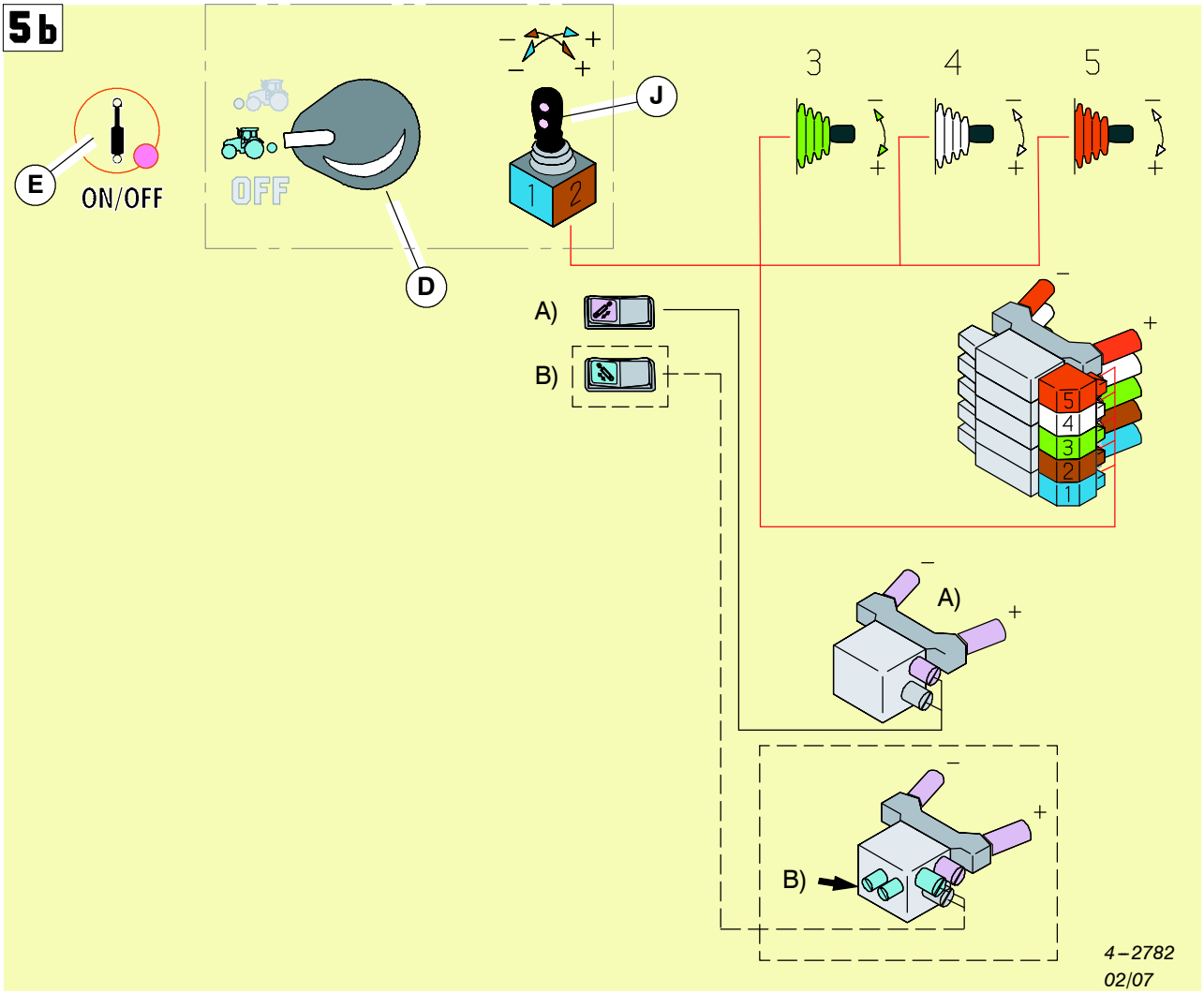
5a: The joystick functions are not activated = the switch **D** is in the OFF–position.

- The upper on/off rocker switch (**A**) of the RH side panel (not adjustable), controls the rear valve blocks, quick couplings at the rear (**A+, A–**) e.g for the hydraulic top link.
- The lower on/off rocker switch (**B**) of the RH side panel, extra equipment (not adjustable), controls the solid mounted implement e.g the levelling gear, hydraulic extension of the trailer hitch etc.

The hydraulics have to be activated with the switch **E**, so that the controlling levers function:

- The lever **3** controls the valve block 3 = quick couplings at the rear (**3–, 3+**).
- The lever **4** controls the valve blocks 4 = quick couplings at the rear (**4–, 4+**).
- The lever **5** controls the valve block 5 = quick couplings at the rear (**5–, 5+**).

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Variation 5 (5 + 2 valves at the rear)

5b: The joystick functions to the rear = the switch D is in the position ○ .

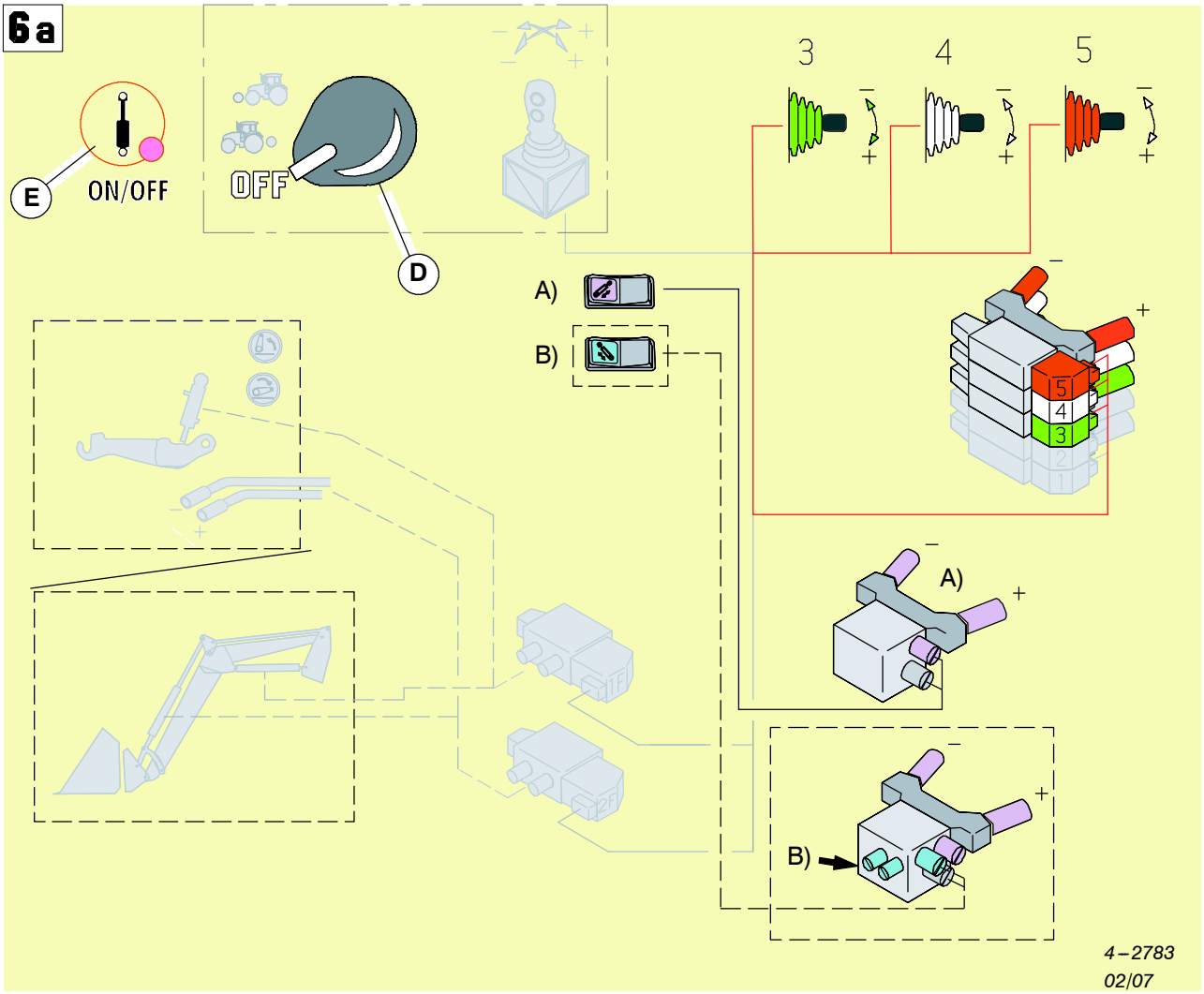
Addition position **5a** functions operate also the following functions:

The hydraulics have to be activated with the switch **E**, so that the controlling levers function.

– The longitudinal movements of the joystick **J** controls the valve block **1**
= quick couplings at the rear (**1–, 1+**).

– The transverse movements of the joystick **J** controls the valve blocks **2**
= quick couplings at the rear (**2–, 2+**).

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Variation 6 (5 + 2 valves at the rear, 2 valves at the front, front loader or front linkage)

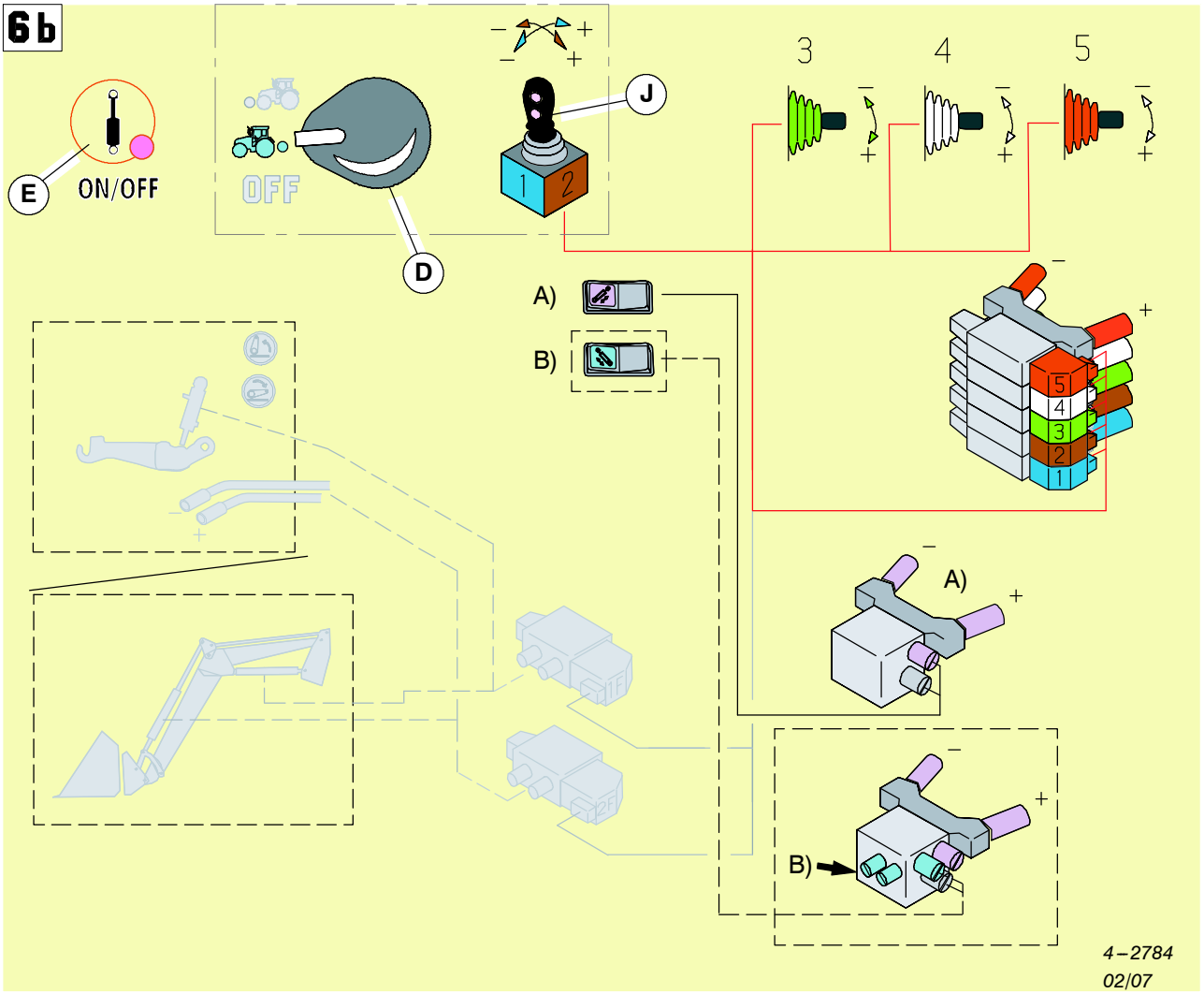
6a: The joystick functions are not activated = the switch D is in the OFF–position.

- The upper on/off rocker switch (**A**) of the RH side panel (not adjustable), controls the rear valve blocks, quick couplings at the rear (**A+, A–**) e.g for the hydraulic top link.
- The lower on/off rocker switch (**B**) of the RH side panel, extra equipment (not adjustable), controls the solid mounted implement e.g the levelling gear, hydraulic extension of the trailer hitch etc.

The hydraulics have to be activated with the switch **E**, so that the controlling levers function:

- The lever **3** controls the valve blocks 3 = quick couplings at the rear (**3–, 3+**).
- The lever **4** controls the valve blocks 4 = quick couplings at the rear (**4–, 4+**).
- The lever **5** controls the valve blocks 5 = quick couplings at the rear (**5–, 5+**).

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Variation 6 (5 + 2 valves at the rear, 2 valves at the front, front loader or front linkage)

6b: The joystick functions to the rear = the switch D is in the position .

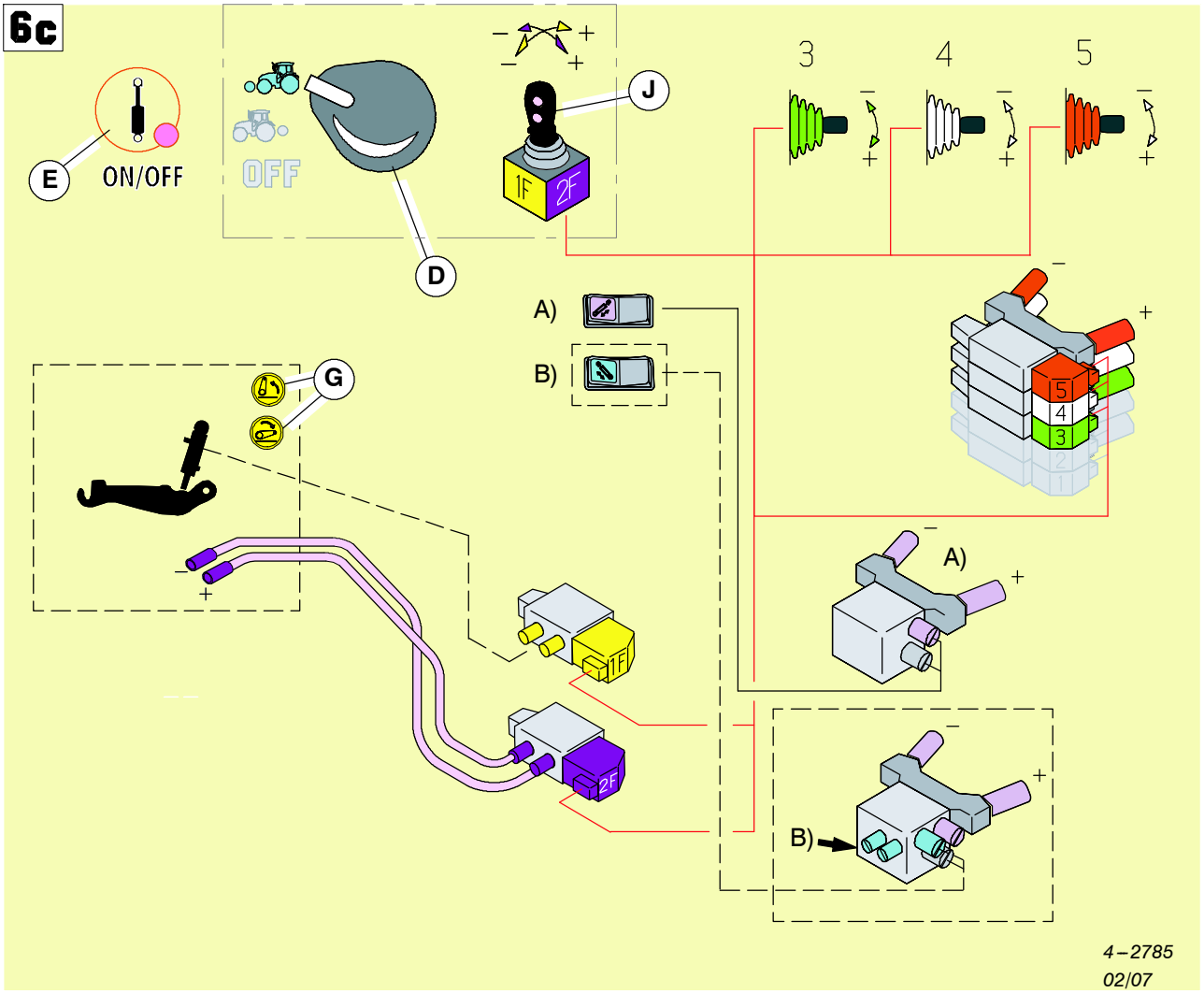
Addition position **6a** functions operate also the following functions:

The hydraulics have to be activated with the switch **E**, so that the controlling levers function.

– The longitudinal movements of the joystick **J** controls the valve block **1**
= quick couplings at the rear (**1–, 1+**).

– The transverse movements of the joystick **J** controls the valve blocks **2**
= quick couplings at the rear (**2–, 2+**).

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Variation 6 (5 + 2 valves at the rear, 2 valves at the front, front linkage)

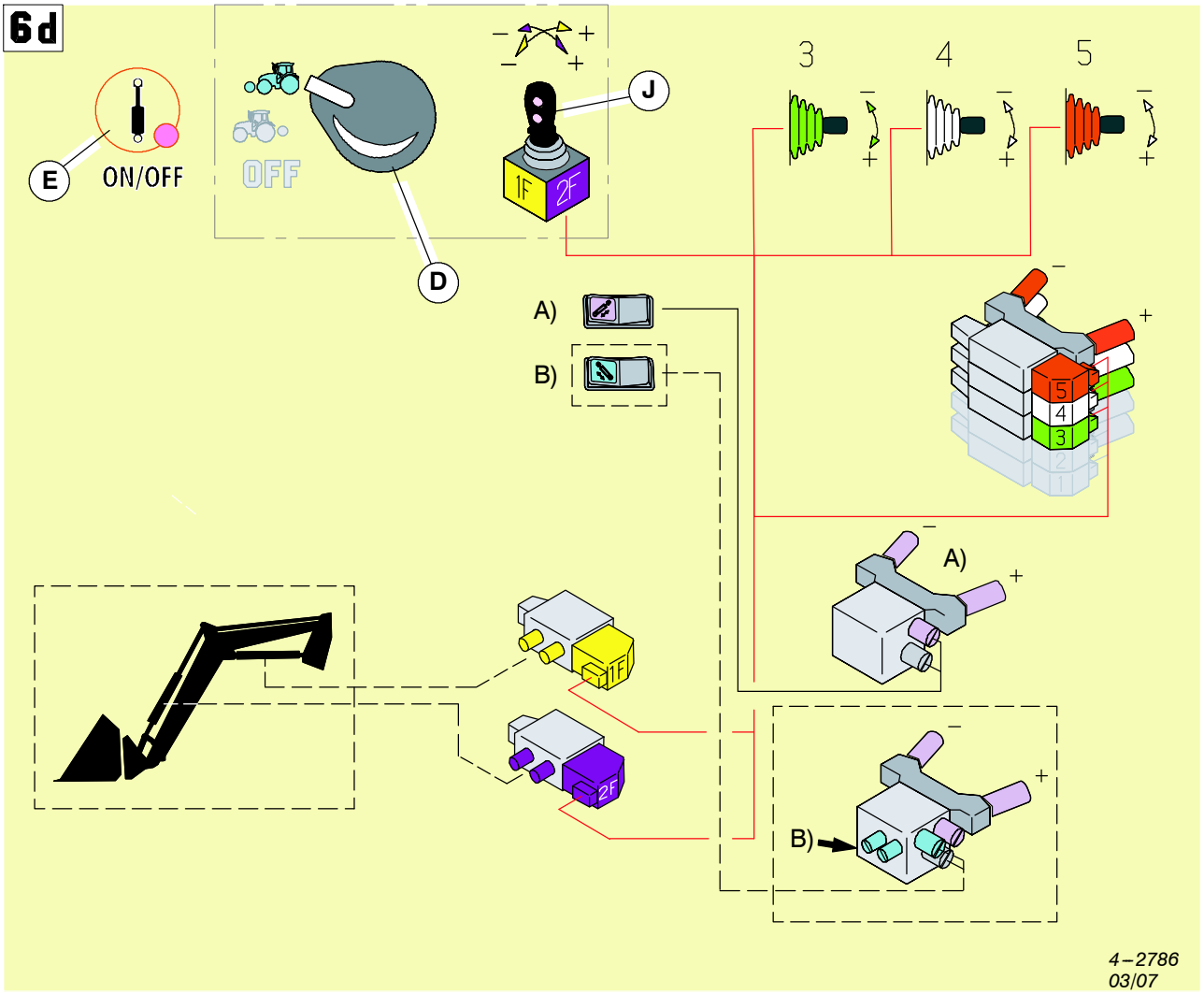
6c: The joystick functions to the front= the switch D is in the position .

Addition position 6a functions operate also the following functions:

The hydraulics have to be activated with the switch **E**, so that the controlling levers function.

- The longitudinal movements of the joystick **J** controls the valve blocks **1F**
  = the front linkage, extra equipment.
- The transverse movements of the joystick **J** controls the valve blocks **2F**
  = quick couplings at the front (**2F–, 2F+**).
- The front linkage can also be controlled by the front switch (**G**).

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Variation 6 (5 + 2 valves at the rear, 2 valves at the front, front loader)

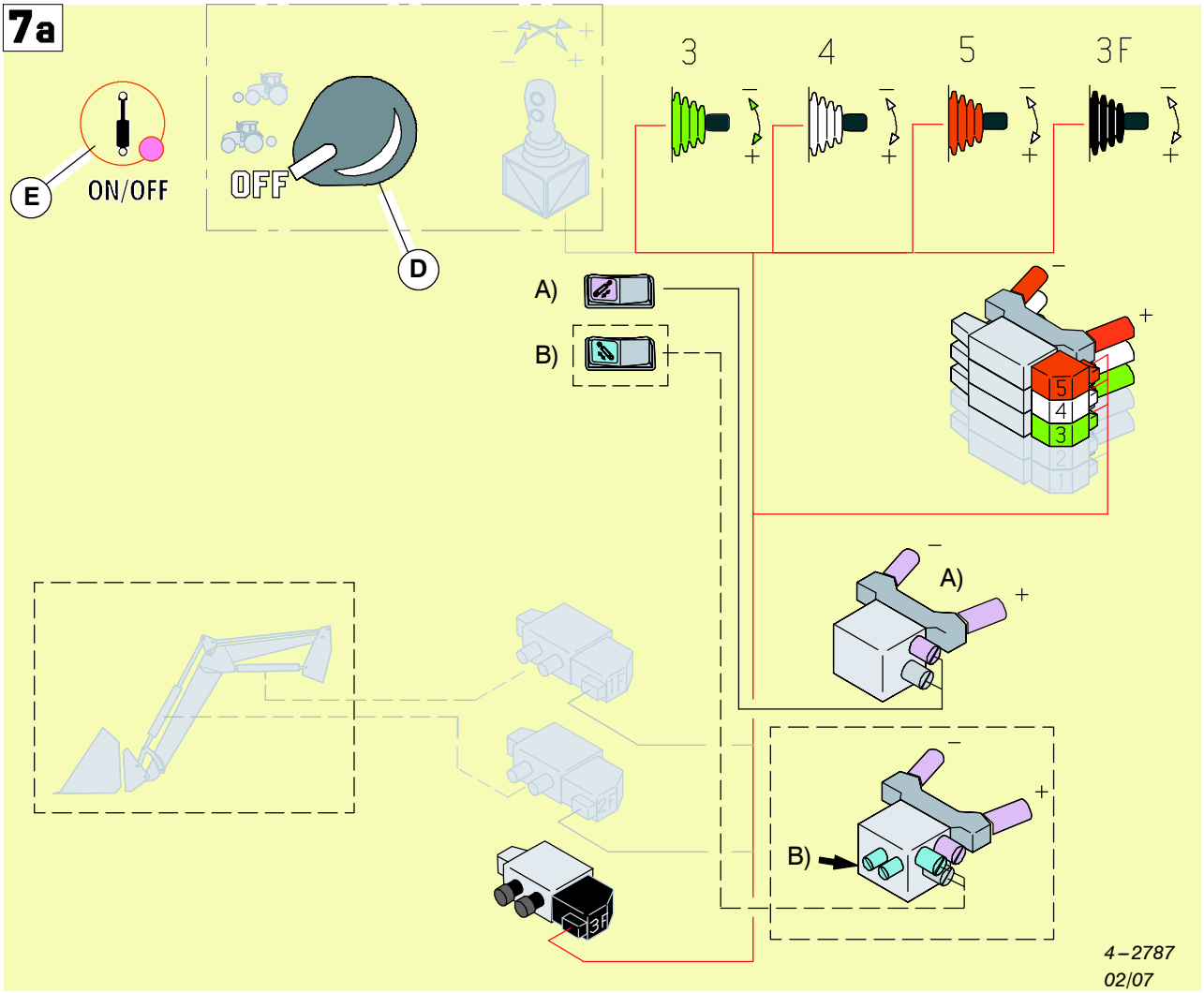
6d: The joystick functions to the front= the switch D is in the position .

