DEUTZ FAHR

SAME DEUTZ-FAHR DEUTSCHLAND GmbH

WORKSHOP MANUAL

AGROTRON 210
AGROTRON 235
AGROTRON 265

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; these bolts should only be removed when the component has been securely attached to a hoist or when supporting blocks have been put in position.

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 wiring looms and wires, ensure that they are properly 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.

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 eyebolts for lifting tractor components, first check that they are not deformed or damaged, screw them fully home and then turn the bolt so that the eye is aligned with the lifting hook.
- 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

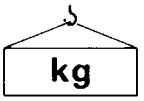
- Tighten nuts and bolts to the specified tightening torques.
- When refitting flexible pipes and wires, take care not to twist or tangle them.
- Always fit new seals, O-rings, cotter pins and safety stop rings on reassembly; make sure that the ends of the cotter pins are separated and bent back so that the pin cannot be withdrawn from the hole.
- Ensure that circlips are correctly installed in their seatings.
- 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.
- 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 push the two halves together firmly; only apply the force necessary to clip the two halves together.
- 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 a variable displacement pump, connect the drain pipe and fill the pump casing with oil through the filler hole provided.
- Grease stub axle housings, cylinder pivot mountings and drive shafts thoroughly after assembly.

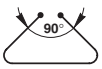
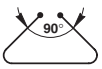
LIFTING INSTRUCTIONS



⚠ 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 

WIRE ROPES - SLINGS

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

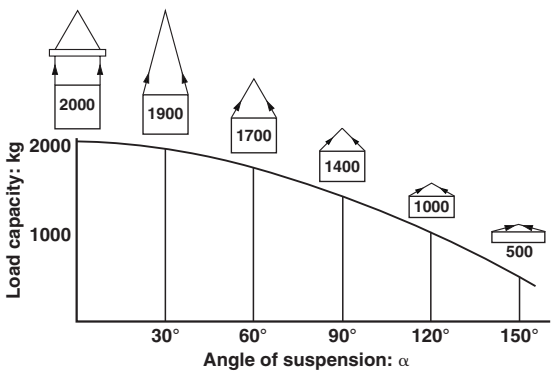
WIRE ROPES (standard twisted «S» or «Z» type)				POLYESTER SLINGS (eye-and-eye - simple loop)				
Ø rope mm	Capacity (kg)			Width (mm)	Capacity (kg)			
								
8	650	620	500	25	500	400	860	700
10	1000	1740	1420	50	1000	800	1730	1410
12	1450	2500	2050	62	1250	1000	2160	1760
14	2000	3460	2820	75	1400	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.



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 information on the tractor's electrical and electronic systems, the procedures for putting into service, the list of alarms and a guide to the use of the software required for tractor and engine configuration and access to diagnostic codes.

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**
Trasmission	**5871 970 001 - 5872 966 001**	**German**
	5872 966 002	**English**
	5872 966 003	**French**
Rear axle	**5871 970 101**	**German**
	5871 970 102	**English**
Front axle ZF AS 2075	**5871 693 011**	**German**
	5871 693 012	**English**
	5871 693 013	**French**

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 Nm 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.

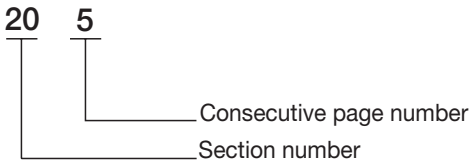
HOW TO USE AND UPDATE THE MANUAL

1. UPDATING THE MANUAL

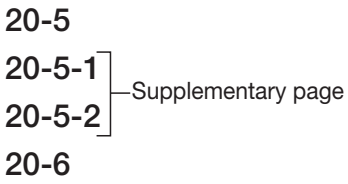
All additions, corrections or amendments to the manual will be sent to the Authorised Service Centres.
Before starting any repair or overhaul operations, check that you have the most recent updates as these may contain supplementary data not present in previous issues.

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:

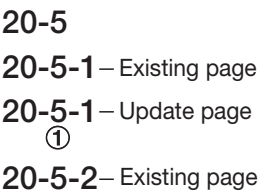


2 - **Supplementary pages:** indicated with a hyphen (-) and consecutive number after the page number. Example:



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:

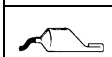


NOTE. All supplementary and updated pages are indicated in the manual page list; a revised page list is sent with each update and supersedes the previous list.

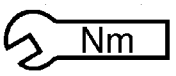
3. SYMBOLS USED IN THE MANUAL

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.

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 573 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.
	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.

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	PAGE
T1	00239496	Tool for removal of steering unit inner gasket	30-81
T2	00239497	Tool for removal of steering unit dust seal	30-81
T3	00239498	Tool for mounting of steering unit inner gasket	30-82
T4	00239499	Tool for mounting of steering unit dust seal	30-85
T5	5.9030.743.1	Test lead for checking sensors with multimete	30-110; 30-126
T6	5.9030.894.0	Specila tool for shaft extraction	30-68

CONVERSION FACTORS

CONVERSION FROM BRITISH TO METRIC UNITS

inch x 25,40	**= mm**
foot x 0,305	**= m**
yard x 0,914	
Eng.miles x 1,609	**= km**
Sq.in. x 6,452	**= cm²**
Sq.ft. x 0,093	**= m²**
Sq.yard x 0,835	
Cu.in. x 16,39	**= cm³**
Cu.ft. x 28,36	**= m³**
Cu.yard x 0,763	
Imp.gall. x 4,547	**= litres**
US gall. x 3,785	
pint x 0,568	
quart x 1,137	
US.gpm x 3,785	**= ℓ/min**
oz. x 0,028	**= kg**
lb. x 0,454	
lb.ft. x 0,139	**= kgm**
lb.in. x 17,87	**= kg/m**
psi x 0,070	**= kg/cm²**
lb./Imp.gall x 0,100	**= kg/ℓ**
lb./US.gall x 0,120	
lb./cu.ft. x 16,21	**= kg/m³**
lb.ft. x 1,356	**= Nm**
psi x 1,379	**= bar**

CONVERSION FROM METRIC TO BRITISH UNITS

mm x 0,0394	**= inch**
m x 3,281	**= foot**
m x 1,094	**= yard**
km x 0,622	**= Eng.miles**
cm² x 0,155	**= Sq.in.**
m² x 10,77	**= Sq.ft.**
m² x 1,197	**= Sq.yard**
cm³ x 0,061	**= Cu.in.**
m³ x 0,035	**= Cu.ft**
m³ x 1,311	**= Cu.yard**
litres x 0,220	**= Imp.gall.**
litres x 0,264	**= US gall.**
litres x 1,762	**= pint**
litres x 0,880	**= quart**
ℓ/min x 0,2642	**= US.gpm**
kg x 35,25	**= oz.**
kg x 2,203	**= lb.**
kgm x 7,233	**= lb.ft.**
kg/m x 0,056	**= lb.in.**
kg/cm² x 14,22	**= psi**
kg/ℓ x 10,00	**= lb./Imp.gal.**
kg/ℓ x 8,333	**= lb./US.gal.**
kg/m³ x 0,062	**= lb./cu.ft.**
Nm x 0,737	**= lb.ft.**
bar x 14,503	**= psi**

SECTION 10

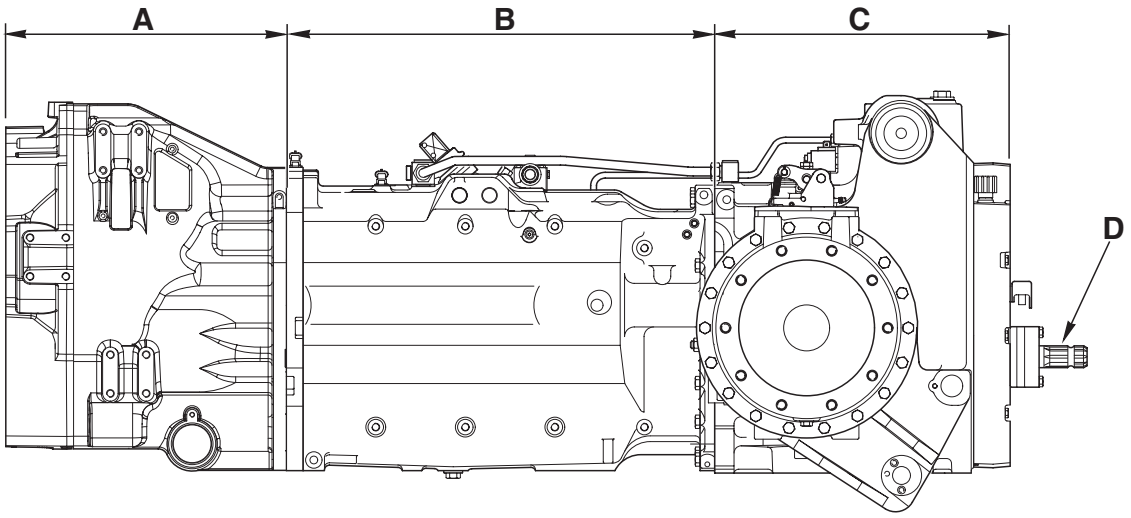
CONTENTS

1. TRANSMISSION

INTRODUCTION

- The models in this tractor series are supplied to the customer with the POWER SHUTTLE transmission.
  In this transmission, reversal of the direction of travel is managed entirely by the electronic control unit without the operator having to depress the clutch pedal.
  This is achieved by way of a proportional solenoid valve that directly controls the main clutch.

