DEUTZ FAHR

SAME DEUTZ-FAHR DEUTSCHLAND GmbH

WORKSHOP MANUAL

AGROTRON 106 MK3
AGROTRON 110 MK3
AGROTRON 115 MK3
AGROTRON 120 MK3
AGROTRON 135 MK3
AGROTRON 150 MK3
AGROTRON 165 MK3

INTRODUCTION

The purpose of this workshop manual is to provide instruction for repair technicians and a practical guide to improving the quality of repairs.

This manual enables repair technicians to acquire a thorough knowledge of the machine, indicating the correct methods for fault diagnosis, for working in safety and for accurate dimensional checks and visual inspections. The instructions also indicate the products to use, the tightening torques and the adjustment data.

The technical material contained in this manual is reserved to Authorised Dealers and Service Centres who will be duly informed of any technical changes to the machines in question through the issue of documents regarding modifications, updates and supplements for optional equipment.

SAFETY NOTES

To ensure that machines entrusted to Authorised Service Centres for repair or overhaul continue to function correctly, it is very important that all repair work is carried out in the prescribed manner.

The procedures for checks and repairs indicated in this manual are safe and effective.

Some of the operations described require the use of special tools and equipment: these tools have been designed for a specific purpose and may ordered directly from the Manufacturers.

DO NOT USE MAKESHIFT TOOLS; not only is there is risk of personal injury, but such tools are rarely suited to the purpose for which they are used.

To prevent injury to operators, the symbols ⚠ and  are used in this manual to indicate the safety precautions required. The warnings accompanying these symbols must always be adhered to carefully.

In potentially hazardous situations, always give priority to personal safety and take the necessary actions to eliminate the danger.

GENERAL SAFETY RULES

1 - Even if you have a thorough knowledge of the machine as regards its components, operation and controls, always take particular care when carrying out the following operations. Remember that the machine you are working on is in need of repair or overhaul and consequently may not always behave as expected.

2 - Before starting work, clean the machine thoroughly to remove all mud, dust and road dirt.
Also clean the cab to remove all traces of oil, snow and ice from the access steps and grab rails.

3 - When climbing up to or down from the cab, always ensure you maintain three points of contact at a time (foot or handholds) in order to keep your balance and prevent accidental falls.

4 - Always take special care when carrying out fault diagnosis operations; these operations often require two persons, who must never stand in front of the wheels when the engine is running.

5 - When carrying out checks and repairs, wear close-fitting clothing, safety goggles and protective gloves that are suitable for the task (cleaning, draining fluids, repairs).
When working near moving parts, long hair should be gathered up and secured safely under a cap to prevent the risk of entanglement and sever injury.

6 - Do not allow anyone who is not directly involved in the work to come near the machine; ensure that they remain at a safe distance.

7 - Keep well clear of moving parts; when the engine is running, some moving parts are not easily visible and therefore present a risk of entanglement, even if protected by safety guards.

8 - Ensure that the area is well ventilated before starting the engine in order to avoid the formation of dangerous concentrations of toxic gases; always connect suitable fume extraction equipment to the exhaust pipe.

9 - Under no circumstances start the engine with the safety guards removed; all repair and adjustment operations must be carried out with the engine stopped.

10 - Do not top up fuel, oil or coolant levels when the engine is running.

11 - Never smoke and ensure there are no naked flames nearby when topping up fuel or oil.
Always remove the battery from the machine before recharging.

12 - Before checking or removing the battery, stop the engine and remove the key from the starter switch.

13 - Remove the battery and recharge in a well-ventilated area where the temperature exceeds 0°C.

14 - When checking or recharging the battery, do not smoke or allow naked flames in the vicinity as the hydrogen gas given off by the battery is highly explosive.

15 - The liquid (electrolyte) contained in the battery is very harmful if it comes into contact with the skin and the eyes; for this reason, always wear gloves and safety goggles with side shields when checking or topping up the battery.
Should any electrolyte accidentally come into contact with your skin, wash the affected parts immediately with copious amounts of water. If electrolyte comes into contact with your clothing, this should be removed as soon as possible.

In case of accidental ingestion of electrolyte, drink copious amounts of water, milk or vegetable oil and take antacids such as magnesium, bicarbonate, etc.. and seek medical attention immediately.

16 - Before working on the electrical systems, always disconnect the battery terminals.
IMPORTANT!
Always disconnect the negative terminal (–) first and then the positive terminal (+); when re-connecting the battery on completion of the work, first connect the positive terminal (+) and then the negative (–).

17 - Before carrying out any arc welding, on the tractor, always disconnect the battery terminals and unplug all the connectors of the electronic control units and the alternator.

18 - When topping up lubricants, always wear suitable protective gloves.

19 - Do not wear clothing contaminated by engine or hydraulic oil; prolonged contact with the skin can be harmful and may cause allergic reactions.

20 - Used engine oil and hydraulic oil must be disposed of in a proper manner; recover used lubricants and dispose of them in accordance with the applicable regulations.

21 - Before carrying out any work on the hydraulic or pneumatic systems, discharge all residual pressure from the circuits.

22 - Before carrying out any work on the hydraulic system or engine, allow the oil and engine coolant to cool down.

23 - When removing and refitting certain assemblies, it will be necessary to support the machine; use stands, jacks or blocks capable of supporting the weight and arrange them in a triangular pattern to prevent the machine from overturning.

24 - To lift heavy components, use a hoist or crane.
Check that wire ropes, chains or fibre slings are not worn and that hooks are not damaged.

25 - Always use lifting equipment of suitable capacity for the weight of the components to be removed. Ensure lifting equipment is attached correctly.

26 - When lifting or supporting an assembly or component, manoeuvre the parts slowly and carefully to avoid oscillation or collision with other components.

27 - Never work on components suspended from a hoist or crane.

28 - When removing the retaining bolts of a component that could fall, always leave two opposing bolts in place for safety; before removing these last two bolts, attach the component to suitable lifting equipment or position support blocks.

29 - Any oil or fuel spilled during removal or dismantling operations should be cleaned up as soon as possible to prevent the risk of slipping and fire.

30 - When refitting electrical cables and wires, ensure that they are secured with their original retaining straps or brackets to prevent the possibility of damage caused by vibration.

31 - Never insert your fingers or hands to check the alignment between fixing holes in components; always use a suitable dowel of soft material.

32 - When refitting assemblies or components, always use the specified tightening torques; the tightening torques indicated in the paragraphs regarding assembly/refitting operations have been determined through experimentation and must be scrupulously adhered to.

33 - When refitting parts that are subject to vibration or that rotate at high speed, take particular care when carrying final installation checks.

HOW THE MANUAL IS STRUCTURED

Section 00 Contains the general safety rules, information on how to use and update the manual, the symbols used, the products required, the standard tightening torques and a conversion table for units of measurement.

Section 10 Contains technical descriptions and information regarding the mechanical and hydraulic operation of machine components, the designations of the various components, hydraulic diagrams and general technical data.

Section 20 Contains a guide to the use of the necessary software for machine and engine configuration and for diagnostic.

Section 30 Contains the methods, checks and adjustments regarding the external components; the operations dealt with in this section do not require removal of the various assemblies that form the tractor frame and cab.

Section 40 Contains information and diagrams regarding the machine's electrical and electronic systems.

ATTENTION!

This manual does not contain the engine and transmision sections.
For these sections refer to the follow manuals:

Engine DEUTZ 1012 - 1013	**0297 9771**	**Italian English French German**
Transmission ZF 7100L	**0298 6837**	**German**
	0298 6838	**English**
	0298 6839	**French**
	0298 6840	**Spanish**
Transmission ZF 7100S	**0298 6871**	**German**
	0298 6872	**English**
	0298 6873	**French**
	0298 6874	**Spanish**
Rear axle 7100	**0298 6877**	**German**
	0298 6878	**English**
	0298 9879	**French**
	0298 9880	**Spanish**
Trasmission/rear axle 7200 L-S-H	**0298 6831**	**German**
	0298 6832	**English**
	0298 6833	**French**
	0298 6834	**Spanish**
Front axle ZF 2025-2035-2045 AS	**0298 6803**	**German**
	0298 6856	**English**
	0298 6857	**French**
	0298 6858	**Spanish**

HOW TO CONSULT THE MANUAL

1. Removal and refitting of assembled units

(1) For the removal or refitting of assembled units, the sequence of operations and the methods to be applied are described in the removal procedure; if the refitting sequence of operations is the exact reverse of the removal procedure, it is not described.

(2) All special techniques that apply only to the refitting procedure are indicated by the symbol ※1 ; this same symbol appears at the end of each major step in the removal procedure to indicate the parts for which special techniques are to be applied during refitting.

E.g.: **REMOVAL OF UNIT** : ..... Operation heading

⚠ : ..... Safety rules to be observed when carrying out the procedure described

1 - Remove part (1):..... Step of the procedure

★: ..... Technique or important information regarding the removal operation.

2 - Disconnect (2) ..... ※1 : .....Indicates the existence of special information regarding refitting of the component in question.

..... ℓ: ..... Recover oil, liquid or fuel and the quantity to be recovered

E.g.: **REFITTING UNIT:** ..... Operation heading

- Refitting is the reverse of removal

※1 :.....Technique to be applied during refitting

★: ..... Technique or important information regarding the refitting operation

- ..... ℓ: ..... Filling with oil or liquid with quantity

2. During removal and refitting operations, in addition to the general safety rules, you must also apply the specific «SAFETY PRECAUTIONS FOR REMOVAL AND REFITTING OPERATIONS».
Always adhere to these precautions.

3. List of special tools

(1) For details regarding the type, code numbers and quantity of all the tools (T1, T2, etc.) specified in the operating procedures, see the heading «SPECIAL TOOLS».

4. Tightening torques

1 - In the operating procedures, the symbol ▽ denotes a specific tightening torque that has been determined experimentally and that must be adhered to.

2 - If the symbol does not appear, the torque values to be used are those indicated in the table in Section 00 of this manual.

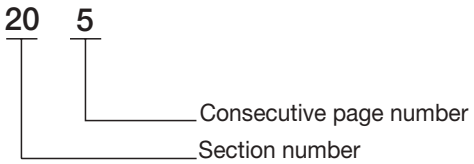
HOW TO USE AND UPDATE THE MANUAL

1. UPDATING THE MANUAL

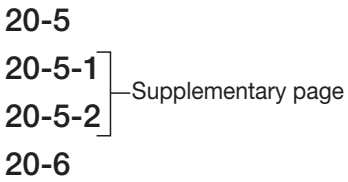
All additions, corrections or amendments to the manual will be sent to the Authorised Service Centres.
Before starting any repair or overhaul operations, check that you have the most recent updates as these may contain supplementary data not present in previous issues.

2. INSERTING UPDATES

1- **Check the** number of the page and insert it in the appropriate section of the manual following the consecutive order of the page numbers. Example:

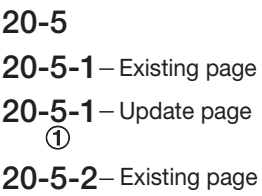


2 - **Supplementary pages:** indicated with a hyphen (-) and consecutive number after the page number. Example:



NOTE. The contents of supplementary pages are structured so that there is no overlap with existing pages.

3 - **Updated pages:** indicated by a consecutive number in a circle; this symbol appears below the page number. Example:



NOTE. All supplementary and updated pages are indicated in the manual page list; a revised page list is sent with each update and supersedes the previous list.

3. SYMBOLS USED IN THE MANUAL

For greater clarity, important information pertaining to operator safety and to critical stages in the working procedures is highlighted by the symbols shown in the following table.

Symbol	Meaning	Notes
	Safety	Safety rules to be applied during operation.
		Operation requiring special safety measures due to internal pressure.
	Warning	Operations requiring special technical or other precautionsto ensure compliance with standard values.
	Weight	Weight of main assemblies. Choose lifting ropes/slings carefully; supports required, etc.

Symbol	Meaning	Notes
	Coating	Parts must be coated with adhesive, lubricant, etc.
	Oil, water	Points at which oil, water or fuel must be added and quantity required.
	Drain	Points from which oil, water or fuel must be drained with quantity.
	Tightening torques	Parts requiring special tightening torque during refitting or assembly.

SAFETY PRECAUTIONS FOR REMOVAL AND REFITTING OPERATIONS

★ When removing or refitting parts, always take the following safety precautions.

1. Precautions for removal operations

- Unless otherwise indicated, lower the working equipment until it rests on the ground.
- After disconnecting hydraulic and fuel system pipes, always fit plugs to the open ends of the pipes to prevent ingress of impurities.
- Before removing a cylinder, fully retract the piston and secure it in this position using a retaining strap.
- Use containers of sufficient capacity when draining oil, coolant or fuel.
- Before removing a part from the machine, check for alignment markings indicating the correct assembly position. If necessary, make new markings to ensure correct assembly.
- When unplugging electrical connectors, always grip the connectors firmly to avoid pulling on the wires.
- Where necessary, label wires and pipes before removal to avoid confusion when reconnecting.
- Check the number and thickness of any shims removed and keep them together in a safe place.
- To lift the machine or any of its main components, use lifting equipment of suitable capacity.
- When using bolts or eye bolts to remove parts, ensure they are screwed home fully.
- Before removing a part, clean the surrounding area and, after removing the part, cover it to prevent the ingress of dirt and dust.

2. Precautions for refitting operations

- Tighten nuts and bolts to the specified tightening torques.
- When refitting flexible pipes and wires, take care not to twist or tangle them.
- Always fit new seals, O-rings, cotter pins and safety stop rings; ensure that cotter pins are bent over so that they cannot work loose.
- Ensure that circlips are correctly installed in their seatings.
- When applying threadlocking compound, first clean the part removing all oil and grease, then cover the thread evenly applying a few drops of the compound.
- When applying sealant, first clean the surface removing all traces of oil and grease and check for dirt or indentations, then apply the sealant evenly making sure that it forms a continuous film around any fixing holes.
- Clean all parts, removing dirt, oxidisation, carbon deposits, burrs and indentations.
- Coat all moving parts with a thin film of engine oil.
- When reconnecting electrical connectors, first remove all traces of oil, dust and water from the inside of the connector and then connect the two halves together firmly.
- When using eyebolts for lifting, check that they are not deformed, screw them fully home and align the eye with the lifting hook.
- Bolt down flanged fittings evenly, tightening the bolts gradually in a crosswise pattern.

3. Precautions to be taken on completion of removal/refitting operations

- If coolant has been drained from the engine, refit the drain plug and add new coolant to the correct level. Start the engine to circulate the coolant and then check the level again and top up.
- After removing hydraulic components, top up the hydraulic oil to the specified level. Start the engine to circulate the oil in the hydraulic circuits and then recheck the level and top up as necessary.
- After having removed the variable displacement pump, before connecting the discharge pipe, fill the pump casing with oil.
- Grease stub axle housings, cylinder pivot mountings and drive shafts thoroughly after assembly.

LIFTING INSTRUCTIONS

kg

⚠ Components weighing over 25 kg or of significant size must be supported and removed using suitable lifting equipment with wire rope or polyester slings.
In the paragraphs regarding removal and refitting operations, the weight of the component or assembly to be lifted is indicated with the symbol kg

WIRE ROPES - SLINGS

- Use wire ropes or polyester slings of suitable capacity for the parts to be lifted, referring to the following tables:

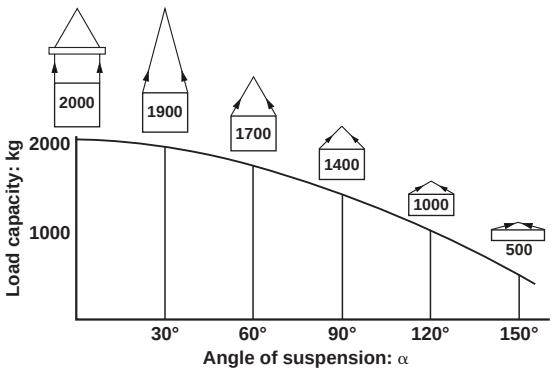
WIRE ROPES (standard twisted «S» or «Z» type)				POLYESTER SLINGS (eye-and-eye - simple loop)				
Ø rope mm	Capacity (kg)			Width (mm)	Capacity (kg)			
		60°	90°				60°	90°
8	650	620	500	25	500	400	860	700
10	1000	1740	1420	50	1000	800	1730	1410
12	1450	2500	2050	62	1250	1000	2160	1760
14	2000	3460	2820	75	1400	1120	2420	1980
16	2600	4500	3670	100	2000	1600	3460	2820
18	3300	5710	4660	150	2500	2000	4330	3530

NOTE. Lifting capacities are calculated with a safety coefficient.

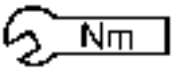
- The lifting hook should be attached to the central part of the rope or sling; if the hook is attached near the ends of the rope/sling, this could cause the load to slip during lifting.
- Never lift a heavy load using a single rope; always use two or more symmetrically arranged ropes.

⚠ Suspension of a load from a single rope could cause the load to start rotating and consequently cause the rope strands to untwist or the load to slip; this could lead to serious injury.

- Never lift a heavy load when the two branches of the ropes form a wide angle.
The permitted load (kg) decreases in inverse proportion to the angle of suspension; the table below indicates how the permitted load varies according to the angle of suspension for two Ø 10 mm ropes each with a load capacity of 1000 kg.



STANDARD TIGHTENING TORQUES FOR NUTS AND BOLTS



⚠ The tightening torques for certain specific components and special tightening methods are indicated in the relative assembly paragraphs.

★ The tightening torques indicated below refer to bolts and nuts assembled without lubrication and, where applicable, with anaerobic threadlocking compound.
The values apply to tightening on steel or cast iron components; for soft materials such as aluminium, copper, plastic, sheet metal or panels, the indicated tightening torques must be reduced by 50%.

BOLT SIZE		BOLT CLASS					
		8.8		10.9		12.9	
		Nm	lb.ft.	Nm	lb.ft.	Nm	lb.ft.
COARSE THREAD	M6x1	8.0–8.8	5.9–6.5	11.8 – 13.0	8.7–9.6	13.8 – 15.2	10.2–11.2
	M8x1.25	19.4–21.4	14.3–15.8	28.5 – 31.5	21.0 – 23.2	33.3 – 36.9	24.5 – 27.2
	M10x1.5	38.4 – 42.4	28.3 – 31.2	56.4 – 62.4	41.6 – 46.0	67.4 – 74.4	49.7 – 54.8
	M12x1.75	66.5 – 73.5	49.0 – 54.2	96.9 – 107	71.4 – 78.9	115 – 128	84.8 – 94.3
	M14x2	106 – 117	78.1 – 86.2	156 – 172	115.0 – 126.8	184 – 204	135.6 – 150.3
	M16x2	164 – 182	120.9 – 134.1	241 – 267	117.6 – 196.8	282 – 312	207.8 – 229.9
	M18x2.5	228 – 252	168.0 – 185.7	334 – 370	246.2 – 272.7	391 – 432	288.2 – 318.4
	M20x2.5	321 – 355	236.6 – 261.6	472 – 522	347.9 – 384.7	553 – 611	407.6 – 450.3
	M22x2.5	441 – 487	325.0 – 358.9	647 – 715	476.8 – 527.0	751 – 830	553.5 – 611.7
	M24x3	553 – 611	407.6 – 450.3	812 – 898	598.4 – 661.8	950 – 1050	700.2 – 773.9
	M27x3	816 – 902	601.4 – 664.8	1198 – 1324	882.9 – 975.8	1419 – 1569	1045.8–1156.4
FINE THREAD	M8x1	20.8 – 23.0	15.3 – 17.0	30.6 – 33.8	22.6 – 24.9	35.8 – 39.6	26.4 – 29.2
	M10x1.25	40.6 – 44.8	29.9 – 33.0	59.7 – 65.9	44.0 – 48.6	71.2 – 78.6	52.5 – 57.9
	M12x1.25	72.2 – 79.8	53.2 – 58.8	106 – 118	78.1 – 87.0	126 – 140	92.9 – 103.2
	M12x1.5	69.4 – 76.7	51.1 – 56.5	102 – 112	75.2 – 82.5	121 – 134	89.2 – 98.8
	M14x1.5	114 – 126	84.0 – 92.9	168 – 186	123.8 – 137.1	199 – 220	146.7 – 162.1
	M16x1.5	175 – 194	129 – 143	257 – 285	189.4 – 210.0	301 – 333	221.8 – 245.4
	M18x1.5	256 – 282	188.7 – 207.8	375 – 415	276.4 – 305.9	439 – 485	323.5 – 357.4
	M20x1.5	355 – 393	261.6 – 289.6	523 – 578	385.5 – 426.0	611 – 676	450.3 – 498.2
	M22x1.5	482 – 532	355.2 – 392.1	708 – 782	521.8 – 576.3	821 – 908	605.1 – 669.2
	M24x2	602 – 666	443.7 – 490.8	884 – 978	651.5 – 720.8	1035 – 1143	762.8 – 842.4

THREADLOCKERS, ADHESIVES, SEALANTS AND LUBRICANTS

FUNCTION	DESIGNATION	DESCRIPTION
THREADLOCKER	**Loctite 222** Colour: opaque fluorescent purple	Anaerobic product suitable or low-strength locking of retaining, adjustment and precision fasteners. All traces of lubricant must first be removed using the specific activator.
	Loctite 242 Colour: fluorescent blue	Anaerobic product that prevents loosening of all types of nut and bolt; used in place of conventional mechanical locking systems. Used for medium-strength locking. All traces of lubricant must first be removed using the specific activator.
	Loctite 243 Colour: opaque fluorescent blue	Alternative product to 242; oil tolerant and so can used on lightly lubricated surfaces without prior use of activator.
	Loctite 270 Colour: fluorescent green	Anaerobic product for high-strength locking of bolts and studs that do not normally require disassembly. Parts must be heated to approximately 80°C for removal. All traces of lubricant must first be removed using the specific activator.
DEGREASERS AND ACTIVATORS	**Loctite 703**	Product used for degreasing and cleaning parts prior to application of Loctite anaerobic products; after drying, promotes uniform curing of threadlockers.
	Loctite 747	Product used for specifically for treatment of passive metals prior to use of slow-cure anaerobic threadlockers(series 5 and 6). Can also be used to increase cure speed at low temperatures or in applications where there is large gaps between the parts.
SEALANTS (for faces and flanges)	**Loctite 510** Colour: red	Super-rapid anaerobic sealant for sealing between rigid metal faces; can eliminate the need for conventional gaskets as it can fill gaps up to 0.4 mm. Does not shrink and therefore fasteners do not need re-tightening to specified torque values after curing.
	Loctite 542 Colour: brown	Anaerobic product used a liquid sealant for threaded fittings up to 3/4” gas; rapid curing and parts may be disassembled with ordinary tools.
	Loctite 554 Colour: red	Anaerobic sealant and locking compound used for sealing cooling and industrial fluid circuits. Slow curing, also suitable for use on non-ferrous alloys.
	Loctite 572 Colour: white	Anaerobic sealant and locking compound used for sealing pipes and threaded fittings up to 2" in diameter. Very slow curing on most metal surfaces.
	Loctite 576 Colour: brown	Anaerobic product used a liquid thread sealant for large diameter threaded fittings (up to 2"). Very slow curing; also suitable for non-ferrous alloys and parts requiring subsequent removal.
	Loctite 576 Colour: green	Thixotropic anaerobic product used for sealing joints between metal faces. Ensures total contact between surfaces with maximum tolerance of 0.10 mm, filling micro-voids caused by flatness errors. Very slow curing on most metal surfaces and requires prior application of an activator.

FUNCTION	DESIGNATION	DESCRIPTION
INSTANT ADHESIVES	**Loctite 401** Colour: colourless	Cyanoacrylate instant adhesive suitable for bonding a wide range of acidic and porous materials including, ceramics, wood, rubber and plastic (excluding polyolefin). Curing takes place in a few seconds as an effect of the condensed humidity present on the surfaces to be bonded, and is independent of environmental conditions.
	Loctite 495 Colour: colourless	Cyanoacrylate instant adhesive suitable for bonding a rubber, plastics and metal in any combination.
SILICONE SEALANTS	**Silastic 738 (Dow Corning)** Colour: milky white	One-part silicone adhesive/sealant, ready for use. Cures on exposure to air to form a rubbery solid and obviates the need for conventional seals on flexible joints, filling gaps greater than 1 mm.
	Dirko Transparent Colour: transparent	One-part silicone adhesive/sealant, shrinking, ready for use. Cures rapidly when exposed to humidity in the air to form a rubbery solid; resistant to high temperatures.
POLYURETHANE SEALANTS	**Betaseal HV3 (Gurit Essex)** Colour: black	Polyurethane prepolymer based adhesive/sealant, high viscosity, suitable for permanent, high-strength flexible bonding. Slow curing, used for bonding glass to frames, wire mesh, metal plates, etc. surfaces must be degreased with primer.
RETAINING COMPOUNDS	**Loctite 601** Colour: fluorescent green	Anaerobic, fast-curing, high-strength adhesive. Suitable for sealing and retaining cylindrical assemblies with gap clearances of up to 0.10 mm; used for retaining rotors, gears, bearings, pulleys, bushes etc. on shafts.
	Loctite 638 Colour: fluorescent green	Anaerobic structural adhesive, quick-curing, very high strength; suitable for bonding cylindrical parts in non-ferrous alloys.
	Loctite 648 Colour: fluorescent green	Anaerobic structural adhesive, quick-curing, high-strength; suitable for bonding cylindrical parts, permanent retention of threaded parts, sealing of refrigeration systems, retention of bearings, etc. Alternative to Loctite 601 in high-temperature applications.
	Loctite 986/AVX Colour: fluorescent red	Anaerobic sealant/retaining compound for metal cylindrical parts. Slow-curing, high-strength, heat-resistant and resistant to chemical pressure. Parts must be first treated with an activator.
LUBRICANTS	**Grease** (NLGI 2 EP ASTM D217: 265/295)	Multi-purpose Lithium grease used for lubrication of seals, to prevent oxidization and to facilitate assembly operations.
	Molikote (Dow Corning)	Anti-wear compound, contains Molybdenum bisulphate, use neat or diluted with engine oil for assembly of main engine bearings.
	Vaseline	Neutral pH compound used to protect battery terminals against oxidization and corrosion.
	Engine oil 10W - 30	Used to dilute Molikote anti-wear lubricant during assembly of main engine bearings.

SPECIAL TOOLS

SYMBOL	CODE	DESCRIPTION	NOTES
T1	00239496	Tool for removal of steering unit inner gasket	
T2	00239497	Tool for removal of steering unit dust seal	
T3	00239498	Tool for mounting of steering unit inner gasket	
T4	00239499	Tool for mounting of steering unit dust seal	
T5	5.9030.743.1	Test lead for checking sensors with multimeter	
T6	5.9030.743.0	Test lead for checking sensors with multimeter	
T7	5.9030.740.0	SERDIA installation disc	
T8	5.9030.741.0	Adapter cable	
T9	5.9030.740.2	Interface level III	
T10	5.9030.742.0	EDS software pack	

CONVERSION FACTORS

CONVERSION FROM BRITISH TO METRIC UNITS

mm =	inch x 25.40
m =	foot x 0.305
	yard x 0.914
km =	Eng.miles x 1.609
cm² =	Sq.in. x 6.452
m² =	Sq.ft. x 0.093
	Sq.yard x 0.835
cm³ =	Cu.in. x 16.39
m³ =	Cu.ft. x 28.36
	Cu.yard x 0.763
litres=	Imp.gall. x 4.547
	US gall. x 3.785
	pint x 0.568
	quart x 1.137
ℓ/min =	US.gpm x 3.785
kg =	oz. x 0.028
	lb. x 0.454
kgm =	lb.ft. x 0.139
kg/m =	lb.in. x 17.87
kg/cm² =	psi x 0.070
kg/ℓ=	lb./Imp.gall x 0.100
	lb./US.gall x 0.120
kg/m³ =	lb./cu.ft. x 16.21
Nm =	lb.ft. x 1.356
bar =	psi x 0.07

CONVERSION FROM METRIC TO BRITISH UNITS

inch =	mm x 0.0394
foot =	m x 3.281
yard =	m x 1.094
Eng.miles =	km x 0.622
Sq.in. =	cm² x 0.155
Sq.ft. =	m² x 10.77
Sq.yard =	m² x 1.197
Cu.in. =	cm³ x 0.061
Cu.ft =	m³ x 0.035
Cu.yard =	m³ x 1.311
Imp.gall. =	litres x 0.220
US gall. =	litres x 0.264
pint =	litres x 1.762
quart =	litres x 0.880
US.gpm =	ℓ/min x 0.2642
oz. =	kg x 35.25
lb. =	kg x 2.203
lb.ft. =	kgm x 7.233
lb.in. =	kg/m x 0.056
psi =	kg/cm² x 14.22
lb./Imp.gal. =	kg/ℓ x 10.00
lb./US.gal. =	kg/ℓ x 8.333
lb./cu.ft. =	kg/m³ x 0.062
lb.ft. =	Nm x 0.737
psi =	bar x 14.503

Example:

42 mm →???? inch

42x0.0394= 1.6548 inch

42 inch →???? mm

42x25.4=1066.8 mm

SECTION 10

CONTENTS

1. TRANSMISSION

INTRODUCTION

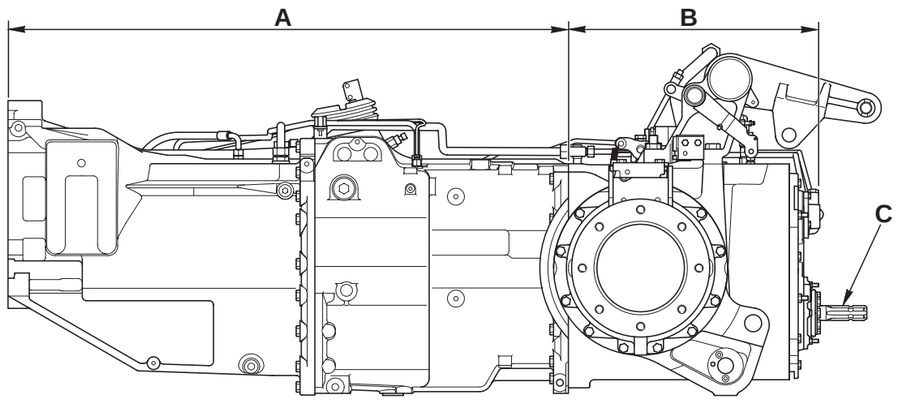
- The AGROTON MARK III series is supplied to the customer with two transmission configurations:

  a. POWER SHIFT transmission

  b. POWER SHUTTLE transmission

  The main difference between these two configurations lies in the behaviour of the electronic control unit when reversing the direction of travel.
  In the POWER SHIFT version, when the operator operates the shuttle control to change the direction of travel, the command is actually only implemented when the speed of the tractor falls below 10 km/h and when the operator depresses the clutch pedal.
  In the POWER SHUTTLE version, the reversal of the direction of travel is managed entirely by the electronic control unit without the operator having to depress the clutch pedal.
  This type of control is achieved by way of a proportional solenoid valve that directly controls the main clutch.

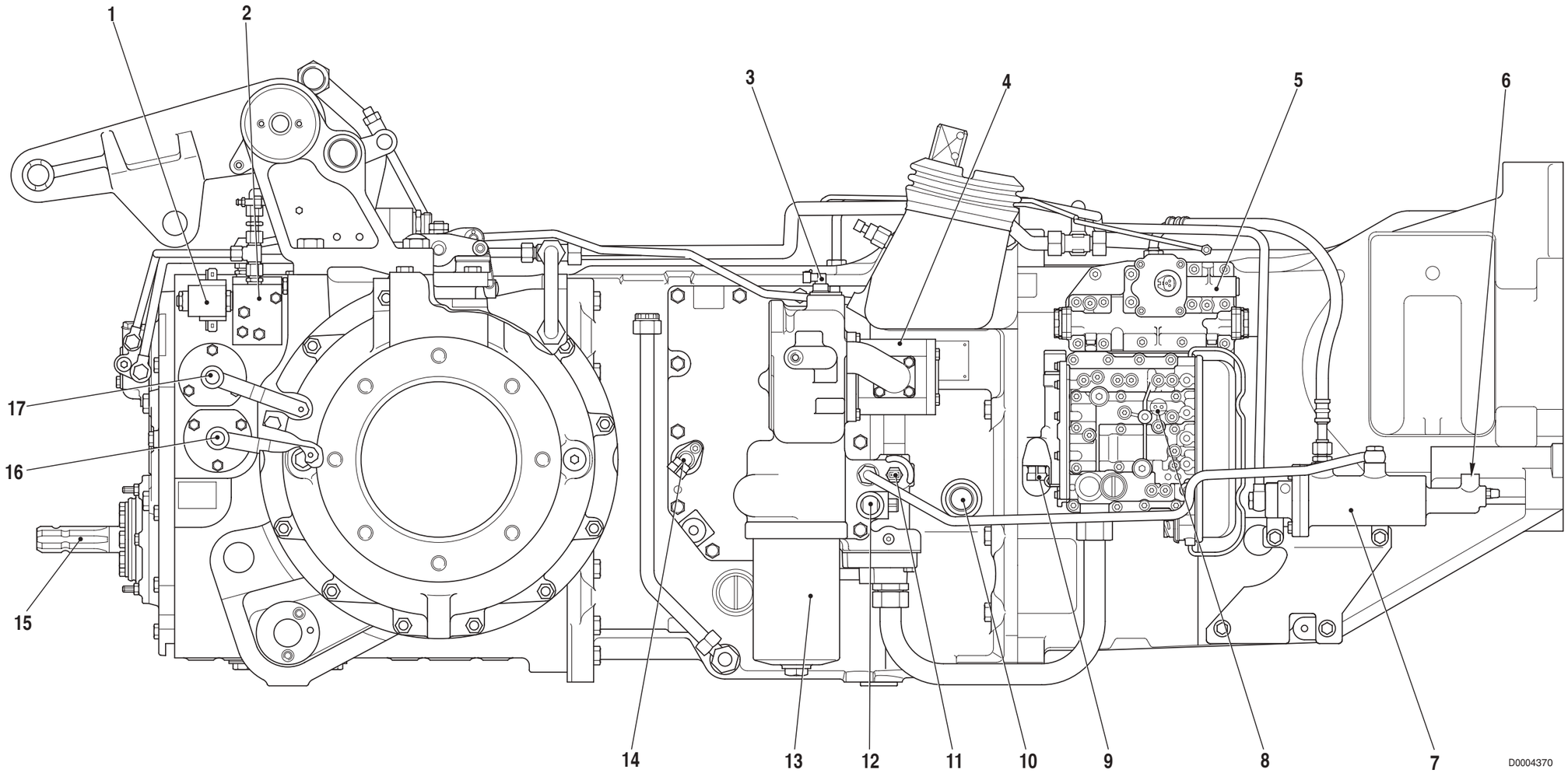
- The transmission can be divided into the following three sections:
  A. Gearbox
  B. Rear axle
  C. Rear PTO



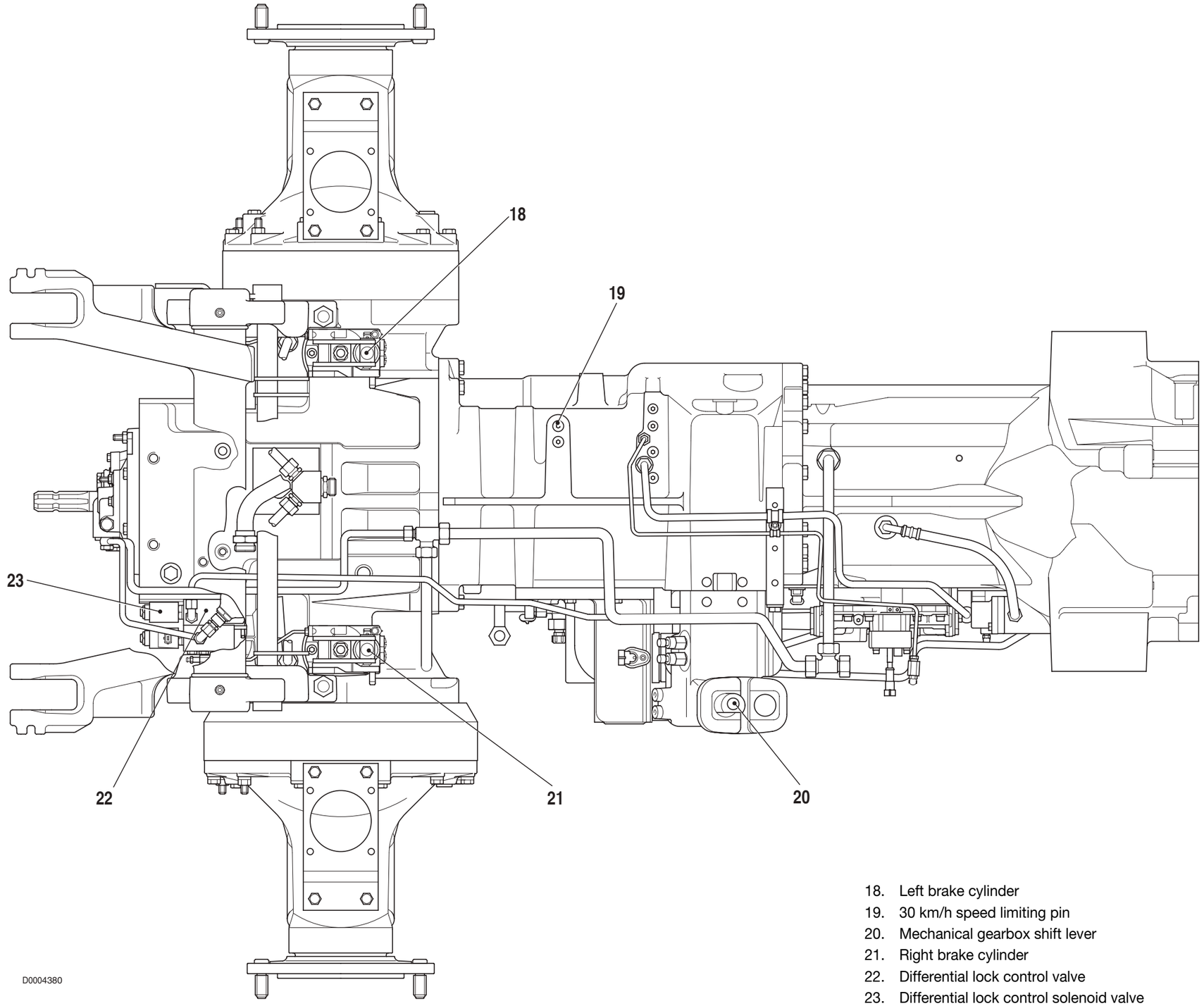
D0004360

1.1 TRANSMISSION (Power Shift version)

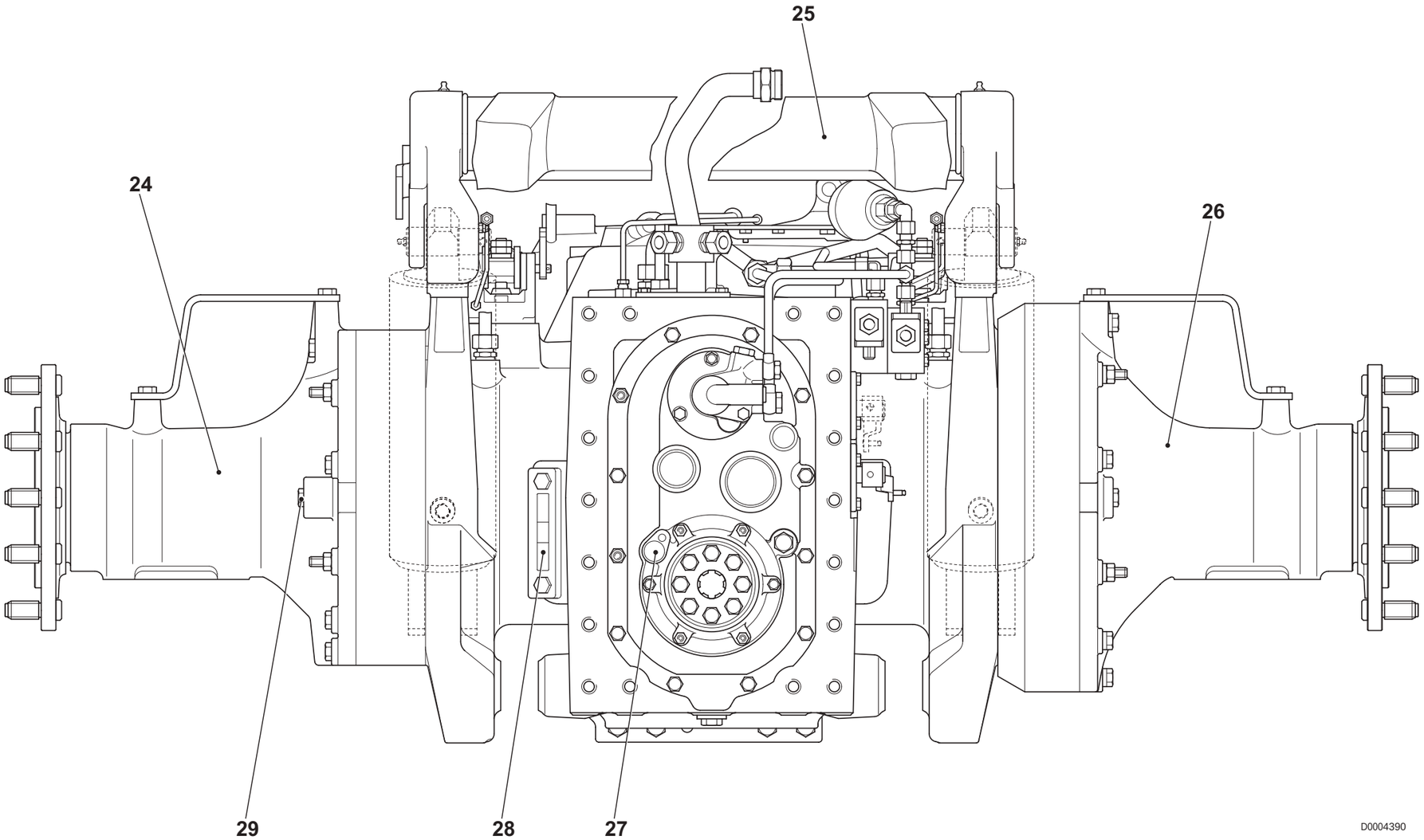
1.1.1 MAIN COMPONENTS



1. Rear PTO control solenoid valve
2. Rear PTO control valve
3. Engine speed sensor (nLse - nMot)
4. Hydraulic pump for transmission
5. Hydraulic gearbox control distribution valve
6. Pilot line fitting for main clutch
7. Main clutch control pump (Booster)
8. Transmission oil low pressure sensor
9. Gearbox output shaft speed sensor (nLsa)
10. Creeper engagement shaft
11. Transmission oil temperature sensor
12. Four-wheel drive control solenoid valve
13. Transmission oil suction line filter
14. Speed sensor for odometer (nAb)
15. Rear power take-off
16. Rear PTO speed selector lever
17. Rear PTO speed selector lever (Optional)



18. Left brake cylinder
19. 30 km/h speed limiting pin
20. Mechanical gearbox shift lever
21. Right brake cylinder
22. Differential lock control valve
23. Differential lock control solenoid valve

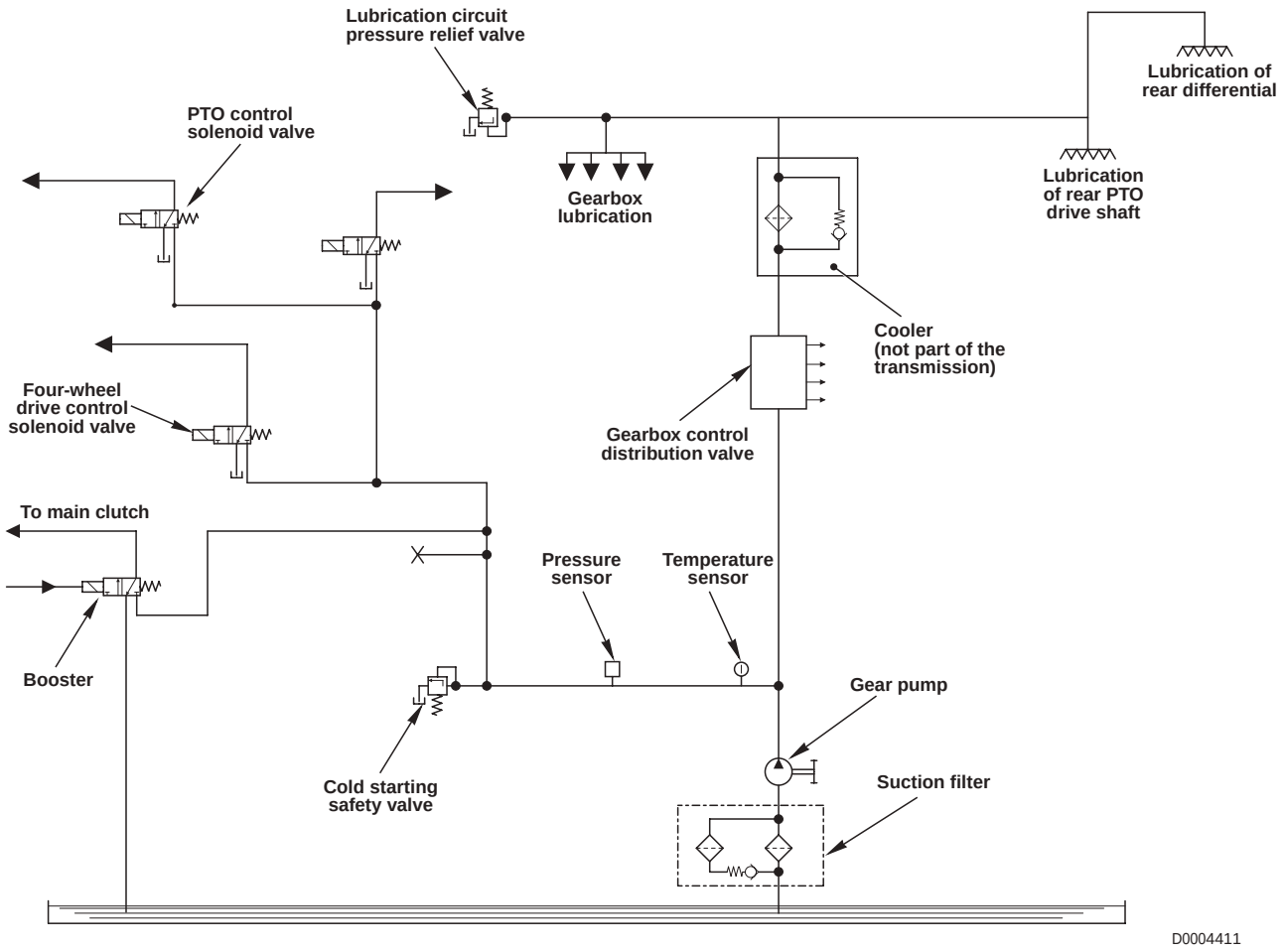


24. Left axle casing
25. Lift shaft
26. Right axle casing
27. Rear PTO speed sensor
28. Gearbox oil level indicator
29. Rear reduction unit oil level indicator

1.1.2 TRANSMISSION HYDRAULIC SYSTEM

The transmission hydraulic system is supplied by a gear pump driven from a lateral power-take-off.
The gear pump supplies pressurised fluid for the following uses:

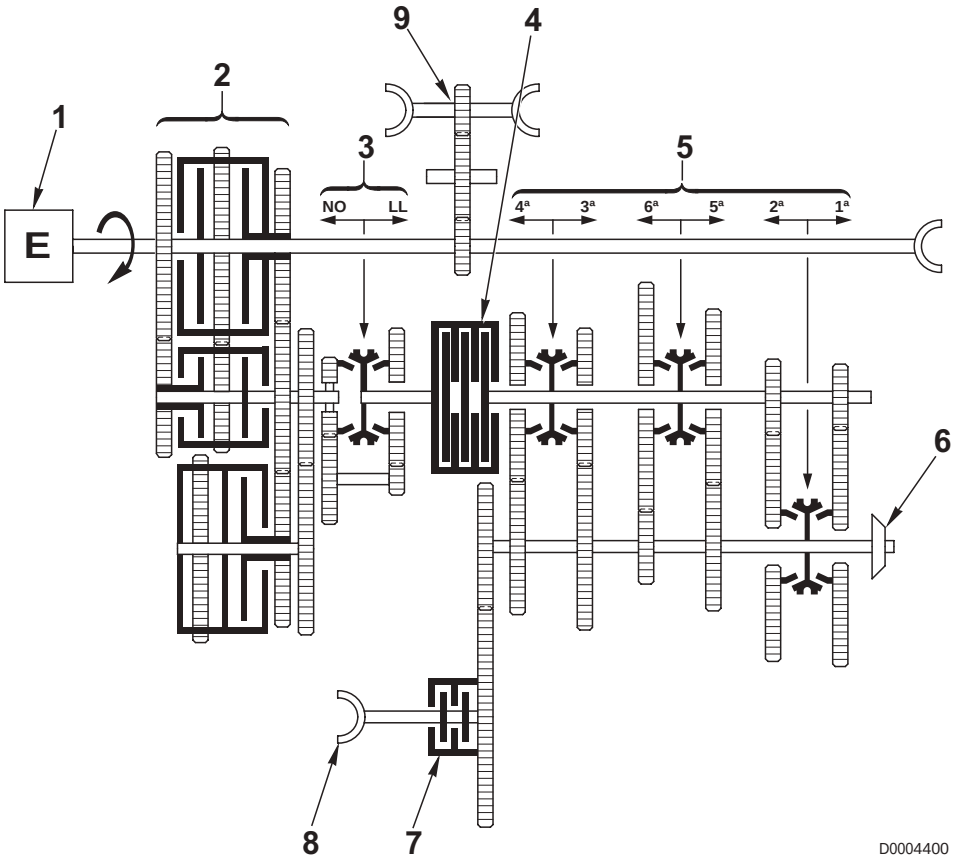
- hydraulic gearbox control valve
- forward/reverse shuttle control valve
- main clutch pump (Booster)
- 4WD control solenoid valve
- rear PTO control solenoid valve
- differential lock control solenoid valve
- lubrication of the gearbox, rear differential and rear PTO clutch control shaft.



1.1.3 GEARBOX

DESCRIPTION

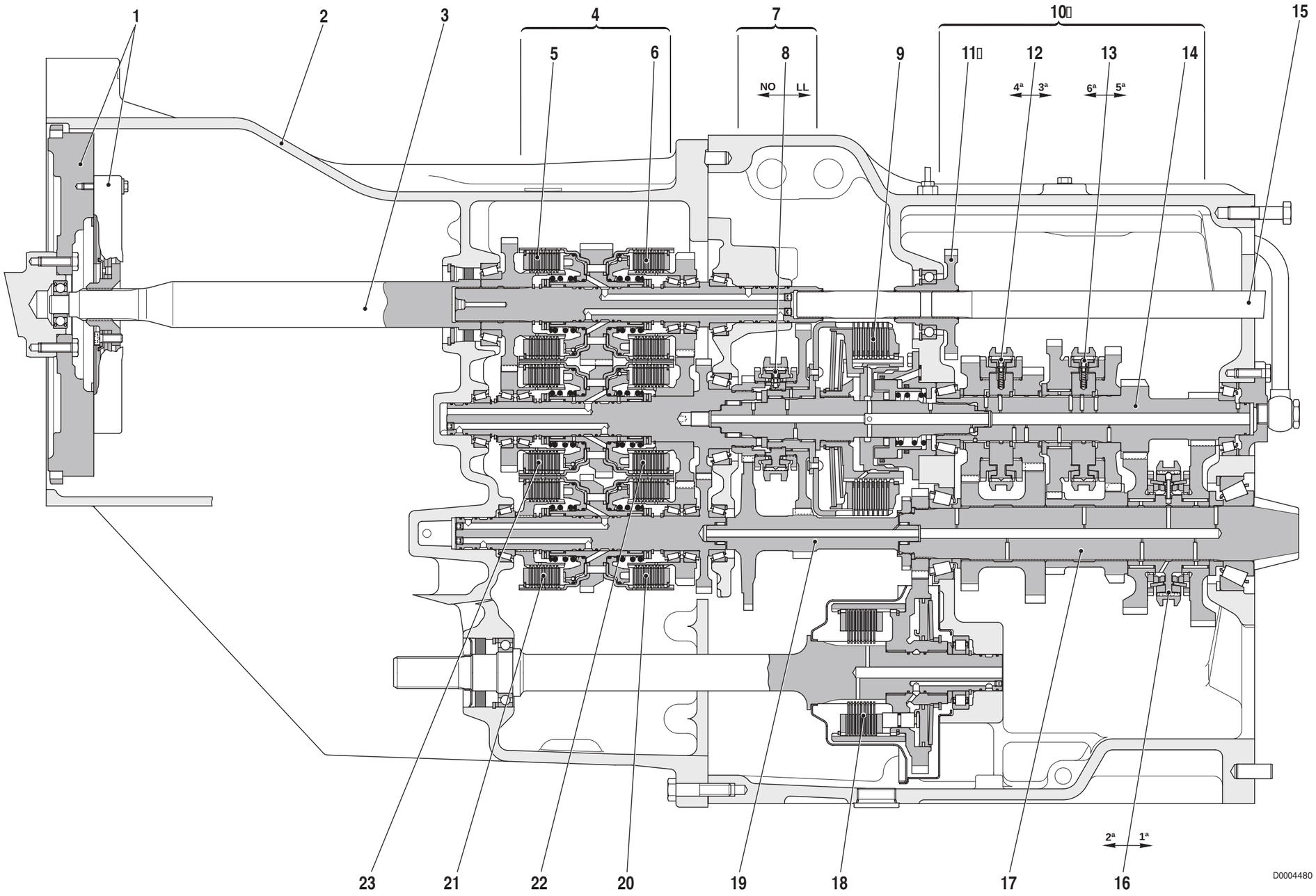
- The POWER SHIFT transmission receives drive from the engine (1) and transmits drive through the hydraulically-controlled gearbox (2), the creeper unit (3), the main clutch (4) and the 6-speed mechanical gearbox (5) to the pinion (6) and the power take-off (7) that provides the drive to the front axle .
  The POWER SHIFT transmission is equipped with a double-output power take-off (9) to drive the hydraulic system pumps.



