WORKSHOP MANUAL

AGROTRON 80 MK3
AGROTRON 85 MK3
AGROTRON 90 MK3
AGROTRON 100 MK3
AGROTRON 105 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 ordered directly from the Manufacturers.

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

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

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

GENERAL SAFETY RULES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

15 - The liquid (electrolyte) contained in the battery is very harmful if it comes into contact with the skin and the eyes; for this reason, always wear gloves and safety goggles with side shields when checking or topping up the battery.
Should any electrolyte accidentally come into contact with your skin, wash the affected parts immediately with copious amounts of water. If electrolyte comes into contact with your clothing, this should be removed as soon as possible.
In case of accidental ingestion of electrolyte, drink copious amounts of water, milk or vegetable oil and take antacids such as magnesium, bicarbonate, etc.. and seek medical attention immediately.

16 - Before working on the electrical systems, always disconnect the battery terminals.

⚠ IMPORTANT!
Always disconnect the negative terminal (–) first and then the positive terminal (+); when re-connecting the battery on completion of the work, first connect the positive terminal (+) and then the negative (–).

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

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

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

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

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

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

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

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

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

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

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

28 - When removing the retaining bolts of a component that could fall, always leave two opposing bolts in place for safety; these bolts should only be removed when the component has been securely attached to a hoist or when supporting blocks have been put in position.

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

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

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

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

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

SAFETY PRECAUTIONS FOR REMOVAL AND REFITTING OPERATIONS

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

1. PRECAUTIONS FOR REMOVAL OPERATIONS

- Unless otherwise indicated, lower the working equipment until it rests on the ground.

- After disconnecting hydraulic and fuel system pipes, always fit plugs to the open ends of the pipes to prevent ingress of impurities.

- Before removing a cylinder, fully retract the piston and secure it in this position using a retaining strap.

- Use containers of sufficient capacity when draining oil, coolant or fuel.

- Before removing a part from the machine, check for alignment markings indicating the correct assembly position. If necessary, make new markings to ensure correct assembly.

- When unplugging electrical connectors, always grip the connectors firmly to avoid pulling on the wires.

- Where necessary, label wires and pipes before removal to avoid confusion when reconnecting.

- Check the number and thickness of any shims removed and keep them together in a safe place.

- To lift the machine or any of its main components, use lifting equipment of suitable capacity.

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

- Before removing a part, clean the surrounding area and, after removing the part, cover it to prevent the ingress of dirt and dust.

2. PRECAUTIONS FOR REFITTING OPERATIONS

- Tighten nuts and bolts to the specified tightening torques.

- When refitting flexible pipes and wires, take care not to twist or tangle them.

- Always fit new seals, O-rings, cotter pins and safety stop rings on reassembly; make sure that the ends of the cotter pins are separated and bent back so that the pin cannot be withdrawn from the hole.

- Ensure that circlips are correctly installed in their seatings.

- Always fit new seals, O-rings, cotter pins and safety stop rings; ensure that cotter pins are bent over so that they cannot work loose.

- When applying sealant, first clean the surface removing all traces of oil and grease and check for dirt or indentations, then apply the sealant evenly making sure that it forms a continuous film around any fixing holes.

- Clean all parts, removing dirt, oxidisation, carbon deposits, burrs and indentations.

- Coat all moving parts with a thin film of engine oil.

- When reconnecting electrical connectors, first remove all traces of oil, dust and water from the inside of the connector and then push the two halves together firmly; only apply the force necessary to clip the two halves together.

- Bolt down flanged fittings evenly, tightening the bolts gradually in a crosswise pattern.

3. PRECAUTIONS TO BE TAKEN ON COMPLETION OF REMOVAL/REFITTING OPERATIONS

- If coolant has been drained from the engine, refit the drain plug and add new coolant to the correct level. Start the engine to circulate the coolant and then check the level again and top up.

- After removing hydraulic components, top up the hydraulic oil to the specified level. Start the engine to circulate the oil in the hydraulic circuits and then recheck the level and top up as necessary.

- After having removed a variable displacement pump, connect the drain pipe and fill the pump casing with oil through the filler hole provided.

- Grease stub axle housings, cylinder pivot mountings and drive shafts thoroughly after assembly.

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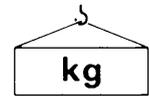
⚠️ Components weighing over 25 kg or of significant size must be supported and removed using suitable lifting equipment with wire rope or polyester slings.
In the paragraphs regarding removal and refitting operations, the weight of the component or assembly to be lifted is indicated with the symbol 🔖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

WIRE ROPES - SLINGS

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

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

NOTE. Lifting capacities are calculated with a safety coefficient.

- The lifting hook should be attached to the central part of the rope or sling; if the hook is attached near the ends of the rope/sling, this could cause the load to slip during lifting.

- Never lift a heavy load using a single rope; always use two or more symmetrically arranged ropes.

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

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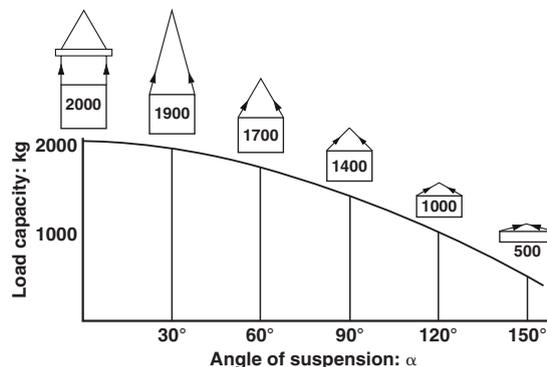
HOW THE MANUAL IS STRUCTURED

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

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

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

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

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

ATTENTION!

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

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

HOW TO CONSULT THE MANUAL

1. Removal and refitting of assembled units

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

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

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

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

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

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

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

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

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

• Refitting is the reverse of removal

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

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

• 🝖 .... ℓ: .... Filling with oil or liquid with quantity

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

3. List of special tools

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

4. Tightening torques

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

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

HOW TO USE AND UPDATE THE MANUAL

1. UPDATING THE MANUAL

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

2. INSERTING UPDATES

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

20 5

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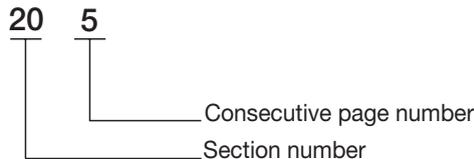
2 - **Supplementary pages:** indicated with a hyphen (-) and consecutive number after the page number. Example:

20-5

20-5-1 ⎤
             ⎥ Supplementary page
20-5-2 ⎦

20-6
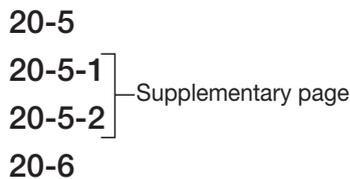
NOTE. The contents of supplementary pages are structured so that there is no overlap with existing pages.

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

20-5

20-5-1 – Existing page

20-5-1 – Update page
  ①

20-5-2 – Existing page
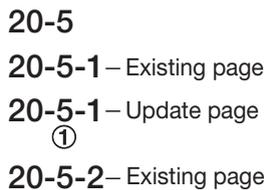
NOTE. All supplementary and updated pages are indicated in the manual page list; a revised page list is sent with each update and supersedes the previous list.

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	Symbol	Meaning	Notes
⚠	Safety	Safety rules to be applied during operation.	🛢	Coating	Parts must be coated with adhesive, lubricant, etc.
⚠		Operation requiring special safety measures due to internal pressure.	🛢	Oil, water	Points at which oil, water or fuel must be added and quantity required.
★	Warning	Operations requiring special technical or other precautions to ensure compliance with standard values.	⏢	Drain	Points from which oil, water or fuel must be drained with quantity.
kg	Weight	Weight of main assemblies. Choose lifting ropes/slings carefully; supports required, etc.	⌇ Nm	Tightening torques	Parts requiring special tightening torque during refitting or assembly.

STANDARD TIGHTENING TORQUES FOR NUTS AND BOLTS

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

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

BOLT SIZE		BOLT CLASS					
		8.8		**10.9**		**12.9**	
		Nm	lb.ft.	Nm	lb.ft.	Nm	lb.ft.
COARSE THREAD	M6x1	8.0–8.8	5.9–6.5	11.8–13.0	8.7–9.6	13.8–15.2	10.2–11.2
	M8x1.25	19.4–21.4	14.3–15.8	28.5–31.5	21.0–23.2	33.3–36.9	24.5–27.2
	M10x1.5	38.4–42.4	28.3–31.2	56.4–62.4	41.6–46.0	67.4–74.4	49.7–54.8
	M12x1.75	66.5–73.5	49.0–54.2	96.9–107	71.4–78.9	115–128	84.8–94.3
	M14x2	106–117	78.1–86.2	156–172	115.0–126.8	184–204	135.6–150.3
	M16x2	164–182	120.9–134.1	241–267	117.6–196.8	282–312	207.8–229.9
	M18x2.5	228–252	168.0–185.7	334–370	246.2–272.7	391–432	288.2–318.4
	M20x2.5	321–355	236.6–261.6	472–522	347.9–384.7	553–611	407.6–450.3
	M22x2.5	441–487	325.0–358.9	647–715	476.8–527.0	751–830	553.5–611.7
	M24x3	553–611	407.6–450.3	812–898	598.4–661.8	950–1050	700.2–773.9
	M27x3	816–902	601.4–664.8	1198–1324	882.9–975.8	1419–1569	1045.8–1156.4

		8.8 Nm	lb.ft.	10.9 Nm	lb.ft.	12.9 Nm	lb.ft.
FINE THREAD	M8x1	20.8–23.0	15.3–17.0	30.6–33.8	22.6–24.9	35.8–39.6	26.4–29.2
	M10x1.25	40.6–44.8	29.9–33.0	59.7–65.9	44.0–48.6	71.2–78.6	52.5–57.9
	M12x1.25	72.2–79.8	53.2–58.8	106–118	78.1–87.0	126–140	92.9–103.2
	M12x1.5	69.4–76.7	51.1–56.5	102–112	75.2–82.5	121–134	89.2–98.8
	M14x1.5	114–126	84.0–92.9	168–186	123.8–137.1	199–220	146.7–162.1
	M16x1.5	175–194	129–143	257–285	189.4–210.0	301–333	221.8–245.4
	M18x1.5	256–282	188.7–207.8	375–415	276.4–305.9	439–485	323.5–357.4
	M20x1.5	355–393	261.6–289.6	523–578	385.5–426.0	611–676	450.3–498.2
	M22x1.5	482–532	355.2–392.1	708–782	521.8–576.3	821–908	605.1–669.2
	M24x2	602–666	443.7–490.8	884–978	651.5–720.8	1035–1143	762.8–842.4

THREADLOCKERS, ADHESIVES, SEALANTS AND LUBRICANTS

FUNCTION	DESIGNATION	DESCRIPTION
THREADLOCKER	**Loctite 222** Colour: opaque fluorescent purple	Anaerobic product suitable or low-strength locking of retaining, adjustment and precision fasteners. All traces of lubricant must first be removed using the specific activator.
	Loctite 242 Colour: fluorescent blue	Anaerobic product that prevents loosening of all types of nut and bolt; used in place of conventional mechanical locking systems. Used for medium-strength locking. All traces of lubricant must first be removed using the specific activator.
	Loctite 243 Colour: opaque fluorescent blue	Alternative product to 242; oil tolerant and so can used on lightly lubricated surfaces without prior use of activator.
	Loctite 270 Colour: fluorescent green	Anaerobic product for high-strength locking of bolts and studs that do not normally require disassembly. Parts must be heated to approximately 80°C for removal. All traces of lubricant must first be removed using the specific activator.
DEGREASERS AND ACTIVATORS	**Loctite 703**	Product used for degreasing and cleaning parts prior to application of Loctite anaerobic products; after drying, promotes uniform curing of threadlockers.
	Loctite 747	Product used for specifically for treatment of passive metals prior to use of slow-cure anaerobic threadlockers(series 5 and 6). Can also be used to increase cure speed at low temperatures or in applications where there is large gaps between the parts.
SEALANTS (for faces and flanges)	**Loctite 510** Colour: red	Super-rapid anaerobic sealant for sealing between rigid metal faces; can eliminate the need for conventional gaskets as it can fill gaps up to 0.4 mm. Does not shrink and therefore fasteners do not need re-tightening to specified torque values after curing.
	Loctite 542 Colour: brown	Anaerobic product used a liquid sealant for threaded fittings up to 3/4" gas; rapid curing and parts may be disassembled with ordinary tools.
	Loctite 554 Colour: red	Anaerobic sealant and locking compound used for sealing cooling and industrial fluid circuits. Slow curing, also suitable for use on non-ferrous alloys.
	Loctite 572 Colour: white	Anaerobic sealant and locking compound used for sealing pipes and threaded fittings up to 2" in diameter. Very slow curing on most metal surfaces.
	Loctite 573 Colour: green	Thixotropic anaerobic product used for sealing joints between metal faces. Ensures total contact between surfaces with maximum tolerance of 0.10 mm, filling micro-voids caused by flatness errors. Very slow curing on most metal surfaces and requires prior application of an activator.
	Loctite 576 Colour: brown	Anaerobic product used a liquid thread sealant for large diameter threaded fittings (up to 2"). Very slow curing; also suitable for non-ferrous alloys and parts requiring subsequent removal.

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

SPECIAL TOOLS

SYMBOL	CODE	DESCRIPTION	PAGE
T1	5.9030.480.0	High pressure seal replacer	30-84; 30-85
T2	5.9030.743.1	Test lead for checking sensors with multimeter	30-112
T3	5.9030.895.0	Tool for extracting transmission pump	30-119
T4	5.9030.743.0	Test lead for checking sensors with multimeter	30-133
T5	5.9030.740.0	SERDIA installation disc	20-4
T6	5.9030.741.0	Adapter cable	20-4
T7	5.9030.740.2	Interface level III	20-4
T8	5.9030.742.0	EDS software pack	20-59

CONVERSION FACTORS

CONVERSION FROM BRITISH TO METRIC UNITS

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

CONVERSION FROM METRIC TO BRITISH UNITS

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

SECTION 10

CONTENTS

1. TRANSMISSION

INTRODUCTION

- The AGROTON MARK III 80-105 series is supplied with the POWER SHUTTLE transmission.
  Shifting between forward and reverse is managed entirely by the electronic control unit without the operator having
  to use the clutch pedal.
  This is achieved by way of a proportional solenoid valve that directly controls the main clutch.

- The transmission can be divided into the following three sections:

  A. Gearbox

  B. Rear axle

  C. Rear PTO
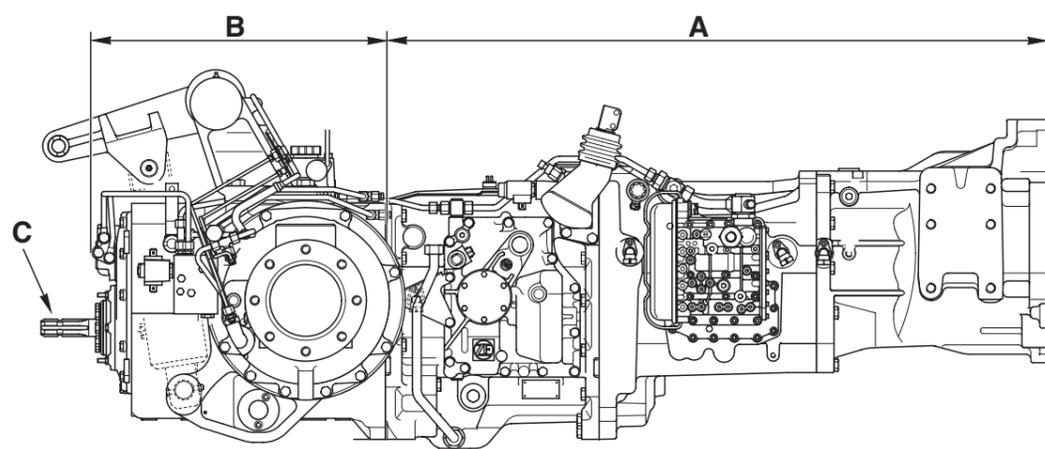
D0012950

1.1 TRANSMISSION

1.1.1 MAIN COMPONENTS
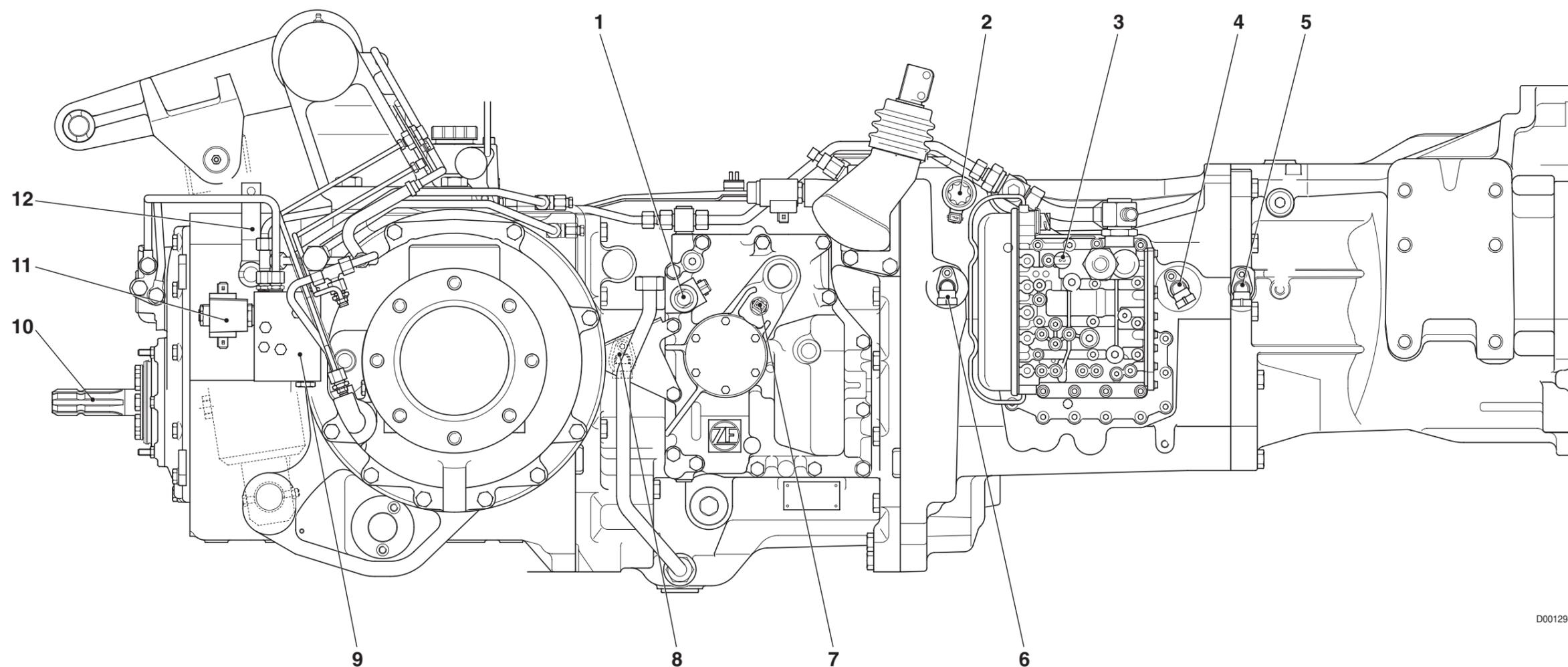
D0012940

1. Four-wheel drive control solenoid valve
2. Proportional solenoid valve for clutch control
3. Transmission oil low pressure sensor
4. Engine speed sensor (nLse - nMot)
5. Gearbox output shaft speed sensor (nLsa)
6. Clutch revs sensor (NHK)
7. Transmission oil temperature sensor
8. Speed sensor for odometer (nAb)
9. Rear PTO control valve
10. Rear power take-off
11. Rear PTO control solenoid valve
12. Rear PTO speed selector lever
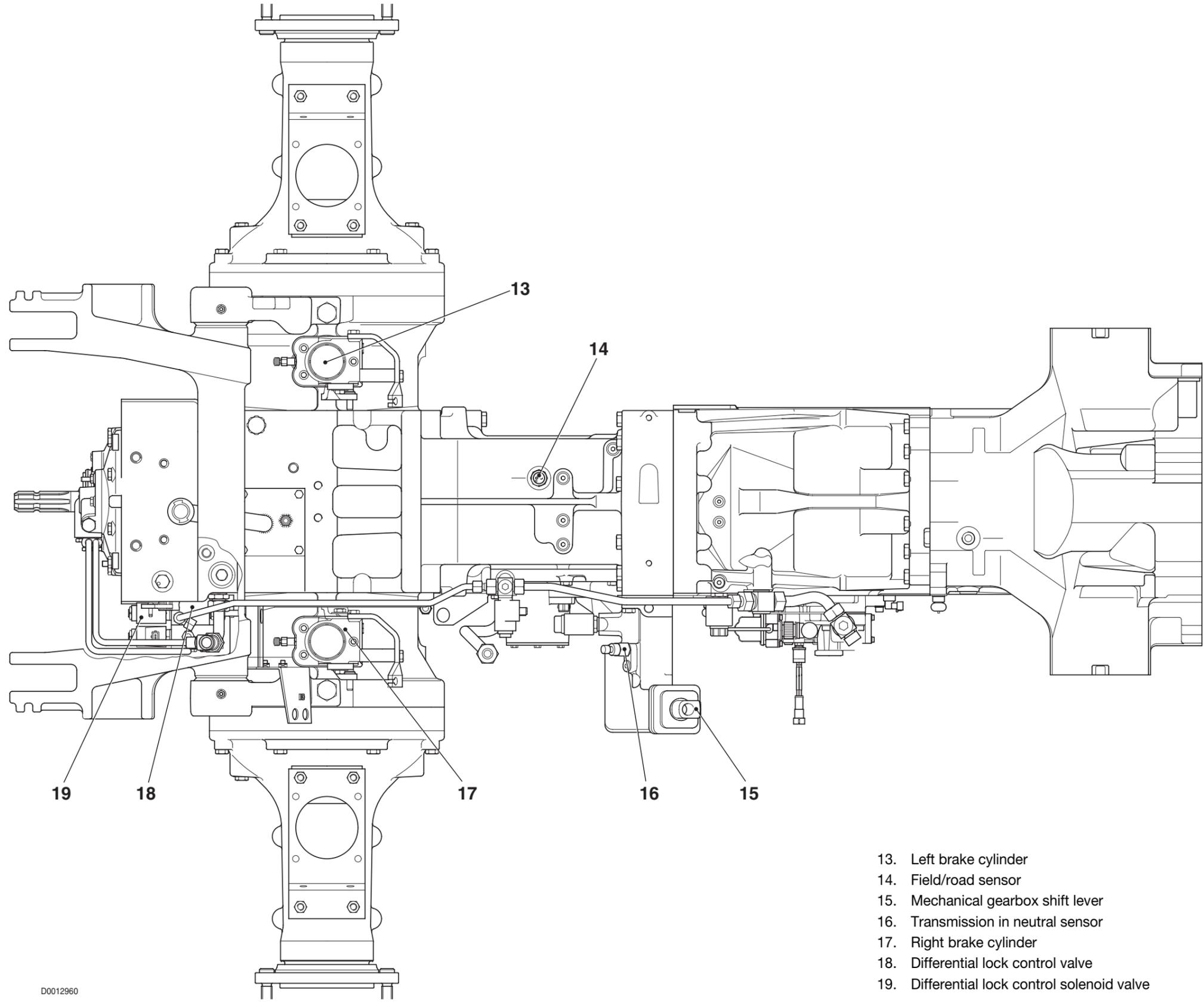
D0012960

13.   Left brake cylinder

14.   Field/road sensor

15.   Mechanical gearbox shift lever

16.   Transmission in neutral sensor

17.   Right brake cylinder

18.   Differential lock control valve

19.   Differential lock control solenoid valve

D0012970
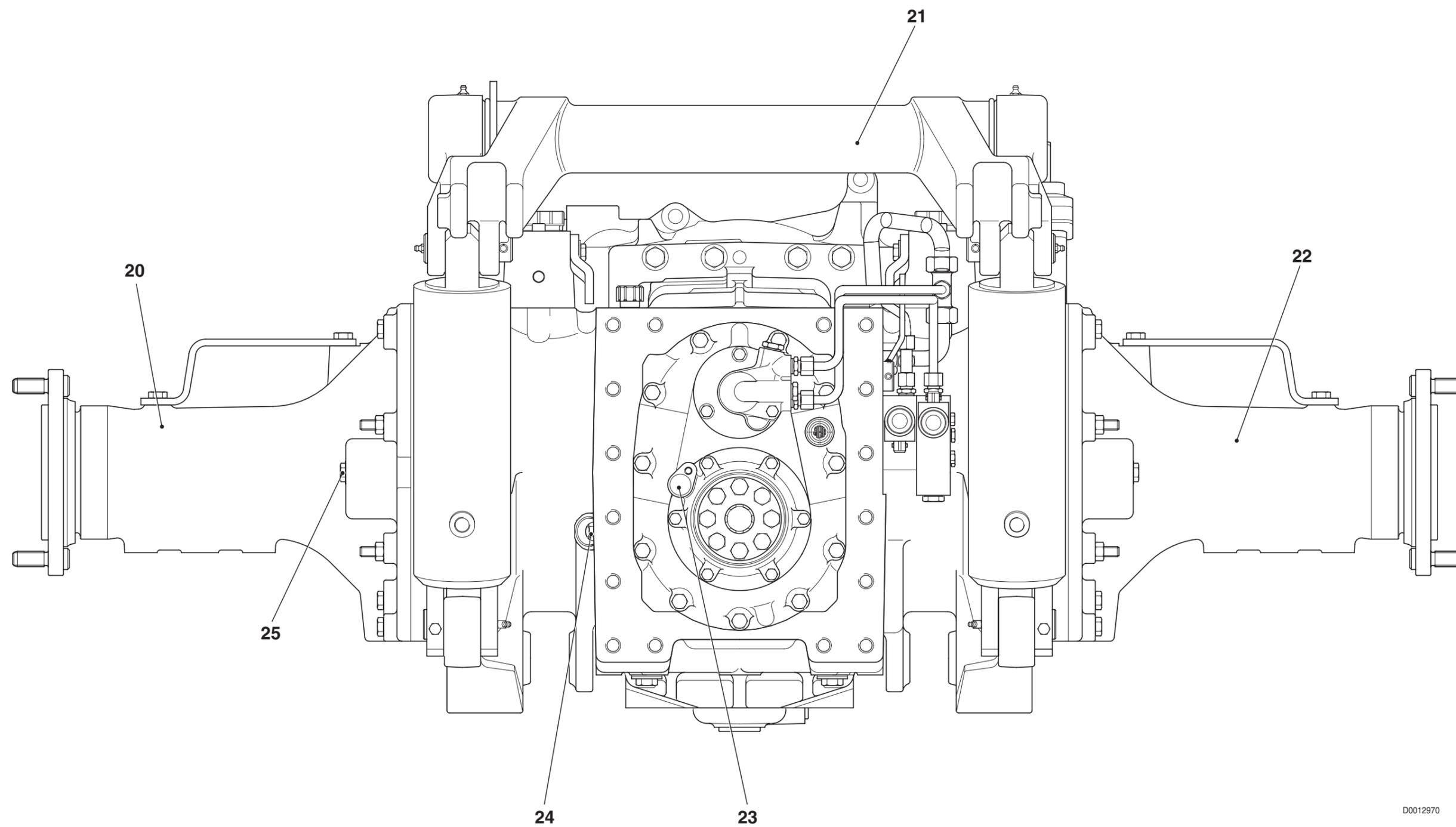
20. Left axle casing
21. Lift shaft
22. Right axle casing
23. Rear PTO speed sensor
24. Gearbox oil level indicator
25. Rear reduction unit oil level indicator

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
- 4WD control solenoid valve
- rear PTO control solenoid valve
- differential lock control solenoid valve
- lubrication of the gearbox
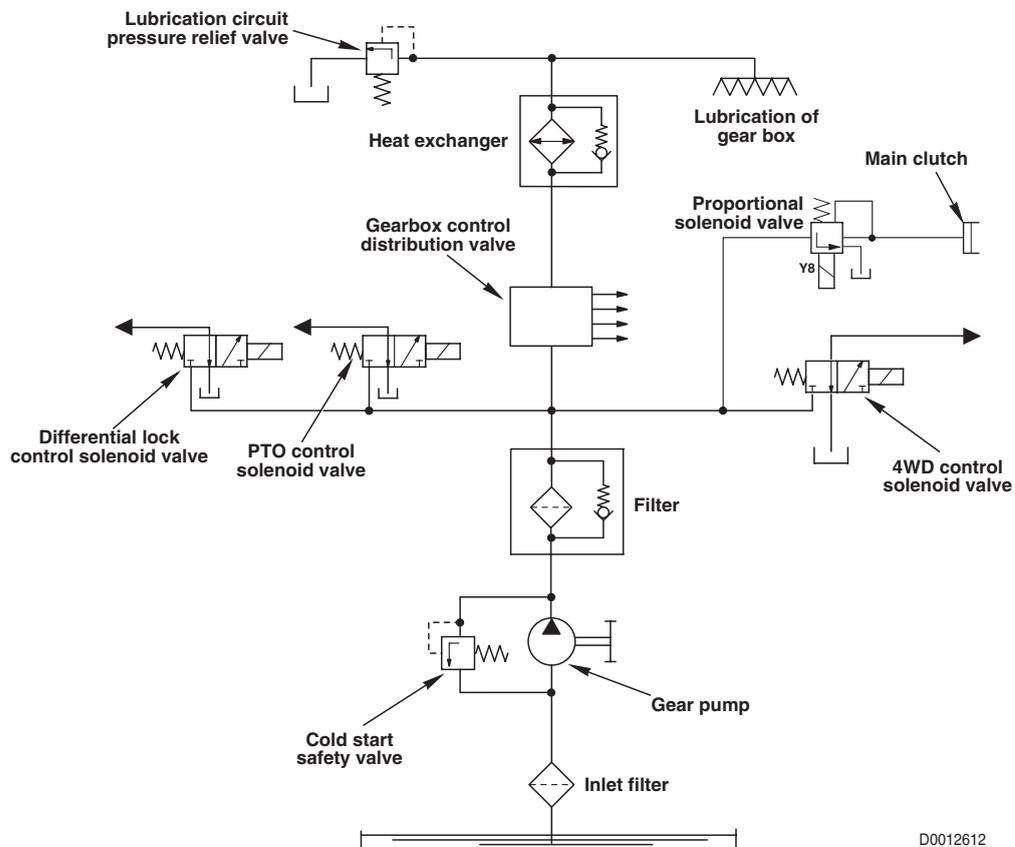
D0012612

1.1.3 GEARBOX

DESCRIPTION

- The drive from the engine (1) is transmitted through the hydraulically-controlled gearbox (2), the main clutch (3), the 4-speed mechanical gearbox (4) and the creeper (8) to the pinion (5) and the power take-off (7), that transfers drive to the front axle.
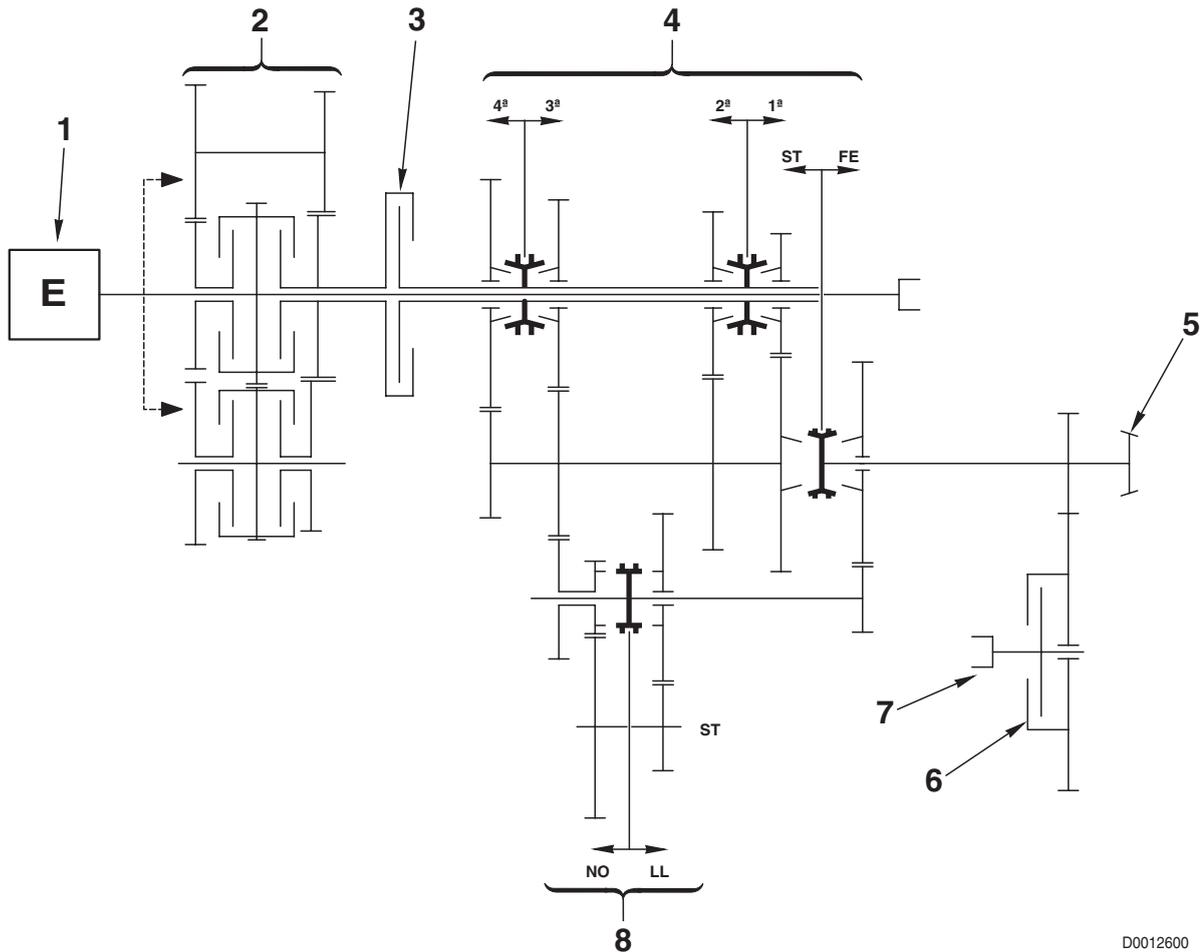
D0012600

COMPONENTS

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

GEARBOX COMPONENTS

D0012660
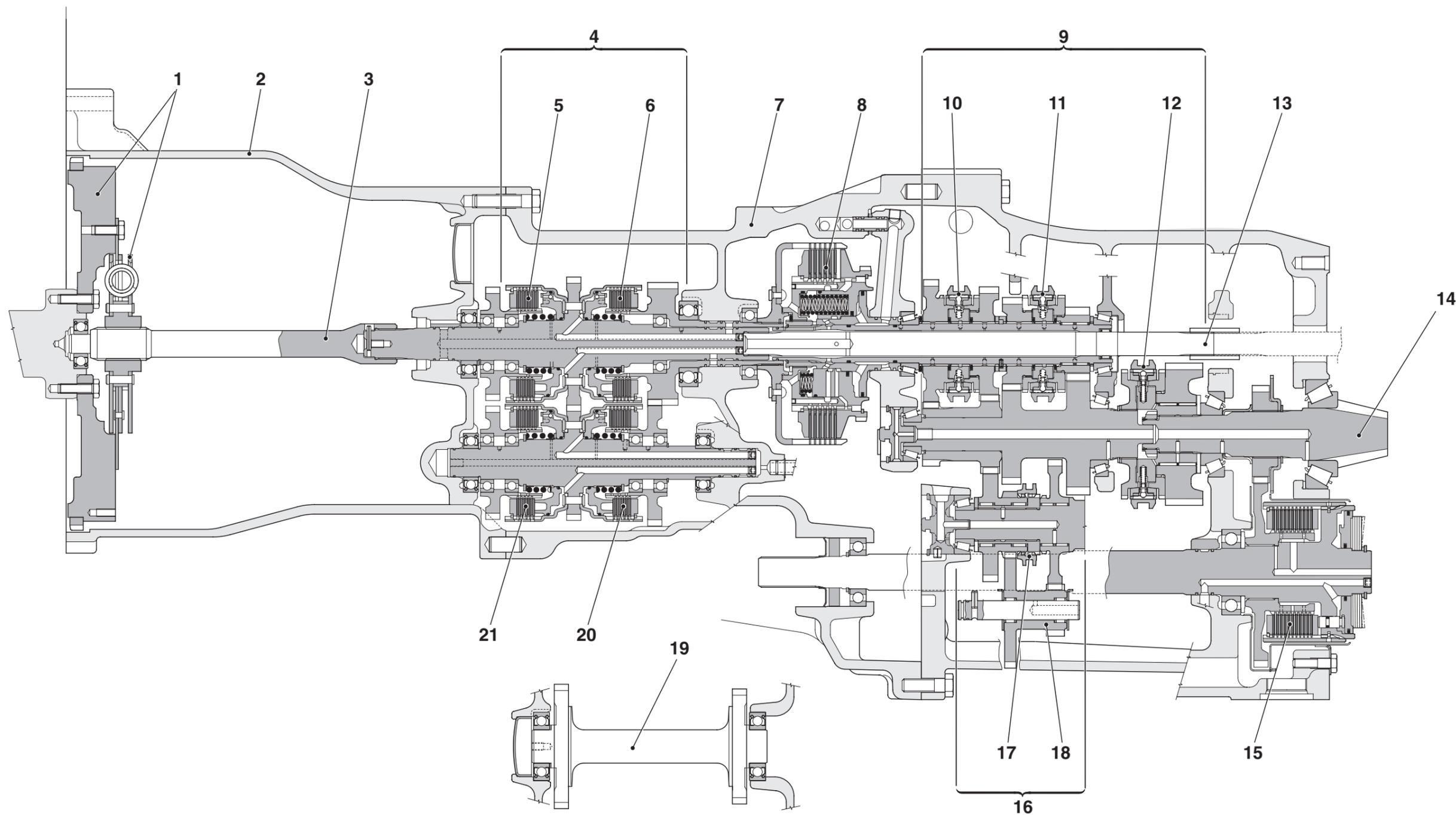
1. Flywheel and damper	8. Main clutch	15. 4WD control clutch
2. Housing	9. Mechanical gearbox	16. Creeper unit
3. Input shaft	10. 3rd and 4th speed synchronizer	17. Creeper unit synchronizer
4. Hydraulically-controlled gearbox	11. 1st and 2nd speed synchronizer	18. Creeper unit driven shaft
5. Clutch "A"	12. Field/road synchronizer	19. Reverse gear driven shaft
6. Clutch "B"	13. Rear PTO drive shaft	20. Clutch "C"
7. Clutch housing	14. Pinion	21. Clutch "D"

1.1.4 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.
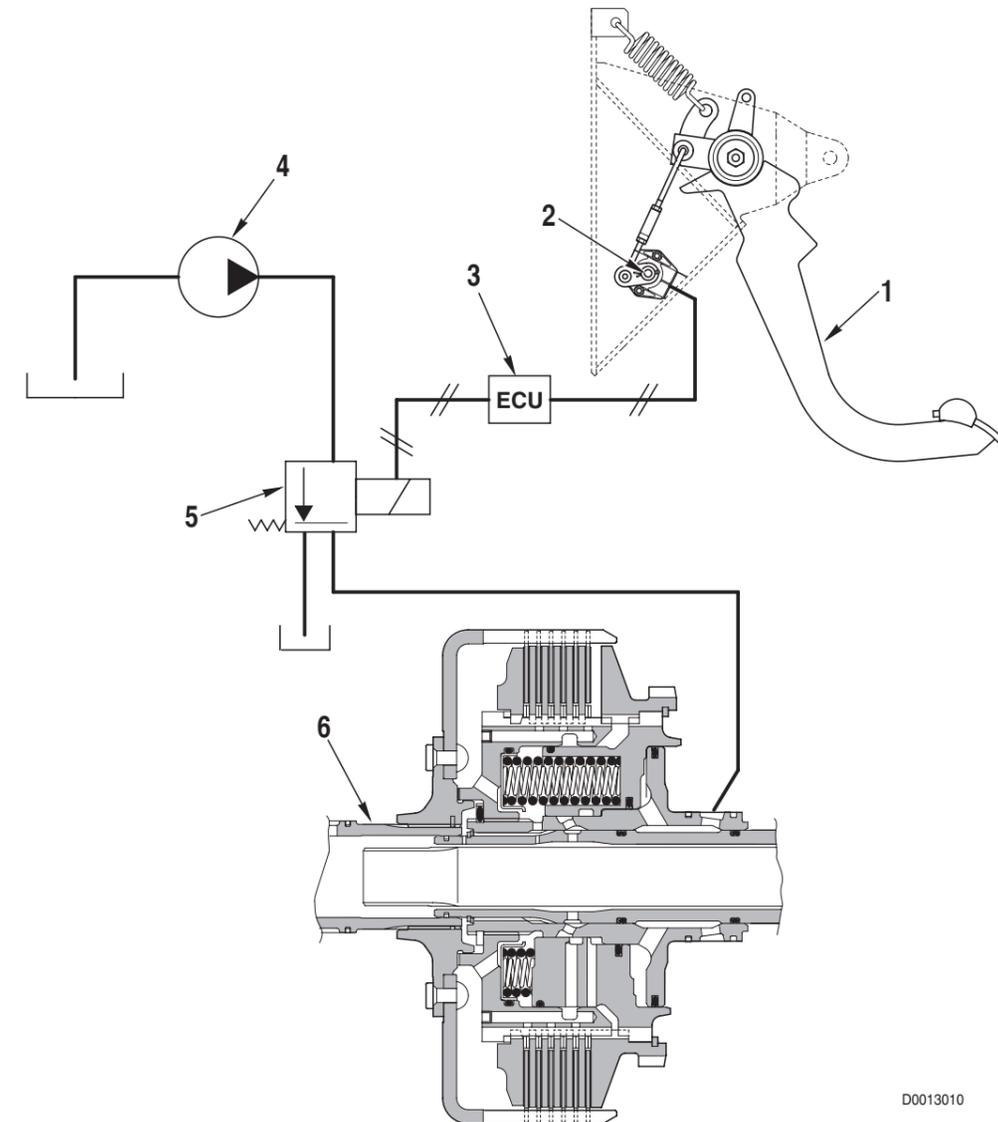
D0013010

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

1.1.5 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 hydraulic gearbox control valve controls the engagement of the **H**, **M** and **L** gears and the direction of travel.

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

D0012630
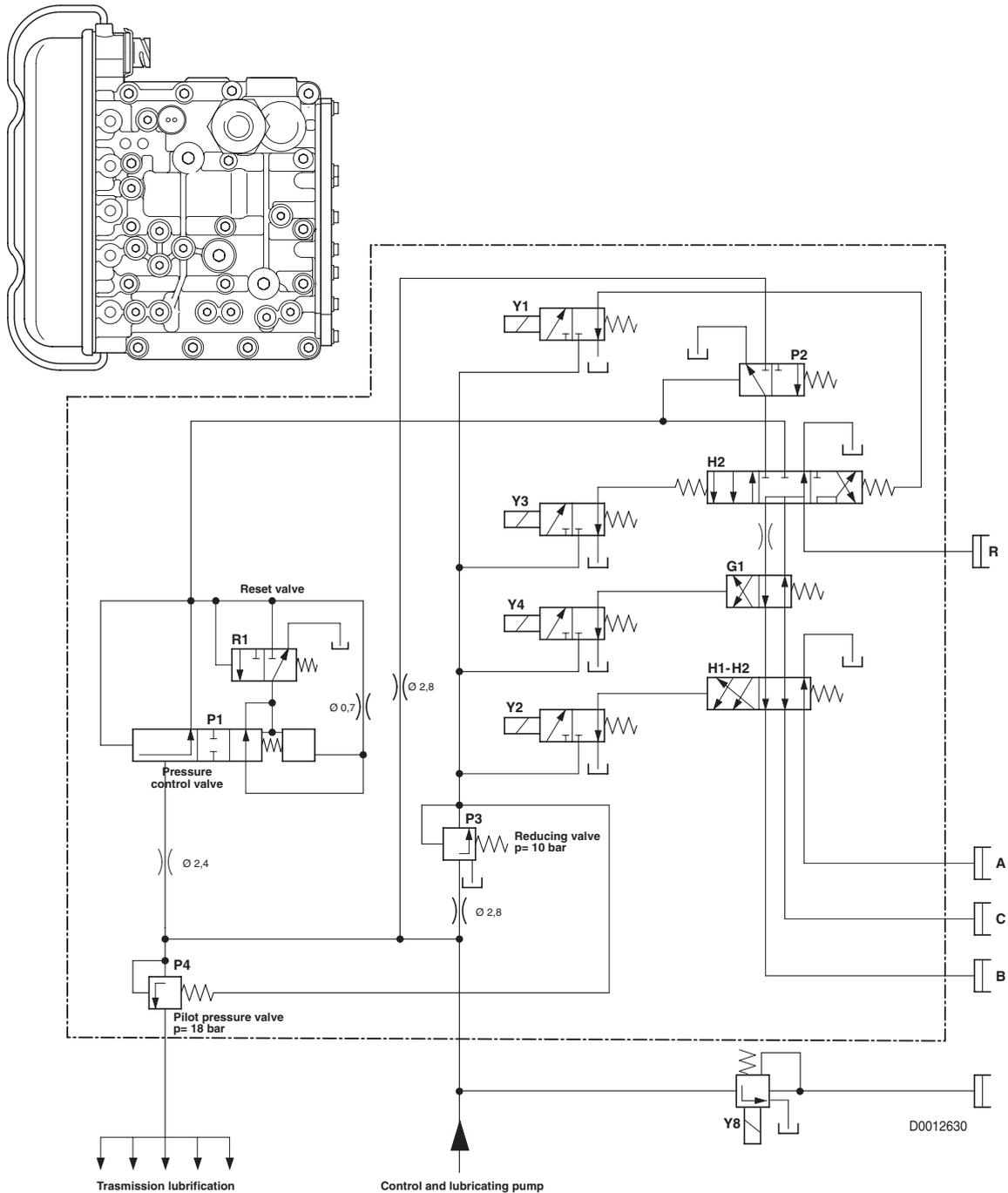
A. GEARBOX CONTROL VALVE

PRESSURE TEST POINTS

D0012640
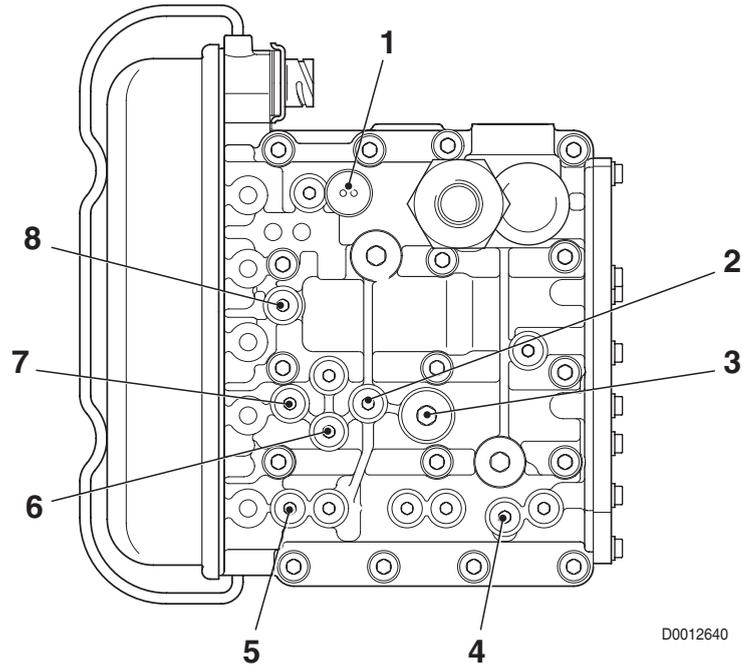
Pos.	Function	Thread size
1	General pressure (18 bar)	M10x1
2	**A** Clutch pressure	M10x1
3	Pressure Pg to relief valve	M10x1
4	Engagement pressure	M10x1
5	**D** clutch pressure	M10x1
6	**C** clutch pressure	M10x1
7	**B** Clutch pressure	M10x1
8	Pilot pressure (10 bar)	M10x1

MAIN COMPONENTS
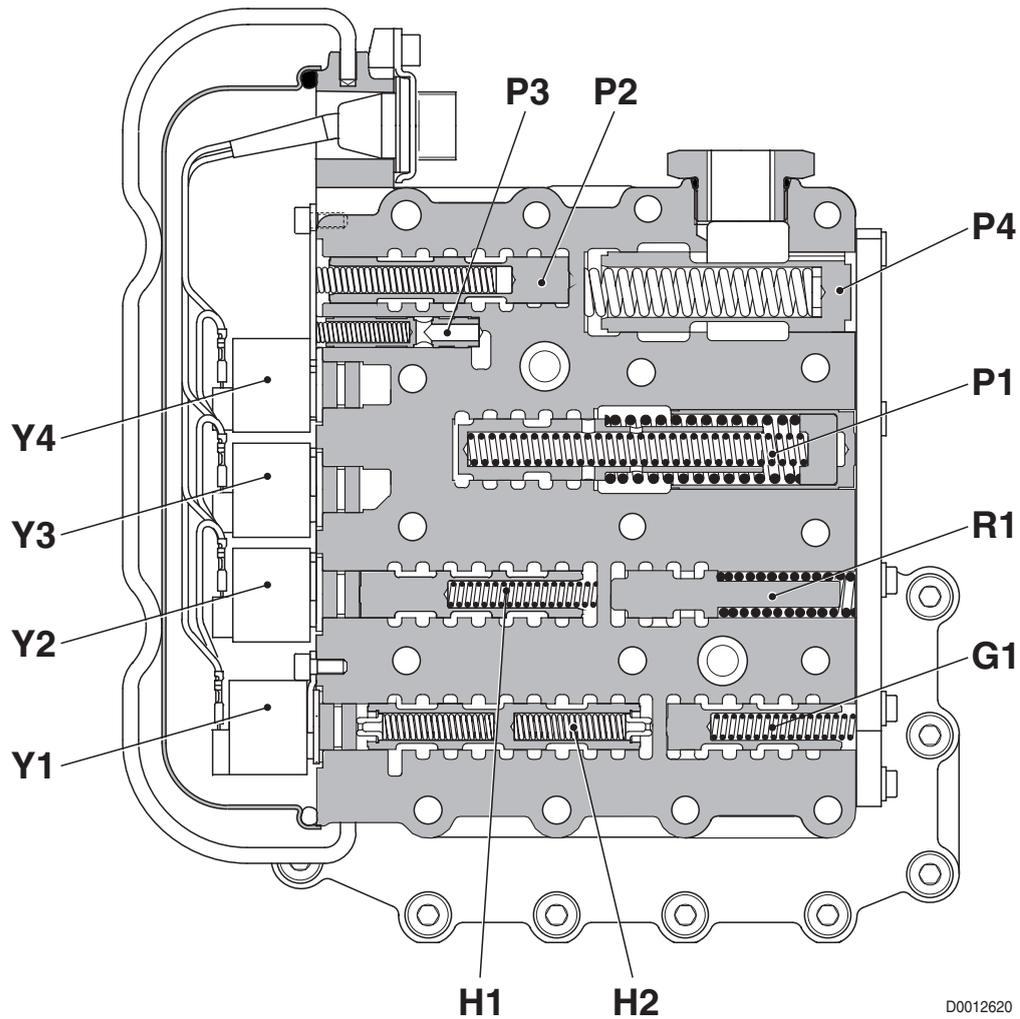
D0012620

G1 Clutch selection valve

H1 Clutch engagement valve for **B/C** or **A/B clutches**

H2 Forward, reverse and neutral selection valve

P1 Pressure modulating valve

P2 Engagement valve

P3 Pilot pressure regulating valve (10 bar)

P4 General pressure regulating valve (18 bar)

R1 Null shift valve

Y1 Pilot solenoid valve for engagement valve **H2** (MRV electr. REV)

Y2 Pilot solenoid valve for engagement valve **H1** (GV1 valve TRASM.1)

Y3 Pilot solenoid valve for engagement valve **H2** (MVV electr. FWD)

Y4 Pilot solenoid valve for valve **G1** (GV2 valve TRASM. 2)

1.1.6 CLUTCH ENGAGEMENT AND SOLENOID VALVE OPERATION SCHEMATIC

Forward

L gear   **M gear**   **H gear**

Input shaft   Output shaft

A B

D C

POSIZIONE FOLLE

A B

D C
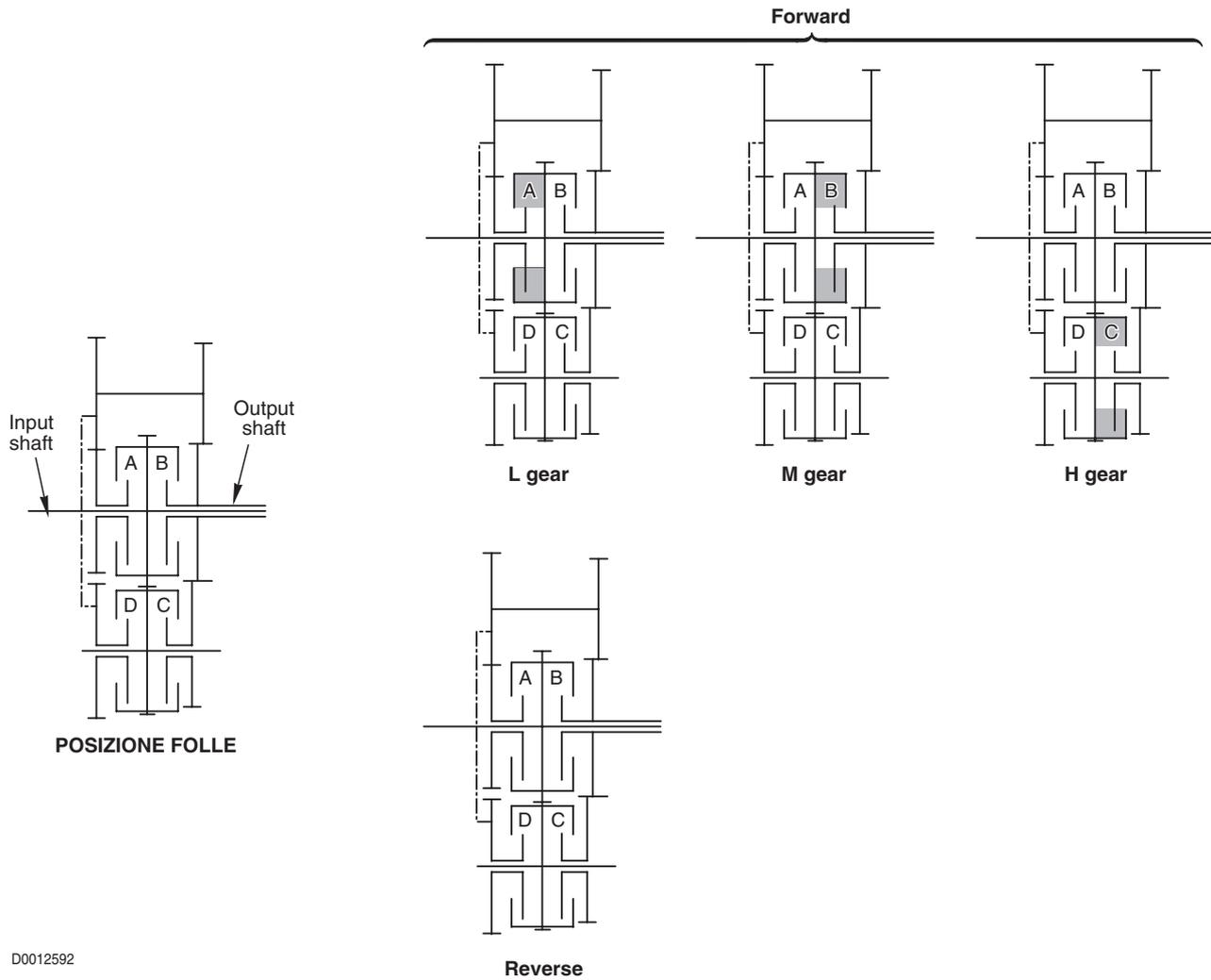
Reverse

D0012592

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

Solenoid valve	Forward			Reverse
	L	**M**	**H**	
Y1				●
Y2	●	●		
Y3	●	●	●	
Y4	●			
Clutch	A	B	C	D
Point of measure	2	7	6	5

● = Solenoid valve energised

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

Solenoid valve	Forward			Reverse
	H	**M**	**L**	
Y1				●
Y2			●	
Y3	●	●	●	
Y4		●	●	
Clutch	C	B	A	D
Point of measure	6	7	2	5

● = Solenoid valve energised

1.1.7 TRANSMISSION ELECTRONIC SYSTEM SCHEMATIC

D0012682
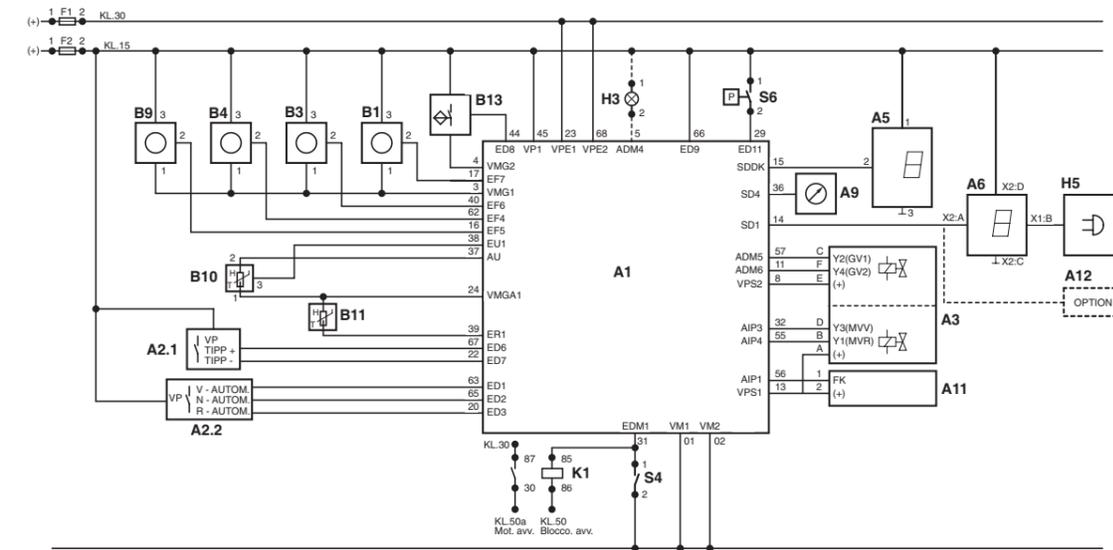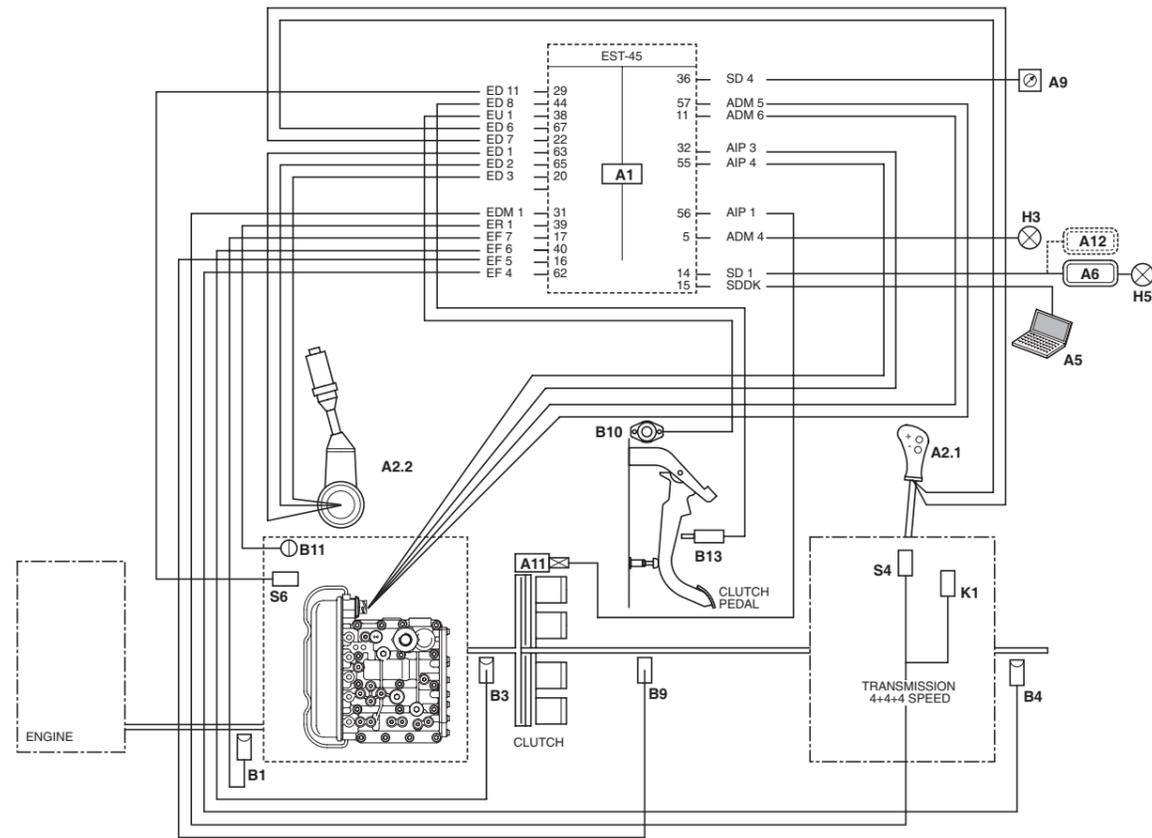
COMPONENTS

A1	Electronic transmission control unit (EST57)
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
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 (7.5A)
F2	Fuse (7.5A)
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)

1.2 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).
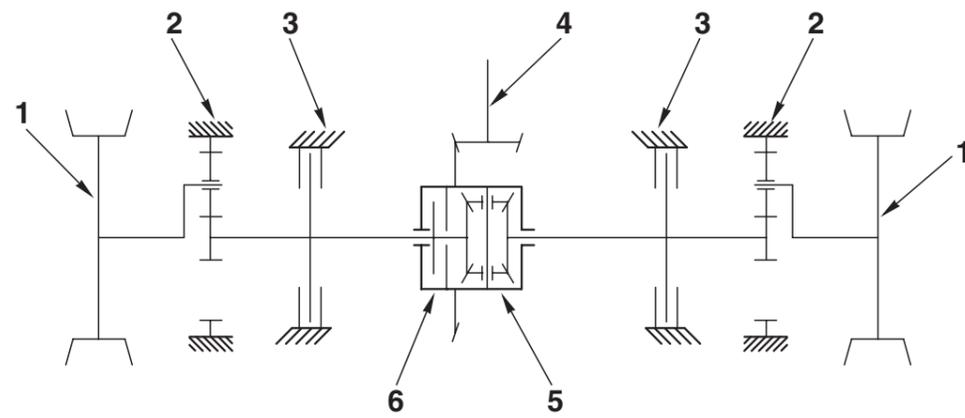
D0012670

COMPONENTS

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

COMPONENTS
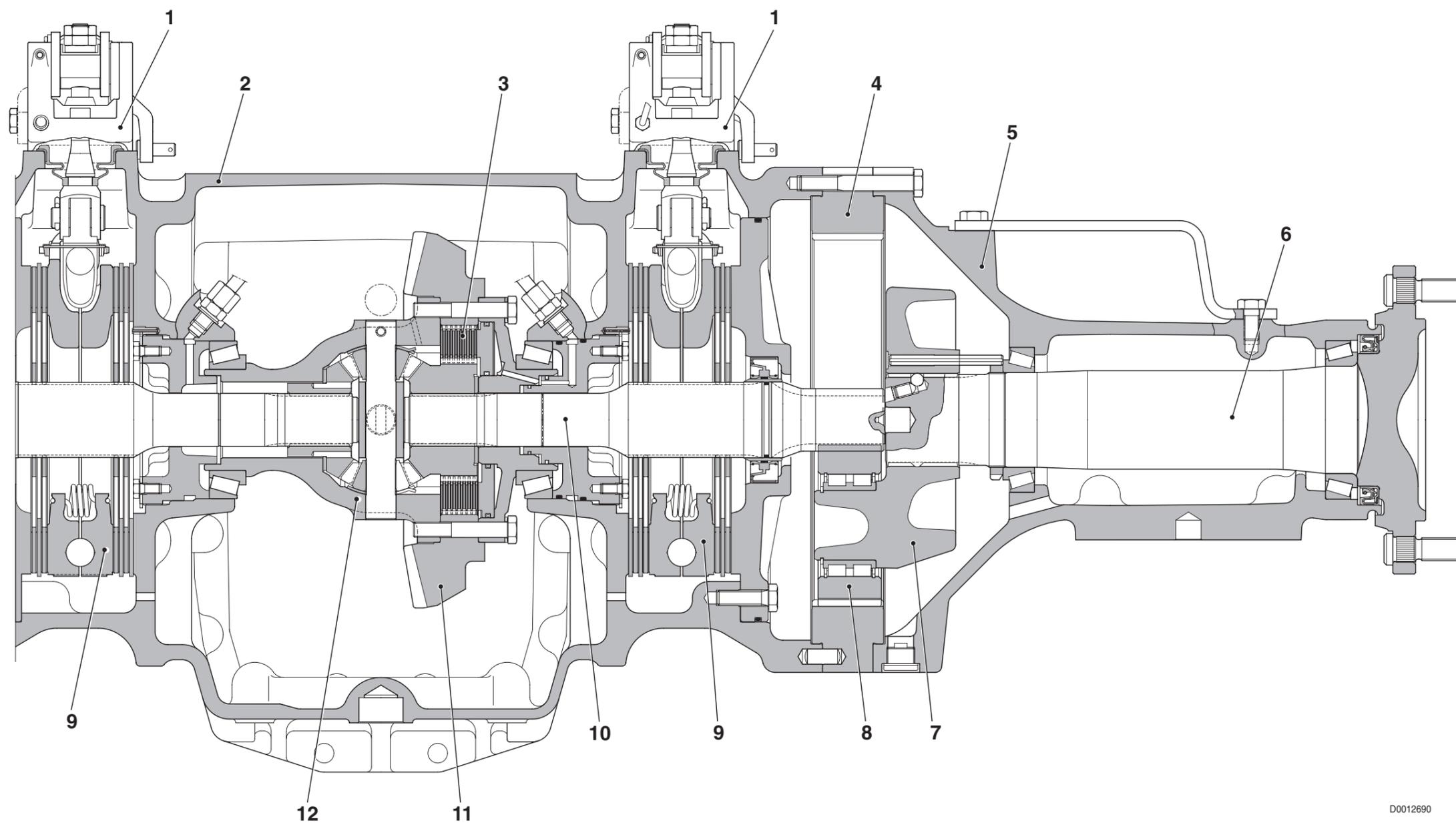
D0012690

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

10-16

1.3 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.

2 SPEED VERSION   **4 SPEED VERSION**

D0012700
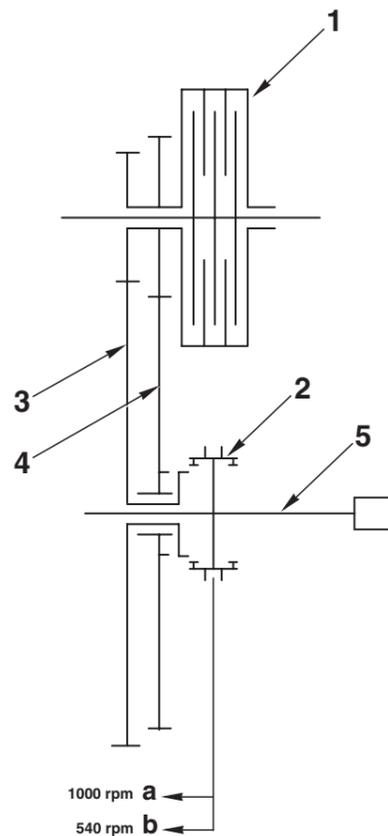
2 SPEED VERSION	4 SPEED VERSION
1. Clutch	1. Clutch
2. Synchronizer	2. Synchronizer
3. 540 rpm driven gear	3. 540 rpm driven gear
4. 1000 rpm driven gear	4. 750 rpm driven gear
5. PTO shaft	5. PTO shaft
	6. 1000 rpm driven shaft
	7. 1400 rpm driven gear

10-17

COMPONENTS

2 SPEED VERSION

4 SPEED VERSION

D0012710
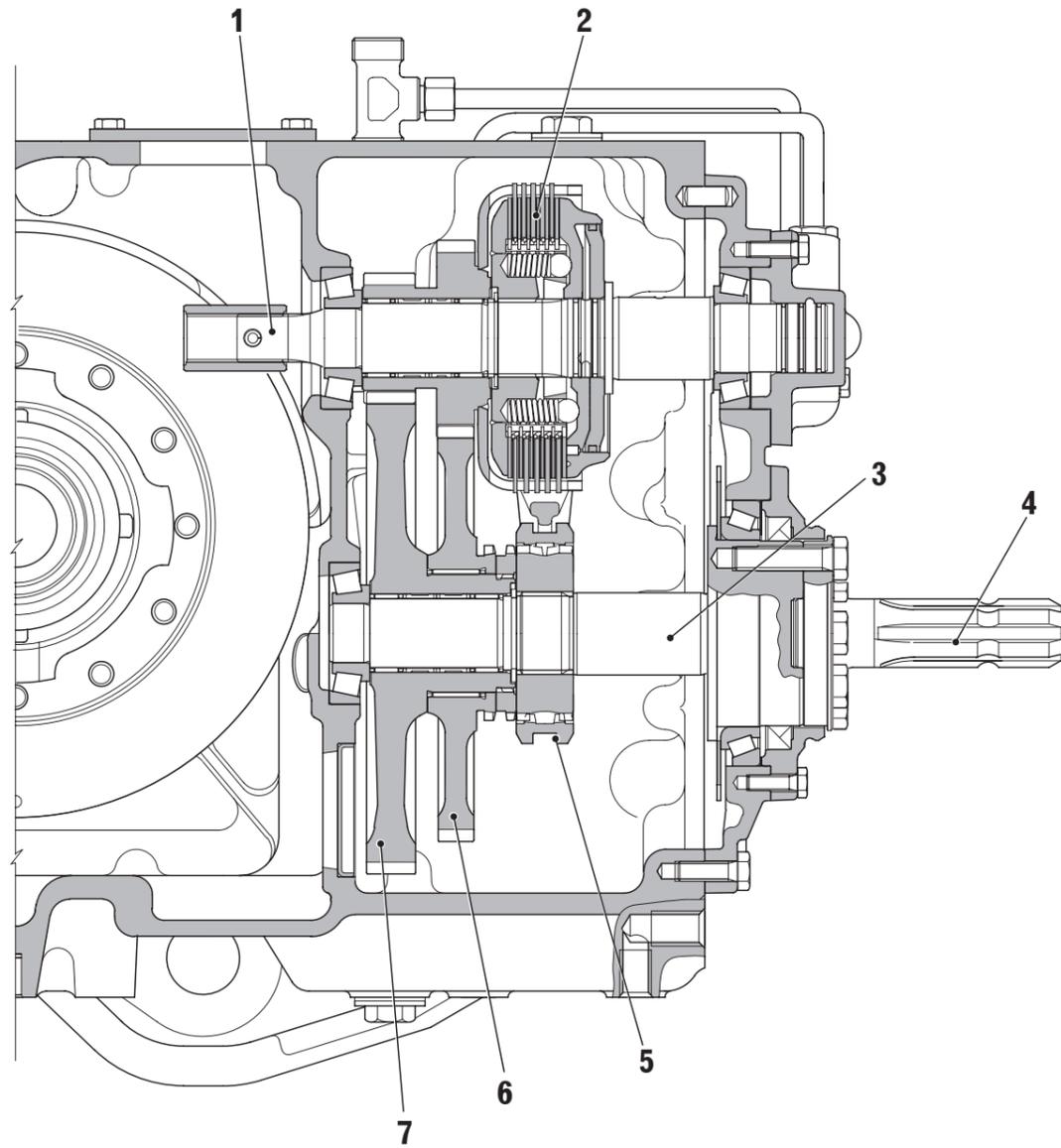
1. PTO input shaft
2. PTO clutch
3. PTO output shaft
4. Power take-off
5. Synchronizer
6. 1000 rpm driven gear
7. 540 rpm driven gear
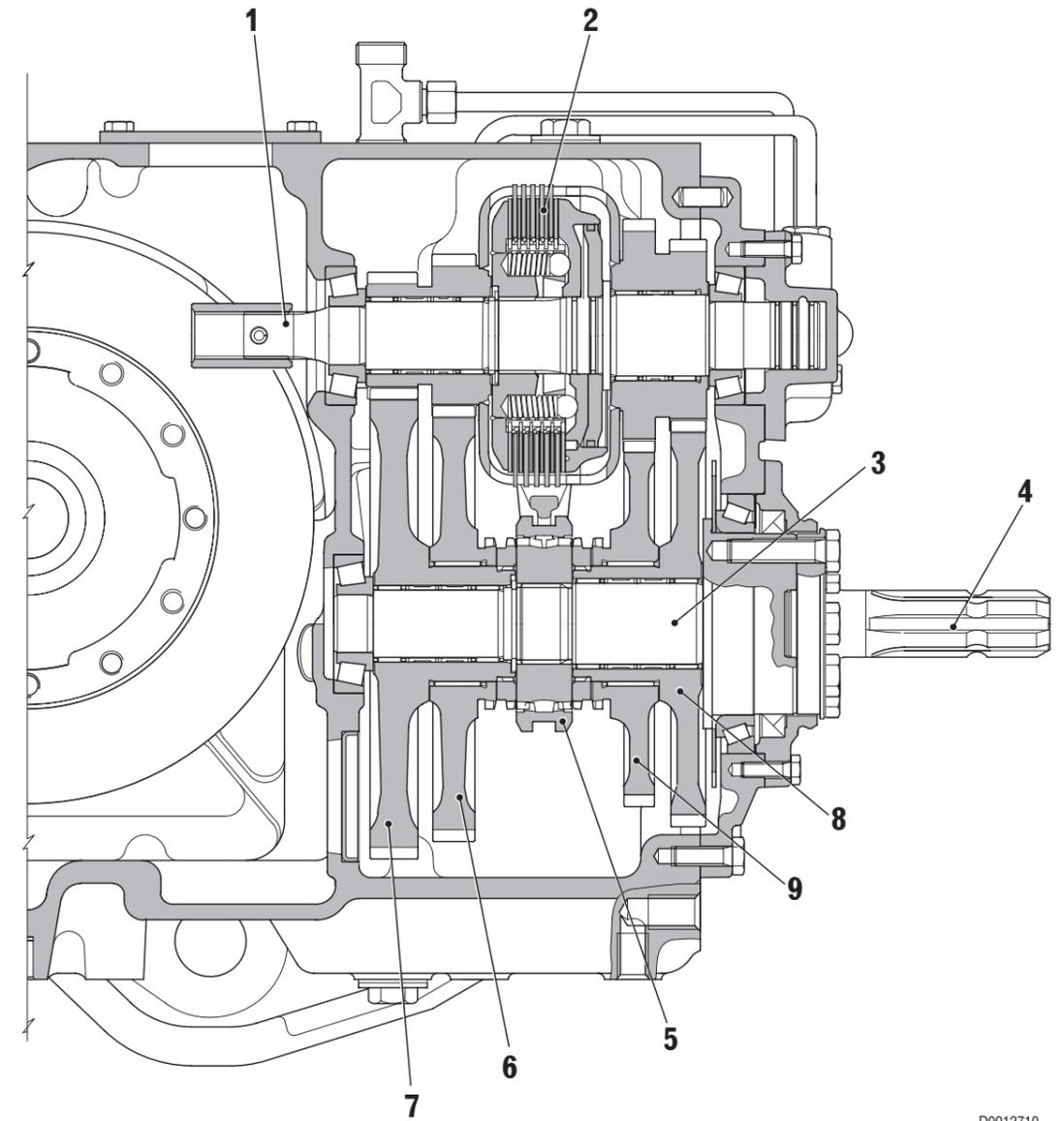
1. PTO input shaft
2. PTO clutch
3. PTO output shaft
4. Power take-off
5. Synchronizer
6. 750 rpm driven gear
7. 540 rpm driven gear
8. 1400 rpm driven gear

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.
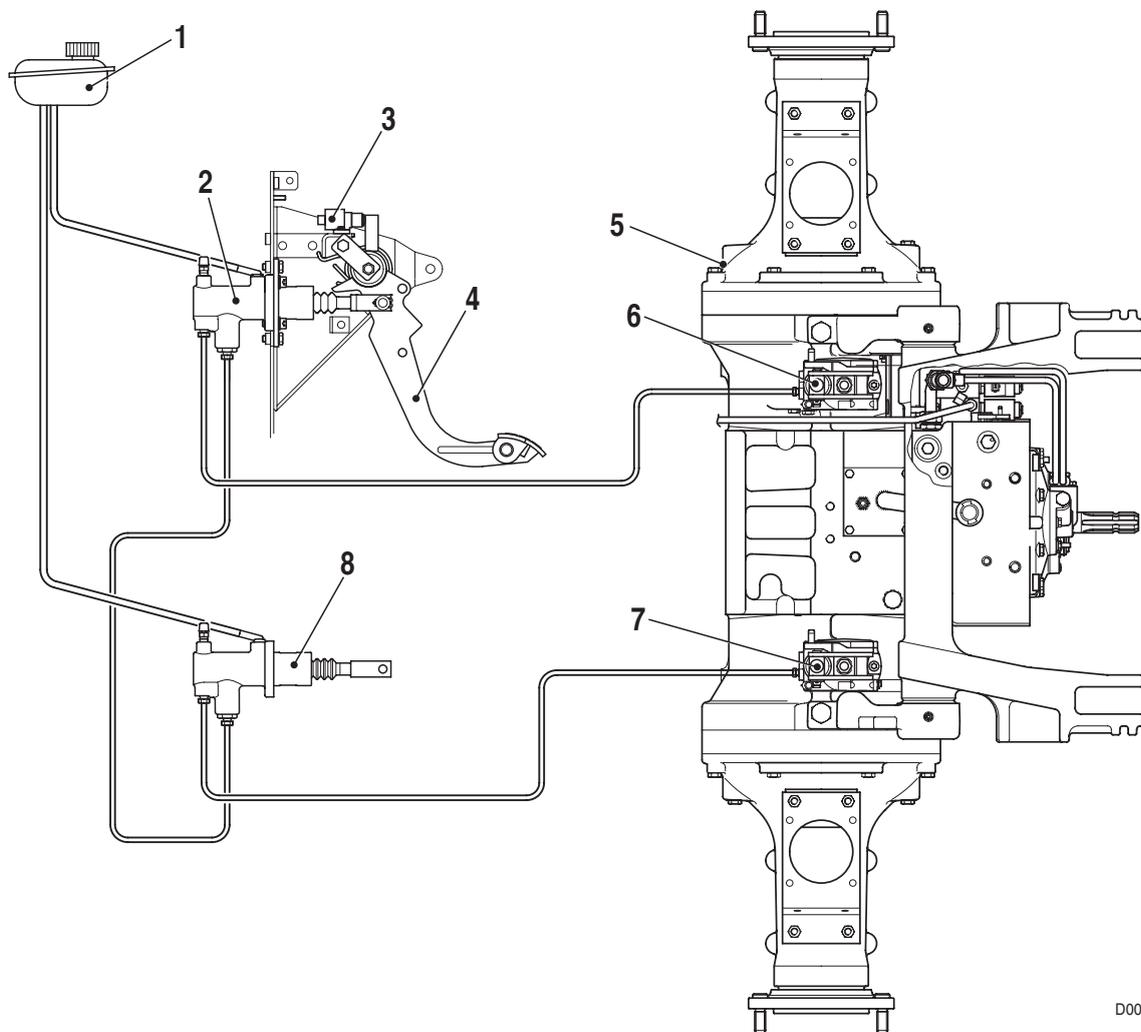
D0011720

1. Brake fluid reservoir

2. Right master cylinder

3. Brake microswitches (n° 2)

4. Brake pedal

5. Rear axle

6 Right brake

7. Left brake

8 Left master cylinder

2.1 BRAKE MASTER CYLINDER
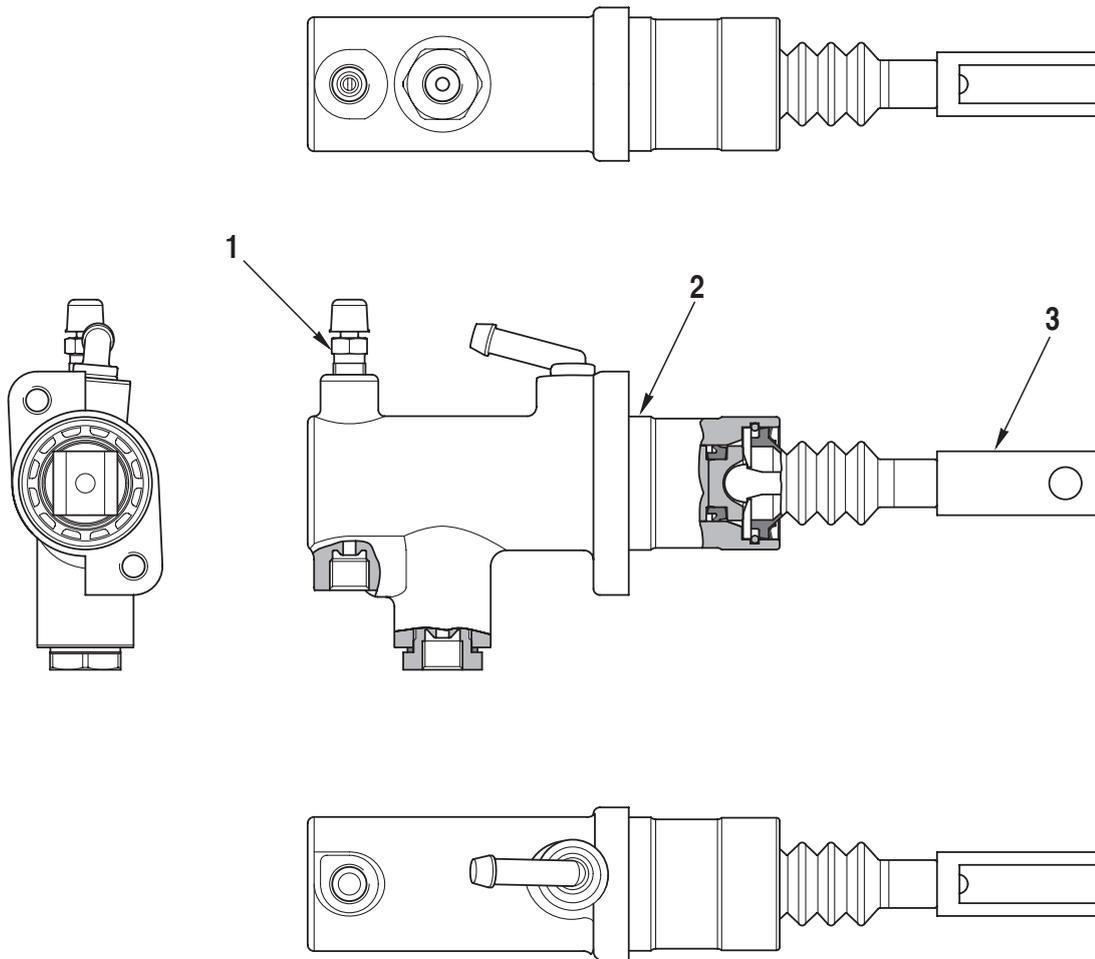
D0004520

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

A - A
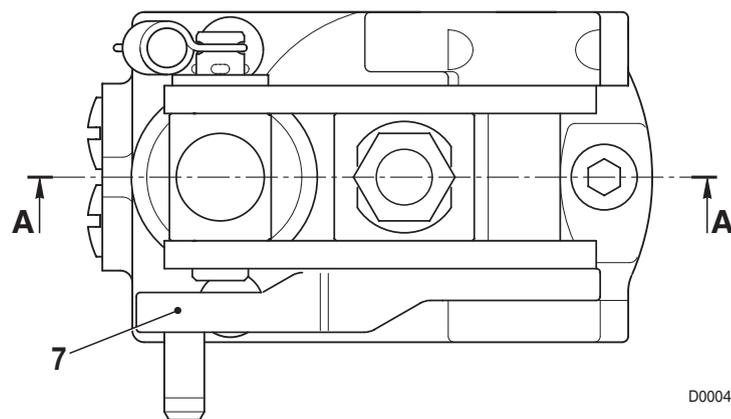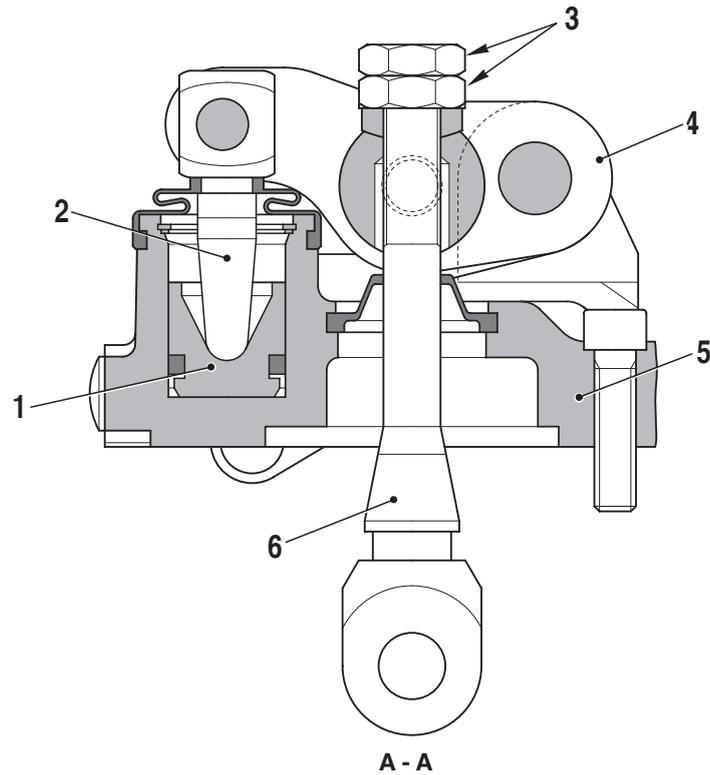
D0004530

1. Piston
2. Plunger
3. Adjustment nuts
4. Lever

5. Support
6. Rod
7. Parking brake control lever

2.3 TRAILER BRAKING SYSTEM

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

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

2.3.1 HYDRAULIC TRAILER BRAKING (ITALY VERSION)
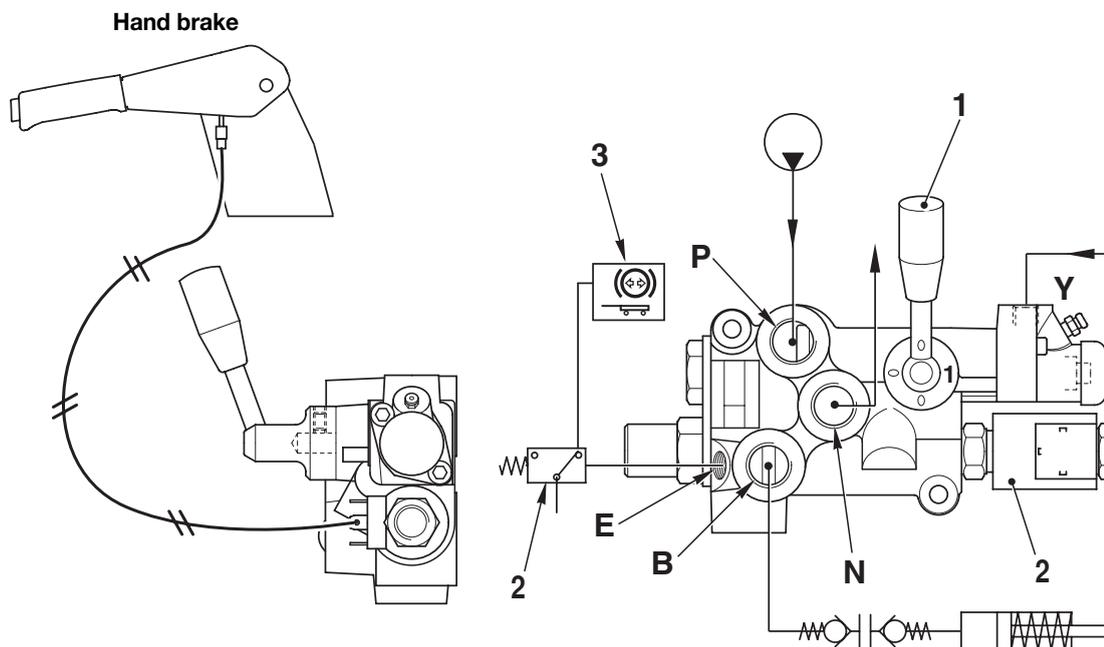
D0012720

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. As a result, the pressure switch (2) detects the lack of pressure and illuminates the indicator light (3) on the dashboard.
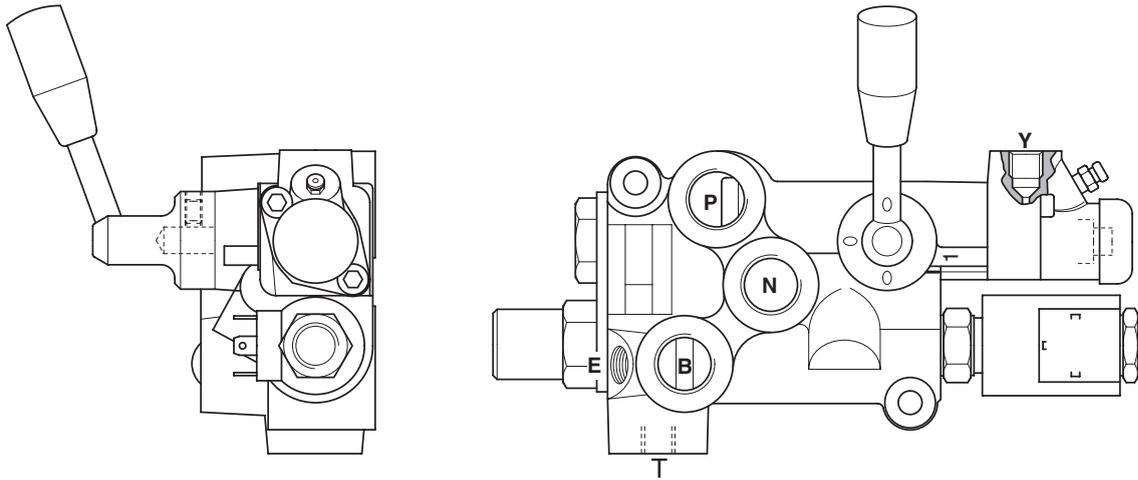
HYDRAULIC DIAGRAM
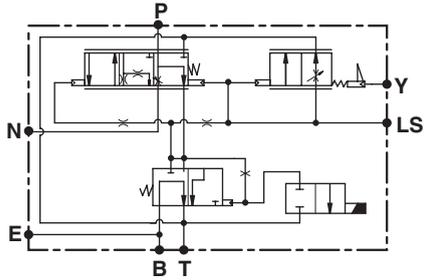
D0012730

FUNCTION

Port P -   Valve feed

Port N -   To auxiliary services control valve

Port B -   To trailer brake

Port T -   Drain

Port Y -   Connection to tractor braking system

Port E -   Low braking pressure sensor
           (for indicator light)

TECHNICAL DATA

- Maximum pressure at port N:
  200 bar (2900 psi)

- Minimum constant pressure at port B:
  12.5±2 bar (181.3±29 psi)

- Maximum pressure at port B:
  135º5 bar (1957.5º72.5 psi)

- Feed flow rate:
  20–80 ℓ/min (5.3 –21.14 US.gpm)

2.3.2 HYDRAULIC TRAILER BRAKING (EXPORT VERSION)

D0012750
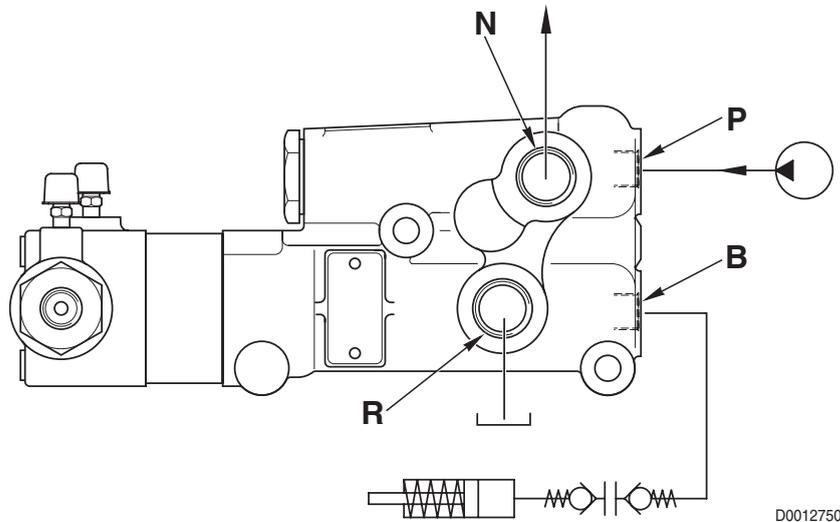
- When the brakes are not operated the pressure at port **B** is null.