Addition position **6a** functions operate also the following functions:

The hydraulics have to be activated with the switch **E**, so that the controlling levers function.

- The longitudinal movements of the joystick **J** controls the valve block **1F**
  = the boom of the front loader, extra equipment.
- The transverse movements of the joystick **J** controls the valve block **2F**
  = bucket of the front loader, extra equipment.

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Variation 7 (5 + 2 valves at the rear, 3 valves at the front, front loader (+2 x 6/2+front linkage))

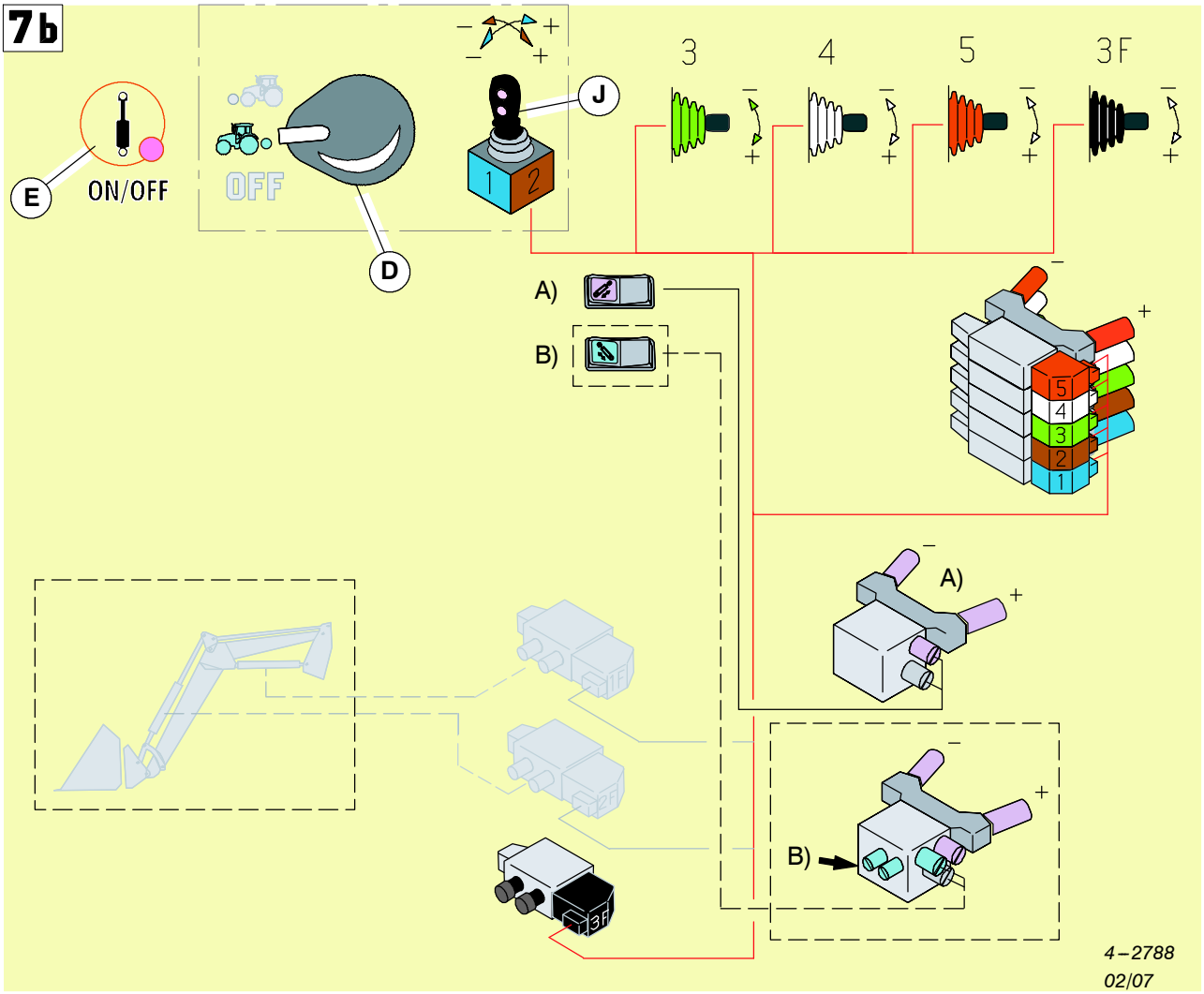
7a: The joystick functions are not activated = the switch D is in the OFF–position.

- The upper on/off rocker switch (**A**) of the RH side panel (not adjustable), controls the rear valve blocks, quick couplings at the rear (**A+, A–**) e.g for the hydraulic top link.
- The lower on/off rocker switch (**B**) of the RH side panel, extra equipment (not adjustable), controls the solid mounted implement e.g the levelling gear, hydraulic extension of the trailer hitch etc.

The hydraulics have to be activated with the switch **E**, so that the controlling levers function:

- The lever **3** controls the valve block **3** = quick couplings at the rear (**3–, 3+**).
- The lever **4** controls the valve block **4** = quick couplings at the rear (**4–, 4+**).
- The lever **5** controls the valve block **5** = quick couplings at the rear (**5–, 5+**).
- The lever **3F** controls the valve blocks **3F**.

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Variation 7 (5 + 2 valves at the rear, 3 valves at the front, front loader)

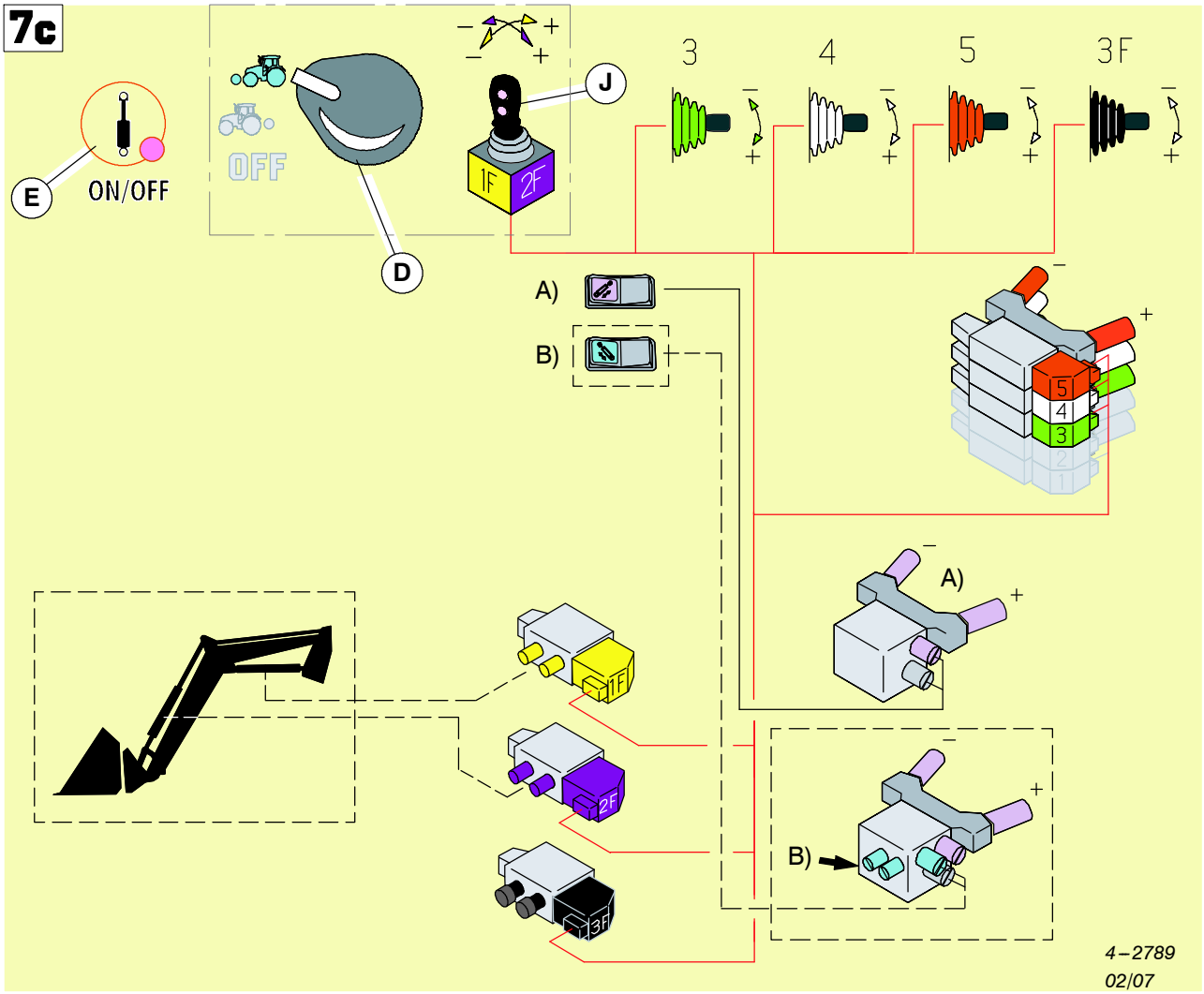
7b: The joystick functions to the rear = the switch D is in the position .

Addition position **7a** functions operate also the following functions:

The hydraulics have to be activated with the switch **E**, so that the controlling levers function.

- The longitudinal movements of the joystick **J** controls the valve block **1**
  = quick couplings at the rear (**1–, 1+**).
- The transverse movements of the joystick **J** controls the valve blocks 2
  = quick couplings at the rear (**2–, 2+**).

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Variation 7 (5 + 2 valves at the rear, 3 valves at the front, front loader)

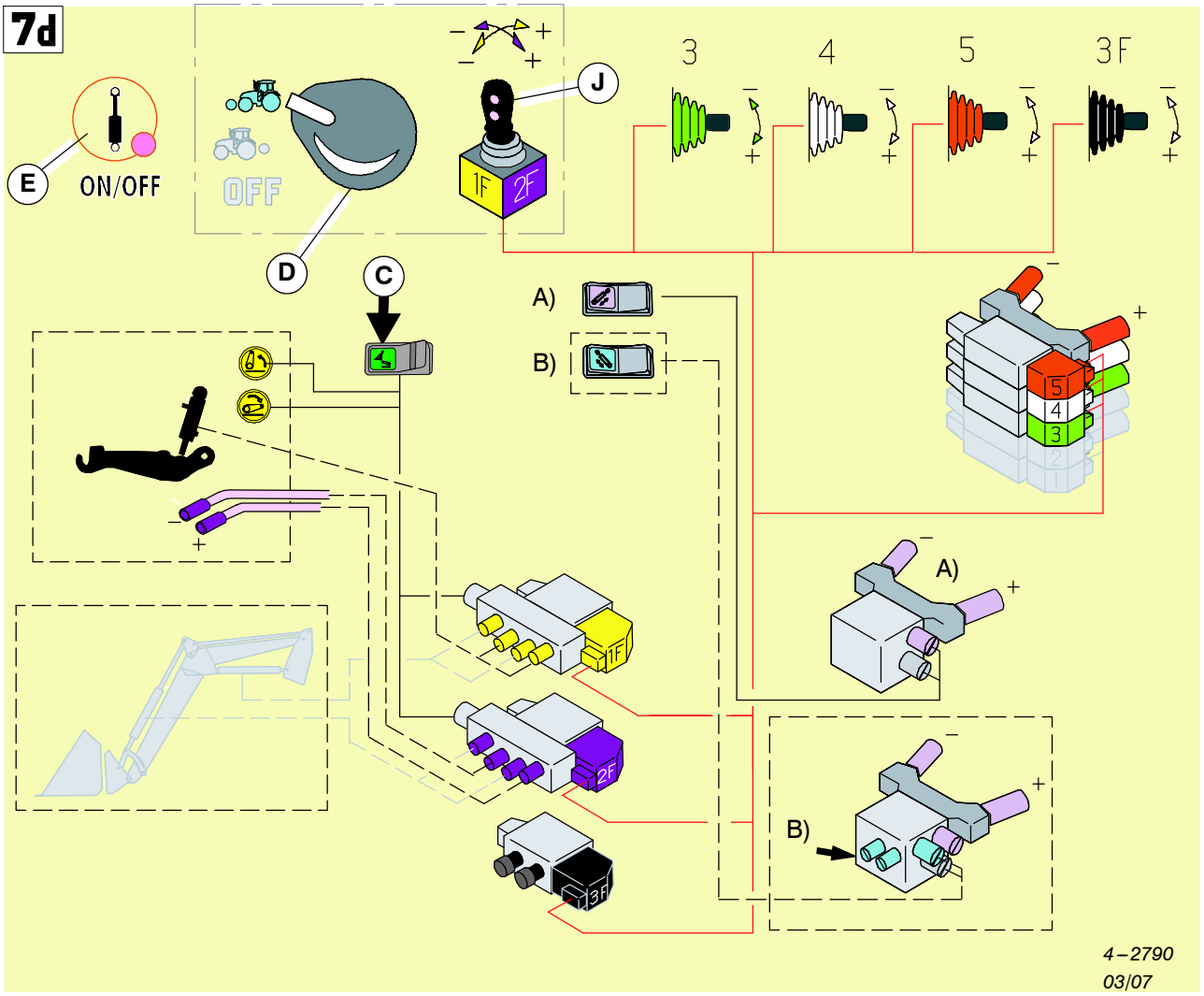
7c: The joystick functions to the front= the switch D is in the position ☼ .

Addition position **7a** functions operate also the following functions:

The hydraulics have to be activated with the switch **E**, so that the controlling levers function.

- The longitudinal movements of the joystick **J** controls the valve blocks **1F**
  = the boom of the front loader, extra equipment.
- The transverse movements of the joystick **J** controls the valve blocks **2F**
  = bucket of the front loader, extra equipment.

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Variation 7 (5 + 2 valves at the rear, 3 valves at the front, from which 2 x 6/2, front loader + front linkage)

7d: The joystick functions to the front= the switch D is in the position ☼ .

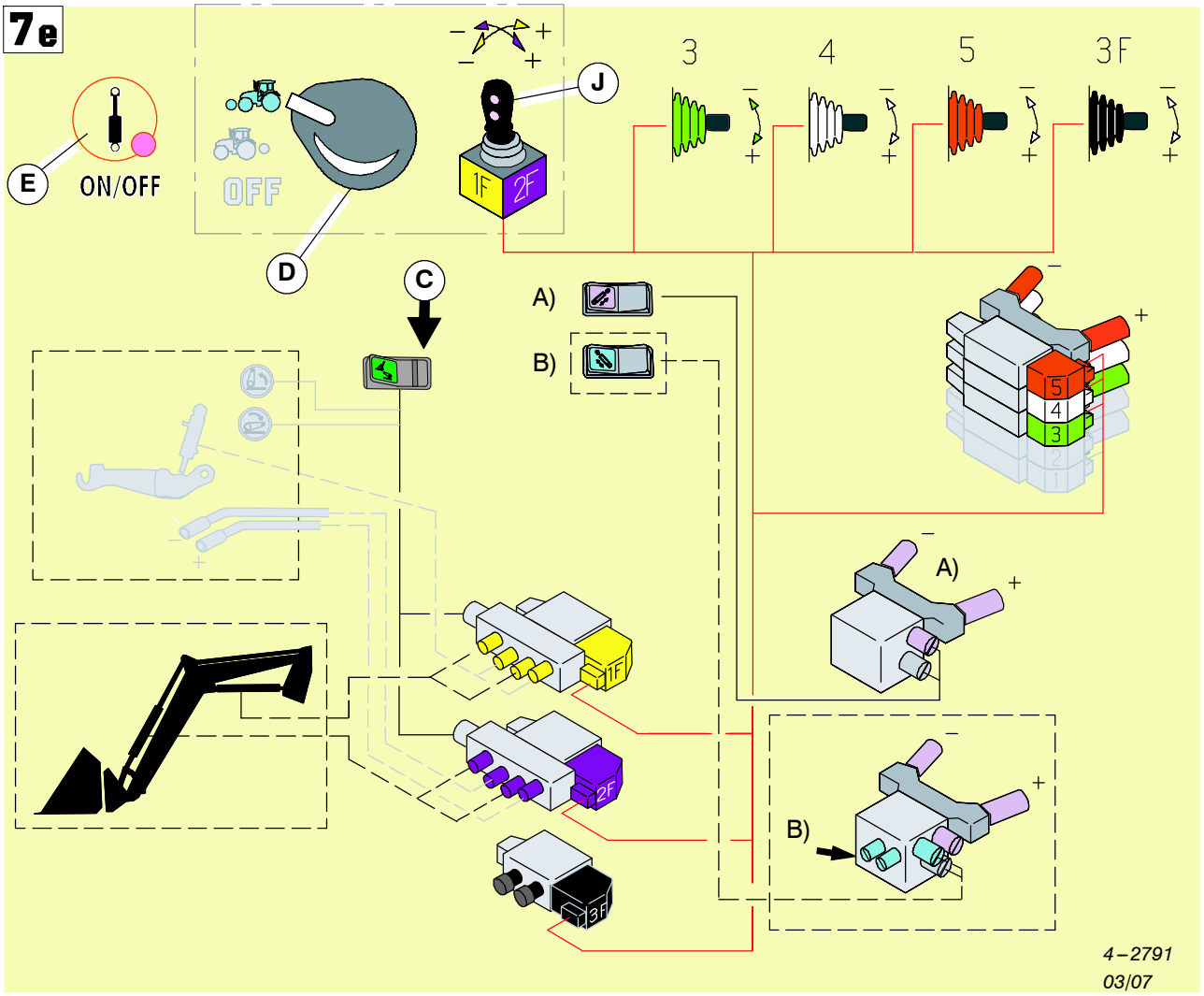
Addition position **7a** functions operate also the following functions:

The hydraulics have to be activated with the switch **E**, so that the controlling levers function.

The symbol side of the change–over switch **C** pressed down:

- The longitudinal movements of the joystick **J** controls the valve blocks **1F**
  = the front linkage, extra equipment.
- The transverse movements of the joystick **J** controls the valve blocks **2F**
  = quick couplings at the front (**2F–, 2F+**).
- The front linkage can also be controlled by the front switch (**G**).

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Variation 7 (5 + 2 valves at the rear, 3 valves at the front, from which 2 x 6/2, front loader + front linkage)

7e: The joystick functions to the front= the switch D is in the position ☼ .

Addition position **7a** functions operate also the following functions:

The hydraulics have to be activated with the switch **E**, so that the controlling levers function.

The opposite side to the symbol of the change–over switch **C** pressed down:

– The longitudinal movements of the joystick **J** controls the valve blocks **1F**
= the boom of the front loader, extra equipment.

– The transverse movements of the joystick **J** controls the valve blocks **2F**
= bucket of the front loader, extra equipment.

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Power lift hydraulics, description

T121c–T171c, T121h–T191h

The power lift control valve is fitted on the RH side of the gearbox. Pressure oil to the valve is fed from the pump via the pressure filter, via the priority valve and through the valve block.

Electrically controlled valve block conducts oil into the lifting rams, holds pressure in the rams and let oil run out in the lowering phase.

There is a shock valve in the control valve, which protects the system against the presssure peaks in the rams.

The working pressure is adjusted by the pressure relief valve fitted in the valve block.

T151eLS–T191LS

The power lift control valve is fitted under the on/off valve block on the top of PTO housing. Pressure oil to the valve is fed from the pump via the brake cooling valve and through the on/off valve block.

Electrically controlled valve block conducts oil into the lifting rams, holds pressure in the rams and let oil run out in the lowering phase.

There is a shock valve in the control valve, which protects the system against the presssure peaks in the rams.

The working pressure is adjusted by the variable displacement pump.

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Power lift control valve Bosch EHR–4 (T121c–T171c, T121h–T191h)

The valve is the same as on Valtra 6000 and 8000 series. The valve is fitted on the RH side of the gearbox. The valve regulates oil flow regardless of loading in the three–point linkage.

There are push buttons on the ends of the both solenoid valves. Thus it is possible to move the control valve main spool manually if, for instance, there is a malfunction of the control valve or if it is suspected that the hydraulic system is not functioning properly.

Note! Solenoid valves must not be connected direct to the tractor battery terminals (e.g. for testing purposes) for long periods (max 10 seconds) since the solenoids cannot withstand strong current and will be damaged
Solenoids can be changed separately. In addition, the shock valve and lowering valve can be cleaned and checked and valve springs can be changed.

Shock valve (20 MPa) protects the system against the presssure peaks in the rams.

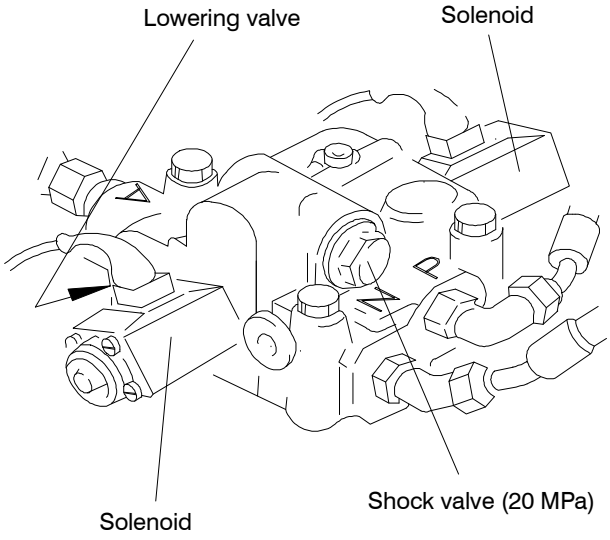


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Control valve in the neutral position

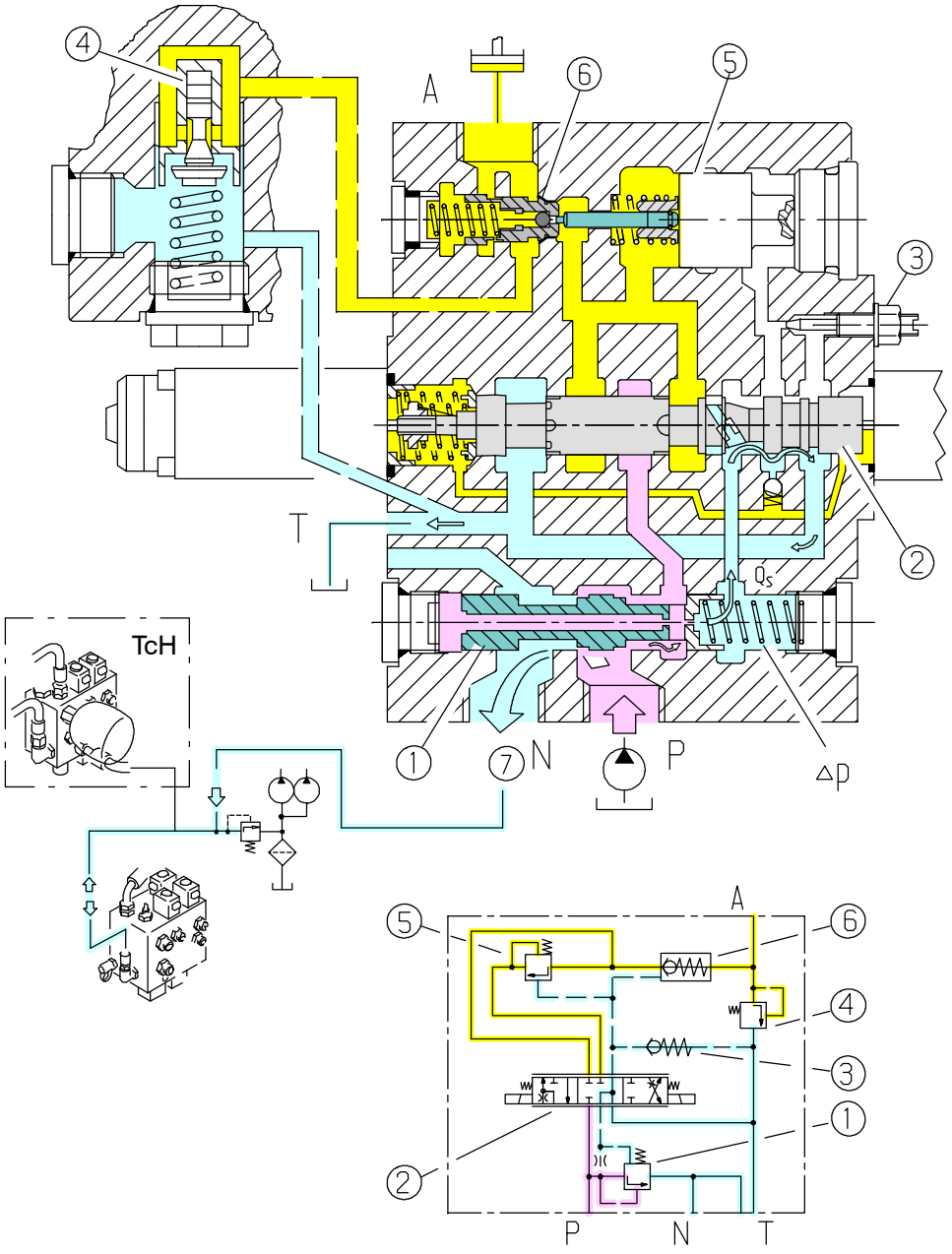


fig002

Function

When the tractor is started, oil flows from the pump (through valves for auxiliary hydraulics) via port **P** to the left end of the slide **1** through a drilling in the middle of the slide. The slide is then pushed to the right against a spring and opens the unloading circuit between ports **P** and **N**.

Oil also flows through a passage to the right end of the slide **1**. The constant oil flow (Qs) via the main spool **2** causes pressure loss on the spring side end of the slide **1**. This pressure loss keeps the slide **1** open. The pump is now in free circulation. The main spool **2** is held in the middle position by the action of the centring springs (left end of slide). The load (+ spring) keeps the lowering valve **6** closed.