COMPONENTS

1. Engine
2. Hydraulically-controlled 8-speed gearbox (4 forward and 4 reverse)
3. Creeper unit
4. Main clutch
5. 6-speed mechanical gearbox
6. Pinion
7. 4WD engagement clutch
8. Power take-off for front axle drive
9. Power take-off for hydraulic pumps

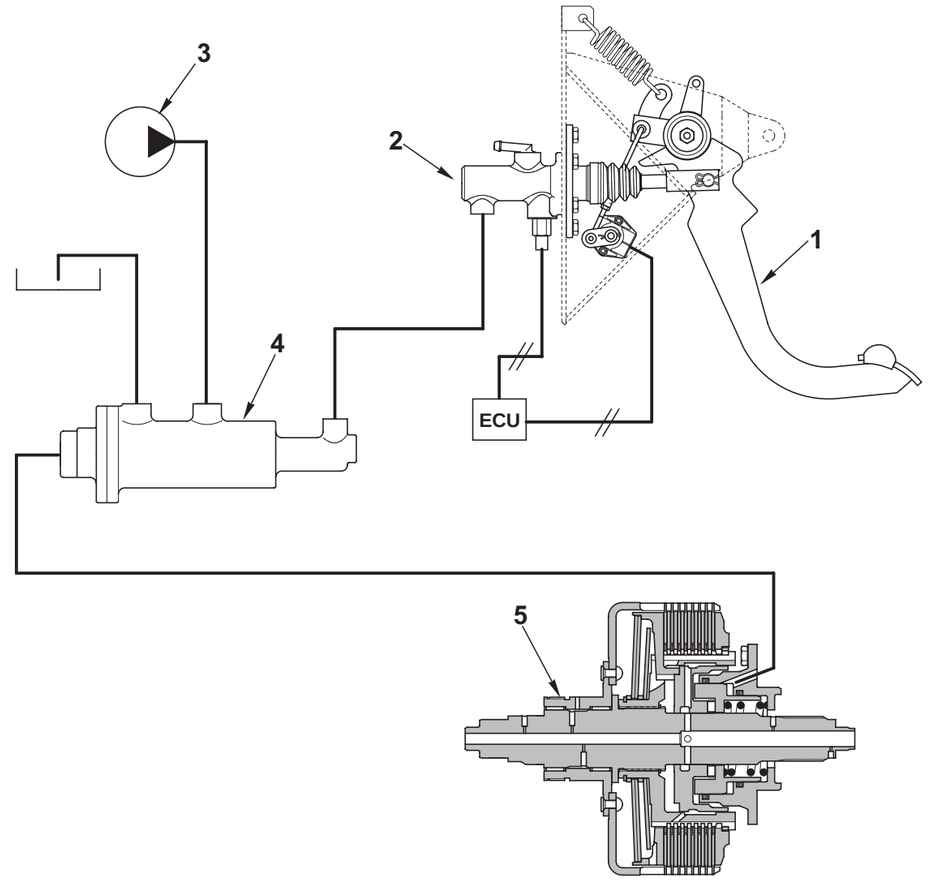
GEARBOX COMPONENTS



1. Flywheel and damper
2. Clutch housing
3. Input shaft
4. Hydraulically-controlled gearbox
5. Clutch “**C**”
6. Clutch “**A**”
7. Creeper unit
8. Creeper unit synchronizer
9. Main clutch
10. Mechanical gearbox
11. Hydraulic pumps PTO drive gear
12. 3rd and 4th speed synchronizer
13. 5th and 6th speed synchronizer
14. 1st and 2nd speed drive shaft
15. Rear PTO drive shaft
16. 1st and 2nd speed synchronizer
17. Pinion
18. 4WD control clutch
19. Creeper unit driven shaft
20. Clutch “**F**”
21. Clutch “**G**”
22. Clutch “**B**”
23. Clutch “**D**”

1.1.4 MAIN CLUTCH

The main clutch of the POWER SHIFT transmission is an oil-bath multiplate unit with servo-assisted engagement and hydraulic pilot system.
Clutch operation is entirely manual by way of the clutch pedal.
The system is equipped with a clutch cylinder (Booster) that directs fluid under pressure to the main clutch in accordance with the travel of the clutch pedal.



1. Clutch pedal
2. Clutch pilot cylinder
3. Transmission gear pump
4. Clutch control cylinder (Booster)
5. Main clutch

1.1.5 HYDRAULIC GEARBOX AND SHUTTLE DISTRIBUTION VALVE

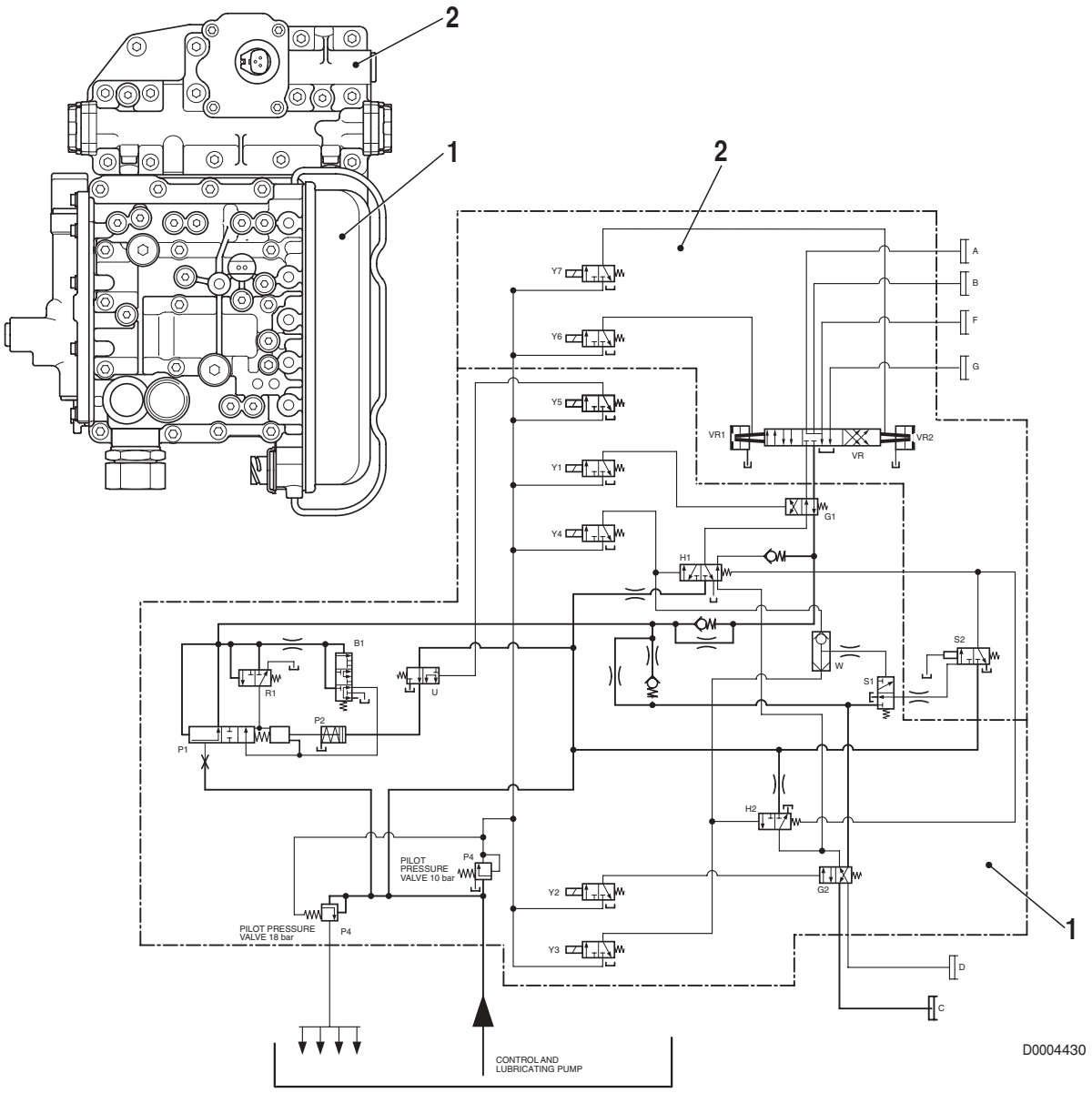
The function of the hydraulic gearbox distribution valve is to pilot and control the engagement of the gears in the hydraulically-controlled gearbox .

The distribution valve controls the operation of:

A. the hydraulic gearbox control valve (1) to select **S**, **H**, **M** and **L** ratios

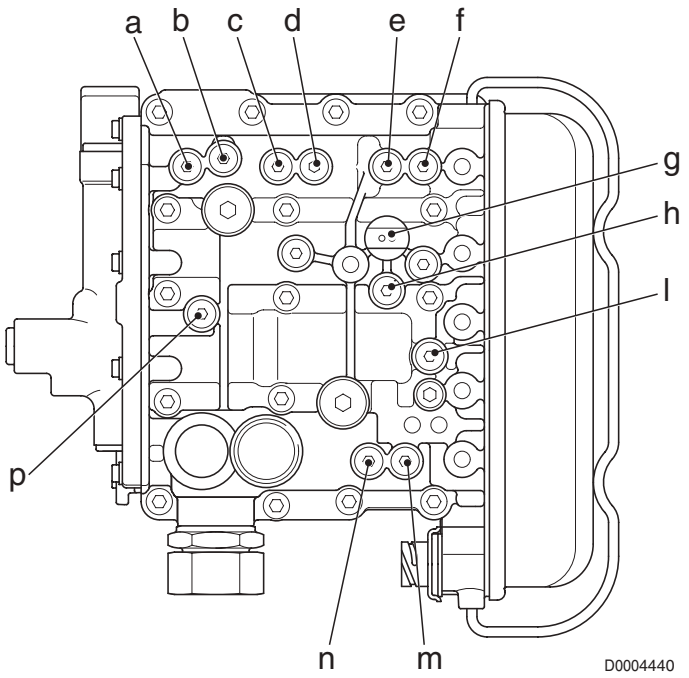
B. the shuttle control valve (2) to select FORWARD and REVERSE gears.

This distribution valve also supplies hydraulic fluid for the lubrication of the mechanical gearbox, the rear differential and the rear PTO control shaft.



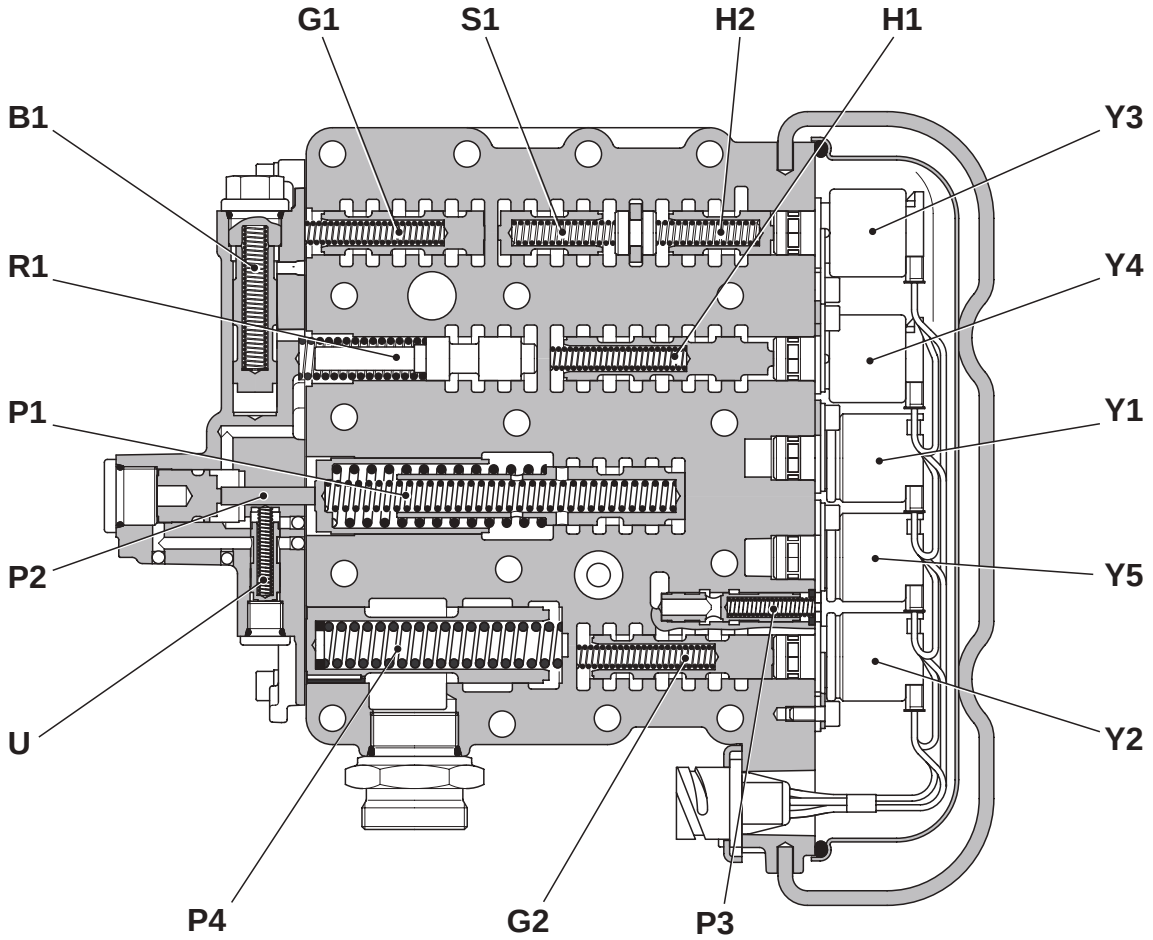
A. GEARBOX CONTROL VALVE

PRESSURE TEST POINTS



Pos.	Function	Thread size
a.	**A** or **F** clutch pressure	M10x1
b.	**B** or **G** clutch pressure	M10x1
c.	**Y3** or **Y4** solenoid valve pressure	M10x1
d.	Pressure **Pg** to relief valve	M10x1
e.	Pressure **Pr** from relief valve (18 bar)	M10x1
f.	Engagement pressure of clutch **C** or **D**	M10x1
g.	General pressure (18 bar)	M10x1
h.	Engagement pressure of clutch **A/B** or **F/G**	M10x1
l.	Pilot pressure (10 bar)	M10x1
m.	**D** clutch pressure	M10x1
n.	**C** clutch pressure	M10x1
p.	Modulated pressure	M10x1

MAIN COMPONENTS



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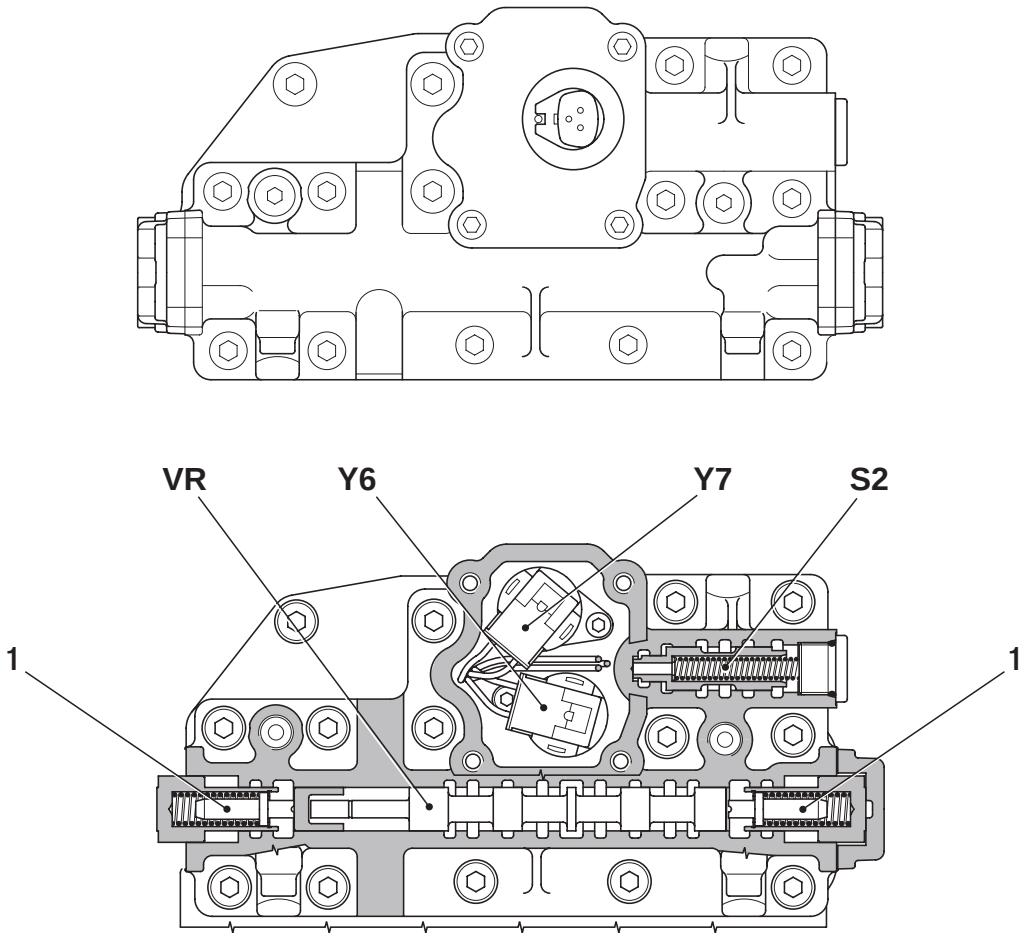
B1 Breather valve
G1 Clutch selection valve for **A/B** or **F/G** clutches
S1 Relief valve
H2 Clutch engagement valve for **C/D clutches**
H1 Clutch engagement valve for **A/B** or **F/G clutches**
Y3 Pilot solenoid valve for engagement valve **H2**
Y4 Pilot solenoid valve for engagement valve **H1**
Y1 Pilot solenoid valve for clutch selection valve **G1**
Y5 Pilot solenoid valve for road/field selection valve
Y2 Pilot solenoid valve for C or D clutch selection valve **G2**
P3 Pilot pressure regulating valve
G2 Clutch selection valve for **C** or **D clutches**
P4 General pressure regulating valve
U Road/field operating mode selection valve
P1 Pressure modulating valve
P2 2-stage valve
R1 Null shift valve

B. SHUTTLE CONTROL VALVE

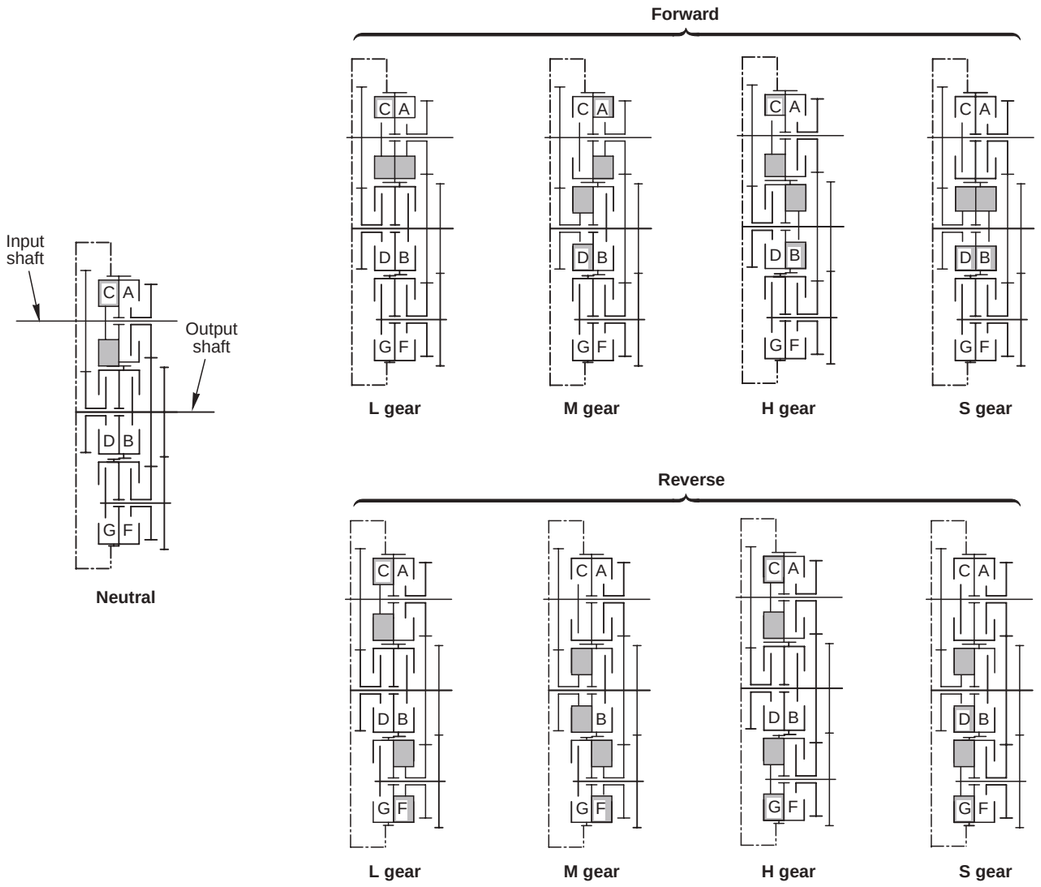
MAIN COMPONENTS



D0005330

Y6 Pilot solenoid valve for FORWARD gear
Y7 Pilot solenoid valve for REVERSE gear
VR FORWARD/REVERSE control spool valve
S2 Relief valve
1 Neutral return device

1.1.6 CLUTCH ENGAGEMENT AND SOLENOID VALVE OPERATION SCHEMATIC



Solenoid valve operation when shifting from L to S gear (L–~~M~~–~~H~~–~~S~~)

Solenoid valve	Forward				Reverse			
	L	M	H	S	L	M	H	S
Y6	●	●	●	●				
Y7					●	●	●	●
Y1	●	●			●	●		
Y2		●		●		●		●
Y3		❍	❍	❍		❍	❍	❍
Y4			❍				❍	

● = Solenoid valve energised

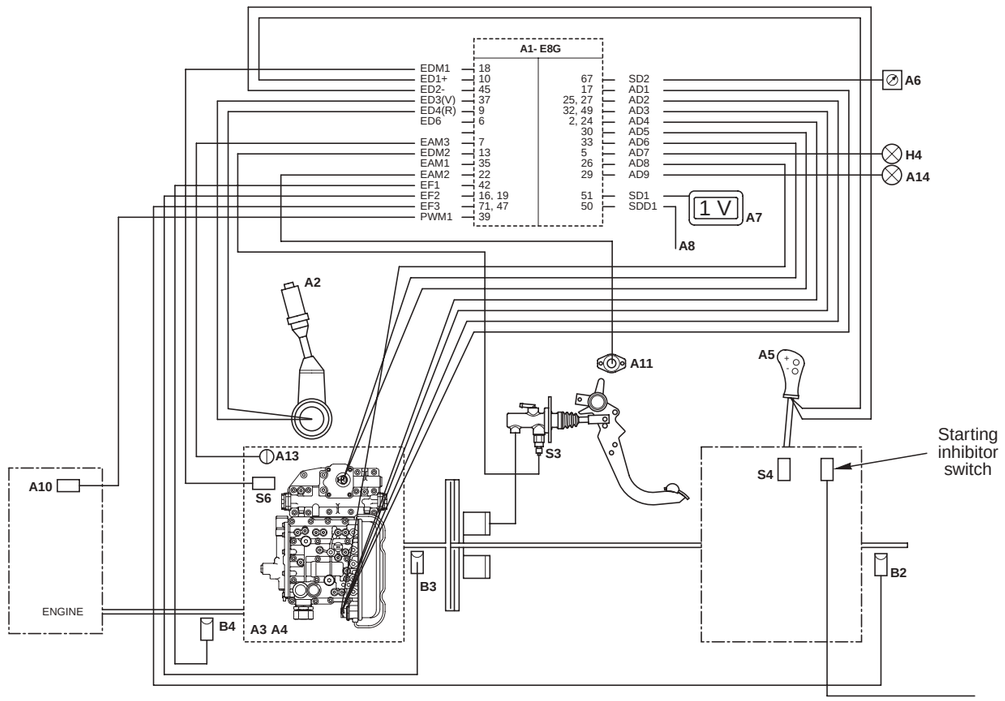
❍ = Solenoid valve briefly energised during gear change

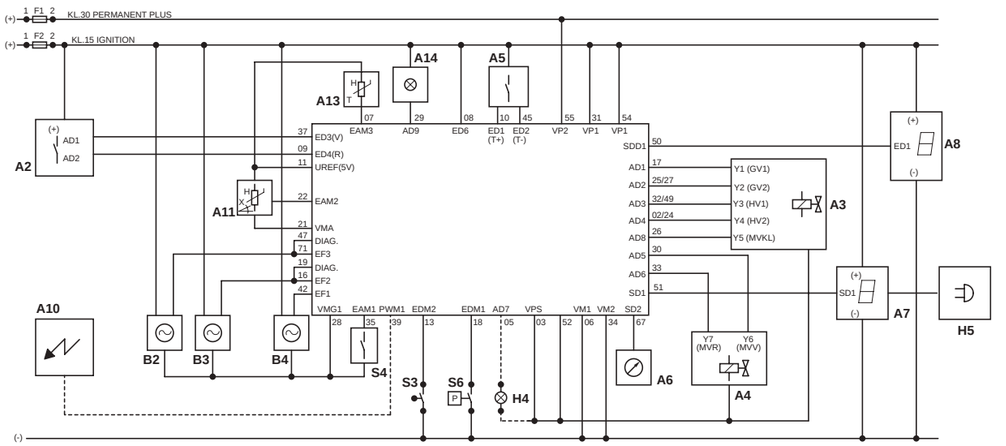
Solenoid valve operation when shifting from S to L gear (S–~~H~~–~~M~~–~~L~~)

Solenoid valve	Forward				Reverse			
	S	H	M	L	S	H	M	L
Y6	●	●	●	●				
Y7					●	●	●	●
Y1			●	●			●	●
Y2	●		●				●	
Y3		❍	❍	❍		❍	❍	❍
Y4			❍				❍	

● = Solenoid valve energised

❍ = Solenoid valve briefly energised during gear change





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1.1.7 TRANSMISSION ELECTRONIC SYSTEM SCHEMATIC

COMPONENTS

A1 Electronic transmission control unit

A2 Shuttle control lever (FORWARD/REVERSE)

A3 Gearbox control valve

A4 Shuttle control valve

A5 Range selector lever (L M H S)

A6 Provision for tachymeter connection

A7 Display

A8 Diagnostics connection

A10 Engine load sensor

A11 Clutch pedal position sensor

A13 Transmission oil temperature sensor

A14 Transmission oil low pressure indicator

B2 Pinion speed sensor (nAb) (theoretical groundspeed)

B3 Hydraulic gearbox output speed sensor (nLsa)

B4 Transmission input speed sensor (nLse - nMot)

F1 Fuse (1A)

F2 Fuse (8A)

H4 FORWARD/REVERSE indicator lamp

H5 Audible alarm

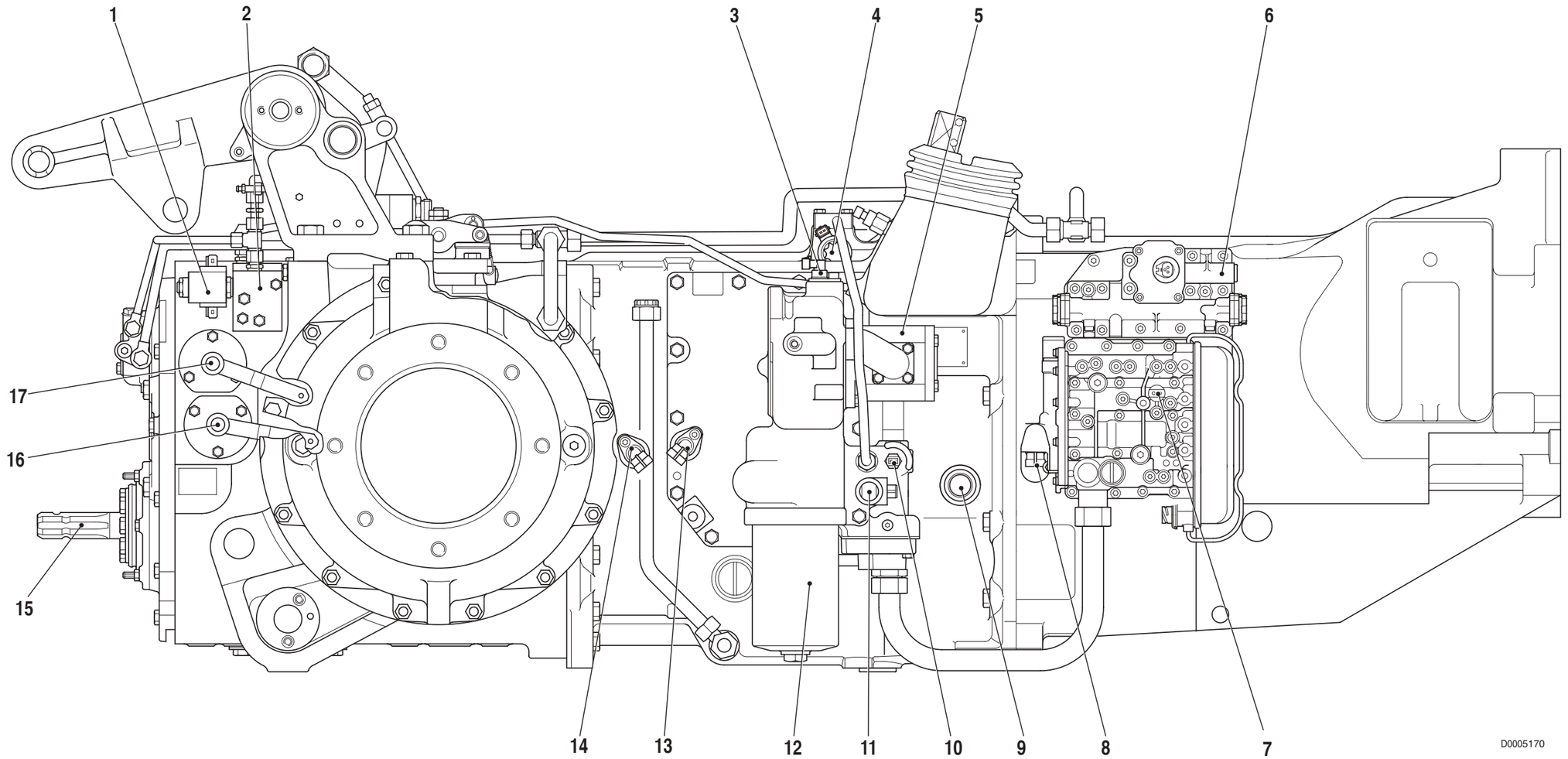
S3 Clutch pedal depressed sensor

S4 Mechanical gearbox neutral sensor

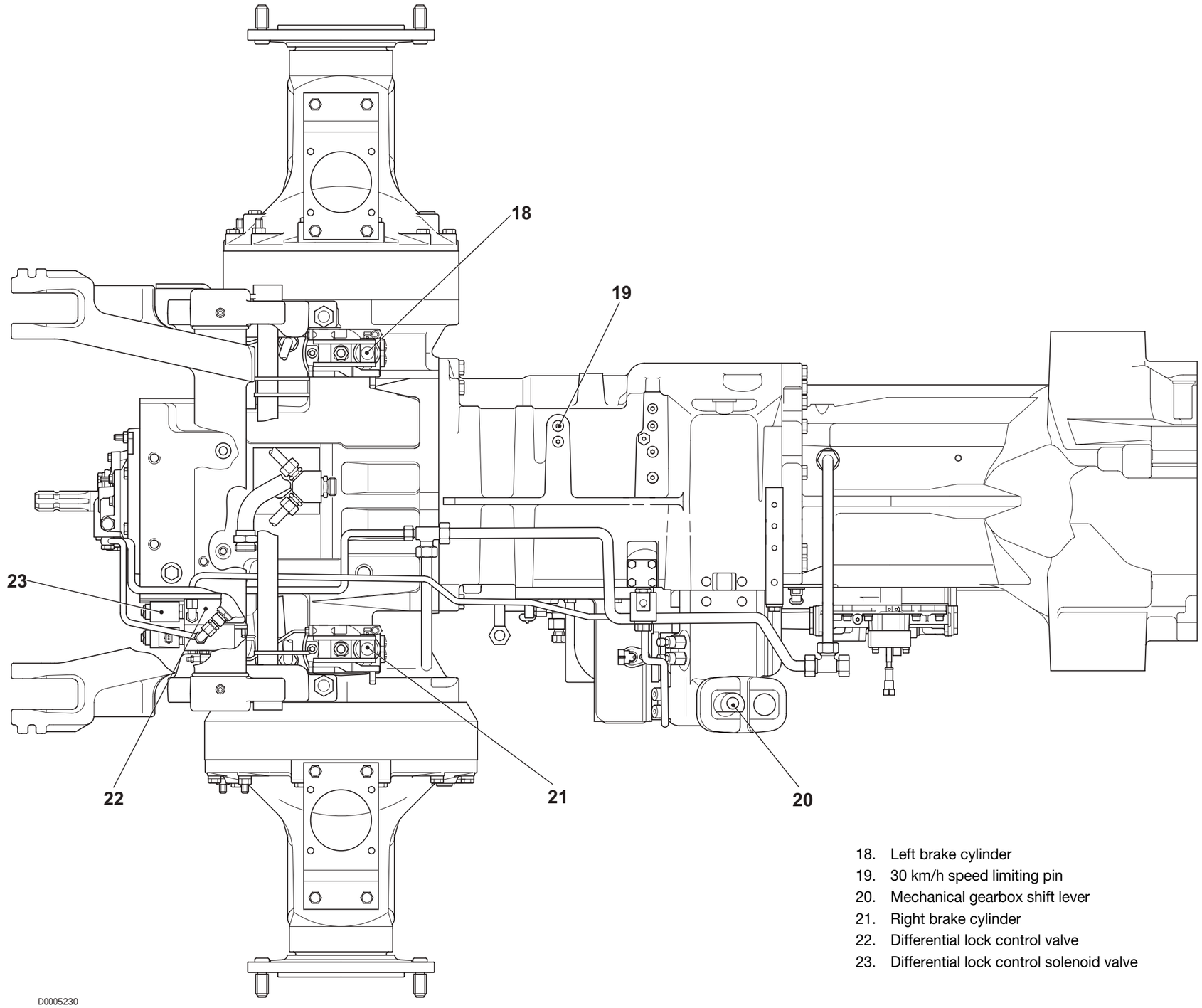
S6 Transmission oil low pressure sensor (18 bar)

1.2 TRANSMISSION (Power Shuttle version)

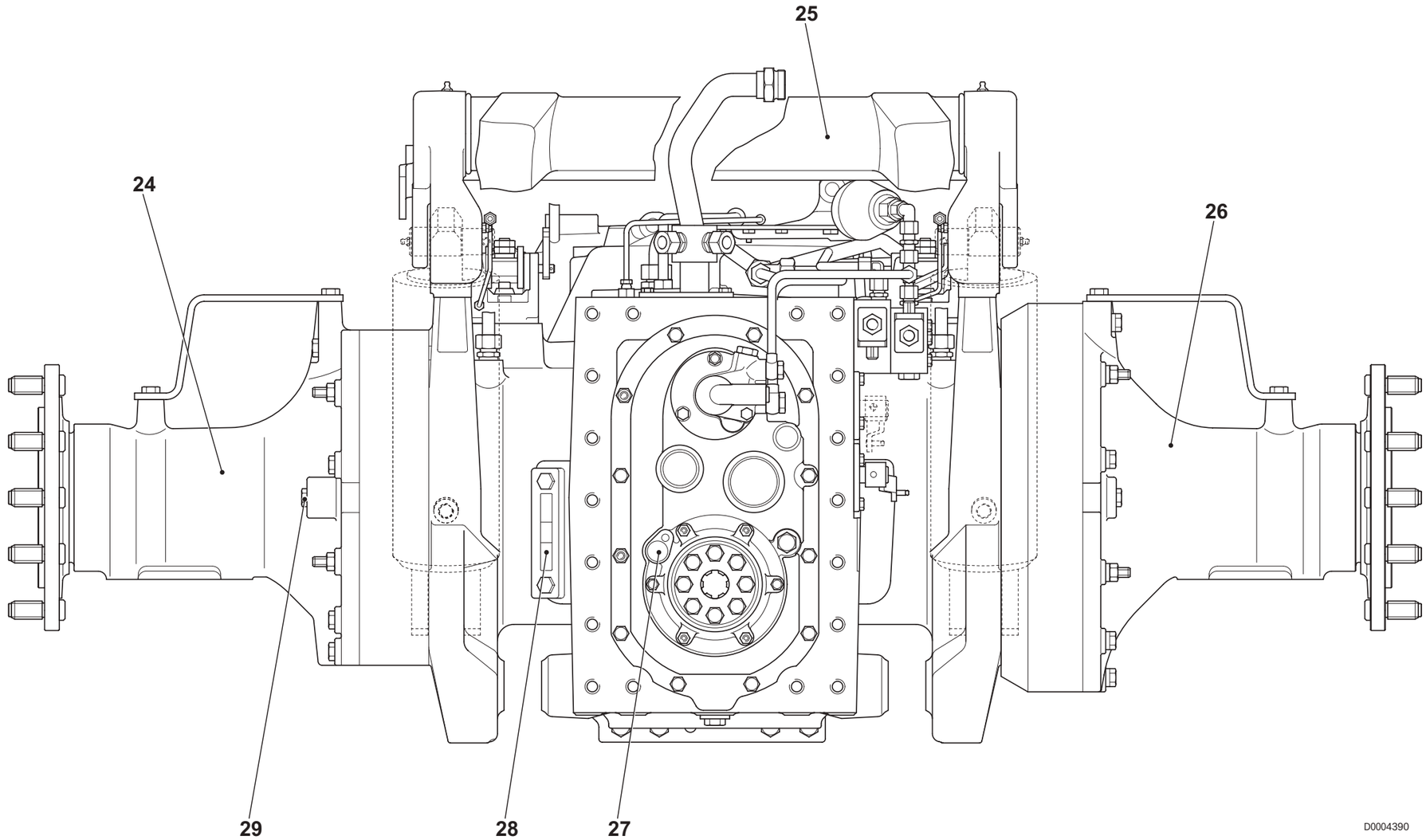
1.1.1 MAIN COMPONENTS



1. Rear PTO control solenoid valve
2. Rear PTO control valve
3. Engine speed sensor (nLse - nMot)
4. Clutch control solenoid valve
5. Hydraulic pump for transmission
6. Hydraulic gearbox distribution valve
7. Transmission oil low pressure sensor
8. Gearbox output shaft speed sensor (nLsa)
9. Creeper engagement shaft
10. Transmission oil temperature sensor
11. Four-wheel drive control solenoid valve
12. Transmission oil suction line filter
13. Speed sensor for odometer (nAb)
14. Clutch speed sensor (nHk)
15. Rear power take-off
16. Rear PTO speed selector lever
17. Rear PTO speed selector lever (Optional)



18. Left brake cylinder
19. 30 km/h speed limiting pin
20. Mechanical gearbox shift lever
21. Right brake cylinder
22. Differential lock control valve
23. Differential lock control solenoid valve

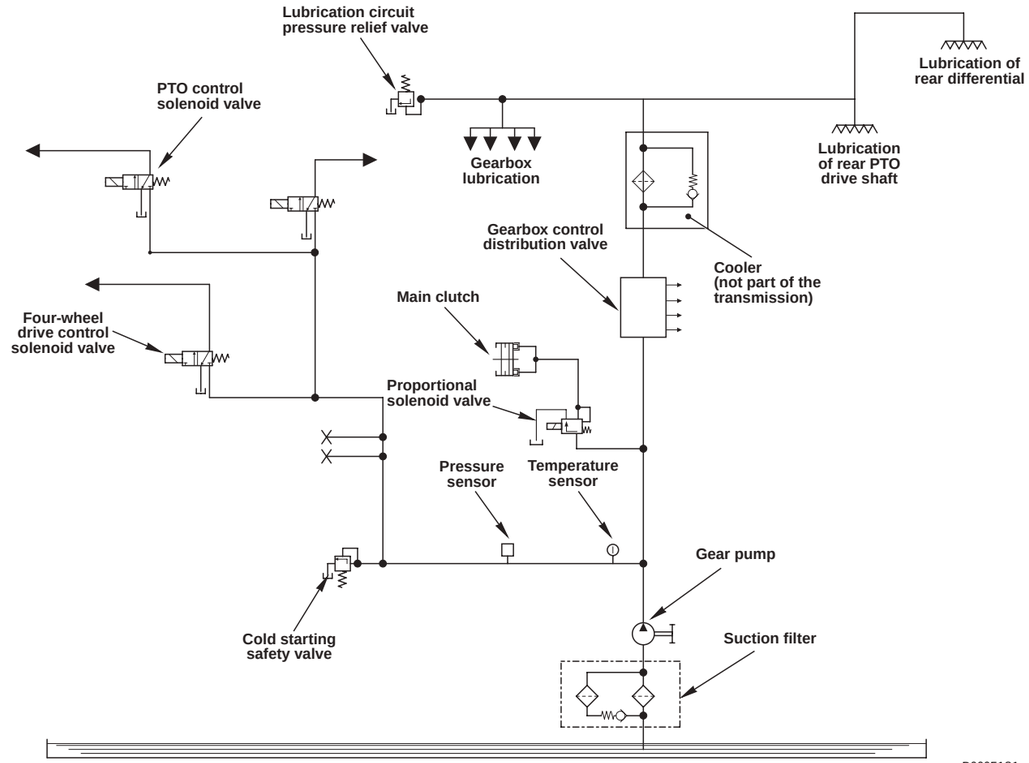


24. Left axle casing
25. Lift shaft
26. Right axle casing
27. Rear PTO speed sensor
28. Gearbox oil level indicator
29. Rear reduction unit oil level indicator

1.1.2 TRANSMISSION HYDRAULIC SYSTEM

The transmission hydraulic system is supplied by a gear pump driven from a lateral power take-off.
The gear pump supplies pressurised fluid for the following uses:

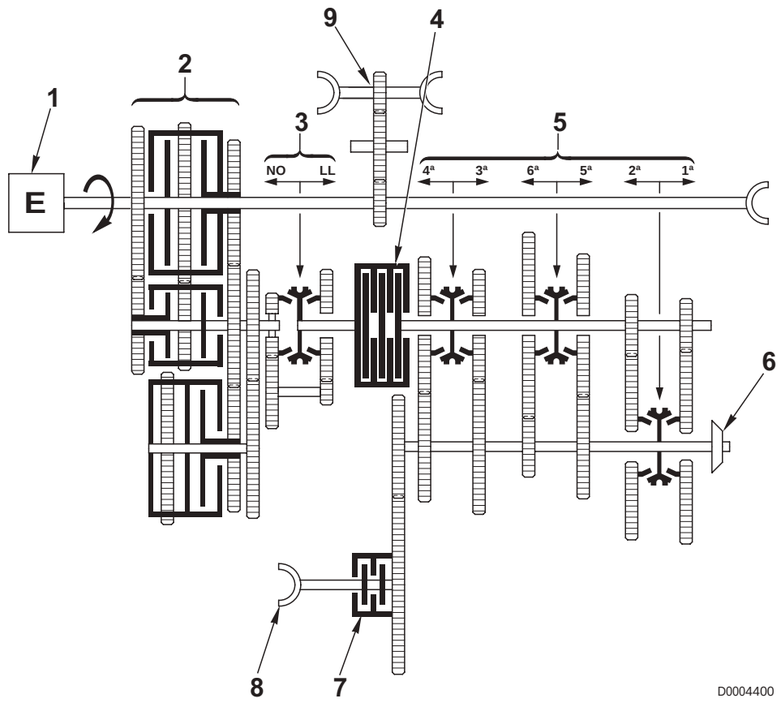
- hydraulic gearbox control valve
- forward/reverse shuttle control valve
- proportional solenoid control valve for main clutch
- 4WD control solenoid valve
- rear PTO control solenoid valve
- differential lock control solenoid valve
- lubrication of the gearbox, rear differential and rear PTO clutch control shaft.



1.2.3 GEARBOX

DESCRIPTION

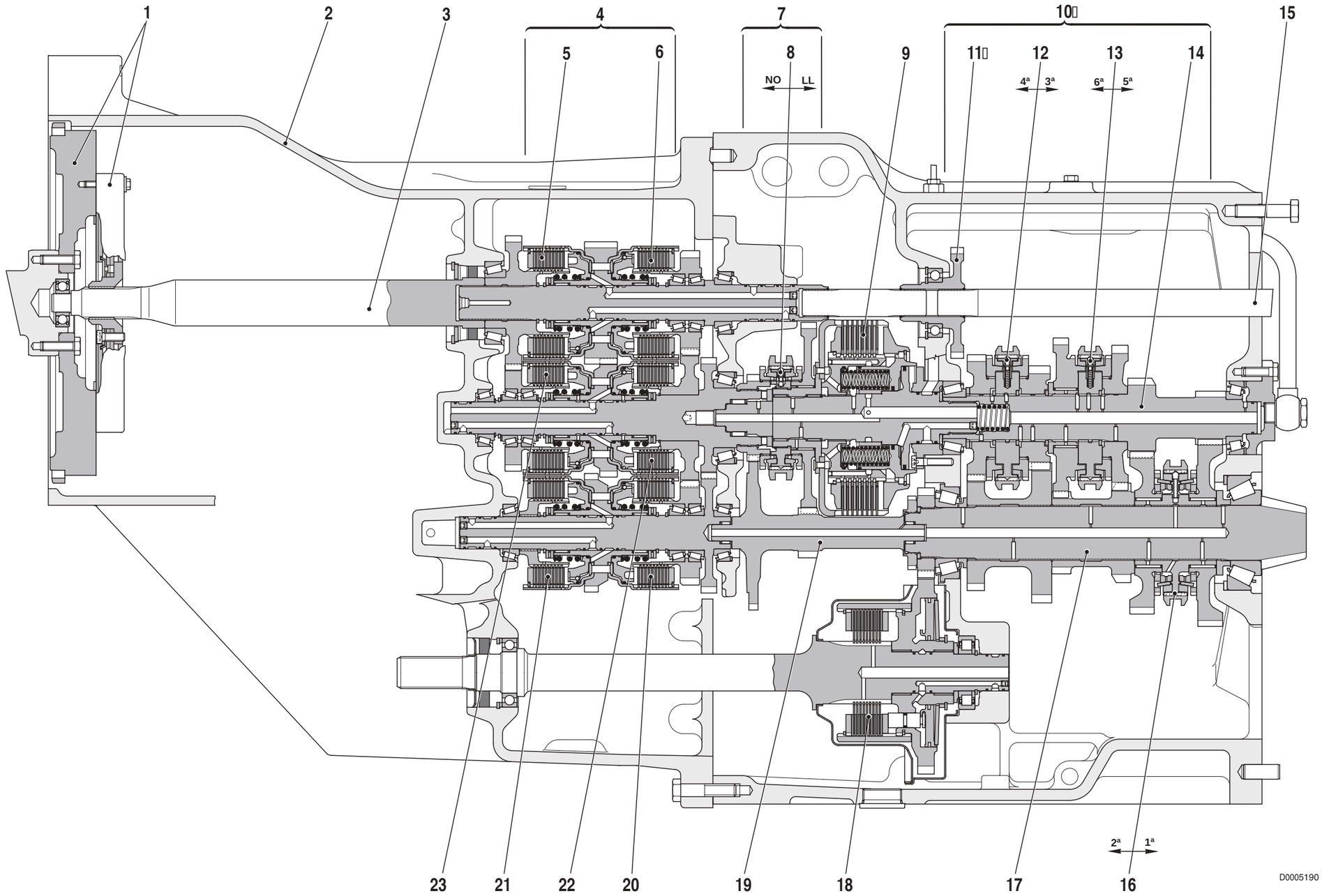
- The POWER SHUTTLE transmission receives drive from the engine (1) and transmits drive through the hydraulically-controlled gearbox (2), the creeper unit (3), the main clutch (4) and the 6-speed mechanical gearbox (5) to the pinion (6) and the power take-off (7) that provides the drive to the front axle .
  The POWER SHUTTLE transmission is also equipped with a double-output power take-off (9) to drive the hydraulic system pumps.



COMPONENTS

1. Engine
2. Hydraulically-controlled 8-speed gearbox (4 forward and 4 reverse)
3. Creeper unit
4. Main clutch
5. 6-speed mechanical gearbox
6. Pinion
7. 4WD engagement clutch
8. Power take-off for front axle drive
9. Power take-off for hydraulic pumps

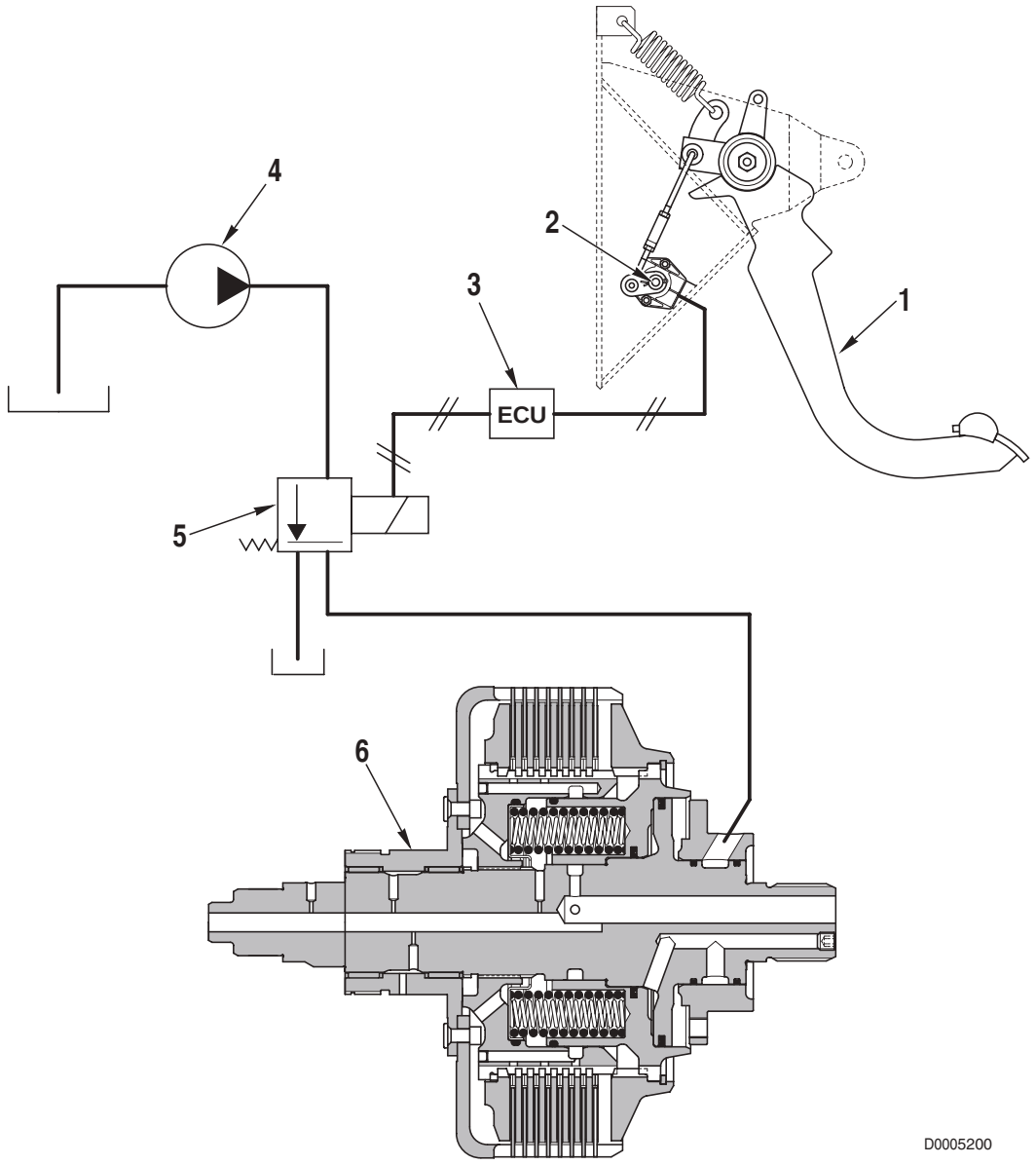
GEARBOX COMPONENTS



1. Flywheel and damper
2. Clutch housing
3. Input shaft
4. Hydraulically-controlled gearbox
5. Clutch “**C**”
6. Clutch “**A**”
7. Creeper unit
8. Creeper unit synchronizer
9. Main clutch
10. Mechanical gearbox
11. Hydraulic pumps PTO drive gear
12. 3rd and 4th speed synchronizer
13. 5th and 6th speed synchronizer
14. 1st and 2nd speed drive shaft
15. Rear PTO drive shaft
16. 1st and 2nd speed synchronizer
17. Pinion
18. 4WD control clutch
19. Creeper unit driven shaft
20. Clutch “**F**”
21. Clutch “**G**”
22. Clutch “**B**”
23. Clutch “**D**”

1.2.4 MAIN CLUTCH

The main clutch of the POWER SHUTTLE transmission is an oil-bath multiplate unit with hydraulic control.
Clutch operation is entirely automatic and is controlled by an electronic control unit which receives signals from the clutch pedal position sensor.
The system has a clutch control solenoid valve that directs pressurised fluid to the clutch in accordance with the pedal position.



1. Clutch pedal
2. Clutch pedal position sensor
3. Electronic transmission control unit
4. Transmission gear pump
5. Clutch control proportional solenoid valve
6. Main clutch

1.2.5 HYDRAULIC GEARBOX AND SHUTTLE DISTRIBUTION VALVE

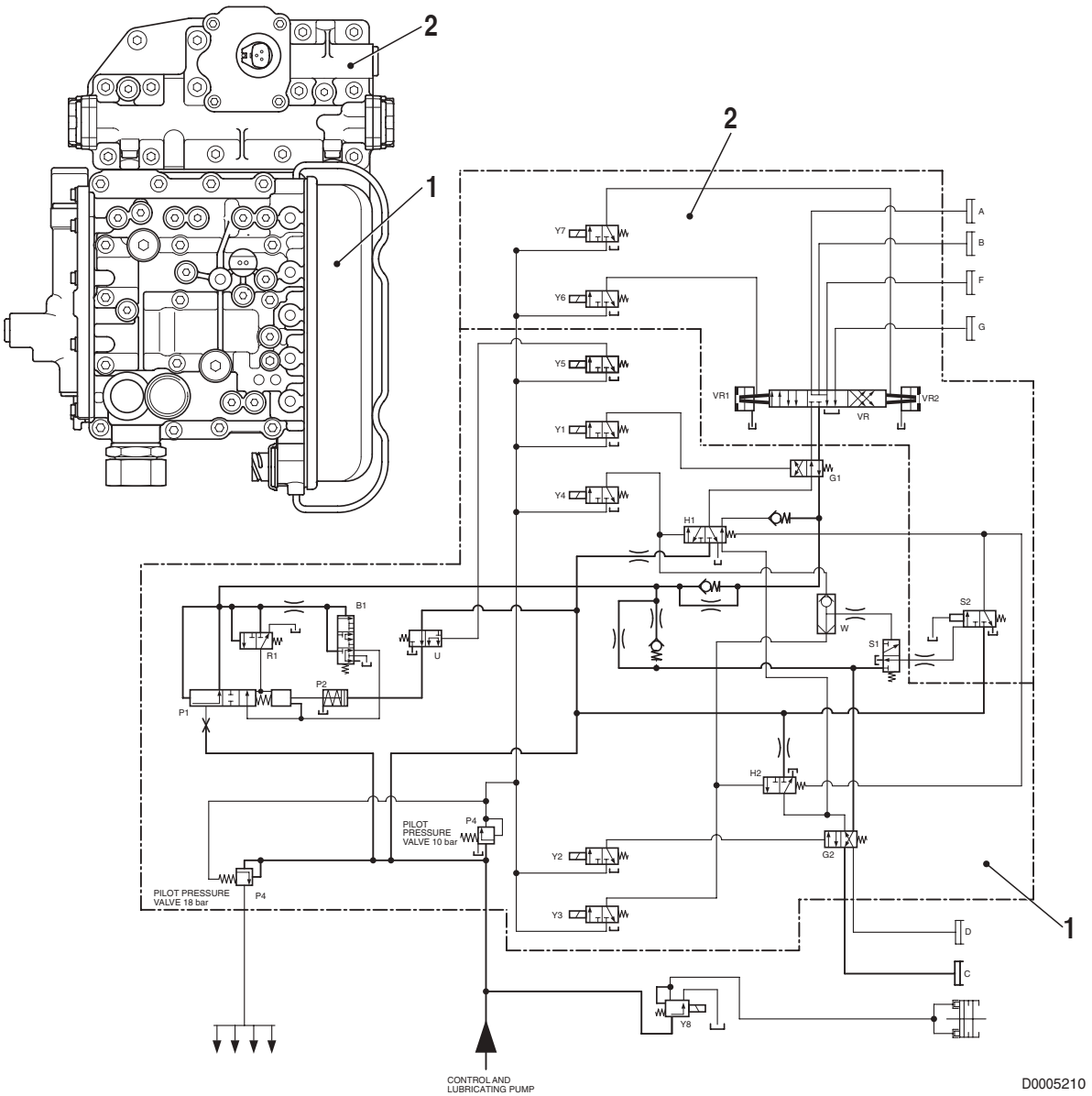
The function of the hydraulic gearbox distribution valve is to pilot and control the engagement of the gears in the hydraulically-controlled gearbox .