- 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.
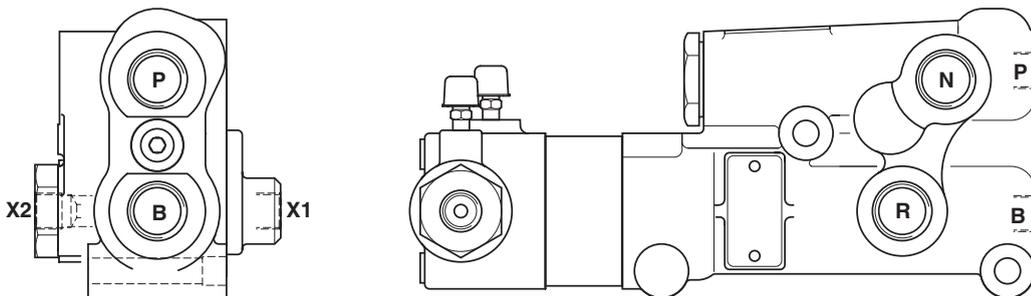
HYDRAULIC DIAGRAM

D0012740
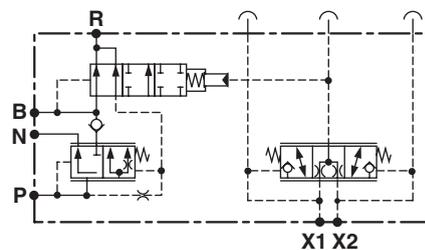
Port P -   Valve feed

Port N -   To auxiliary services control valve

Port B -   To trailer brake

Port X1-X2 - Connection to tractor braking system

Port R -   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:
  $142 {}_{0}^{+8}$ bar ($2059 {}_{0}^{+116}$ psi)

- Feed flow rate:
  20–80 ℓ/min (5.3 – 21.14 US.gpm)

2.3.3 AIR TRAILER BRAKING (ITALY VERSION)
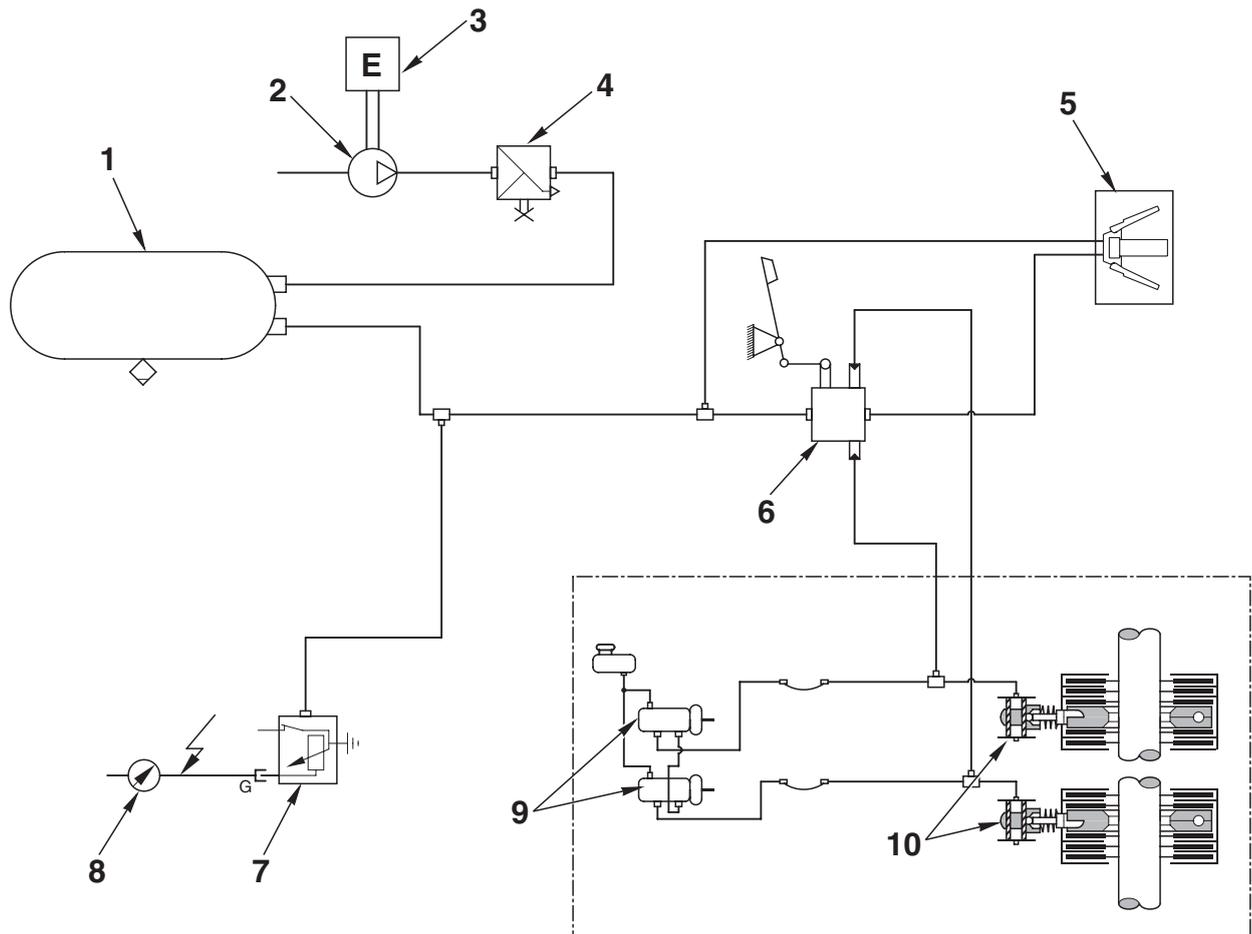
D0011690

COMPONENTS

1. Compressed air reservoir
2. Air compressor
3. Engine
4. Pressure limiting valve (7.8 bar (113 psi))
5. Quick-action coupler for trailer

6. Trailer braking valve
7. Circuit pressure sensor
8. Circuit pressure indicator
9. Brake master cylinder
10. Brake

10-25

2.3.4 AIR TRAILER BRAKING (EXPORT VERSION)
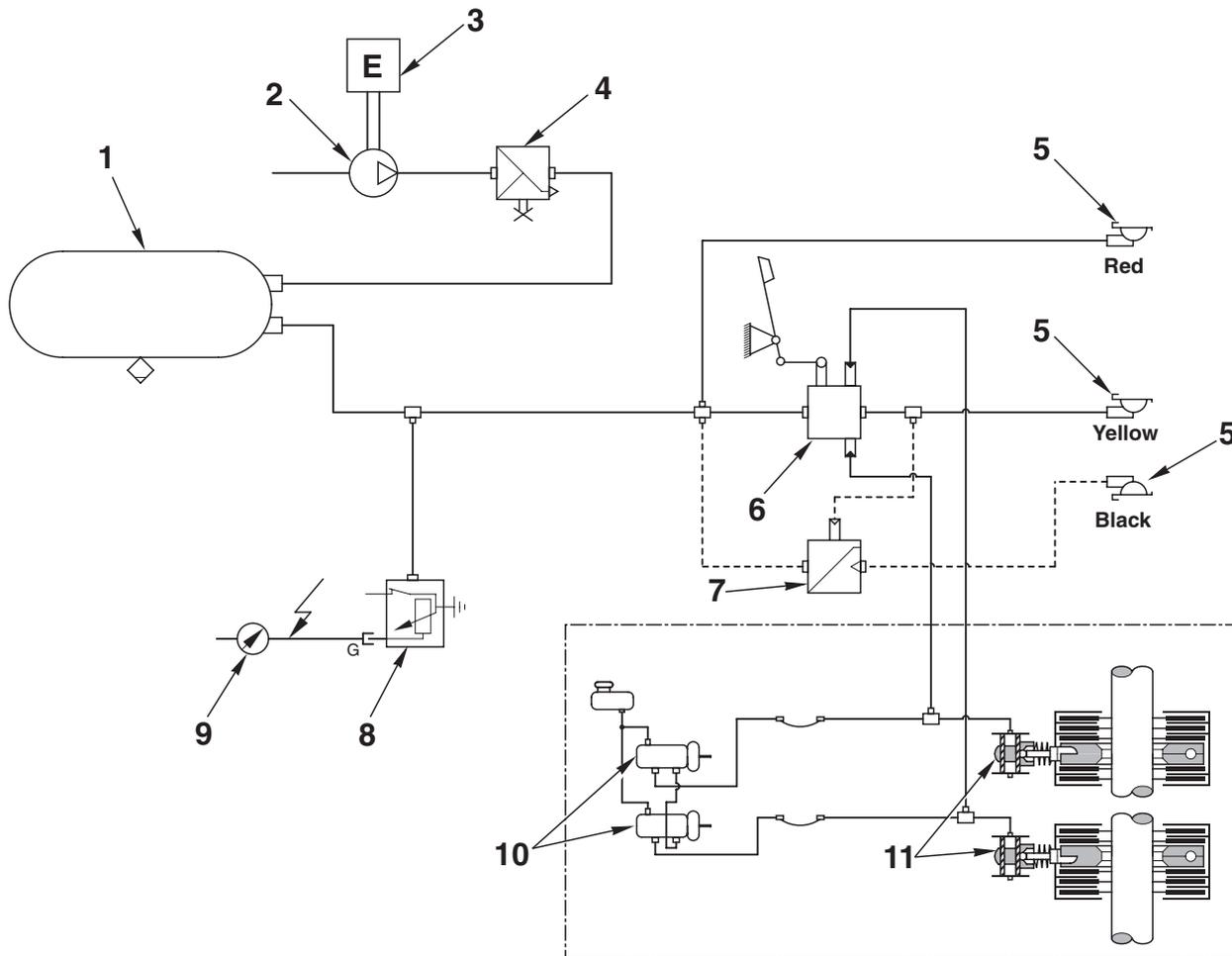
D0011681

1. Compressed air reservoir
2. Air compressor
3. Engine
4. Pressure limiting valve (7.8 bar (113 psi))
5. Quick-action coupler for trailer
6. Trailer braking valve (2-way)

7. Trailer braking valve (1-way)
8. Circuit pressure sensor
9. Circuit pressure indicator
10. Brake master cylinder
11. Brake

COMPRESSOR

D0012880

a.   Compressor lubrication
b.   Compressor lube oil return
c.   Port 0 - Air intake
d.   Port 2 - Air delivery

1.   Cylinder head
2.   Cylinder
3.   Drive shaft

TECHNICAL DATA

Bore: 75 mm
Stroke: 36 mm
Displacement: 159 cm³
Max. pressure: 18 bar
Crankshaft end float: 0.2 – 0.6 mm

10-27

PRESSURE LIMITING VALVE
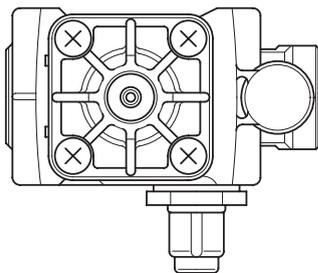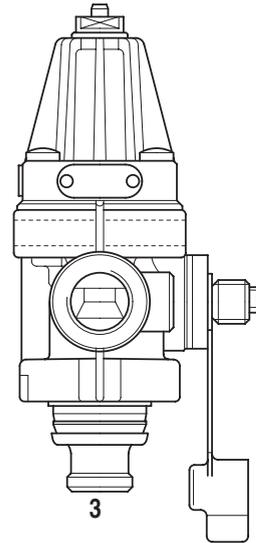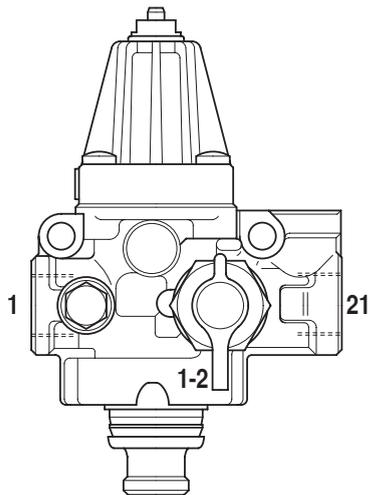
DIAGRAM
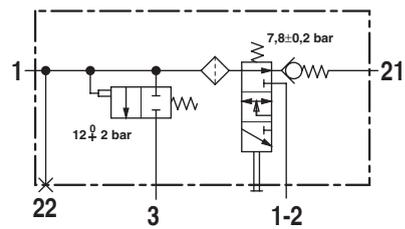
D0004690

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

TECHNICAL DATA

Cut-out pressure: 7.8±0.2 bar (113±2.9 psi)
Cut-in pressure: 0.6–1 bar (8.7 – 14.5 psi)
Relief valve setting: $12^{0}_{+}2$ bar ($174^{0}_{+}29$ psi)
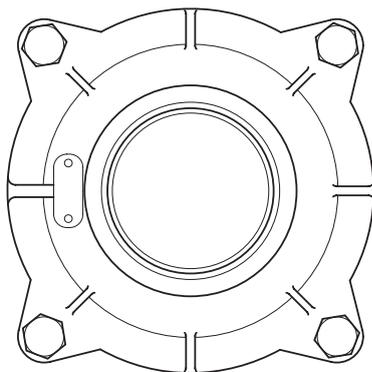
TRAILER BRAKING VALVE (2-WAY)

DIAGRAM

P2 (bar)

Delivery pressure

P41/P42 (bar)

Hydraulic control pressure
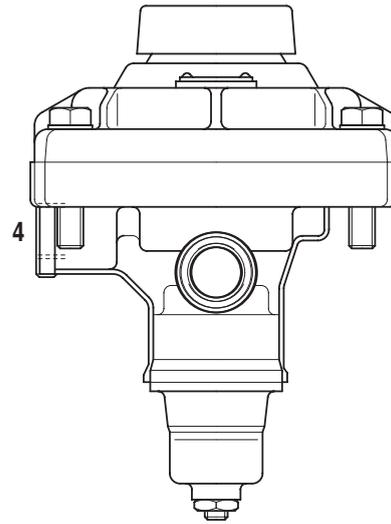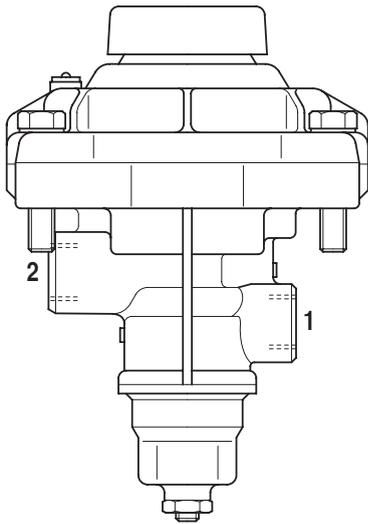
P42= f (P41,42)

P42= f (P41)

P42= f (42)
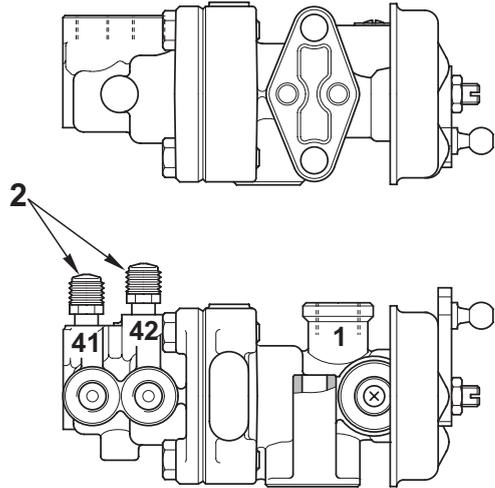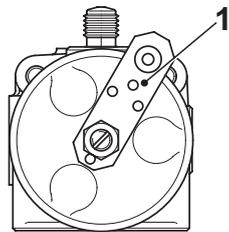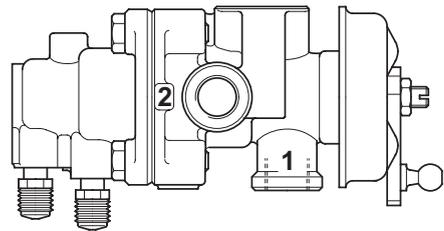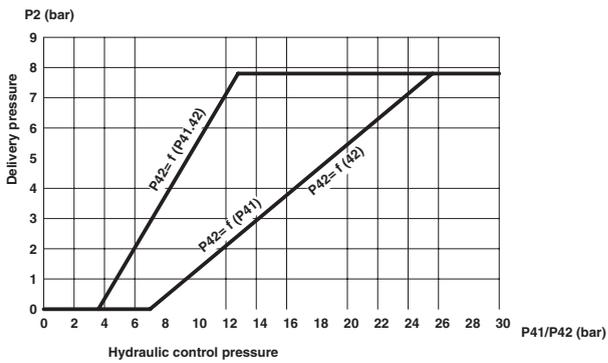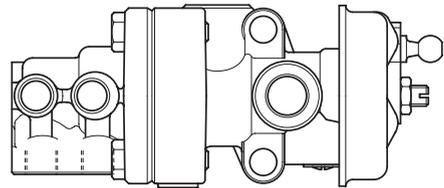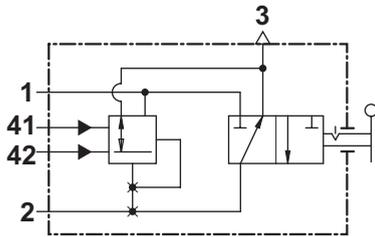
D0004761

a. Parking brake actuating lever
b. 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.
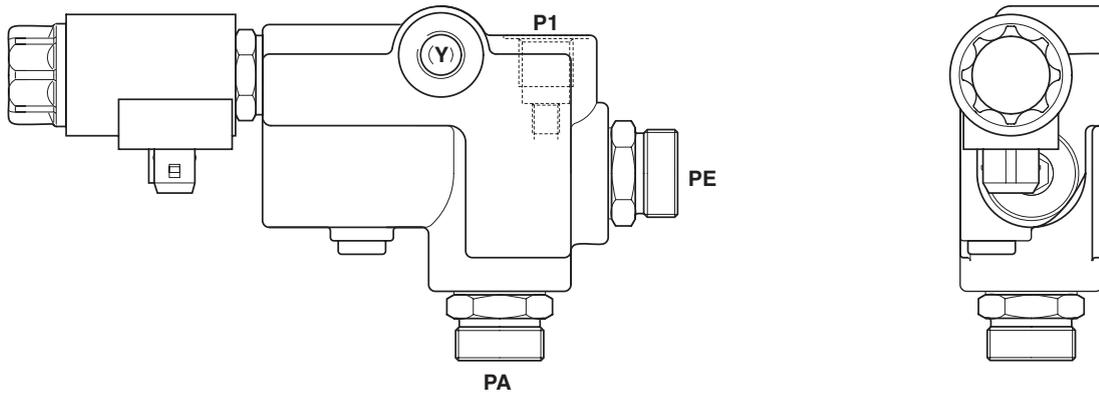
The system comprises:

• swinging axle support arm (1)

• position sensor (2)

• 2 suspension cylinders (3)

• front suspension control valve (4)

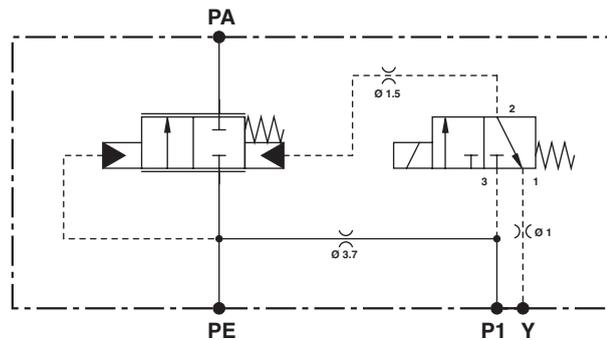• control valve feed solenoid valve (5)

• electronic control unit (6)
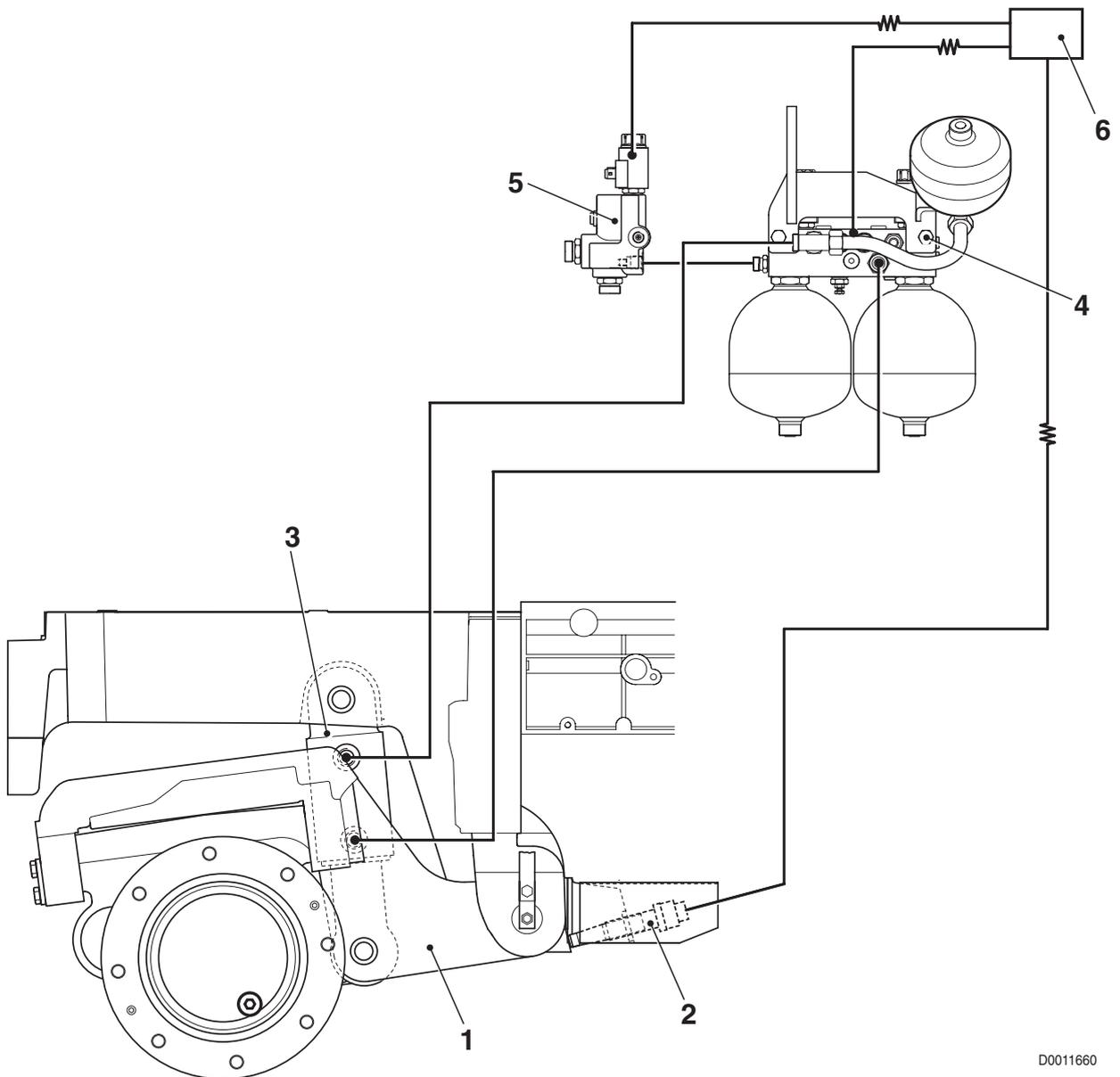
D0011660

3.1 SOLENOID VALVE - SUPPLY TO FRONT SUSPENSION CONTROL VALVE

DIAGRAM

D0011700

FUNCTION

| Port Y: | Drain |
Port P1:	Supply to front axle suspension control valve
Port PA:	Supply to auxiliary services control valve
Port PE:	Valve supply

CHARACTERISTICS

Rated pressure: 210 bar

Maximum flow rate (PE -> PA): 80 ℓ/min

3.2 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.
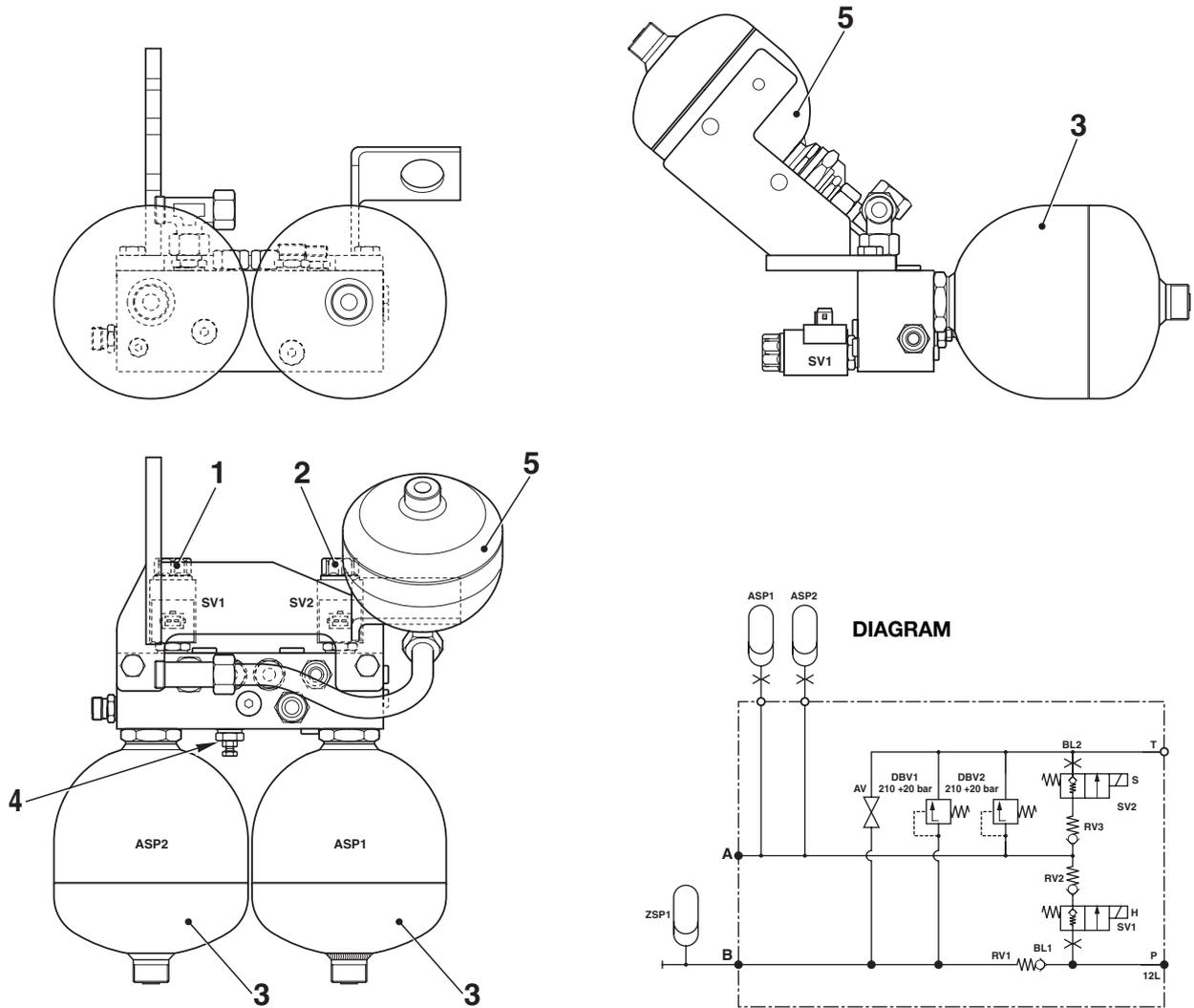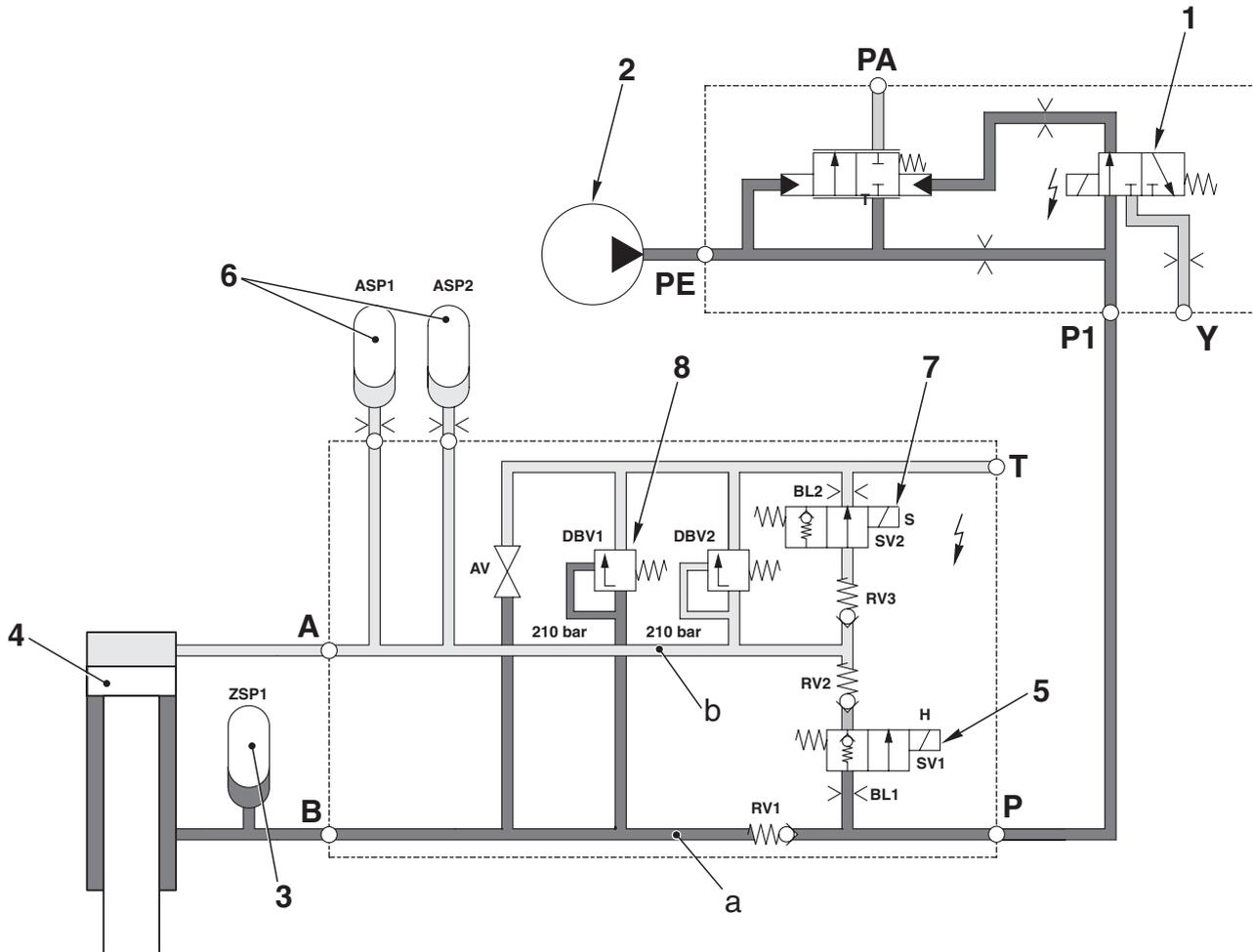

D0012890

1. Cylinder extension control solenoid valve
2. Cylinder retraction control solenoid valve
3. Accumulator (setting: 65 bar)
4. Pressure discharge valve
5. Accumulator (setting: 140 bar)

OPERATION

1.   When the suspension is deactivated

D0013030

- When the suspension is deactivated, the electronic control unit energises the solenoid that controls the oil supply to the control valve (1).

- 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
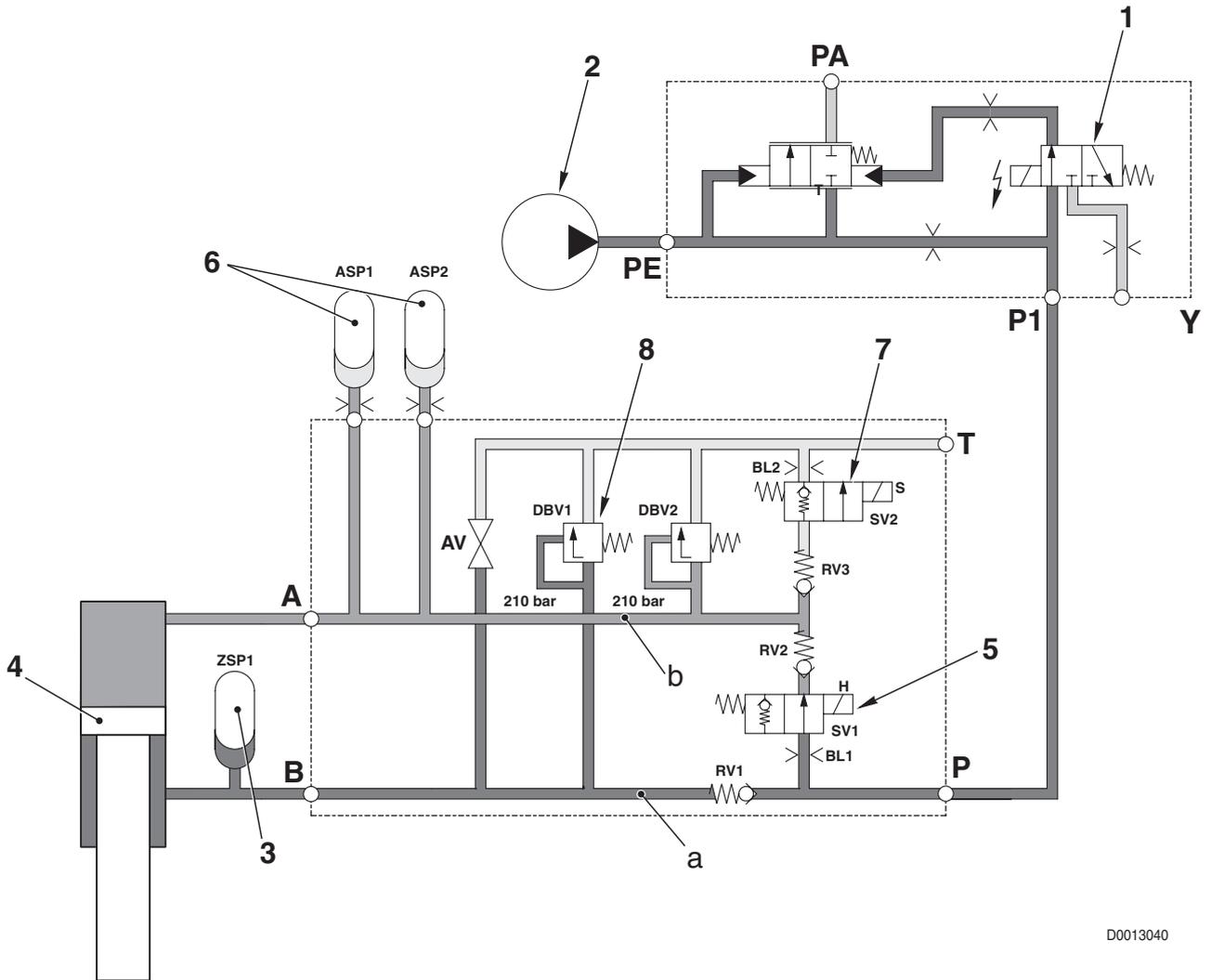
D0013040

- 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.
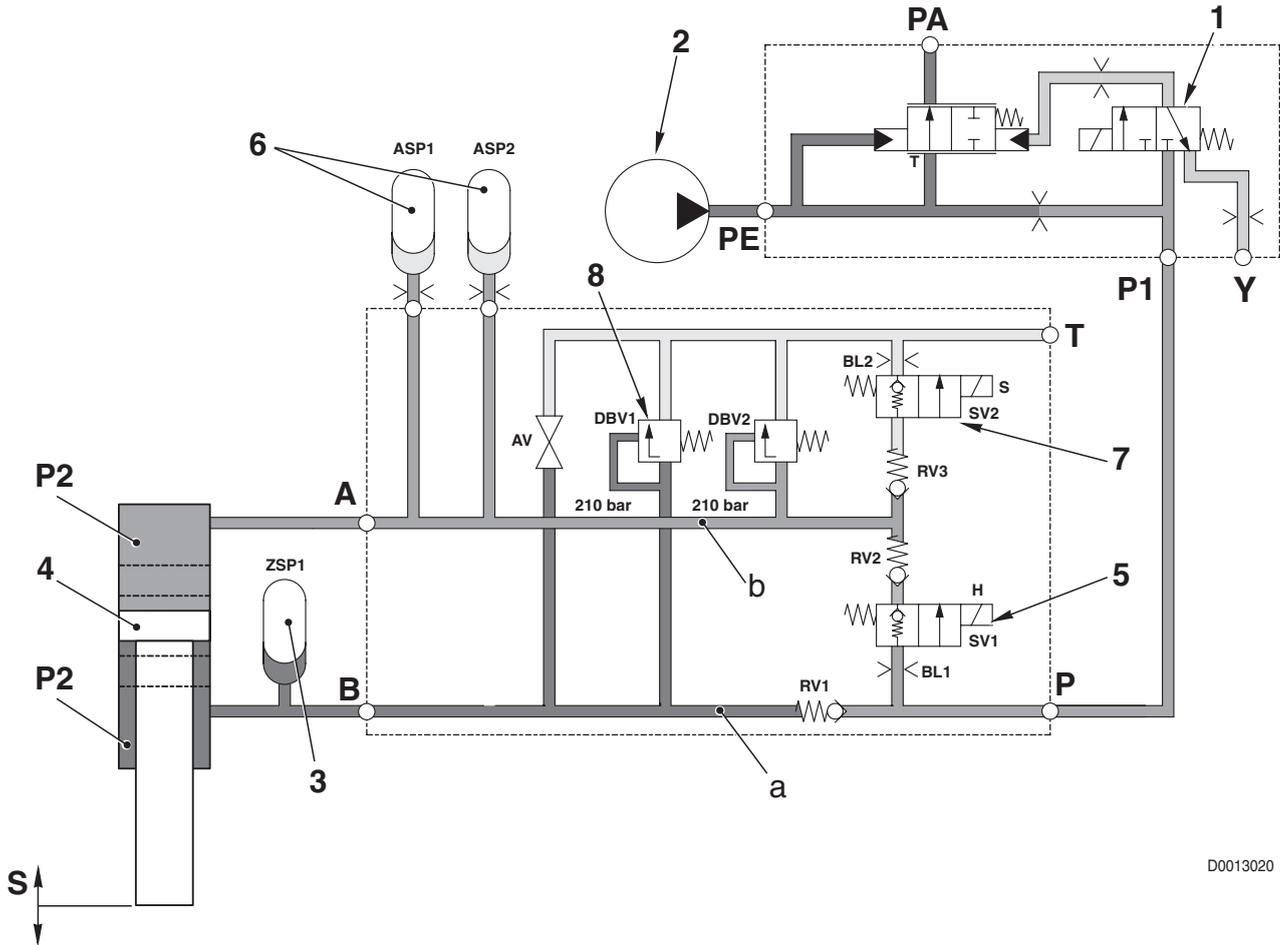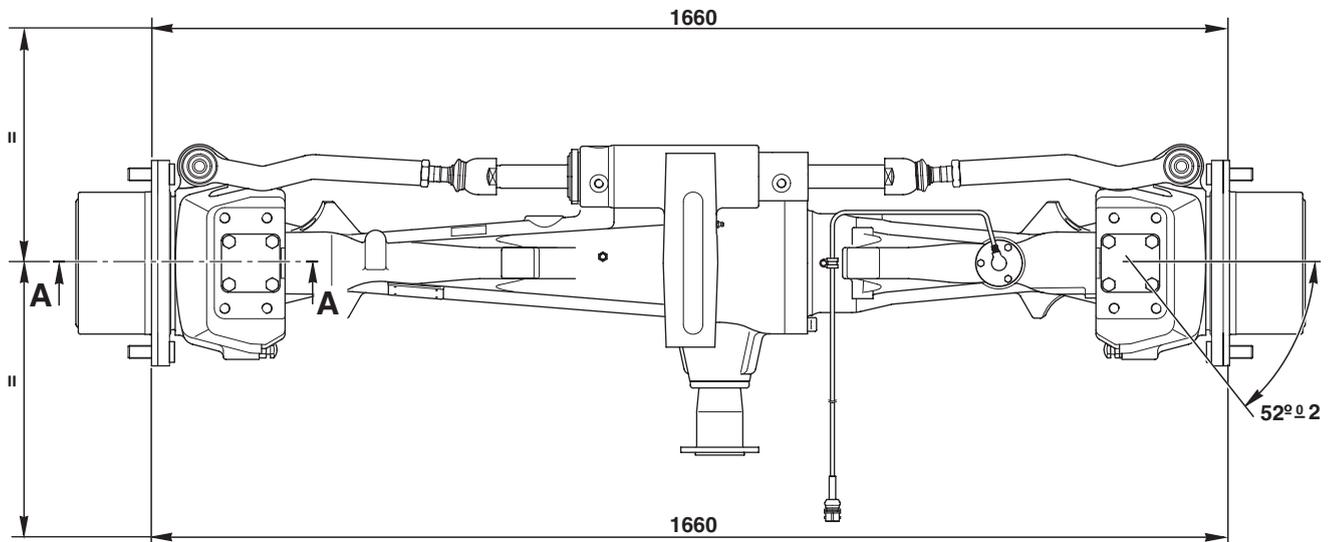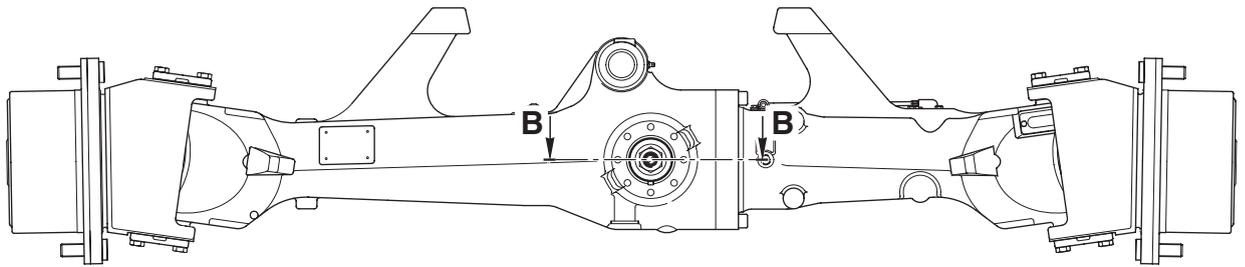

D0013020
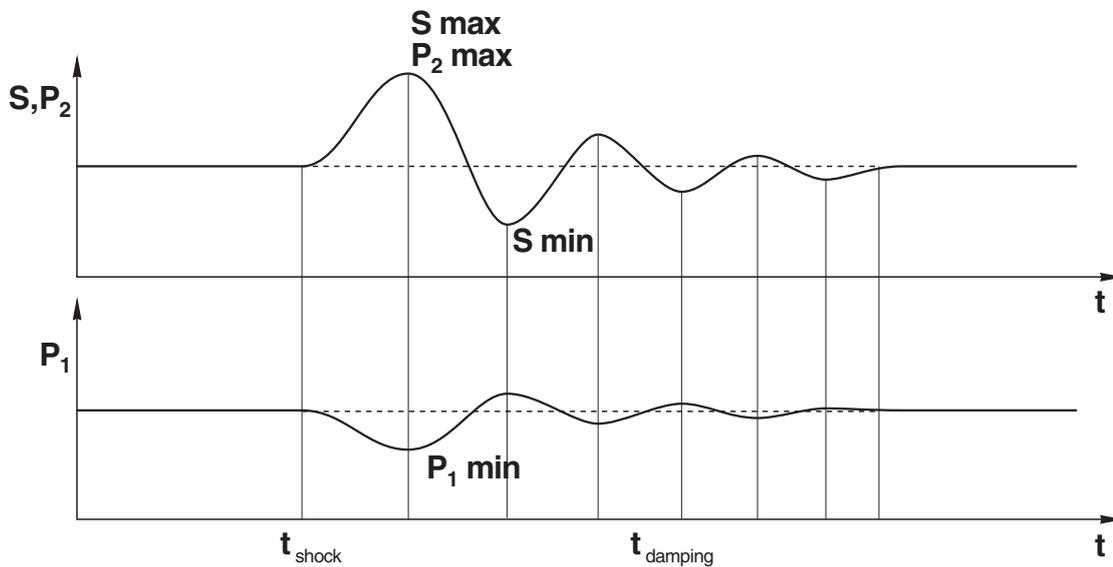
D0002411

4. FRONT AXLE


1660

52º₀ 2

1660

D0011790

5. HYDRAULIC SYSTEM

DESCRIPTION

The Agrotron MKIII series is equipped with a Closed Centre (CC) hydraulic system, with one gear pump to supply the transmission circuit and a tandem gear pump to supply the steering circuit and services (auxiliary service control valves, trailer braking, etc.).

The CC hydraulic system supplies oil to the loads at a rate of flow that is proportional to the engine speed.

This means that when the engine is running at top speed and no hydraulic services are in operation (e.g. during road use), the pump will continue to circulate oil in the hydraulic circuit at the rate of approximately 80 litres per minute (with a consequent increase in temperature and oil consumption) without any of this oil being used.

5.1 HYDRAULIC SYSTEM
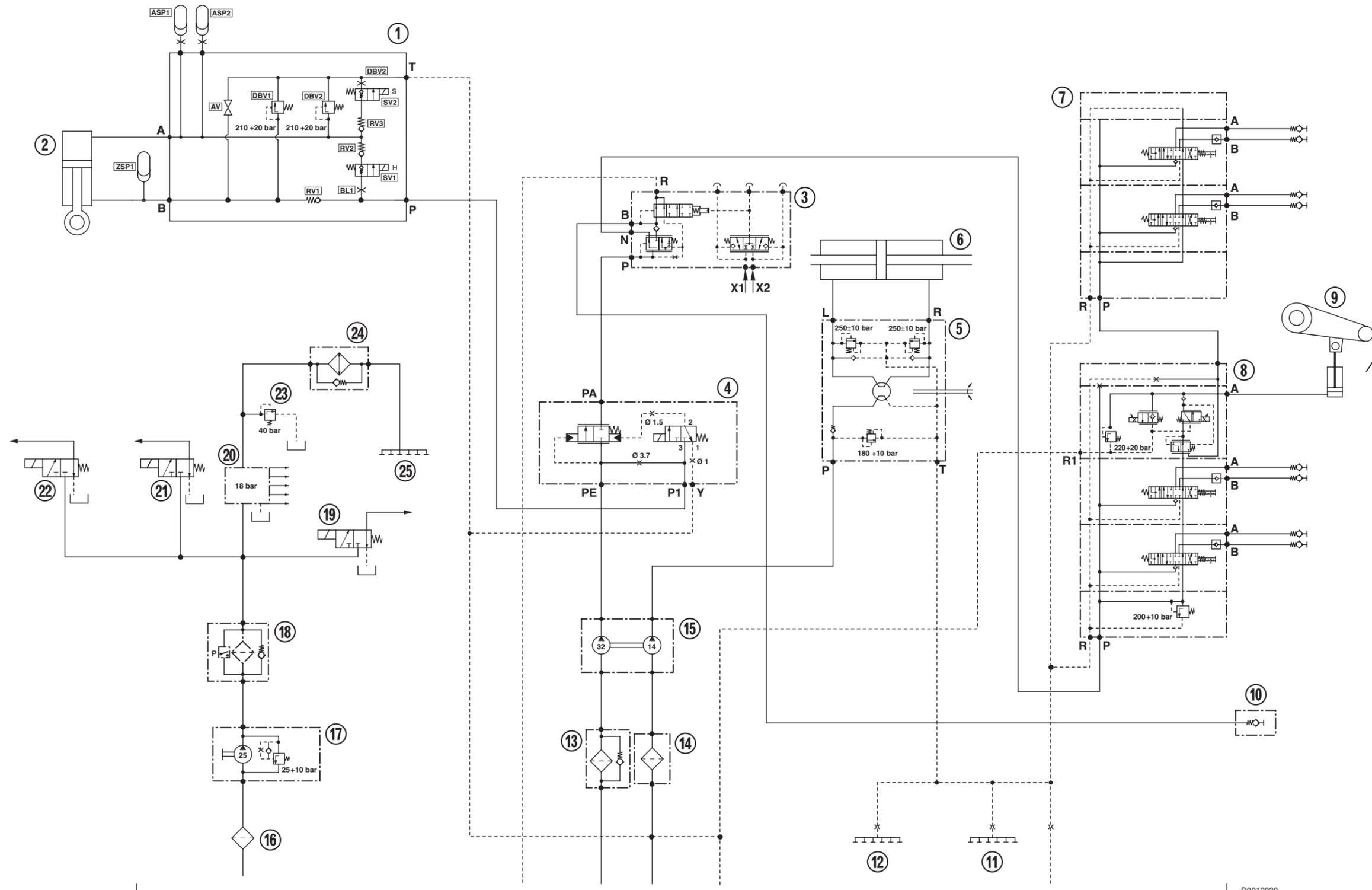
1. Suspension control valve Load Sensing suspension
2. Front axle suspension cylinder (2)
3. Trailer braking valve
4. Solenoid valve controlling flow to front axle control valve
5. Power steering
6. Steering cylinder
7. Auxiliary services control valve (spools 3 and 4)
8. Auxiliary services control valve (spools 1, 2 and lift)
9. Lift
10. Trailer brake connection
11. Rear PTO lubrication
12. Rear axle lubrication
13. Filter for services circuit
14. Filter for steering circuit
15. Gear pump for services and steering circuit
16. Filter for transmission circuit
17. Gear pump for transmission circuit
18. Filter for transmission circuit
19. Four-wheel drive control solenoid valve
20. Hydraulic gearbox control solenoid valve
21. Differential lock control solenoid valve
22. Rear PTO control solenoid valve
23. Lubrication circuit pressure relief valve
24. Cooler
25. Transmission lubrication

D0012930

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5.2 GEAR PUMP FOR TRANSMISSION ZF 7100

View X
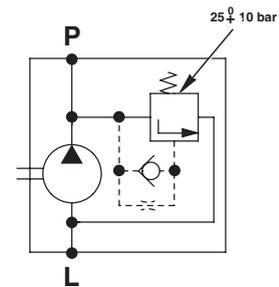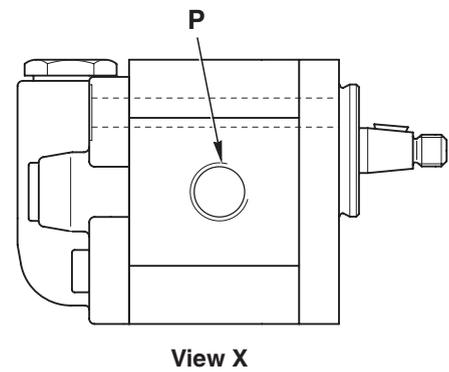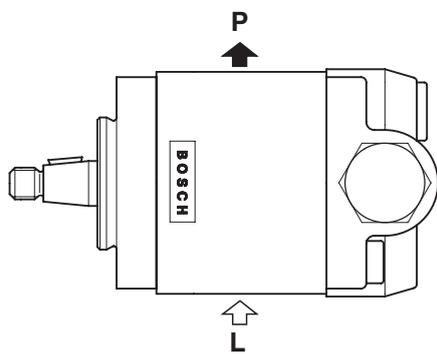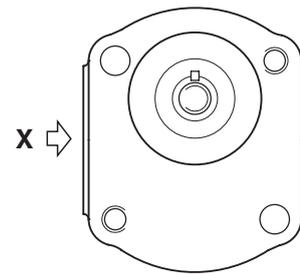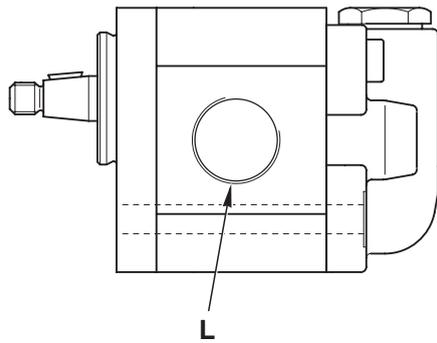
D0011730

FUNCTION

Port L: suction

Port P: delivery

TECHNICAL DATA

Displacement: 25 cc/rev

Maximum pressure: 25±10 bar

5.3 GEAR PUMP FOR HYDRAULIC SERVICES AND STEERING

View X
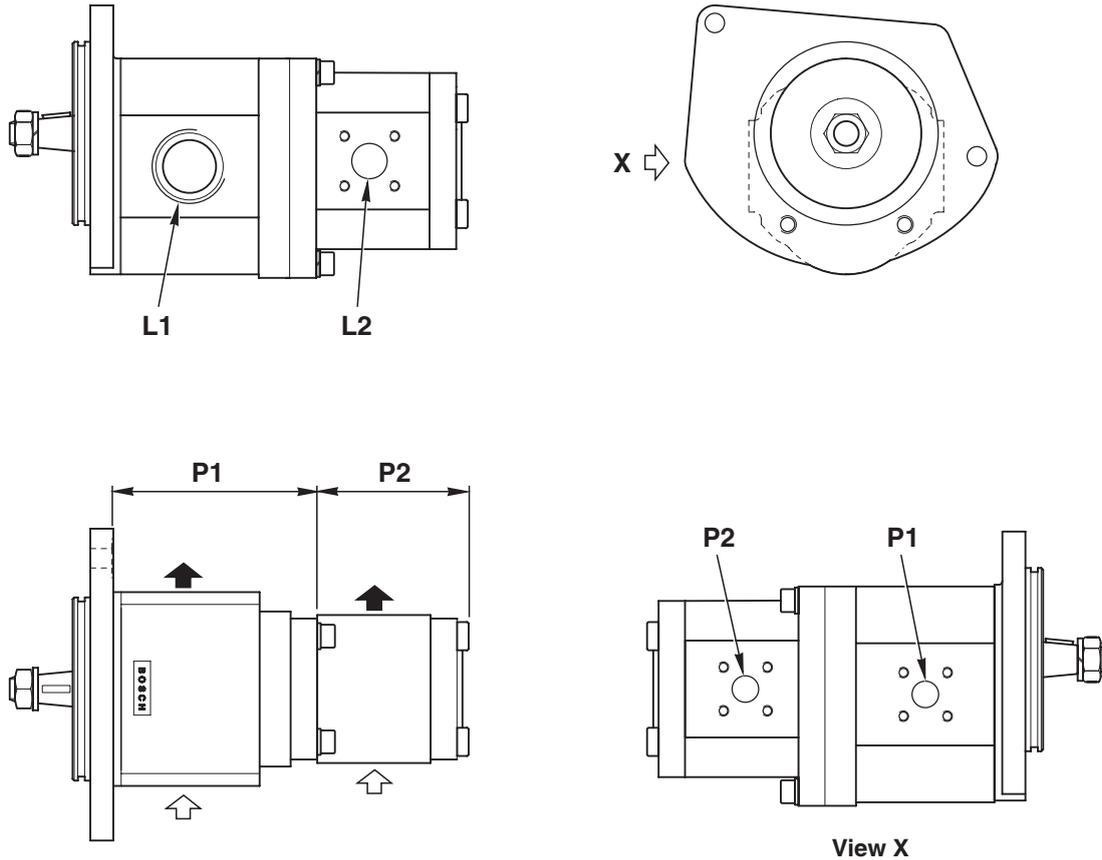
D0011710

FUNCTION

Port L1: inlet

Port L2: suction

Port P1: supply to services

Port P2: supply to power steering

CHARACTERISTICS

Pump P1

Displacement: 32 cc/rev

Maximum pressure: 200 bar (2900 psi)

Pump P2

Displacement: 14 cc/rev

Maximum pressure: 180 bar (2610 psi)

5.4 POWER STEERING
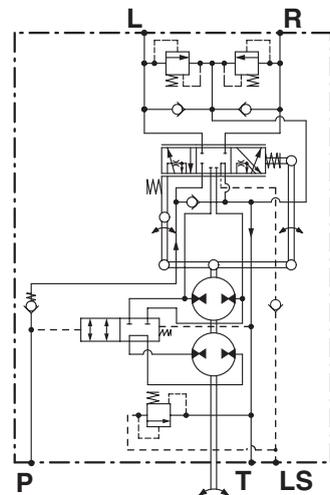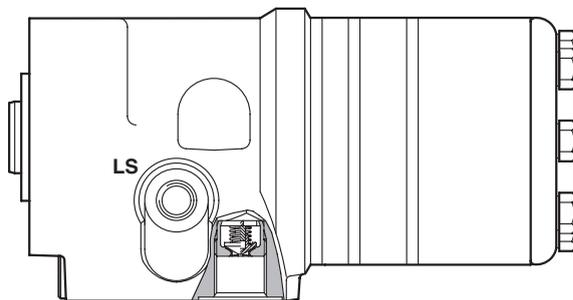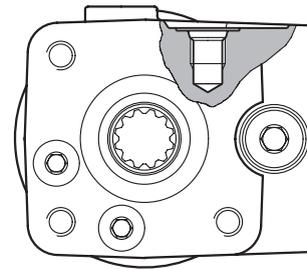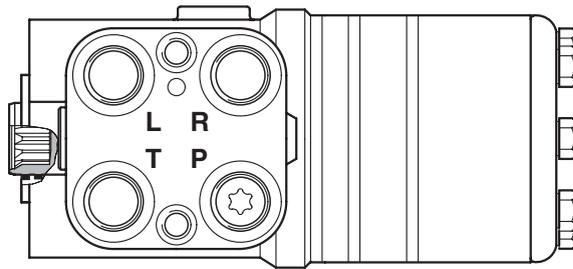
D0012010

FUNCTION

Port P: delivery
Port T: return
Port R: right steering
Port L: left steering

CHARACTERISTICS

Displacement: 150 cc/rev
Maximum pressure: 180–190 bar
Relief valve: 240–260 bar

5.5 AUXILIARY SERVICES CONTROL VALVE

FUNCTION

- The function of the auxiliary services control valve is to control the flow of oil to the auxiliary services and the rear lift.
- This control valve is of the serial type, i.e. it can be operated one spool at a time.

REAR GEARBOX
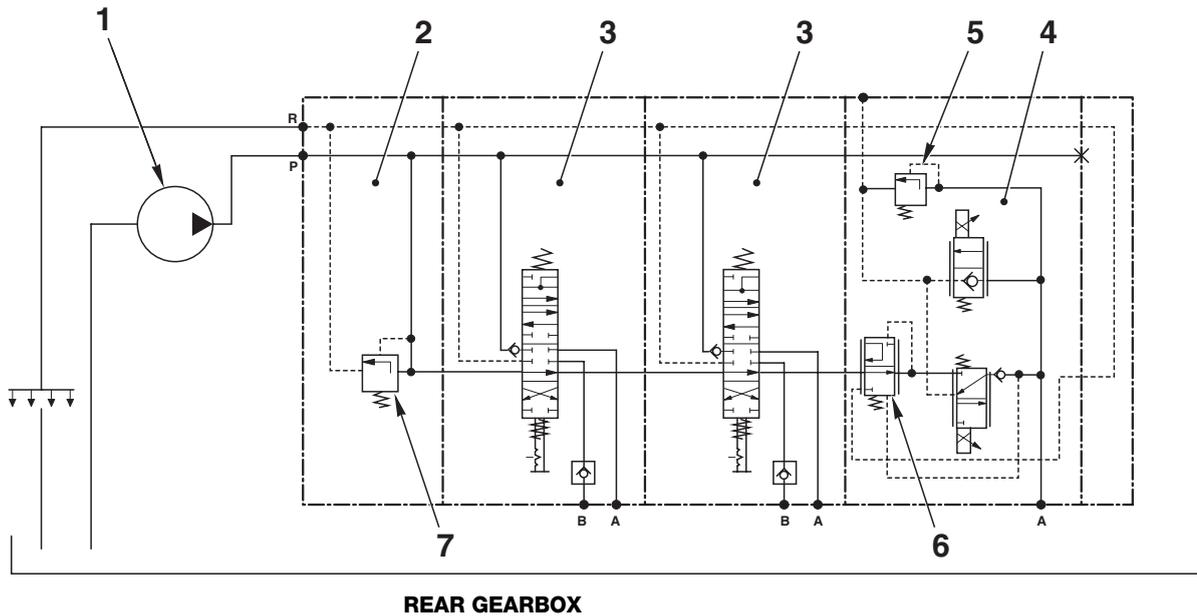
D0011800

DESCRIPTION

- The pressurised oil from the pump (1) enters the inlet section (2), from where it is distributed to the spools (3), (4) through the internal passages.
- The inlet section (2) has a pressure relief valve (7) that serves to prevent an excessive increase in the operating pressure of the loads.
- On the lift element (4) there is a flow control valve (6) that serves to send excess oil supplied by the pump to the lubrication circuit.
- On the lift control element (5) there is also an antishock valve (on the "up" control side), which serves to prevent any excessive pressure surges caused by jolting of the implement.

5.5.1 TYPES OF CONTROL VALVE

4-WAY VERSION

HYDRAULIC DIAGRAM
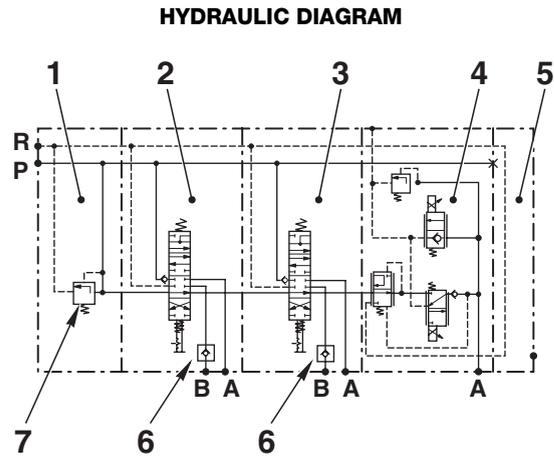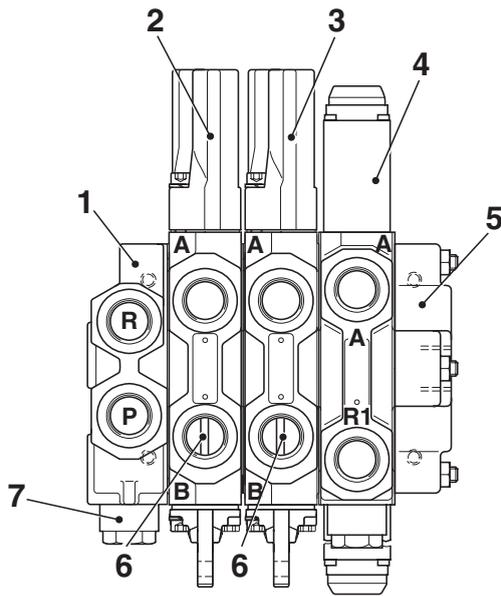
D0012910

1. Inlet manifold
2. Control valve section n° 1
3. Control valve section n° 2
4. Lift control valve section

5. End cover
6. Check valve
7. Pressure relief valve

8-WAY VERSION

D0012900

1. Inlet manifold
2. Control valve section n° 1
3. Control valve section n° 2
4. Lift control valve section
5. End cover
6. Inlet manifold

7. Control valve section n° 3
8. Control valve section n° 4
9. End cover
10. Check valve
11. Pressure relief valve

5.5.2 SERVICES CONTROL SECTION
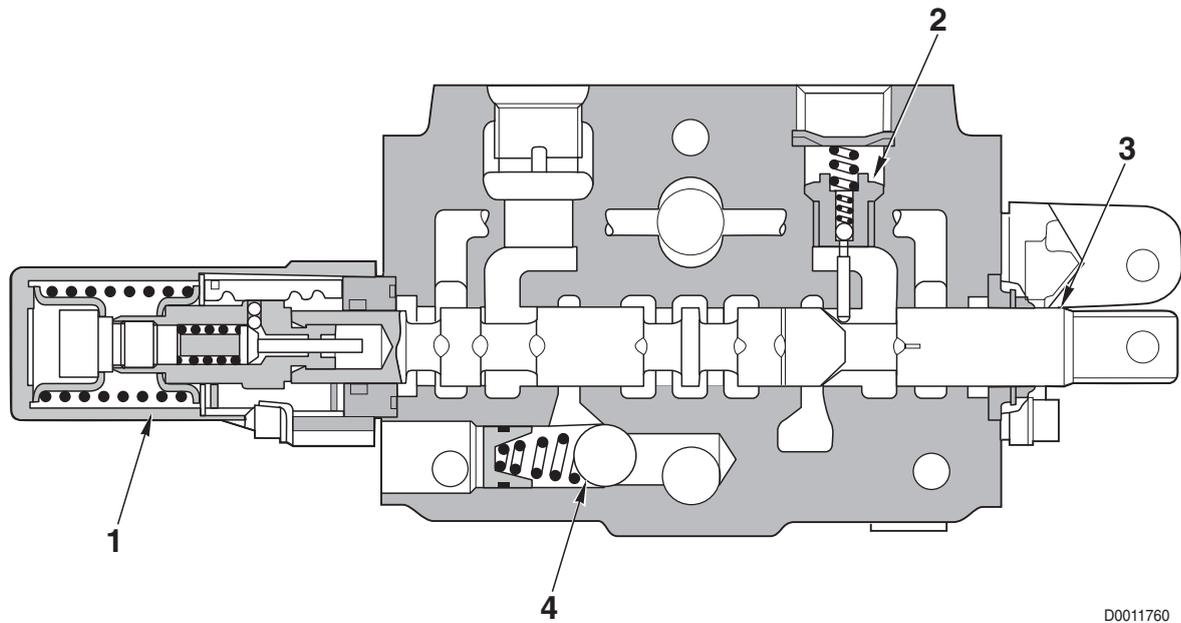
D0011760

1.   Spool return device
2.   Check valve
3.   Spool
4.   Check valve

5.5.3 DESCRIPTIONS OF COMPONENTS

SPOOL RETURN DEVICE
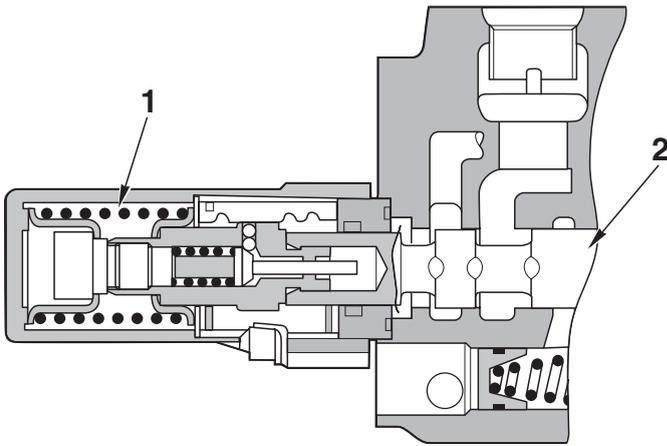
D0011770

1. Spool return spring
2. Spool

CHECK VALVE (NR)
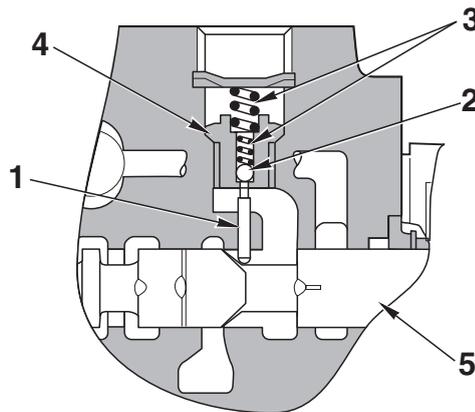
D0011780

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

5.5.4 INLET MANIFOLD

DESCRIPTION

The function of the inlet manifold is to send the required amount of oil to the actuators and to limit their operating pressure.
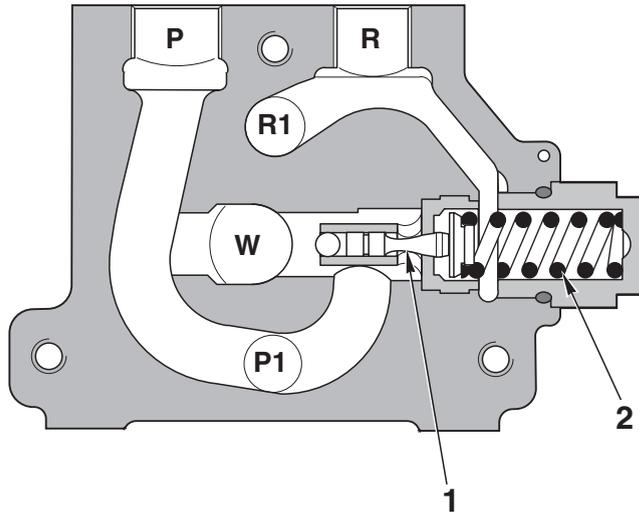
HYDRAULIC DIAGRAM
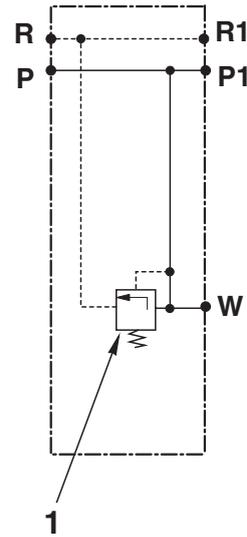
D0011750

1. Pressure relief valve
2. Relief valve spring

5.5.5 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.
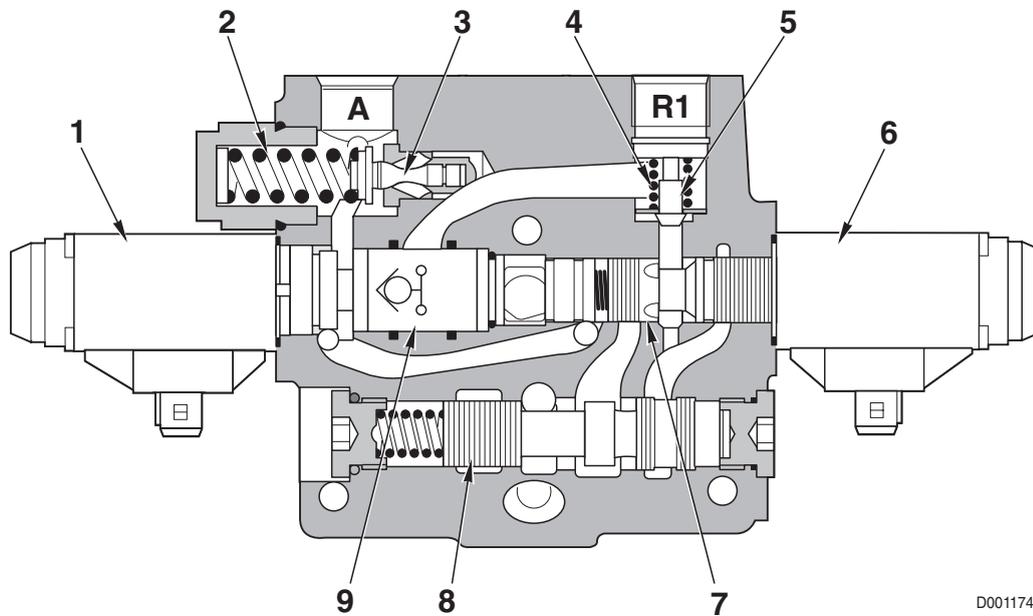
D0011740

COMPONENTS

1. DOWN control solenoid valve
2. Antishock valve spring
3. Antishock valve
4. Check valve spring
5. Check valve

6. UP control solenoid valve
7. UP control spool
8. DOWN control spool
9. Flow control valve

SECTION 20

CONTENTS

OPERATOR'S MANUAL

SERDIA (LEVEL III)

1. ENTRY AND COMMUNICATION

1.1 OVERVIEW

Digital electronic engine ECUs have become a normal part of modern engine technology.

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

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

b) a commercially available notebook (or PC),

SERDIA forms a special tool

.
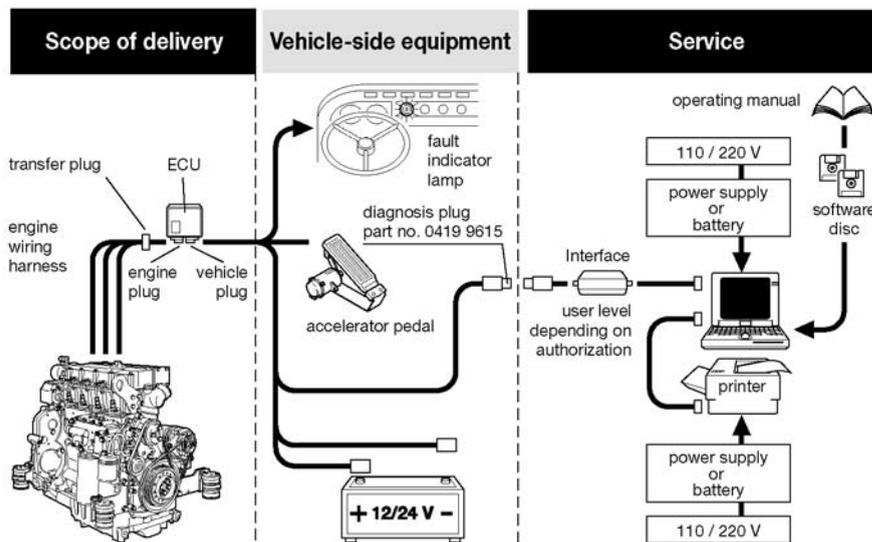
1.1.1 INTRODUCTION

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

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

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

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

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

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

The menu points listed below are available:

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

1.1.2 HARDWARE AND SOFTWARE

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

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

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

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

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

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

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

1.2 ORDERING

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

<div align="center">

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

Viale F. CASSANI, 15

24047 TREVIGLIO (BG) - ITALIA

</div>

1.2.1 FIRST-TIME USERS

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

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

1.2.2 ORDERING SINGLE PARTS

Ser. No.	Part	Competence level	Re-order No.
T5	Installation diskette		5.9030.740.0
T6	Adapter		5.9030.741.0
T7	Interface level III	Major overhaul	5.9030.740.2

1.2.3 Adapter

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

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

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

DEUTZ Part No. 5.9030.741.0

1.3   SWITCH ON NOTEBOOK AND INSTALL SOFTWARE

1.3.1 INSTALLING MS WINDOWS®

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

1.3.2 INSTALLING SERDIA

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

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

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

With Windows 3.11 (3.1):
• In the main group, open "File manager" by double clicking on the symbol using the mouse.
• Select disk drive A:
• Start "install.exe" by double clicking with the mouse.
• Follow the installation instructions appearing on the screen.
• Remove the installation disk from the disk drive and keep safe.
• After re-starting, open the "SERDIA" program group by double clicking.
• Start "Diagnostics Service" by double clicking.

With Windows 95 (98):
• Open "Desktop" by double clicking.
• Open "3.5 disk (A:)" by double clicking.
• Start "install.exe" (Run Me!) by double clicking.
• Follow the installation instructions on the screen.
• Remove the installation disk from the disk drive and keep safe.
• After re-starting, click on the "Start" button and select the "Programs" folder.
• Start the program "Diagnostics service" in the "Serdia" sub-menu.

1.3.3 SERDIA UPDATES

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

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

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

1.4   USER LEVEL, ACCESS AUTHORIZATION

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

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

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

1.5   MAKING A CONNECTION BETWEEN ECU (ENGINE) AND NOTEBOOK

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

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

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

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

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

✋ ATTENTION!

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

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

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

1.6   PROGRAM START

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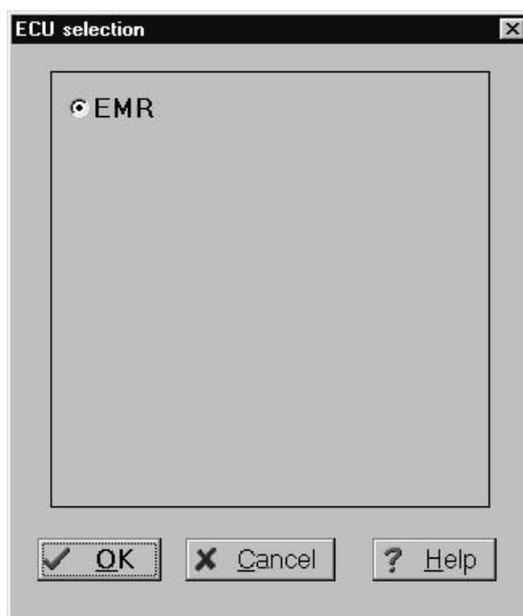
1.6.1 ESTABLISHING COMMUNICATION WITH THE ECU

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

• If no ECU or interface is connected, SERDIA will operate in offline mode, see Chapter 1.7.2 DEMO mode.

• If communication with the ECU cannot be established, the system issues an error message, see Chapter Error in establishing the communication link.

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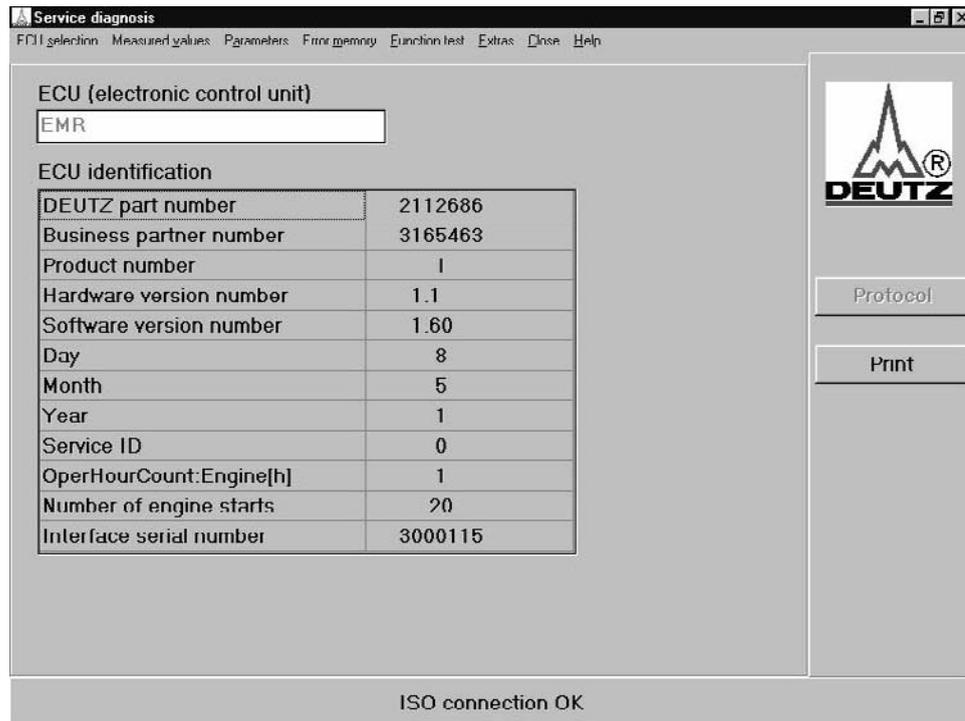
1.7   OFFLINE MODE

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

The password-protected mode and the DEMO mode are always offered by SERDIA if no successful establishment of communications has been reported.
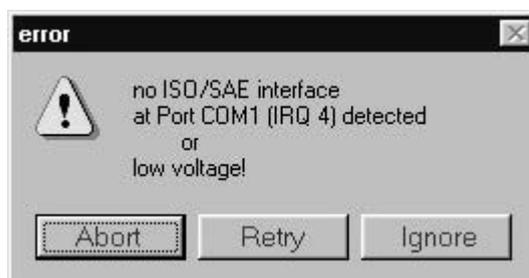
Click on "**Ignore**". The desired mode is selected in the "Confirm" window.

Confirmation

? Password protected mode [y] or demonstration mode[n]

Yes   No   Cancel
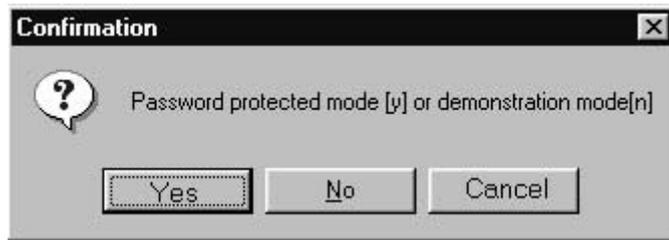
1.7.1 PASSWORD-PROTECTED MODE

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.

Password

******

✓ OK

1.7.2 DEMO MODE (TRAINING WITHOUT ECU)

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

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

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

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

1.8   WORKING WITH THE PROGRAM

Brief description:

1)   Call SERDIA under Windows

2)   Click on ECU selection in the SERDIA main screen

3)   Select the ECU you require in the screen "ECU selection"

4)   Select the menu point you require in the SERDIA main screen

1.8.1 MAIN SCREEN, MENU SELECTION

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

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

1.8.2 MENU POINT "ECU SELECTION"

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

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

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

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

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

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

Displayed measured values that have exceeded an upper or lower value (if applicable) are stored in color.

Only those measuring points that are appropriate to the ECU are displayed in sequence, differentiated by the following:

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

displayed by:

- designation
- value
- unit

The measured values are rerreshed after a predefined sensor rate. They can be displayed with the engine shut down as well as with the engine in operation.

For rnore information, please see Chapter 3. Meas,ed values.

1.8.4 MENU POINT "PARAMETERS"

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

- custonner requiremenis
- abaptation to locai requirements
- replacement installation

The pararneters can only be changed with SERDIA!

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

For more information. please see Chapter 4, Parameters..

1.8.5 MENU POINT "ECU SELECTION"

The error messages stored in the ECUs can be read from this menu point.

Error messages refer solely to the electrical parts of the engine system, such as the cable harness and the measured value sensors.

An error message may take the form of: "Broken cable or short-circuit".

Only passive error messages can be cleared, active messages are retained. When the error is corrected, active error messages are changed into passive error messages. The error message will be retained even if you disconnect the battery/power supply.

Error messages display information on

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

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

1.8.6 MENU POINT "FUNCTION TEST"

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

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

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

Before doing so, the engine must be shut down!

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

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

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

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

1.8.7 MENU POINT "EXTRAS"

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

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

For more information, please see Chapter 7, Extras.

1.8.8 Help

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

1.9 PRINT (OUTPUT)

The data for identifying the ECU, and also the data in other windows, can be issued in two different ways.
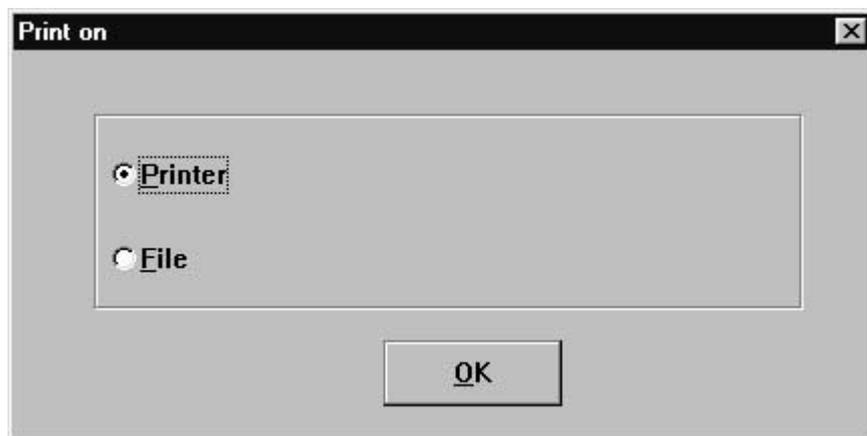
1) As a printout. A suitable printer driver has to be selected under Windows. At the top of all printouts, the logistical data appear:
- Type of ECU
- Date and time
- Interface serial number
- Engine number
- Part number functional data set
- Number of operating hours

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

The following table gives an overview of the possibilities for storing data from the various screens:
- as printable files for further processing, e.g. in Excel
- as configuration files to report changes
- as a graphic file (*.egr) readable in the SERDIA demo mode.

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

1.10 PROTOCOL (PROTOKOLL)

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

1.11 END COMMUNICATION

1.11.1 PROGRAM END

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

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

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

1.11.2 DISCONNECTING THE ECU

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

2.   ECU SELECTION

2.1   GENERAL

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

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

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

Possible ECUs:

EMR (Electronic Engine Governor)

MVS (Magnetic Valve System)

EMS (Engine-Monitoring System)

2.2 RECOGNITION OF ECUS

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

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

2.3   IDENTIFICATION DATA

2.3.1 EMR IDENTIFICATION

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

3   MEASURED VALUES

3.1   ACTUAL MEASURED VALUES (GENERAL)

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

Actual measured values			
Pick-up point	Value	Unit	**Meas. values**
Battery voltage	11,8	V	
Engine speed	0	1/min	**Graphics**
Control rod position	0,000	mm	Collect. time/s
(M9)Coolant temperature	29	°C	10
Fuel injection quantity	110,0	cmm/Hub	
			File
			Print
			Help
			Close

Figure: Current measured values of the EMR

✋ **ATTENTION!**

Values beyond the sensor measuring range are underlayed in colour:

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

Description 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.

Errore	✕
✕ More than 5 measured values selected!	
OK	
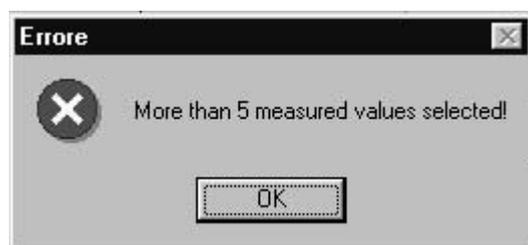
Collect, time:

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

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

A measurement duration of 10 s gives

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

Since the program can cover a maximum of approximately 2000 measuring points, before data recording starts the scanning rate is adjusted automatically as necessary.

The lowest possible scanning rate is determined by the duration of the data transfer from the ECU to the PC. The more variables are to be displayed at the same time, the longer the data transfer will take and the lower the scanning rate will be.

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

Print: The displayed measured values are printed.

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

3.1.1 MEASURED VALUE SELECTION
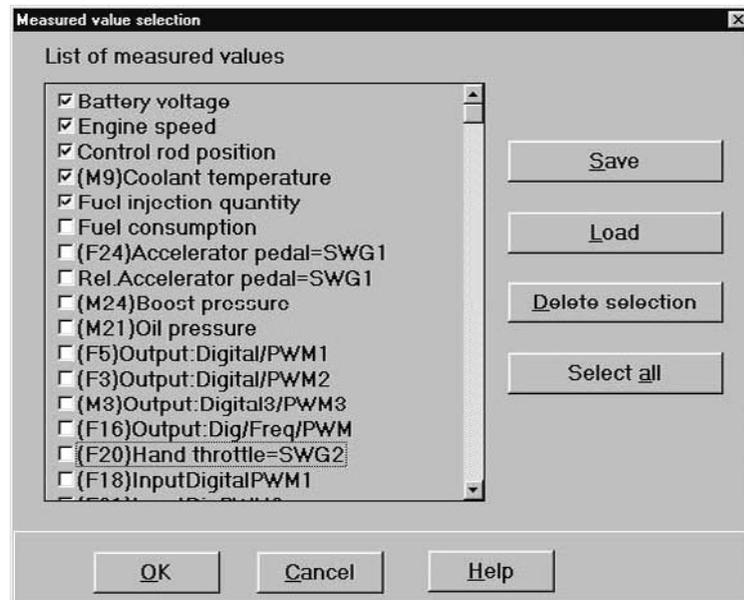
Figure: Measured value selection EMR

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

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

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

Delete selection: All measured values are deactivated for display.

Select all: All measured values are activated for display.

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

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

3.1.1.1 MEASURED VALUES EMR

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

Measured value selection

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

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

3.1.2 GRAPHICS

Once any desired measured values are selected, up to a maximum of 5, the window "Graphic display" can be opened by clicking on "Graphics".
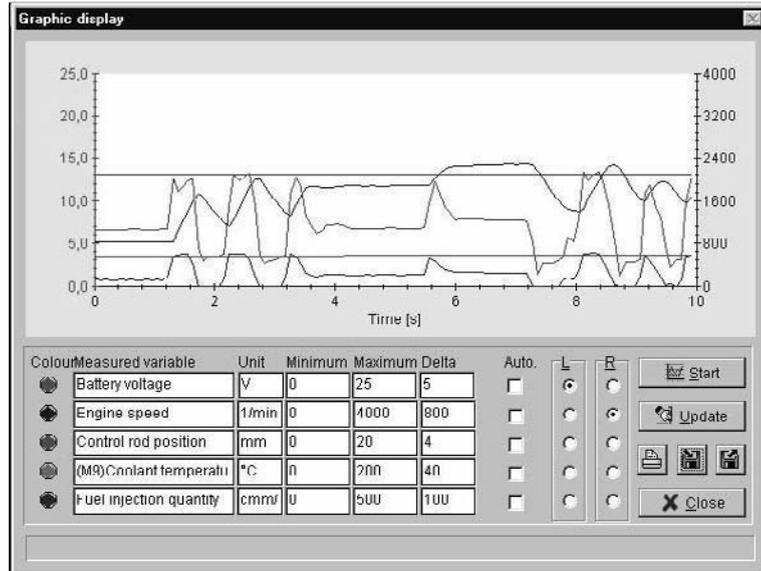
The measured values are represented inside the display range (minimum to maximum). The scaling steps for the axes are set in the column "Delta". By activating the control field "Auto", it is possible to have the program carry out scaling automatically. Since the program carries out this scaling taking into account the minimum and maximum values for the variables concerned, it is not possible to have automatic scaling with variables which are constant in time. A maximum of two axes, one on the left and one on the right side of the display area, are shown.

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

EXPLANATION OF THE FUNCTION SWITCHES:

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

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

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

SAVE: The Information from the representation displayed can be saved in a file in two different ways:
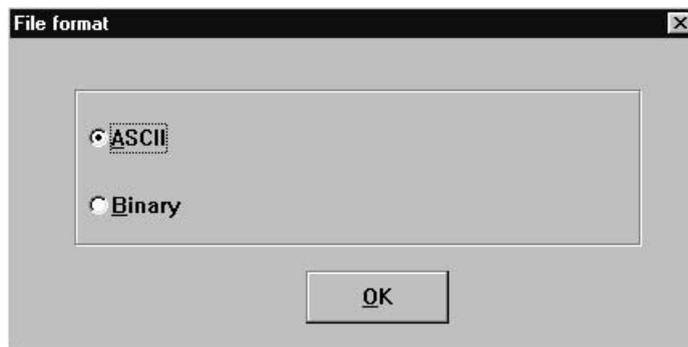
- As an ASCII file ('.agr) for further processing in Excel
- As a binary file (*.egr) to represent measurement graphics in OFFLINE mode. See 1.7 Offline mode.

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

3.2 RAM VALUES

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

3.3 DATA LOGGER (ONLY EMS)

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

3.4 INPUT/OUTPUT ASSIGNMENT

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

Restriction: Only applies for EMS and EMR ECUs.

3.5 CAN-Status

This window displays the CAN bus activities of the EMR.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3.6 EXAMPLE OF A DISPLAYED ERROR INFORMATION:

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

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

4.   PARAMETERS

4.1   CONFIGURATION

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

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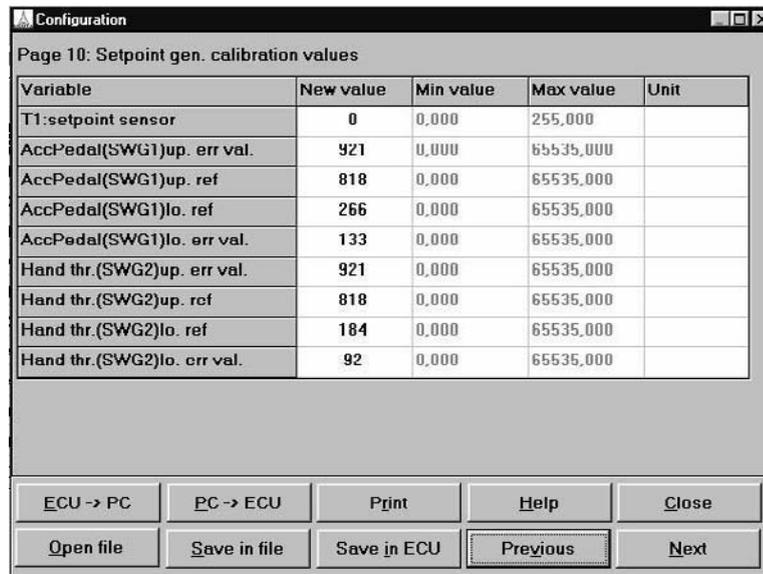
Configuration   ☐☐☒

Page 10: Setpoint gen. calibration values

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	

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

MK 3	TTG	Parameter	Unit	Min.	Max.	typ Wert	Description
Page 5: Position governor							
Only change the following 10 parameters in consultation with the head office							
		Posgvnr: P part	%	0	100	10	Gain factor P part
		Posgvnr: 1 part	%	0	100	5	Gain factor I part
		Posgvnr: D part	%	0	100	5	Gain factor D part
		Posgvnr: DT2 part	%	0	100	10	Gain factor DT2 part
		Posgvnr: Gain	%	100	200	180,1	Gain factor with minor speed fluctuation
		Posgvnr: gain range	mm	0	1	0,25	Gain fluctuation range for gain factor
		QuickCurrentDecSteepness	1/min	0	65535	40000	
		QuickCurrentDecTime	ms	0	65535	50	
Page 6: Functions							

		Assign config. top curve		0	2	0	Torque curve variants (2 variants∗), Perm, values: 0 = torque curve 1 1 = Switching betw. torque curves 1+2
		Ass spec. eng. speed config		0	6	0	Setpoint eng. speed values (6 variants ∗) Perm, values: 0 = Only variable speed governing 1 = Switching betw. eng. speeds 1 and 2 2 = Switching betw. fixed / variable speed 3, 4 = Switching betw.speed variable / save: (3 = w. setp.speed, 4 = w. actual speed) 5 = two setpoint transmitters
		Ass droop config		0	3	0	Speed droop selection (4 variants∗) Perm, values: 0 = constant speed droop 1 = variable speed droop 2 = switching between speed droop 1 and 2 3 = switching betw.const. / variable speed droop
		Ass governor config		0	6	0	Type of governing (4 variants∗) Perm, values: 0 = Variable-speed governing 1 = Min-max-speed governing 2 = Switching betw.var./min.-max. speed governingx

For the following 14 functions: On = 1, Off = 0						
		BoostPressSim (on/off)		0	1	0	Boost pressure simulation
		BoostPressMeas (on/off)		0	1	1	Boost pressure measurement
		EngSpeed sensor2 (on/off)		0	1	0	Redundant eng. speed sensing
		VehSpeedLimit (on/off)		0	1	1	Veh. speed limit
		CylinderShutoff (on/off)		0	1	1	Overrun cond. with overspeed
		LimpHomeOper		0	1	0	Limp-home upon control rod travel sensor failure
		Torque Indicator(on/off)		0	1	1	Torque computation (off: referred to torque curve, on: torque curve point)
		SAME Output (on/off)		0	1	0	Customer-specific output function
		QuickCurrentDec (on/off)		0	1	0	
		BOSCH EDC inline p. (on/off)		0	1	0	
		TempMonitoring (on/off)		0	1	0	Temperature monitoring
		OilPressMon(on/off)		0	1	0	Oil pressure monitoring

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

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

MK 3	TTG	Parameter	Unit	Min.	Max.	typ Wert	Description
Page 14: Start behaviour and cold start aid						
		Starting fuel quantity	mm³/ str.	0	200	110	Fuel quantity at start up to idling eng. speed. Applies to coolant temperature > 0°C
		Fuel quantity high idle	mm³/ corsa	0	200	10	Fuel quantity at high idle
		Suction fuel quantity	mm³/ 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	mm³/ 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	mm³/ 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.	mm³/ 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.	mm³/ str.			20	Fuel inj. quantiy limitation =fct(eng.speed, time)
Page 20: Power parameters						
		Max. torque (fix)	Nm	0	64255	500	

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

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

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

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

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

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

4.2   OVERALL PROGRAMMING

✋ ATTENTION!

