

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.

All technicians and their colleagues are expressly forbidden from reproducing any part of this manual in any form or from communicating the contents to third parties without the express written permission of the Manufacturer, who remains the sole owner of this document with all rights reserved in accordance with applicable laws.



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 be 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 transmission 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 ; 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)  : 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

 : 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.

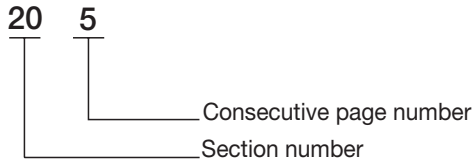
HOW TO USE AND UPDATE THE MANUAL

1. UPDATING THE MANUAL

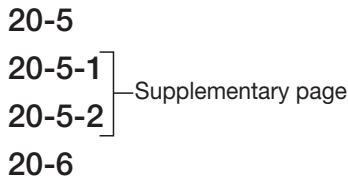
All additions, corrections or amendments to the manual will be sent to the Authorised Service Centres. Before starting any repair or overhaul operations, check that you have the most recent updates as these may contain supplementary data not present in previous issues.

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:

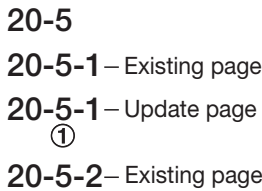


2 - **Supplementary pages:** indicated with a hyphen (-) and consecutive number after the page number. Example:



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 precautions to 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.

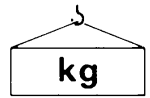
2. Precautions for refitting operations

- 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, oxidation, 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










! 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:

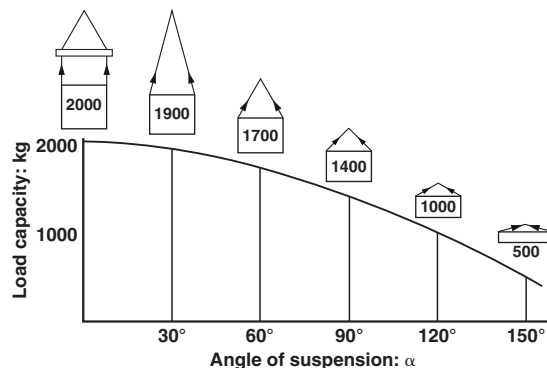
WIRE ROPES (standard twisted «S» or «Z» type)				POLYESTER SLINGS (eye-and-eye - simple loop)				
Ø rope mm	Capacity (kg)			Width (mm)	Capacity (kg)			
								
8	650	620	500	25	500	400	860	700
10	1000	1740	1420	50	1000	800	1730	1410
12	1450	2500	2050	62	1250	1000	2160	1760
14	2000	3460	2820	75	1400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

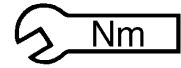
- The lifting hook should be attached to the central part of the rope or sling; if the hook is attached near the ends of the rope/sling, this could cause the load to slip during lifting.
- Never lift a heavy load using a single rope; always use two or more symmetrically arranged ropes.


! 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.



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 for 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 be 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 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 are 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 as 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 as 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 microvoids caused by flatness errors. Very slow curing on most metal surfaces and requires prior application of an activator.

THREADLOCKERS, ADHESIVES, SEALANTS AND LUBRICANTS

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. =	cm ² x 0.155
Sq.ft. =	m ² x 10.77
Sq.yard =	m ² x 1.197
Cu.in. =	cm ³ x 0.061
Cu.ft =	m ³ x 0.035
Cu.yard =	m ³ 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/cm ² x 14.22
lb./Imp.gal. =	kg/ℓ x 10.00
lb./US.gal. =	kg/ℓ x 8.333
lb./cu.ft. =	kg/m ³ 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

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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.

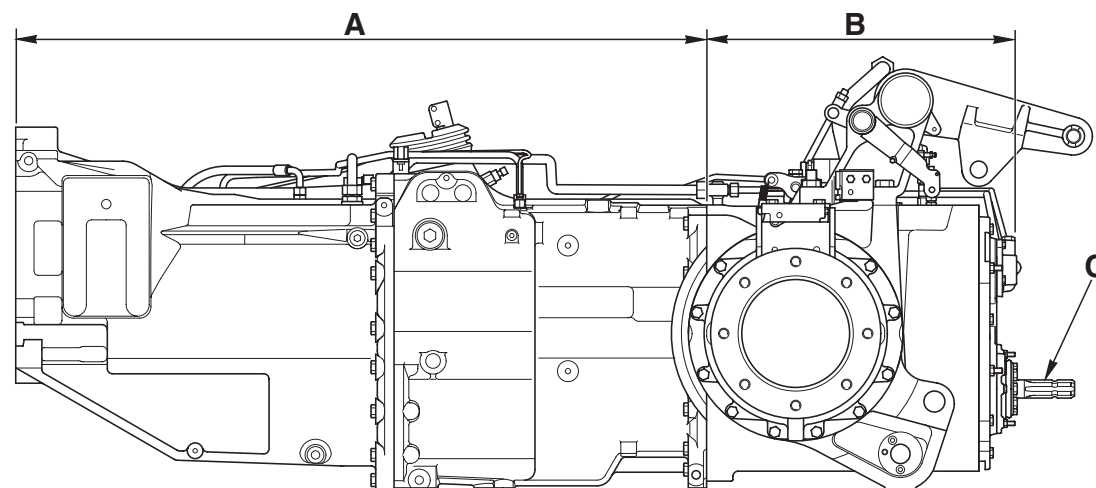
In the POWER SHIFT version, when the operator operates the shuttle control to change the direction of travel, the command is actually only implemented when the speed of the tractor falls below 10 km/h and when the operator depresses the clutch pedal.

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:

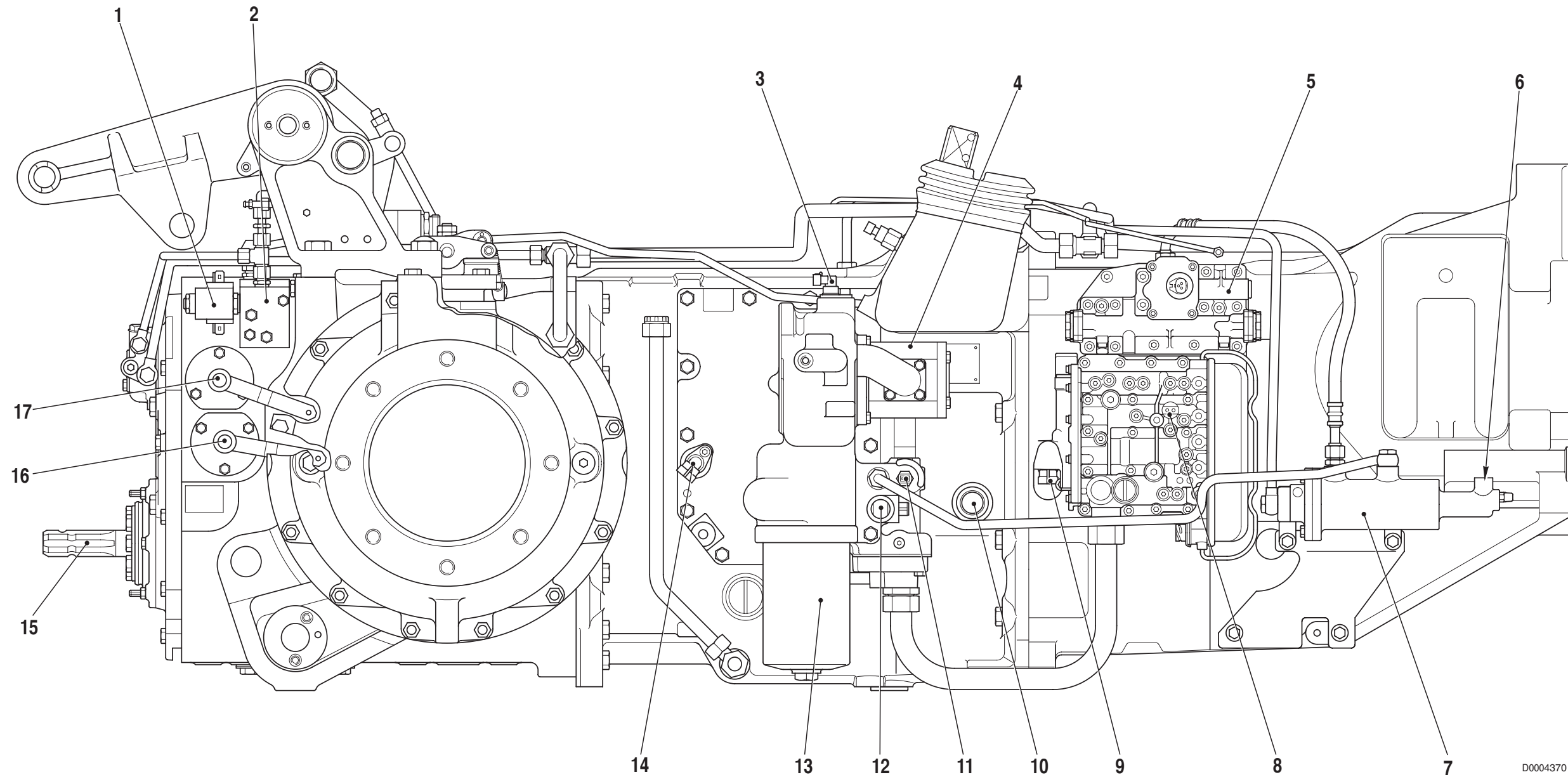
- A.** Gearbox
- B.** Rear axle
- C.** Rear PTO



D0004360

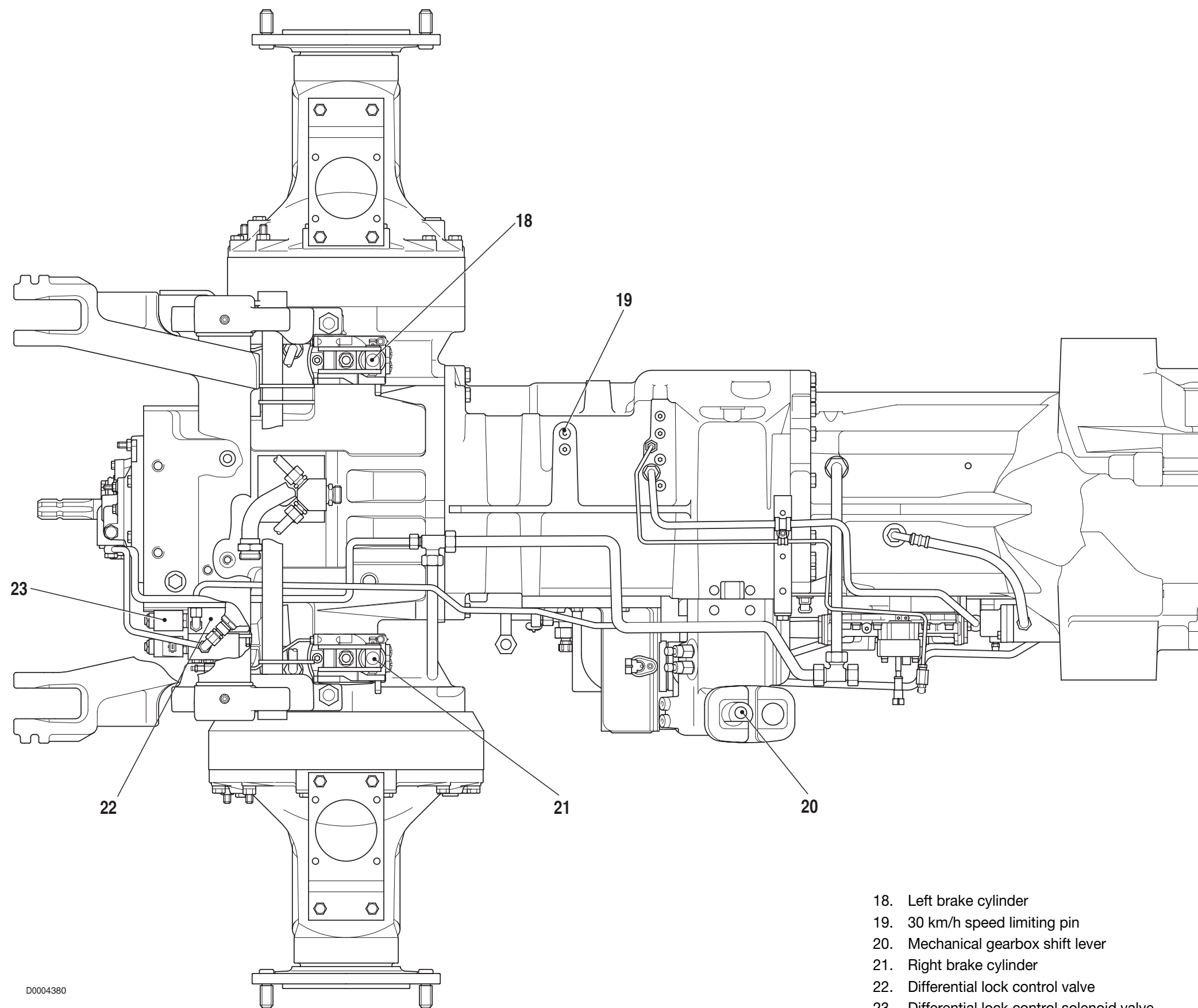
1.1 TRANSMISSION (Power Shift version)

1.1.1 MAIN COMPONENTS



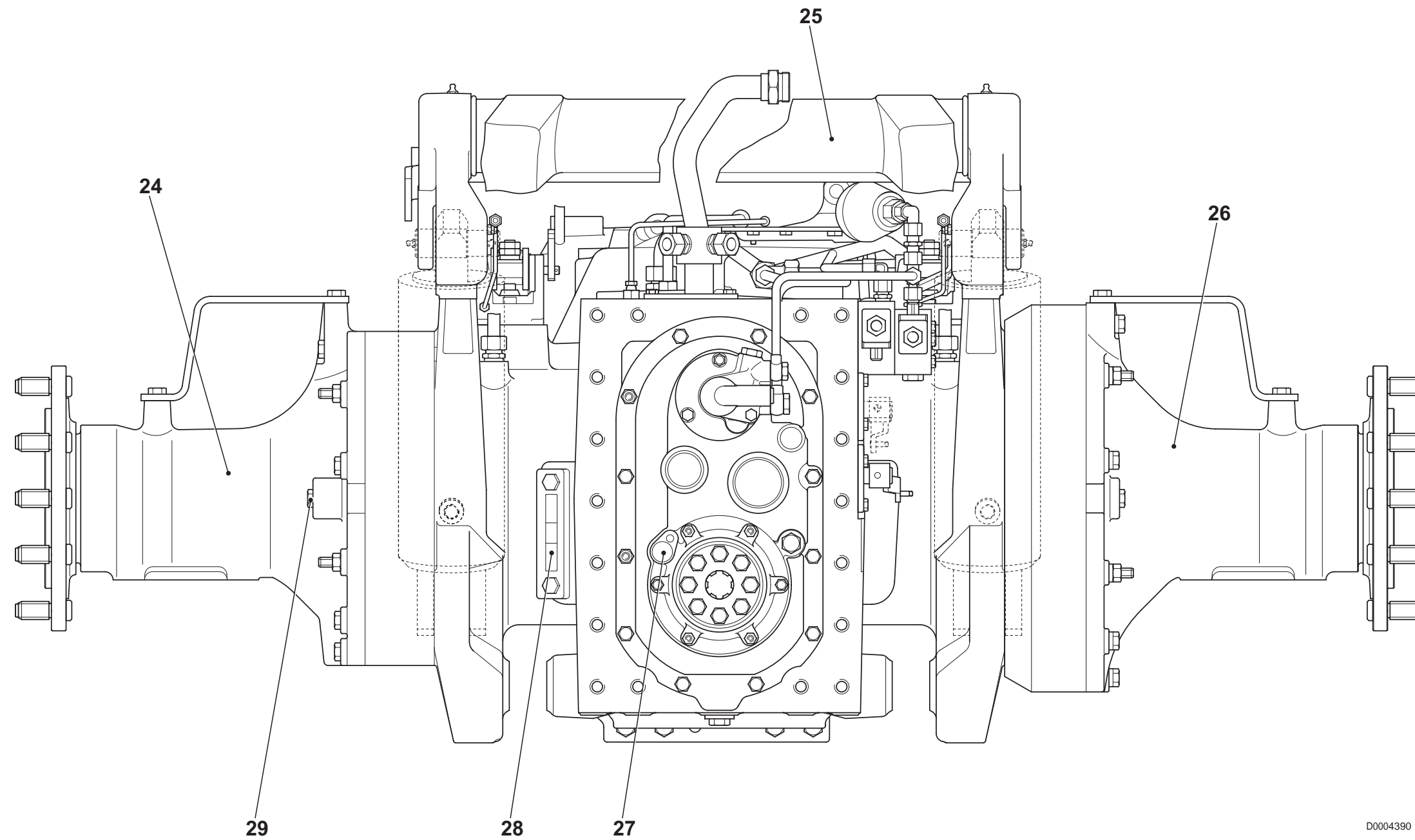
D0004370

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



D0004380

- 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



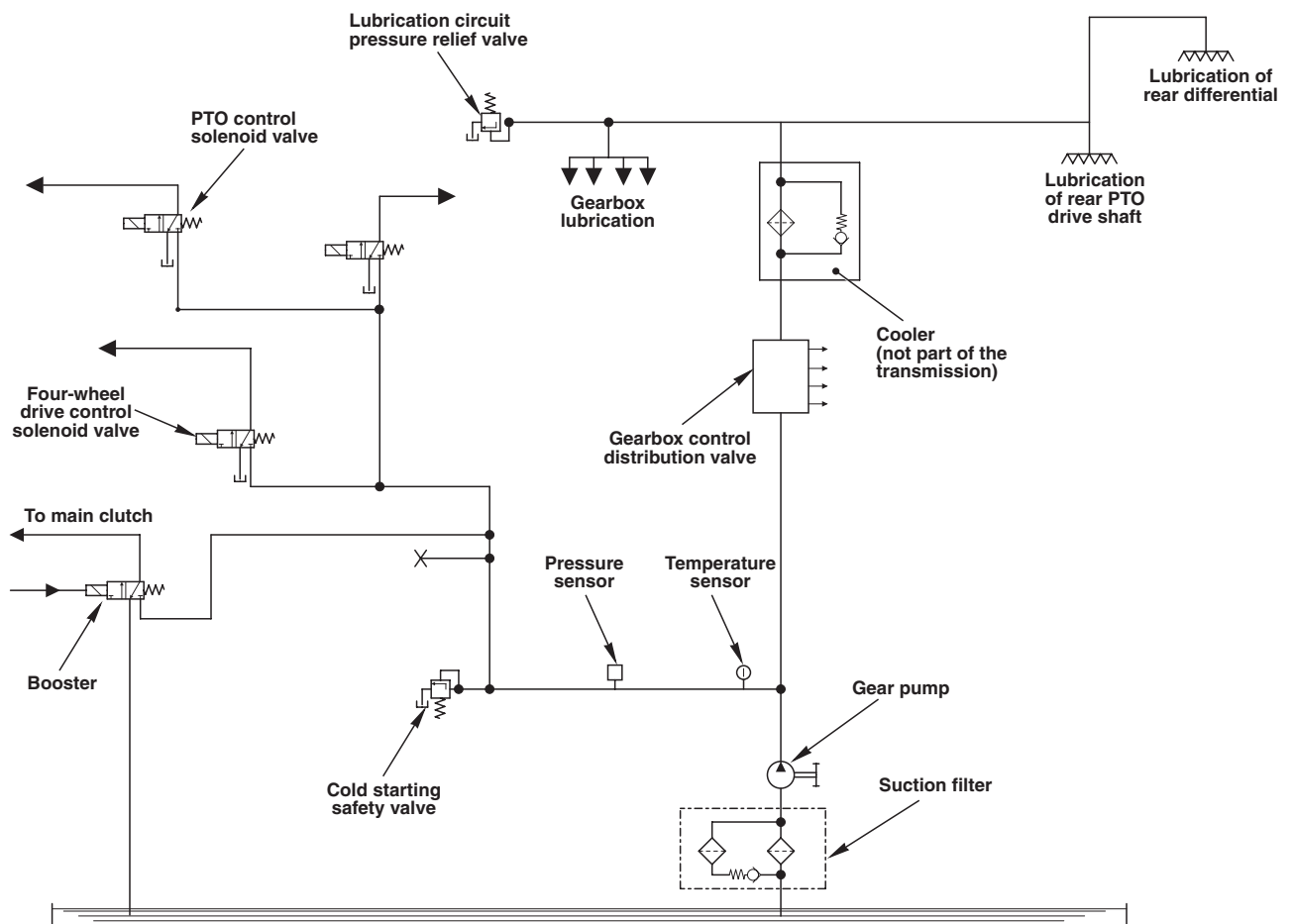
D0004390

- 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.

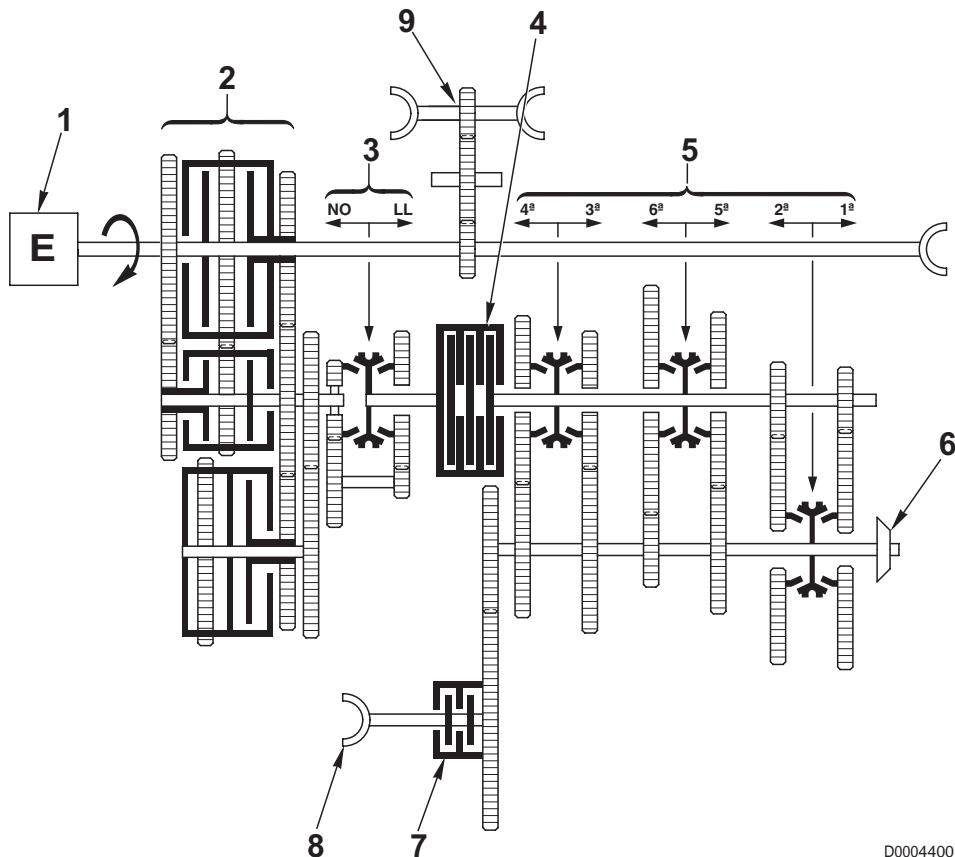


D0004411

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.

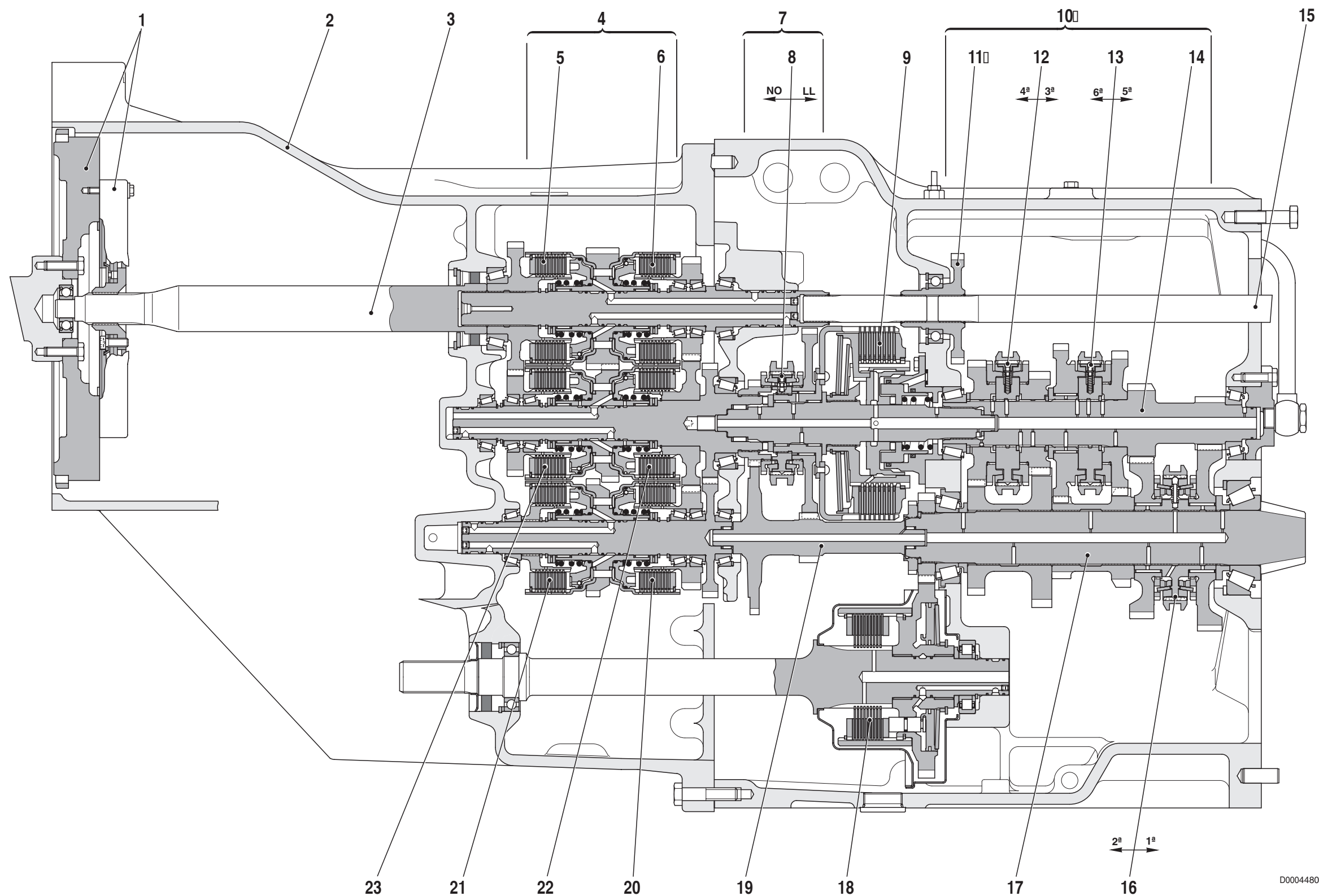


D0004400

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"

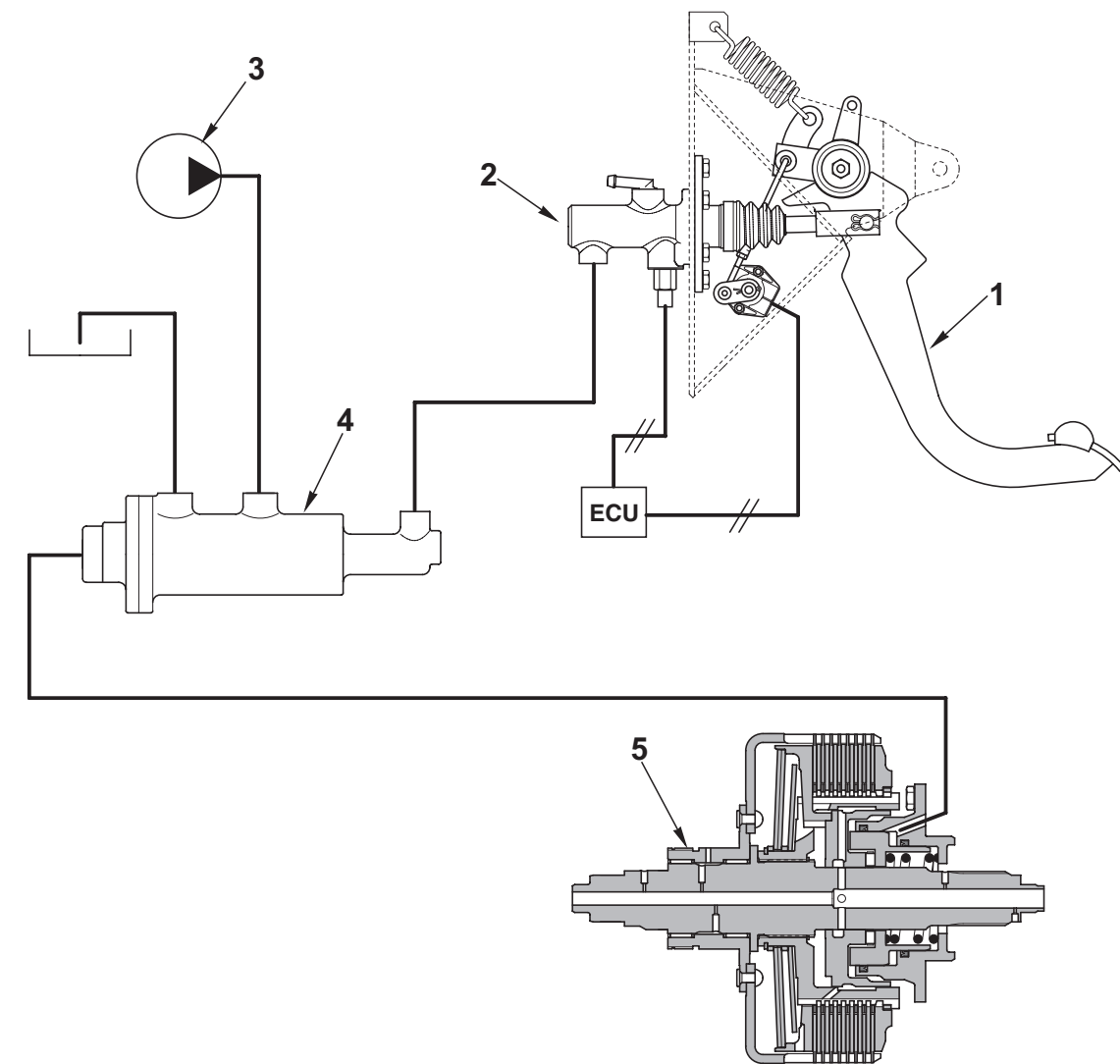
- 21. Clutch "G"
- 22. Clutch "B"
- 23. Clutch "D"

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

D0004420

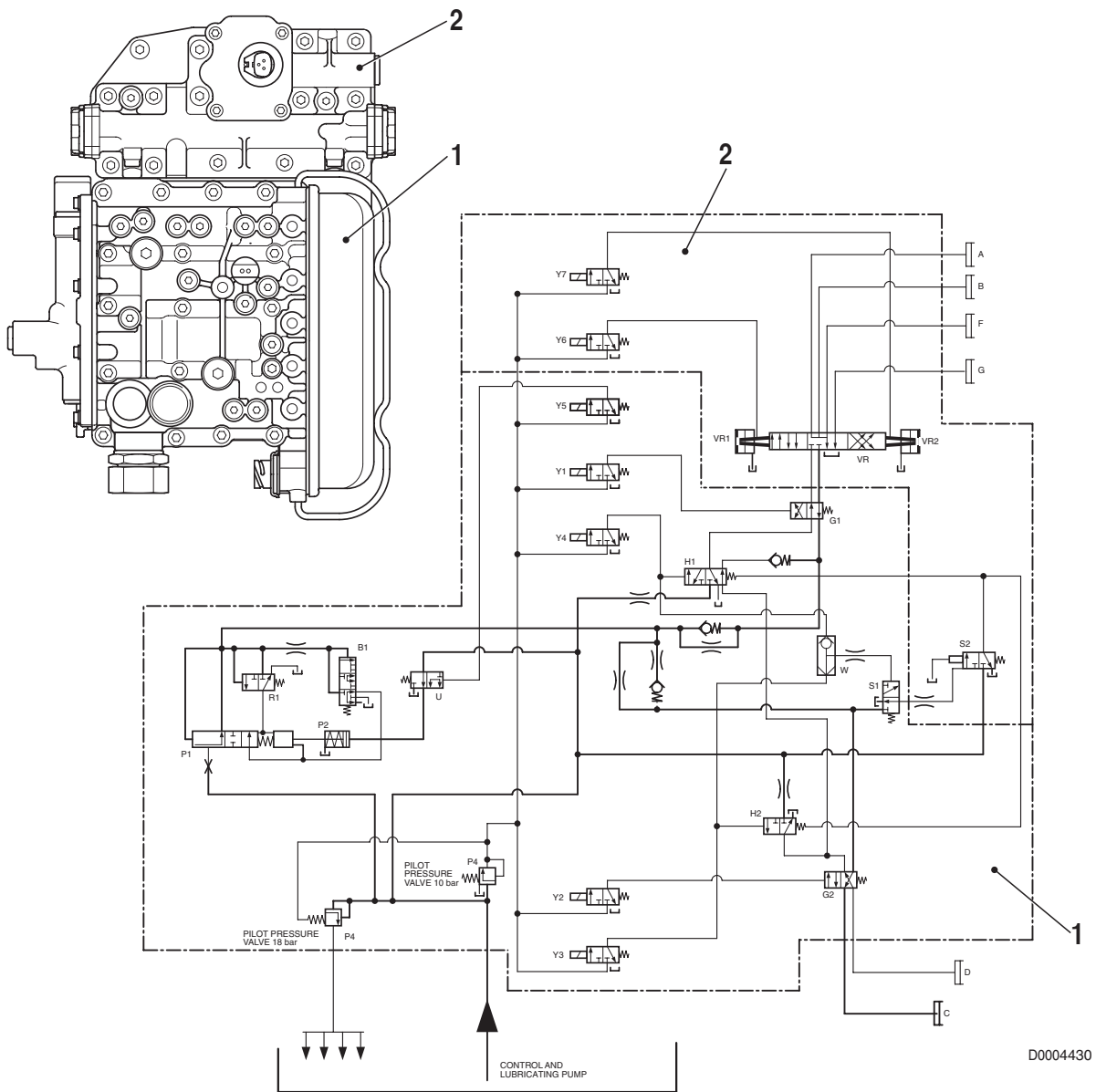
1.1.5 HYDRAULIC GEARBOX AND SHUTTLE DISTRIBUTION VALVE

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:

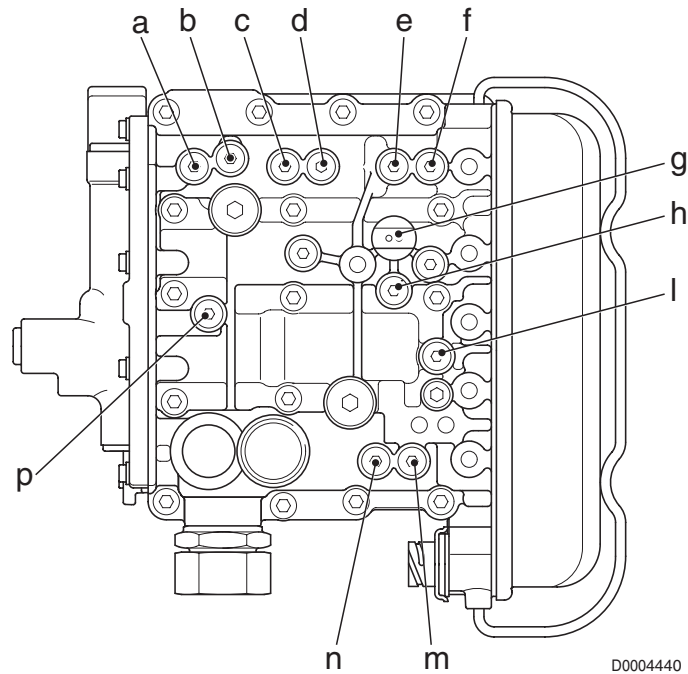
- A. the hydraulic gearbox control valve (1) to select **S**, **H**, **M** and **L** ratios
- B. the shuttle control valve (2) to select FORWARD and REVERSE gears.

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

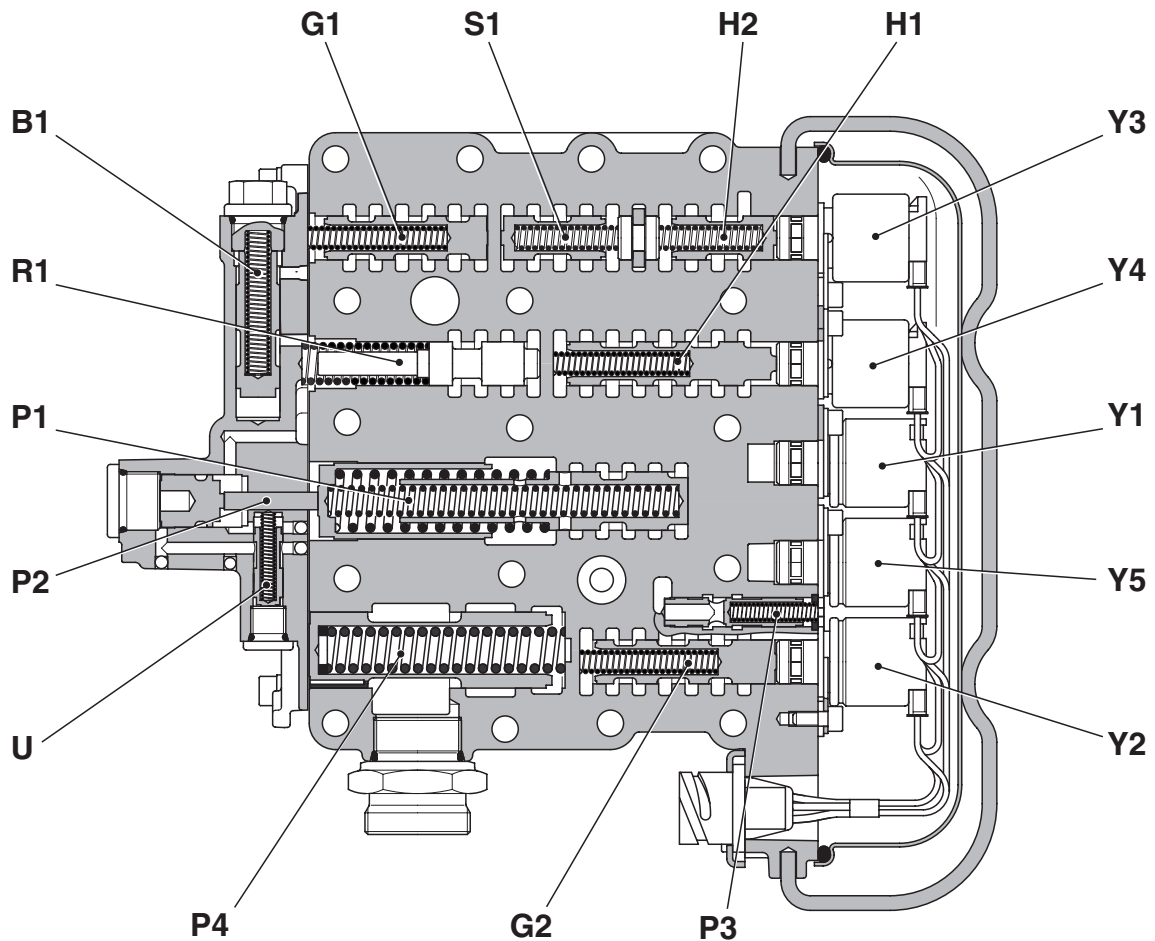
PRESSURE TEST POINTS



D0004440

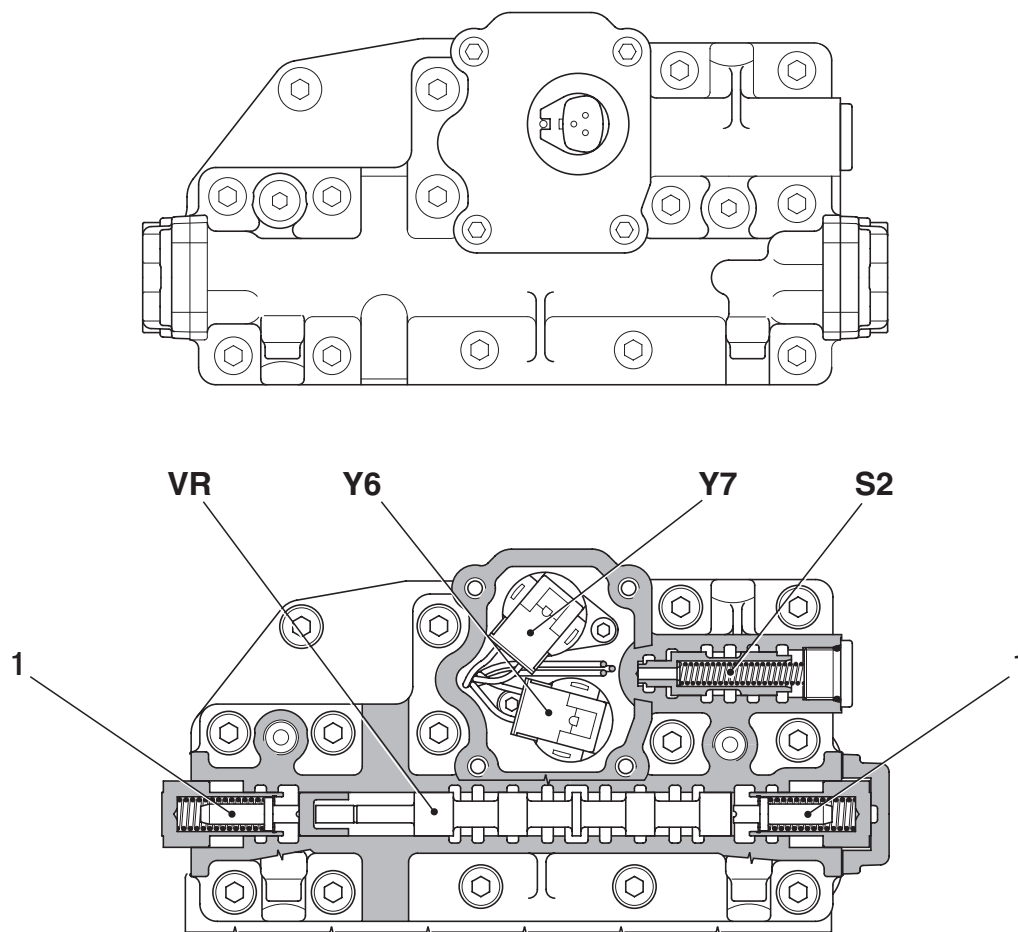
Pos.	Function	Thread size
a.	A or F clutch pressure	M10x1
b.	B or G clutch pressure	M10x1
c.	Y3 or Y4 solenoid valve pressure	M10x1
d.	Pressure P_g to relief valve	M10x1
e.	Pressure P_r from relief valve (18 bar)	M10x1
f.	Engagement pressure of clutch C or D	M10x1
g.	General pressure (18 bar)	M10x1
h.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

MAIN COMPONENTS



D0005320

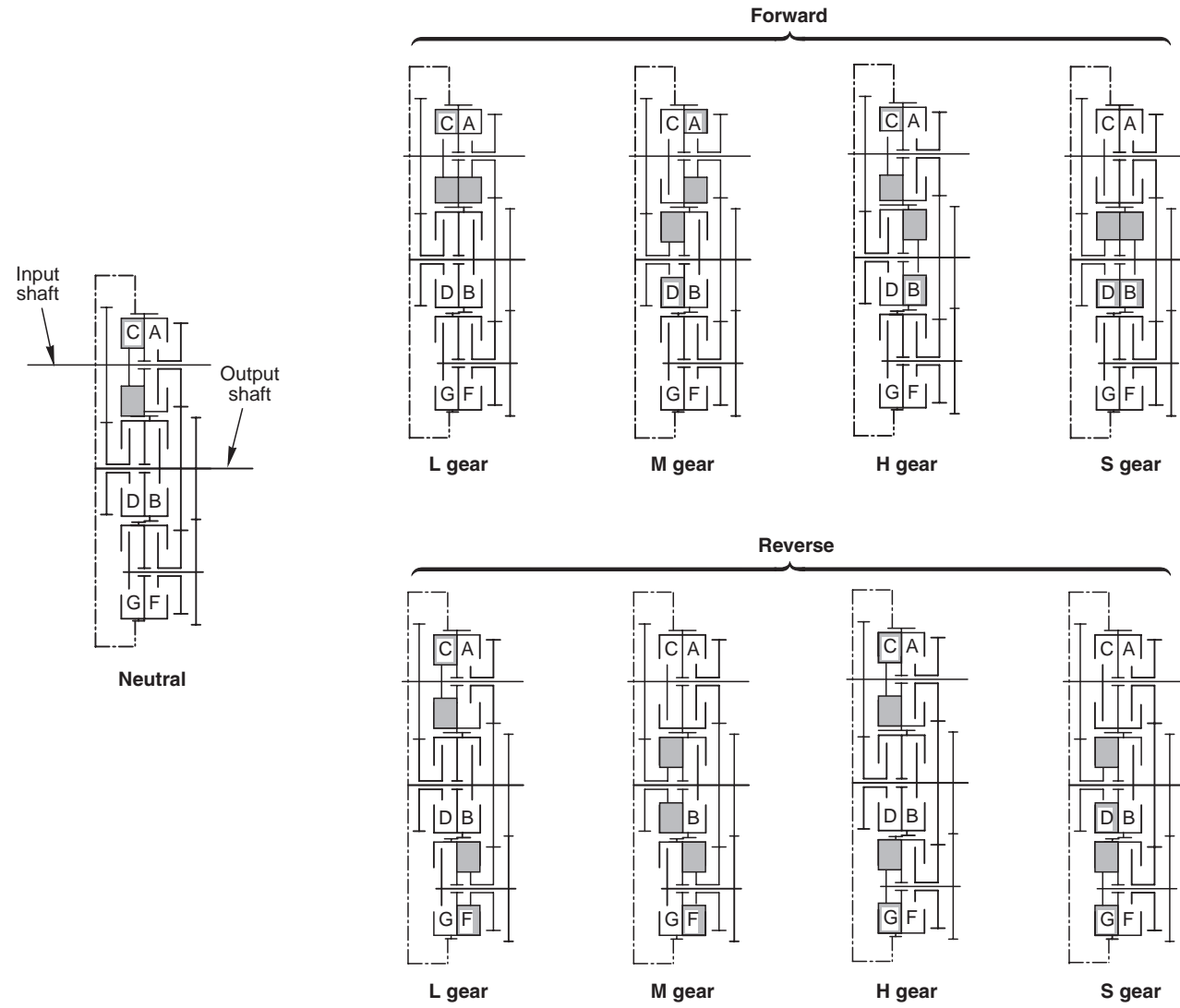
- B1** Breather valve
- G1** Clutch selection valve for **A/B** or **F/G** clutches
- S1** Relief valve
- H2** Clutch engagement valve for **C/D** clutches
- H1** Clutch engagement valve for **A/B** or **F/G** clutches
- Y3** Pilot solenoid valve for engagement valve **H2**
- Y4** Pilot solenoid valve 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



D0004501

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			○				○	

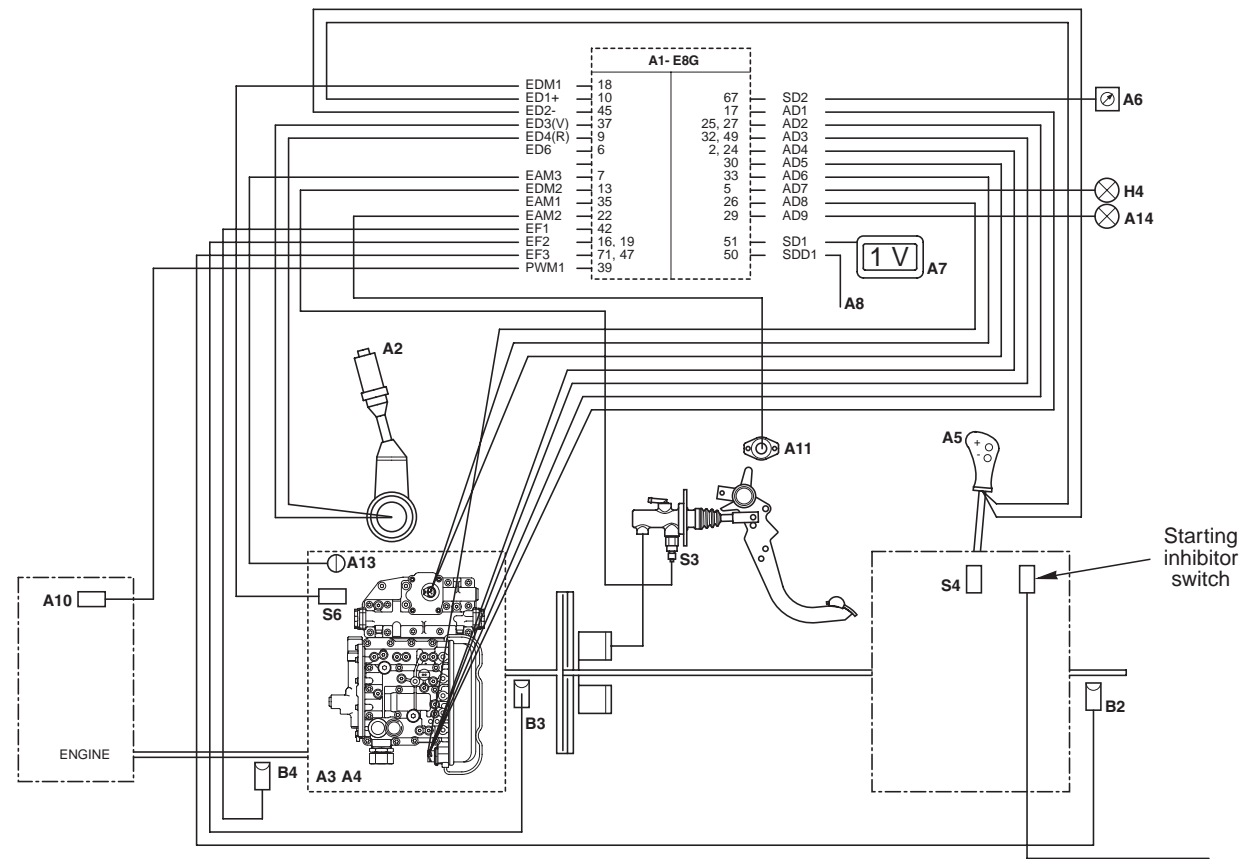
● = Solenoid valve energised
○ = Solenoid valve briefly energised during gear change

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			○				○	

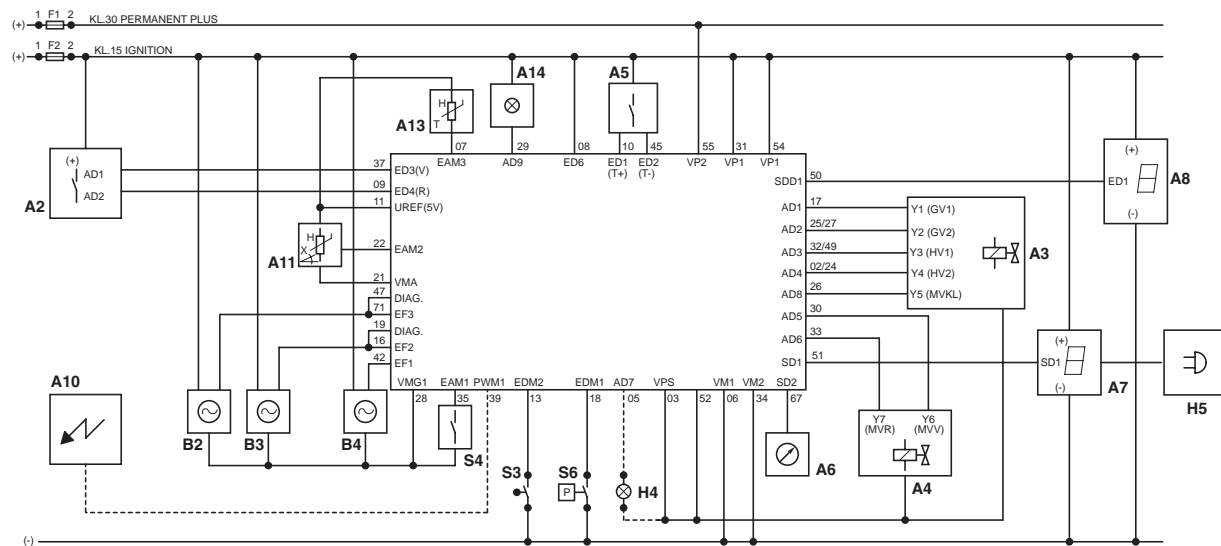
● = Solenoid valve energised
○ = Solenoid valve briefly energised during gear change

1.1.7 TRANSMISSION ELECTRONIC SYSTEM SCHEMATIC



COMPONENTS

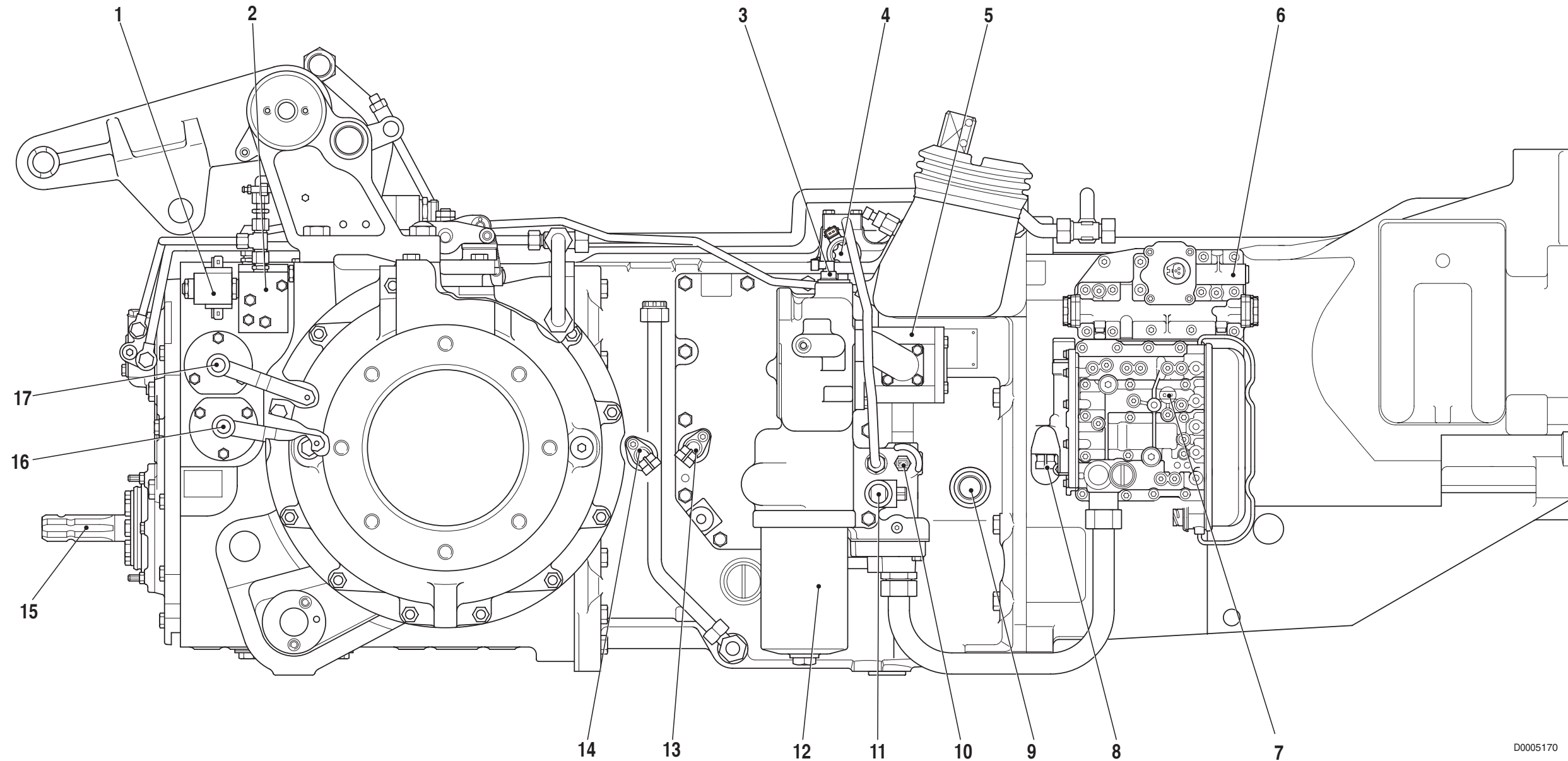
- A1 Electronic transmission control unit
- A2 Shuttle control lever (FORWARD/REVERSE)
- A3 Gearbox control valve
- A4 Shuttle control valve
- A5 Range selector lever (L M H S)
- A6 Provision for tachymeter connection
- A7 Display
- A8 Diagnostics connection
- A10 Engine load sensor
- A11 Clutch pedal 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)



D0004491

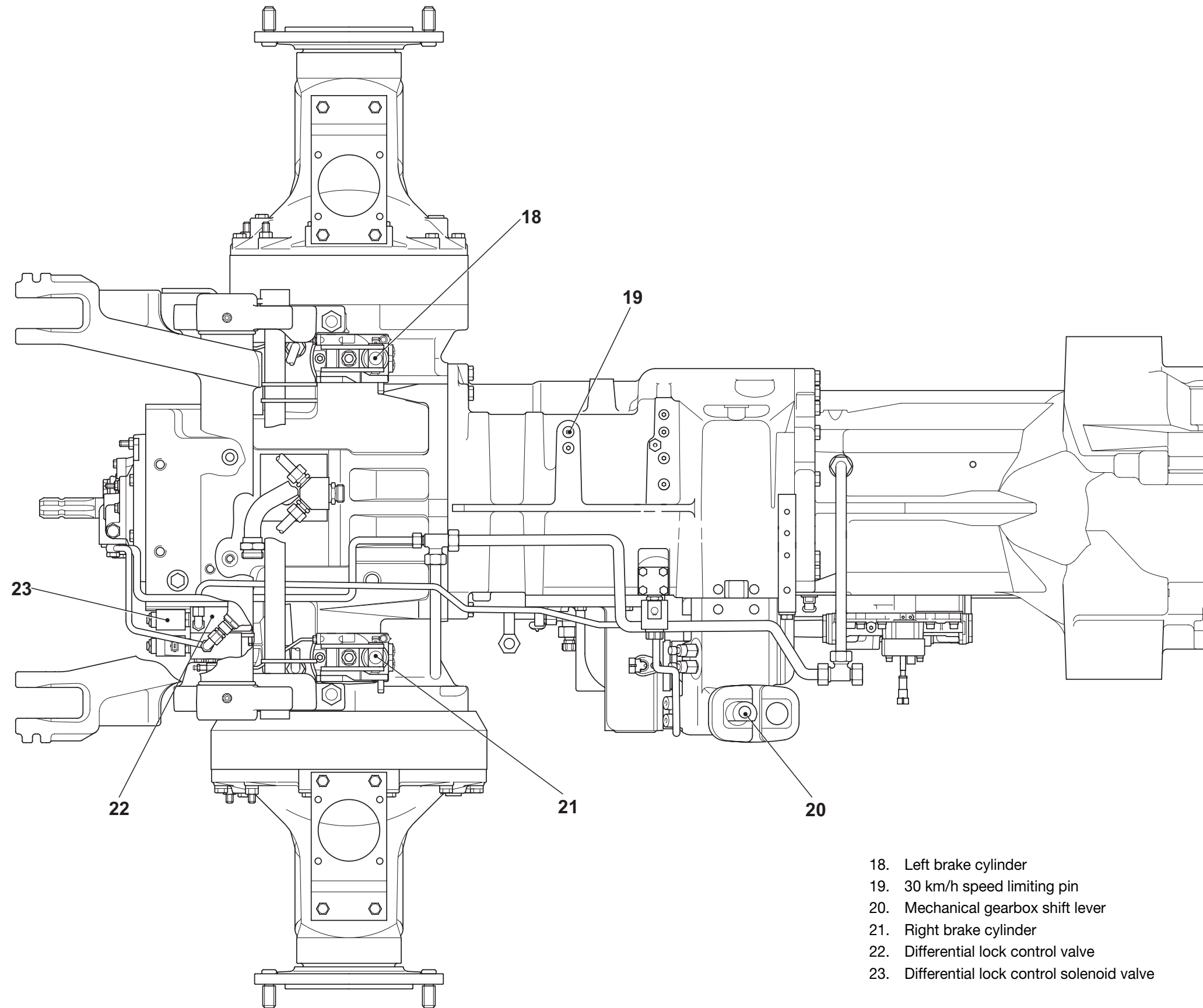
1.2 TRANSMISSION (Power Shuttle version)

1.1.1 MAIN COMPONENTS



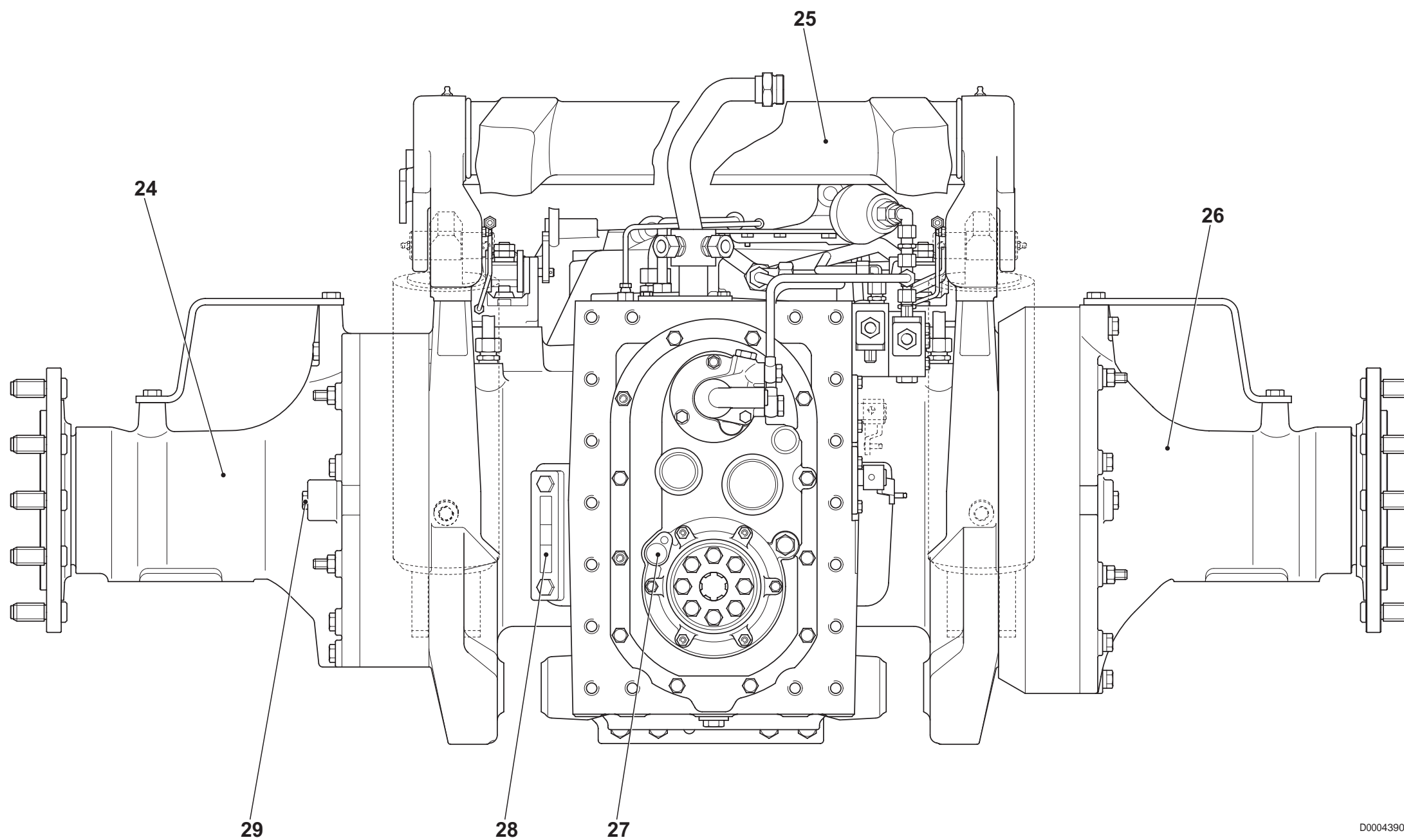
D0005170

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



- 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

D0005230



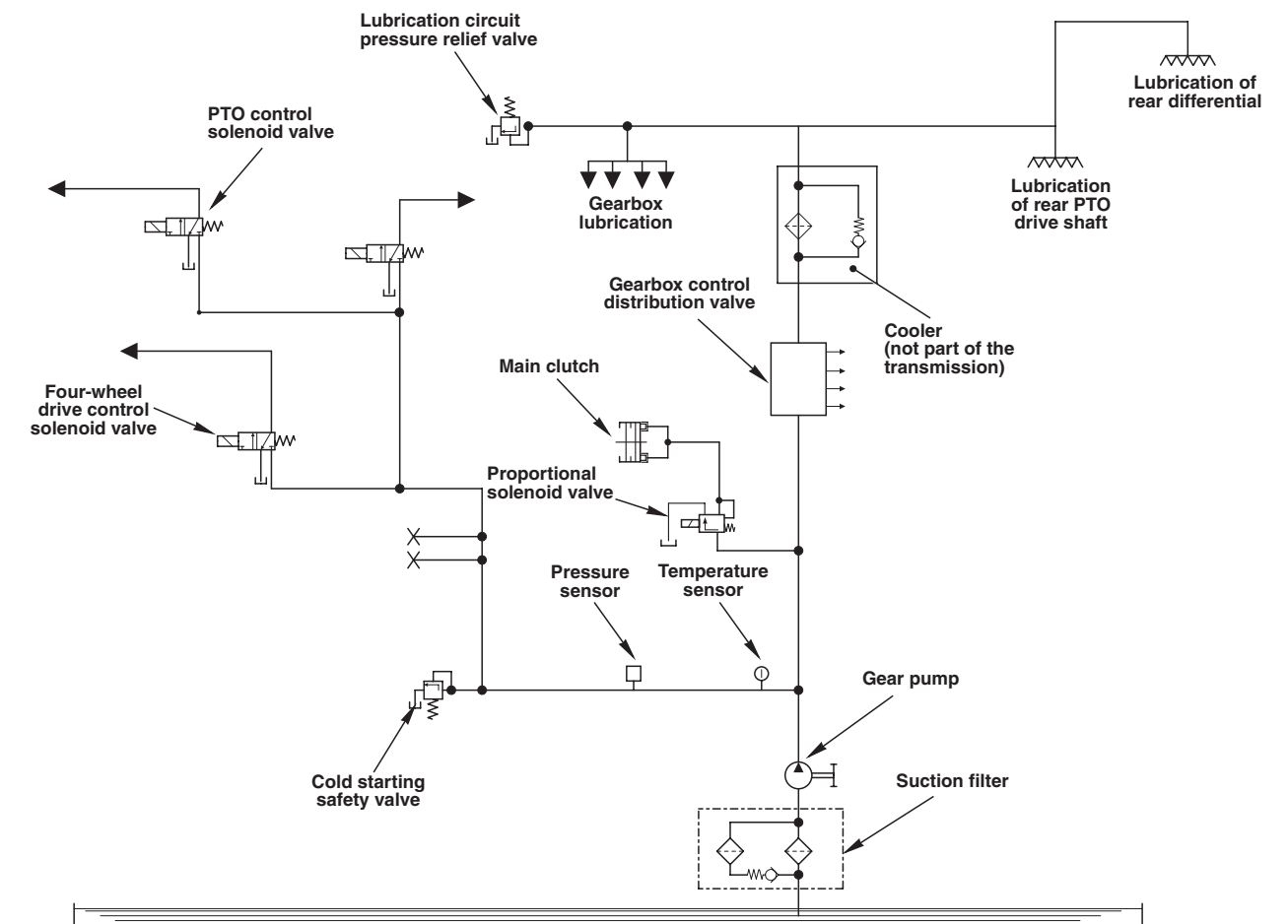
D0004390

- 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.

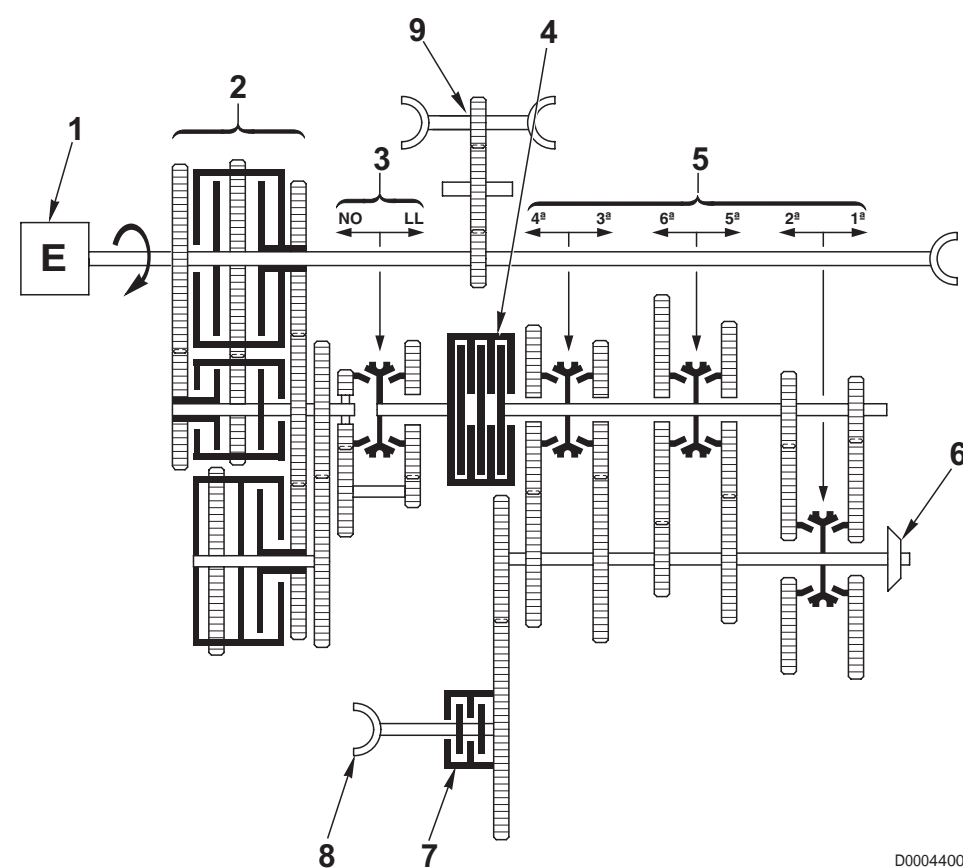


D0005181

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.

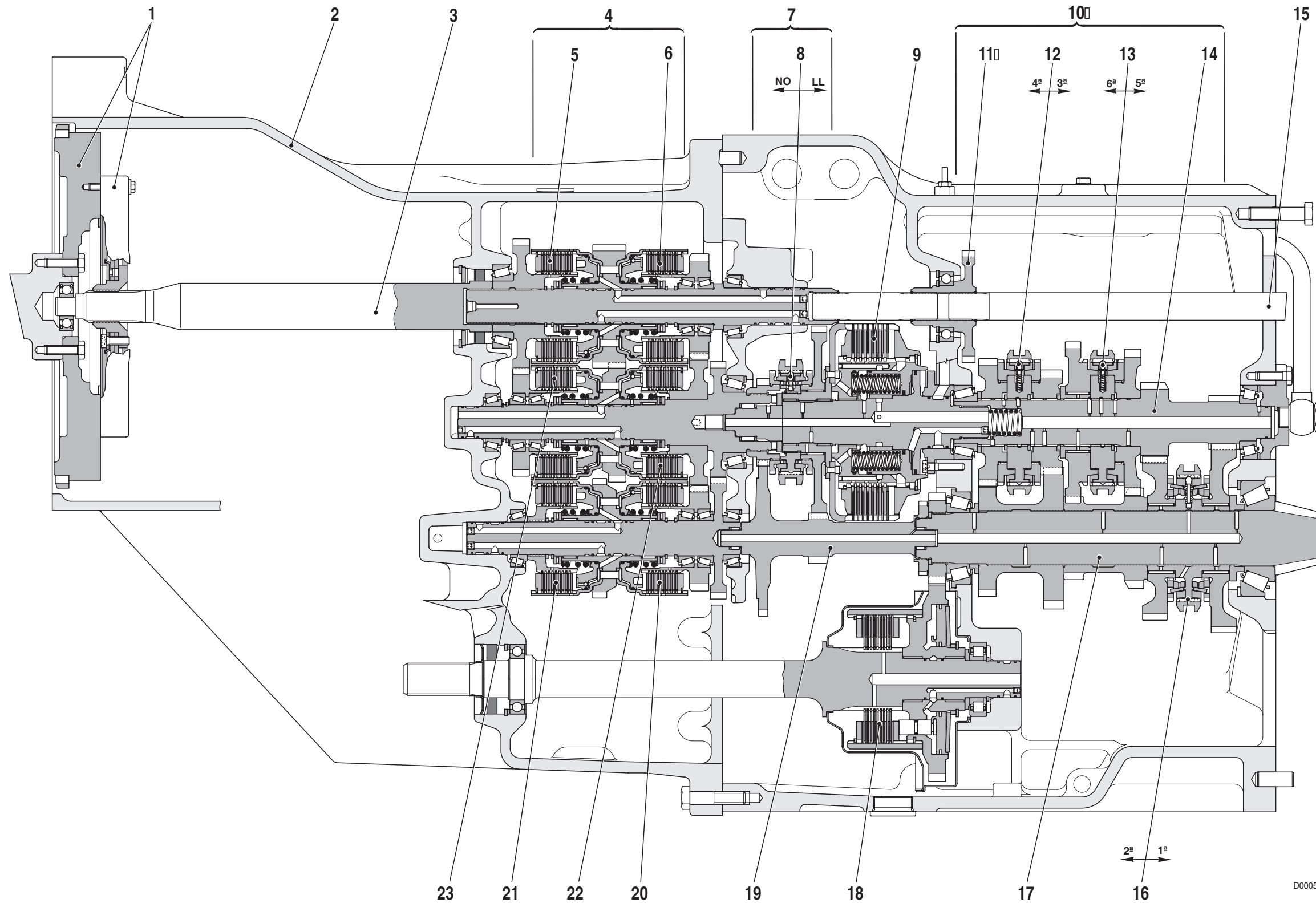


D0004400

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"

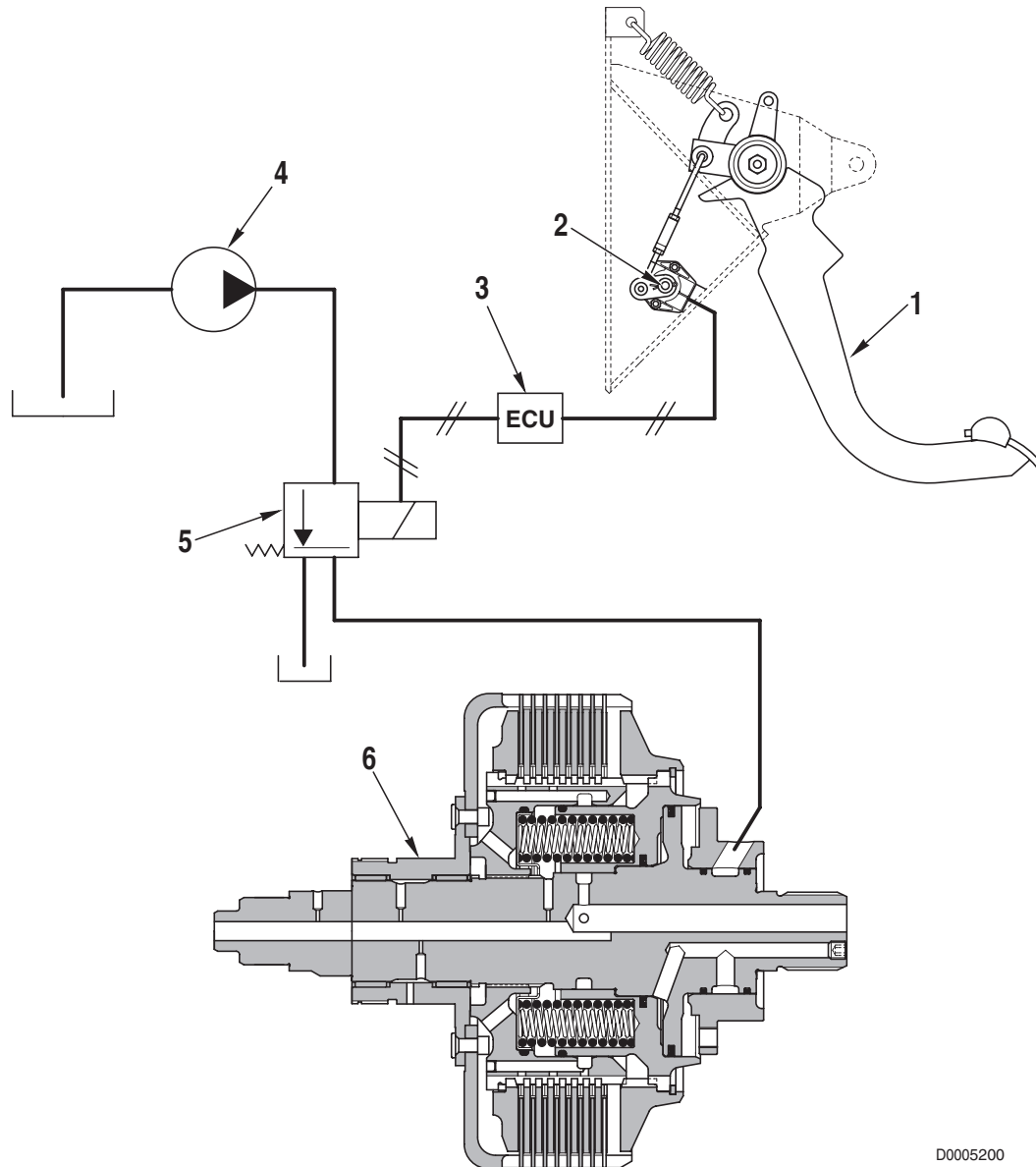
D0005190

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.



D0005200

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

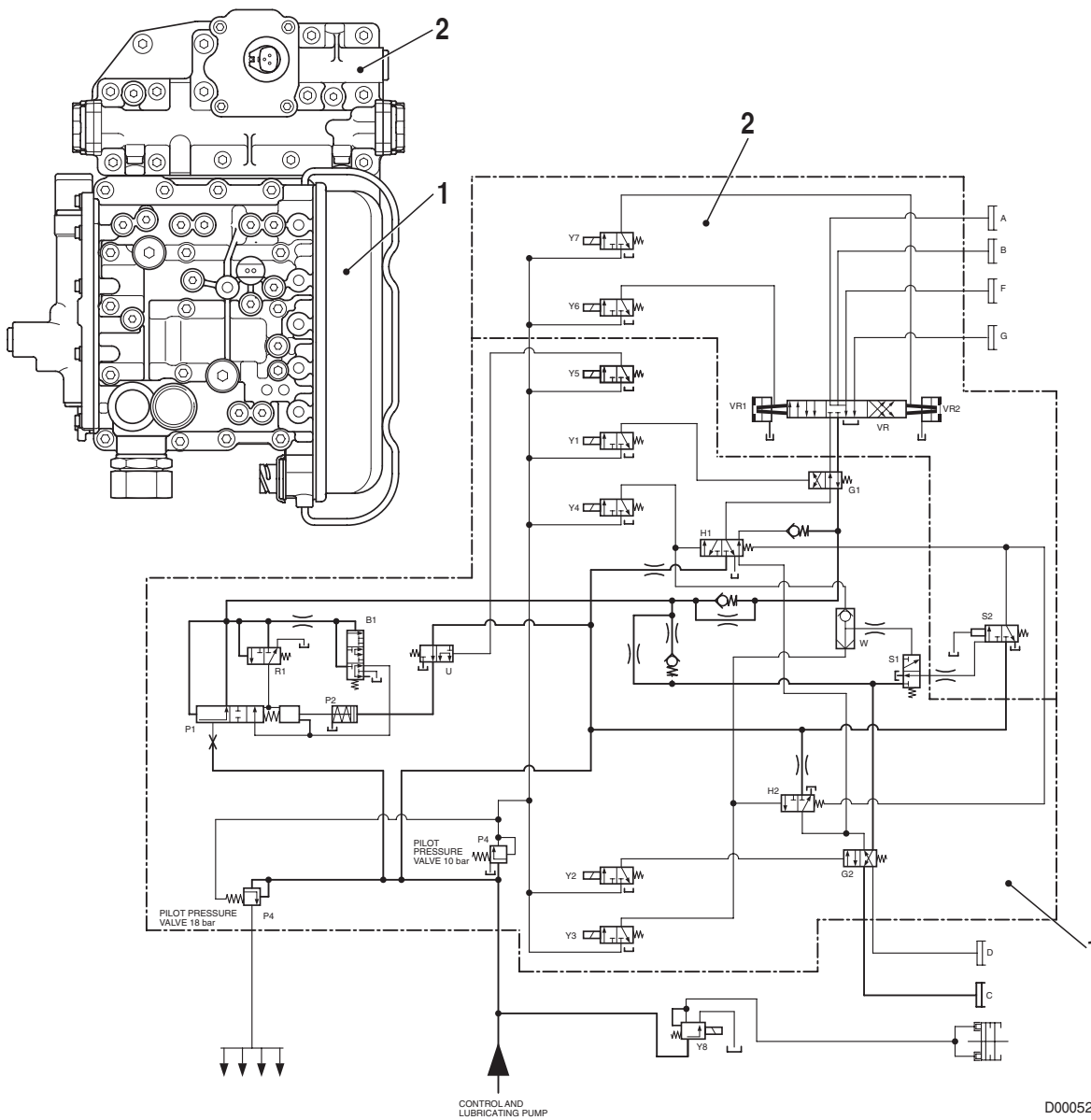
1.2.5 HYDRAULIC GEARBOX AND SHUTTLE DISTRIBUTION VALVE

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.

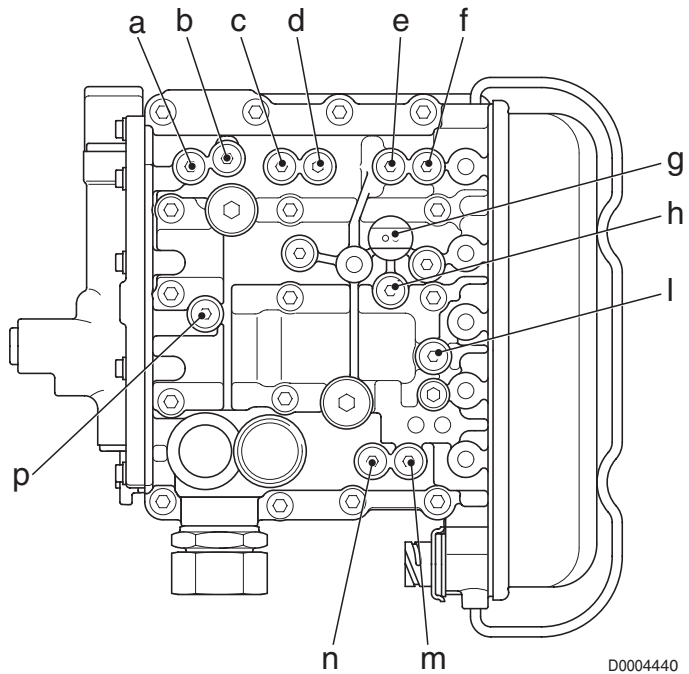
This distribution valve also supplies hydraulic fluid for the lubrication of the mechanical gearbox, the rear differential and the rear PTO control shaft.



D0005210

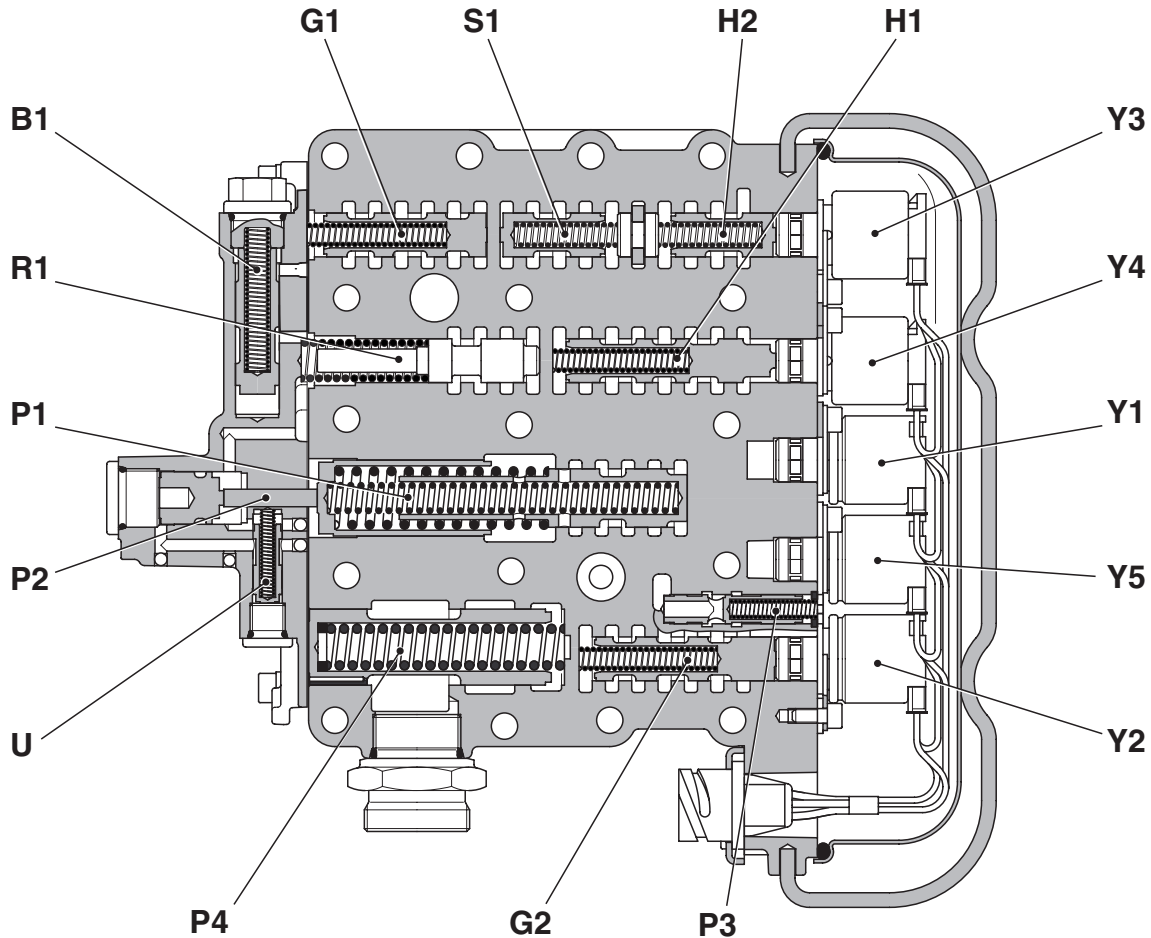
A. GEARBOX CONTROL VALVE

PRESSURE TEST POINTS



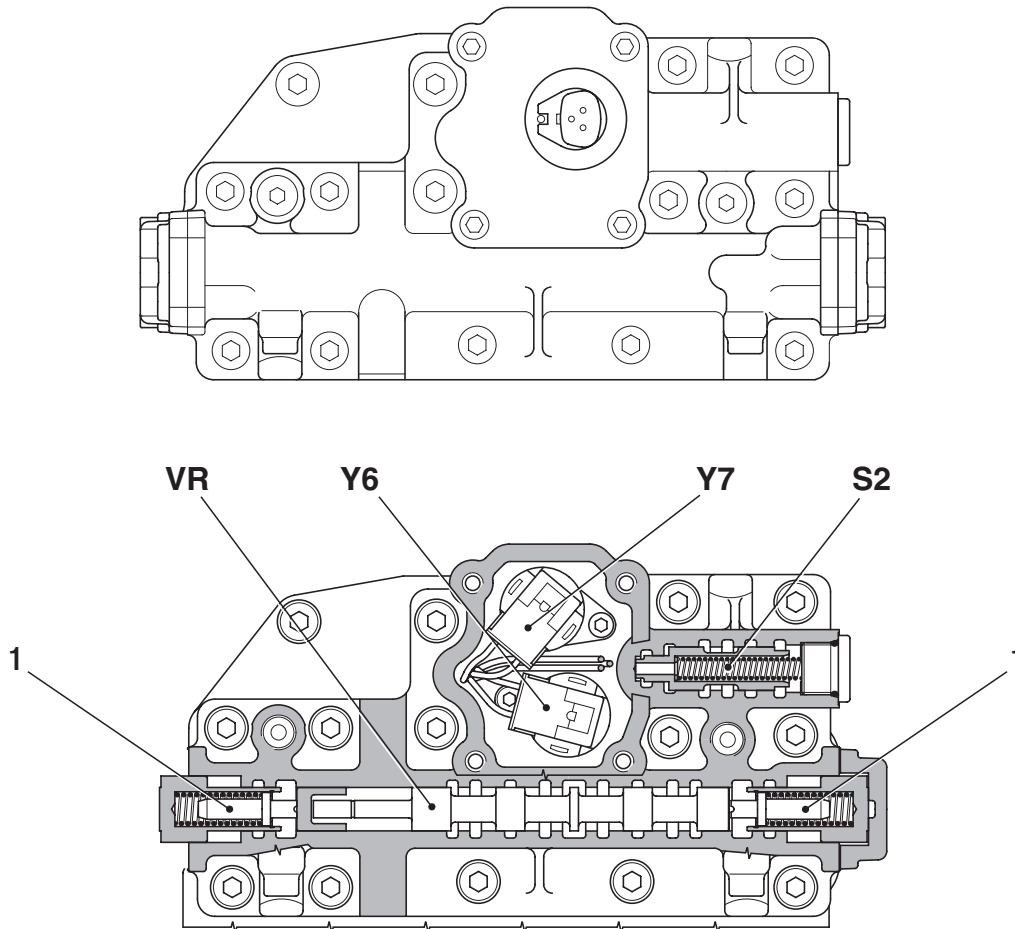
Pos.	Function	Thread size
a.	A or F clutch pressure	M10x1
b.	B or G clutch pressure	M10x1
c.	Y3 or Y4 solenoid valve pressure	M10x1
d.	Pressure P_g to relief valve	M10x1
e.	Pressure P_r from relief valve (18 bar)	M10x1
f.	Engagement pressure of clutch C or D	M10x1
g.	General pressure (18 bar)	M10x1
h.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

MAIN COMPONENTS



D0005320

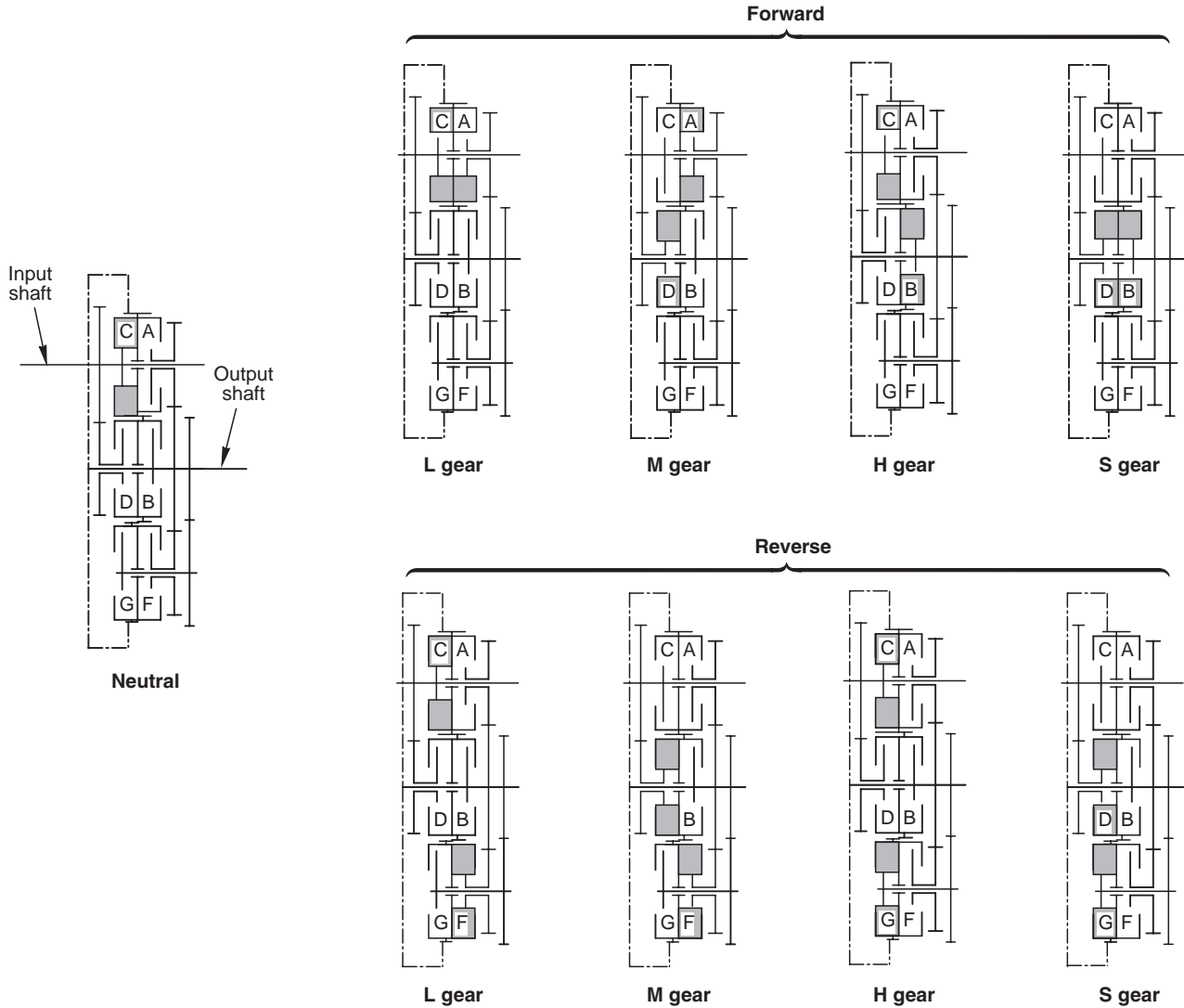
- B1** Breather valve
- G1** Clutch selection valve for **A/B** or **F/G** clutches
- S1** Relief valve
- H2** Clutch engagement valve for **C/D** clutches
- H1** Clutch engagement valve for **A/B** or **F/G** clutches
- Y3** Pilot solenoid valve for engagement valve **H2**
- Y4** Pilot solenoid valve 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



D0004501

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			○				○	

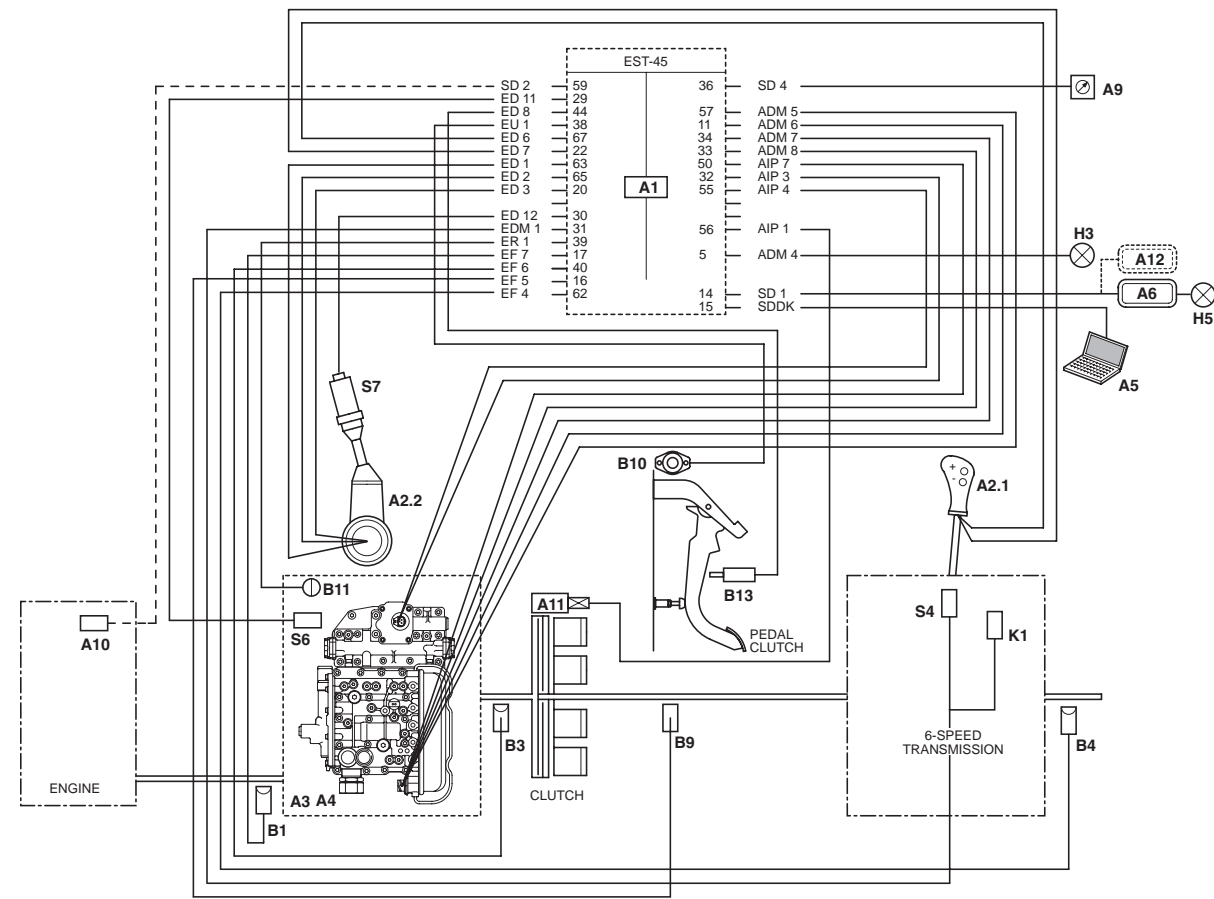
● = Solenoid valve energised
○ = Solenoid valve briefly energised during gear change

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			○				○	

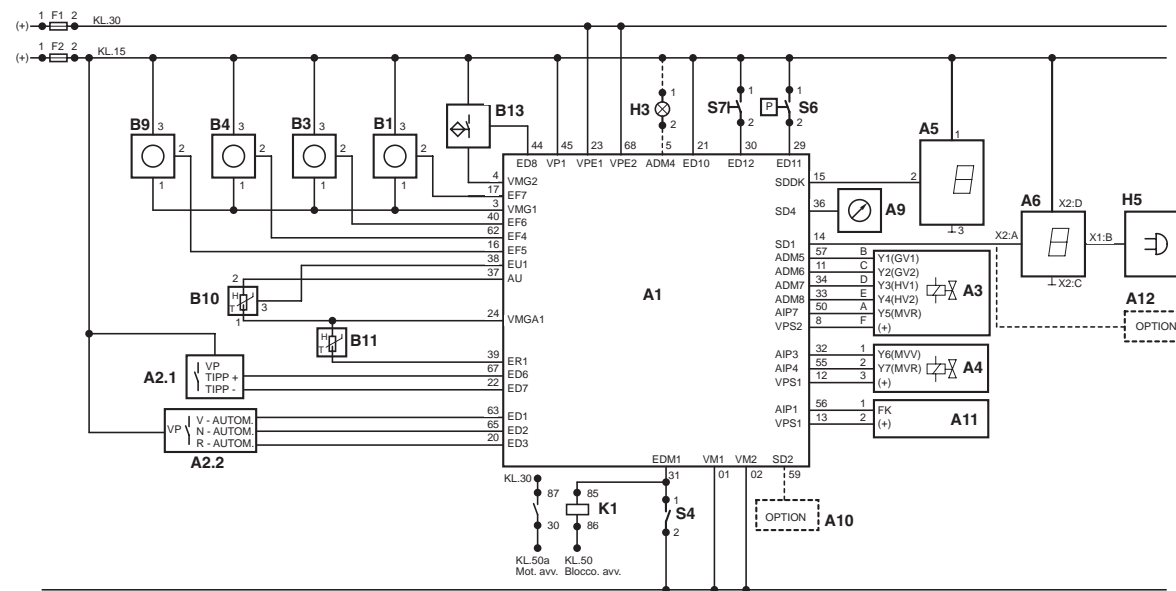
● = Solenoid valve energised
○ = Solenoid valve briefly energised during gear change

1.2.7 TRANSMISSION ELECTRONIC SYSTEM SCHEMATIC



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



D0005221

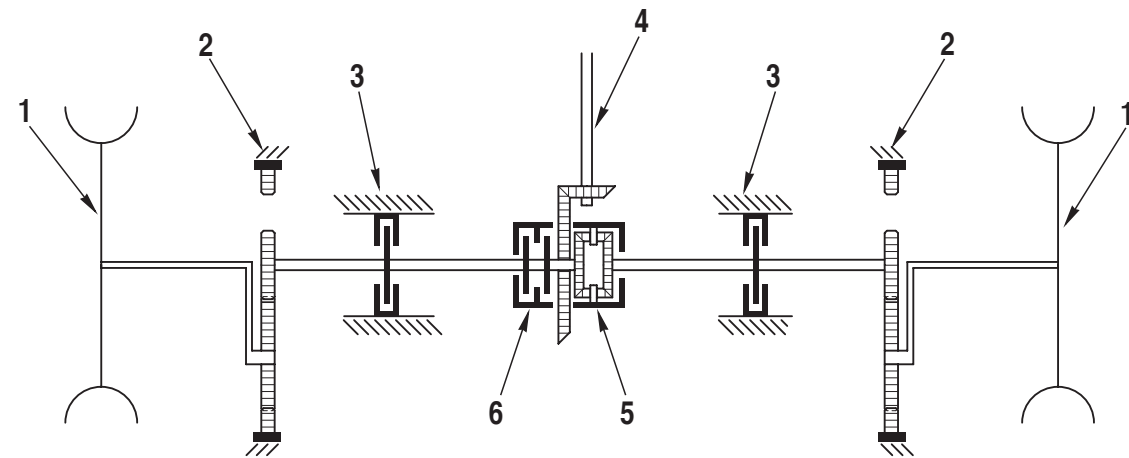
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1.3 REAR AXLE

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).

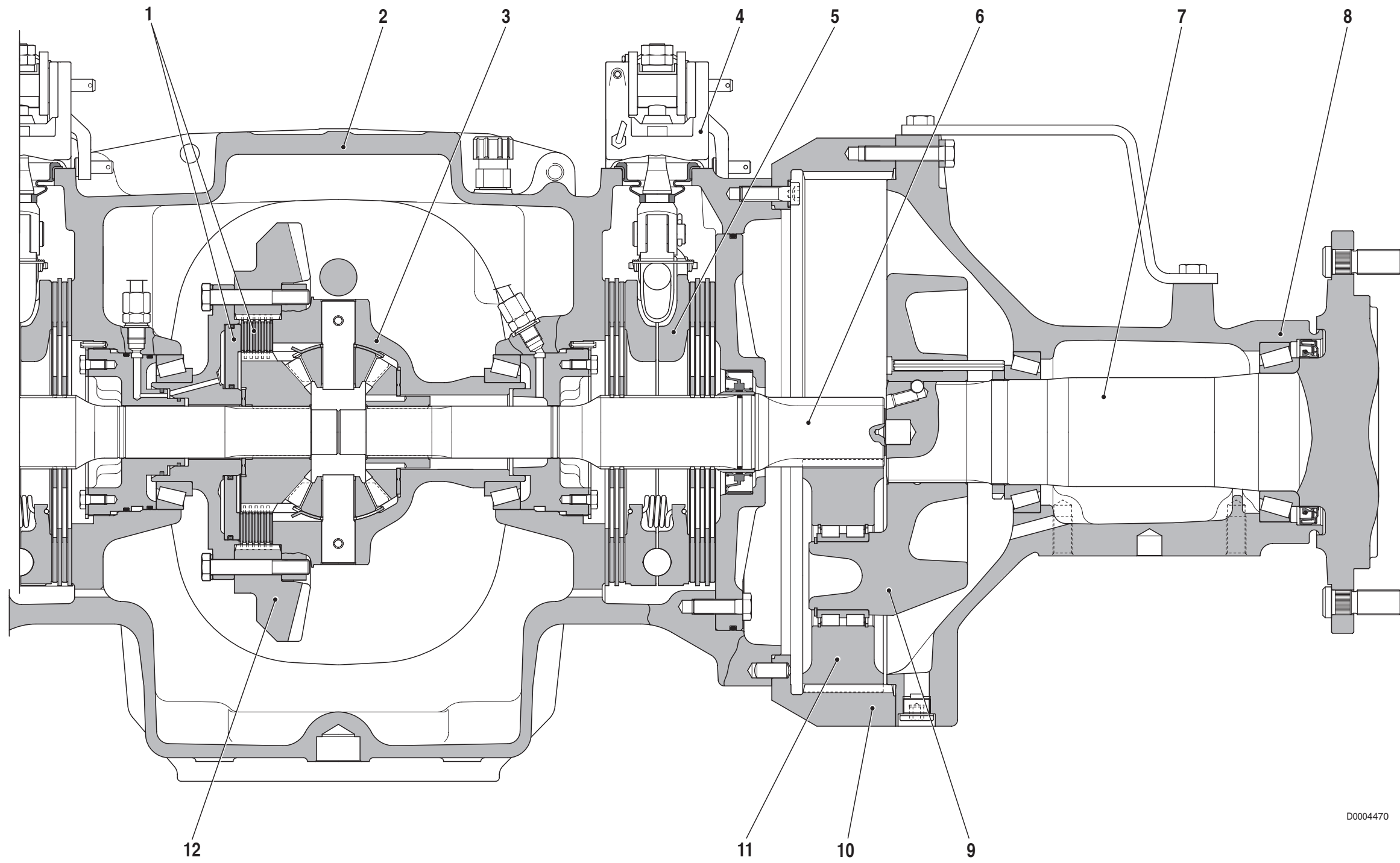


D0004450

COMPONENTS

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

COMPONENTS



D0004470

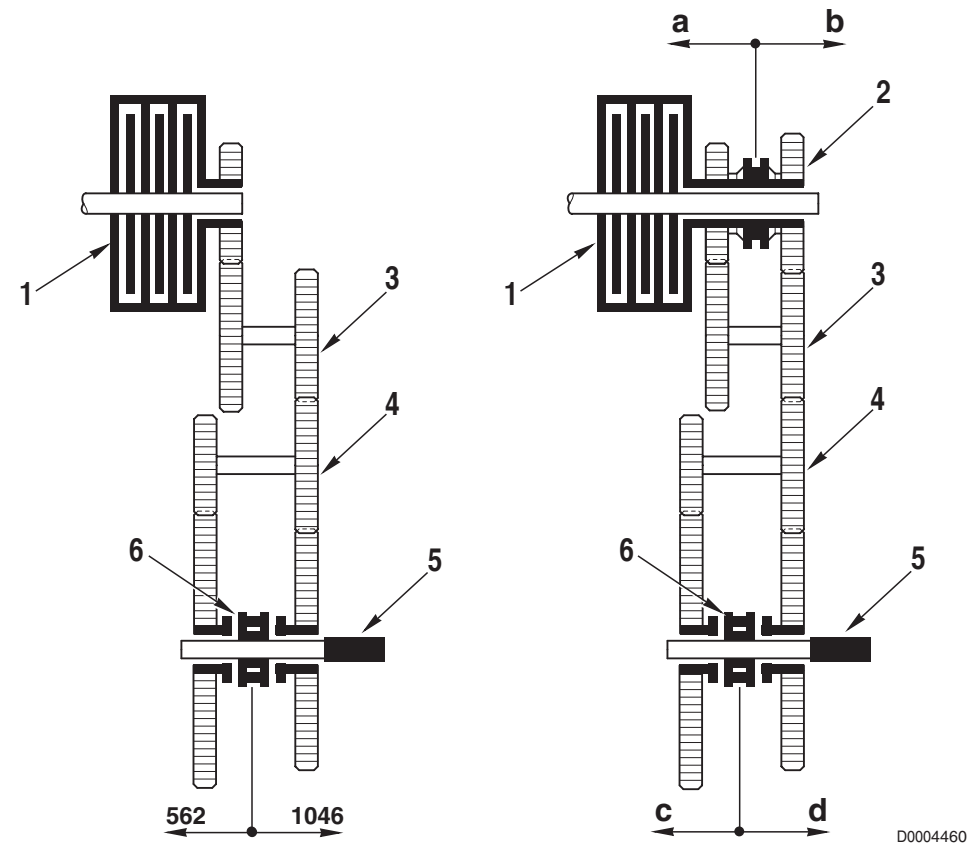
- 1. Differential lock
- 2. Central axle housing
- 3. Differential
- 4. Brake control device
- 5. Brake
- 6. Half-shaft

- 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 .



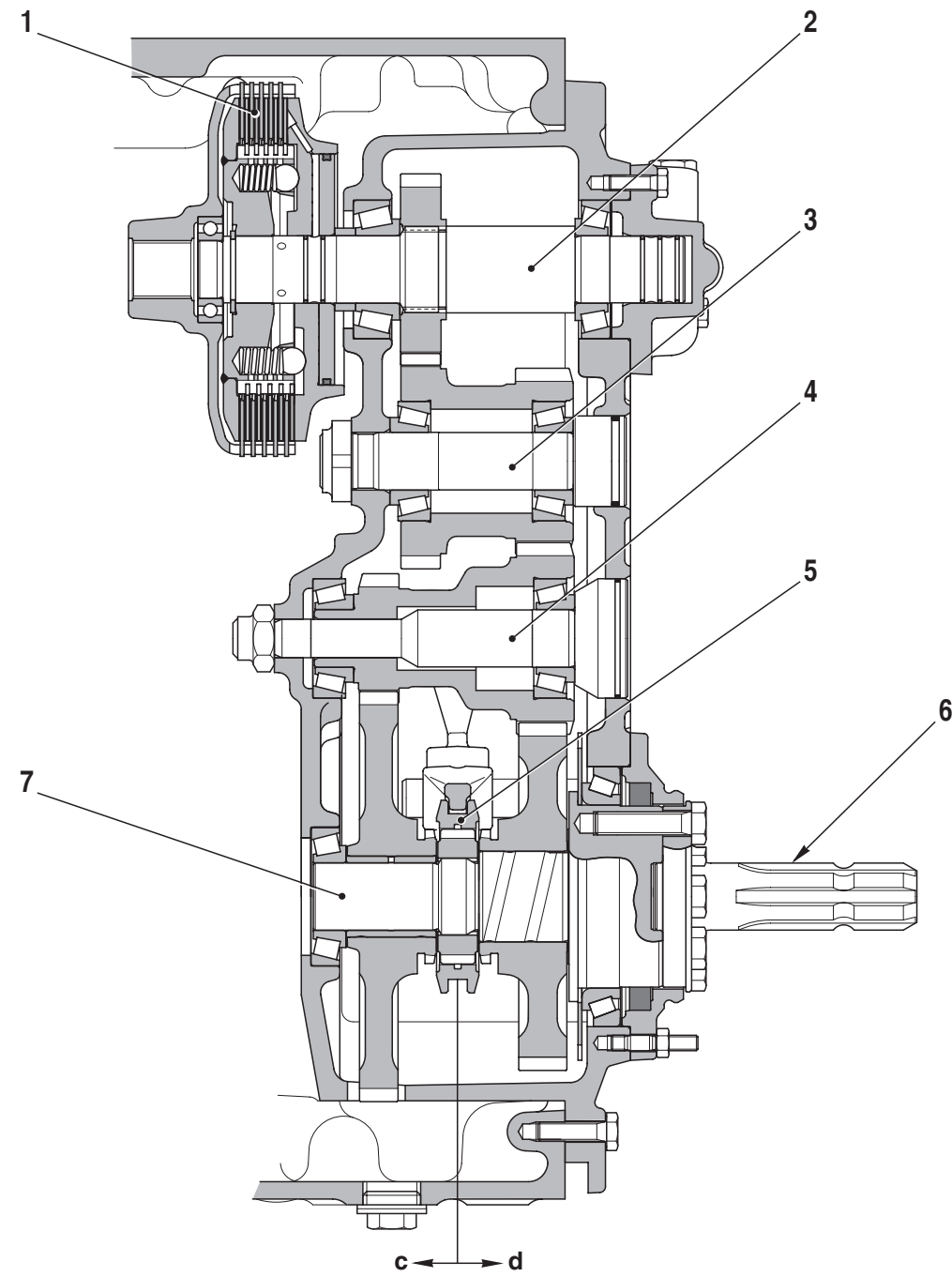
- 1. Clutch
- 2. Synchronizer 1
- 3. Intermediate shaft
- 4. Intermediate shaft
- 5. PTO shaft
- 6. Synchronizer 2

Speed of PTO output shaft - 4-speed version

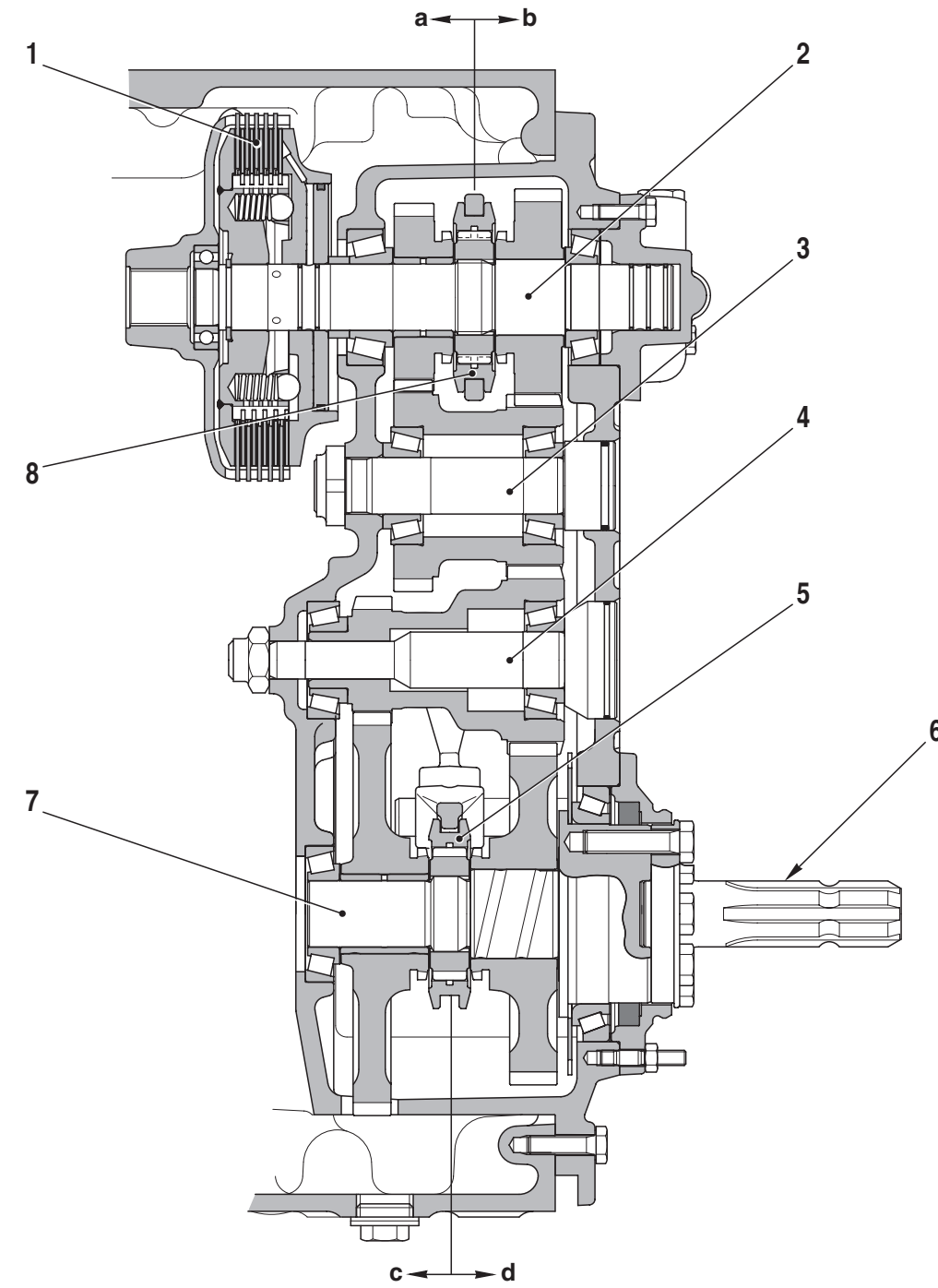
Synchronizer 1	Synchronizer 2	
	c	d
a	562	1046
b	772	1437

COMPONENTS

2 SPEED VERSION



4 SPEED VERSION



- 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)

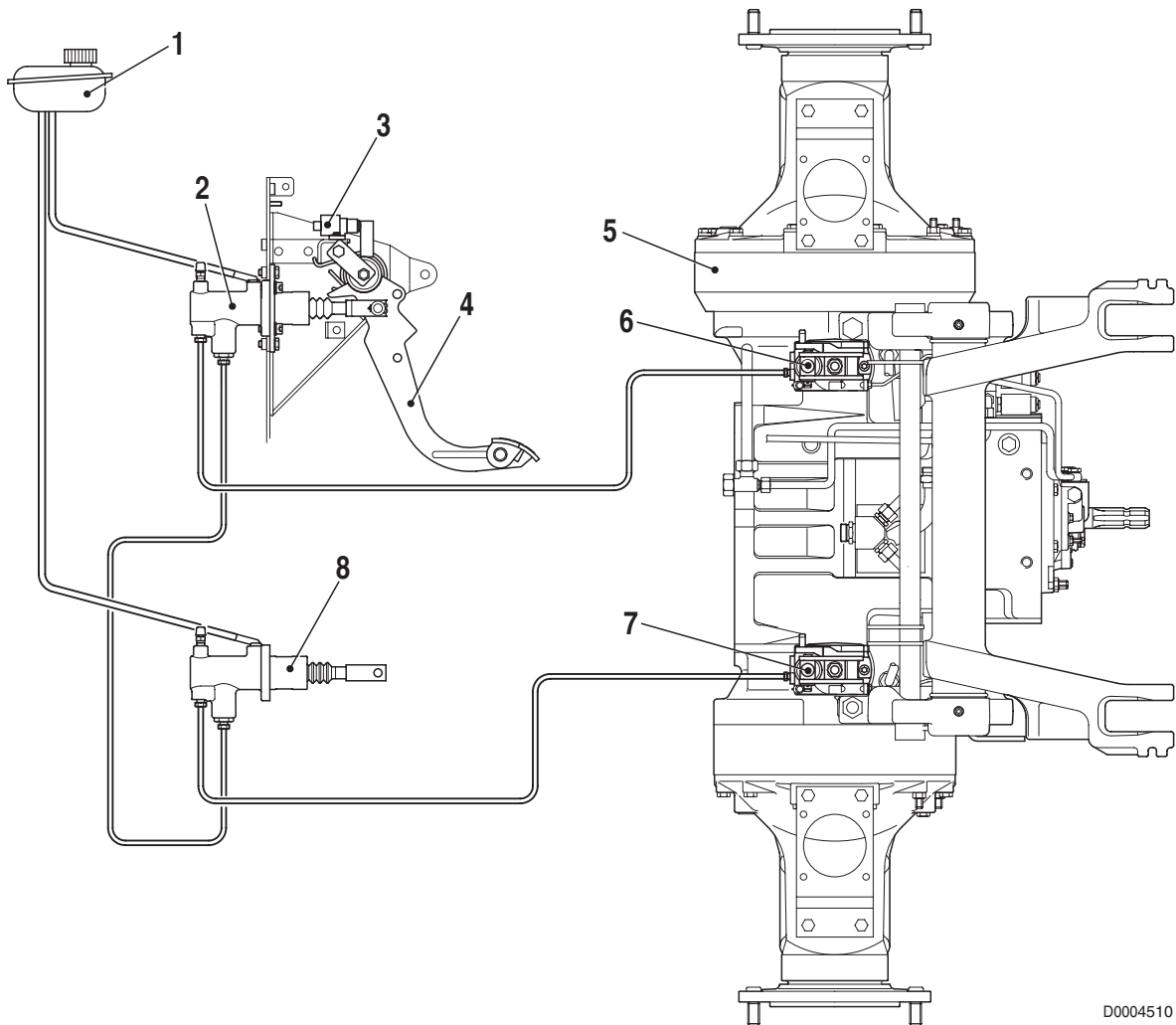
D0005340

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.

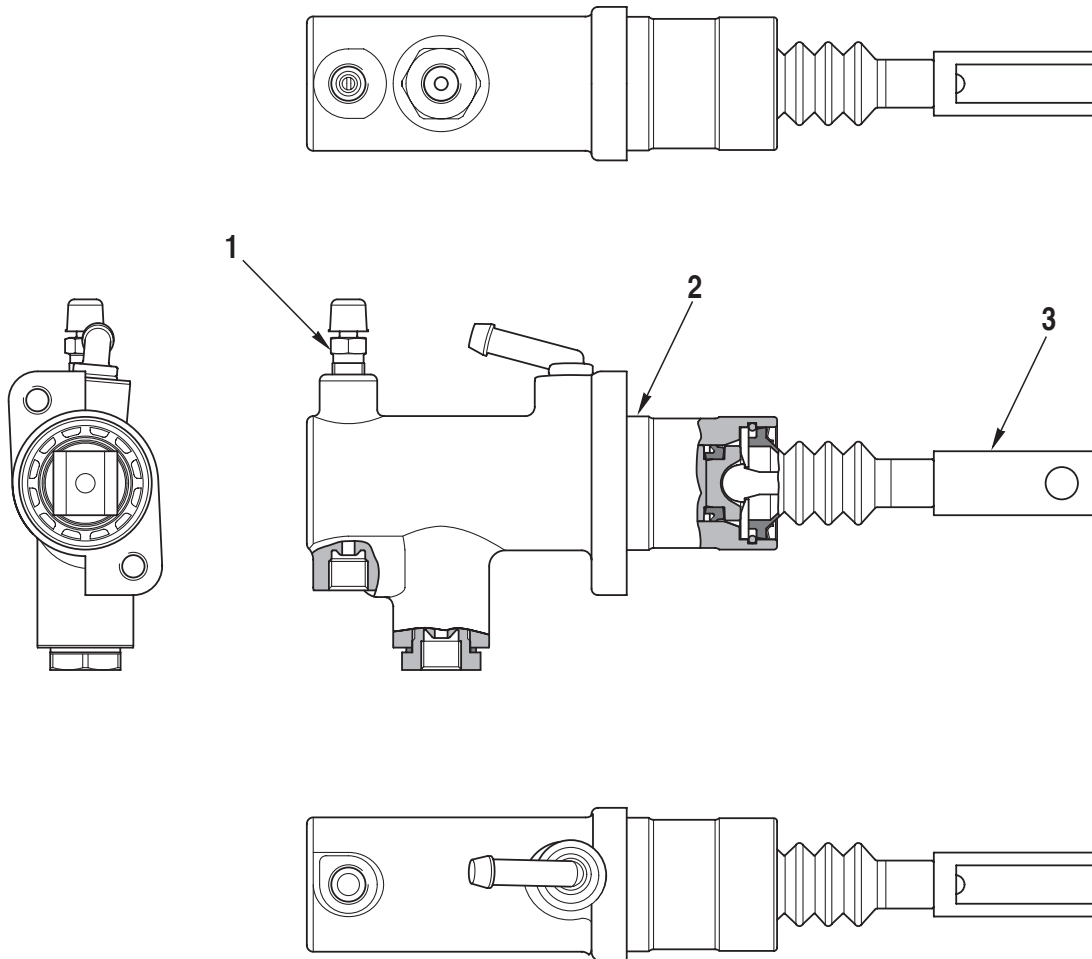
Each pump supplies fluid to the brake on one side (left or right) thereby allowing the operator to brake on one side only and thus reduce the steering radius.



D0004510

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

2.1 BRAKE MASTER CYLINDER



D0004520

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

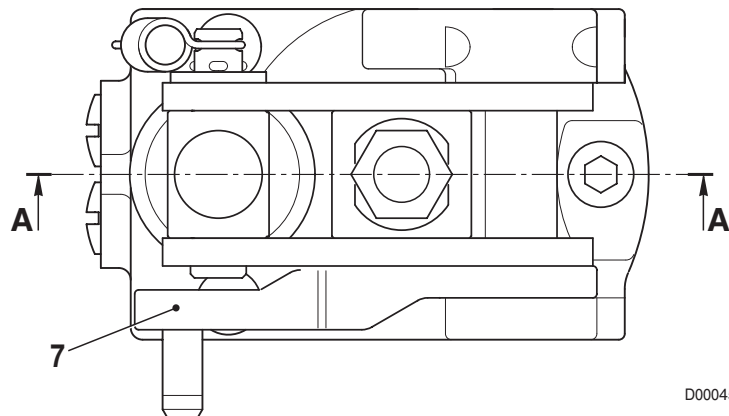
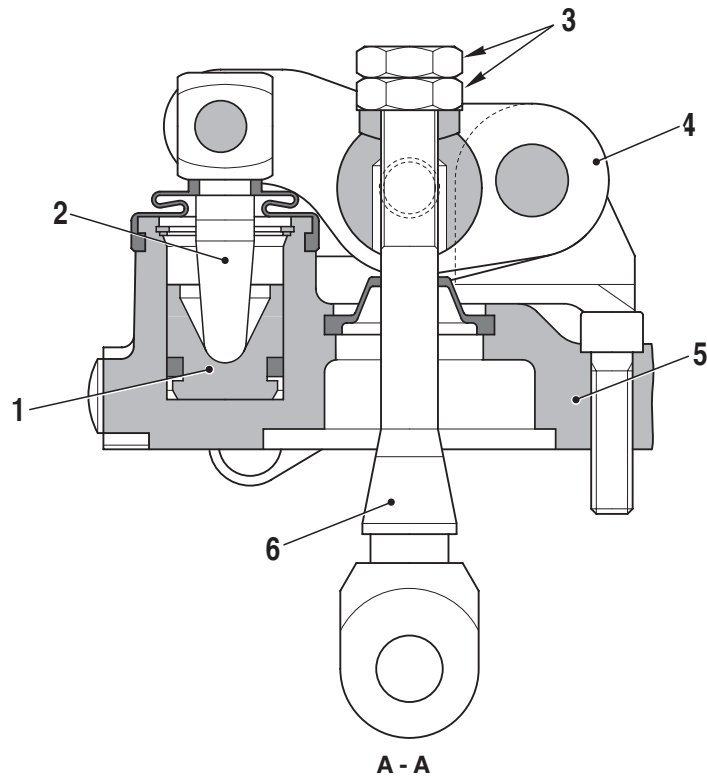
TECHNICAL DATA

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



D0004530

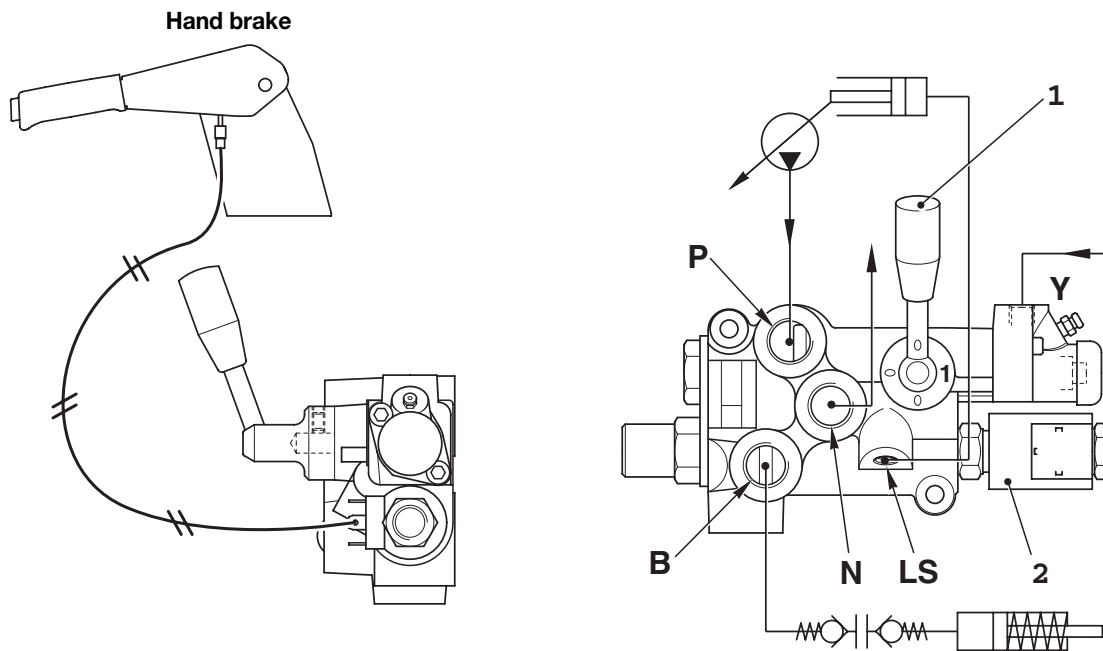
- | | |
|--------------------|--------------------------------|
| 1. Piston | 5. Support |
| 2. Plunger | 6. Rod |
| 3. Adjustment nuts | 7. Parking brake control lever |
| 4. Lever | |

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)



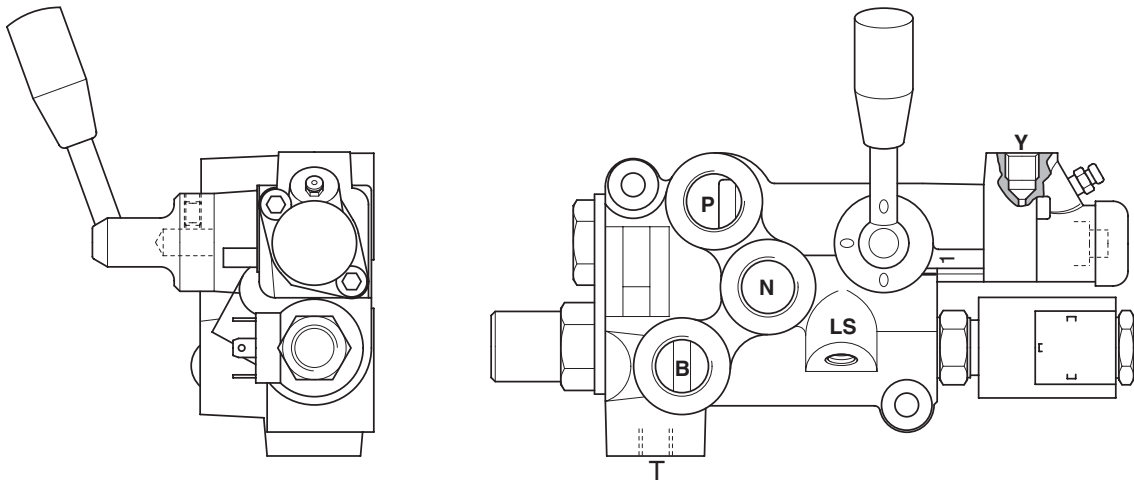
D0004540

1. Valve activation lever in position "1"

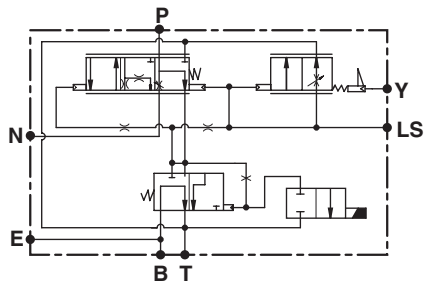
- When the lever (1) is in position "1" (valve activated) and the brake pedals are not pressed, a pressure of 12.5 bar (181.3 psi) is available at port **B**.
- This pressure is supplied constantly to the trailer to release the parking brake.
- When the operator engages the parking brake, the solenoid 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

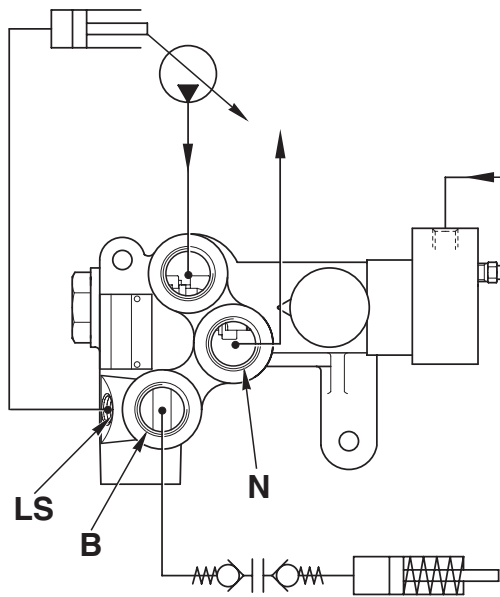
FUNCTION

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:
 135 ± 5 bar (1957.5 ± 72.5 psi)
- Feed flow rate:
20–80 ℓ/min (5.3 – 21.14 US.gpm)

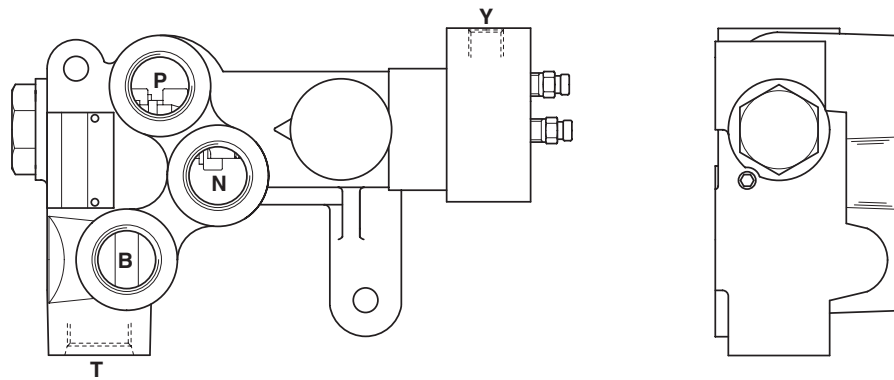
2.3.2 HYDRAULIC TRAILER BRAKING (EXPORT VERSION)



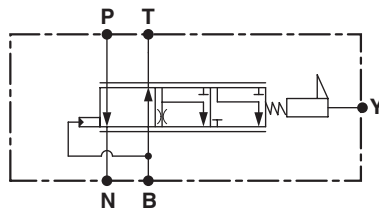
D0004560

- 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



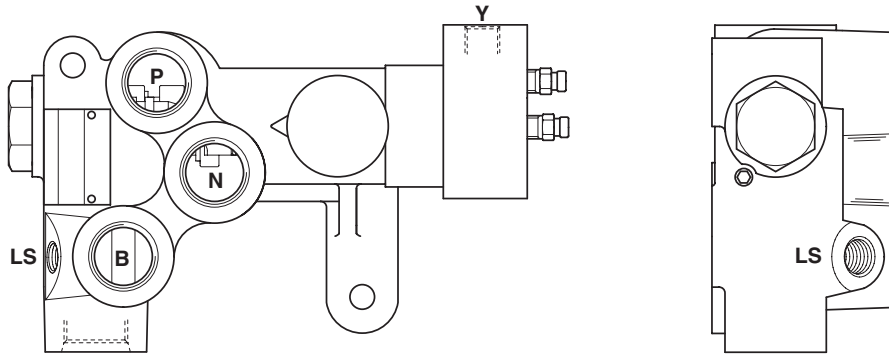
D0004570

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

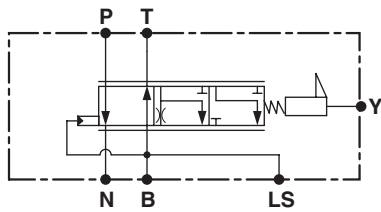
TECHNICAL DATA

- 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 bar (2059 ± 116 psi)
- Feed flow rate:
20–80 ℓ /min (5.3–21.14 US.gpm)

MODELS 120 - 135 - 150 - 165 CV



HYDRAULIC DIAGRAM



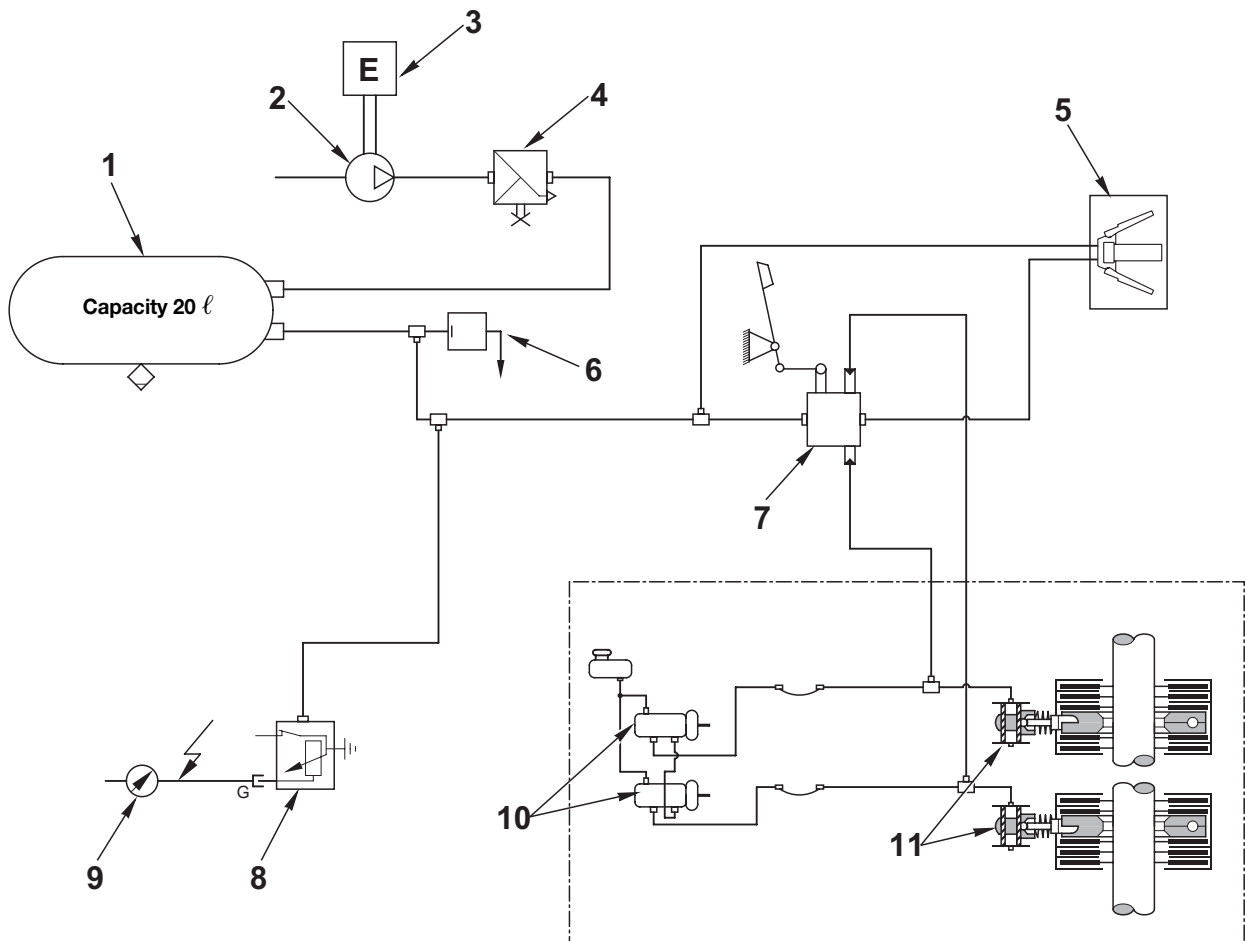
D0004580

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 bar (2059 ± 116 psi)
- Feed flow rate:
20–80 ℓ/min (5.3–21.14 US.gpm)

2.3.3 AIR TRAILER BRAKING (ITALY VERSION)



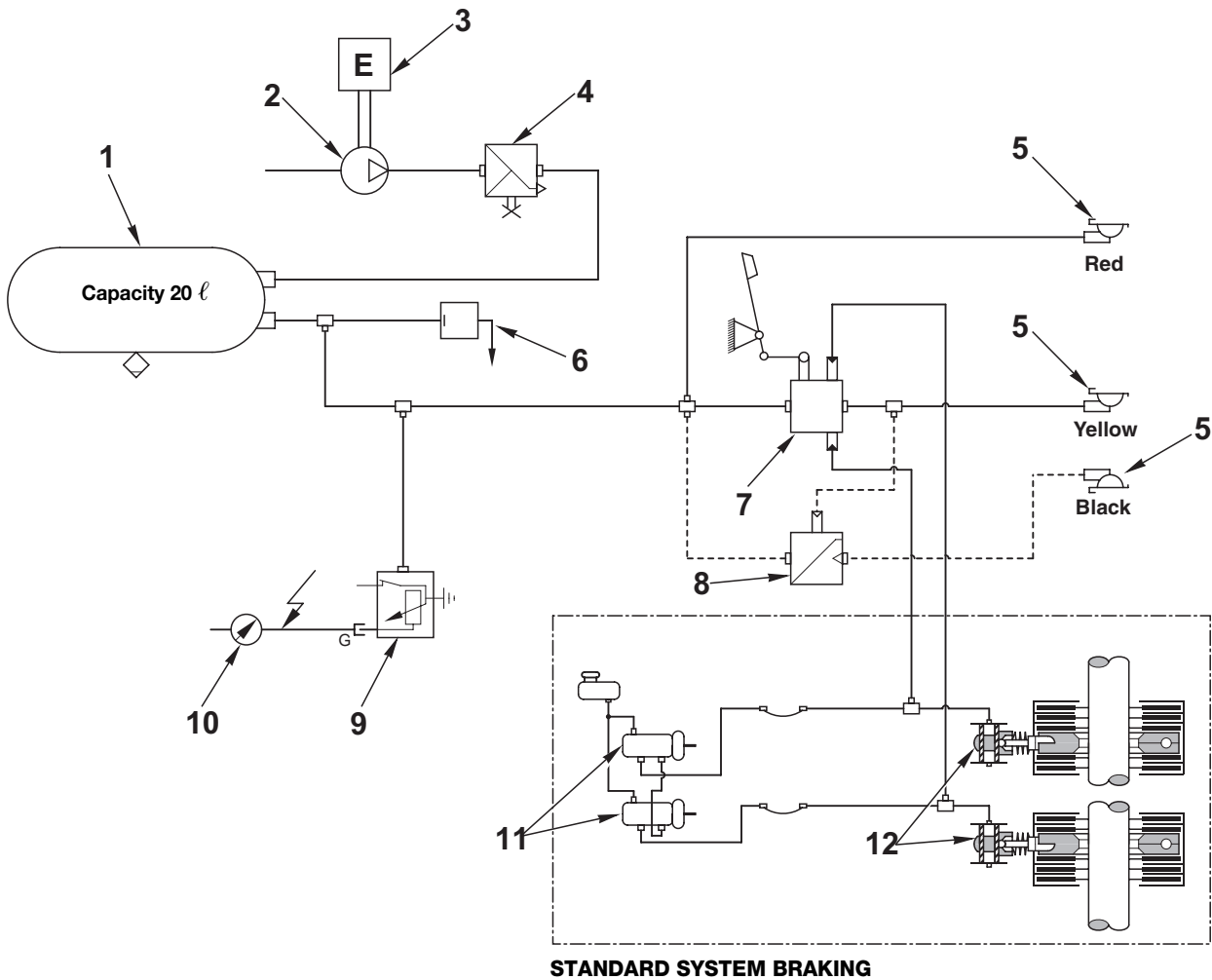
STANDARD SYSTEM BRAKING

D0004600

COMPONENTS

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

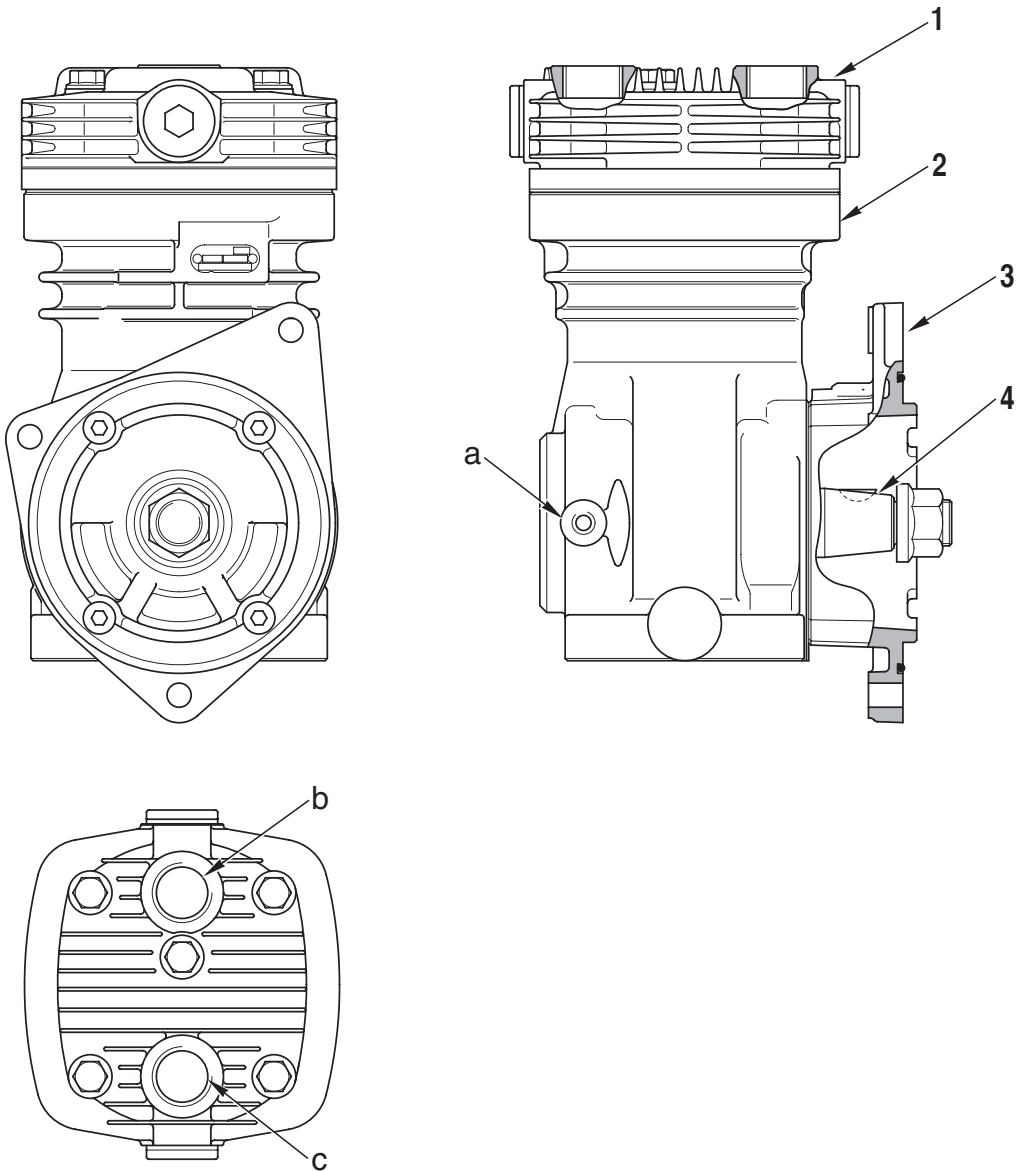
2.3.4 AIR TRAILER BRAKING (EXPORT VERSION)



D0004591

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

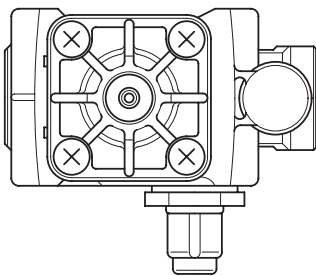
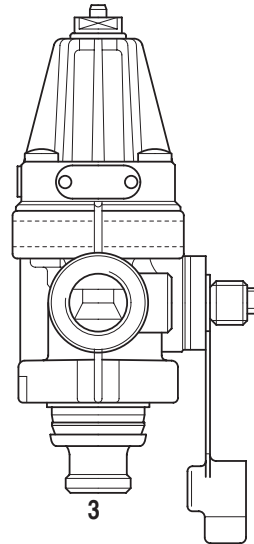
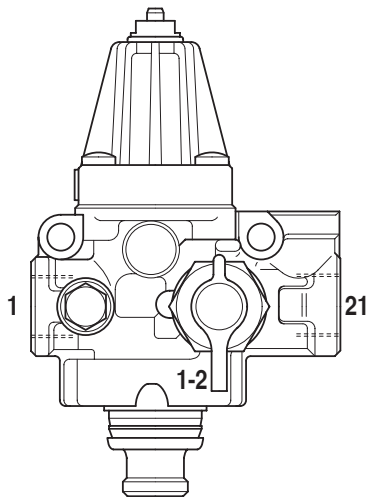
Stroke: 36 mm (1.418 in.)

Displacement: 229 cm³

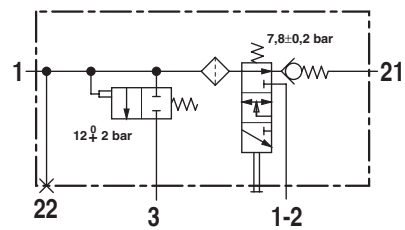
Max. pressure.: 10 bar (145 psi)

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 DATACut-out pressure: 7.8 ± 0.2 bar (113 \pm 2.9 psi)

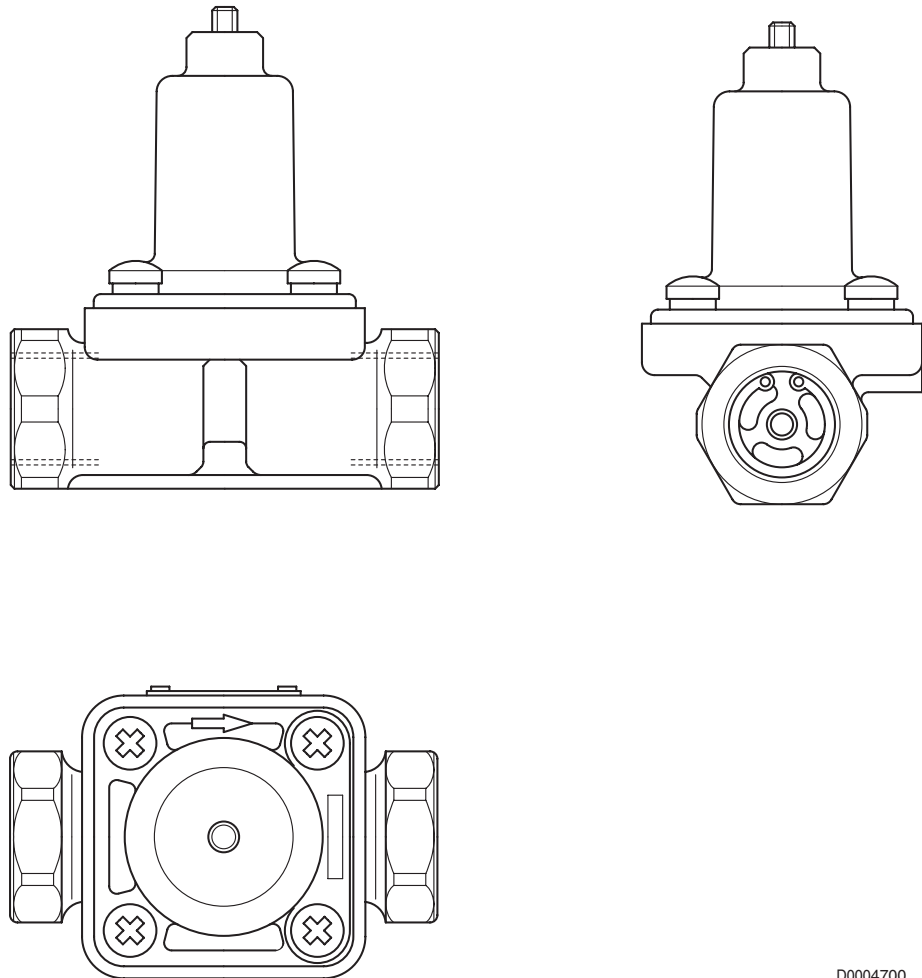
Cut-in pressure: 0.6–1 bar (8.7 – 14.5 psi)

Relief valve setting: 12 ± 2 bar (174 \pm 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 \pm 0.3 bar (87 \pm 4.35 psi)



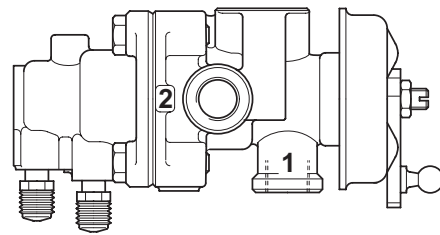
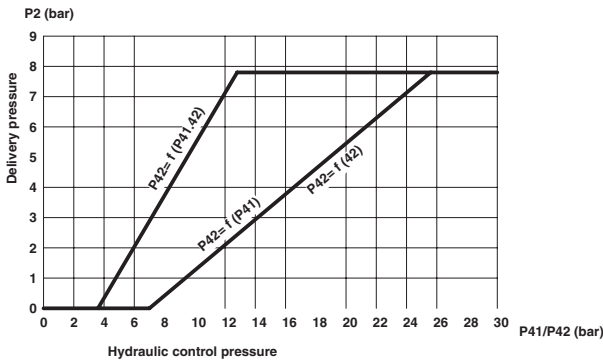
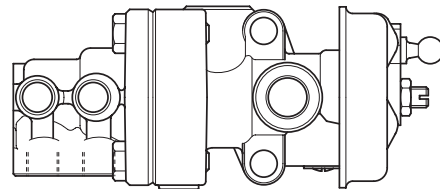
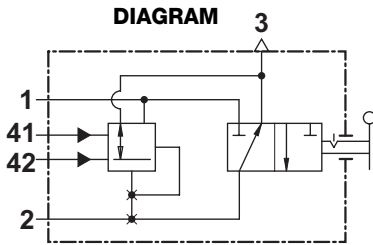
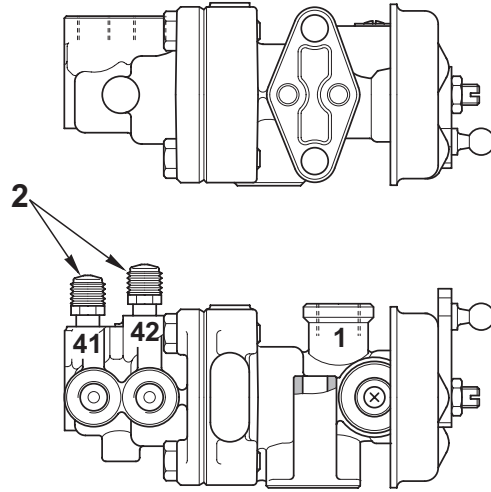
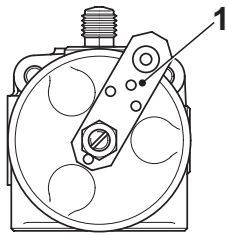
D0004700

TECHNICAL DATA

Opening pressure: 6 \pm 0.3 bar (87 \pm 4.35 psi)

Maximum operating pressure: 13 bar (188 psi)

TRAILER BRAKING VALVE (2-WAY)

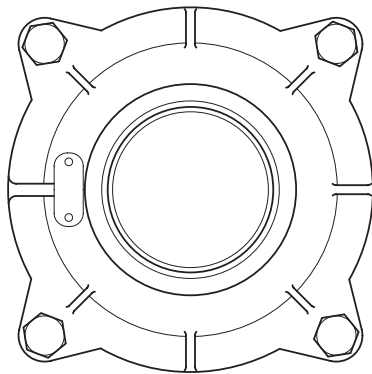
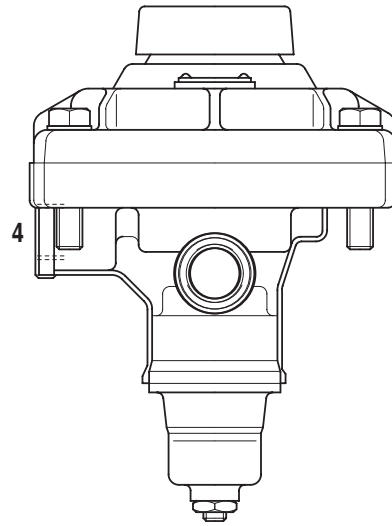
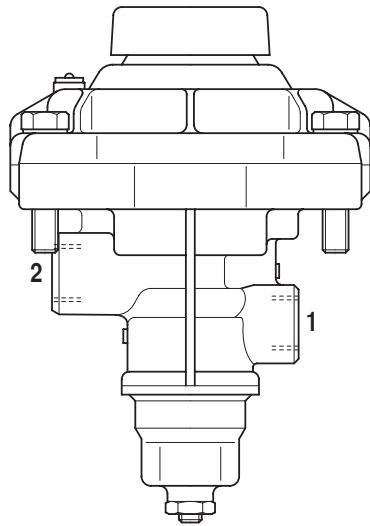


D0004761

- 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)

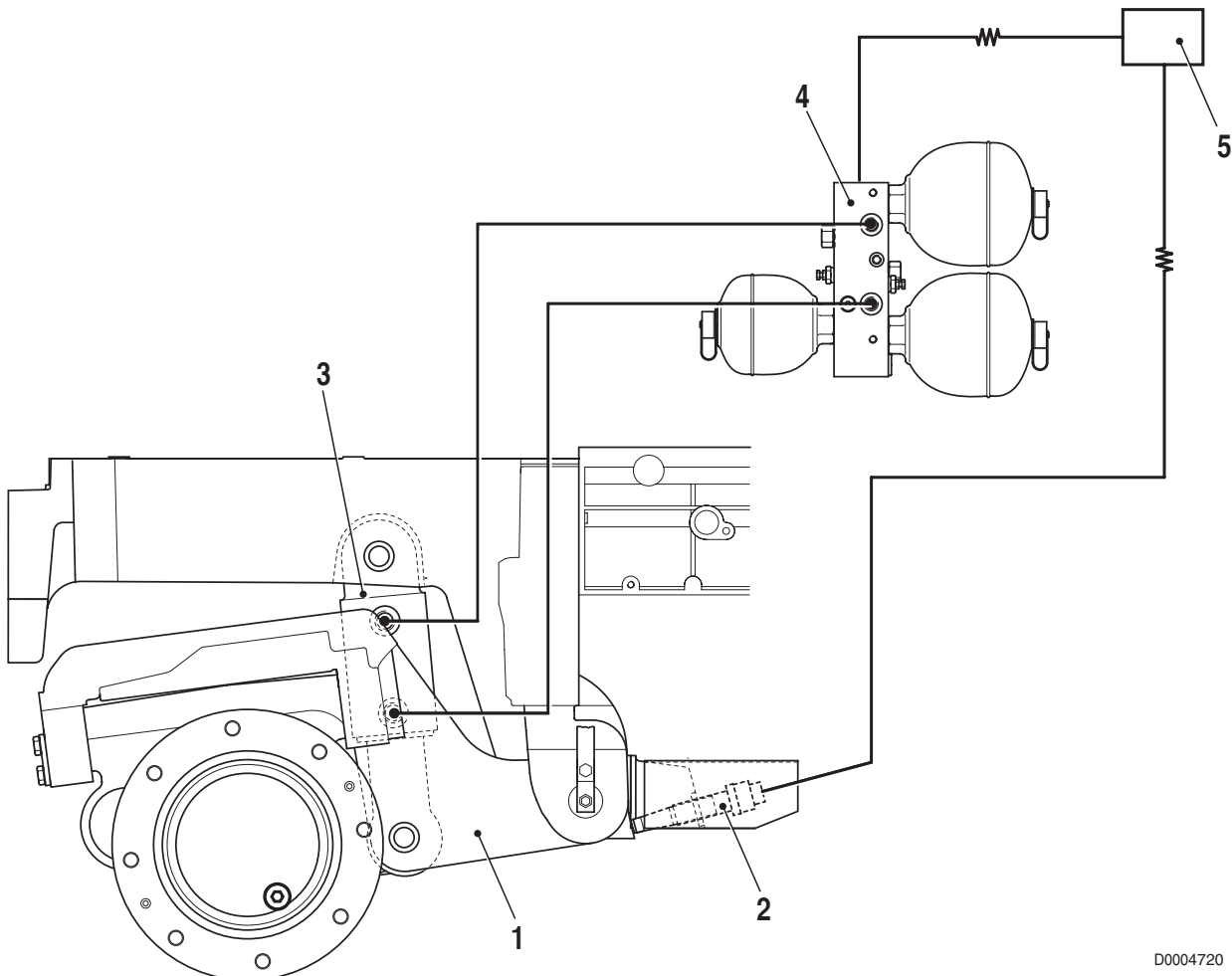
3. HYDRAULIC FRONT AXLE SUSPENSION

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)

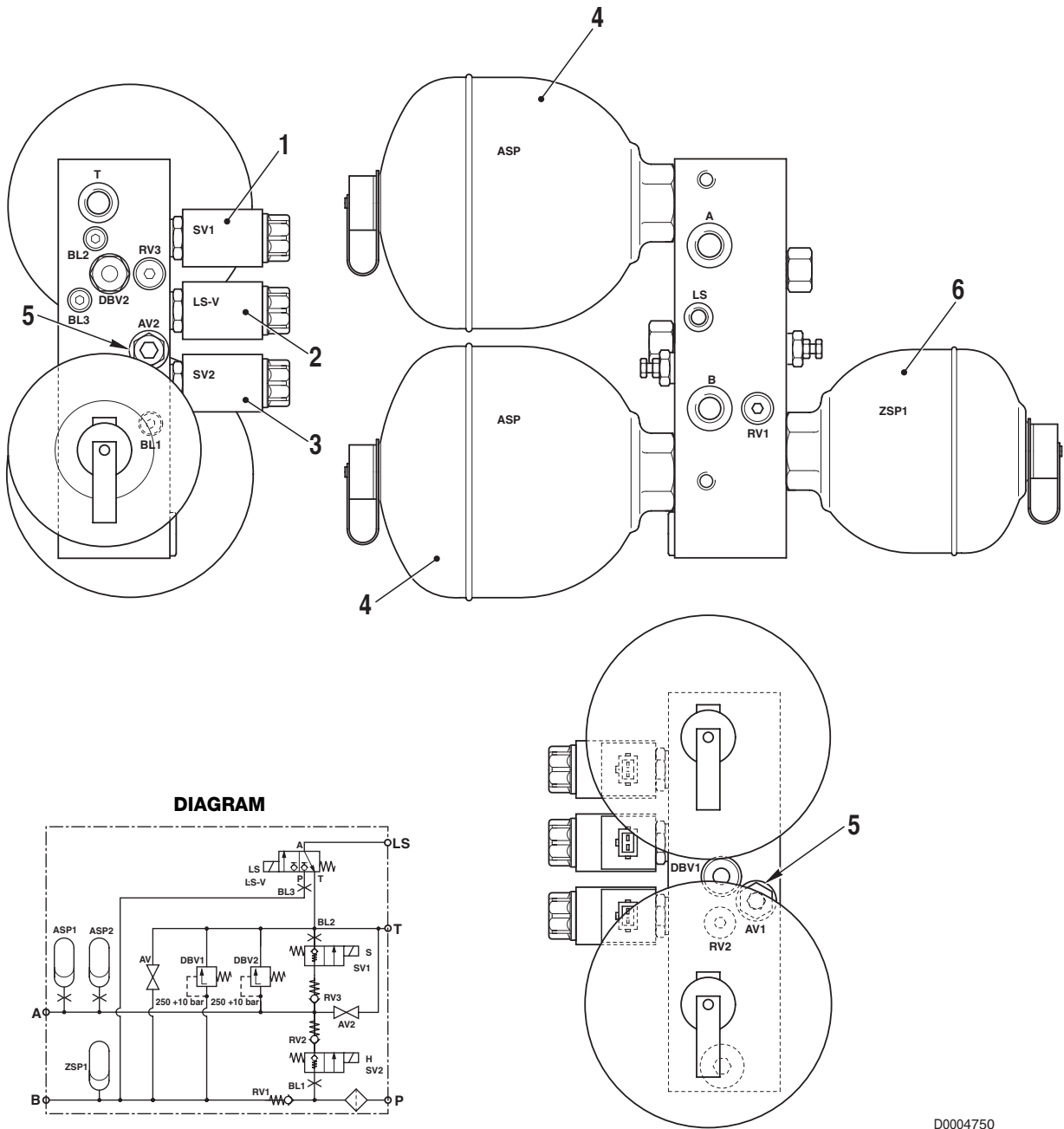


D0004720

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.



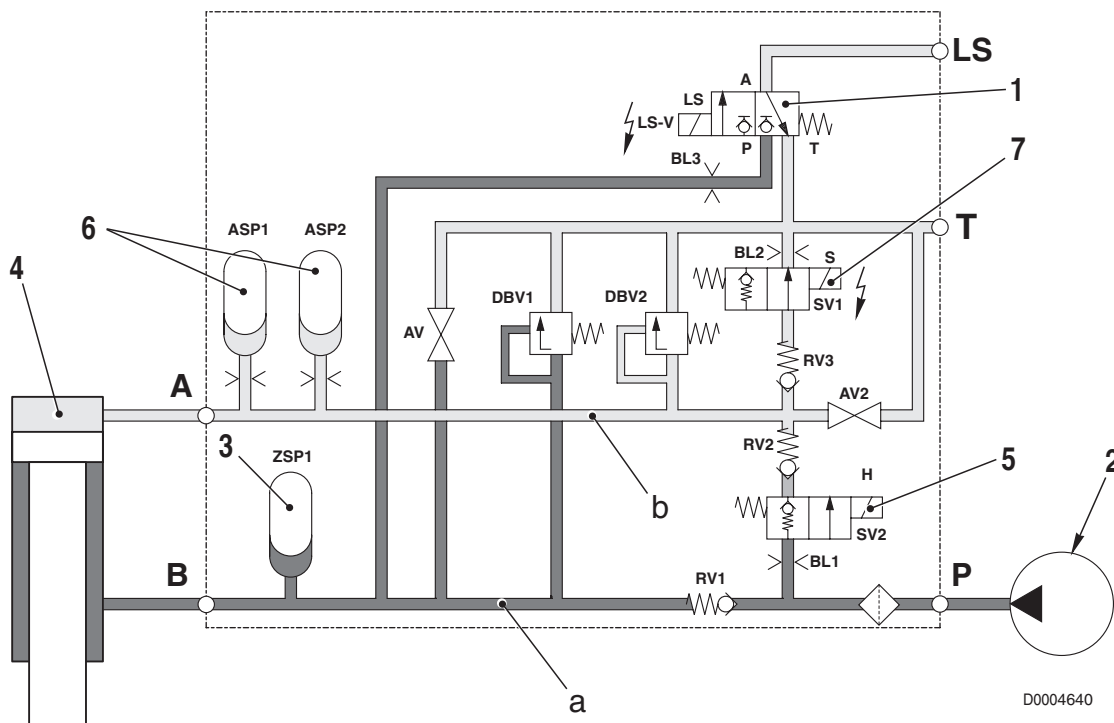
D0004750

- 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)

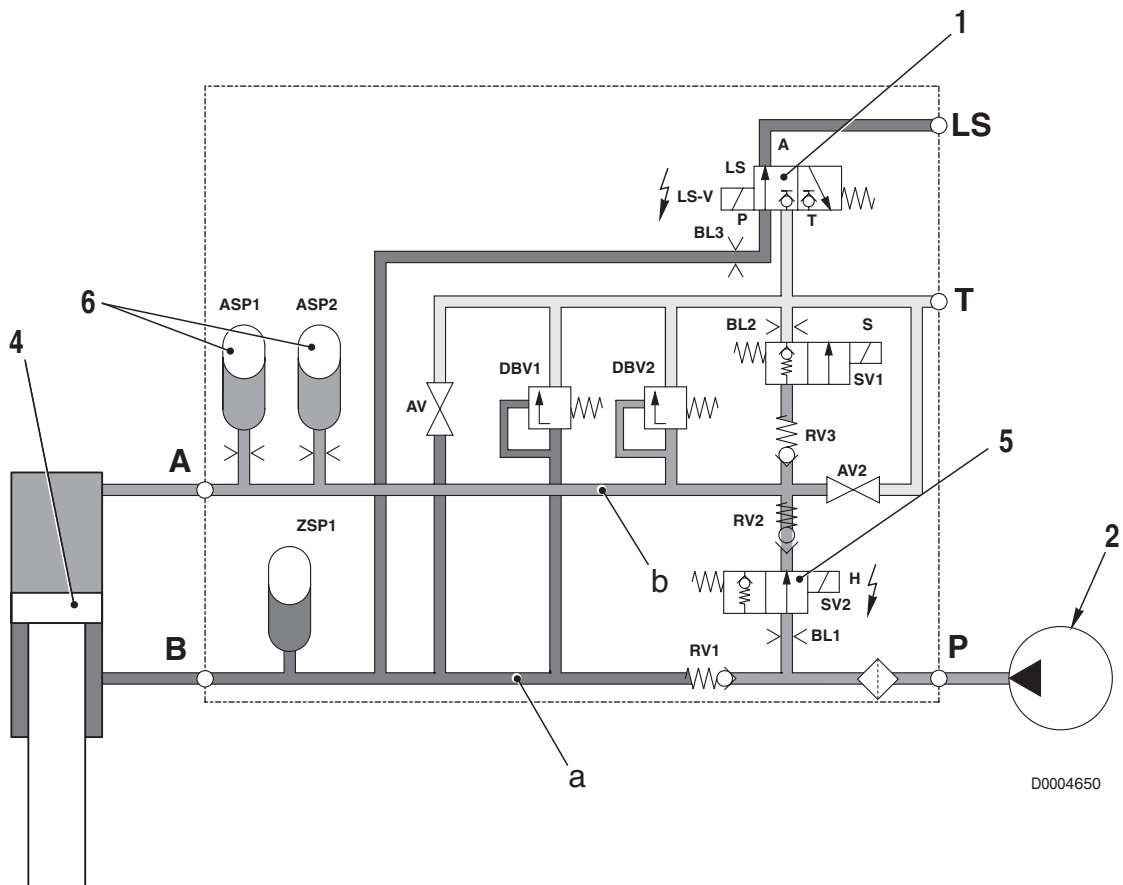
OPERATION

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.

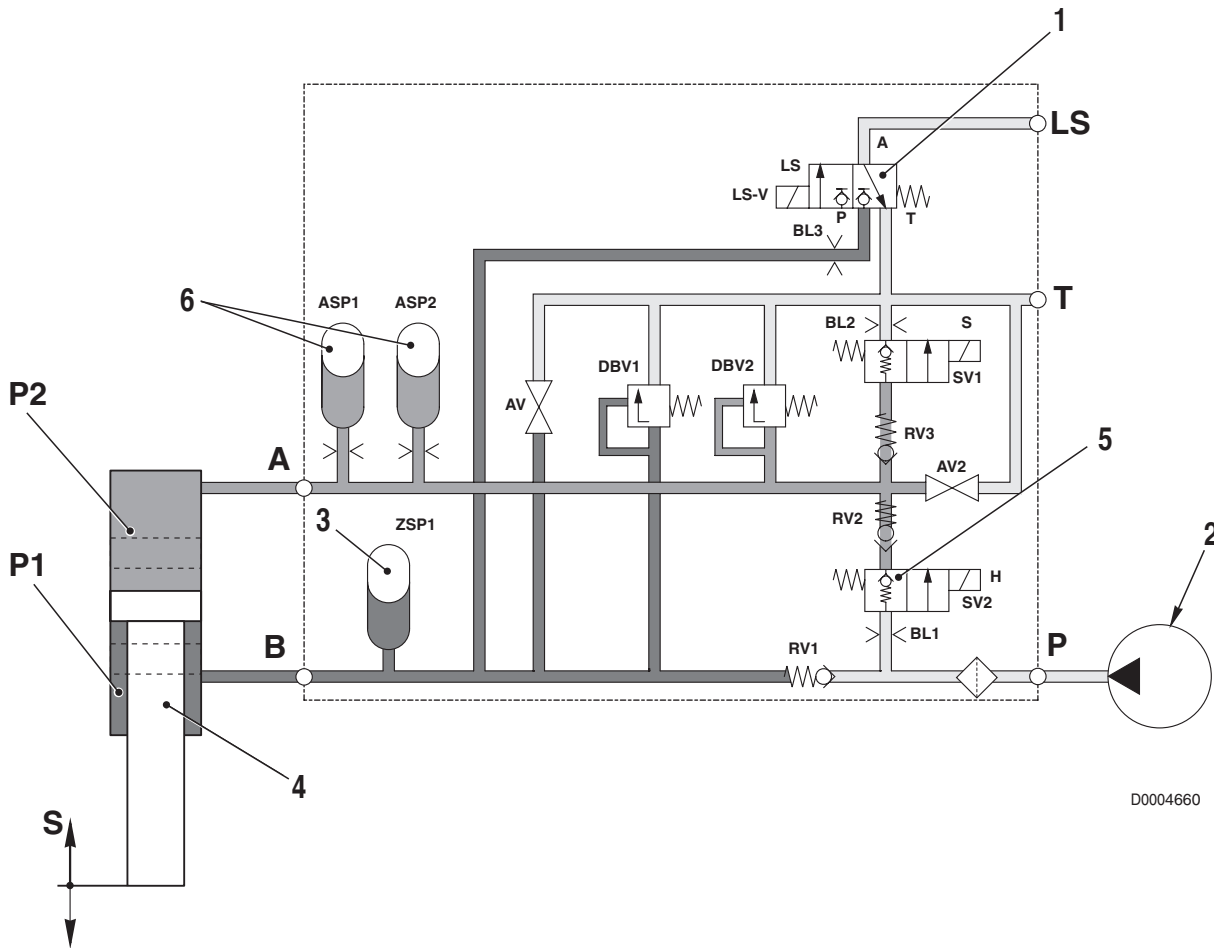
2. When the operator activates the system



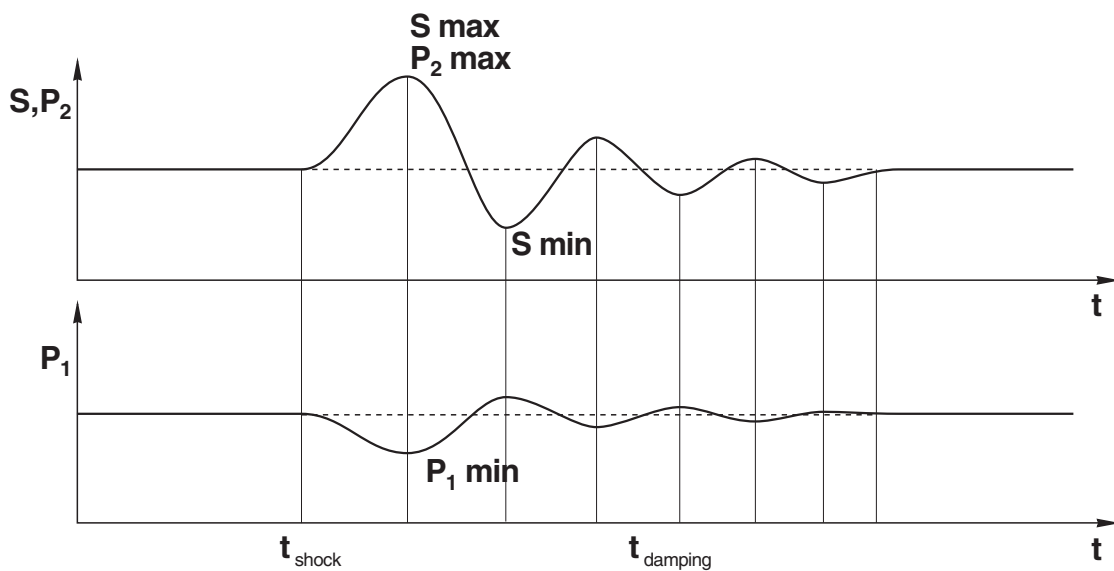
- When the operator presses the switch to activate the suspension, the electronic control unit energises the solenoids (1) and (5).
- This allows the pressurised oil from the pump (2) to flow to line **b** and thus start to push the piston (4) downwards.
- At the same time, the oil compresses the membranes 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.

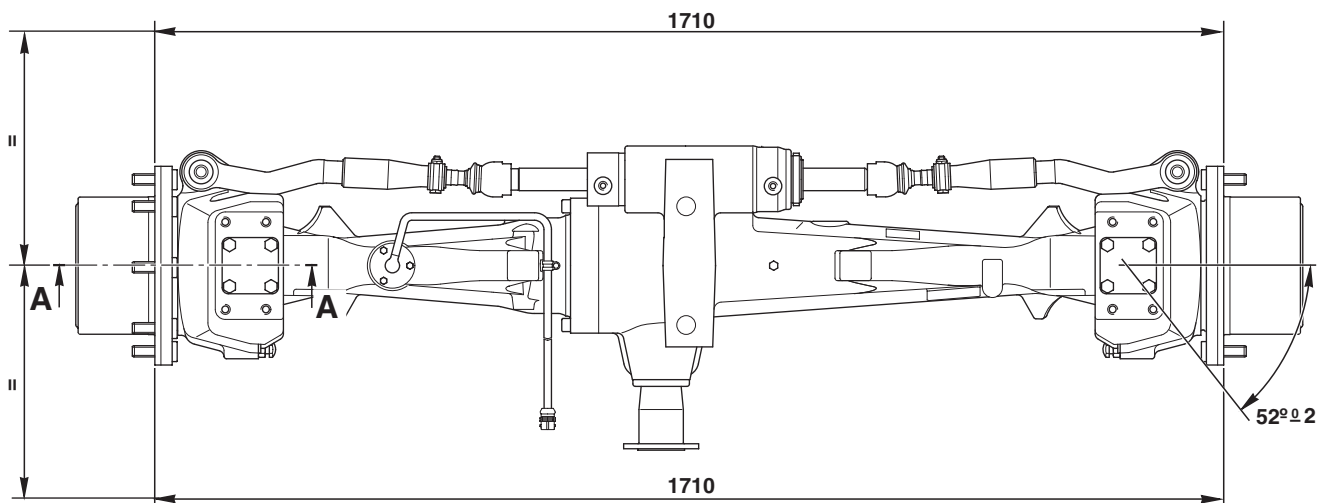
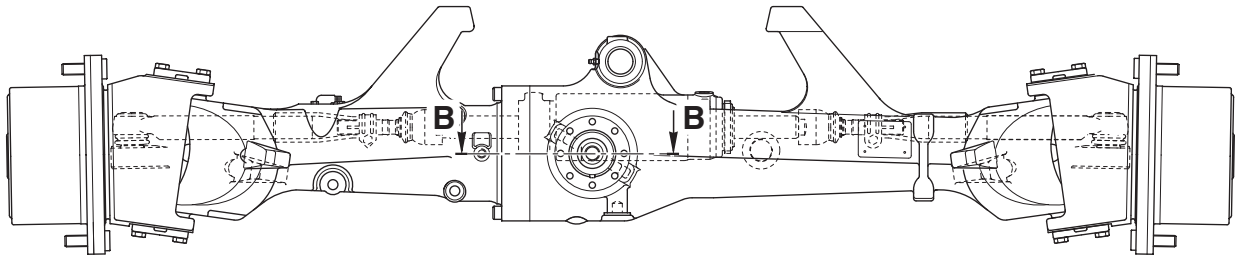


D0004660



D0002411

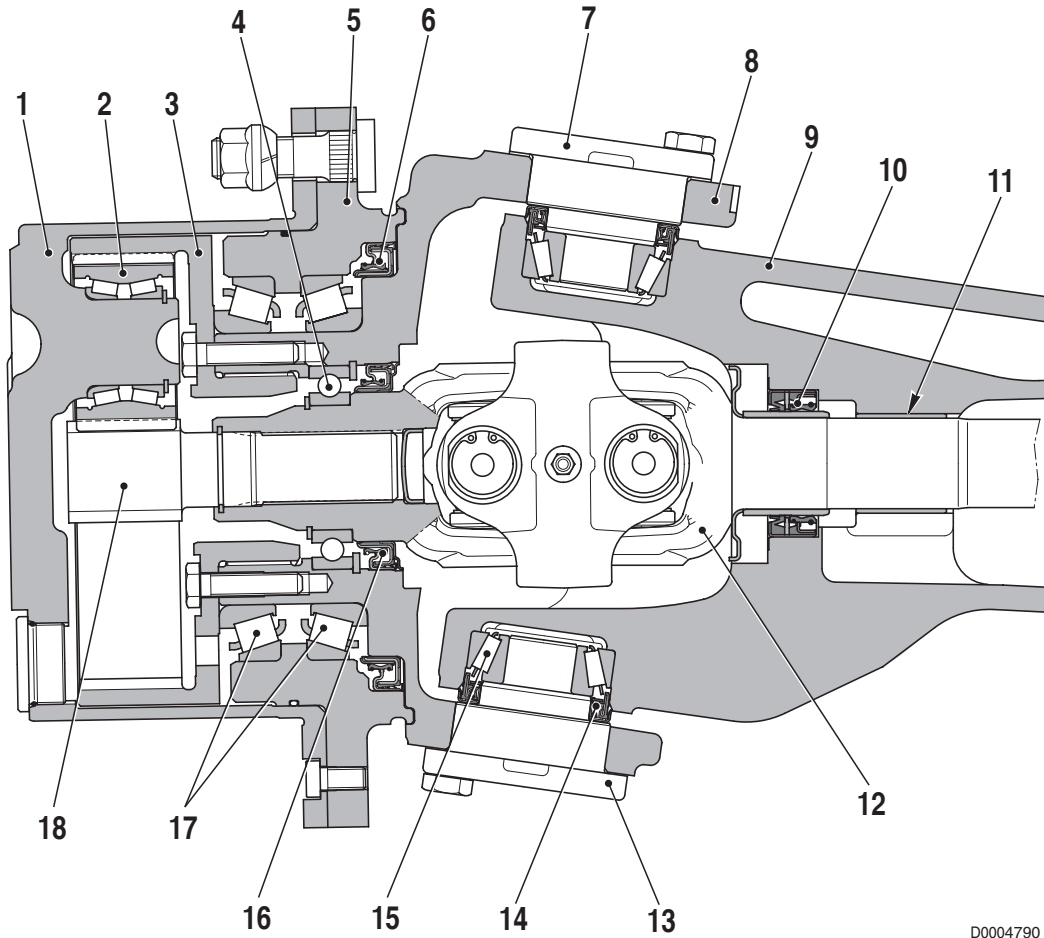
4. FRONT AXLE



D0004780

4.1 HUB CARRIER AND FINAL REDUCTION UNIT

VERSION WITHOUT SBA

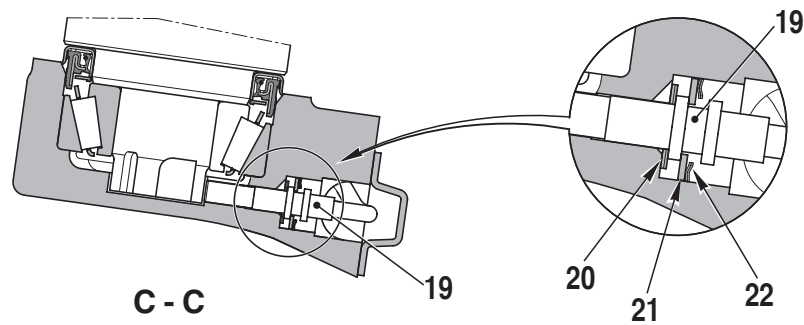
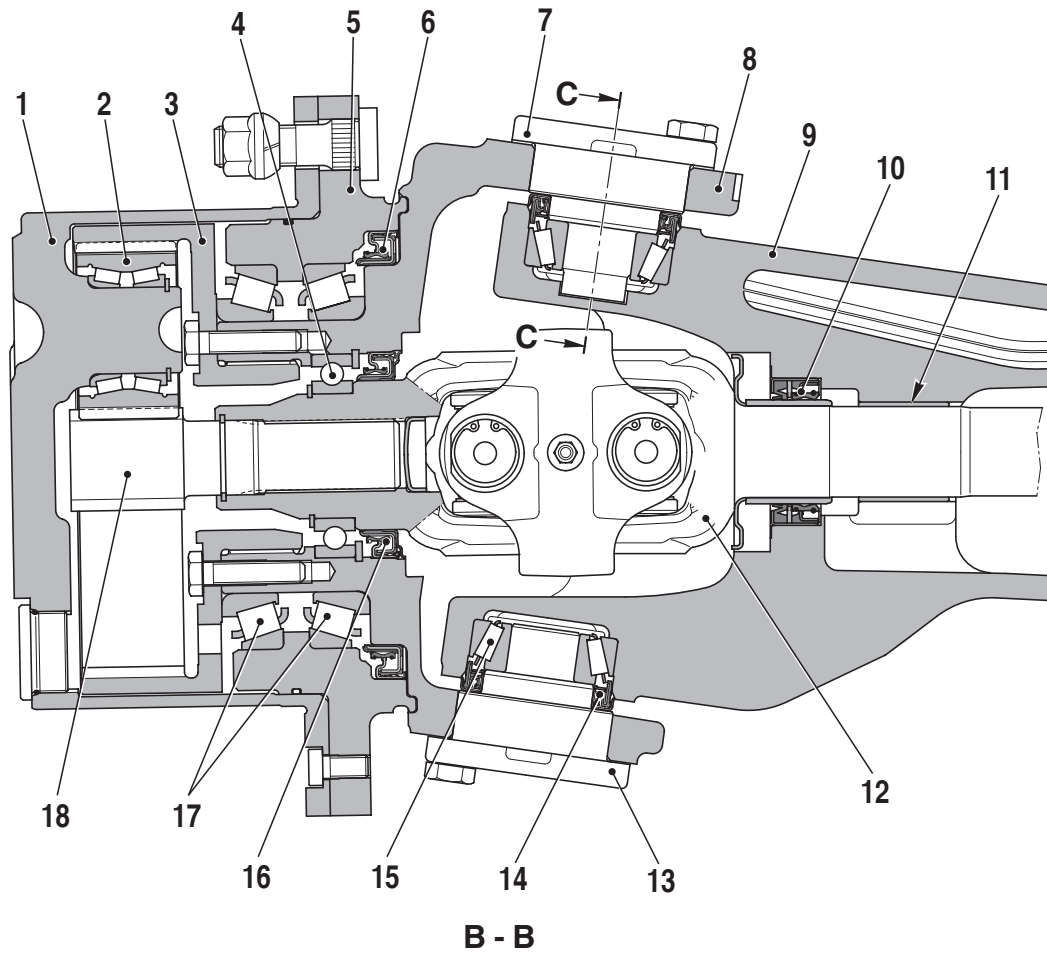


D0004790

A - A

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

VERSION WITH SBA

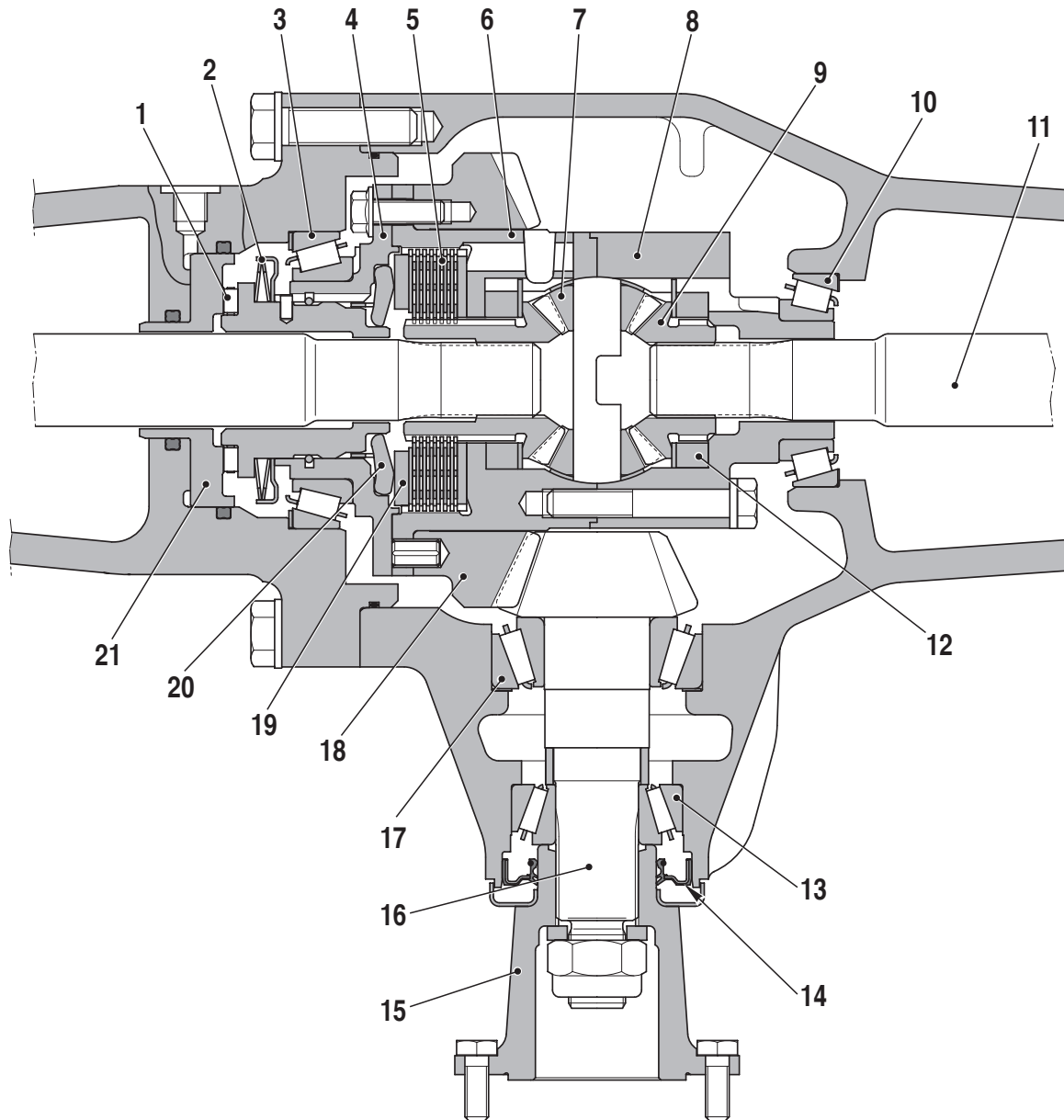


D0004800

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

4.2 DIFFERENTIAL

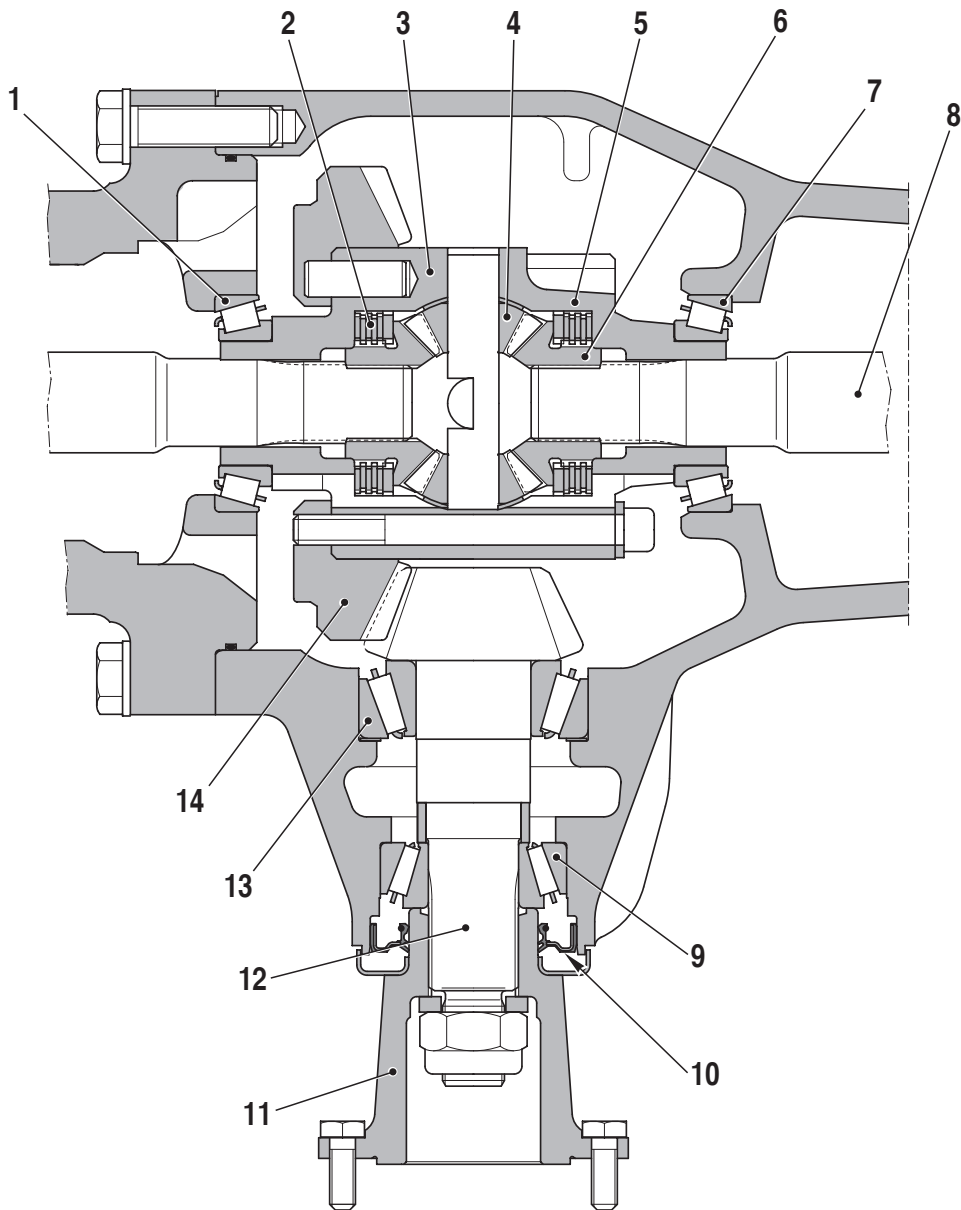
VERSION WITH 100% HYDRAULIC LOCKING



D0004810

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

45% SELF-LOCKING VERSION



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

D0005350

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).

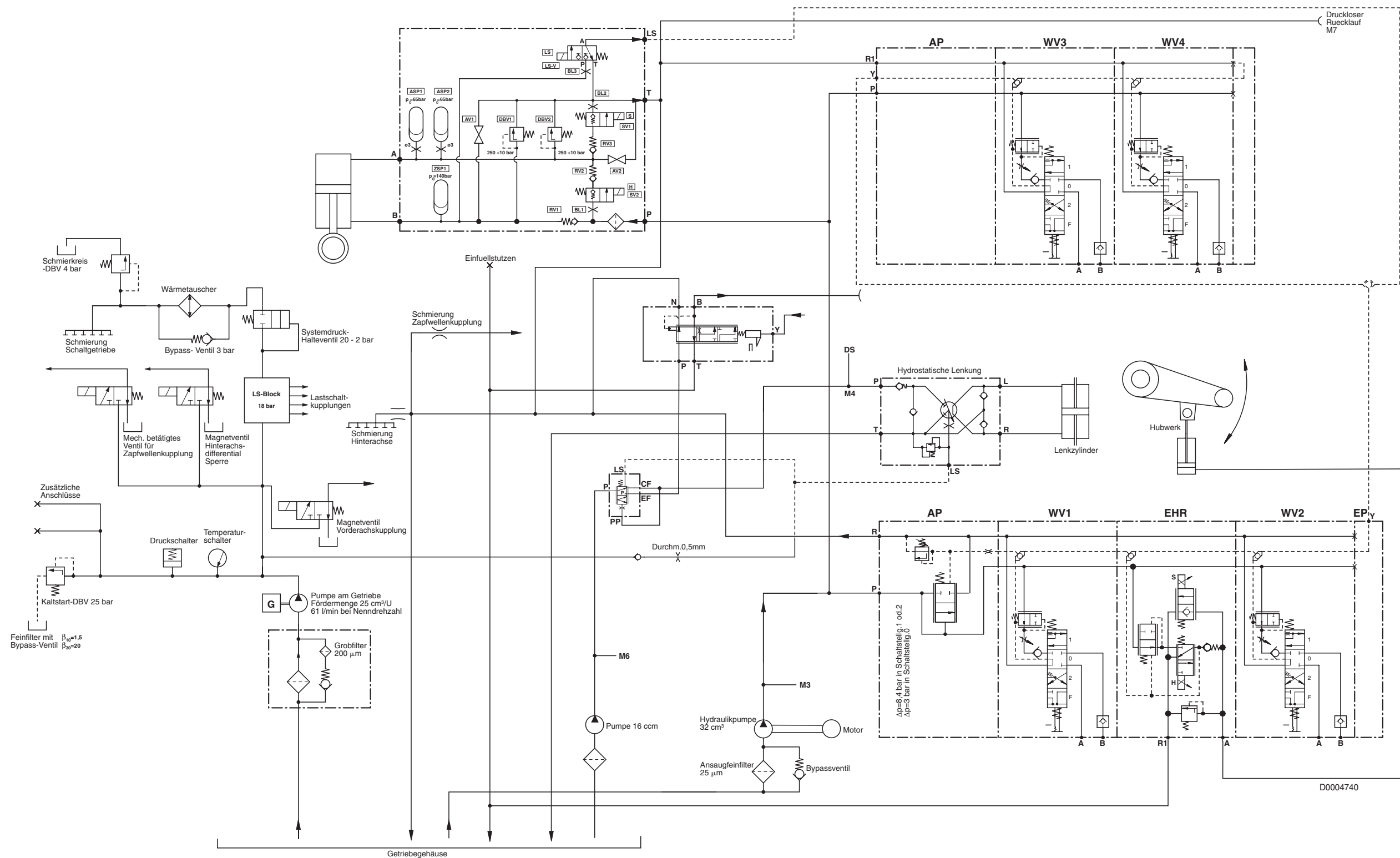
Furthermore, if two or more actuators are operated when the engine is running at low speed, the pump will be unable to meet the demand and consequently the actuators will operate at a lower speed in accordance with the available oil flow.

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

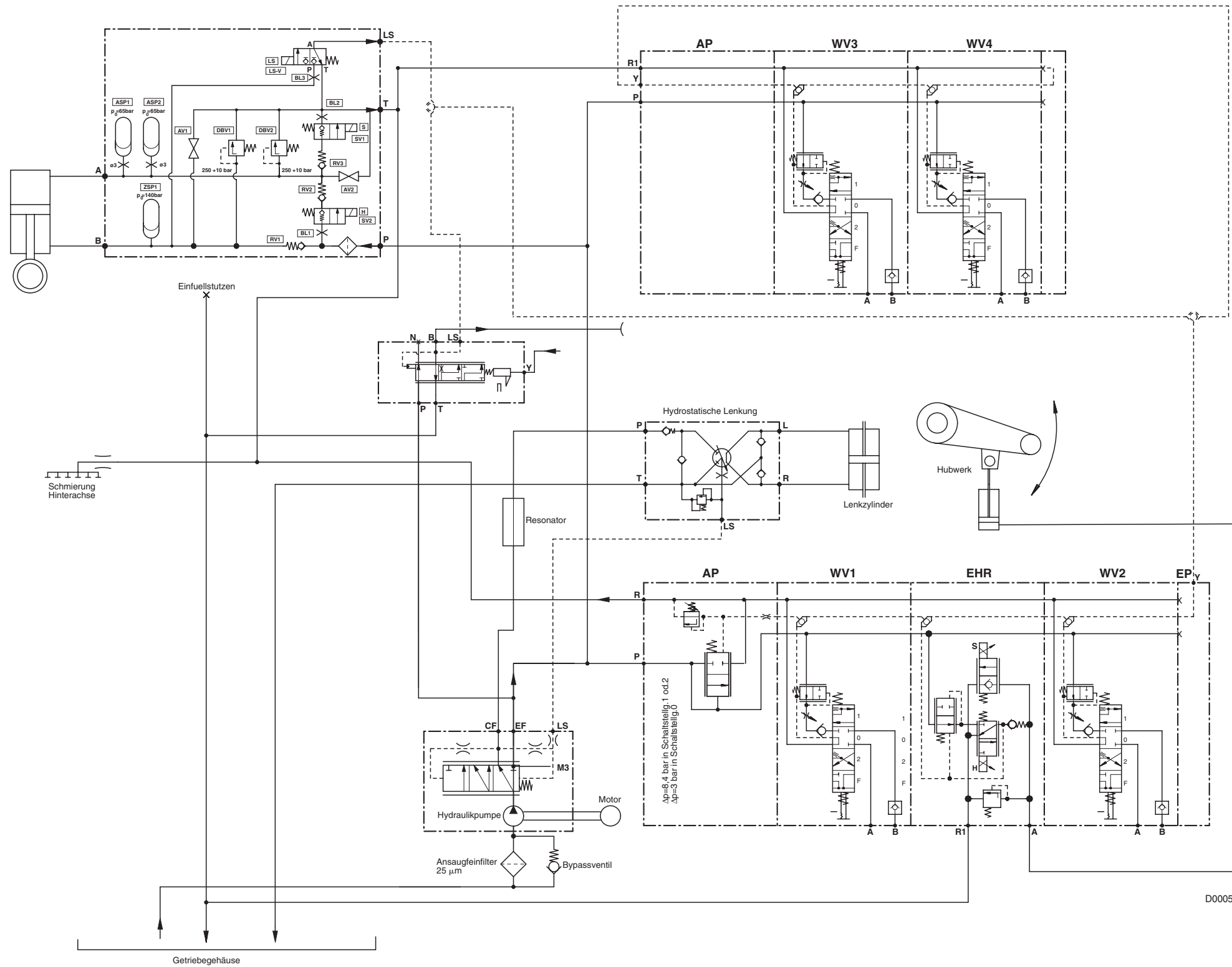
In this system, when the engine is running at maximum speed and no hydraulic actuators are in operation, the pump effectively only circulates the oil that is dispersed through internal leakage in the devices connected to the system (just a few litres per minute), thus saving energy and fuel.

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.

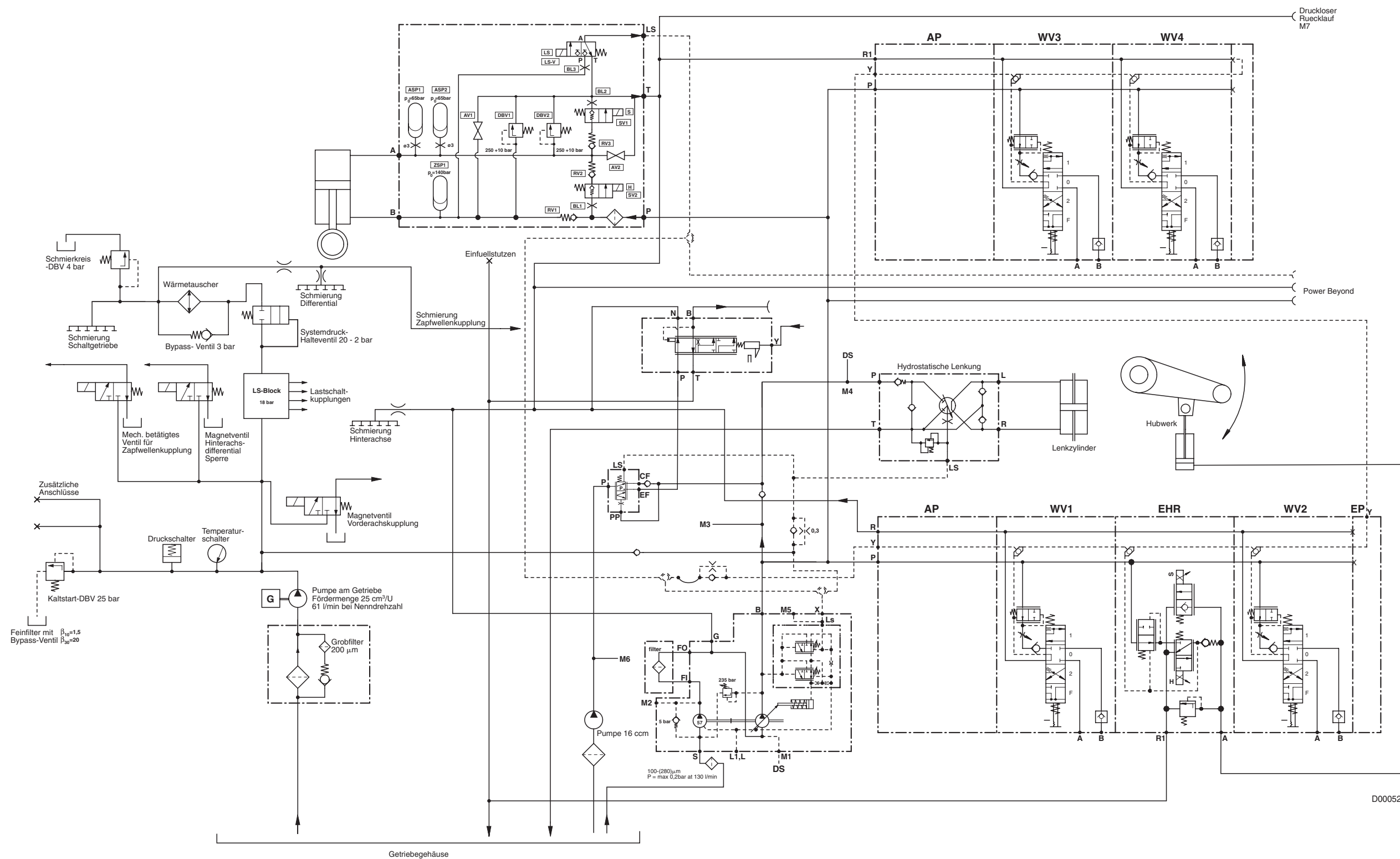
HYDRAULIC SYSTEM (106-115 CV models) (CCLS version)



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

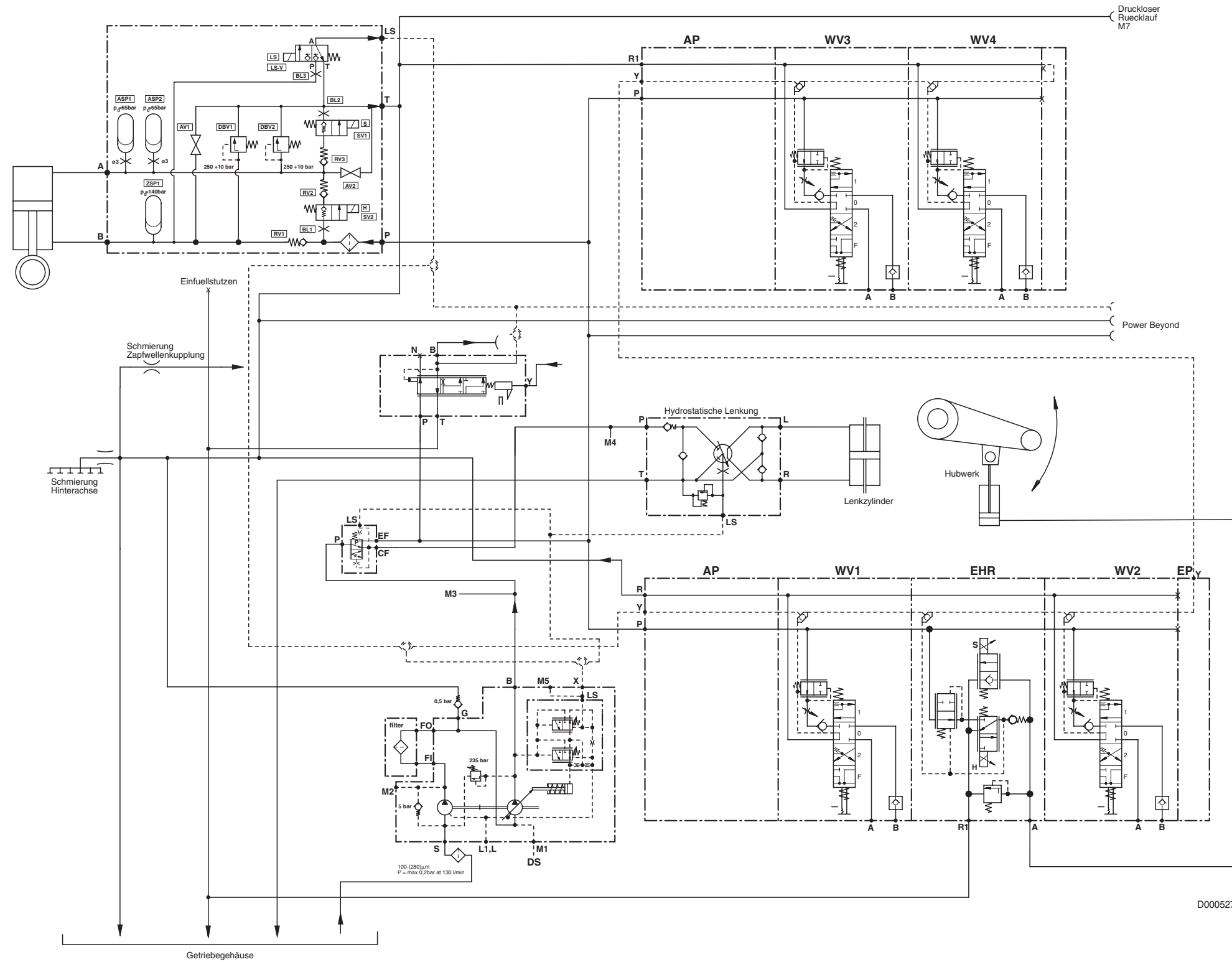


HYDRAULIC SYSTEM (106-115 CV models) (LS version)



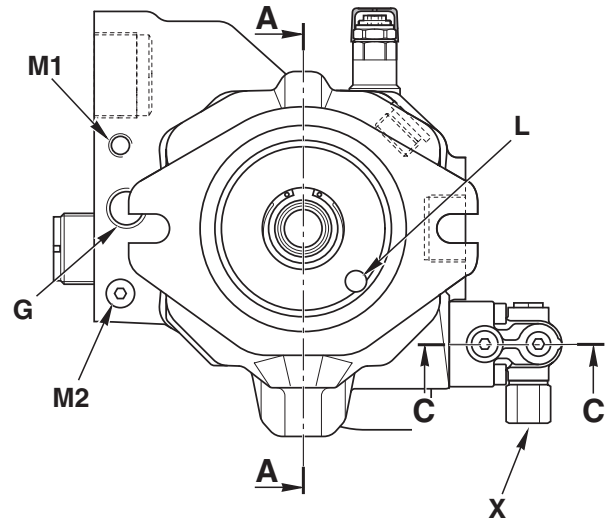
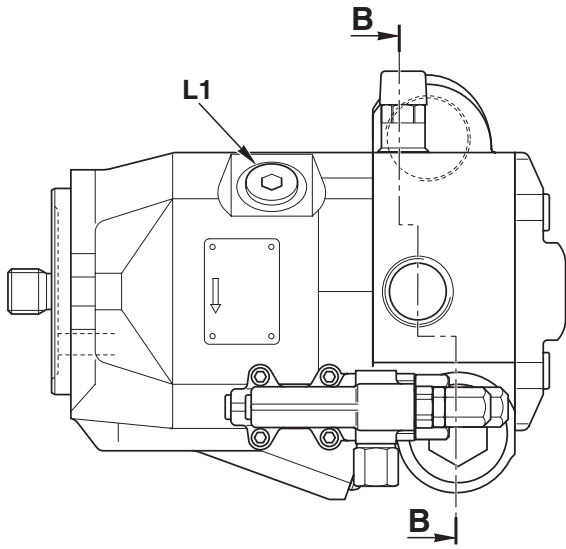
D0005260

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

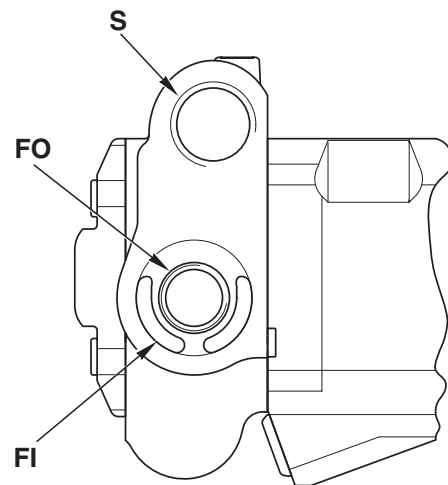
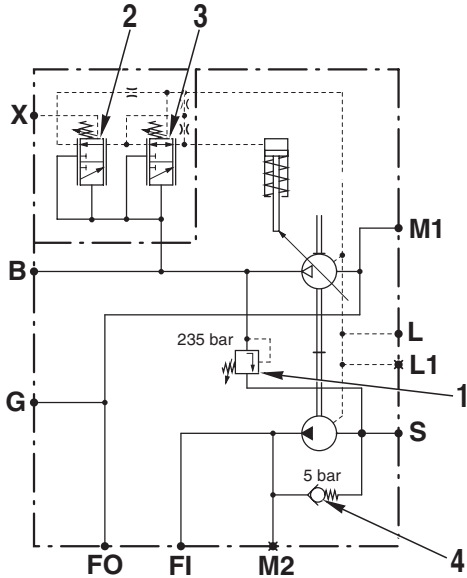


D0005270

5.1 VARIABLE DISPLACEMENT PUMP



HYDRAULIC DIAGRAM



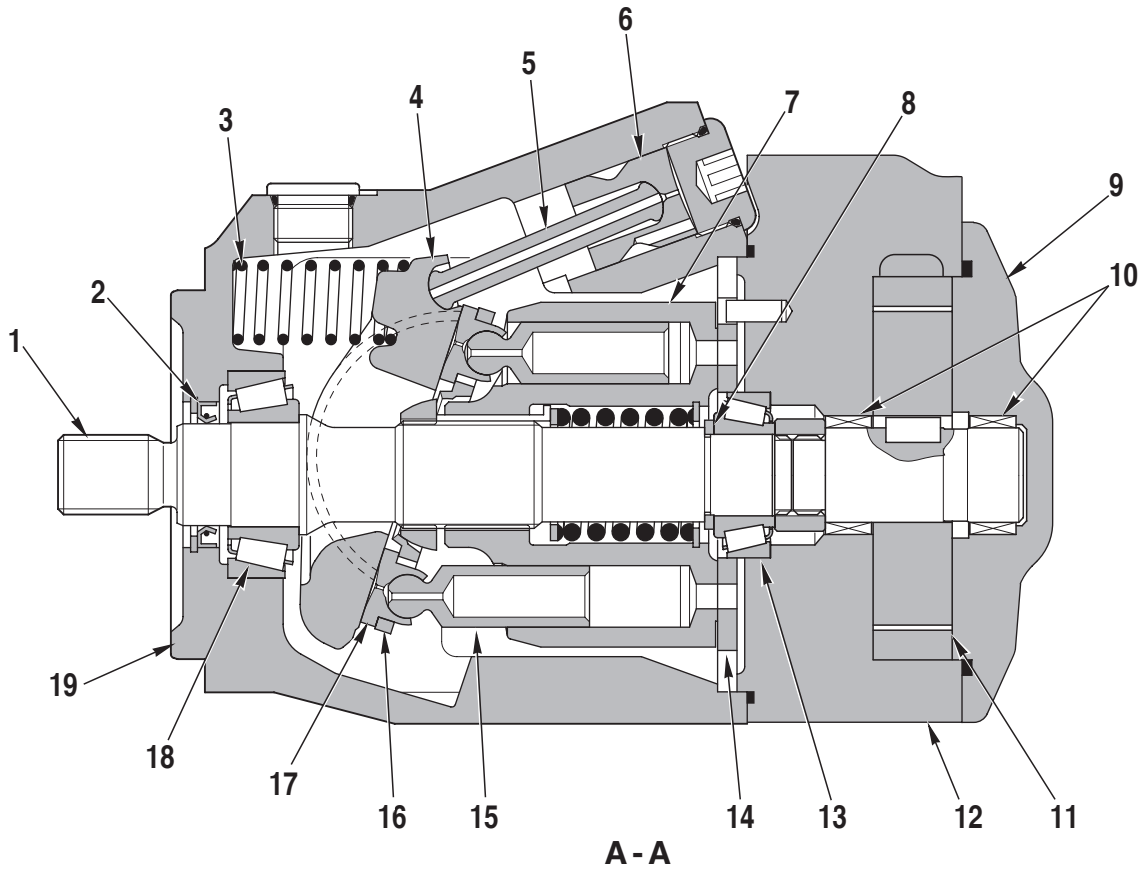
D0004900

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

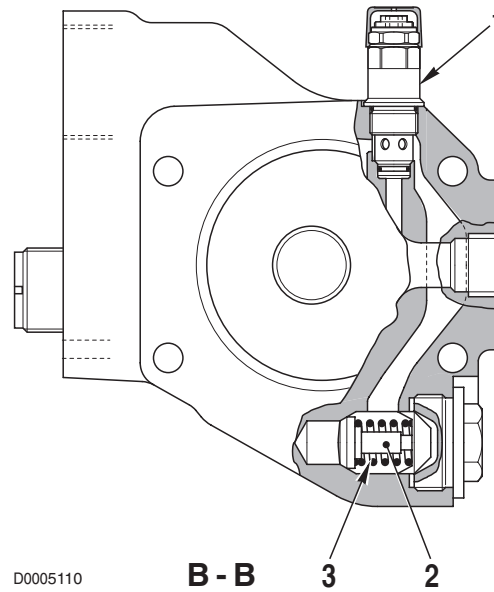
1. Antishock valve
2. Load Sensing valve
3. Pressure cut-off valve
4. By-pass valve



D0004960

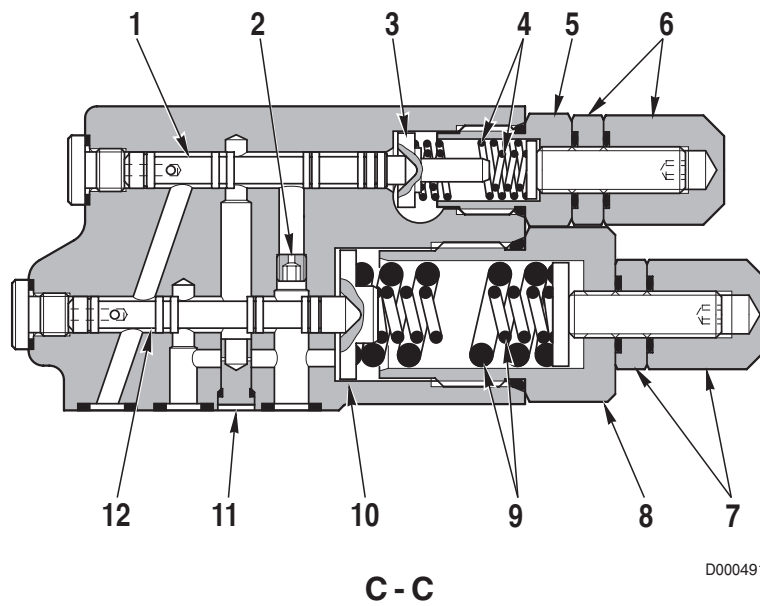
COMPONENTS

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



COMPONENTS

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



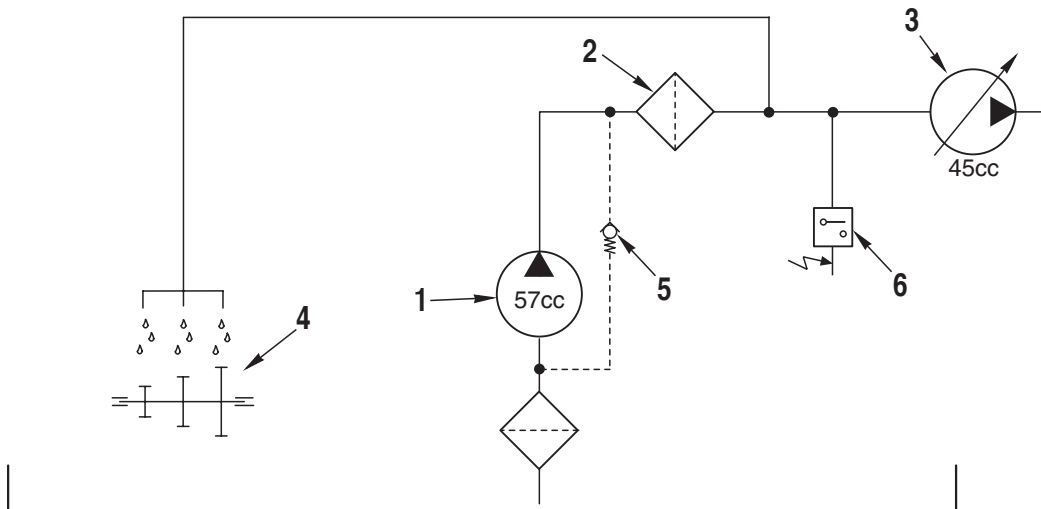
COMPONENTS

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

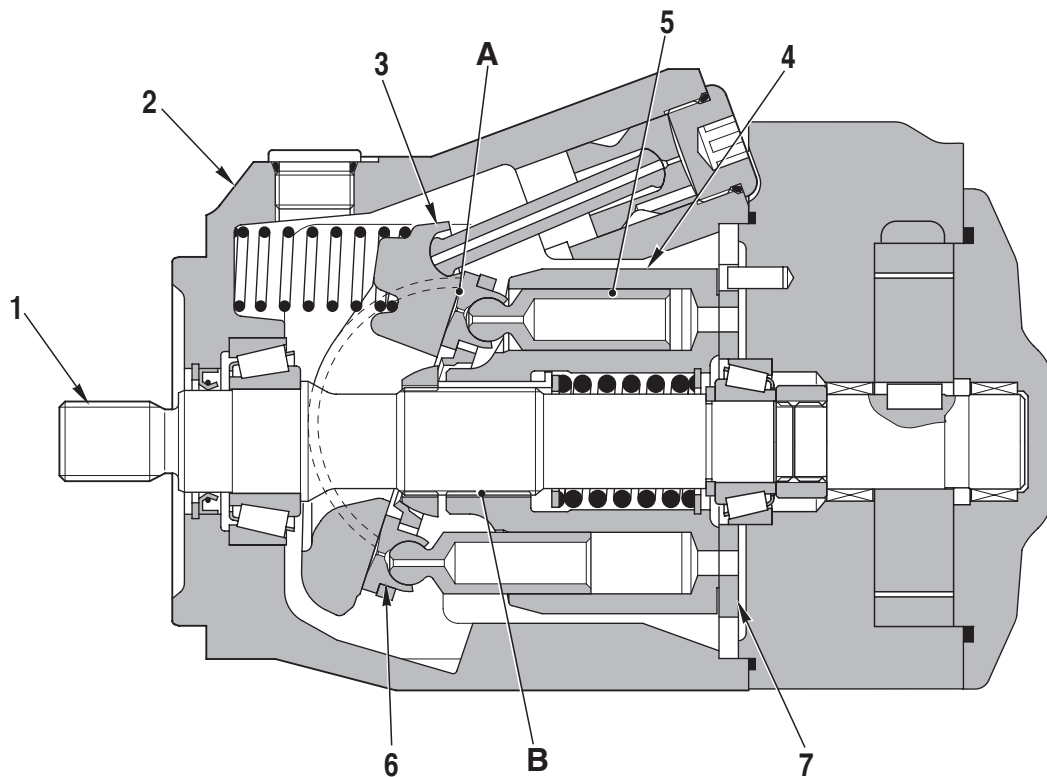
OPERATION

- 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.



D0005010

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 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 ».

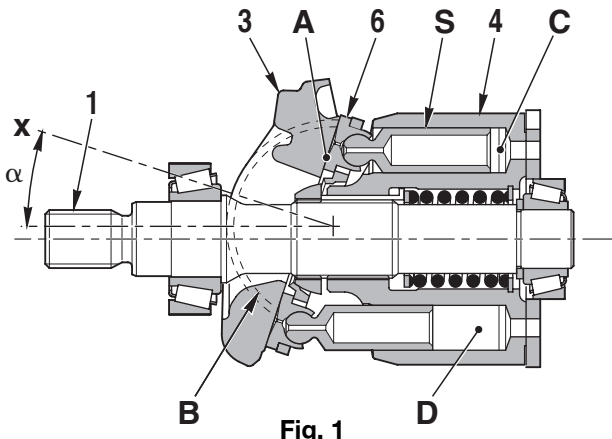


Fig. 1

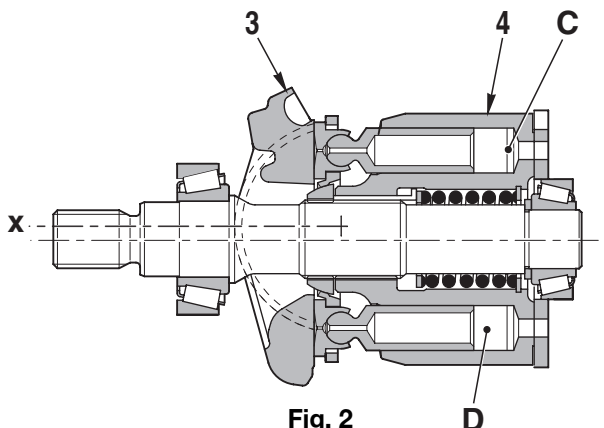


Fig. 2

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 wished. (Fig. 3).

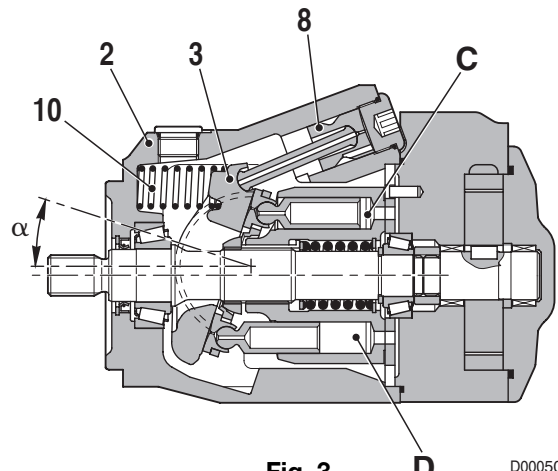
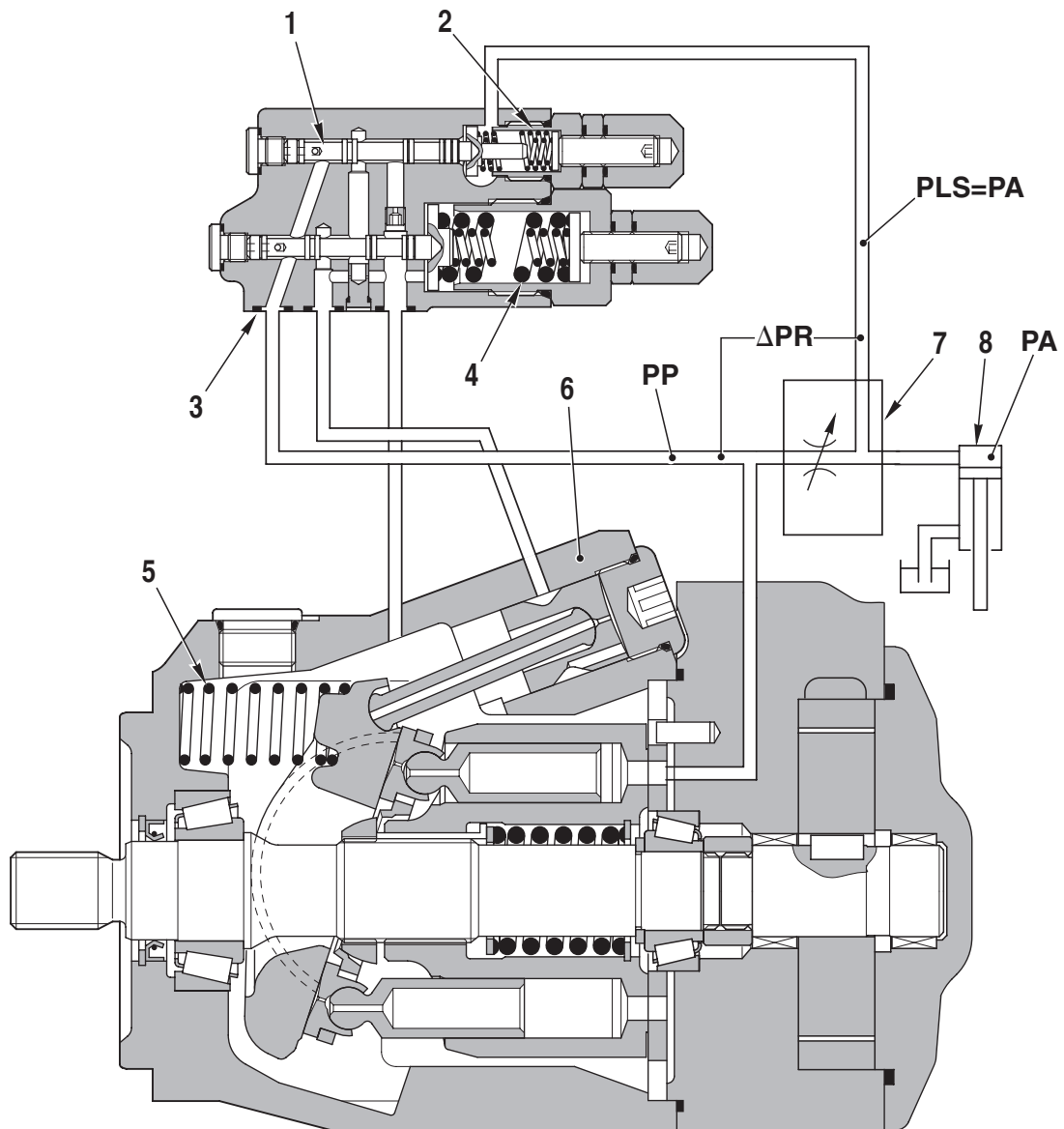


Fig. 3

D00005020

5.1.3 LOAD SENSING VALVE, PRESSURE CUT-OFF VALVE



D0004830

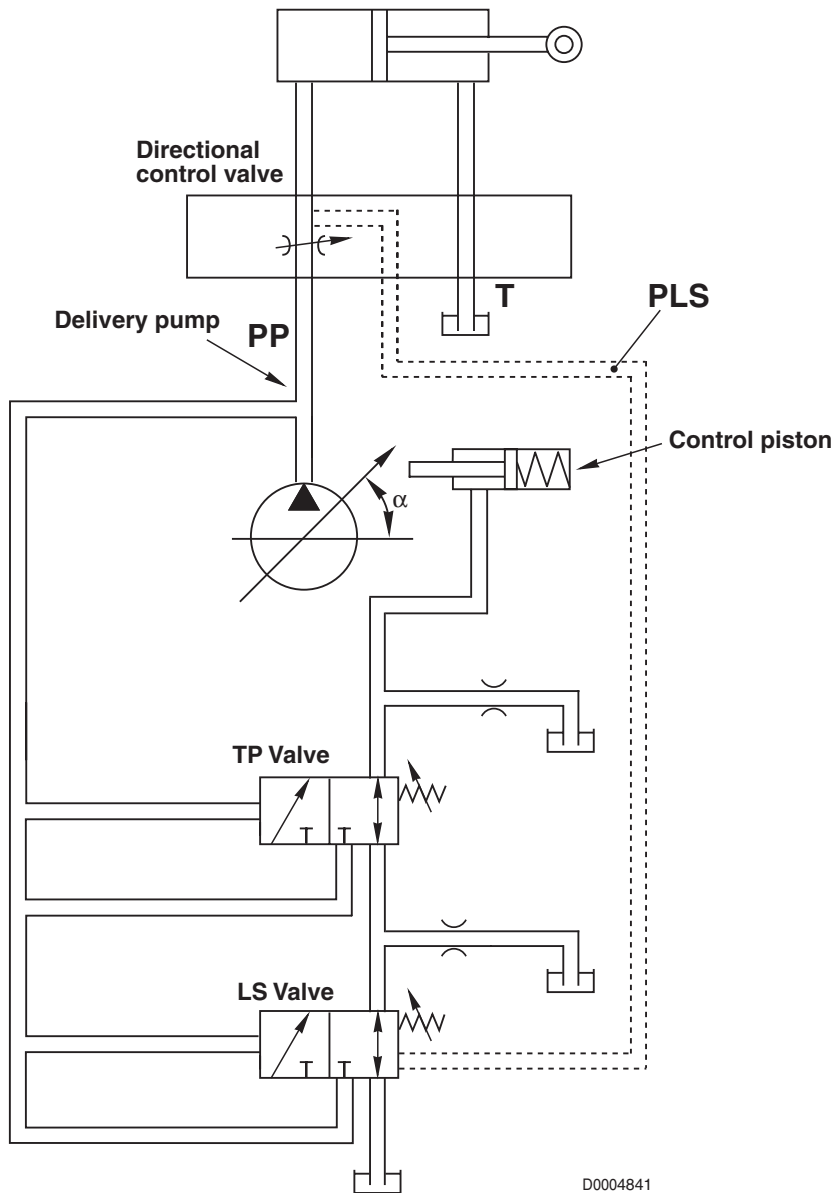
COMPONENTS

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 ΔPR 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. ($\Delta PR = \text{Pump delivery pressure } PP - \text{PLS delivery pressure to load}$).
- If the pressure difference ΔPR falls relative to the pressure setting of the **LS** valve, the swash plate angle will increase. If the pressure difference ΔPR rises, the swash plate angle will decrease.
- ★ For details of this mechanism, see the description of the «HYDRAULIC PUMP».