The distribution valve controls the operation of:

A. the hydraulic gearbox control valve (1) to select **S**, **H**, **M** and **L** ratios

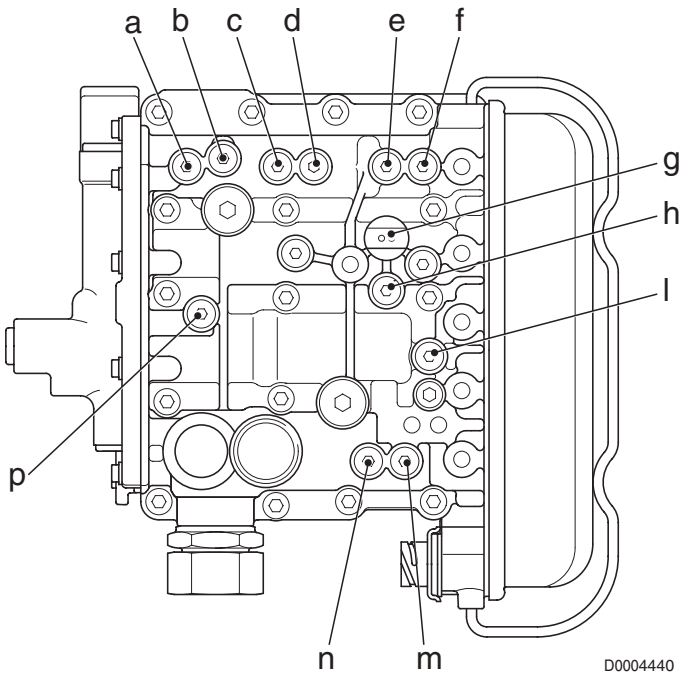
B. the shuttle control valve (2) to select FORWARD and REVERSE gears.

This distribution valve also supplies hydraulic fluid for the lubrication of the mechanical gearbox, the rear differential and the rear PTO control shaft.



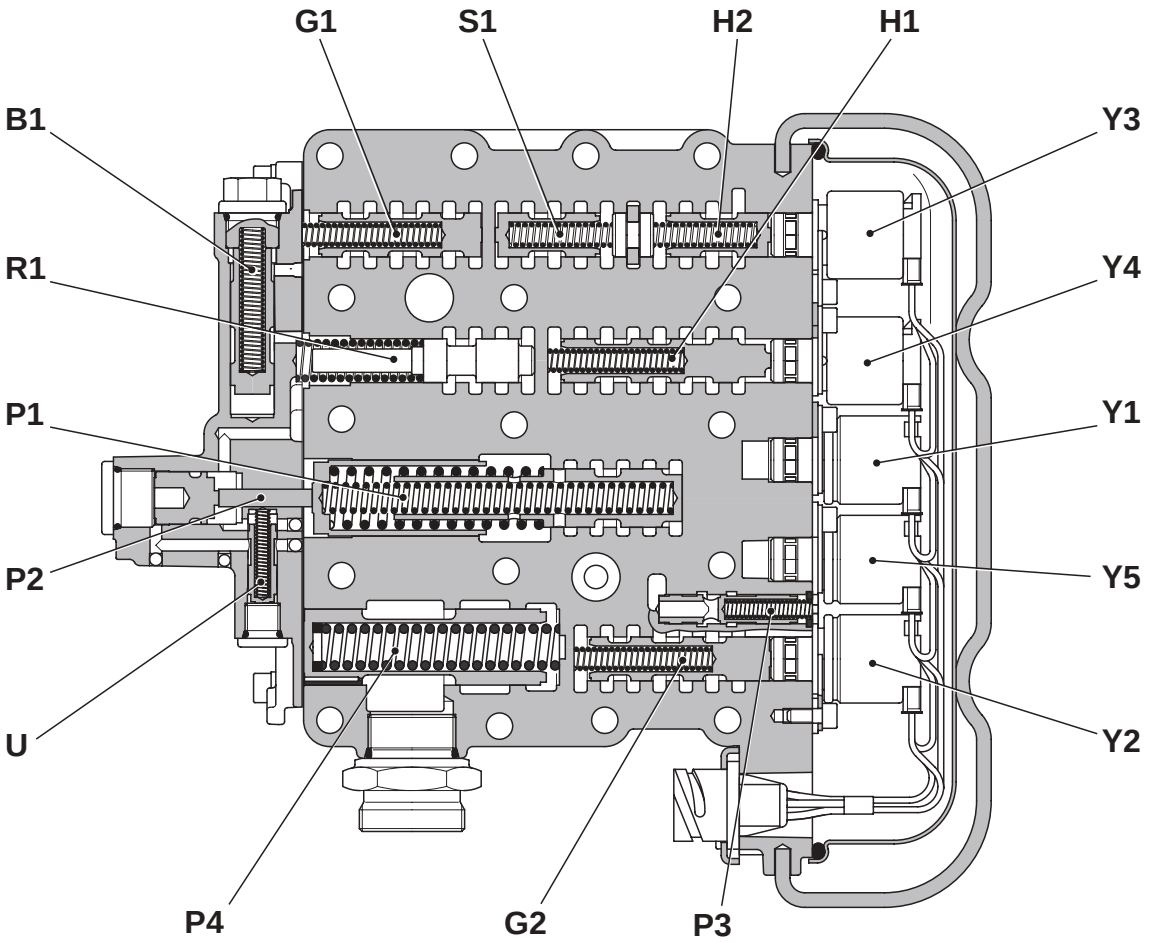
A. GEARBOX CONTROL VALVE

PRESSURE TEST POINTS



Pos.	Function	Thread size
a.	**A** or **F clutch pressure**	M10x1
b.	**B** or **G clutch pressure**	M10x1
c.	**Y3** or **Y4 solenoid valve pressure**	M10x1
d.	Pressure **Pg** to relief valve	M10x1
e.	Pressure **Pr** from relief valve (18 bar)	M10x1
f.	Engagement pressure of clutch **C** or **D**	M10x1
g.	General pressure (18 bar)	M10x1
h.	Engagement pressure of clutch **A/B** or **F/G**	M10x1
l.	Pilot pressure (10 bar)	M10x1
m.	D clutch pressure	M10x1
n.	C clutch pressure	M10x1
p.	Modulated pressure	M10x1

MAIN COMPONENTS



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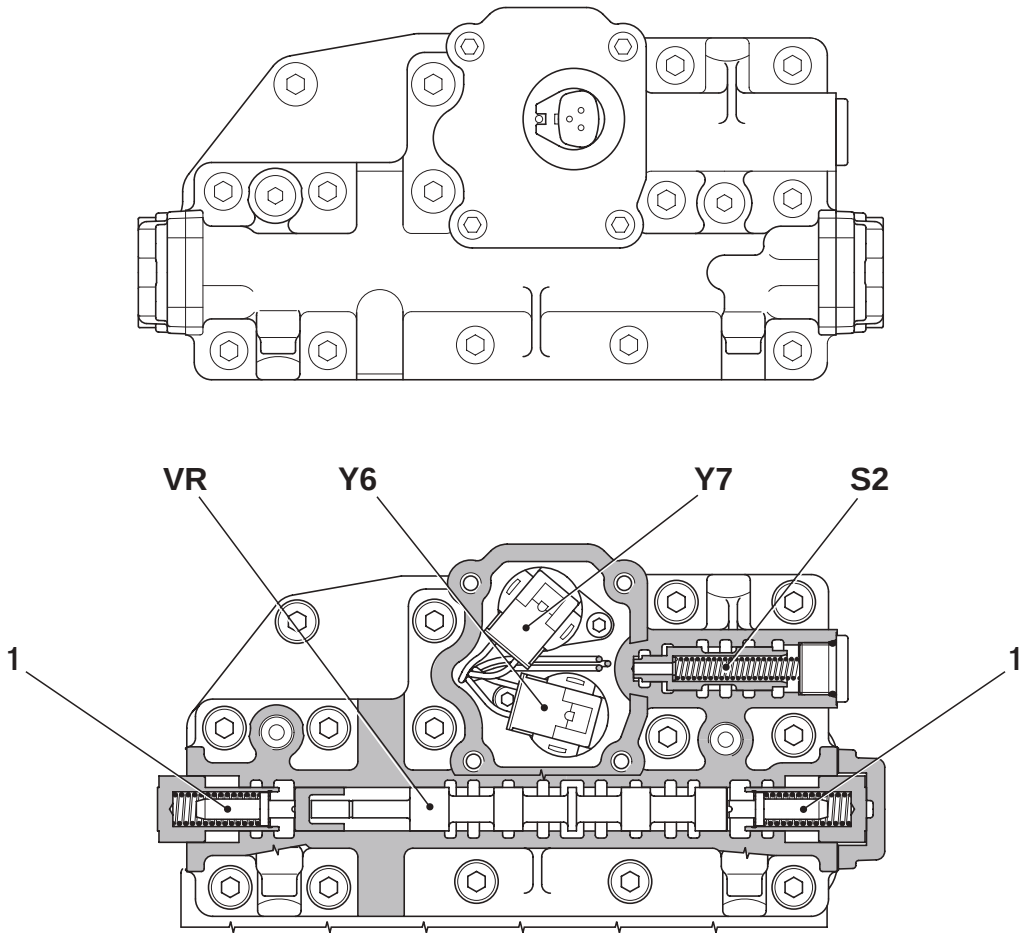
B1 Breather valve
G1 Clutch selection valve for **A/B** or **F/G** clutches
S1 Relief valve
H2 Clutch engagement valve for **C/D** clutches
H1 Clutch engagement valve for **A/B** or **F/G** clutches
Y3 Pilot solenoid valve for engagement valve **H2**
Y4 Pilot solenoid valve for engagement valve **H1**
Y1 Pilot solenoid valve for clutch selection valve **G1**
Y5 Pilot solenoid valve for road/field selection valve
Y2 Pilot solenoid valve for **C** or **D** clutch selection valve **G2**
P3 Pilot pressure regulating valve
G2 Clutch selection valve for**C** or **D** clutches
P4 General pressure regulating valve
U Road/field operating mode selection valve
P1 Pressure modulating valve
P2 2-stage valve
R1 Null shift valve

B. SHUTTLE CONTROL VALVE

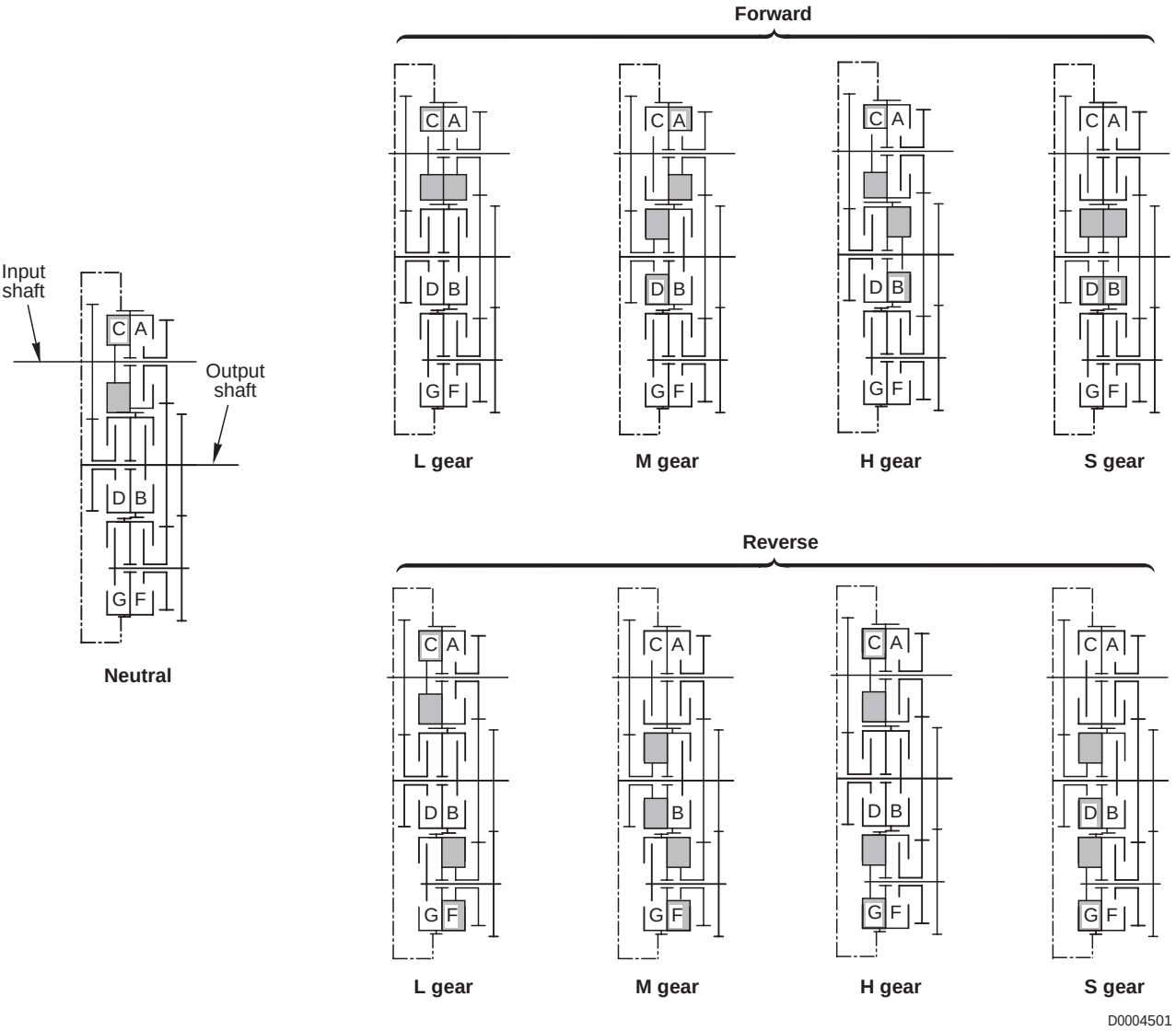
MAIN COMPONENTS



D0005330

Y6 Pilot solenoid valve for FORWARD gear
Y7 Pilot solenoid valve for REVERSE gear
VR FORWARD/REVERSE control spool valve
S2 Relief valve
1 Neutral return device

1.2.6 CLUTCH ENGAGEMENT AND SOLENOID VALVE OPERATION SCHEMATIC



Solenoid valve operation when shifting from L to S gear (L→M→H→S)

Solenoid valve	Forward				Reverse			
	L	M	H	S	L	M	H	S
Y6	●	●	●	●				
Y7					●	●	●	●
Y1	●	●			●	●		
Y2		●		●		●		●
Y3		❍	❍	❍		❍	❍	❍
Y4			❍				❍	

● = Solenoid valve energised

❍ = Solenoid valve briefly energised during gear change

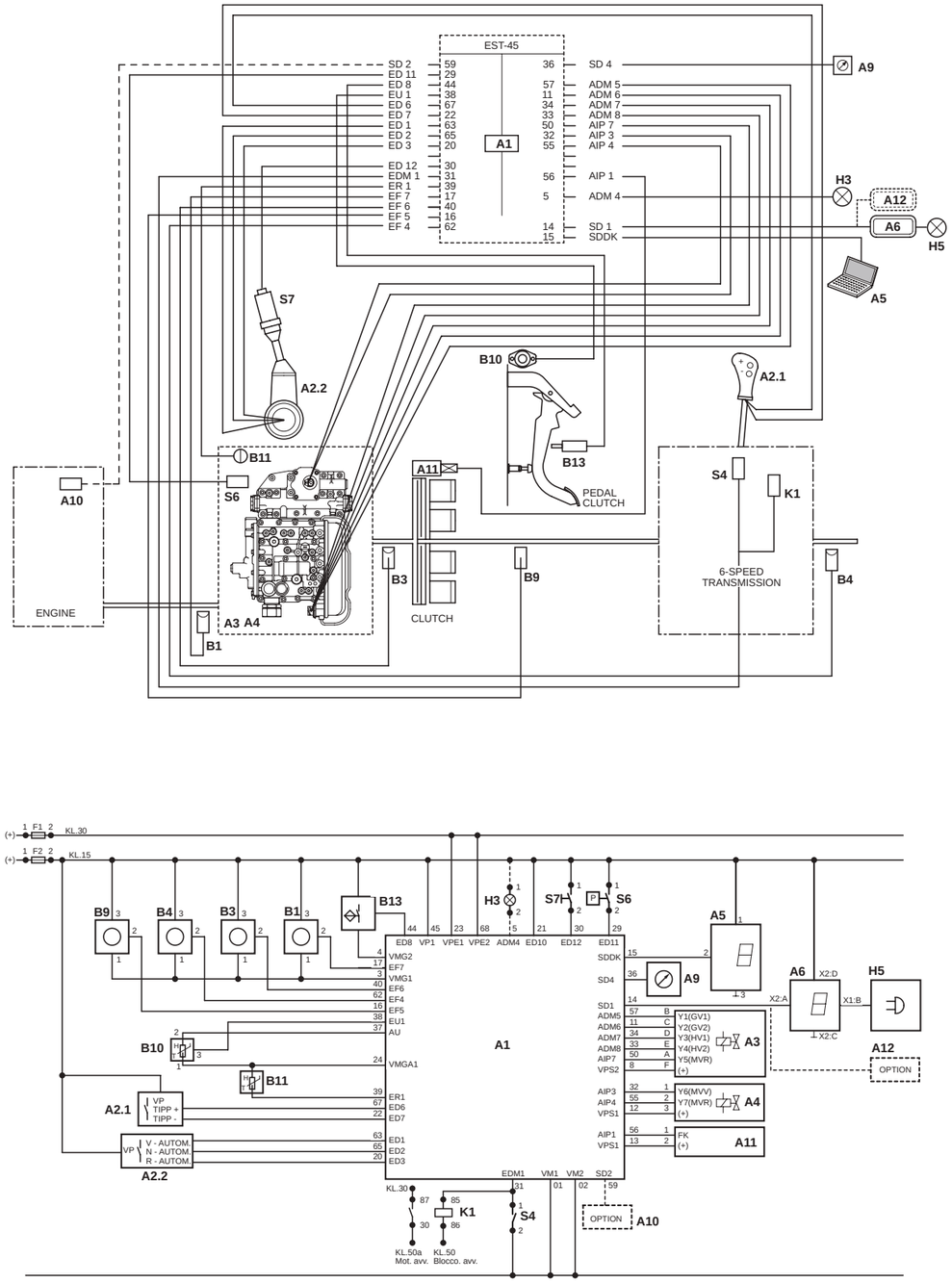
Solenoid valve operation when shifting from S to L gear (S→H→M→L)

Solenoid valve	Forward				Reverse			
	S	H	M	L	S	H	M	L
Y6	●	●	●	●				
Y7					●	●	●	●
Y1			●	●			●	●
Y2	●		●				●	
Y3		❍	❍	❍		❍	❍	❍
Y4			❍				❍	

● = Solenoid valve energised

❍ = Solenoid valve briefly energised during gear change

1.2.7 TRANSMISSION ELECTRONIC SYSTEM SCHEMATIC



D0005221

COMPONENTS

A1 Electronic transmission control unit(EST45)

A2.1 Range selector lever (L M H S)

A2.2 Shuttle control lever (FORWARD/REVERSE)

A3 Gearbox control valve

A5 Diagnostics

A6 Display

A9 Tachymeter

A10 Engine load sensor

A11 Proportional solenoid valve for main clutch control

A12 INFOCENTER

B1 Engine speed sensor (nLse - nMot)

B3 Hydraulic gearbox output speed sensor (nAb)

B4 Transmission input speed sensor (nLsa)

B9 Clutch speed sensor (nHk)

B10 Clutch pedal position sensor

B11 Temperature sensor

B13 Clutch proximity sensor

F1 Fuse (8A)

F2 Fuse (8A)

H3 Low oil pressure indicator lamp

H5 Audible alarm

K1 Interlock starter relay 70A

S4 Mechanical gearbox neutral sensor

S6 Transmission oil low pressure sensor (18 bar)

S7 Interlock button

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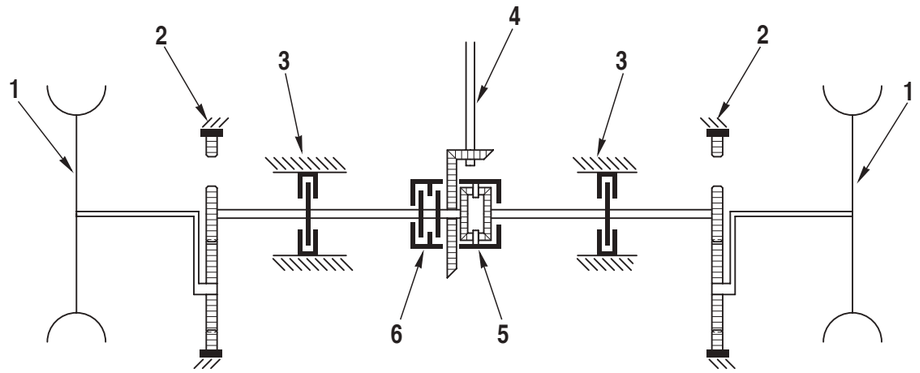
1.3 REAR AXLE

DESCRIPTION

The rear axle receives drive from the pinion (4) and transmits drive through the differential (5) and epicyclic reduction units (2) to the rear wheels (1).

The rear axle is equipped with an electro-hydraulically controlled differential lock (6) and two hydraulically operated brakes (3).

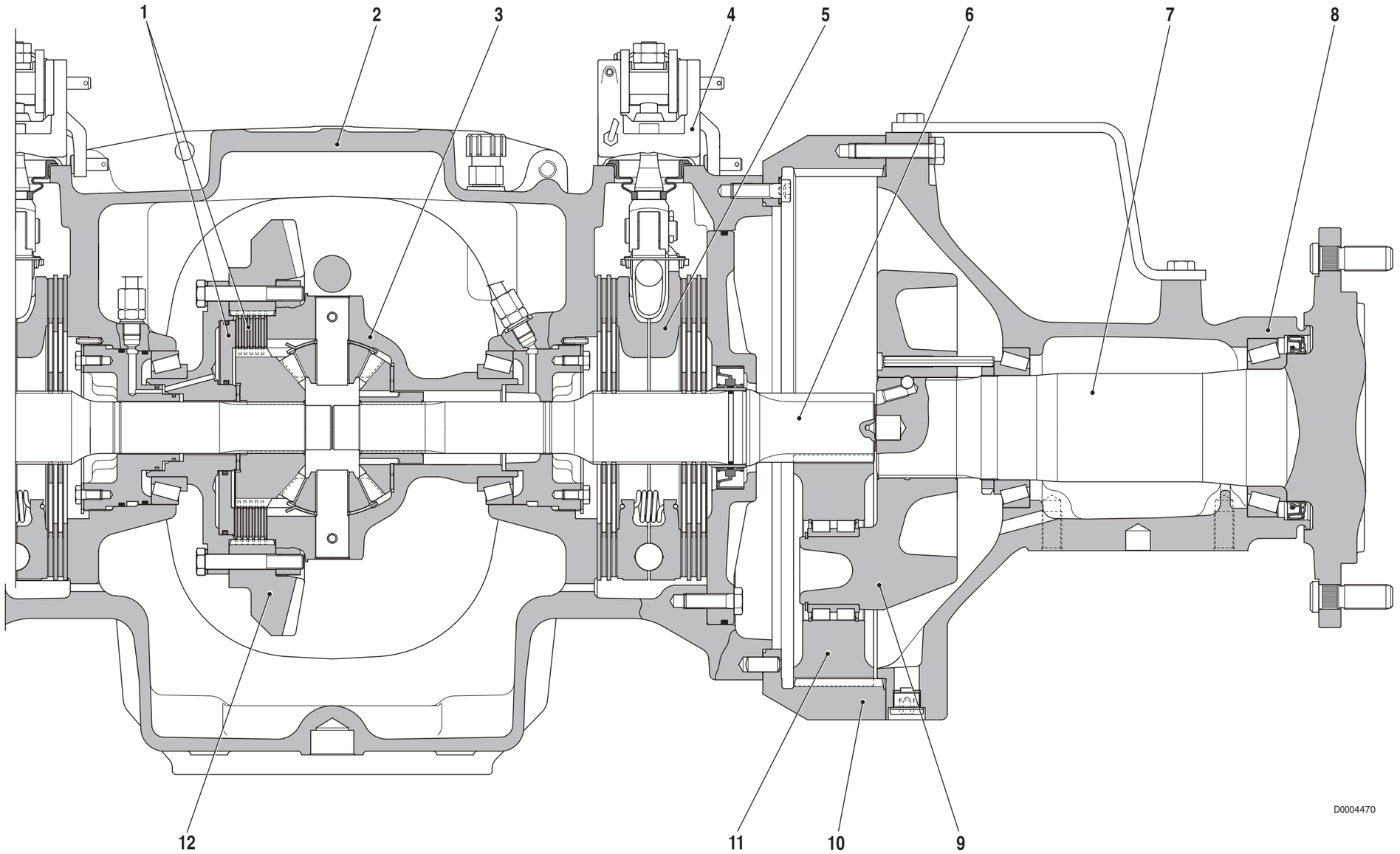


D0004450

COMPONENTS

1. Wheels
2. Epicyclic reduction unit
3. Brake
4. Pinion
5. Differential
6. Differential lock

COMPONENTS

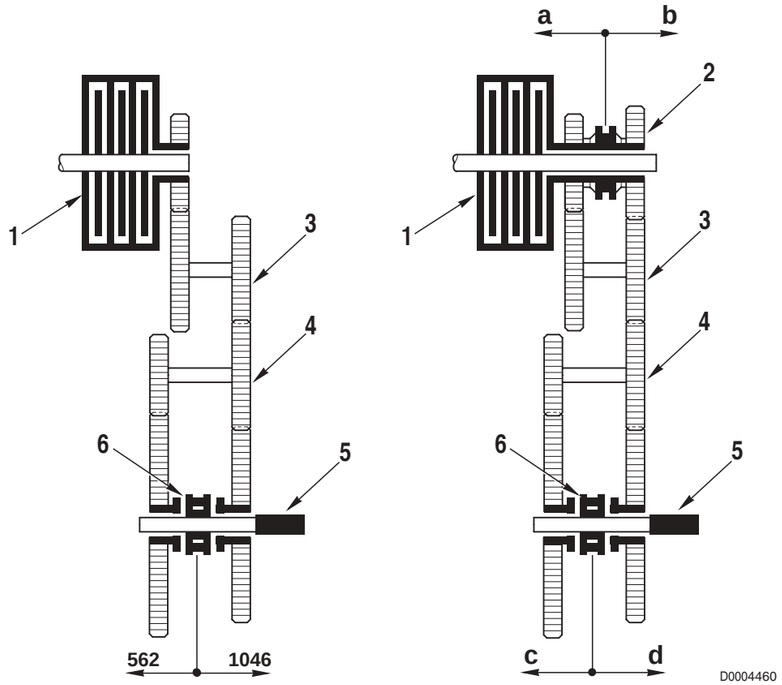


1. Differential lock
2. Central axle housing
3. Differential
4. Brake control device
5. Brake
6. Half-shaft
7. Hub
8. Axle casing
9. Planet carrier
10. Ring gear
11. Planet pinion
12. Crown wheel

1.4 REAR PTO

DESCRIPTION

The rear PTO provides drive for external implements at a preselected rotation speed.
The rotary drive is taken directly from the engine and then reduced through a 2 -or 4-speed gearbox with manual speed selection.
The PTO is engaged by way of an electro-hydraulically controlled clutch .



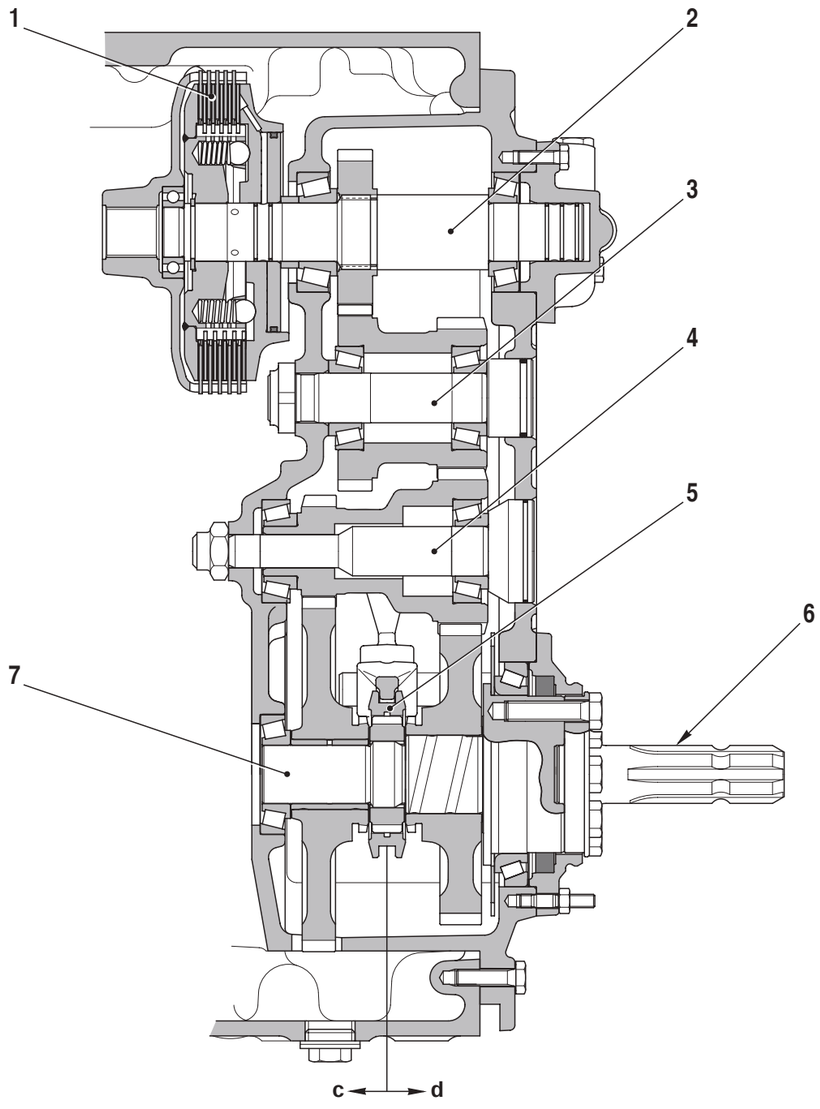
1. Clutch
2. Synchronizer 1
3. Intermediate shaft
4. Intermediate shaft
5. PTO shaft
6. Synchronizer 2

Speed of PTO output shaft - 4-speed version

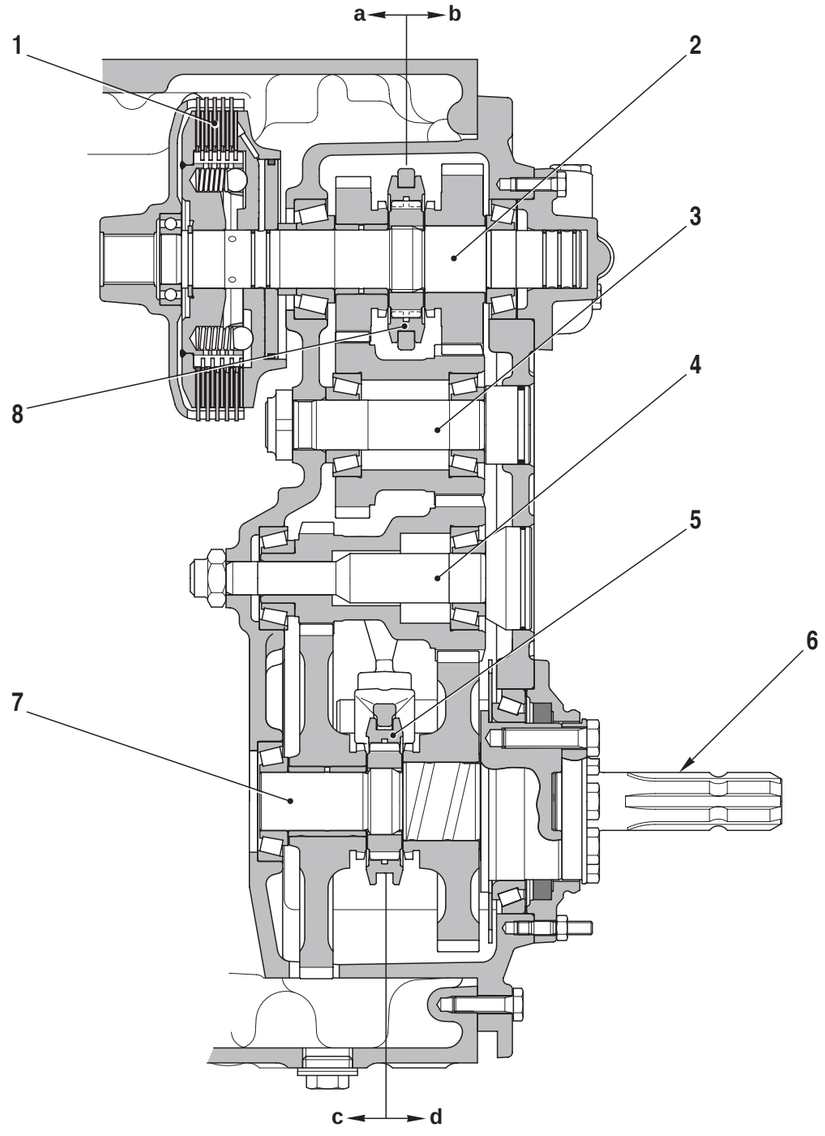
Synchronizer 1	Synchronizer 2	
	c	d
a	562	1046
b	772	1437

COMPONENTS

2 SPEED VERSION



4 SPEED VERSION



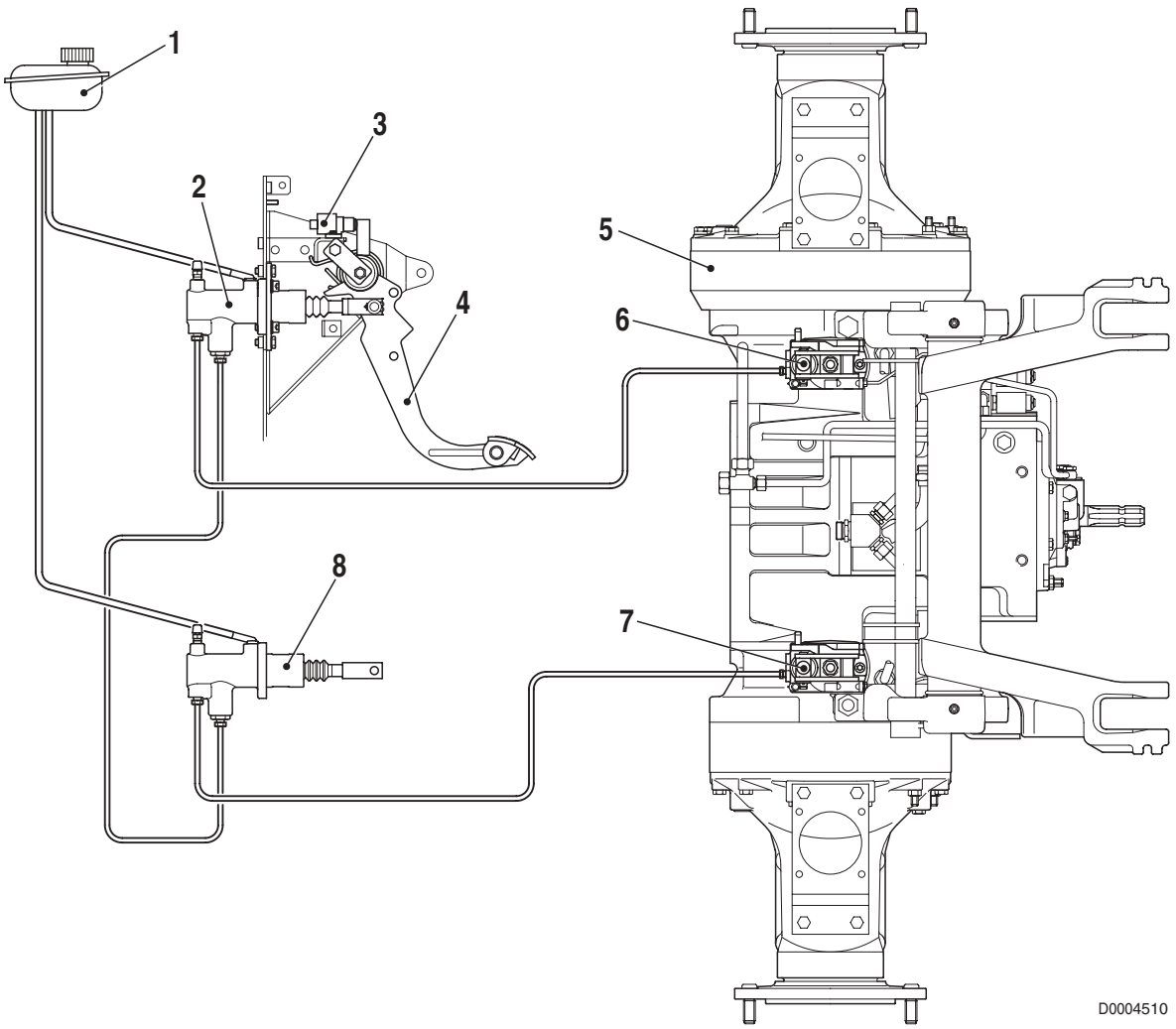
D0005340

1. PTO engagement clutch
2. PTO input shaft
3. Intermediate shaft
4. Intermediate shaft
5. Synchronizer (speeds a/b)
6. PTO end shaft
7 PTO output shaft
8. Synchronizer (speeds c/d)

2. BRAKING SYSTEM

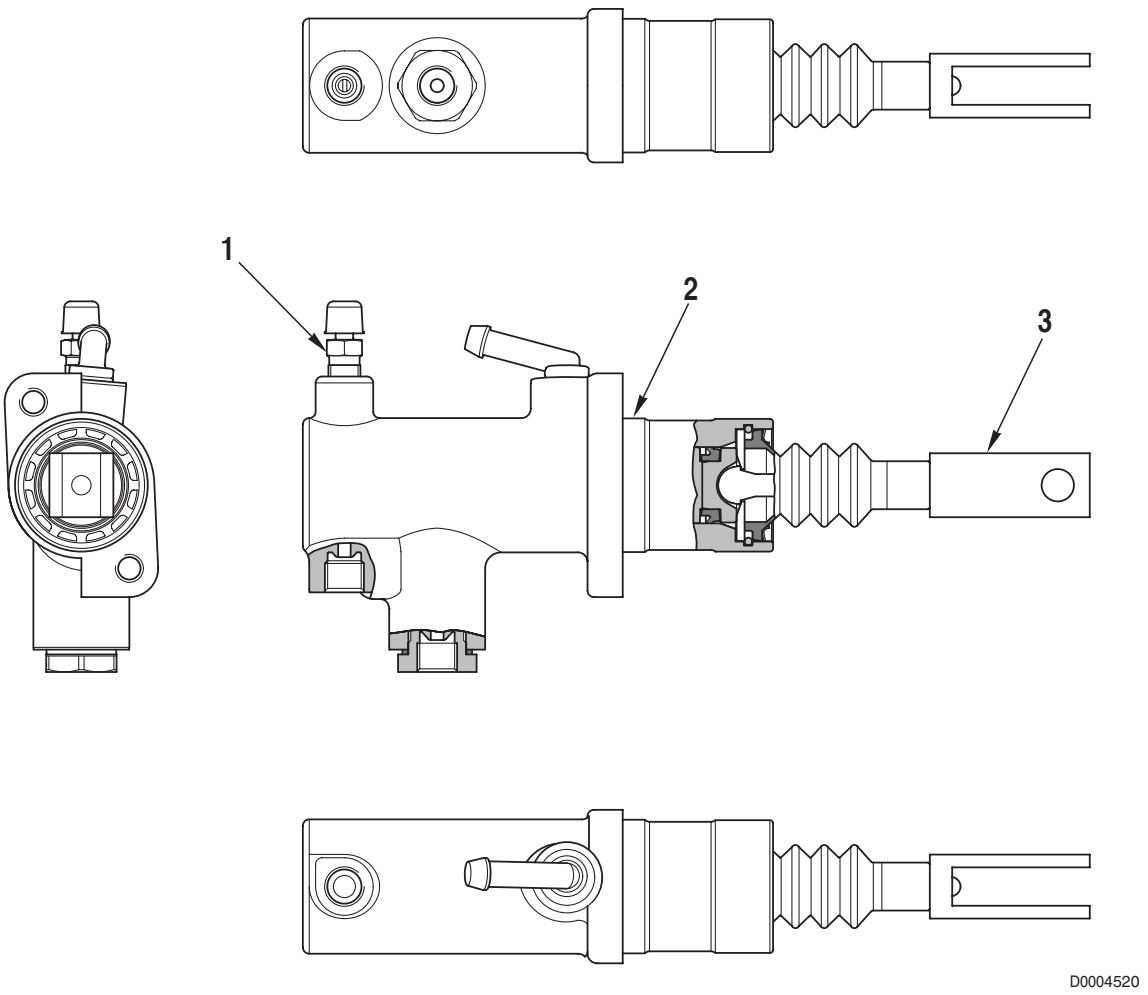
DESCRIPTION

The braking system is comprised of 2 braking devices (one for each rear wheel) operated by two hydraulic pumps by way of mechanical controls.
Each pump supplies fluid to the brake on one side (left or right) thereby allowing the operator to brake on one side only and thus reduce the steering radius.



1. Brake fluid reservoir
2. Right master cylinder
3. Brake microswitches (n° 2)
4. Brake pedal
5. Rear axle
6 Right brake
7. Left brake
8 Left master cylinder

2.1 BRAKE MASTER CYLINDER

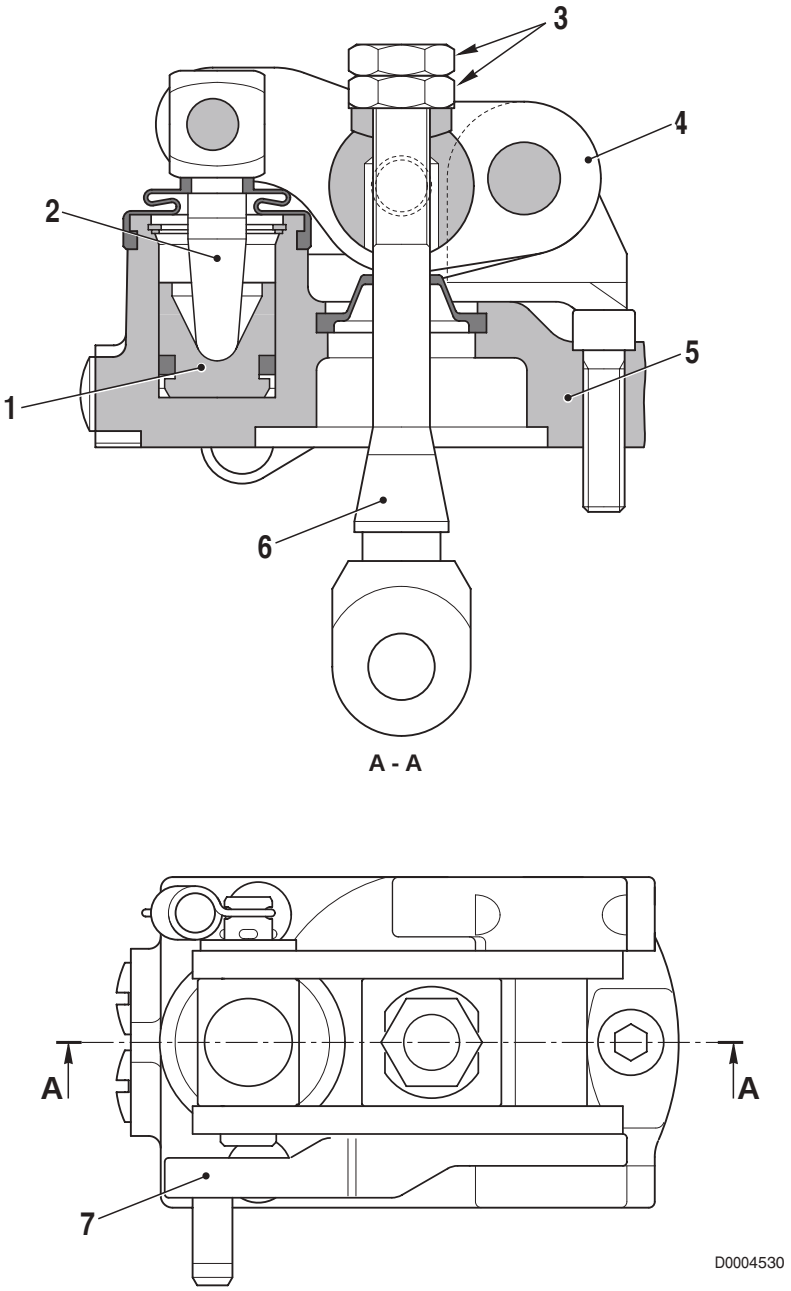


1. Bleed screw
2. Barrel
3. Push-rod

TECHNICAL DATA

Piston diameter: 23.81 mm (0.938 in.)
Piston stroke: 30 mm (1.182 in.)
Maximum operating pressure: 120 bar (1740 psi)

2.2 BRAKE



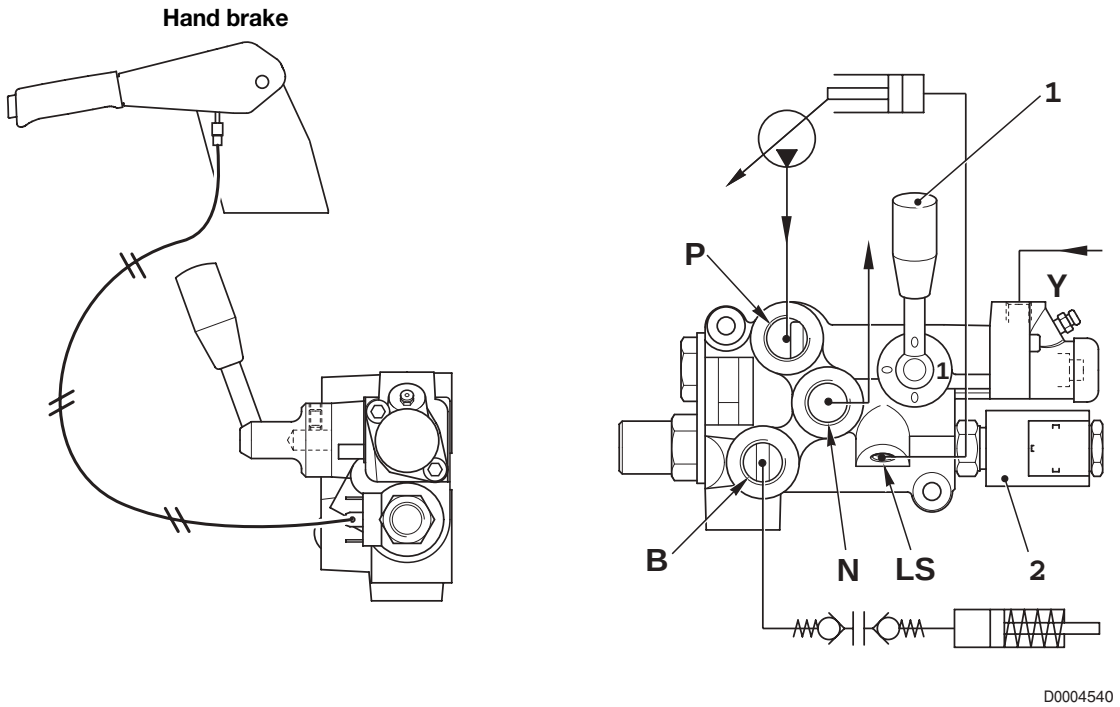
1. Piston
2. Plunger
3. Adjustment nuts
4. Lever
5. Support
6. Rod
7. Parking brake control lever

2.3 TRAILER BRAKING SYSTEM

The tractor may be equipped with one of the four following trailer braking systems:

1. hydraulic trailer braking (Italy version)
2. hydraulic trailer braking (Export version)
3. air trailer braking (Italy version)
4. air trailer braking (Export version)

2.3.1 HYDRAULIC TRAILER BRAKING (ITALY VERSION)

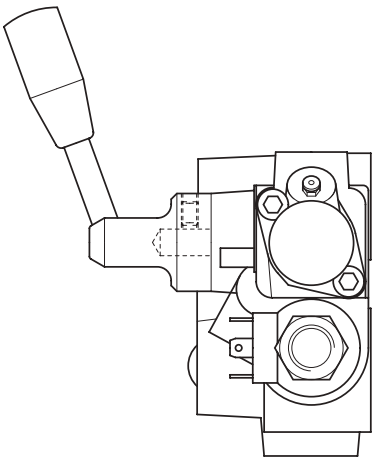


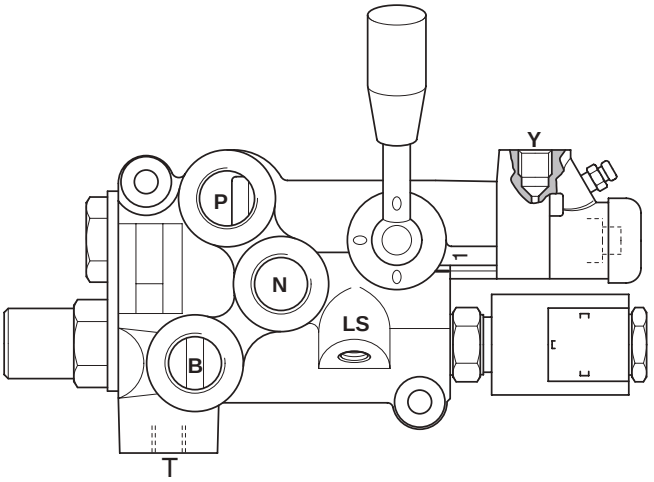
1. Valve activation lever in position "1"

- When the lever (1) is in position "1" (valve activated) and the brake pedals are not pressed, a pressure of 12.5 bar (181.3 psi) is available at port **B**.
- This pressure is supplied constantly to the trailer to release the parking brake.
- When the operator engages the parking brake, the solenoid valve (2) is energised; this nullifies the pressure at port **B**.
- The pressure at port **B** is directly proportional to the pressure present in the tractor braking circuits **Y**.

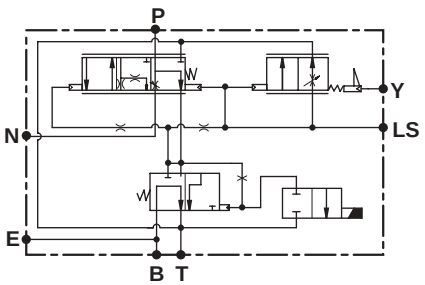
2. Valve activation lever in position "O"

- When the lever (1) is in position "**O**" (valve deactivated), there is no pressure at port **B**.
  In this condition, the pressure at port **B** is always null independently of the pressure in the tractor braking circuits.





HYDRAULIC DIAGRAM



D0004550

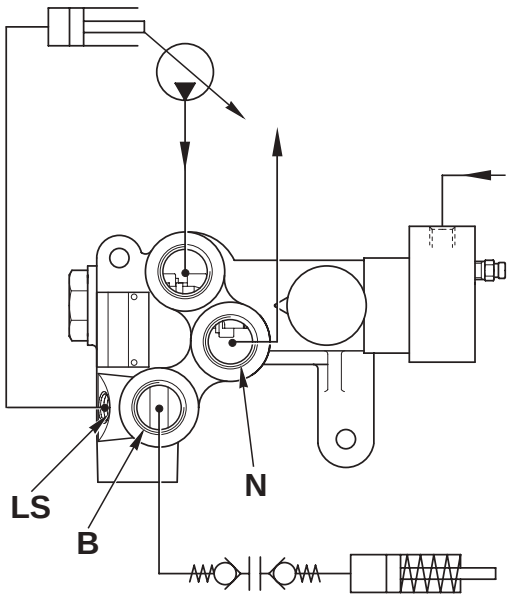
FUNCTION

Port P - Valve feed
Port N - To lubrication line
Port B - To trailer brake
Port T - Drain
Port Y - Connection to tractor braking system
Port LS - Load Sensing signal

TECHNICAL DATA

- Maximum pressure at port N:
  210 bar (3046 psi)
- Minimum constant pressure at port B:
  12.5±2 bar (181.3±29 psi)
- Maximum pressure at port B:
  135º5 bar (1957.5º72.5 psi)
- Feed flow rate:
  20–80 ℓ/min (5.3 –21.14 US.gpm)

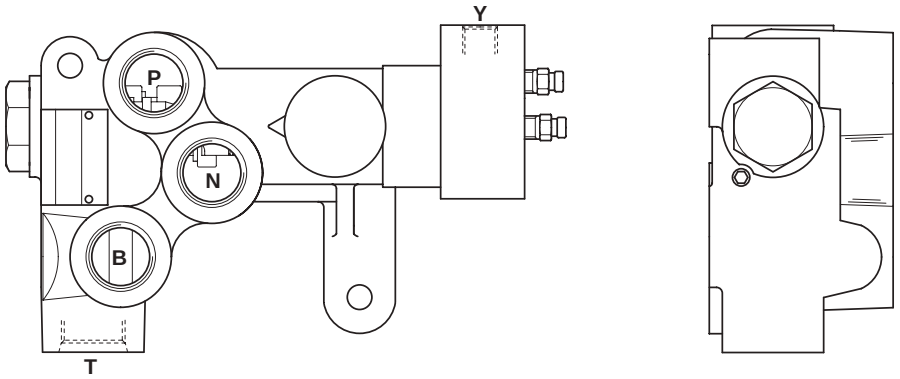
2.3.2 HYDRAULIC TRAILER BRAKING (EXPORT VERSION)



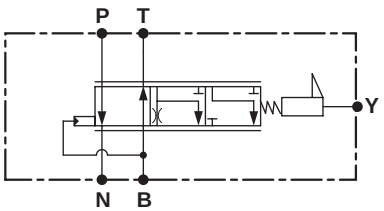
D0004560

- When the brakes are not operated the pressure at port **B** is null.
- When the operator applies the tractor brakes, the pressure in the circuit pilots the braking valve and the pressure at port **B** increases proportionally to the pressure in the tractor braking circuit.