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

Saving data contained in the ECU:

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

Complete programming of ECU:

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

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

Overall programing	ECU data	IntHex data	Tranfer data
OperHourCount:Engine[h]	1,00	-	1,00
Number of engine starts	21	-	21

ECU > file	Programming	Save in ECU	Help	Close
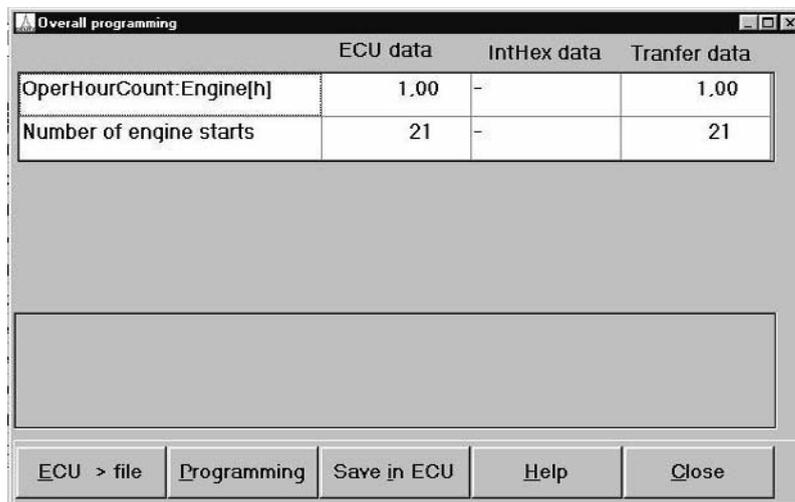
Figure: Menu complete programming ("Overal programming")

EXPLANATION OF FUNCTION[SWITCH:

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

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

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

Restriction: Only applies for EMR and EMS.

4.3 CALIBRATION

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

Important prerequisites:

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

```
┌─────────────────────────────────────────────────────────────────┐
│ Calibration                                            _ □ ×      │
│ Select calibration method:                                       │
│ Acceler(SWG1)parked position [lower limit]        840.665[mV] ▲  │
│ Acceler(SWG1)full throttle [pressed down, upper limit]  845.552 [mV]│
│ Acceler(SWG1)lower fault limit[0V...parked pos.]                 │
│ Acceler(SWG1)upper fault limit[full throttle...5V]               │
│ Hand throttle(SWG2)min.eng.speed (lower limit)        13 [ %]    │
│ Hand throttle(SWG2)max.eng.speed (upper limit)        13 [ %]    │
│ Hand throttle(SWG2)lower fault limit(0V...lower limit)           │
│ Hand throttle(SWG2)upper fault limit(upper limit...5V)        ▼  │
│                                                                  │
│ Calibration value:      [ 840.665 ]      mV                      │
│ Hint                                                             │
│ ┌──────────────────────────────────────────────────────────┐   │
│ │ 1st step: 'get value', 2nd step: transmit value to ECU with 'PC>SG', 3rd step:│
│ │ 'save in ECU'                                            │   │
│ │                                                          │   │
│ └──────────────────────────────────────────────────────────┘   │
│ ┌──────────┐ ┌─────────┐ ┌────────────┐ ┌───────┐ ┌────────┐   │
│ │Get value │ │ PC->ECU │ │ Save in ECU│ │ Close │ │  Help  │   │
│ └──────────┘ └─────────┘ └────────────┘ └───────┘ └────────┘   │
└─────────────────────────────────────────────────────────────────┘
```

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".
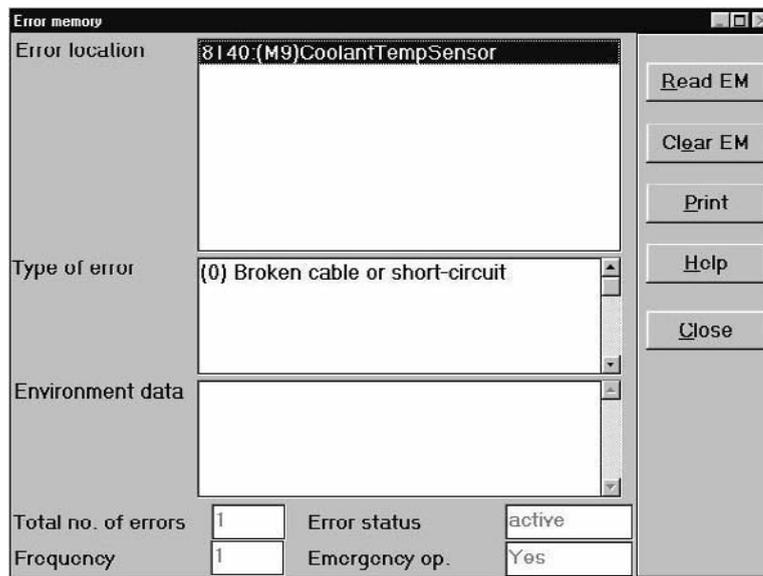
Figure: Example of an error memory output.

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-lnp1
- 8012: F21)Signal monitoring PWM-lnp2
- 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	• 8120: (F24)AcceterPedal =SWG1[1] • 8130:(F20)HandThrottle = SWG 2[2] • 8140:(M9)CoolantTempSensor[3] • 8150:(M24)BoostPressure Sensor • 8160:(M21)OilPressure Sensor • 8170:(M13)Speed 1, camshaft[4] • 8180:(M11)Speed 2, terminal W • 8190:(intern)Electronics Temperature	Plug-in connection interrupted. **OK ↓** Plug-in contacts contaminated or corroded **OK ↓** Sensor defective **OK ↓** Cable harness defective.	→ → → →	Restore plug-in connection Clean connector and replace if necessary Replace sensor Check cable harness and replace if necessary
	(2) Measuring point defective	• 8002:(F18)Signal monitoring PWM-Inp1 • 8012:(F21)Signal monitoring PWM-Inp2	PWM signal cannot be evaluated	→	Check signal
	• (3)Power reduced[5]	• 8343:Coolant temp, monitoring • 8363:Oil pressure monitoring	Temperature warning limit exceeded too long. Fallen below oil pressure alarm limit for too long. **OK ↓** Faulty configuration.	→ →	Check coolant Check oil level Check data in SERDIA menu Check "configuration" and change if necessary
	(5) Shutoff limit exceeded/ fallen below6	• 8305:Speed monitoring	Overrun cond. activated.		
Flashing (Engine off)	(0)Broken cable or short-circuit	• 8170:(M13)Speed 1, camshaft7	Plug-in connection interrupted **OK ↓** Plug-in contacts contaminated or corroded **OK ↓** Sensor defective **OK ↓** Cable harness defective	→ → → →	Restore plug-in connection. Clean connector and replace if necessary Replace sensor Check cable harness and replace if necessary
	(2) Measuring point defective	• 8112:(M17)Rack travel sensor	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

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	• 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 ↓**	→	Check coolant Check oil level
			Faulty configuration (e.g. overrun cond. OFF)	→	Check data in SERDIA menu "Configuration" and change if necessary
			Actuator defective	→	Replace actuator
Engine start not ipossible a) Flashing	(0) Broken cable or short-circuit	• 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) 0ff	(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
			Actuator defective **OK ↓**	→	Replace actuator
			Cable harness defective	→	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 availabtel. Fixed speed with 2% speed droop is set.

[2] Switch to SWG 1 (if SWG 1 available). Fixed speed vyilh 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.

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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 measurment	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 mesu-red values available
Speed sensor camshaft	0419 0811	Resistor ACvoltage. 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	$R_i \cong 2,3k\Omega$ a 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 postioner (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.

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.**

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:

```
┌─────────────────────────────────────────────┐
│ error                                  [X]   │
├─────────────────────────────────────────────┤
│   ⚠    no ISO/SAE interface                  │
│   !    at Port COM1 (IRQ 4) detected         │
│               or                             │
│            low voltage!                      │
│                                              │
│  [ Abort ]      Retry        Ignore          │
└─────────────────────────────────────────────┘
```
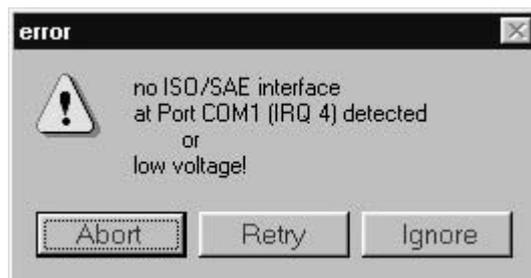
POSSIBLE CAUSES OF THE ERROR MESSAGE:
• There is no power supply to the EMR or to the interface.
• The power supply was interrupted when the engine was shut down.
• The wrong serial interface has been assigned on the PC (see 8.1.2).
• There is an incorrect polarity of the power supply from the engine 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.**
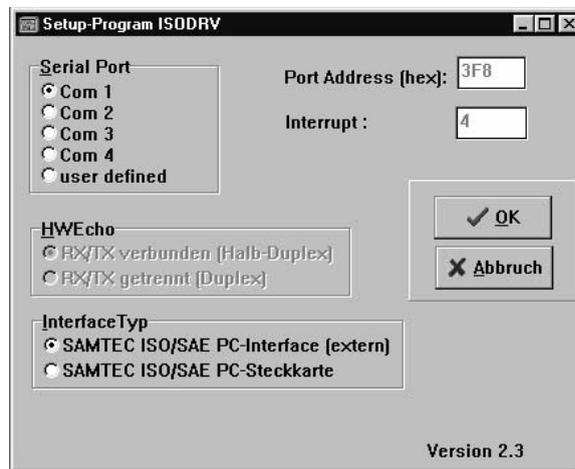
Figure: Help file screen from SETUP.EXE

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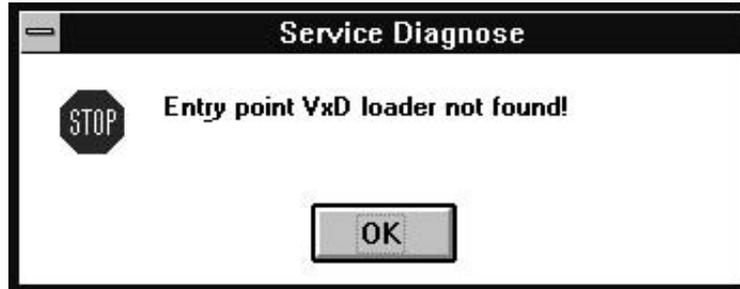
The cause is the non-active driver VXDLDR.386.

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.
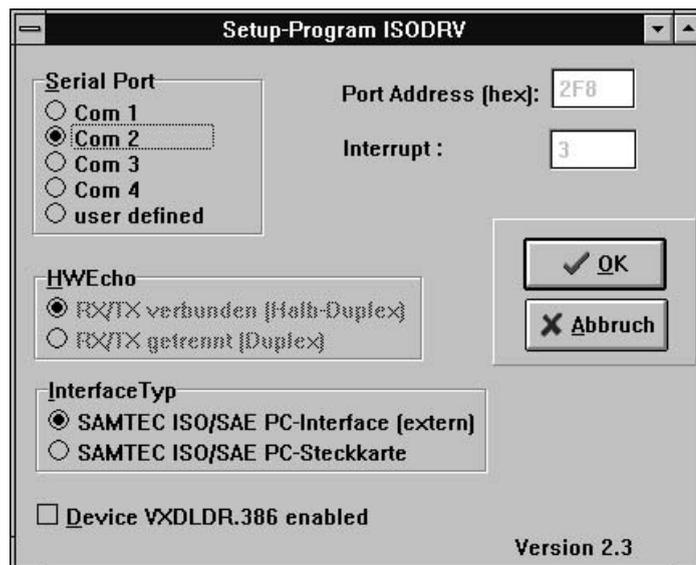
8.2 EMR

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	0,000	100,000	%
SpeedGvnr: damping range	80,0	0,000	100,000	1/min
Engine speed ramp down	10000,0	0,000	10000,000	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: DT2 part	0	0,000	100,000	%
PosGvnr: Gain	139,8	100,000	200,000	%
PosGvnr: gain range	0,250	0,000	1,000	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 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	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 SpeedGvnr: 1 part SpeedGvnr: D part	18-20[1] 10,0 5-12	4,0 10,0 2.5	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: 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 PosGvnr: I part PosGvnr: D part PosGvnr: DT2 part PosGvnr: gain PosGvnr: gain range	10,0 10-15[1] 5-10[1] 8,0 160-180 0,25	10,0 5,0 5,0 8.0 180.0 0,25	Corrections to settings should only be made following approval of head office.

[1]Differing 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, und 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 ±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
				5V = 1023 digits	
	[mV]	[digits]	[mV]	[mV]	[digits]
AccPedal(SWG1)up. err val.	4750	973		4357[1]	893
AccPedal(SWG1)up. ref)	4500	921	4150	4150	850
AccPedai(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

a) Restriction of angle of rotation

b) 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:
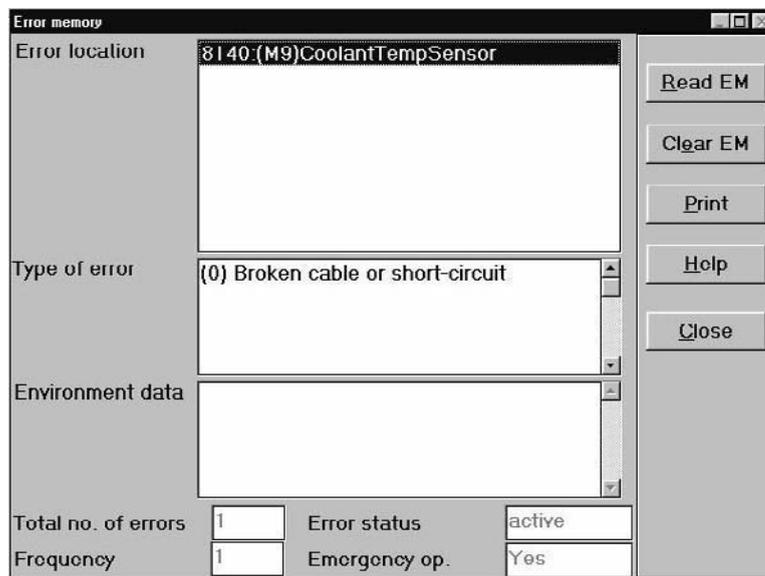
DIAGNOSTICS:I

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.	• Replace battery. • Clean earth wire connections.
Starter speed ok, fuel rack travels to start position.	Faulty fuel supply.	• Restore fuel supply.
Starter speed ok, fuel rack stays at zero position.	No power supply, connected to wrong pins or incorrect polarity. Shutoff solenoid defective or not connected. Fuel rack stiff. Speed sensor defective Starting fuel charge limitation is set too low or coolant temperature is too high for the EMR.	• 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.	• 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	• 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.	• 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	• 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.	• 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.	• Replace sensor, plug and line control.
SERDIA error message: **"8120: (F24) Acceler Pedal(SWGI)"**	Accelerator pedal sensor incorrectly calibrated.	•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: • Fuel supply • Speed monitoring independent of EMR. • Interruption of supply voltage.	• 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: • Overspeed (is reached for instance upon sudden load change). • e.g. "Oil pressure" additional remark: "inactive".	Carry out systematic check depending on error message: • 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.
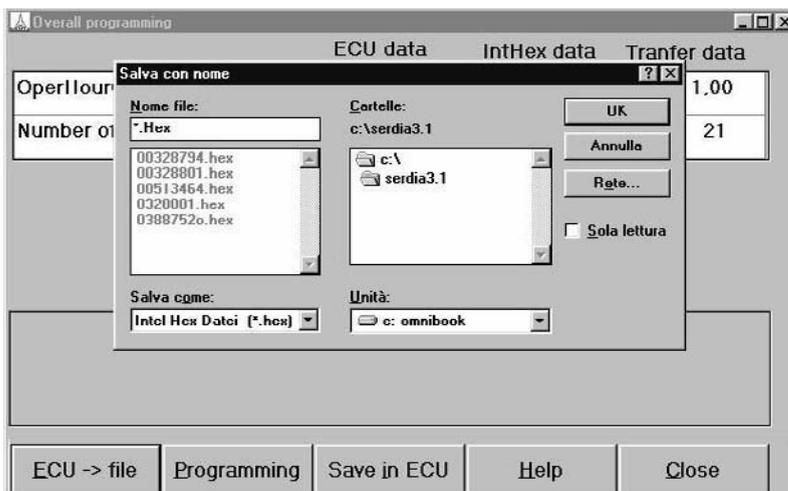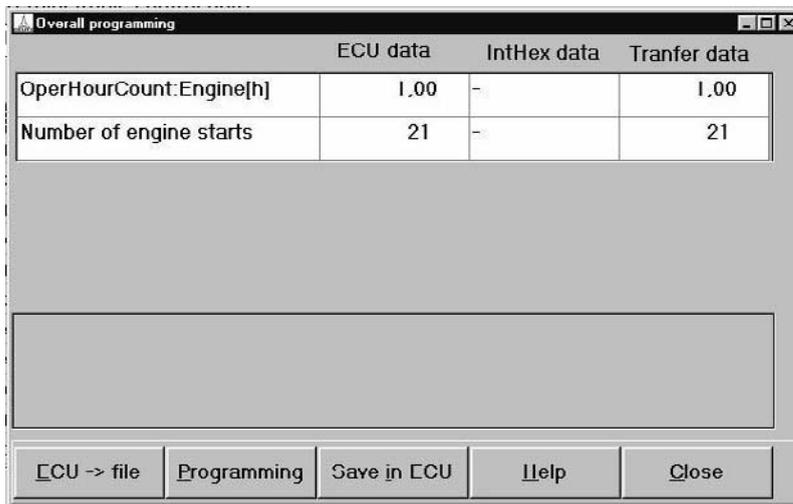
The engine number will be suggested as file name for storage on from SERDIA 2.5. This suggestion is not compulsive; other file names may be chosen nevertheless. Then confirm with OK. The file (i.e. the engine data record) is then saved under the name <Engine number>. hex. When the data record is transferred 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".
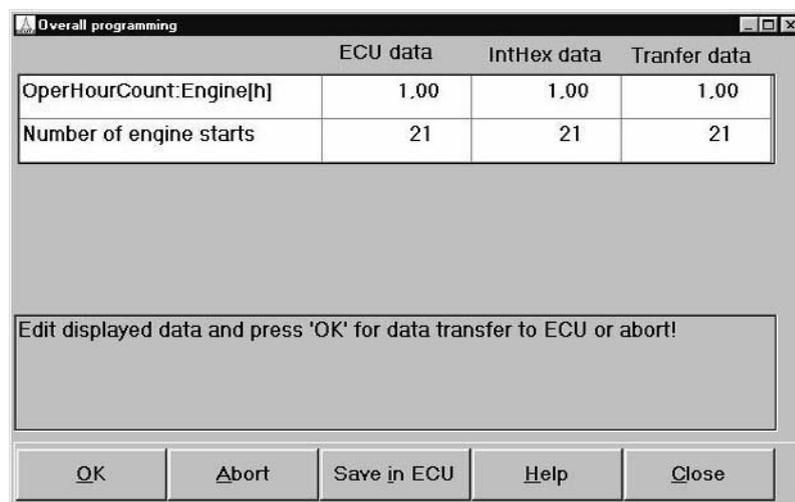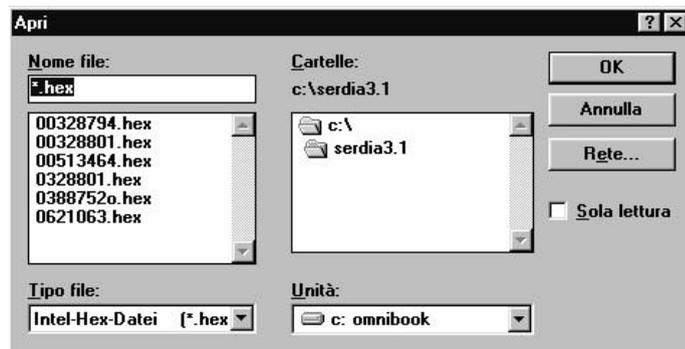
3rd step: Start up the engine and check it is running satisfactorily.
- In the menu "Error memory", delete the error memory. 2.

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 de-livered 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
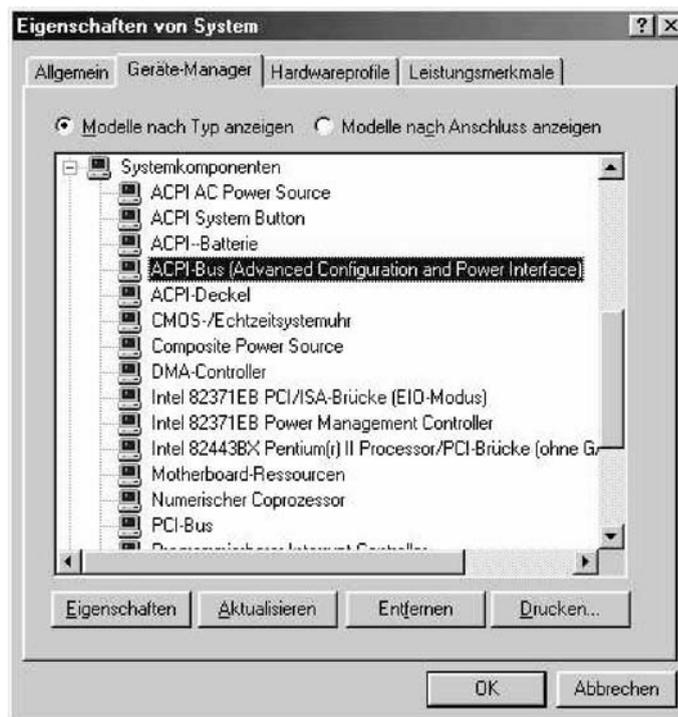
Example with ACPI enabled

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

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)
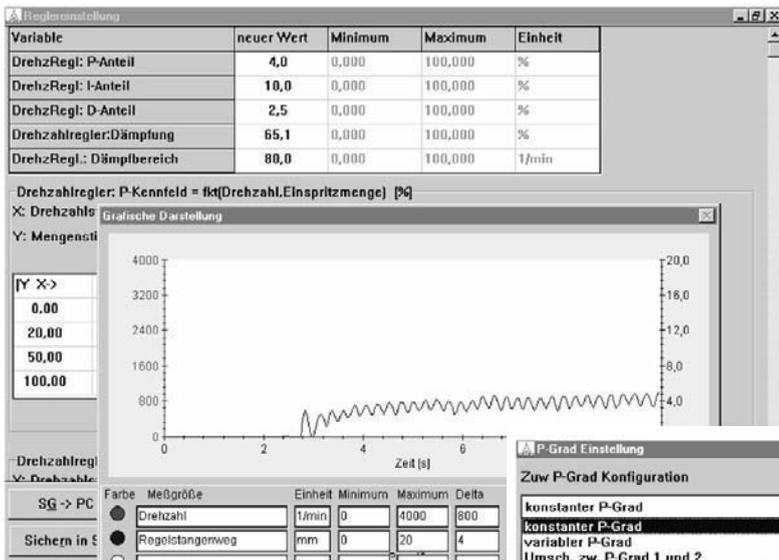
Example: "Adjusting offset" (P-Grad Einstellung)
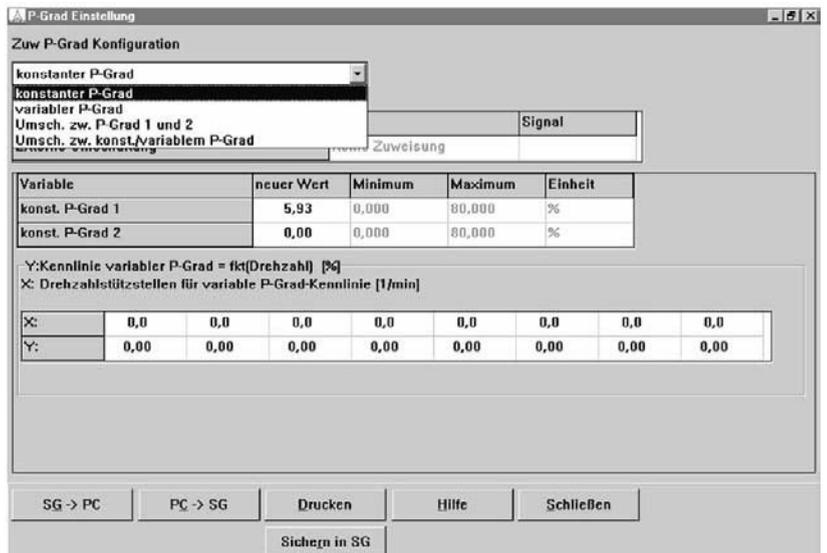
9.4 IN- AND OUTPUT ASSIGNMENT IS NOW ADDITIONALLY CONFIGURABLE USING PLAIN TEXT (PREVIOUSLY ONLY CODE NUMBERS)

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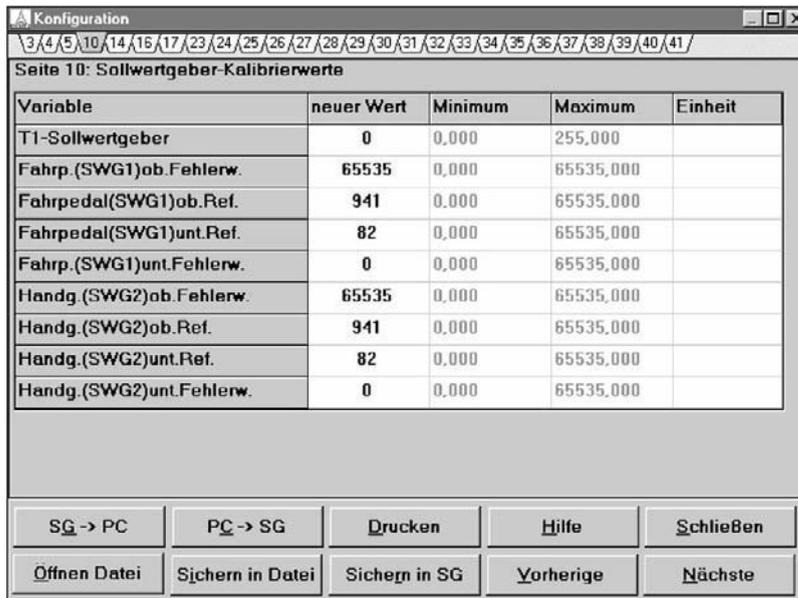
9.5.2 With the highest access level subrecords can now be created and roof 1curves displayed graphically

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

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 ITALIA S.p.A.

Viale F. CASSANI, 15

24047 TREVIGLIO (BG) - ITALIA

1.1 FUNCTIONAL SCOPE

The EDS software includes the following subprograms:

- **POWERSHIFT (not used for MK3 80-105) 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 (not used for MK3 80-105)**
  - Diagnosis
  - Readout of the AGROTRONIC-hD box error memory
  - Calibrate valves

- **Infocenter**
  - Diagnosis
  - Programming of the constant values

- **Spring-suspended front axle (not used for MK3 80-105)**
  - Diagnosis
  - Readout of the control box error memory
  - Reading resp. loading of the control box standard data (parameters) converter

1.2 HARDWARE REQUIREMENTS
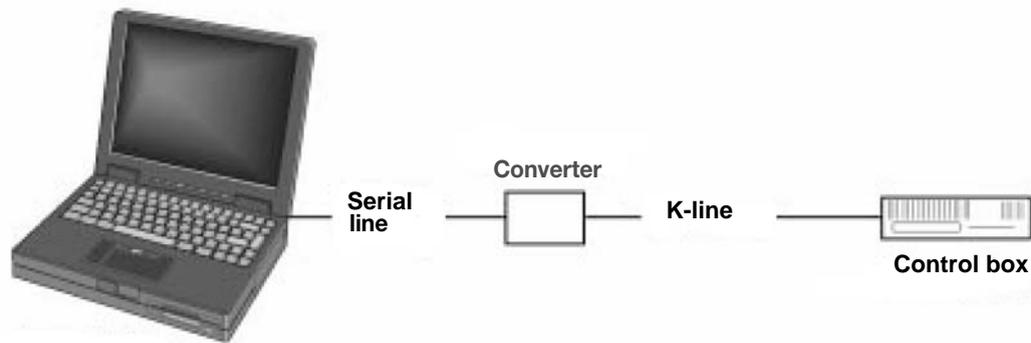
Hardware Setup

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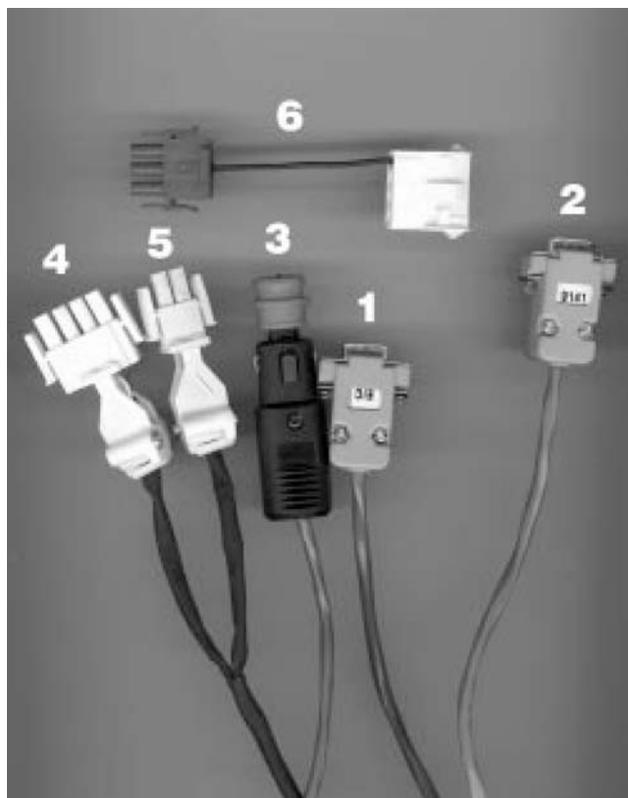
The depicted interface cable is plugged into the serial interface (COM 1 or COM 2) of the computer and connected with the corresponding connectors of the adapter cable.

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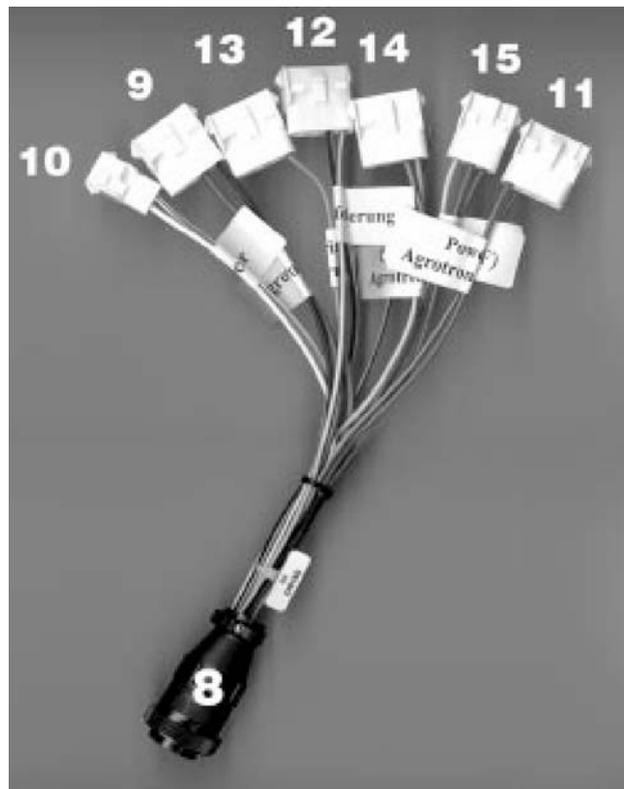
The depicted adapter cable is plugged into the diagnosis interface in the fuse box and connected with the corresponding connectors of the PC interface cable.

  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

The installation procedure is as follows:
- Open "My computer" with a double click.
- Open "31/2" floppy" with a double click.
- Launch "EDS330.exe" with a double click.
- Follow the on-screen installation instructions.
- Take the floppy disk out of the drive and store it in a safe place.
- Restart the computer, then click the "Start" button and select "Programs".

1.3 STARTING THE EDS PROGRAM

- Launch the program by double clicking the icon created on the Desktop.
- The following message is displayed:
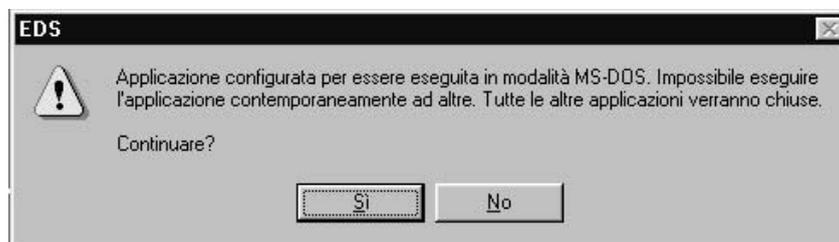
- Click "Yes" to continue.
- The initial screen appears:

Fig. 1 - Initial menu

Press one of the number keys (from 1 to7) in the initial menu to select the component (e.g. Agrotronic- hD+ASM) to be checked and the interface (COM 1 or COM 2) for the incoming signals.

2. TRANSMISSION DIAGNOSIS

On selecting 1 (Powershift/Powershuttle transmission) by pressing the corresponding number key, the following screen is displayed in which you can select the type of lever installed on the tractor:

```
.
.                    Travel direction switch
.
.        1)       Powershuttle lever with electric consent
.                     (OLD lever, partnumber 0443 7341)
.
.        2)       Powershuttle lever without electric consent
.                     (NEW lever, partnumber 0.012.6472.4)
.
.
.                 CAUTION ! ! Wrong selection can cause ACCIDENT
.
.
Select option:[1,2]?_
```

Press 1 or 2 to select the lever.

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

```
File|  |Control|  |Options|                              Mainmenue  /
[End]  [DEST38]   | Select colours ...
                  | Language
       DEST39     |
       DEST45     | ' Interface COM1
                  |   Interface COM2
                  |   Simulated communication








Quit program!
```
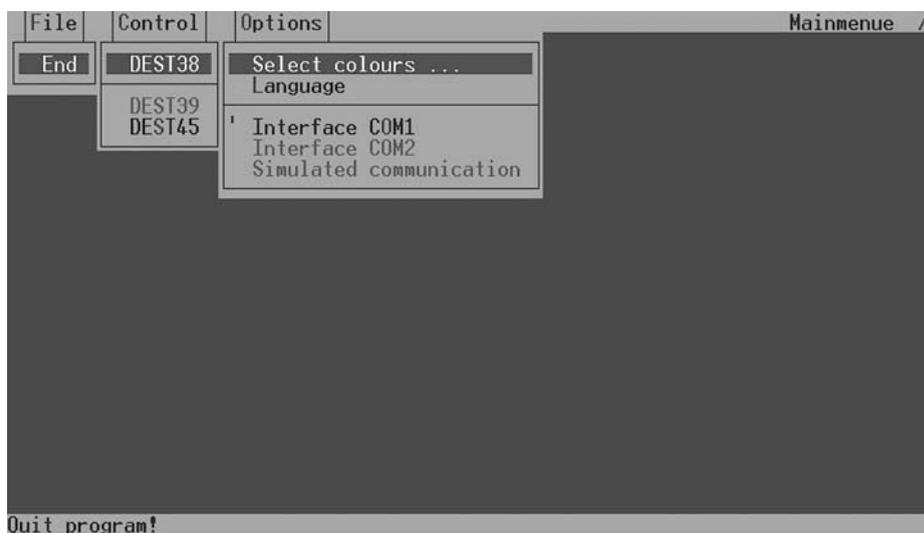
Fig. 2 - Struttura dei menu

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 occured 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
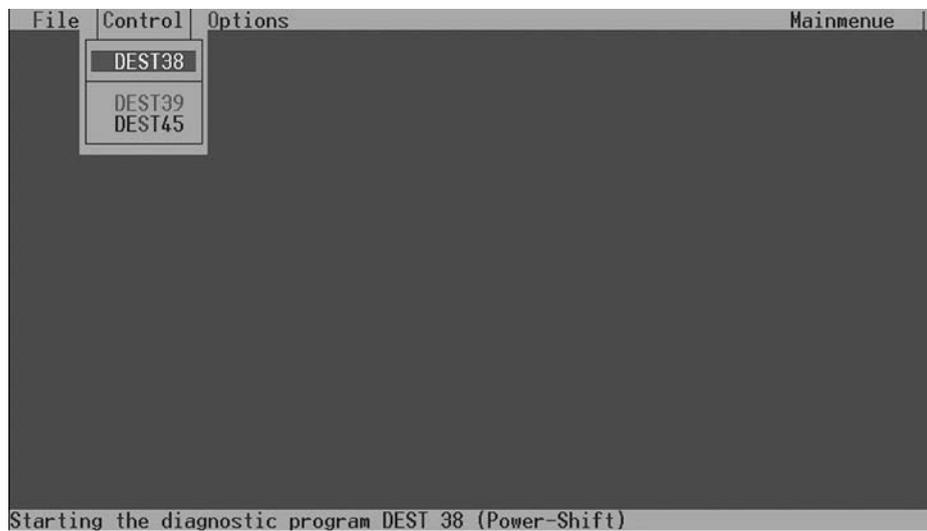
Fig. 3 - Menu Control

- **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.
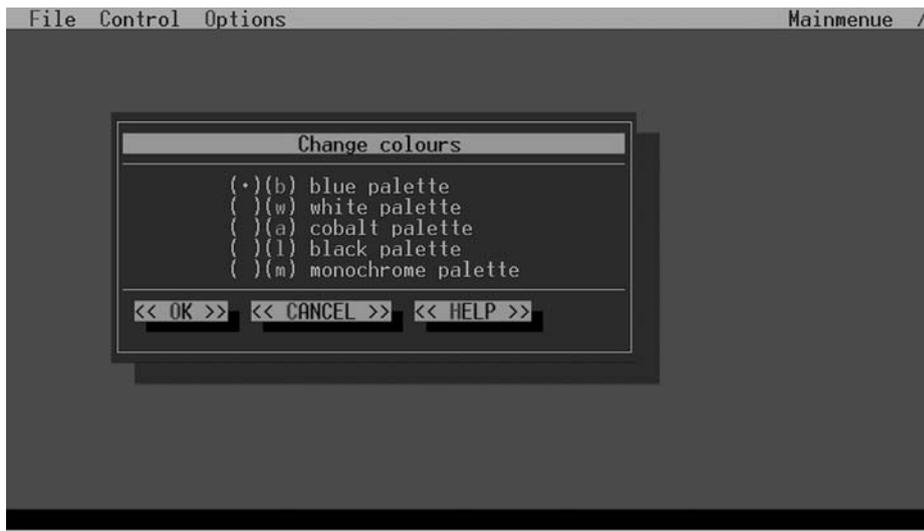
Fig. 4 - Menu Colour

- **Options > Language (Lingua)**
  Changes the communication language between user and program.
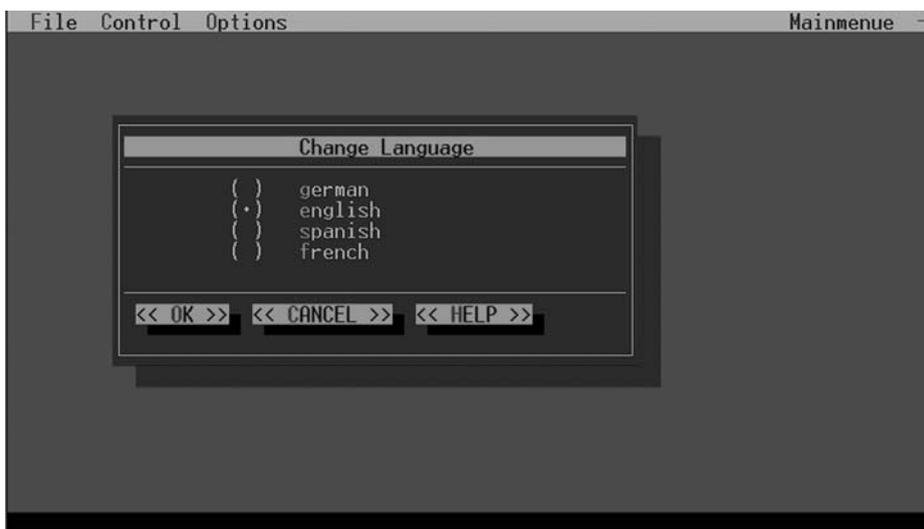
Fig. 5 - Menu Change language

- **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-SHUTTLE DIAGNOSISPROGRAMM DEST 45

3.1   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.
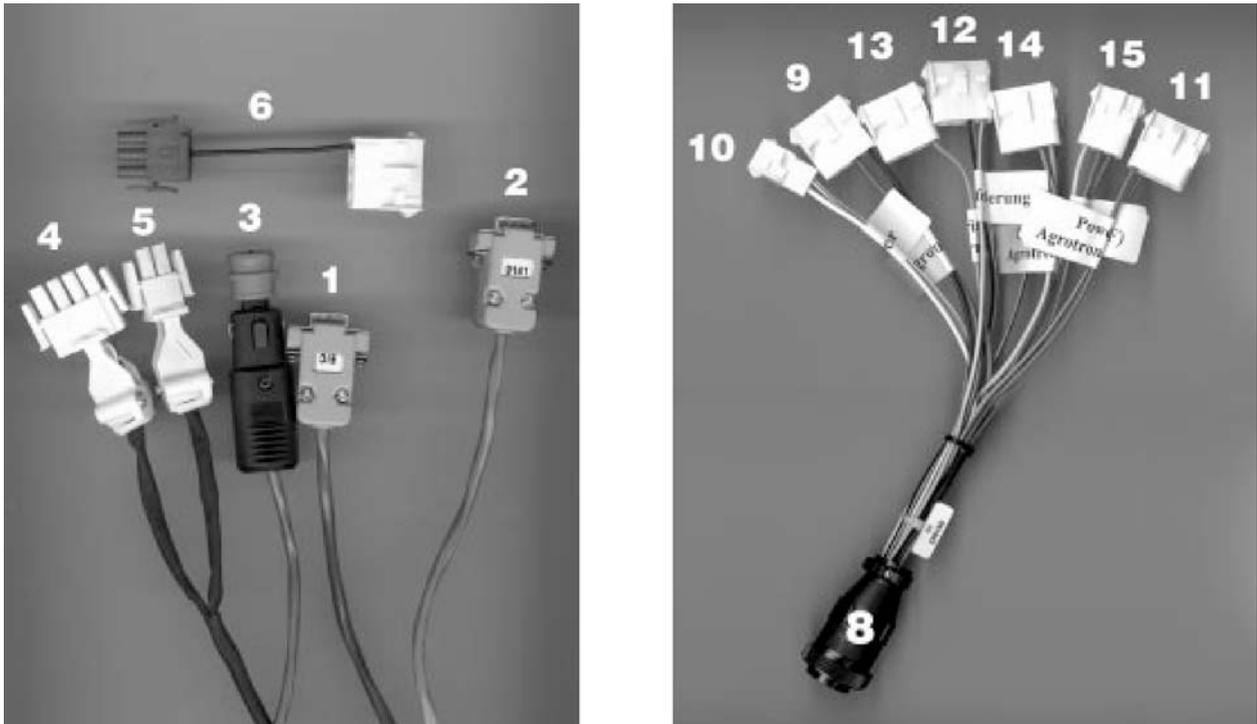
Fig. 23 - Interface cable and adapter cable

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 – V 2.2 – 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!

3.2   DEST 45 PROGRAM DESCRIPTION

3.2.1 FILE >MAIN MENU
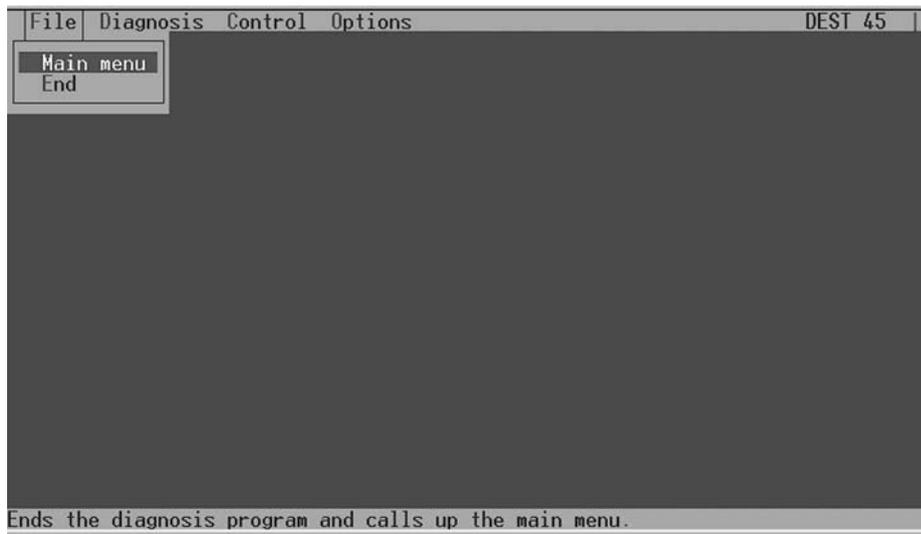
Fig. 24 - File >Main menu

- **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.

3.2.2 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.

```
 File  Diagnosis  Control  Options              ! SIMULATION !    DEST 45  −

┌Read error memory────────────┐  ┌Description of errors────────────────┐
│                             │  │Error no. 67 occured 1 times!        │
│ Oper. hrs.  E-box:   512 h 58 min │  │First occurence: 13330 h         │
│                             │  │                                     │
│      3    read errors       │  │Undervolt. in power supply to sens.  │
│                             │  │                                     │
│ Error  active  no. of  operating hour │  │Possible remedies:           │
│                             │  │− Check cabling                      │
│  7D     Y       1    13330 h │  │Check cabling on temperat. sensor/  │
│  67     Y       1    13330 h │  │   clutch sensor                    │
│  EF     Y       1    13330 h │  │− Check power supply to sensor      │
│                             │  │                                     │
│                             │  │Note:                                │
│                             │  │Possibly consequence of error from   │
│                             │  │− under voltage of vehicle circuit   │
│                             │  │− can also lead to following error   │
│                             │  │   − temperature sensor              │
│                             │  │   − clutch sensors            −↓− │
│ ≪ OK ≫  ≪ CANCEL ≫  ≪ HELP ≫ │  │ ≪ CANCEL ≫  ≪ HELP ≫             │
└─────────────────────────────┘  └─────────────────────────────────────┘
```

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 occured. The information under "Operating-hours" indicates when the respective error has occured.

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).

```
 File  Diagnosis  Control  Options                        DEST 45
 ┌Plaintext data display┐
 ┌─CONT Speeds/Information──── F3 ┐ ┌─CONT Digital input ports──── F4 ┐
    Signal name      pin  value unit    Signal name      pin  value
  Engine speed      EF07    0  1/min   Tip plus         ED06    0
  Output speed      EF04    0  1/min   Tip minus        ED07    0
  Powershift outp.  EF06    0  1/min  .Ign.sw. neutral  ED02    0
  HK (main clutch)  EF05    0  1/min   Ign.sw. forward  ED01    1
                                       Ign.sw. reverse  ED03    0
  Hkpedal sensor    EA01 0.836  V      System pressure  ED11    0
  Temperature       EA03   27  °C      Hkpedal switch   ED08    1
                                       Pin code 1       ED09    0
  Powershift stage  SG00   L           Pin code 2       ED10    1
  HK sensors        SG01 Engaged       Sync.gear trans. ED13    1
                                       Starter inhibit  ED12    0

                                          << DIG_IN  >>─<< ERRORS >>
 << OK >>  << CANCEL >>  << HELP >>  << STAT >>
                                          << DIG_OUT >>  <<INTERNAL>>
```

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.

```
File  Diagnosis  Control  Options                        DEST 45  /
┌Plaintext data display┐
┌CONT Speeds/Information────────< F3 >┐ ┌CONT Digital output ports───< F4 >┐
   Signal name     pin  value unit        Signal name      pin  value error
  Engine speed     EF07    0  1/min      .Transm.warn.lamp AD04    1    --
  Output speed     EF04    0  1/min      Gear valve 1      AD05    1    --
  Powershift outp. EF06    0  1/min      Gear valve 2      AD06    0    --
  HK (main clutch) EF05    0  1/min
                                         Retaining valve1  AD07    0    --
  Hkpedal sensor   EA01 0.836  V         Retaining valve2  AD08    0    --
  Temperature      EA03   27  °C         Forwards valve    AD50    0    --
                                         Reverse valve     AD51    0    --
  Powershift stage SG00   L              Field/road valve  AD54    1    --
  HK sensors       SG01 Engaged

                                      ┌ << DIG_IN  >>─ << ERRORS >>─┐
  << OK >>  << CANCEL >>  << HELP >>  << STAT >>
                                        << DIG_OUT >>  <<INTERNAL>>
```

Fig. 29 - Digital outputs

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

```
File  Diagnosis  Control  Options                        DEST 45  /
┌Plaintext data display┐
┌CONT Speeds/Information────────< F3 >┐ ┌CONT Sensor error───────────< F4 >┐
   Signal name     pin  value unit        Signal name      pin  status
  Engine speed     EF07    0  1/min      Engine speed      EF07  No error
  Output speed     EF04    0  1/min      Output speed      EF04  No error
  Powershift outp. EF06    0  1/min      Powershift outp.  EF06  No error
  HK (main clutch) EF05    0  1/min      HK speed          EF05  No error

 .Hkpedal sensor   EA01 0.836  V         HK pedal sensor   EA01  No error
  Temperature      EA03   27  °C

  Powershift stage SG00   L
  HK sensors       SG01 Engaged

                                      ┌ << DIG_IN  >>─ << ERRORS >>─┐
  << OK >>  << CANCEL >>  << HELP >>  << STAT >>
                                        << DIG_OUT >>  <<INTERNAL>>
```

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.

-

```
 File  Diagnosis  Control  Options                         DEST 45
┌─Plaintext data display────────────────────────────────────────────┐
│┌CONT Speeds/Information──────< F3 >┐┌CONT   Internal dimensions──< F4 >┐│
││  Signal name      pin  value unit ││  Signal name      value unit     ││
││.Engine speed      EF07    0  1/min││HK pressure          1   bar      ││
││ Output speed      EF04    0  1/min││HK start pressur    6.2  bar      ││
││ Powershift outp.  EF06    0  1/min││Hkacc. route        0.1  %        ││
││ HK (main clutch)  EF05    0  1/min││                                  ││
││                                   ││                                  ││
││ Hkpedal sensor    EA01 0.836  V   ││                                  ││
││ Temperature       EA03   28  °C   ││                                  ││
││                                   ││                                  ││
││ Powershift stage  SG00    L       ││                                  ││
││ HK sensors        SG01 Engaged    ││                                  ││
││                                   ││                                  ││
│└───────────────────────────────────┘└──────────────────────────────────┘│
│                                        ┌── << DIG IN  >>─┬─<< ERRORS >>─┐│
│┌<< OK >>┐┌<< CANCEL >>┐┌<< HELP >>┐┌<< STAT >>                           ││
│└────────┘└────────────┘└──────────┘└────────   << DIG OUT >>  <<INTERNAL>>│
│                                                                          │
└──────────────────────────────────────────────────────────────────────────┘
```

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!**

```
 File  Diagnosis  Control  Options                         DEST 45
┌─Select output ports────────────────────────────────────────────────┐
│          Digital output ports            Analogue output ports      │
│    Signal name     Pin value error     Signal name   Pin  value   error│
│ Transmission war  AD04  0     --     HK prop. valve  AA01   15  mA   --│
│ Gear valve 1      AD05  0     --                                      │
│ Gear valve 2      AD06  0     --                                      │
│                                                                       │
│ Retaining valve1  AD07  0     --                                      │
│ Retaining valve2  AD08  0     --                                      │
│.Forwards valve    AD50  0     --                                      │
│ Reverse valve     AD51  0     --                                      │
│ Field/road valve  AD54  0     --                                      │
│                                                                       │
│                                                                       │
│                                                                       │
│                                                                       │
│ ┌<< OK >>┐┌<< CANCEL >>┐┌<< HELP >>┐                                  │
│ └────────┘└────────────┘└──────────┘                                  │
└───────────────────────────────────────────────────────────────────────┘
```

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).
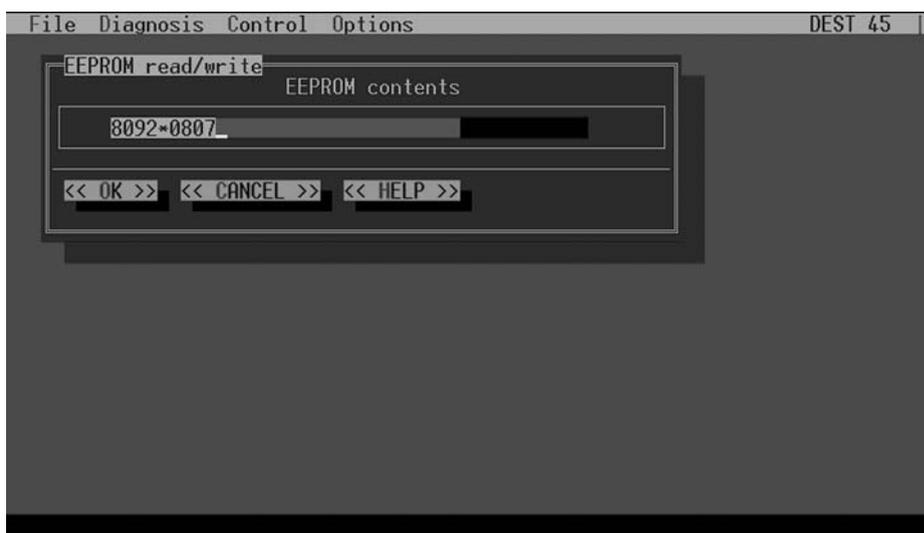
Fig. 33 - EEPROM read/write

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

3.2.3 CONTROL

The submenu "Control" contains the menu items "Information" and "End-of-line programming"
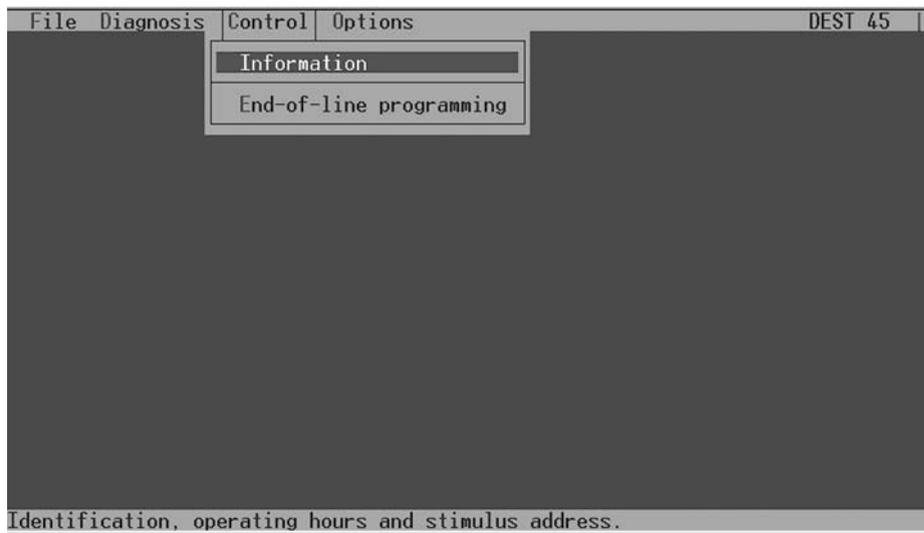
Fig. 35 - Control

- **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.
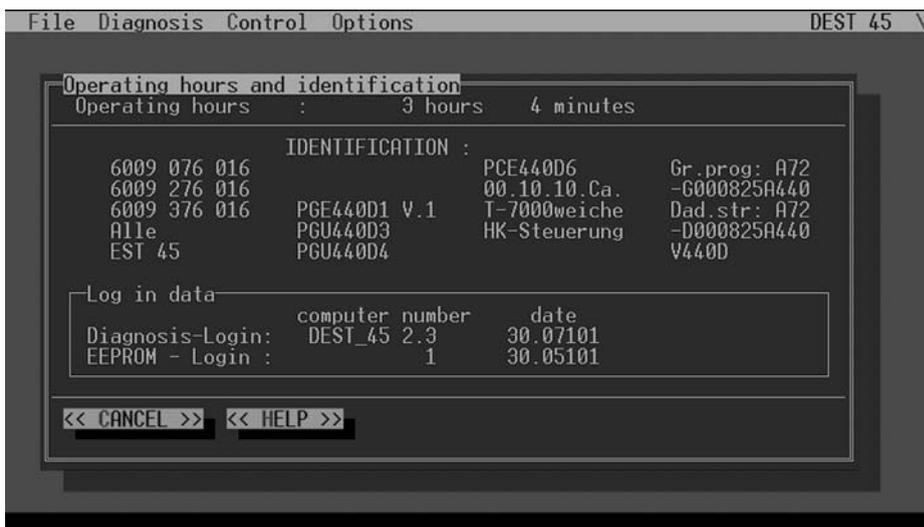
Fig. 36 - Information

- **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.
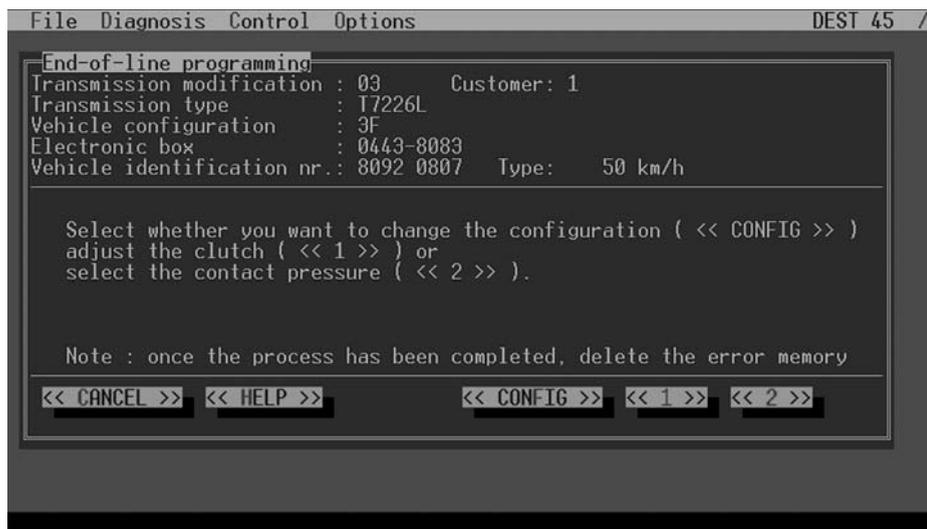
Fig. 37 - End-of-line programming

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.
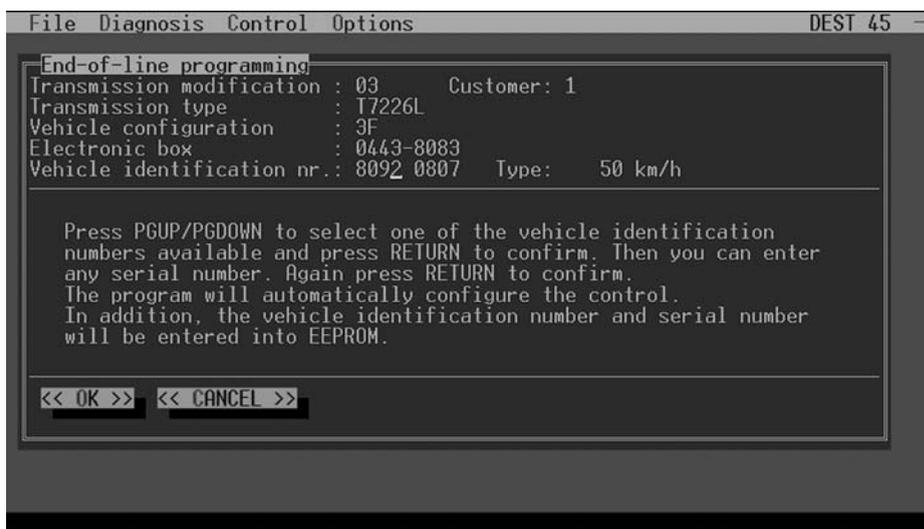
Fig. 38 - Select vehicle identification number

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.
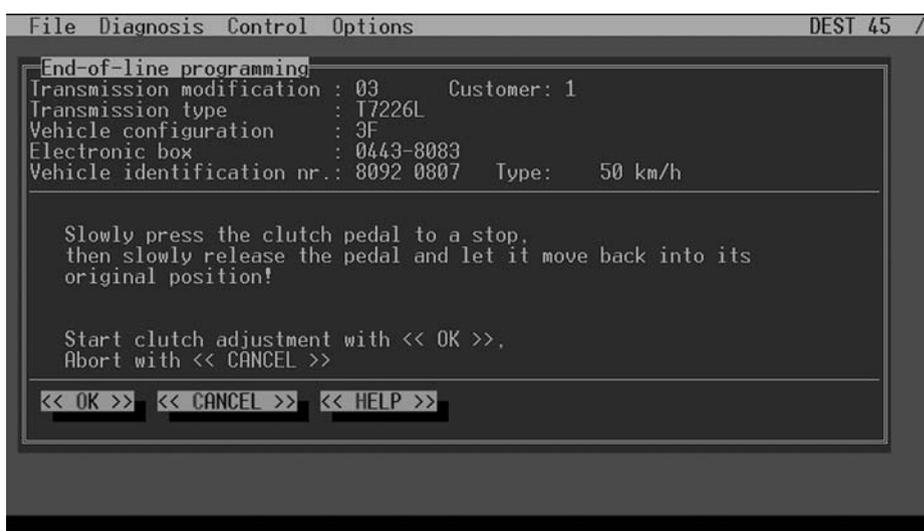
Fig. 39 - Clutch adjustment

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 succesfully 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.

```
File   Diagnosis   Control   Options                    DEST 45  /

  End-of-line programming
  Transmission modification : 03      Customer: 1
  Transmission type         : T7226L
  Vehicle configuration     : 3F
  Electronic box            : 0443-8083
  Vehicle identification nr.: 8092 0807   Type:   50 km/h

     Selecting contact pressure:  observe preconditions (<< HELP >>) !

     Start   : - Move gear selector from NEUTRAL to FORWARDS
               - wait until process is complete
                 (activate starting interlock)
     End     : - Recognized speed on output / main clutch output
     Abort   : - move gear selector to NEUTRAL or REVERSE
               - Depress HK pedal

  << HELP >>
```

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!

```
File   Diagnosis   Control   Options                    DEST 45  /

  End-of-line programming
  Transmission modification : 03      Customer: 1
  Transmission type         : T7226L
  Vehicle configuration     : 3F
  Elec
  Vehi
       *********************************************************************
       *!! WARNING !!        !! WARNING !!        !!WARNING!!      *
   S   *
   a   *There must be at least 5 clear metres in front of the vehicle*
   s   *because the vehicle will move independently.             *
       *
   *   !! WARNING !!        !! WARNING !!        !!WARNING!!      *
       *********************************************************************
   N

  <<     << OK >>
```
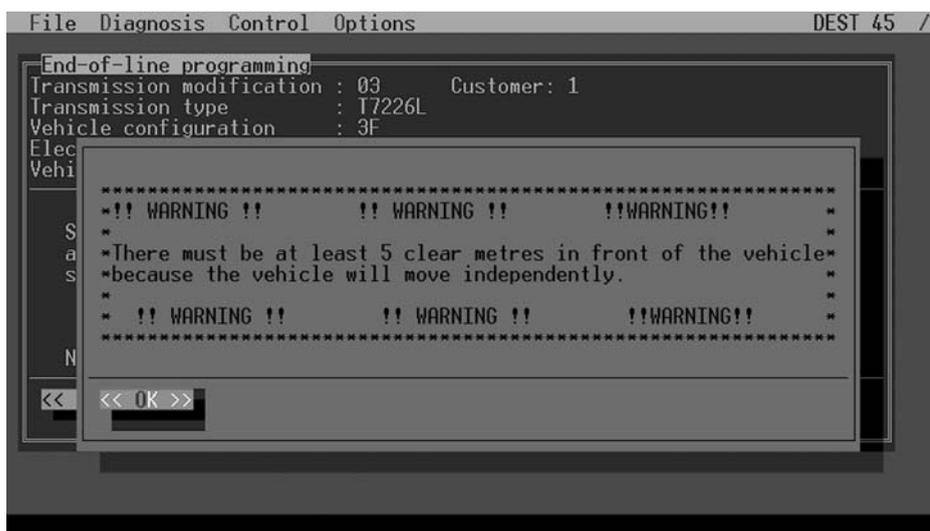
Fig. 41 - Safety note

The determination of the contact pressure is started by means of << 2 >>. For this purpose the followinf 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 ist 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.

3.2.4 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.
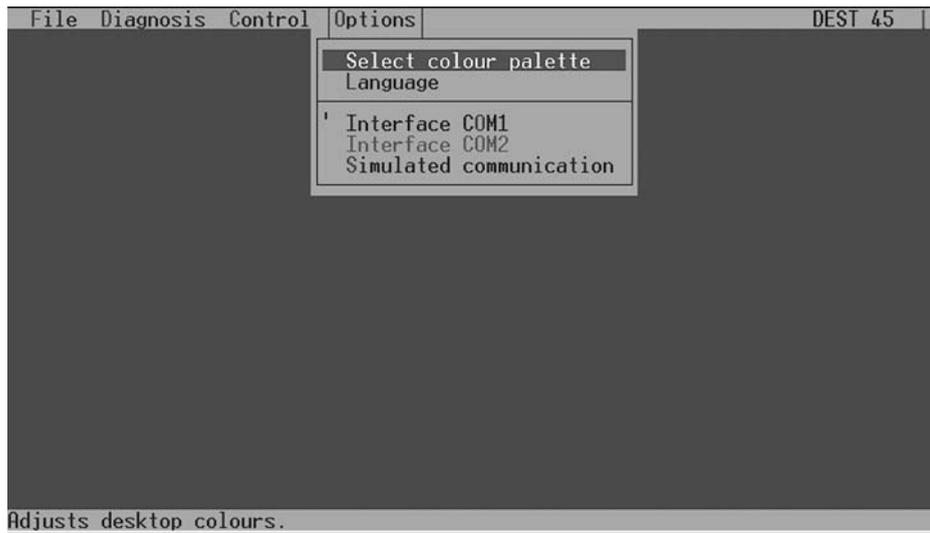
Fig. 42 - Options

- **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.
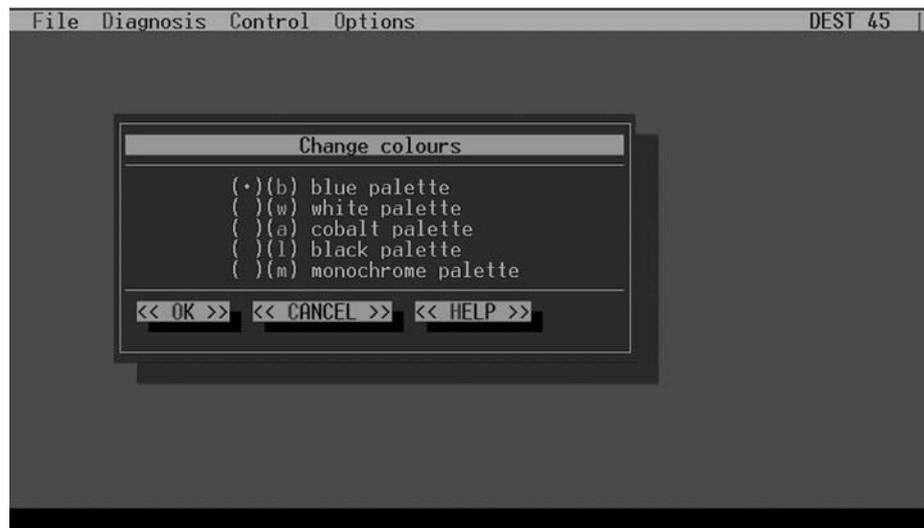
Fig. 43 - Change colours

- **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.
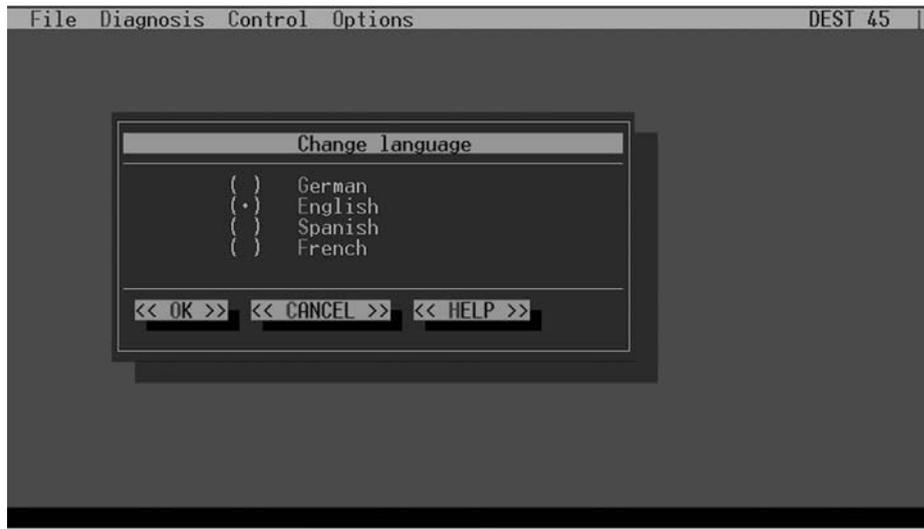
Fig. 44 - Change language

- **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.

3.3   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)

3.4   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.

3.5 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	• 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	• 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	• 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	• 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	• 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	• 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	•Diagnosis only if configured • KM can only bediagnosed 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	• 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	• Error code is not used
20	Signal line display K+	On display "EE", permanent beep No change of operation mode	Check cabling Check display	• 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	• Diagnosis only if configured
22	Temperature exceeded	Upon exceeding 5x beep, subsequently 1x beep every 2 min.	Reduce load Shut down engine	• 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)	• 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)	• 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)	• 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)	• 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)	• 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)	• 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)	• Only for T7200 • Possibly sequence error from LU VPS2 • Self preservation • 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)	• 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)	• 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

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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)	• Possibly sequence error from LU VPS2 • LU can only be diagnosed in disconnected state (toggling only upon defined peed ratio)
37	Transfer valve 2 KM	Operation mode STAND-BY STRATEGY (Powershift blocked)	Check cabling Check valve Check valve supply (VPS2)	• 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)	• 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)	• 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)	• 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)	• 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	• 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	• 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	• 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	• Upon reversing demand neutral shifting, permanent beep
51	nHK speed transmitter KM	Operation mode LIMP-HOME	Check cabling Check speed sensor	• 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	• 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	• Upon reversing demand neutral shifting, permanent beep
54	nLSA speed transmitter KM	Operation mode LIMP-HOME	Check cabling Check speed sensor	• 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	• 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	• Upon reversing demand neutral shifting, permanent beep
57	nMOT speed transmitter KM	Operation mode LIMP-HOME	Check cabling Check speed sensor	• 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	• 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+	• 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 sensoryl system LU, KM	Neutral shifting Operation mode EMERGENCY OPERATION	Check cabling Check sensor mounting Check sensor Check sensor supply	• 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	• Possibly sequence error from: • EMERGENCY K+ temperature sensor or OPERATION K+ sensor supply AU1
66			Check sensor Check sensor supply	• 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	• 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	• 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	• 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	• 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)	• 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)	• Self preservation • Upon neutral shifting permanent beep

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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)	• 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)	• 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)	• 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)	• 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	• 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	• Self preservation • Pin code is evaluated only upon initialisation • Defectice 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+)	• 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+)	• 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 Nlsa, Nhk Check hydraulic system	• 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	• 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	• 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	• 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	• Error can only occur upon wrongly programmed application controls (not upon standard controls) • Wrong parameterization of: • 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)	• 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	• Self preservation • Checksum of the EEPROM configuration data defective. No vehicle version can be selected.

3.6 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 vehicle version Speed sensor Nmot and Nlsa 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 Nlsa Check speed sensors Nmot and Nlsa 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 Nlsa 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 Nlsa Check cabling transfer valves GV1/GV2 Check speed sensors Nmot and Nlsa Check hydraulic system
Short traction force interruption during driving with Closed drive train (LS pressure modulation)	Wrong vehicle version selected upo end-of-line programming Speed sensor Nmot and Nlsa defective Fault in hydraulic system (pressure modulation by GV toggling)	Check/correct end-of-line programmed vehicle version Check cabling speed sensors Nmot and Nlsa Check speed sensors Nmot and Nlsa Check hydraulic system
Automatic starting not possible, vehicle remains in neutral	Starting block signal not existing	Check starting block signal (LU, KM, K+)

3.7 SENSORS AND SOLENOID VALVES AT THE TRANSMISSION T-7100

18 bar system pressure switch

speed output powershift gear output n Lsa

speed output powershift gear input/engine speed n Mot; n Lse

electro-hydraulic gear shift

proportional valve (only with power shuttle)

ram switches: neutral switch (outside) starting block switch (inside/only with powershift)

speed output driving clutch (gear shift input) n HK (only with power shuttle)

temperature transmission oil

locking magnet for street/field shifting

solenoid valve all-wheel drive

switches for street/field display

speed output output/ground speet n Ab

solenoid valves for: power take off (outside) differential lock (inside)

speed output power take off

3.8 ELECTRO-HYDRAULIC GEAR SHIFT T-7100

Main pressure valve 18 bar

Pressure control valve

Release valve

Cannon Bayonet plug-socket

Hydraulic pressure retaining valve

Pressure-reducing valve 10 bar

Pilot valve

Pilot valve

Two-way valve forward/neutral/reverse

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

3.9 SENSORS AND SOLENOID VALVES AT THE TRANSMISSION T-7200

18 bar system pressure switch

electrical connection forward/reverse control block

electro-hydraulic gear shift

electrical connection

speed output powershift gear output N Lsa

temperature transmission oil

solenoid valve all-wheel drive

speed output output/ground speed n Ab

ram switches:
neutral switch (outside)
starting block switch
(inside/only with powershift)

proportional valve
(only with power shuttle)

speed output
powershift gear input/engine speed
n Mot; n Lse

speed output
driving clutch (gear shift input)
n HK (only with power shuttle)

solenoid valves for:
power take off (outside)
differential lock (inside)

speed output
power take off

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

Safety valve

Magnet Y7
reverse

Magnet Y6
forward; MVV

Reversing piston

Release valve for
neutral position

FORWARD-REVERSE CONTROL BLOCK

Magnet Y3
Clutch C/D
Retaining valve 2; HV2

Magnet Y4
Clutch A/B; F/G
Retaining valve 1; HV1

Magnet Y1
Clutch A/B; F/G
Retaining valve 1; GV1

Magnet Y5
Field/street characteristik MVK

Magnet Y2
Clutch C/D
Transfer valve 2; GV2

Retaining valve C/D

Retaining valve A/B; F/G

Gear shift
valve A/B; F/G

Safety valve

Bleed Valve

Release Valve

Pressure
control valve

Two-step valve

Two-way valve
field or street
characteristic

Shift pressure
valve 18 Bar

Transfers valve C/D pilot

Pressure valve 10 bar

4-GEAR POWERSHIFT CONTROL UNIT

3.11 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:

3.11.1 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" ‡ 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" ‡ 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

3.11.2 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.

3.11.3 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

3.11.4 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

3.11.5 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

4.   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).
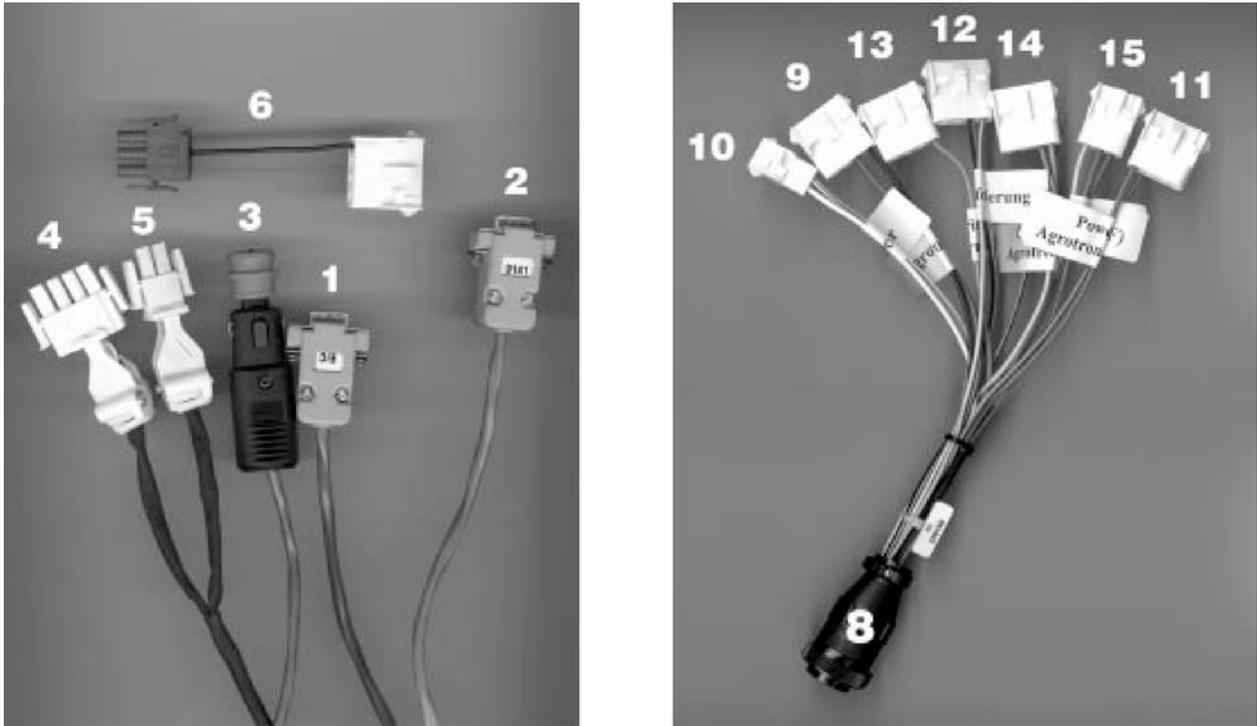
Fig. 51 - Interface cable and adapter cable

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. 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 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.

4.1   PROGRAM DESCRIPTION

4.1.1 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  Var  I                      │
│     SW-Version : FF     Serien Software                            │
│     SW-Datum   : FF.FF.FF                                          │
│                                                                    │
│                                                                    │
│                                                                    │
│                                                                    │
├────────────────────────────────────────────────────────────────────┤
│ Funktion :   «                                                     │
│ F1=Konstanten   F2=Diagnose     F3=TestMode              ENDE      │
│    ändern          ausdruck                                        │
└────────────────────────────────────────────────────────────────────┘
```

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.

4.1.2 F1 – CONSTANTS CHANGE

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

```
┌─────────────────────────────────────────────────────────────────┐
│ DEUTZ-FAHR            │ Programm für Fahrzeug Diagnose │ 2.04     │
├──────────────────────┴────────────────────────────────┴──────────┤
│ Schnittstellen-Modus : COM1  9600Baud, 8bit, 2Stop, nopar         │
│ ID: HW-Version : 08      TN 0441 19-44  Var  I                    │
│     SW-Version : 15      Serien Software                           │
│     SW-Datum   : 0D.05.15                                          │
│                           ┌──────────────────────────────────┐    │
│                           │ Konstanten anzeigen, programmieren│    │
│                           │ K1  theor. Fahrgeschw. fest   :  538│  │
│                           │ K2  Zählrad Heckzapfwelle     : 2069│  │
│                           │ K3  nicht belegt              : 5381│  │
│                           │ K4  Übersetzung Frontzapfwelle: 5381│  │
│                           │ K5  Betriebsstunden           : 5384│  │
│                           │ K6  Übersetzung Lichtmaschine : 1293│  │
│                           │ K7  Radar  Fahrgeschw. fest   :  129│  │
│                           │ K8  Kodierwort                : 2069│  │
│                           │ K9  theor. Fahrgeschw. kalibr.:  207│  │
│                           │ K10 Radar  Fahrgeschw. kalibr.:  335│  │
│                           │ K11 nicht belegt              : 5384│  │
│ Funktion :     «          │ K12 Impulse Heckzapfwelle     : 3349│  │
│ F1=Konstanten   F2=Diagnose│ K13 nicht belegt             : 1293│  │
│    ändern       ausdruck  │ Ende Konstantenmenü              │    │
│                           └──────────────────────────────────┘    │
└───────────────────────────────────────────────────────────────────┘
```

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.

4.1.3 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                          xxxx
min. ADC-Wert Tank                        xxxx
max. ADC-Wert Tank                        xxxx
Temp. Warnung Schwelle                    xxxx
Leerdrehzahl                              xxxx
Zeiger Rücklaufwinkel                     xxxx

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.

4.1.4 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.)