1) 3–way oil flow regulating slide.
   This valve can be opened and cleaned. The valve slide must move easily in its boring.
2) Main spool
3) Pilot pressure limiting valve (lowering)
   The valve plug must not be screwed fully home but is must be open 1/2–1 turn.
4) Shock valve (20 MPa)
   If the lift does not hold the load, the possible fault can also be leaking shock valve.
   In this case, open and clean the shock valve and, if necessary, change the valve spring or adjust it with shims.
5) Lowering valve pilot piston
6) Lowering valve
   If the hydraulic power lift makes many lifting corrections (reactions) per minute when a weight is attached to the three–point linkage, a possible fault can be faulty lowering valve (or its pilot piston). In this case, the lowering valve can be disassembled and cleaned as well as the pilot piston. **Note!** If the lift does not hold the load, possible fault can also be leaky lifting cylinder piston seal.
7. Oil to valve block

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Control valve in the lifting position

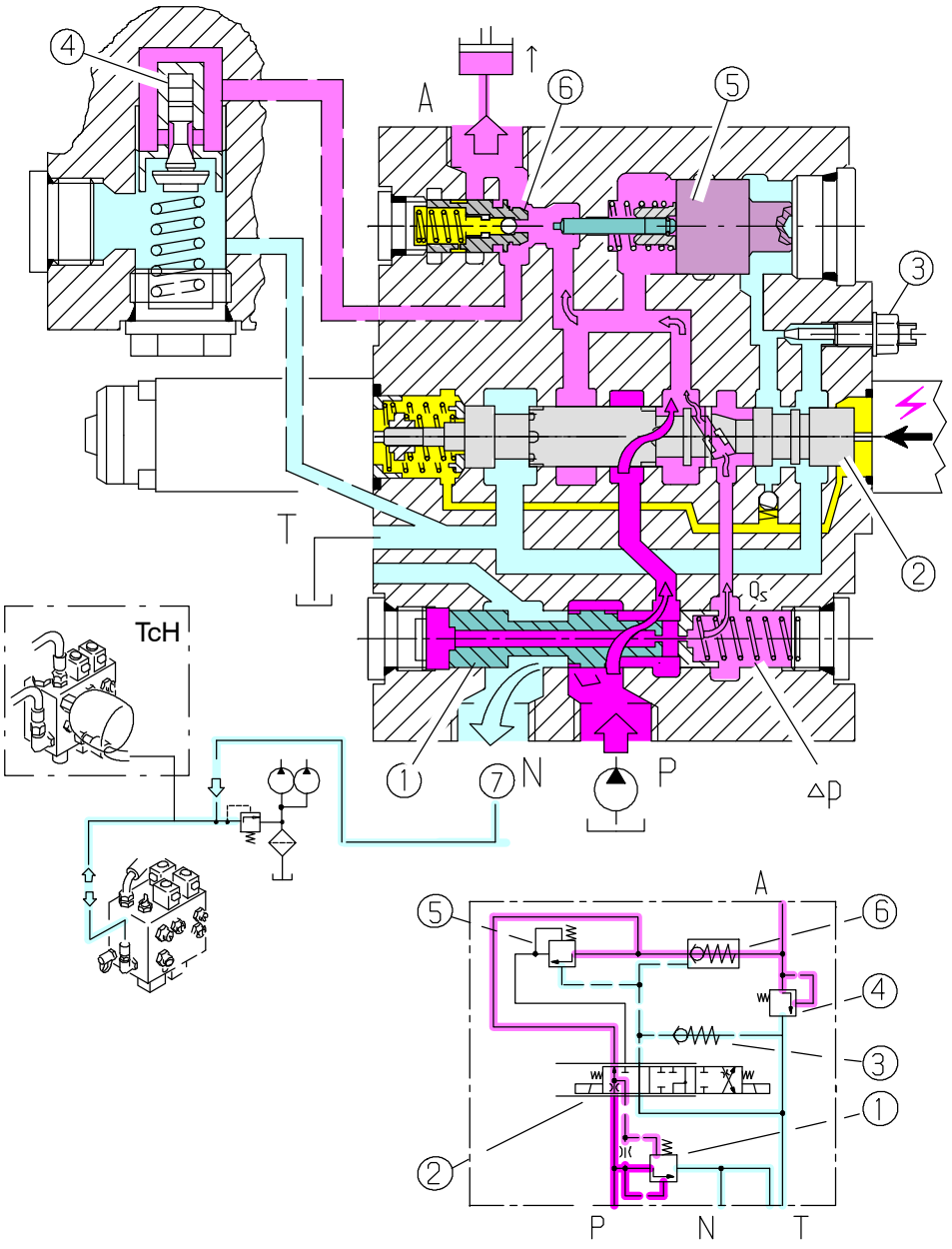


fig003

Function

In the lifting position the RH solenoid is energized. The magnet presses the main spool **2** to the left against the centring spring. Then it opens the passage from the slide **1** to the lifting cylinders by an amount proportional to the strength of the current supplied to the RH solenoid.

The right end of the slide **1** is under lifting cylinder pressure. Pump pressure becomes equal in value to lifting cylinder pressure + pilot pressure (=spring). The pressure difference through the restriction of the main spool **2** is always equal to pilot pressure so the oil flow depends only on the position of the main spool **2** (and oil viscosity).

The lifting solenoid is controlled so that in the beginning and in the end of the lifting movement, the solenoid current is cut a period of some milliseconds, so that the movement becomes smooth. The actual lifting movement is carried out with full current (otherwise as in the lowering position).

Excess oil from the pump flows via slide **1** to the **N** passage (to the valve block).

1) 3–way oil flow regulating slide.
2) Main spool
3) Pilot pressure limiting valve (lowering)
4) Shock valve (20 MPa)
5) Lowering valve pilot piston
6) Lowering valve
7) Oil to valve block

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Control valve in the lowering point

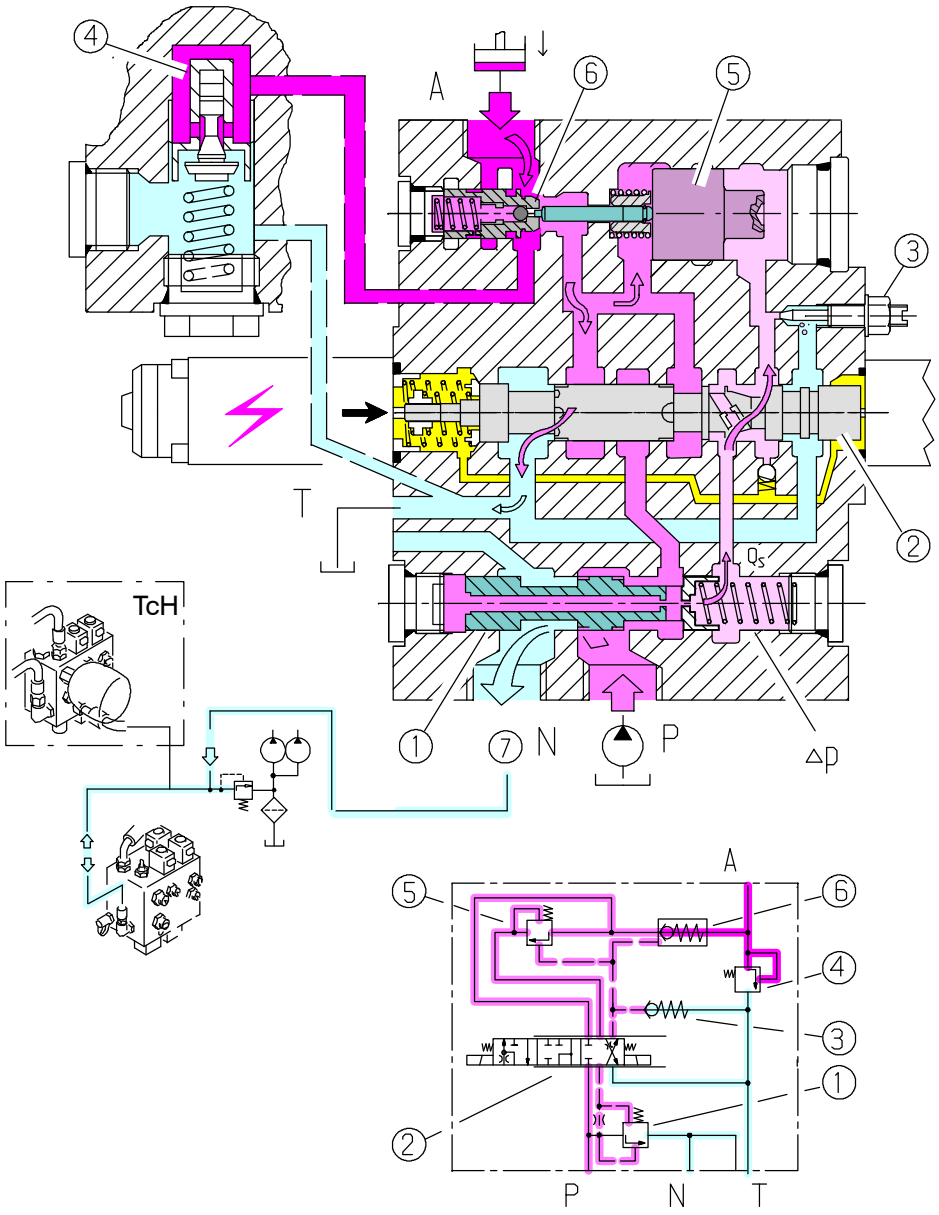


fig004

Function

In the lowering position the LH side solenoid is energized.The magnet presses the main spool **2** to the right against the inner spring. The spool opens the passage between the lowering valve **6** and tank **T**.

At the same time the spool **2** also allows oil (Qs) to flow behind the pilot piston **5**. The piston moves to the left and opens the lowering valve pilot ball. The pressure behind the lowering valve decreases (compared with the pressure in the working line) and the lowering valve opens and allows oil to flow from the lifting cylinders to the tank.

The return oil flow pressure also acts on the front side of the piston **5**. If this pressure reached a sufficient level (greater than the force of pressure Qs), the holding valve stops the flow.

Therefore the return flow does not depend on the pressure caused by the load on the three point linkage. The rate (lowering speed) of the return flow is proportional to the current supplied to the solenoid for lowering.

The pilot pressure limiting valve **3** sets a pressure difference which acts over the main spool **2** when the load is being lowered.The free circulation circuit from the pump **P** to the **N** passage functions as in the neutral position.

1) 3–way oil flow regulating slide
2) Main spool
3) Pilot pressure limiting valve (lowering)
4) Shock valve (20 MPa)
5) Lowering valve pilot piston
6) Lowering valve
7) Oil to valve block

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Power lift control valve Bosch EHR 23–LS (T151eLS–T191LS)

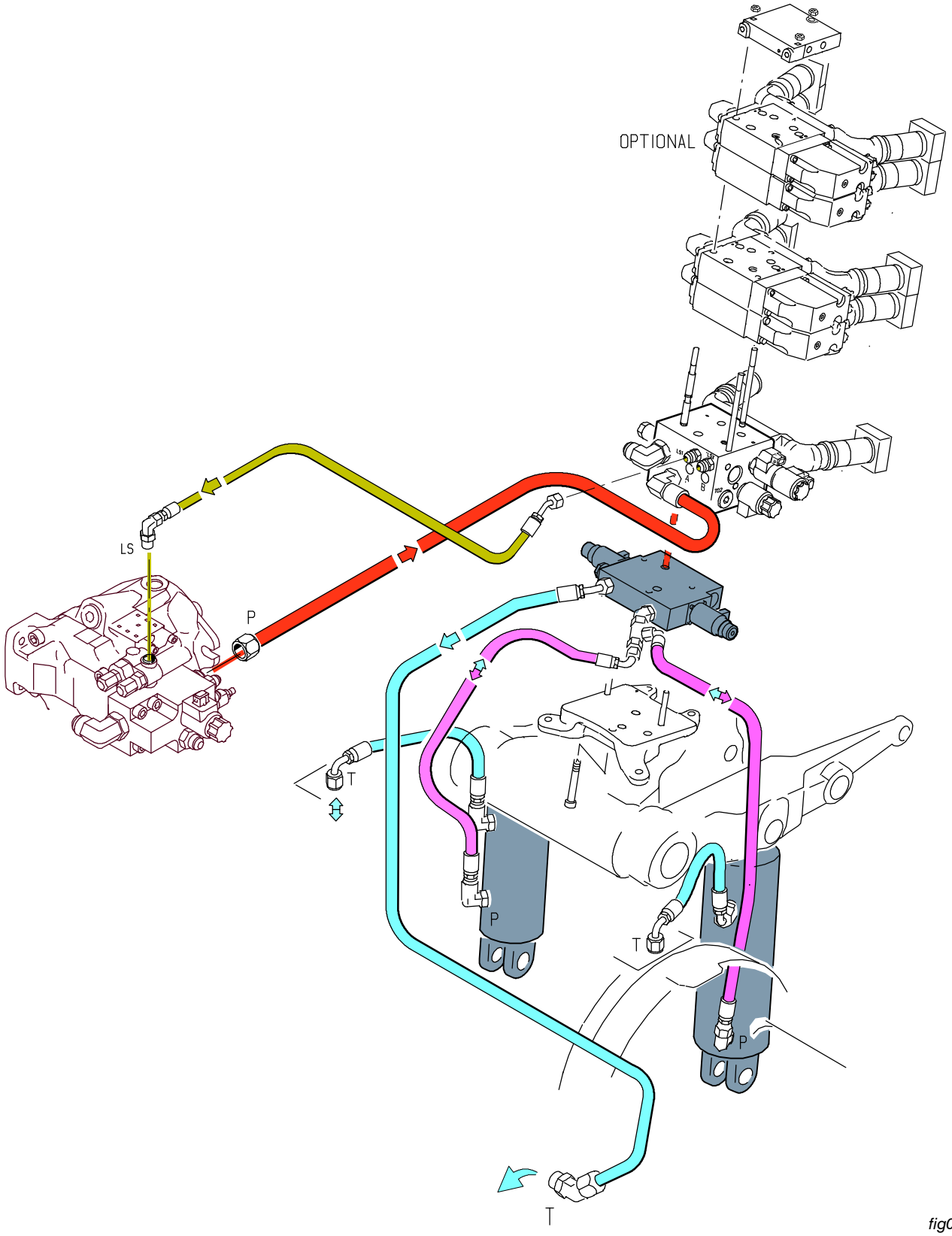


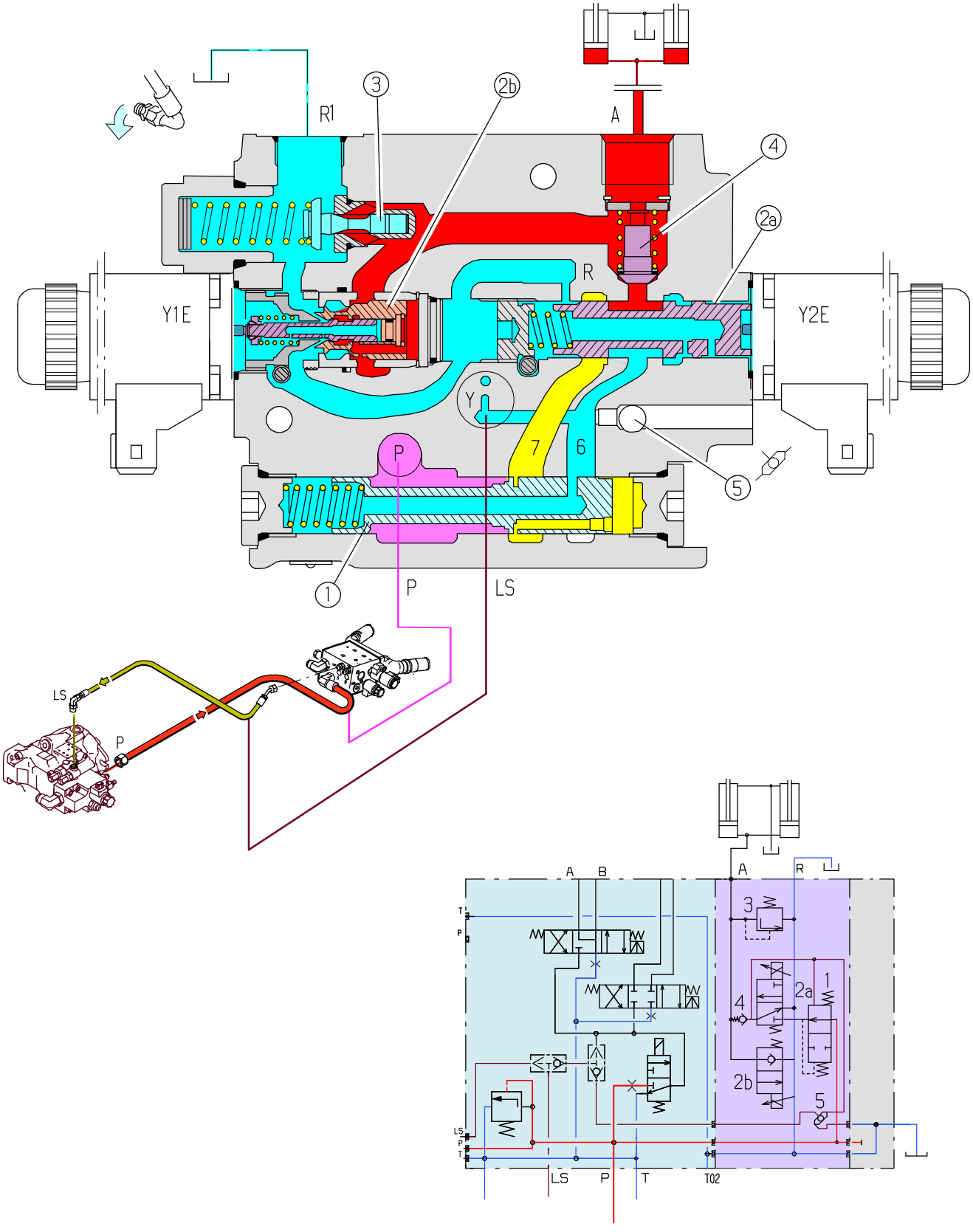
fig045

Note! The proportional valves must not be connect directly to the battery voltage (allowable time max. 10 second) for testing purposes. The valves do no withstand such a high voltage.

The solenoids can be changed separately. In addition, the shock valve and the holding valve can be opened and cleaned and the damaged parts can be replaced into new ones.

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Control valve in neutral position



4–2261
02/08

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Function (in the neutral position):

In the neutral position both solenoids are unenergized and the springs centralise the control spools (**2a**, **2b**) so that oil pressure is kept in the rams. Pressure peaks from the rams can discharge via the shock valve (**3**).

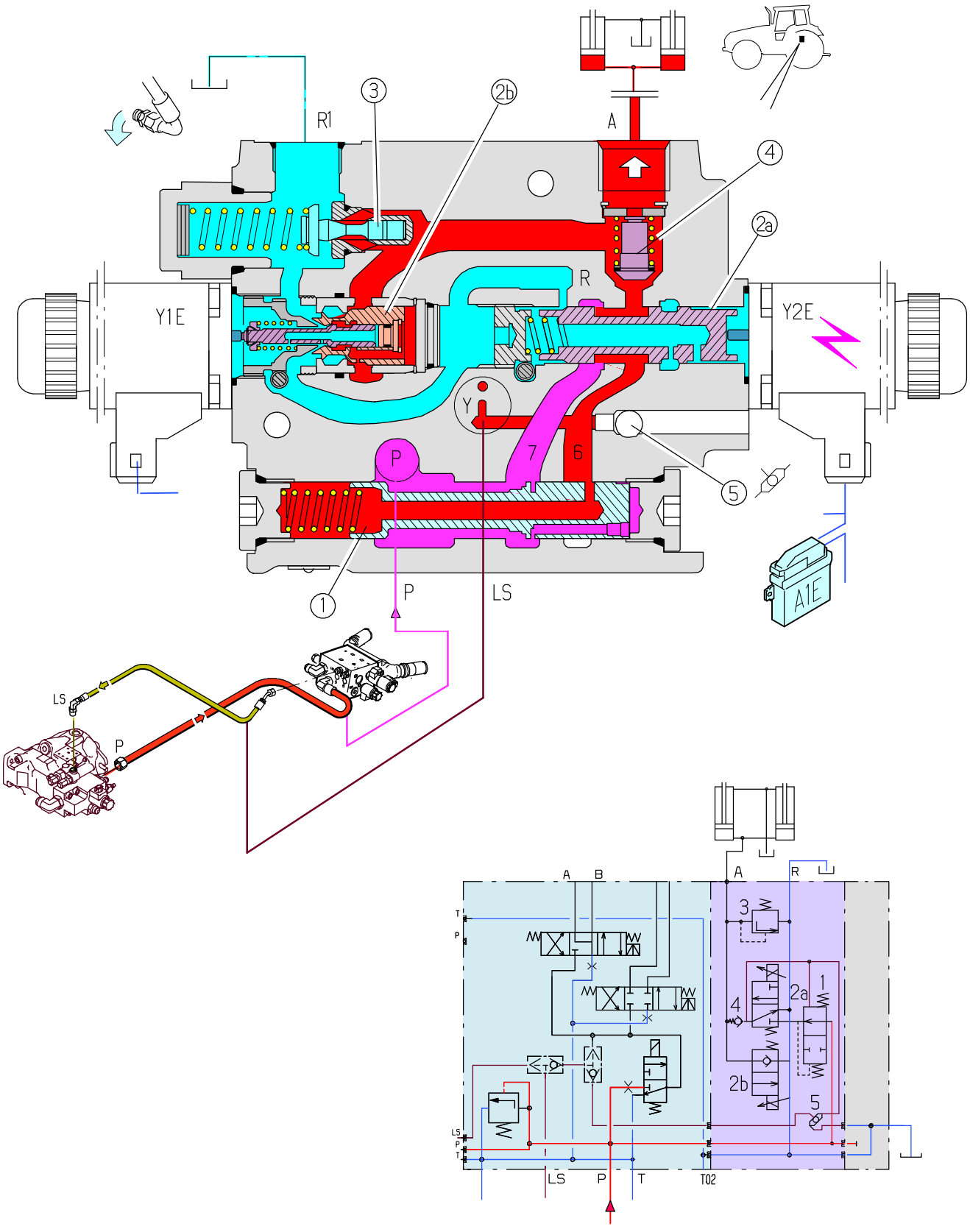
When the engine is started and the power lift is not used, there is pressure in the right end of the spool (**1**). This pressure can be either small or high, depending on the use of the other hydraulic valves, and it moves the spool (**1**) to the left against the spring. The spool closes the port to the channel (**7**). The pump LS–pressure in passage (**6**) is near zero. The pressure on both ends of the spool (**1**) is balanced. Thus, in the channel (**7**) and also on the right end of the spool there is a low pressure which corresponds to the spring force.

The oil channel between pressure space **P** and the spool (**2a**) is closed.

1) 2–way oil flow regulating spool (pressure balance)
2a) Control spool, lifting
2b) Control spool, lowering
3) Shock valve
4) Holding valve
5) Change–over valve
T) To tank
LS) Pump LS–pressure
A) Ram pressure
P) Pump pressure

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Control valve in lifting position



4–2262
02/08

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Function (lifting):

In the lifting phase the LH side lifting solenoid (**Y2E**) is energized and it pushes the control spool (**2a**) to the left (see picture).

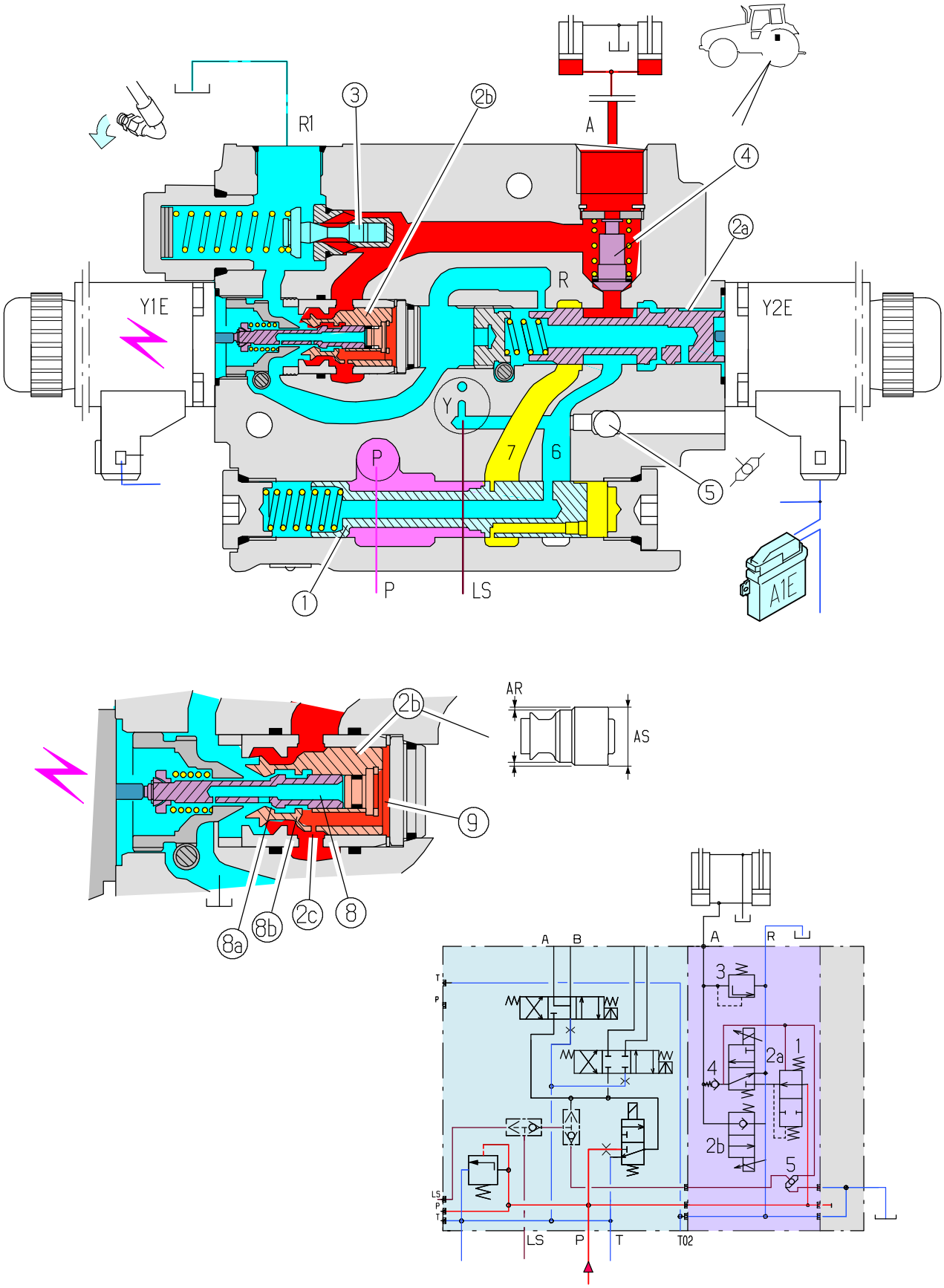
When the lower links start to lift, the pressure in the pump LS – space in the channel (**6**) starts to increase. This pressure is transferred to the left end of the spool (**1**) and presses the spool to the right. Oil channel (**7**) from the pump pressure channel **P** to the control spool (**2a**) opens. When the spool (**2**a) has been moved to the left by the lifting solenoid, it opens the channel via the holding valve (**4**) to the lifting rams and the lower links start to raise. The control spool (**2b**) is forced to the middle position by springs and pressure oil from the rams cannot flow into the tank channel (**T**). In the lifting phase, the pump pressure **P** always exceeds the LS – pressure by the pressure difference. (The pressure difference is generatedby the spring of the free flow valve.)