D0004841

LOAD SENSING (LS) VALVE

FUNCTION

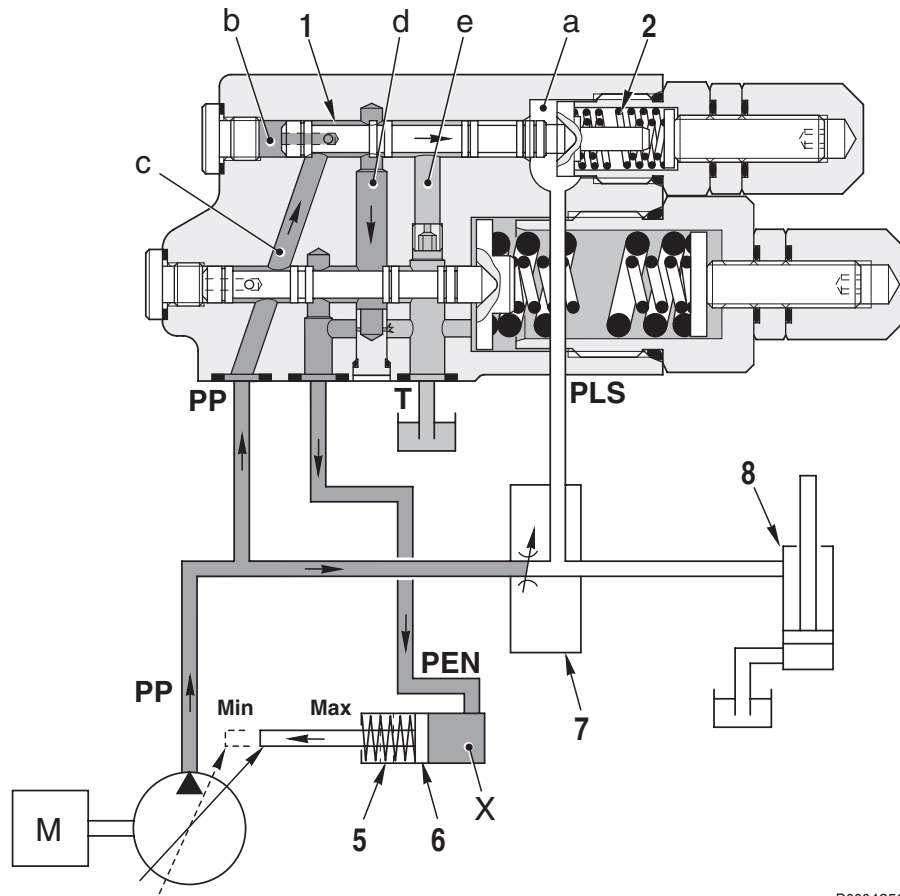
- The **LS** valve regulates the pump delivery in accordance with the position of the control lever of the directional control valve i.e. in accordance with the demand from the loads.
- The **LS** valve senses the demand from the loads by way of the pressure difference ΔPR between the pump delivery pressure **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 ΔPR , 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 ΔPR , 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

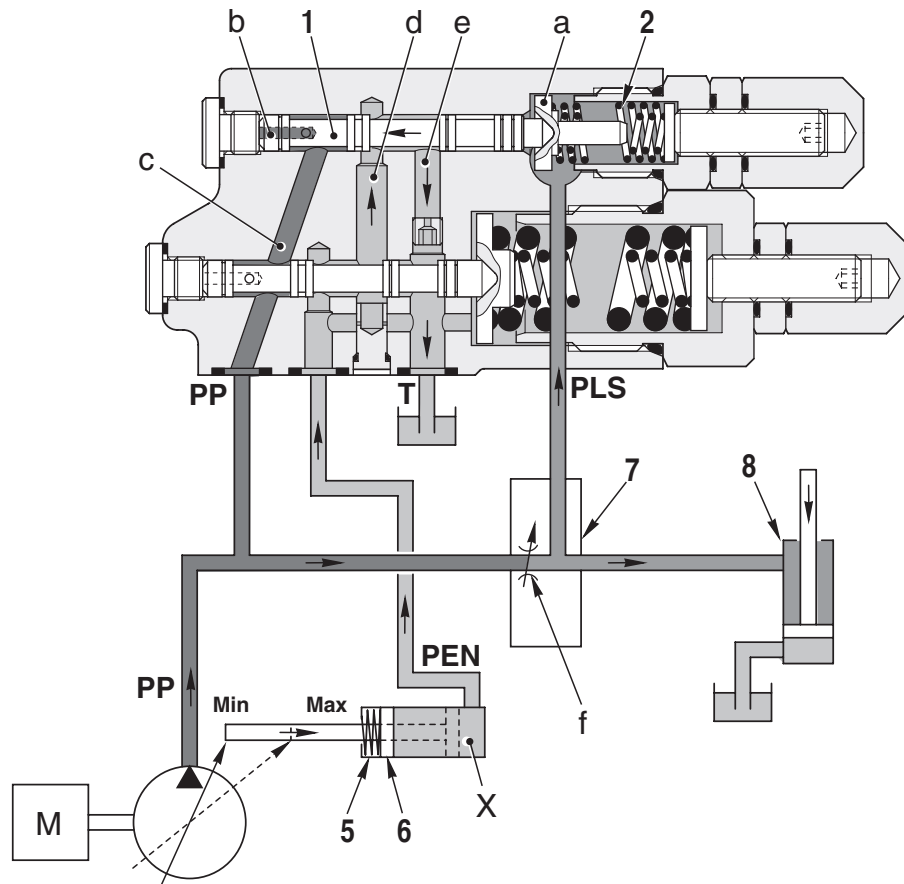
a. When the directional control valve is in «NEUTRAL» position



D0004850

- 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.

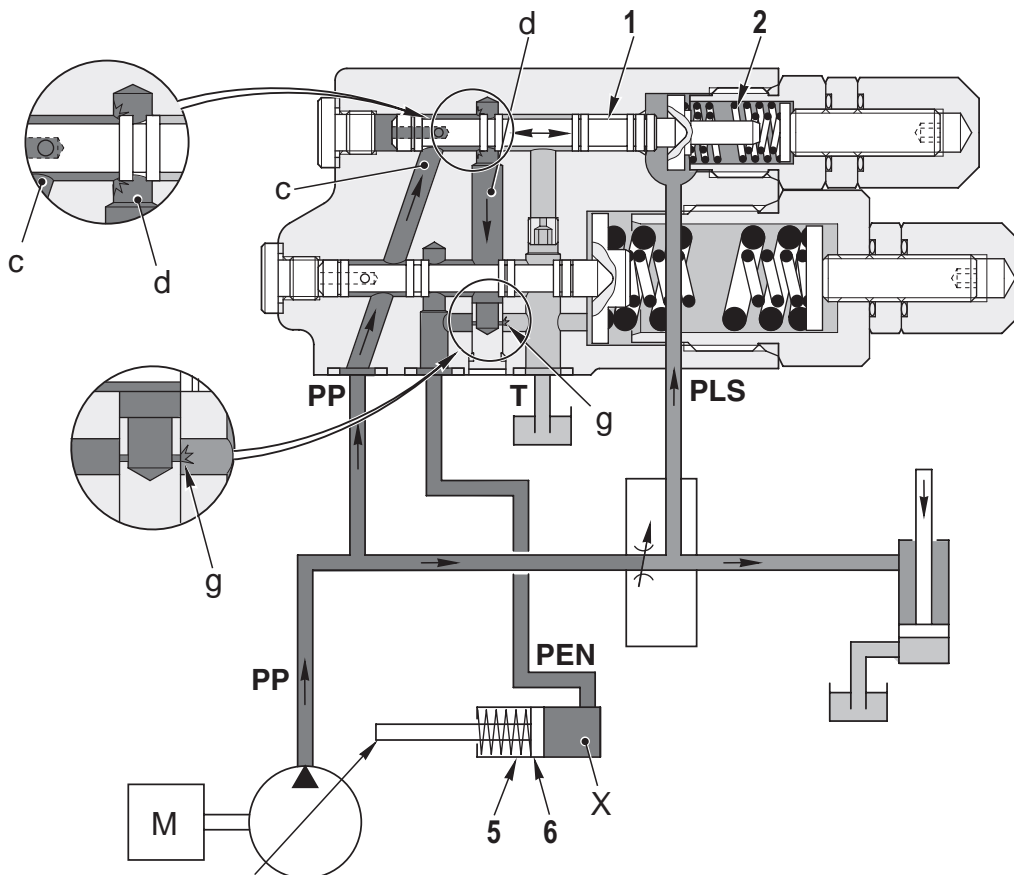
b. When a control lever is operated



D0004860

- 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 ΔPR 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**.

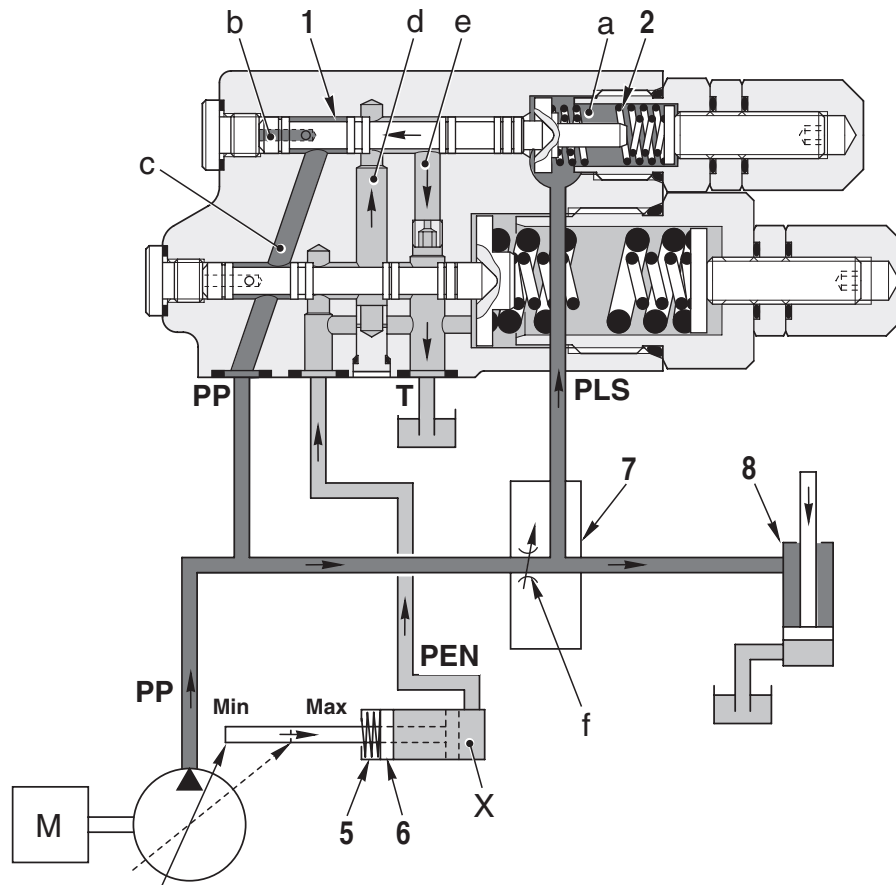
c. When the flow rate stabilises



D0004870

- 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 = ΔPR = 22 bar (319 psi)**.
- In practical terms, pump delivery is made proportional to the aperture of the auxiliary control valve, maintaining the pressure difference **ΔPR = 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

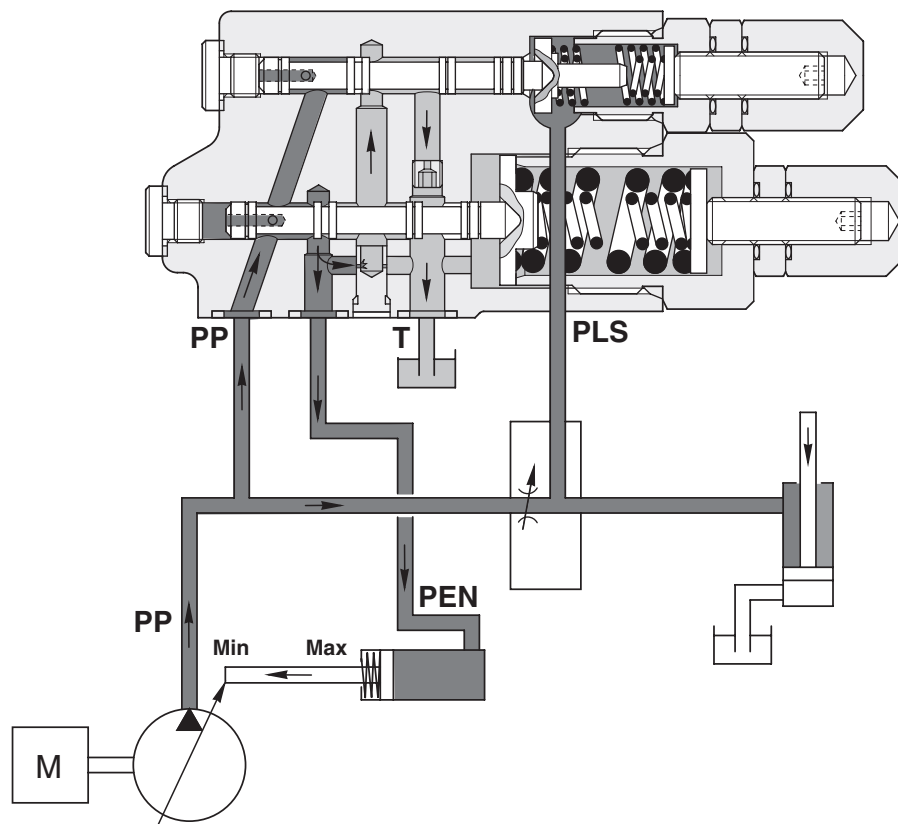


D0004880

- 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 ΔPR) 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.

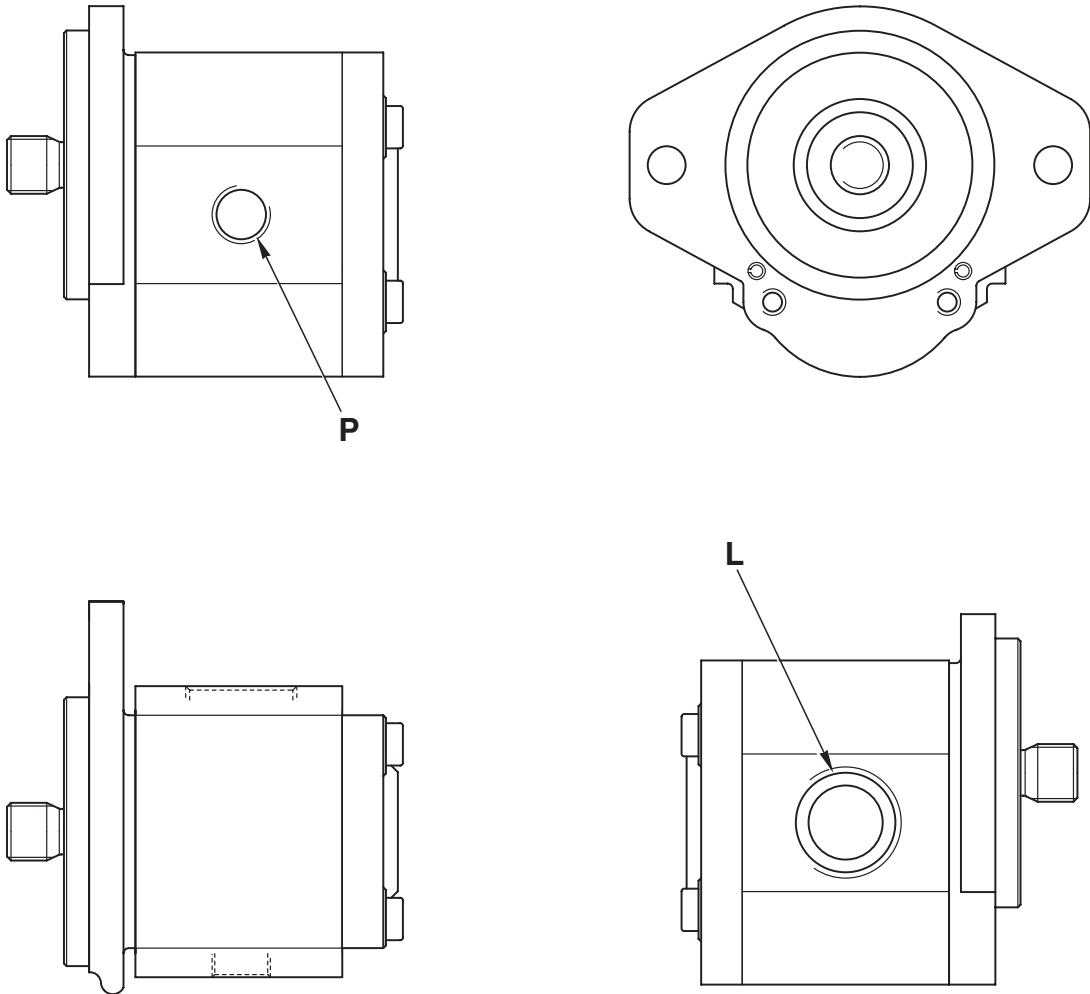


D0004890

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)



D0005280

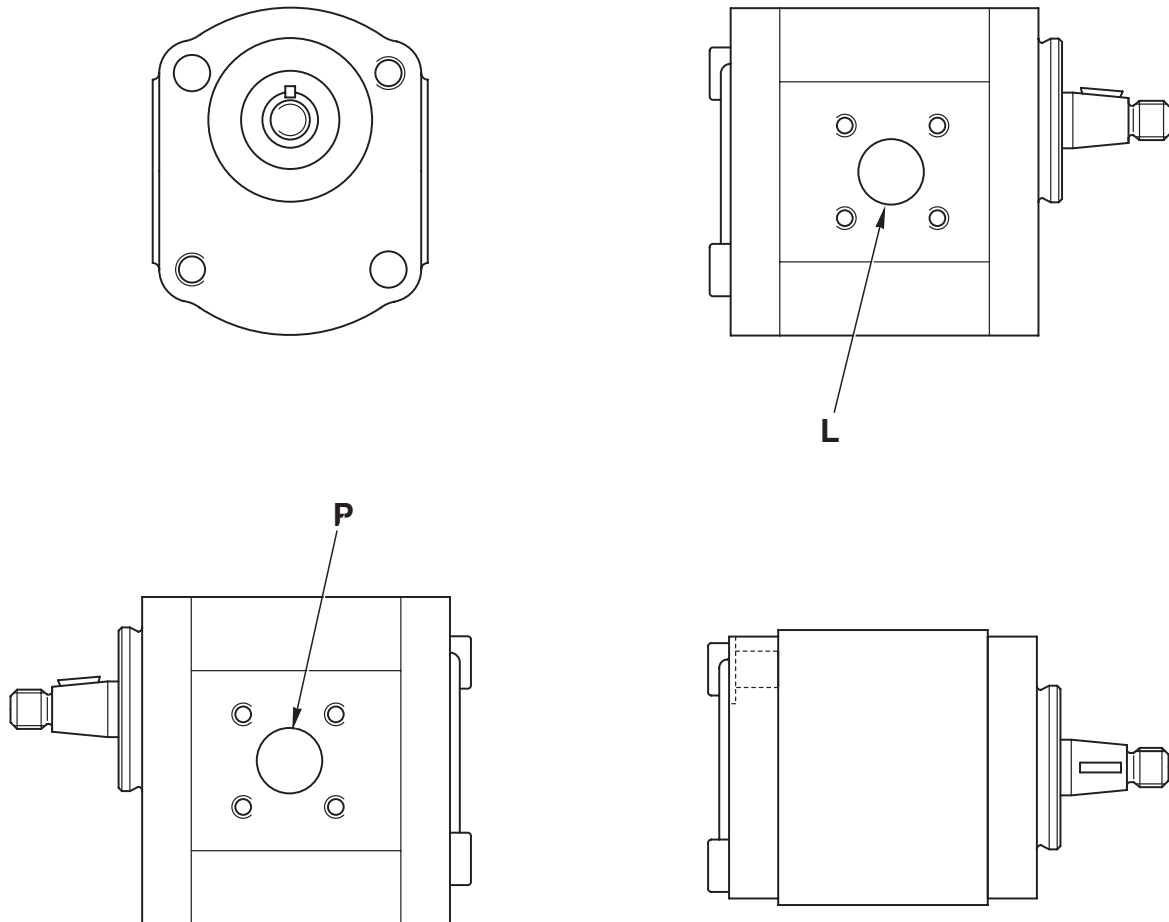
FUNCTION

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

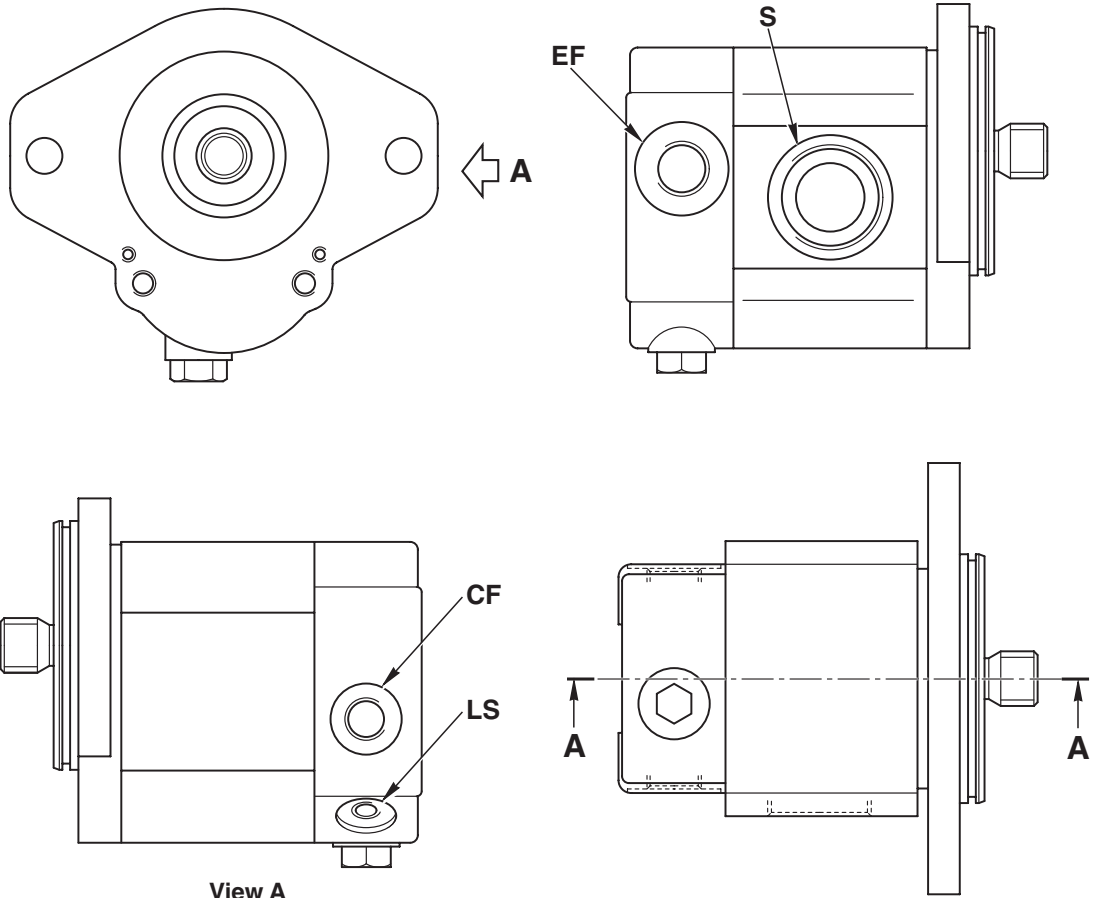
Port P: delivery

TECHNICAL DATA

Displacement: 16 cc/rev.

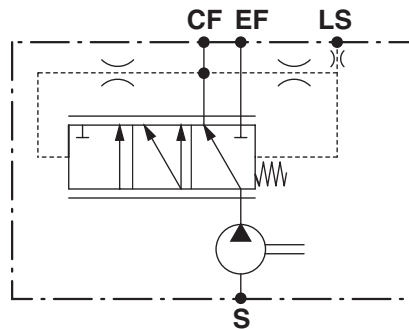
Maximum pressure: 180 bar (2610 psi)

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



View A

HYDRAULIC DIAGRAM



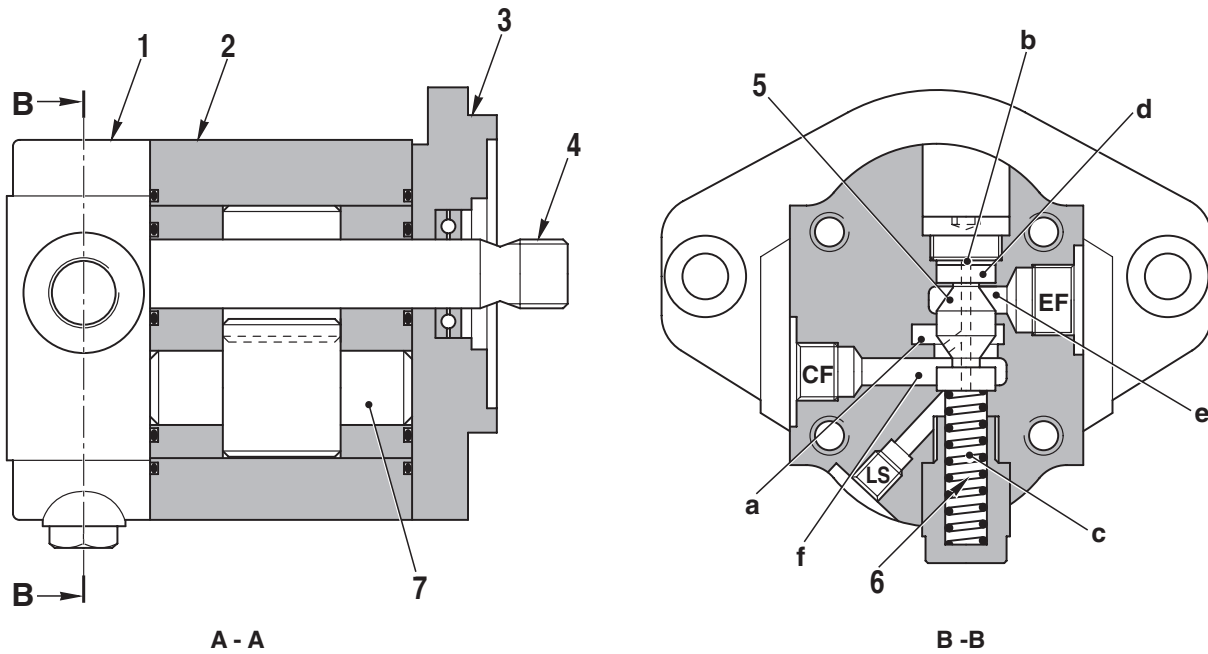
D0004970

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)



D0004980

COMPONENTS

- | | |
|---|--|
| <ul style="list-style-type: none"> 1. Priority valve body 2. Pump housing 3. End cover 4. Input shaft | <ul style="list-style-type: none"> 5. Spool 6. Spring 7. Driven shaft |
|---|--|

DESCRIPTION

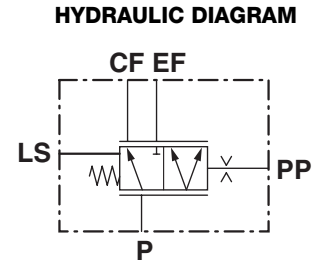
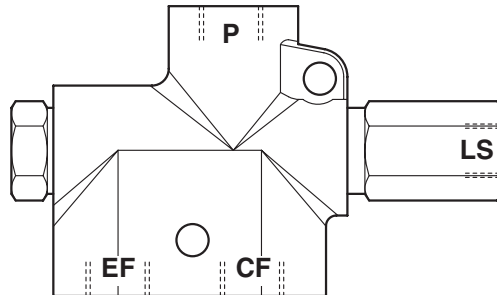
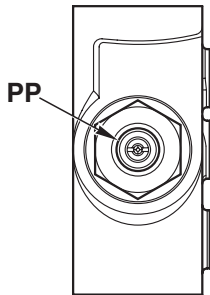
The gear pump sends oil under pressure to the chamber **a** from where it is sent through the port **CF** to the power steering. At the same time, the pressurised oil reaches chamber **b** of the spring (6) and the chamber **c** opposite the spring (6) through the passage **d**.

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



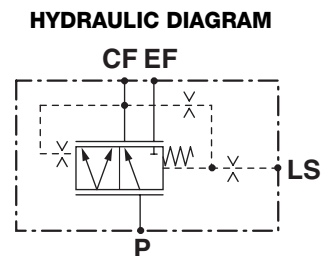
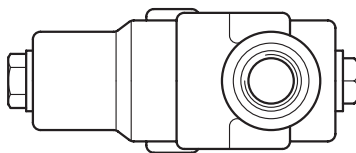
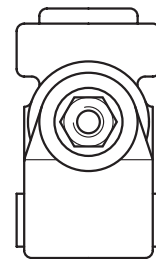
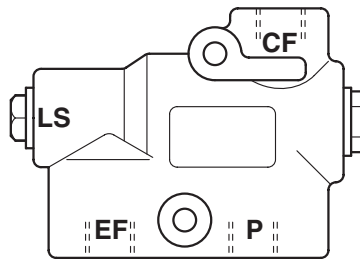
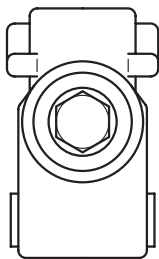
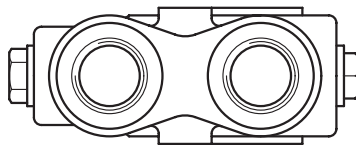
D0005300

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



D0005310

FUNCTION

Port CF - Delivery to the power steering
 Port P - Valve feed

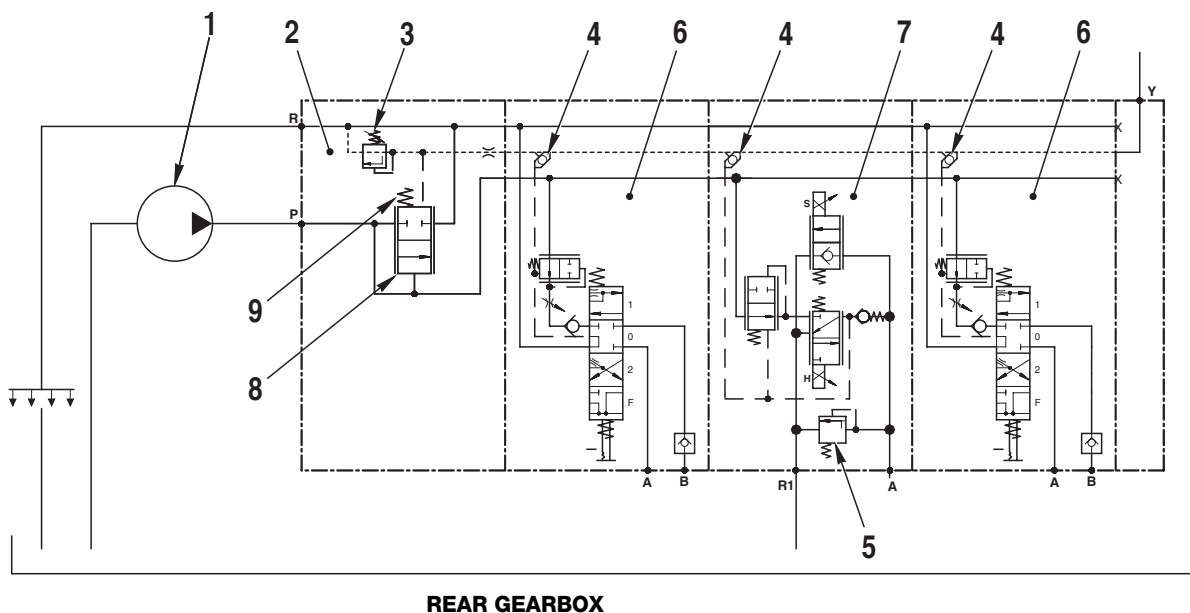
Port EF - Delivery to services
 Port LS - Load Sensing signal

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 .



D0004990

DESCRIPTION

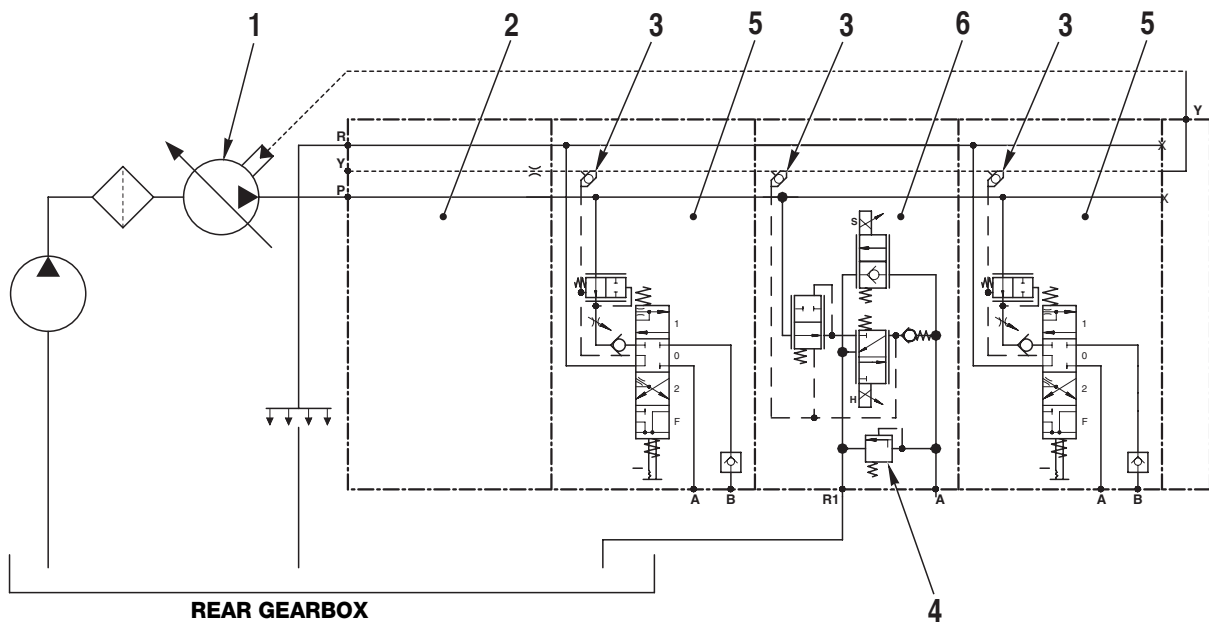
- The pressurised oil from the pump (1) enters the inlet section (2); from here it is distributed to the spool sections through internal passages.
- In the inlet section (2) we find an input gauge (8) and a relief valve (3) for LS-signal.
- The input gauge adjusts the pressure to supply the auxiliary 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

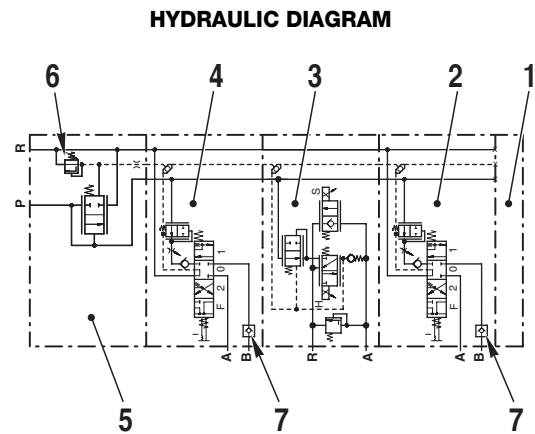
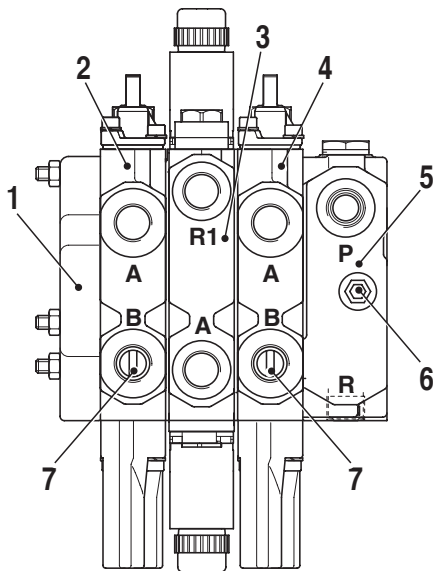
DESCRIPTION

- 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)

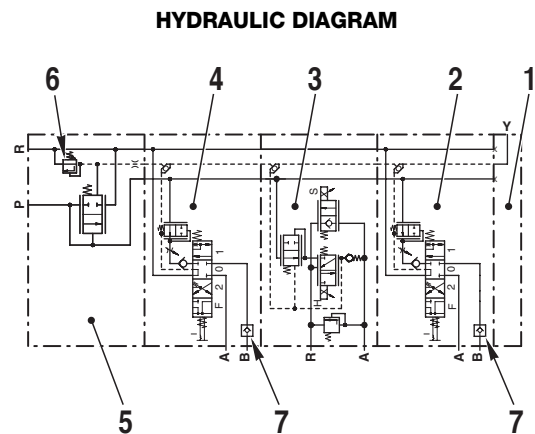
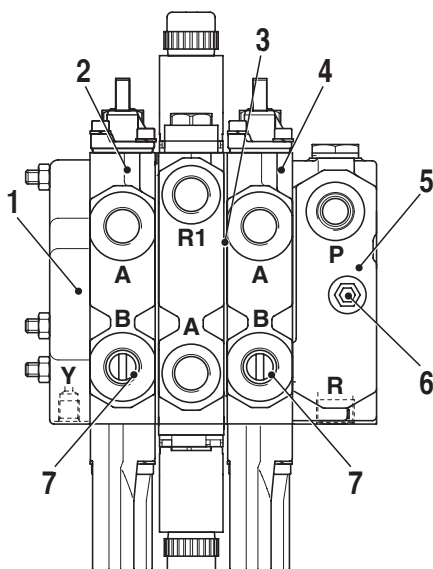
4-WAY VERSION WITHOUT FURTHER EQUIPMENT (I.E. FRONT AXLE SUSPENSION)



D0005150

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

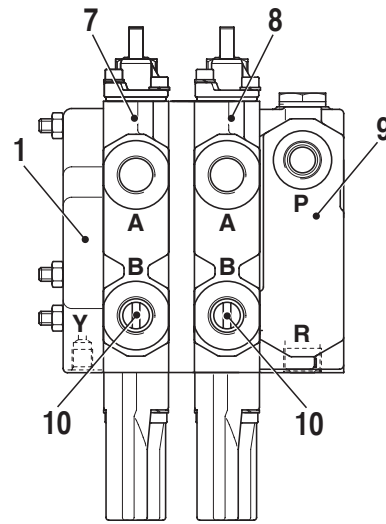
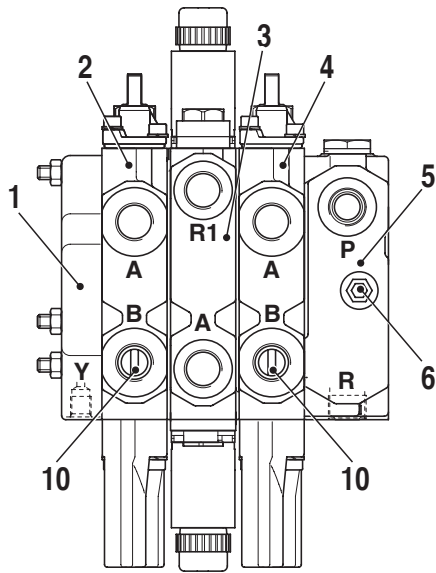
4-WAY VERSION WITH FURTHER EQUIPMENT (I.E. FRONT AXLE SUSPENSION)



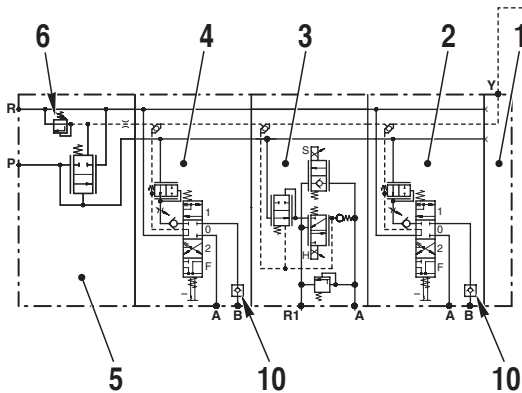
D0005160

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

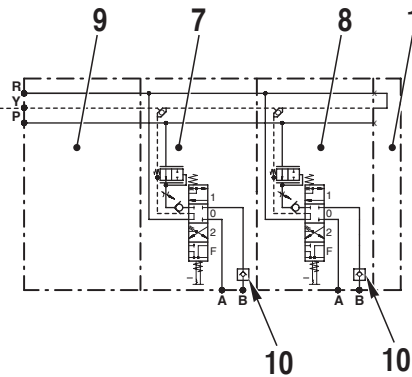
8-WAY VERSION



HYDRAULIC DIAGRAM



HYDRAULIC DIAGRAM



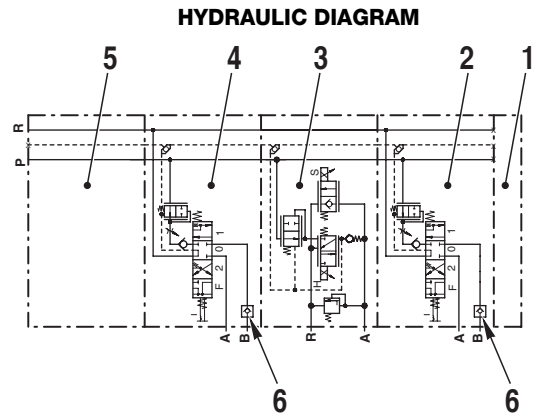
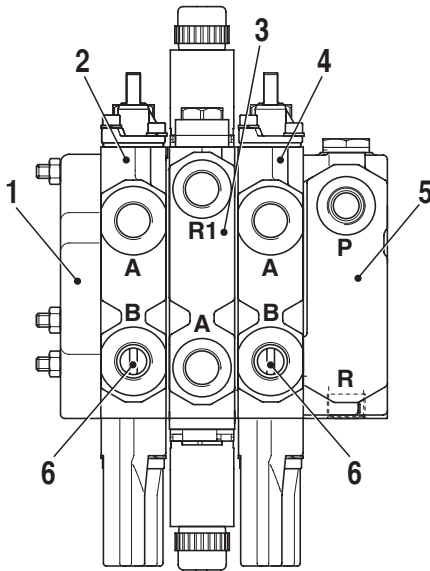
D0005140

- 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

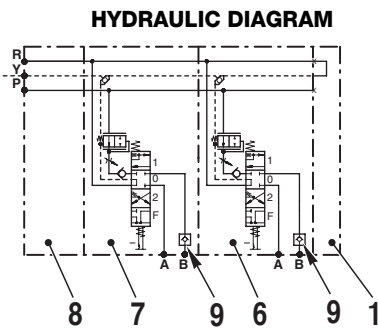
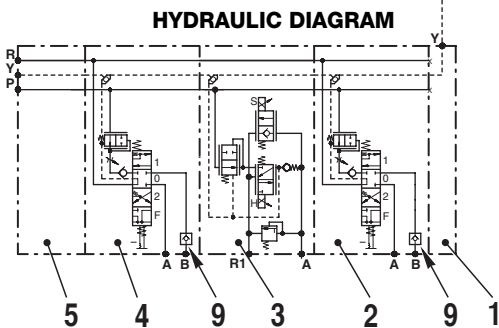
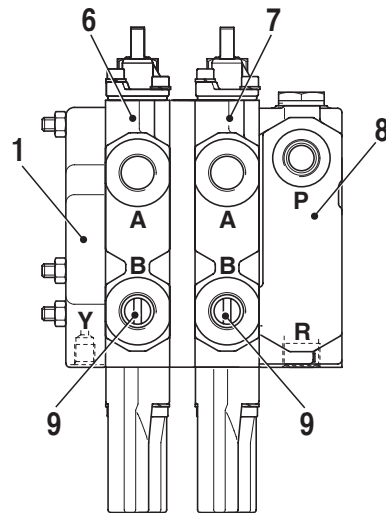
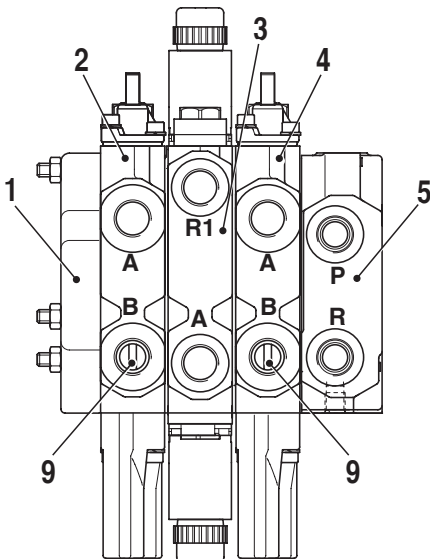


D0005120

- 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

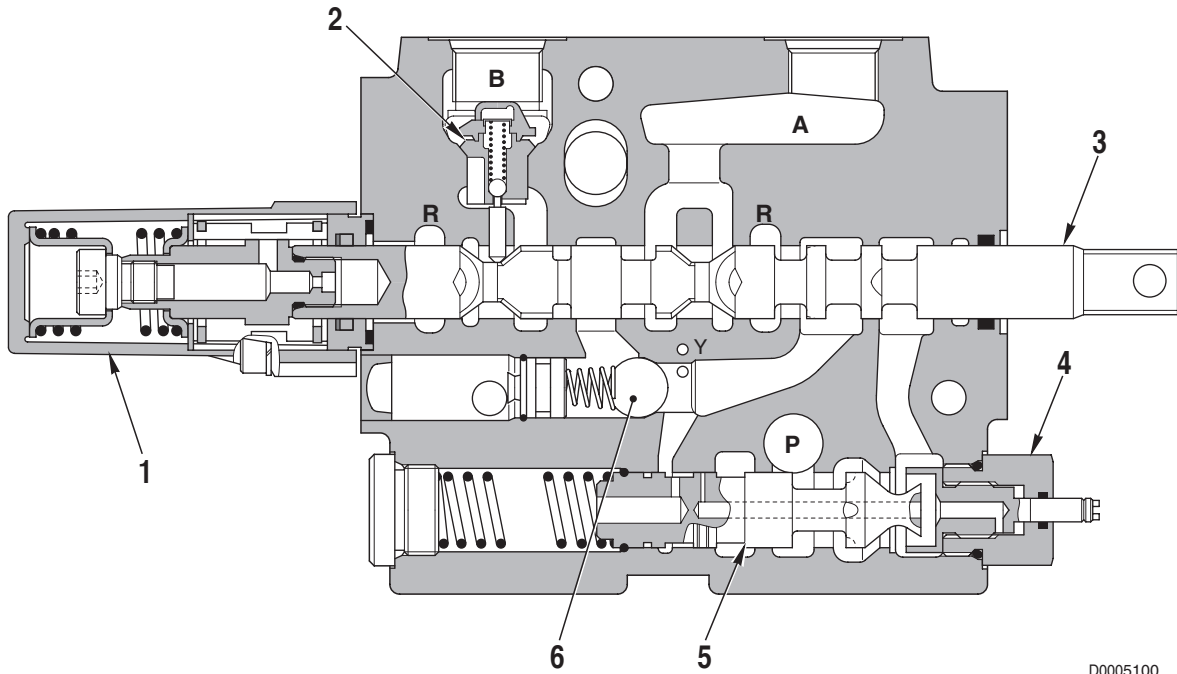


D0005130

- 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

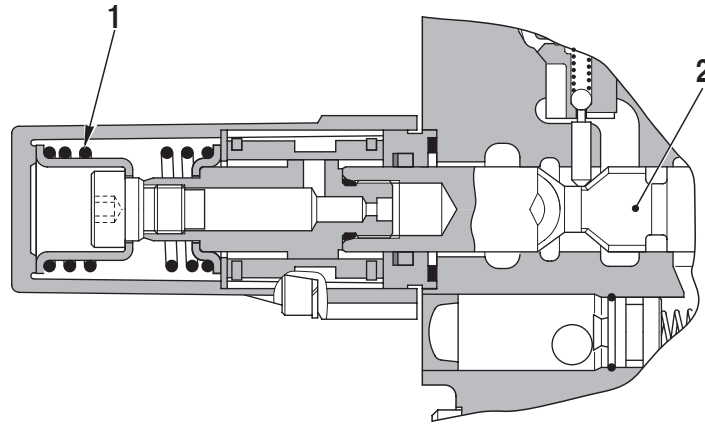


D0005100

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

5.6.4 DESCRIPTIONS OF COMPONENTS

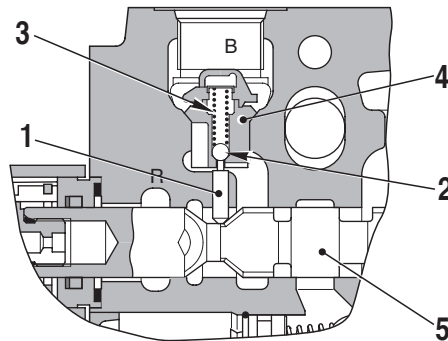
SPOOL RETURN DEVICE



D0005040

- 1. Spool return spring
- 2. Spool

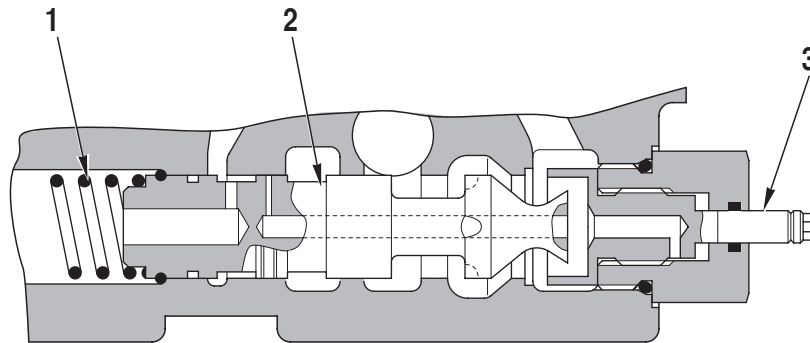
Check valve (NR)



D0005050

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

FLOW CONTROL VALVE



D0005060

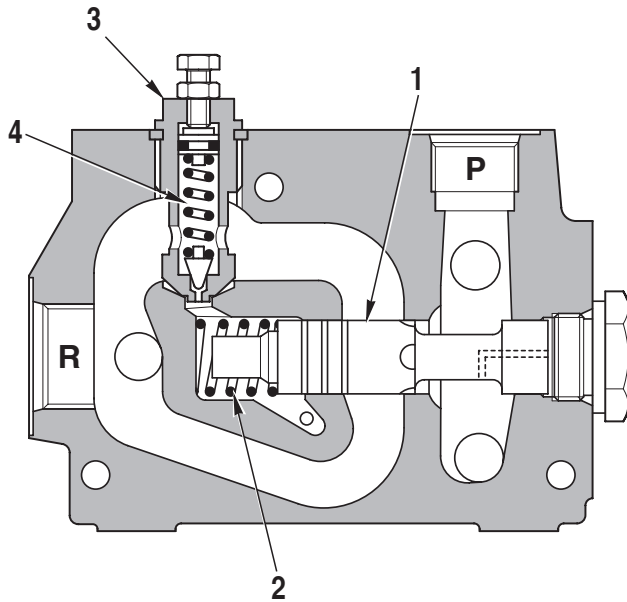
1. Spring
2. Flow control spool
3. Control shaft

5.6.5 INLET MANIFOLD (CC version)

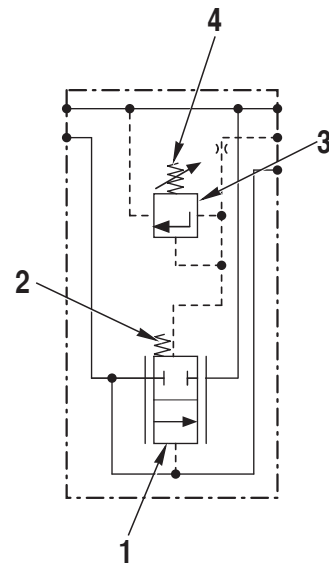
DESCRIPTION

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

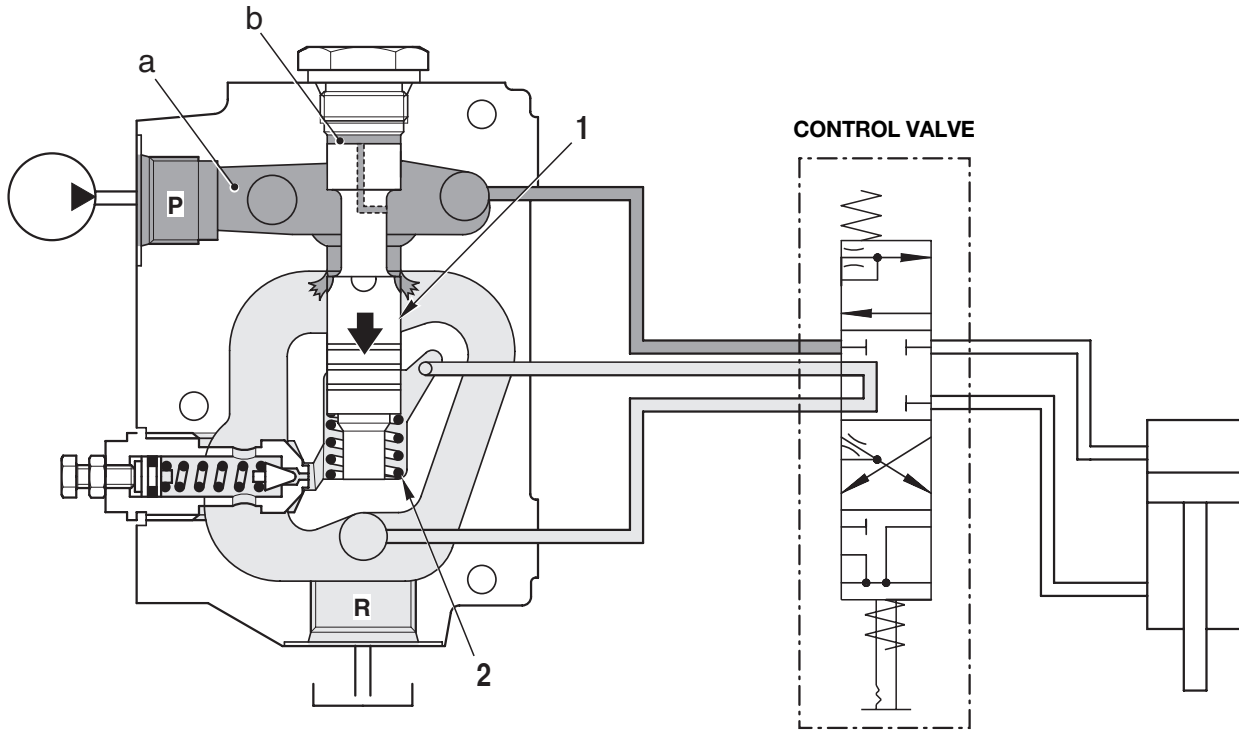


D0005070

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

OPERATION

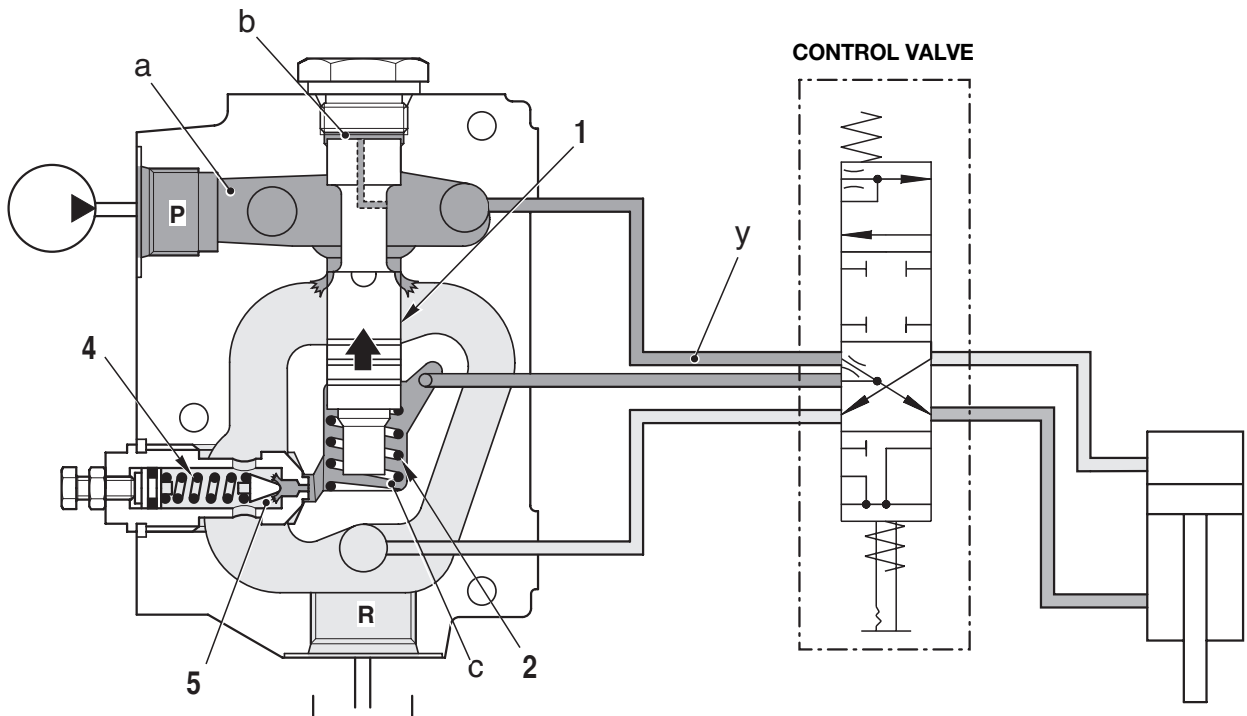
1. When the actuators are not operated



D0005080

- 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



D0005090

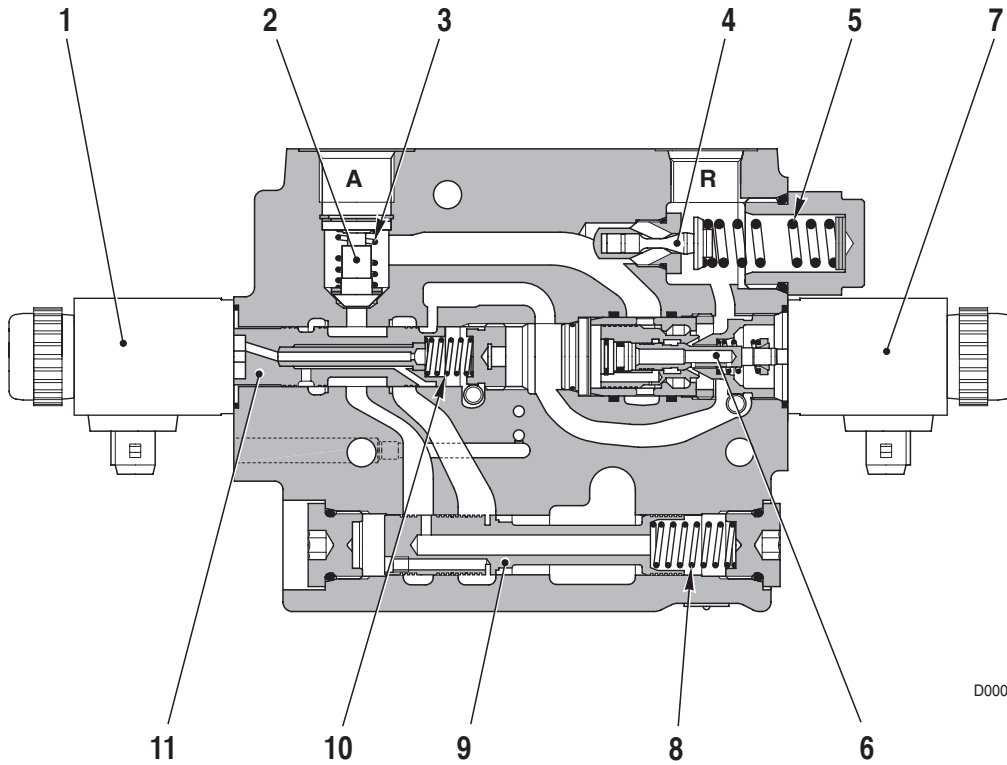
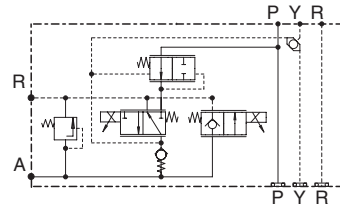
- When an actuator is operated, the pressure required for its operation is also directed to the channel **y** (Load Sensing signal channel) and then sent to chamber **c** of the manifold.
- This causes the spool (1) to shift upwards and the oil required to operate the load is sent to the control valve.
- 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



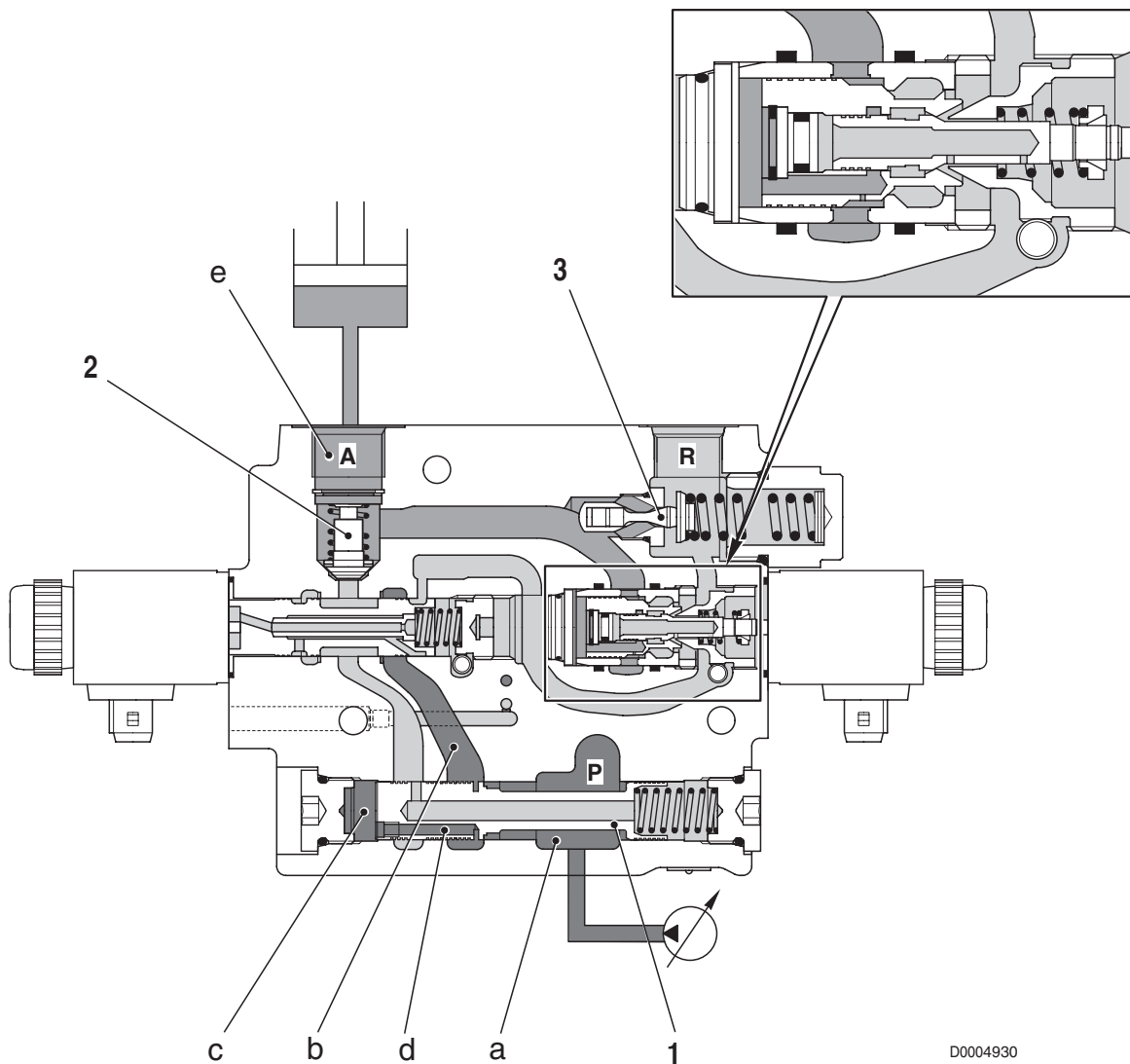
D0004920

COMPONENTS

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

OPERATION**1. When the lift control is in neutral position**

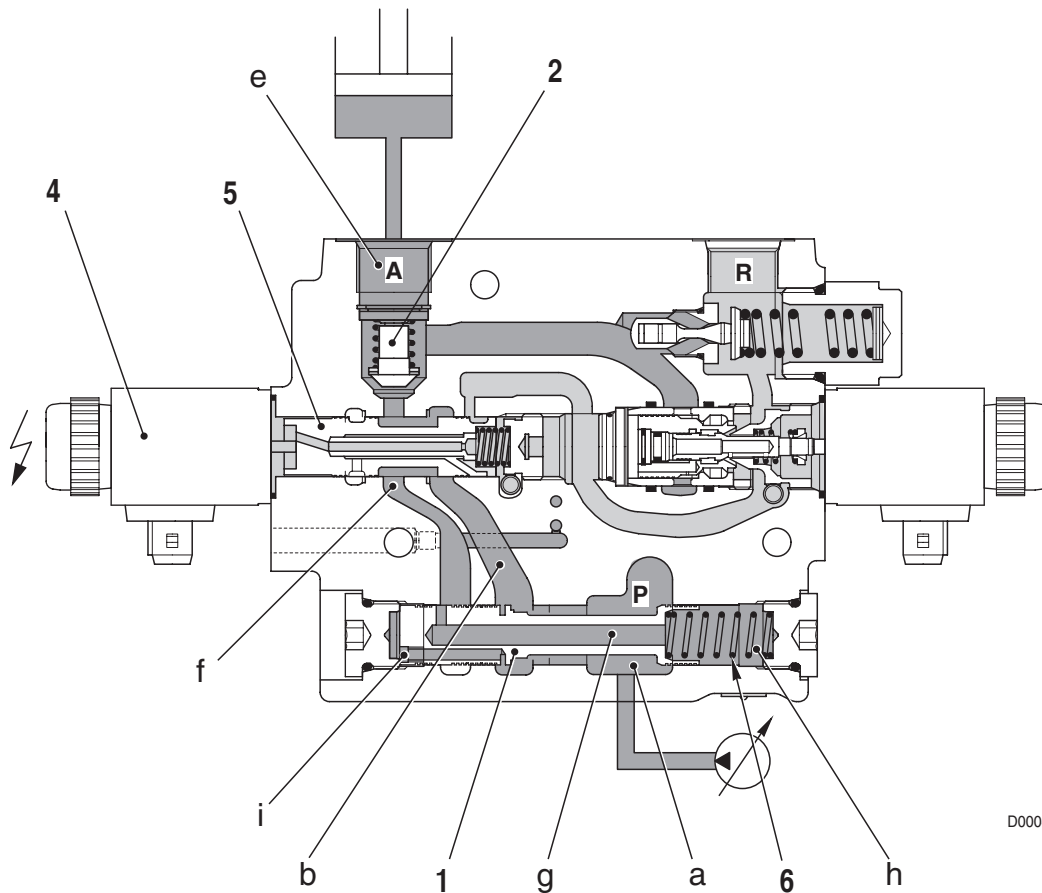
- The oil from the pump enters chamber **a** and from here flows into passage **b**.
- At the same time the oil flows into chamber **c** of the flow control (1) through passage **d**.
- This causes the spool to shift to the right until the connecting passage between chamber **a** and passage **b** is 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.



D0004930

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**.



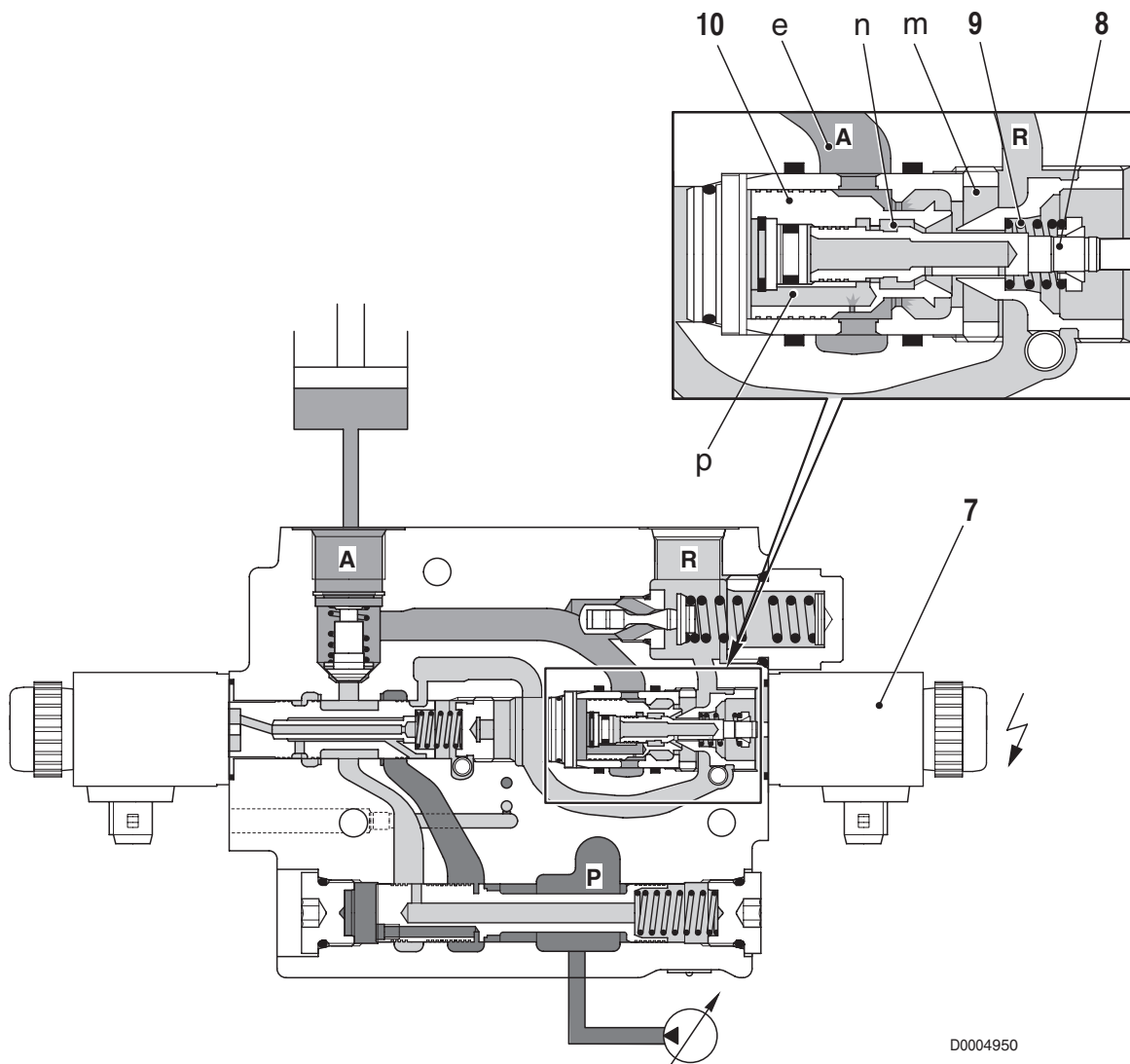
D0004940

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.



D0004950

SECTION 20

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OPERATOR'S MANUAL



SERDIA (LEVEL III)

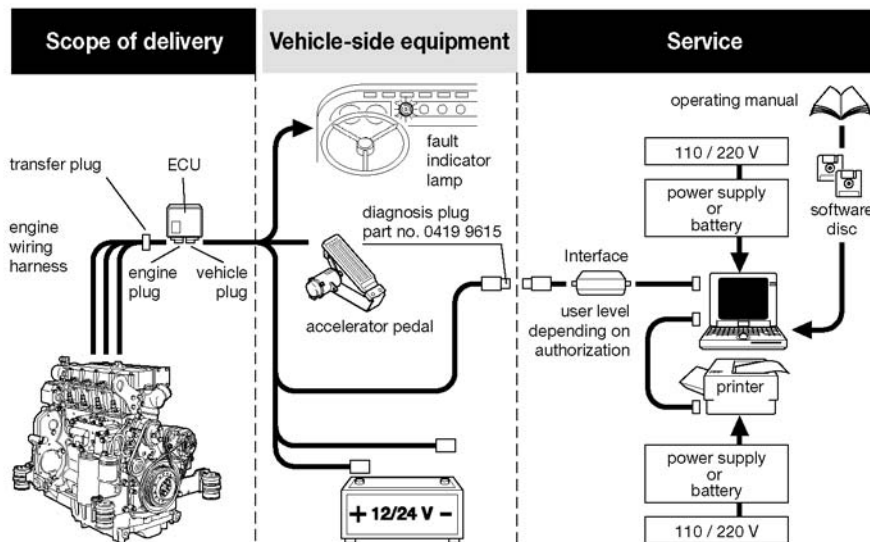
1. ENTRY AND COMMUNICATION

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 mechanical 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 calibration 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
- Graphics card:..... VGA/SVGA
- Processor: 80486 (or later)
- Frequency:..... 100 MHz
- RAM:..... 8 MB RAM (or later)
- Hard disk (free memory capacity): 15 MB (or later)
- Disk drive:..... 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 adaptor 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 version 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 useful 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 notebook).



ATTENTION!

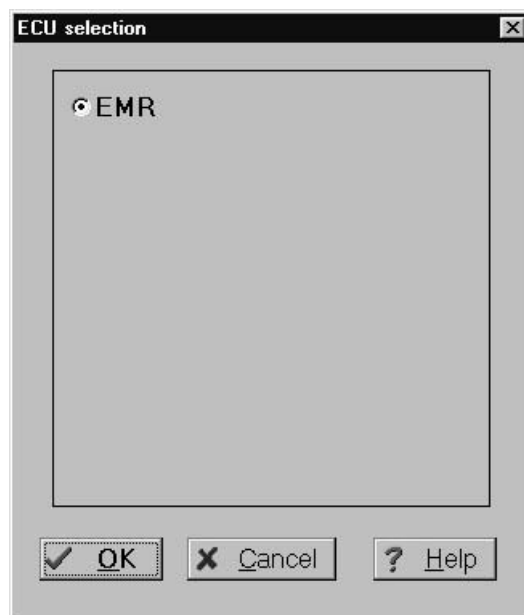
On PCs, the COM1 interface may sometimes be occupied by the mouse. If this is the case, you should connect the interface to the second serial interface (COM2). This must then be configured (see Chapter 8, What should you do if...?).

- 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".

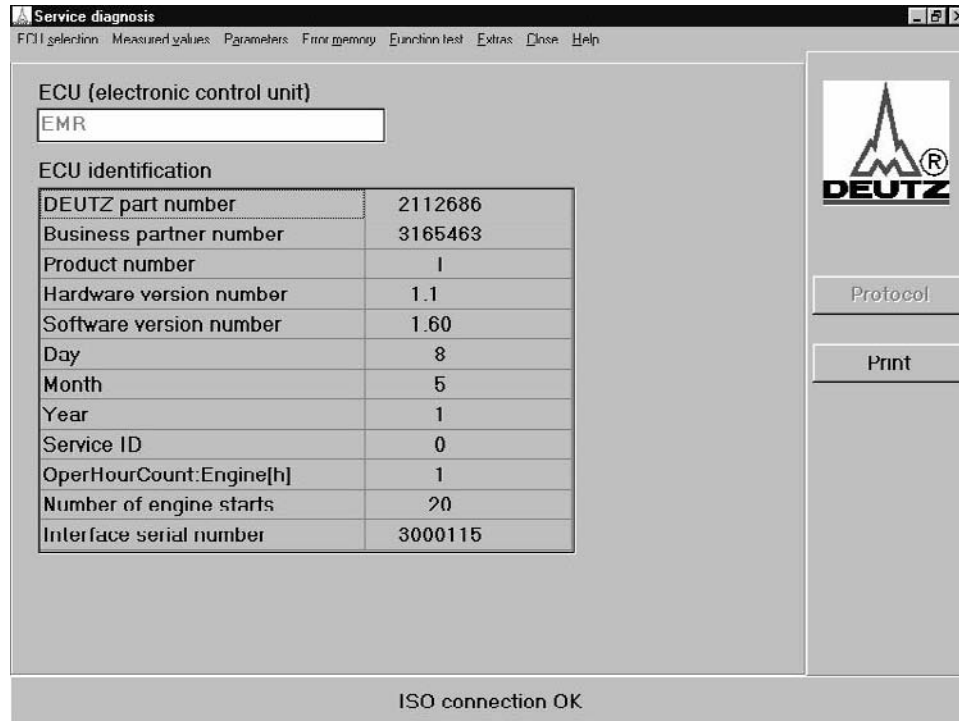


1.6.1 ESTABLISHING COMMUNICATION WITH THE ECU

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.

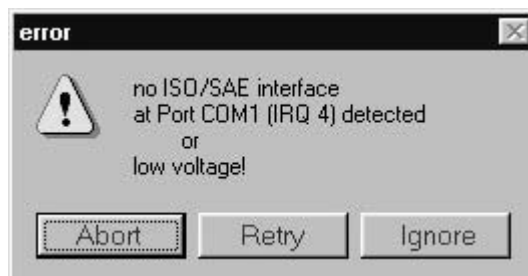
Once communication has been successfully established, the main screen "Diagnostics service" is displayed with the fields "ECU (electronic control unit)" and "ECU identification". This main screen contains a predefined selection menu.



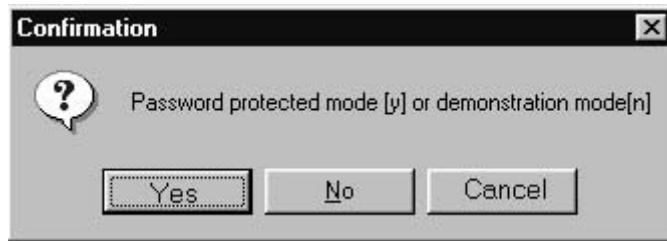
1.7 OFFLINE MODE

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 eelectronics measured values
- read mcortex 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 rmore 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 specif\c programrnng IS requireci in accordance with each indivtduel applicauon case Changes to parametrization beconne necessary if:

- customner requiremenis
- abaptation to locai requirements
- replacement installation

The parameters can only be changed with SERDIA!

This menu point also does away with the need for screwdriver setting, as is necessary with analog ECUs. Individual parameters (such as dynamic go~ernor characteristics) can use LE changed 'nithin predefnsed limits. Parametrization is carried out in two separate screens, one for configuration and one for calibration. Access to the fields 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

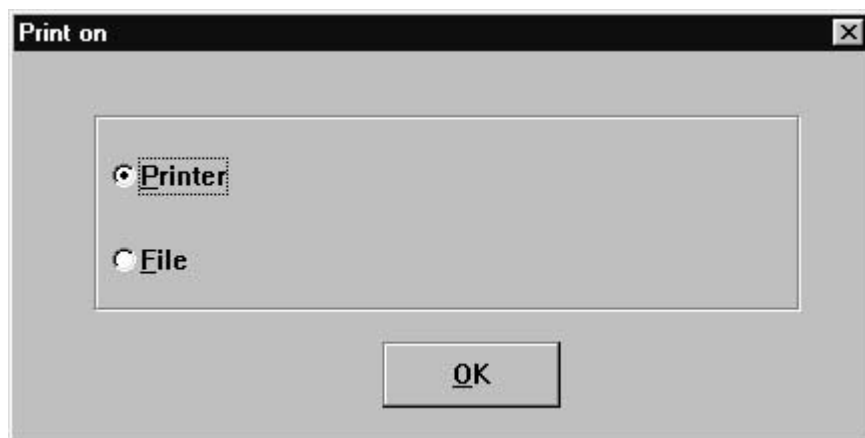
For more information, please see Chapter 7, Extras.

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 point "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 overlaid. 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" ..

Pick-up point	Value	Unit
Battery voltage	11.8	V
Engine speed	0	1/min
Control rod position	0.000	mm
(M9)Coolant temperature	29	°C
Fuel injection quantity	110.0	cmm/Hub

Actual measured values

Meas. values

Graphics

Collect. time/s

10

File

Print

Help

Close

Figure: Current measured values of the EMR



ATTENTION!

Values beyond the sensor measuring range are underlined in colour:

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

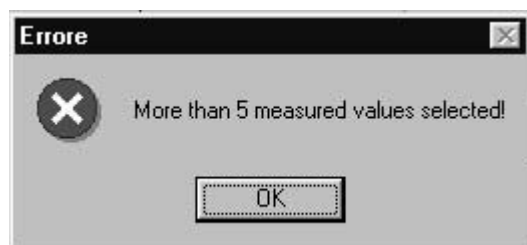
De.scription of keys:

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 duration 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".

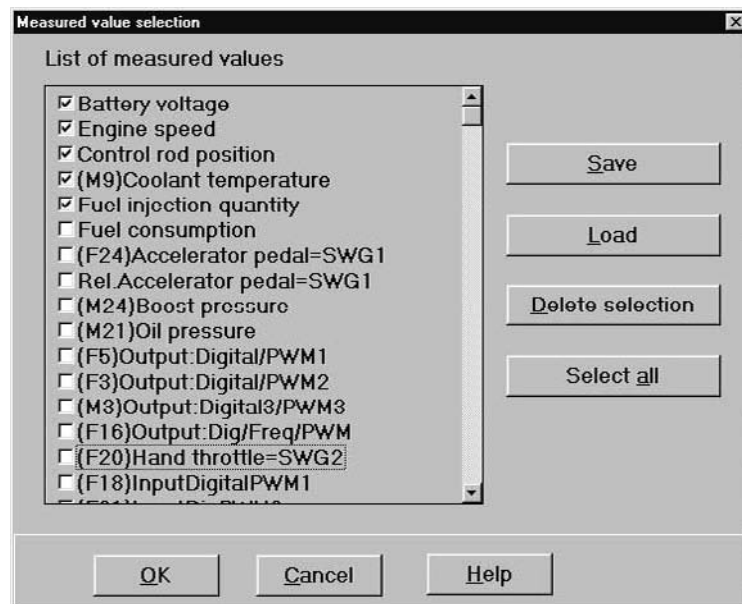
3.1.1 MEASURED VALUE SELECTION

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).

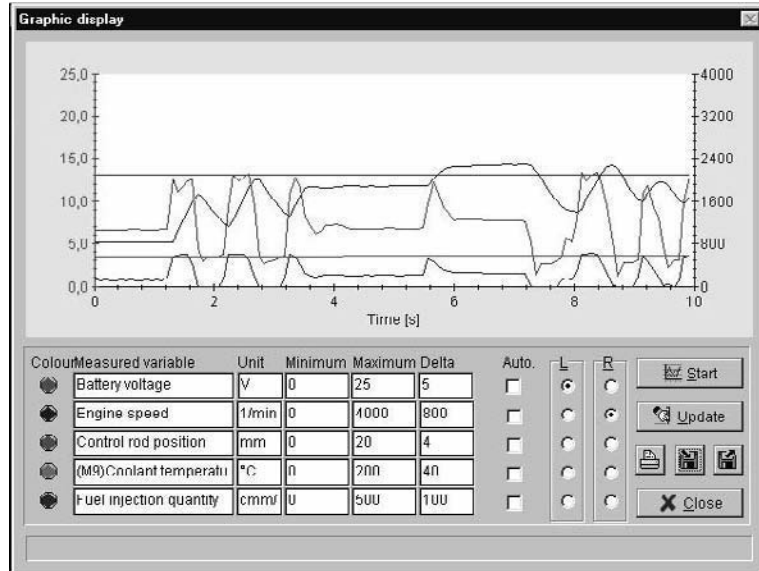
Measured value selection

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)Coolant 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.

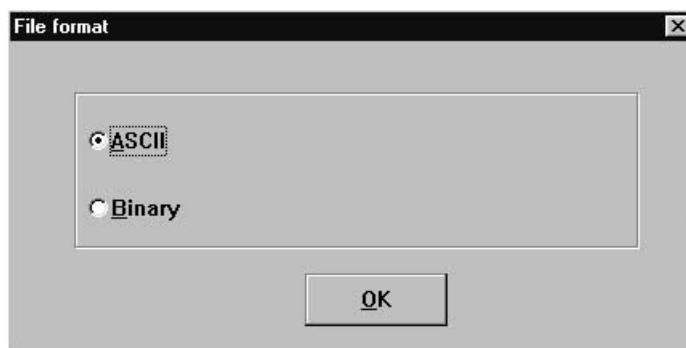
EXPLANATION OF THE FUNCTION SWITCHES:

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.

Pin No.	Signal name	Application
EMR F_18	Pwm In 1	0
EMR F_21	Pwm In 2	0
EMR F_24	Analog In 1	3511 SetpointVal1 MeasVal
FMR M_24	Analog In 2	3531 BoostPressMeasVal
EMR M_9	Analog In 3	3551 CoolTempMeasVal
EMR M_21	Analog In 4	0
EMR F_20	Dig/Analog In	3521 SetpointVal2MeasVal
0		DigInTorqueCurve
0		DigInDroop
0		DigInSetpointSpeed
0		DigInGvrType
EMR F_21	SWITCH 2	DigInLowerEngSpeed
FMR F_18	SWITCH 1	DigInUpperEngSpeed
EMR F_19	SWITCH 3	DigInHoldEngSpeed
EMR F_24	Analog In 1	DigInSelectorSwitch
EMR F_b	Pwm 1	0

3.5 CAN-Status

This window displays the CAN bus activities of the EMR.

Status: offline

Phase: 0:Engine standstill, Initialization

Error information:
No fault existing

sent	received	Bus off
0	0	0

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, phase1, 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 alright
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

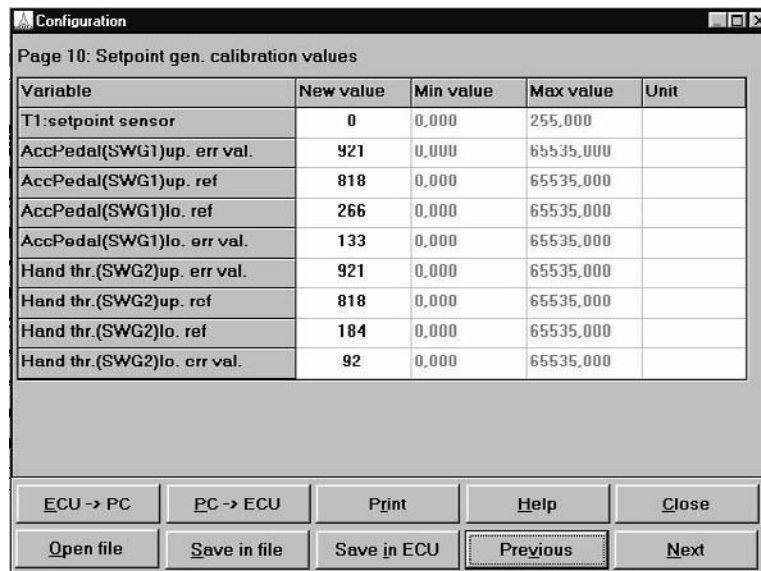
VanRxTimeOutBit	Text
0	Engine Temperature
1	Inlet / Exhaust Conditions
2	Engine Fluid Level /Pressure
3	TSC1
4	Engine protection
5	Function shift
6	Dc
7	Dc
8	Dc
9	Dc
10	Dc
11	Dc
12	Dc
13	Dc
14	Dc
15	Dc

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 disquette.



The screenshot shows a window titled "Configuration" with the subtitle "Page 10: Setpoint gen. calibration values". It contains a table with the following data:

Variable	New value	Min value	Max value	Unit
T1:setpoint sensor	0	0,000	255,000	
AccPedal(SWG1)up. err val.	921	0,000	65535,000	
AccPedal(SWG1)up. ref	818	0,000	65535,000	
AccPedal(SWG1)lo. ref	266	0,000	65535,000	
AccPedal(SWG1)lo. err val.	133	0,000	65535,000	
Hand thr.(SWG2)up. err val.	921	0,000	65535,000	
Hand thr.(SWG2)up. ref	818	0,000	65535,000	
Hand thr.(SWG2)lo. ref	184	0,000	65535,000	
Hand thr.(SWG2)lo. err val.	92	0,000	65535,000	

Below the table are two rows of buttons:

Row 1: ECU -> PC, PC -> ECU, Print, Help, Close

Row 2: Open file, Save in file, Save in ECU, Previous, Next

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		acc. 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: I 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...260 0	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) Analnp1 (Pedal)		0	3999	3511	(F24) Input: Analog 1 (accel.pr. sensor)
		Ass (M24) Analnp2 (boostPr)		0	3999	3531	(M24) Input: Analog 2 (boost pr. sensor)
		Ass (M9) Analnp3 (CoolTemp)		0	3999	3551	(M9) Input: Analog 3 (coolant temp. sensor)
		Ass (M21) Analnp4 (OilPress)		0	3999	3541	(M21) Input: Analog 4 (oil pr. sensor)
		Ass (F20) DigAnalnp (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.		<p>If the sign is changed, the switch positions (open/closed) are reversed.</p> <p>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 Analog 4 (Pin M21) 6 = F3 is input (only for ECU 0211 2088)</p> <p>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</p>			
		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. quantity 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	Imp/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 Pt1 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 Pt1 (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 Object		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	
		EngSpeedSensor1 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 OdiagTelegr. (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 Sensor1 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.

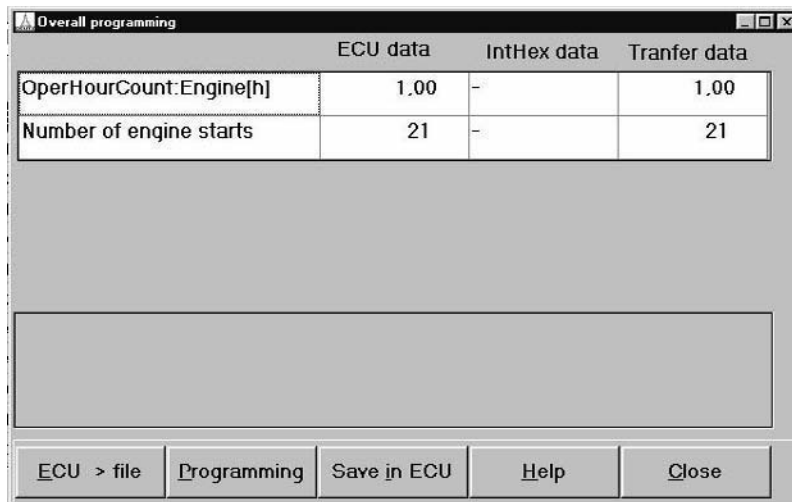


Figure: Menu complete programming ("Overall programming")

EXPLANATION OF FUNCTION[SWITCH:

ECU->file: 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

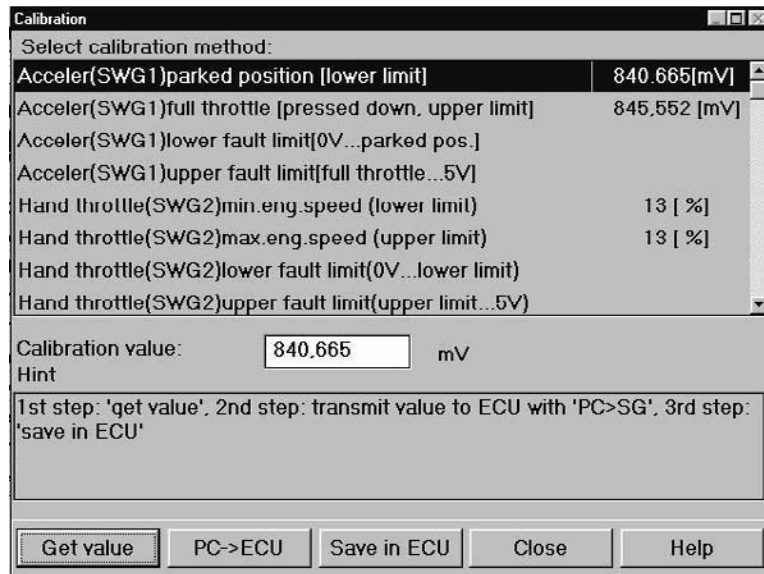
Restriction: Only applies for EMR and EMS.

4.3 CALIBRATION

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

Important prerequisites:

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



TERMINOLOGY EXPLANATIONS:

Acceler(SWG1): Accelerator pedal sensor (setpoint generator 1), Input 24 FS

Hand throttle(SWG2): Hand throttle potentiometer (setpoint generator 2), Input 20 FS

GENERAL PROCEDURE DURING CALIBRATION PROCESS:

- Select calibration size in upper window.
- Move accelerator pedal/hand throttle potentiometer to desired position.
- "Get value" switch activated: Actuate switch, the calibration value assigned to the position is shown in the editing field.
- "Get value" switch not activated: Enter calibration value in editing field.
- Upload calibration value with "PC->ECU" to ECU.
- Save calibration value with "Save in ECU" in ECU.
- Switch ignition on/off.

EXPLANATION OF FUNCTION SWITCH:

Get value: If the "Get value" switch has been set to activated, you can fetch the calibration value belonging to a pedal position using this switch.

PC->ECU: The calibration value displayed is uploaded to the ECU.

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

5. ERROR MEMORY

5.1 GENERAL

The error memory lists the errors which have occurred since the memory was last cleared and which can be diagnosed. Selection of the menu point "Error memory" causes the current content of the error memory to be displayed.

- When errors have been eliminated, the relevant error messages in the "Error memory" window can be deleted:
- Have messages from the error memory displayed by actuating the "Read EM" button.
- Mark in the "Error location" window the indicated error location using the mouse (Example: "8112:(M17)Rack travel sensor"). The error location receives a gray background.
- Click on "Clear EM" button. The error location is deleted, the message disappears.
- Quit the "Error memory" window with "Close".

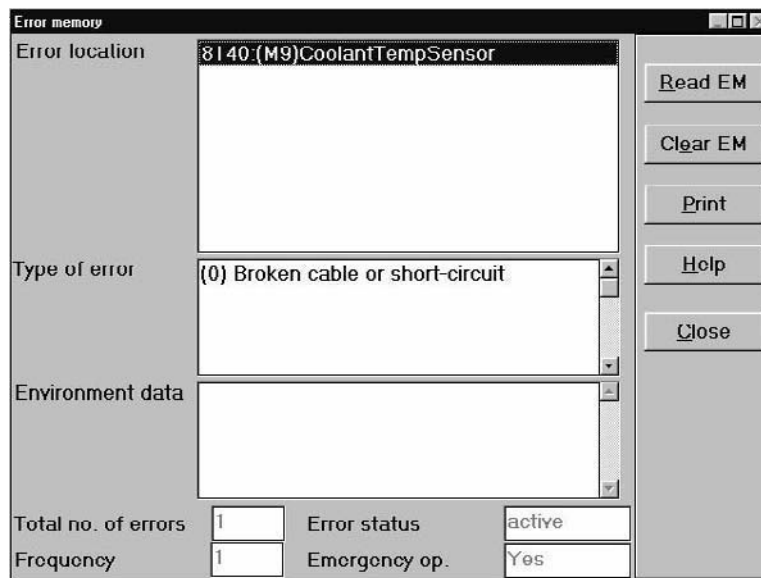


Figure: Example of an error memory output.

DESCRIPTION OF THE FIELDS:

Error location: List of error location: From this list you can select a single error location for more detailed information.

Type of error: All data in this field of the list refer to the error location selected in the upper field.

Environment data: Additional data (e.g. measured values) containing further information on the error location you have selected.

Total number of errors: Total of all registered error locations.

Frequency: Frequency of occurrence of the error location selected.

Error status: Selected error active or passive.

EXPLANATION OF THE FUNCTION SWITCHES:

Read EM: With this function switch you can retrieve the error memory from the ECU, and the display is updated.

Clear EM: With this function switch you can send a command to the ECU to delete the error memory.

5.1.1 ERROR MEMORY (EMR)

List of possible error locations of the EMR:

- 8002: (F18)Signal monitoring PWM-Inp1
- 8012: F21)Signal monitoring PWM-Inp2
- 8020: ECU (positioner actuation)
- 8030: shutoff magnet
- 8112: (M17) Rack travel sensor
- 8120: (F24) AccelerPedal(SWG1) = SWG 1
- 8130: (F20) HandThrottle(SWG2) = SWG 2
- 8140: (M9) CoolantTempSensor
- 8150:(M24) BoostPressureSensor
- 8160:(M21) OilPressureSensor
- 8170:(M13)Speed 1, camshaft
- 8180:(M11)Speed 2, terminal W
- 8190:(interno)ElectronicsTemperature
- 81A0:(M11)Engine speed sensor
- 8210:Data loss EEPROM
- 8220:Data loss coil data
- 8230: EDCcalibration error
- 8305:Speed monitoring
- 8343:Coolant temp, monitoring
- 8345:Eng.OFF->CoolantTempMonit
- 8363:Oil pressure monitoring
- 8365:Eng.OFF->OilPressMonit
- 8405:Actuator (positioner, travel meter, fuel rack)
- 8500:ISO-Bus-Error
- 8600:CAN-Bus-Error

The possible types of error are:

- (0) Broken cable or short-circuit
- (1) Broken cable or short-circuit
- (2) Measuring point defective
- (3) Power reduced
- (4) Limit exceeded, power reduction activated
- (5) Shutoff limit exceeded/ fallen below

The following table may be used as tool for eliminating possible causes of errors occurred. The status of the error pilot light is to be observed:

- Permanent light: Error status during which limited engine operation is still possible.
- The defect must be eliminated as soon as possible to prevent further damage. Error statuses which result in engine shutdown or prevent engine start. The defect must be eliminated to allow restarting of the engine

ERROR MESSAGES, CAUSES AND REMEDIES

Error pilot lamp	Error messages (only readable with SERDIA)		Possible causes	n. O.K	Remedy
	Type of error	Error location			
Permant light (Engine operation restricted)	(0) Broken cable or short-circuit	<ul style="list-style-type: none"> • 8120:(F24)AcceterPedal =SWG1¹ • 8130:(F20)HandThrottle = SWG 2² • 8140:(M9)CoolantTempSensor³ • 8150:(M24)BoostPressure Sensor • 8160:(M21)OilPressure Sensor • 8170:(M13)Speed 1, camshaft⁴ • 8180:(M11)Speed 2, terminal W • 8190:(intern)Electronics Temperature 	Plug-in connection interrupted. OK ↓	→	Restore plug-in connection
			Plug-in contacts contaminated or corroded OK ↓	→	Clean connector and replace if necessary
			Sensor defective OK ↓	→	Replace sensor
			Cable harness defective.	→	Check cable harness and replace if necessary
	(2) Measuring point defective	<ul style="list-style-type: none"> •8002:(F18)Signal monitoring PWM-Inp1 •8012:(F21)Signal monitoring PWM-Inp2 	PWM signal cannot be evaluated	→	Check signal
	•(3)Power reduced ⁵	<ul style="list-style-type: none"> •8343:Coolant temp, monitoring •8363:Oil pressure monitoring 	Temperature warning limit exceeded too long. Fallen below oil pressure alarm limit for too long. OK ↓	→	Check coolant Check oil level
	(5) Shutoff limit exceeded/ fallen below ⁶	• 8305:Speed monitoring	Overrun cond. activated.	→	Check data in SERDIA menu Check "configuration" and change if necessary
Flashing (Engine off)	(0)Broken cable or short-circuit	• 8170:(M13)Speed 1, camshaft ⁷	Plug-in connection interrupted OK ↓	→	Restore plug-in connection.
			Plug-in contacts contaminated or corroded OK ↓	→	Clean connector and replace if necessary
			Sensor defective OK ↓	→	Replace sensor
			Cable harness defective	→	Check cable harness and replace if necessary
	(2) Measuring point defective	• 8112:(M17)Rack travel sensor	Plug-in connection interrupted OK ↓	→	Restore plug-in connection
			Plug-in contacts contaminated or corroded OK ↓	→	Clean connector and replace if necessary
			Actuator defective OK ↓	→	Replace actuator
			Cable harness defective	→	Check cable harness and replace if necessary

Error pilot lamp	Error messages (only readable with SERDIA)		Possible causes	n. O.K	Remedy
	Type of error	Error location			
Flashing (Engine off)	(5) Shutoff limit exceeded/ fallen below	<ul style="list-style-type: none"> • 8305:Speed monitoring • 8345:Eng.OFF->CoolantTemp-Monit. • 8365:Eng.OFF->OilPressMonit • 8405:Actuator (positioner, travel meter, fuel rack) 	Overspeed reached Temperature alarm limit exceeded for too long. Fallen below oil pressure alarm limit for too long. OK ↓ Faulty configuration (e.g. overrun cond. OFF) Actuator defective	→	Check coolant Check oil level Check data in SERDIA menu "Configuration" and change if necessary Replace actuator
Engine start not possible a) Flashing	(0) Broken cable or short-circuit	<ul style="list-style-type: none"> • 8210:Data loss EEPROM • 8220:Data loss coil data • 8020:ECU (positioner actuation) 	Battery or cable harness defective, ECU failure	→	Check battery. Check cable harness. Replace ECU.
b) Flashing or Permanent light			Error in central electronics, program in EMR was not executed	→	Replace ECU
c) Off	(0) Broken cable or short-circuit	• 8170:(M13)Speed 1, camshaft ⁷	Plug-in connection interrupted OK ↓ Plug-in contacts contaminated or corroded OK ↓ Actuator defective OK ↓ Cable harness defective	→	Restore plug-in connection Clean connector and replace if necessary Replace actuator Check cable harness and replace if necessary
	(5) Shutoff limit exceeded/ fallen below	• 8405: Actuator (positioner, travel meter, fuel rack)	Actuator defective	→	Replace actuator

¹ Switch to SWG 2 (if SWG 2 available). Fixed speed with 2% speed droop is set.

² Switch to SWG 1 (if SWG 1 available). Fixed speed with 2% speed droop is set.

³ Electronics temperature is evaluated.

⁴ Continued running with reduced rated speed, if speed sensor 2 is available.

⁵ Injected fuel limitation (if activated).

⁶ The measured value exceeds maximum speed.

⁷ Speed sensor 2 not available or defective.

Defective sensors or pickups can be checked for their correct reference values with the help of the following table.
It is recommended to use a multimeter as measurement aid.

REFERENCE VALUES FOR SENSORS AND PICKUPS

Component	DEUTZ part number	Mode of measurement	Ref. value for intact component
Accelerator value pickup BOSCH	0419 9457	Resistor	$R_{total} \cong 1k\Omega$
Accelerator value pickup Philips KMA20-30		DC voltage	Hall-effect pickup, no measured values available
Speed sensor camshaft	0419 0811	Resistor AC voltage. Inductivity	$R = 310\Omega$ $V_{ACpeak} \cong 40mV$ $L = 140mH$
Oil pressure sensor KAVLICO	0419 9478	Resistor DC voltage ¹	Between pin 1 + 2: $R_i \cong 47k\Omega$ Between pin 1 + 3: $R_i \cong 13k\Omega$ Between pin 3 + 2: $R_i \cong 47k\Omega$ $U_{betr} = 5V$ at 1083mbar $U \cong 0,49V$
Charge air pr. sensor KAVLICO	0419 9552	Resistor DC voltage ¹	Between pin 1 + 2: $R_i \cong 58k\Omega$ Between pin 1 + 3: $R_i \cong 13k\Omega$ Between pin 3 + 2: $R_i \cong 58k\Omega$ $U_{es} = 5V$ at 1083mbar $U \cong 1,083V$
Coolant temp. sensor BOSCH	0419 9333	Resistor	$R_i \cong 2,3k\Omega$ at 21,5° C
Solenoid ETO		Resistor	$R_i \cong 0,5\Omega$
Travel meas. system in EMR-positioner (Meas.coil=Pin 3 u. Pin 4)		Resistor Inductivity	$R_i \cong 8\Omega$ $L \cong 27mH$ stop position $L \cong 6mH$ full throttle position
Travel meas. system in EMR positioner (Meas.coil=Pin 3 u. Pin 5)		Resistor Inductivity	$R_i \cong 8\Omega$ $L \cong 12mH$ constant
Actuator in EMR positioner (Meas.coil=Pin 1 + Pin 2)		Resistor Inductivity	$R \cong 1,3\Omega$ $L \cong 8mH$

¹ Additional aid: power supply unit

6. FUNCTION TEST

6.1 GENERAL

This menu item is only activated for users of access level III.

The actuator should only be operated with the engine switched off.

Pick-up point	Value	Unit
Battery voltage	11.8	V
Engine speed	0	1/min
Control rod position	0.000	mm
(M9)Coolant temperature	34	°C
Fuel injection quantity	110.0	cmm/Hub

Actuator	Setpoint value	Actual value
Control rod position	0.000	0.000 mm
(F16)Output:Dig/Freq/PWM	0	0 %
(F5)Output:Digital/PWM1	0	0 %
(F3)Output:Digital/PWM2	0	0 %
(M3)Output:Digital3/PWM3	0	0 %
(F4) digital outp. 1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
(F15)digital outp. 2	<input type="checkbox"/>	<input type="checkbox"/>

Figure: Menu for function test of EMR actuator

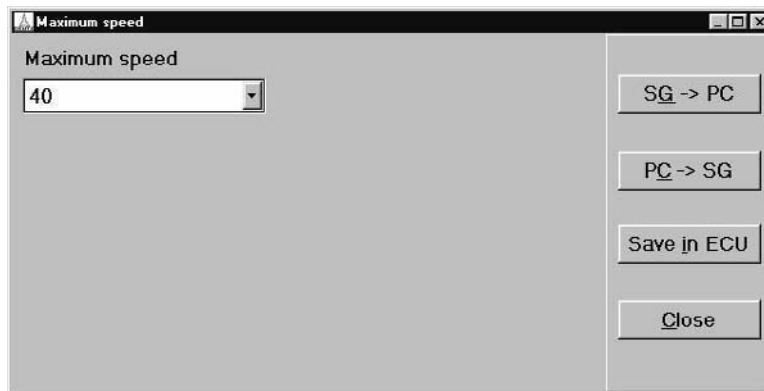
STRUCTURE OF THE DISPLAY WINDOW

- Measured values are displayed in the top window.
- You use the "Meas. values" switch to select those measured values you wish to display from all the measured values available (see Chapter 3 Measured values).
- In the bottom table, the setpoint values and actual values of the actuators are entered. You can only make entries in this table if the ECU has been switched to test mode.
- You switch to test mode by activating the field "Test mode". You deactivate this field in order to switch off test mode.
- You can specify values in the "Setpoint value" in test mode. The actual values are read consecutively and are displayed in the right-hand column.

7. EXTRAS

7.1 MAXIMUM VEHICLE SPEED

Three different maximum vehicle speeds (30, 40, 50 km/h) can be selected on this screen..



7.2 LOGISTIC DATA

On this screen the logistic data

- Engine serial number
- Part number of EMR function data record
- Part number of ASAP2 data record
- Day, month and year of production can be read from the ECU and printed.



ATTENTION!

- Only DEUTZ man enter and save data in the ECU.

Engine number	621063
Part number ECU Fct data record	2112274
Part number ASAP2 data record	108
Day of manufacture	7
Month of manufacture	5
Year of manufacture	1
OperHourCount:Engine[h]	1
Number of engine starts	21

Figure: Logistic data of the EMR

7.3 LOAD SPECTRUM (ONLY EMS)

This screen provides an overview of speed and load ranges at which the engine is being operated. Entries in the ECU can be deleted by a user with a higher level of access authorization.

Restriction: Only applies for EMS

7.4 MAINTENANCE INTERVAL EXCEEDED (ONLY EMS)

Exceeded maintenance intervals are displayed. Users with a higher level of access authorization can also delete exceeded maintenance intervals.

Restriction: Only applies for EMS

7.5 OVERRIDE MEMORY (ONLY EMS)

For individual measured values this screen displays periods during which the engine was operated in warning or shut-down range. Entries in the ECU can be deleted by a user with a higher level of access authorization.

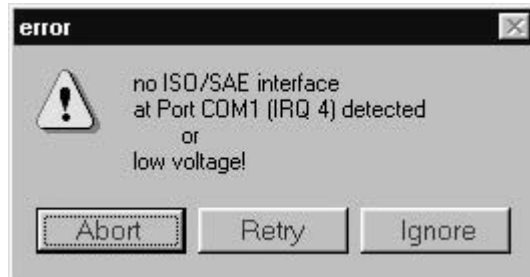
Restriction: Only applies for EMS

8 WHAT SHOULD YOU DO IF ...?

8.1 SERDIA IN GENERAL

8.1.1 ERROR IN ESTABLISHING THE COMMUNICATION LINK

If you are unable to establish a communication link despite having an interface and an ECU connected, you will receive the following error message:



POSSIBLE CAUSES OF THE ERROR MESSAGE:

- There is no power supply to the EMR or to the interface.
- The power supply was interrupted when the engine was shut down.
- The wrong serial interface has been assigned on the PC (see 8.1.2).
- There is an incorrect polarity of the power supply from the engine to the interface.
- You have not connected all 4 leads (+, -, k, l).
- Incorrect or faulty ECU.

TROUBLESHOOTING, QUICK CHECK FEATURES:

- The yellow interface LED should light up when you call SERDIA.
- Measure the power supply diagnostics plug (the interface requires 8-28V DC).
- Check the serial interface assignment under Windows, usually COM1.
- Connect a different ECU.

ADDITIONAL INFORMATION ON OPERATING VOLTAGE FOR ECUS. INTERFACE AND PC:

- The EMR ECU is suitable for an operating voltage of a minimum of 10 V to a maximum of 30 V (type12-24V).
Current consumption: 5A at 12V 7A at 24V
- The MVS is only suitable for a operating voltage of 24 V
- The interface is fed with power from the engine side and is suited for voltages between 12 V and 24 V
- The ECUs and the interface are protected against incorrect polarity and surge voltage. Nevertheless, connection by mistake (e.g. to 230 V) can result in damage.
- An optoelectronic coupler integrated in the interface allows you to connect the PC (notebook and printer) to the vehicle battery or the earth without any risk of damage to the ECU and the interface, and without any loss of data.

8.1.2 INTERFACE CONFIGURATION WITH ISETUP

On PCs the COM1 interface may be occupied by the mouse. In this case, you should connect the interface to the second serial interface (COM2). You can then configure this port using SETUP in order to communicate with the interface.

PROCEED AS FOLLOWS:

- Call program SETUP.EXE.
- Select the other COM port and confirm with OK..
- Initialization file ISODRV.INI is updated automatically.
- Re-start Windows.



ATTENTION!

- On many PCs the second serial interface is 25 pole. If this is the case, you should use a hardware adapter (conversion from 25 to 9 poles) when connecting the 9 pole diagnostics interface.

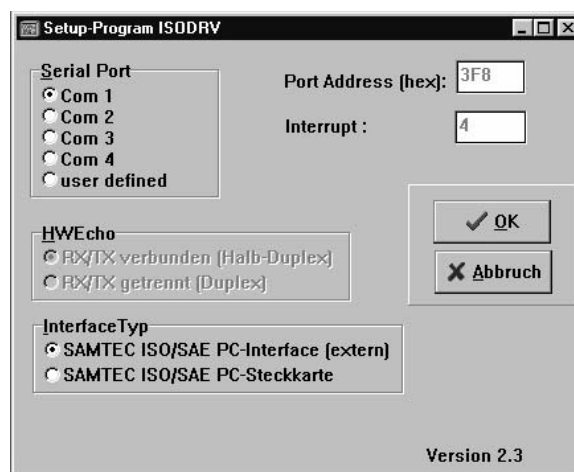


Figure: Help file screen from SETUP.EXE

8.1.3 ACCESS CONFLICTS UNDER WINDOWS 3.1

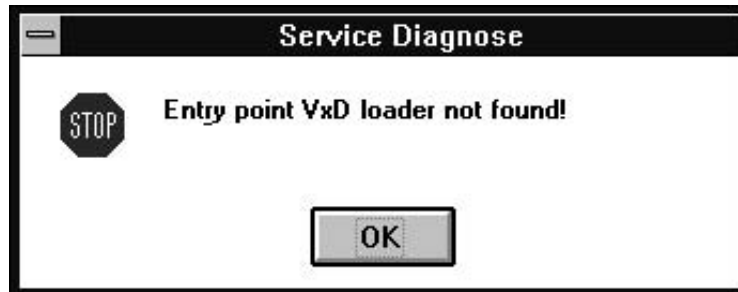
The interface driver ISODRV.386 can only be loaded statically. You enter the driver ISODRV.386 in Windows file SYSTEM.INI under section [386Enh] (at the same time specifying your current directory). This can result in problems with other application programs occurring that also access the serial interface.

REMEDY:

- Call program ISETUP.EXE.
- Delete driver entry from SYSTEM.INI.
- Re-start Windows 3.1.

8.1.4 ERROR MESSAGE UNDER WINDOWS 3.11 WHEN STARTING UP SERDIA

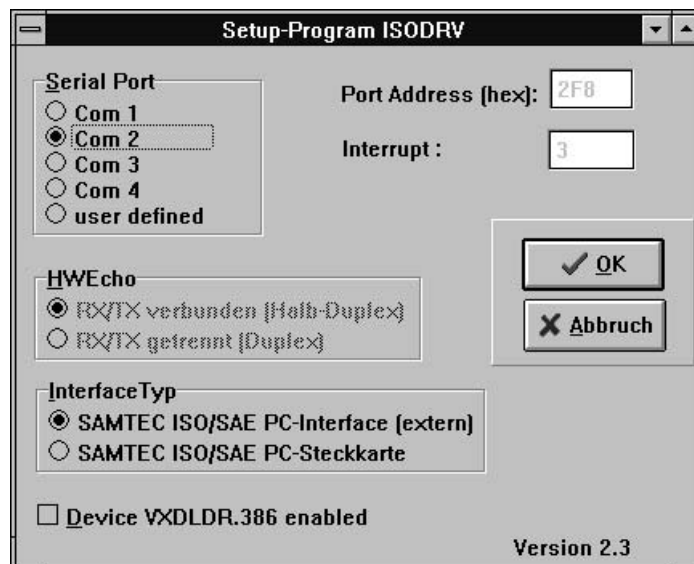
When you start up SERDIA under Windows 3.11, you may receive the following error message:



The cause is the non-active driver VXDLDR.386.

REMEDY:

- Call program SETUP.EXE.
- Check the field 'Device VXDLDR.386 enabled' and confirm with OK. The appropriate driver entry is made automatically in the file SYSTEM.INI.
- Re-start Windows 3.11.



8.2 EMR

8.2.1 THE ENGINE "SURGES"

TRACING THE CAUSE:

As with engines featuring a mechanical governor, on engines which have EMR, technical components such as the pump, a well-running fuel rack, fuel supply, etc., must be included. It is particularly the case if the engine has already been running satisfactorily that "engine surges" occurring afterwards are not usually related to the EMR.

GOVERNOR ADJUSTMENT:

Governor adjustment applies primarily for new applications. It must be thoroughly tested and **documented** with the system (engine and equipment) under all operating conditions.

When the new application has been concluded and cleared, you must notify head office of the governor parameters pertaining to the application. For subsequent engines with the same application no further adaptation is necessary as a rule.

MENU ENTRY:

Main menu SERDIA -> Menu parameters -> Menu configuration -> pages 4, 5 and 17.

Configuration Page 4: Speed governor

Variable	New value	Min value	Max value	Unit
SpeedGvnr: P part	4,0	0,000	100,000	%
SpeedGvnr: I part	10,0	0,000	100,000	%
SpeedGvnr: D part	2,5	0,000	100,000	%
SpeedGvnr: damping	65,1	0,0000	100,0000	%
SpeedGvnr: damping range	80,0	0,000	100,000	1/min
Engine speed ramp down	10000,0	0,0000	100000,0000	1/min/s
Engine speed ramp up	10000,0	0,000	10000,000	1/min/s

ECU -> PC PC -> ECU Print Help Close

Open file Save in file Save in ECU Previous Next

Configuration Page 5: Position governor

Variable	New value	Min value	Max value	Unit
PosGvnr: P part	10,0	0,000	100,000	%
PosGvnr: I part	5,0	0,000	100,000	%
PosGvnr: D part	5,0	0,000	100,000	%
PosGvnr: DTZ part	0	0,0000	100,0000	%
PosGvnr: Gain	139,8	100,000	200,000	%
PosGvnr: gain range	0,250	0,0000	1,0000	mm
QuickCurrentDecSteepness	3000,0	0,000	3000,000	1/min
QuickCurrentDecTime	0	0,000	65535,000	ms

ECU -> PC PC -> ECU Print Help Close

Open file Save in file Save in ECU Previous Next

Configuration Page 17: Speed-dependent PID control

-Speed governor: P map - fct(engine speed, fuel injection quantity) [%]
 X: Engine speed position values for PID map of injection governor [1/min]
 Y: Quantity position values for PID map [cmm/l lub]

Y \ X >	600,0	750,0	1000,0	1200,0	1500,0	2000,0
0,00	119,92	119,92	119,92	200,00	200,00	200,00
20,00	119,92	119,92	119,92	200,00	200,00	200,00
50,00	119,92	119,92	119,92	200,00	200,00	200,00
100,00	100,00	100,00	100,00	200,00	200,00	200,00

-Speed governor: I map - fct(engine speed, fuel injection quantity) [%]
 X: Engine speed position values for PID map of speed governor [1/min]
 Y: Quantity position values for PID map [cmm/Hub]

Y \ X->	600,0	750,0	1000,0	1200,0	1500,0	2000,0
0,00	50,00	50,00	50,00	100,00	100,00	100,00
20,00	50,00	50,00	50,00	100,00	100,00	100,00
50,00	100,00	100,00	100,00	100,00	100,00	100,00

ECU -> PC PC -> ECU Print Help Close

Open file Save in file Save in ECU Previous Next

BASIC INFORMATION ON MAKING CORRECTIONS TO SETTINGS:

- Corrections to settings should be made with the engine running.
- Increase of P-I-D parts results in broader speed control fluctuation range.
- Enter the value you wish to correct in the field "new value". One possible method is as follows: mark the old value with the mouse and type in the new value (this automatically removes the old value).
- Click on the switch "PC->ECU" in order to send the new value to the ECU. The governor takes over the new governor characteristics; you will recognise the result by the engine's running characteristics.
- After you have successfully made the required corrections to the settings and before you disconnect the power supply (Chapter 15), you must save the new parameter setting in the EMR. To do so, click on the switch "Save in ECU".

BASIC GOVERNOR SETTING:

The ECU at end of line is programmed with the following standard values:

Parameter (Variable)	Standard values		Remarks
	Genset	Vehicle	
SpeedGvnr: P part	18-20 ¹	4,0	Basic setting gain factors P-I-D parts. These parameters are independent of the engine status (speed, continuous load active). They are the main instruments used when setting the governor.
SpeedGvnr: I part	10,0	10,0	
SpeedGvnr: D part	5-12	2,5	
SpeedGvnr: damping	90,0	65,0	Reduction of the governor parameters for the static range.
SpeedGvnr: damping range	15,0	80,0	Speed band around setpoint value. Within this speed band the engine runs under steady-state conditions accurately and smoothly without reacting violently to speed variations.
PosGvnr: P part	10,0	10,0	Corrections to settings should only be made following approval of head office.
PosGvnr: I part	10-15 ¹	5,0	
PosGvnr: D part	5-10 ¹	5,0	
PosGvnr: DT2 part	8,0	8,0	
PosGvnr: gain	160-180	180,0	
PosGvnr: gain range	0,25	0,25	

¹Differing standard values are possible, depending on the engine type and the application!

Standard values, speed and load-dependent parameters (page 17):

3 performance maps for P, I, and D part = fct (speed, fuel injection volume).

Parameters (Variable)	Standard value	Remarks
X: Engine speed position values (1/min)	600 ... 2500	7 speed values
Y: Quantity position values (cmm/Hub)	0, 20...100	4 injection volume values
Map (%)	100	Total of 3 x 28 entries. The entry "100%" results in assumption of the governor P-I-D parts (page 4). Corrections must be made at the relevant working point.

CARRYING OUT CORRECTIONS TO SETTINGS:

Before changing a parameter we recommend that you save the current configuration with "Save in file" and/or that you print out the configuration.

There are three stages to the setting procedure:

1. Parametri di base unità di controllo PID.

PID governor basic parameters. Basically, settings are made using the basic parameters.

- Should it be necessary to reset the basic governor settings, you should set all the governor maps (page 17) to 100%.
- The P part is the most important parameter and must be set first. Increase the parameter value for "SpeedGvnr: P part" starting from 10% until, following excitation by a load step, the engine tends to a vibration of $f > 1$ Hz. Then reduce the P part again by 25%. Example: P part with vibration tendency (unstable) = 12.12-25% of 12 = 9 (new set value).

The setting depends very much on the system's moment of inertia (engine+generator). For moments of inertia up to 8 kgm², the P part value range lies between 10 and 45%. For greater moments of inertia, the P part can be increased up to 90%.

Note for genset engines: You should determine the optimal governor values under operating speed conditions and under different loads. Note the various P parts thus determined, and enter them as mean value in "**SpeedGvnr: P part**".

For double frequency systems, you should include the second frequency in the calculation of the mean value.

Note for motor vehicle engines: Optimal governor values should be determined at a number of speed and load points. Note the various P parts thus determined, and enter them as mean value in "**SpeedGvnr: P part**".

The various P parts resulting from the various load and speed points must be corrected in the PID map.

Le parti P risultanti dai diversi punti di carico e di numeri di giri devono essere corrette nelle caratteristiche PID.

- The D and I parts are then set following the same procedure (page 4); i.e. you increase the values **starting from 5%** until the system becomes unstable. Then reduce by 25%.

2. Parameters for static and dynamic operation.

Setting the parameters "**SpeedGvnr: damping**" and "**SpeedGvnr: damping range**"

Con il parametro "RegolGiri: Settore smorzamento" viene definito il settore di velocità nel quale il numero di giri è in condizione statica. Ad esempio l'immissione del valore 15 min⁻¹ nel numero di giri nominale determina un settore di +/-15 min⁻¹.

The parameter "SpeedGvnr: damping range" determines the speed range within which the engine speed is situated under steady-state conditions, e.g. the entry 15 min⁻¹ represents a band of +/-15 min⁻¹ about the setpoint speed. The parameter "SpeedGvnr: damping" determines the reduction of the governor parameters (PID parts) for the static range; i.e. if the speed lies within the speed band around the setpoint value, the governor parameters (PID parts) are reduced to the value in accordance with the damping factor,

e.g.: SpeedGvnr: P part=10%

SpeedGvnr: damping =65%

This has the effect of reducing the P part to 6.5% under steady-state engine operating conditions of the setpoint speed range \pm damping range. The purpose of this measure is to ensure that the engine runs accurately and quietly within the speed range without reacting violently to small changes in speed. If, as a result of a fault, the engine runs outside the speed range, the governor parameters that have been set will again become 100% effective, and the governor will correct the speed error as quickly as possible.

For standard settings, see Basic governor settings. Corrections to settings can only be made during the engine test phase.

3. Speed and load-dependent parameters.

A parameter map is envisaged for each of the basic parameters R, I, D, depending on the speed and the quantity of fuel injected (load) (page 17). The effective parameters are determined by multiplying the basic parameters by the contents of the maps,

e.g.: SpeedGvnr: P part =10%

Map P part=200% at 20001 /min and 50 cmm/stroke

Result; The P part becomes 20% effective for the working point.

8.2.2 CALIBRATING THE-ACCELERATOR

As a rule, the accelerator takes the form of a pedal and is controlled by the driver. However, the input envisaged for the accelerator (24 pin vehicle plug) may also be used as a remote control input, as is the case in locomotive and marine applications. Regardless of the application, calibration must be carried out in every case.

Calibration must be carried out before the initial startup as well as in the event of a replacement. This work is to be undertaken by the customer or by Service.

The accelerator pedal does not always come as part of the DEUTZ AG scope of supply. However, we recommend use of the accelerator pedal sensor DEUTZ part number 0419 9457. Other pedals may be used, but you should first obtain approval from head office. The following requirements apply:

- Connection in accordance with the EMR system overview:
Signal input (24 pin/vehicle plug) to GND (23 pin/vehicle plug)
- Analog signal:
> 0,5 V (pedal at rest), e.g. 1V
< 4,5 V (pedal pressed against the stop), e.g. 4V
- The EMR makes a reference voltage available at the vehicle plug (25 pin, +5V).
This reference voltage is also intended for the hand throttle potentiometer. The charging current should therefore not exceed a total of 25 mA if the accelerator pedal sensor and hand throttle potentiometers are connected in parallel, (i.e. total resistance > 200).

CALIBRATING THE ACCELERATOR PEDAL USING THE "CALIBRATION" MENU:

Calibration is menu-guided. The two stop positions "parked position" and "full throttle" are calibrated as limit values. See "General procedure for calibration", Chapter 4.3, Calibration.

CALIBRATING THE ACCELERATOR PEDAL USING THE MENUS "MEASURED VALUES" AND "CONFIGURATION":

It is the purpose of calibration to inform the ECU of the limit values "parked position" as lower reference point and "full throttle" as upper reference point. In addition, the "upper fault value" (+5% of the upper reference point) and the "lower error value" (-5% of the upper reference point) must be entered in accordance with the two reference points.

PARAMETER DESIGNATIONS

Configuration screen	Calibration screen	Value
AccPedal(SWG1)up. err val.	Acceler(SWG1) upper fault limit[full throttle.. .5V]	max. setpoint x 1.05
AccPedal(SWG1)up. ref	Acceler(SWG1) full throttle [pressed down, upper limit]	max. setpoint
AccPedal(SWG1)lo. ref	Acceler(SWG1) parked position [lower limit]	Pedal at rest = Idle
AccPedal(SWG1)lo. err val.	Acceler(SWG1) lower fault limit [OV... parked pos.]	Pedal at rest – 0.05 x max setpoint

MEASUREMENT OF THE LIMIT VALUES:

- Call the menu "Measured values", "Actual measured values".
- Measured value "(F24)Accelerator pedal=SWG1": with pedal at rest (lower reference) and pedal fully pressed down (upper reference) "Get value" and transfer to ECU and save.

CONFIGURATION:

- Call menu point "Parameters", "Configuration".
- Enter values in accordance with the table of examples shown below ("Configuration of pedal input", see below).
Conversion: 5V=1023 digits.

Example: Configuration of the accelerator pedal input

Parameter	Factory setting		Actual value/ Measured value	Calibration	Configuration page 10
	[mV]	[digits]		5V = 1023 digits	
			[mV]	[mV]	[digits]
AccPedal(SWG1)up. err val.	4750	973		4357 ¹	893
AccPedal(SWG1)up. ref)	4500	921	4150	4150	850
AccPedal(SWG1)lo. ref	500	102	670	670	137
AccPedal(SWG1)lo. err val.	250	51		463 ²	95

¹ Measured value "upper reference point" + 5 % (of the upper reference point)

² Measured value "lower reference point" - 5 % (of the lower reference point)

8.2.3 CALIBRATION OF HAND THROTTLE

The hand throttle (Pin 20 FS) is provided for vehicles and agricultural machinery. The driver has the possibility to preset a relevant engine operating speed during ploughing, for instance, and then remove his foot from the accelerator pedal. As with comparable mechanical control levers, the hand throttle control must be reset to zero (lowest engine speed) before starting.

The hand throttle control overrides the accelerator pedal and determines the minimum engine speed. Proportional to the setpoint value the speed is adjustable between low idling (LI) (e.g. 650 min⁻¹) and rated speed (e.g. 2300 min⁻¹). According to the hand throttle setpoint input, the engine responds analogous to the accelerator pedal. If a speed is preset, for instance, to 1500 min⁻¹ with the hand throttle, the accelerator pedal can only increase the speed from this value.

The hand throttle control is not part of the DEUTZ scope of supply and must be programmed, however, in the EMR ex factory.

A potentiometer may be used as adjusting element and installed by the customer.

Requirement for hand throttle setpoint value (potentiometer) for installation by the customer:

- Input Pin 20 vehicle plug
- Supply of potentiometer as pedal sensor, 5V reference voltage Pin 25, and GND Pin 23.
- Load reference voltage together with accelerator pedal sensor < 25 mA.
- Protective system IP65
- Adjustment of end stops between 10% and 90% of potentiometer value.

E.g. potentiometer resistor = 5kW, the adjustment range between the mechanical stops may then be between 500W and 4500W. Such an adjustment range can be obtained by

- Restriction of angle of rotation
- Series resistors in the supply lines.

CALIBRATION OF HAND THROTTLE POTENTIOMETER:**ATTENTION!**

- **The two end stops of the potentiometers must be calibrated.**

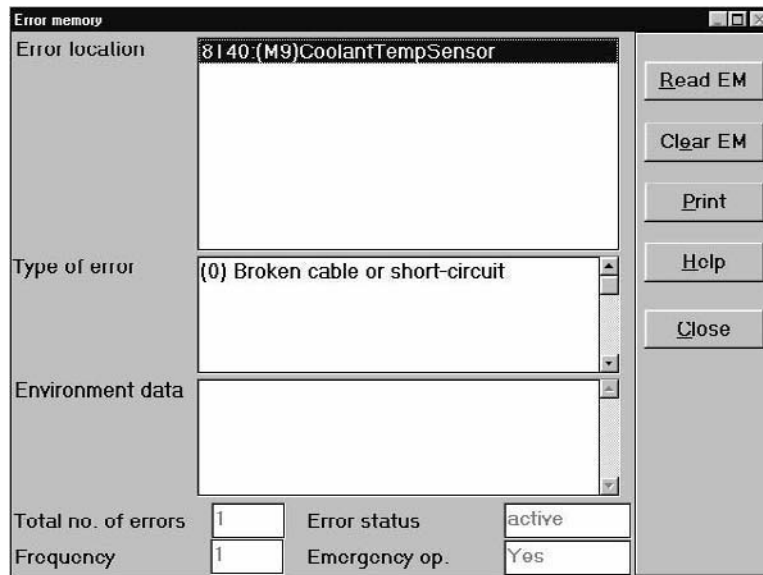
It is the aim that the ECU be informed of the limit values of the two stops "Potentiometer stop LI speed" as lower reference point and "Potentiometer stop rated speed" as upper reference point. Depending on the two reference points, the "Upper error value" (+5% of the upper reference point) and the "Lower error value" (-5% of the upper reference point) must be additionally entered.

DESIGNATION OF PARAMETERS

Configuration screen	Calibration screen	Value
Hand thr.(SWG2)up, err val.	Hand throttle(SWG2)upper fault limit (upper limit. ..5V)	Rated engine speed x 1 .05
Hand thr.(SWG2)up. ref	Hand throttle(SWG2)max.eng. speed (upper limit)	Rated engine speed
Hand thr.(SWG2)lo. ref	Hand throttle(SWG2)min.eng.speed (lower limit)	Low idling engine speed
Hand thr.(SWG2)lo. err val.	Hand throttle(SWG2)lower fault limit (OV... lower limit)	LI engine speed - 0.05 x rated eng. speed

8.2.4 EXAMPLE OF DIAGNOSTICS

ON-LINE DISPLAY:



DIAGNOSTICS:I

Trouble	n.O.K.	Remedy
Plug-in connection disconnected? OK ↓	→	Re-connect plug-in connection.
Plug contacts dirty or corroded? OK ↓	→	Clean or if necessary replace plug.
Sensor defective? OK ↓	→	Replace sensor.
Cable harness defective?	→	Check and if necessary replace cable harness.

8.2.5 ENGINE DOES NOT START

Indication	Possible cause	Remedy
Starter speed > 160 1/min is not reached.	Check using multimeter: terminal voltage at starter < 7V (1 2V system).	<ul style="list-style-type: none"> • Replace battery. • Clean earth wire connections.
Starter speed ok, fuel rack travels to start position.	Faulty fuel supply.	<ul style="list-style-type: none"> • Restore fuel supply.
Starter speed ok, fuel rack stays at zero position.	<p>No power supply, connected to wrong pins or incorrect polarity.</p> <p>Shutoff solenoid defective or not connected. Fuel rack stiff.</p> <p>Speed sensor defective</p> <p>Starting fuel charge limitation is set too low or coolant temperature is too high for the EMR.</p>	<ul style="list-style-type: none"> • Remove vehicle plug and check for correct connections pin 14F = + Ubatt pin 1F = -Ubatt pin 2F = -Ubatt • Locate site causing stiffness and remedy as appropriate. • Replace sensor, check plug connection and line. Using SERDIA check measured value "(M9)coolant temperature" in the menu "current measured values".
Flashing pilot light.	There is a serious fault in the EMR system. You should remedy the fault before attempting any further starts.	<ul style="list-style-type: none"> • Locate error using SERDIA.
SERDIA error message: "8405: Actuator (positioner, travel meter, fuel rack)".	Identification of fuel rack travel deviation, measured value in shutdown range	<ul style="list-style-type: none"> • Replace actuator, see service example, actuator replacement. Additional setting is not necessary.
SERDIA error message "8170: (M13) Speed 1, camshaft".	Short circuit or interruption on the speed sensor (camshaft sensor) or supply line or plug connection.	<ul style="list-style-type: none"> • Replace sensor, check plug connection for contamination or corrosion, check lines between vehicle plug and sensor for damage.
SERDIA error message: "8210: Data loss EEPROM" "8220: Data loss coil data" "8020: ECU (positioner actuation)"	Memory error in the EMR Memory error in the EMR ECU Failure	<ul style="list-style-type: none"> • Replace ECU. Transfer data from old ECU to the new one (1:1)
SERDIA error message: "8160: (M21) OilPressure-Sensor"	Oil pressure measured value (M21) lies outside permitted range, also with engine switched off.	<ul style="list-style-type: none"> • Replace sensor, check plug connection for contamination or corrosion, check lines between vehicle plug and sensor for damage.
SERDIA error message: "8140: (M9) CoolantTemp-Sensor"	Coolant temperature measured value (M9) lies outside the permitted range, also with engine switched off.	<ul style="list-style-type: none"> • Replace sensor, plug and line control.
SERDIA error message: "8120: (F24) Acceler Pedal(SWGI)"	Accelerator pedal sensor incorrectly calibrated.	<ul style="list-style-type: none"> • Check calibration values in the menu "Calibration" and change if necessary.

8.2.6 ENGINE SHUTS OFF FOR NON-DEFINABLE REASONS

Following shutdown: (Key switch not yet actuated, off/on) Error pilot light off	Shutdown not initiated by error message in the EMR. Other possibilities: <ul style="list-style-type: none"> • Fuel supply • Speed monitoring independent of EMR. • Interruption of supply voltage. 	<ul style="list-style-type: none"> • Restore fuel system. • Check whether additional speed monitoring (e.g. solenoid) is available and make relevant system check. • Check EMR vehicle plug, fuse, key switch etc. for loose contact.
Following shutdown: (Key switch not yet actuated, off/on). Error pilot light Permanent light	Trace error location and error environment with SERDIA. Error message: <ul style="list-style-type: none"> • Overspeed (is reached for instance upon sudden load change). • e.g. "Oil pressure" additional remark: "inactive". 	Carry out systematic check depending on error message: <ul style="list-style-type: none"> • Guide value: rated speed+15% to be corrected if necessary. • Check connector on oil pressure sensor for loose contact and replace sensor if necessary.
Following shutdown: (Key switch not yet actuated, off/on) Error pilot light flashing	A serious error in the EMR system is involved. Prior to engine start,, trace error location with SERDIA.	Take actions according to error location definition. This may be replacement of ECU, actuator or sensor. The additional remark "inactive" indicates a loose contact at the indicated error location.

8.2.7 REPLACING THE EMR ACTUATOR

The actuator is a purely mechanical part of the EMR. As such, it forms a fixed part of the engine. The operating magnet it contains is controlled by the EMR and serves to position the fuel rack and thus regulate fuel supply to the engine. A travel meter contained in the actuator informs the EMR of the fuel rack position.

The following error messages may mean that you need to replace the actuator:

- 8112:(M17) Rack travel sensor
- 8405: Actuator (positioner, travel meter, fuel rack)

INSTRUCTIONS FOR REPLACEMENT:

- Switch off the power supply to the EMR and disconnect the cable connection from the actuator. For safety reasons it is essential that you remove the positive pole battery connection.
- Remove the old actuator and clean the contact surface on the engine.



ATTENTION!

- **With the actuator removed, the fuel rack is in its maximum filling position, i.e. on no account should you start the engine!!**
- Fit the new actuator to the engine using sealing compound DEUTZ part number 0101 6102. If you are replacing the actuator, make sure that the new actuator is compatible with the ECU. Currently, 3 combinations are possible:

ACTUATOR/ECU COMPATIBILITY

ECU Part No.	Software version No. EMR	Corresponding actuator, P/N	What to do if the actuator fails
0211 1846		0211 1841	If you are replacing parts, this combination must be replaced in its entirety by the combination 0211 1911 / 0211 1910. Please consult head office before proceeding further.
0211 1910		0211 1911	
0211 2017 < K 953 430	1,08 1,11	0211 1926	The actuator is identical with 0211 1911 as far as contents are concerned. Only the casing securing method is different.
0211 2088	1,10	0211 1926	

- Re-connect to the ECU and switch on engine.
- Using SERDIA, under the menu "Parameters" -> "Configuration" use the button "PC->ECU" to transfer the parameters to the EMR and test the engine for correct running.
- If the engine is running properly, save the parameters in the EC.
- When you have completed the tests with SERDIA, delete the error memory.
- In the SERDIA main menu, print out the list for ECU identification and under "Extras" print out the logistics data, to serve as documentation.
- You must send the old actuator to head office together with the documentation.

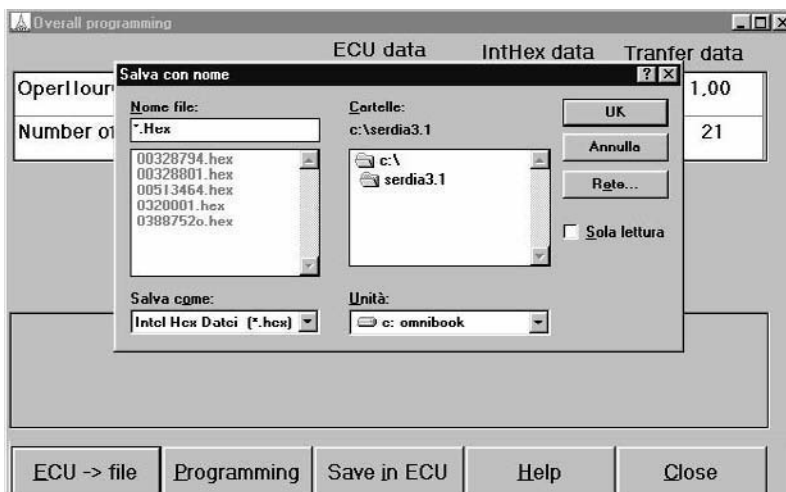
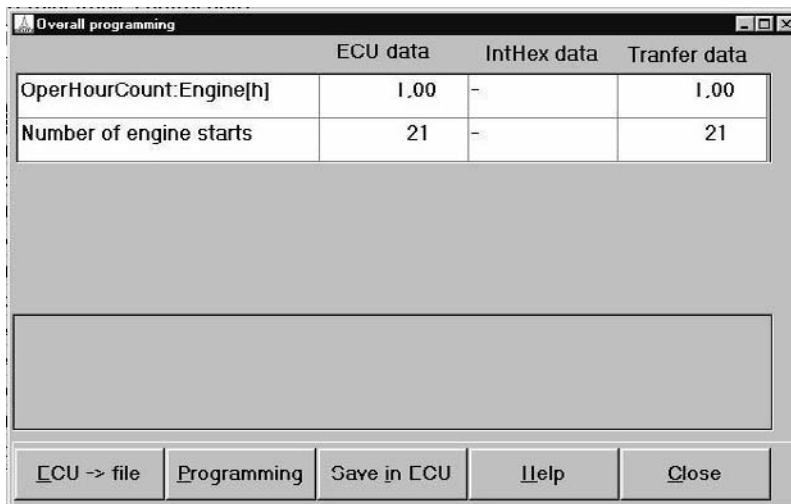
8.2.8 REPLACING THE EMR ECU

The ECU can be replaced in two ways:

1. If the old ECU is damaged but data can still be read (communication with SERDIA is still possible).

1st step: Copy the engine data record from the old ECU:

- Switch on ignition/power supply.
- Call the program SERDIA.
- In SERDIA, change over to the menu "Parameters" -> "Overall programming".
- Click on the button "ECU -> file". This will read the configuration files. Next, the window "Save as" is opened.
- Save the file under a name. Save the file under a name.



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. When the data record is transferred from the old ECU, it is then assigned information regarding the number of hours of engine operation and the number of engine starts.

- End the program. Switch off ignition/power supply.

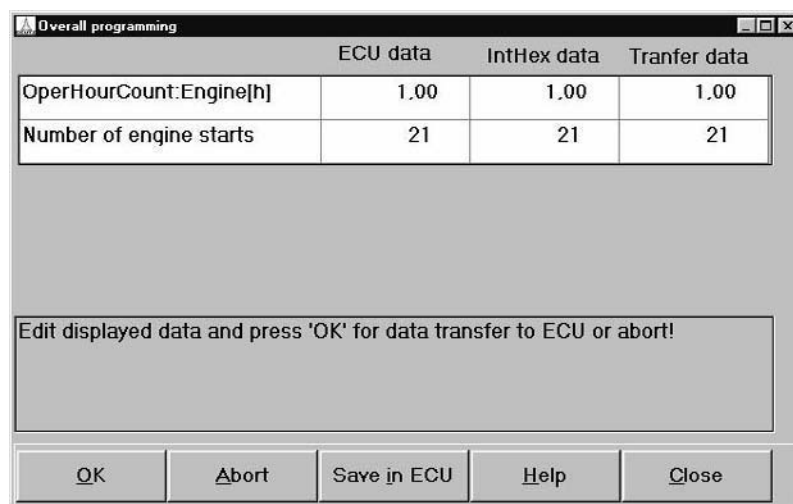
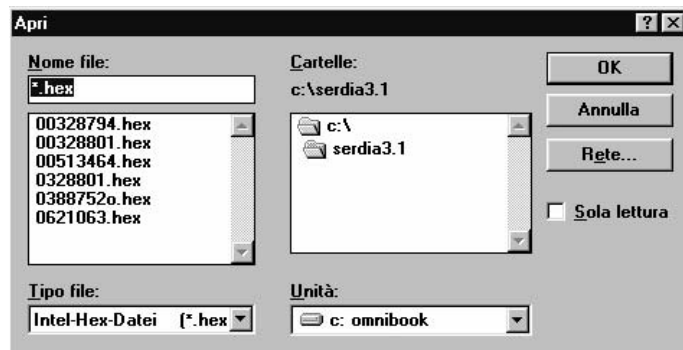
2nd step: Replace ECU:

You must check the compatibility of the ECUs by referring to the following table (same part number). You should also check and ensure the compatibility of the ECU with the actuator.

ACTUATOR/ECU COMPATIBILITY

ECU Part No.	Software version No. EMR	Corresponding actuator, P/N	What to do if the ECU fails
0211 1846		0211 1841	If you are replacing parts, this combination must be replaced in its entirety by the combination 0211 1911 /0211 1910. Please consult head office before proceeding further.
0211 1910		0211 1911	Can only be replaced by P/N 0211 1918
0211 2017 < K 953 430	1,08	0211 1926	For 101 2/1 01 3: replace with P/N 021 1 201 7 software version no. 1.11, identifiable by the housing no., from K 953 430. For 1015: replace with P/N 0422 61 78.
0211 2017 < K 953 430	1.11	0211 1926	Cannot be replaced by different ECUs. It is essential to ensure that the housing no. > K 953 430.
0211 2088	1.10	0211 1926	Only for DEUTZFAHR.

- Switch on ignition/power supply.
- Call SERDIA.
- In SERDIA, switch over to the menu "Parameters"->"Overall programming".
- Click on the button "Programming". The window "Open" will then appear.
- Select the engine data record stored in the memory (<engine number>.hex) by double clicking with the mouse.
- Transfer the engine data record to the EMR by clicking on the button "OK".
- Save the engine data record in the ECU by clicking on the button "Save in ECU".

**3rd step: Start up the engine and check it is running satisfactorily.**

- In the menu "Error memory", delete the error memory. 2.

2. Installing a new ECU with a factory-programmed engine data record.

Every EMR has an engine-specific data record which is stored in a central computer at DEUTZ AG when the engine is delivered to the customer. DEUTZ AG should be notified in the event of any changes being made to the settings in the EMR configuration. If you order a new ECU, it will be programmed with a data record to which DEUTZ AG has access under the appropriate engine number.



ATTENTION!

- **i.e. if you do not notify DEUTZ AG of any corrections to the engine settings, these cannot be taken into account when a new ECU is programmed.**
- Switch off ignition/power supply,
- Release the two plugged connections on the old ECU.
- Connect the ECU to the engine and the vehicle plug (both 25 pole).
- Switch on ignition/power supply.
- Call SERDIA program.
- Delete error memory in the menu "Error memory".
- Start engine and check for satisfactory running.

8.2.9 Error when entering configuration data

This error message is triggered when SERDIA is unable to enter the hex file. It may be that the file contains umlauts (ä, ö, ü) or certain special symbols that SERDIA is unable to read.

9. SERDIA UPGRADE FROM VERSION 2.5 TO VERSION 3.1

9.1 IMPROVEMENTS AND HELP WITH PROBLEMS IN COMMUNICATING WITH NOTEBOOKS/WIN 98

Since Windows 98 began to be more and more frequently used in notebook computers various problems have appeared in SERDIA's interaction with notebooks - e.g. ,Control unit cannot be found' or sporadic connection breakdowns etc.; the causes vary, depending on manufacturer.

SERDIA 3.1 solves some of these problems.

Another problem is being caused by a new function in Windows 98 called ACPI (Advanced Configuration and Power Interface).

It is absolutely essential to disable ACPI.

Windows 98 does not however permit this function to be disabled easily.

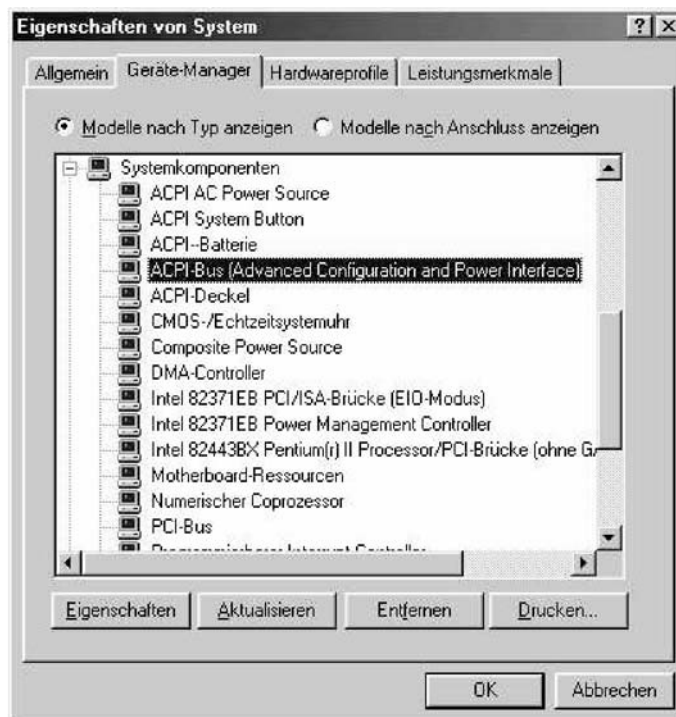
SERDIA 3.1 therefore includes files with which you can disable the ACPI function and reactivate the "old" APM (Advanced Power Management) function (as in Windows 95).

This procedure cannot be automated (because only some notebooks are affected).

Your manual assistance is therefore needed.

What can you do in such a case?

- Read the "Readme.txt" file supplied with SERDIA 3.1
- Check whether ACPI has been enabled on your notebook:
(Start\Settings\System Control\System\Device Manager\System Components)
- If there are ACPI entries present, ACPI can be disabled with the file "disable_ACPI_neu.reg" - to be found in the working directory of SERDIA 3.1. (ACPI can be re-enabled with "enable_ACPI_neu.reg").
- Perform hardware detection. (Start\Settings\System Control\Hardware\Continue\Search for new hardware).
NOTE: the Windows 98 installation CD may be needed.
- Restart computer



Example with ACPI enabled

9.2 NEW ENTRY MASK WITH MEASURED VALUES AND COLOURED-CODED INDICATION OF CONNECTION STATUS

Aufgaben	
Identifikation	2112017
Geschäftspartner-Nr.	3165463
Produktnummer	1
Hardware Versionsnummer	1.0
Software Versionsnummer	1.14
Tag	22
Monat	3
Jahr	99
Service-ID	0
BetrStdZähl:Motor[h]	0
Anzahl Motorstarts	8
Interface Seriennummer	4000001

Meßwerte	
Batteriespannung	22,9 [V]
Regelstangenweg	0,000 [mm]
Drehzahl	0 [1/min]
(M9)Kühlmitteltemperatur	28 [°C]
(F24)Fahrpedal=SWG1	1,095 [V]
(M21)Öldruck	0,000 [bar]
(M24)Ladedruck	65,535 [bar]
(F20)Handgas=SWG2	13
(F19)Eing:Digital	100 [%]

Innovations individually

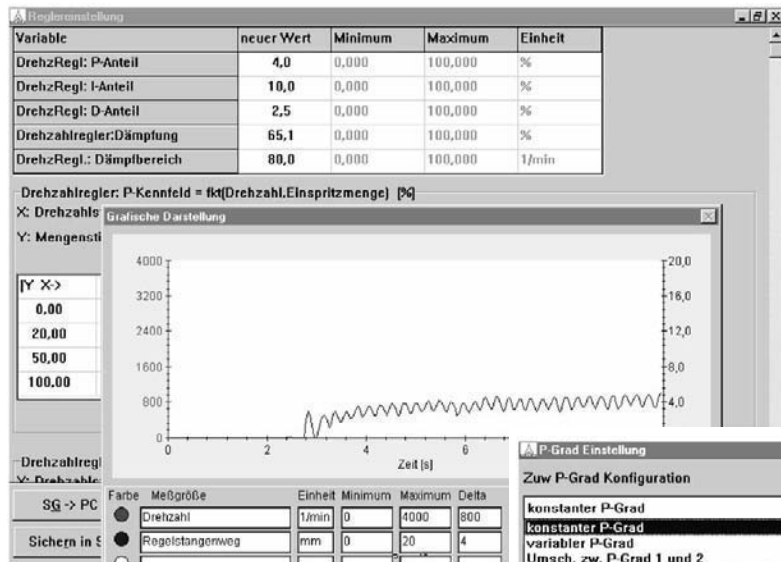
- Some measured values are displayed direct (selection not configurable).
- Additional switch "Jobs", see also 3.0.
- Output of complete content possible with "Select control unit/print".
- In "Select control unit" the control unit can now be re-stimulated without quitting SERDIA.
- The communication status between PC/notebook and control unit is now indicated by a coloured code in the status-bar as well as in plain text:
 - **Yellow** (flashing): ISO-block processing: i.e. actual data (e.g. measured values) are being exchanged between SERDIA and control unit.
 - **Green** (flashing): ISO-connection OK, i.e. only blocks for maintaining communication are being exchanged between SERDIA and control unit.
 - **Red**: Communication interrupted

9.3 NEW SWITCH “JOBS“ FOR PERFORMING SELECTED SERVICING OPERATIONS, E.G. ADJUSTING CONTROLLER OR ADJUSTING OFFSET

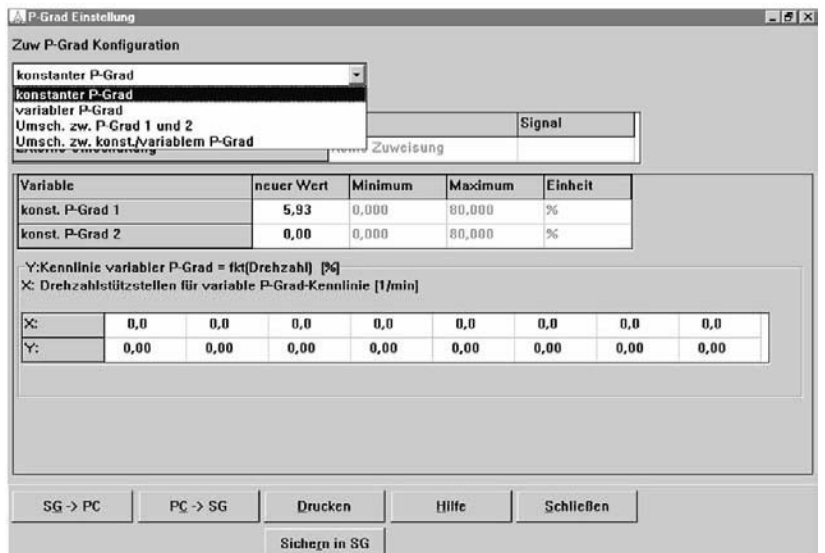
The advantage of this added feature is that settings and views are visible and operator-accessible grouped together on a single screen page according to job (servicing operation), not spread over several pages as in SERDIA Vers. 2.5.



Example: "Adjusting controller" (Reglereinstellung)



Example: "Adjusting offset" (P-Grad Einstellung)



9.4 IN- AND OUTPUT ASSIGNMENT IS NOW ADDITIONALLY CONFIGURABLE USING PLAIN TEXT (PREVIOUSLY ONLY CODE NUMBERS)

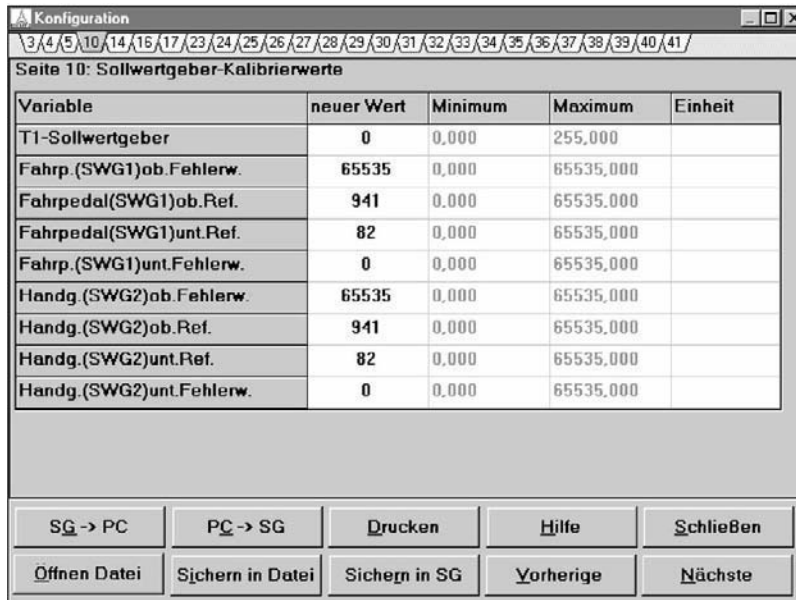
With the "Jobs" switch the possible assignments are now displayed in "Specification of in- and outputs" (right mouse-click) and assigned (left mouse-click). From the same mask the switch-selectable functions can also be assigned and the measured values for all in- and outputs displayed. This configuration option is available only from Level III upwards.



9.5 UPGRADES IN "PARAMETER SETTING/CONFIGURATION"

9.5.1 Configuration pages with "rider"

By means of the "riders" it is now possible to jump between selected pages.



9.5.2 With the highest access level subrecords can now be created and roof 1curves displayed graphically

First and foremost this affects service personnel at company headquarters. The service network benefits mainly from easier handling of changes in functional scope.

9.5.3 For programming reasons it has been necessary to move the configuration pages

In SERDIA 3.1 all pages from 21 onwards are now 2 pages away from their position in SERDIA 2.5. E.g. the previous page 25 is now page 27. Account is taken of the change in the SERDIA Manual Vers. 3.1.

OPERATOR'S MANUAL



EDS (Electronic Diagnosis System)

1. GENERAL INTRODUCTION

The electronic components in the AGROTRON are tested and programmed by means of the Electronic Diagnosis System (EDS) from DEUTZ-FAHR.

The existing version of the EDS consists of an interface cable and an adapter cable as well as of an installation disk with the corresponding programs.

The PC program and the cables are distributed via:

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

Viale F. CASSANI, 15

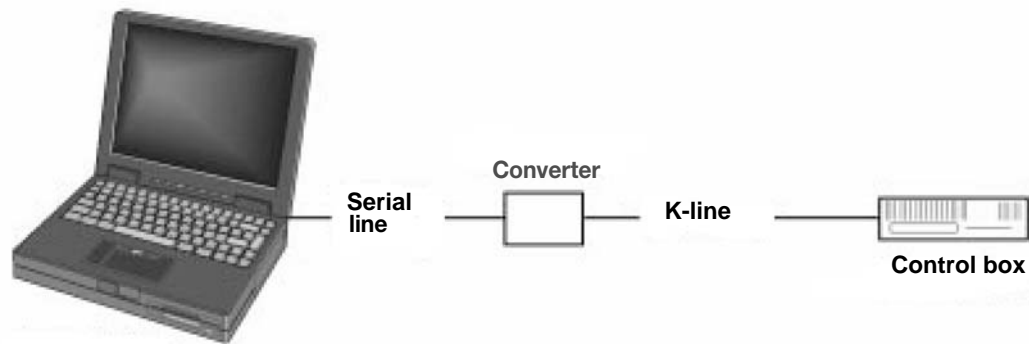
24047 TREVIGLIO (BG) - ITALIA

1.1 FUNCTIONAL SCOPE

The EDS software includes the following subprograms:

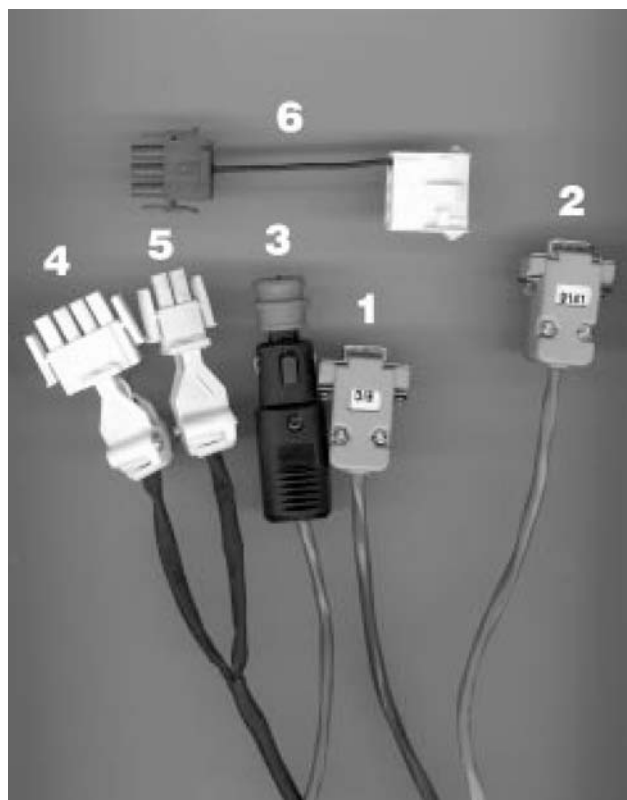
- **POWERSHIFT and POWERSHUTTLE transmission**
 - Diagnosis
 - Readout of the gear box error memory
 - Programming of the gear box, e.g. upon replacement of the box (end-of-line programming)
 - Calibration of the sensor at the clutch pedal (end-of-line programming)
 - Evaluation of the contact pressure of the main clutch (only for power shuttle)
- **Agrotronic-hD**
 - Diagnosis
 - Readout of the AGROTRONIC-hD box error memory
 - Calibrate valves
- **Infocenter**
 - Diagnosis
 - Programming of the constant values
- **Spring-suspended front axle**
 - Diagnosis
 - Readout of the control box error memory
 - Reading resp. loading of the control box standard data (parameters) converter

1.2 HARDWARE REQUIREMENTS



Hardware Setup

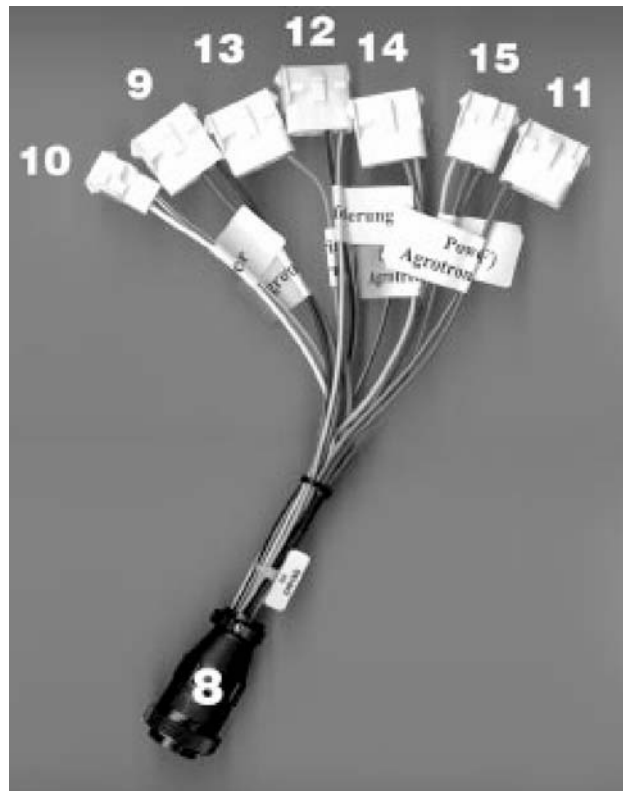
1.2.1 INTERFACE CABLE (SERIAL)



The depicted interface cable is plugged into the serial interface (COM 1 or COM 2) of the computer and connected with the corresponding connectors of the adapter cable.

- 1 - Plug (designation "EIC") for connection to the serial interface (RS 232) at the computer for diagnosis INFOCENTER.
- 2 - Plug (designation "9141") for connection to the serial interface (RS 232) at the computer for diagnosis POWERSHIFT- and POWERSHUTTLE-transmission, AGROTRONIC-hD and spring-suspended front axle.
- 3 - Plug for 12 V supply of the interface cable for connection to the cigar lighter.
- 4 - Diagnosis plug for AGROTRONIC-hD, gear box control and spring-suspended front axle, 4-pole.
- 5 - Diagnosis plug for INFOCENTER, 2-pole.
- 6 - Adapter for diagnosis POWERSHIFT transmission, old version.

1.2.2 ADAPTER CABLE FOR CENTRAL DIAGNOSIS INTERFACE



The depicted adapter cable is plugged into the diagnosis interface in the fuse box and connected with the corresponding connectors of the PC interface cable.

- 8 - Central plug 14-pole for connection in the fuse box
- 9 - Diagnosis plug for "Agrotronic-hD", 4-pole
- 10 - Diagnosis plug for "Infocenter", 2-pole
- 11 - Diagnosis plug "Powershift Agrotron 4.70 – 6.45", 4-pole
- 12 - Diagnosis plug "Spring-suspended front axle", 4-pole
- 13 - Diagnosis plug "Electronic motor control", 4-pole
- 14 - Diagnosis plug for "Full powershift Agrotron 160-200", 3-pole
- 15 - Diagnosis connection for "MOBI-DIG (ZF)", 4-pole

NOTE. Both free cable ends are not used.

1.2.3 SYSTEM REQUIREMENTS

The applied computer (notebook, laptop or portable system) needs to fulfill the following requirements in order to install and execute EDS:

- IBM compatible personal computer with at least a 80486 processor.



CAUTION!

For the use of SERDIA – SERVICE DIAGNOSIS program for the electronic motor control from DEUTZ AG – a Pentium[®]-processor is recommended.

- Main memory (RAM) at least 640 kB
- Disk drive 3,5" for 1,44 MB floppy disks (HD)
- Hard disk with at least 2,5 MB of free memory space
- at least one serial interface COM 1 (RS 232)
- Operating system MS-DOS from version 6.xx on
- An additional serial/k-line converter is required for the communication with the diagnosis interface (included in the scope of supply of the company Wilbär).

1.2.4 SOFTWARE INSTALLATION



IMPORTANT!

The EDS program needs to be installed and executed in the DOS mode of the computer in order to prevent malfunctions! The installation has to be carried out according to the installation instructions included in the scope of supply.

The installation procedure valid according to the current release is shown step by step in the subsequent description:

- Start computer in DOS mode (C:_)
- Insert floppy disk in drive A
- Change to drive A (A:_) by means of entering **A:** and pressing of the **ENTER-key**
- The automatic installation procedure is launched by means of entering **install**
Hereby a new subdirectory (C:\EDS) is created on the hard disk in which the EDS program will be installed. During the installation process the user is assisted by instructions on the screen.
- After successful installation the EDS program is launched automatically.
- The program is terminated by selecting **Option 8** (C:\EDS_)
- The subdirectory EDS is quit (C:_) by means of entering **cd.** (resp. cd\).

1.3 STARTING AND TERMINATING OF THE EDS PROGRAM



IMPORTANT!

If Windows 95/Windows 3.1 is installed as operating system the EDS program needs to be launched in DOS mode (in case of Win'95 via the MS-DOS input prompt icon). Otherwise malfunctions may occur during the diagnosis!

1.3.1 STARTING OF THE EDS PROGRAM

- Start computer in DOS mode (C:_)
- Change into the subdirectory EDS (C:\EDS:>_) by means of entering **CD EDS.**
- The program is launched by entering **EDS**; the initial menu appears with the following select options:

```

*****
*           D E U T Z - F A H R           *
*****

Elektronisches Diagnose System (EDS) V3.2

1 = POWERSHIFT Getriebe           (COM1/2)
2 = AGROTRONIC-hD + ASM           (COM1)
3 = AGROTRONIC-hD + ASM           (COM2)
4 = INFOCENTER                     (COM1)
5 = INFOCENTER                     (COM2)
6 = GEFEDERTE VORDERACHSE         (COM1)
7 = GEFEDERTE VORDERACHSE         (COM2)
8 = Ende

Option wählen: [1,2,3,4,5,6,7,8]?

```

Fig. 1 - Initial Menu

Within the initial menu, pressing one of the numerical keys (1 to 7) determines which component (e.g. Agrotronic-hD+ASM) is supposed to be checked and on which computer interface (COM 1 or COM 2) the signals arrive.

1.3.2 Terminating of the EDS program

- The initial menu (see figure) appears again after terminating the selected subprogram (e.g. Agrotronic-hD+ASM)
- The EDS program is quit by means of selecting **Option 8**.
- The display **C:\EDS:>_** shows that the operating system is still located in the subdirectory EDS which is quit by entering **cd..**, causing DOS to return to the root directory.
- If EDS was launched in DOS mode under Windows 95 (via the MS-DOS input prompt), entering **EXIT** causes Windows to close the DOS window and return to the Windows desktop.

2. TRANSMISSION DIAGNOSIS

DEST is a program for diagnosis and end-of-line programming of the transmission control units DEST 38 and DEST 45. It consists of a main menu in which the corresponding control unit is selected and the actual diagnosis programs.

The user interface of this program is realized according to the SAA standard. This means for the user:

- a uniform menu prompting system
- an online help available at any time
- mouse-support
- operation via hotkeys (designated by highlighted characters)

2.1 THE MAIN MENU

On start-up of DEST (compare part 1.1.3: "Starting and terminating of the EDS program") the last selected diagnosis control is started automatically. The corresponding diagnosis program must be quit in order to return to the main menu (DEST 38 – menu item File > End; DEST 39/45 – menu item File > main menu). From the DEST 38 diagnosis it is always possible to return to the main menu.

2.1.1 SCREEN AND MENU STRUCTURE

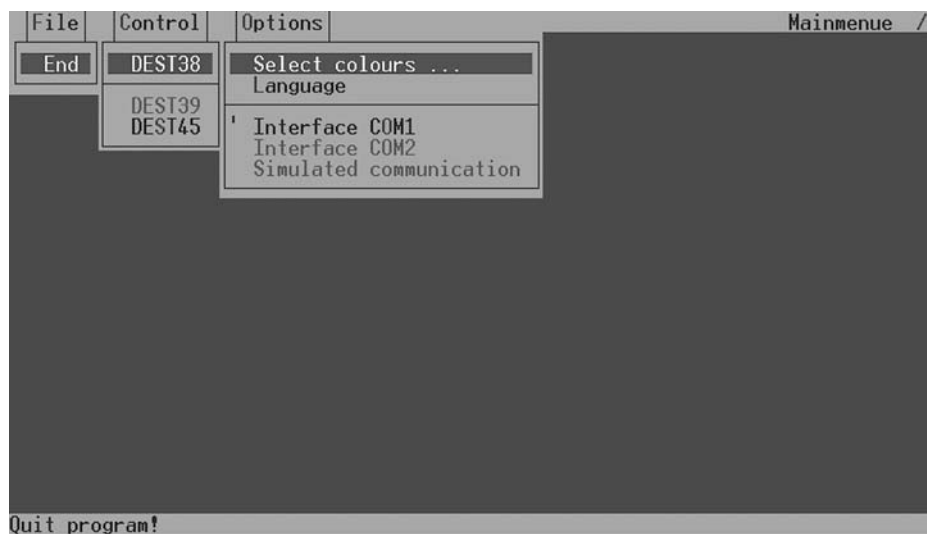


Fig. 2 - Menu structure

The screen setup with the main menu is identical for the transmission diagnosis programs; in the diagnosis programs DEST 38, 39/45 the menu line is merely supplemented by the menu item Diagnosis. Left at the top in the menu line the current program level is indicated, e.g. MAIN MENU. The rotating dash left beside it signalizes to the user that the program is working correctly on the lowest level. If this dash stands still an error has occurred and the program must be restarted.

The user activates the menu by means of pressing the ALT key or the F10 key and may select a submenu by means of the cursor keys. The same goal is accomplished by means of pressing the ALT key and one of the hotkeys assigned to every menu item simultaneously.

This hotkey is a highlighted character for every menu item (e.g. the "F" for the menu item File, invoked with the combination ALT + F).

The menu may be quit by means of the ESC key (resp. the ALT key).

2.1.2 FILE

- **File >End**

Terminates the program; altered settings (language, colour palette and interface in use) are stored. If the program is terminated directly after quitting DEST 38 the start menu of DEST 38 is invoked automatically on the next start-up; otherwise the main menu reappears.

2.1.3 CONTROL

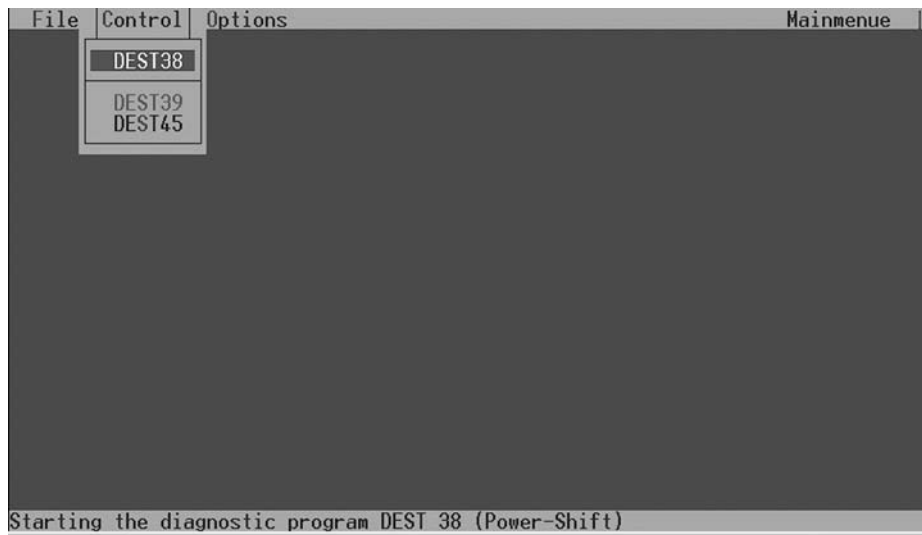


Fig. 3 - Control

- **Control > DEST38**

Launches the diagnosis program DEST 38 after a confirmation.



CAUTION!

Colour, language and interface settings cannot be taken over!

- **Control > DEST39**

Launches the diagnosis program DEST 39 after a confirmation.



CAUTION!

This program cannot be started if there is no file dest39.ini existing!

- **Control > DEST45**

Launches the diagnosis program DEST 45 after a confirmation and takes over the current settings.

2.1.4 OPTIONS

- **Options > Colour palette**

Selection of various colour palettes for the screen display.

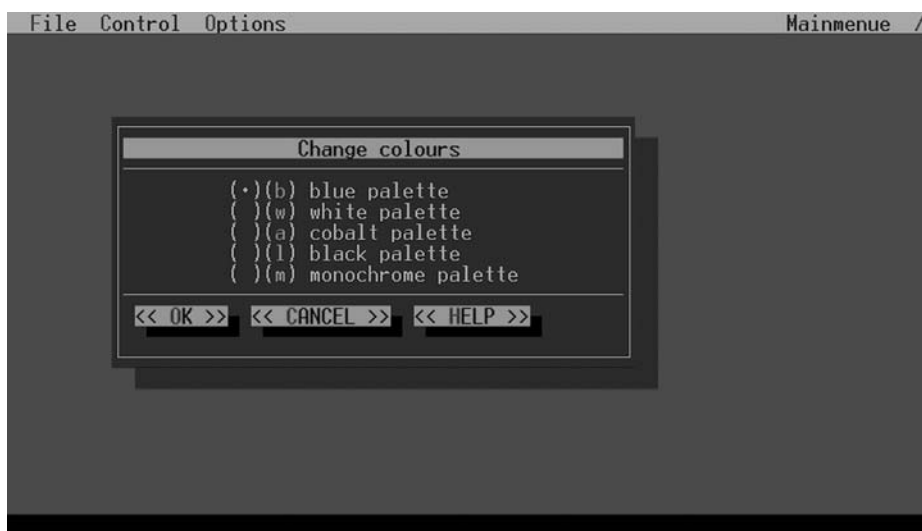


Fig. 4 - Menu Colour

- **Options > Language (Lingua)**

Changes the communication language between user and program.

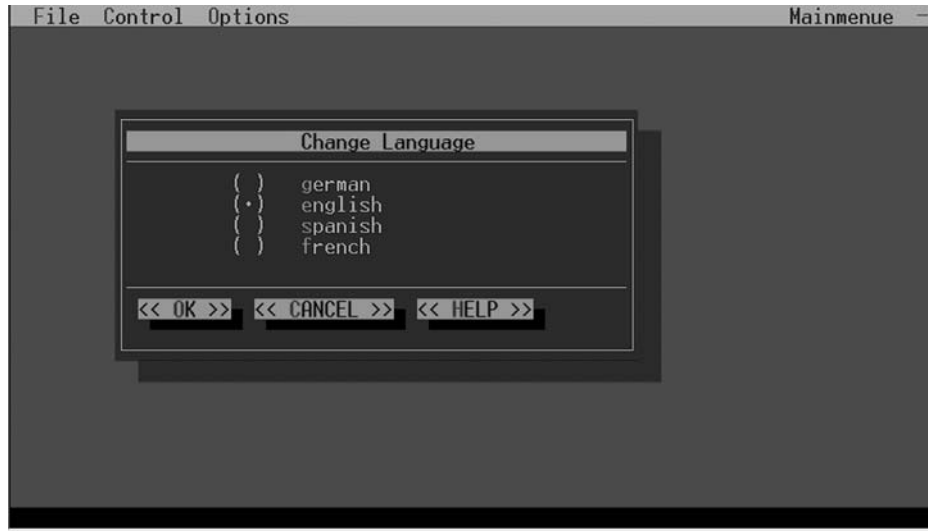


Fig. 5 - Menu Change language

- **Selection of the serial interface COM1** for the communication between control device and PC.
- **Options >Interface COM 2)**
Selection of the serial interface COM2 for the communication between control device and PC.
- **Options > Simulated communication**
This menu item is disabled due to safety reasons; the selection Simulation is not stored.

2.2 ONLINE HELP

The diagnosis program DEST offers the user help at any time about the current environment (context help) as well as help about the current key assignment. All help texts are stored as text files to be displayed at any time during the running program. Future supplements or changes of these texts can be carried out without problems by means of a text editor.

The user of the diagnosis program DEST has the opportunity to invoke an online help within the program context at any time:

- by means of pressing the F1 key
- by means of pressing ALT + H
- by means of clicking on the << HELP >> button with the mouse

The online help basically describes the operation of the currently active window. Further texts (e.g. a detailed description of specific control device data) can also be included.

The possible key combinations in the context are shown by means of pressing the F9 key.

3. POWER-SHIFT DIAGNOSISPROGRAMM DEST 38

3.1 PREPARATIONS FOR TRANSMISSION DIAGNOSIS WITH DEST 38

As a preparatory measure the connection between tractor and computer needs to be established so as to check the transmission control by means of DEST 38 resp. to be able to carry out the end-of-line programming. The interface cable and the adapter cable are serving for this purpose.

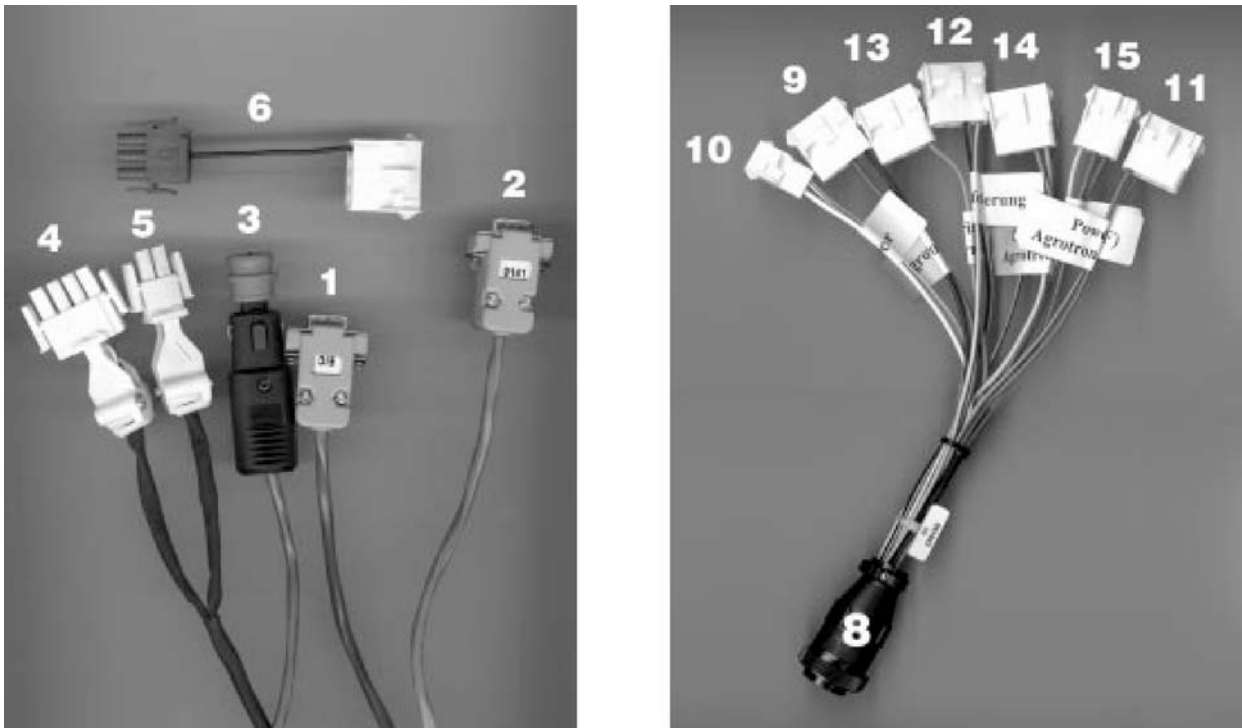


Fig. 6 - I interface cable - and adapter cable

- 1 - Connect plug (2) of the interface cable with the designation "9141" to the computer (COM interface)
- 2 - Connect plug (3) of the interface cable for the 12 V supply to the cigar lighter
- 3 - Connect the 4-pole plug of the interface cable to the plug (11) – designation "powershift Agrotron 4.70-6.45" – of the adapter cable
- 4 - Insert the central plug of the adapter cable into the central diagnosis interface in the fuse box
- 5 - Switch **ON** ignition
- 6 - Start the computer and call the EDS program (compare item A 1.3 – Launching and terminating of the EDS program)
- 7 - Call **option 1** in the initial menu
- 8 - Make sure that the right diagnosis program (DEST 38) is invoked. On the right side in the bottom frame of the screen DEST 38 needs to be displayed, e.g. DEST 38 – V 2.2 – 16.12.97.
If necessary change to the main menu and launch DEST 38 via the menu item Control > DEST 38.



CAUTION!

Before starting the diagnosis verify that the proper interface (COM 1 or COM 2) is selected!

NOTE. Agrotron tractors with the vehicle identification numbers up to 80xx 1999 (i.e. green cabin) usually are not equipped with a central diagnosis interface. To be able to check the transmission control however, with these tractors it is necessary to connect the 4-pole plug (4) of the interface cable with the 3-pole diagnosis terminal of the transmission using the intermediate cable (6).

The diagnosis terminal is located in the cabin at the rear on the right side under the floor mat, resp. in the right panelling (close to the E-box).

3.2 DEST 38 PROGRAM DESCRIPTION

3.2.1 FILE

- **File > End**

The menu item "End" saves the settings selected under the menu item "options" (colour palette, language and selected interface) and terminates the diagnosis program.

Upon the next start-up of the diagnosis program the settings are automatically read and set.

3.2.2 DIAGNOSIS

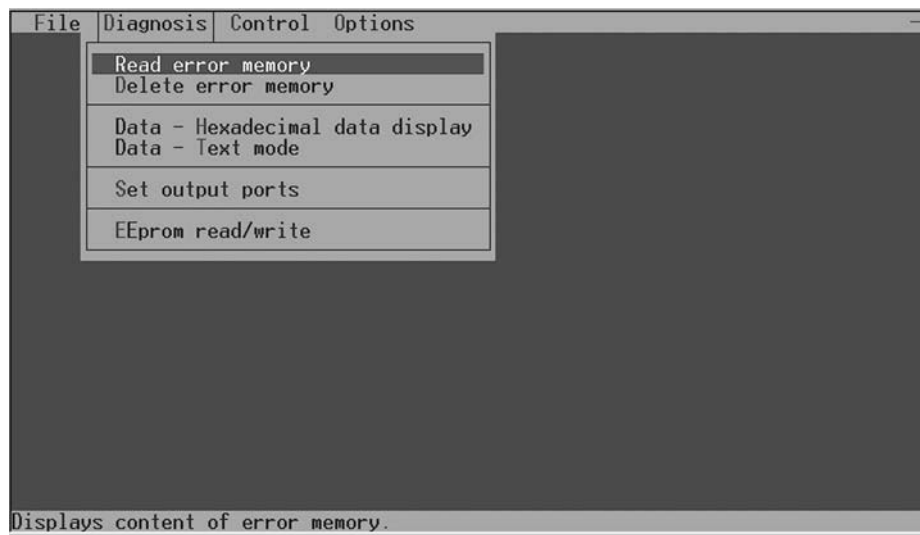


Fig. 7 - Menu Diagnosis

- **Diagnosis > Read error memory**

The menu item Read error memory opens a window divided into two parts (see figure). The double frame and the highlighted lines Read error memory resp. Error description show which part of the window is currently active.

In the left part of the window in **the first line** the current operating-hours of the transmission-E-box are displayed. As the operating-hours counter of the E-box is always running when the ignition is switched on, the hour data of Infocenter and transmission-E-box do not match!

The **second line** indicates the number of errors stored in the error memory of the transmission box.

The **lower window** section shows the stored errors of the transmission box. Under the column Error no. the corresponding error number resp. the error code is displayed.

The **column Number** indicates how many times this error has occurred and in the column Operating-hours the number of operating-hours during the first occurrence of the corresponding error are indicated.

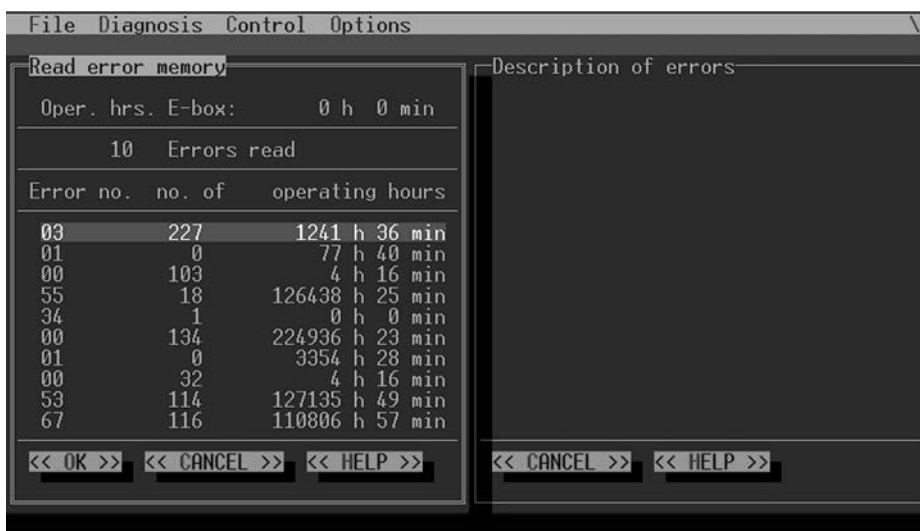


Fig. 8 - Read error memory

The user can select an error with the cursor keys and cause a detailed error description to be displayed on the right side of the screen by means of clicking on OK or pressing ENTER. The error text can be scrolled by means of the cursor keys if it exceeds the size of the right window. Pressing of ESC or C reactivates the left screen window.

If the left window is active, all errors can be saved in a text file with their detailed description by means of pressing F2. In addition to the error descriptions the current operating-hours counter, the identification data, the current date as well as the vehicle identification number and the number of the electronic box are saved. However, vehicle identification number and number of the electronic box can only be saved if the corresponding entry in the EEPROM is valid.

- **Diagnosis > Delete error memory**

"Delete error memory" opens a window which prompts the user to confirm the deletion of the error memory. If the user confirms with ENTER the error memory will be erased. Pressing ESC (or C) aborts the procedure without erasing the error memory.

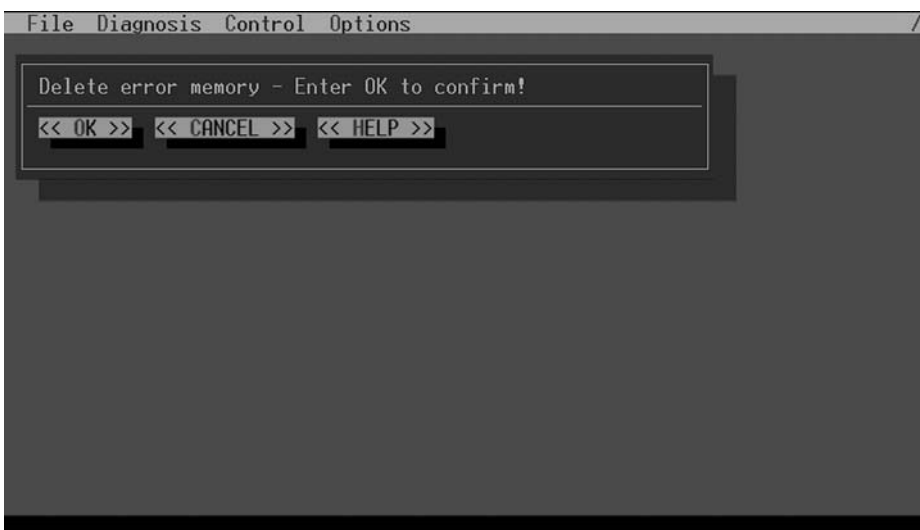


Fig. 9 - Delete error memory

- **Diagnosis > HEX data display**

This menu item is not relevant for diagnosis, as only internal data in hexadecimal notation is displayed here. On selection of the menu item HEX data display the window shown below appears, in which the user can enter up to four hexadecimal addresses.

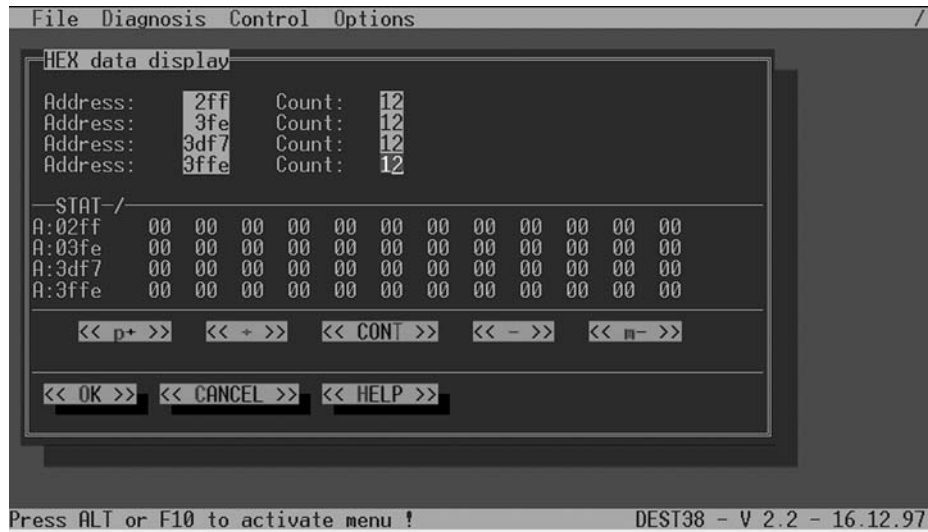


Fig. 10 - HEX data display

In addition to the address data the user has to enter the number of bytes (maximum 13) he wants to read at this start address. On confirmation with OK their contents are dumped on the screen.

With << + >> / << - >> the start addresses are incremented resp. decremented by one.

With << ++ >> / << -- >> the start addresses are increased resp. decreased by 13 (decimal).

With << CONT >> the contents are read continually. Selection of this button causes the label to change to "<< STAT >>". Reselection toggles again. Pressing the key ESC or ALT + C quits this menu item.

- **Diagnosis > Plaintext data display**



CAUTION!

After quitting the menu item "End-of-line programming" the ignition on the vehicle needs to be switched off and on again in order to update all data in the window "Plaintext data display"!

Plaintext data display opens a window in which the data is displayed in their corresponding physical units. The structure and contents of the window are shown below.

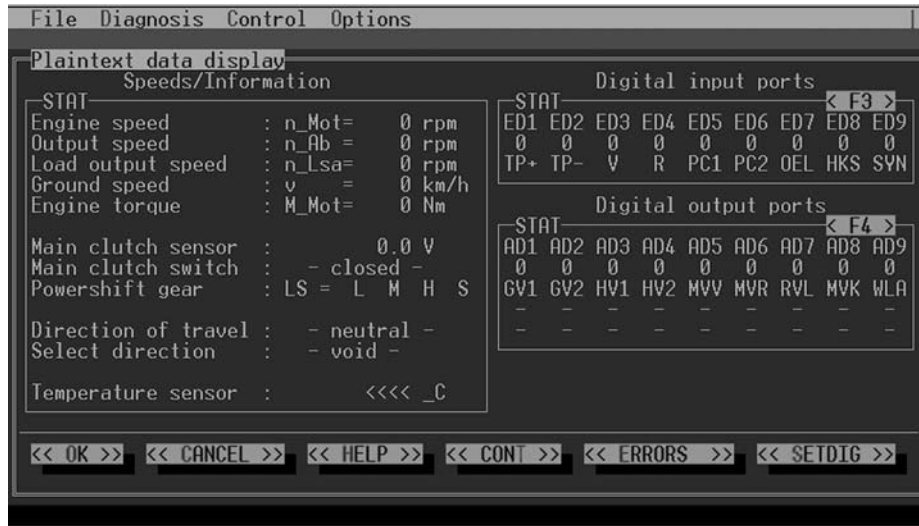


Fig. 11 - Plaintext data display

The window (see figure) is divided into three areas. In the left area the data of various sensors are indicated in their corresponding physical unit among other things. The upper area on the right indicates the status of the digital inputs, the lower area on the right shows the status of the digital outputs.

In addition, as for the digital outputs, the errors of the corresponding outputs recognized by the control unit are also displayed. Thereby the letter "K" under the output signifies a short circuit to the supply voltage. The letter "U" stands for a line interruption resp. a short circuit to ground.

In the bottom line of the window several select fields, so-called buttons, are shown which can be selected by pressing the corresponding highlighted letter.

By pressing the button <<CONT>> (continuous display) located at the bottom window border, resp. by pressing the letter "T" the static display toggles to continuous display; i.e. all areas are refreshed continually.

Hereby the button label changes to <<STAT>>. The current status can be seen at the upper left border of each area. Beside it a turning dash indicates the refresh rate. If once an area has been updated the dash turns clockwise into the next position.

Reselecting this button or pressing the letter "T" again toggles to singular reading of the areas again (static display), except for the error display of the digital outputs which are constantly refreshed.

Charts with the descriptions about the pin assignment and the applied abbreviations of the digital inputs and outputs can be called by means of pressing the keys F3 and F4.

The sensor errors are displayed by means of selecting the button << ERRORS >> (see figure).

Regardless of the setting the sensor errors are also constantly updated. The display of the sensor errors covers the display of the digital inputs/outputs. If the display of the sensor errors is selected the button label << ERRORS >> changes into << DIG I/O >>. Activating this button causes the digital inputs/outputs to show up again.

As to the fact that in the window "Plaintext data display" even in "STAT" mode data are read and refreshed continuously, the program may possibly show slightly delayed reactions after pressing a key.

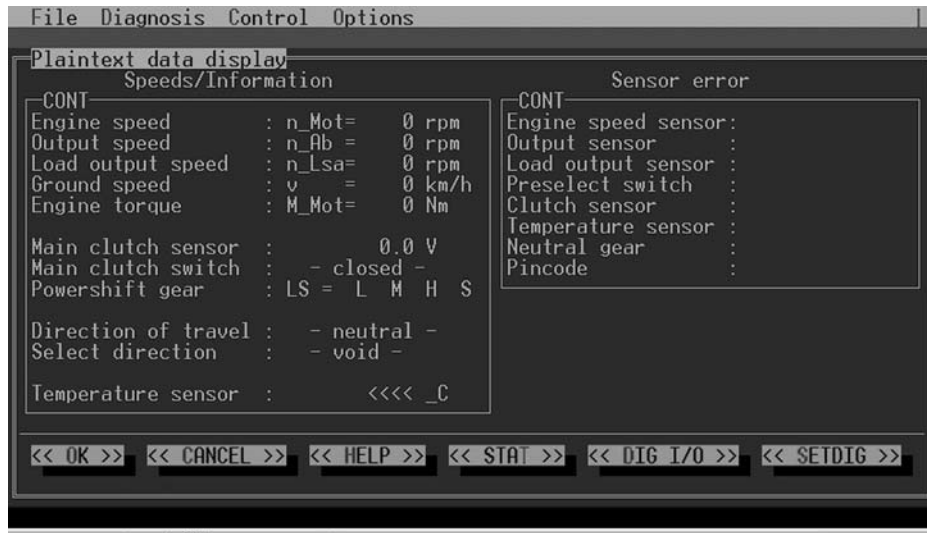


Fig. 12 - Sensor errors

All digital outputs can be set individually by means of activating the button << SETDIG >> which causes the window shown on the next page to appear. This window can also be invoked via the menu item "Diagnosis > set output ports". If "Activate outputs" is selected via the button << SETDIG >> the window "Plain text data display" will be kept open. However the data will not be refreshed any more, regardless of the setting.

• **Diagnosis > Set output ports**



CAUTION!

- **Due to safety reasons this menu item can only be selected when the engine has stopped!**
- **After terminating the menu item "End-of-line programming" the ignition on the vehicle needs to be switched off and on again before the menu item "Set output ports" can be selected. Otherwise the call is aborted by prompting the error message "Set output ports not possible!"**

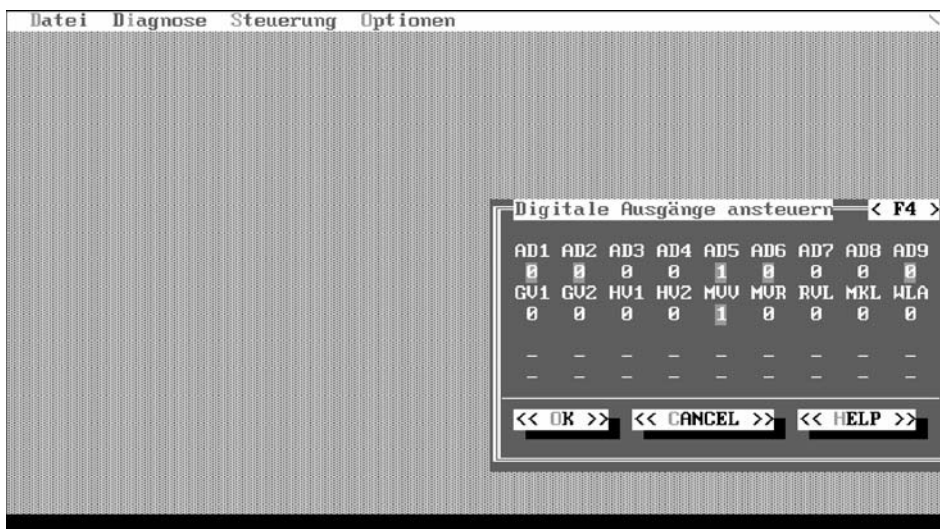


Fig. 13 - Set output ports

Via the menu item "Set output ports" it is possible to set or reset the individual digital outputs. After calling the menu item "Set output ports" a window appears in which the data of the individual outputs of the transmission-E-box is displayed. The data display is divided into nine columns and six lines, whereby every column is assigned one digital output of the E-box.

Line 1: In this line the internal addresses of the digital outputs are indicated.

Line 2: This line indicates the current status of the output. Hereby the indication "1" signifies that the output is set and therefore a signal (voltage) is existing at the corresponding pin of the E-box. The indication "0" signifies that the output is not set and therefore no signal is existing.

Highlighted fields in different colours show to the user those outputs which are connected to the E-box and therefore are ready to be activated.

Line 3: In this line the activated components of the corresponding output are indicated.

Line 4: In this line the user can select one of the connected outputs by means of the cursor keys, i.e. the desired field is highlighted in a different colour. This output status can be toggled (activated resp. deactivated) by pressing the ENTER key. The output will be set in the E-box and subsequently be read in again by the DEST program. After the reading process lines 2 and 4 are refreshed. Due to safety reasons the changes which have been carried out will be reset to the normal state after the menu item "Set output ports" has been quit.

Lines 5 and 6: In these lines the errors of the digital outputs are shown. Thereby the letter "K" signifies a short circuit to the supply voltage and the letter "U" stands for a line interruption resp. a short circuit to ground.

A Chart with the description of the applied abbreviations can be called by means of selecting the <<HELP>> button.

- **Diagnosis > EEPROM read/write**

This menu item allows the user to read and edit the customer area contents of the EEPROM. On selection a window appears in which the contents are shown (see figure). The user can alter individual characters with the help of the cursor keys and confirm these changes with <<OK>> (key combination ALT + O or ENTER). By this means the altered data are stored in the EEPROM.

This menu item can be quit by means of pressing the ESC key or ALT + C.

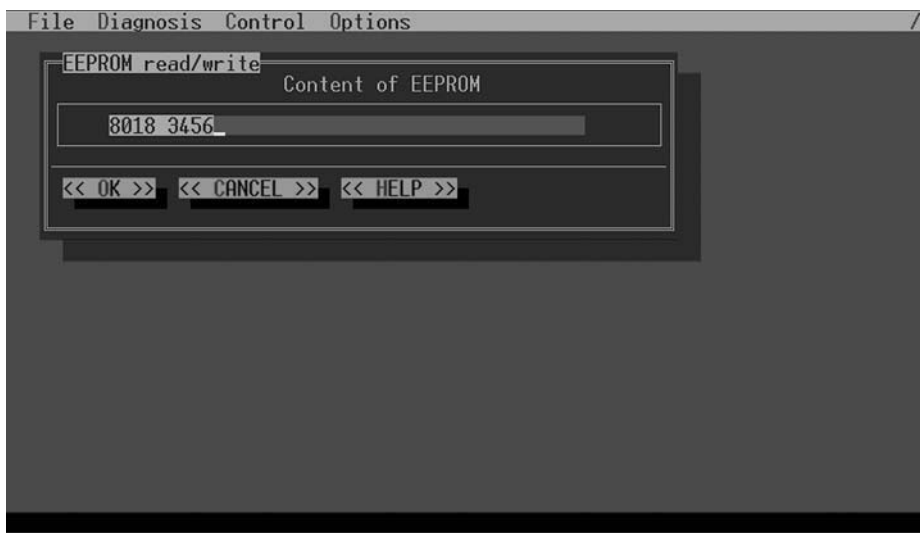


Fig. 14 - EEPROM read/write

The first nine characters of the customer area are highlighted in a different colour. The menu item "End-of-line programming" fills in the vehicle identification number into this area.

In case of storing the contents of the error memory into a file DEST 38 checks whether the first four characters of the EEPROM customer area correspond to a valid vehicle identification number. If this is the case the vehicle identification number and the corresponding number of the electronic box will also be stored into the file. Otherwise both values cannot be stored. Due to the aforementioned reasons this area should not be edited by the user himself.

Therefore, on opening the window the cursor is located at the position on the right beside it.

3.2.3 MENU CONTROL

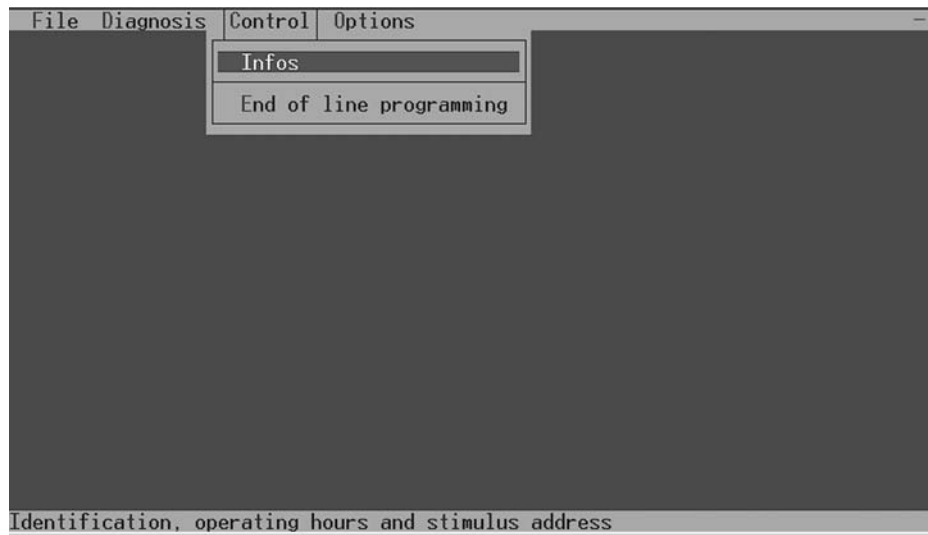


Fig. 15 - Control

- **Control > Infos**

The menu item "Infos" indicates the operating-hours of the transmission box in a window (see below) as well as its specific identification data. These data cannot be altered.



Fig. 16 - Control >Infos

- **Control > End of line programming**



CAUTION!

After terminating the menu item "Set output ports" the ignition on the vehicle needs to be switched off and on again before the menu item "End of line programming" can be selected. Otherwise the call is aborted by prompting the error message "Select transmission version not possible!".

The menu item "End of line programming" opens a divided window for the purpose of configuration of the transmission box and for adjustment of the clutch. In the upper window area the configuration data is displayed. In the lower area the user can find instructions for the end-of-line programming.

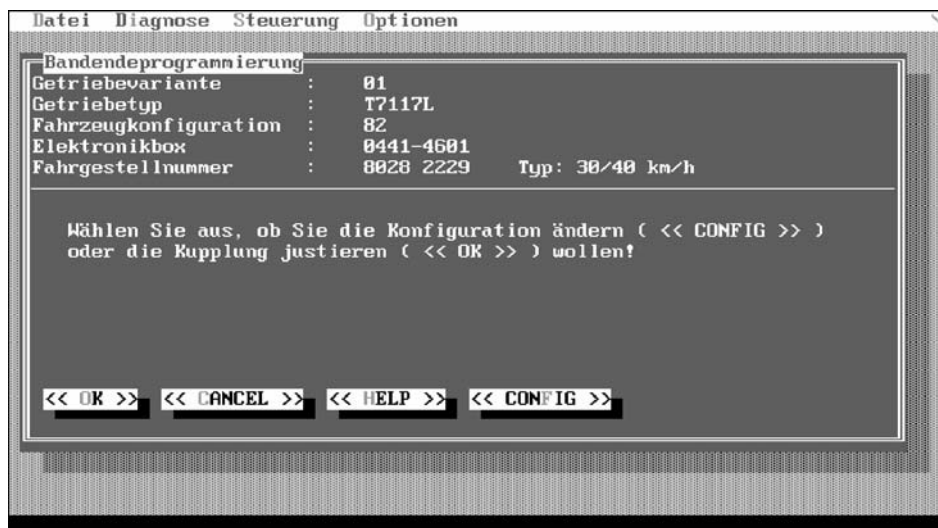


Fig. 17 - End of line programming

First the program reads the 8 digit vehicle identification number from the EEPROM. If the first four digits correspond to a valid vehicle identification number the configuration data are read directly from the box. If the configuration data of the box are consistent to the corresponding data of the vehicle identification prenumber all data (transmission version, type of transmission, vehicle configuration, electronic box and vehicle identification number) will be displayed. If they are not consistent only the read out data from the control unit will be displayed. In addition, a warning will appear with instructions to reconfigure the box. The same applies if the vehicle identification number read from the EEPROM is invalid.

The vehicle configuration can be changed by means of selecting the button <<CONFIG>> or the letter "F". At first the vehicle identification prenumber (the first four digits of the vehicle identification number) is highlighted in a different colour. The vehicle identification number defined for the corresponding type of vehicle can be selected from a table stored in the program by means of the cursor keys. The configuration data belonging to the respective type of tractor are altered simultaneously.

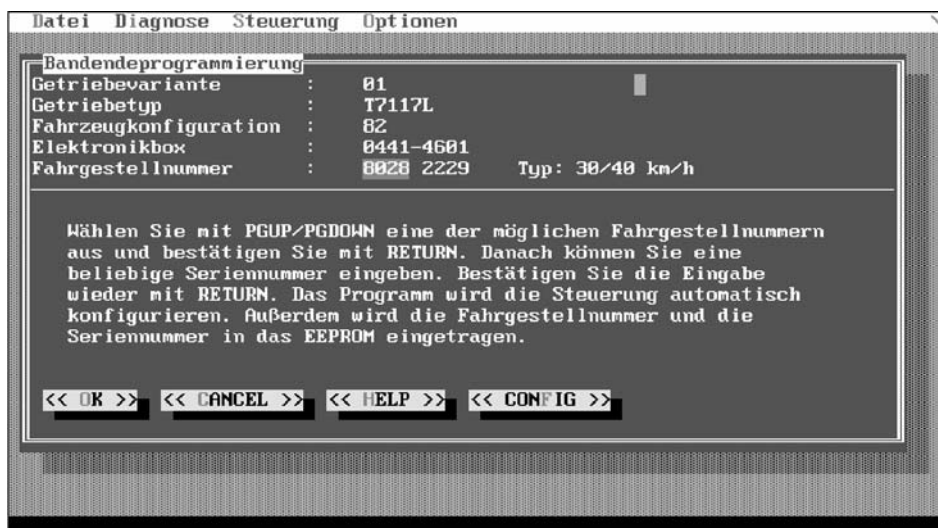


Fig. 18 - End of line programming/Change configuration (Modifica della configurazione)

Before these data are stored by pressing the ENTER key it is obligatory to compare the pre-set speed version (30 / 40 km/h or 50 km/h) with the actual speed version of the tractor. If these do not match the proper speed version has to be set by means of pressing the cursor keys again.

After pressing the ENTER key the last four digits of the vehicle identification number will be highlighted in a different colour. Here the user has to fill in the serial number of the tractor which is stored in the EEPROM by pressing the ENTER key.

Subsequently the transmission box will be configured with the corresponding data by activating <<OK>> or pressing ENTER. In addition, the entire vehicle identification number will be written into the first nine bytes of the EEPROM customer area.

If the configuration is completed the clutch can be adjusted by means of <<OK>> or ENTER (see figure). If the instructions are executed the clutch adjustment can also be terminated with <<OK>> or ENTER causing a message to appear whether the clutch adjustment was carried out successfully or not.



Fig. 19 - End of line programming/Clutch adjustment (Regolazione della frizione)

Leaving end-of-line programming:

The end-of-line mode can be quit by shortly switching the ignition off and on again. Simultaneously, the "01 display" and the wrench symbol in the Powershift display disappear.

3.2.4 OPTIONS

The option menu offers the user the possibility to alter the program environment. These settings are saved when the program is terminated.

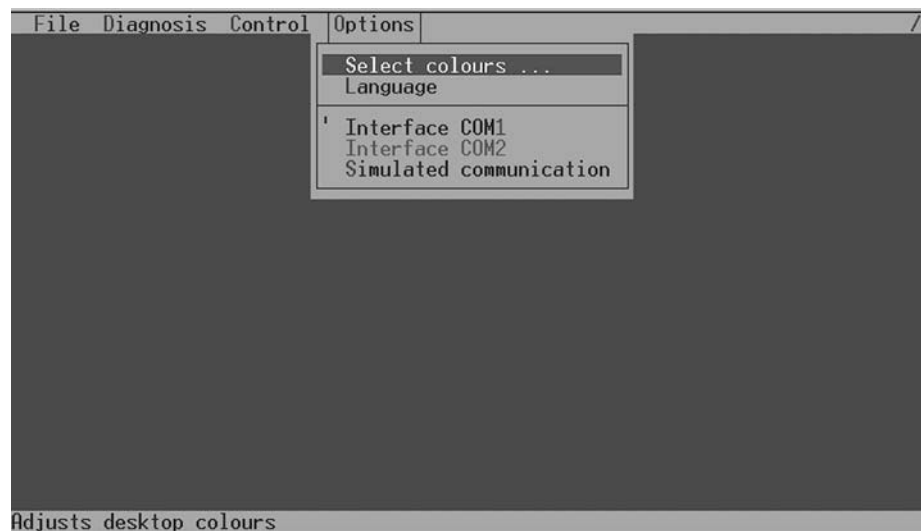


Fig. 20 - Options

- **Options > Select colours**

In this menu item settings for the appropriate screen colours can be selected. In the select menu all possible palettes are shown and can be selected by means of the cursor keys. The colours of the selected palette are shown in a preview. If the selected colour palette is determined to be kept, confirm by pressing the ENTER key.



Fig. 21 - Select colours (Modifica colori)

- **Options > Language**

In the submenu "Options – Language" another language can be selected. After confirming with ENTER (resp. ALT + O) all screen texts are displayed in the selected language.

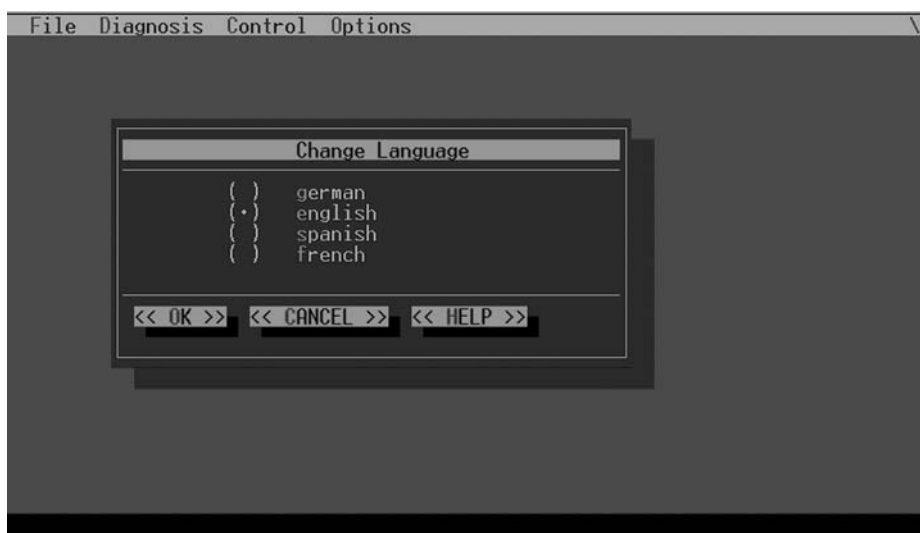


Fig. 22- Language

- **Options > Interface COM 1**

By selecting one of the two menu items the communication with the box is carried out via the corresponding interface. The selected interface is marked..



CAUTION!

Only an interface actually available on the computer can be selected!

- **Options > Simulated communication**

Selecting this menu item causes allows most of the program functions to be called without a connection to a transmission control unit. For this purpose the program EDS simulates the communication between computer and transmission box. However not all the functions are currently executable with simulated control.

3.3 Error codes POWERSHIFT /DEST 38

3.3.1 GENERAL

In case of an error only the error code with the highest error number will be displayed on the screen (depends on the priority). Simultaneously the error symbol "wrench" appears on the display. On errors which lead to neutral position on the next reversing (clutch disengaged) an acoustic alarm signal is being created (3 beeps). Every neutral gear shift results in a permanent alarm signal (beep). Independently of that the detected errors are saved in the EEPROM.

Error code: 1. Digit →type of error (rising priority) 2. Digit →error location

- 1n ... digital input failure
- 2n ... analog input failure
- 3n ... signal input failure
- 8n ... interruption/short circuit to ground at digital output
- 9n ... short circuit to plus at digital output
- An ... other system errors
- En ... error results in standby driving program
- Fn ... no driving possible, permanent neutral

Display of special program mode on the screen

- 01 + wrench: End-of-line programming
- 02 + wrench: Activate outputs; in case of diag. errors the corresponding error code is displayed

Abbreviations

- LU Line interruption
- KM Short circuit to ground
- K+ Short circuit to vehicle electrical system plus (+UB) general
- K15 Short circuit to terminal 15 (switched plus)
- 5VREF 5V reference voltage for clutch sensor and temperature sensor
- LS Powershift ...
- Nmot Speed at powershift gear input, engine speed
- Nlsa Speed at powershift gear output
- Nab Speed at output, ground speed
- AMUX Analog multiplexer (component in the E-box)
- BE End-of-line

Definitions for key words in the error code list

- **Main clutch neutral position:** Clutch pedal is in neutral position; not actuated
- **Main clutch actuated:** Clutch pedal is in "inch area", not neutral, not disengaged
- **Main clutch disengaged:** Clutch pedal is entirely kicked; clutch disengaged
- **Permanent neutral**
 - Relay is switched off
 - Outputs (valves) are switched off
 - Can only be left by switching the ignition off and on again

Multiple error

Multiple errors can occur as sequence error due to overdrive of one of the input signals speed sensor Nlsa, temperature sensor, clutch sensor (AMUX overdrive).

Check: Nlsa, temperature sensor, clutch sensor

- 1 - In the following table the most probable error cause resp. the most probable error location are respectively mentioned in first place.
- 2 - The displayed error code is an indication for the faulty component. Type of error or error location can also possibly be caused by other components (e.g. in case of multiple errors, defective power supply).
- 3 - Error code table is valid for T7100 and T7200 / T7300 vehicles.

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3.4 ERROR CODE LIST WITH DESCRIPTION

Code	Type of error/location	Possible error cause	Possible remedy	System reaction	Remarks
10	system pressure 18 bar	oil pressure switch defective (does not open) KM system pressure defective	check switch check cabling check system pressure	warning lamp is lighting pressure	Only diagnosed if Nmot > 2,55 sec over 1000 rpm; switch opens on
20	temperature sensor	LU, KM, K+ temperature sensor defective multiple error	check cabling check temperature sensor Check sensor Nlisa cabling check clutch sensor	Default: cold clutch hold time, filling time only field characteristic on K+: permanent neutral, permanent beep	in case of AMUX overdrive: permanent neutral
30	engine load signal	LU, KM, K+ engine load signal faulty wrong configuration on end-of-line programming	check cabling check engine load signal del motore (300 Hz, 5-95% pul- se width)	field characteristic substitution torque	reserved, as no engine load signal is existing Observe configuration on end-of-line programming!
80		-	-	-	reserved for further digital ou- tput, LU, KM
81	transfer valve 1 LU, KM	LU, KM valve faulty	check cabling check valve	powershift blocked	LU, KM is diagnosed if valve is switched off
82	transfer valve 2 LU, KM	LU, KM valve faulty	check cabling check valve	powershift blocked	LU, KM is diagnosed if valve is switched off
81	characteristic line valve LU, KM	LU, KM valve faulty	check cabling check valve	powershift blocked	only for T7200 LU, KM is diagnosed if valve is switched off
82	warning lam (oil pressure, overspeed)	LU, KM lamp defective	check cabling check lamp	-	LU, KM can only be diagnosed when system is switched on LU, KM diagnosis depends on vehicle configuration customer: no diag.
90	(LU, KM)	-	-	-	(LU, KM) reserved for further di- gital output, K+

Code	Type of error/location	Possible error cause	Possible remedy	System reaction	Remarks
91	transfer valve 1K+	K+ valve faulty	check cabling check valve	powershift blocked	K+ is diagnosed if solenoid valve is switched on
92	transfer valve 2 (K+)	K+ valve faulty	check cabling check valve	powershift blocked	K+ is diagnosed if solenoid valve is switched on
95	characteristic line valve (K+)	K+ valve faulty	check cabling check valve	powershift blocked	only for T7200 K+ is diagnosed if solenoid valve is switched on
96	warning lamp (oil pressure, overspeed) (K+)	K+ lamp defective	check cabling check lamp	-	K+ can only be diagnosed when system is switched on
A0	overvoltage Terminal 15	-	-	powershift blocked, 3 beeps on reversing (clutch disengaged) permanent neutral, permanent beep	diagnosis only active if engine is running (>2,5 sec) Ub > 16 V
A1	undervoltage Terminal 15	-	-	powershift blocked, 3 beeps on reversing (clutch disengaged) permanent neutral, permanent beep	diagnosis only active if engine is running (>2,5 sec) Ub > 16 V
A2	terminal 30 faulty	LU, KM fuse defective	check cabling check fuse	operating-hours counter is not counting any more	active monitoring: if term 15 > term 30 + 2V
A3	retaining valves (LU, KM, K+)	LU, KM, K+ at retaining valve 1 or retaining valve 2	check cabling check valve	powershift blocked only field characteristic	only for T7200 LU, KM is diagnosed only when system is switched off K+ is diagnosed only when system is switched on
A4	correction data for filling times defective	EEPROM of new appliance was not erased data incorrectly entered ignition off and terminal 30 defective during EEPROM writing process EEPROM defective	ignition off/on re-enter/check the correction data by means of Mobidig Mobidig 200 (only special ZF customer service)	alternative value (0) as correction offset	error code is saved, but disappears at display after ignition off/on Input of correction values according to specification by ZF customer service. Special plug-in for Mobidig 200 required!.

Code	Type of error/location	Possible error cause	Possible remedy	System reaction	Remarks
E2	speed Nisa defective (grad. monitoring)	LU, KM, K+ speed sensor defective multiple error	ignition off/on OFF/ON check cabling check speed sensor check cabling temperature sensor, clutch sensor	3 beeps upon reversing demand and clutch disengaged: neutral shift, permanent beep aggravated reversing conditions powershift blocked upon KS+: permanent neutral, permanent beep	inadmissible speed step change from > sensor failure threshold to < minimum speed in case of AMUX overdrive: permanent neutral
E3	speed Nisa defective (active monitoring)	LU, KM, K+ speed sensor defective multiple error	check cabling check speed sensor check cabling temperature sensor, clutch sensor	3 beeps upon reversing demand and clutch disengaged: neutral shift, permanent beep aggravated reversing conditions powershift blocked upon KS+: permanent neutral, permanent beep	active monitoring only upon standstill observe limit values: Umin = 0,5V Umax = 4,5V in case of AMUX overdrive: permanent neutral
E4	speed Nab defective (grad. monitoring)	LU, KM, K+ speed sensor defective full braking on slippery subsoil	ignition off/on check cabling check speed sensor	3 beeps upon reversing demand and clutch disengaged: neutral shift, permanent beep aggravated reversing conditions	inadmissible speed step change from > sensor failure threshold to < minimum speed
E5	speed Nab defective (active monitoring)	LU, KM, K+ speed sensor defective	check cabling check speed senso	3 beeps upon reversing demand and clutch disengaged: neutral shift, permanent beep aggravated reversing conditions	active monitoring only upon standstill Umin = 0,5V Umax = 4,5V

Code	Type of error/location	Possible error cause	Possible remedy	System reaction	Remarks
E6	speed N1 not defective (grad. monitoring)	LU, KM, K+ speed sensor defective fast engine stall	ignition OFF/ON check cabling check speed sensor	3 beeps upon reversing demand and clutch disengaged: neutral shift, permanent beep N1 not has no active aggravated reversing conditions ignition "on" this failure powershift blocked	inadmissible speed step change from > sensor failure threshold to < minimum speed Caution: Speed sensor monitoring (voltage monitoring), i.e. upon cannot be detected: Vehicle breaks down!
E7	reversing lamp (K+)	K+ lamp defective	check cabling check lamp permanent beep	3 beeps upon reversing demand and clutch disengaged: neutral shift, aggravated reversing conditions	K+ is diagnosed only when system is switched on Deutz: No reversing lamp
E8	reversing lamp (LU, KM)	LU, KM lamp defective	check cabling check lamp conditions	3 beeps upon reversing demand and clutch disengaged: neutral shift, permanent beep aggravated reversing depending	LU, KM is diagnosed only when system is switched on activation is depending on vehicle configuration diagnosis LU, KM is on vehicle configuration Deutz: no diagnosis, no reversing lamp
E9	synchro neutral switch	LU, KM, K+ neutral switch defective supply voltage defective	check cabling check neutral switch and clutch disengaged: check supply voltage	3 beeps upon reversing demand: neutral shift, permanent beep aggravated reversing conditions	switch suited for diagnosis

Code	Type of error/location	Possible error cause	Possible remedy	System reaction	Remarks
EA	clutch sensor	sensor incorrectly adjusted LU, KM, K+ sensor defective multiple error	check sensor mounting check cabling check sensor check cabling sensor Nlisa, temperature sensor	3 beeps upon reversing demand neutral shift, permanent beep permanent neutral aggravated reversing conditions powershift blocked	limit values: Umin = 0,4V Umax = 4,6V in case of AMUX overdrive:
EB	plausibility: clutch sensor/clutch switch	end-of-line programming "clutch sensory" was not carried out after changes in the clutch sensory switch point clutch switch out of tolerance range clutch switch disadjusted clutch sensor disadjusted LU, KM, K+ at clutch senso LU, KM, K+ at clutch switch clutch switch defective clutch sensor defective	end-of-line programming: clutch sensory check mechanical tolerances of clutch sensory check/change admissible tolerance range check cabling check clutch sensor mounting check clutch switch mounting check cabling sensor Nlisa, temperature sensor	3 beeps upon reversing demand neutral shift, permanent beep aggravated reversing conditions powershift blocked	error will not be reset after detection tolerance range $\pm 20\%$ of programmed switch point Clutch switch is closed upon clutch in neutral position. In neutral position LU is detected clutch sensor signal: neutral: LOW disengaged: High in case of AMUX overdrive: permanent neutral
EC	plausibility: end-of-line data for clutch thresholds, clutch switch point	end-of-line programming with disadjusted clutch sensory error in the EEPROM EEPROM defective	carry out end-of-line programming check clutch sensor mounting check clutch switch mounting	3 beeps upon reversing demand neutral shift, permanent beep aggravated reversing conditions	error will not be reset after detection plausibility monitoring of end-of-line programming thresholds: - clutch neutral position - clutch disengaged - clutch switch point
EE	communication failure to display	LU, KM, K+ invalid signal fuse E-box defective	check cabling check communication (scope) check E-box fuse	Deutz beep interval	"EE" if communication failure to display > 2,5 sec

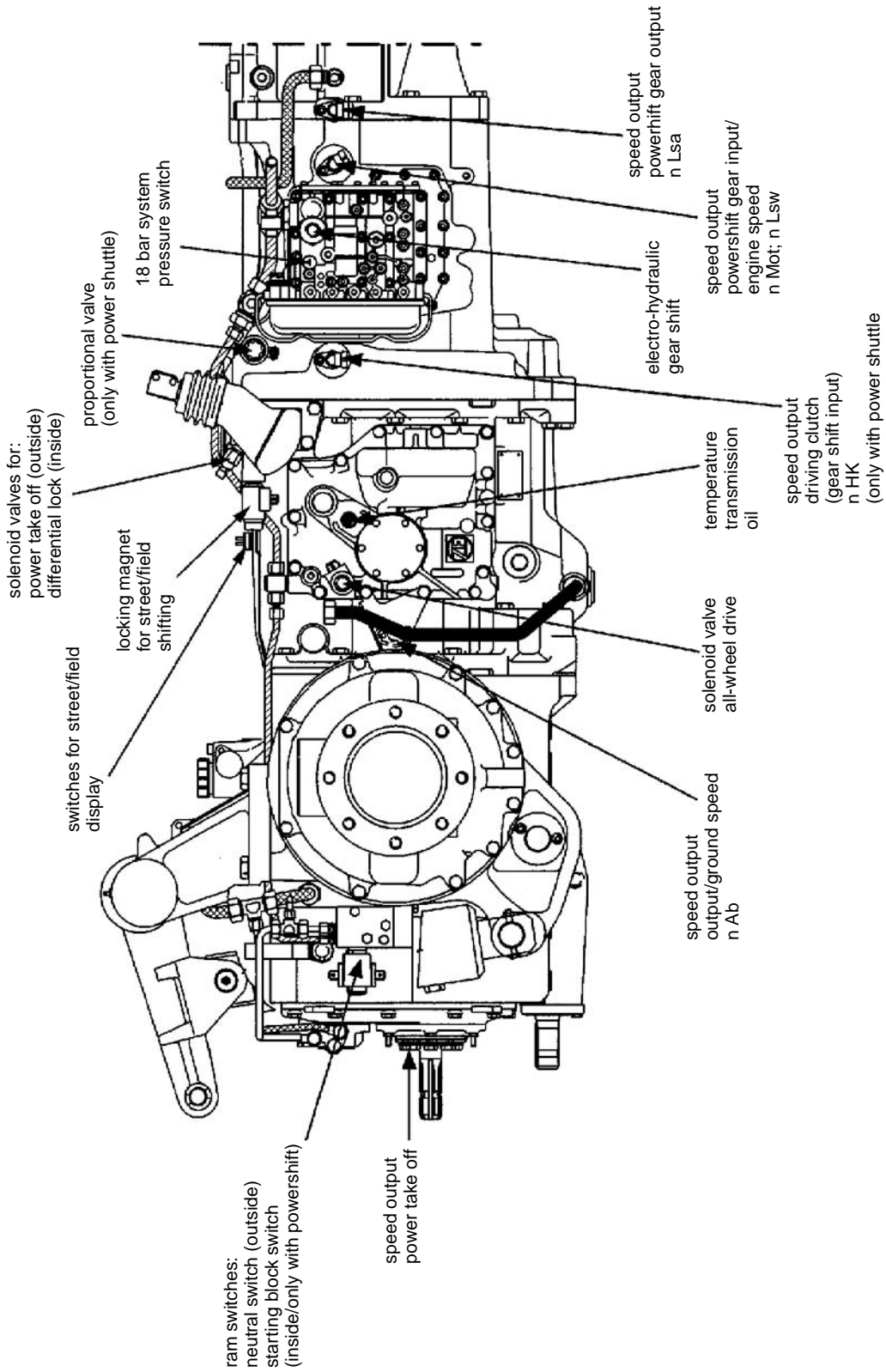
Code	Type of error/location	Possible error cause	Possible remedy	System reaction	Remarks
F0	pin code (T71/T72)	wrong control unit (T71/T72) LU, KM, K+	replace control unit initialisation (ignition on) check cabling	permanent neutral upon evaluated	pin code is only upon initialisation can only be quit by means of ignition off/on
F1	EEPROM data inconsistent	error in the EEPROM T7100 vehicle equipped with T7200 E-box or vice versa EEPROM defective	ignition off/on check E-box T7100/T7200 carry out end-of-line programming	permanent neutral,	can only be quit by means of ignition off/on vehicle version or EEPROM configuration within a BE block inconsistent, faulty
F2	V valve (LU, KM)	LU, KM valve defective	check cabling check valve	permanent neutral, permanent beep	LU, KM is diagnosed when valve is shut off
F3	V valve (K+)	K+ valve defective	check cabling check valve	permanent neutral, permanent beep	K+ is diagnosed when solenoid valve is switched on
F4	R valve (LU, KM)	LU, KM valve defective	check cabling check valve	permanent neutral, permanent beep	LU, KM is diagnosed when valve is shut off
F5	R valve (K+)	K+ valve defective	check cabling check valve	permanent neutral, permanent beep	K+ is diagnosed when solenoid valve is switched on
F6	F/R preset switch	LU, KM, K+ F/R preset switch defective	check cabling check F/R preset switch	3 beeps when clutch disengaged: permanent neutral, permanent beeps	upon invalid signal > 0,5 sec when clutch is defective: permanent neutral
FA	5V supply (Clutch sensor, Temperature sensor)	K+ at 5VREF supply multiple error	check cabling check cabling Nisa, temperature sensor, clutch sensor	permanent neutral, permanent beep	U _{max} = 6V in case of AMUX overdrive: permanent neutral error will not be reset after detection can only be quit by means of ignition off/on

Code	Type of error/location	Possible error cause	Possible remedy	System reaction	Remarks
FB	end-of-line data defective	ESGT7 electronic "new" terminal 30 defective during EEPROM writing process EEPROM defective	carry out end-of-line programming	permanent neutral, permanent beep	both BE blocks are defective, no restoration possible
FC	supply VPS outputs (switched plus) defective	KM at the MV supply K+ at an output (AD1...AD9) upon power on K+ at the MV supply upon power on	check cabling (MV supply)	permanent neutral shift upon KM: permanent beep, 3 beeps	counter supply (K+) is only detected upon power on! error will not be reset after detection indication in error memory about output causing K+ "relay" is not activated upon power on Caution: If counter supply occurs at the MV supply during operation ignition "off" cannot be detected any more permanent beep, 3 beeps in case of KM depending on the short circuit current (relay cut off)

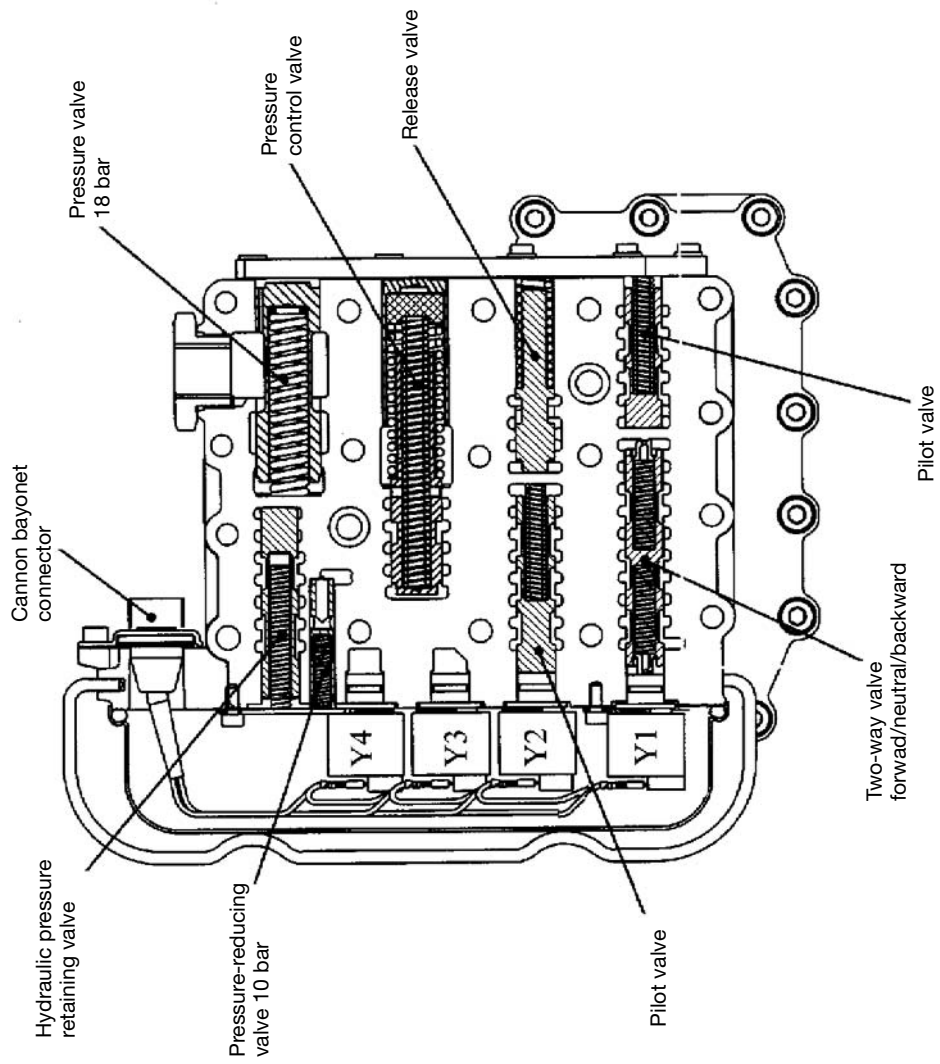
OTHER INFORMATIONS

Error consequence/System reaction	Possible error cause	Possible remedy
no display activation resp. display "EE"	ZF electronic system is not running up communication line defective power supply (plus, ground) defective	check supply paths (battery voltage < 9V), LU, KM check fuses (term15, term30) check communication lines
upon start-up powershift gear switches back immediately to neutral (jerk can be observed), display: "N", but no error code	cabling speed sensor Nmot LU, KM, K+	check cabling speed sensor Nmot

3.5 SENSORS AND SOLENOID VALVES AT THE TRANSMISSION T-7100

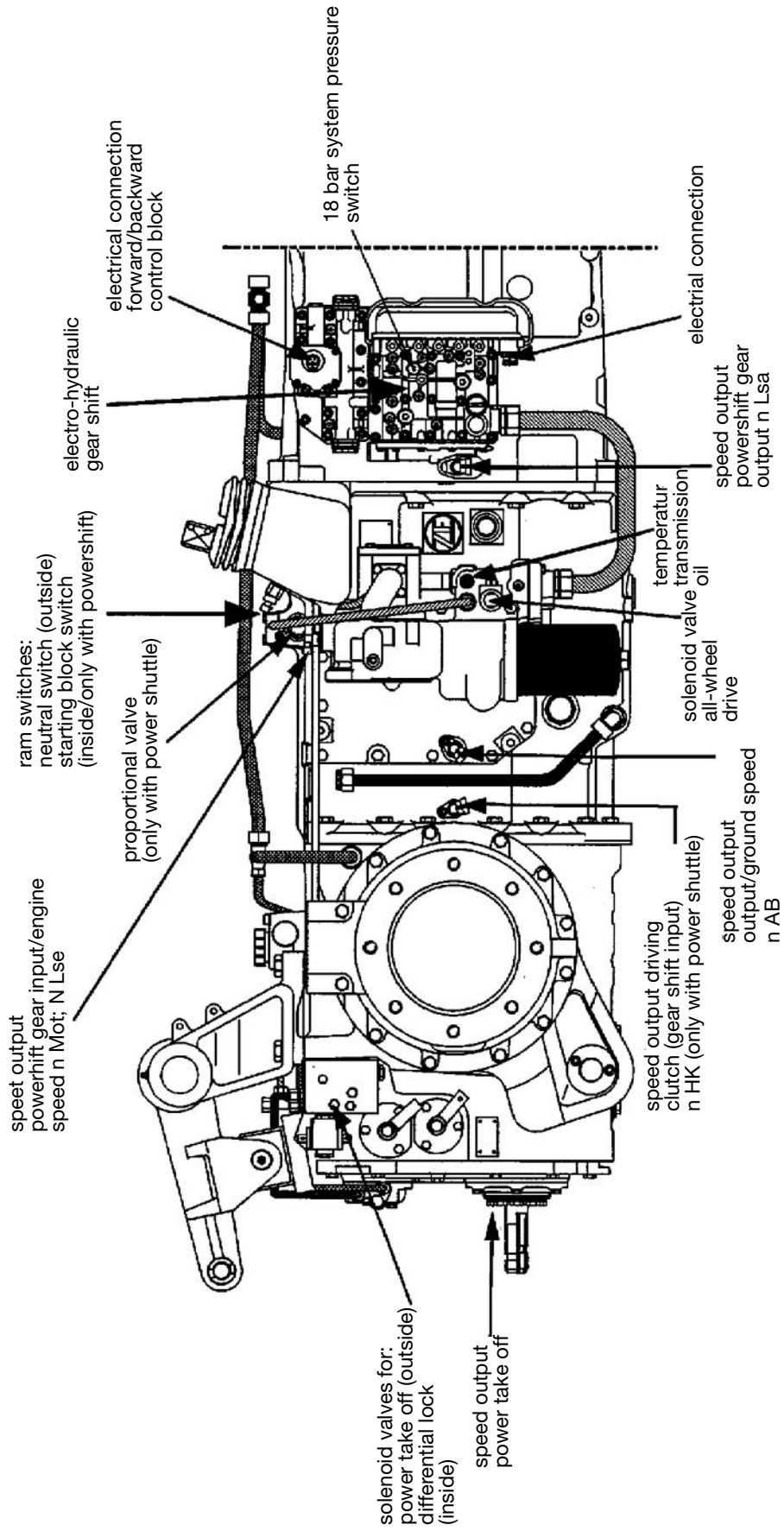


3.6 ELECTRO-HYDRAULIC GEAR SHIFT T-7100

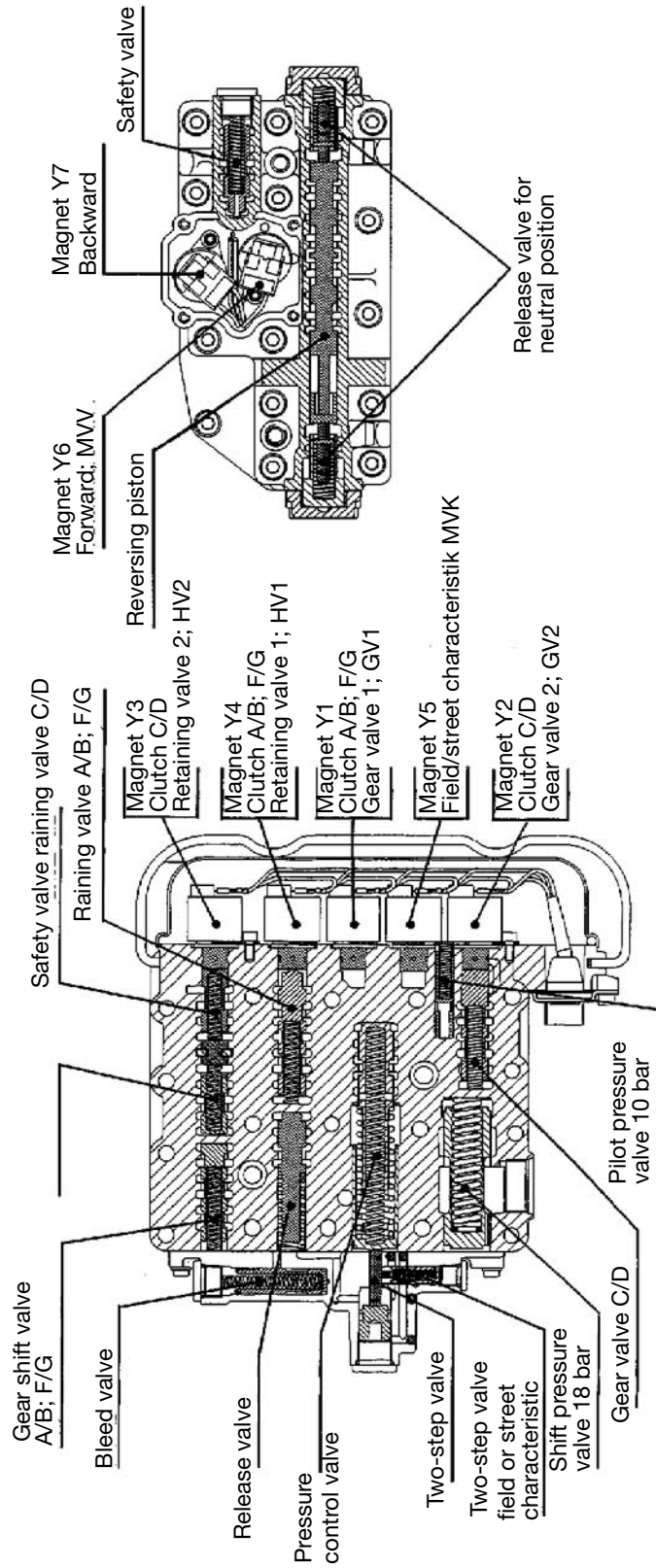


Solenoid valves Y1 – Y4:
 Y1 = MVR; solenoid valve backward
 Y2 = GV1; transfer valve 1
 Y3 = MVV; solenoid valve forward
 Y4 = GV2; transfer valve 2

3.7 SENSORS AND SOLENOID VALVES AT THE TRANSMISSION T-7200



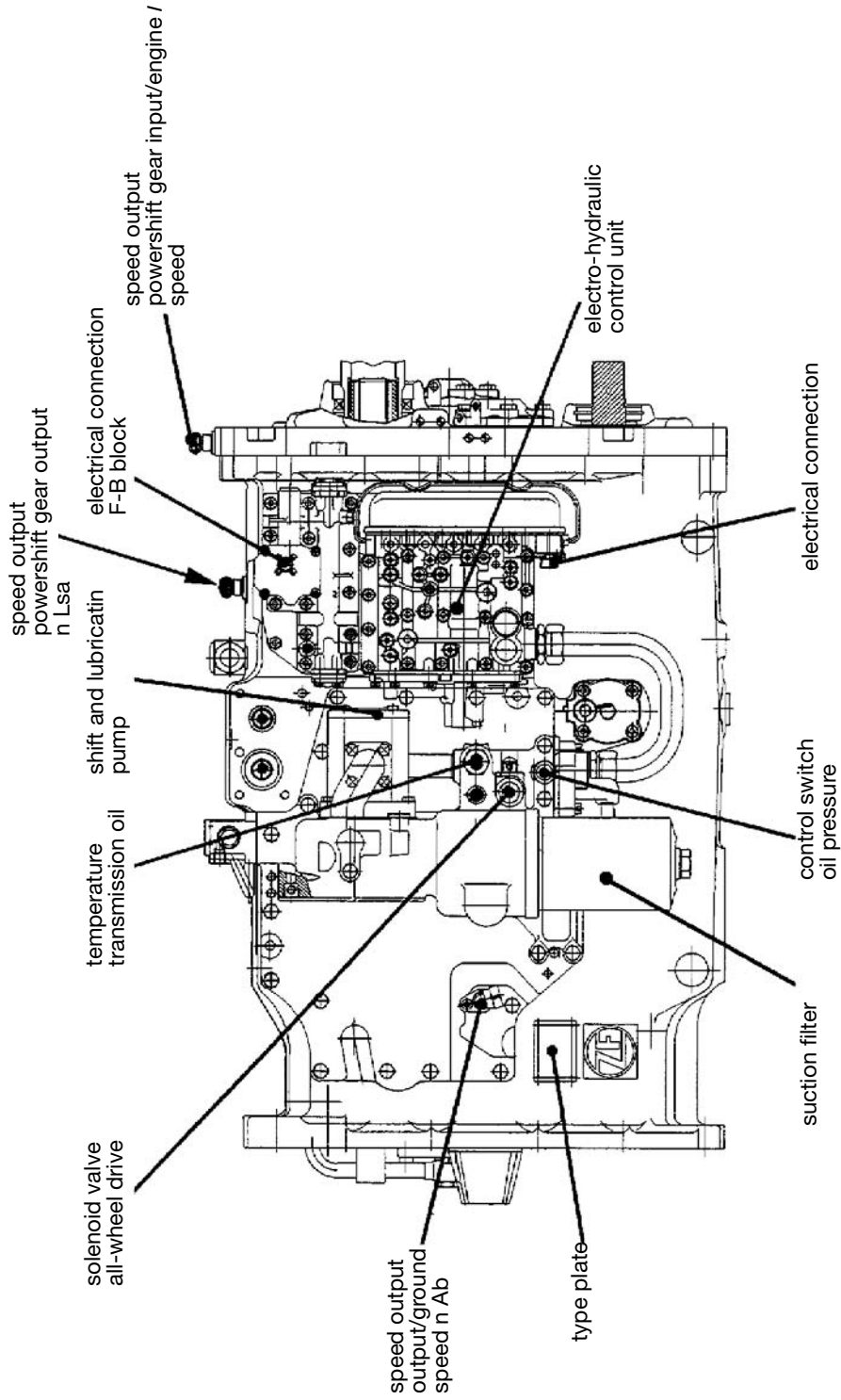
3.8 ELECTRO-HYDRAULIC GEAR SHIFT T-7200 / T-7300



4-GEAR POWERSHIFT CONTROL UNIT

FORWARD-BACKWARD CONTROL BLOCK

3.9 SENSORS AND SOLENOID VALVES AT THE TRANSMISSION T-7300



3.10 ERROR ANALYSIS

Interchanging of electrical connectors at the transmission T-7100 L and T-7200 L

Various sensors/solenoid valves/switches at the transmission are located very close to each other and are equipped with the same type of connector. At these locations the electrical mating connectors at the cable harness cannot be layed in a way which ensures that accidental interchanging may be absolutely excluded.