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



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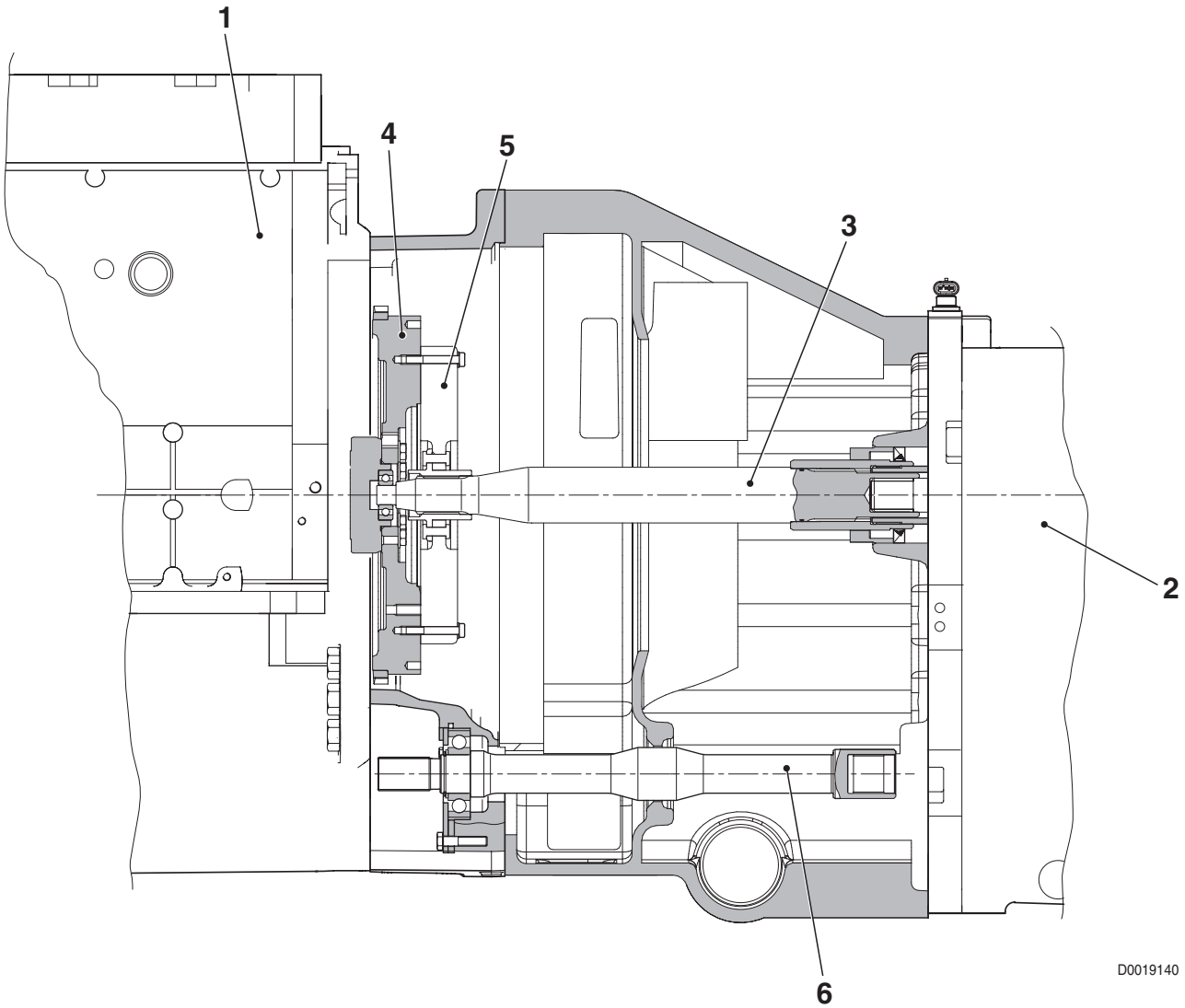
1.1 ENGINE-TRANSMISSION CONNECTION

1.1.1 FLEXIBLE COUPLING

The flexible coupling (5) receives drive from the engine (1) and transmits it to the gearbox (2) through the shaft (3). The engine (1) transmits motion to the flywheel (4), on which is mounted the flexible coupling (5); this coupling absorbs the vibration generated by the engine and the high torque values generated by the transmission.

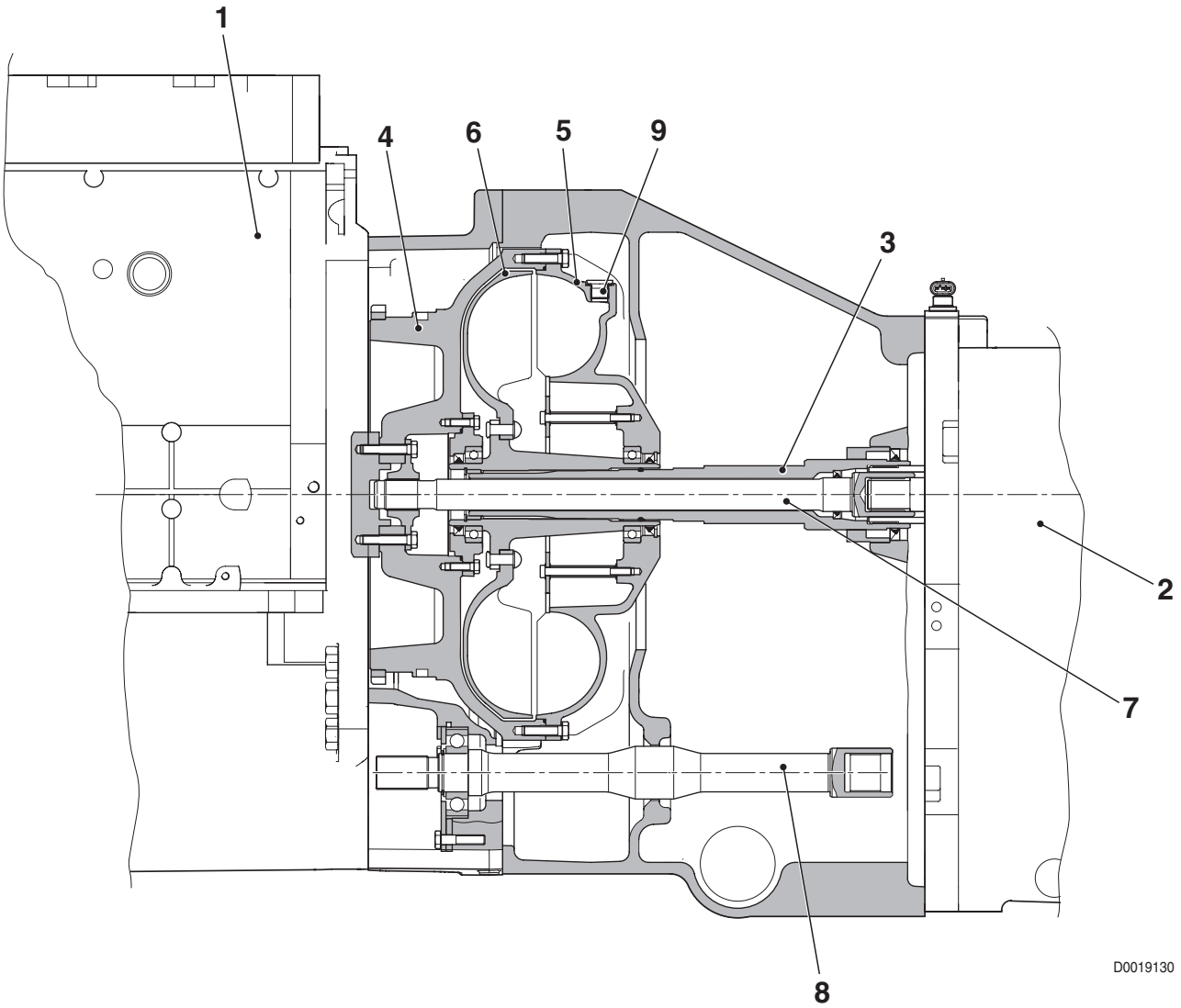


1. Engine
2. Gearbox
3. Shaft
4. Flywheel
5. Flexible coupling
6. Front axle propeller shaft

1.1.2 FLUID COUPLING

DESCRIPTION

The fluid coupling receives drive from the engine (1) and transmits drive to the gearbox (2) through the shaft (3).
The engine (1) transmits motion to the flywheel (4), on which is mounted the impeller (5). As the impeller rotates, it picks up oil and flings it against the vanes of the turbine (6), causing it to rotate along with the shaft (3) on which it is mounted.
As the engine (1) speed increases, so does the amount of oil flung by the impeller (5), thereby increasing the torque transmitted to the turbine (6).