The lifting solenoid is controlled so that in the beginning and end of the lifting phase the supply current is decreased, which causes the final movement to occur smoothly. The actual lifting movement occurs with full current supply. (In the lowering position the current supply can be adjusted with switches to obtain different lowering speeds.)

1) 2 – way oil flow regulating spool (pressure balance)
2a) Control spool, lifting
2b) Control spool, lowering
3) Shock valve
4) Holding valve
5) Change – over valve
T) To tank
LS) Pump LS – pressure
A) Ram pressure
P) Pump pressure

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Control valve in lowering position



4–2263
02/08

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Function (lowering):

The most important parts of the lowering function are the pre–steering spool (**8**) with bores and main spool (**2b**). Spring **8c** pulls the pre–steering spool **8** to the left against the seat **8a**. Since the pre–steering seat is integrate machined in the main spool, it is also pulled to the left against the main seat. The pre–steering spool is in a pressure balance by means of passage **8**. The same does not hold true for main spool **2b**. The load pressure affects the ring surface AR and in the closed situation the face AS on the right side. Since the surface of AS is larger thanthe AR surface, pressure forces the main spool into this position.

When the power lift is switched to lowering, the lifting solenoid (**Y2E**) becomes unenergized and the spring pushes the spool (**2a**) to the right, at which time the connection from the pump pressure space (**P**) to the cylinders (**A**) via the holding valve (**4**) is closed. In the lowering position the lowering solenoid valve (**Y1E**) is energized. When the lowering solenoid pushes the pre–steering spool to the right, the pre–steering seat surface **8a** is opened first, followed by the pre–steering groove **8b**. This allows oil to flow into the tank from space **9**. The pressure drops below the load pressure. Oil flows (load pressure) via restriction **2c** to this space.

Intermediate pressure in space **9** depends on the opening surface of the pre–steering grooves. If the force against surface AS is equal to force of the load pressure against ring surface AR, the main spool follows in this position the pre–steering spool.

Oil can flow from the lifting rams (**A**) into the tank (**T**) via spool **2b**. The retrun oil flow volume (lowering speed) depends on the position of the spool (**2b**) (i.e. on the current fed to the lowering solenoid).

Hydraulic load sensing is not arranged like in the lifting position. The load sensing function in the lowering position is arranged electronically. Thus, the return flow is not dependent on the load pressure.

1) 2–way oil flow regulating spool (pressure balance)
2a) Control spool, lifting
2b) Control spool, lowering
2c) Throttle
3) Shock valve
4) Holding valve
5) Cange–over valve
5) Change–over valve
7) Channel
8) Pre–steering spool (+ bore)
8a) Pre–steering seat surface
8b) Pre–steering groove
9) RH side of the main spool
A) Cylinder pressure
T) Tank
P) Pump pressure

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Lifting cylinders

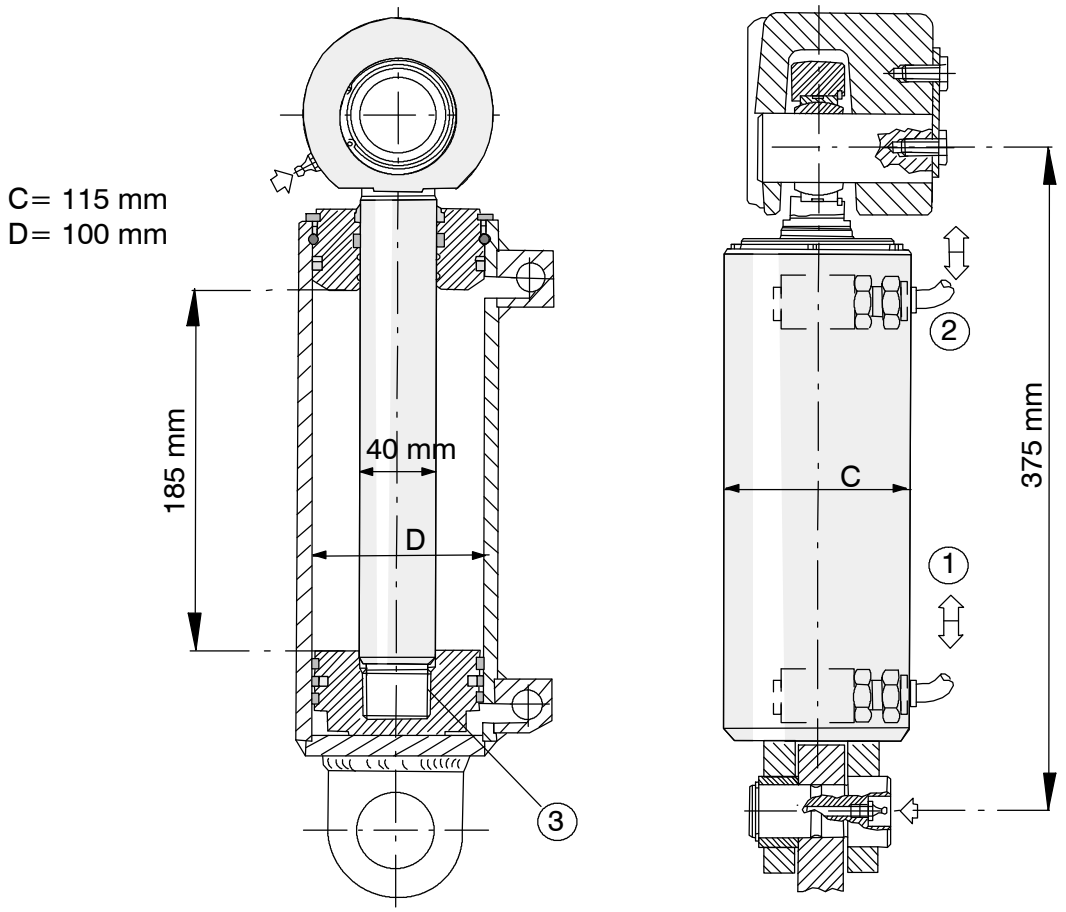


fig005

1. Working pressure
2. Breathing pressure
3. Tightening torque 150 Nm. Loctite 270. (UK 0062)

Note! The arms can be loaded in both directions. Grease the nipples weekly/at intervals of 50 running hours.

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Electrical system

– ACD and ACB power lift has a digital control unit.
– ACD and ACB power lift has as standard a Drive Balance Control, which damps in transport driving oscillation movements of the tractor caused by a heavy implement which is attached to the three point linkage unit.
– Slip control is available as an option (ACD). The system also includes a radar.
– For slip control and Drive Balance Control the tractor has a gearbox speed sensor (not ACB) below the shuttle unit.
– The ACB and ACD power lift switch panel has a diagnostic light, which indicates self–testing and locking of the power lift. It also indicates fault codes with flashing numbers so that possible faults can be localised. The flashing of the diagnostic light also confirms that a new switch–on frequency of the Drive Balance Control is valid (not ACB).

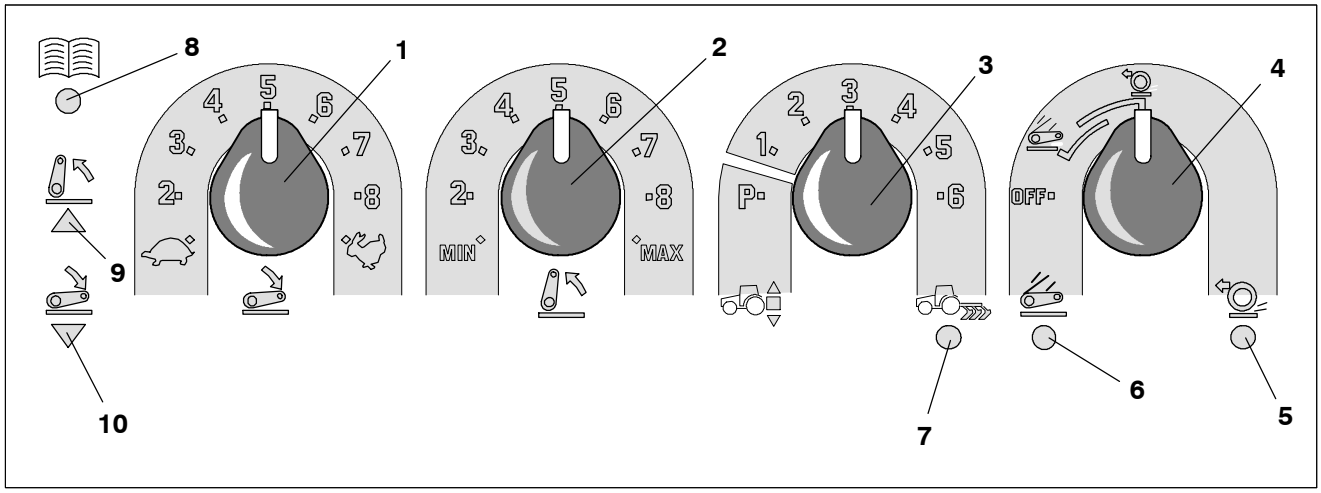
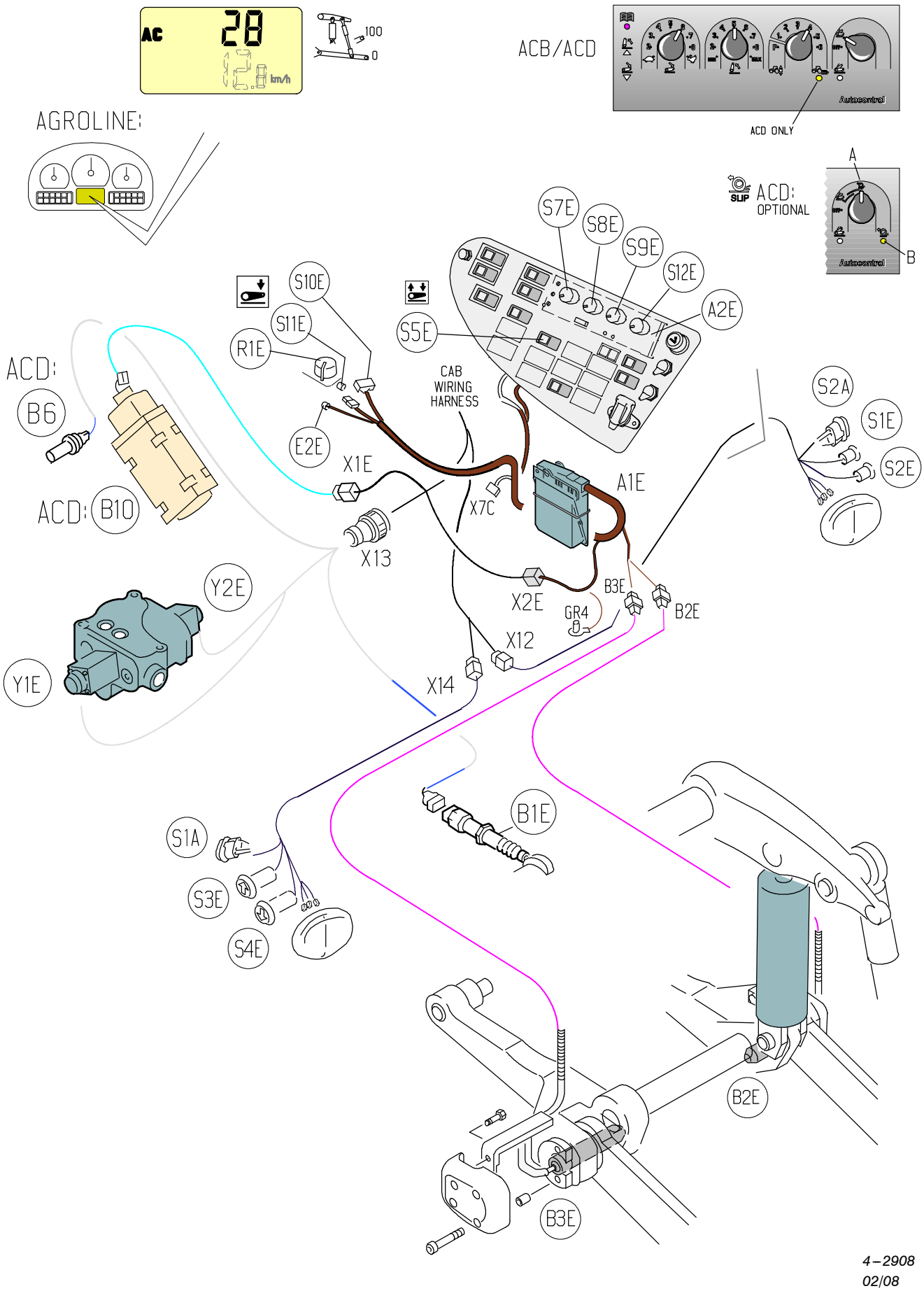


fig007

1. Lowering speed selector (9 positions)
2. Transport height selector (9 positions)
3. Position control/Draft control selector (position P is for position control, the draft control has 6 different positions)
4. Drive Balance Control/Slip Control
– OFF; Drive Balance Control and slip control are switched off
– Drive Balance Control switched on
– Both Drive Balance Control and Slip Control switched on (not ACB)
– Position in picture; Slip control switched on (if fitted)
5. Indication light if slip control fitted
6. Indicator light, Drive Balance Control switched on
7. Indicator light, Draft control is switched on (positions 1–6, not ACB)
8. Diagnostic light
9. Indicator light, lifting
10. Indicator light, lowering

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Wiring (T121c–T171c, T121h–T191h)



4–2908
02/08

https://truckmanualshub.com/

– A1E Control unit, power lift

– A2E Switch panel, power lift

– B1E Electronic control unit

– B2E Draft sensor, power lift, r.h

– B3E Draft sensor, power lift, l.h

– B6 Speed sensor, gearbox

– B10 Radar

– E2E Lightning, position potentiometer

– R1E Potentiometer, power lift, position control

– S1A Push button, PTO rear start, left

– S1E Push button, rear operation, lifting, r.h.

– S2A Push button, PTO rear start, right

– S2E Push button, rear operation, lowering, r.h.

– S3E Push button, rear operation, lifting, l.h.

– S4E Push button, rear operation, lowering, l.h.

– S5E Rocker switch 3–pos. inside operation, lifting/lowering

Inner switch for connecting implement
The lower links are raised and lowered by the switch in the cab and by push button on the rear mudguards. These are useful, for instance, when implements are being attached. The lower links lift or lower as long as the corresponding switch/button is pressed. The switch/push buttons operate when the lift/stop/lower switch (S10E) is in the lower position or the middle position control system must be activated by operation of the lift/stop/lower switch.

CAUTION: The transport height selector (S8E) does not limit the lifting height when these switch/push buttons are being used.

– S7E Lowering speed selector, hydraulic lift

– S8E Transport height selector, hydraulic lift

– S9E Draft control selector, hydraulic lift

– S10E Rocker switch, 3–pos. power lift lifting/lowering

- **The symbol side pressed down lowers the linkage = Autocontrol II position.**
- **Centre position stops the arms.**
- **The opposide side to the symbol pressed down lifts the linkage = transport position**
  By switching it to the lift position, the operator can use this switch to lift the implement into the transport position; by switching it to the lower position the implement is then lowered to the right depth (as selected with the position control knob R1E). Linkage movement can be **stopped** by placing the lift/stop/lower switch in the **centre position**.

– S11E Rocker switch, power lift, forced lowering

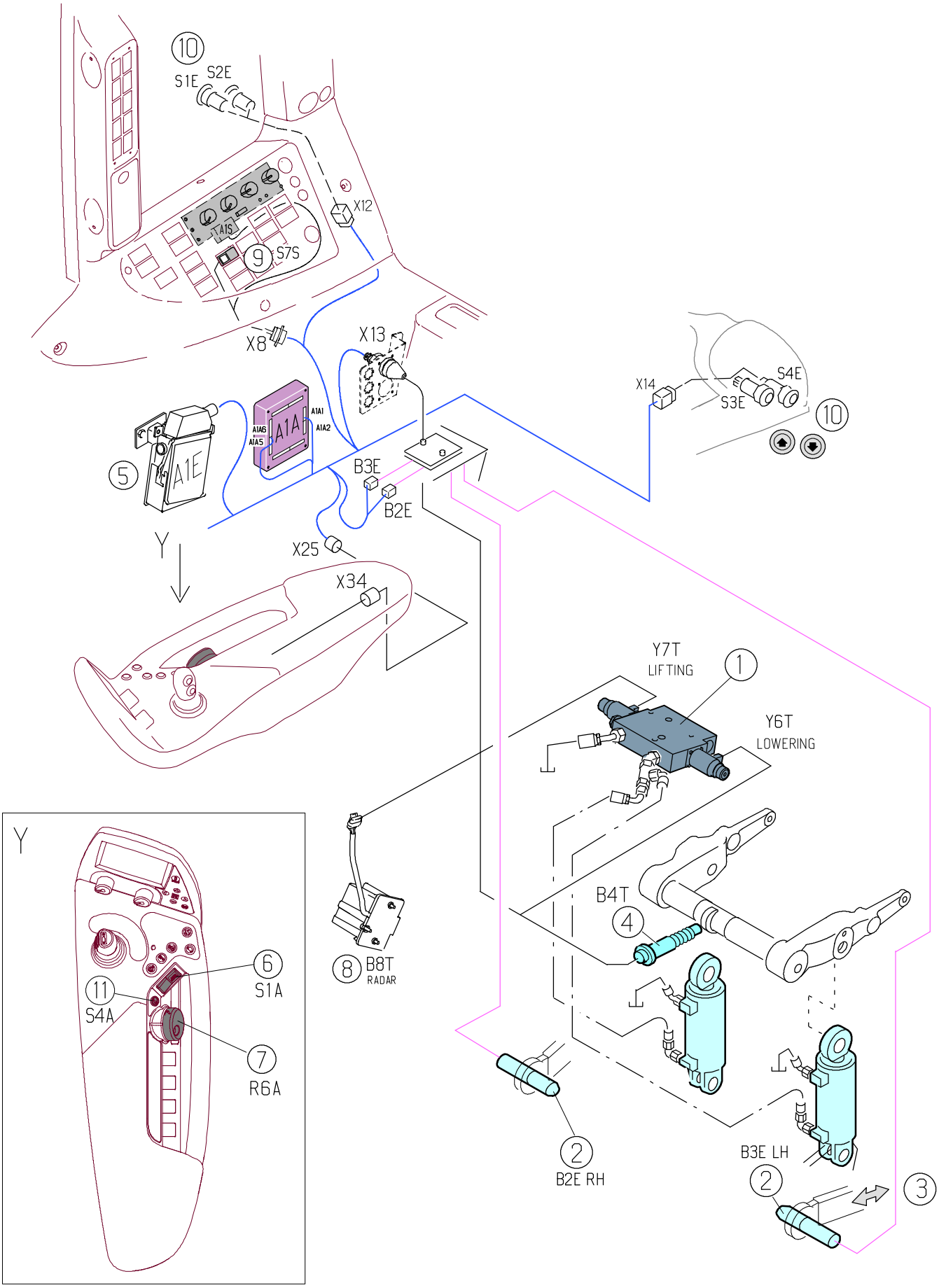
By pushing the switch, the lower links lower under the position, which has been set by the position control knob **R1E**. After freeing the switch the lower links go back to the value, which has been set by the position control knob. The switch is spring returned. The forced lowering operates only when the lift/stop/lower switch **S10E** is in the lowering = Autocontrol position. When using the forced lowering switch it uses the lowering speed set by the lowering speed selector.

– S12E Drive balance control

Technical data:
– Lift force, max 75kN
– Lifting cylinder ø 100 mm
– The length of the lower links about 980 mm
– Lifting range at end of lower links max. 185 mm

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Wiring (T151eLS–T191LS)



4–2711
10/06

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1. Control valve
2. Draft control sensor
3. Pull or push force caused by working equipment
4. Position sensor, B4T
5. Electronic unit
6. Lift/stop/lower switch (three positions)

   This switch is used to activate the position control. To do this, it is switched first to the lift position and then to the lowering position. This must always be done when the main power has been switched off and the push button control has been used.

   By pushing the switch to the lift position the operator can lift an implement into the transport position. After this, the switch can be pushed to the lowering position, which lowers the implement to the right level (as adjusted with the position control knob **7**).

   Linkage movement can be **stopped** by placing the lift/lowering switch **in the middle position**.
7. Position control knob
8. Radar
9. Inner switch (S7S) for connecting an implement (the lower links are raised and lowered by the switch in the cab and by the push buttons on the rear mudguards: see point **10**).
10. Push buttons for lifting and lowering (rear mudguards).

    The push buttons (and switch **9**) function only when the lifting/stop/lowering switch (**6**) is in a lowering position or the middle position. N.B. When the push button (or switch **9**) is pressed, lifting height is not restricted by the electronics; the pistons can move to their extreme position.
11. Bypass switch for position control knob = forced lowering switch (S4A).

    By pushing the switch, the lower links quickly lower to the position set with the position control knob. After releasing the switch the lower links go back to the value, which has been set by the position control knob. The switch is spring–returned. Forced lowering operates only when the lift/stop/lowering switch (**6**) is in the lowering position. When using the forced lowering switch, the lowering speed set with the lowering speed selector is applied.

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Sensors

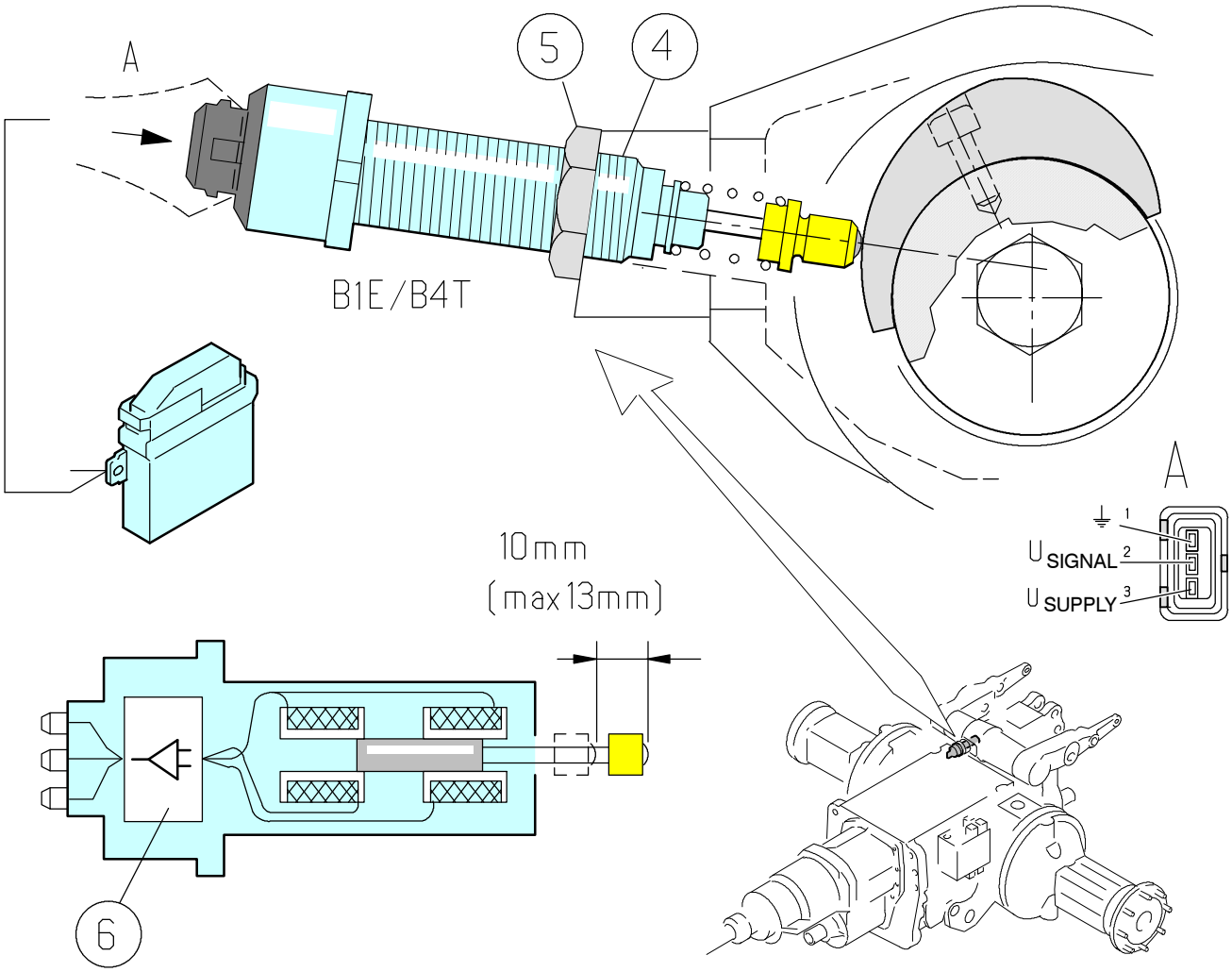


fig009

4. Permatex Super 300 to threads
5. Locking nut
6. In–built amplifier

Connector A:
1. Earth wire
2. Signal wire
3. Supply wire

Direct current (DC) is fed into the ACDS position sensor (earlier alternating current).