MODELS 106 - 110 - 115 CV



HYDRAULIC DIAGRAM



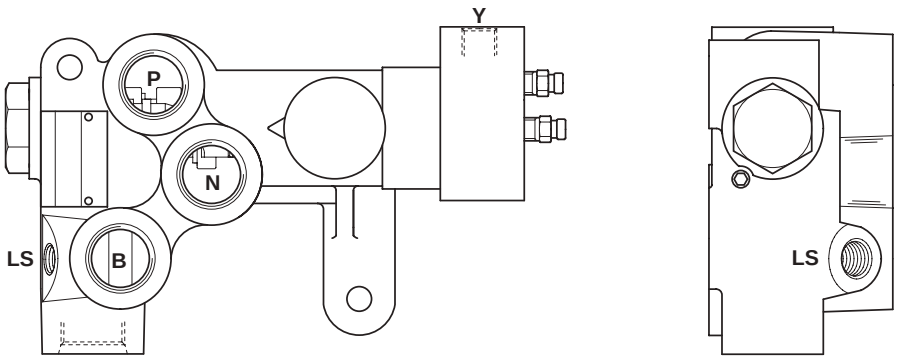
D0004570

Port P - Valve feed
Port N - To lubrication line
Port B - To trailer brake
Port Y - Connection to tractor braking system
Port T - Drain

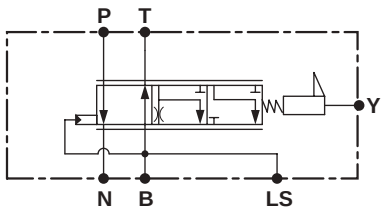
TECHNICAL DATA

- Maximum pressure at port N: 210 bar (3046 psi)
- Minimum constant pressure at port B: 0 bar (0 psi)
- Maximum pressure at port B: $142\ ^{+8}_{0}$ bar ($2059\ ^{+116}_{0}$ psi)
- Feed flow rate: 20–80 ℓ/min (5.3 –21.14 US.gpm)

MODELS 120 - 135 - 150 - 165 CV



HYDRAULIC DIAGRAM



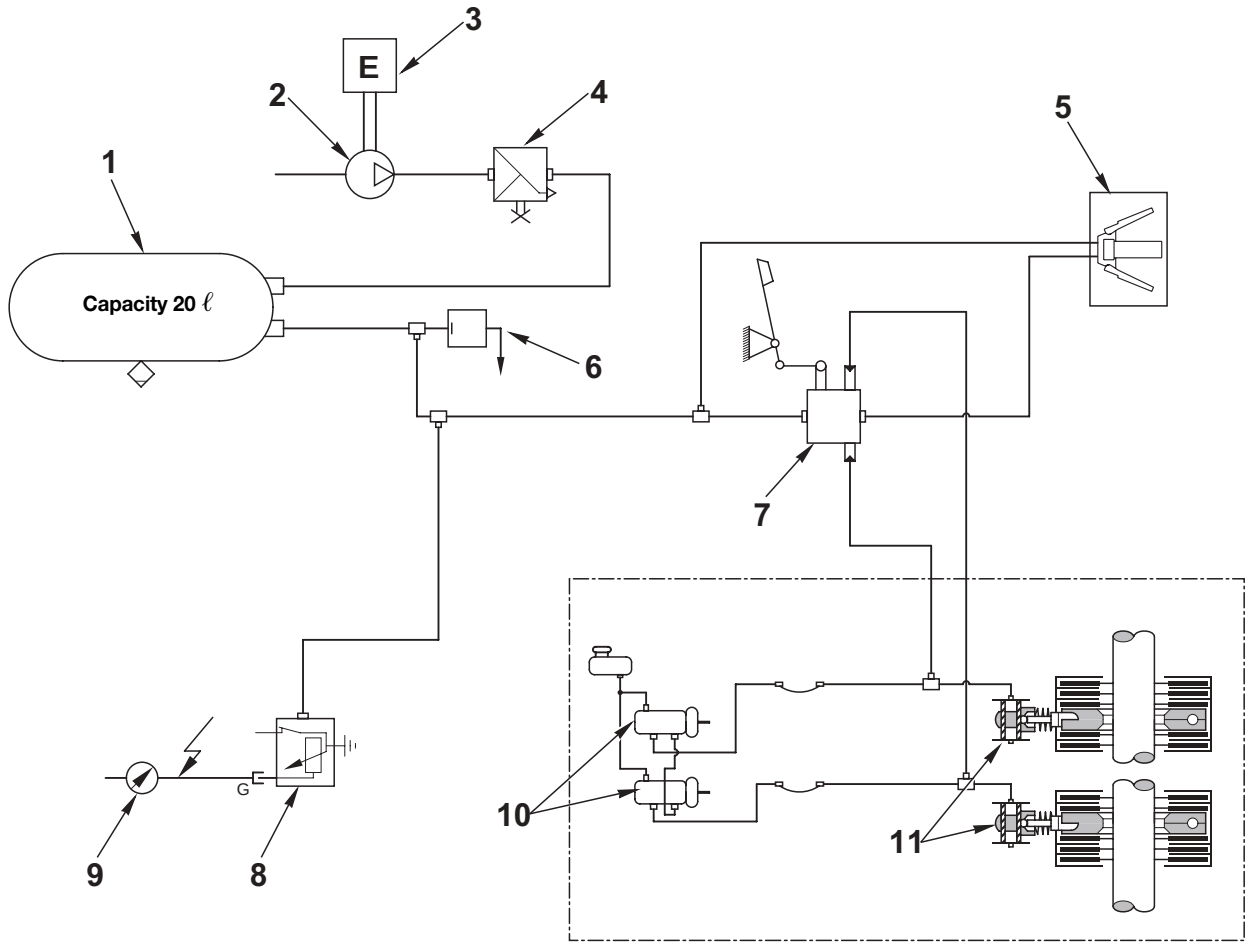
D0004580

Port P - Valve feed
Port N - To lubrication line
Port B - To trailer brake
Port T - Drain
Port Y - Connection to tractor braking system
Port LS - Load Sensing signal

TECHNICAL DATA

- Maximum pressure at port N: 210 bar (3046 psi)
- Minimum constant pressure at port B: 0 bar (0 psi)
- Maximum pressure at port B: $142 \,^{+8}_{0}$ bar ($2059 \,^{+116}_{0}$ psi)
- Feed flow rate: 20–80 ℓ/min (5.3 – 21.14 US.gpm)

2.3.3 AIR TRAILER BRAKING (ITALY VERSION)



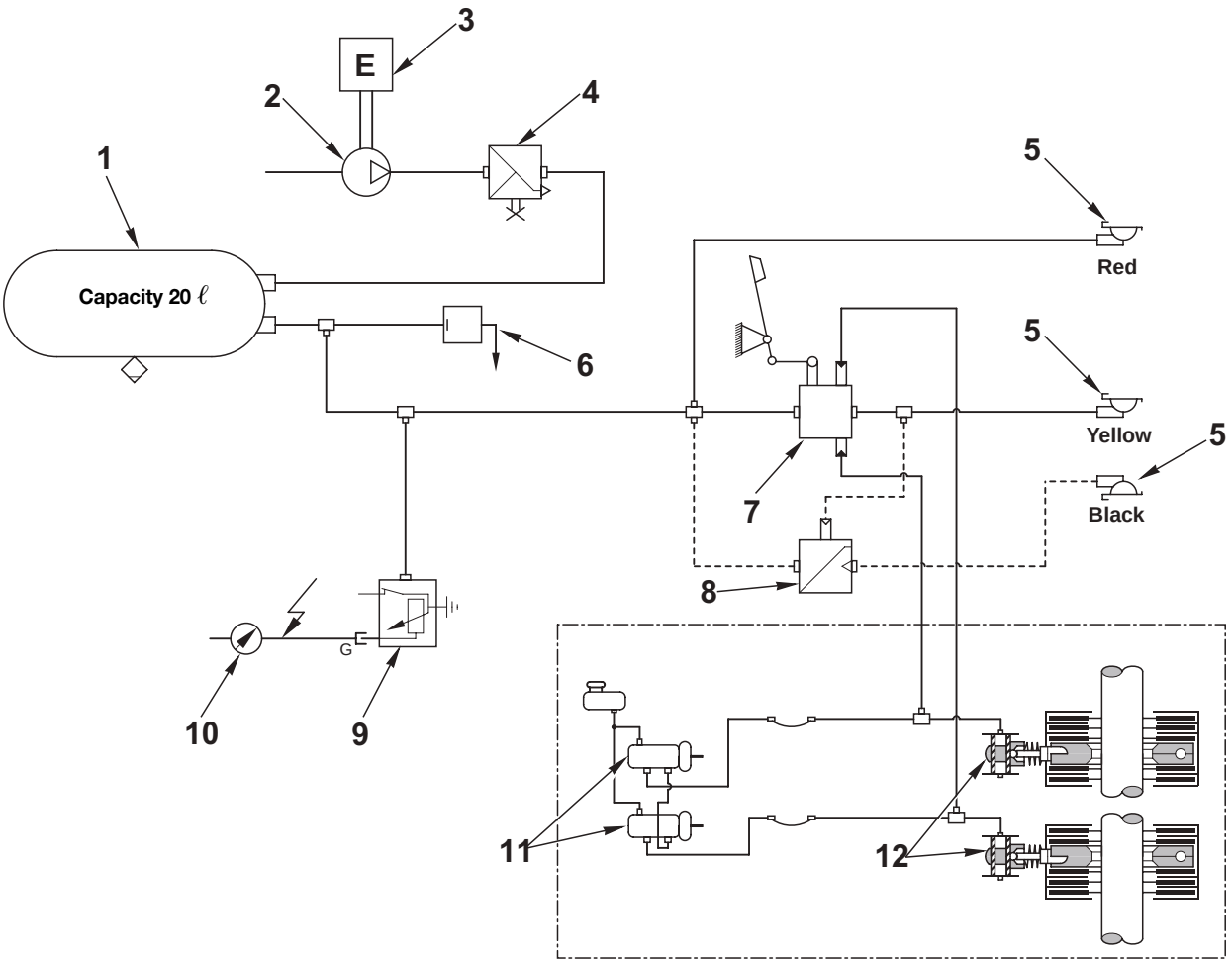
STANDARD SYSTEM BRAKING

D0004600

COMPONENTS

1. Compressed air reservoir
2. Air compressor
3. Engine
4. Pressure limiting valve (7.8 bar (113 psi))
5. Quick-action coupler for trailer
6. Feed valve for cab air suspension
7. Trailer braking valve
8. Circuit pressure sensor
9. Circuit pressure indicator
10. Brake master cylinder
11. Brake

2.3.4 AIR TRAILER BRAKING (EXPORT VERSION)

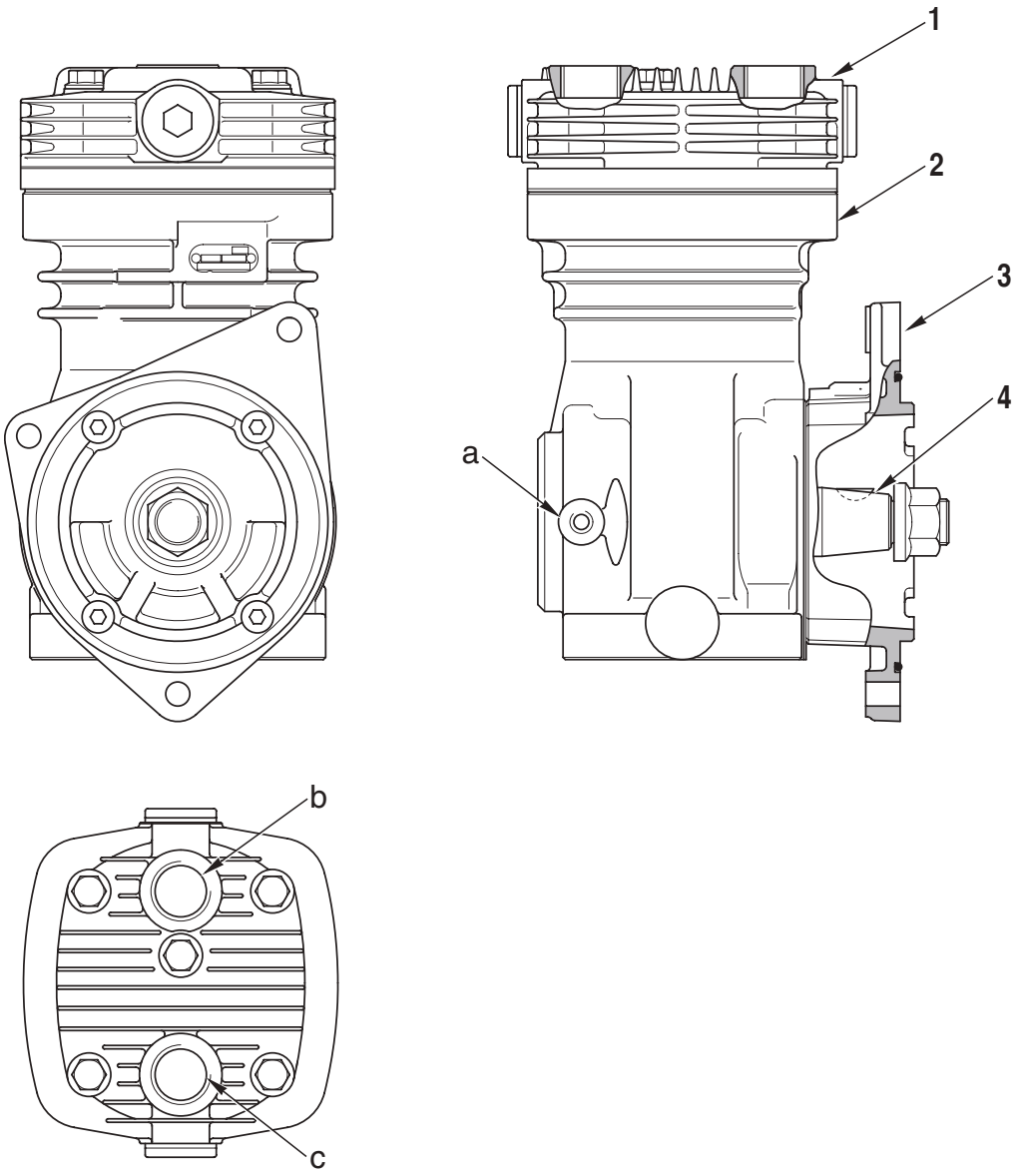


STANDARD SYSTEM BRAKING

D0004591

1. Compressed air reservoir
2. Air compressor
3. Engine
4. Pressure limiting valve (7.8 bar (113 psi))
5. Quick-action coupler for trailer
6. Feed valve for cab air suspension
7. Trailer braking valve (2-way)
8. Trailer braking valve (1-way)
9. Circuit pressure sensor.
10. Circuit pressure indicator
11. Brake master cylinder
12. Brake

COMPRESSOR



D0004620

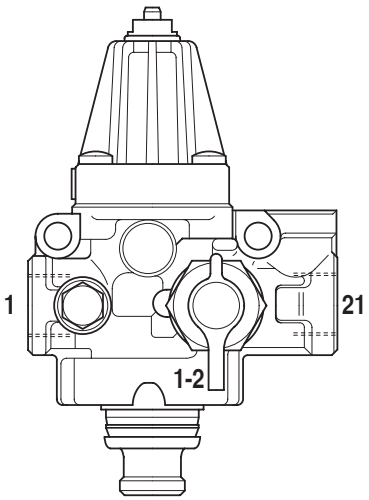
a. Port 0.1 - Compressor lubrication
b. Port 0
c. Port 2 - Compressed air delivery

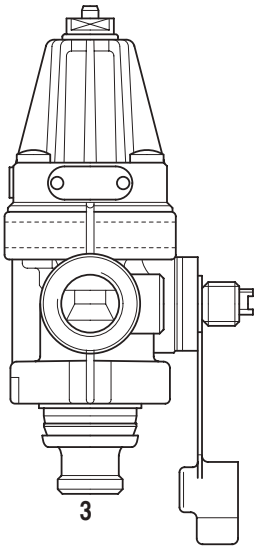
1. Cylinder head
2. Cylinder
3. Flange
4. Crankshaft

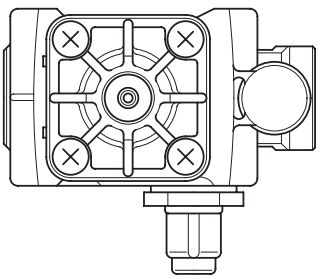
TECHNICAL DATA

Bore: 90 mm (3.546 in.)
Stroke: 36 mm (1.418 in.)
Displacement: 229 cm^3
Max. pressure.: 10 bar (145 psi)
Crankshaft end float: 0.08–0.38 mm (0.003 – 0.015 in.)

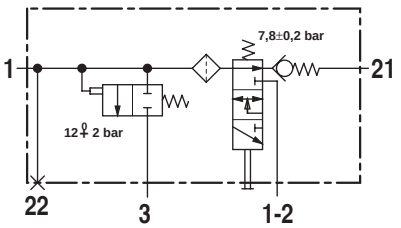
PRESSURE LIMITING VALVE







DIAGRAM



D0004690

Port 1 - From compressor
Port 3 - Excess pressure vent
Port 21 - To compressed air reservoir

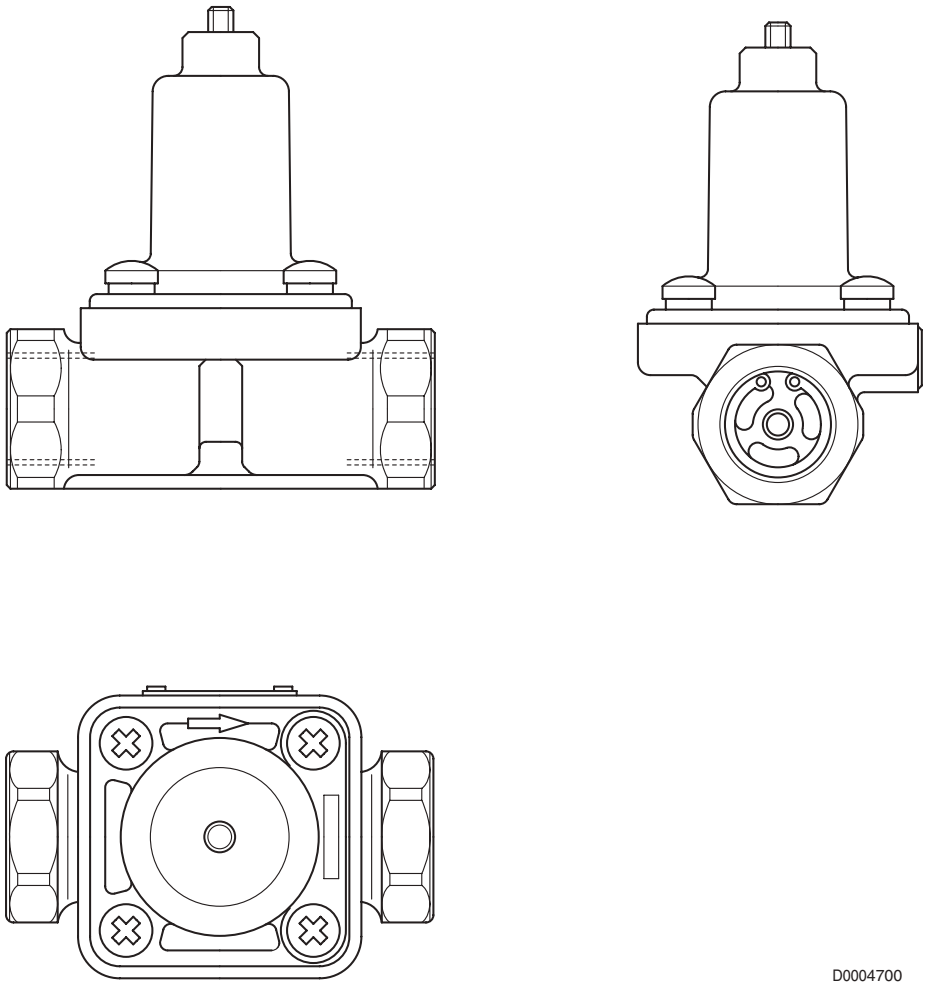
TECHNICAL DATA

Cut-out pressure: 7.8±0.2 bar (113±2.9 psi)
Cut-in pressure: 0.6–1 bar (8.7 – 14.5 psi)
Relief valve setting: 12 2 bar (174 29 psi)

CAB SUSPENSION FEED VALVE

FUNCTION

Supplies compressed air to the pneumatic cab suspension system only when the pressure in the trailer braking circuit exceeds 6±0.3 bar (87±4.35 psi)



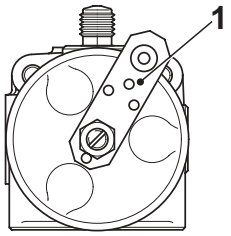
D0004700

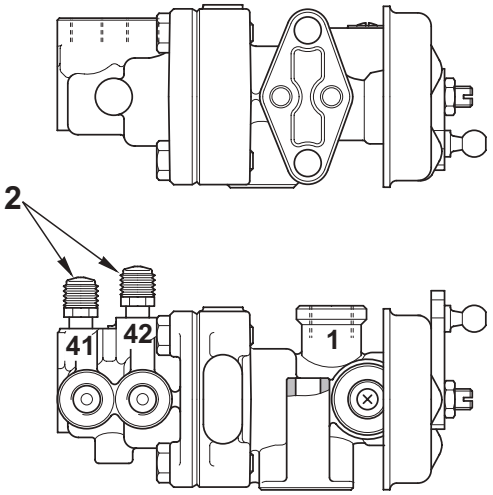
TECHNICAL DATA

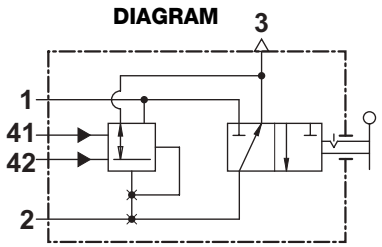
Opening pressure: 6±0.3 bar (87±4.35 psi)

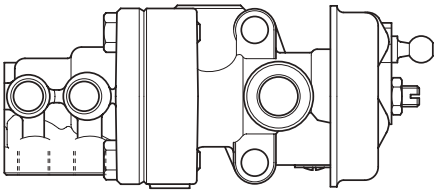
Maximum operating pressure: 13 bar (188 psi)

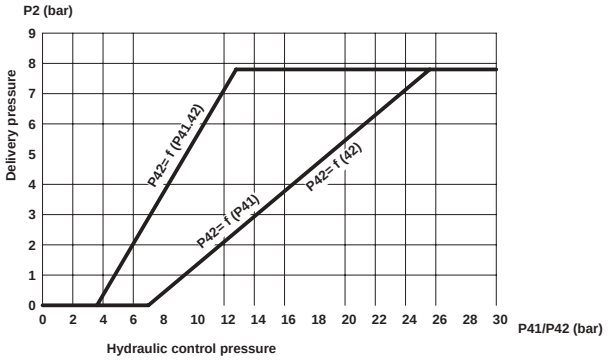
TRAILER BRAKING VALVE (2-WAY)

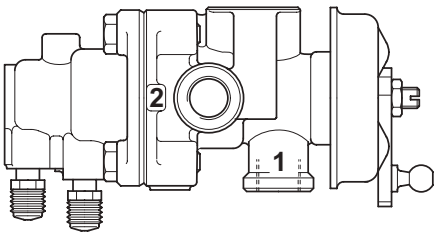










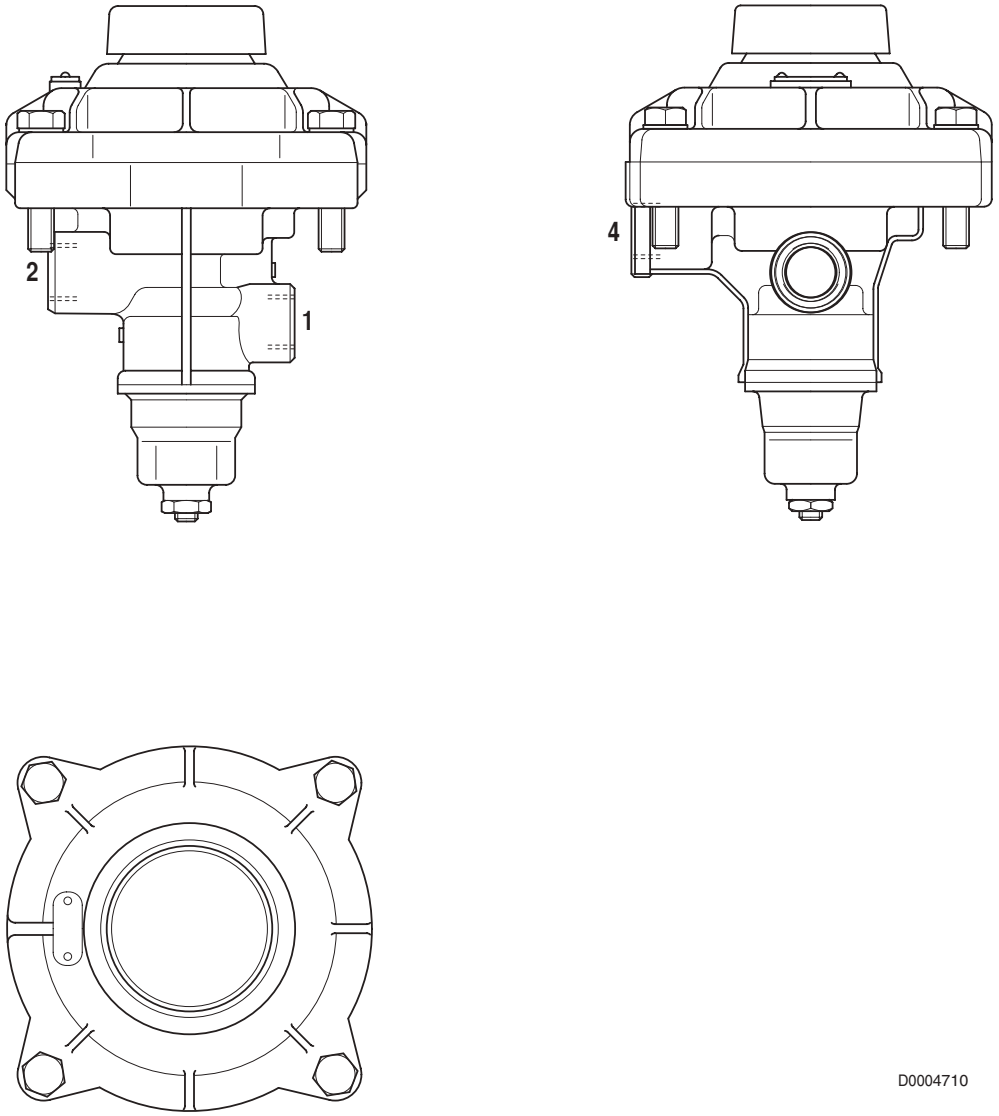


D0004761

1. Parking brake actuating lever
2. Bleed screw

Port 1 - From compressed air reservoir
Port 2 - To trailer brake
Port 41 - From left brake
Port 42 - From right brake

TRAILER BRAKING VALVE (1-WAY)



D0004710

Port 1 - From compressed air reservoir
Port 2 - To trailer brake
Port 4 - Pilot from delivery line to trailer (2-way braking)

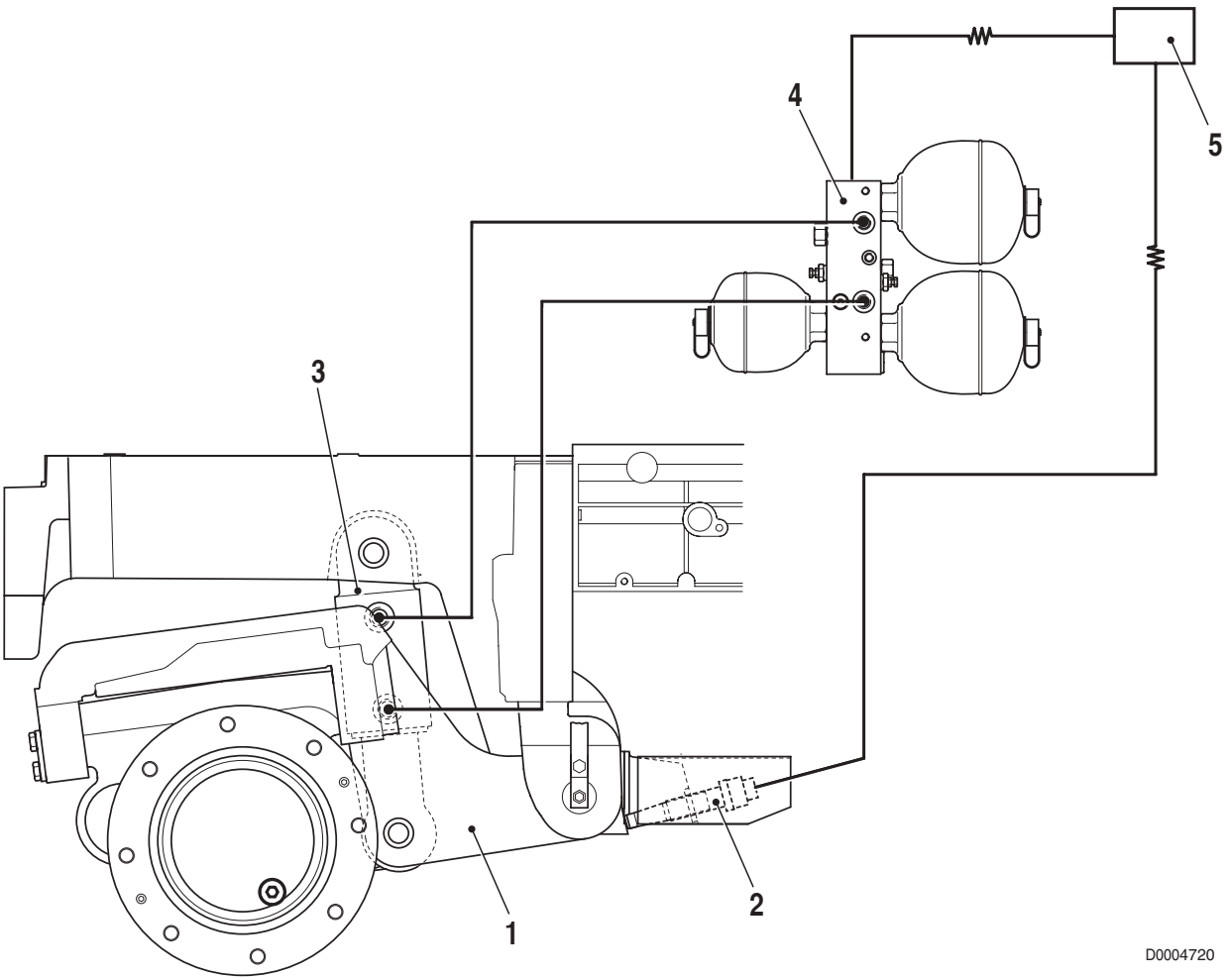
3. HYDRAULIC FRONT AXLE SUSPENSION

DESCRIPTION

The function of the hydraulic front suspension system is to absorb impacts when travelling over rough terrain and to keep the tractor body on an even keel on the road.

The system comprises:

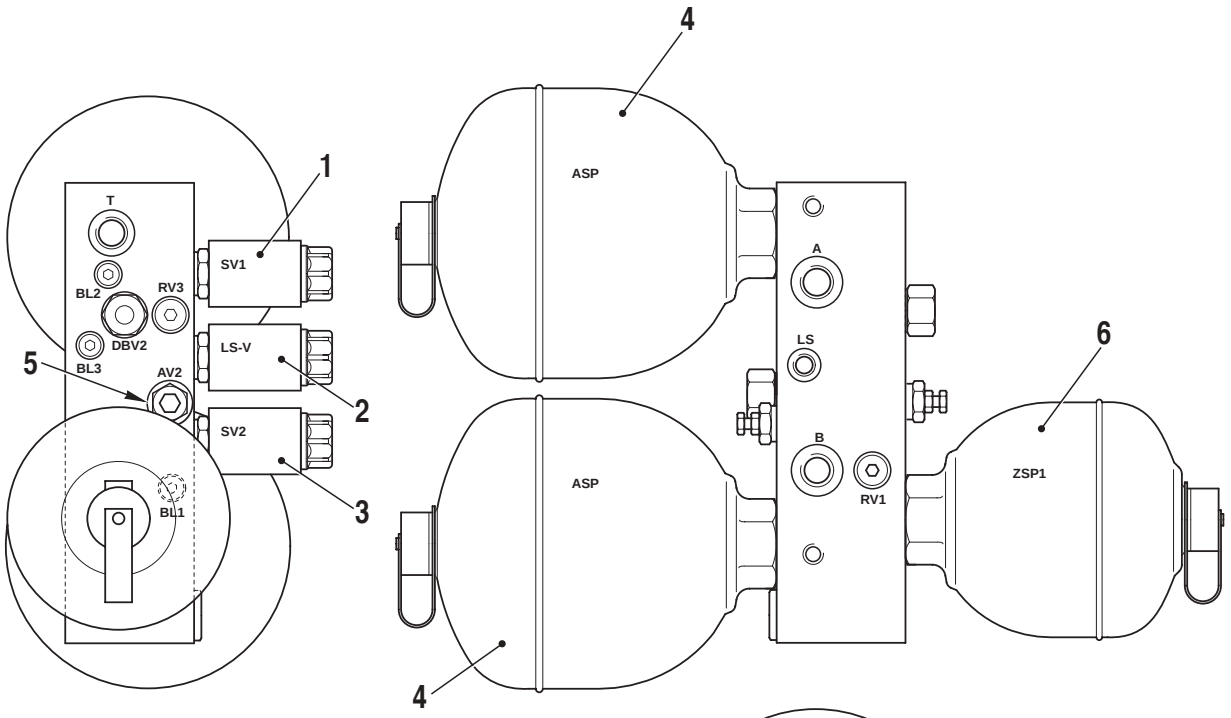
- swinging axle support arm (1)
- position sensor (2)
- 2 suspension cylinders (3)
- front suspension control valve (4)
- electronic control unit (5)



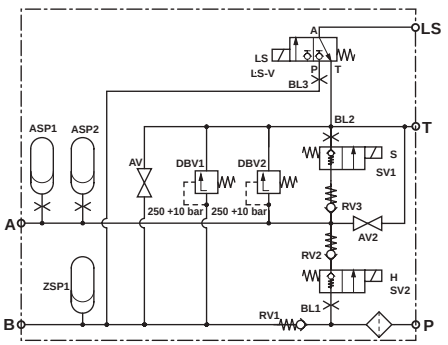
3.1 FRONT SUSPENSION CONTROL VALVE

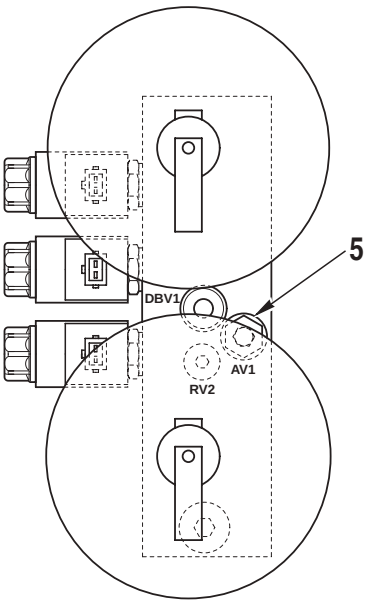
FUNCTION

In addition to the primary function of enabling front axle suspension by charging the hydraulic-pneumatic accumulators that constitute the elastic elements of the system, the front suspension control valve also serves to control the raising and lowering of the front axle.



DIAGRAM



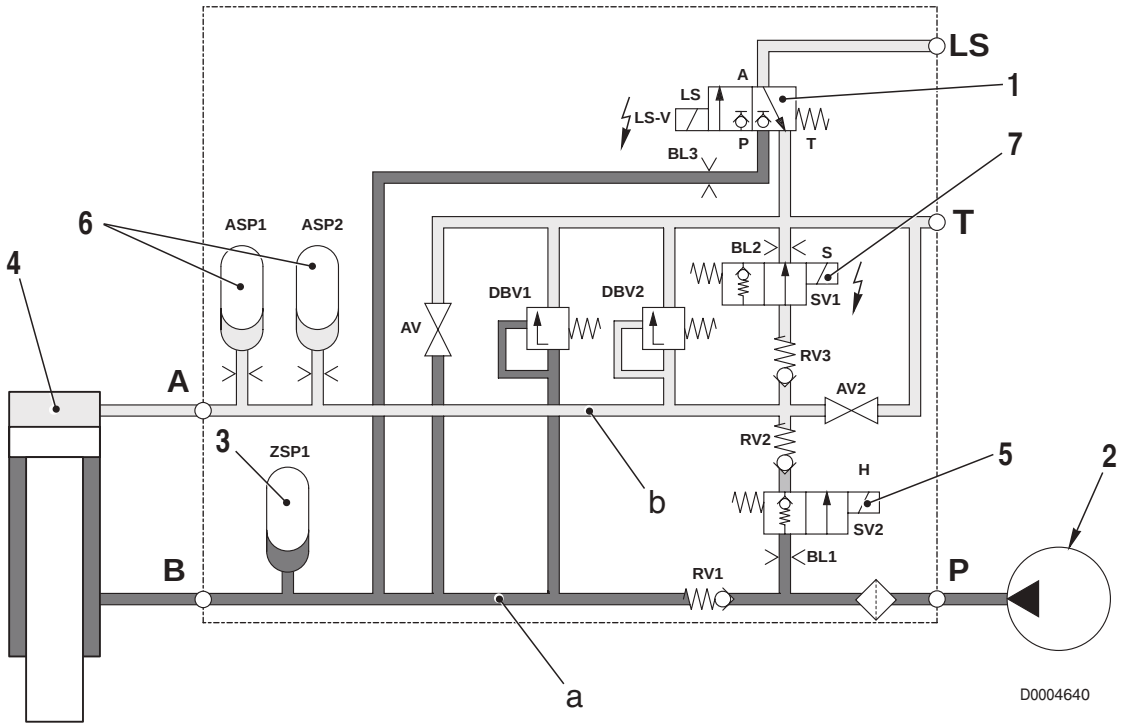


D0004750

1. Cylinder retraction control solenoid valve
2. LS signal control solenoid valve
3. Cylinder extension control solenoid valve
4. Accumulator (setting: 65 bar)
5. Pressure discharge valve
6. Accumulator (setting: 140 bar)
7. Use A relief valve (setting: 250 bar)
8. Use B relief valve (setting: 250 bar)

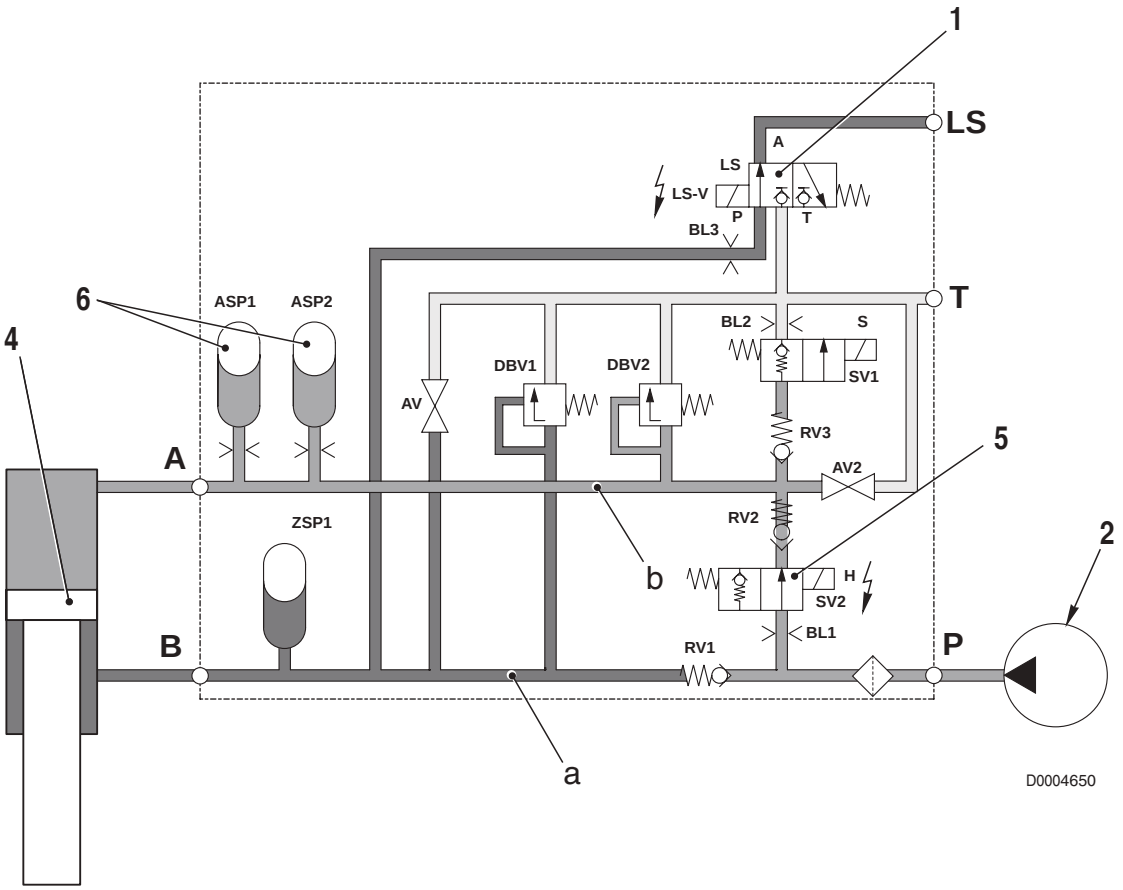
OPERATION

1. When the suspension is deactivated



- When the suspension is deactivated, the electronic control unit energises the solenoid (1) by sending an **LS** signal to the priority valve (in the case of the gear pump version) or to the variable displacement pump.
- This allows the pressurised oil from the pump (2) to flow to line **a** and compress the membrane of the accumulator (3) up to the maximum circuit pressure.
- The oil is discharged from the piston side through passage **B** and through the solenoid valve (7) which is energised.
- The piston (4) is consequently pushed upwards to its stroke-end position, thereby returning the system to fixed axle condition.
- The suspension is deactivated by the operator pressing a switch.

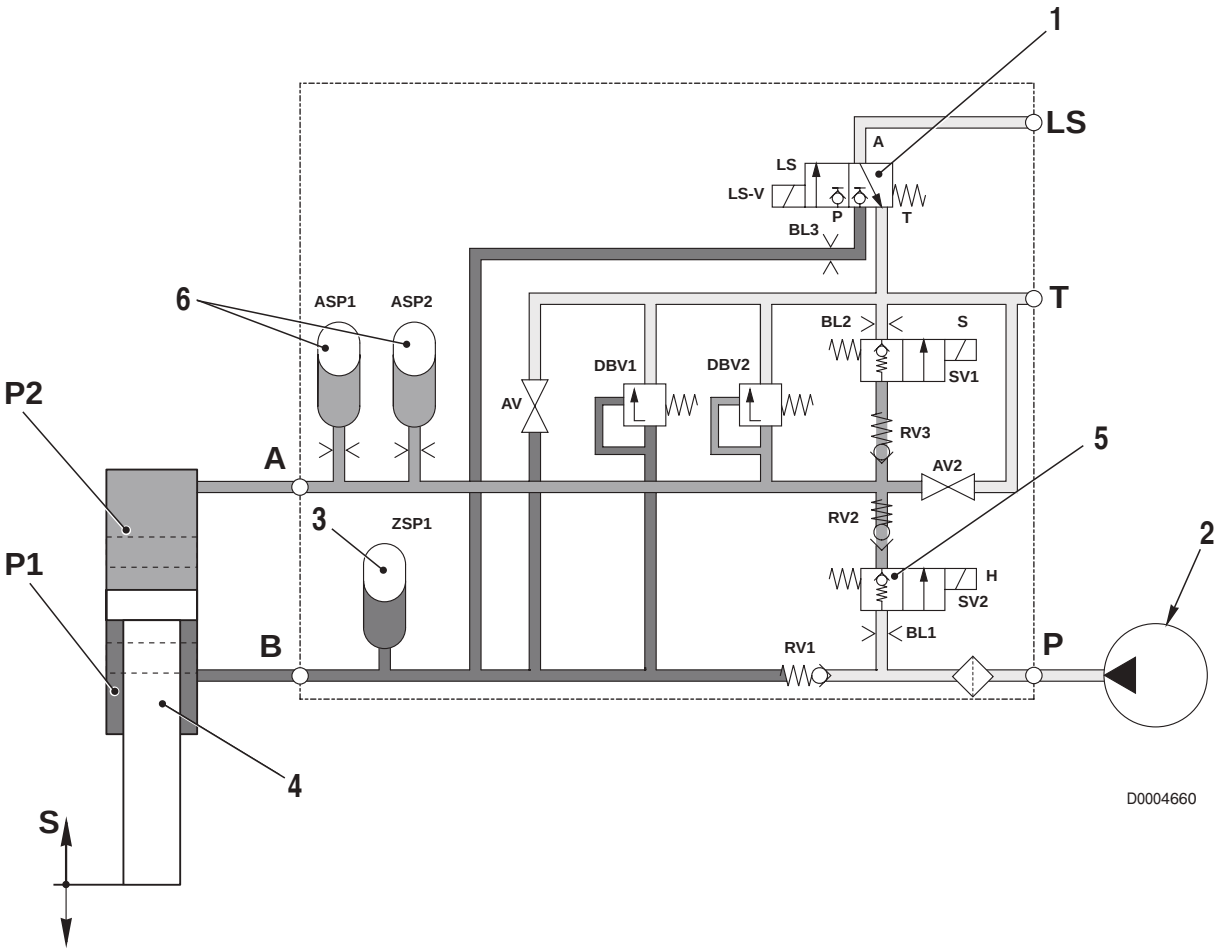
2. When the operator activates the system

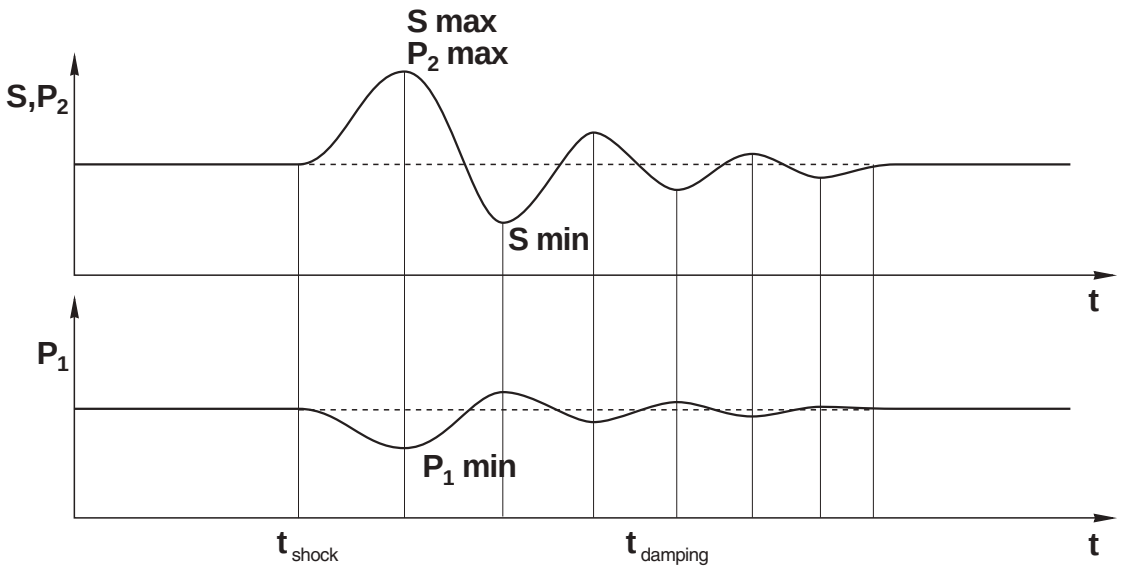


- When the operator presses the switch to activate the suspension, the electronic control unit energises the solenoids (1) and (5).
- This allows the pressurised oil from the pump (2) to flow to line **b** and thus start to push the piston (4) downwards.
- At the same time, the oil compresses the membranes of the accumulators and the oil in lines **a** and **b** increases.
- When the pressure in line **a** reaches the opening pressure of the relief valve (8), the valve opens and discharges some of the oil to the drain circuit.
- When the position sensor detects that the suspension has attained the levelling position, the electronic control unit de-activates the solenoids (1) and (5) and the part of the system containing the precharged accumulators is isolated from the rest of the system.

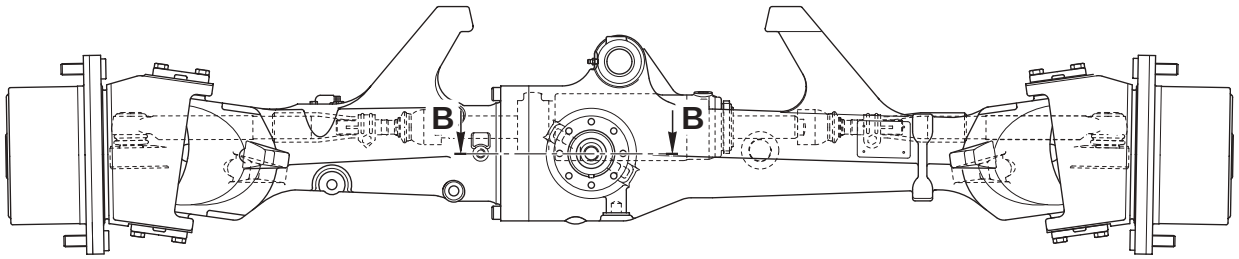
3. When the system is active

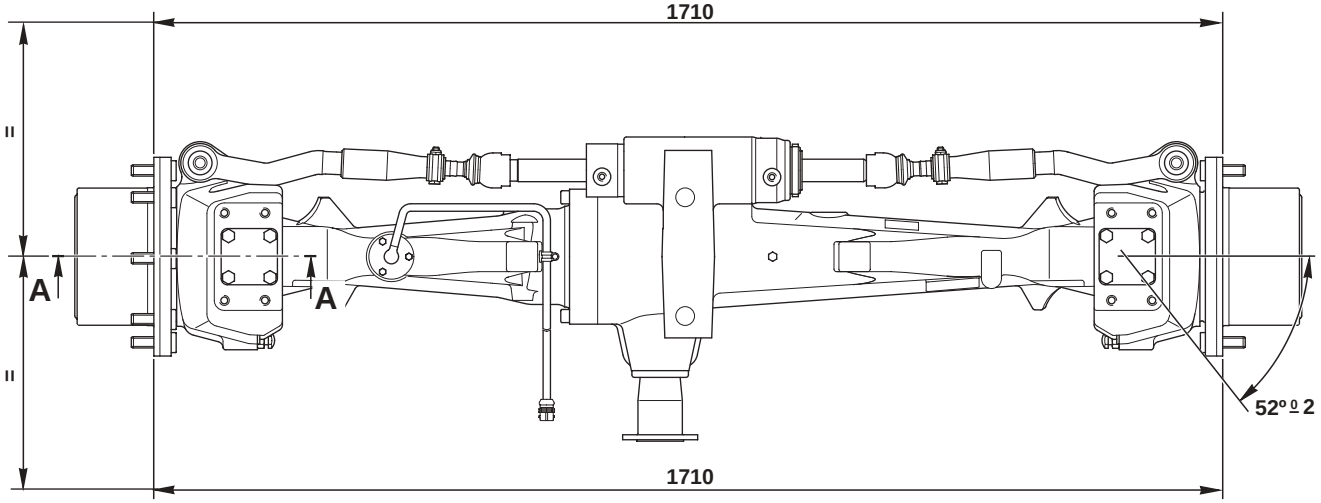
- When the tractor is in motion and the wheels encounter an obstacle, the front axle is pushed upwards.
- This causes the pressure P2 to increase (the accumulators 6 are compressed) while the pressure P1 decreases (accumulator 3 is decompressed).
- The pressure balance is thus altered and the system (which is closed) acts to restore the original condition.