The following consideration shows the consequences if electrical connectors are interchanged:

3.10.1 SOLENOID VALVE AND TEMPERATURE SENSOR T-7100 L AND T-7200 L

Both elements are equipped with Jet-Tronic connectors; distance approx. 75 mm with T-7100 and 55 mm with T-7200.

VA plug on temperature sensor and VA – SV "OFF"

- All-wheel "OFF" \pm 12V voltage at temperature sensor
- Error code on display
- Electronic system shifts gear to permanent neutral
- Vehicle cannot be moved any more!

VA plug on temperature sensor and VA – SV "ON"

- All-wheel "ON" \pm 0V voltage at temperature sensor
- Error code on display; temperature sensor defective
- Hard gear shifts (5V supply in electronic system is overloaded, but short circuit proof)

Temperature sensor plug on VA – SV

- Error code on display; temperature sensor defective
- Hard gear shifts

3.10.2 STARTING BLOCK SWITCH AND NEUTRAL SWITCH T-7100 L AND T-7200 L

- Starting block switch normally closed contact "green"
- Neutral switch normally opened contact "red"

Both switches are equipped with 2-pole AMP superseal connectors of different colour (green/red)

Neutral plug on starting switch

- Error code on display

Neutral switch defective, standby driving is possible

Starting block on neutral switch

Neutral switch not closed = no synchro gear is shifted --> 510 W

- Starting relay is not picking up

Engine start-up not possible

Neutral switch closed = synchro gear is shifted --> 121 W

- Starting relay is picking up
- Engine start-up with gear engaged

LS transmission on "N"

Clutch actuation required for driving

Error code on display

Neutral switch defective, standby driving possible (also with non connected plug)

3.10.3 SV DIFFERENTIAL LOCK AND SV POWER TAKE OFF CLUTCH T-7100 L AND T-7200 L

Both valves are equipped with Jet-Tronic connectors; distance approx. 40 mm

Plug differential lock on SV power take off valve

- Interchanged functions upon switch actuation in cabin
- Power take off stub is running upon diff. "ON"

Upon ZW clutch "ON" and differential lock "OFF" the differential lock is engaged. Critical driving state with regard to safety, e.g. when driving in a curve, etc.

3.10.4 SPEED SENSORS INPUT/OUTPUT WITH T-7100 L

AMP superseal 3-pole connectors at both sensors, distance approx. 80 mm

Plug output on input sensor and vice versa

(both plugs are connected!)

Upon powershift step L and H

- Error message on display
- LS transmission in neutral

Upon powershift step M

- Error is not detected

No consequences

Only one plug is connected

OUTPUT not connected

- Error code on display

Standby driving possible

INPUT not connected

- Error code on display

- Plausibility

Standby driving possible

3.10.5 LOCKING MAGNET FIELD/STREET AND TEMPERATURE SENSOR T-7100 L

Both elements are equipped with Jet-Tronic connectors; distance approx. 115 mm

Locking magnet plug on temperature sensor

- Error see item 1.4.1

4. POWER-SHUTTLE DIAGNOSISPROGRAMM DEST 45

4.1 PREPARATIONS FOR TRANSMISSION DIAGNOSIS WITH DEST 45

As a preparatory measure the connection between tractor and computer needs to be established so as to check the transmission control by means of DEST 45 resp. to be able to carry out the end-of-line programming.

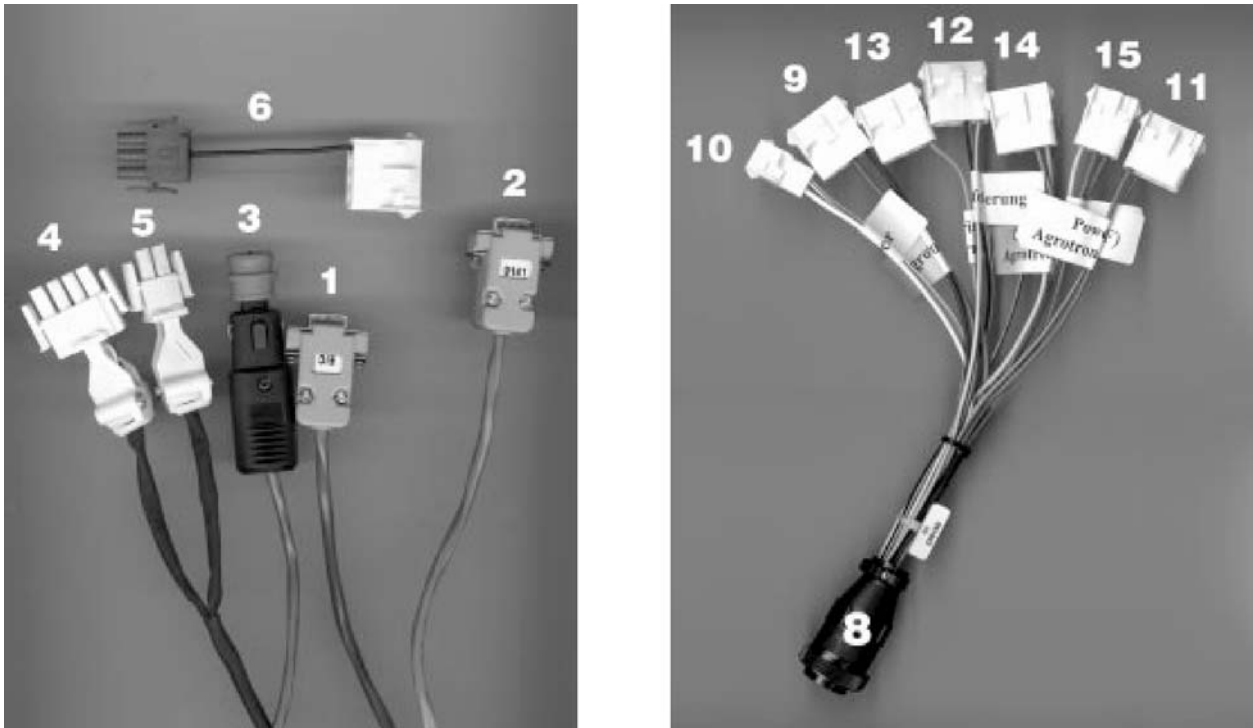


Fig. 23 - Interface cable and adapter cable

The interface cable and the adapter cable are serving for this purpose (see figure).

- 1 - Connect plug (2) of the interface cable with the designation "9141" to the computer (COM interface)
- 2 - Connect plug (3) of the interface cable for the 12 V supply to the cigar lighter
- 3 - Connect the 4-pole plug (4) of the interface cable to the plug (11) – designation "powershift Agrotron 4.70-6.45" – of the adapter cable
- 4 - Insert the central plug (8) of the adapter cable into the central diagnosis interface in the fuse box
- 5 - Switch ON ignition
- 6 - Start the computer and call the EDS program (compare item A 1.3 – Launching and terminating of the EDS program)
- 7 - Call **Option 1** in the initial menu
- 8 - Make sure that the right diagnosis program (DEST 345) is invoked. On the right side in the upper frame of the screen DEST 45 needs to be displayed, and below e.g. DEST 45 – V2.2 – 16.12.97. If necessary change to the main menu and launch DEST 45 via the menu item Control > DEST 45.



CAUTION!

Before starting the diagnosis verify that the proper interface (COM 1 or COM 2) is selected in the menu item Options!

4.2 DEST 45 PROGRAM DESCRIPTION

4.2.1 FILE >MAIN MENU

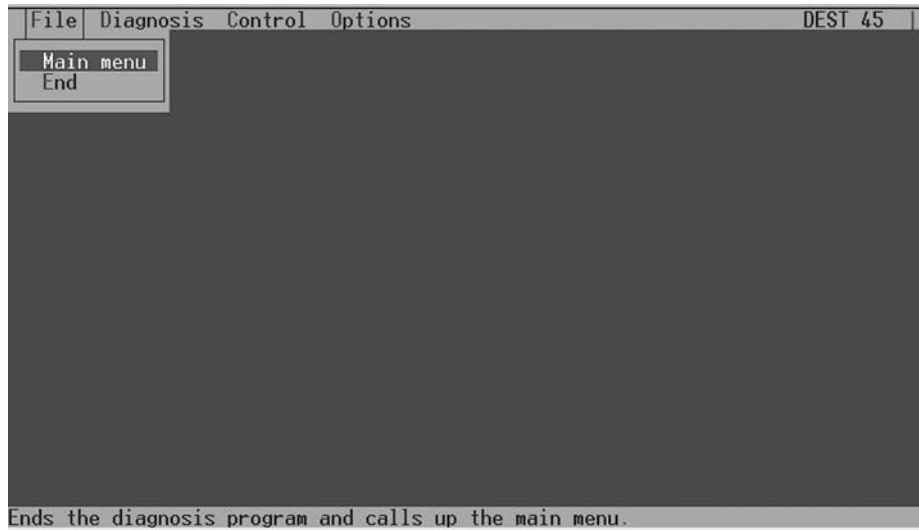


Fig. 24 - File >Main menu

- **File > Main menu**
Selecting this menu item quits the active control and calls the main menu in which the user can select the next control to be diagnosed or quit the program. All current settings are saved and upon the next start-up the main menu reappears.
- **File > End**
The menu item "End" saves the settings selected under the menu item "options" (colour palette, language and selected interface) and terminates the diagnosis program.
Upon the next start-up of the diagnosis program the settings are automatically taken over and the diagnosis program DEST 45 is called.

4.2.2 MENU DIAGNOSIS

- **Diagnosis > Read error memory**

The menu item "Read error memory" opens a window divided into two parts in which the contents of the error memory are displayed in chronological order.

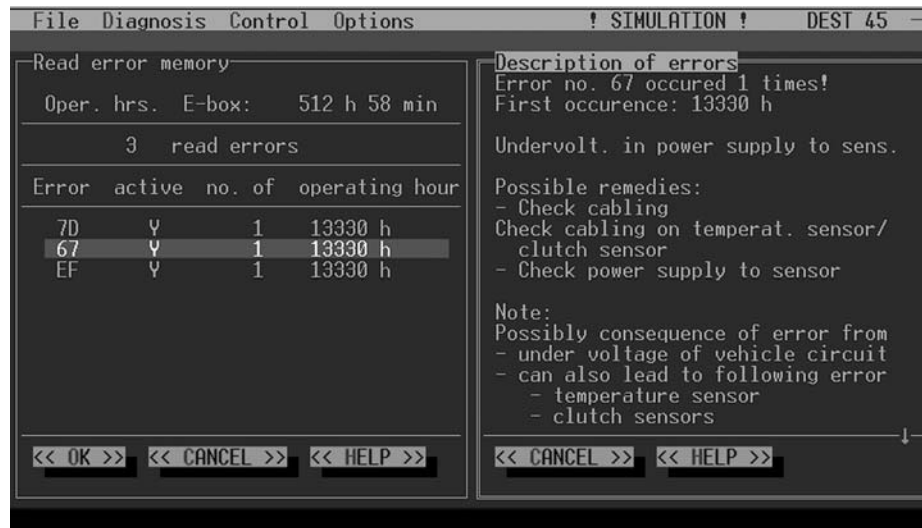


Fig. 25 - Read error memory

The double frame and the highlighted lines "Read error memory" resp. "Error description" show which part of the window is currently active.

In the left part of the window the current operating-hours of the transmission-E-box (not to be compared with the operating hours of the infocenter!) and the number of the various errors detected by the transmission-E-box are displayed. Below the errors stored in the E-box are indicated. In the column "Errors" the respective error codes are listed. The column "active" indicates the corresponding error status. "Y" stands for yes; i.e. the error is currently active – resp. "N" for no; i.e. the error is currently not active. The third column "Number" indicates how many times the respective error has occurred. The information under "Operating-hours" indicates when the respective error has occurred.

The user can select an error with the cursor keys and cause a detailed error description to be displayed on the right side of the screen by means of clicking on OK or pressing ENTER. The error text can be scrolled by means of the cursor keys if it exceeds the size of the right window.

Pressing of ESC or C reactivates the left screen window.

If the left window is active, all errors can be saved in a text file with their detailed description by means of pressing F2. In addition to the error descriptions the current operating-hours counter, the identification data, the current date as well as the vehicle identification number and the number of the electronic box are saved. However, vehicle identification number and number of the electronic box can only be saved if the corresponding entry in the EEPROM is valid.

- **Diagnosis > Delete error memory (Cancellazione memoria errori)**

“Delete error memory” opens a window which prompts the user to confirm the deletion of the error memory.

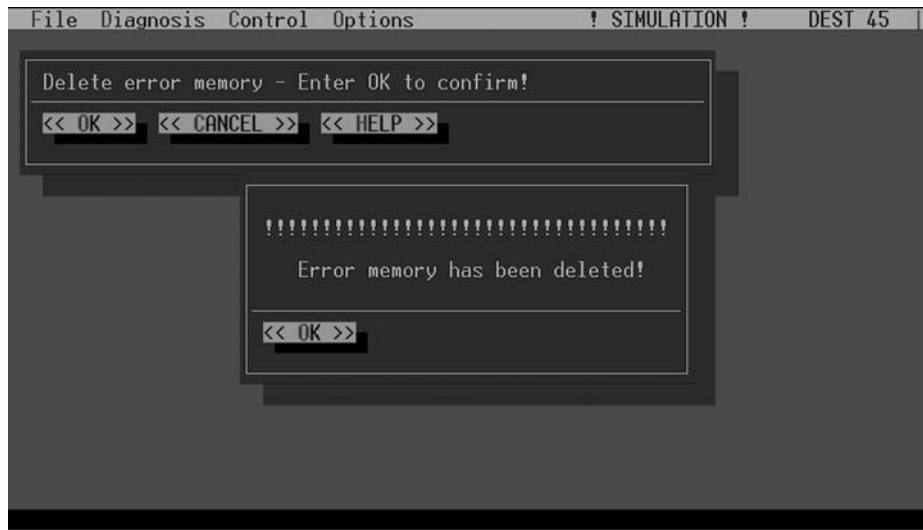


Fig. 26 - Delete error memory

- **Diagnosis > HEX data display**

This menu item is not relevant for diagnosis, as only internal data in hexadecimal notation are displayed here.

On selection of the menu item HEX data display a window appears, in which the user can enter up to four hexadecimal addresses (see figure). In addition to the address data the user has to enter the number of bytes (maximum 12) he wants to read at this start address. On confirmation with OK their contents are dumped on the screen..

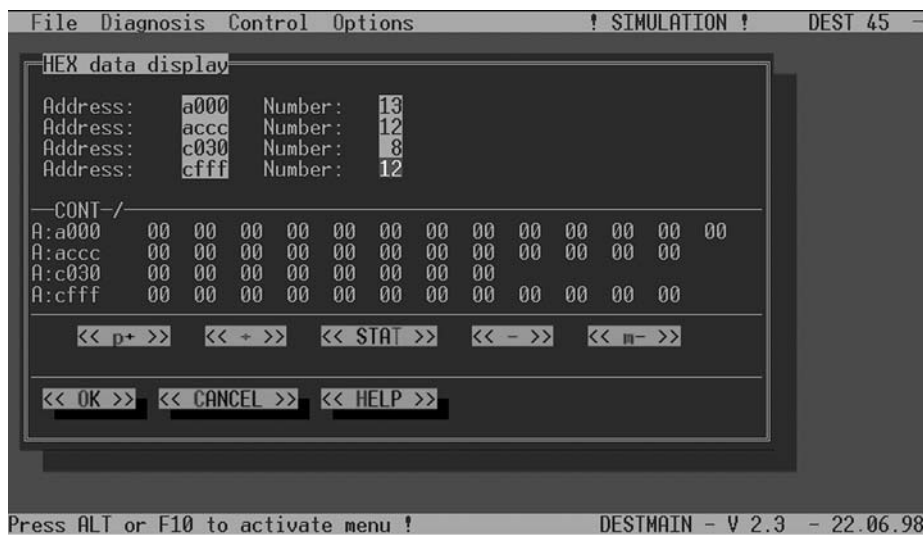


Fig. 27 - HEX data display

With << + >> / << - >> the start addresses are incremented resp. decremented by one.

With << ++ >> / << -- >> the start addresses are increased resp. decreased by 12 (decimal).

With << CONT >> the contents are read continually (default). Selection of this button causes the label to change to “<< STAT >>”. Reselection toggles again.

Pressing the key ESC (or ALT + C) quits this menu item.

- **Diagnosis > Plaintext data display**



CAUTION!

After selecting the menu item "End-of-line programming" the ignition on the vehicle needs to be switched off and on again in order to update all data in the window "Plaintext data display"!

Plain text data display opens a window in which the data are converted and displayed in their corresponding physical units. The structure and contents of the window are shown in the figure below.

By pressing the key "T" it is possible to toggle between continuous display and static display.

The current status is indicated left at the top of the window as CONT (for continuous display) resp. STAT (for static display).



Fig. 28 - Plaintext data display

It is possible to switch between the individual windows for digital inputs, digital outputs, sensor errors and internal variables by means of the select fields (buttons) << DIG_IN >>, << DIG_OUT >>, << ERRORS >> and << INTERNAL >> (also compare "DEST 38 program description"). The window for speeds/drive information is always visible.

Possible errors are indicated in each individual window.

In case of continuous display a rotating dot indicates which variable resp. which value is currently being refreshed. Charts with descriptions about matching internal pin assignments and for the contacts of the E-box for the respective windows can be called by means of pressing the keys F3 and F4.

Pressing the key ESC (or C) quits this menu item.

- **<< DIG_IN >> Digital inputs**

Upon selecting << DIG_IN >> a list of the digital inputs appears on the right side of the screen together with their corresponding addresses and values. So in the continuous display mode (CONT) it is possible to check whether the respective signal is being transferred in to the E-box.

Tip plus Powershift plus at the gear lever

Tip minus Powershift minus at the gear lever

FS neutral Drive switch (power-shuttle lever) in neutral position

FS forward Drive switch (power-shuttle lever) in forward position

FS reverse Drive switch (power-shuttle lever) in reverse position

System pressure 18 bar system pressure switch

HK pedal switch Proximity switch at main clutch pedal

Pin code 1 Set to value 1 if type of transmission is T7100

Pin code 2 Set to value 1 if type of transmission is T7200

Gear sync transm Starter inhibit switch at control console

Starter inhibit Push-button switch at drive switch (POWER-SHUTTLE lever)

- << DIG_OUT >> Digital outputs

Upon selecting << DIG_OUT >> a list of the "digital outputs" appears on the right side of the screen together with their corresponding addresses and values. So in the continuous display mode (CONT) it is possible to display the output signals of the E-box.

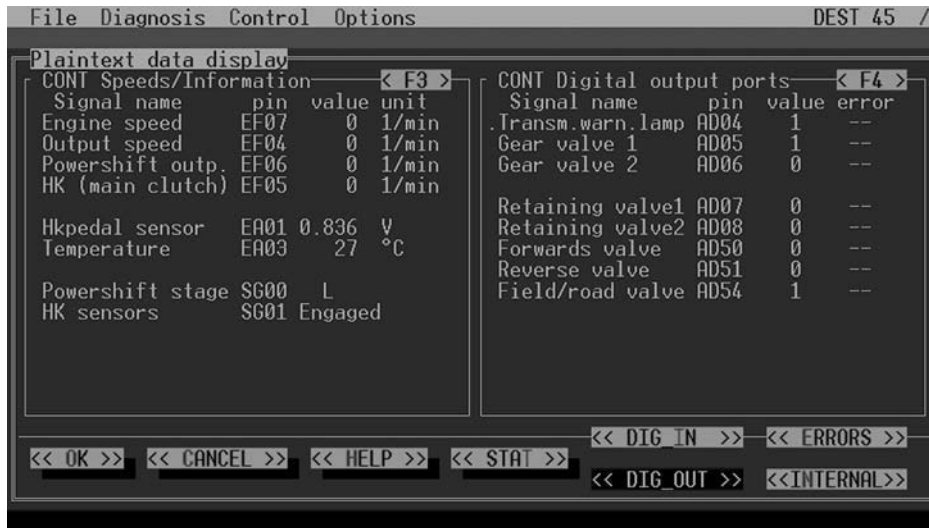


Fig. 29 - Digital outputs

- << ERRORS >> Sensor errors

Upon selecting << ERRORS >> a list of the sensor errors appears on the right side of the screen.

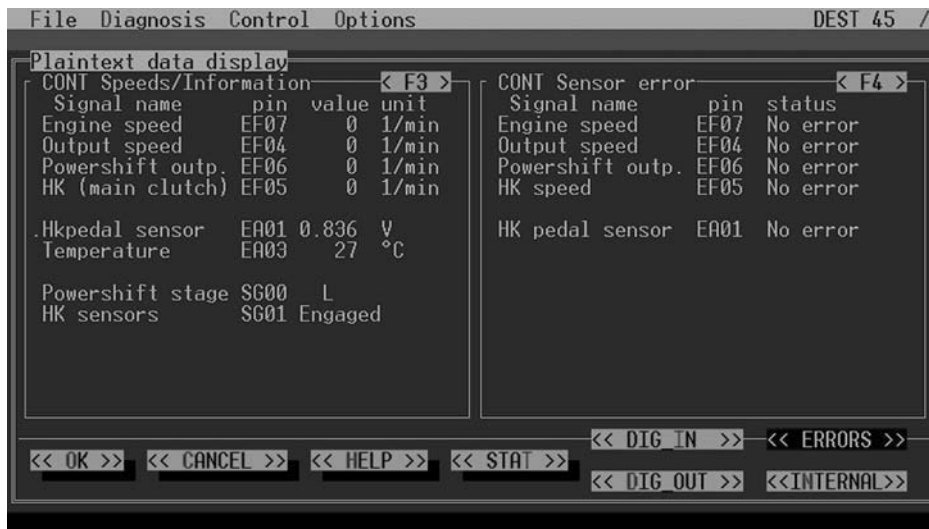


Fig. 30 - Sensor errors

• << INTERNAL >> Internal variables

Upon selecting << INTERNAL >> a list of the "internal variables" appears on the right side of the screen together with their values and physical units. All displayed values are calculated by the E-box.

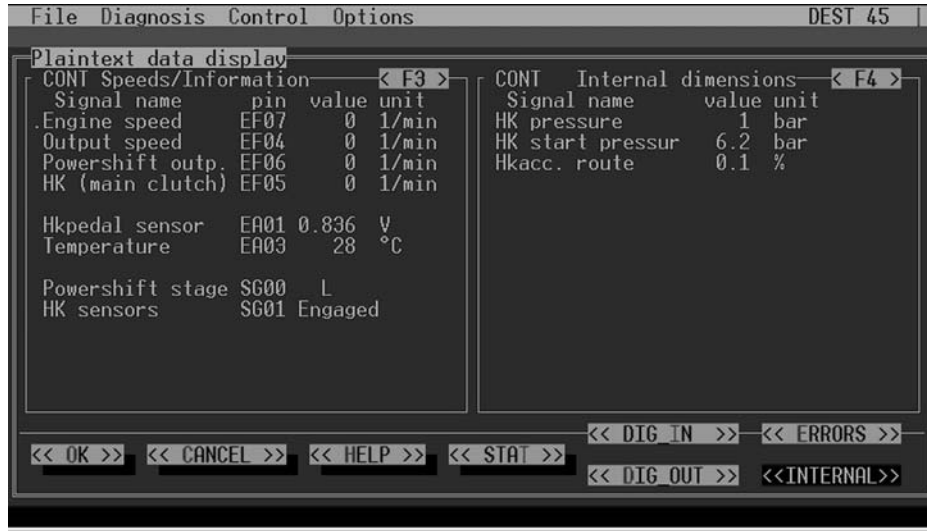


Fig. 31 - Internal variables

- HK pressure** Pressure at the main clutch (calculated by means of measuring the current which flows to the proportional valve)
- HK contact pres** Contact pressure of the main clutch evaluated during end-of-line programming
- HK pedal position** Position of the clutch pedal (calculated from the voltage level of the angle sensor at the clutch pedal)

• Diagnosis > Set output ports



CAUTION!

- Due to safety reasons this menu item can only be selected when the engine has stopped!
- If the menu item "End-of-line programming" has been previously executed the ignition on the vehicle needs to be switched off and on again once. Otherwise the digital outputs cannot be activated!

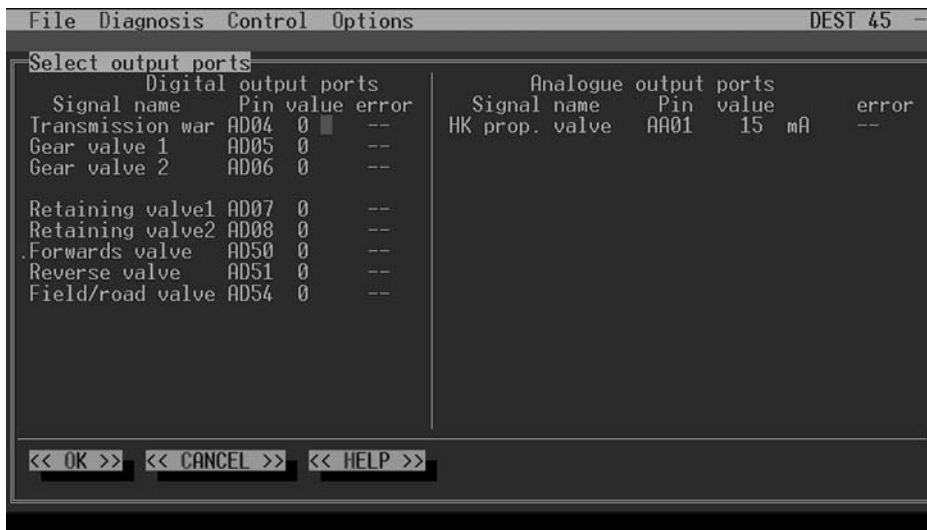


Fig. 32 - Select output ports

Via the menu item "Select output ports" it is possible to set or reset the individual digital outputs. After calling the menu item "Select output ports" a window appears in which the data of the individual outputs of the transmission-E-box are displayed. The outputs are indicated line by line.

Column 1: In this column the components activated by the respective output are indicated.

Column 2: In this column the internal addresses (pins) of the digital outputs are indicated.

Column 3: This column indicates the current status of the output: Hereby the indication "1" signifies that the output is set and therefore a signal (voltage) is existing at the corresponding pin of the E-box. The indication "0" signifies that the output is not set and therefore no signal is existing. Highlighted fields in different colours show to the user those outputs which are connected to the E-box and therefore are ready to be activated.

Column 4: In this column the user can select one of the connected outputs by means of the cursor keys, i.e. the desired field is highlighted in a different colour. This output status can be toggled (activated resp. deactivated) by pressing the ENTER key. The output will be set in the E-box and subsequently be read in again by the DEST program. Due to safety reasons the changes which have been carried out will be reset to the normal state after the menu item "Activate outputs" has been quit.

Column 5: In this column the errors of the digital outputs are shown. Thereby the letters "KM" signify a short circuit to ground and "LU" stands for a line interruption.

- **Diagnosis > EEPROM read/write**

This menu item allows the user to read and edit the customer area contents of the EEPROM. On selection a window appears in which the contents are shown (see figure). The user can alter individual characters with the help of the cursor keys and confirm these changes with <<OK>> (ALT + O or ENTER). Subsequent to every writing process into the EEPROM customer area an identification (date) is saved which can be read later on via the menu item Control > Information. This menu item can be quit by means of pressing the ESC key (or ALT + C).

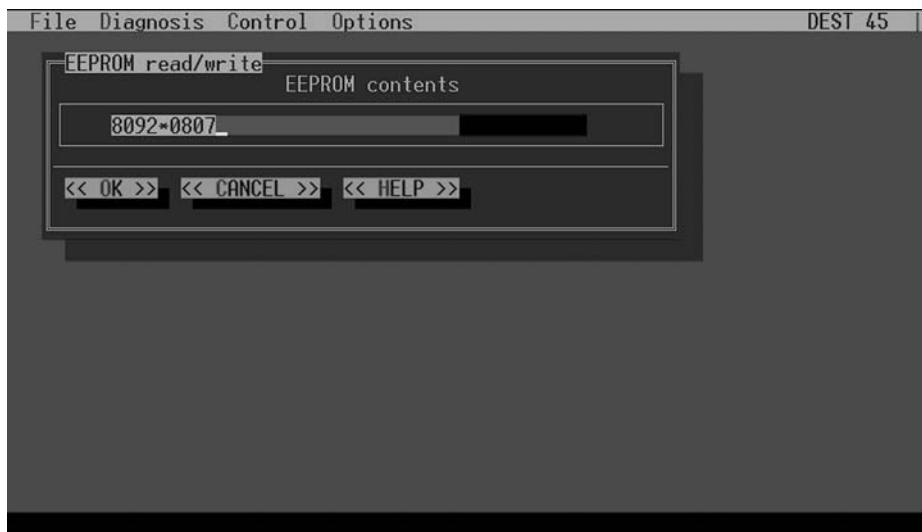


Fig. 33 - EEPROM read/write

The first nine characters of the customer area are highlighted in a different colour. The menu item "End-of-line programming" fills in the vehicle identification number into this area.

In case of storing the contents of the error memory into a file DEST 45 checks whether the first four characters of the EEPROM customer area correspond to a valid vehicle identification prenumber. If this is the case the vehicle identification number and the corresponding number of the electronic box will also be stored into the file. Otherwise both values cannot be stored.

Due to the aforementioned reasons this area should not be edited by the user himself. Therefore, upon opening the window the cursor is located at the position on the right beside it.

- **Diagnosis > Operating-hours counter**

This menu item enables the user to read and edit the contents of the electronic operating-hours counter. Subsequent to the initial input a window is opened in order to confirm the data. The input itself is to be carried out with decimal values in hours.

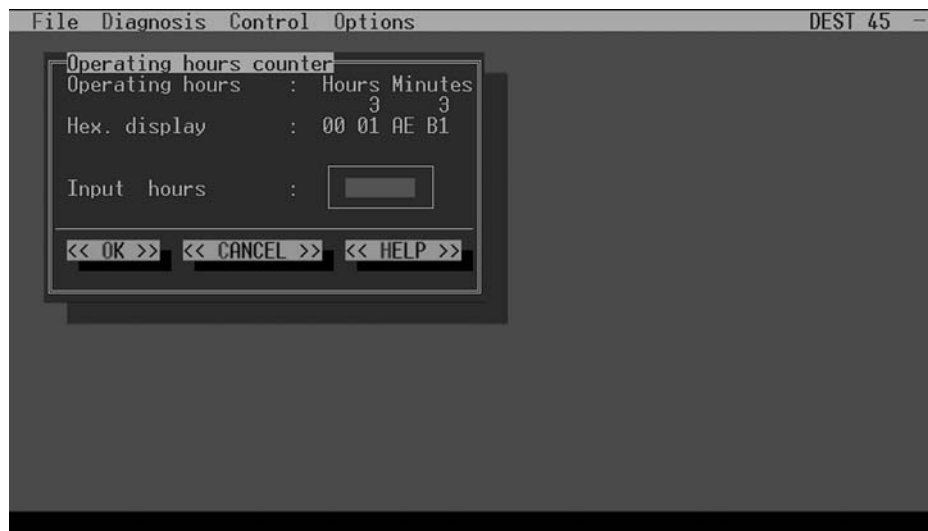


Fig. 34 - Operating-hours counter

4.2.3 CONTROL

The submenu "Control" contains the menu items "Information" and "End-of-line programming"

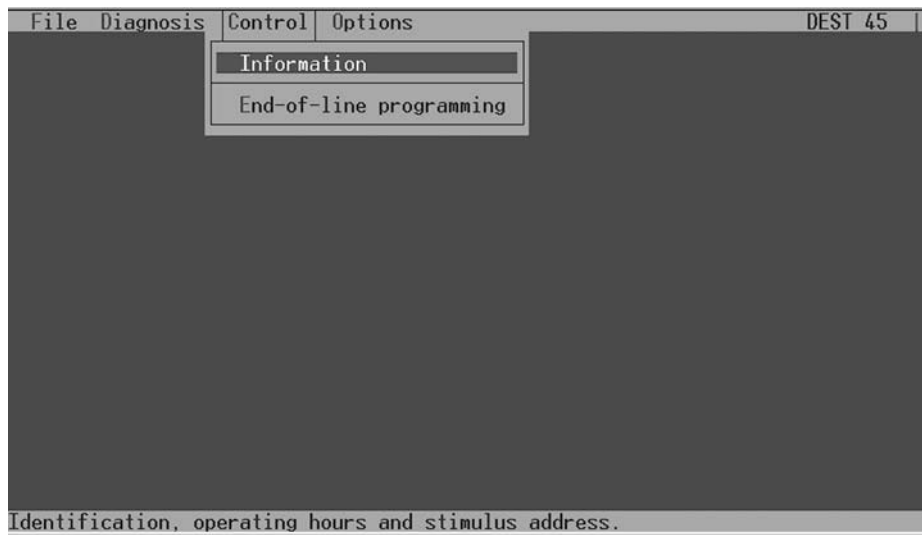


Fig. 35 - Control

- **Control > Information**

The menu item "Information" indicates in a window the operating-hours, the EEPROM login data, the control unit login data as well as the control unit identification data. These data cannot be edited.

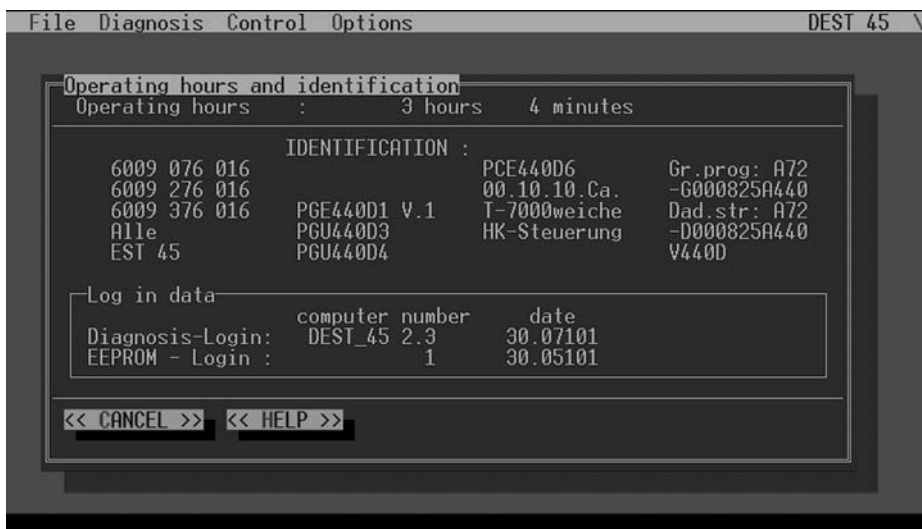


Fig. 36 - Information

- Control > End of line programming



CAUTION!

After terminating the menu item "Activate outputs" the ignition on the vehicle needs to be switched off and on again before the menu item "End-of-line programming" can be selected. Otherwise the call is aborted by prompting the error message "Select transmission version not possible!".

The menu item "End-of-line programming" opens a divided window for the purpose of configuration of the transmission box and for adjustment of the clutch. In the upper window area the configuration data is displayed. In the lower area the user can find instructions for the end-of-line programming.

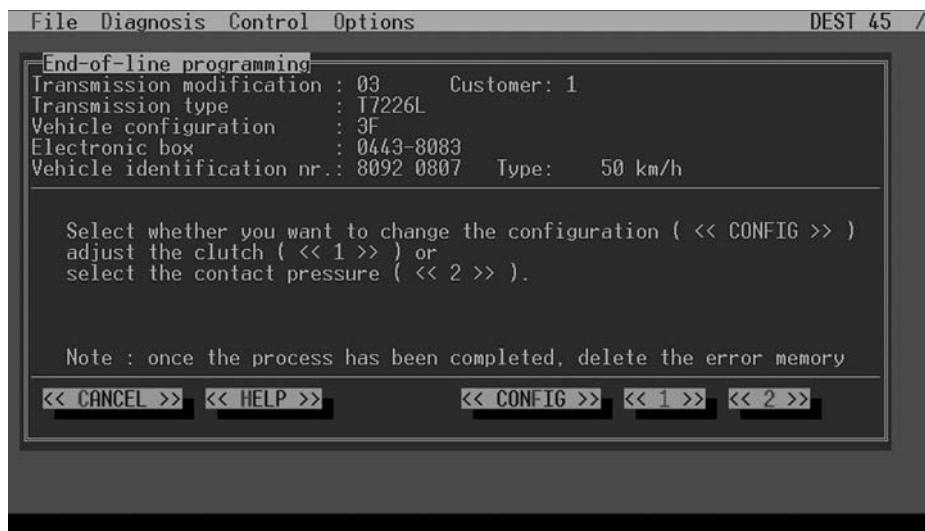


Fig. 37 - End-of-line programming

First the program reads the 8 digit vehicle identification number from the EEPROM. If the first four digits correspond to a valid vehicle identification prenumber the configuration data are read directly from the box. If the configuration data of the box are consistent to the corresponding data of the vehicle identification prenumber all data (transmission version, type of transmission, vehicle configuration, electronic box and vehicle identification number) will be displayed. If they are not consistent only the read out data from the control unit will be displayed. In addition, a warning will appear with instructions to reconfigure the box. The same applies if the vehicle identification prenumber read from the EEPROM is invalid.

The vehicle configuration can be changed by means of selecting the button << CONFIG >> or the letter "F". At first the vehicle identification prenumber (the first four digits of the vehicle identification number) is highlighted in a different colour. The vehicle identification number defined for the corresponding type of vehicle can be selected from a table stored in the program by means of the cursor keys. The configuration data belonging to the respective type of tractor are altered simultaneously.

Before these data are stored by pressing the ENTER key it is obligatory to compare the pre-set speed version (30 / 40 km/h or 50 km/h) with the actual speed version of the tractor. If these do not match the proper speed version has to be set by means of pressing the cursor keys again.

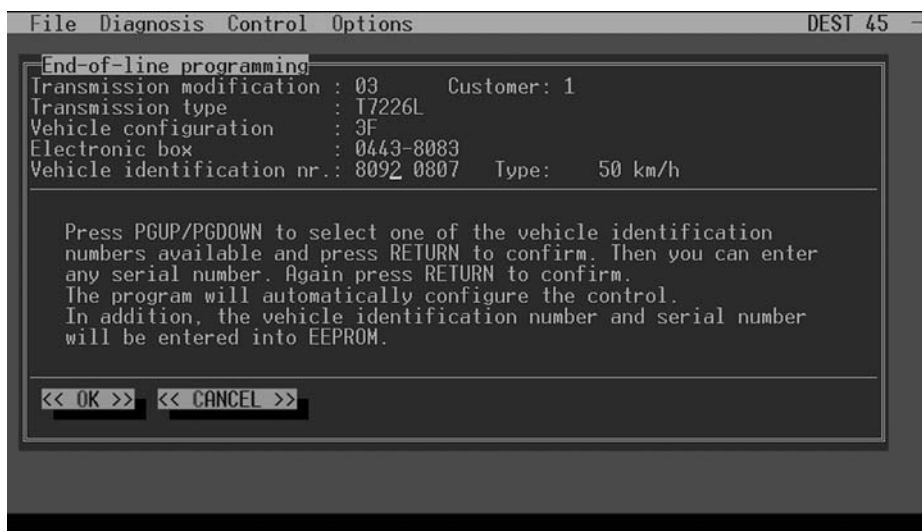


Fig. 38 - Select vehicle identification number

After pressing the ENTER key the last four digits of the vehicle identification number will be highlighted in a different colour. Here the user has to fill in the serial number of the tractor which is stored in the EEPROM by pressing the ENTER key.

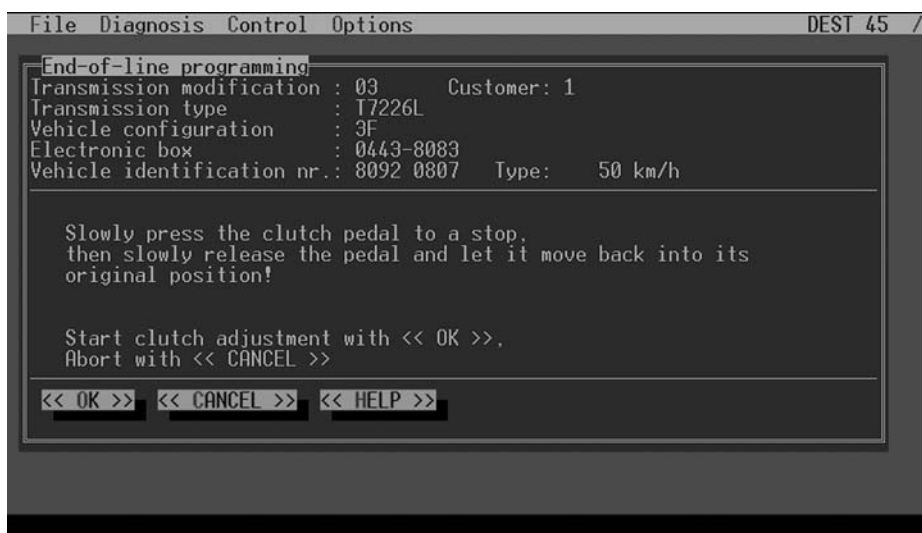


Fig. 39 - Clutch adjustment

Subsequently the transmission box will be configured with the corresponding data by activating << OK >> or pressing ENTER. In addition, the entire vehicle identification number will be written into the first nine bytes of the EEPROM customer area. If the configuration is completed the clutch can be adjusted by means of << 1 >>. If the instructions are executed the clutch adjustment is terminated with << OK >> (or ENTER) causing a message to appear whether the clutch adjustment was carried out successfully or not.

Determination of the contact pressure of the main clutch

In order to insure engaging without a jerk upon automatical reversing, the components transmission control unit (E-box), proportional valve and main clutch are to be coordinated by means of determining the contact pressure.

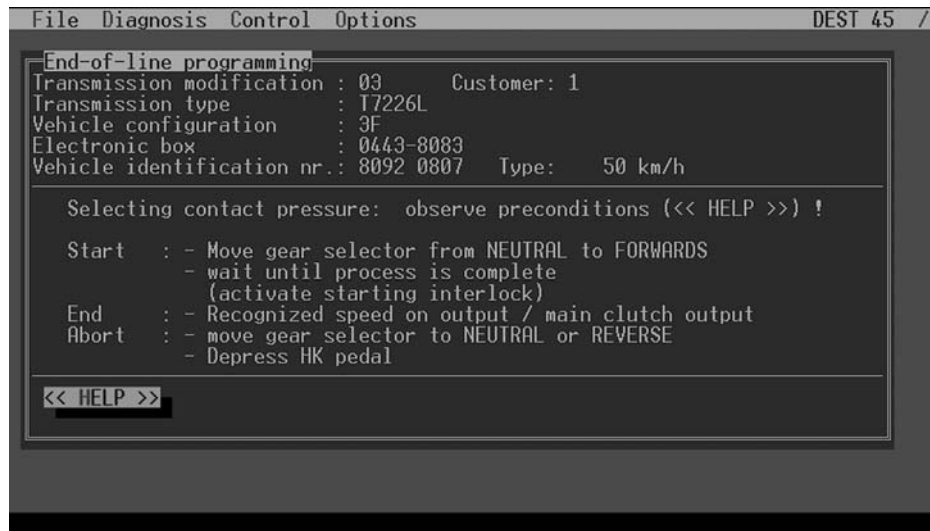


Fig. 40 - Determination of contact pressure



CAUTION!

As the vehicle starts moving on its own during the process, take care that there is sufficiently free space in front of the tractor!

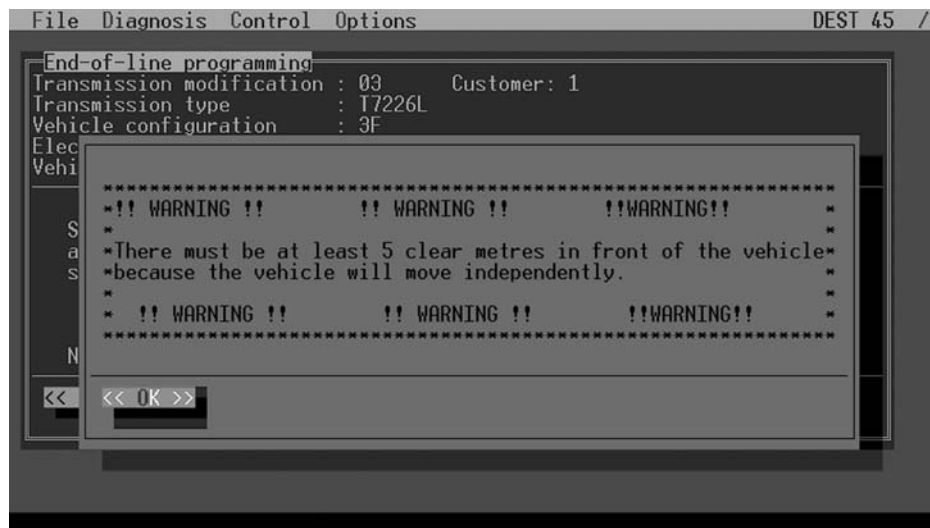


Fig. 41 - Safety note

The determination of the contact pressure is started by means of << 2 >>. For this purpose the following works need to be carried out:

- Remedy all pending errors at the power-shuttle system
- Warm up the tractor (transmission oil temperature at least 40 °C).
- Place the tractor on a solid leveled surface and move the drive switch into the neutral position. Let the engine run.
- Create a safety area with a size of at least 5 meters in front of the tractor which nobody is allowed to enter!
- Engage the gear (T7100 = 2. Gear; T7200 = 3. Gear).
- Connect the computer, boot the system and call "Control > End-of-line programming". The determination of the contact pressure is started by means of << 2 >>.

- Further instructions can be directly taken from the <<HELP>> file stored in the computer. After quitting the help file the determination of the contact pressure is carried on according to the instruction.
- During the calibration process the pressure in the main clutch upon which frictional connection occurs is determined. Hereby the tractor moves about 0,5 m forward on its own. Simultaneously the E-box detects the "speed at the output of the main clutch" and terminates the determination of the contact pressure.
 - > **Contact pressure T 7200 5,0 – 8,0 bar**
 - > **Contact pressure T 7100 6,0 – 9,0 bar**
- The determined value is stored in the transmission control unit (E-box) by means of switching the ignition off and on again and can be looked up in the plain text display under << INTERNAL >>.

Leaving end-of-line programming:

The end-of-line mode is quit by pressing C (or ESC). The determined values are stored in the EEPROM by means of switching the ignition off and on again.

4.2.4 OPTIONS

The option menu offers the user the possibility to alter the program environment. All settings executed under this menu item are saved when the program is terminated.

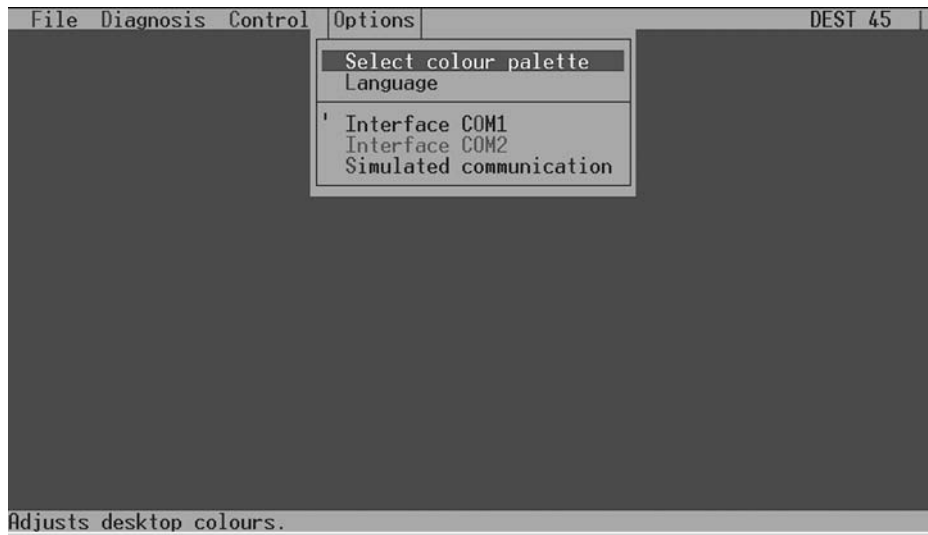


Fig. 42 - Options

- **Options > Colour palette**

In this menu item settings for the appropriate screen colours can be selected. All possible palettes can be selected by means of the cursor keys and be shown in a preview. The selected colour palette is retained by means of pressing ENTER.

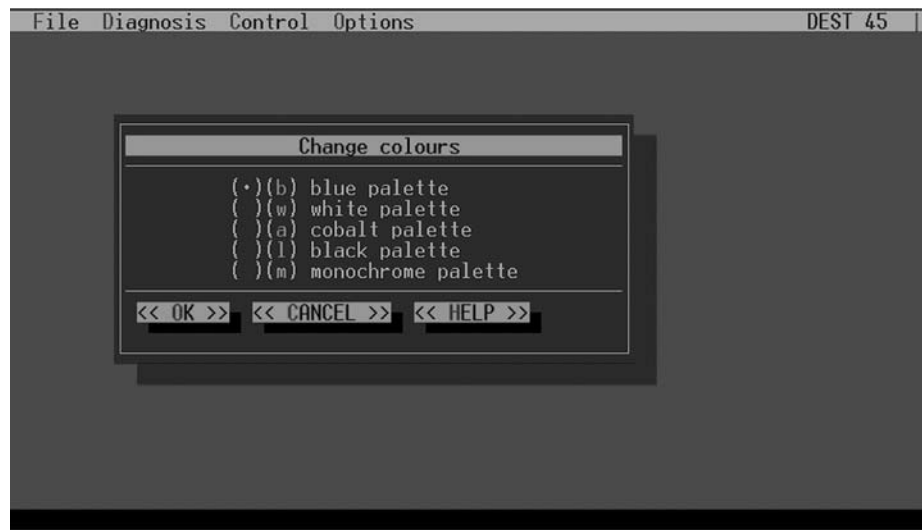


Fig. 43 - Change colours

- **Options > Language**

In the submenu "Options – Language" another language can be selected. After confirming with ENTER (resp. ALT + O) all screen texts are displayed in the selected language.

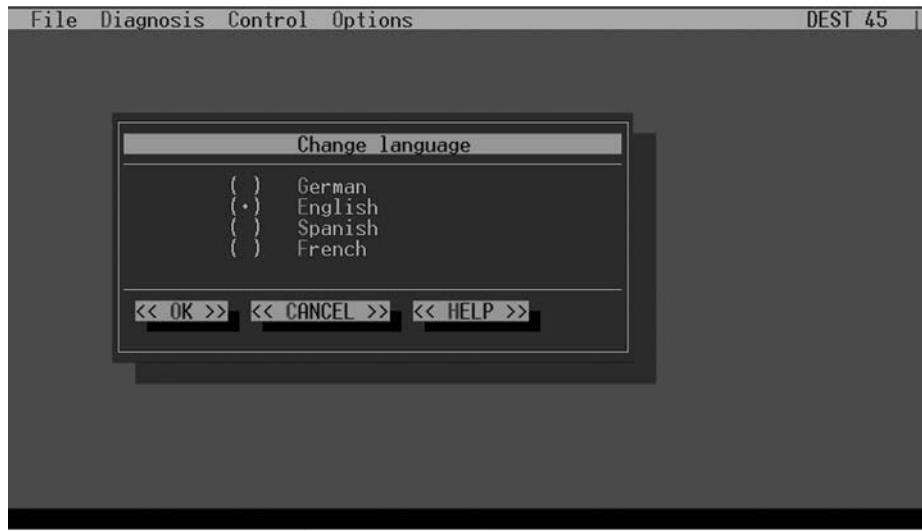


Fig. 44 - Change language

- **Options > Interface COM 1**

By selecting one of the two menu items the communication with the box is carried out via the corresponding interface. The selected interface is marked.

Only an interface actually available on the computer can be selected!

- **Options > Simulated communication**

Selecting this menu item causes allows most of the program functions to be called without a connection to a transmission control unit. For this purpose the program EDS simulates the communication between computer and transmission box. However not all the functions are currently executable with simulated control.

4.3 ERROR CODES POWER-SHUTTLE /DEST 45

Legend error code list T7x00 V/R-auto EST 45

Validity: V410 (IV) version

General

In case of a multiple error only the error code with the highest external error number will be displayed on the screen. Simultaneously the error symbol "wrench" appears on the display. The external error numbers are sorted according to the severity of the required reaction upon an error.

Rough sub-division of the external error number

0 ...9 reserved for operation indications

10 ...99 Operation mode normal, operation mode stand-by strategy, operation mode limp home, operation mode emergency operation, operation mode vehicle shut-down (except for EE), operation mode permanent neutral

Abbreviations

- LU Line interruption
- KM Short circuit to ground
- K+ Short circuit to vehicle electrical system plus general
- Nmot Speed at powershift gear input (=nLSE)
- nLSA Speed at powershift gear output
- nHK Speed at main clutch output
- nAB Speed at output, ground speed
- HK Main clutch
- HKPed Main clutch pedal
- ED Digital input
- EU Analog input voltage (U)
- ER Analog input resistance (R)
- EF Frequency input (F)
- AU Voltage output (U) (plus supply sensor system)
- VMG Ground supply transmitter (sensor system)
- VMGA Ground supply transmitter analog (sensor system)
- ADM Digital output ground
- AIP Current output (I) proportional
- VPS Plus supply (actuator system)

4.4 DISPLAY POWERSHUTTLE

Error code	Drive program	Significance/function
10-20	Normal driving	Non-critical error, tractor can be operated normally. Start-up / change of directions possibly delayed or only by jerks.
21	Normal driving	Ground speed too high. Reduce ground speed until error code disappears. If the error code is not disappearing contact a DEUTZ-FAHR workshop.
22	Normal driving	Transmission oil temperature too high. Reduce tractor load until error code disappears. If the error code is not disappearing contact a DEUTZ-FAHR workshop.
27-41	Limited driving	Powershift bloccato.
47-58	Stand-by program (Limp home)	Powershifts are blocked. Conditions for starting upon change of directions: Commutator switch at least 1 second in neutral position upon standstill of tractor.
64-70	Emergency program	Powershifts are blocked. Driving clutch is not working – driving only possible by means of change of directions switch. Commutator switch at least 1 second in neutral position upon standstill of tractor. Contact a DEUTZ-FAHR workshop immediately and have the error be eliminated.
76-99	No driving possible	Contact the DEUTZ-FAHR after-sales service.

4.5 ERROR CODE LIST WITH DESCRIPTION

Code	Error location/error cause	System reaction	possible remedy	Remarks
11	EEPROM end-of-line data invalid (contact pressure)	Operation mode NORMAL Default contact pressure	Carry out/repeat HK adjustment	<ul style="list-style-type: none"> Generally upon "new" electronic system Self-preservation Reserve value Checks or plausibility invalid Both EEPROM blocks defective no automatic restoration possible
12	Temperature sensor LU, K+	Default value: cold (HK pedal holding time, splitter holding time, slip times) No change of operation mode	Check cabling Check temperature sensor Check sensor supply Check vehicle electr. system voltage	<ul style="list-style-type: none"> Possible sequence error from: K+ HK sensor K+ sensor supply AU1
13	Temperature sensor KM	Default value: cold (HK pedal holding time, splitter holding time, slip times) No change of operation mode	Check cabling Check temperature sensor Check sensor supply Check vehicle electr. system voltage	<ul style="list-style-type: none"> Possible sequence error from: K+ HK sensor K+ sensor supply AU1
14	Synchronous neutral switch plausibility (Start interlock switch)	No change of operation mode	Check cabling Check neutral switch (Start interlock switch) Check speed sensor/cabling Nab, Nhk	<ul style="list-style-type: none"> Self-preservation Plausibility circuit Nhk-SyncN-Nab
15	Warning light LU (Oil pressure/HK overspeed)	No change of operation mode	Check cabling Check lamp in disconnected state	<ul style="list-style-type: none"> Diagnosis only if configured LU can only be diagnosed
16	Warning light KM (Oil pressure/HK overspeed)	No change of operation mode	Check cabling Check supply warning light	<ul style="list-style-type: none"> Diagnosis only if configured KM can only be diagnosed in disconnected state
17	Warning light K+ (Oil pressure/HK overspeed)	No change of operation mode	Check cabling Check supply warning light	<ul style="list-style-type: none"> Diagnosis only if configured KM can only be diagnosed in connected state

Code	Error location/error cause	System reaction	possible remedy	Remarks
18	System pressure plausibility	Warning light is lighting No change of operation mode	Check oil pressure switch Check cabling Check system pressure Check speed sensor Nmot	<ul style="list-style-type: none"> Is only diagnosed if Nmot > Nmot threshold Switch closed if pressure is existing
19	Signal line display KM	On display "EE", permanent beep No change of operation mode	Check cabling Check display	<ul style="list-style-type: none"> Error code is not used
20	Signal line display K+	On display "EE", permanent beep No change of operation mode	Check cabling Check display	<ul style="list-style-type: none"> Error code is not used
21	Speed limit exceeded	Permanent beep as long as overspeed is existing No change of operation mode	Reduce driving speed	<ul style="list-style-type: none"> Diagnosis only if configured
22	Temperature exceeded	Upon exceeding 5x beep, subsequently 1x beep every 2 min.	Reduce load Shut down engine	<ul style="list-style-type: none"> Temperature monitoring only if configured Error code upon exceeding of max. permissible upper limit temperature Indication "temperature warning" is independent of EC priority
27	Characteristic line valve LU	Operation mode STAND-BY STRATEGY (Powershift blocked)	Check cabling Check valve Check valve supply (VPS2)	<ul style="list-style-type: none"> Possibly sequence error from LU VPS2 Only for T7200
28	Characteristic line valve KM	Operation mode STAND-BY STRATEGY (Powershift blocked)	Check cabling Check valve Check valve supply (VPS2)	<ul style="list-style-type: none"> Possibly sequence error from LU VPS2 Only for T7200
29	Characteristic line valve K+	Operation mode STAND-BY STRATEGY (Powershift blocked)	Check cabling Check valve Check valve supply (VPS2)	<ul style="list-style-type: none"> Possibly sequence error from LU VPS2 Self preservation Can also lead to error "VPS2-Plausi" (Int. EC:47) Only for T7200
30	Retaining valve 2 LU	Operation mode STAND-BY STRATEGY (Powershift blocked)	Check cabling Check valve Check valve supply (VPS2)	<ul style="list-style-type: none"> Only for T7200 Possibly sequence error from LU VPS2 LU can only be diagnosed in

Code	Error location/error cause	System reaction	possible remedy	Remarks
31	Retaining valve 2 KM	Operation mode STAND-BY STRATEGY (Powershift blocked)	Check cabling Check valve Check valve supply (VPS2)	<ul style="list-style-type: none"> Only for T7200 Possibly sequence error from LU VPS2 KM can only be diagnosed in disconnected state Self preservation
32	Retaining valve 2 K+	Operation mode STAND-BY STRATEGY (Powershift blocked)	Check cabling Check valve Check valve supply (VPS2)	<ul style="list-style-type: none"> Only for T7200 Possibly sequence error from LU VPS2 Self preservation Can also lead to error "VPS2-Plausi" (Int. EC:47) K+ can only be diagnosed in connected state
33	Retaining valve 1 LU	Operation mode STAND-BY STRATEGY (Powershift blocked)	Check cabling Check valve Check valve supply (VPS2)	<ul style="list-style-type: none"> Only for T7200 Possibly sequence error from LU VPS2 LU can only be diagnosed in disconnected state
34	Retaining valve 1 KM	Operation mode STAND-BY STRATEGY (Powershift blocked)	Check cabling Check valve Check valve supply (VPS2)	<ul style="list-style-type: none"> Only for T7200 Possibly sequence error from LU VPS2 KM can only be diagnosed in disconnected state Self preservation
35	Retaining valve 1 K+	Operation mode STAND-BY STRATEGY (Powershift blocked)	Check cabling Check valve Check valve supply (VPS2)	<ul style="list-style-type: none"> Only for T7200 Possibly sequence error from LU VPS2 Self preservation Can also lead to error "VPS2- Plausi" (Int. EC:47) K+ can only be diagnosed in connected state

Code	Error location/error cause	System reaction	possible remedy	Remarks
36	Transfer valve 2 LU	Operation mode STAND-BY STRATEGY (Powershift blocked)	Check cabling Check valve Check valve supply (VPS2)	<ul style="list-style-type: none"> Possibly sequence error from LU VPS2 LU can only be diagnosed in disconnected state (toggling only upon defined speed ratio)
37	Transfer valve 2 KM	Operation mode STAND-BY STRATEGY (Powershift blocked)	Check cabling Check valve Check valve supply (VPS2)	<ul style="list-style-type: none"> Possibly sequence error from LU VPS2 LU can only be diagnosed in disconnected state Self preservation
38	Transfer valve 2 K+	Operation mode STAND-BY STRATEGY (Powershift blocked)	Check cabling Check valve Check valve supply (VPS2)	<ul style="list-style-type: none"> Possibly sequence error from LU VPS2 Can also lead to error "VPS2-Plausi" (CE int.: 47) Self preservation
39	Transfer valve 1 LU	Operation mode STAND-BY STRATEGY (Powershift blocked)	Check cabling Check valve Check valve supply (VPS2)	<ul style="list-style-type: none"> Possibly sequence error from LU VPS2 LU can only be diagnosed in disconnected state (toggling only upon defined speed ratio)
40	Transfer valve 1 KM	Operation mode STAND-BY STRATEGY (Powershift blocked)	Check cabling Check valve Check valve supply (VPS2)	<ul style="list-style-type: none"> Possibly sequence error from LU VPS2 LU can only be diagnosed in disconnected state (toggling only upon defined speed ratio) Self preservation
41	Transfer valve 2 K+	Operation mode STAND-BY STRATEGY (Powershift blocked)	Check cabling Check valve Check valve supply (VPS2)	<ul style="list-style-type: none"> Possibly sequence error from LU VPS2 Can also lead to error "VPS2-Plausi" (CE int.: 47) Self preservation
47	nAB speed transmitter LU, K+	Operation mode LIMP-HOME	Check cabling Check speed sensor	<ul style="list-style-type: none"> Upon reversing demand neutral shifting, permanent beep Upon reversing standstill is not absolutely required!

Code	Error location/error cause	System reaction	possible remedy	Remarks
48	nAB speed transmitter KM	Operation mode LIMP-HOME	Check cabling Check speed sensor	<ul style="list-style-type: none"> Upon reversing demand neutral shifting, permanent beep Upon reversing standstill is not absolutely required!
49	nAB speed transmitter gradient (Plausibility)	Operation mode LIMP-HOME Check cabling Check speed sensor	Ignition off/on standstill threshold	<ul style="list-style-type: none"> Inadmissible speed discontinuity from transmitter failure threshold to Upon reversing demand neutral shifting, permanent beep Upon reversing standstill is not absolutely required!
50	nHK speed transmitter LU, K+	Operation mode LIMP-HOME	Check cabling Check speed sensor	<ul style="list-style-type: none"> Upon reversing demand neutral shifting, permanent beep
51	nHK speed transmitter KM	Operation mode LIMP-HOME	Check cabling Check speed sensor	<ul style="list-style-type: none"> Upon reversing demand neutral shifting, permanent beep
52	nHK speed transmitter gradient (Plausibility)	Operation mode LIMP-HOME	Ignition off/on Check cabling Check speed sensor	<ul style="list-style-type: none"> Inadmissible speed discontinuity from transmitter failure threshold to standstill threshold Upon reversing demand neutral shifting, permanent beep
53	nLSA speed transmitter LU, K+	Operation mode LIMP-HOME	Check cabling Check speed sensor	<ul style="list-style-type: none"> Upon reversing demand neutral shifting, permanent beep
54	nLSA speed transmitter KM	Operation mode LIMP-HOME	Check cabling Check speed sensor	<ul style="list-style-type: none"> Upon reversing demand neutral shifting, permanent beep
55	nLSA speed transmitter gradient (Plausibility)	Operation mode LIMP-HOME	Ignition off/on Check cabling Check speed sensor	<ul style="list-style-type: none"> Inadmissible speed discontinuity from transmitter failure threshold to standstill threshold Upon reversing demand neutral shifting, permanent beep
56	nMOT speed transmitter LU, K+	Operation mode LIMP-HOME	Check cabling Check speed sensor	<ul style="list-style-type: none"> Upon reversing demand neutral shifting, permanent beep
57	nMOT speed transmitter KM	Operation mode LIMP-HOME	Check cabling Check speed sensor	<ul style="list-style-type: none"> Upon reversing demand neutral shifting, permanent beep

Code	Error location/error cause	System reaction	possible remedy	Remarks
58	nMOT speed transmitter gradient (Plausibility)	Operation mode LIMP-HOME	Ignition off/on Check cabling Check speed sensor	<ul style="list-style-type: none"> Inadmissible speed discontinuity from transmitter failure threshold to standstill threshold Upon reversing demand neutral shifting, permanent beep
64	Clutch pedal sensory system plausibility Sensor/switch	Neutral shifting Operation mode EMERGENCY OPERATION HK pedal adjustment	Ignition off/on End-of-line programming Carry out/repeat permanent beep Check/adjust mechanical tolerance, Of the HK pedal sensory system Check cabling Check HK switch Check sensor supply Check sensor/switch LU, KM, K+	<ul style="list-style-type: none"> Switch point out of tolerance range Self preservation Upon neutral shifting HK pedal switch is closed with HK pedal in idle position HK pedal sensor signal: Idle: LOW stepped: HIGH
65	Clutch pedal sensory system LU, KM	Neutral shifting Operation mode EMERGENCY OPERATION	Check cabling Check sensor mounting Check sensor Check sensor supply	<ul style="list-style-type: none"> Upon neutral shifting permanent beep Possibly sequence error from: LU sensor supply (AU1) Limit values: Umin approx. 0,5V Umax approx. 4,5V
66	Clutch pedal sensory system K+	Neutral shifting Operation mode EMERGENCY OPERATION	Check cabling Check sensor mounting	<ul style="list-style-type: none"> Possibly sequence error from: EMERGENCY K+ temperature sensor or OPERATION K+ sensor supply AU1
66			Check sensor Check sensor supply	<ul style="list-style-type: none"> Upon neutral shifting permanent beep Limit values: Umin approx. 0,5V Umax approx. 4,5V

Code	Error location/error cause	System reaction	possible remedy	Remarks
67	Sensor supply undervoltage	Neutral shifting Operation mode EMERGENCY OPERATION	Check cabling Check cabling del sensore temperatura / sensore frizione Check cabling at temperature sensor/clutch sensor	<ul style="list-style-type: none"> Upon neutral shifting permanent beep Possibly sequence error from: Vehicle electrical system undervoltage Can also lead to sequence errors Temperature sensor Clutch sensory system
68	Sensor supply overvoltage	Neutral shifting Operation mode EMERGENCY OPERATION Check cabling at temperature sensor/clutch sensor	Check cabling Check cabling at temperature sensor/clutch sensor	<ul style="list-style-type: none"> Upon neutral shifting permanent beep Possibly sequence error from: K+ HK sensor K+ temperature sensor Can also lead to sequence errors Temperature sensor Clutch sensory system
69	Clutch pedal sensory system plausibility End-of-line data	Neutral shifting Operation mode EMERGENCY OPERATION	Ignition off/on End-of-line programming Carry out/repeat HK pedal adjustment	<ul style="list-style-type: none"> Self preservation Programmed thresholds not logical (Idle position, switch point, disengaged)
70	EEPROM end-of-line	Neutral shifting Operation mode EMERGENCY OPERATION	Ignition off/on End-of-line programming Carry out/repeat HK pedal adjustment	<ul style="list-style-type: none"> Self preservation Generally upon "new" electronic system Both EEPROM blocks are defective (invalid checksum), no automatic restoration possible Can also lead to errors "HK sensor/switch plausibility" (Int. code 6)
76	Proportional valve LU	Neutral shifting Operation mode SHUT DOWN VEHICLE	Check cabling Check valve Check valve supply (VPS1)	<ul style="list-style-type: none"> Self preservation Possibly sequence error of LU VPS1! Upon neutral shifting permanent beep
77	Proportional valve KM	Neutral shifting Operation mode SHUT DOWN VEHICLE	Check cabling Check valve Check valve supply (VPS1)	<ul style="list-style-type: none"> Self preservation Upon neutral shifting permanent beep

Code	Error location/error cause	System reaction	possible remedy	Remarks
79	Forward valve LU	Neutral shifting Operation mode SHUT DOWN VEHICLE	Check cabling Check valve Check valve supply (VPS1)	<ul style="list-style-type: none"> Self preservation Possibly sequence error of LU VPS1! Upon neutral shifting permanent beep
80	Forward valve KM	Neutral shifting Operation mode SHUT DOWN VEHICLE	Check cabling Check valve Check valve supply (VPS1)	<ul style="list-style-type: none"> Self preservation Upon neutral shifting permanent beep
82	Reverse valve LU	Neutral shifting Operation mode SHUT DOWN VEHICLE	Check cabling Check valve Check valve supply (VPS1)	<ul style="list-style-type: none"> Self preservation Possibly sequence error of LU VPS1 Upon neutral shifting permanent beep
83	Reverse valve KM	Operation mode SHUT DOWN VEHICLE	Check cabling Check valve Check valve supply (VPS1)	<ul style="list-style-type: none"> Self preservation Upon neutral shifting permanent beep
85	Combining error drive switch (LU, KM, K+)	Neutral shifting Operation mode SHUT DOWN VEHICLE	Check cabling Check drive switch	<ul style="list-style-type: none"> Self preservation Upon neutral shifting permanent beep
87	Pin code not corresponding to type of vehicle (T7100/T7200)	Operation mode PERMANENT NEUTRAL	Check pin code Ignition off/on Check end-of-line data, carry out end-of-line programming (type of vehicle, vehicle version) Check cabling	<ul style="list-style-type: none"> Self preservation Pin code is evaluated only upon initialisation Defective pin code. Wrong type of vehicle/version programmed

Code	Error location/error cause	System reaction	possible remedy	Remarks
89	VPS1 plausibility (KM, K+)	Neutral shifting Operation mode SHUT DOWN VEHICLE	Check cabling (KM, K+) Check voltage at VPS 1 Check voltage at term30 Check cabling delle valvole F/R (K+)	<ul style="list-style-type: none"> • Self preservation • Upon neutral shifting permanent beep • EC also defective with term30 • LU VPS can also lead to sequence errors F-/R-/prop.-SV) • Possibly sequence error resulting from counter supply (K+) at F/R valve upon power on • Possibly sequence error from LU proportional valve • Possibly sequence error from: Safety processor not programmed
90	VPS2 plausibility (KM, K+)	Neutral shifting Operation mode PERMANENT NEUTRAL	Check cabling (KM, K+) Check voltage at VPS 2 Check voltage at term30 Check cabling di GV/HV/MVKI (K+)	<ul style="list-style-type: none"> • Self preservation • Upon neutral shifting permanent beep • EC also defective with term30 • LU VPS2 can only be detected via sequence errors • Possibly sequence error resulting from counter supply (K+) at GV/HV/MVKI upon power on • Possibly sequence error from: Safety processor not programmed
91	HK plausibility circuit	Neutral shifting Operation mode SHUT DOWN VEHICLE	Engage/disengage creep speed lever Check cabling at proportional valve (K+) Check proportional valve Check HK Check speed sensory system Nisa, Nhk Check hydraulic system	<ul style="list-style-type: none"> • HK plausibility only if configured • Self preservation • Plausibility circuit: Nisa-HK-Nhk • For T72 creep speed lever Position "N" is possible!
92	Vehicle electrical system overvoltage	Neutral shifting Operation mode SHUT DOWN VEHICLE	Ignition off/on Check vehicle electrical system Check cabling	

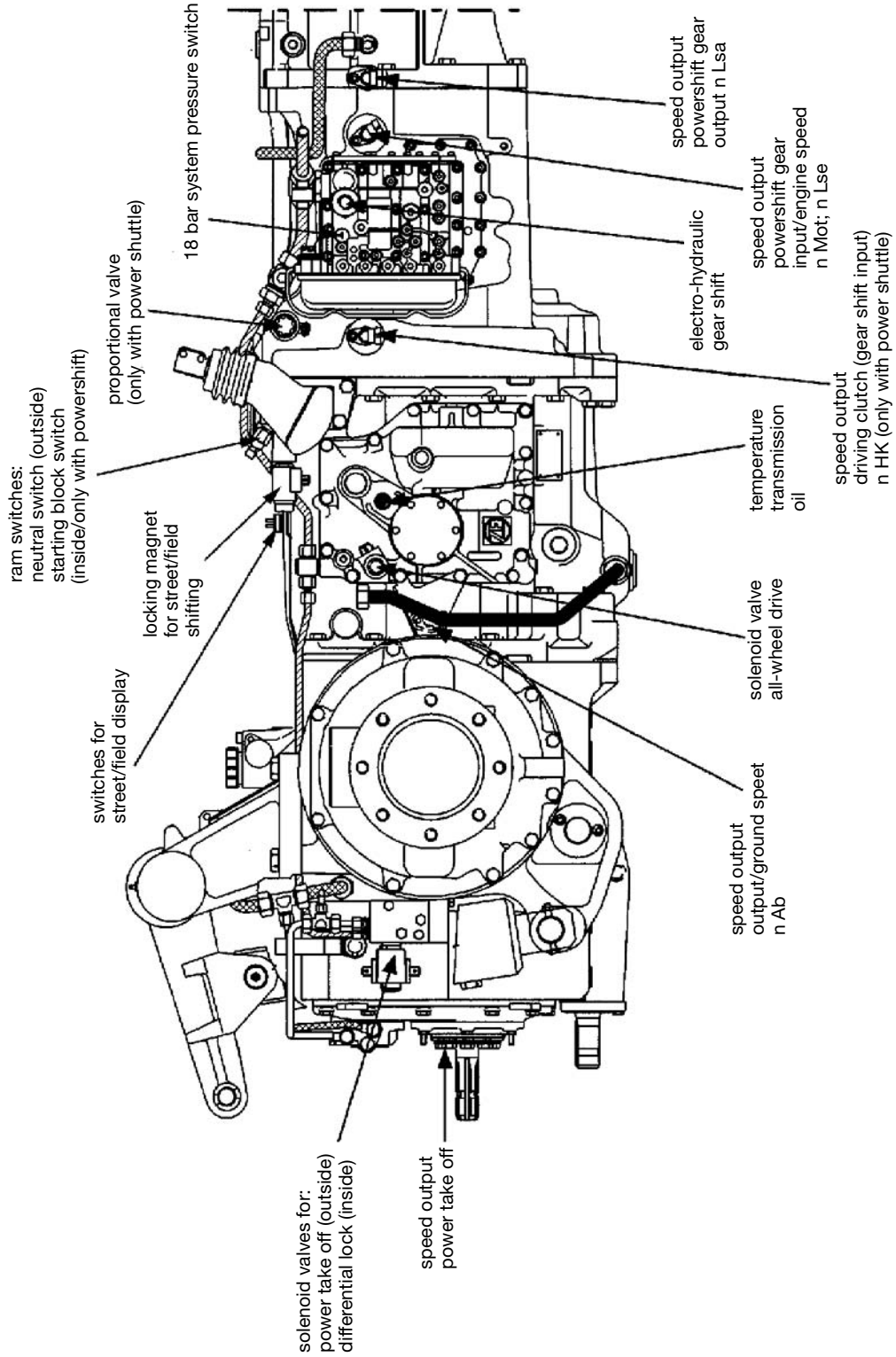
Code	Error location/error cause	System reaction	possible remedy	Remarks
93	Vehicle electrical system undervoltage	Neutral shifting Operation mode SHUT DOWN VEHICLE	Ignition off/on Check vehicle electrical system Check cabling	
94	Proportional valve K+	Neutral shifting Operation mode SHUT DOWN VEHICLE	Check cabling Check valve	<ul style="list-style-type: none"> • Self preservation • Upon neutral shifting permanent beep • Can also lead to error "VPS1-plausibility" (int. EC 46)
95	Forward valve K+	Neutral shifting Operation mode SHUT DOWN VEHICLE	Check cabling Check valve	<ul style="list-style-type: none"> • Self preservation • Upon neutral shifting permanent beep • Can also lead to error "VPS1-plausibility" (int. EC 46)
96	Reverse valve K+	Neutral shifting Operation mode SHUT DOWN VEHICLE	Check cabling Check valve	<ul style="list-style-type: none"> • Self preservation • Upon neutral shifting permanent beep • Can also lead to error "VPS1-plausibility" (int. EC 46)
97	Application error	Operation mode PERMANENT NEUTRAL	Check application data	<ul style="list-style-type: none"> • Error can only occur upon wrongly programmed application controls (not upon standard controls) • Wrong parameterization of: <ul style="list-style-type: none"> • Slip_configuration • _LS_Plausi_Konfig • _PC_Konfig • _Diag_Disable • _Syncn_Plausi_Disable • _Kplp_Plausi_Disable • GP-ID invalid • KD-ID invalid • FD-ID invalid • KUNDE_KD_FD invalid • GP-KD-vers. Invalid • GP-FD-vers. invalid

Code	Error location/error cause	System reaction	possible remedy	Remarks
98	Configuration error	Operation mode PERMANENT NEUTRAL	Ignition off/on Check/carry out end-of-line programming (customer, version)	<ul style="list-style-type: none"> • Customer programming (customer, version) invalid, not existing • Basic program not suitable for end-of-line programming - by customer
99	EEPROM end-of-line data defective (vehicle configuration)	Operation mode PERMANENT NEUTRAL	Ignition off/on Repeat end-of-line programming	<ul style="list-style-type: none"> • Self preservation • Checksum of the EEPROM configuration data defective. No vehicle version can be selected.

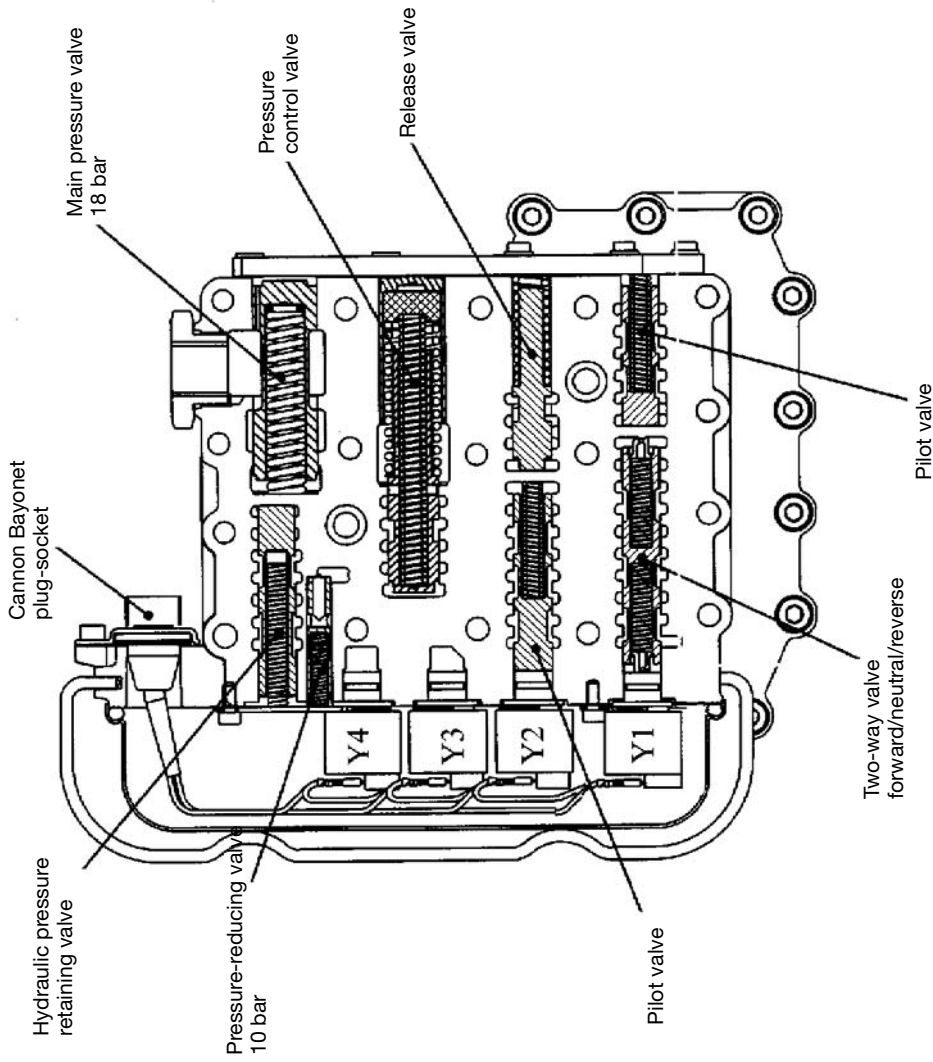
4.6 OTHER INFORMATIONS

Error consequence/System reaction	possible error cause	possible remedy
no display activation resp. display "EE"	EST45 is not running up Communication line defective Power supply defective	Check supply paths LU, KM Check fuse (term15, term30) Check communication line (LU)
Diagnosis tool cannot establish connection	EST45 is not running up Communication line defective Power supply defective	Ignition off/on, repeat Check supply paths LU, KM Check fuse (term15, term30) Check communication line (LU)
Upon starting/reversing powershift gear shifts over to neutral (jerk can be observed). display: "N", FR-arrows flashing, no error code, permanent beep	Wrong vehicle version selected upon end-of-line programming Speed sensor Nmot and Nlisa defective Fault in hydraulic system (neutral by reversing monitoring)	Check/correct end-of-line programmed in programmazione fine linea Check cabling speed sensor Nmot and Nlisa Check speed sensors Nmot and Nlisa Check hydraulic system
Automatic shifting upward/downward in the splitter, shifting noise every 1-2 sec.	Wrong vehicle version selected upon end-of-line programming Speed sensor Nmot and Nlisa defective, interchanged Transfer valves GV1/GV2 interchanged Fault in hydraulic system (pressure modulation by GV toggling)	Check/correct end-of-line programmed vehicle version Check cabling speed sensors Nmot and Nlisa Check cabling transfer valves GV1/GV2 Check speed sensors Nmot and Nlisa Check hydraulic system
Short traction force interruption during driving with Closed drive train (LS pressure modulation)	Wrong vehicle version selected upon end-of-line programming Speed sensor Nmot and Nlisa defective Fault in hydraulic system (pressure modulation by GV toggling)	Check/correct end-of-line programmed vehicle version Check cabling speed sensors Nmot and Nlisa Check speed sensors Nmot and Nlisa Check hydraulic system
Automatic starting not possible, vehicle remains in neutral	Starting block signal not existing	Check starting block signal (LU, KM, K+)

4.7 SENSORS AND SOLENOID VALVES AT THE TRANSMISSION T-7100

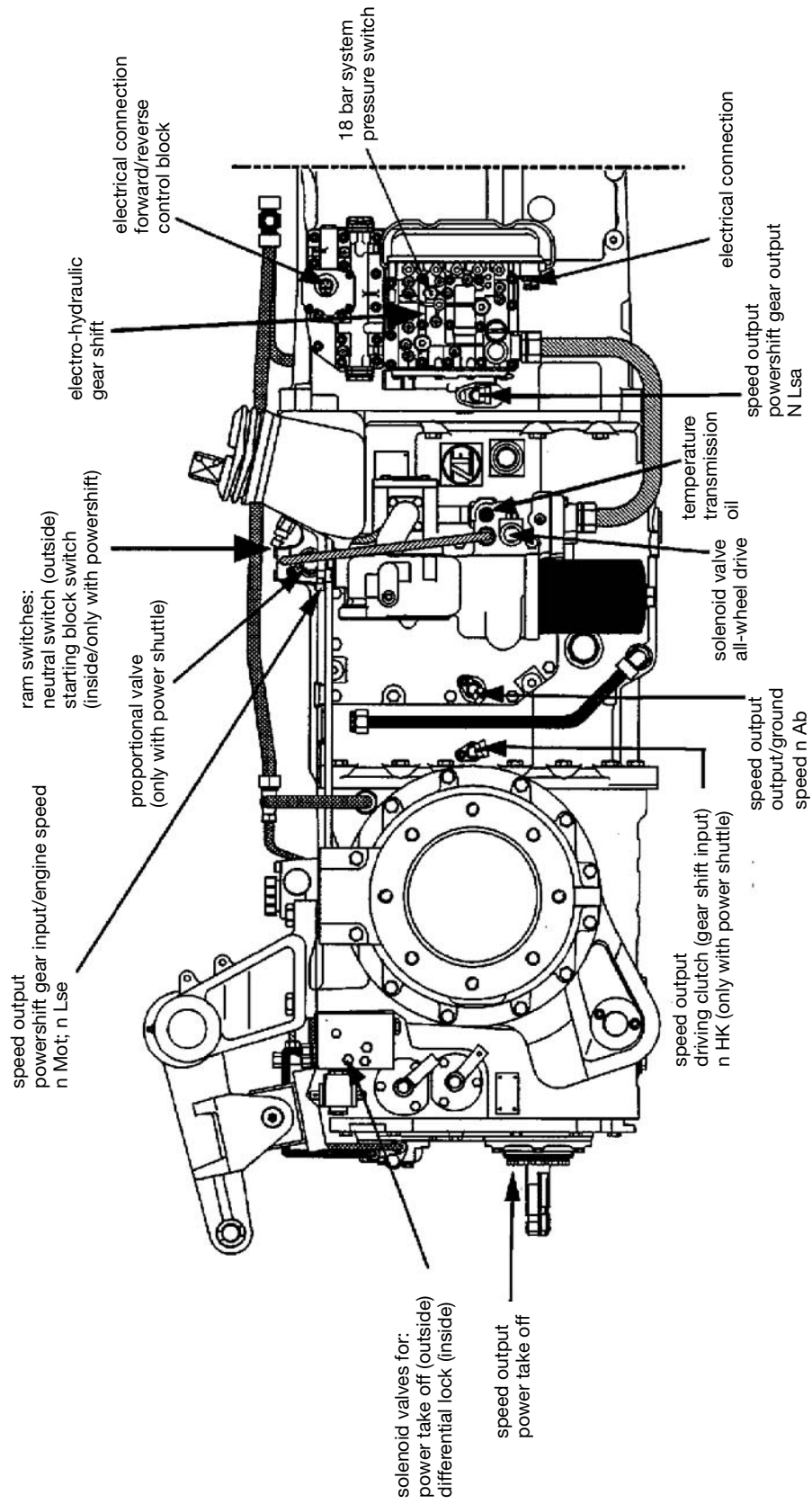


4.8 ELECTRO-HYDRAULIC GEAR SHIFT T-7100

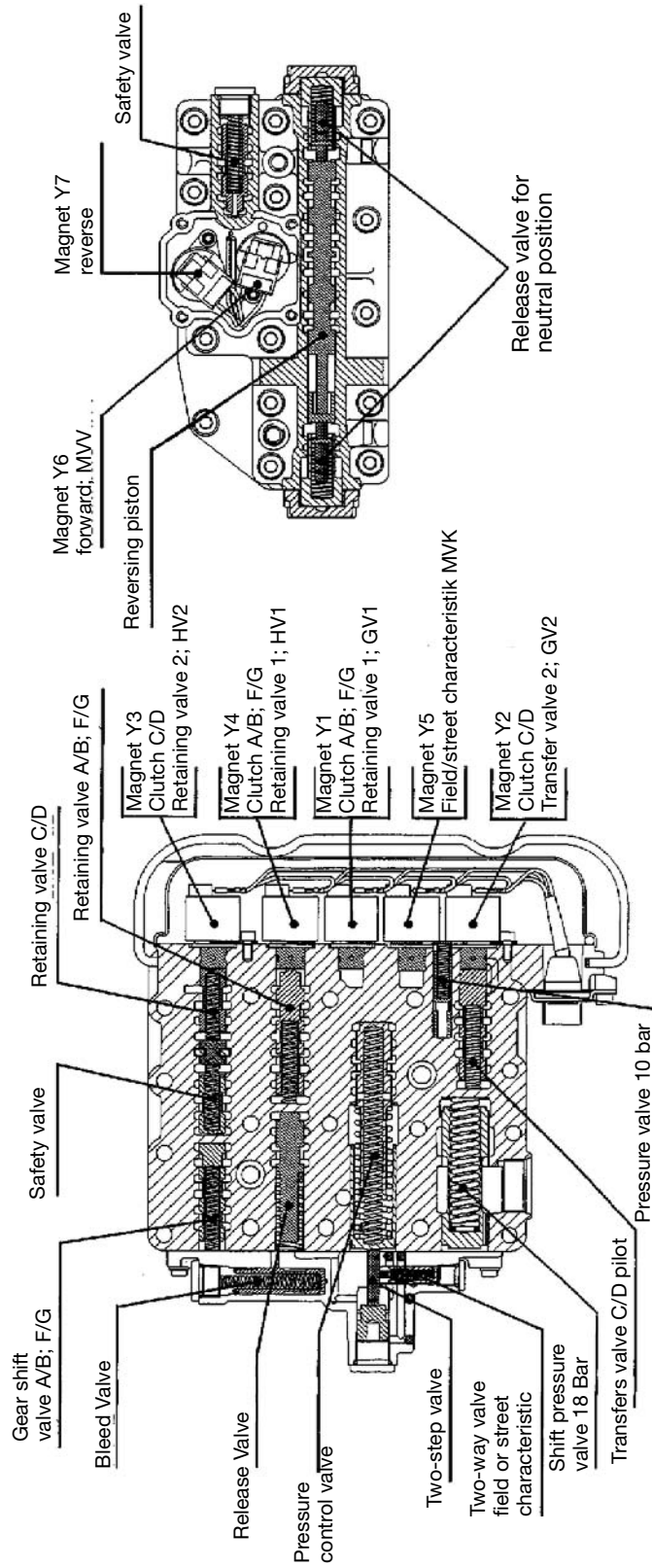


Solenoid valves Y1 – Y4:
Y1 = MVR; solenoid valve reverse
Y2 = GV1; transfer valve 1
Y3 = MVV; solenoid valve forward
Y4 = GV2; transfer valve 2

4.9 SENSORS AND SOLENOID VALVES AT THE TRANSMISSION T-7200



4.10 ELECTRO-HYDRAULIC GEAR SHIFT T-7200 / T-7300



4-GEAR POWERSHIFT CONTROL UNIT

FORWARD-REVERSE CONTROL BLOCK

4.11 ERROR ANALYSIS

Interchanging of electrical connectors at the transmission T-7100 L and T-7200 L

Various sensors/solenoid valves/switches at the transmission are located very close to each other and are equipped with the same type of connector. At these locations the electrical mating connectors at the cable harness cannot be layed in a way which ensures that accidental interchanging may be absolutely excluded.

The following consideration shows the consequences if electrical connectors are interchanged:

4.11.1 VA SOLENOID VALVE AND TEMPERATURE SENSOR T-7100 L AND T-7200 L

Both elements are equipped with Jet-Tronic connectors; distance approx. 75 mm with T-7100 and 55 mm with T-7200.

VA plug on temperature sensor and VA – SV "OFF"

- All-wheel "OFF" \pm 12V voltage at temperature sensor
- Error code on display
- Electronic system shifts gear to permanent neutral

Vehicle cannot be moved any more!

VA plug on temperature sensor and VA – SV "ON"

- All-wheel "ON" \pm 0V voltage at temperature sensor
- Error code on display; temperature sensor defective
- Hard gear shifts (5V supply in electronic system is overloaded, but short circuit proof)

Temperature sensor plug on VA – SV

- Error code on display; temperature sensor defective
- Hard gear shifts

4.11.2 SV DIFFERENTIAL LOCK AND SV POWER TAKE OFF CLUTCH T-7100 L AND T-7200 L

Both valves are equipped with Jet-Tronic connectors; distance approx. 40 mm

Plug differential lock on SV power take off valve

- Interchanged functions upon switch actuation in cabin
- Power take off stub is running upon diff. "ON"

Upon ZW clutch "ON" and differential lock "OFF" the differential lock is engaged. Critical driving state with regard to safety, e.g. when driving in a curve, etc.

4.11.3 SPEED SENSORS INPUT/OUTPUT WITH T-7100 L

AMP superseal 3-pole connectors at both sensors, distance approx. 80 mm

Plug output on input sensor and vice versa

(both plugs are connected!)

Upon powershift step L and H

- Error is not detected
- LS transmission in neutral

Upon powershift step M

- Error is not detected

No consequences

Only one plug is connected

OUTPUT not connected

- Error code on display

Standby driving possible

INPUT not connected

- Error code on display
- Plausibility

Standby driving possible

4.11.4 LOCKING MAGNET FIELD/STREET AND TEMPERATURE SENSOR T-7100 L

Both elements are equipped with Jet-Tronic connectors; distance approx. 115 mm

Locking magnet plug on temperature sensor

4.11.5 PLUG DRIVING CLUTCH NHK ON OUTPUT/GROUND SPEED NAB AND VICE VERSA WITH T-7200 L (both plugs are connected)

- Tractor is starting for a short time
- Error message "91" on display: Powershift gear in neutral

5. AGROTRONIC-HD + ASM

As a preparatory measure the connection between tractor (E-box) and computer needs to be established so as to check the Agrotronic-hD + ASM resp. to calibrate the valves. The interface cable and the adapter cable are serving for this purpose (see figure).

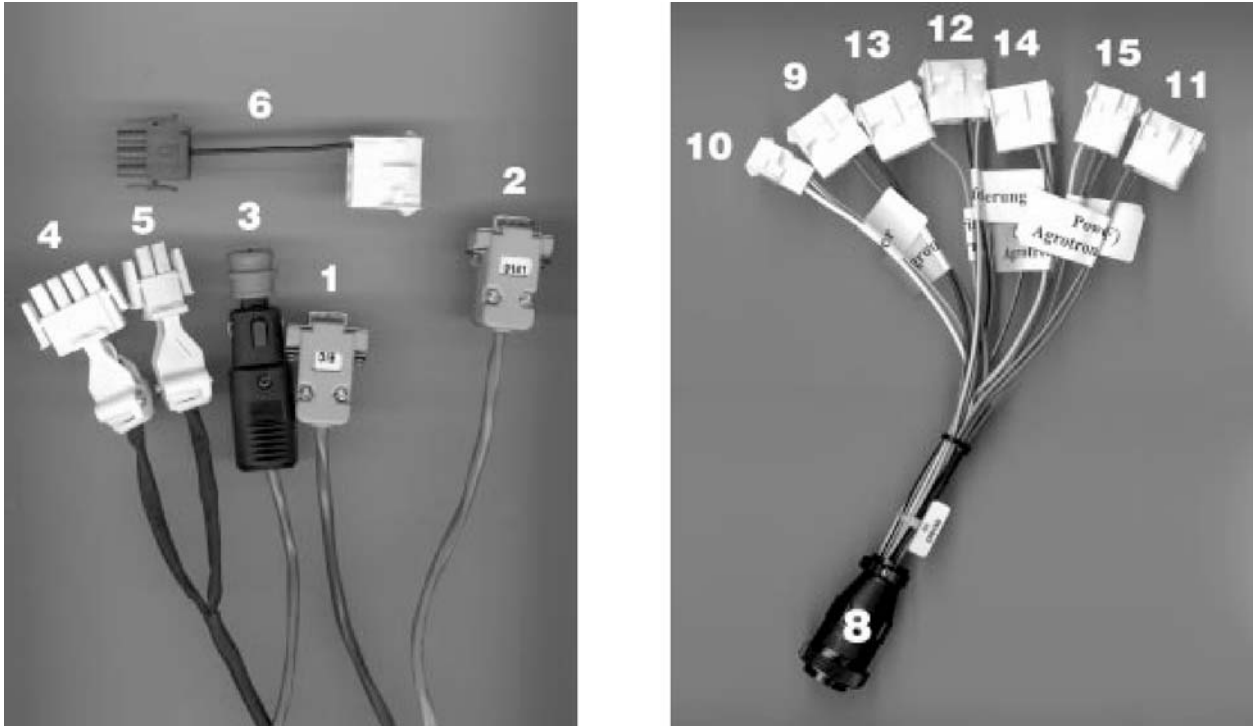


Fig. 45 - Interface cable and adapter cable

- Connect plug (2) of the interface cable with the designation "9141" to the computer (COM interface)
- Connect plug (3) of the interface cable for the 12 V supply to the cigar lighter
- Connect the 4-pole plug (4) of the interface cable to the plug (9) – designation "Agrotronic-hD" – of the adapter cable
- Insert the central plug (8) of the adapter cable into the central diagnosis interface in the fuse box
- Switch on ignition and start the motor
- Start the computer and call the EDS program (compare item A 1.3 – Launching and terminating of the EDS program)
- Make sure that the right option is called in the initial menu:
 - Opzione 2** -> plug (2) with the designation "9141" to interface **COM 1**
 - Opzione 3** -> plug (2) with the designation "9141" to interface **COM 2**

NOTE. Agrotron tractors with the vehicle identification numbers up to 80xx 1999 (i.e. green cabin) usually are not equipped with a central diagnosis interface.

To be able to check the Agrotronic-hD however, with these tractors it is necessary to connect the 4-pole plug (4) of the interface cable directly with the 4-pole diagnosis terminal of the hydraulic system. The diagnosis terminal is located in the cabin at the rear on the right side under the floor mat, resp. in the right panelling (close to the E-box).

5.1 PROGRAM DESCRIPTION

5.1.1 MAIN MENU

After selecting **Option 2** resp. **Option 3** (depending on the computer interface) the main menu appears:

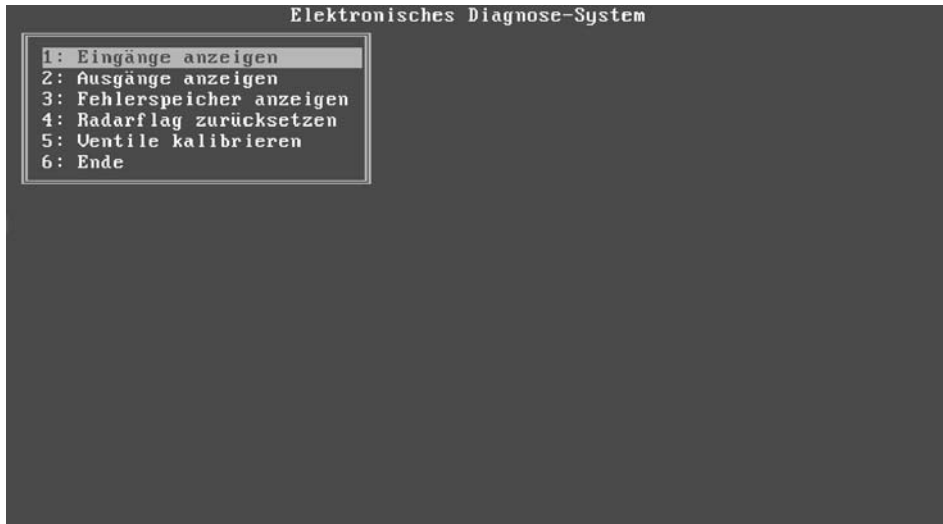


Fig. 46 - Main menu

In the main menu the individual submenus can be activated. There are two possibilities to accomplish this:

- Press one of the keys 1 – 6
- Select the desired subprogram by means of the cursor keys (cursor up/cursor down) and confirm by pressing the ENTER key.

Press the ESC key to quit the respective subprogram and to return to the main menu.

5.1.2 QUERY INPUTS



Fig. 47 - Query inputs

- **Query inputs > Lower rate**
The signal input into the electronic box is tested. Slowly turn the drop speed dial. The reading is supposed to be updated continually:
 - Min. drop speed (turtle) display: approx. 0,35V
 - Max drop speed (rabbit) display: approx. 8,00V
- **Query inputs > Maximum Height**
The signal input into the electronic box is tested. Slowly turn the drop speed dial. The reading is supposed to be updated continually:
 - Min. lift height (figure 0) display: approx. 0,35V
 - Max lift height (figure 10) display: approx. 8,00V
- **Query inputs > Intermix**
The signal input into the electronic box is tested. Slowly turn the system selector. The reading is supposed to be updated continually:
 - 100% tractive force (left stop, plough symbol), display: approx. 0,35V
 - 100% position (right stop, lift system symbol) display: approx. 8,00V
- **Query inputs > Depth Set**
The signal input into the electronic box is tested. Slowly turn the setpoint dial. The reading is supposed to be updated continually:
 - Left stop (position F = free floating) display: approx. 0,35V
 - Right stop (position F = full lift) display: approx. 8,00V
- **Query inputs > Main Control**
The signal input into the electronic box is tested. Move the lever to the following positions:
 - Lift display: approx. 5,1 ... 5,8 Volt
 - Stop display: approx. 3,5 ... 4,0 Volt
 - Lower display: approx. 1,9 ... 2,3 Volt
 - Fast drop display: approx. 1,3 ... 1,7 Volt
- **Query inputs > Hitch Position**
The signal input into the electronic box is tested. Move the hoisting unit from lowered position to fully lifted position (caution: set lift height dial to figure 10, position sensor is adjusted correctly). The reading is supposed to be updated continually upon hoisting linkage movements:
 - Hoisting unit lowered display: approx. 5,2V
 - Hoisting unit lifted display: approx. 0,7V
- **Tractive force sensors:**
Tension: Voltage decreases; direction of force along the tractor longitudinal axis
Compression: Voltage increases; direction of force along the tractor longitudinal axis
- **Query inputs > Draft Right**
The signal input into the electronic box is tested.
There is no load on the hoisting unit, display 3,5 ... 4,5V

The reading indicates the signal voltage of the tractive force sensor upon no-load state of the hoisting unit. The signal voltage should be $4,0 \pm 0,5$ Volt. This requires an 8 V supply (DC) on the tractive force sensor, see reference voltage 8 V
- **Query inputs > Draft Left**
The signal input into the electronic box is tested.
There is no load on the hoisting unit, display 3,5 ... 4,5V
The reading indicates the signal voltage of the tractive force sensor upon no-load state of the hoisting unit. The signal voltage should be $4,0 \pm 0,5$ Volt.

- **Query inputs > External sensor** (e.g. beet digger)
The signal input into the electronic box is tested. With a mounted external sensor the reading is supposed to be updated continually upon actuation of the sensor. For this purpose the external sensor needs to be connected to the external socket.
- **Query inputs > Input Power**
The voltage input into the electronic box is tested.
The setpoint is $13,5 \pm 0,5$ V (DC)
If the actual value matches this setpoint while the engine is running, the electrical system, the battery and the electric generator are working properly.
- **Query inputs > 8 Volt Sensor Ref**
*The supply voltage output of the electronic box to the operator's console (drop speed, lift height dial, system selection, setpoint) to the tractive force sensors
The setpoint is $8 \pm 0,5$ V (DC)
- **Query inputs > Position Sensor Ref**
The supply voltage output of the electronic box: - to the position sensor.
The setpoint is $5,0 +0,5/ -0,1$ V (DC)
- **Query inputs > 4 WD Feedback** (not valid for Agrottron 160-200)
The supply voltage output of the electronic box to the all-wheel drive valve is tested. The actual value depends on the charge condition of the battery.
- Spring return switch all-wheel drive not actuated, display approx. 0,16 V
- Spring return switch all-wheel drive or differential lock actuated, display approx. 12 V
- Spring return switch ASM and spring return switch all-wheel drive actuated, (and wheels in straight position) display approx. 11 V
- **Query inputs > Indicated Speed**
The signal input of the theoretical ground speed sensor into the electronic box is tested. The theoretical ground speed is displayed while driving. The display is in accordance with the display in the INFOCENTER.
- **Query inputs > True speed**
The signal input of the true ground speed sensor (radar sensor) into the electronic box is tested. The true ground speed is displayed while driving. The display is in accordance with the display in the INFOCENTER..
- **Query inputs > Slip Percent**
The signal input of the slip signal is tested by which the electronic box is realizing the traction control. There is only a reading if the tractor is equipped with a radar sensor and after proper calibration of the tractor. The traction control reading is in accordance with the reading in the INFOCENTER.
- **Query inputs > Radar Installed Flag**
0 = There is no radar signal (i.e. the tractor is not equipped with a radar sensor)
1 = The radar signal is existing
The electronic box detects the radar signal and automatically sets the flag after traction control has been active for the first time. If the radar sensor is mounted subsequently the radar flag needs to be set to "0".
- **Query inputs > Brake** (not valid for Agrottron 160-200)
Geprüft wird das Eingangssignal von den Bremsschaltern in die Box. Mit diesem Signal wird bei der ASM-Funktion die Differentialsperre ausgeschaltet.
- Operating brake is not applied, display 0
- Operating brake is applied, display 1
- Upon applying of single-wheel brake, display 1
- **Query inputs > Slip Control On/Off**
The signal of the wheel-slip switch into the electronic box is tested.
- Wheel-slip switch is not actuated, display 0
- Wheel-slip switch is actuated, display 1

- **Query inputs > Diff-Lock On/Off** (not valid for Agrottron 160-200)
The signal of the ASM control function of the box is tested, i.e. the input signal of the differential lock spring return switch.

Spring return switch ASM needs to be actuated.

- Differential lock spring return switch is not actuated, display 0
- Differential lock spring return switch is actuated, display 1

- **Query inputs > ASM On/Off**

Getestet wird die ASM-Steuerfunktion der Box.

Spring return switch ASM needs to be actuated.

- Differential lock spring return switch or all wheel drive is not actuated, display 0
- Differential lock spring return switch or all wheel drive is actuated, display 1

- **Query inputs > Steering angle 1**

The input signal of the steering angle sensors into the box is tested. Start the engine and turn the steering to the left and subsequently to the right. While doing this, observe the reading as it is updated according to the steering angle..

Agrottron	Type of front	Steering angle axle sensor	Reading upon steering			
			0° ...15°	15° ...25°	25° ...30°	>30°
80 - 105	AS-2025	Sensor 1 Sensor1	0	0	1	1
			0	1	1	0
106-150	AS-2035/ AS-2045	Sensor 1 Sensor 2	0	1	1	0
			0	0	1	1
230 - 260	AS-2075	Sensor 1 Sensor 2	0	1	1	-
			0	0	1	-

- **Query inputs > Steering angle 2**

The input signal of the steering angle sensors into the box is tested. Start the engine and turn the steering to the right and subsequently to the left. While doing this, observe the reading as it is updated according to the steering angle.

Agrottron	Type of front	Steering angle axle sensor	Reading upon steering			
			0° ...15°	15° ...25°	25° ...30°	>30°
80 - 105	AS-2025	Sensor 1 Sensor1	0	0	1	0
			0	1	1	1
106-150	AS-2035/ AS-2045	Sensor 1 Sensor 2	0	0	1	1
			0	1	1	0
230 - 260	AS-2075	Sensor 1 Sensor 2	0	0	1	-
			0	1	1	-

- **Query inputs > External Raise**

The input signal into the box sent from the remote push-buttons for lifting is tested.

Gleichzeitig wird die Hydraulik für die interne Betätigung gesperrt!

- Remote push-button for lifting (right or left) is not pressed display 0
- Remote push-button for lifting (right or left) is pressed display 1

- **Query inputs > External Lower**

The input signal into the box sent from the remote push-buttons for lowering is tested.

Simultaneously the hydraulic system is blocked for internal actuation!

- Remote push-button for lifting (right or left) is not pressed display 0
- Remote push-button for lifting (right or left) is pressed display 1

Press ESC to return to the main menu.

5.1.3 QUERY OUTPUTS

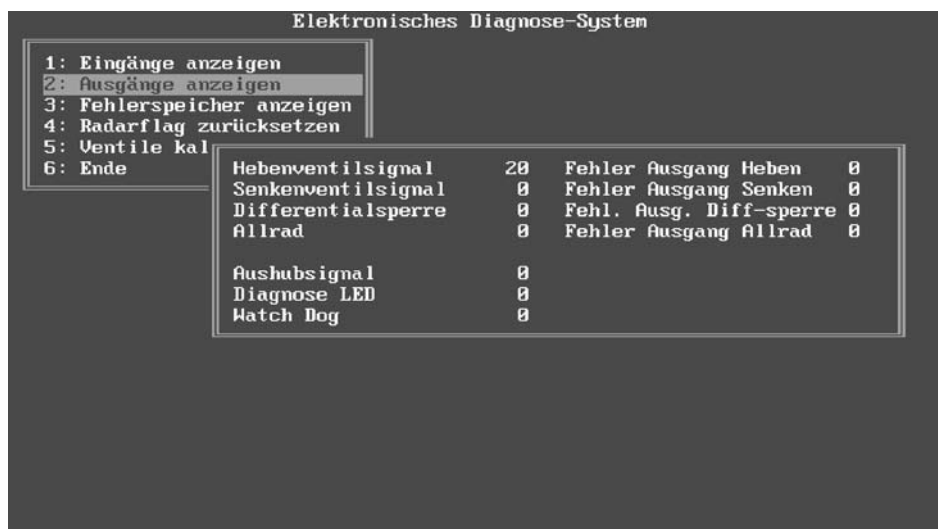


Fig. 48 - Set outputs

- **Query outputs > Raise Duty Cycle**

The output signal of the electronic box to the solenoid valve for lifting is tested. The AGROTRONIC-hD is always locked upon switching-on the ignition – the yellow LED is lighting.

- Display = 0

Activate the AGROTRONIC-hD – the yellow LED extinguishes. Move the operating lever to position lift – the red LED is lighting up.

- Display > 0

- **Query outputs > Lower Duty Cycle**

The output signal of the electronic box to the solenoid valve for lowering is tested. The AGROTRONIC-hD is always locked upon switching-on the ignition – the yellow LED is lighting.

- Display = 0

Activate the AGROTRONIC-hD – the yellow LED extinguishes. Move the operating lever to position drop – the green LED is lighting up.

- Display > 0

- **Query outputs > Diff-Lock /4WD (not valid for Agrottron 160-200)**

Only in connection with switched-on ASM.

The differential lock push-button and the all-wheel drive push-button are not pressed.

- Display: Differential lock 0, all-wheel drive 0

Press the ASM push-button and the differential lock push-button.

- Display: all-wheel drive 1, Differential lock 1

Press the ASM push-button and the all-wheel drive push-button.

- Display: all-wheel drive 1, Differential lock 0

- **Query outputs > Monitor Output**

The output signal of the electronic box to the solenoid valve for lifting is tested. Activate the AGROTRONIC-hD - the yellow LED extinguishes.

Move the operating lever to position lift – the red LED is lighting up.

- Display 0

Move the operating lever to position stop – the red LED extinguishes.

- Display 1

- **Query outputs > Diagnosis LED**

The yellow LED is lighting upon switching-on the ignition (the AGROTRONIC-hD is locked).

- Display 1

Activate the AGROTRONIC-hD – the yellow LED extinguishes.

- Display 0

- **Query outputs > Watch dog**

The watch dog is a low test current which the box sends through both of the solenoids (lifting and lowering solenoids) in order to check them.

- Watch dog existing display 1

- Watch dog not existing display 0

- **Query outputs > Error in outputs for raising, lowering, differential lock and all-heel drive**

The outputs of the electronic box to the respective solenoid valve are tested.

- Display 0, if no error is existing.

- Display 1, in case of an error.

Errors for differential lock and all-wheel drive are displayed only if the ASM push-button is pressed.

Press ESC to return to the main menu.

5.1.4 ERROR HISTORY

In this menu all errors in the Agrotronic-hD are displayed. All occurring errors being indicated by means of a blinking code are saved in the electronic box and can thus be retrieved if necessary.

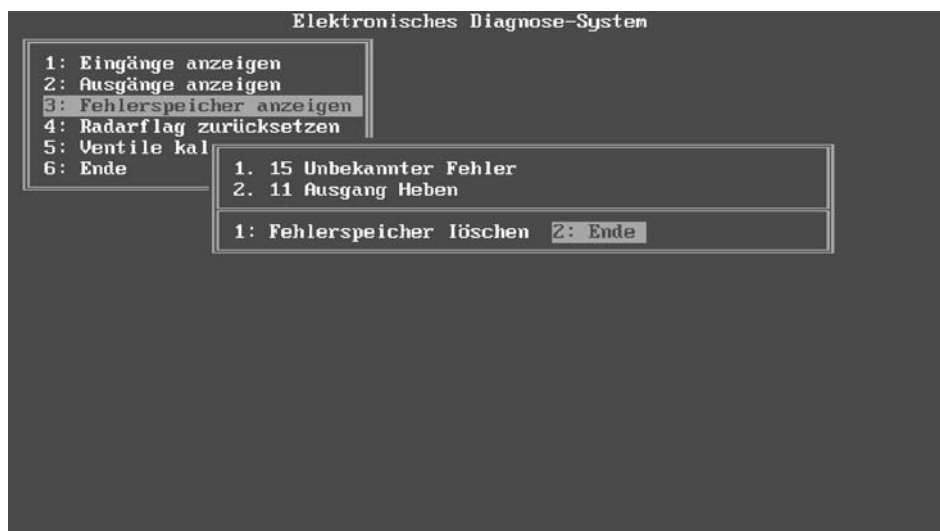


Fig. 49 - Error History

For description of the error codes refer to the appendix of this chapter resp. to the workshop manual.

- **1: Clear All Errors**

Press push-button 1 or select “Clear All Errors” by means of the arrow keys – the text will be highlighted - and press the return-key.

Subsequently the display reads **No Error**.

NOTE. After having been recovered an error please erase the error memory.

- **2: Quit**

Press push-button 2 or select “Quit” by means of the arrow keys – the text will be highlighted -and press the ENTER-key. Subsequently the initial menu appears.

5.1.5 CLEAR RADARFLAG

In case of a mounted radar sensor the electronic box detects the connected sensor and sets the radar flag automatically. If the radar sensor is removed the AGROTRONIC-hD signals an error code. Upon removal of the radar sensor the radar flag needs to be reset in order to avoid this error message.

5.1.6 CALIBRATE VALVES

Due to solenoid valve tolerances of the control device an uncomfortable jerking can be felt upon lifting/lowering or upon driving with shock absorption.

The electronic box can be calibrated individually to the lifting and lowering solenoid in order to eliminate this non uniform behaviour. The procedure is as follows:



CAUTION!

During the calibration process the hoisting gear is lifted and lowered automatically.

- 1 - Connect attaching device:
 - with hydraulic cylinder Ø 80 approx. 1 t
 - with hydraulic cylinder Ø 100 approx. 1,5 t
- 2 - Warm up tractor, lower and lift hoisting gear several times, check the proper adjustment of the position sensor = the unit must not operate against overpressure.
- 3 - Lift the attaching device to a medium elevating height (approx. 100 mm cylinder travel distance) and move the operating lever to the stop position.



CAUTION!

The attaching device must have sufficient distance to the ground.

- 4 - Press key 5, the following indication is displayed: **Valves are being calibrated.**
Press any key.
The calibration process runs automatically. During the calibration process the yellow diagnosis LED is flashing. Additionally the respective LEDs of the outputs under calibration are lighting: First lifting (red LED), subsequently lowering (green LED).
Upon termination of the calibration process the yellow LED is lighting permanently, the AGROTRONIC-hD is interlocked and can be activated.
- If the calibration process has not been carried out properly error codes 51 and 52 are being displayed.
 - The calibration process is aborted by means of pressing any key.

5.1.7 QUIT

Quit the Agrotronic-hD program by means of pressing the key 6 or by selecting via the cursor keys.

5.2 ERROR CODES OF THE AGROTRONIC-HD

The AGROTRONIC-I-h - hD includes a diagnosis system which constantly monitors all functions as well as the sensors. Occuring errors are indicated by flashing of the yellow LED (1) and then saved in the error memory of the E-box.

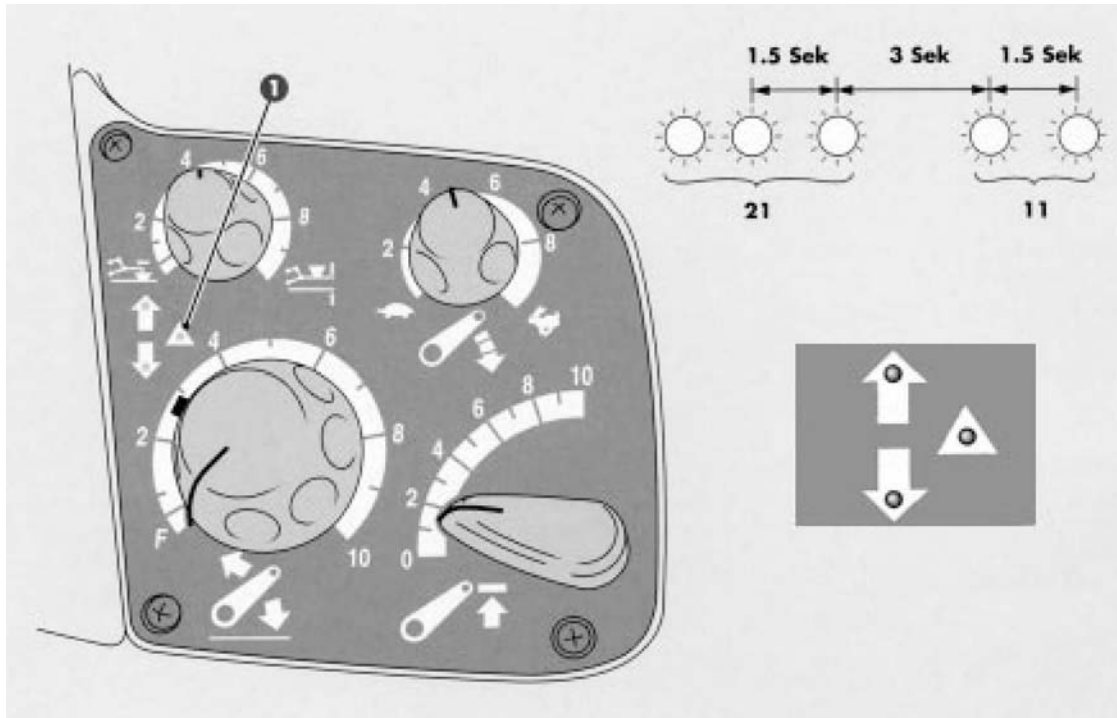


Fig. 50 - Diagnosis LED

Example (see figure 49)

Error code 21 = blinking two times (tens) – blinking pause of 1,5 sec –blinking one time (ones)

Error code 11 = blinking one time (tens) – blinking pause of 1,5 sec –blinking one time (ones)

Two error codes are separated from each other by a blinking pause of 3 sec.

5.2.1 EHR I – H - HD LEVEL ERRORS

All occurring errors are classified into three error levels upon which the AGROTRONIC I – I – hD reacts differently:

- Critical error: Error code 11 ... 19
- Medium error: Error code 22 ... 26
- Non-critical error: Error code 31 ... 52

Error level	Reaction of the AGROTRONIC-hD
Critical error	Error codes with initial digit 1. The control is stopped; the system is locked. The control can only be resumed after recovering the error, switching the ignition off and on again and reactivating the system.
Medium error	Error codes with initial digit 2. The control is stopped; the system is locked and cannot be reactivated. The error display can only be terminated after recovering the error, switching the ignition off and on again and reactivating the system. Upon these errors lifting and lowering of the hoisting unit is still possible by means of the remote push-buttons.
Non-critical error	Error codes with initial digit 3. The control is not stopped; the system is not locked. The error display will only be terminated after recovering the error.

5.2.2 CRITICAL ERROR

Error code	Short description	Error description
11	Output stage lifting	Cable to lifting solenoid: Short circuit or open connection
12	Output stage lowering	Cable to lowering solenoid: Short circuit or open connection
16	Power supply for voltage	The operator's console and for the operating lever is not OK
17	Battery	Battery voltage too high (exceeds 16 V)
18	Main control	Signal not OK. - Operating lever not connected or wire breakage
19	Battery	Battery voltage too low (below 10 V)

5.2.3 MEDIUM ERRORS

Error code	Short description	Error description
22	Position sensor	Signal not OK - Wire breakage - Position sensor not connected - Short circuit or short circuit to ground - Wrong adjustment of the position sensor
23	Depth set	Signal not OK. - Wire breakage or potentiometer not connected
24	Maximum height	Signal not OK. - Wire breakage or potentiometer not connected
26	Power supply voltage	Power supply voltage for the position sensor not OK (U _v ref = 5,5 ± 1V (CC))

5.2.4 NON-CRITICAL ERRORS

Error code	Short description	Error description
31	Draft sensor right	Signal not OK. - Wire breakage - Draft sensor not connected - Short circuit or short circuit to ground - Draft sensor has been overloaded
32	Draft sensor left	Signal not OK. - Wire breakage - Draft sensor not connected - Short circuit or short circuit to ground - Draft sensor has been overloaded
34	Lower rate (Lowering speed control)	Signal not OK - Wire breakage or potentiometer not connected
36	Intermix (Function selector knob)	Signal not OK. - Wire breakage or potentiometer not connected
37	Main control valve unit	Despite of current flowing through the solenoid for lifting the hoisting unit is not lifting within 30 sec because. - the oil supply for the control drive unit is not OK - the control drive unit became stuck
41	True ground speed (RADAR)	Signal not OK. - Error only occurs when the traction control is switched on.
42	Indicated (theoretical) ground	Signal not OK. - speed Error only occurs when the traction control is switched on. CAUTION: If both speed signals are not OK no error will be indicated, as this state is normal upon standstill of the tractor.
44	External sensor	Signal not OK or short circuit to power supply voltage.
45	Output signal to front axle drive relay	Signal not OK. Wire breakage or short circuit
46	Output signal to solenoid valve differential lock	Signal not OK. Wire breakage or short circuit
51	Calibration lifting solenoid	Calibration not carried out correctly.
52	Calibration lowering solenoid	Calibration not carried out correctly.

6. PREPARATIONS FOR DIAGNOSIS OF THE INFOCENTER

As a preparatory measure the connection between tractor (infocenter) and computer needs to be established so as to check the infocenter by means of the EDS program resp. to change the constant values. The interface cable and the adapter cable are serving for this purpose (see figure).

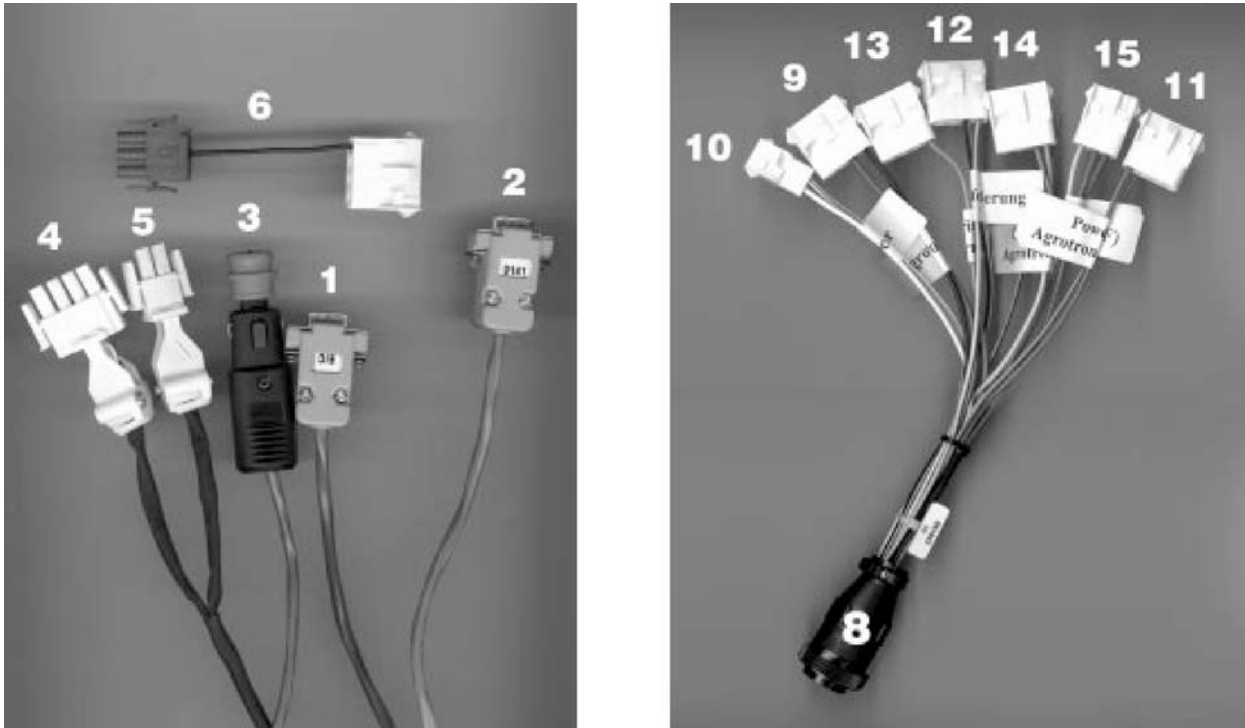


Fig. 51 - Interface cable and adapter cable

- 1 - Connect plug (1) of the interface cable with the designation "EIC" to the computer (COM interface).
- 2 - Connect plug (3) of the interface cable for the 12 V supply to the cigar lighter
- 3 - Connect the 2-pole plug (4) of the interface cable to the plug (10) – designation "Info center" – of the adapter cable
- 4 - Insert the central plug (8) of the adapter cable into the central diagnosis interface in the fuse box
- 5 - Switch on ignition
- 6 - Start the computer and call the EDS program (compare item A 1.3 – Launching and terminating of the EDS program)
- 7 - Make sure that the right option is called in the initial menu:
 - Option 4** -> plug (2) with the designation "9141" to interface **COM 1**
 - Option 5** -> plug (2) with the designation "9141" to interface **COM 2**

NOTE. Agrotion tractors with the vehicle identification numbers up to 80xx 1999 (i.e. green cabin) usually are not equipped with a central diagnosis interface.

To be able to check the Infocenter however, with these tractors it is necessary to connect the 2-pole plug of the interface cable directly with the diagnosis terminal of the Infocenter. The diagnosis terminal is located in the cable harness at the backside of the Infocenter.

6.1 PROGRAM DESCRIPTION

6.1.1 MAIN MENU

After selecting Option 4 resp. Option 5 (depending on the computer interface) the main menu appears:

DEUTZ-FAHR	Programm für Fahrzeug Diagnose	2.04
Schnittstellen-Modus : COM1 9600Baud, 8bit, 2Stop, nopar		
ID: HW-Version : FF TN 0441 19-44 Uar I		
SW-Version : FF Serien Software		
SW-Datum : FF.FF.FF		
Funktio n : «		
F1=Konstanten ändern	F2=Diagnose ausdruck	F3=TestMode
		ENDE

Fig. 52 - Main menu

In the upper part of the window information about the selected interface (COM 1, COM 2) as well as information about the hardware version (Infocenter) and the software can be found.

The lower part of the window contains the select menu for the subprograms of the Infocenter diagnosis. The cursor is flashing behind "function".

The respective subprograms can be called by means of pressing the specified key:

- **F1** launches the subprogram "Change constant values"
- **F2** launches the subprogram "Diagnosis printout"
- **F3** launches the subprogram "Test mode"
- **END** terminates the Infocenter diagnosis program and calls the EDS initial menu.

6.1.2 F1 – CONSTANTS CHANGE

By pressing the key F1 an additional window headlined “display and program constants” appears:



Fig. 53 - Display and program constants

It is possible to compare the stored constants in the Infocenter with the help of the constant list (see item 3, resp. vehicle workshop manual).

- **Procedure for changing constant values:**

- Select the desired constant value by means of the cursor keys (the corresponding line is highlighted)
- Press the ENTER key. By doing so, another window appears in which the new value can be entered.
- Press the ENTER key again to confirm the change and return to the constant values menu.

When the proper values are assigned to all constants, the main menu is called again by selecting the bottom line “End constant values menu” (and pressing ENTER).



CAUTION!

The realized changes are only saved after terminating the diagnosis program and subsequently switching the ignition off and on again.

6.1.3 F2 – DIAGNOSIS PRINT

Upon pressing the key F2 the diagnosis printout menu appears:

- Printer ready?
- ESC = No, abort
- Return = Yes, printout

Press the ESC key (keyboard top left) to abort the procedure and to return to the main menu.

Press the ENTER key (Return) to start the diagnosis printout:

```

K1 theor. Fahrgeschw. fest 3809
K2 Zählrad Heckzapfwelle 20
K3 nicht belegt 0
K4 Übersetzung Frontzapfwelle 210
K5 Betriebsstunden 0
K6 Übersetzung Lichtmaschine 1800
K7 Radar Fahrgeschw. fest 1000
K8 Kodierwort 65
K9 theor. Fahrgeschw. kalibr. 3809
K10 Radar Fahrgeschw. kalibr. 1000
K11 nicht belegt 0
K12 Impulse Heckzapfwelle 6
K13 nicht belegt 0

Produktionsdatum xxxxx
min. ADC-Wert Tank xxxxx
max. ADC-Wert Tank xxxxx
Temp. Warnung Schwelle xxxxx
Leerdrehzahl xxxxx
Zeiger Rücklaufwinkel xxxxx

EEprom 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F
00 FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
10 FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
20 FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
30 FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
40 FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
50 FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
60 FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
70 FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF

```

Fig. 54 - Diagnosis printout

The data from “production date” are only valid for the supplier of the INFOCENTER.

6.1.4 F3 – TEST MODE

Upon pressing the key F3 the test mode appears. At the lower screen edge the **test mode menu** is displayed:

```

Funktion : «
F1=Eingänge prüfen   F3=LCD prüfen   F5=Analog Eingänge   F6=Zeiger
F2=Ausgänge setzen   ENDE
  
```

It is possible to do the following by pressing the key:

- **F1** Check the inputs into the INFOCENTER.
- **F2** Set (activate) the outputs of the INFOCENTER.
- **F3** Check the LCDs (upon INFOCENTER 2 and 3).
- **F5** Check the analog inputs into the INFOCENTER.
- **F6** Check the pointer instruments.
- **END** Leave the test mode; subsequently the main menu appears.

TEST MODE > F1 CHECK INPUTS

Upon pressing the key F1 the following window appears:

(The representation shows the example of an INFOCENTER 2 in the AGROTRON 150. The ignition is switched ON.)

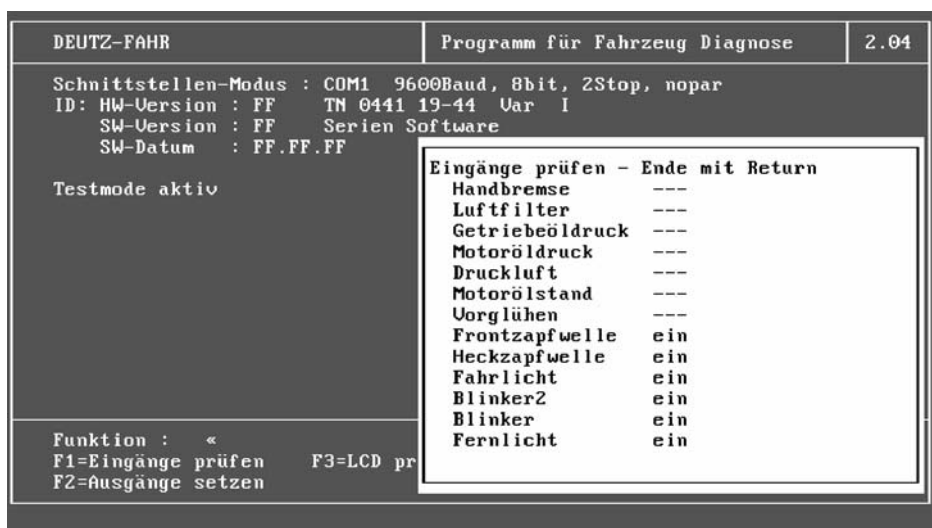


Fig. 56 - Check inputs

• Check inputs > parking brake

The signal input of the hand brake control switch at plug X 130, pin 8 of the INFOCENTER (only for INFOCENTER 3) is tested.

- Locking brake actuated: Indication hand brake ON
- Locking brake released: Indication hand brake OFF

• Check inputs > Air filter

The signal input of the negative pressure switch air filter at plug X 131, pin 8 of the INFO-CENTER (only for INFOCENTER 3) is tested.

- Ignition on, indication air filter OFF
- Start engine, connect cable of negative pressure switch, indication air filter ON

- **Check inputs > Transm.fl.press.**
The signal input of the system pressure switch at plug X 130, pin 7 of the INFOCENTER (only for INFOCENTER 3) is tested.
 - Engine off, ignition on: Indication transmission oil pressure ON
 - Start engine: Indication transmission oil pressure OFF
- **Check inputs > air pressure**
The signal input of the pressure transducer at plug X 131, pin 17 of the INFOCENTER (only for INFOCENTER 3) is tested.
Engine off, ignition on, indication pressurized air gauge > 7 bar:
 - Indication pressurized air offIgnition on, reduce boiler pressure to < 5 bar by repeated braking:
 - Indication pressurized air ON
- **Check inputs > eng. oil level**
This function cannot be tested as it is not realized (transmitter not existing).
- **Check inputs > Preheat**
The signal input of the preheating time control unit at plug X 131, pin 19 of the INFOCENTER (only for INFOCENTER 3) is tested.
 - Ignition ON, during preheating process indication ON, subsequently indication OFF.
- **Check inputs > Front PTO**
The signal input of the switch front power take-off at plug X 131, pin 10 of the INFOCENTER is tested.
 - Ignition ON, indication FRONT power take-off OFF
 - Start engine, front power take-off ON, indication front power take-off ON
- **Check inputs > Rear PTO**
The signal input of the switch rear power take-off at plug X 131, pin 11 of the INFOCENTER is tested.
 - Ignition ON, indication rear power take-off OFF
 - Start engine, rear power take-off ON, indication rear power take-off ON
- **Check inputs > road lights**
The signal input of the switch dipped beam at plug X 130, pin 4 of the INFOCENTER is tested .
 - Ignition ON, switch dipped beam OFF, indication dipped beam OFF
 - Ignition ON, switch dipped beam ON, indication dipped beam ON
- **Check inputs > turn signal 2**
The signal input of the multifunctional switch at plug X 131, pin 2 of the INFOCENTER is tested.
With connected trailer the indication changes between flashing indicator 2 on and flashing indicator 2 off in the rhythm of the flashing.
- **Check inputs > turn signal**
The signal input of the multifunctional switch at plug X 131, pin 4 of the INFOCENTER is tested.
 - Ignition on, flashing indicator not actuated indication flashing indicator off
 - Ignition on, actuate flashing indicator indication changes between flashing indicator on and off.
- **Check inputs > high beam**
The signal input of the multifunctional switch at plug X 131, pin 16 of the INFOCENTER is tested.
 - Ignition ON, Indication: Main beam OFF
 - Switch ON main beam (flash light) Indication: Main beam ON

Press the ENTER key to return to the TEST MODE.

TEST MODE > F2 SET OUTPUTS

Upon pressing the key F2 the following window appears:



Fig. 57 - Set outputs

The last line “End output menu” is marked by a bar. Press the cursor keys to move the bar to the desired function and start the function by pressing ENTER.

- **Set outputs > Lamp test**

All LEDs (light emitting diodes) in the INFOCENTER are tested.

- Indication: All LEDs are lighting up.

For terminating the test step select “Reset outputs” and press the RETURN key.

- Indication: All LEDs are extinguishing.

- **Set outputs > Warning lamp**

The central warning light in the INFOCENTER 3 is tested.

- Indication: The warning light is lighting up.

For terminating the test step select “Reset outputs” and press the RETURN key.

- Indication: The warning light is extinguishing.

- **Set outputs > Beep**

The acoustic alarm - beep - in the INFOCENTER 3 is tested.

- Indication: The acoustic alarm - beep – is sounding.

For terminating the test step select “Reset outputs” and press the RETURN key.

- Indication: Beep stops.

- **Set outputs > true ground speed**

With this test step a signal is transmitted from the output of the true ground speed (plug X130 pin 5) to pin 1 of the signal socket.

- Indication: Ground frequency on.

Now a voltage signal is existing at the 7-pole signal socket. Measuring is possible between pin 1 (true ground speed signal) and pin 7 (ground).

- Setpoints

with ground frequency on: approx. 0,8 V (DC)

with ground frequency off: approx. 8 V (DC)

- **Set outputs > theor. ground speed**

With this test step a signal is transmitted from the output of the theoretical ground speed (plug X130 pin 11) to pin 2 of the signal socket.

- Indication: Wheel frequency ON.

Now a voltage signal is existing at the 7-pole signal socket. Measuring is possible between pin 2 (theoretical ground speed signal) and pin 7 (ground).

- Setpoints: with wheel frequency on: approx. 0,8 V (DC)
with wheel frequency off: approx. 8 V (DC)

- **Set outputs > rear P.T.O.**

With this test step a signal is transmitted from the output of the power take-off speed (plug X130 pin 6) to pin 3 of the signal socket.

- Indication: RPTO frequency on.

Now a voltage signal is existing at the 7-pole signal socket. Measuring is possible between pin 3 (power take-off speed signal) and pin 7 (ground).

- Setpoints: with RPTO frequency on: approx. 0,8 V (DC)
with RPTO frequency off: approx. 8 V (DC)

- **Set outputs > Reset outputs**

All set outputs are reset and replaced by the original values.

Select "End output menu" and press the ENTER key to reset all outputs automatically and change into the test mode.

TEST MODE > F3 CHECK LCD

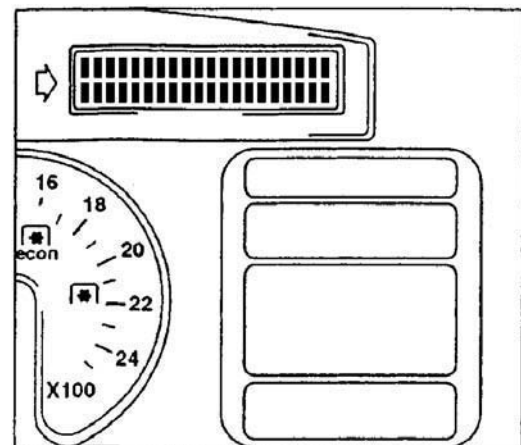
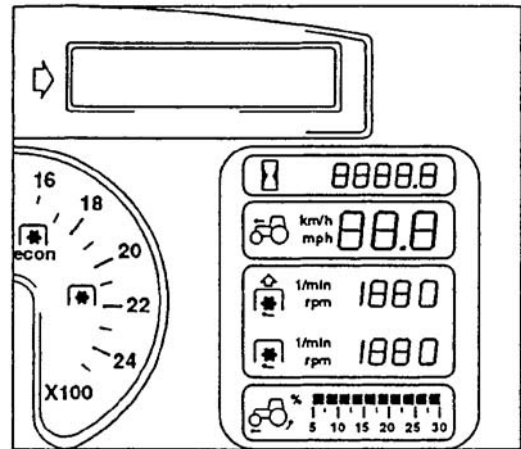
Upon pressing the key F3 the following window appears:



Fig. 58 - Check LCD displays

The last line "End LCD menu" is marked by a bar. Press the cursor keys to move the bar to the desired function and start the function by pressing ENTER.

- **Check LCD > 7 segment all segments off**
All segments are cleared in the indication fields for operating-hours, speed, etc.
- **Check LCD > 7 segment horizontal segments**
All horizontal segments appear in the indication fields.
- **Check LCD > 7 segment vertical segments**
All vertical segments appear in the indication fields.
- **Check LCD > 7 segment all segments on**
All segments appear in the indication fields.
- **Check LCD > Checkctl – all dots off**
All indications are deleted in the warning and maintenance display (only for INFOCENTER 3).
- **Check LCD > Checkctl – chess board pattern**
In the warning and maintenance display every field is filled with a weak grid (only for INFOCENTER 3).
- **Check LCD > Checkctl – all dots on**
In the warning and maintenance display every field is filled with a slightly stronger grid than in the test step “chess board pattern” (only for INFOCENTER 3).
- **Check LCD > End LCD menu**
Select this item to return to the test mode menu.



TEST MODE > F5 ANALOG INPUTS

Upon pressing the key F5 when the ignition is switched on the following window appears:



Fig. 59 - Check analog inputs

The values of charge control and terminal 15 reference will change when the engine is running:

Check analog inputs:

0	Tank	11,4%	analog value
1	Temperature	100%	analog value
2	Charge control	100%	analog value
3	Terminal 15 reference	13,7 Volt	terminal 15 voltage

- **Analog inputs > Tank**

The signal of the tank transducer at plug X 131, pin 13 of the INFOCENTER is tested: The indicated % value corresponds to the actual tank level. It is the percentage of the existing terminal 15 reference. When the plug is pulled off from the tank transducer 100% will be indicated.

- **Analog inputs > Temperature**

The signal of the temperature sensor (engine coolant) at plug X 131, pin 15 of the INFO-CENTER is tested. The relation between the input signal and the reference voltage terminal 15 is indicated in %.

- **Analog inputs > Charge control**

The signal of the charge control for the electric generator at plug X 131, pin 7 of the INFO-CENTER is tested. When the engine is running a display of 100% indicates proper charging by the electric generator.

- **Analog inputs > Terminal 15 reference**

The power supply on terminal 15 at plug X 130, pin 2 of the INFOCENTER is tested. The indication 13,7 V is the actual operating voltage.

Press the ENTER key to return to the TEST MODE.

TEST MODE > F6 POINTER

Upon pressing the key F6 the following window appears: The cursor is flashing behind "engine speed angle". Engine speed angle signifies Revolution Counter Angle.



Fig. 60 - Move pointer to position

- **Pointer > Engine speed angle**

Enter an angle, e.g. 180.

- Display: DZM angle 180 <<

After pressing the ENTER key the pointer of the engine speed indication will move from its 0 position by 180 (to about 1900 rpm).

- **Pointer > Tank angle**

After having performed the previous test step the following window appears:

- The cursor is flashing behind "Tank angle".

```

Zeiger auf Position fahren:

DZM Winkel : 180<
Tank Winkel :  <

alle Zeigerpositionen sind
in vollen Winkelgrad
  
```

Enter an angle, e.g. 45.

- Display: Tank angle 45 <<

Dopo aver premuto il tasto INVIO il puntatore del serbatoio si sposterà dalla posizione 0 di 45° verso il centro dello strumento indicatore (il quale dispone di un angolo di indicazione generale di 90° ù

- **Pointer > Temperature angle**

After pressing the ENTER key the tank pointer will move from its 0 position by 45 towards the center of the indicating instrument. (The indicating instrument has an overall indication angle of 90.)

```

Zeiger auf Position fahren:

DZM Winkel : 180<
Tank Winkel : 45<
Temp Winkel :  <

alle Zeigerpositionen sind
in vollen Winkelgrad
  
```

Enter an angle, e.g. 45.

- Display: Temp angle 45 <<

After pressing the ENTER key the temperature pointer will move from its 0 position by 45 o towards the center of the indicating instrument. (The indicating instrument has an overall indication angle of 90 o.) Simultaneously the pointer window is quit and the main menu reappears.

6.1.5 END =QUIT THE INFOCENTER PROGRAM

Upon pressing the "End" key the following window appears:

```

bitte kurz warten ...

bis Kombiinstrument
Neustart durchgeführt hat.
  
```

In case of INFOCENTER 3 a gong is sounding now and all LEDs are lighting up. Subsequently, for about three seconds the message "Read EProm from multipurpose instrument" appears.

The realized changes from the item “F1=change constant values” are saved. Changes like “Move pointer to position” etc. are rejected and a self-test of the INFOCENTER will be performed.

Subsequently the EDS initial menu reappears (compare part A 1.3 “Launching and terminating of the EDS program”).

6.2 CONSTANT VALUES FOR INFOCENTER

Every INFOCENTER is programmed with 14 constant values in order to take into account the design features of the tractor, which can be, e.g.

- Indication of the **ground speed** in km/h or mph
- Indication of the **power take-off speed**
- **Radar sensor:** existing or not existing

The central unit needs to be programmed with a specific progression of constant values which determines the type of tractor and the design features. Every progression of constant values has a running number (K...) which is unique.

NOTE. Upon calibration (traveling the 100 m distance) the constant values 9 and 10 will be newly determined.

The constant values are displayed by the central unit upon the following conditions:

- Ignition OFF; dipped beam OFF
- Pull the main beam switch **and** hold it
- Switch ON the ignition
- After approx. 10 sec the constant values are flashing and can thus be read; Release the main beam switch
- Return to normal indication by means off ignition OFF-ON

The number of the constant value is indicated in the “speed” display and the value is indicated in the “Operating-hours” display.

- K1 - Theoretical ground speed **above** 15 km/h
- K2 - Rear power take-off
- K3 - not occupied
- K4 - Front power take-off 100 rpm
Upon later up-grading of the front power take-off K4 does not need to be programmed.
- K5 - Operating-hours
- K6 - (Gear ratio engine – electric generator) engine speed
- K7 - Constant value for the true ground speed (radar sensor) **above** 15 km/h
- K8 - Determination of km/h or mph, language, radar sensor existing/not existing
- K9 - Theoretical ground speed **below** 15 km/h. Determined by calibration (traveling the 100 m distance)
- K10 - True ground speed (radar sensor) **below** 15 km/h. Determined by calibration (traveling the 100 m distance)
- K11 - not occupied
- K12 - Rear power take-off
- K13 - not occupied
- K14 - not occupied

Table 1: Constant values K1 – K14

Agrotron						
Constant	80-100 4.70 - 4095	105 6.01	106 - 135 6.00 - 6.30	150 6.45	160 - 200	230 - 260
K1 ¹⁾	3809	3675	2438	2826	1660/1440 ²⁾	2220/2078 ³⁾
K2	20				29/6 ⁴⁾	70
K3	0					
K4	210					
K5	Operating hours					
K6	1800 (mechanical engine speed controller)				4800 (electronic engine speed controller)	
K7	1000					
K8	see Table 2					
K9 ¹⁾	3809	3675	2438	2826	1660/1440 ²⁾	2220/2078 ³⁾
K10	1000					
K11	0					
K12	6					
K13	0					
K14	0					

NOTA

- 1) In case of the Agrotron tractors 80 – 150 the data of K1 and K9 refer to the 30 / 40 km/h version. For the 50 km/h version these values need to be taken from **table 3** and are to be entered accordingly.
- 2) Until month of construction 01/99: 1660, from month of construction 01/99 on: 1440
- 3) The constant values K1 and K9 for Agrotron 230/260 need to be chosen according to the tyre size (group 1; group 2) as stated in **table 4**.
- 4) 29: with factory mounted sensor
6: with upgraded sensor (assembly set 04426723)

Table 2: Values of constant K8

Value of constant K8	Language	Speed display	Radar sensor existing?	Flashing light - beep
75	danish	km/h	NO	ON
107	danish	km/h	SI	ON
11	danish	km/h	NO	OFF
43	danish	km/h	SI	OFF
65	german	km/h	NO	ON
97	german	km/h	SI	ON
1	german	km/h	NO	OFF
33	german	km/h	SI	OFF
66	english	km/h	NO	ON
67	english	km/h	NO	ON
98	english	km/h	YES	ON
99	english	km/h	YES	ON
2	english	km/h	NO	OFF
3	english	km/h	NO	OFF
34	english	km/h	YES	OFF
35	english	km/h	YES	OFF
69	french	km/h	NO	ON
101	french	km/h	YES	ON
5	french	km/h	NO	OFF
37	french	km/h	YES	OFF
77	italian	km/h	NO	ON
109	italian	km/h	YES	ON
13	italian	km/h	NO	OFF
45	italian	km/h	YES	OFF
79	dutch	km/h	NO	ON
111	dutch	km/h	YES	ON
15	dutch	km/h	NO	OFF
47	dutch	km/h	YES	OFF
73	portugese	km/h	NO	ON
105	portugese	km/h	YES	ON
10	portugese	km/h	NO	OFF
41	portugese	km/h	YES	OFF
71	spanish	km/h	NO	ON
103	spanish	km/h	YES	ON
7	spanish	km/h	NO	OFF
39	spanish	km/h	YES	OFF

Table 3: Constants K1; K9 for 30/40 km/h version, resp. 50 km/h version, and constant K6 depending on the engine controller

Typ	Vehicle ID no.	K1 = K9	K1 = K9	Engine version, K6	EMR**
		30/40	50 km/h	mech. controller	
8001/8002	4.70	3809	-	1800	4400
8003/8004	4.80/80	3809	-	1800	4400
8005/8006	4.85/85	3809	-	1800	4400
8007/8008	4.90/90	3809	-	1800	4400
8009/8010	4.95/100	3809	-	1800	4400
8011	6.00/106	2438	-	1800	4800
8012	6.00/106	2438	2372	1800	4800
8013	6.05/110	2438	-	1800	4800
8014	6.05/110	2438	2372	1800	4800
8015	6.15	2438	-	1800	4800
8016	6.15	2438	2372	1800	4800
8017	6.20/120	2438	-	1800	4800
8018	6.20/120	2438	2267	1800	4800
8019	6.30/135	2438	2267	1800	4800
8020	6.45/150	2826	2411	1800	4800
8028	6.01/105	3675	-	1800	4400
8029	160	1660/1440*	-	-	4800
8030	175	1660/1440*	-	-	4800
8031	200	1660/1440*	-	-	4800
8058	230	-	2220	-	4800
8058	230	-	2078	-	4800
8059	260	-	2220	-	4800
8059	260	-	2078	-	4800
8063	115	2438	2372	1800	4800
8092/8093	120/135	-	2326	-	4800

* 1660: until month of construction 01/99, 1440 from month of construction 01/99

** EMR= electronic motor controller

Table 4: Constants K1; K9 for Agrottron 230 and 260 depending on the rear wheel tyres.

Group 1 K1 = K9 =2220		Group 2 K1 = K9 =2220	
Designation	Circumferential line (mm)	Designation	Circumferential line (mm)
20.8 R 42	5783	710 / 70 R 42	6180
650 / 65 R 42	5744	650 / 65 R 46	6060
620 / 70 R 42	5810	650 / 85 R 38	6084
710 / 75 R 34	5761	620 / 70 R 46	6120
710 / 70 R 38	5780	-	-
580 / 70 R 42	5700	-	-

7. PREPARATIONS FOR DIAGNOSIS OF THE SPRING-SUSPENDED FRONT AXLE

As a preparatory measure the connection between tractor and computer needs to be established so as to check the front axle control unit. The interface cable and the adapter cable are serving for this purpose (see figure).

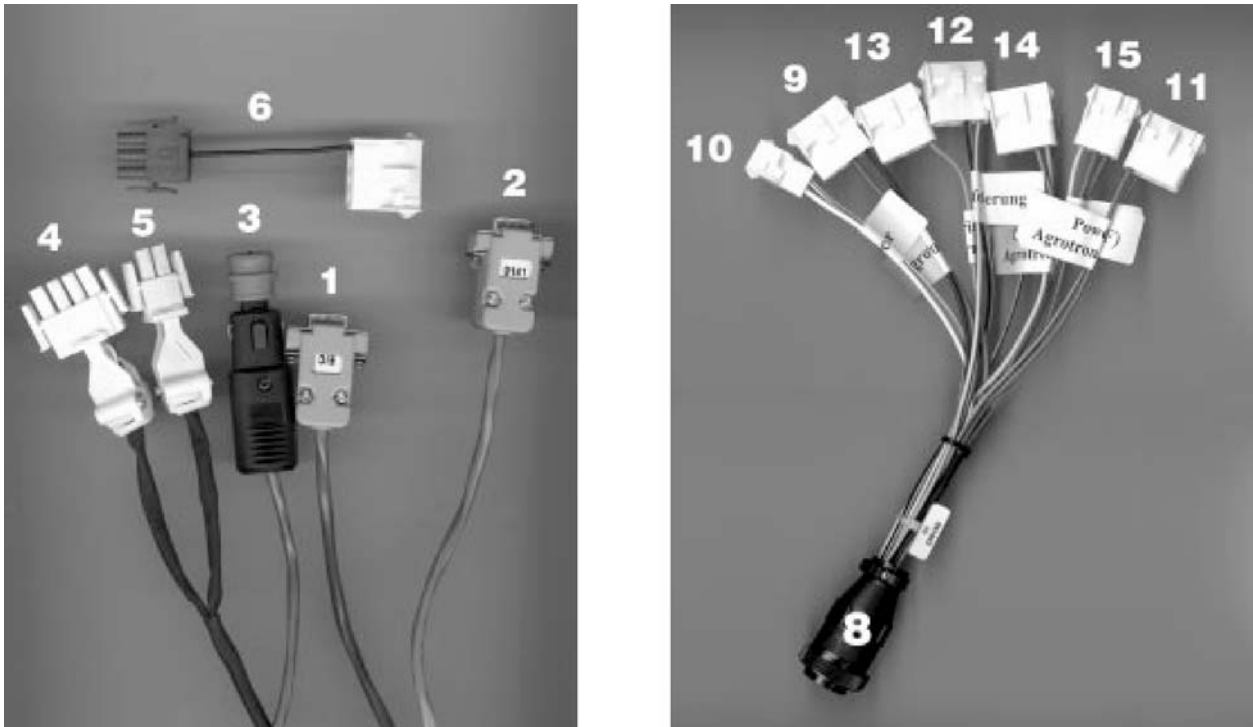


Fig. 64 - Interface cable and adapter cable

- 1 - Connect plug (2) of the interface cable with the designation "9141" to the computer (COM interface)
- 2 - Connect plug (3) of the interface cable for the 12 V supply to the cigar lighter
- 3 - Connect the 4-pole plug (4) of the interface cable to the plug (12) – designation "front axle spring-suspension" – of the adapter cable
- 4 - Insert the central plug (8) of the adapter cable into the central diagnosis interface in the fuse box
- 5 - Switch on ignition and start the engine
- 6 - Start the computer and call the EDS program (compare item A 1.3 – Launching and terminating of the EDS program)
- 7 - Make sure that the right option is called in the initial menu:
 - Option 6** -> plug (2) with the designation "9141" to interface **COM 1**
 - Option 7** -> plug (2) with the designation "9141" to interface **COM 2**

7.1 PROGRAM DESCRIPTION

7.1.1 MAIN MENU

After selecting **Option 6** resp. **Option 7** (depending on the computer interface) the main menu appears:

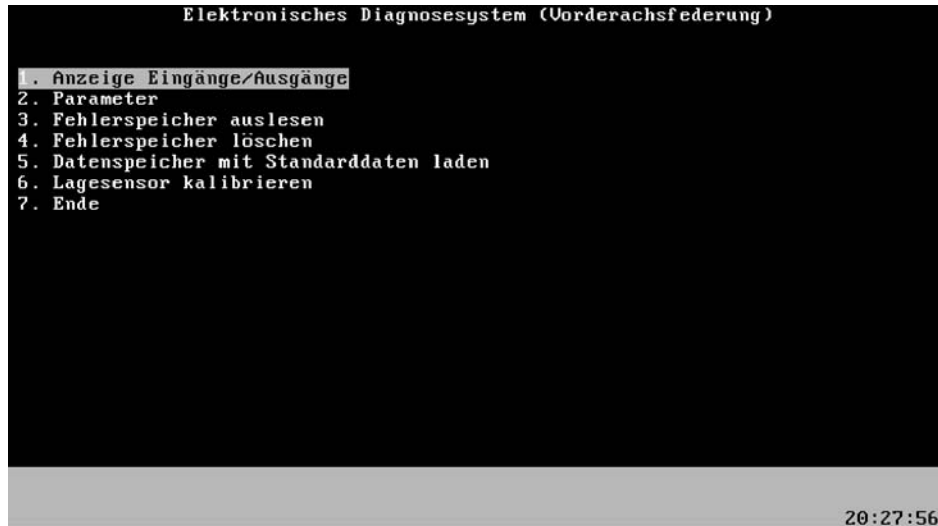


Fig. 65 - Main menu

The main menu serves for the activation of the individual submenus. There are two ways to accomplish this purpose:

- Press one of the keys 1 – 7
- Select the desired subprogram by means of the cursor keys (arrow up/arrow down) and confirm by pressing the ENTER key.

Press the ESC key to quit the subprograms and to return to the main menu.

7.1.2 MONITOR INPUT/OUTPUT

There are two plugs connected at the electronic box of the spring-suspended front axle (below the bottle holder): A black plug with the designation JX3 and a white plug with the designation JX4. The input and output signals are transferred into the electronic box via these two plugs.

Upon selection of menu item 1, all input and output signals existing at the control box of the spring-suspended front axle are displayed on the screen.



Fig. 66 - Monitor Input/output

- **Monitor input/output > 4WD (4RM)**

The all-wheel drive input signal is transferred into the electronic box via plug JX4, pin 11. When the all-wheel drive is switched off you can measure a voltage of 12 V between pin 11 and ground. This voltage is transferred from the central electrical system (safety circuit board) via plug P3, pin 17.
For switching the axle ON/OFF upon standstill of the tractor ($v < 2$ km/h) this signal must amount to 12 Volt.
- **Monitor input/output > Brake**

The input signal of the brake is transferred into the electronic box via plug JX4, pin 13. When the brake is not actuated a voltage of 12 V is transferred into the electronic box from the central electric system plug P3, pin 19 via relay 8 and fuse no. 10.
For switching the axle ON/OFF upon standstill of the tractor ($v < 2$ km/h) this signal must amount to 12 Volt.
- **Monitor input/output > Switch**

Input signal of the rocker switch spring-suspension on/off. When the rocker switch is pressed, a voltage of 12 V is existing at pin 1 of the rocker switch plug being transferred to the electronic box JX4, pin 12.
- **Monitor input/output > Ground speed (km/h)**

The signal (130 pulses/meter travel distance) is generated from the bevel gear shaft sensor, being transferred into the electronic box via the plug AS3, pin 4 (under the right side console near the floor mat) and via the plug JX4, pin 19.
- **Monitor input/output > Sensor Position (Volt)**

The position sensor signal is transferred from pin 2 (middle pin) at the position sensor into the electronic box via the plug JX4, pin 14. The setpoints are:
Axle off lowered: 1,8 ... 1,9 Volt
Axle on in medium position: 4,0 Volt
Axle on fully lifted: 6,0 Volt
Removed sensor in normal position: 1,5 Volt; pressed position: 6,4 Volt
- **Monitor input/output > Raise Valve**

When the vehicle is lifted a current is injected into the solenoid valve for lifting via pin 1 at the plug JX3. Between pin 1 and 2 of the solenoid valve for lifting a voltage of 12 Volt can be measured.
- **Monitor input/output > Lower Valve**

During the lowering process of the axle a current is injected into the solenoid valve for lowering via pin 2 at the plug JX3. Between pin 1 and 2 of the solenoid valve for lowering a voltage of 12 Volt can be measured.
- **Monitor input/output > Load sense Valve**

During the lowering/lifting process of the axle a current is injected into the load sensing valve via pin 2 at the plug JX4. Between pin 1 and 2 of the load sensing valve a voltage of 12 Volt can then be measured.
- **Monitor input/output > Lamp**

When the spring-suspension of the axle is active, the electronic box transfers a voltage to the lamp located in the rocker switch via JX4, pin 8. This lamp indicates whether the spring-suspension is switched on and serves for indicating the error code by flashing in case of a pending error.
Read error code indication: Example: Error code 15
blinking one time (tens) – short pause (1,5 seconds) –blinking five times (ones). Two error codes are separated from each other by a blinking pause of approx. 3 seconds. For a list of error codes see item E4.

7.1.3 OPERATIONAL PARAMETERS

The parameters saved in the control box (standard data) are displayed.

Elektronisches Diagnosesystem (Vorderachsfederung)	
Parameter	Wert
Sollwert (Volt)	4,00
Sollwert - Federung AUS (Volt)	2,00
Innere Lagehysterese (Volt)	0,19
Äußere Lagehysterese (Volt)	1,50
Totzeit nach Bremsbetätigung (Sek.)	0,50
Totzeit der Regelung (Sek.)	1,50
Öffnungszeit des Senkenventils (Sek.)	10,00
Niveauregulierung in Funktion ab km/h	1,94

15:40:21

Fig. 67 - Operational Parameters



CAUTION!

In this program item the parameters cannot be altered.

7.1.4 DISPLAY CONTROLLER ERRORS

In this menu all errors saved in the control box are displayed.

Elektronisches Diagnosesystem (Vorderachsfederung)	
1. Anzeige Eingänge/Ausgänge	
2. Parameter	
3. Fehlerspeic	
4. Fehlerspeic	
5. Datenspeich	
6. Lagesensor	
7. Ende	

Fehlerspeicher	
Code	Fehlerbeschreibung
15	Lagesensor
11	Endstufe Heben

<Beliebige Taste drücken>

15:40:37

Fig. 68 - Display Controller Errors

7.1.5 CLEAR CONTROLLER ERROR

All errors saved in the control box are erased.



Fig. 69 - Clear Controller Errors

7.1.6 RELOAD EEPROM WITH DEFAULT

By means of this menu the parameters (standard data) are written into the control box, e.g. upon replacement or data loss of the control box (for the list of parameters refer to submenu item 2.3 in this manual). The parameters are permanently saved in the program EDS and cannot be altered.



Fig. 70 - Reload EEPROM with Defaults

7.1.7 CALIBRATE SENSOR

This menu item is not executable. The position sensor setting is carried out upon lowered axle by means of corresponding adjustment in the support to 1,8 – 1,9 Volt.

7.1.8 QUIT

The diagnosis program of the spring-suspended front axle is terminated and the EDS initial menu reappears.

7.2 PIN ASSIGNMENT OF THE ELECTRONIC BOX “SPRING-SUSPENDED FRONT AXLE ”

Black plug JX3		
Pin	Designation	Remarks
JX3-1	Output solenoid valve “lifting”	12V
JX3-2	Output solenoid valve “lowering”	12V
JX3-4	Power supply electronic box	12 V ZE: J2-7 ; Fuse F17 with 7,5A (with old design via overhung relay)
JX3-5	Power supply electronic box	12 V ZE: J2-7 ; Fuse F17 with 7,5A (with old design via overhung relay)
JX3-20	Ground electronic box	
White plug JX4		
Pin	Designation	Remarks
JX4-2	Output solenoid valve load sensing	12V
JX4-8	Output diagnosis lamp	12V
JX4-9	Power supply position sensor	8V
JX4-11	Input all-wheel drive signal	12 V in case of all-wheel drive “OFF” from ZE P3-17
JX4-12	Input spring-suspension “ON/OFF”	12 from push-button PIN 1
JX4-13	Input brake signal	12 V if brake is not actuated; from ZE P3-19 via RL8 and F11
JX4-14	Analog input position sensor	PIN 2 position sensor (2-6 V)
JX4-15	ISO-9141 serial interface k-line	PIN 13 at diagnosis plug
JX4-17	Ground position sensor	PIN 1 position sensor
JX4-19	Input theoretical ground speed	pulses/m via INFOCENTER from bevel gear shaft sensor (from AS3-4)
JX4-22	ISO-9141 serial interface k-line	PIN 14 at diagnosis plug

NOTE. The pins not mentioned are not occupied!

Mounting position of the E-box: Left side console under the bottle holder

Regarding the old system (press key for about 5 sec.): Overhung relay serves for resetting the E-box; switching is performed through terminal 50 (picked up at AS1-4) and fuse-protected via an overhung fuse (5A).

7.3 ERROR CODES

Code	Error description	Connection	Error description
11	Lifting solenoid	JX3-1	Short circuit or interruption in the output to solenoid valve "lifting"
12	Lowering solenoid	JX3-2	Short circuit or interruption in the output to solenoid valve "lowering"
13	Load sensing solenoid	JX4-2	Short circuit or interruption in the output to LS solenoid valve
15	Position sensor	JX4-14	Position sensor signal missing or out of working range, setpoint: Axle lowered 1,8 ... 1,9 Volt
16	Position sensor	JX4-9	Error in the power supply voltage, setpoint 8 Volt between pin 1 and 3 at the sensor
17	Battery	JX3-4 JX3-5	Battery voltage exceeds 16 Volt
19	Battery	JX3-4 JX3-5	Battery voltage is below 10 Volt
21	Rocker switch	JX4-8	Short circuit in the rocker switch lamp.

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SECTION 30

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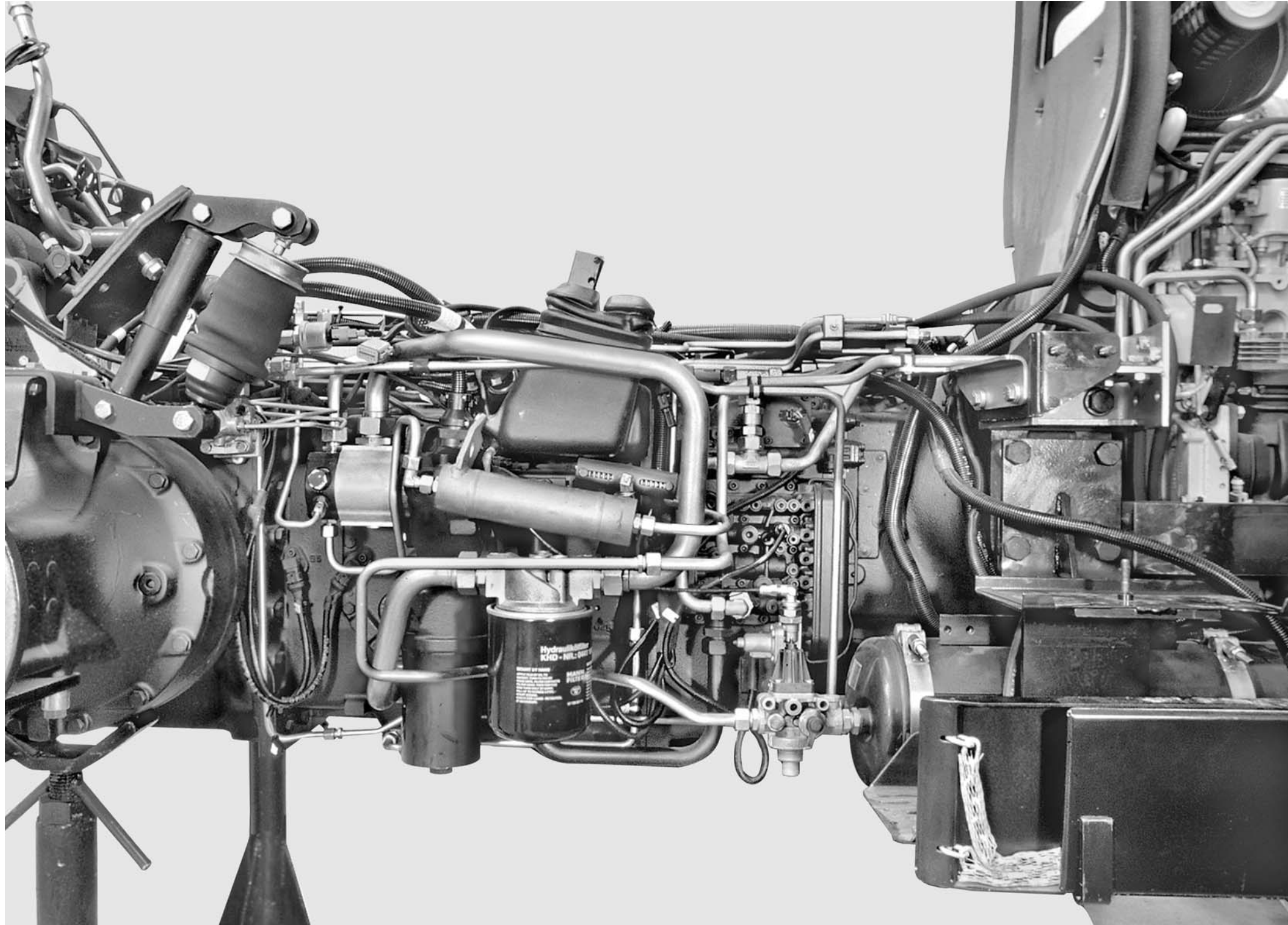
METHOD FOR REMOVAL AND REFITTING OF RIGID PIPES AND WIRING

- 1 - The rigid pipes of the various systems can all be removed individually, i.e. without having to remove any pipes belonging to other systems.
- 2 - For particularly complex removal operations, number the pipes in the order in which they are removed, label any intermediate connections and the positions of the intermediate retaining clamps. Refit the pipes in reverse order to removal.
- 3 - After having repositioned the pipes in their original locations, tighten the fittings by hand and locate the retaining clamps and intermediate fixings.
- 4 - First tighten the fittings using also a holding wrench to the torques specified in the tables in Section 00, and then tighten the pipe clamps.
- 5 - To enable the operator to determine the correct routes for the rigid pipes and the wiring harnesses on the tractor frame, we have provided photographs showing the original routes for the two versions of the tractor with additional oil flow obtained by gear pumps and a variable displacement pump, both of which are equipped with air trailer braking.

IMPORTANT

- 1 - After removing pipes, immediately plug the ends of the pipes and the open fittings on the components from which they were disconnected in order to prevent the entry of contaminants.**
- 2 - After disconnecting electrical connectors, protect them against oil, dust and other contaminants by covering them in bags made of waterproof material and attach the bags to the wiring with insulating tape.**
- 3 - Should any oil, coolant, moisture or water come into contact with the connectors, clean them with compressed air at low pressure (max. 2 bar) and clean the wires and contacts with isopropyl alcohol or a specific water-repellent product.**
- 4 - Check wiring fixings carefully; these must not impinge on the connectors and must be positioned at regular intervals of about 30 cm to prevent vibration that could cause an interruption in current flow or signal loss.**

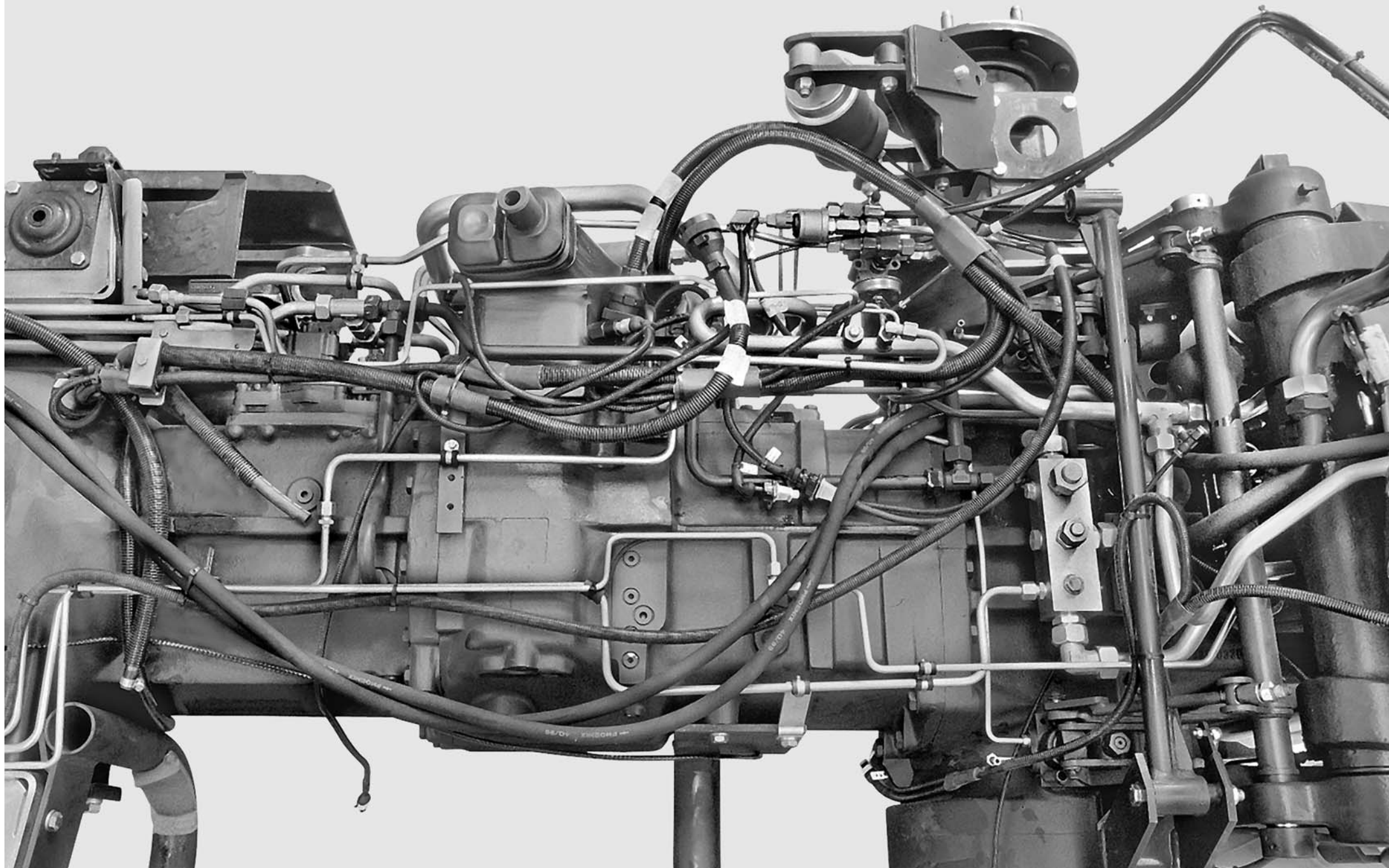
PUMP SIDE SYSTEMS AND WIRING (CC VERSION WITH PRIORITY VALVE)



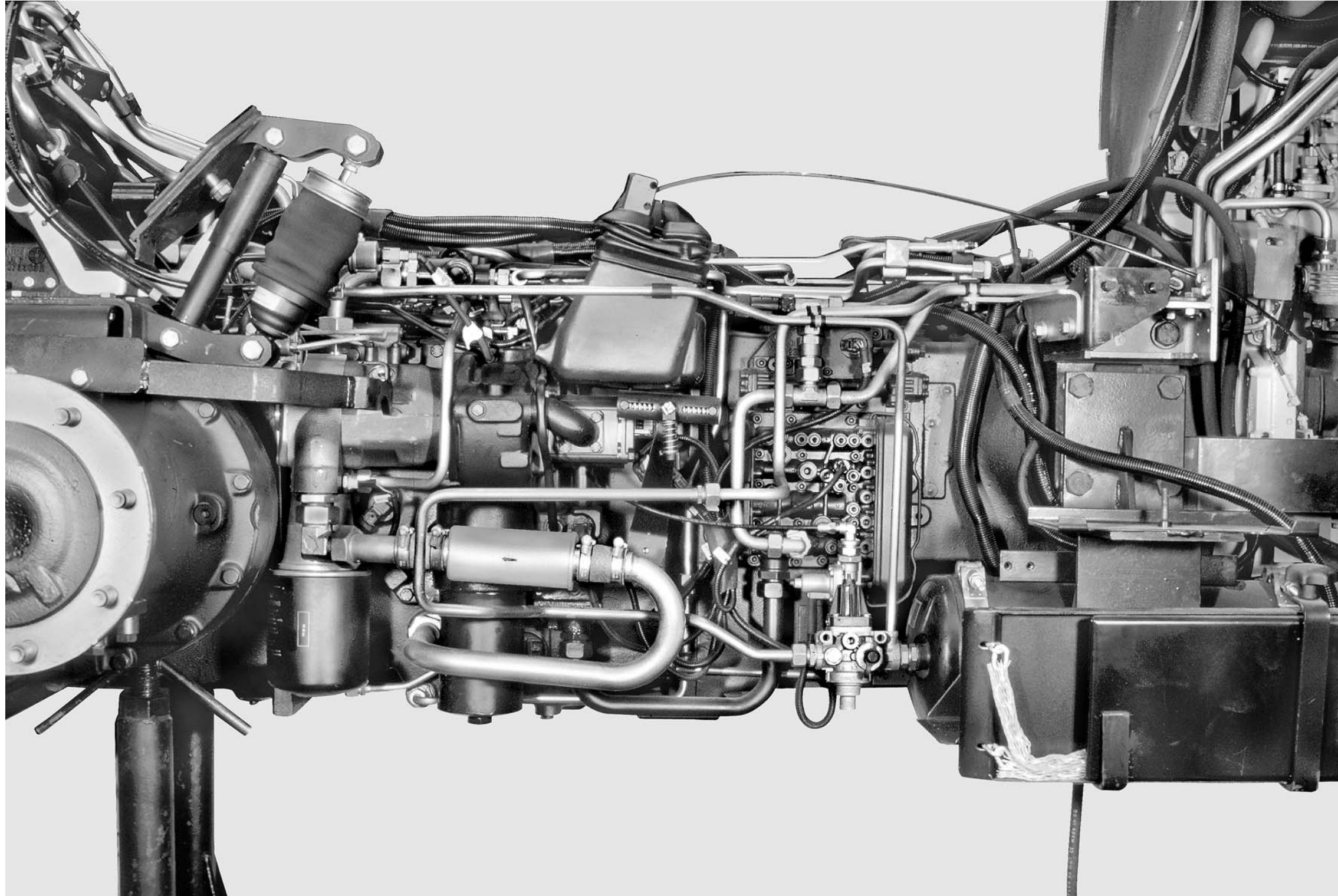
DETAIL OF PUMP SIDE SYSTEMS AND WIRING (CC VERSION WITH PRIORITY VALVE)



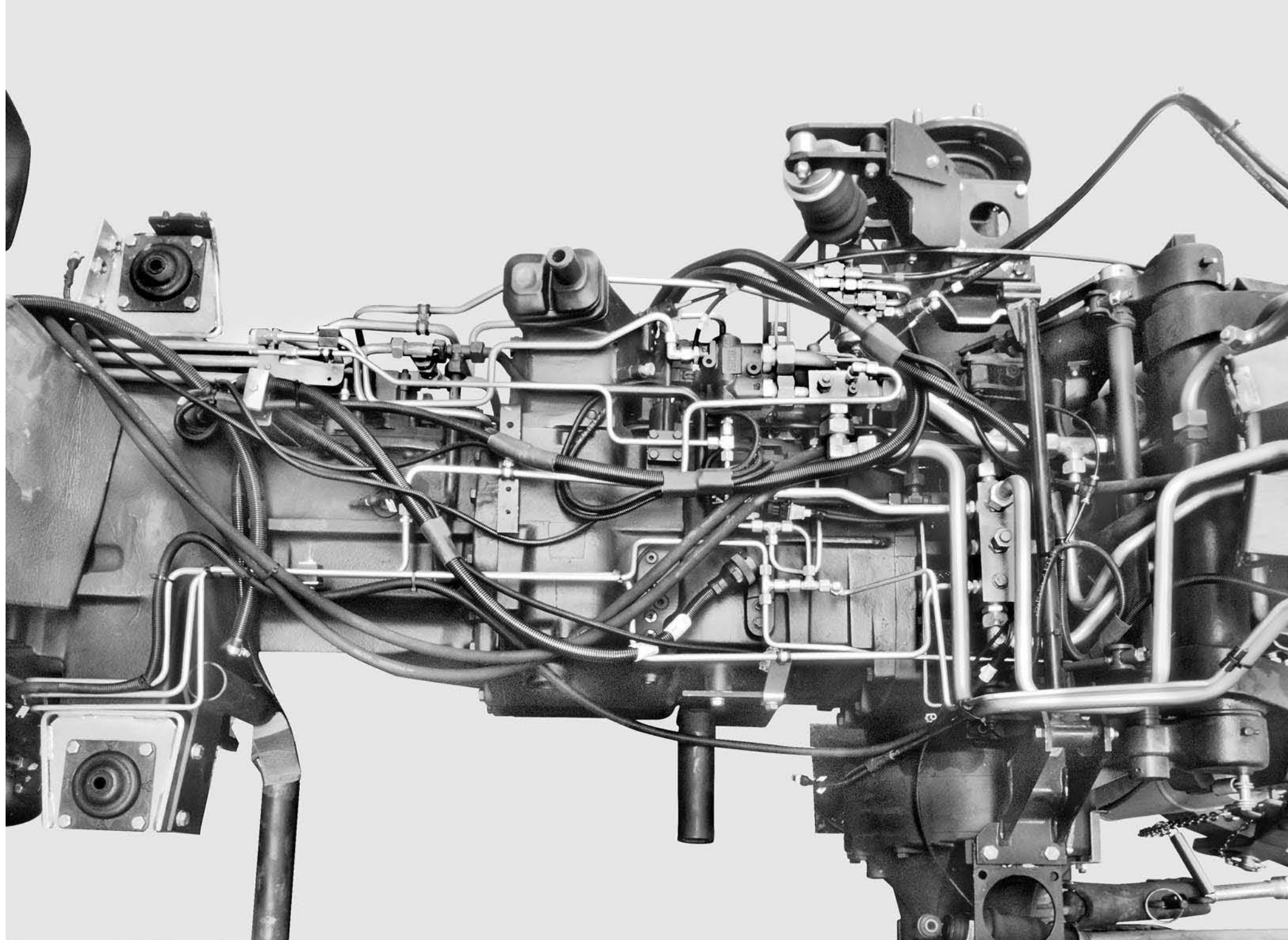
UPPER SYSTEMS AND WIRING (CC VERSION WITH PRIORITY VALVE)



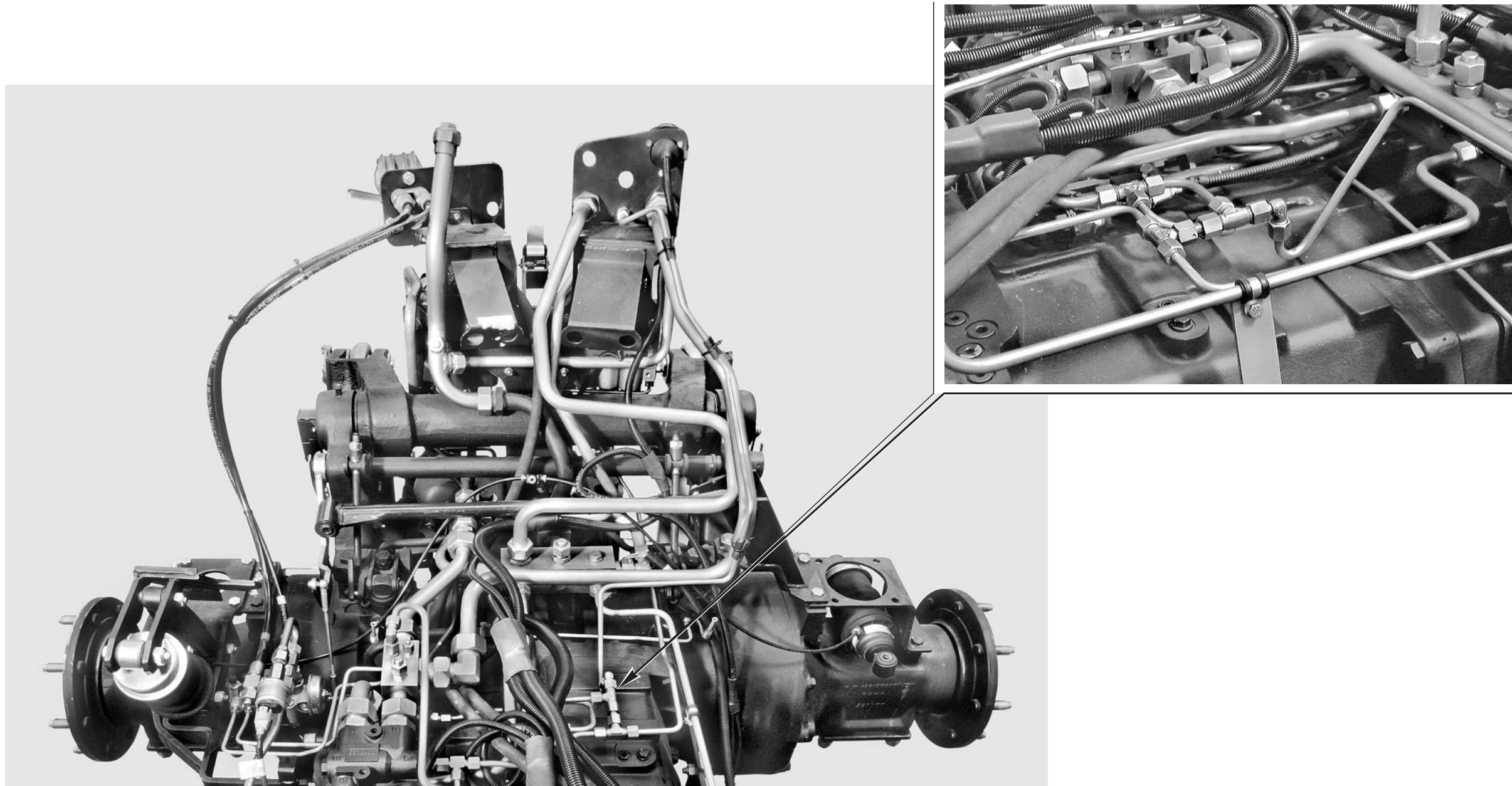
PUMP SIDE SYSTEMS AND WIRING (LS VERSION)



UPPER SYSTEMS AND WIRING (LS VERSION)



SYSTEMS AND SUPPLEMENTARY HYDRAULIC COUPLERS (LS VERSION)

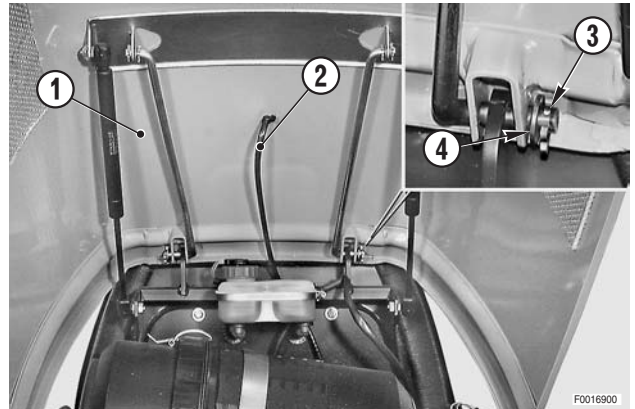


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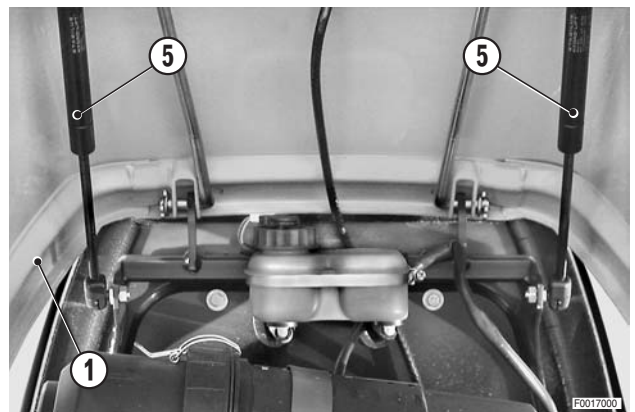
REMOVAL AND ADJUSTMENT OF ENGINE HOOD AND LAMP ASSEMBLIES

1. Removal of the hood

- 1 - Raise the hood (1) fully.
- 2 - Disconnect the screen washer pipe (2).
- 3 - While keeping the hood in the raised position, remove the cotter pins (3) and the washers (4).

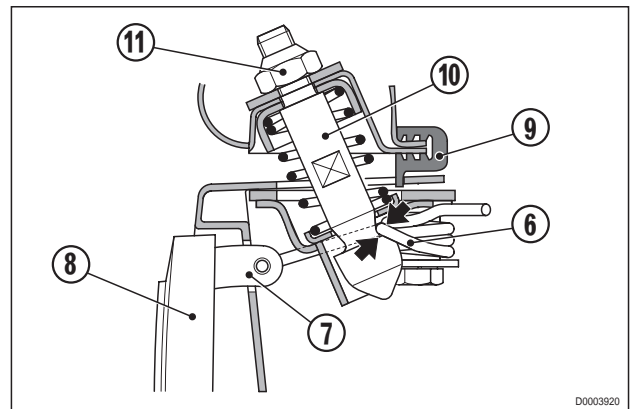


- 4 - Detach the gas springs (5) from the frame and remove the complete hood assembly (1).



1.1 Adjustment of the hood latch

- ★ Before adjusting the hood latch, make sure that the hood release button is fitted and that the gas springs are disconnected.
- 1 - Check that the spring (6) is engaged with the plate (7) of the release button (8) and check that when the hood gasket (9) comes to rest on the frame, the spring (6) engages the groove on the striker (10). If necessary, adjust the depth of the striker by way of self-locking nut (11).

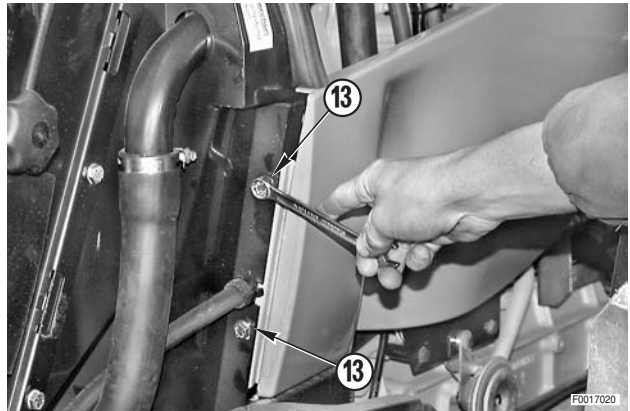


2. Removal of the side panels

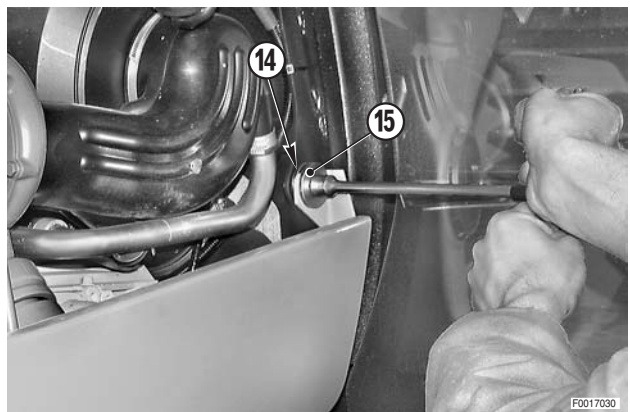
- 1 - Lift and remove the grilles (12).



2 - Unscrew and remove the front bolts (13).



3 - Unscrew and remove the rear nut (14) and remove the washer (15).

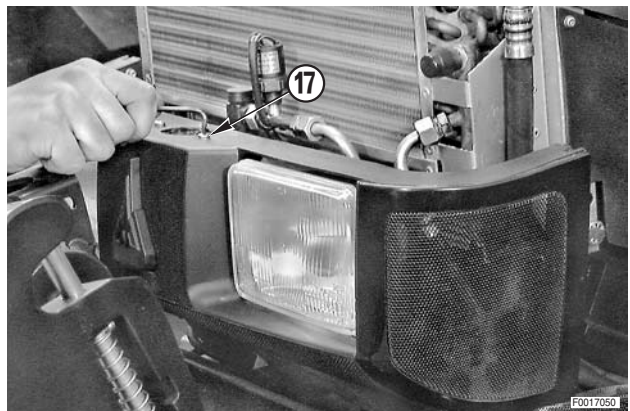


3. Removal of the lamp assemblies and hood release button

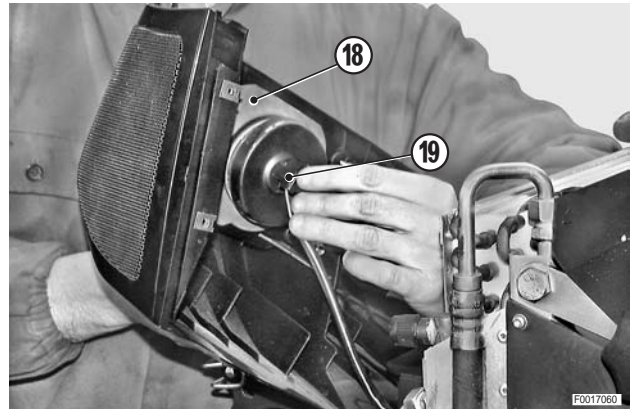
1 - Remove the lateral retaining screws (16).



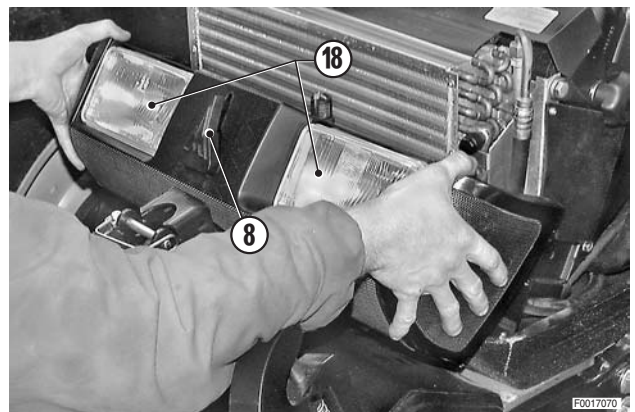
2 - Remove the central retaining screws (17).



- 3 - Unplug the lamp connectors (19) from the lamp assemblies (18).

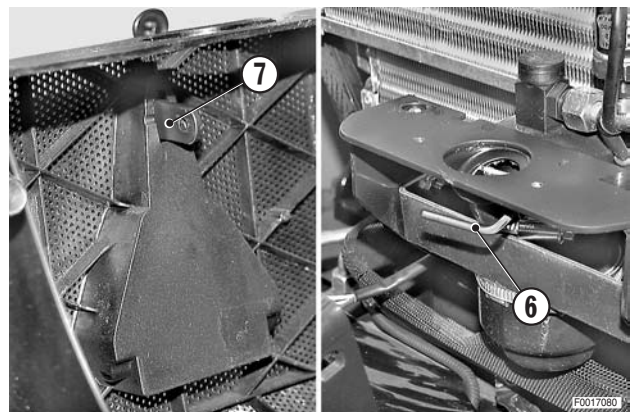


- 4 - Remove the lamp assemblies (18) by rotating them to the rear and moving them sideways to disengage the release button (8).



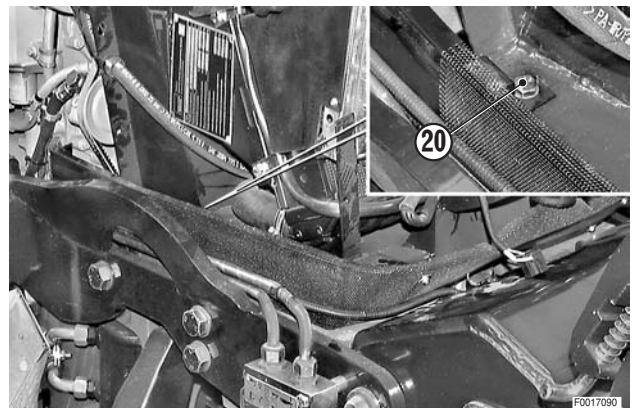
- 5 - If necessary, press the plate (7) of the release button (8) to help disengage the spring (6).

※ 1

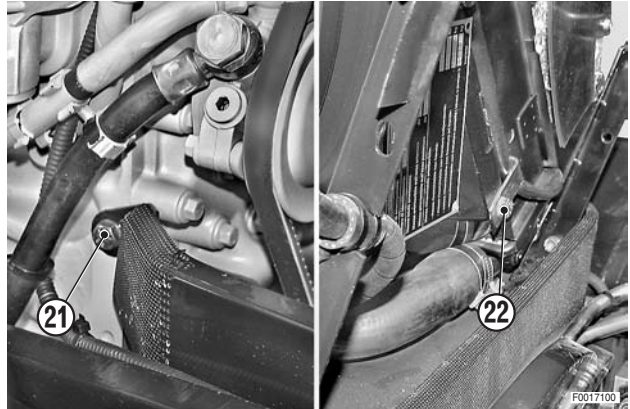


4. Removal of the lower guard

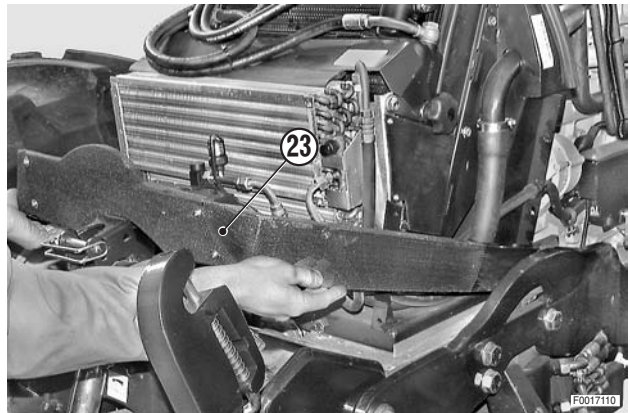
- 1 - Remove the four central retaining bolts (20).



2 - Removal the side bolts (21), (22) and their washers.



3 - Remove the lower guard (23) by withdrawing it towards the front of the tractor.

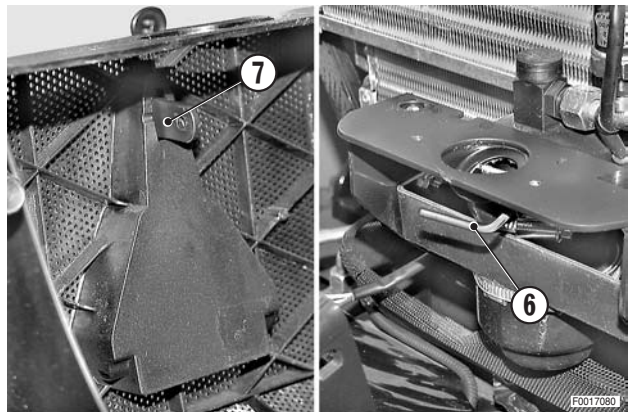


REFITTING AND ADJUSTMENT OF ENGINE HOOD AND LAMP ASSEMBLIES

- Refitting is the reverse of removal.

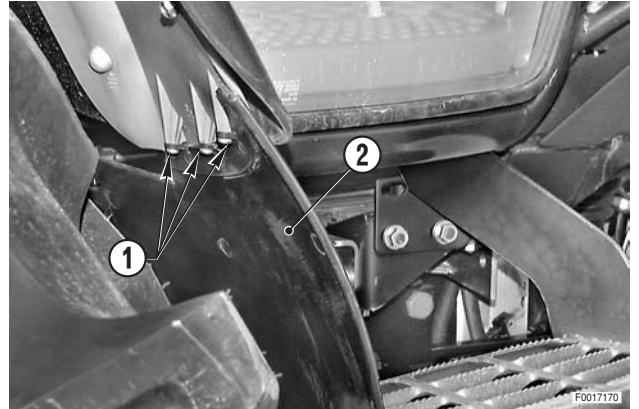
※ 1

- ★ While engaging the release button with the spring (6), take care not to break the latch plate (7) by applying excessive force.

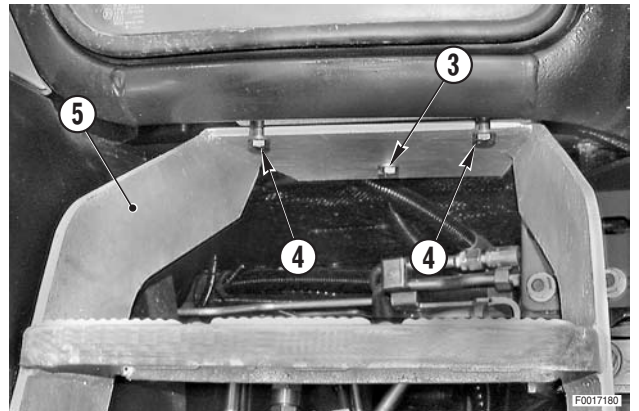


REMOVAL OF THE CAB ACCESS STEPS

- 1 - Unscrew and remove the bolts (1) securing the lower fender (2).



- 2 - Loosen the bolts (3) and (4) securing the steps (5).
 - ★ For safety reasons, do not remove the bolts yet.

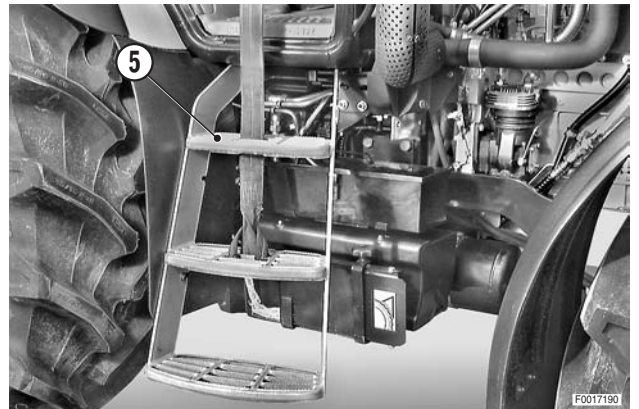


- 3 - Attach a hoist to the steps (5).



Steps: 17 kg (37.5 lb.)

- 4 - Remove the central bolt (3), disengage the steps (5) from the two remaining bolts (4) and remove the steps.

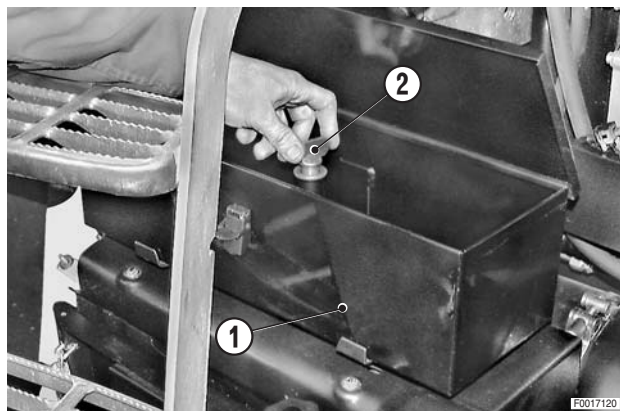


REFITTING THE CAB ACCESS STEPS

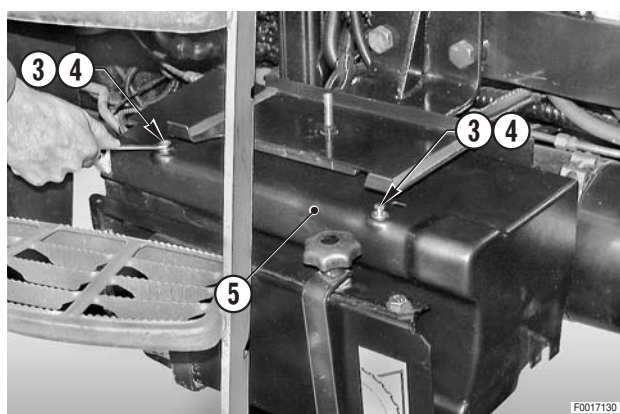
- Refitting is the reverse of removal.

REMOVAL OF THE BATTERY

- 1 - Open the tool box (1) and remove the retaining nut (2).
Remove the tool box (1).



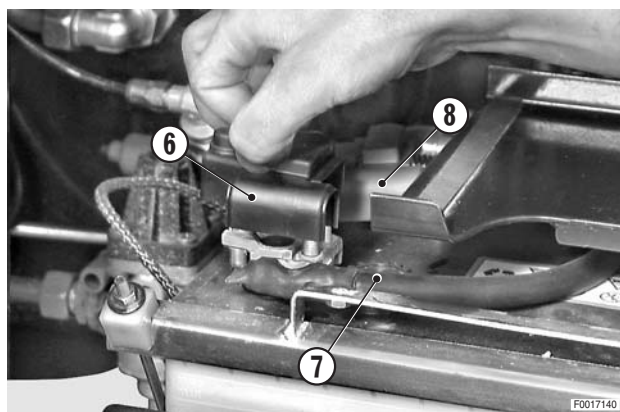
- 2 - Remove the bolts (3) with their washers (4) and remove the battery cover (5).



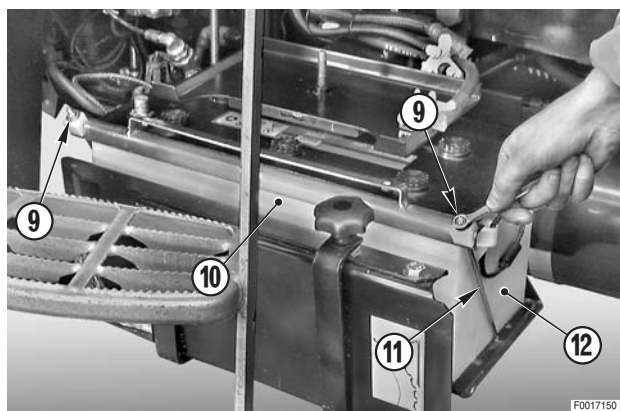
- 3 - Remove the terminal covers (6) and disconnect the leads (7) and (8).

⚠ 1

! Always disconnect the negative lead (-) before the positive lead (+).

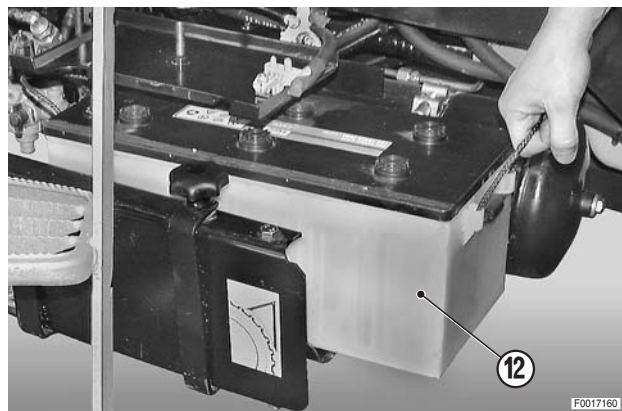


- 4 - Loosen off the nuts (9) sufficiently to tilt and remove the battery (12) securing clamp (10) and rods (11).



5 - Remove the battery (12) using the handles provided.

- ⚠ If the battery is not to be used for several days, store it in a dry, well-ventilated place at a temperature above +5°.



REFITTING THE BATTERY

- Refitting is the reverse of removal.

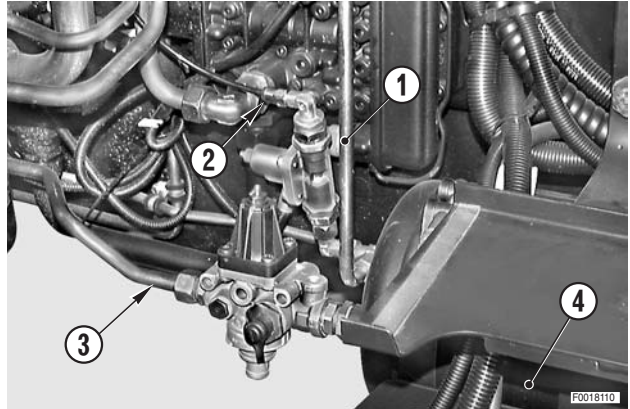


- ⚠ Always re-connect the positive lead (+) before the negative lead (-).

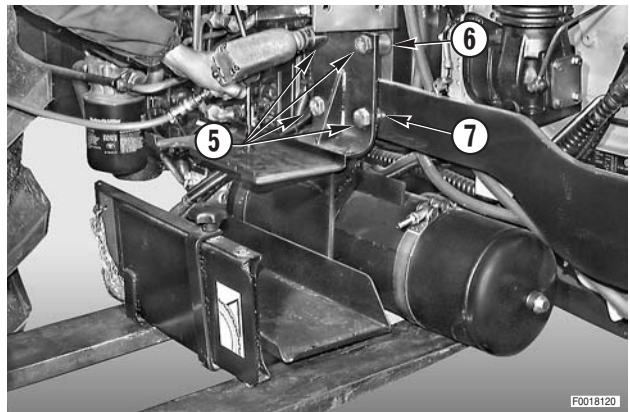
REMOVAL OF THE AIR RESERVOIR AND BATTERY SUPPORT (versions with air trailer braking only)

! Discharge the residual pressure from the reservoir.

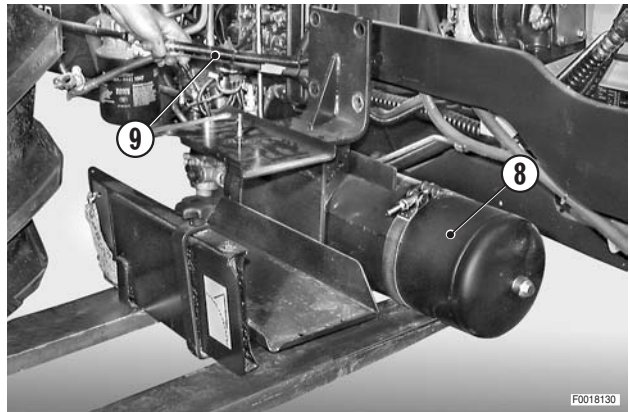
- 1 - Remove the battery.
(For details, see «REMOVAL OF THE BATTERY»).
- 2 - Disconnect the pipes (1), (2) and (3) from the valves mounted directly on the reservoir (4).



- 3 - Support the assembly using suitable lifting equipment; unscrew and remove the bolts (5) and spacers (6) and (7).
★ Note that the thicker spacers are located at the top of the bracket.



- 4 - Lower the assembly (8); move the battery leads (9) out of the way and remove the complete assembly.



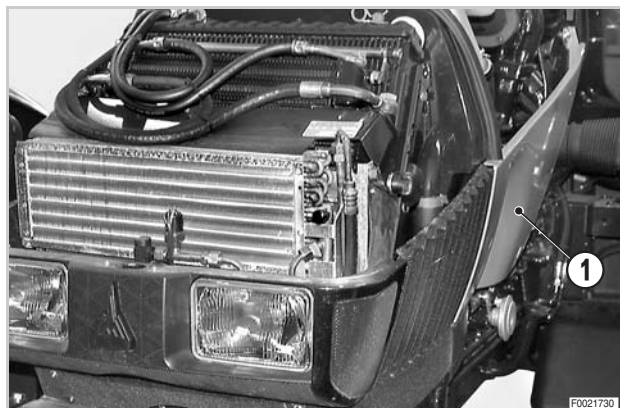
REFITTING THE AIR RESERVOIR AND BATTERY SUPPORT

- Refitting is the reverse of removal.

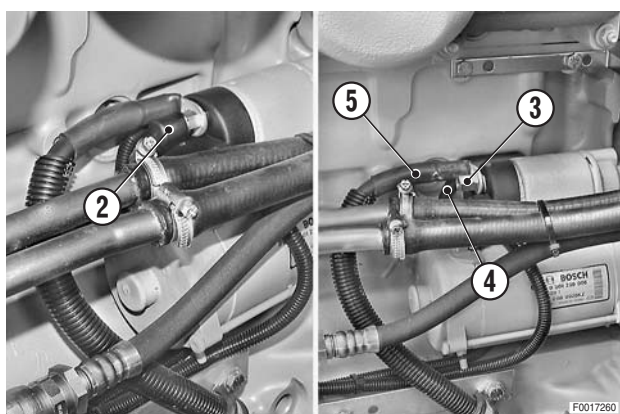
REMOVAL OF THE STARTER MOTOR

! Remove the battery cover and disconnect the negative battery lead (-).

1 - Remove the left hood side panel (1).

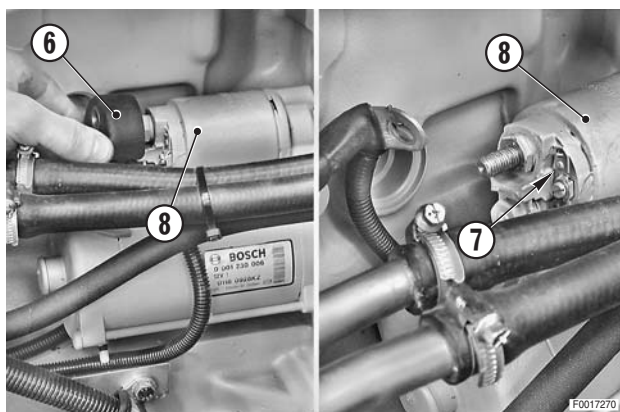


2 - Remove the terminal protector (2) and the nut (3) securing leads (4) and (5).



3 - Remove the terminal cover (6) and disconnect the lead (7).

4 - Remove the starter motor (8).
For details, see the engine manual.



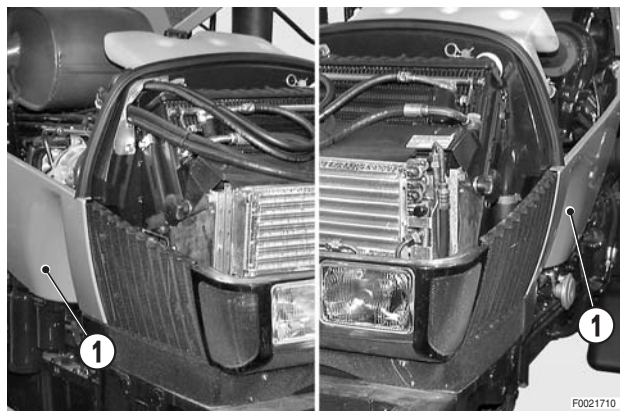
REFITTING THE STARTER MOTOR

- Refitting is the reverse of removal.

REMOVAL AND RENEWAL OF THE ALTERNATOR

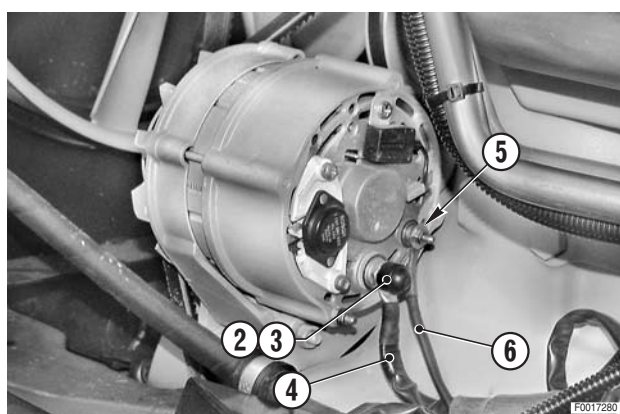
! Remove the battery cover and disconnect the negative battery lead (-).

1 - Remove the left and right side panels (1).



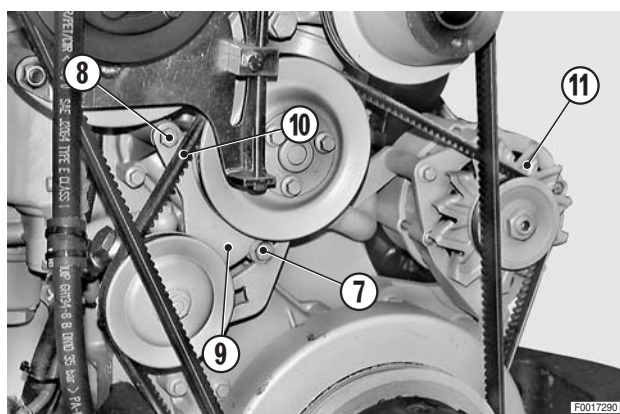
2 - Remove the terminal protector (2), remove the nut (3) and disconnect the lead (4).

3 - Remove the nut (5) and disconnect the lead (6).



4 - Loosen the bolts (7) and (8) of the fuel pump bracket (9) in order to slacken off the drivebelt (10).

5 - Remove the alternator (11).
For details, see the engine manual.



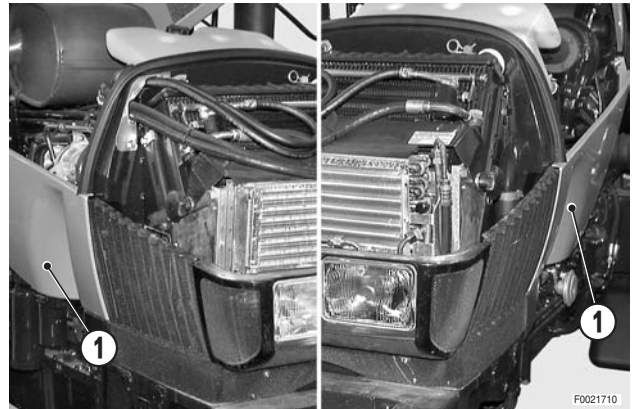
REFITTING THE ALTERNATOR

- Refit the alternator following the removal steps in reverse order and adjust the drivebelt tension.
(For details, see «RENEWAL AND TENSIONING OF THE ALTERNATOR DRIVEBELT»).

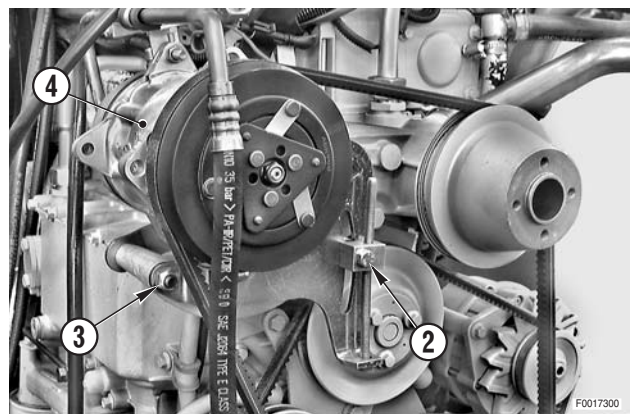
RENEWAL AND TENSIONING OF THE ALTERNATOR DRIVEBELT

- ★ The drivebelt must be renewed at the first sign of wear. Check for fraying, cracks and separation of the belt plies.
- ★ Some of the operations described below refer only to models equipped with front PTO and cab air conditioning. For machines not equipped with these items, these operations should be ignored.
- ⚠ Remove the battery cover and disconnect the negative battery lead (-).

1 - Remove the side panels (1).

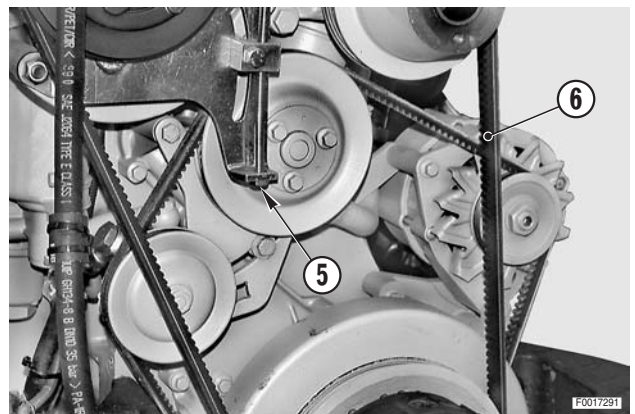


2 - Loosen the tensioner block (2) and the nut (3) securing the compressor (4).



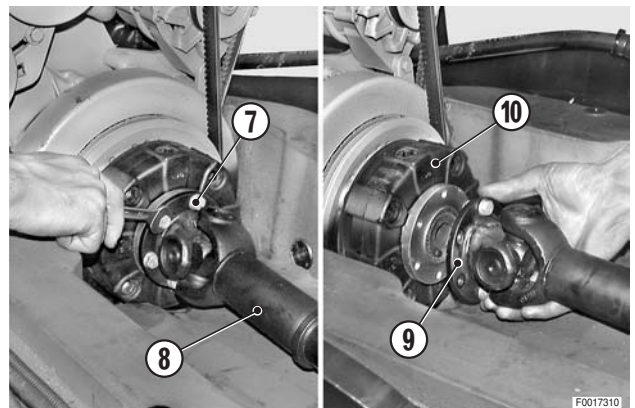
3 - Unscrew the threaded rod (5) of the tensioner to slacken off the fan drivebelt (6).

- ★ Loosen the drivebelt sufficiently to be able to slip it off the compressor pulley.

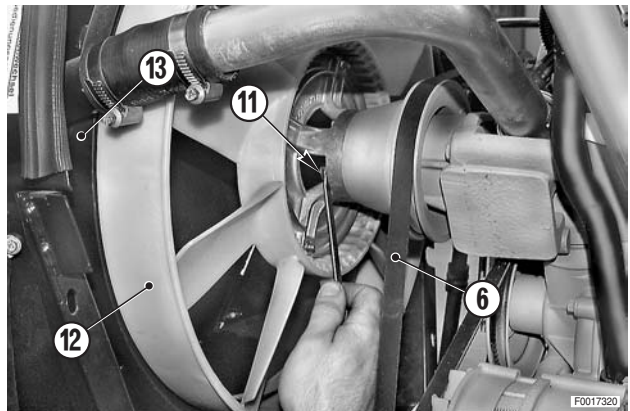


4 - **Models with front PTO only:** loosen and fully unscrew the six bolts (7) securing the flange of the cardan shaft (8).

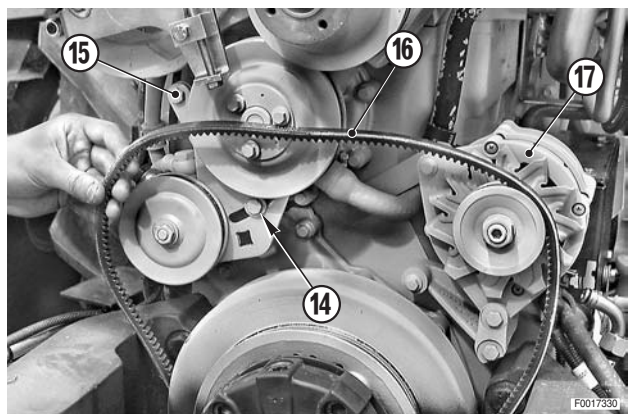
5 - Detach the flange (9) from the flexible coupling (10).



- 6 - Remove the bolts (11) and detach the fan (12) from the drive pulley; insert the fan in the fan housing (13) and remove the fan and compressor drivebelt (6).

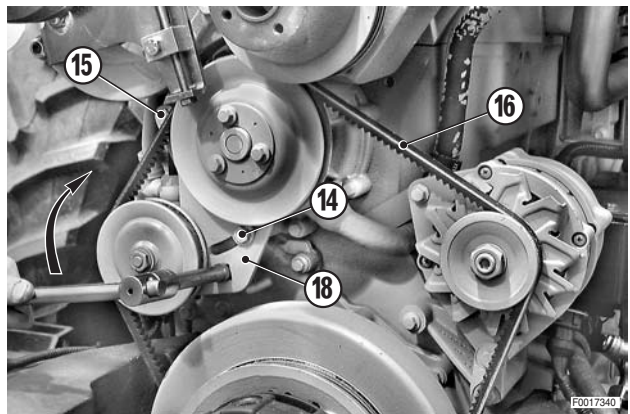


- 7 - Loosen the bolts (14), (15) securing the fuel pump, slip off the alternator drivebelt (16) and remove it by passing it between the crankshaft pulley and the front carrier.