U_{Supply} = 9,5±0,3 V_{DC}
U_{SIGNal} = 25–75 % x U_{Supply} (lower links down–up)

The position sensor connector is fitted at the end of the sensor.

Note! The positon sensor cannot be repaired but a defect sensor must be changed for a new one.

Measuring position sensor supply and signal voltages

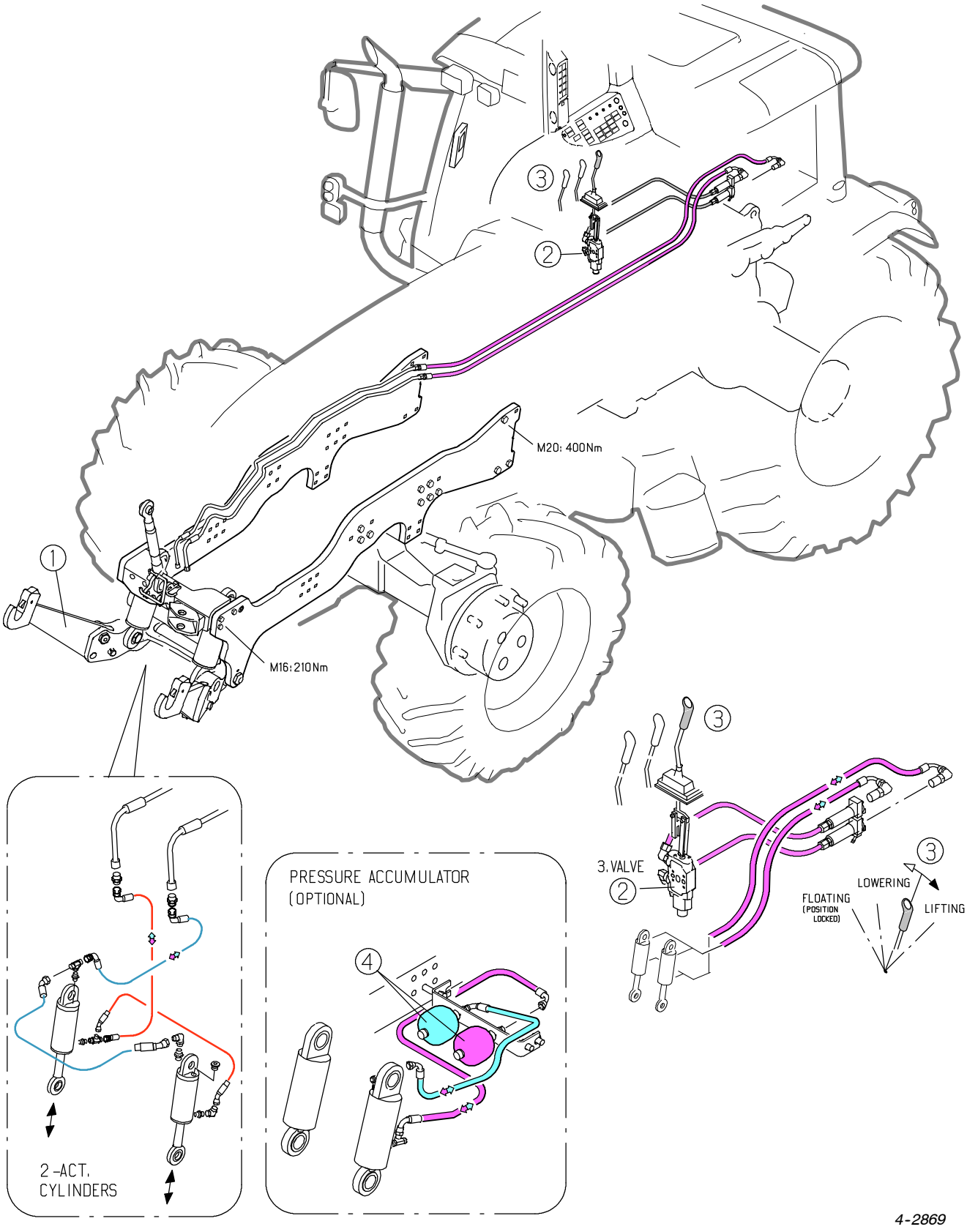
Sensor voltages can be measured as earlier by using special tool **ETV 894 100** and a universal instrument.

Measuring values
– Supply voltage . . . . . **9,2–9,8 V_{DC}**
– Signal, lower links down . . . . . **2,3–2,5 V_{DC}**
– Signal, lower links up . . . . . **6,9–7,4 V_{DC}**

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Front power lift (T121c–T171c, T121h–T191h)

With 3rd rear valve (manually controlled)



4-2869
09/07

https://truckmanualshub.com/

1) Front linkage
2) Auxiliary hydraulic valve
3) Valve lever
4) Pressure accumulator

Front linkage hydraulics is connected to the third valve of the external hydraulic (optional equipment) (on driving direction the third lever (**3**) from front).

The lifting cylinders are double–action types, the valve can be adjusted either to double– or single–action.
When the valve is adjusted to single–action the lifting links do not lower with small load (due to the 0–leak property). It is recommended to use the third valve as double–action.

The front linkage rises when the lever (**3**) is pulled towards the driver and lowers when the lever is pushed away from the driver. When pushing the lever further away from the driver, it will be engaged in the locked floating position, the machine will then follow the contour of the ground.

WARNING! Always use the FLOATING position for implements following the ground contour, otherwise the implement may be damaged or the traction for the front wheels may be lost. The implement following the ground contour has to be first lowered down carefully and just after that push the control lever to the floating position.

The pressure accumulators (**4**) are extra equipment for the front linkage. There are pressure accumulators both for the lift and lowering and they are continuously working.

When driving the pressure accumulators even out the pressure peaks coming from the front linkage load. This makes driving smoother and the stresses on the front linkage are reduced.

Maintenance

1. Check regularly that all screws and nuts are tight.
2. Tighten all screws and nuts of the linkage after the first 15–25 running hours. Check also that the hydraulic connections have no leakage.
3. Every 250 hours: grease the pins of the lifting cylinders and the shaft of the lifting links with Valtra Grease Universal. The grease nipple for the shaft of the lifting links is placed on the rear side of the axle.

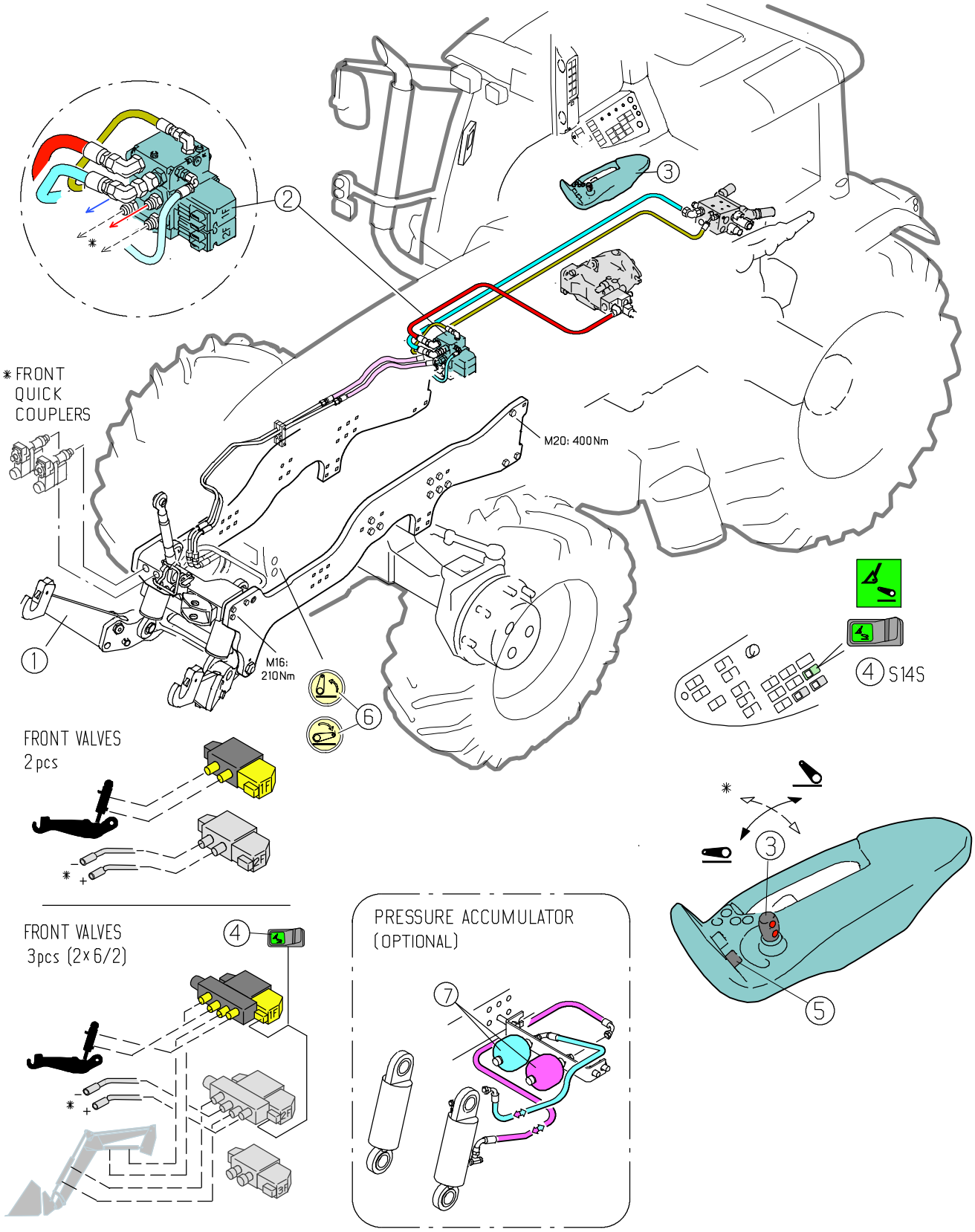
Specifications

– Lifting power, 35 kN
– The diameter of the lifting cylinders, 2 pcs 90 mm
– Lifting range at the end of the lifting links 750 mm
– The ends of the lifting links can be turned up
– Quick coupling hooks, category 3/2
– Front pulling eye as standard

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Front power lift (T151eLS–T191LS)

With front valve (+quick couplers)



4–2871
09/07

https://truckmanualshub.com/

The front linkage is used as follows:

– The functional activation switch (**5**) of the joystick has to be in position 

– If the tractor is equipped also with 6/2 change–over switch (**4**) for front linkage and front loader, the symbol side of the switch must be pressed down.

– **The front linkage raises:**
When the joystick (**3**) is pulled rearwards
or
When pressing the upper front switch (**6**)

– **The front linkage lowers:**
When the joystick is pushed forwards
or
When pressing the lower front switch (**6**)

– With the joystick (**3**) sideways movements controlling the oil flow outputs of the front quick–action couplings. Pulling the joystick to the driver supplies the oil flow to the + connector (from the front right) and pushing it away from the driver – connector (from the front left).

IMPORTANT: Always use the **FLOAT** position (the valve 1F has to be adjusted to the float position) for implements following the ground contour, otherwise the implement may be damaged or the traction for the front wheels may be lost. The implement following the ground contour has to be first lowered down carefully using the joystick (**3**) and just after that set to the floating position using the joystick quickly in the forward position (less than one second).

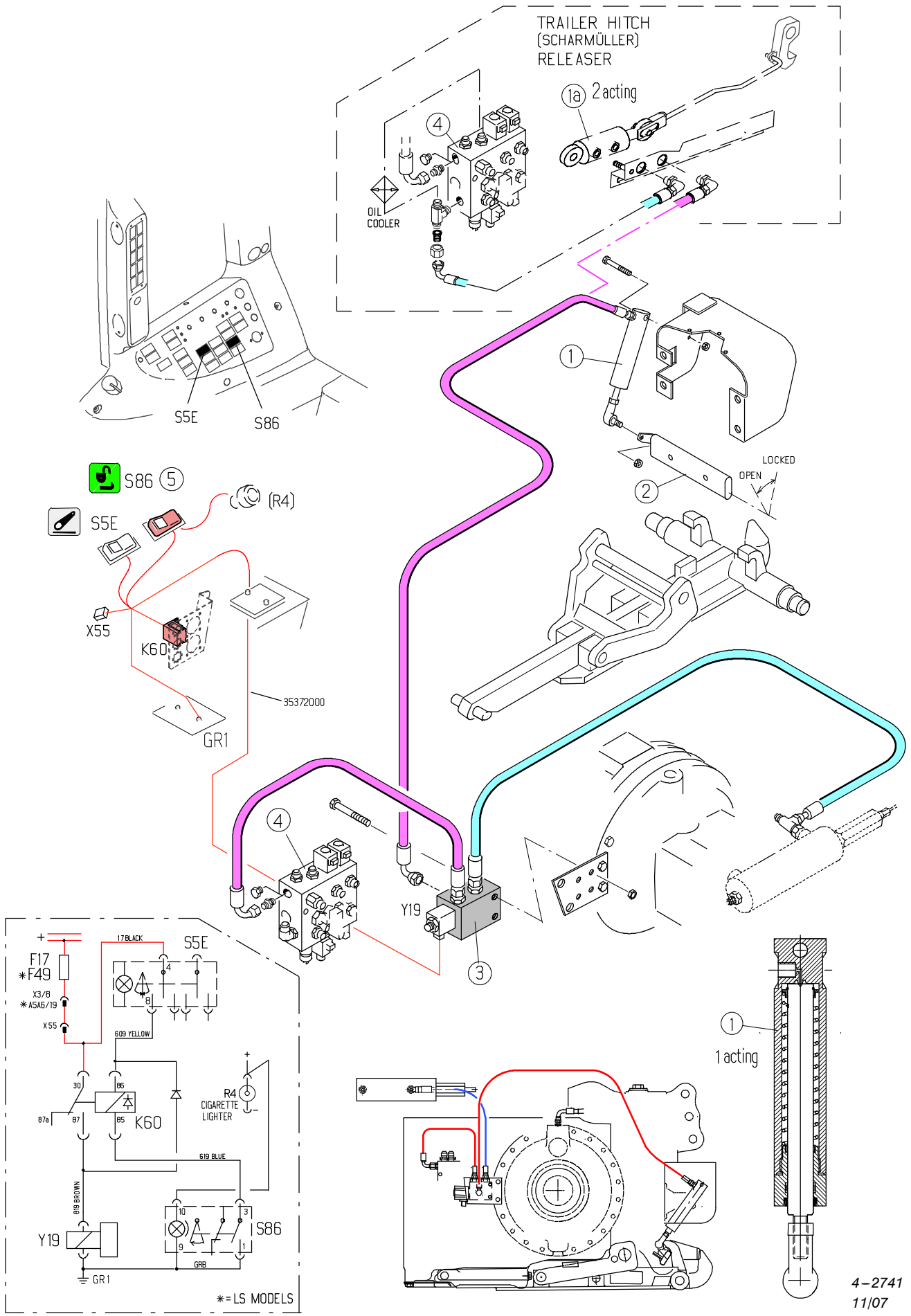
IMPORTANT: When using the front loader the front linkage lifting link arms should be folded into the transport position and locked with the locking bar into the attachment point of the top link.

IMPORTANT: The front loader has to be detached before using the front linkage.

1) Front linkage
2) Valve for auxiliary hydraulics (+beneath the valve for front quick couplers)
3) Joystick
4) 6/2 change–over switch (if valves 3pcs 2x6/2)
– then the front loader can also be fitted
5) The functional activation switch
6) Front switches
7) Pressure accumulator

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Hydraulic trailer hitch releaser



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The trailer hitch release system is included in all tractors with a cab suspension. It is available for other tractors as an option.

Hitch release requires also the use of switch **S5E** (inner switch for connecting implement) before the release operates.

The use of release switch S86:

Lowering:

1. Raise the linkage fully up with the inner switch for connecting the implement (**S5E**). Press the side opposite to the symbol (lift).

2. When the linkage is fully up keep the inner switch (**S5E**) pressed down (in the lifting position) and simultaneously press down the symbol side of the switch for releasing the trailer hitch latch (**S86**).
   The relay **K60** activates and connects a current to solenoid valve **Y19**. The locking latch (**2**) opens.

3. Keep the switch for releasing the trailer hitch latch (**S86**) pressed down and lower the towing device by pressing the symbol side of the inner switch (**S5E**).

   The diode (holding circuit) is fitted so that the switch **S5E** can be “released” and then the hitch be lowered by pressing the switch **S5E** to the lowering position. Relay **K60** cuts the current supply to solenoid valve **Y19** after releasing the switch **S86**. This use of the two switches is for safety reasons (the considered use of the releasing).

Raising:

1. Reverse up to the trailer and attach the trailer hitch with the trailer drawbar.

2. Raise the linkage fully up with the inner switch (**S5E**) for connecting the implement until the linkage latch locks.

3. After that lower the linkage slightly so that the towing device is locked and supported by the latch.

The lower links are raised and lowered by the switch **S5E** in the cab (or the push buttons on the rear mudguards). These are useful, for instance, when implements are being attached. The lower links lift or lower as long as the corresponding switch/button is pressed.

After these switch/buttons have been used the position control system must be activated by operation of the lift/stop/lower switch.

CAUTION: The transport height selector does not limit the lifting height when these switch/push buttons are being used. Instead, the arms are moved to their extreme positions when the switch/buttons are pushed.

1) Cylinder (1 acting)

   1a) Cylinder (2 acting)
   – The return hose of the cylinder has been coupled to the lubrication / oil cooler line with a minor pressure, because the 2 acting cylinder needs a small pressure on the other side in order to come back. The lubrication pressure secures the closing of the locking system and keeps it in the locking position.

2) Locking latch

3) Valve block

4) Low pressure valve block

5) Release switch (S86)

Checking the function of ACB/ACDS power lift

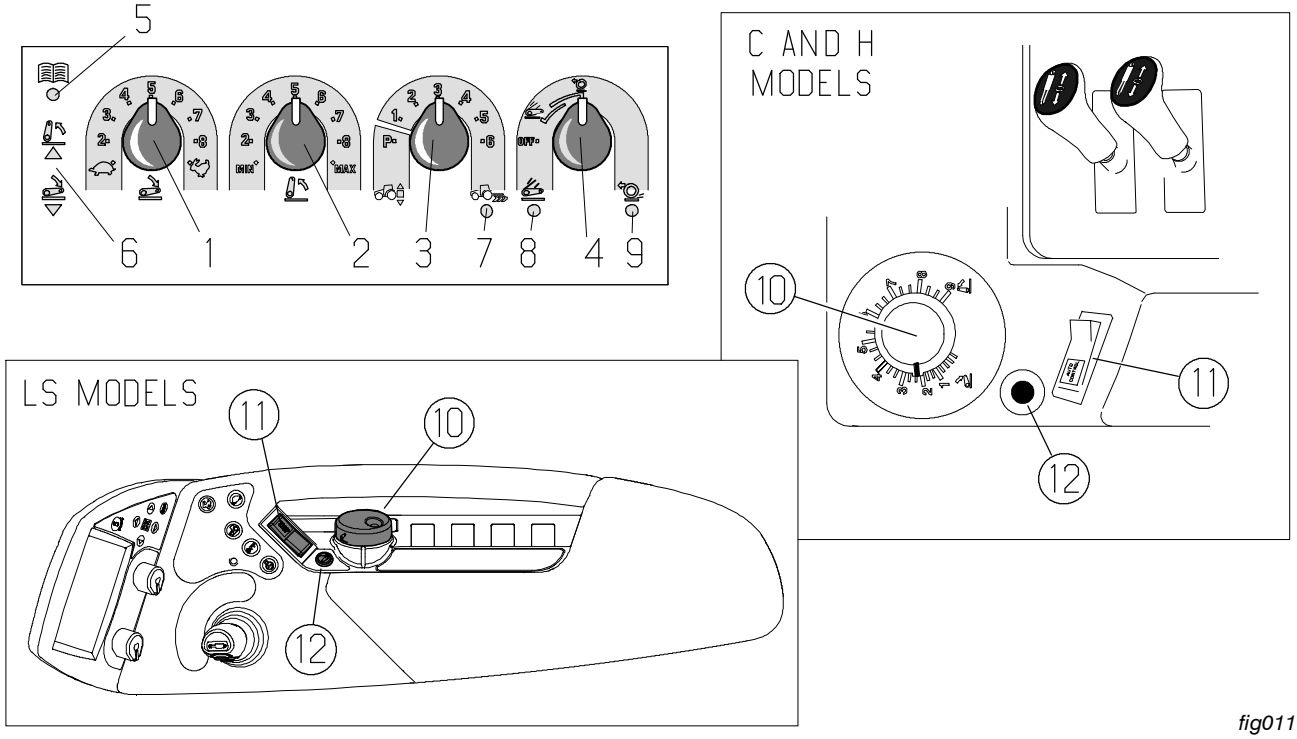


fig011

Note! The slip control is an optional equipment on ACDS Power lift. ACB Power lift has not a pilot light (7) for the draft control mode. In ACB Power lift the activating speed of the DBC cannot be adjusted.

Note! The Power lift must function in the way written in this instruction.

1. Start the engine. The red diagnostic light (5) comes on. Activate the Power lift with the Autocontrol – switch (11), at which time the diagnostic light (5) goes out. Leave the Autocontrol – switch (11) in the lowering position and adjust the lower links with the position control potentiometer (10) to the lowest position.
2. Set the lowering speed (1) and transport height (2) to the minimum and position control/draft control switch (3) to position P.
3. Turn the Autocontrol – switch (11) into the transport position.
4. Turn step by step the transport height selector (2). The lower links rise with even intervals, the red lifting ind. light (6) is lit when the lower links move up. Leave the transport height selector (2) to the max. value (MAX).
5. Press the Autocontrol switch (11) to the lowering position. When the lower links go down, turn the lowering speed selctor (1) to the max. value. The lowering speed increases clearly and the green light (6) is lit. Leave the lowering speed in the max. value.

5. Turn the draft control switch (3) to the max. value (pos 6) and adjust the lower links with the position control potentiometer (10) to horizontal position so that indicator lights (6) don't lit. Cause a draft to the lower links; Indicator light (6) lits and lower links rises.