1. Engine
2. Gearbox
3. Shaft
4. Flywheel
5. Impeller
6. Turbine
7. Rear PTO control shaft
8. Front axle propeller shaft
9. Filler plug for fluid coupling

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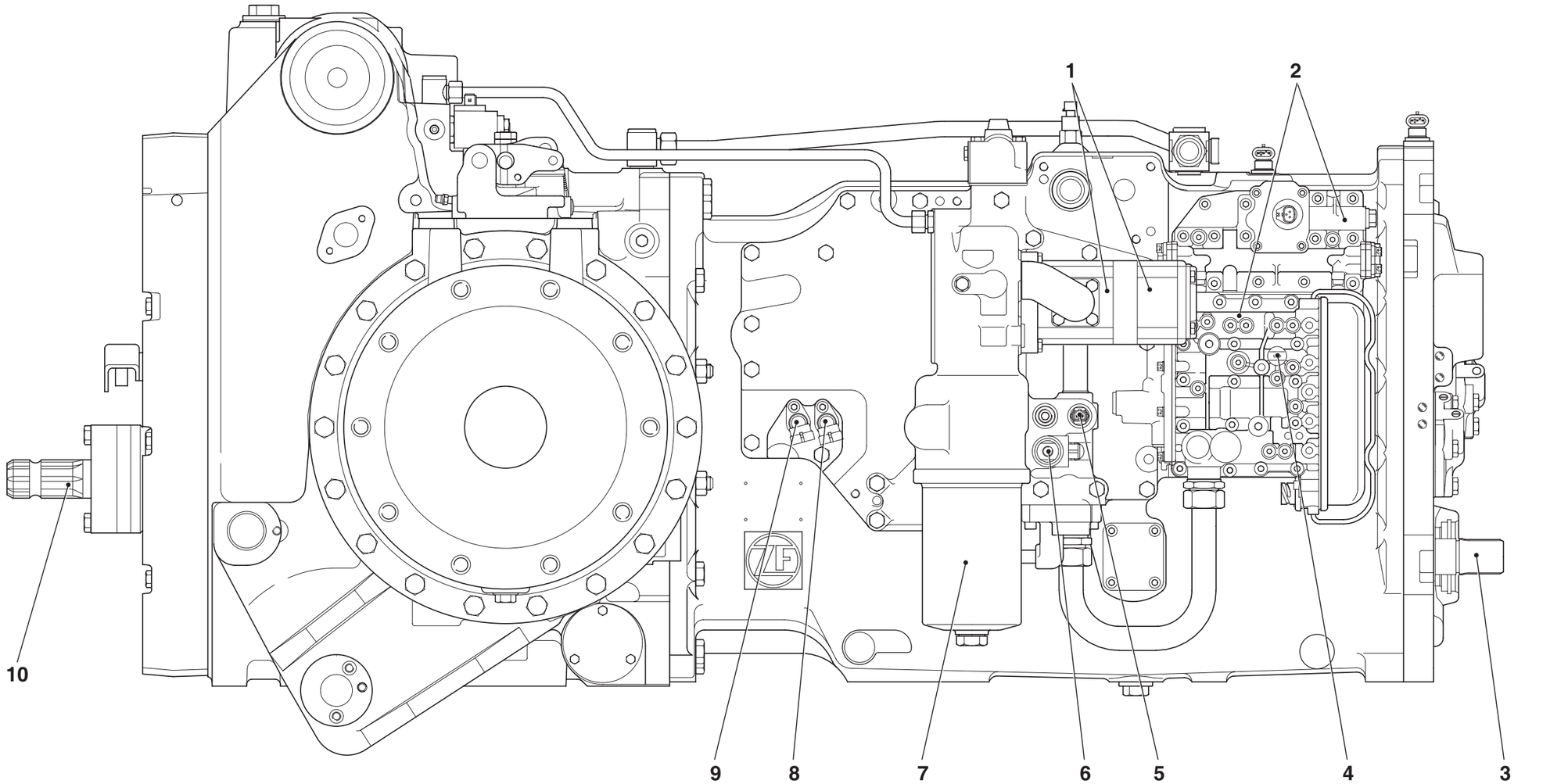
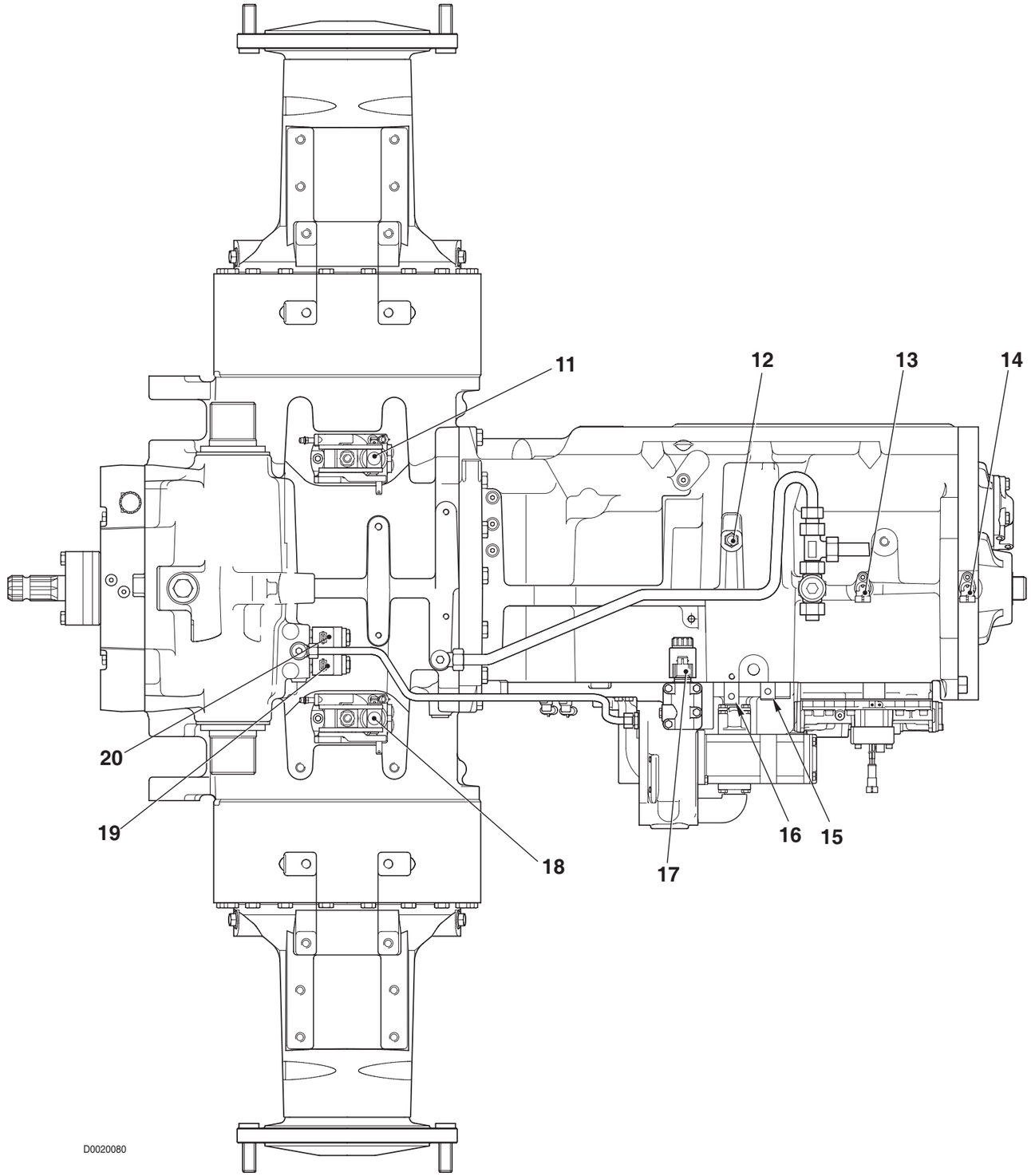
1.2 TRANSMISSION

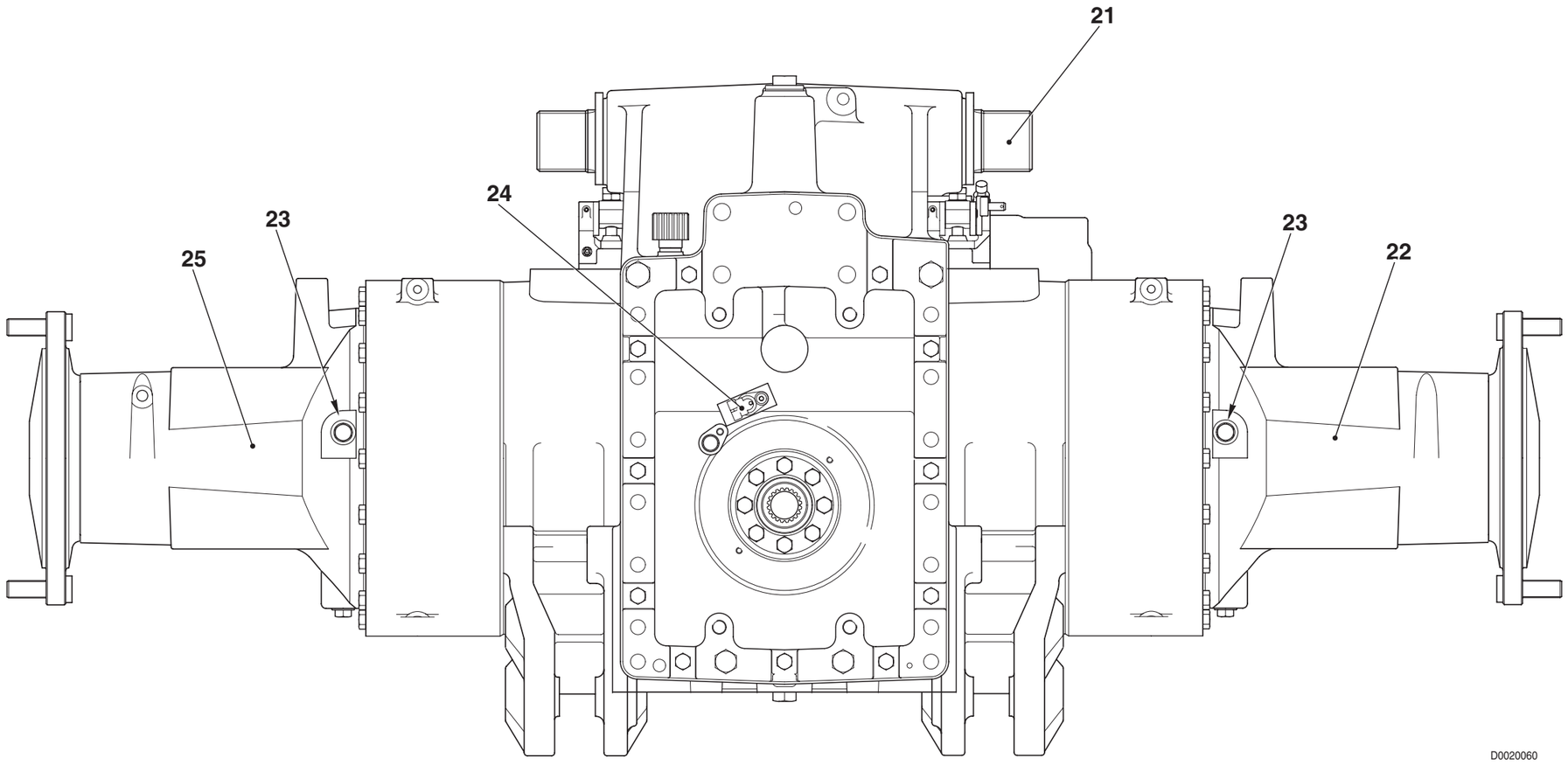
1.2.1 MAIN COMPONENTS (1-SPEED PTO VERSION)