```
DEUTZ-FAHR                  | Programm für Fahrzeug Diagnose  | 2.04

Schnittstellen-Modus : COM1  9600Baud, 8bit, 2Stop, nopar
ID: HW-Version : FF     TN 0441 19-44  Var  I
    SW-Version : FF     Serien Software
    SW-Datum   : FF.FF.FF

Testmode aktiv         Eingänge prüfen – Ende mit Return
                         Handbremse        ---
                         Luftfilter        ---
                         Getriebeöldruck   ---
                         Motoröldruck      ---
                         Druckluft         ---
                         Motorölstand      ---
                         Vorglühen         ---
                         Frontzapfwelle    ein
                         Heckzapfwelle     ein
                         Fahrlicht         ein
                         Blinker2          ein
                         Blinker           ein
Funktion :    «          Fernlicht         ein
F1=Eingänge prüfen    F3=LCD pr
F2=Ausgänge setzen
```

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 pressureOFF

- **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 off
  Ignition 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:

```
┌─────────────────────────────────────────────────────────────┐
│ DEUTZ-FAHR          │ Programm für Fahrzeug Diagnose │ 2.04  │
│                                                               │
│ Schnittstellen-Modus : COM1  9600Baud, 8bit, 2Stop, nopar    │
│ ID: HW-Version : FF     TN 0441 19-44  Var  I                │
│     SW-Version : FF     Serien Software                       │
│     SW-Datum   : FF.FF.FF      ┌──────────────────────────┐  │
│                                │ Ausgänge setzen          │  │
│ Testmode aktiv                 │ Lampentest               │  │
│                                │ Warnlampe                │  │
│                                │ Beep                     │  │
│                                │ Ground Frequenz          │  │
│                                │ Wheel  Frequenz          │  │
│                                │ RPTO   Frequenz          │  │
│                                │ Ausgänge zurücksetzen    │  │
│                                │ Ende Ausgangs Menü       │  │
│                                │                          │  │
│                                │                          │  │
│ Funktion :   «                 │                          │  │
│ F1=Eingänge prüfen    F3=LCD pr│                          │  │
│ F2=Ausgänge setzen             └──────────────────────────┘  │
└─────────────────────────────────────────────────────────────┘
```

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.
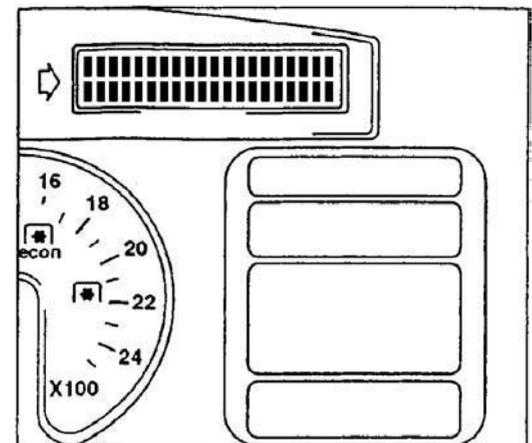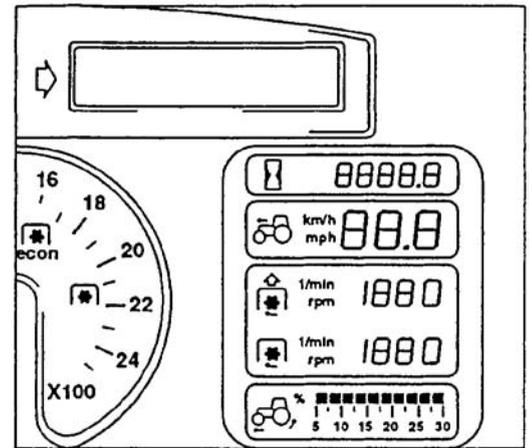
TEST MODE > F5 ANALOG INPUTS

Upon pressing the key F5 when the ignition is switched on the following window appears:
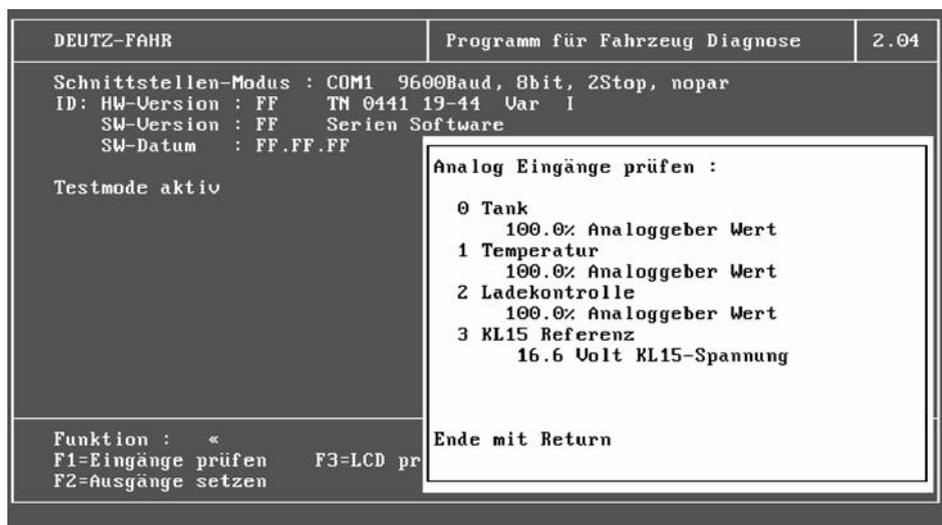
Fig. 59 - Check analog inputs

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 menue reappears.

4.1.5 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").

4.2   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

Constant	80-100 4.70 - 4095	105 6.01	106 - 135 6.00 - 6.30	150 6.45	160 - 200	230 - 260
Agrotron						
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 30/40	K1 = K9 50 km/h	Engine version, K6 mech. controller	EMR✳✳
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 Agrotron 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	–	–

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ALL ROUND TESTER MANUAL - MK3 80-105 SERIES

ELECTRONIC COMPONENTS CONTROL AND SETTING SYSTEM

STRUCTURE OF THE SYSTEM

Settings are made for electronic components using the same device as used for collecting diagnostics information, the "ALL ROUND TESTER ®", which is also referred to on the following pages as ART®.

This device can be used to:

- Display alarm codes
- Carry out calibration and setting operations
- Display vehicle operating data picked up and relayed back through the various control units (e.g. sensor readings) piloting the different electronically controlled systems.

The exchange of data between the control units and the ART® is enabled by connecting the ART® to the diagnostics and communication socket on the right hand console.

To help you carry out the programming for the specific tractor, set the parameters that can be programmed using the ART® and list the alarms detected by the control units. The following section contains all the screen pages relative to the individual control units along with explanations of the messages displayed on the ART®.

The functions of the ART® can also be performed using a Personal Computer, having installed the relative software "PCTESTER" (code 0.011.7437.4).

-	-	-	-	-	L	I	F	T	-	-	-	-	-	-	-
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
						E	H	D	+						
	S	o	f	t	w	a	r	e		0	.	0	0	A	
		1	8	-	0	5	-	1	9	9	8				
			H	W	-	#	#								
	T	R	A	C	T	O	R		T	Y	P	E			
		2	3	0	-	2	6	0		C	V				
	A	S	M		i	n	s	t	a	l	l	e	d		
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

PRESENTATION SCREEN

⬅ **Software version**.

⬅ **Release date.**

⬅ If the control unit has not been programmed or is damaged, the following message is displayed:

	C	O	N	F	I	G	.		E	R	R	O	R		

⬅ If ASM has not been installed, the following message is displayed:

A	S	M		n	o	t		i	n	s	t	a	l	l	.

Press ⬚E⬚ to continue.

		M	A	I	N		M	E	N	U					
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
1	-	M	o	n	i	t	o	r							
2	-	C	o	n	f	i	g	u	r	a	t	i	o	n	
3	-	C	a	l	i	b	r	a	t	i	o	n	s		
4	-	A	l	a	r	m		l	i	s	t				
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

MAIN MENU

1 - Monitor session:
used to display information processed by the vehicle control units from input signals returned by sensors (display of processed data).

2 - Configuration session:
for configuration of the tractor.

3 - Calibration session:
indicates procedures for setting up the tractor (calibration of sensors, routine maintenance check) and tractor configuration information (optional devices).

4 - Alarms session:
listing of active and passive alarms recorded by the control units.
Active alarm: error or fault detected and still present.
Passive alarm: error or fault detected but no longer active.

Press ⬚E⬚ to exit this menu.

		M	O	N	I	T	O	R		M	E	N	U		
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
	1	–	L	I	F	T									
	2	–	C	O	N	S	O	L	E						
	3	–	A	S	M										
	4	–	P	O	W	E	R								
	5	–	S	E	N	S	O	R	S						
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

1.MONITOR

This menu is used to show the status of input signals for each function.

Press ⬚E⬚ to exit this menu.

				L	I	F	T								
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
	S	t	a	t	u	s	.	.	.	X	X	X	X	X	X
	M	i	n		P	o	s	i	t	.		M	a	x	
		X	%			X	.	X	%				X	%	
		L	h		d	r	a	f	t				R	h	
	X	.	X	X		X	.	X	%			X	.	X	X
				W	h	e	e	l	s	l	i	p			
	R	e	f	:		X	X	X		X	X	X	%		
	R	a	d	a	r		K	m	h			X	.	X	
	W	h	e	e	l	s	K	m	h			X	.	X	
	M	o	d	e	->					X	X	X	X	X	
	E	V		u	p							X	X	X	
	E	V		d	w							X	X	X	
	P	w	m		X	X	X			X	X	X	m	A	
[	E	]	E	x	i	t									

1.1   LIFT

- **Status....:** Status of lift system
  Values displayed:
  LOCK lift locked
  STOP lift inactive
  CTRL lift in control condition (e.g. when ploughing)
  TO UP lift being raised
  SAFE lift in safety condition

- **Min Pos. Max:** Lift position
  Three columns are displayed:
  Min: setting selected with the minimum height potentio-meter (values from 0 to max setting).
  Pos'n: indicates current position of the lift (values from 0 to 100).
  Max.: setting selected with the maximum height poten-tiometer (values between 0 and 100).

- **Lh Draft Rh**: Draft response, right and left.
  Three columns are displayed:
  Lh: signal (in volts) generated by the left side draft sensor.
  Draft: the value computed as a percentage of the draft generated through the lift.
  With the tractor stationary and no implement, draft must be 50% approx.
  Rh: signal (in volts) generated by the right side draft sensor.

				L	I	F	T								
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
	S	t	a	t	u	s	.	.	.	X	X	X	X	X	X
	M	i	n		P	o	s	i	t	.		M	a	x	
		X	%			X	.	X	%			X	%		
		L	h		d	r	a	f	t			R	h		
	X	.	X	X		X	.	X	%		X	.	X	X	
				W	h	e	e	l	s	l	i	p			
	R	e	f	:		X	X	X		X	X	X	%		
	R	a	d	a	r		K	m	h		X	.	X		
	W	h	e	e	l	s	K	m	h		X	.	X		
	M	o	d	e	->					X	X	X	X	X	
	E	V		u	p						X	X	X		
	E	V		d	w						X	X	X		
	P	w	m		X	X	X		X	X	X	m	A		
[	E	]	E	x	i	t									

- **Wheelslip:** Wheelslip status

  Ref: setting selected with the wheelslip potentiometer (settings: ON = active - OFF = inactive)
  The value displayed after the setting indicates actual wheelslip (0–100).
  With the tractor stationary, the value must be 0%.

- **Radar:** Ground speed detected by radar.
  Values displayed:

  | - | - | - | - | : radar not active

  | X | X | . | X | : speed (0-50 kmh)

- **Wheels:** Wheel speed detected by sensor.
  Values displayed:

  | X | X | . | X | : speed (0-50 kmh)

- **Mode ->**: Lift control mode selected by way of "MIX" potentiometer.
  Values displayed:

  DRAFT: lift in draft control mode

  POS: lift in position control mode

  MIX: draft and position control intermixed.

- **Up SV:** Status of linkage Up solenoid valve

- **Down SV:** Status of linkage Down solenoid valve

NOTE

"Up SV" and "Dw SV" must not register "**ON**" status at one and the same time.

- **Pwm:** control signal sent to "Up" or "Down" solenoid valve currently active.
  Two columns are displayed:

  0-1000 value of control signal

  0-5000 mA value of current

Press | E | to exit this menu.

			C	o	n	s	o	l	e						
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
L	e	v	e	r						X	.	X	X	V	
C	o	n	t	r	o	l	P	o	t		X	.	X	X	V
M	a	x	H	e	i	g	h	t			X	.	X	X	V
C	t	r	l	M	o	d	e				X	.	X	X	V
D	w	S	p	e	e	d					X	.	X	X	V
W	h	e	e	l	s	l	i	p			X	.	X	X	V
U	P		P	B											
D	W		P	B											
[	E	]	E	x	i	t									

1.2 CONSOLE

- **Lever:** output voltage of control lever comando.
  Values displayed:
  - transport position: 4.70–6.69
  - stop position: 3.00–4.32
  - control position: 1.61–2.59
  - Float position: 0.72–1.61

- **ControlPot.:** output voltage of control potentiometer (value 0–8V)

- **MaxHeight:** output voltage of maximum height potentiometer (value 0–8V)

- **CtrlMode**: output voltage of operating mode potentiometer (value 0–8V)

- **DwSpeed**: output voltage of lowering speed potentiometer (value 0–8V)

- **Wheelslip**: output voltage of wheelslip switch (value 0–8V)

- **UPpb**: external linkage Up pushbutton
  (Values: ON=pressed - OFF= released)

- **DWpb**: external linkage Down pushbutton
  (Values: ON=pressed - OFF= released)

Press ⏣E to exit this menu.

				A	S	M									
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
M	o	d	e								X	X	X	X	
W	h	e	e	l	s			k	m	h		X	X	.	X
W	h	e	e	l	s	l	i	p		X	X	X	.	X	%
	S	t	e	e	r	i	n	g							
S	1	=	X		S	2	=	X		I	–	0	0	–	I
B	r	a	k	e	s									X	
A	U	T	O		P	B								X	
D	I	F	F		P	B								X	
D	I	F	F							X	X	X	X	m	A
4	W	D								X	X	X	X	m	A
[	E	]	E	x	i	t									

1.3 ASM

- **Mode:** transmission operating mode
  (values AUTO - MAN)

- **Wheels:** Ground speed

- **Wheelslip:** wheelslip percentage value

- **Steering:** steering control is effected by way of two sensors that relay a sequence of signals from which it can be determined if the tractor is steering to the left, to the right or straight ahead.
  The control sequence is indicated in the folowing table:

	Steering angle	S1	S2	Symbol
Steering to the left	$\alpha \geq 30$	0	1	\ - 30 - \
	$25 \leq \alpha < 30$	1	1	\ - 25 - \
	$15 \leq \alpha < 25$	1	0	\ - 15 - \
Straight ahead	$0 \leq \alpha < 15$	0	0	| - 00 - |
Steering to the right	$15 \leq \alpha < 25$	0	1	/ - 15 - /
	$25 \leq \alpha < 30$	1	1	/ - 25 - /
	$\alpha \geq 30$	1	0	/ - 30 - /

						A	S	M							
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
M	o	d	e									X	X	X	X
W	h	e	e	l	s		k	m	h			X	X	.	X
W	h	e	e	l	s	l	i	p		X	X	X	.	X	%
	S	t	e	e	r	i	n	g							
S	1	=	X		S	2	=	X		I	–	0	0	–	I
B	r	a	k	e	s									X	
A	U	T	O		P	B								X	
D	I	F	F		P	B								X	
D	I	F	F							X	X	X	X	m	A
4	W	D								X	X	X	X	m	A
[	E	]	E	x	i	t									

- **Brakes:** when one of the brake pedals is pressed, the letter P is displayed; when the pedal is released or both pedals are pressed together the letter R is displayed.
- **AUTOpb - DIFFpb:** these pushbuttons are used to control the ASM system in accordance with the following table:

Console switches			Status on tester	
ASM	4WD:4 wheel drive	DIFF	Auto pb	DIFF pb
OFF	OFF	OFF	R	R
OFF	OFF	ON	R	**P**
OFF	ON	OFF	R	R
OFF	ON	ON	R	**P**
ON	OFF	OFF	R	R
ON	OFF	ON	**P**	**P**
ON	ON	OFF	**P**	R
ON	ON	ON	**P**	**P**

- **DIFF:** current supplied to the differential solenoid valve
- **4WD** current supplied to the 4WD solenoid valve.

Press [E] to exit this menu.

					P	O	W	E	R						
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
+	5	V			O	U	T		V		X	X	.	X	
+	8	V			O	U	T		V		X	X	.	X	
B	a	t	t	e	r	y			V		X	X	.	X	
[	E	]	E	x	i	t									

1.4 POWER
This menu displays the power supply voltages of the ECU and components connected to it.

Press [E] to exit this menu.

				S	E	N	S	O	R	S					
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
				P	O	S	I	T	I	O	N				
X	.	X	X	V						X	X	X	.	X	%
			D	R	A	F	T		R	H					
X	.	X	X	V						X	X	X	.	X	%
			D	R	A	F	T		L	H					
X	.	X	X	V						X	X	X	.	X	%
			E	X	T	E	R	N	A	L					
X	.	X	X	V						X	X	X	.	X	%
[	E	]	E	x	i	t									

1.5   SENSORS

This screen page displays the voltages (V) supplied to the position sensors, the right and left draft sensors and the external sensor.

It also displays the lift position (%) and the signals from the draft sensors and the external sensor.

The values displayed are:

POSITION: 0-5 V - 0-100%

RH DRAFT - LH DRAFT - EXTERNAL: 0-8 V - 0-100%

NOTE

With no implement attached, the percentage values for the left and right draft sensors should be approximately 50%.

Press ⟨E⟩ to exit this menu.

P	A	R	A	M	E	T	R	E	R	S		M	E	N	U
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
1	-	S	p	e	e	d		c	o	n	s	t	a	n	t
2	-	O	p	t	i	o	n	s							
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

2. PARAMETERS

1 - **Speed constants:** in this menu you can configure the radar and tyre parameters.

2 - **Options:** this menu allows you to enable or disable the optional functions/devices on the tractor.

Press ⟨E⟩ to exit this menu.

S	P	E	E	D		C	O	N	S	T	A	N	T	S	
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
1	–	R	A	D	A	R						6	5	0	0
2	–	W	H	E	E	L	S					3	2	5	0
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

2.1 SPEED CONSTANTS

1 - Radar:
- If the radar is installed, the value displayed will be 6500.
- If the radar is not installed, the value displayed will be 0.

2 - Wheels: the value is 3250 and must not be modified.

Press E to exit this menu.

			O	P	T	I	O	N	S						
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
1	–	A	S	M											1
2	–	A	U	T	O	D	R	O	P						0
3	–	4	W	D	–	3	0	D	E	G					0
4	–	R	O	T	A	T	E	A	L	A	R	M			1
5	–	E	X	T	D	A	L	A	R	M					1
6	–	S	E	N	S	I	T	I	V	.			2	5	5
7	–	T	R	A	C	T	O	R							1
8	–	E	X	T	S	E	N	S	O	R					1
9	–	M	I	X		M	O	D	E						0
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

2.2 OPTIONS
The screen shows the factory-set values for the various options.

NOTE

The ART can only display the screen pages of this menu in English.

1 - ASM: on selecting this option you can enable or disable ASM.
(1 - ON: enabled / 0 - OFF: disabled)

2 - AUTODROP: on selecting this option you can enable or disable the automatic lowering of the linkage down to the working height at the preset speed.
(1 - ON: enabled / 0 - OFF: disabled)

3 - 4WD - 30 DEG: on selecting this option, providing ASM is also enabled, you can enable or disable the automatic engagement of 4WD when the steering angle is equal to or greater than 30°.
(1 - ON: enabled / 0 - OFF: disabled)

4 - ROTATEALARM: if this option is enabled, all active alarms will be displayed in rotation on the diagnostic LED. If the option is disabled, only the alarm with the lowest code will be displayed.
(1 - ON: enabled / 0 - OFF: disabled)

				O	P	T	I	O	N	S					
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
1	-	A	S	M											1
2	-	A	U	T	O	D	R	O	P						0
3	-	4	W	D	-	3	0	D	E	G					0
4	-	R	O	T	A	T	E	A	L	A	R	M			1
5	-	E	X	T	D	A	L	A	R	M					1
6	-	S	E	N	S	I	T	I	V	.			2	5	5
7	-	T	R	A	C	T	O	R							4
8	-	E	X	T	S	E	N	S	O	R					1
9	-	M	I	X		M	O	D	E						0
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

		C	A	L	I	B	R	A	T	I	O	N	S			
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	
1	-	M	I	N	.	H	E	I	G	H	T	X	.	X	X	
2	-	M	A	X	.	H	E	I	G	H	T	X	.	X	X	
3	-	L	O	C	K	S	P	E	E	D				2	0	
4	-	W	H	E	E	L	S	L	I	P	%			1	0	
-	-	C	O	N	T	R	O	L		L	E	V	E	R	-	
5	-	T	R	A	N	S	P	O	R	T		X	.	X	X	
6	-	S	T	O	P						X	.	X	X		
7	-	C	O	N	T	R	O	L			X	.	X	X		
8	-	F	L	O	A	T					X	.	X	X		
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	
[	E	]	E	x	i	t										

5 -　**EXTDALARM:** if this option is enabled, alarm codes will be displayed in the extended format, i.e., with a different code for each alarm type.
If this option is disabled, different alarms may be grouped together under a single standard code.
(1 - ON: enabled / 0 - OFF: disabled)

6 -　**SENSITIV.:** this options allows you to change the sensitivity of the draft and wheelslip control functions.
Decreasing the value reduces the reaction speed, whereas if the value is set to 0, it will be possible to alter the control sensitivity by way of the lowering speed control knob.

7 -　**TRACTOR:** this option serves to select the type of tractor.

8 -　**EXTSENSOR:** this option tells the ECU whether the signal from the external sensor is to be used in the control cycle or to limit the opening of the linkage Up valve.
(1 - ON: enables use of the signal to limit opening of the linkage Up valve / 0 - OFF: enables use of the signal in the control cycle)

9 -　**MIX MODE**: this option allows you to select the operating mode of the MIX potentiometer. If this option is enabled, the MIX potentiometer is used to set the draft/position or draft/position/wheelslip mix.
(1 - ON: enabled / 0 - OFF: disabled)

Press ⌷E⌷ to exit this menu.

3.CALIBRATIONS

This menu contains all the calibration operations that can be performed when the ECU or the position sensor is replaced.

1 - Min. height: calibration of the minimum lift height.

2 - Max. height.: calibration of the maximum lift height.

3 - Lock speed: tractor speed at which the lift lock is applied.

4 - Wheelslip: wheelslip percentage limit value used by the wheelslip control function.

5 - Transport: output current of the lift control lever in TRANSPORT position.

6 - Stop: output current of the lift control lever in STOP position.

7 - Control: output current of the lift control lever in CONTROL position.

8 - Float: output current of the lift control lever in FLOAT position.

Press ⌷E⌷ to exit this menu.

	M	I	N	I	M	U	M		H	E	I	G	H	T	
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
1	–	C	U	R	R	E	N	T				#	#	#	#
2	–	N	E	W								#	#	#	#
[	A	]	A	B	O	R	T								
[	C	]	C	O	N	F	I	R	M						

3.1 MINIMUM HEIGHT

In this menu you can set the minimum lift height.

PROCEDURE

1 - Start the engine and run it at idle speed.

2 - Unlock the lift.

3 - Fully lower the lift using the external pushbuttons.

4 - Press pushbutton $\boxed{\text{E}}$ to confirm the value.

5 - Press pushbutton $\boxed{\text{C}}$ to confirm again or pushbutton $\boxed{\text{A}}$ to cancel.

	M	A	X	I	M	U	M		H	E	I	G	H	T	
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
1	–	C	U	R	R	E	N	T				#	#	#	#
2	–	N	E	W								#	#	#	#
[	A	]	A	B	O	R	T								
[	C	]	C	O	N	F	I	R	M						

3.2 MAXIMUM HEIGHT

In this menu you can set the maximum lift height.

PROCEDURE

1 - Start the engine and run it at idle speed

2 - Unlock the lift

3 - Fully raise the lift using the external pushbuttons.

> **WARNING!**
> **Carry out these manoeuvres with the engine idling to avoid mechanical damage to the lift.**

4 - When the lift has reached maximum height, lower it by 2-3 degrees (approx. 0.2 V).

5 - Press pushbutton $\boxed{\text{E}}$ to confirm the value.

6 - Press pushbutton $\boxed{\text{C}}$ to confirm again or pushbutton $\boxed{\text{A}}$ to cancel.

		L	O	C	K		S	P	E	E	D				
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
1	–	C	U	R	R	E	N	T				#	#	#	#
2	–	N	E	W								#	#	#	#
[	A	]	A	B	O	R	T								
[	C	]	C	O	N	F	I	R	M						

3.3　LOCK SPEED
This value **must not be modified**.

		W	H	E	E	L	S	L	I	P					
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
1	–	C	U	R	R	E	N	T				#	#	#	#
2	–	N	E	W								#	#	#	#
[	A	]	A	B	O	R	T								
[	C	]	C	O	N	F	I	R	M						

3.4　WHEELSLIP
This value **must not be modified**.

		T	R	A	N	S	P	O	R	T				
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
1	–	C	U	R	R	E	N	T			#	#	#	#
2	–	N	E	W							#	#	#	#
[	A	]	A	B	O	R	T							
[	C	]	C	O	N	F	I	R	M					

3.5   TRANSPORT

The voltage value relative to the TRANSPORT position of the lift control lever is already programmed and stored in the ECU memory.

You can change this value by putting the lift lever in the TRANSPORT position and confirming the new value by pressing $\boxed{C}$.

The permissible value range is 4.70V to 6.69V.

				S	T	O	P							
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
1	–	C	U	R	R	E	N	T			#	#	#	#
2	–	N	E	W							#	#	#	#
[	A	]	A	B	O	R	T							
[	C	]	C	O	N	F	I	R	M					

3.6   STOP

The voltage value relative to the STOP position of the lift control lever is already programmed and stored in the ECU memory.

You can change this value by putting the lift lever in the STOP position and confirming the new value by pressing $\boxed{C}$.

The permissible value range is 3.00V to 4.32V.

			C	O	N	T	R	O	L						
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
1	–	C	U	R	R	E	N	T				#	#	#	#
2	–	N	E	W								#	#	#	#
[	A	]	A	B	O	R	T								
[	C	]	C	O	N	F	I	R	M						

3.7   CONTROL

The voltage value relative to the CONTROL position of the lift control lever is already programmed and stored in the ECU memory.

You can change this value by putting the lift lever in the CONTROL position and confirming the new value by pressing $\boxed{C}$.

The permissible value range is 4.70V to 6.69V.

					F	L	O	A	T						
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
1	–	C	U	R	R	E	N	T				#	#	#	#
2	–	N	E	W								#	#	#	#
[	A	]	A	B	O	R	T								
[	C	]	C	O	N	F	I	R	M						

3.8   FLOAT

The voltage value relative to the FLOAT position of the lift control lever is already programmed and stored in the ECU memory.

You can change this value by putting the lift lever in the FLOAT position and confirming the new value by pressing $\boxed{C}$.

The permissible value range is 3.00V to 4.32V.

		A	L	A	R	M		L	I	S	T			
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	D	]	A	b	o	r	t							
[	E	]	E	x	i	t								

4. ALARMS LIST

← **Most recent alarm**

This screen displays the last 10 alarm signals to be generated.