4. FRONT AXLE

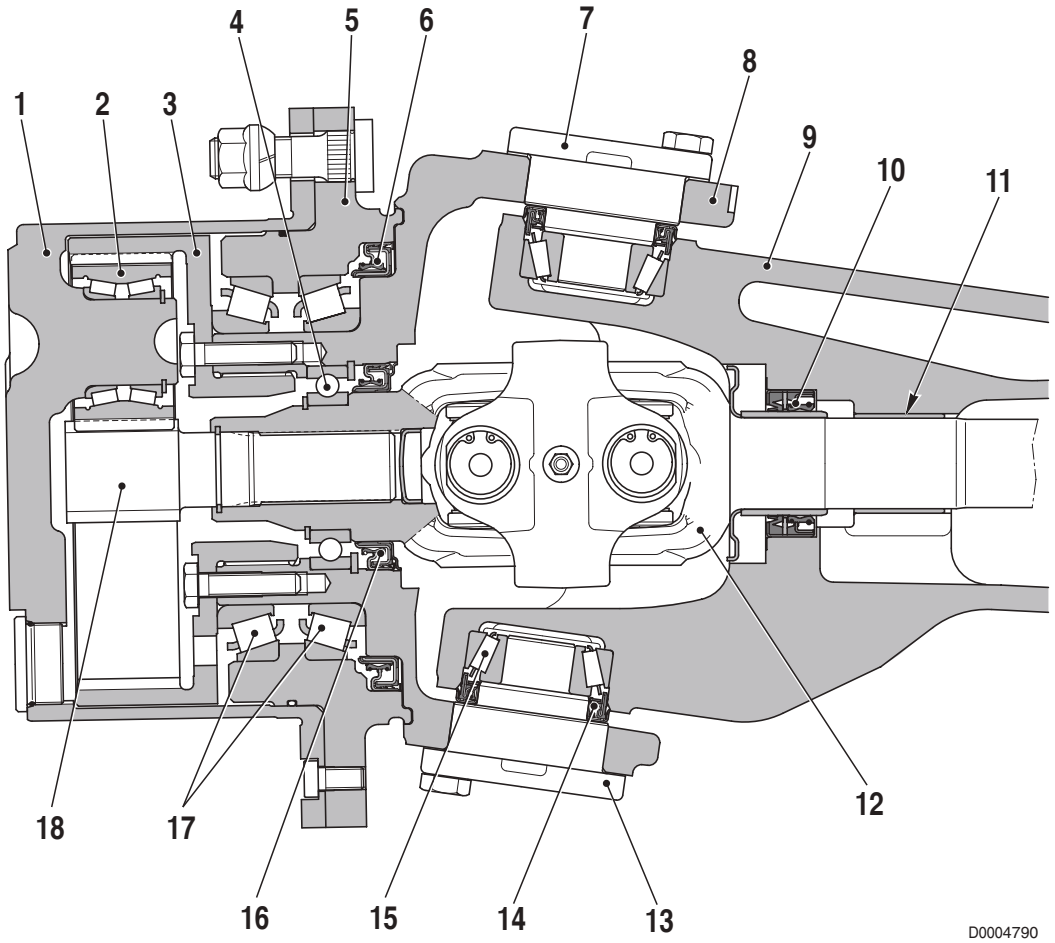




D0004780

4.1 HUB CARRIER AND FINAL REDUCTION UNIT

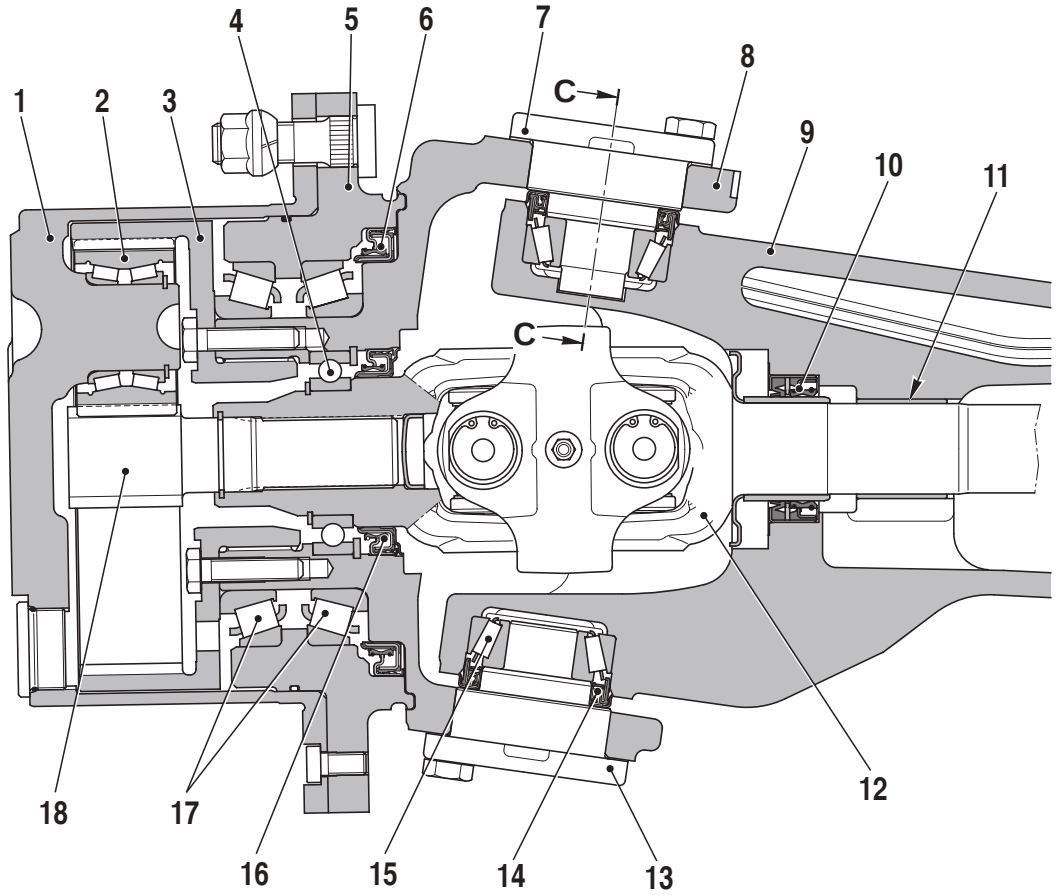
VERSION WITHOUT SBA

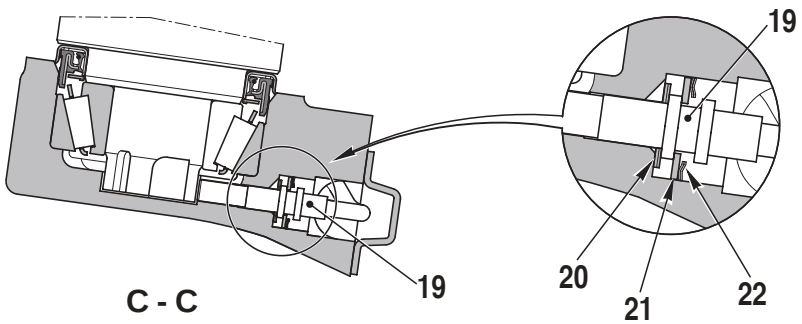


A - A

1. Planet carrier
2. Planet pinion
3. Ring gear
4. Bearing
5. Flange
6. Oil seal
7. Upper kingpin
8. Hub carrier
9. Front axle
10. Oil seal
11. Plain bearing
12. Half-shaft
13. Lower kingpin
14. Oil seal
15. Bearing
16. Oil seal
17. Bearing
18. Sun wheel

VERSION WITH SBA



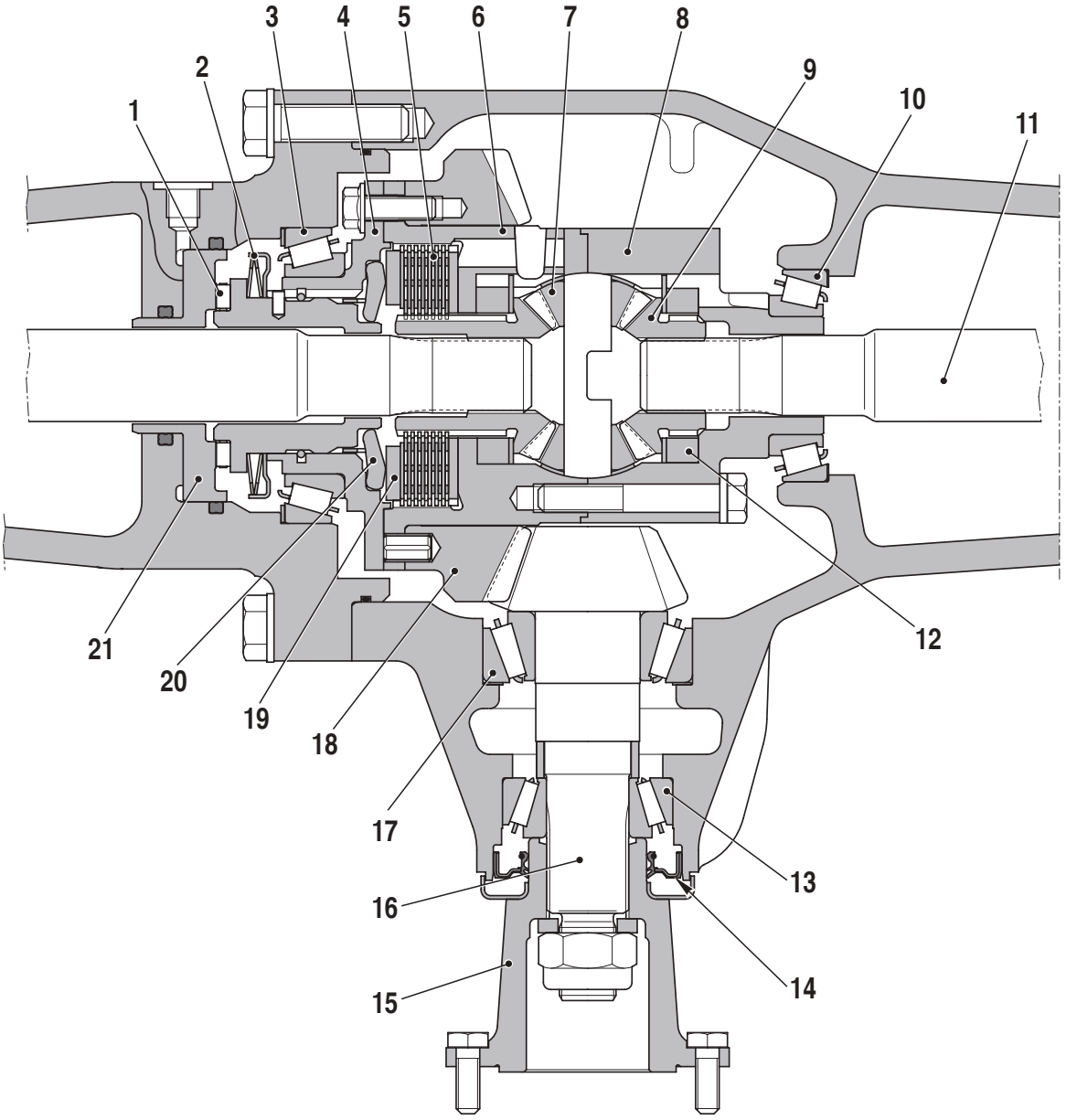


D0004800

1. Planet carrier
2. Planet pinion
3. Ring gear
4. Bearing
5. Flange
6. Oil seal
7. Upper kingpin
8. Hub carrier
9. Front axle
10. Oil seal
11. Plain bearing
12. Half-shaft
13. Lower kingpin
14. Oil seal
15. Bearing
16. Oil seal
17. Bearing
18. Sun wheel
19. Steering sensor (n° 2)
20. Shim
21. Disc
22. Lock ring

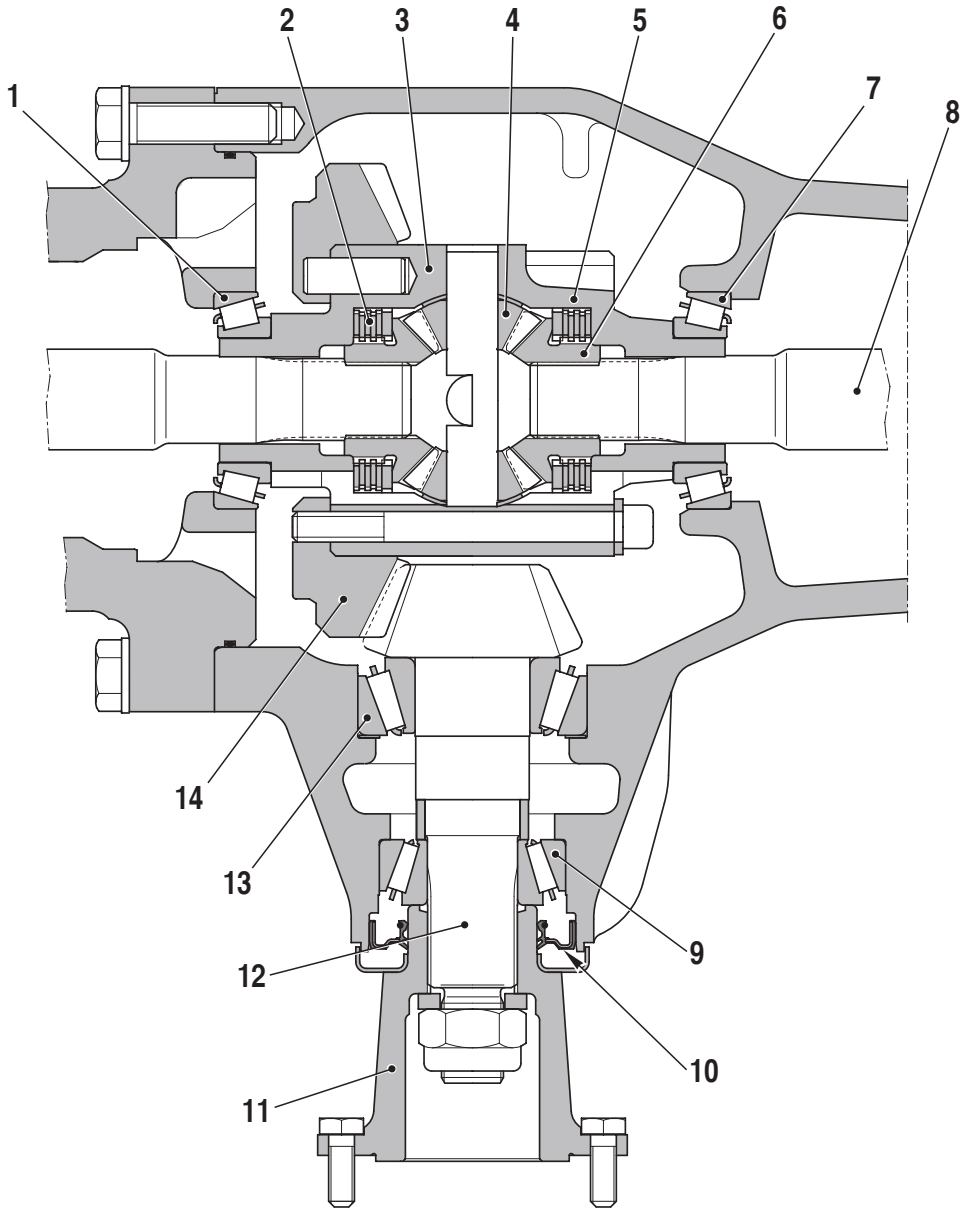
4.2 DIFFERENTIAL

VERSION WITH 100% HYDRAULIC LOCKING



1. Roller cage
2. Belleville springs
3. Bearing
4. Cover
5. Clutch plates
6. Differential cage
7. Planet pinion
8. Differential cage
9. Sun gear
10. Bearing
11. Half-shaft
12. Spacer
13. Bearing
14. Oil seal
15. Hub
16. Pinion shaft
17. Bearing
18. Crown wheel
19. Thrust plate
20. Thrust levers
21. Piston

45% SELF-LOCKING VERSION



D0005350

1. Bearing
2. Clutch plates
3. Differential cage
4. Planet pinion
5. Differential cage
6. Sun gear
7. Bearing
8. Half-shaft
9. Bearing
10. Oil seal
11. Hub
12. Pinion shaft
13. Bearing
14. Crown wheel

5. HYDRAULIC SYSTEM

DESCRIPTION

The AGROTON MK3 series may be equipped with two different types of hydraulic system:

1 - CCLS hydraulic system, with fixed displacement pump.

2 - LS hydraulic system, with variable displacement pump.

The CCLS system has fixed displacement gear pump that supplies oil to the various hydraulic functions at a flow rate that is proportional to the engine speed.

When the engine is running at maximum speed and none of the hydraulic actuators are in operation (e.g. during road use), oil is pumped through the system at around 80 litres per minute (with a consequent increase in temperature and fuel consumption).

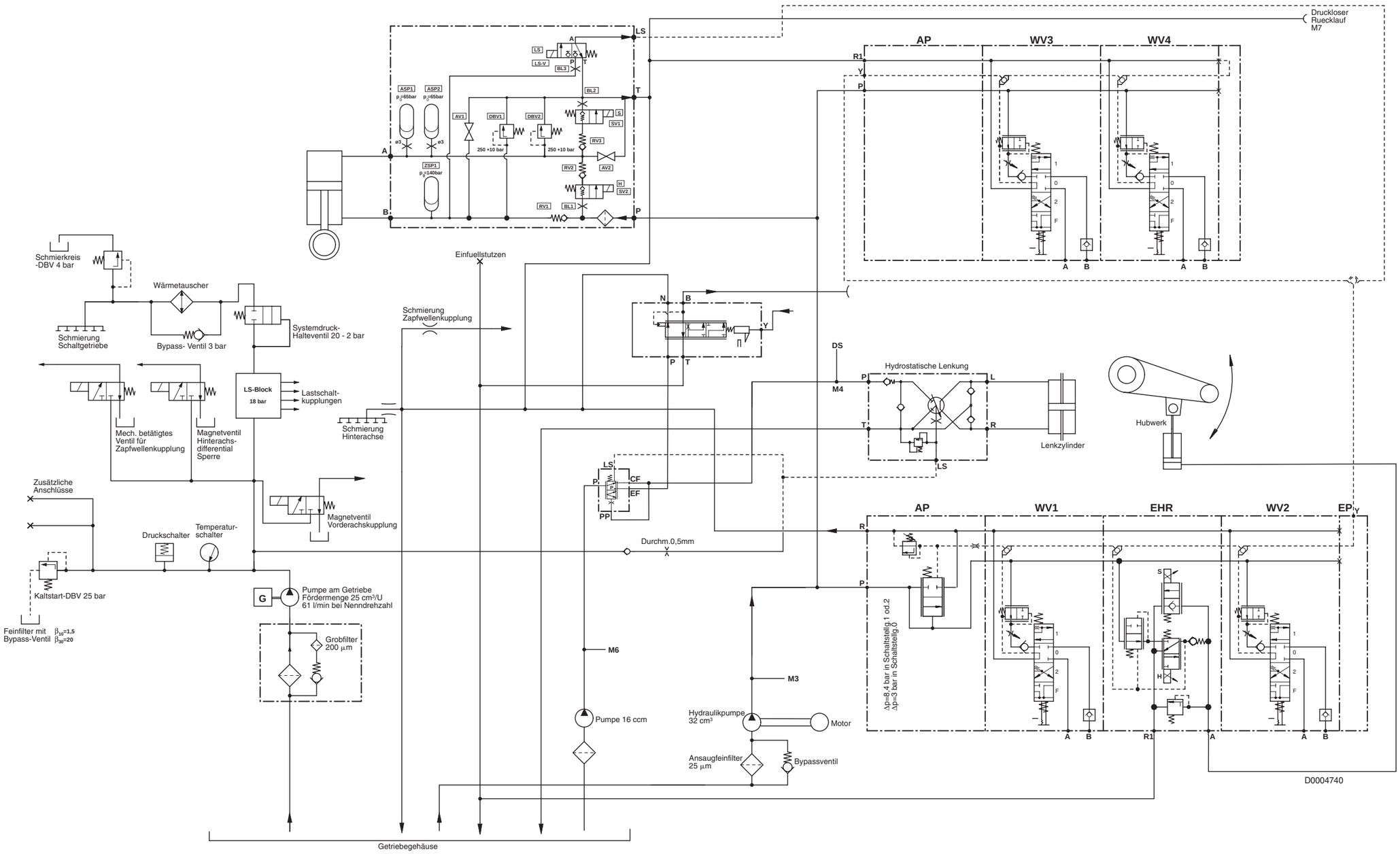
Furthermore, if two or more actuators are operated when the engine is running at low speed, the pump will be unable to meet the demand and consequently the actuators will operate at a lower speed in accordance with the available oil flow.

The LS system has a variable displacement piston pump which sends oil to the hydraulic functions only according to need.

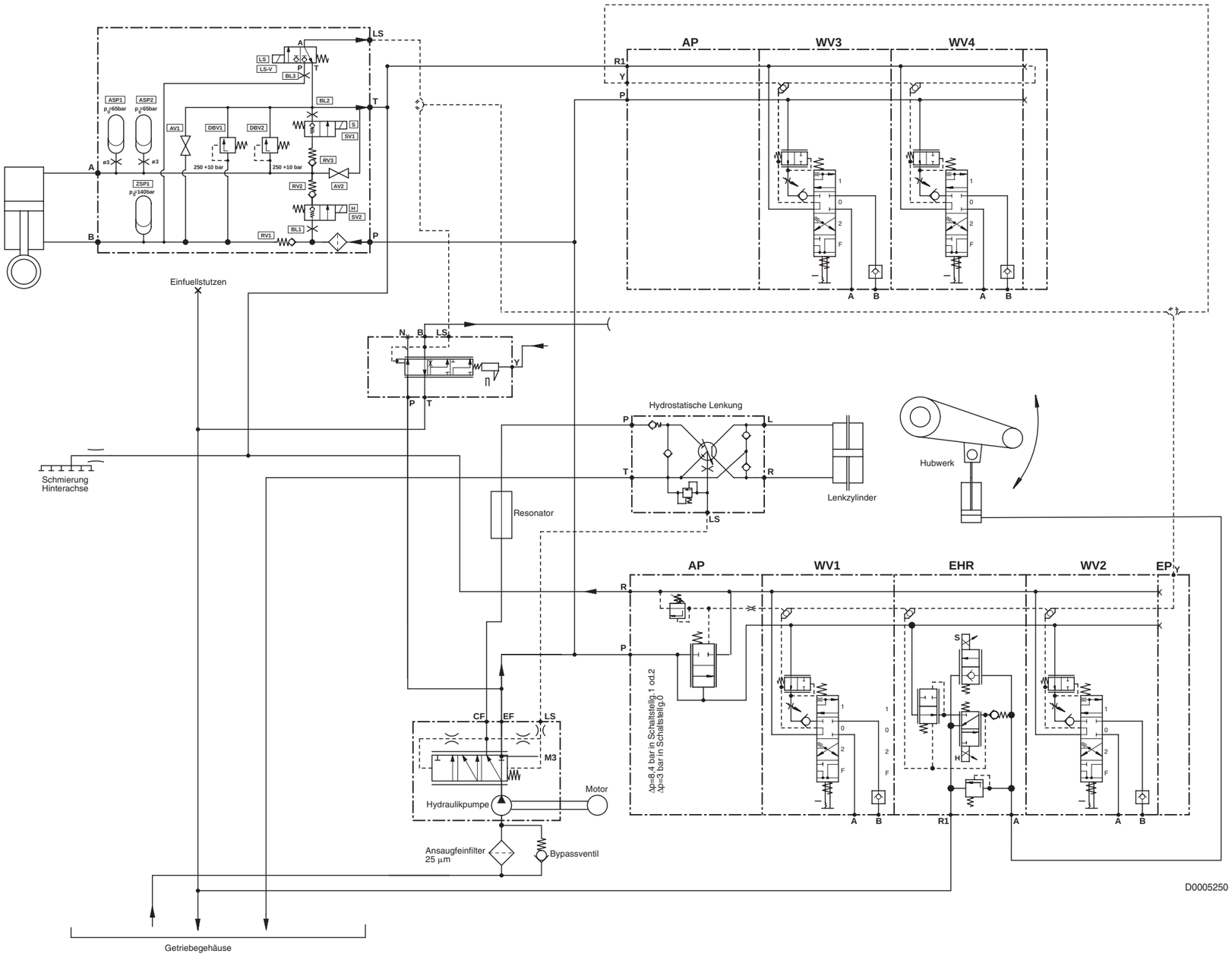
In this system, when the engine is running at maximum speed and no hydraulic actuators are in operation, the pump effectively only circulates the oil that is dispersed through internal leakage in the devices connected to the system (just a few litres per minute), thus saving energy and fuel.

Furthermore, the variable displacement pump has a higher capacity than the gear pump (120 litres/min.) and can thus provide a sufficient flow rate to operate all the hydraulic functions simultaneously.

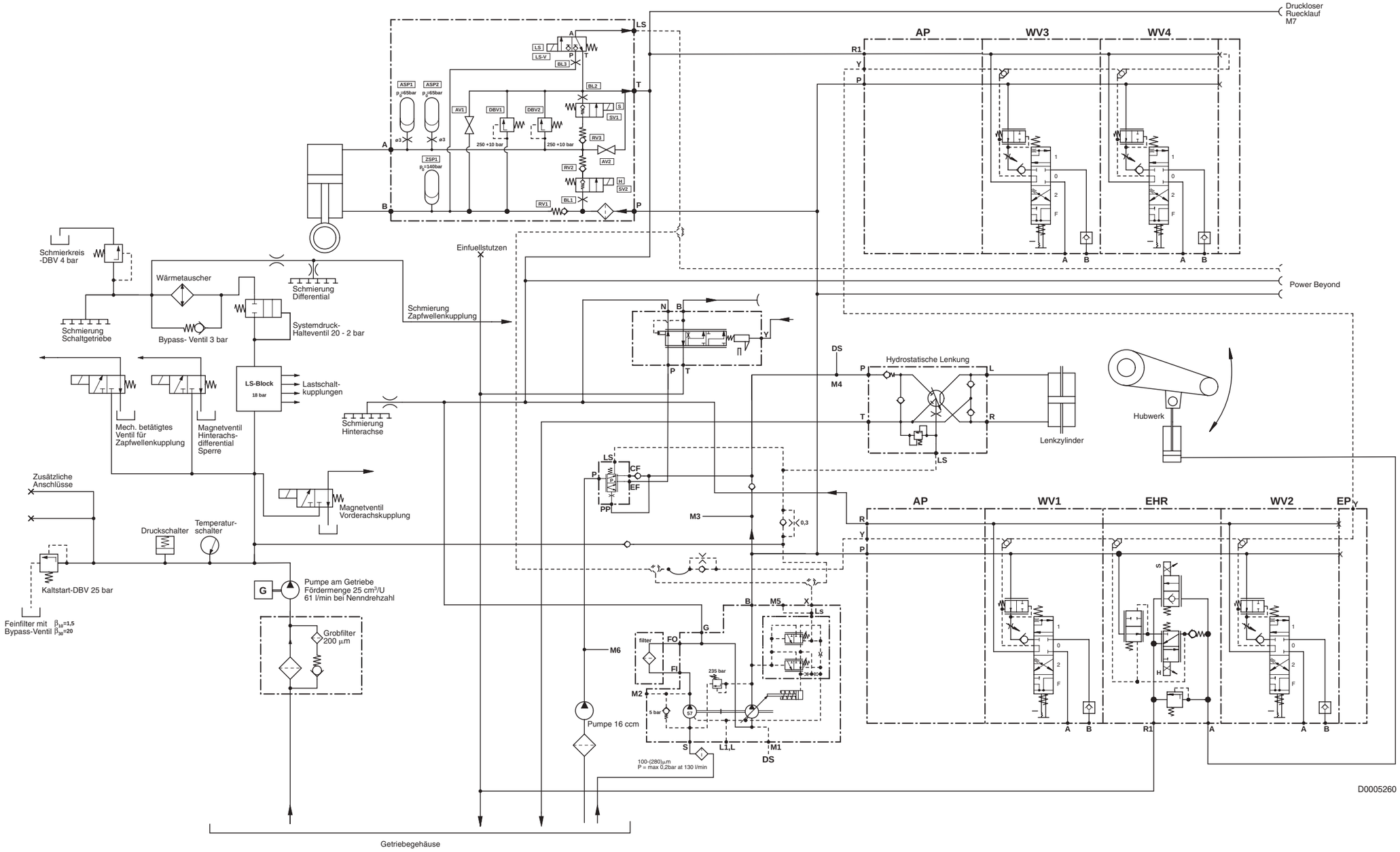
HYDRAULIC SYSTEM (106-115 CV models) (CCLS version)



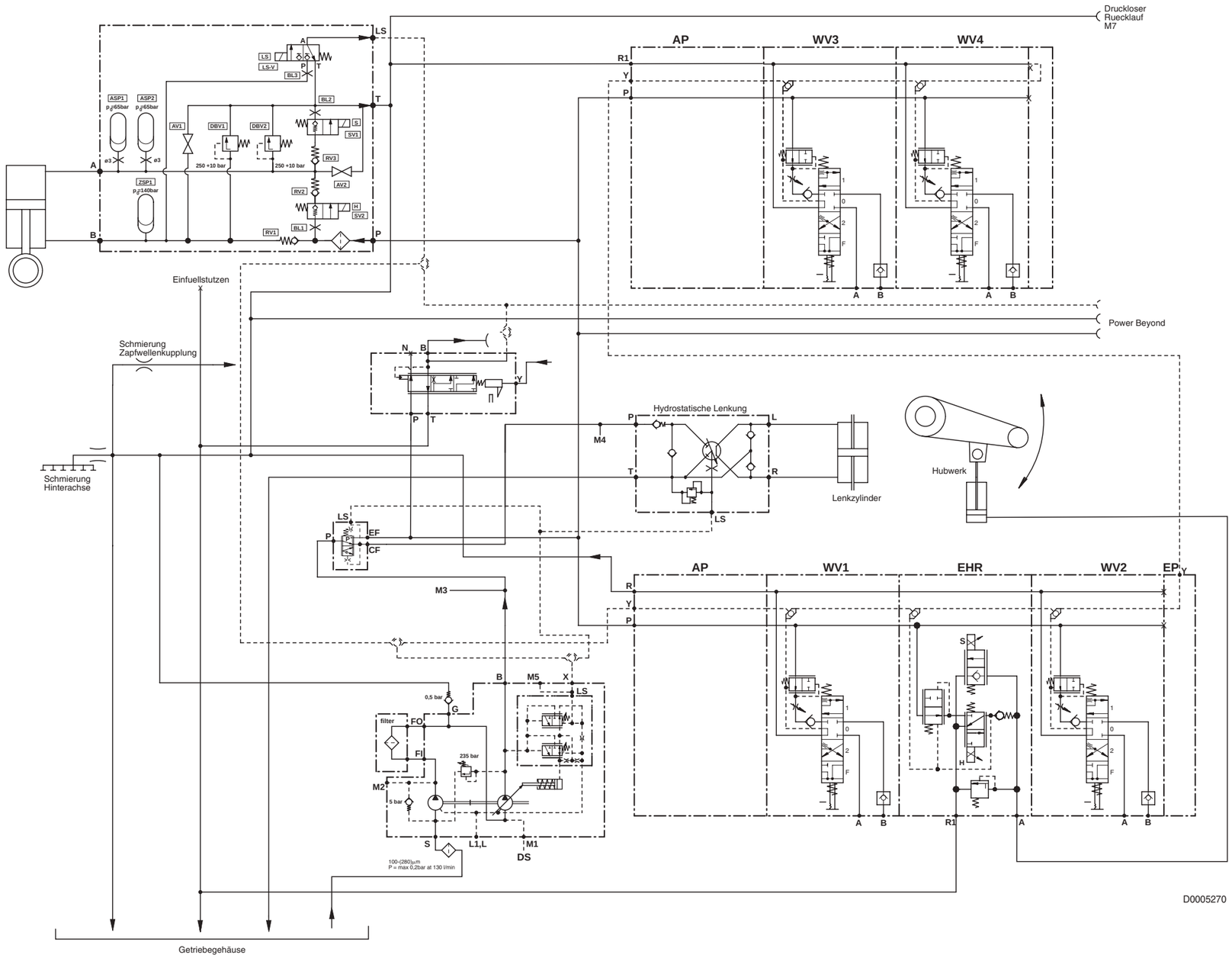
HYDRAULIC SYSTEM (120-165 CV models) (CCLS version)



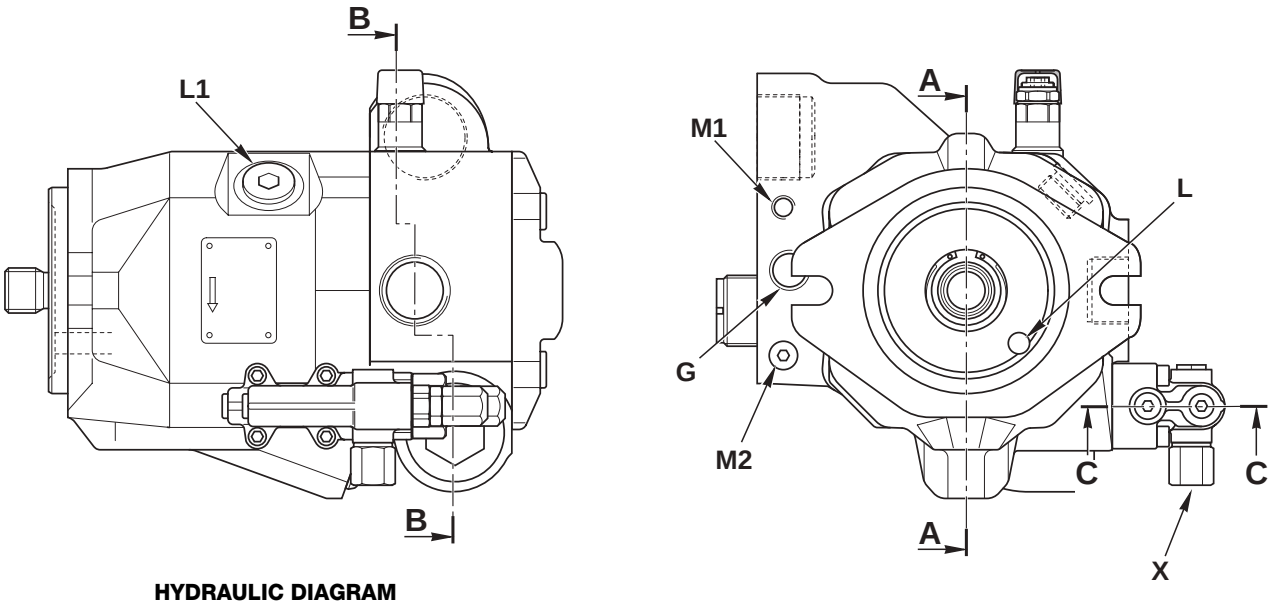
HYDRAULIC SYSTEM (106-115 CV models) (LS version)



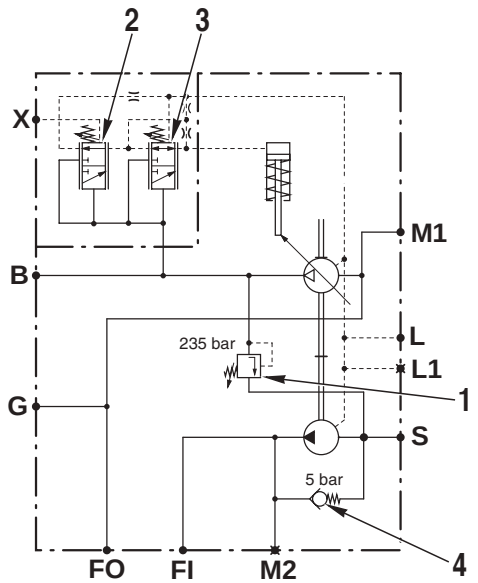
HYDRAULIC SYSTEM (120-165 CV models) (LS version)

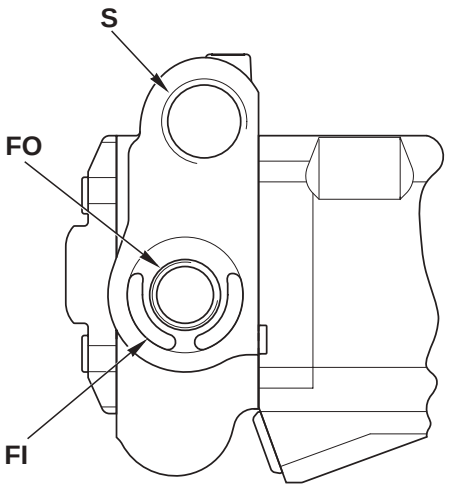


5.1 VARIABLE DISPLACEMENT PUMP



HYDRAULIC DIAGRAM





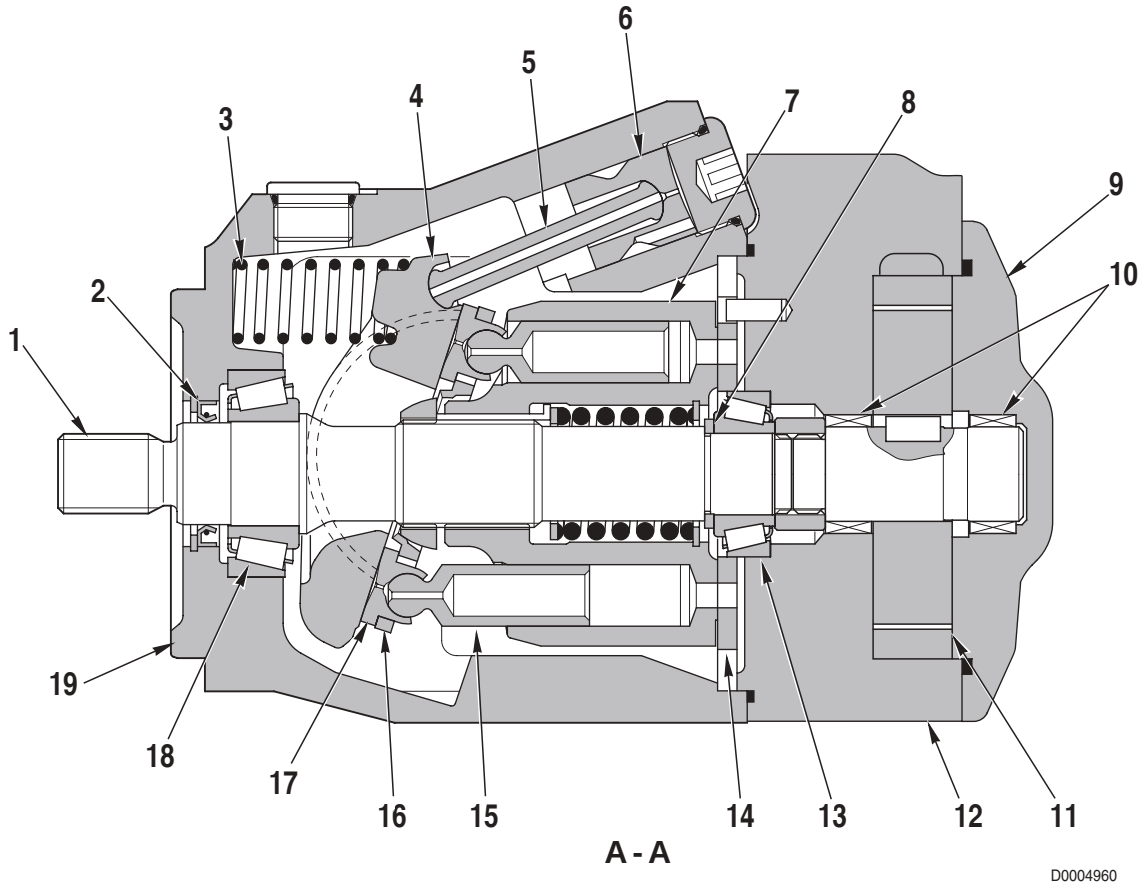
D0004900

FUNCTION

Port L: drain
Port X: LS signal
Port S: suction
Port B: delivery
Port G: transmission lubrication
Port FI: filter inlet
Port FO: filter outlet

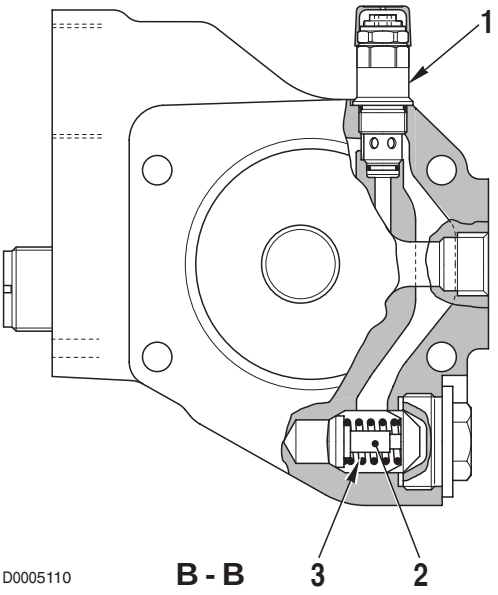
COMPONENTS

1. Antishock valve
2. Load Sensing valve
3. Pressure cut-off valve
4. By-pass valve



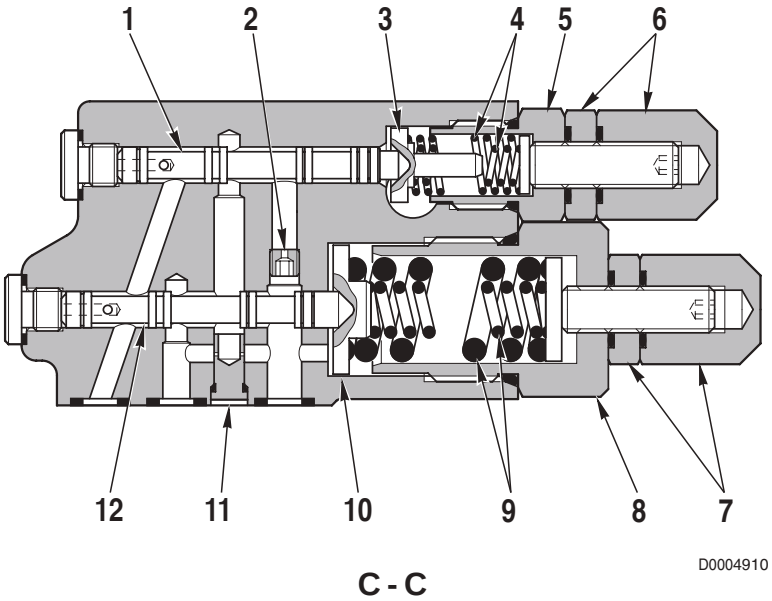
COMPONENTS

1. Input shaft
2. Oil seal
3. Swash plate return spring
4. Swash plate
5. Control rod
6. Control piston
7. Cylinder barrel
8. Spacer
9. End cover
10. Roller bearings
11. Boost pump
12. Boost pump housing
13. Bearing
14. Valve plate
15. Pistons (n° 9)
16. Piston retainer ring
17. Piston shoe
18. Taper roller bearing
19. Pump housing



COMPONENTS

1. Pressure limiting valve
2. Filter by-pass valve
3. Filter by-pass valve spring



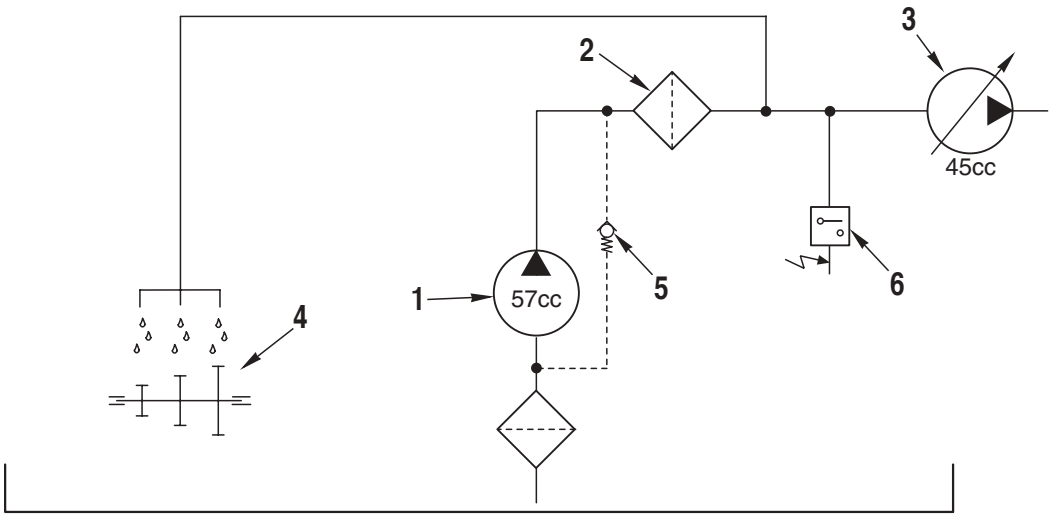
COMPONENTS

1. Load Sensing spool valve
2. Restrictor
3. Collar
4. Load Sensing valve spring
5. Spring cover
6. Adjustment nuts
7. Adjustment nuts
8. Spring cover
9. Pressure cut-off valve spring
10. Collar
11. Restrictor (Ø 0.6 mm) (0.024 in.)
12. Pressure cut-off valve spool

5.1.1 BOOST PUMP

FUNCTION

- Rotary drive and torque is transmitted to the pump from the shaft and converted into hydraulic energy. The pressurised oil flow from the boost pump is directed to the variable displacement pump and the transmission lubrication circuit.



D0004820

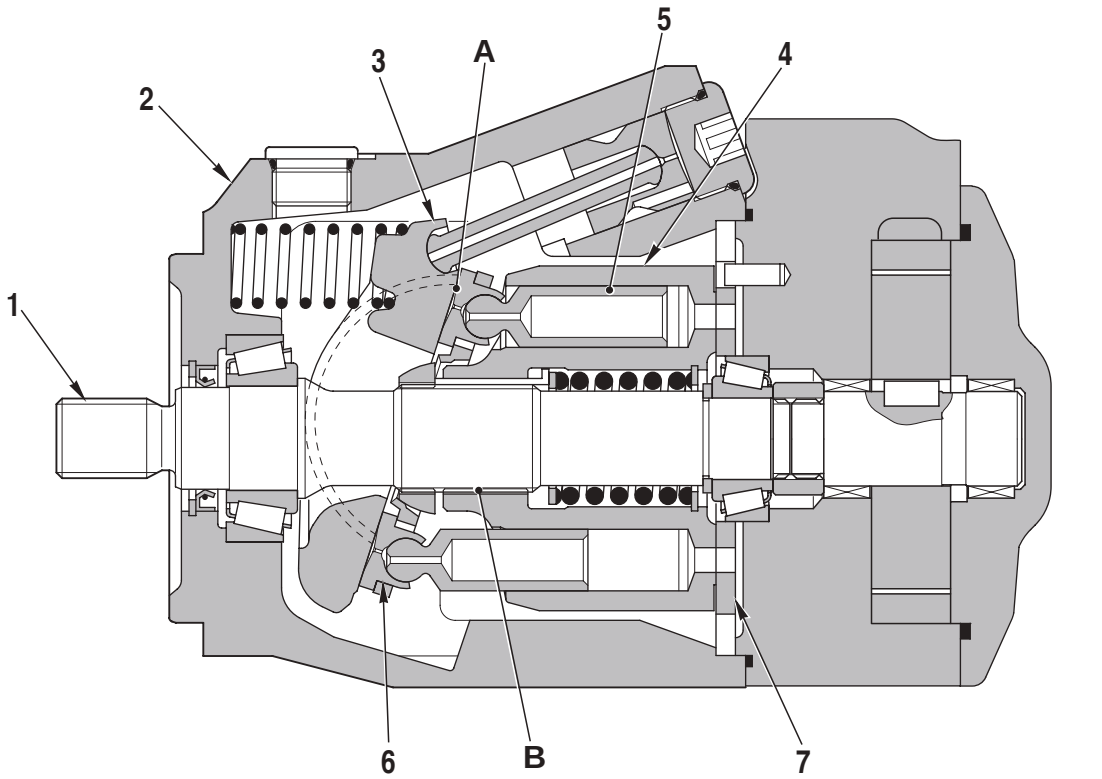
OPERATION

- The boost pump (1) draws oil from the rear gearbox and directs it under pressure to the filter (2) and the variable displacement pump (3).
- The pressurised oil from the boost pump is also used for lubrication of the transmission (4).
- The pressure generated by the boost pump is regulated by the pressure limiting valve (5) (setting: 5 bar (72.3 psi)) that prevents excessive pressure from building in the lubrication circuit on cold-starting and during cold weather conditions.
- The pressure-boosting circuit also includes a low boost pressure sensor (6) (set to 5 bar) that detects clogging of the filter (2) and alerts the operator by illuminating a warning light.

5.1.2 HYDRAULIC PUMP

FUNCTION

- The rotary drive and torque transmitted from the shaft to the pump is converted into hydraulic energy; the pressurised flow from the pump varies according to the demand from the hydraulic loads.
- The flow rate can be varied by altering the angle of the swash plate.



STRUCTURE

- The cylinder block (4) is fixed to the shaft (1) by a broached fitting **B** and the shaft (1) is supported by the front and rear bearings.
- The pistons (5) have ball ends; the piston shoes (6) fit around the ball ends of the pistons to form a single assembly. The pistons (5) and the shoes (6) together form a ball joint.
- The swash plate (3) has a flat surface **A** against which the piston shoes slide (6) with a circular motion.
- The pistons (5) stroke axially within their bores in the cylinder block (4).
- The rotation of the cylinder block (4) causes the oil in the bores to be pressurised; the positions of the inlet and outlet ports are determined by slots in the valve plate (7).
  The oil is drawn into the bores and forced out through the slots in the valve plate (7).

OPERATION

1. Pump operation

1 - The cylinder block (4) rotates with the shaft (1) and the piston shoes (6) slide on the flat surface «**A**».
The swash plate (3) can swing within the arc «**B**»; the stroke of the pistons varies according to the angle «α» between the shaft axis (1) and the **X** axis of the swash plate (3).
Angle «α» is known as the «swash plate angle».

2 - When the axis **X** of the swash plate (3) is at an angle «α» to the shaft (1) and consequently to the cylinder block (4), the surface «**A**» acts as a cam for the piston shoes (6). Consequently, as the shaft rotates, the pistons (5) stroke within their bores in the cylinder block (4), thereby a creating a difference between the volumes **C** and **D** which causes oil to be drawn in and forced out in quantities equal to this difference (**D** – **C**=delivery).
In other terms, as the cylinder block (4) rotates, the volume of chamber **D** is reduced while the volume of chamber **C** is increased, thereby causing oil to be drawn in.
(Fig. 1 shows the condition of the pump on completion of the suction stage in chamber **D** and the delivery stage in chamber **C**).

3 - When the axis **X** of the swash plate (3) is parallel to the axis of the cylinder block (4) (swash plate angle «α»=0), the difference between the volumes **C** and **D** inside the cylinder block (6) is zero and no oil is pumped (Fig. 2).
(In reality, the swash plate angle «α» is never truly equal to 0).

4 - The pump delivery is therefore directly proportional to the swash plate angle «α».

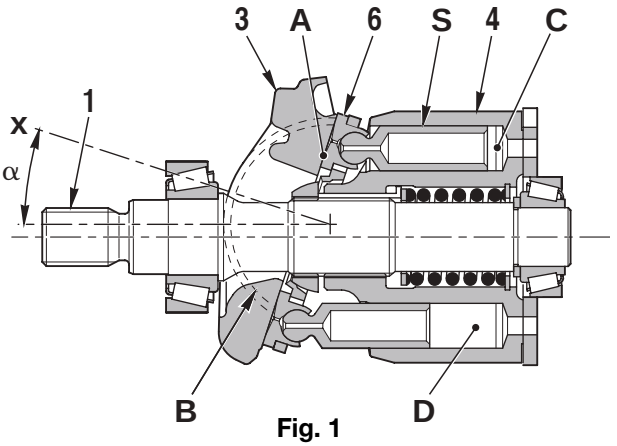


Fig. 1

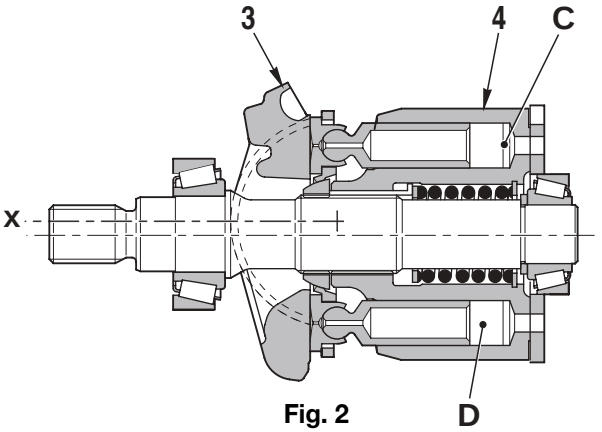


Fig. 2

D0000530

2. Controlling the requirement of oil

- At a given rotation speed input, the required oil flow is controlled by the angle «α» between the swash plate (3) and the shaft (1).
The swash plate (3) is inclined by the springs (10).
Against the spring works the control piston (8).
The position of the control piston (8) defines the angle «α».
- Below the max. pressure «α» is adjusted in this way, that between the pressure of the pump and the pressure of LS-signal is a certain difference (control pressure difference).
- Work the pump at the max. pressure, «α» is adjusted to that position which guaranteed not to exceed this pressure.
That means «α» is set to a smaller value than from LS-signal whished. (Fig. 3).

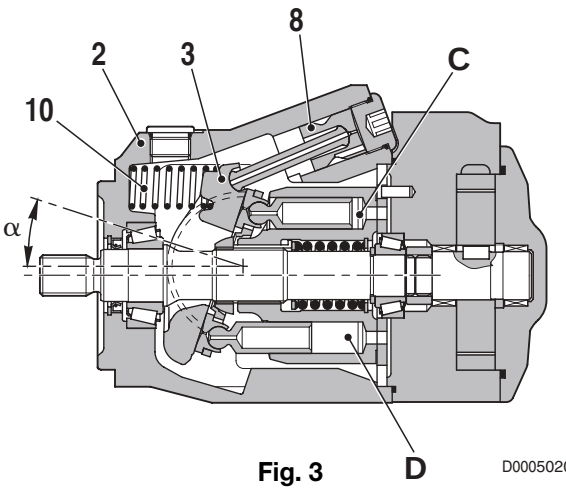
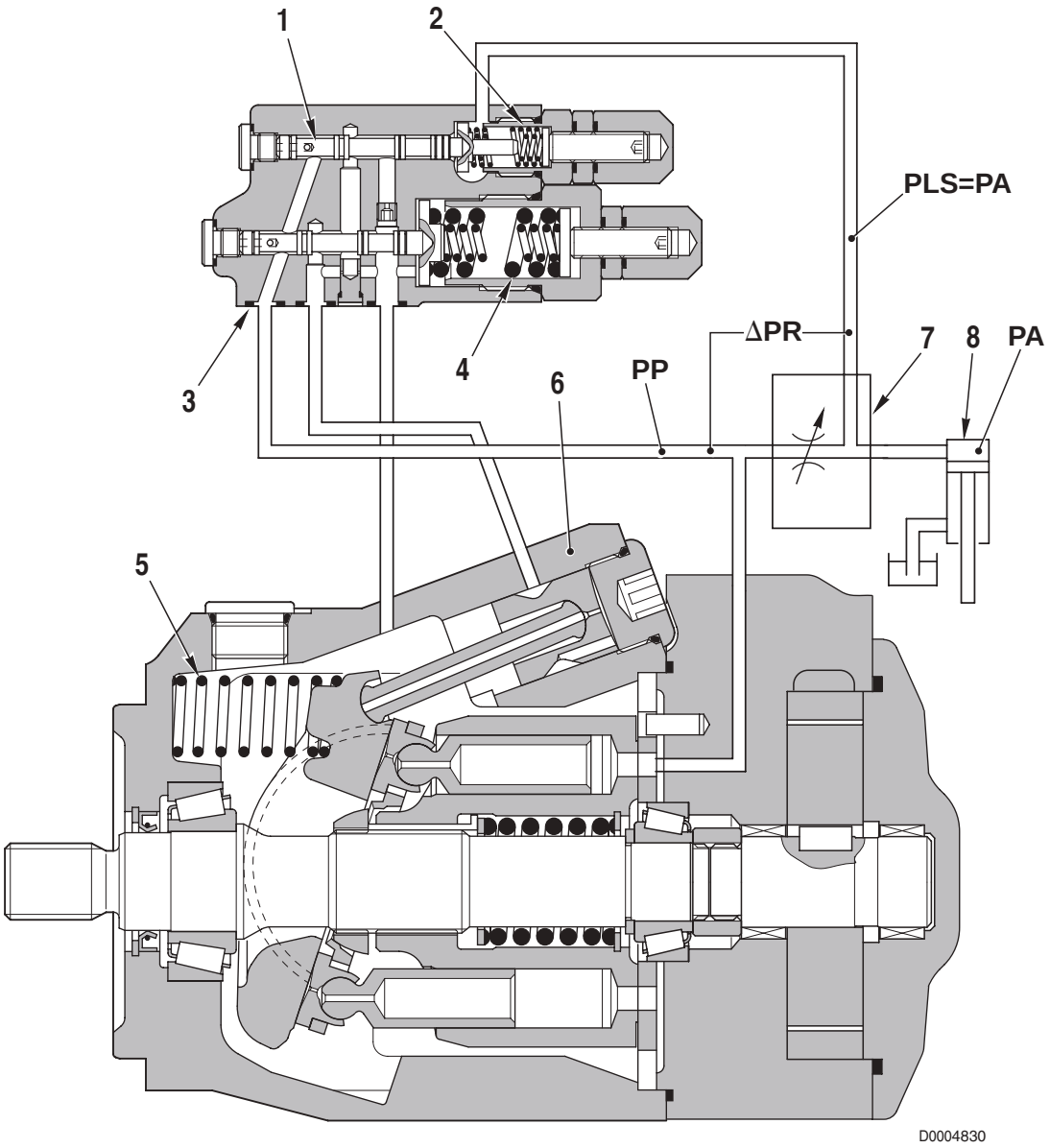


Fig. 3

D0005020

5.1.3 LOAD SENSING VALVE, PRESSURE CUT-OFF VALVE



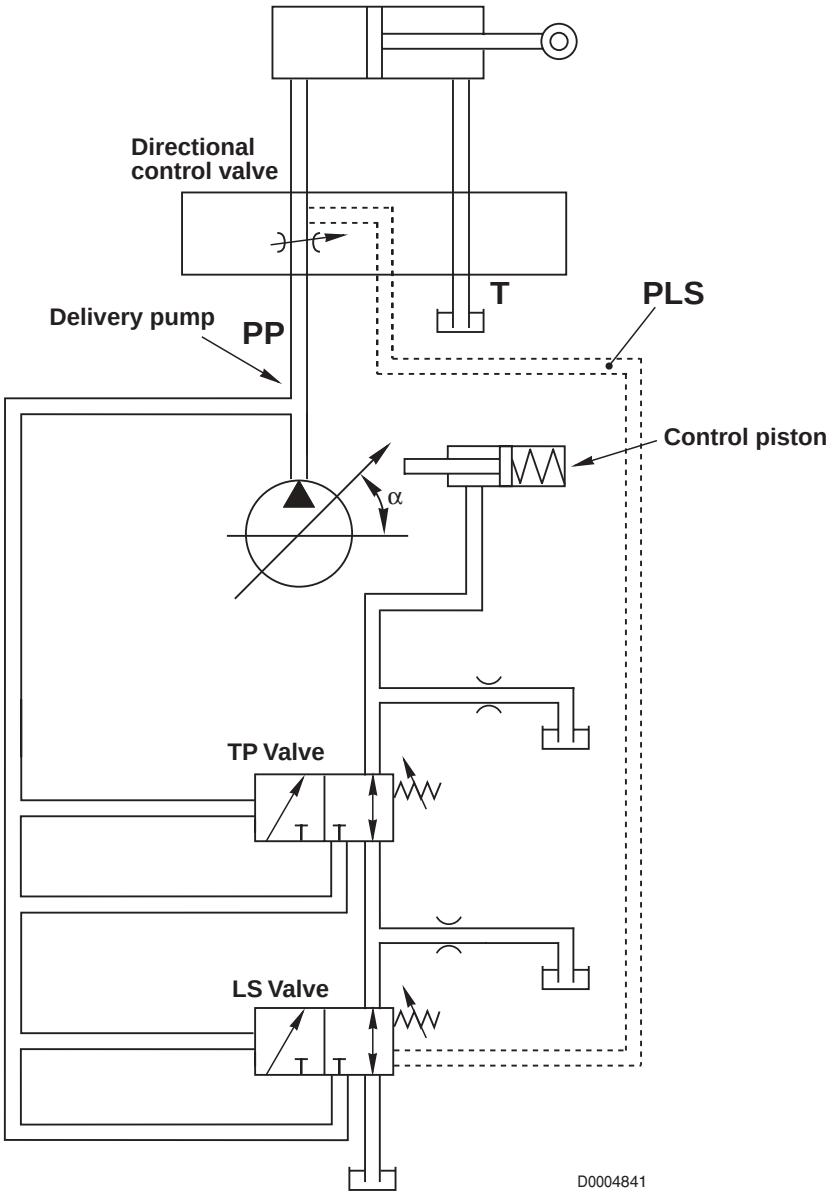
COMPONENTS

1. Load Sensing valve spool
2. Load sensing valve spring
3. Pressure cut-off valve spool
4. Pressure cut-off valve spring
5. Swash plate return spring
6. Control piston
7. Directional control valve
8. Load

OPERATING PRINCIPLE

Swash-plate angle control

- The swash-plate angle of the pump (and consequently the pump displacement), is controlled in such a way that the pressure difference ∆**PR** between the pump delivery pressure **PP** and the delivery pressure **PLS** to the load at the work port of the control valve is maintained at a constant value. (∆**PR** = Pump delivery pressure **PP** – **PLS** delivery pressure to load).
- If the pressure difference ∆**PR** falls relative to the pressure setting of the **LS** valve, the swash plate angle will increase. If the pressure difference ∆**PR** rises, the swash plate angle will decrease.
  ★ For details of this mechanism, see the description of the «HYDRAULIC PUMP».