- 8 - Fit the new alternator drivebelt (16) in the same way and tension it using a "T" drive bar and a 3/4" extension, or using a 3/4" angle drive bar through the hole in the fuel pump bracket (18).

- 9 - To tension the drivebelt, turn the bar clockwise and tighten the bolts (14) and (15).



- 10 - The tension is to be checked using the tool and procedure indicated in the engine manual (code 0297 9771).

★ Static deflection "A" on first fitting:

13 mm belt: 550±50 N

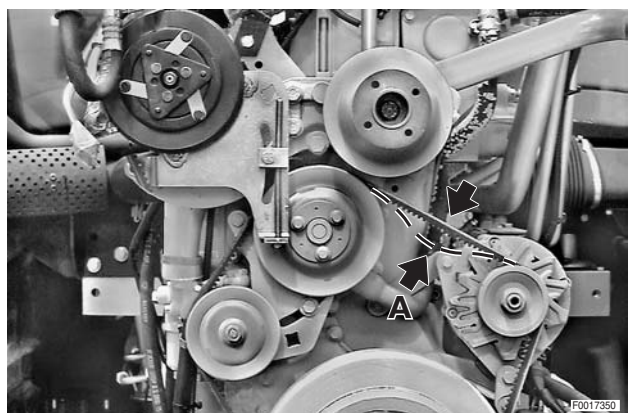
15 mm belt: 650±50 N

★ Static deflection "A" after 15 minutes:

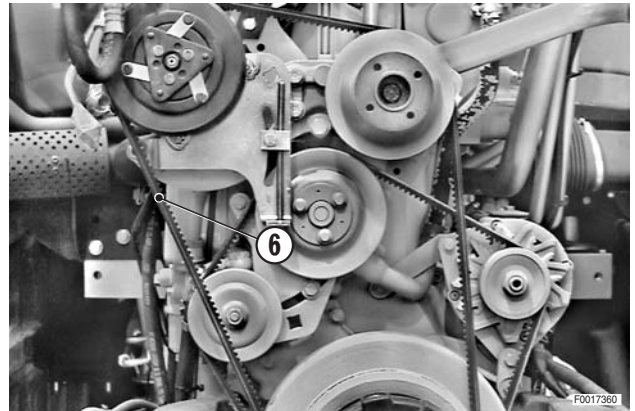
13 mm belt: 400±50 N

15 mm belt: 500±50 N

⚠ The check should be carried out with the engine cold.



- 11 - Fit the fan drivebelt (6) and tension it as described in «REMOVAL OF THE CONDITIONING COMPRESSOR».
- 12 - Complete the refitting procedure by following the first stage of the removal operations in reverse order.

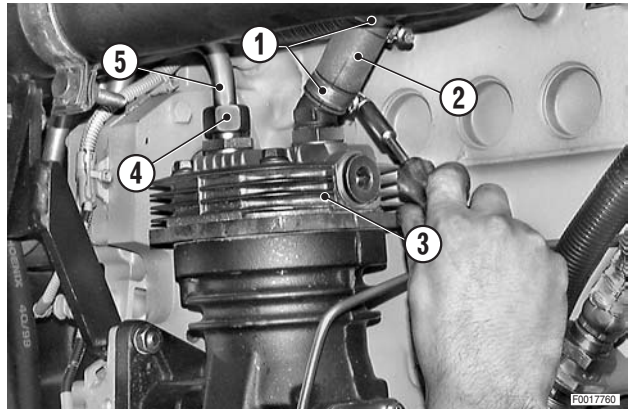


REMOVAL OF THE AIR COMPRESSOR (for air trailer braking)

★ For models with separate power steering pump, first remove the pump. (For details, see «REMOVAL OF THE POWER STEERING PUMP».)

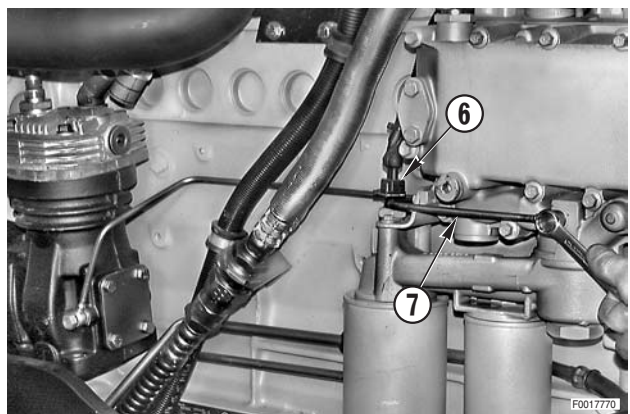
1 - Loosen the hose clamp (1) and disconnect the hose (2) from the compressor (3).

2 - Loosen the pipe fitting (4) and disconnect the delivery pipe (5).



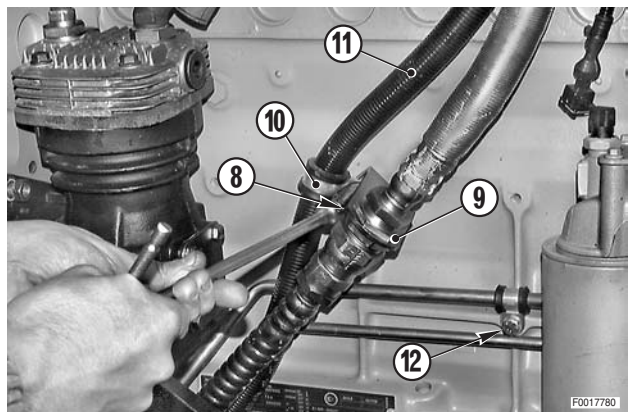
3 - Disconnect the connector (6) of the engine oil filter clogging sensor and remove the compressor lube pipe (7).

★ Recover the gaskets, which may be re-utilised if they are not damaged.

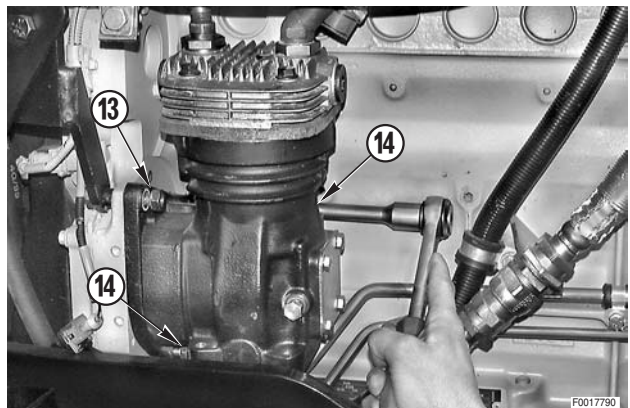


4 - Remove the bolt (8) securing the bracket (9) and the retaining strap (10) for the wiring (11).

5 - Remove the retaining bolt (12) of the fuel inlet pipe clamp.



6 - Unscrew and remove the nut (13) and the two bolts (14).

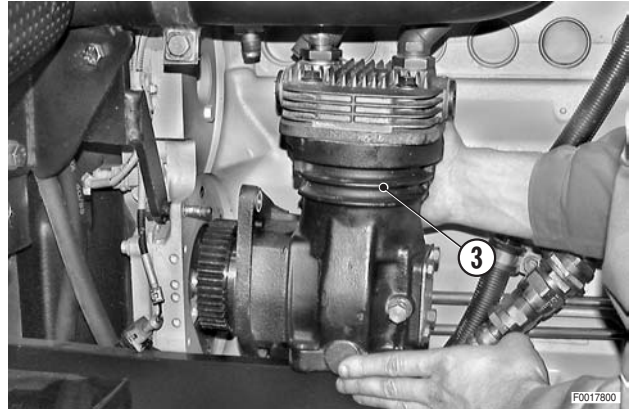


7 - Remove the compressor (3) complete with the O-ring seal (15).

※ 1



Compressor: 12 kg (26.4 lb.)



REFITTING THE AIR COMPRESSOR

- Refitting is the reverse of removal.



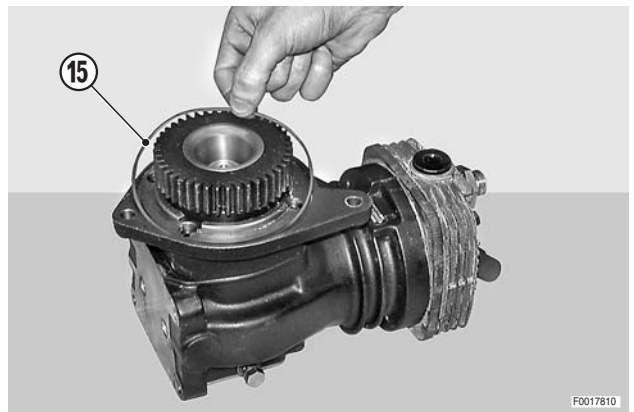
If the oil has been drained from the compressor crank-case, add engine oil before re-connecting the lube pipe.





Quantity of lubricating oil:
approximately 100 g (0.220 lb.)

※ 1

- ★ Check the condition of the O-ring (15).
- ★ Apply grease to the seating to hold the O-ring (15) in position.

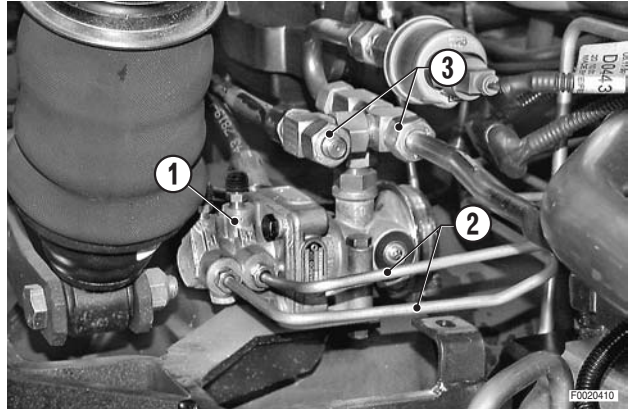


REMOVAL OF THE TRAILER PARKING AND SERVICE AIR BRAKE CONTROL VALVES

-  Switch off the engine and remove the key from the ignition.
-  Eliminate all residual pressure from the trailer air braking circuit.

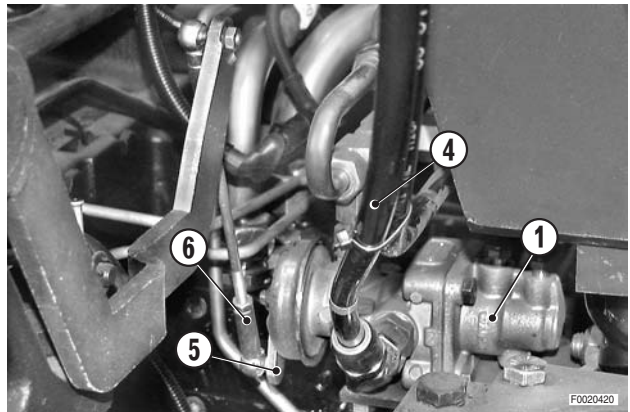
PARKING BRAKES (Versions with air braking)

- 1 - Disconnect the hydraulic brakes pipes (2) and upper air delivery pipes (3) from the valve (1).

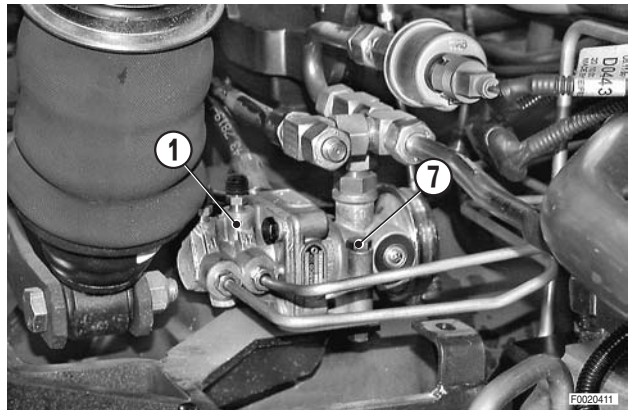


- 2 - Disconnect the pipe (4) from the rear of the valve (1).
- 3 - Disconnect the tie-rod (6) from the valve control lever (5).

 1

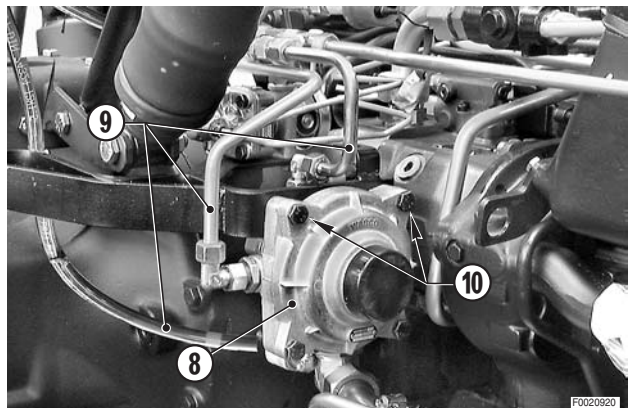


- 4 - Remove the two lower nuts and bolts (7); remove the valve (1).



SERVICE BRAKES (Version EXPORT F)

- 1 - Disconnect the three brake control and delivery pipes (9) from the valve (8).
- 2 - Remove the bolts (10) and remove the valve.



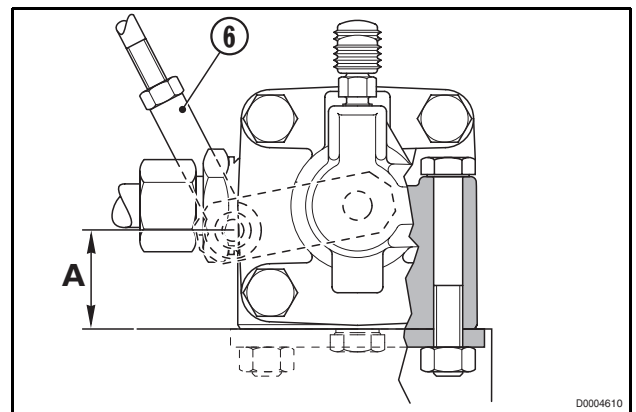
REFITTING THE TRAILER PARKING AND SERVICE AIR BRAKE CONTROL VALVES

- Refitting is the reverse of removal.
- 1 - Start the engine and allow the pressure to build in the air braking circuit.
- 2 - Check the seal at all removed fittings using a soapy solution.
- 3 - Bleed the braking system
(For details see «BLEEDING THE BRAKE SYSTEM»).
- 4 - Check that the parking brake valve control lever operates at the correct point and, if necessary, adjust the length of the tie-rod (6).

Adjusting the length of the tie-rod

※ 1


- 1 - Check that the parking brakes are perfectly adjusted and that they are released.
- 2 - Check that distance between the valve mounting surface and the axis of the control lever ball joint is 27.2 ± 0.1 mm (1.072 \pm 0.004 in.) "A".
- 3 - If necessary, adjust the length of the tie-rod (6) to obtain the correct distance.
- 4 - Apply the parking brake a few times, checking that tractor and trailer brakes are applied simultaneously.




D0004610

REMOVAL OF THE PRESSURE TRANSDUCER

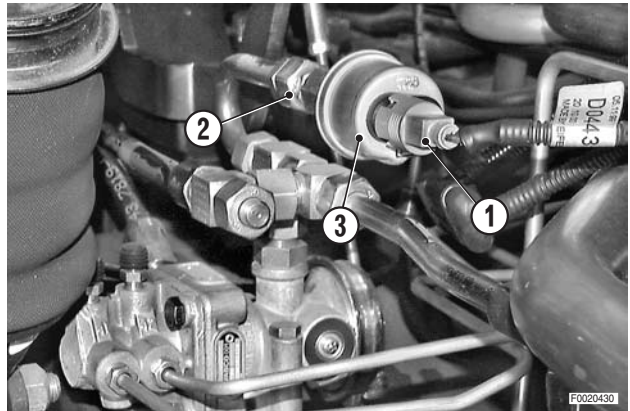
(Version with air braking)

 Switch off the engine and remove the key from the ignition.

 Eliminate all residual pressure from the air braking circuit.

1 - Disconnect the connector (1).

2 - Loosen the fitting (2) and remove the transducer (3).

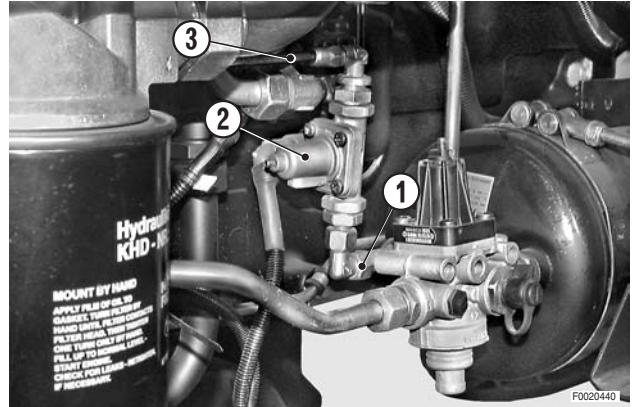


REFITTING THE PRESSURE TRANSDUCER

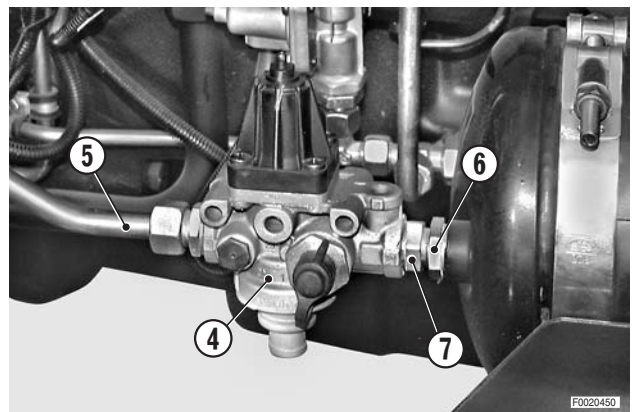
- Refitting is the reverse of removal.

REMOVAL OF THE AIR PRESSURE REGULATING/REDUCTION VALVE FOR CAB LIFTING

- ⚠ Switch off the engine and remove the key from the ignition.
- ⚠ Eliminate all residual pressure from the air braking circuit.
- 1 - Loosen the fitting (1), remove the pressure reducing valve (2) and position it to one side.
 - ★ If the valve is to be renewed, disconnect also the pipe (3).



- 2 - Disconnect the pipe (5) from the pressure regulating valve (4).
 - ★ Also loosen the fitting on the other end of the pipe.
- 3 - Hold firm the fitting (6) on the reservoir while unscrewing the fitting (7) and remove the valve..



REFITTING OF THE AIR PRESSURE REGULATING/REDUCTION VALVE FOR CAB LIFTING

- Refitting is the reverse of removal.
- 1 - Start the engine and allow pressure to build in the circuit.
- 2 - Check the seals for leaks using a soapy solution.

REMOVAL AND RENEWAL OF THE TRAILER AIR BRAKES COUPLING VALVE

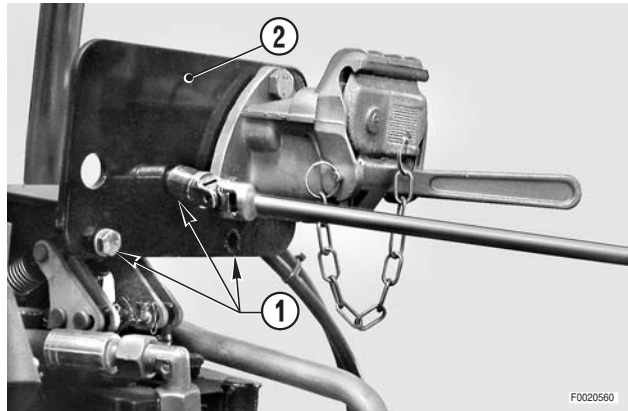
★ The removal operation illustrated refers to the version I.

⚠ Switch off the engine and remove the key from the ignition.

1. Removal

★ The valve complete with its support should only be removed in the event of removal of the complete control valve assembly.

1 - Remove the three retaining bolts (1) of the support (2) and position the assembly to one side.

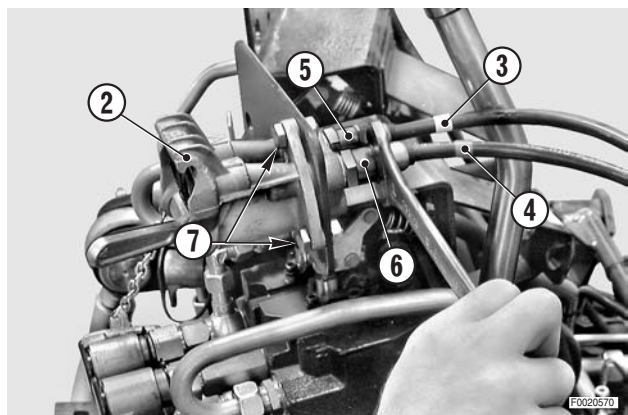


2. Renewal

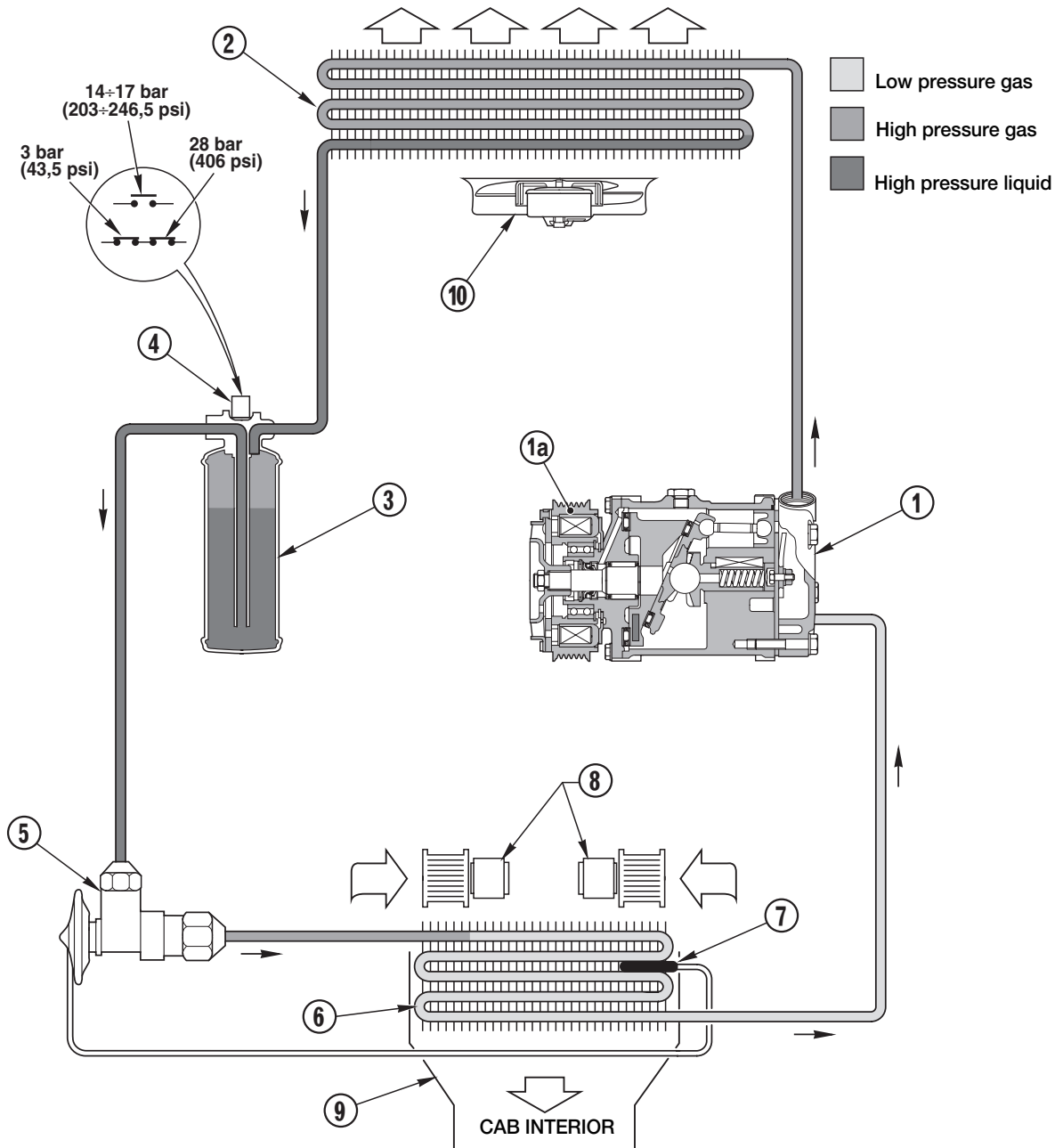
1 - Label the pipes (3), (4) and the fittings (5), (6) to avoid confusion on refitting.

2 - Disconnect the pipes (3) and (4) from the valve (2).

3 - Remove the valve (2) after removing the three retaining nuts and bolts (7).



AIR CONDITIONING SYSTEM



D0000121

- 1 - Compressor with electromagnetic clutch
- 2 - Condenser
- 3 - Receiver-drier
- 4 - Bistable pressure switch for compressor clutch engagement/disengagement
- 5 - Expansion valve
- 6 - Evaporator
- 7 - Evaporator temperature sensor
- 8 - Cab air blowers
- 9 - Air cowling
- 10 - Condenser cooling fan (for 165 CV models only)

TECHNICAL SPECIFICATIONS

- Minimum and maximum safety pressure: 2.4-28.5 bar (34.8 - 413.3 psi)
- Refrigerant type: R134a
- Refrigerant quantity:

Mod.	106	110	115	120	135	150	165
g	1600	1600	1600	1600	1600	1600	1950
oz.	56.4	56.4	56.4	56.4	56.4	56.4	68.74

- Total quantity of moisture-free oil added at 1st charging: 210 cm³ (12.81 Cu.in.)

OPERATION OF THE AIR CONDITIONING SYSTEM

The compressor (1) is driven from the crankshaft via a drivebelt and pulley with an electromagnetic clutch (1a), which is operated from a switch on the control panel.

The system is protected by a safety pressure switch, which performs the following functions:

- 1 - To inhibit engagement of the electromagnetic clutch (1a) when the system pressure falls below 2.4 bar (34.8 psi) as a result of incomplete charging or refrigerant loss.
- 2 - To disengage the clutch (1a) and thereby stop the compressor when the pressure exceeds the permitted maximum of 28.5 bar (413.3 psi) (generally as a result of over-heating).

For 165 CV models only: a further contact controls the operation of the condenser fan (10) in order to maintain normal operating pressure within the range of 16 – 20 bar (232 – 290 psi).

The refrigerant (in vapour state) is drawn in by the compressor where it is compressed, causing the temperature of the vapour to rise; the refrigerant flows to the condenser (2), where its heat is radiated to the air flow and it is thus cooled to the point where it condenses to high-pressure liquid.

On leaving the condenser, the liquefied refrigerant flows to the receiver-drier (3) which performs three main functions: to filter out any impurities, to absorb any water in the circuit, and finally, to act as a storage reservoir.

On leaving the receiver-drier, the clean, dry liquid passes to the evaporator (6) through an expansion valve (5), which meters the flow of refrigerant into the evaporator to ensure optimum evaporation.

In the evaporator, the refrigerant is heated and expands to the point of evaporation with an ambient temperature of around -8°C (17.6°F).

The temperature of the air flow over the evaporator (6) generated by the centrifugal blowers (8) is significantly higher than -8°C (17.6°F), and therefore it gives up its heat to the refrigerant, causing it to boil and evaporate.

On leaving the evaporator (6), the refrigerant returns to the compressor (1) to repeat the cycle.

The removal of heat from the ambient air flowing over the evaporator causes the moisture in the air to condense, and the air is thus dehumidified; the moisture condenses on the fins of the evaporator, where, if it is not maintained at temperature above 0°C (32°F), it will freeze and comprise the efficiency of the evaporator.

The task of maintaining the evaporator at a temperature above 0°C (32°F) (and within the optimum temperature for efficient heat exchange), is performed by an electronic temperatures sensor (7); this sensor disengages the compressor clutch (1a) when the temperature falls to the lower limit and engages the clutch (1a) when the evaporator temperature reaches an upper limit.

The condensate that forms on the evaporator fins contains dust, pollen and other particles suspended in the air; continuous condensation thus has the effect of purifying the air, and the drips of condensate are conveyed out of the vehicle via two ducts.

A fixed quantity of moisture-free oil is added to the circuit in order to lubricate all the mechanical components of the system; a certain percentage of this oil continuously circulates in the form of an oil mist, thereby lubricating the compressor (pistons and bearings) and the expansion valve.

MAINTENANCE OF THE AIR CONDITIONING SYSTEM

The checks and servicing operations required for the air conditioning system are as follows:

- 1 - Checking the tension and condition of the compressor drivebelt.
- 2 - Discharging, flushing and recharging of the system using a specific servicing machine and R134a refrigerant.
- 3 - Removal and renewal of the compressor.
- 4 - Inspection and renewal of the electromagnetic clutch pulley (to be carried out at a specialised service centre).

5 - Removal and renewal of the receiver-drier.

6 - Removal and renewal of the condenser.

7 - Removal of the evaporator and the electronic temperature sensor.

(For these operations see «REMOVAL OF THE AIR CONDITIONING EVAPORATOR»).

ADJUSTING THE TENSION OF THE COMPRESSOR DRIVEBELT

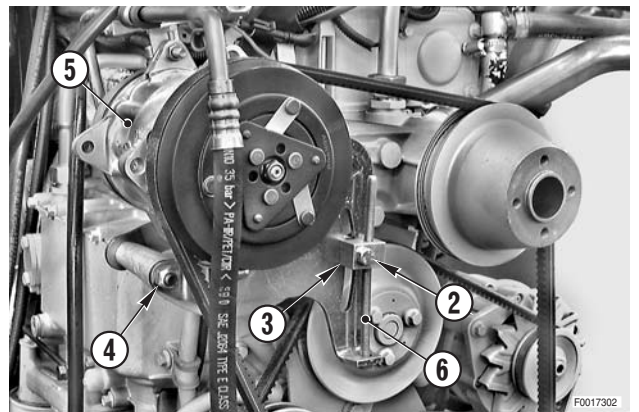
- ★ Before adjusting the tension, carefully examine the drivebelt for signs of wear. The belt must be renewed immediately at the first sign of cracking, fraying or separation of the plies.

! If a new belt is fitted, re-adjust the tension after approx. 15 operating hours.

- 1 - Remove the right-hand grille (1).



- 2 - Loosen the screw (2) of the tensioner block (3) and loosen the nut (4) securing the compressor (5).



- 3 - Turn the rod (6) to obtain a belt deflection of:

- ★ Static deflection "A" on first fitting:

13 mm belt: 550 ± 50 N

15 mm belt: 650 ± 50 N

- ★ Static deflection "A" after 15 minutes:

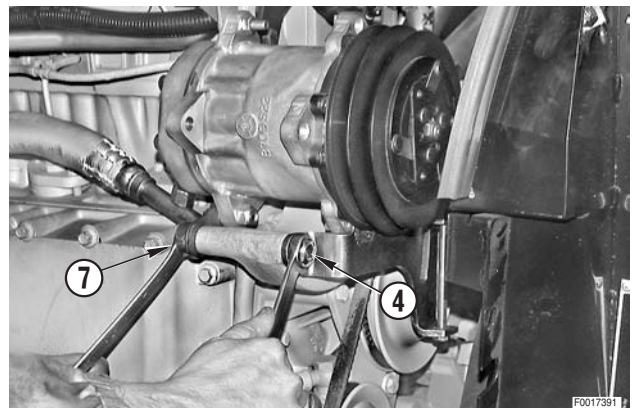
13 mm belt: 400 ± 50 N

15 mm belt: 500 ± 50 N

- ★ Use the same tool used for tensioning the the alternator drivebelt.

! The check should be carried out with the engine cold.

- 4 - Tighten the screw of the tensioner block (3) and tighten the nut (4) and bolt (7) to secure the compressor in position.



- 5 - Recheck the drivebelt tension.

DISCHARGING, FLUSHING AND RECHARGING THE AIR CONDITIONING SYSTEM

- ⚠ 1 - Before discharging, flushing and recharging the air conditioning system, inspect the system for leaks using a suitable leak detector.
- 2 - In order to carry out the system servicing operations you will require a dedicated servicing machine capable of performing the following tasks:
 - a - Aspiration of the refrigerant fluid.
 - b - Creation of a high vacuum to purge the system of contaminants.
 - c - Filtration of the recovered refrigerant.

1. Discharging the system

- 1 - Connect the service machine to the high pressure service valve (1) and follow the specific instructions for the service machine to discharge the system.
- 2 - Disconnect the system component to be renewed or overhauled immediately after the service machine stops; **plug the open ends of the system pipes as quickly as possible.**

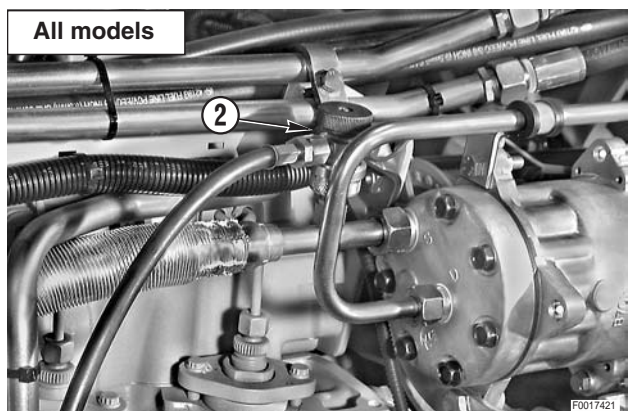
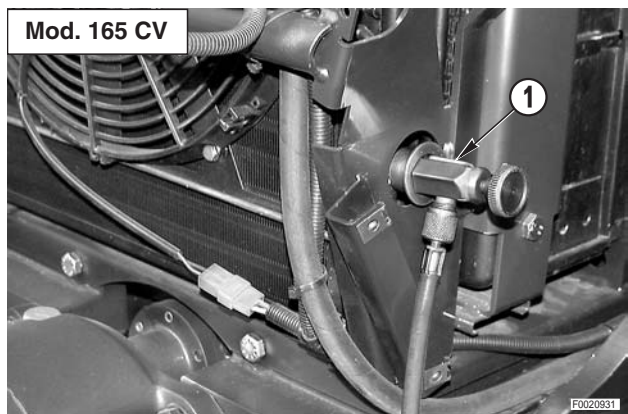
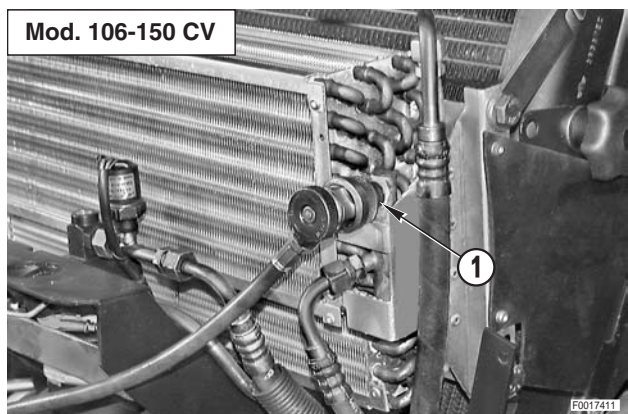
2. Flushing and recharging the system

Before each recharging, the system must be purged of all air, moisture and contaminants (oxides, deposits). This entails creating a high vacuum within the system to evaporate any moisture present. The vapour, when extracted, draws with it any contaminants present in the system.

- ★ For the flushing and recharging operations, the service machine must be connected to the high (1) and low (2) pressure service valves.

- ⚠ Maximum vacuum" must be maintained for at least 10 minutes.

- d - Separation of the moisture-free oil from the liquid refrigerant and determination of its quantity by weight.
- e - Recharging the system with exactly the same amounts of refrigerant and oil as those recovered.
- f - Measuring the system delivery side pressure and return pressure (low pressure).





After flushing, the moisture-free oil recovered during the discharging operation must be re-introduced into the system, followed by the refrigerant.



Quantity of refrigerant (R134a):

Mod.	106	110	115	120	135	150	165
g	1600	1600	1600	1600	1600	1600	1950
oz.	56.4	56.4	56.4	56.4	56.4	56.4	68.74

Quantity of oil: the quantity recovered.

-  If the system has to be discharged and flushed in order to renew a system component, the quantity of oil in the replaced component must be measured and the same amount of new oil must be added to that recovered with the refrigerant.
-  For details of the oil and refrigerant recharging procedure, refer to the instructions supplied with the service machine.


REMOVAL OF THE AIR CONDITIONING COMPRESSOR

1 - Discharge the liquid refrigerant from the system.
(For details, see «DISCHARGING, FLUSHING AND RECHARGING THE AIR CONDITIONING SYSTEM»).

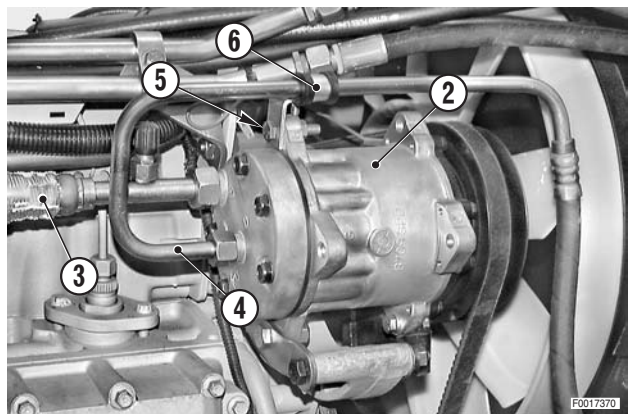
2 - Remove the right-hand side panel (1).



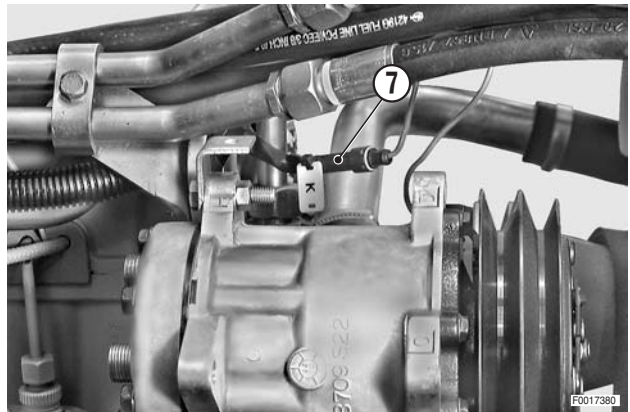
3 - Disconnect the inlet (3) and delivery (4) lines from the compressor (2).

★ Immediately plug the open fittings to prevent the entry of moisture.  1

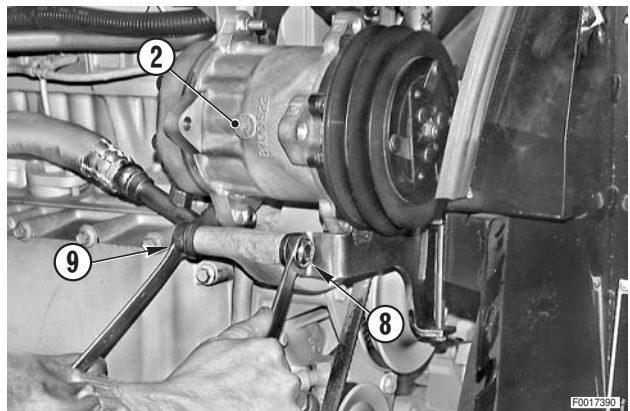
4 - Remove the retaining bolt (5) of the collar (6) and move the delivery pipe (4) to one side.



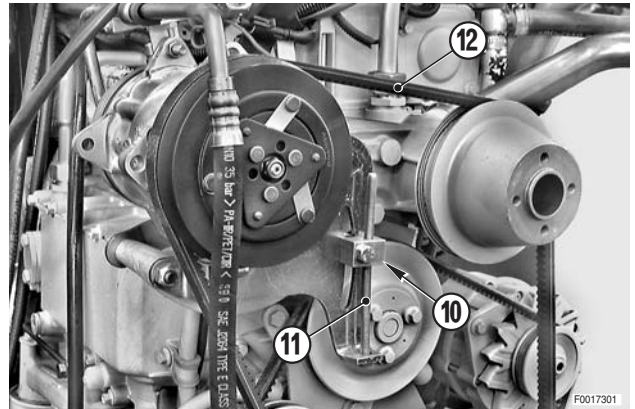
5 - Unplug the electrical connector (7) of the electromagnetic clutch.



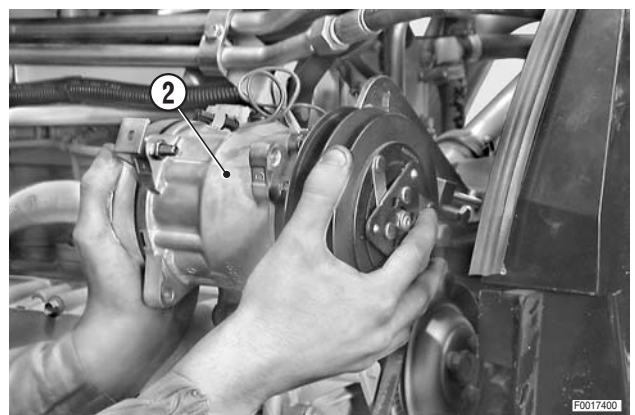
6 - Loosen the self-locking nut (8) of the compressor pivot bolt (9).



- 7 - Loosen the screw of the tensioner block (10).
- 8 - Unscrew the threaded tensioner rod (11) to slacken the compressor/fan drivebelt (12).
 - ★ Slacken the drivebelt sufficiently to be able to slip it off the compressor pulley.



- 9 - Remove the pivot bolt and remove the complete compressor assembly (2).



REFITTING THE AIR CONDITIONING COMPRESSOR

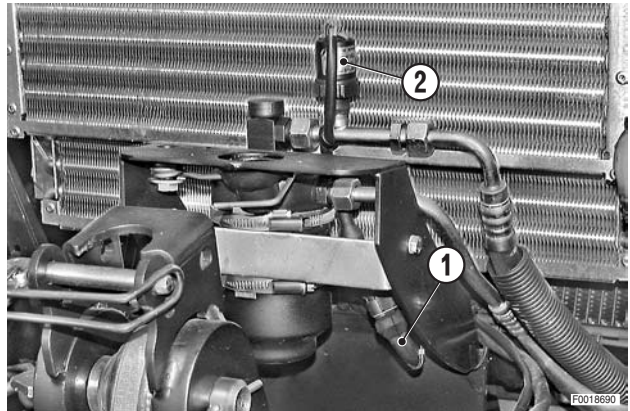
- Refitting is the reverse of removal.


※ 1

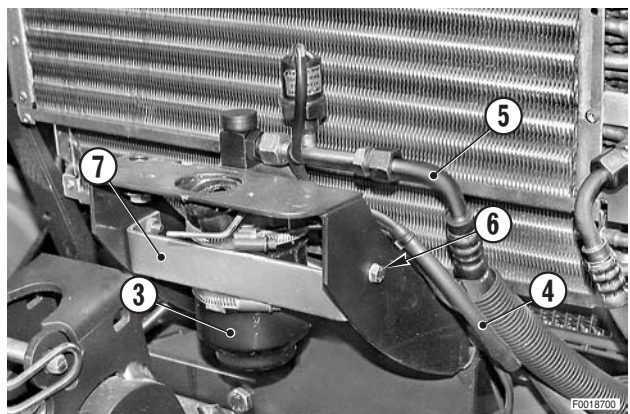
- ★ Remove the plugs and connect the pipes immediately, fully tightening the fittings, to prevent the entry of moisture.
 - ★ Check the condition of the O-ring seals and renew them if damaged.
- 1 - Adjust the tension of the compressor/fan drivebelt. (For details see «ADJUSTING THE TENSION OF THE COMPRESSOR DRIVEBELT»).
 - 2 - Flush and recharge the system. (For details see «DISCHARGING, FLUSHING AND RECHARGING THE AIR CONDITIONING SYSTEM»).


REMOVAL OF THE RECEIVER-DRIER (Models 106-150 CV)

- 1 - Recover the refrigerant from the system.
(For details, see «MAINTENANCE OF THE AIR CONDITIONING SYSTEM»).
- 2 - Disconnect the connector (1) of the pressure switch (2).



- 3 - Disconnect the inlet (4) and outlet (5) pipes from the receiver-drier (3).
★ Plug the ends of the pipes immediately to prevent moisture getting into the system.. 
- 4 - Unscrew and remove the bolts(6) securing the bracket (7) and remove the assembly.



-  If a new receiver-drier is to be installed, measure the quantity of oil contained in the old unit in order to determine the quantity of oil to be added to the system..

REFITTING THE RECEIVER-DRIER

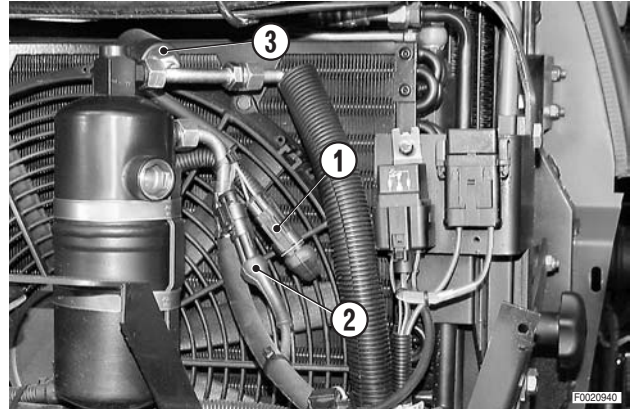
- Refitting is the reverse of removal.





- ★ Remove the plugs and connect the pipes immediately, fully tightening the fittings, to prevent the entry of moisture.
 - ★ Check the condition of the O-rings and replace them if damaged.
- 1 - Flush and recharge the system.
(For details see «DISCHARGING, FLUSHING AND RECHARGING THE AIR CONDITIONING SYSTEM»).

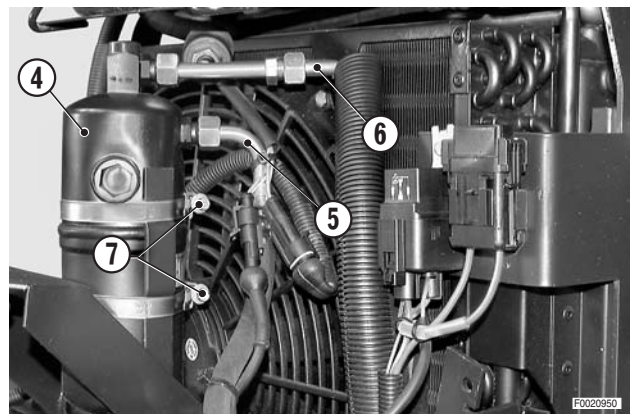
REMOVAL OF THE RECEIVER-DRIER (Model 165 CV)

- 1 - Recover the refrigerant from the system.
(For details, see «MAINTENANCE OF THE AIR CONDITIONING SYSTEM»).
- 2 - Disconnect the connectors (1) and (2) of the pressure switch (3).



- 3 - Disconnect the inlet (5) and outlet (6) pipes from the receiver-drier (4).
 - ★ Plug the ends of the pipes immediately to prevent moisture getting into the system. 
- 4 - Loosen the filter retaining clamp (7) and remove the unit.

 If a new receiver-drier is to be installed, measure the quantity of oil contained in the old unit in order to determine the quantity of oil to be added to the system..



REFITTING THE RECEIVER-DRIER

- Refitting is the reverse of removal.

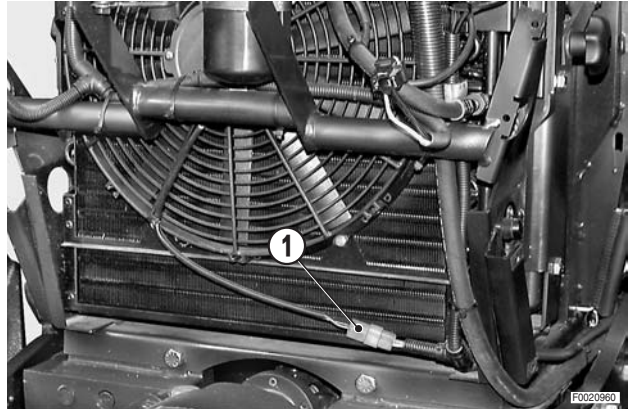
 1

- ★ Remove the plugs and connect the pipes immediately, fully tightening the fittings, to prevent the entry of moisture.
 - ★ Check the condition of the O-rings and replace them if damaged.
- 1 - Flush and recharge the system.
(For details see «DISCHARGING, FLUSHING AND RECHARGING THE AIR CONDITIONING SYSTEM»).

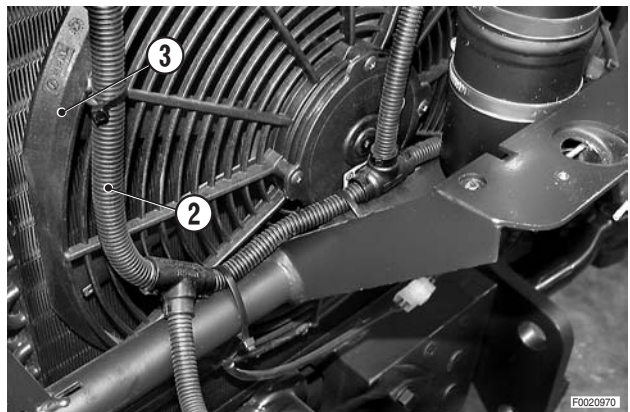
REMOVAL OF THE CONDENSER FAN (Model 165 CV)

 Remove the key from the ignition.

1 - Disconnect the connector (1).

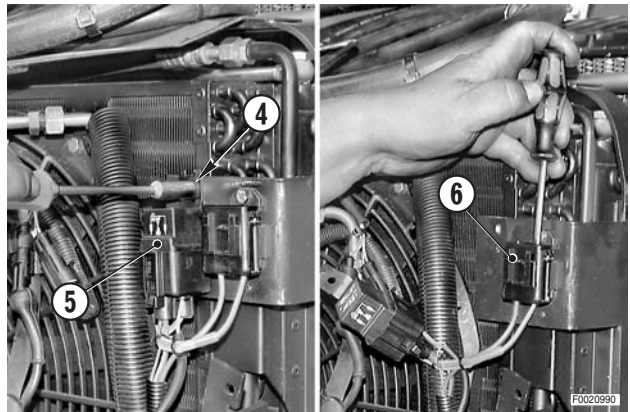


2 - Release the wires (2) from the cable clips fixed to the fan guard (3).



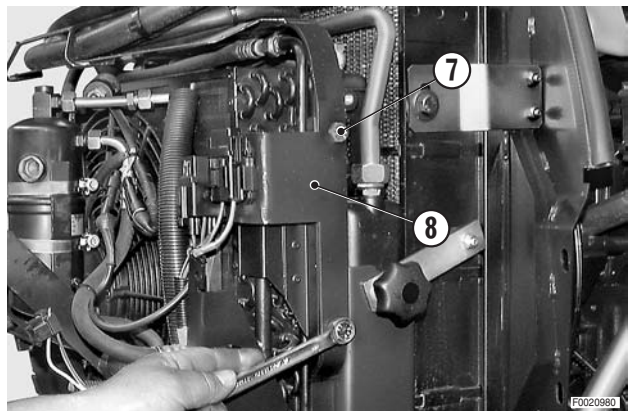
3 - Remove the screw (4) and remove the contactor (5).

4 - Using a thin blade, remove the complete fuse box (6).

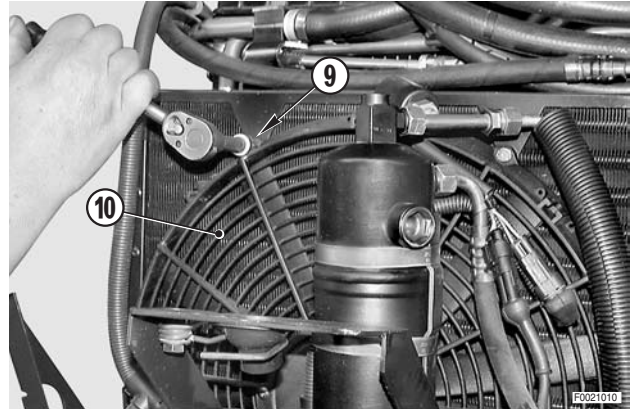


5 - Remove the bolts (7) and remove the pipe support (8).

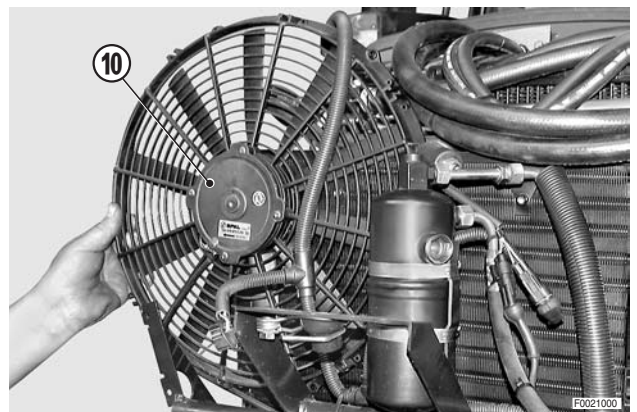
6 - Position the upper pipes towards the rear of the tractor and secure them.



7 - Remove the bolts (9) securing the fan (10).



8 - Remove the fan (10).



REFITTING THE COOLING FAN

- Refitting is the reverse of removal.

REMOVAL OF THE CONDENSER ASSEMBLY (Models 106-150 CV)

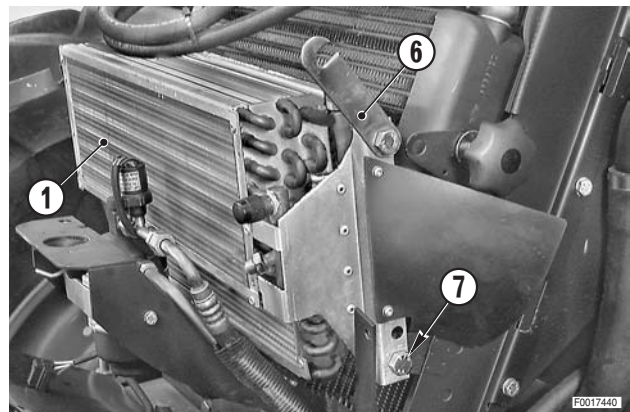
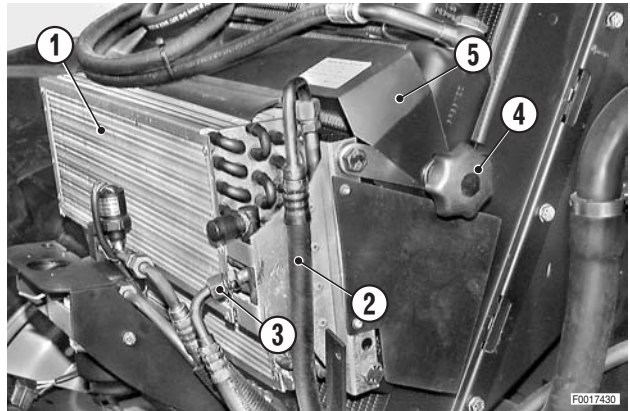
! Remove the key from the ignition.

- 1 - Remove the side panels.
- 2 - Recover the refrigerant from the system.
(For details see «DISCHARGING, FLUSHING AND RECHARGING THE AIR CONDITIONING SYSTEM»).
- 3 - Disconnect the pipes (2) and (3) from the condenser (1).

⚠ 1

★ Immediately plug the open ends of the pipes to prevent moisture from getting into the system..

- 4 - Unscrew the knobs (4) and remove the cowling (5).
- 5 - Tilt the mounting brackets (6) forwards.
- 6 - Remove the lower pivot bolts (7).



- 7 - Remove the condenser assembly (1).
★ Take care not to damage the fins.



REFITTING THE CONDENSER ASSEMBLY

- Refitting is the reverse of removal.

⚠ 1

- ★ Remove the plugs and connect the pipes immediately, fully tightening the fittings, to prevent moisture getting into the system.
- ★ Check the condition of the O-ring seals and renew them if damaged.

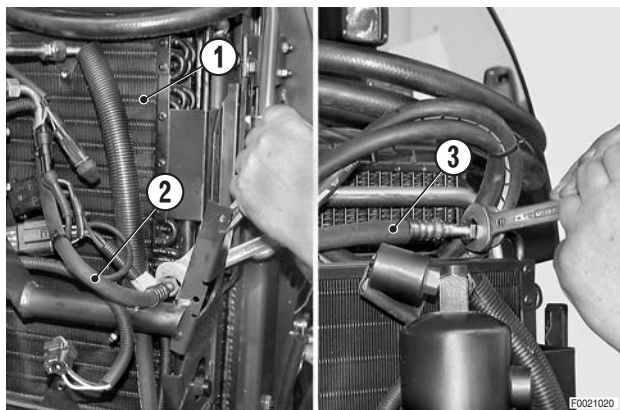
- 1 - Flush and recharge the system.
(For details see «DISCHARGING, FLUSHING AND RECHARGING THE AIR CONDITIONING SYSTEM»).

REMOVAL OF THE CONDENSER ASSEMBLY (Model 165 CV)

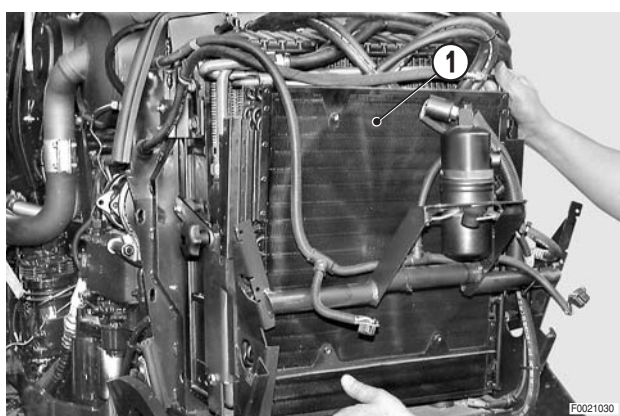
- 1 - Remove the cooling fan.
(For details, see «REMOVAL OF THE COOLING FAN»).
- 2 - Recover the refrigerant from the system.
(For details see «DISCHARGING, FLUSHING AND RECHARGING THE AIR CONDITIONING SYSTEM»).
- 3 - Disconnect the pipes (2) and (3) from the condenser (1).

※ 1

- ★ Immediately plug the open ends of the pipes to prevent moisture from getting into the system..



- 4 - Remove the condenser assembly (1) by withdrawing it upwards.
★ Take care not to damage the fins.



REFITTING THE CONDENSER ASSEMBLY

- Refitting is the reverse of removal.

※ 1

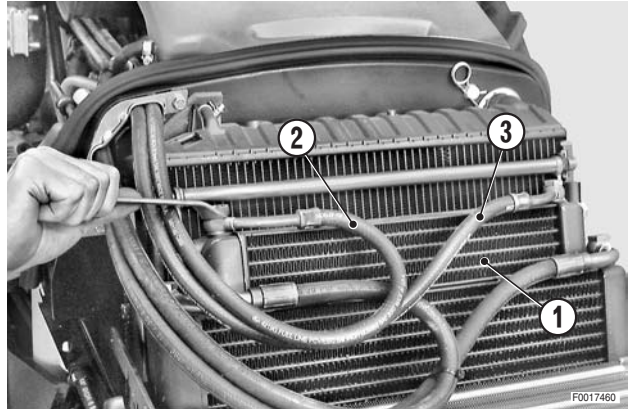
- ★ Remove the plugs and connect the pipes immediately, fully tightening the fittings, to prevent moisture getting into the system.
- ★ Check the condition of the O-ring seals and renew them if damaged.

- 1 - Flush and recharge the system.
(For details see «DISCHARGING, FLUSHING AND RECHARGING THE AIR CONDITIONING SYSTEM»).

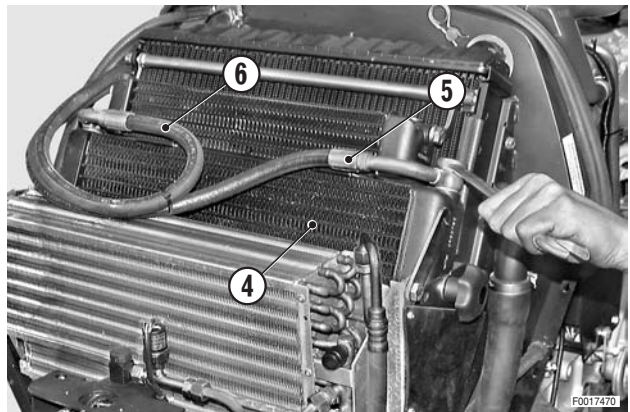
REMOVAL OF THE GEARBOX OIL/FUEL COOLERS

(Models 106-150 CV)

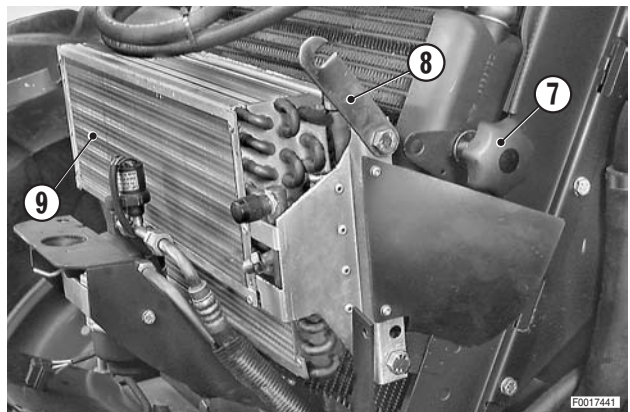
- 1 - Remove the side panels.
- 2 - Disconnect the inlet and outlet pipes (2) and (3) from the fuel cooler (1).
 - ★ Label the pipes and fittings to avoid confusion on reconnection..



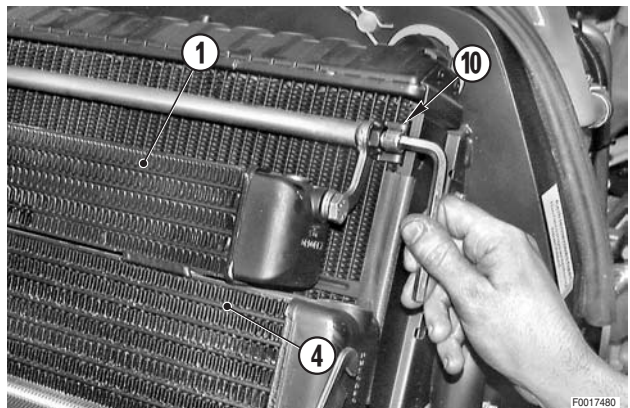
- 3 - Disconnect the inlet and outlet pipes (5) and (6) from the oil cooler (4).
 - ★ Label the pipes and fittings to avoid confusion on reconnection.
 - ★ Plug the open ends of the pipes to prevent moisture getting into the system.




- 4 - Unscrew the knobs (7) and tilt the condenser (9) mounting brackets (8) forwards.

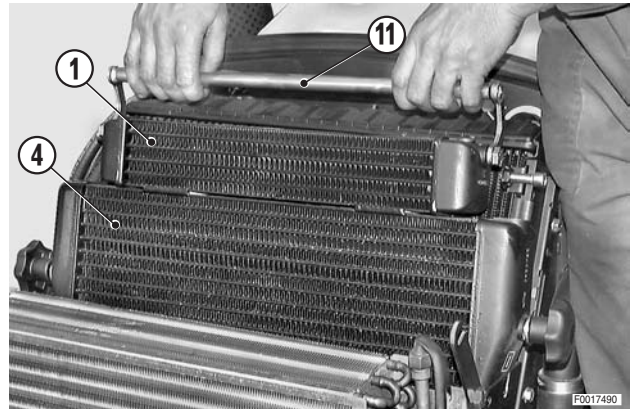


- 5 - Remove the two bolts (10) supporting the coolers (1) and (4).



- 6 - Remove the cooler assembly (1), (4) by pulling the handle (11) upwards.

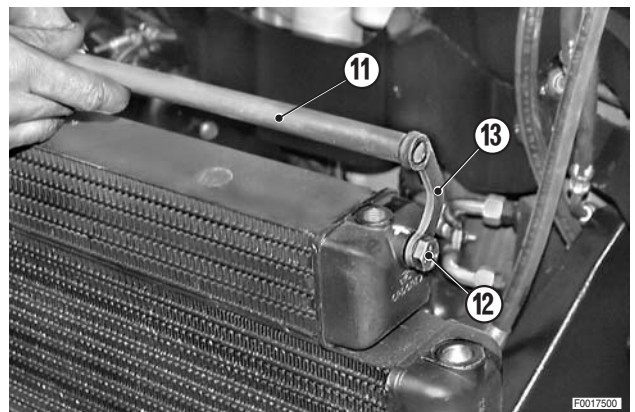
 Keep the coolers vertical to prevent spillage of oil/fuel.



- 7 - **Only if the assembly is to be renewed:**

- a - Draw off the fuel and oil from the coolers.
b - Recover the pivot bolts (12), the brackets (13) and the handle (11) and fit to the new assembly.

 1




REFITTING THE GEARBOX OIL/ FUEL COOLERS

- Refitting is the reverse of removal.

 1

 Bracket retaining bolts: Loctite 222

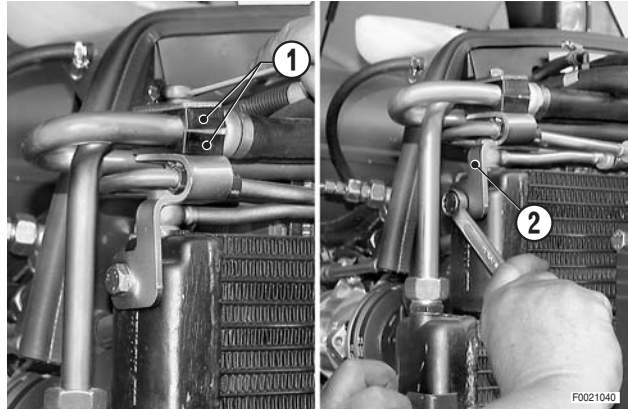
- 1 - Start the engine and allow the gearbox oil and fuel to circulate for about 5 minutes to fill the coolers; check the seals and fittings for leaks.
- 2 - Stop the engine and check the gearbox oil level; top up, if necessary.

 This operation is essential if new coolers have been fitted.

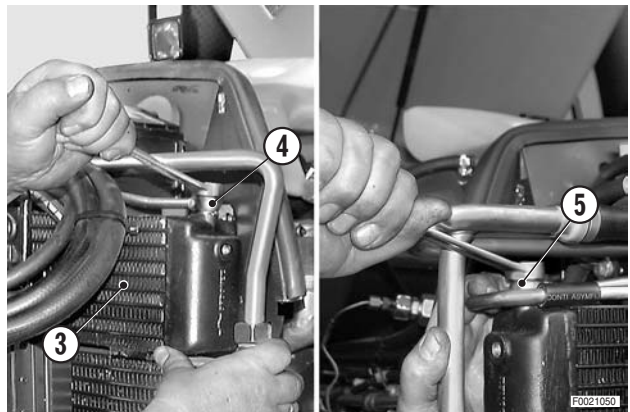
REMOVAL OF THE GEARBOX OIL/FUEL COOLERS

(Model 165 CV)

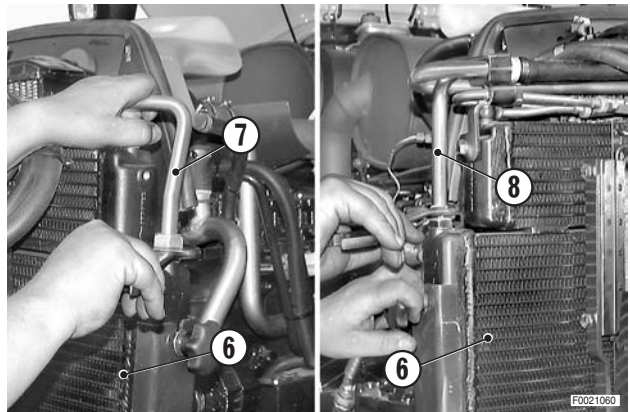
- 1 - Remove the side panels.
- 2 - Remove the clamp (1) and the bracket (2).



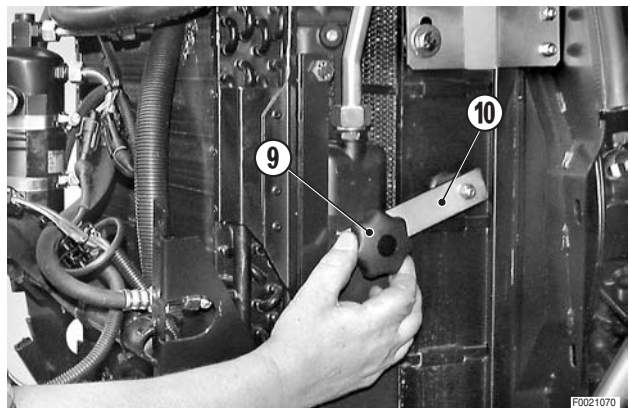
- 3 - Disconnect the pipes (4) and (5) from the fuel cooler (3).
 - ★ Plug the pipes and the open fittings on the cooler to prevent the entry of contaminants.
 - ★ Renew the gaskets on refitting.



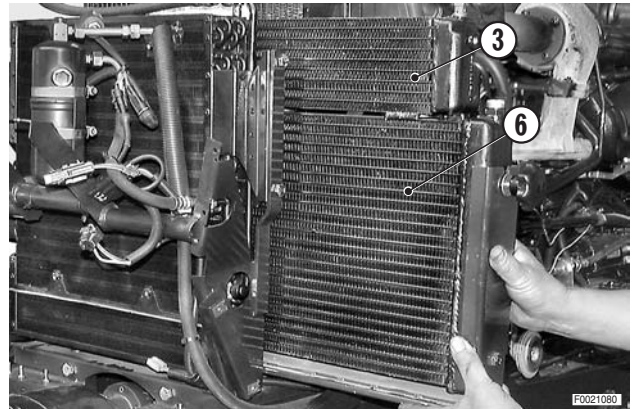
- 4 - Disconnect the pipes (6) and (7) from the gearbox oil cooler (6).
 - ★ Plug the pipes and the open fittings on the cooler to prevent the entry of contaminants.




- 5 - Unscrew the knobs (9) and move the mounting brackets (10) to the vertical position.



- 6 - Remove the coolers assembly (3), (6) by withdrawing it towards the left.




REFITTING THE GEARBOX OIL/ FUEL COOLERS

- Refitting is the reverse of removal.
- 1 - Start the engine and allow the gearbox oil and fuel to circulate for about 5 minutes to fill the coolers; check the seals and fittings for leaks.
 - 2 - Stop the engine and check the gearbox oil level; top up, if necessary.
-  This operation is essential if new coolers have been fitted.

REMOVAL OF THE RADIATOR (Models 106-150 CV)

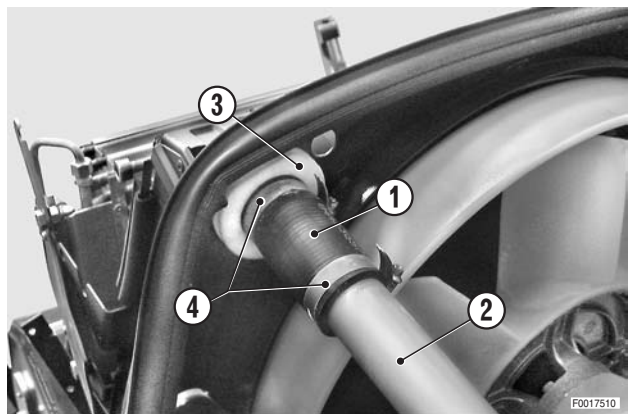
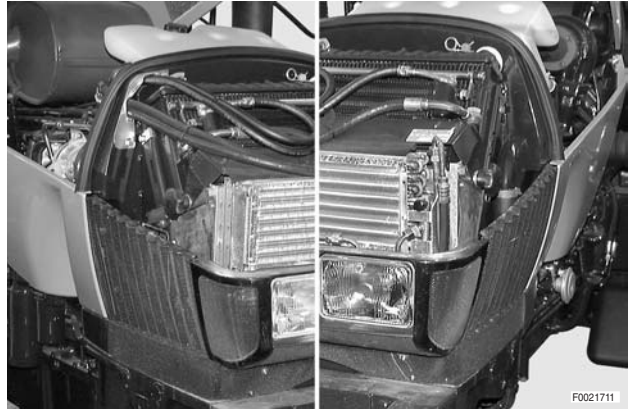
! Remove the battery cover and disconnect the negative battery lead (-).

- 1 - Remove the side panels.
- 2 - Drain off the engine coolant.

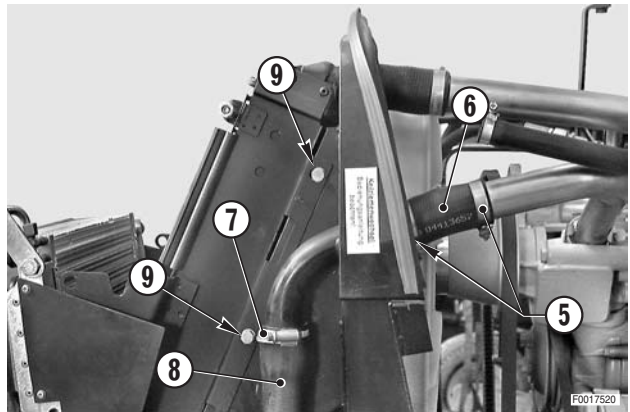
 Coolant:

Mod.	106	110	115	120	135	150
ℓ	17.5	17.5	17.5	21	21	21
US. gall.	4.62	4.62	4.62	5.54	5.54	5.54

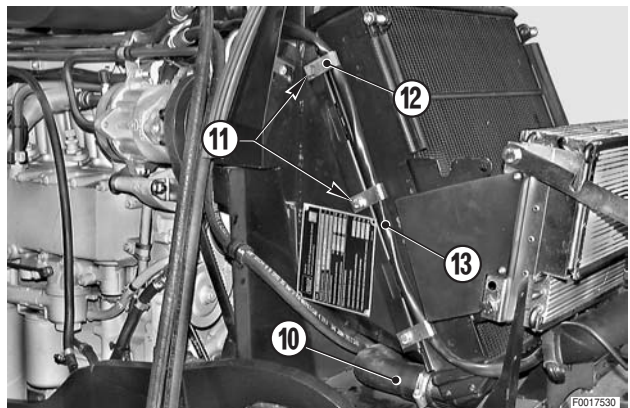
- 3 - Remove the gearbox oil/ fuel coolers.
(For details, see «REMOVAL OF THE GEARBOX OIL/ FUEL COOLERS»).
- 4 - Remove the expansion tank.
(For details, see «REMOVAL OF THE EXPANSION TANK»).
- 5 - Disconnect the hose (1) of the pipe (2) to the engine and remove the bulkhead fitting (3).
★ Slacken off the two hose clamps (4) and slide the hose (1) over the pipe (2).



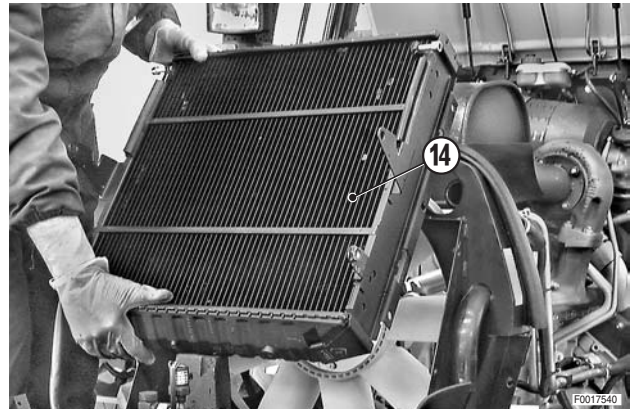
- 6 - Slacken off the hose clamps (5) and disconnect the radiator hose (6).
- 7 - Slacken off the hose clamp (7) and disconnect the hose (8).
- 8 - Remove the retaining bolts (9) on the left-hand side of the radiator.



- 9 - Disconnect the lower hose (10) from the radiator.
- 10 - Remove the bolts (11) and clamps (12) securing the wiring (13) to the right-hand side of the radiator.



- 11 - Remove the radiator (14).



REFITTING THE RADIATOR

- Refitting is the reverse of removal.

- 1 - Fill the engine cooling system.



Coolant:

Mod.	106	110	115	120	135	150
<i>ℓ</i>	17.5	17.5	17.5	21	21	21
US. gall.	4.62	4.62	4.62	5.54	5.54	5.54

- 2 - Start the engine and run for a few minutes to allow the coolant to circulate; check the system for leaks.
- 3 - Stop the engine, check the coolant level in the expansion tank and top up if necessary.

REMOVAL OF THE RADIATOR (Mod. 165 CV)

! Remove the battery cover and disconnect the negative battery lead (-).

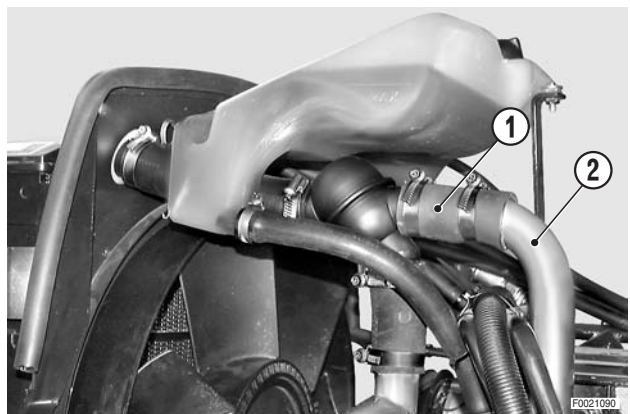
- 1 - Remove the side panels.
- 2 - Drain off the engine coolant.

 Coolant: 23 ℓ (6.07 US.gall.)

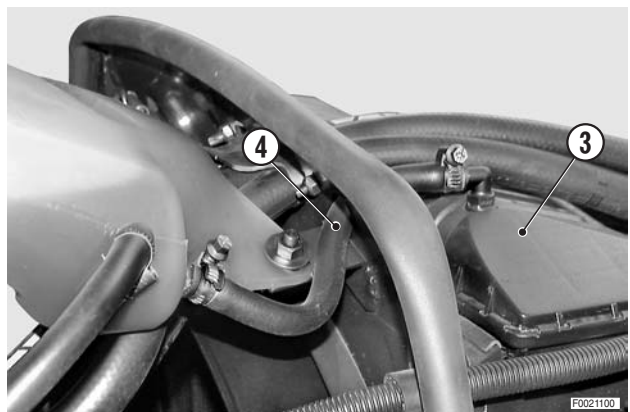
- 3 - Remove the gearbox oil/ fuel coolers.
(For details, see «REMOVAL OF THE GEARBOX OIL/
FUEL COOLERS»).



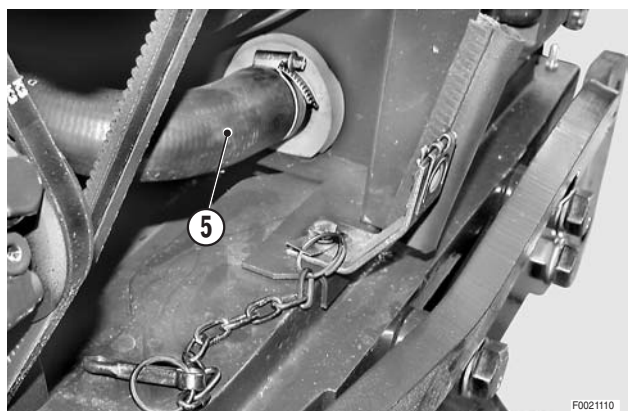
- 4 - Disconnect the hose (1) of the engine connection pipe (2).



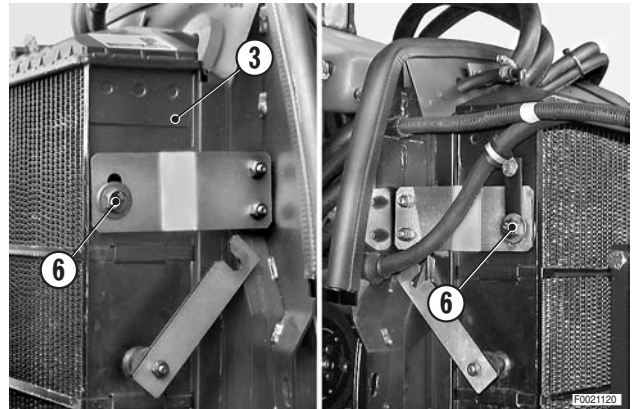
- 5 - Disconnect the expansion tank connection pipe (4) from the radiator (3).




- 6 - Disconnect the lower hose (5) from the radiator.



- 7 - Remove the bolts (6) and remove the radiator (3) by moving it forwards and lifting it upwards.




REFITTING THE RADIATOR

- Refitting is the reverse of removal.
- 1 - Fill the engine cooling system.
 Coolant: 23 ℓ (6.07 US.gall.)
 - 2 - Start the engine and run for a few minutes to allow the coolant to circulate; check the system for leaks.
 - 3 - Stop the engine, check the coolant level in the expansion tank and top up if necessary.

REMOVAL OF THE EXPANSION TANK

★ The illustration shows the 135 CV model, but the procedure is identical for all models.

1 - Partially drain the engine cooling system..

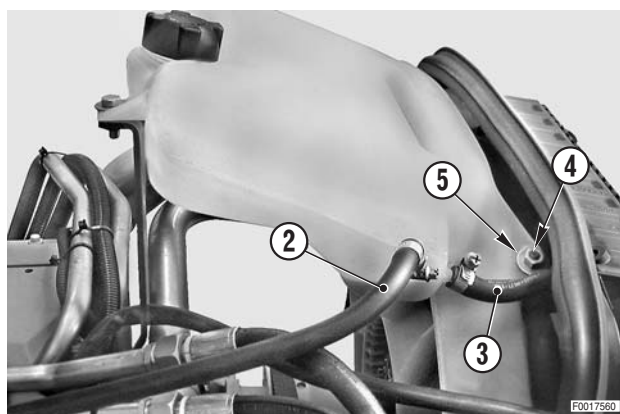
 Coolant: approx. 12 ℓ (3.17 US. gall.)

2 - Disconnect the pipe (1) on the left-hand side.



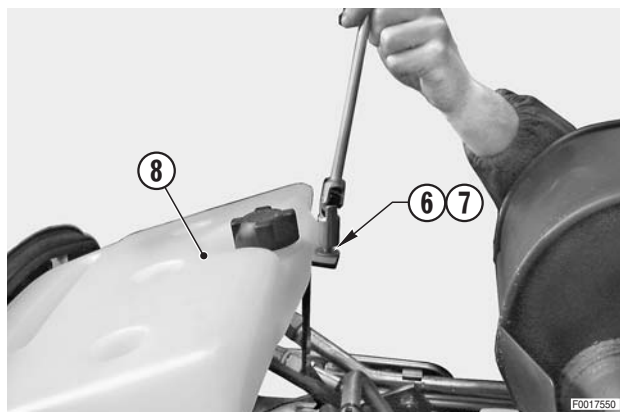
3 - Disconnect the pipes (2) and (3) on the right-hand side.

4 - Unscrew and remove the nut (4) and washer (5).



5 - Unscrew and remove the bolt (6) and washer (7).


6 - Remove the expansion tank (8).



REFITTING THE EXPANSION TANK

• Refitting is the reverse of removal.

1 - Fill the engine cooling system.

 Coolant: approx 12 ℓ (3.17 US. gall.)

2 - Start the engine and run for a few minutes to allow the coolant to circulate.


3 - Stop the engine, check the level in the expansion tank and top up if necessary.

REMOVAL OF THE FAN (Models 106-150 CV)

! Remove the battery cover and disconnect the negative battery lead (-).

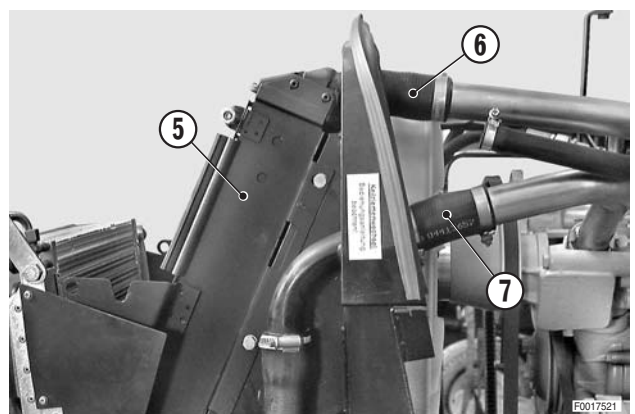
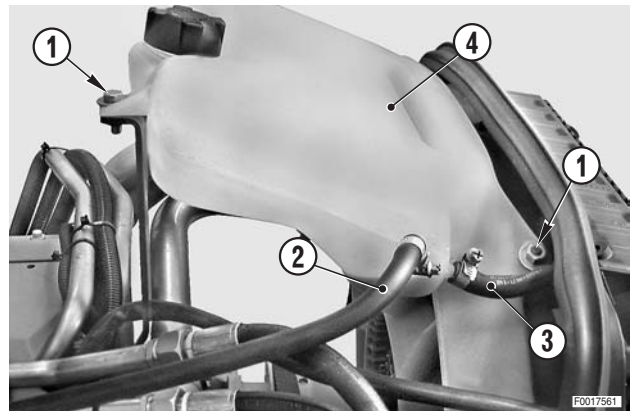
1 - Remove the side panels, the lamp assemblies and lower grille.
(For details, see «REMOVAL OF THE HOOD AND SIDE PANELS»).

2 - Partially drain the engine cooling system.

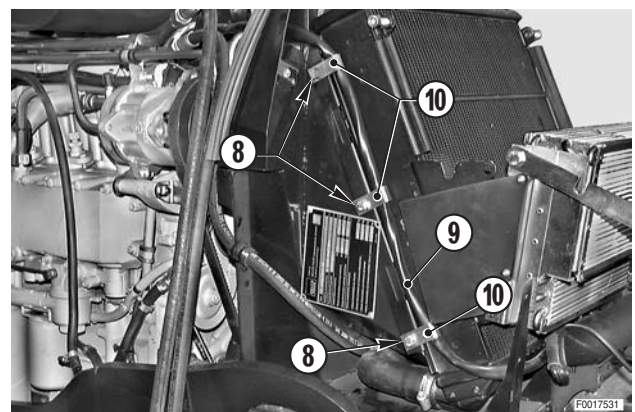
 Coolant: approx. 12 ℓ (3.17 US. gall.)

3 - Disconnect the expansion tank (4) from the mechanical fixings (1) and from the pipes (2), (3) on the right-hand side.

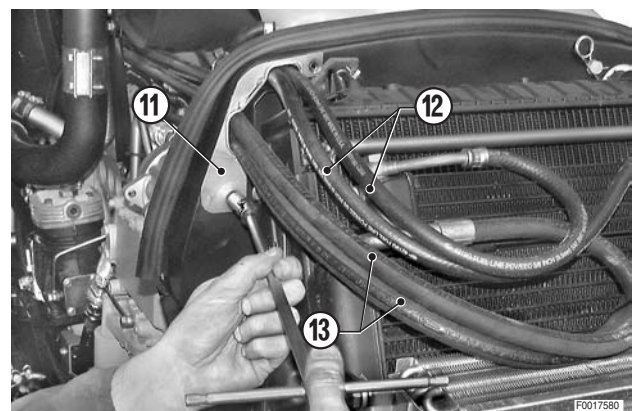
4 - Disconnect the hoses (6) and (7) from the radiator assembly (5).



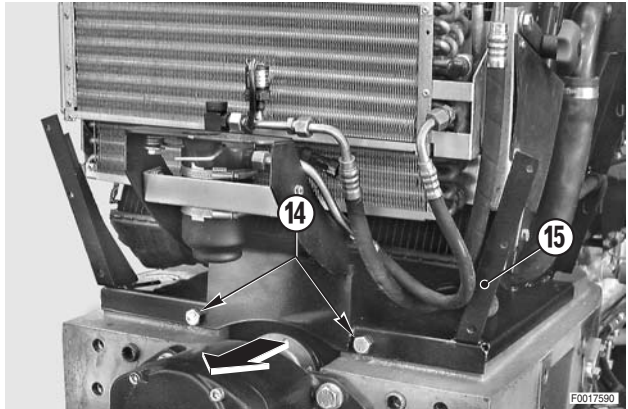
5 - Loosen the bolts (8) and release the wiring (9) from the retaining straps (10) and from the radiator support.



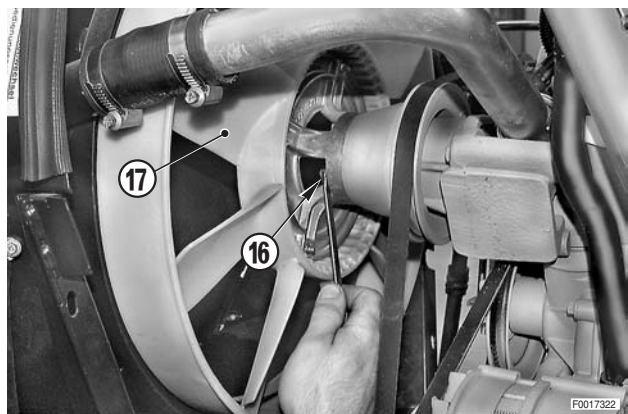
6 - Undo and remove the guide (11) for the cooler connection pipes (12) and (13).



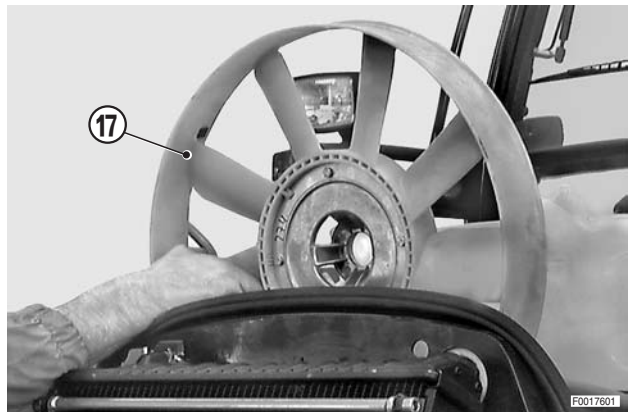
- 7 - Unscrew and remove the two front retaining bolts (14) of the support (15) and move the entire assembly towards the front of the tractor so that the fan is clear of the cowling.




- 8 - Unscrew and remove the retaining bolts (16) of the fan (17).



- 9 - Remove the fan (17) by withdrawing it vertically upwards.



REFITTING THE FAN


- Refitting is the reverse of removal.
- 1 - Fill the engine cooling system with coolant.
 Coolant: approx. 12 ℓ (3.17 US. gall.)
 - 2 - Start the engine and run for a few minutes to allow the coolant to circulate.
 - 3 - Stop the engine, check the coolant level in the expansion tank and top up if necessary.

REMOVAL OF THE FAN (Model 165 CV)

! Remove the battery cover and disconnect the negative battery lead (-).

1 - Remove the side panels, the lamp assemblies and lower grille.
(For details, see «REMOVAL OF THE HOOD AND SIDE PANELS»).

2 - Drain the engine cooling system.

 Coolant: 23 ℓ (6.07 US.gall.)

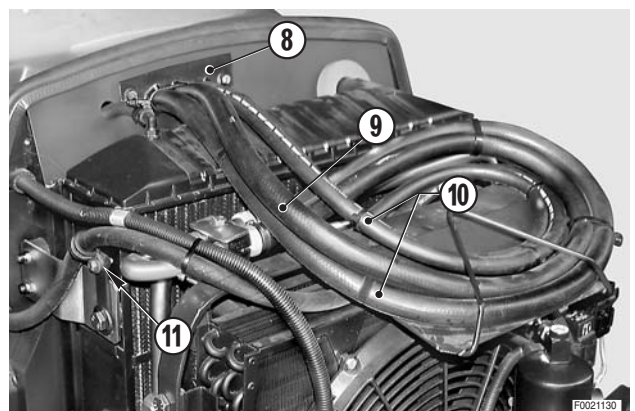
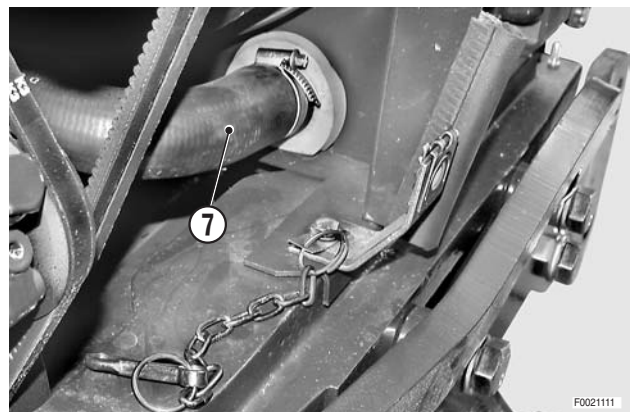
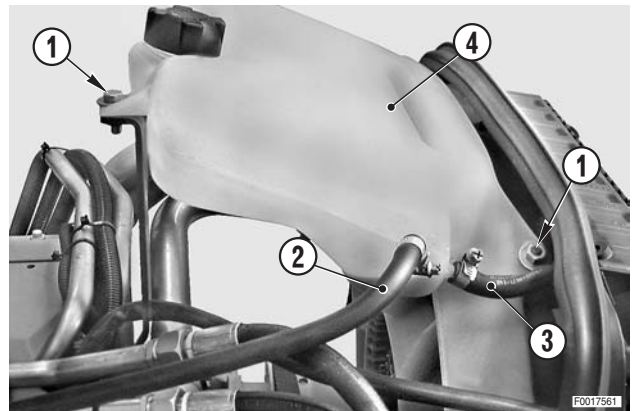
3 - Disconnect the expansion tank (4) from the mechanical fixings (1) and from the pipes (2), (3) on the right-hand side.

4 - Disconnect the upper hoses (6) from the radiator assembly (5).

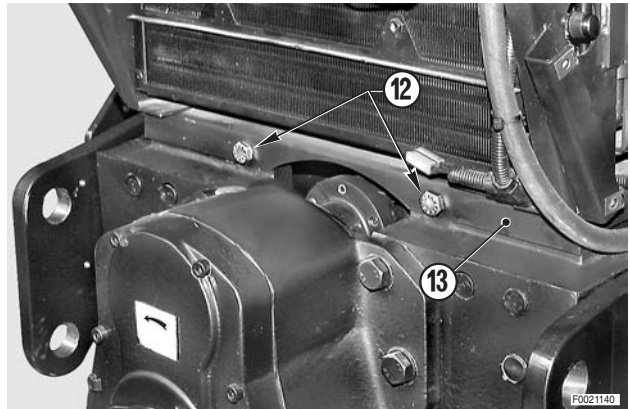
5 - Disconnect the lower hose (7) from the radiator assembly.

6 - Undo and remove the guide (8) for the pipes (9) and (10).

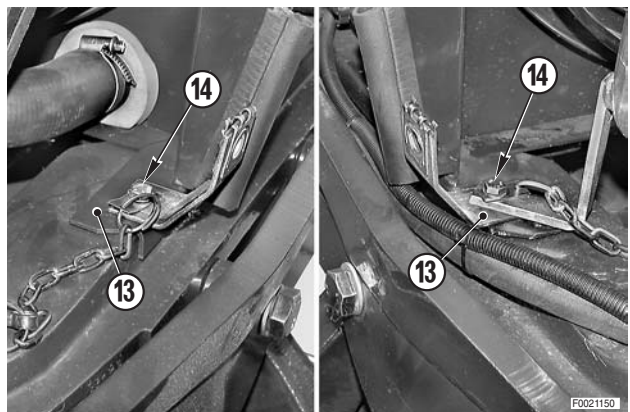
7 - Loosen the screw (11) and release the wiring clip.



- 8 - Unscrew and remove the front retaining bolts (12) of the support (13).

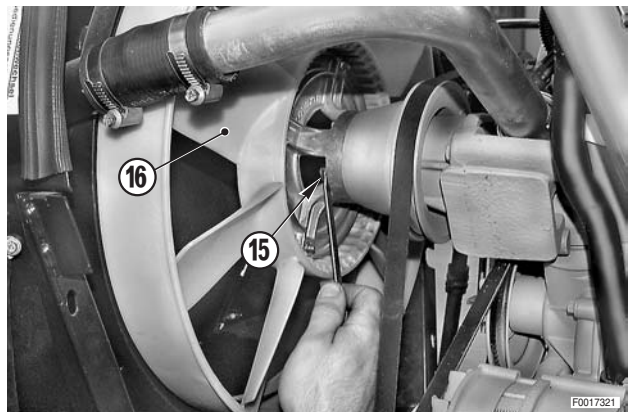


- 9- Unscrew and remove the rear retaining bolts (14) of the support (13) and move the entire assembly forward so that the fan is clear of the cowling.




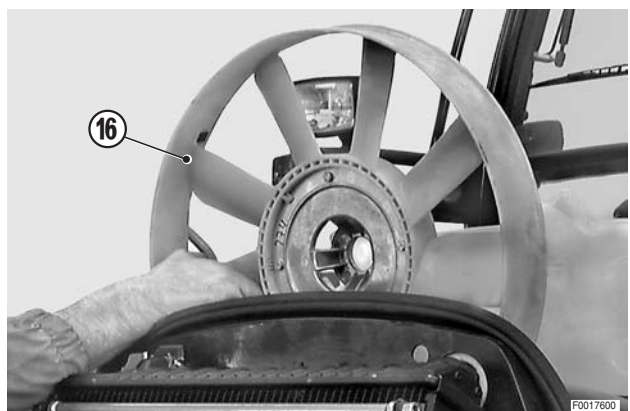
- 10 - Unscrew and remove the retaining bolts (15) of the fan (16).

- 11 - Remove the fan (16) by withdrawing it vertically upwards.




REFITTING THE FAN

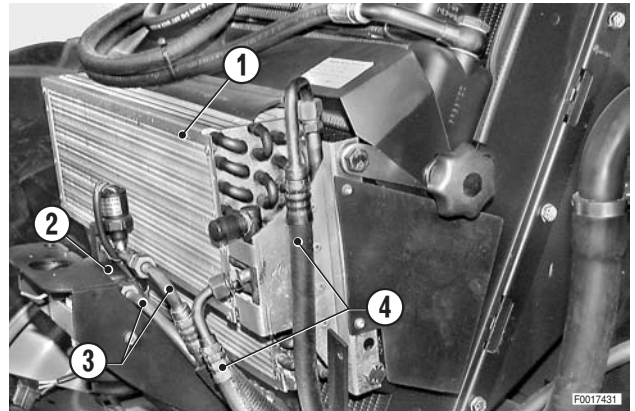
- Refitting is the reverse of removal.
- 1 - Fill the engine cooling system with coolant.
 Coolant: 23 ℓ (6.07 US.gall.)
 - 2 - Start the engine and run for a few minutes to allow the coolant to circulate.
 - 3 - Stop the engine, check the coolant level in the expansion tank and top up if necessary.



REMOVAL OF THE COMPLETE RADIATOR/COOLERS ASSEMBLY


★ The illustration shows the 135 CV model, but the procedure is identical for all models.

- 1 - Remove the side grilles, the lamp assemblies and the lower cover.
- 2 - Recover the refrigerant from the air conditioning system.
(For details, see «MAINTENANCE OF THE AIR CONDITIONING SYSTEM»).
- 3 - Disconnect pipes (3) and (4) from the condenser (1) and the receiver-drier (2). 

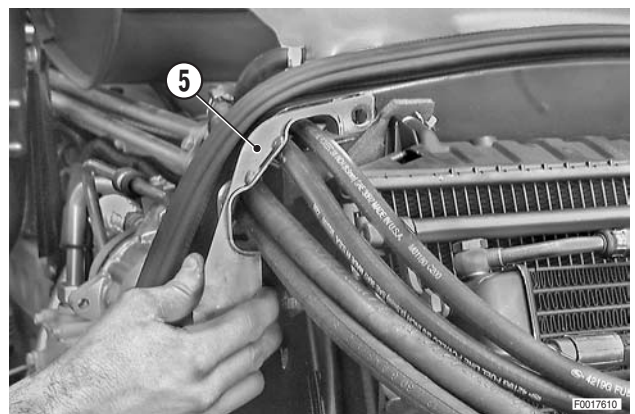


★ Immediately plug the ends of the pipes and the open fittings on the condenser and receiver-drier to prevent moisture from getting into the system.

- 4 - Drain the coolant from the engine cooling system..

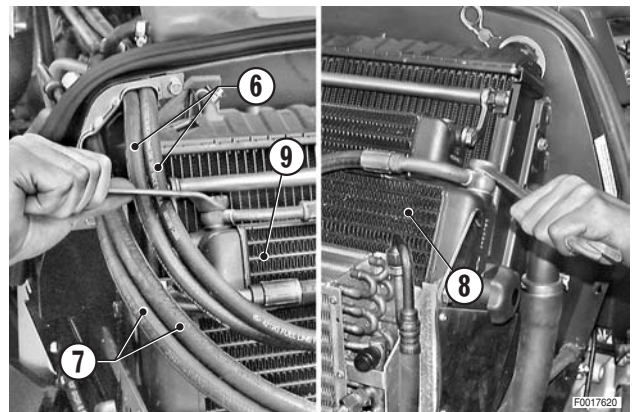
 Coolant:

Model	106	110	115	120	135	150	165
ℓ	17.5	17.5	17.5	21	21	21	23
US. gall.	4.62	4.62	4.62	5.54	5.54	5.54	6.07



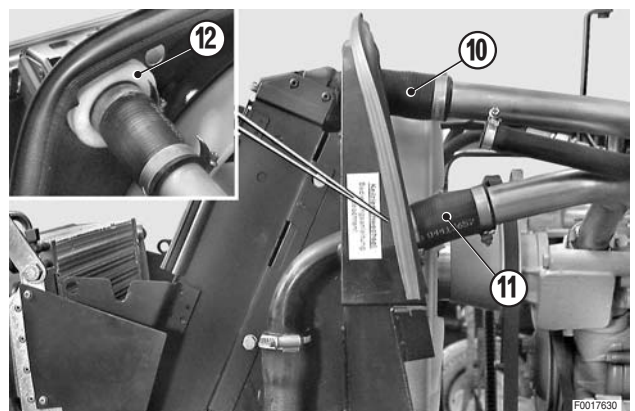
- 5 - Remove the bolts and remove the pipe and wiring guide plate (5).

- 6 - Release the pipes (6), (7) and the wiring from the retaining straps.
- 7 - Label and disconnect the pipes from oil cooler (8) and fuel cooler (9).
★ Immediately plug the ends of the pipes and the open fittings on the coolers to prevent the entry of contaminants.

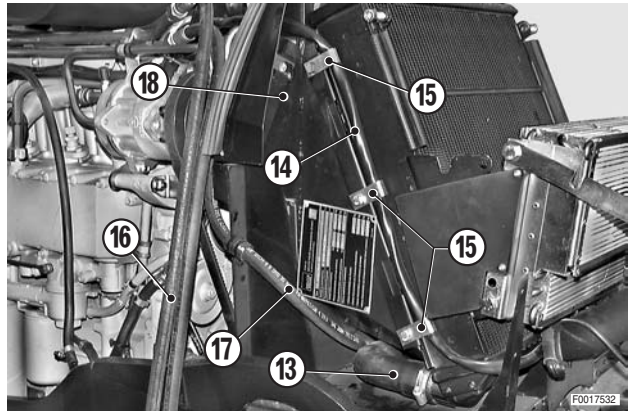


- 8 - Remove the expansion tank.
(For details, see «REMOVAL OF THE EXPANSION TANK»).

- 9 - Disconnect the hoses (10), (11) from the radiator; recover the bulkhead fitting (12).



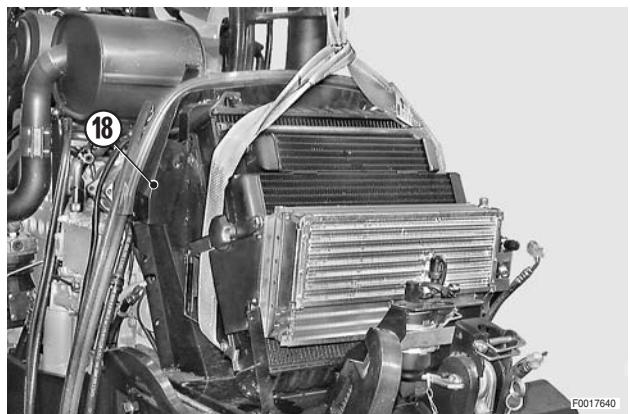
- 10 - Remove the hose (13).
- 11 - Release the wiring (14) from the retaining clamps (15).
- 12 - Route the cooler pipes (16), (17) and the wiring towards the rear of the tractor through the aperture in the frame (18).



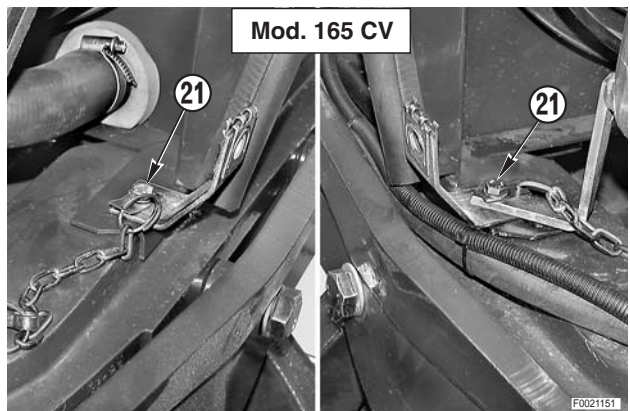
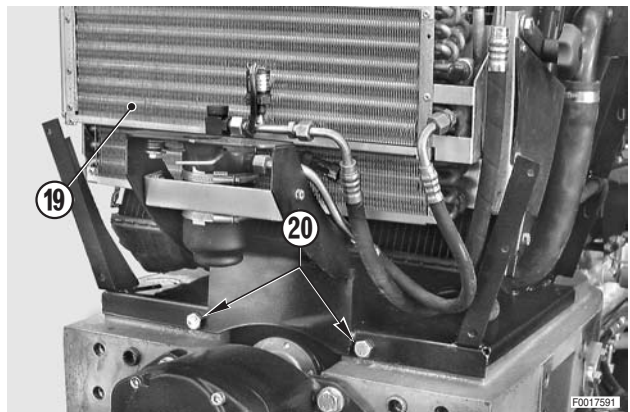
- 13 - Attach a hoist to the complete assembly.



Assembly: 28 kg (61.7 lb.)



- 14 - Remove the front retaining bolts (20) and remove the complete assembly (19).
- ★ On the 165 CV model, remove also the rear bolts (21).



REFITTING THE RADIATOR/COOLERS ASSEMBLY

- Refitting is the reverse of removal.



- ★ Remove the plugs and immediately connect the pipes, fully tightening the fittings, to prevent moisture from getting into the system.
- ★ Check the condition of the seals and renew them if damaged.

1 - Flush and recharge the air conditioning system.
(For details, see «DISCHARGING, FLUSHING AND RECHARGING THE AIR CONDITIONING SYSTEM»).

2 - Fill the engine cooling system with coolant.



Coolant:

Model	106	110	115	120	135	150	165
ℓ	17.5	17.5	17.5	21	21	21	23
US. gall.	4.62	4.62	4.62	5.54	5.54	5.54	6.07

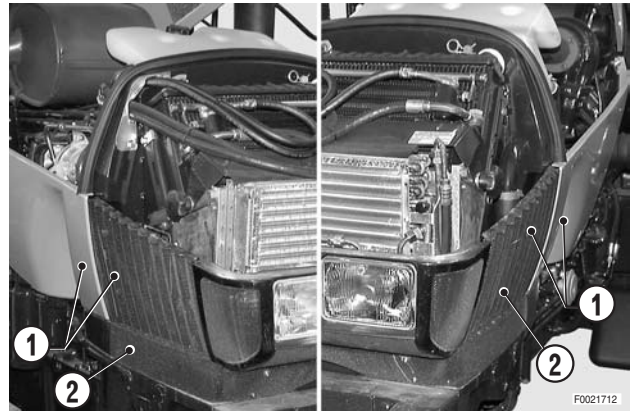
3 - Start the engine and run for a few minutes to allow the coolant to circulate.

4 - Stop the engine, check the coolant level in the expansion tank and top up if necessary.

RENEWAL OF THE FLEXIBLE COUPLING OF THE FRONT PTO

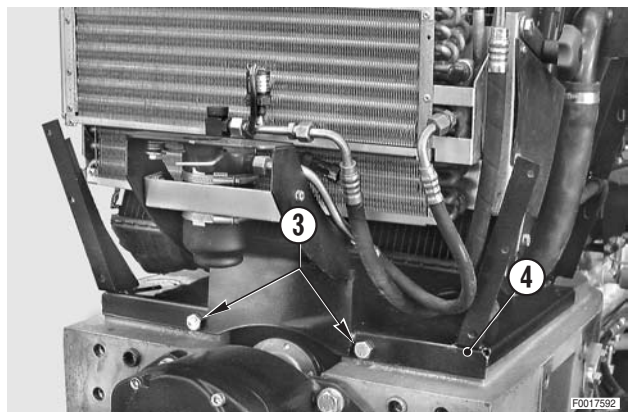
★ The illustration shows the 135 CV model, but the procedure is identical for all models.

1 - Remove the side grilles (1), and the lower cover (2).




2 - Remove the front retaining bolts (3) of the radiator supports (4).

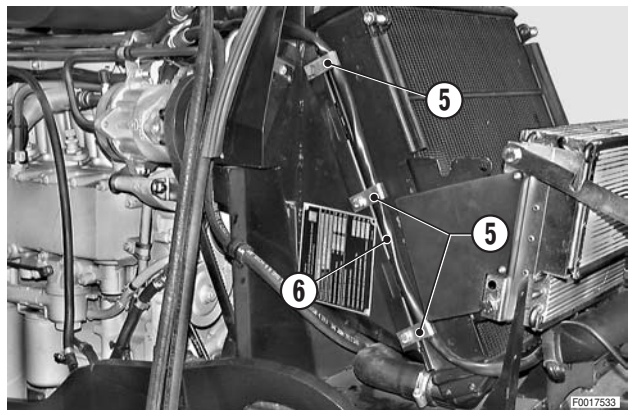
★ On the 165 CV model, remove also the two rear bolts.



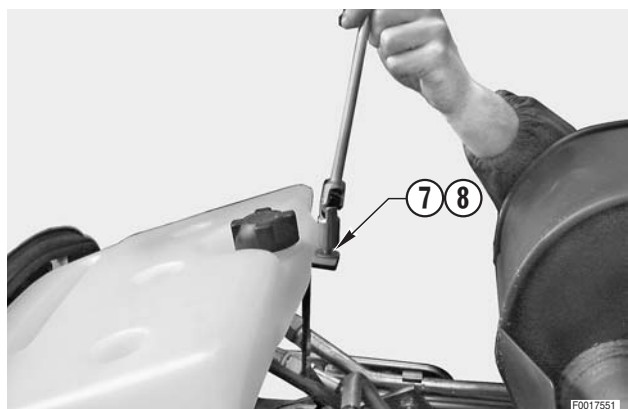
3 - Release the lamp wiring (6) from the retaining straps (5).

4 - Partially drain the engine cooling system.

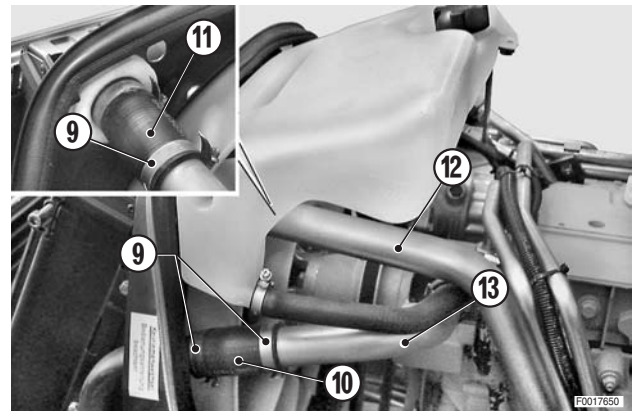
 Coolant: approx. 12 ℓ (3.17 US. gall.)



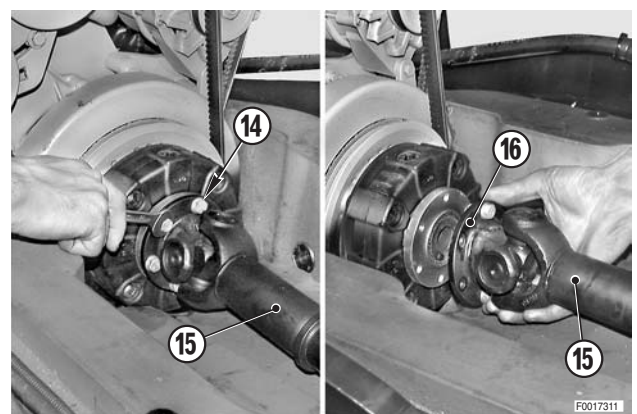
5 - Remove the rear retaining bolt (7) and the washer (8) of the expansion tank.




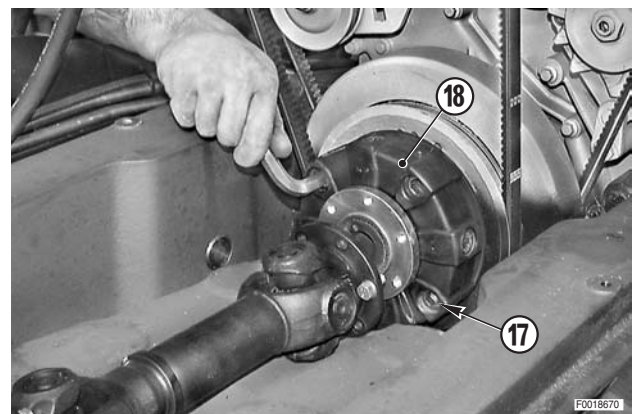
- 6 - Loosen the hose clamps (9) and slide the hoses (10), (11) onto the engine connection pipes (12), (13). Push the radiator assembly towards the front of the tractor.



- 7 - Fully loosen the flange bolts (14) of the drive shaft (15).
 8 - Disengage the drive shaft (15) by pushing the flange (16) towards the front of the tractor.



- 9 - Unscrew and remove the retaining bolts (17) of the coupling (18) and remove the coupling itself. 




REFITTING THE FLEXIBLE COUPLING OF THE FRONT PTO


- Refitting is the reverse of removal.



 Bolts: Loctite 243

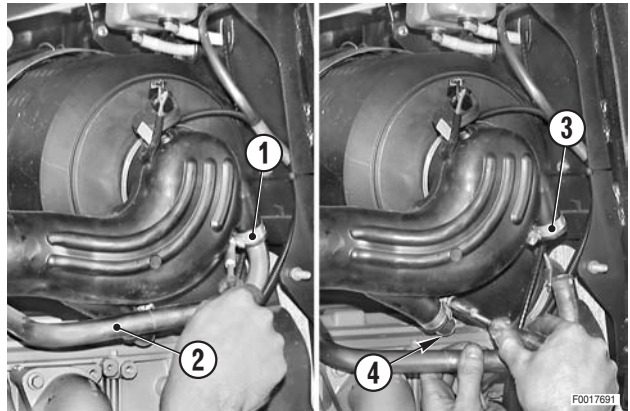
 Bolts: 139±10% Nm (102.4±10% lb.ft.)

- 1 - Fill the engine cooling system with coolant.

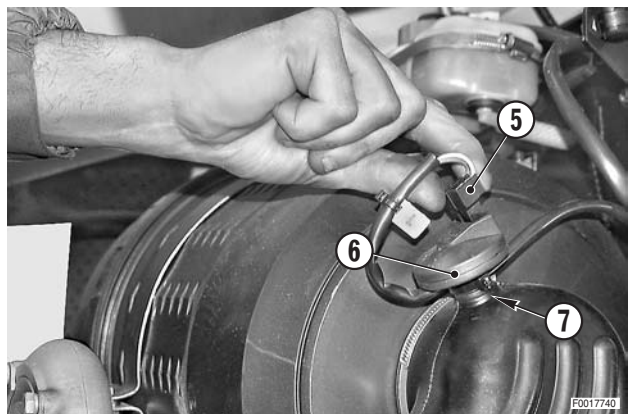
 Coolant: approx. 12 ℓ (3.17 US. gall.)

REMOVAL OF THE TURBOCHARGER

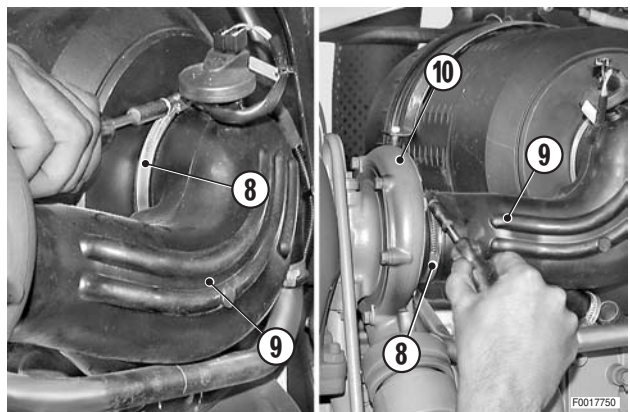
- 1 - Remove the silencer.
(For details, see «REMOVAL OF THE SILENCER»).
- 2 - Loosen the clamp (1) and disconnect the inlet pipe (2) of the air compressor for the trailer braking system.
- 3 - Loosen the clamp (3) and disconnect the oil vapour pipe (4).



- 4 - Unplug the connector (5) of the filter clogging sensor (6).
★ Release the wiring from the strap (7).



- 5 - Loosen the clamp (8) securing the filter – turbocharger (10) connection hose (9); remove the hose (9).
- 6 - Remove the turbocharger (10) following the instructions in the «ENGINE WORKSHOP MANUAL».

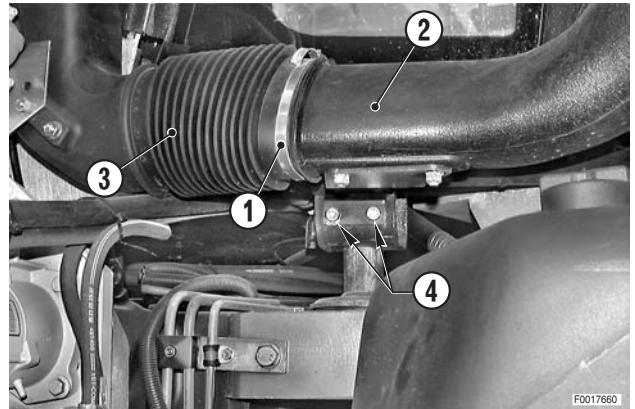


REFITTING THE TURBOCHARGER

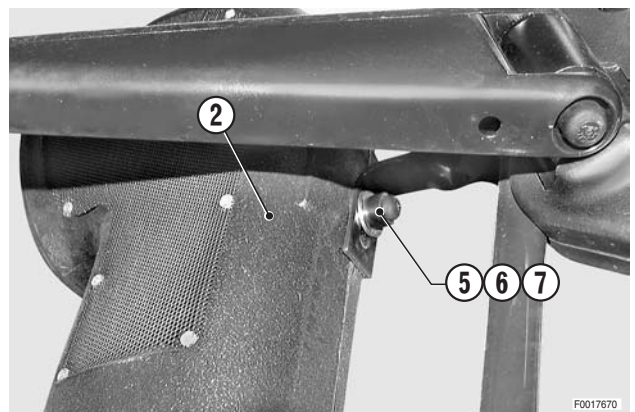
- Refitting is the reverse of removal.

REMOVAL OF THE AIR INLET PIPE

- 1 - Loosen the hose clamp (1) and disconnect the hose (3) from the pipe (2).
- 2 - Unscrew and remove the bolts (4).



- 3 - Remove the nut cover (5) and, while supporting the pipe (2), remove the upper retaining nut (6) and washer (7).

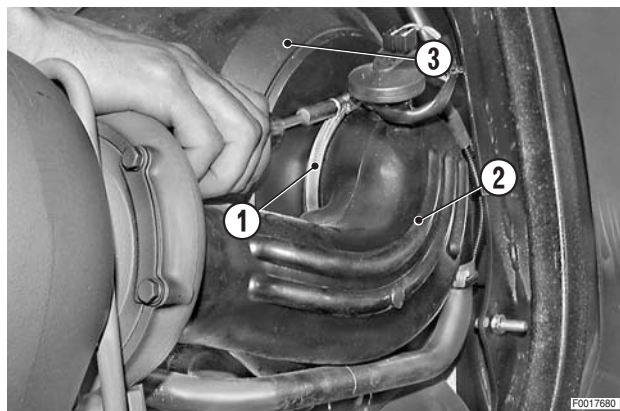


REFITTING THE AIR INLET PIPE

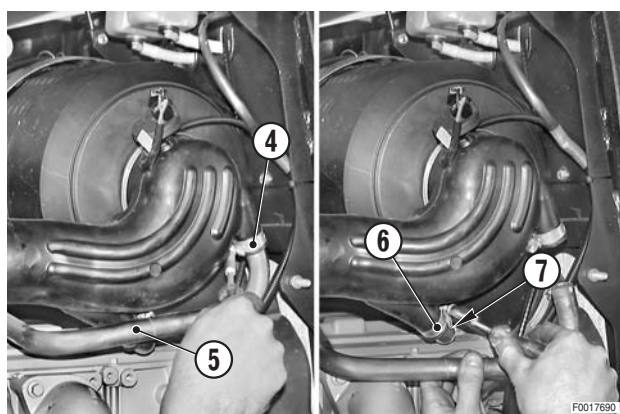
- Refitting is the reverse of removal.

REMOVAL OF THE AIR CLEANER

- 1 - Loosen the hose clamp (1) securing the turbocharger inlet hose (2); disconnect the hose from the air cleaner (3).



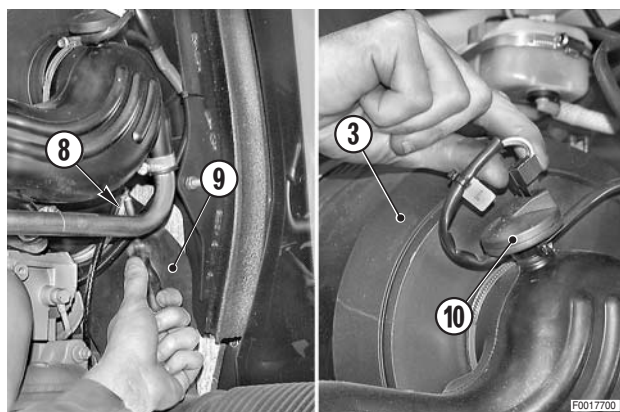
- 2 - Loosen the hose clamp (4) and disconnect the inlet pipe (5) of the air compressor for trailer braking.



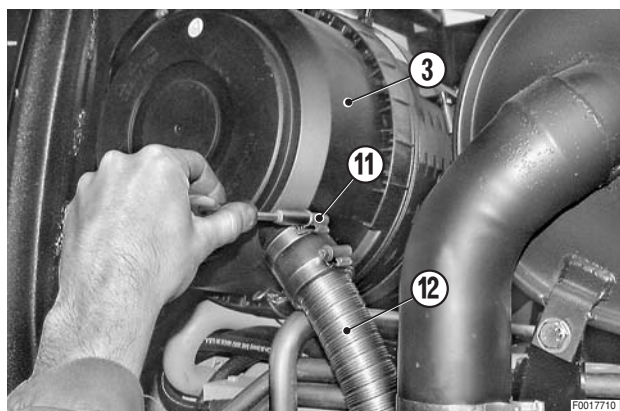
- 3 - Loosen the hose clamp (6) and disconnect the oil vapour pipe (7).

- 4 - Loosen the hose clamp (8) and disconnect the inlet hose (9) from the air cleaner (3).

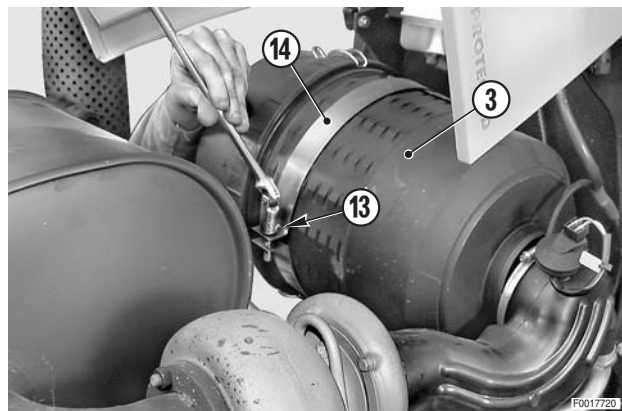
- 5 - Unplug the connector of the filter clogging sensor (10).



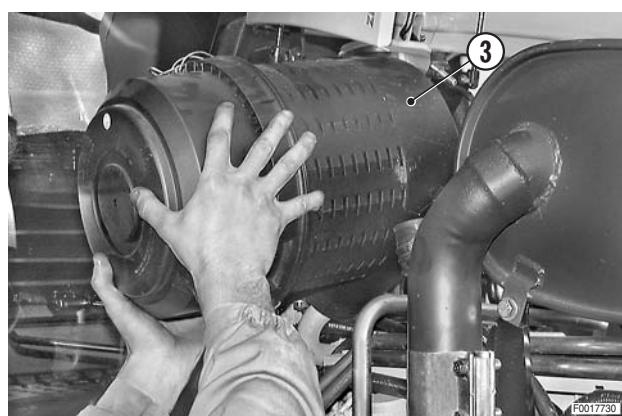
- 6 - Loosen the hose clamp (11) and disconnect from the air cleaner (3) the connection hose (12) of the dust exhauster pipe.



- 7 - Slacken off the screw (13) of the air cleaner (3) retaining strap (14).



- 8 - Remove the complete air cleaner assembly (3).



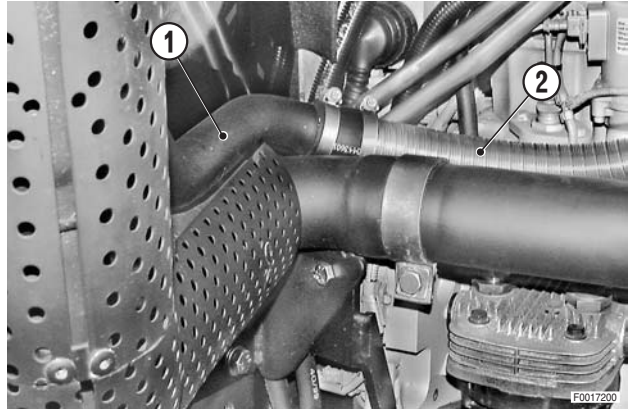
REFITTING THE AIR CLEANER

- Refitting is the reverse of removal.
 - ★ Check that all the hose clamps are fully tightened.

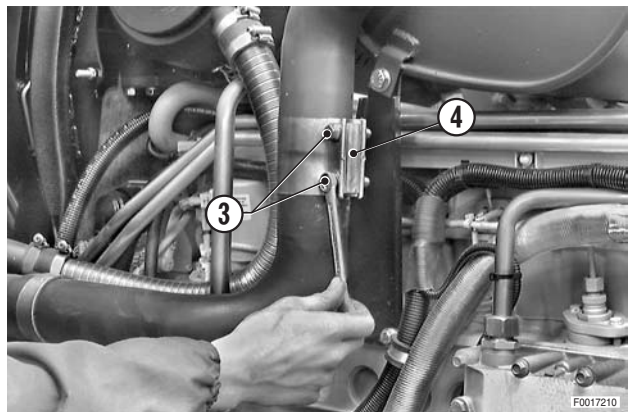
REMOVAL OF THE EXHAUST PIPE

! Remove the key from the ignition.

- 1 - Disconnect the dust exhauster pipe (2) from the exhaust pipe (1).



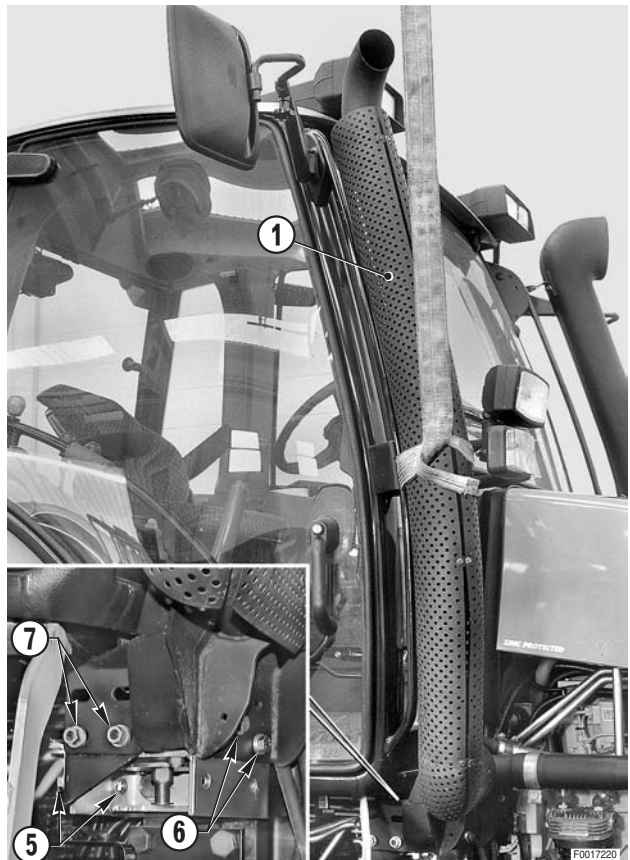
- 2 - Unscrew the bolts (3) and move the clamp (4) joining the exhaust and the silencer.



- 3 - Attach a hoist to the exhaust pipe (1) and put the lifting sling under slight tension.

 Exhaust pipe: 23 kg (50.7 lb.)

- 4 - Remove the bolts (5), (6) and the nuts (7).
- 5 - Remove the exhaust pipe (1).



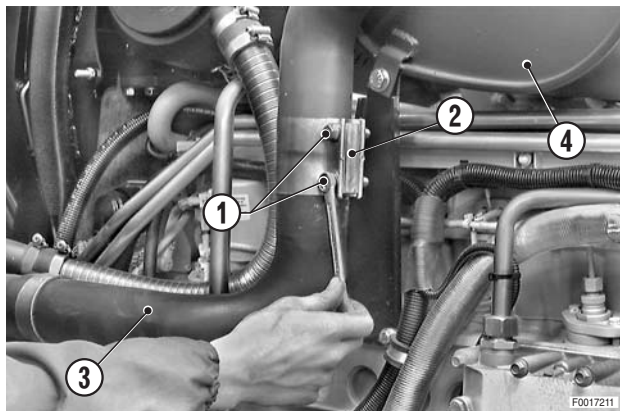
REFITTING THE EXHAUST PIPE

- Refitting is the reverse of removal.

REMOVAL OF THE SILENCER

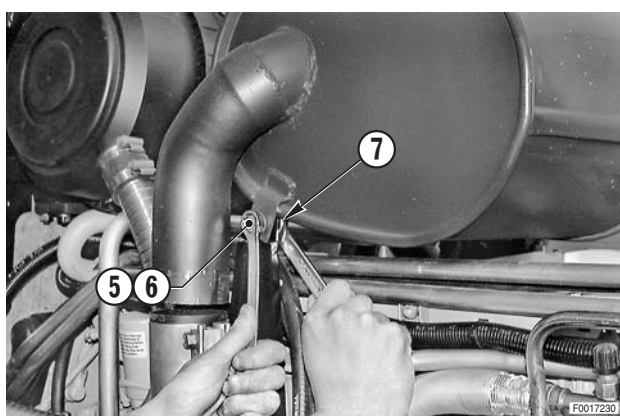
! Remove the key from the ignition switch.

- 1 - Loosen the bolts (1) and move the clamp (2) joining the exhaust pipe (3) to the silencer (4).



- 2 - Position supports between the cylinder head and the silencer.

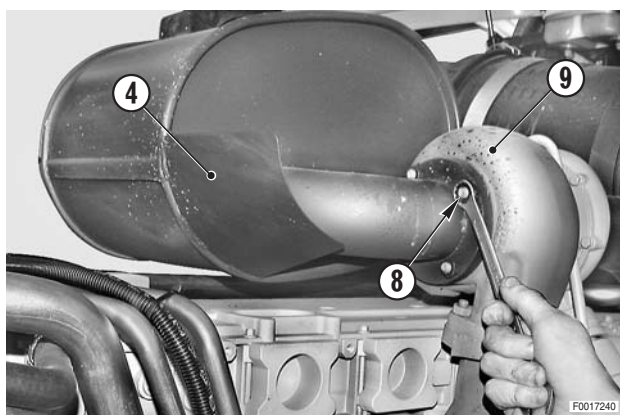
- 3 - Unscrew and remove the bolt (5), washer (6) and nut (7).



- 4 - Remove the nuts (8) securing the silencer to the turbocharger (9) and remove the silencer (4).



Silencer: 15 kg (33 lb.)

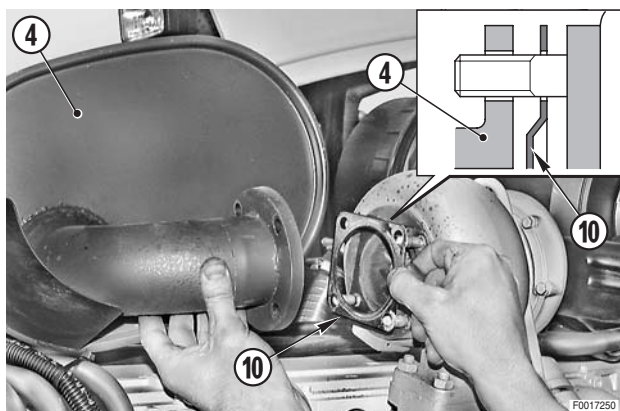


- 5 - Remove the gasket (10).

★ Note which way round it is fitted.

REFITTING THE SILENCER

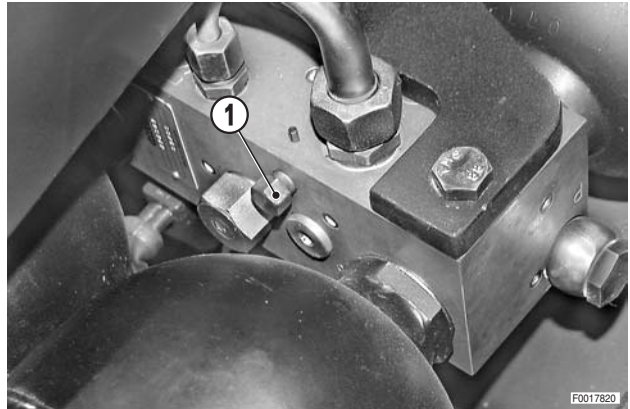
- Refitting is the reverse of removal.



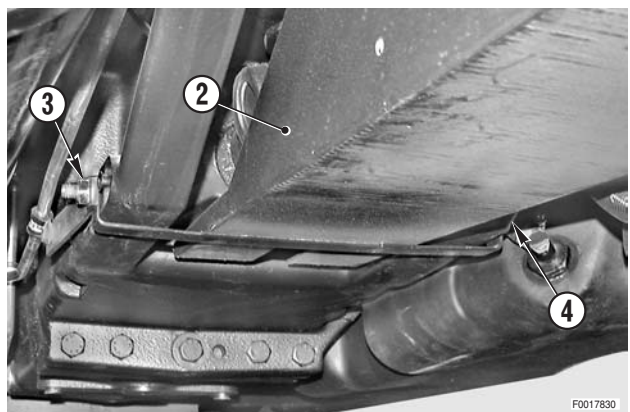
REMOVAL OF THE 4WD PROPELLER SHAFT

(Version with front suspension)

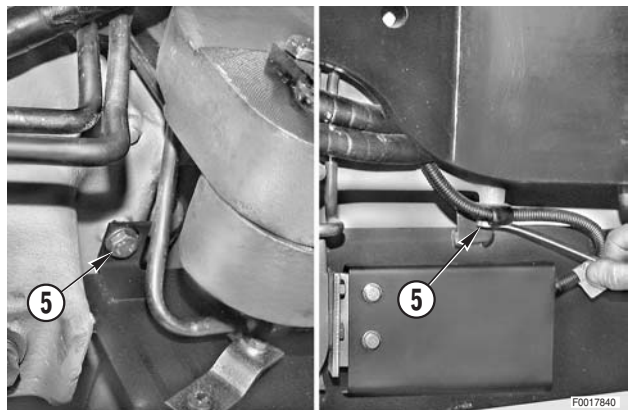
- ⚠ Before switching off the engine, disengage the front axle suspension by pressing the relative button in the cab.
- ⚠ Remove the battery cover and disconnect the negative battery lead (-).
- ⚠ Discharge the residual pressure from the suspension system by unscrewing the valve (1) two full turns.
 - ★ Reclose the valve after having discharged the pressure.



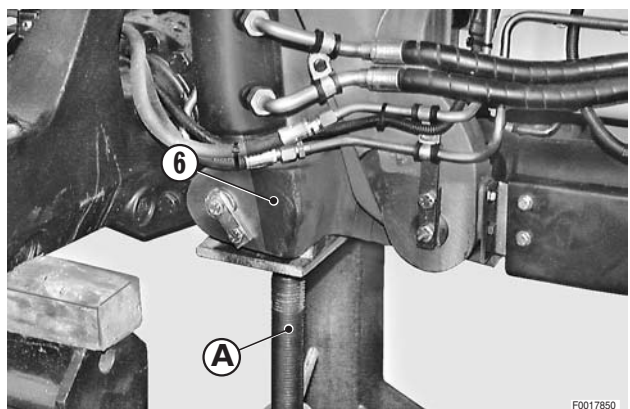
- 1 - While supporting the lower guard (2), remove the nut (3), the rear washer on the right and the rear bolt (4) on the left.



- 2 - Remove the front bolts (5) and remove the lower guard (2).



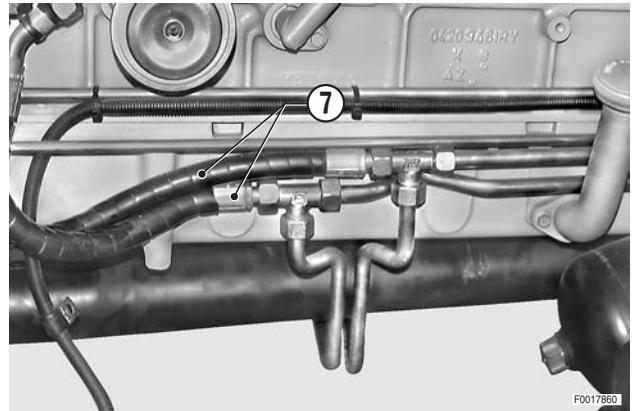
- 3 - Force an adjustable jack "A" under the suspension (6); it must be possible to lower the jack by approx. 10 cm (4 in.).



4 - Disconnect the pipes (7) of the left-hand suspension cylinder.

★ Plug the ends of the pipes to prevent the entry of contaminants.

⚠ Loosen the fittings of the flexible hoses by a few turns and, before removing them, push them to detach them from the couplers and thereby discharge any residual pressure from the system.

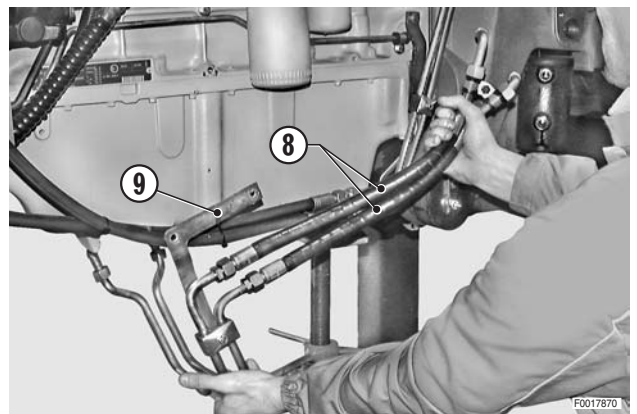


5 - Disconnect the pipes (8) from the right-hand suspension cylinder.

★ Label the pipes to avoid confusion on refitting.

★ Plug the pipes and the open fittings to prevent the entry of contaminants.

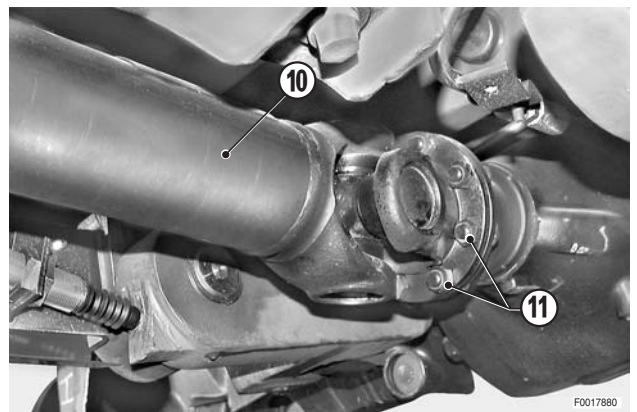
6 - Remove the bracket (9) and remove the pipes.



7 - Position a jack "B" under the shaft (10) and remove the flange bolts and nuts (11).

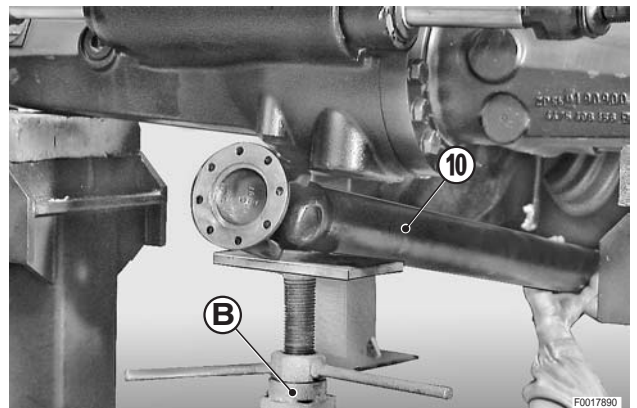
⊠ 1

★ In order to remove the upper bolts, lower the jack positioned in step 3.



8 - Disconnect the flange, lower the jack "B" and withdraw the shaft (10) towards the front of the tractor.


⊠ 2



REFITTING THE 4WD PROPELLER SHAFT


- Refitting is the reverse of removal.

※ 1

 Nuts: 43.5±10% Nm (32±10% lb.ft.)

★ Tighten the nuts in a cross-wise sequence.

※ 2

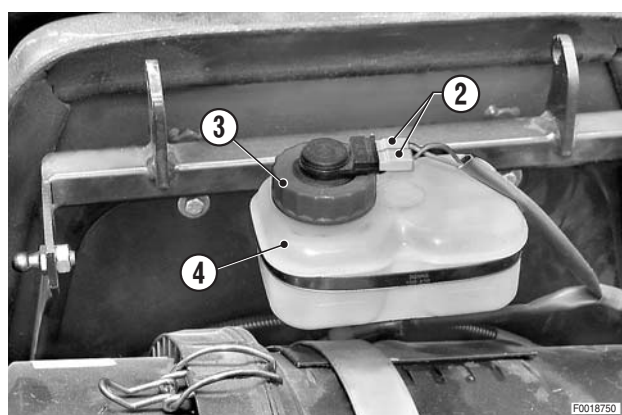
 Rear coupling: Grease

- 1 - Start the engine and engage the front suspension by pressing the relative button in the cab.
- 2 - Wait a few seconds and then disengage the front suspension.
- 3 - Repeat this operation a number of times to purge the air from the system.
- 4 - Stop the engine, check the oil level and top up if necessary.

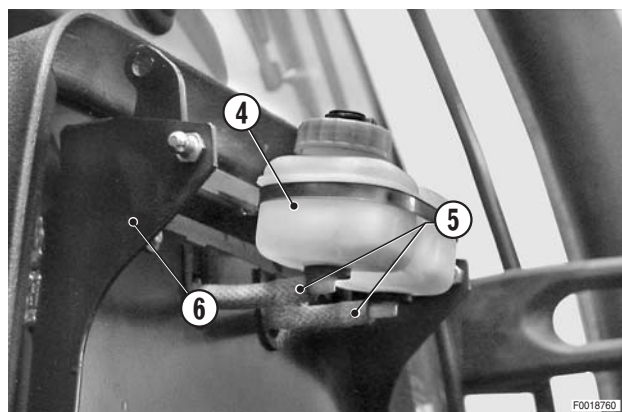
REMOVAL OF THE BRAKE MASTER CYLINDERS

! Remove the battery cover and disconnect the negative battery lead (-).

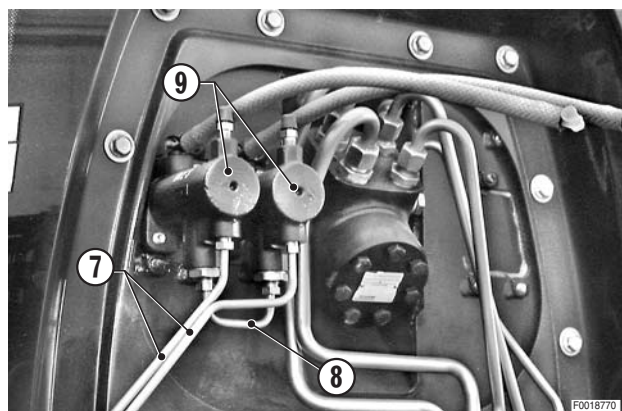
- 1 - Remove the console shroud. (For details, see «REMOVAL OF THE CENTRE CONSOLE AND SHROUD»)
- 2 - Remove the engine hood side panels. (For details, see «REMOVAL OF THE ENGINE HOOD AND FRONT GRILLE»).
- 3 - Remove the air cleaner. (For details, see «REMOVAL OF THE AIR CLEANER»).
- 4 - Remove the screws and remove the insulation panel (1).
- 5 - Unplug the connectors (2) of the brake fluid level warning light.
- 6 - Remove the cap (3) and draw off the fluid contained in the brake fluid reservoir (4).



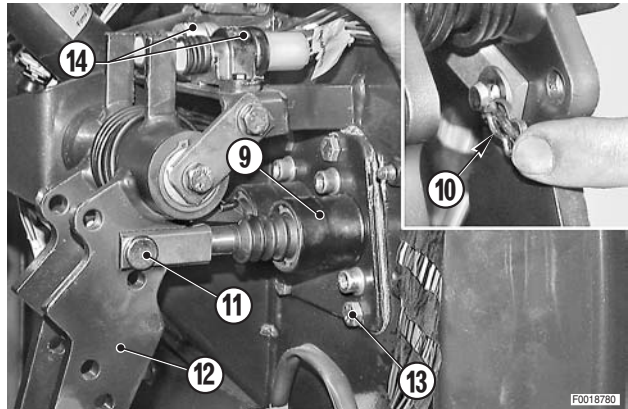
- 7 - Disconnect the pipes (5) from the reservoir (4); remove the hood support (6) complete with the reservoir.



- 8 - Disconnect the feed pipes (7) and the by-pass pipe (8) between the cylinders (9).



- 9 - Remove the cotter pins (10) and remove the pins (11) connecting the pedals (12) to the cylinders (9).
- 10 - Unscrew and remove the three bolts (13) with their washers and remove the cylinders (9).

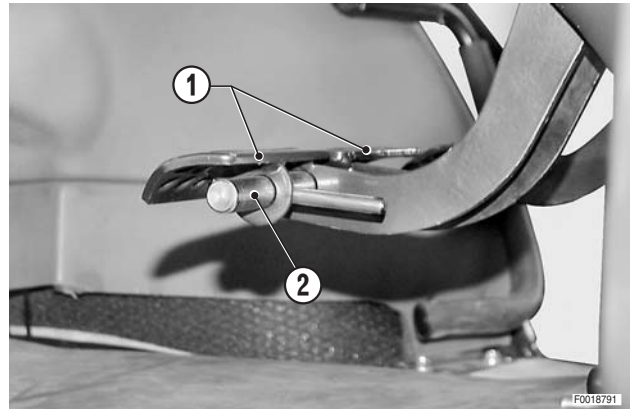


REFITTING THE BRAKE MASTER CYLINDERS

- Refitting is the reverse of removal.
- 1 - Fill the brake fluid reservoir to the maximum level.
 - 2 - Check the positions of the switches.
(For details, see «ADJUSTMENT OF THE BRAKE LIGHT SWITCHES»).
 - 3 - Bleed the air from the braking system.
(For details, see «BLEEDING THE BRAKING SYSTEM»).

BLEEDING THE BRAKING SYSTEM

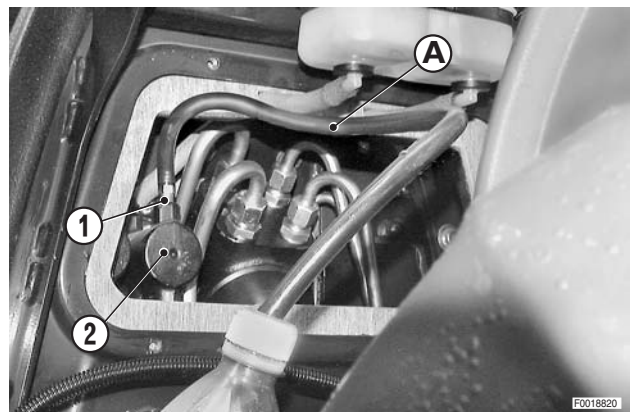
- 1 - Disconnect the two brake pedals (1) by disengaging the latch pin (2).
- 2 - Bleed the left rear brake.
- 3 - Bleed the right rear brake.
- 4 - **For tractors with hydraulic or air trailer braking only:** bleed the trailer brake valve before bleeding the service brake system.



Brake bleeding procedure

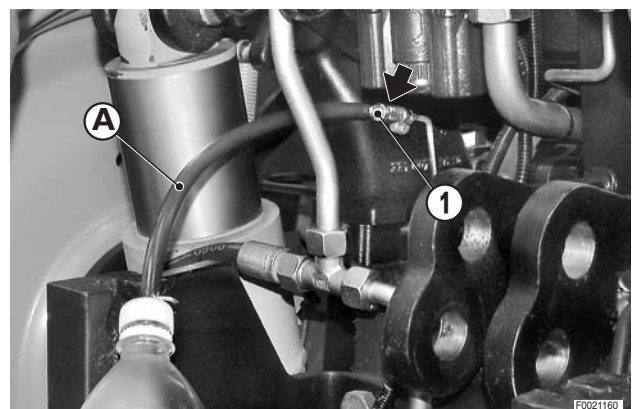
⚠ During brake bleeding operations, ensure that the fluid in the brake fluid reservoir is always above the minimum level.

- 1 - Remove the dust cap and attach a transparent bleed tube "A" to the bleed screw (1) of the cylinder (2).
- 2 - Fully depress the brake pedal corresponding to the brake to be bled.
- 3 - Slowly open the bleed screw (1) and allow the fluid and air to flow throughout the entire pedal travel.
- 4 - While holding the pedal fully depressed, tighten the bleed screw.
- 5 - Repeat the operation until the fluid flowing from the bleed screw is entirely free of air bubbles.
- 6 - Repeat the procedure for the remaining brake cylinder.
- 7 - After bleeding, replace the bleed screw (1) dust caps.



- 8 - Use the same method also for the service brakes.

⚠ Bleed in the order given: the pilot valve, the left brake and then the right brake.



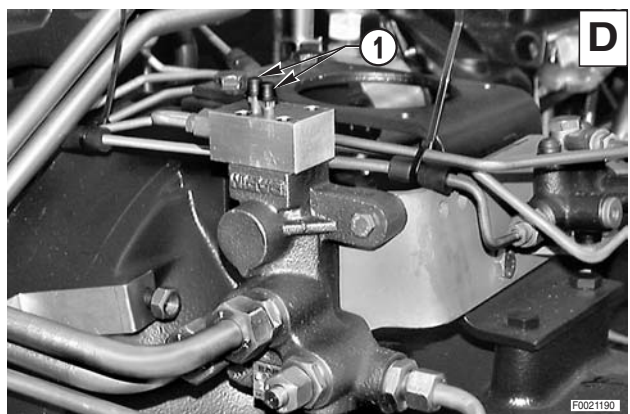
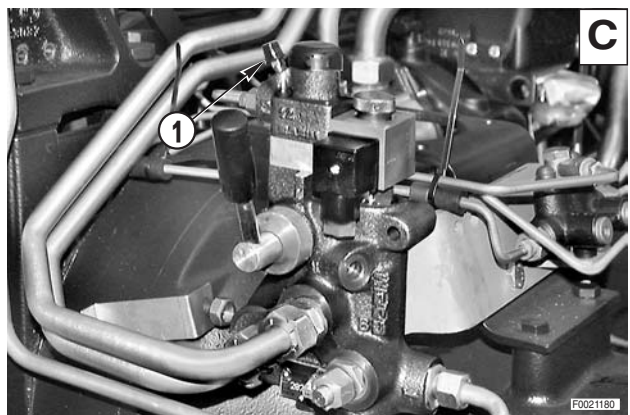
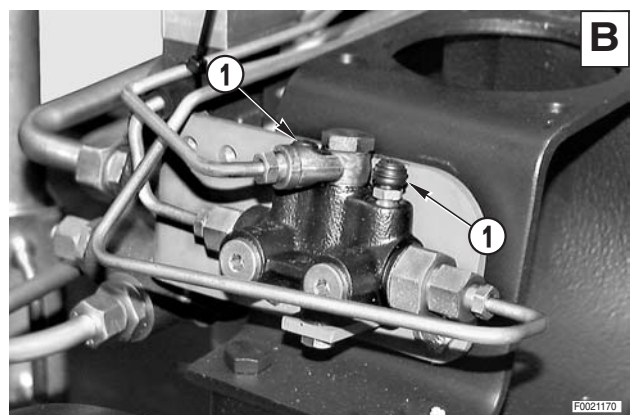
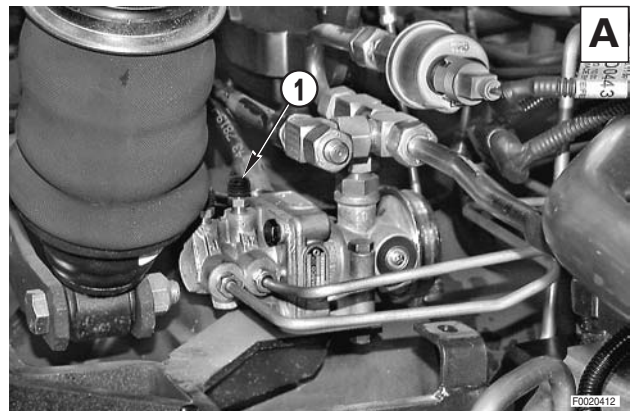
9 - Bleed the braking valve at the bleed screws (1) (protected by caps) using the method indicated for the pumps and choosing from among the following versions:

A - Pneumatic parking brake control valve.

B - Pilot valve.

C - Hydraulic braking valve (CUNA).

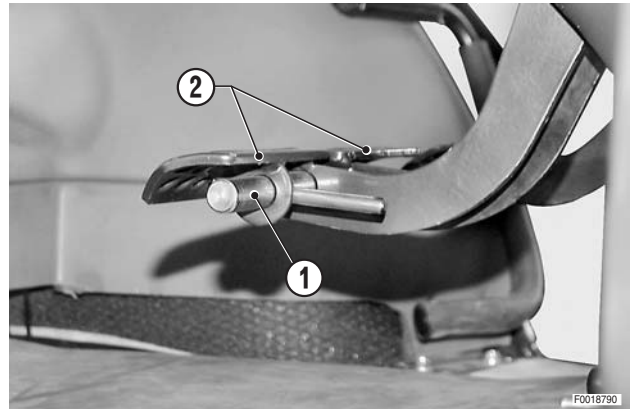
D - Hydraulic braking valve (EXPORT).



ADJUSTMENT OF THE BRAKE LIGHT SWITCHES

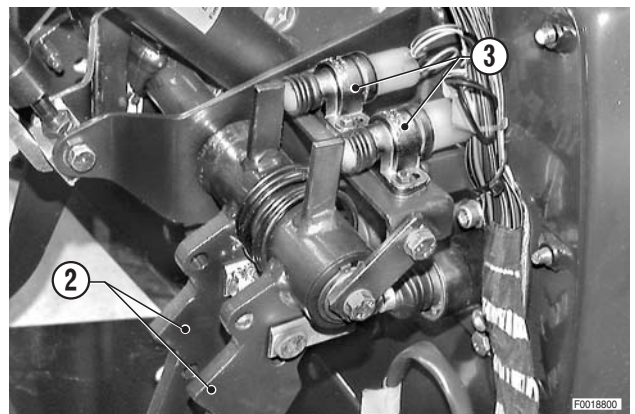
★ The switch for each pedal is adjusted separately.

1 - Check that the pedal latch pin (1) slides freely to connect and disconnect the two pedals (2).

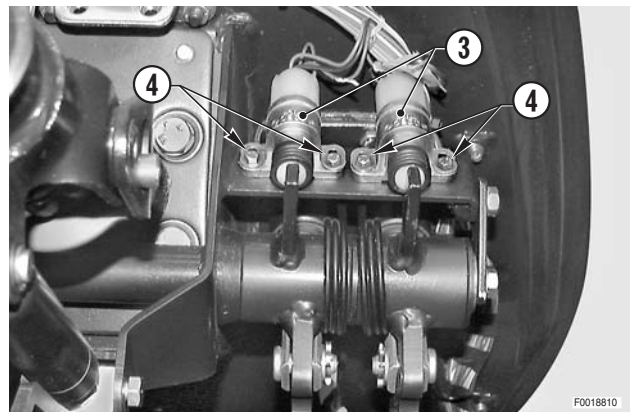


2 - Force the pedals (2) upwards and check that the brake light switches (3) have an extra opening travel of 1 ± 0.2 mm (0.04 ± 0.008 in.).

★ This extra travel protects the switches from impacts at the end of travel caused by sudden release of the pedals.



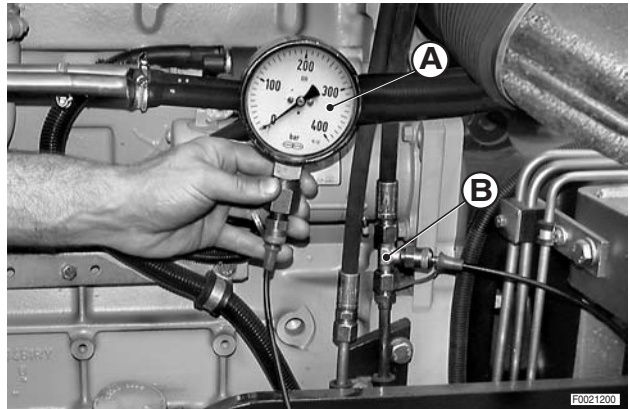
3 - If the switches (3) do not have this extra travel, loosen the screws (4) so that they just grip the switch; move the switch towards the front of the tractor and tighten down the screws (4) to fix it in position.



TESTING AND REMOVAL OF THE POWER STEERING UNIT

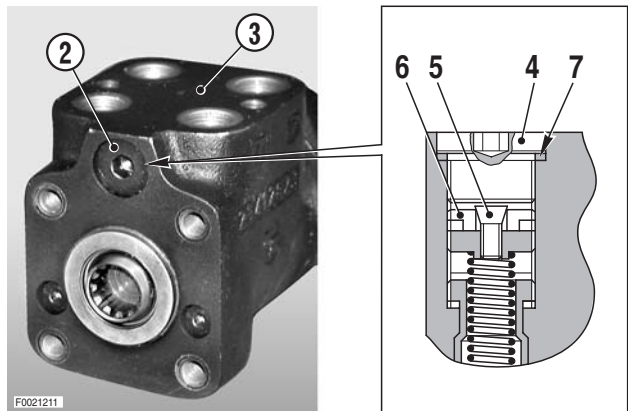
1. Testing

- 1 - Disconnect a steering pipe (1) and connect a fitting "B" with a 400 bar pressure gauge "A".
- 2 - Start the engine and turn the wheel back and forth between the full lock positions to eliminate all air from the system.
- 3 - Force the steering to full lock on the side to which the pressure gauge is connected and read off the maximum continuous pressure on the gauge "A".
 - ★ Maximum permissible pressure:
191–198 bar (2270–2871 psi)
- 4 - If the pressure reading differs from that specified, adjust the maximum pressure valve (2) of the power steering unit (3).



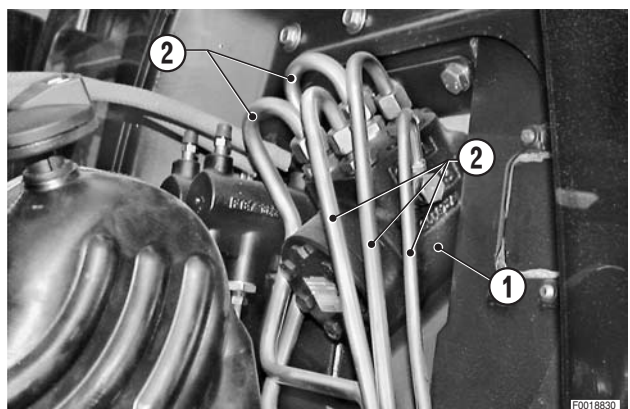
2. Adjustment

- 1 - Remove the plug (4).
- 2 - Loosen off the screw (5) using a 4 mm hex socket wrench.
- 3 - Turn the screw (6) to adjust the pressure.
 - To INCREASE the pressure, turn the screw CLOCKWISE.
 - To REDUCE the pressure, turn the screw COUNTER-CLOCKWISE
- 4 - Stop the engine and fix the adjuster screw (6) in position by tightening the lock screw (5).
- 5 - Refit the plug (4), checking the gasket (7) is in its seating.
 - ⚙️ Nm Plug: 20±5 Nm (14.7±3.7 lb.ft.)

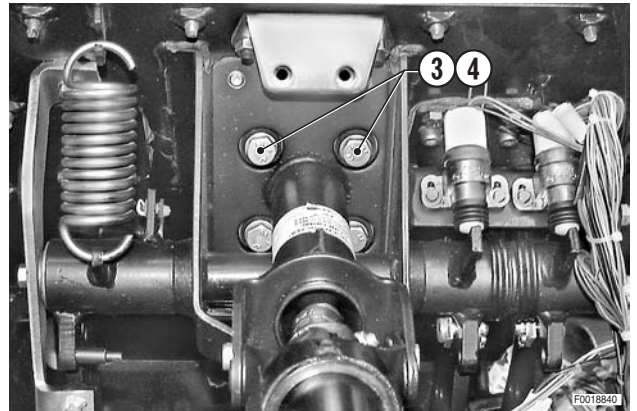


3. Removal of the power steering unit

- 1 - Remove the console shroud. (For details, see «REMOVAL OF THE CENTRE CONSOLE AND SHROUD»).
- 2 - Disconnect the five pipes (2) from the power steering unit (1).
 - ⊠ 1



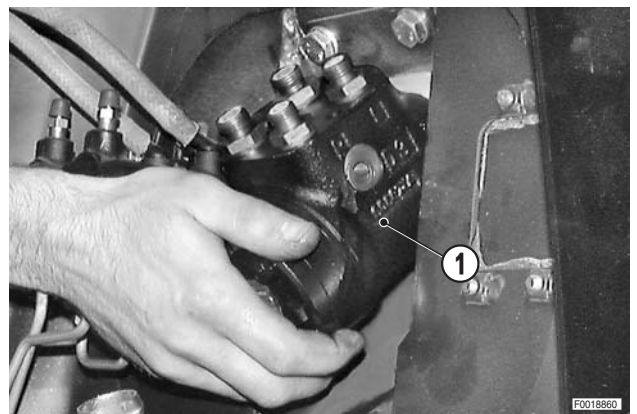
3 - Unscrew the retaining bolts (3) and washers (4).



4 - Remove the power steering unit (1).

- ★ If necessary, reposition the plate (5) with the relative bushes (6).


※ 2



REFITTING THE POWER STEERING UNIT

- Refitting is the reverse of removal.

※ 1

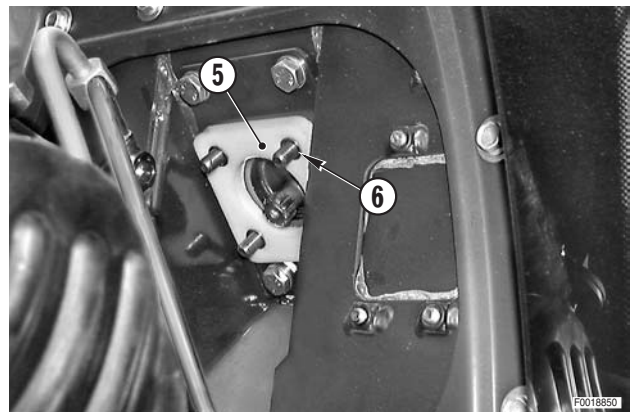
 Pipe fittings: 60 Nm (44.2 lb.ft.)
Eye fitting: 29 Nm (21.4 lb.ft.)

※ 2

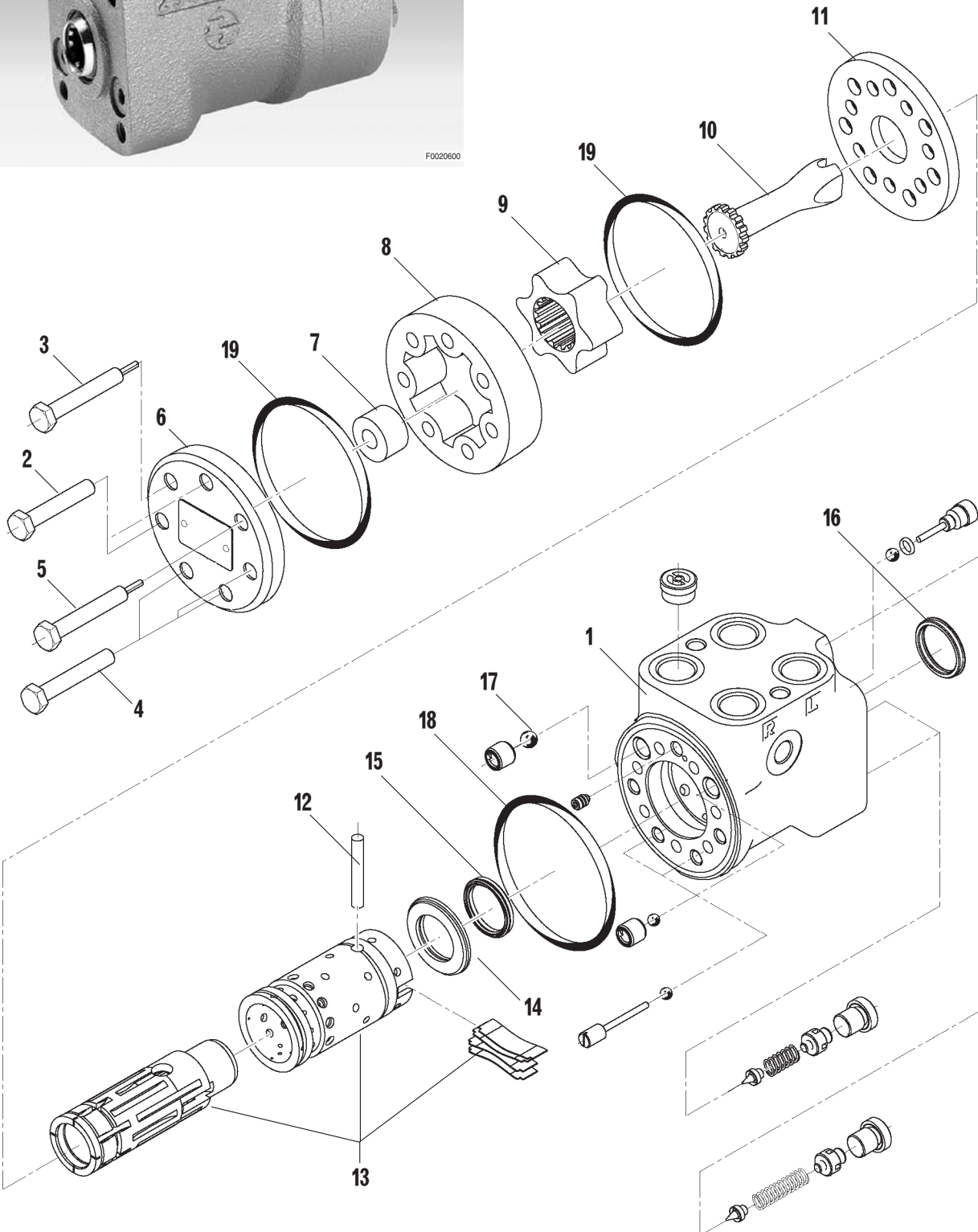
- ★ If the power steering fittings have been undone, renew the gaskets and tighten the fittings to a torque of 70 Nm (51.6 lb.ft.).

1 - Start the engine and turn the steering wheel repeatedly in both directions to eliminate any air from the power steering system.

2 - Check the fittings for leaks.



REMOVAL AND RENEWAL OF POWER STEERING UNIT SEALS



D0004350

- ★ For parts identification, see exploded view of the power steering unit.

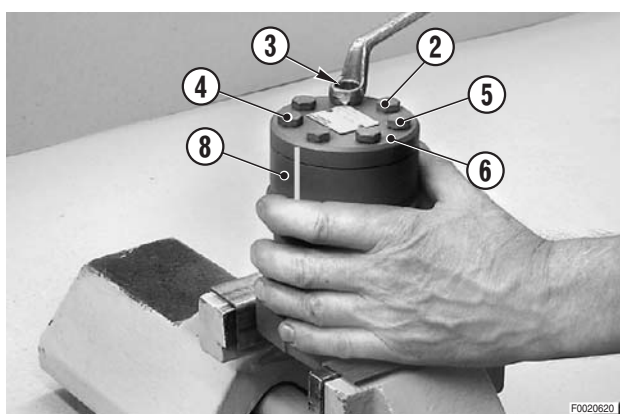
1. Disassembly

1 - Hold the body of the power steering unit (1) in a vice with the jaws faced in a soft material (aluminium or soft steel), with the bolts of the unit uppermost.

- ★ Do not over-tighten the vice to avoid damaging the body of the power steering unit.



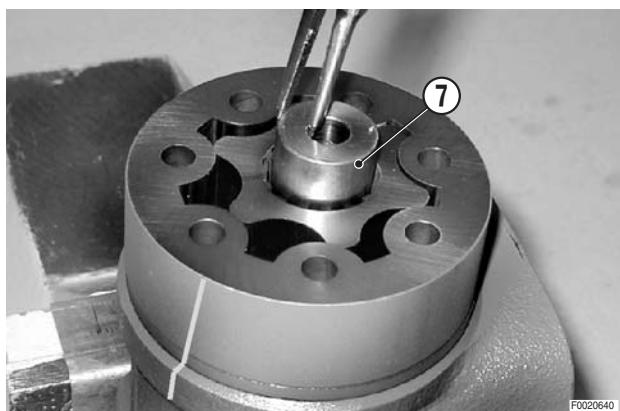
2 - Mark the relative positions of the bolts, the cover (6) and the metering unit (8). Loosen the bolts (2), (3), (4), (5) gradually in a cross-wise sequence and remove them.



3 - Remove the cover (6) by sliding it off sideways.



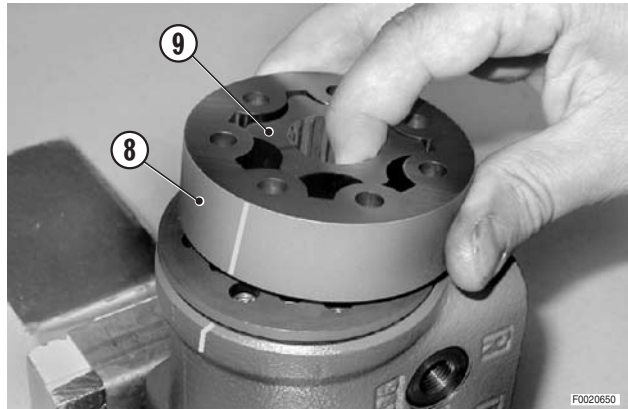
4 - Using a pair of round-nosed pliers, remove the bush (7).



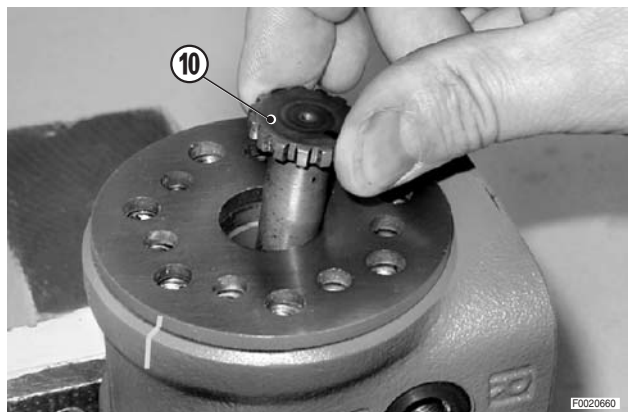
5 - Mark the relative positions of the drive shaft (10) and the rotor (9).

Remove the outer ring (8) and the rotor (9).

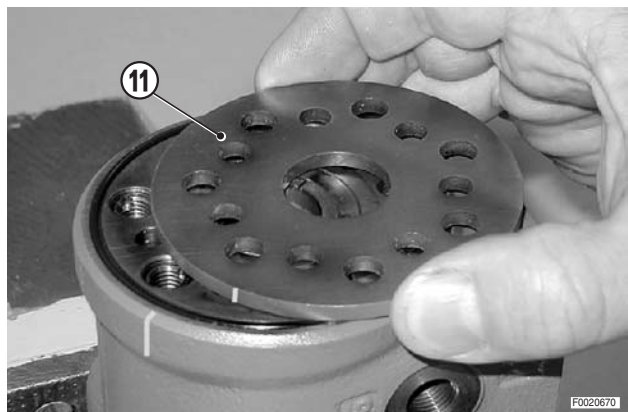
★ To remove the assembly, slide it to the side while simultaneously lifting it.



6 - Withdraw the drive shaft (10).

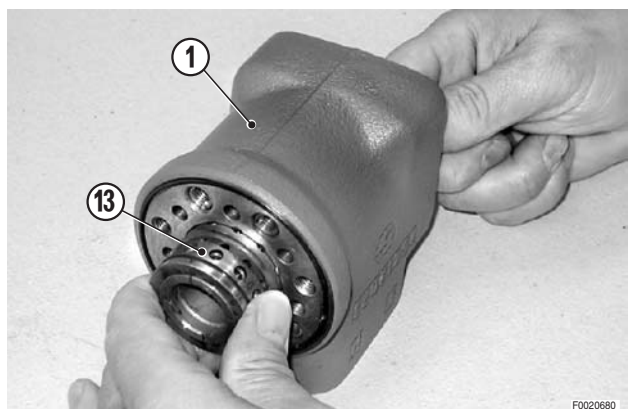


7 - Remove the stop disc (11) by sliding it off sideways.



8 - Remove the power steering unit (1) from the vice and position it horizontally on a bench.

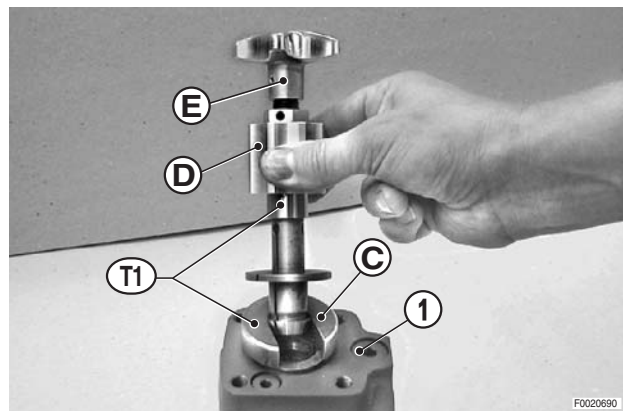
Rotate the trim pin (12) inserted in the control valve (13) so that it is horizontal and withdraw the complete control valve assembly without removing the bearing (14).



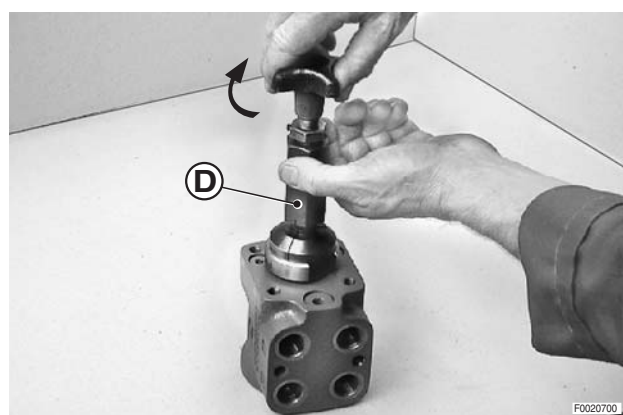
2. Removal of the seals

1 - The inner seal (15) is to be removed using tool **T1** (code. 00239496).

Insert the ring "**C**" in the power steering housing (1) followed by the expander "**E**" fully closed.

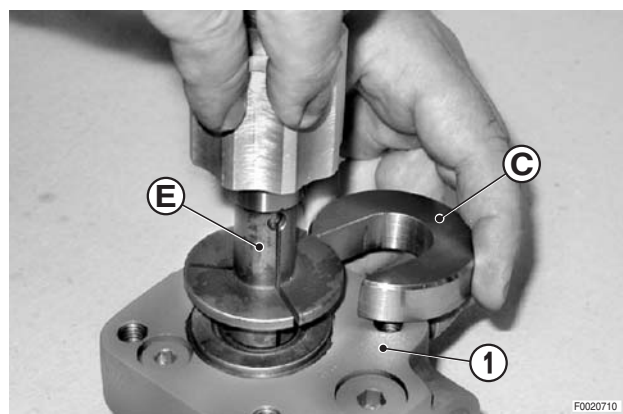


2 - Open the expander "**E**" by turning the knob while holding the locknut "**D**".



3 - Remove the ring "**C**" and push the expander "**E**" inside the power steering housing (1) to withdraw the seal (15).

4 - Slacken off the expander and withdraw it.

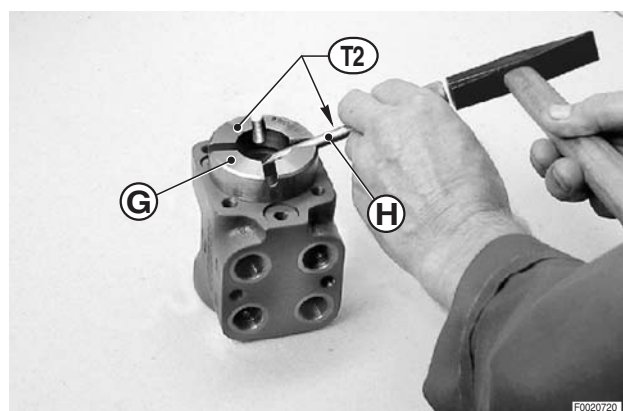


3. Removal of the dust seal

Remove the dust seal using tool **T2** (code. 00239497).

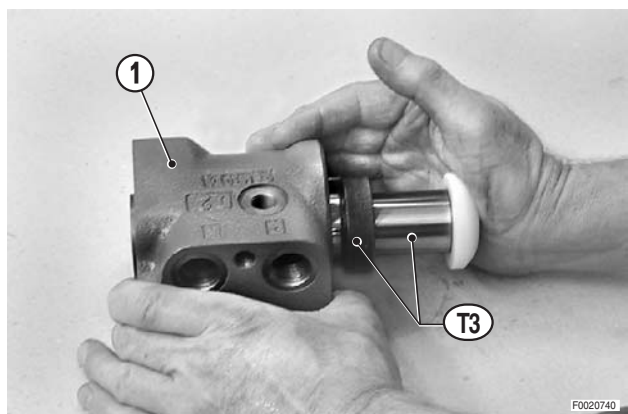
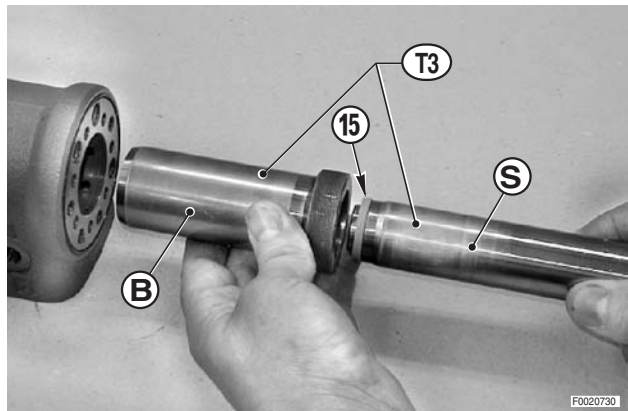
Insert the ring nut "**G**" in the housing and, using the extractor "**H**" and a hammer, remove the dust seal (16).

★ Take care not to damage the seating.



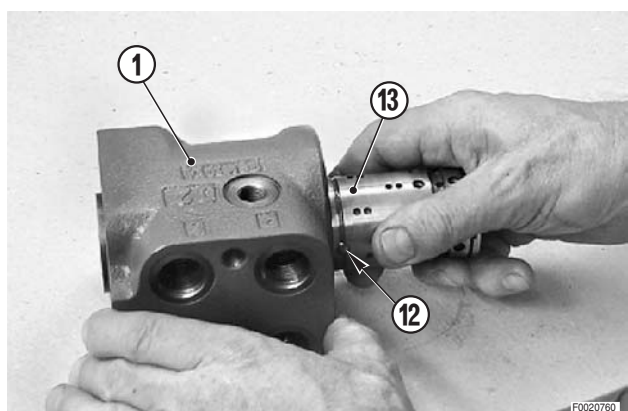
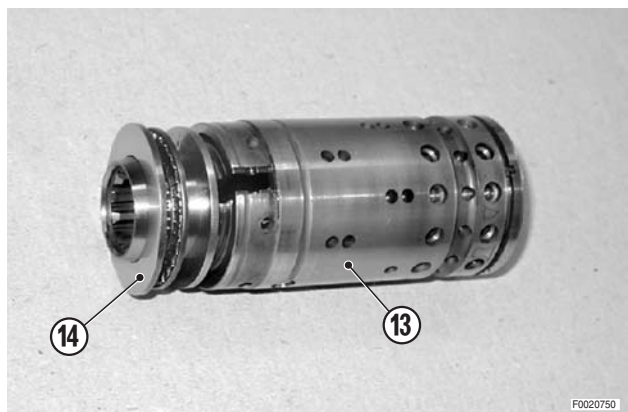
4. Installing the inner seal (15)

- 1 - Before installing the inner seal, ensure that the seal seating, the inside of the housing and the cover are completely free of all traces of grease.
Fit the seal (15) onto the installer "S" of tool T3 (code 00239498) and insert the installer in the bush "B" of the tool.
- 2 - Insert the bush "B", the installer "S" and the seal (15) in the housing (1).
- 3 - Push the bush and installer fully in.
★ After removing the tool T3 (code. 00239498) check that the seal is correctly positioned in its seating.
- 4 - Lubricate the seal with mineral oil.



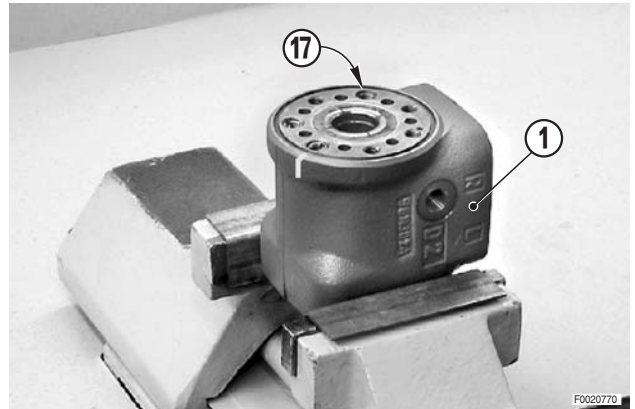
5. Installing the control valve

- 1 - Lightly lubricate the control valve assembly (13) with a little oil.
Check that the bearing (14) is installed with thinner thrust plate positioned behind the outer bush of the control valve
- 2 - Insert the control valve (13) in the housing (1) bearing (14) side first while keeping the trim pin (12) horizontal.
★ The control valve should fit easily into the housing without force.

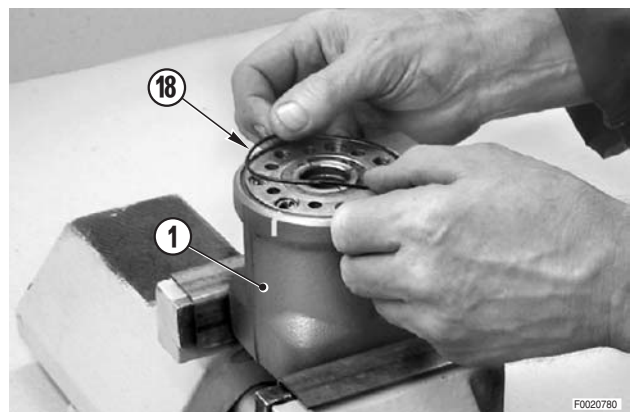


6. Final assembly

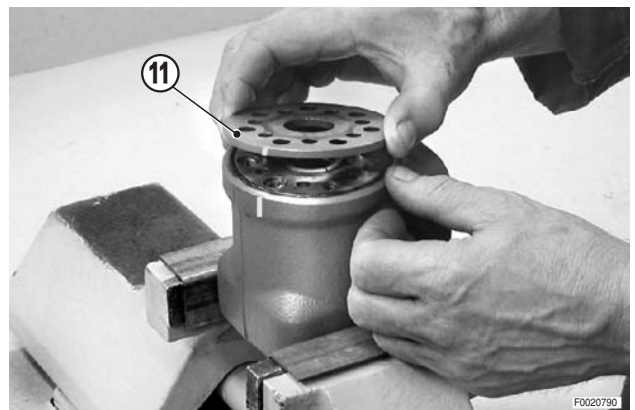
- 1 - Hold the power steering unit (1) in a vice as shown in the photo.
Check that the ball (17) (anticavitation valve) is positioned correctly.



- 2 - Lubricate the O-ring (18) with grease and locate it on the power steering housing (1).



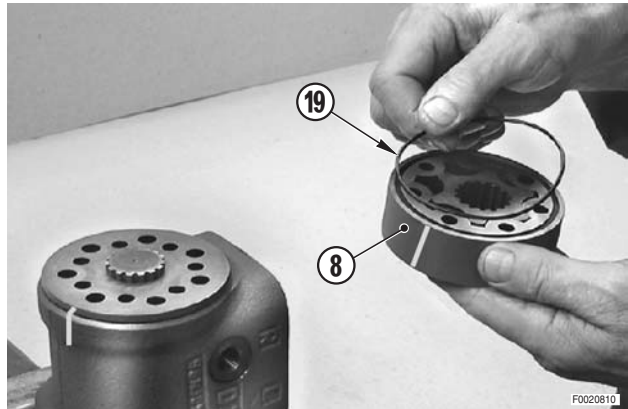
- 3 - Install the stop disc (11), aligning the holes with those in the housing.



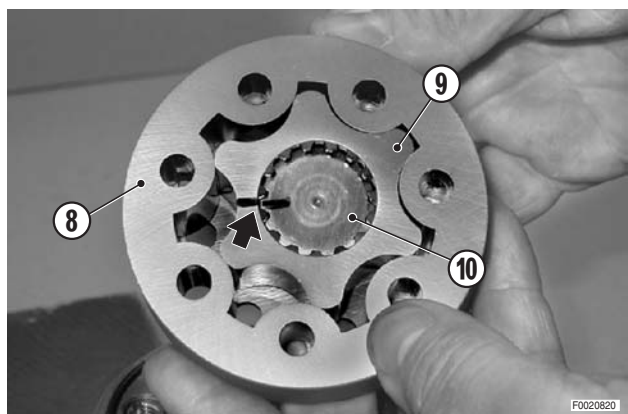
- 4 - Insert the drive shaft (10), engaging it in the trim pin (12) of the control valve (13).



- 5 - Lubricate the O-ring (19) with grease and locate it on the outer ring (8).



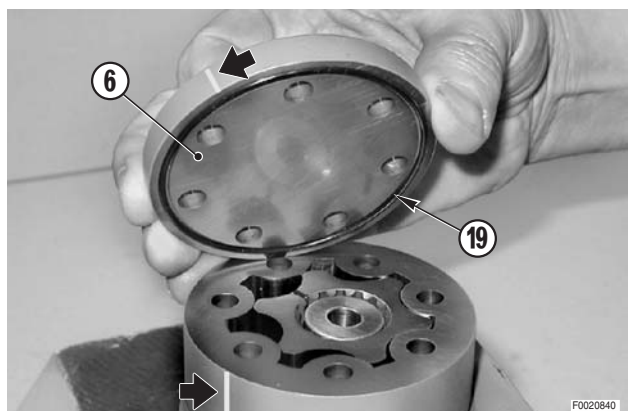
- 6 - Locate the rotor (9) on the drive shaft (10) aligning the reference marks made on disassembly.
 7 - Locate the outer ring (8), centering it relative to the housing (1) and the rotor (9).



- 8 - Locate the bush (7).

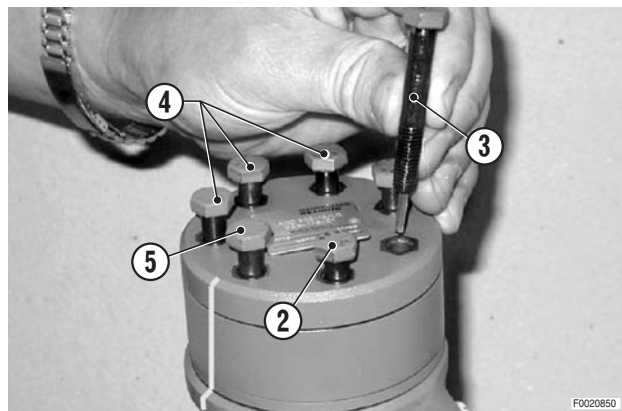


- 9 - Lubricate the 2nd O-ring (19) with grease and seat it in the groove in the cover (6).
 10 - Locate the cover (6) on the metering unit, aligning the reference marks made on disassembly.




11 - Insert the screws (2), (3), (4), (5) following the indications in the exploded view.

- ★ Screw (3) must be installed in the position in correspondence to the ball valve (17).

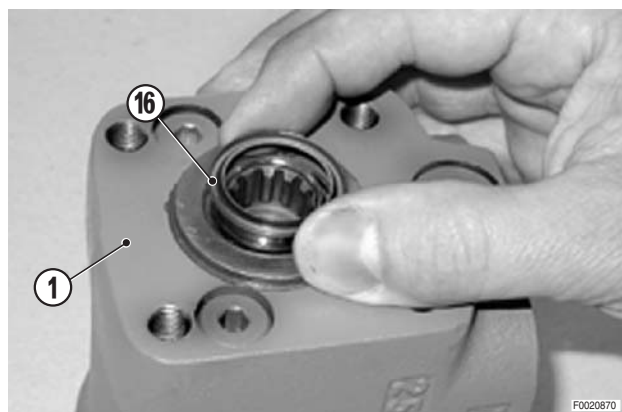


12 - Tighten down the cover screws (6) and the metering unit (8) in a cross-wise sequence.

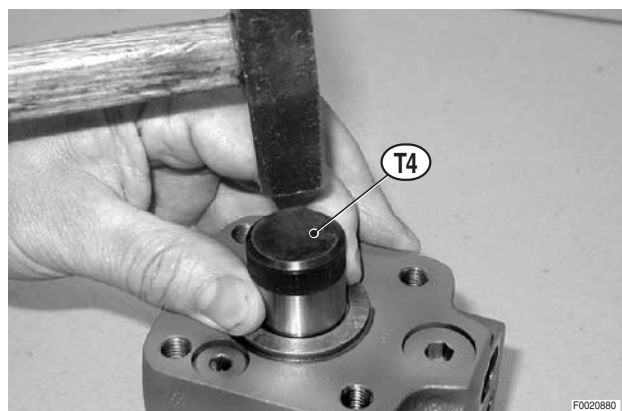
-  Screws: 30±3 Nm (22±2 lb.ft.)



13 - Turn the power steering unit over; locate the dust seal (16) on the housing (1) with seal lip facing upwards.



14 - Using the tool **T4** (code 00239499), and a hammer, drive the dust seal home without using excessive force.



REMOVAL OF THE FRONT WHEELS

! On tractors with front suspension, before stopping the engine to remove the front wheels, disengage the front axle suspension by pressing the relative button in the cab.

- 1 - Apply the parking brake.

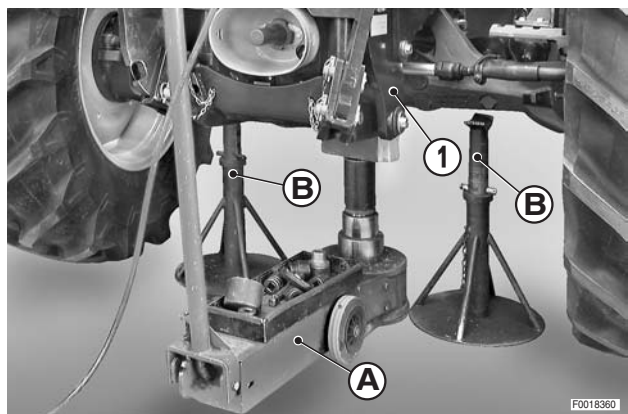
For normal front axles

- 2 - Position under the differential housing a trolley jack "A" with a minimum lifting capacity of 5 tons and a maximum lift height of at least 15 cm (6 in.).
 - ★ Drive safety wedges between the axle and the axle support.

For suspended front axles

- 2 - Position centrally under the pivoting support (1) a trolley jack "A" with a minimum lifting capacity of 5 tons and maximum lift height of at least 15 cm (6 in.).
- 3 - Raise the front end of the tractor sufficiently to eliminate flexure of the tyre walls and to lift the wheels by approximately 2 cm (0.8 in.).
- 4 - Position two jacks "B" under the axle; lower the trolley jack so that the axle is supported on the jacks "B" with the wheels off the ground and then remove trolley jack "A".
 - ★ Jack lifting capacity: minimum 2 tons.
- 5 - Slacken off all the wheel nuts (2); remove the wheel nuts, leaving one (for safety) at the top of the wheel.

⊠ 1
- 6 - While holding the wheel vertical, remove the last nut and remove the wheel (3).
- 7 - Repeat the above operations to remove the other rear wheel.



REFITTING THE FRONT WHEELS

- Refitting is the reverse of removal.

⊠ 1

 4WD wheel nuts: 350 Nm (258 lb.ft.)

- ★ Tighten the wheel nuts gradually in a crosswise sequence.

REMOVAL OF THE FRONT FENDERS

- ★ Removal of the front fenders is only necessary for major repairs and overhauls where additional working space is required at the side of the tractor and whenever the tractor is to be supported on stands.

- 1 - Remove the front wheels.
(For details, see, «REMOVAL OF THE FRONT WHEELS»).

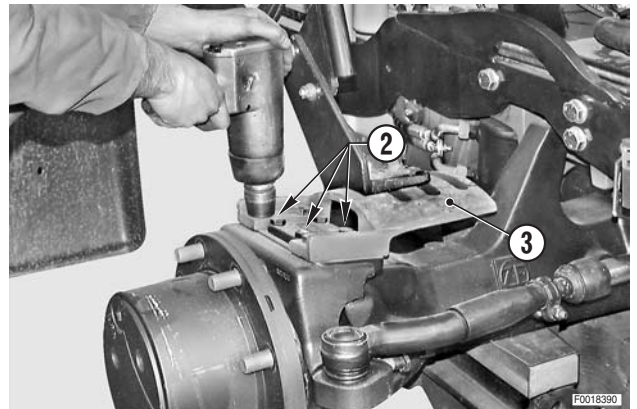
- 2 - Attach a hoist to the fender to be removed (1).



Fender assembly: 19 kg (42 lb.)



- 3 - Unscrew and remove the bolts (2) and remove the fender (1) complete with the mounting bracket (3).

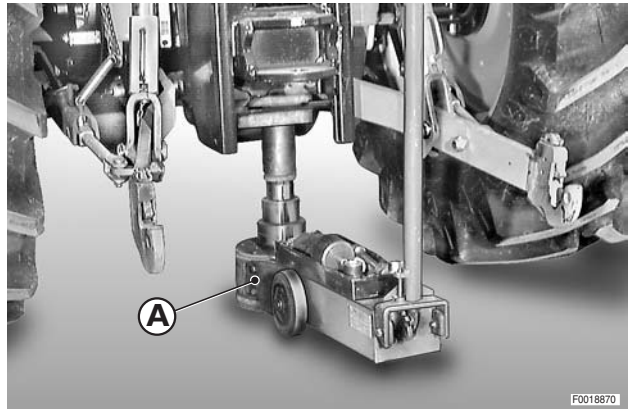


REFITTING THE FRONT FENDERS

- Refitting is the reverse of removal.

REMOVAL OF THE REAR WHEELS

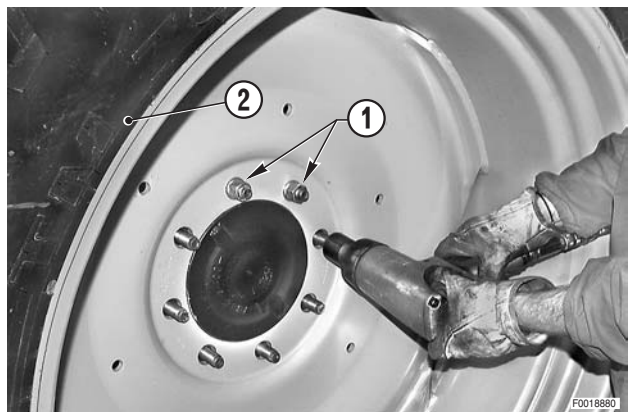
- 1 - Position under the rear gearbox a trolley jack "A" with minimum lifting capacity of 5 tons and a maximum lifting height of at least 15 cm (6 in.).
 - ★ Position the trolley jack "A" so that it is nearer to the wheel to be removed.
- 2 - Raise the tractor sufficiently to eliminate the flexure of the tyre wall.



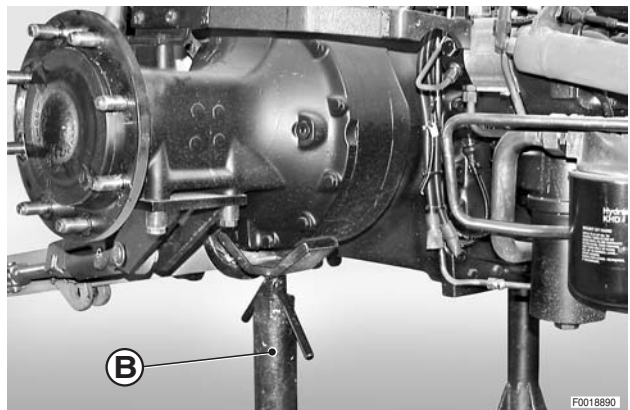
- 3 - Slacken off all the wheel nuts (1); leaving one (for safety) at the top of the wheel.



- 4 - While holding the wheel vertical, remove the last wheel nut and remove the wheel (2).




- 5 - Position under the rear axle an axle stand "B" with lateral retaining wings for safety and lower the trolley jack until the axle is resting on the axle stand.
 - ★ Axle stand load capacity: 2 tons minimum.
- 6 - Check that the stand is in exactly the right position and then remove the trolley jack.
- 7 - Repeat the above operations to remove the other wheel.



REFITTING THE REAR WHEELS

Refitting is the reverse of removal.



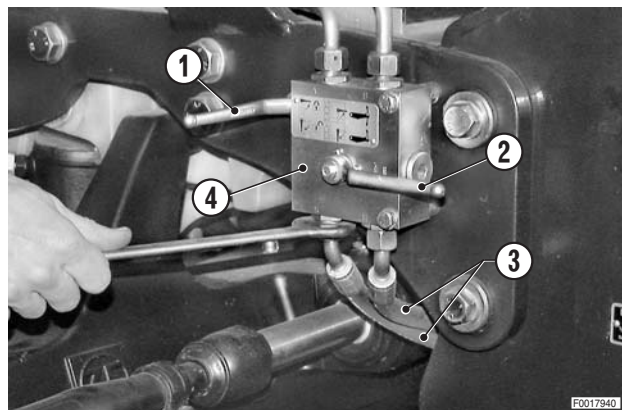
-  Wheel nuts:
- M18x1.5: 350 Nm±10% (258 lb.ft. ±10%)
 - M20x1.5: 500 Nm±10% (369 lb.ft. ±10%)
 - M22x1.5 (mod. 165CV):
 - 500 Nm±10% (369 lb.ft. ±10%)

- ★ Tighten the wheel nuts gradually in a crosswise sequence.

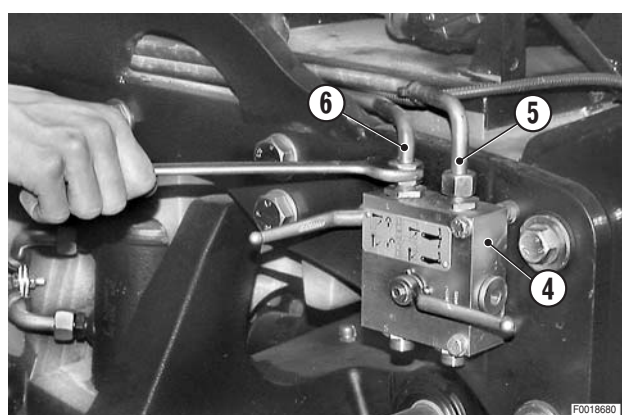
REMOVAL OF THE LIFT VALVE BLOCK

! Fully lower the lift and switch off the engine.

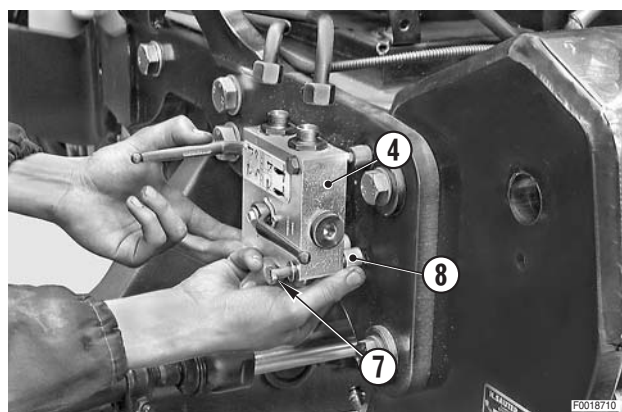
- 1 - With the control levers (1), (2) in the horizontal position, label the lower pipes (3) and disconnect them from the valve block (4).
 - ★ Label the pipes to avoid confusion on reconnection.



- 2 - Disconnect the rigid upper pipes (5), (6).
 - ★ Plug the ends of the pipes to prevent the entry of contaminants.



- 3 - Unscrew the bolts (7) and remove the valve block (4) with the rear spacers (8).



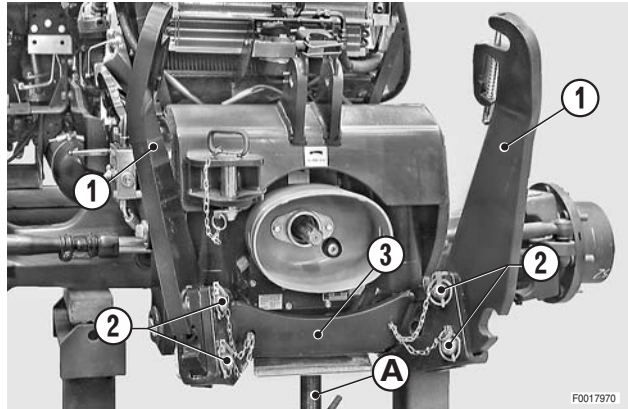
REFITTING THE LIFT VALVE BLOCK

- Refitting is the reverse of removal.

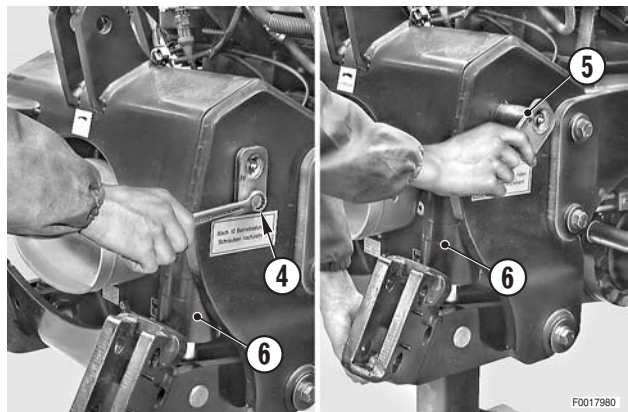
REMOVAL OF THE FRONT LIFT CYLINDERS

★ Raise the lift to its full height and switch off the engine.

- 1 - Remove the lift arms (1) and the pivot pins (2) along with their retaining chains.
- 2 - Position under the lift assembly (3) a jack "A" which can be lowered at least 10 cm (4 in.).



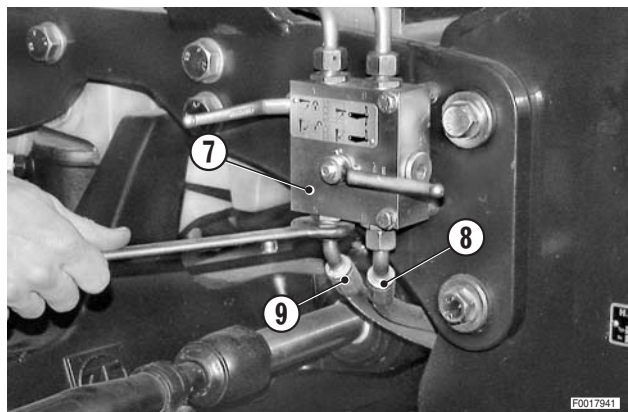
- 3 - Remove the bolts (4) and remove the upper pins (5) of the cylinders (6).



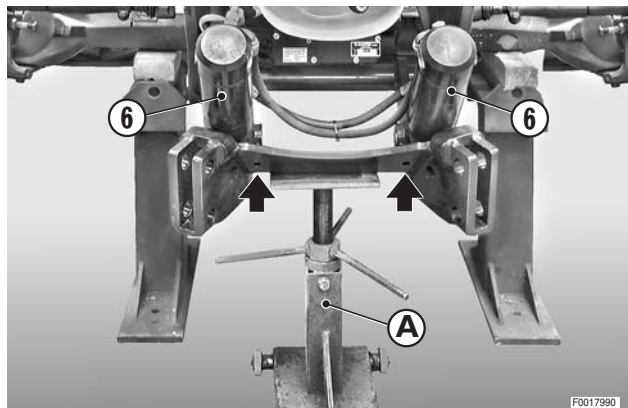
- 4 - Disconnect the cylinder feed pipes (8), (9) from the valve block (7).

⚠ Loosen the fitting by a few turns, but before fully disconnecting them, push them to detach them from the couplers and release any residual pressure in the system.

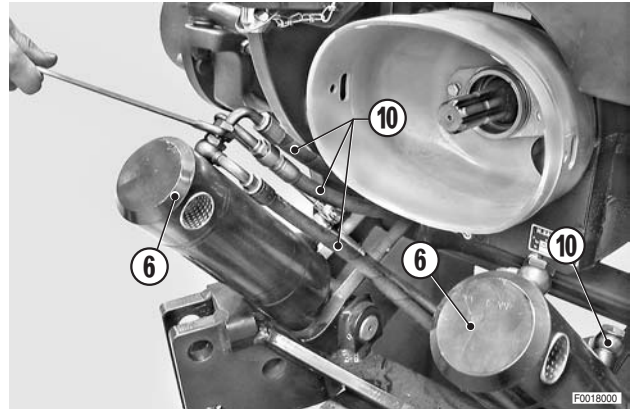
★ Label the pipes to avoid confusion on reconnection.



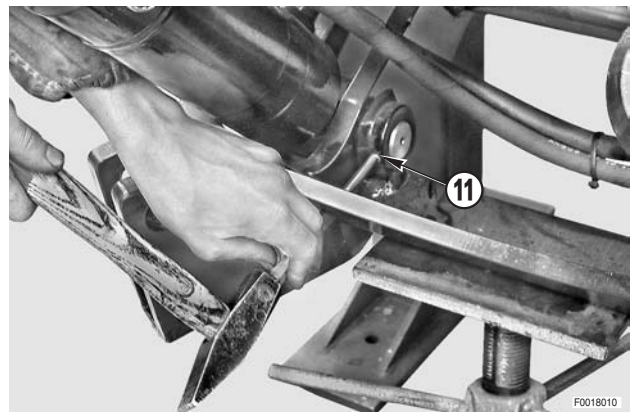
- 5 - Lower the jack "A" until the cylinders (6) can be tilted outwards in order to access the connection pipes and to align the hole provided for removal of the spring pins securing the lower pivot pins of the cylinders.



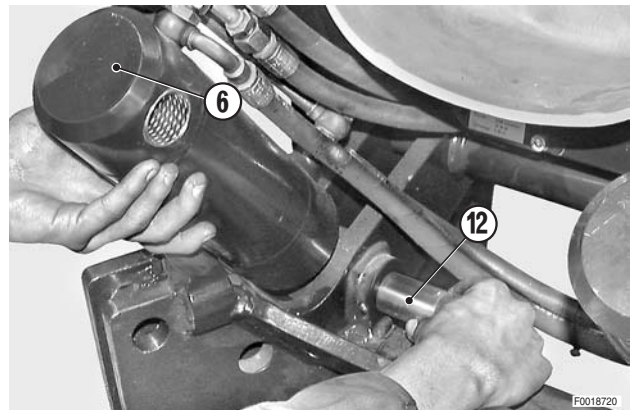
- 6 - Disconnect the four pipes (10) from the cylinders (6).
 ★ Label the pipes to avoid confusion on reconnection.



- 7 - Using a pin punch, remove the spring pins (11) securing the lower cylinder pivot pins.



- 8 - Withdraw the pivot pins (12) and remove the cylinders (6).



REFITTING OF THE FRONT LIFT CYLINDERS

- Refitting is the reverse of removal.
- 1 - Start the engine and repeatedly raise and lower the lift to the limit of its travel in order to bleed the system and check for leaks.
 - 2 - Stop the engine, check the gearbox oil level and top up if necessary.

REMOVAL OF THE FRONT LIFT ASSEMBLY

- ★ Raise the lift arms to the maximum height and stop the engine.

1 - Disconnect the lower pipes from the valve block (1).

- ⚠ Loosen the fitting by a few turns, but before fully disconnecting them, push them to detach them from the couplers and release any residual pressure in the system.

- ★ Label the pipes to avoid confusion on reconnection.

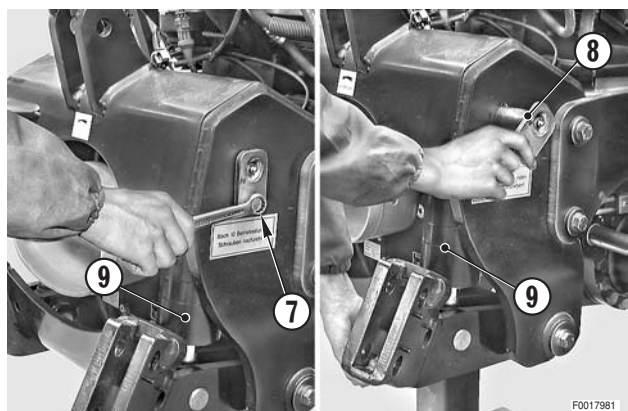
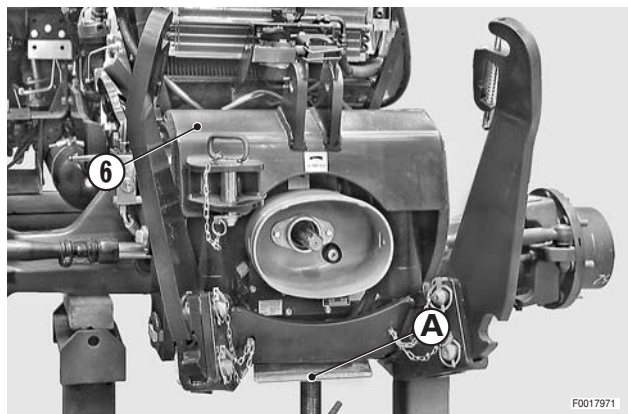
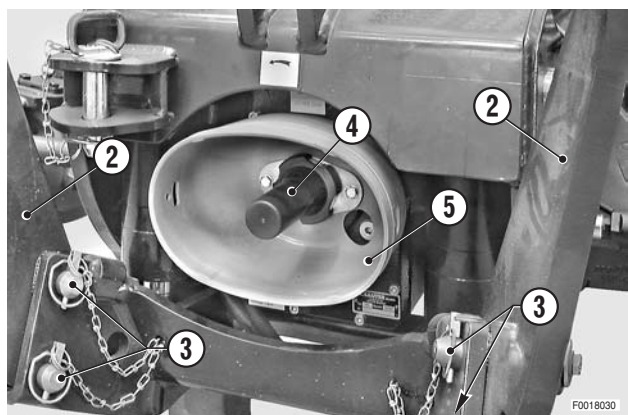
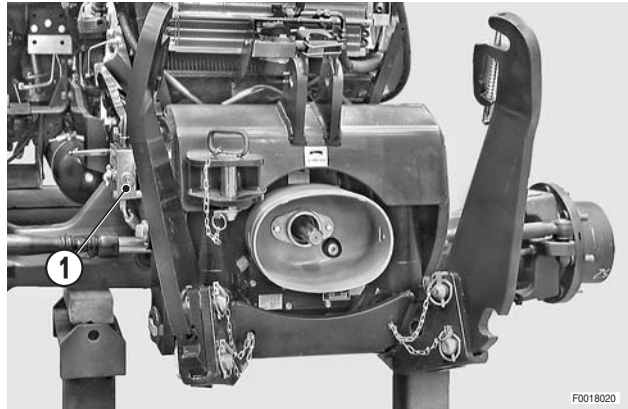
- ★ Plug the ends of the pipes and the open fittings on the valve block to prevent the entry of contaminants.

2 - Remove the lift arms (2) and the pivot pins (3) complete with their retaining chains.

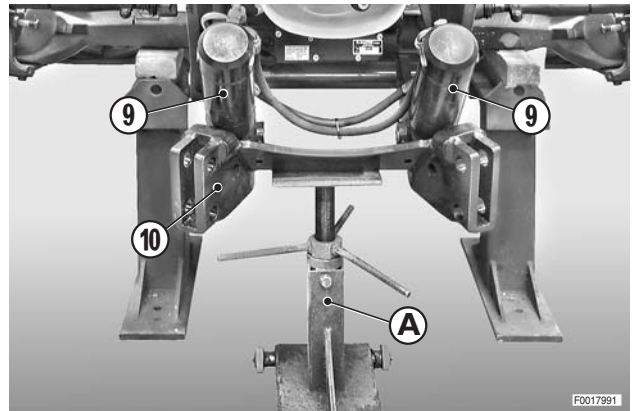
3 - Remove the shaft end cover (4) and the shield (5).

4 - Position under the lift assembly (6) a jack "A" that can be lowered by at least 10 cm. (4 in.).

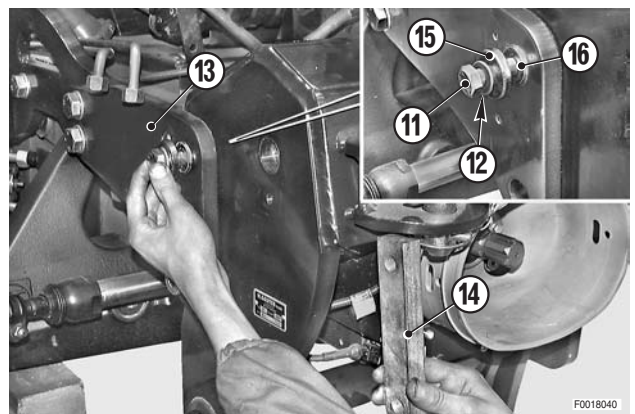
5 - Remove the bolts (7) and remove the upper pivot pins (8) of the cylinders (9).




- 6 - Lower the jack "A" so that the cylinders (9) can be tilted outwards.
- 7 - Remove the jack "A" and guide the rocker assembly (10) to the vertical position.

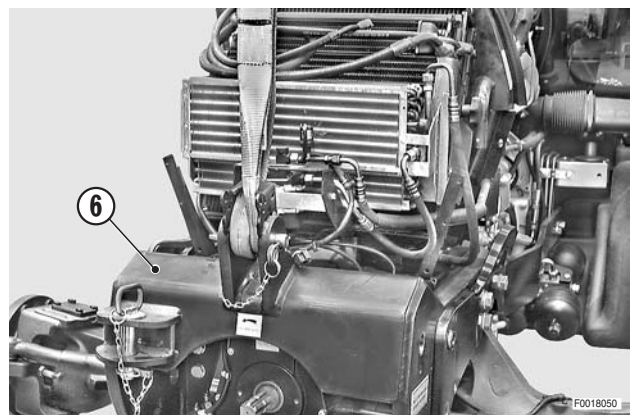


- 8 - Unscrew and remove the bolts (11) and washers (12) securing the brackets (13); recover the inner brackets (14).
- 9 - Remove the spacer (15) and the lower bushes (16).
 - ★ Do not remove the upper bushes yet for safety.



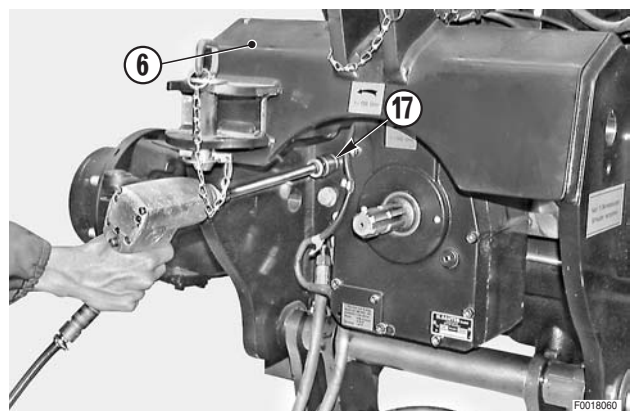
- 10 - Attach a hoist to the lift assembly (6) and put the lifting slings under slight tension.

 Lift: 80 kg (176 lb.)

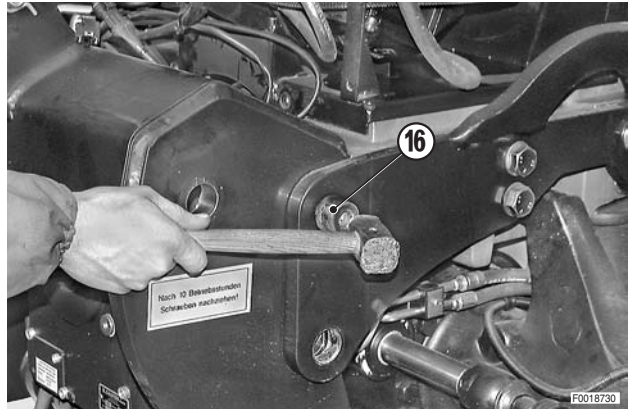


- 11 - Unscrew and remove the ten bolts (17) and washers securing the lift (6) to the front carrier.

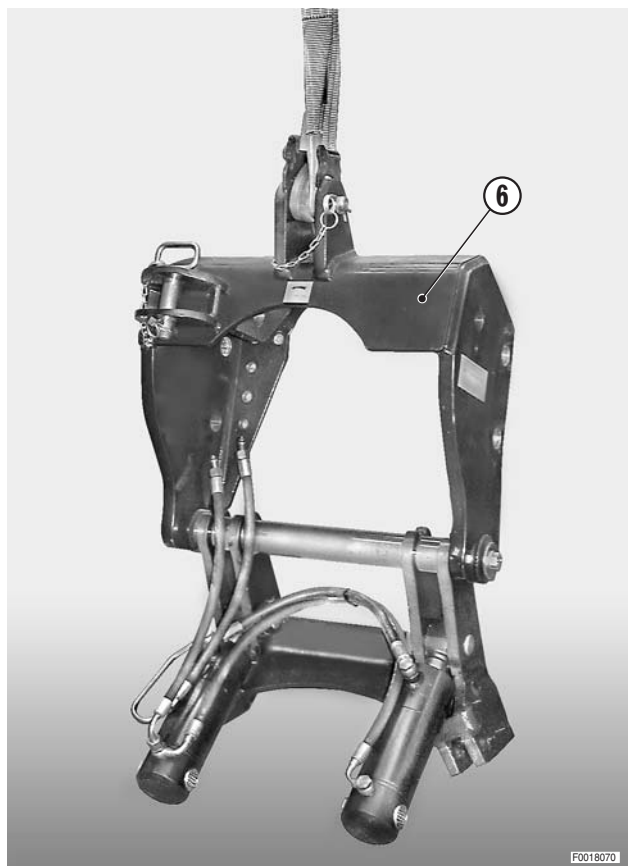
✖ 1



- 12 - Remove the upper bushes (16) but leave them in position for safety.




- 13 - Remove the lift assembly (6).
 ★ If necessary, use a lever to separate the assembly from the front locating dowels.



REFITTING THE LIFT ASSEMBLY

- Refitting is the reverse of removal.

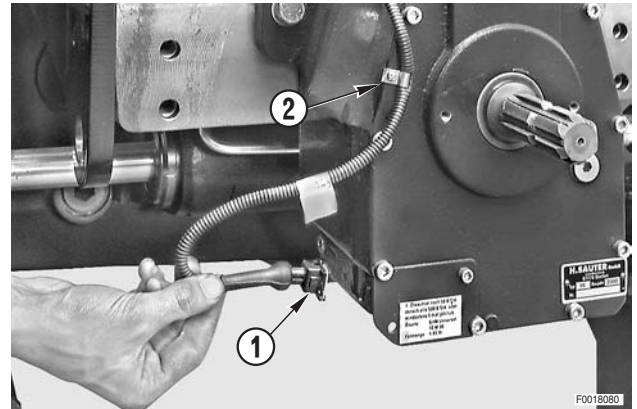


 Bolts M16: 214 Nm (158 lb.ft.)
 Bolts M20: 455 Nm (355 lb.ft.)

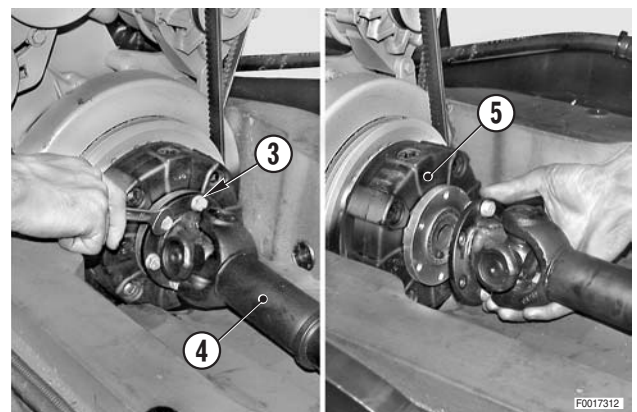
- 1 - Start the engine, repeatedly raise and lower the lift to its maximum travel to bleed the system and check for leaks.
- 2 - Stop the engine, check the gearbox oil level and top up if necessary.

REMOVAL OF THE FRONT PTO ASSEMBLY

- 1 - Remove the front lift assembly.
(For details, see «REMOVAL OF THE FRONT LIFT ASSEMBLY»)
- 2 - Unplug the connector (1) and release the wiring from the clip (2).



- 3 - Fully unscrew the bolts (3) securing the cardan shaft (4) to the flexible coupling (5) and detach the flange.




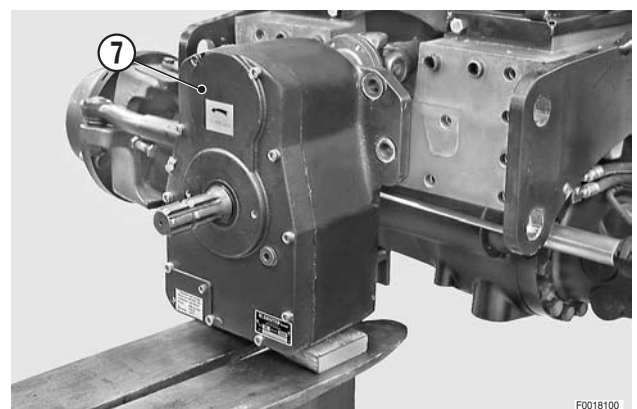
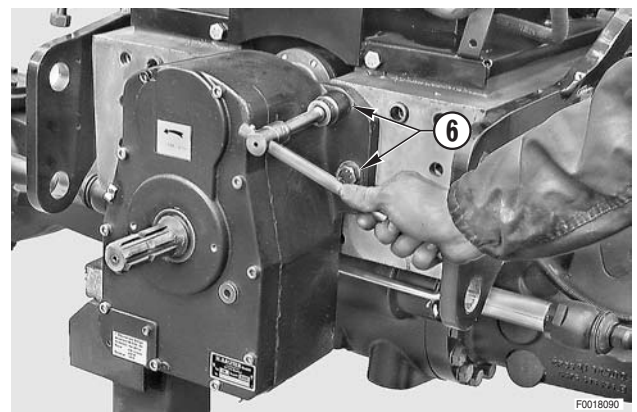
- 4 - Unscrew the four bolts (6) but only remove the two lower bolts.
★ Leave the two upper bolts in position for safety.

⊠ 1

- 5 - Fit a non-slip block to a trolley jack; position the non-slip block under the PTO assembly.
- 6 - Remove the two upper bolts previously left for safety and remove the PTO assembly (7) while supporting the cardan shaft (4).

- ★ If necessary, use a lever to help separate the assembly from the tractor.

 PTO: 70 kg (154 lb.)



REFITTING THE FRONT PTO ASSEMBLY

- Refitting is the reverse of removal.

⊠ 1

 Screw: 214 Nm (157.7 lb.ft.)

REMOVAL OF THE FRONT SUSPENSION CYLINDERS

(Where fitted)

! 1 - Before switching off the engine, disengage the front suspension by pressing the pushbutton in the cab for at least 20 seconds.

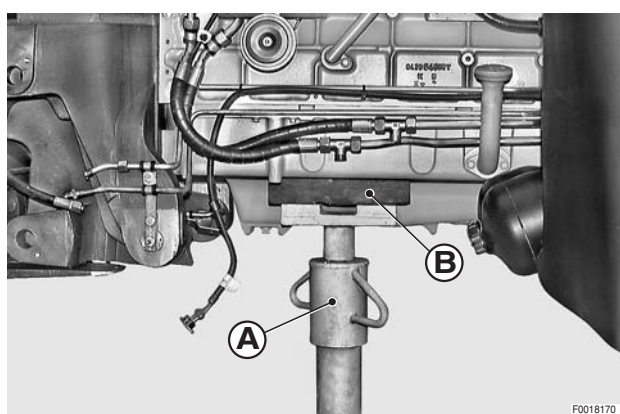
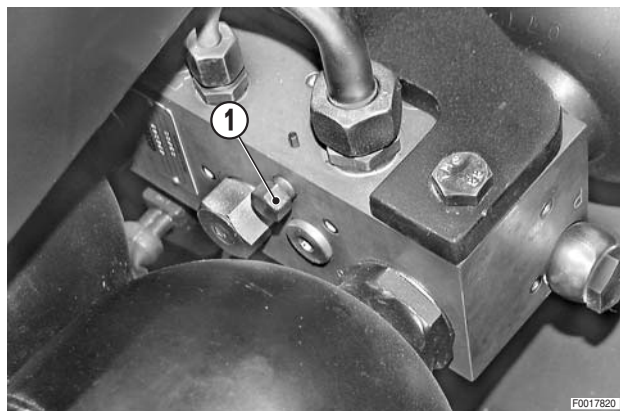
2 - Apply the parking brake.

⚠ Discharge the residual pressure from the suspension system by unscrewing the valve (1) about two full turns.

★ Wait a few minutes after discharging the pressure, then re-close the valve.

1 - Remove the reinforcing side members.
(For details, see «REMOVAL OF THE REINFORCING SIDE MEMBERS»).

2 - Position a jack "A" and a non-slip block "B" under the sump pan.

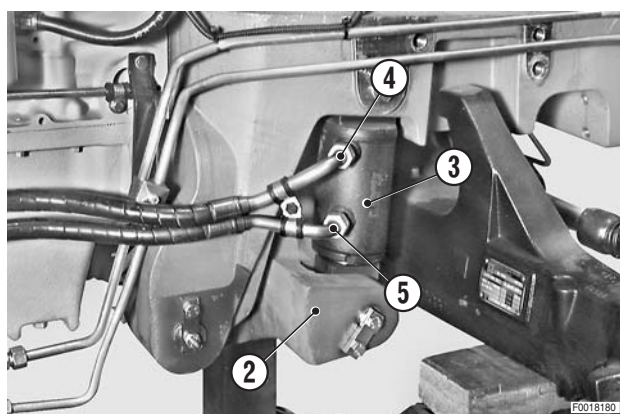


3 - Support the swinging support (2) with a jack that can be lowered through 10-15 cm.(4-6 in.).

4 - Disconnect the pipes (4), (5) from the left cylinder (3).

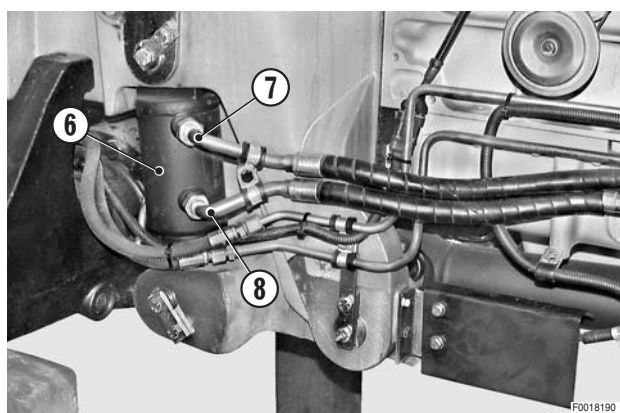
⚠ First loosen the fittings by a few turns, then, before disconnecting the pipes, push them to detach them from the couplers and release any residual pressure.

★ Plug the ends of the pipes to prevent the entry of contaminants.

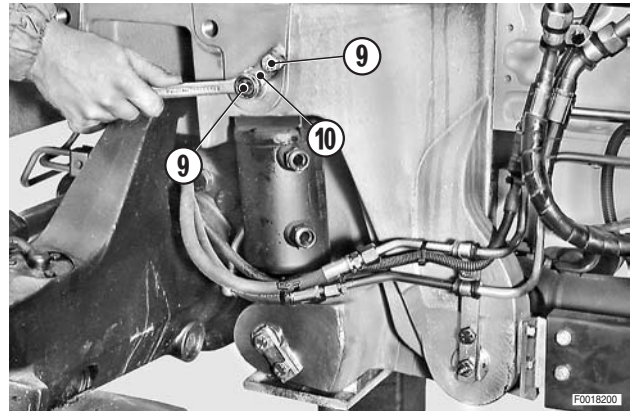


5 - Disconnect the pipes (7), (8) from the right cylinder (6).

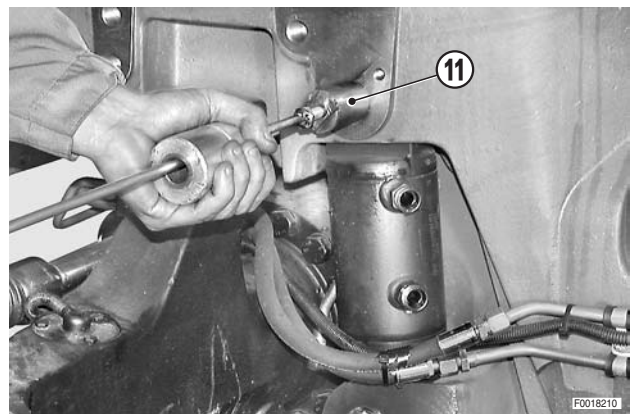
★ Plug the ends of the pipes to prevent the entry of contaminants.



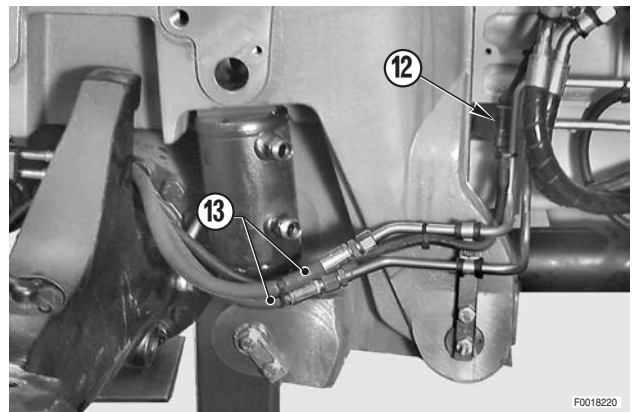
- 6 - Remove the bolts (9) and the plates (10) securing the upper cylinder pivot pins.



- 7 - Using a slide hammer puller, remove the upper pivot pins (11).

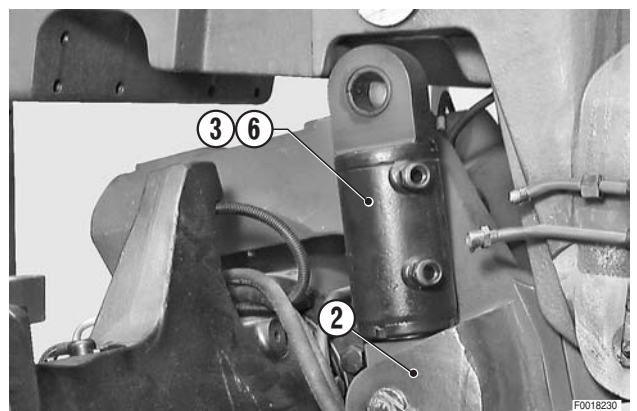


- 8 - Unplug the steering sensor connector (12) and release the wiring from the straps.

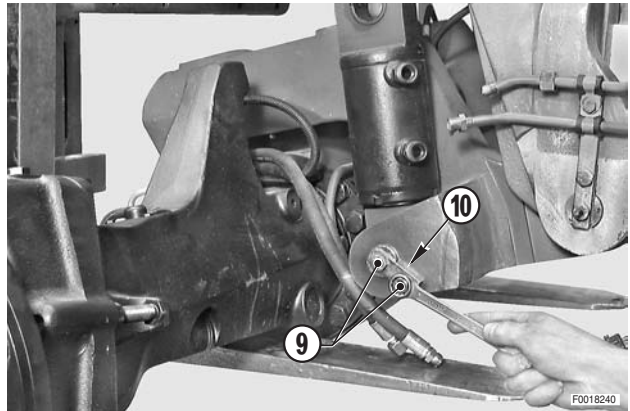


- 9 - Disconnect the steering cylinder pipes (13).
★ Plug the ends of the pipes to prevent the entry of contaminants.