1. Hydraulic pump for the transmission
2. Hydraulic gearbox distribution valve
3. Four-wheel drive control shaft
4. Transmission oil low pressure sensor
5. Transmission oil temperature sensor
6. Four-wheel drive control solenoid valve
7. Transmission oil suction line filter
8. Speed sensor for odometer (nAb)
9. Clutch speed sensor (nHk)
10. Rear power take-off

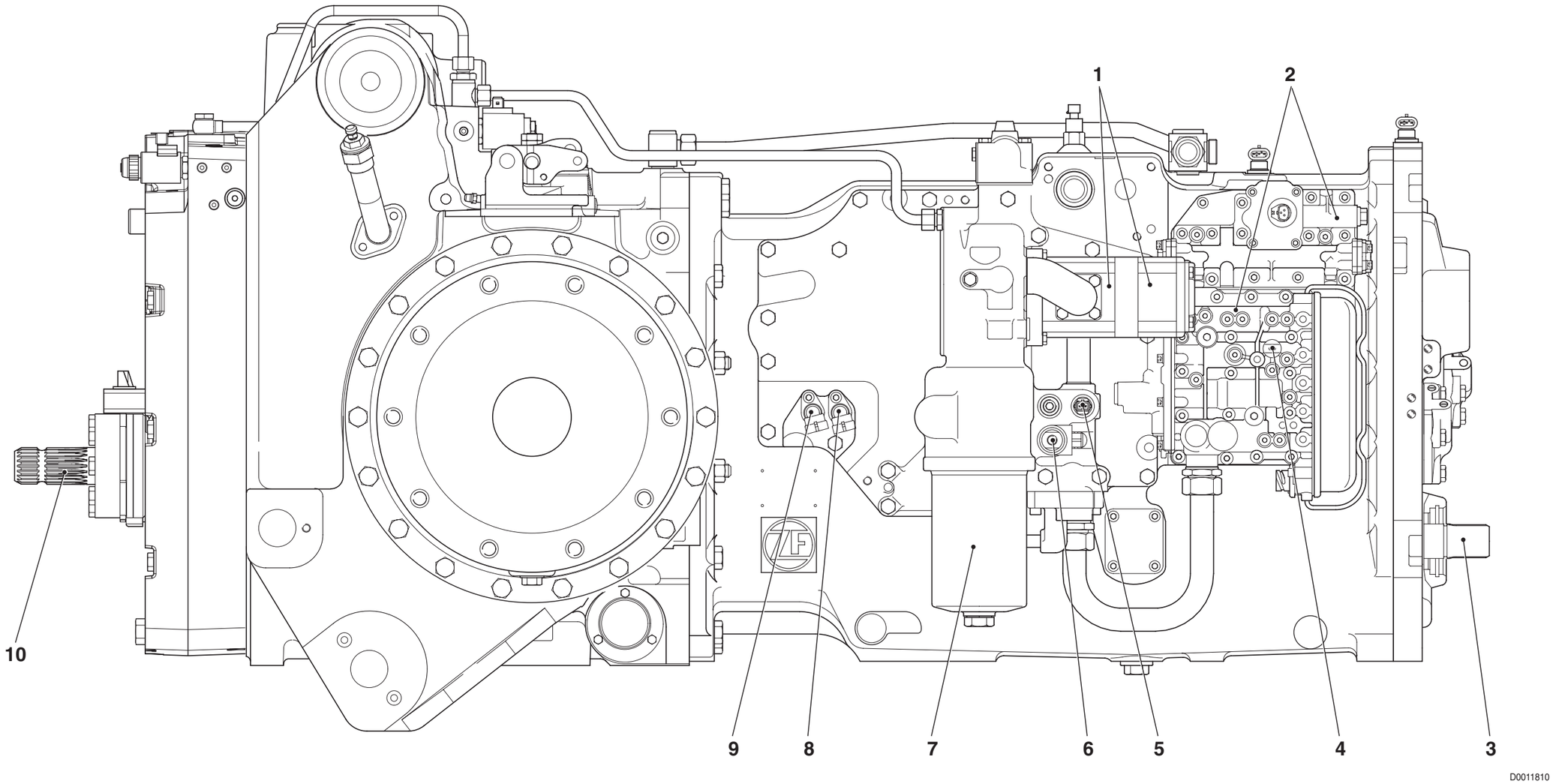


11. Left brake cylinder
12. Start enabling sensor
13. Speed sensor (Nlsa)
14. Speed sensor (Nlse)
15. Creeper engagement control shaft
16. Gears control shaft
17. Clutch control solenoid valve
18. Right brake cylinder
19. Rear PTO control solenoid valve
20. Differential lock control solenoid valve

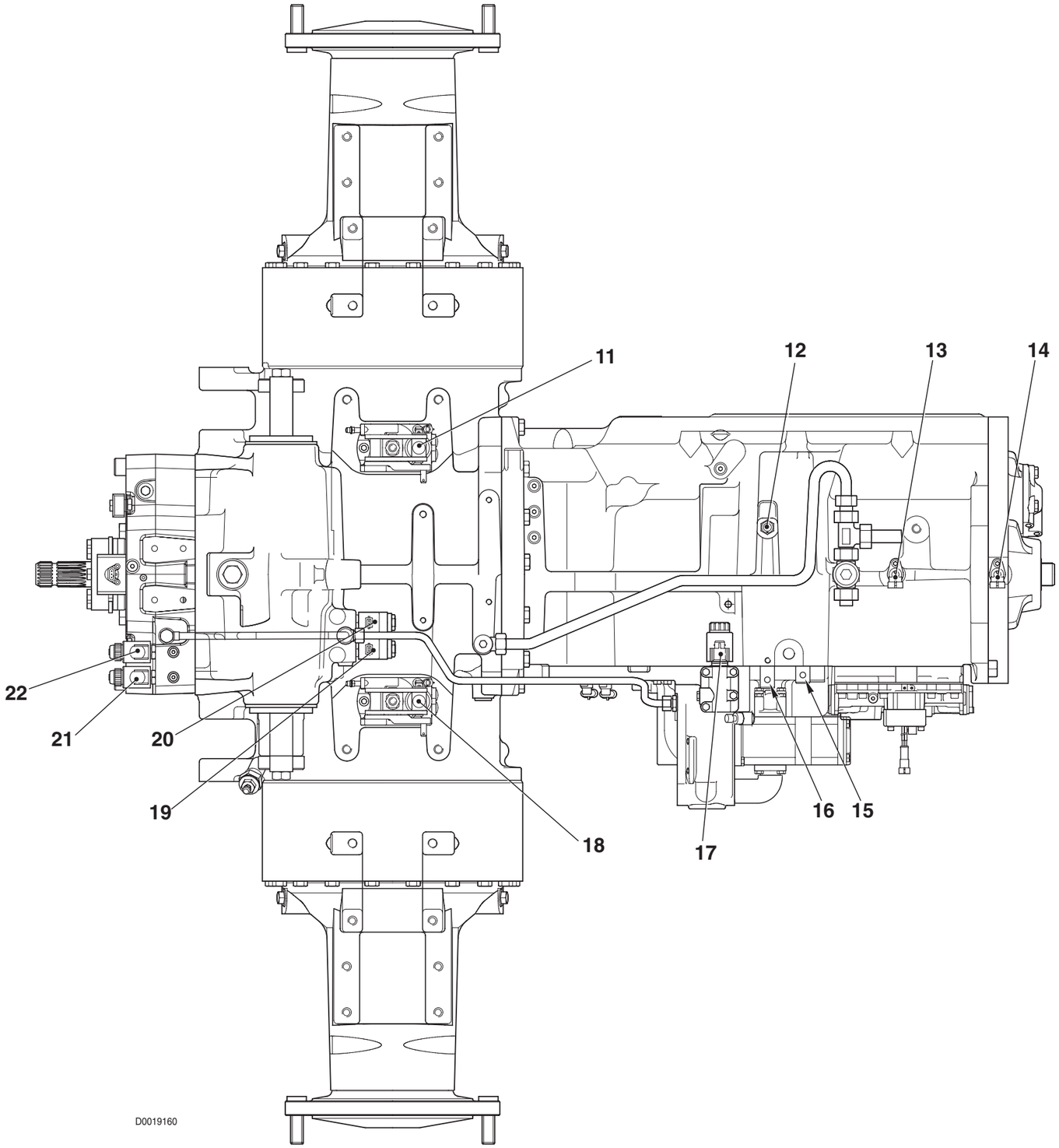


21. Power lift shaft
22. Right axle casing
23. Reduction unit oil filler/level plug
24. Rear PTO speed sensor
25. Left axle casing