LOAD SENSING (LS) VALVE

FUNCTION

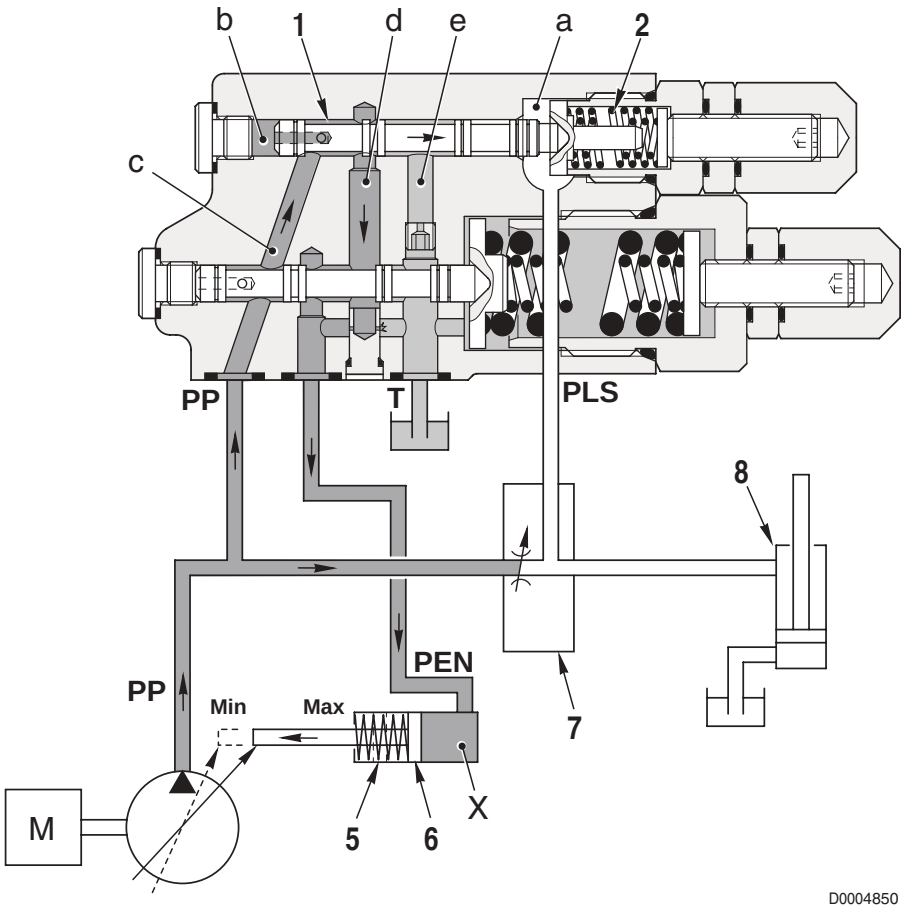
- The **LS** valve regulates the pump delivery in accordance with the position of the control lever of the directional control valve i.e. in accordance with the demand from the loads.
- The **LS** valve senses the demand from the loads by way of the pressure difference ∆**PR** between the pump delivery pressure **PP** and the pressure at the outlet port of the directional control valve **PLS** ; this enables the valve to regulate the delivery **Q** of the main pump.
  (**PP**, **PLS** and ∆**PR**, are respectively: the pump delivery pressure, the pressure of the Load Sensing signal and difference between these two pressures).
- In other terms, the **LS** valve detects the pressure difference ∆**PR**, generated by the the flow of oil passing through the passages uncovered by the spool and regulates the pump delivery **Q** so as to maintain a constant pressure drop. This means that the pump delivery is proportional to the demand from the directional control valve.

OPERATION

Pump operation can be divided into four stages:

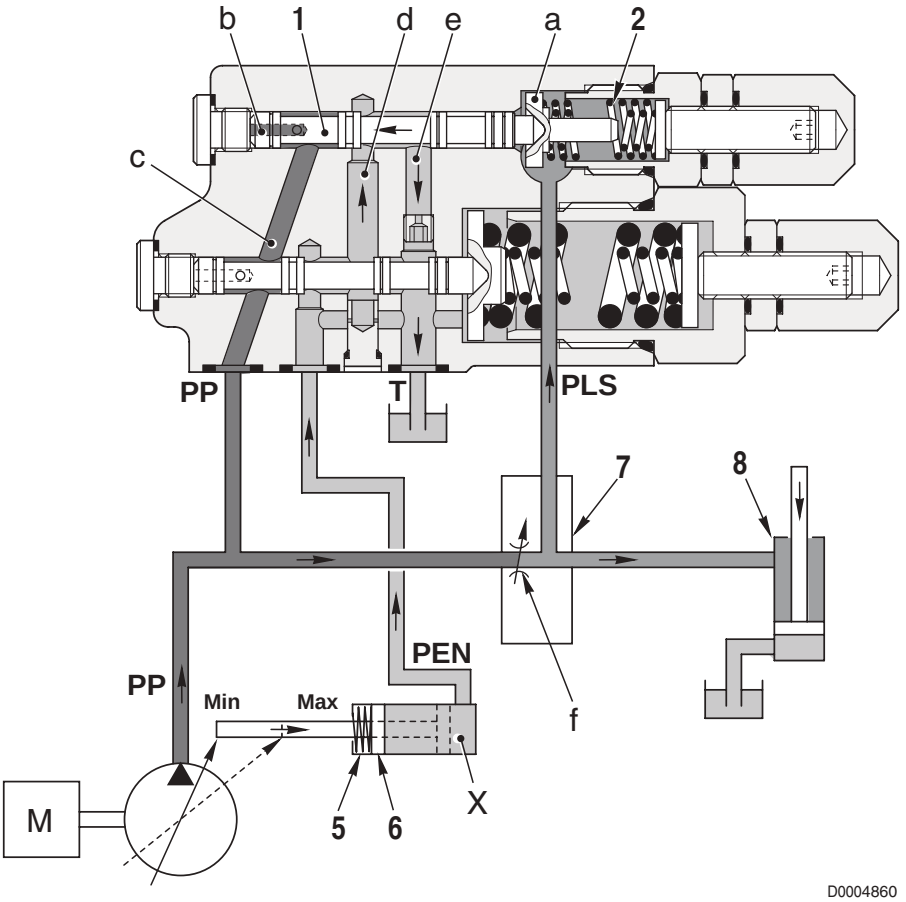
a. When the directional control valve is in neutral position
b. When a control lever is operated
c. When the flow rate stabilises
d. When the system enters “saturation” condition

a. When the directional control valve is in «NEUTRAL» position



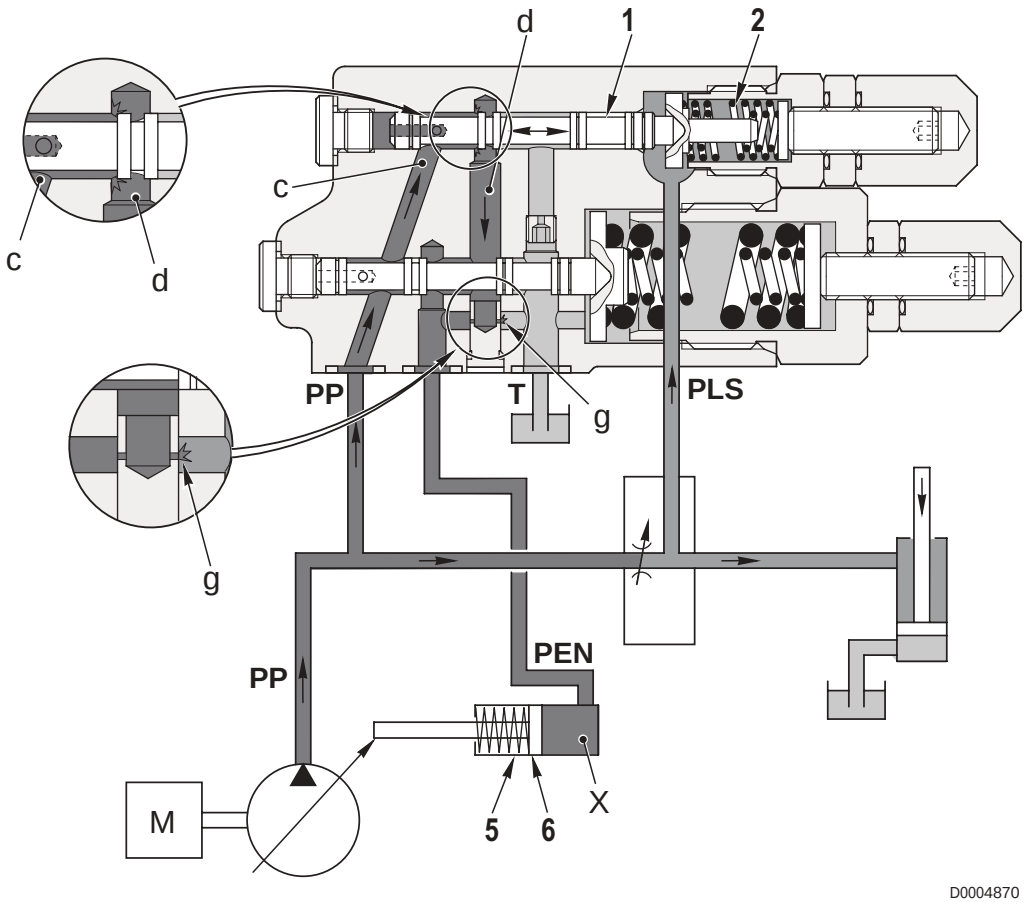
- The pressure **PLS** of the **LS** signal from the control valve outlet port, enters the chamber **a** of the **LS** valve; the pump delivery pressure **PP** enters the chamber **b** on the opposite side.
- The shift in the position of the spool (1) is determined by the combination of the force exerted by the pressure **PLS** plus the force of the spring (2) and the force exerted on the opposite side of the spool by the pressure **PP**.
- Before the engine is started, the control piston (6) is pushed to the right by the spring (5) (position corresponding to the maximum swash plate angle).
- When the engine is started, if all the control valve spools are in «NEUTRAL» position, the pressure **PLS** of the **LS** signal remains at 0 bar (0 psi) because there is no flow through the control valves and the signal is connected to drain. At the same time, the pump delivery pressure **PP** increases because the hydraulic actuators are stationary. When the force exerted by the pressure **PP** in chamber **b** overcomes the force of the spring (2), the spool (1) shifts to the right thereby allowing the pressure **PP** to flow to the chamber **X** of the piston (6) as the connection is made between the passages **c** and **d**.
- The force exerted by the oil pressure on the piston (6) overcomes the force exerted by the spring (5). This causes the piston to shift to the left i.e. in the direction of the minimum swash plate angle.
- The pump delivery pressure **PP** stabilises around 22 bar (319 psi), which corresponds to the standby pressure.

b. When a control lever is operated



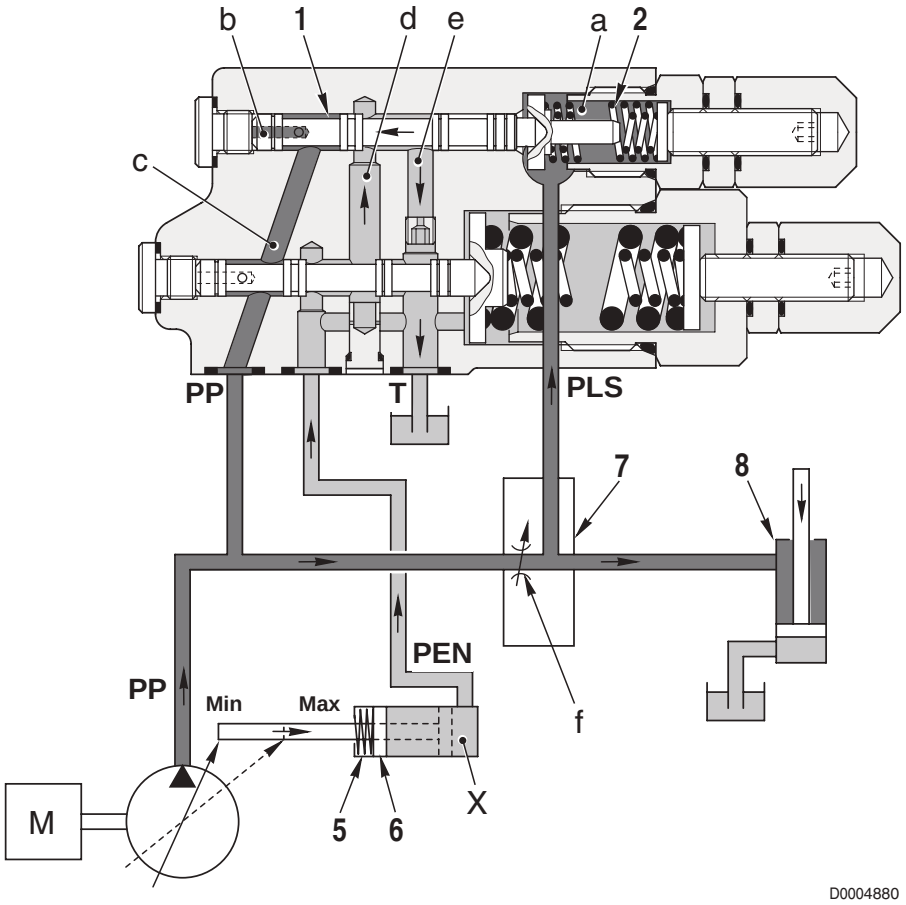
- When a control lever is moved from the NEUTRAL position, this generates an **LS** signal corresponding to the load delivery pressure **PLS**.
- The **LS** signal pressure in chamber **a** causes the spool to shift to the left, thereby connecting the passages **d** and **e**. The chamber **X** is depressurised and the spring (5) causes the swash plate to move to the maximum displacement angle.
- System balance is restored when the pressure Δ**PR** exerts on the spool (1) a force equal to the difference in force due to the spring (2) thus restoring the connection between the passages **c** and **d**.

c. When the flow rate stabilises



- When the pump delivery reaches the demand from the auxiliary control valve, the pump delivery pressure **PP** present in the chamber **b** of the **LS** valve balances the combined force of the pressure **PLS** of the **LS** in chamber **a** and the force exerted by the spring (6).
  On reaching this state of equilibrium, the piston (1) comes to a stop in an intermediate position.
- In this condition, the passage connecting chamber **c** to chamber **d** remains partially open, thereby maintaining the pressure in chamber **d**.
  An oil flow enters the control piston (6) at a sufficient pressure to balance the force exerted by the spring (5).
- The stability of this equilibrium is ensured by a stabilised flow from the restrictor **g**.
- The force of the spring (2) is regulated so that the piston (1) is balanced when
  PP – **PLS** = Δ**PR** = 22 bar (319 psi).
- In practical terms, pump delivery is made proportional to the aperture of the auxiliary control valve, maintaining the pressure difference Δ**PR** = 22 bar (319 psi).
- This condition remains unaltered until there is a change in the operating conditions (e.g. a change in engine speed, reduction or increase in the demand for flow or pressure, etc.).

d. When the system enters “saturation” condition

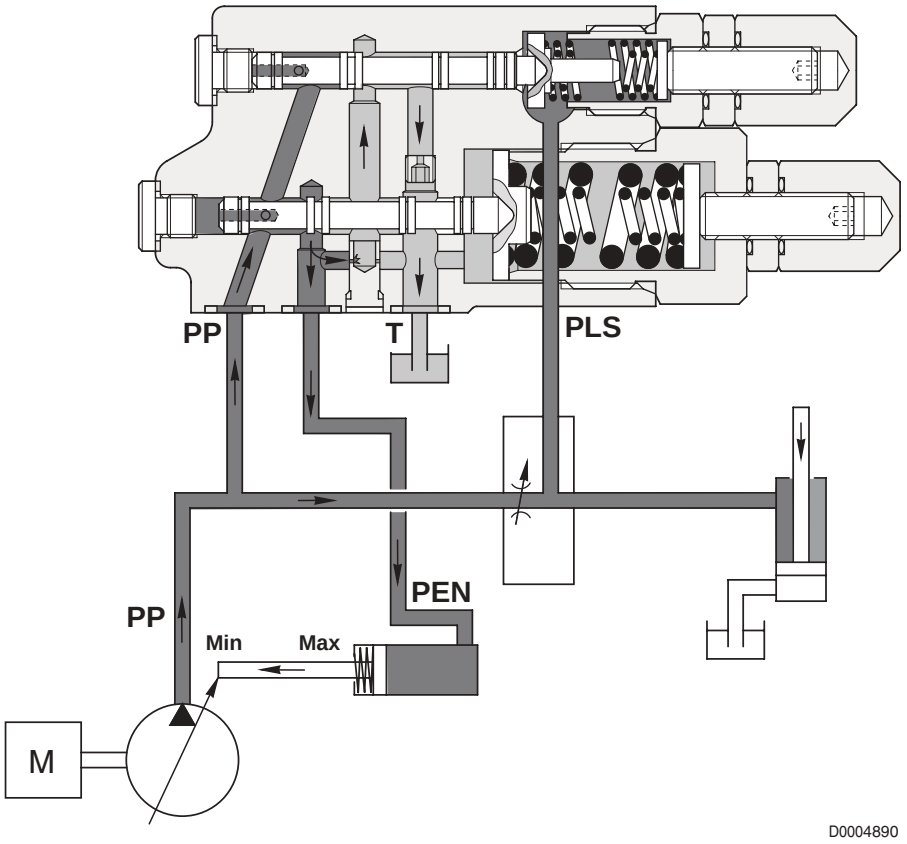


- If the engine speed is reduced during the operation of one or more loads, there will be a corresponding reduction in the flow from the pump. It follows that the pump will compensate for this by altering the swash plate angle.
- When the pump reaches its maximum displacement, and thus can no longer increase its delivery, the difference between the pump delivery pressure **PP** and the pressure **PLS** of the **LS** (pressure difference Δ**PR**) will become smaller (“saturation” condition).
- The pressure **PLS** present in chamber **a** of the **LS** valve will be nearly equal to the pressure **PP** and the piston (1) will be moved left by the combined force of the pressure **PLS** and the spring (2).
  The piston thus closes the passage **c** and connects the passages **d** and **e**.
- The pressurised oil in chamber **X** of the control piston (6) flows through the passages **d** and **e** to reach the pump drain chamber; in this way the pressure in chamber **X** of the control piston (6) becomes equal to the drain pressure.
- As a result, the control piston (6) is shifted to the right by the movement of the swash plate determined by the spring (5) up to the maximum swash plate angle.

PRESSURE CUT-OFF VALVE (TP)

FUNCTION

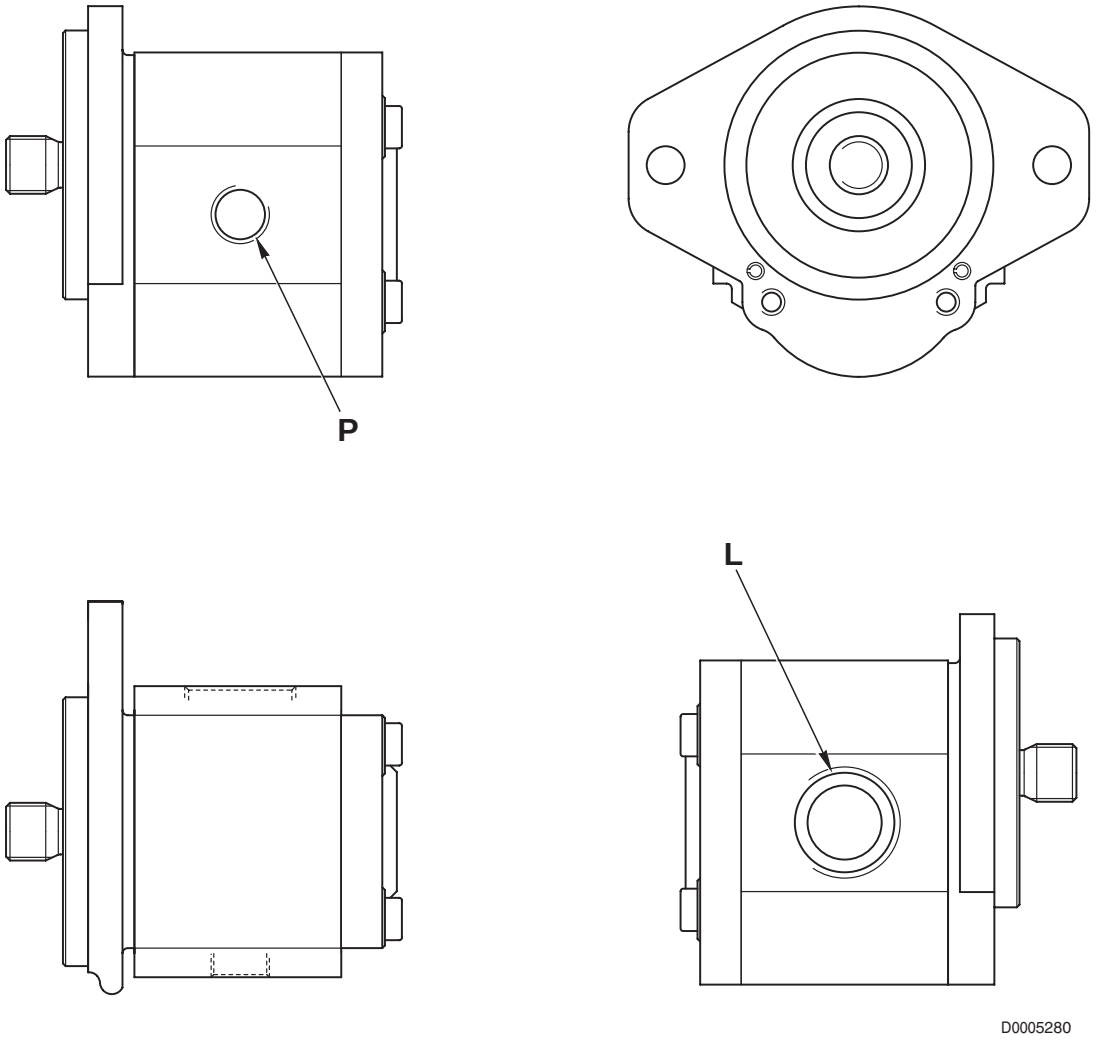
- The pressure cut-off valve regulates the pump delivery on reaching maximum pressure.



OPERATION

- The pressure cut-off valve senses the pump delivery pressure and, on reaching the maximum pressure setting, reduces the pump delivery to zero, by-passing the action of the LS valve.
- The pump delivery is thus returned to a minimum value sufficient for the internal lubrication of the pump of the main auxiliary services and to maintain the hydraulic system at maximum pressure.

5.2 HYDRAULIC SERVICES GEAR PUMP (106-115 CV models)



FUNCTION

Port L: suction

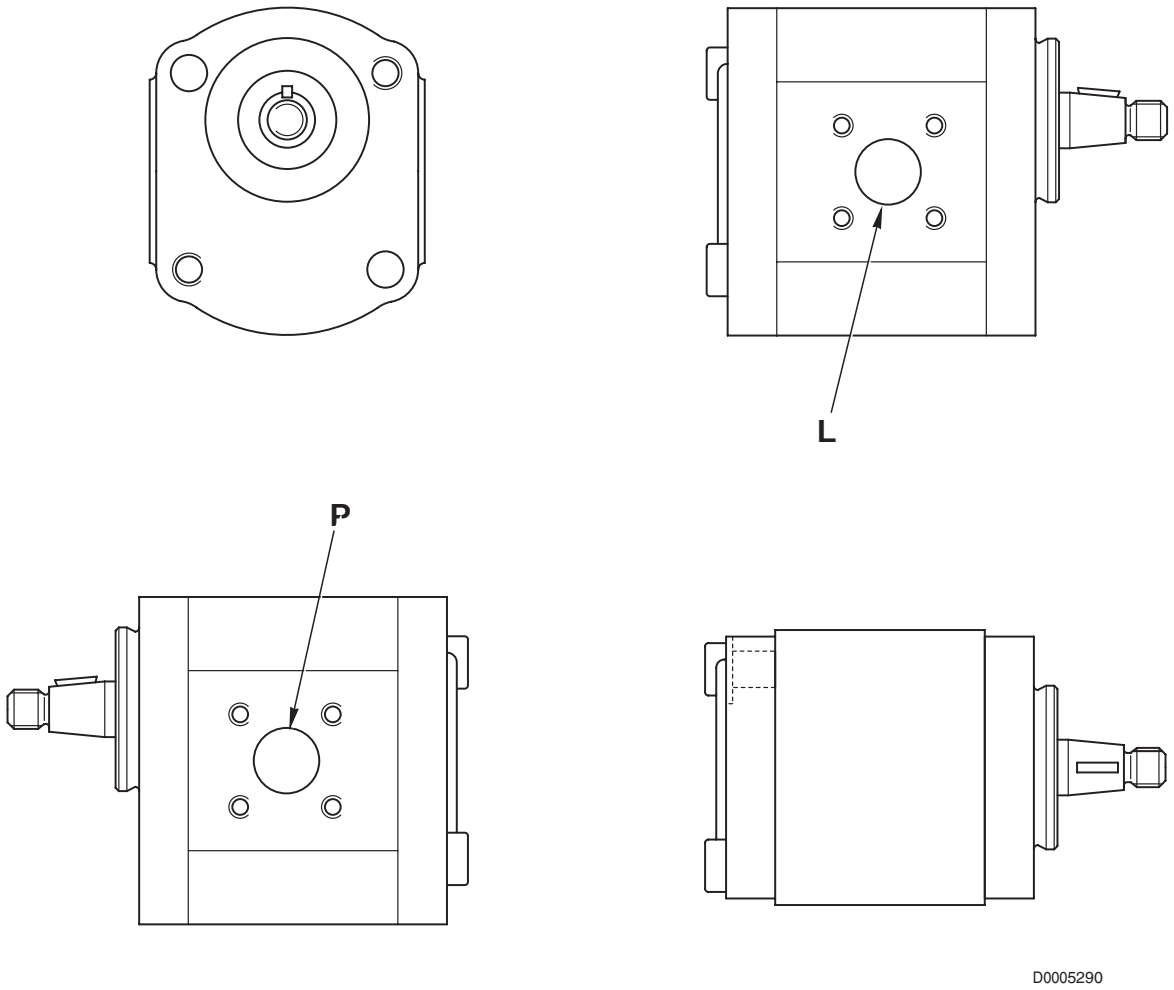
Port P: delivery

TECHNICAL DATA

Displacement: 32 cc/rev

Maximum pressure: 200 bar (2900 psi)

5.3 STEERING GEAR PUMP (106-115 CV models)



D0005290

FUNCTION

Port L: suction

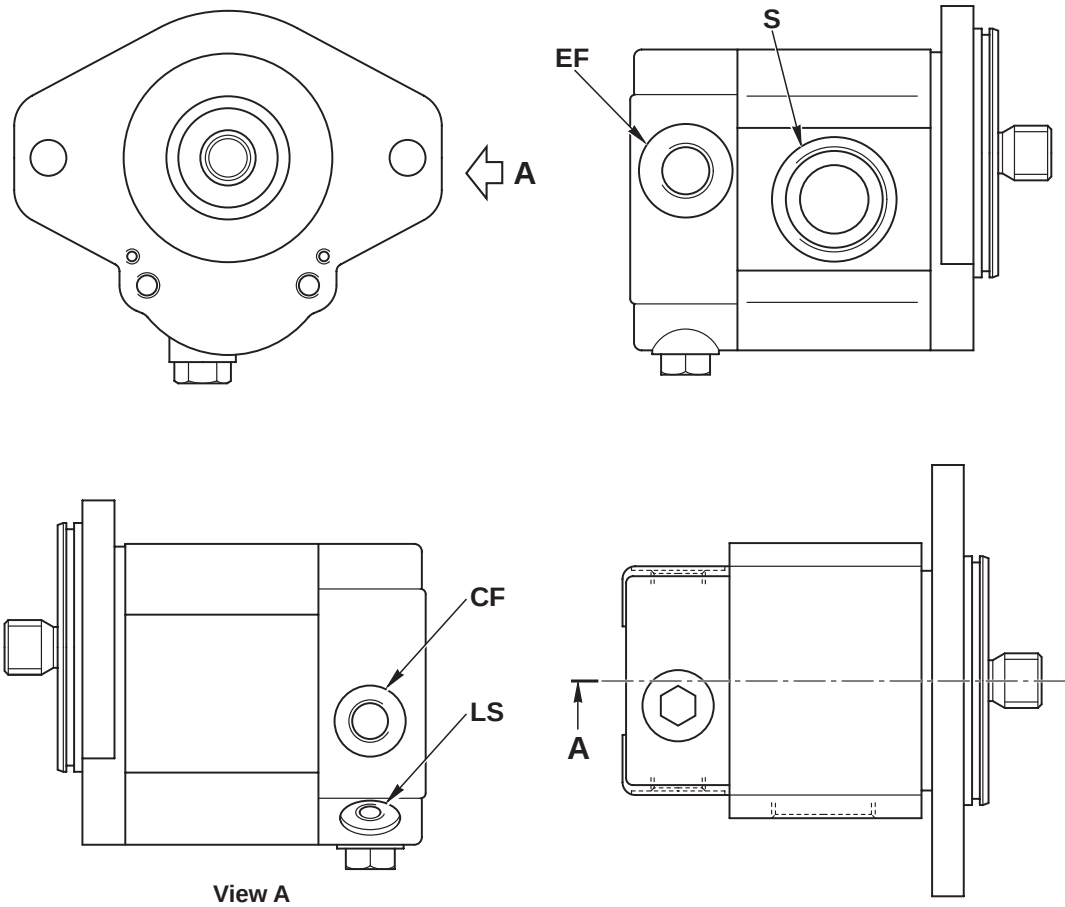
Port P: delivery

TECHNICAL DATA

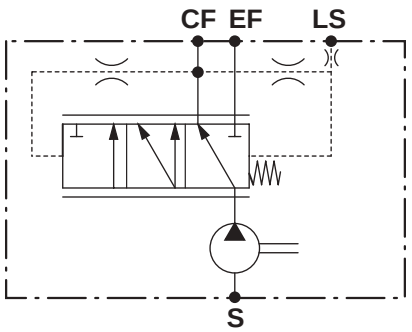
Displacement: 16 cc/rev.

Maximum pressure: 180 bar (2610 psi)

5.4 GEAR PUMP FOR HYDRAULIC SERVICES AND STEERING (120-165 CV models)



HYDRAULIC DIAGRAM



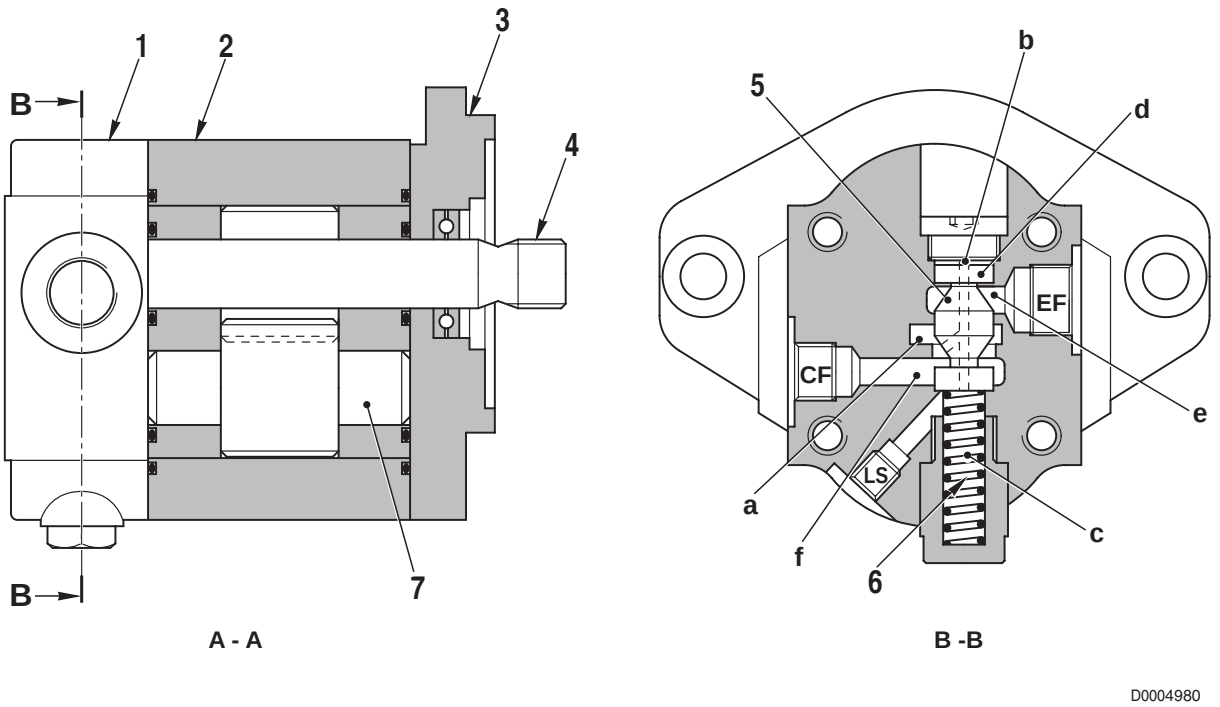
D0004970

FUNCTION

Port S: suction
Port CF: priority delivery
Port EF: secondary delivery
Port LS: LS signal

TECHNICAL DATA

Displacement: 32 cc/rev.
Maximum pressure: 200 bar (2900 psi)



COMPONENTS

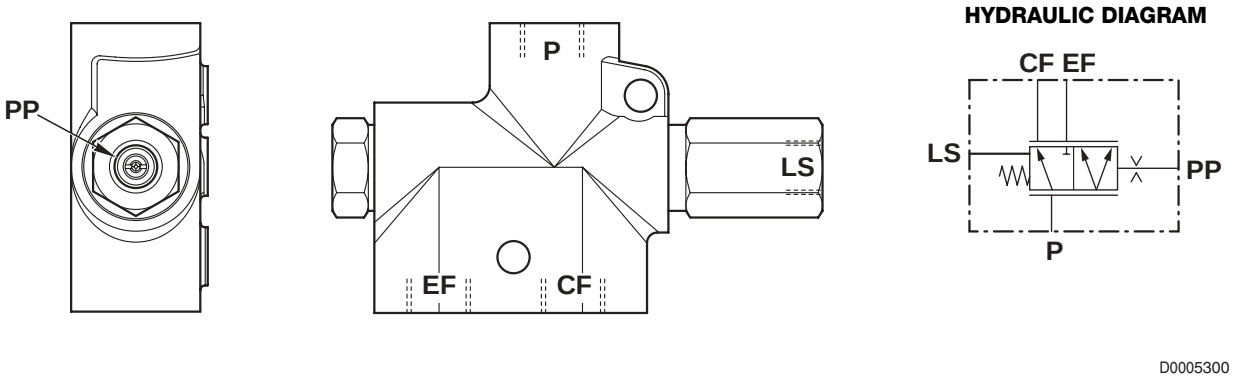
1. Priority valve body
2. Pump housing
3. End cover
4. Input shaft
5. Spool
6. Spring
7. Driven shaft

DESCRIPTION

The gear pump sends oil under pressure to the chamber **a** from where it is sent through the port **CF** to the power steering. At the same time, the pressurised oil reaches chamber **b** of the spring (6) and the chamber **c** opposite the spring (6) through the passage **d**.
As the LS line is sent to drain by the power steering, a small amount of oil (about 1 litre/min.) flows through the port **LS**. This creates a pressure difference between the two sides of the spool (5) that is consequently pushed downwards, thereby allowing the oil to flow to chamber **e** and from there to the auxiliary services .
When the steering wheel is turned, the connection between the drain and the **LS** line is broken and the **LS** line is connected to the delivery line to the steering cylinder. This nullifies the pressure difference between the two sides of the spool and causes the spring to push the spool upwards, thereby allowing oil to flow from chamber **a** to chamber **f**.

5.5 PRIORITY VALVE

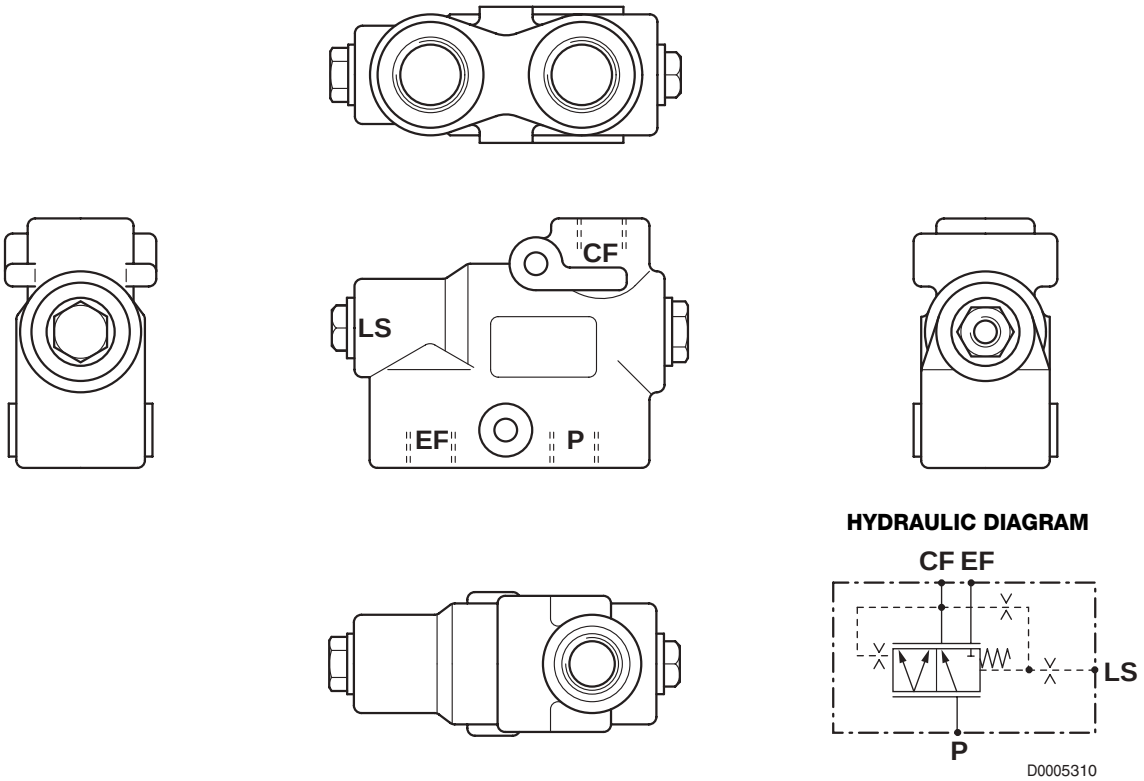
106-115 CV VERSION



FUNCTION

Port P - Valve feed
Port LS - Load Sensing signal
Port CF - Delivery to power steering
Port EF - Delivery to services
Port PP - Valve pilot flow

120-165 CV VERSION



FUNCTION

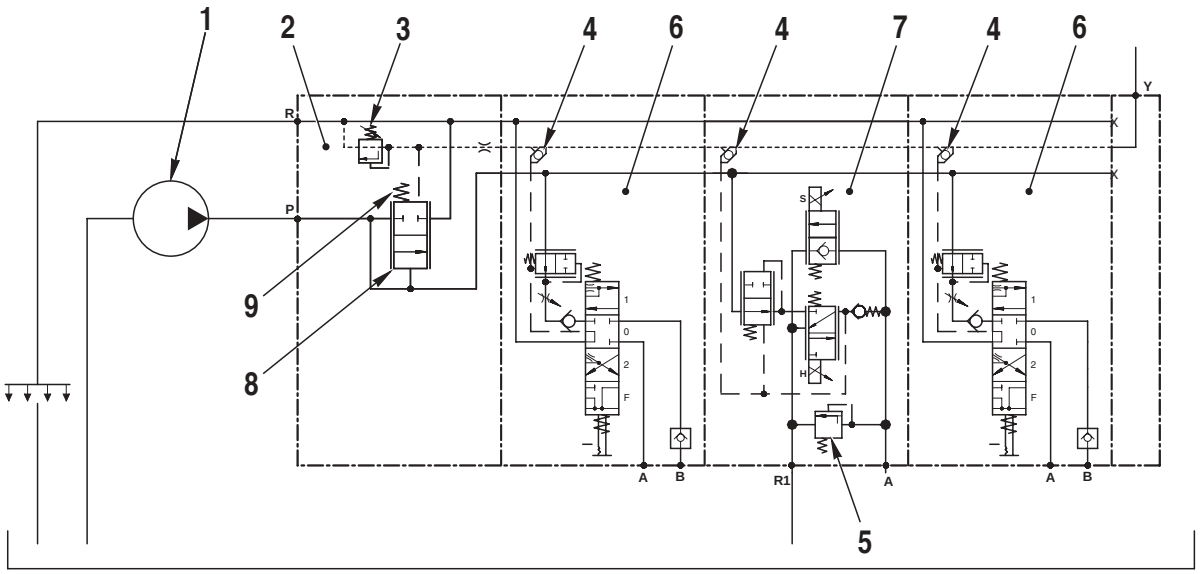
Port CF - Delivery to the power steering
Port P - Valve feed
Port EF - Delivery to services
Port LS - Load Sensing signal

5.6 AUXILIARY SERVICES CONTROL VALVE

VERSION WITH FIXED DISPLACEMENT PUMP

FUNCTION

- The function of the auxiliary services control valve is to control the flow of pressurised oil to the auxiliary services and the rear lift.
- This control valve is a parallel circuit valve, which means that all the services receive oil flow simultaneously .



REAR GEARBOX

D0004990

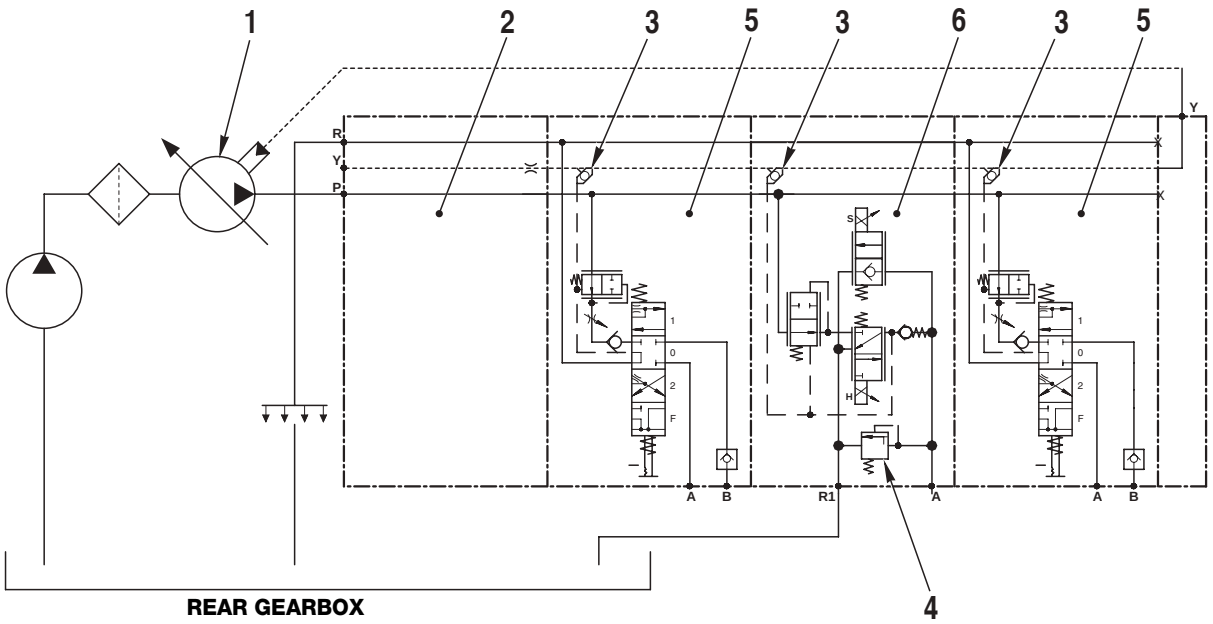
DESCRIPTION

- The pressurised oil from the pump (1) enters the inlet section (2); from here it is distributed to the spool sections through internal passages.
- In the inlet section (2) we find an input gauge (8) and a relief valve (3) for LS-signal.
- The input gauge adjusts the pressure to supply the auxiliary valves (6) in this way, that it is always corresponding to the spring force (9) higher than the pressure of the LS-signal.
- The pressure limitation is provided by limitation of the LS-signal pressure, done by valve (3).
- All the spools, when operated, generate a pressure signal (Load Sensing signal) that is equal to the pressure demand from each load.
  The highest of these pressure signals, selected by the bistable valves (4), is directed to the pressure relief valve (3).
- On the lift spool section there is an antishock valve (5) (on the UP control side) that serves to prevent excessive pressure caused by jolting of the implement.

VERSION WITH VARIABLE DISPLACEMENT PUMP

FUNCTION

The function of the auxiliary services control valve is to control the flow of pressurised oil to the auxiliary services and the rear lift.
This control valve is of the parallel circuit Load Sensing type.



D0005000

DESCRIPTION

- The pressurised oil from the pump (1) enters the inlet section (2); from here it is distributed to the spool sections through internal passages.
- All the spools, when operated, generate a pressure signal (Load Sensing signal) that is equal to the pressure demand from each load.
  The highest of these pressure signals, selected by the bistable valves (3), is sent to the variable displacement pump through port **Y** of the control valve.
- On the lift spool section (6) there is an antishock valve (4) (on the UP control side) that serves to prevent excessive pressure caused by jolting of the implement.