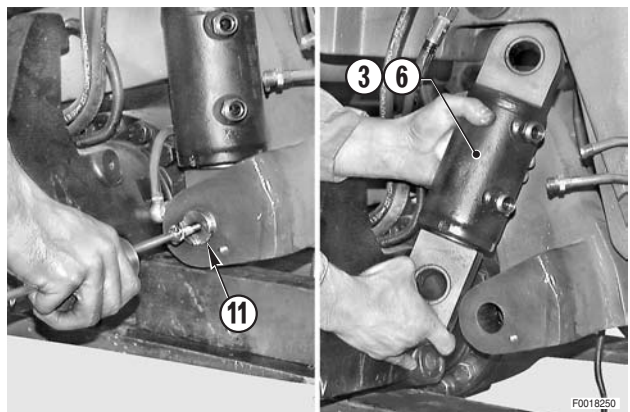
- 10 - Lower the support (2) to disengage the upper mountings of the cylinders (3), (6).



11 - Remove the bolts (9) and the plates (10) of the lower pivot pins.



12 - Using the slide hammer puller, remove the lower pivot pins (11) and the cylinders (3), (6).



REFITTING THE FRONT SUSPENSION CYLINDERS

- Refitting is the reverse of removal.
- 1 - Start the engine and turn the steering wheel repeatedly to full lock in both directions. Activate and deactivate the suspension a number of times to expel air from the system and check for leaks.
 - 2 - Stop the engine, check the gearbox oil level and top up if necessary.

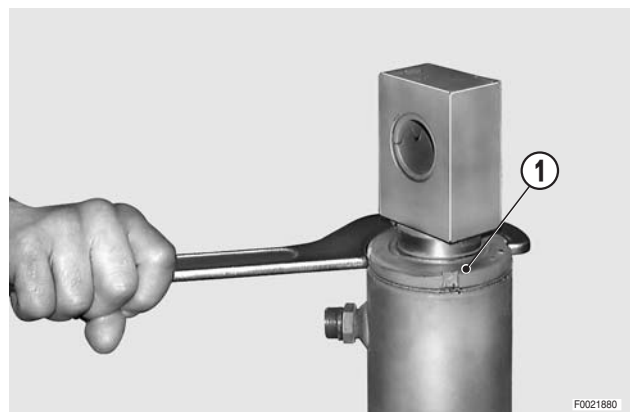
DISASSEMBLY AND ASSEMBLY OF THE FRONT SUSPENSION CYLINDERS

1. Disassembly

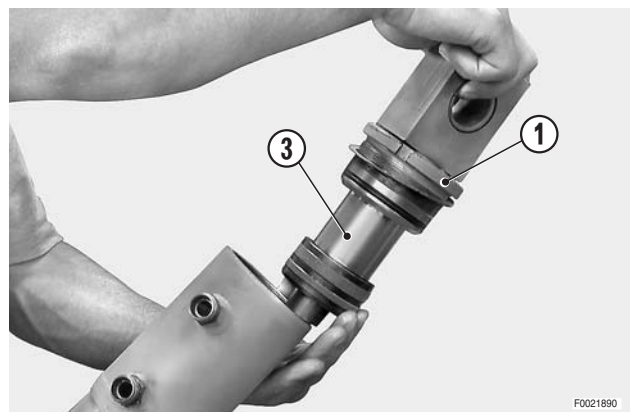
- 1 - Relieve the staking on the lock washer located between the end cap (1) and the cylinder (2).



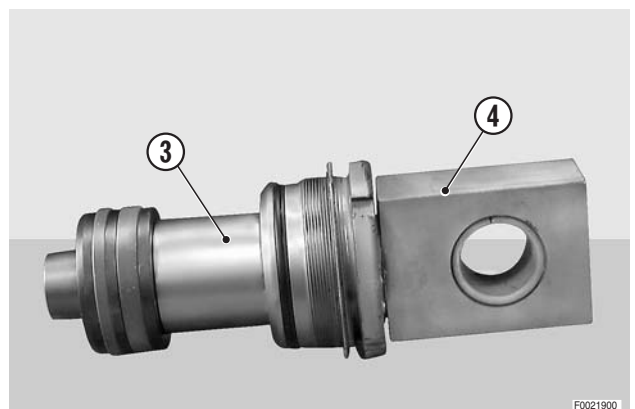
- 2 - Using a pin wrench, unscrew the end cap (1)..



- 3 - Withdraw the rod (3) complete with end cap (1) and seals..



- 4 - Heat the eye of the piston (4) to a temperature of 100–120 °C (212–248 °F) and unscrew it from the rod (3).



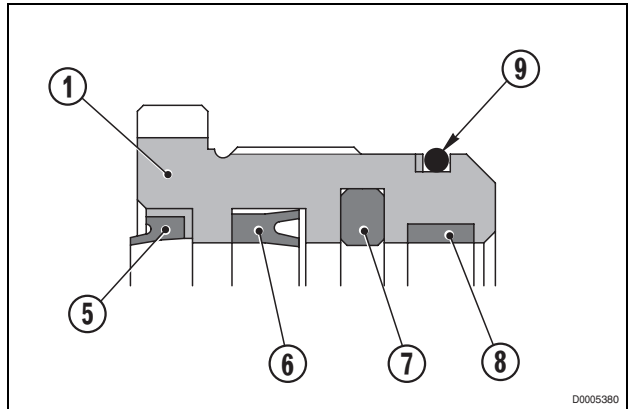
5 - Withdraw the end cap (1) from the rod and remove in order the rod wiper (5), the seals (6), (7) and the guide (8).

※ 2

★ Take care not to damage the seatings of the seals.

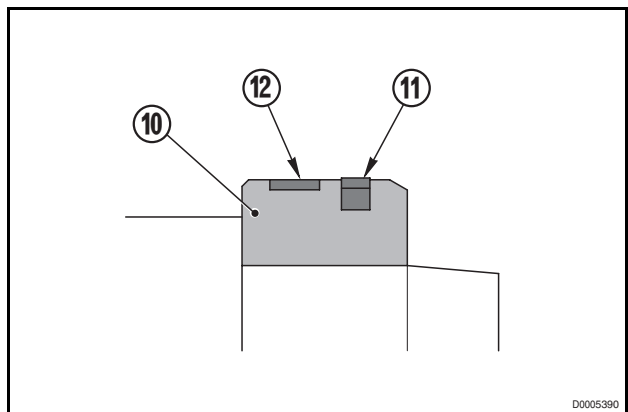
6 - Remove the O-ring seal (9).

★ Note which way round the seals are fitted.



7 - Remove the seal (11) and the guide (12) from the piston (10).


★ Take care not to damage the seal seating.




2. Assembly

- Assembly is the reverse of disassembly.

※ 1


 End cap: 320÷370 Nm (236–273 lb.ft.)

※ 2

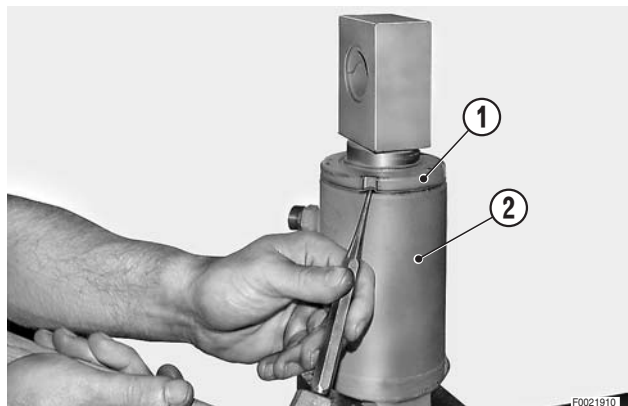
 Seals: Gearbox oil

※ 3

 Piston eye: Loctite 638

 Piston eye: 50–70 Nm (37–52 lb.ft.)

1 - Stake the lock washer tabs into the notch on the cylinder (2) and into one of the notches on the end cap (1).




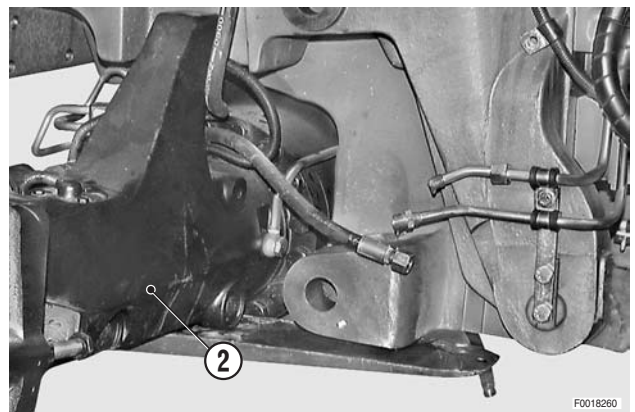
REMOVAL OF THE FRONT AXLE AND SWINGING SUPPORT (Versions with front suspension)

- ⚠ 1 - Before switching off the engine, disengage the front suspension by pressing the pushbutton in the cab for at least 20 seconds.
- 2 - Apply the parking brake.
- ⚠ Discharge the residual pressure from the suspension system by unscrewing the valve (1) about two full turns.
- ★ Wait a few minutes after discharging the pressure, then re-close the valve.

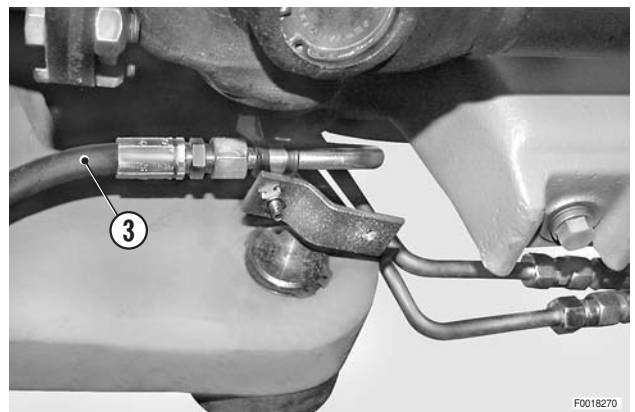


- 1 - Remove the front suspension cylinders. (For details, see «REMOVAL OF THE FRONT SUSPENSION CYLINDERS»).
- 2 - Position a trolley jack under the axle (2) and the swinging support; raise the jack until it supports both the assemblies.

 Group assembly: 455 kg (1002 lb.)

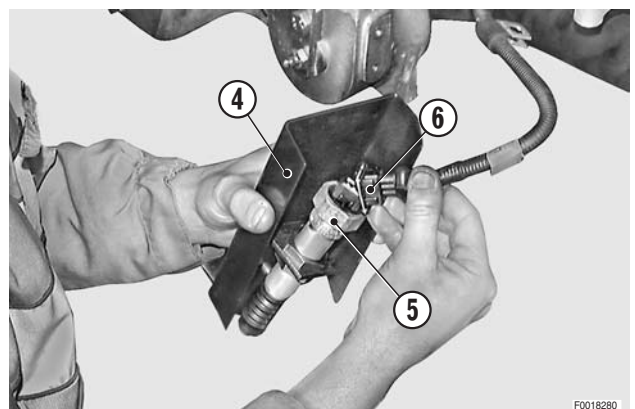


- 3 - Remove the cover and the 4WD shaft . (For details see «REMOVAL OF THE 4WD PROPELLER SHAFT»).
- Disconnect the differential lock pipe (3).
- ★ Plug the ends of the pipes to prevent the entry of contaminants.



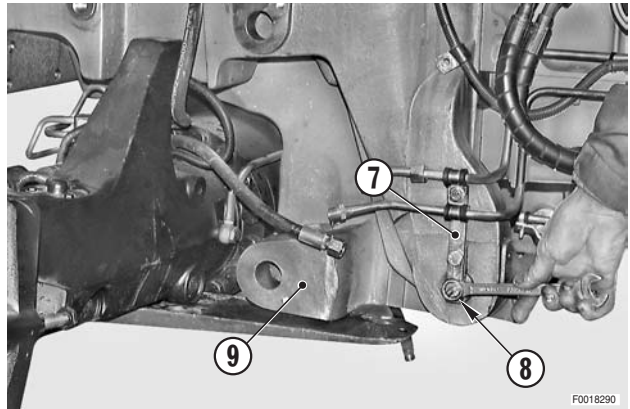
- 4 - Remove the support (4) of the position sensor (5) and unplug the connector (6).

⊠ 1

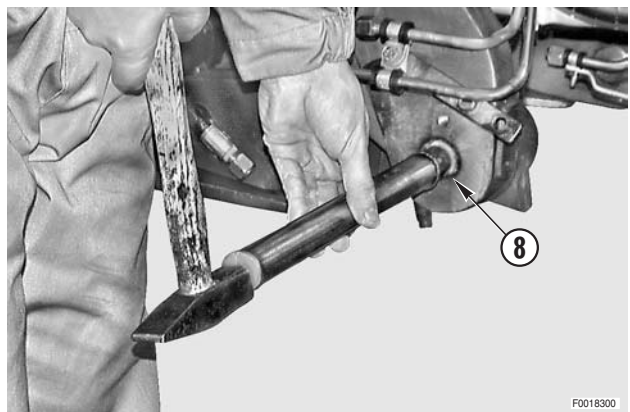


FRONT AXLE AND SWINGING SUPPORT (Versions with front suspension)

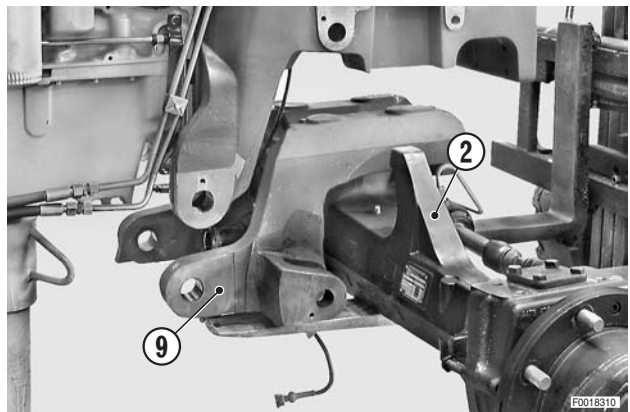
- 5 - Remove the plates (7) securing the pivot pins (8) of the swinging axle support (9).
- 6 - Loosen the screw of the clips for the rigid steering pipes and rotate the plate (7) to the left to release the pivot pin (8).



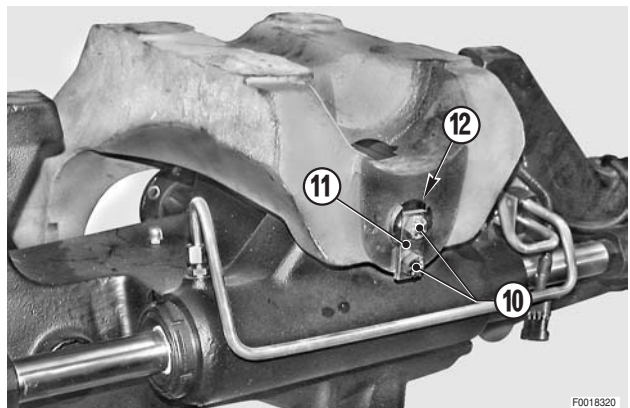
- 7 - Using a suitable drift made of soft material (aluminium, copper, etc.), remove the pivot pins (8).




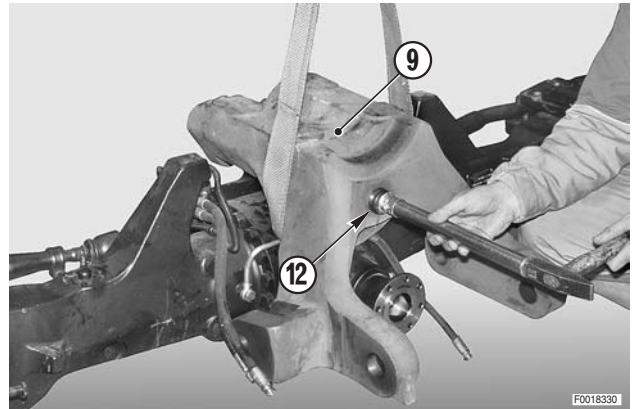
- 8 - Slowly lower the jack and remove the swinging support (9) complete with the axle (2).



- 9 - Remove the screws (10) and remove the plate (11) securing the axle pivot pin (12).



- 10 - Attach the swinging support (9) to lifting slings and attach the slings to a hoist; put the slings under slight tension.
- 11 - Using a suitable drift made of soft material (aluminium, copper, etc.), drive out the axle pivot pin (12) and remove the swinging support. 



REFITTING THE FRONT AXLE AND SWINGING SUPPORT

- Refitting is the reverse of removal.

1

- ★ Check the calibration of the position sensor.
(For details, see «REMOVAL AND POSITIONING OF THE FRONT SUSPENSION POSITION SENSOR).

2

 Pivot pin and plain bearings: grease

- 1 - On starting the engine, bleed the systems as follows:
 - a - turn the steering wheel repeatedly to full lock in both directions;
 - b - repeatedly activate and deactivate the suspension;
 - c - repeatedly engage and disengage the differential lock.
- 2 - Stop the engine, check the gearbox oil level and top up if necessary.
- 3 - Lubricate the axle pivot pin.

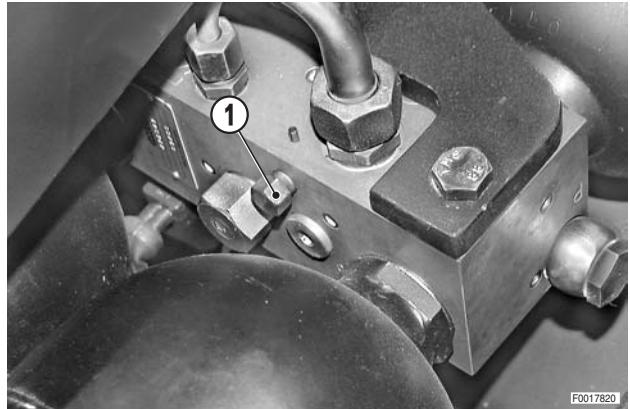
REMOVAL OF THE FRONT SUSPENSION VALVES

! 1 - Before switching off the engine, disengage the front suspension by pressing the pushbutton in the cab for at least 20 seconds.

2 - Apply the parking brake.

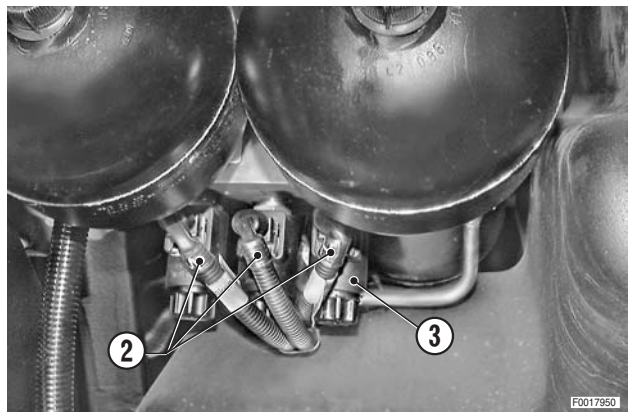
⚠ Discharge the residual pressure from the suspension system by unscrewing the valve (1) about two full turns.

★ Wait a few minutes after discharging the pressure, then re-close the valve.



1 - Unplug the connectors (2) from the solenoid valves (3).

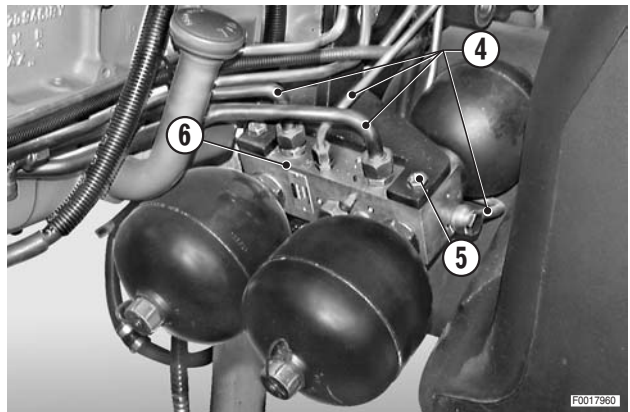
★ Label the connectors and solenoid valves to avoid confusion on reconnection.



2 - Disconnect the five connecting pipes (4).

⚠ First loosen the fittings by a few turns, then, before disconnecting the pipes, push them to detach them from the couplers and release any residual pressure.

3 - Remove the bolts (5) and remove the assembly (6).



REFITTING THE FRONT SUSPENSION VALVES

- Refitting is the reverse of removal.

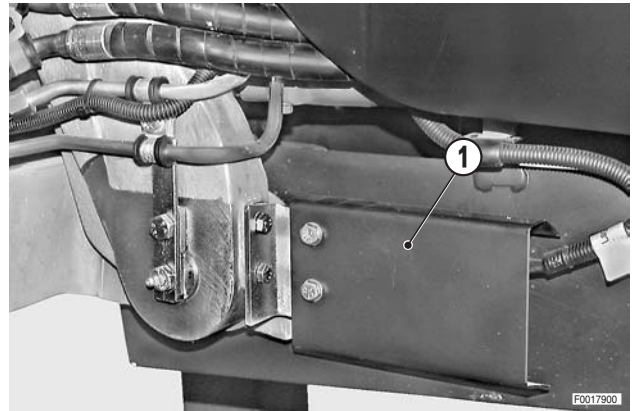
1 - Start the engine and repeatedly activate and deactivate the front suspension in order to expel any air from the system and check for leaks.

2 - Stop the engine, check the gearbox oil level and top up if necessary.

REMOVAL AND POSITIONING OF THE FRONT SUSPENSION POSITION SENSOR

1. Removal

1 - Remove the cover (1).

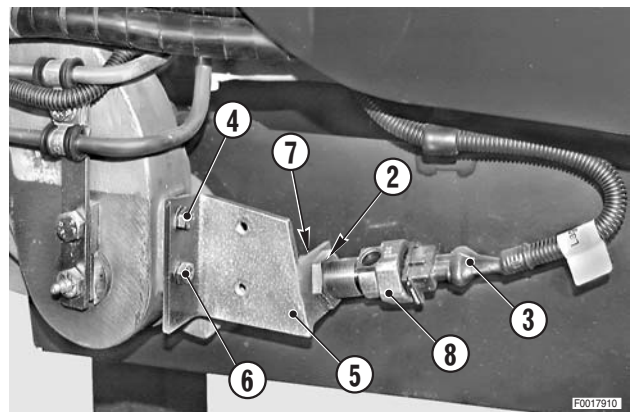


2 - Loosen the rear nut (2).

3 - Unplug the connector (3).

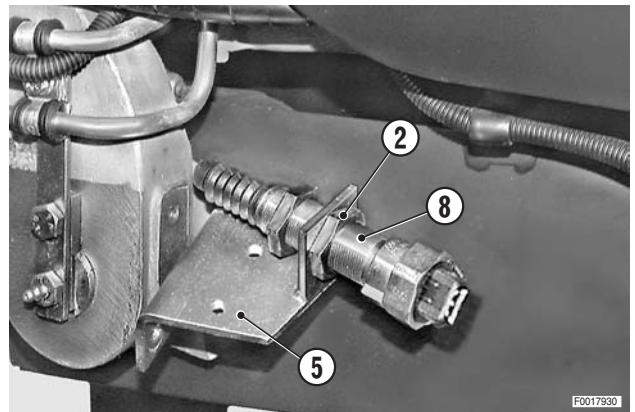
4 - Unscrew and remove the upper retaining bolt (4) of the support (5) and loosen the lower bolt (6); rotate the support (5).

5 - Remove the front nut (7) and remove the sensor (8).



2. Positioning

1 - Start the engine, fully extend the front suspension cylinders and fit the sensor (8) to the support (5) with the front nut (2) fully unscrewed.



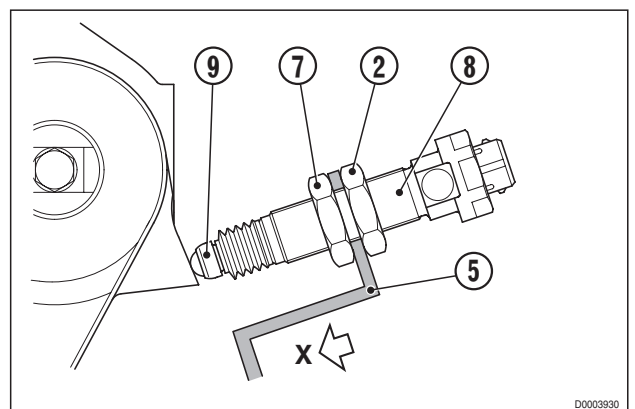
2 - Fix the support (5) and push the sensor (8) in the direction "X" until the pin (9) is fully retracted.


3 - Keeping the pin in this position, screw in the rear nut (2) right up to the support (5).

4 - Screw the front nut (7) up to the support (5).

5 - Back off the nut (7) by one turn and tighten the nut (2) to secure the sensor.

★ This adjustment prevents the possibility of the sensor sustaining impact damage at the end of its travel.



 Nuts: 30±6 Nm (22.1±4.4 lb.ft.)

3. Testing

- 1 - Connect the test lead **T5** (code 5.9030.743.1) between the sensor (8) and the wiring (3); start the engine and, using a multimeter, check the voltage when the cylinders are in the mid-stroke position.

★ **Voltage with cylinders in mid-stroke position = 3.8V**

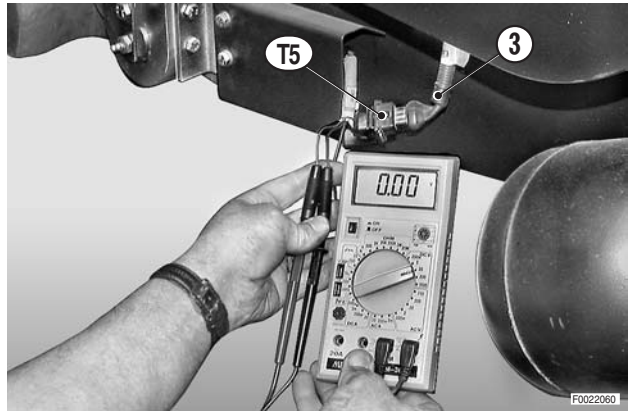
Fully retract the cylinders and check the voltage.

★ **Voltage with cylinders retracted = 1.90÷1.95V**

★ The voltage is measured between the terminals of the brown (earth) and blue (signal) wires

NOTE. The same reading can also be taken using the suspension section of the EDS program.
(For details, see EDS in section 20)

- 2 - Stop the engine, disconnect the lead **T5** (code 5.9030.743.1) and reconnect the wiring to the sensor.
- 3 - Refit the cover (1).



REMOVAL OF THE REINFORCING SIDE MEMBERS

(For versions with front lift only)

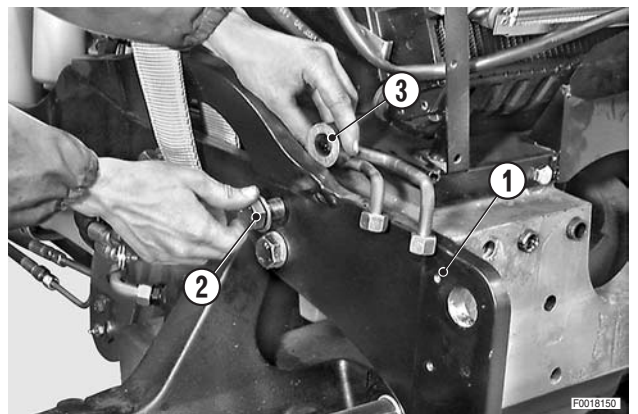
- 1 - Remove the front lift valve block.
(For details, see «REMOVAL OF THE VALVE BLOCK»).
- 2 - Remove the air reservoir and the battery support.
(For details, see «REMOVAL OF THE AIR RESERVOIR AND BATTERY SUPPORT»)
- 3 - Attach a hoist to the side member to be removed and put the lifting sling under slight tension.



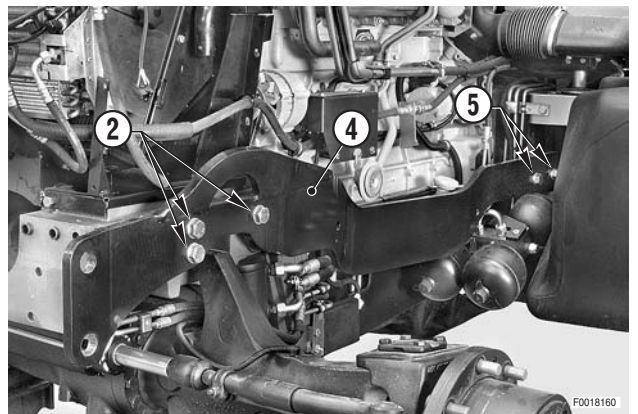
Side member: 45 kg (99 lb.)



- 4 - **Right side member (1):** Unscrew and remove the front bolts (2) complete with their washers and recover the spacers (3).




- 5 - **Left side member (4):** Unscrew and remove front bolts (2) as per the right side member and the two rear bolts (5) complete with washers.



REFITTING THE SIDE MEMBERS

- Refitting is the reverse of removal.



 Bolts: M16: 214 Nm (158 lb.ft.)
Bolts: M20: 455 Nm (335 lb.ft.)

REMOVAL OF THE FRONT CARRIER (Versions with front suspension)

! Before stopping the engine, deactivate the front suspension by pressing the relative button in the cab.

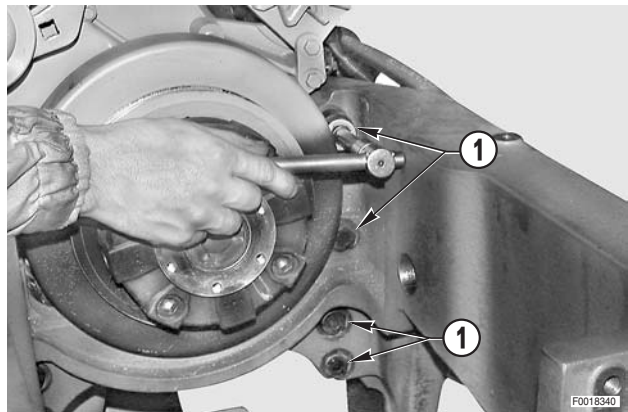
! Remove the battery cover and disconnect the negative battery lead (-).

1 - Remove:

- the radiator/coolers assembly;
- the alternator and air conditioning compressor drivebelts;
- the reinforcing side members;
- the lift assembly;
- the front PTO (if present);
- the front suspension cylinders;
- the front axle and swinging support.

(For details, see the corresponding headings).

2 - Loosen the bolts (1) to eliminate the tightening torque.

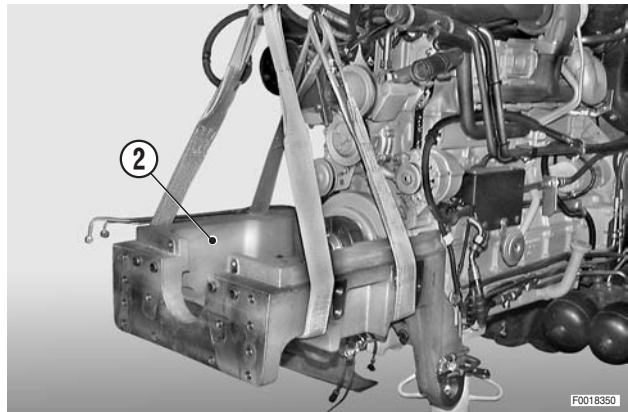


3 - Attach lifting slings to the front carrier (2), attach the slings to a hoist and put them under slight tension.

4 - Remove the bolts (1) with their washers and remove the front carrier (2).




★ If necessary, use a lever to separate the locating dowels from the engine.




REFITTING THE FRONT CARRIER

- Refitting is the reverse of removal.



 Bolts: 260±10% Nm (191.6±10% lb.ft.)



 Locating dowels: grease

1 - Start the engine and operate the controls to expel air from the various systems.

RENEWAL AND TESTING OF THE ACCELERATOR POTENTIOMETER

1. Renewal

⚠ Remove the battery cover and disconnect the negative battery lead (-).

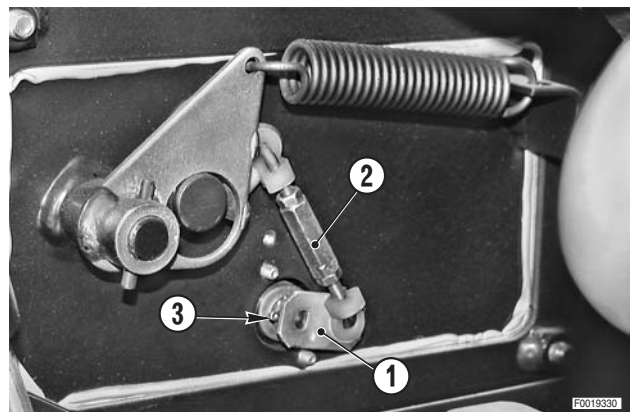
1 - Remove the right-hand side panel.



2 - Disconnect the tie-rod (2) from the lever (1).

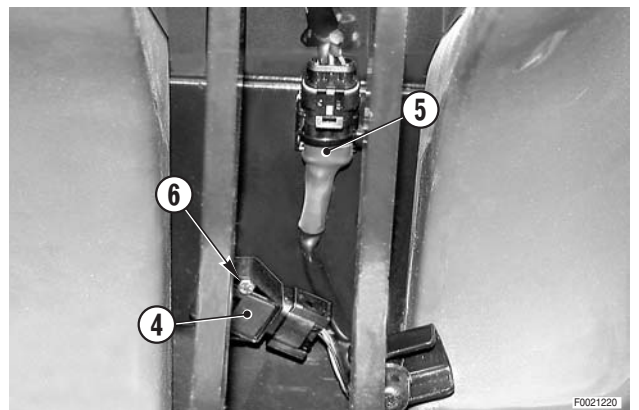
3 - Remove the cotter pin (3) securing the lever (1) to the potentiometer shaft; remove the lever (1).

★ Renew the cotter pin at each re-assembly.



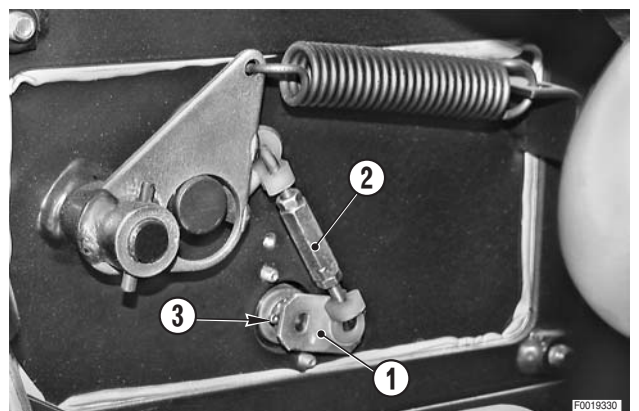
4 - Unplug the connector (5) from the potentiometer (4).

5 - Remove the screws (6) and remove the potentiometer.




6 - Fit a new potentiometer and connect it to the lever (1) with a new cotter pin (3).

7 - Connect the tie-rod (2).



2. Potentiometer calibration

 Whenever you replace and/or calibrate the accelerator pedal potentiometer, it is also necessary to check the calibration of the hand throttle potentiometer
To calibrate the potentiometers, use the SERDIA program. (For details, see SERDIA in section 20).

- ★ Check with pedal released: 1 +0.05/-0.15V
- Check with pedal fully depressed: 4 +0.25V
- Check with hand throttle at minimum: 0.9V
- Check with hand throttle at maximum: 4V

REMOVAL OF THE FUEL TANK

! Remove the battery cover and disconnect the negative battery lead (-).

1 - Remove the left rear wheel.
(For details, see «REMOVAL OF THE REAR WHEELS»).

2 - Discharge all the compressed air from the cab suspension system.

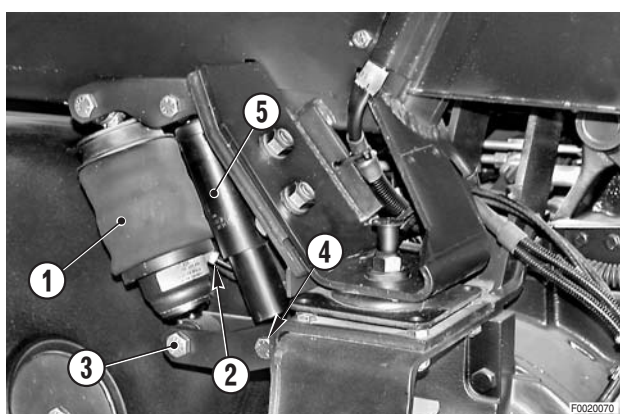
★ On tractors equipped with air trailer braking, discharge all the compressed air from the braking system..



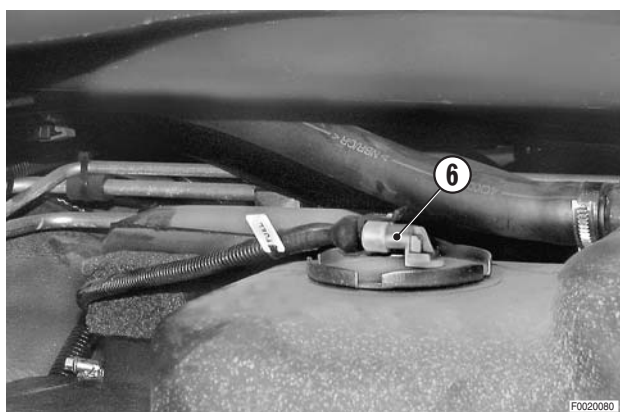
3 - Disconnect the air feed pipe (2) from the left cab suspension piston (1).

4 - Unscrew and remove the lock nut and the bolts (3), (4) securing the piston (1) and the damper (5).

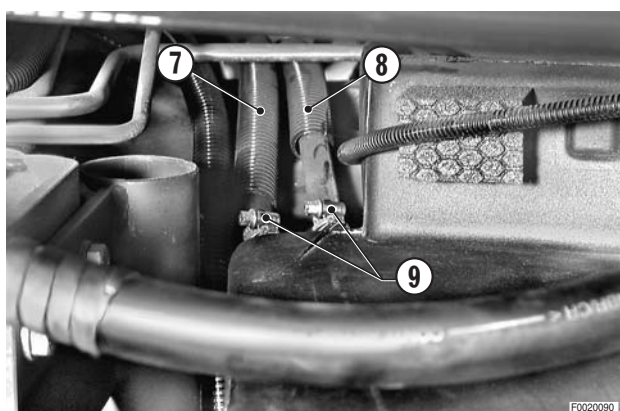
★ Recover the shims from the damper.



5 - Unplug the fuel level sensor connector (6).

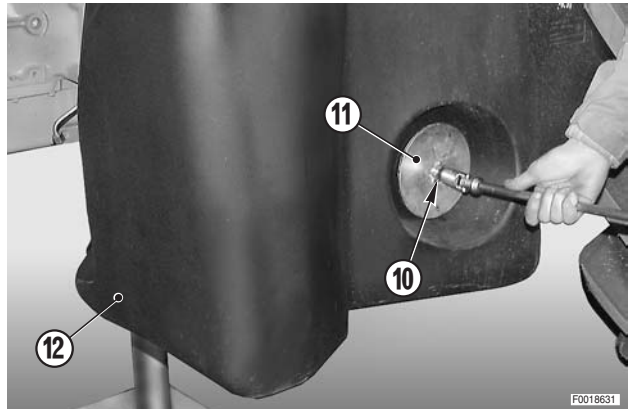


6 - Label the fuel pick-up and return pipes (7), (8). Loosen the retaining clamps (9) and disconnect the pipes.



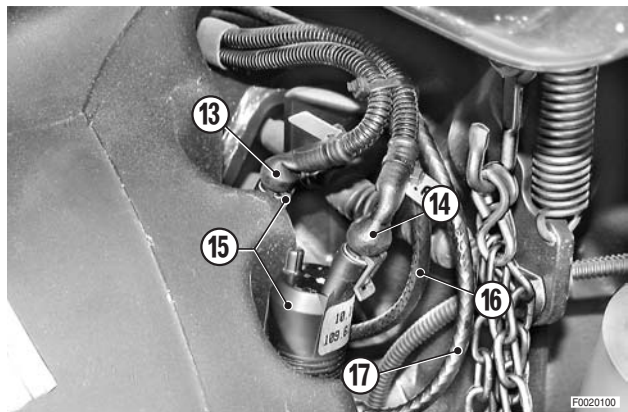
7 - Remove the bolts (10) and remove the locating discs (11) of the fuel tank (12).

★ Label the discs to avoid confusion on reassembly.

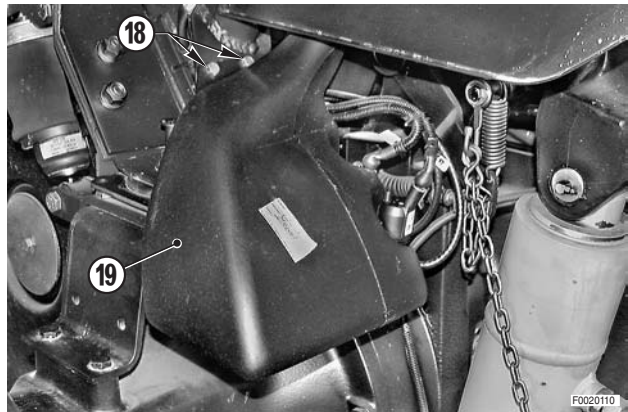


8 - Empty the screenwash reservoir.
Label the connectors (13), (14) and disconnect them from the pumps (15).

9 - Label the feed pipes (16), (17) and disconnect them from the pumps.

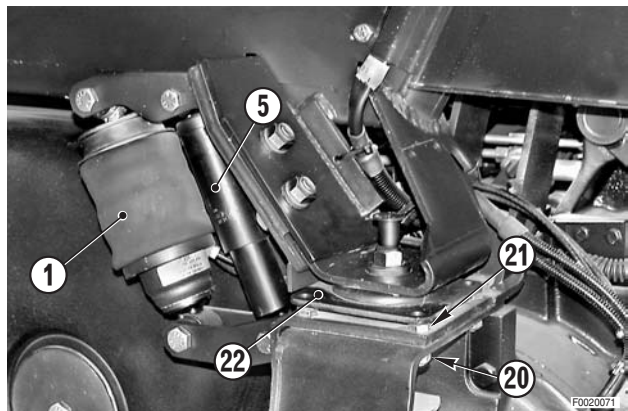


10 - Remove the screws (18) and remove the screenwash reservoir (19).

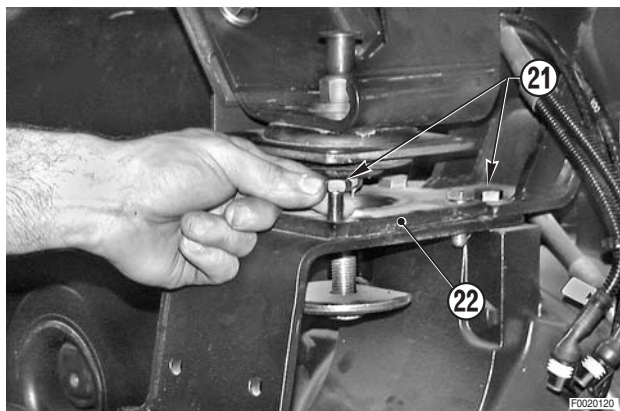


11 - Unscrew the four nuts (20) and remove the four retaining bolts (21) of the lower support (22) for the piston (1) and damper (5).

★ If the delivery pipe to the piston (1) was removed, on refitting, tighten the fitting to the specified torque.



- 12 - Using suitable lifting equipment, raise the cab so as to be able to remove the retaining bolts (21) of the support (22).

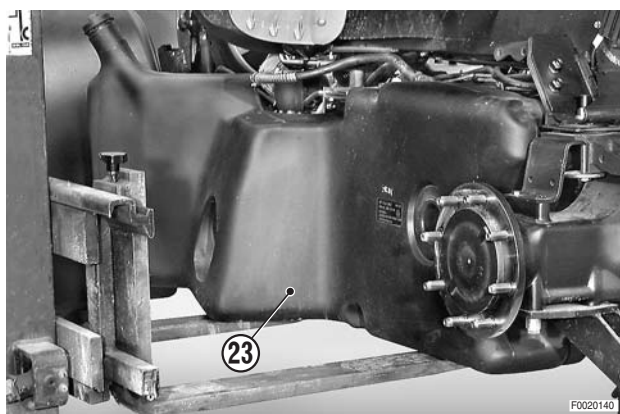


- 13 - Rotate the support (22) through 180° to disengage it from the fuel tank.



- 14 - For safety, insert the bolts (21) in the support (22) and lower the cab.


- 15 - Support the fuel tank (23) with lifting equipment and withdraw it from the guide tubes.

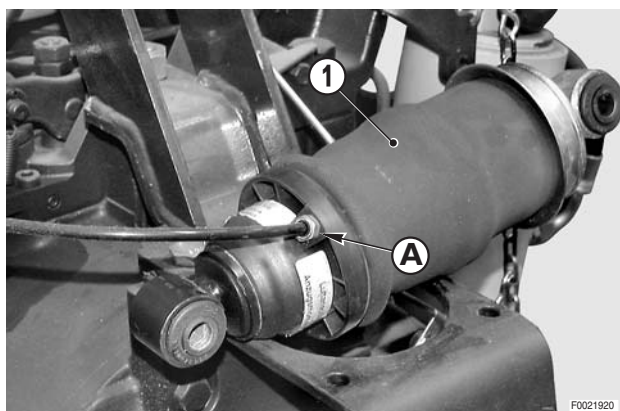


REFITTING THE FUEL TANK

- Refitting is the reverse of removal.



 Fittings "A": 3 Nm (2.2 lb.ft.)



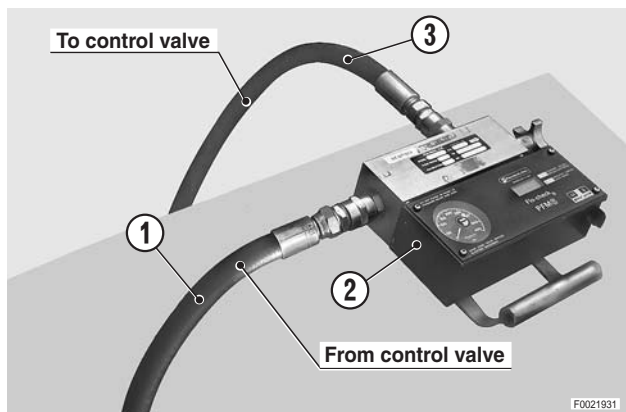
TESTING THE AUXILIARY SERVICES PUMPS

★ Test conditions:

- Engine at operating temperature
- Hydraulic fluid: 60–70 °C (140–158 °F)
- Handbrake on
- Gearbox in neutral

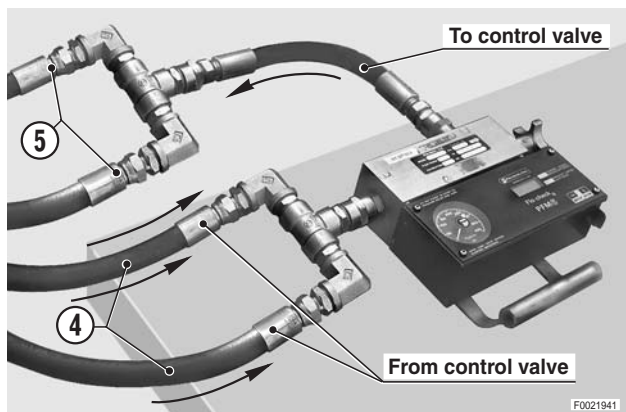
1. Flow meter connection (CC version)

- 1 - Connect the delivery line (1) to the flow meter (2) to the upper port of a mechanically-controlled spool valve.
- 2 - Connect the return line (3) from the flow meter (2) to the lower port of the same spool.



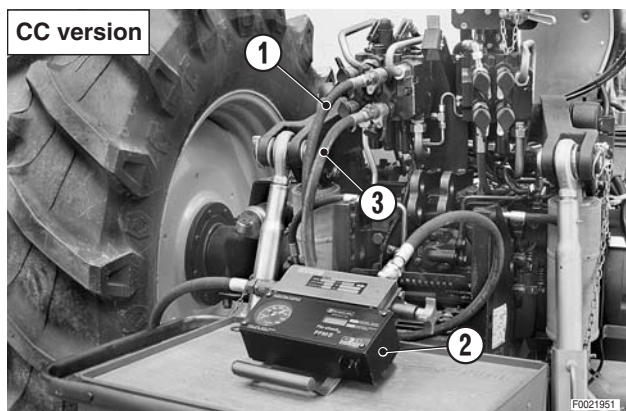
2. Flow meter connection (LS version)

- 1 - Connect the delivery lines (4) of the flow meter (2) to the upper ports of two mechanically-controlled spool valves.
- 2 - Connect the return lines (5) from the flow meter to the lower ports of the same two spool valves.



3. Measuring the flow rate

- 1 - Start the engine and bring the revs up to 1000 rpm.
- 2 - Operate the levers of the control valve/s connected to the flow meter delivery line/s.
- 3 - Set the delivery pressure to 50 bar (725 psi) and read off the pump flow rate.
- 4 - Release the levers and repeat the operation a number of times.
- 5 - Repeat the operations in points 2, 3 and 4 at pressures of 100 bar (1450.3 psi) and 150 bar (2175.5 psi).



6 - Take the engine revs up to 2300 rpm and repeat the operations in points 2, 3, 4 and 5 also in this condition.

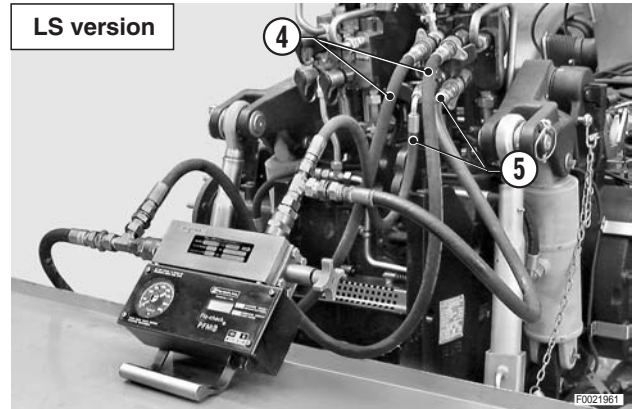
7 - Check the readings taken against the values indicated in the tables below.

CC CIRCUIT

Pressure bar (psi)	Flow rate at 1000 rpm ℓ/min (US.gpm)	Flow rate at 2350 rpm ℓ/min (US.gpm)
50 (725)	32.0 (8.45)	76.0 (20.08)
100 (1450.3)	31.5 (8.32)	75.0 (19.82)
150 (2175.5)	31.0 (8.19)	73.5 (19.42)

LS CIRCUIT

Pressure bar (psi)	Flow rate at 1000 rpm ℓ/min (US.gpm)	Flow rate at 2350 rpm ℓ/min (US.gpm)
50 (725)	44.5 (11.76)	107 (28.27)
100 (1450.3)	44.0 (11.62)	106 (28.00)
150 (2175.5)	43.5 (11.50)	104 (27.48)

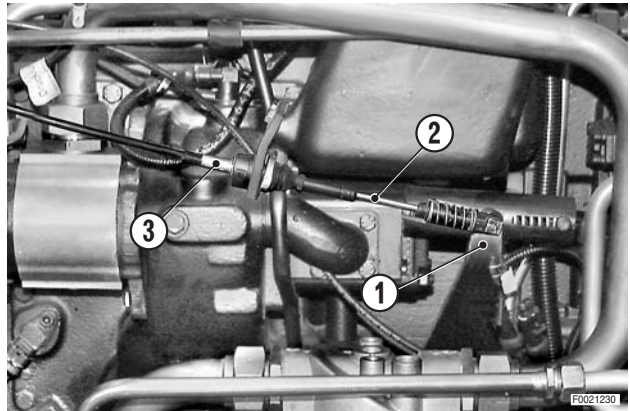


REMOVAL OF THE HYDRAULIC SERVICES GEAR PUMP (Models 106-115 CV) (CC Version)

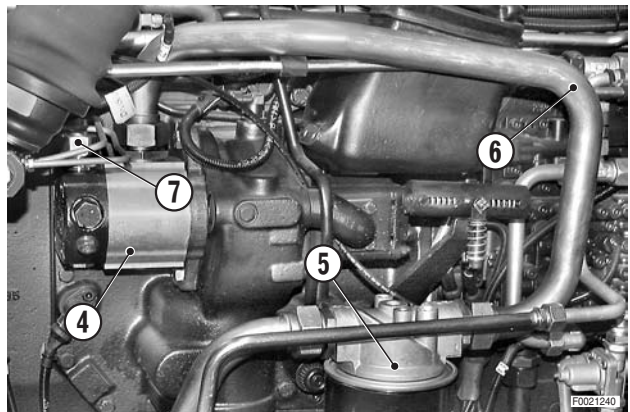
! Switch off the engine and remove the key from the ignition.

★ Remove the right rear wheel.
(For details see «REMOVAL OF THE REAR WHEELS»).

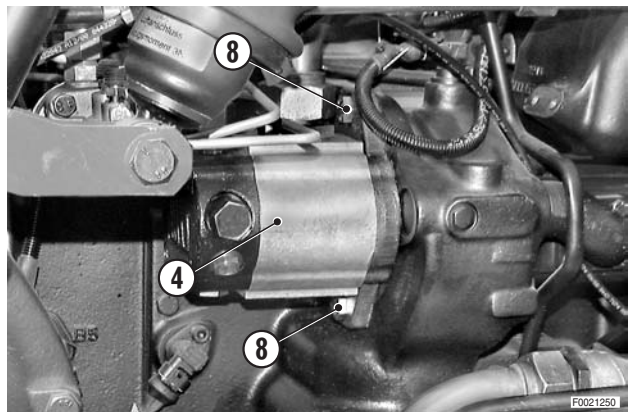
1 - Disconnect the inner control cable (2) from the creeper engagement lever (1); disconnect also the outer cable (3).



2 - Disconnect the suction pipe (6) from the pump (4) and the filter (5); disconnect the delivery pipe (7).

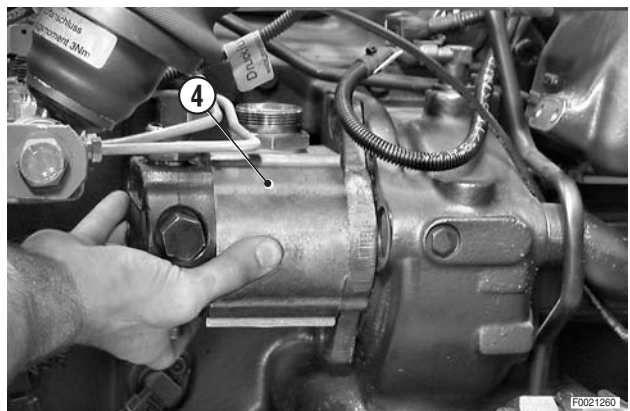


3 - Unscrew and remove the retaining bolts (8) of the pump (4).

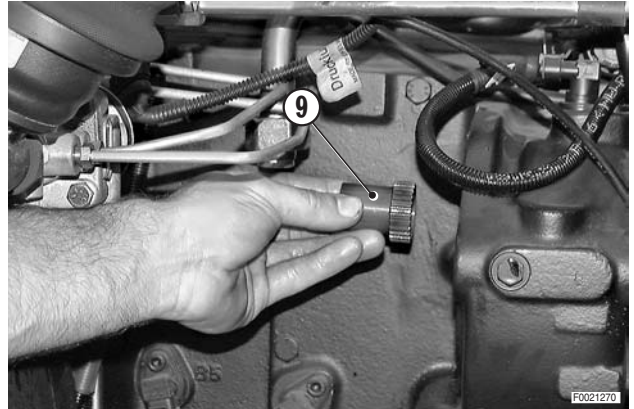


4 - Remove the pump (4) and its gasket.

★ The gasket should be renewed at each re-assembly.



5 - Withdraw and check the drive coupling (9).



REFITTING THE HYDRAULIC SERVICES GEAR PUMP

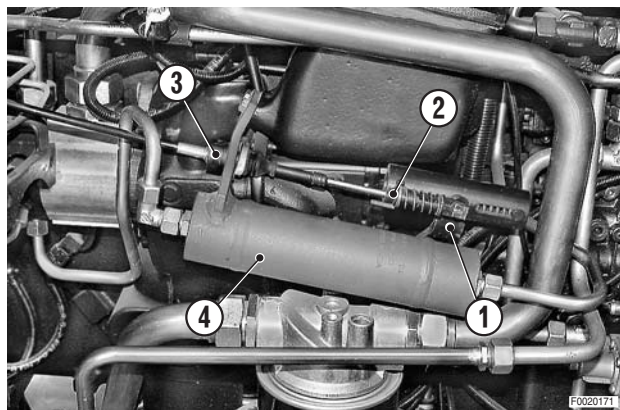
- Refitting is the reverse of removal.

REMOVAL OF THE GEAR PUMP ASSEMBLY (Models 120-165 CV) (CC Version)

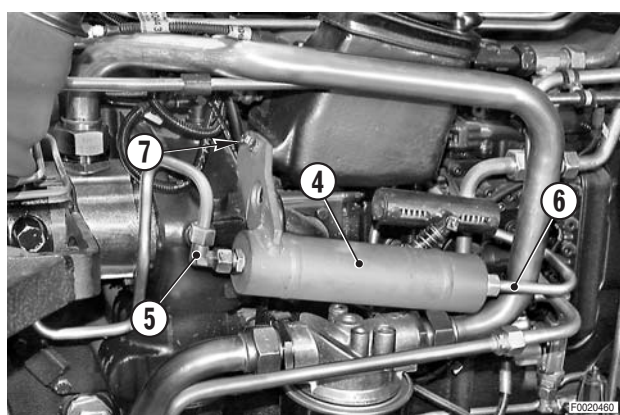
! Switch off the engine and remove the key from the ignition.

★ Remove the right rear wheel.
(For details see «REMOVAL OF THE REAR WHEELS»).

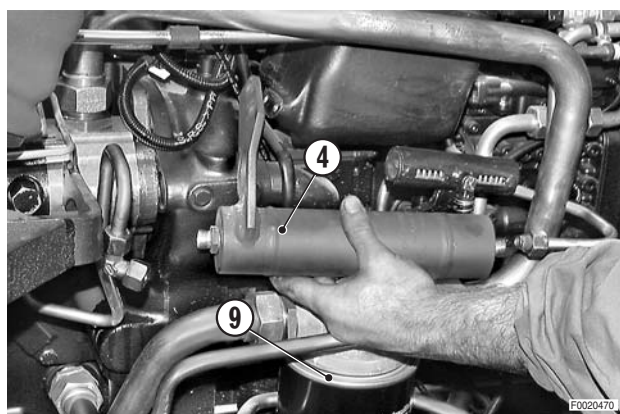
1 - Disconnect the cable (2) from the creeper unit control lever (1) and detach the outer sheath (3) from the damping chamber support (4).



2 - Disconnect the inlet (5) and outlet (6) pipes from the damping chamber (4).

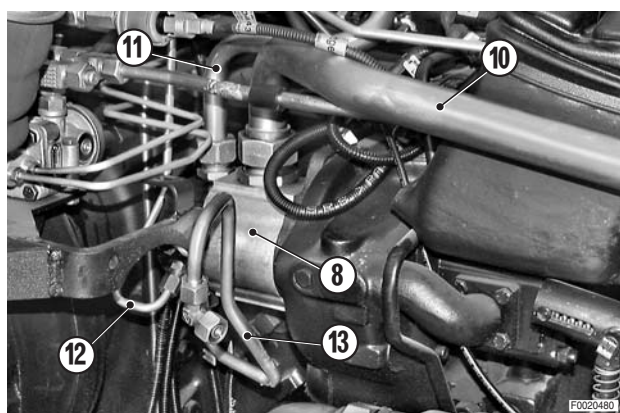


3 - Remove the bolts (7) and remove the chamber (4).

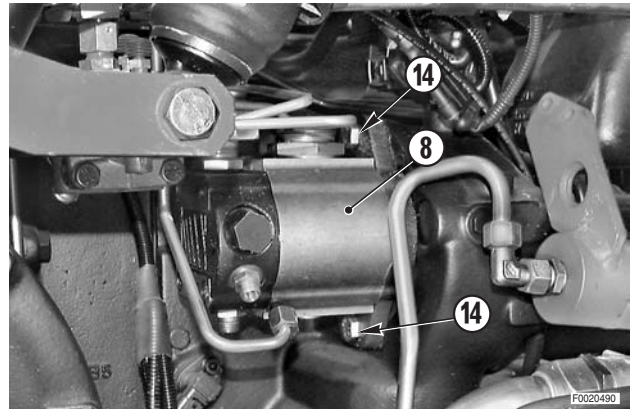


4 - Disconnect the suction pipe (10) from the pump (8) and the filter (9).

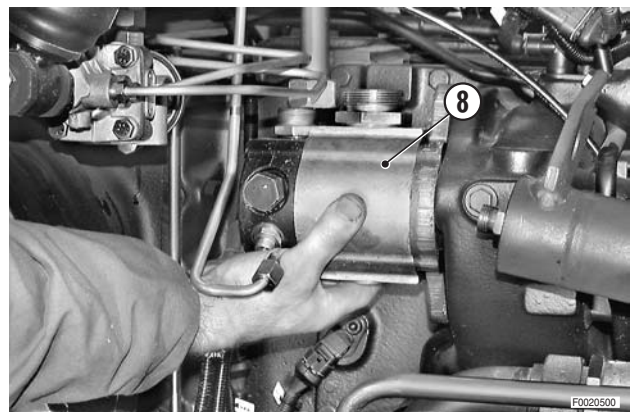
5 - Disconnect the pipes (11), (12) and (13) from the pump.



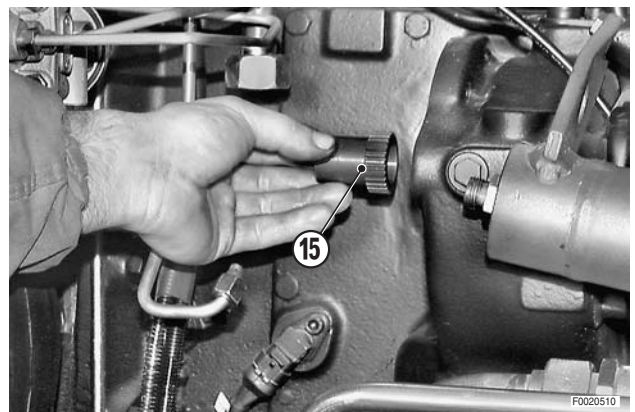
- 6 - Unscrew and remove the retaining bolts (14) of the pump (8).



- 7 - Remove the pump (8) and its gasket.
★ The gasket should be renewed at each re-assembly.



- 8 - Withdraw the drive coupling (15).



REFITTING THE GEAR PUMP

- Refitting is the reverse of removal.

REMOVAL OF THE VARIABLE DISPLACEMENT PUMP

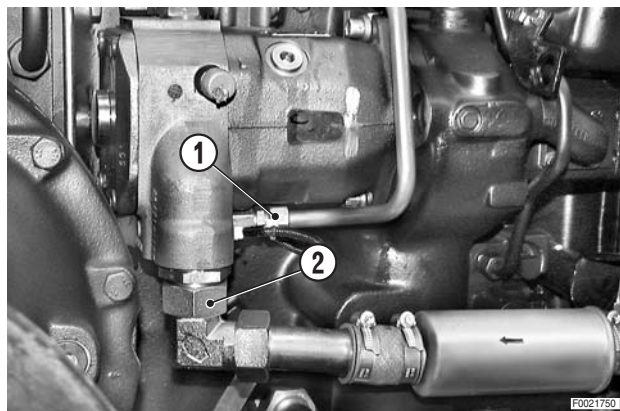
(Models 106-165 CV) (LS version)

! Remove the key from the ignition and apply the parking brake.

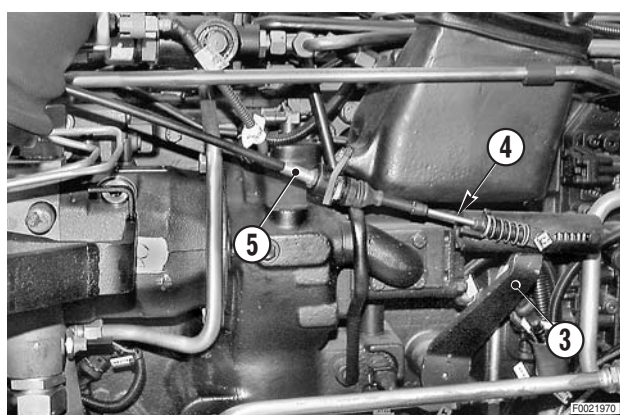
★ Remove the right rear wheel.
(For details, see «REMOVAL OF THE REAR WHEEL-SI»).

⚠ **For tractors with air trailer braking only:**
↑ discharge the pressure from the air braking system.

1 - Partially loosen the fittings (1) and (2) and allow the oil contained in the suction branch and the lubrication circuit to drain off.

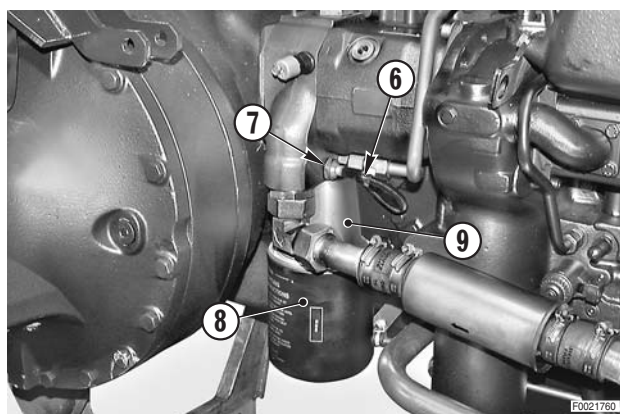


2 - Disconnect the inner control cable (4) from the creeper engagement lever (3); remove also the outer cable (5) and position the entire cable to one side.

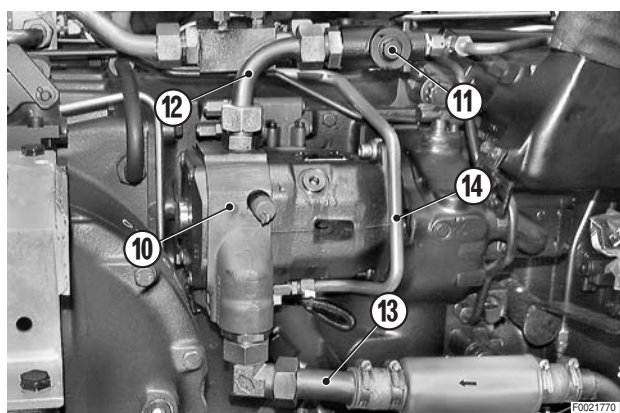


3 - Disconnect the connector (6) of the pressure switch (7).

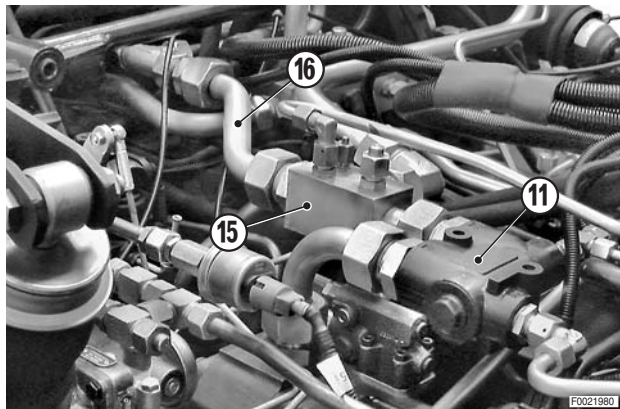
4 - Unscrew and remove the oil filter (8) complete with the fitting (9).



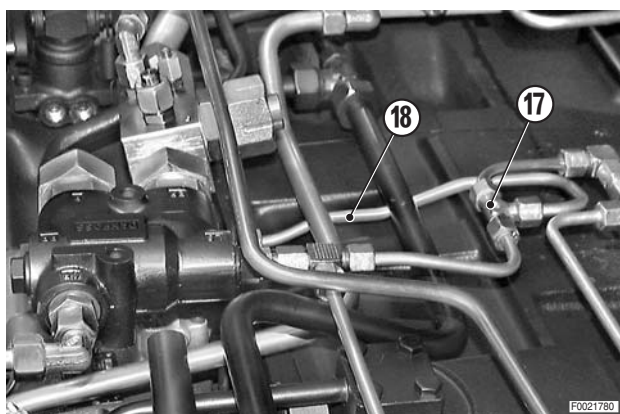
5 - Disconnect the delivery pipe (12) and the suction pipe (13) from the pump (10) and the priority valve (11) and remove the lubrication pipe (14).



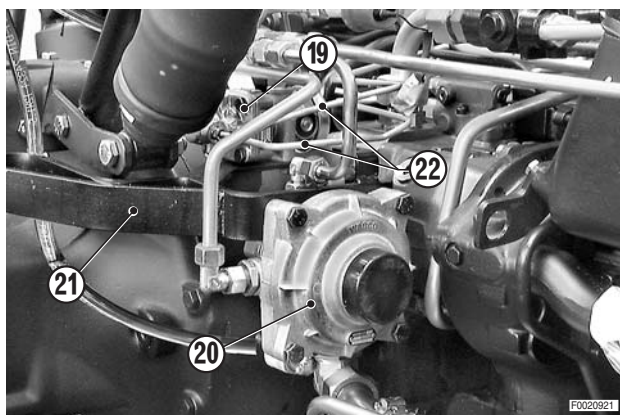
- 6 - Remove the priority valve (11) and the distribution block (15) complete with the delivery pipe (16).



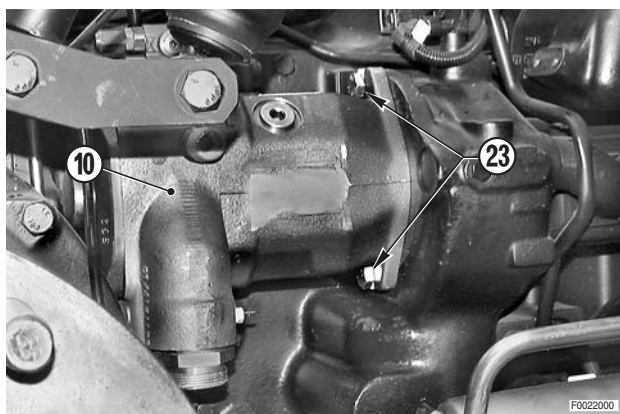
- 7 - Disconnect the Load Sensing pipe (18) from the pump (10) and the fitting (17).




- 8 - **For tractors with air trailer braking only:** disconnect and remove the parking brake valve (19), the regulator (20) (if present) and the support (21). (For details, see: «REMOVAL OF THE TRAILER AIR BRAKING VALVES»).



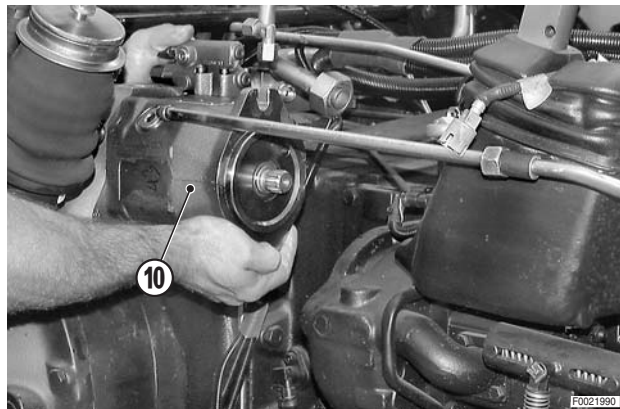
- 9 - Remove also the pipes (22) preventing removal of the pump.



- 10 - Unscrew and remove the bolts (23) and remove the pump (10) with its O-ring. 

11 - Detach the pump (10) from the transmission and withdraw it upwards.

- ★ Check the condition of the O-ring.



12 - Withdraw and examine the drive coupling (24).



REFITTING THE VARIABLE DISPLACEMENT PUMP

- Refitting is the reverse of removal.

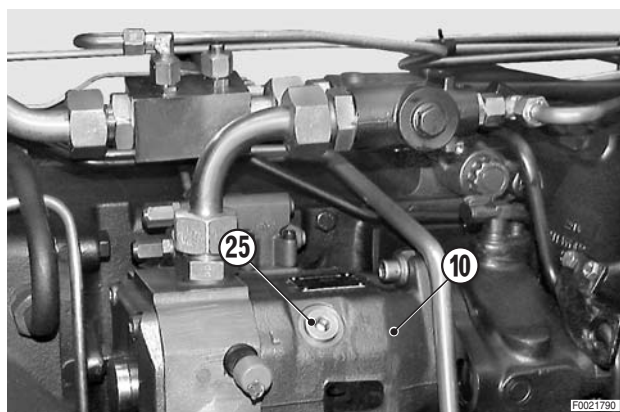


⚠ After connecting the pipes, remove the plug (25) and fill the body of the pump (10) with oil.



Oil: 1 kg (2 lb.)

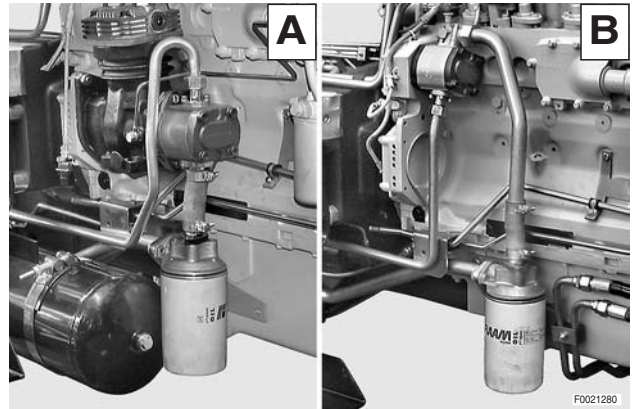
- 1 - Check the oil level in the transmission and top up if necessary.
- 2 - **For tractors with air trailer braking only:** bleed the air from the braking system. (For details see «BLEEDING THE BRAKING SYSTEM»).
- 3 - Start the engine and turn the wheel back and forth between the full lock positions to expel all air from the steering system, the lubrication circuit and the LS circuit; check the fittings of all the re-connected pipes for leaks.
- 4 - Stop the engine, and re-check the oil level in the transmission.



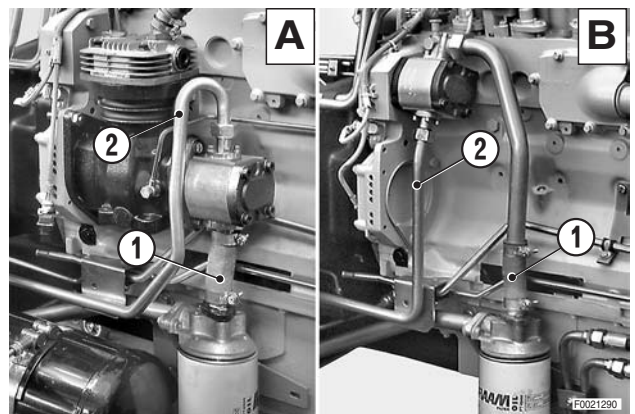
REMOVAL OF THE POWER STEERING PUMP (Models 106-115 CV) (CC version)

- ★ The power steering pump may be installed in two different positions depending on the tractor version:
 - A** - Version with compressor for air trailer braking with pump mounted in line with the compressor.
 - B** - Version without air trailer braking with pump mounted directly on the upper engine power take-off.

The pump removal procedure is the same for both versions.

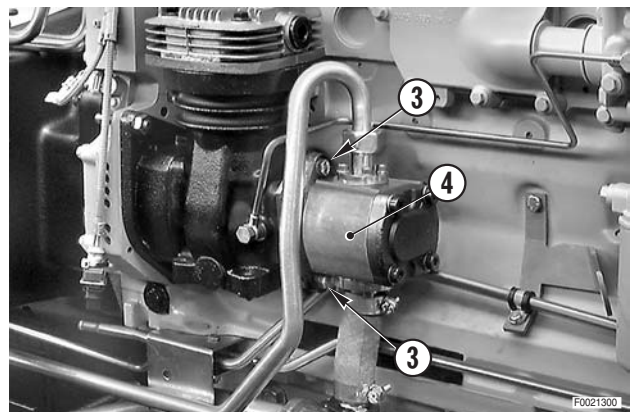


- 1 - Disconnect the suction and delivery pipes (1) and (2) from the pump.



- 2 - Unscrew and remove the bolts (3) and remove the pump (4) with its gasket.

- ★ Renew the gasket on refitting.

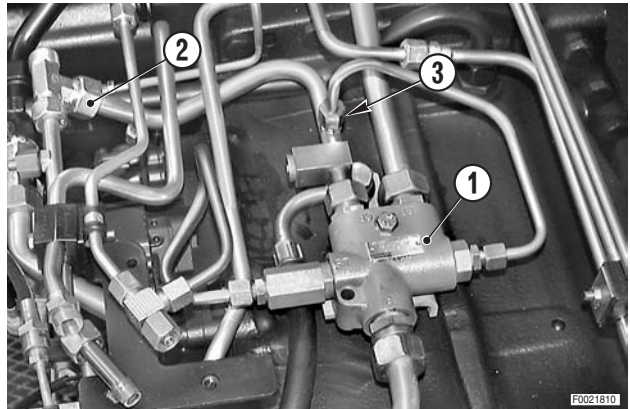


REFITTING THE POWER STEERING PUMP

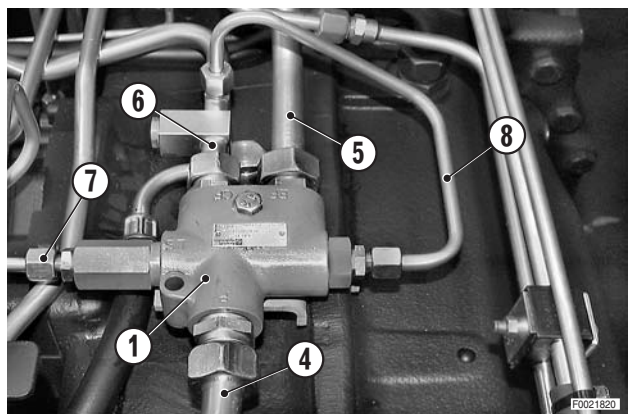
- Refitting is the reverse of removal.

REMOVAL OF THE PRIORITY VALVE (Models 106 - 115 CV)

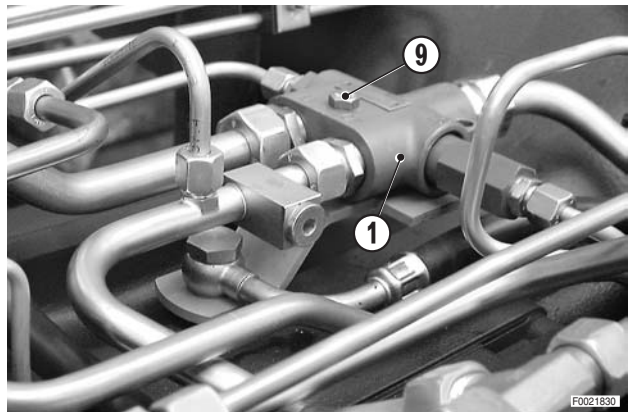
- 1 - Remove the left rear wheel.
(For details see «REMOVAL OF THE REAR WHEELS»).
- 2 - Remove the key from the ignition and thoroughly clean the area around the valve (1).
- 3 - Loosen the fittings (2) and (3) by about three turns.



- 4 - Disconnect, in the order given, the inlet pipe (4), the lubrication and hydraulic trailer braking pipe (5), the delivery pipe to the power steering (6), the Load Sensing signal pipe (7) and finally the pilot pipe of the valve (8).
★ Plug the ends of the pipes immediately to prevent the entry of contaminants.



- 5 - Remove the retaining bolt (9) and remove the valve (1).

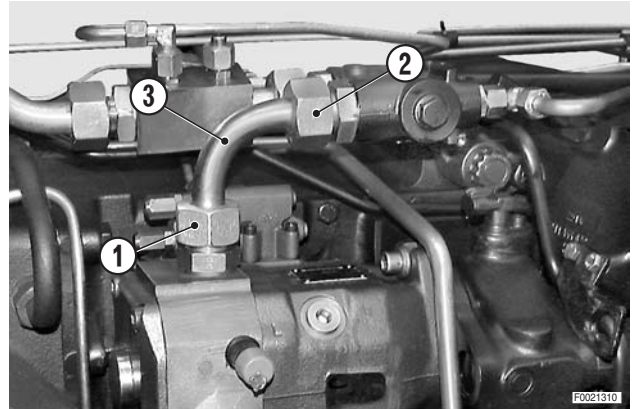


REFITTING THE PRIORITY VALVE

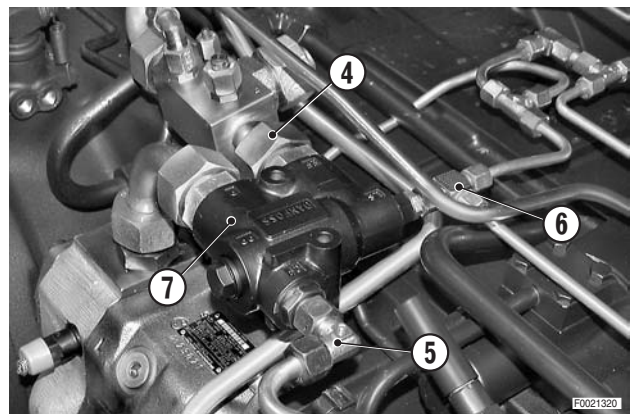
- Refitting is the reverse of removal.
- 1 - Start the engine and turn the steering wheel repeatedly to full lock in both directions in order to expel air from the steering system and check for leaks.
 - 2 - Stop the engine and bleed the hydraulic trailer braking system.

REMOVAL OF THE PRIORITY VALVE (Modd. 120-165 CV) (..... ->) (Versions with variable displacement pump)

- 1 - Remove the right rear wheel.
(For details, see «REMOVAL OF THE REAR WHEELS»).
- 2 - Switch off the engine and thoroughly clean the area around the valve.
- 3 - Loosen the fittings (1), (2) and remove the pipe (3).
 - ★ Plug the pipes and the open fittings to prevent the entry of contaminants.



- 4 - Disconnect, in the order given, the return pipe (4), the power steering delivery pipe (5) and the Load Sensing signal pipe (6).
- 5 - Remove the valve (7).



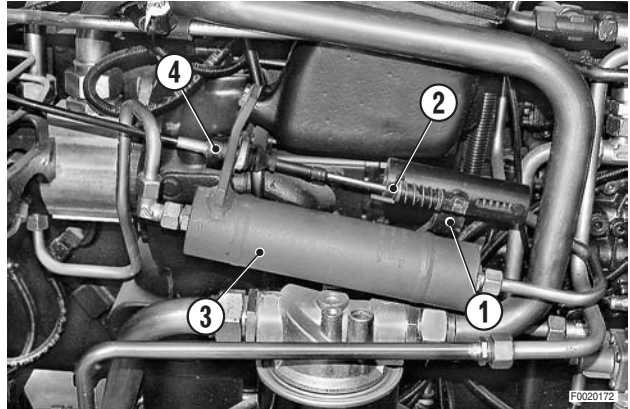
REFITTING THE PRIORITY VALVE

- Refitting is the reverse of removal.
- 1 - Start the engine and turn the steering wheel repeatedly to full lock in both directions in order to expel air from the steering system and check for leaks.

REMOVAL OF THE CREEPER ENGAGEMENT LEVER

! Switch off the engine and remove the key from the ignition.

- 1 - Disconnect the transmission cable (2) from the lever (1) and detach the outer cable (4) from the damping chamber (3).



For OC versions only

- 2 - Disconnect the inlet and outlet pipes (5), (6) from the chamber (3).

- 3 - Remove the bolts and remove the chamber (3).

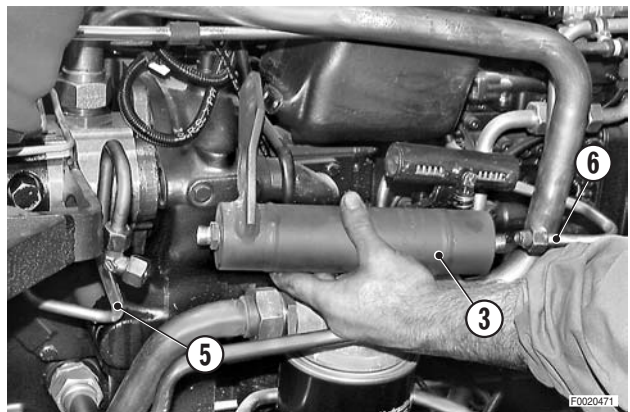
★ For models:

106 CV->

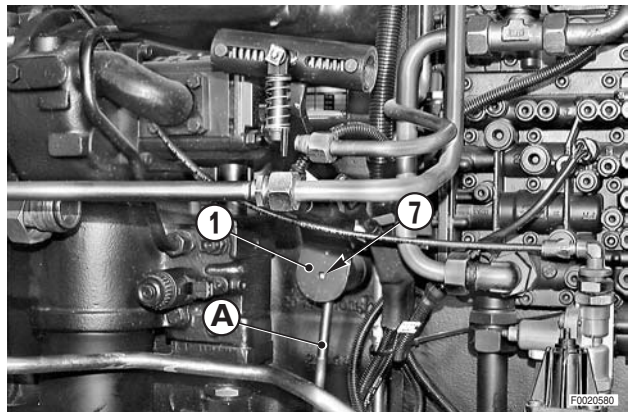
110 CV->

115 CV->

these operations are not necessary.



- 4 - Using a pin punch "A" remove the spring pin (7) securing the lever (1); remove the complete lever assembly.



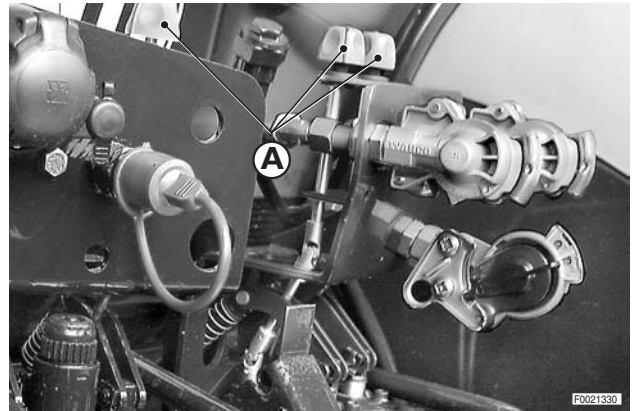
REFITTING THE LEVER

- Refitting is the reverse of removal.

REMOVAL OF THE CONTROL VALVE ASSEMBLIES (CC version)

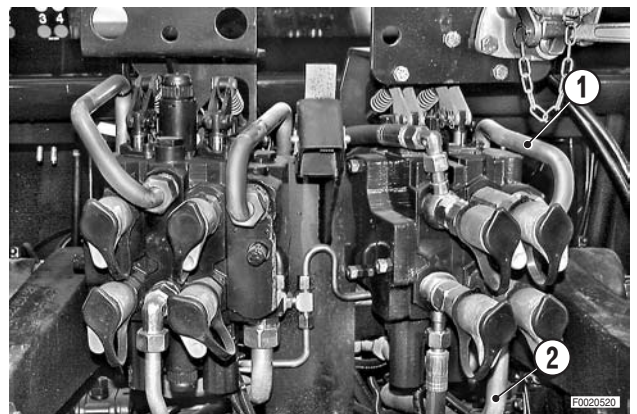
! Switch off the engine and remove the key from the ignition.

★ **Only if fitted**
Remove the optional linkages "A" of the control valve flow controls.

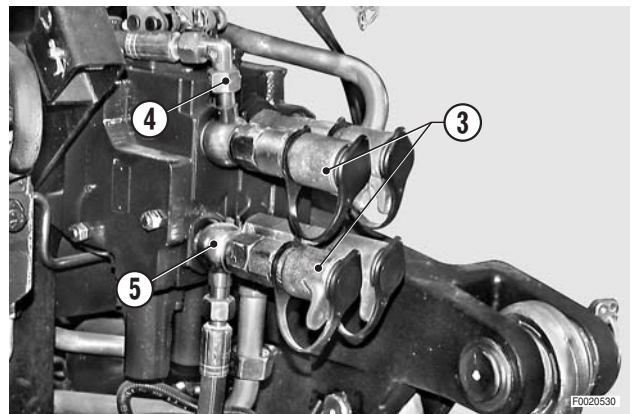


1. Right control valve

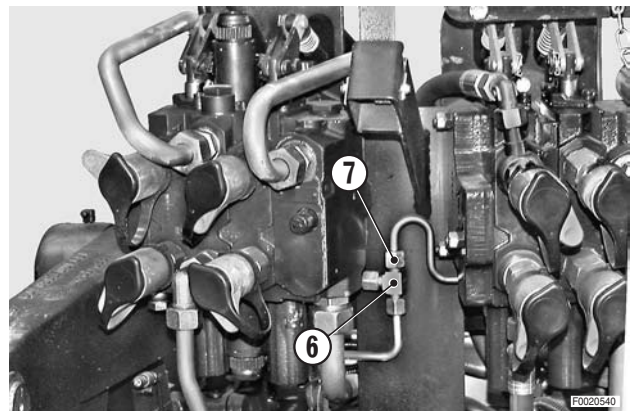
1 - Disconnect the delivery (1) and return (2) pipes from the right control valve.



2 - **For versions with front lift only:** remove the quick-action couplers (3) of the right control valve and disconnect the lift connection pipes (4) and (5).

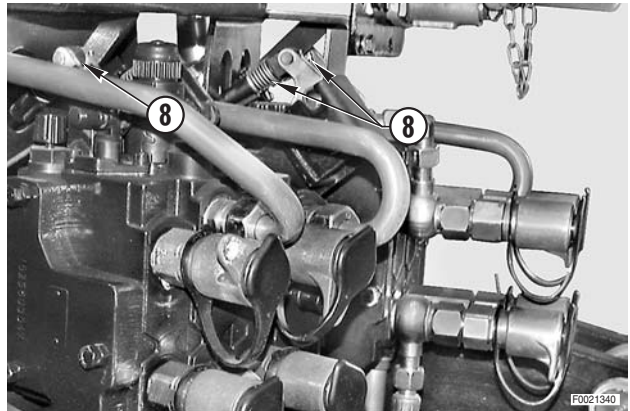


3 - Disconnect the connection pipe (7) to the right control valve from the LS signal Tee fitting (6).

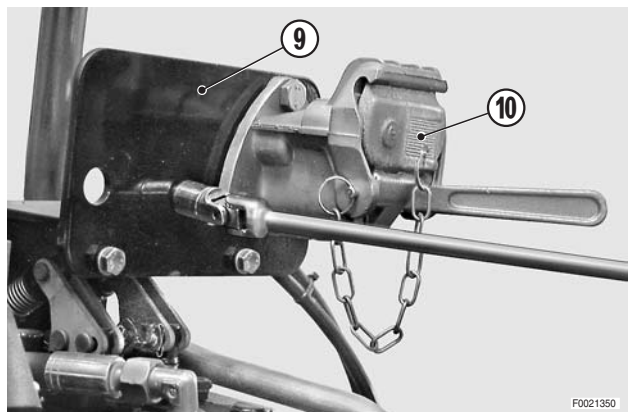


4 - Disconnect the control cables (8) from the control valve levers.

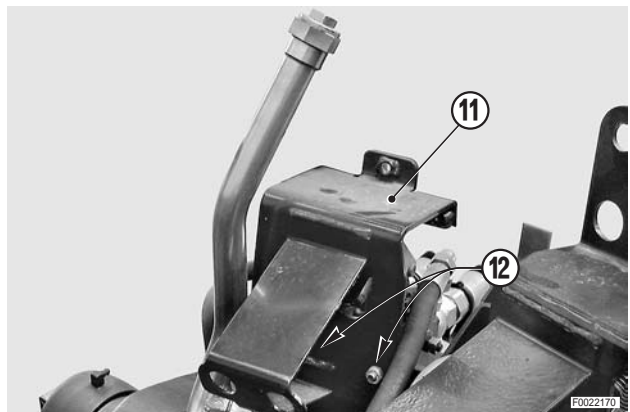
- ★ Label the control cables to avoid confusion on re-connection.



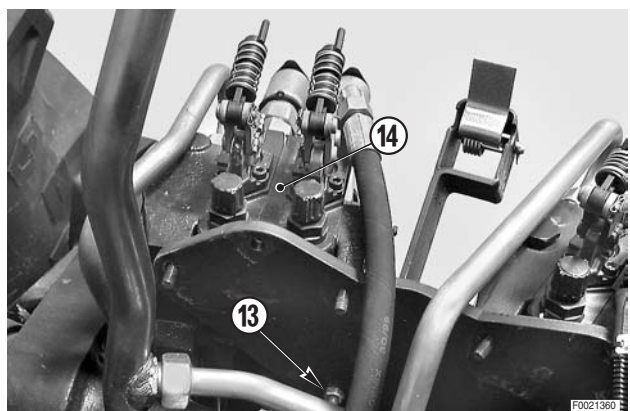
5 - Remove the support (9) (3 screws) for the trailer braking couplers (10) and position it to one side.



6 - Remove the bracket (11) fixed to the upper studs (12) of the control valve and to the control valve support plate.

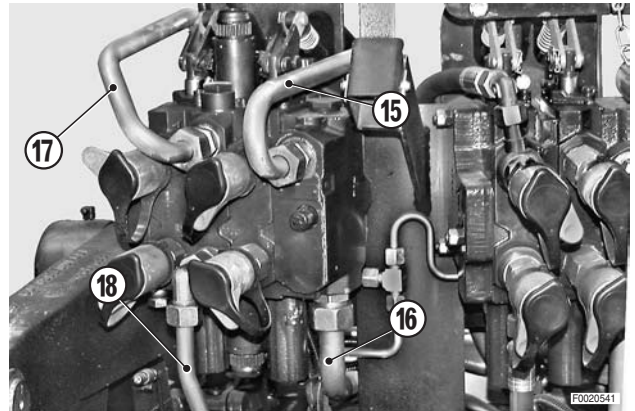


7 - Remove the lower nut (13) and remove the control valve assembly (14).

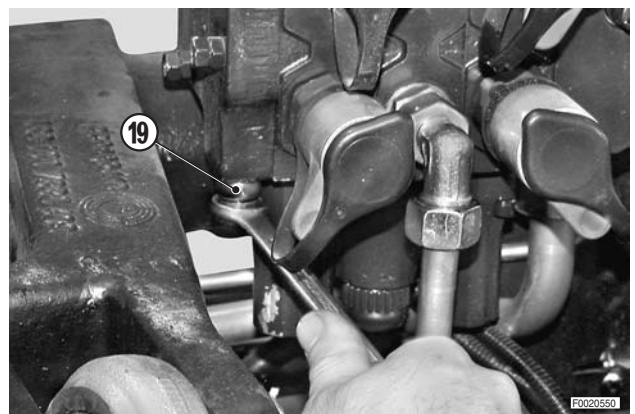


2. Left control valve

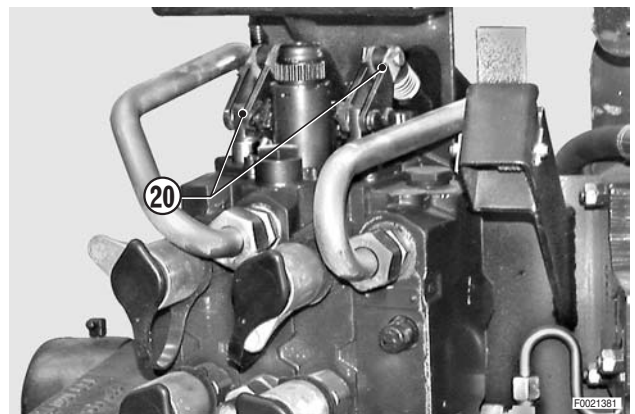
- 1 - Disconnect the delivery (15) and return (16) pipes from the control valve.
- 2 - Disconnect the pipes (17) and (18) from the lift control valve.



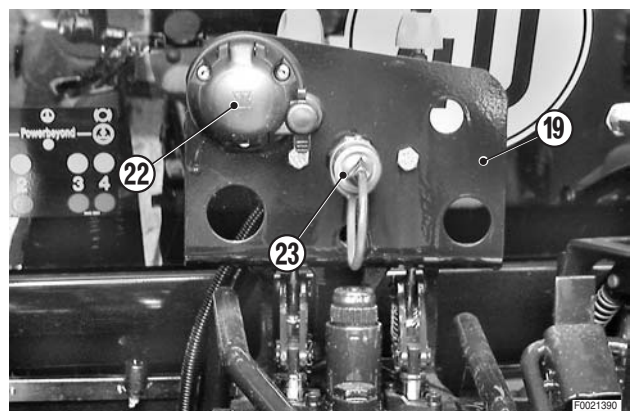
- 3 - Disconnect the LS signal pipe (19) from the outer control valve.
 - ★ Always renew the copper gaskets.



- 4 - Disconnect the control cables (20) from the control valve levers.
 - ★ Label the control cables to avoid confusion on re-connection.

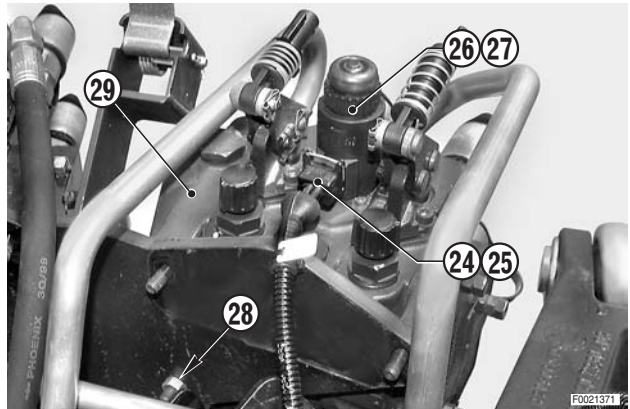


- 5 - Remove the bracket (21) supporting the external electrical outlet (22) and, where present, the supplementary hydraulic couplers (23) and position the bracket to one side.
 - ★ The bracket (21) is fixed to the upper studs of the control valve and to the control valve support plate.



6 - Unplug the connectors (24 upper and 25 lower) from the solenoids (26) and (27) of the lift control valve.

7 - Remove the last rear nut (28) and remove the control valve assembly (29).



REFITTING THE CONTROL VALVE ASSEMBLIES

- Refitting is the reverse of removal.



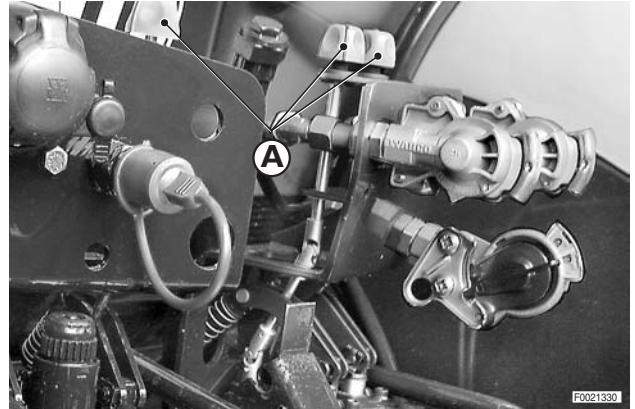
- ★ Position the connectors on the solenoids of the lift control valve spool
 - DW** upper (24)
 - UP** lower (25)

1 - Start the engine and operate the lift to expel air from the circuits and check for leaks.

REMOVAL OF THE CONTROL VALVE ASSEMBLIES (LS version)

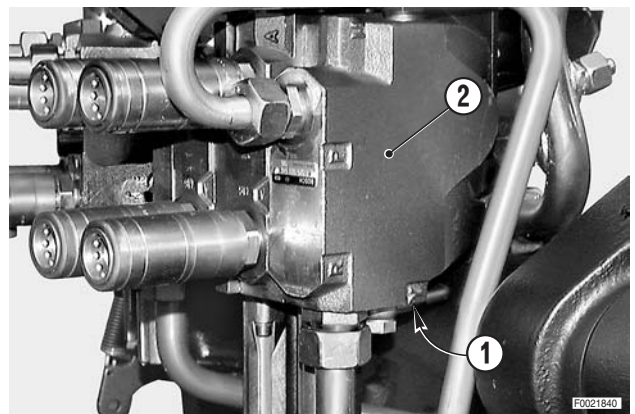
! Switch off the engine and remove the key from the ignition.

★ **Only if fitted**
Remove the optional linkages "A" of the control valve flow controls.



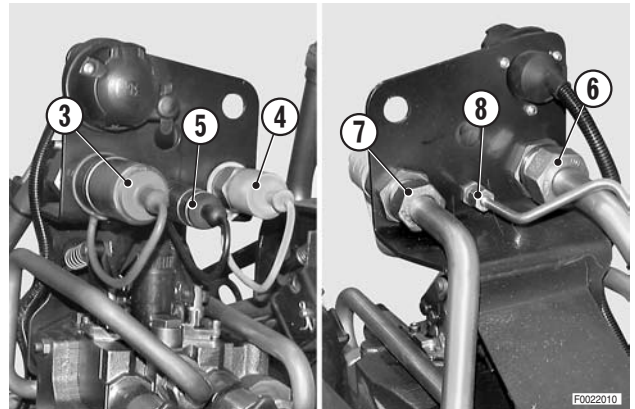
1. Right control valve

- 1 - To remove this valve, refer to the procedure described in «REMOVAL OF THE CONTROL VALVES (CC version)», the only difference being that the LS signal pipe (1) must also be disconnected and removed from the control valve (2).



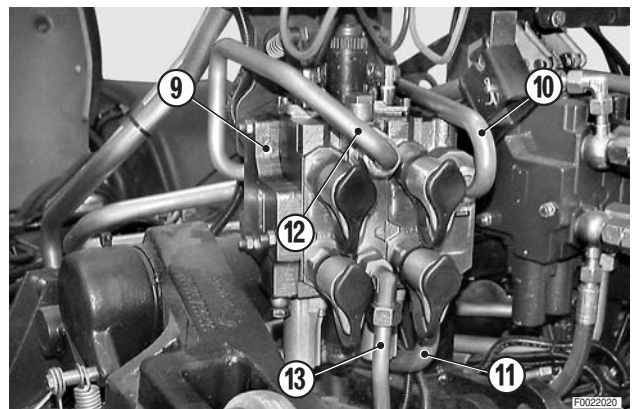
2. Left control valve

- 1 - Disconnect the pipes (6), (7) and (8) from the external pressure coupler (3), the return (4) and the LS (5).



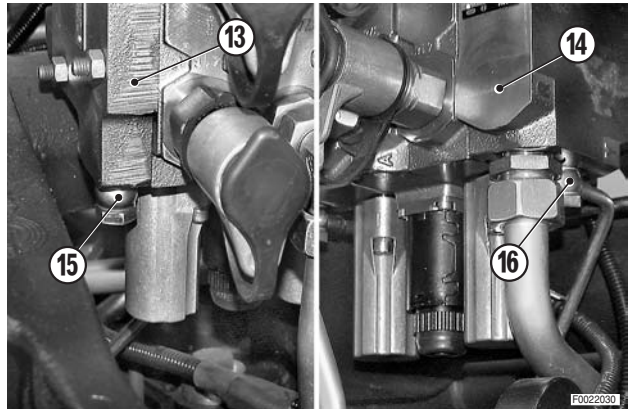
- 2 - Disconnect the delivery (10) and return (11) pipes from the left control valve (9).

- 3 - Disconnect the pipes (12) and (13) from the lift control valve.



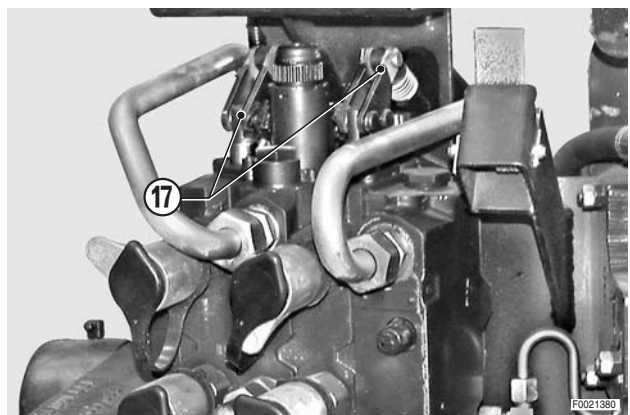
- 3 - Disconnect the LS signal pipes (15) and (16) from the end plate (13) and the head (14).

★ Always renew the copper gaskets.



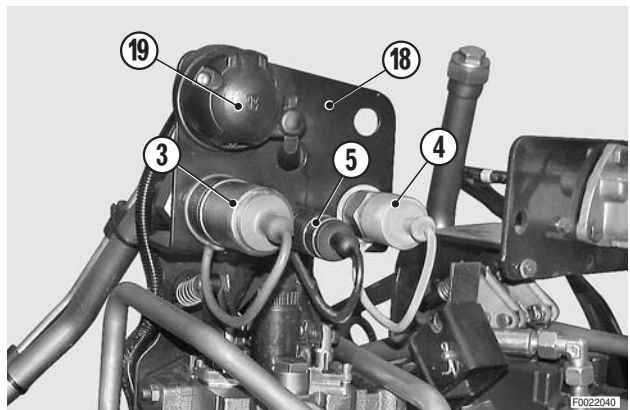
- 4 - Disconnect the control cables (17) from the control valve levers.

★ Label the control cables to avoid confusion on re-connection.



- 5 - Remove the bracket (18) supporting the external electrical outlet (19) and the supplementary hydraulic couplers (3), (4), (5) and position the bracket to one side.

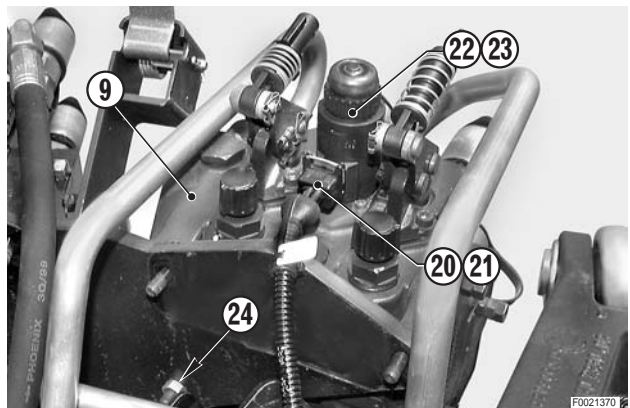
★ The bracket (18) is fixed to the upper studs of the control valve and to the control valve support plate.



- 6 - Unplug the connectors (20 upper and 21 lower) from the solenoids (22) and (23) of the lift control valve.

- 7 - Remove the last rear nut (24) and remove the control valve assembly (9).

※ 1



REFITTING THE CONTROL VALVE ASSEMBLIES

- Refitting is the reverse of removal.



- ★ Position the connectors on the solenoids of the lift control valve spool
 - DW** upper (20)
 - UP** lower (21)

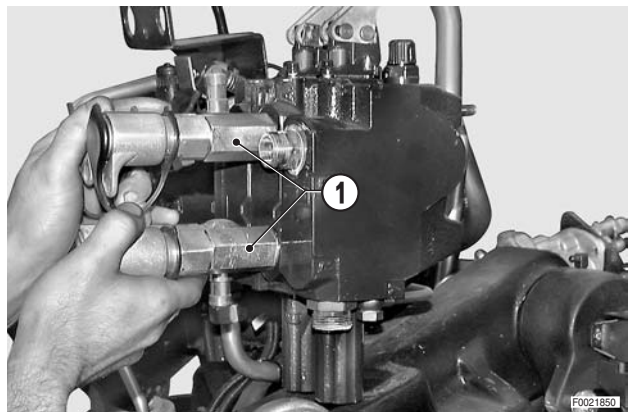
- 1 - Start the engine and operate the lift to expel air from the circuits and check for leaks.

DISASSEMBLY OF THE AUXILIARY CONTROL VALVE BLOCKS

(Description refers to left control valve)

- ★ The control valves are assembled in stacks and should only be disassembled in order to renew parts; any overhaul of the control valves should be carried out directly by the manufacturer or an authorised service centre.

- 1 - Loosen and remove the quick-action couplers (1) and the relative seals.

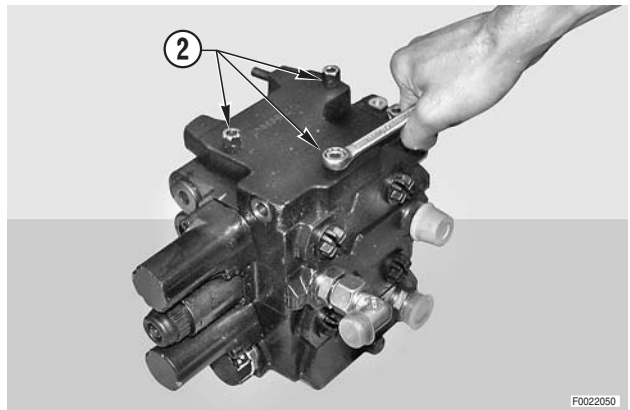


- 2 - Remove the control valve blocks.
(For details, see «REMOVAL OF THE CONTROL VALVES»).

- 3 - Loosen and remove the nuts (2) securing the control valve spool sections.

- ★ Loosen the nuts gradually to eliminate the elasticity of the seals between the spool sections.

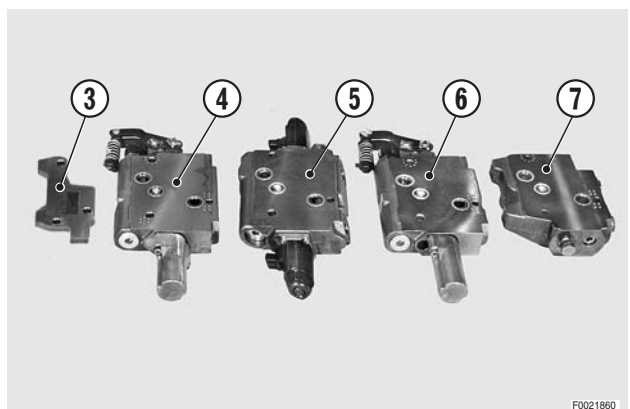
※ 1



- 4 - Remove in order the end cap (3), the first spool section (4), the spool section piloted by the lift (5), the second spool section (6) and the end cap (7).

※ 2


- 5 - Repeat these operations for the right control valve block, bearing in mind that this block consists of just 2 manually controlled spool sections separated by a spacer.



ASSEMBLY OF THE AUXILIARY CONTROL VALVE BLOCKS

- Assembly is the reverse of disassembly.

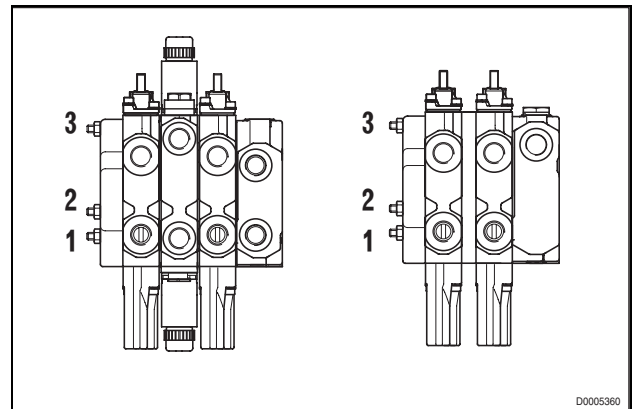
※ 1

 Nut tightening torque:
30 \pm 3 Nm (22 \pm 2.2 lb.ft.)

- ★ Nut tightening sequence: 1-2-3
(See drawing)

※ 2

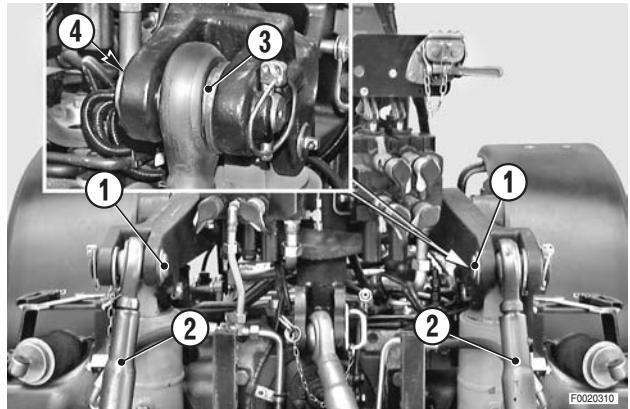
- ★ Ensure that the O-ring seals are correctly positioned before fitting the sections together.



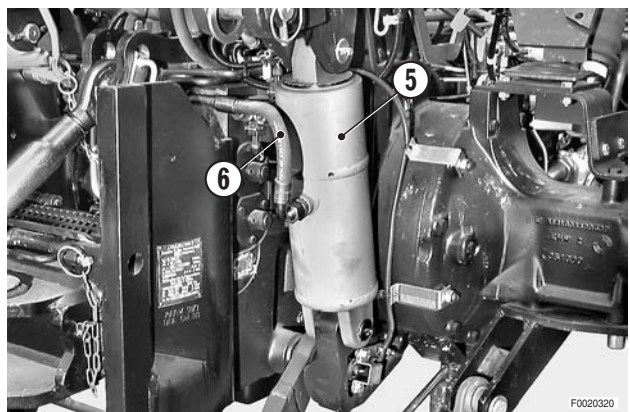
REMOVAL OF THE LIFT CYLINDERS

! Switch off the engine and remove the key from the ignition.

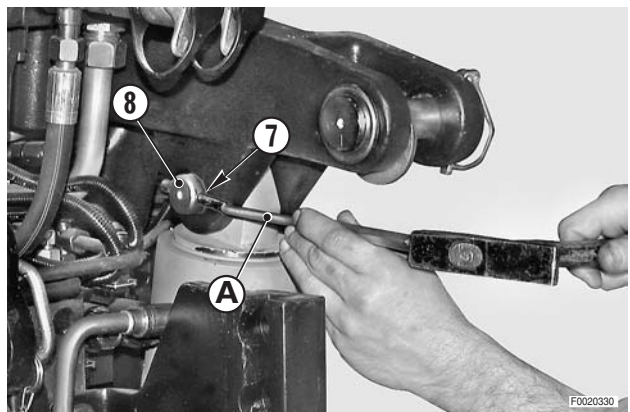
- 1 - Remove the pins (1) and lower the lift rods (2) towards the rear of the tractor.
 - ★ Recover the spacers (3) and washers (4); make a note of their positions.



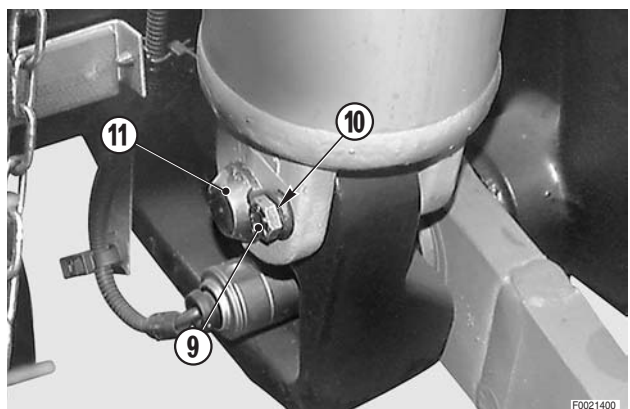
- 2 - Disconnect the pipes (6) from the cylinders (5).
 - ★ Plug the ends of the pipes to prevent the entry of contaminants.




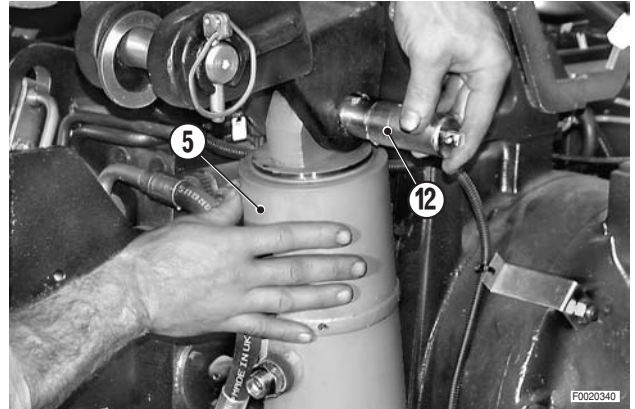
- 3 - Using a pin punch "A", remove the spring pin (7) securing the upper pivot pin (8).



- 4 - Remove the screws (9) and remove the bracket (10) securing the lower pivot pin (11).



- 5 - Support the cylinder (5) while removing the upper pivot pin (12). 

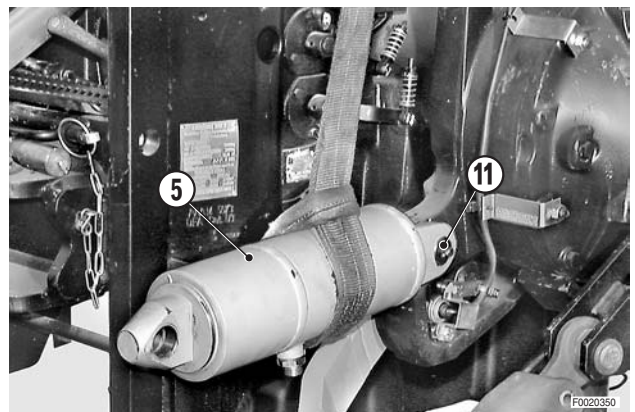


- 6 - Rotate the cylinder (5) so that it is horizontal and attach it to a hoist.



Cylinder: approx. 55 kg (121.2 lb.)

- 7 - Remove the lower pivot pin (11) and the cylinder. 



REFITTING THE LIFT CYLINDERS

- Refitting is the reverse of removal.



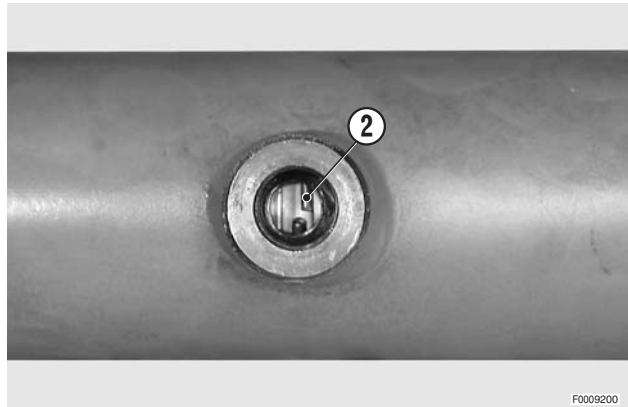
- ★ Lubricate the pivot pins.

- 1 - Start the engine and repeatedly extend the cylinders to their full extent in order to expel air from the system..

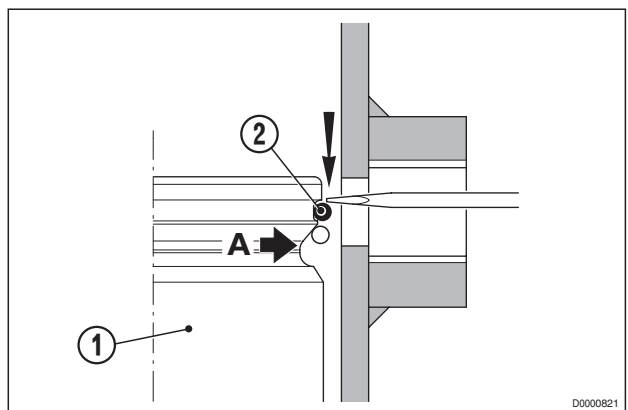
DISASSEMBLY AND ASSEMBLY OF THE LIFT CYLINDERS

1. Disassembly

- 1 - Withdraw the piston (1) to the point where the circlip (2) is visible through the hole of the delivery pipe fitting.
- 2 - Rotate the rod so that the gap in the circlip (2) is visible.



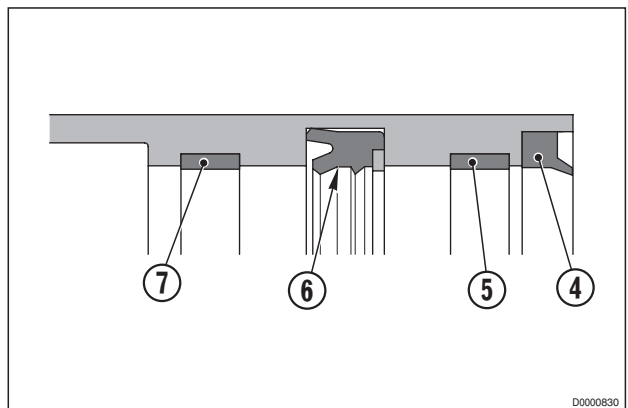
- 3 - Using a screwdriver through the delivery line hole, push one end of the circlip (2) towards the groove "A" in the piston (1) while simultaneously rotating the piston (1) in order to release the circlip (2).
- 4 - Withdraw the complete piston assembly (1).



- 5 - Remove in sequence the wiper seal (4), the guide (5), the seal (6) and the second guide (7).

※ 1 ※ 2


★ Note which way round the seal is fitted.



2. Assembly

- Assembly is the reverse of disassembly.

※ 1

 Seal and guides: Gearbox oil.

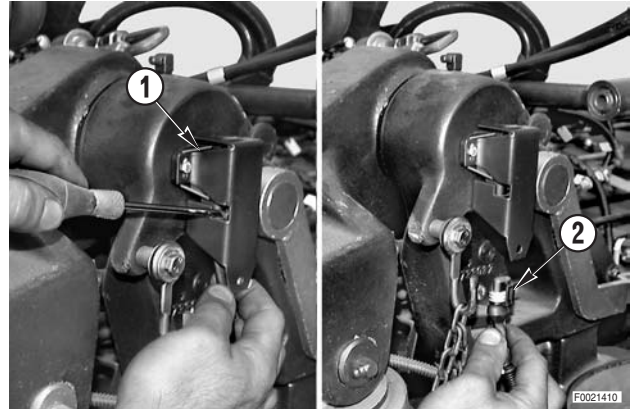
※ 2

- ★ Before inserting the piston, check that the guides are correctly positioned in the seatings in the cylinder.

TESTING THE LIFT POSITION SENSOR

! Switch off the engine and remove the key from the ignition.

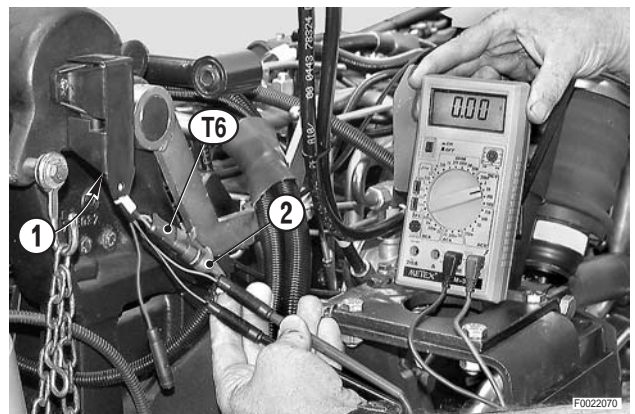
- 1 - Cut the retaining strap and, using a thin blade, disconnect the connector (2) from the position sensor (1).



- 2 - Connect the test lead **T6** (code 5.9030.743.0) between the connector (2) and the sensor (1).

- 3 - Start the engine and with a multimeter check that the supply voltage and the signal voltages with the lift raised and lowered are within the specified ranges:

- ★ Supply voltage (red-blue wires): 5.5 ± 1 Vdc
 - ★ Signal voltage with lift raised (brown-blue wires): equal to or greater than 0.5Vdc
 - ★ Signal voltage with lift lowered (brown-blue wires): less than or equal to 4.5Vdc
- ★ If the voltage readings are not within the specified ranges, renew the sensor.

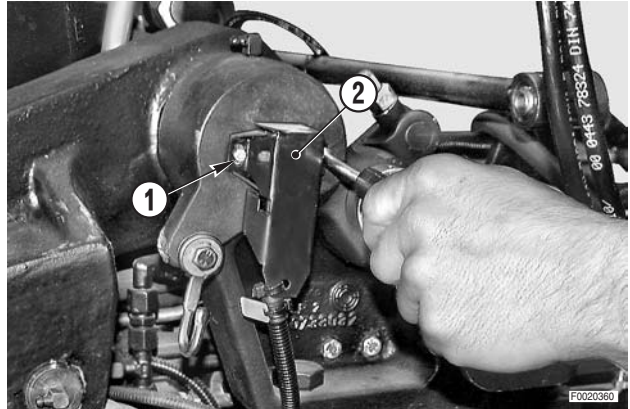


RENEWAL OF THE LIFT POSITION SENSOR

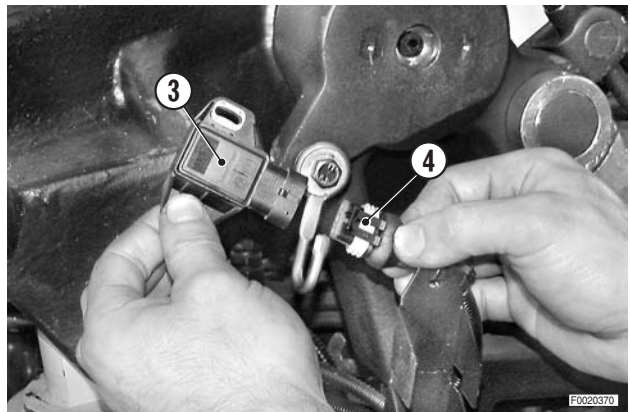
! Switch off the engine and remove the key from the ignition.

1. Removal of the position sensor

1 - Remove the screws (1) securing the cover (2) and the sensor.



2 - Remove the sensor (3) and unplug the connector (4).




2. Renewal of the position sensor bush (only if necessary)

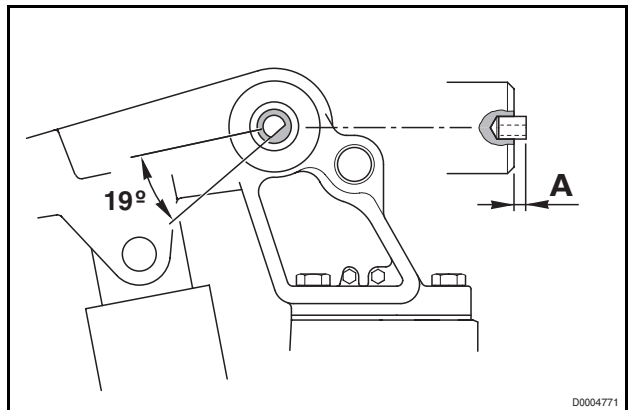
1 - After removing the worn bush, clean and activate the seating.

 Activator: Loctite 7649

2 - Apply sealant to the surfaces of the hole and fit the new bush, aligning the machined guide surfaces of 19° maintaining the protusion "A" of 4.5 ± 0.5 mm.

 Sealant: Loctite 648

3 - Allow the sealant to cure for at least 30 minutes before fitting the sensor.



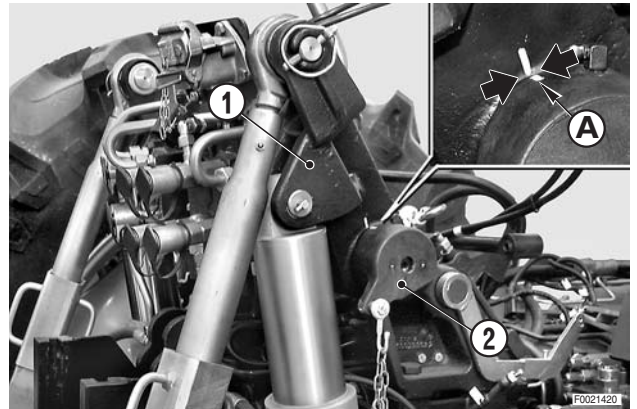
3. Refitting the position sensor

• Refitting is the reverse of removal.

★ Before finally tightening the screws, rotate the sensor fully in a counter-clockwise direction; adjust the position sensor as described in the following paragraph.

4. Position sensor adjustment

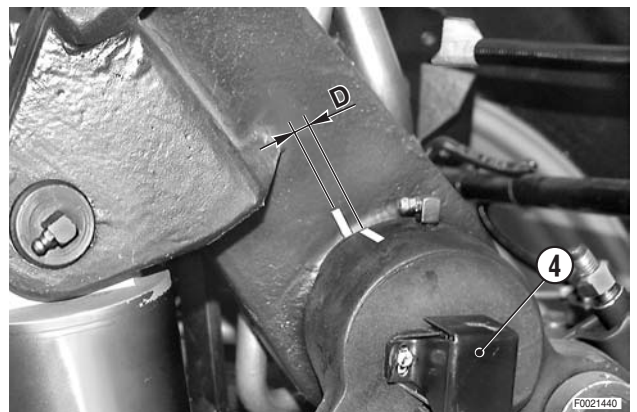
- 1 - Detach any mounted implements from the 3-point linkage.
- 2 - With the engine stopped, raise the lift arms to their maximum height using suitable lifting equipment.
- 3 - Make reference marks on the lever (1) and on the bearing support (2).



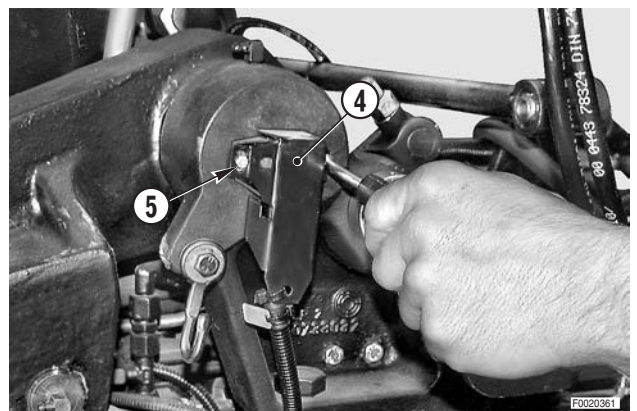
- 4 - Lower the lift to its maximum depth position.
- 5 - Start the engine, push the external pushbutton (3) to rise the lift arms up to its stop. Hold the pushbutton (3) depressed and at the same time rotate the sensor (4) in clockwise.



- 6 - As the sensor (4) is rotated, the lift will start to rise; stop rotating the sensor and release the pushbutton (3) when the reference marks made in step 3 are apart a distance of "D" of 5-6 mm (0.20 - 0.24 in.).



- 7 - Fix the sensor (4) in position by tightening the screws (5).



- 8 - Check the adjustment by first lowering the lift (using external pushbutton (3)) to an intermediate position and then raising to the maximum height by holding the pushbutton pressed; the lift arms should stop before reaching the mechanical limit and thus over-pressurising the hydraulic system, at which point the reference marks should be the distance apart indicated in step 6.

! If the hydraulic system is maintained at maximum pressure for more than 30 seconds during the adjustment procedure, the system will automatically switch to neutral and the error code “37” will be signalled.

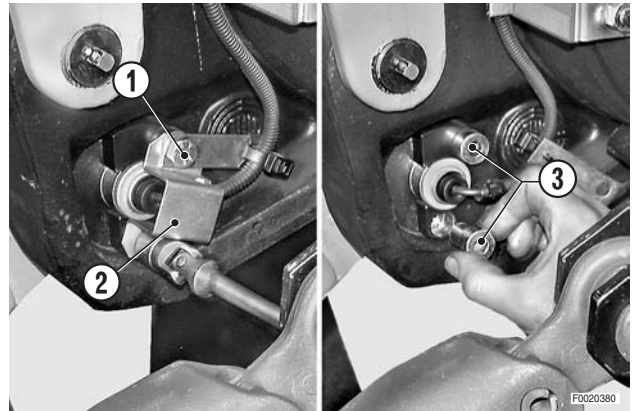
In this case, before repeating the adjustment procedure, first turn the ignition key to the “O” position.

- 9 - If necessary, alter the position of the sensor by turning it a few degrees in a counter-clockwise direction.

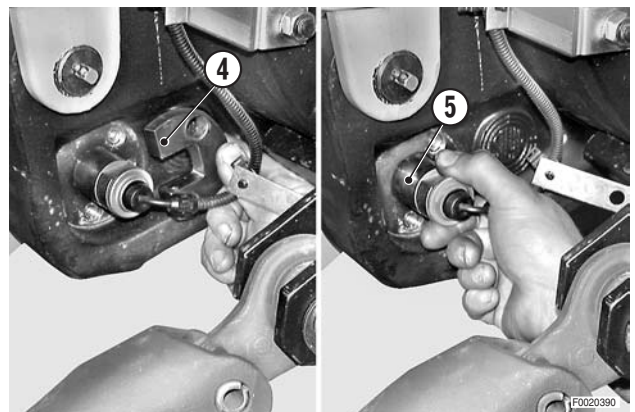


REMOVAL OF THE LIFT DRAFT SENSOR

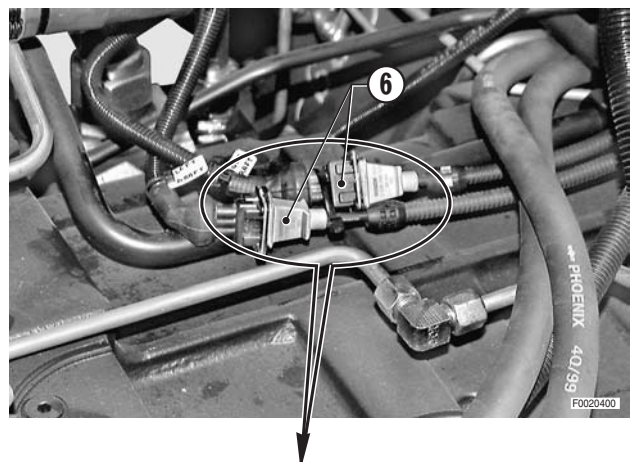
- 1 - Remove the screws (1) and remove the cover (2) and the spacers (3).



- 2 - Support the lever and remove the bracket (4) and then the sensor (5).

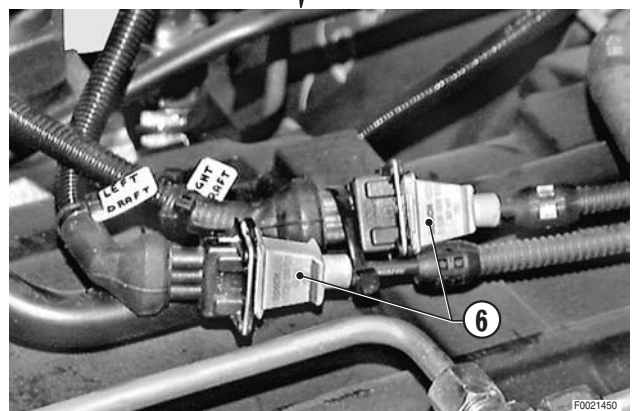


- 3 - Release the wiring from the retaining straps and unplug the sensor connector (6).
 ★ The connectors are located under the cab and can be accessed from the left-hand side of the tractor.



REFITTING THE LIFT DRAFT SENSOR

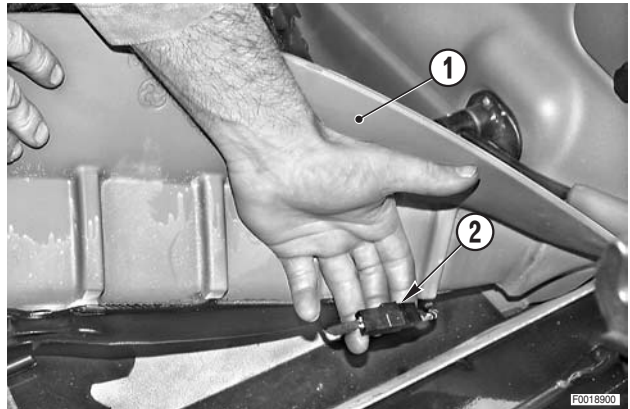
- Refitting is the reverse of removal.
 ★ Make sure the sensor is installed the right way round.



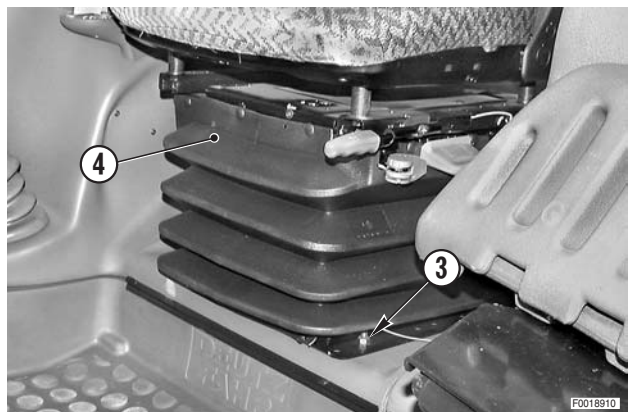
REMOVAL OF THE DRIVER'S SEAT

! Remove the battery cover and disconnect the negative battery lead (-).

- 1 - Lift the rear floor mat (1) and withdraw the feed wire (2) for the compressor for the seat.



- 2 - Remove the four nuts (3) and remove the complete seat assembly (4).



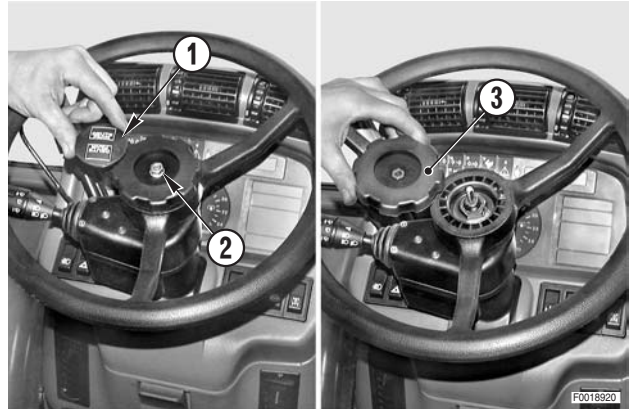
REFITTING THE DRIVER'S SEAT

- Refitting is the reverse of removal.

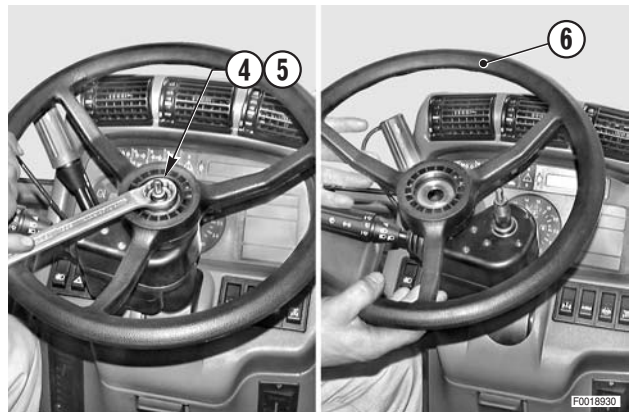
REMOVAL OF THE STEERING WHEEL, STEERING COLUMN SWITCH UNIT AND INSTRUMENT PANEL

⚠ Remove the battery cover and disconnect the negative battery lead (-).

- 1 - Remove the centre cover (1) and remove the nut (2) with its washer.
- 2 - Remove the locknut (3) for telescopic adjustment of the steering wheel.



- 3 - Remove the nut (4), the toothed washer (5) and remove the steering wheel (6). ※ 1

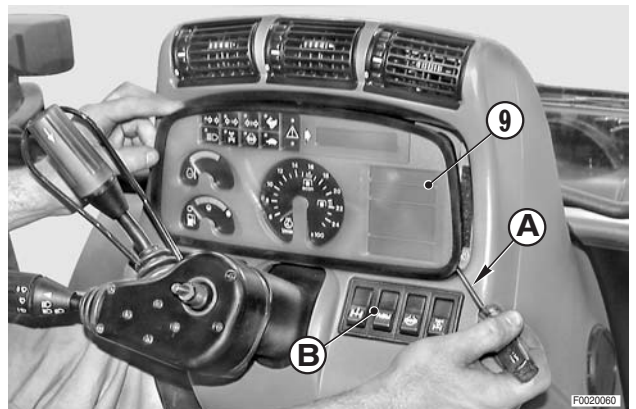


- 4 - Remove the circlip (7) and remove the steering column switch unit (8) from the steering column.

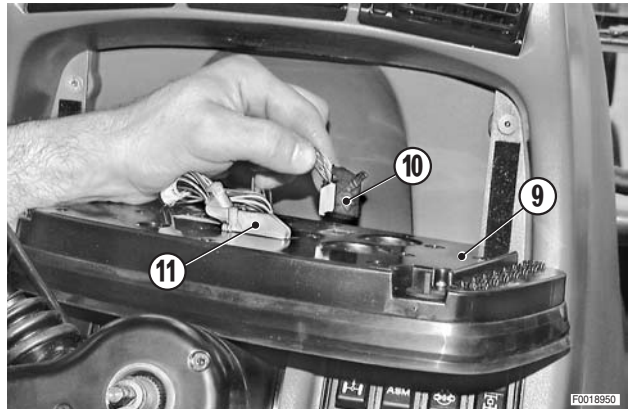


- 5 - Insert a thin blade "A" under the gasket and prise off the instrument panel (9).

★ Alternatively, withdraw the right and left switch groups "B" and push the instrument panel from the inside.




- 6 - Unplug the connectors (10) and (11) from the instrument panel (9); remove the assembly.



REFITTING THE STEERING WHEEL, STEERING COLUMN SWITCH UNIT AND INSTRUMENT PANEL

- Refitting is the reverse of removal.

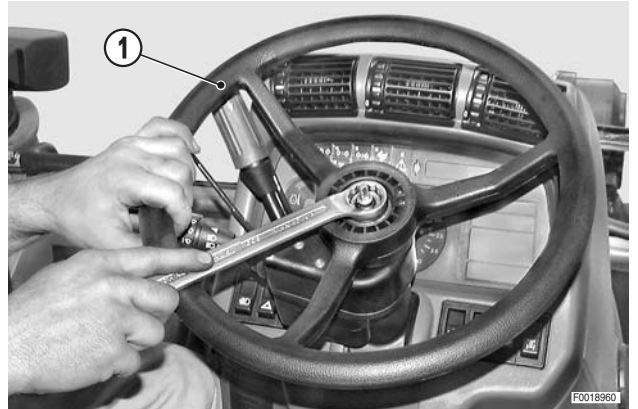
※ 1

-  Steering wheel nut:
M18x1.5: 40±10% Nm (29.5±10% lb.ft.)
M8: 10±2 Nm (7.4±1.5 lb.ft.)

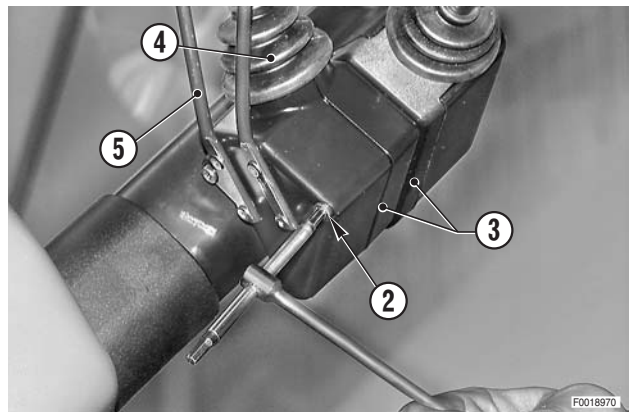
RENEWAL OF THE STEERING COLUMN SWITCH UNIT AND THE SHUTTLE CONTROL LEVER

! Remove the battery cover and disconnect the negative battery lead (-).

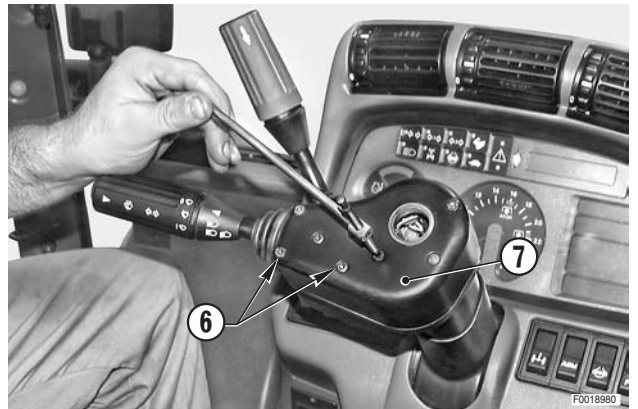
- 1 - Remove the steering wheel (1).
(For details, see «REMOVAL OF THE STEERING WHEEL, STEERING COLUMN SWITCH UNIT AND INSTRUMENT PANEL»).



- 2 - Remove the lower screws (2) joining the shrouds (3) of the shuttle control lever (4) and remove the safety bar (5).



- 3 - Unscrew and remove six screws (6) securing the shrouds of the steering column switch unit (7).

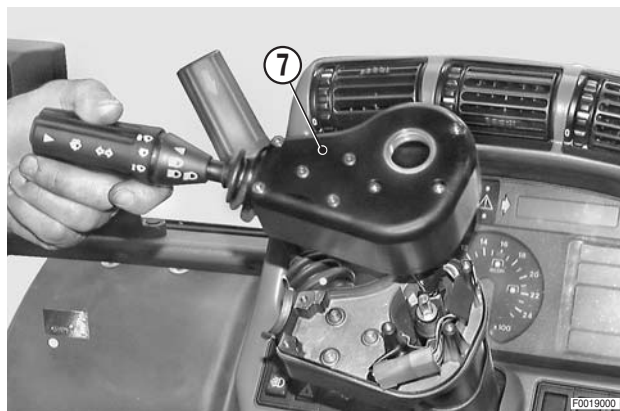


- 4 - Remove the circlip (8) of the steering column switch unit (7).

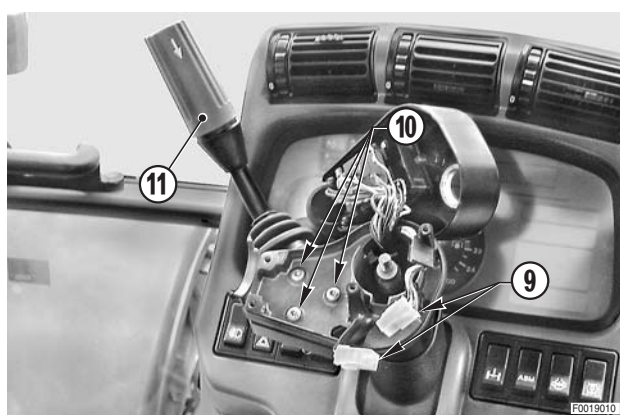


5 - Lift off the switch unit (7) and place it to one side.

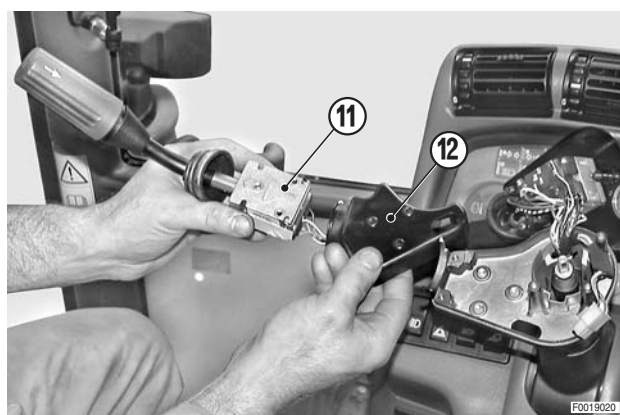
⚠ The contacts of the switch unit are protected by adhesive insulation material; recover this insulation as it will have to be repositioned.



6 - Unplug the connector (9), remove the screws (10) and detach the shuttle control lever assembly (11).



7 - Remove the shuttle control lever (11), detaching it from the cover (12).



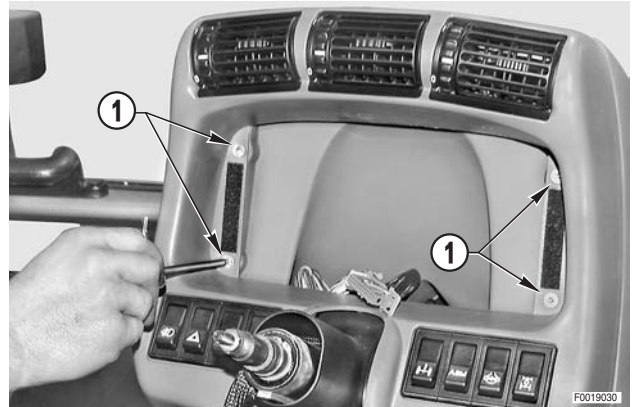
ASSEMBLY OF THE STEERING COLUMN SWITCH UNIT AND THE SHUTTLE CONTROL LEVER

- Refitting is the reverse of removal.
- 1 - Turn the ignition key to position "I" and check operation of the direction indicators, lights and windscreen wiper.
 - 2 - Start the engine and run it at idle speed ; engage a gear and check that the shuttle control lever functions correctly.

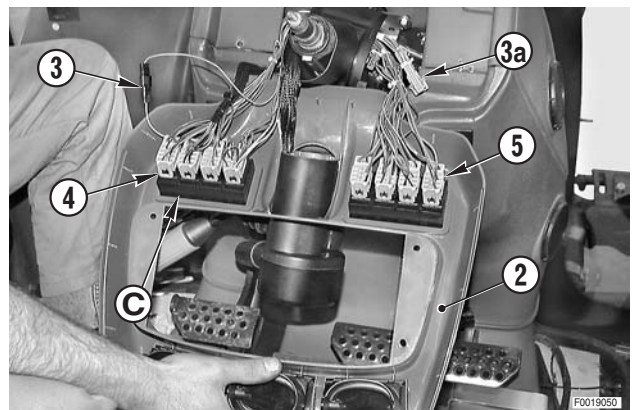
REMOVAL OF CENTRE CONSOLE AND SHROUD

! Remove the battery cover and disconnect the negative battery lead (-).

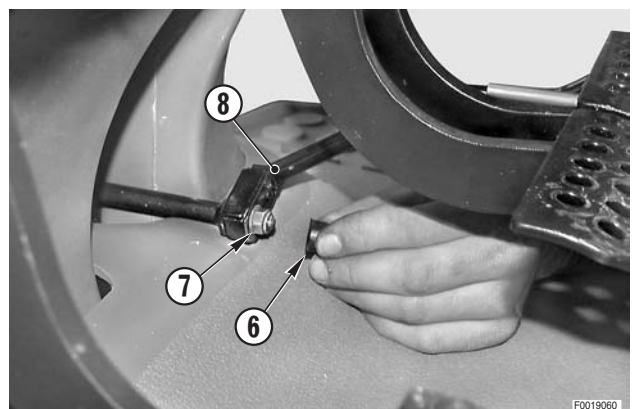
- 1 - Remove the seat.
(For details, see «REMOVAL OF THE DRIVER'S SEAT»).
- 2 - Remove the floor mats.
- 3 - Remove the steering wheel and steering column switch unit.
(For details, see «REMOVAL OF THE STEERING WHEEL, STEERING COLUMN SWITCH UNIT AND INSTRUMENT PANEL».)
- 4 - Unscrew and remove the screws (1).
- 5 - Remove the upper centre console (2) by lifting it upwards.



- 6 - Rotate the console (2) towards the rear of the tractor and unplug the connectors (3), (4) and (5).
 - ★ Note that connectors and pushbuttons all bear identification marks with the exception of the 2nd pushbutton "C" from the left.
 - ★ The unmarked pushbutton is to be connected to its connector **only on models equipped with a front lift**.
 - ★ The connector marked **3a** is not to be connected.



- 7 - Remove cap (6), remove the self-locking nut (7) and its washer and remove the accelerator pedal (8).

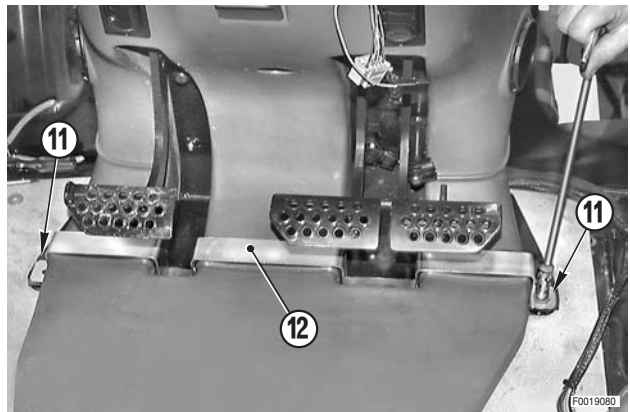


- 8 - Fully lower the steering column.
Pull outwards the lock handle (9) of the steering tilt adjustment; remove the cotter pin (10) and remove the handle.

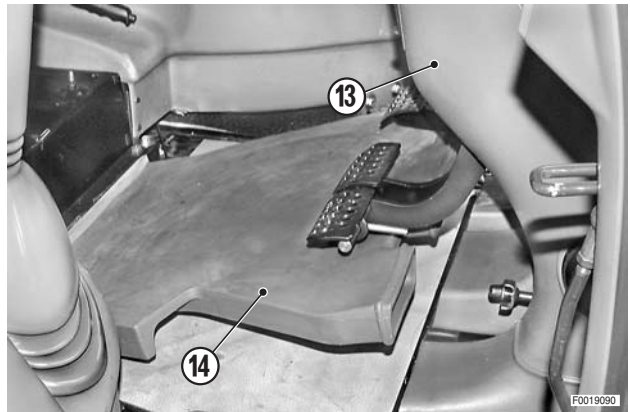
★ Renew the cotter pin at each reassembly.



- 9 - Unscrew and remove the retaining screws (11) of the air duct fascia (12).

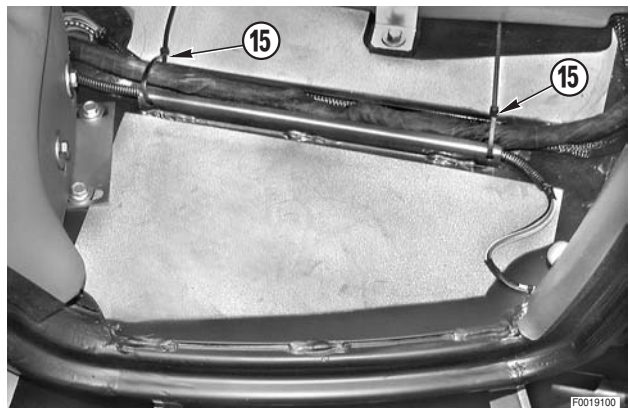


- 10 - Detach the air duct (14) from the centre shroud (13) and remove it.

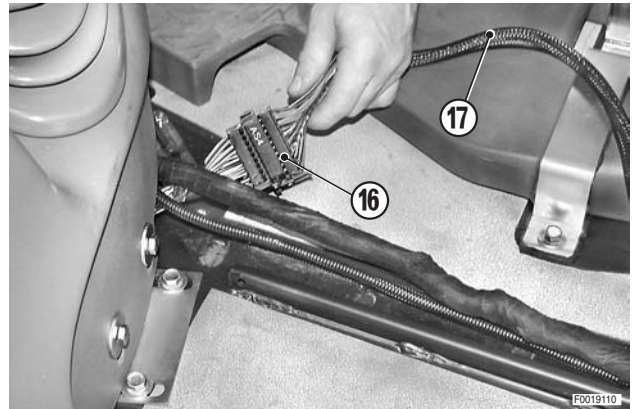


- 11 - Remove the cable ties (15) to release the wiring from the guide fixed to the footplate.

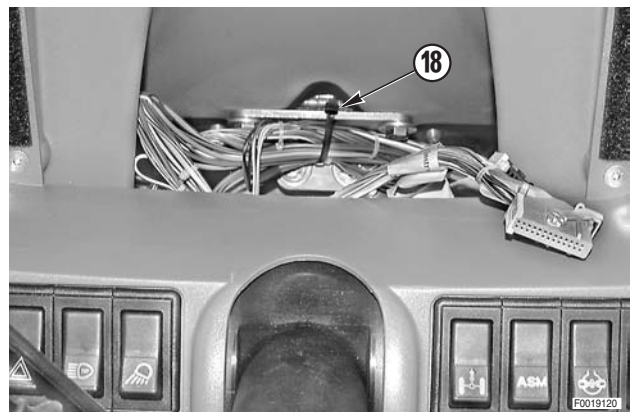
★ Note that the cable ties are located in grooves.



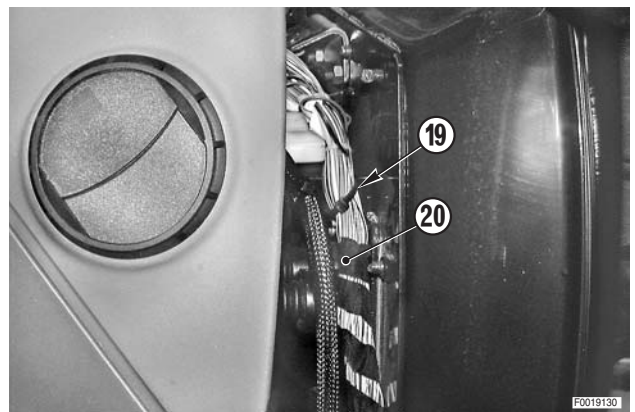
- 12 - Withdraw the wiring (17) from the right-hand console (16).



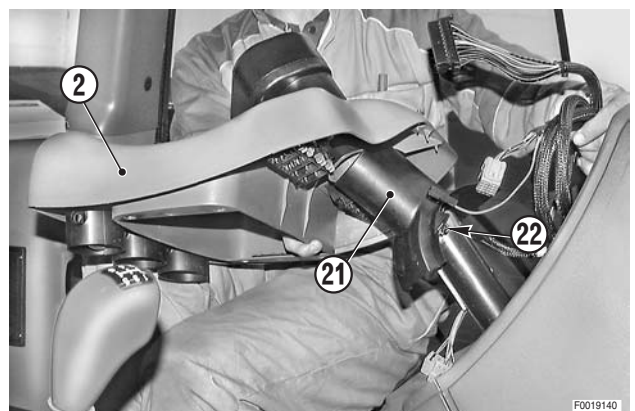
- 13 - Release the wires of the pushbutton connectors from the cable ties (18).



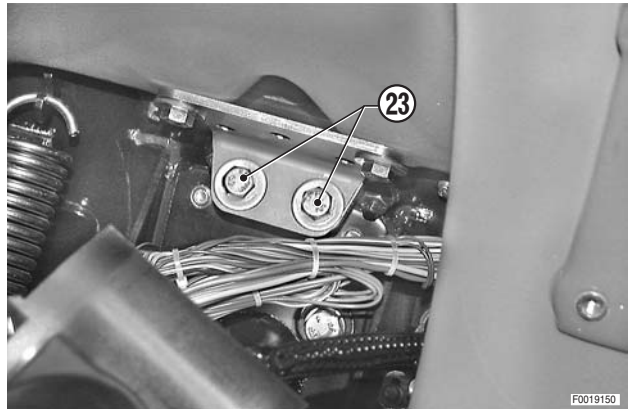
- 14 - Release the vertical wiring (20) from the cable tie (19); withdraw the complete wiring harness through the aperture exposed by tilting the console forwards.



- 15 - Rotate the shroud (21) to align the rotation lock key with the spring (22); remove the shroud (21).
 16 - Remove the complete console assembly (2).



17 - Remove the screws (23).



18 - Lift and tilt the console shroud (13) towards the rear of the tractor to disengage it from the clutch and brake pedals.



REFITTING THE CENTRE CONSOLE AND SHROUD

- Refitting is the reverse of removal.

※ 1

- ★ Check the condition of the fascia gasket; renew it if damaged.

OPENING AND REMOVAL OF THE RIGHT-HAND CONSOLE

- The right-hand console can be partially opened to inspect the wiring and the air conditioning blower and for removal of the hand throttle assembly.

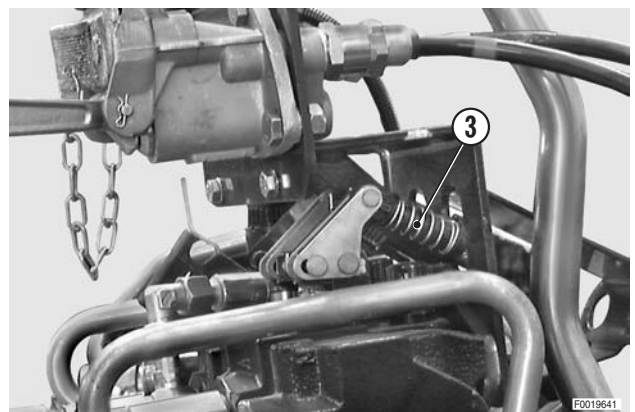
! Remove the battery cover and disconnect the negative battery lead (-).

- 1 - Remove the seat.
(For details, see «REMOVAL OF THE DRIVER'S SEAT»).
- 2 - Remove the gaiter (1) and unplug the connector (2).

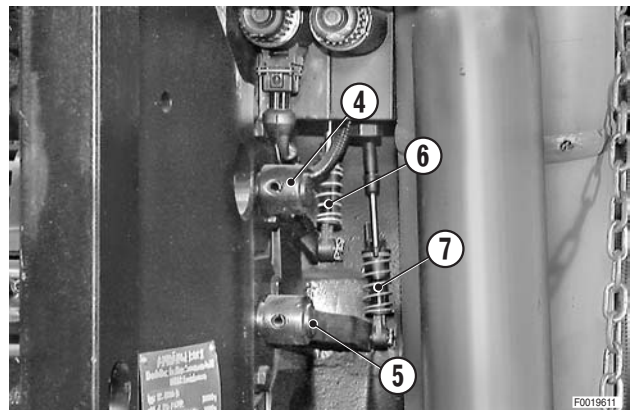


- 3 - **In case of removal only:** disconnect the control cables (3) from the auxiliary service control valves.

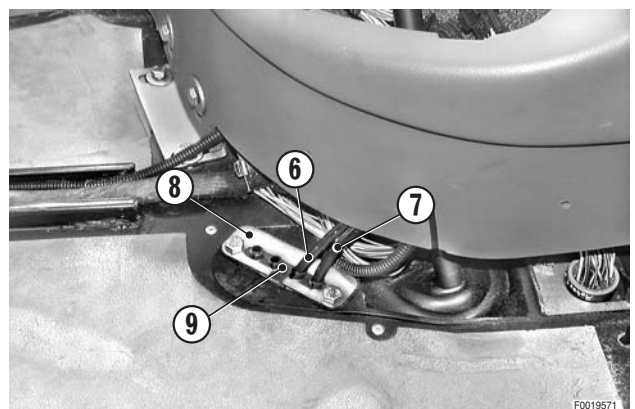
※ 1



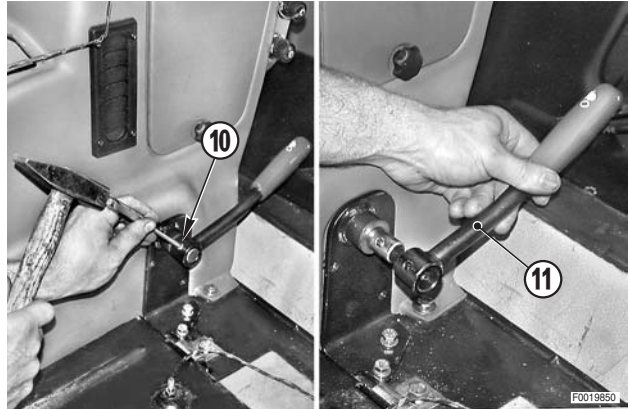
- 4 - Disconnect the control cables (6) and (7) from the speed selector lever (4) or the operating mode lever (5).



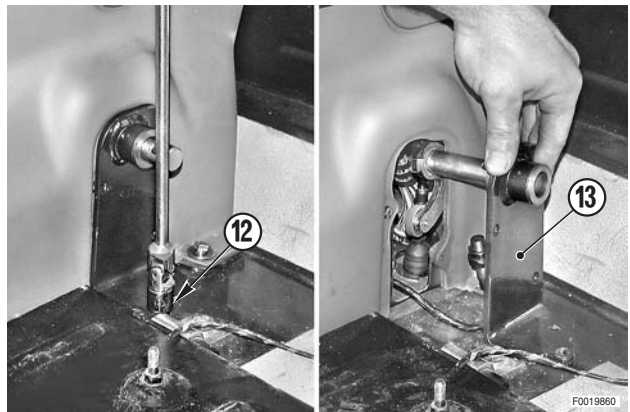
- 5 - Remove the front floor mat and remove the plate (8) of the cable guide (9) in order to free the control cables (6) and (7).



- 6 - Drive out the spring pin (10) and remove the creeper engagement lever (11).

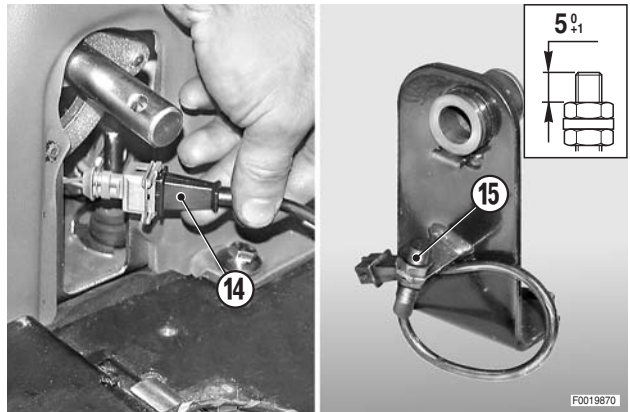


- 7 - Remove the screw (12) move the support (13).

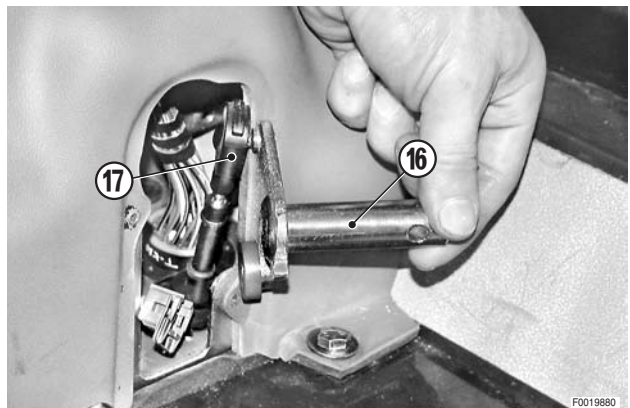


- 8 - Unplug the connector (14) of the lever position sensor (15).

⚠ If the sensor (15) has been removed or replaced, on refitting adjust the protrusion to 5 ± 1 mm (0.197 ± 0.04 in.) relative to the tightened nut.



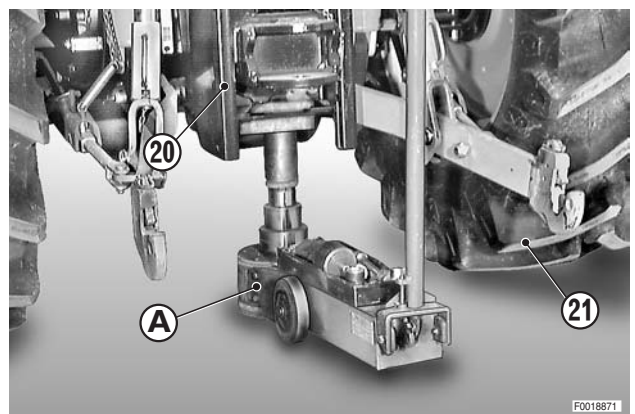
- 9 - Withdraw the pin (16) and disconnect the creeper control cable (17). ※ 1



- 10 - Unscrew and remove the lower bolt (18) of the console (19).



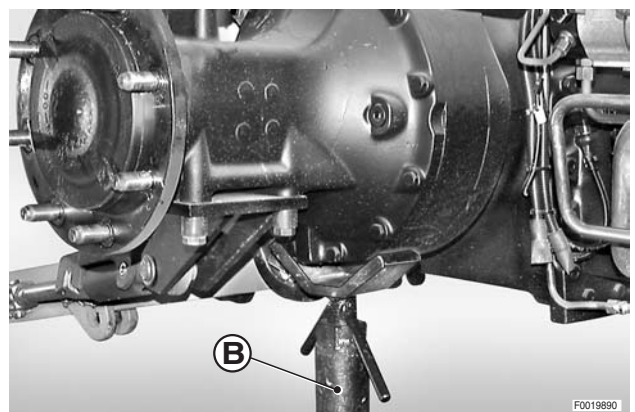
- 11 - Position a hydraulic jack "A" with a non-slip block under the tow hook (20) so that it is inclined towards the right-hand wheel; raise the tractor so that the right wheel is off the ground (21).



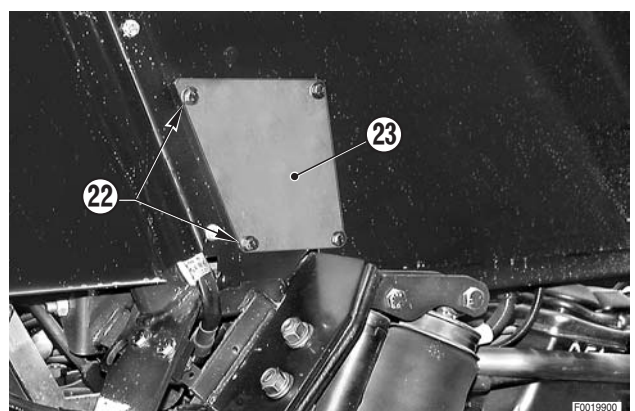
- 12 - Position a jack "B" with safety wings under the right brake assembly; remove the right wheel and lower the tractor onto the stand.

⊠ 1

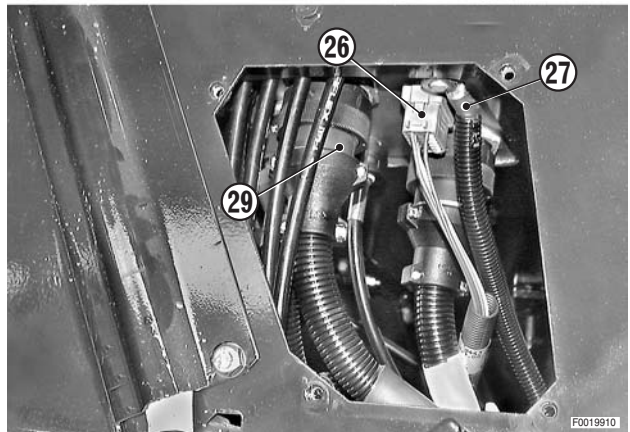
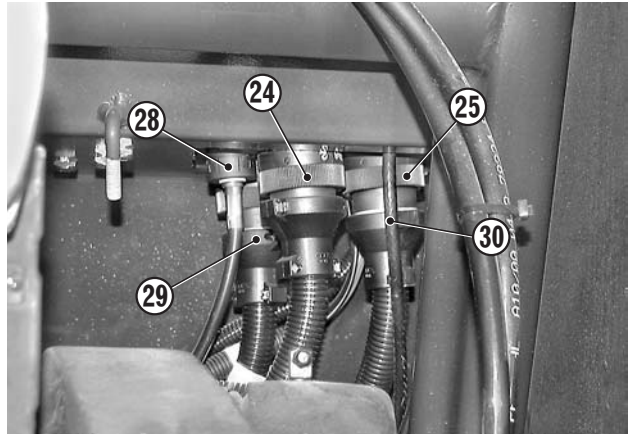
★ Stand load capacity: minimum 2 tons



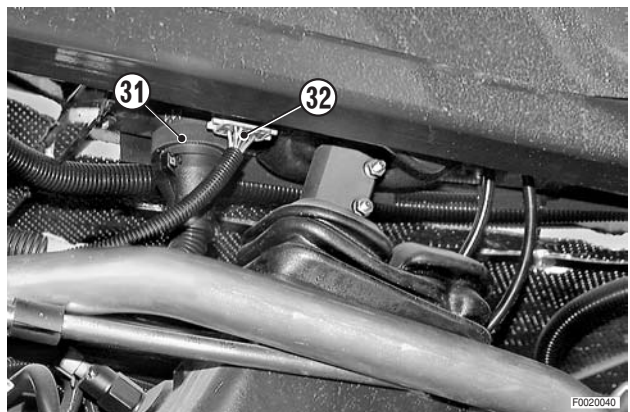
- 13 - **In case of console removal only:**
Remove the four screws (22) and remove the cover plate (23).



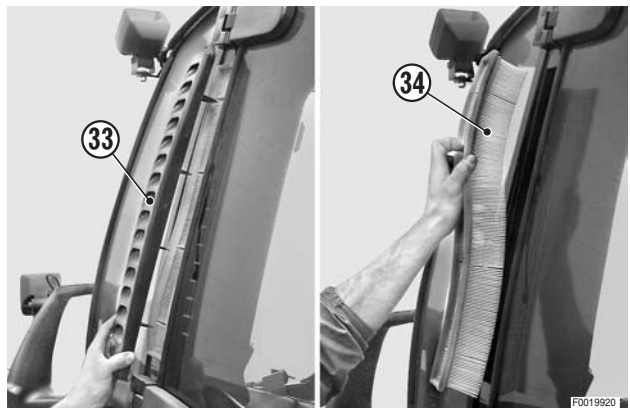
14 - **In case of console removal only:** disconnect from the bulkhead fitting the connectors of the lift line (24) (TKAB2), the transmission (25) (TKAB1), the front suspension (26), the feed cable (27), the creeper engagement indicator cable (28), the cab lights connector (29) and the feed cable (30).



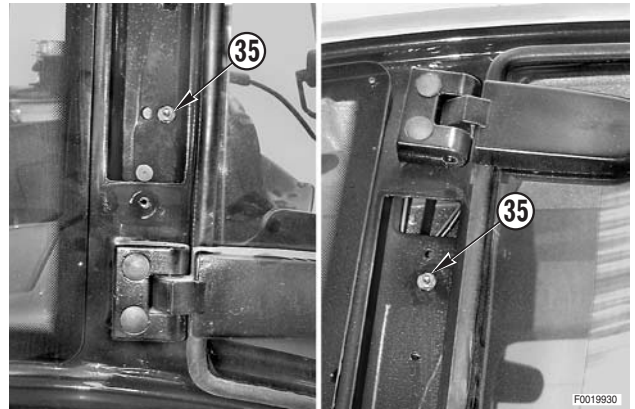
15 - Disconnect the engine line connector (31) and the connector (32) from the bulkhead fitting.



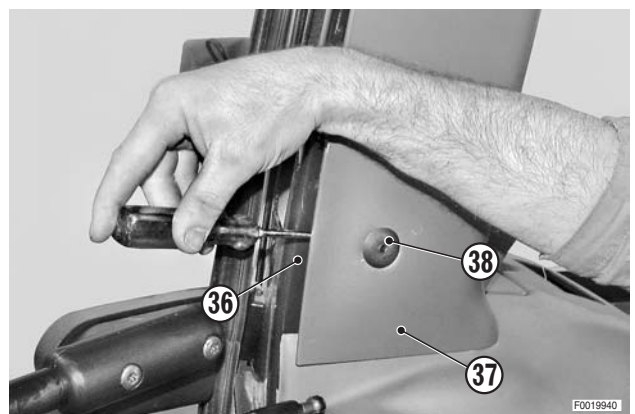
16 - Remove the grille (33) and the filter (34) from the right-hand cab pillar.



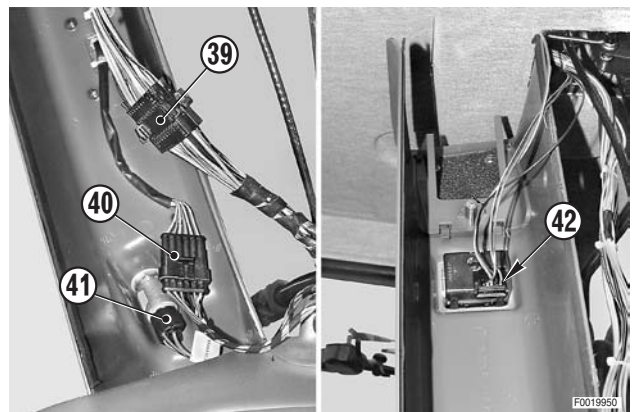
- 17 - Unscrew and remove the trim panel retaining screws (35).



- 18 - Insert a thin blade between the cab pillar (36) and the interior trim (37) and detach the clips (38) from the pillar and the trim.
Remove the trim (37).



- 19 - Unplug the lower connectors (39), (40) and (41) and the upper connector (42).



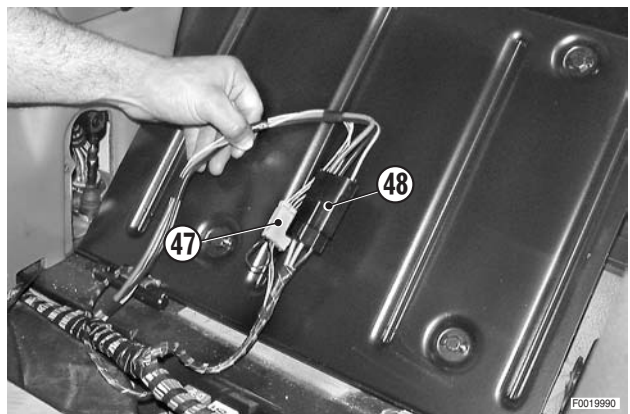
- 20 - Disconnect the gas spring (43) of the right-hand door and remove the mounting pin (44).



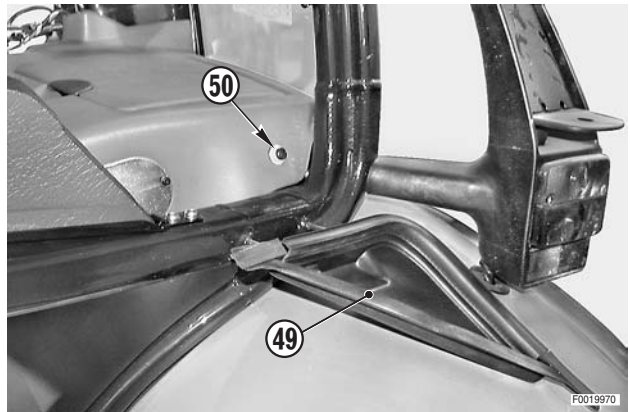
21 - Remove the bolts, lift the seat support (45) and disconnect the hose (46).



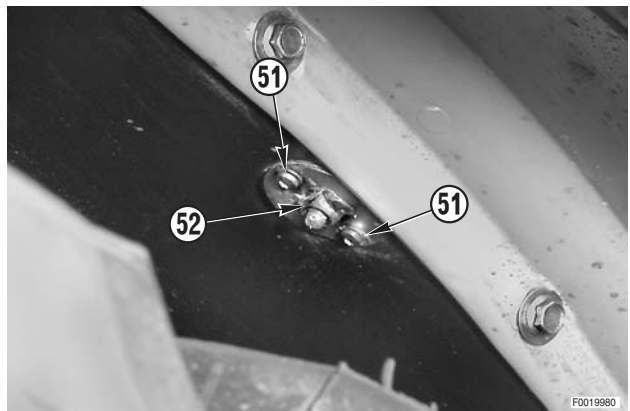
22 - **In case of console removal only:** unplug the connectors (47) and (48).



23 - Open the rear right cable hatch (49) to access the screw (50).



24 - Remove the screws (51) and remove the flanged nut (52) located under the right fender.



25 - Loosen and remove the bolt (53).



26 - Unscrew and remove the front retaining screws (54).



27 - Raise the front of the right-hand console (55) and move it away from the side of the cab; if necessary, remove the console.

- ★ When removing the console, support the electrical wiring and control cables.



REFITTING THE RIGHT-HAND CONSOLE

- Refitting is the reverse of removal.

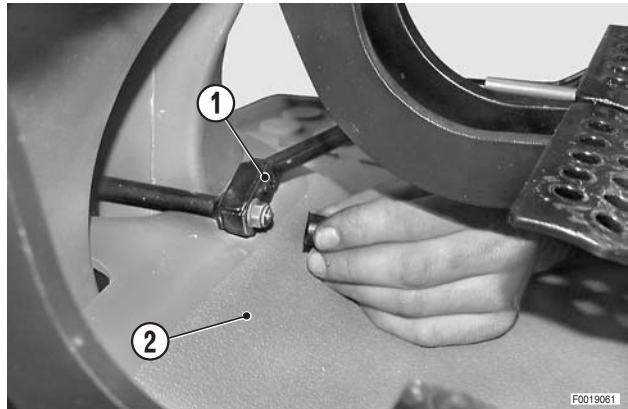
⊠ 1

- ★ Connect the control cables following the operations described in the heading «REFITTING THE AUXILIARY VALVE CONTROL CABLES» AND «REFITTING THE CONTROL CABLES FOR PTO ENGAGEMENT AND SPEED SELECTION»).

REMOVAL OF THE LEFT-HAND CONSOLE

! Remove the battery cover and disconnect the negative battery lead (-).

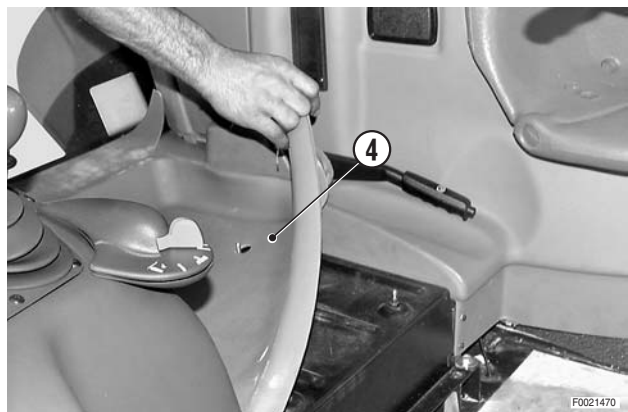
- 1 - Remove the seat. (For details, see «REMOVAL OF THE DRIVER'S SEAT»).
- 2 - Remove the accelerator pedal (1) and remove the front floor mat (2).



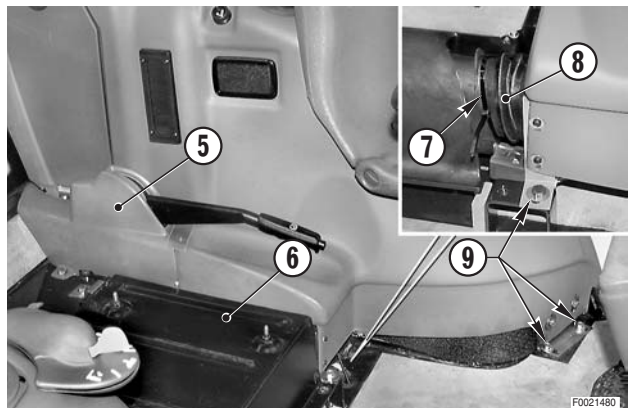
- 3 - **Only where fitted.**
Remove the passenger seat (3).



- 4 - Remove the rear floor mat (4).



- 5 - Remove the parking brake cover (5).
- 6 - Remove the seat support (6) and remove the strap (7) to disconnect the hose (8).
Remove the screw (9).



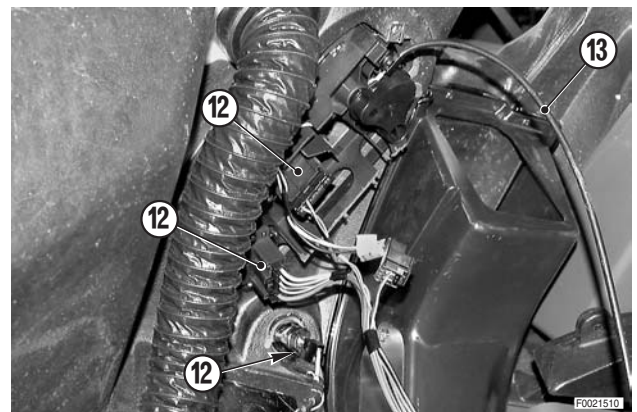
- 7 - Remove the interior trim (10) from the cab pillar.
- 8 - Disconnect the gas spring of the left door and remove the mounting pin.
(For details, see «REMOVAL OF THE RIGHT-HAND CONSOLE»).



- 9 - Remove the fixing screws and move the left-hand console (11) away from the side of the cab.



- 10 - Unplug the four connectors (12).
- 11 - Disconnect the heating valve control cable (13).
- 12 - Remove the left-hand console (11).



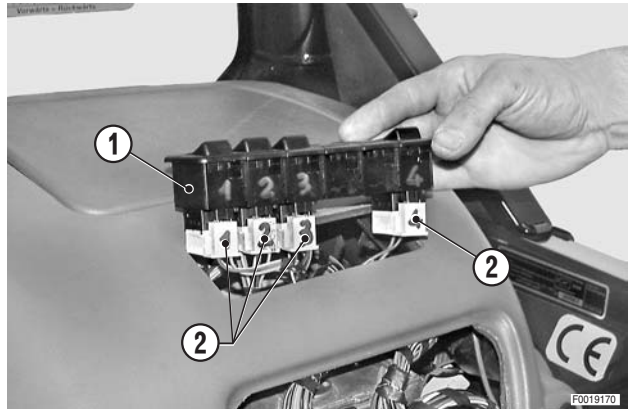
REFITTING THE LEFT-HAND CONSOLE

- Refitting is the reverse of removal.

REMOVAL OF THE LIFT, FRONT SUSPENSION AND TRANSMISSION ELECTRONIC CONTROL UNITS

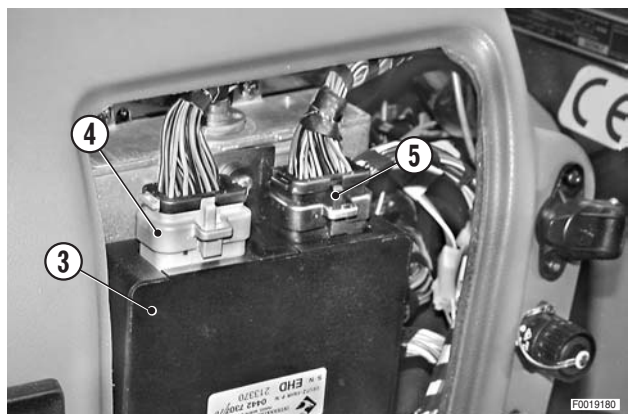
! Remove the battery cover and disconnect the negative battery lead (-).

- 1 - Remove the rear hatch of the right-hand console.
- 2 - Withdraw the switch assembly (1).
- 3 - Label the switches and the corresponding connectors to avoid confusion on reconnection; unplug the connectors (2) and remove the switches.

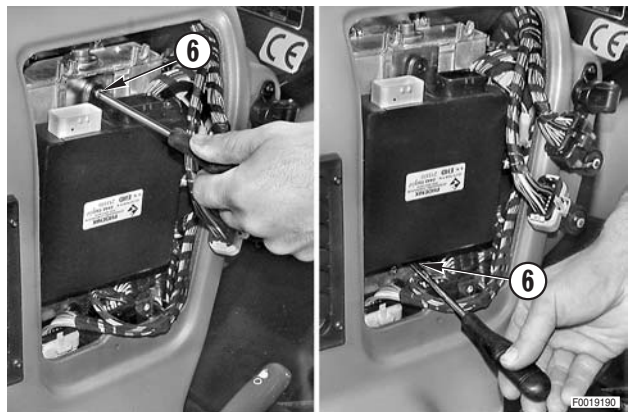


1. Lift ECU

- 1 - Unplug the connectors (4) and (5) from the ECU (3).



- 2 - Unscrew and remove the fixing screws (6) of the lift ECU.

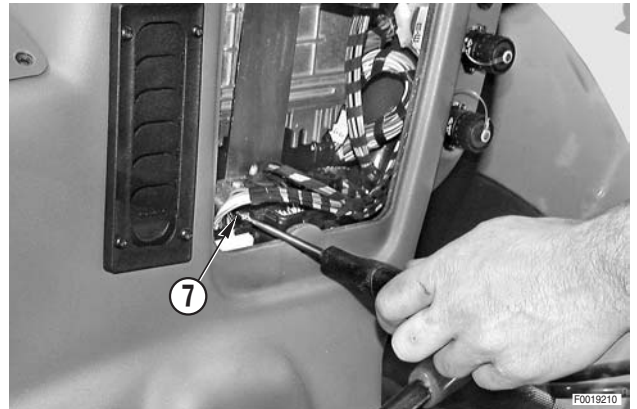


- 3 - Withdraw the ECU (3).

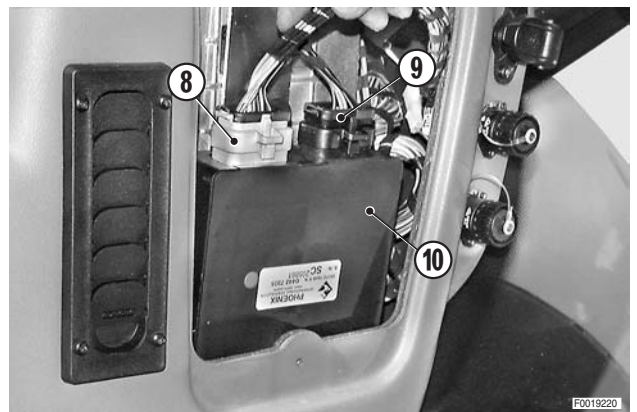


2. Front suspension ECU

- 1 - Remove the lift ECU (see previous paragraph).
- 2 - Unscrew and remove the ECU fixing screw (7).

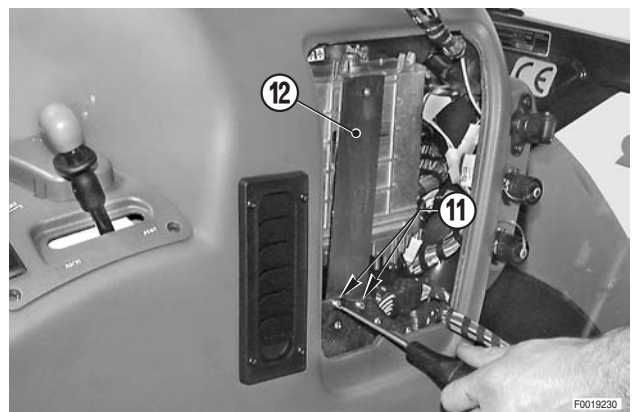


- 3 - Unplug the connectors (8) and (9) and withdraw the ECU (10).

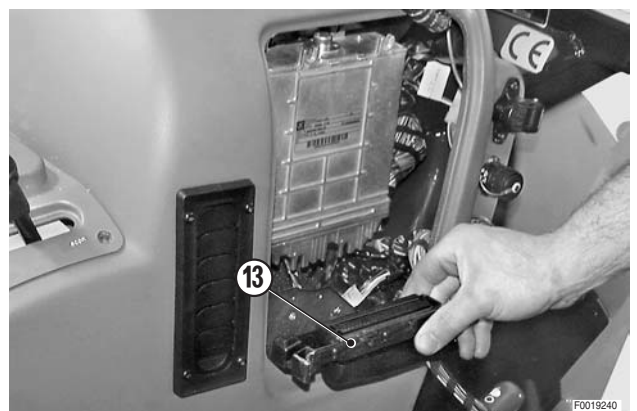


3. Transmission ECU

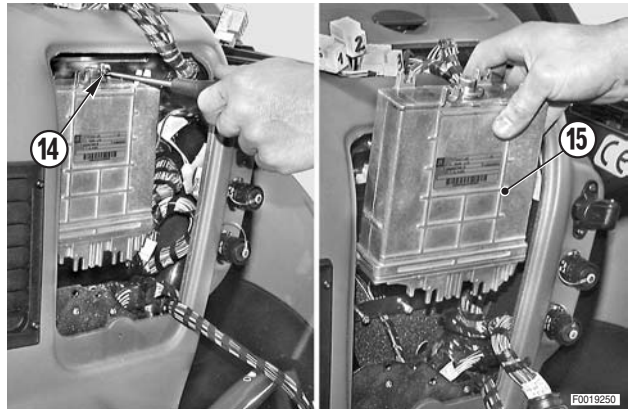
- 1 - Unscrew and remove the screws (11) and remove the bracket (12).



- 2 - Unplug the connector (13).



- 3 - Remove the fixing screws (14) and withdraw the ECU (15).



REFITTING THE LIFT, FRONT SUSPENSION AND TRANSMISSION ELECTRONIC CONTROL UNITS

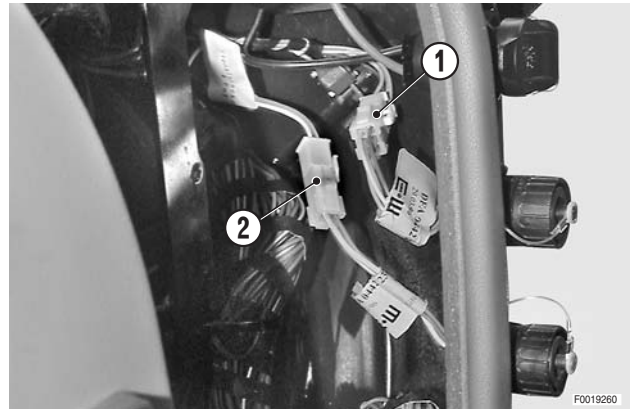
- Refitting is the reverse of removal.

REMOVAL OF THE FUSE AND RELAY BOARD

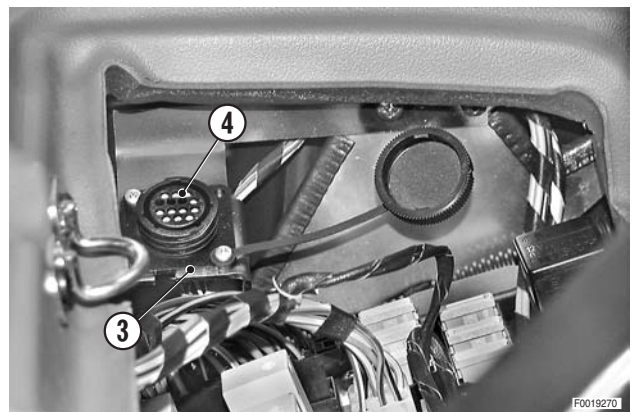
! Remove the battery cover and disconnect the negative battery lead (-).

1 - Remove the ECUs of the lift, the front suspension and the transmission.
(For details, see «REMOVAL OF THE LIFT, FRONT SUSPENSION AND TRANSMISSION ELECTRONIC CONTROL UNITS»).

2 - Unplug the connectors (1) and (2) from the signal outlet sockets and the external outlet socket for trailer-mounted implements.



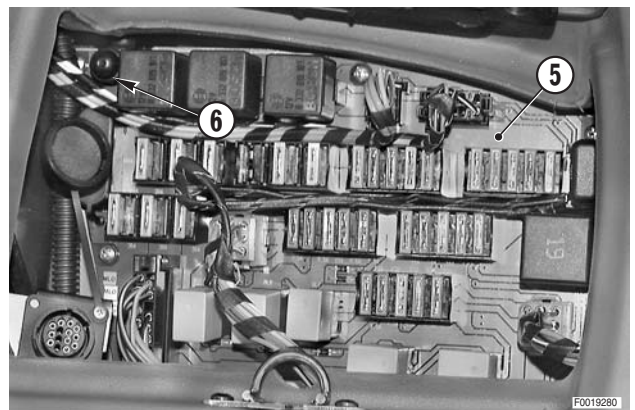
3 - Remove the bracket (3) of the diagnostics outlet (4) and place it to one side.



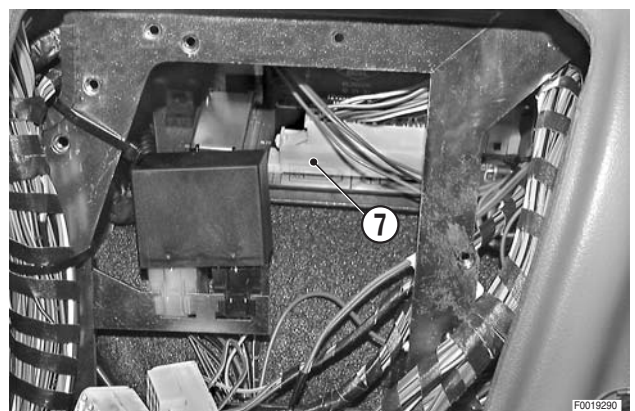
4 - Disconnect the connectors (P2), (P6), (P3), (P5), (J1), (J2) and (J3) from the fuse/relay board.

★ The connectors are marked with the same symbols as the sockets on the circuit board.

5 - Remove the cover and disconnect the earth lead (6).

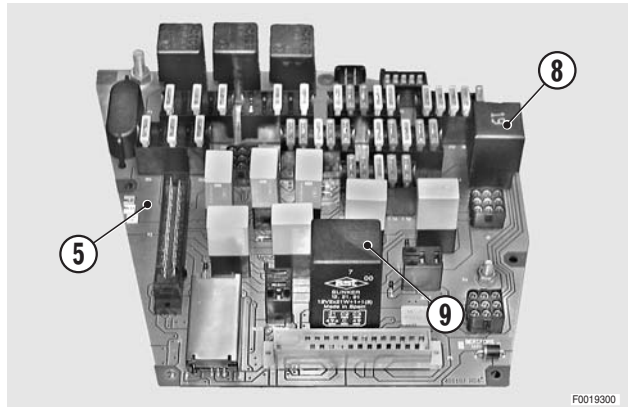


6 - Disconnect the connector (7) (P5), which is accessed through the ECU compartment.

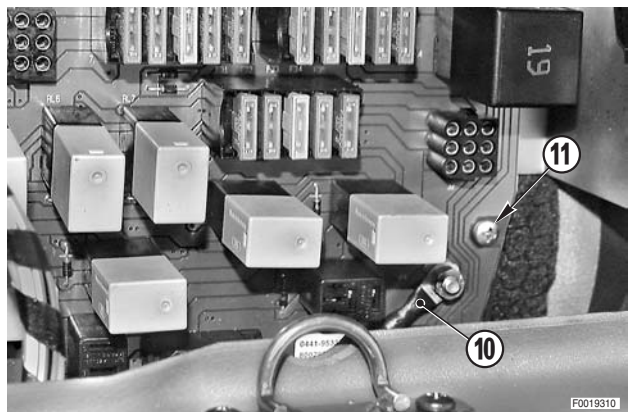


7 - Remove the relays from the board (5) which prevent its removal:

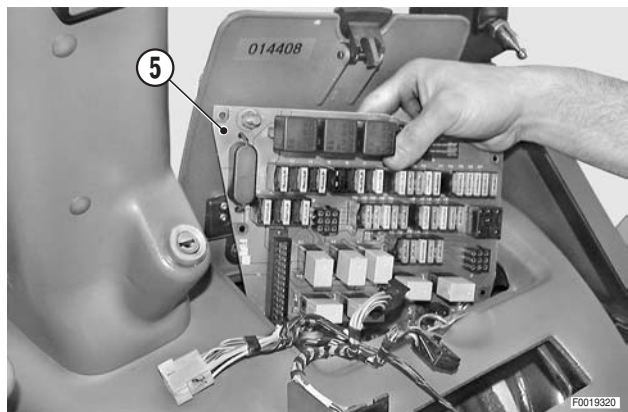
- RL4 - front windscreen (8)
- RL14 - direction indicators (9)



8 - Disconnect the lead (10) and remove the five fixing screws (11).



9 - Remove the board (5).



REFITTING THE FUSE AND RELAY BOARD

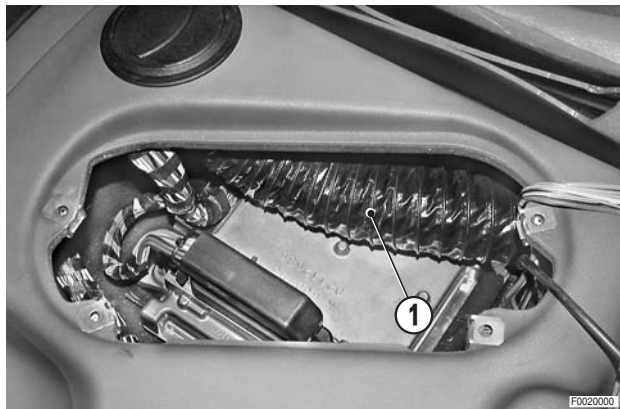
- Refitting is the reverse of removal.

REMOVAL OF THE ENGINE ECU

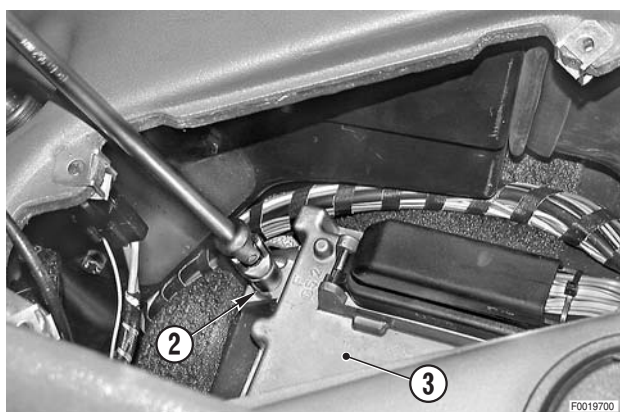
! Remove the battery cover and disconnect the negative battery lead (-).

- 1 - Remove the ventilation and heater control panel. (For details, see «REMOVAL OF CLIMATE CONTROL PANEL»).
- 2 - Disconnect the air hose (1) from the outlet vent and position it to one side.

※ 1

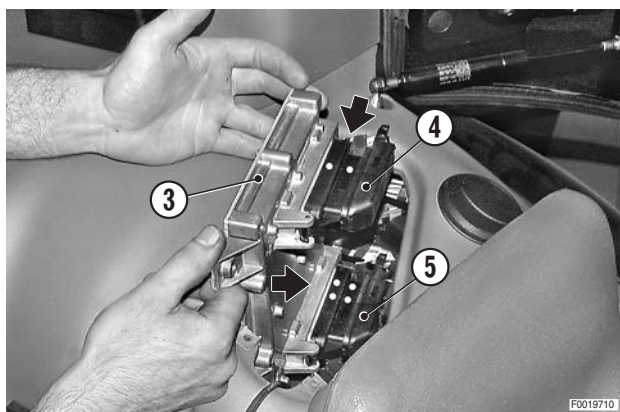


- 3 - Loosen the fixing screws (2) and partially withdraw the ECU (3).



- 4 - Label and unplug the connectors (4) and (5).

- 5 - Remove the ECU (3).



REFITTING THE ENGINE ECU

- Refitting is the reverse of removal.

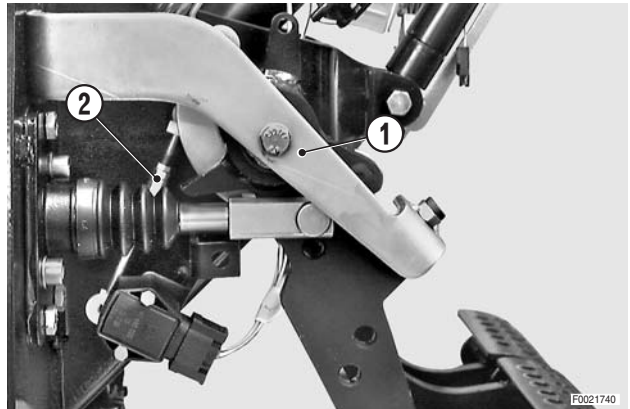
※ 1

- The air hose must be routed over the top of the ECU between the two connectors.

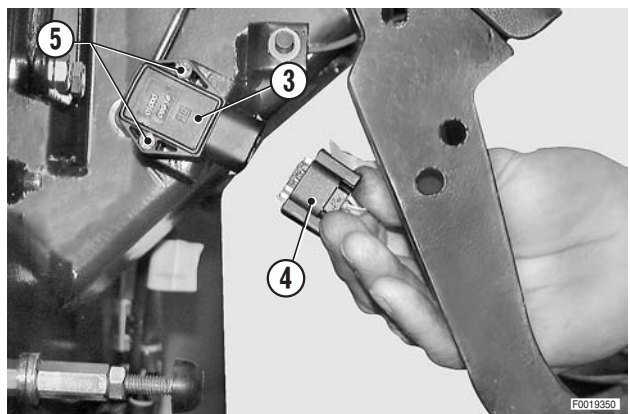
CLUTCH PEDAL AND RELATED DEVICES (Power Shift version)

1. Removal of the potentiometer

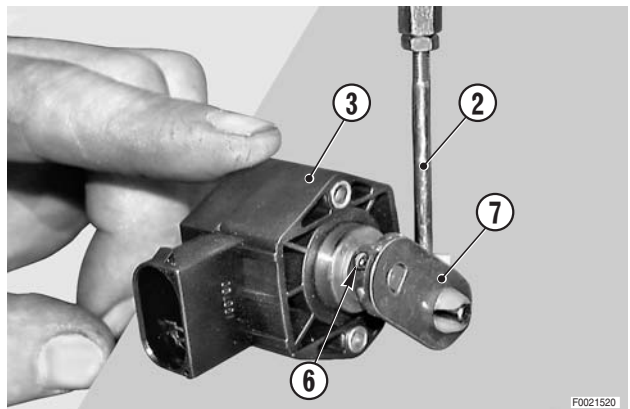
- 1 - Remove the centre console and console shroud.
(For details, see «REMOVAL OF THE CENTRE CONSOLE AND SHROUD»).
- 2 - Disconnect the tie-rod (2) from the clutch pedal (1).



- 3 - Unplug the connector (4) from the potentiometer (3).
- 4 - Remove the screws (5) and remove the potentiometer complete with the tie-rod.



- ★ If a new potentiometer is to be fitted, disconnect the tie-rod (2), remove the cotter pin (6) and the lever (7).
- ★ Renew the cotter pin at each re-assembly.



1.1. Refitting the potentiometer.

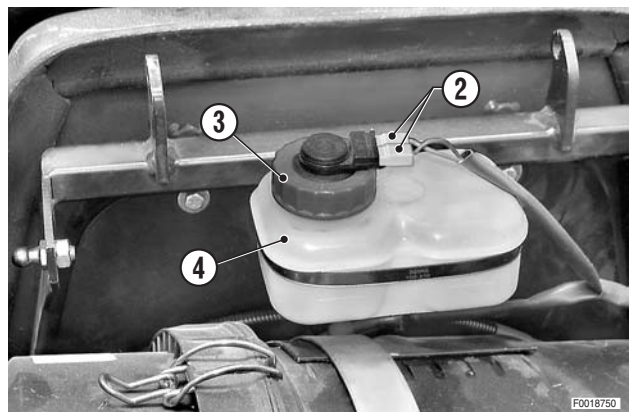
- Refitting is the reverse of removal.
- ⚠ After refitting the potentiometer, check the position of the pedal and its travel; check also the calibration values using the programming/diagnostics tester.
(For details, see EDS Programming in section 20).

2. Renewal of the clutch master cylinder

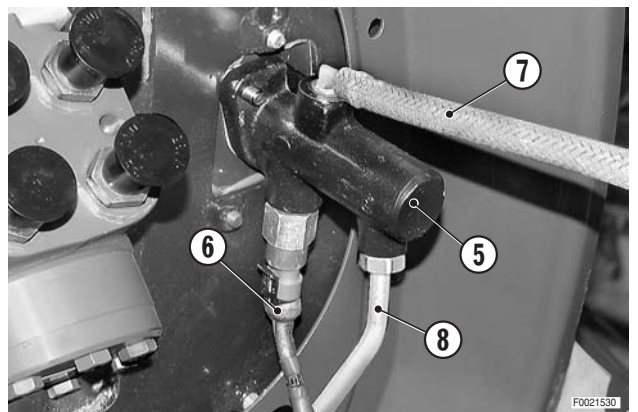
- 1 - Remove the engine hood side panels. (For details, see «REMOVAL OF THE ENGINE HOOD AND FRONT GRILLE»).
- 2 - Remove the air cleaner. (For details, see «REMOVAL OF THE AIR CLEANER»).
- 3 - Remove the screws and remove the insulation panel (1).



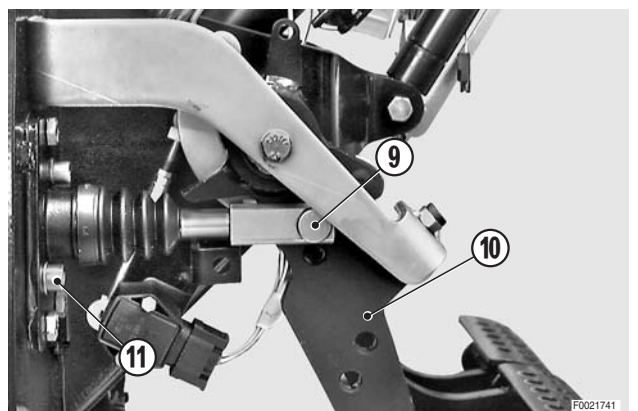
- 4 - Unplug the connectors (2) of the brake fluid level warning light.
- 5 - Remove the cap (3) and draw off the fluid contained in the brake fluid reservoir (4).



- 6 - Disconnect the connector (6), the suction pipe (7) and the delivery pipe (8) from the clutch master cylinder (5).
 - ★ Plug the ends of the pipes to prevent the entry of contaminants.



- 7 - Remove the rod (9) and disconnect the clutch master cylinder from the pedal (10).
- 8 - Remove the screws (11) and remove the master cylinder.

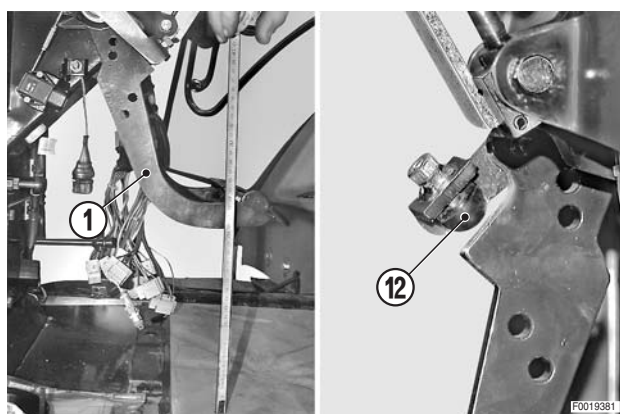


2.1 Refitting the clutch master cylinder

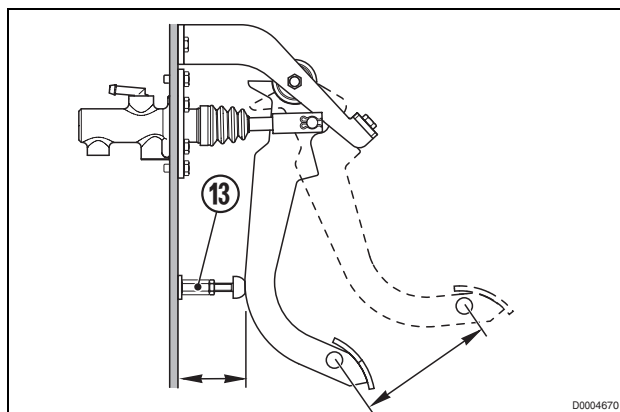
- Refitting is the reverse of removal.
- 1 - Fill the brake fluid reservoir to the maximum level.
 - 2 - Bleed the air from the clutch control circuit using the same procedure as for bleeding the braking system. (For details, see «BLEEDING THE BRAKING SYSTEM»).

3. Adjustment of the clutch pedal position and travel

- 1 - Check that the distance between the top edge of the clutch pedal and floor is the same as that of the brake pedals.
If necessary, adjust the pedal height by adjusting the buffer (12).



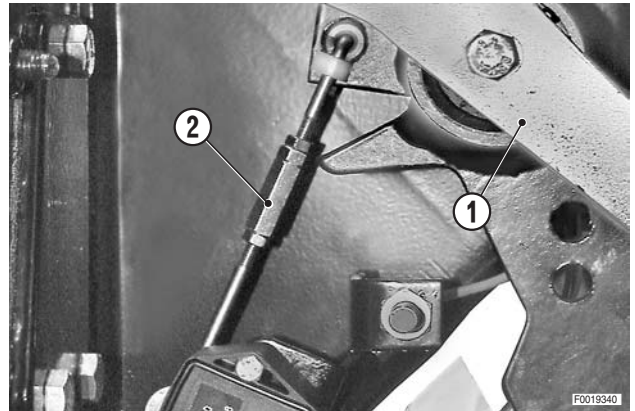
- 2 - Adjust the buffer (13) so that it protrudes 68 ± 1 mm (2.68 ± 0.04 in.), equivalent to a pedal travel of approximately 144–145 mm (5.67–5.71 in.).



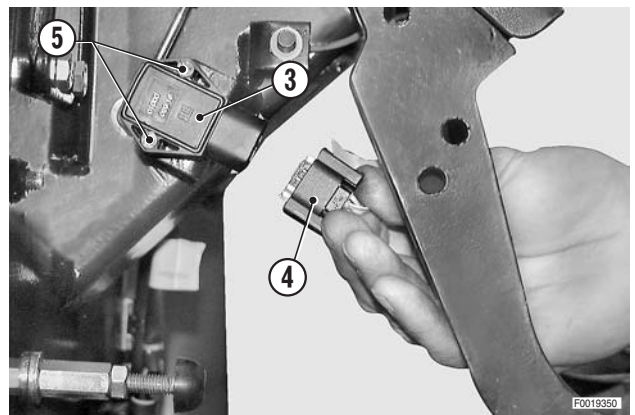
CLUTCH PEDAL AND RELATED DEVICES (Power Shuttle version)

1. Removal of the potentiometer

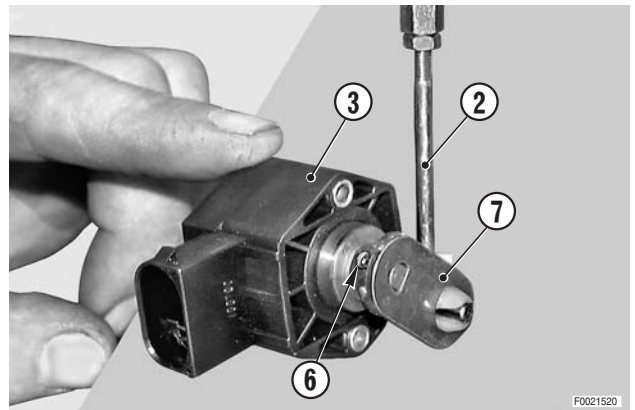
- 1 - Remove the centre console and console shroud.
(For details, see «REMOVAL OF THE CENTRE CONSOLE AND SHROUD»).
- 2 - Disconnect the tie-rod (2) from the clutch pedal (1).



- 3 - Unplug the connector (4) from the potentiometer (3).
- 4 - Remove the screws (5) and remove the potentiometer complete with the tie-rod.



- ★ If a new potentiometer is to be fitted, disconnect the tie-rod (2), remove the cotter pin (6) and the lever (7).
- ★ Renew the cotter pin at each re-assembly.

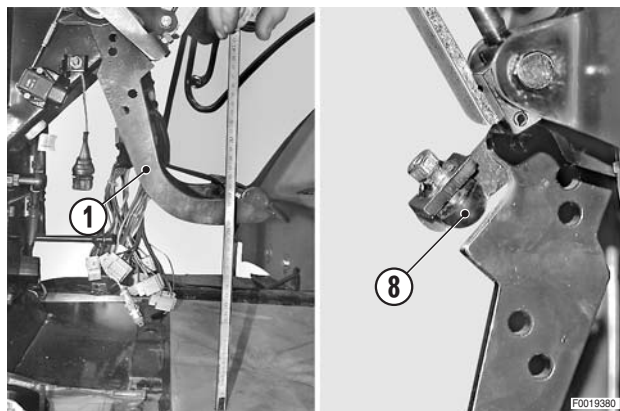


1.1. Refitting the potentiometer.

- Refitting is the reverse of removal.
 - ⚠ After refitting the potentiometer, check the position of the pedal and its travel; check also the calibration values using the programming/diagnostics tester.
- NOTE.** After adjusting the height of the clutch pedal, check using the EDS program in section 20 that the output voltage of the potentiometer is 4.3V.
If necessary, adjust the length of the tie-rod (2) to obtain this value.

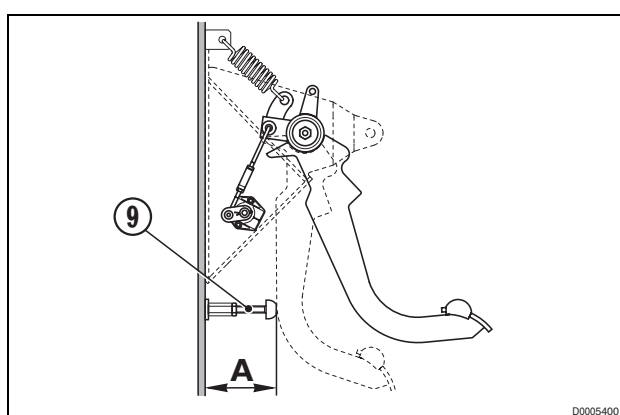
2. Adjustment of the clutch pedal position and travel

- 1 - Check that the distance between the top edge of the clutch pedal (1) and floor is the same as that of the brake pedals.
If necessary, adjust the pedal height by adjusting the buffer (8).



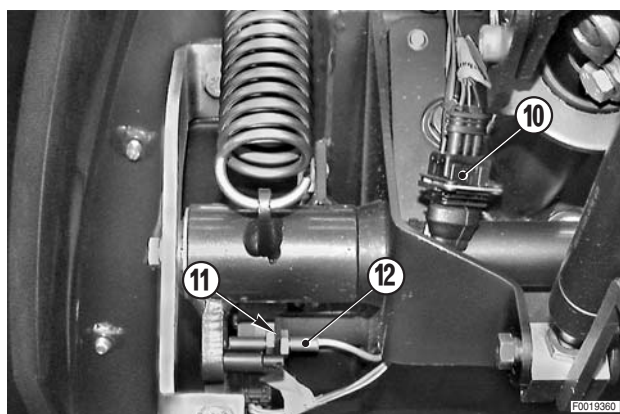
- 2 - Regolare il tampone (9) fino ad ottenere una corsa del pedale "A" di 155 ± 5 mm (6.107 ± 0.197 in.)

NOTE. With the EDS program in section 20, check that the voltage reaches a value of 0.9–1.1V.

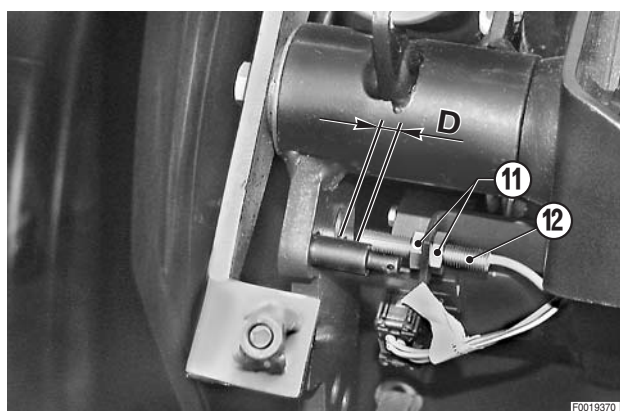


3. Renewal of the proximity sensor

- 1 - Unplug the connector (10).
- 2 - Unscrew the nut (11) sufficiently to disengage it from the sensor (12).
- 3 - Check that the axial play of the pedal is within the range of 0.1–0.6 mm (0.004 – 0.024 in.); if the play exceeds the permitted maximum, adjust it before adjusting the position sensor (12).



- 4 - Fit the new sensor (12) following the removal procedure in reverse.
Fully depress the clutch pedal.
- 4 - Adjust the position of the sensor relative to the lever by way of the adjuster nuts (11).
★ Distance "D" between the lever and the sensor:
0.5–1 mm (0.02 – 0.04 in.)

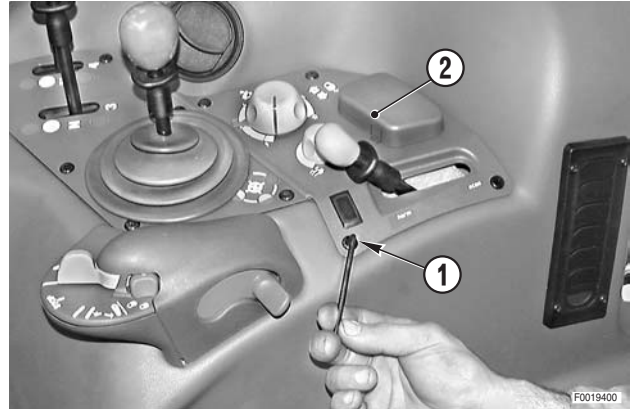


REMOVAL OF THE CONTROL PANELS AND LEVERS OF THE AUXILIARY SERVICE VALVES AND THE PTO

! Remove the battery cover and disconnect the negative battery lead (-).

1. Removal of the lift and rear PTO control panel.

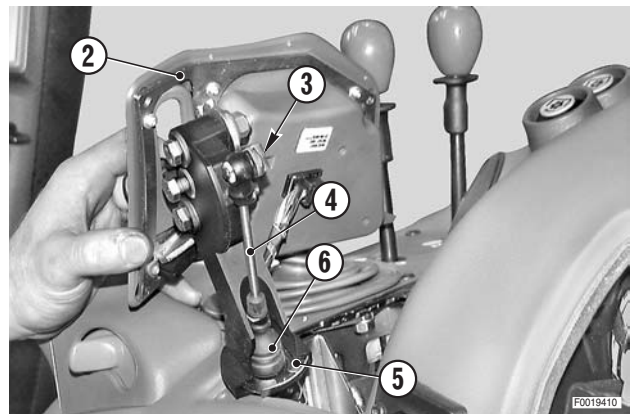
1 - Unscrew and remove fixing screws (1) of the lift control panel (2).



2 - Lift the assembly (2) and disconnect the PTO selector control cable (4) from the lever (3).

3 - Remove the yoke (5) securing the outer cable (6) and disconnect it.

✳ 1

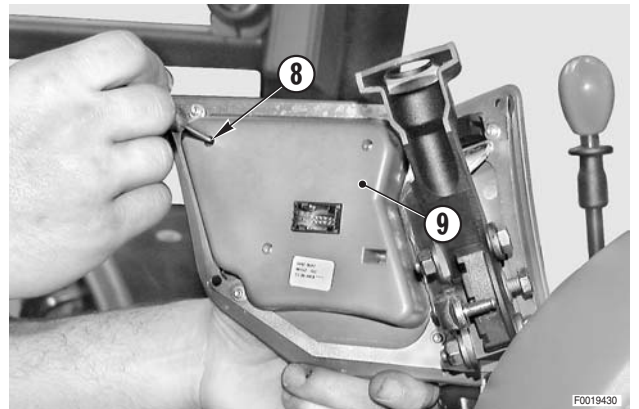


4 - Unplug the connector (7) and remove the assembly (2).



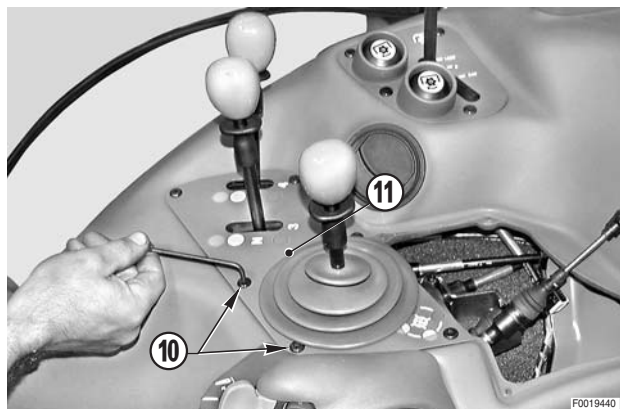
5 - **Only in the case of testing or renewal of the potentiometers.**

Unscrew and remove the screws (8) and remove the lower cover (9).

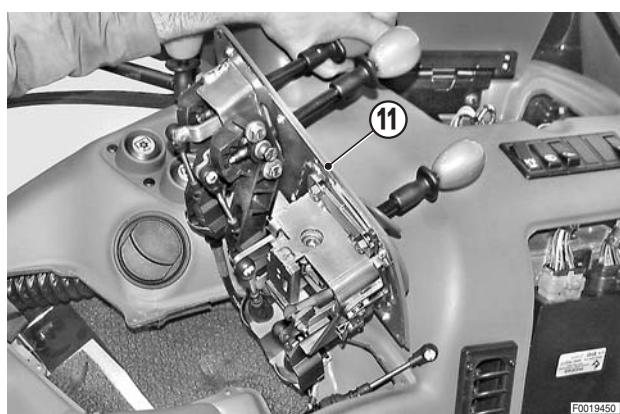


2. Removal of the auxiliary service valve control levers

- 1 - Remove the lift control panel as described in the previous paragraph.
- 2 - Unscrew and remove fixing screws (10) of the control levers assembly (11).

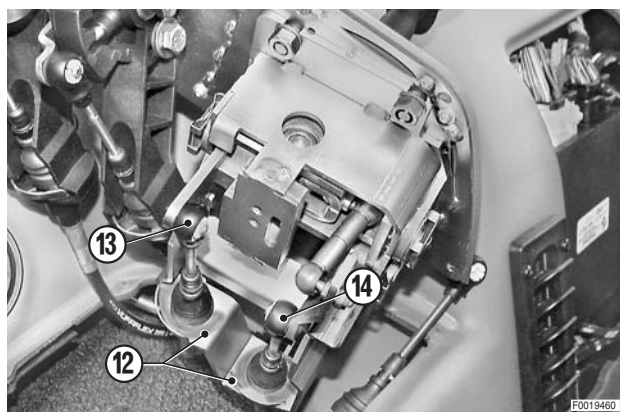


- 3 - Lift the assembly (11) and rotate it through 90°.

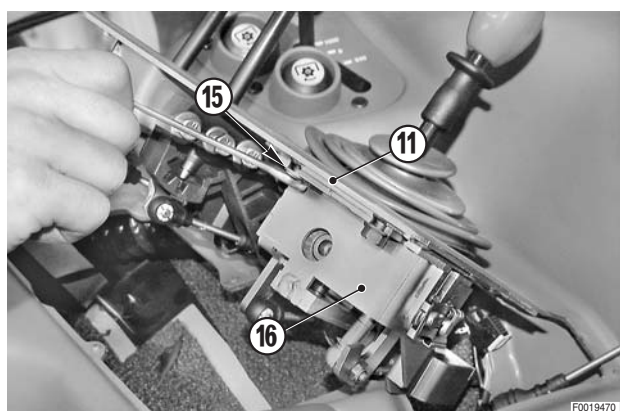


2.1 Removal of the cross-gate control lever assembly


- 1 - Remove the yokes (12) securing the outer cables and disconnect the cables (13) and (14). ✖ 1
 ★ Label the control cables to avoid confusion on re-connection.



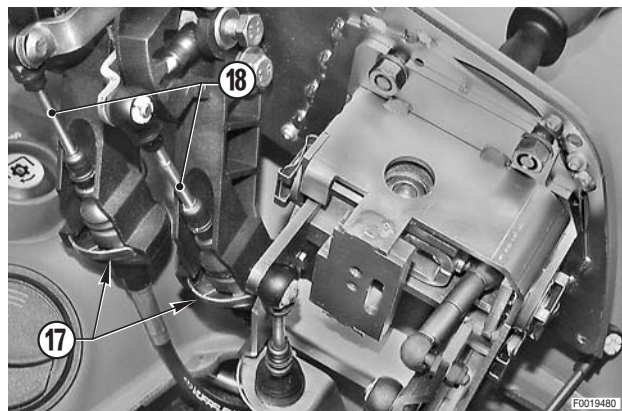
- 2 - Unscrew and remove the nuts (15) with their washers; withdraw the control assembly (16) from the panel (11).



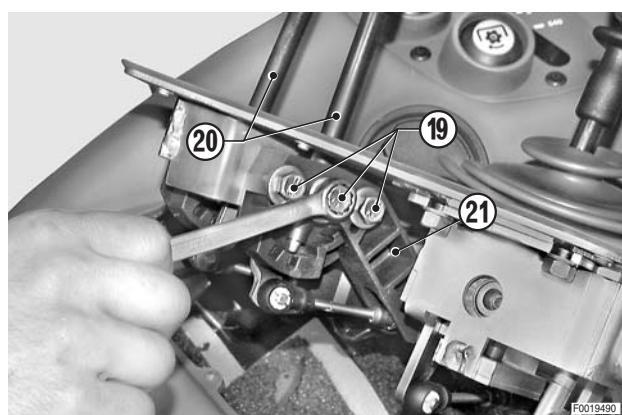
2.2 Removal of the individual service valve control levers

- 1 - Remove the yokes (17) securing the outer cables and disconnect the inner cables (18). 

★ Label the cables to avoid confusion on reconnection.



- 2 - Unscrew and remove bolts (19) with their washers and remove the levers (20) and the lever pivot supports (21).



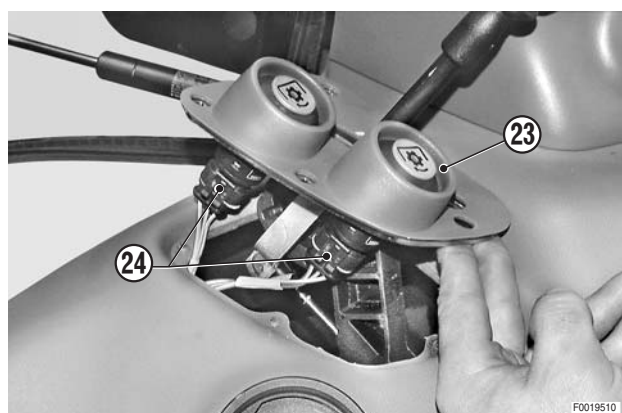
2.3 Removal of the PTO control panel

- 1 - Unscrew and remove the screws (22).



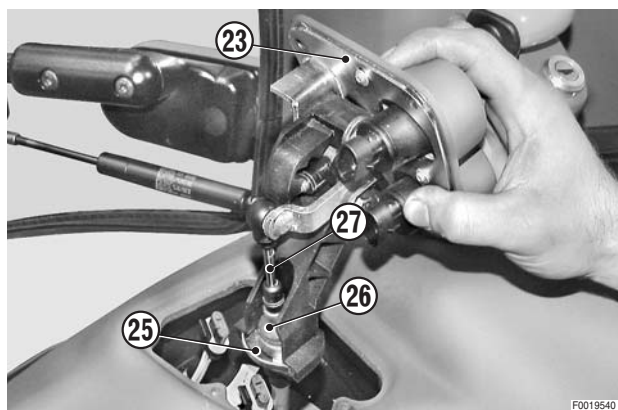
- 2 - Lift the control panel (23) and unplug the connectors (24).

★ Label the connectors to avoid confusion on reconnection.



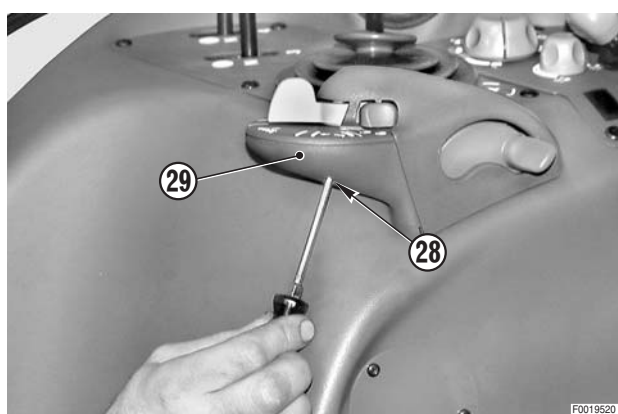
- 3 - Remove the yoke (25) securing the outer cable (26), disconnect the cable (27) and remove the assembly (23).

※ 1



2.4 Removal of the lift control assembly and the hand throttle

- 1 - Unscrew and remove the two outer fixing screws (28) of the assembly (29).

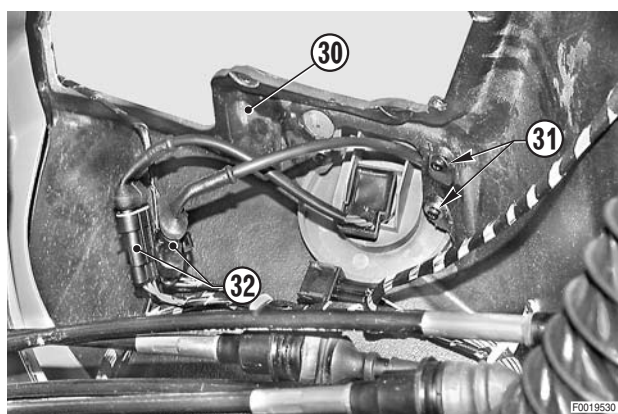


- 2 - Release the right-hand console (30) from its fixings and tilt it towards the centre of the cab in order to remove the inner screws (31) and unplug the connectors (32).

★ (For details, see «REMOVAL OF THE RIGHT-HAND CONSOLE»).

- 3 - Remove the lift control assembly.

※ 2



REFITTING THE CONTROL PANELS AND LEVERS OF THE AUXILIARY SERVICE VALVES AND THE PTO

- Refitting is the reverse of removal.

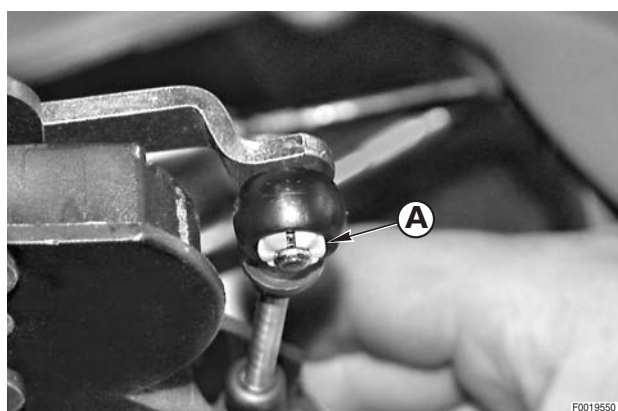
※ 1

★ The slotted bush "A" securing the cable must be oriented towards the outer end of the fixing pin.

- 1 - Adjust the length of the control cables.
(For details, see «RENEWAL OF THE AUXILIARY VALVE CONTROL CABLES»).

※ 2

★ If a new hand throttle is fitted, it will have to be calibrated. (See the SERDIA program in section 20).