All the active alarms are displayed on the last line against a dark background.

Press to cancel $\boxed{D}$ or press to $\boxed{E}$ quit.

LIST OF DIAGNOSTIC ALARMS

Standard CODE	Extended CODE	MESSAGE on PC Tester or ART	DESCRIPTION
88	11	Alarm not recorded	Checksum EPROM program not valid
26	12	"Posit.Sens.Power"	Position sensor power supply incorrect
13	13	"ShortCirc.PWM"	Short-circuit of PWM outputs
53	14	"ShortCirc.ASM"	Short-circuit of ASM outputs
18	16	"LiftCntrlLever."	Lift control lever
22	18	"Pos.Sens.Disc"	Position sensor not connected
11	21	"ShortCirc.EVUP"	Short-circuit of SvUp
11	23	"SvUpDisc. L"	SvUp not connected (static test - Sv off)
11	24	"SvUpDisc. D"	SvUp not connected (dynamic test - Sv on)
12	31	"ShortCirc.SvDw "	High short-circuit of SvDw
12	33	"SvDwDisc. L"	SvDw not connected (static test - Sv off)
12	34	"SvDwDisc. D"	SvDw not connected (dynamic test - Sv on)
51	41	"ShortCirc. 4WD"	Short-circuit of 4WD output
51	43	"4WD Disc. "	4WD output not connected (static test - Sv off)
52	51	"ShortCirc.DIF"	Short-circuit of SvDIFF
52	53	"SvDIFDisc. "	DIFF solenoid valve not connected (static test - Sv off)
31	62	"RHDraftDisc."	Right-hand draft sensor not connected
32	63	"LHDraftDisc."	Left-hand draft sensor not connected
42	64	"Wheel sens.disc."	Wheel sensor not connected or faulty
41	65	"Radar Disconnected"	Radar not connected or faulty
26	67	"5V power "	5V sensor power incorrect
16	68	"8V power "	8V sensor power incorrect
34	71	"Low.SpeedPot.Disc."	Lowering speed potentiometer short-circuited or disconnected
23	72	"Control Pot. "	Control potentiometer short-circuited or disconnected
36	73	"Mix Pot. "	Mix potentiometer short-circuited or disconnected
24	74	"Max.HeightPot. "	Maximum Height potentiometer short-circuited or disconnected
54	76	"EEPROM :OPTION "	EEPROM checksum not correct - Options menu
54	77	"EEPROM : SPEED "	EEPROM checksum not correct - Parameters menu
54	78	"EEPROM : CALIB "	EEPROM checksum not correct - Calibrations menu
55	81	"EEPROM : CTRL "	EEPROM checksum not correct - Control menu
55	82	"EEPROM : PWM "	EEPROM checksum not correct - PWM menu
55	83	"EEPROM : DRAFT "	EEPROM checksum not correct - Draft menu
55	84	"EEPROM : SLIP "	EEPROM checksum not correct - Slip menu
55	85	"EEPROM : POS "	EEPROM checksum not correct - Position menu
55	86	"EEPROM : AB "	EEPROM checksum not correct - Antidumping menu
55	87	"EEPROM : SFCFG "	EEPROM checksum not correct - Draft config. menu
55	88	"EEPROM : SLCFG "	EEPROM checksum not correct - Slip Config. menu
88	--	Non coded alarm	All non coded alarms (probable software problem)

SECTION 30

CONTENTS

IMPORTANT! Assemblies are arranged by subject and are listed in alphabetical order

CHASSIS

ELECTRICAL AND ELECTRONIC CONTROLS

ENGINE

ENGINE HOODS

FRONT AXLE

FRONT LIFT

HYDRAULIC SERVICE BRAKES AND PARKING BRAKE

METHOD FOR REMOVAL AND REFITTING OF RIGID PIPES AND WIRING

1 - The rigid pipes of the various systems can all be re-moved individually , i.e. without having to remove any pipes belonging to other systems.

2 - For particularly complex removal operations, num-ber the pipes in the order in which they are removed, label any intermediate connections and the posi-tions 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 help the operator trace the routes of the rigid pi-pes and cables on the tractor frame, the following photos show the relative positions of pipes and ca-bles for the version with air trailer braking.

IMPORTANT

1 - **After removing pipes, immediately plug the ends of the pipes and the open fittings on the compo-nents from which they were disconnected in or-der to prevent the entry of contaminants.**

2 - **After disconnecting electrical connectors, pro-tect them against oil, dust and other contami-nants 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 al-cohol or a specific water-repellent product.**

4 - **Check wiring fixings carefully; these must not im-pinge on the connectors and must be positioned at regular intervals of about 30 cm to prevent vi-bration that could cause an interruption in cur-rent flow or signal loss.**

TOP VIEW OF WIRING AND PIPES
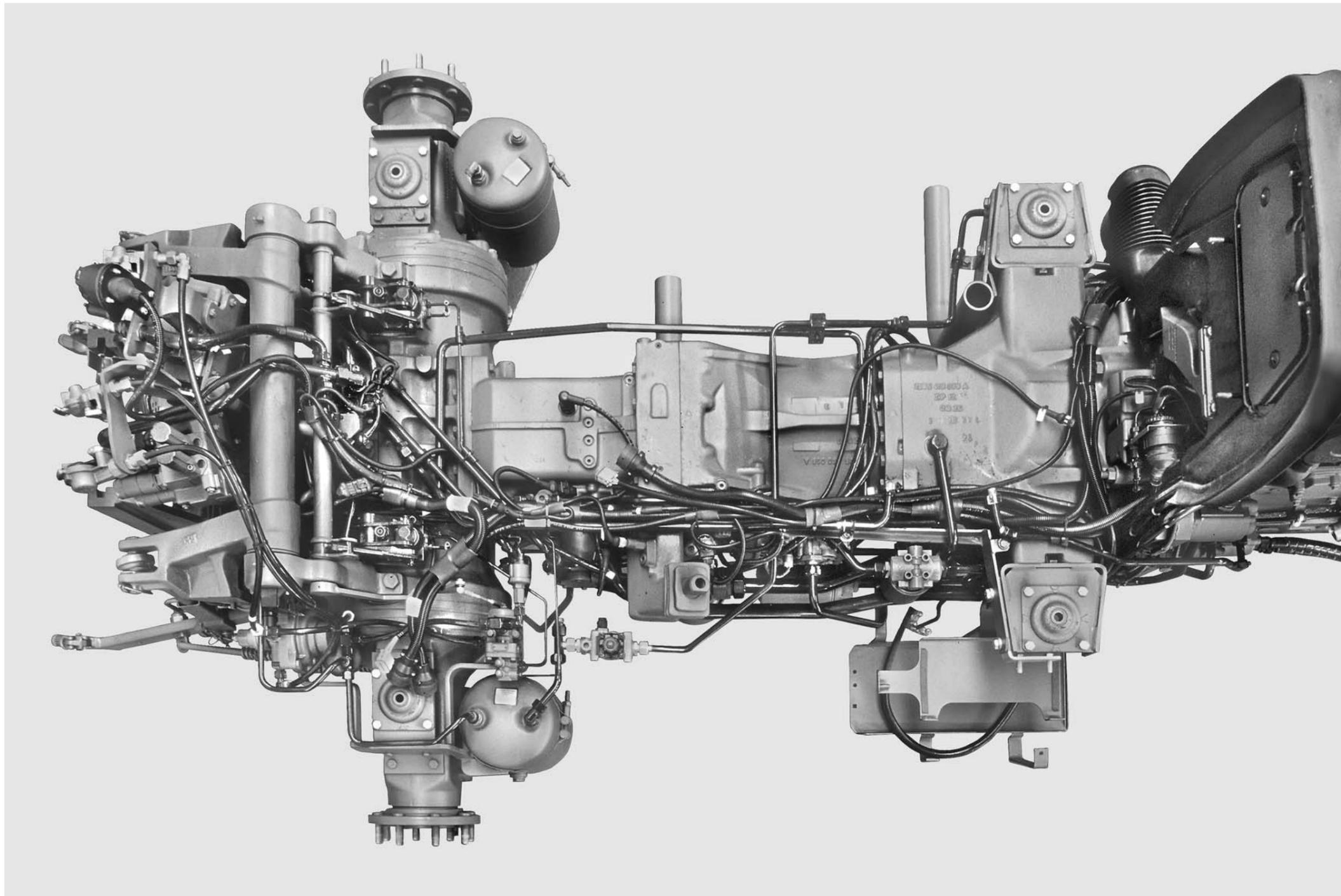
VIEW OF UPPER WIRING AND PIPES
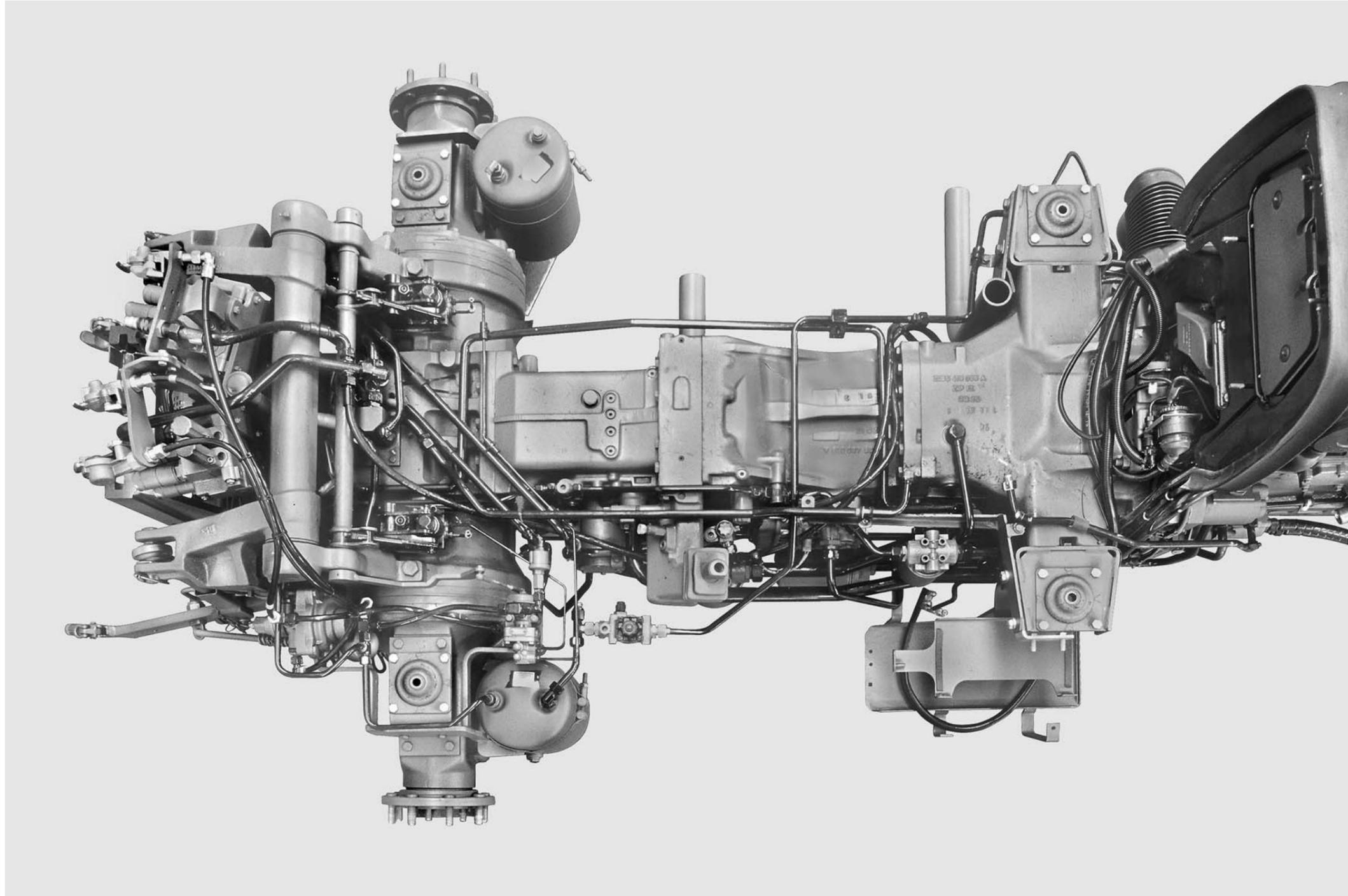
PIPES ON RIGHT-HAND SIDE
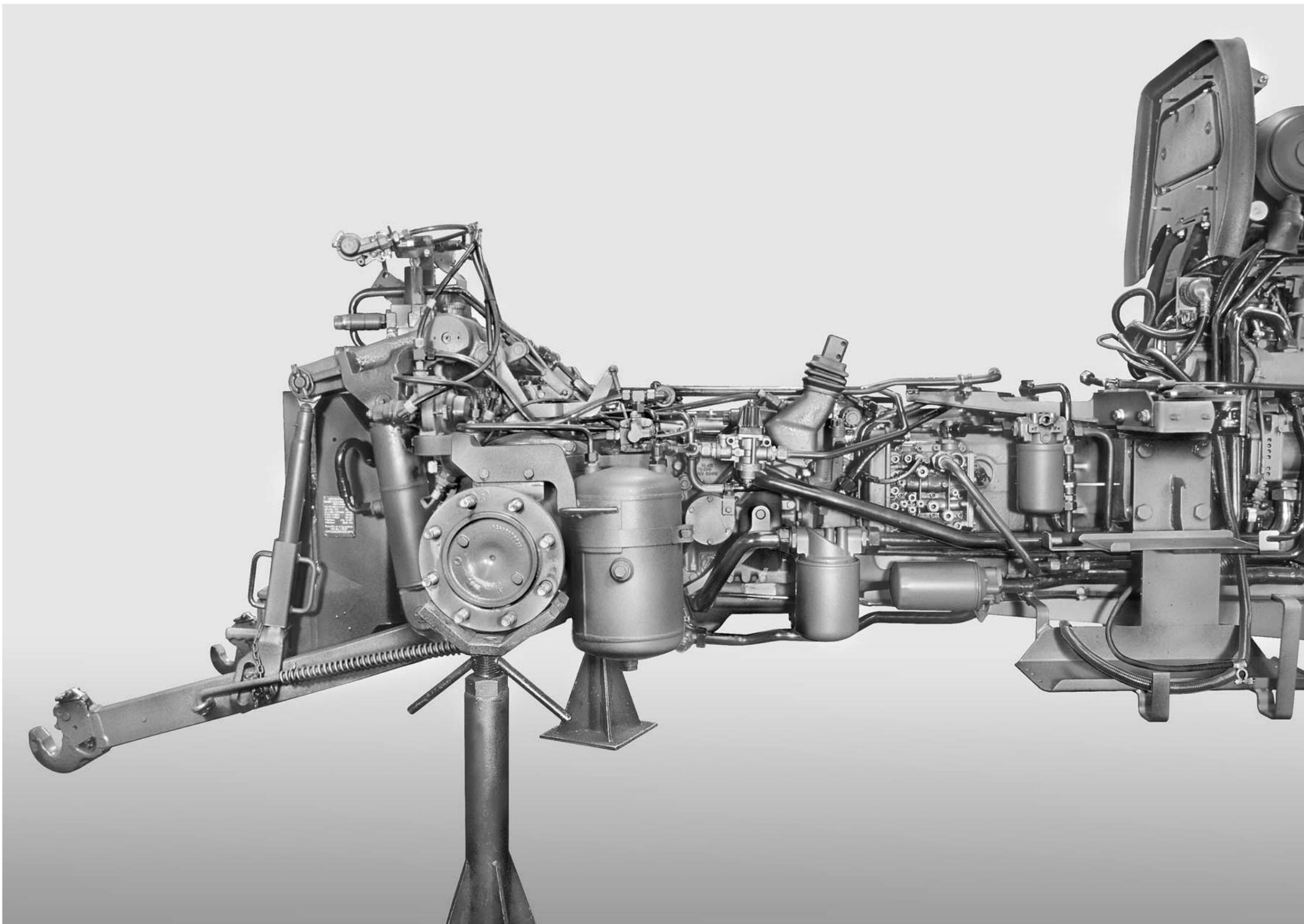
TOP VIEW OF REAR PIPES
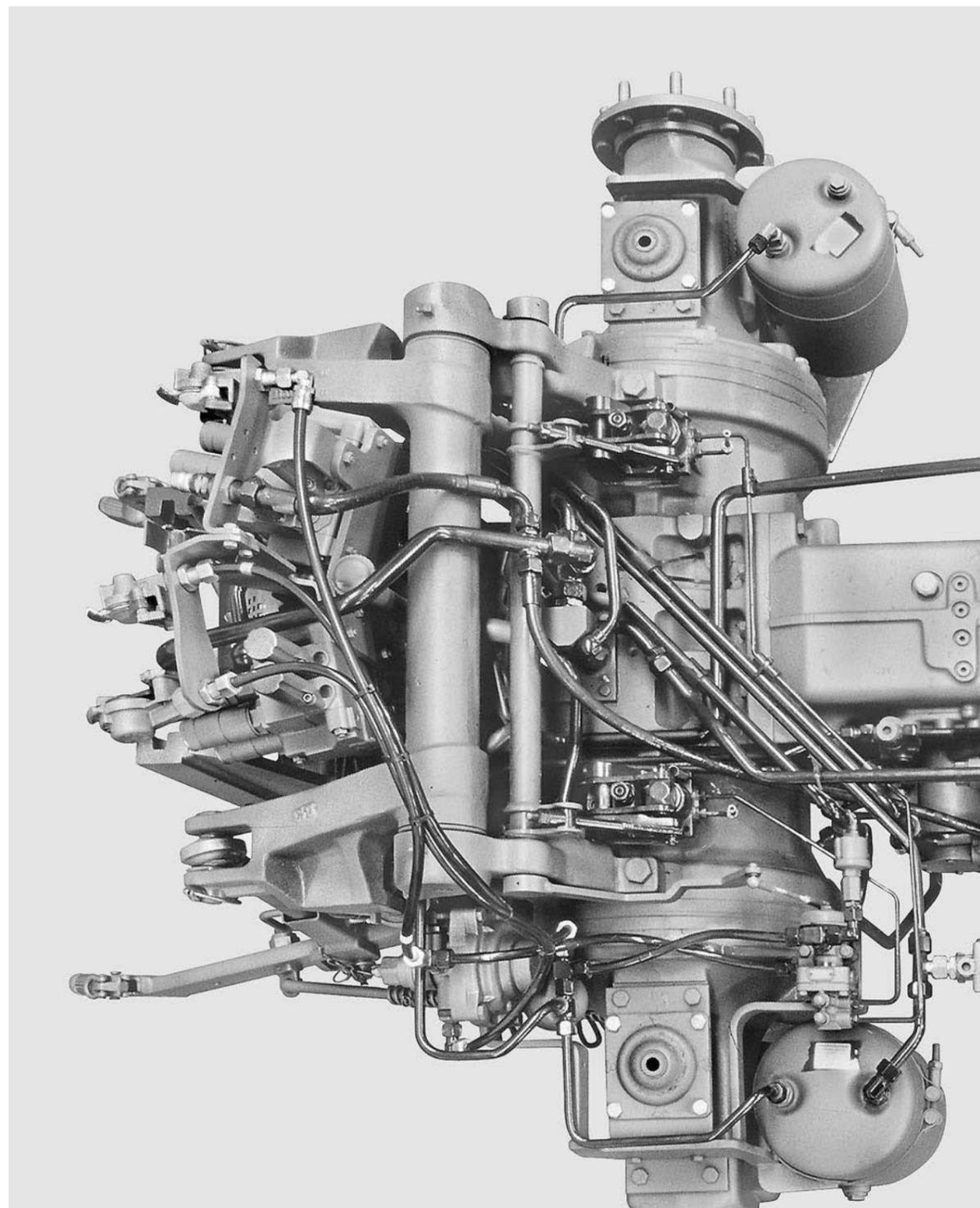
DETAIL OF AIR TRAILER BRAKING SYSTEM
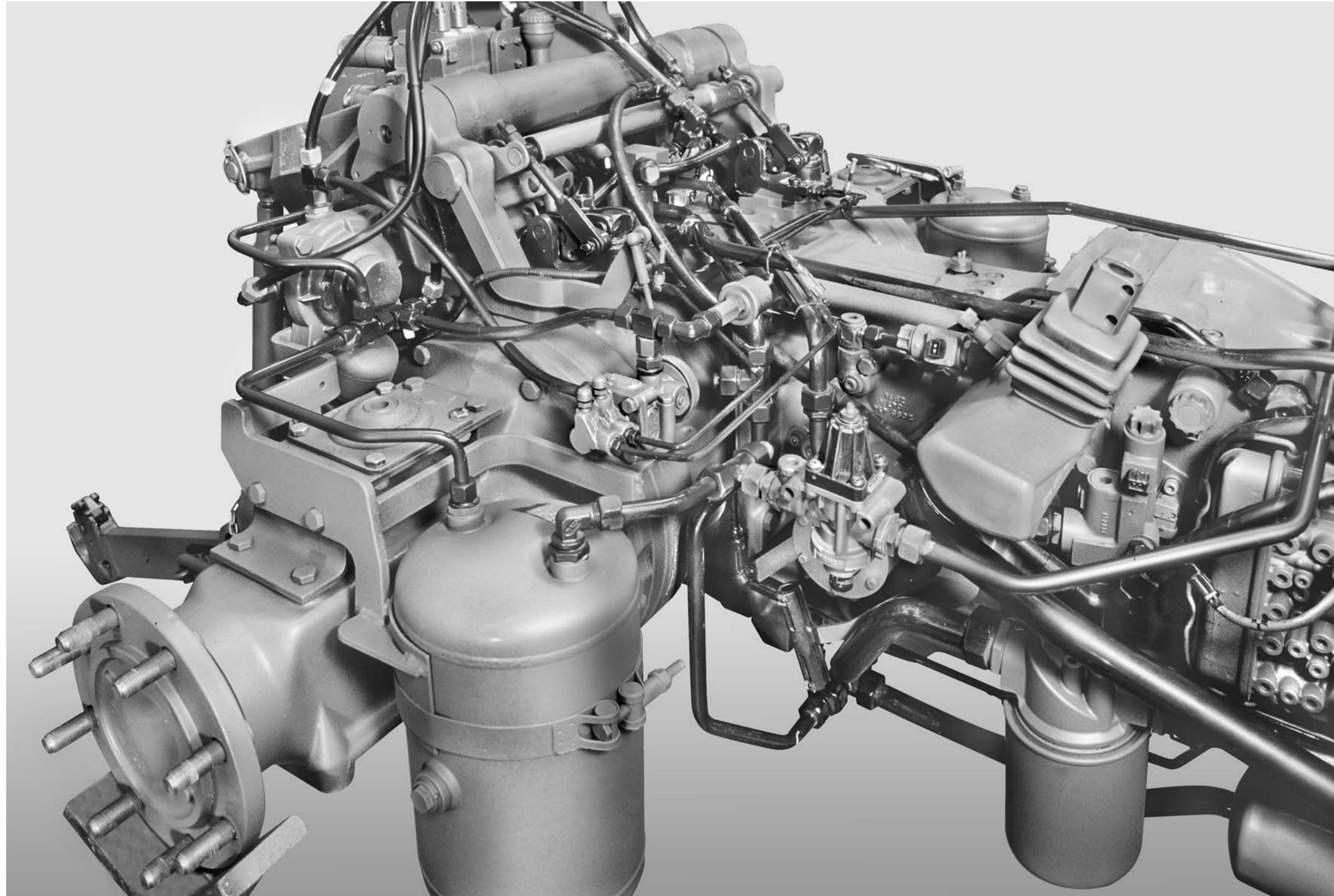
REMOVAL AND ADJUSTMENT OF ENGINE HOOD AND LAMP ASSEMBLIES

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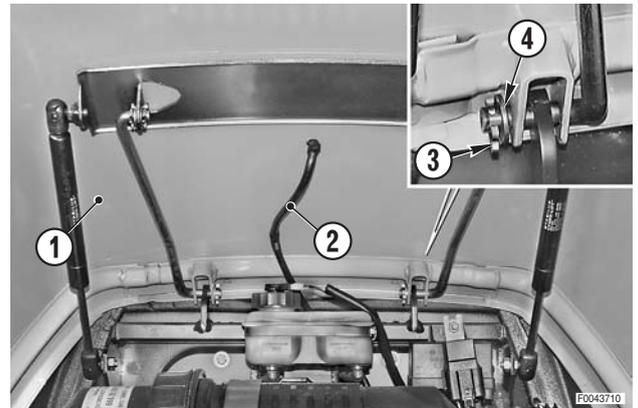
4 - Detach the gas springs (5) from the frame and remove the complete hood assembly (1).
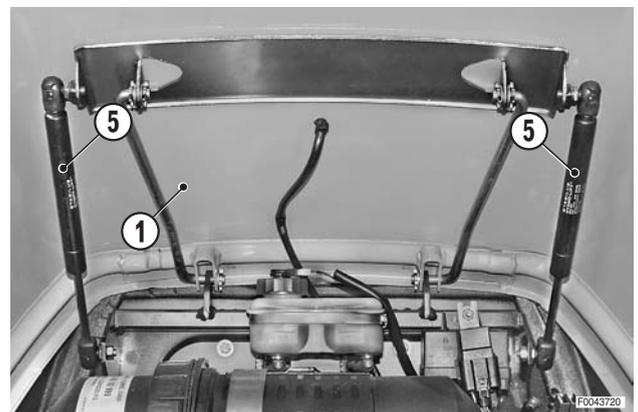
1.1 Adjustment of the hood latch

★ Before adjusting the hood latch, make sure that the hood release buttton 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).
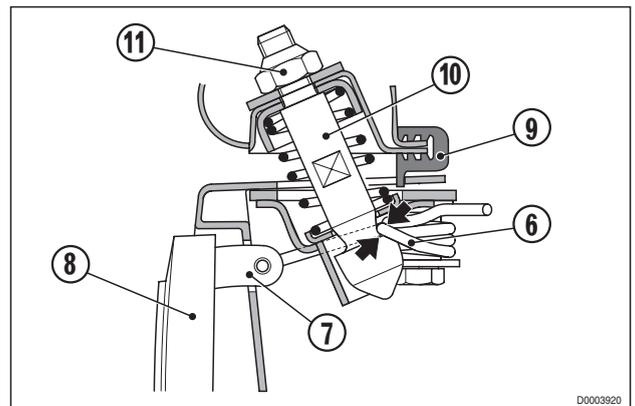
2. Removal of the side panels

1 - Lift and remove the grilles (12).
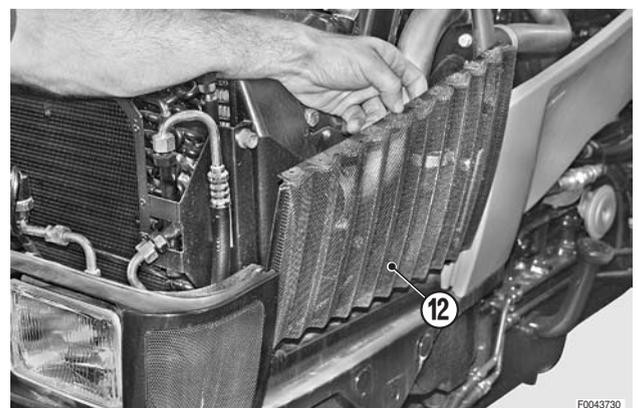
2 - Unscrew and remove the front bolts (13).

F0017020
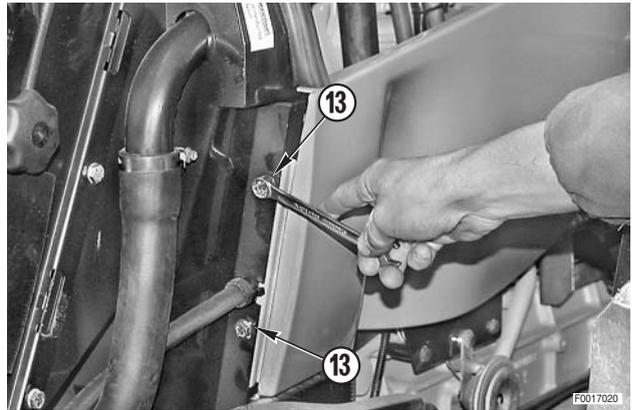
3 - Unscrew and remove the rear nut (14) and remove the washer (15).

F0043740
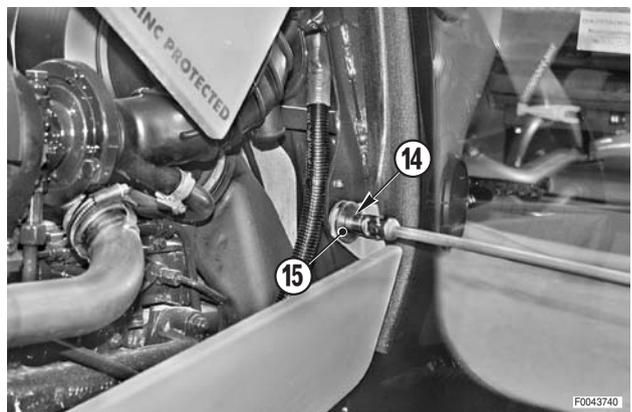
3. Removal of the lamp assemblies and hood release button

1 - Remove the lateral retaining screws (16).

F0017040

2 - Remove the central retaining screws (17).

F0017050
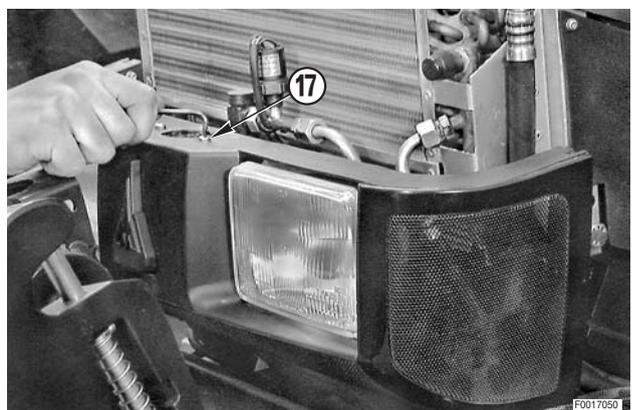
3 - Unplug the lamp connectors (19) from the lamp assemblies (18).
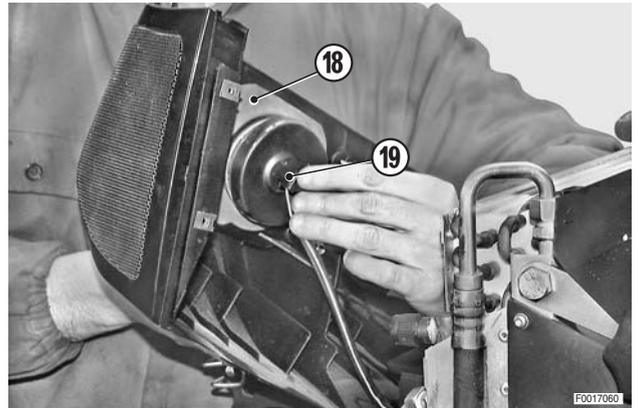
4 - Remove the lamp assemblies (18) by rotating them to the rear and moving them sideways to disengage the release button (8).
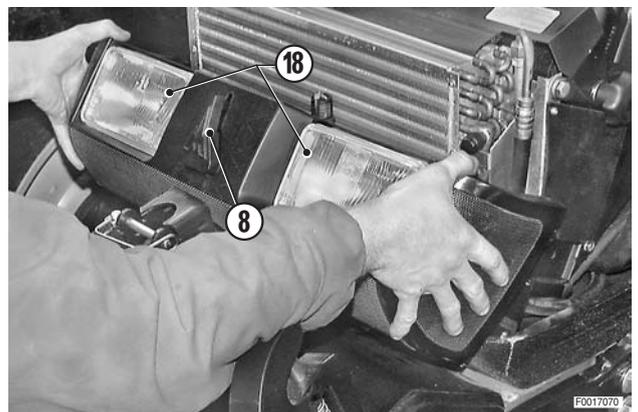
5 - If necessary, press the plate (7) of the release button (8) to help disengage the spring (6).

※ 1
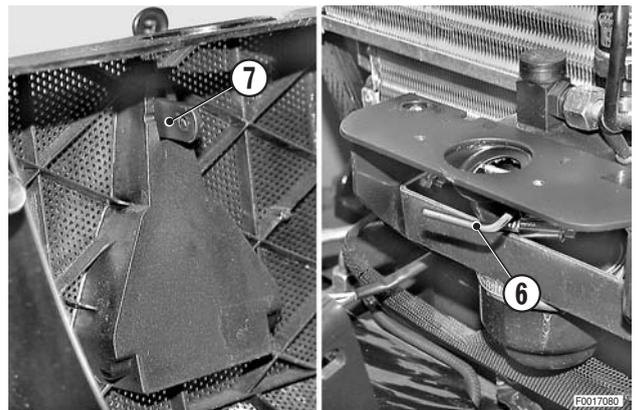
REFITTING AND ADJUSTMENT OF ENGINE HOOD AND LAMP ASSEMBLIES

• 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 BATTERY

1 - Unscrew and remove the nut (1) securing the toolbox (2).
Remove the toolbox (2) by sliding it towards the front of the tractor.
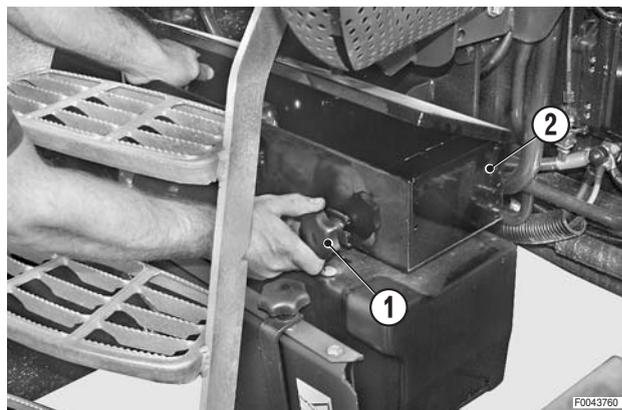
2 - Remove the bolts (3) with their washers (4) and remove the battery cover (5).
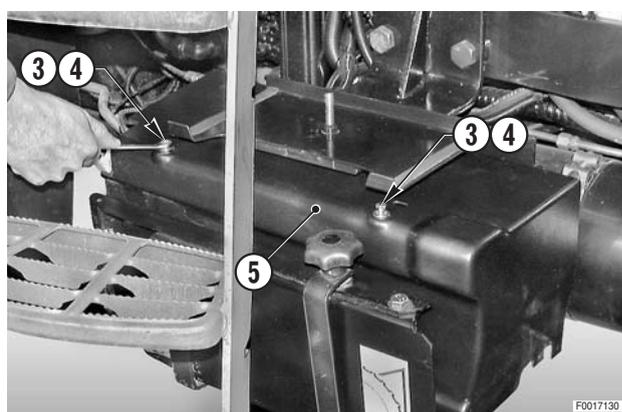
3 - Remove the terminal covers (6) and disconnect the leads (7) and (8).   ※ 1

   ⚠ Always disconnect the negative lead (–) before the positive lead (+).
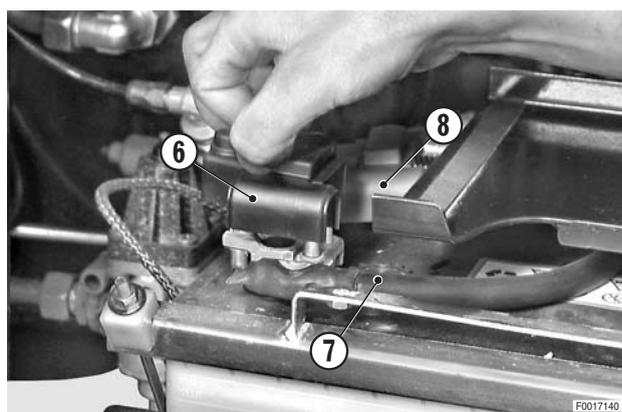
4 - Loosen off the nuts (9) sufficiently to tilt and remove the battery (12) securing clamp (10) and rods (11).
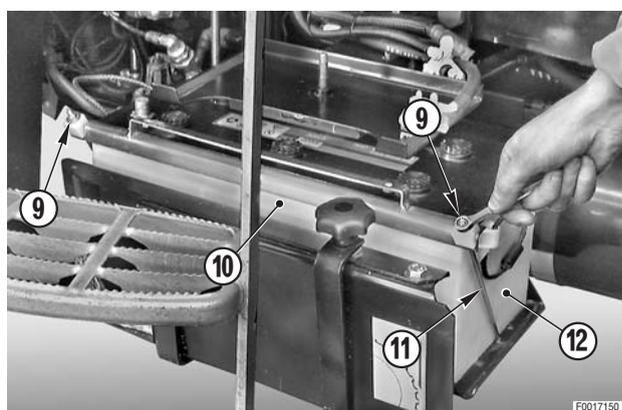
5 - Remove the battery (12) using the handles provided.

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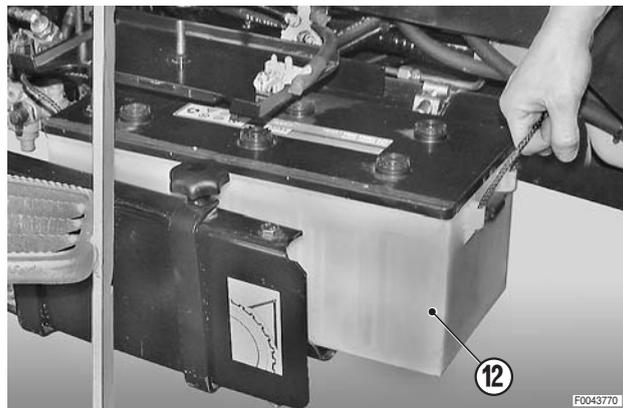
REFITTING THE BATTERY

• Refitting is the reverse of removal.

※ 1

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

REMOVAL OF THE CAB ACCESS STEPS

1 - Unscrew and remove the bolts (1) securing the lower fender (2).
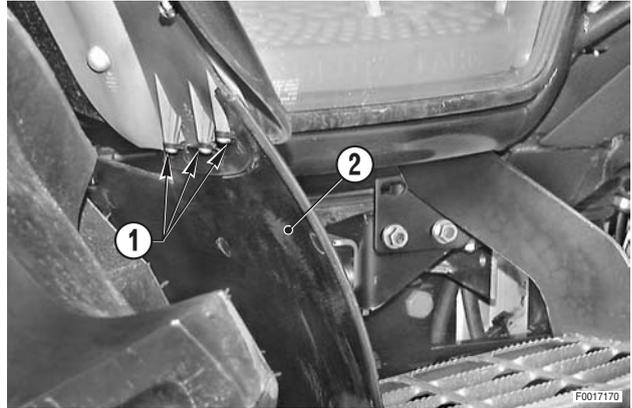
2 - Loosen the bolts (3) and (4) securing the steps (5).
   ★ For safety reasons, do not remove the bolts yet.
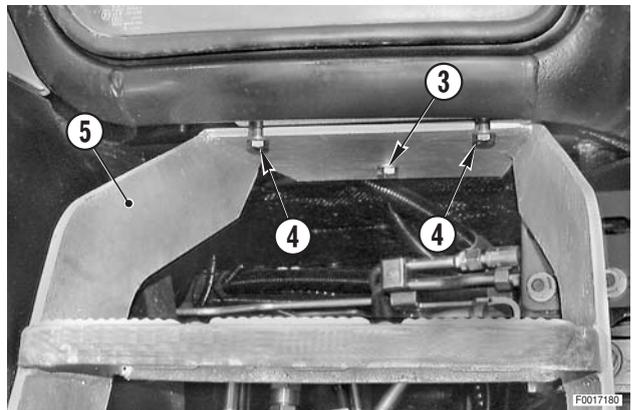
3 - Attach a hoist to the steps (5).

   [kg] 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.
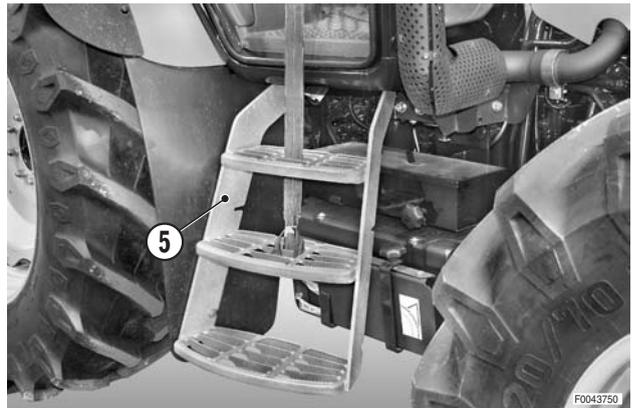
REFITTING THE CAB ACCESS STEPS

• Refitting is the reverse of removal.

REMOVAL OF THE BATTERY SUPPORT

1 - Remove the battery.
(For details see «REMOVAL OF THE BATTERY»).

2 - Unscrew and remove the lateral fixing bolt (1).
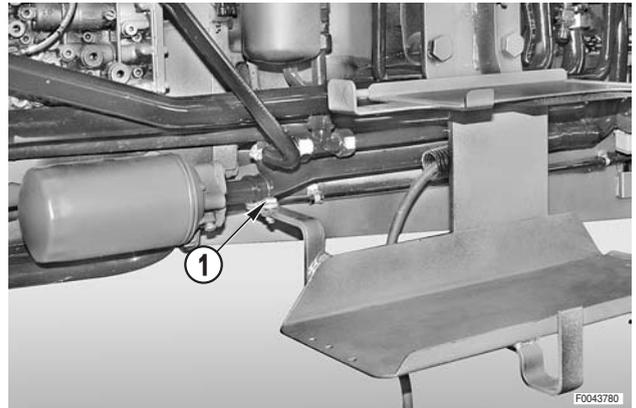
3 - Loosen the central fixing bolts (2).

4 - While supporting the battery support (3), remove the bolts (2); remove the support.

★ Recover the four spacers (4) from between the gearbox and the support (3).

NOTA On tractors equipped with a front lift, spacers are only fitted to the two upper bolts.
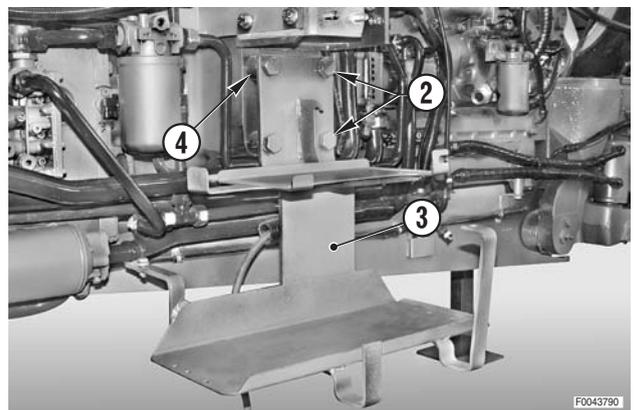
REFITTING THE BATTERY SUPPORT

• Refitting is the reverse of removal.

REMOVAL OF THE STARTER MOTOR

⚠️ Remove the battery cover and disconnect the nega-
tive battery lead (–).

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

2 - Remove the terminal protector (2) and the nut (3) se-
curing leads (4) and (5).
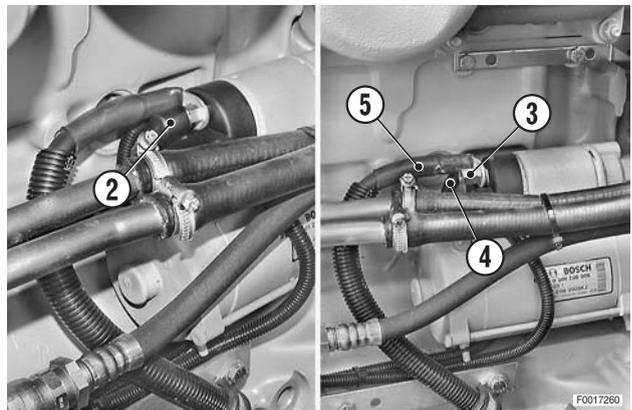
3 - Remove the terminal cover (6) and disconnect the lead
(7).

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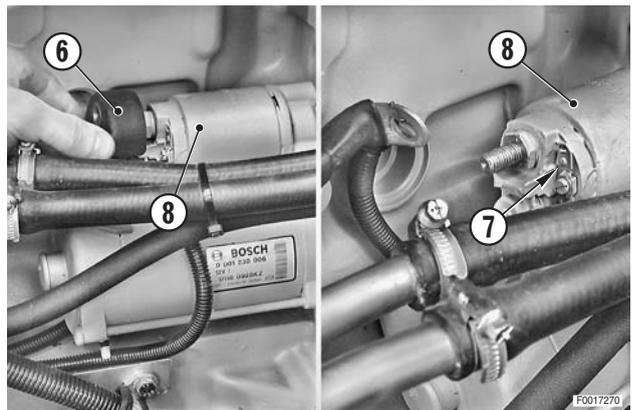
REFITTING THE STARTER MOTOR

• Refitting is the reverse of removal.

REMOVAL 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 air compressor.
(For details see «REMOVAL OF THE AIR COMPRESSOR»).
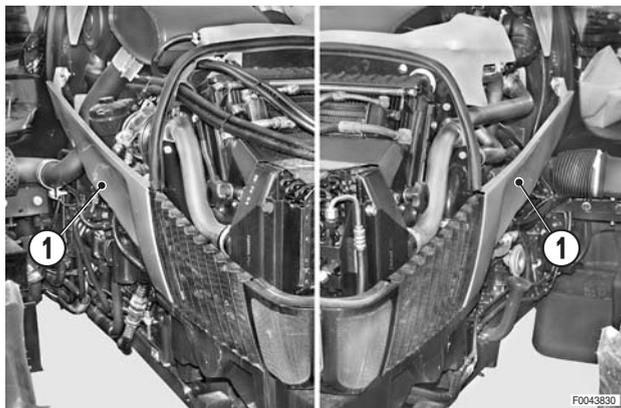
3 - Remove the terminal protector (2), remove the nut (3) and disconnect the lead (4).

4 - Remove the nut (5) and disconnect the lead (6).
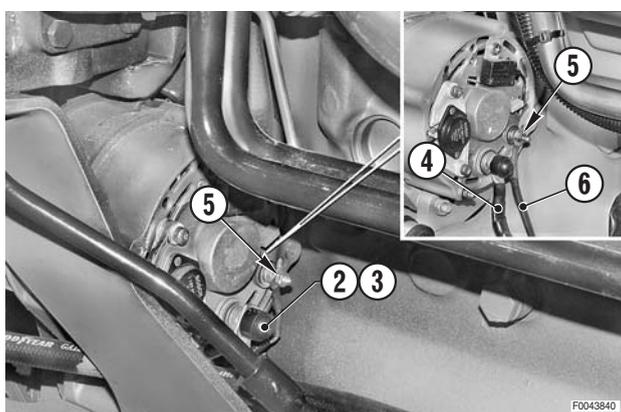
5 - Loosen the bolts (7) and (8) of the fuel pump bracket (9) in order to slacken off the drivebelt (10).

6 - Remove the alternator (11).
For details, see the engine manual.
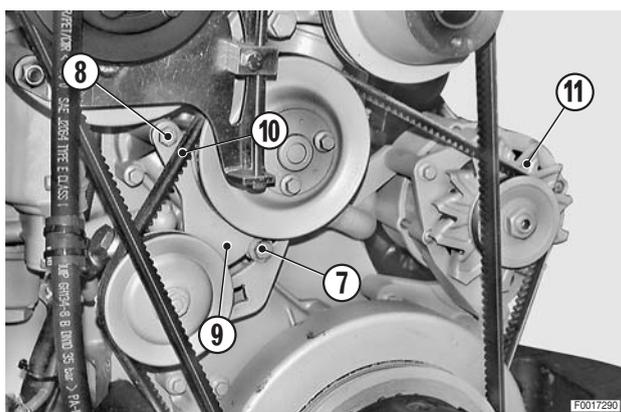
REFITTING THE ALTERNATOR

• 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»).

1 - Start the engine and check the compressor pipe fittings for leaks.

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 - Remove the air compressor and its drivebelt. (For details see «REMOVAL OF THE AIR COMPRESSOR»).

3 - Loosen the tensioner block (2) and the nut (3) securing the compressor (4).
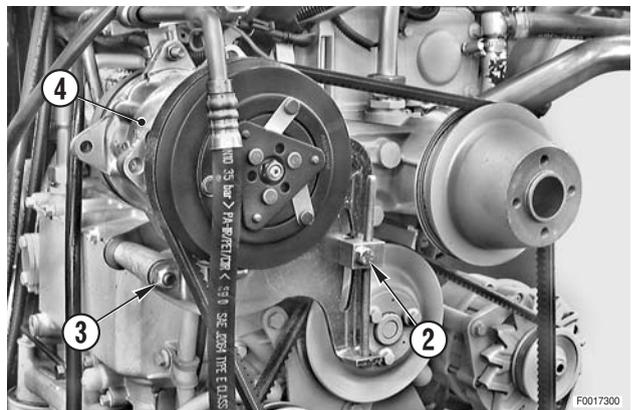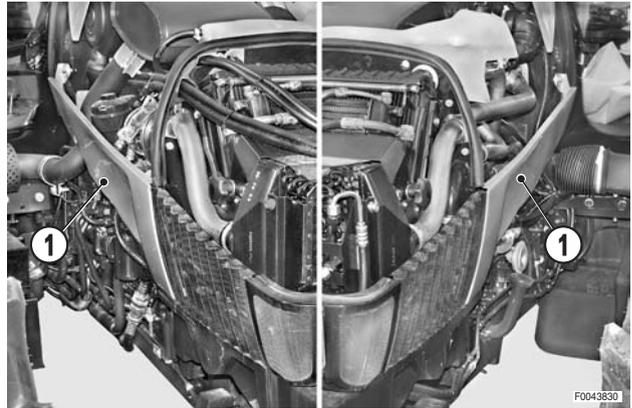
4 - Unscrew the threaded rod (5) of the tensioner to slacken off the fan drivebelt (6).

★ Loosen the drivebelt sufficiently to be able to slip it off the compressor pulley.
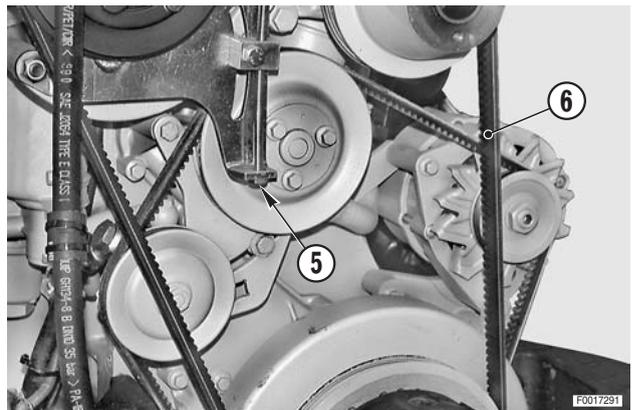
5 - **Models with front PTO only:**
loosen and fully unscrew the six bolts (7) securing the flange of the cardan shaft (8).

6 - Detach the flange (9) from the flexible coupling (10).
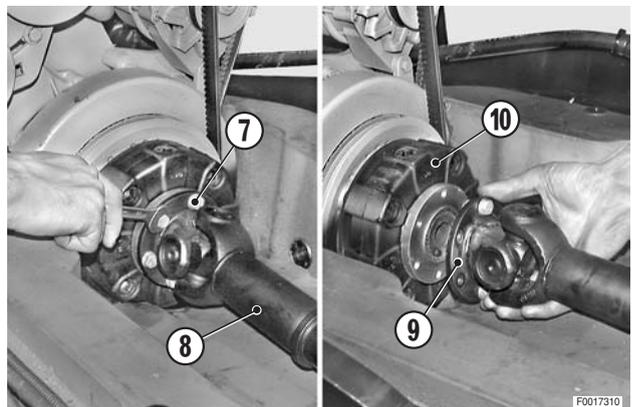
7 - Remove the bolts (11) and detach the fan (12) from the drive pulley; insert the fan in the fan housing (13) and remove the fan and compressor drivebelt (6).
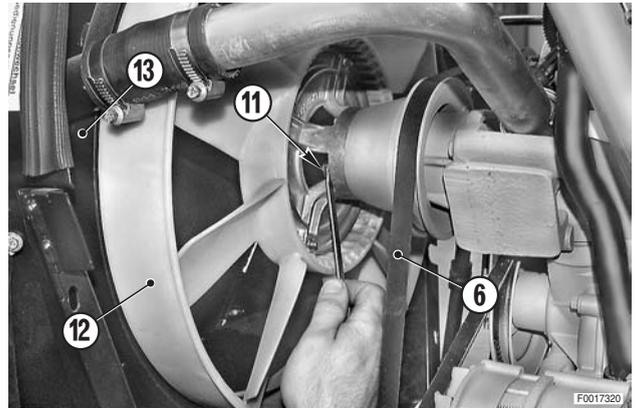
8 - Loosen the bolts (14), (15) securing the fuel pump, slip off the alternator drivebelt (16) and remove it by passing it between the crankshaft pulley and the front carrier.
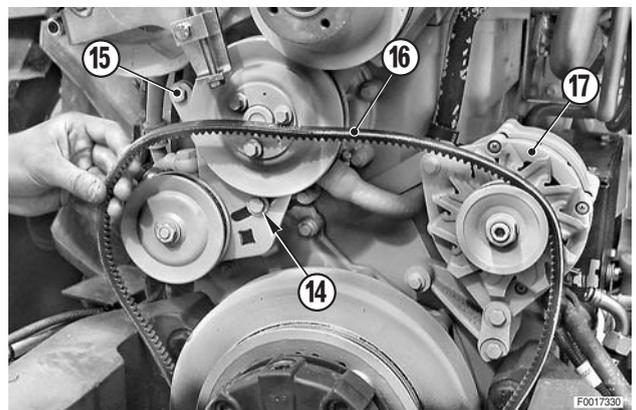
9 - Fit the new alternator drivebelt (16) in the same way and tension it using a "**T**" drive bar and a 3/4" extension, or using a 3/4" angle drive bar through the hole in the fuel pump bracket (18).

10 - To tension the drivebelt, turn the bar clockwise and tighten the bolts (14) and (15).
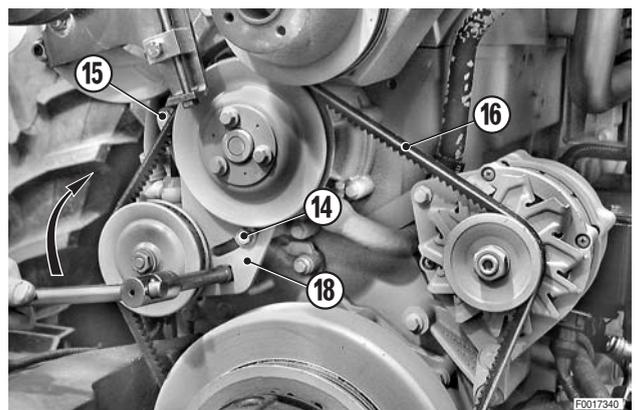
11 - The tension is to be checked using the tool and procedure indicated in the engine manual.

★ Static deflection "**A**" on first fitting:
13 mm belt: 450±50 N

★ Static deflection "**A**" after 15 minutes:
13 mm belt: 300±50 N

⚠ The check should be carried out with the engine cold.
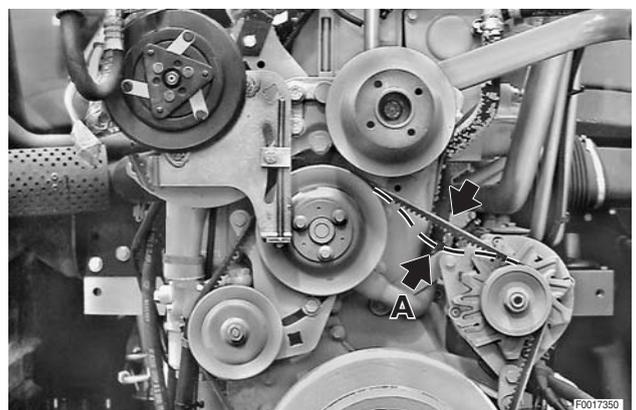
12 - Fit the fan drivebelt (6) and tension it as described in «REMOVAL OF THE CONDITIONING COMPRESSOR».

13 - Complete the refitting procedure by following the first stage of the removal operations in reverse order.

F0017360
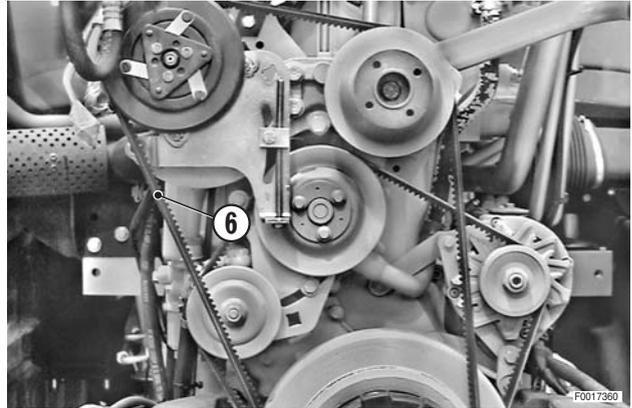
REMOVAL OF THE FAN

⚠ 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. 10 ℓ (2.64 US. gall.)

3 - Remove the expansion tank.
(For details see «REMOVAL OF THE EXPANSION TANK»).

4 - Disconnect the hoses (1) and (2) from the radiator assembly.
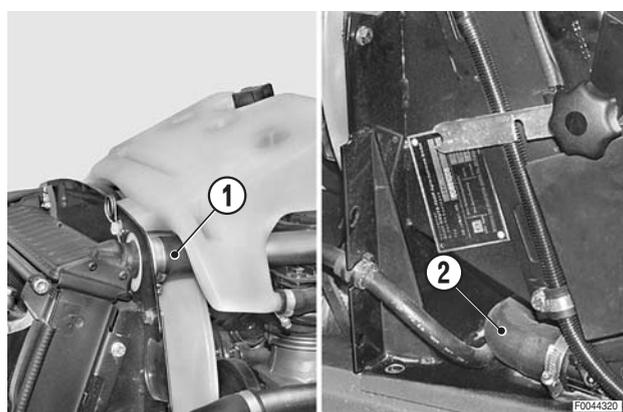
5 - Loosen the bolts (3) and release the wiring (4) from the retaining straps (5) and from the radiator support.
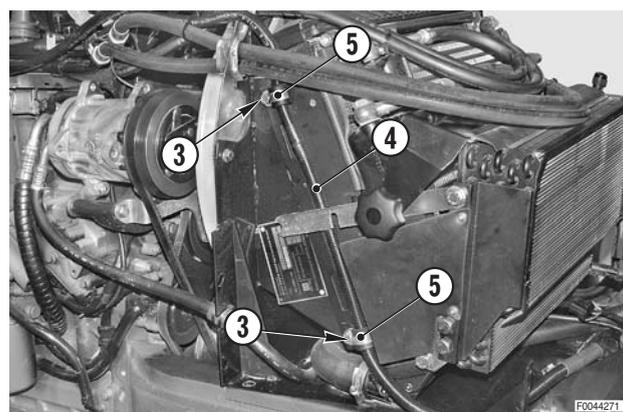
6 - Undo and remove the guide (6) for the cooler connection pipes (7) and (8).

30-19
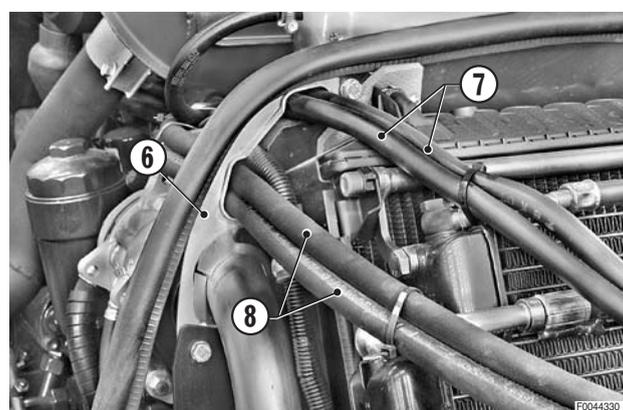
7 - **For models with intercooler only:** loosen and remove the guide (9) and the left bulkhead (10) for the air intake pipe.
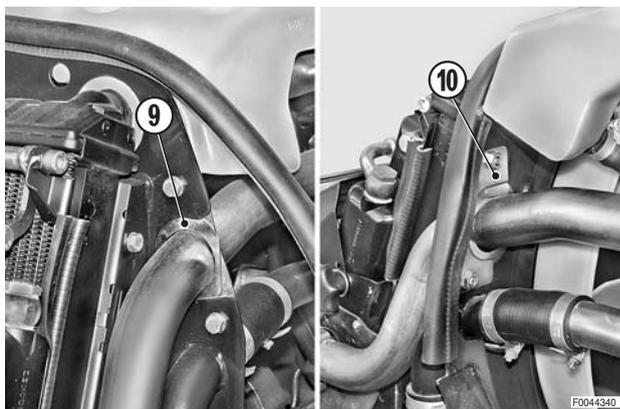
8 - Unscrew and remove the two front retaining bolts (11) of the support (12) and move the entire assembly towards the front of the tractor so that the fan is clear of the cowling.
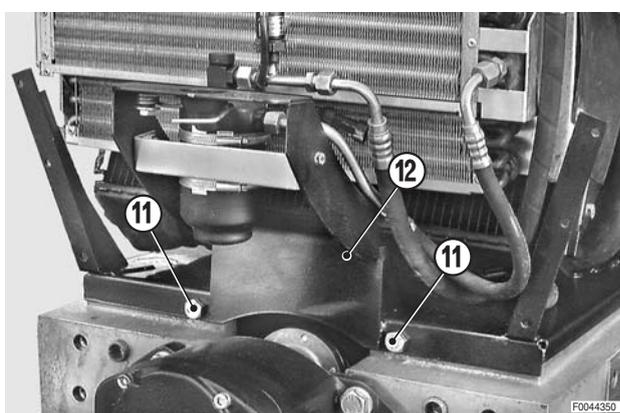
9 - Unscrew and remove the retaining bolts (13) of the fan (14).
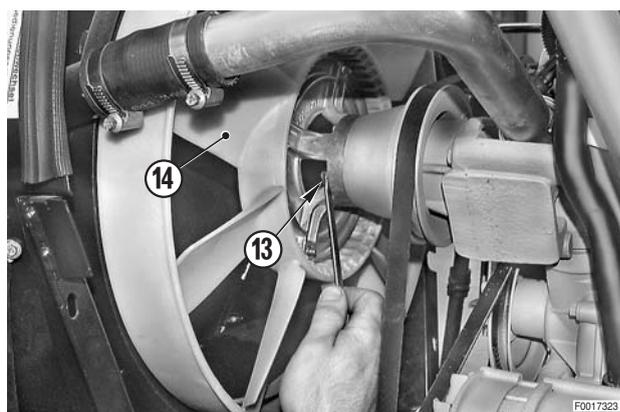
10 - Remove the fan (14) by withdrawing it vertically upwards.
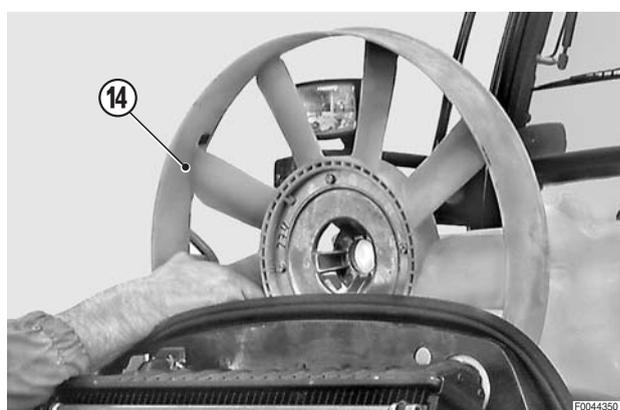
REFITTING THE FAN

- Refitting is the reverse of removal.

1 - Fill the engine cooling system with coolant.

   Coolant: approx. 10 ℓ (2.64 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.

RENEWAL OF THE COMPRESSOR DRIVEBELT

⚠ Remove the key from the ignition and apply the parking brake.

1 - Loosen the pivot and fixing bolts (1), (2) of the bracket (3) supporting the belt tensioner pulley (4).
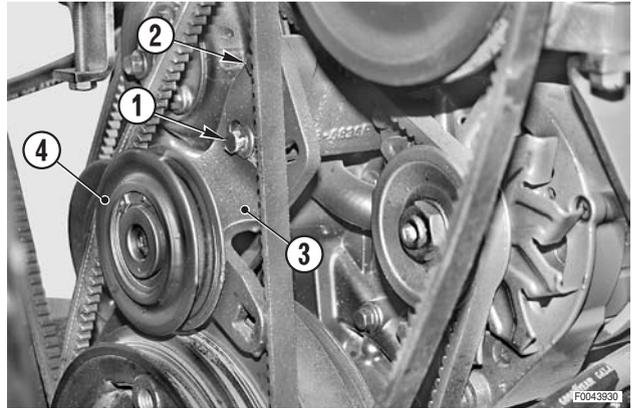
2 - **For models with front PTO only:** loosen and fully unscrew the six bolts (3) securing the flange of the cardan shaft (4).

3 - Detach the flange (5) from the flexible coupling (6).
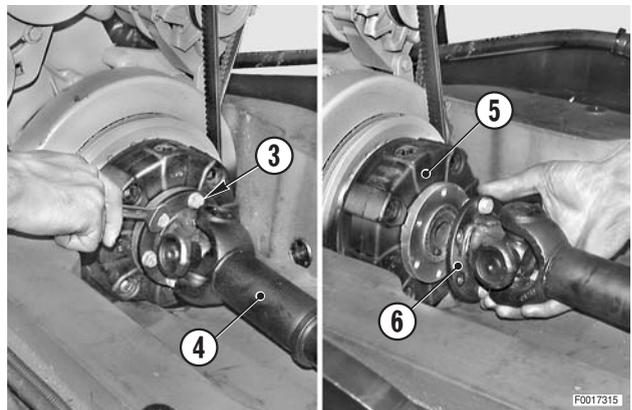
4 - Remove the old drivebelt (7) and fit the new one.

5 - Tension the drivebelt.
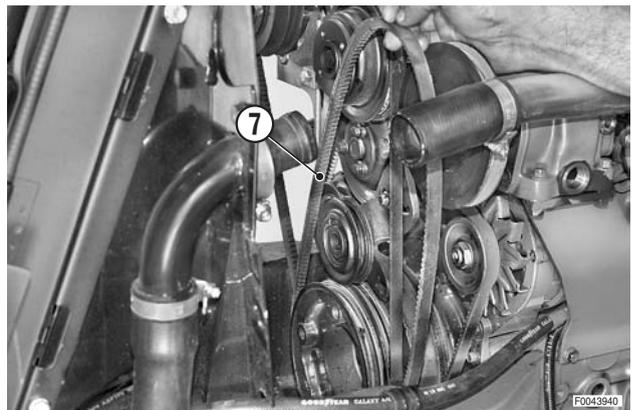
1. Tensioning the drivebelt

★ 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 guard (8) and the engine hood.

2 - Loosen the pivot and fixing bolts (1), (2) of the bracket (3) as for the belt renewal procedure.
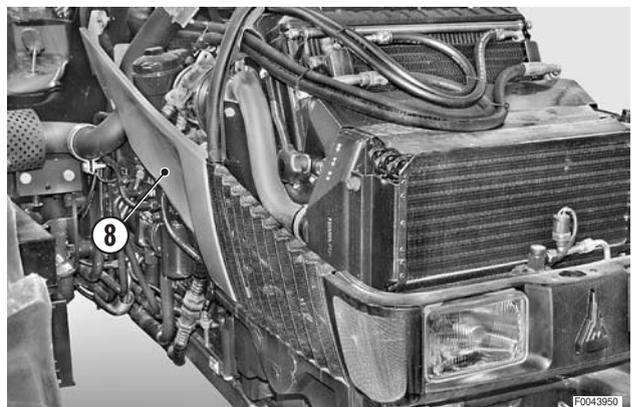
3 - Tension the drivebelt using a "T" bar and 3/4" extension inserted in the hole in the bracket (3).

4 - To tension the drivebelt, turn the bar clockwise and then tighten the bolts (1), (2).

5 - Check the tension adjustment using the tool and method described in the engine manual.

★ Static deflection immediately after fitting:

550±50 N

★ Static deflection after 15 minutes:

400±50 N

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

F0043921
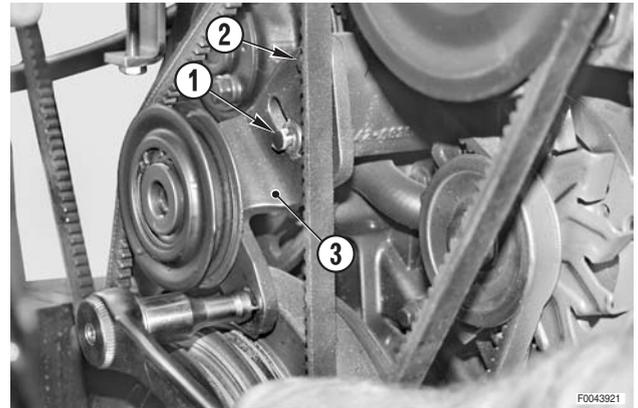
REMOVAL OF THE AIR COMPRESSOR
(for air trailer braking)

⚠️ Remove the key from the ignition and apply the parking brake.

★ **For 4-cylinder models only:** remove the bolts (1) and the nut (2) securing the expansion tank so as to be able to raise it from side of the compressor.
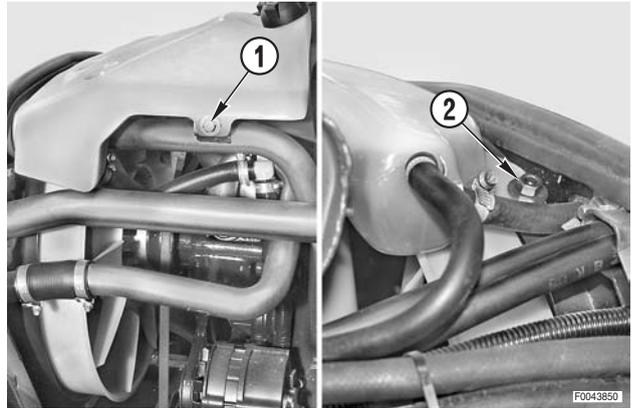
1 - Disconnect the oil recovery pipe (4) and the oil lubrication pipe (5) from the compressor (3).
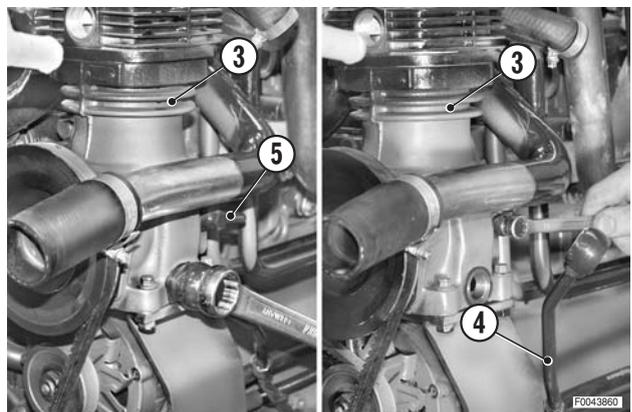
2 - Disconnect the air intake pipe (6).
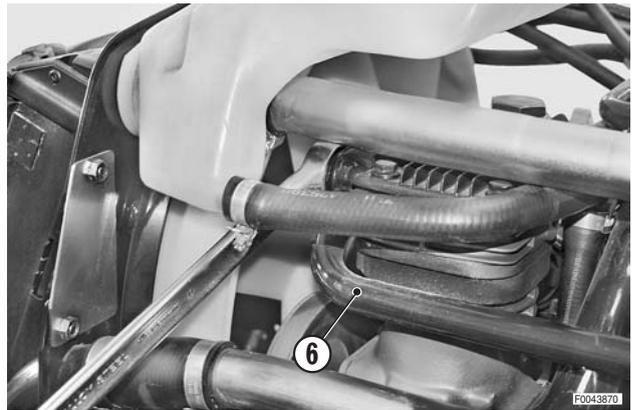
3 - Disconnect the air discharge pipe (7).

4 - Loosen the bolt (8) securing the bracket (9) of the belt tensioner pulley (10) and the pivot bolt (11).

※ 1

5 - Disengage the drivebelt (12) from the compressor pulley (13).
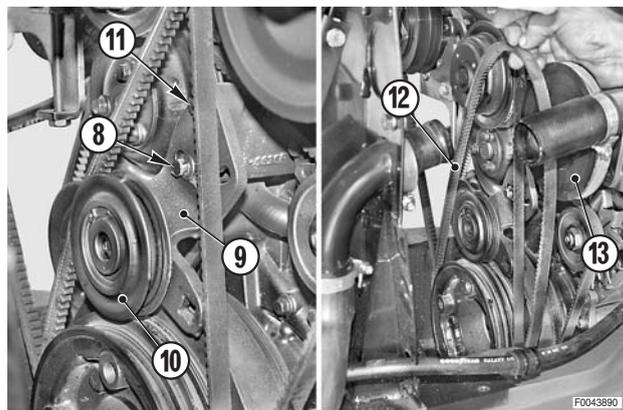
6 - Remove the fixing bolts (14) of the compressor support (15).
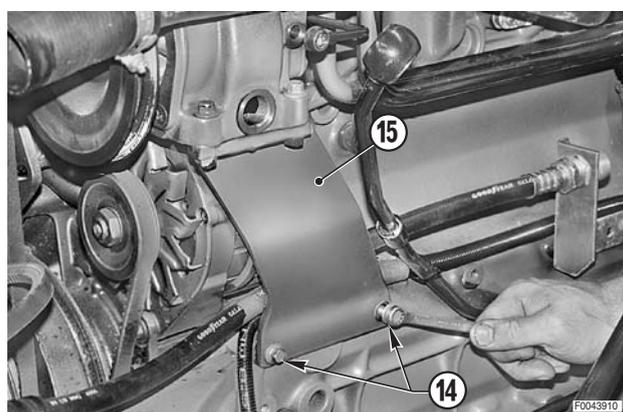
7 - Remove the compressor (3) in downward direction.
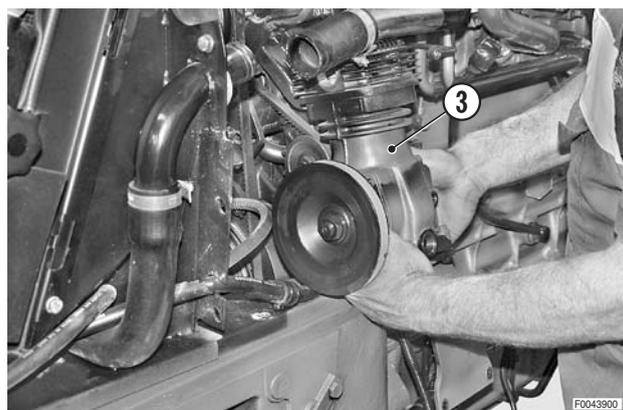
REFITTING THE AIR COMPRESSOR

- • 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 oil: approx.: 100 g (0.220 lb.)

❋ 1

- ★ Tension the drivebelt to obtain a static deflec-tion "**A**":
  immediately after fitting of = 550±50 N
  after 15 minutes of operation: 400 N.
- ★ For details see «RENEWAL OF THE COMPRES-SOR DRIVEBELT - 1. Drivebelt tensioning».

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

1 - **For 4-cylinder models:** fix the expansion tank.

F0043920
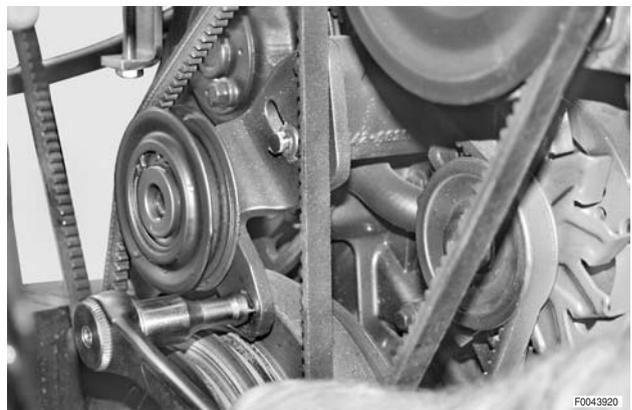
REMOVAL OF THE AIR RESERVOIRS
(for version with air trailer braking only)

⚡⚠️ Vent residual pressure from the reservoir by removing the cap (1) and pressing the button (2) on the pressure regulator valve (3).
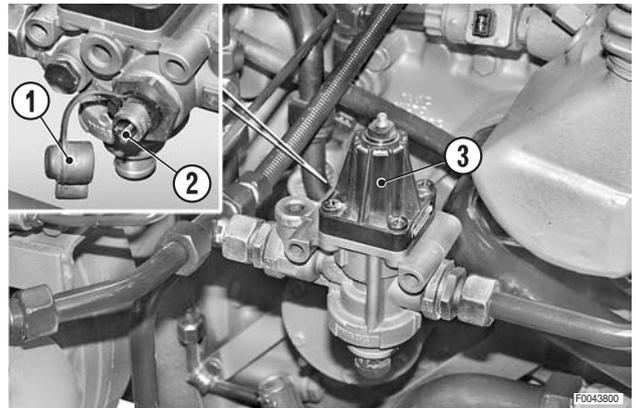
1 - Disconnect the inlet and outlet pipes (5) from the right-hand reservoir (4). ⟨※ 1⟩

★ On the left-hand reservoir, disconnect the pipe to the pressure regulator valve.

2 - While supporting the reservoir (4), unscrew and remove the nut (6) and the spacer (7) of the retaining strap (8).

3 - Remove the reservoir (4).
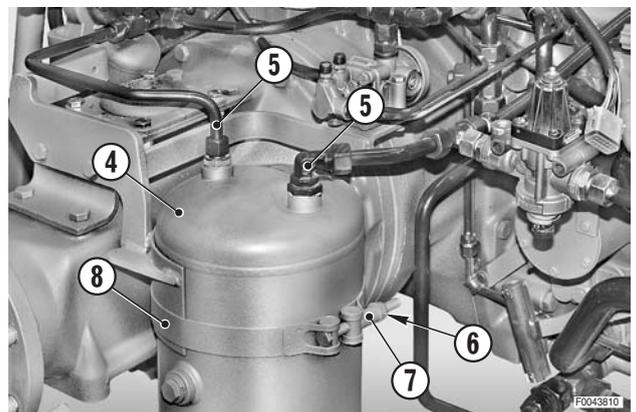
REFITTING THE AIR RESERVOIRS

• Refitting is the reverse of removal.

⟨※ 1⟩

★ Before tightening down the reservoir, tighten the fittings of the inlet and outlet pipes.

REMOVAL OF THE AIR BRAKING SYSTEM VALVES

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

⚠ Eliminate all residual pressure from the trailer air braking circuit.

1. Pressure regulator valve

1 - Loosen the fittings (1), disconnect the pipe (2) and remove the valve (3).
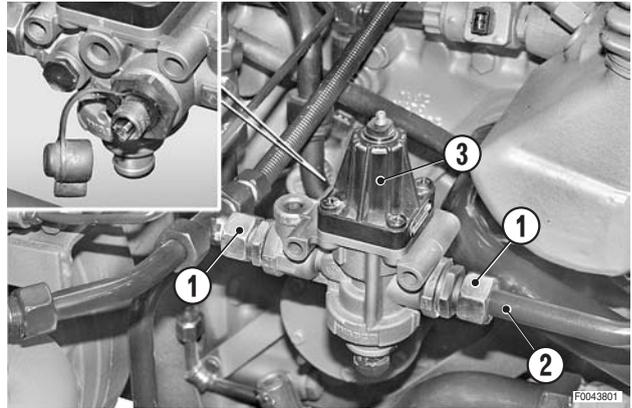
2. Parking brakes valve

1 - Disconnect the hydraulic brakes pipes (2) and pipe (3) for the pressure switch (4) from the valve (1).
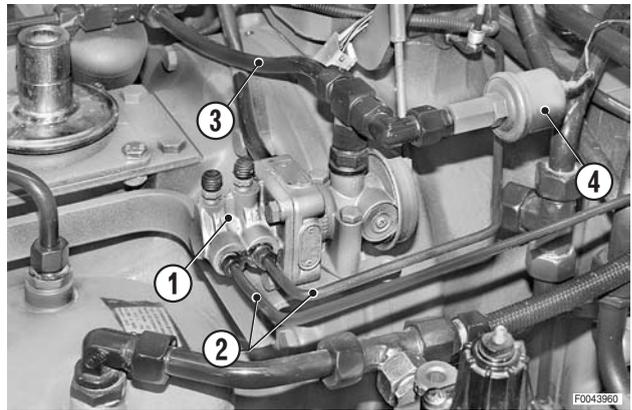
2 - Disconnect supply pipe (5) from the inner side of the valve (1).
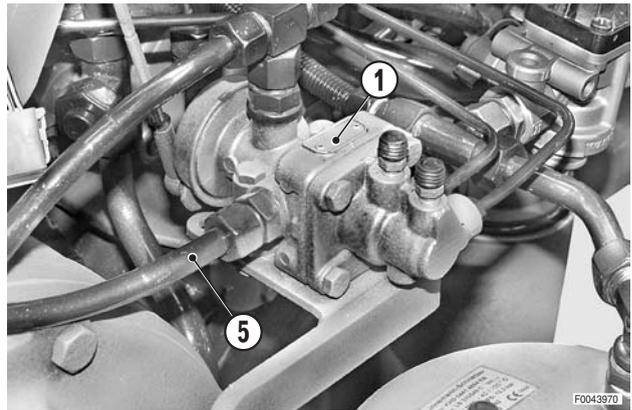
3 - Disconnect the tie-rod (7) from the valve control lever (6).　　　※ 1
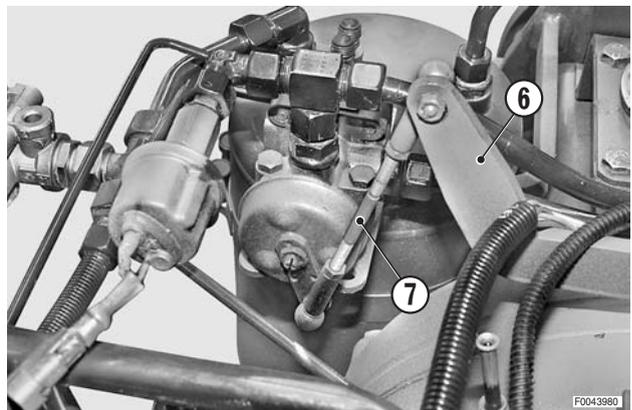
4 - Remove the lower nuts (8) and two bolts (9); remove the valve (1).
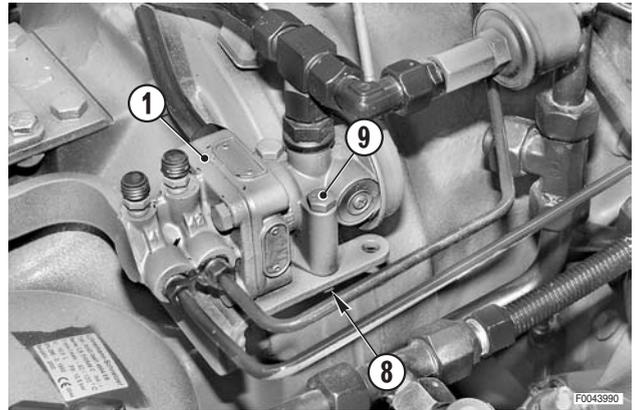
3. Service brakes (EXPORT F version)

1 - Disconnect the supply pipes (2) and the two brake control pipes (3) from the valve (1).

2 - Unscrew the bolts (4) and remove the valve.
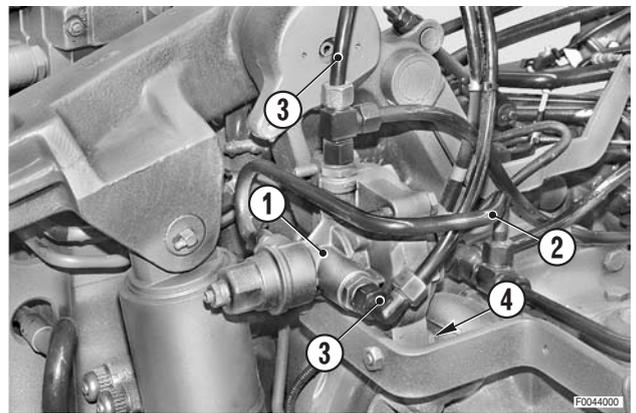
4. Pressure transducer

1 - Unplug the connector (1).

2 - Loosen the fitting (2) and remove the transducer (3).
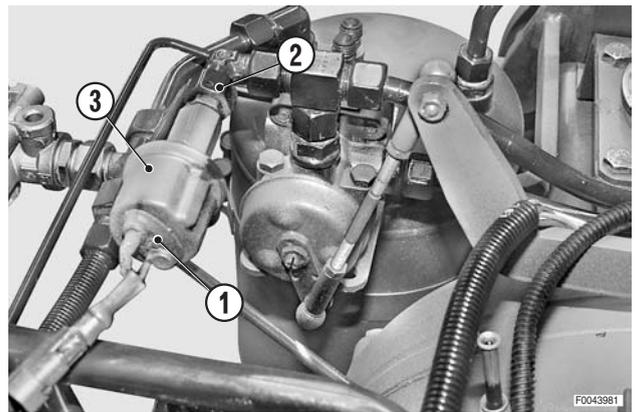
REFITTING THE AIR BRAKING SYSTEM VALVES

- 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 brake circuit of air.
(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.

Adjusting the length of the tie-rod

※ 1

1 - Check that the parking brakes are perfectly adjusted and that they are released.

2 - Raise the parking brake lever to the first notch; you should distinctly hear the parking brake valve operate in correspondence with the first notch position.

3 - If the valve operation is too ADVANCED, lengthen the control rod.
If the valve operation is too RETARDED, shorten the control rod.

4 - Operate the parking brake a few times, checking that the tractor and trailer brakes are applied simultaneously.

REMOVAL OF THE TRAILER AIR BRAKES COUPLING HEADS

⚠ Vent residual pressure from the reservoir by pressing the button on the regulator valve.

⚠ Remove the key from the ignition and apply the parking brake.

1 - Label the three pipes (1) and disconnect them from the valves (2).
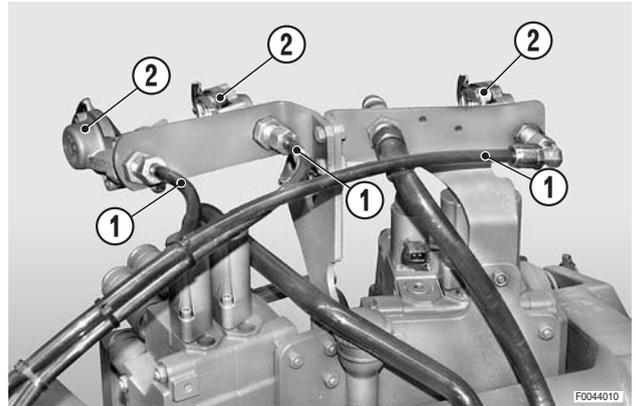
2 - Loosen the retaining nut (3) and remove the coupling head (4) that is to be replaced.
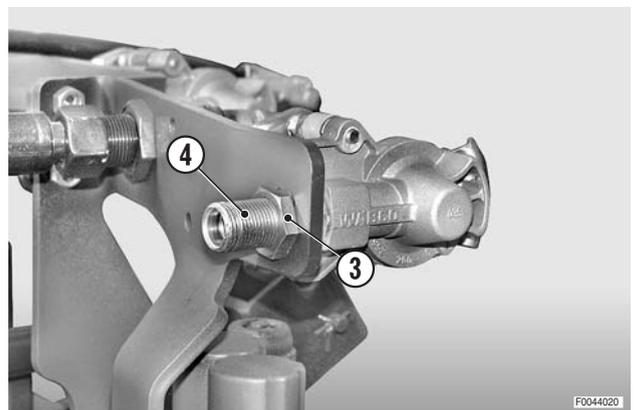
1. Removal of the complete assembly

1 - Disconnect the pipe (5) from the free drain quick coupler.
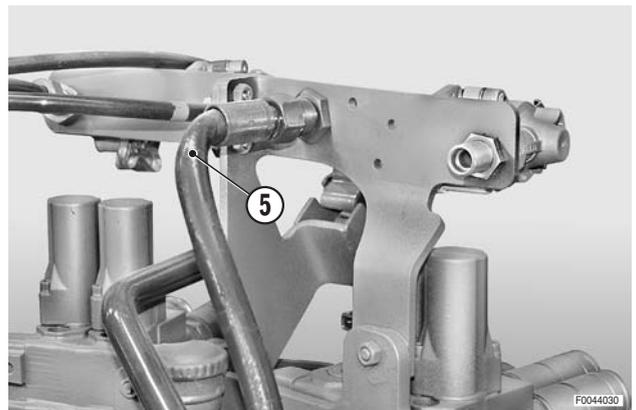
2 - Unscrew and remove the bolts (6) and remove the assembly (7).

REFITTING OF THE TRAILER AIR BRAKES COUPLING HEADS

• Refitting is the reverse of removal.

30-31
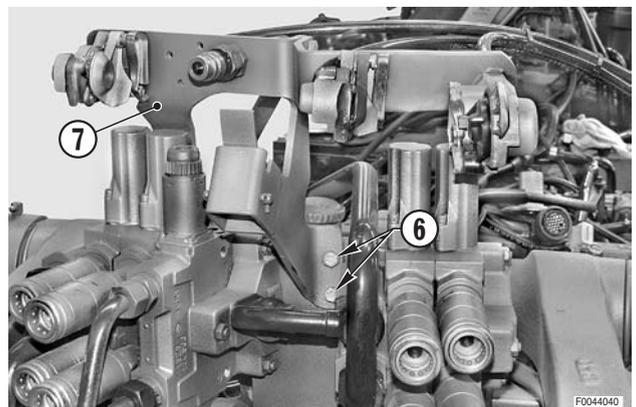
REMOVAL OF THE HYDRAULIC TRAILER BRAKING VALVES

⚠ Remove the key from the ignition.

1. EXPORT VERSION

1 - Remove the right rear wheel.
(For details, see «REMOVAL OF REAR WHEELS»).

⚠ Thoroughly clean the area before commencing removal.

2 - Disconnect pipes (2), (3) and (4) from the valve (1).
   ★ Plug the pipelines and ports to prevent impurities getting in.

3 - Disconnect the supply pipes (5), (6) to the service brakes.

   ※ 1

4 - Unscrew and remove the bolts (7) with their nuts. Remove the valve (1).
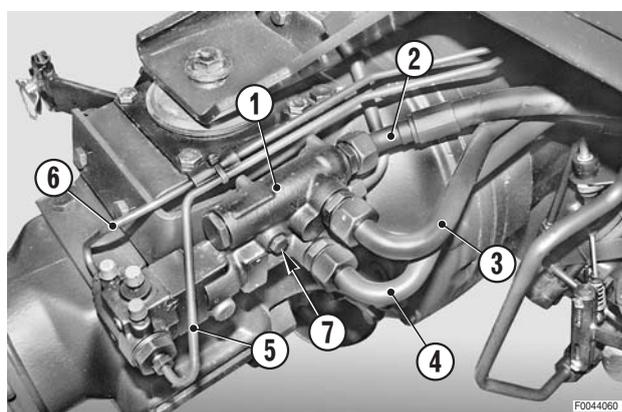
2. Italy version

1 - Remove the right rear wheel.
(For details, see «REMOVAL OF THE REAR WHEELS»).

⚠ Clean the area thoroughly before starting the removal procedure.

2 - Unplug the connector (2) from the pressure switch (1).

3 - Disconnect, in the order given, pipes (4), (5), (6), (7) and (8) from the valve (3).
   ★ Plug the pipelines and ports to prevent impurities getting in.   ※ 1

4 - Unscrew and remove the bolts (9) with their nuts. Remove the valve (3).
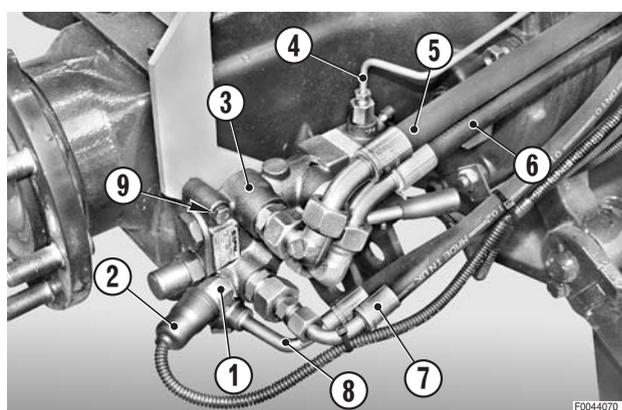
REFITTING THE HYDRAULIC TRAILER BRAKING VALVES

- Refitting is the reverse of removal.

※ 1

★ Bleed the braking system.
(For details, see «BLEEDING THE BRAKE SYS-
TEM»).

AIR CONDITIONING SYSTEM

Low pressure gas

High pressure gas

High pressure liquid

14÷17 bar
(203÷246,5 psi)

3 bar
(43,5 psi)

28 bar
(406 psi)

CAB INTERIOR
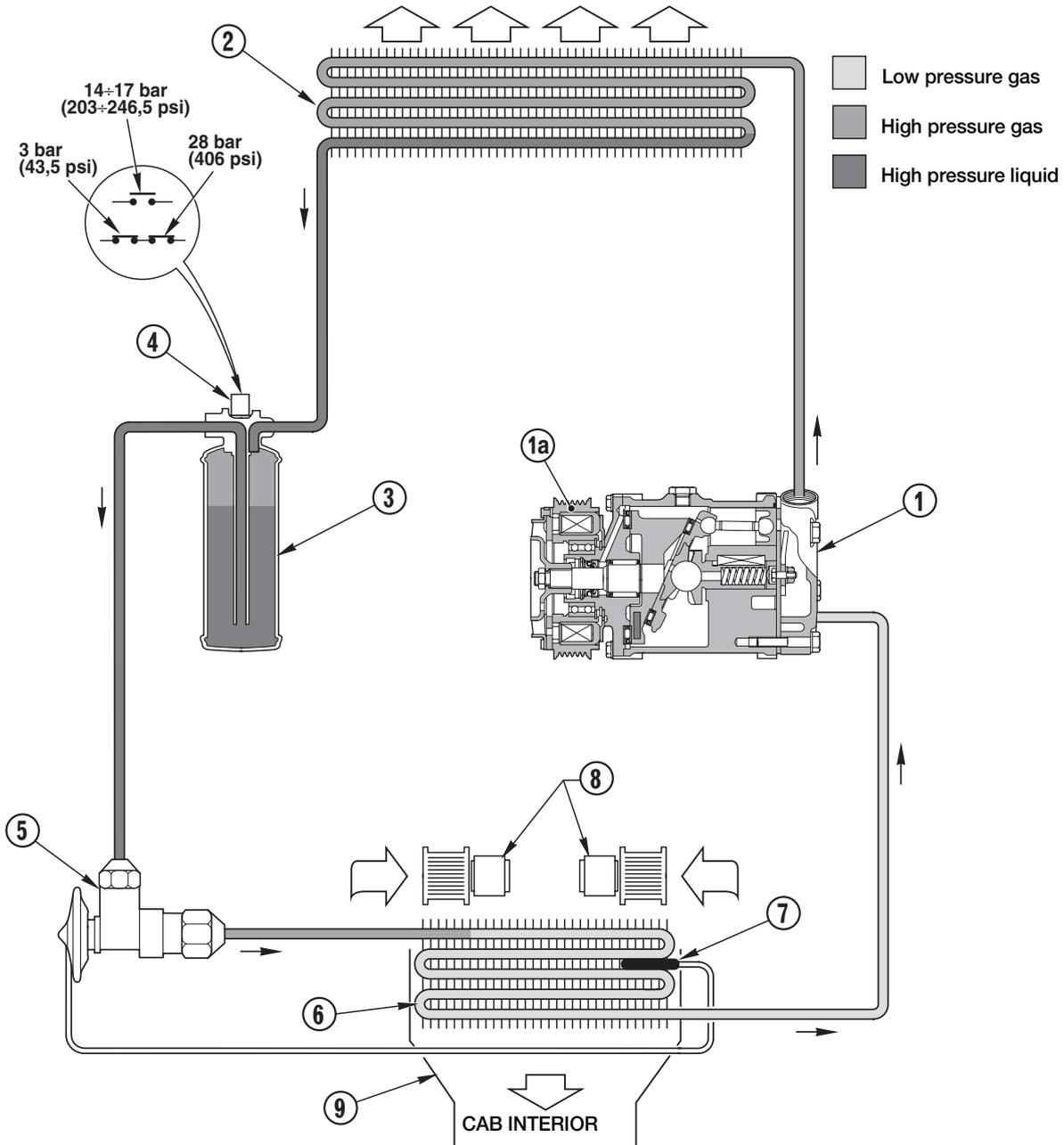
D0013150

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 - Condenser cooling fan

TECHNICAL SPECIFICATIONS

• Minimum and maximum safety pressure:
2.4–28.5 bar (34.8 – 413.3 psi)

• Refrigerant type: R134a

• Refrigerant quantity:1600 g (56.4 oz.)

• 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 drive-belt 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).

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 R134 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).
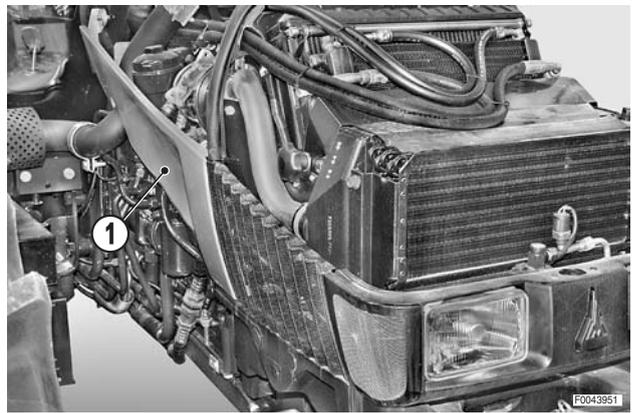
2 - Loosen the screw (2) of the tensioner block (3) and loosen the nut (4) securing the compressor (5).

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.
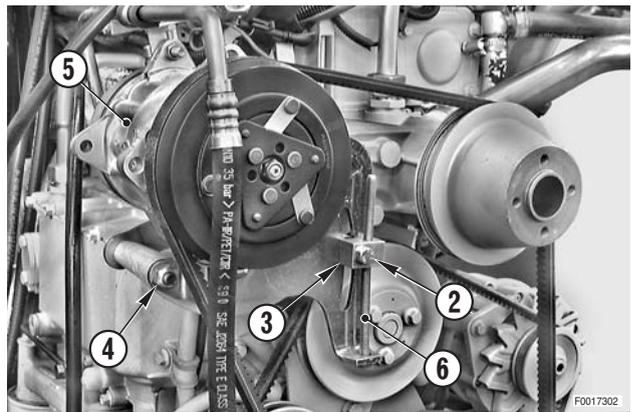
4 - Tighten the screw of the tensioner block (3) and tighten the nut (4) and bolt (7) to secure the compressor in position.

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.

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).

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.**
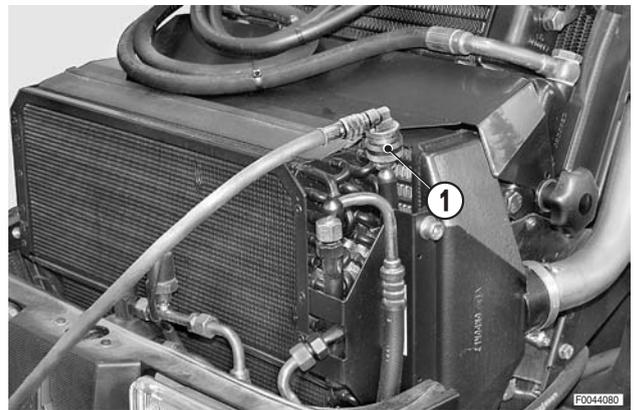
2. Flushing and recharging the system

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.
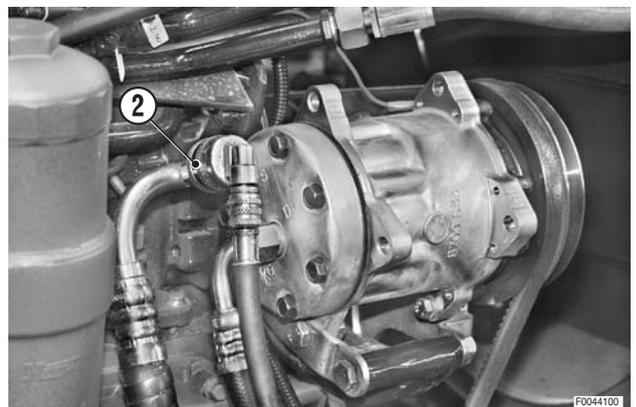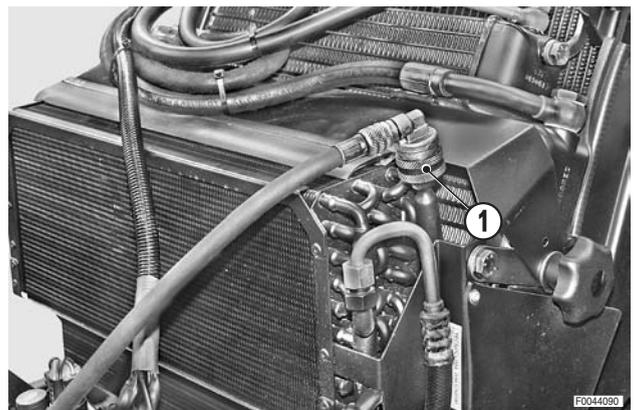
After flushing, the moisture-free oil recovered during the discharging operation must be re-introduced into the system, followed by the refrigerant.

Quantity of refrigerant (R134a): 1600 g (56.4 oz.)
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 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).
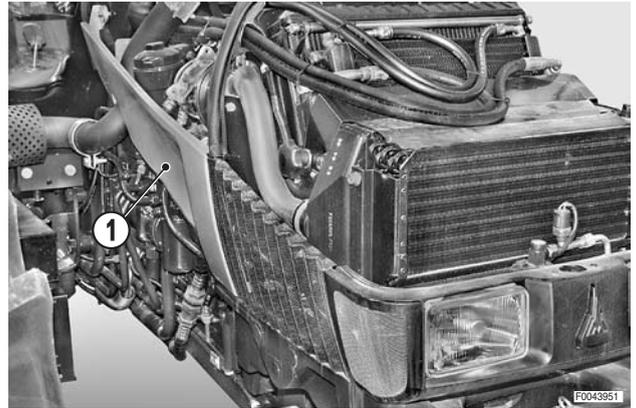
3 - Disconnect the inlet (3) and delivery (4) lines from the compressor (2).

★ Immediately plug the open fittings to prevent the entry of moisture. ※ 1
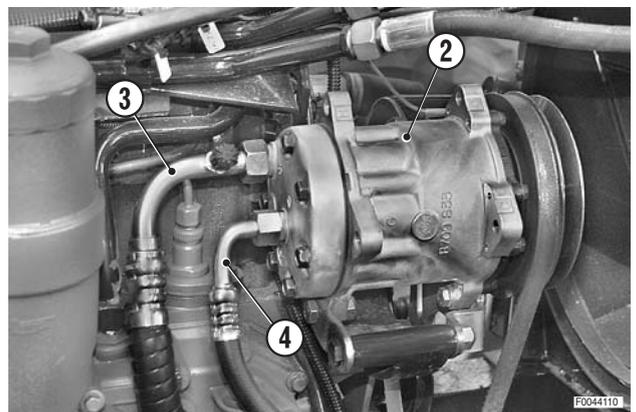
4 - Disconnect the electromagnetic clucth control connector (5).
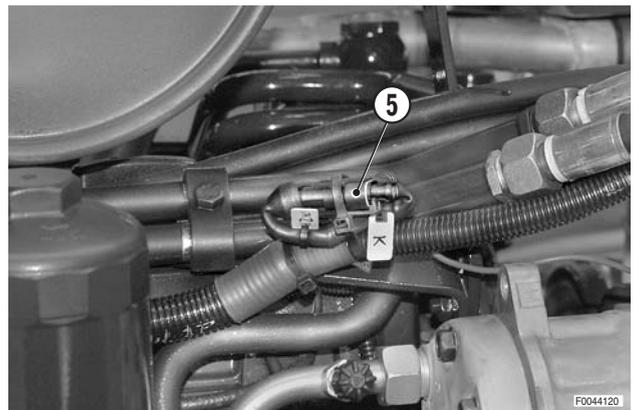
5 - Loosen the self-locking nut (6) of the compressor (2) pivot bolt (7).
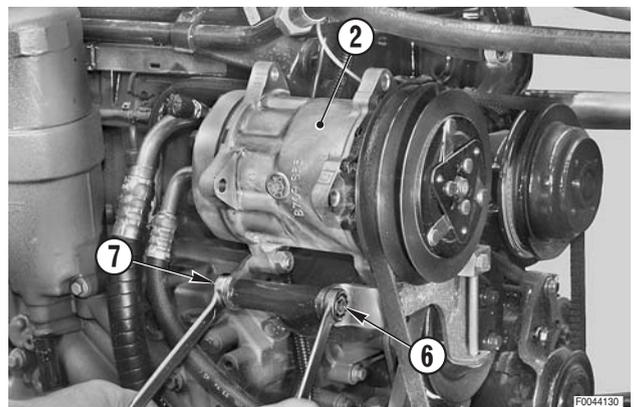
6 - Loosen the screw of the tensioner block (8).

8 - Unscrew the threaded tensioner rod (9) to slacken the compressor/fan drivebelt (10).

   ★ Slacken the drivebelt sufficiently to be able to slip it off the compressor pulley.
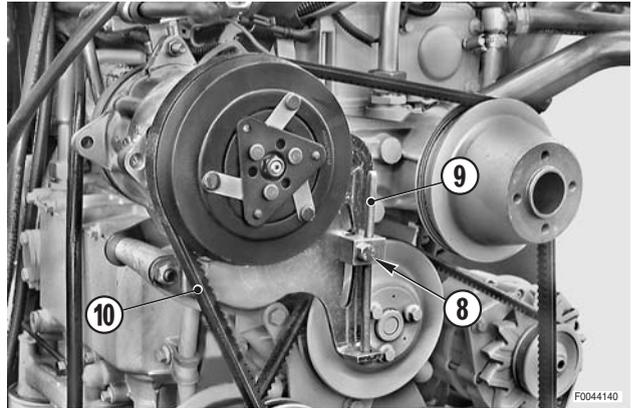
8 - Remove the pivot bolt and remove the complete compressor assembly (2).