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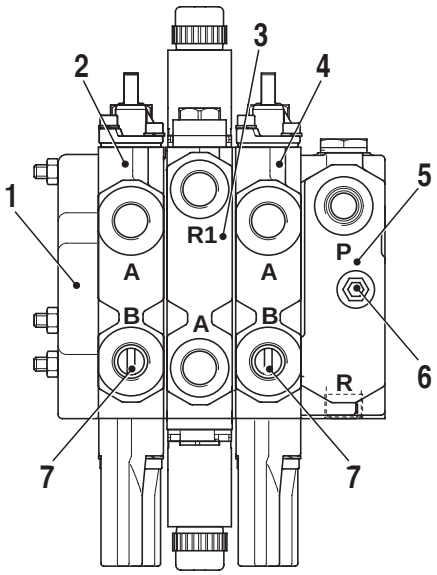
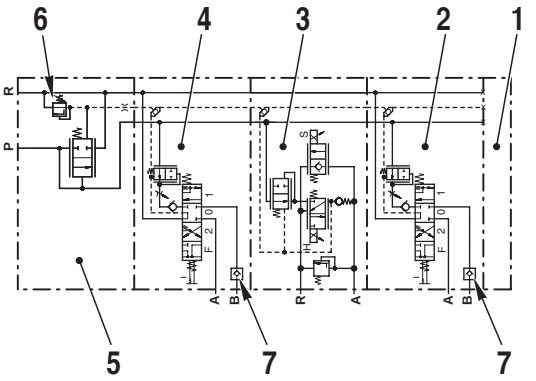
5.6.1 TYPES OF CONTROL VALVE WITH FIXED DISPLACEMENT PUMP (CCLS)

4-WAY VERSION WITHOUT FURTHER EQUIPMENT (I.E. FRONT AXLE SUSPENSION)



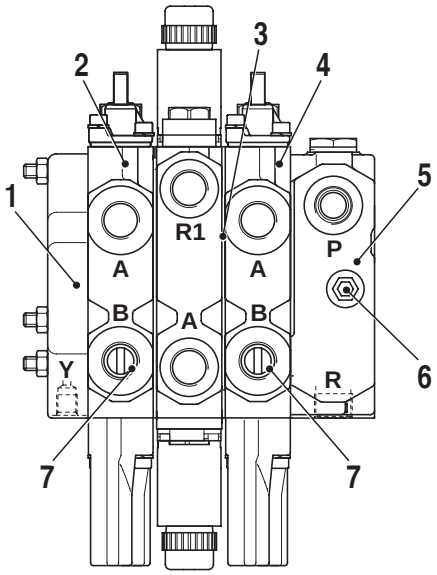
HYDRAULIC DIAGRAM



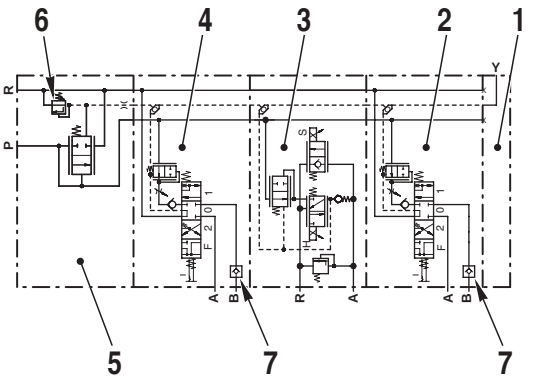
D0005150

1. Cover plate
2. Control valve section n° 1
3. Lift control valve section
4. Control valve section n° 2
5. Inlet manifold
6. Relief valve
7. Check valve

4-WAY VERSION WITH FURTHER EQUIPMENT (I.E. FRONT AXLE SUSPENSION)



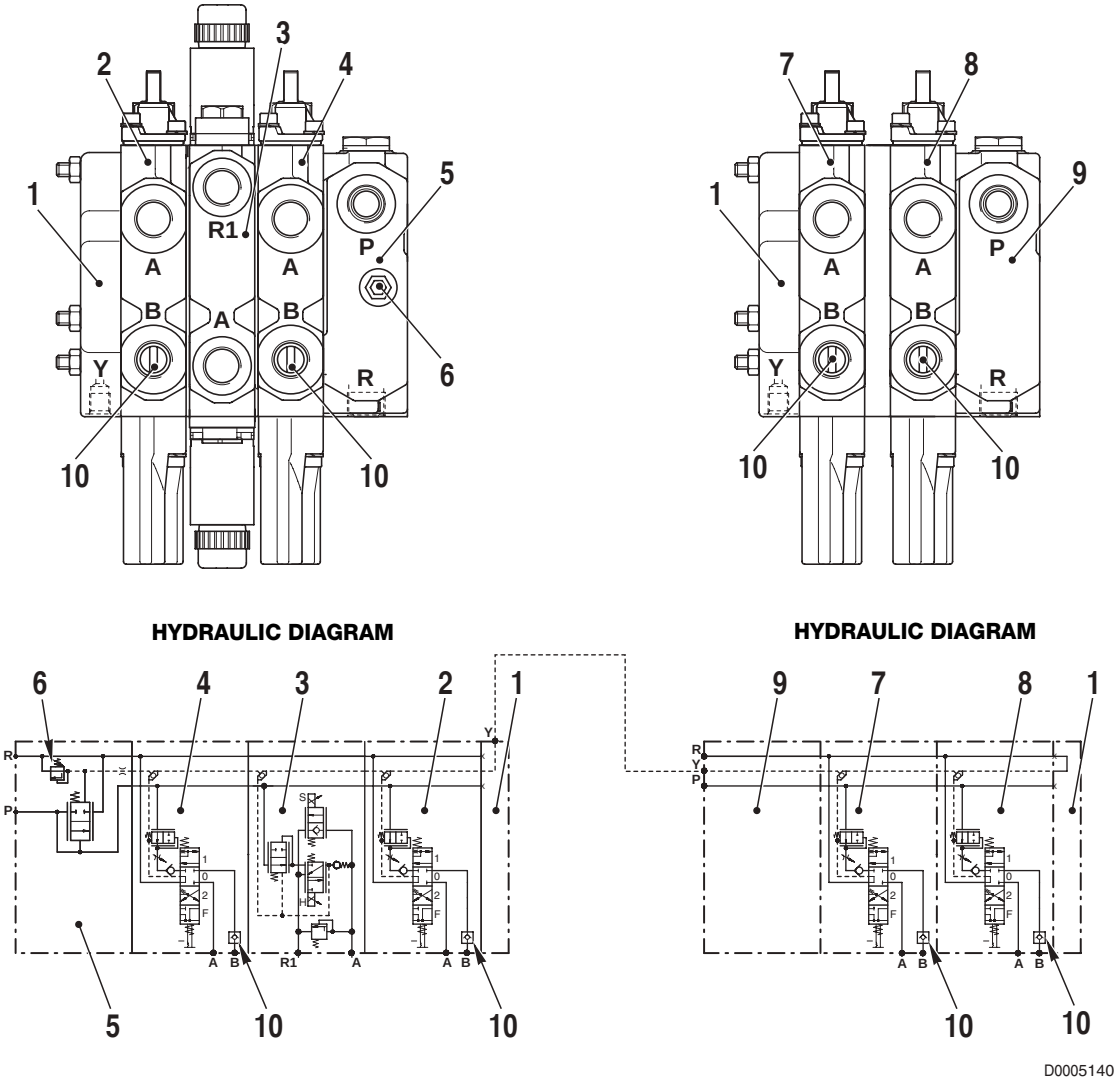
HYDRAULIC DIAGRAM



D0005160

1. Cover plate
2. Control valve section n° 1
3. Lift control valve section
4. Control valve section n° 2
5. Inlet manifold
6. Relief valve
7. Check valve

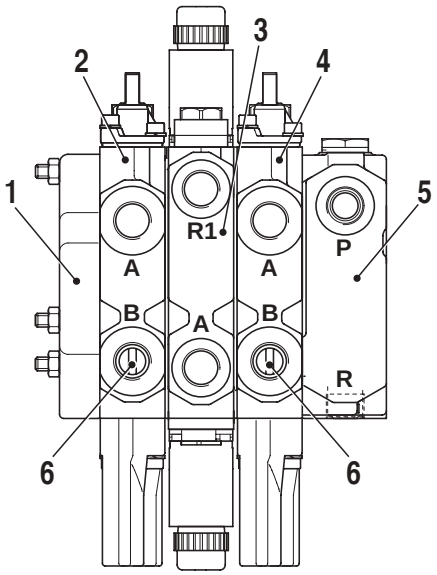
8-WAY VERSION

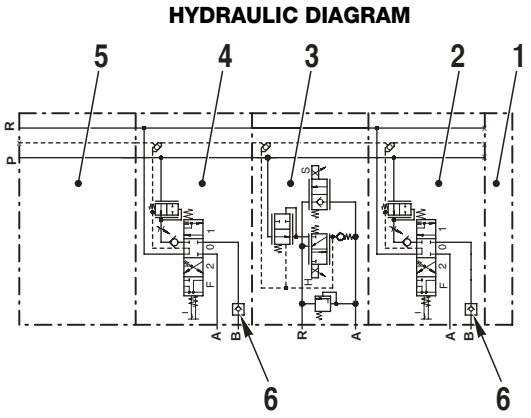


1. Cover plate
2. Control valve section n° 1
3. Lift control valve section
4. Control valve section n° 2
5. Inlet manifold
6. Relief valve
7. Control valve section n° 3
8. Control valve section n° 4
9. Inlet manifold
10. Check valve

5.6.2 TYPES OF CONTROL VALVE WITH VARIABLE DISPLACEMENT PUMP (LS)

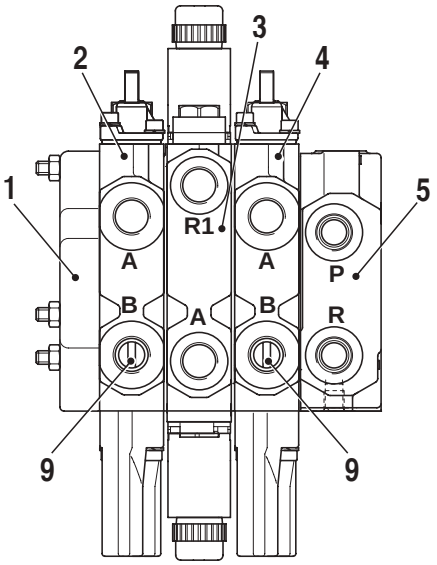
4-WAY VERSION

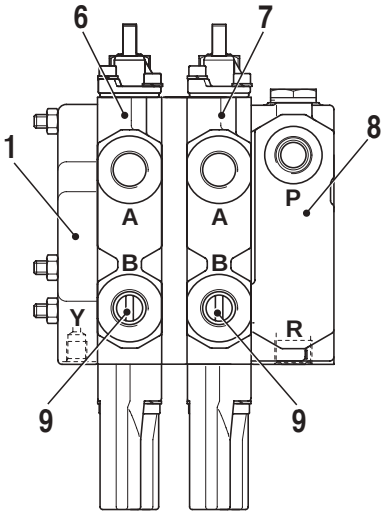


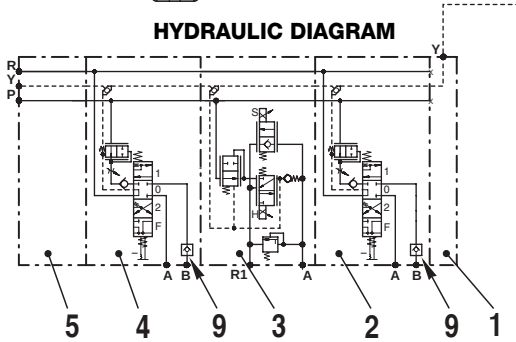


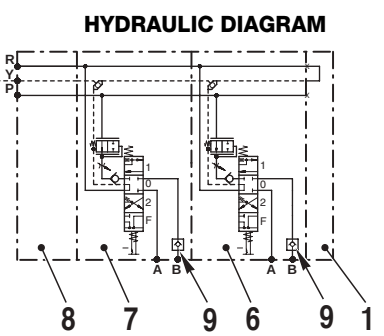
1. Cover plate
2. Control valve section n° 1
3. Lift control valve section
4. Control valve section n° 2
5. Inlet manifold
6. Check valve

8-WAY VERSION



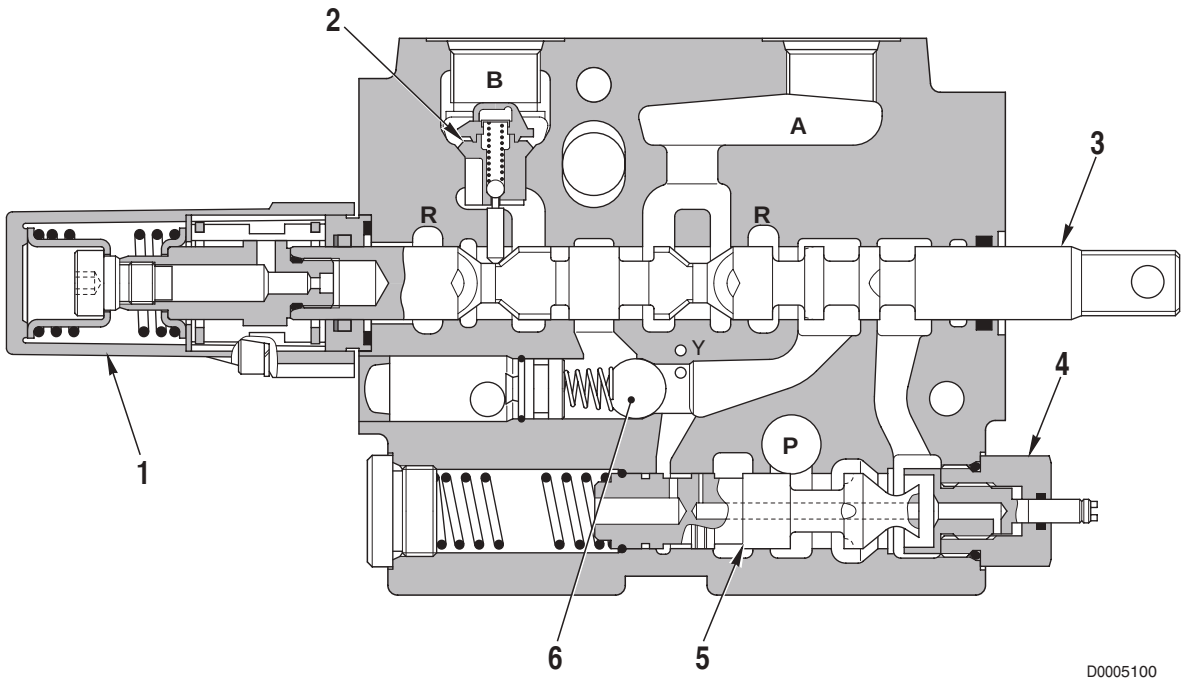






1. Cover plate
2. Control valve section n° 1
3. Lift control valve section
4. Control valve section n° 2
5. Inlet manifold
6. Control valve section n° 3
7. Control valve section n° 4
8. Manifold
9. Check valve

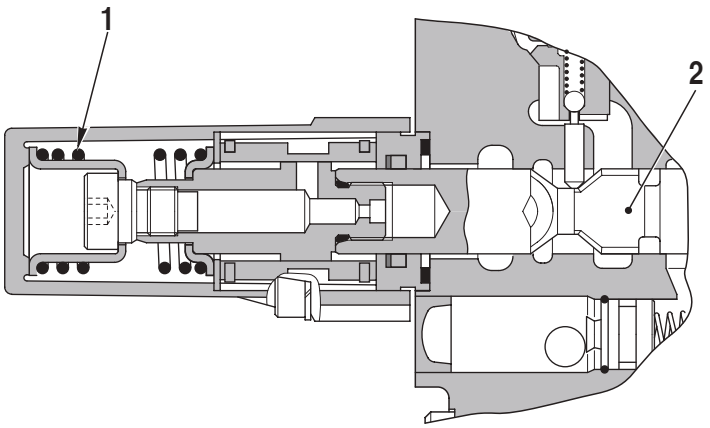
5.6.3 SERVICES CONTROL SECTION



1. Spool return device
2. Check valve
3. Spool
4. Flow control
5. Flow control spool
6. Check valve

5.6.4 DESCRIPTIONS OF COMPONENTS

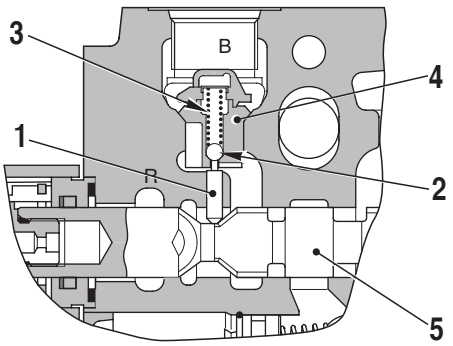
SPOOL RETURN DEVICE



D0005040

1. Spool return spring
2. Spool

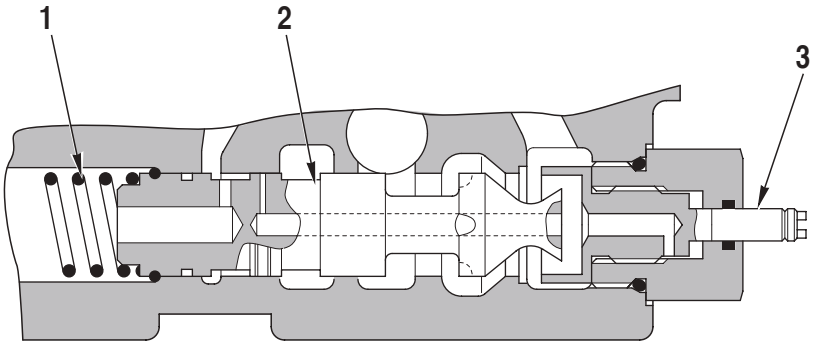
Check valve (NR)



D0005050

1. Slide
2. Ball
3. Check valve spring
4. Valve seat
5. Spool

FLOW CONTROL VALVE



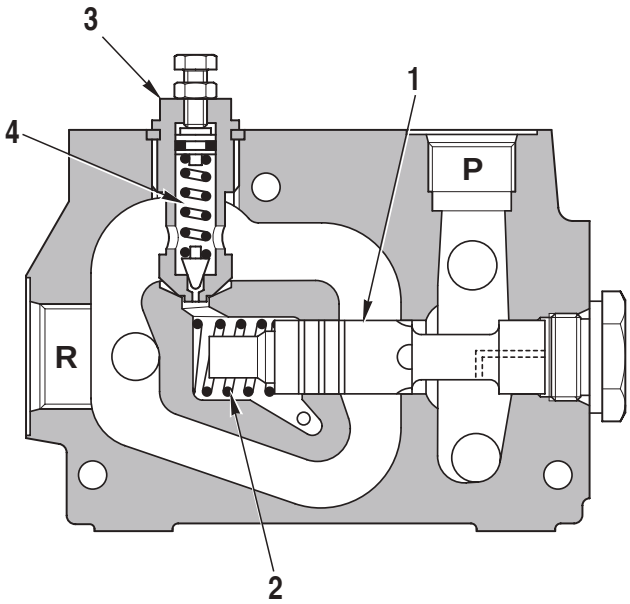
D0005060

1. Spring
2. Flow control spool
3. Control shaft

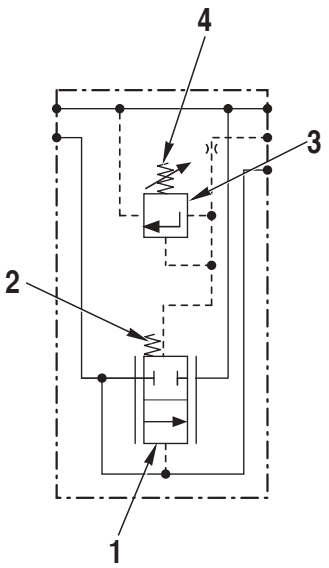
5.6.5 INLET MANIFOLD (CC version)

DESCRIPTION

The function of the inlet manifold is to send only the required amount of oil to the actuators and to send any excess oil supplied by the pump to the drain circuit.
The inlet manifold also includes a relief valve that limits the operating pressure of the actuators.



HYDRAULIC DIAGRAM

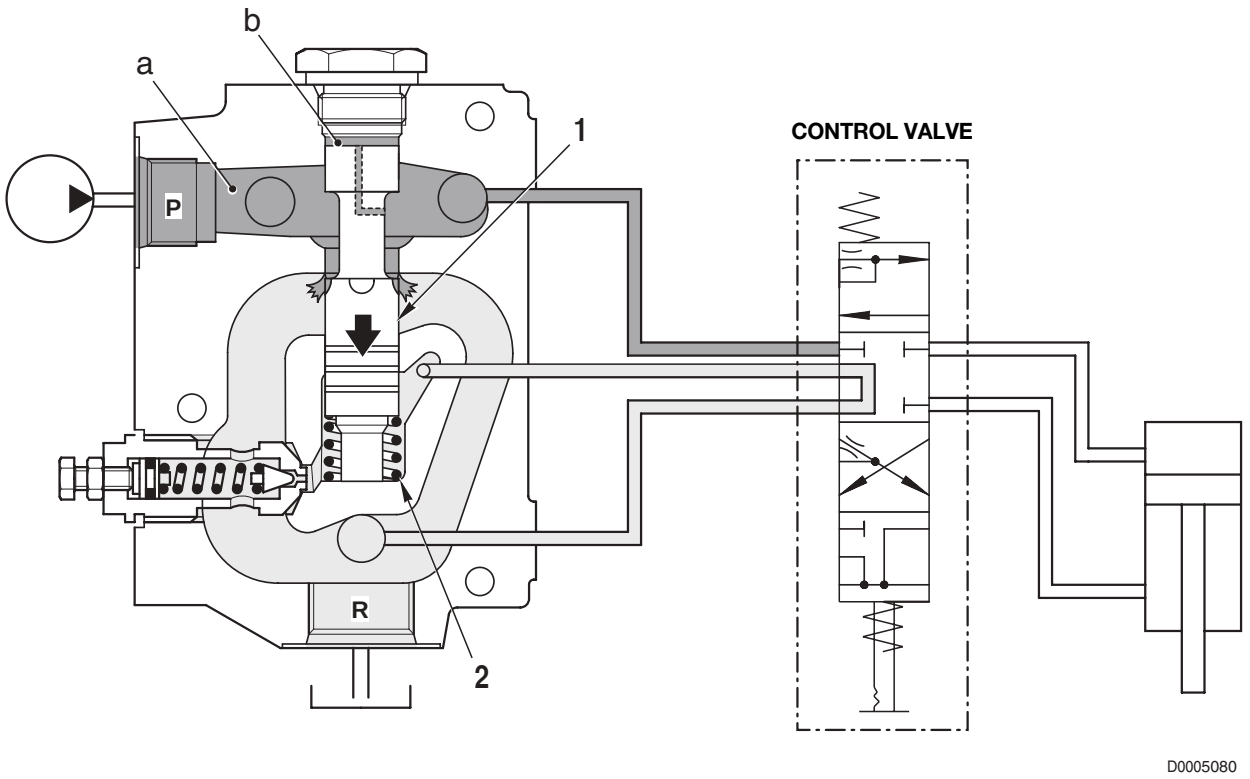


D0005070

1. Pressure compensating valve spool
2. Compensating valve spring
3. Relief valve
4. Relief valve spring

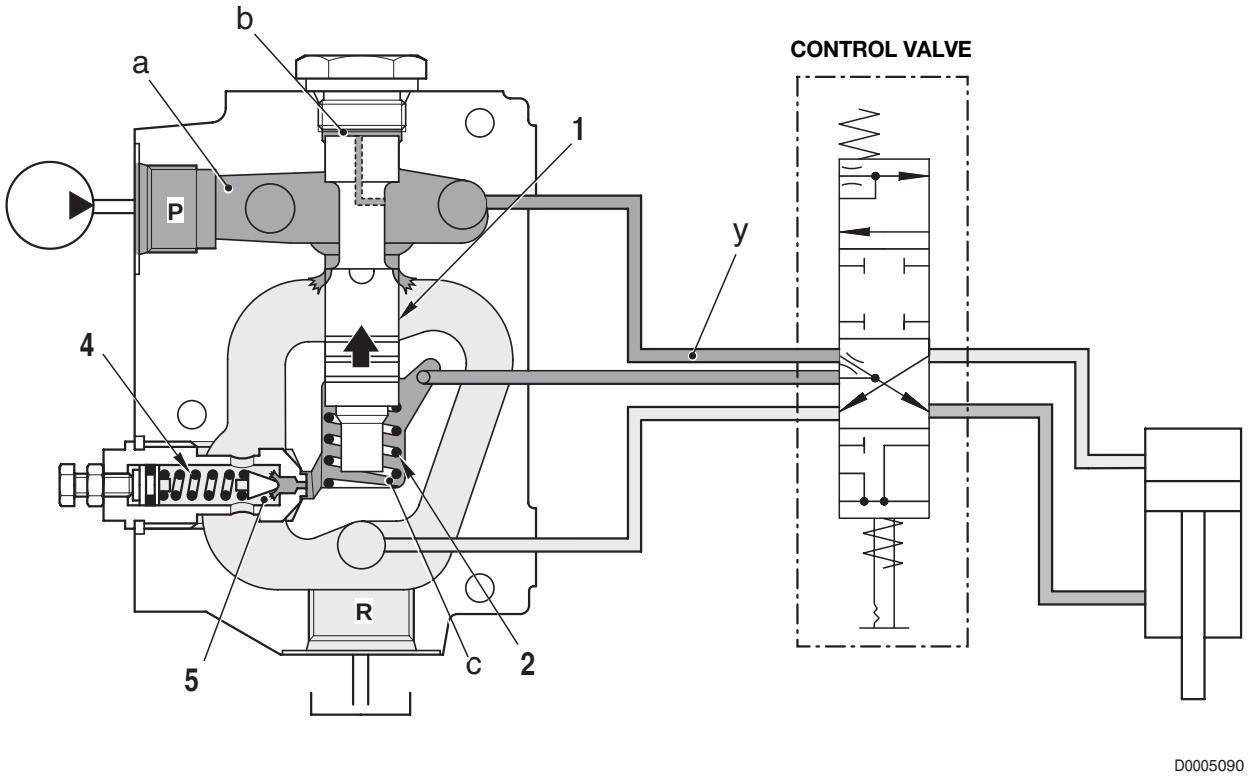
OPERATION

1. When the actuators are not operated



- When the engine is running and the driver does not operate any of the hydraulic service controls, the pump sends oil to the inlet manifold (port **P**).
- As all the actuators are stationary, the oil pressure increases in chamber **a** and consequently also in chamber **b**.
- When the oil pressure in chambers **a** and **b** exceeds the force exerted by the spring (2), the spool (1) is shifted downwards, allowing the excess oil from the pump to flow to drain.

2. When an actuator is operated



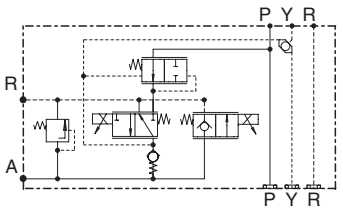
- When an actuator is operated, the pressure required for its operation is also directed to the channel **y** (Load Sensing signal channel) and then sent to chamber **c** of the manifold.
- This causes the spool (1) to shift upwards and the oil required to operate the load is sent to the control valve.
- When the load pressure balances the force of the spring (4), poppet (5) is shifted to the left, allowing limitation of the operating pressure.

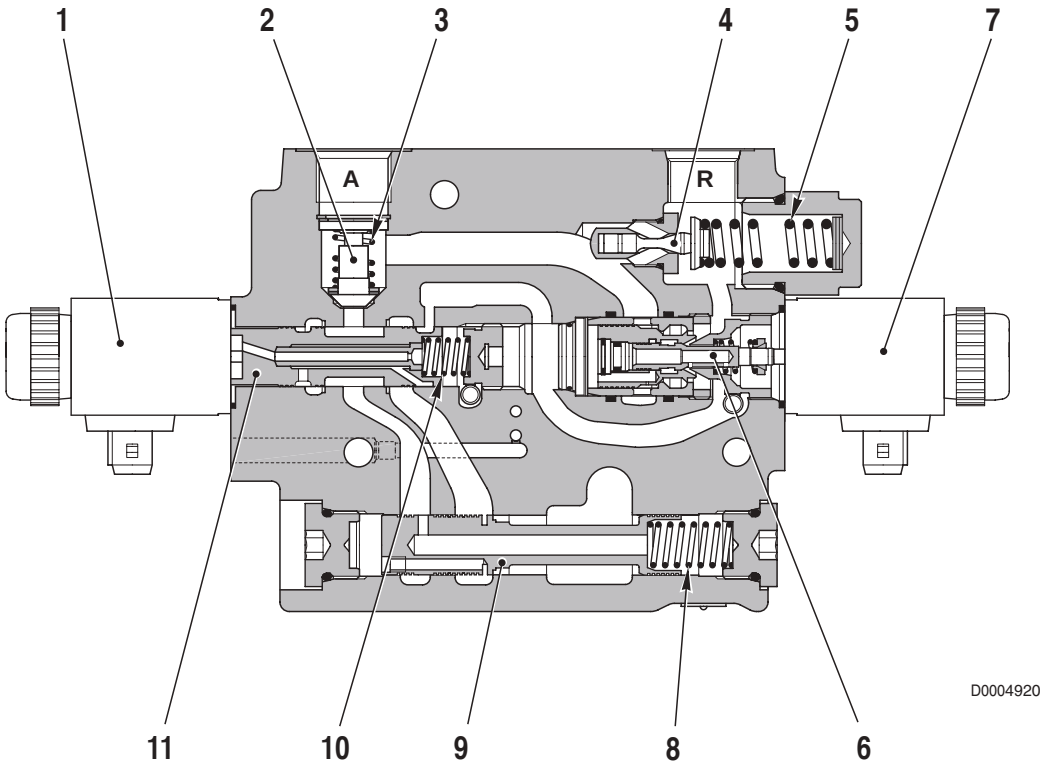
5.6.6 LIFT CONTROL VALVE SECTION

DESCRIPTION

- The lift control section is a 1-way hydraulic control valve operated by two proportional solenoid valves.
- The control incorporates an antishock valve that protects the hydraulic circuit and against pressure surges caused by jolting of the implement during work and transport.

HYDRAULIC DIAGRAM





COMPONENTS

1. UP control solenoid valve
2. Check valve
3. Check valve spring
4. Antishock valve
5. Antishock valve spring
6. DOWN control spool
7. DOWN control solenoid valve
8. Flow control spring
9. Flow control spool
10. Spring
11. UP control spool

OPERATION

1. When the lift control is in neutral position

- The oil from the pump enters chamber **a** and from here flows into passage **b**.
- At the same time the oil flows into chamber **c** of the flow control (1) through passage **d**.
- This causes the spool to shift to the right until the connecting passage between chamber **a** and passage **b** is closed.
- The pressure in chamber **e** caused by the weight of the implement mounted on the linkage (e.g.: plough), keeps the check valve (2) closed, thereby ensuring that the lift maintains its position.
- The chamber **e** is thus a closed chamber that prevents any uncontrolled movement of the lift.
- The pressure in chamber **e** also acts on the antishock valve (3) that eliminates any pressure surges caused by jolting of the implement during work or transport.

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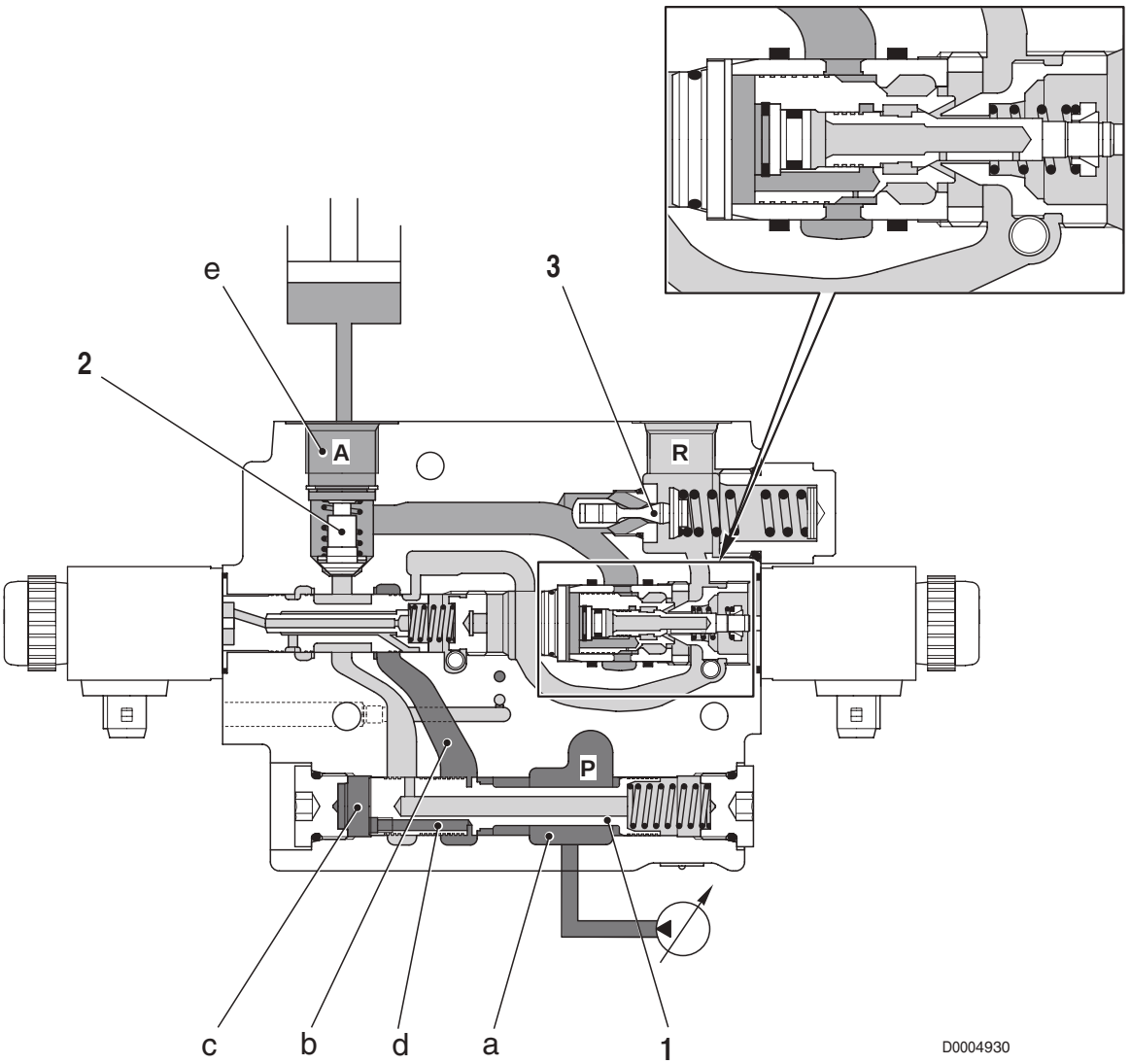
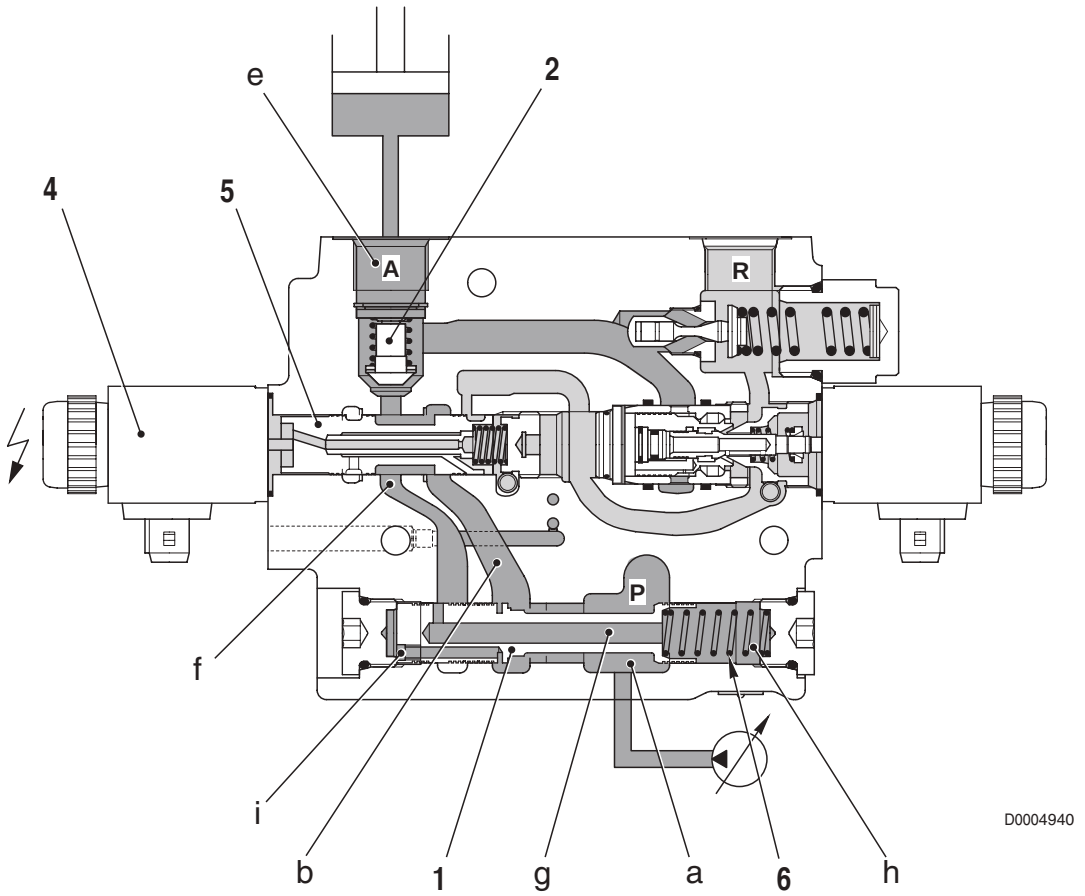


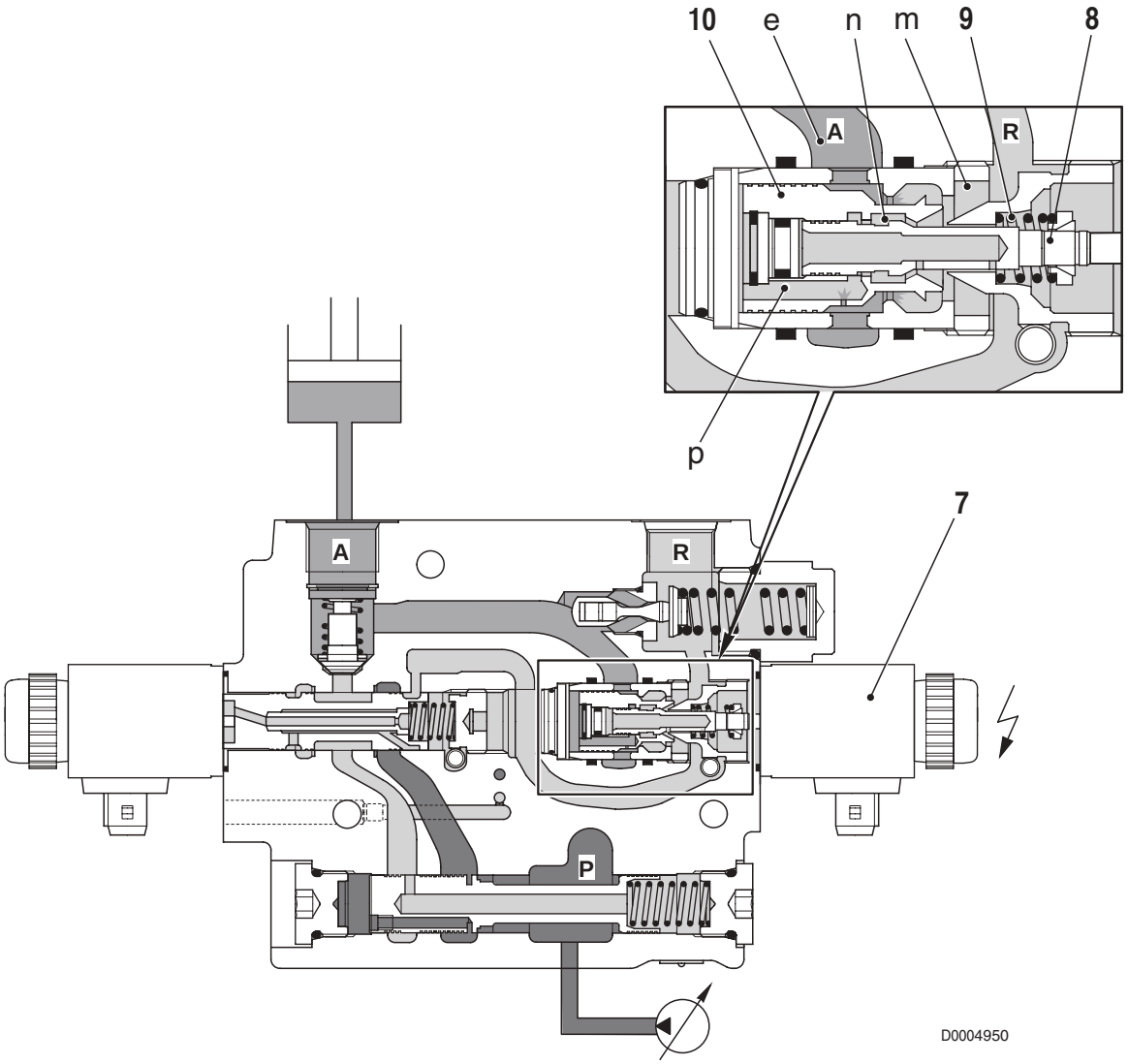
2. When the lift is raised

- When the lift is raised, the electronic lift control energises the solenoid (4) which move the spool (5) to the right.
- The oil in passage **b** can therefore flow through the check valve (2) into chamber **e** and from there to the lift cylinders.
- At the same time, the pressure present in passage **b** can flow into the chamber **i** and into the passage **f** and from there through the channel **g** into chamber **h** of the flow control (1).
- As the oil pressure is the same on both sides of the spool, the spool is shifted by the force of the spring (6) and the oil can flow from chamber **a** into the passage **b**.



3. When the lift is lowered

- During lifting or when the lift is stationary, the spool (8) is pushed to the right by the spring (9).
- As a result, the passage between the chambers **m** and **n** is closed and the pressure in chamber **p** pushes the spool (10) to the right.
  When the lift is lowered, the electronic lift control energises the solenoid (7) that moves the spool (8) to the left. The oil in chamber **n** can flow into chamber **m** and the pressure in chamber **p** is reduced.
- Now the force balance coming from the pressure in the chambers **e** and **p** influencing the spool (10), is disturbed and moved to the left. Oil can flow now from **e** to **m**.
- As a result, the oil in the lift cylinders is directed to the drain circuit and the lift is lowered.
- As the solenoid is of the proportional type, the more current supplied, the more the spool (8) shifts to the left, thereby allowing more oil to flow and the lift to descend more rapidly.
- The electronic control obtains float position by energising the solenoid valve (7) and holding it fully open.
- In this condition, the oil in the lift cylinders is sent to the drain circuit so that the lift is free to move up and down and follow the contours of the terrain.



SECTION 20

CONTENTS

OPERATOR'S MANUAL

SERDIA (LEVEL III)

1. ENTRY AND COMMUNICATION

1.1 OVERVIEW

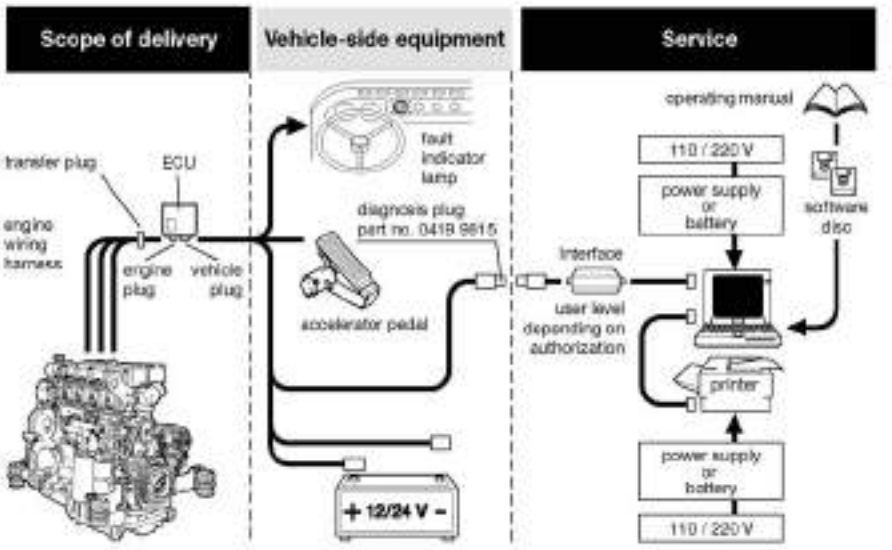
Digital electronic engine ECUs have become a normal part of modern engine technology.
These ECUs are designed, at the very least, to fulfil the functions of comparable mechnical modules (e.g. governors), as well as to provide additional functionality. SERDIA is required in order to make communication with these digital electronic DEUTZ ECUs possible. With

a) an interface (cable with diagnostics plug and copy protection) and

b) a commercially available notebook (or PC),

SERDIA forms a special tool

.



1.1.1 INTRODUCTION

SERDIA is a software program. Together with the notebook and the interface, it constitutes a tool which serves as an aid to communication with the engine ECUs.

SERDIA supports DEUTZ ECUs EMR, EMS and MVS. You can also communicate with three different ECUs using just one software product.

Any changes you wish to make to the ECUs as far as settings, parametrizations, error deletion and calibra-tion are concerned are only possible with SERDIA.

SERDIA runs under the MS Windows®3.11 and Windows95(98) user surface.

You can choose English or German as the user language when carrying out program installation.

The user surface enables the user to call up the functions required simply by clicking on the appropriate buttons.

The menu points listed below are available:

- ECU selection
- Measured values
- Parameters
- Error memory
- Function test
- Extras

1.1.2 HARDWARE AND SOFTWARE

You should have the following minimum system configuration in order to work with SERDIA:

Hardware:

- Notebook o PC (IBM-AT compatible):.... with 1 serial interface RS 232 (There should be no mouse connected) and parallel printer interface
- Grafiphs carde:..... VGA/SVGA
- Processor: ..... 80486 (or later)
- Frequenz:..... 100 MHz
- RAM:..... 8 MB RAM (or later)
- Hard disk (free memory capacity): ..... 15 MB (or later)
- Diskdrive:..... 3,5” (1,44 MB)

ECUs (engine):

- EMR (Elektronischer Motor-Regler)..... Electronic engine governor,
  ECU TN 0211 1910 e 0211 2017
  Software Version N° 12.1.08 and lower
- Diagnostics interface..... Serial in ace. with ISO 9141

Interface, connector piece between ECU (engine) and PC:

- Level adaptator for ISO 9141, SAE J1708 e RS 485
- Safety switch with dongle function, copy protection
- Power supply range 12-24 V
- Power supply side: Engine
- Protective switch against incorrect polarity and surge voltage
- Decoupling

Software:

- Operating system ..... DOS versione 5.0 or later
- User surface ..... MS-Windows® 3.11 or Windows 95

Installation is also possible under Windows 3.1; however, this creates a specific Windows problem: Conflicts may occur when accessing serial interface COM1 (see Chapter 8, What should you do if...?). Further information is also given in the Readme file supplied with SERDIA).

For proper display of the contents of the SERDIA windows under Windows 3.11, you should install the standard screen driver (VGA).

1.2 ORDERING

SERDIA can be ordered, like the DEUTZ special tools, through:

SAME-DEUTZ-FAHR GROUP S.p.A.

Viale F. CASSANI, 15

24047 TREVIGLIO (BG) - ITALIA

1.2.1 FIRST-TIME USERS

For first-time users, we recommend the SERDIA package Re-order No. 5.9030.740.4/10.

Scope of supply:

- SERDIA software (1 x 3.5' installation diskette)
- Diagnostics interface with implemented user level
- Brief instructions on installation
- A list of tools and modifications usefui when troubleshooting, is included
- Carrying case

1.2.2 ORDERING SINGLE PARTS

Ser. No.	Part	Competence level	Re-order No.
T7	Installation diskette		5.9030.740.0
T8	Adapter		5.9030.741.0
T9	Interface level III	Major overhaul	5.9030.740.2

1.2.3 Adapter

Some OEMs have different diagnostics plugs for certain versions. An adapter is therefore required for the interface from the 12 pole DE UTZ plug to the appropriate OEM plug.

The DEUTZ 12 pole counterpart is available as a genuine DEUTZ part.

A ready-made adapter is available, for diagnostics on engines in DE UTZ Fahr tractors (DEUTZ 12 pole -> DFA 14 pole):

DEUTZ Part No. 5.9030.741.0

1.3 SWITCH ON NOTEBOOK AND INSTALL SOFTWARE

1.3.1 INSTALLING MS WINDOWS®

If you do not already have MS Windows® or Windows95(98) installed on your hard disk, you must do this first of all, following the instructions for installation given for MS Windows® and Windows95(98).

1.3.2 INSTALLING SERDIA

Before you begin installation, you must first make sure that all applications are closed. To be sure, you should therefore leave MS Windows® and start anew.

In order to operate SERDIA software, you require an interface with a connection to an engine ECU. If this interface is not available, it is still possible to install SERDIA, but you will only be able to operate it in offline mode. Chapter 1.6.2 Offline mode tells you which program restrictions this involves.

TO INSTALL:

- Switch on the computer
- Insert the SERDIA installation disk in the 3.5" disk drive (drive A:).
- Start Windows.

With Windows 3.11 (3.1):

- In the main group, open "File manager" by double clicking on the symbol using the mouse.
- Select disk drive A:
- Start "install.exe" by double clicking with the mouse.
- Follow the installation instructions appearing on the screen.
- Remove the installation disk from the disk drive and keep safe.
- After re-starting, open the "SERDIA" program group by double clicking.
- Start "Diagnostics Service" by double clicking.

With Windows 95 (98):

- Open "Desktop" by double clicking.
- Open "3.5 disk (A:)" by double clicking.
- Start "install.exe" (Run Me!) by double clicking.
- Follow the installation instructions on the screen.
- Remove the installation disk from the disk drive and keep safe.
- After re-starting, click on the "Start" button and select the "Programs" folder.
- Start the program "Diagnostics service" in the "Serdia" sub-menu.

1.3.3 SERDIA UPDATES

You will be informed of software updates by our service information department, as they occur.

There is no automatic exchange against older versions of the software.

When installing the update the target directory should contain the SERDIA version number.

1.4 USER LEVEL, ACCESS AUTHORIZATION

DEUTZ Service has defined three different user levels (I, II, III) for SERDIA users. These levels are specified in the interface.

We make these distinctions in order to prevent unauthorized users from gaining access to the setting parameters (comparable to the lead seals on fuel injection pumps).

Access authorization functions in such a way that only certain parameters and function fields are allowed through a filter. This then allows access to the appropriate user level.

1.5 MAKING A CONNECTION BETWEEN ECU (ENGINE) AND NOTEBOOK

- Serial communication
- Baud rate = 9600
- Serial port = COM1

An interface forming part of the SERDIA scope of delivery serves as a link between the ECU and the notebook. Despite a large number of safety measures in the interface and the ECU, such as protection against incorrect polarity, surge voltage protection and decoupling, the possibility of errors can never be entirely excluded.
For this reason, the connection should be made by adhering closely to the following sequence:

1 - Switch off engine, turn off ignition switch (terminal). Do not switch on the notebook yet.

2 - Plug the diagnostics plug on the interface into the diagnostics socket on the vehicle/equipment.

3 - Connect the other interface side with serial interface RS 232/COM1 . (9 pole plug at the back of your noteback).

ATTENTION!

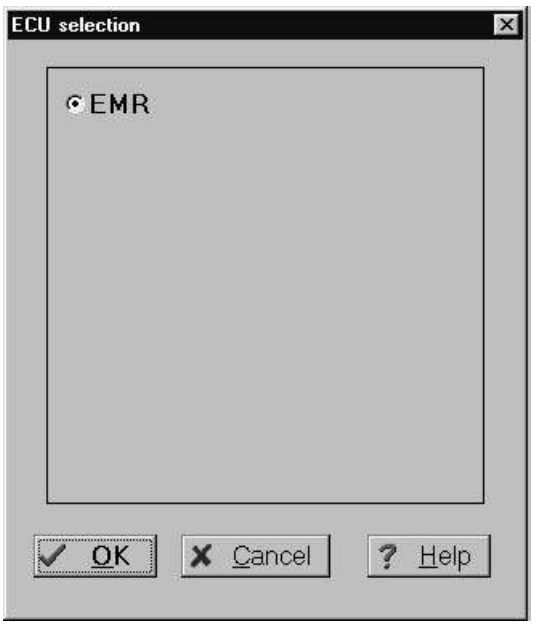
On PCs, the COM1 interface may sometimes be occupied by the mouse. If this is the case, you should connect the interface to the second serial interface (COM2). This must then be configured (see Chapter 8, What should you do if...?).

4 - You can now switch on the ignition (terminal 1 5) and the notebook. For the time being, do not switch on the engine.

5 - You can now start the program SERDIA in accordance with the instructions given in Chapter 1.6 Program start.

1.6 PROGRAM START

Call the program SERDIA under Windows by double clicking.
SERDIA starts up with a main screen and a sub-screen "ECU selection". In this screen, you can only select "OK", "Cancel" or "Help".

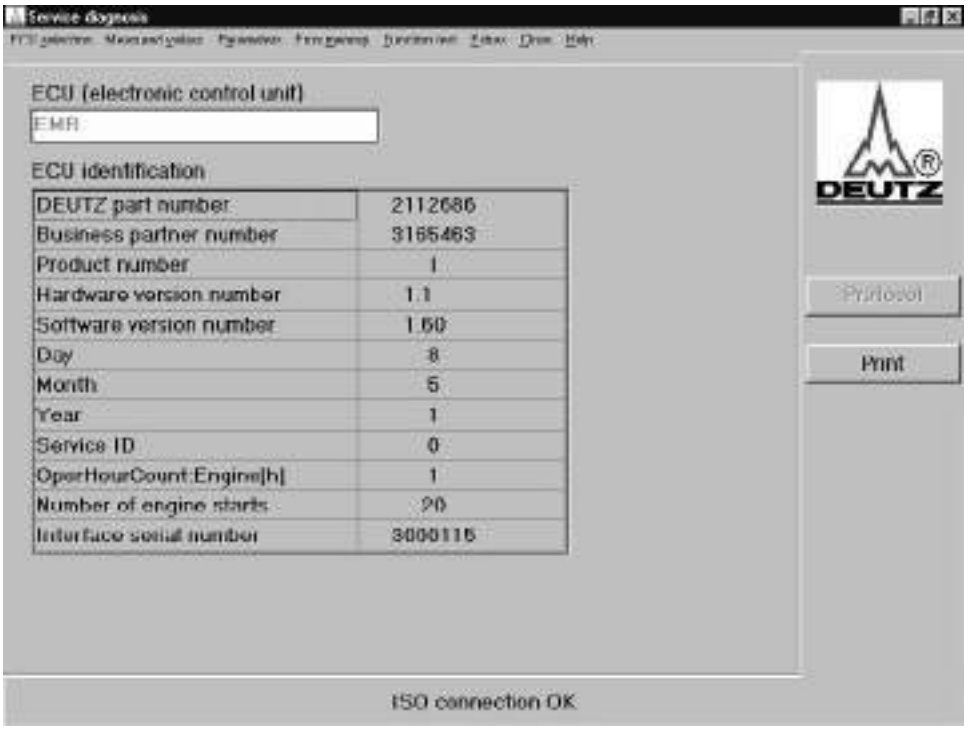


1.6.1 ESTABLISHING COMMUNICATION WITH THE ECU

Automatic recognition (identification) of the ECU can take up to 60 seconds as the program checks out all the possible interfaces and ECUs one after the other.

- If no ECU or interface is connected, SERDIA will operate in offline mode, see Chapter 1.7.2 DEMO mode.
- If communication with the ECU cannot be established, the system issues an error message, see Chapter Error in establishing the communication link.

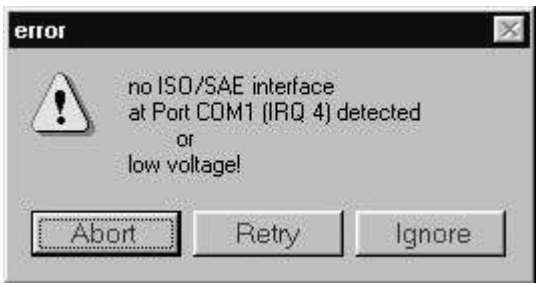
Once communication has been successfully established, the main screen "Diagnostics service" is displayed with the fields "ECU (electronic control unit)" and "ECU identification". This main screen contains a predefined selection menu.



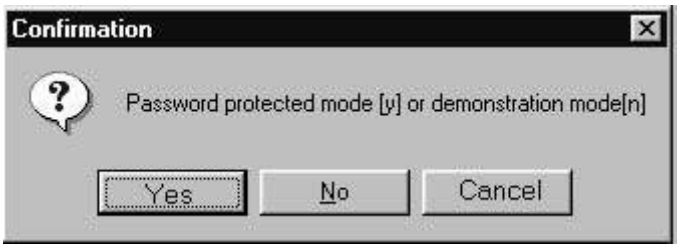
1.7 OFFLINE MODE

If no ECU/engine and/or interface is available, SERDIA can be operated for training purposes in the password-protected mode or in the DEMO mode.

The password-protected mode and the DEMO mode are always offered by SERDIA if no successful establishment of communications has been reported.



Click on "**Ignore**". The desired mode is selected in the "Confirm" window.



1.7.1 PASSWORD-PROTECTED MODE

If "Yes" is selected in the "Confirm" window, authorized users can enter a password (inquiries at head office) and then read and print out configuration files without an ECU. However, they cannot alter the files.

1.7.2 DEMO MODE (TRAINING WITHOUT ECU)

If "No" is selected in the "Confirm" window, the user reaches the DEMO mode.

1 - Here, handling of SERDIA can be practiced, without actual figures.

2 - Stored graphics can be read and printed out, provided that the graphics were stored in binary format (file-name extension ".egr"). See 3.1.2 Graphics.

ATTENTION!

It is not possible to carry out function tests covering the functioning of the ECU.

1.8 WORKING WITH THE PROGRAM

Brief description:

1) Call SERDIA under Windows
2) Click on ECU selection in the SERDIA main screen
3) Select the ECU you require in the screen "ECU selection"
4) Select the menu point you require in the SERDIA main screen

1.8.1 MAIN SCREEN, MENU SELECTION

A predefined selection menu is displayed in the main screen. Brief description of the buttons:

Menu point	ECUs	Explanation
ECU selection	All	Selection of the required ECU. (Only one ECU can be selected at any time)
Aktuelle Actual measured values	All	Display of current actual values (also if engine not in operation, but in this case with U-Blatt)
RAM values		Only for level III
Data logger	EMS Only	Display recorder contents
Input/output assignment	All	Assignment of the signals used to the ECU pins
CAN-Status		
Parameters		
Configuration	All	Read and update configuration data
Overall programming	EMR, EMS	
Calibration	All	Calibration of measured value sensor, e.g. accelerator pedal sensor
Error memory		
Error memory	All	Copy, display and delete error memory
Function test	EMR Only	Operate actuator
Extras		
Maximum speed	EMR Only	Selection of three different maximum speeds
Logistic data	All	
Load spectrum	EMS Only	
Maintenance interval exceeded	EMS Only	
Override memory	EMS Only	
Help	All	General help for the main screen and the associated buttons

1.8.2 MENU POINT "ECU SELECTION”

It may be the case that one DEUTZ engine is fitted with one or several ECUs (e.g. the combination of MVS with EMS). However, SERDIA can only communicate with one ECU.

Exception: It is also possible for the list of errors to be read via EMS, and measured values can be read from the MVS.

You must therefore first select the ECU you require from the menu point 'ECU selection'.

For more details, please see Chapter 2, ECU selection.

1.8.3 MENU POINT "MEASURED VALUES” ("ACTUAL MEASURED VALUES")

Selection and display of measured values is also possible from a list of measured values (including input and output values).

Displayed measured values that have exceeded an upper or lower value (if applicable) are stored in color.
Only those measuring points that are appropriate to the ECU are displayed in sequence, differentiated by the following:

- read measured values
- read ejectronics measured values
- read mcorter data (EMS speda menu)

displayed by:

- designation
- value
- unit

The measured values are rerreshed after a predefined sensor rate. They can be displayed with the engine shut down as well as with the engine in operation.
For rnore information, please see Chapter 3. Meas,ed values.

1.8.4 MENU POINT "PARAMETERS"

The wide range of possibilities open to you with DEUIZ ECUs means that very specit\c programrning IS requireci in accordance with each indivtdual applicauon case Changes to parametrization beconne necessary if:

- custonner requiremenis
- abaptation to locai requirements
- replacement installation

The pararneters can only be changed with SERDIA!
This menu point also does away with the neecl br screwdriver setting, as is necessary with analog ECUs. Individuai parameters (such as dynamic go~ernor characteristics) can uso LE changed 'nithin predefsned limits. Parametrization is carried out in two separate screens, one for configuration and one for calibration. Access to the flelds in the various screens is controlled from the user level. Fields for which no access authorization exists are not displayed. It is even possible to swap over entire blocks or parameters from this function field in order to create variants.
For more information. please see Chapter 4, Parameters..

1.8.5 MENU POINT "ECU SELECTION”

The error messages stored in the ECUs can be read from this menu point.
Error messages refer solely to the electrical parts of the engine system, such as the cable harness and the measured value sensors.
An error message may take the form of: "Broken cable or short-circuit".
Only passive error messages can be cleared, active messages are retained. When the error is corrected, active error messages are changed into passive error messages. The error message will be retained even if you disconnect the battery/ power supply.
Error messages display information on

- error location
- type of error
- total number of errors (at the error locations)
- frequency
- error status (active / passive)
- environment data at the time the error was detected.

SERDIA provides help in remedying defects; you may also find it useful to consult the menu points "Measured values" and "Function test". For more information, please see Chapter 5, Error memory.

1.8.6 MENU POINT "FUNCTION TEST"

SERDIA supports a wide range of function tests, distinguishing between the various actuators (e.g. actuator test for EMR).

Functional checks are a particular help when investigating defects and carrying out maintenance work.

For instance, it is possible to activate and check individual actuator outputs. To carry out this work, you must switch over to test mode.

Before doing so, the engine must be shut down!

During a function test, the actuators are activated by the tester program while the engine is shut down.

You switch the actuators on and off by clicking on the check box next to the actuator designation in the "setpoint" column. The reaction of the actuator status triggered by the ECU is displayed under the actual value.