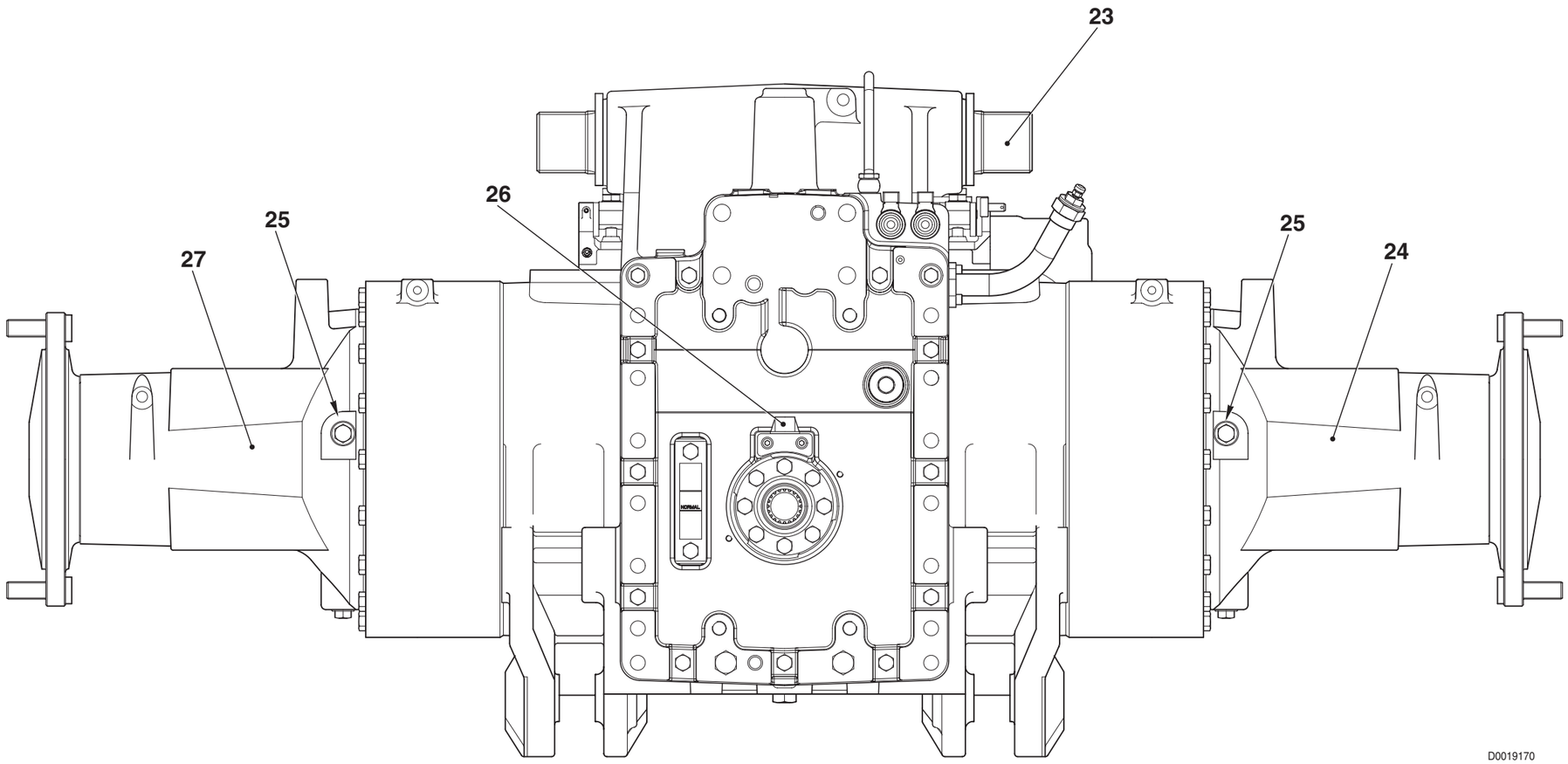
1.2.2 MAIN COMPONENTS (2-SPEED PTO VERSION)



1. Hydraulic pump for the transmission
2. Hydraulic gearbox distribution valve
3. Four-wheel drive control shaft
4. Transmission oil low pressure sensor
5. Transmission oil temperature sensor
6. Four-wheel drive control solenoid valve
7. Transmission oil suction line filter
8. Speed sensor for odometer (nAb)
9. Clutch speed sensor (nHk)
10. Rear power take-off



11. Left brake cylinder
12. Start enabling sensor
13. Speed sensor (NIsa)
14. Speed sensor (NIse)
15. Creeper engagement control shaft
16. Gears control shaft
17. Main clutch control solenoid valve
18. Right brake cylinder
19. Rear PTO control solenoid valve
20. Differential lock control solenoid valve
21. PTO 750 selection solenoid valve
22. PTO 1000 selection solenoid valve

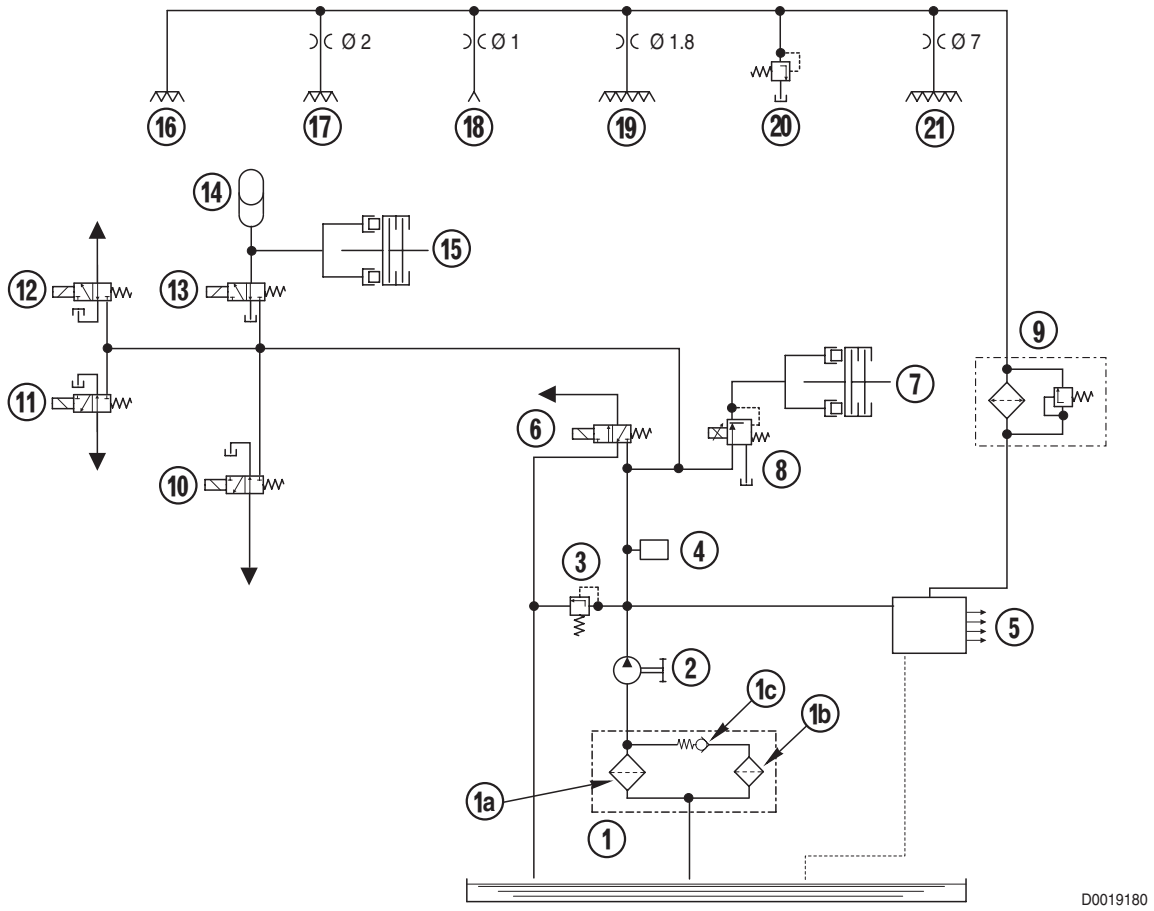


23. Lift shaft
24. Right axle casing
25. Reduction unit oil filler/level plug
26. Rear PTO speed sensor
27. Left axle casing

1.2.3 TRANSMISSION HYDRAULIC SYSTEM

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

- hydraulic gearbox control valve (5)
- PTO 1000 control solenoid valve (11)
- proportional solenoid control valve for main clutch (7)
- 4WD control solenoid valve (6)
- PTO 750 control solenoid valve (12)
- differential lock control solenoid valve (10)
- lubrication of the mechanical gearbox (20), rear differential bearings (17), brakes (18), bevel gear pair (16) and rear PTO (15).