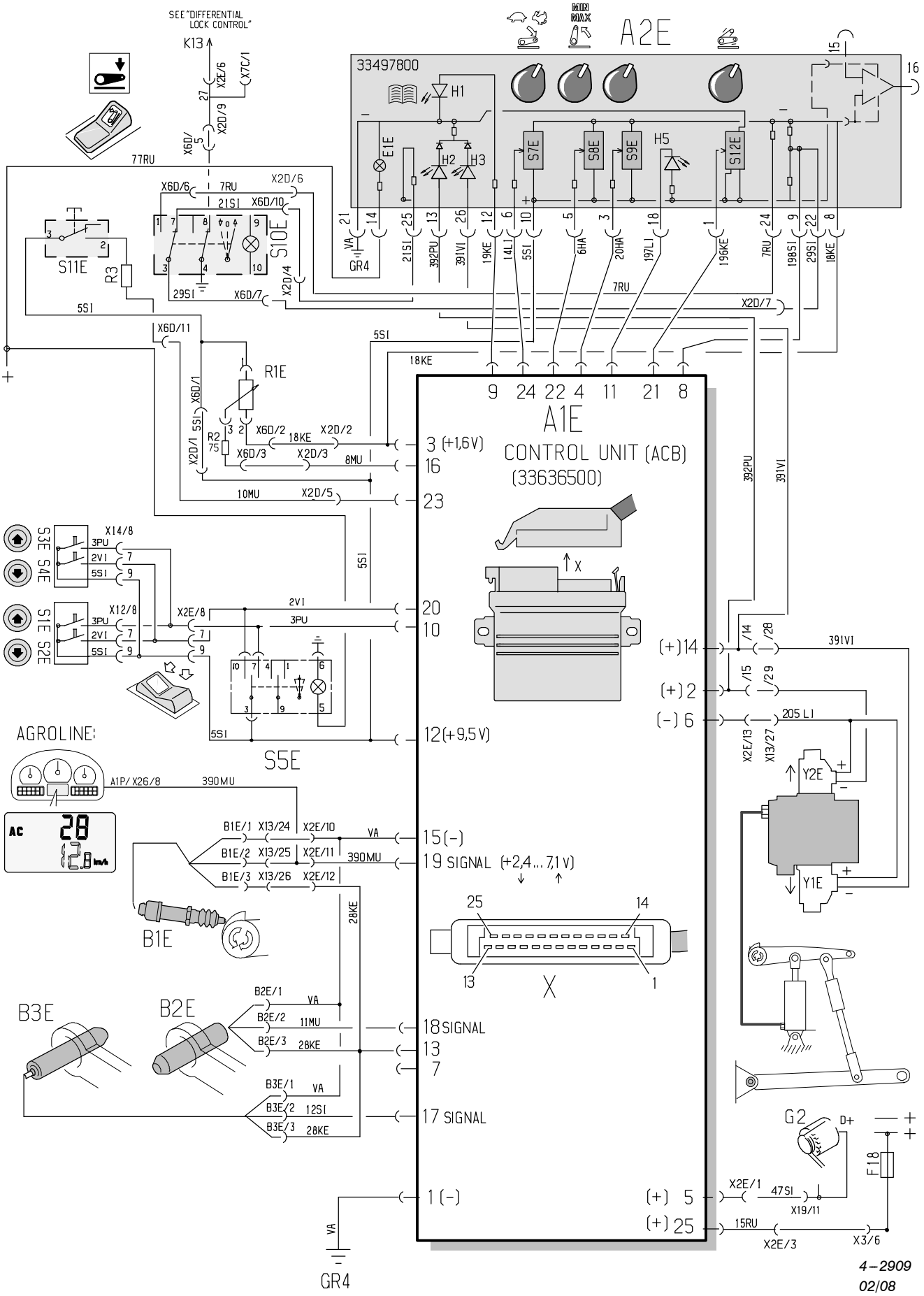
7. Adjust the lower links to the lowest position. When the lower links are in the bottom position, the green light (6) is lit (floating position).
8. Lift the lower links up step by step (1 – 9) by using the position control potentiometer (10); The lifting intervals are almost the same and the red light (6) is lit when the links move up. Leave the knob (10) in the max. upper position.
9. Raise the lower links more to the topmost position with lift/lower switch, diagnostic light (5) comes on and shows that the Power lift is locked. Release the towing hook and lower the lower links. Check the functionality of all external buttons (the buttons function in all positions of the Autocontrol – switch (11).
10. Turn the Autocontrol – switch (11) to the transport position and immediately back to the middle position; the lower links start to rise but stop immediately, when the switch is turned to the middle position. The standard instrument shows running hours in the middle and transport position.
11. Turn switch (11) to the transport position, at which time the lower links rise up and the towing hook is locked by the pawl.
12. Switch on the position control mode (P). Push switch (12), at which time the lower links go down. Release the switch, at which time the lower links return to the original position.
13. **ACB**: Turn the switch (11) to the transport position, switch on the DBC with switch (4); lower links lower approximately 4 cm. Switch off the DBC, at which time the lower links rise up to the top position.
    ACDS: In order to activate the DBC (to lower the lower links approximately 4 cm) the tractor must be driven over the adjusted activating speed.

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Power lift wiring

ACB (T121c–T171c, T121h–T191h)



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– Control unit (33636500)
– The background plate is the same as in model ACD. The amplifier part in the plate (above right in the picture) is not in use.
– The lights H4 (draft control), and H6 (slip control) are not in use.

A1E Autocontrol
A2E Autocontrol, switch panel

B1E Position sensor
B2E Draft sensor, r.h
B3E Draft sensor, l.h

E1E Lighting switch panel
R1E Potentiometer, pos. control

S1E Switch, rear operation, r.h., lifting
S2E Switch, rear operation, r.h., lowering
S3E Switch, rear operation, l.h., lifting
S4E Switch, rear drive, l.h., lowering
S5E Switch, cabin, lifting/lowering
S7E Switch, lowering speed
S8E Switch, top limit
S9E Switch, sensitivity /mixing
S10E Switch, lifting /stop/lowering
S11E Switch, forced lowering
S12E Switch, Drive Balance Control

Y1E Solenoid valve, lowering
Y2E Solenoid valve, lifting

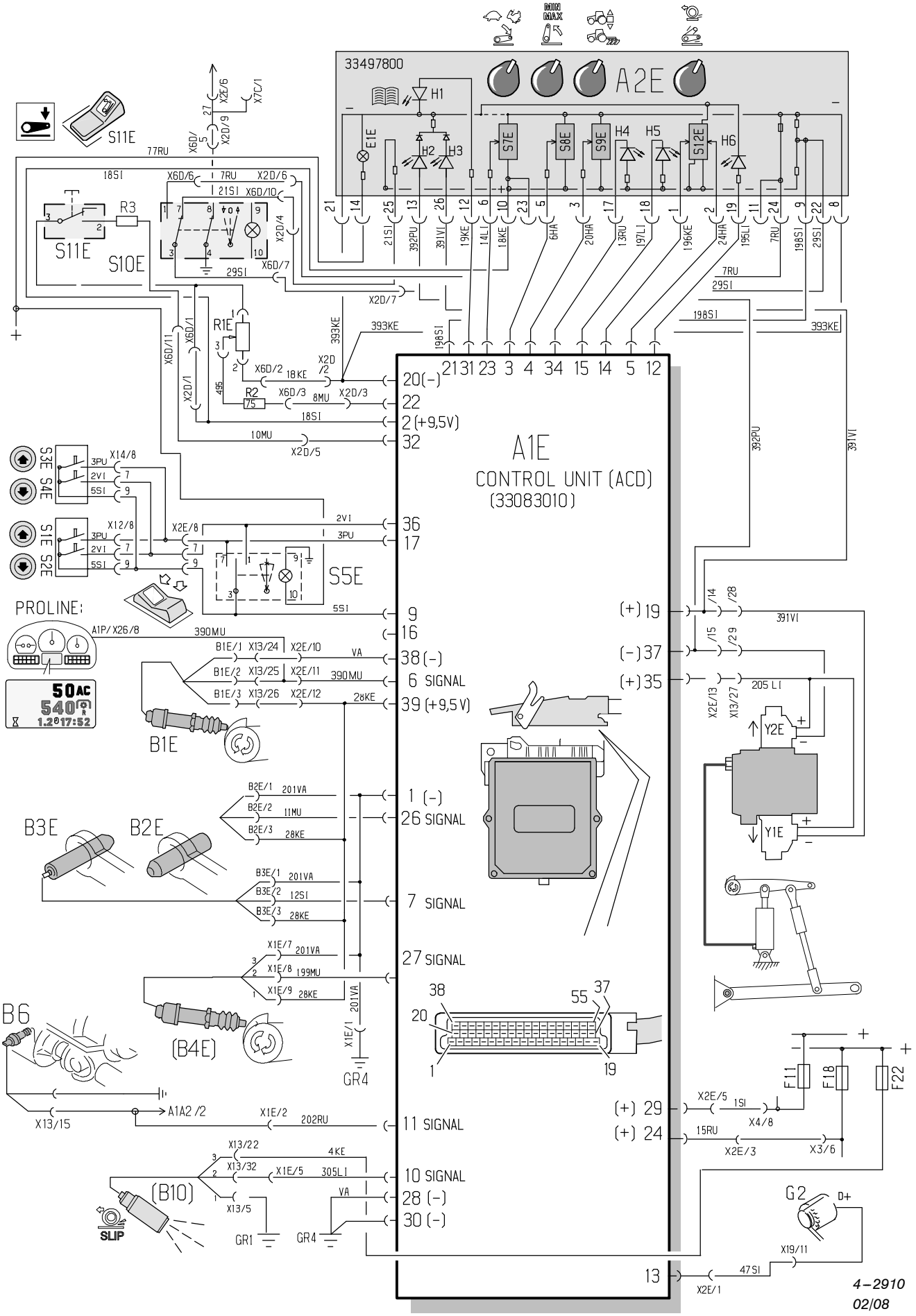
Position of lower links %, 0–100 AC (Agroline instrumentation): the display shows symbol AC and the position of the lower links as a percentage on a scale of 0 to 100. 0 = the lower links are in the lowest position. 100 = the lower links are in the top position. When the lower links are in the middle position, value 50 is displayed.

ACB/ACD: The function of the forced lowering switch S11 is enclosed in the control unit A1E.

In the centre position (automatic position): the lock is always engaged when the linkage lift/stop/lower switch is switched off from the lift position.

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ACD (T121h–T191h), optional



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ACD power lift control includes a slip control (radar as standard). The circuit board (33497800) is also used in the ACB system.

A1E Autocontrol
A2E Autocontrol, switch panel

B1E Position sensor
B2E Draft sensor, r.h
B3E Draft sensor, l.h
(B4E) Position sensor, implement
B6 Velocity sensor, gearbox
(B10) Speed radar

E1E Lighting switch panel

R1E Potentiometer, pos. control

S1E Switch, rear operation, r.h., lifting
S2E Switch, rear operation, r.h., lowering
S3E Switch, rear operation, l.h., lifting
S4E Switch, rear operation, l.h., lowering
S5E Switch, cabin, lifting/lowering
S7E Switch, lowering speed
S8E Switch, top limit
S9E Switch, sensitivity /mixing
S10E Switch, lifting /stop/lowering
S11E Switch, forced lowering
S12E Switch, Drive Balance Control (+slip)

Y1E Solenoid valve, lowering
Y2E Solenoid valve, lifting

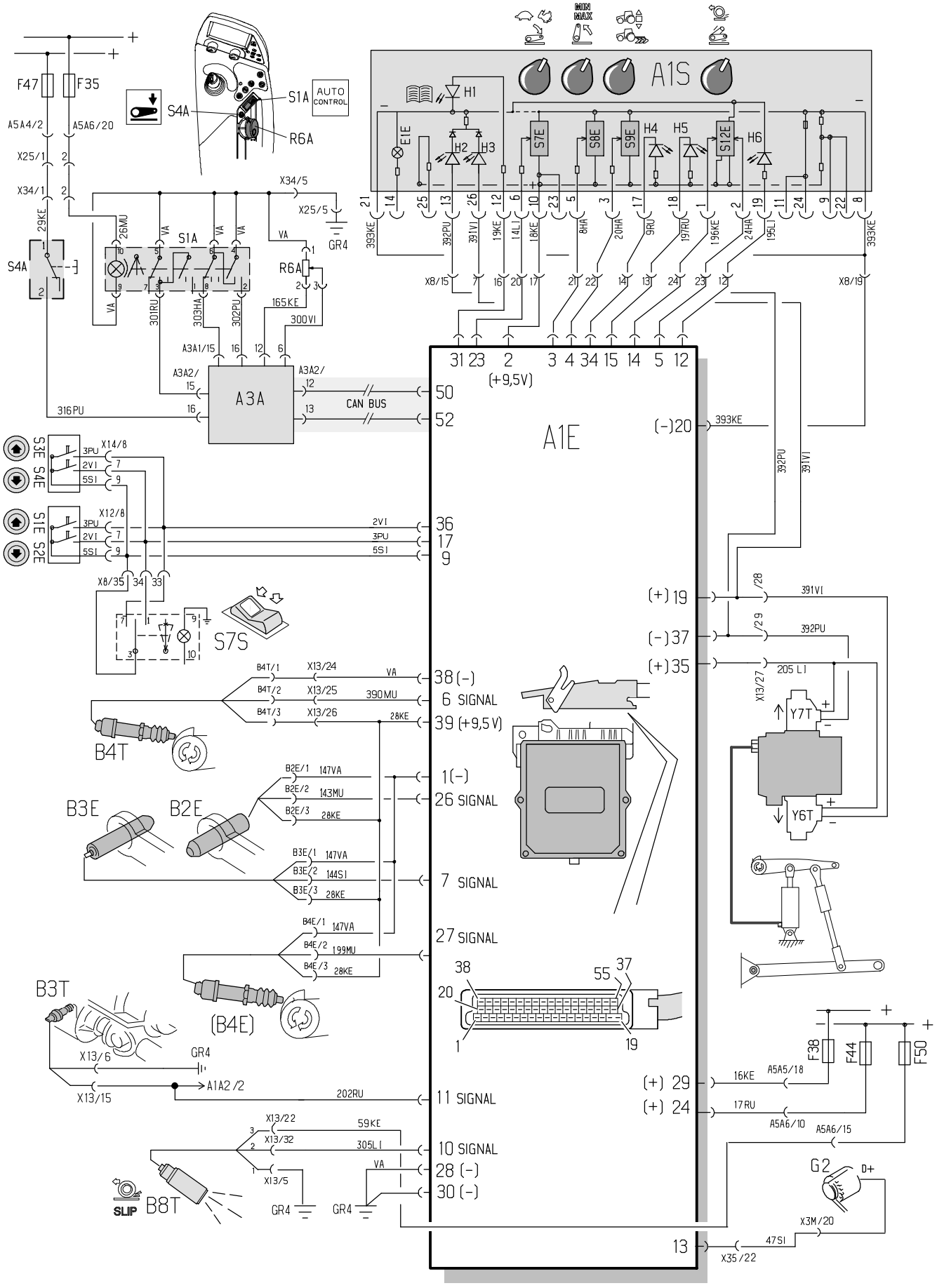
Position of lower links %, 0–100 AC (by pressing the right side of the change over switch for LCD display unit the display changes):

The display shows symbol AC and the position of the lower links as a percentage on a from scale 0 to 100. 0 = the lower links are in the lowest position. 100 = the lower links are in the top position. When the lower links are in the middle position, the display shows the number 50.

ACB/ACD: The function of the forced lowering switch S11 is enclosed in the control unit A1E.

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ACD (T151eLS–T191LS)



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A1E Autocontrol
A1S Autocontrol, switch panel
A3A Control unit, UC1

B2E Draft sensor, r.h
B3E Draft sensor, l.h
B3T Velocity sensor, gearbox
B4T Position sensor
B4E Position sensor, implement
B8T Speed radar

E1E Lighting switch panel

R6A Potentiometer, pos. control

S1E Switch, rear operation, r.h., lifting
S1A Switch, lifting /stop/lowering
S2E Switch, rear operation, r.h., lowering
S3E Switch, rear operation, l.h., lifting
S4A Switch, forced lowering
S4E Switch, rear operation, l.h., lowering
S7E Switch, lowering speed
S7S Switch, cabin, lifting/lowering
S8E Switch, top limit
S9E Switch, sensitivity /mixing
S12E Switch, Drive Balance Control (+slip)

Y6T Solenoid valve, lowering
Y7T Solenoid valve, lifting

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Checking switch panel of ACDS

Remove the switch panel from the lever console (do not disconnect the connector). Switch on currrent and activate the ACDS power lift. Measure from the terminals on the rear side of the circuit card (DC).

Measuring supply voltage

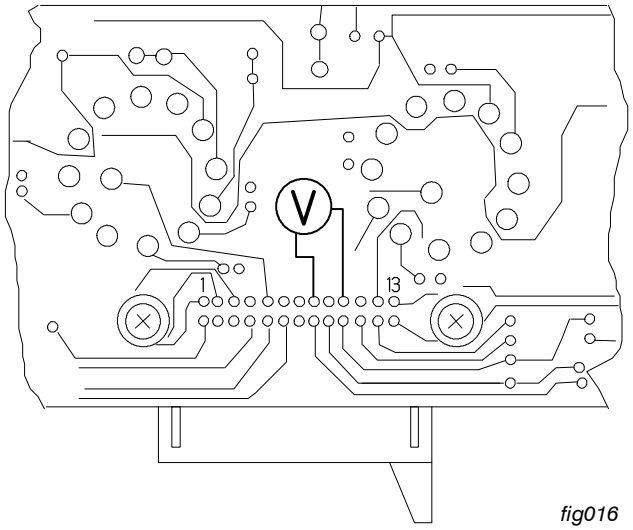


fig016

Measure supply voltage between terminals **8** (–) and **10** (+): Correct value is **9,2–9,8 V (DC)**.

Note! If the measured value is incorrect. the fault lies in the connectors.

Checking lowering speed selector S7E

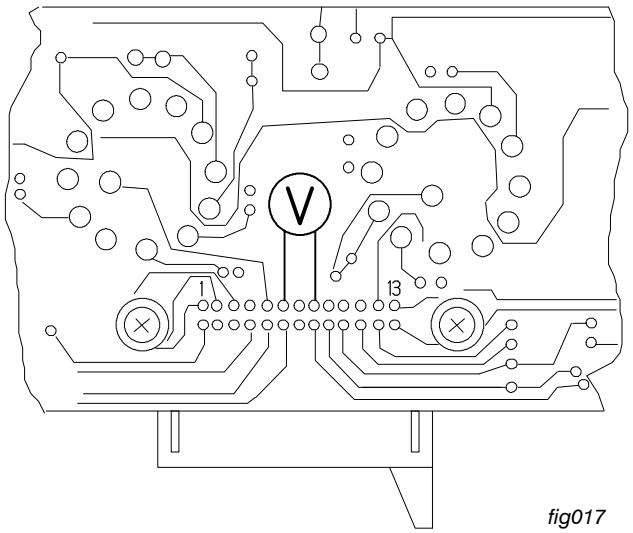


fig017

Measure voltage (DC) between terminals **8** and **6** with all selector positions:

Position	Pin 6
1	0,4–0,6 V
2	0,9–1,3 V
3	1,3–1,8 V
4	1,9–2,4 V
5	2,8–3,5 V
6	3,8–4,5 V
7	5,0–5,6 V
8	6,9–7,4 V
9	9,2–9,8 V

Checking transport height selector S8E

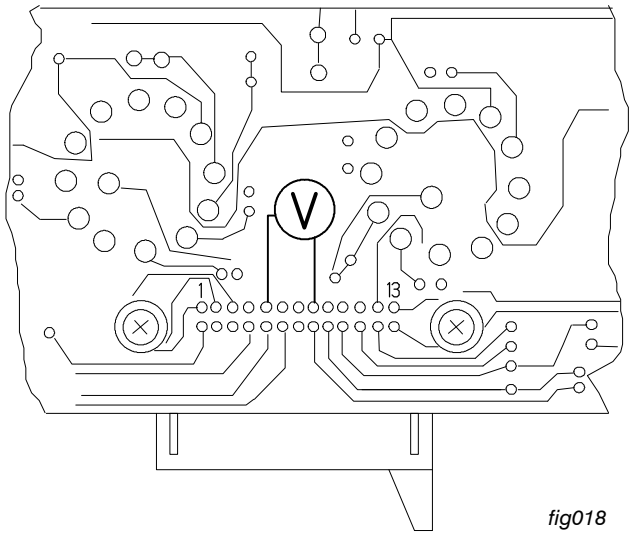


fig018

Measure voltage between pins **8** and **5** with all selector positions:

Position	Pin 5
1	0
2	1,1–1,5 V
3	2,3–2,8 V
4	3,6–4,0 V
5	4,8–5,2 V
6	6,0–6,6V
7	7,2–7,8 V
8	8,5–9,1 V
9	9,2–9,8 V

Draft control selector S9E

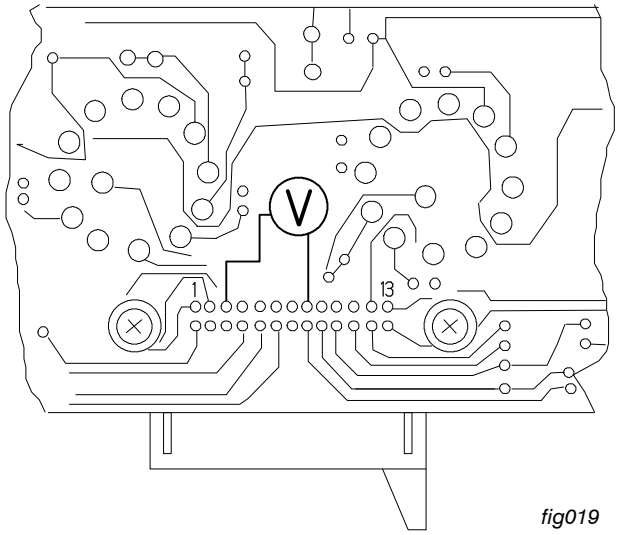


fig019

Measure voltage between pin **8** and **3** with all selector positions:

Pos.	Pin 3
P	9,2–9,8 V
1	4,9–5,3 V
2	4,0–4,4 V
3	3,0–3,5 V
4	2,0–2,4 V
5	0,9–1,3 V
6	0

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Checking DBC/slip control selector S12E

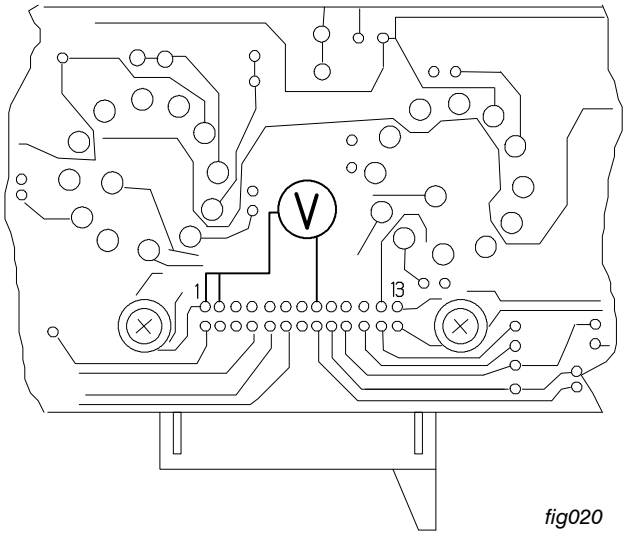


fig020

Measure voltage between pin **8** and pins **1** (**DBC**) and **2** (**slip control**) with all selector positions:

Position	Pin 1	Pin 2
OFF	4,5–5,2 V	0
DBC	0	0
DBC+slip control	0	4,5–5,2 V
Slip control	4,5–5,2 V	4.5–5,2 V

Note! If the measured values in points **2–5** deviate from the given values, the fault lies in the switch panel circuit card which should be changed.

Checking lift/lower switch S10E/S1A

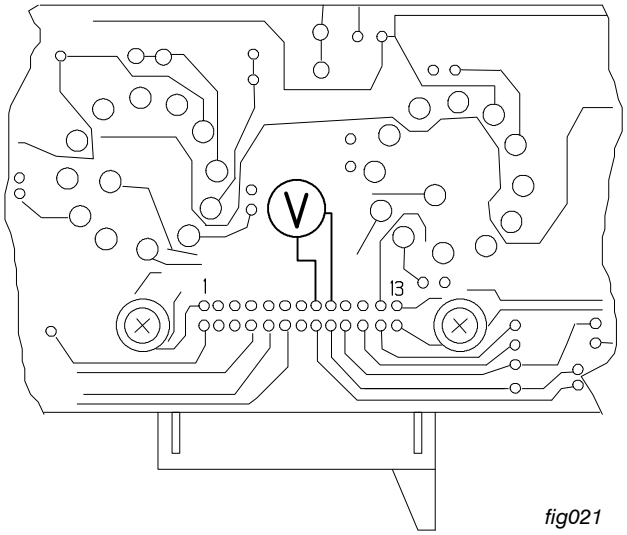


fig021

Measure voltage between pin **8** and **9** in all rocker switch positions:

Position	Pin 9
Lowering position	3,0–3,4 V
Middle position	4,3–4,8 V
Transport position	6,0–6,6 V

Note! If the measured values deviate from the given values, check the switch connector. If the values are further incorrect, the fault lies in the circuit card which should be changed.

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Checking switch panel of ACB

Remove the switch panel from the lever console (do not disconnect the connector). Switch on currrent and activate the ACB power lift. Measure from the terminals on the rear side of the circuit card (DC).

Measuring supply voltage

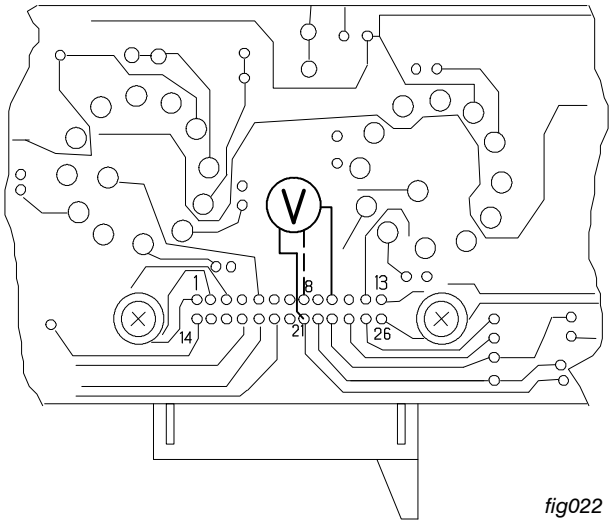


fig022

Measure supply voltage between pins **21** (–) and **10** (+): Correct value is **9,2–9,8 V** (DC). Measure also voltage between pins **21** and **8**. Correct value is about **1,6 V**.

Note! If the supply voltage is incorrect, the fault lies in connectors/wires.