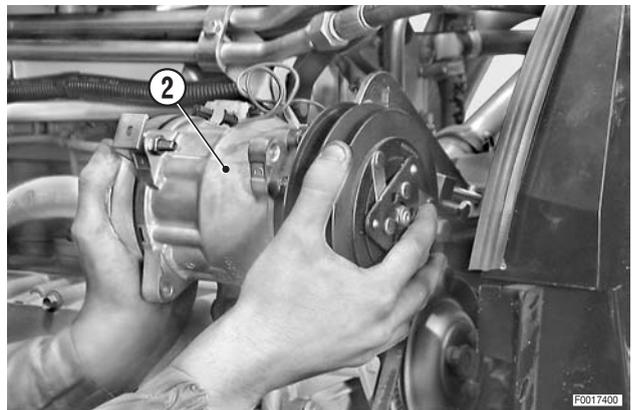
REFITTING THE AIR CONDITIONING COMPRESSOR

• 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

1 - Recover the refrigerant from the system.
(For details, see «MAINTENANCE OF THE AIR CON-DITIONING SYSTEM»).

2 - Disconnect the connector (1) of the pressure switch (2).
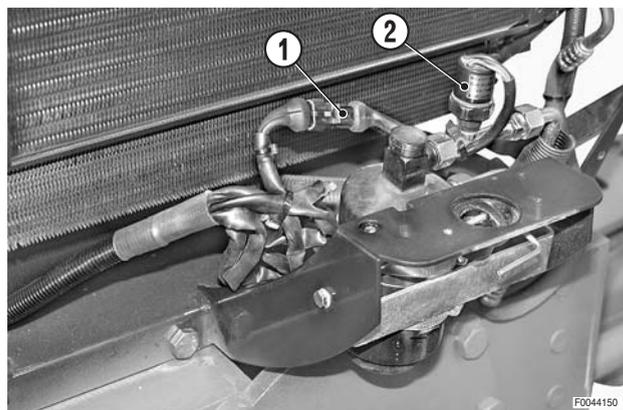
3 - Disconnect the inlet (4) and outlet (5) pipes from the re-ceiver-drier (3).

★ Plug the ends of the pipes immediately to prevent moisture getting into the system.. ※ 1

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 de-termine the quantity of oil to be added to the system.
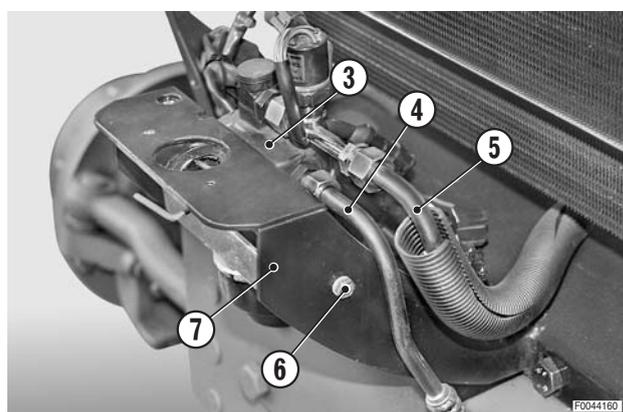
REFITTING THE RECEIVER-DRIER

• Refitting is the reverse of removal.

※ 1

★ Remove the plugs and connect the pipes immediate-ly, 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 ASSEMBLY
(The figures depict models with 6-cylinder engines)

⚠️ Remove the key from the ignition and engage the parking brakes.

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).
   ★ On models with 4-cylinder engines, remove the four bolts (8).
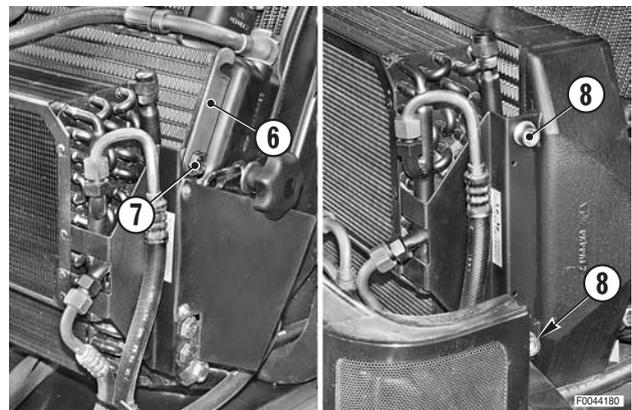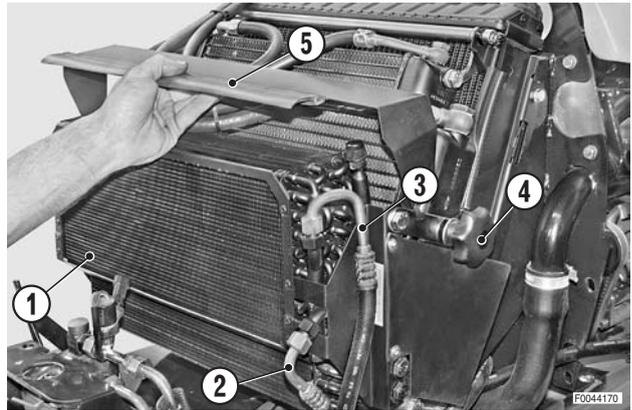
7 - Remove the condenser assembly (1).
   ★ Take care not to damage the fins.
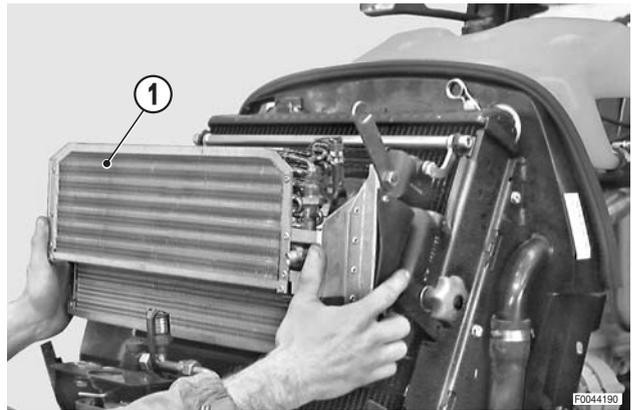
REFITTING THE CONDENSER ASSEMBLY

• 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 GEARBOX OIL/FUEL COOLERS

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.
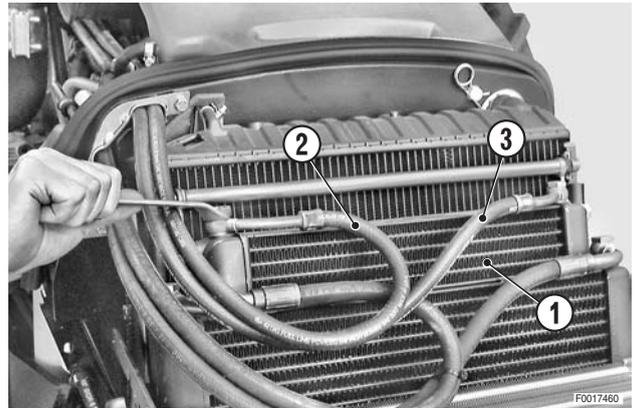
3 - Disconnect the inlet and outlet pipes (5) and (6) from the oil cooler (4).

   ★ Label the pipes and fittings to avoid confusion on reconnection.

   ★ Plug the open ends of the pipes to prevent moisture getting into the system.
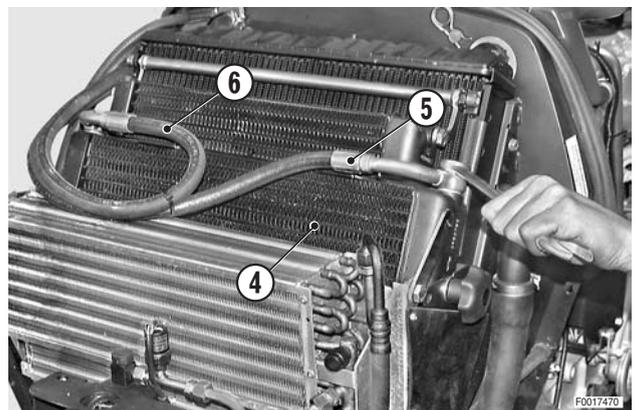
4 - Unscrew the knobs (7) and tilt the condenser (9) mounting brackets (8) forwards.
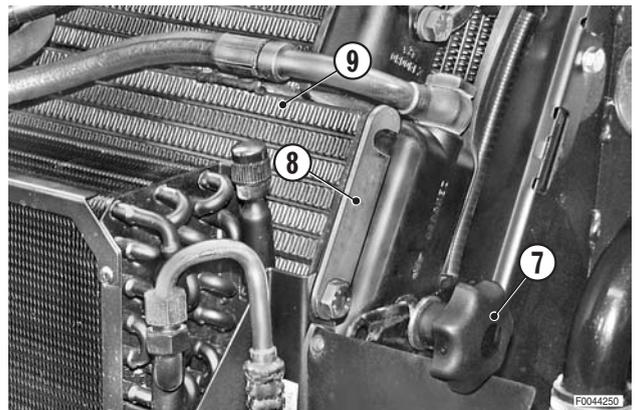
5 - Remove the two bolts (10) supporting the coolers (1) and (4).
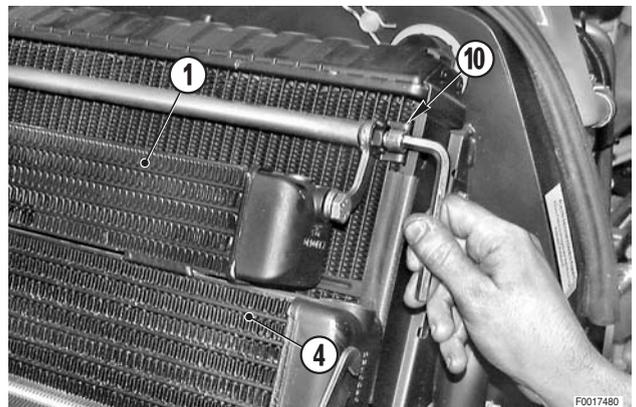
6 - Remove the cooler assembly (1), (4) by pulling the handle (11) upwards.

⚠️ Keep the coolers vertical to prevent spillage of oil/fuel.

F0017490
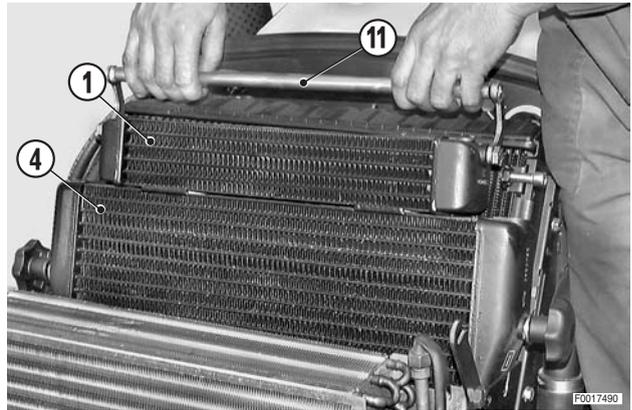
7 - **Only if the assembly is to be renewed:**

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

F0017500
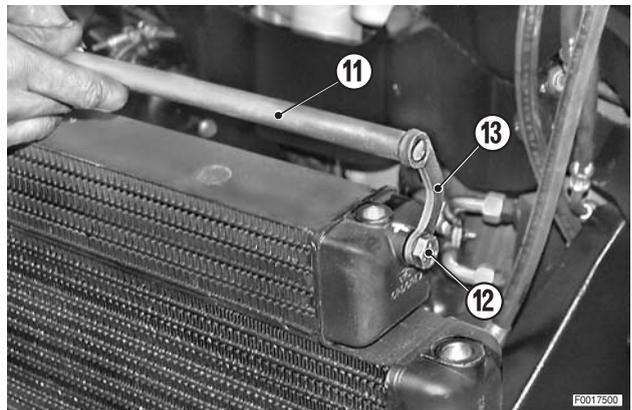
REFITTING THE GEARBOX OIL/ FUEL COOLERS

• 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 RADIATOR

⚠️ Remove the battery cover and disconnect the negative battery lead (–).

1 - Remove the side panels.

2 - Drain off the engine coolant.

🛢️ Coolant:

Mod.	80	85	90	100	105
ℓ	15.5	15.5	15.5	15.5	17.5
US.gall.	4.10	4.10	4.10	4.10	4.62

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 - **On some 4-cylinder models only:** remove the intercooler. (For details «REMOVAL OF THE INTERCOOLER»).

6 - 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).

7 - Slacken off the hose clamps (5) and disconnect the radiator hose (6).

8 - Slacken off the hose clamp (7) and disconnect the hose (8).

9 - Remove the retaining bolts (9) on the left-hand side of the radiator.
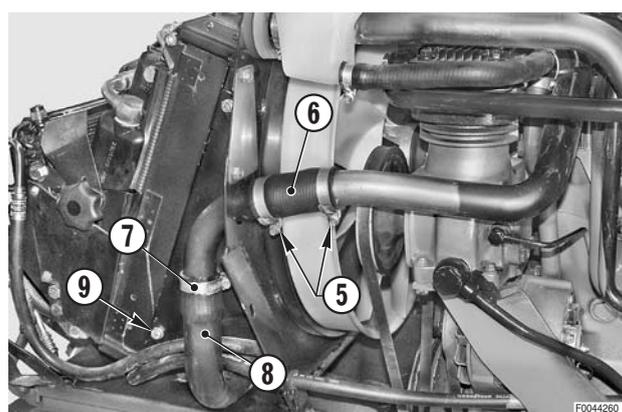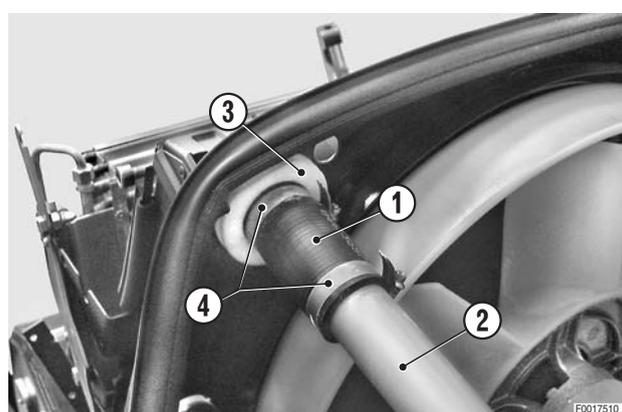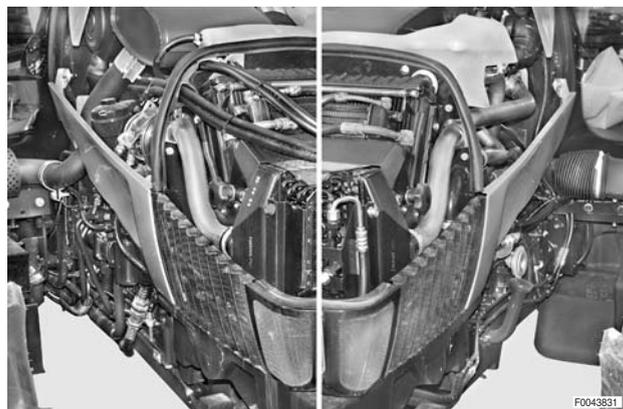
10 - Disconnect the lower hose (10) from the radiator.

11 - Remove the strap (11) securing the wiring loom (12) on the right-hand side of the radiator.

30-45
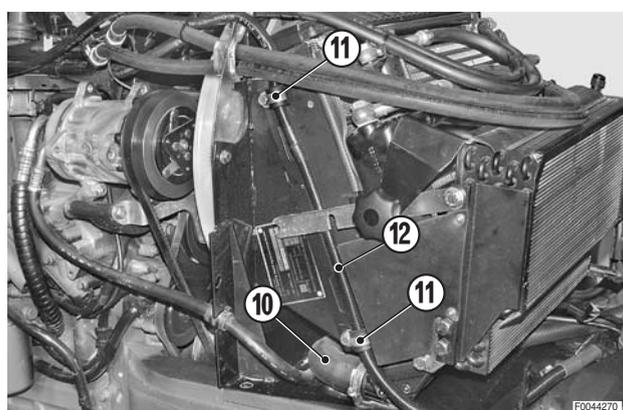
12 - Remove the radiator (13).
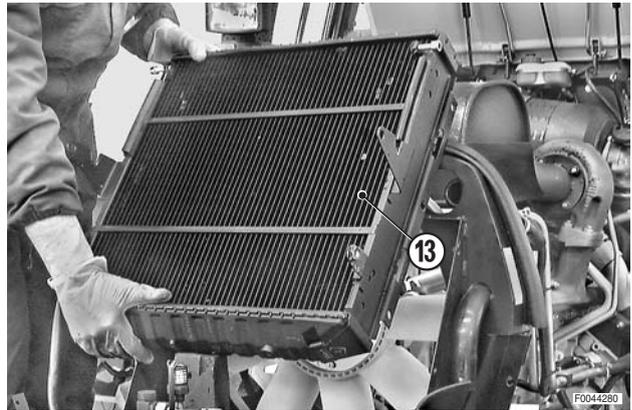
REFITTING THE RADIATOR

• Refitting is the reverse of removal.

1 - Fill the engine cooling system

Coolant:

Mod.	80	85	90	100	105
ℓ	15.5	15.5	15.5	15.5	17.5
US.gall.	4.10	4.10	4.10	4.10	4.62

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

1 - Partially drain the engine cooling system.

> Coolant: approx.10 ℓ (2.64 US. gall.)

2 - **For 4-cylinder models:** disconnect the pipe (1) and remove the retaining nut (2) of the tank (3).
For 6-cylinder models: disconnect the pipe (4) on the left-hand side and remove the pin (5) securing the tank (3).
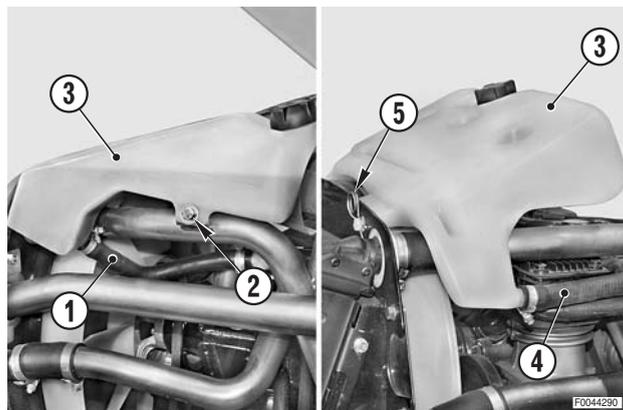
3 - Disconnect the pipes (6) and (7) on the right-hand side.

4 - Unscrew and remove the nut (8) and washer (9).
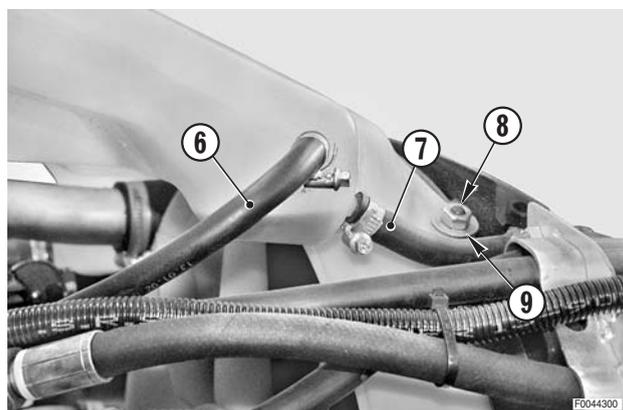
5 - **For 6-cylinder models:** unscrew and remove the bolt (10) with the washer (11) and spacer (12).

6 - Remove the expansion tank (8).
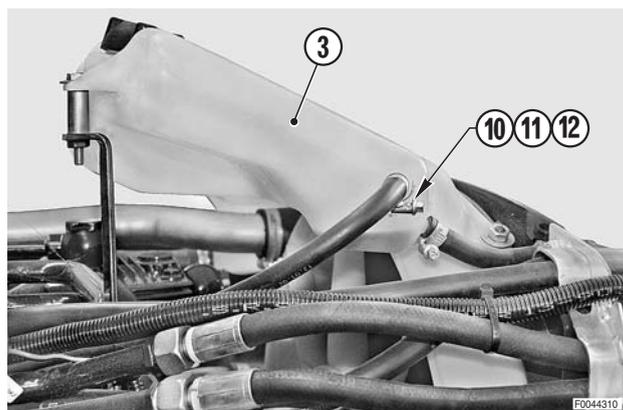
REFITTING THE EXPANSION TANK

• Refitting is the reverse of removal.

1 - Fill the engine cooling system.

> Coolant: approx 10 ℓ (2.64 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 INTERCOOLER
(4-cylinder models)

⚠ Remove the key from the ignition and apply the parking brake.

1 - Remove the side panels.

2 - Unscrew the knobs (1) and remove the cowling (2).
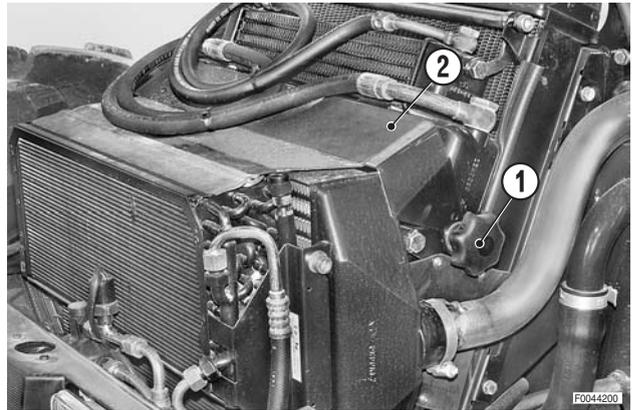
3 - Raise the gearbox oil/fuel cooler assembly (3).
   ★ Support the assembly above the radiator.
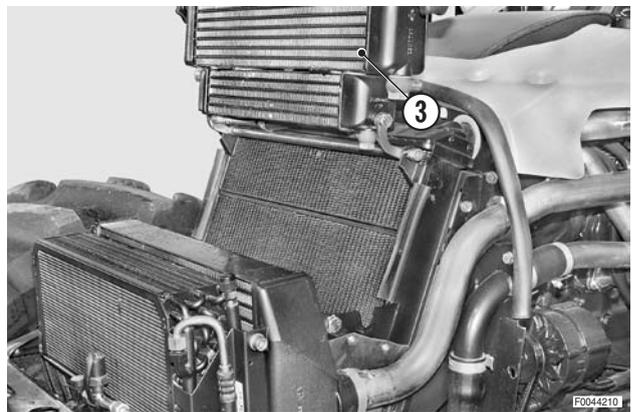
4 - Loosen the hose clamps (4) securing the air inlet (5) and outlet (6) pipes to the intercooler.
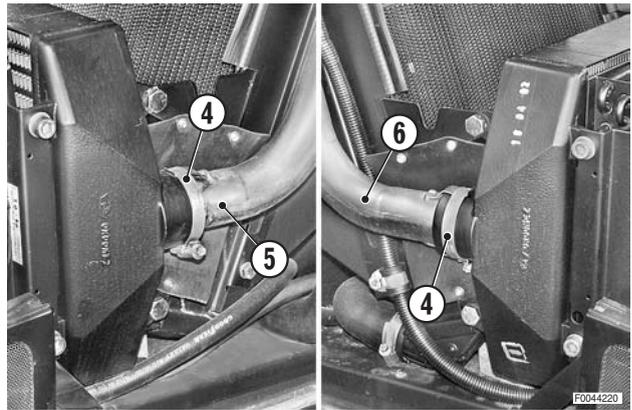
5 - Unscrew and remove the fixing bolts (7) of the condenser (8).

6 - Raise the condenser (8) and move it towards the front of the tractor, past the receiver-drier assembly.
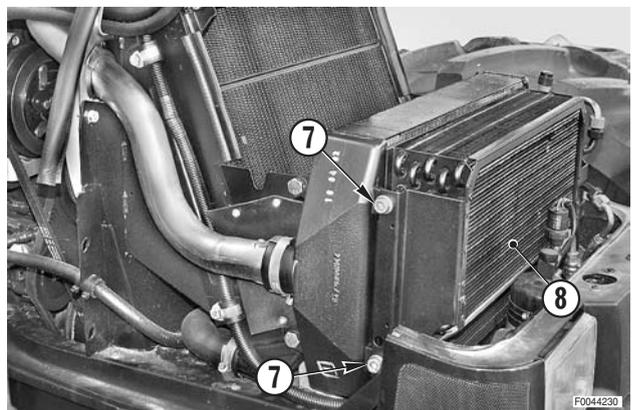
7 - Remove the rear bolts (9) and remove the intercooler (10), moving it towards the front of the tractor to free it from the pipes. ⁂ 1

F0044240
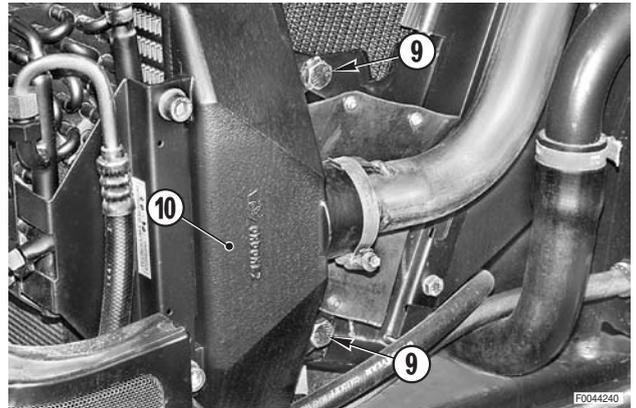
REFITTING THE INTERCOOLER

• Refitting is the reverse of removal.

⁂ 1

★ Carefully check the condition of the O-rings on the fittings of the air inlet and outlet pipes.

REMOVAL OF THE COMPLETE RADIATOR/COOLERS ASSEMBLY

1 - Remove the side panels and the lamp assemblies.

2 - Recover the refrigerant from the system.
(For details see «DISCHARGING, FLUSHING AND RECHARGING THE AIR CONDITIONING SYSTEM»).

3 - Disconnect pipes (1) and (2) from the condenser and the receiver-drier and the wiring harness (3).

⁂ 1

★ 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.
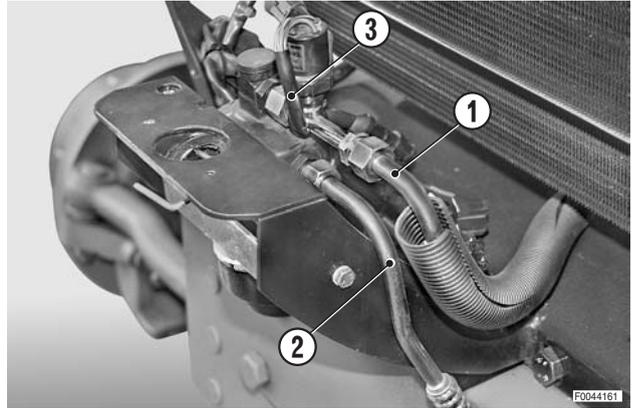
4 - Drain the coolant from the engine cooling system.

Coolant:

Mod.	80	85	90	100	105
ℓ	15.5	15.5	15.5	15.5	17.5
US.gall.	4.10	4.10	4.10	4.10	4.62

5 - Remove the bolts and remove the right-hand pipe guide (4), the intercooler pipe (where present) and the retaining straps (5) of the front wiring loom.
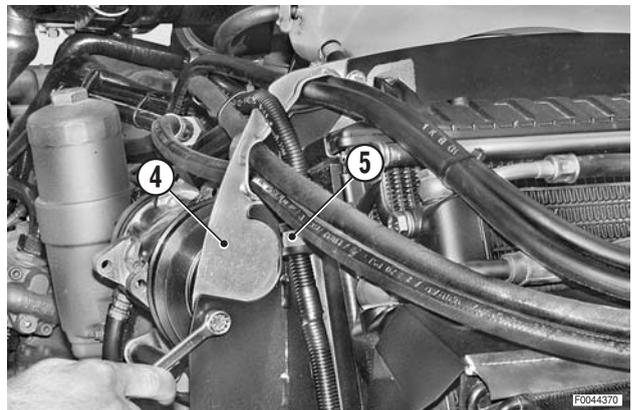
6 - For models with intercooler, remove also the left-hand guide (6) for the air pipe.
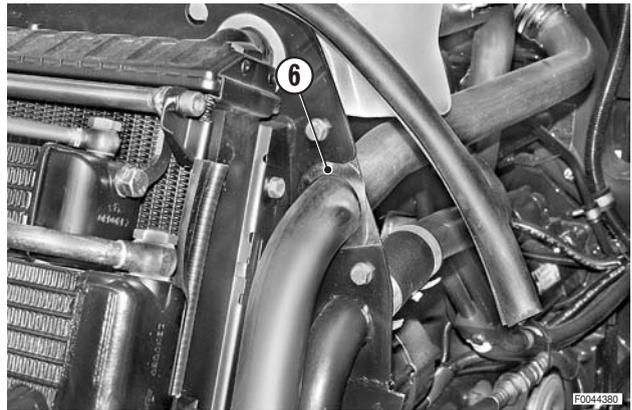
7 - Release the pipes (7), (8) and the wiring from the retaining straps

8 - 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.

9 - Disconnect the hoses (10), (11) from the radiator; recover the bulkhead fitting (12).
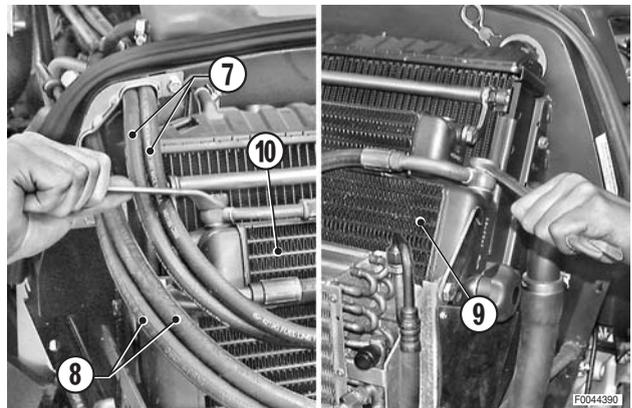
10 - Disconnect the hoses (11), (12) from the radiator; re-cover the bulkhead fitting (13).
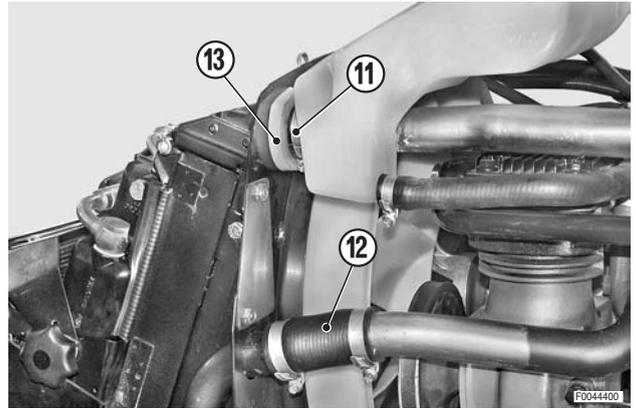
11 - Remove the hose (14).

12 - Release the wiring (15) from the retaining clamps (16).

13 - Route the cooler pipes (17), (18) and the wiring to-wards the rear of the tractor through the aperture in the frame.
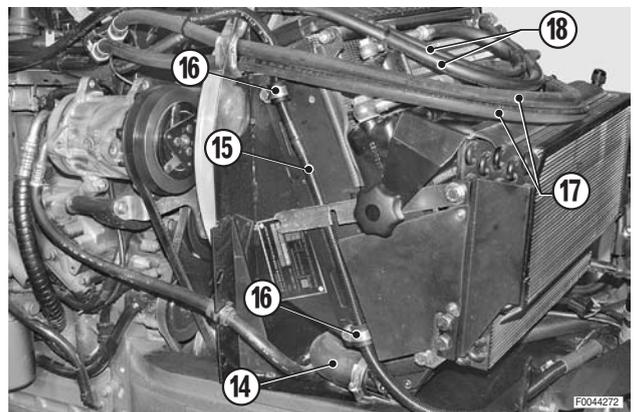
14 - **For versions with intercooler only.**
Loosen the hose clamps, and disconnect and remove the supply pipe (20) from the intercooler. ※ 2
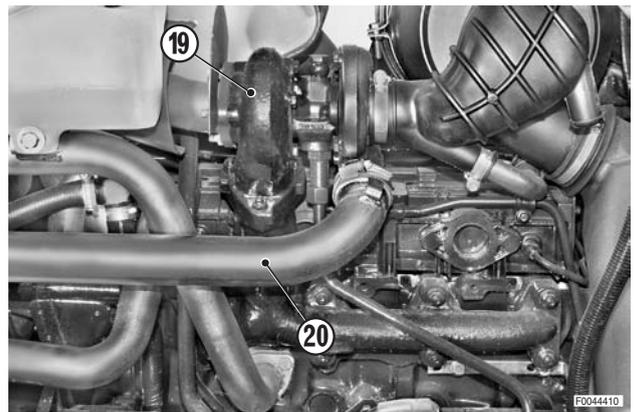
15 - Remove the bolts (21) and disconnect the intake pipe (22) from the engine manifold; loosen also the hose clamp (23) securing the pipe to the intercooler.
※ 2

16 - Attach a hoist to the complete assembly.

    📐 Assembly: 28 kg (61.7 lb.)
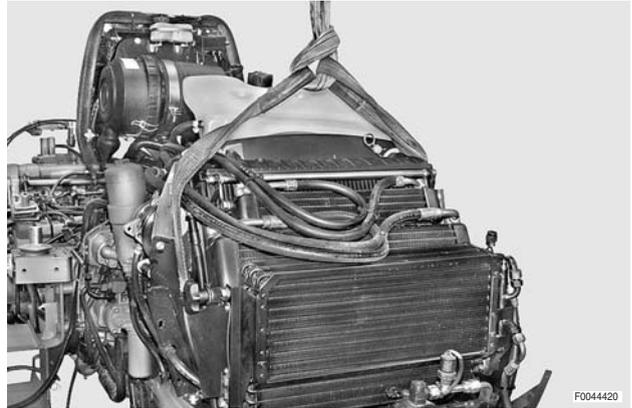
17 - Remove the front retaining bolts (24) and remove the complete assembly (25).
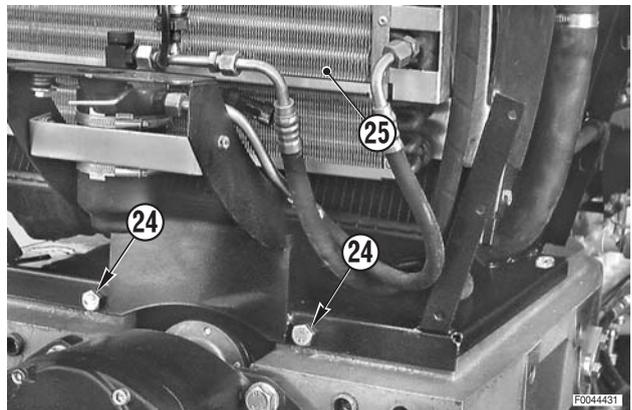
REFITTING THE RADIATOR/COOLERS ASSEMBLY

- Refitting is the reverse of removal.

※ 1

  ★ 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.

※ 2

  ★ Carefully check the condition of the O-ring seals on the pipes; if in the least doubt about the condition of these parts, fit new ones.

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:

Mod.	80	85	90	100	105
ℓ	15.5	15.5	15.5	15.5	17.5
US.gall.	4.10	4.10	4.10	4.10	4.62

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 105 CV model, but the procedure is identical for all models.**

1 - Remove the side grilles (1), and the lower cover (2).
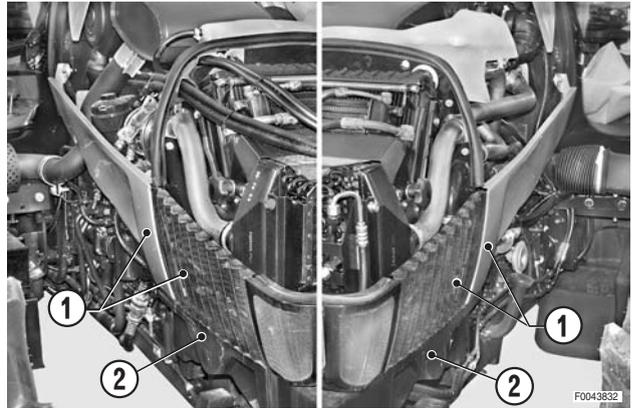
2 - Remove the front (3) and rear (4) retaining bolts of the radiator support (5).
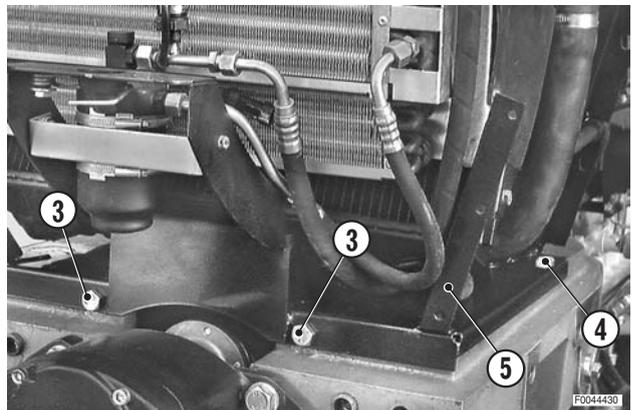
3 - Release the lamp wiring (7) from the retaining straps (6).

4 - Partially drain the engine cooling system.

   ⏣ Coolant: approx. 12 ℓ (3.2 US. gall.)
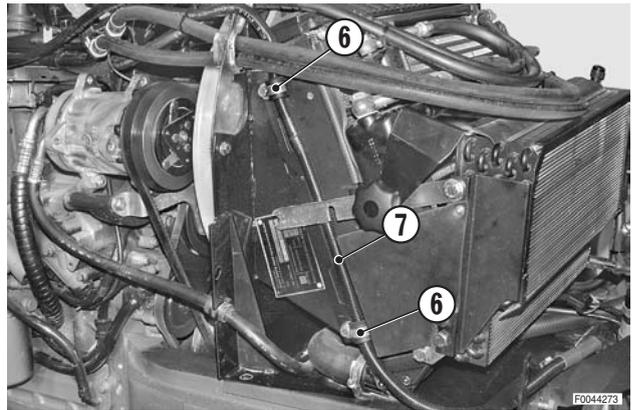
5 - Disconnect the connection pipe (8) to the expansion tank (9) from the radiator.

6 - Remove the nut (10) and the washer (11).
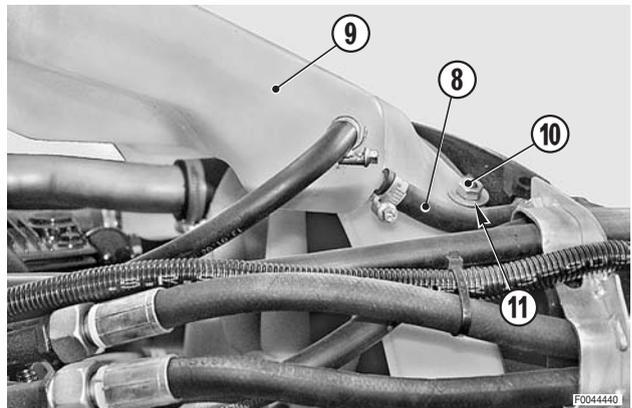
7 - Disconnect the pipe (12) from the expansion tank (left side).

4 CYLINDER   **6 CYLINDER**
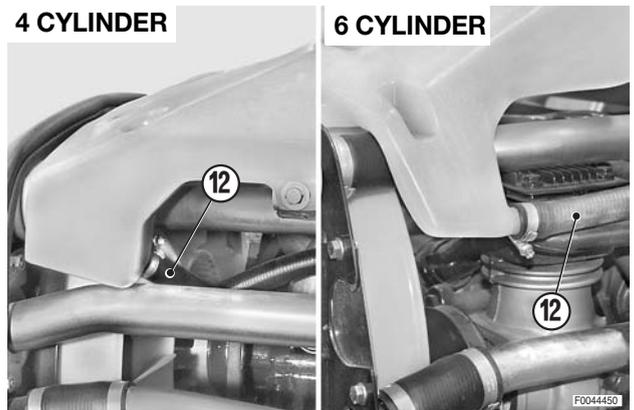
8 - Loosen the hose clamps (13) slide the hoses (14), (15) on to the pipes (16), (17).

9 - Withdraw the lock pin (18) securing the tank.

10 - Remove the left and right guide (19).
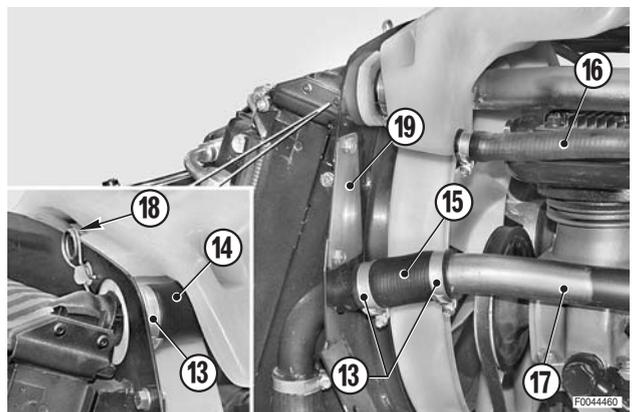
11 - **For models with intercooler only:** remove also the guides (20) for the inlet and outlet pipes.

12 - **For models with intercooler only:** remove the pipes (21) and (22).
For details see «REMOVAL OF THE COMPLETE RADIATOR-COOLERS ASSEMBLY»)
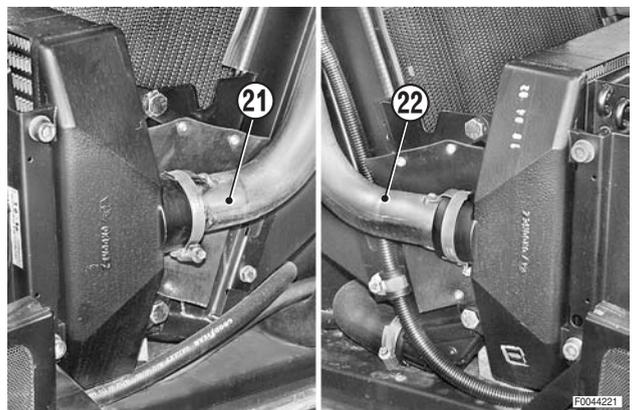
13 - Remove the retaining bolts and push the complete ra-
diator-coolers assembly towards the front of the trac-
tor.
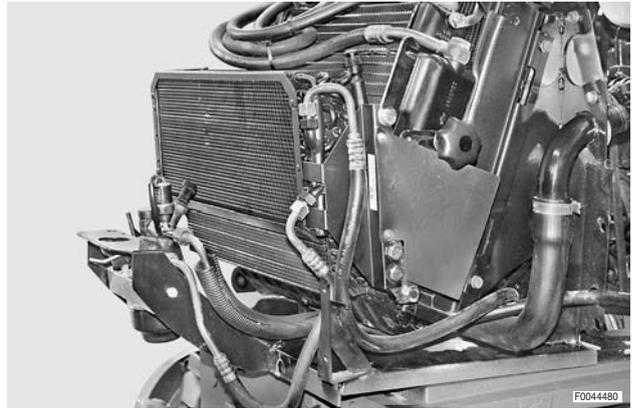
14 - Fully loosen the flange bolts (23) of the drive shaft (24).

15 - Disengage the drive shaft (25) by pushing the flange
(16) towards the front of the tractor.
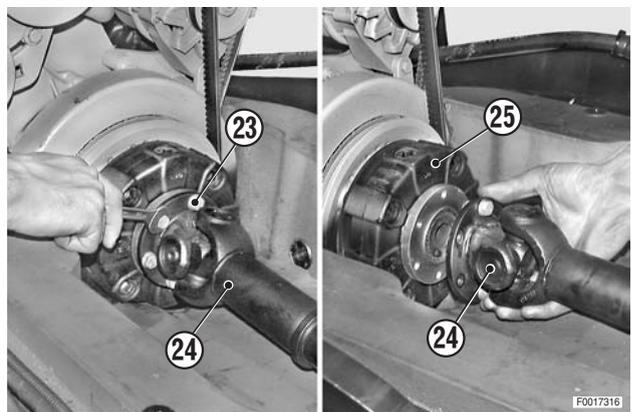
16 - Unscrew and remove the retaining bolts (26) of the
coupling (27) and remove the coupling itself. ☒ 1
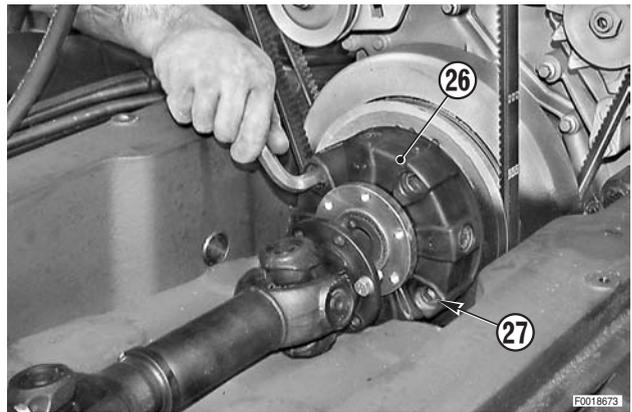
REFITTING THE FLEXIBLE
COUPLING OF THE FRONT PTO

• Refitting is the reverse of removal.

☒ 1

    Bolts: Loctite 243

    Bolts: 139±10% Nm (102.4±10% lb.ft.)

1 - Fill the engine cooling system with coolant.

    Coolant: approx. 12 ℓ (3.2 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).
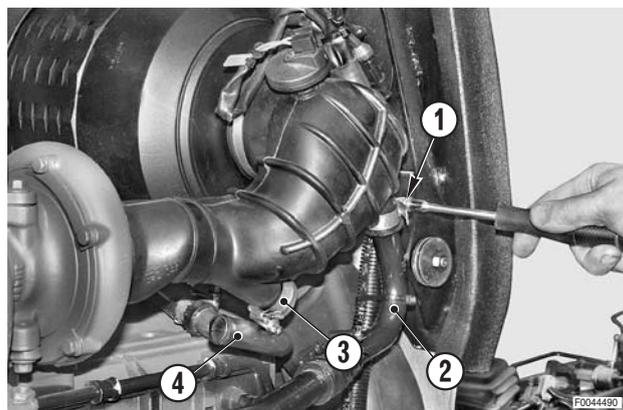
4 - Unplug the connector (5) of the filter clogging sensor (6).
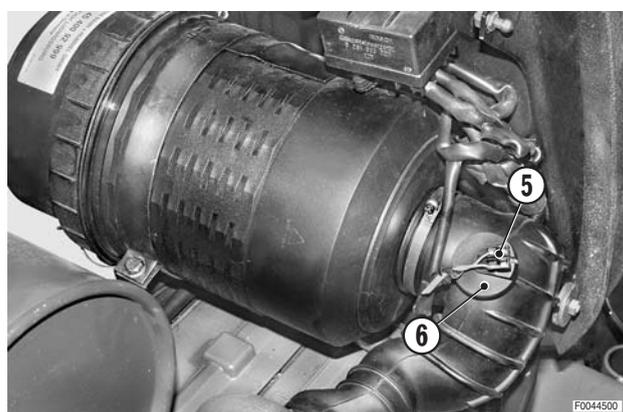
5 - Loosen the clamp (7) securing the filter – turbocharger connection hose (8); remove the hose (8).

6 - Remove the turbocharger (9) following the instructions in the «ENGINE WORKSHOP MANUAL».
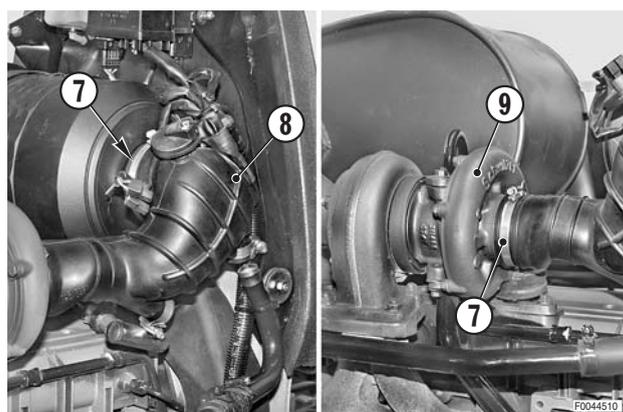
7 - **For models with intercooler only:** loosen the retaining clips and disconnect the air supply pipe (10).

REFITTING THE TURBOCHARGER

- Refitting is the reverse of removal.
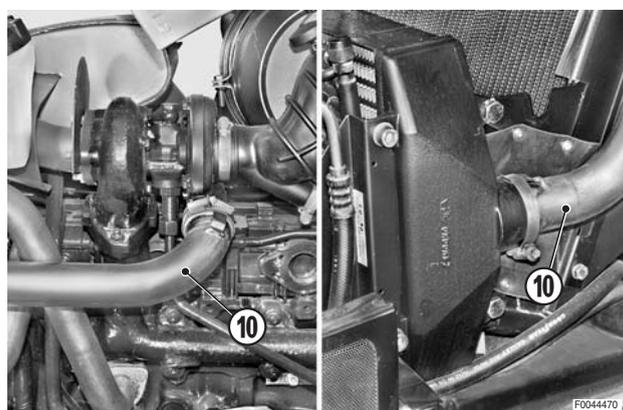
REMOVAL OF THE AIR INLET PIPE

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

2 - Unscrew and remove the bolts (4).
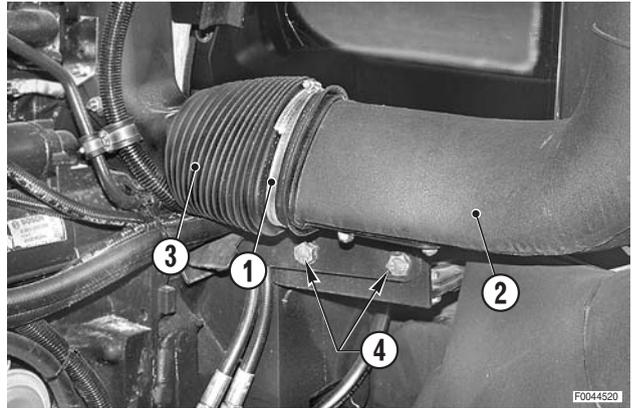
3 - Remove the nut cover (5) and, while supporting the pipe (2), remove the upper retaining nut (6) and washer (7).
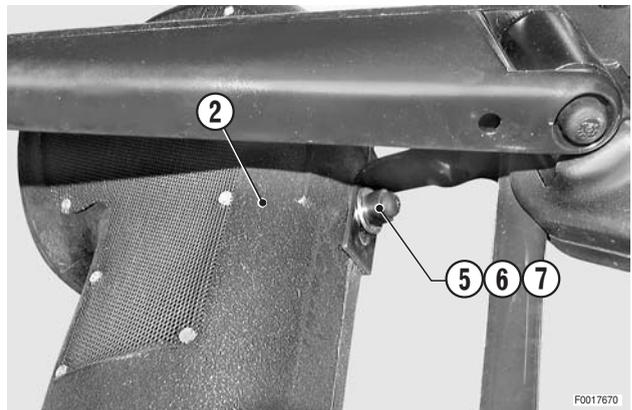
REFITTING THE AIR INLET PIPE

• Refitting is the reverse of removal.

REMOVAL OF THE AIR CLEANER

1 - Loosen the hose clamp (1) and disconnect the inlet pipe (2) of the air compressor for trailer braking.

2 - Loosen the hose clamp (3) and disconnect the oil vapour pipe (4)..
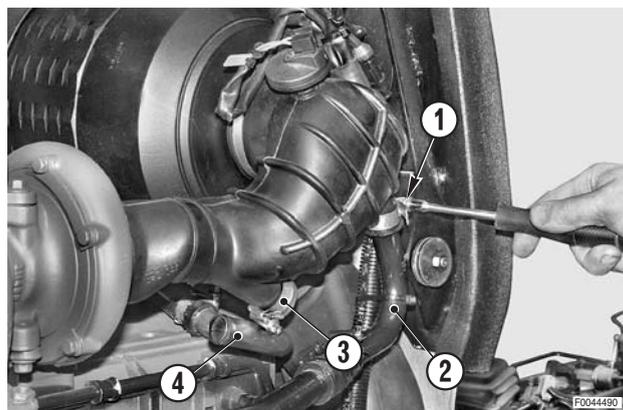
3 - Unplug the connector of the filter clogging sensor (5).

4 - Loosen the hose clamp (6) and disconnect the inlet hose (8) from the turbocharger (9) air cleaner (7).
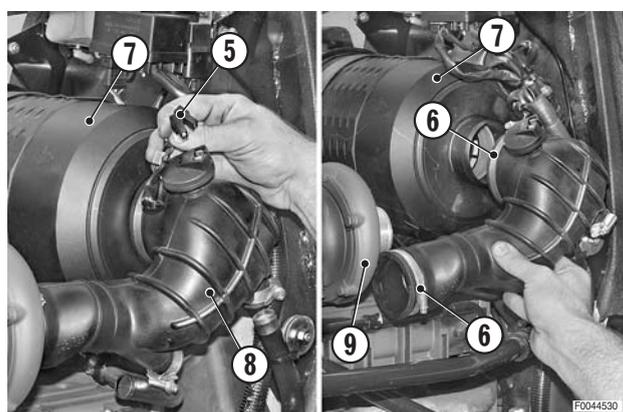
5 - Loosen the hose clamp (10) and disconnect from the air cleaner (7) the connection hose (11) of the dust exhauster pipe.
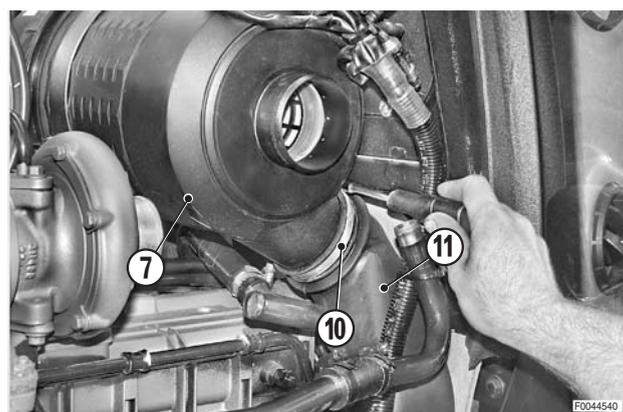
6 - Slacken off the screw (12) of the air cleaner (7) retaining strap (13).
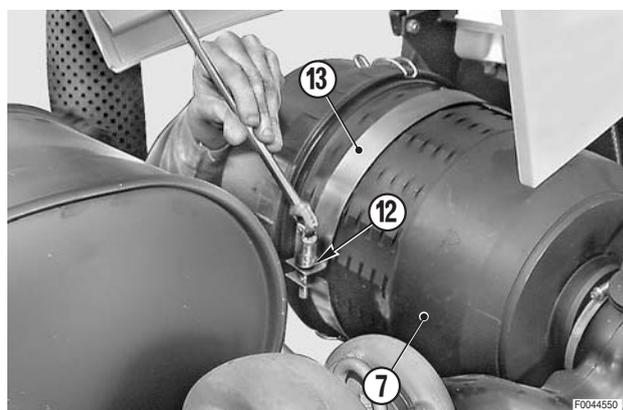
7 - Remove the complete air cleaner assembly (7).

F0044560
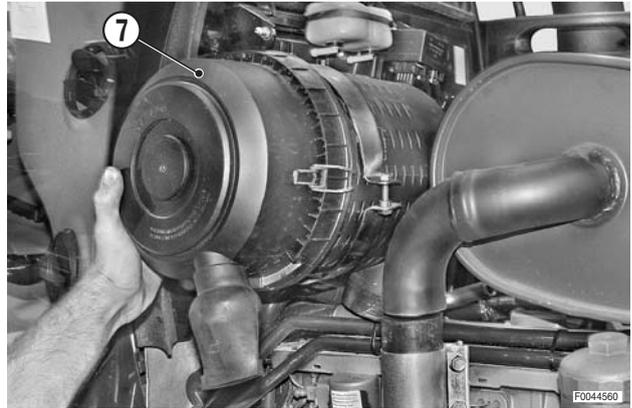
REFITTING THE AIR CLEANER

- 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 and apply the parking brake.

1 - Unscrew the bolts (1) and move the clamp (2) joining the exhaust and the silencer.

6 CYLINDER
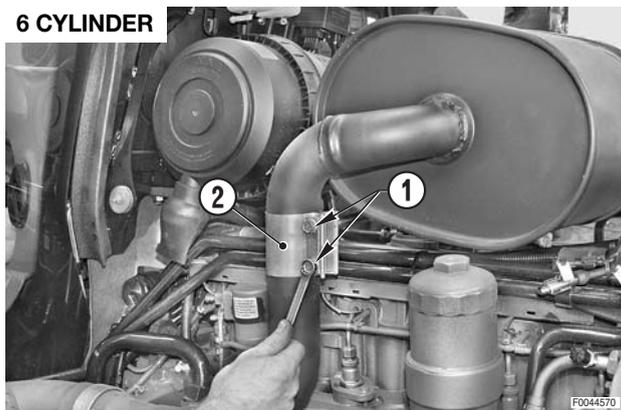
4 CYLINDER
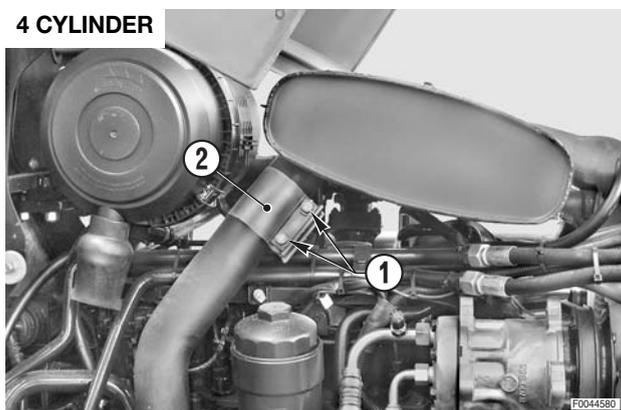
2 - Attach a hoist to the exhaust pipe (3) and put the lifting sling under slight tension.

⬛ kg   Exhaust pipe: approx. 23 kg (50.7 lb.)

3 - Remove the bolts (4) and the nuts (5).

4 - Remove the exhaust pipe (3).

REFITTING THE EXHAUST PIPE

• Refitting is the reverse of removal.

REMOVAL OF THE SILENCER

⚠ Remove the key from the ignition and apply the parking brake.

1 - Loosen the bolts (1) and move the clamp (2) joining the exhaust pipe to the silencer.

2 - Position supports between the cylinder head and the silencer.
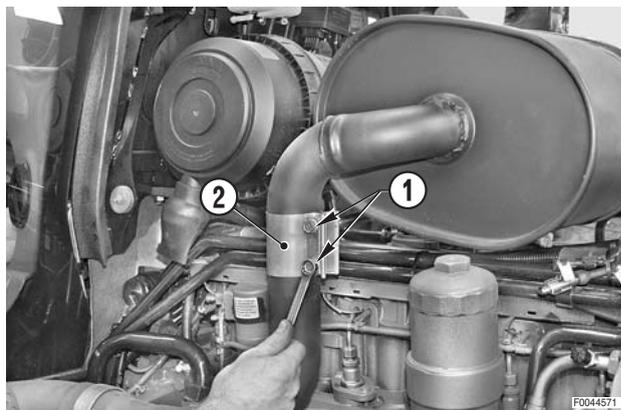
3 - **For turbocharger 4-cylinder models only:** remove the heat shield (3).

4 - Loosen the clamp (4) and disconnect from turbocharger (6) the delivery pipe (5).
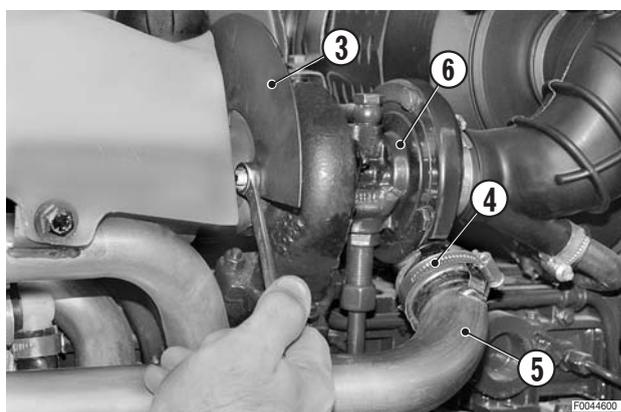
5 - Remove the nuts (7) securing the silencer to the turbocharger (6) and remove the silencer (8).

   🏋 kg   Silencer: 15 kg (33 lb.)
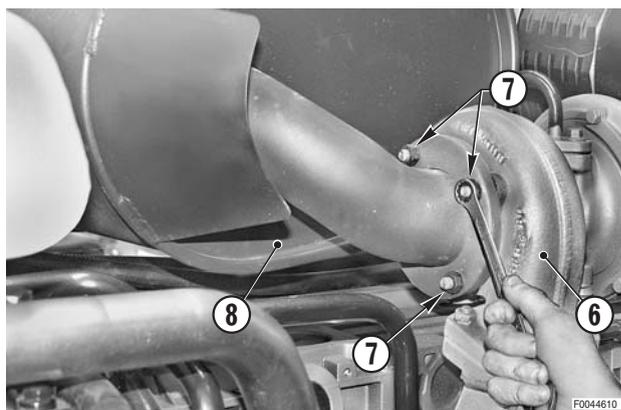
6- Remove the gasket (9).
   ★ Note which way round it is fitted.

REFITTING THE SILENCER

• Refitting is the reverse of removal.
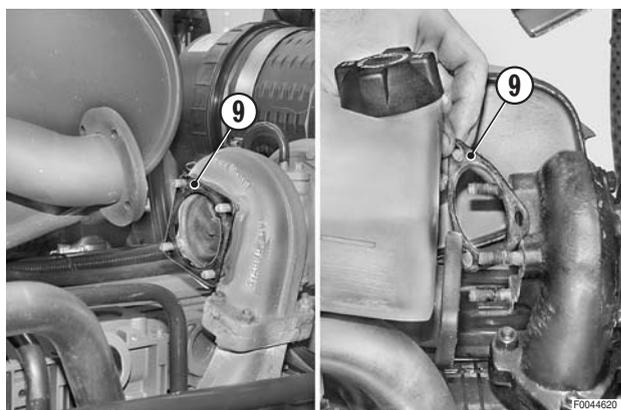
REMOVAL OF THE 4WD PROPELLER SHAFT
(Version without front suspension)

⚠ Remove the key from the ignition and apply the parking brake.

1 - Using suitable lifting equipment, raise the front of the tractor by about 10-12 cm (4-5 in.).

2 - Position a jack "**A**" capable of supporting the tractor's weight under the front carrier.
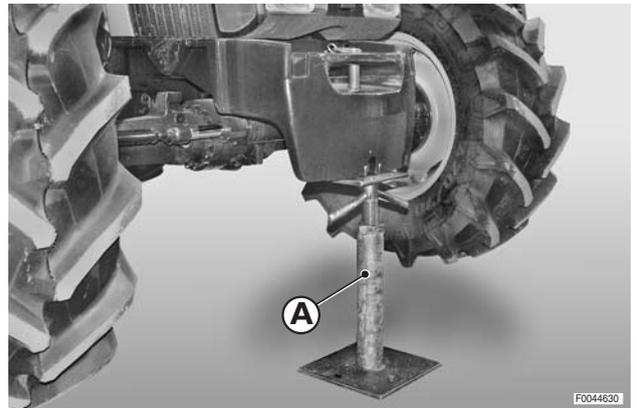
3 - Support the lower guard (1), remove the nut (2) with its washer and the bolt (3).

4 - Remove the front bolts and remove the guard (1).
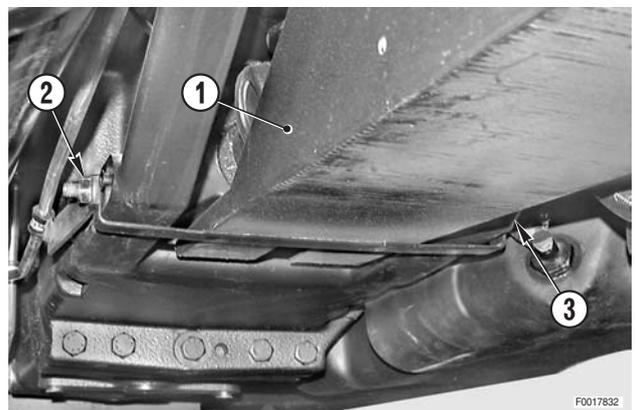
5 - Position a jack"**B**" under the shaft (4) and remove the flange bolts and nuts (5).

　　　　　　　　　　　　　　　　　　　　 ※ 1

★ To enable removal of the upper bolts, turn the wheels by hand.
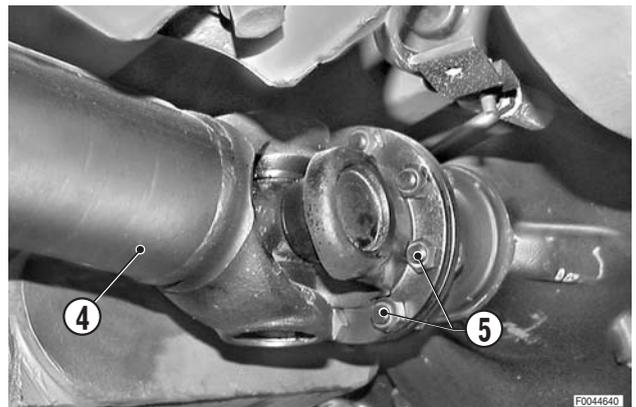
6 - Position a jack under the shaft (4) and remove the flange bolts and nuts.

　　　　　　　　　　　　　　　　　　　　 ※ 2
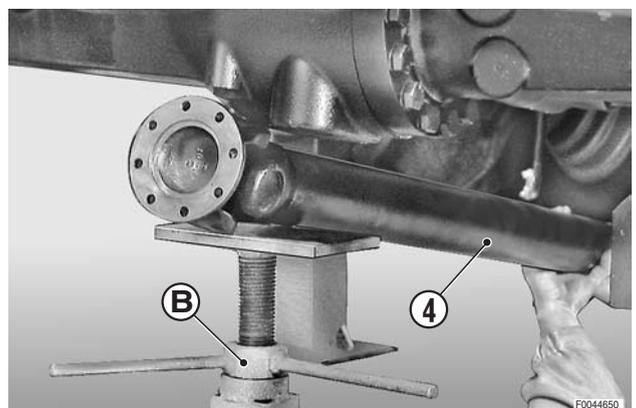
30-63

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

REMOVAL OF THE 4WD PROPELLER SHAFT
(Version with front suspension)

⚠ Before switching off the engine, disengage the front suspension by pressing the button in the cab for at least 20 seconds.

⚠ Remove the key from the ignition and apply the parking brake.

1 - Using suitable lifting equipment, lift the front of the tractor so that the wheels are raised by about 10-12 cm (4-5 in.).

2 - Position a jack "**A**" capable of supporting the tractor's weight under the front carrier (1).

3 - Position under the swinging suspension support (2) a stand "**B**" that can be lowered through 10-12 cm (4-5 in.).
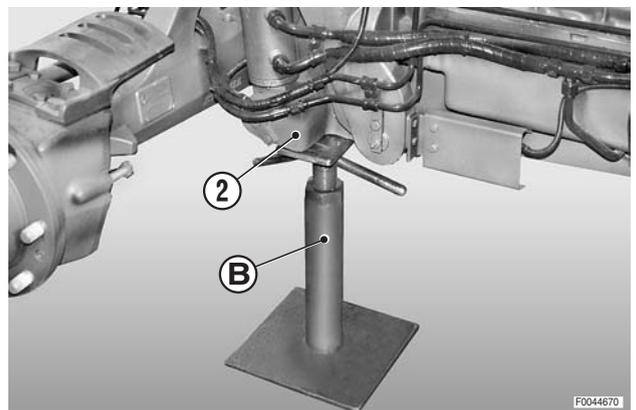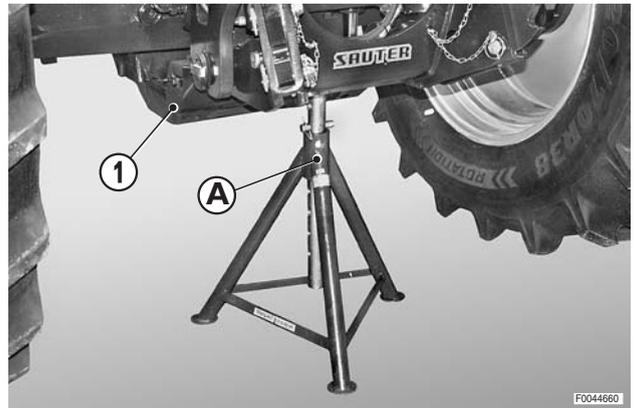
4 - Discharge the residual pressure from the suspension system by unscrewing the valve (3) two full turns.
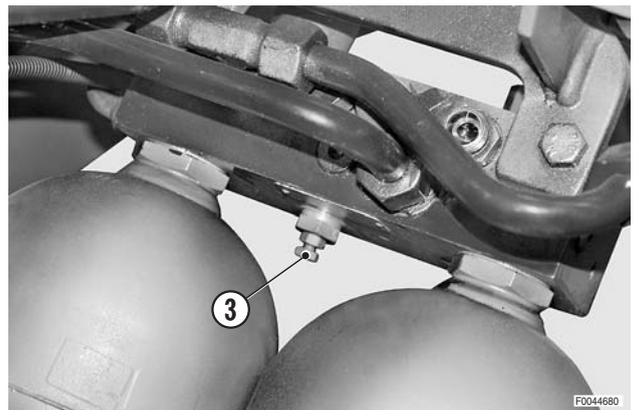
5 - Remove the clips (4) to release the differential lock pipe (5).
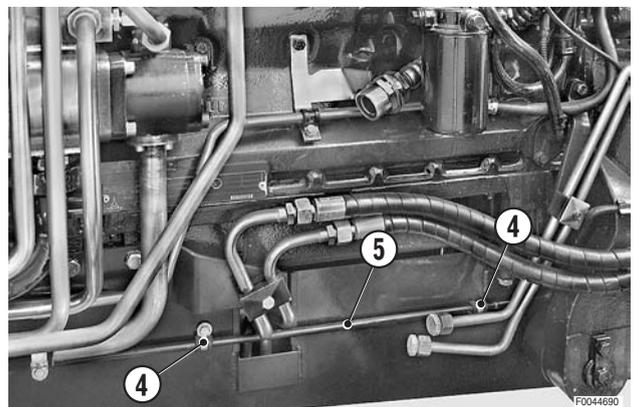
6 - While supporting the lower guard (6), remove the nut (7) with its washer and the bolt (8).
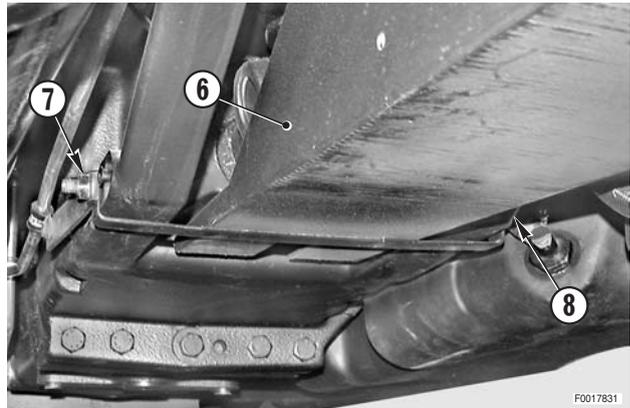
7 - Remove the front bolts (9) and remove the lower guard (6).
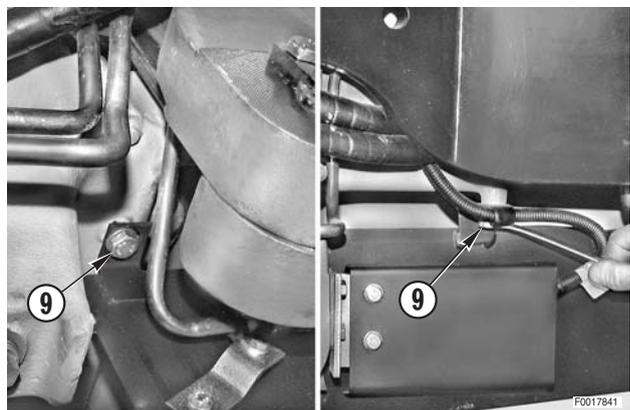
8 - Disconnect the pipes (10) of the left-hand suspension cylinder.

★ 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.
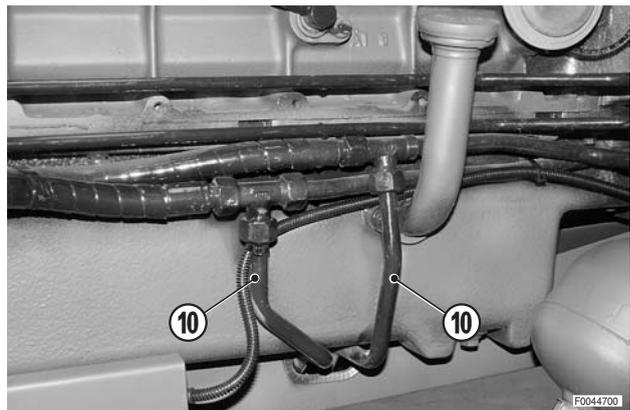
9 - Disconnect the pipes (11) from the right-hand suspension cylinder.

★ Label the pipes to avoid confusion on refitting.

★ Plug the pipes and the open fittings to prevent the entry of contaminants.
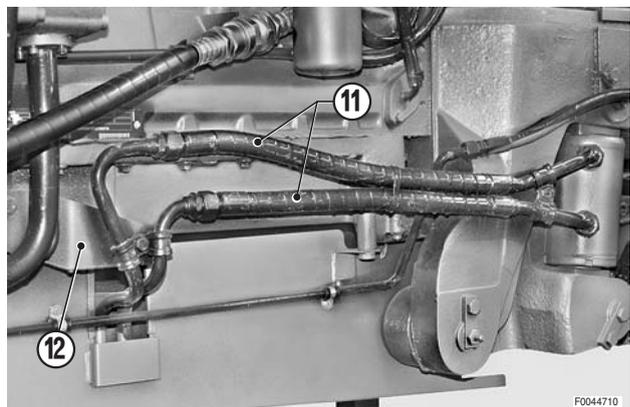
10 - Remove the bracket (12) and remove the pipes.

11 - Position a jack "**C**" under the shaft (13) and remove the flange bolts and nuts (14). ⚹ 1
   ★ In order to remove the upper bolts, lower the jack positioned in step 3.
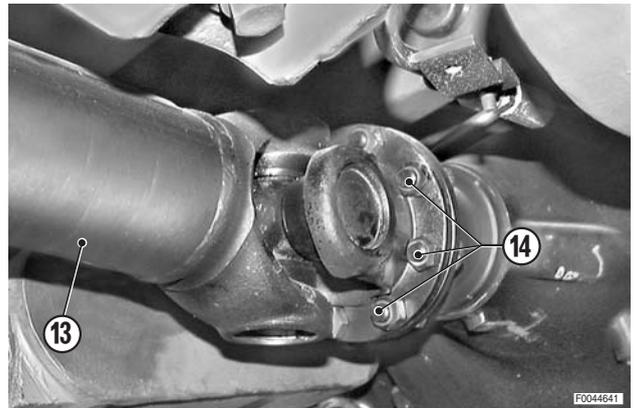
12 - Separate the flanges, lower the jack "**C** "and withdraw the shaft (13) towards the front of the tractor. ⚹ 2
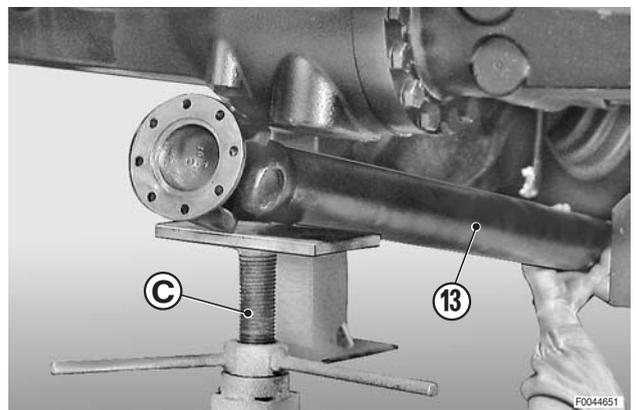
REFITTING THE 4WD PROPELLER SHAFT

•   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 upper side panels. (For details, see «REMOVAL OF THE HOOD AND SIDE PANELS»).

3 - Remove the air cleaner. (For details, see «REMOVAL OF THE AIR CLEANER»).

4 - Unplug the connectors (1) of the brake fluid level warning light.

5 - Remove the cap (2) and draw off the fluid contained in the brake fluid reservoir (3).

6 - Remove the screws and remove the insulation panel (4).
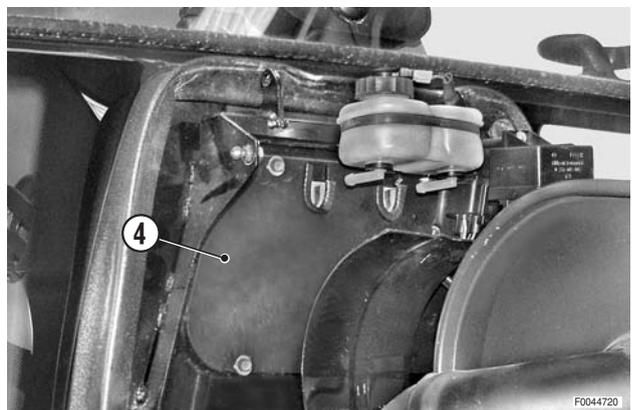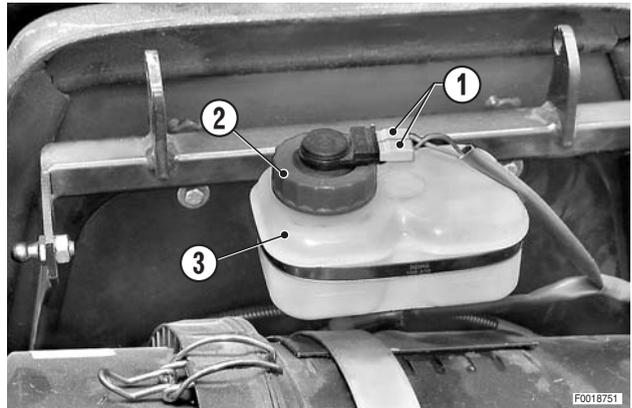
7 - Disconnect the pipes (5) from the reservoir (3); remove the hood support (6) complete with the reservoir.
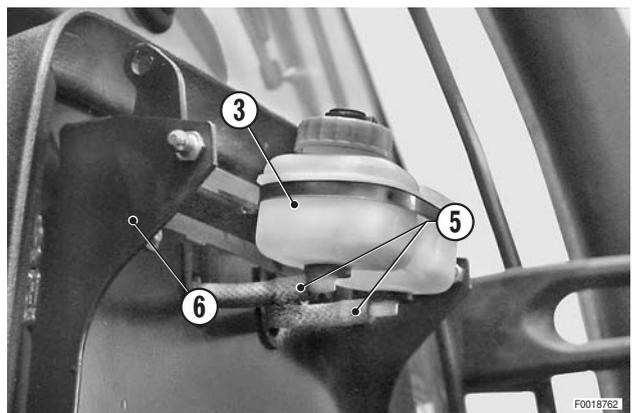
8 - Disconnect the feed pipes (7) and the by-pass pipe (8) between the cylinders (9).
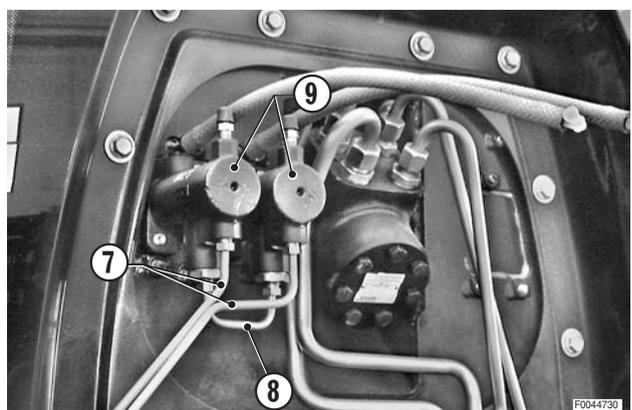
9 - Remove the cotter pins (10) and remove the pins (11) connecting the pedals (12) to the cylinders (9).

10 - Unscrew and remove the three bolts (13) with their washers and remove the cylinders (9).

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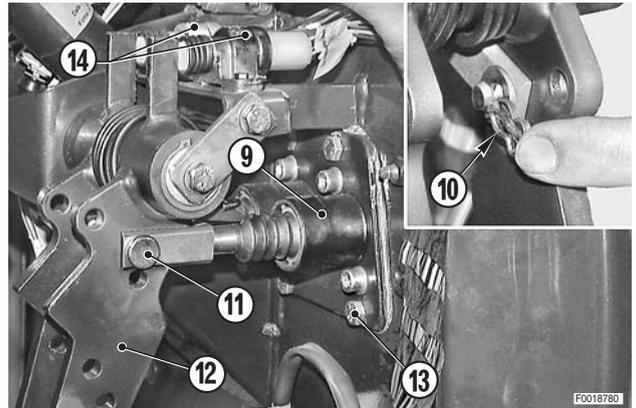
REFITTING THE BRAKE MASTER CYLINDERS

• 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 LI-GHT SWITCHES»).

3 - Bleed the air from the braking system.
(For details, see «BLEEDING THE BRAKING SYS-TEM»).

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.
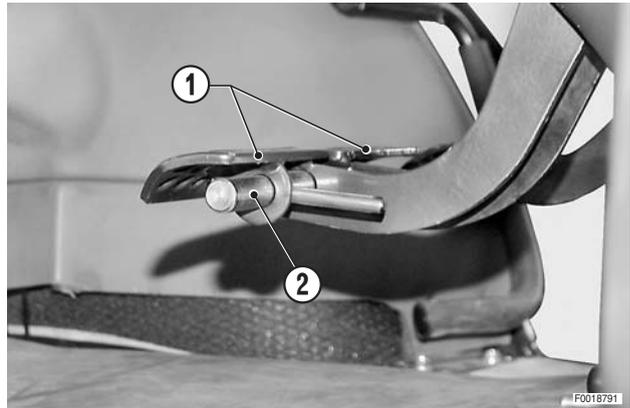
Brake bleeding procedure

⚠ 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.
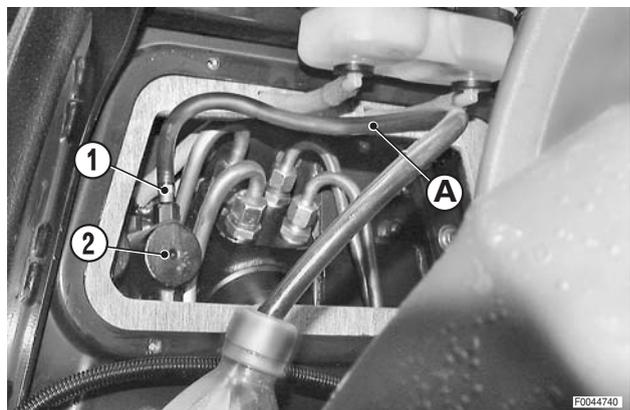
8 - Use the same method also for the service brakes.

⚠ Bleed the left brake first 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.
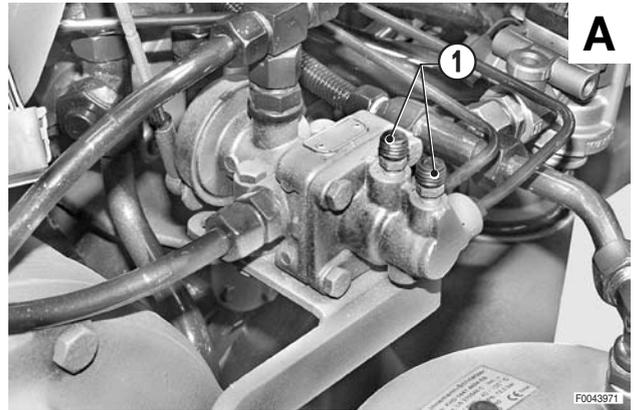
B - Hydraulic braking valve (CUNA).
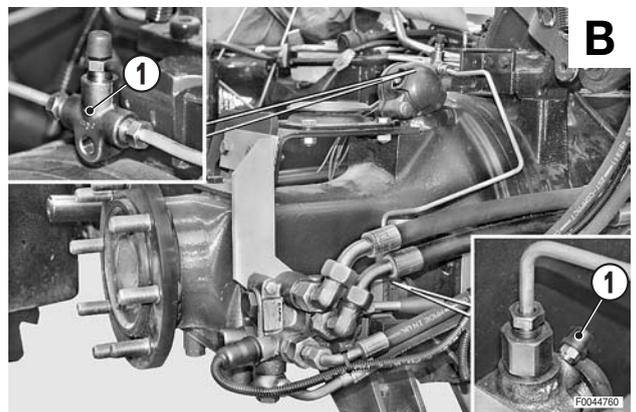
C - Hydraulic braking valve (EXPORT).
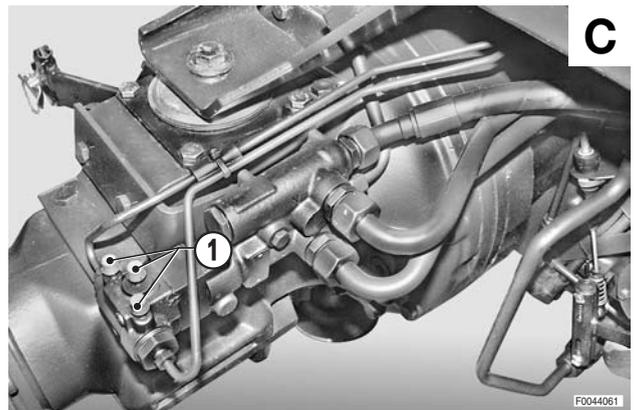
ADJUSTMENT OF THE BRAKE LIGHT SWITCHES

★   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).
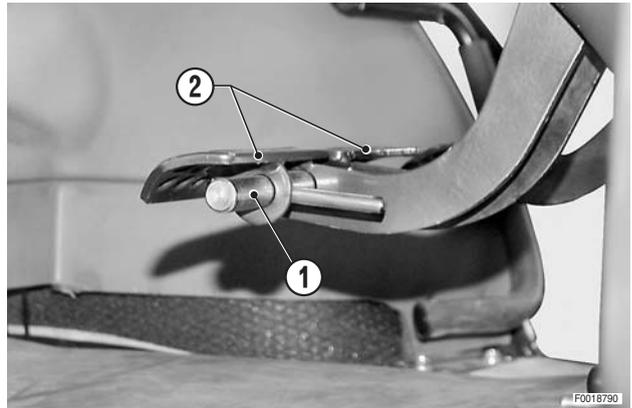
2 - Force the pedals (2) upwards and check that the brake light switches (3) have an extra opening travel of 1±0.2 mm (0.04±0.008 in.).

   ★   This extra travel protects the switches from impacts at the end of travel caused by sudden release of the pedals.
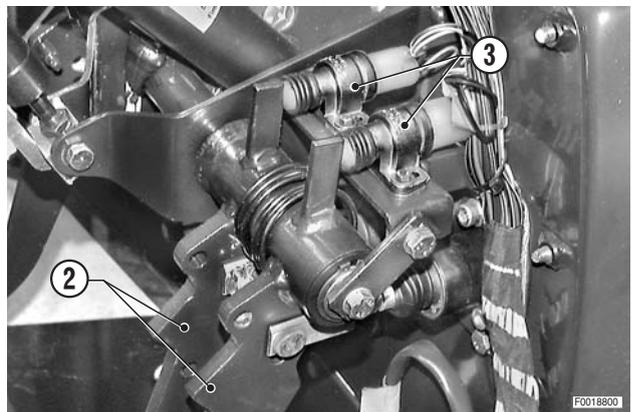
3 - If the switches (3) do not have this extra travel, loosen the screws (4) so that they just grip the switch; move the switch towards the front of the tractor and tighten down the screws (4) to fix it in position.
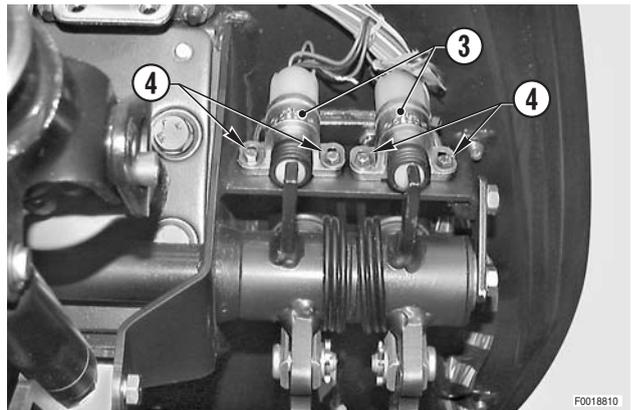
TESTING OF THE POWER STEERING UNIT

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).
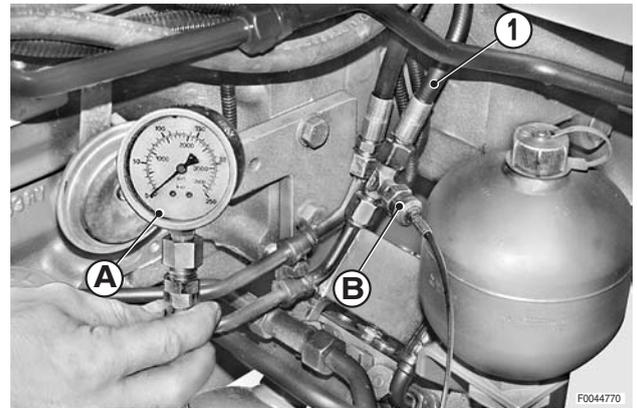
2. Adjustment

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.

Plug: 50±10 Nm (36.8±7.4 lb.ft.)

F0044770

F0012581
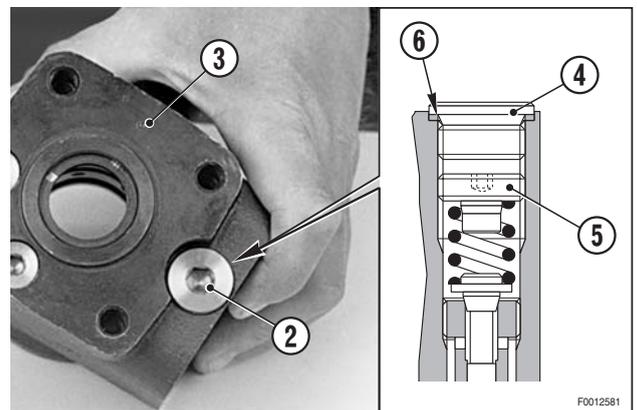
REMOVAL OF POWER STEERING UNIT

1 - Remove the console shroud. (For details, see «RE-MOVAL OF CENTRE CONSOLE»).

2 - Mark the hoses (1) and disconnect them from the power steering unit (2).

   ★ Plug the pipelines and ports to prevent impurities getting in.

   ※ 1
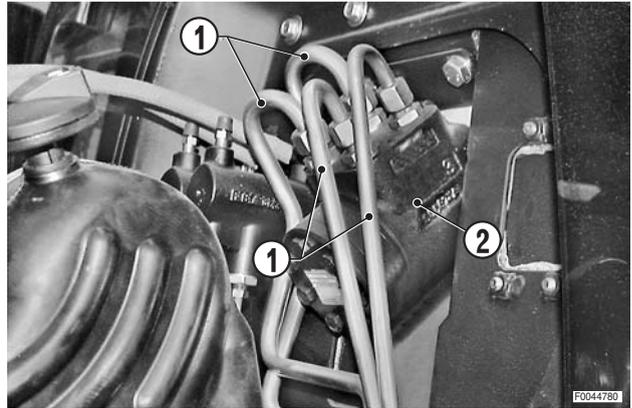
3 - Unscrew the retaining bolts (3) and washers (4).
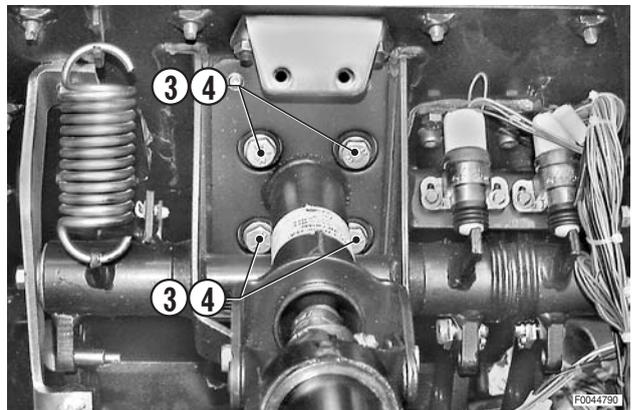
4 - Remove the power steering unit (2).

   ★ If necessary, reposition the plate (5) with the relative bushes (6).   ※ 2
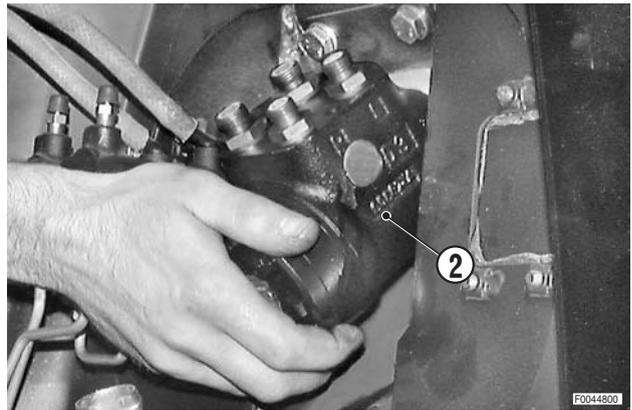
REFITTING POWER STEERING UNIT

• Refitting is the reverse of removal.

※ 1

   🔧Nm Pipe fittings: 60 Nm (44.2 lb.ft.)
         Eye fitting: 29 Nm (21.4 lb.ft.)

※ 2

   ★ If the fittings have been removed, replace the seals. Torque reassembled fittings to 70 Nm (51.6 lb.ft.).

1 - Start the engine, and steer full lock on each side a few times to eliminate any air from the power steering circuit.

2 - Check the fittings and pipelines for leaks.
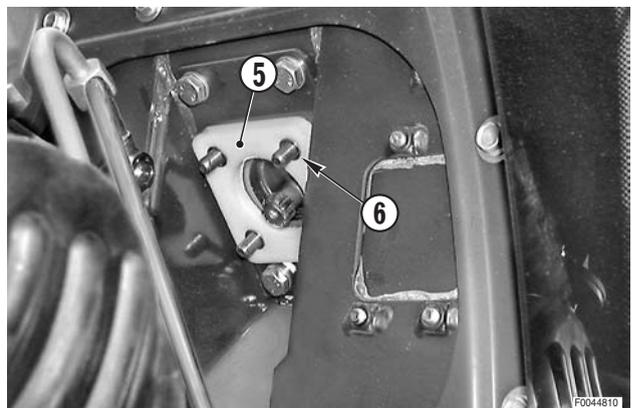
DISMANTLING THE POWER STEERING UNIT

D0001200
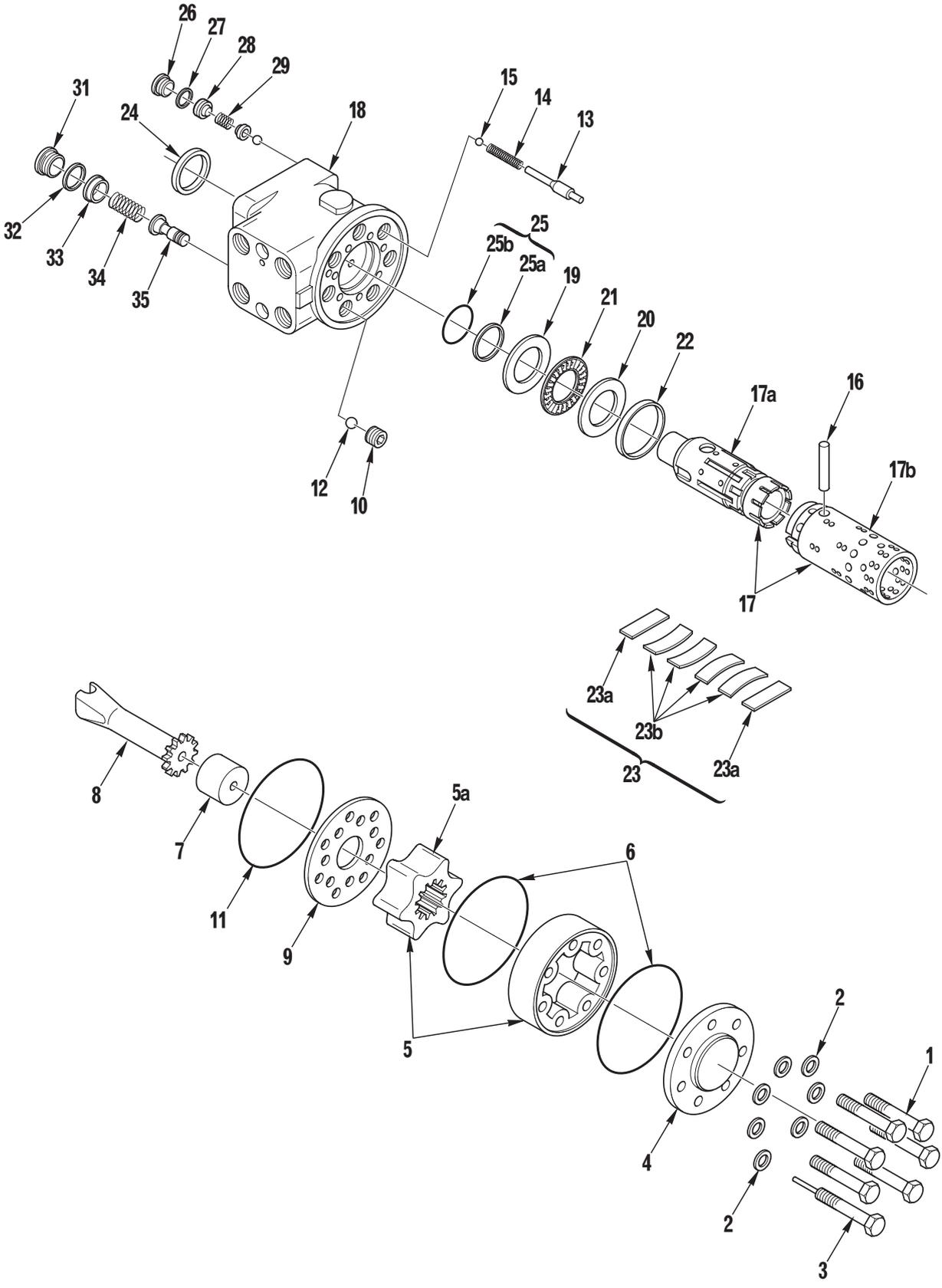
Dismantling the power steering unit

1 - Loosen and remove the screws (1) and (3) and washers (2) securing the cover (4) (6 bolts plus 1 special screw).
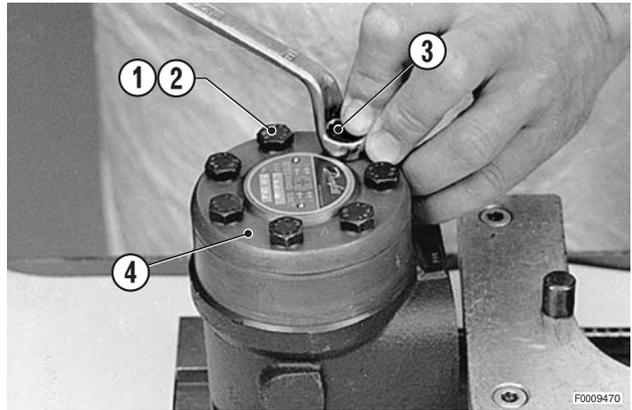
2 - Remove the cover (4) by sliding it off sideways.
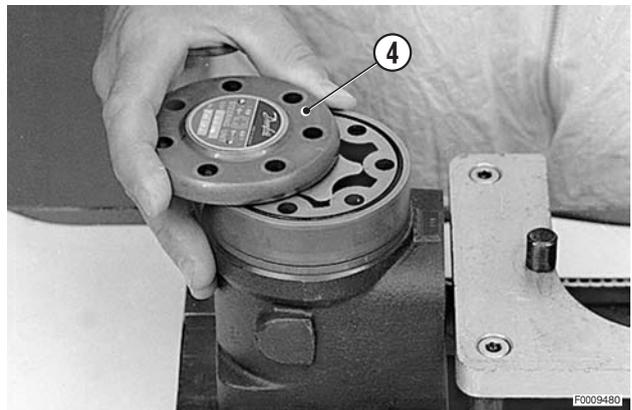
3 - Lift off the rotor assembly (5) complete with O-rings (6) and distance piece (7).
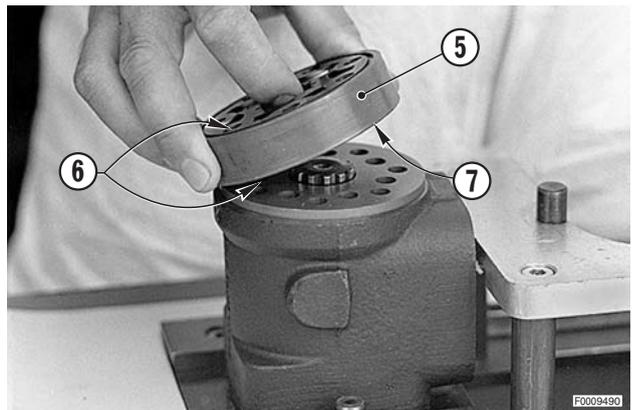
4 - Remove the shaft (8).
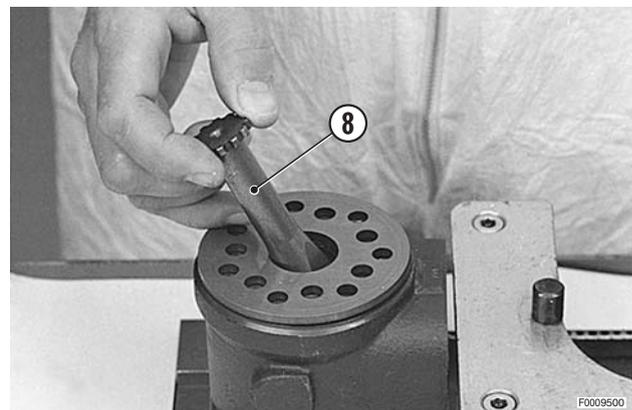
5 - Remove the distributor plate (9).
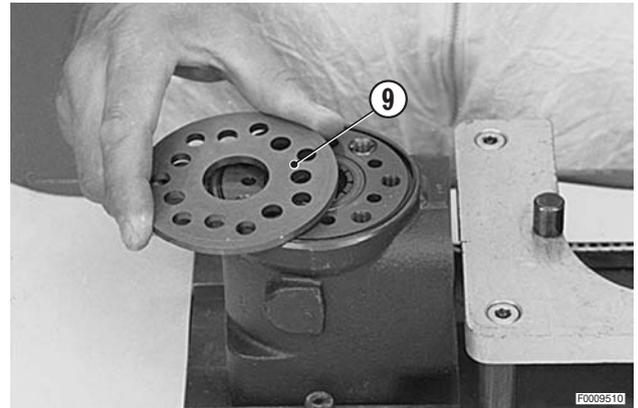
6 - Remove the stop bushing (10) of the safety valve.
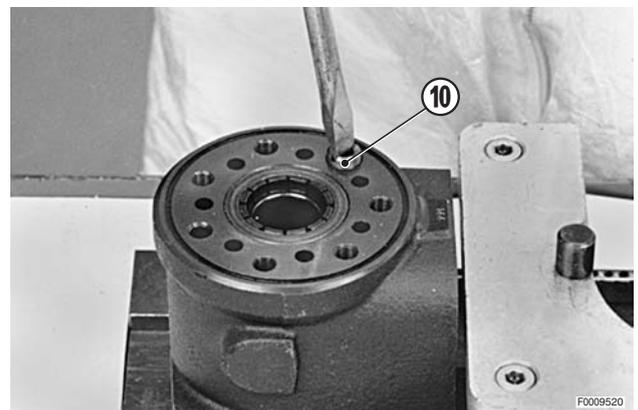
7 - Remove the O-ring (11).
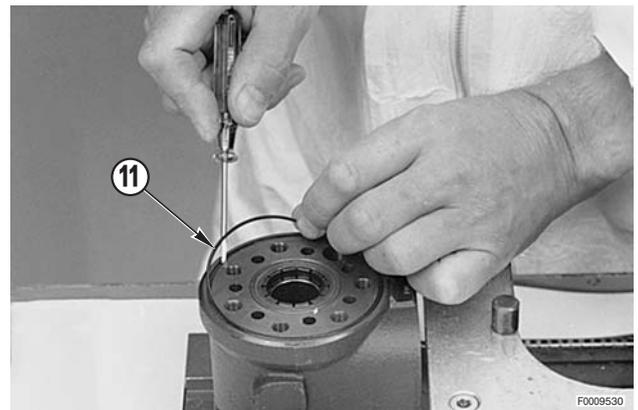
8 - Withdraw the ball (12) of the check valve, the valve stems (14), the springs (14) and the balls (15) of the anti-cavitation valves.
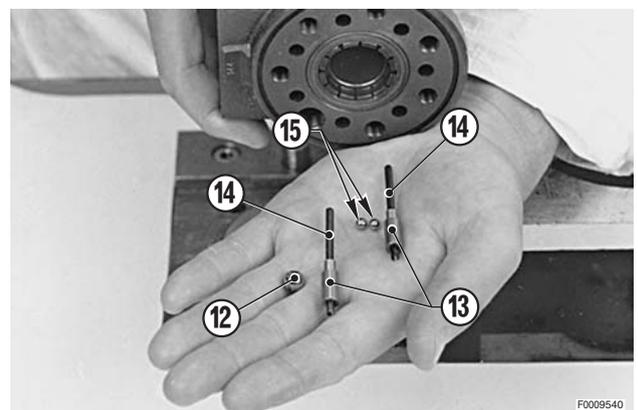
9 - Checking through the central hole of the spool valve, ensure that the pin (16) connecting the inner and outer sleeves of the spool is positioned horizontally. Push the entire spool assembly (17) and the bearing out of the steering unit housing (18).
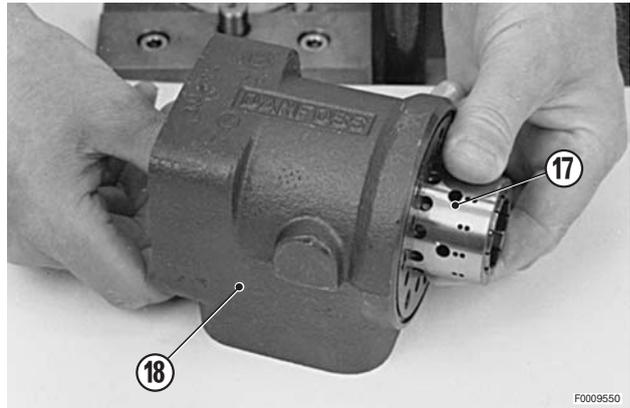
10 - Remove the outer thrust washer (19), the inner thrust washer (20) and the needle roller bearing (21) from the spool; remove also ring (22).

★ The inner thrust washer (20) (thin) can sometimes remain inside the housing; check that it is removed.
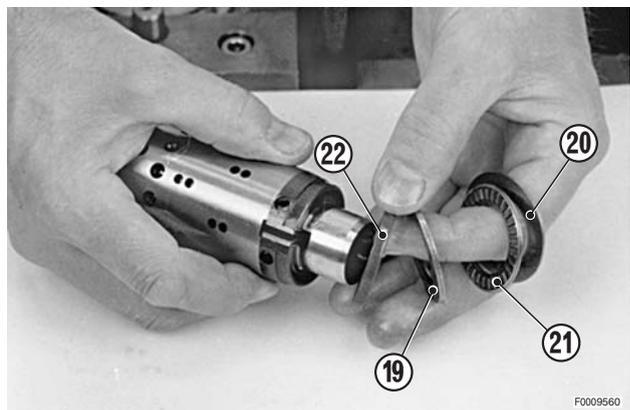
11 - Remove the trim spin (16), outer sleeve (17b) and the inner sleeve (17a).

★ Use the special cover bolt (3).
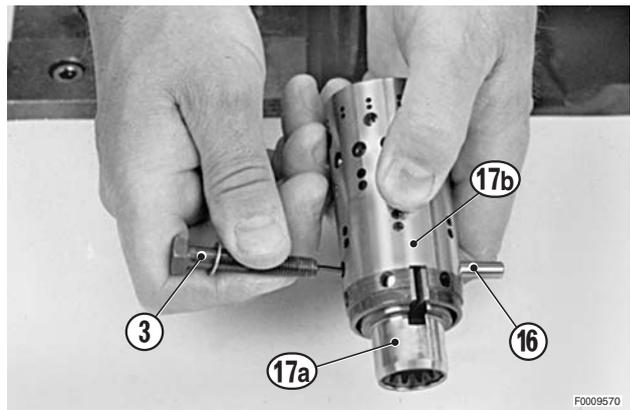
12 - Carefully slide the inner sleeve (17a) out of the outer sleeve (17b).
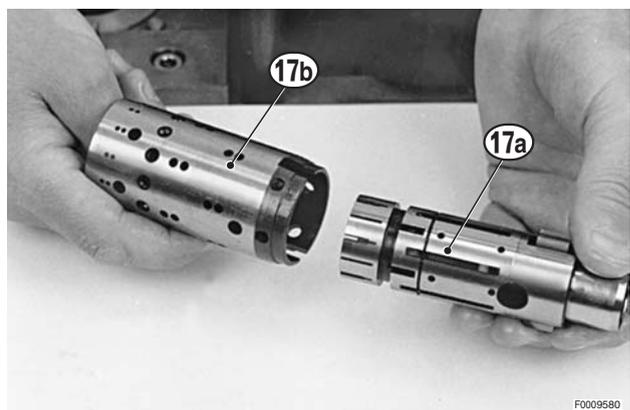
13 - Push the springs (23) into the neutral position and withdraw them from the inner sleeve (17a).
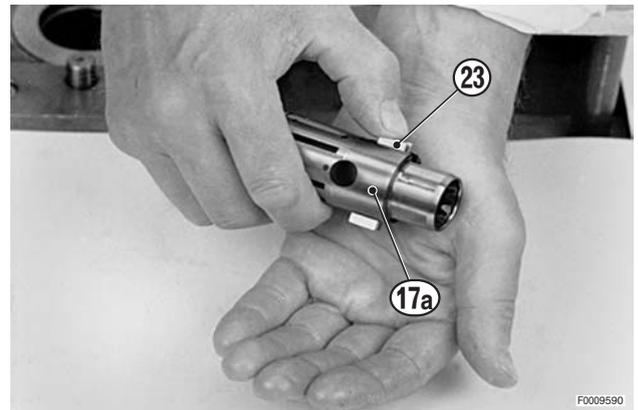
14 - Remove the dust seal (24) and the composite seal (25) (O-ring + gasket).
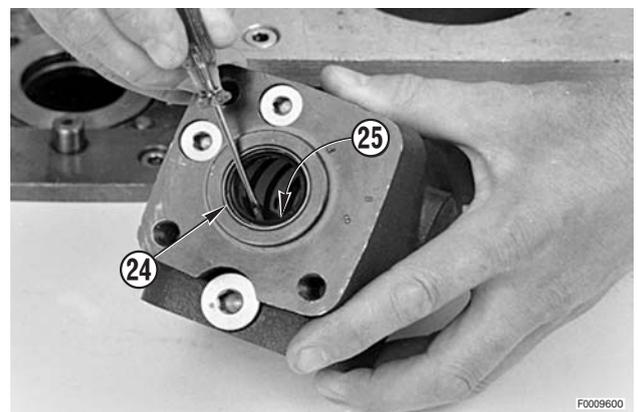
15 - Remove the plugs (26) of the anti-shock valve.
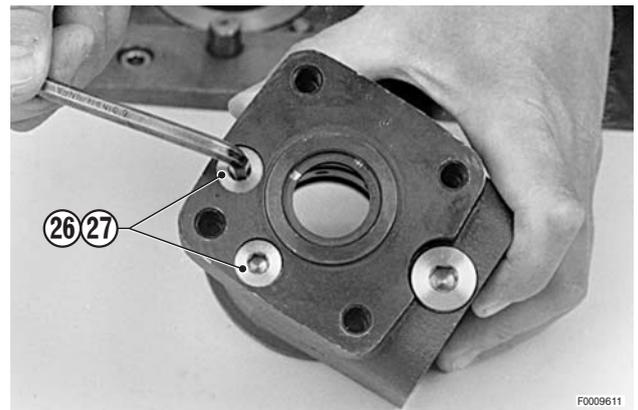
16 - Remove the seals (27).