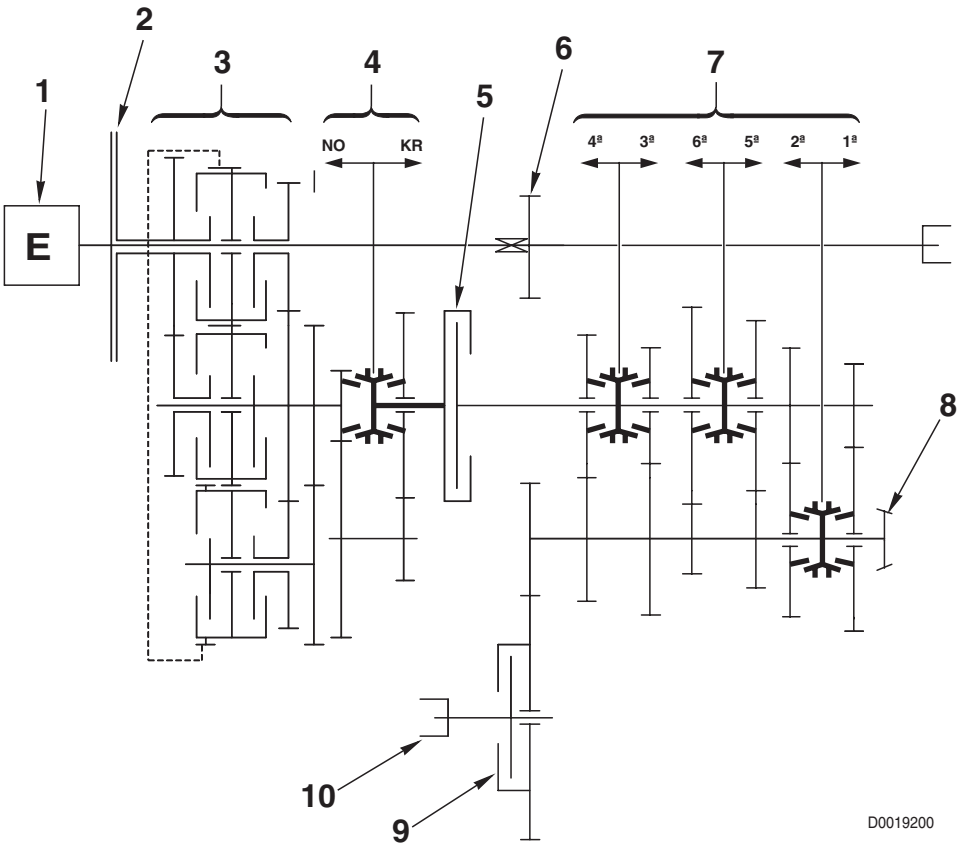


1. Suction line filter
   1a. Filter (15 µm)
   1b. Filter (20 µm)
   1c. By-pass valve (opening pressure 0.25 bar)
2. Gear pump (40 cc/rev at 19.8 bar)
3. Cold starting safety valve (27‡3 bar)
4. Temperature sensor
5. Gearbox control distribution valve
6. 4WD control solenoid valve
7. Main clutch control proportional solenoid valve
8. Main clutch
9. Transmission oil cooler
10. Solenoid valve for front and rear differential lock control
11. 1000 rpm PTO solenoid control valve
12. 750 rpm PTO solenoid control valve
13. Rear PTO control solenoid valve
14. Accumulator (0.16 ℓ)
15. Rear PTO clutch
16. Rear PTO lubrication
17. Bevel gear pair lubrication
18. Rear differential bearings lubrication
19. Brake lubrication
20. Lubrication circuit pressure relief valve (3.8‡0.5 bar)
21. Mechanical gearbox lubrication

1.2.4 GEARBOX

DESCRIPTION

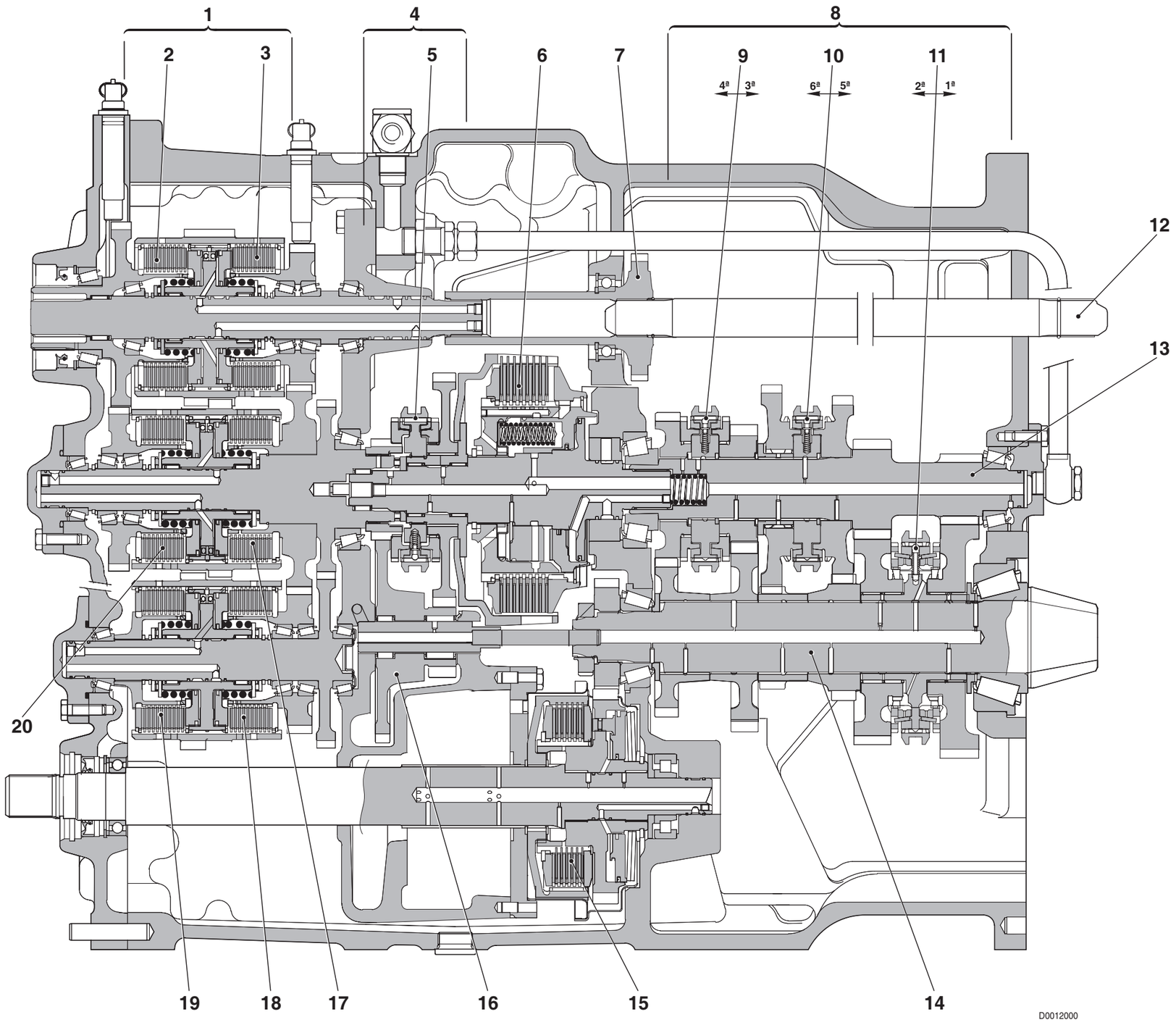
- The gearbox receives drive from the fluid coupling (2) and transmits it, through the hydraulically controlled gearbox (3), the creeper (4), the main clutch (5) and the 6-speed mechanical gearbox (7), to the bevel pinion (8) and the power take-off (9), which, in turn, transmits drive to the front axle.
  The gearbox also has a double power take-off (6) to drive the hydraulic system pumps.