Checking lowering speed selector S7E

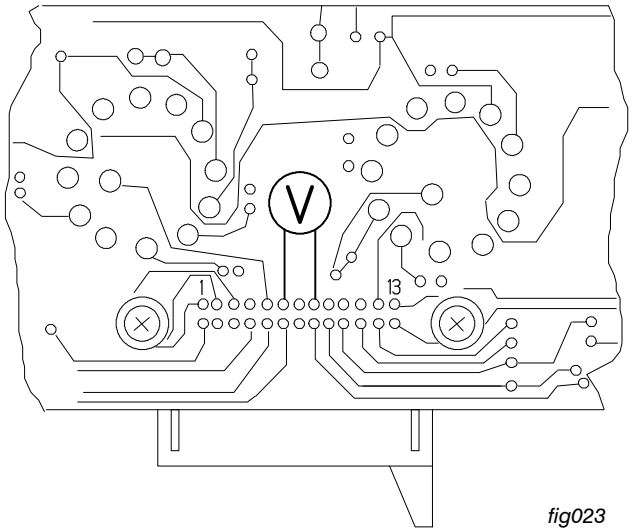


fig023

Measure voltage between pins **8** and **6** with all selector positions:

Position	Pin 6
1	0,3–0,5 V
2	0,7–1,1 V
3	1,1–1,5 V
4	1,6–2,0 V
5	2,3–2,9 V
6	3,1–3,7 V
7	4,1–4,7 V
8	5,6–6,0 V
9	7,6–8,2 V

Checking transport height selector S8E

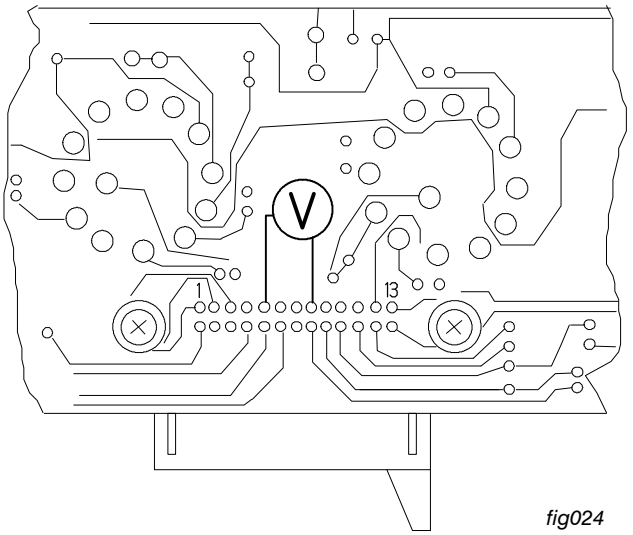


fig024

Measure voltage between pins **8** and **5** with all selector positions:

Position	Pin 5
1	0
2	0,9–1,2 V
3	1,9–2,3 V
4	2,9–3,3 V
5	3,9–4,3 V
6	4,9–5,4 V
7	5,9–6,4 V
8	6,8–7,5 V
9	7,6–8,2 V

Draft control selector S9E

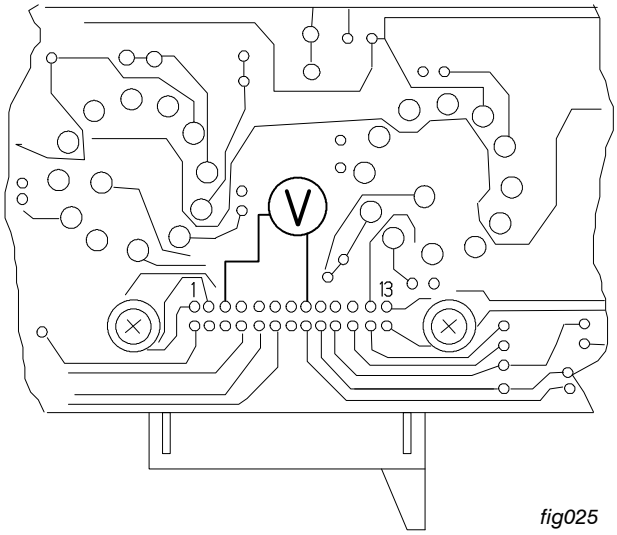


fig025

Measure voltage between pins **8** and **3** with all selector positions:

Position	Pin 3
P	7,6–8,2 V
1	4,0–4,4 V
2	3,3–3,6 V
3	2,4–2,9 V
4	1,6–2,6 V
5	0,7–1,0 V
6	0

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Checking DBC selector S12E

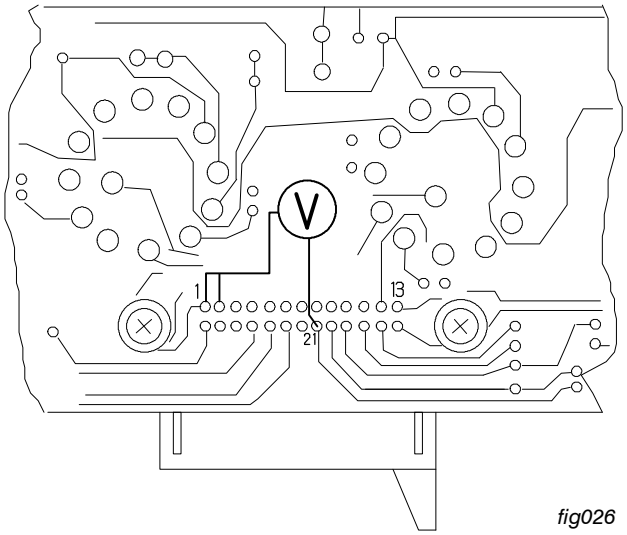


fig026

Measure voltage between pins **21** and **1** (DBC) with two selector positions**:**

Position	**Pin 1**
OFF	2,0–2,4 V
DBC switched on	0

Note! If the measured values in points **2–5** deviate from the given values, the fault lies in the switch panel circuit card which should be changed.

Checking lift/stop/lowering switch S10E

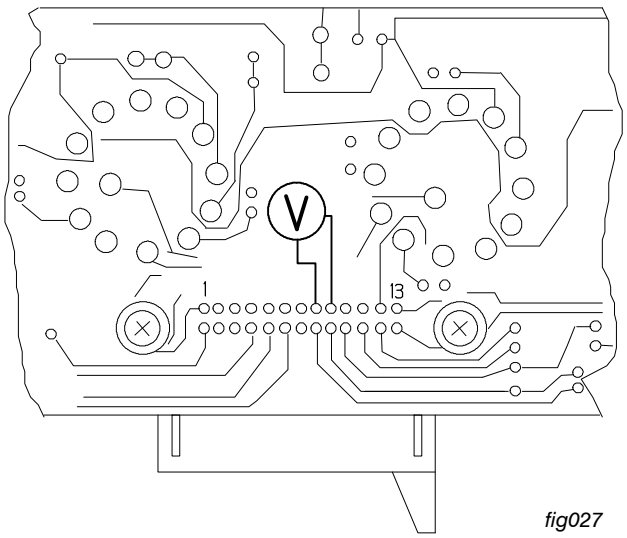


fig027

Measure voltage between pins **8** and **9** with all three switch positions:

Position	**Pin 9**
Lowering	2,4–2,8 V
Middle position (Stop)	3,5–4,0 V
Transport position	4,9–5,4 V

Note! If the measured values deviate from the given values, check the switch connector. If the values are further incorrect, the fault lies in the circuit card which should be changed.

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Changing switch panel, ACB/ACDS

Note! If the voltage measurements show that the switch panel is defective the panel must be replaced as a complete unit as follows:

1. Remove the DPS circuit card support plate and the card from the ACDS switch panel.
2. Detach the switch panel from the bracket by removing selector knobs and by unscrewing ring nuts. Remove the dust seals.
3. Detach the switch panel connector so that the panel can be removed.

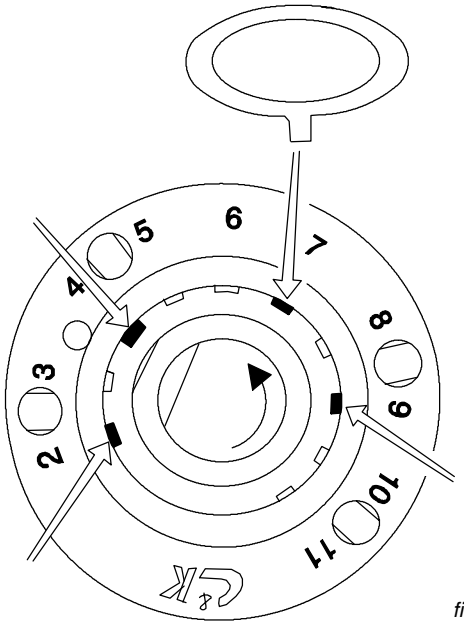


fig028

4. Fit onto new selectors washers with lugs. These washers limit selector positions. Before fitting the washers turn every selector anti–clockwise as far as possible to their extreme positions. After this fit washers so that the lugs engage in the holes given below:
   – lowering speed selector; hole 9.
   – transport height selector; hole 9.
   – draft control selector; hole 7.
   – DBC without slip control; hole 2.
   – DBC with slip control; hole 4.
5. Ensure by rotating the selectors, that the lowering speed and transport height selectors have 9 positions, draft control selector 7 position and DBC selector 2 (DBC) or 4 (DBC +slip control) positions.
6. Connect the connector to the new switch panel. Fit the dust covers (no 317 204 20) onto the washers and fasten the circuit card to the switch panel with the ring nuts (under the nuts locking washers JE 9423).
7. Fit the knobs and fasten the DPS circuit card. Attach the selector panel onto the lever console.

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Checking switch panel indicator lights

If the ACB/ACDS functions properly, but the indicator lights on the switch panel do not function correctly the following steps must be taken:

– Detach the switch panel and move the connector on the panel so that possible poor contacts are eliminated.

– If an indicator light is still out of order the voltage measurements shown in instruction **F** must be carried out.

– If the voltages are between allowable limits but the light is still out of order the fault is in the bulb and the whole switch panel has to be changed as a complete unit.

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Checking control valve and its solenoid valves

If the lifting or lowering speeds do not function correctly, it is necessary to clear up whether the fault lies in the electric system or in the control valve (valve spools can get trapped etc.).

T121c–T171c, T121h–T191h

Checking electric system

Note! When checking **ACB** power lift, there must be load in the three–point linkage.

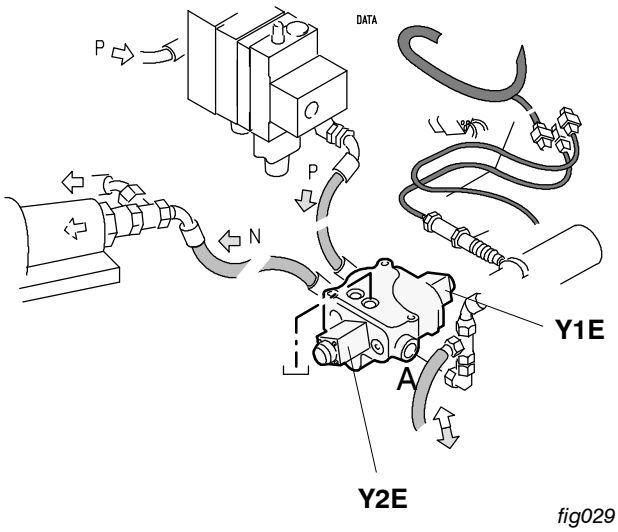


fig029

Connect an ampere–meter in series with control valve solenoids. Y1E lowering and Y2E lifting. Use ETV 894 220 when measuring these values.

Lifting (push button, mudguard) . . . . . approx 1,60 A (maximum current when the Autocontrol rocker switch is turned into the transport height).

Lowering (Push button, mudguard):
– ACDS . . . . . approx 1,50 A
– ACB . . . . . approx 1,40 A

Lowering speed positions:

	ACDS	ACB
1	approx 0,90 A	approx 1,25 A
2	approx 1,00 A	approx 1,50 A
3	approx 1,15 A	approx 1,65 A
4	approx 1,30 A	approx 1,85 A
5	approx 1,60 A	approx 2,10 A
6	approx 1,85 A	approx 2,35 A
7	approx 2,20 A	approx 2,80 A *)
8	approx 2,65 A	approx 3,10 A *)
9	approx 3,00 A	approx 3,20 A *)

*) Values inaccurate, since lowering speed is so large, that ampere–meter reading is difficult to read off.

Resistance of solenoids . . . . . approx **1,6** Ω

Checking the control valve

If the measured values agree with the correct values above, but malfunctions occur in the lowering and lifting functions, the control valve should be removed and checked

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T151eLS–T191LS

Checking the control valve

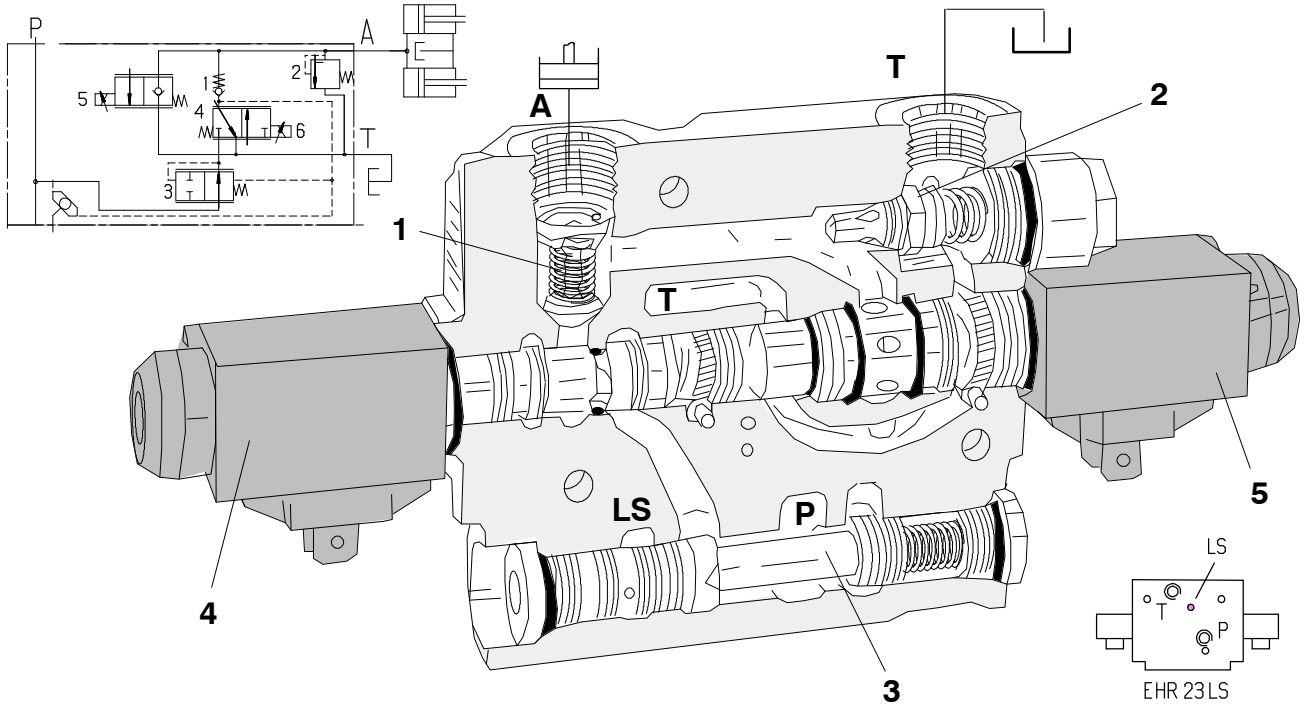


fig049

1 = Holding valve

If the power lift makes many lifting reactions during one minute, when it is loaded, the fault can lie in this valve. The holding valve can be opened and cleaned. Leaking valve is changed. Also the spring can be replaced.

Note! If the power lift does not hold load, the reason can also lie in the shock valve or in the lifting ram piston seals.

2 = Shock valve (safety valve)

In the holding phase the load rests on the shock valve. If the power lift doesn't hold load in upper position, may problem be in leaking shock valve. The shock valve allows pressure peaks to discharge to the tank and thus protects the control valve unit.

The shock valve can be opened and cleaned. If needed, the spring can be changed. Washers can be put under the spring to adjust the opening pressure.

3 = 2–way flow regulating spool

Thus valve can be dismantled and cleaned. The spool must move easy in its bore.

4 = Lifting solenoid and 5 = Lowering solenoid

Solenoids are delivered as a spare part. When fitting a new solenoid, the same adjusting parts must be fitted on the spools (if any). Do not tighten the solenoid bolts too hard. The resistance of a solenoid should be about 1,6 ohms.

Note! When opening the control valve, always fit a new seal rings under the plugs. The plugs can be very tight. Ensure that the allen key fits well. First tap the key with a hammer and then open.

A Port to lifting rams
T Tank port
P Pressure oil passage from pump
LS Load sensing passage from the pump

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Adjusting position sensor

Normally the position sensor does not require any adjustment. If the sensor has been removed, adjustment is necessary.

1. Apply sealing compound to the sensor threads. Screw the sensor locking nut to a point where the distance between the nut front side and the end of the thread is about 14 mm (rough adjustment). Screw the sensor into place until the lock nut touches the PTO housing.

Warning! If the sensor is screwed too deep, the eccentric on the lifting arm shaft damages the sensor when the shaft rotates.

2. Start the engine. Raise the lower links to the max. transport position. By turning the sensor, find a point, where the pump relief valve is blowing off *) and screw the sensor from that point inwards **1**/**4** of a turn.
3. Lower the lower links.
4. Raise the lower links again to the transport position and ensure that the relief valve is not blowing off.
5. Raise the lower links to the max. upper position by using the yellow push button. In this position the relief valve is blowing off and the lifting cylinder stroke from the max. transport height is **3–4 mm**.
6. After adjustment, tighten the sensor locking nut.

*) When the pump is on, the load on the engine can be heard easily.

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Power lift control valve (T121c–T171c, T121h–T191h)

Checking shock valve opening pressure

1. Lower the lower links to the lowest position.

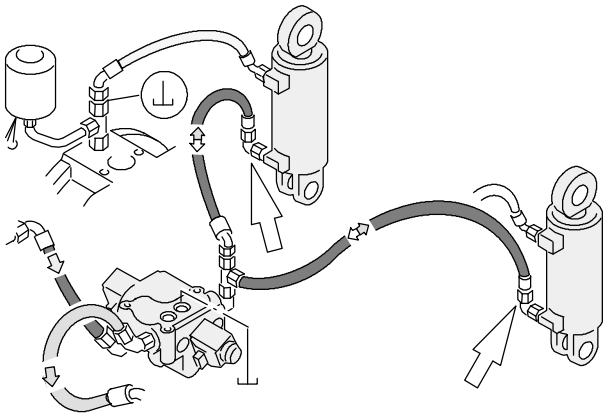


fig030

2. Connect a pressure gauge and a hand pump to one pressure hose of the lifting cylinder (see arrows).
3. Raise the lower links to the upper position, stop the engine and switch off current.
4. Pump with the hand pump pressure into the control valve and read the opening pressure, which should be **20–21 MPa**..

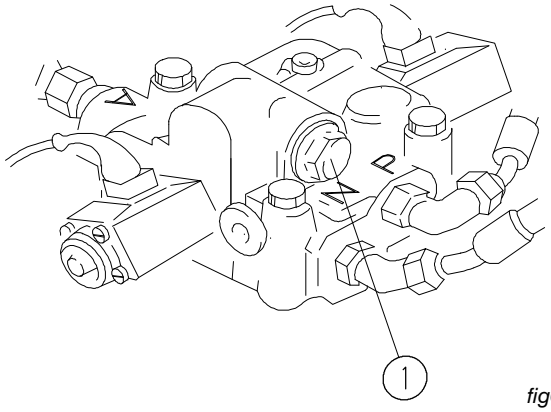


fig031

Note! The shock valve (**1**) is accessible without removing the control valve.

Note! If you want to lower the lower links without starting the engine (e.g. during repair work), unscrew the shock valve after which the lower links can be pressed to the lower position.

Removing control valve

1. Disconnect the solenoid valve leads from the control valve.

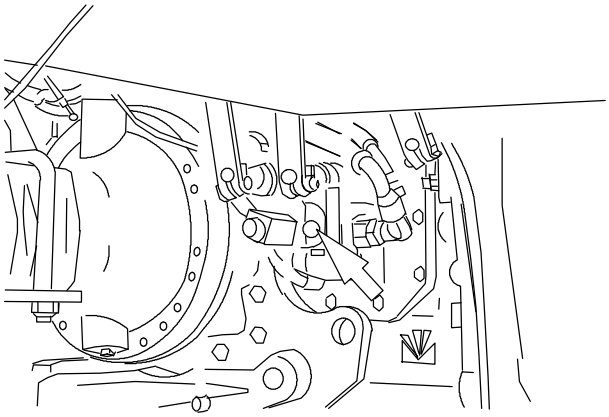


fig032

2. Disconnect all oil hoses from the control valve. Unscrew the control valve fixing bolts (3 pcs) and remove the valve.

Note! There is an oil hole between the control valve and the selector cover. This hole has been sealed with an o–ring, which must be fitted back when the control valve is fitted.

Fitting control valve

1. Make sure that the o–ring is in place between the control valve and the selector cover.
2. Fit the control valve and tighten the fixing bolts evenly to **23–27 Nm**.
3. Connect the solenoid valve leads and all oil hoses.
4. Test–drive the tractor and check the function of the hydraulic power lift.

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Power lift control valve service

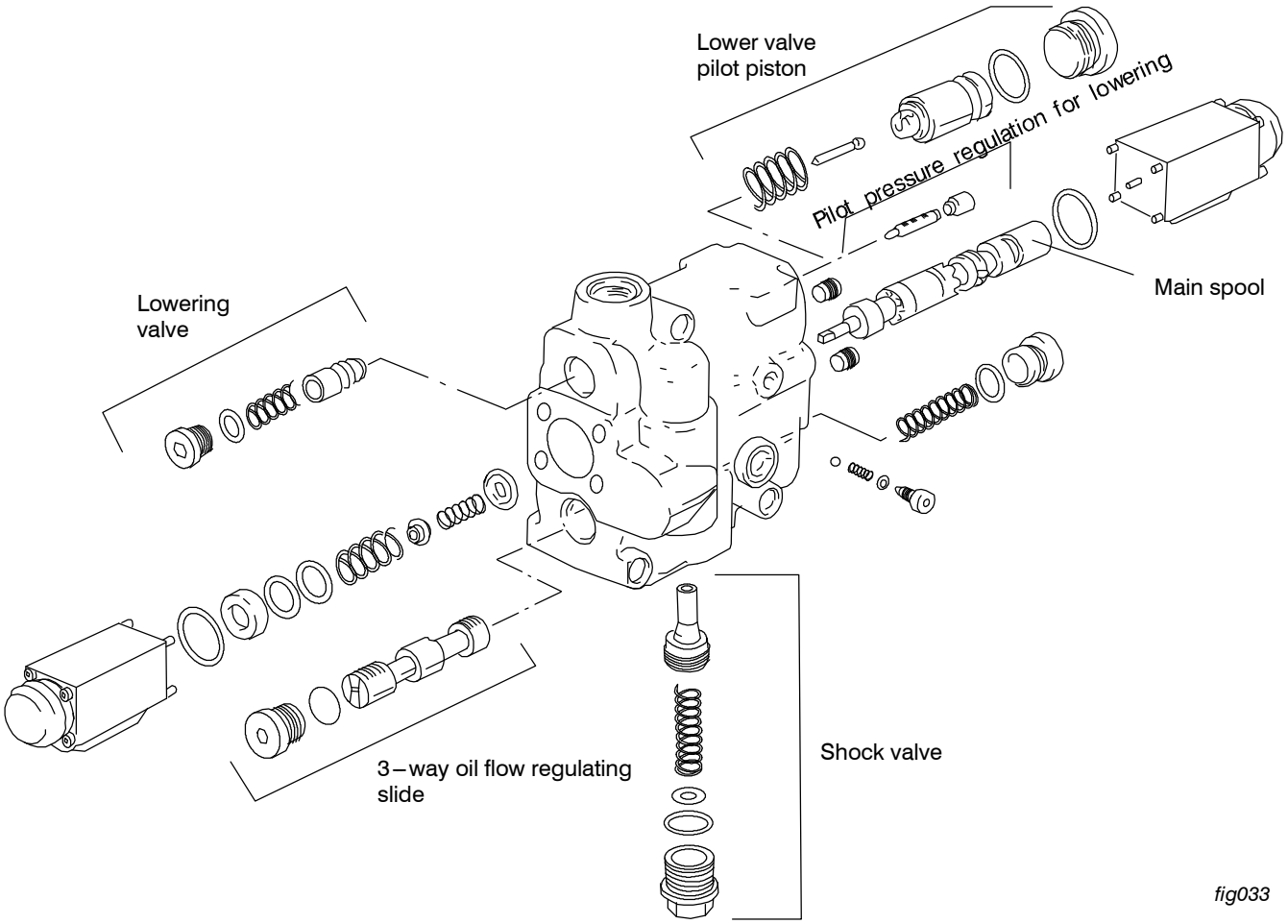


fig033

Lowering valve

If the hydraulic power lift makes many lifting corrections (reactions) per minute when a weight is attached to the three–point linkage, a possible fault can be faulty lowering valve (or its pilot piston).

In this case, the lowering valve can be disassembled and cleaned as well as the pilot piston. Leaking lowering valve must be changed. In addition, the valve spring must be checked and changed. **Note!** If the lift does not hold the load, possible fault can also be leaky lifting cylinder piston seal.

Shock valve (20 MPa)

If the lift does not hold the load, the possible fault can also be leaking shock valve. When the control valve is in neutral position, the load rests on the shock valve.

In this case, open and clean the shock valve and, if necessary, change the valve spring or adjust it with shims.

3–way oil regulating valve

This valve can be opened and cleaned. The valve slide must move easily in its bore.

Pilot pressure limiting valve

Note! The new pilot valve has neither a ball nor a spring but only a tapered valve pin and a locking nut. The valve must not be screwed fully home, it must be opened 1/2–1 turn.

Adjusting pilot pressure:

Connect a pressure gauge to the pressure filter test point. Activate the power lift and adjust the engine revs to 1500 rpm. Turn the position potentiometer to lowering. Now the free circulation pressure must rise 5 bar, e.g.: not activated 20 bar and activated 25 bar.

The tighter the valve is, the greater is the lowering speed (if the valve is tightened too great, the free flow pressure rises too much in the lowering movement). If the valve is too loose, the lower links do not lower at all (lowering valve does not open).

Solenoids

Solenoid valves are available as a spare part. When fitting a new solenoid, fit the same shims onto the end of the main spool spring. **Do not tighten the solenoid screws too hard.**

Tightening torques

Shock valve plug	46 Nm
Lowering valve plug	30 Nm
Pilot piston plug	103 Nm

Note! When reconditioning the control valve, always fit new sealing rings. When opening the valve plugs, use good tight Allen keys because the plugs can be very tight. When slackening the plugs, knock at the Allen keys with a hammer.