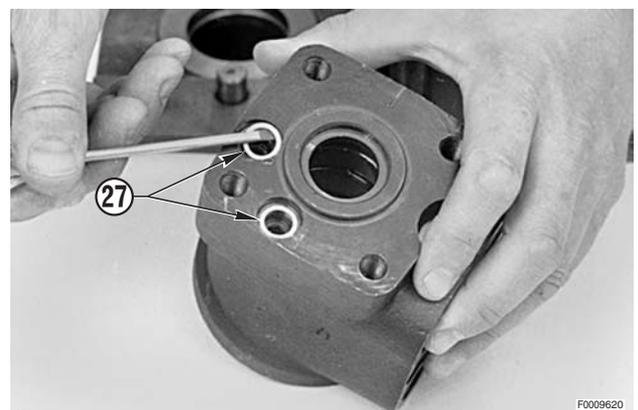
17 - Remove the calibration screws (28).

F0009630
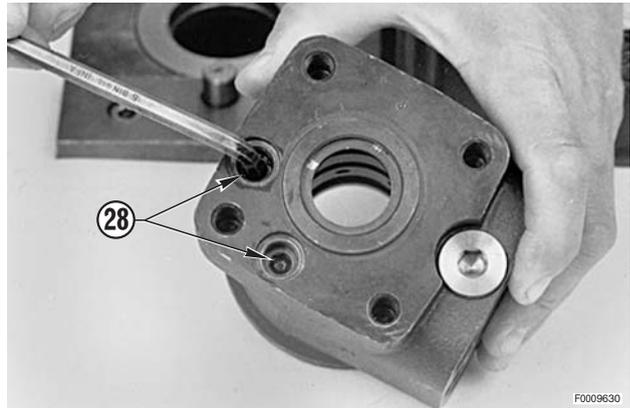
18 - Remove the springs (29) and the two balls (30).
   ★ The valve seats are force fit in power steering unit and cannot be removed.

F0009641
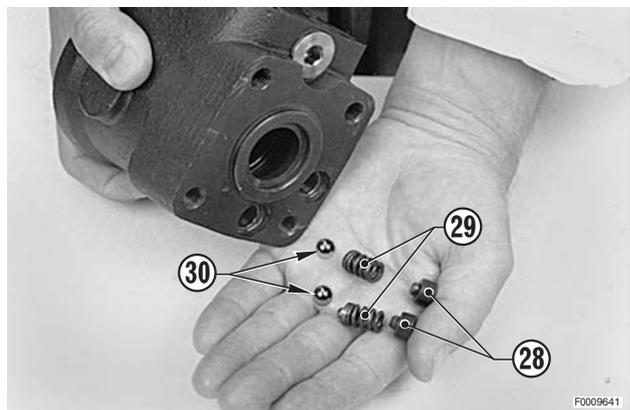
19 - Check that all the valve parts are present as show in the photo.

F0009650
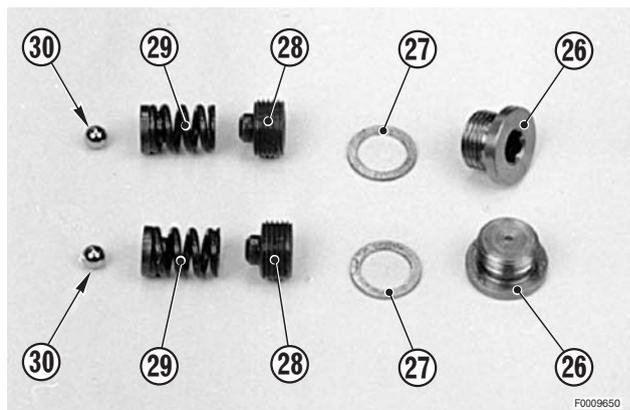
Removal of the safety valve

20 - Remove the plug (31) and the relative seal.

F0009660
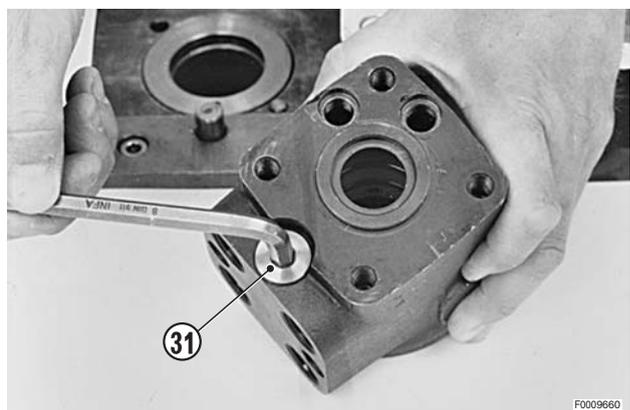
21 - Remove the maximum pressure adjustment screw (33).
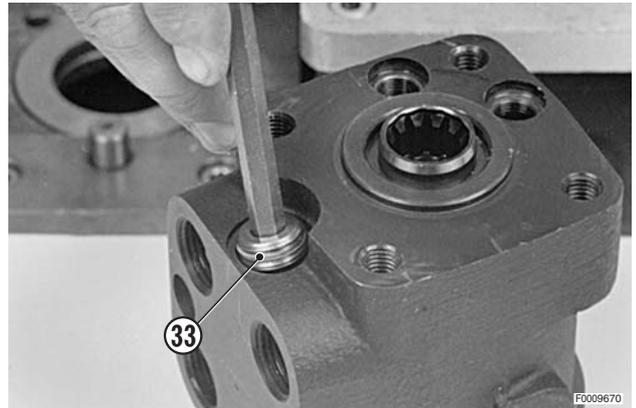
22 - Turn the power steering unit upside down and remove the spring (34) and valve (35).

★ The valve seat is a force fit in the power steering housing and cannot be removed.
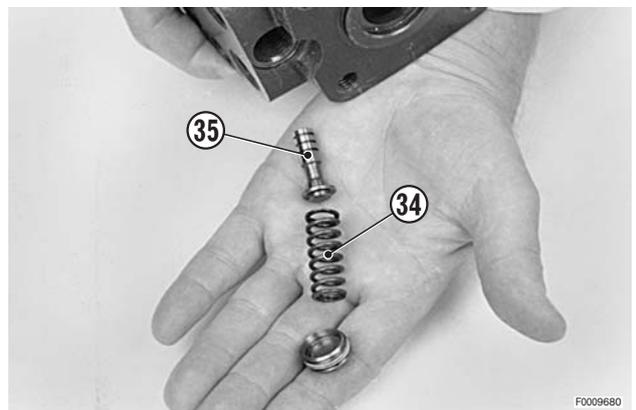
ASSEMBLY OF THE POWER STEERING UNIT

★ Before assembly, lubricate all components with gear-box oil.

1 - Insert the two flat springs (23a) and position them centrally relative to the diameter of inner sleeve of the spool (17a). Insert the four curved springs (23b), arranged in pairs, between the two flat springs (23a) and push them in fully.

F0009690
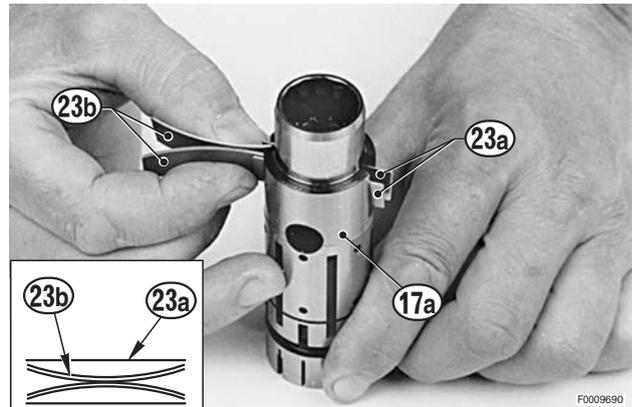
2 - Align the springs (23).

F0009700

3 - Insert the inner sleeve (17a) in outer sleeve (17b).

★ Check that the relative positions of the inner and outer sleeve are as described in stage 1.

F0009580
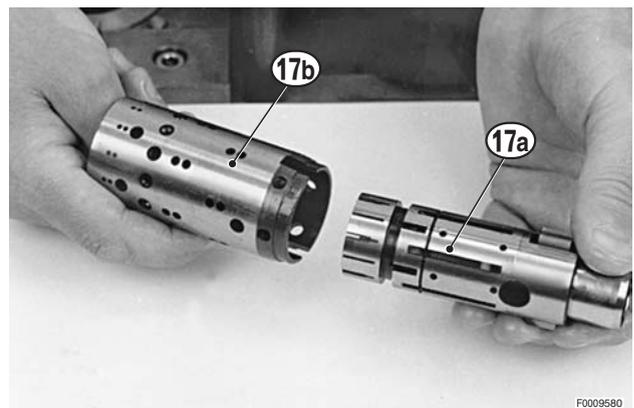
4 - Simultaneously push the springs (23) and the inner sleeve (17a) so that the springs locate in the outer sleeve (17b).

F0009710

5 - Align the springs (23) and position them centrally rel-
ative to the diameter of the outer sleeve (17b).
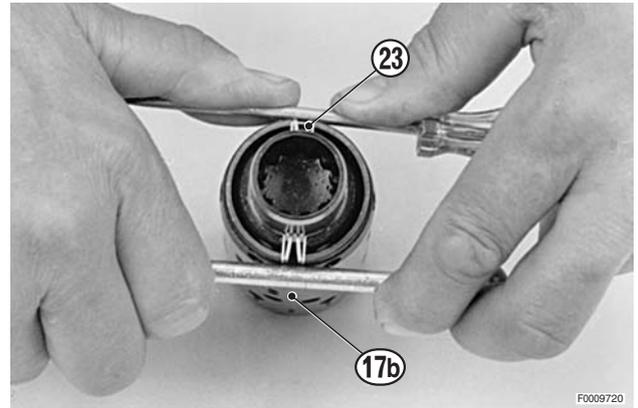
6 - Fit the ring (22) on to its seating on the outer sleeve
(17b).
   ★ The ring (22) must rotate freely without interfer-
   ence with the springs (23).
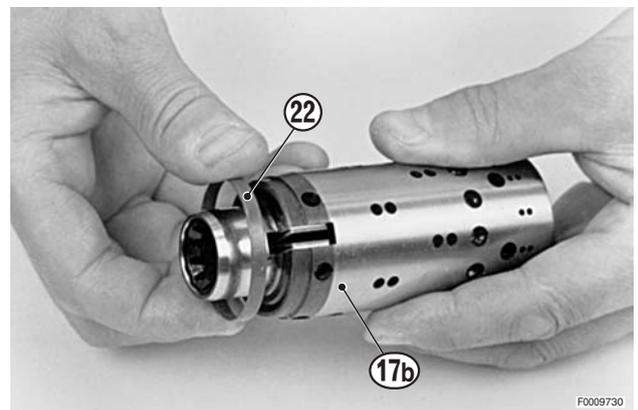
7 - Insert the trim pin (16).
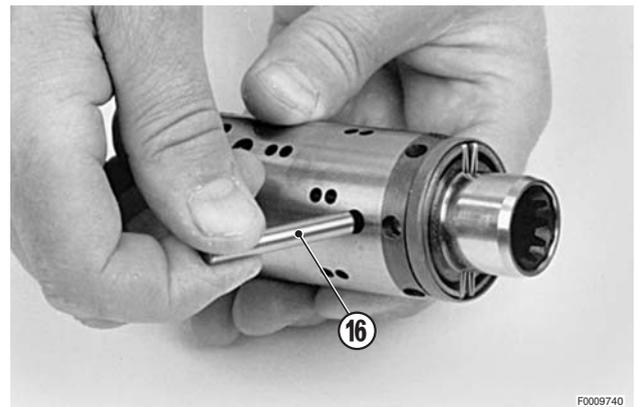
8 - Fit the thrust bearing parts in the order indicated in the
assembly diagram in point 9.
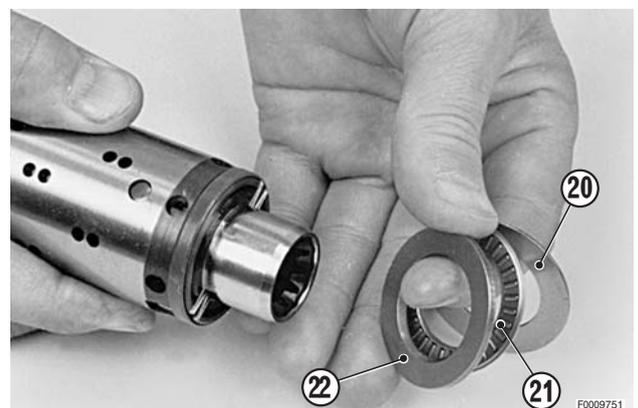
9 - Bearing assembly diagram

    17a - Inner sleeve

    17b - Outer sleeve

    21- Needle roller bearing

    20 - Inner thrust washer

    22 - Outer thrust washer

    ⚠ The chamfer "**X**" of the outer thrust washer must be oriented towards the shoulder on the inner sleeve.
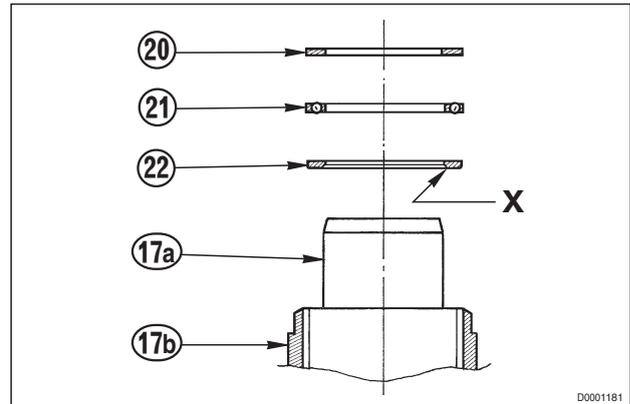
10 - Position the steering unit (18) so that the central bore is horizontal.
Insert the guide of tool **T1** (code 5.9030.480.0) into the bore of the inner/outer sleeve assembly.
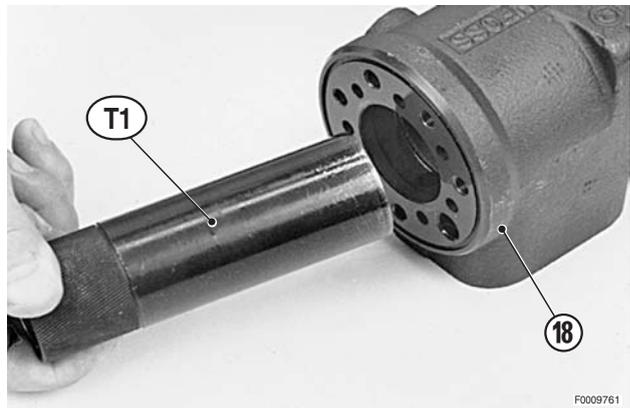
11 - Oil the seal (25a) and O-ring (25b) and fit them on the plunger of tool **T1** (code 5.9030.480.0).
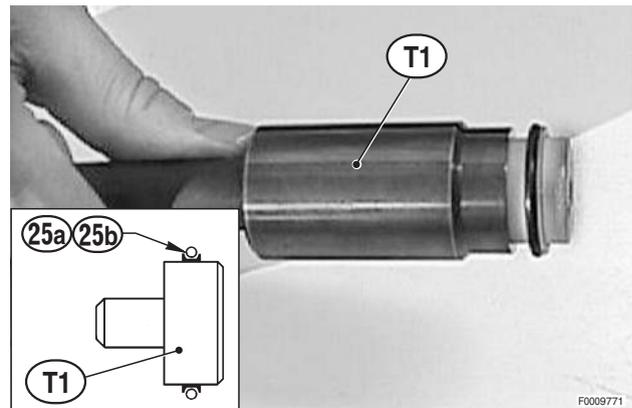
12 - Assemble tool **T1** (code 5.9030.480.0) and insert it in the guide previously inserted in the central bore of the power steering unit.
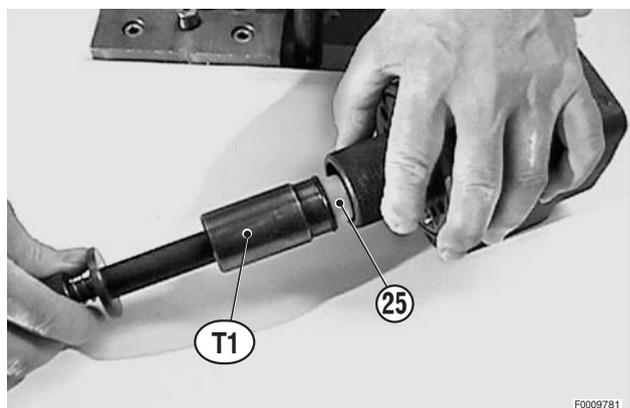
13 - Push the seal (25) into the seating in the power steering unit (18), turning it slightly to ensure correct positioning.

F0009790
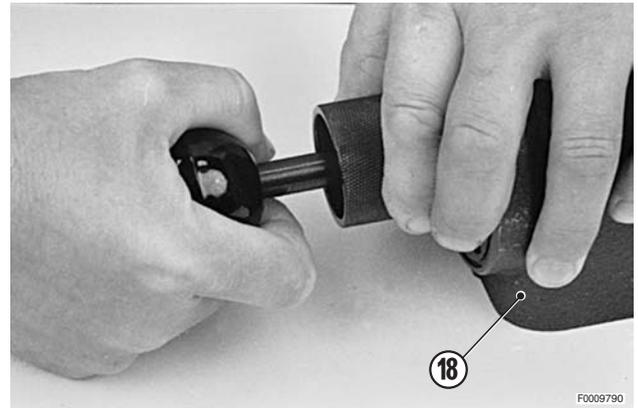
14 - Withdraw the tool **T1** (code 5.9030.480.0) and the guide from the steering unit housing, leaving the seal installer plunger in place.

F0009801
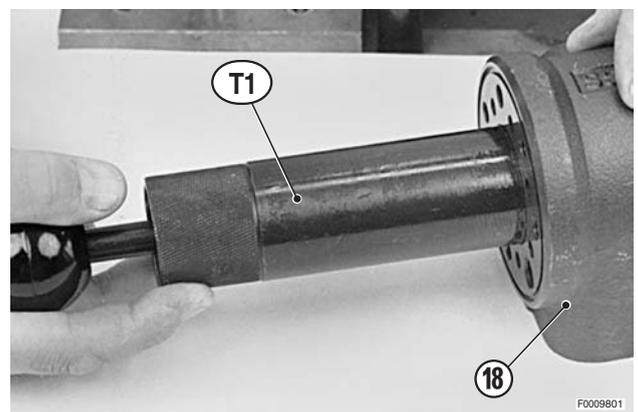
15 - Insert the spool assembly (17) in the bore of the power steering unit (18), turning its slightly to assist insertion.
  ★ Insert the assembly while keeping the trim pin in a horizontal position.

F0009810
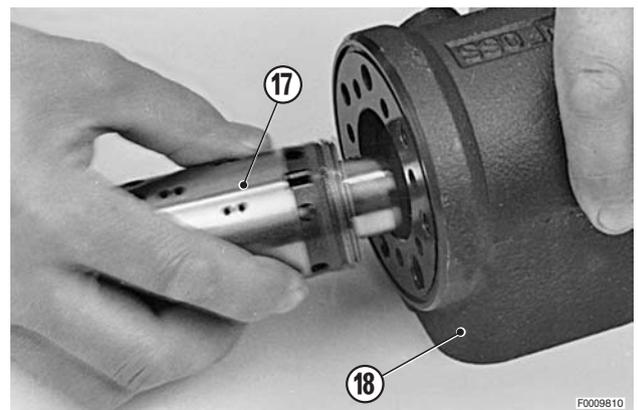
16 - Push the spool assembly (17) fully home in order to expel the seal installer plunger left in the bore in step 14.

F0009820
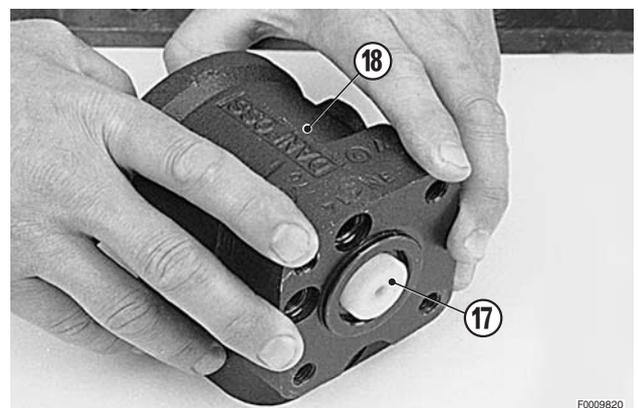
17 - Turn over the power steering housing (18) so that the central bore is vertical.
Insert the ball (12) of the safety valve in the hole indicated in the photo.
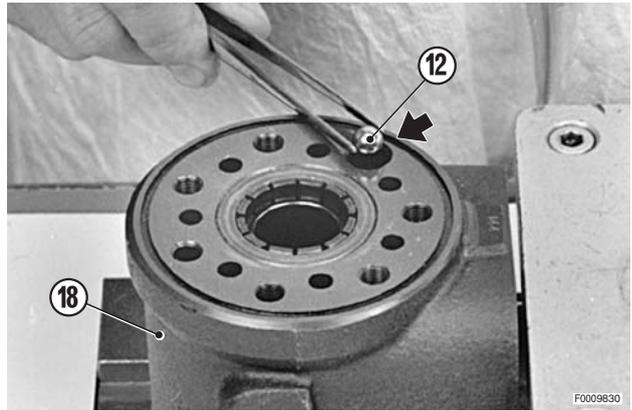
18 - Screw the stop bush (10) into the safety valve hole.
★ The top of the bush must be positioned lower than the face of the steering unit housing (18).
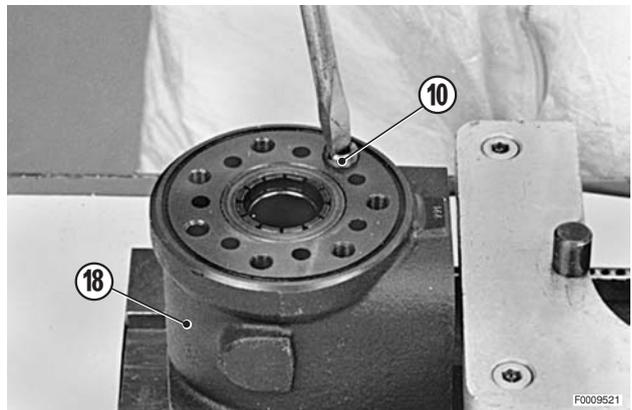
Assembly of the anti-cavitation valve

19 - Insert the balls (15) into the two holes indicated by the arrows.
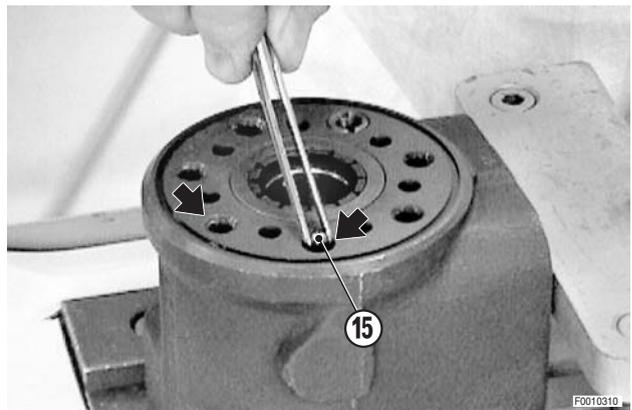
20 - Insert the valve stems (13) complete with springs (14) into the same holes.
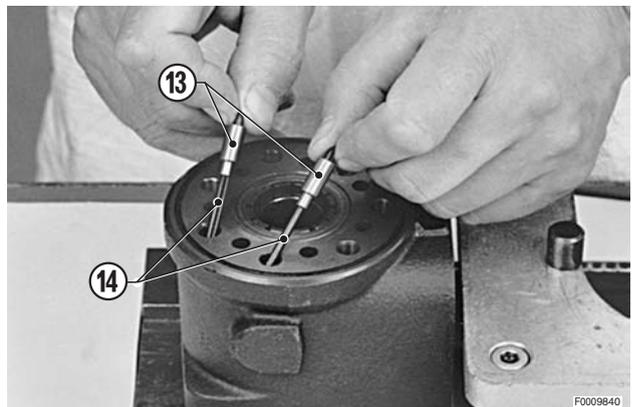
21 - Oil the O-ring (11) and fit it in its seat.

    ⟋⟍ O-ring: gearbox oil
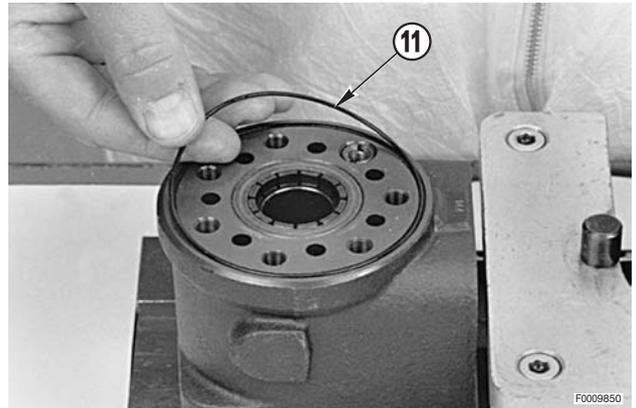
22 - Position the distributor plate (9) so that its holes are aligned with those in the power steering housing (18).
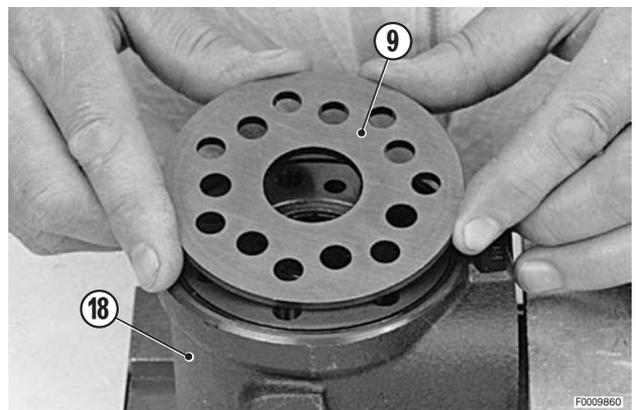
23 - Insert the shaft (8) in to the central bore so that engages the trim pin; check that trim pin engagement is parallel to the face of the power steering unit by which it is attached to the steering column.
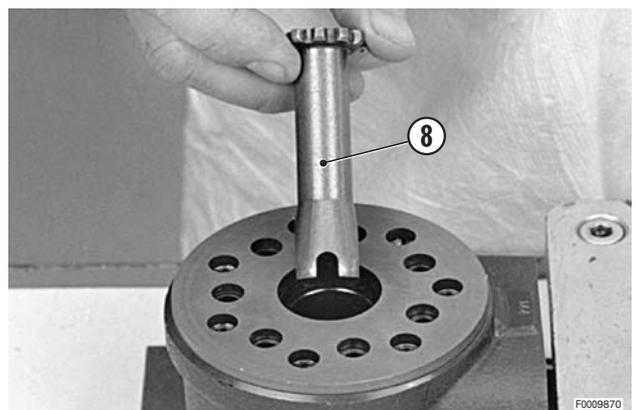
24 - Position the shaft vertically and hold it in place using the specific tool.
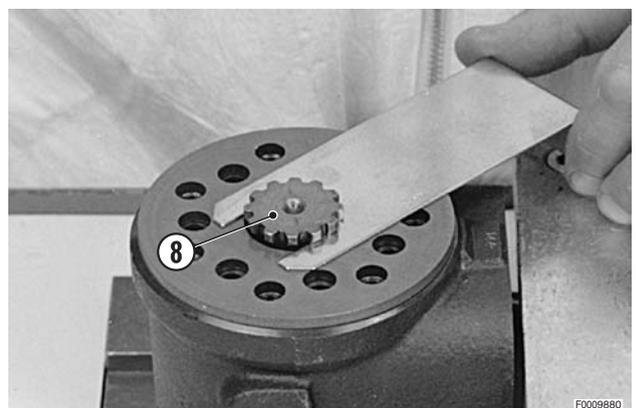
25 - Oil the two O-rings (6) and install them in the two seats in the rotor assembly (5).

⟋⟍ O-rings: gearbox oil
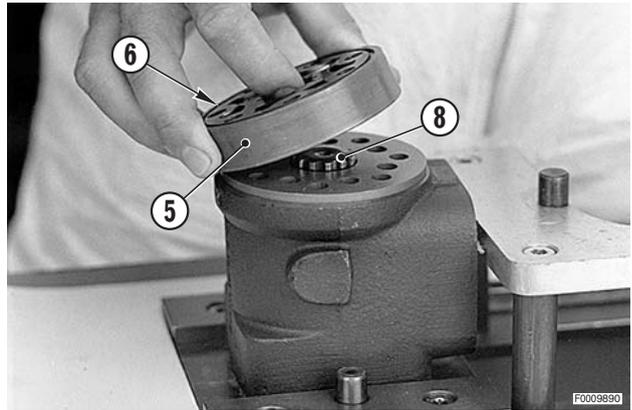
⚠ Fit the inner rotor (5a) on the shaft (8) so that the lowest part between two lobes of the rotor is aligned with the trim pin groove on the shaft. The rotate the outer rotor (5) to align the fixing holes.
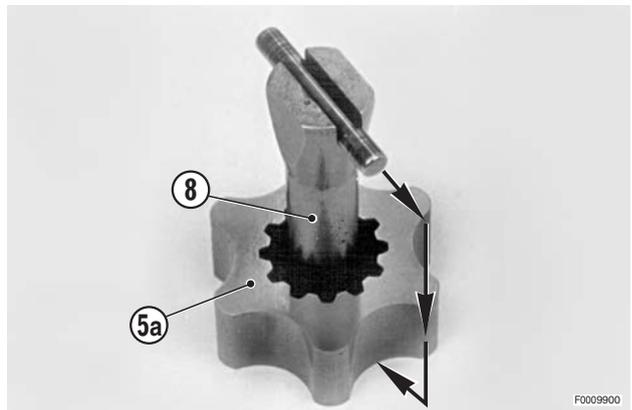
26 - Fit the distance piece (7).
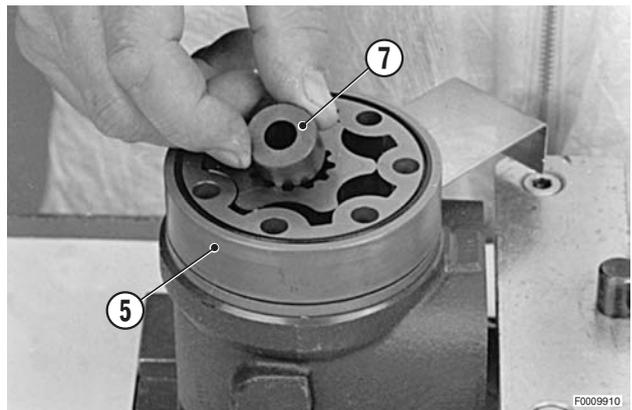
27 - Fit the cover (4).
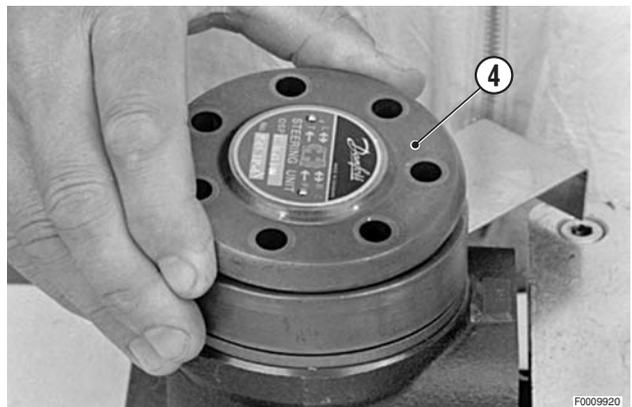
28 - Insert the special screw (3) complete with washer (2) in the hole shown in the photo.
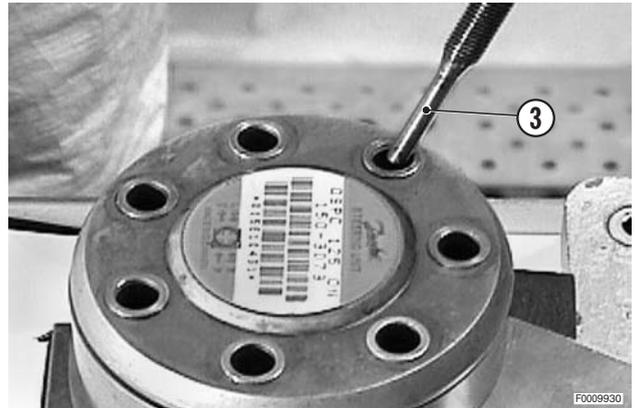
29 - Insert the six screws (1) with washers (2).
Tighten the screws(1) and (3) in crosswise pattern to a torque of 30±6 Nm (22.1±4.4 lb.ft.).
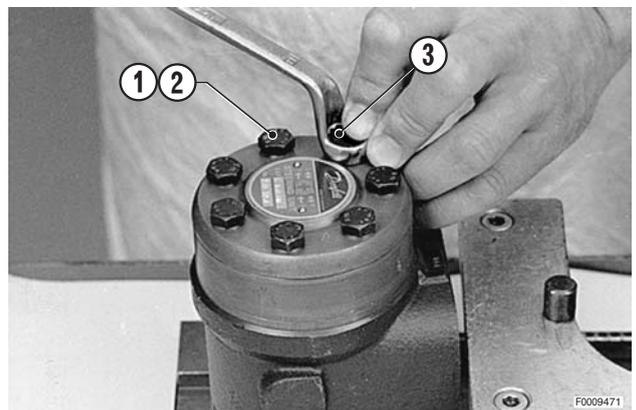
Assembly of the pressure relief valve

30 - Insert the valve (35).
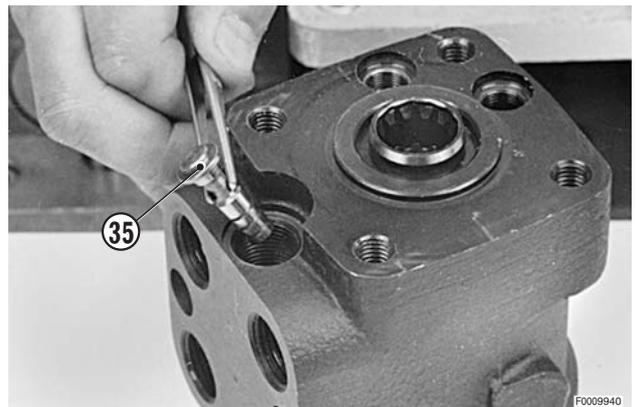
31 - Insert the spring (34)

32 - Fit the pressure adjuster screw (33).

★ Set the maximum operating pressure on a test bench.

★ Pressure: 180+10 bar (2610+145 psi)
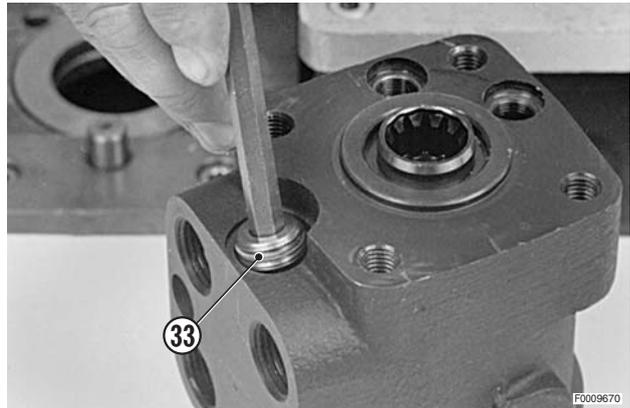
33 - Fit plug (31) complete with seal.

🔧 Plug: 50±10 Nm (36.8±7.4 lb.ft.)
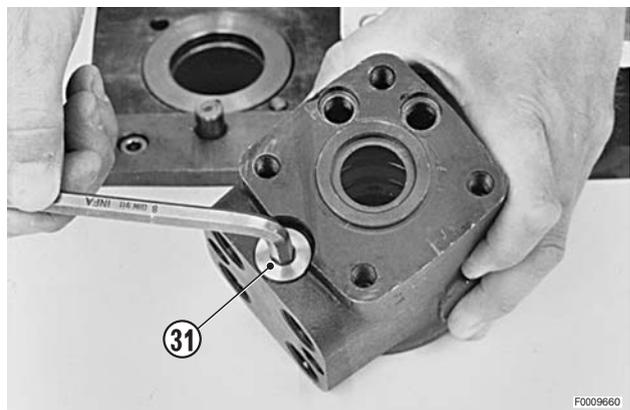
34 - Position the dust seal (24) in the power steering unit housing (18).
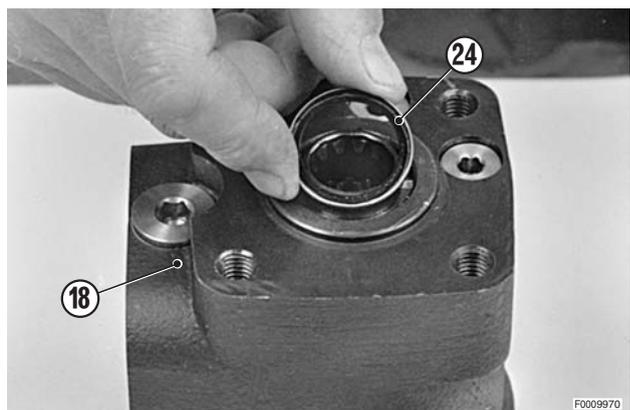
35 - Drive the dust seal (24) into its seating using a suitable drift and a plastic mallet.
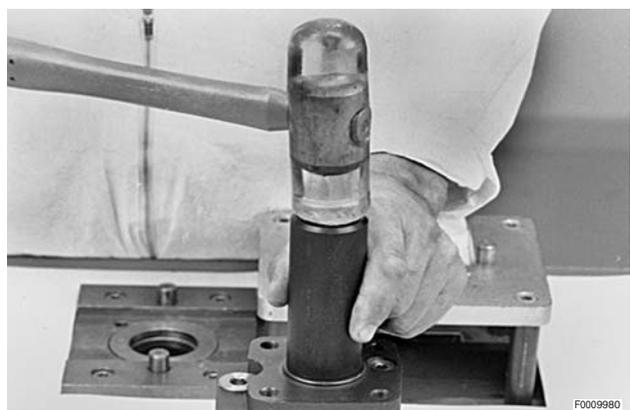
Assembly of shock valves

36 - Insert the balls (30), springs (29) and setscrews (28) in their sockets.
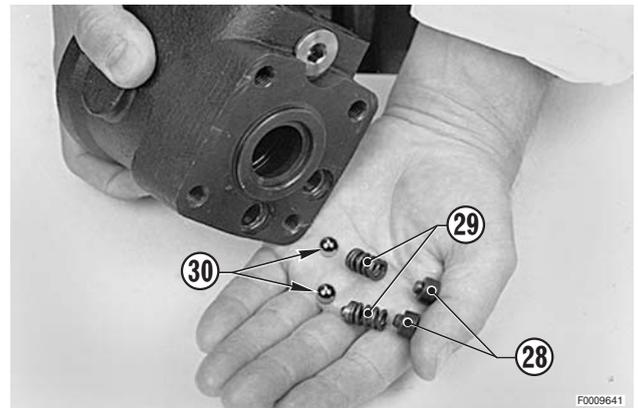
37 - Lock the setscrews (28) in their seats.
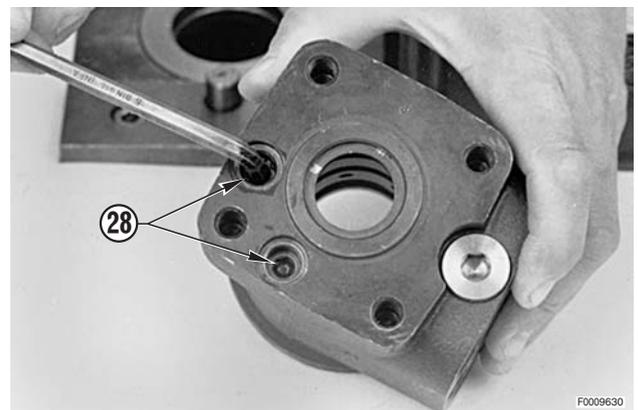
38 - Fit the seals (27) and screw in the plugs (26).

    🔧 Plugs: 30 Nm (22.1 lb.ft.)
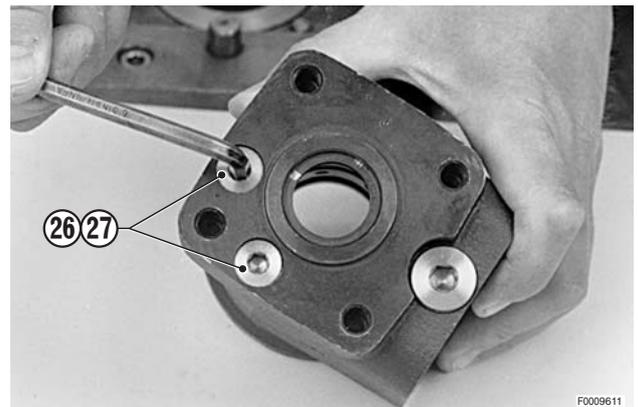
39 - Close off the oil ports with plastic plugs to prevent impurities getting in.

    ★ Fit the plugs by hand pressure alone; do not hammer.
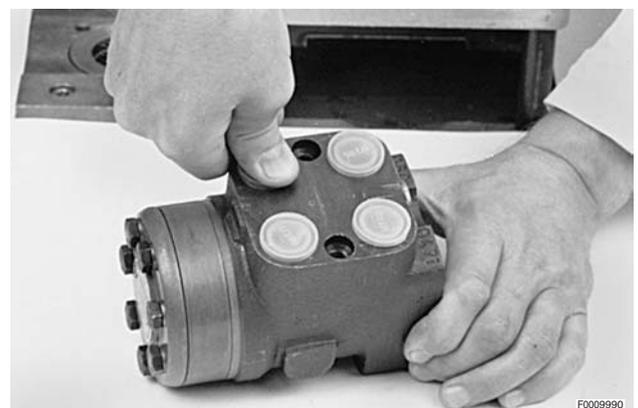
REMOVAL OF THE FRONT WHEELS

⚠ 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.
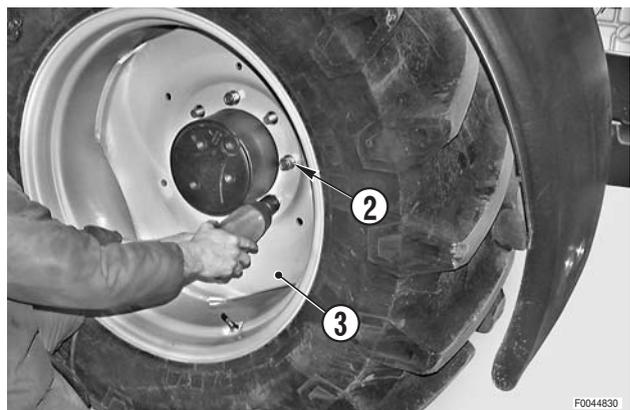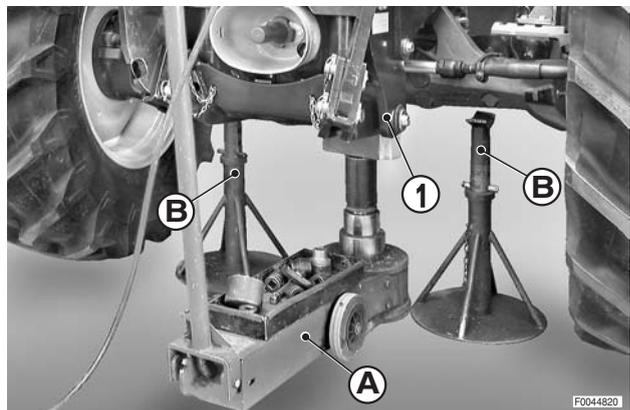
REFITTING THE FRONT WHEELS

• 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).

     kg   Fender assembly: 19 kg (42 lb.)

3 -   Unscrew and remove the bolts (2) and remove the fender (1) complete with the mounting bracket (3).
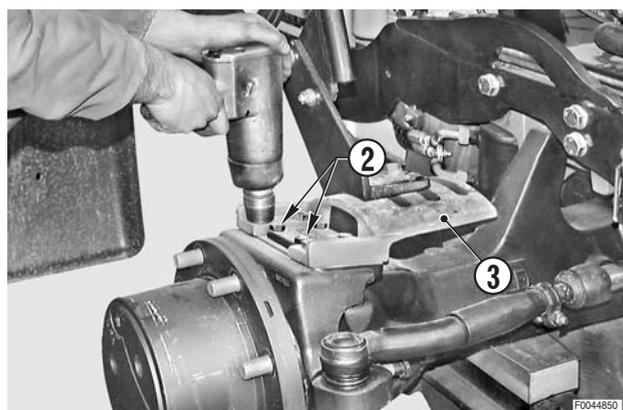
REFITTING THE FRONT FENDERS

•   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.
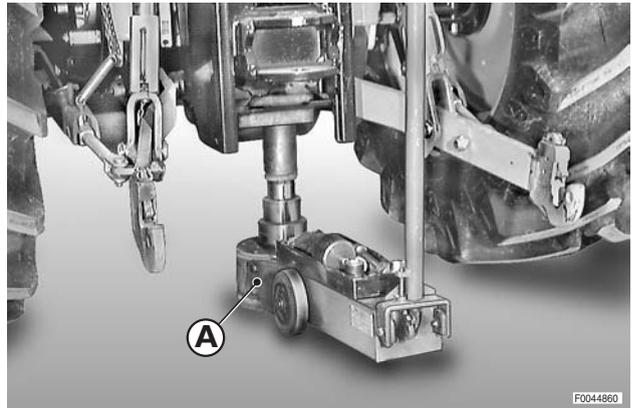
3 - Slacken off all the wheel nuts (1); leaving one (for safety) at the top of the wheel.

※ 1

4 - While holding the wheel vertical, remove the last wheel nut and remove the wheel (2).
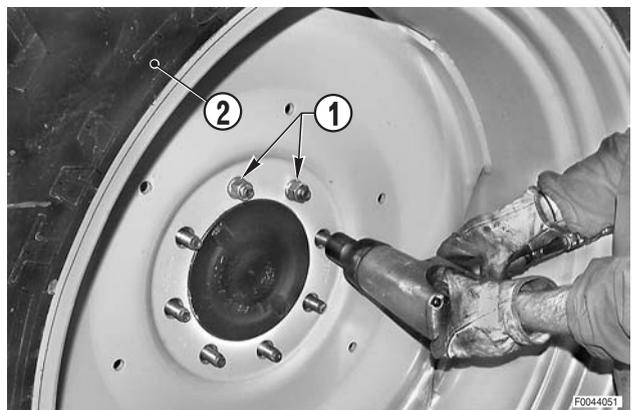
5 - Position under the rear axle an axle stand "**B**" with lateral retaining wings for safety and lower the trolley jack until the axle is resting on the axle stand.

★ 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.
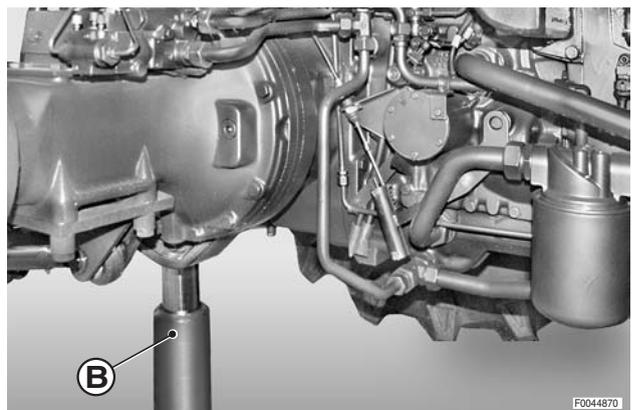
REFITTING THE REAR WHEELS

• Refitting is the reverse of removal.

※ 1

🕐 Wheel nuts:
M18x1.5: 350 Nm± 10%(258 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.
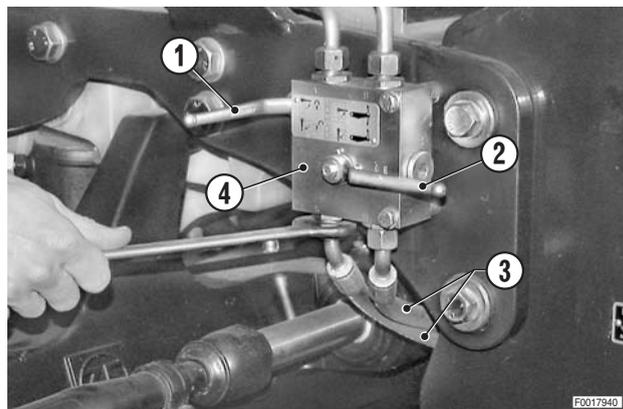
2 - Disconnect the rigid upper pipes (5), (6).

★ Plug the ends of the pipes to prevent the entry of contaminants.
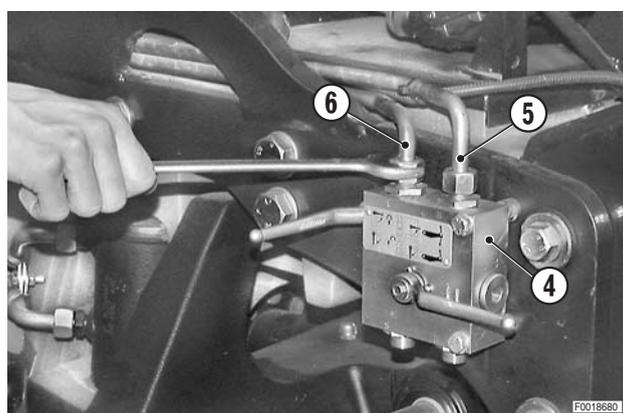
3 - Unscrew the bolts (7) and remove the valve block (4) with the rear spacers (8).
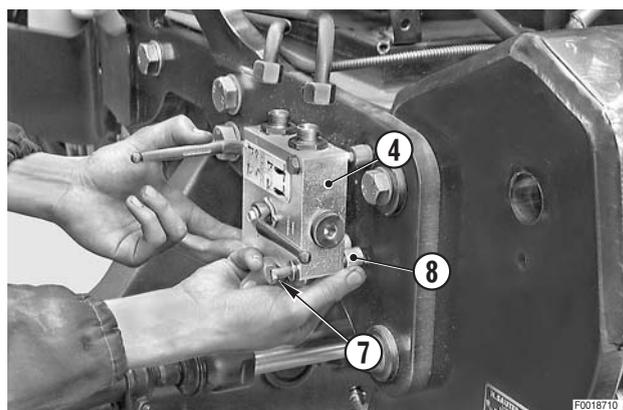
REFITTING THE LIFT VALVE BLOCK

• 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.).
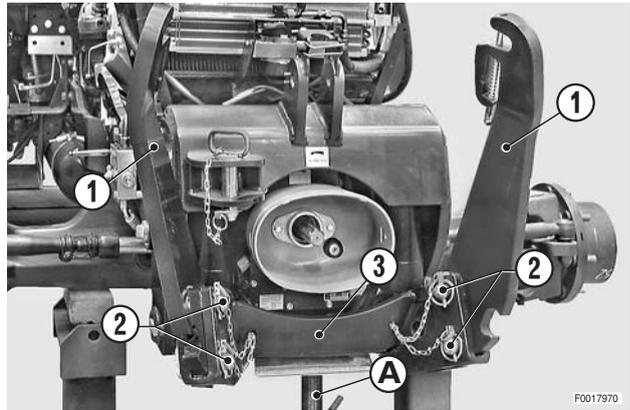
3 - Remove the bolts (4) and remove the upper pins (5) of the cylinders (6).
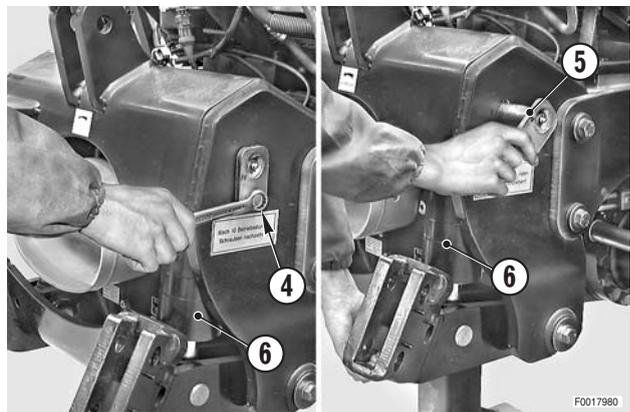
4 - Disconnect the cylinder feed pipes (8), (9) from the valve block (7).

   ⚠ 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.
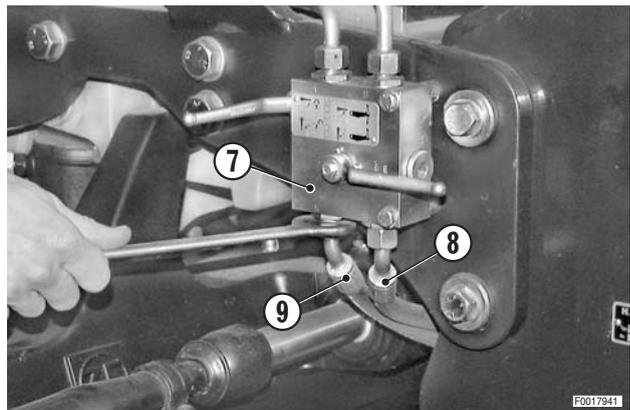
5 - Lower the jack "A" until the cylinders (6) can be tilted outwards in order to access the connection pipes and to align the hole provided for removal of the spring pins securing the lower pivot pins of the cylinders.
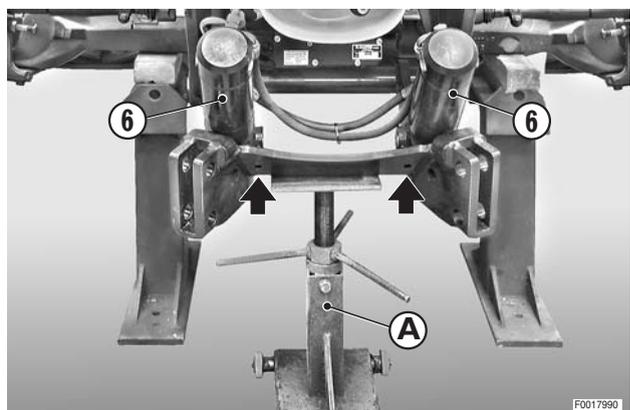
6 - Disconnect the four pipes (10) from the cylinders (6).
   ★ Label the pipes to avoid confusion on reconnection.
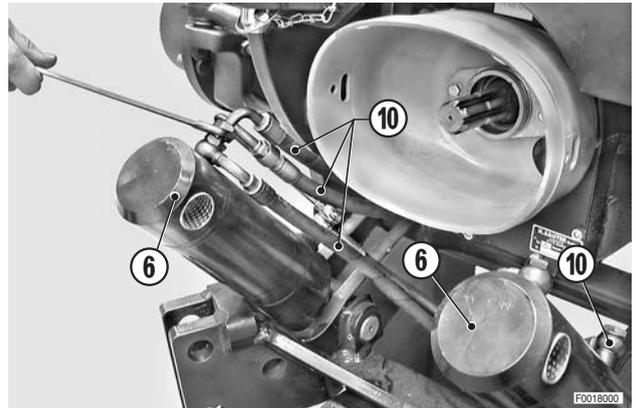
7 - Using a pin punch, remove the spring pins (11) securing the lower cylinder pivot pins.
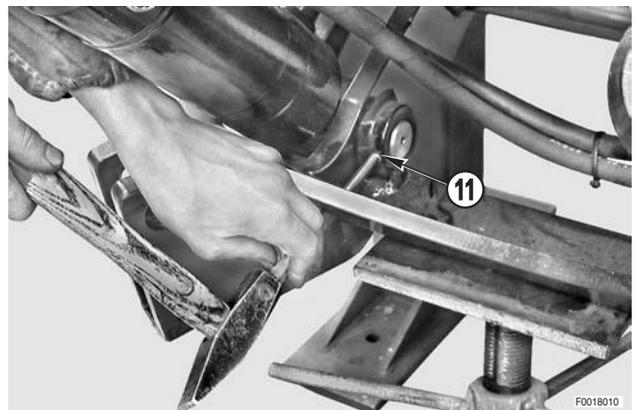
8 - Withdraw the pivot pins (12) and remove the cylinders (6).
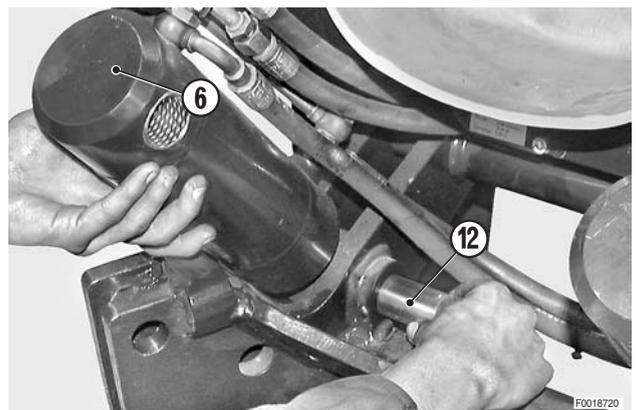
REFITTING OF THE FRONT LIFT CYLINDERS

• 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.

F0018020
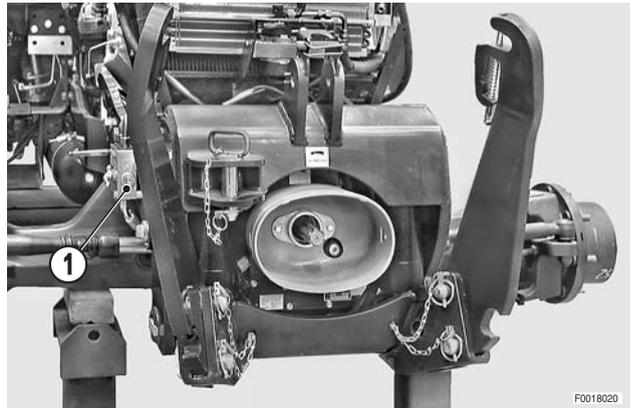
2 - Remove the lift arms (2) and the pivot pins (3) complete with their retaining chains.

3 - Remove the shaft end cover (4) and the shield (5).

F0018030
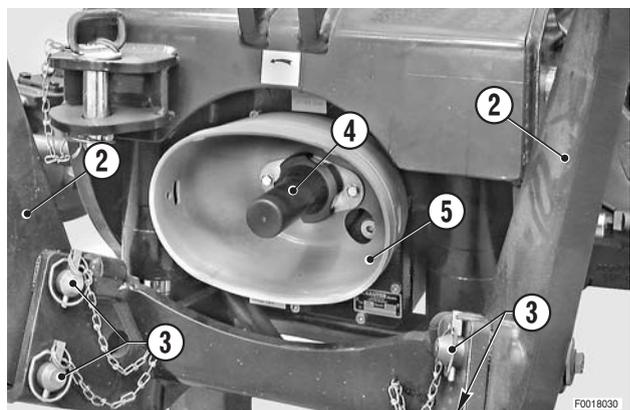
4 - Position under the lift assembly (6) a jack"**A**" that can be lowered by at least 10 cm. (4 in.).

F0017971
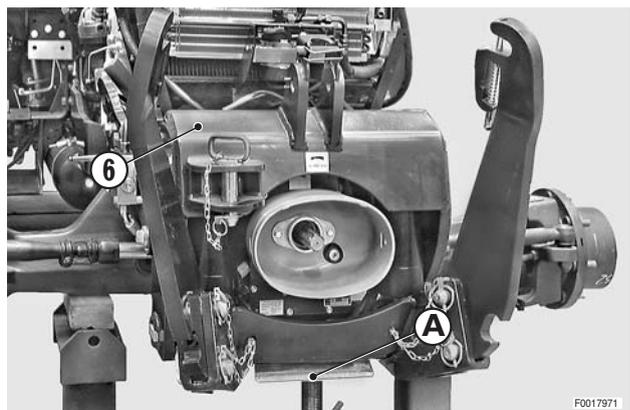
5 - Remove the bolts (7) and remove the upper pivot pins (8) of the cylinders (9).

F0017981
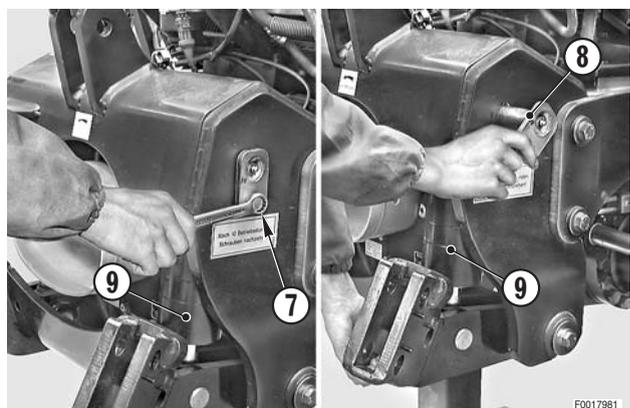
6 - Lower the jack"**A**" so that the cylinders (9) can be tilted outwards.

7 - Remove the jack"**A**" and guide the rocker assembly (10) to the vertical position.
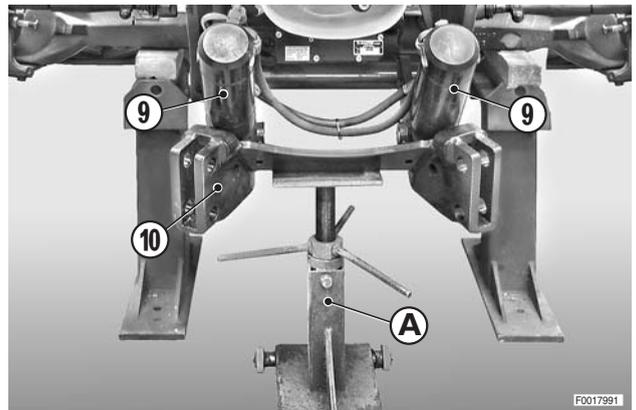
8 - Unscrew and remove the bolts (11) and washers (12) securing the brackets (13); recover the inner brackets (14).

9 - Remove the spacer (15) and the lower bushes (16).
   ★ Do not remove the upper bushes yet for safety.
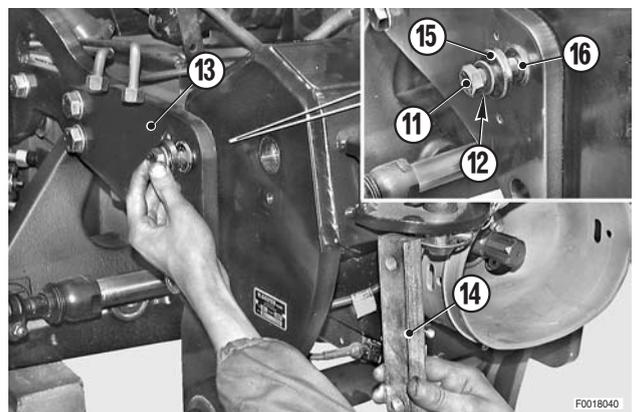
10 - Attach a hoist to the lift assembly (6) and put the lifting slings under slight tension.

   ⌂ kg   Lift: 80 kg (176 lb.)
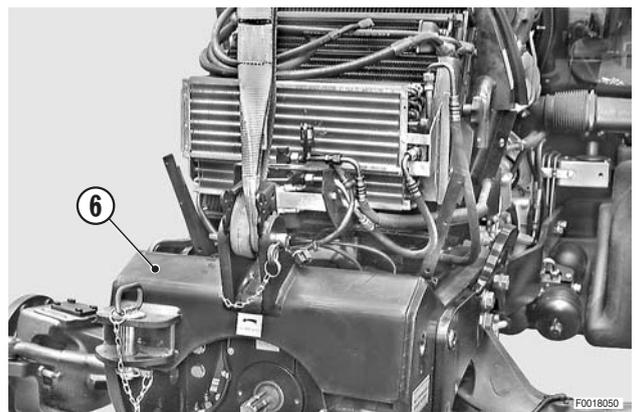
11 - Unscrew and remove the ten bolts (17) and washers securing the lift (6) to the front carrier.

   ※ 1

30-99
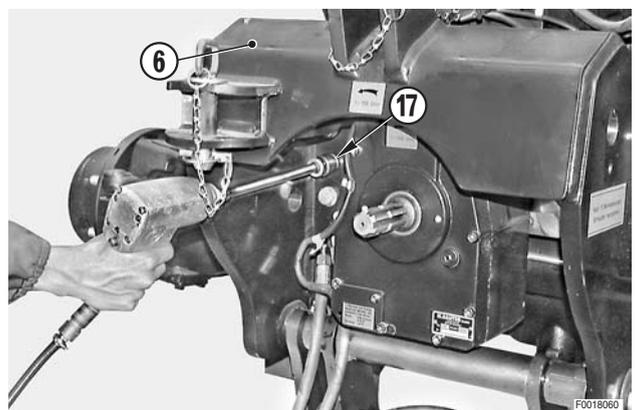
12 - Remove the upper bushes (16) but leave them in position for safety.
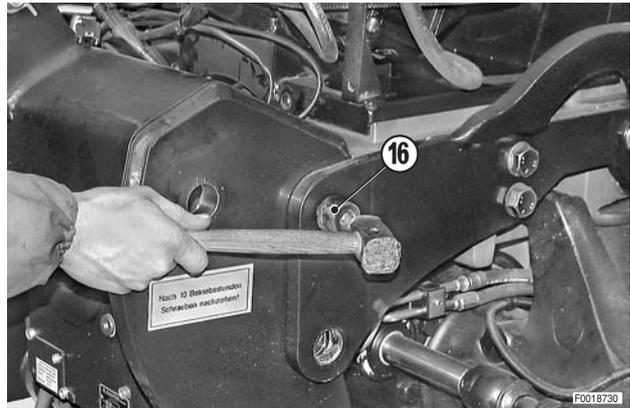
13 - Remove the lift assembly (6).
   ★ If necessary, use a lever to separate the assembly from the front locating dowels.

REFITTING THE LIFT ASSEMBLY

• Refitting is the reverse of removal.

※ 1

   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 AS-
SEMBLY»)

2 - Unplug the connector (1) and release the wiring from
the clip (2).

F0018080
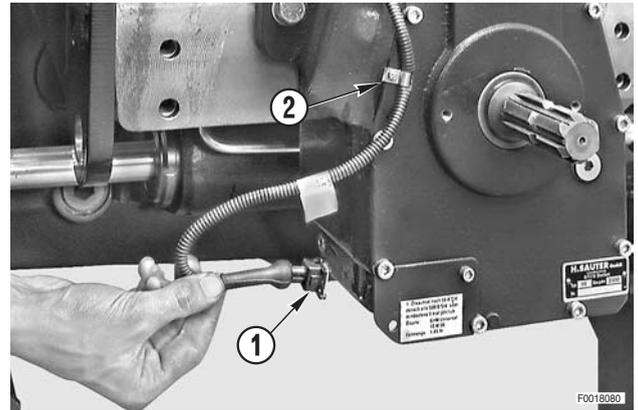
3 - Fully unscrew the bolts (3) securing the cardan shaft
(4) to the flexible coupling (5) and detach the flange.

F0017312
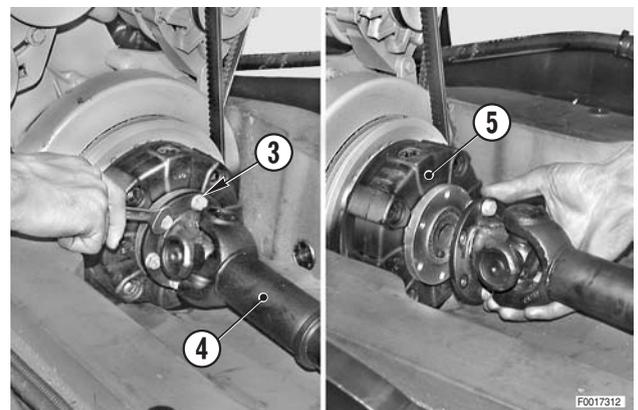
4 - Unscrew the four bolts (6) but only remove the two
lower bolts.

★ 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 neccessary, use a lever to help separate the as-
sembly from the tractor.

⏚ kg PTO: 70 kg (154 lb.)

F0018090
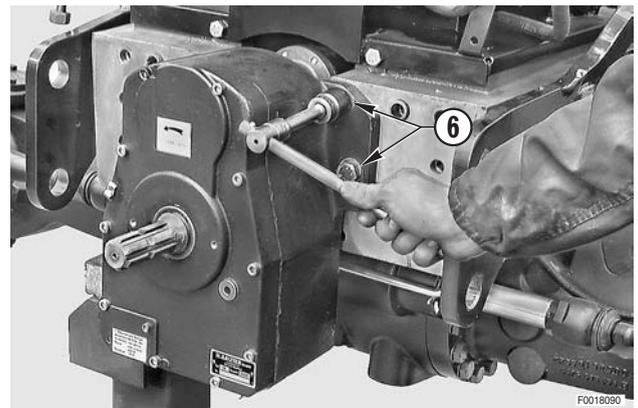
REFITTING THE FRONT PTO ASSEMBLY

• Refitting is the reverse of removal.

⚹ 1

🔧 Screw:214 Nm (157.7 lb.ft.)

F0018100
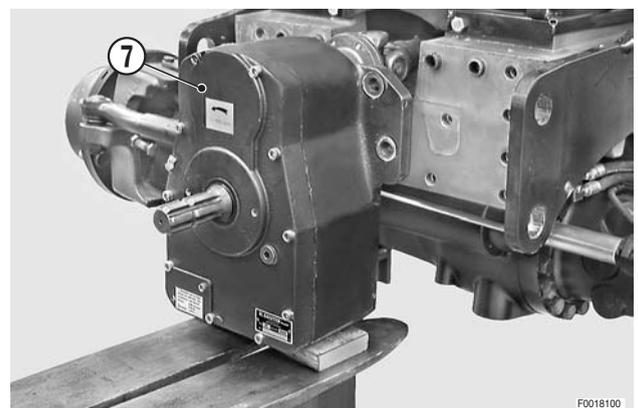
REMOVAL OF THE FRONT SUSPENSION CYLINDERS
(Where fitted)

⚠ All operations must be carried out with the parking brakes applied.

1 - Operate the button in the cab to activate the front suspension, fully extending the suspension cylinders.

2 - Position and tighten a jack "**A**" under the front carrier (1).
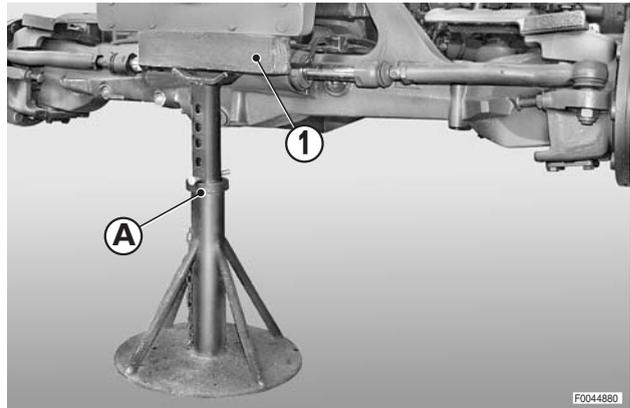
3 - Deactivate the suspension so that the cylinders are fully retracted.

4 - Support the swinging support (2) on a stand "**B**" that can be lowered through10-12 cm (4- 5 in.) and switch off the engine.

5 - Remove the front wheels.
(For details, see «REMOVAL OF THE FRONT WHEELS»).
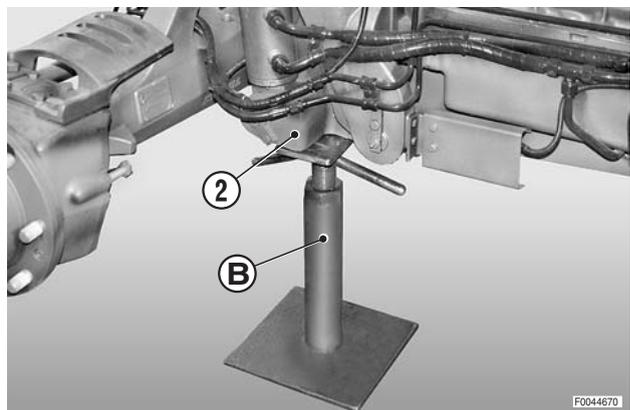
⚠ Discharge residual pressure from the suspension system by unscrewing the front and rear valves (3) approximately two full turns.

★ Wait a few minutes after discharging the pressure, then re-close the valve.

6 - Remove the reinforcing side members.
(For details, see «REMOVAL OF THE REINFORCING SIDE MEMBERS»).
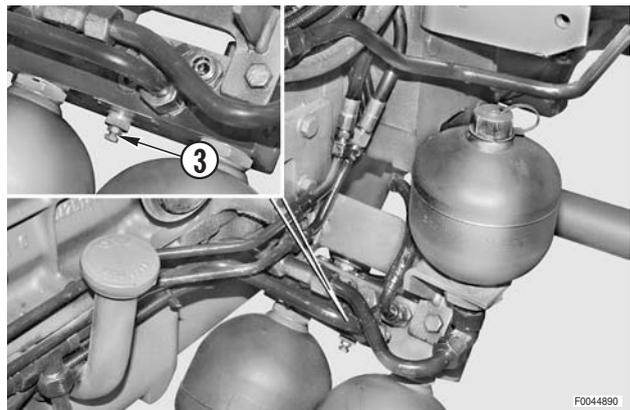
7 - Disconnect the pipes (5), (6) from the left cylinder (4).

⚠ 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.

★ Plug the ends of the pipes to prevent the entry of contaminants.

8 - Unplug the steering sensor connector (7)
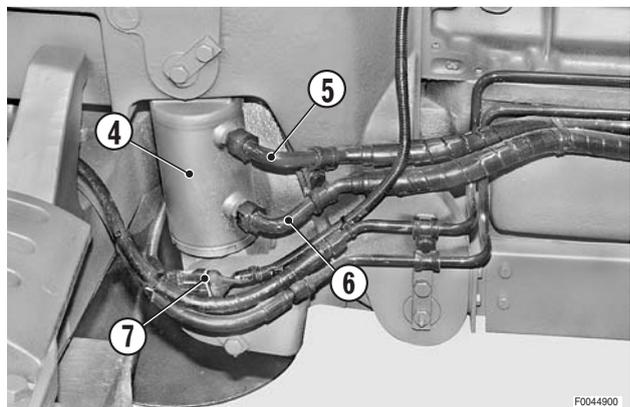
9 - Disconnect the pipes (9), 10 from the right-hand suspension cylinder (8).; disconnect the locking differential pipe (11).

★ Plug the pipes to prevent impurities getting in.

F0044910
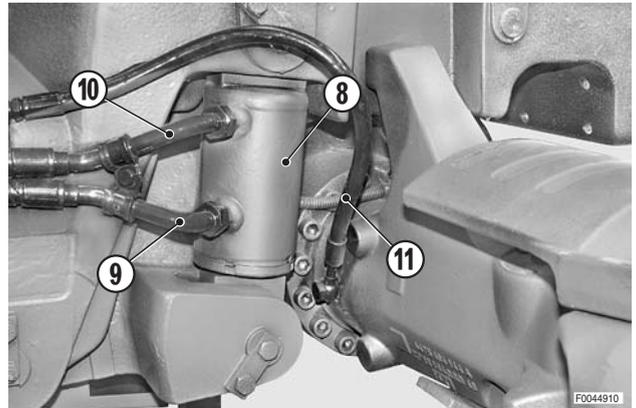
10 - Remove the bolts (12) and the plates (13) securing the upper cylinder pivot pins.

F0018202
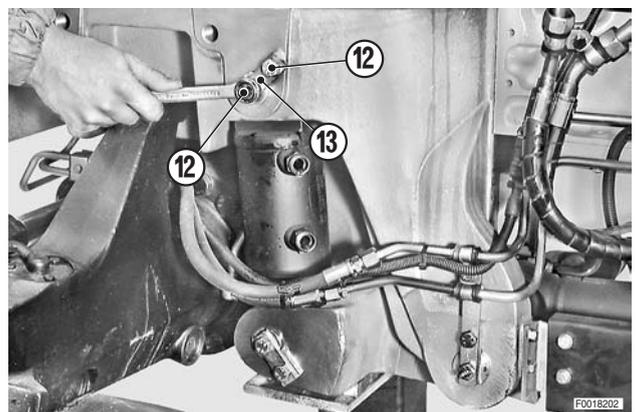
11 - Using a slide hammer puller, remove the upper pivot pins (14).

F0018212
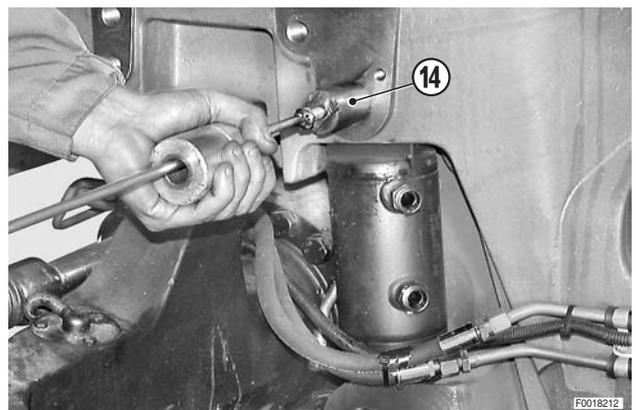
12 - Disconnect the steering cylinder pipes (15).

★ Plug the ends of the pipes to prevent the entry of contaminants.

F0044920
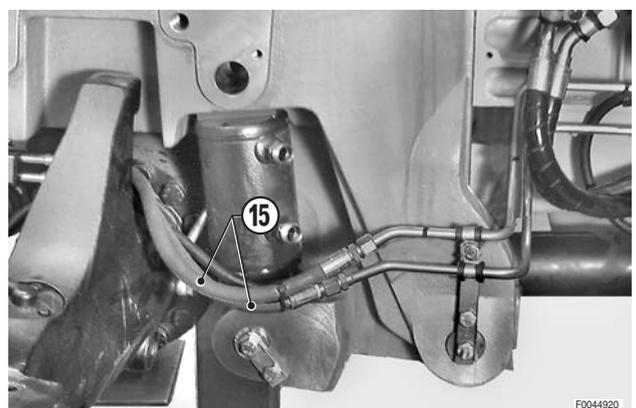
13 - Lower the support (2) to disengage the upper mountings of the cylinders (4), (8).
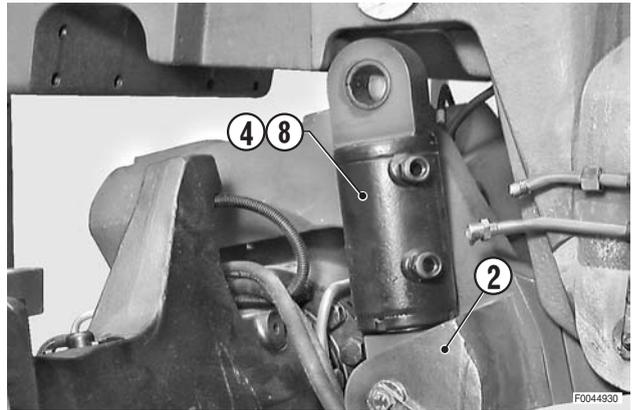
14 - Remove the bolts (16) and the plates (17) of the lower pivot pins.
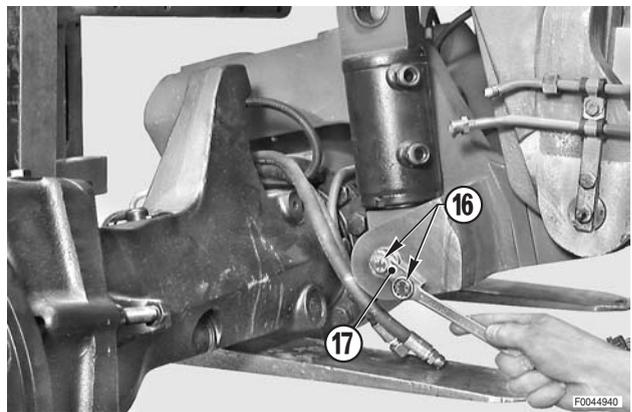
15 - Using the slide hammer puller, remove the lower pivot pins (18) and the cylinders (4), (8).
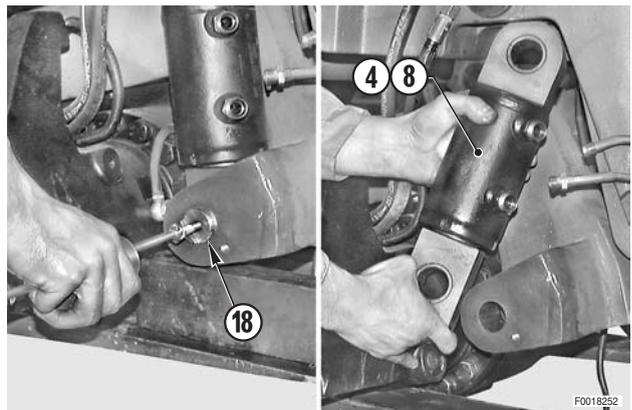
REFITTING THE FRONT SUSPENSION CYLINDERS

• 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).

F0041180
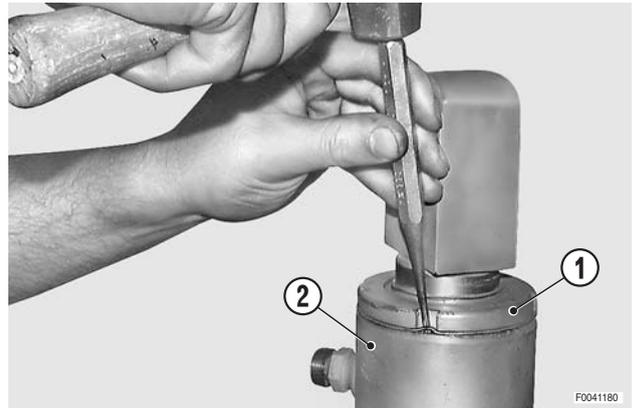
2 - Using a pin wrench, unscrew the end cap (1).

✕ 1

F0041190
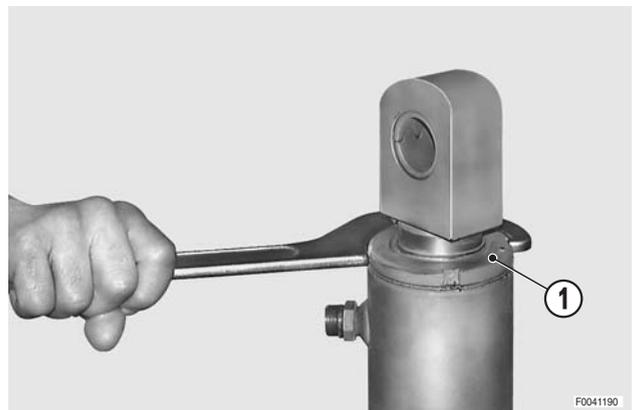
3 - Withdraw the rod (3) complete with end cap (1) and seals.

✕ 2

F0041200
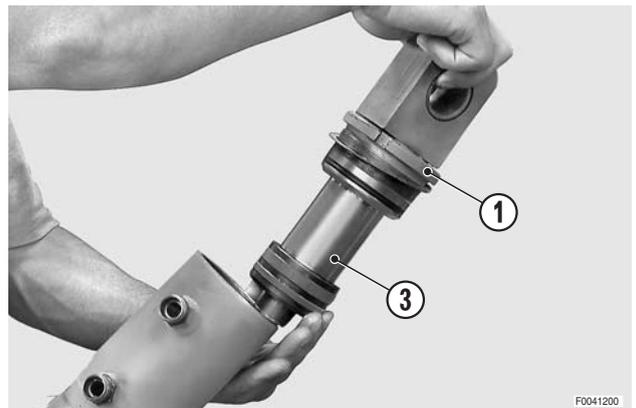
4 - Heat the eye of the piston (4) to a temperature of 100–120 °C (212–248 °F) and unscrew it from the rod (3).

✕ 3

F0041210

30-105
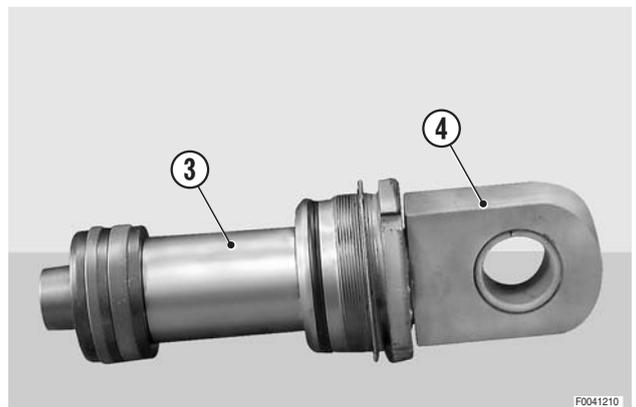
5 - Withdraw the end cap (1) from the rod and remove in order the rod wiper (5), the seals (6), (7) and the guide (8).

⁅ ※ 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.

D0005380
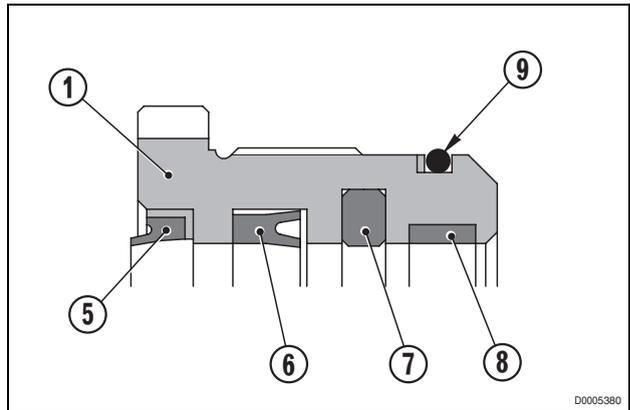
7 - Remove the seal (11) and the guide (12) from the piston (10).

★ Take care not to damage the seal seating.

D0005390
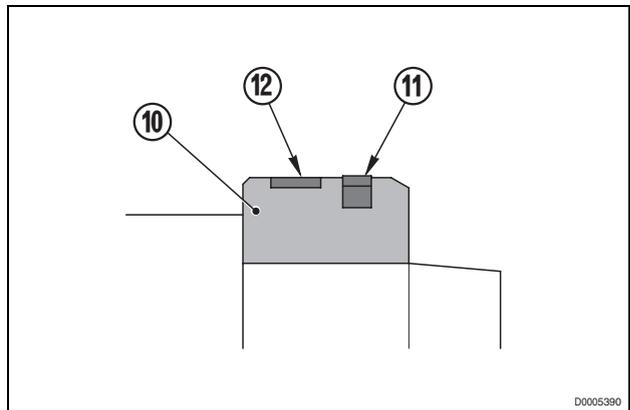
2. Assembly

- 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).

F0041220
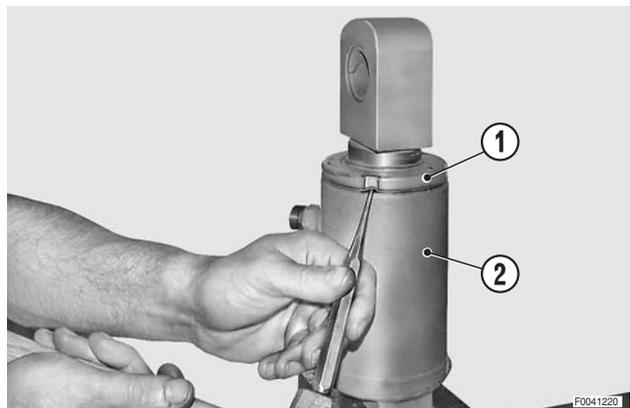
REMOVAL OF THE FRONT AXLE AND SWINGING SUPPORT
(Versions with front suspension)

⚠️ All operations are to be carried out with the parking brake applied.

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: 302 kg (665 lb.)
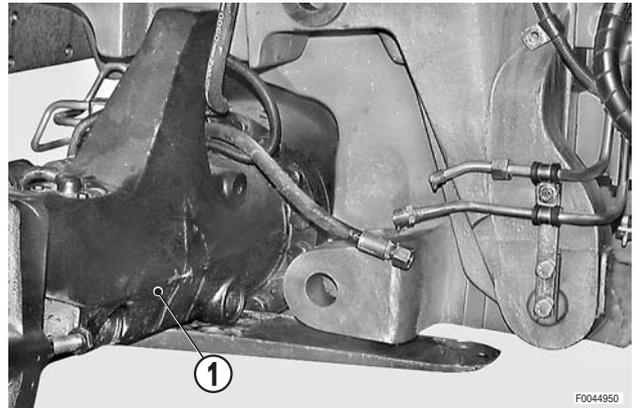
3 - Remove the cover and the 4WD shaft.
(For details, see «REMOVAL OF THE 4WD PROPELLER SHAFT»).
Disconnect the differential lock pipe (2).

★ Plug the ends of the pipes to prevent the entry of contaminants.
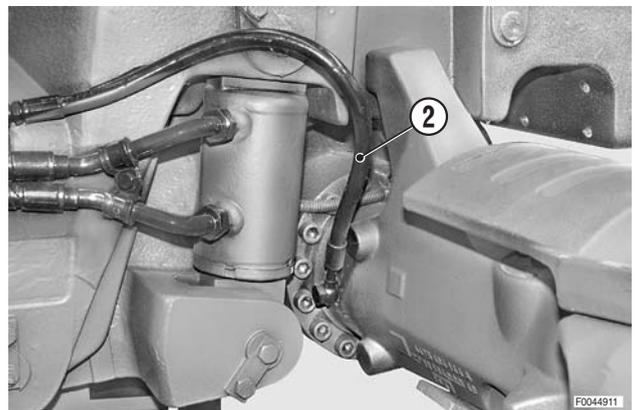
4 - Remove the support (3) of the position sensor (4) and unplug the connector (5).   ※ 1
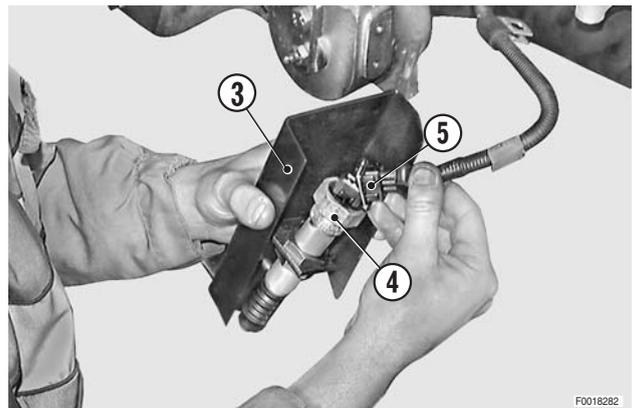
5 - Remove the plates (6) securing the pivot pins (7) of the swinging axle support (8).

6 - Loosen the screw of the clips for the rigid steering pipes and rotate the plate (6) to the left to release the pivot pin (7).
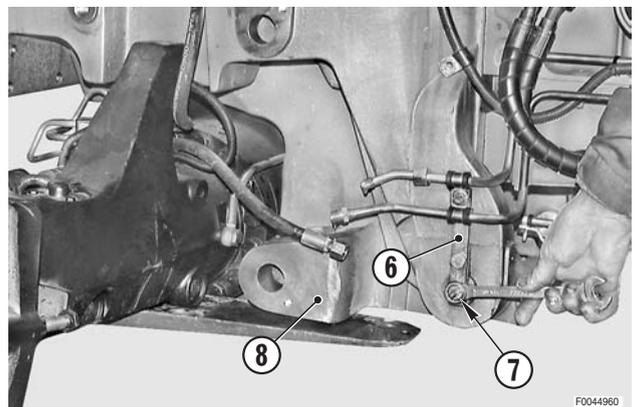
7 - Using a suitable drift made of soft material (aluminium, copper, etc.,), remove the pivot pins (7).

8 - Slowly lower the jack and remove the swinging support (8) complete with the axle (1).
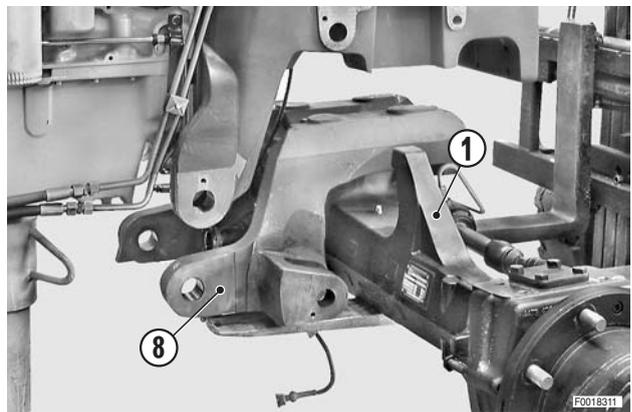
9 - Remove the screws (9) and remove the plate (10) securing the axle pivot pin (11).
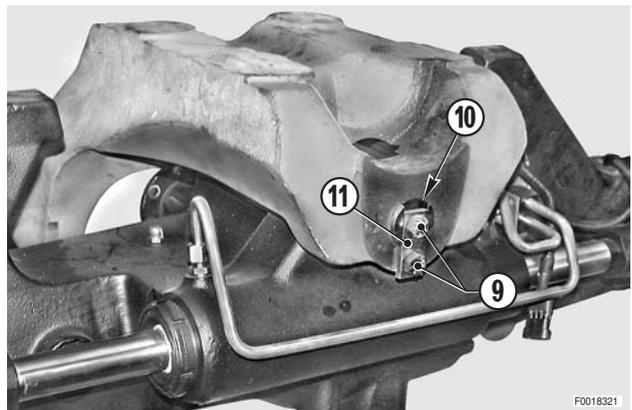
10 - Attach the swinging support (8) to lifting slings and attach the slings to a hoist; put the slings under slight tension.

11 - Using a suitable drift made of soft material (aluminium, copper, etc.,), drive out the axle pivot pin (11) and remove the swinging support.   ※ 2
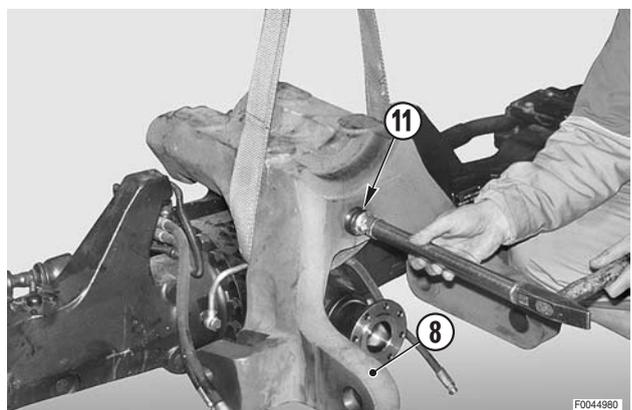
REFITTING THE FRONT AXLE AND SWINGING SUPPORT

- 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 SEN-SOR»).

☒ 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 fully the axle pivot pins, the swinging support and cylinder and piston mountings.

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.
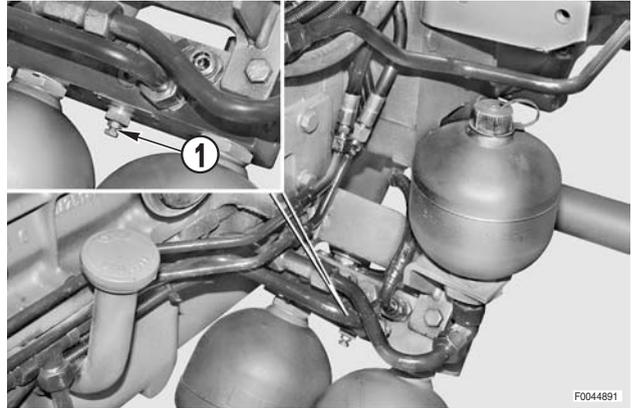
1 - Unplug the connectors (2) from the solenoid valves (3).

★ Label the connectors and solenoid valves to avoid confusion on reconnection.
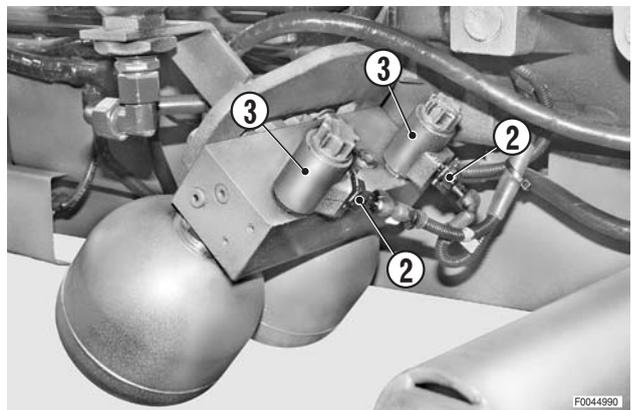
2 - Disconnect the five connecting pipes (4).

⚠ 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).
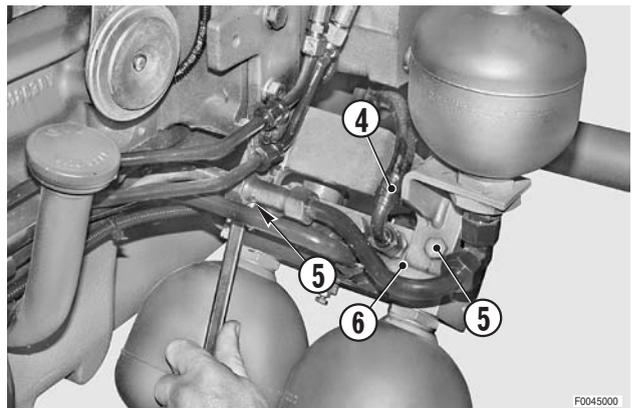
REFITTING THE FRONT SUSPENSION VALVES

• 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).
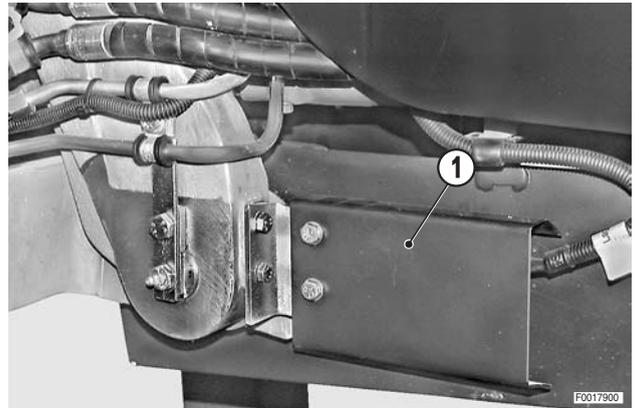
2 - Loosen the rear nut (2).

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).
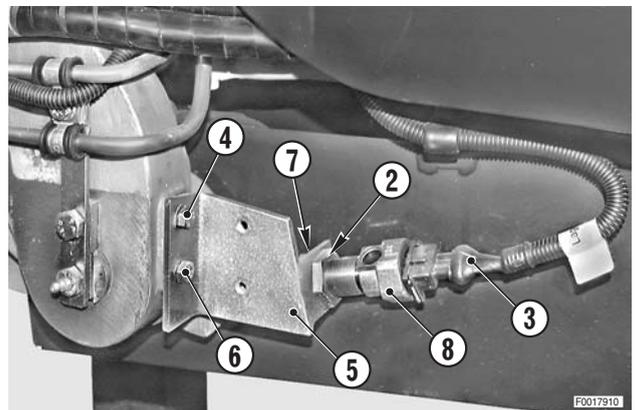
2. Positioning

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.
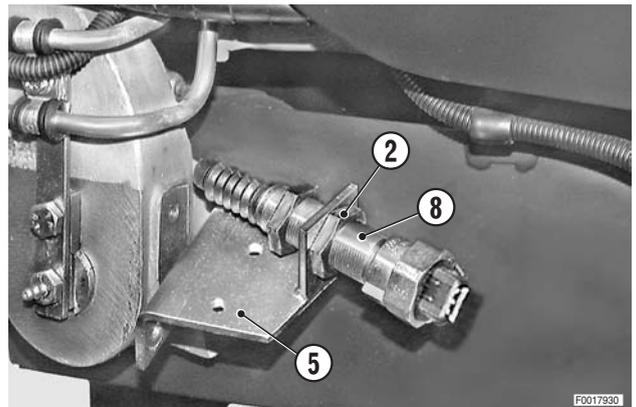
2 - Fix the support (5) and push the sensor (8) in the direction "**X**" until the pin (9) is fully retracted.

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.)
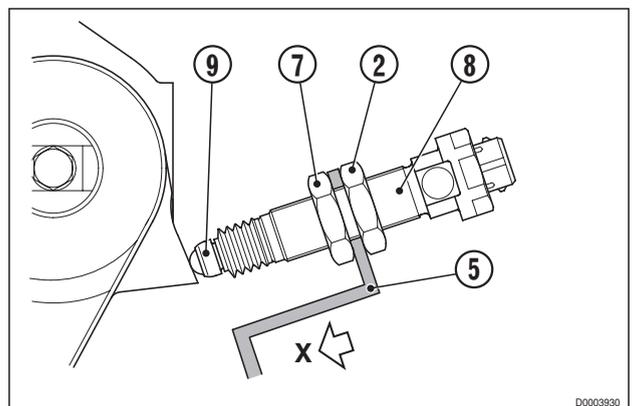
3. Testing

1 - Connect the test lead **T2** (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 ART program. (For details see ART in section 20)

2 - Stop the engine, disconnect the lead **T2** (code 5.9030.743.1) and reconnect the wiring to the sensor.

3 - Refit the cover (1).

F0022062
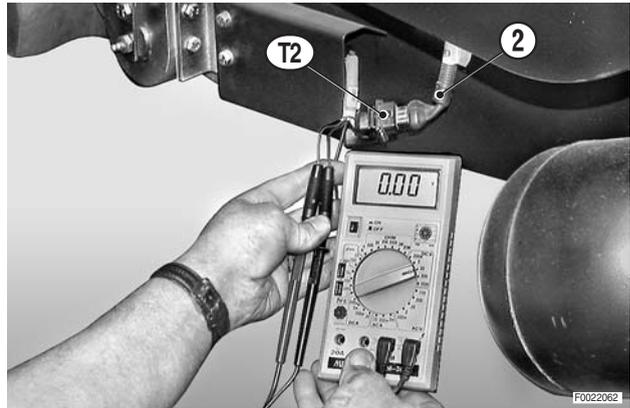
REMOVAL OF THE REINFORCING SIDE MEMBERS
(For versions with front lift only)

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.

   ⬚kg Side member: 45 kg (99 lb.)

F0045010

4 - **Right side member (1):** Unscrew and remove the front bolts (2) complete with their washers and recover the spacers (3).   ※ 1

F0045020
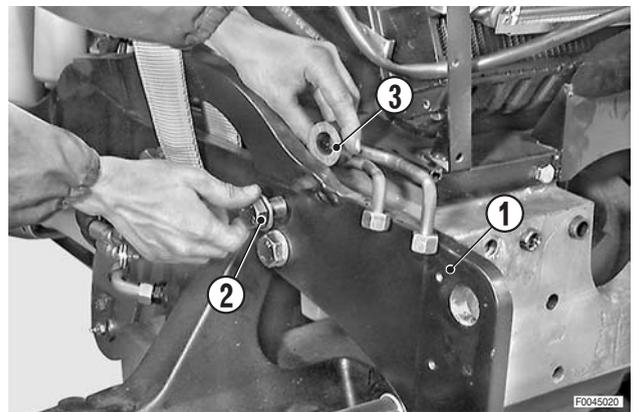
5 - **Left side member (4)**: Unscrew and remove front bolts (2) as per the right side member and the two rear bolts (5) complete with washers.   ※ 1

F0045030
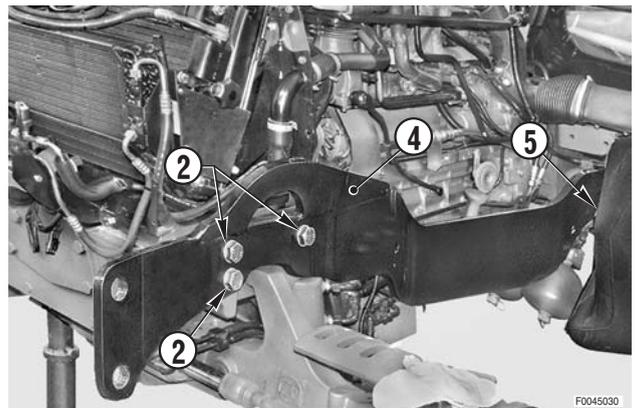
REFITTING THE SIDE MEMBERS

• Refitting is the reverse of removal.

※ 1

   ⬚Nm Bolts M16: 214±21 Nm (158±15.5 lb.ft.)
   Bolts M20: 455±21 Nm (335±15.5 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.

※ 1

F0018340
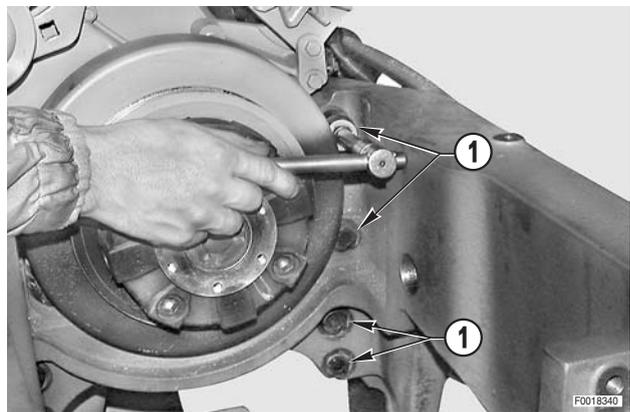
3 - Attach lifting slings to the front carrier (2), attach the slings to a hoist and put them under slight tension.

4 - Remove the bolts (1) with their washers and remove the front carrier (2). ※ 2
   ★ If necessary, use a lever to separate the locating dowels from the engine.

F0045040
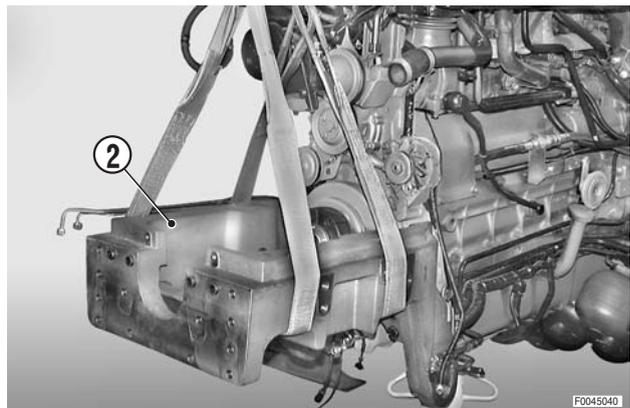
REFITTING THE FRONT CARRIER

- Refitting is the reverse of removal.

※ 1

🔧Nm Bolts: 260±10% Nm (191.6±10% lb.ft.)

※ 2

🛢 Locating dowels: grease

1 - Start the engine and operate the controls to expel air from the various systems.

RENEWAL OF THE ACCELERATOR POTENTIOMETER

⚠ Remove the battery cover and disconnect the negative battery lead (–).

1 - Loosen the grub screw, remove the accelerator pedal (1) and remove the front floor mat (2).

2 - Unplug the connector (3).

3 - Remove the screws (4) and remove the potentiometer (5).
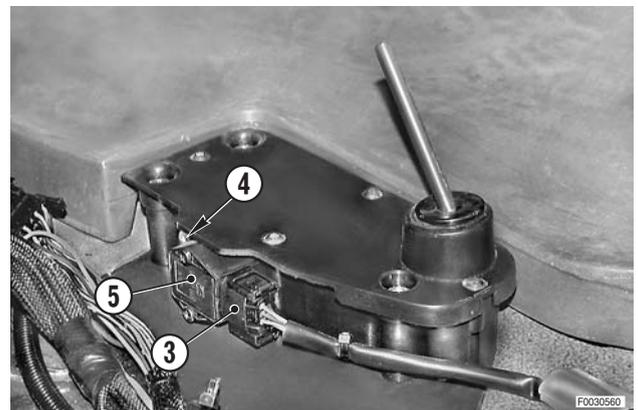
REFITTING THE ACCELERATOR POTENTIOMETER

• Refitting is the reverse of removal.

1 - When fitting a replacement potentiometer, check the engine speed settings with the programming/diagnostics tester.

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 - Unplug the fuel level sensor connector (1).
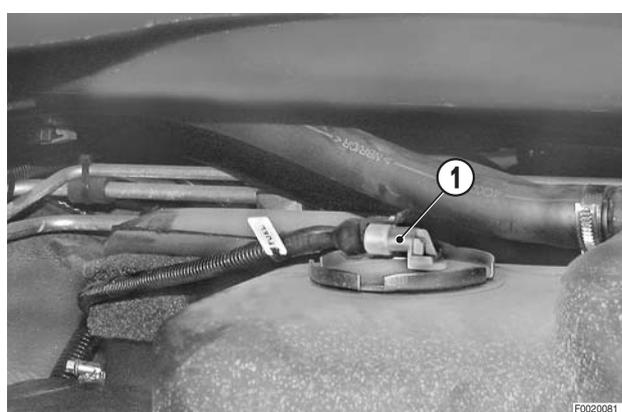
3 - Label the fuel pick-up and return pipes (2), (3).
Loosen the retaining clamps (4) and disconnect the pipes.
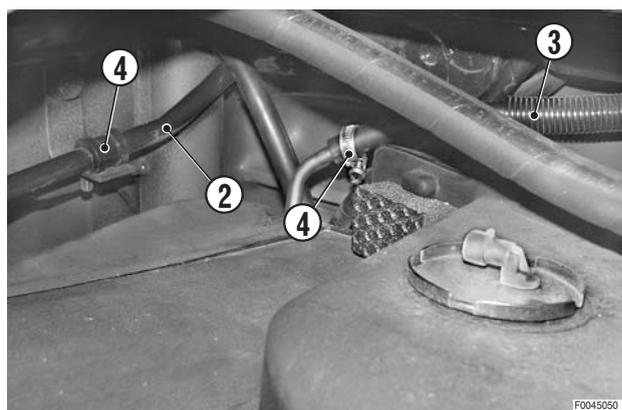
4 - Remove the bolts (5) and remove the locating discs (6) of the fuel tank (7).
★ Label the discs to avoid confusion on reassembly.
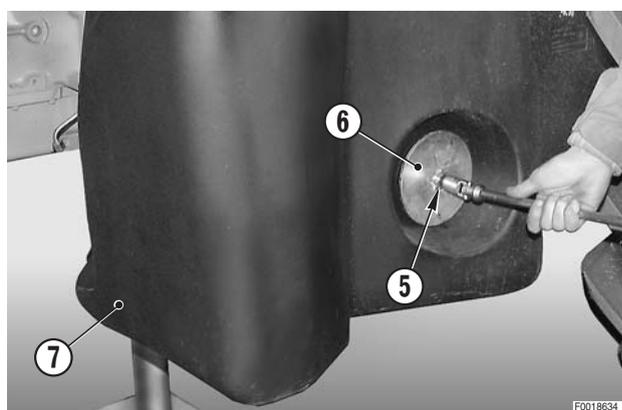
5 - Support the fuel tank (7) with lifting equipment and withdraw it from the guide tubes.
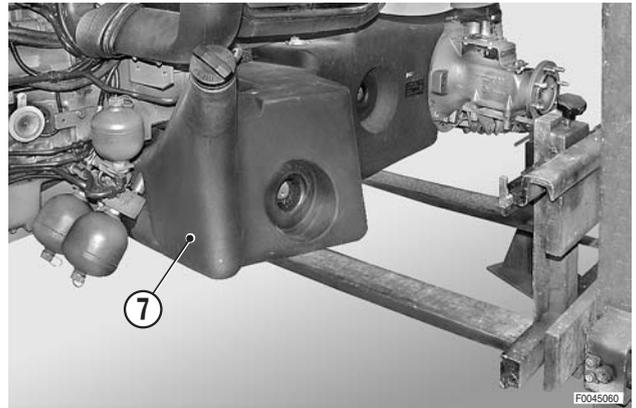
REFITTING THE FUEL TANK

• Refitting is the reverse of removal.

REMOVAL OF THE GEARBOX GEAR PUMP

⚠ 1 - Switch off the engine, remove the key from the ignition and apply the parking brake.

2 - Allow the engine to cool down to ambient temperature.

1 - Remove the right-hand side panel.
(For details see «REMOVAL AND ADJUSTMENT OF THE ENGINE HOOD AND SIDE PANELS»).

2 - Remove the cab.
(For details see «REMOVAL OF THE CAB»).

3 - Disconnect the suction and delivery pipes (2) and (3) from the pump (1).

★ Plug the pipes to prevent impurities getting in.
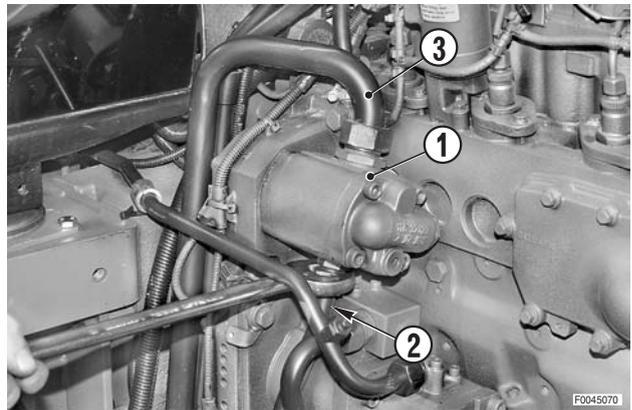
4 - Remove the screw (4) and remove the complete cover (5).
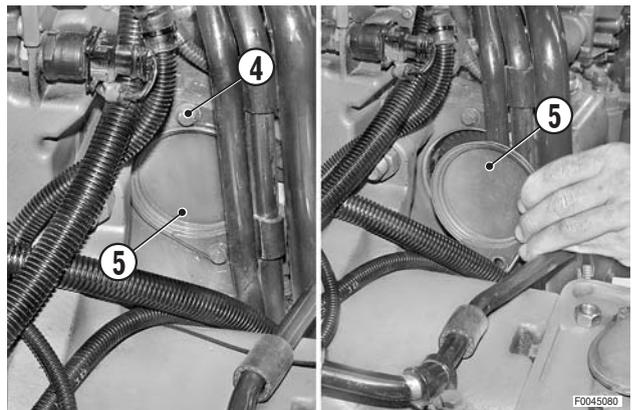
⚠ Before proceeding, close the passage between the lower part of the pump gear and the engine sump.

★ Use non-crushable material.

5 - Remove the nut (6) securing the gear (7) and the washer (8).
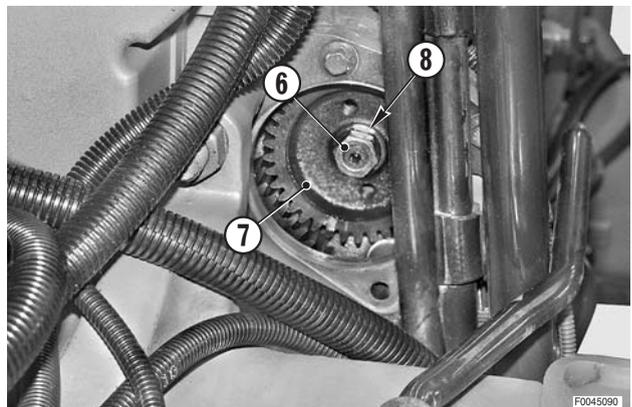
6 - Turn the engine over by hand so that the slot for the machine key is in the top position.
Using puller **T3** (code 5.9030.895.0) withdraw the pump drive gear (7).
Remove the machine key.

⚠ Take care not to drop the key into the crankcase.
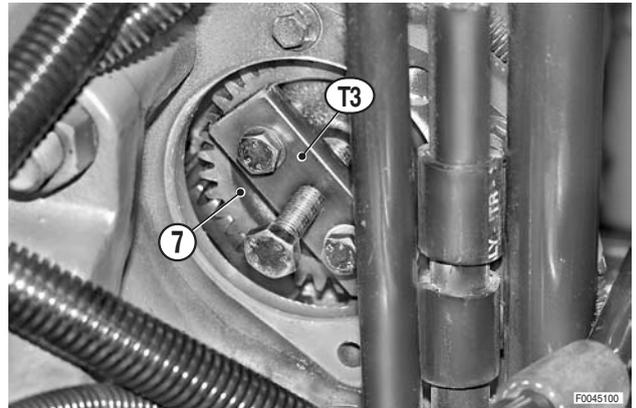
7 - Unscrew and remove the bolts (9) and remove the pump (1).
★ Recover also the gasket (10) that should be renewed on reassembly.
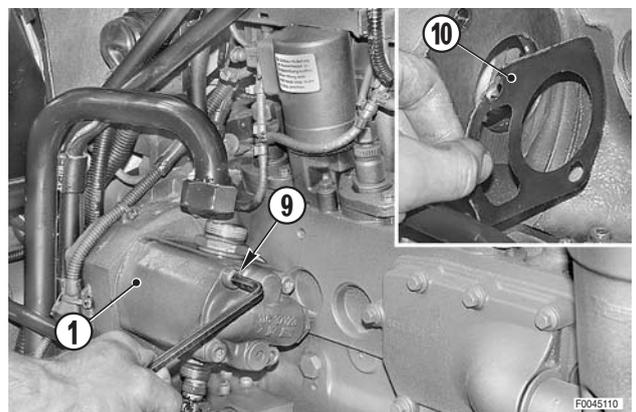