RENEWAL OF THE PTO ENGAGEMENT AND SELECTION CONTROL CABLES

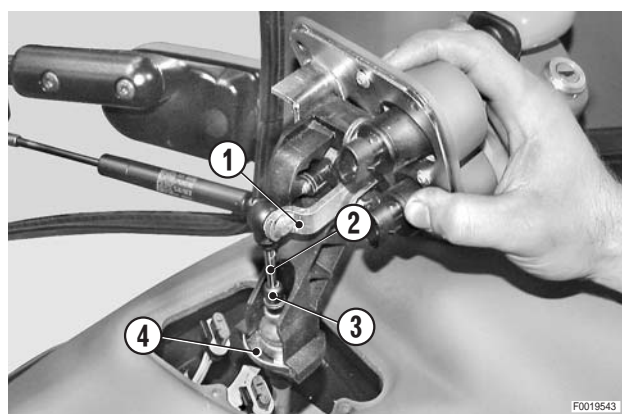
REMOVAL

(Figures refer to the speed selector)

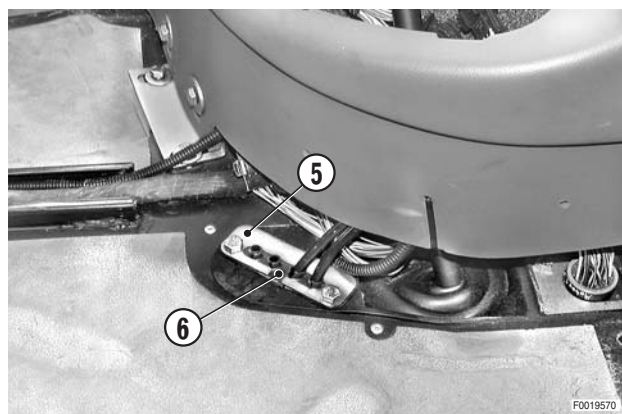
- 1 - Remove the lever assembly relative to the cable to be renewed.
(For details, see «REMOVAL OF LEVERS OF THE AUXILIARY SERVICE VALVES AND THE PTO»).



- 2 - Disconnect the control cable (1) from the control lever (2) and remove the yoke (3) to remove the outer cable (4).



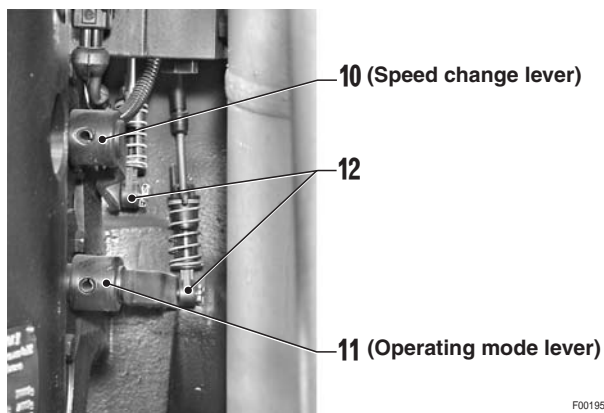
- 3 - Remove the front floor mat and remove the plate (5) of the cab guide (6) in order to release the outer cable to be renewed.



- 4 - Loosen the fixing screw (7) of the gear lever gaiter (8).
- 5 - Raise the gaiter (8), unplug the connector (9) and withdraw the control cable to be renewed.

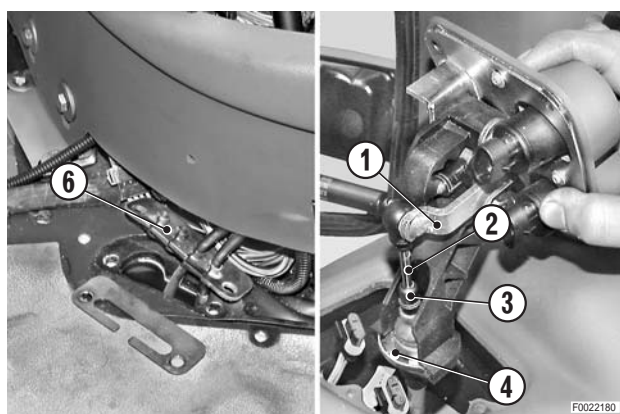


- 6 - Disconnect the cable end fitting (10) from the speed change lever (11) or the operating mode lever (12); remove the yoke securing the outer cable and remove the control cable.

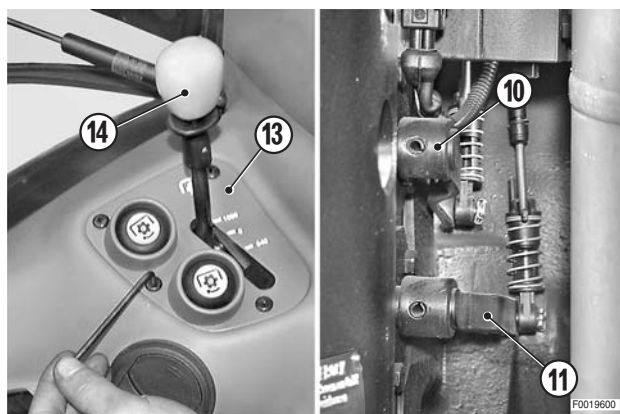


REFITTING

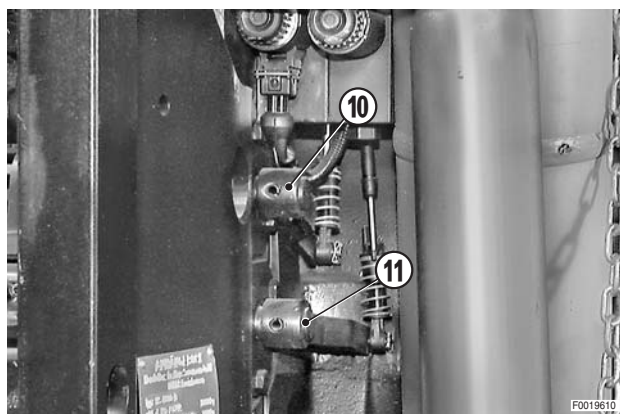
- 1 - Extend the new cable and engage it in the cable guide (6).
- 2 - Connect the end fitting of the inner control cable (2) to the control lever (1) and secure the outer cable (3) with the yoke (4).



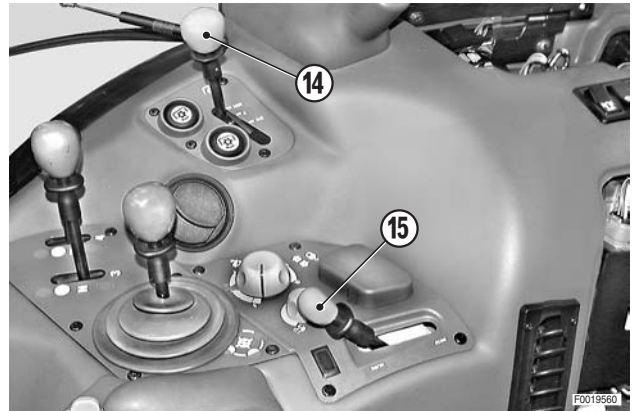
- 3 - Fix the lever assembly (13) to the right-hand console.
- 4 - Move the lever (14) to the position corresponding to the position of the lever (10) or (11) mounted on the transmission.



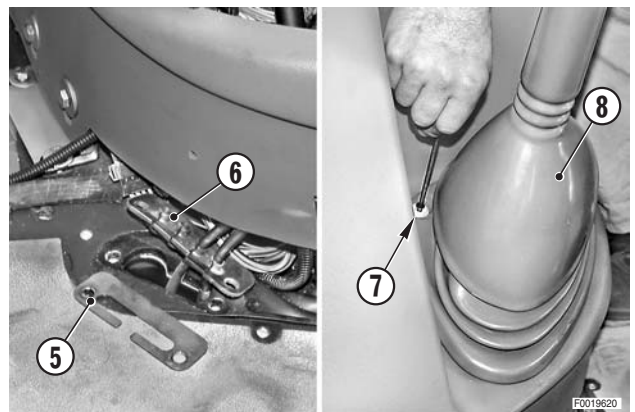
- 5 - Secure the outer cable with the yoke.
- 6 - Stretch the cable slightly to connect it to the fitting on the lever (10) or (11), making sure that the lever on the console is still in the correct position.



- 7 - Move the lever (14) or (15) in the cab and check that the corresponding lever on the transmission moves through its entire travel and changes the gear.
- ★ Check that the travel of the lever (14) or (15) is centred relative to the slot in the console.



- 8 - Secure the outer cable in the bulkhead fitting (6) by installing the plate (5).
- 9 - Reconnect the connector, reposition the gaiter (8) of the gear lever and fix in position with the screw (7) and its washer.

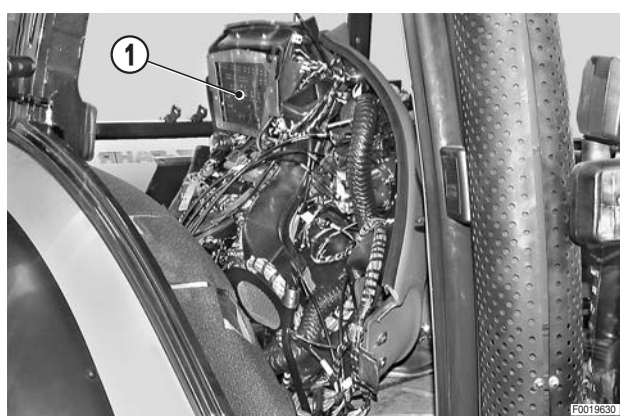


RENEWAL OF THE AUXILIARY SERVICE VALVE CONTROL CABLES

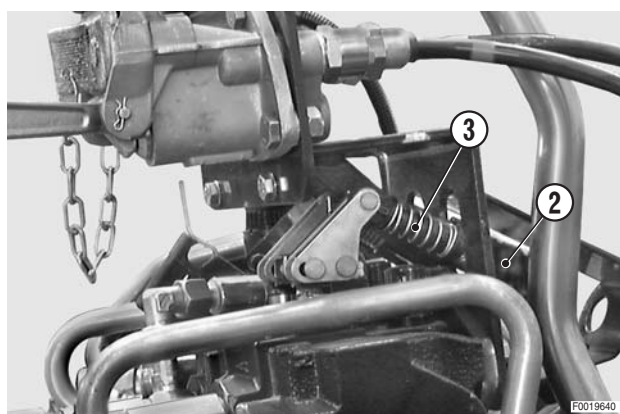
- 1 - Remove the seat.
(For details, see «REMOVAL OF THE DRIVER'S SEAT»).
- 2 - Remove the control levers assembly and disconnect the control cables to be renewed from the levers.
(For details, see «REMOVAL OF THE CONTROL PANELS AND LEVERS OF THE AUXILIARY SERVICE VALVES AND THE PTO»).



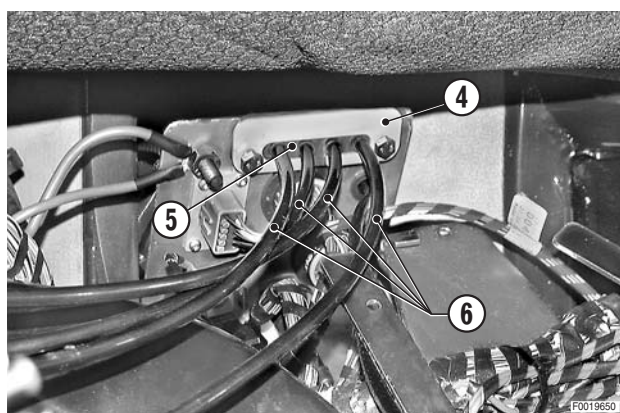
- 3 - Detach the right-hand console (1) from the cab, but do not unplug any of the connectors.
(For details, see «OPENING AND REMOVAL OF THE RIGHT-HAND CONSOLE»).



- 4 - Disconnect the outer cables (2) and inner cables (3) from the control valve assembly.



- 5 - Remove the screws and remove the plate (4) securing the bulkhead gasket (5).
Release the control cables (6) from the bulkhead fitting and withdraw them towards the rear of the tractor.

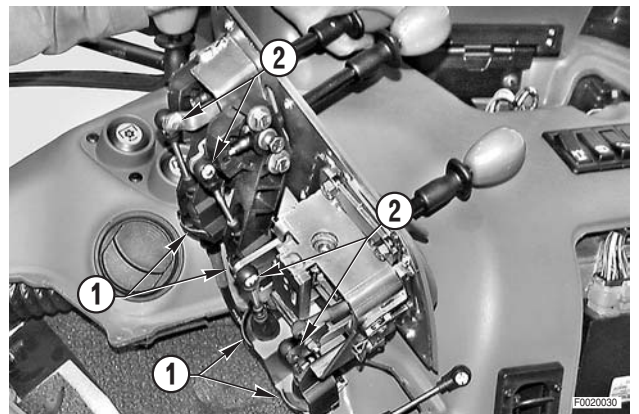


REFITTING THE AUXILIARY SERVICE VALVE CONTROL CABLES

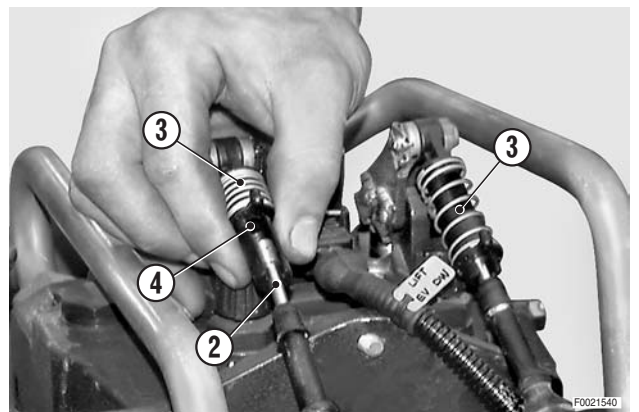
- Refitting is the reverse of removal.
- 1 - Check that the control cable lever and the corresponding control valve lever are both in neutral.



- 2 - Fix the outer cables with the yokes (1).
- 3 - Connect the inner cables (2) to the control levers.



- 4 - With the control lever in neutral position, lift the retaining bush (3) and, while keeping the cable under slight tension, insert the end in the fitting (4).

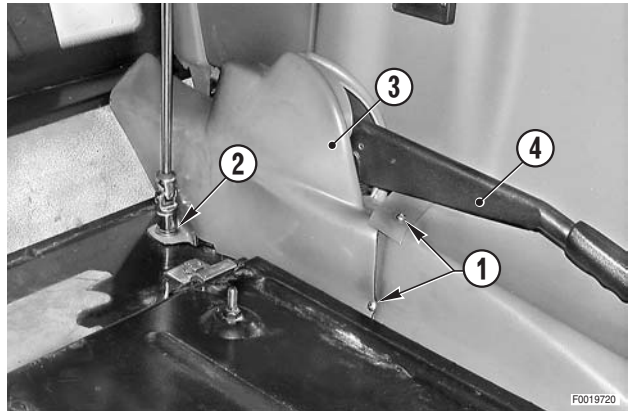


- 5 - Lower the retaining bush (3); check that the control valve spool travels through its full stroke and that the control lever is positioned centrally in its slot when the control valve is in neutral.
- ★ For the cross-gate control lever, check the spool travel for both side-to-side and vertical movements of the lever.

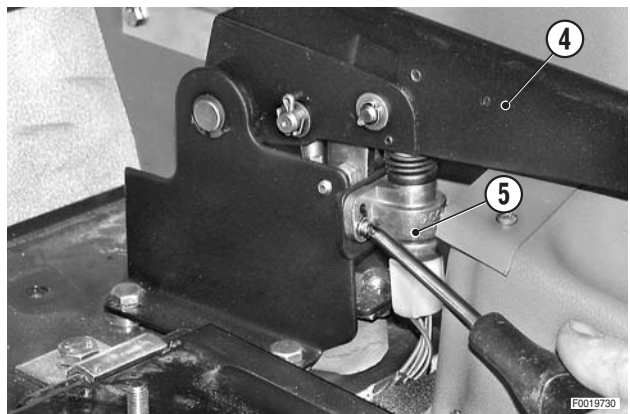


ADJUSTMENT OF THE PARKING BRAKE SWITCH

- 1 - Remove the screws (1) and (2) and remove the shroud (3).



- 2 - Operate the lever (4) repeatedly to eliminate any play in the mechanism.
- 3 - With the lever (4) fully lowered, adjust the height of the microswitch (5) by raising it to its maximum height and then lowering it to obtain the correct amount of residual travel.
 - ★ Residual travel: 1 mm (0.04 in.)
- 4 - Replace the shroud (3).



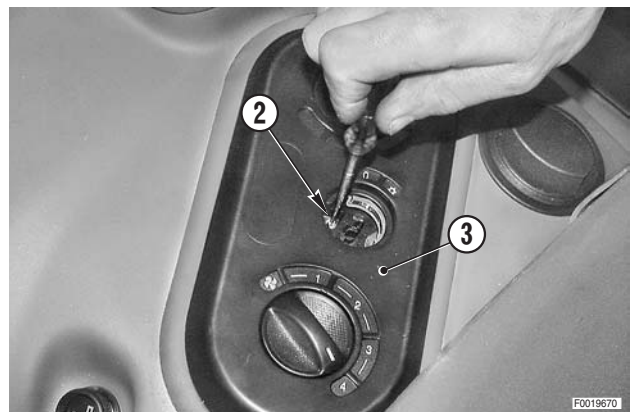
REMOVAL OF THE CLIMATE CONTROL PANEL

! Remove the battery cover and disconnect the negative battery lead (-).

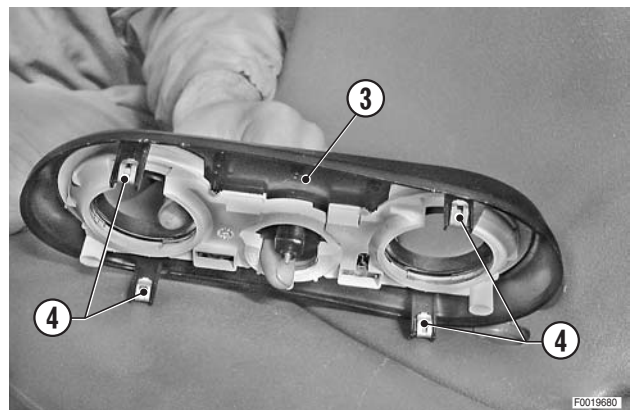
1 - Pull off the air conditioning on/off knob (1).



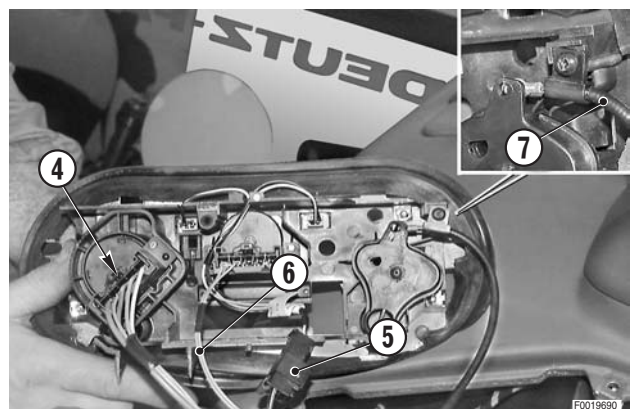
2 - Unscrew and remove the fixing screws (2) of the control panel (3).



3 - Detach the control panel (3) by pressing the spring clips (4) securing it to the left-hand console.



4 - Lift the panel (3), disconnect the connectors (4) and (5), the wiring (6), and the heater control cable (7).



REFITTING THE CLIMATE CONTROL PANEL


- Refitting is the reverse of removal.

RENEWAL OF THE HEATER VALVE


1. Removal

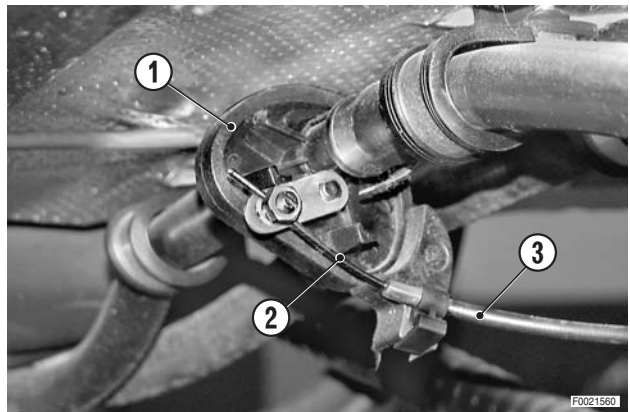
! Switch off the engine and remove the key from the ignition.

1 - Drain the coolant from the engine cooling system.

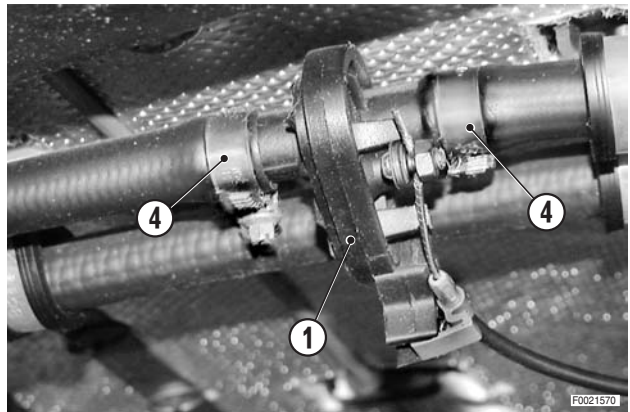
 Coolant:

Mod.	106	110	115	120	135	150	165
ℓ	17.5	17.5	17.5	21	21	21	23
US. gall.	4.62	4.62	4.62	5.54	5.54	5.54	6.07

2 - Disconnect the inner control cable (2) and the outer cable (3) from the valve (1). 



3 - Loosen the retaining straps (4) and remove the valve (1).



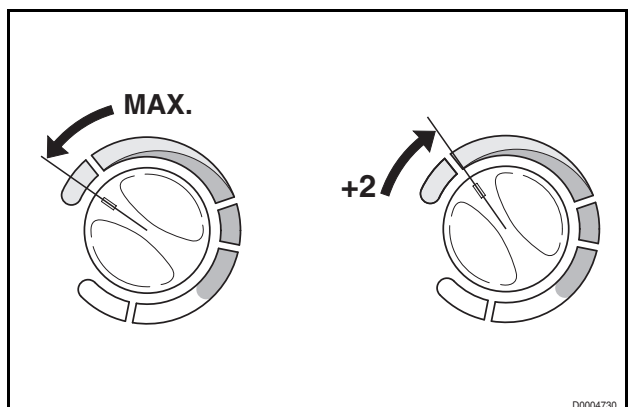
2. Refitting and adjustment of the control cable.

- Refitting is the reverse of removal.



★ Connect the heating valve control cable as follows:

1 - Turn the heater control knob fully to the left (blue section) and then two notches back to the right (red section).



2 - Turn the lever (5) of the heater valve (1) up to the stop (6).

3 - Fix the outer part (7) of the control cable (2) with the spring clip (8) and the inner cable (2) with the screw (9).

1 - Fill the cooling system.



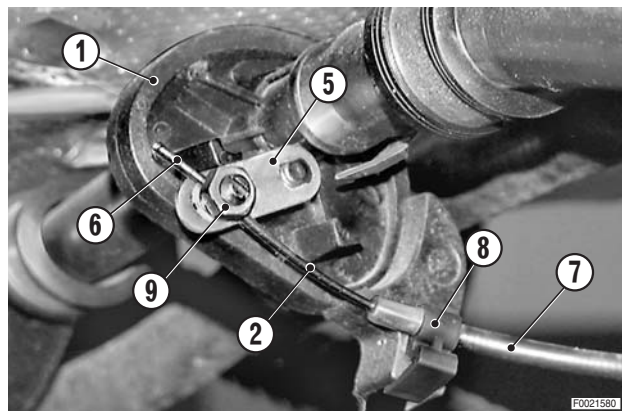
Coolant:

Mod.	106	110	115	120	135	150	165
<i>ℓ</i>	17.5	17.5	17.5	21	21	21	23
US. gall.	4.62	4.62	4.62	5.54	5.54	5.54	6.07

2 - Fully open the heater valve.

3 - Start the engine: allow the coolant to circulate and check for leaks.

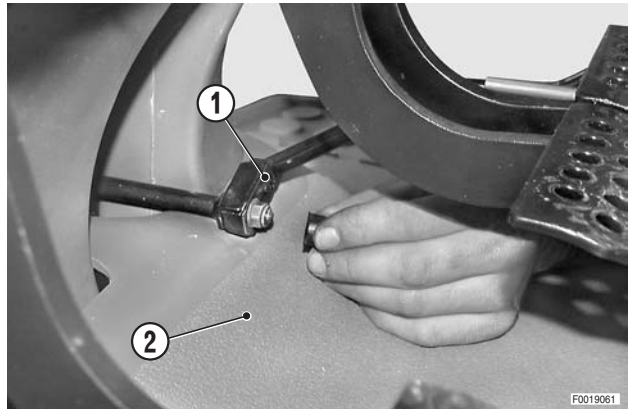
4 - Stop the engine and top up the coolant level.



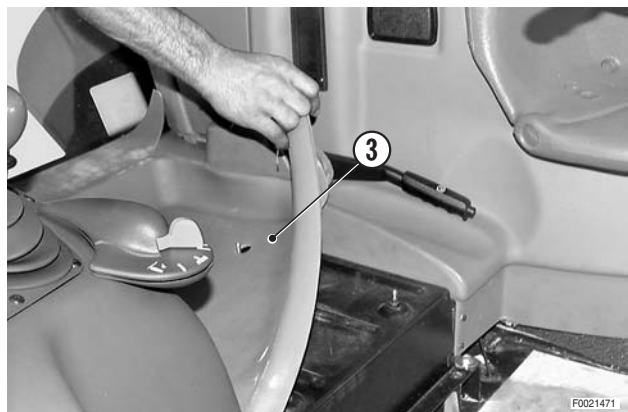
REMOVAL OF THE HEATER MATRIX

! Remove the battery cover and disconnect the negative battery lead (-).

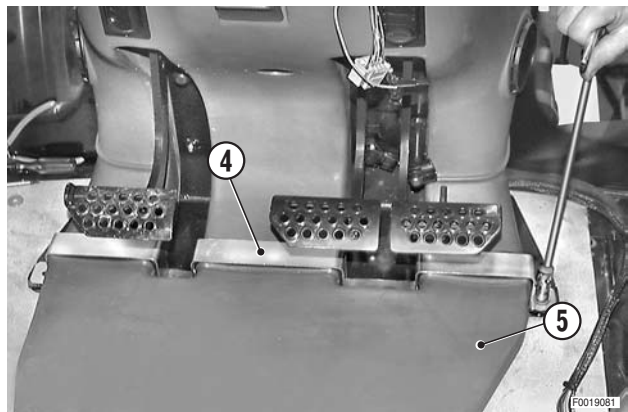
- 1 - Remove the seat. (For details, see «REMOVAL OF THE DRIVER'S SEAT»).
- 2 - Remove the accelerator pedal (1) and remove the front floor mat (2).



- 3 - Remove the rear floor mat (3).



- 4 - Remove the retaining strap (4) and the air hose (5).



- 5 - Remove the bolts and lift the seat support (6).
- 6 - Remove the bolts and remove the upper cover (7) of the air conditioning assembly.

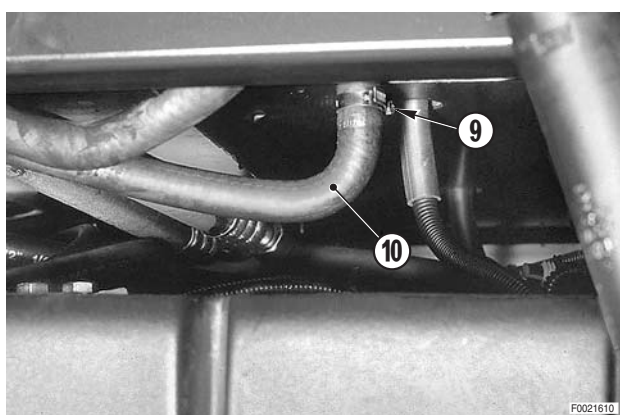
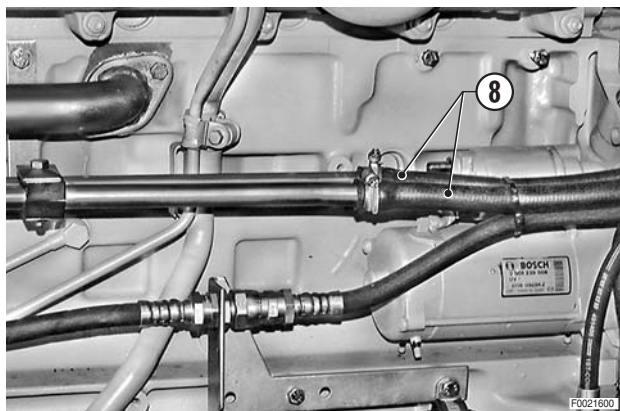


- 7 - Turn the heater control knob to the MAX position (red section).
 Drain the coolant from the engine and the heater matrix by disconnecting the pipes (8).

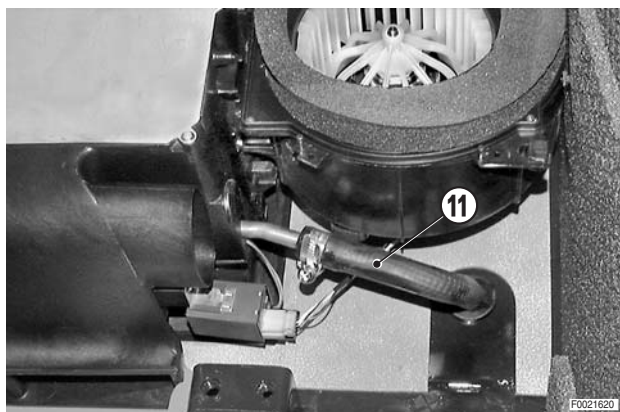
 Coolant:

Mod.	106	110	115	120	135	150	165
ℓ	17.5	17.5	17.5	21	21	21	23
US. gall.	4.62	4.62	4.62	5.54	5.54	5.54	6.07

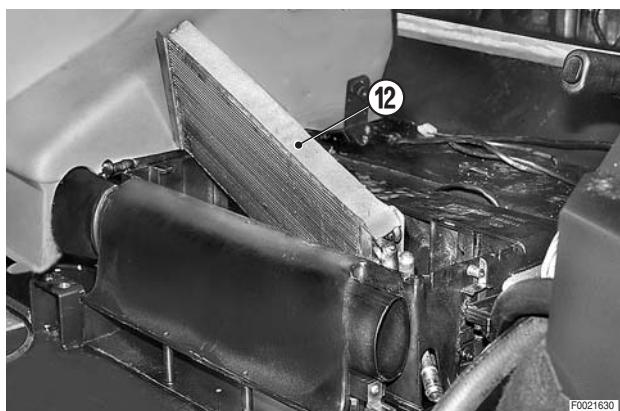
- ★ After draining the system, reconnect the pipes (8).
- 8 - Remove the evaporator.
 (For details, see «REMOVAL OF THE AIR CONDITIONING EVAPORATOR»).
- 9 - Remove the hose clamp (9) and disconnect the vertical return hose (10) from the matrix.



- 10 - Remove the hose clamp and disconnect the horizontal delivery pipe (11) from the matrix.



- 11 - Remove the matrix (12) by lifting the right side vertically and then rotating it towards the rear of the tractor.



REFITTING THE HEATER MATRIX

- Refitting is the reverse of removal.

1 - Fill the cooling system.



Coolant:

Mod.	106	110	115	120	135	150	165
<i>ℓ</i>	17.5	17.5	17.5	21	21	21	23
US. gall.	4.62	4.62	4.62	5.54	5.54	5.54	6.07

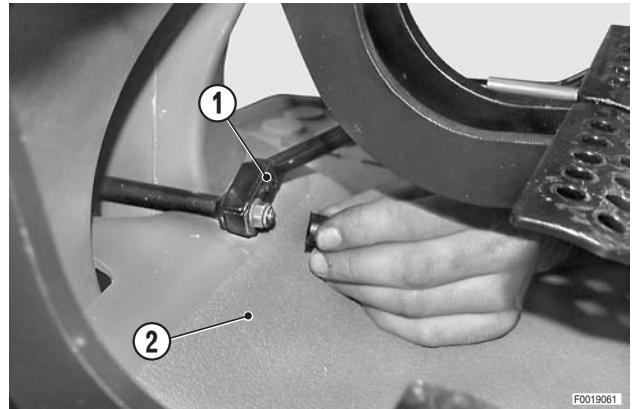
2 - Start the engine: allow the coolant to circulate and check for leaks.

3 - Stop the engine and top up the coolant level.

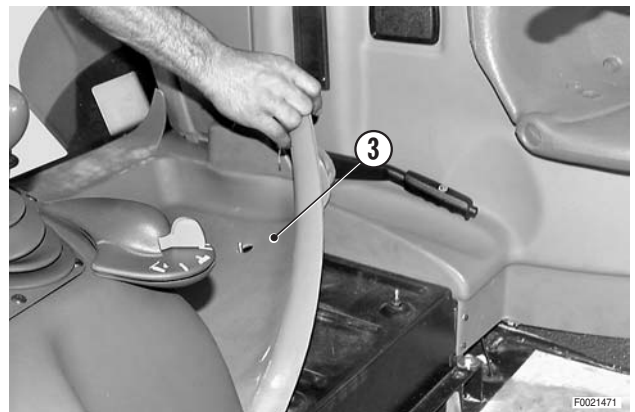
REMOVAL OF THE AIR CONDITIONING EVAPORATOR

! Remove the battery cover and disconnect the negative battery lead (-).

- 1 - Remove the seat. (For details, see «REMOVAL OF THE DRIVER'S SEAT»).
- 2 - Remove the accelerator pedal (1) and remove the front floor mat (2).

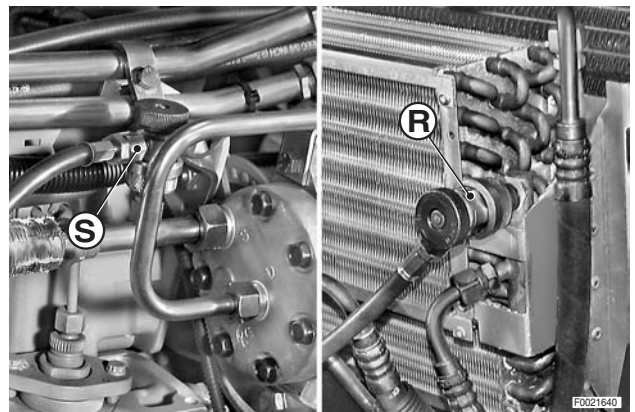


- 3 - Remove the rear floor mat (3).

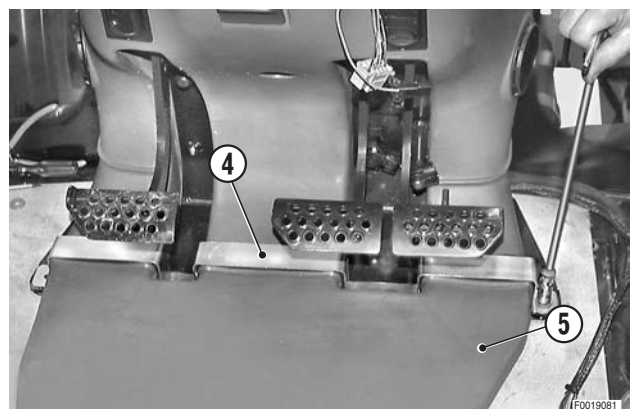


- 4 - Connect the quick-fit couplers of the high (R) and low (S) pressure pipes to the refrigerant (R134A) charging, testing and recovery machine. Set the machine for recovery operation and start it; allow the machine to run until all the refrigerant has been recovered, then disconnect it. ✖ 1

★ Measure the quantity of oil recovered and consequently to be reintroduced into the system.



- 5 - Remove the hose clamp (4) and the air hose (5).



- 6 - Remove the bolts and lift the seat support (6).
- 7 - Remove the screws and remove the cover (7) of the air conditioning assembly.

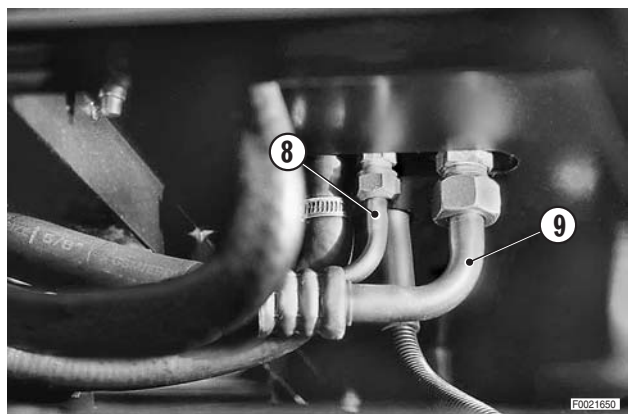


- 8 - Disconnect the inlet (8) and outlet (9) pipes from the evaporator.

⊗ 2

! Immediately seal the ends of the pipes (8) and (9) to prevent atmospheric moisture from getting into the air conditioning system.

- 9 - Release the rubber diaphragm (10).



- 10 - Lift up the evaporator (11); remove the temperature sensor (12) and place it on one side.

⊗ 3

- 11 - Remove the evaporator (11).

REFITTING THE EVAPORATOR

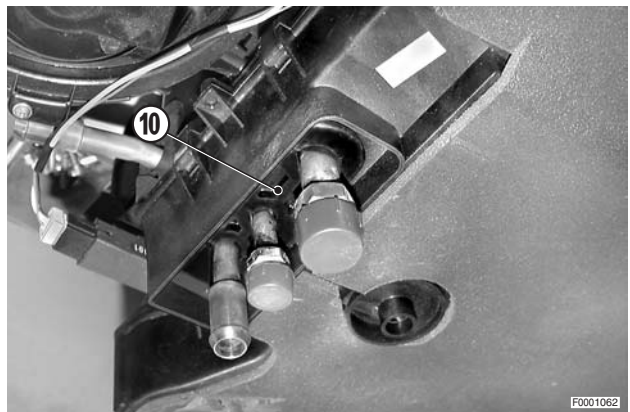
- Refitting is the reverse of removal.

⊗ 1


★ Quantity of R134a:


Mod.	106	110	115	120	135	150	165
g	1600	1600	1600	1600	1600	1600	1950
oz.	56.4	56.4	56.4	56.4	56.4	56.4	68.74

★ After recharging the system, check the seals on the pipes (R and S) and throughout the system using a leak detector.



⊗ 2

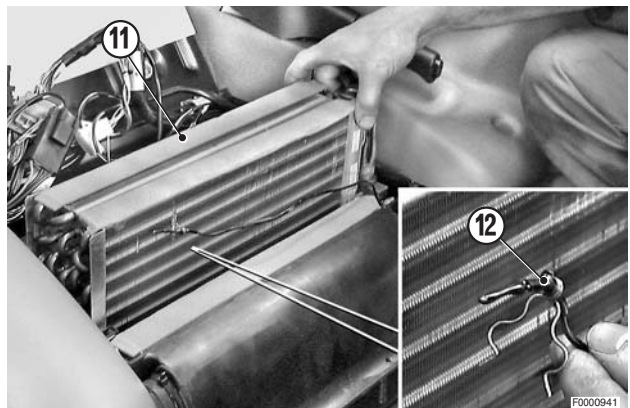
 High pressure fitting (5/8" - 18UNF):
13.6 – 20.3 Nm (10 – 15 lb.ft.)

 Low pressure fitting (7/8" - 14UNF):
35.3 – 42 Nm (26 – 31 lb.ft.)

⊗ 3

★ Check that the temperature sensor is securely fixed.

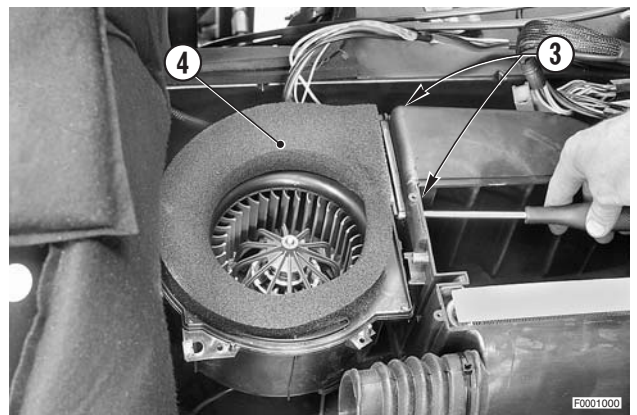
- 1 - Carefully check the seal around the upper cover (7).



REMOVAL OF THE RIGHT-HAND AIR CONDITIONING FAN

⚠ Remove the battery cover and disconnect the negative battery lead (-).

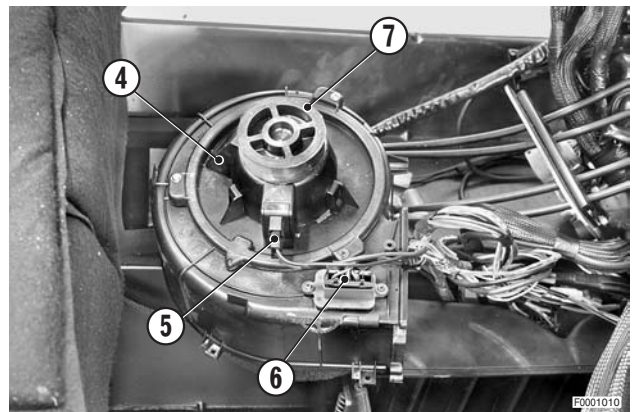
- 1 - Remove the seat. (For details, see «REMOVAL OF THE DRIVER'S SEAT»).
- 2 - Remove the centre console shroud. (For details, see «REMOVAL OF THE CENTRE CONSOLE AND SHROUD»).
- 3 - Remove the fixing screws of the right-hand console. (For details, see «REMOVAL OF THE RIGHT-HAND CONSOLE»).
- 4 - Remove the seat support (1) and upper cover (2) of the air conditioning assembly.
- 5 - Remove the evaporator. (For details, see «REMOVAL OF THE EVAPORATOR»)
- 6 - Remove four bolts (3) securing the fan (4).
- 7 - Remove the fan (4) and turn it over.



- 8 - Unplug the connectors (5) and (6).

※ 1

⚠ If a new fan is to be fitted, the support block (7) should also be renewed.



REFITTING THE RIGHT-HAND AIR CONDITIONING FAN

- Refitting is the reverse of removal.

※ 1

★ Stick the support block on to the fan screw before positioning the fan

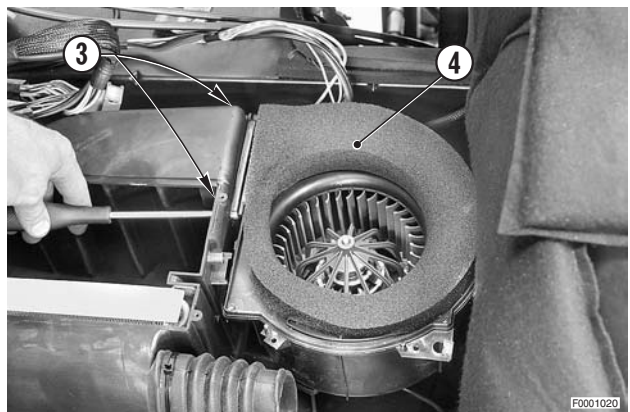
 Block: Loctite 401

- 1 - Carefully check the seal around the upper cover.

REMOVAL OF THE LEFT-HAND AIR CONDITIONING FAN

! Remove the battery cover and disconnect the negative battery lead (-).

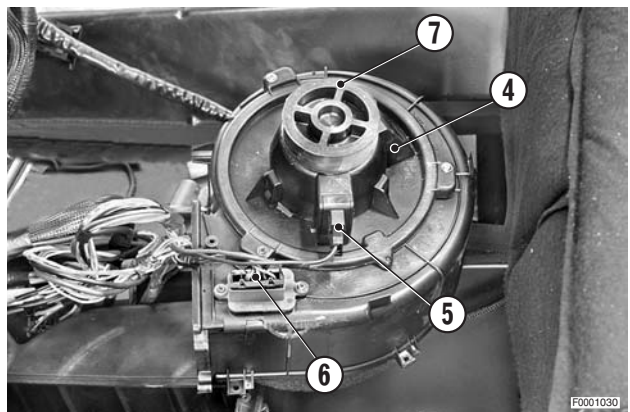
- 1 - Remove the seat.
(For details, see «REMOVAL OF THE DRIVER'S SEAT»).
- 2 - Remove the left-hand console without disconnecting the control cable of the heater valve. (For details, see «REMOVAL OF THE LEFT-HAND CONSOLE»).
- 3 - Remove the seat support (1) and the upper cover (2) of the air conditioning assembly
- 4 - Withdraw the evaporator. (For details, see «REMOVAL OF THE EVAPORATOR»).
- 5 - Remove the four screws (3) securing the fan (4).
- 6 - Remove the fan (4) and turn it over.



- 7 - Unplug the connectors (5) and (6).

※ 1

! If a new fan is to be fitted, the support block (7) should also be renewed.



REFITTING THE LEFT-HAND AIR CONDITIONING FAN

- Refitting is the reverse of removal.

※ 1

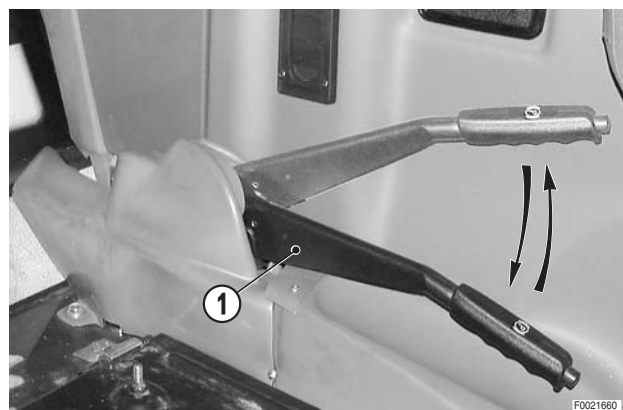
★ Stick the block to the fan screw before positioning the fan.

 Block: Loctite 401

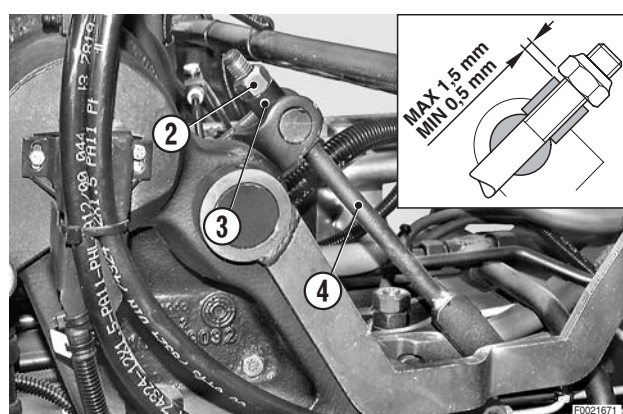
- 1 - Carefully check the seal around the upper cover.

ADJUSTMENT OF THE PARKING BRAKES

- 1 - Before proceeding with the adjustment, operate the handbrake lever (1) repeatedly in order to eliminate any play and check that the control cable slides freely.
- 2 - Apply a dynamometer with a scale of up to 500 Nm to the handgrip, and raise the handbrake lever to the first notch; check that the force applied to reach the first notch is within the normal limits.
 - ★ Normal force: 300±30 N (55±5 lb.)

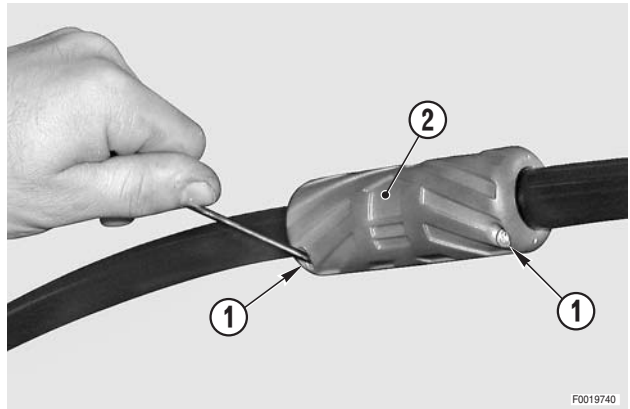


- 3 - If the force is outside these limits, screw out the nut (2) with the least clearance and screw in the nut (3) with most clearance.
- 4 - Then check that the distances between the nuts (2) and (3) of the tie-rods (4) are 0.5–1.5 mm (0.02 – 0.06 in.).
- 5 - Take the tractor to straight section of asphalted road at least 50 m (97 yard) in length.
- 6 - Engage gear and move off.
- 7 - With the tractor in motion, depress the clutch pedal and fully apply the handbrake (1); check that the rear wheels lock up simultaneously.
- 8 - If the rear wheels do not lock up at the same time, **screw in** gradually and by just a few degrees the nut (2) **corresponding to the wheel that fails to lock up** and **screw out the nut corresponding to the other wheel**.
- 9 - Repeat the previous operations until both rear wheels lock up simultaneously when the handbrake is fully applied.

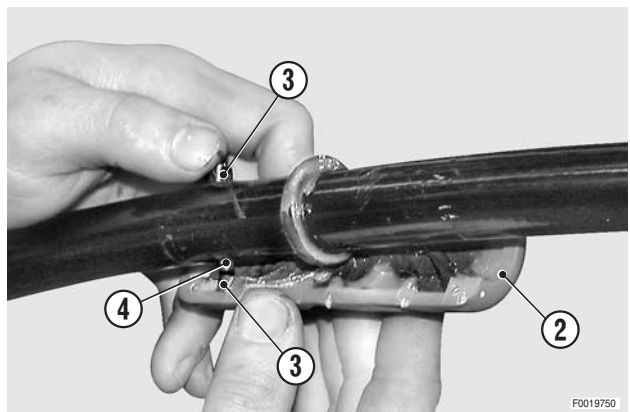


RENEWAL OF CAB DOOR CABLE

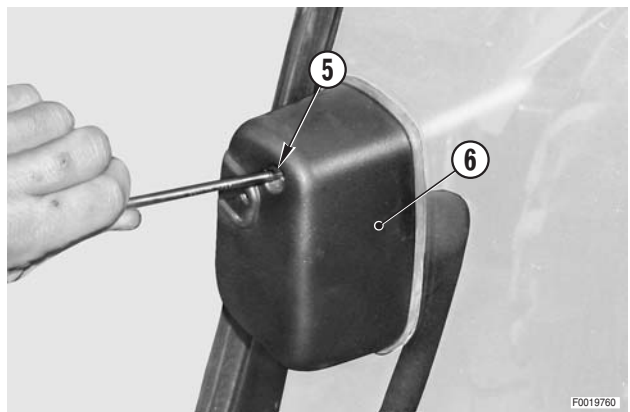
1 - Unscrew and remove the four screws (1) securing the two halves of the handle (2).



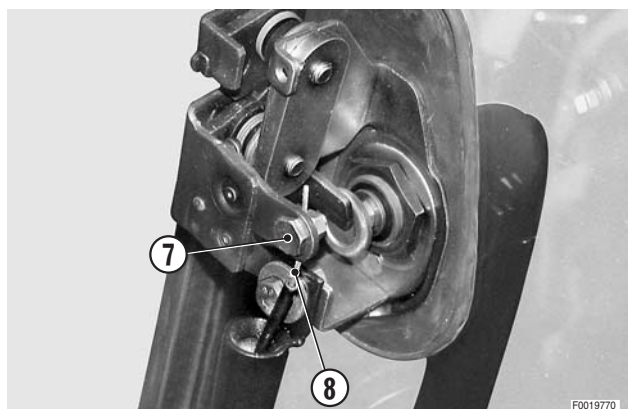
2 - Remove the two halves of the handle and recover the bushes (3) and the pin (4).



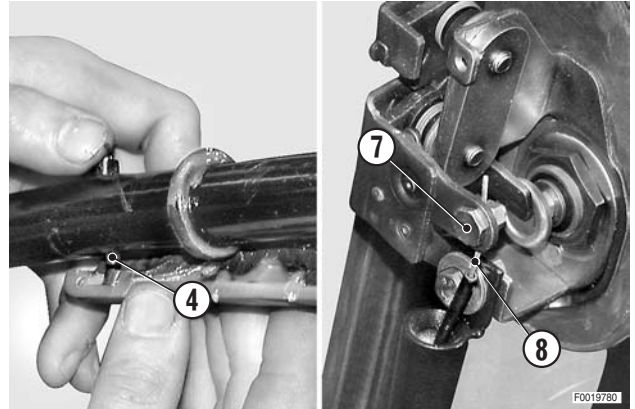
3 - Unscrew and remove the fixing screws (5) of the door lock cover (6).




4 - Loosen the clamp nut (7) and withdraw the cable (8).



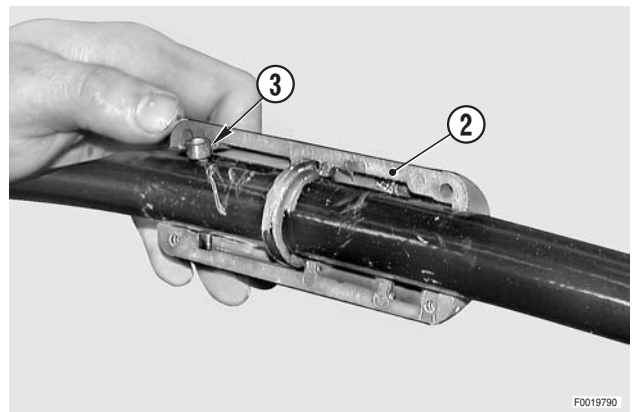
- 5 - Feed the new cable starting from the handle side; engage it with the pin (4) and the clamp nut (7).
With the cable under slight tension, tighten down the clamp nut.



- 6 - Lubricate the bushes (3) and the slide ways for the handle; fit the bushes to the pin and refit the handle (2).

 Slide ways and bushes: Molikote

- 7 - Check that the door opens correctly and complete the refitting procedure.



REMOVAL OF THE TRAILER BRAKING AIR PRESSURE GAUGE

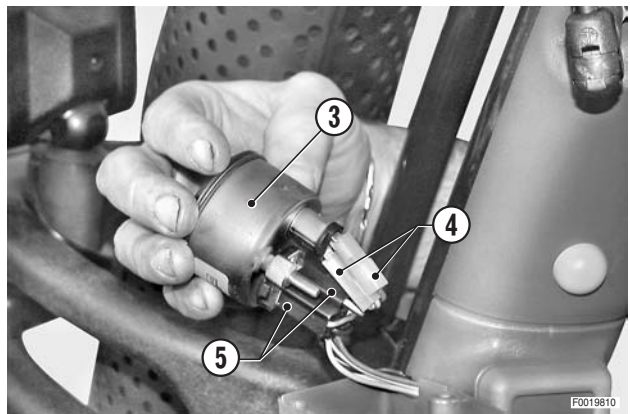
! Remove the key from the ignition.

- 1 - Unscrew and remove fixing screws (1) of the upper cover (2); remove the cover.



- 2 - Remove the gauge (3); if a new gauge is to be fitted, unplug the connectors (4) and (5).

★ Label the connectors (5) to avoid confusion on re-connection.




- 3 - To replace the bulb, unplug the connectors (4) and withdraw the bulb holder (6).



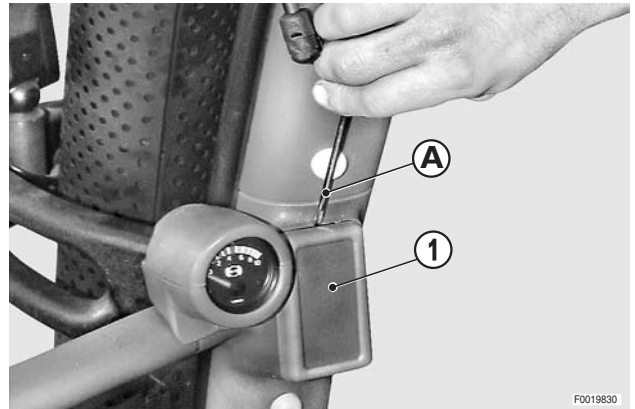
REFITTING THE TRAILER BRAKING AIR PRESSURE GAUGE

- Refitting is the reverse of removal.

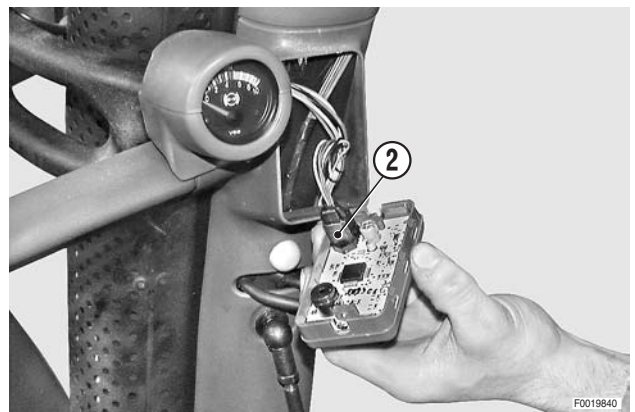
REMOVAL OF THE POWERSHIFT - POWERSHUTTLE STATUS DISPLAY

 Remove the key from the ignition switch.

- 1 - Insert a thin blade "A" between the cab pillar and the display unit (1).
- 2 - Prise off the display (1).



- 3 - Unplug the connector (2).



REFITTING THE POWERSHIFT - POWERSHUTTLE STATUS DISPLAY

- Refitting is the reverse of removal.

REMOVAL OF THE CAB

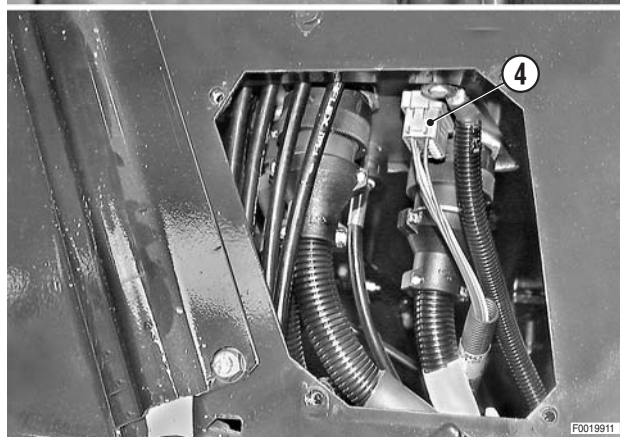
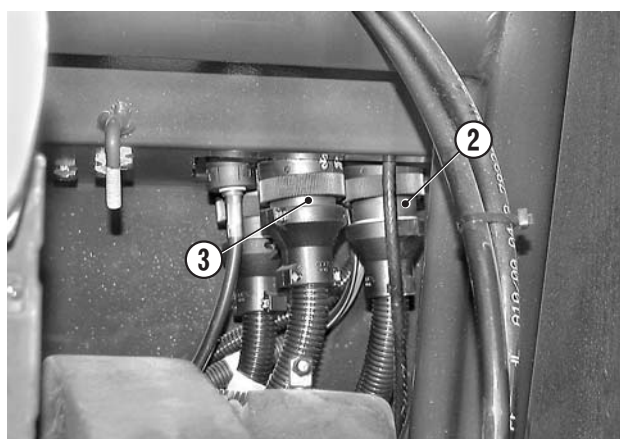
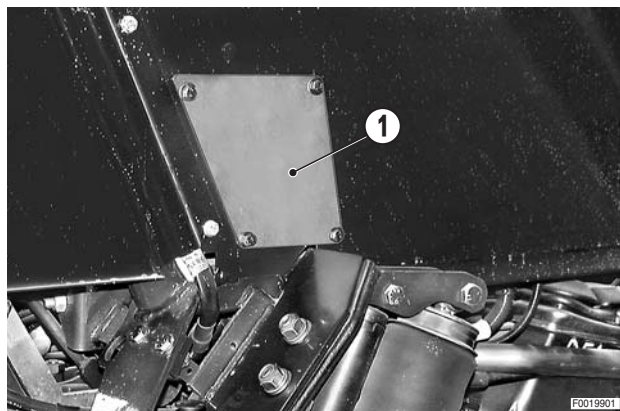
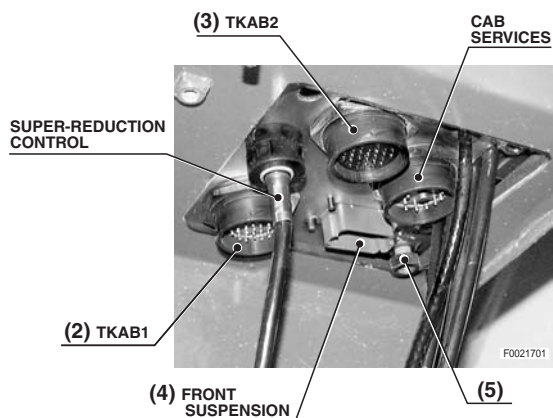
! Remove the battery cover and disconnect the negative battery lead (-).

! Discharge any residual pressure from the trailer braking air reservoir and the cab suspension system.

1 - Remove the rear wheels.
(For details, see «REMOVAL OF THE REAR WHEELS»).

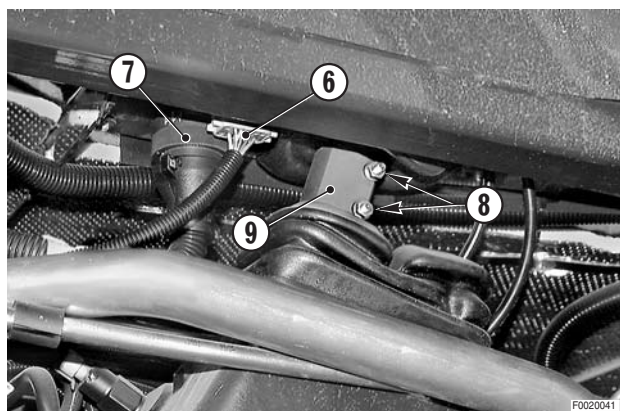
2 - Remove the air cleaner.
(For details, see «REMOVAL OF THE AIR FILTER»).

3 - Remove the cover plate (1) and disconnect from the bulkhead fitting the connectors of the electrical leads of the transmission (2) (TKAB1), the lift (3) (TKAB2) and the connector (4) and power supply lead (5) for the front axle (if present).

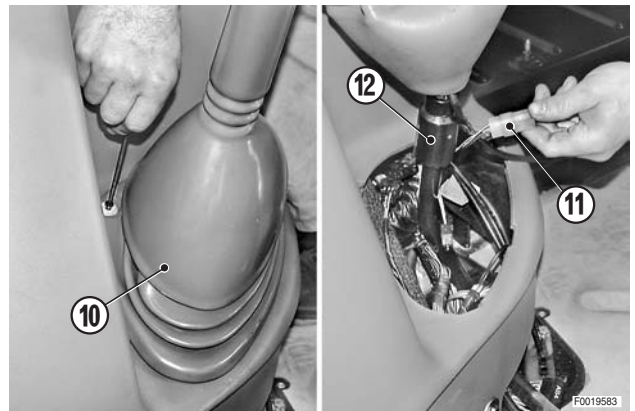


4 - Disconnect from the front bulkhead plate the connector (6) and the connector (7) of the engine wiring.

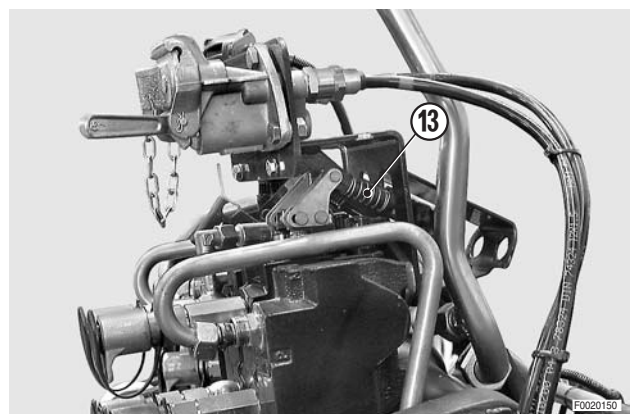
5 - Remove the bolts and nuts (8) of the gear lever (9).



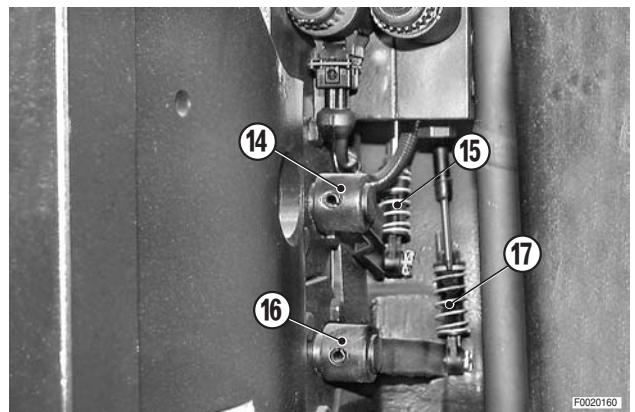
- 6 - Remove the gear lever gaiter (10), unplug the connector (11) and remove the complete lever assembly (12).



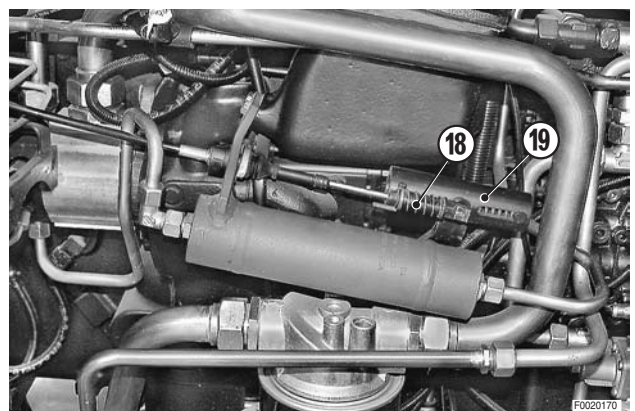
- 7 - Disconnect the control cables (13) from the auxiliary service control valves.
- ★ Label the cables to avoid confusion on reconnection.
 - ★ Disconnect also the outer cables.



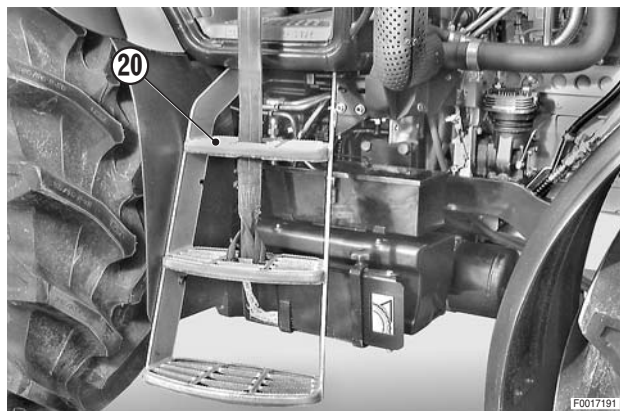
- 8 - Disconnect the control cable (14) from the PTO speed selector lever (15).
- 9 - Disconnect the control cable (16) from the PTO operating mode selector lever (17).
- ★ Label the cables to avoid confusion on reconnection.
 - ★ Disconnect also the outer cables.



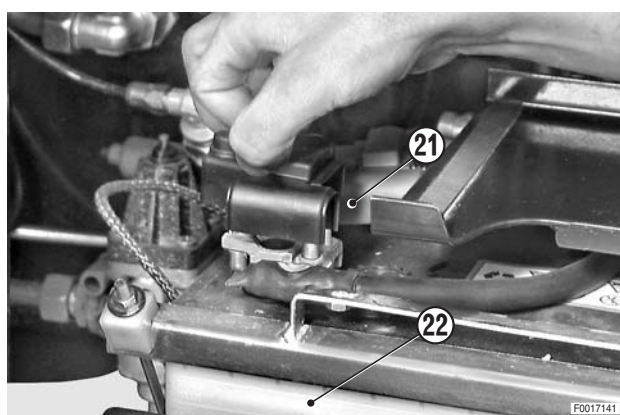
- 10 - Disconnect the control cable (18) from the creeper control lever (19).
- ★ Disconnect also the outer cable.



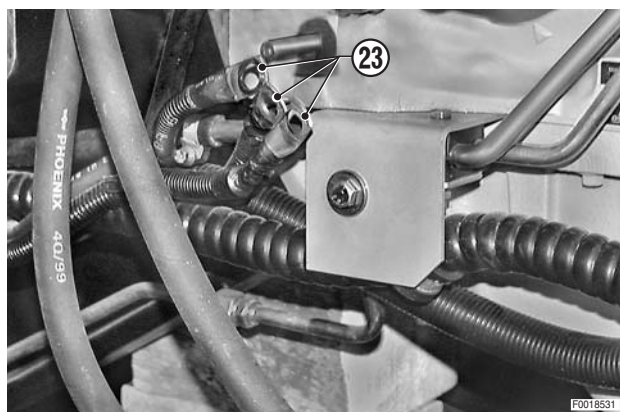
- 11 - Remove the cab access steps (20).
- 12 - Remove the fuel tank.
(For details, see «REMOVAL OF THE FUEL TANK»).



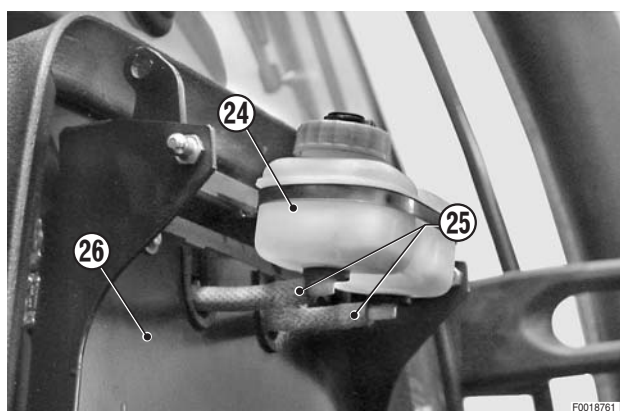
- 13 - Disconnect the system feed wire from the positive terminal (21) (+) of the battery (22).



- 14 - Disconnect the earth leads (23) from the engine.

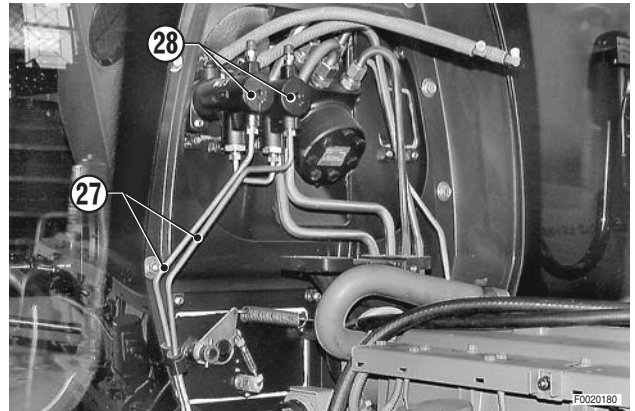


- 15 - Draw the fluid out of the brake fluid reservoir (24); disconnect the suction pipes (25) and remove the panel (26).



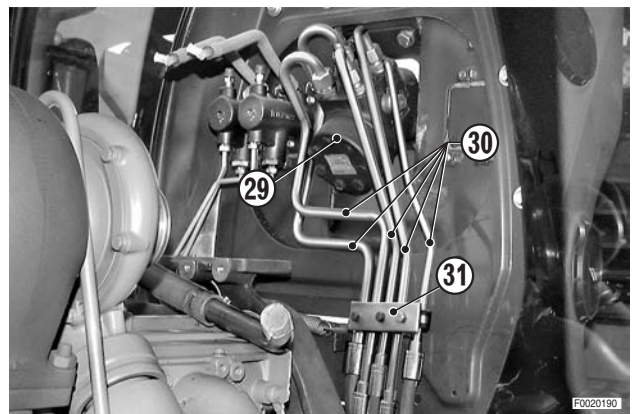
16 - Disconnect the delivery pipes (27) of the brake cylinders (28) and remove them by disconnecting the lower coupling.

- ★ Plug the ends of the pipes to prevent the entry of contaminants.




17 - Disconnect the five pipes (29) from the power steering unit (30).

- ★ Plug the ends of the pipes to prevent the entry of contaminants.



18 - Remove the bracket (31) and bend the pipes towards the front of the tractor.

19 - Drain the engine cooling system.

 Coolant:

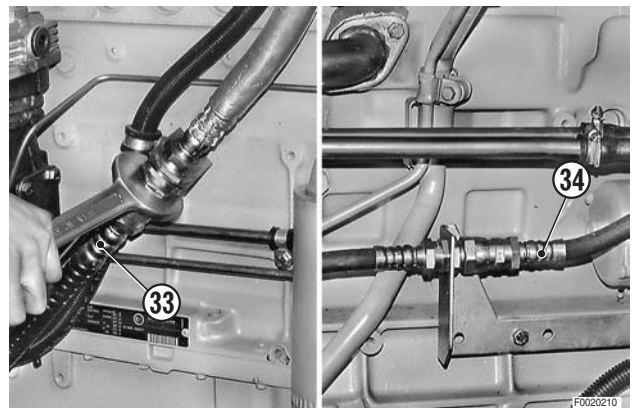
Mod.	106	110	115	120	135	150	165
ℓ	17.5	17.5	17.5	21	21	21	23
US. gall.	4.62	4.62	4.62	5.54	5.54	5.54	6.07



20 - Disconnect the cab heating pipes (32).

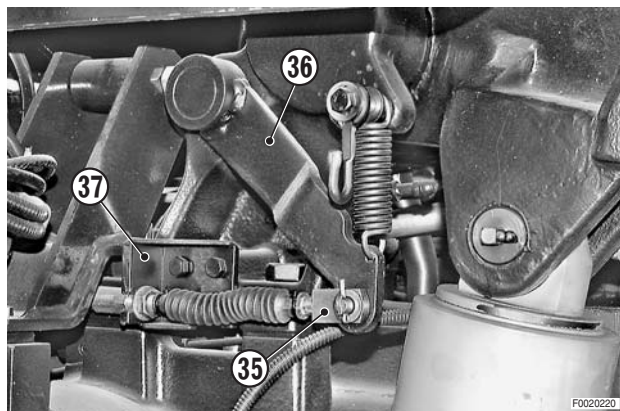
21 - Disconnect the inlet pipe (33) and the outlet pipe (34) of the air conditioning compressor.

※ 1

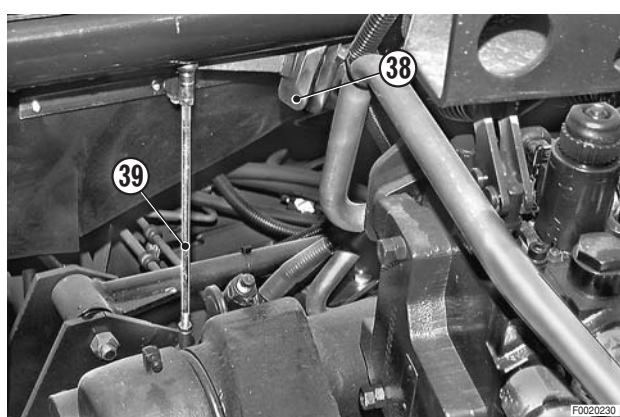


22 - Disconnect the control cable (35) from the parking brake lever (36).

- ★ Disconnect also the outer cable from the support (37).



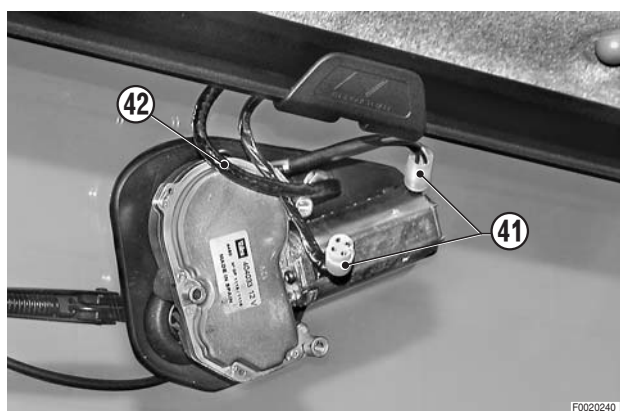
23 - Detach the tie-rod (38) from the cab lifting control valve (39). ※ 2



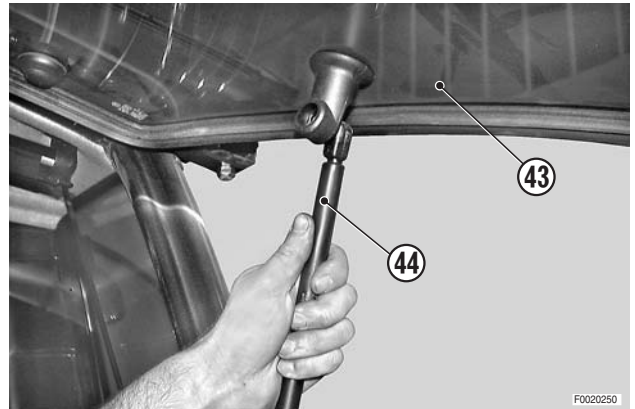
24 - Remove the exhaust pipe end fitting (40) from the cab.
(For details, see «REMOVAL OF THE EXHAUST PIPE»).



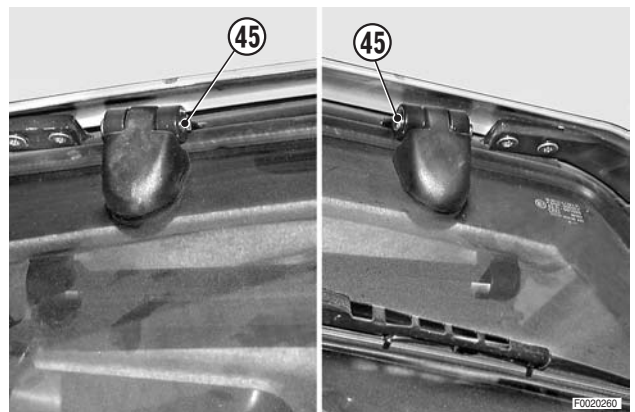
25 - Remove the cover of the rear screen wiper and unplug the connector (41) and the screen wash pipe (42).



- 26 - Disconnect the gas springs (44) from the rear window (43); lower the window (43).

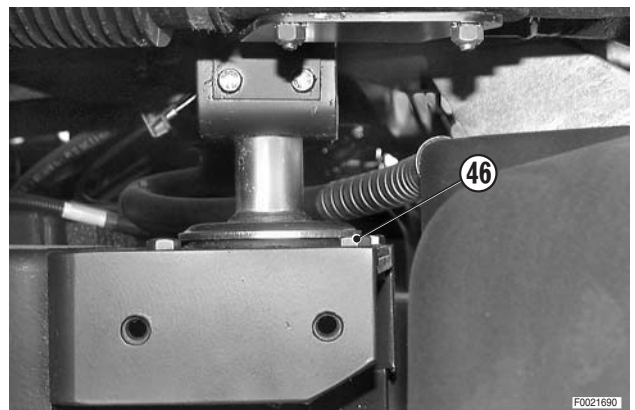


- 27 - While supporting the rear window, remove the hinge pins (45) with a pin punch.

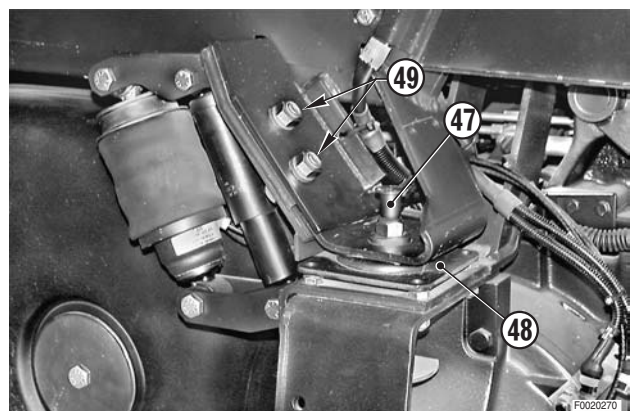


- 28 - Remove the complete rear window assembly (43).

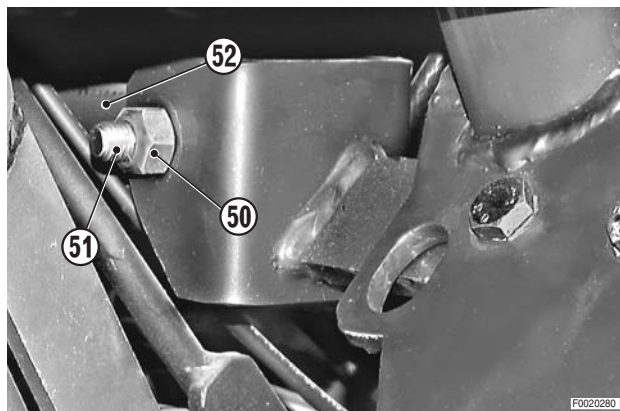
- 29 - Remove the front centre screws fixing the cab to the vibration damping mountings (46).



- 30 - Remove the centre bolts (47) of the rear supports (48) and the cab fixing bolts (49).

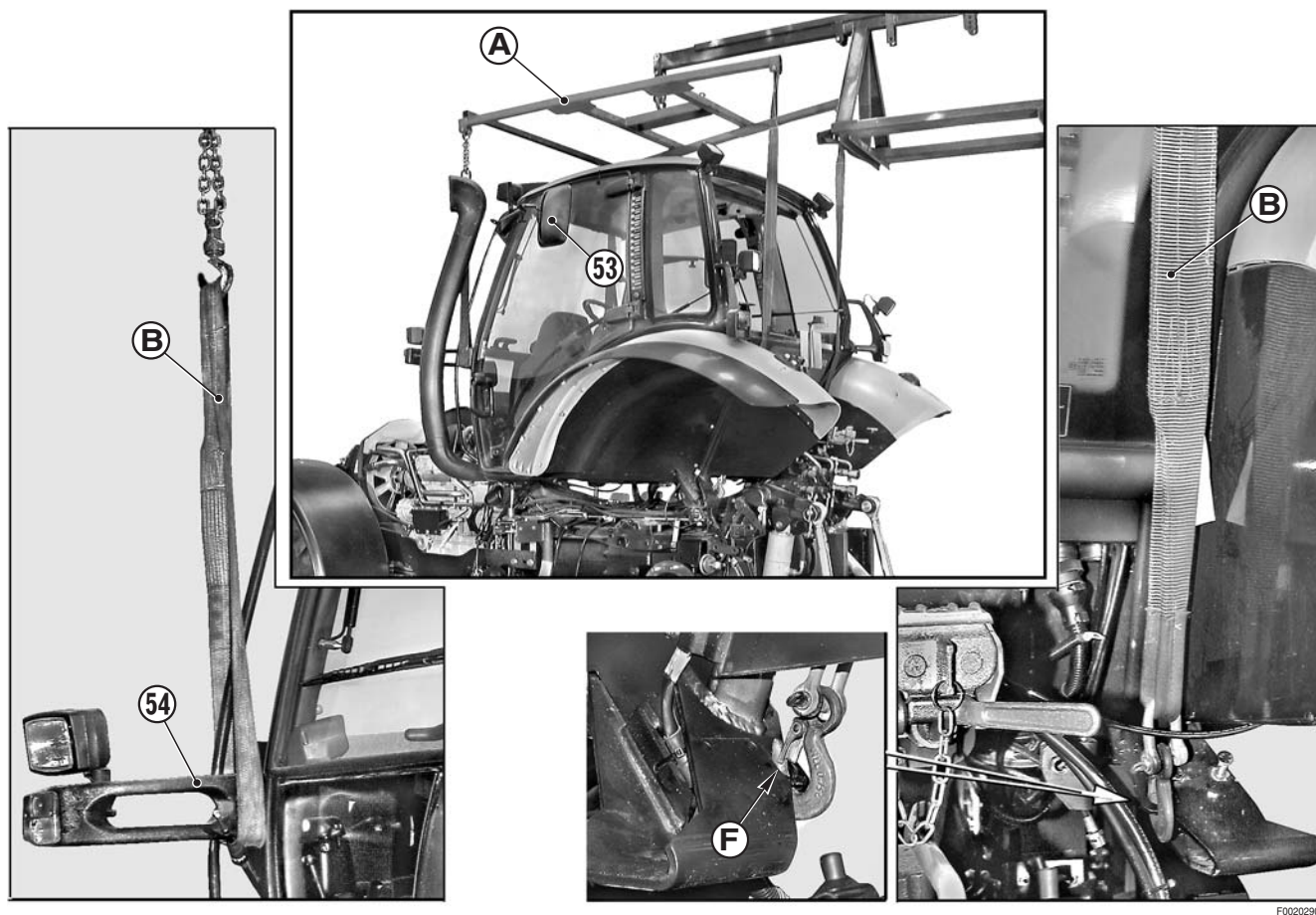


31 - Remove the nut (50) and the bolt (51); disengage the stabilizer bar (52) on the right-hand side at the rear.




32 - Fold the rearview mirrors (53) against the cab windows.

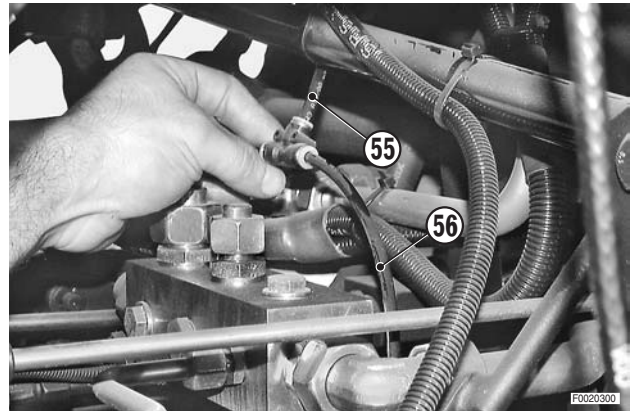
33 - Attach the cab lifting frame "A" to a hoist. Attach slings "B" of different length to the cab using the holes "F" provided on the rear supports and the supports (54) for the work lights and direction indicators.



34 - Slowly raise the cab by about 15 cm and disconnect the connection pipe (55) to the cab suspension valve and the pipe (56) from the reservoir (54) from the T fitting.

 Complete cab assembly: 780 kg (1718 lb.)


35 - Release the wiring from all the clips and remove the cab while guiding the pipes and control cables.



REFITTING THE CAB

- Refitting is the reverse of removal.



 Air conditioning pipes fittings:
 delivery (5/8" - 18UNF): 13.6–20.3 Nm (10–15 lb.ft.)
 suction (7/8" - 14UNF): 35.3–42 Nm (26–31 lb.ft.)



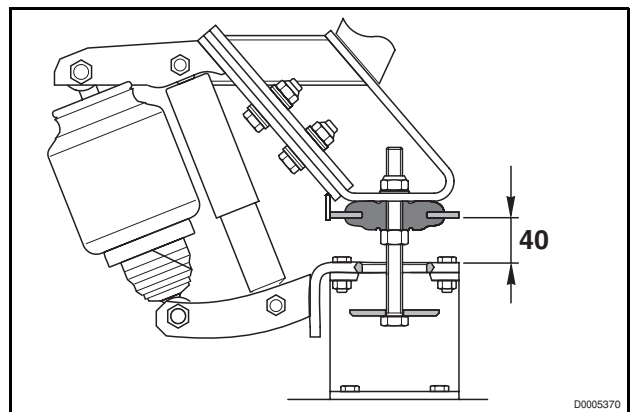
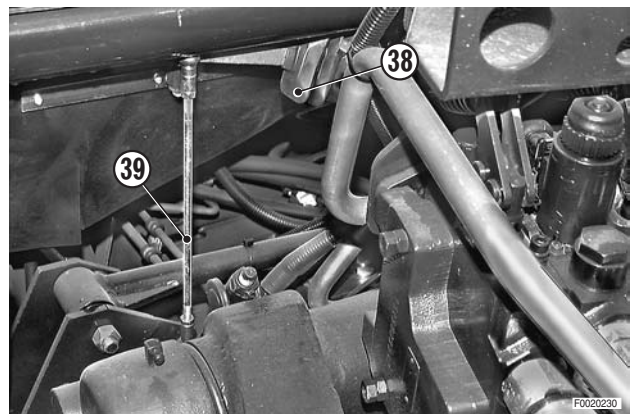
- ★ Check the adjustment of the tie-rod (39) to obtain the correct cab lifting height (without operator).

1 - Fill the engine cooling system.

 Coolant:

Mod.	106	110	115	120	135	150	165
ℓ	17.5	17.5	17.5	21	21	21	23
US. gall.	4.62	4.62	4.62	5.54	5.54	5.54	6.07

- 2 - Fully open the cab heater valve.
- 3 - Start the engine and check the hydraulic, pneumatic and heating systems for leaks.
- 4 - Turn the steering wheel back and forth between the full lock positions to expel any air from the power steering circuit.
- 5 - Switch off the engine; check the coolant level and top up if necessary.
- 6 - Bleed the hydraulic brake system.
(For details, see «BLEEDING THE BRAKE SYSTEM»).



SEPARATION OF THE ENGINE -TRANSMISSION

★ This operation does not require the removal of the cab.

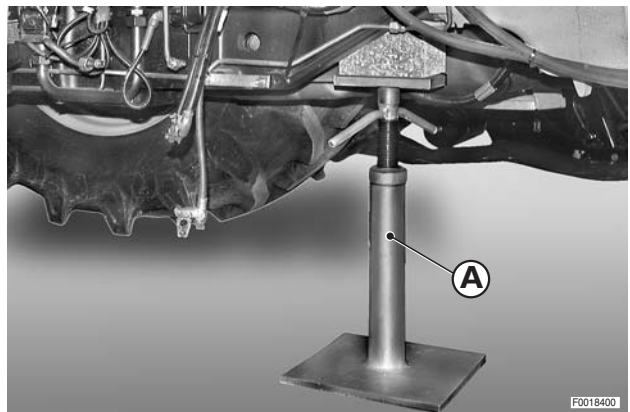
⚠ Make sure that the parking brake is applied.

★ Remove the following components in order:

- Front wheels
- Fenders
- Radiator – coolers – condenser assembly
- Front lift assembly and relative control pipes complete with support bracket
- Front PTO assembly
- Front axle – swinging axle support
- Front carrier
- Exhaust pipe
- Cab access steps
- Battery support – air reservoir for trailer braking (if present)
- Air conditioning compressor
- Silencer
- Air cleaner

For detailed instructions, refer to the corresponding sections in this manual.

1 - Position a jack "A" with non-slip block under the centre of the gearbox and raise the jack to support the load.

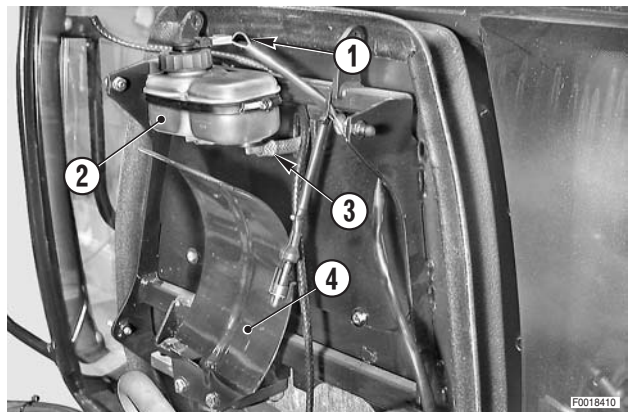


2 - Unplug the connectors (1) of the brake fluid level sensor.

3 - Draw off the fluid from the brake fluid reservoir (2); disconnect the pipes (3) from the reservoir and plug the open ends.

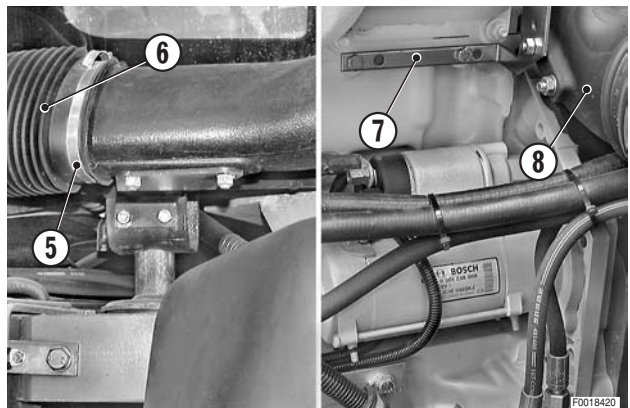
⊗ 1

4 - Remove the air cleaner mounting plate (4).

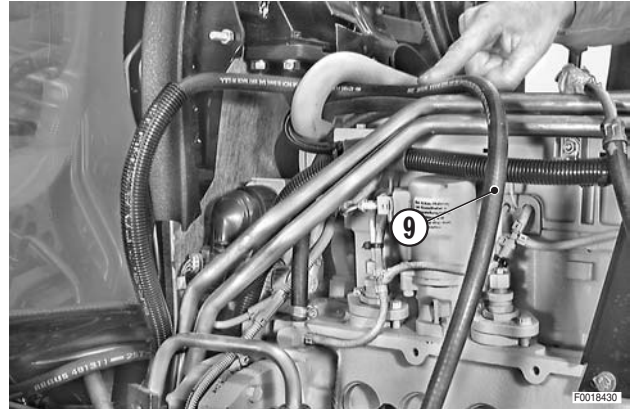


5 - Loosen the clamp (5) securing the inlet manifold (6); disconnect the manifold from the inlet hose.

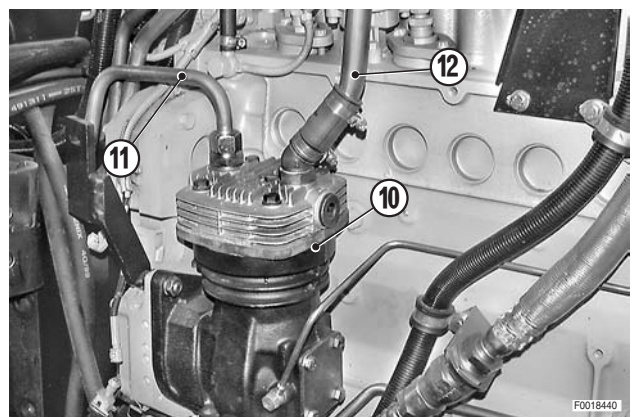
6 - Remove the bracket screws (7) and remove the complete manifold assembly (8).



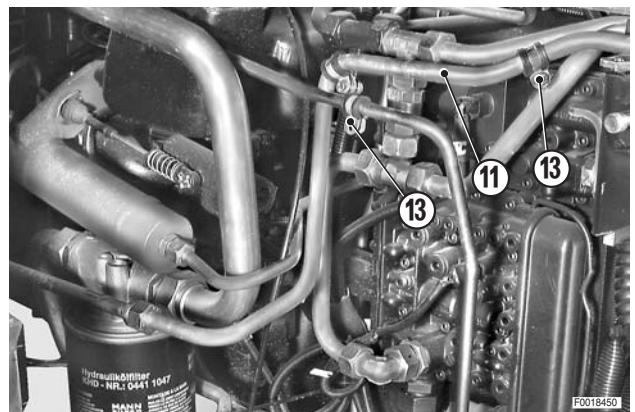
- 7 - Release the fuel return pipe (9) from the retaining clips and reposition the pipe so that it is directed towards the rear of the tractor.



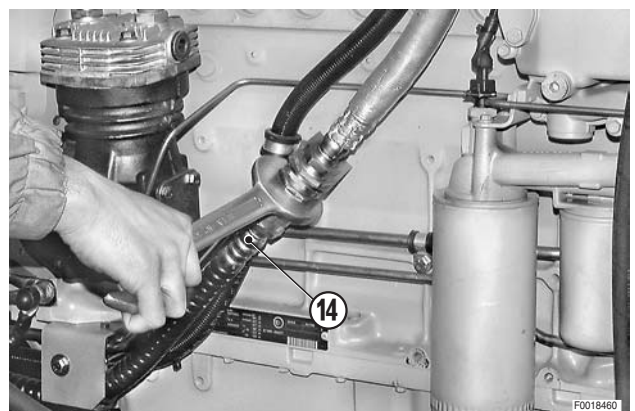
- 8 - Disconnect the delivery pipe (11) from the air compressor (10).
- 9 - Disconnect the suction pipe (12) from the compressor and remove it.
 - ★ Plug the open fittings on the compressor to prevent the entry of contaminants.



- 10 - Remove the clamps (13); disconnect the compressor delivery pipe (11) and remove it.
 - ★ Plug the end of the pipe and the open fitting to prevent the entry of contaminants.

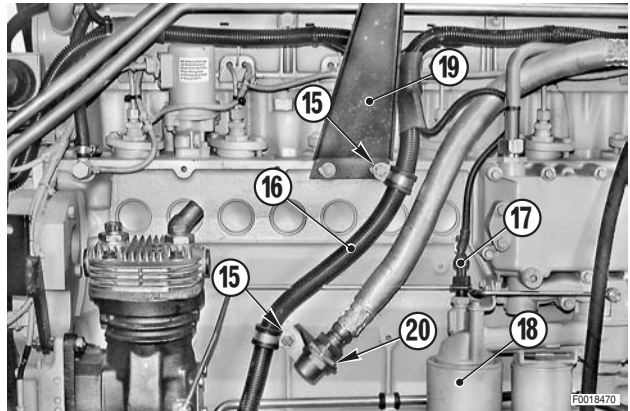


- 11 - Disconnect the suction pipe (14) of the air conditioning compressor.



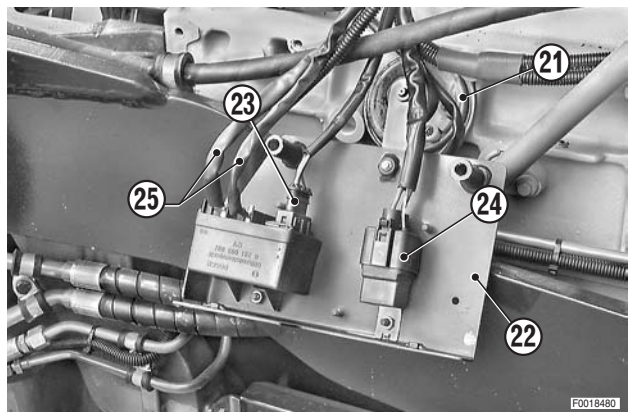
12 - Remove the fixing screws (15) of the clips of the engine wiring harness (16) and unplug the connector (17) of the filter clogging sensor (18).

13 - Remove the support (19) and bracket (20) of the suction pipe of the air conditioning compressor.

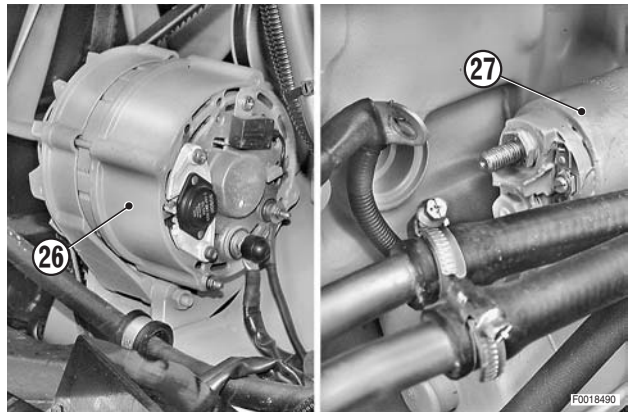


14 - Unplug the horn connectors (21).

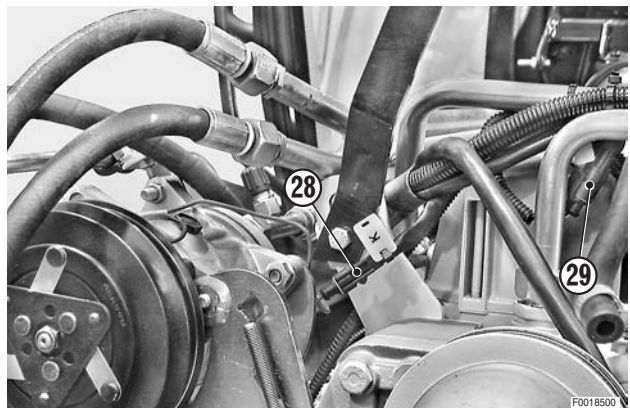
15 - Remove the relay box (22) and disconnect all the connectors (23), (24) and the wiring (25).



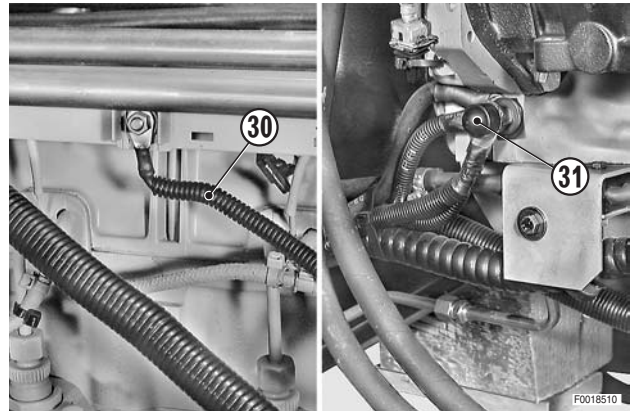
16 - Disconnect the wires from the alternator (26) and the starter motor (27).
(For details, see «REMOVAL OF THE STARTER MOTOR – REMOVAL OF THE ALTERNATOR»).



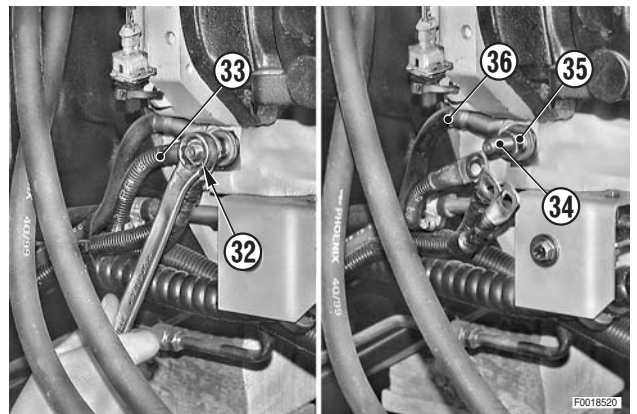
17 - Disconnect the connectors (28), (29) of the air conditioning compressor pulley engagement and the wiring for the front PTO.



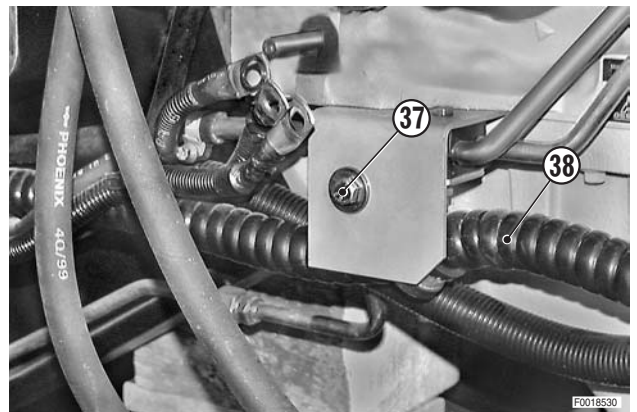
- 18 - Disconnect the earth lead (30) from the cylinder head.
- 19 - Remove the cover (31).



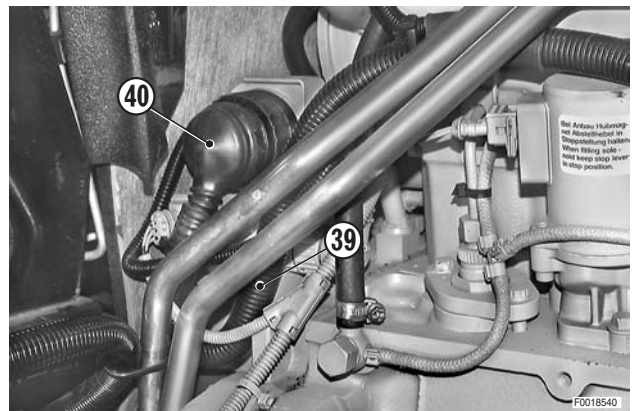
- 20 - Remove the nut (32) securing the earth terminals (33) and slide them off the stud (34).
- 21 - Remove the nut (35) and remove the earth lead (36) from the battery.



- 22 - Remove the screw (37) securing the clamp of the air conditioning compressor suction pipe (38).



- 23 - Release the wiring (39) from the straps and unplug the connector (40) of the engine ECU.
 - ★ Turn the ringnut counter-clockwise.



24 - Unplug the connector (41) of the coolant temperature sensor.

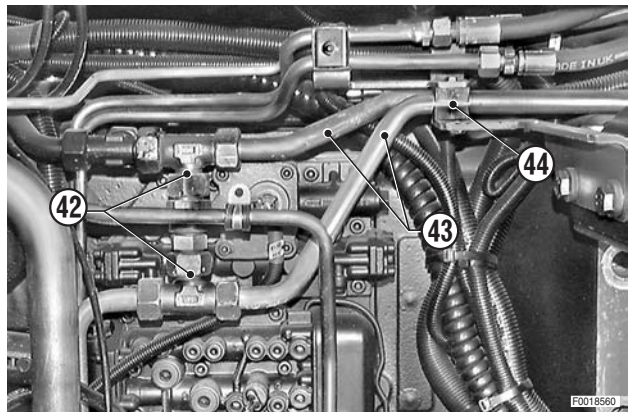
- ★ Release all the wiring from the retaining straps and arrange it in an orderly fashion towards the rear of the tractor.



25 - Disconnect the inlet and outlet pipes (43) of the gear-box oil cooler from the fittings (42).

- ★ Plug the ends of the pipes to prevent the entry of contaminants.

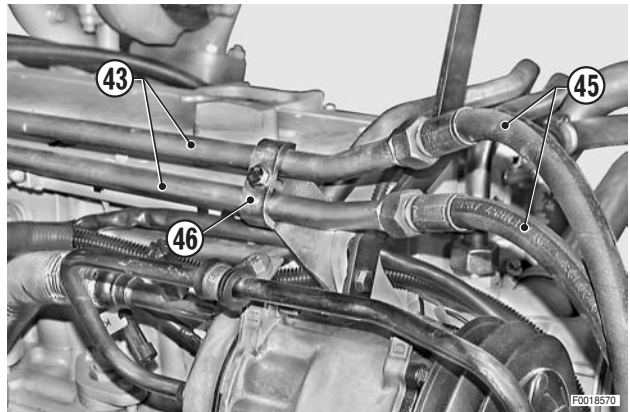
26 - Remove the clamp (44).



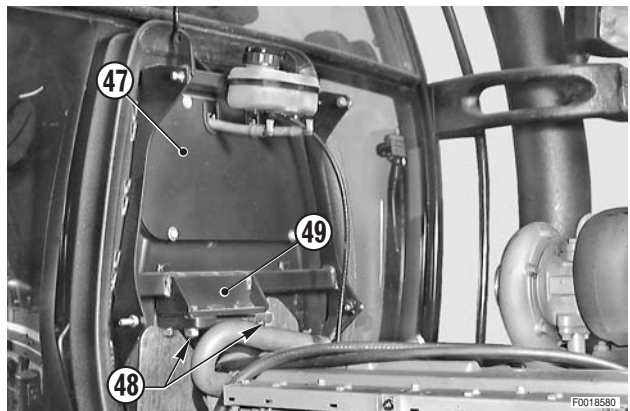
27 - Disconnect the flexible hoses (45) from the rigid pipes (43) and remove them.

- ★ Label the hoses to avoid confusion on reconnection.

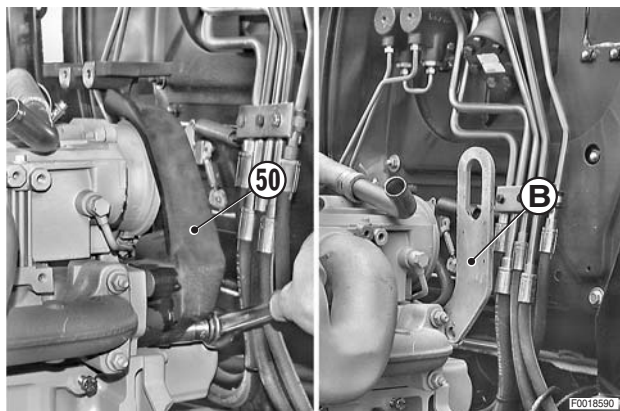
28 - Remove the clamp (46) and remove the pipes (43).



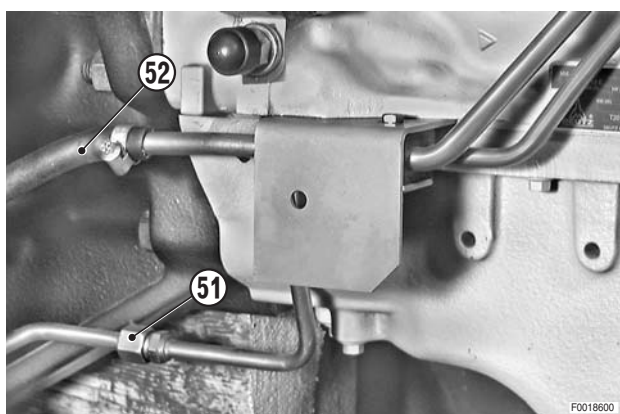
29 - Remove the insulation panel (47). Unscrew and remove the nuts (48) and remove the hood support (49) complete with the brake fluid reservoir.



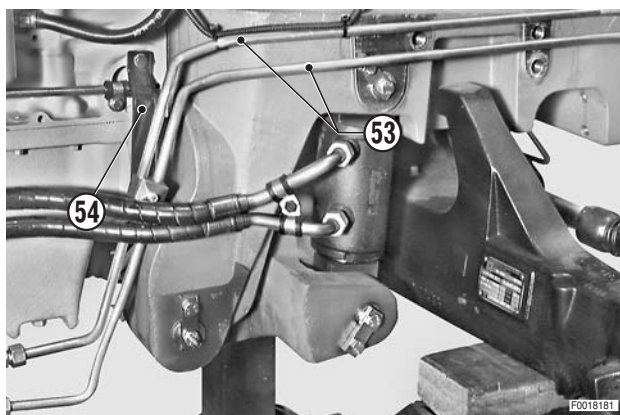
- 30 - Remove the hood support bracket (50) and attach a lifting bracket "B" to the same holes.



- 31 - Disconnect the differential lock pipe (51) and the fuel suction pipe (52).
 ★ Plug the ends of the pipes to prevent the entry of contaminants.



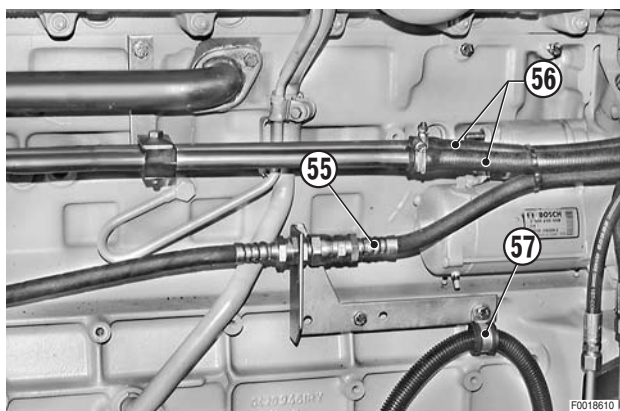
- 32 - Remove the lift control pipes (53) with the relative support bracket (54).



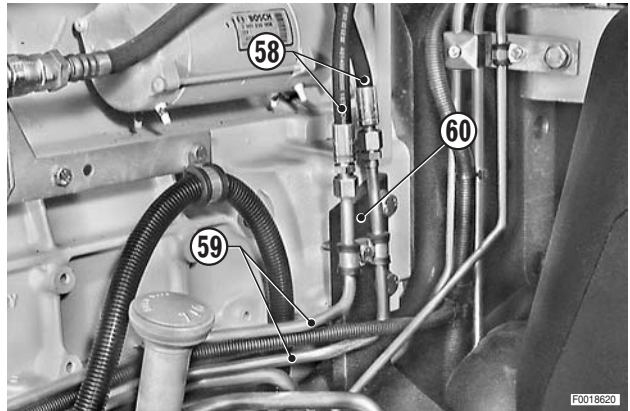
- 33 - Disconnect the delivery pipe (55) of the air conditioning compressor.

- 34 - Disconnect the cab heater hoses (56).

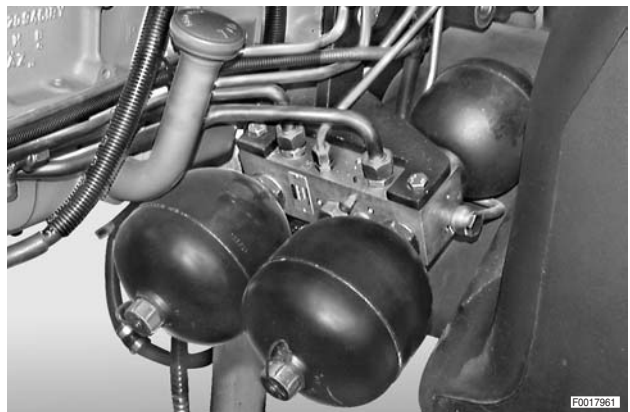
- 35 - Disconnect the wiring clip (57).



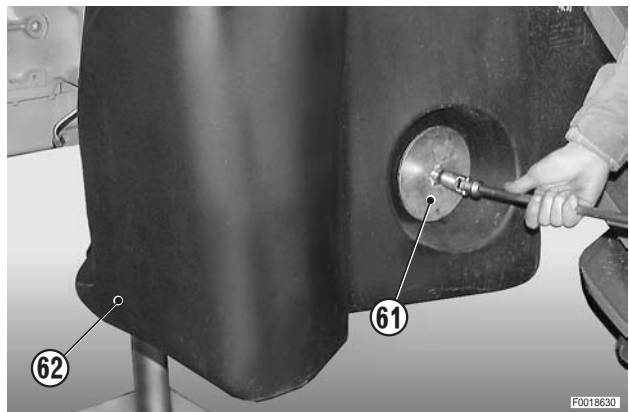
- 36 - Disconnect the steering system hoses (58).
- 37 - Remove the rigid pipes (59) complete with the retaining bracket (60).



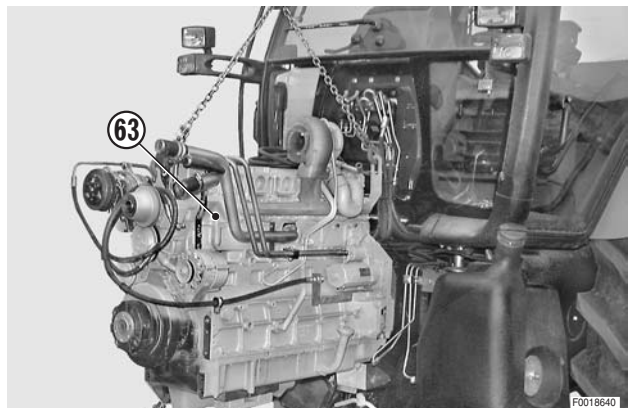
- 38 - Remove the front suspension accumulators assembly.
(For details, see «REMOVAL OF THE FRONT SUSPENSION ACCUMULATORS»).



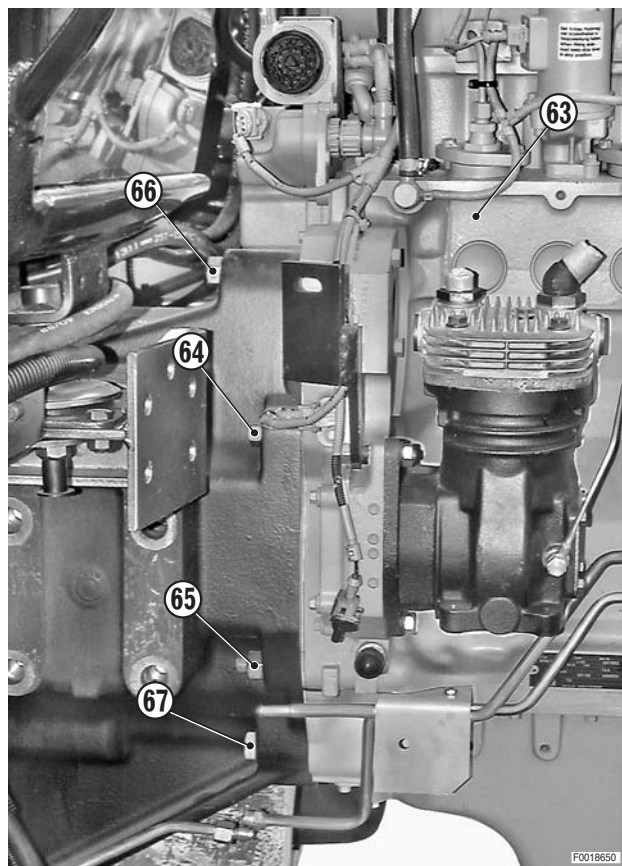
- 39 - Undo the bolt and remove the front flange (61) of the fuel tank; unscrew the rear flange bolt by about 20 mm.
- 40 - Move the fuel tank (62) to the side in order to access the lower bolt and the upper nuts securing the engine.



- 41 - Attach a hoist to the engine (63) using the front lifting bracket and the bracket fitted in step 30. Put the lifting chains or slings under tension.



- 42 - Unscrew and remove the lower engine (63) mounting nuts (64), (65) and bolts (66), (67). ✖ 2



- 43 - Separate the engine (63) from the transmission assembly (68) using a lever if necessary. ✖ 3



RECONNECTION OF THE ENGINE-TRANSMISSION

- Refitting is the reverse of removal.

✖ 1

- ★ Bleed the braking system. (For details, see «BLEEDING THE BRAKING SYSTEM»).


✖ 2

-  M12 nuts and bolts:
110±10% Nm (81±10% lb.ft.)
-  M16 nuts and bolts:
260±10% Nm (191.7±10% lb.ft.)

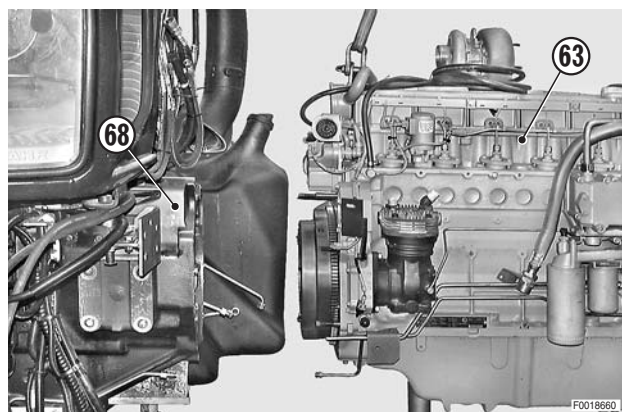
- ★ Tighten first the nuts and then the bolts gradually in a cross-wise sequence.

✖ 3

- ★ Thoroughly clean the surfaces and lubricate the surfaces and locating dowels.

 Locating dowels: Engine oil

- 1 - Fill all the systems with the appropriate fluids. Start the engine and run for a few minutes to allow the fluids to circulate, then check for leaks.
- 2 - Bleed the air from the hydraulic circuits by performing a few manoeuvres.
- 3 - Stop the engine, check all the fluid levels and top up if necessary.



SECTION 40

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THE STRUCTURE OF THE UNIT

For easier consultation, this unit has been divided into the following chapters:

1. Introduction

Contains a brief description of the terminology used, the procedures to follow for troubleshooting and repairs, and the instruments required for troubleshooting.

2. Indices

Contains the indices arranged by connector name, by component code and by component description.

3. Components

Contains the layouts of the connectors used in the electrical system, descriptions of the components installed on the tractor, the technical data necessary for functional testing and the pinouts of the electronic control units.

4. Systems

Contains the electrical diagrams of the tractor's systems.

5. Wiring harnesses

Contains the layouts, the wiring diagrams and the positioning of connectors on the tractor.

HOW TO CONSULT THE UNIT

A

INDICES 2.1 COMPONENT DESCRIPTION INDEX

Description	Code	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)	Notes
Start enable switch (green)	0441.6066	11	START	2	
Starter motor			X47	2	
Starter switch			X86		

C

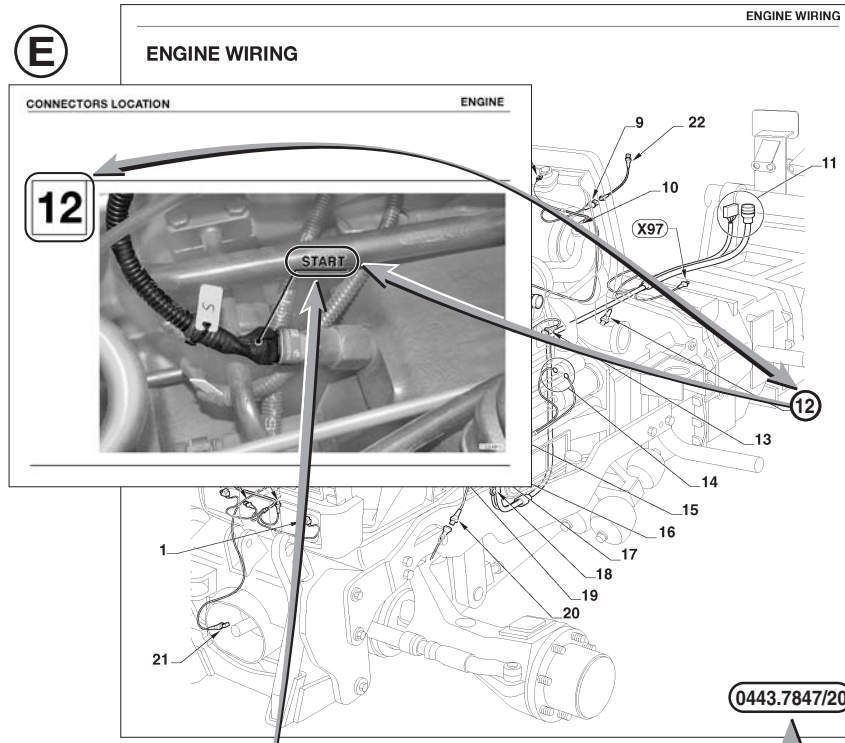
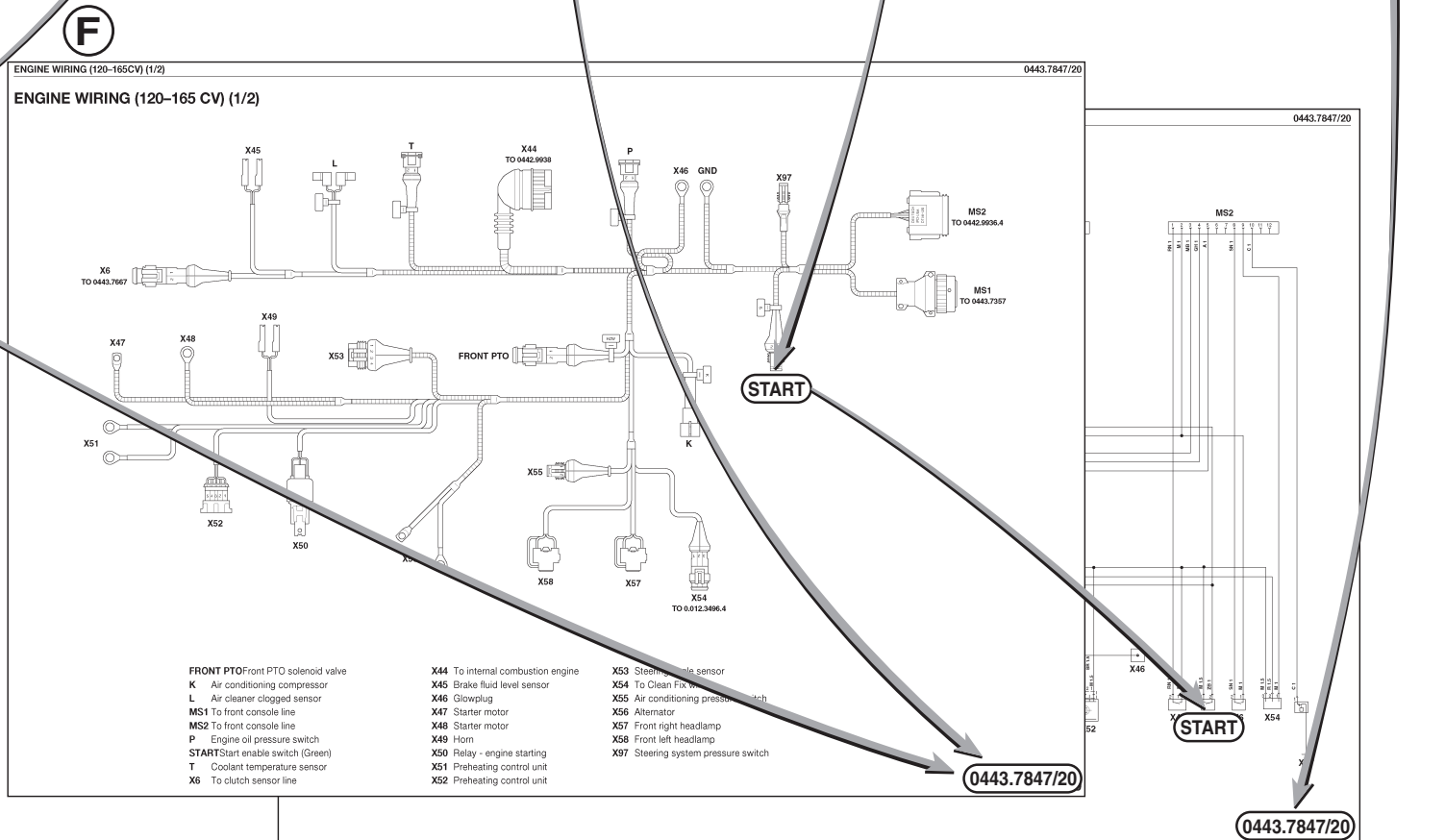
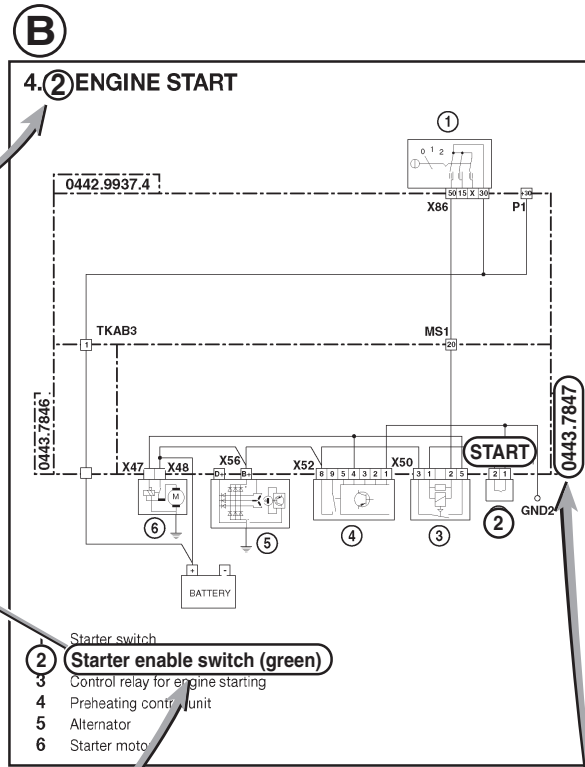
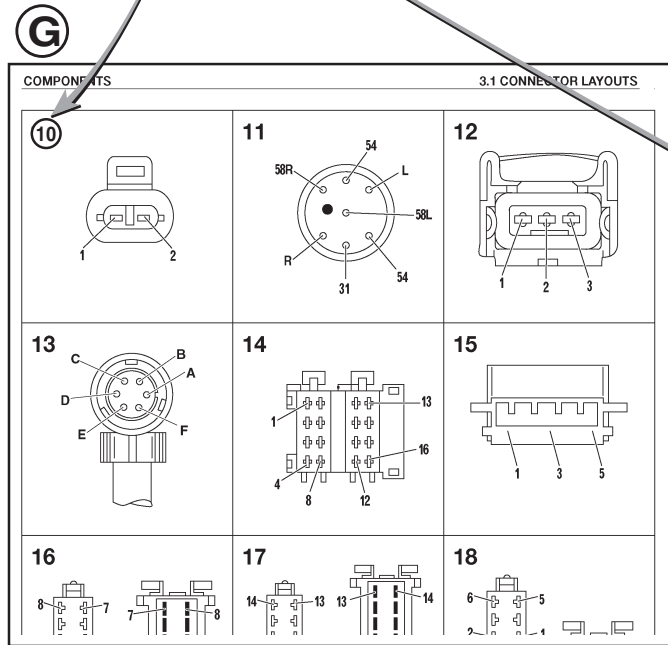
COMPONENTS 3.2 COMPONENT TECHNICAL DATA

N°	Description	Code	Characteristics	Notes	Connector
11	Start enable switch	0441.6066	Normally closed switch (NC) resistance with contact closed 3.9 Ohm	Green	START
12	Handbrake switch	0439.1395	Normally closed switch (NC) resistance with contact closed 3.9 Ohm		X90

D

INDICES 2.3 CONNECTOR INDEX

Connector	Type	Wiring code	Connection wiring or component code	Component description
ST1	32	0442.9936.4		Infocenter (1)
ST2	20	0442.9936.4		Infocenter (2)
START		0443.7847	0441.6066	Start enable switch (green)
		0.012.3639.4		



How to consult the table

The quickest way to determine the cause of a malfunction of a component (e.g. the starter motor) is to check all the components in the system in which the component is incorporated.

In this example, the problem is a malfunction of the starter motor, which fails to start the engine.

- 1 - Look in paragraph "2.1. Component description index" for the starter motor and identify the system in which it is incorporated. The system is indicated in the column "System (para. 4.xx)" and in this case is "2" (figure A).
- 2 - Consult paragraph "4.2 Starting" (figure B), in which the electrical diagram indicates all the components in the system; these components are accompanied by numbers that correspond to the key on the same page.
- 3 - Check all the components in the system, starting, for example, with the switch "2".
- 4 - Look in paragraph "2.1. Component description index" (figure A) for "Starting enabling switch (Green)" and check in the column "Technical (para. 3.2.xx)" if there is a technical description of the component (in this case it is given at n° 11 of the paragraph "3.2 Component technical data") (figure C). Note down also the name of the connector to which the component is connected (in this case "START").

Only if the position of the component is not known

- 5 - Look in paragraph "2.3 Connector index" (figure D) for the name of the connector to which the component is connected (in this case "START") and note down the wiring harness in which it is incorporated (in this case "0443.7847" or "0.012.3639.4") and the type of connector (in this case "10").
- 6 - Look for the wiring harness in chapter "5. Layouts, electrical wiring diagrams, connector positions" using the index at the beginning of the chapter.
- 7 - Look for the name of the connector in the photos attached to the electrical diagrams and determine its position on the tractor from the drawing (figure E). **NOTE.** In the electrical diagrams (figure F) are indicated the names of the connectors and the descriptions that are used in all the tables of chapter 2.
- 8 - Using the data contained in the paragraph "3.2 Component technical data" (figure C) in position n° 11, check the operation of the switch.

! If the pinout of the connector is not known, look in paragraph "3.1 Connector layouts" (figure G) for the number found in the column "Type" of paragraph "2.3 Connector index".

1. INTRODUCTION

This section of the workshop manual is intended as a practical guide to troubleshooting the tractor's electrical and electronic systems.

The following pages provide the technician with all the necessary information regarding the tractor's systems and components.

Due to the possible time difference between the introduction of technical modifications (in line with our policy of continuous product improvement) and the corresponding amendment of our printed documentation, we are obliged to state that the data contained in this document are subject to modification and as such are not binding.

1.1 LIST OF WIRING HARNESSSES

DESCRIPTION	CODE
Internal combustion engine wiring	0419.9751
Engine wiring (106–115 CV)	0.012.3639.4/10
Engine wiring (120–165CV)	0443.7847/20
Clutch sensor wiring	0443.7667
Clean fix wiring	0.012.3496.4
Wiring for supplementary air conditioning fan	0443.7871
Transmission wiring	0443.7848
Wiring for hydraulic and air trailer braking (Italy)	0443.7356.4
Wiring for air trailer braking	0443.7355
Wiring for front suspension control unit (cab)	0443.7850
Wiring for cab power supply	0443.7846/10
Wiring for cab line front suspension	0443.7849
Number plate light wiring	0.012.2018.4
	0441.4114
	0442.9887
Fender wiring	0.012.2010.4
	0.012.4420.4
	0442.9835
	0442.9886
Front console wiring	0442.9936.4/20
Accelerator pedal sensor wiring	0443.8666
Side console wiring (Power Shuttle)	0442.9937.4/20
Side console wiring (Power Shift)	0443.7357/20
Air conditioning wiring (cab)	010.2562.2
Display wiring	0443.7875.01
Roof wiring	0443.7851/10
Worklights wiring	0442.4189
Rotating beacon wiring	0441.4780
Armrest wiring	0443.7354.4
Internal armrest wiring	0443.5497
Control unit - fuses - relays	0441.9533

1.2 DEFINITION OF COMPONENTS AND SYMBOLS

To prevent any misunderstanding or ambiguity, listed below are definitions for some of the key terms used in this unit.

TERM	DESCRIPTION
Connector	Element used to connect two components (e.g. wiring-switch. wiring-wiring)
Temperature sensor	Electrical component that converts the temperature of a medium (air, water, oil, etc.) into a voltage or resistance
Pressure sensor	Electrical component that converts the pressure of a medium (air, water, etc.) into a voltage or resistance
Position sensor	Electrical component that converts the angular or linear position of an object into a voltage
Pressure switch	Switch that changes state (opens or closes a contact) according to the operating pressure in the circuit in which it is installed
Thermostat	Switch that changes state (opens or closes a contact) according to the temperature of the medium in which it is immersed.
Switch	Mechanical component that opens or closes one or more electrical contacts.
Solenoid valve	Valve operated by applying electrical current to a coil (or solenoid)

1.3 GENERAL RULES

The inspection, maintenance, troubleshooting and repair operations are essential to ensure that the tractor continues to operate correctly over time and to prevent malfunctions and breakdowns.

The scope of this paragraph is to describe repair procedures and to help improve the quality of repairs.

1.3.1 MODIFICATION OF THE TRACTOR'S ELECTRICAL/ELECTRONIC CIRCUITS

The manufacturer prohibits any modification or alteration of the electrical wiring for the connection of any non-approved electrical appliances or components.

In particular, if it is discovered that the electrical system or a component has been modified without authorisation, the manufacturer will accept no liability for any damage to the vehicle and the vehicle warranty will be invalidated.

1.3.2 MAIN WIRING FAULTS

a. Poor contact between connectors

The main causes of poor contact between connectors are incorrect insertion of the male into the female connector, deformation of one or both connectors, and corrosion or oxidation of the pin contact surfaces.

b. Defective pin welding or crimping

The pins of the male and female connectors make good contact in the crimped or welded area, but the wires are subjected to excessive tension, leading to breakage of the insulation or the wire itself and a poor connection.

c. Disconnecting wiring

If components are disconnected by pulling on the wires, or if components are removed with the wires still connected, or if the wiring is subject to a heavy impact this could damage the connections at the pins, breaking strands of wire.

d. Penetration of water in connectors

The connectors are designed to prevent penetration of liquids (water, oil etc.); however, it is possible that when the tractor is cleaned using high-pressure water or steam, water could penetrate or condense in the connectors.

As the connectors are designed to prevent liquid penetration, any water that does get in will not be able to drain out, and thus may cause shortcircuits across the pins.

For this reason it is good practice to dry the connectors with a low pressure jet of compressed air after washing the tractor.

e. Oil or dirt on connectors

Oil or grease on the connectors or pins can create a poor contact (oil and grease are non-conductors) .

Clean the connectors thoroughly using a dry cloth or a low pressure jet of compressed air and use specific products (deoxidising sprays, etc.) to degrease the contacts.

- ★ Take care not to bend the pins when cleaning them.
- ★ Use dehydrated not lubricated compressed air.

1.3.3 REMOVAL, REFITTING AND DRYING OF CONNECTORS AND WIRING**a. Disconnection of connectors**

When disconnecting wiring, pull on the connectors rather than on the wires themselves. For connectors that are held in position with screws or levers, fully loosen the screws, then pull on the connector.

For connectors that are clipped together, fully depress the clip then pull the connector apart.

After disconnecting connectors, cover them in a waterproof material to prevent dirt or moisture getting into the contacts.

b. Connecting the connectors

Check the condition of the connectors:

- Make sure the pin contact surfaces are free of water, dirt or oil.
- Check that the connectors are not deformed and that the pins are not corroded.
- Check that the connector casings are not damaged or split.
- ★ If a connector is contaminated with oil or grease, or if moisture has penetrated the casing, clean it as described in paragraph 1.3.2.
- ★ If a connector is damaged, deformed or broken, replace it with a new one.

When connecting connectors, make sure they are properly aligned before applying any force.

For connectors with clips, insert the two halves until they clip together.

c. Cleaning and drying wiring

When wiring is dirty or contaminated with oil or grease, clean it with a dry cloth, or, if necessary, with water or steam.

If the wiring has to be cleaned with water, avoid directing the water or steam jet on the connectors; if water penetrates the connector, proceed as described in paragraph 1.3.2.

- ★ Check that the connector is not short circuited by water by testing the continuity across the pins.
- ★ After checking the connector is in good condition, degrease the contacts using a deoxidising product.

d. Renewal of damaged electrical components.

- When replacing electrical components (fuses, relays, etc.), use only original parts supplied by the manufacturer.
- When replacing fuses, check that the new fuse conforms to DIN 72581 standards and in particular:
 - fuse F1 (100A) DIN 72581/2
 - bayonet fuse (F2, F3, etc.) DIN 72581/3C
 The fitting of replacement fuses that do not comply with these standards will invalidate the warranty with immediate effect and release the manufacturer from any liability.
- When replacing relays, make sure that the new relay conforms to the standards marked on the original relay.

1.4 DIAGNOSTIC INSTRUMENTS

For the correct diagnosis of any faults in the tractor's electrical system, the following instruments are required:

- 1 - **Digital multimeter** with the following minimum characteristics:
 - AC VOLT 0-600
 - DC VOLT 0-600
 - OHM..... 0-32M
 - AC AMP 0-10
 - DC AMP 0-10
- 2 - **Computer** loaded with the “**SERDIA**” and “**EDS** (Electronic Diagnosis System)” software.

1.5 WIRE COLOUR CODES

COLOUR CODES		COLOUR CODES	
A	Light blue	M	Brown
B	White	N	Black
C	Orange	R	Red
G	Yellow	S	Pink
H	Grey	V	Green
L	Dark blue	Z	Purple

2. INDICES

2.1 COMPONENT DESCRIPTION INDEX

Description	Code	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)	Notes
4WD control solenoid valve	0443.1661	5	DT	13-15-18	
4WD switch	0441.1496.4		8	18	
Accelerator control lever	0442.7318		EMR	4	
Accelerator pedal position sensor	0443.2708	26	X40	10-13	
Actuator	0211.1926	1	Y3	4	
Air cleaner clogged sensor	0441.9015		L	9	
Air conditioning compressor	0443.7338		K	12	
Air conditioning control switch	010.2532.0		X110	12	
Air conditioning fuse F50 (30 A)			X79	12	
Air conditioning pressure switch	0442.6492		X55	12	
Air conditioning thermostat	010.2537.1		X111	12	
Alternator			X56	2-3-12-20	
ASM switch	0441.1498		6	18	
Autoradio			X34	11	
Auxiliary power socket (Earth)	0114.3529		X67-X68		
Brake fluid level sensor			X45	13	
Brake lights fuse F102 (15 A)			X82	13	
Cab roof worklights switch	0441.1496.4		3	5-7	
Camshaft speed sensor (PICK-UP)	0419.0811	40	B40	4	
CB power connector			X20	11	
Cigar lighter	0441.2338		X91	6	
Clean Fix fuse F101 (15 A)			X66	21	
Clean Fix control compressor			X64	21	
Clean Fix control solenoid valve	0445.0262		X63	21	
Clean Fix control switch			X70	21	
Clock	0441.2337		X32	6	
Clutch pedal depressed proximity sensor	0442.4165	31	X62	16	Powershuttle
Clutch pedal position sensor	0443.2708	27	X61	16-17	
Compressed air pressure gauge	0442.5709	14	X94	14	
Compressor for driver's seat air suspension	010.2274.1		X87	6	
Connector for air conditioning control panel lighting			X112	12	
Control relay for 1st speed and air conditioning power on			X109	12	
Control relay for 3rd speed heater fans			X102	12	
Control relay for 4th speed heater fans			X103	12	

Description	Code	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)	Notes
Control relay for Clean Fix			X65	21	
Control relay for engine starting			X50	2-3	
Control relay for front upper worklights			X35	7	
Coolant temperature sensor	0419.9260	35	B43	4	
Coolant temperature sensor (For Infocenter)	0419.9260	34	T	9	
Diagnostics connector			X81	4-13-15-16-17-19	
Diff lock solenoid valve	0441.7555	4	EV DF	18	
Diff lock switch	0441.1498		7	18	
Direction indicator lights control unit (Red)			X83	5	
Door open alarm switch			X37	6	
Engine boost pressure sensor	0419.9552	33	B41	4	
Engine ECU			MX1	4-10-16-17	
Engine oil pressure switch	0419.0807	17	P	9	
Engine speed keypad			X42	4	
Engine speed sensor	010.2874.2	37	NLSE	16-17	
Engine stop coil	0420.6912	2	Y1	4	106-115CV
Engine stop coil	0420.6915	3	Y1	4	120-165CV
Fan speed selector switch	010.2528.1		X108	12	
Forward/reverse selector	0441.9670.4		X113	17	Powershift
Forward/reverse selector	0443.7341		X113	16	Powershuttle
Forward/reverse solenoid valves	0441.6685		ADD. EV. V/R	16-17	
Front axle suspension control unit	0442.7305		JX3-JX4	10	
Front axle suspension position sensor	0439.1530	29	X14	15	
Front left headlamp			X58	5	
Front left side lights and direction indicators			X25	5-7	
Front left worklight			X22	5-7	
Front PTO control pushbutton (in cab)	0441.1533		X76	20	
Front PTO solenoid valve	0441.7405	8	FRONT PTO	20	
Front right headlamp			X57	5	
Front right side lights and direction indicators			X24	5-7	
Front right worklight			X21	5-7	
Front suspension switch	0442.2763		5	15	
Front windscreen washer pump	0441.4105		FP	8	
Fuel level sensor	0441.1109	24	FUEL	9	106-115CV
Fuel level sensor	0441.1112	23	FUEL	9	120-150CV
Fuel level sensor	0443.8120/10	25	FUEL	9	165CV

Description	Code	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)	Notes
Fuse F100 (30 A)	0442.7647		X16	12	
Gear change solenoid valves	0441.6685		EV GROUP	16-17	
Gear change solenoid valves	0443.6315		EV GROUP	16-17	
Gear shift pushbutton panel			X74	16-17	
Gearbox output shaft speed sensor	0443.8449	42	NLSA	16-17	
Glowplug			X46	3	
Handbrake switch	0439.1395	12	X90	13-14	
Hazard lights switch lighting			X96	5	
Horn	0116.9304		X49	5	
Infocenter			ST1-ST2	3-4-5-9-10- 13-14-16- 17-18-19-20	
Interior roof light	0442.6316		X23	6	
ISO4 socket (Power for external implements)	0442.2323.4		ISO4	10	
ISO7 socket (Connection for external implements)	0442.2324.4		ISO7	4-10-20	
Left brake pedal switch	0439.1395	13	X60	13-15-18	
Left front loudspeaker	012.1725.0		X29	11	
Left heater fan	010.2537.0		X105	12	
Left rear loudspeaker	012.1726.0		X30	11	
Lift control lever			X78	19	
Lift control lever			EHR	19	
Lift draft sensor	0441.5586.4	32	LEFT DRAFT RIGHT DRAFT	19	
Lift lowering solenoid valve	0441.8229	6	EV DW	19	
Lift raising solenoid valve	0441.8229	10	EV UP	19	
Lights selector switch	0443.8653		AS4	5-8	Powershift
Lights selector switch	0443.8656		AS4	5-8	Powershuttle
Lower worklights switch	0441.1496.4		3A	5-7	
Motor for supplementary air conditioning fan	0442.6490		X19	12	
Number plate light			X92	5	
Preheating control unit	0117.9712		X52	2	
Pressure switch - hydraulic oil filter clogging	0118.0413		FILTER	16-17	
Pressure switch for supplementary air conditioning fan	0442.3185		X18	12	
Pressure switch, clutch pedal depressed	0441.3195	18	X101	17	Powershift
Proportional solenoid valve	0443.4425	7	EV PROP	16	
PTO AUTO control switch			X98	20	
Radar	0443.8654	20	RADAR	19	
Radar (UK)	0443.8655	21	RADAR	19	
Radar control switch	0441.4584		X73	19	

Description	Code	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)	Notes
Rear left side lights and direction indicators			X4	5-13	
Rear lift "lower" control pushbutton	0441.2688	19	DW	19	
Rear lift "raise" control pushbutton	0441.2688	19	UP	19	
Rear lift position sensor	0443.8667	28	POS. SENS.	19	
Rear lower left worklights			X3	7	
Rear lower right worklights			X3	7	
Rear power lift ECU			JX1-JX2	10-19-20	
Rear PTO control pushbutton (in cab)	0441.1533		X77	20	
Rear PTO control pushbutton (on fender)	0441.1533		PTO	20	
Rear PTO solenoid valve	0441.7555	9	EV PTO	20	
Rear PTO speed sensor	0441.3198	39	PTO SEN	20	
Rear right side lights and direction indicators			X4	5-13	
Rear screen washer pump	0441.4105		RP	8	
Rear screen wiper	0441.9283		X69	7-8	
Rear screen wiper motor	0441.3192		X27	8	
Rear upper left worklights			X99	7	
Rear upper right worklights			X99	7	
Rear worklights switch	0441.1496.4		X72	7	
Relay - supplementary air conditioning fan	0440.2772		X17	12	
Resistor - left heater fan	010.2535.1		X104	12	
Resistor - right heater fan	010.2535.1		X107	12	
Right brake pedal switch	0439.1395	13	X59	13-15-18	
Right front loudspeaker	012.1725.0		X28	11	
Right heater fan	010.2535.0		X106	12	
Right rear loudspeaker	012.1726.0		X31	11	
Rotating beacon control switch	0441.1496.4		X71	7	
Rotating light			X100	7	
Side console courtesy light	0441.2616		X36	6	
Side lights switch	0441.1497		1	7	
Solenoid valve for control of front axle Load Sensing suspension			X15	15	
Solenoid valve for front axle raising control			H	15	
Solenoid valve for front axle lowering control			S	15	
Solenoid valve for trailer parking brake			X9	14	
Speed sensor for odometer	0443.8436	38	NAB	16-17	

Description	Code	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)	Notes
Start enable switch (Green)	0441.6066	11	START	2	
Starter motor			X47	2-3	
Starter switch	0441.1512.4		X86		
Steering angle sensor	0441.5266		X53	18	
Steering circuit pressure switch			X97	9	
Super-reduction engagement switch	0443.6527		X75	16-17	
Trailer braking air pressure sensor	011.9428.0	30	X8	14	
Trailer braking low pressure switch			X10	14	
Trailer socket (For lights and auxiliary power)	0442.4116		X38	10-13	
Transmission display	0441.9280.4		X93	16-17	
Transmission ECU			ECU LS	16-17	
Transmission neutral sensor (red switch)	0441.6995	22	NEUTRAL LS	17	Powershift
Transmission oil low pressure switch	0441.6706	15	PRESS. SWITCH	17	Powershift
Transmission oil low pressure switch	0443.1690	16	PRESS. SWITCH	16	Powershuttle
Transmission oil temperature sensor	0441.6649	36	TEMP	16-17	
Transmission speed sensor	0443.8450	41	NHK	16	Powershuttle
Windscreen wiper motor	0441.3192		X26	8	

2.2 COMPONENT CODE INDEX

Code	Description	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)	Notes
010.2274.1	Compressor for driver's seat air suspension		X87	6	
010.2528.1	Fan speed selector switch		X108	12	
010.2532.0	Air conditioning control switch		X110	12	
010.2535.0	Right heater fan		X106	12	
010.2535.1	Resistor - right heater fan		X107	12	
010.2535.1	Resistor - left heater fan		X104	12	
010.2537.0	Left heater fan		X105	12	
010.2537.1	Air conditioning thermostat		X111	12	
010.2874.2	Engine speed sensor	37	NLSE	16-17	
011.9428.0	Trailer braking air pressure sensor	30	X8	14	
0114.3529	Auxiliary power socket (Earth)		X67		
0114.3529	Auxiliary power socket (Positive)		X68		
0116.9304	Horn		X49	5	
0117.9712	Preheating control unit		X52	2	
0118.0413	Pressure switch - hydraulic oil filter clogging		FILTER	16-17	
012.1725.0	Right front loudspeaker		X28	11	
012.1725.0	Left front loudspeaker		X29	11	
012.1726.0	Right rear loudspeaker		X30	11	
012.1726.0	Left rear loudspeaker		X31	11	
0211.1926	Actuator	1	Y3	4	
0419.0807	Engine oil pressure switch	17	P	9	
0419.0811	Camshaft speed sensor (PICK-UP)	40	B40	4	
0419.9260	Coolant temperature sensor	34	T	9	
0419.9333	Coolant temperature sensor	35	B43	4	
0419.9552	Engine boost pressure sensor	33	B41	4	
0420.6912	Engine stop coil	2	Y1	4	106-115CV
0420.6915	Engine stop coil	3	Y1	4	120-165CV
0439.1395	Handbrake switch	12	X90	13-14	
0439.1395	Right brake pedal switch	13	X59	13-15-18	
0439.1395	Left brake pedal switch	13	X60	13-15-18	

Code	Description	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)	Notes
0439.1530	Front axle suspension position sensor	29	X14	15	
0440.2772	Relay - supplementary air conditioning fan		X17	12	
0441.1109	Fuel level sensor	24	FUEL	9	106-115CV
0441.1112	Fuel level sensor	23	FUEL	9	120-150CV
0441.1496.4	Rotating beacon control switch		X71	7	
0441.1496.4	Rear worklights switch		X72	7	
0441.1496.4	4WD switch		8	18	
0441.1496.4	Lower worklights switch		3A	5-7	
0441.1496.4	Cab roof worklights switch		3	5-7	
0441.1497	Side lights switch		1	7	
0441.1498	ASM switch		6	18	
0441.1498	Diff lock switch		7	18	
0441.1512.4	Starter switch		X86		
0441.1533	Front PTO control pushbutton (in cab)		X76	20	
0441.1533	Rear PTO control pushbutton (in cab)		X77	20	
0441.1533	Rear PTO control pushbutton (on fender)		PTO	20	
0441.2337	Clock		X32	6	
0441.2338	Cigar lighter		X91	6	
0441.2616	Side console courtesy light		X36	6	
0441.2688	Rear lift "lower" control pushbutton	19	DW	19	
0441.2688	Rear lift "raise" control pushbutton	19	UP	19	
0441.3192	Windscreen wiper motor		X26	8	
0441.3192	Rear screen wiper motor		X27	8	
0441.3195	Pressure switch, clutch pedal depressed	18	X101	17	Powershift
0441.3198	Rear PTO speed sensor	39	PTO SEN	20	
0441.4105	Front windscreen washer pump		FP	8	
0441.4105	Rear screen washer pump		RP	8	
0441.4584	Radar control switch		X73	19	
0441.5266	Steering angle sensor		X53	18	
0441.5586.4	Lift draft sensor	32	RIGHT DRAFT LEFT DRAFT	19	

Code	Description	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)	Notes
0441.6066	Start enable switch (Green)	11	START	2	
0441.6649	Transmission oil temperature sensor	36	TEMP	16-17	
0441.6685	Forward/reverse solenoid valves		ADD. EV. V/R	16-17	
0441.6685	Gear change solenoid valves		EV GROUP	16-17	
0441.6706	Transmission oil low pressure switch	15	PRESS. SWITCH	17	Powershift
0441.6995	Transmission neutral sensor (red switch)	22	NEUTRAL LS	17	Powershift
0441.7405	Front PTO solenoid valve	8	FRONT PTO	20	
0441.7555	Diff lock solenoid valve	4	EV DF	18	
0441.7555	Rear PTO solenoid valve	9	EV PTO	20	
0441.8229	Lift lowering solenoid valve	6	EV DW	19	
0441.8229	Lift raising solenoid valve	10	EV UP	19	
0441.9015	Air cleaner clogged sensor		L	9	
0441.9280.4	Transmission display		X93	16-17	
0441.9283	Rear screen wiper		X69	7-8	
0441.9670.4	Forward/reverse selector		X113	17	Powershift
0442.2323.4	ISO4 socket (Power for external implements)		ISO4	10	
0442.2324.4	ISO7 socket (Connection for external implements)		ISO7	4-10-20	
0442.2763	Front suspension switch		5	15	
0442.3185	Pressure switch for supplementary air conditioning fan		X18	12	
0442.4116	Trailer socket (For lights and auxiliary power)		X38		
0442.4165	Clutch pedal depressed proximity sensor	31	X62	16	Powershuttle
0442.5709	Compressed air pressure gauge	14	X94	14	
0442.6316	Interior roof light		X23	6	
0442.6490	Motor for supplementary air conditioning fan		X19	12	
0442.6492	Air conditioning pressure switch		X55	12	
0442.7305	Front axle suspension control unit		JX4	10	
0442.7318	Engine speed keypad		X42	4	
0442.7647	Fuse F100 (30 A)		X16	12	
0443.1661	4WD control solenoid valve	5	DT	13-15-18	
0443.1690	Transmission oil low pressure switch	16	PRESS. SWITCH	16	Powershuttle

Code	Description	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)	Notes
0443.2708	Accelerator pedal position sensor	26	X40	10-13	
0443.2708	Clutch pedal position sensor	27	X61	16-17	
0443.4425	Proportional solenoid valve	7	EV PROP	16	
0443.6315	Gear change solenoid valves		EV GROUP	16-17	
0443.6527	Super-reduction engagement switch		X75	16-17	
0443.7338	Air conditioning compressor		K	12	
0443.7341	Forward/reverse selector		X113	16	Powershuttle
0443.8120/10	Fuel level sensor	25	FUEL	9	165CV
0443.8436	Speed sensor for odometer	38	NAB	16-17	
0443.8449	Gearbox output shaft speed sensor	42	NLSA	16-17	
0443.8450	Transmission speed sensor	41	NHK	16	Powershuttle
0443.8653	Lights selector switch		AS4	5-8	Powershift
0443.8654	Radar	20	RADAR	19	
0443.8655	Radar (UK)	21	RADAR	19	
0443.8656	Lights selector switch		AS4	5-8	Powershuttle
0443.8667	Rear lift position sensor	28	POS. SENS.	19	
0445.0262	Clean Fix control solenoid valve		X63	21	

2.3 CONNECTOR INDEX

Connector	Type	Wiring code	Connection wiring or component code	Component description
1	25	0442.9936.4	0441.1497	Side lights switch
3	25	0442.9936.4	0441.1496.4	Cab roof worklights switch
3A	25	0442.9936.4	0441.1496.4	Lower worklights switch
5	25	0442.9936.4	0442.2763	Front suspension switch
6	25	0442.9936.4	0441.1498	ASM switch
7	25	0442.9936.4	0441.1498	Diff lock switch
8	25	0442.9936.4	0441.1496.4	4WD switch
ADD. EV. V/R	9	0443.7848	0441.6685	Forward/reverse solenoid valves
AS1	26	0442.9936.4	0443.7357	
			0442.9937.4	
AS2	27	0442.9936.4	0443.7357	
			0442.9937.4	
AS3	17	0442.9936.4	0443.7357	
			0442.9937.4	
AS4	26	0443.7357	0443.8656	Lights selector switch (Powershuttle)
		0442.9937.4	0443.8653	Lights selector switch (Powershift)
AS5	18	0443.7875	0443.7357	
			0442.9937.4	
AS6	16	0442.9936.4	0443.7357	
			0442.9937.4	
B40		0419.9751		Camshaft speed sensor (Pick-Up)
B41		0419.9751		Engine boost pressure sensor
B43		0419.9751	0419.9260	Coolant temperature sensor
DS1	16	0443.7851	0443.7357	
			0442.9937.4	
DT	9	0443.7848	0443.1661	4WD control solenoid valve
DW	9	0.012.2010.4	0441.2688	Rear lift "lower" control pushbutton
		0.012.4420.4		
		0442.9835		
		0442.9886		

Connector	Type	Wiring code	Connection wiring or component code	Component description
ECU LS	36	0443.7357		Transmission control unit (Powershift)
	37	0442.9937.4		Transmission control unit (Powershuttle)
EHR	9	0443.7354.4	0443.7357	
			0442.9937.4	
	0443.7357		Lift control lever	
	0442.9937.4		Lift control lever	
EMR	9	0443.7354.4	0443.7357	
			0442.9937.4	
	0443.7357	0442.7318	Throttle lever	
	0442.9937.4	0442.7318	Throttle lever	
EV DF	6	0443.7848	0441.7555	Diff lock solenoid valve
EV DW	6	0443.7848		Lift lowering solenoid valve
EV GROUP	13	0443.7848	0441.6685	Gear change solenoid valves
			0443.6315	
EV PROP	6	0443.7848	0443.4425	Proportional solenoid valve
EV PTO	6	0443.7848	0441.7555	Rear PTO solenoid valve
EV UP	6	0443.7848		Lift raising solenoid valve
FE1		0443.7850	0443.7357	
			0442.9937.4	
FE2		0443.7849		
		0443.7850		
FILTER		0443.7848	0118.0413	Pressure switch - hydraulic oil filter clogging
FP	10	0443.7848	0441.4105	Front windscreen washer pump
FRONT PTO		0443.7847		Front PTO solenoid valve
		0.012.3639.4		Front PTO solenoid valve
FUEL	10	0443.7848	0441.1112	Fuel level sensor
			0443.8120/10	
H	6	0443.7849		Solenoid valve for raising front axle

Connector	Type	Wiring code	Connection wiring or component code	Component description
ISO4		0443.7357	0442.2323.4	ISO4 socket (Power for external implements)
		0442.9937.4		
ISO7		0443.7357	0442.2324.4	ISO7 socket (Connection for external implements)
		0442.9937.4		
J1	22	0443.7357		
		0442.9937.4		
J2	22	0443.7357		
		0442.9937.4		
J3	22	0443.7357		
		0442.9937.4		
JX1	30	0443.7357		Rear lift control unit
		0442.9937.4		
JX2	30	0443.7357		Rear lift control unit
		0442.9937.4		
JX3	30	0443.7850	0442.7305	Front axle suspension control unit
JX4	30	0443.7850	0442.7305	Front axle suspension control unit
K	29	0443.7847	0443.7338	Air conditioning compressor
		0.012.3639.4		
L		0443.7847	0441.9015	Air cleaner clogged sensor
		0.012.3639.4	0441.9015	Air cleaner clogged sensor
LEFT DRAFT	12	0443.7848	0441.5586.4	Lift draft sensor (left)
LS	10	0443.7848		Configuration connector (LS)
LS/PS	10	0443.7848		Configuration connector (LS/PS)
MS1	34	0443.7847	0442.9937.4	
		0.012.3639.4	0443.7357	
MS2		0443.7847	0442.9936.4	
		0.012.3639.4		
MX1	38	0443.7357		Engine control unit
		0442.9937.4		
MX2	38	0443.7357		Engine control unit
		0442.9937.4		

Connector	Type	Wiring code	Connection wiring or component code	Component description
NAB	9	0443.7848	0443.8436	Speed sensor for odometer
NEUTRAL LS	10	0443.7848	0441.6995	Transmission neutral sensor (red switch)
NHK	9	0443.7848	0443.8450	Transmission speed sensor
NLSA	9	0443.7848	0443.8449	Gearbox output shaft speed sensor
NLSE	9	0443.7848	010.2874.2	Engine speed sensor
P	6	0443.7847		Engine oil pressure switch
		0.012.3639.4		
P1		0443.7357		
		0442.9937.4		
P2	18	0443.7357		
		0442.9937.4		
P3	20	0443.7357		
		0442.9937.4		
P4		0443.7357		
		0442.9937.4		
P5	20	0443.7357		
		0442.9937.4		
P6	21	0443.7357		
		0442.9937.4		
POS. SENS.	9	0443.7848	0443.8667	Rear lift position sensor
PRESS. SWITCH	10	0443.7848	0441.6706	Transmission oil low pressure switch
			0443.1690	
PS	10	0443.7848		Configuration connector (PS)
PTO	9	0.012.2010.4	0441.1533	Rear PTO control pushbutton (on fender)
		0.012.4420.4		
		0442.9835		
		0442.9886		
PTO SEN	9	0443.7848		Rear PTO speed sensor
RADAR		0443.7848	0443.8654	Radar
			0443.8655	
RIGHT DRAFT	12	0443.7848	0441.5586.4	Lift draft sensor (left)

Connector	Type	Wiring code	Connection wiring or component code	Component description	
RP	10	0443.7848	0441.4105	Rear screen washer pump	
S	6	0443.7849		Solenoid valve for lowering front axle	
ST1	32	0442.9936.4		Infocenter (1)	
ST2	33	0442.9936.4		Infocenter (2)	
START	10	0443.7847	0441.6066	Start enable switch (Green)	
		0.012.3639.4			
T	6	0443.7847		Coolant temperature sensor	
		0.012.3639.4			
TEMP	6	0443.7848	0441.6649	Transmission oil temperature sensor	
TKAB1	35	0443.7848	0443.7357		
			0442.9937.4		
TKAB2	34	0443.7848	0443.7357		
			0442.9937.4		
TKAB3		0443.7846	0443.7357		
			0442.9937.4		
UP	9		0.012.2010.4	0441.2688	Rear lift "raise" control pushbutton
			0.012.4420.4		
			0442.9835		
			0442.9886		
X1			0.012.2010.4	0443.7846	
			0.012.4420.4		
			0442.9835		
			0442.9886		
X2			0.012.2010.4	0443.7846	
			0.012.4420.4		
			0442.9835		
			0442.9886		
X3			0.012.2010.4		Rear lower worklights
			0.012.4420.4		
			0442.9835		
			0442.9886		

Connector	Type	Wiring code	Connection wiring or component code	Component description
X4		0.012.2010.4	0113.5950	Rear sidelights and direction indicators
		0.012.4420.4		
		0442.9835		
		0442.9886		
X5		0.012.2018.4 0441.4114 0442.9887	0.012.2010.4	
			0.012.4420.4	
			0442.9835	
			0442.9886	
X6	10	0443.7667	0.012.3639.4	
			0443.7847	
X7	3	0443.7355.4	0443.7848	
		0443.7356.4		
X8	31	0443.7355.4	011.9428.0	Trailer braking air pressure sensor
		0443.7356.4		
X9		0443.7356.4		Solenoid valve for trailer parking brake
X10		0443.7356.4		Trailer braking low pressure switch
X11		0442.4189	0443.7851	
X12		0442.4189	0443.7851	
X13		0441.4780	0443.7851	
X14	9	0443.7849	0439.1530	Front axle suspension position sensor
X15	6	0443.7849		Solenoid valve for Load Sensing front axle suspension
X16		0443.7871	0442.7647	Fuse F100 (30 A)
X17		0443.7871	0440.2772	Relay - supplementary air conditioning fan
X18		0443.7871	0442.3185	Pressure switch for supplementary air conditioning fan
X19		0443.7871	0442.6490	Motor for supplementary air conditioning fan
X20		0443.7851		CB power connector
X21		0443.7851		Front right worklight
X22		0443.7851		Front left worklight
X23		0443.7851	0442.6316	Interior roof light

Connector	Type	Wiring code	Connection wiring or component code	Component description
X24		0443.7851	0112.1407	Front right sidelight and direction indicator
X25		0443.7851	0112.1407	Front left sidelight and direction indicator
X26	5	0443.7851	0441.3192	Windscreen wiper motor
X27	4	0443.7851	0441.3192	Rear screen wiper motor
X28	1	0443.7851	012.1725.0	Right front loudspeaker
X29	1	0443.7851	012.1725.0	Left front loudspeaker
X30		0443.7851	012.1726.0	Right rear loudspeaker
X31		0443.7851	012.1726.0	Left rear loudspeaker
X32	15	0443.7851	0441.2337	Clock
X33	14	0443.7851		Radio (brown)
X34	14	0443.7851		Radio (grey)
X35		0443.7851		Relay - upper front worklights
X36		0443.7851	0441.2616	Side console courtesy light
X37		0443.7851		Door open warning signal switch
X38	11	0443.7848	0442.4116	Trailer socket (For lights and auxiliary power)
X39	9	0443.8666.4	0442.9936.4	
X40		0443.8666.4	0443.2708	Accelerator pedal position sensor
X41		0443.5497	0443.7354.4	
X42		0442.9937.4	0442.7318	Engine speed keypad
		0443.7357		
X43		0443.7354.4	0442.9937.4	
			0443.7357	
X44		0419.9751	0.012.3639.4	
			0443.7847	
X45		0.012.3639.4		Brake fluid level sensor
		0443.7847		
X46		0.012.3639.4		Glowplug
		0443.7847		

Connector	Type	Wiring code	Connection wiring or component code	Component description
X47		0.012.3639.4		Starter motor
		0443.7847		
X48		0.012.3639.4		Starter motor
		0443.7847		
X49		0.012.3639.4	0116.9304	Horn
		0443.7847		
X50	7	0.012.3639.4		Relay - engine starting
		0443.7847		
X51		0.012.3639.4	0117.9712	Preheating control unit
		0443.7847		
X52	8	0.012.3639.4	0117.9712	Preheating control unit
		0443.7847		
X53	3	0.012.3639.4		Steering angle sensor
		0443.7847		
X54	9	0.012.3639.4	0.012.3496.4	
			0443.7847	
X55	10	0.012.3639.4	0442.6492	Air conditioning pressure switch
		0443.7847		
X56		0.012.3639.4		Alternator
		0443.7847		
X57	2	0.012.3639.4	0443.5915	Front right headlamp
		0443.7847		
X58	2	0.012.3639.4	0443.5913.4	Front left headlamp
		0443.7847		
X59	5	0442.9936.4	0439.1395	Right brake pedal switch
X60	5	0442.9936.4	0439.1395	Left brake pedal switch
X61		0442.9936.4	0443.2708	Clutch pedal position sensor
X62	9	0442.9936.4	0442.4165	Clutch pedal depressed proximity sensor
X63		0.012.3496.4	0445.0262	Clean Fix control solenoid valve
X64		0.012.3496.4		Clean Fix control compressor
X65		0.012.3496.4		Relay - Clean Fix control

Connector	Type	Wiring code	Connection wiring or component code	Component description
X66		0.012.3496.4		Fuse F101 (15 A)
X67		0442.9937.4	0114.3529	Auxiliary power socket (Earth)
		0443.7357		
X68		0442.9937.4	0114.3529	Auxiliary power socket (Positive)
		0443.7357		
X69	25	0442.9937.4	0441.9283	Rear screen wiper switch
		0443.7357		
X70	25	0442.9937.4		Clean Fix control switch
		0443.7357		
X71	25	0442.9937.4	0441.1496.4	Rotating beacon control switch
		0443.7357		
X72	25	0442.9937.4	0441.1496.4	Rear worklights switch
		0443.7357		
X73		0442.9937.4	0441.4584	Radar control switch
		0443.7357		
X74	28	0442.9937.4		Gearshift control pushbutton panel
		0443.7357		
X75		0442.9937.4	0443.6527	Super-reduction engagement switch
		0443.7357		
X76	9	0442.9937.4	0441.1533	Front PTO control pushbutton (in cab)
		0443.7357		
X77	9	0442.9937.4	0441.1533	Rear PTO control pushbutton (in cab)
		0443.7357		
X78	24	0442.9937.4		Lift control lever
		0443.7357		
X79		0442.9937.4		Fuse F50 (30 A)
		0443.7357		
X80		0442.9937.4		Supplementary power
		0443.7357		
X81	23	0442.9937.4		Diagnostics connector
		0443.7357		

Connector	Type	Wiring code	Connection wiring or component code	Component description
X82		0442.9937.4		Fuse (15 A)
		0443.7357		
X83		0442.9937.4		Direction indicators flasher unit (Red)
		0443.7357		
X84		0442.9937.4		Direction indicators flasher unit (Black)
		0443.7357		
X85		0442.9937.4		Direction indicators flasher unit
		0443.7357		
X86	19	0442.9937.4	0441.1512.4	Starter switch
		0443.7357		
X87	1	0442.9937.4	010.2274.1	Compressor for driver's seat air suspension
		0443.7357		
X88		010.2562.2	0442.9937.4	
			0443.7357	
X89		010.2562.2	0442.9937.4	
			0443.7357	
X90		0442.9937.4	0439.1395	Handbrake switch
		0443.7357		
X91	1	0442.9937.4	0441.2338	Cigar lighter
		0443.7357		
X92		0.012.2018.4	0441.4115	Number plate light
		0441.4114		
		0442.9887		
X93		0443.7875	0441.9280.4	Transmission display
X94		0443.7875	0442.5709	Compressed air pressure gauge
X95		0443.7875		Compressed air pressure gauge light
X96		0442.9936.4		Hazard switch light (+58)
X97		0.012.3639.4		Steering system pressure switch
		0443.7847		
X98		0442.9937.4		PTO AUTO switch
		0443.7357		

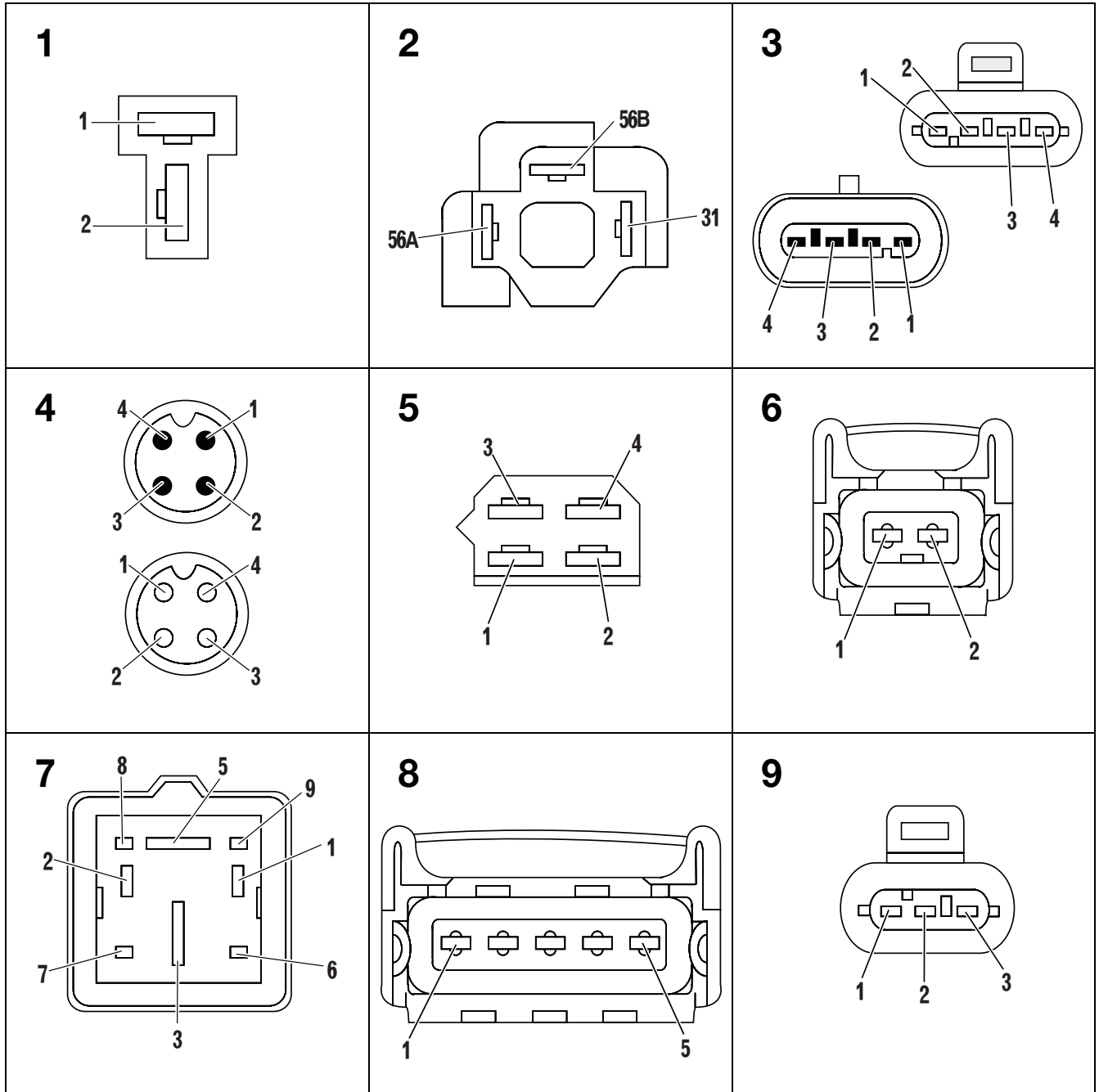
Connector	Type	Wiring code	Connection wiring or component code	Component description
X99		0442.4189		Rear upper worklights
X100		0441.4780		Rotating beacon
X101	10	0443.7667	0441.3195	Pressure switch, clutch pedal depressed
X102		010.2562.2		Relay - 3rd heater fan speed
X103		010.2562.2		Relay - 4th heater fan speed
X104		010.2562.2	010.2535.1	Resistor - left heater fan
X105		010.2562.2	010.2537.0	Left heater fan
X106		010.2562.2	010.2535.0	Right heater fan
X107		010.2562.2	010.2535.1	Resistor - right heater fan
X108		010.2562.2	010.2528.1	Fan speed selector switch
X109		010.2562.2		Relay - 1st heater fan and air conditioning on
X110		010.2562.2	010.2532.0	Air conditioning control switch
X111		010.2562.2	010.2537.1	Air conditioning thermostat
X112		010.2562.2		Connector for air conditioning control panel lights
X113		0443.8656	0443.7341	Forward/reverse selector (Powershuttle)
		0443.8653	0441.9670.4	Forward/reverse selector (Powershift)
X114		0443.8656		Hazard warning lights switch
		0443.8653		
XB		0443.7871		Power for supplementary air conditioning fan
Y1		0419.9751	0420.6915	Engine stop coil
Y3		0419.9751		Actuator

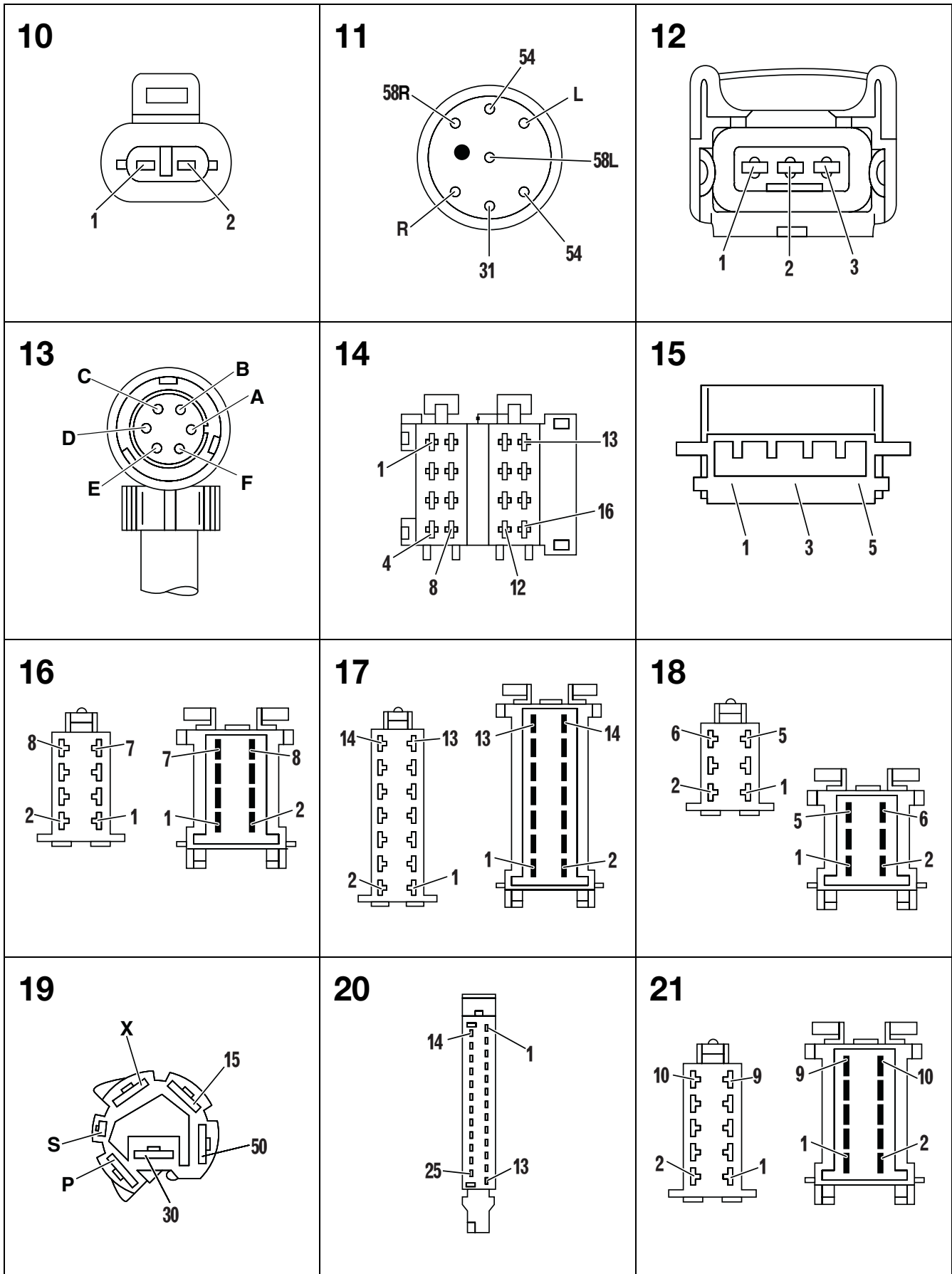
3. COMPONENTS

This chapter contains:

- 1 - Connectors table: the shapes and pinouts of the connectors
- 2 - Components table: technical and functional description of the components
- 3 - Pinouts of the electronic control units

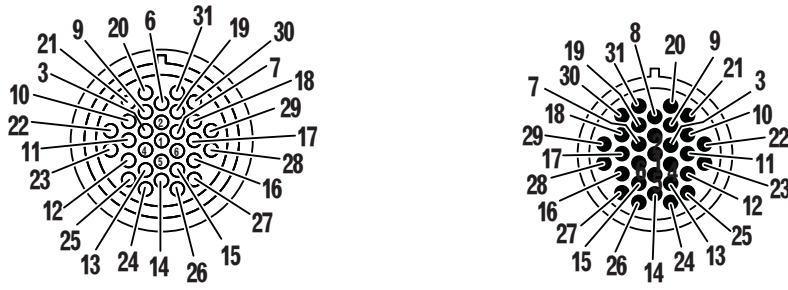
3.1 CONNECTOR LAYOUTS



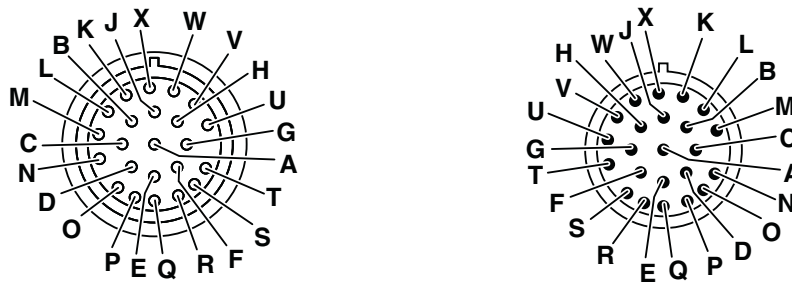


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<p>25</p>	<p>26</p>	<p>27</p>
<p>28</p>	<p>29</p>	<p>30</p>
<p>31</p>	<p>32</p>	<p>33</p>

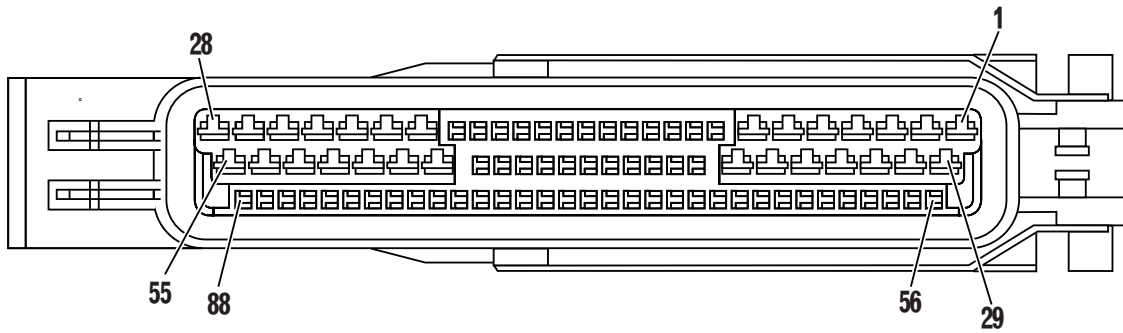
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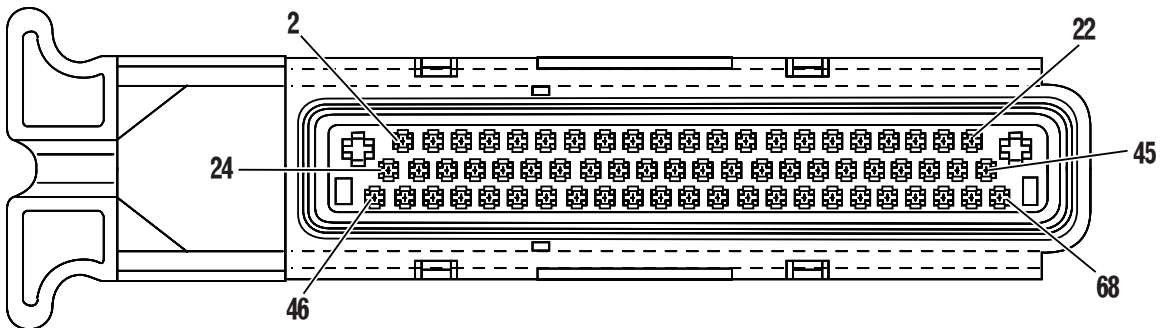
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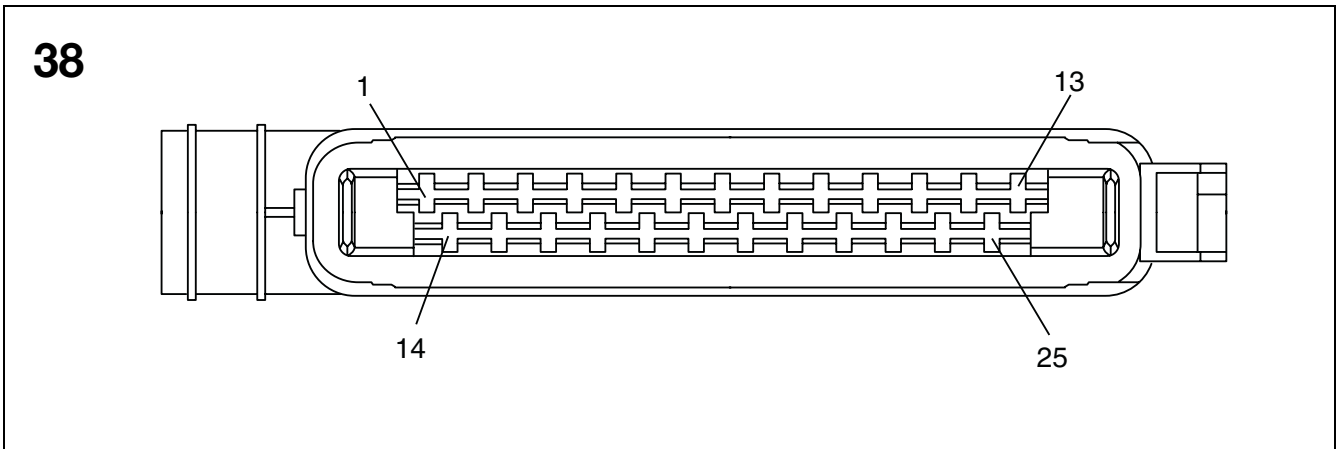


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3.2 COMPONENT TECHNICAL DATA

N°	Description	Code	Characteristics	Notes	Connector
1	Actuator	0211.1926	Measured across pin 3 and pin 4: Resistance: 8 Ohm Inductance with engine stopped: 27 mH Inductance with engine at max speed: 6mH Measured across pin 3 and pin 5: Resistance: 8 Ohm Inductance: 12 mH Measured across pin 1 and pin 2: Resistance: 8 Ohm Inductance: 8 mH		Y3
2	Engine stop coil	0420.6912	Pin1 = earth Pin2 = 12V power Resistance between pin1 and pin 2: 4 Ohm	106-115 CV	Y1
3	Engine stop coil	0420.6915	Pin1 = earth Pin2 = 12V power Resistance between pin1 and pin 2: 4 Ohm	120-165 CV	Y1
4	Diff lock solenoid valve	0441.7555	Pin1 = earth Pin2 = power Resistance between pin1 and pin 2: 8 Ohm		EV DF
5	4WD control solenoid valve	0443.1661	Pin1 = earth Pin2 = power Resistance between pin1 and pin 2: 10 Ohm		4WD
6	Lift lowering solenoid valve	0441.8229	Pin1 = earth Pin2 = power Resistance between pin1 and pin 2: 1.56-1.66 Ohm		EV DW
7	Proportional solenoid valve	0443.4425	Pin1 = earth Pin2 = power Resistance between pin1 and pin 2: approx. 5 Ohm		EV PROP
8	Front PTO solenoid valve	0441.7405	Pin1 = power Pin2 = earth Resistance between pin1 and pin 2: 8 Ohm		FRONT PTO
9	Rear PTO solenoid valve	0441.7555	Pin1 = earth Pin2 = power Resistance between pin1 and pin 2: 8 Ohm		EV PTO
10	Lift raising solenoid valve	0441.8229	Pin1 = earth Pin2 = power Resistance between pin1 and pin 2: 1.56-1.66 Ohm		EV UP
11	Start enable switch	0441.6066	Normally closed switch (NC) resistance with contact closed 3.9 Ohm	Green	START

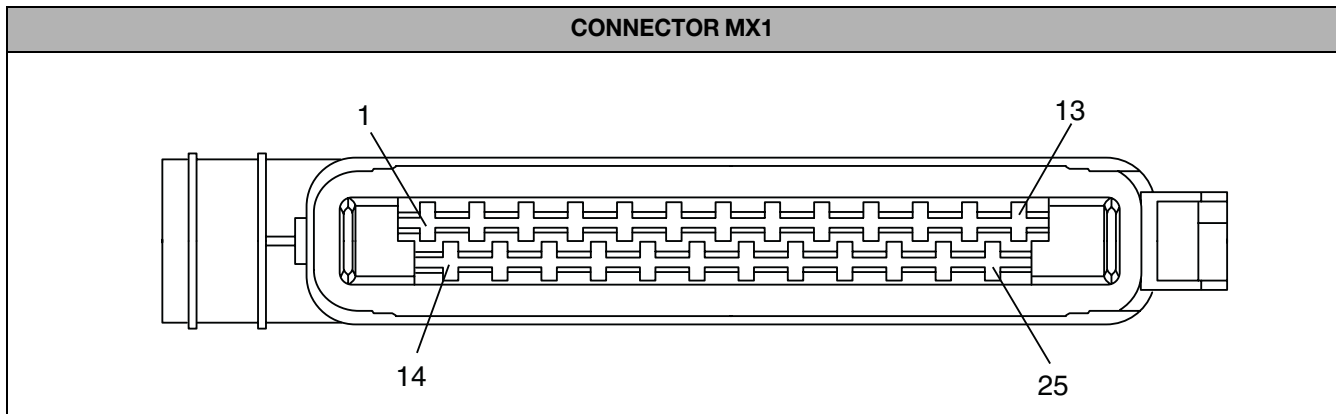
N°	Description	Code	Characteristics	Notes	Connector
12	Handbrake switch	0439.1395	Across Pin 1 and Pin 2: Normally closed switch (NC) resistance with contact closed 3.9 Ohm Across Pin 3 and Pin 4: Normally open switch (NO) resistance with contact closed 3.9 Ohm		X90
13	Brake pedal switch	0439.1395	Across Pin 1 and Pin 2: Normally closed switch (NC) resistance with contact closed 3.9 Ohm Across Pin 3 and Pin 4: Normally open switch (NO) resistance with contact closed 3.9 Ohm		X59 X60
14	Compressed air pressure gauge	0442.5709	Pin G = input from sensor Pin + = 12V power Pin - = earth		X94
15	Low transmission oil pressure switch	0441.6706	Normally closed (NC) pressure switch Opening pressure 12 bar	Green	PRESS. SWITCH
16	Low transmission oil pressure switch	0443.1690	Normally open (NO) pressure switch Closing pressure 18 bar	Red	PRESS. SWITCH
17	Engine oil pressure switch	0419.0807	Normally closed (NC) pressure switch Opening pressure 0.5 bar		P
18	Pressure switch, clutch pedal depressed	0441.3195	Normally closed (NC) pressure switch resistance with contact closed 3.9 Ohm	Dark blue	X101
19	Rear lift control pushbutton	0441.2688	Normally open switch (NO)		DW UP
20	Radar	0443.8654	Pin1 = earth Pin2 = square wave signal (100 pulses per metre) Pin3 = 12V power		RADAR
21	Radar (UK)	0443.8655	Pin1 = earth Pin2 = square wave signal (100 pulses per metre) Pin3 = 12V power		RADAR
22	Transmission neutral sensor	0441.6995	Normally open switch (NO) resistance with contact closed 120 Ohm resistance with contact open 510 Ohm	Red	NEUTRAL LS
23	Fuel level sensor	0441.1112	Resistance with tank empty: 0-3 Ohm Resistance with tank full: 178-192 Ohm	120-150CV	FUEL
24	Fuel level sensor	0441.1109	Resistance with tank empty: 0-3 Ohm Resistance with tank full: 178-192 Ohm	106-115CV	FUEL
25	Fuel level sensor	0443.8120/10	Resistance with tank empty: 4.2-5.8 Ohm Resistance with tank full: 165-195 Ohm	165CV	FUEL

N°	Description	Code	Characteristics	Notes	Connector
26	Accelerator pedal position sensor	0443.2708	Pin1 = 5.0V DC power Pin2 = earth Pin4 = analogue signal 0.5V DC output (Pedal fully released) 4.5V DC output (Pedal fully depressed)		X40
27	Clutch pedal position sensor	0443.2708	Pin1 = 5.0V DC power Pin2 = earth Pin4 = analogue signal 0.5V DC output (Pedal fully released) 4.5V DC output (Pedal fully depressed)		X61
28	Rear lift position sensor	0443.8667	Pin1 = earth Pin2 = 4.5-6.5V DC power (Nominal 5.5V) Pin3 = analogue signal 0.6V DC output (Lift fully raised) 4.5V DC output (Lift fully lowered)		POS. SENS.
29	Front axle suspension position sensor	0439.1530	Pin1 = earth Pin2 = analogue signal Pin3 = 8V DC power 1.8 +0.1V output (with cylinders fully retracted)		X14
30	Trailer braking air pressure sensor	011.9428.0	12V DC power Resistance at 0 bar 10-13 Ohm Resistance at 6 bar 119-129 Ohm		X8
31	Clutch pedal depressed proximity sensor	0442.4165	Normally closed sensor (NC) Pin1 = earth Pin2 = analogue signal Pin3 = 12V power	Powershuttle	X62
32	Lift draft sensor	0441.5586.4	Pin1 = earth Pin2 = analogue signal Pin3 = 8V power Signal without implement attached: 4V ±0.2 V		RIGHT DRAFT LEFT DRAFT
33	Engine boost sensor	0419.9552	Resistance between pin1 and pin 2: ~58 kOhm Resistance between pin1 and pin 3: ~13 kOhm Resistance between pin 2 and pin 3: ~58 kOhm Supply voltage: 5V DC Output voltage at 1083 mbar: ~ 1.083 V		B41
34	Coolant temperature sensor	0419.9260	Resistance at 20 °C 1138±140 Ohm Resistance at 90 °C 83.3±7 Ohm		B43
35	Coolant temperature sensor	0419.9333	Resistance at 21.5 °C: ~2.3 kOhm		B43
36	Transmission oil temperature sensor	0441.6649	5V DC power Output at 0 °C approx. 2.8V Output at 100 °C approx. 1.8V		TEMP

N°	Description	Code	Characteristics	Notes	Connector
37	Engine speed sensor	010.2874.2	Pin1 = earth Pin2 = square wave signal Pin3 = 12V power High level: 3.5-4.3 V Low level: 0.6-1.2 V		NLSE
38	Speed sensor for odometer	0443.8436	Pin1 = earth Pin2 = square wave signal Pin3 = 12V power High level: 3.5-4.3 V Low level: 0.6-1.2 V		NAB
39	Rear PTO speed sensor	0441.3198	Pin1 = earth Pin2 = square wave signal Pin3 = 12V power High level: 7.8-8.9 V Low level: 0.6-1.2 V		PTO SEN
40	Camshaft speed sensor (Pick-Up)	0419.0811	Resistance: 310 Ohm Inductance: 140mH Peak voltage: 40mV		B40
41	Transmission speed sensor	0443.8450	Pin1 = earth Pin2 = square wave signal Pin3 = 12V power High level: 3.5-4.3 V Low level: 0.6-1.2 V		NHK
42	Gearbox output shaft speed sensor	0443.8449	Pin1 = earth Pin2 = square wave signal Pin3 = 12V power High level: 3.5-4.3 V Low level: 0.6-1.2 V		NLSA

3.3 PINOUTS AND DESCRIPTIONS OF ELECTRONIC CONTROL UNITS

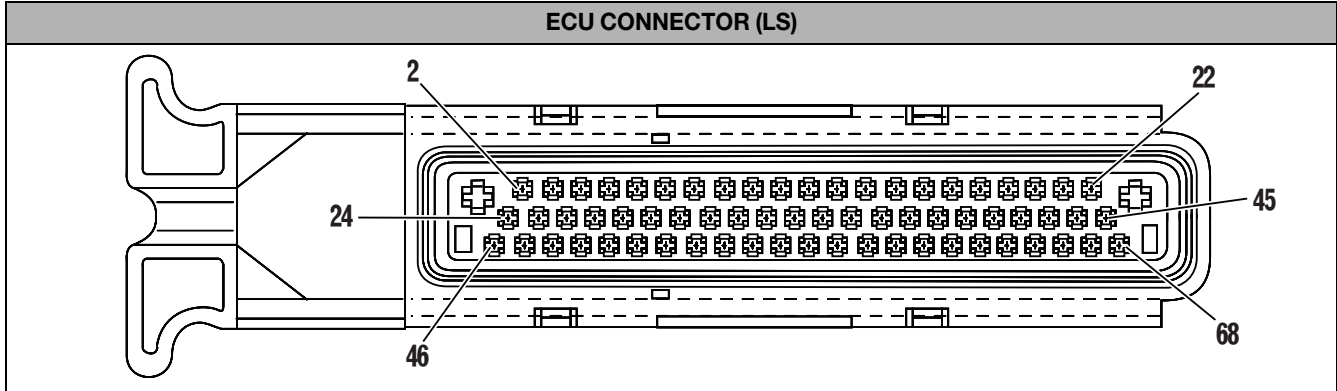
3.3.1 ENGINE CONTROL UNIT



Pin	Volts	Code	Description
1			Not utilised
2			Digital output, stop magnet
3			Not utilised
4			Not utilised
5			Not utilised
6			Not utilised
7			Not utilised
8	0V	GND	Reference voltage for signal on pin 9
9			Analogue input, coolant temperature sensor
10	0V	GND	Reference voltage for signal on pin 11
11			Digital input, speed 2 (crankshaft) (optional)
12	0V	GND	Reference voltage for signal on pin 13
13			Digital input, speed 1 (camshaft)
14		STG-	PWM output, signal for electromagnet of actuator
15		STG+	PWM output, signal for electromagnet of actuator
16			Shielding of control rack position sensor (for pins 17, 18 and 19)
17		RF-	Common connection for measurement and reference coils
18		RF REF	Analogue input, measurement signal from reference coil
19		RF MESS	Analogue input, measurement signal from reference coil
20	0V		Reference voltage for signal on pin 21
21			Analogue input, signal from engine oil pressure sensor
22	+5V		+5V power engine oil pressure sensor pin 21
23	0V	GND	Reference voltage for signal on pin 24
24			Analogue input, signal from boost pressure sensor
25	+5V	+5V LDA	+5V reference voltage for signal on pin 24 (max 15mA)

CONNECTOR MX2			
Pin	Volts	Code	Description
1	0V	-31	Battery negative
2			Not utilised
3			Not utilised
4			Fault signalling lamp
5			Not utilised
6			Not utilised
7			Not utilised
8			Not utilised
9			Not utilised
10		L	ISO 9141 serial interface (Diagnostics connector)
11		K	ISO 9141 serial interface (Diagnostics connector)
12			Not utilised
13			Not utilised
14	+12V	15+	Battery positive
15			Engine memory LED
16			Engine speed output
17	0V	GND	Reference voltage for signal on pins 18, 19, 20
18			“MAX” key signal
19			“HOLD” key signal
20			Hand throttle signal
21			“MIN” key signal
22			Not utilised
23	0V	GND	Reference voltage for signal on pin 24
24			Analogue input, signal from accelerator pedal sensor (SWG)
25	+5V	+5V REF	+5V reference voltage for signal on pin 24 (max 15mA)

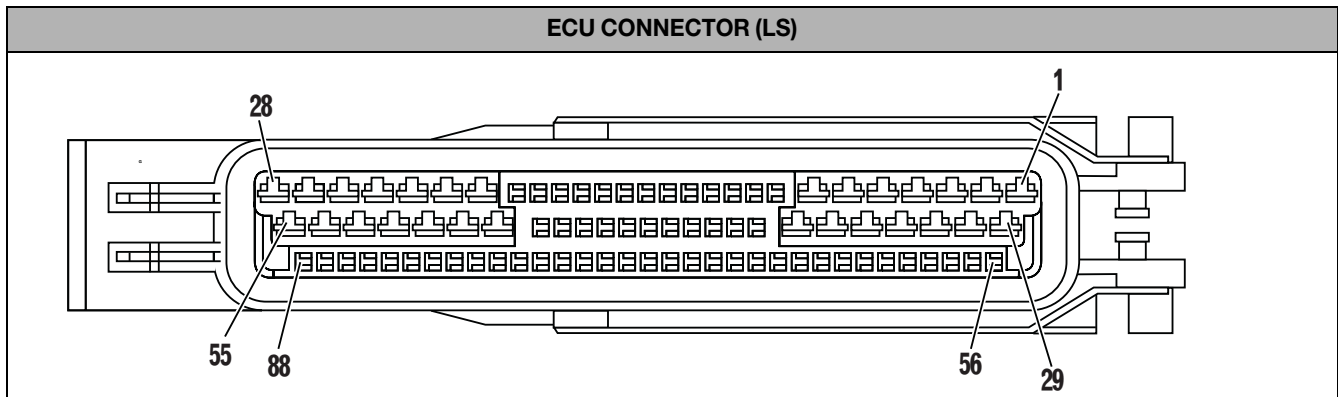
3.3.2 POWERSHUTTLE TRANSMISSION CONTROL UNIT



Pin	Volts	Code	Description
1	0V	VM1	Battery negative
2	0V	VM2	Battery negative
3	0V	VMG1	Reference voltage for signal on pins 16, 17, 40 and 62
4	0V	VMG2	Reference voltage for signal on pin 44
5		ADM4	Output for fault warning light
6			Not utilised
7			Not utilised
8		VPS2	Power (+) common solenoid valves Y1, Y2, Y3, Y4, Y5
9			Not utilised
10			Not utilised
11		ADM6	Power - solenoid valve Y2
12			Common for solenoid valves Y6 and Y7
13	+12V	VPS1	Power (+) proportional solenoid valve
14		SD1	Display control signal
15		SDDK	Diagnostics connector
16		EF5	Digital input, main clutch revs sensor (NHK)
17		EF7	Digital input, input revs sensor (nMot. nLse)
18			Not utilised
19			Not utilised
20		ED3	Analogue input, reverse travel command signal
21		ED10	Battery positive (15+)
22		ED7	Digital signal - range downshift pushbutton
23		VPE1	Battery positive (30+)
24		VMGA1	Power (-) clutch pedal angular position sensor and temperature sensor
25			Not utilised
26			Not utilised
27			Not utilised
28			Not utilised
29		ED11	Analogue input, low transmission oil pressure signal
30		ED12	Input for signal from direction change enable button

Pin	Volts	Code	Description
31	+12V	EDM1	Engine start signal (+50)
32		AIP3	Power - solenoid valve Y6
33		ADM8	Power - solenoid valve Y4
34		ADM7	Power - solenoid valve Y3
35			Not utilised
36		SD4	Vehicle speed output
37		AU	Power (+) clutch pedal angular position sensor
38		EU1	Analogue input, angular position of clutch pedal sensor signal
39		ER1	Analogue input, temperature sensor signal
40		EF6	Digital input, output revs sensor (nLsa)
41			Not utilised
42			Not utilised
43			Not utilised
44		ED8	Digital input, clutch pedal travel limit sensor
45		VPI	Battery positive (15+)
46			Not utilised
47			Not utilised
48			Not utilised
49			Not utilised
50		AIP7	Power - solenoid valve Y5
51			Not utilised
52			Not utilised
53			Not utilised
54			Not utilised
55		AIP4	Power - solenoid valve Y7
56	0V	AIP1	Power (-) proportional solenoid valve
57	+12V	ADM5	Power - solenoid valve Y1
58			Not utilised
59			Not utilised
60			Not utilised
61			Not utilised
62		EF4	Digital input, revs sensor (nAb)
63		ED1	Analogue input, forward travel command signal
64			Not utilised
65		ED2	Analogue input, neutral command signal
66			Not utilised
67		ED6	Digital signal - range upshift pushbutton
68	+12V	VPE2	Battery positive (30+)

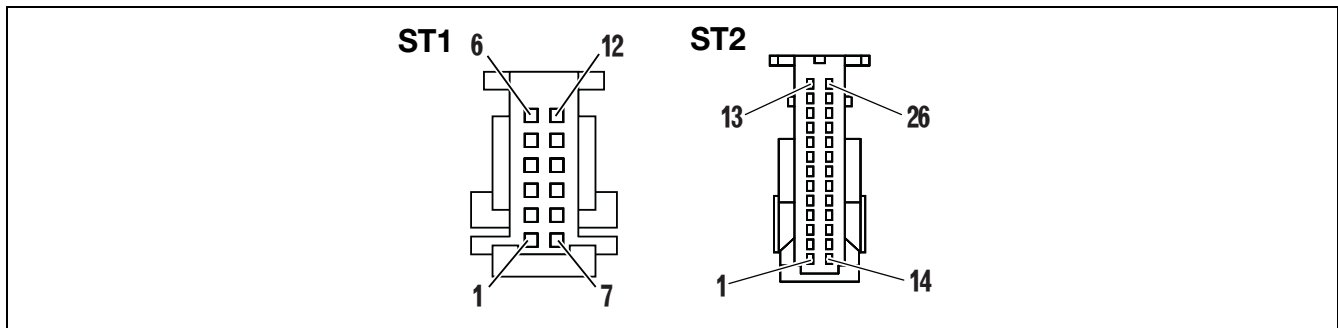
3.3.3 POWERSHIFT TRANSMISSION CONTROL UNIT



Pin	Volts	Code	Description
1			Not utilised
2		AD4	Power - solenoid valves Y4
3		VPS	Power (+) common solenoid valves Y1, Y2, Y3, Y4, Y5, Y6, Y7
4			Not utilised
5		AD7	Not utilised
6	0V	VM1	Battery negative
7		EAM3	Analogue input, temperature sensor signal
8	+12V	ED6	Battery positive
9		ED4	Analogue input, forward travel
10		ED1	Analogue/digital signal - shift up
11	+5V	Uref	+5V reference voltage for signal on pins 7 and 22
12			Not utilised
13		EDM2	Input, clutch engaged signal
14			Not utilised
15			Not utilised
16		EF2	Digital input, powershift revs sensor
17		AD1	Power - solenoid valve Y1
18		EDM1	Analogue input, low transmission oil pressure signal
19		DIAG	Diagnosis of powershift speed sensor
20			Not utilised
21	0V	VMA	Reference voltage for signal on pin 22
22		EAM2	Analogue input, angular position of clutch pedal sensor signal
23			Not utilised
24		AD4	Power - solenoid valves Y4
25		AD2	Power - solenoid valve Y2
26		AD8	Power - solenoid valves Y5
27		AD2	Power - solenoid valves Y2
28	0V	VMG1	Reference voltage for signal on pins 16, 35, 42 and 71

Pin	Volts	Code	Description
29		AD9	Analogue output, low oil pressure warning light
30		AD5	Power - solenoid valves Y6
31	+12V	VP1	Battery positive (15+)
32		AD3	Power - solenoid valves Y3
33		AD6	Power - solenoid valves Y7
34	0V	VM2	Battery negative
35		EAM1	Analogue input, gearbox in neutral
36			Not utilised
37		ED3	Analogue input, reverse travel
38			Not utilised
39			Not utilised
40			Not utilised
41			Not utilised
42		EF1	Digital input, powershift input revs sensor (engine)
43			Not utilised
44			Not utilised
45		ED2	Analogue/digital signal - shift down
46			Not utilised
47		DIAG	Diagnosis of powershift output speed sensor
48			Not utilised
49		AD3	Power - solenoid valves Y3
50		SDDI	Diagnostics interface
51		SD1	Analogue/digital signal - display
52		VPS	Power (+) common solenoid valves Y1, Y2, Y3, Y4, Y5, Y6, Y7, forward/reverse indicator lamp
53			Not utilised
54	+12V	VP1	Battery positive (15+)
55	+12V	VP2	Battery positive (30+)
56-88			Not utilised

3.3.4 INFOCENTER 2 AND 3



CONNECTOR ST1

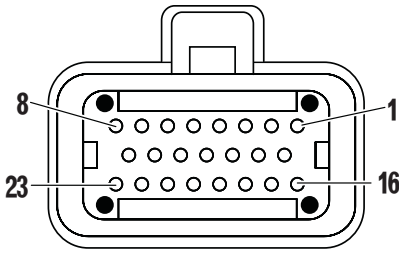
Pin	Volts	Code	Description
1		TXD	Diagnostics interface transmission
2	+12V	KL15-ST	+15 key
3		KL31	Lamps earth
4	+12V	KL58	+58 lights
5		GROUT	Actual vehicle speed output (radar)
6		RPOUT	Rear PTO speed output
7		GETOEL	Transmission oil pressure
8		HANDBR	Handbrake on warning light
9	0V	KL30-ST	Vehicle earth
10		RXD	Diagnostic interface reception
11		VHOUT	Theoretical vehicle speed output (wheels)
12	0V	KL31E	Electronics earth

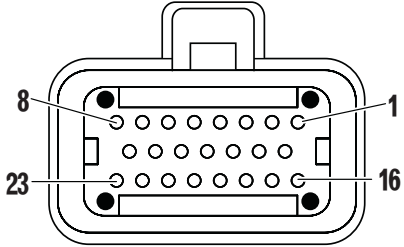
CONNECTOR ST2

Pin	Volts	Code	Description
1		DIFF	Diff lock indicator lamp
2		BLINK2	2nd trailer flasher warning light
3		BLINK1	1st trailer flasher warning light
4		BLINK	Tractor flasher warning light
5		FELD	FIELD indication
6		STRAS	ROAD indication
7		LADEK	Battery charging indicator light
8		LUFTF	Air cleaner clogged
9		MOTOEL	Engine oil pressure warning light
10		FRONTZ	Front PTO indicator light
11		HECKZ	Rear PTO indicator light
12		MOTOR	Engine rpm
13		TANK	Fuel gauge
14		ALLRAD	4WD indicator lamp
15		KUEHLT	Engine coolant temperature

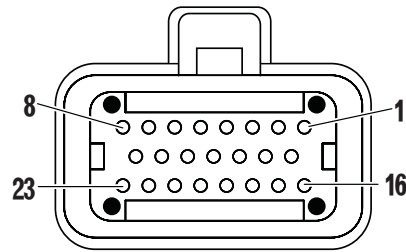
Pin	Volts	Code	Description
16		FERNL	Main beam warning light
17		HYDRA	Hydraulic system oil filter clogged
18		OELDRU	Engine oil level (Infocenter 3 only)
19		VORGL	Glowplugs test
20		RPTO	Rear PTO rpm
21		GROUND	Input, actual ground speed (radar)
22		WHEEL	Input, theoretical vehicle speed
23		TRAILER	Input, trailer braking indicator light
24		BRAKENIV	Input, brake fluid level
25		EMR	Input, engine indicator light
26			Not utilised

3.3.5 POWER LIFT CONTROL UNIT

CONNECTOR JX1 (RED)			
			
Pin	Volts	Code	Description
1			Raising solenoid valve
2			Lowering solenoid valve
3	8V		Power for draft sensors
4	12V		Control unit power (F34)
5	12V		Control unit power (F34)
6			Control lever: Transport 5.5 V
			Brake lights: 3.8 V
			Test: 2.1 V
			Float: 1.7 V
7	0.3-8.0V		Depth potentiometer
8	0.3-8.0V		Lowering speed potentiometer
9			Manual UP key
10	0-8.0V		Input, left draft sensor
11			PTO speed output
12			ISO 9141 K line
13			Output, status indicator LED
14	0.3-8.0V		Maximum height potentiometer
15	5.0 V		Power for position sensor
16			Manual DOWN key
17	0-8.0V		Input, right draft sensor
18	0V		Earth for potentiometer panel
19	0.3-8.0V		Mix potentiometer
20	0V		Control unit earth
21	0V		Sensors earth
22	8V		Power for panel and lever
23			Lift position sensor: high position: 0.6V (\pm 0.1V) low position: 4.5V (\pm 0.1V)

CONNECTOR JX2 (BLACK)			
			
Pin	Volts	Code	Description
1			D_AUX3 (Not utilised)
2			Differential output
3			Input, radar (130 pulses per metre)
4			CAN_H (Not utilised)
5			CAN_L (Not utilised)
6			CAN_RES (Not utilised)
7			D_AUX2 (Not utilised)
8			4WD output
9	8V		Power for external sensor (ISO4 socket)
10	8V		Power for steering sensors
11			Input, ASM AUTO
12			Input, wheelslip control
13			Input, differential
14			Input, external sensor (ISO4 socket)
15			ISO9141 K Line
16			Input, steering sensor 1
17	0V		Earth for external sensor (ISO4 socket)
18			Input, steering sensor 2
19			Input, wheel speed (130 pulses per metre)
20			Input, brakes
21			D_AUX1 (Not utilised)
22			ISO9141 L Line
23	0V		Earth for steering sensors

3.3.6 FRONT SUSPENSION CONTROL UNIT

**CONNECTOR JX3 (BLACK)**

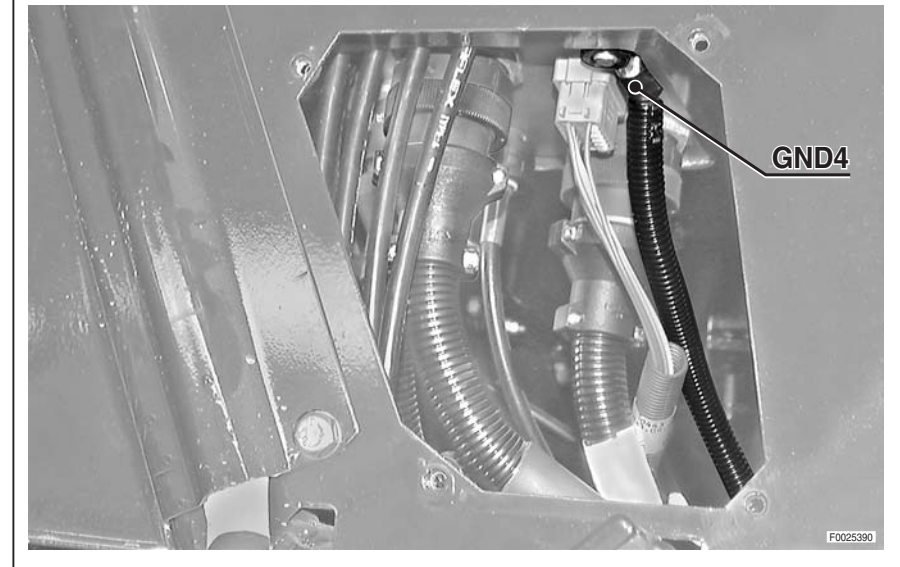
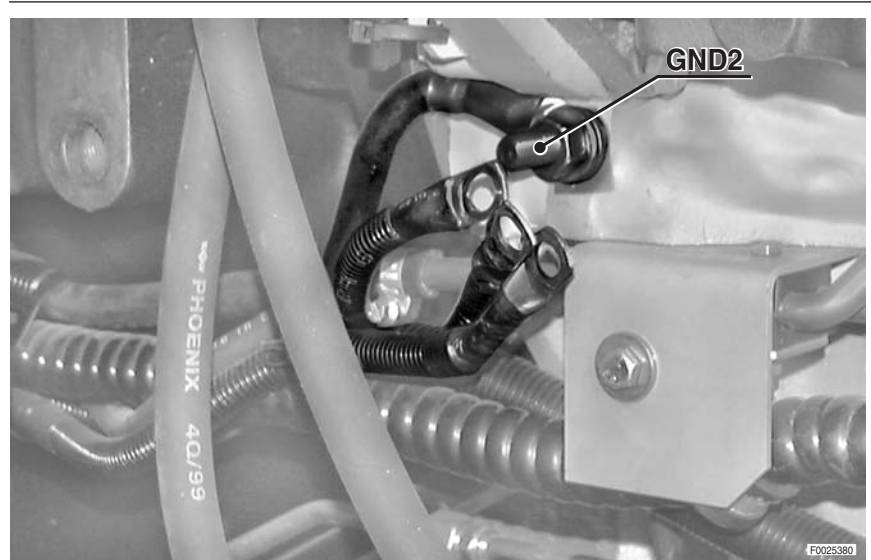
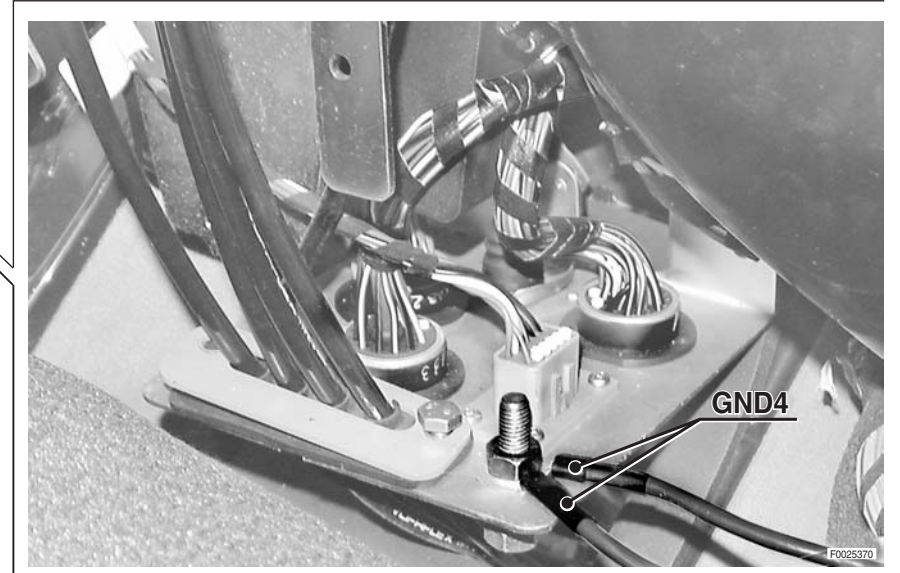
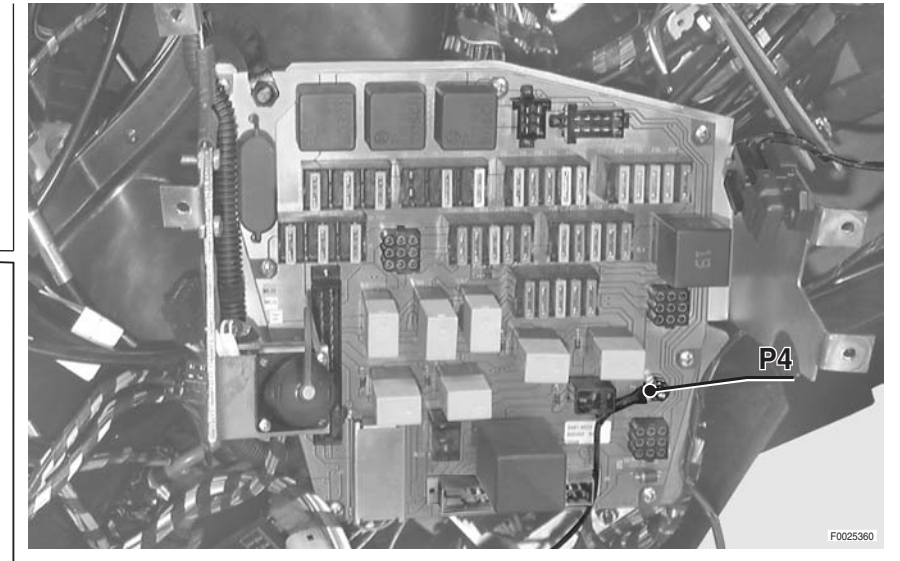
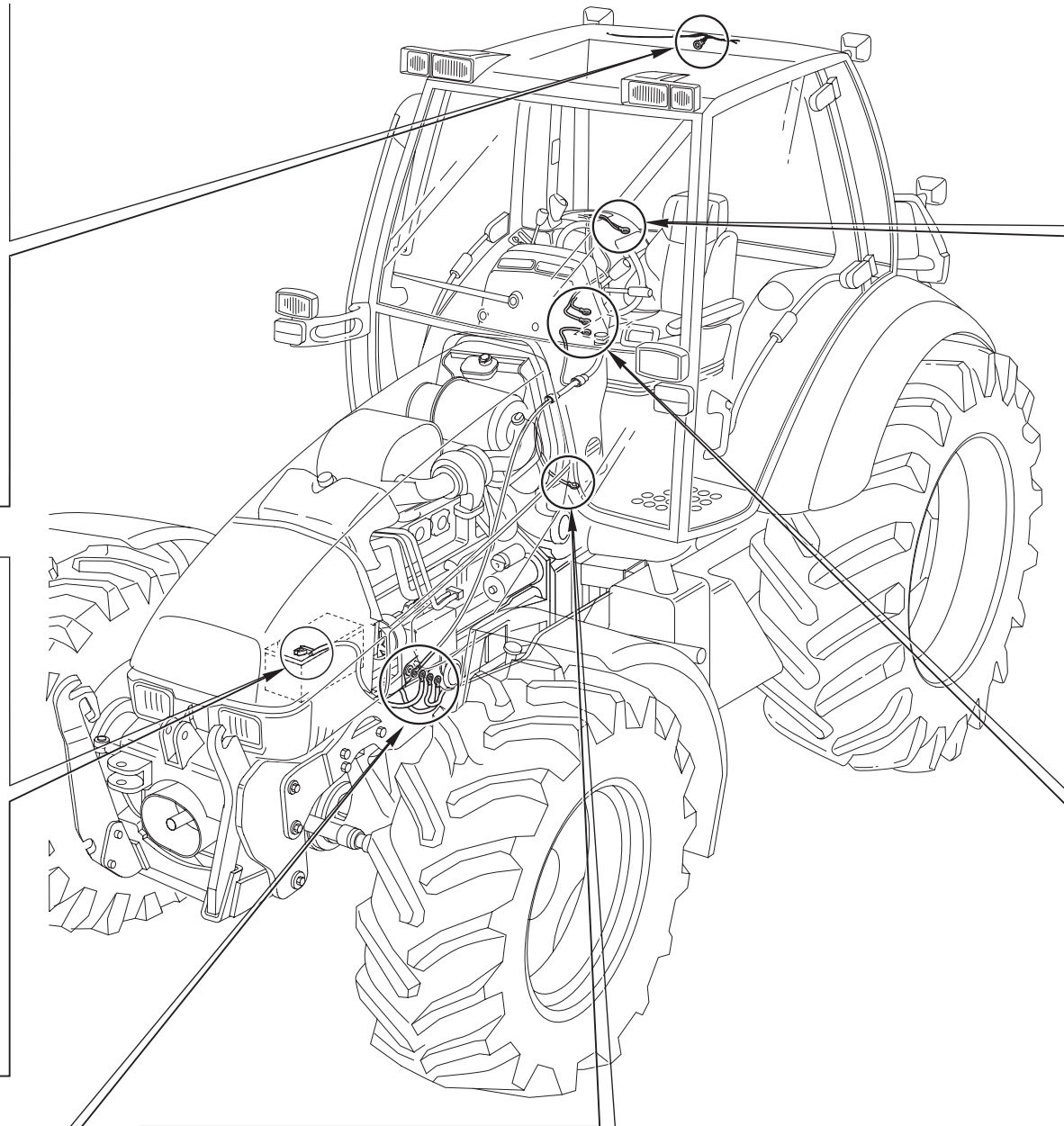
Pin	Volts	Code	Description
1			Output, raising solenoid valve
2			Output, lowering solenoid valve
3			Not utilised
4	+12 V		+12 V
5	+12 V		+12 V
6÷19			Not utilised
20	0V		Control unit earth
21÷23			Not utilised

CONNECTOR JX4 (WHITE)

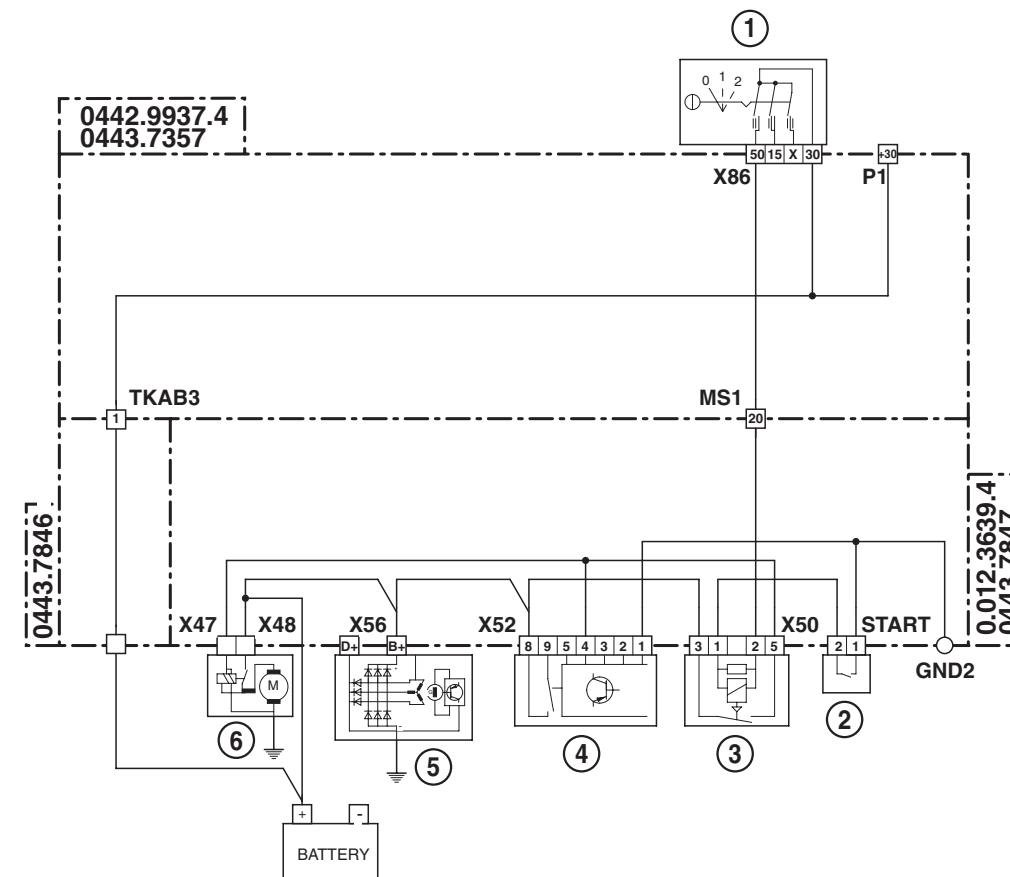
Pin	Volts	Code	Description
1			Not utilised
2			Output, load sensing solenoid valve
3÷7			Not utilised
8			Control light output
9			Power for external sensor
10			Not utilised
11			Input, 4WD status
12			Input, control button
13			Input, brakes switches
14			Input, position sensor
15			ISO 9141 K diagnostic line
16			Not utilised
17	0V		Earth for external sensor
18			Not utilised
19			Input, wheel speed
20			Not utilised
21			Not utilised
22			ISO 9141 L diagnostic line
23			Not utilised

4. SYSTEMS

4.1 GROUND POINTS

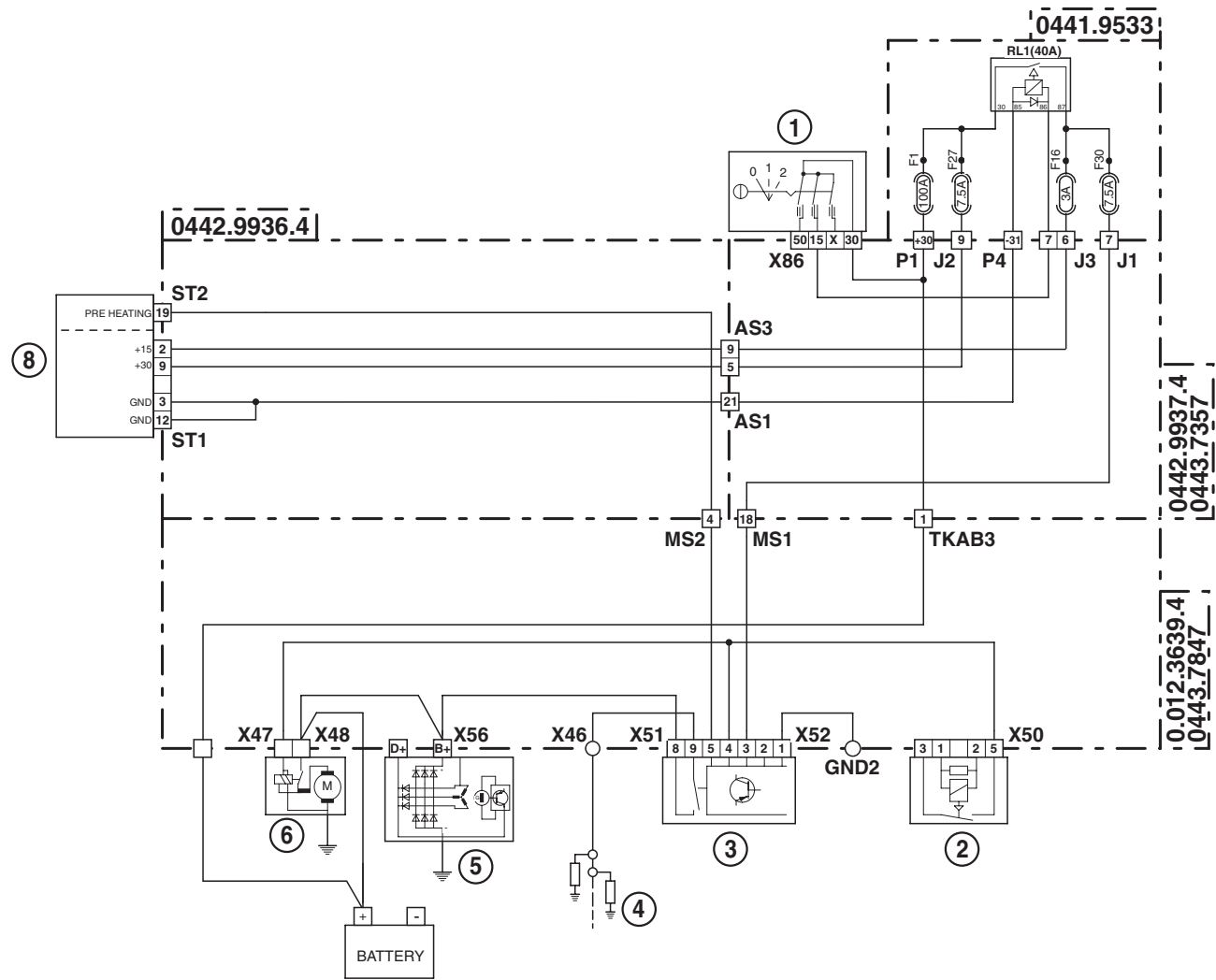


4.2 ENGINE START



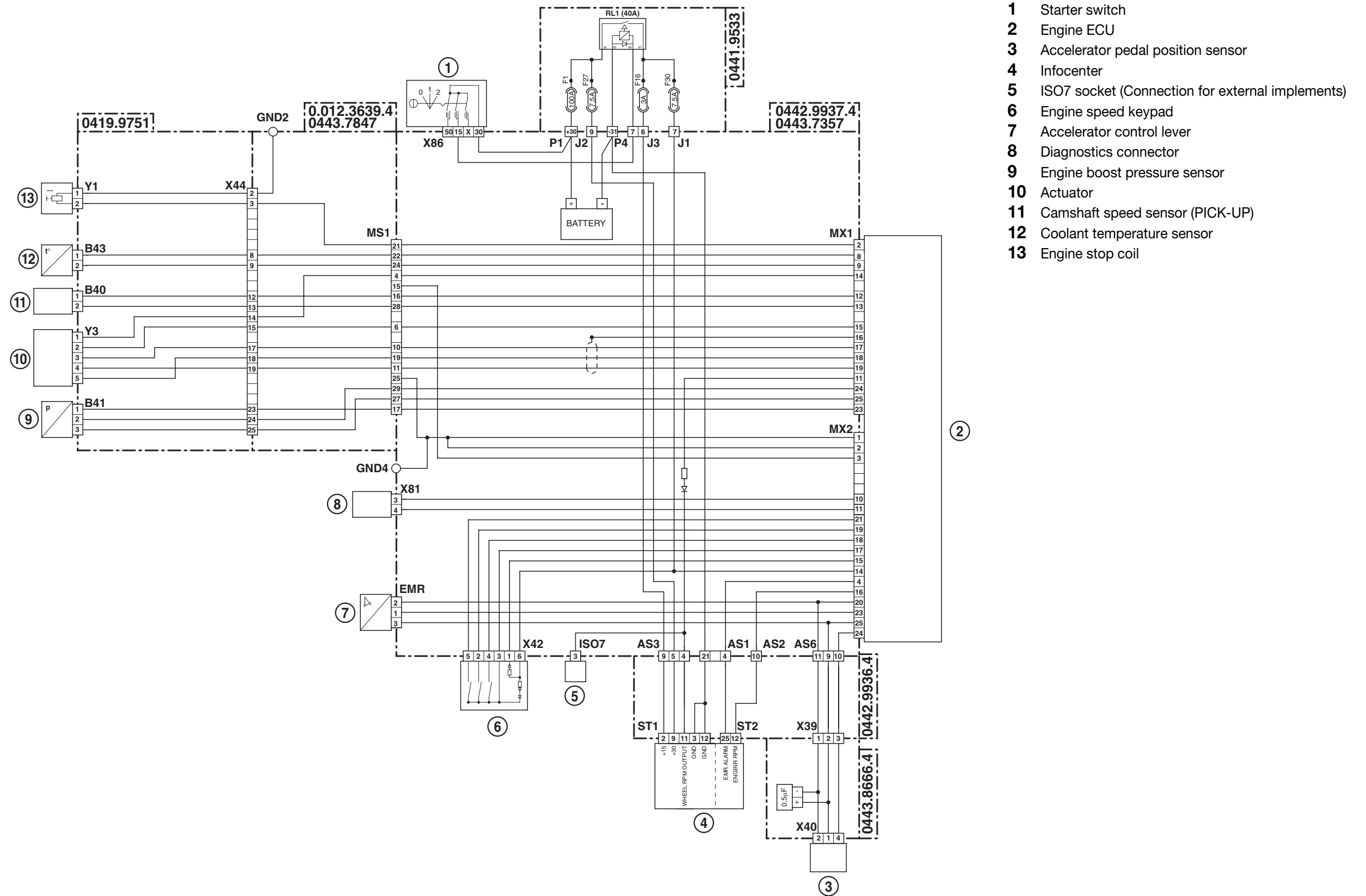
- 1 Starter switch
- 2 Start enable switch (Green)
- 3 Control relay for engine starting
- 4 Preheating control unit
- 5 Alternator
- 6 Starter motor