COMPONENTS

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

GEARBOX COMPONENTS



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

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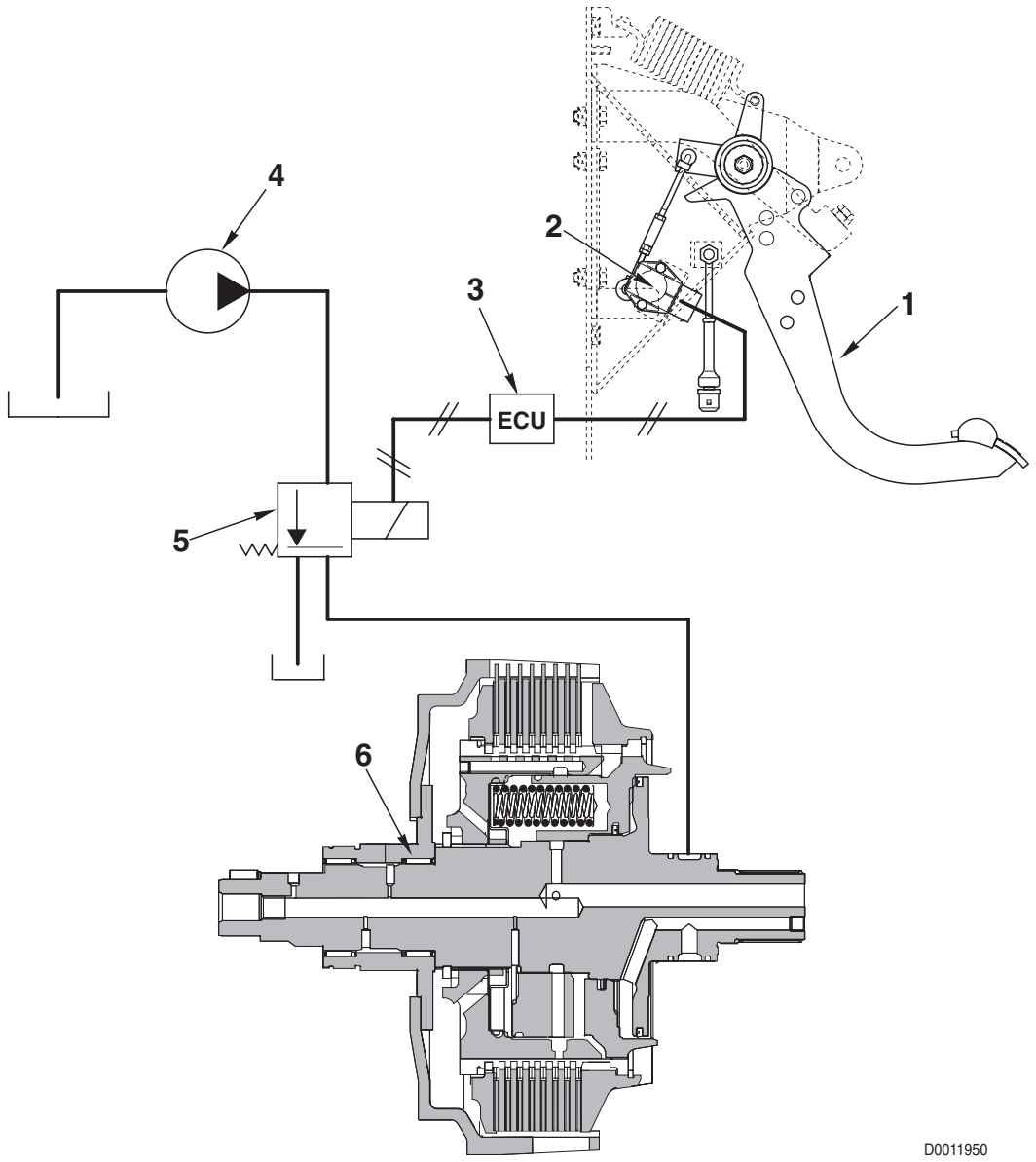
1.2.5 MAIN CLUTCH

The main clutch of the 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

1.2.6 HYDRAULIC GEARBOX AND SHUTTLE DISTRIBUTION VALVE

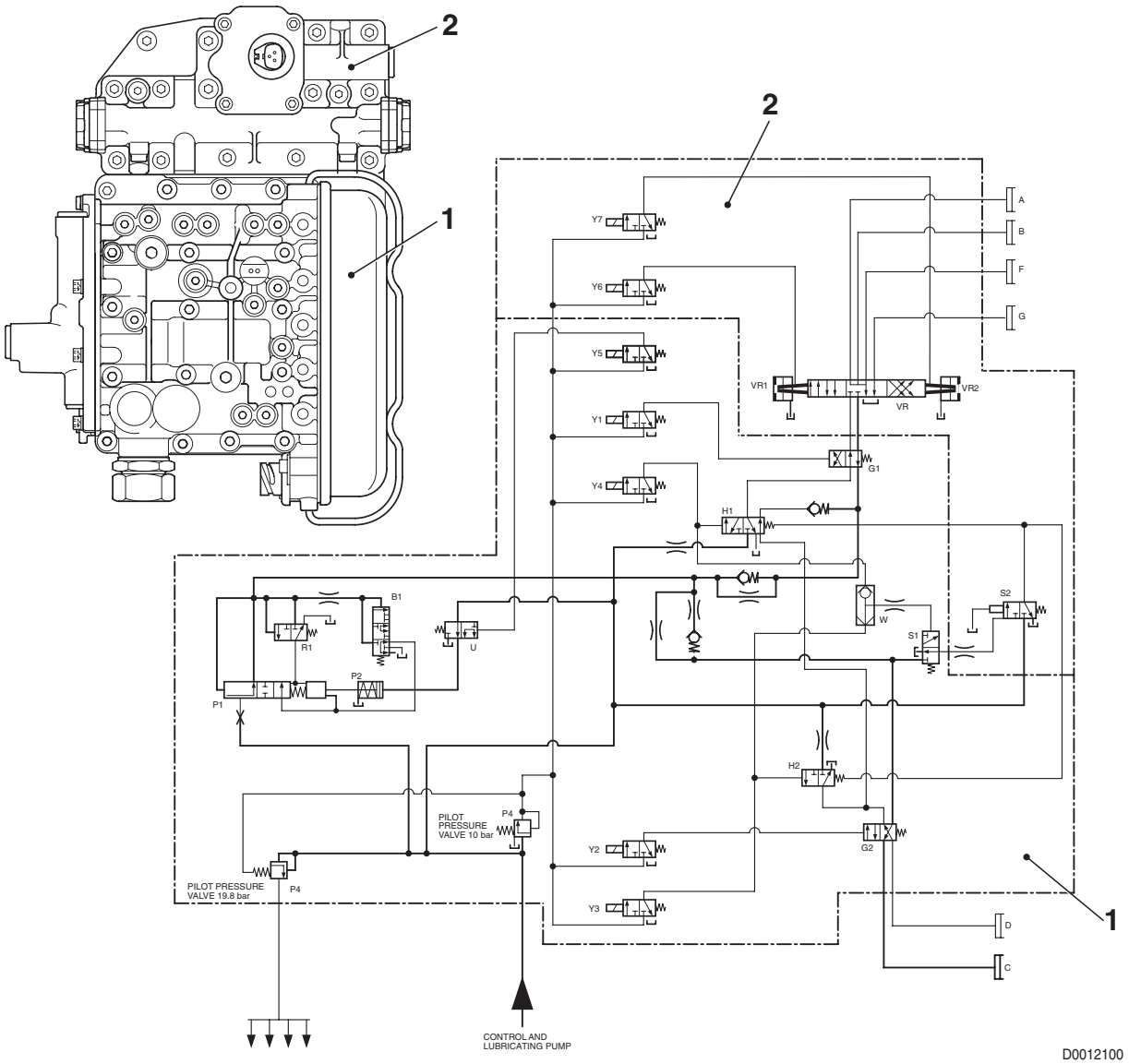
The function of the hydraulic gearbox distribution valve is to pilot and control the engagement of the gears in the hydraulically-controlled gearbox.

The distribution valve controls the operation of:

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

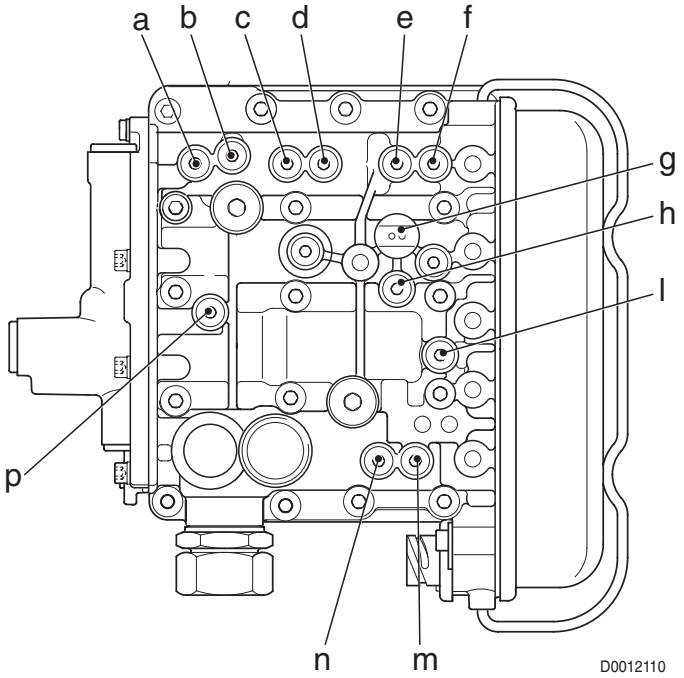
B. the shuttle control valve (2) to select FORWARD and REVERSE gears.