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Power lift control valve (T151eLS–T191LS)

Checking shock valve opening pressure

1. Warm the hydraulic oil to a normal operating temperature.
2. Lower the lower links (cylinder piston rod in).

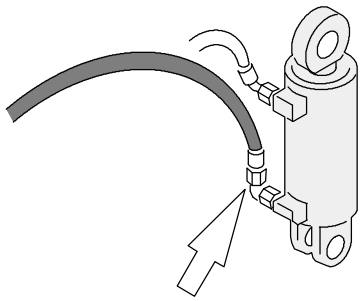


fig051

3. Connect a pressure gauge and a hand pump with a T–connector to a pressure hose of one lifting cylinder.
3. Lift the lower links up, stop the egine and switch off the ignition.
4. Pump with the hand pump pressure into the power lift control valve and read off the opening pressure of the shock valve, which must be between **22,0–22,2 MPa**.

Note! The shock valve is accessible without removing the control valve.

Note! If you want to lower the lower links without starting the engine (e.g. during repair work), unscrew the shock valve after which the lower links can be pressed to the lower position.

Removing/refitting power lift control valve

Note! The control valve is fitted in the valve group, which is placed on the top of PTO housing.

Important! Always bear in mind cleanliness when the valve group is disassembled. E.g. the valve blocks for the auxiliary hydraulics can get malfunctions if impurities enter into them. Before opening the valve group, clean the valves, pipes and surrounding parts throughly.

Tightening torques:

valve group assembly studs . . . . . **23±2 Nm**
valve group assembly nuts . . . . . **22+5 Nm**

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Power lift control valve service

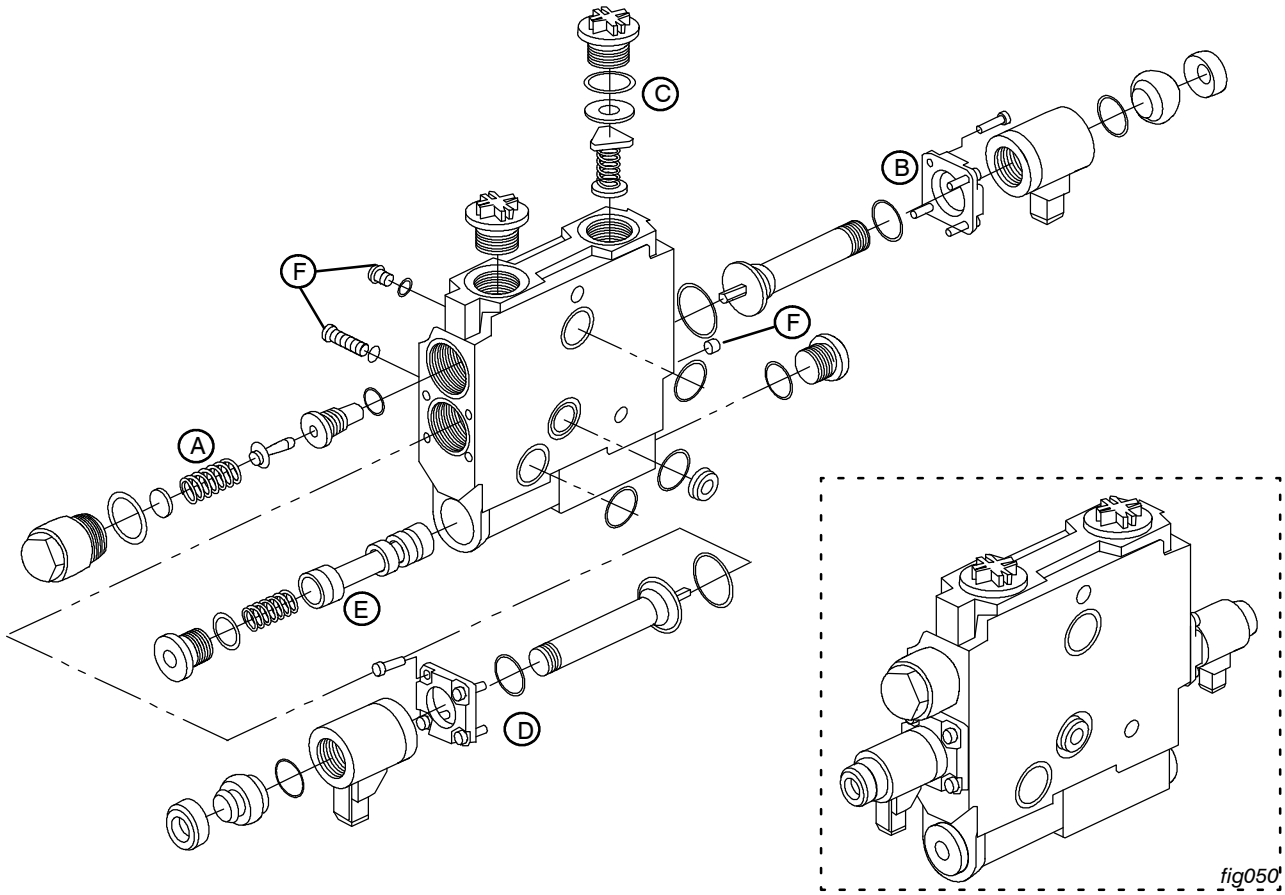


fig050

Safety valve service

Open valve locking thread. Service valve and fit the parts of the safety valve on its location and tighten thelocking thread.

2–way flow control spindle

Open spindle locking thread and service it. Assemble parts of the spindle and lock it by locking thread.

Control spindles

Open spindle locking thread and remove all parts up to solenoid. Loosen four screws to get mounting flange off. Remove the flange and the spindle. Service spindle and assemble it back into housing. Tighten mounting flange with four screws. Assemble solenoid and parts of the locking thread.

Holding valve service

Open locking thread and service if necessary.

Note! Use always vaseline when assembling o–rings. Make sure, o–ring is in the right place (in the groove). Replace always bad or damaged o–ring.

Explanations:
A) Safety valve
B) Control spindle (lifting)
C) Holding valve
D) Control spindle (lowering)
E) 2–way flow control spindle
F) Lock nut

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Changing lifting cylinder seals

1. Disconnect the lift cylinder pressure lines and remove the cylinder.
2. Take out the circlip and backing ring of the cover.

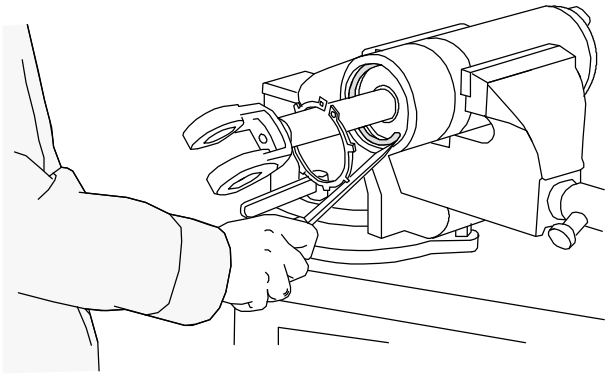


fig034

3. Knock the cover into the cylinder until the o–ring and circlip of the cover inside the cylinder can be removed.

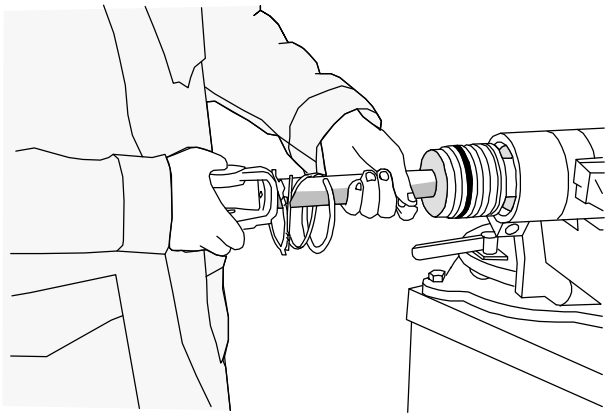


fig035

4. Pull the cover and piston out of the cylinder with a sharp movement.
5. Remove the sealing ring of the piston (cut off with a knife), the o–ring and guide ring. Remove the piston from the piston rod.

Note! Removal of the piston is facilitated by heating it up so that the locking fluid on the threads melts.

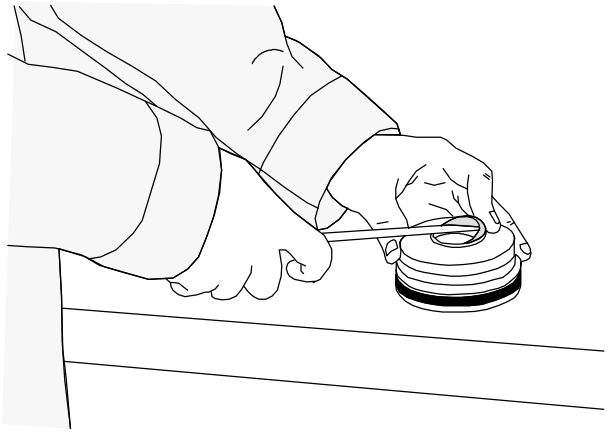


fig036

6. 6. Remove the cover from the piston rod and the seals from the cover.

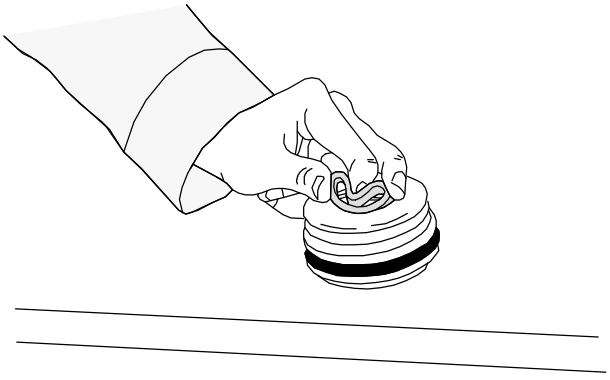


fig037

7. Squeeze the new seal as shown in the figure and press it into its groove (sealing lip downwards). Fit the piston rod oil stripper.
8. Change the o–ring and backing ring of the cover.
9. Place the circlip and backing ring on the piston rod. Grease the inside seals of the cover and push the cover on the piston rod.
10. Fit the piston on the piston rod. Use locking fluid Loctite 270 on the threads. The piston nut tightening torque is **150 Nm**

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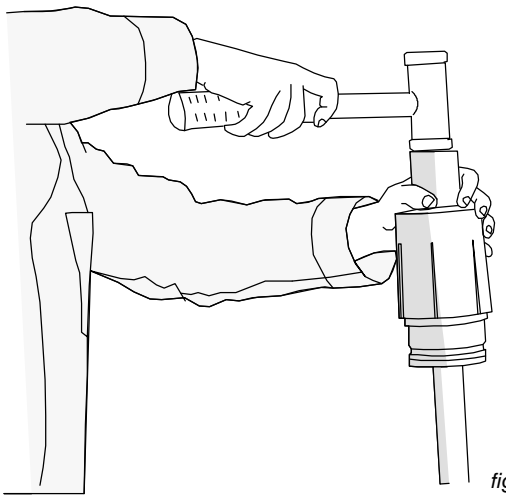


fig038

11. Fit the o–ring on the middle groove of the piston and the outside sealing ring. ETV 894 280 (Ø 90), ETV 894 240 (ø 100) and ETV 894 300 (Ø 90), ETV 894 260 (ø 100). Apply grease on the sliding surfaces of the tool.



fig039

12. Squeeze the seal into the groove with ETV 894 290 (Ø 90), ETV 894 250 (ø 100). Grease the sliding surface. Push the tool onto the seal ring fully home and pull it out.

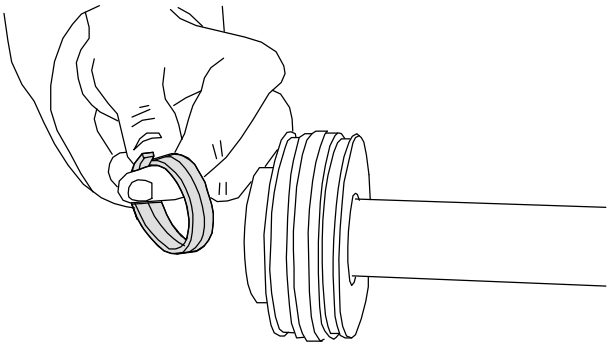


fig040

13. Roll the two guide rings together as shown in the figure and fit them on the piston.

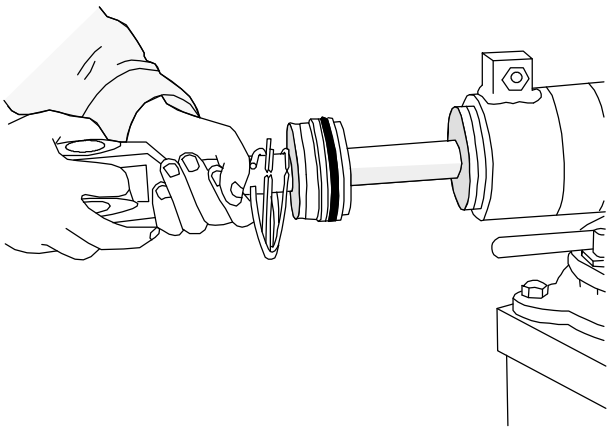


fig041

14. Lubricate the sealing surfaces of the piston and cover and push the unit into the cylinder with a sharp movement. Fit the circlip inside the cylinder. Pull out the cover against the circlip and fit the o–ring, backing ring and outer circlip.
15. Fit the lift cylinder. Connect the oil hoses and tighten to **45 Nm.**

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Three–point linkage and towing hook

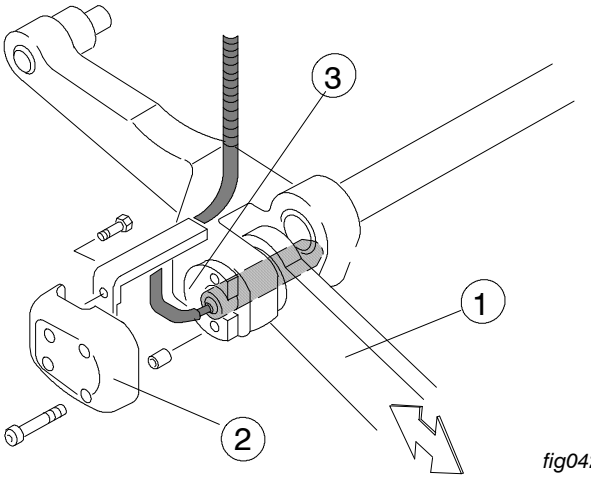


fig042

Lower links

If the lower link (1) must be changed, first remove the draft sensor cover (2) and the draft sensor locking piece (3). Now the lower link can be removed after the draft sensor is pulled out.

Pick–up hitch

When removing the pick–up hitch the lower links must be detached first. After that drive out the locking pins of the pick–up hitch shaft and remove the pick–up hitch shaft.

Note! Remove the check link bracket from one rear axle housing. Remove, if necessary one rear wheel, if the pick–up hitch shaft cannot be pulled out from its place.

The pick–up hitch loosens when the locking pins at the front end of the hitch is removed. Now the hitch releases from its cast iron guide ways under the gearbox housing.

Lifting arm shaft

If the lifting arm shaft has to be changed, the PTO housing must be detached from the tractor. Then remove the PTO unit front cover and the PTO clutch shaft.

Remove the position sensor cam from the lifting arm shaft through the opening in the upper part of the PTO housing.

Note! Do not damage the position sensor when removing the PTO housing. Remove the position sensor always before detaching the PTO housing from the tractor (see section **46**).

Remove the lifting arms and pull out the lifting arm shaft from its location on the PTO housing.

Adjusting pick–up hitch lifting links

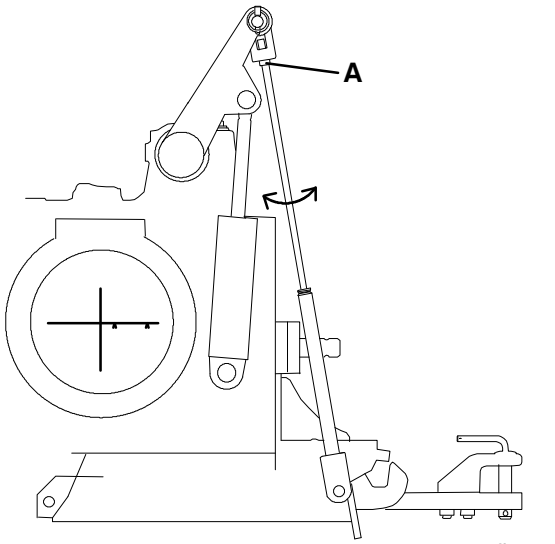


fig043

The lifting links should always have a certain amount of clearance when the hydraulic lift is in its upper position. However, they must be adjusted in such a way that the pick–up hitch is securely locked by the pawl, even when the towing hook is loaded.

Before adjusting, raise the hydraulic lift to its upper position using the position control knob (towing hook unloaded). Check the adjustment by moving the lifting links manually. Adjustment is correct when the link moves loosely and when the lift is lowered the towing hook is locked positively by the pawl. Make sure that the spring returns the pawl fully home.

Adjust the length of the links if necessary by removing the cotter at the upper end of the links and turning until the correct length is obtained. Check that **both lifting links are the same length after adjustment**.The lifting links may be tightened when lifting with push buttons.

Correctly adjusted lifting links ensure that the hydraulic lift can be raised to its uppermost position. The pick–up hitch is locked when the lift is lowered to the point where the hitch rests on the pawl, thereby preventing unnecessary loading on the hydraulic pump and overheating of the oil.

Checking locking of pick–up hitch

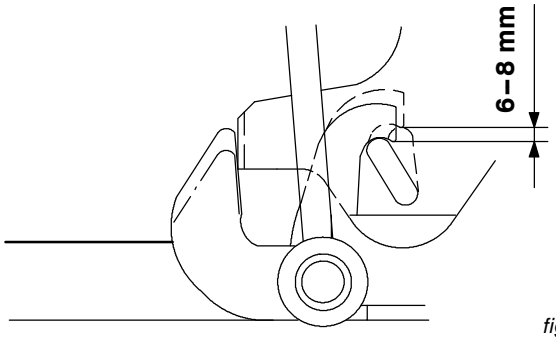


fig044

Make sure that the spring returns the pawl fully home. When the pawl is turned upwards the pick–up hitch should move up by **6–8 mm**.

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100. Special tools

101. Special tools (ETV)

102. Locally prepared tools (ET)

Contents

Technical data, technical specifications, training material

1011.1 . . Special tools (ETV) 1

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Special tools

Engine

1. . . . 9051 73100 . . . . Puller for cylinder liner . . . . . code 214.1
2. . . . 9025 87400 . . . . Drift for fitting camshaft cup plug . . . . . code 214.1
3. . . . 9101 65600 . . . . Milling cutter for cylinder liner seat . . . . . code 214.1
– . . . 9045 87600 . . . . Spare cutting blade for milling cutter . . . . . code 214.1
4. . . . 9101 66300 . . . . Press tool for cylinder liner . . . . . code 214.1
5. . . . 9025 79200 . . . . Holder for dial gauge . . . . . code 214.1
6. . . . 9052 46620 . . . . Drift for 40 mm cup plug . . . . . code 214.1
7. . . . 9052 46650 . . . . Drift for 16 mm cup plug . . . . . code 214.1

8. . . . 9052 46400 . . . . Centring tool for flywheel housing . . . . . code 214.1
9. . . . 9025 98700 . . . . Drift for tension pins in timing gear- and flywheel housing . . . . . code 214.1
10. . . 9052 46300 . . . . Drift for fitting rear crankshaft seal . . . . . code 214.1
11. . . 9101 65700 . . . . Spanner for crankshaft nut . . . . . code 214.1
12. . . 9025 98800 . . . . Drift for tension pins in timing gear housing . . . . . code 214.1
13. . . 9030 15200 . . . . Drift for fitting front crankshaft seal . . . . . code 214.1
14. . . 9201 30270 . . . . Centring tool for idler gear, narrow timing gear housing

15. . . 9052 47200 . . . . Counter nut for lever above . . . . . code 214.1
16. . . 9101 66200 . . . . Lever for compressing valve spring . . . . . code 214.1
17. . . 9120 85400 . . . . Milling tool for injector seat, 4V engines . . . . . code 214.1
18. . . 9120 85300 . . . . Drift for removing valve guide, 4V engines . . . . . code 214.1
19. . . 9120 85000 . . . . Drift for fitting valve guide, 4V engines . . . . . code 214.1
20. . . 9103 94800 . . . . Drift for 45 mm cup plug . . . . . code 214.1
21. . . 8370 62635 . . . . Milling cutter kit for valve seat, 4V engines . . . . . code 214.1
22. . . 9101 66100 . . . . T-handle for valve seat milling cutter . . . . . code 214.1
23. . . 9101 71100 . . . . Milling cutter for facing exhaust valve seat . . . . . code 214.1
24. . . 9101 65502 . . . . Milling cutter for exhaust valve seat . . . . . code 214.1
25. . . 9101 65503 . . . . Inner milling cutter for exhaust valve seat . . . . . code 214.1
26. . . 9101 75800 . . . . Milling cutter for facing inlet valve seat . . . . . code 214.1
27. . . 9101 65505 . . . . Milling cutter for inlet valve seat . . . . . code 214.1
28 . . . 9101 65506 . . . . Inner milling cutter for inlet valve seat . . . . . code 214.1
29. . . 9052 46660 . . . . Drift for 36 mm cup plug . . . . . code 214.1
30. . . 9052 48800 . . . . Puller for crankshaft gears . . . . . code 214.1
31. . . 9103 94700 . . . . Drift for fitting crankshaft gears . . . . . code 214.1

32. . . 9024 55800 . . . . Spanner for crankshaft nut . . . . . code 214.1
33. . . 9104 53300 . . . . Puller for crankshaft hub . . . . . code 214.1
34. . . 9052 46900 . . . . Piston ring pliers . . . . . code 214.1
35. . . 9020 01100 . . . . Conical sleeve for fitting pistons . . . . . code 214.1

36. . . 9120 85400 . . . . Milling tool for injector seat . . . . . code 224.1
37. . . 36 000 400 . . . . MultiTool and necessary equipment, with protection case . . . . . code 224.1

38. . . 9101 93200 . . . . Puller for coolant pump impeller . . . . . code 234.1
39. . . 9051 79300 . . . . Drift for fitting coolant pump water seal . . . . . code 234.1

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Power transmission

1. . . . 892 570 . . . . . Kit for checking clutch . . . . . code 414.1

2. . . . 893 300 . . . . . Puller for differential bearings . . . . . code 424.1
3. . . . 894 120 . . . . . Counter hold for puller ETV 893 300. . . . . code 424.1
4. . . . 893 302 . . . . . Claws for puller ETV 893 300 . . . . . code 424.1
5. . . . 892 230 . . . . . Socket spanner for bevel pinion shaft ring nut . . . . . code 424.1
6. . . . 893 340 . . . . . Plate for fitting bearing race, pinion shaft rear bearing . . . . . code 424.1
7. . . . 892 370 . . . . . Sleeve for fitting input shaft front end bearing
Sleeve for fitting bevel pinion shaft front end bearing . . . . . code 424.1
8. . . . 894 080 . . . . . Drift for fitting selector fork rail for LL–range . . . . . code 424.1
Drift for fitting selector fork rail locking ball . . . . . code 464.1
9. . . . 893 400 . . . . . Plate for fitting differential bearings . . . . . code 424.1
10. . . 891 870 . . . . . Plate for fitting thrust bearing for differential side of gear . . . . . code 424.1

11 . . . 894 350 . . . . . Compressing tool for F–clutch large coil spring (Nh) . . . . . code 444.1

12 . . . 893 320 . . . . . Plate for fitting outer drive shaft bearing race . . . . . code 454.1
13 . . . 890 220 . . . . . Universal handle . . . . . code 454.1, 464.1
14 . . . 893 310 . . . . . Plate for fitting outer drive shaft inner oil seal . . . . . code 454.1
15 . . . 893 690 . . . . . Plate for fitting outer drive shaft inner oil seal . . . . . code 454.1

16 . . . 891 870 . . . . . Plate for fitting PTO shaft seal . . . . . code 464.1
17 . . . 894 420 . . . . . Ring for fitting PTO shaft cassette seal (to be used with below listed sleeves) . . . . code 464.1
18 . . . 894 430 . . . . . Sleeve (ø 35) for fitting PTO shaft cassette seal
(to be used with above mentioned ring) . . . . . code 464.1
19 . . . 894 440 . . . . . Sleeve (ø 44,6) for fitting PTO shaft cassette seal
(to be used with above mentioned ring) . . . . . code 464.1

Steering system and front axle

1. . . . 894 330 . . . . . Fitting tool for steering valve seal . . . . . code 614.1

Contents

Technical data, technical specifications, training material

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Locally prepared tools (ET)

Part no	Description	Code
ET 894 060	Press tool adjusting selector forks	424.1
ET 893 410	Support for removing outer drive shaft bearing race	454.1
ET 894 000	Tool for unscrewing locking flange at front end of PTO shaft	464.1
ET 894 090	Sleeve for fitting PTO clutch circlip	464.1
ET 894 020	Fitting tool for the cassette seal	644.1
ET 894 030	Fitting tool for the outer oil seal of the drive shaft	644.1
ET 894 040	Fitting tool for the bushing of the drive shaft	644.1, 654.1
ET 894 050	Fitting tool for the inner oil seal of the drive shaft	644.1
ET 894 070	Fitting tool for the seal of the bevel pinion shaft	644.1
ET 894 080	Fitting tool for the outer oil seal of the drive shaft	654.1
ET 894 100	Fitting tool for the inner oil seal of the drive shaft	654.1
ET 894 120	Fitting tool for the seal of the bevel pinion shaft	654.1
ET 894 140	Tool for pinion/crown wheel tooth backlash measurement	654.1
ET 894 150	Fitting tool for the cassette seal	654.1
ET 894 160	Fitting tool for the inner oil seal of the drive shaft	654.1

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