4.3 PREHEATING



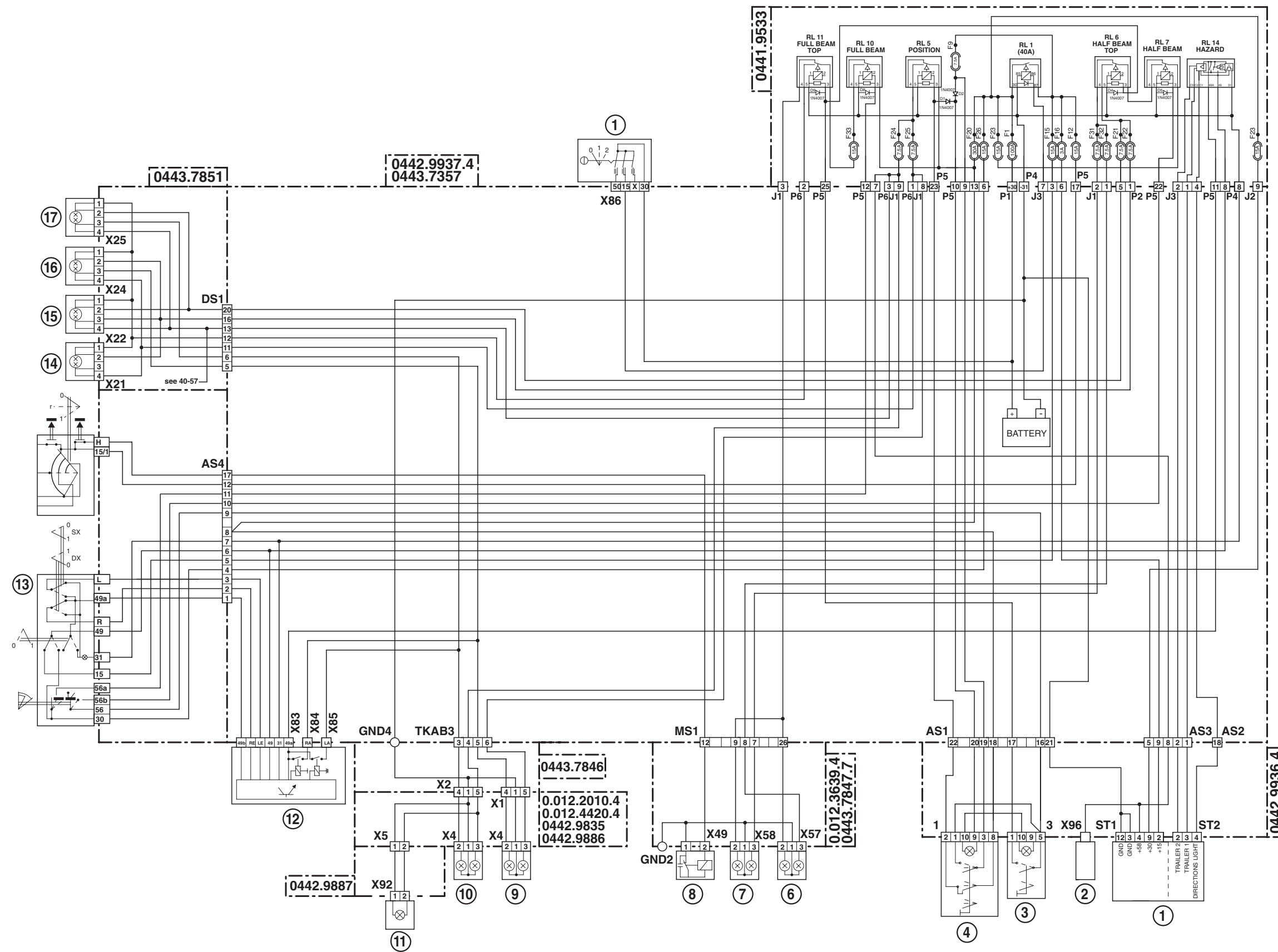
- 1 Starter switch
- 2 Control relay for engine starting
- 3 Preheating control unit
- 4 Glowplug
- 5 Alternator
- 6 Starter motor
- 7 Infocenter

4.4 ELECTRICAL ENGINE CONTROL



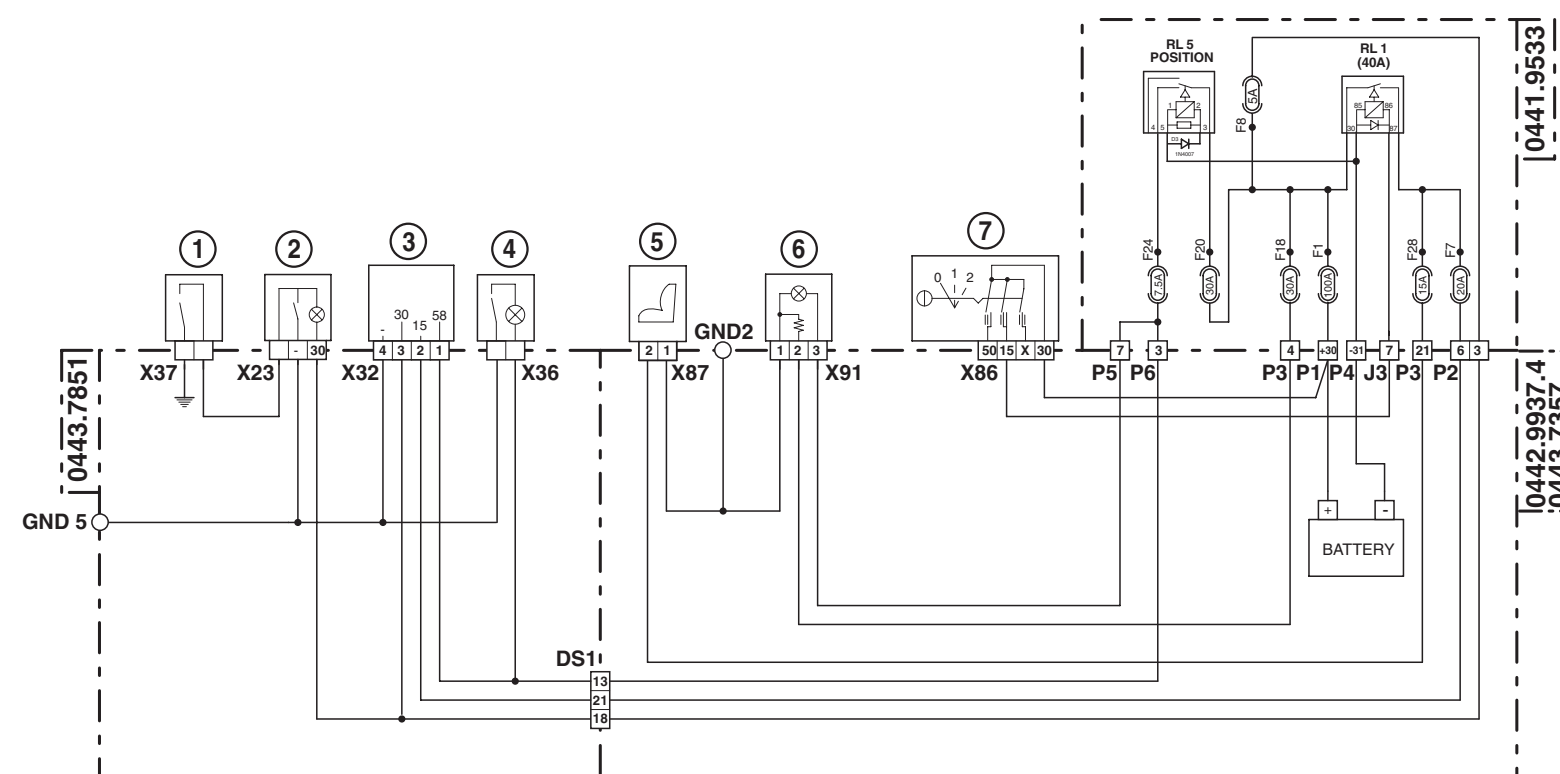
- 1 Starter switch
- 2 Engine ECU
- 3 Accelerator pedal position sensor
- 4 Infocenter
- 5 ISO7 socket (Connection for external implements)
- 6 Engine speed keypad
- 7 Accelerator control lever
- 8 Diagnostics connector
- 9 Engine boost pressure sensor
- 10 Actuator
- 11 Camshaft speed sensor (PICK-UP)
- 12 Coolant temperature sensor
- 13 Engine stop coil

4.5 LIGHTS - LIGHT SELECTOR SWITCH



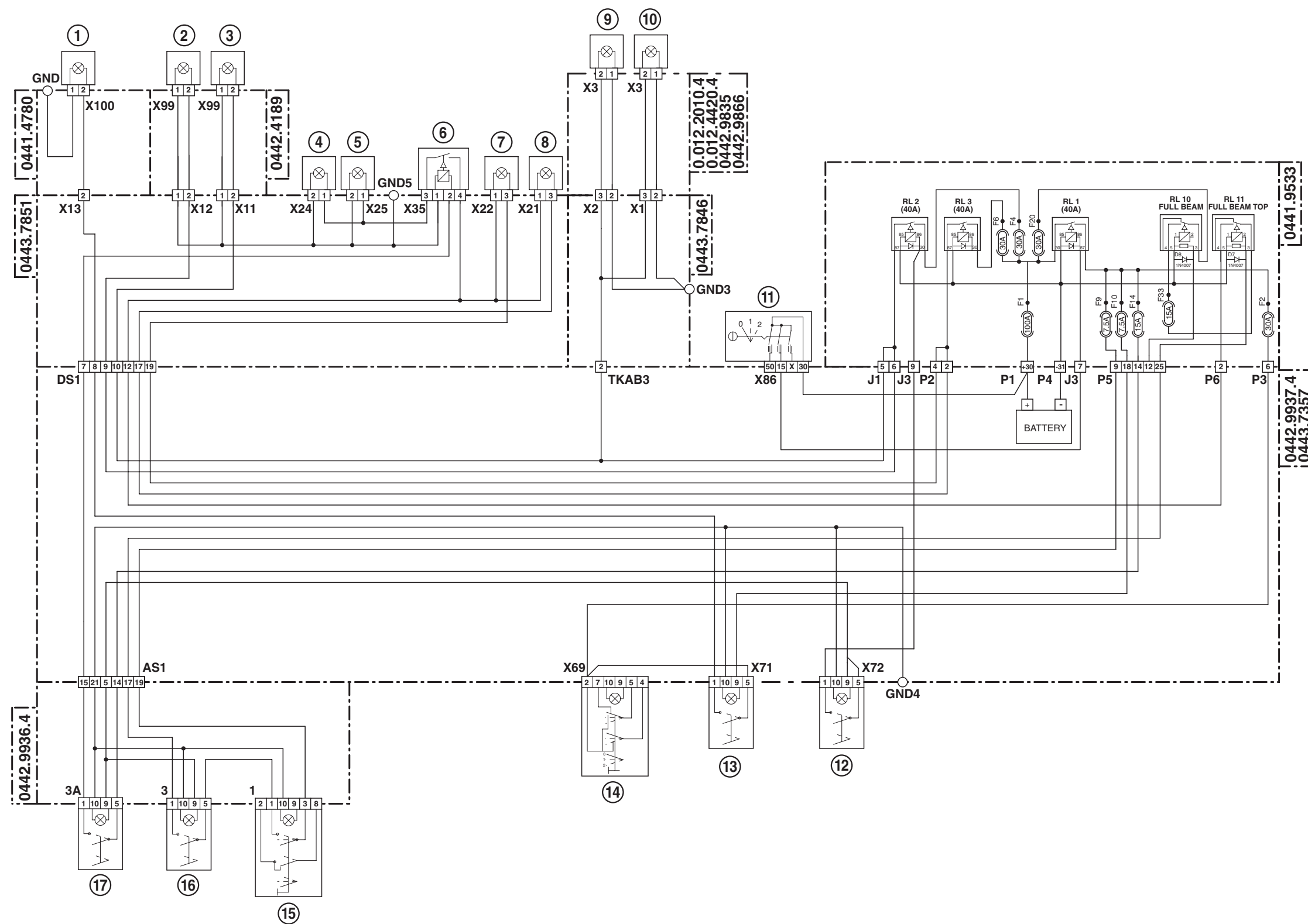
- 1 Starter switch
- 2 Infocenter
- 3 Hazard lights switch lighting
- 4 Cab roof worklights switch
- 5 Lower worklights switch
- 6 Front right headlamp
- 7 Front left headlamp
- 8 Horn
- 9 Rear right side lights and direction indicators
- 10 Rear left side lights and direction indicators
- 11 Number plate light
- 12 Direction indicator lights control unit (Red)
- 13 Lights selector switch
- 14 Front right worklight
- 15 Front left worklight
- 16 Front right side lights and direction indicators
- 17 Front left side lights and direction indicators

4.6 CAB ACCESSORY



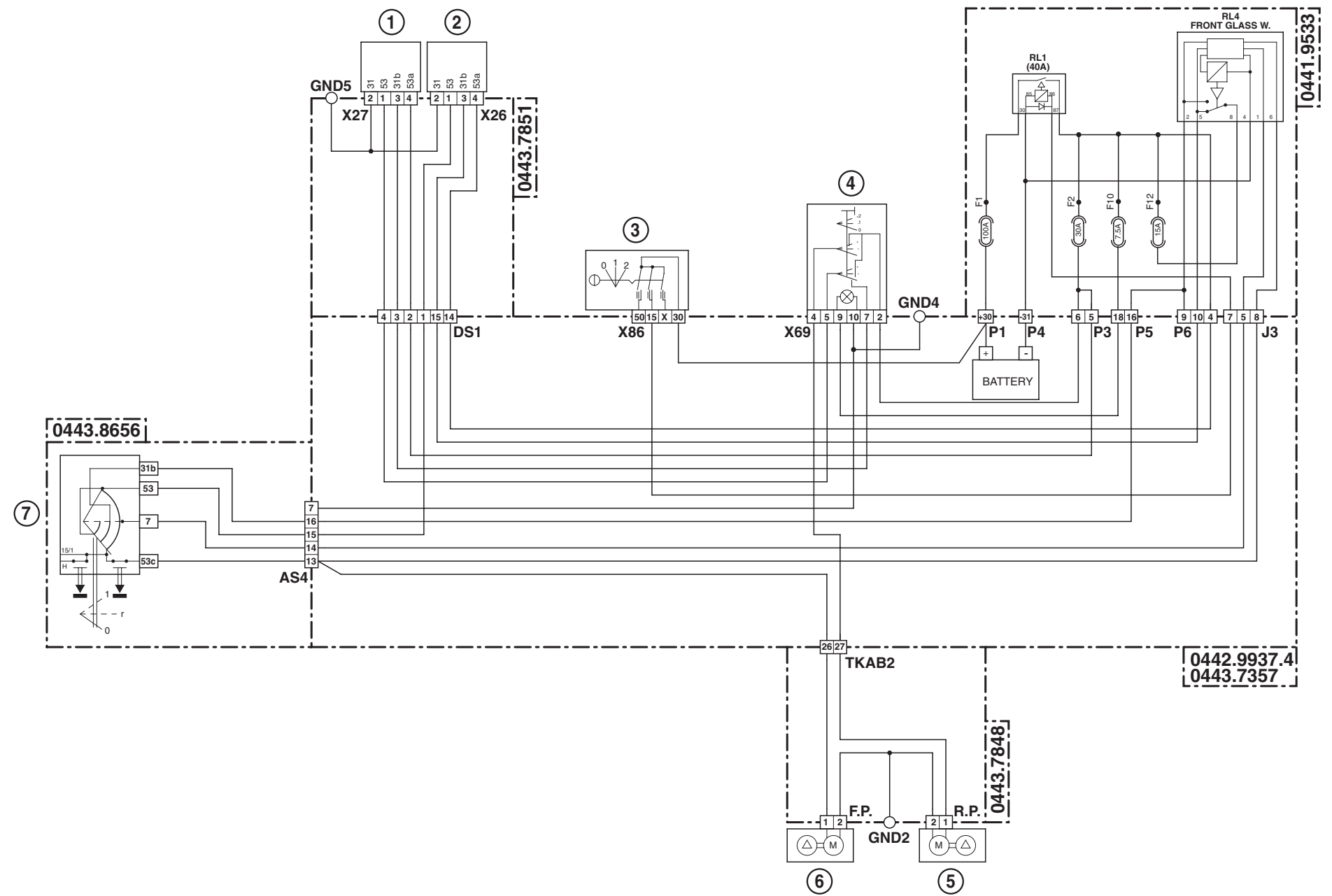
- 1 Door open alarm switch
- 2 Interior roof light
- 3 Clock
- 4 Side console courtesy light
- 5 Compressor for driver's seat air suspension
- 6 Cigar lighter
- 7 Starter switch

4.7 WORKING LIGHTS



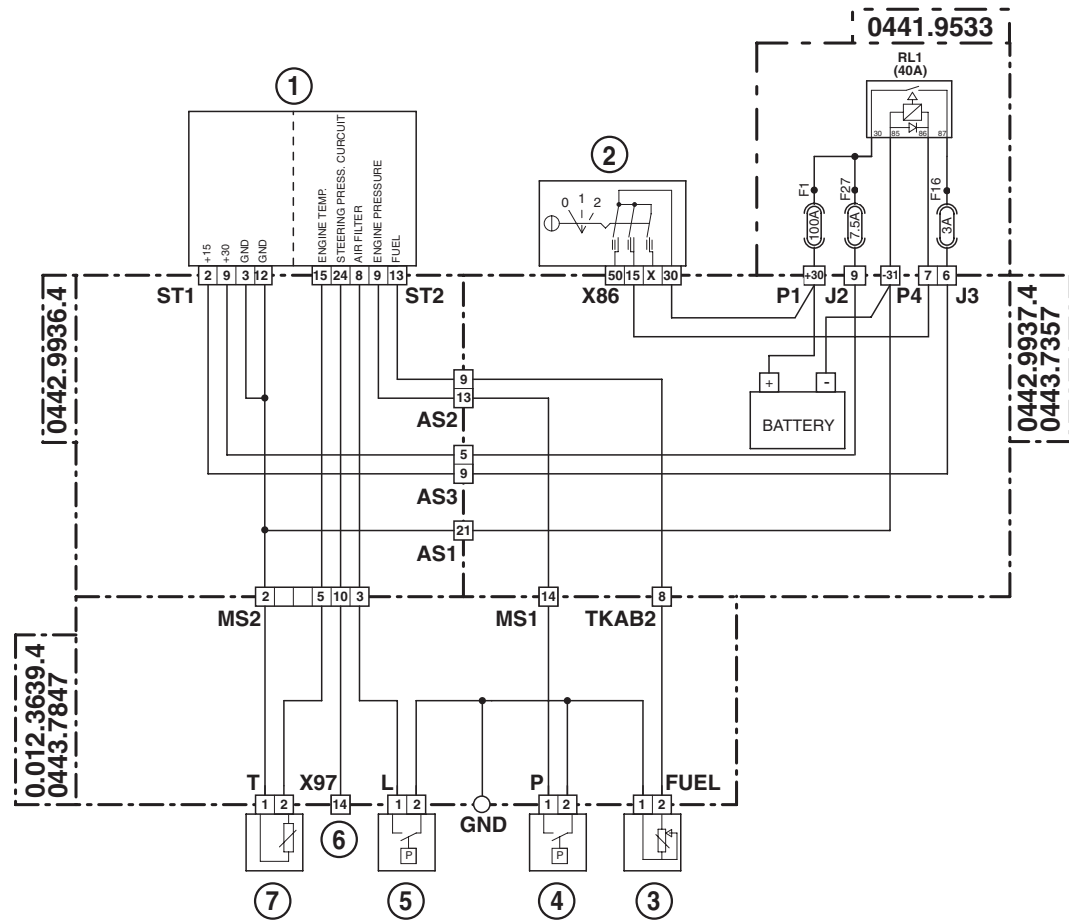
- 1 Rotating light
- 2 Rear upper left worklights
- 3 Rear upper right worklights
- 4 Front right side lights and direction indicators
- 5 Front left side lights and direction indicators
- 6 Control relay for front upper worklights
- 7 Front left worklight
- 8 Front right worklight
- 9 Rear lower left worklights
- 10 Rear lower right worklights
- 11 Starter switch
- 12 Rear worklights switch
- 13 Rotating beacon control switch
- 14 Rear screen wiper
- 15 Side lights switch
- 16 Cab roof worklights switch
- 17 Lower worklights switch

4.8 WINDSCREEN WIPER



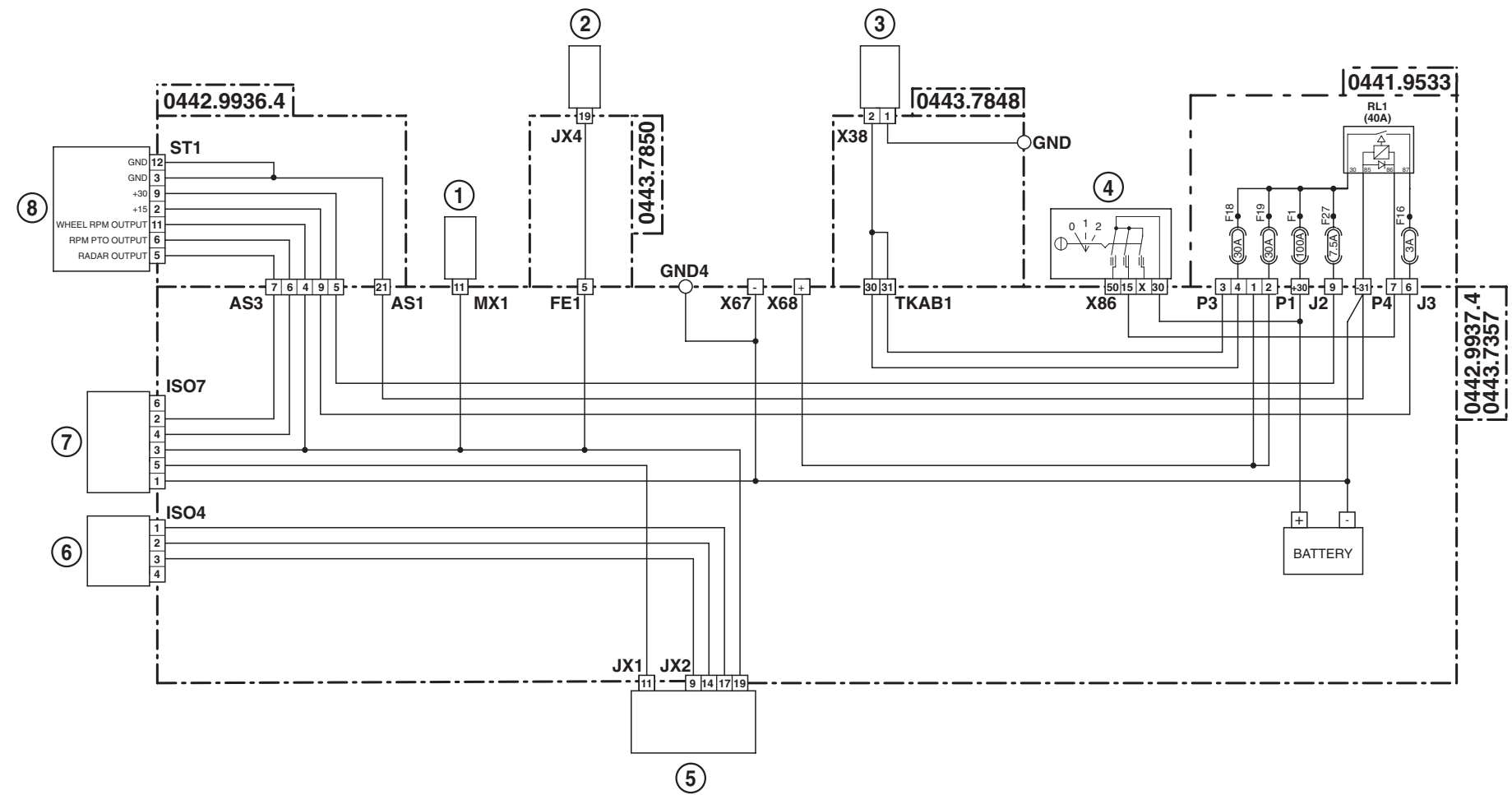
- 1 Rear screen wiper motor
- 2 Windscreen wiper motor
- 3 Starter switch
- 4 Rear screen wiper
- 5 Rear screen washer pump
- 6 Front windscreen washer pump
- 7 Lights selector switch

4.9 INFOCENTER



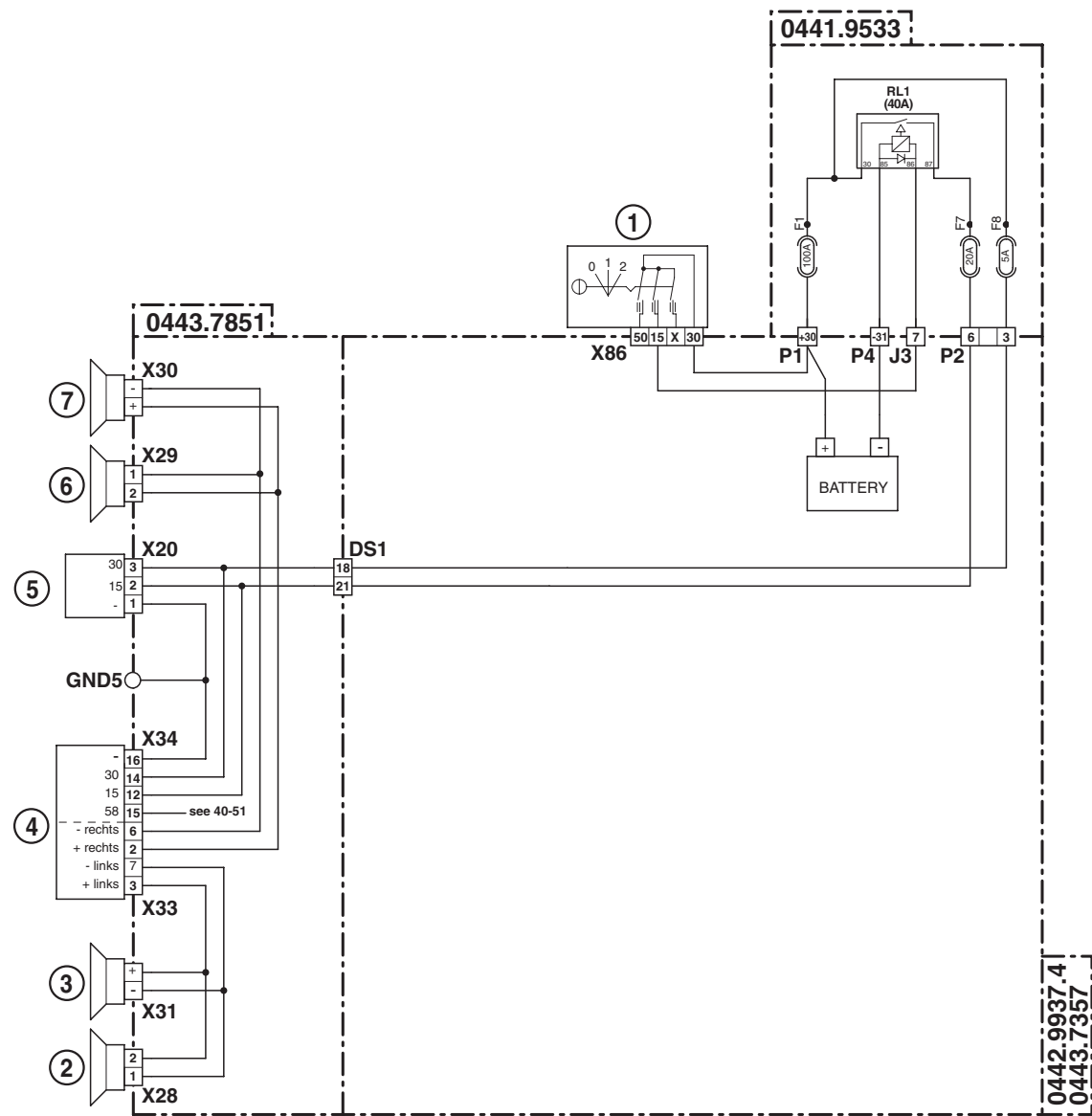
- 1 Infocenter
- 2 Starter switch
- 3 Fuel level sensor
- 4 Engine oil pressure switch
- 5 Air cleaner clogged sensor
- 6 Steering circuit pressure switch
- 7 Coolant temperature sensor

4.10 ELECTRICAL POWER SUPPLY



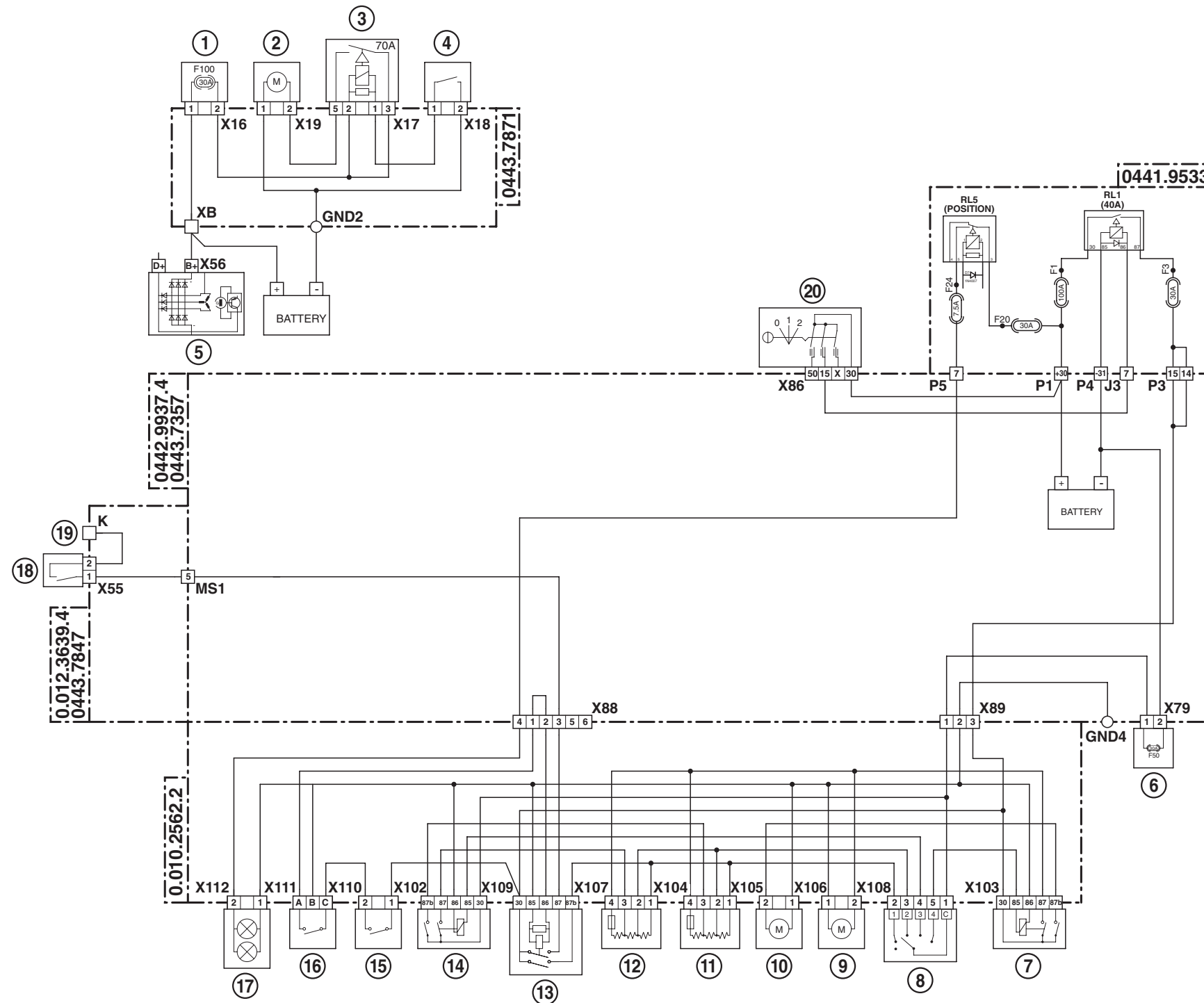
- 1 Engine ECU
- 2 Front axle suspension control unit
- 3 Trailer socket
(For lights and auxiliary power)
- 4 Starter switch
- 5 Rear power lift ECU
- 6 ISO4 socket
(Power for external implements)
- 7 ISO7 socket
(Connection for external implements)
- 8 Infocenter

4.11 AUTORADIO - CB



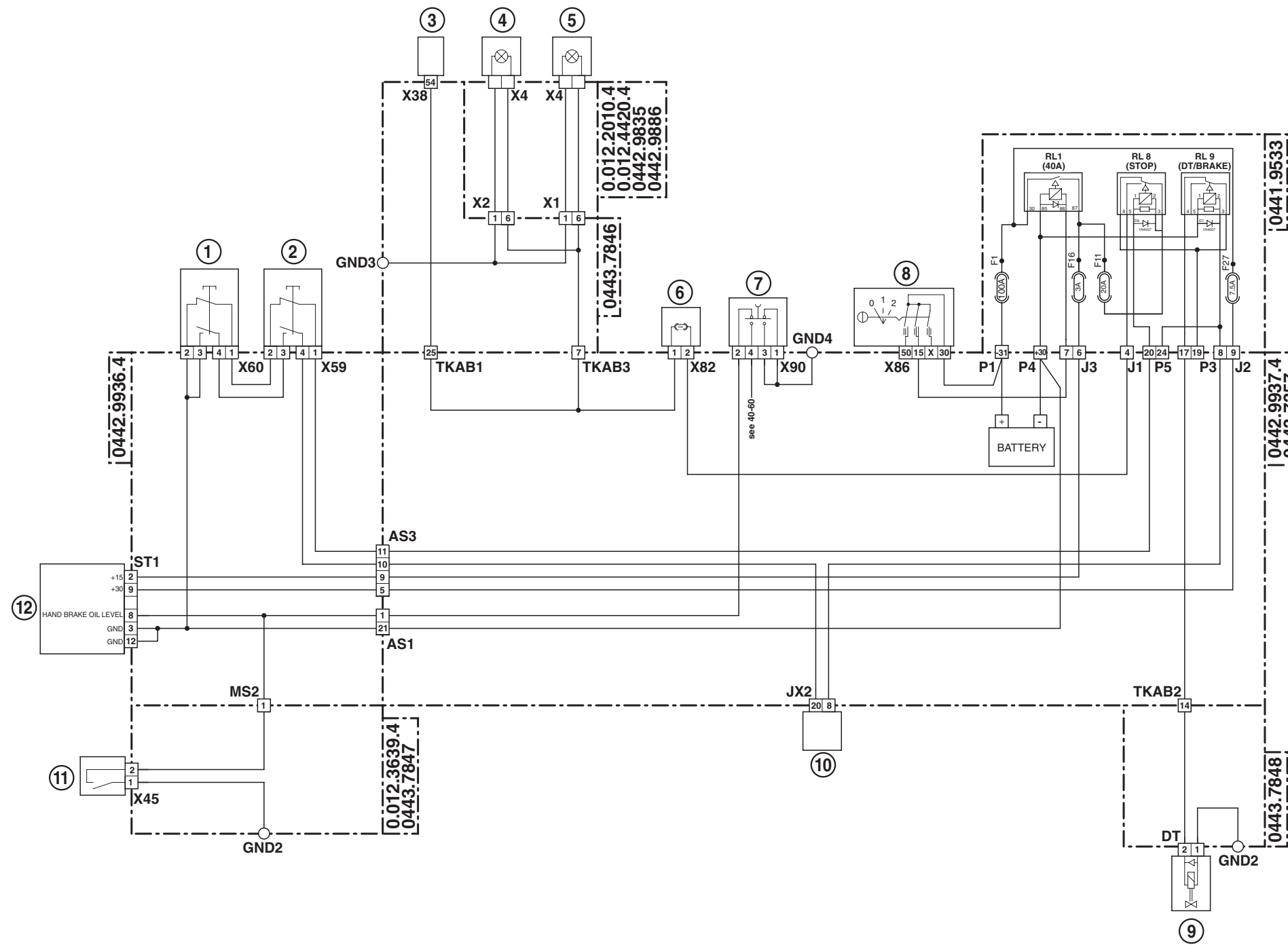
- 1 Starter switch
- 2 Right front loudspeaker
- 3 Right rear loudspeaker
- 4 Autoradio
- 5 CB power connector
- 6 Left front loudspeaker
- 7 Left rear loudspeaker

4.12 AIR CONDITIONING - HEATING FAN



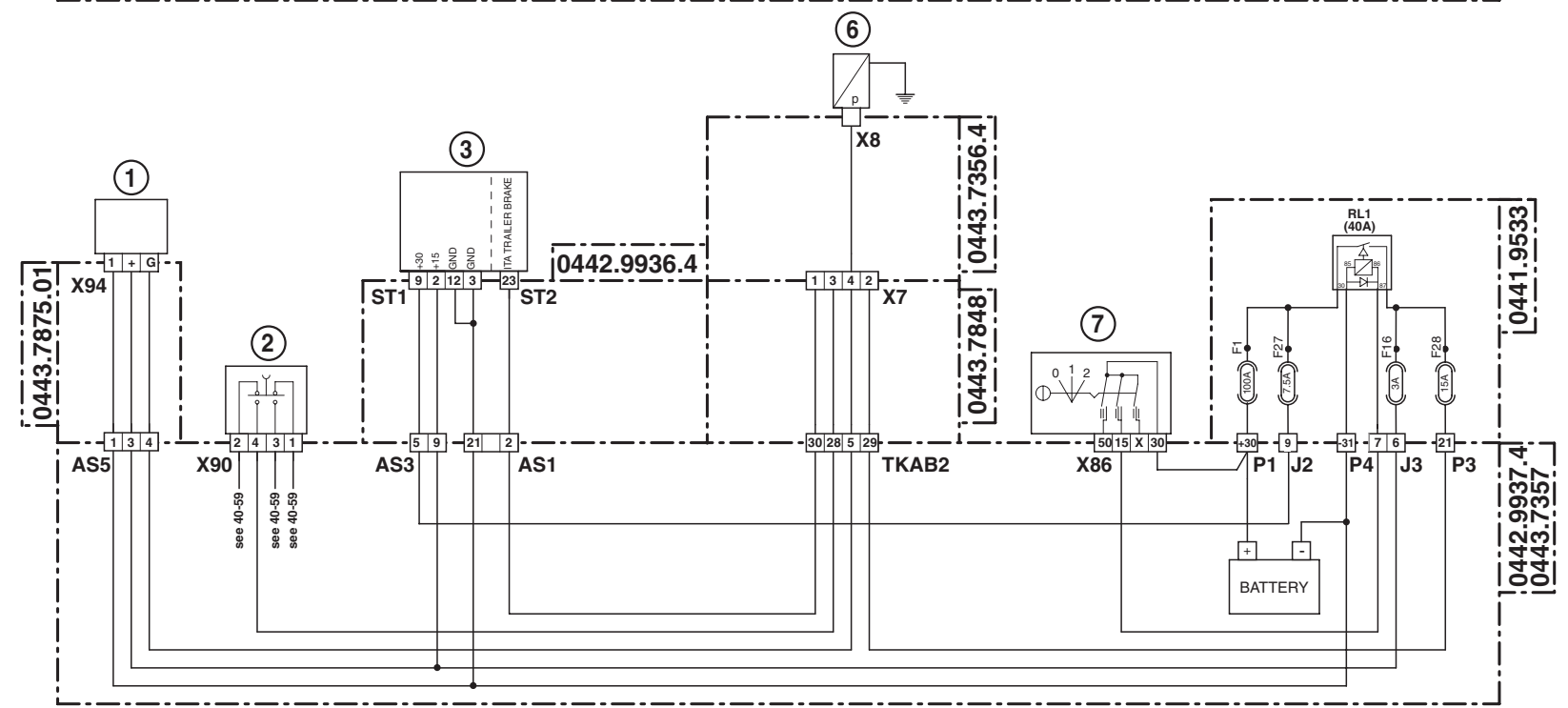
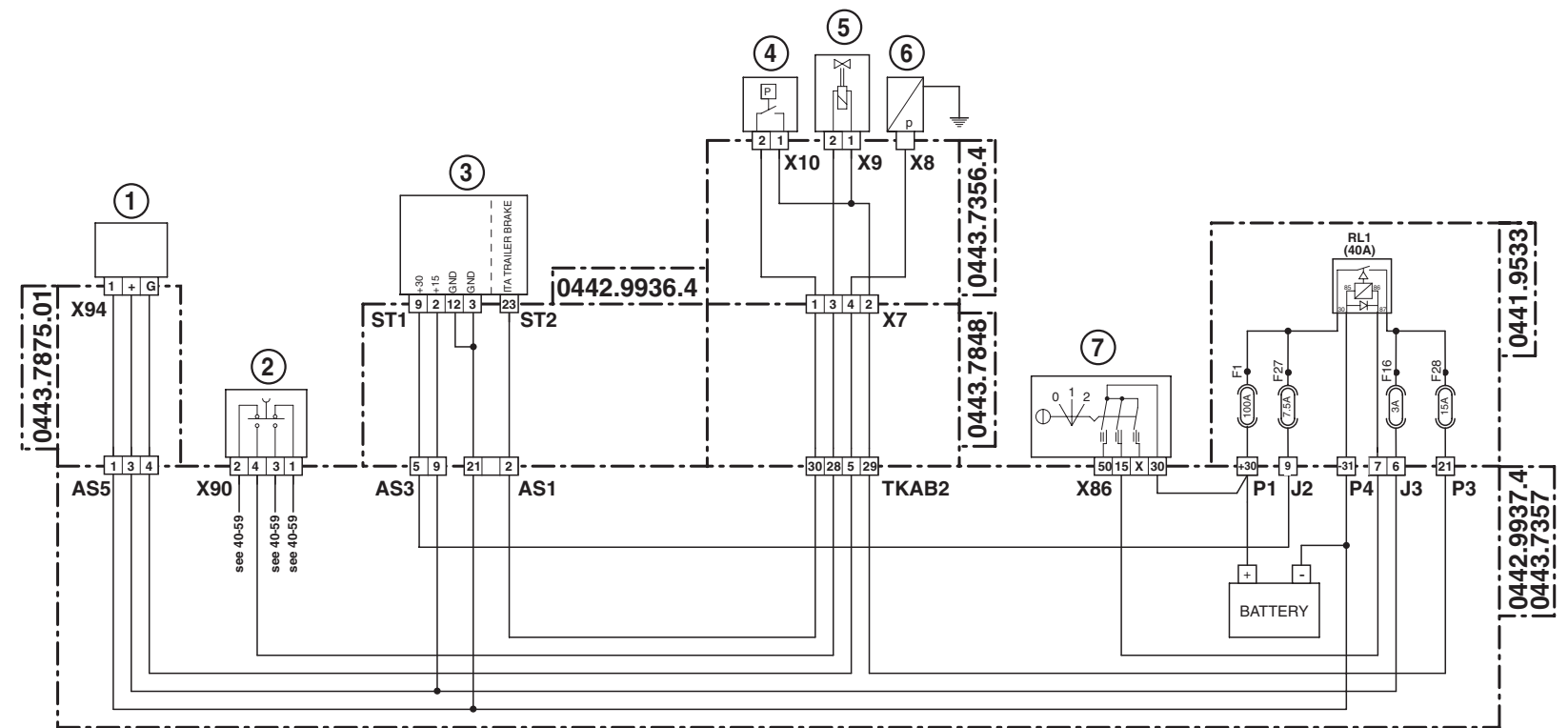
- 1 Fuse F100 (30 A)
- 2 Motor for supplementary air conditioning fan
- 3 Relay - supplementary air conditioning fan
- 4 Pressure switch for supplementary air conditioning fan
- 5 Alternator
- 6 Air conditioning fuse F50 (30 A)
- 7 Control relay for 4th speed heater fans
- 8 Fan speed selector switch
- 9 Right heater fan
- 10 Left heater fan
- 11 Resistor - left heater fan
- 12 Resistor - right heater fan
- 13 Control relay for 1st speed and air conditioning power on
- 14 Control relay for 3rd speed heater fans
- 15 Air conditioning control switch
- 16 Air conditioning thermostat
- 17 Connector for air conditioning control panel lighting
- 18 Air conditioning pressure switch
- 19 Air conditioning compressor
- 20 Starter switch

4.13 BRAKES



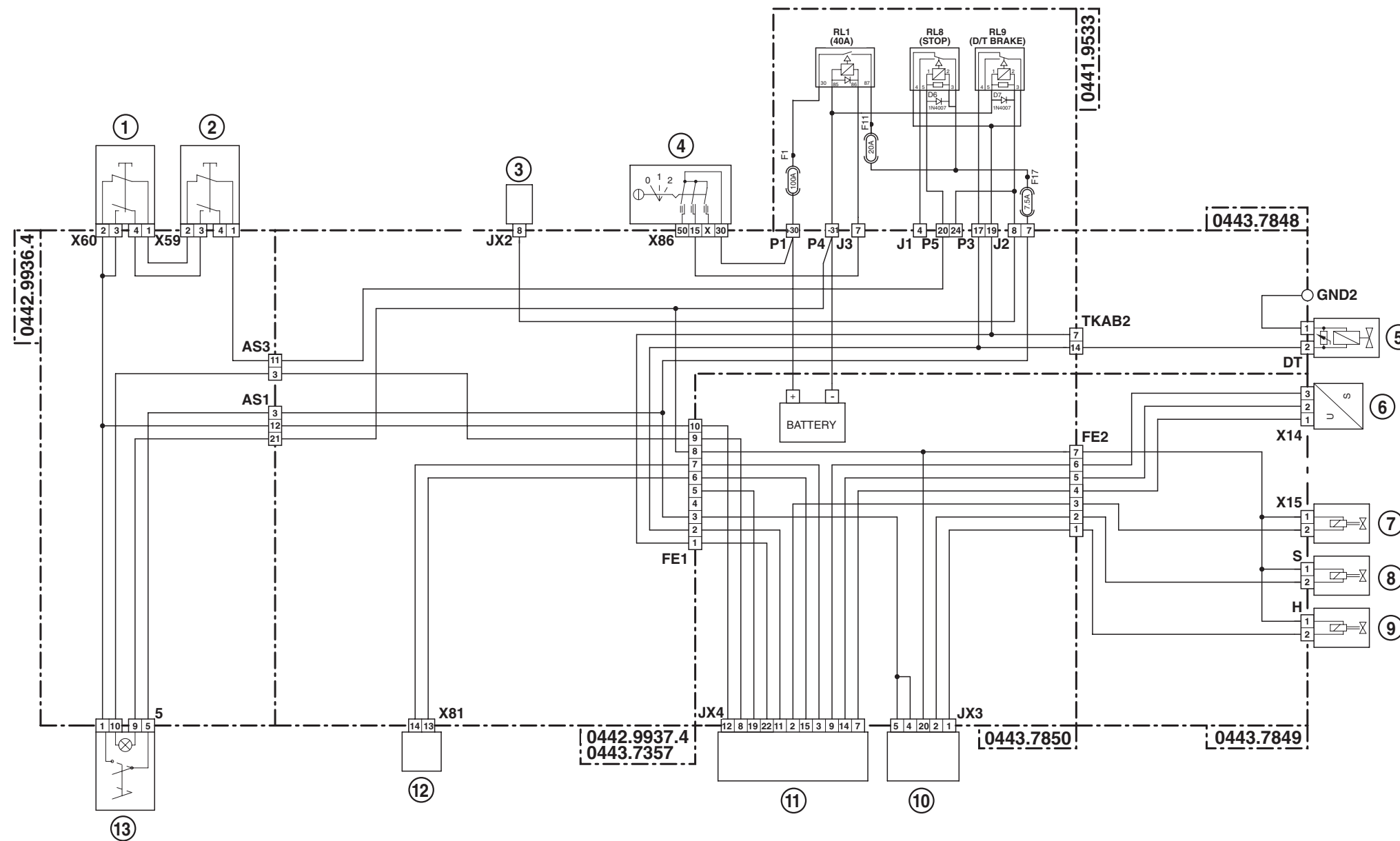
- 1 Left brake pedal switch
- 2 Right brake pedal switch
- 3 Trailer socket (For lights and auxiliary power)
- 4 Rear left side lights and direction indicators
- 5 Rear right side lights and direction indicators
- 6 Brake lights fuse F102 (15 A)
- 7 Handbrake switch
- 8 Starter switch
- 9 4WD control solenoid valve
- 10 Diagnostics connector
- 11 Brake fluid level sensor
- 12 Infocenter

4.14 TRAILER BRAKES



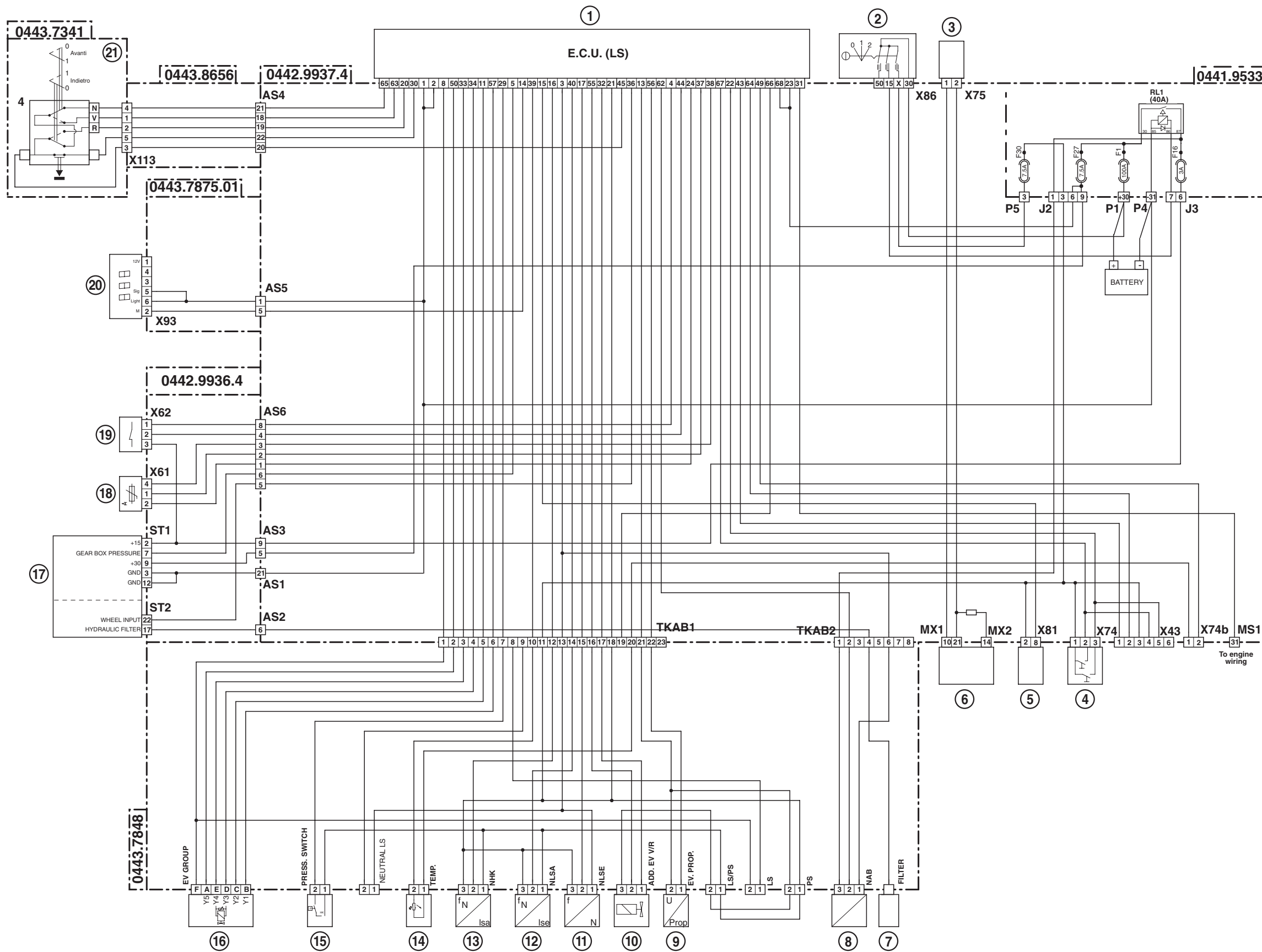
- 1 Compressed air pressure gauge
- 2 Handbrake switch
- 3 Infocenter
- 4 Trailer braking low pressure switch
- 5 Solenoid valve for trailer parking brake
- 6 Trailer braking air pressure sensor
- 7 Starter switch

4.15 FRONT AXLE SUSPENSION



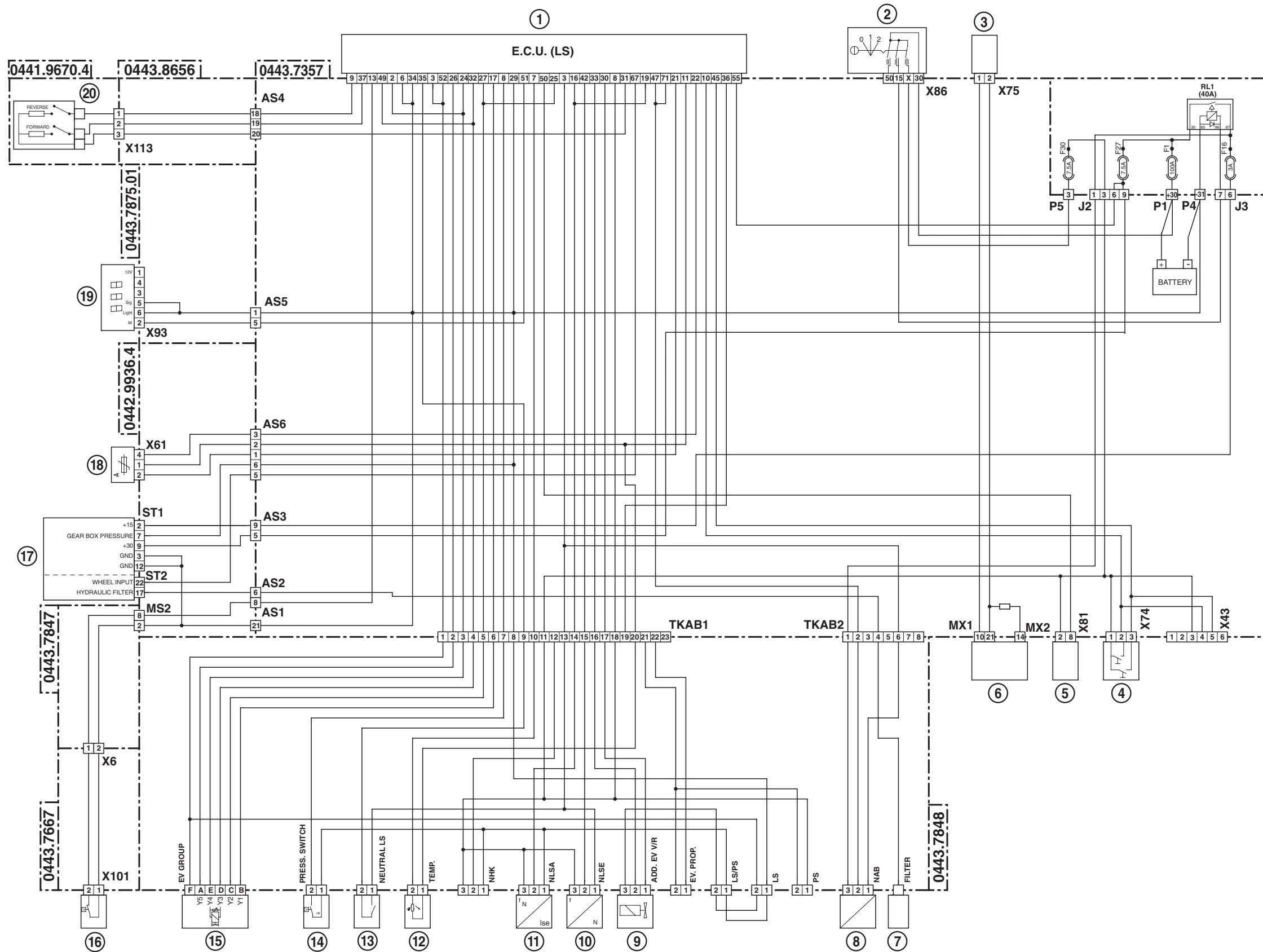
- 1 Left brake pedal switch
- 2 Right brake pedal switch
- 3 Rear power lift ECU
- 4 Starter switch
- 5 4WD control solenoid valve
- 6 Front axle suspension position sensor
- 7 Solenoid valve for control of front axle Load Sensing suspension
- 8 Solenoid valve for front axle lowering control
- 9 Solenoid valve for front axle raising control
- 10 Front axle suspension control unit
- 11 Diagnostics connector
- 12 Front suspension switch

4.16 POWER SHUTTLE TRANSMISSION



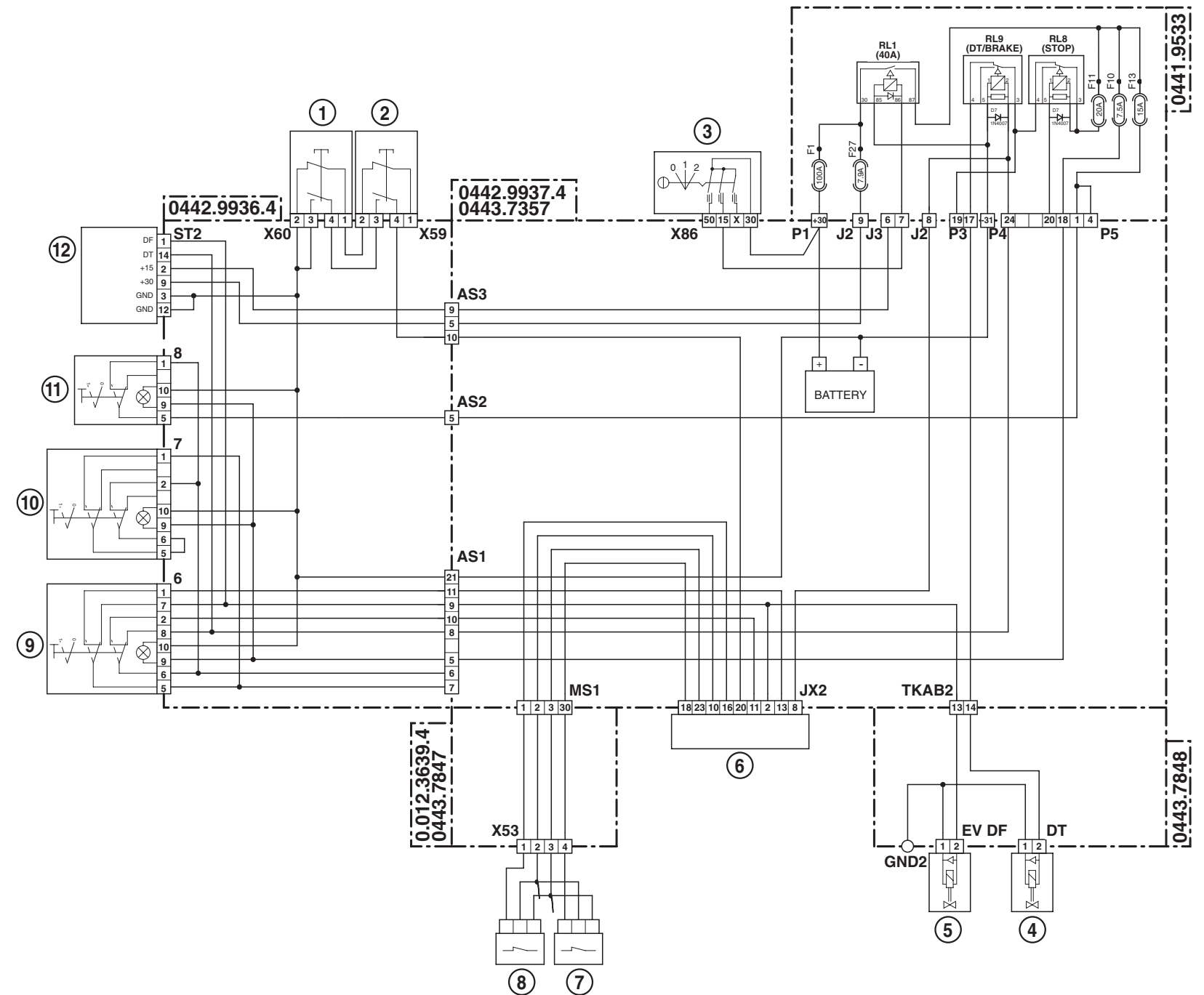
- 1 Transmission ECU
- 2 Starter switch
- 3 Super-reduction engagement switch
- 4 Gear shift pushbutton panel
- 5 Diagnostics connector
- 6 Engine ECU
- 7 Pressure switch - hydraulic oil filter clogging
- 8 Speed sensor for odometer
- 9 Proportional solenoid valve
- 10 Forward/reverse solenoid valves
- 11 Engine speed sensor
- 12 Gearbox output shaft speed sensor
- 13 Transmission speed sensor
- 14 Transmission oil temperature sensor
- 15 Transmission oil low pressure switch
- 16 Gear change solenoid valves
- 17 Infocenter
- 18 Clutch pedal position sensor
- 19 Clutch pedal depressed proximity sensor
- 20 Transmission display
- 21 Forward/reverse selector

4.17 POWER SHIFT TRANSMISSION



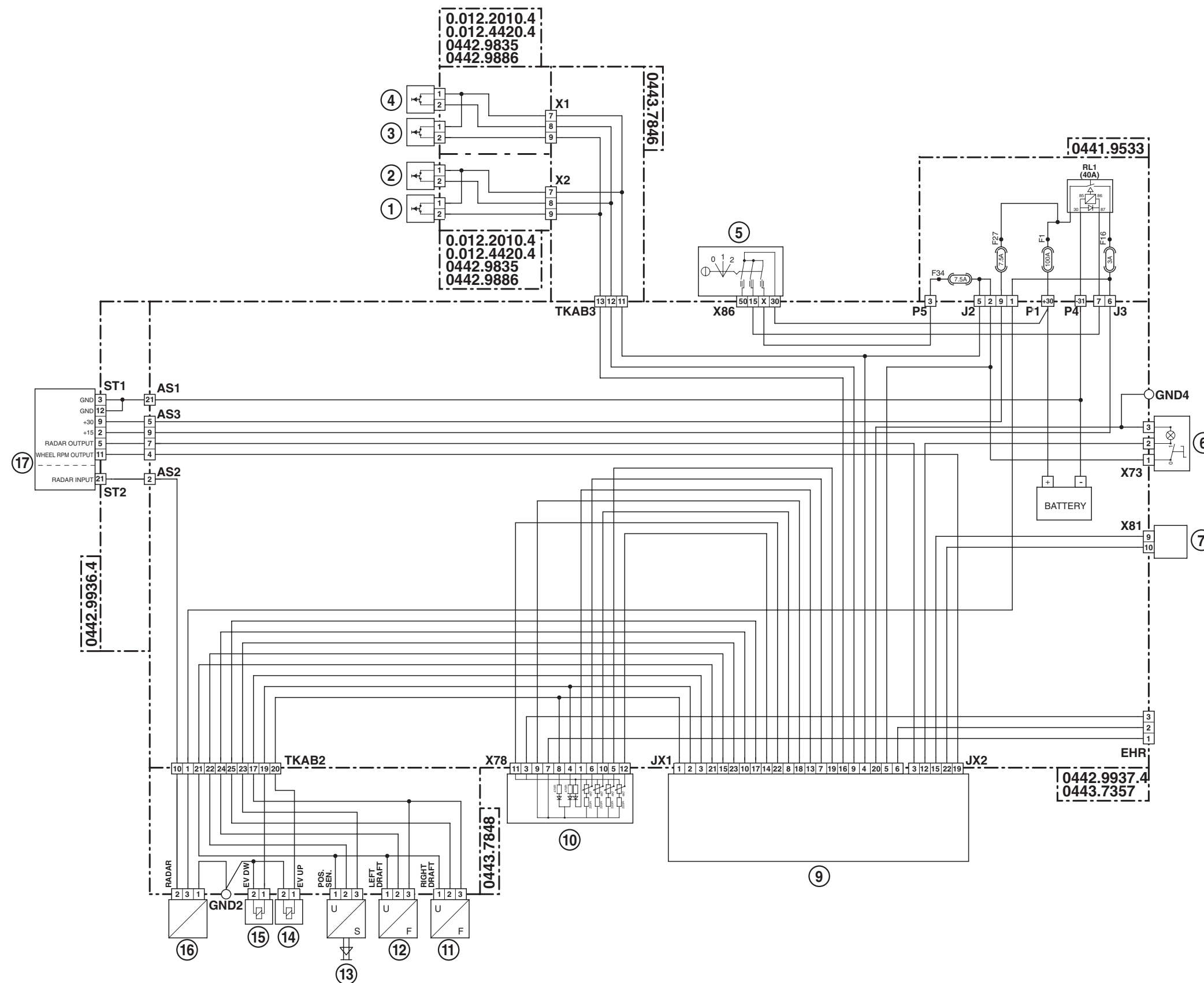
- 1 Transmission ECU
- 2 Starter switch
- 3 Super-reduction engagement switch
- 4 Gear shift pushbutton panel
- 5 Diagnostics connector
- 6 Engine ECU
- 7 Pressure switch - hydraulic oil filter clogging
- 8 Speed sensor for odometer
- 9 Forward/reverse solenoid valves
- 10 Engine speed sensor
- 11 Gearbox output shaft speed sensor
- 12 Transmission oil temperature sensor
- 13 Transmission neutral sensor (red switch)
- 14 Transmission oil low pressure switch
- 15 Gear change solenoid valves
- 16 Pressure switch, clutch pedal depressed
- 17 Infocenter
- 18 Clutch pedal position sensor
- 19 Transmission display
- 20 Forward/reverse selector

4.18 ASM - 4WD - DIFFERENTIAL



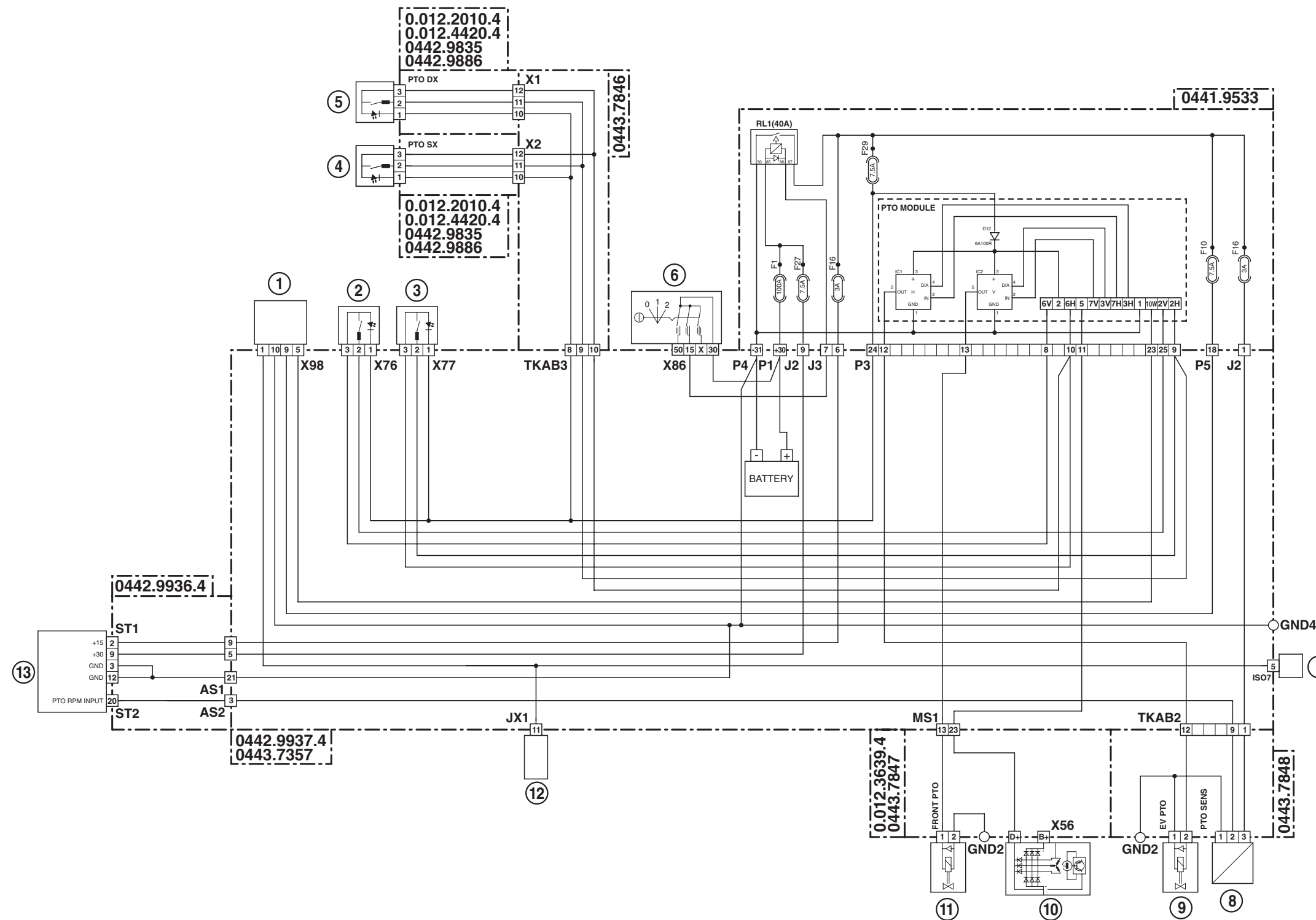
- 1 Left brake pedal switch
- 2 Right brake pedal switch
- 3 Starter switch
- 4 4WD control solenoid valve
- 5 Diff lock solenoid valve
- 6 Rear power lift ECU
- 7 Steering angle sensor 2
- 8 Steering angle sensor 1
- 9 ASM switch
- 10 Diff lock switch
- 11 4WD switch
- 12 Infocenter

4.19 REAR LIFTER



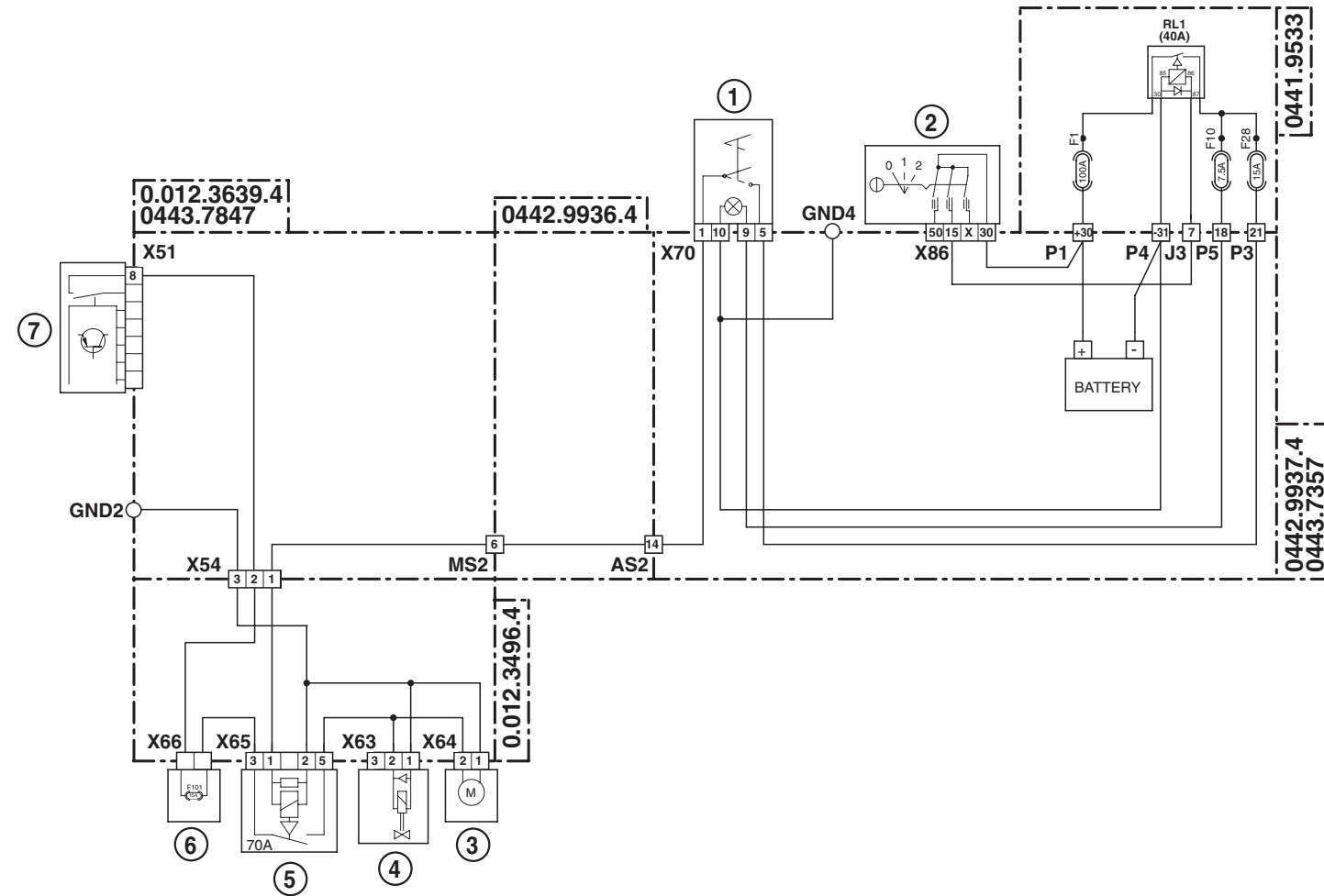
- 1 Left rear lift "lower" control pushbutton
- 2 Left rear lift "raise" control pushbutton
- 3 Right rear lift "lower" control pushbutton
- 4 Right rear lift "raise" control pushbutton
- 5 Starter switch
- 6 Radar control switch
- 7 Diagnostics connector
- 8 Lift control lever
- 9 Rear power lift ECU
- 10 Lift control lever
- 11 Lift draft sensor
- 12 Lift draft sensor
- 13 Rear lift position sensor
- 14 Lift raising solenoid valve
- 15 Lift lowering solenoid valve
- 16 Radar
- 17 Infocenter

4.20 FRONT AND REAR PTO



- 1 PTO AUTO control switch
- 2 Front PTO control pushbutton (in cab)
- 3 Rear PTO control pushbutton (in cab)
- 4 Rear PTO control pushbutton (left)
- 5 Rear PTO control pushbutton (right)
- 6 Starter switch
- 7 ISO7 socket (Connection for external implements)
- 8 Rear PTO speed sensor
- 9 Rear PTO solenoid valve
- 10 Alternator
- 11 Front PTO solenoid valve
- 12 Rear power lift ECU
- 13 Infocenter

4.21 CLEANFIX



- 1 Clean Fix control switch
- 2 Starter switch
- 3 Clean Fix control compressor
- 4 Clean Fix control solenoid valve
- 5 Control relay for Clean Fix
- 6 Clean Fix fuse F101 (15 A)
- 7 Preheating control unit

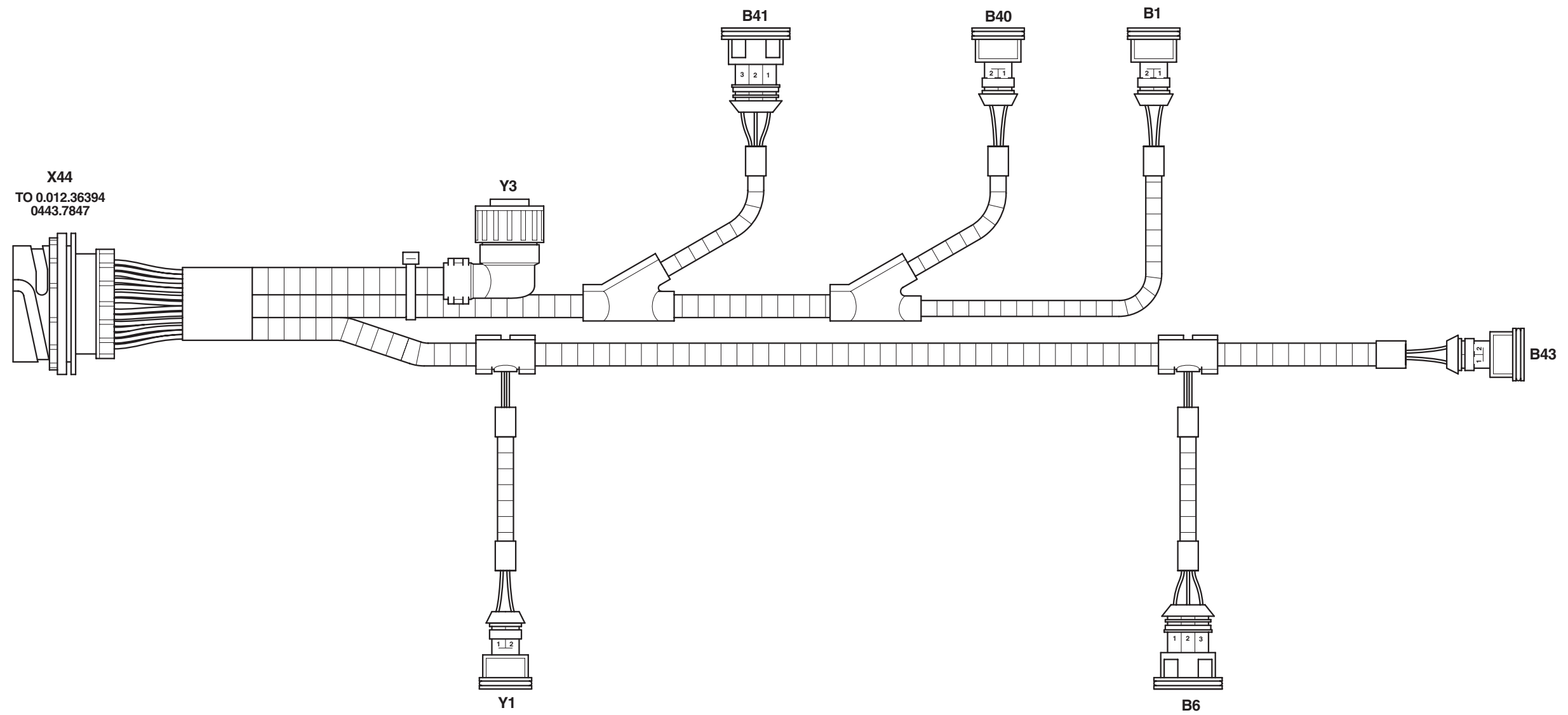
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5. PLANIMETRY, WIRING DIAGRAM AND CONNECTORS LOCATION

WIRING	CODE	PAGE
ACCELERATOR PEDAL SENSOR	0443.8666	40-143
AIR CONDITIONING WIRING (CAB)	010.2562.2	40-165
AIR TRAILER BRAKING	0443.7355	40-112
ARMREST	0443.7354.4	40-189
ARMREST (INTERNAL)	0443.5497	40191
CAB LINE FRONT SUSPENSION	0443.7849	40-125
CAB POWER SUPPLY	0443.7846/10	40-119
CLEAN FIX	0.012.3496.4	40-93
CLUTCH SENSOR	0443.7667	40-81
CONTROL UNIT - FUSES - RELAYS	0441.9533	40-193
DISPLAY	0443.7875.01	40-171
ENGINE (106-115 CV)	0.012.3639.4/10	40-77
ENGINE (120-165CV)	0443.7847/20	40-79
	0.012.2010.4	40-133
	0.012.4420.4	40-134
FENDER	0442.9835	40-135
	0442.9886	40-136
FRONT CONSOLE	0442.9936.4/20	40-141
FRONT SUSPENSION CONTROL UNIT (CAB)	0443.7850	40-115
HYDRAULIC AND AIR TRAILER BRAKING (ITALY)	0443.7356.4	40-111
INTERNAL COMBUSTION ENGINE	0419.9751	40-71
	0.012.2018.4	40-129
NUMBER PLATE LIGHT	0441.4114	40-130
	0442.9887	40-131
ROOF	0443.7851/10	40-175
ROTATING BEACON	0441.4780	40-179
SIDE CONSOLE (POWER SHIFT)	0443.7357/20	40-153
SIDE CONSOLE (POWER SHUTTLE)	0442.9937.4/20	40-149
SUPPLEMENTARY AIR CONDITIONING FAN	0443.7871	40-95
TRANSMISSION	0443.7848	40-99
WORKLIGHTS	0442.4189	40-177

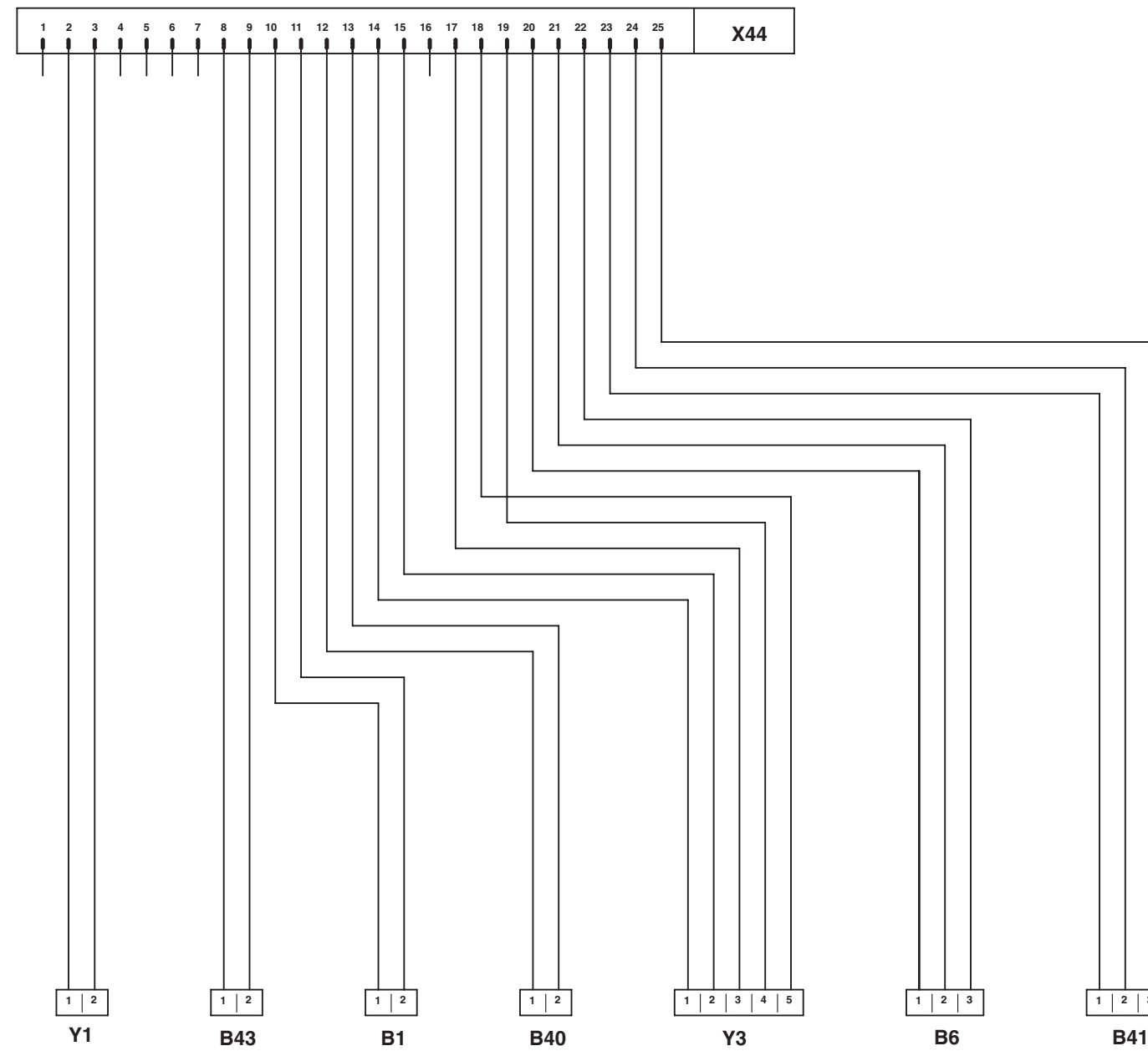
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INTERNAL COMBUSTION ENGINE WIRING (120-165 CV)



- B1** Not used
- B40** Camshaft speed sensor (Pick-Up)
- B41** Engine boost pressure sensor
- B43** Coolant temperature sensor
- B6** Not used
- X44** To engine wiring
- Y1** Engine stop coil
- Y3** Actuator

INTERNAL COMBUSTION ENGINE WIRING (120-165 CV)

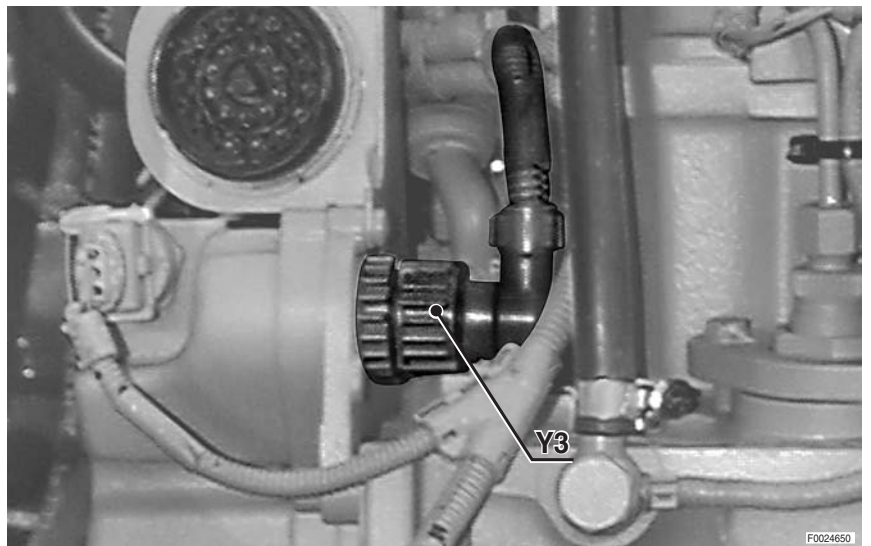


INTERNAL COMBUSTION ENGINE CONNECTORS LOCATION

1



2



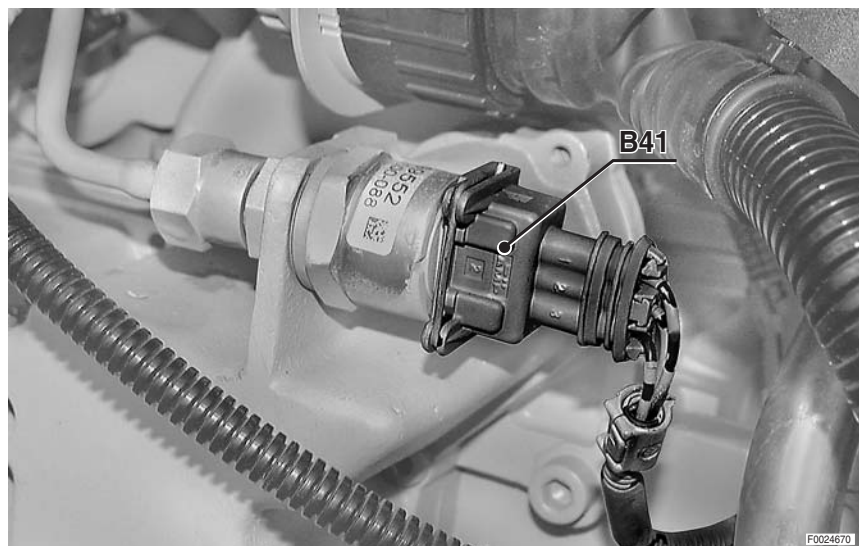
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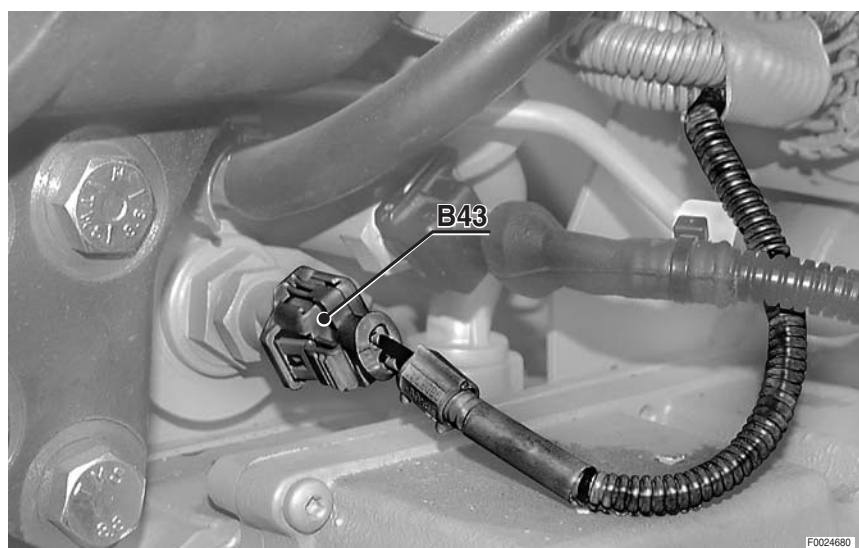
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INTERNAL COMBUSTION ENGINE WIRING (120-165 CV)

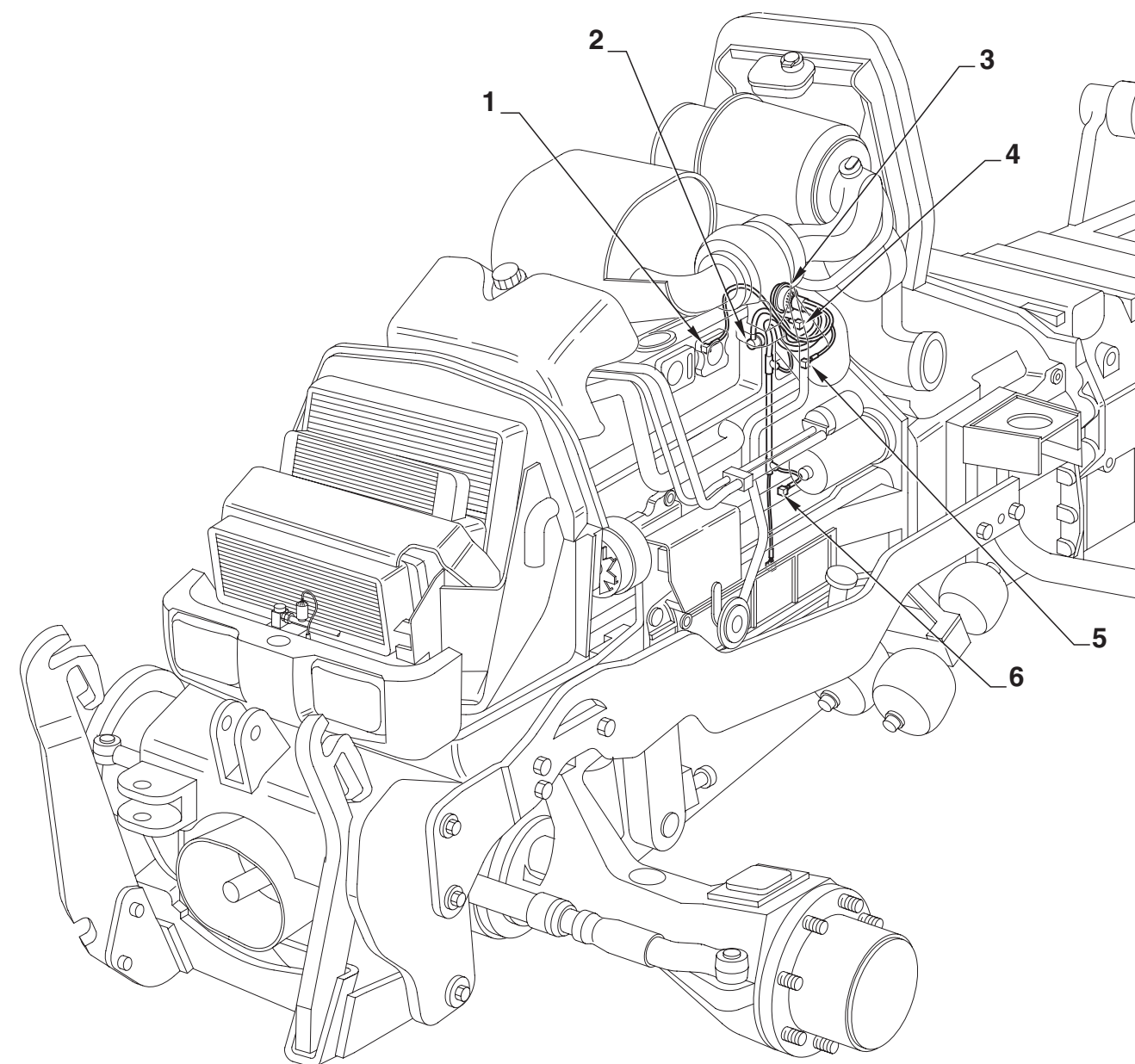
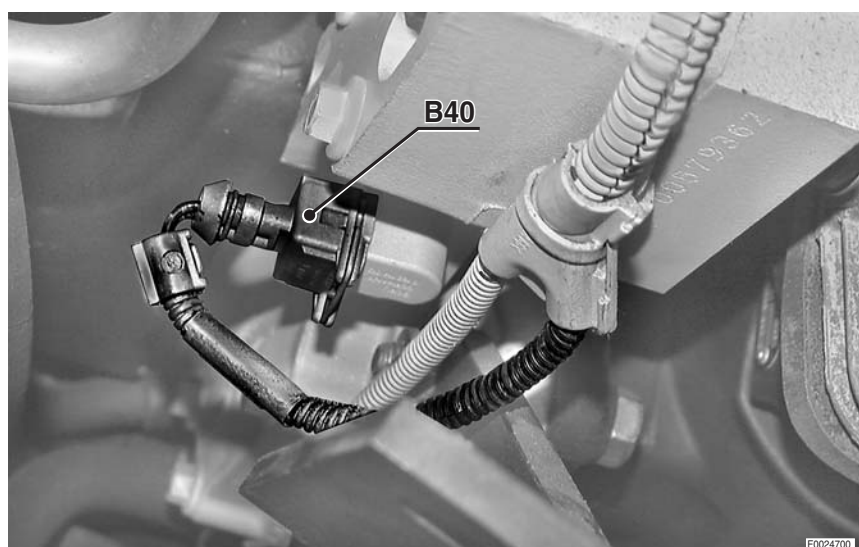
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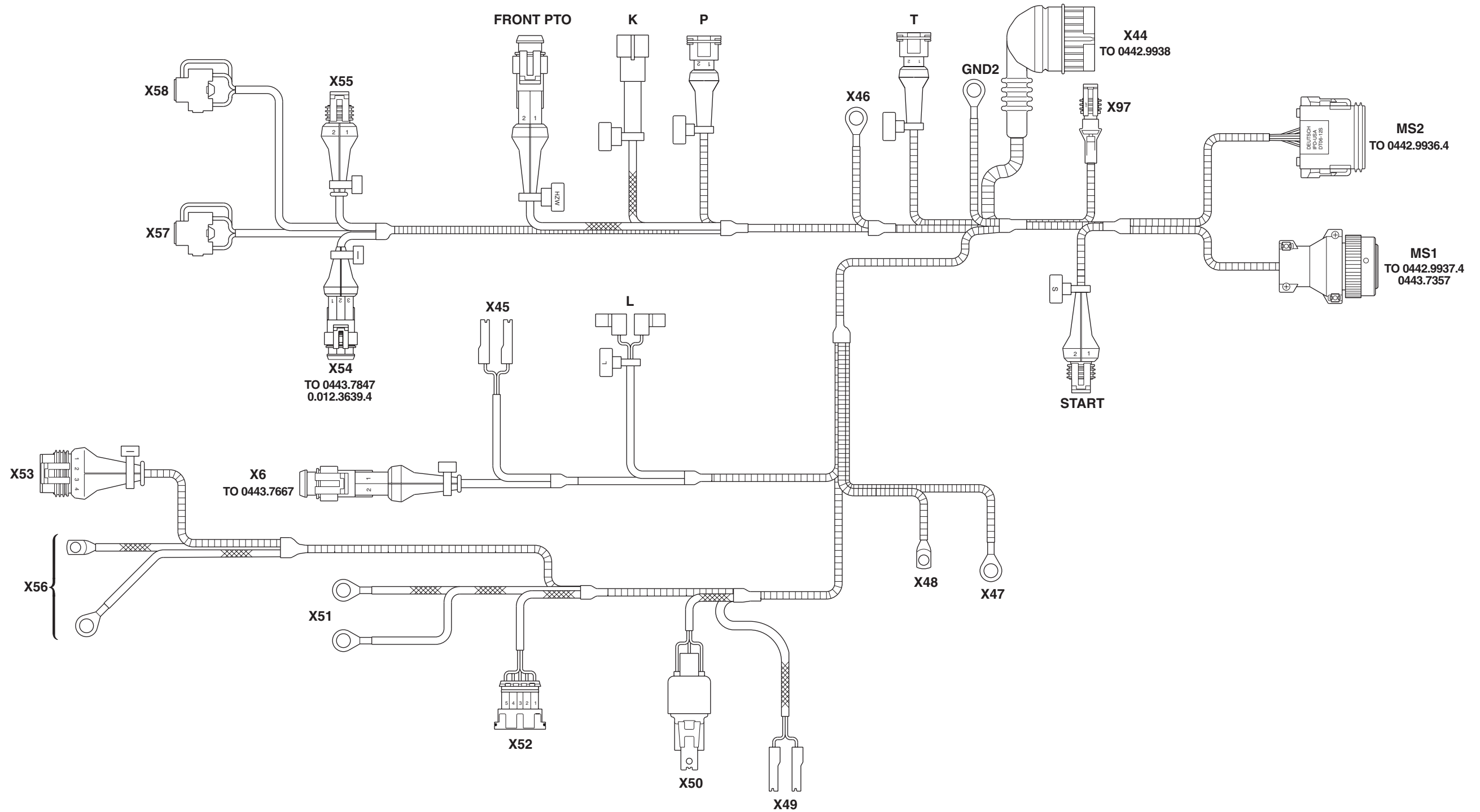


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ENGINE WIRING (106-115 CV) (1/2)

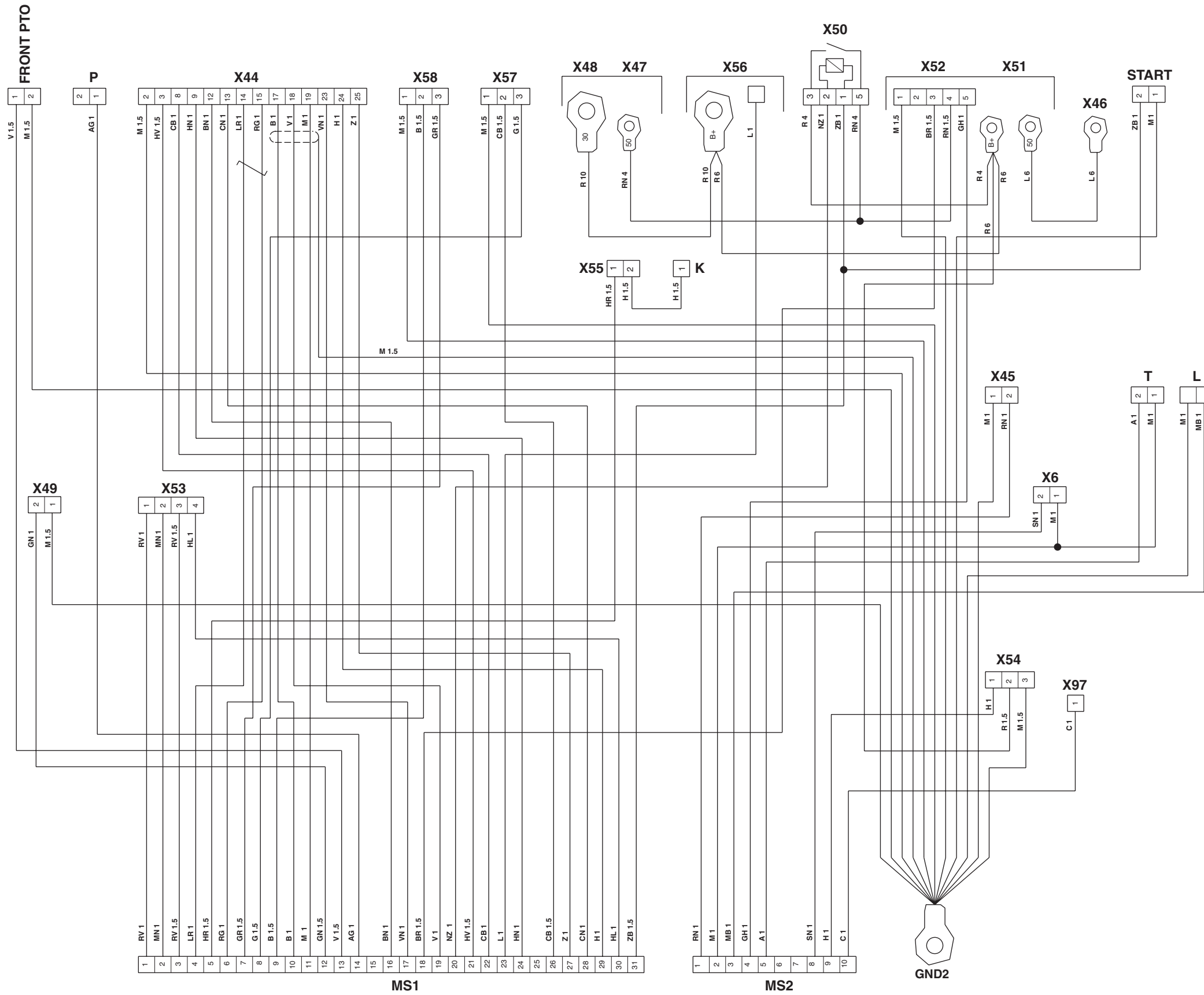


FRONT PTO Front PTO solenoid valve
K Air conditioning compressor
L Air cleaner clogged sensor
MS1 To front console wiring
MS2 To front console wiring
P Engine oil pressure switch
START Start enable switch (Green)
T Coolant temperature sensor
X6 To clutch sensor wiring

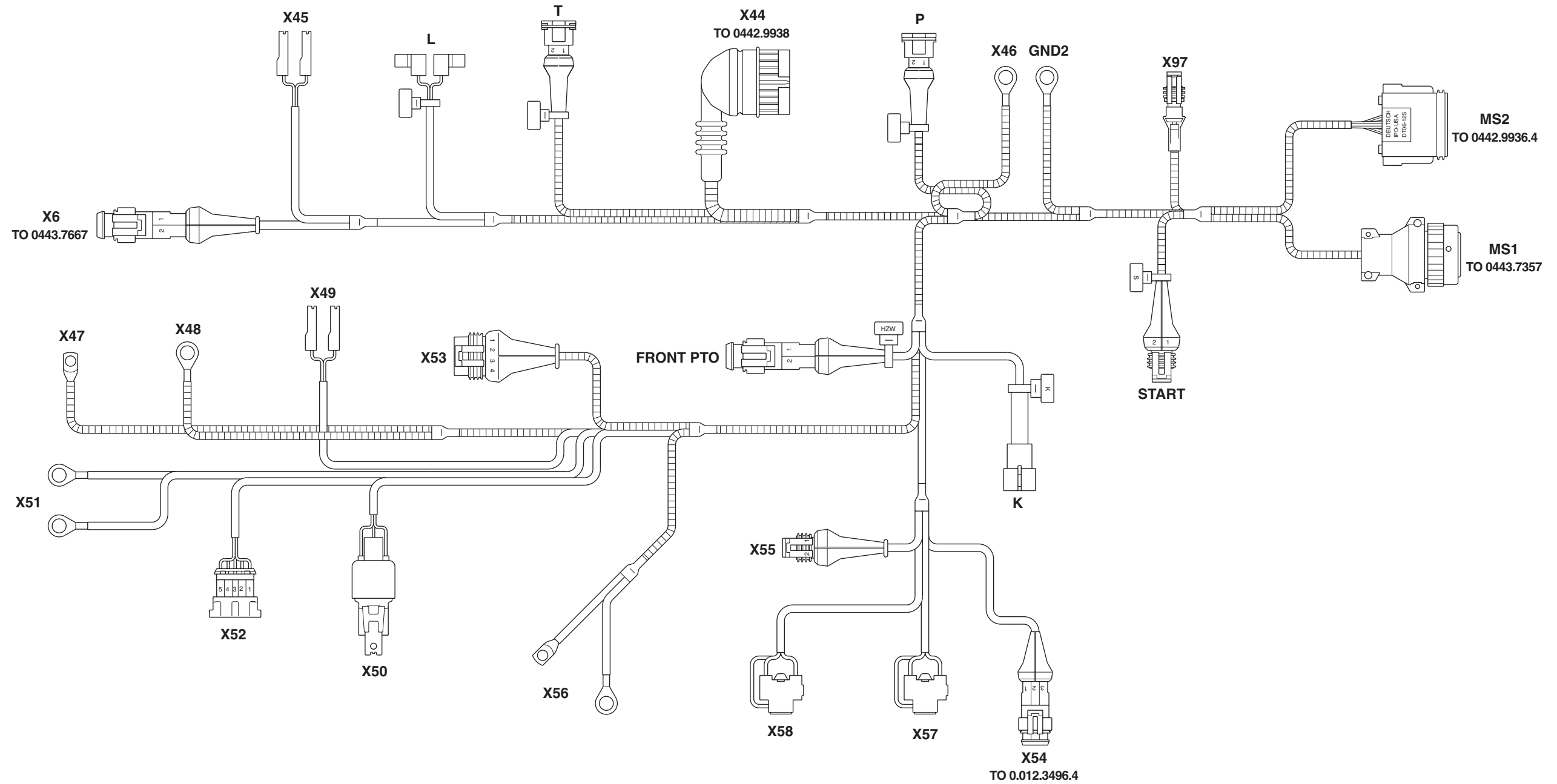
X44 To internal combustion engine wiring
X45 Brake fluid level sensor
X46 Glowplug
X47 Starter motor
X48 Starter motor
X49 Horn
X50 Relay - engine starting
X51 Preheating control unit
X52 Preheating control unit

X53 Steering angle sensor
X54 To Clean Fix wiring
X55 Air conditioning pressure switch
X56 Alternator
X57 Front right headlamp
X58 Front left headlamp
X97 Steering system pressure switch

ENGINE WIRING (106-115 CV) (2/2)



ENGINE WIRING (120-165 CV) (1/2)

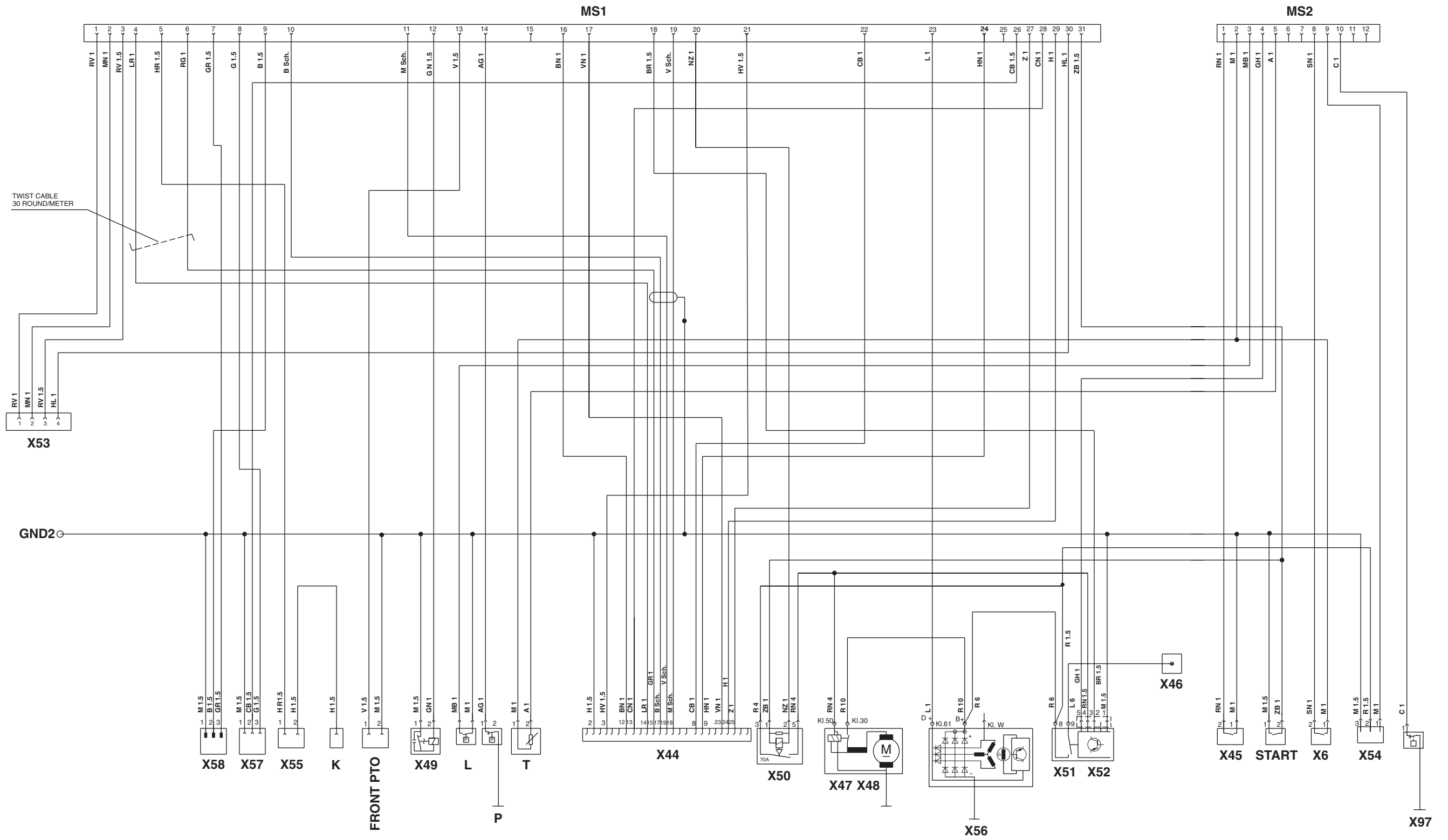


FRONT PTO Front PTO solenoid valve
K Air conditioning compressor
L Air cleaner clogged sensor
MS1 To front console wiring
MS2 To front console wiring
P Engine oil pressure switch
START Start enable switch (Green)
T Coolant temperature sensor
X6 To clutch sensor wiring

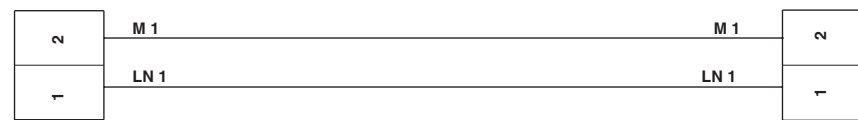
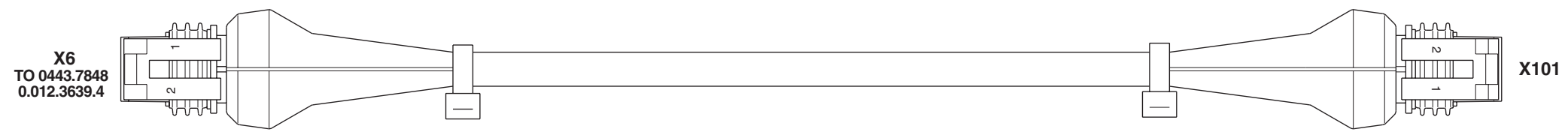
X44 To internal combustion engine wiring
X45 Brake fluid level sensor
X46 Glowplug
X47 Starter motor
X48 Starter motor
X49 Horn
X50 Relay - engine starting
X51 Preheating control unit
X52 Preheating control unit

X53 Steering angle sensor
X54 To Clean Fix wiring
X55 Air conditioning pressure switch
X56 Alternator
X57 Front right headlamp
X58 Front left headlamp
X97 Steering system pressure switch

ENGINE WIRING (120-165 CV) (2/2)



CLUTCH SENSOR WIRING



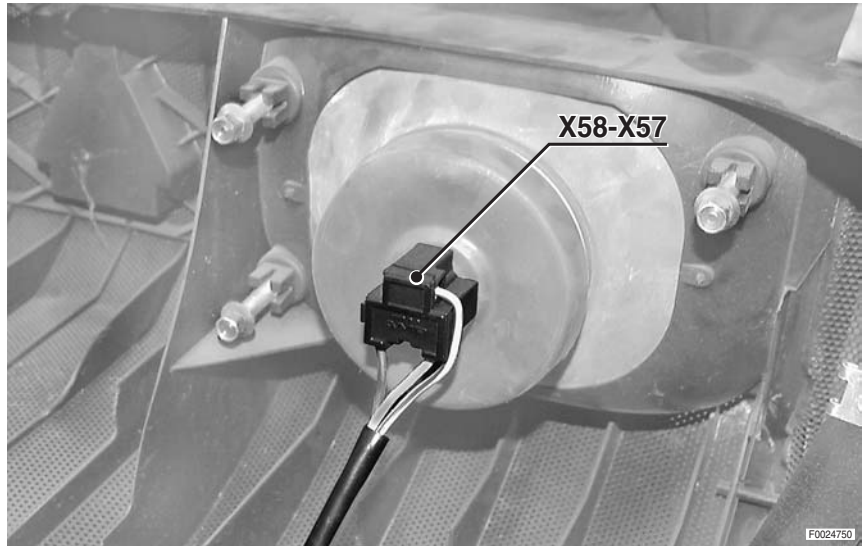
X6 To engine wiring

X101 Pressure switch, clutch pedaldepressed

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ENGINE CONNECTORS LOCATION

1

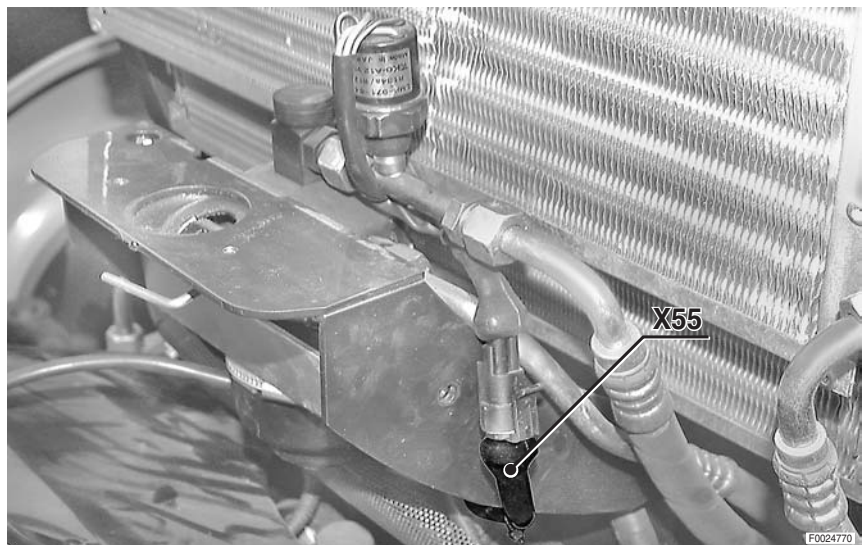


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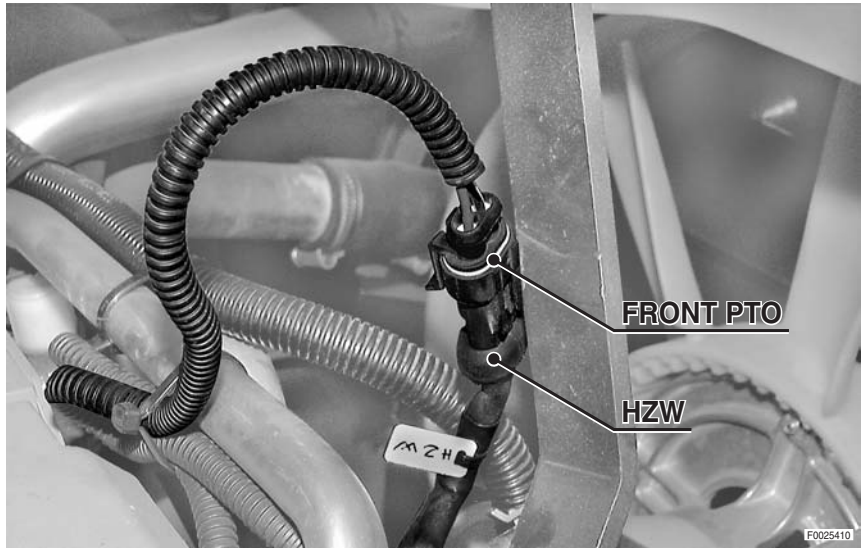


ONLY FOR
POWER SHIFT VERSION

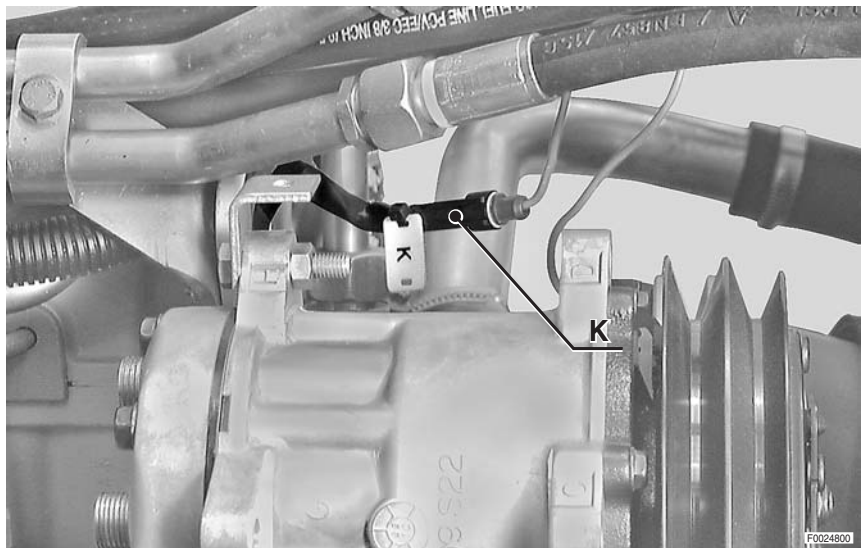
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4



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6



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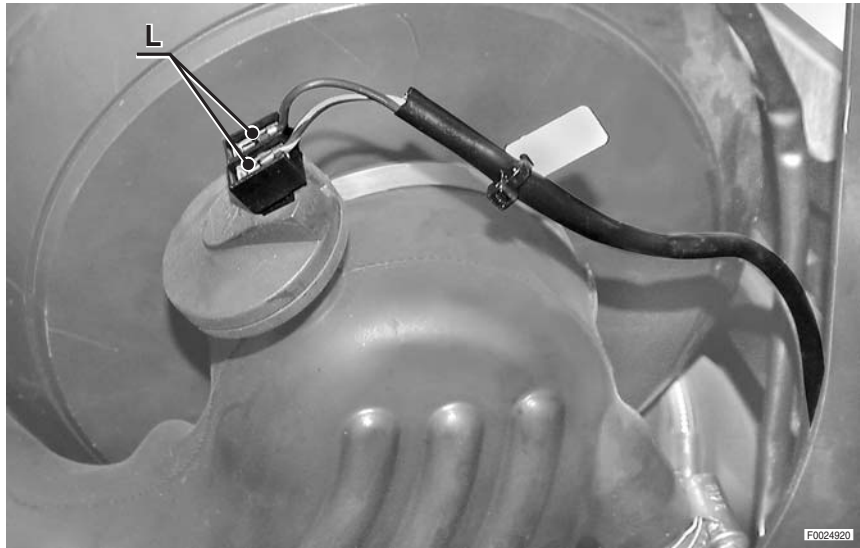
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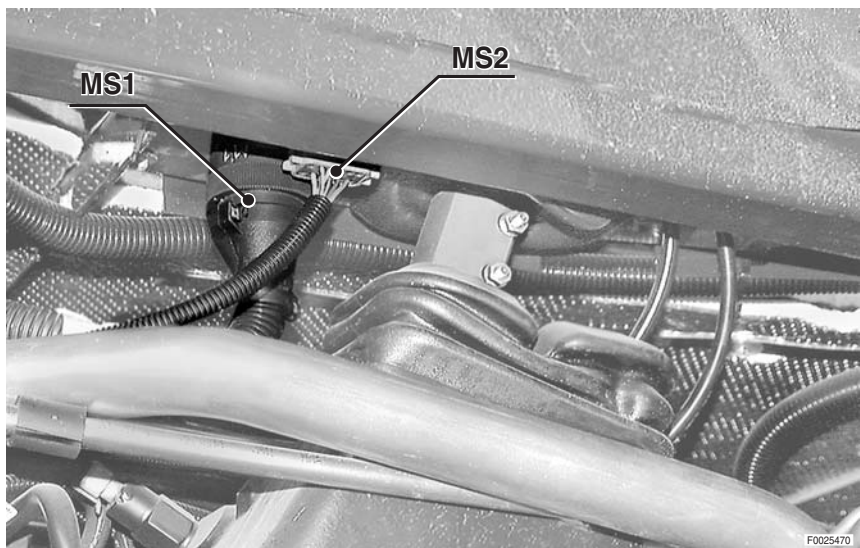
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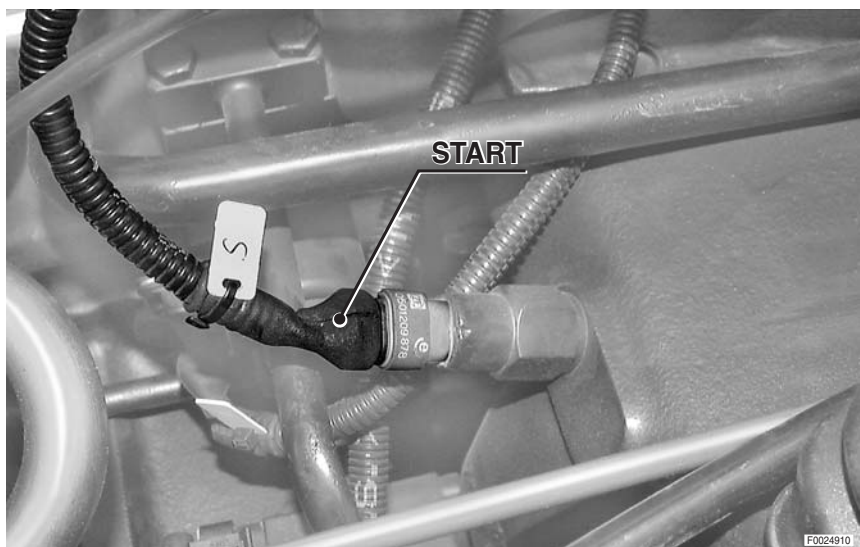
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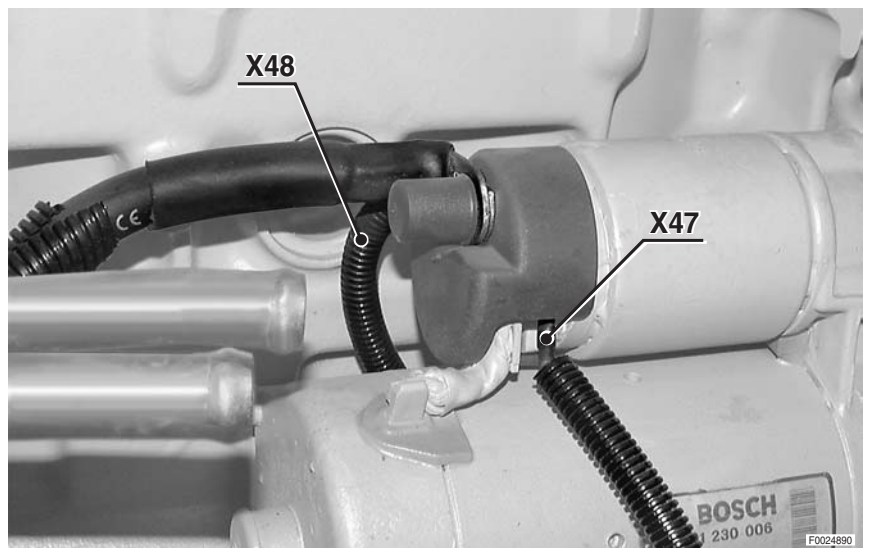
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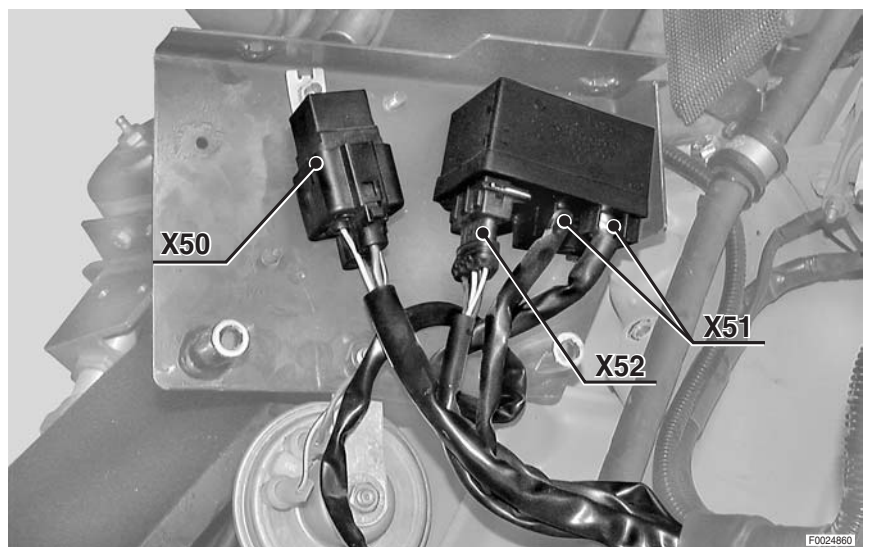
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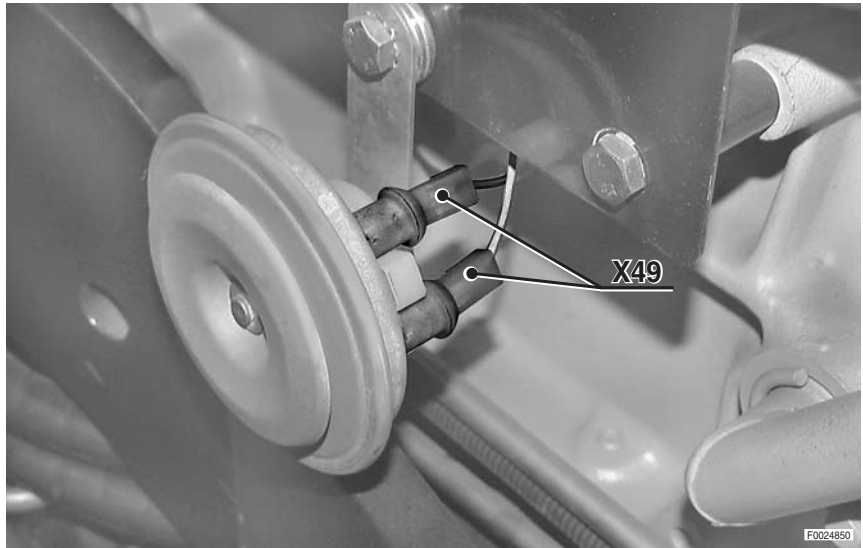
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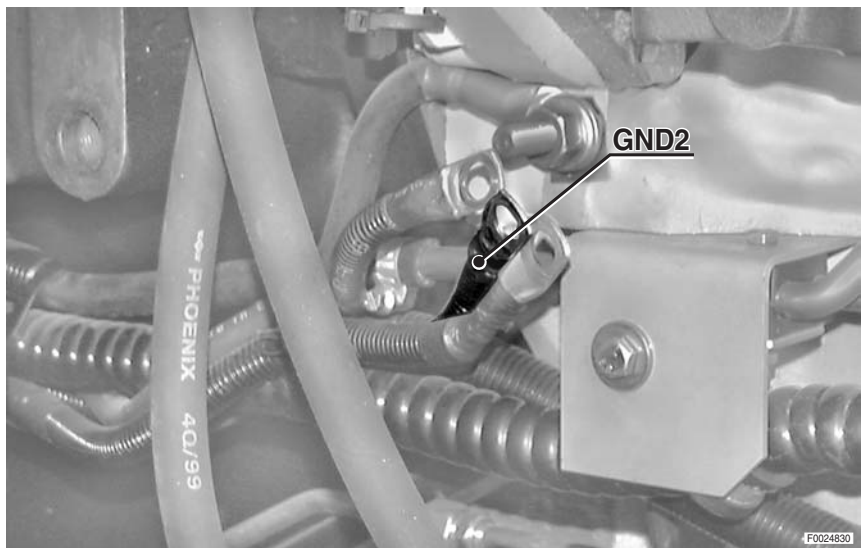
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17



18



19

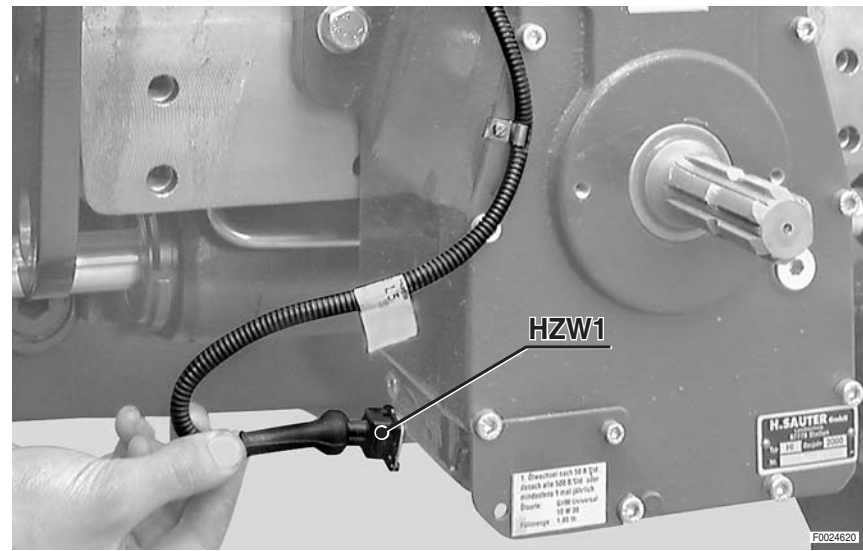


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21

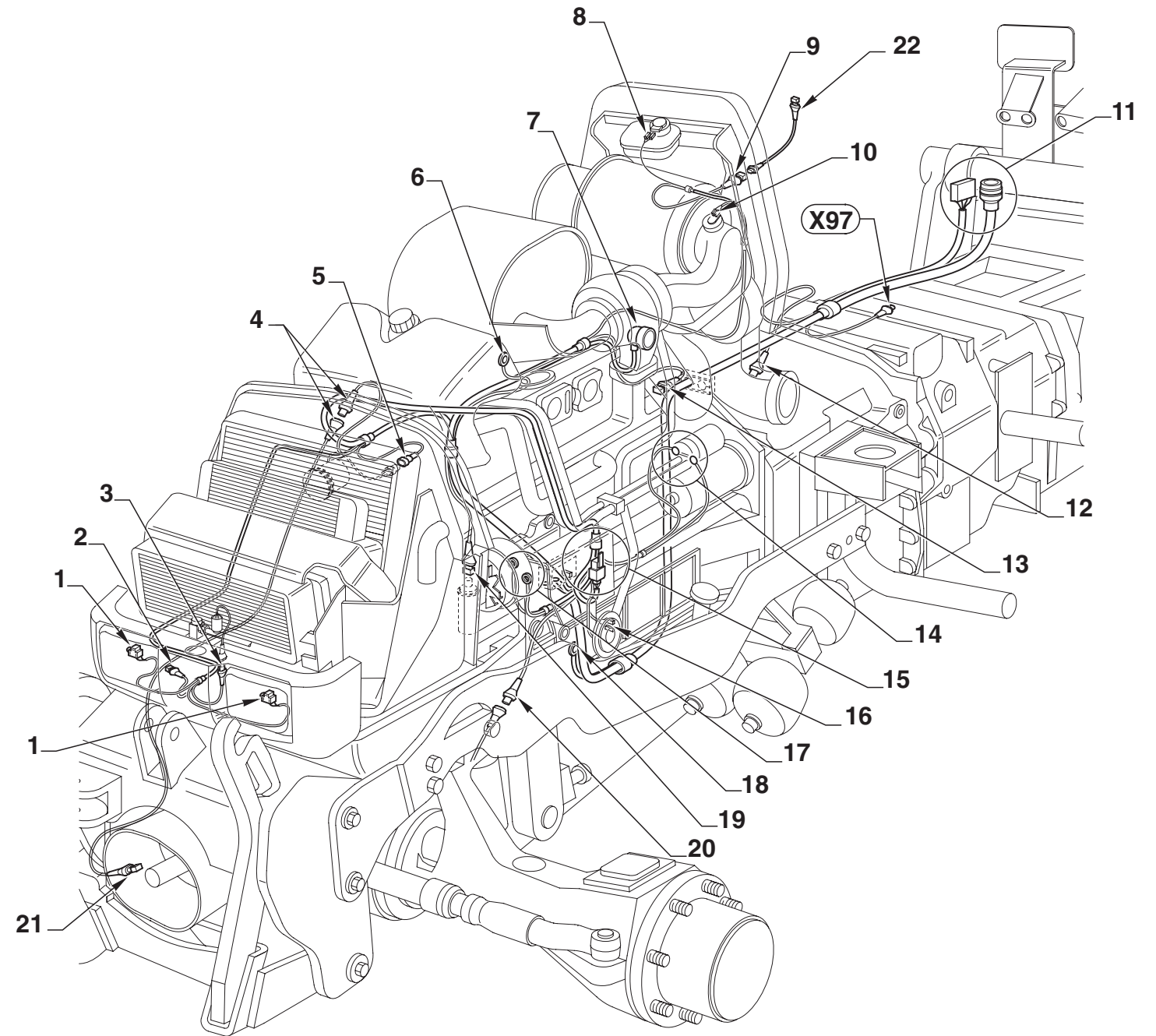


22



ONLY FOR
POWER SHIFT VERSION

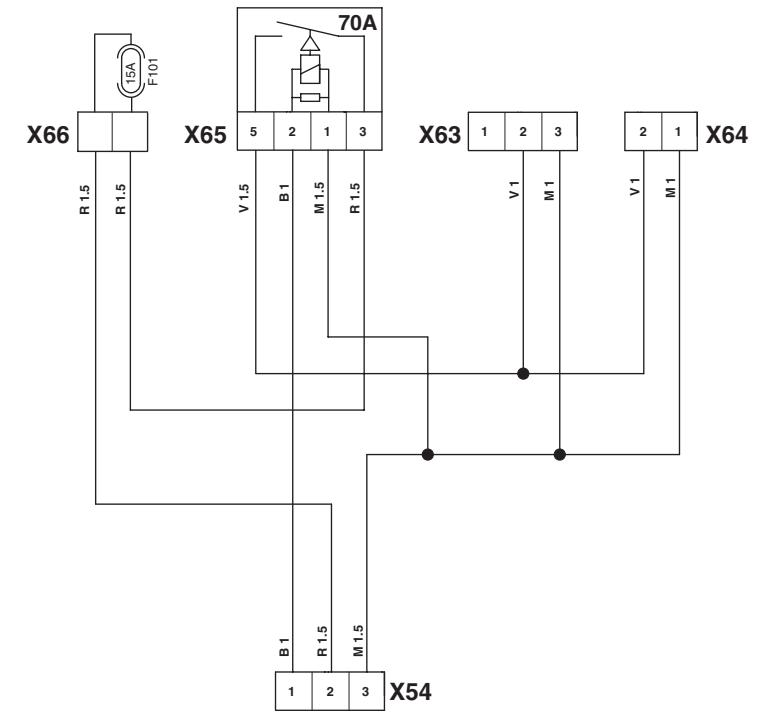
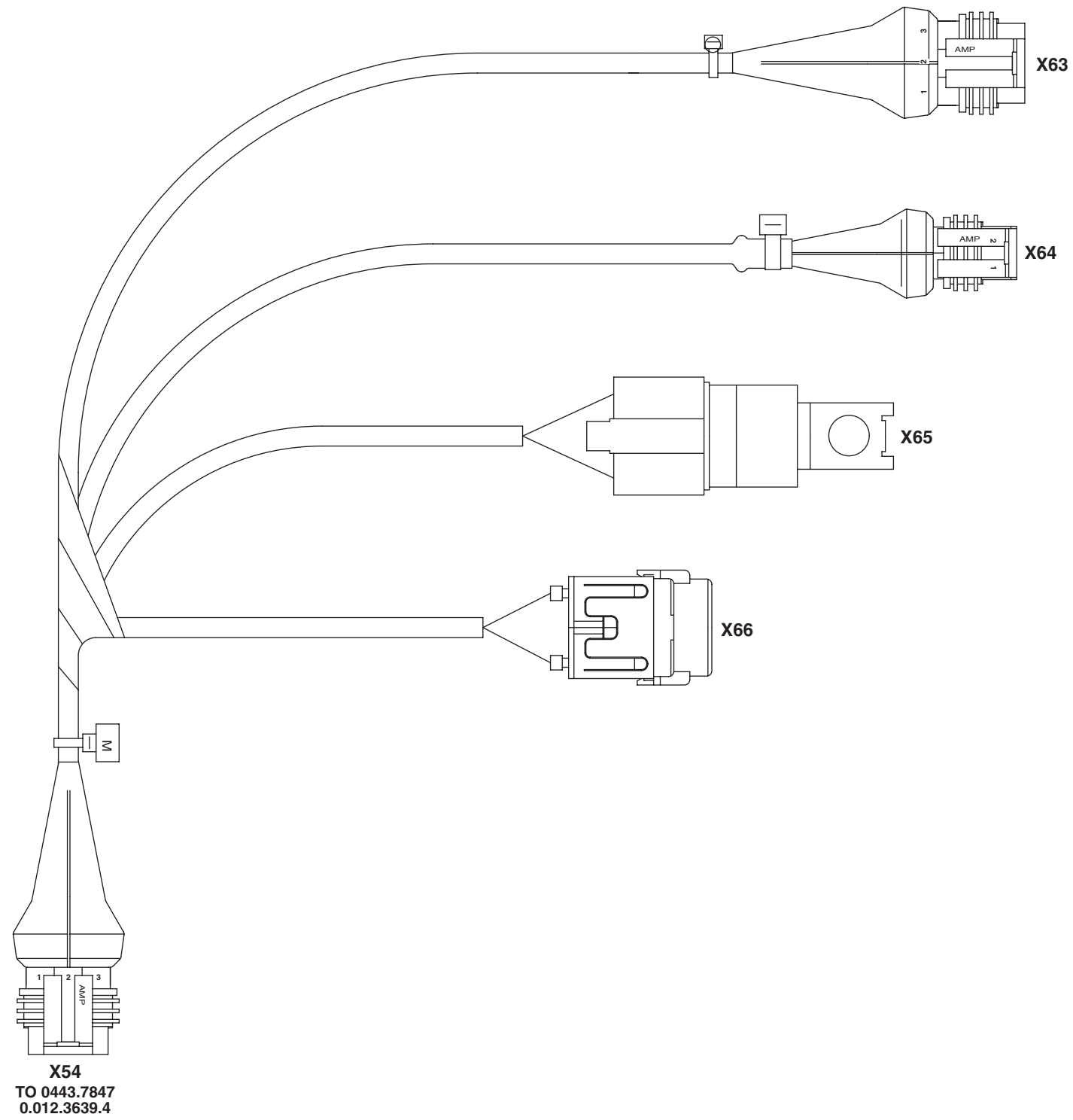
ENGINE WIRING



0.012.3639.4/10
0443.7847
0443.7667

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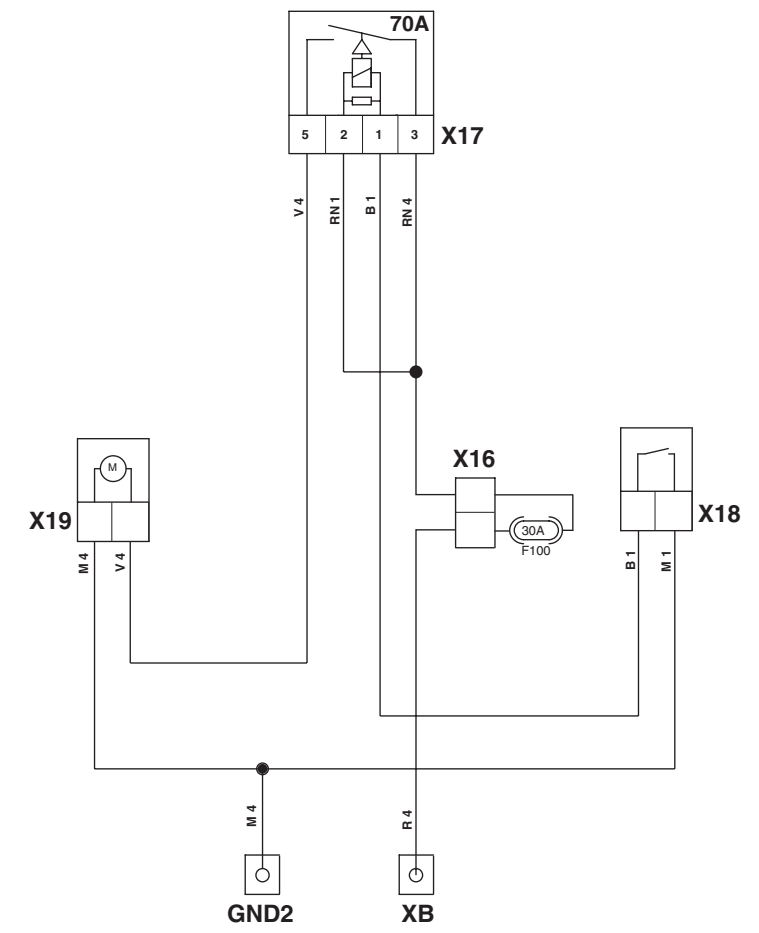
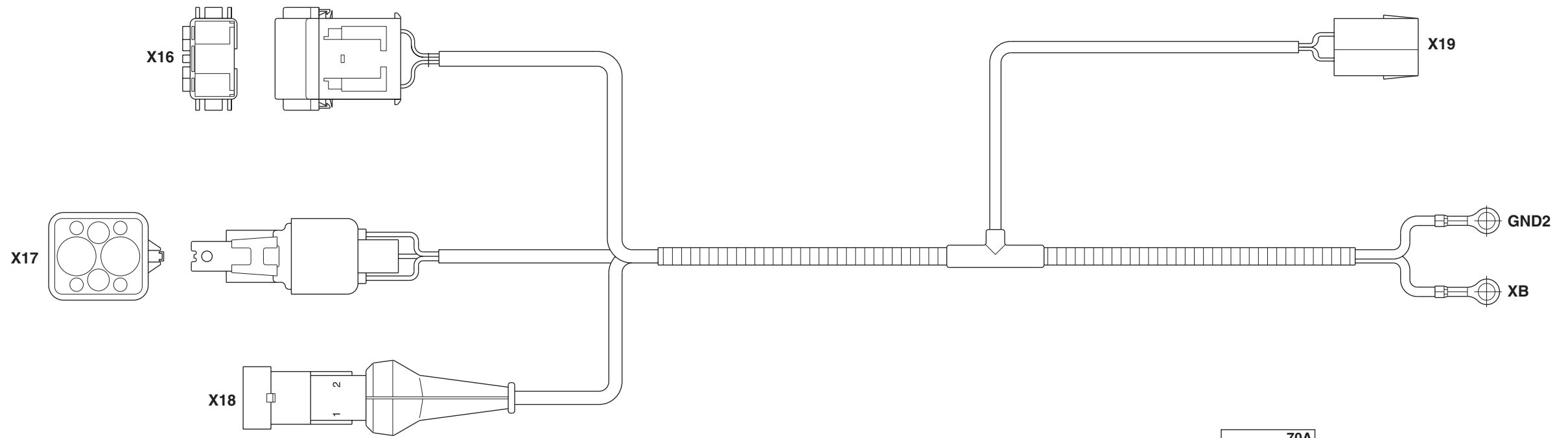
CLEAN FIX WIRING



- X54** To side console wiring
- X63** Clean Fix control solenoid valve
- X64** Clean Fix control compressor
- X65** Relay - Clean Fix control
- X66** Fuse F101 (15 A)

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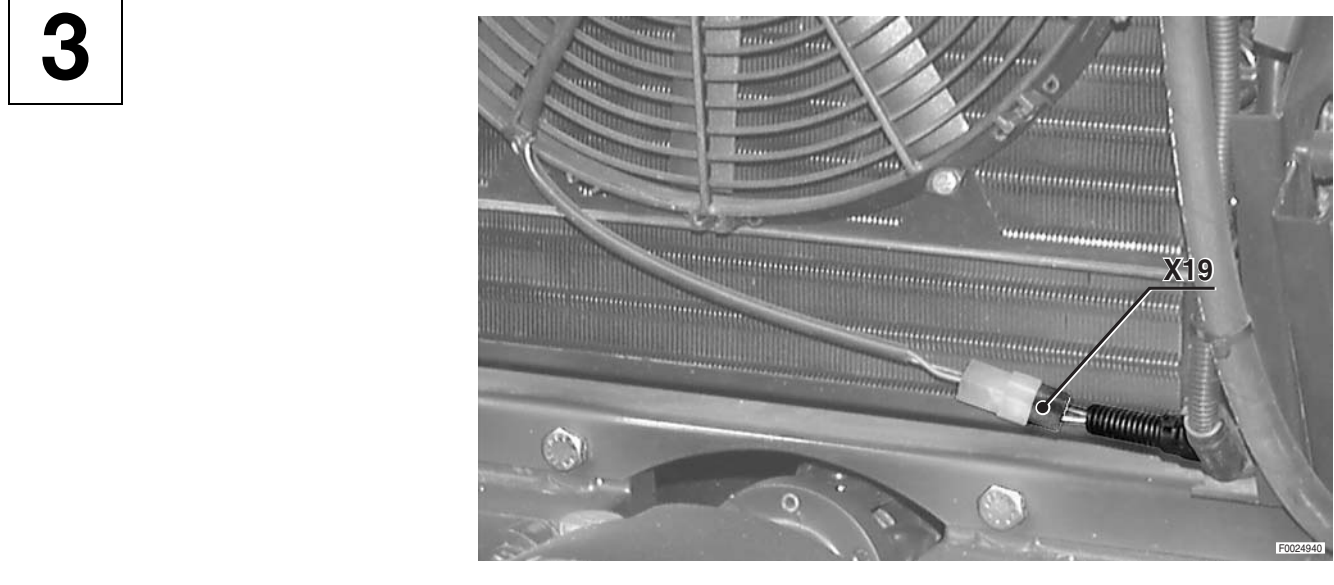
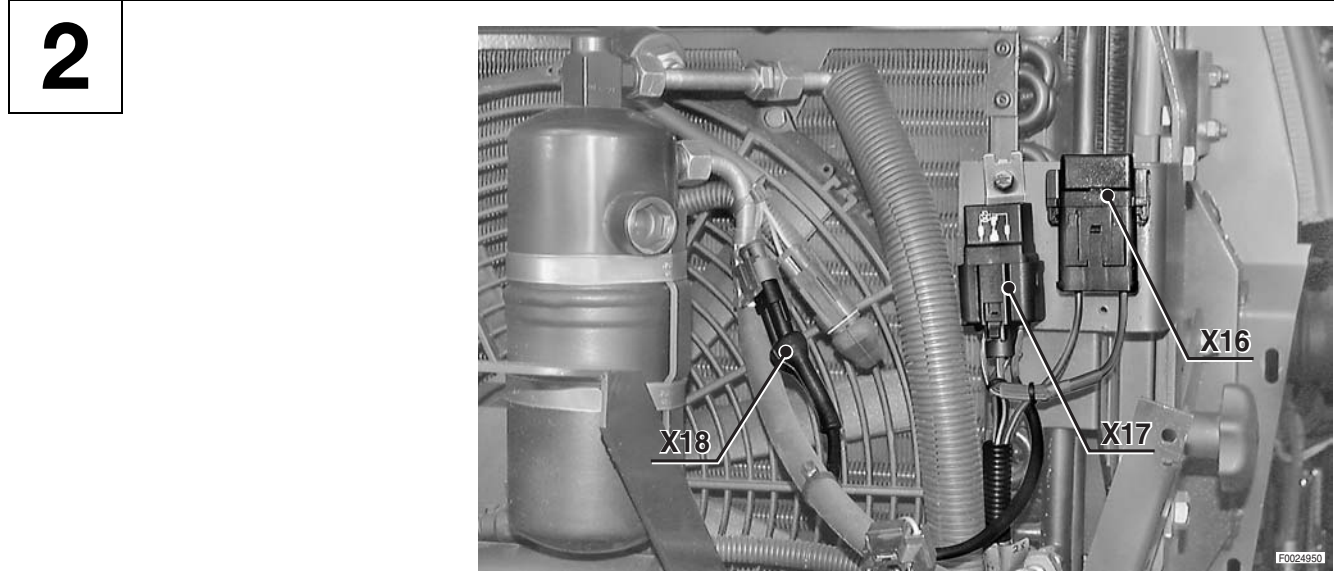
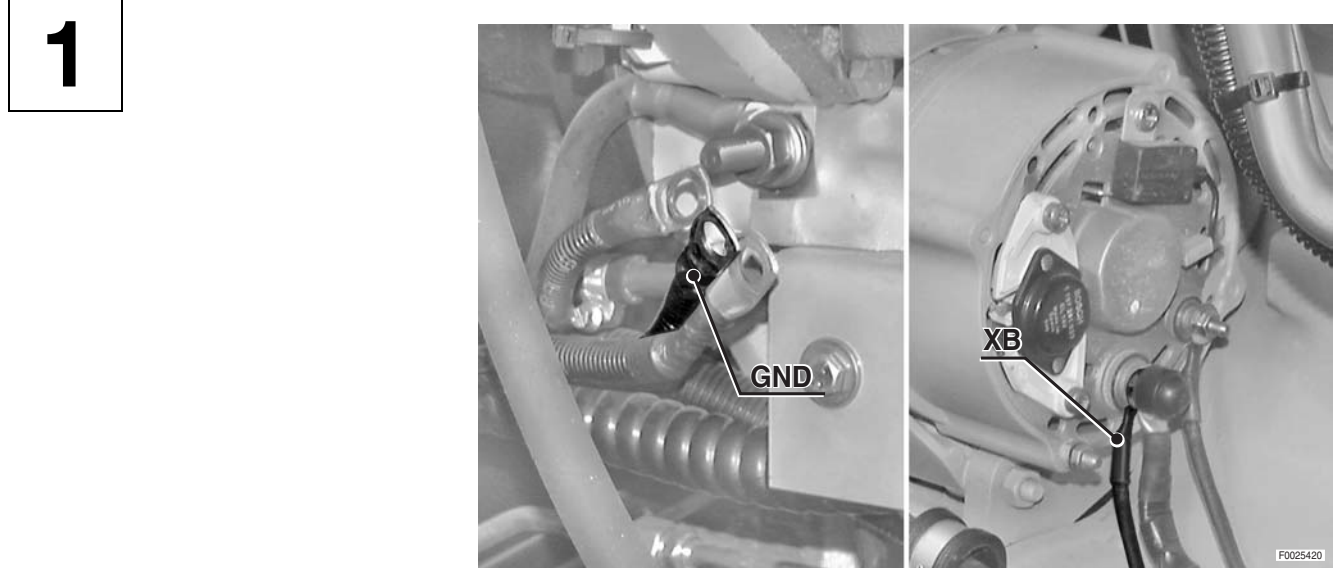
SUPPLEMENTARY AIR CONDITIONING FAN WIRING



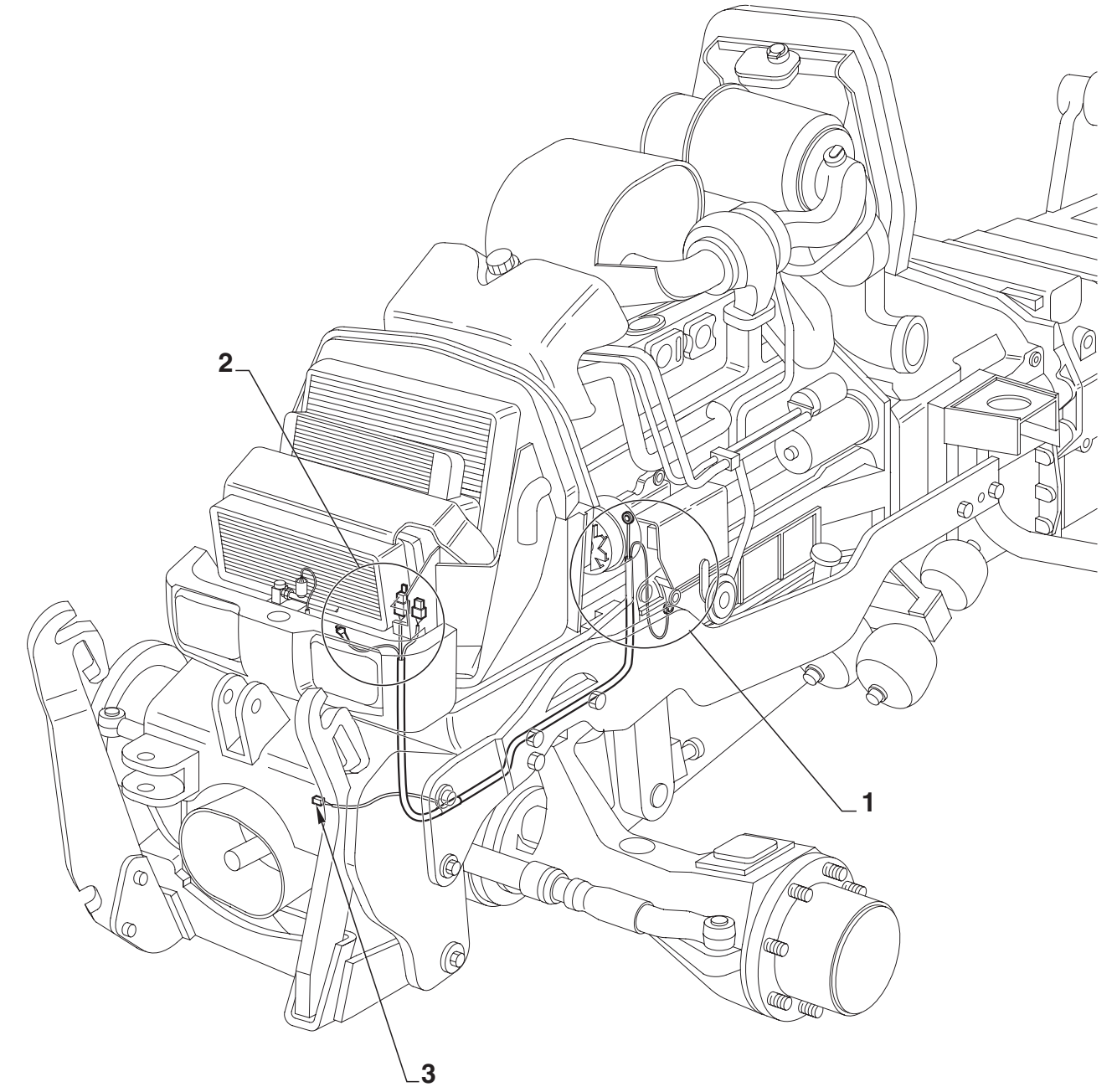
- X16 Fuse F100 (30 A)
- X17 Relay
- X18 Pressure switch
- X19 Fan
- XB Power (+)

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CONNECTORS LOCATION

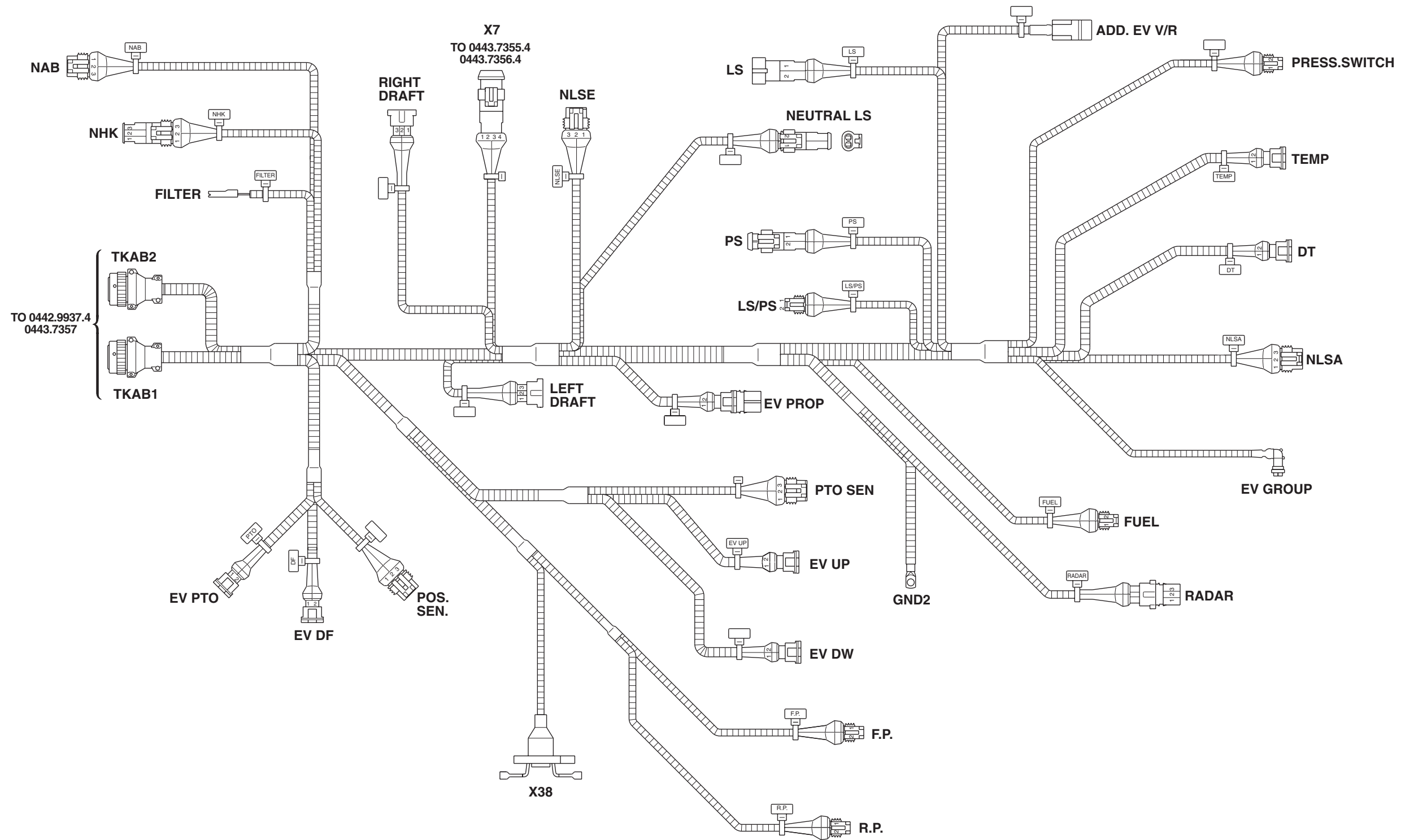


SUPPLEMENTARY AIR CONDITIONING FAN WIRING



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TRANSMISSION WIRING (1/2)



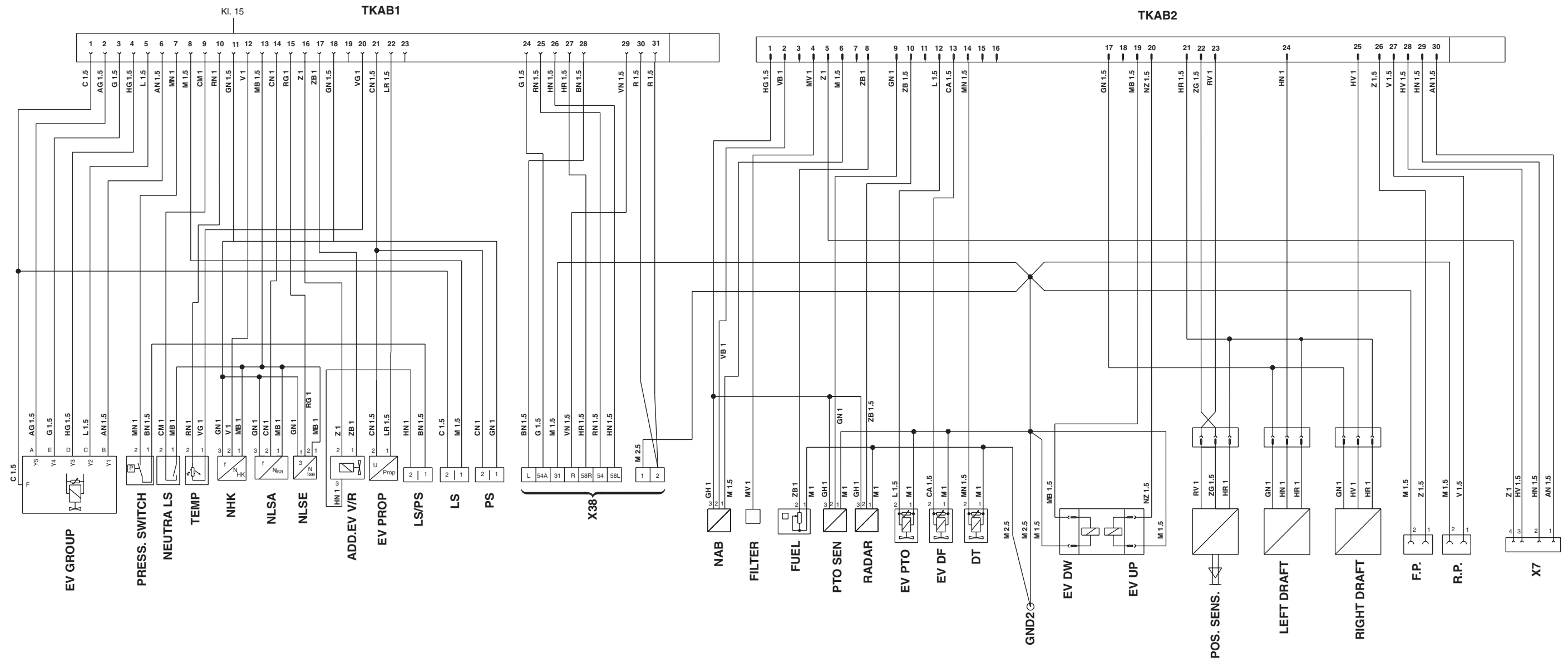
ADD. EV. V/R Forward/reverse solenoid valves
DT 4WD control solenoid valve
EV DF Diff lock solenoid valve
EV DW Lift lowering solenoid valve
EV GROUP Gear change solenoid valves
EV GROUP Gear change solenoid valves
EV PROP Proportional solenoid valve
EV PTO Rear PTO solenoid valve
EV UP Lift raising solenoid valve

FILTER Pressure switch - hydraulic oil filter clogging
FP Front windscreen washer pump
FUEL Fuel level sensor
LEFT DRAFT Lift draft sensor (left)
LS Configuration connector (Power shift)
LS/PS Configuration connector Power Shift/Power Shuttle
NAB Speed sensor for odometer
NEUTRAL LS Transmission neutral sensor (red switch)
NHK Transmission speed sensor

NLSA Gearbox output shaft speed sensor
NLSE Engine speed sensor
POS. SENS. Rear lift position sensor
PRESS. SWITCH Transmission oil low pressure switch
PS Configuration connector Power Shuttle
PTO SEN Rear PTO speed sensor
RADAR Radar
RIGHT DRAFT Lift draft sensor (right)
RP Rear screen washer pump

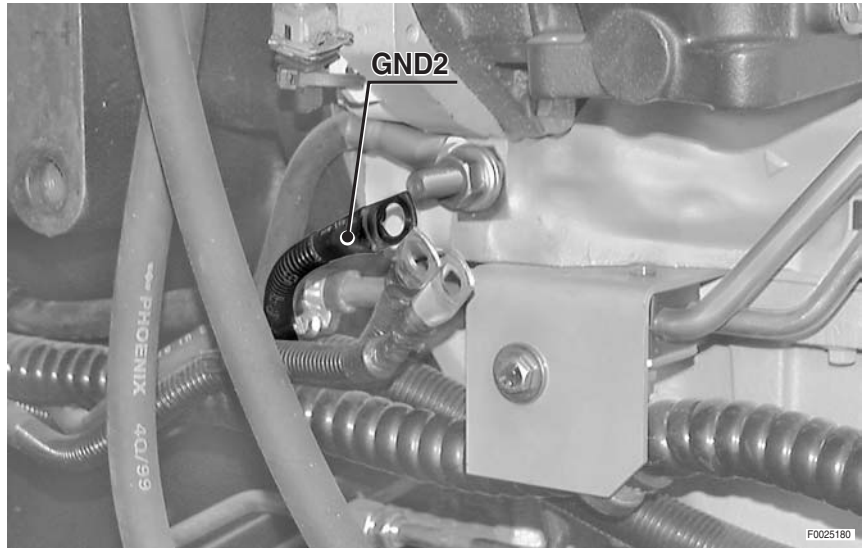
TEMP Transmission oil temperature sensor
TKAB1 To side console wiring
TKAB2 To side console wiring
X7 To trailer braking wiring
X38 Trailer socket

TRANSMISSION WIRING (2/2)

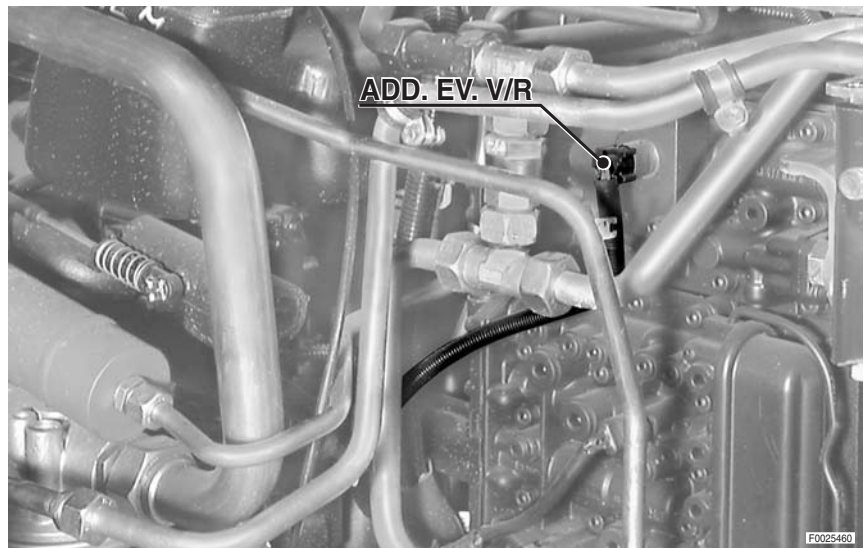


TRANSMISSION CONNECTORS LOCATION

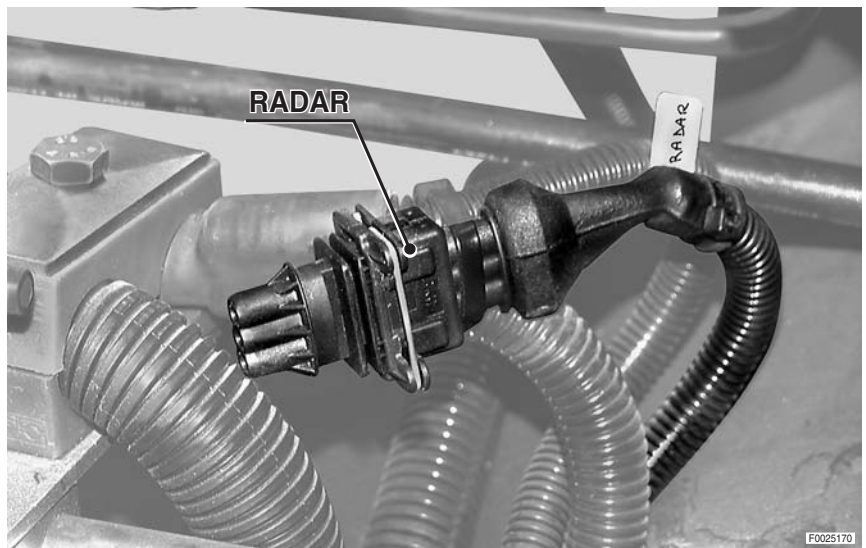
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2

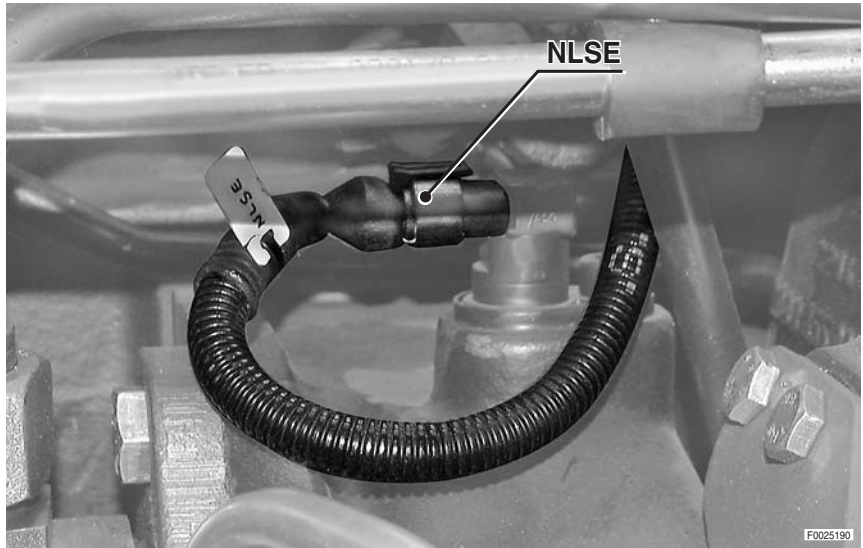


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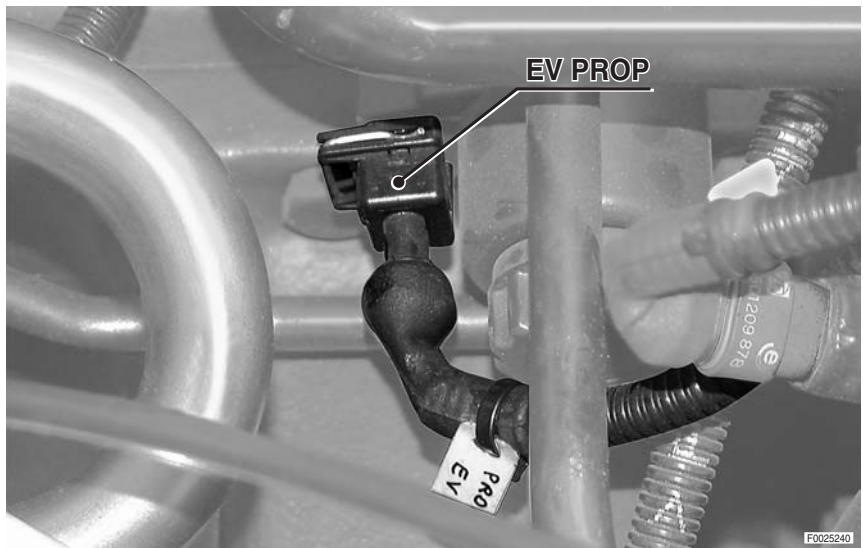


OPTIONAL

4



5



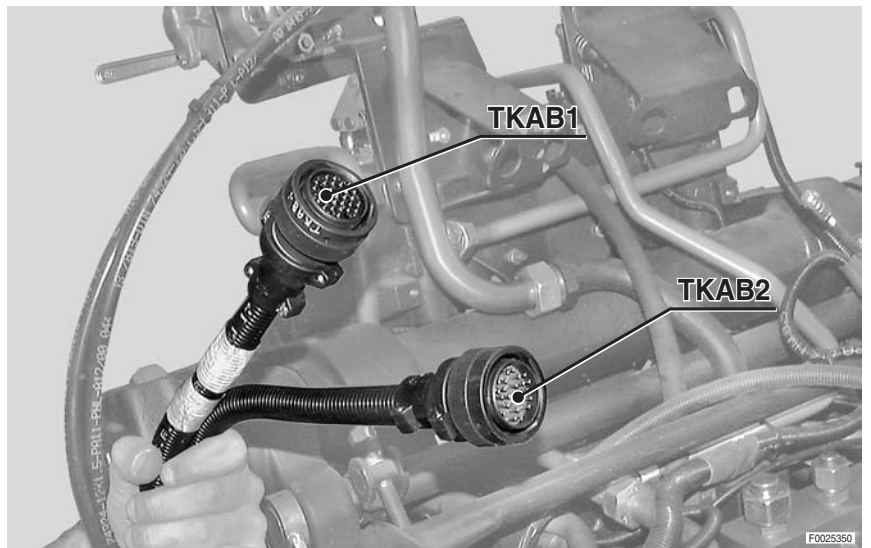
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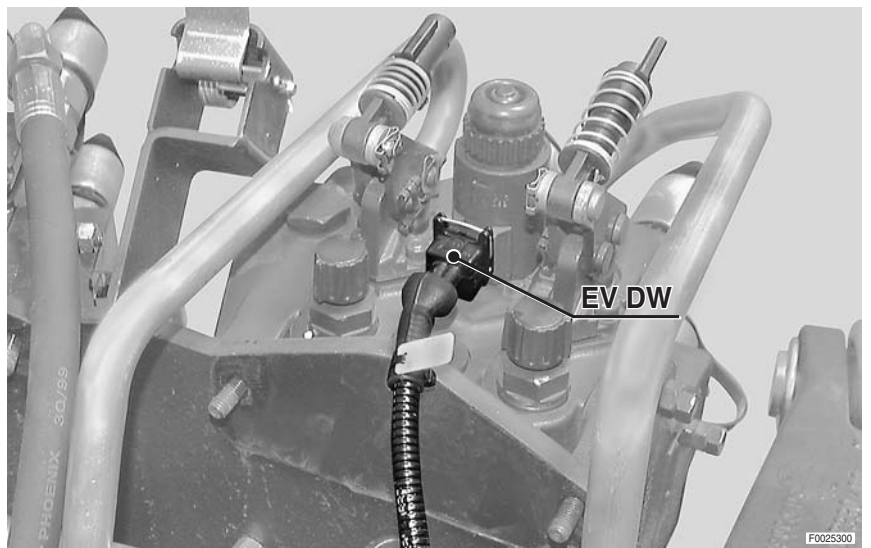
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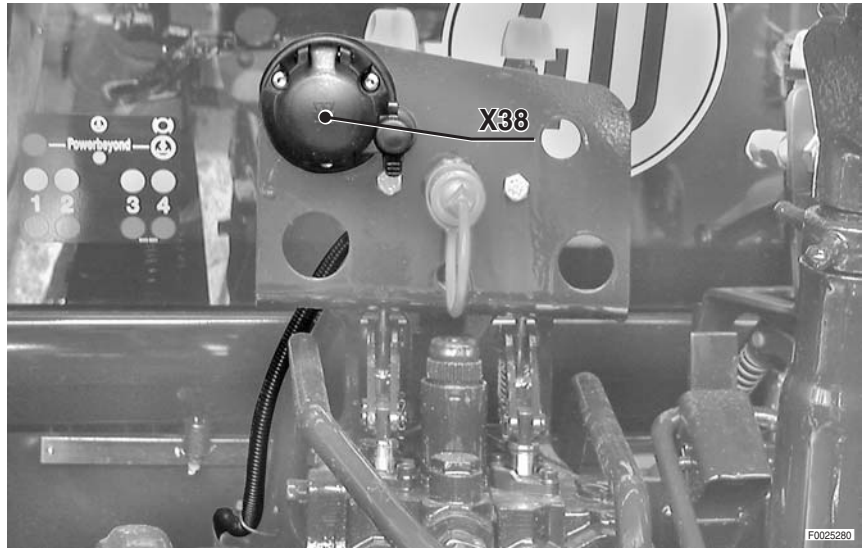
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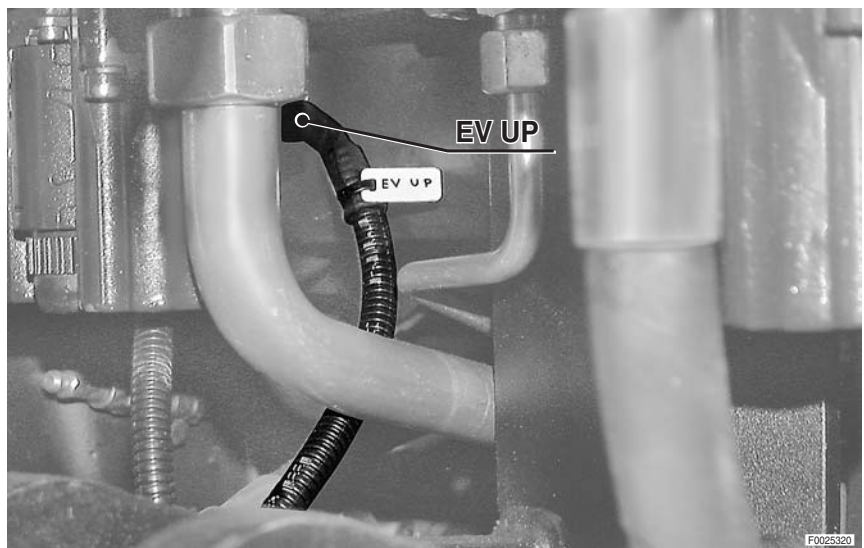
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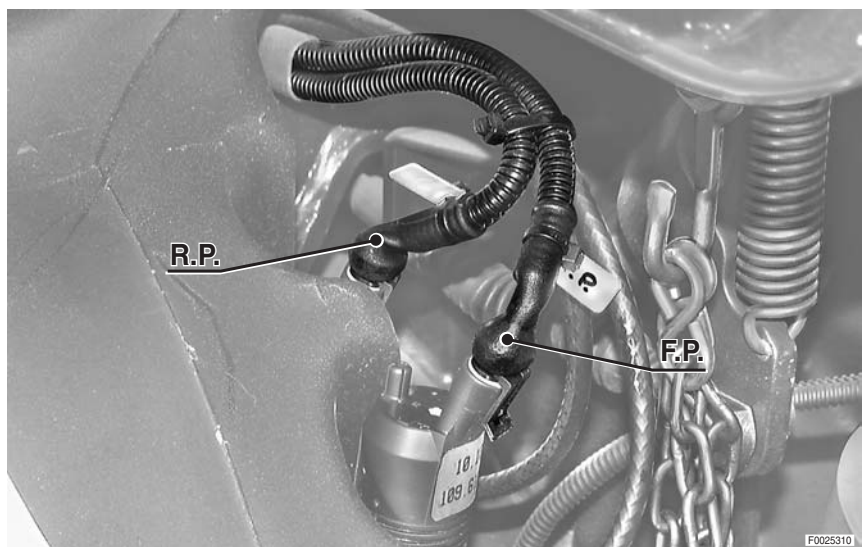
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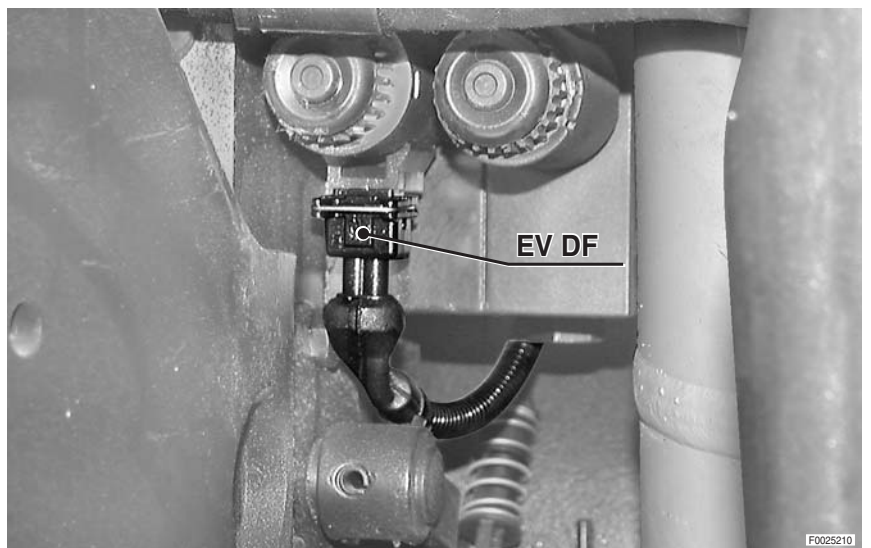
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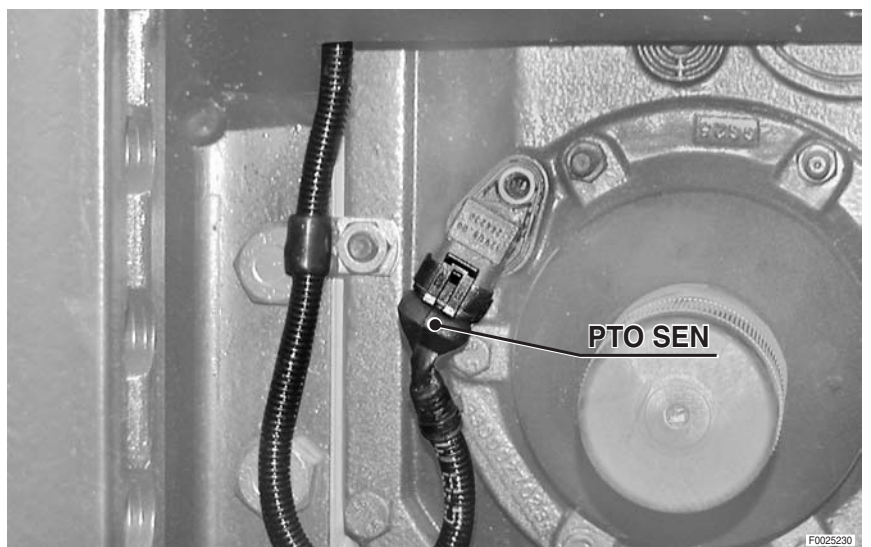
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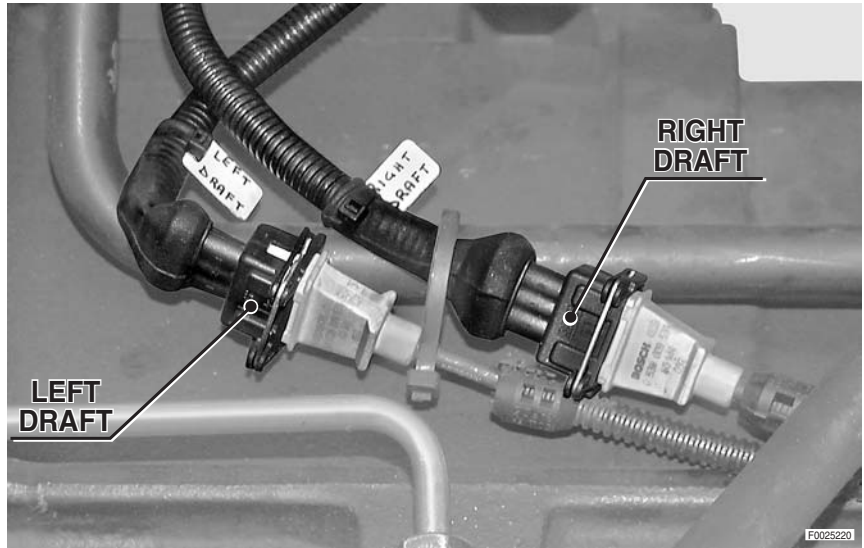
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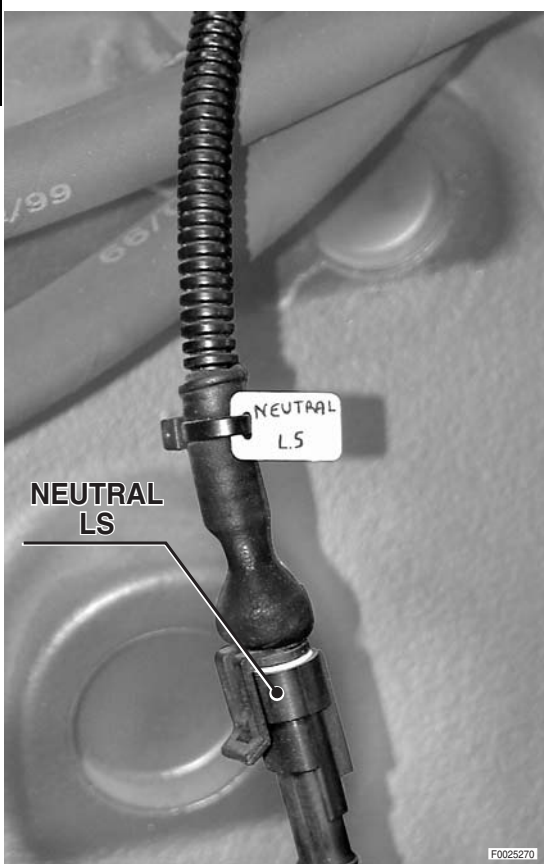
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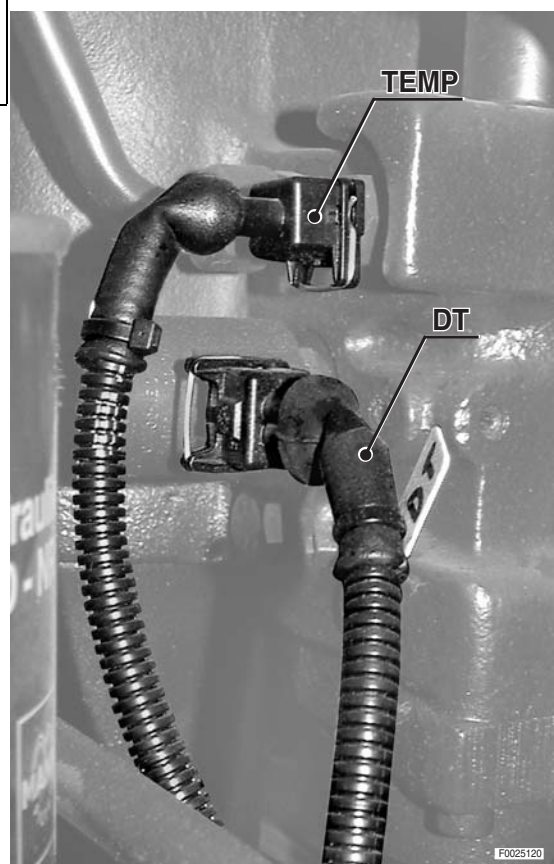
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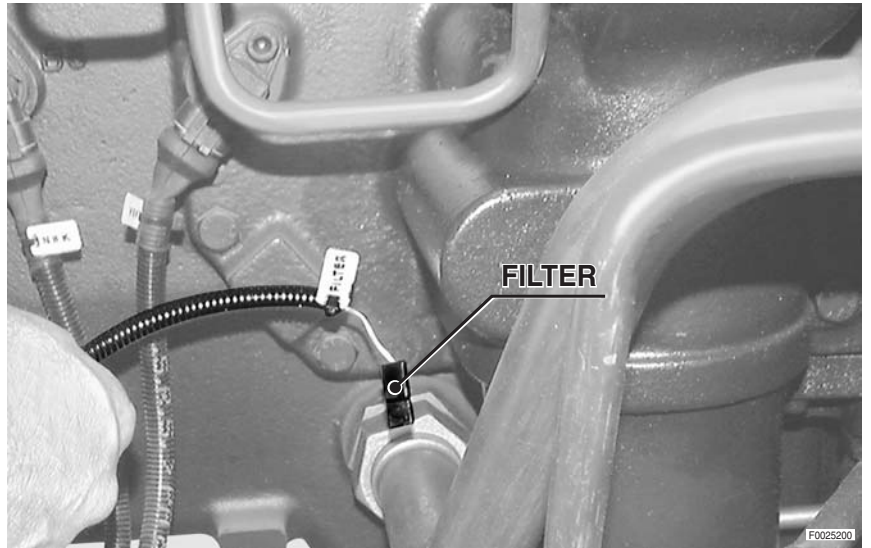
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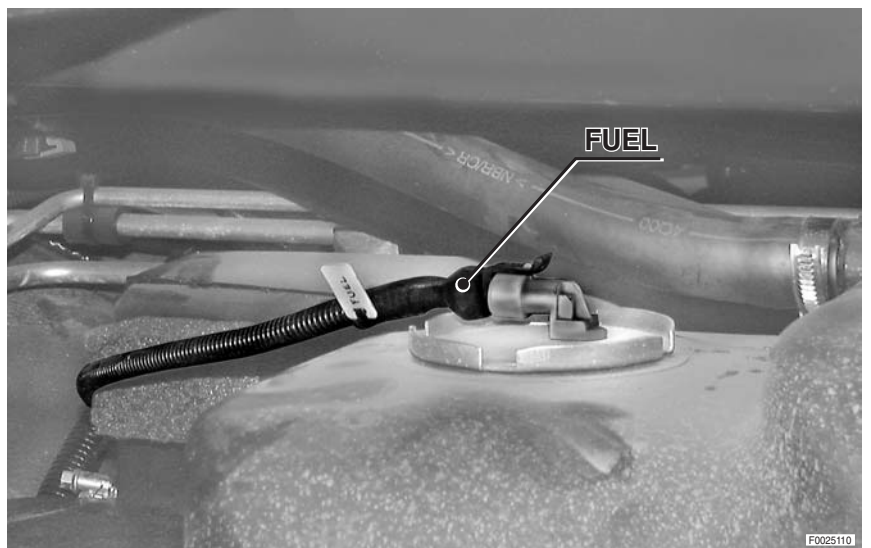
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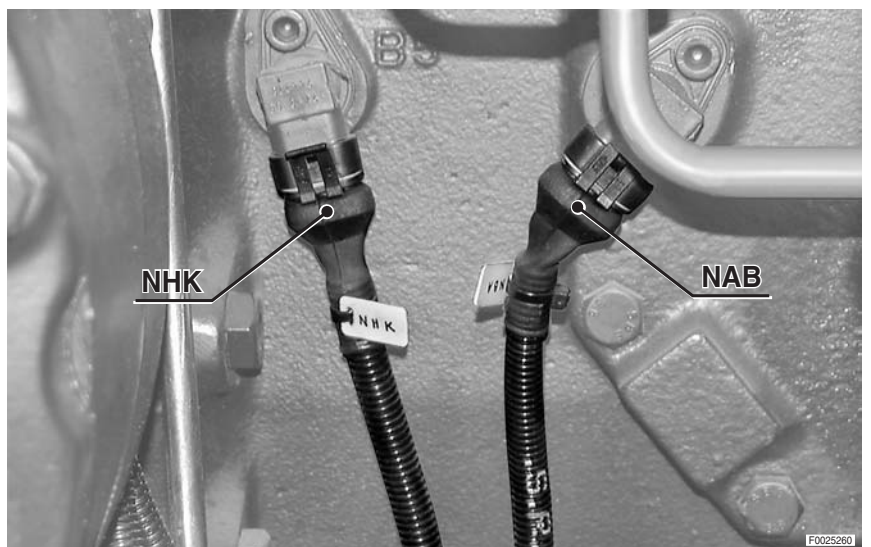
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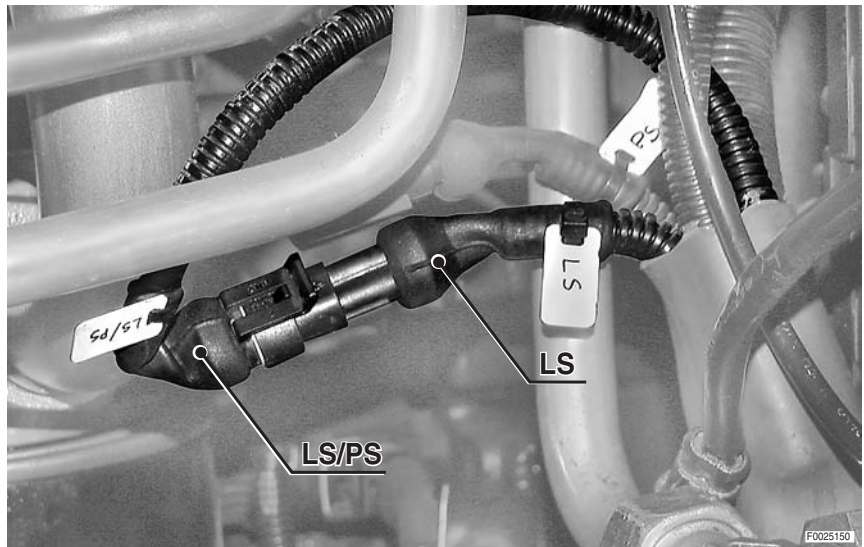
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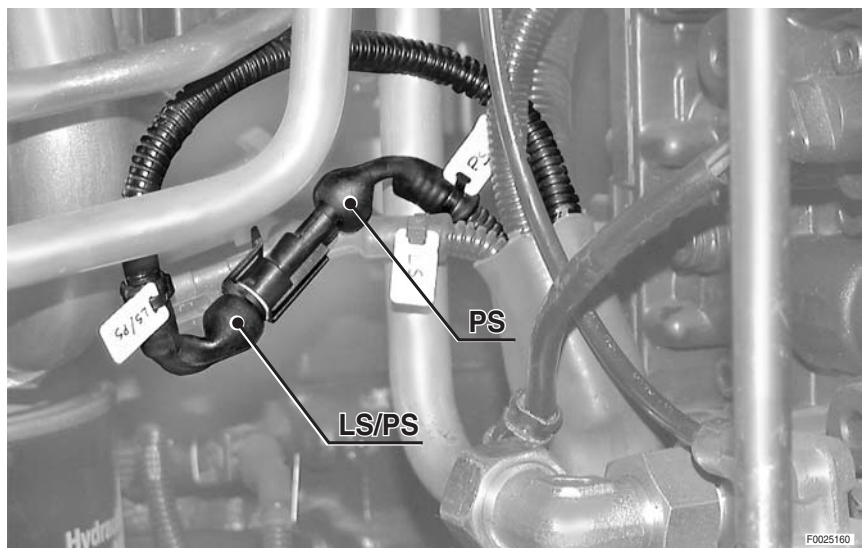
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23



POWER SHIFT VERSION



POWER SHUTTLE VERSION

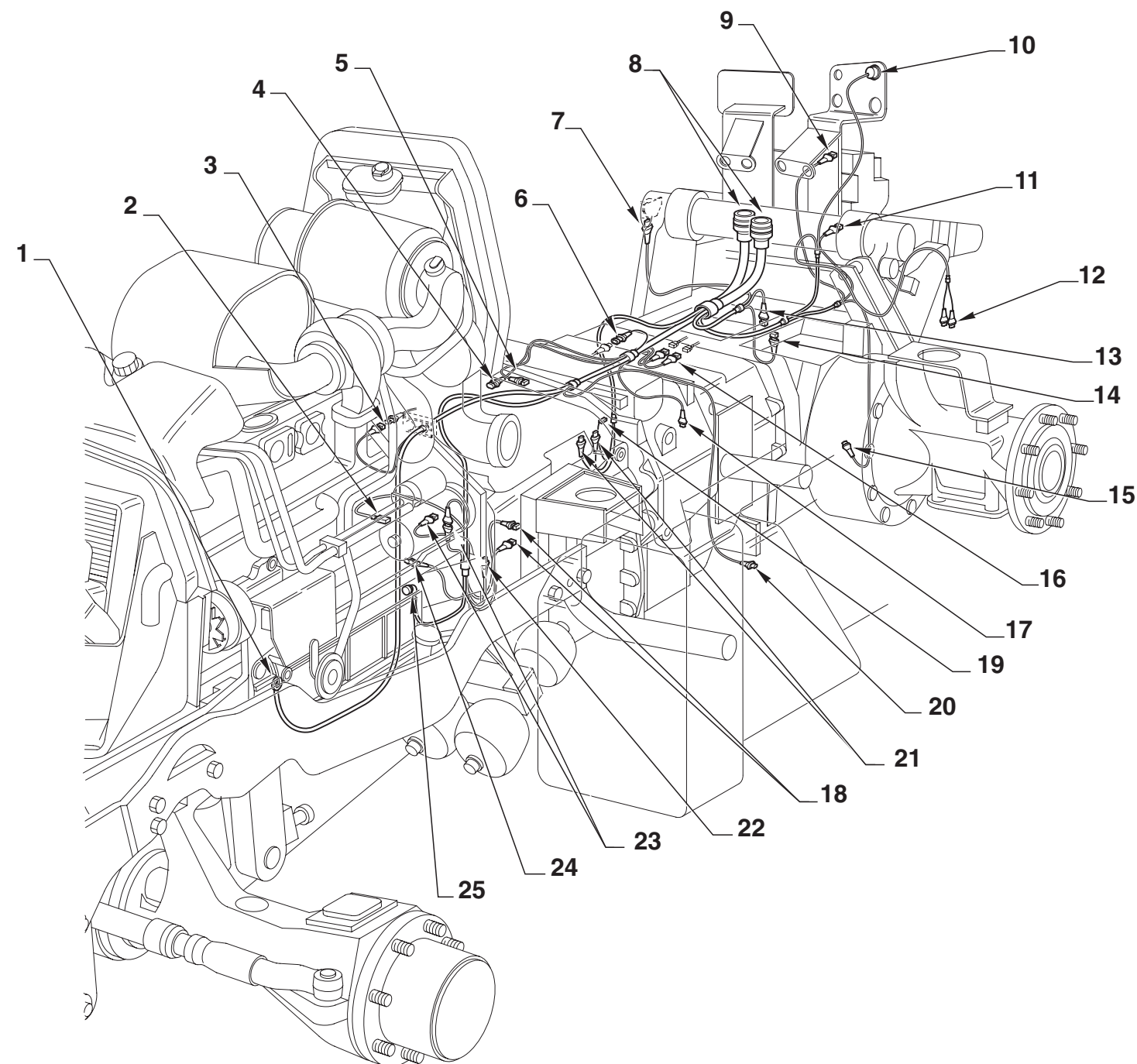
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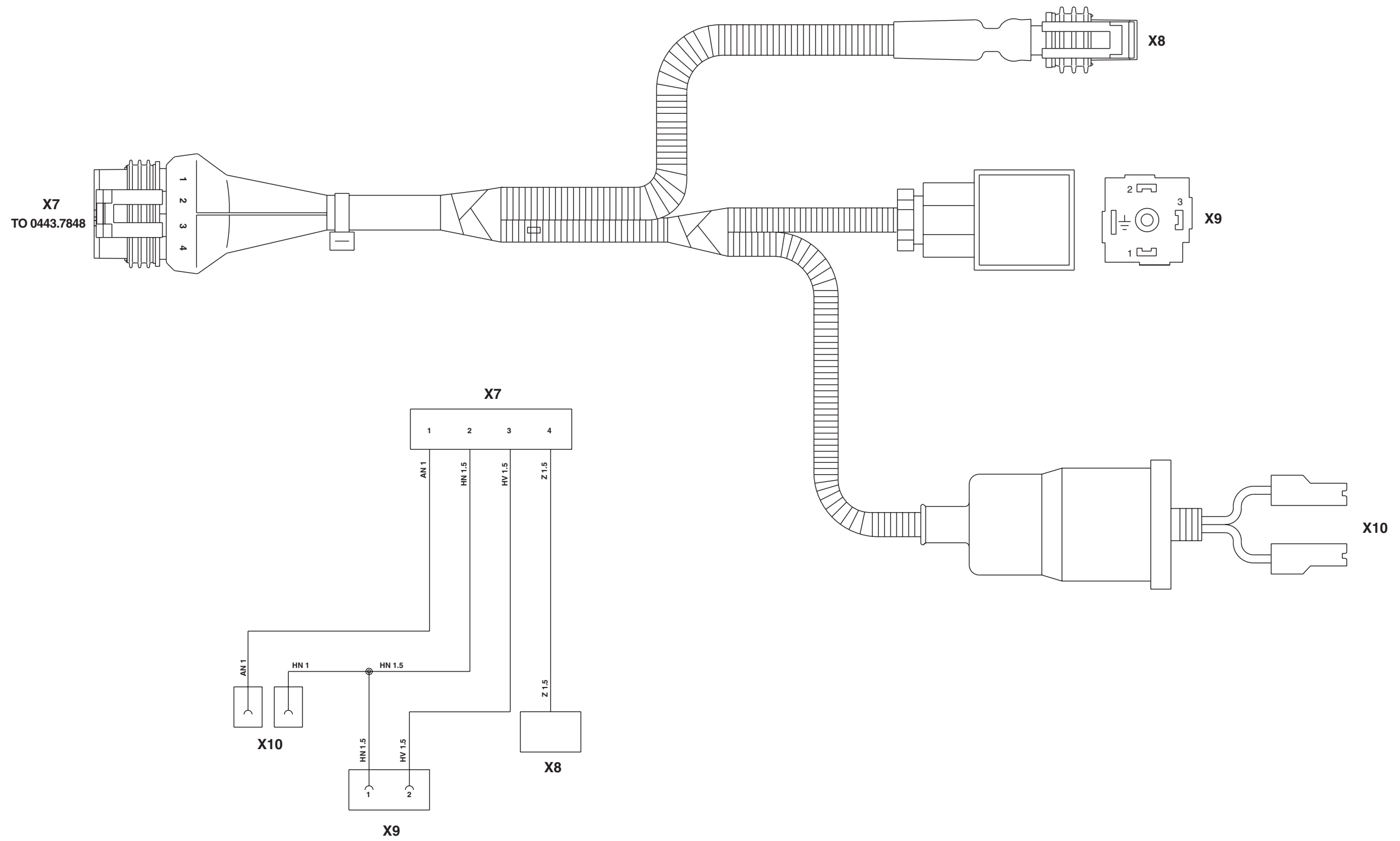


TRANSMISSION WIRING



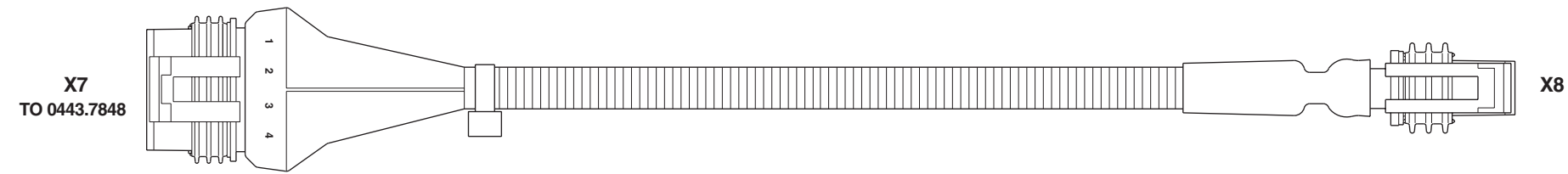
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HYDRAULIC AND AIR TRAILER BRAKING WIRING (ITALY)



- X7** To transmission wiring
- X8** Trailer braking air pressure sensor
- X9** Solenoid valve for trailer parking brake
- X10** Trailer braking low pressure switch

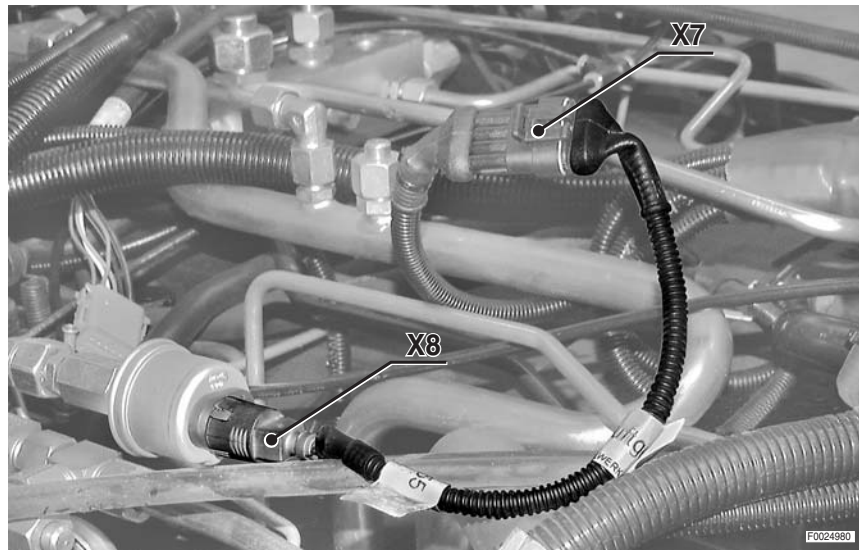
AIR TRAILER BRAKING WIRING



- X7 To transmission wiring
- X8 Trailer braking air pressure sensor

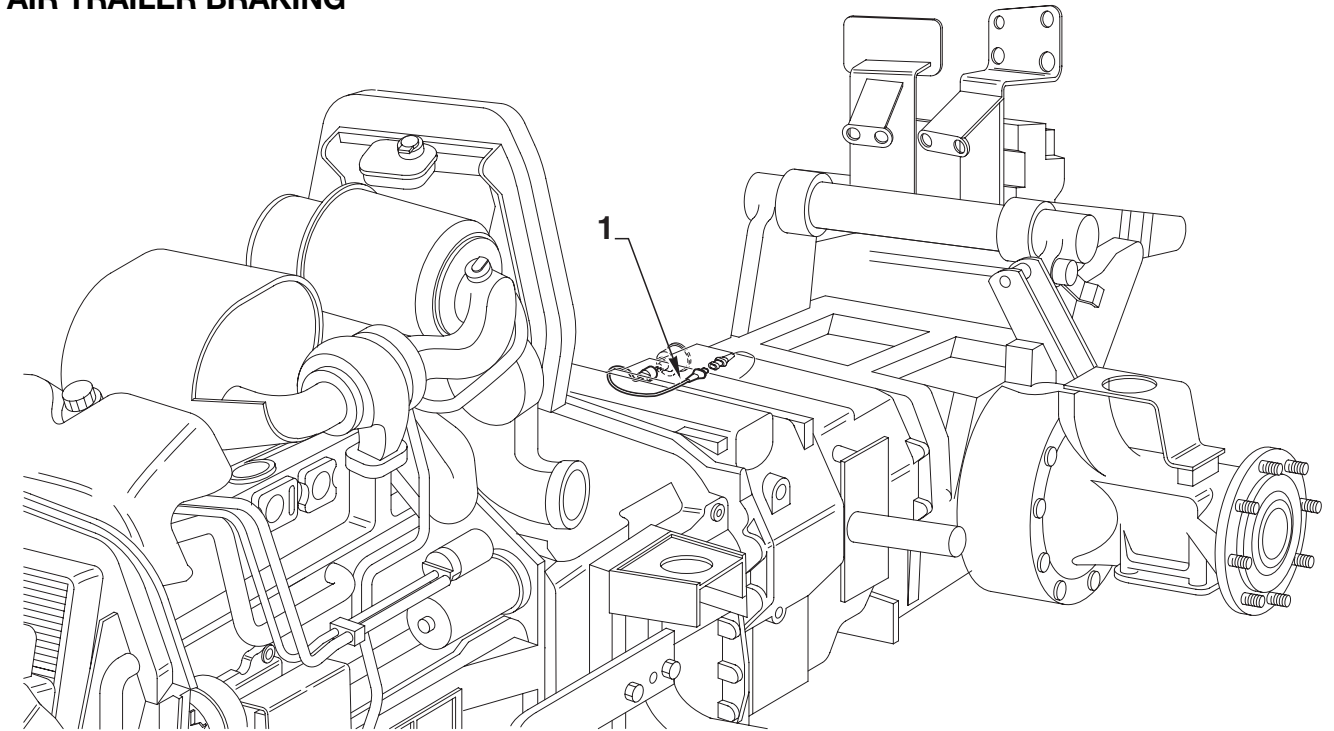
TRAILER BRAKING CONNECTORS LOCATION

1

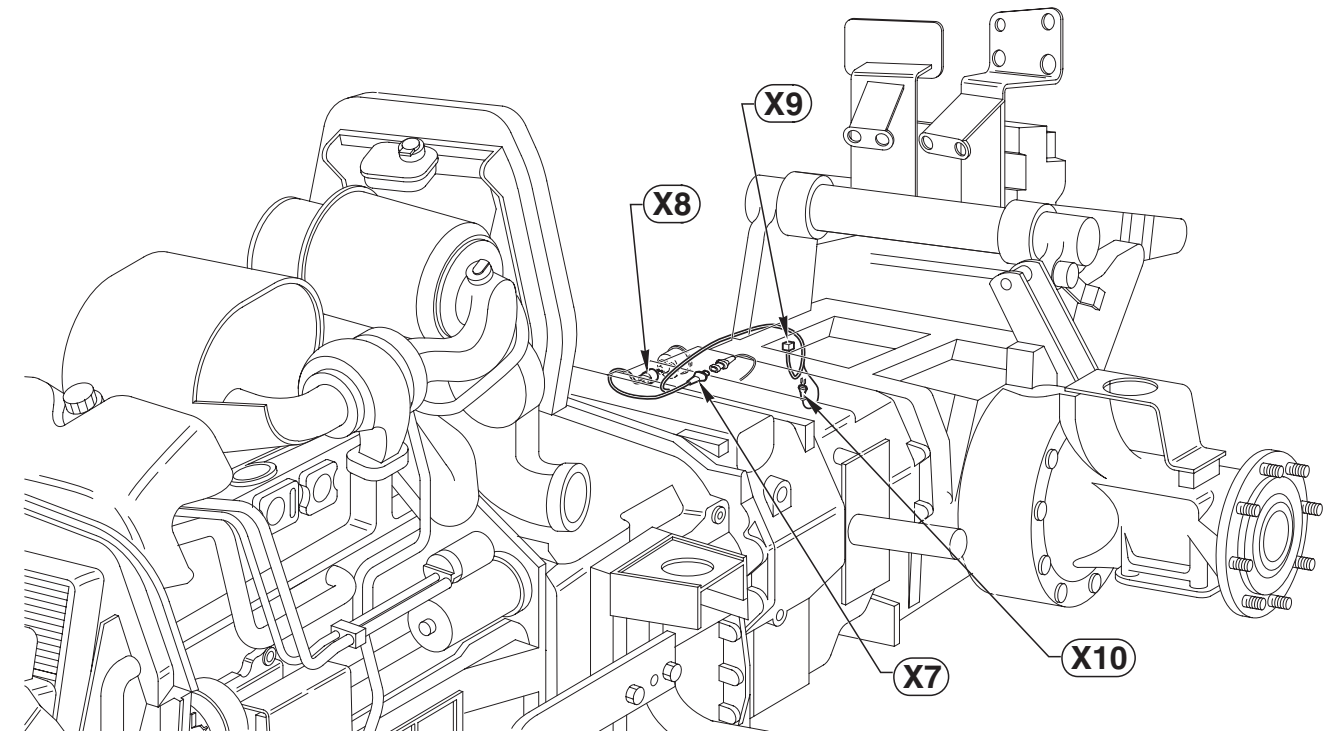


TRAILER BRAKING WIRING

AIR TRAILER BRAKING



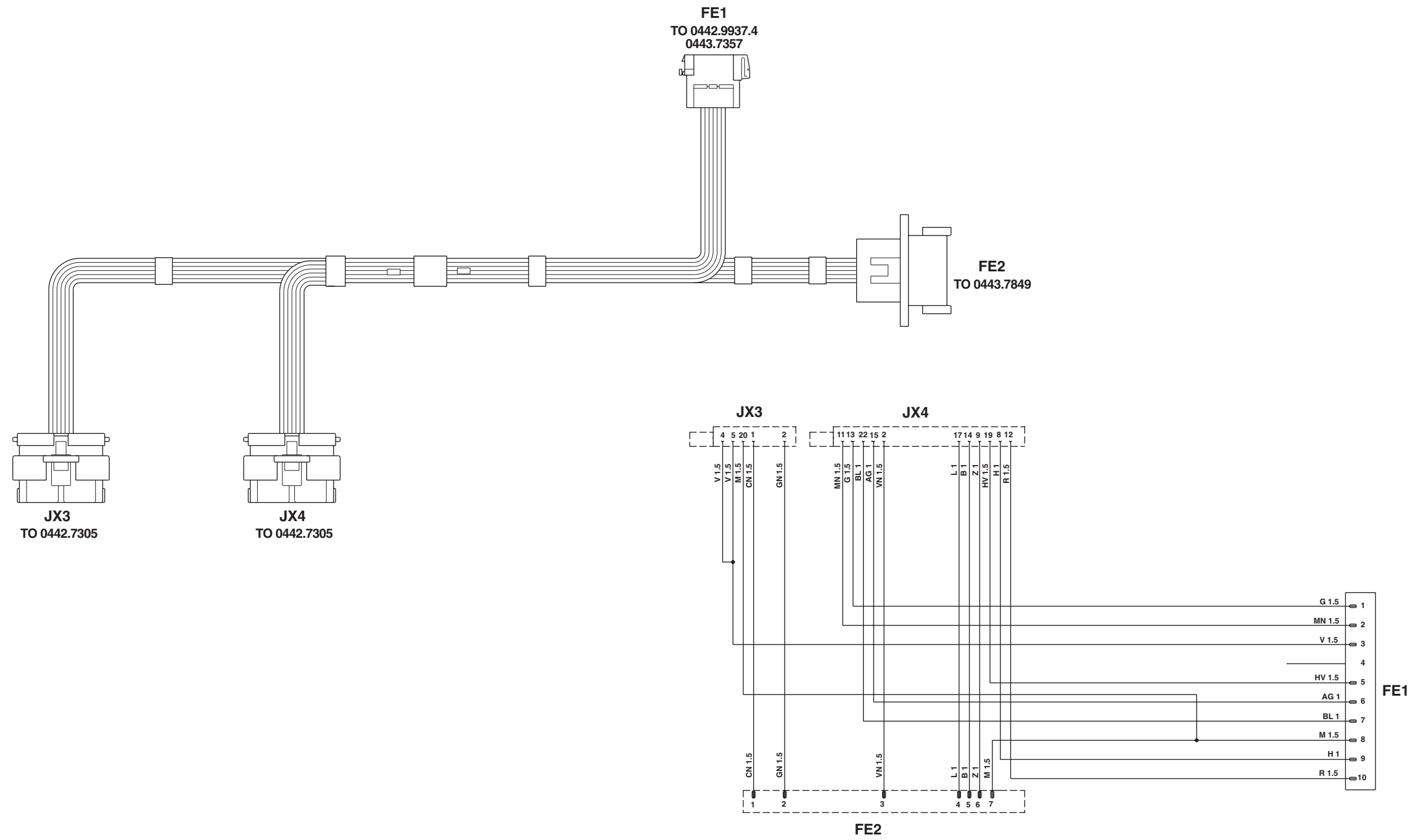
HYDRAULIC AND AIR TRAILER BRAKING (ITALY)



0443.7356.4
0443.7355.4

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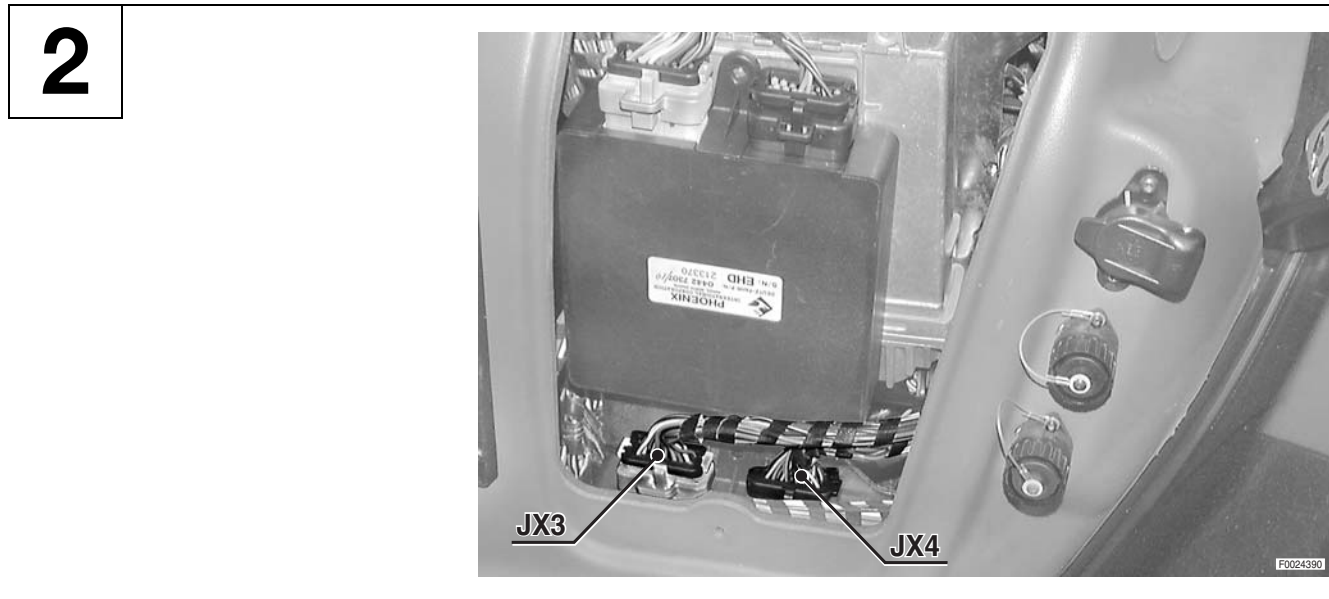
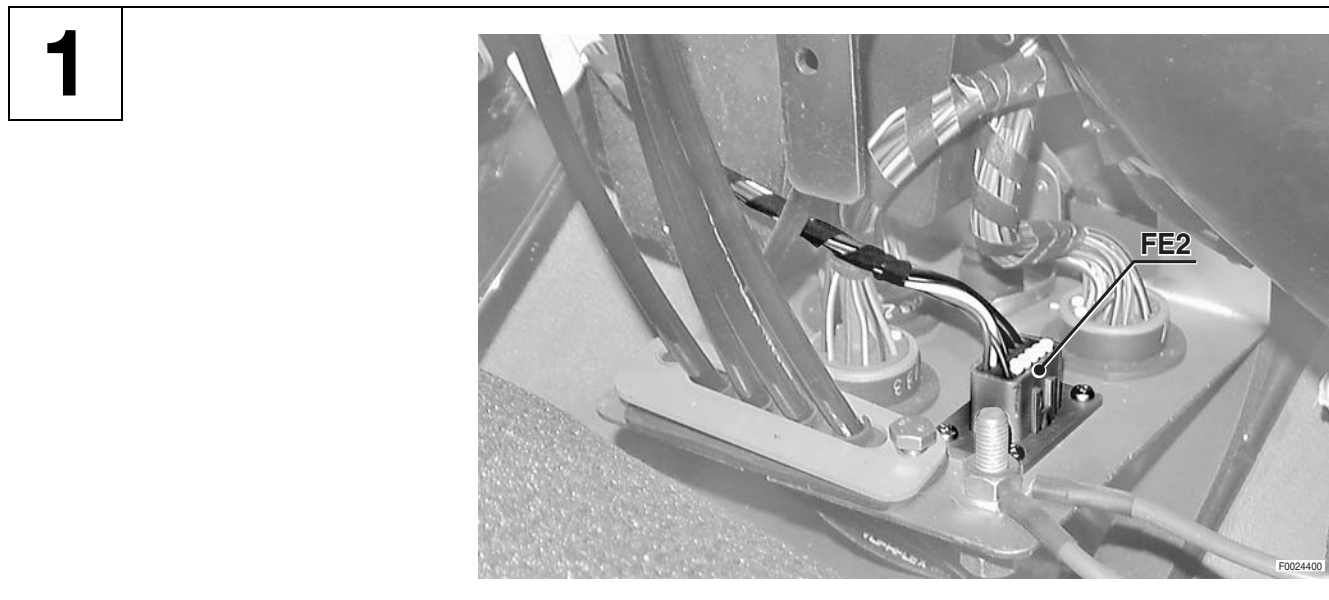
FRONT SUSPENSION CONTROL UNIT (CAB) WIRING



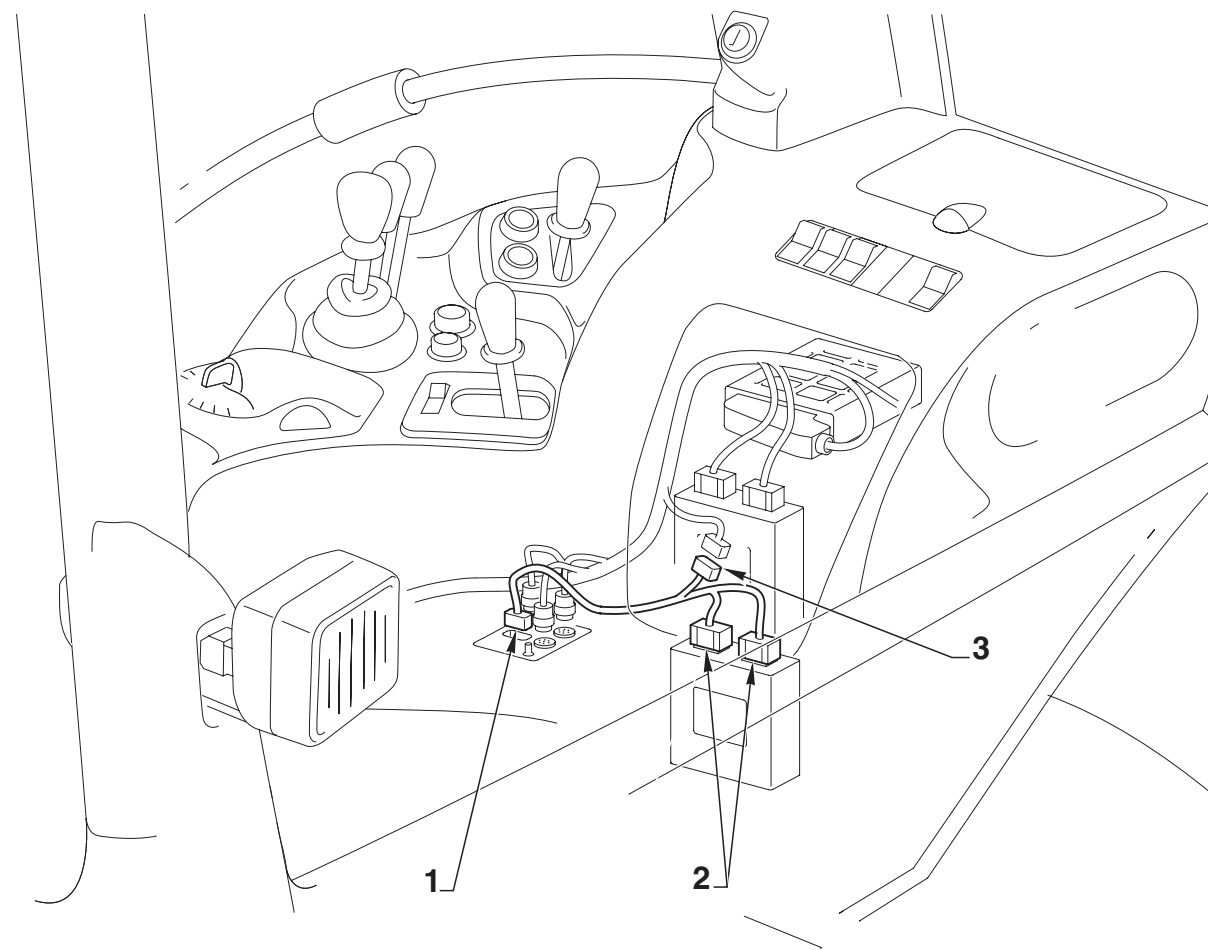
- FE1** To side console wiring
- FE2** To front suspension wiring
- JX3** To front suspension wiring
- JX4** To front suspension wiring

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CONNECTORS LOCATION

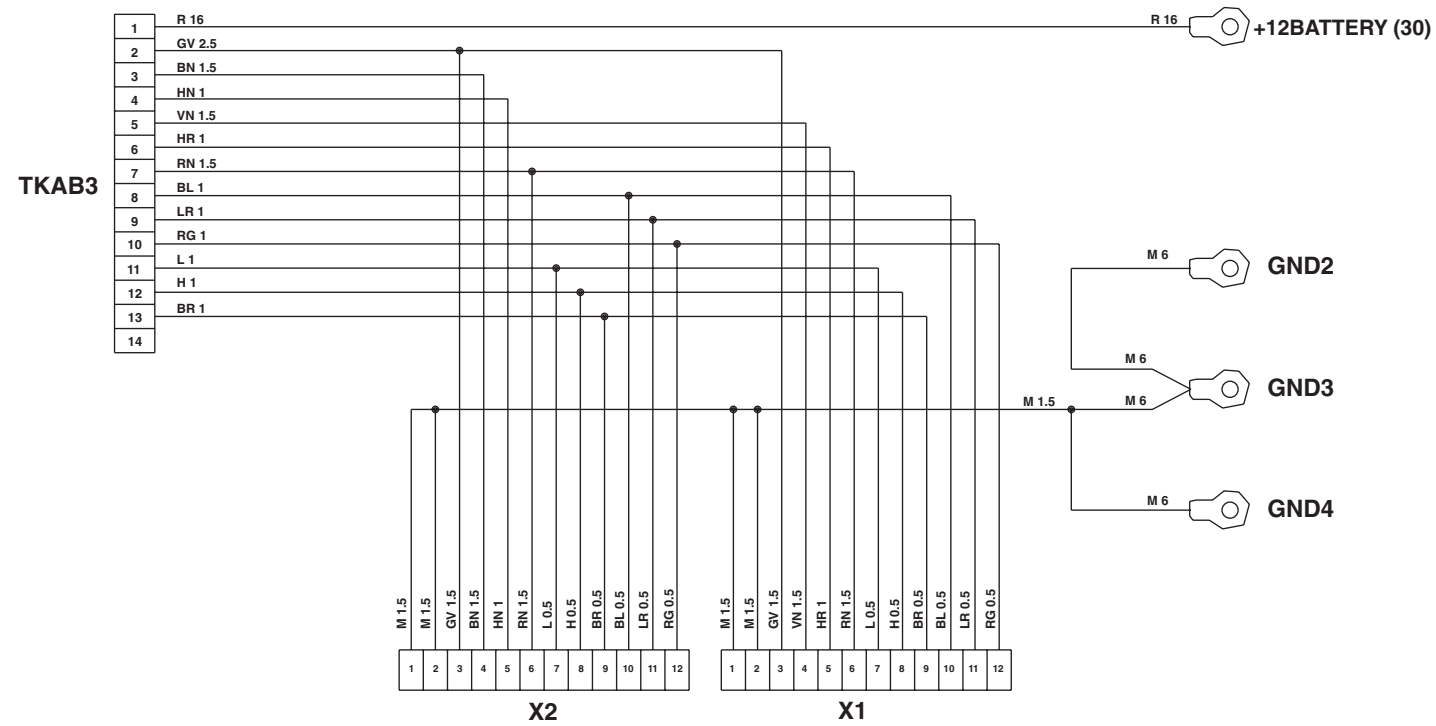
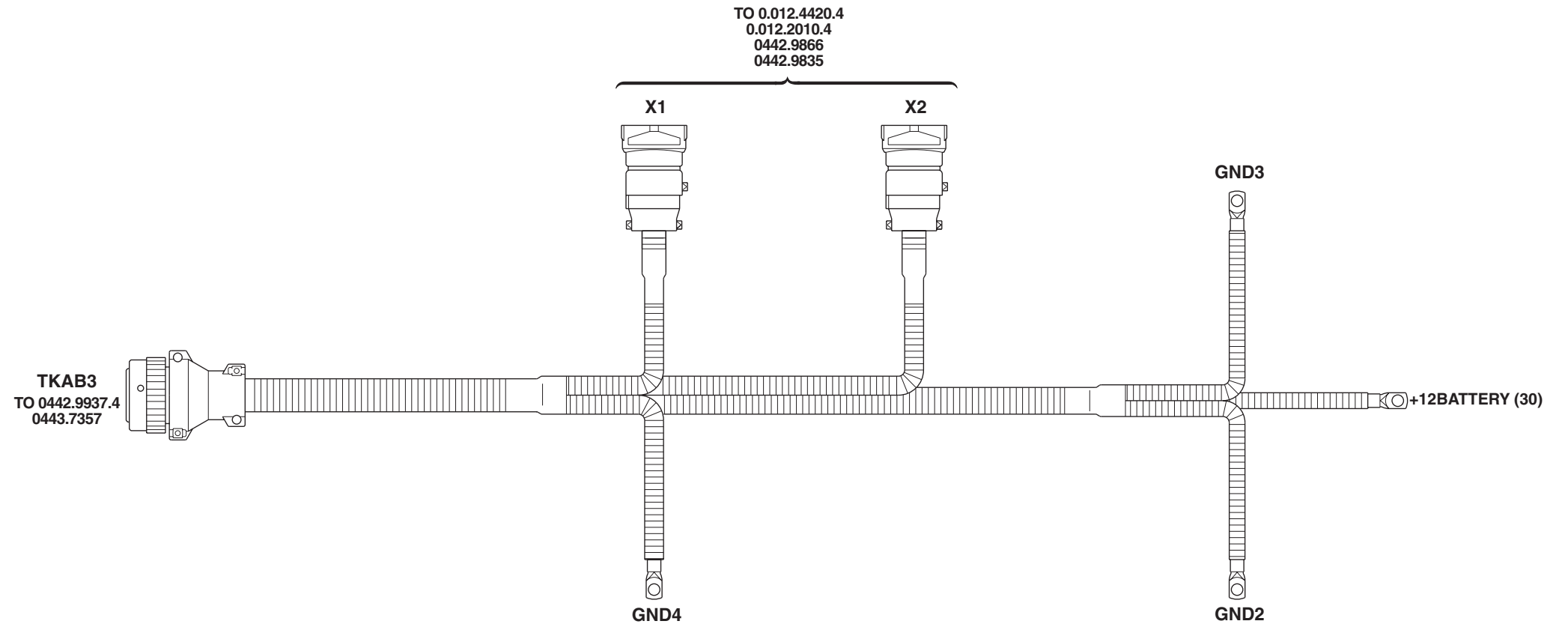


FRONT SUSPENSION CONTROL UNIT (CAB) WIRING



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CAB POWER SUPPLY WIRING



TKAB3 To side console wiring

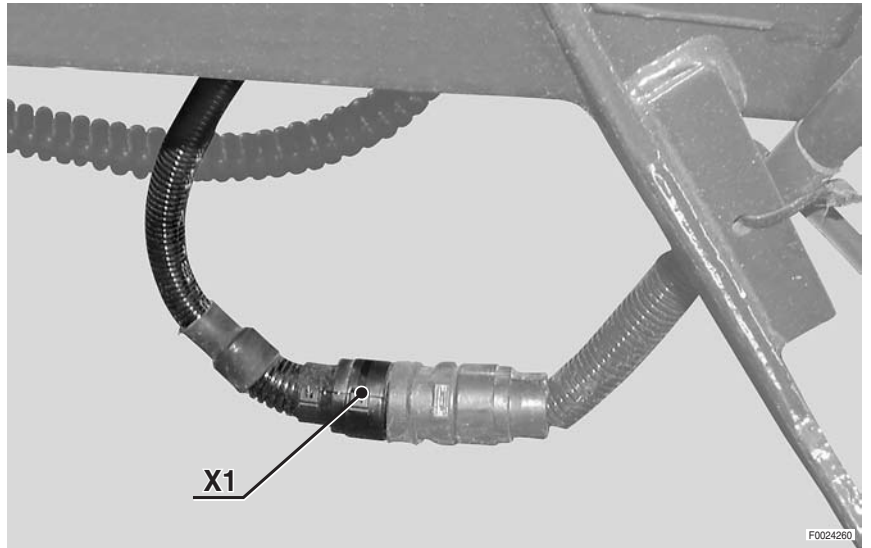
X1 To fender wiring

X2 To fender wiring

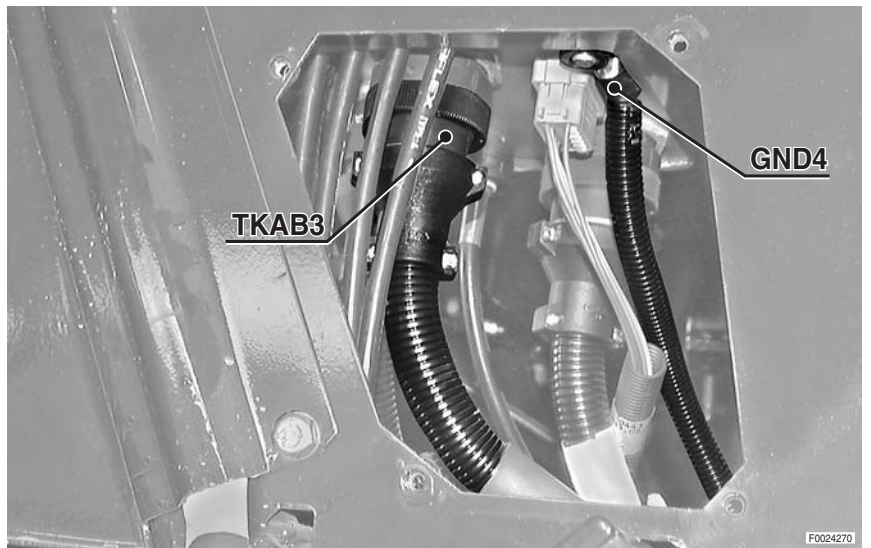
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CAB POWER SUPPLY CONNECTORS LOCATION