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



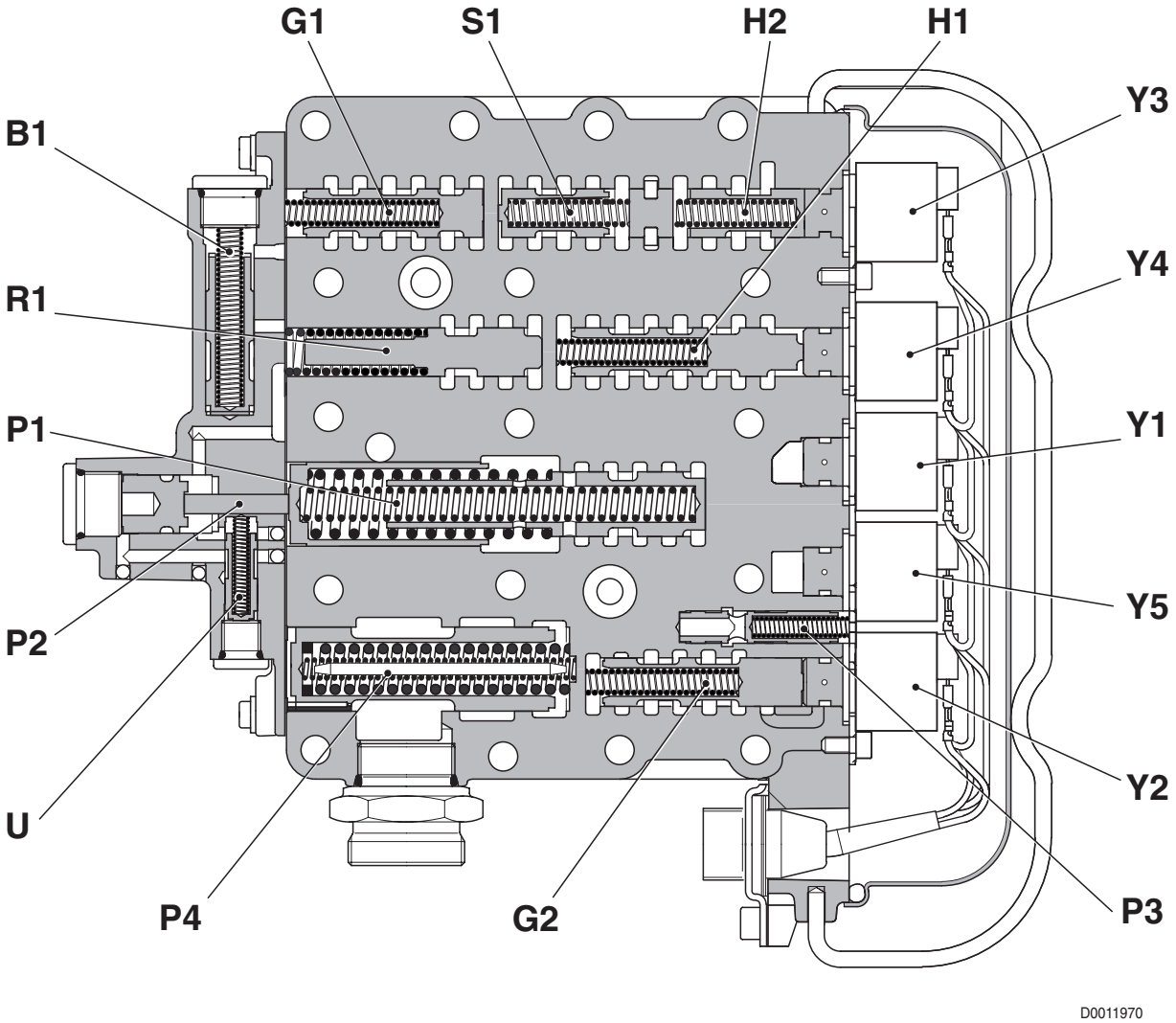
A. GEARBOX CONTROL VALVE

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

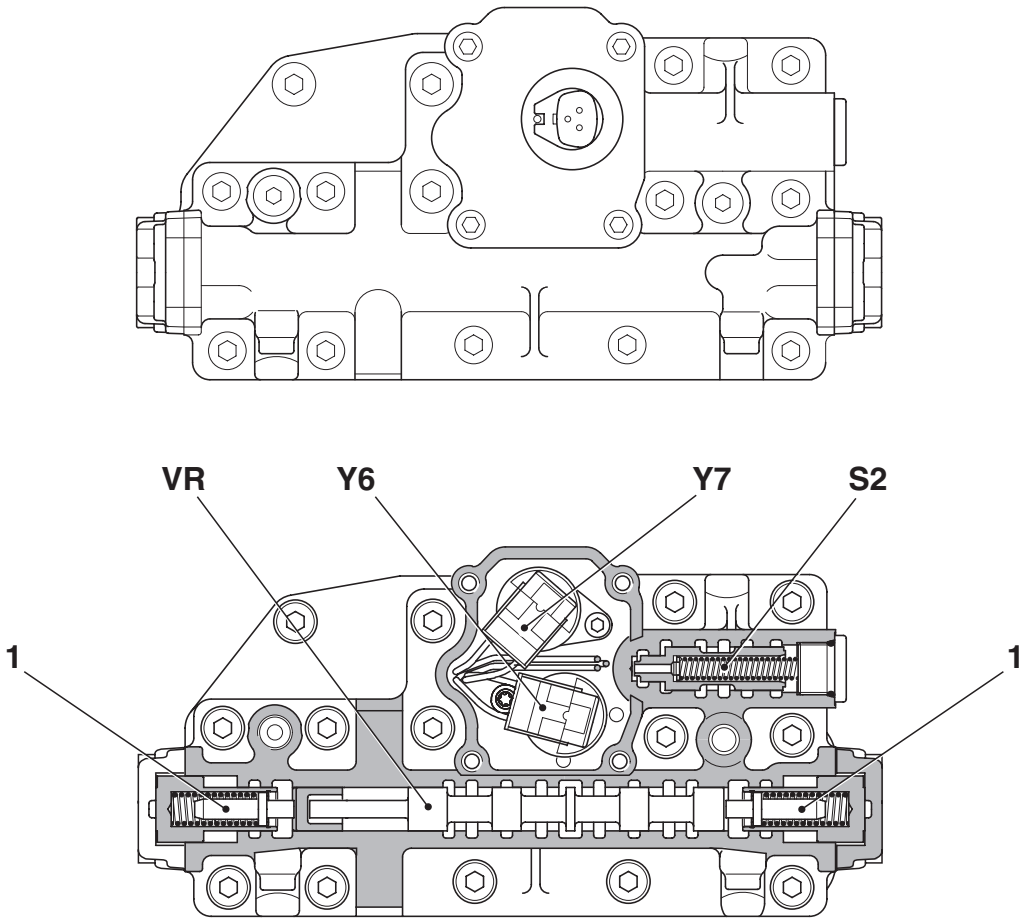
MAIN COMPONENTS



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 COMPONENTSI



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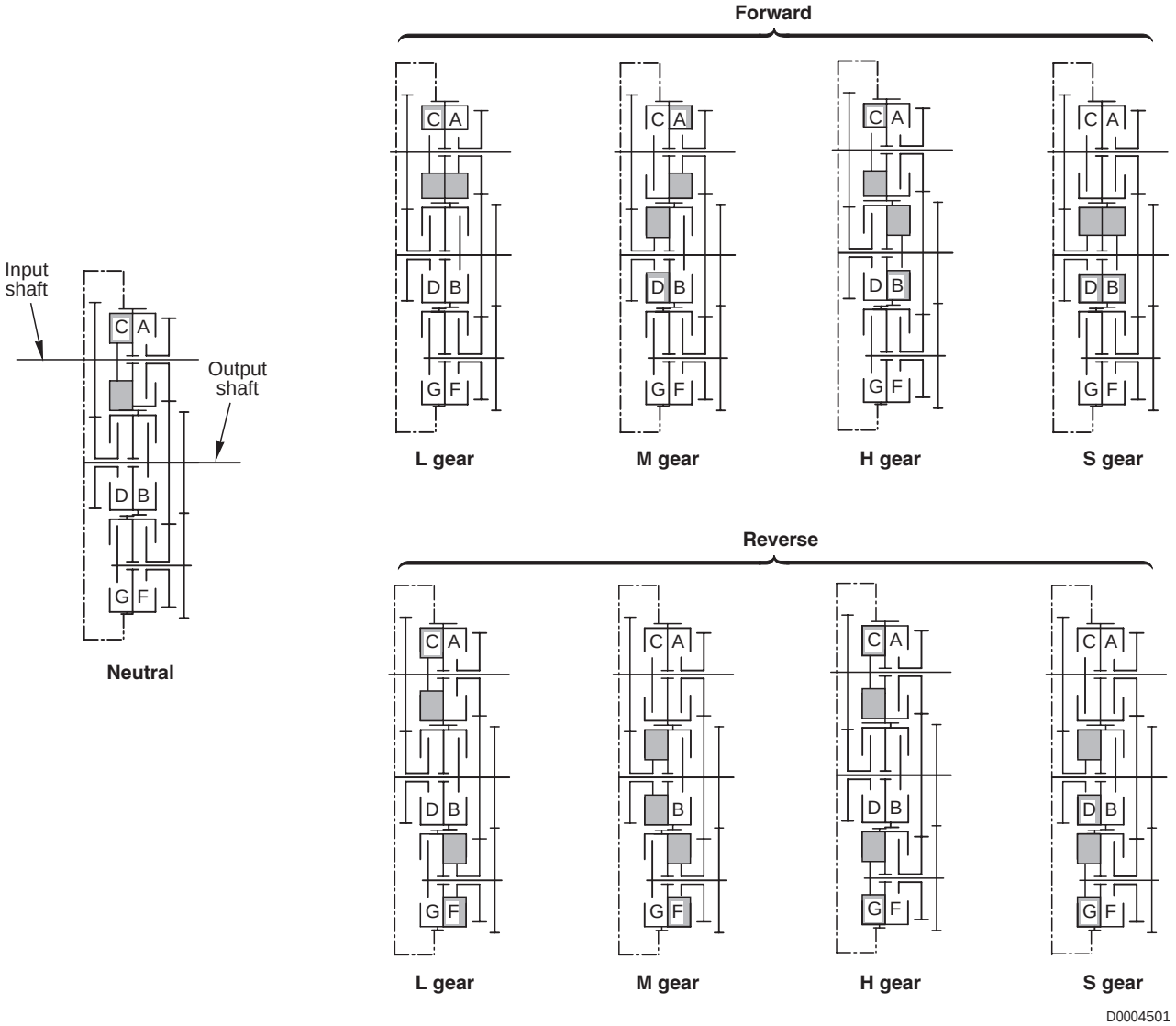
Y6 Pilot solenoid valve for FORWARD gear
Y7 Pilot solenoid valve for REVERSE gear
VR FORWARD/REVERSE control spool valve
S2 Relief valve
1 Neutral return device

1.2.7 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