The actuator statuses are always controlled in the ECU. This control function can only be transferred to SERDIA by the ECU, i.e. if the required actual value is not produced, this is probably due to a wiring error. It can then be helpful to make use of the combination of the menu points "Error message" and "Function test" in order to track down the cause.

For further information about function testing, please see Chapter 6, Function test".

1.8.7 MENU POINT "EXTRAS"

SERDIA supports a large number of Extra points; these differ from ECU to ECU. To access these Extra points, you must call up the sub-menu points, each of which will lead you to its own screen:

- Maximum speed
- Logistics data
- Load spectrum
- Maintenance interval exceeded
- Override memory

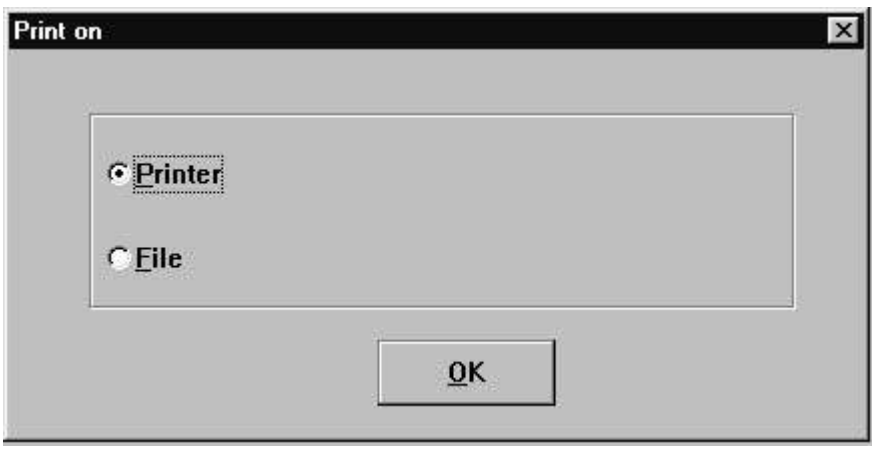
For more information, please see Chapter 7, Extras.

1.8.8 Help

In addition to these operating instructions, you may find it useful to consult the on-line "Help" provided by the SERDIA program. I.e., click on the button "Help" under Windows.

1.9 PRINT (OUTPUT)

The data for identifying the ECU, and also the data in other windows, can be issued in two different ways.



1) As a printout. A suitable printer driver has to be selected under Windows. At the top of all printouts, the logistical data appear:

- Type of ECU
- Date and time
- Interface serial number
- Engine number
- Part number functional data set
- Number of operating hours

2) The ECU data can also be stored as a file. This file can be further processed in Excel.

The following table gives an overview of the possibilities for storing data from the various screens:

- as printable files for further processing, e.g. in Excel
- as configuration files to report changes
- as a graphic file (*.egr) readable in the SERDIA demo mode.

From screen	Button	Extension	Notes
Service Diagnosis	Print (File)	*. Ecu	for further processing, e.g. in Excel
Actual measured values	File	*. Msw	for further processing, e.g. in Excel
Graphics	(ASCII)	*. Agr	for further processing, e.g. in Excel
Graphics	(binario)	*. Egr	readable in the SERDIA demo mode
Input/output assignment	Print (File)	*. Ino	for further processing, e.g. in Excel
Configuration	Print (File)	*. Kfg	for further processing, e.g. in Excel
Configuration	Save in file	*. Hex	Configuration file (partial data set, level-dependent)
Overall programming	ECU -> File	*. Hex	Configuration file (complete data set, Level III and IIia)
Error memory	Print (File)	*. Err	for further processing, e.g. in Excel
Logistical data	Print (File)	*. Dat	for further processing, e.g. in Excel

1.10 PROTOCOL (PROTOKOLL)

This switch is only provided within the scope of development for configuration of the interface.

1.11 END COMMUNICATION

1.11.1 PROGRAM END

Before you disconnect the notebook from the engine ECU, you should return to the main menu and click on "Close".

If you have modified any parameters, in many cases it is worth checking the current parametrization, for safety's sake. Proceed by carrying out the following steps:

1. End SERDIA
2. Switch off engine power supply, and then switch on again
3. Start SERDIA again
4. Re-activate the ECU
5. Activate the menu point “Parameters”
6. Click on -> PC” (“SG -> PC”) in the configuration screen.
7. To print out the configuration data, press "Print" (“Print ON”).
8. File the printout with the engine documentation

1.11.2 DISCONNECTING THE ECU

You should only disconnect the engine ECU from the notebook (i.e. interface with cable) after you have left the program SERDIA by pressing "Close".

2. ECU SELECTION

2.1 GENERAL

DEUTZ engines may be equipped with one or several ECUs (e.g. the combination MVS with EMS). SERDIA, however, can only communicate with one ECU. Exception: the error list can also be read from the MVS ECU via EMS.

It is therefore necessary to first select the desired ECU from the menu poin "ECU selection".

Recognition of the different ECUs is managed by SERDIA for the user.

Possible ECUs:

EMR (Electronic Engine Governor)

MVS (Magnetic Valve System)

EMS (Engine-Monitoring System)

2.2 RECOGNITION OF ECUS

SERDIA automatically assists recognition of the connected ECUs upon program start. Identification may take up to 60 seconds as the possible interfaces and ECUs have to be polled one after the other.

Following successful recognition the ECU selection screen is automatically overlayed. Only the recognized ECUs are offered for selection. The ECUS which are not selectable are marked by a grey font.

2.3 IDENTIFICATION DATA

2.3.1 EMR IDENTIFICATION

- Meaning of data displayed: **DEUTZ part number**.
- **Product number:** Type of selected ECU: 1 = EMR - 2 = MVS - 3 = EMS
- **Hardware version number:** This number indicates the development status of the ECU.
- **Software version number:** Number of the EEPROM contained in the ECU. If the digit left from the decimal changes (e.g. from 2.1 to 3,1), the data set does no longer suit the ECU. In this case it is necessary to consult the headquarters.
- **Day, month, year:** Date of the latest parameterization on the ECU.
- **Service ID:** Serial number of the interface used for the previous access. The leading digit indicates the access level.
- **Interface serial number:** Serial number of the currently used interface.

3 MEASURED VALUES

3.1 ACTUAL MEASURED VALUES (GENERAL)

The measured values are read cyclically and displayed on the screen "actual measured values"..

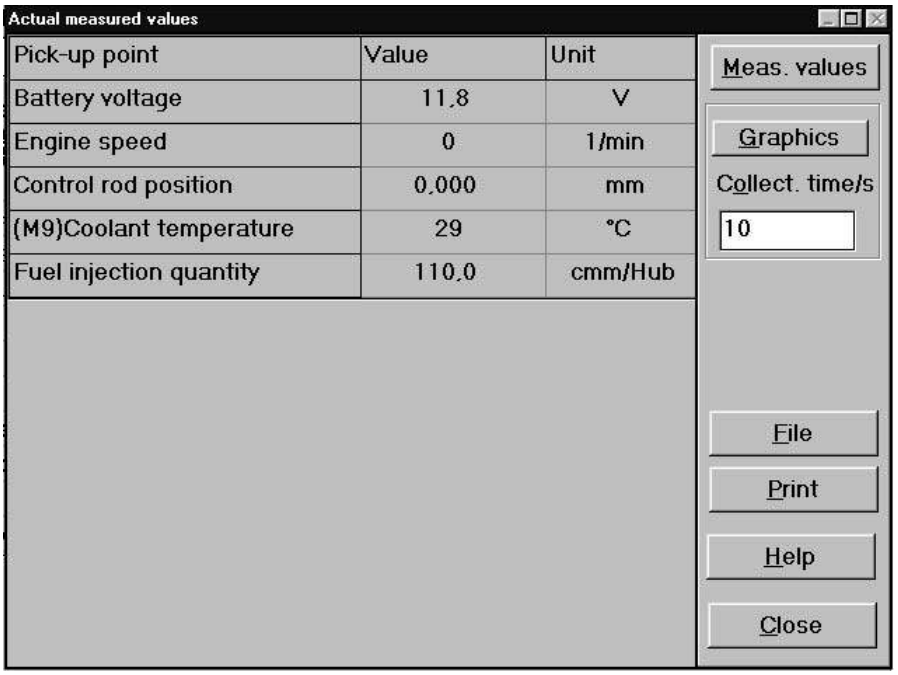


Figure: Current measured values of the EMR

ATTENTION!

Values beyond the sensor measuring range are underlayed in colour:

- **yellow: above measuring range,**
- **blue: below measuring range.**

De.scription of keys:

Meas. values: ("Actual measured values"):

The window "Measured value selection" is displayed with all measured values available. Measured values to be displayed can be selected there. In general, the repeat rate of display is increased through a reduced number of measured values to be displayed. The possible measured values available may vary according to the type of the ECU.

Graphics:

The "Graphics" switch is used to display the pattern over time of the selected measured variables (maximum 5). If more than 5 variables are selected, an error message appears.

Collect, time:
The duration of the recording appears in the field ”Collect. time”, in seconds. The lowest value for the dura-tion of recording is one second. The upper measurement time can be entered as several hours (expressed in seconds). The basic setting is 10 s. The shortest scanning rate is:

- 40 ms for RAM values
- 60 ms for the other values.

A measurement duration of 10 s gives

- 250 measuring points (10000 ms / 40 ms) with RAM values
- 166 measuring points (10000 ms / 60 ms) with the other values.

Since the program can cover a maximum of approximately 2000 measuring points, before data recording starts the scanning rate is adjusted automatically as necessary.
The lowest possible scanning rate is determined by the duration of the data transfer from the ECU to the PC. The more variables are to be displayed at the same time, the longer the data transfer will take and the lower the scanning rate will be.

File: The current measured values can be stored in a file and reloaded later, for example for further processing in Excel.

Print: The displayed measured values are printed.

Close: Return to the main window "Service diagnosis".

3.1.1 MEASURED VALUE SELECTION

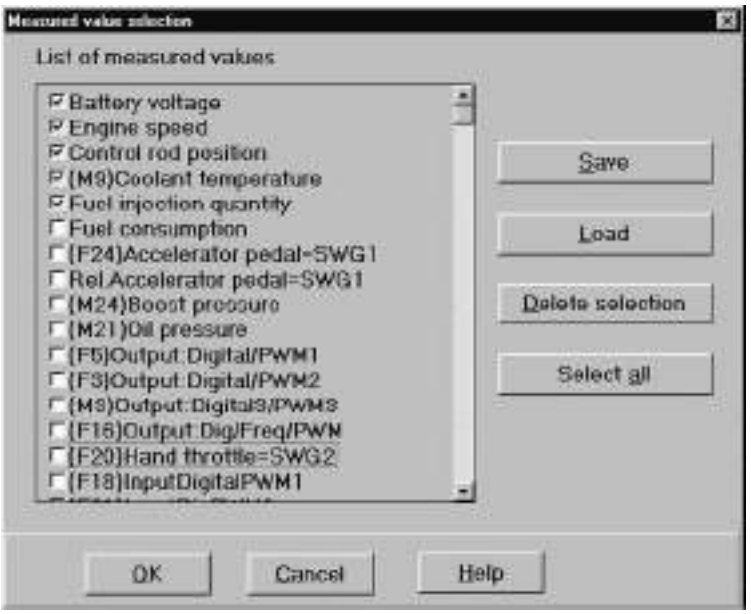


Figure: Measured value selection EMR

In this list you can activate or deactivate measured values for display. You can activate and deactivate individual values by clicking on the check box; alternatively you select all the values by using one of the switches described below.

Save: The measured values displayed are saved to a file.

Load: A selected measured value is entered from a file.

Delete selection: All measured values are deactivated for display.

Select all: All measured values are activated for display.

OK: The updated measured value selection is adopted and the program returns to a display of the current measured values.

Cancel: The program returns to a display of the current measured values. Updates to the measured value selection are rejected.

3.1.1.1 MEASURED VALUES EMR

The following table gives an overview of the measured values which can be displayed. Some parameters require configuration for that purpose (see Chapter 4 Parameters), in which case specific measuring points may be assigned to the inputs and outputs of the EMR (Menu "Configuration", page 11: assignment inputs/ measured values and page 13: assignment outputs/measured values). The values required for the parameter configuration are given in the table. The assignment can be checked in the menu "Measured values" with the window "Display of inputs and outputs" (see 3.4 Input/ output assignment).

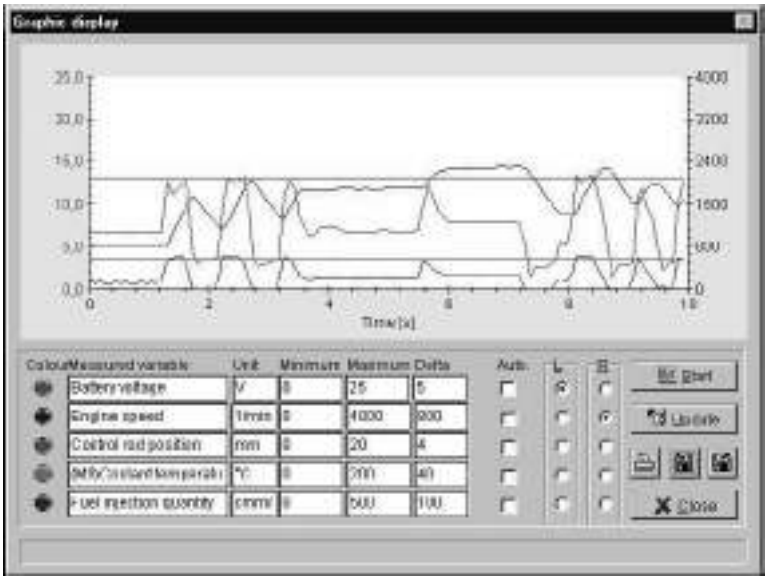
Measured value selection

Meas. point designation	Unit	Description	Configuration parameter ✻	Parameter value
Battery voltage	V	Battery voltage	-	-
Engine speed	1/min	Engine speed 1 (camshaft) Engine speed 2 (crankshaft)	Ass(F1 6)Out/Dig/PWM/Freq	2000 2002
Control rod position	mm	Control rod position	-	-
(M9)Cooiant temperature	°C	Coolant temperature	Ass(M9)Analnp3(CoolTemp)	3551
Fuel injection quantity	cmm/ Hub	Fuel injection quantity	-	-
Fuel consumption	l/h	Fuel consumption	-	-
(F24)Accelerator pedal =SWG1	V	Accelerator pedal voltage	Ass(F24)Analnp1 (Pedal)	3511
Rel. Accelerator pedal = SWG1	%	Scanning pos. acceleratorpoti	Ass(F24)Analnp1 (Pedal)	3511
(M24)Boost pressure	bar	Boost pressure	Ass(M24)Analnp2(boostPr)	3531
(M21)Oil pressure	bar	Oil pressure	Ass(M21)Analnp4 (OilPress)	3541
(F5)Output:Digital/PWM1	%	Torque	Ass(F5)Out/Dig/PWM1	2701
(F3)Output: Digita l/PWM2	%	Alarm signal oil pressure	Ass(F3)Out/Dig/PWM2	3011
(M3)Output:Digital3/PWM3	%	Reserve		
(F16)Output:Dig/Freq/PWM	%	Engine speed 1 Engine speed2	Ass(F1 6)Out/Dig/PWM/Freq	2000 2002
(F20)Hand throttle =SWG2		Hand throttle	Ass(F20)DigAnalnp(H.thr.)	3521
(F18)Input:Digital/PWM1	%			
(F21)Input:Digital/PWM2	%			
(F19)Input:Digital	%			
Outp:0,0,0,0,0,M2, F15,F4(LSB)		Summary outputs		
Selector switch		Selector switch		
Vehicle speed	km/h	Vehicle speed		

✻ See also table with configurable parameters in Chapter 4 Parameters.

3.1.2 GRAPHICS

Once any desired measured values are selected, up to a maximum of 5, the window "Graphic display" can be opened by clicking on "Graphics".



The measured values are represented inside the display range (minimum to maximum). The scaling steps for the axes are set in the column "Delta". By activating the control field "Auto", it is possible to have the program carry out scaling automatically. Since the program carries out this scaling taking into account the minimum and maximum values for the variables concerned, it is not possible to have automatic scaling with variables which are constant in time. A maximum of two axes, one on the left and one on the right side of the display area, are shown.

In the columns L (left) and R (right) a representation of an axis can be assigned to a measured variable.

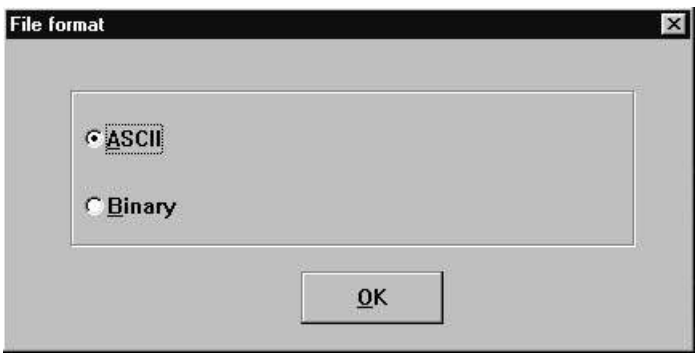
EXPLANATION OF THE FUNCTION SWITCHES:

START: This function switch is used to start recording of the data.

UPDATE: This function switch is used to update the displayed information. This is necessary if there has been a change in the minimum, maximum or delta values. The update process takes the new values into account.

PRINT ON: By clicking on this switch the transmission to a printer is started. First the printer selection appears, then a comment can be inserted if desired, and then printing starts.

SAVE: The Information from the representation displayed can be saved in a file in two different ways:



- As an ASCII file ('.agr) for further processing in Excel
- As a binary file (*.egr) to represent measurement graphics in OFFLINE mode. See 1.7 Offline mode.

The graphics information saved in a file is read in and displayed.

3.2 RAM VALUES

Access to the RAM values is not possible for Level III.

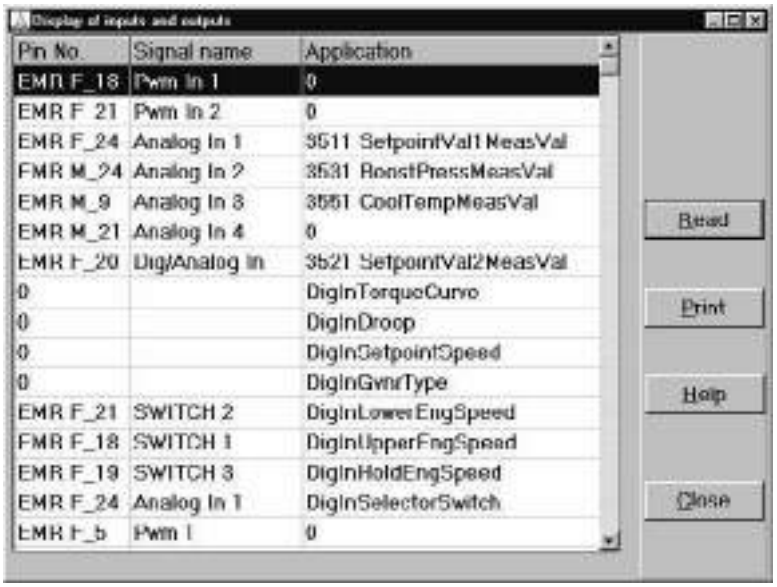
3.3 DATA LOGGER (ONLY EMS)

The screen of this menu point is only selectable when an EMS ECU has been selected.

3.4 INPUT/OUTPUT ASSIGNMENT

Inputs and outputs can be configured. This item in the menu displays the current input and output status.

Restriction: Only applies for EMS and EMR ECUs.



3.5 CAN-Status

This window displays the CAN bus activities of the EMR.

Sent: Contains the information Can: TxCounter (0 to 65535, word). The value is increased with each CAN sending message and indicates the sending activity of the EMR.

Received: Contains the information Can: RxIrCounter (0 to 65535, word). The values is increased with each CAN sending message and indicates the sending activity of the EMR.

Bus Off: Counter that indicates how often the EMR has separated from the CAN bus because of constant errors (CanBusOffCounter 0 to 255, byte).toma

Status: CanOnline indicates whether the EMR is active on the CAN bus. Via the ISO 9141 interface a value 1 is sent for online and a value 0 for offline. The program SERDIA displays the text "online" (for value 1) or "offline" (for value 0).

Phase: The variable CanSetPointPhase (0 to 255, byte) is sent via the ISO 9141 interface. This variable displays the procedure with regard to time of the setpoint assignments:

Phase	Text
0	0: Engine standstill, Initialization
1	1: Engine standstill, phase! , no CAN error
2	2: Engine standstill, phase2, CAN timeout error
3	3: Engine start, ... until idling speed is recognized
4	4: Engine runs, wait for CAN setpoint
5	5: Engine runs, setpoint preset via CAN is allright
6	6: Engine runs, emergency op., setpoint preset via CAN failed
7	7: This phase doesn't exist

Error information: The EMR sends an error number CanErrorNumber (0 to 255, byte) specifically for CAN bus errors via the-ISO 9141 interface. A text is assigned in SERDIA to these numbers, which is displayed in the window of the CAN interface.

Code	Text
0	0: No fault existing
1	1: Message request not received bei controller object 15
2	2: Invalid controller object
3	3: controller object multi assignment
4	4: CAN active, but no message activated
5	5: Diagnosis object not activated
6	6: Scan rate 0 in diagnosis message
7	7: Scan rate 0 in measure value telegram
8	8: preset engine speed config.6 does not match TSC2 activation
9	9: TSC1 activated, but 'Setpoint eng. speed not set to 6’
10	10: ”GovernConf=6,neither TSC1 nor function shift is activated
11	11: GovernConf=6 & Setp.eng.speed=6', but TSC1 is not activated
12	12: TSC1 activated, but Governor config!=6
13	13: TSC1NotAct&FunctShiftAct& GovernConf.!=6 => ShiftMGovernMode!=0
14	14: TSC1Act&FunctShiftAct&GovernConf.=6'=--'ShiftMaskGovernMode!=0
100	100 Receipt message failed
101	101 Setpoint telegram failed w.eng.idle (repl, value)
102	102 Setpoint telegram missing w.eng.idle due to low battery voltage
103	103 Setpoint telegram missing after eng.start due to low battery
104	104 Setpoint telegram missing after eng,start, repl.value used
105	105 Setpoint telegram missing during eng.open, repl.value used

Time-Out errors of receipt messages require special handling. All of these are reported with an error number

To identify which message causes a Time-Out error, SERDIA proceeds as follows:

- CanRxObjActive indicates the active, i.e. actually received messages in bits.
- CanConf_bits contains the configured receipt messages in bits.

SERDIA negates CanRxObjActive in bits (inactive message) and then performs an AND combination with CanConf_bits in bits. As result one obtains in bits the receipt messages which are configured and inactive (CanRxTimeOutBits).

A text is assigned to each bit of CanRxTimeOutBits, which represents the name of the relevant receipt messages. As not all bits may be used, it is defined in the text by entering "dc" for "don't care" that the text output is suppressed for this bit.

If the text "100 Receipt message failed" is displayed, there is an additional text output of the list of missing receipt messages.

3.6 EXAMPLE OF A DISPLAYED ERROR INFORMATION:

100 Receipt message failed
Engine Temperature
Engine Fluid Level
Pressure Function shift
Inlet / Exhaust Conditions

VanRxTimeOutBit	Text
0	Engine Temperature
1	Inlet / Exhaust Conditions
2	Engine Fluid Level /Pressure
3	TSC1
4	Engine protection
5	Function shift
6	Dc
7	Dc
8	Dc
9	Dc
10	Dc
11	Dc
12	Dc
13	Dc
14	Dc
15	Dc

4. PARAMETERS

4.1 CONFIGURATION

Via the menu item "Parameters" in the menu bar, you get to the "Configuration" screen. The configuration procedure is as follows:

- Scroll with keys "Next" and "Previous" to the page which contains the Parameter to be set (example: "AccPedal (SWG1)up. ref" on page 10: Setpoint gen. calibration values).
- Click on the field "New value" and enter the necessary numerical value. This must be between the indicated minimum and maximum.
- Click on "PC->ECU". All configuration data is transmitted to the ECU.
  The data is now incorporated in the ECU and can be used for testing the engine setting. It is however lost upon shutting off the supply voltage.
- Save data record with the key "Save in ECU" (old data is overwritten).
- For checking purposes the data can be read out and displayed with the key "ECU->PC".
- Following satisfactory engine run the data record can be saved with the "Save in file" key on the hard disc or on a diskette.

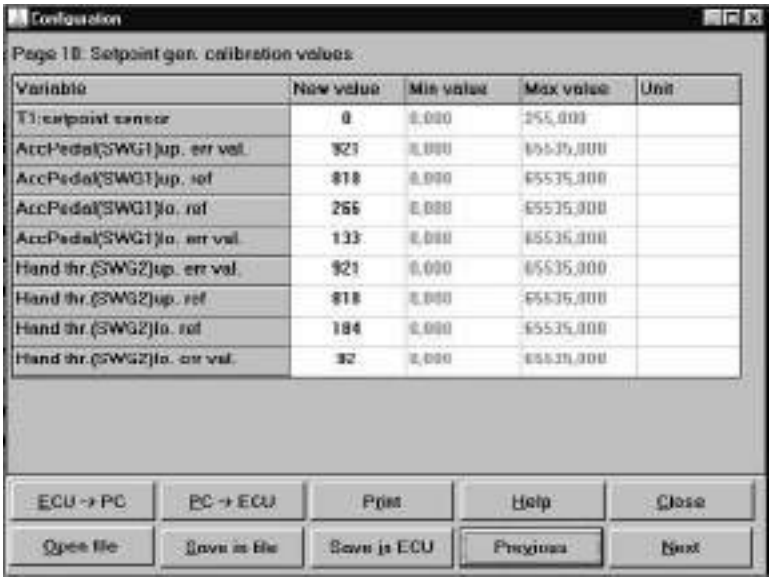


Figure: Example of a choice of configuration parameters.

EXPLANATION OF THE FUNCTION SWITCH

ECU->PC: The configuration data is read from the ECU and is displayed.

PC->ECU: Updated configuration data is uploaded to the ECU. In order for the uploaded data to be permanent, you must activate the "Save in ECU" switch for the ECU.

Open file: The configuration data is read and displayed from a hex file.

Save in file: The configuration data is saved in a hex file.
The engine number will be suggested as file name for storage on from SERDIA 2.5. This suggestion is not compulsive; other file names may be chosen nevertheless.
Then confirm with OK. The file (i.e. the engine data record) is then saved under the name <Engine number> hex.

Save in ECU (applies for EMR only): The configuration data are permanently saved in the ECU. changes to the configuration have to be reported!

ATTENTION!

- **All changes to the configuration have to be reported!**
- **The reporting procedure is described in Service Bulletin 0199-99-9287.**

Previous: The reporting procedure is described in Service Bulletin 0199-99-9287**.**

Next: Displays data for the next screen page.

Print ON: A print-out is made of the configuration data currently displayed.

4.1.1 EMR

.

1 - The following table gives an overview of the possible configuration parameters.
2 - Settings that cannot be made while the engine is running are identified by the message ”Stop engine”
3 - SERDIA only displays one page at a time.

EMR PARAMETERS CONFIGURABLE WITH LEVEL III

MK 3	TTG	Parameter	Unit	Min.	Max.	typ Wert	Description
Page 1: General overview							
		Engine serial number		0	$4{,}2x10^9$	12345678	8 digits
		Number of cylinders		4	8		ace. to engine type
		No. of teeth eng. speed 2	48 1013 44 1012	18	200	129	
		PassLevel 1 (OEM)		0	$4{,}2x10^9$		
		PassLevel 2 (Service)		0	$4{,}2x10^9$		
Page 2: Only for BOSCH EDO inline pumps							
		RefVal.EDC RackPos 20 mm		0	65535	4000	
		RefVal.EDC RackPos. 0 mm		0	65535	1800	
		RefVal.EDCValueRefCoil		0	65535	1800	
		AutoCalib:Current	%	0	100	78,2	
		AutoCalib:WaitingTime	s	0	100	1,0	
Page 3: Engine speed settings							
		Idling speed	1/min	500	4000	770	Idling speed engine (< rated speed)
		Fixed eng. speed 1	1/min	500	4000	1000	Fixed speed setpoint 1
		Fixed eng. speed 2	1/min	500	4000	1000	Rated speed engine
		Rated speed	1/min	500	4000	2300	Fixed speed setpoint 2
		Rated speed limp home	1/min	500	4000	2000	Rated speed upon failure of speed sensor 1
		Overspeed	1/min	500	4000	3000	Limit overspeed
		Recov. speed overrun	1/min	500	4000	2000	Reset limit overspeed
		average:0=1 turn, 1=2 turns		0	1	0	Average speed smoothing
Page 4: Speed governor							
		SpeedGvnr: P part	%	0	100	18/4,0	Gain factor P part (genset/automotive)
		SpeedGvnr: I part	%	0	100	10/10,0	Gain factor I part (genset/automotive.)
		SpeedGvnr: D part	%	0	100	10/5,0	Gain factor D part (genset/automotive)
		SpeedGvnr: damping	%	0	100	90/65,1	Damping factor w. minor speed fluctuation (genset. /automotive)
		SpeedGvnr: damping range	1/min	0	100	15/80,0	Speed governor: damping range (gensets/ automotive)
		Engine speed ramp down	1/min/s	0	10000	100	Max. contr. speed setpoint speed ramp down
		Engine speed ramp up	1/min/s	0	10000	10,1	Max. contr. speed setpoint speed ramp up

MK 3	TTG	Parameter	Unit	Min.	Max.	typ Wert	Description
Page 5: Position governor							
Only change the following 10 parameters in consultation with the head office							
		Posgvnr: P part	%	0	100	10	Gain factor P part
		Posgvnr: 1 part	%	0	100	5	Gain factor I part
		Posgvnr: D part	%	0	100	5	Gain factor D part
		Posgvnr: DT2 part	%	0	100	10	Gain factor DT2 part
		Posgvnr: Gain	%	100	200	180,1	Gain factor with minor speed fluctuation
		Posgvnr: gain range	mm	0	1	0,25	Gain fluctuation range for gain factor
		QuickCurrentDecSteepness	1/min	0	65535	40000	
		QuickCurrentDecTime	ms	0	65535	50	
Page 6: Functions							
		Assign config. top curve		0	2	0	Torque curve variants (2 variants∗), Perm, values: 0 = torque curve 1 1 = Switching betw. torque curves 1+2
		Ass spec. eng. speed config		0	6	0	Setpoint eng. speed values (6 variants ∗) Perm, values: 0 = Only variable speed governing 1 = Switching betw. eng. speeds 1 and 2 2 = Switching betw. fixed / variable speed 3, 4 = Switching betw.speed variable / save: (3 = w. setp.speed, 4 = w. actual speed) 5 = two setpoint transmitters
		Ass droop config		0	3	0	Speed droop selection (4 variants∗) Perm, values: 0 = constant speed droop 1 = variable speed droop 2 = switching between speed droop 1 and 2 3 = switching betw.const. / variable speed droop
		Ass governor config		0	6	0	Type of governing (4 variants∗) Perm, values: 0 = Variable-speed governing 1 = Min-max-speed governing 2 = Switching betw.var./min.-max. speed governingx
For the following 14 functions: On = 1, Off = 0							
		BoostPressSim (on/off)		0	1	0	Boost pressure simulation
		BoostPressMeas (on/off)		0	1	1	Boost pressure measurement
		EngSpeed sensor2 (on/off)		0	1	0	Redundant eng. speed sensing
		VehSpeedLimit (on/off)		0	1	1	Veh. speed limit
		CylinderShutoff (on/off)		0	1	1	Overrun cond. with overspeed
		LimpHomeOper		0	1	0	Limp-home upon control rod travel sensor failure
		Torque Indicator(on/off)		0	1	1	Torque computation (off: referred to torque curve, on: torque curve point)
		SAME Output (on/off)		0	1	0	Customer-specific output function
		QuickCurrentDec (on/off)		0	1	0	
		BOSCH EDC inline p. (on/off)		0	1	0	
		TempMonitoring (on/off)		0	1	0	Temperature monitoring
		OilPressMon(on/off)		0	1	0	Oil pressure monitoring

MK 3	TTG	Parameter	Unit	Min.	Max.	typ Wert	Description
Page 7: Monitoring							
		CoolTempMon.: ShutoffValue	°C	-30	130	118	Limit engine shutoff (130° = none)
		CoolTempMon.: Shutoff Delay	s	0	600	0	Time delay engine shutoff
		CoolTempMon.: RecovValue	°C	-30	130	110,0	Reset limit
		CoolTempMon.: Fuel qty red.	%	0	100	20	Fuel inj. quantity reduction (0% = none)
		CoolTempMon.: Red. delay	s	0	600	15	Time delay fuel inj.quantity reduction
		CoolTempMon.: Alarm limit	°C	-30	130	113	Limit alarm
		OilPrMonitor: shutoff fact	%	0	100	80	Factor for limit engine shutoff (0% = none)
		OilPrMonitor: shutoff delay	%	0	100	20	Time delay engine shutoff
		OilPrMonitor: recov fact	%	0	100	20	Factor for reset value
		OilPrMon.: Power Red. delay	s	0	600	15	Time delay fuel inj. quantity reduction
		Engine speed position valuesp	1/min			500...2600	8 Engine speed values
		Oil pressure warning	bar			0...0,5	Oil pressure warning limit=fct(speed)
Page 9: Sensor calibration values							
The following values are dependent only on the type of sensor used and consequently do not generally need to be changed.							
		BPSensor: upper err limit	digits	0	1023	820	Boost pr. sensor: upper failure trigger point
		BPSensor: upper ref (2 bar)	digits	0	1023	454	Boost pr. sensor: voltage at 2 bar
		BPSensor: lower ref (1 bar)	digits	0	1023	219	Boost pr. sensor: voltage at 1 bar
		BPSensor: lower err limit	digits	0	1023	60	Boost.pr. sensor: lower failure trigger point
		OilPrSens.:upper err limit	digits		1023	820	Oil pr. sensor: upper failure trigger point
		OilPrSens.:upper ref (5 bar)	digits	0	1023	511	Oil pr. sensor: voltage at 5 bar
		OilPrSens.:lower ref (0 bar)	digits	0	1023	102	Oil pr. sensor: voltage at 0 bar
		OilPrSens.:lower err limit	digits	0	1023	40	Oil pr. sensor: lower failure trigger point
		CoolTempSens.:up. err limit	digits	0	1023	1020	Coolant temp. sensor: upper failure trigger point
		CoolTempSens.:lo. err limit	digits	0	1023	10	Coolant temp. sensor: lower failure trigger point
		LowerMapBranch TempSensor	digits	0		26...394	4 values
		UpperMapBranch TempSensor.	digits			64...838	6 values
Page 10: Setpoint gen. calibration values							
		T1:setpoint sensor		0	255	2	Smoothing time constant SWG
The following 8 parameters can be set with the menu ”Calibration”, see 4.3. - *SWG = setpoint sensor							
		AccPedal(SWG1)up. err val.	digits	0	65535	963	SWG1: upper failure trigger point
		AccPedal(SWG1)up. ref.	digits	0	65535	922	SWG1: voltage max. position
		AccPedal(SWG1)lo. ref.	digits	0	65535	103	SWG1: voltage min. position
		AccPedal(SWG1)lo. err val.	digits	0	65535	62	SWG1: lower failure trigger point
		Hand thr. (SWG2)up. err val.	digits	0	65535	961	SWG2: upper failure trigger point
		Hand thr. (SWG2)up. ref.	digits	0	65535	830	SWG2: voltage max. position
		Hand thr. (SWG2)lo. ref.	digits	0	65535	190	SWG2: voltage min. position
		Hand thr. (SWG2)lo. err val.	digits	0	65535	61	SWG2: lower failure trigger point

MK 3	TTG	Parameter	Unit	Min.	Max.	typ Wert	Description
Page 11: Assignment inputs/measured values							
		Ass (F18) Inp/PWM1		0	3999	1	(F18) Input: Digital / PWM 1 (PWM setpoint)
		Ass (F21) Inp/PWM2		0	3999	2	(F21) Input: Digital / PWM 2 (PWM setpoint alternate to F18)
		Ass (F24) AnaInp1 (Pedal)		0	3999	3511	(F24) Input: Analog 1 (accel.pr. sensor)
		Ass (M24) AnaInp2 (boostPr)		0	3999	3531	(M24) Input: Analog 2 (boost pr. sensor)
		Ass (M9) AnaInp3 (CoolTemp)		0	3999	3551	(M9) Input: Analog 3 (coolant temp. sensor)
		Ass (M21) AnaInp4 (OilPress)		0	3999	3541	(M21) Input: Analog 4 (oil pr. sensor)
		Ass (F20) DigAnaInp (H.thr.)		0	3999	3521	(F20) Input: Digital / Analog (hand throttle)
		Monitoring delay		0	50	1	ON delay of input monitoring
Page 12: Assignment switch inputs/functions							
		Max. 5 inputs can be assigned to the total of 7 switch inputs.	If the sign is changed, the switch positions (open/closed) are reversed. 1 = Input Digital / PWM 1 (Pin F18) 2 = Input Digital / PWM 2 (Pin F21) 3 = Input Digital (Pin F19) 4 = Input Digital / Analog (Pin F20) 5 = Input AnaInput4 (Pin M21) 6 = F3 is input (only for ECU 0211 2088) Example: AssInpTorque curve switching betw.1 / 2: Entry -3: At Input Pin F19 the torque curve can be switched: closed = torque curve 2 open = torque curve 1 Entry 3: At Input Pin F19 the torque curve can be switched: closed = torque curve 1 open = torque curve 2				
		AssInp:torque curve 1 or 2		-5	5	3	Switching between two torque curves
		AssInp:speed droop 1 or 2		-5	5	2	Switching between two fixed speed droops
		AssInp:speed specificationi		-5	5	1	Switching between two eng. speeds
		AssInp:governor type		-5	5	4	Switching between two governor types
		AssInp:lower engine speed		-5	5	0	Fixing lower eng. speed
		AssInp:upper engine speed		-5	5	0	Fixing upper eng. speed
		AssInp:hold engine speed		-5	5	0	Holding eng. speed
		AssInp:selector switch		-5	5	5	Selector switch
Page 13: Assignment outputs/measured values							
		PWMfreq. for all inp/outp	Hz	50	500	100	
		Ass (F16) Out/Dig/PWM/Freq		-3999	3999	2000	(F16) Output: Digital / PWM / Frequency (Eng. speed 1)
		Ass (F5) Out/Dig/PWM1		-3999	3999	2701	(F5) Output: Digital / PWM 1 (torque)
		Ass (F3) Out/Dig/PWM2		-3999	3999	3011	(F3) Output: Digital / PWM 2 (Warn.sign. KMT)
		Ass (M3) Out/Dig3/PWM3		-3999	3999	0	(M3) Output: Digital / PWM 3
		Ass (F4) OutputDig1		-3999	3999	3200	(F4) Output: Digital 1 (error pilot light)
		Zuw (F15) OutputDig2		-3999	3999	3013	(F15) Output: Digital 2 (Warn.sign. oil pr.)
		Zuw (M2) OutputDig3		-3999	3999	3201	(M2) Output: Digital 3 (solenoid)

MK 3	TTG	Parameter	Unit	Min.	Max.	typ Wert	Description
Page 14: Start behaviour and cold start aid							
		Starting fuel quantity	mm^3/ str.	0	200	110	Fuel quantity at start up to idling eng. speed. Applies to coolant temperature > 0°C
		Fuel quantity high idle	mm^3/ corsa	0	200	10	Fuel quantity at high idle
		Suction fuel quantity	mm^3/ str.	0	200	90	Initial injection quantity w. boost pressure simulation
		Overfueling		0	20	0	
		Overfueling recovery		0	25	0	
		Cold start fuel qty times	s	0	600	30	Cold start overfueling time
		Cold start overfueling	mm^3/ str.	0	50	20,01	Engine start overfueling for T < 0°C
		Eng.speed ramp cold start	1/min/s	5	250	100	Max. eng. speed ramp cold start
		Max. PreHeatTime	s	0	600	10	
		Min. PreHeatTime	s	0	600	0	
		ColdSt:PreHeatBackupTime	s	0	600	2	
		Max. PostHeatTime	s	0	600	10	
		Min. PostHeatTime	s	0	600	0	
		const. speed droop	°C	-30	130	0	
		CoStMaxHeat Temp(pre&post)	°C	-30	130	-30	
Page 16: Breakaway characteristics							
		const. speed droop 1	%	0	80	6	Speed droop 1
		const. speed droop 2	%	0	80	0	Speed droop 2
		Engine speed position values	1/min			600...20000	8 engine speed values
		Variable droop = fct(engine speed)	%				Speed droop=fct(engine speed)
Page 17: Speed-dependent PID control							
		Engine speed position values	1/min			600...2500	7 Engine speed values
		Quantity position values	mm^3/ Hub			0...100	4 fuel injection quantity values (ref. points)
		Speed governor: P map	%			100...200	P-Part=fct(eng.speed, fuel quantity) (28 values)
		RSpeed governor: I map	%			50...100	I-Part=fct(eng.speed, fuel quantity) (28 values)
		Speed governor: D map	%			25...400	D-Part=fct(eng.speed, fuel quantity) (28 values)
Page 18: Smoke limitation							
		Boost pressure position values	bar			4,0	4 Boost pressure values
		Engine speed position values	1/min			800...2000	5 Engine speed values
		fuel injection quantity limit.	mm^3/ corsa			68...104	Fuel injection quantity=fct(eng.speed,boost pressure) (20 values)
Page 19: Simulation of boost pressure sensor after failure							
		Eng. speed pos. values for boost pr. simul	1/mm			800...2500	8 Speed values
		fuel inj. qty limiting for boost pr. simul.	mm^3/ str.			20	Fuel inj. quantiy limitation =fct(eng.speed, time)
Page 20: Power parameters							
		Max. torque (fix)	Nm	0	64255	500	

MK 3	TTG	Parameter	Unit	Min.	Max.	typ Wert	Description
Page 21: Min/max speed governor							
		Engine speed position values	1/min			600...2500	5 Engine speed values
		AccelPos. Position pts	%			0...41	5 Setpoint generator
		DrivMap: injection qty	mm^3/ Hub			0...100	fuel inj. quantity=fct(eng.speed, Accel. pedal position) (25 values)
Page 22: Vehicle speed governor							
		Speed limiting	km/ora	0	300	40	Veh.speed limiting
		Tacho calibration	lmp/m	1	150	130	Tachometer constant
		VehSpeedLimit: P-factor	%	0	100	10	Governor parameter speed limit
		VehSpeedLimit: I-factor	%	0	100	10	Governor parameter speed limit
		VehSpeedLimit: D-factor	%	0	100	10	Governor parameter speed limit
		EngSpeed:TachometerFail.	1/min	500	4000	2000	Maximum permissible speed after tachometer fail
		Tacho Timeout	s	0	100	5	
		Max. consumption	l/ora	0	200	200	
Page 23: CAN, general settings							
		CAN bus (on/off)		0	1	0	
		CAN time out Mon (on/off)		0	1	0	
		CAN: EMR Adress					
		Can: Baud Rate	kBaud	0	255	0	
		Can:Start Time Out	s	0	100	10	
		Can: Rx Obj Mincount		0	255	4	
		Can: Low Voltage	V	0	66	9	
		Can: Volt Timeout	s	0	100	30	
		Can: Rx Obj Missing No		0	255	4	
		Can: Config Tel On		0	63	0	
		Can :Dia Tel On		0	2047	1961	
		Can: Meß Tel On		0	3	1	
		CAN-Sensor ON/OFF		0	65535		
		LC1: Eng Speed Ptl Ref)	1/min	1500	0	4000	
		LC1: Eng Speed Pt2 (Upper)	1/min	1500	0	4000	
		LC1: Eng Speed Pt3 (Lower)	1/min	1700	0	4000	
		LC2: Eng Speed Ptl (Ref)	1/min	0	0	4000	
		LC2: Eng Speed Pt2(Upper)	1/min	0	0	4000	
		LC2: Eng Speed Pt3(Lower)	1/min	0	0	4000	
Page 24: CAN: (7700)Rec/Send Telegr. Objects (controller setting)							
		Rec: EngineTemperature		0	15	0	
		Recilmake/ ExhaustCond		0	15	0	
		Rec: Eng Qii Level/ OilPres		0	15	0	
		Rec:TSC1		0	15	8	
		Rec: EMR Engine Protection		0	15	12	
		Rec: EMR function shift		0	15	0	

MK 3	TTG	Parameter	Unit	Min.	Max.	typ Wert	Description
		Rec: Request		0	15	15	
		Rec:Del. active errors		0	15	6	
		Rec:Del. error memory		0	15	7	
		Rec: free		0	15	0	
		Send:EEC1		0	15	1	
		Send;EEC2		0	15	2	
		Send: Meas Value Objeet		0	15	10	
		Send: Diagnosis Object		0	15	13	
		Send: Config Object.		0	15	0	
Page 25: CAN- (7720)Source Adr.Rec.messages							
		Engine temperature		0	255	0	
		Inlet/Exhaust conditions		0	255	0	
		Engine fluid level/pressure		0	255	0	
		TSC1		0	255	3	
		EMR: Engine protection		0	255	3	
		EMR function shift		0	255	0	
		Request		0	255	0	
		Del. active errorsi		0	255	3	
		Del. error memory		0	255	3	
		Free		0	255	0	
Page 26: CAN: (7850)Priorities: Object Telegr.							
		engine temperature		0	7	0	
		Inlet/Exhaust conditions		0	7	0	
		engine fluid level/pressure		0	7	0	
		TSC1		0	7	3	
		EMR:Engine protection		0	7	3	
		EMR function shift		0	7	0	
		Request		0	7	6	
		Del. active errors		0	7	6	
		Del. error memory		0	7	6	
		free		0	7	0	
		EEC1		0	7	3	
		EEC2		0	7	3	
Page 27: CAN: (7865)Priorities: Diagnosis Telegr.							
		Active errors		0	7	6	
		EMR status DigInputs		0	7	0	
		EMR status DigOutputs		0	7	0	
		Engine temperature		0	7	6	
		Engine fluid level/pressure		0	7	6	
		Inlet/Exhaust conditions		0	7	6	
		Engine configuration		0	7	0	
		Number of errors		0	7	6	
		Passive errors		0	7	6	
		Error Environment Data		0	7	6	
		Engine hours		0	7	6	

MK 3	TTG	Parameter	Unit	Min.	Max.	typ Wert	Description
Page 28: CAN: (7880)Priorities: Config. Telegr.							
		EMR: Controfler Config.		0	7	0	
		EMR: AnalogInput 1 Config.		0	7	0	
		EMR: AnalogInput 2 Config.		0	7	0	
		EMR: AnalogInput 2 Config.		0	7	0	
		EMR:PWM-Output Config.		0	7	0	
		EMR:Dig. Output Config.		0	7	0	
Page 29: CAN: (7888)Priorities: Meas. Values Telegr.							
		Fuel economy		0	7	6	
		EMR measured values		0	7	0	
Page 30: CAN: (7750)SendRepeatRate: ObjectTelegr.							
		engine temperature	ms	0	15000	0	
		Inlet/Exhaust conditions	ms	0	15000	0	
		engine fluid level/pressure	ms	0	15000	0	
		TSC1	ms	0	15000	80	
		EMR: Engine protection	ms	0	15000	100	
		EMR function shift	ms	0	15000	0	
		Request	ms	0	15000	0	
		Del. active errorsi	ms	0	15000	0	
		Del. error memory	ms	0	15000	0	
		free	ms	0	15000	0	
		EEC1	ms	0	15000	80	
		EEC2	ms	0	15000	200	
Page 31: CAN: (776S)SendRepeatRate: DiagnosisTelegr.							
		Active errors	ms	0	15000	1000	
		EMR status Dig Inputs	ms	0	15000	0	
		EMR status Dig Outputs	ms	0	15000	0	
		Engine temperature	ms	0	15000	1000	
		engine fluid level/pressure	ms	0	15000	500	
		Inlet/Exhaust conditions	ms	0	15000	500	
		engine configuration	ms	0	15000	0	
Page 32: CAN: (7788)SendRepeatRate: MeasValueTelegr.							
		Fuel economy	ms	0	15000	100	
		EMR measured values	ms	0	15000	0	
Page 33: CAN: (7900)PDU IdentPart Object Telegr.							
		engine temperature		0	65535	0	
		Inlet/Exhaust conditions		0	65535	0	
		engine fluid level/pressure		0	65535	0	
		TSC1		0	65535	0	
		EMR:Engine protection		0	65535	65283	
		EMR function shift		0	65535	0	
		Request		0	65535	59904	
		Del, active errors		0	65535	65235	
		Del, error memory		0	65535	65228	
		free		0	65535	0	
		EEC1		0	65535	61444	
		EEC2		0	65535	61443	

MK 3	TTG	Parameter	Unit	Min.	Max.	typ Wert	Description
Page 34: CAN: (7915)PDU IdentPart Diagnosis Telegr.							
		Active errors		0	65535	65226	
		EMR status DigInputs		0	65535	0	
		EMR status DigOutputs		0	65535	0	
		Engine temperature		0	65535	65262	
		engine fluid level/pressure		0	65535	65263	
		Inlet/Exhaust conditions		0	65535	65270	
		engine configuration		0	65535	0	
		Number of errors		0	65535	65230	
		Passive errors		0	65535	65227	
		Error Environment Data		0	65535	65229	
		Engine hours		0	65535	65253	
Page 35: CAN: (7930)PDU IdentPart Config. Telegr.							
		EMR: Controller Config.		0	65535	0	
		EMR:AnalogInput1 Config.		0	65535	0	
		EMR:AnalogInput2 Config.		0	65535	0	
		EMR:PWM-Input Config.		0	65535	0	
		EMR:PWM-Output Config.		0	65535	0	
		EMR:Dig.Output Config.		0	65535	0	
Page 36: CAN: (7938)PDU IdentPart Meas.Values Telegr.							
		Fuel economy		0	65535	65266	
		EMR measured values		0	65535	0	
Page 37: CAN: (7960)Fault codes of rel. fault messages							
		Setpoint generator 1		0	65535	91	
		Setpoint generator 2		0	65535	201	
		Boost pressure sensor		0	65535	102	
		Coolant temperature sensor		0	65535	110	
		Oil pressure sensor		0	65535	100	
		Electronics temperature		0	65535	171	
		EngSpeedSensorl EngRun		0	65535	190	
		EngSpeedSensor2 EngRun		0	65535	190	
		RackTravelSensor not vibr.		0	65535	200	
		Oversp. only during shutd		0	65535	190	
		Actuator deviation excessive		0	65535	209	
		Coolant Temp.high(alarm)		0	65535	110	
		Coolant Temp. high (shutdown)		0	65535	110	
		Oil pressure low (alarm)		0	65535	100	
		Oil pressure low (shutdown)		0	65535	100	
		PWM Input 2		0	65535	204	
		PWM Input 1		0	65535	205	
		Fault data set		0	65535	206	
		Fault hardware parameters		0	65535	210	
		Fault CAN		0	65535	203	
		Fault CAN, voltage too low		0	65535	207	
		Fault shutdown solenoid		0	65535	208	
		Fault EDC AutoRegulation		0	65535	202	

MK 3	TTG	Parameter	Unit	Min.	Max.	typ Wert	Description
Page 38: CAN: (7740)SwitchoverRelease: Governor, speed droop, limiting curve, preset engine speed							
		Shift mask: setpoint speed		0	63	8	
		Shift mask: limiting curve		0	7	0	
		Shift mask: speed droop		0	7	0	
		Shift mask: governor mode		0	7	0	
Page 39: CAN: (7662)EMR-fault message via OiagTelegr. ***(on/off)***							
		Setpoint generator 1		0	1	1	
		Setpoint generator 2		0	1	1	
		Boost pressure sensor		0	1	1	
		Coolant temperature sensor		0	1	1	
		Oil pressure sensor		0	1	1	
		Electronics temperature		0	1	1	
		Eng Speed Sensorl Eng Run		0	1	1	
		Eng Speed Sensor 2 Eng Run		0	1	1	
		Rack Travel Sensor not vibr.		0	1	1	
		Oversp. only during shutd.		0	1	1	
		Actuator deviation excessive		0	1	1	
		Coolant Temp. high (alarm)		0	1	1	
		Coolant Temp. high (shutdown)		0	1	1	
		Oil pressure low (alarm)		0	1	1	
		Oil pressure low (shutdown)		0	1	1	
		PWM Input 2		0	1	1	
		PWM Input 1		0	1	1	
		Fault data set		0	1	1	
		Fault hardware parameters		0	1	1	
		Fault CAN		0	1	1	
		Fault CAN, voltage too low		0	1	1	
		Fault shutdown solenoid		0	1	1	
		Fault EDC Auto Regulation		0	1	1	

⁎ See also system description EMR, Chapter 3 System functions.

4.2 OVERALL PROGRAMMING

ATTENTION!

- **Complete programming (i.e. access to all parameters) is only possible on level III.**

Saving data contained in the ECU:

- With "ECU -> file" read data from ECU. The "Save file under" window is shown.
- Save data under any name as Hex-File (file name.hex).

Complete programming of ECU:

- Click on key "Programming" and the "Open" window is shown.
- Select desired Hex file and open.
- " Click on key "Save in ECU".

Of the configuration data only that operating data is shown which was read from the ECU (2nd column) or from a file (3rd column. Prior to uploading of the configuration data to the ECU, the operating data can be edited in the 4th column. This data is also uploaded when uploading the configuration data to the ECU.

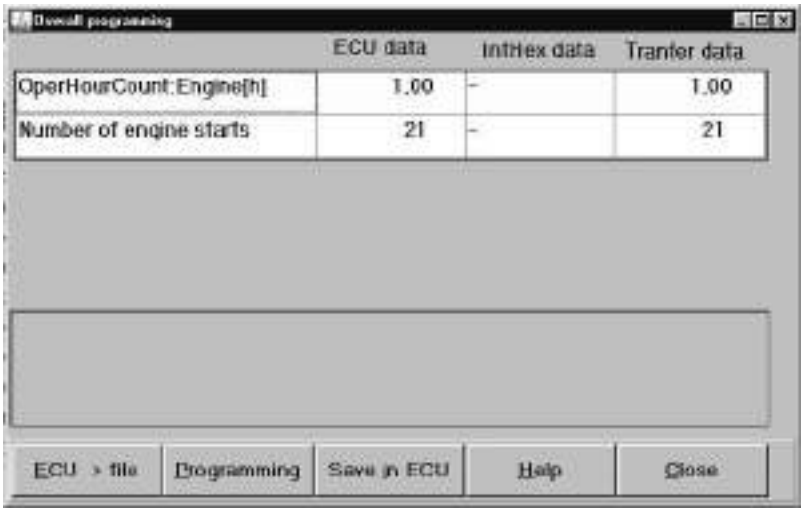


Figure: Menu complete programming (“Overal programming”)

EXPLANATION OF FUNCTION[SWITCH:

ECU->fi!e: The configuration data is read from the ECU, displayed and can be saved as HEX file.

Programming: Updated configuration data is uploaded to the ECU, In order for the upload to be permanent, you must operate the "Save in ECU" switch on the ECU.

Save in ECU (only applies for EMR): The configuration data are permanently saved in the ECU

Restriction: Only applies for EMR and EMS.

4.3 CALIBRATION

The accelerator pedal and the hand throttle potentiometer (if any) must be calibra-ted in combination with the EMR (not applicable for gensets).

Important prerequisites:

- Engine shut off
- Supply voltage (ignition/terminal 15) switched on
- Accelerator in frame