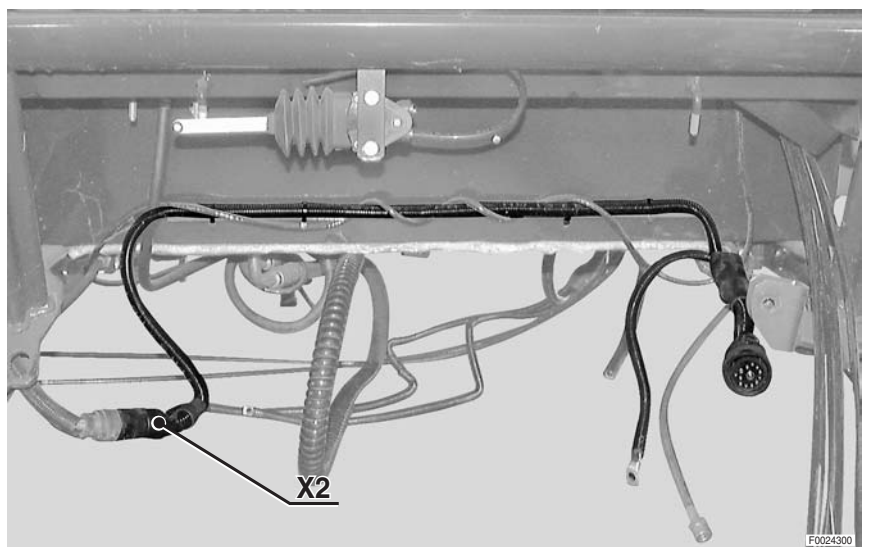
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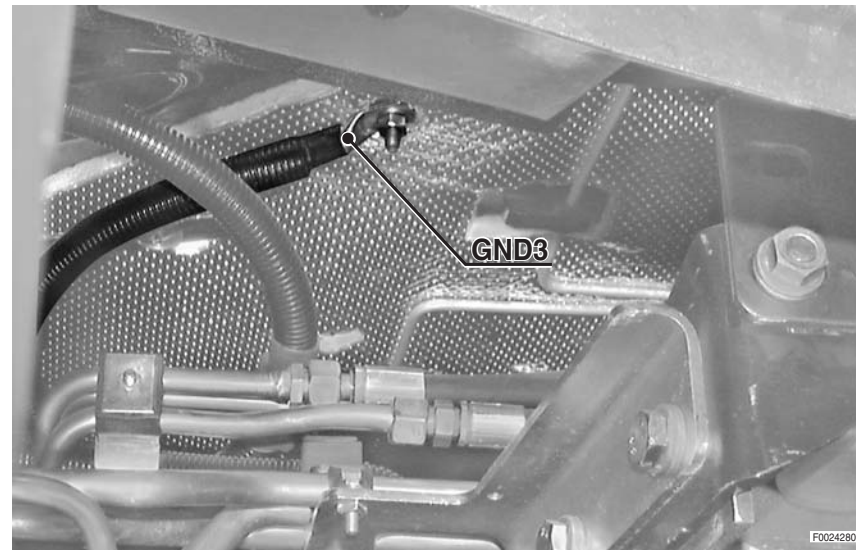
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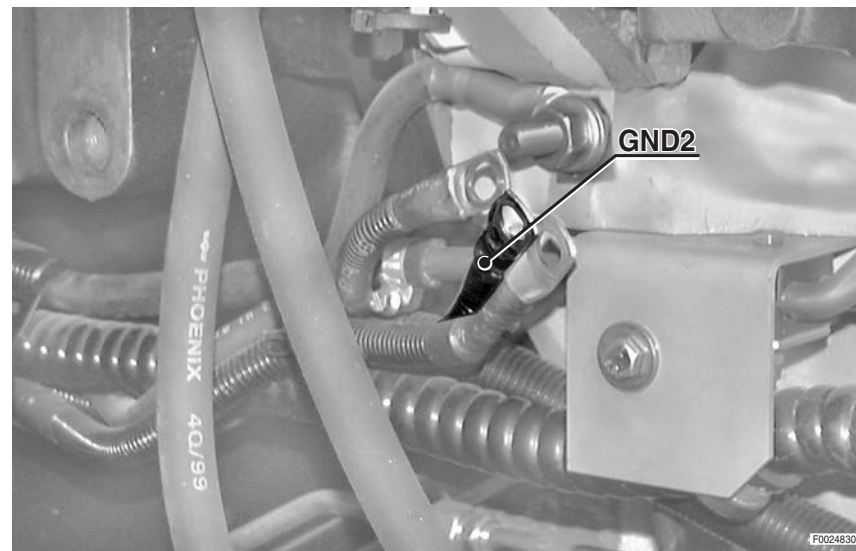
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CAB POWER SUPPLY WIRING

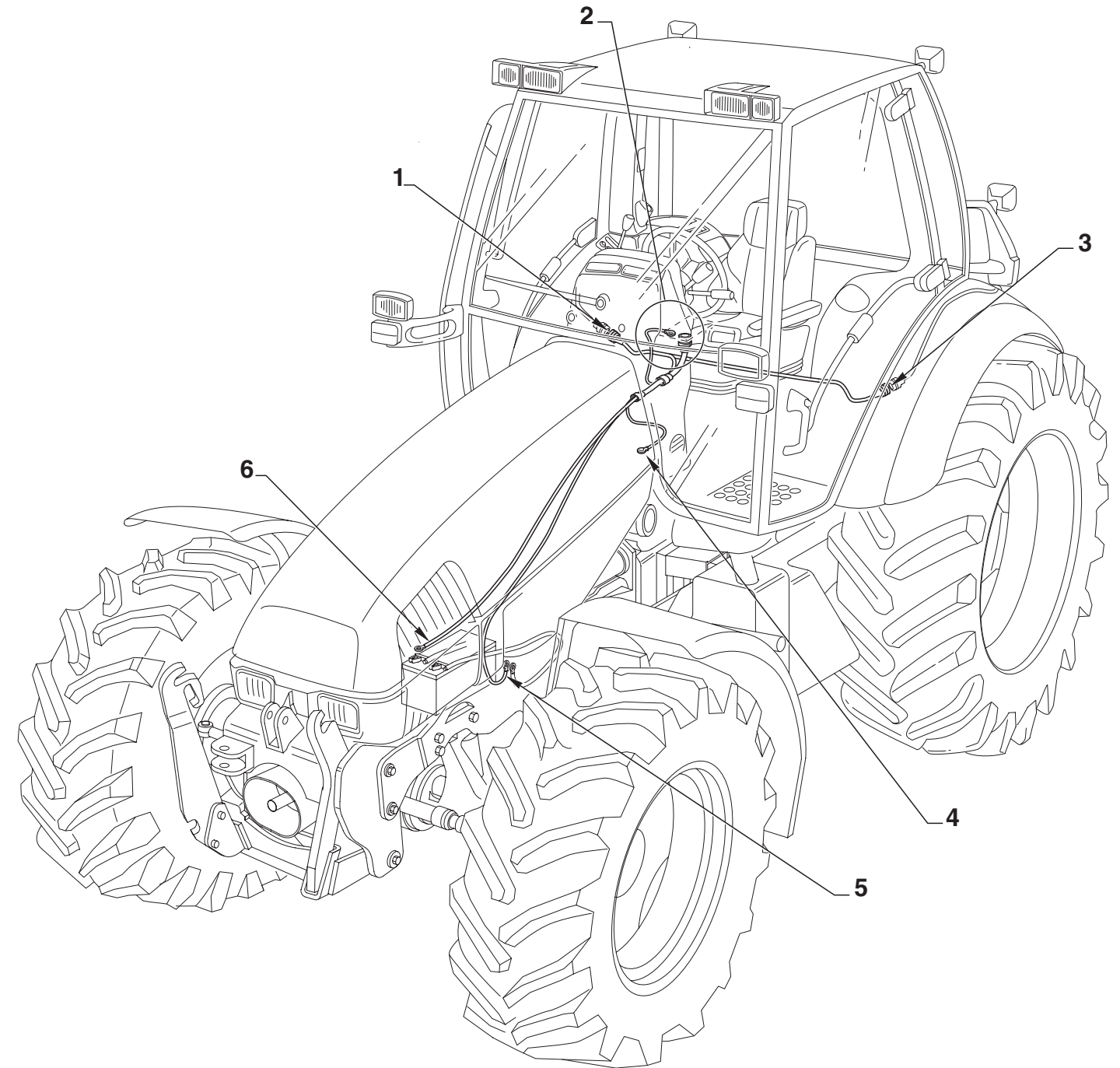
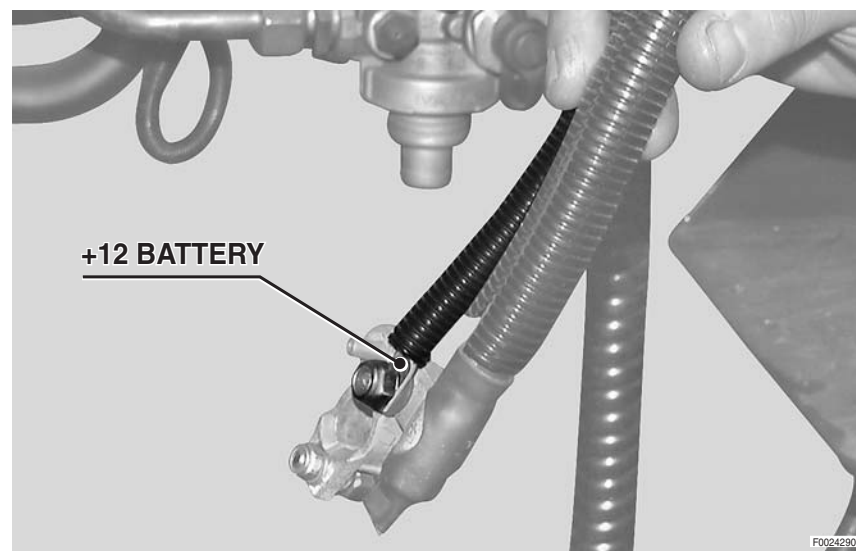
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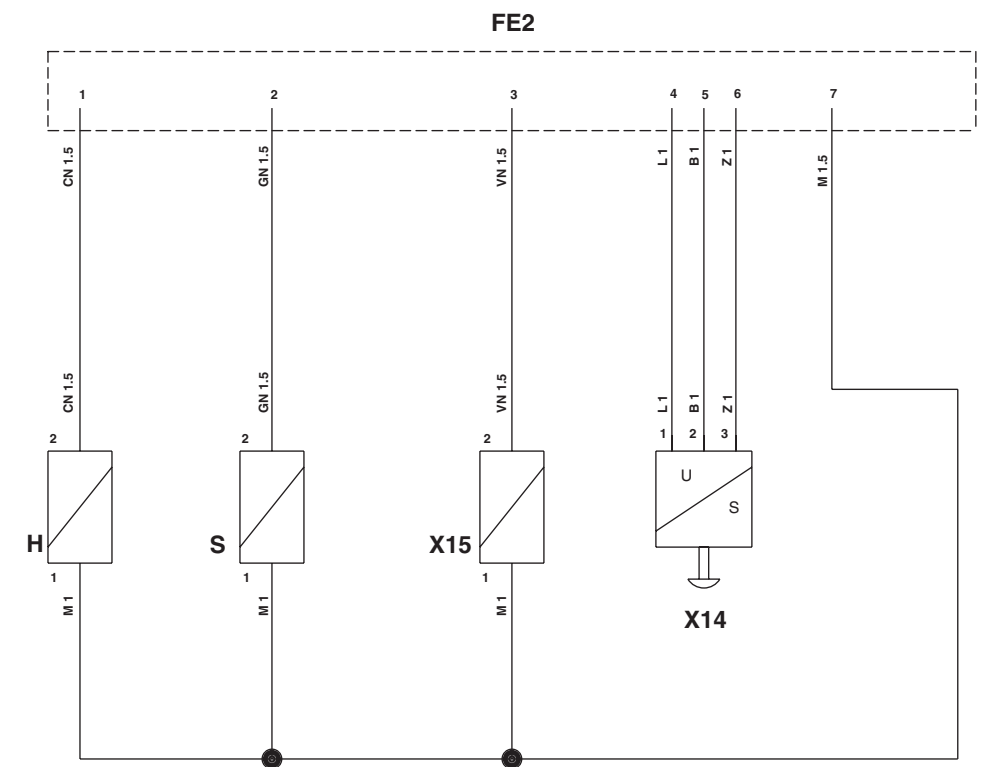
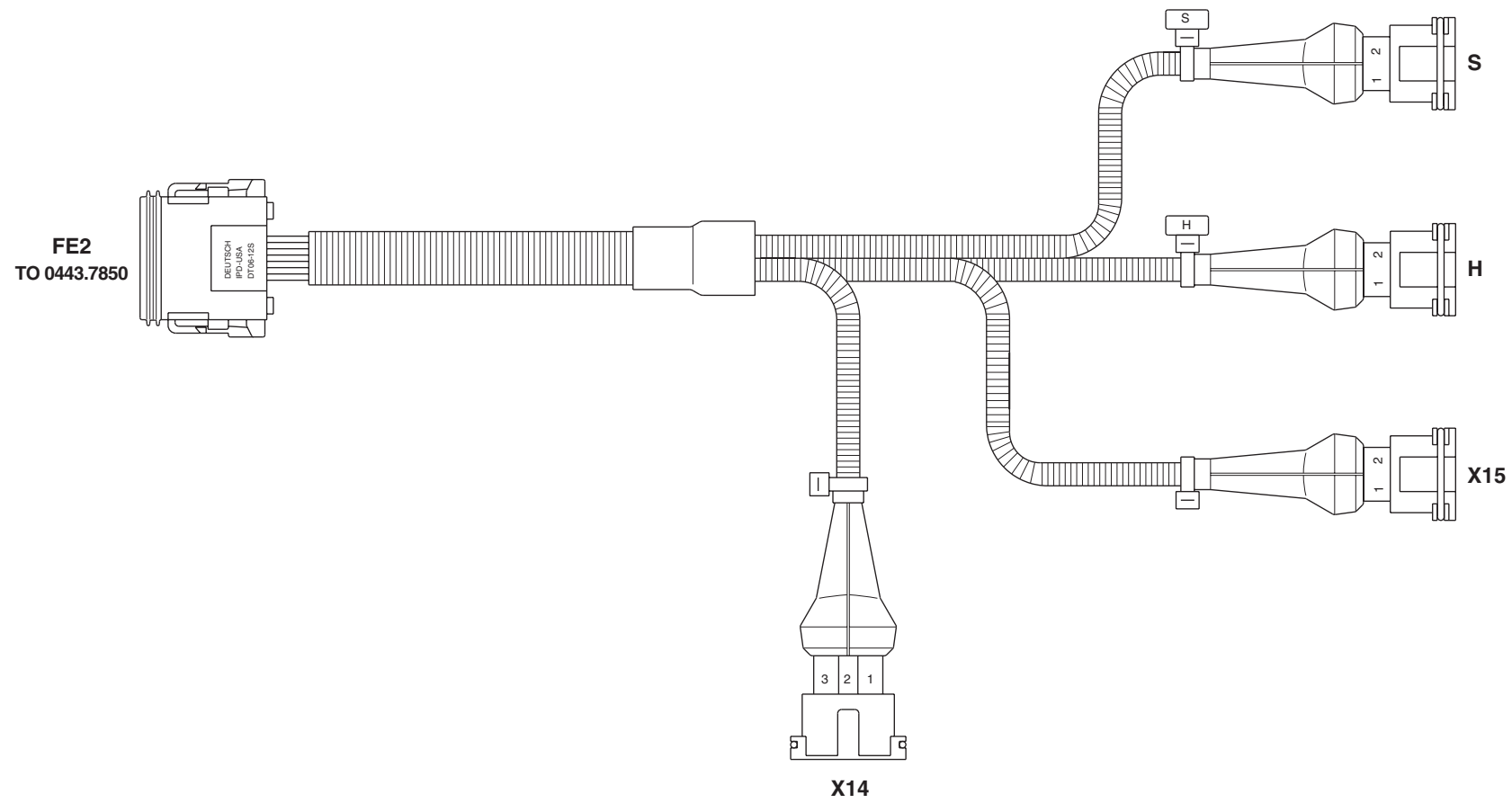


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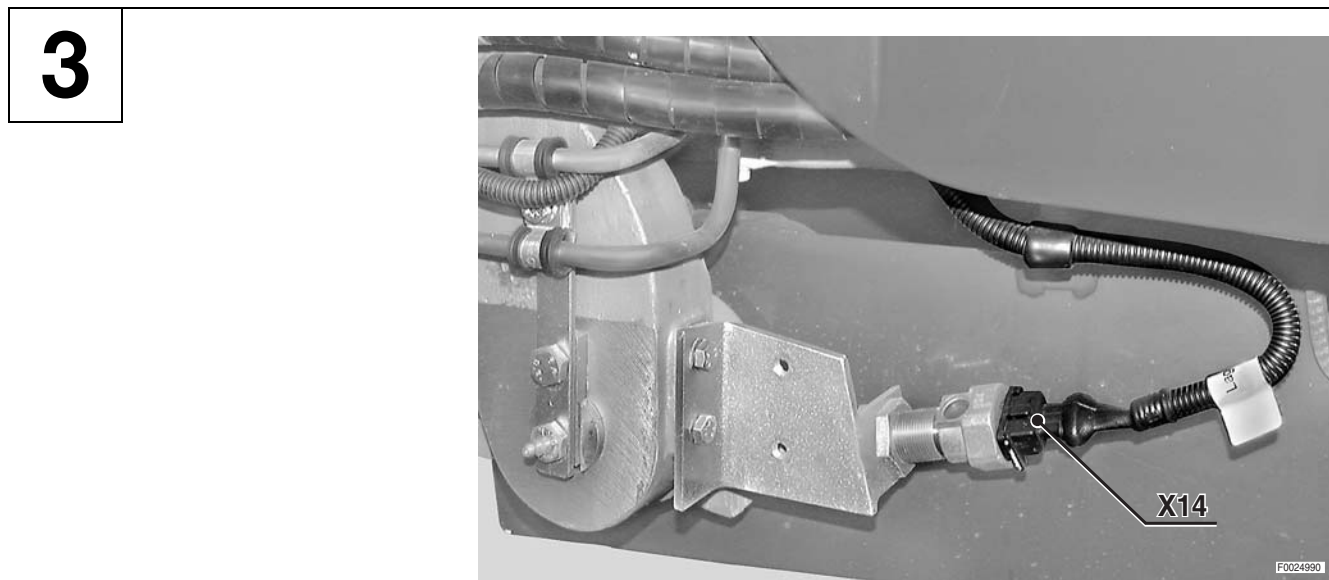
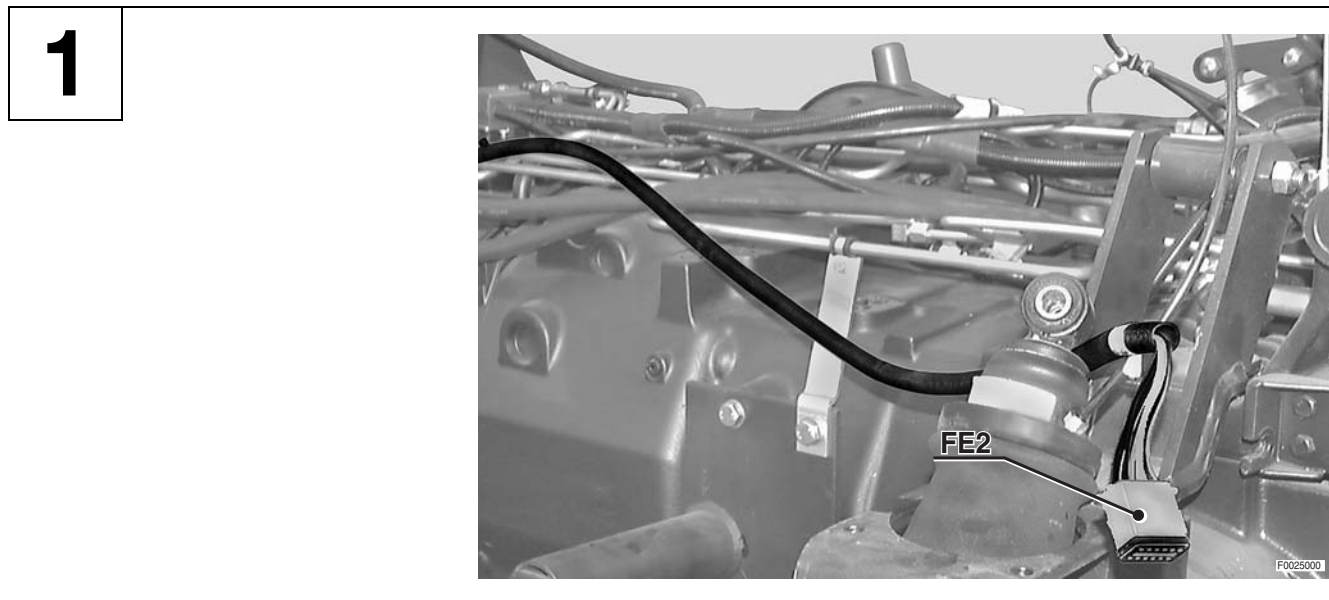
CAB LINE FRONT SUSPENSION WIRING



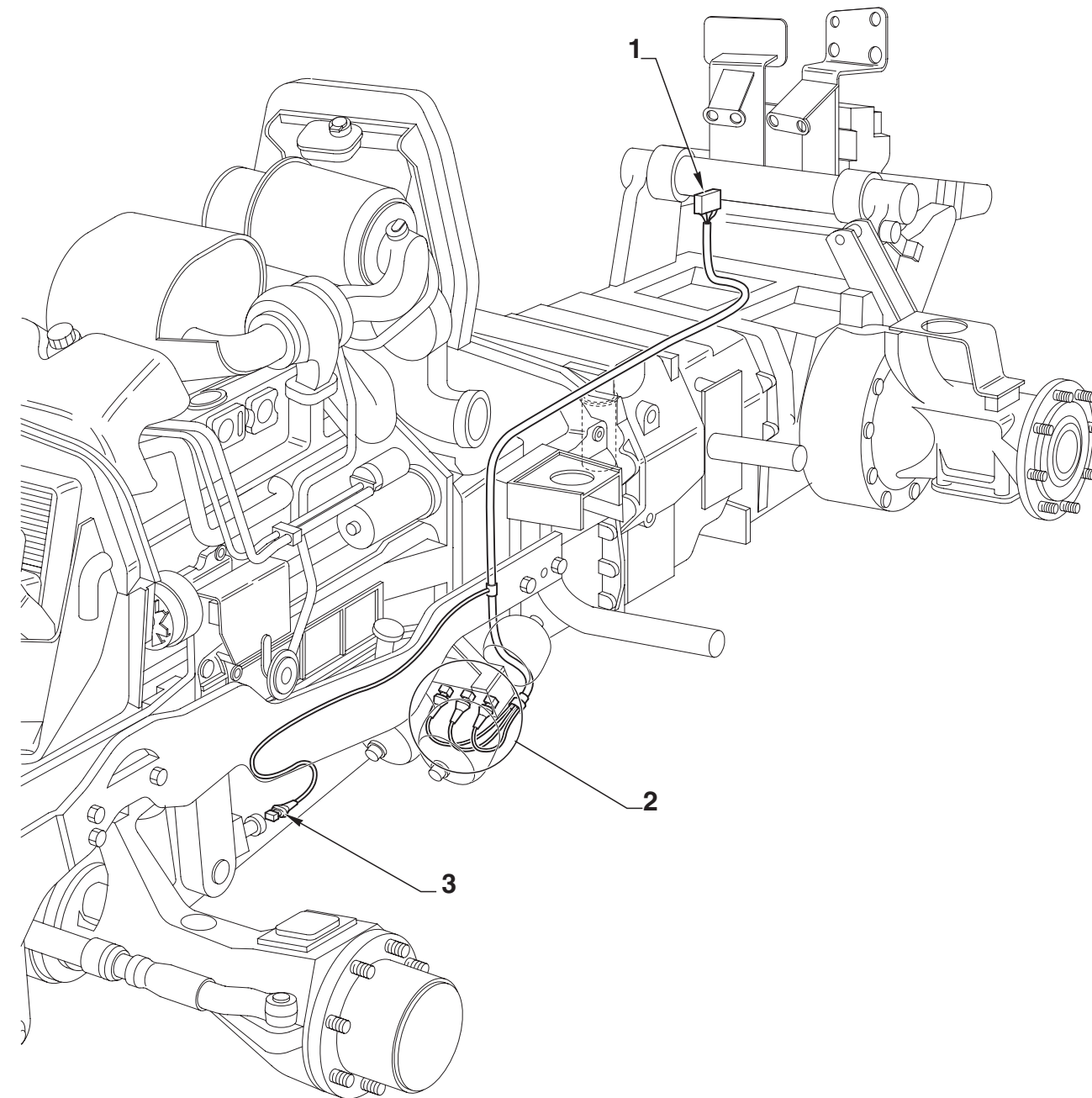
- FE2** To front suspension ECU wiring
- H** Solenoid valve for raising front axle
- S** Solenoid valve for lowering front axle
- X14** Front axle suspension position sensor
- X15** Solenoid valve for Load Sensing front axle suspension

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CONNECTORS LOCATION

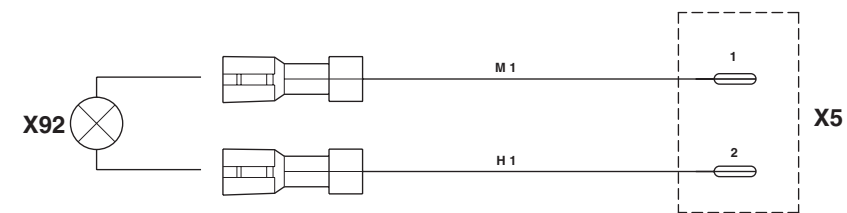
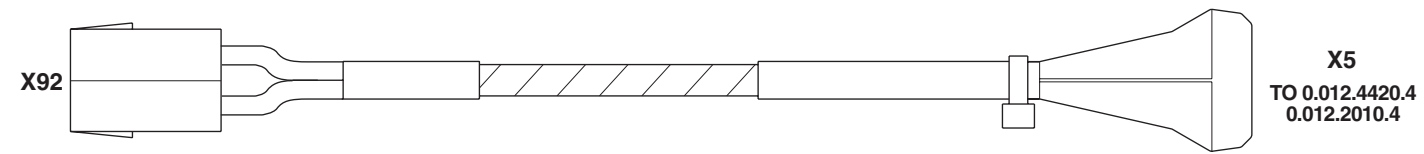


CAB LINE FRONT SUSPENSION WIRING



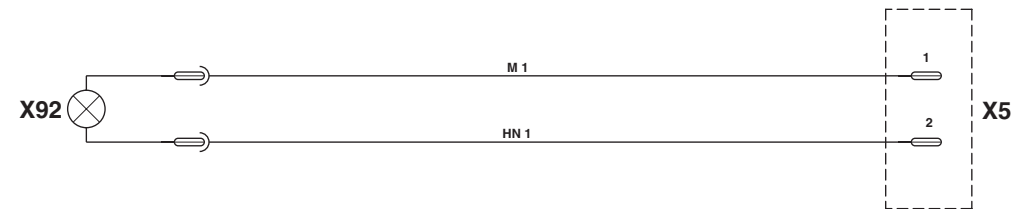
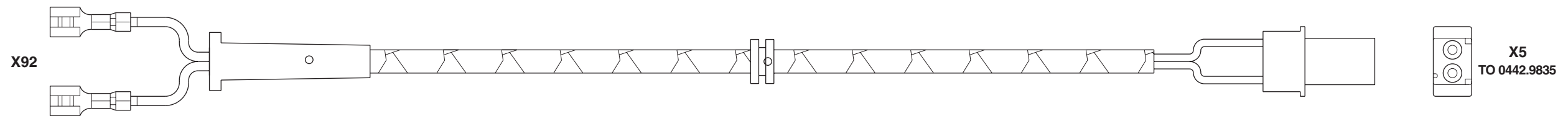
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NUMBER PLATE LIGHT WIRING



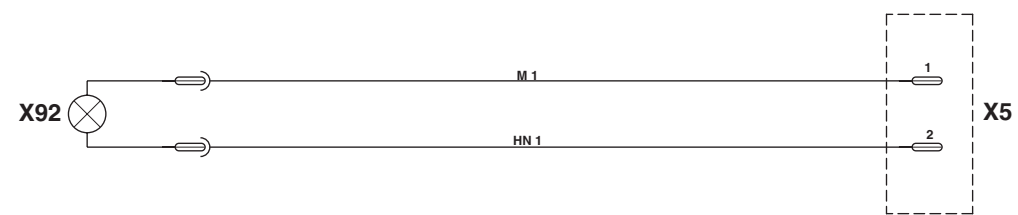
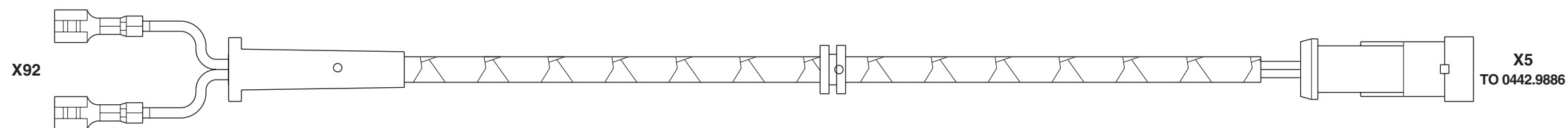
X5 To fender wiring
X92 Number plate light

NUMBER PLATE LIGHT WIRING



X5 To fender wiring
X92 Number plate light

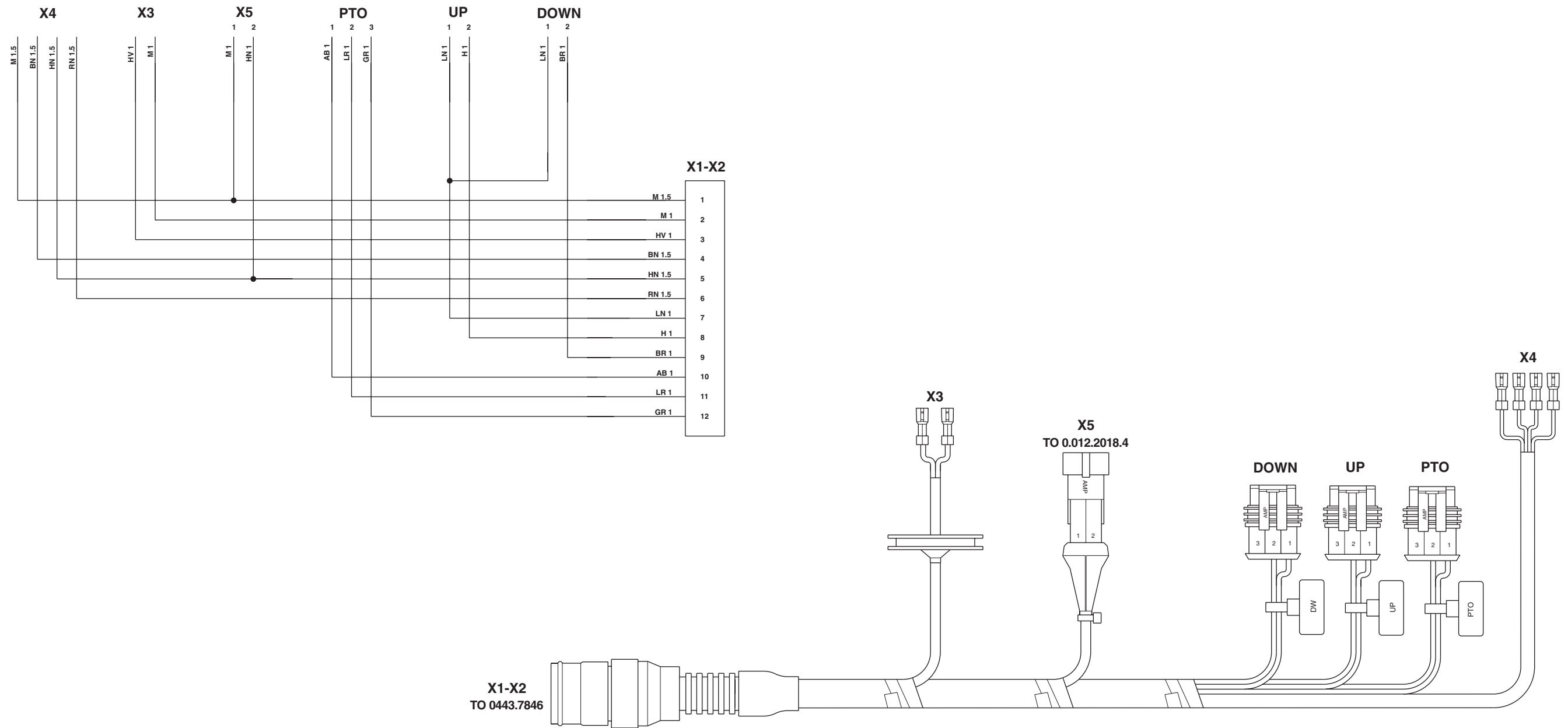
NUMBER PLATE LIGHT WIRING



X5 To fender wiring
X92 Number plate light

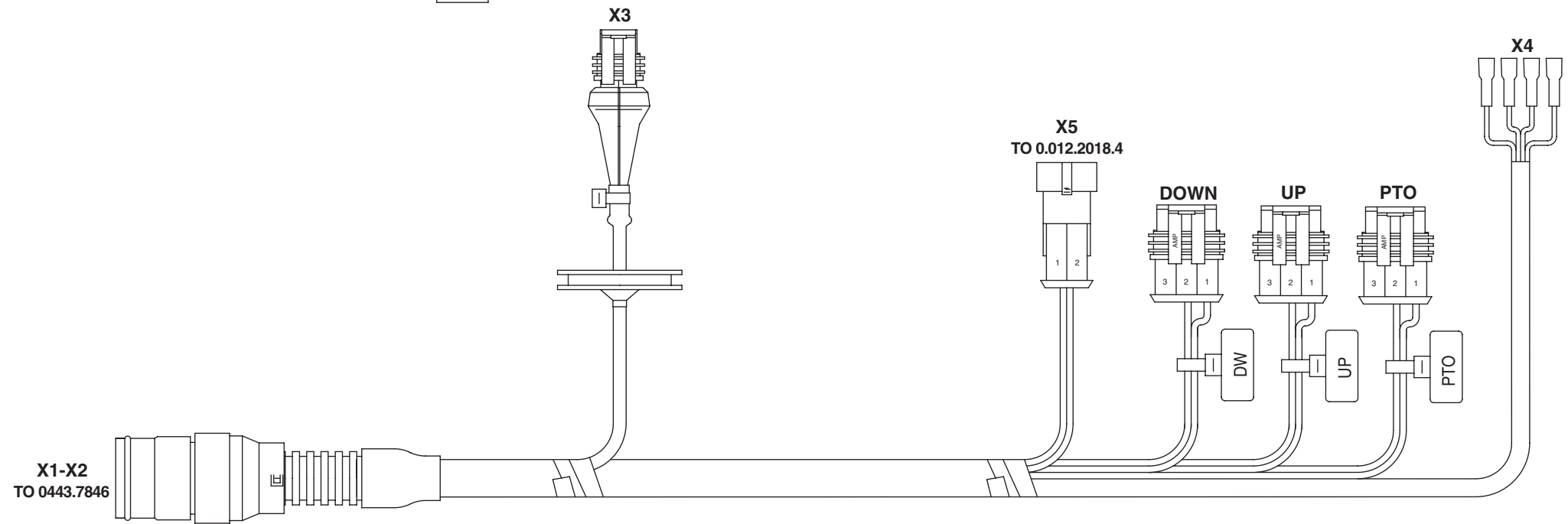
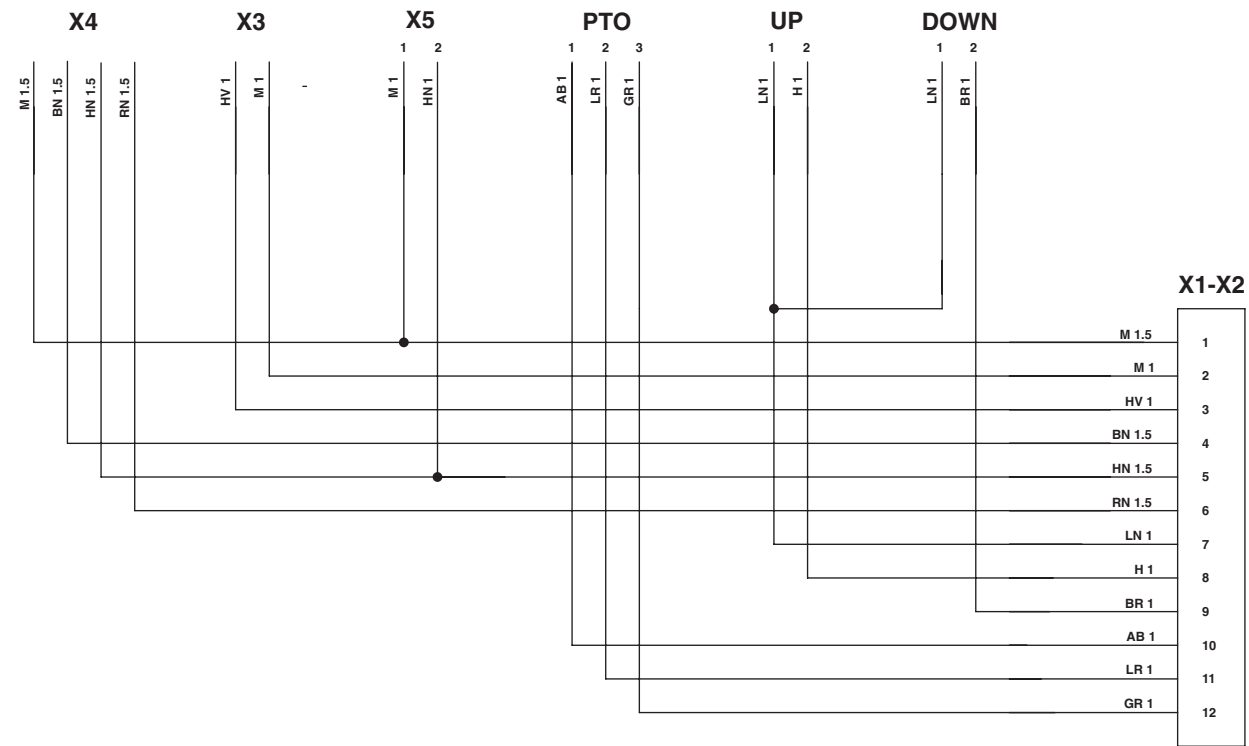
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FENDER WIRING



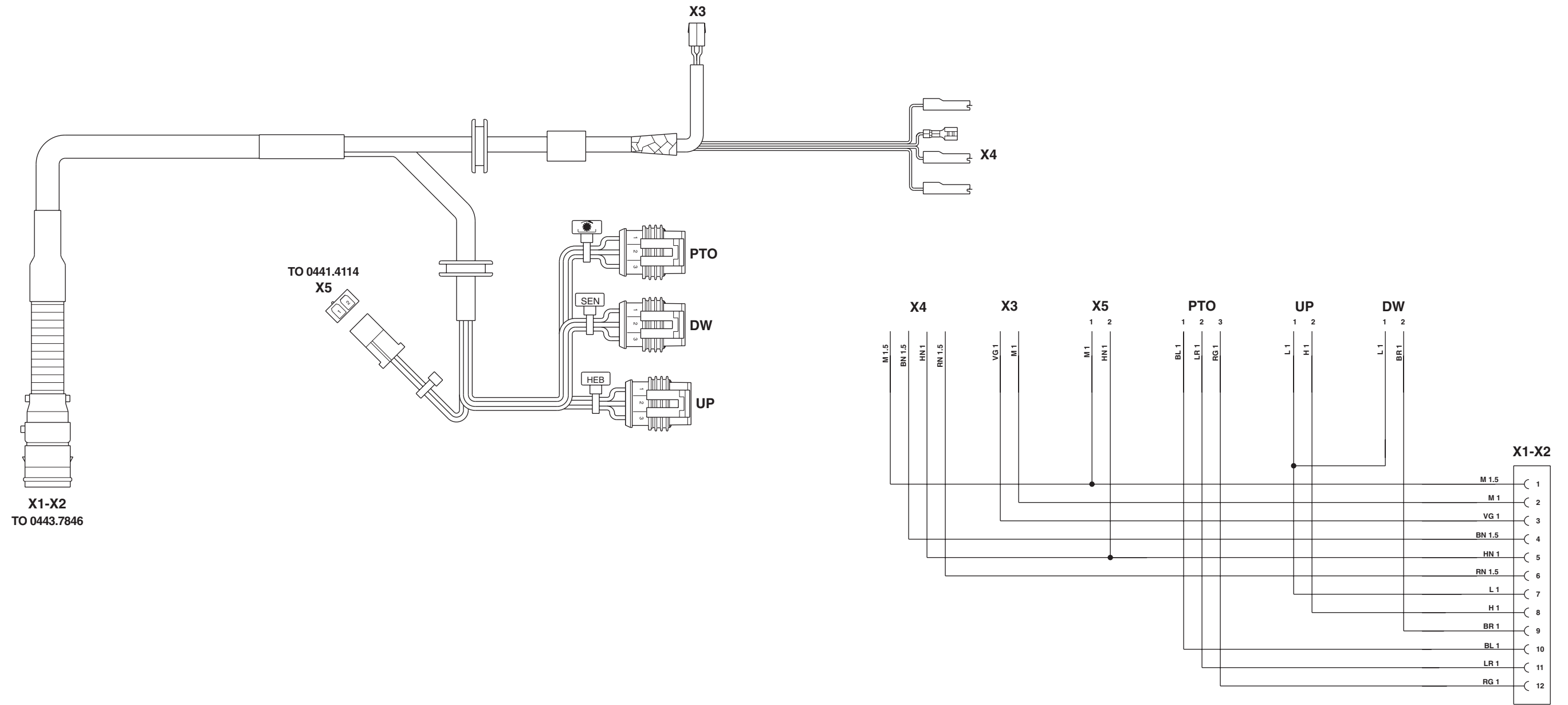
- DW** Rear lift "lower" control pushbutton
- PTO** Rear PTO control pushbutton
- UP** Rear lift "raise" control pushbutton
- X1** To cab power supply wiring (R.H. line)
- X2** To cab power supply wiring (L.H. line)
- X3** Rear lower worklights
- X4** Rear sidelights and direction indicators
- X5** To number plate light wiring

FENDER WIRING



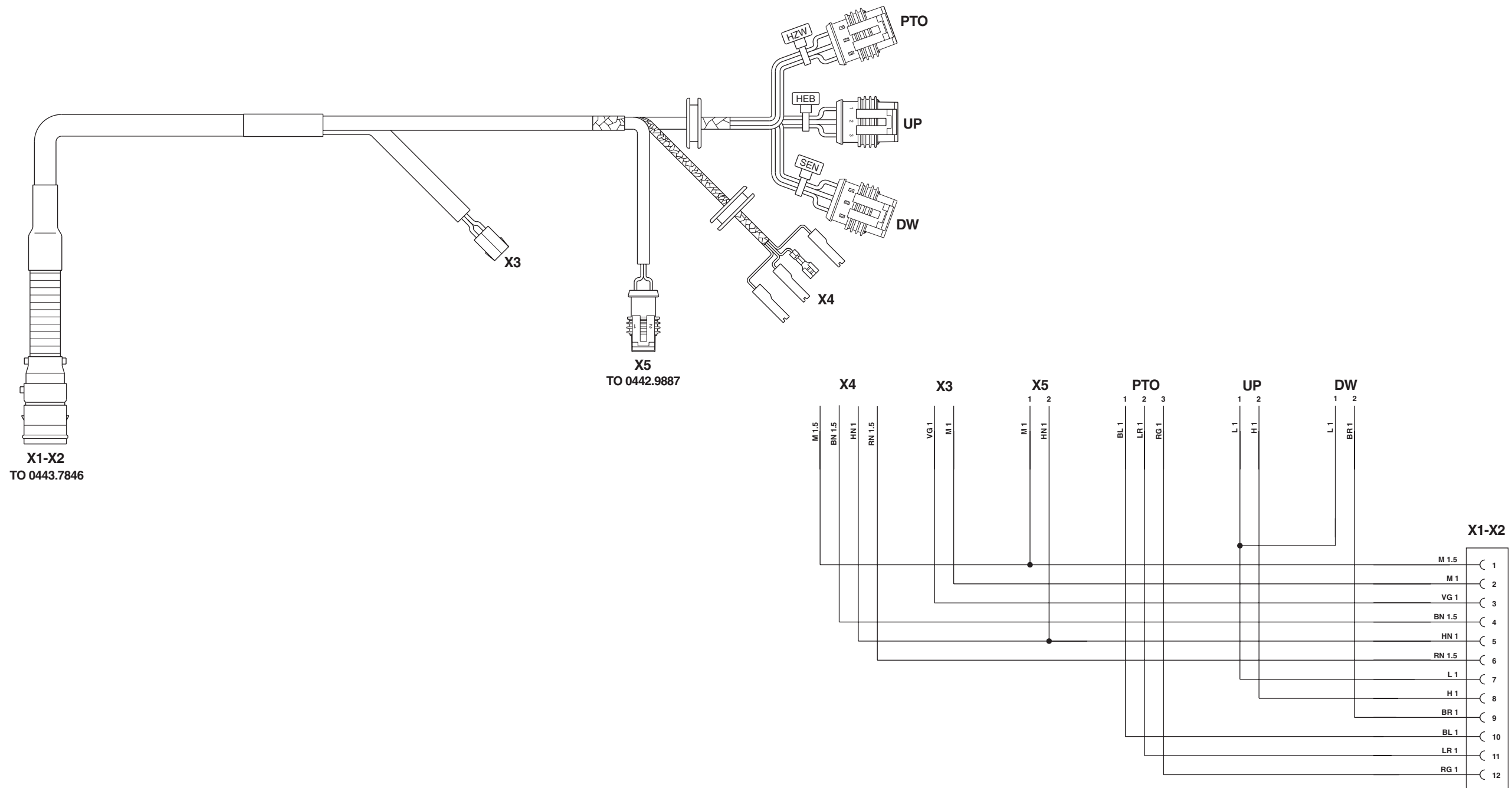
- DW** Rear lift "lower" control pushbutton
- PTO** Rear PTO control pushbutton
- UP** Rear lift "raise" control pushbutton
- X1** To cab power supply wiring (R.H. line)
- X2** To cab power supply wiring (L.H. line)
- X3** Rear lower worklights
- X4** Rear sidelights and direction indicators
- X5** To number plate light wiring

FENDER WIRING



- DW** Rear lift "lower" control pushbutton
- PTO** Rear PTO control pushbutton
- UP** Rear lift "raise" control pushbutton
- X1** To cab power supply wiring (R.H. line)
- X2** To cab power supply wiring (L.H. line)
- X3** Rear lower worklights
- X4** Rear sidelights and direction indicators
- X5** To number plate light wiring

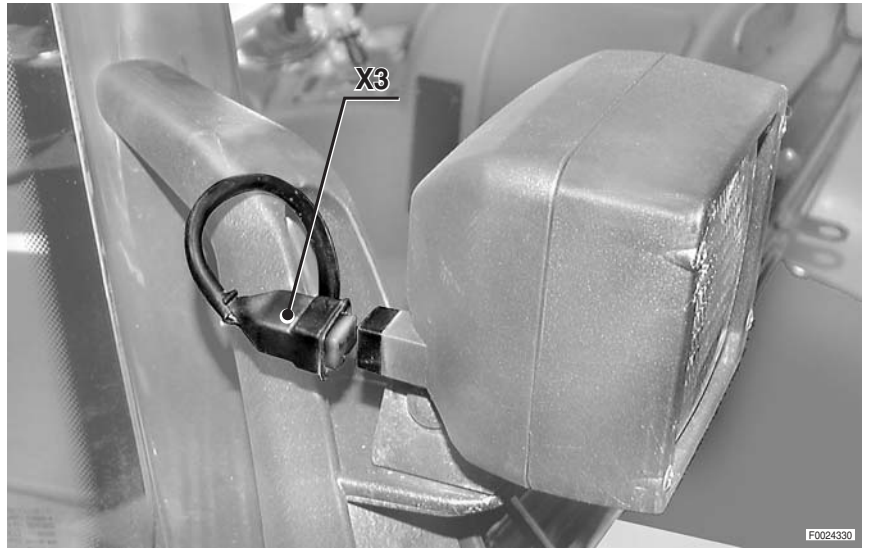
FENDER WIRING



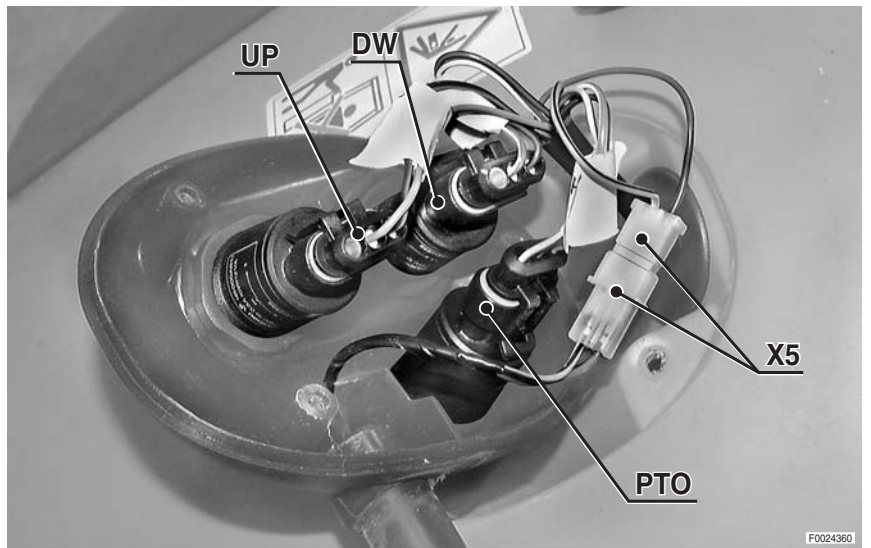
- DW** Rear lift "lower" control pushbutton
- PTO** Rear PTO control pushbutton
- UP** Rear lift "raise" control pushbutton
- X1** To cab power supply wiring (R.H. line)
- X2** To cab power supply wiring (L.H. line)
- X3** Rear lower worklights
- X4** Rear sidelights and direction indicators
- X5** To number plate light wiring

FENDER AND NUMBER PLATE LIGHT CONNECTORS LOCATION

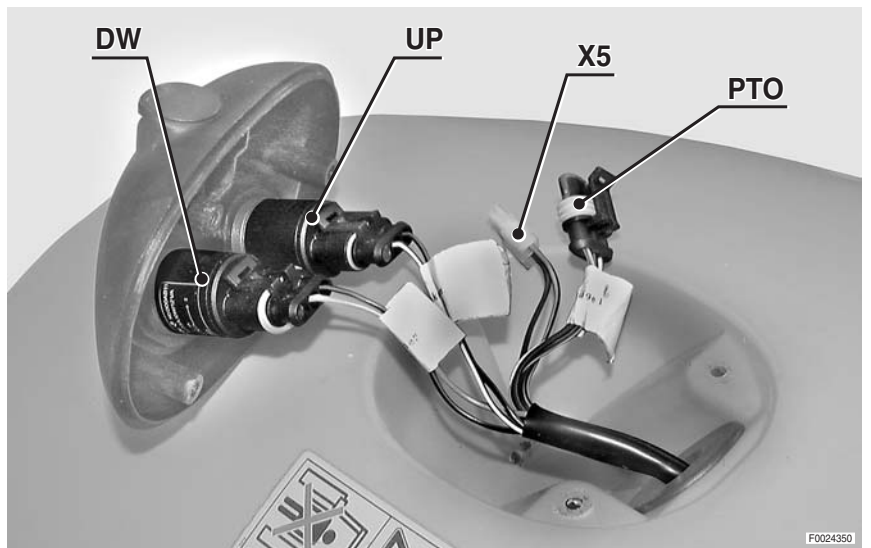
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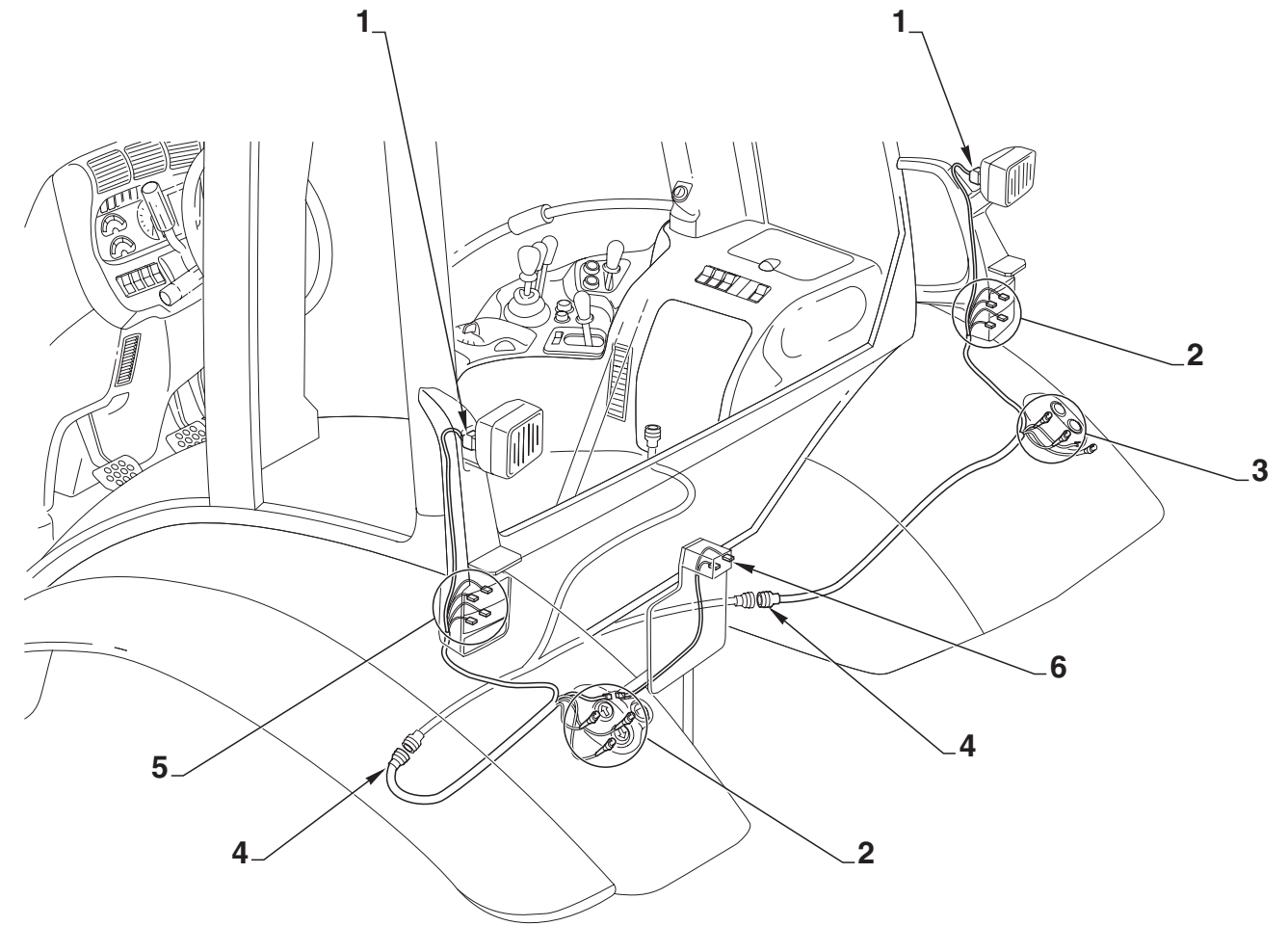
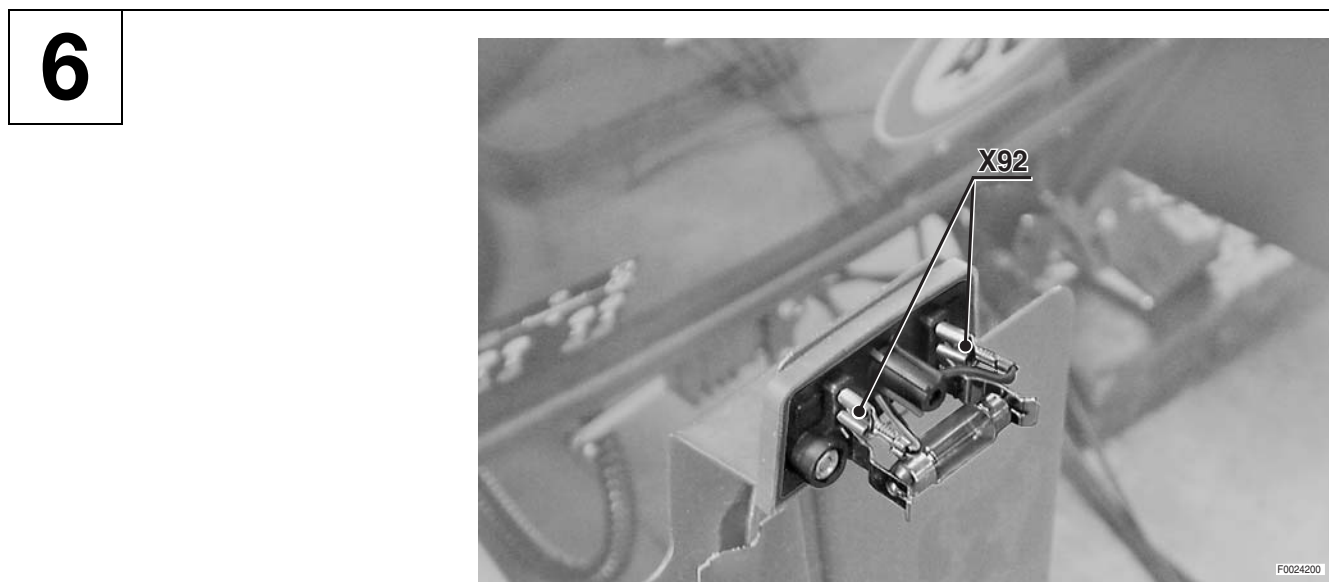
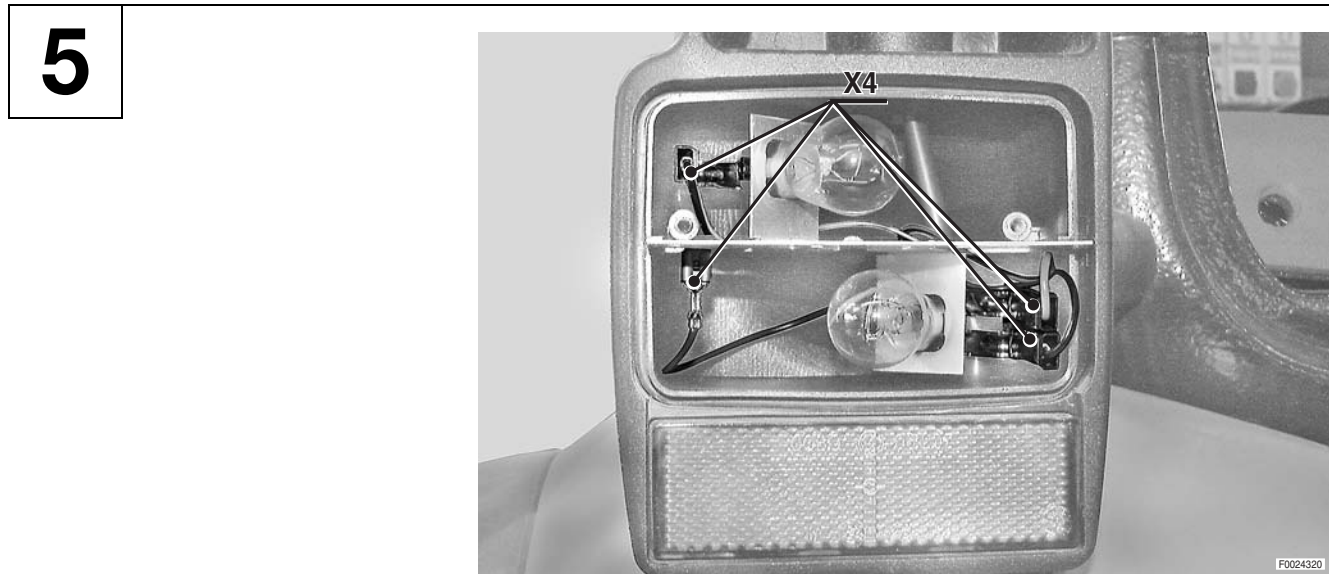
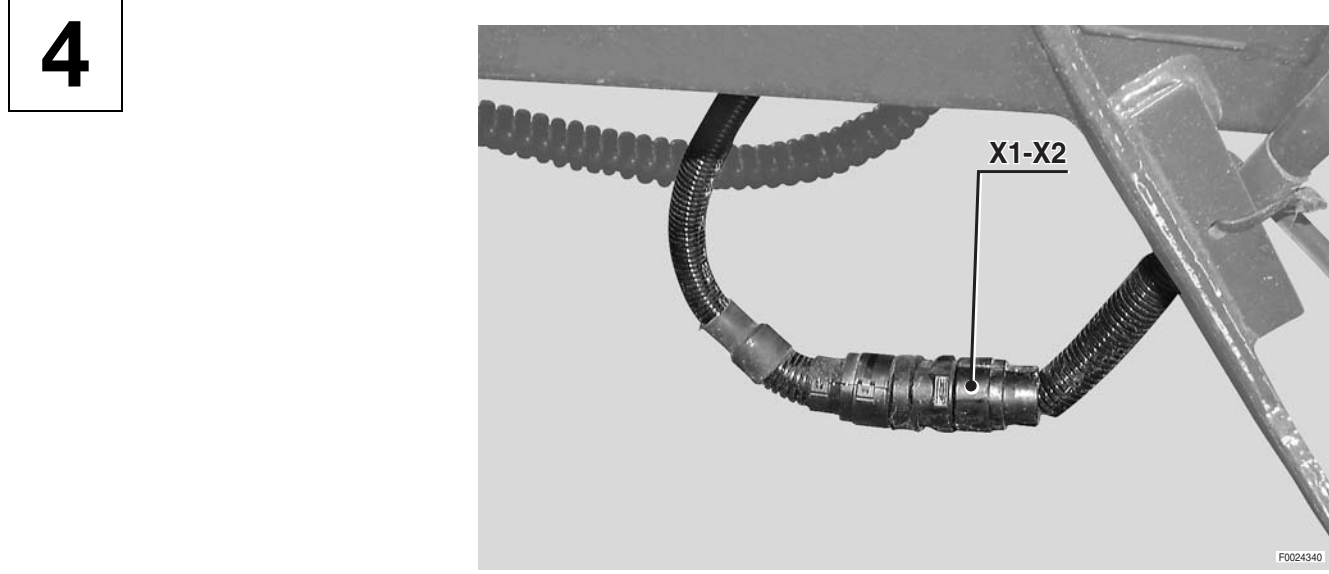


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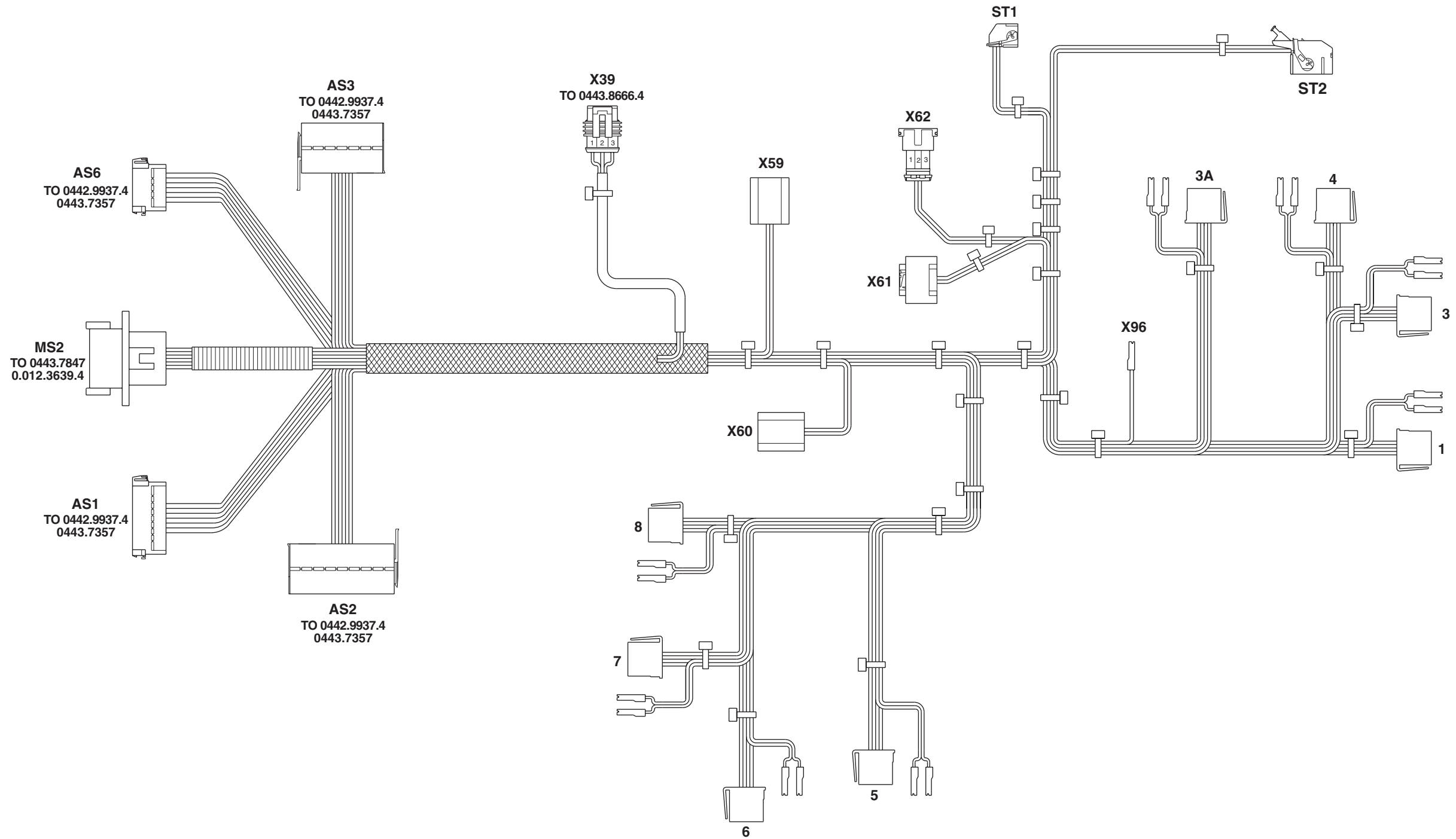
FENDER AND NUMBER PLATE LIGHT WIRINGS



FENDER	PLATE LIGHT
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0.012.4420.4	0441.4114
0442.9835	0442.9887
0442.9886	

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FRONT CONSOLE WIRING (1/2)

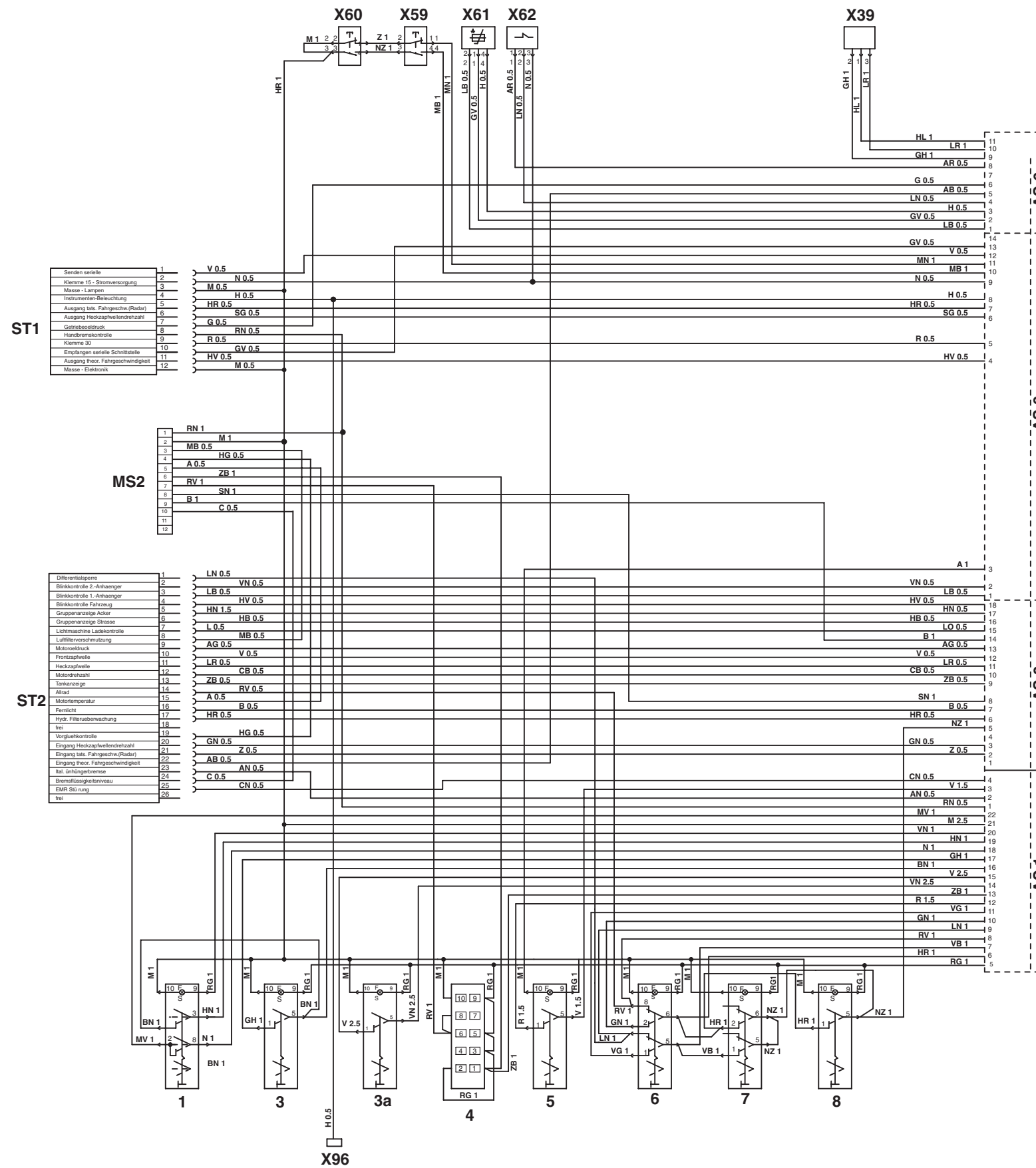


- 1 Side lights switch
- 3 Cab roof worklights switch
- 3A Lower worklights switch
- 4 Worklights switch 50S (not used)
- 5 Front suspension switch
- 6 ASM switch
- 7 Diff lock switch
- 8 4WD switch

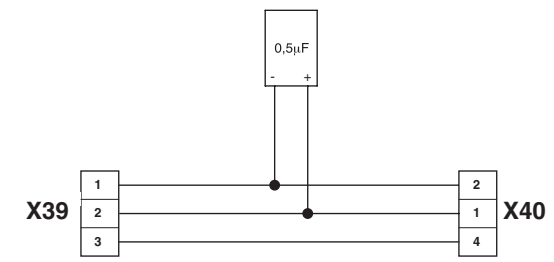
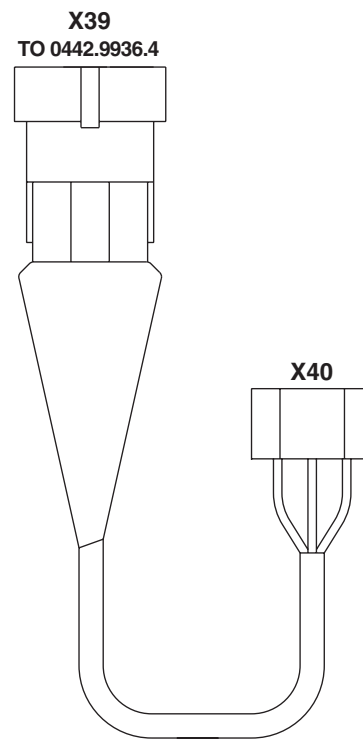
- AS1 To side console wiring
- AS2 To side console wiring
- AS3 To side console wiring
- AS6 To side console wiring
- MS2 To engine wiring
- ST1 INFOCENTER 1
- ST2 NFOCENTER 2
- X39 To accelerator pedal sensor wiring

- X59 Right brake pedal switch
- X60 Left brake pedal switch
- X61 Clutch pedal position sensor
- X62 Clutch pedal depressed proximity sensor
- X96 Hazard switch light (+58)

FRONT CONSOLE WIRING (2/2)



ACCELERATOR PEDAL SENSOR WIRING

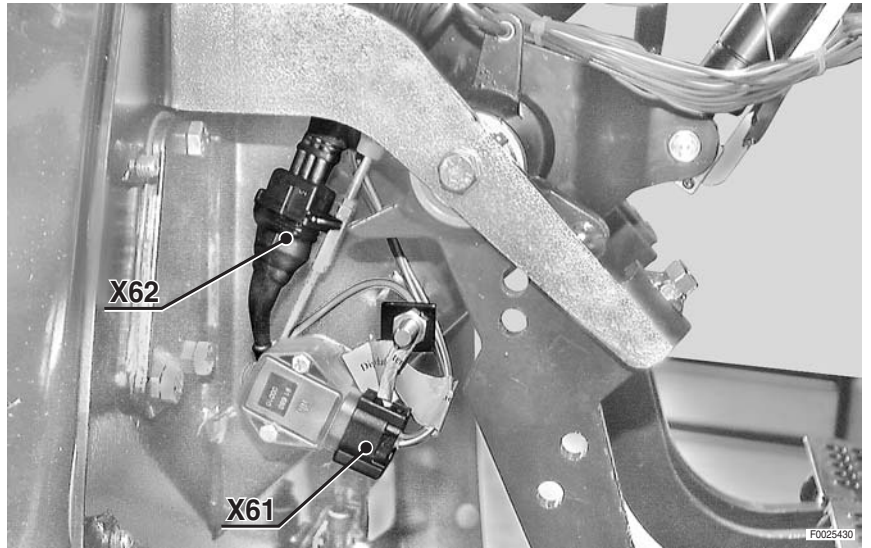


X39 To front console wiring
X40 Accelerator pedal position sensor

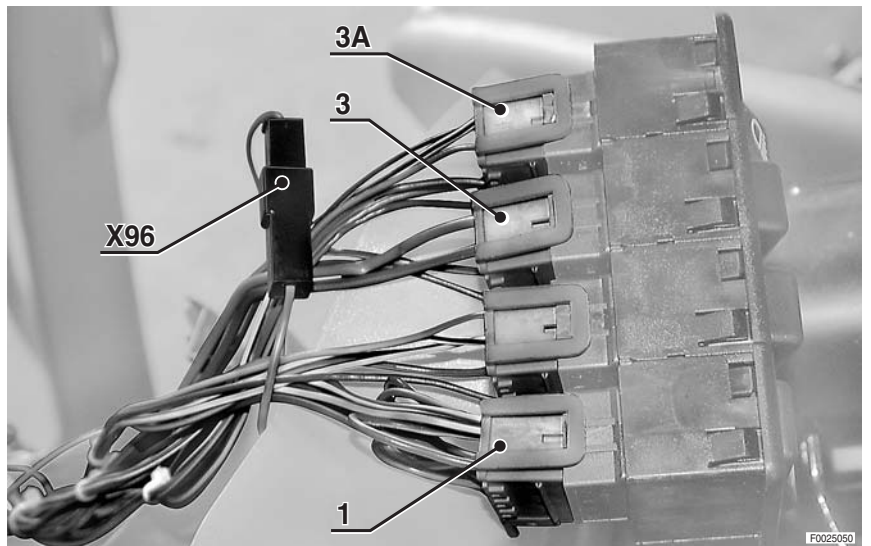
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FRONT CONSOLE CONNECTORS LOCATION

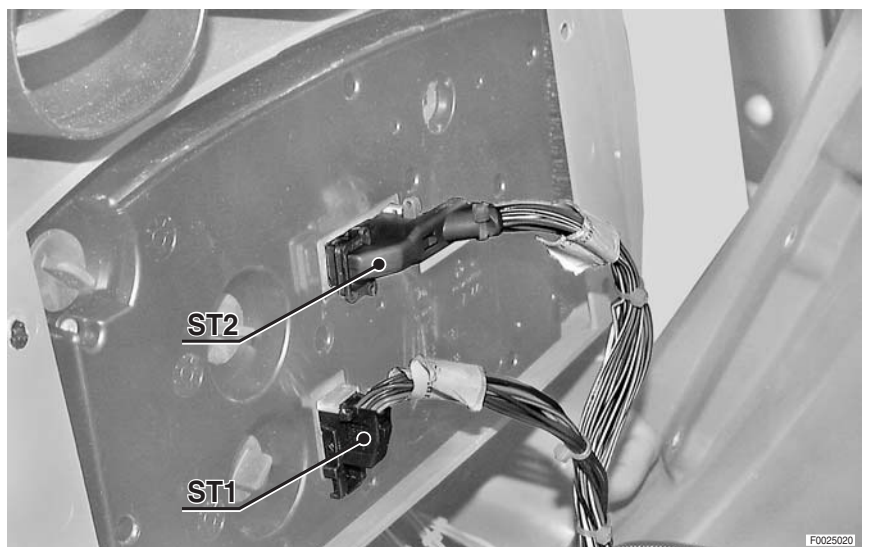
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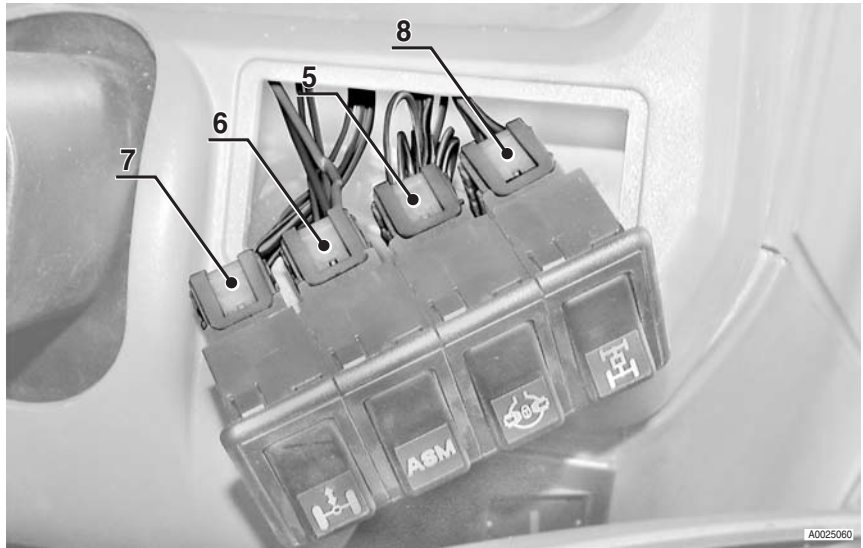
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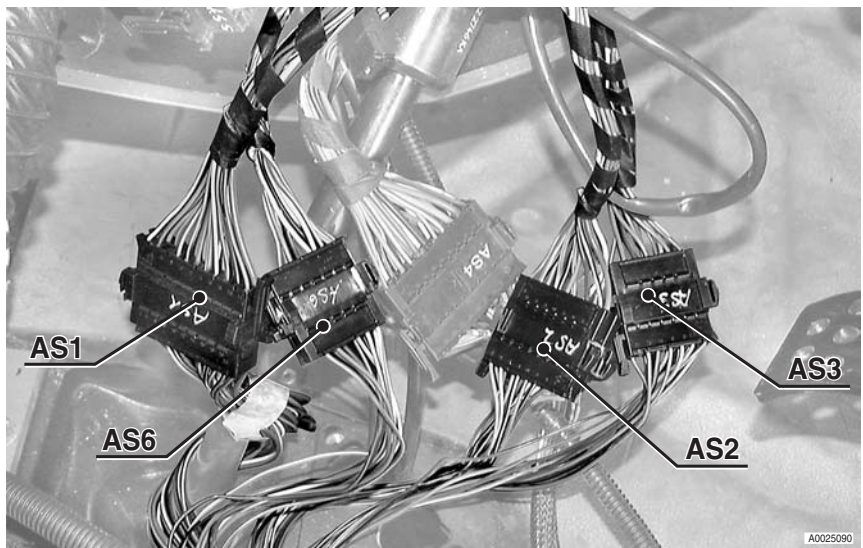
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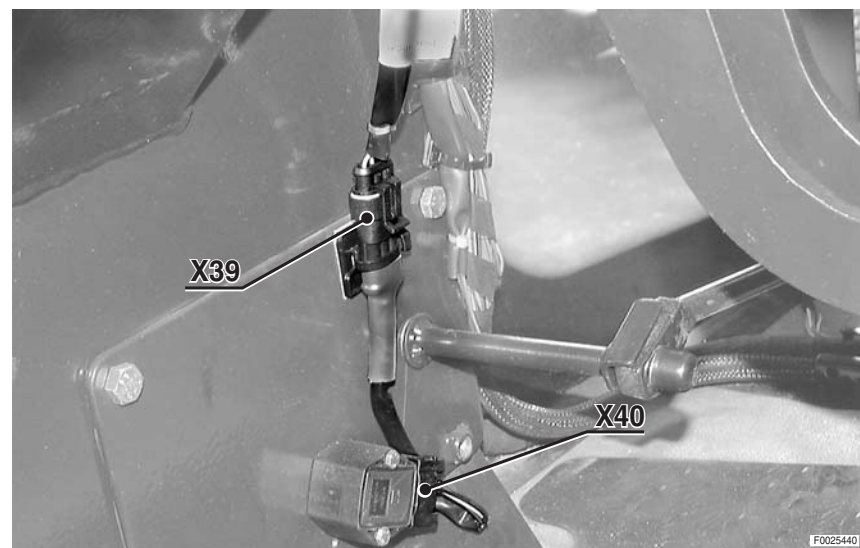


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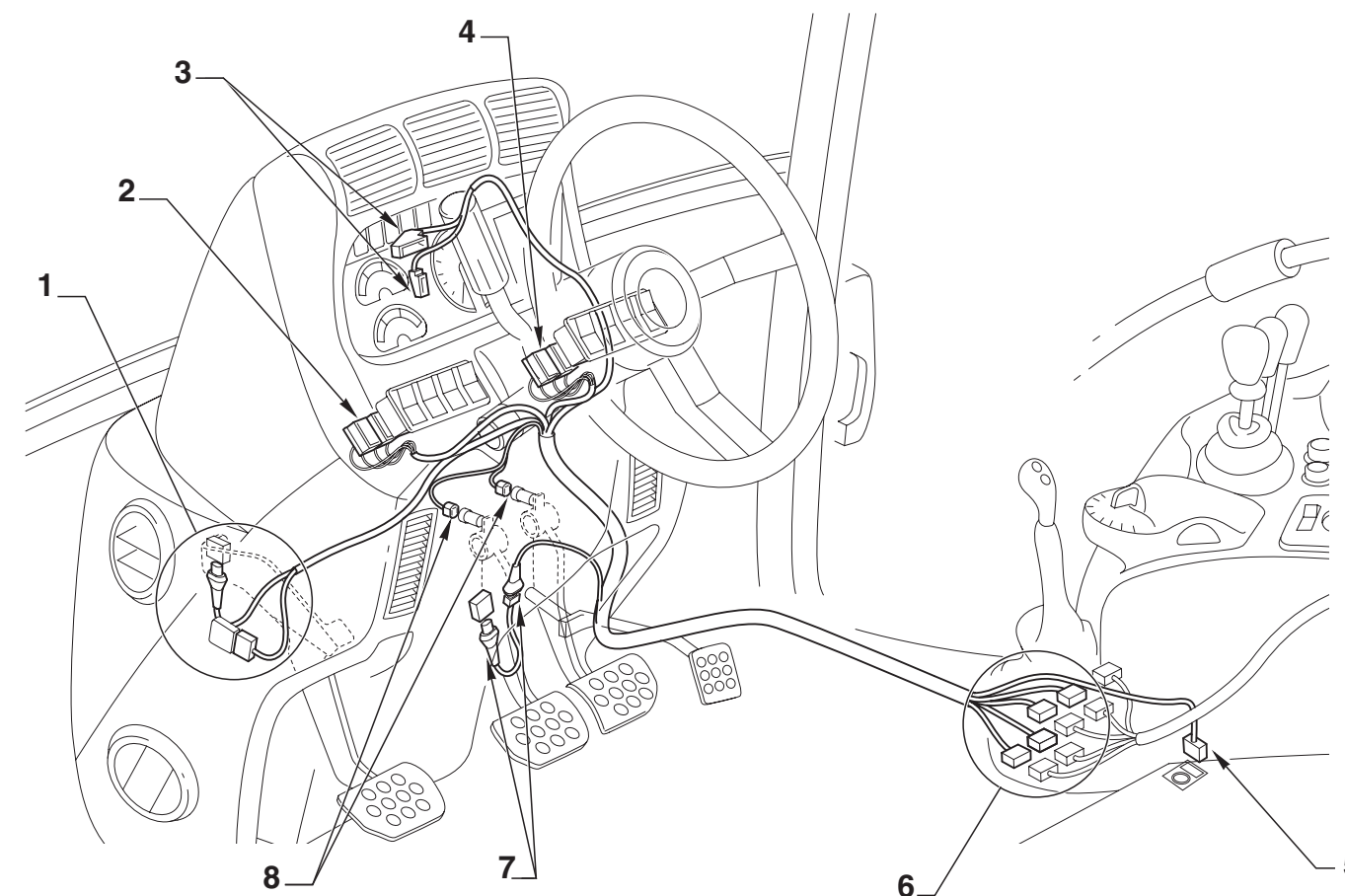


FRONT CONSOLE WIRING

7

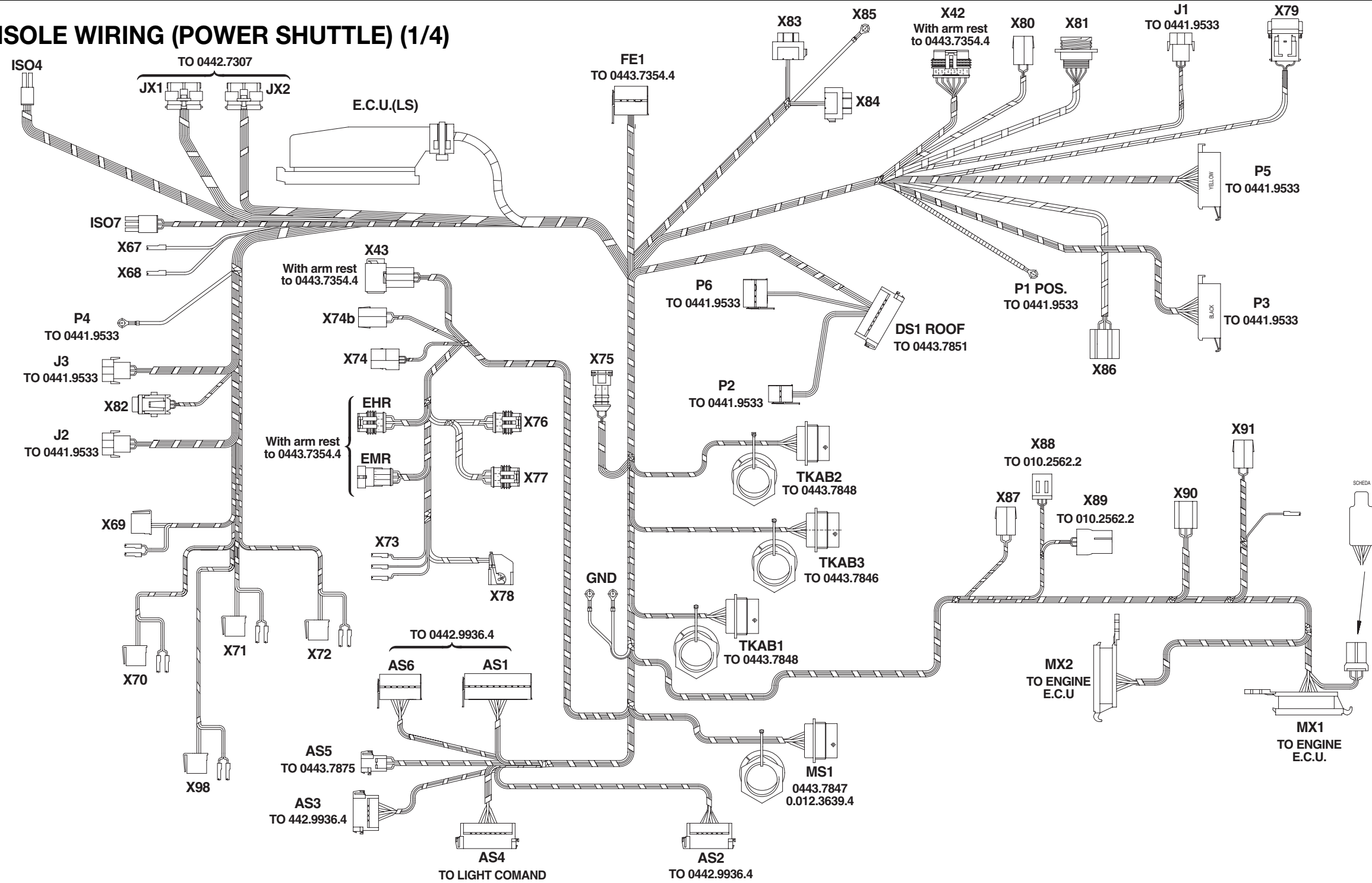


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SIDE CONSOLE WIRING (POWER SHUTTLE) (1/4)



- AS1** To front console wiring
- AS2** To front console wiring
- AS3** To front console wiring
- AS4** Lights selector switch
- AS5** To display wiring
- AS6** To front console wiring
- DS1** To roof wiring
- ECU LS** Transmission control unit
- EHR** Lift control lever
- EMR** Throttle lever
- FE1** To cab front suspension ECU
- ISO4** Socket (Power for external implements)
- ISO7** Socket (Connection for external implements)

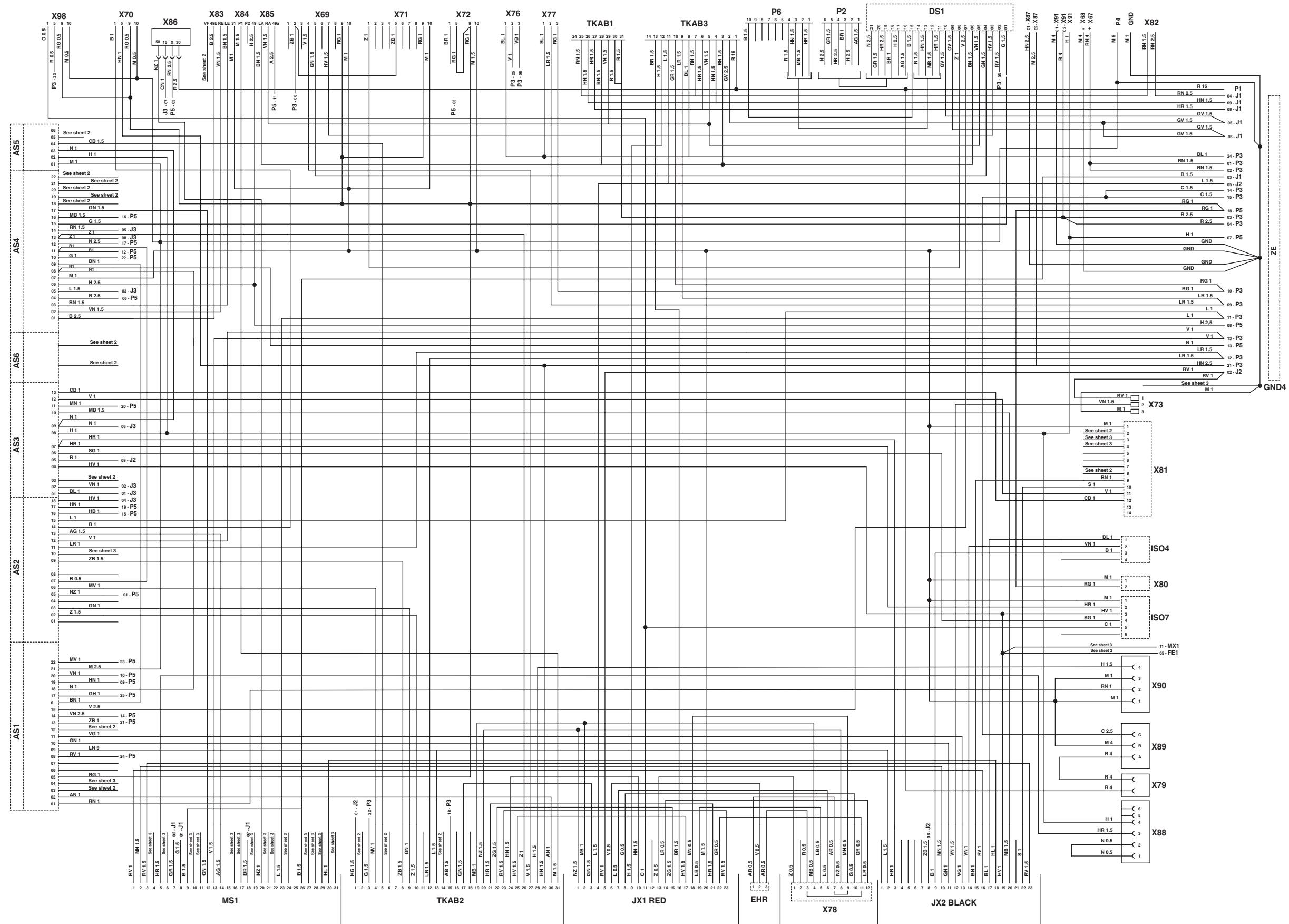
- J1** To fuses plate
- J2** To fuses plate
- J3** To fuses plate
- JX1** Rear lift control unit
- JX2** Rear lift control unit
- MS1** To engine wiring
- MX1** Engine control unit
- MX2** Engine control unit
- P1** To fuses plate
- P2** To fuses plate
- P3** To fuses plate
- P4** To fuses plate
- P5** To fuses plate

- P6** To fuses plate
- TKAB1** To transmission wiring
- TKAB2** To transmission wiring
- TKAB3** To cab power supply wiring
- X42** Engine speed keypad
- X43** To armrest wiring
- X67** Auxiliary power socket (Earth)
- X68** Auxiliary power socket (Positive)
- X70** Clean Fix control switch
- X71** Rotating beacon control switch
- X72** Rear worklights switch
- X73** Radar control switch

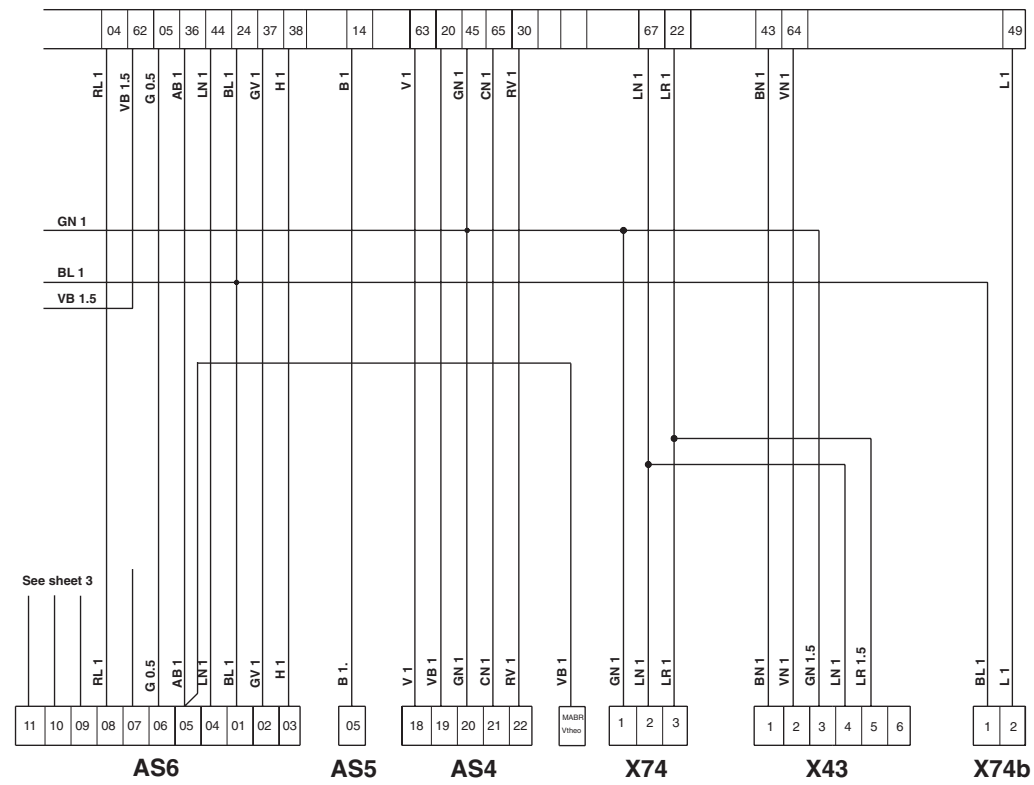
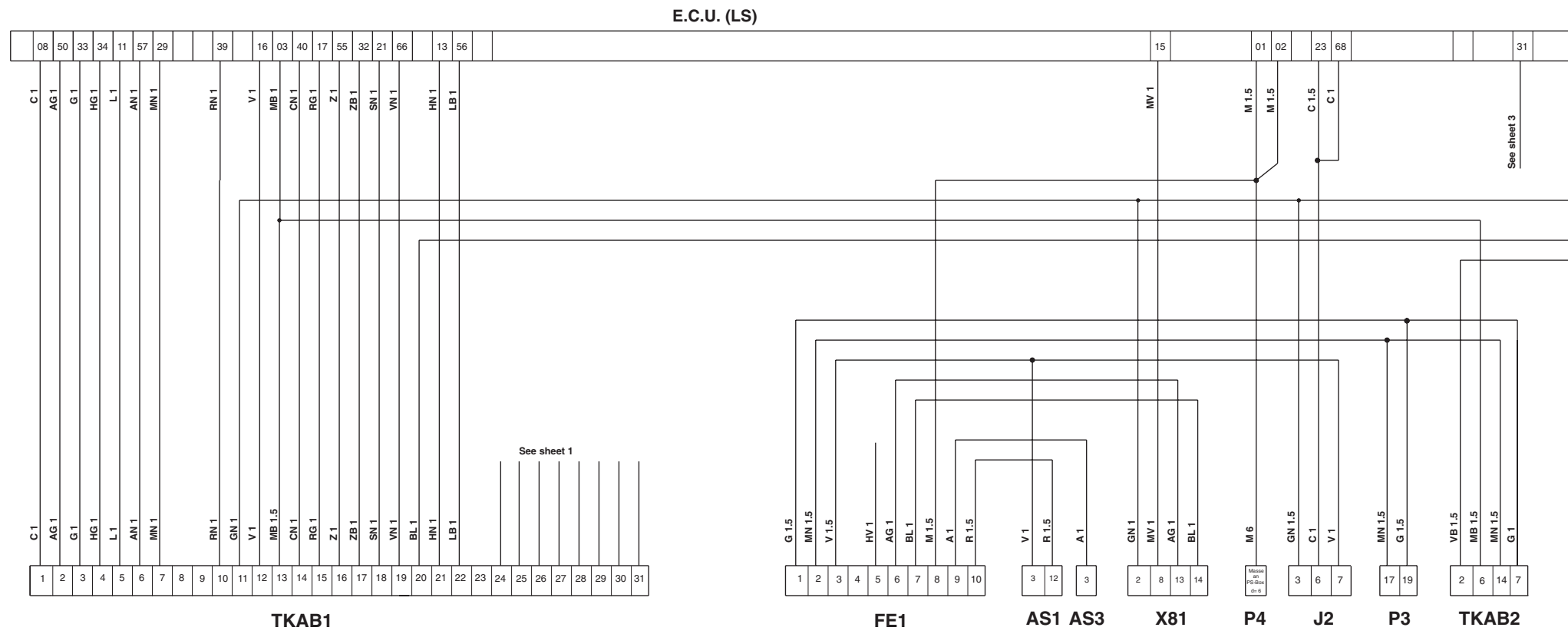
- X74** Gearshift control pushbutton panel
- X74b** Gearshift control pushbutton panel (not used)
- X75** Super-reduction engagement switch
- X76** Front PTO control pushbutton
- X77** Rear PTO control pushbutton
- X78** Lift control lever
- X79** Fuse F50 (30 A)
- X80** Supplementary power
- X81** Diagnostics connector
- X82** Fuse (15 A)
- X83** Direction indicators flasher unit
- X84** Direction indicators flasher unit
- X85** Direction indicators flasher unit

- X86** Starter switch
- X87** Compressor for driver's seat air suspension
- X88** To air conditioner wiring (Cab)
- X89** To air conditioner wiring (Cab)
- X90** Handbrake switch
- X91** Cigar lighter
- X98** PTO AUTO switch

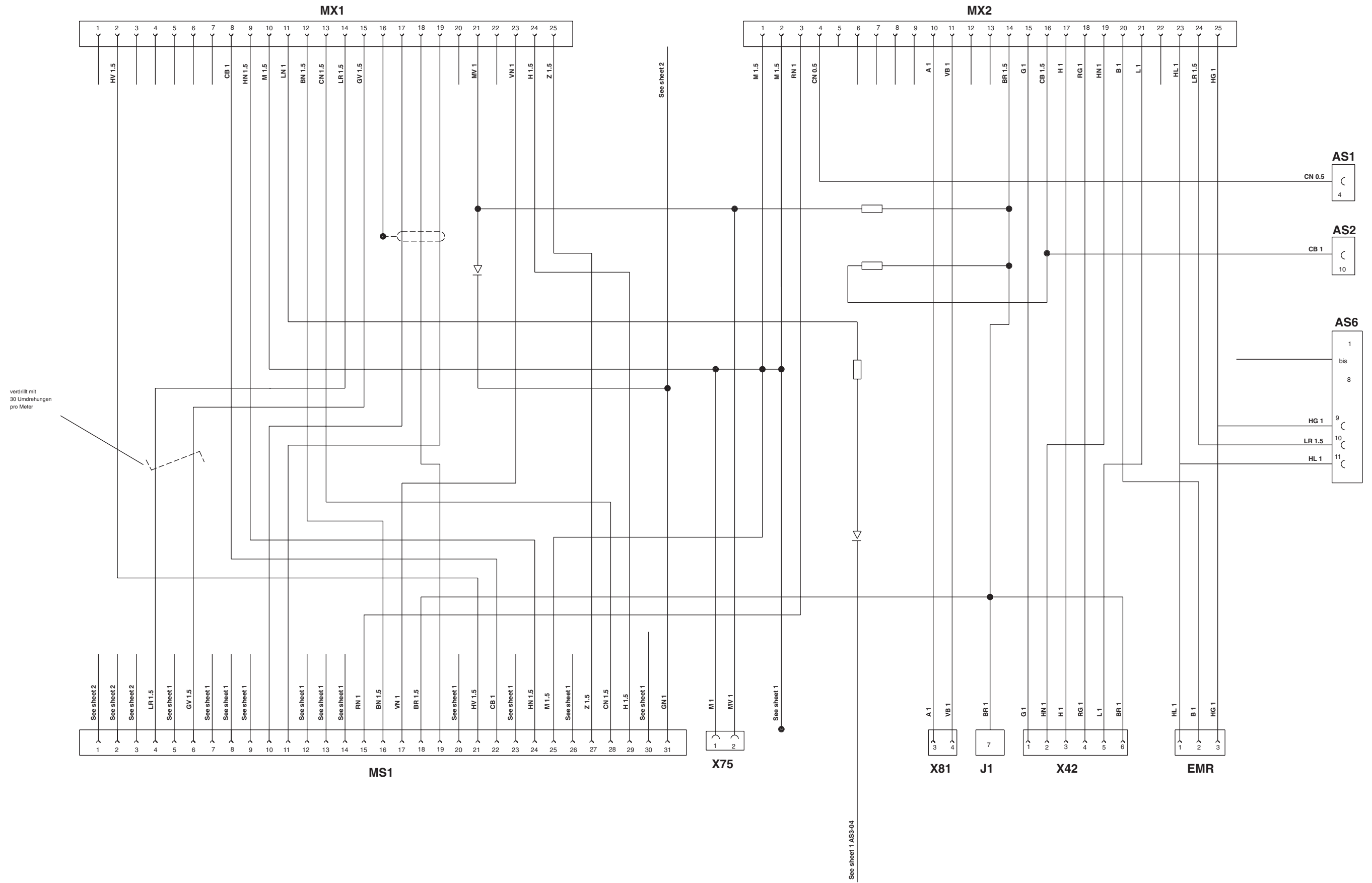
SIDE CONSOLE WIRING (POWER SHUTTLE) (2/4)



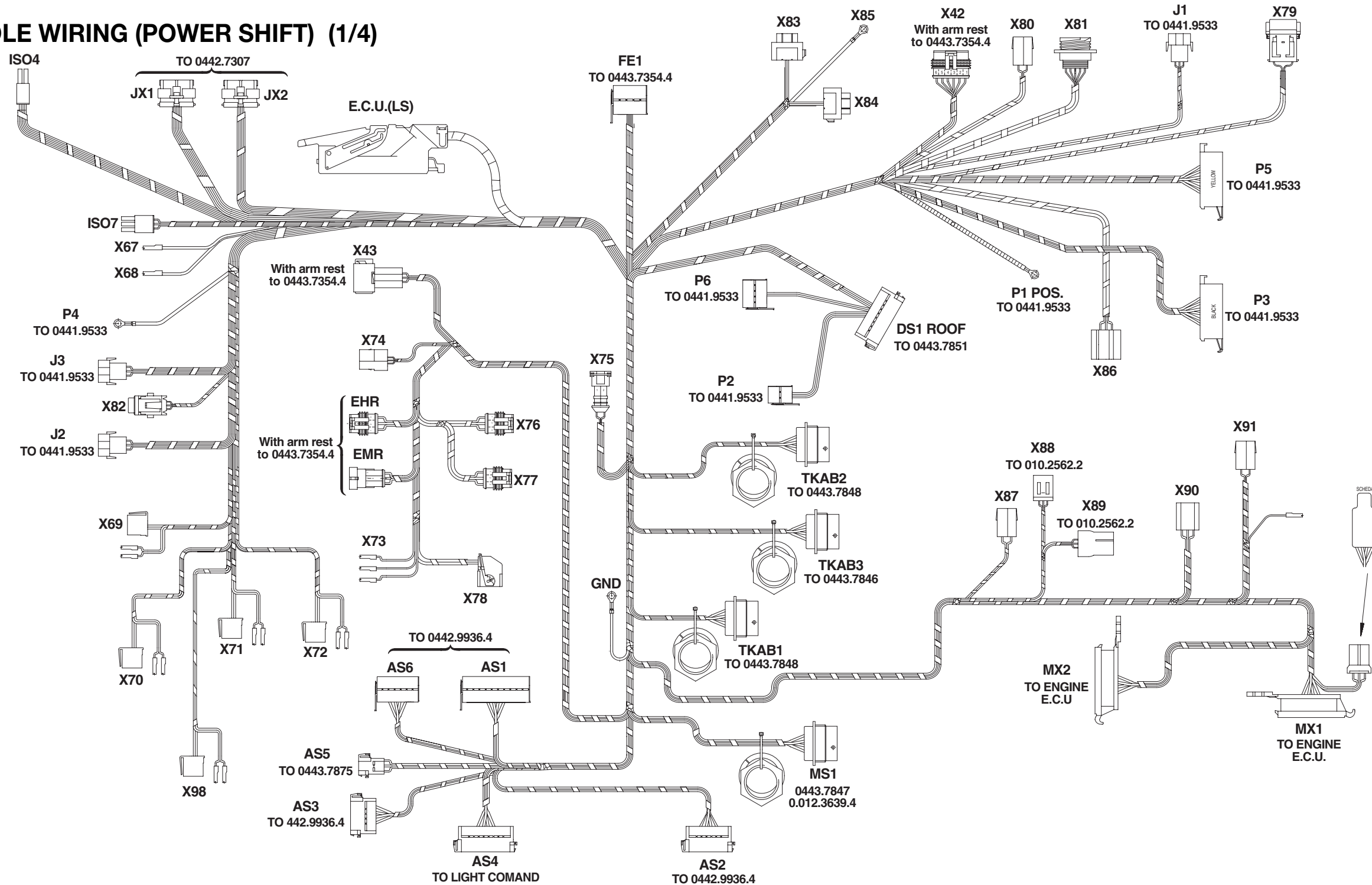
SIDE CONSOLE WIRING (POWER SHUTTLE) (3/4)



SIDE CONSOLE WIRING (POWER SHUTTLE) (4/4)

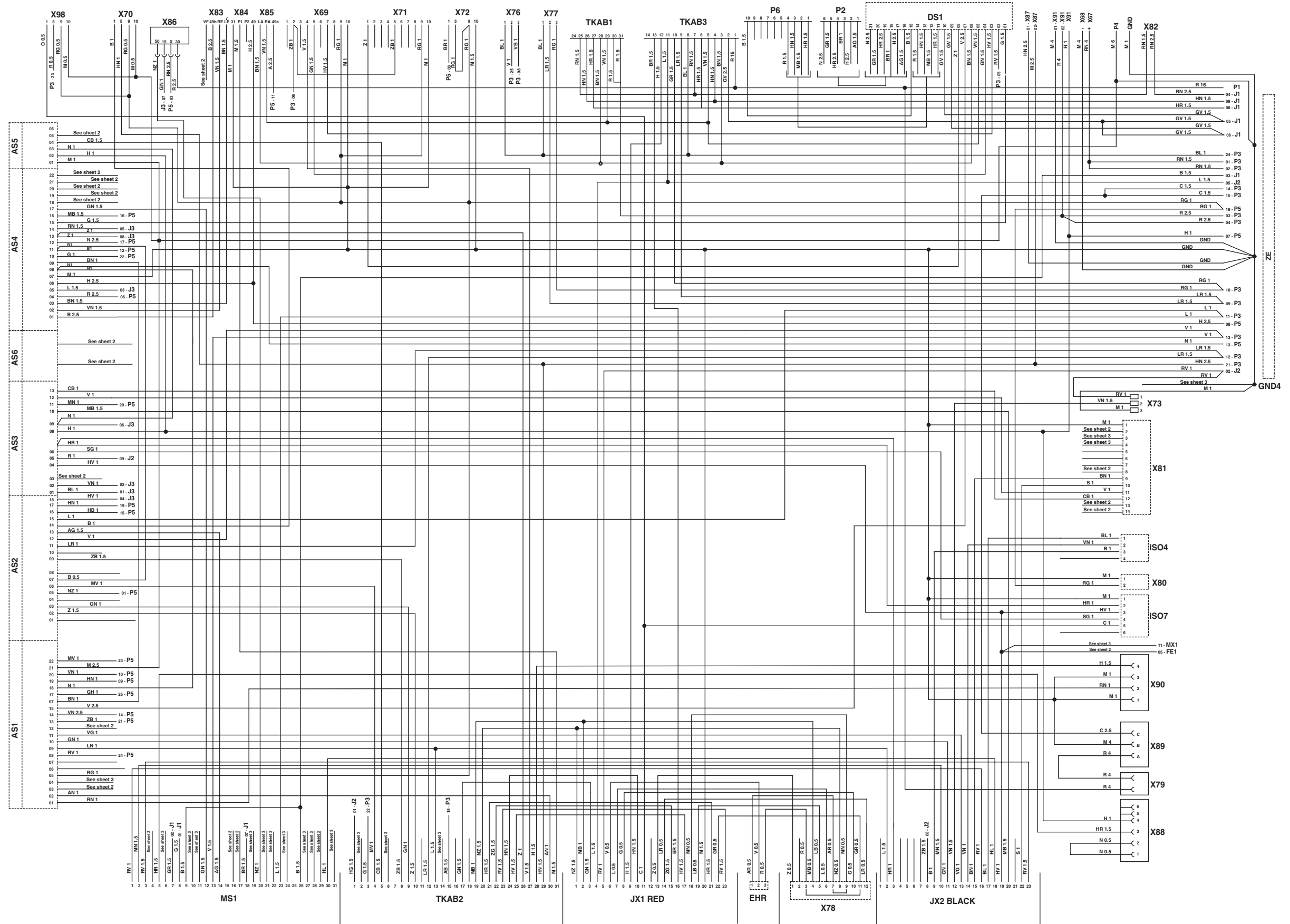


SIDE CONSOLE WIRING (POWER SHIFT) (1/4)

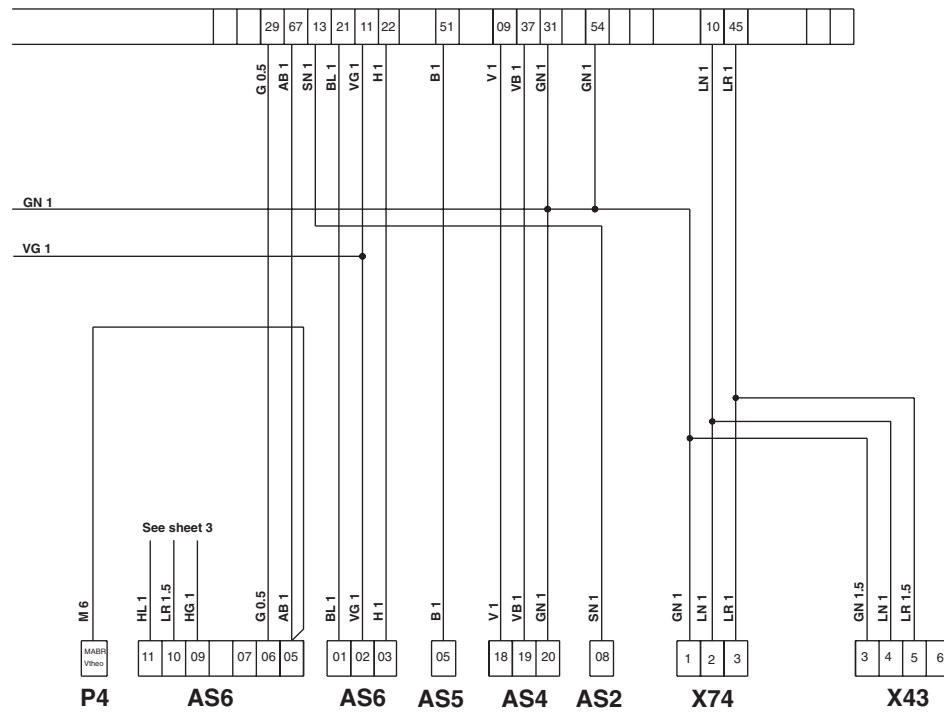
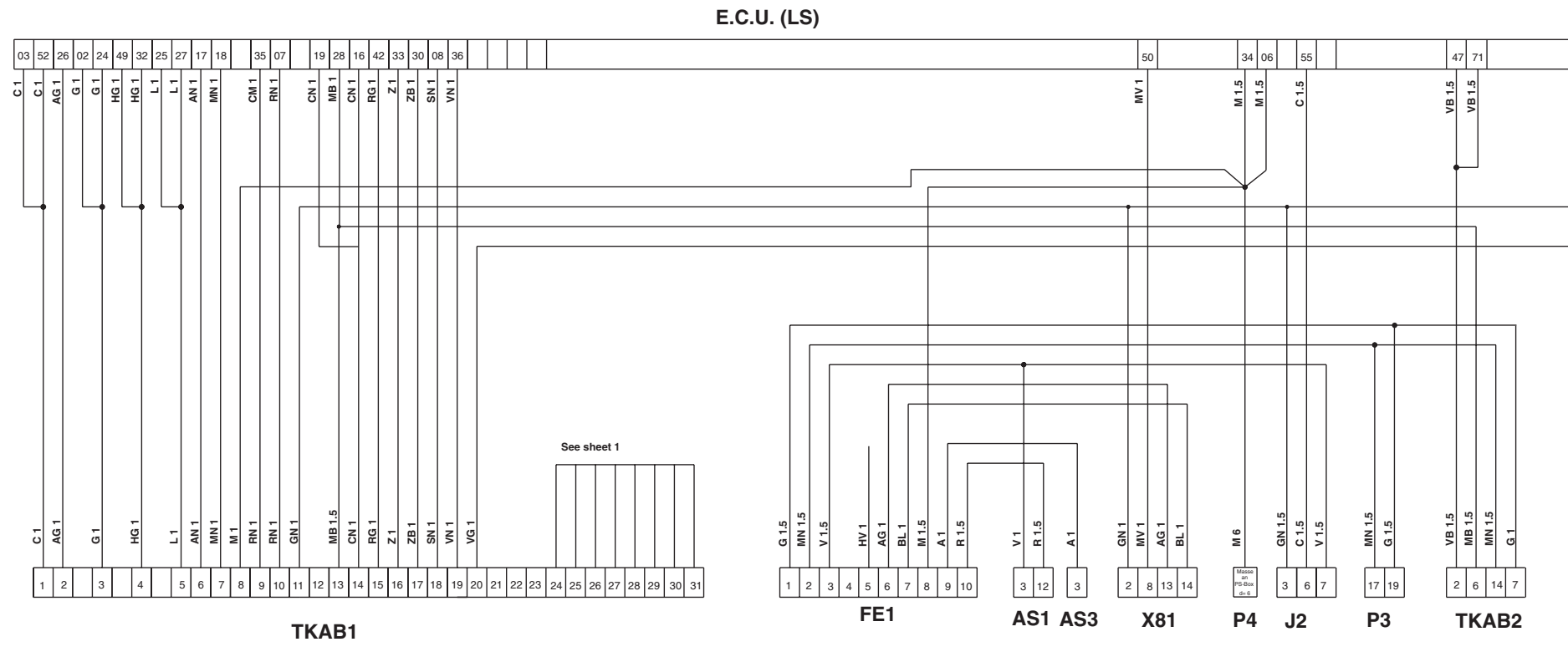


- | | | | | |
|---|-----------------------------------|--|---|--|
| AS1 To front console wiring | J1 To fuses plate | P6 To fuses plate | X74 Gearshift control pushbutton panel | X87 Compressor for driver's seat air suspension |
| AS2 To front console wiring | J2 To fuses plate | TKAB1 To transmission wiring | X75 Super-reduction engagement switch | X88 To air conditioner wiring (Cab) |
| AS3 To front console wiring | J3 To fuses plate | TKAB2 To transmission wiring | X76 Front PTO control pushbutton | X89 To air conditioner wiring (Cab) |
| AS4 Lights selector switch | JX1 Rear lift control unit | TKAB3 To cab power supply wiring | X77 Rear PTO control pushbutton | X90 Handbrake switch |
| AS5 To display wiring | JX2 Rear lift control unit | X42 Engine speed keypad | X78 Lift control lever | X91 Cigar lighter |
| AS6 To front console wiring | MS1 To engine wiring | X43 To armrest wiring | X79 Fuse F50 (30 A) | X98 PTO AUTO switch |
| DS1 To roof wiring | MX1 Engine control unit | X67 Auxiliary power socket (Earth) | X80 Supplementary power | |
| ECU LS Transmission control unit | MX2 Engine control unit | X68 Auxiliary power socket (Positive) | X81 Diagnostics connector | |
| EHR Lift control lever | P1 To fuses plate | X69 Rear screen wiper switch | X82 Fuse (15 A) | |
| EMR Throttle lever | P2 To fuses plate | X70 Clean Fix control switch | X83 Direction indicators flasher unit | |
| FE1 To cab front suspension ECU | P3 To fuses plate | X71 Rotating beacon control switch | X84 Direction indicators flasher unit | |
| ISO4 Socket (Power for external implements) | P4 To fuses plate | X72 Rear worklights switch | X85 Direction indicators flasher unit | |
| ISO7 Socket (Connection for external implements) | P5 To fuses plate | X73 Radar control switch | X86 Starter switch | |

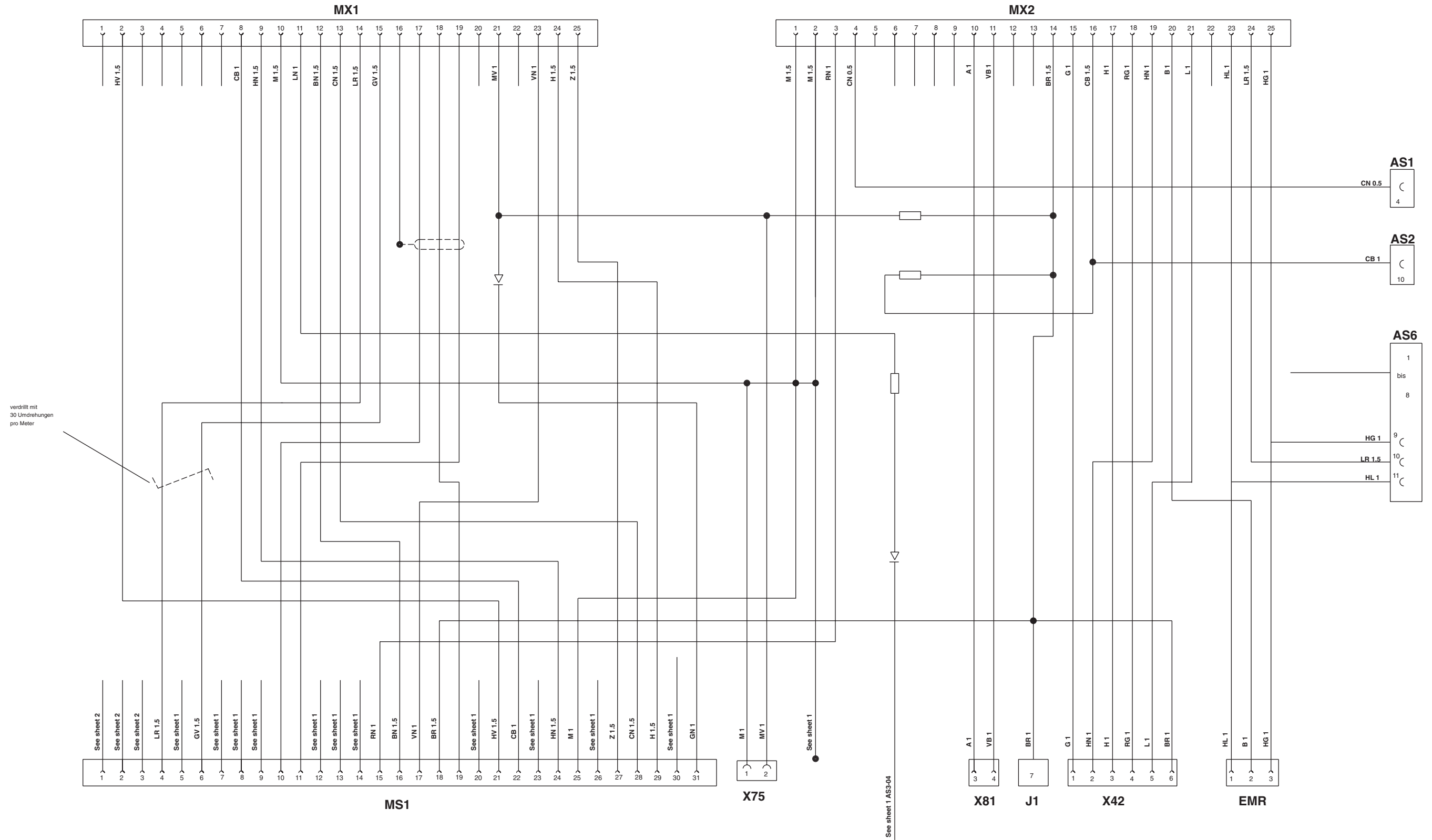
SIDE CONSOLE WIRING (POWER SHIFT) (2/4)



SIDE CONSOLE WIRING (POWER SHIFT) (3/4)

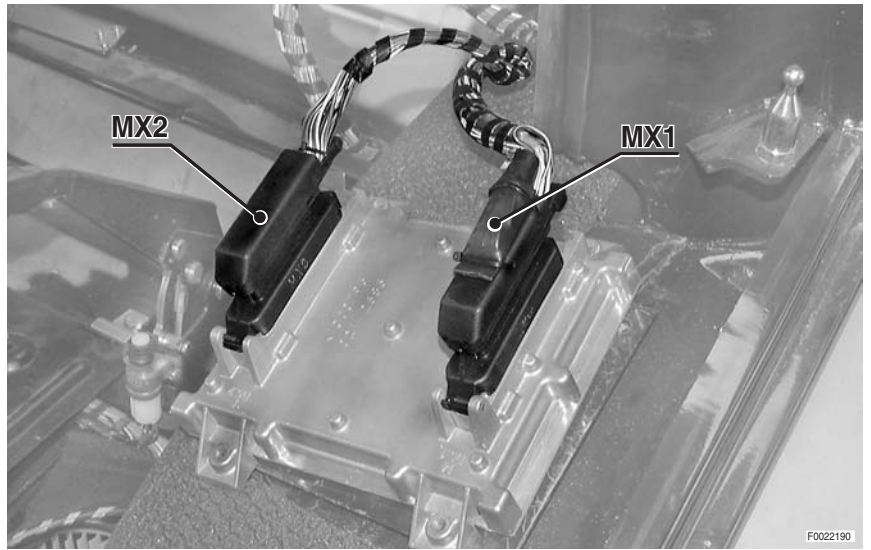


SIDE CONSOLE WIRING (POWER SHIFT) (4/4)

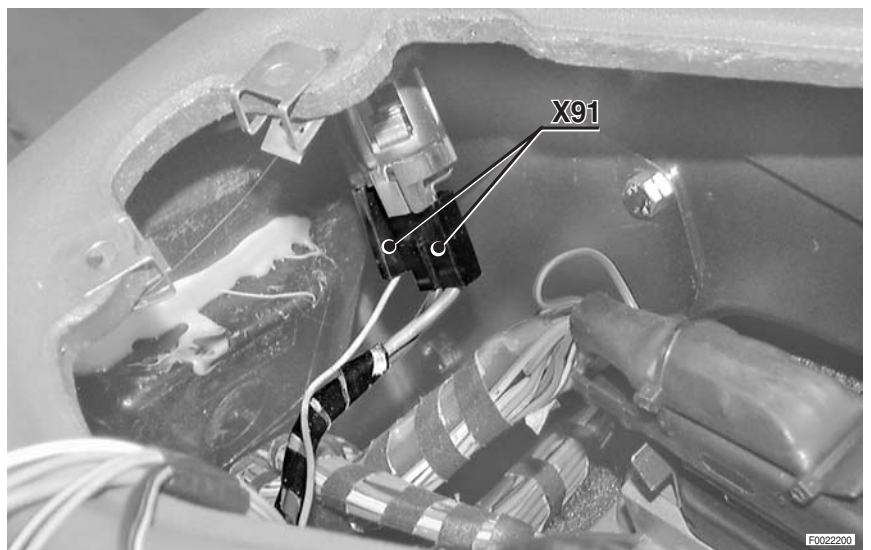


SIDE CONSOLLE CONNECTORS LOCATION

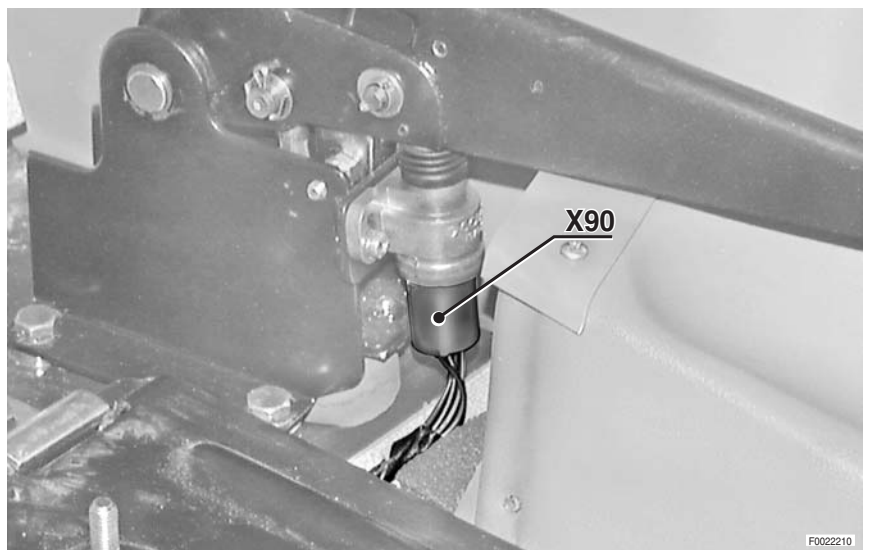
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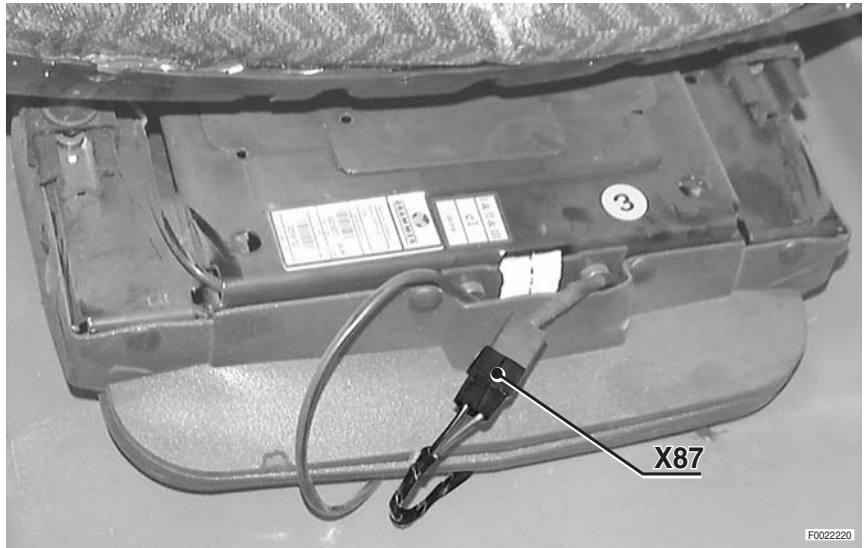
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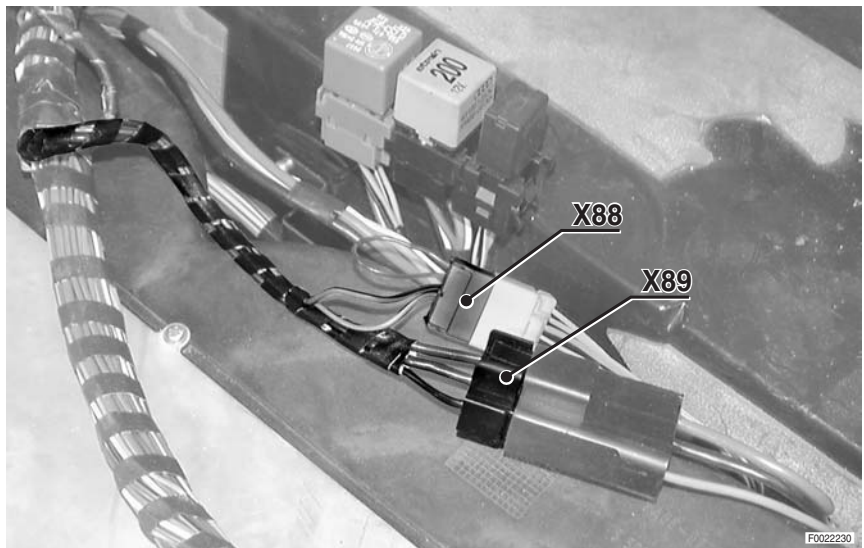
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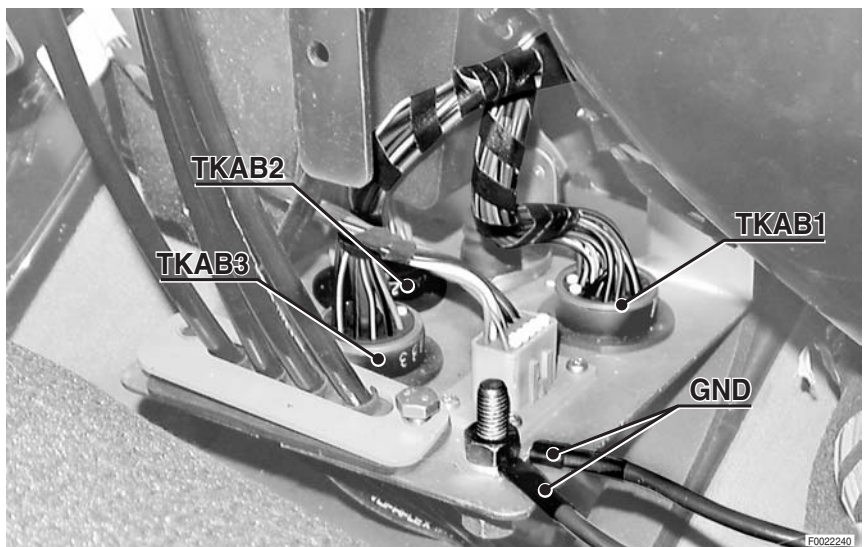
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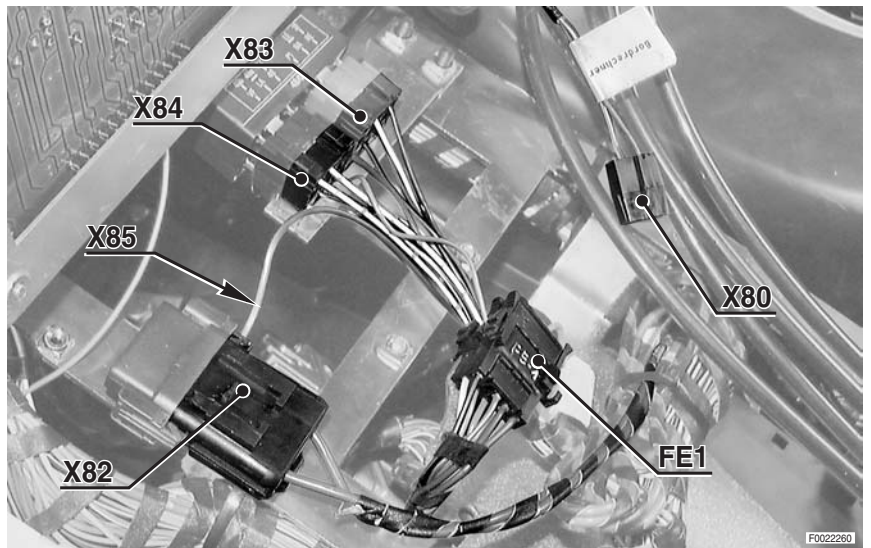
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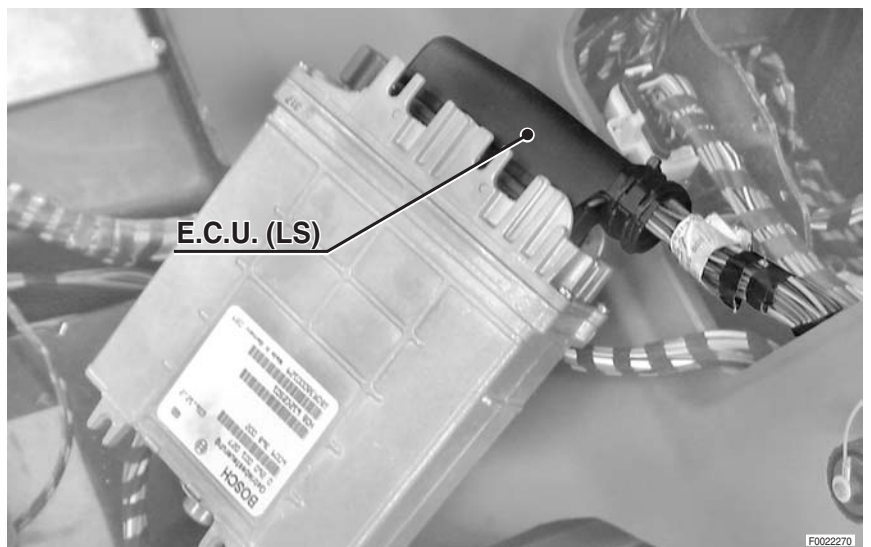
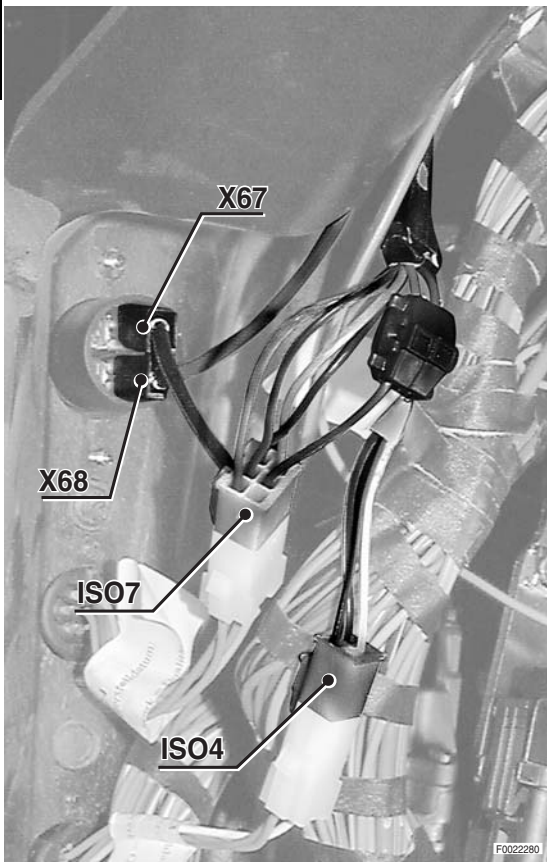


PHOTO SHOWS
THE POWER SHUTTLE
VERSION

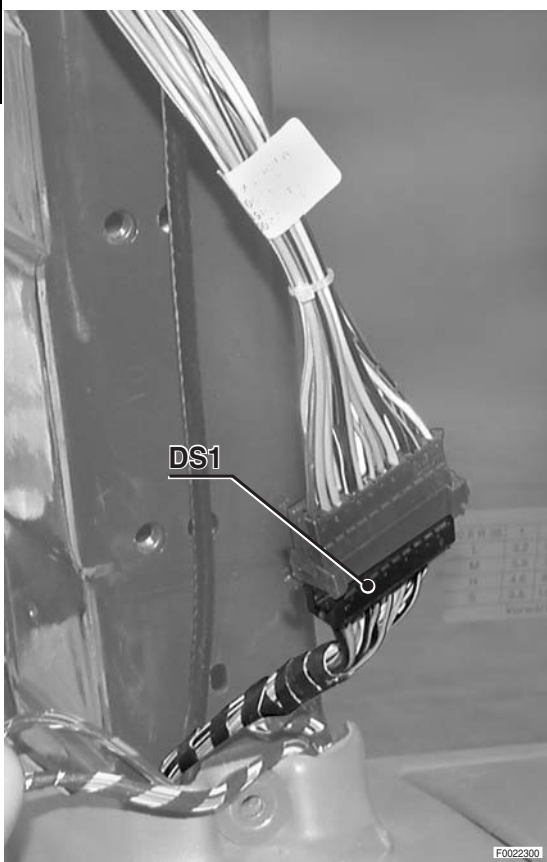
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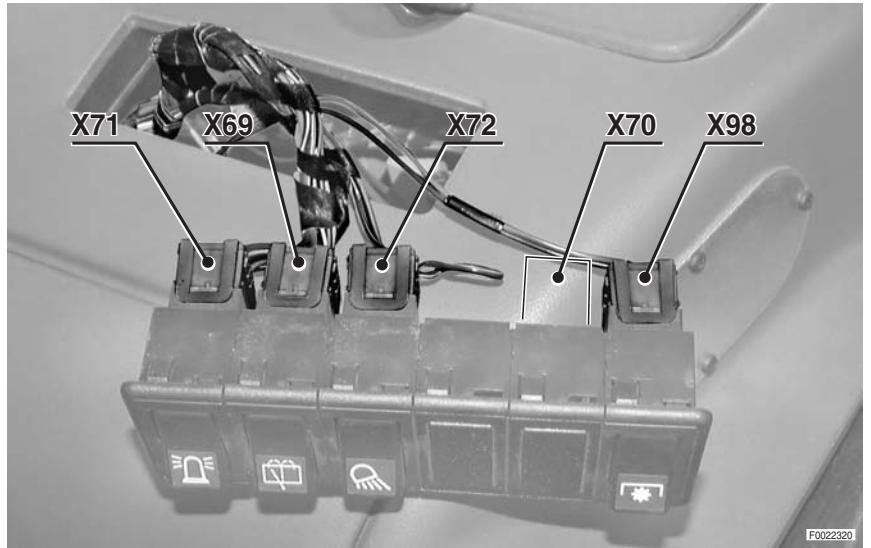
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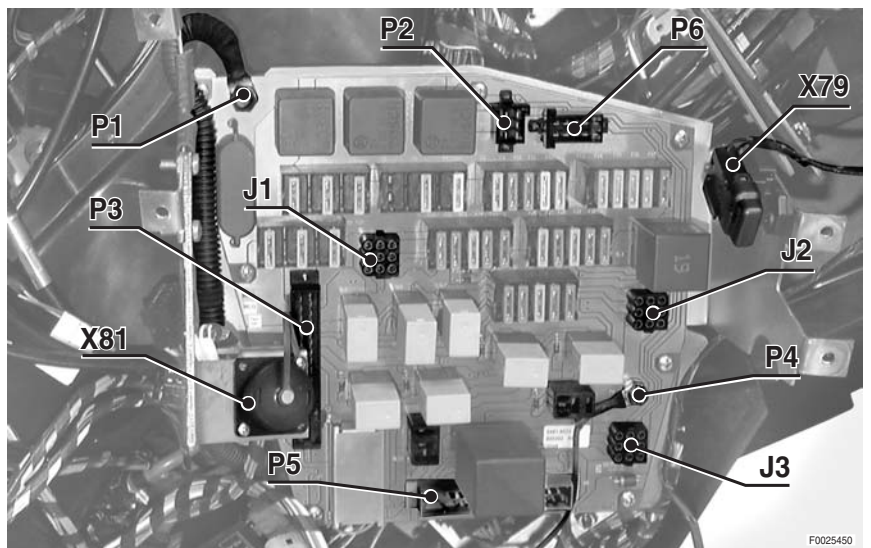
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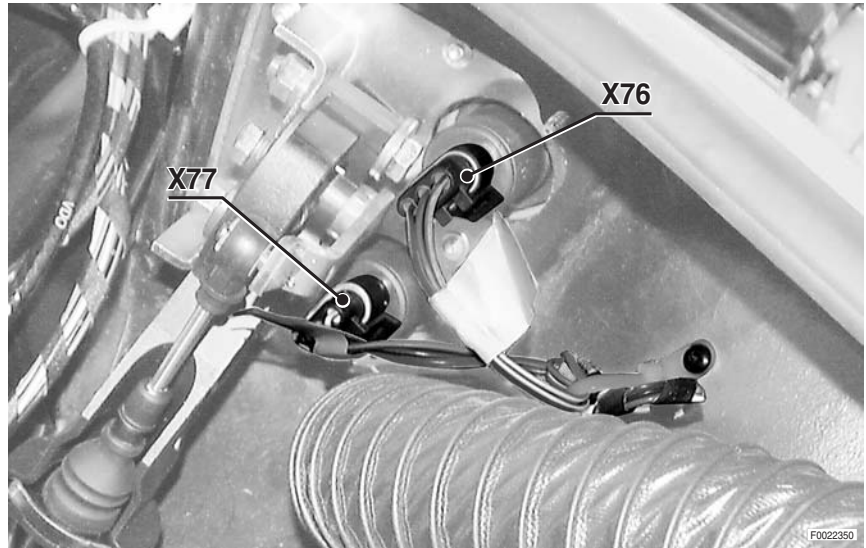
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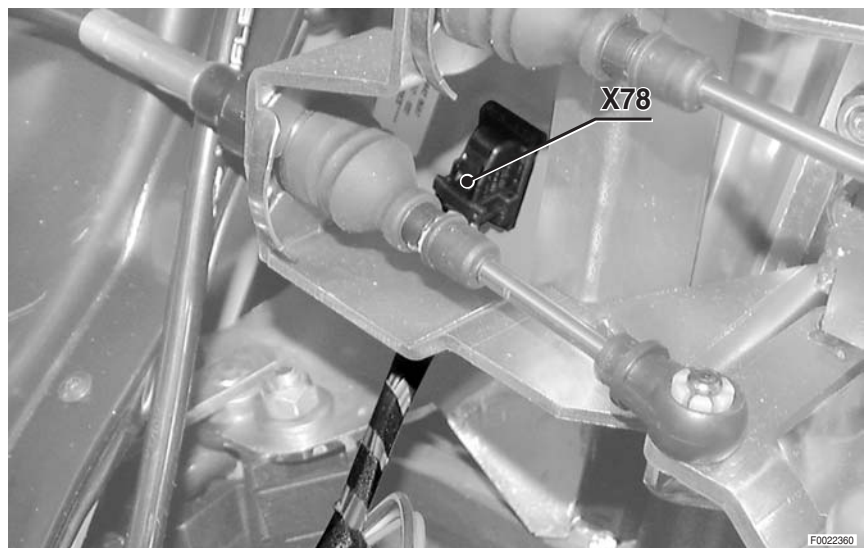
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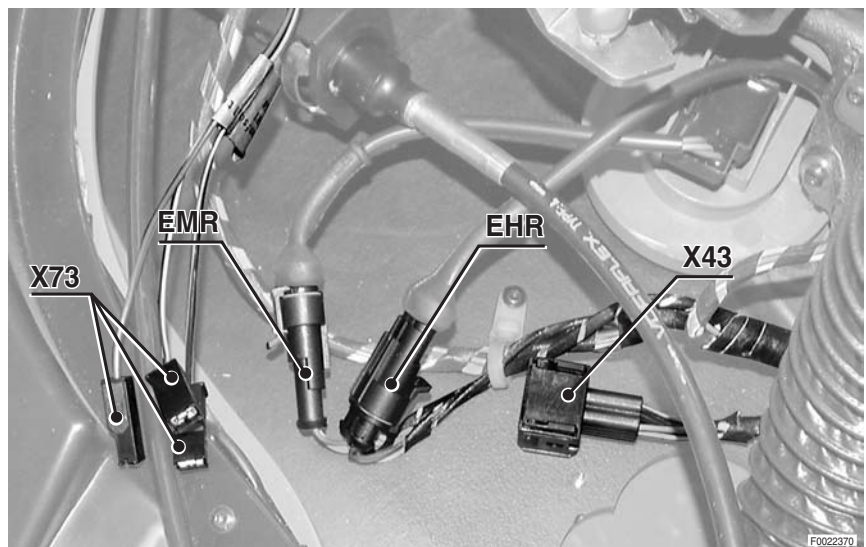
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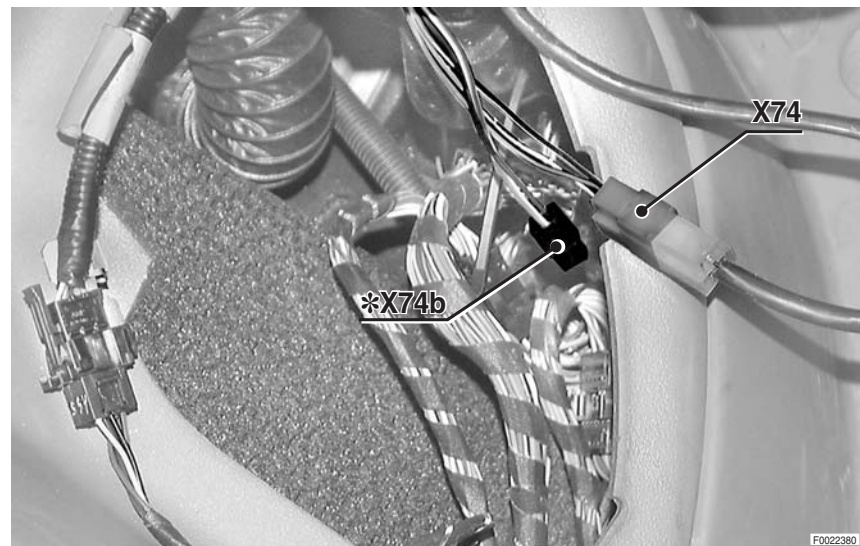
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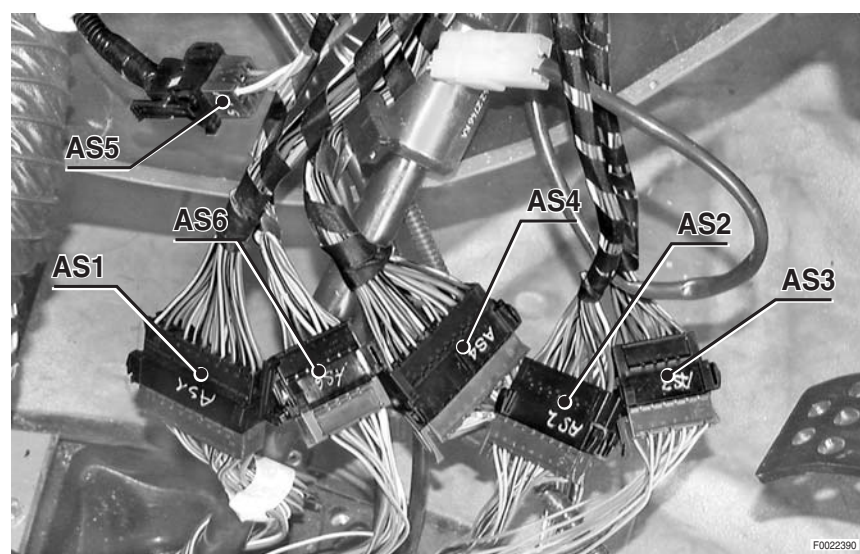


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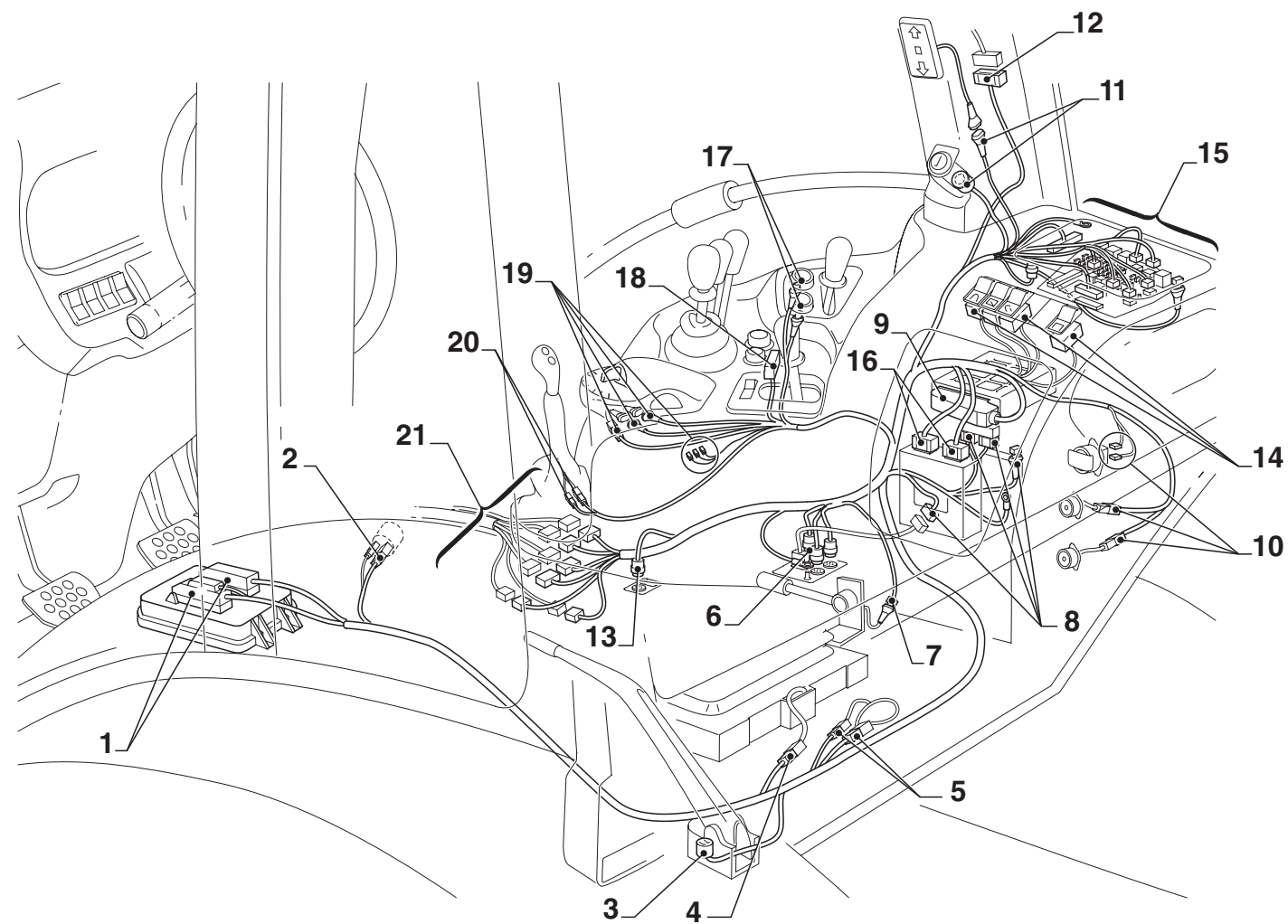


X74b: NOT USED

21

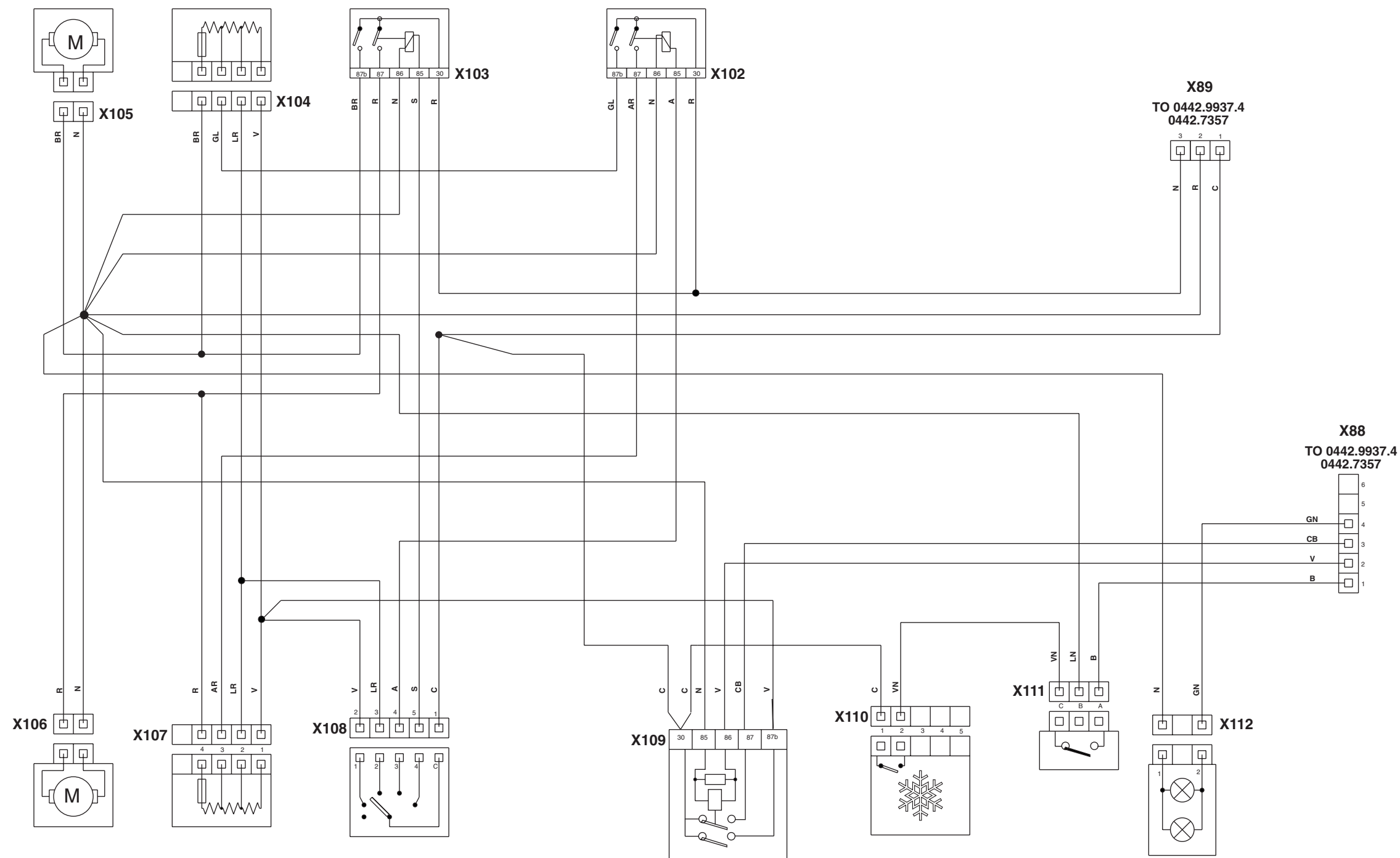


SIDE CONSOLE WIRING



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AIR CONDITIONING WIRING (CAB)



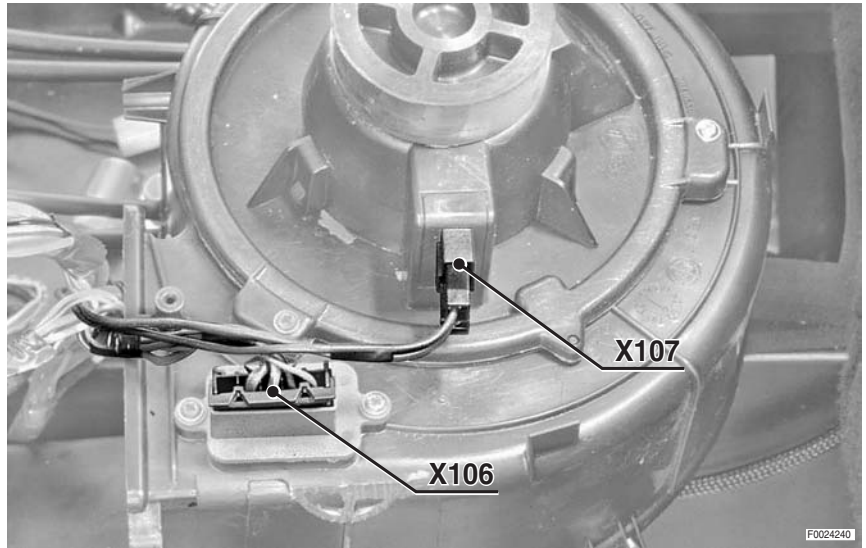
- X88** To side console wiring
- X89** To side console wiring
- X102** Relay - 3rd heater fan speed
- X103** Relay - 4th heater fan speed
- X104** Resistor - left heater fan
- X105** Left heater fan
- X106** Right heater fan

- X107** Resistor - right heater fan
- X108** Fan speed selector switch
- X109** Relay -1st heater fan and air conditioning on
- X110** Air conditioning control switch
- X111** Air conditioning thermostat
- X112** Connector for air conditioning control panel lights

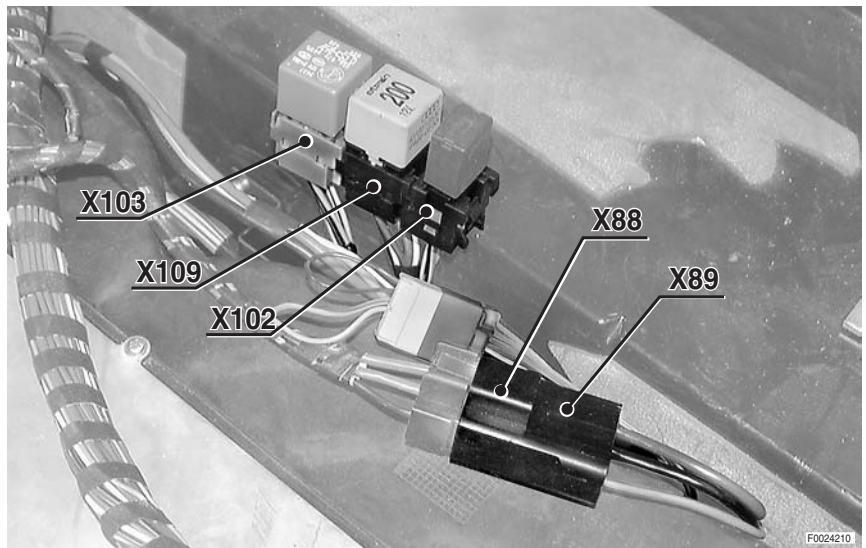
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AIR CONDITIONING CONNECTORS LOCATION

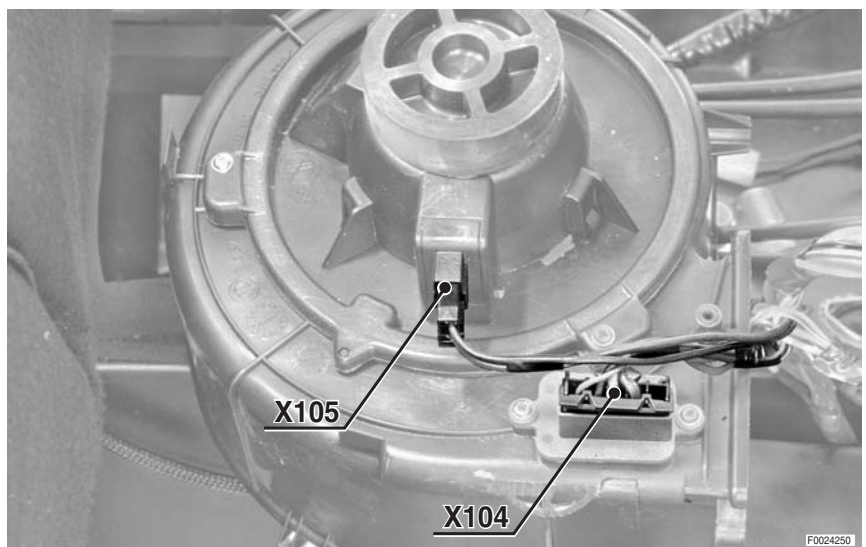
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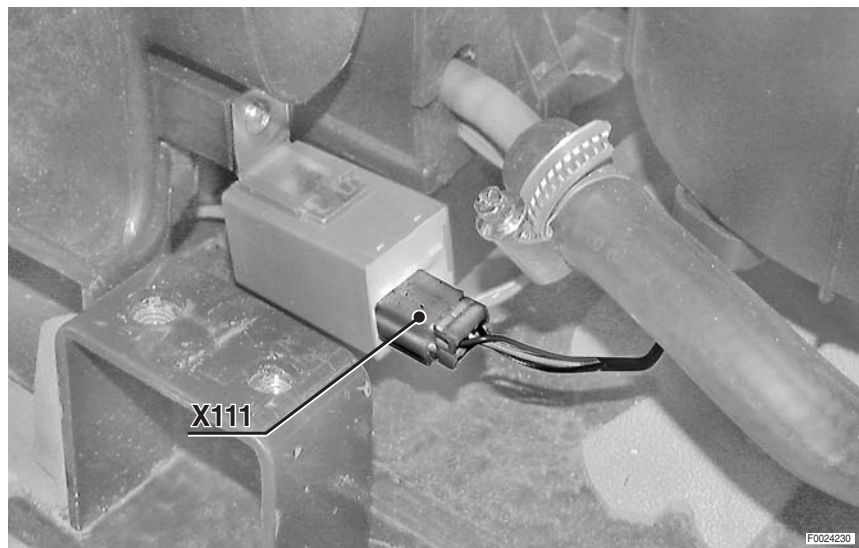
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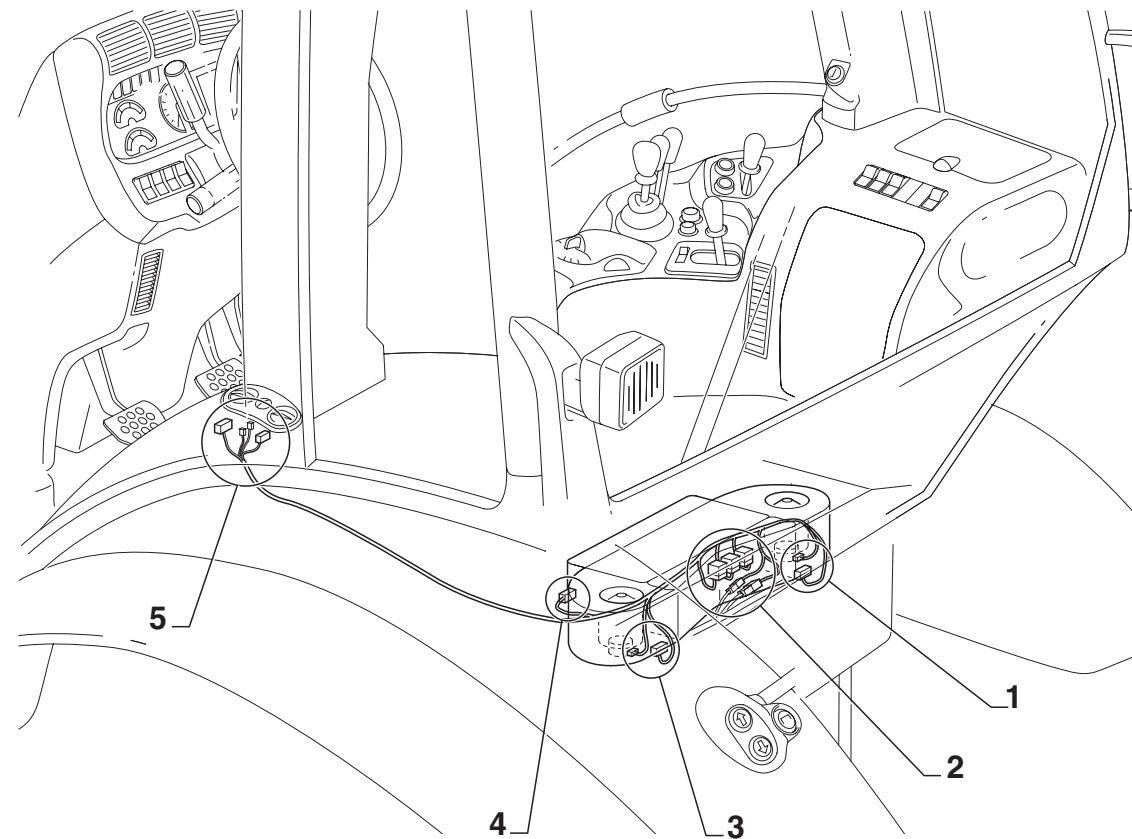
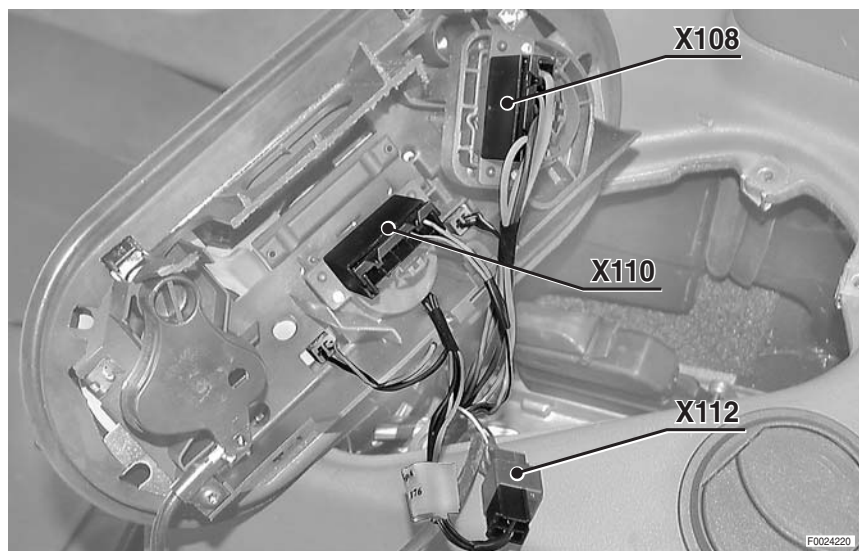
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AIR CONDITIONING WIRING

4

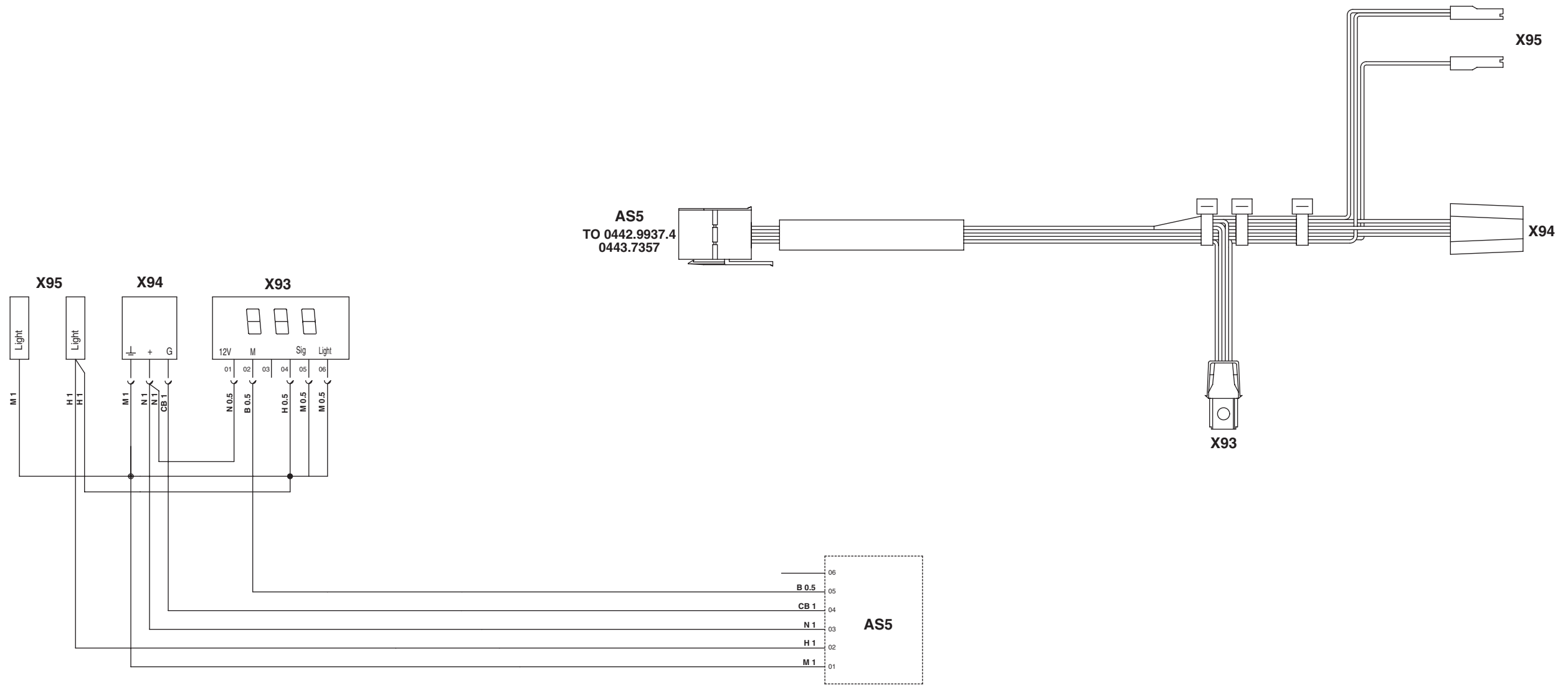


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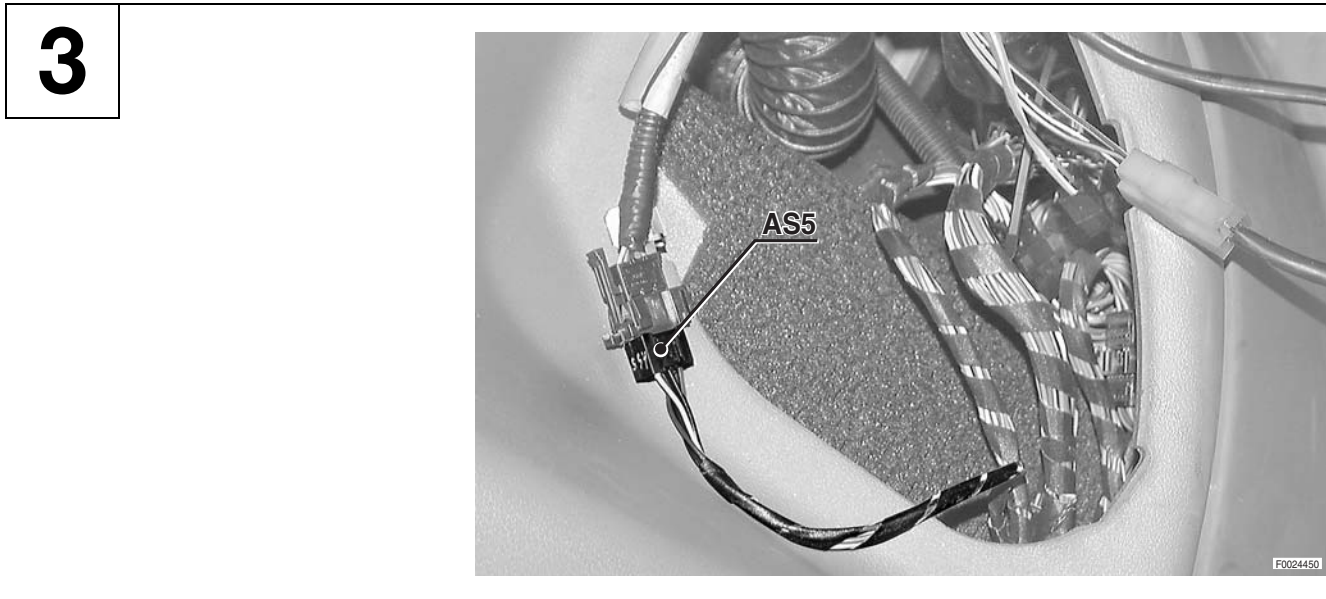
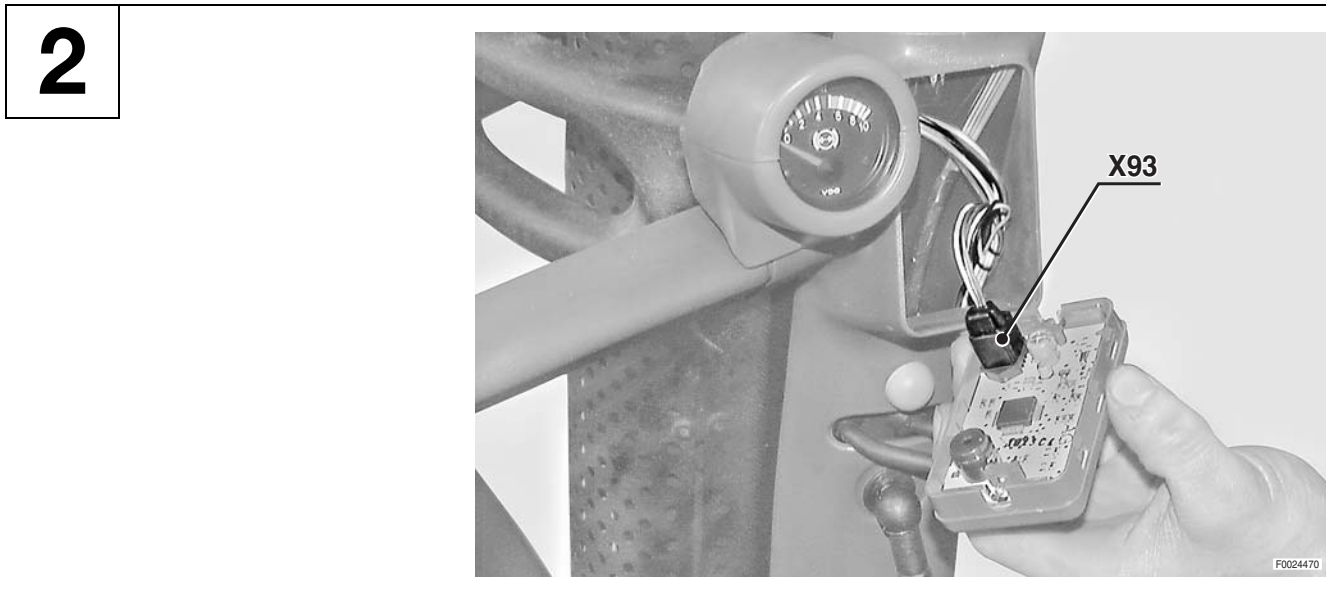
DISPLAY WIRING



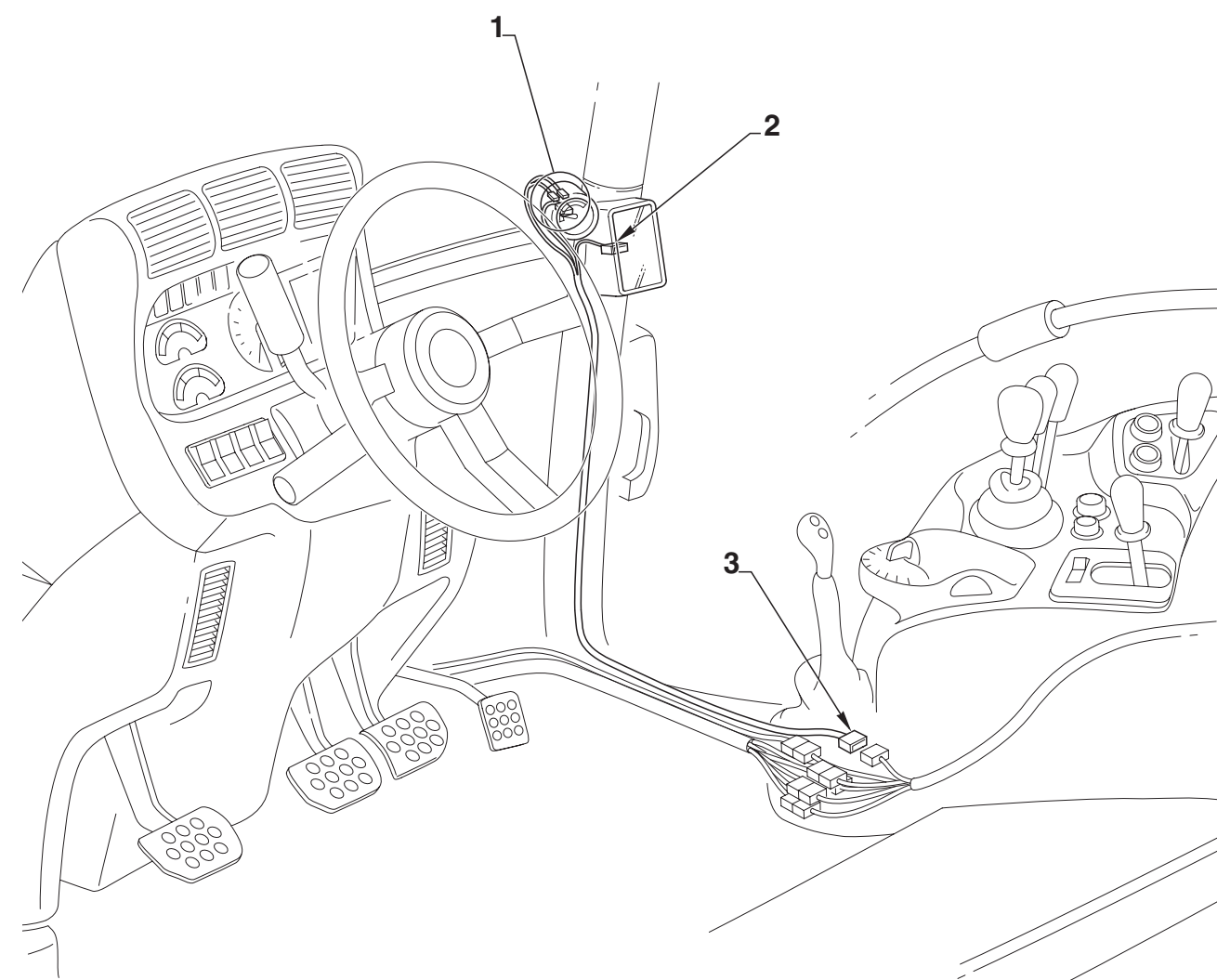
- AS5 To side console wiring
- X93 Display
- X94 Compressed air pressure gauge
- X95 Compressed air pressure gauge light

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CONNECTORS LOCATION

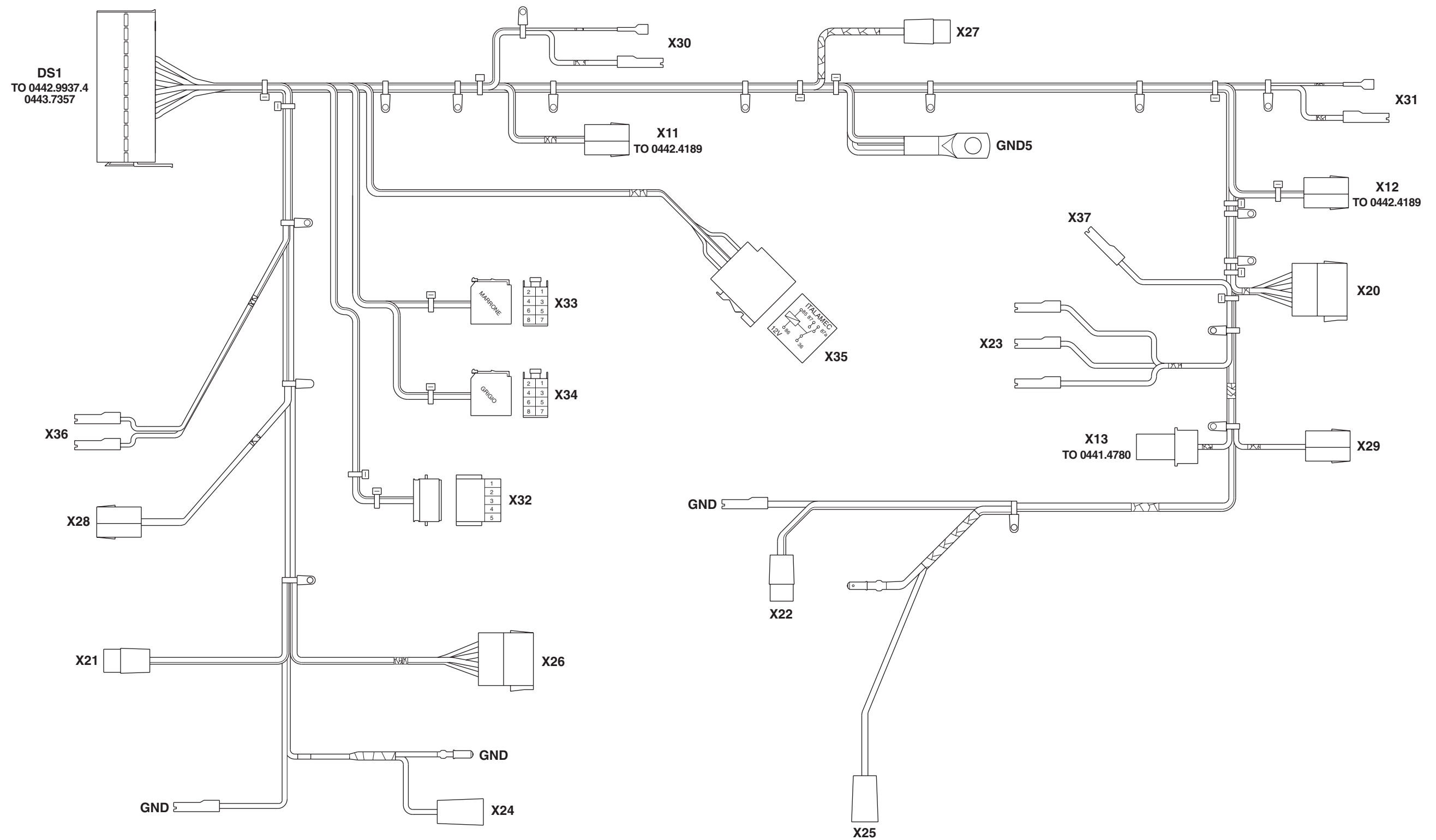


DISPLAY WIRING



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ROOF WIRING (1/2)

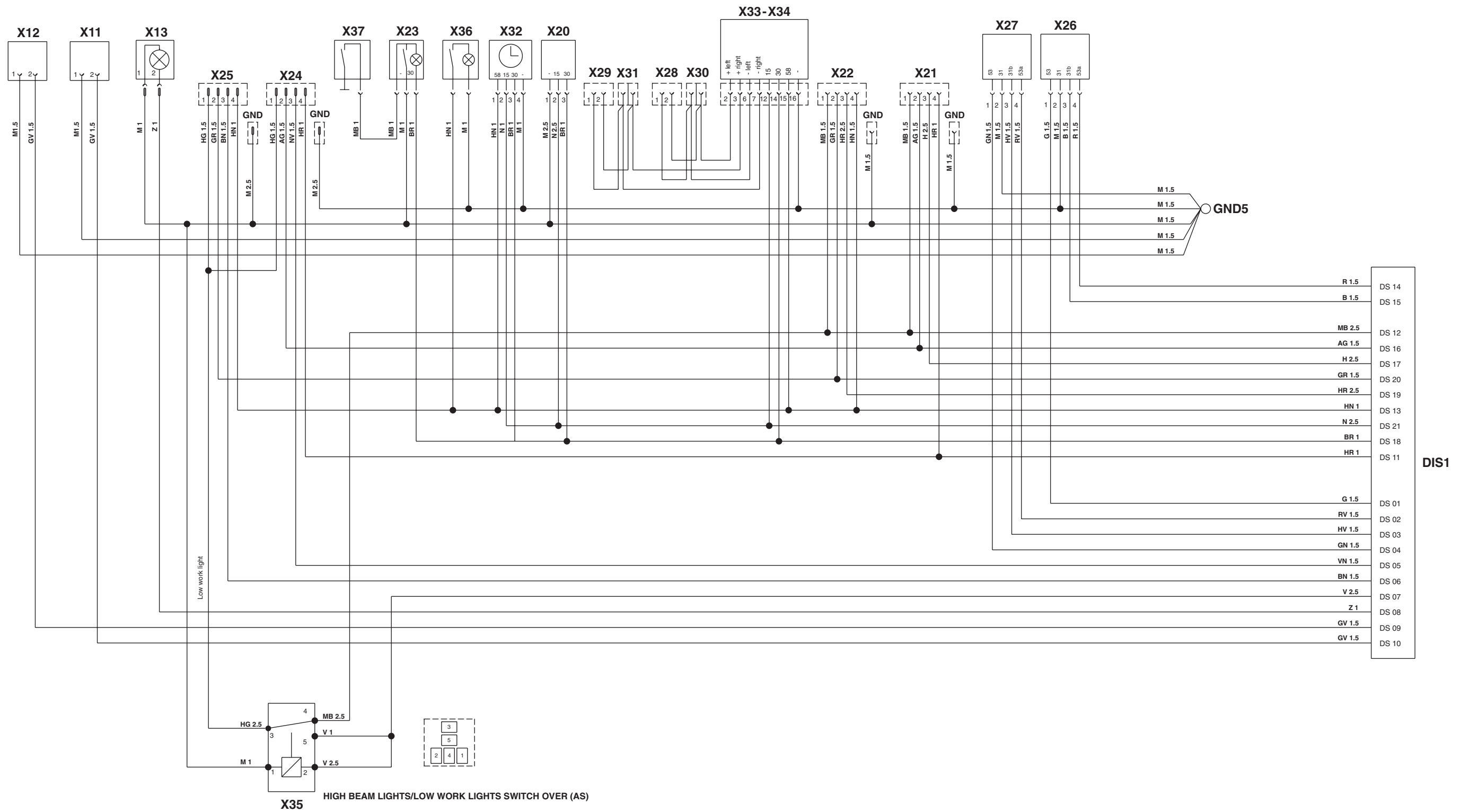


- DS1** To side console wiring
- X11** To worklights wiring
- X12** To worklights wiring
- X13** To roof wiring
- X20** CB connector
- X21** Front right worklight
- X22** Front left worklight
- X23** Interior roof light

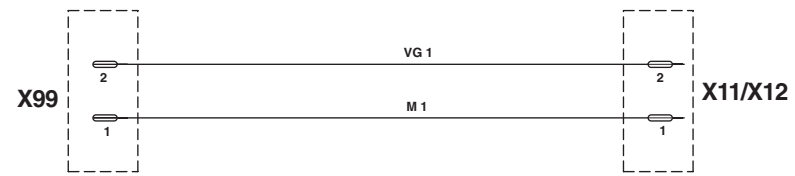
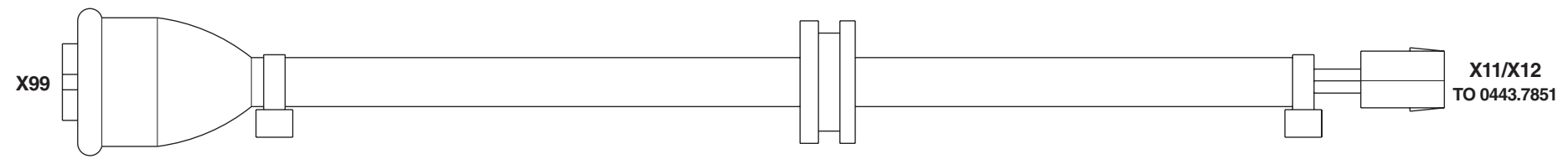
- X24** Front right sidelight and direction indicator
- X25** Front left sidelight and direction indicator
- X26** Windscreen wiper motor
- X27** Rear screen wiper motor
- X28** Right front loudspeaker
- X29** Left front loudspeaker
- X30** Right rear loudspeaker
- X31** Left rear loudspeaker

- X32** Clock
- X33** Radio (brown)
- X34** Radio (grey)
- X35** Relay - upper front worklights
- X36** Side console courtesy light
- X37** Door open warning signal switch

ROOF WIRING (2/2)



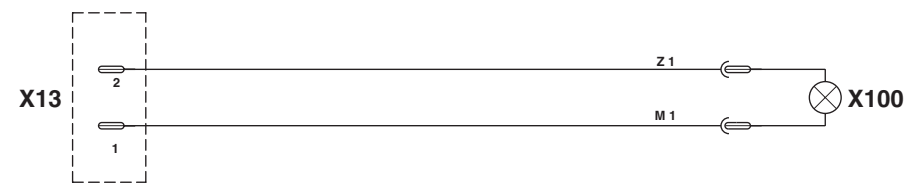
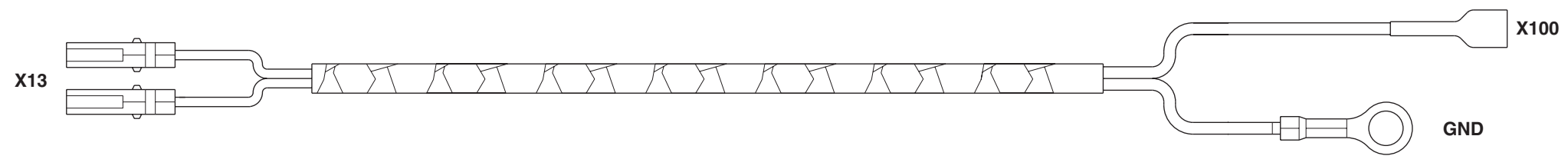
WORKLIGHTS WIRING



- X11 To roof wiring
- X12 To roof wiring
- X99 Rear upper worklights

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ROTATING BEACON WIRING

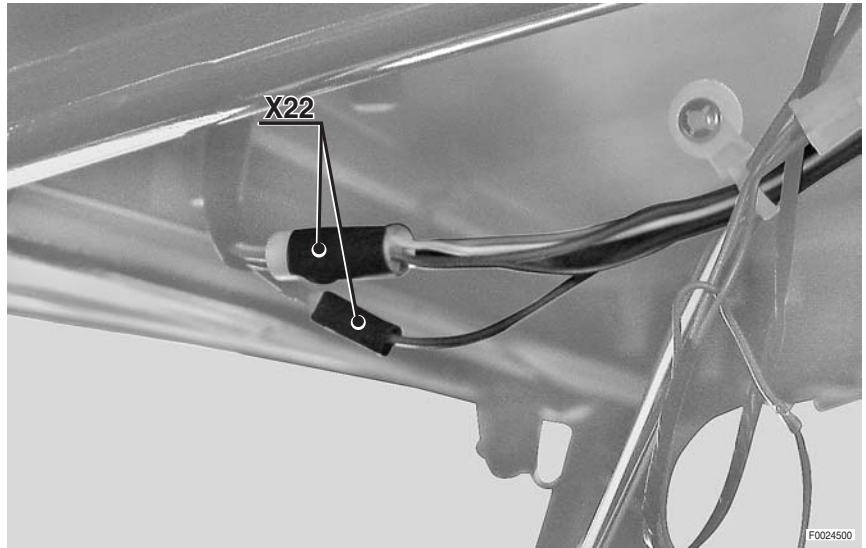


X13 To roof wiring
X100 Rotating beacon

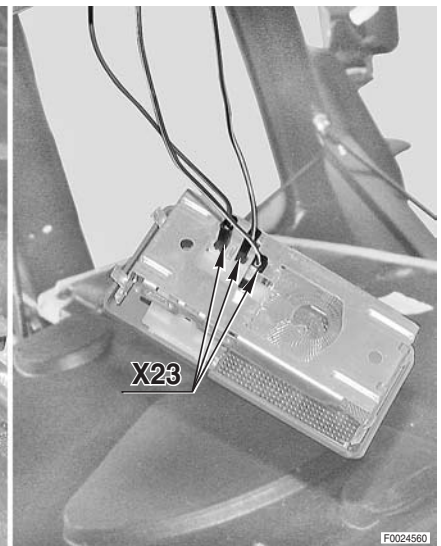
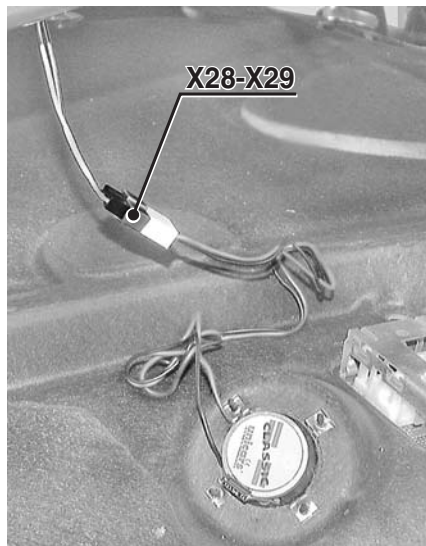
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ROOF CONNECTORS LOCATION

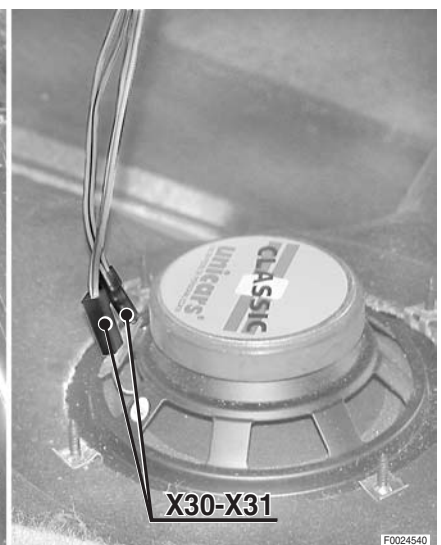
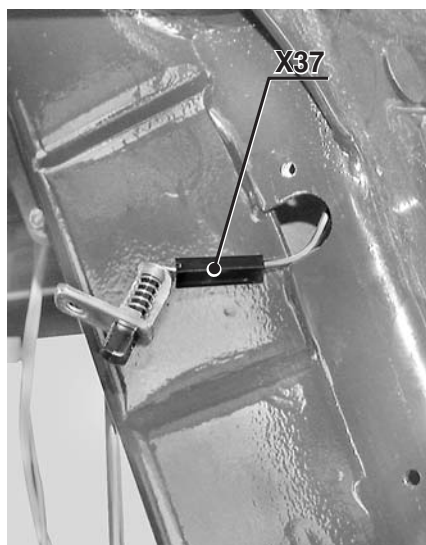
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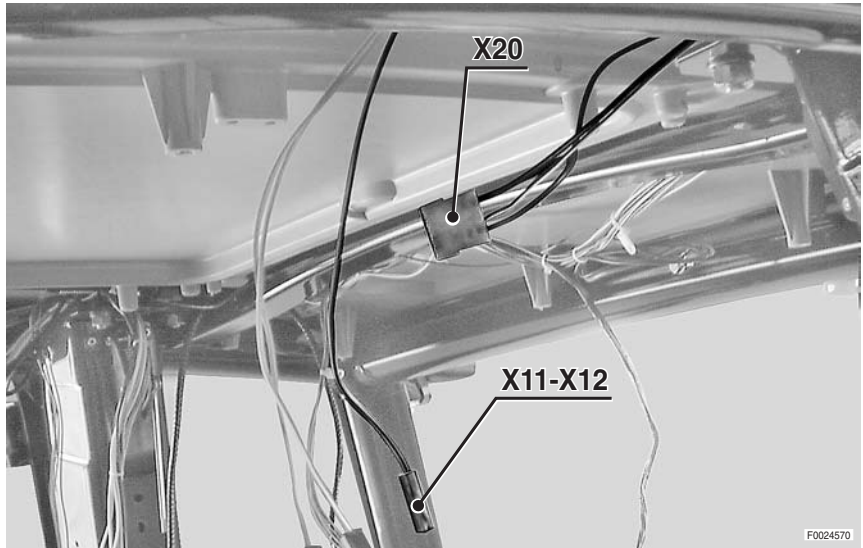
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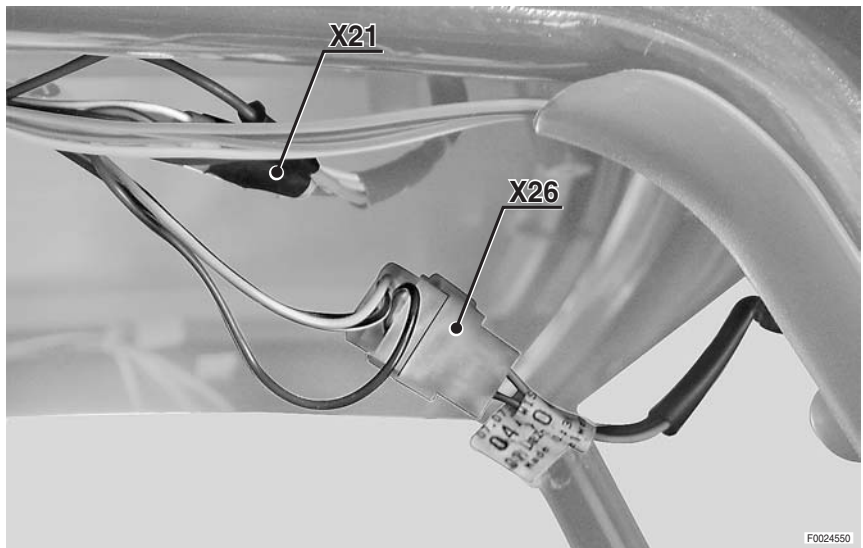


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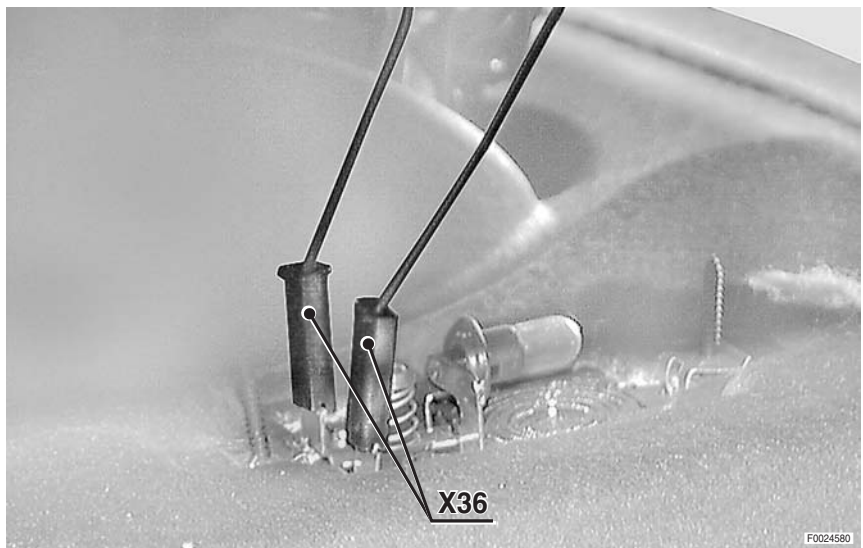
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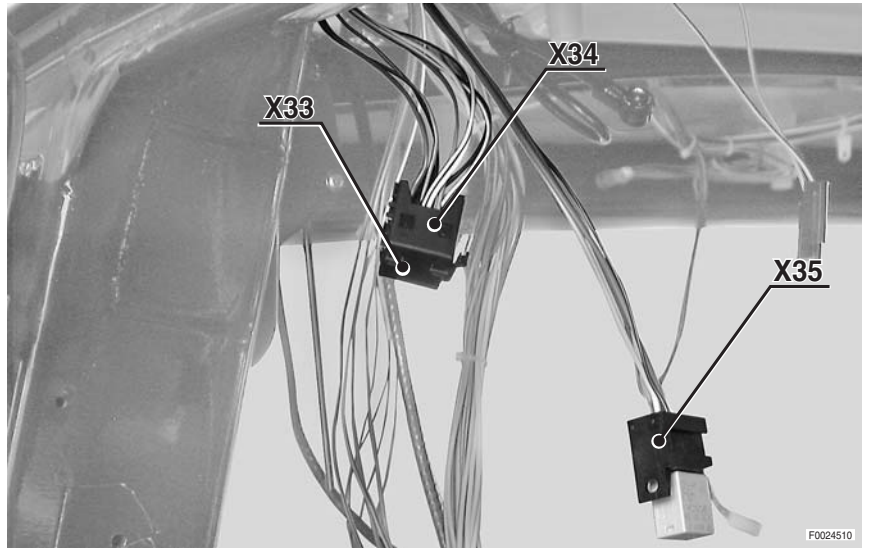
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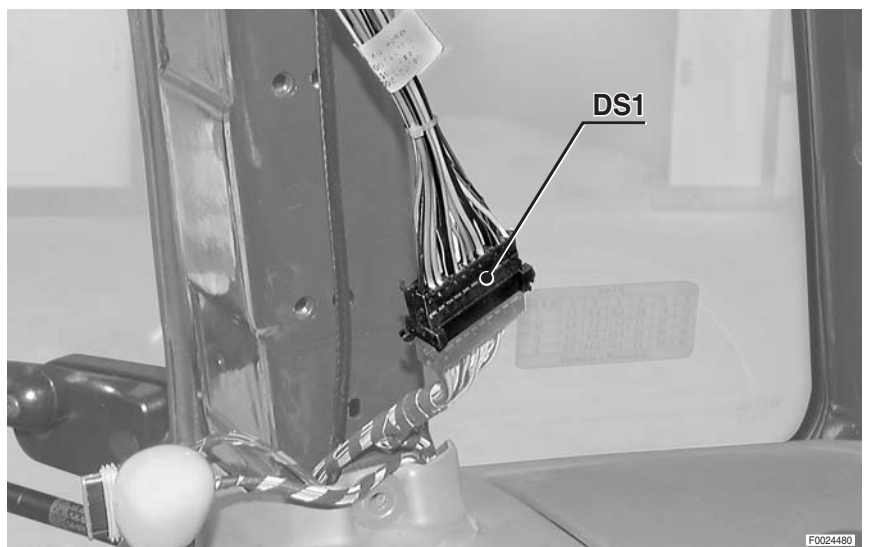
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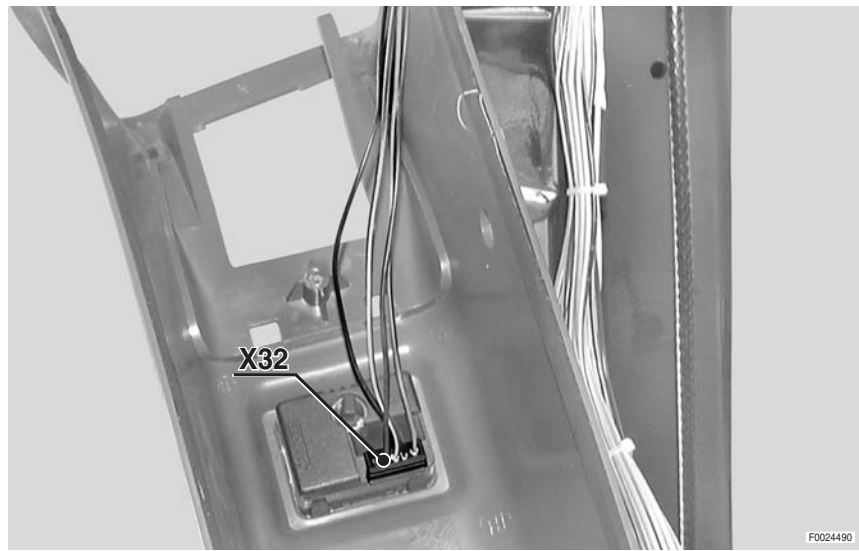


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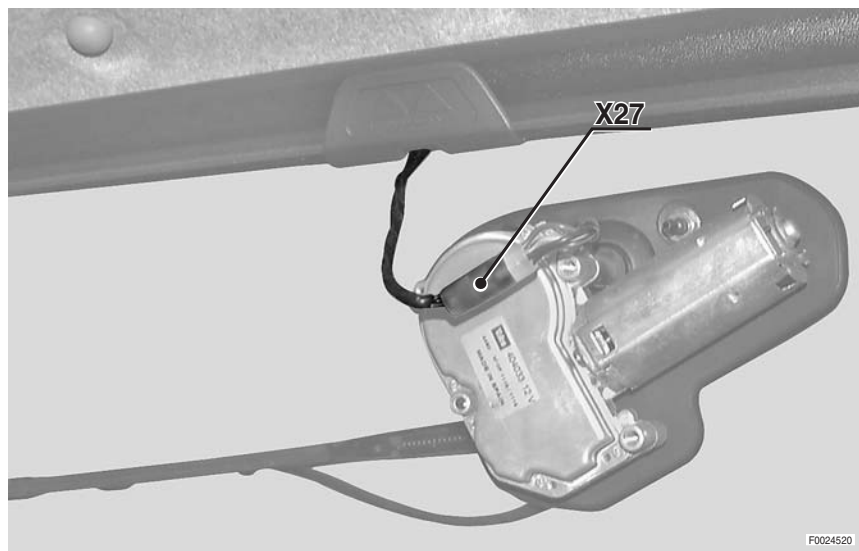


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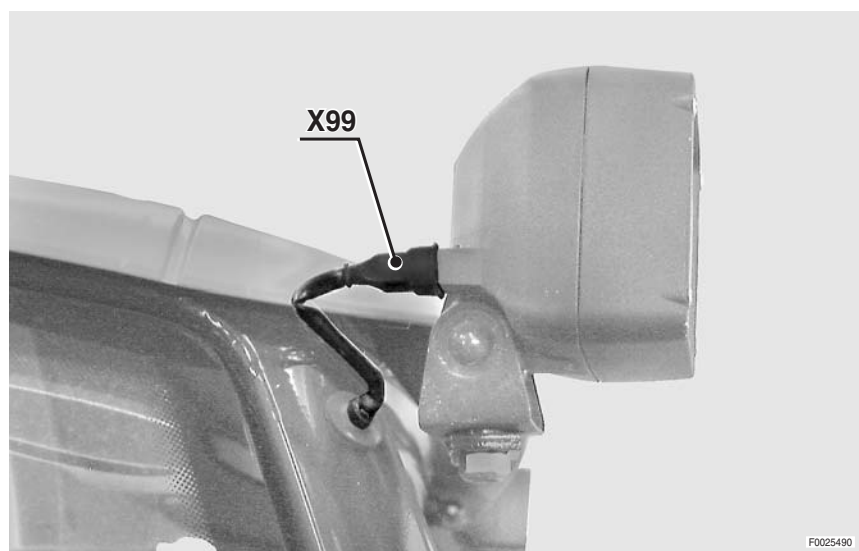
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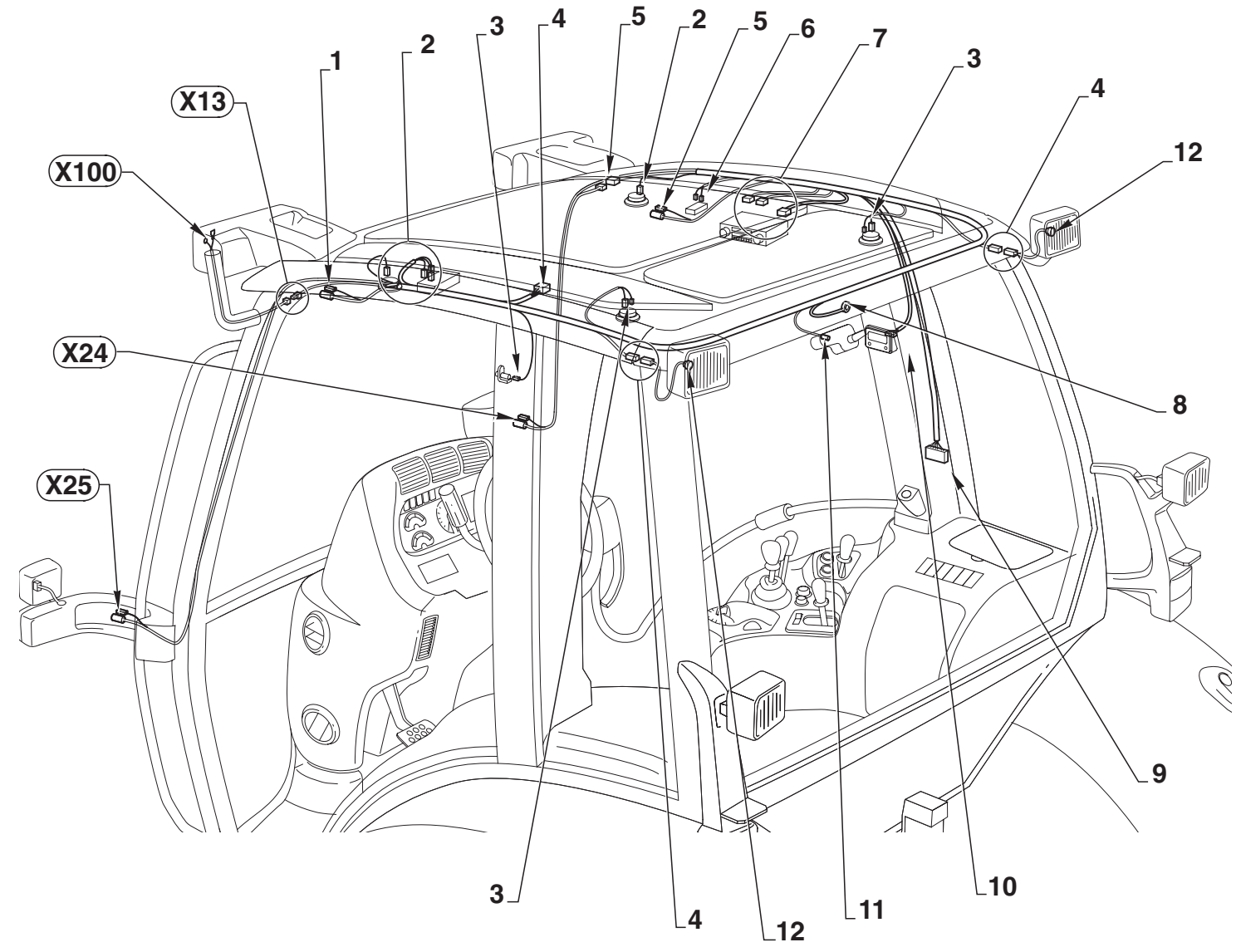
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12



ROOF WIRING

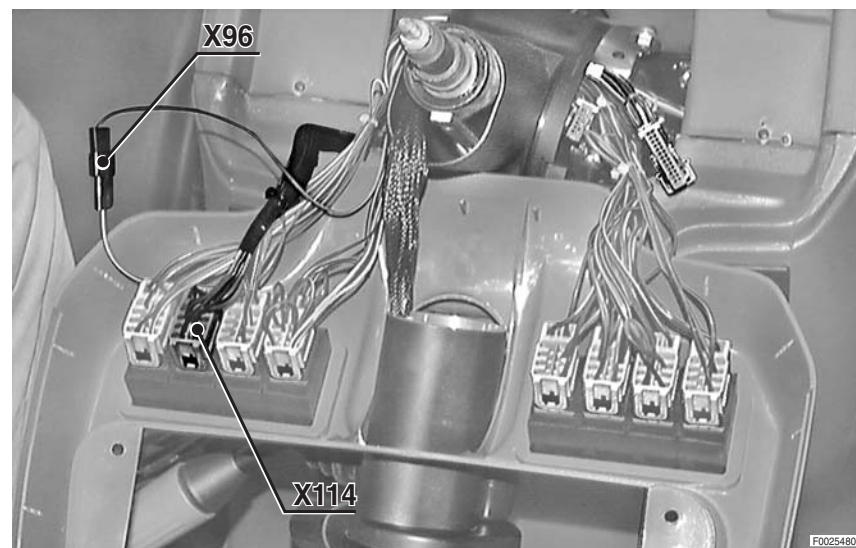


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0441.4780

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CONNECTORS LOCATION

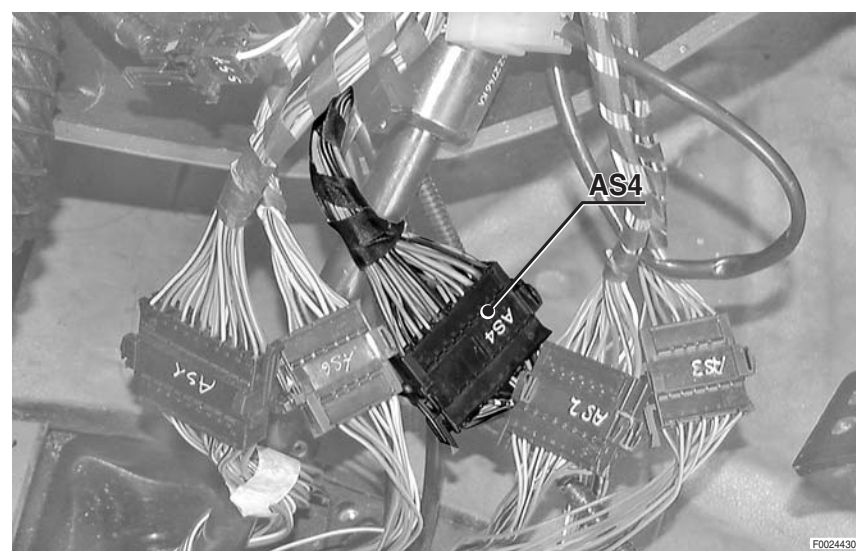
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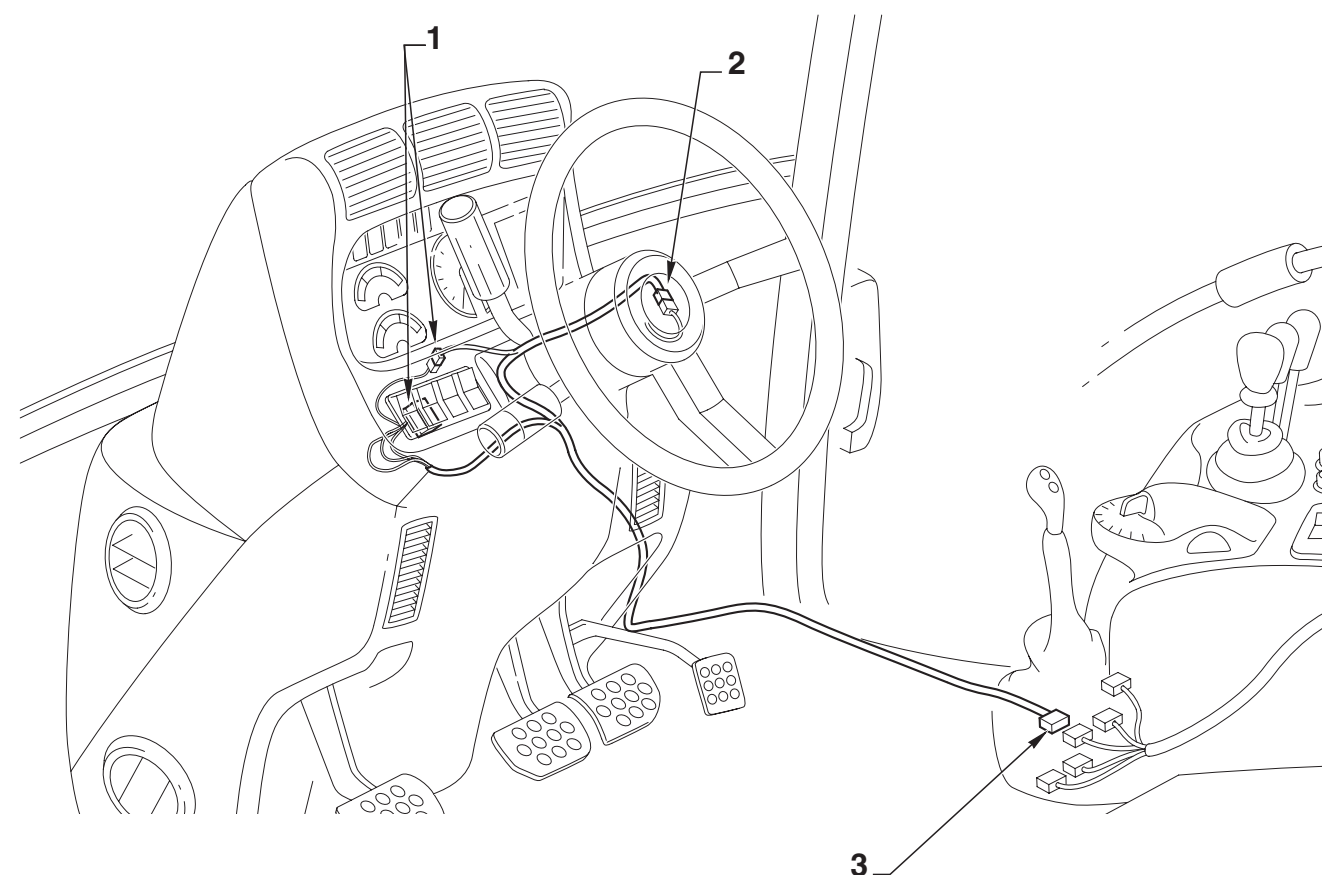
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3



LIGHTS SELECTOR SWITCH WIRING

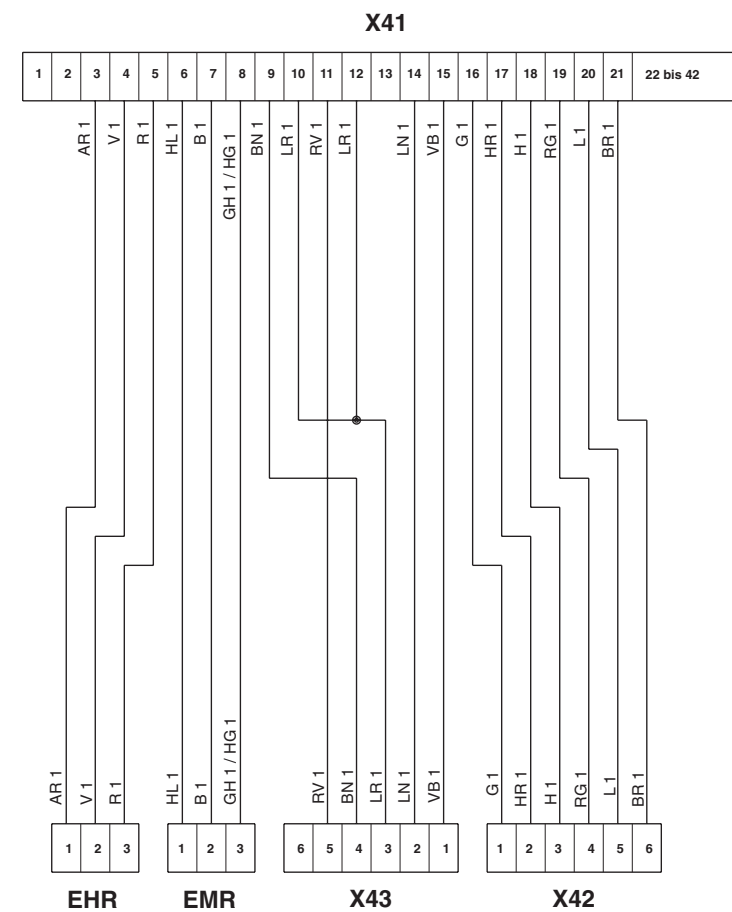
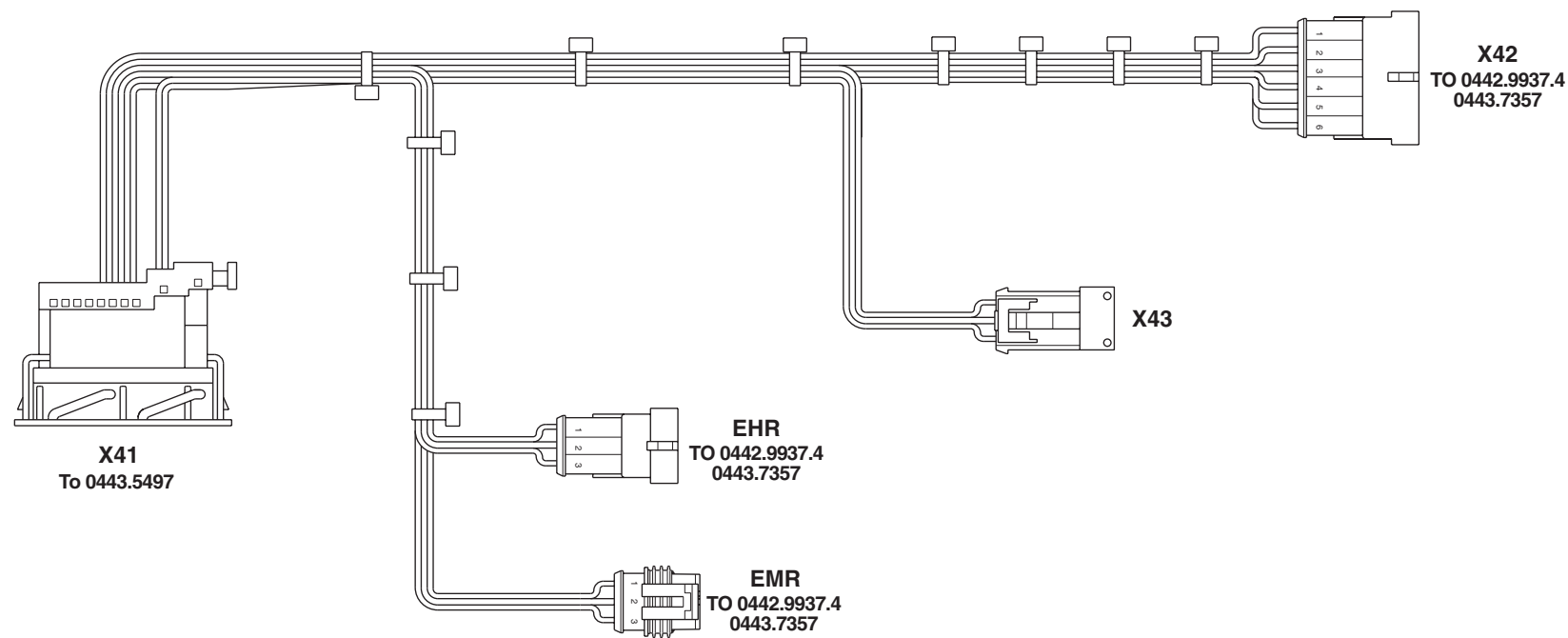


- AS4 Lights selector switch
- X96 Hazard switch light (+58)
- X113 Forward/reverse selector
- X114 Hazard warning lights switch

POWER SHUTTLE: 0443.8656
POWER SHIFT: 0443.8653

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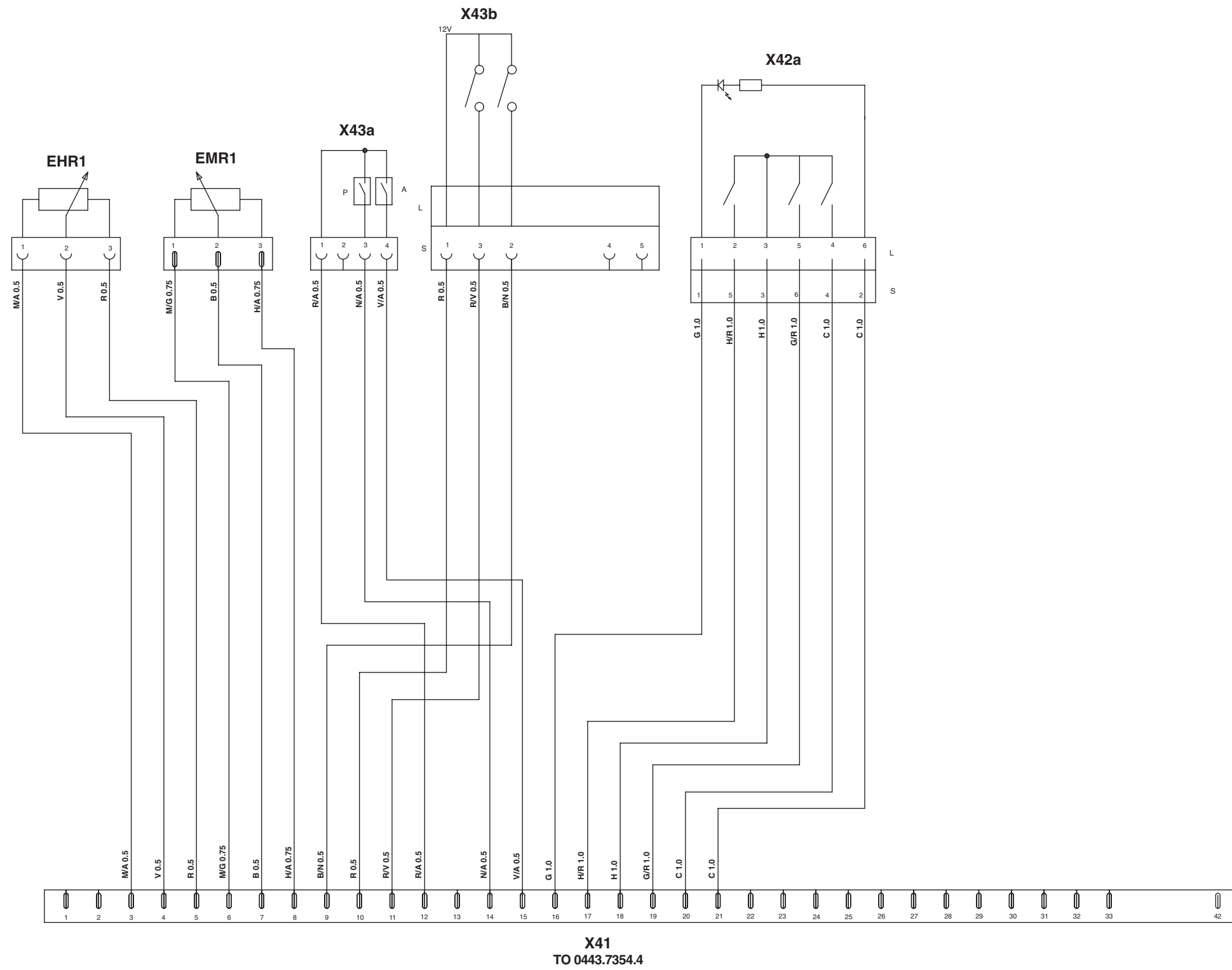
ARMREST WIRING



- EHR** Lift control lever
- EMR** Throttle lever
- X41** To armrest wiring
- X42** To side console wiring
- X43** To side console wiring

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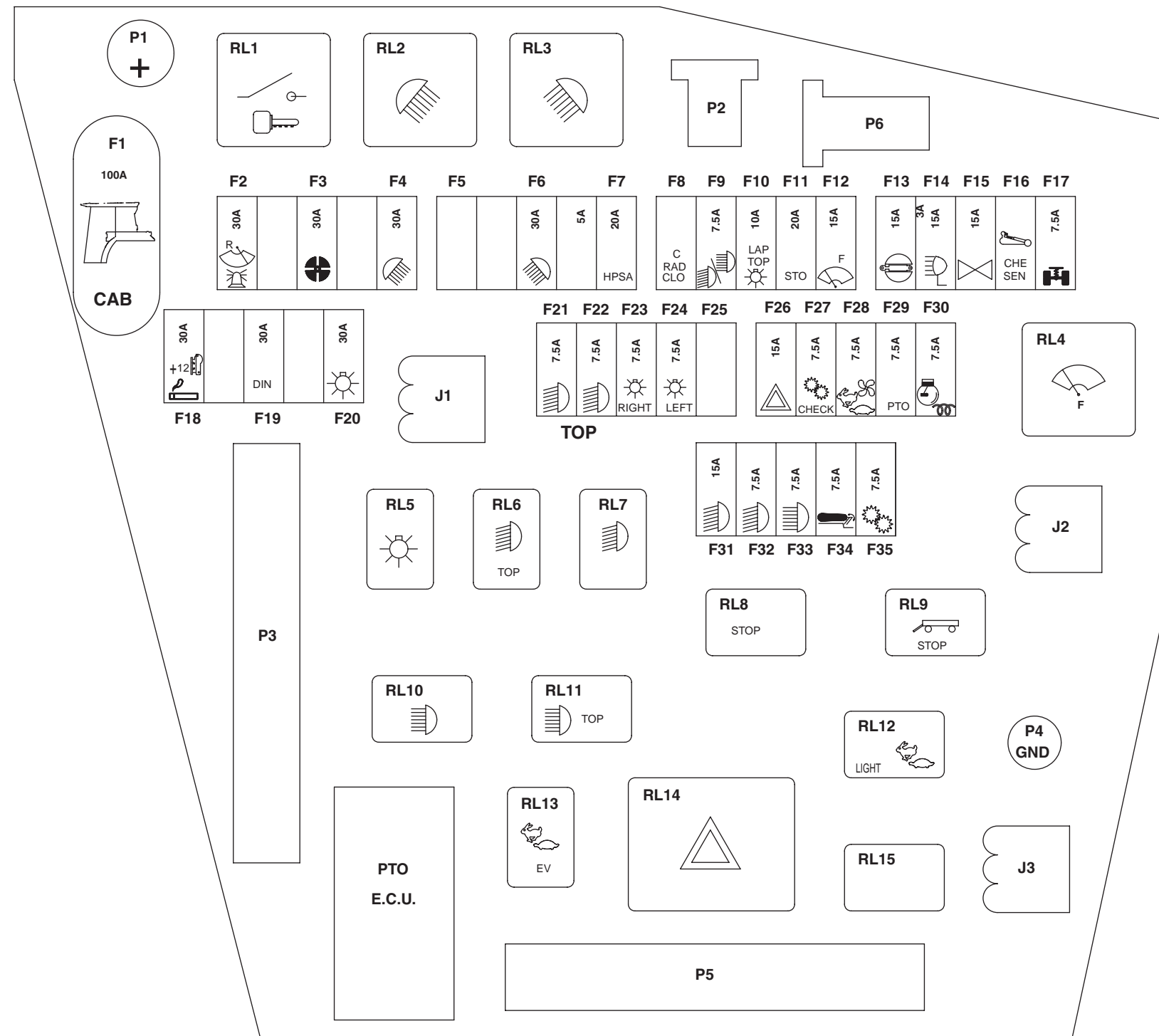
ARMREST WIRING (INTERNAL)



- EHR1** Lift control lever
- EMR1** Throttle lever
- X41** To armrest wiring
- X42a** Keypad connector
- X43a** Change gear connector
- X43b** Change gear connector

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CONTROL UNIT - FUSES - RELAYS (1/2)



FUSES

- F1 Main fuse (100A)
- F2 Rotating beacon - Rear screen wiper (30A)
- F3 Fan - Air conditioning system (30A)
- F4 Rear worklights (see F10 too) (30A)
- F5 Not used
- F6 Front worklights (see F10 too) (30A)
- F7 Radio - CB - terminal +15 (20A)
- F8 Radio - clock - CB - courtesy light - terminal +15 (5A)
- F9 Lower beam - lower beam including lights switch (see F21 - F22 - F23 too) (7.5A)
- F10 Computer - lights switch lighting (7.5A)
- F11 Stop lights - 4WD (15A)
- F12 Front screen wiper - Horn (15A)
- F13 4WD - diff. locking (15A)
- F14 Front worklights on the flashing pilot lamp (15A)
- F15 Direction indicators lights (15A)
- F16 INFOCENTER - Transmission speed sensor - Rear PTO - Transmission display - air compressed generator - Radar sensor - Switchs pilot lamp (3A)
- F17 Front axle suspension (see F11 too) (7.5A)
- F18 Cigar lighter - Connection socket (30A)
- F19 Electric socket (30A)
- F20 Lower beam including lights switch - High lights (see F24 - F25 too) (30A)
- F21 Upper left high light (see F23 - F9 too) (7.5A)
- F22 Upper right high light (see F23 - F9 too) (7.5A)
- F23 High lights (15A)
- F24 Left lower beam - light - Rear left side lights - Trailer socket terminal 58L - Left number plate light (7.5A)
- F25 Right lower beam - Right number plate light - Rear right side lights - railer socket terminal 58 right (7.5A)
- F26 Emergency lights (15A)
- F27 Power Shift - Infocenter (7.5A)
- F28 Operator's seat(15A)
- F29 PTO control - PTO keypad (7.5A)
- F30 Electronic control engine speed (7A)
- F31 Left lower beam (see F23 too) (7.5A)
- F32 Right lower beam (see F23 too) (7.5A)
- F33 Lower and upper lower beam (15A)
- F34 Agronotric h - hD (7.5A)
- F35 Power Shift terminal 15 (7.5A)

RELAYS

- RL1 Terminal 15 (40A)
- RL2 Rear worklights (40A)
- RL3 Front worklights (40A)
- RL4 Front screen wiper (10A)
- RL5 Lights (10A)
- RL6 Upper and lower lower beacon (10A)
- RL7 Lower beacon (10A)
- RL8 Stop lights - 4WD (10A)
- RL9 4WD solenoid valve (10A)
- RL10 High lights
- RL11 High lights(10A)
- RL12 Field/road indicator (10A)
- RL13 4WD solenoid valve (10A)
- RL14 Direction indicators - emergency lights (10A)
- RL15 High lights commutator (10A)

CONNECTORS

- J1 To side console wiring
- J2 To side console wiring
- J3 To side console wiring
- P1 To side console wiring
- P2 To side console wiring
- P3 To side console wiring
- P4 To side console wiring
- P5 To side console wiring
- P6 To side console wiring

CONTROL UNIT - FUSES - RELAYS (2/2)