REFITTING THE GEARBOX GEAR PUMP

• Refitting is the reverse of removal.

1 - Position the gasket (10).
★ To hold the gasket in place, apply grease to the contact surface of the engine.

2 - Position the machine key (11) on the pump shaft with the slot facing upwards.
★ Keep the flat face of the key inclined towards the gear hub spline.
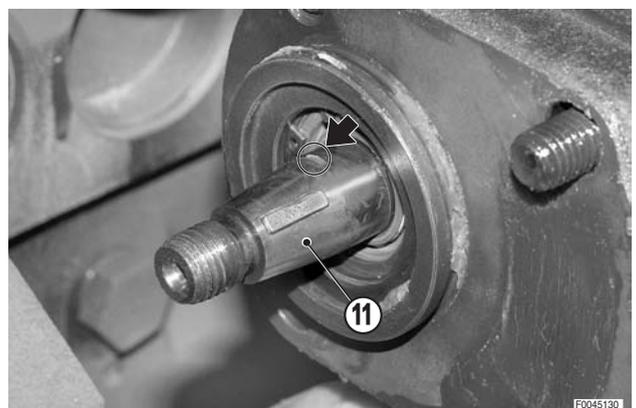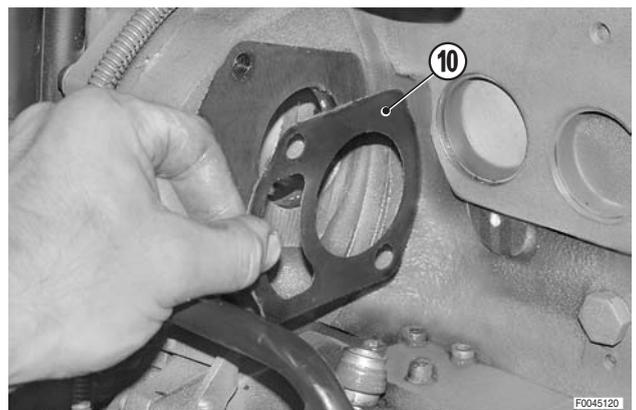
3 - Fit the pump (1) and gear (7) simultaneously.

   ★ To help seat the gear and the machine key cor-
     rectly, gently turn the pump (1).
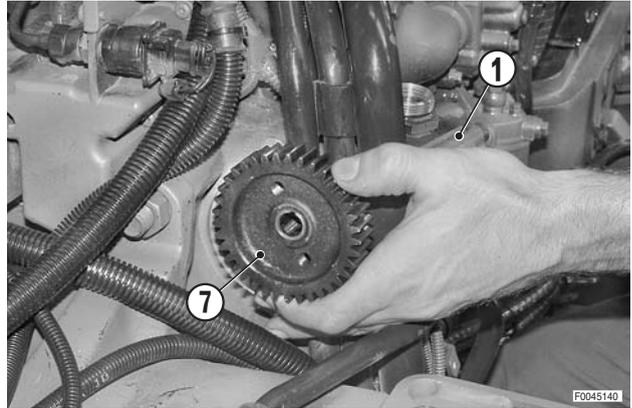
4 - Hold the gear (7) in position by hand tightening the nut
   (6) with the washer (8).
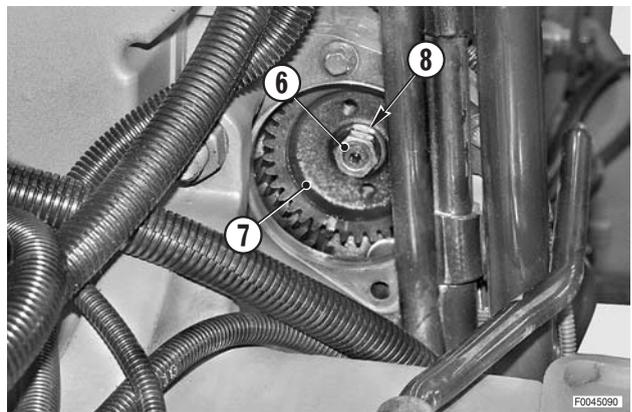
5 - Tighten down the pump with the bolts (9).

   ★ Tighten alternate bolts gradually in sequence.

   ✎ Nm M10 bolts: 50±10 Nm (36.9±7.4 lb.ft.)

6 - Secure the gear (7) with the nut (6).

   ✎ Nm M12x2.5 nut: 50±10 Nm (36.9±7.4 lb.ft.)
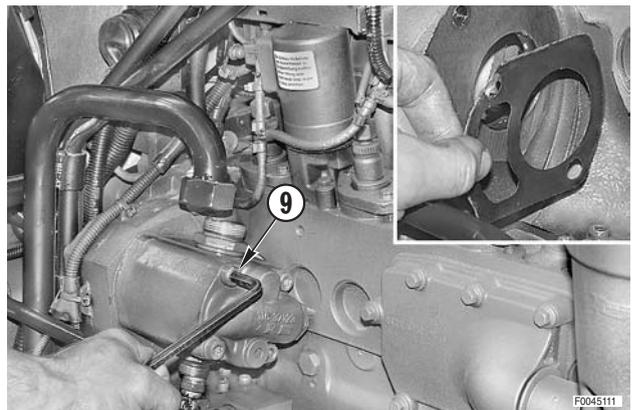
7 - Remove the material closing the passage between the
   engine sump and fit the cover (5).

   ★ Carefully check the condition of the O-ring (12).
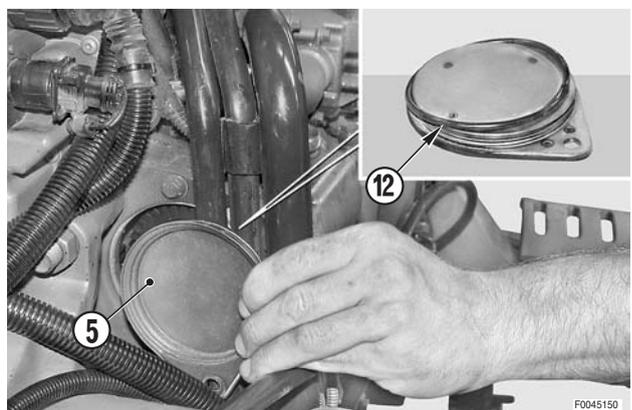
8 - Connect the suction and delivery pipes (2) and (3).
  ★ Before connecting the upper suction pipe, fill the pump with gearbox oil.

F0045071
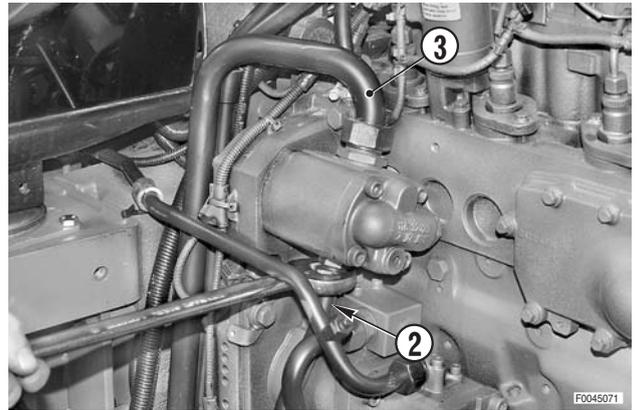
9 - Fit the cab and the hood side panel.

10 - Start the engine and check the gaskets and test the operation of the gearbox.

REMOVAL OF THE POWER STEERING - LIFT AND HYDRAULIC SERVICES PUMPS

⚠ 1 - Switch off the engine, remove the key from the ignition and apply the parking brake.

2 - Allow the engine to cool down to ambient temperature.

1 - Remove the righthand hood side panel.
(For details see «REMOVAL AND ADJUSTMENT OF THE ENGINE HOOD AND SIDE PANELS»).

1. Removal of the power steering pump

1 - Disconnect the suction and delivery pipes (2) and (3) from the pump (1).

★ Plug the pipes to prevent impurities getting in.

★ Renew the O-ring on the suction pipe flange on reassembly.
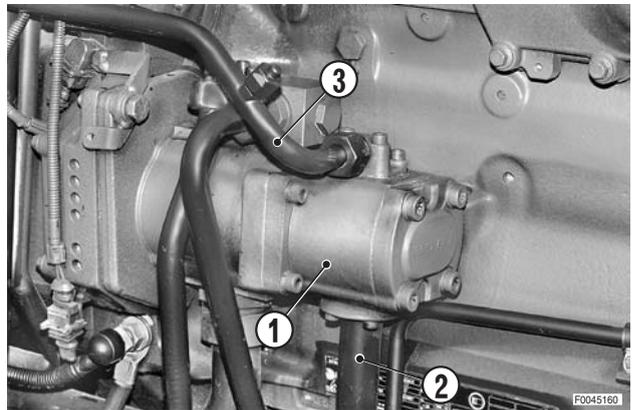
2 - Unscrew and remove the bolts (4) and remove the pump (1).
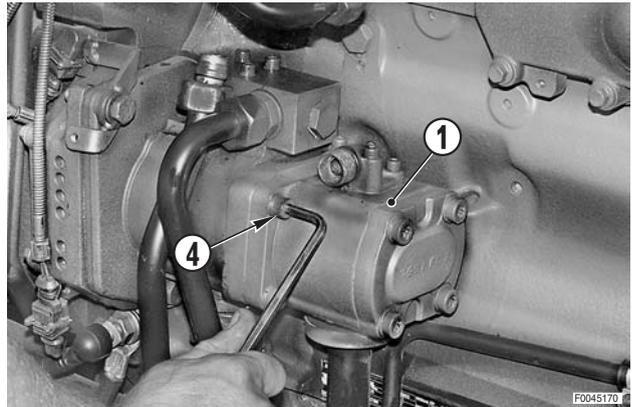
3 - Remove the pumps coupling (5) and the O-ring (6).

※ 1
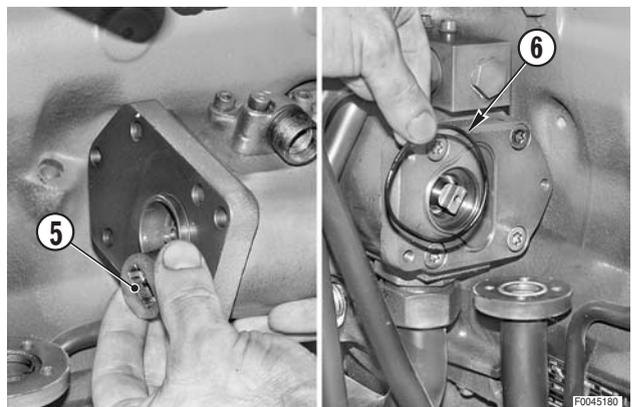
2. Removal of the lift and hydraulic services pump

1 - Remove the power steering pump as described under the previous heading.

2 - Disconnect the delivery pipe (2) from the gearbox pump (1).
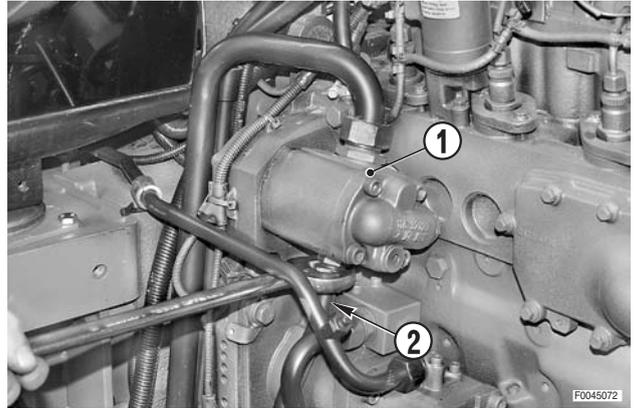
3 - Disconnect the suction and delivery pipes (4) and (5) from the pump (3).
   ★ Renew the O-ring on the suction flange on re-assembly.
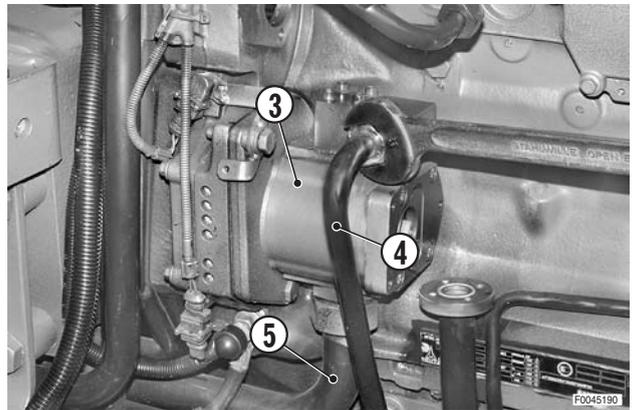
4 - Disconnect and remove the pump connection pipe (7) from the suction filter (6).
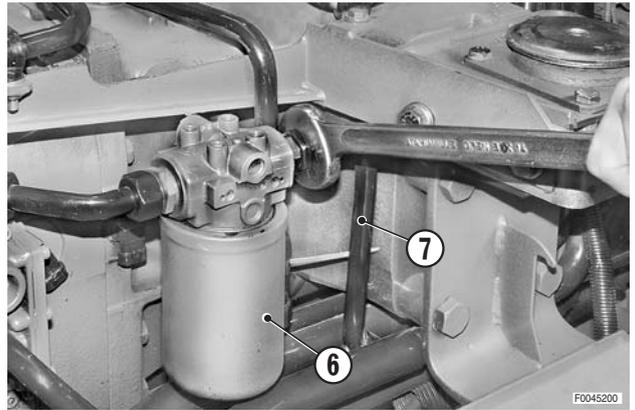
5 - Remove the bolt (8) and remove the bracket (9) securing the sensor (10).
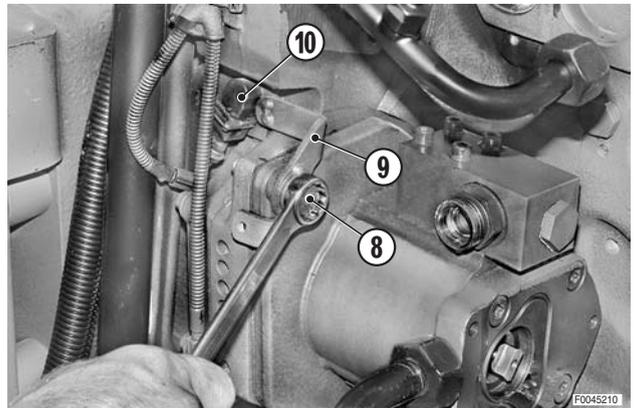
6 - Remove the remaining bolts (8).

7 - Remove the complete pump assembly (3).
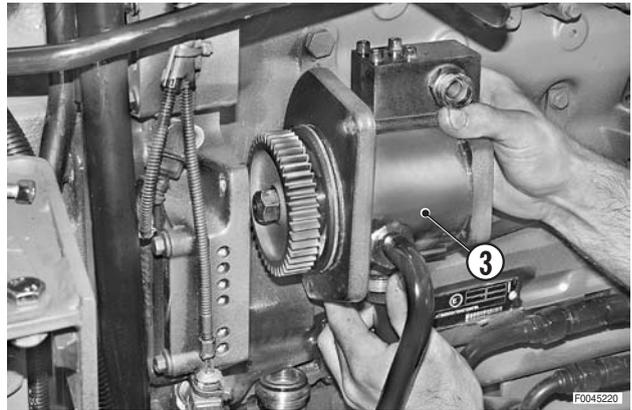
8 - Remove the self-locking nut (11).

9 - Using a puller, remove the drive gear (12).
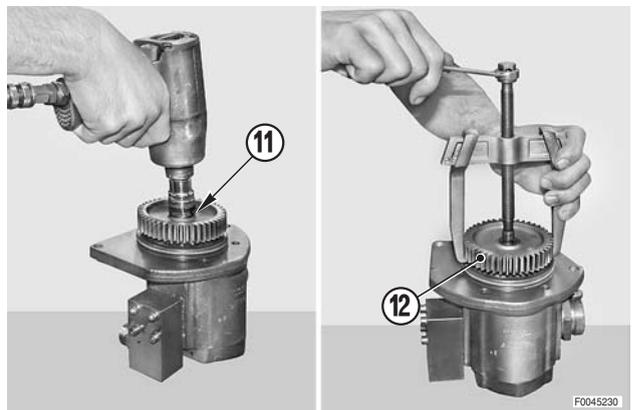
10 - Remove the key (13) and the O-ring (14).
    ★ Renew the O-ring on reassembly.
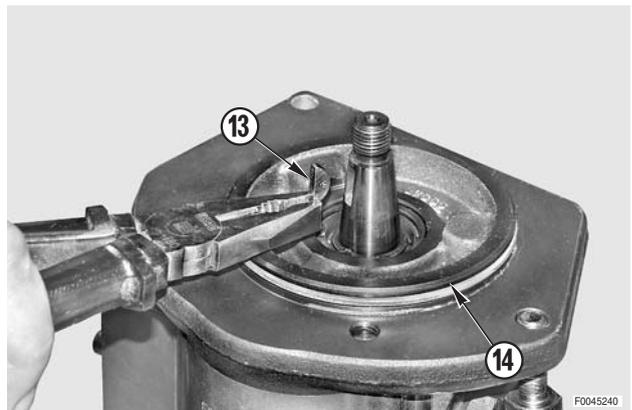
REFITTING THE POWER STEERING - LIFT AND HYDRAULIC SERVICES PUMPS

• Refitting is the reverse of removal.

※ 1

    Coupling: grease

REMOVAL OF THE SUPPLY VALVE FOR THE FRONT SUSPENSION CONTROL VALVE

⚠ Fully lower the front suspension and discharge the hydraulic pressure.

⚠ 1 - Stop the engine, remove the key from the ignition and apply the parking brake.

2 - Allow the engine to cool down to ambient temperature.

1 - Unplug the connector (3) from the solenoid (1) of the valve (2).

F0045250
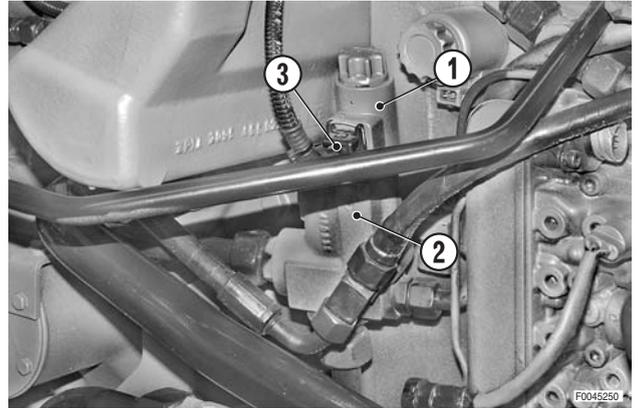
2 - Unscrew and disconnect the following from the valve (2): the drain port fitting (4), the delivery pipes to the control valve (5), the pipe (6) from the pump and the front axle suspension supply pipe (7).
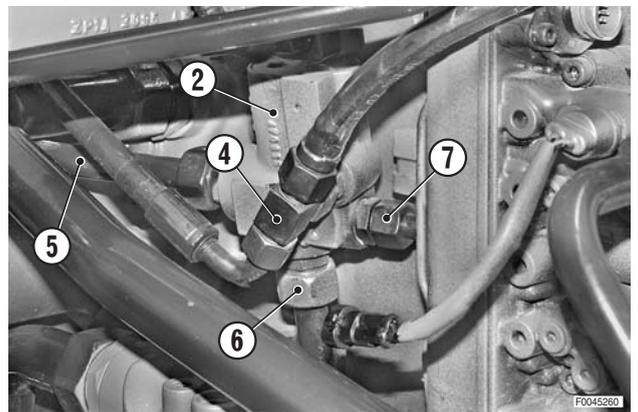
3 - Remove the valve (2).

F0045260

4 - **Only if necessary:** remove the solenoid (1) and the spindle (8).

★ Carefully check the condition of the O-rings (9) and the backup rings (10).

※ 1

F0045270
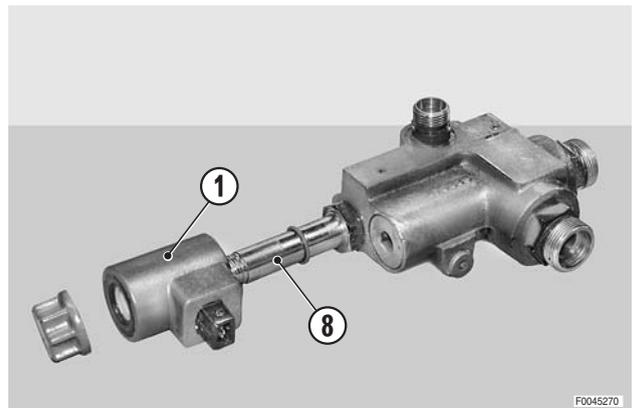
REFITTING

• Refitting is the reverse of removal.

※ 1

★ If new O-rings (8) and backup rings (9) are fitted, check they are positioned correctly.

1 - Start the engine and raise and lower the front axle suspension a few times to expel all the air from the system.

F0045280
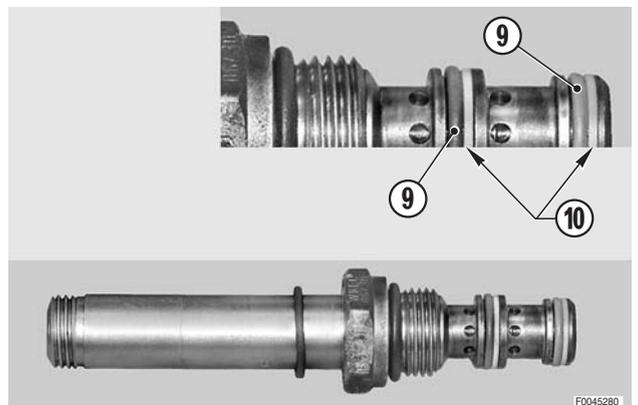
REMOVAL OF THE CONTROL VALVE ASSEMBLIES

⚠ Remove the key from the ignition and apply the parking brake.

1 - Disconnect the control cables (1) from the control valve assembly.

★ Mark the positions to avoid confusion on reassembly.

★ **For left control valve only:** disconnect the connectors from the proportional lift control valve.

※ 1
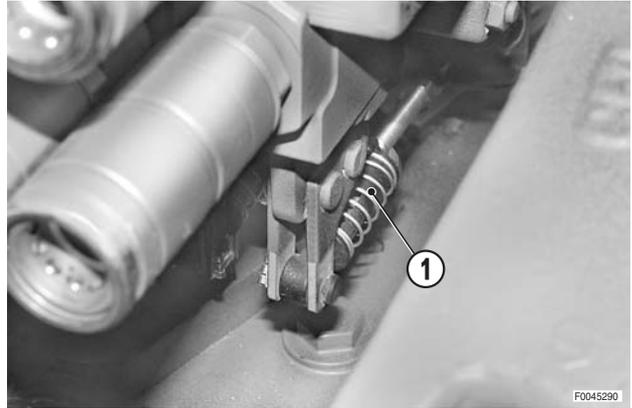
1. Right control valve

1 - Disconnect the drain line (1).

2 - Remove the supply pipe (2).
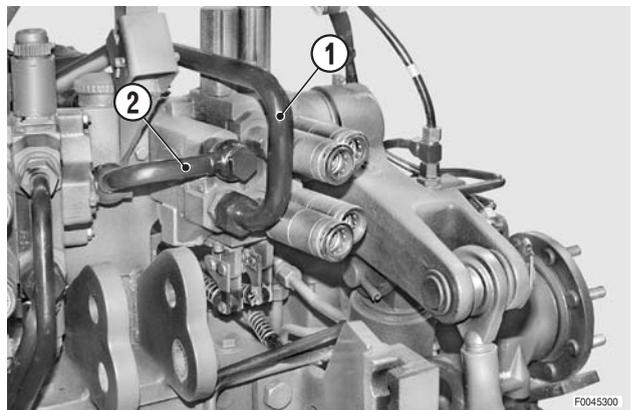
3 - Unscrew and remove the retaining nuts (3) and remove the control valve (4).
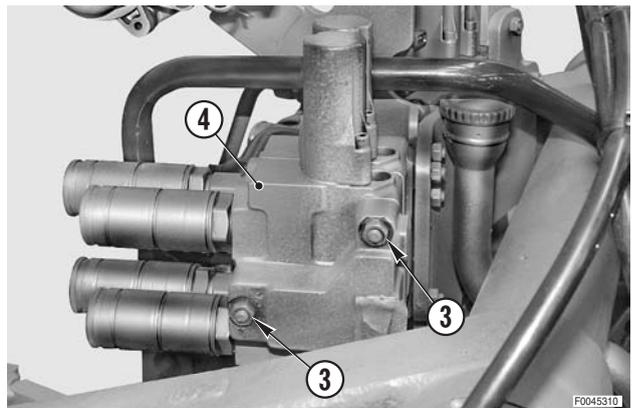
2. Left control valve

1 - Disconnect delivery (1) and drain (2) lines from the end cover.

2 - Disconnect delivery (3) and drain (4) lines from the lift control valve.

3 - Remove the supply pipe (5) of the right control valve.
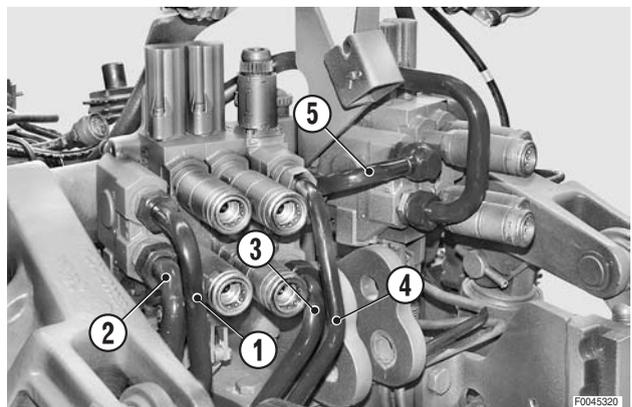
4 - Unscrew and remove the nuts (6) and remove the control valve assembly (7).

F0045330
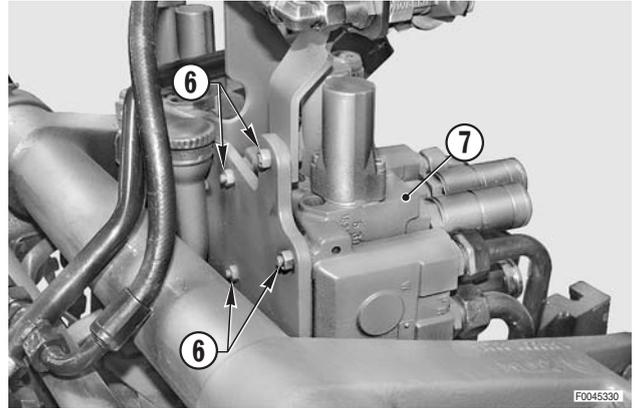
REFITTING CONTROL VALVE ASSEMBLIES

• Refitting is the reverse of removal.

※ 1

★ Attach the connectors on the solenoids of the lift control valve spool DW top UP bottom

1 - Start the engine and operate the lift to expel air from the circuits and check for leaks.

DISASSEMBLY OF THE AUXILIARY CONTROL VALVE STACK
(Description refers to left control valve assembly)

★ 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.

★ To disassemble the right control valve, follow the same procedure.

1 - Loosen and remove the quick-action couplers (1) and the relative seals.
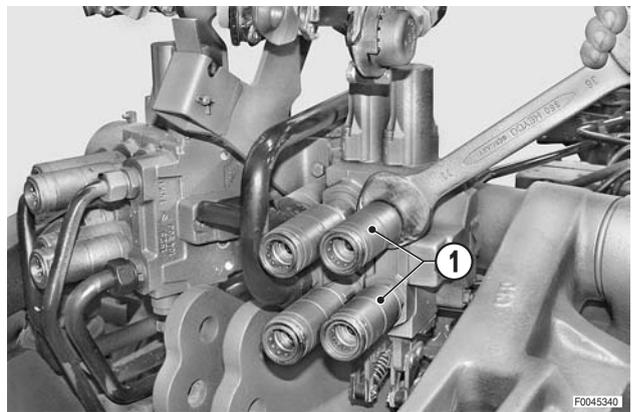
2 - Remove the control valve blocks.
(For details, see «REMOVAL OF THE CONTROL VALVES»).

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
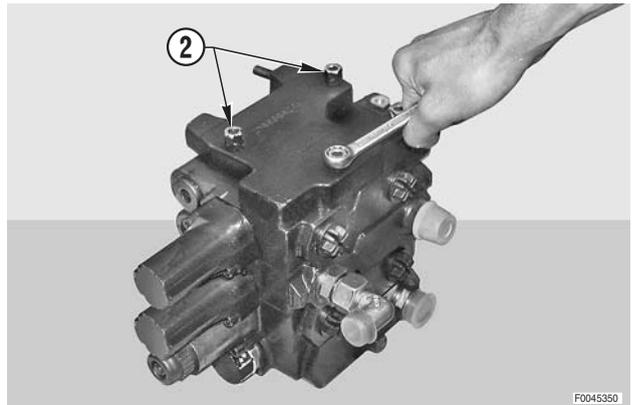
4 - Remove in order the end cap (3), the first spool section (4), the spool section piloted by the lift (5), the second spool section (6) and the end cap (7). ✳ 2

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.
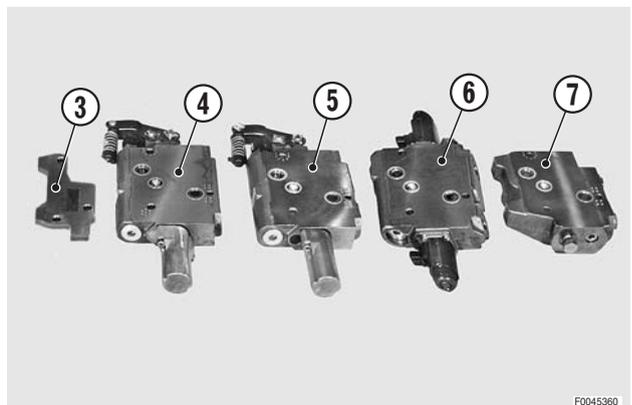
ASSEMBLY OF THE AUXILIARY CONTROL VALVE BLOCKS

- Refitting is the reverse of removal.

❋ 1

🔧 Nm Nut tightening torque:
30⁰₃ Nm (22⁰₂.2 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.

D0005360
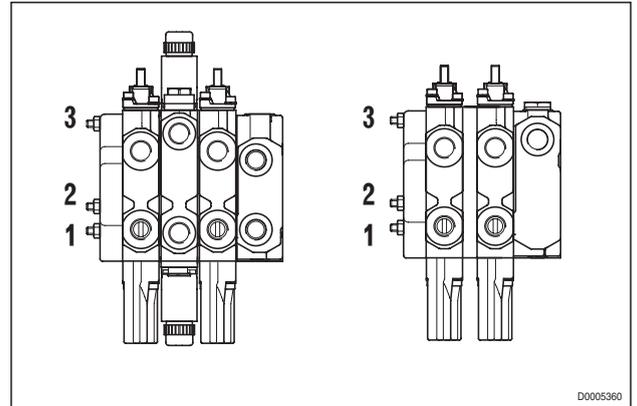
REMOVAL OF THE LIFT CYLINDERS

⚠ 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 postions.
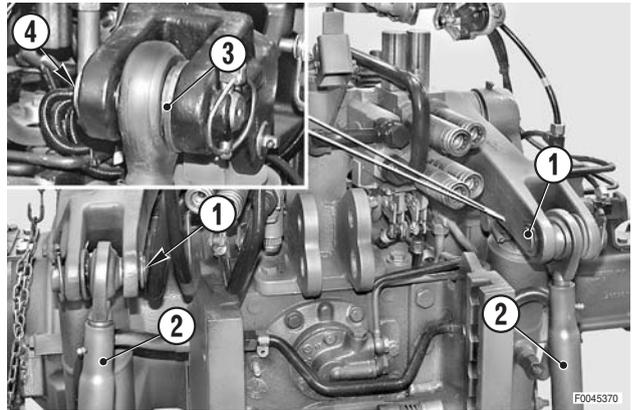
2 - Disconnect the pipes (6) from the cylinders (5).

★ Plug the ends of the pipes to prevent the entry of contaminants.
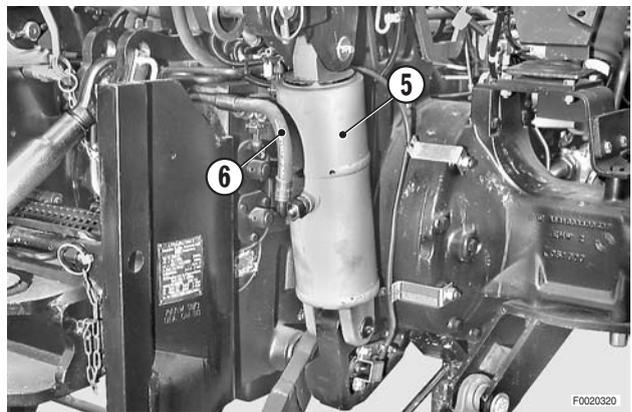
3 - Using a pin punch "**A**", remove the spring pin (7) securing the upper pivot pin (8).
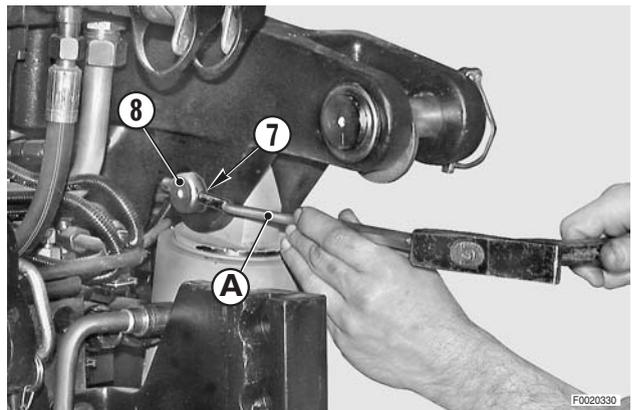
4 - Remove the screws (9) and remove the bracket (10) securing the lower pivot pin (11).
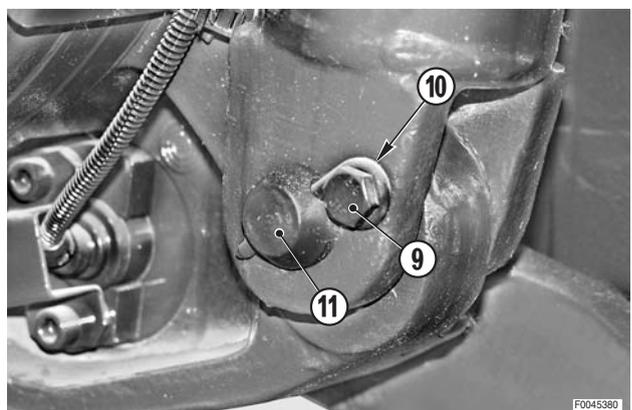
5 - Support the cylinder (5) while removing the upper pivot pin (12).   ※ 1
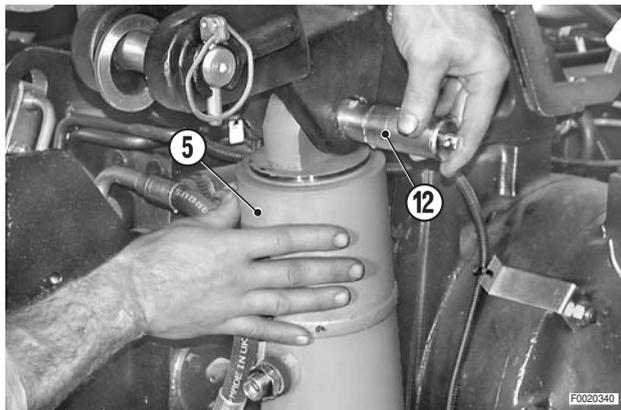
6 - Rotate the cylinder (5) so that it is horizontal and attach it to a hoist.

⌒ kg   Cylinder: approx.55 kg (121.2 lb.)

7 - Remove the lower pivot pin (11) and the cylinder.

※ 1
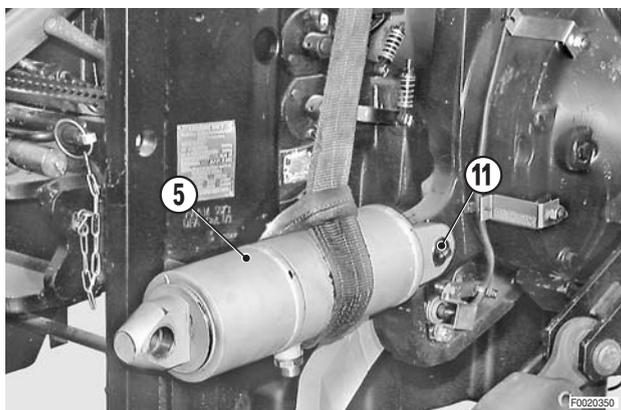
REFITTING THE LIFT CYLINDERS

• Refitting is the reverse of removal.

※ 1
★ 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.

F0009200

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).

D0000821
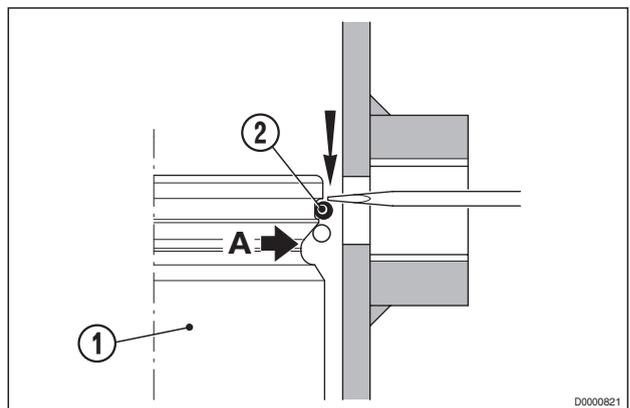
5 - Remove in sequence the wiper seal (4), the guide (5), the seal (6) and the second guide (7).

   ※ 1   ※ 2
   ★ Note which way round the seal is fitted.

D0000830
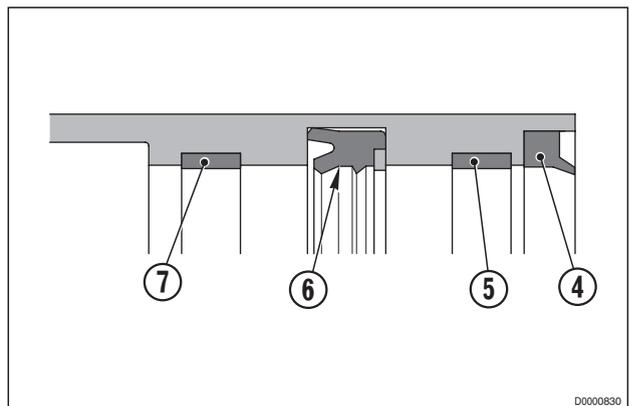
2. Assembly

• 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).
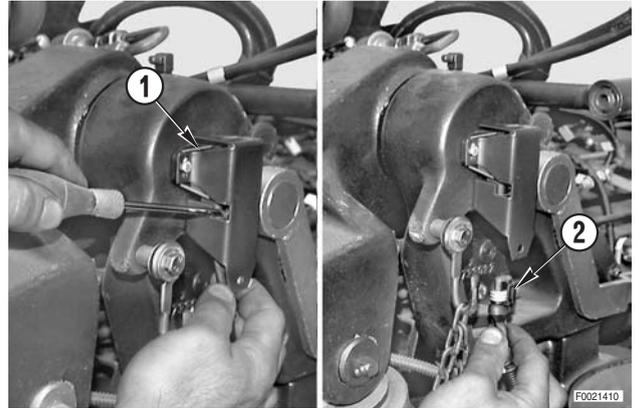
2 - Connect the test lead **T4** (code 5.9030.743.0) between the connector (2) and the sensor (1).

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±1Vdc

   ★ 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.
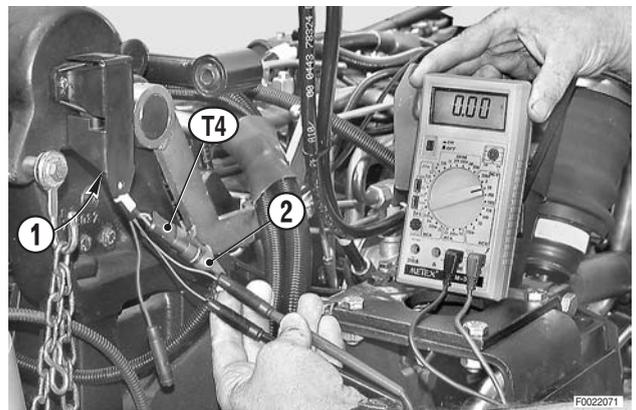
RENEWAL OF THE LIFT POSITION SENSOR

⚠️ 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.
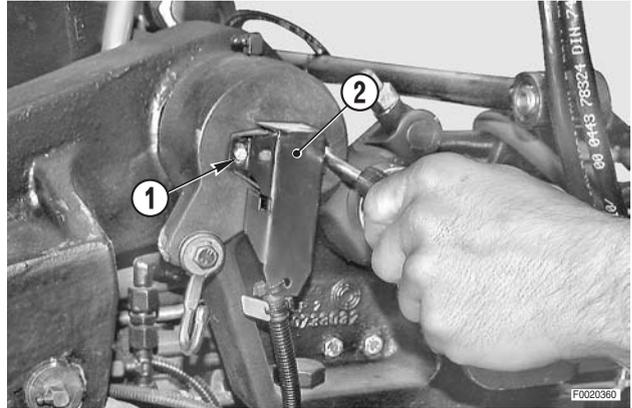
2 - Remove the sensor (3) and unplug the connector (4).
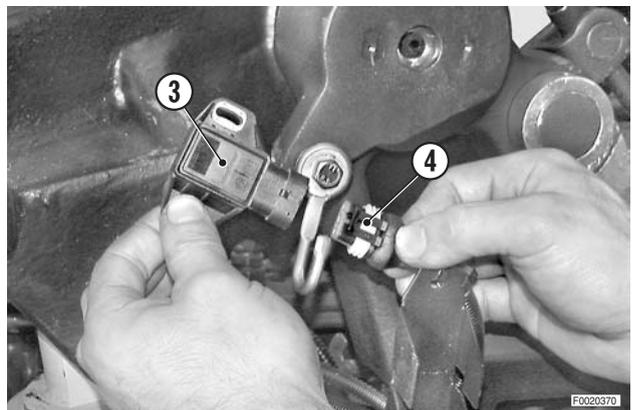
2. Renewal of the position sensor bush (only if necessary)

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° manteining the protusion "A" of 4.5º0.5 mm.

   Sealant: Loctite 648

3 - Allow the sealant to cure for at least 30 minutes before fitting the sensor.
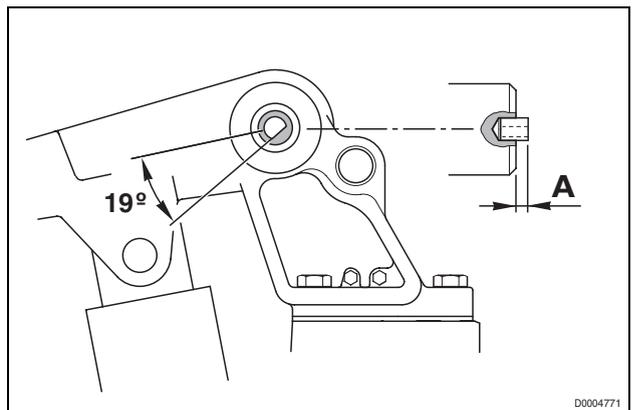
3. Refitting the position sensor

• 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).
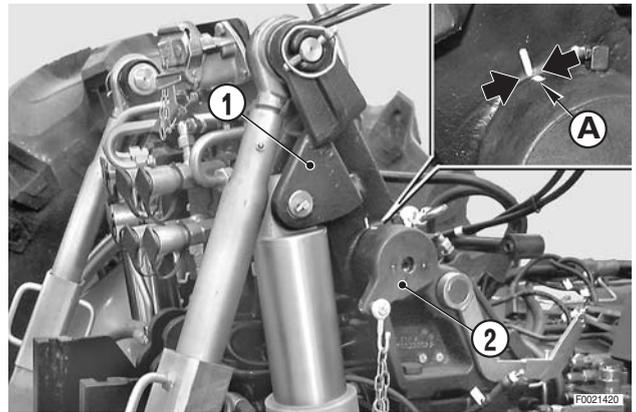
4 - Lower the lift to its maximum depth position.

5 - Start the engine, push the external pushbutton (3) to rise the lift arms up to it 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; top 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.).
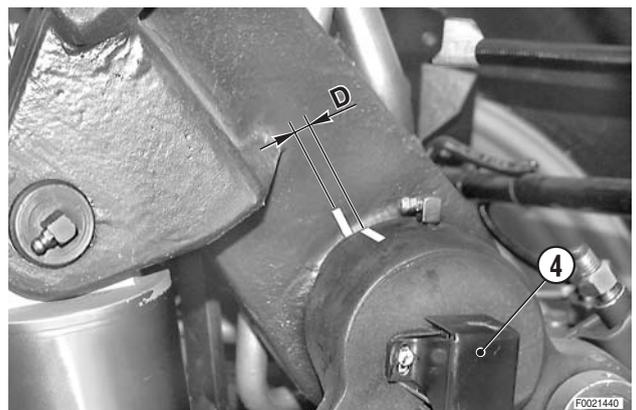
7 - Fix the sensor (4) in position by tightening the screws (5).
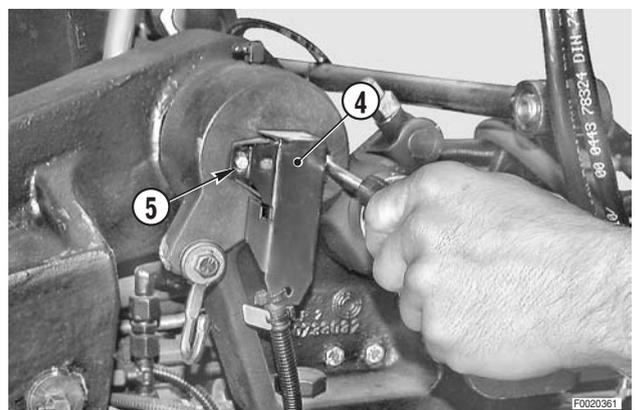
8 - Check the adjustment by first lowering the lift (using external pushbutton (3)) to an intermediate position and then raising to the maximum height by holding the pushbutton pressed; the lift arms should stop before reaching the mechanical limit and thus over-pressurising the hydraulic system, at 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.

F0021430

REMOVAL OF THE LIFT DRAFT SENSOR

1 - Remove the screws (1) and remove the cover (2) and the spacers (3).
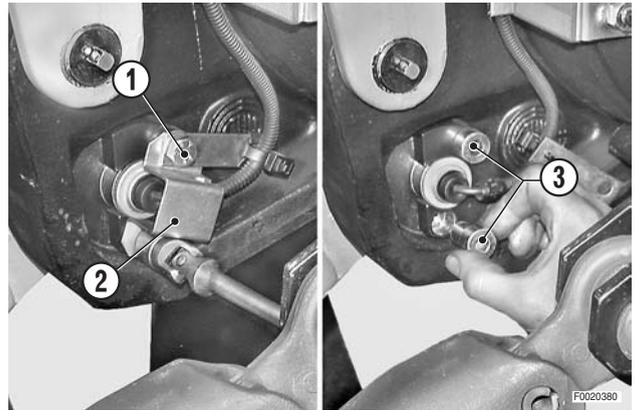
2 - Support the lever and remove the bracket (4) and then the sensor (5).
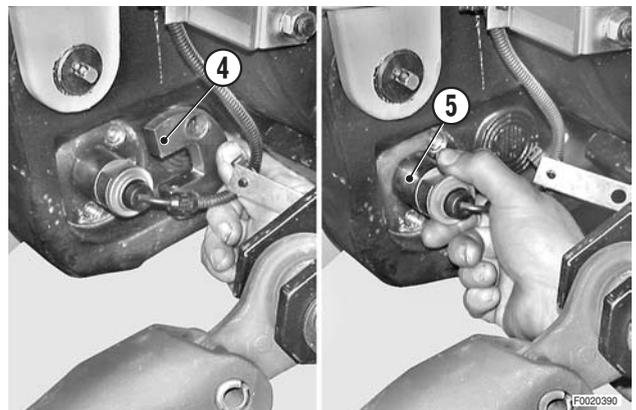
3 - Release the wiring from the retaining straps and unplug the sensor connector (6).

    ★ 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.
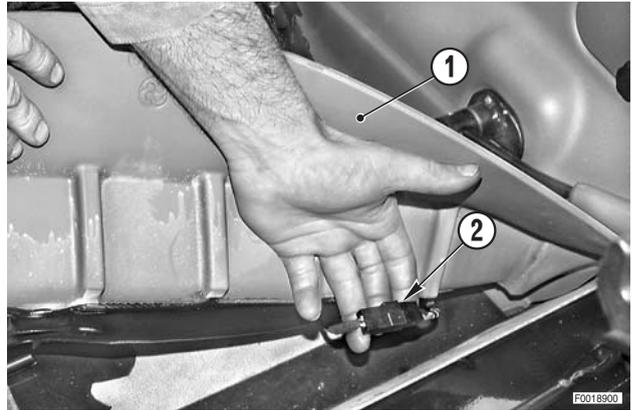
2 - Remove the four nuts (3) and remove the complete seat assembly (4).
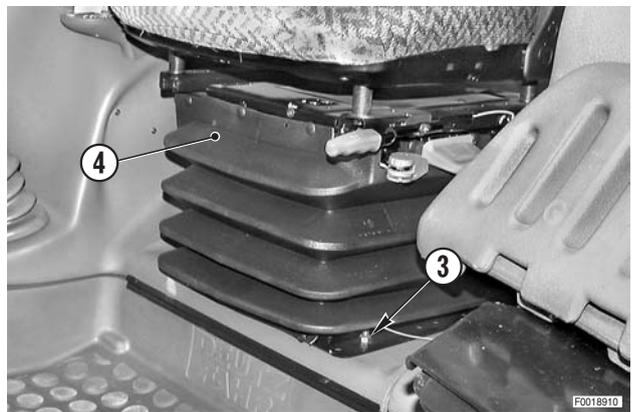
REFITTING THE DRIVER'S SEAT

• 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.
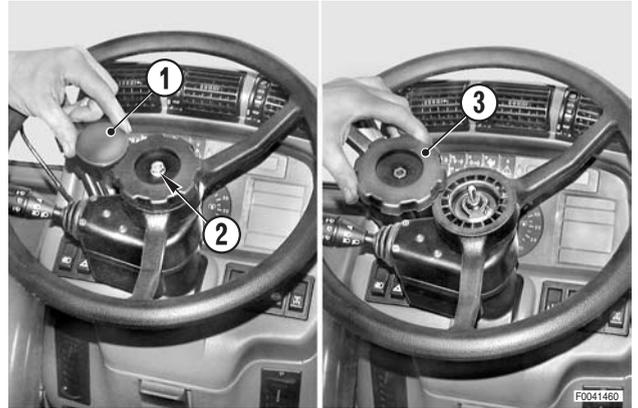
3 - Remove the nut (4), the toothed washer (5) and remove the steering wheel (6).   ※ 1
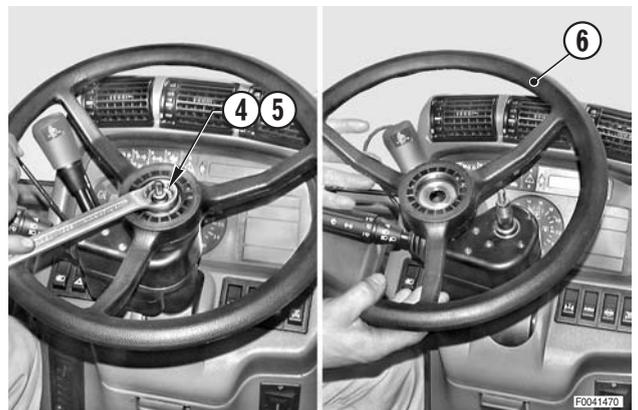
4 - Remove the circlip (7) and remove the steering column switch unit (8) from the steering column.

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.
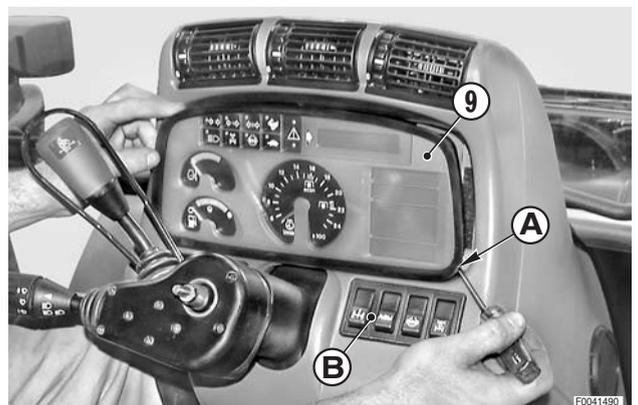
6 - Unplug the connectors (10) and (11) from the instrument panel (9); remove the assembly.
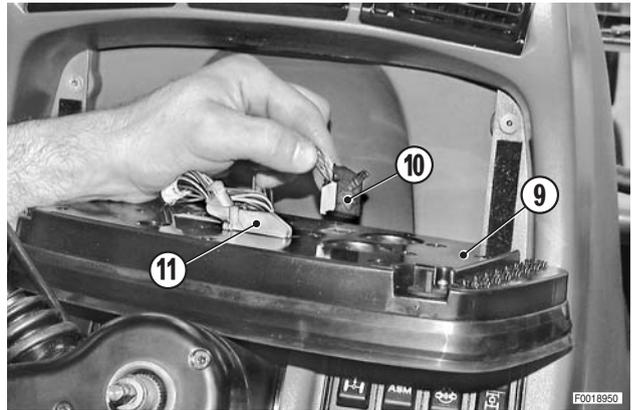
REFITTING
THE STEERING WHEEL,
STEERING COLUMN SWITCH
UNIT AND INSTRUMENT PANEL

• Refitting is the reverse of removal.

※ 1

⌇Nm 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»).
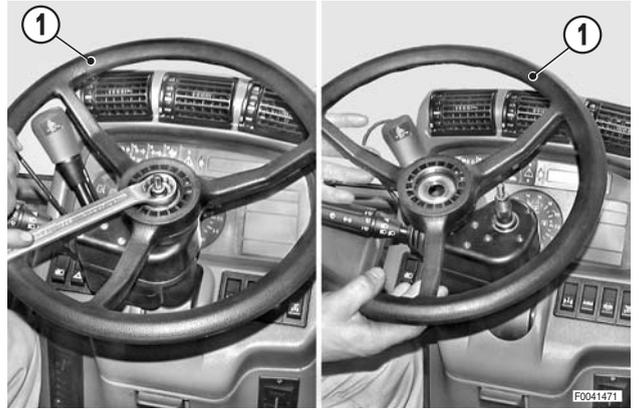
2 - Remove the lower screws (2) joining the shrouds (3) of the shuttle control lever (4) and remove the safety bar (5).
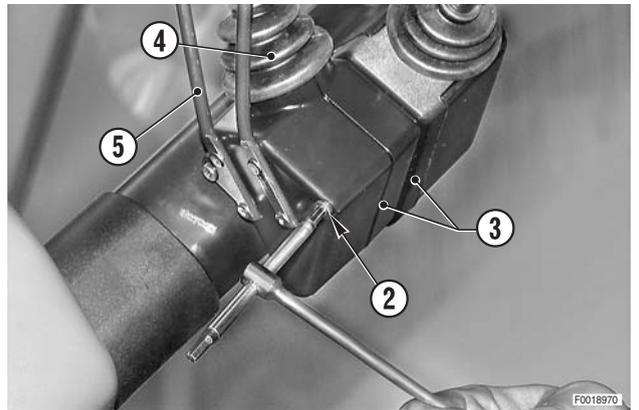
3 - Unscrew and remove six screws (6) securing the shrouds of the steering column switch unit (7).
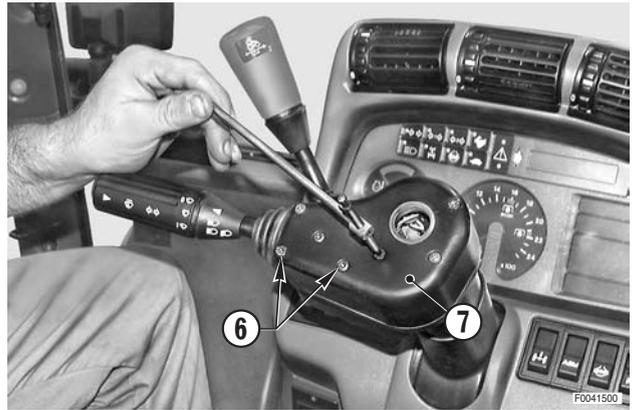
4 - Remove the circlip (8) of the steering column switch unit (7).

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.
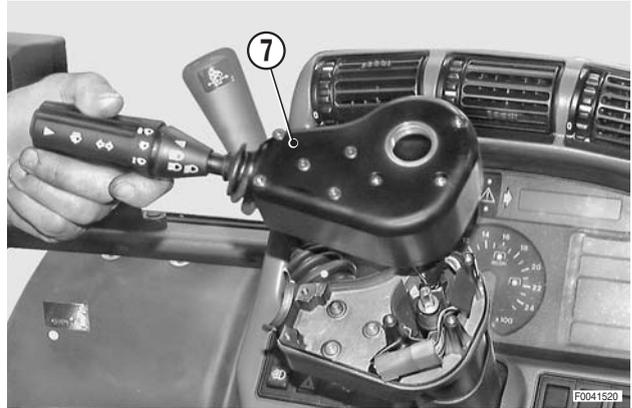
6 - Unplug the connector (9), remove the screws (10) and detach the shuttle control lever assembly (11).
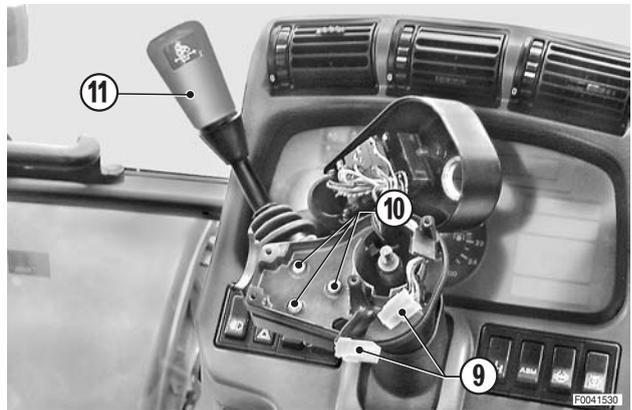
7 - Remove the shuttle control lever (11), detaching it from the cover (12).
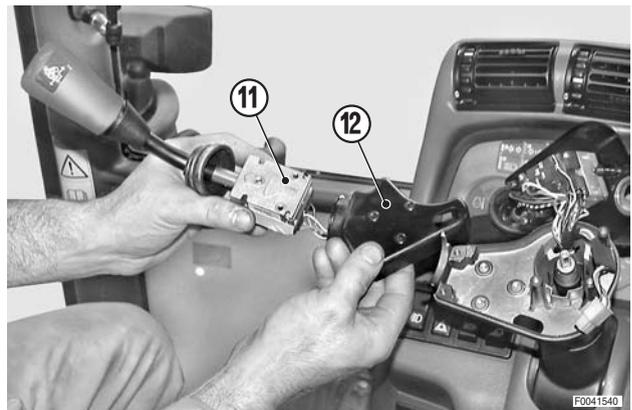
ASSEMBLY OF THE STEERING COLUMN SWITCH UNIT AND THE SHUTTLE CONTROL LEVER

• 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.
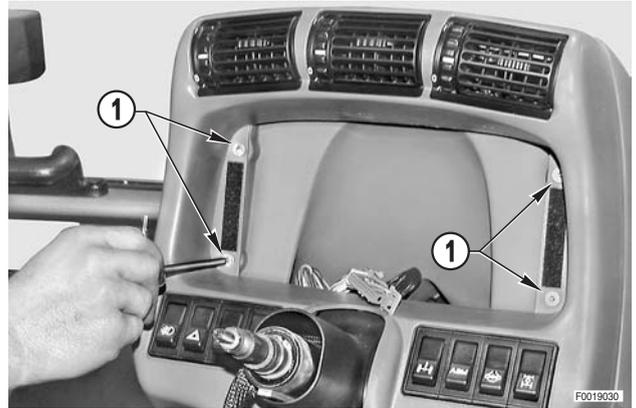
6 - Rotate the console (2) towards the rear of the tractor and unplug the connectors (3), (4) and (5).

★ 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.
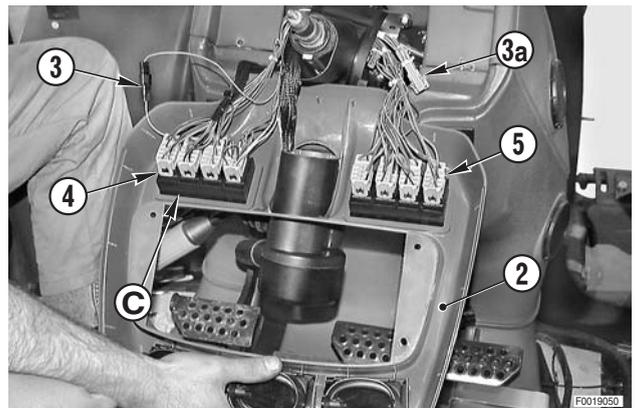
7 - Loosen the grub screw (6), remove the accelerator pedal (7) and remove the front floor mat (8).
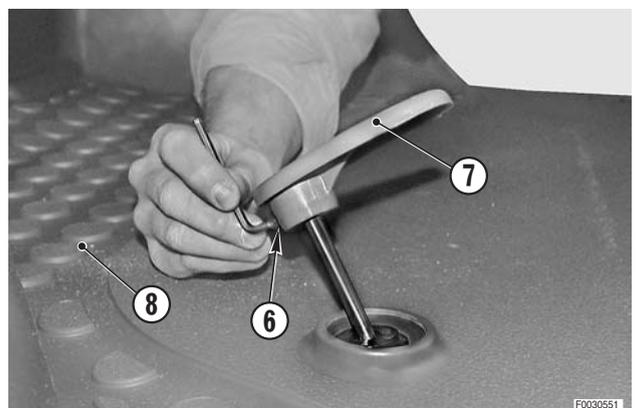
8 - Fully lower the steering column.
Pull outwards the lock handle (9) of the steering tilt adjustment; remove the cotter pin (10) and remove the handle.

★ Renew the cotter pin at each reassembly.

9 - Unscrew and remove the retaining screws (11) of the air duct fascia (12).
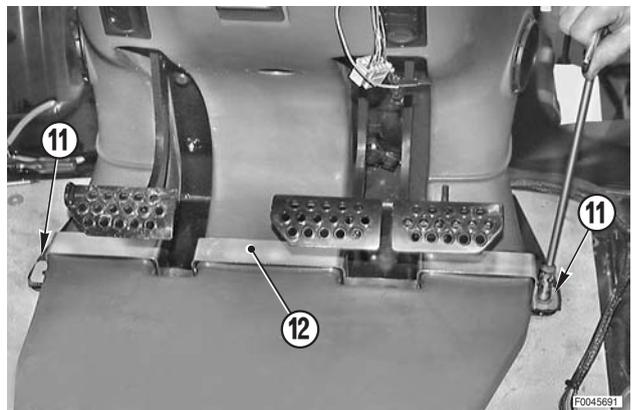
10 - Detach the air duct (14) from the centre shroud (13) and remove it.
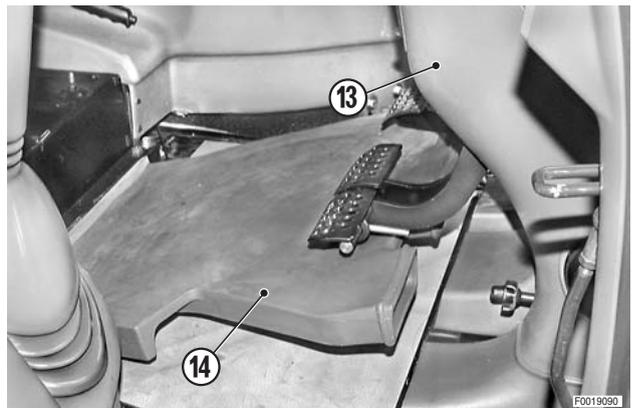
11 - Remove the cable ties (15) to release the wiring from the guide fixed to the footplate.

★ Note that the cable ties are located in grooves.

12 - Withdraw the wiring (17) from the right-hand console (16).

※ 1
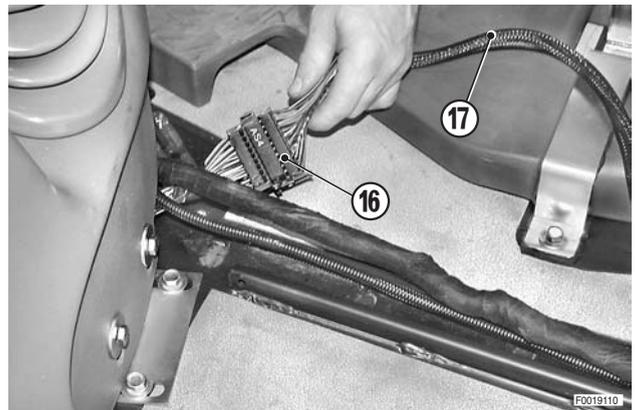
13 - Release the wires of the pushbutton connectors from the cable ties (18).
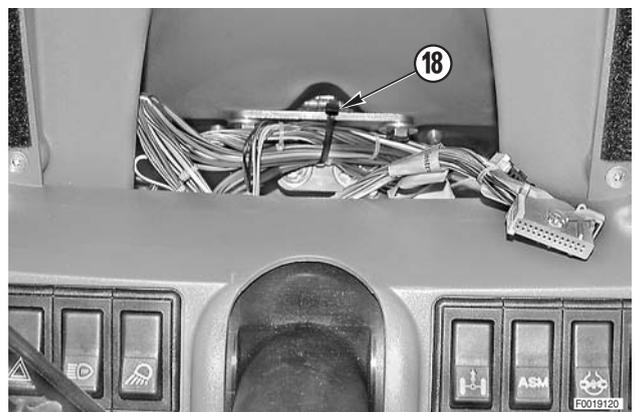
14 - Release the vertical wiring (20) from the cable tie (19); withdraw the complete wiring harness through the aperture exposed by tilting the console forwards.
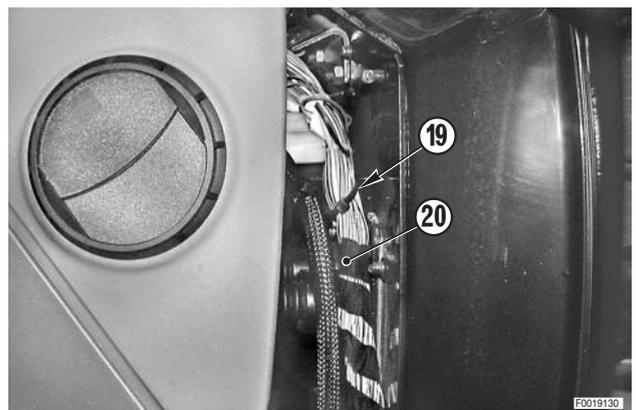
15 - Rotate the shroud (21) to align the rotation lock key with the spring (22); remove the shroud (21).

16 - Remove the complete console assembly (2).

17 - Remove the screws (23).
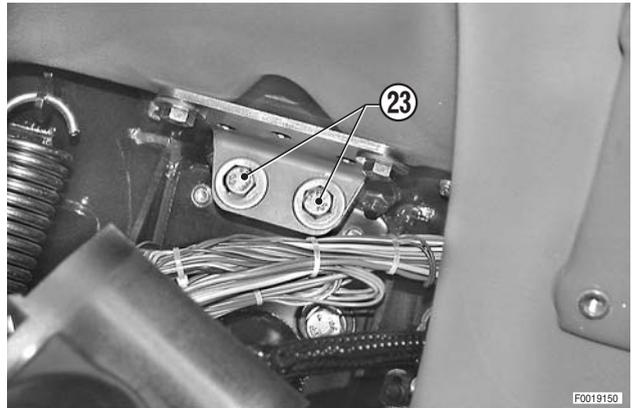
18 - Lift and tilt the console shroud (13) towards the rear of the tractor to disengage it from the clutch and brake pedals.

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
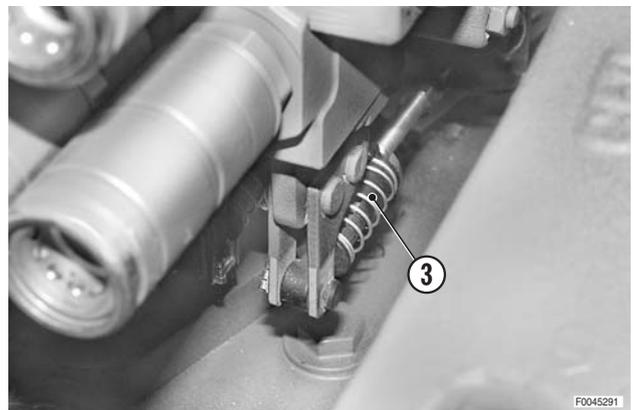
4 - Disconnect the control cable (5) from the lever (4). Detach also the cable sleeve (6).
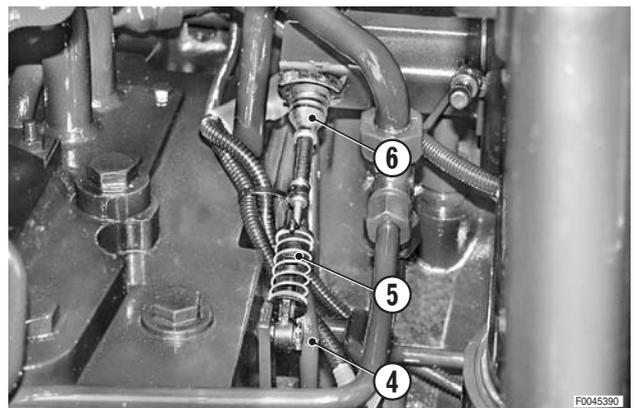
5 - Remove the front floor mat and remove the plate (7) of the cable guide (8) in order to free the control cables (5).
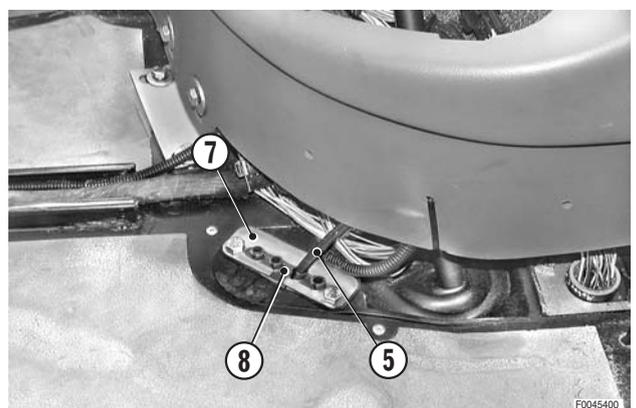
6 - Drive out the spring pin (9) and remove the creeper engagement lever (10).
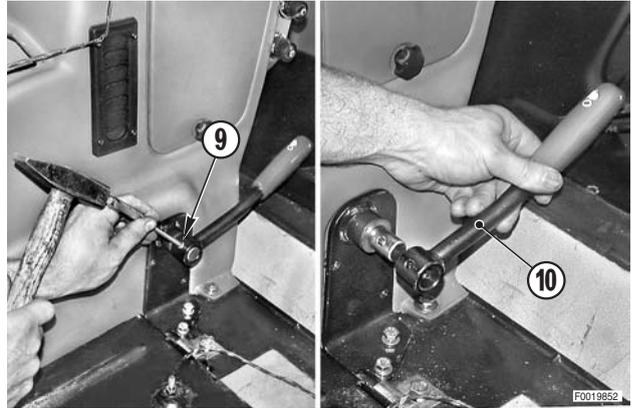
7 - Remove the screw (11) move the support (12).

8 - Unplug the connector (13) of the lever position sensor (14).

⚠️ If the sensor (14) has been removed or replaced, on refitting adjust the protrusion to 5^{0}_{+1} mm ($0.197^{0}_{+0.04}$ in.) relative to the tightened nut.
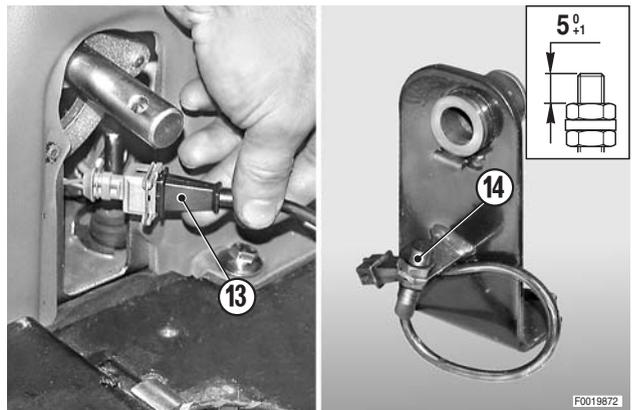
9 - Withdraw the pin (15) and disconnect the creeper control cable (16).   ※ 1
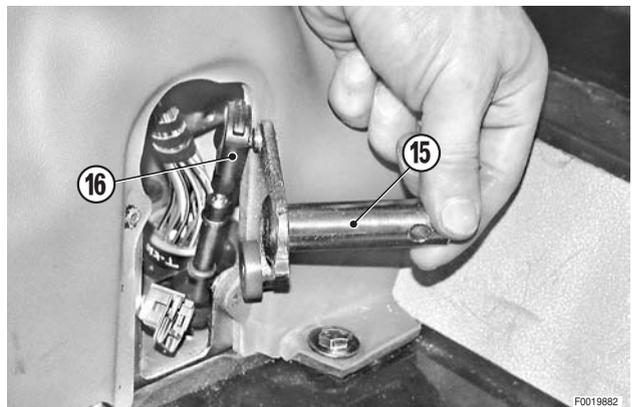
10 - Unscrew and remove the lower bolt (17) of the console (18).

11 - Position a hydraulic jack "**A**" with a non-slip block under the tow hook (20) so that it is inclinded towards the right-hand wheel; raise the tractor so that the right wheel is off the ground (20).
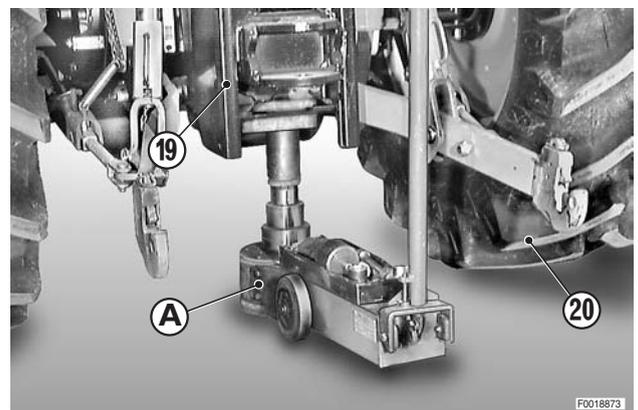
12 - Position a jack "**B**" with safety wings under the right brake assembly; remove the right wheel and lower the tractor onto the stand. ※ 1
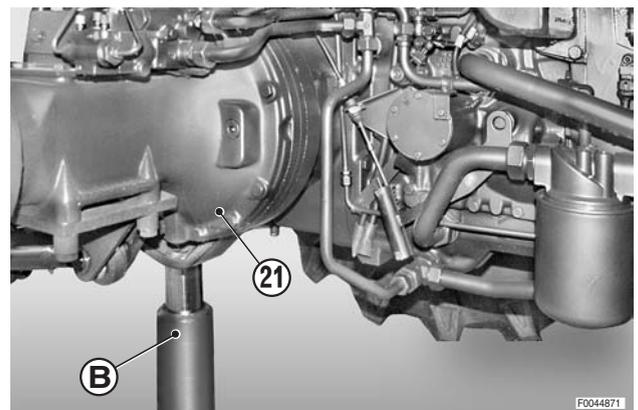
★ Stand load capacity: minimum 2 tons.

13 - **In case of console removal only**:
Remove the four screws (22) and remove the cover plate (23).

RIGHT-HAND CONSOLE
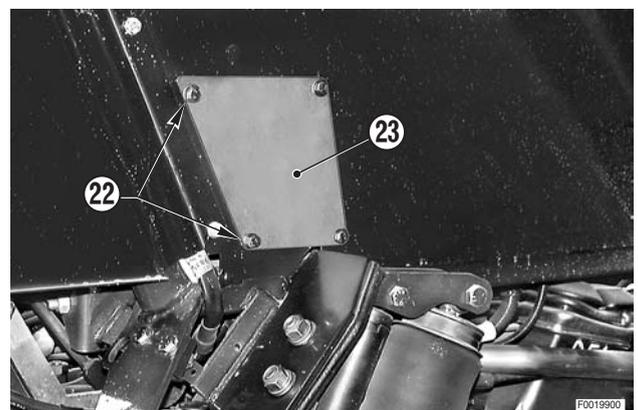
14 - **In case of console removal only**: disconnect from
the bulkhead fitting the connectors of the lift line (24)
(TKAB2), the transmission (25) (TKAB1), the front sus-
pension (26), the feed cable (27), the creeper engage-
ment indicator cable (28),the cab lights connector (29)
and the feed cable (30).
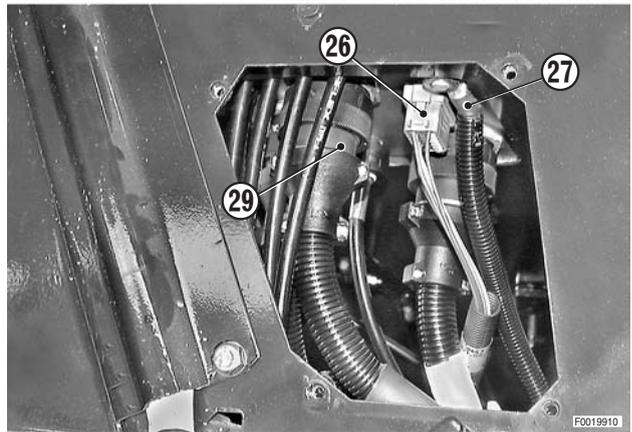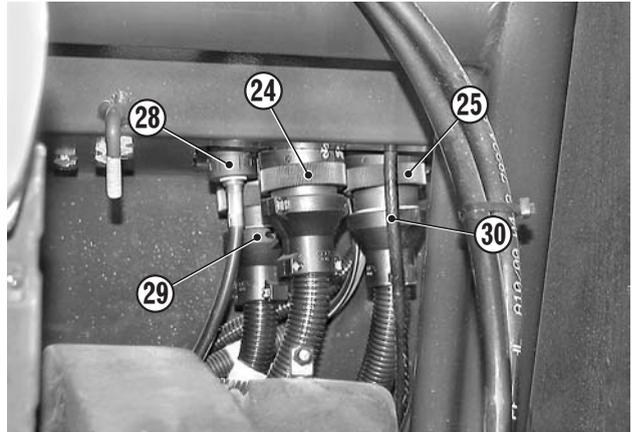
15 - Disconnect the engine line connector (31) and the
connector (32) from the bulkhead fitting.
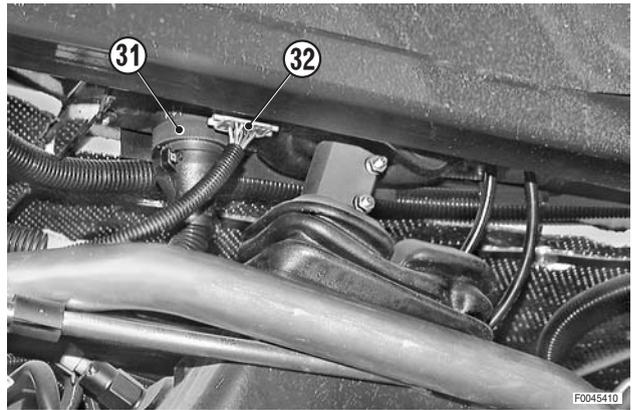
16 - Remove the grille (33) and the filter (34) from the right-
hand cab pillar.

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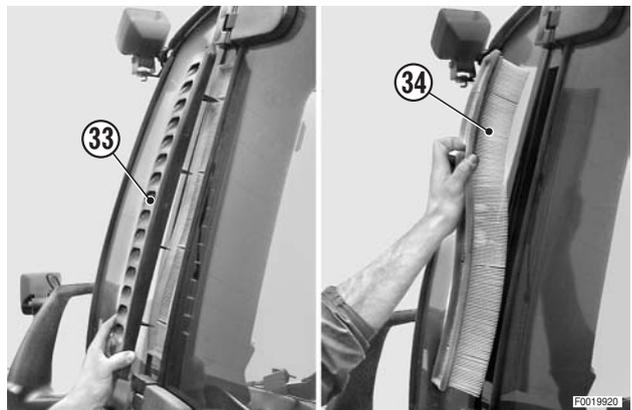
17 - Unscrew and remove the trim panel retaining screws (35).
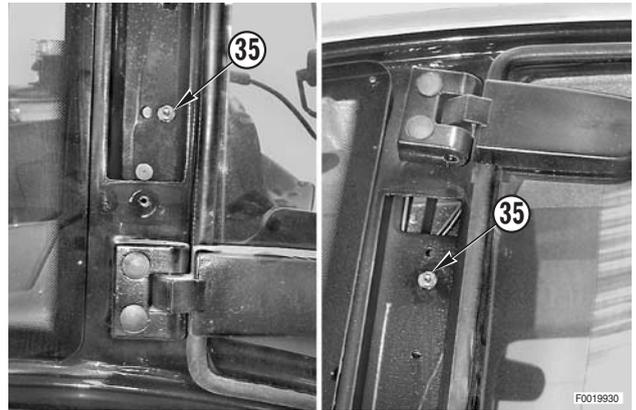
18 - Insert a thin blade between the cab pillar (36) and the interior trim (37) and detach the clips (38) from the pillar and the trim.
Remove the trim (37).
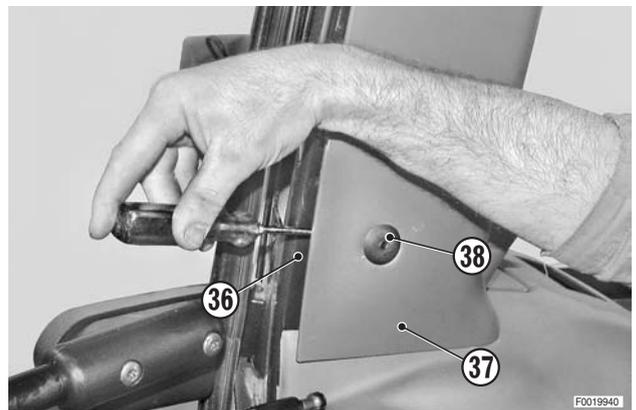
19 - Unplug the lower connectors (39), (40) and (41) and the upper connector (42).
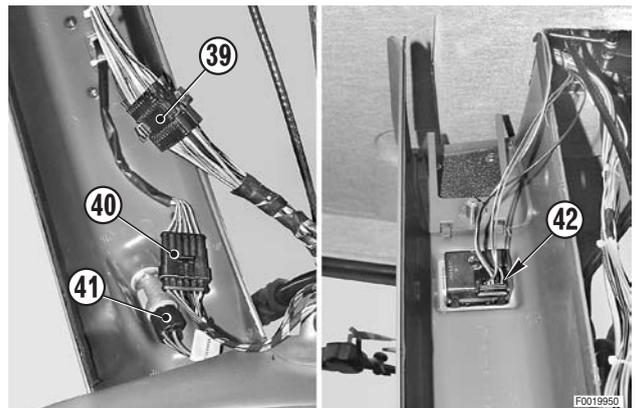
20 - Disconnect the gas spring (43) of the right-hand door and remove the mounting pin (44).

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).
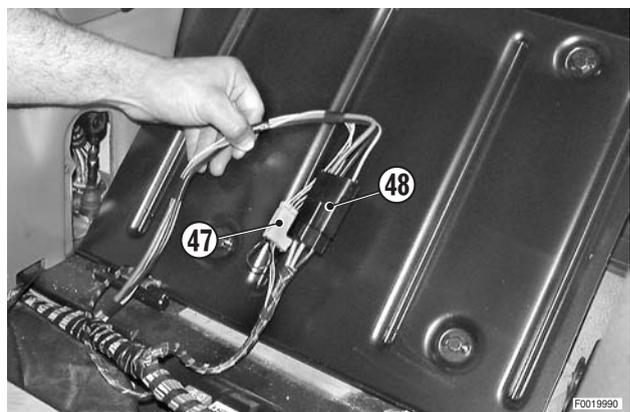
23 - Open the rear right cable hatch (49) to access the screw (50).
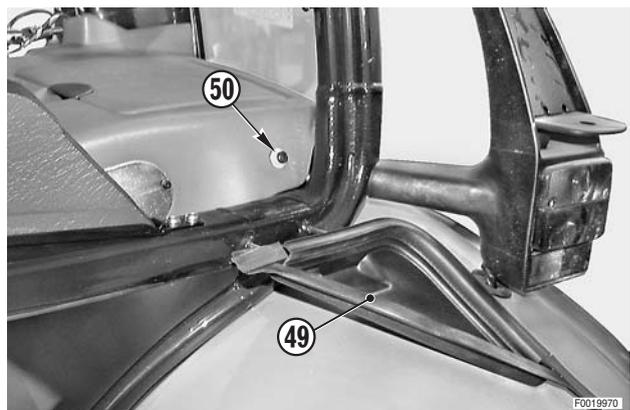
24 - Remove the screws (51) and remove the flanged nut (52) located under the right fender.
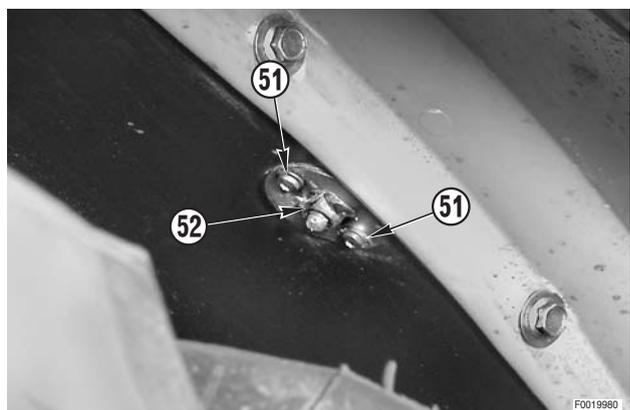
25 - Loosen and remove the bolt (53).

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).
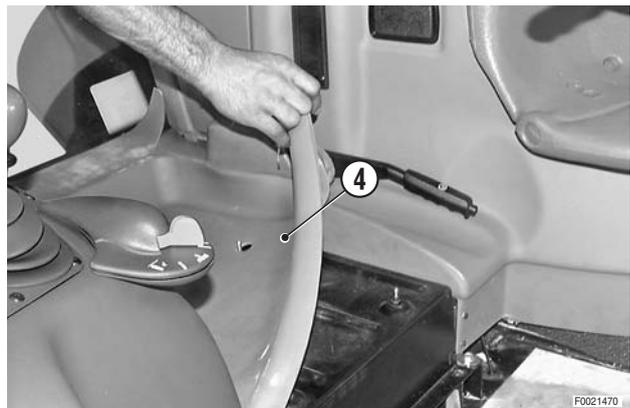
5 - Remove the parking brake cover (5).

6 - Remove the seat support (6) and remove the strap (7) to disconnect the hose (8).
Remove the screw (9).
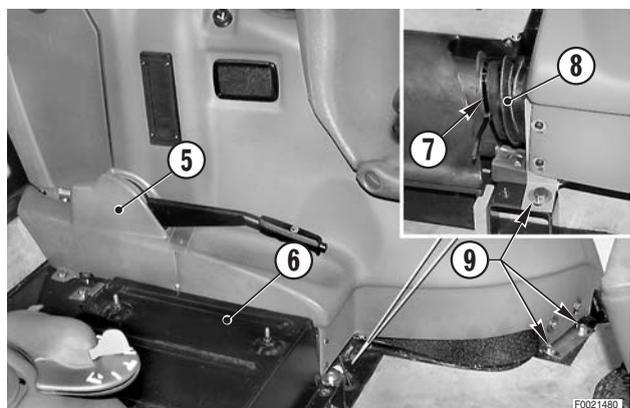
7 - Remove the interior trim (10) from the cab pillar.

8 - Disconnect the gas spring of the left door and remove the mounting pin.
   (For details, see «REMOVAL OF THE RIGHT-HAND CONSOLE»).
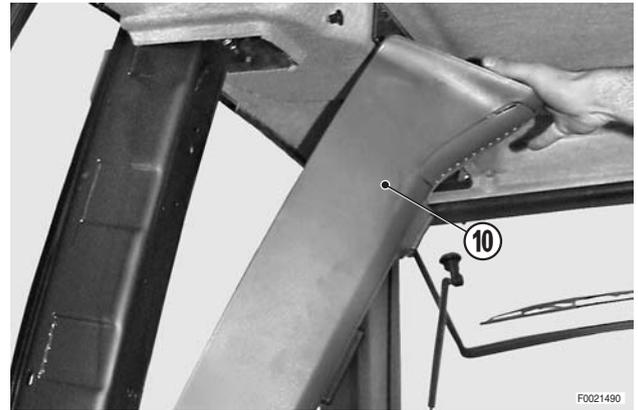
9 - Remove the fixing screws and move the left-hand console (11) away from the side of the cab.
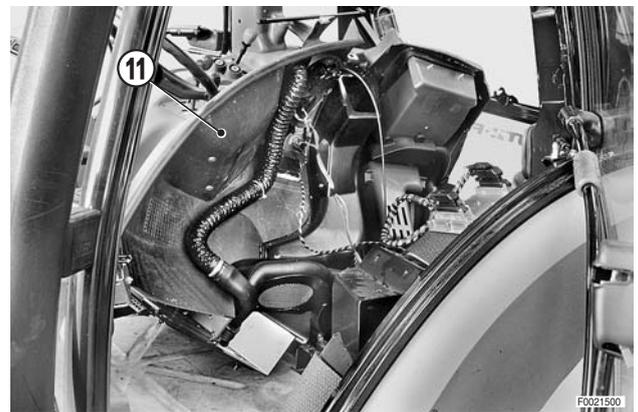
10 - Unplug the four connectors (12).

11 - Disconnect the heating valve control cable (13).

12 - Remove the left-hand console (11).
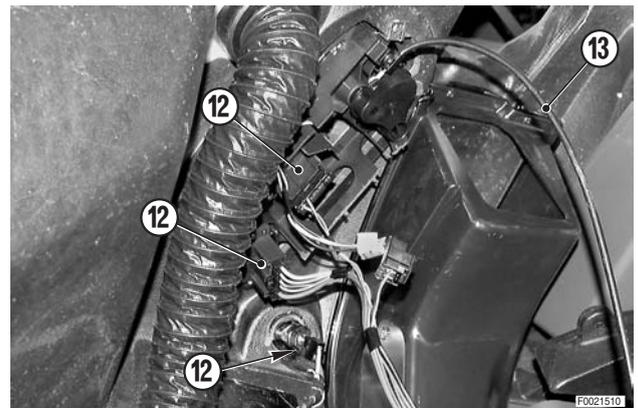
REFITTING THE LEFT-HAND CONSOLE

• 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.
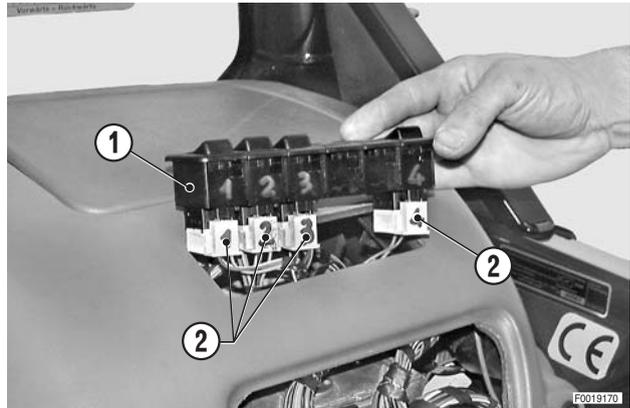
1. Transmission ECU

1 - Unscrew and remove the screws (3) securing the ECU (4).

2 - Unplug the connector (5).
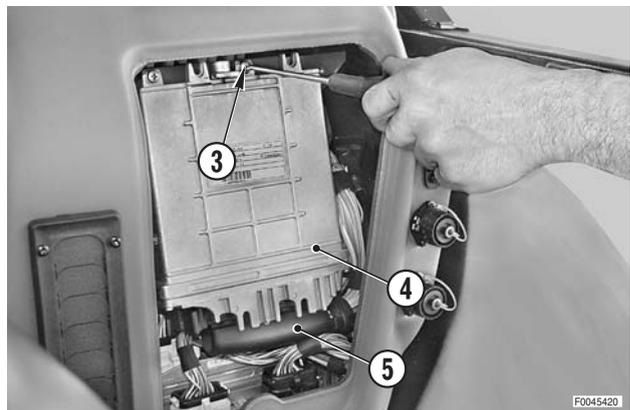
2 - Withdraw the ECU (4).

2. Lift ECU

1 - Unplug the connectors (7) and (8) from the ECU (6).
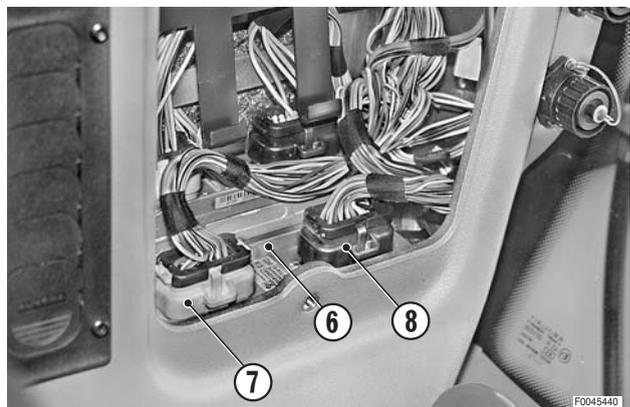
2 - Unscrew and remove the fixing screws and withdraw the ECU (6).

3. Front suspension ECU

1 - Unscrew and remove the fixing screws (9).

2 - Unplug the connectors (10), (11) and withdraw the ECU.
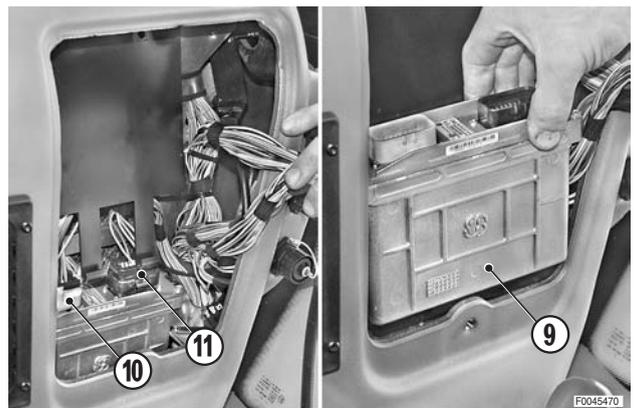
REFITTING THE LIFT, FRONT SUSPENSION AND TRANSMISSION ECUs

• 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.
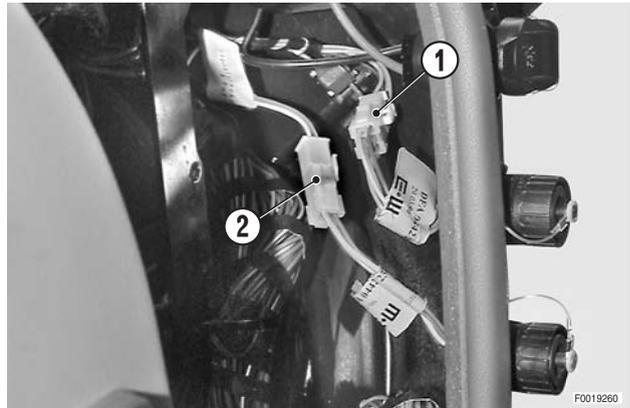
3 - Remove the bracket (3) of the diagnostics outlet (4) and place it to one side.

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).
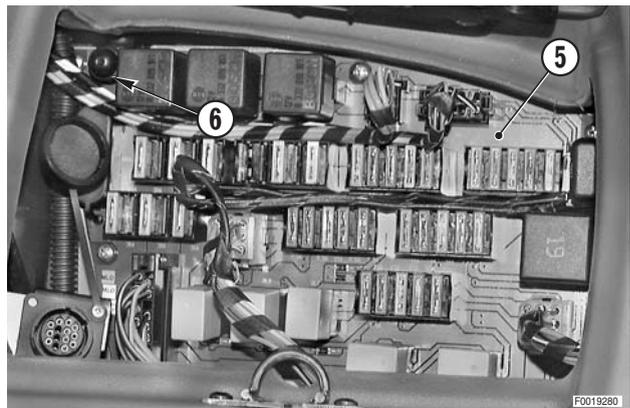
6 - Disconnect the connector (7) (P5), which is accessed through the ECU compartment.
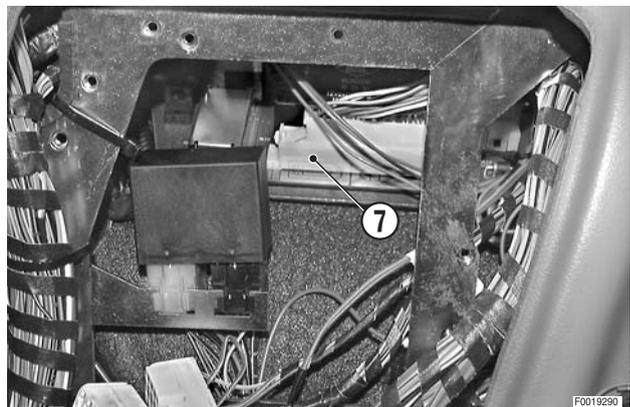
7 - Remove the relays from the board (5) which prevent its
   removal:
   RL4   - front windscreen (8)
   RL14 - direction indicators (9)
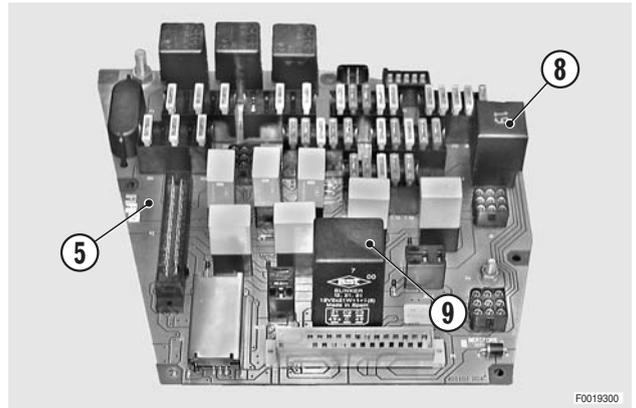
8 - Disconnect the lead (10) and remove the five fixing
   screws (11).
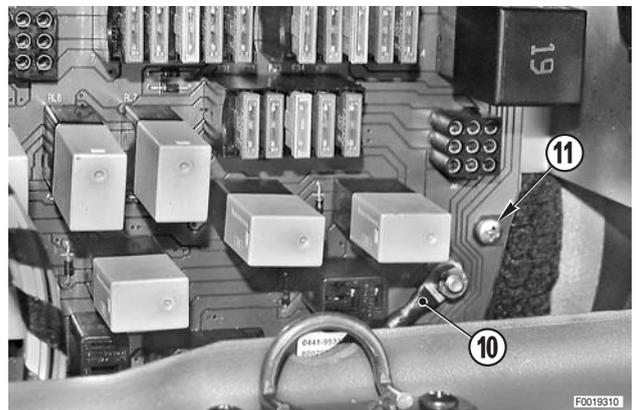
9 - Remove the board (5).
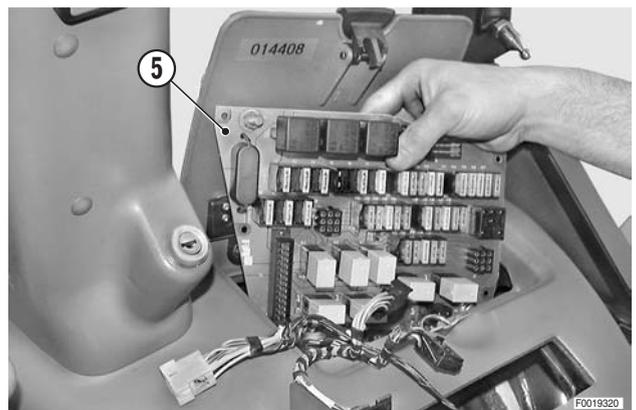
REFITTING THE FUSE AND RELAY BOARD

•   Refitting is the reverse of removal.

REMOVAL OF THE ENGINE ECU

⚠️ Remove the battery cover and disconnect the nega-
tive 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
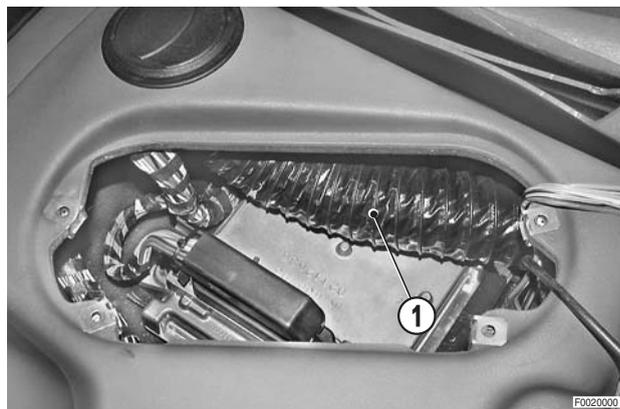
3 - Loosen the fixing screws (2) and partially withdraw the
ECU (3).
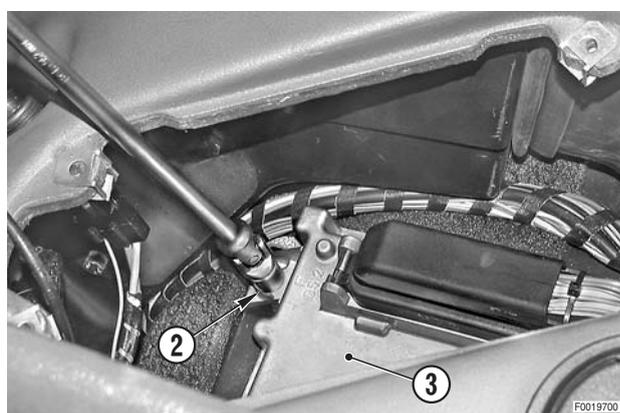
4 - Label and unplug the connectors (4) and (5).

5 - Remove the ECU (3).
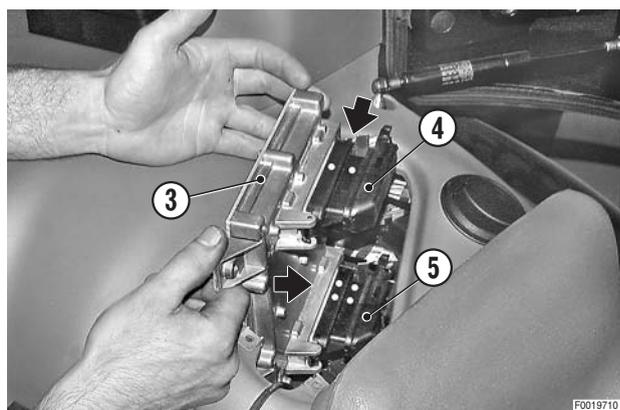
REFITTING THE ENGINE ECU

• 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

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).
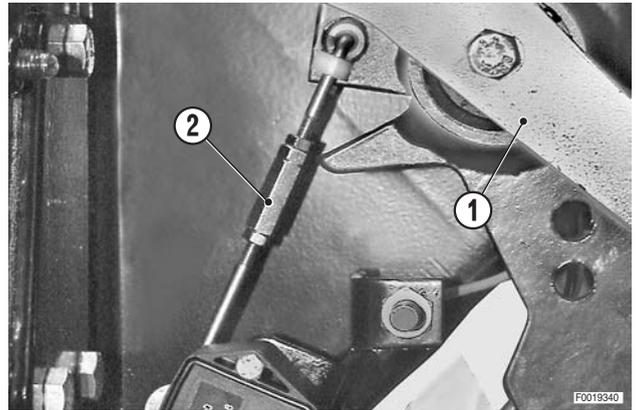
3 - Unplug the connector (4) from the potentiometer (3).

4 - Remove the screws (5) and remove the potentiometer complete with the tie-rod.
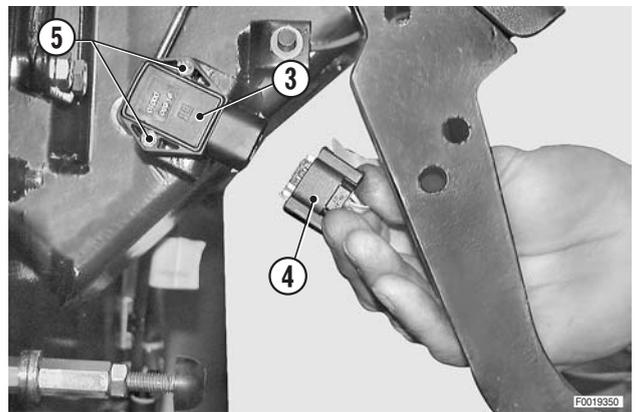
★ If a new potentiometer is to be fitted, disconnect the tie-rod (2), remove the cotter pin (6) and the lever (7).

★ Renew the cotter pin at each re-assembly.
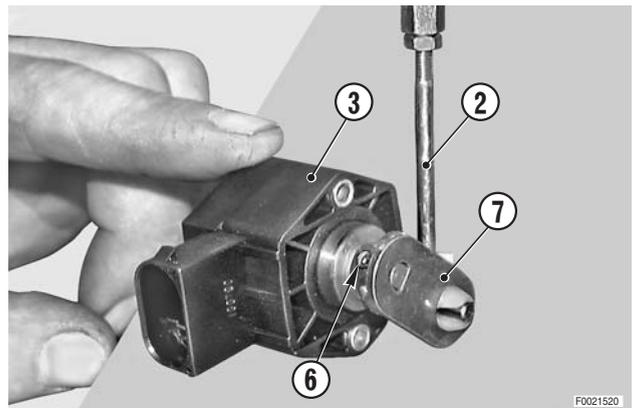
1.1. Refitting the potentiometer.

• 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.

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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).
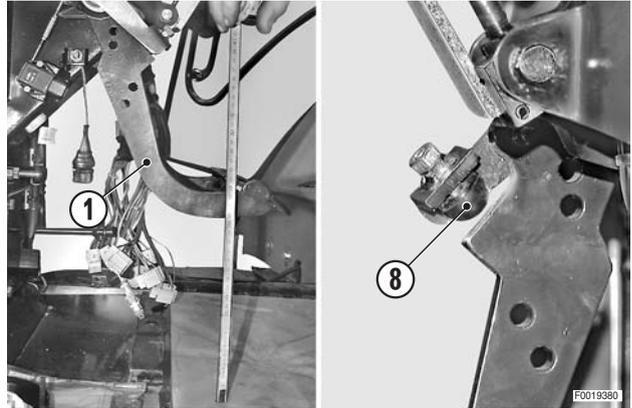
2 - Regolare il tampone (9) fino ad ottenere una corsa del pedale "**A**" di 155⁺₋5 mm (6.107⁺₋0.197 in.)
   NOTE With the EDS program in section 20, check that the voltage reaches a value of 0.9–1.1V.
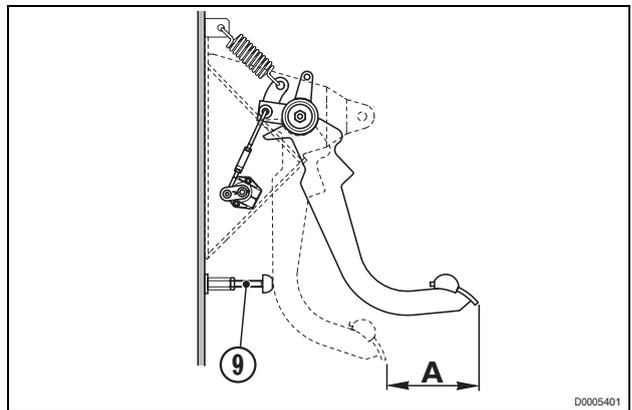
3. Renewal of the proximity sensor

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).
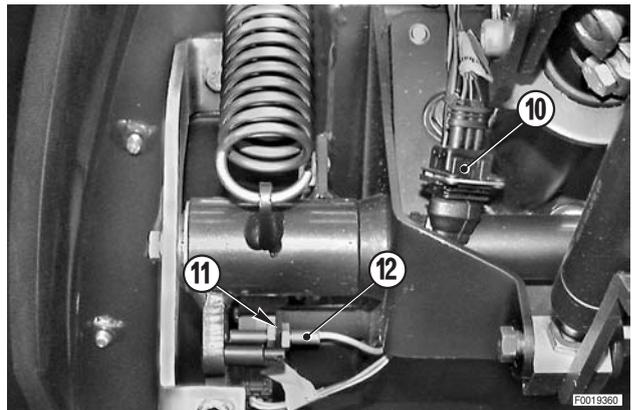
4 - Fit the new sensor (12) following the removal procedure in reverse.
Fully depress the clutch pedal.

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.)
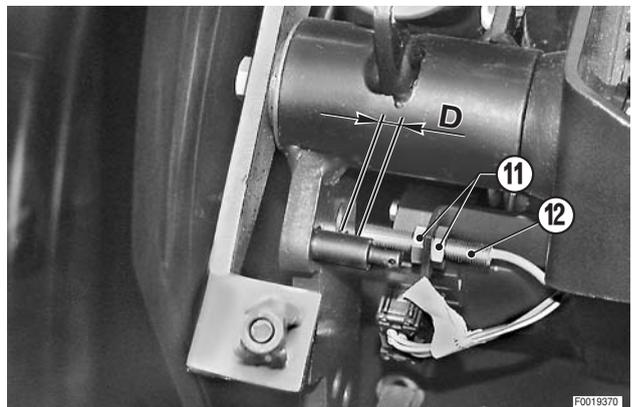
REMOVAL OF THE CONTROL PANELS AND LEVERS OF THE AUXILIARY SERVICE VALVES AND THE PTO

★ The illustrations refer to a model equipped with a front PTO.

⚠ Disconnect the negative lead (-) from the battery.

1. Remove the lift control panel

1 - Unscrew and remove fixing screws (1) of the lift control panel (2).
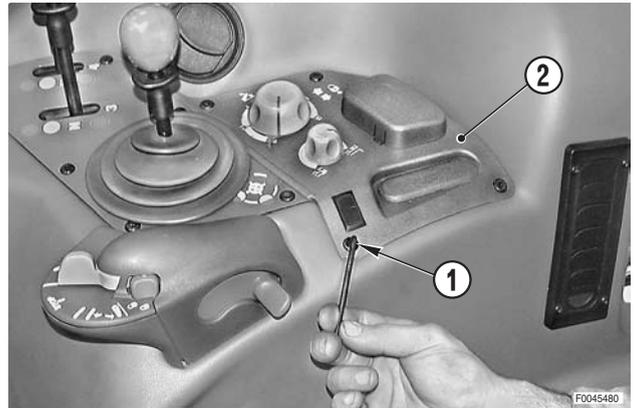
2 - Unplug the connector (3) and remove the assembly (2).

3 - **Only in the case of testing or renewal of the potentiometers.**
Unscrew and remove the screws (4) and remove the lower cover (5).
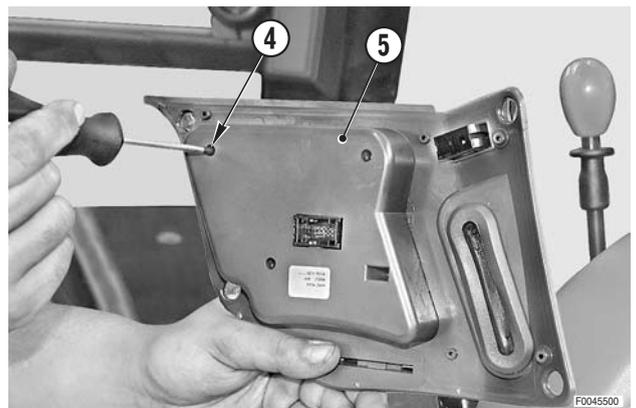
2. Removal of the auxiliary service valve control levers

1 - Remove the lift control panel as described in the previous paragraph.

2 - Unscrew and remove fixing screws (6) of the control levers assembly (7).
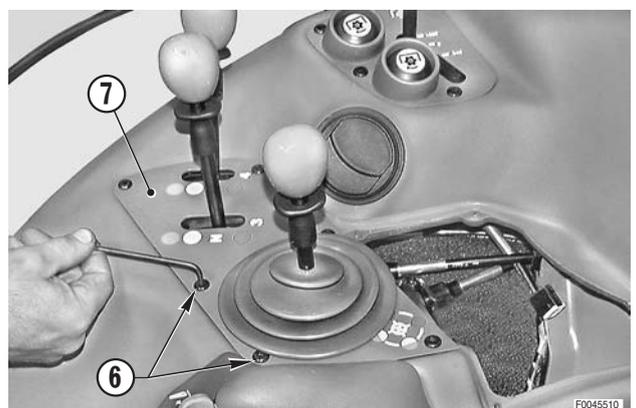
3 - Lift the assembly (7) and rotate it through 90°.
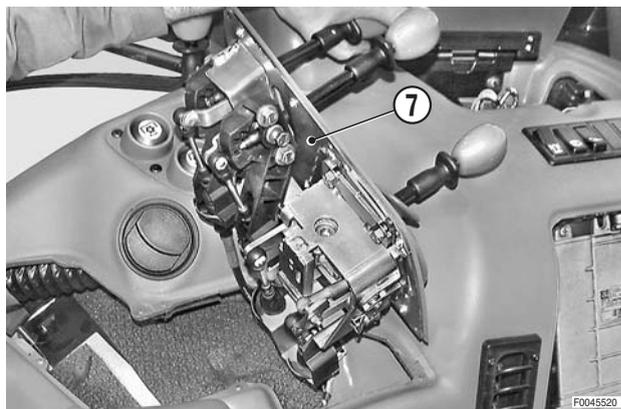
2.1 Removal of the cross-gate control lever assembly

1 - Remove the yokes (8) securing the outer cables and disconnect the cables (9) and (10). ※ 1
   ★ Label the control cables to avoid confusion on re-connection.
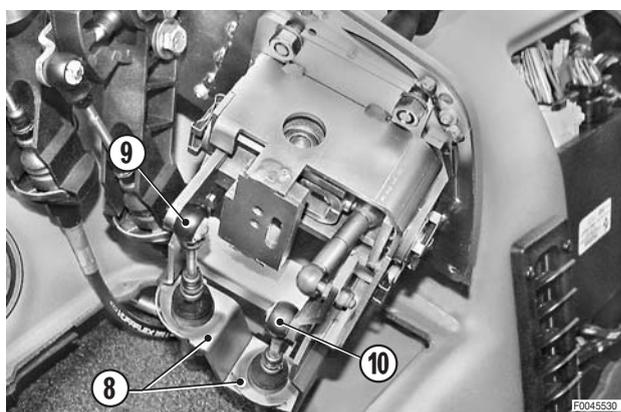
2 - Unscrew and remove the nuts (11) with their washers; withdraw the control assembly (12) from the panel (7).
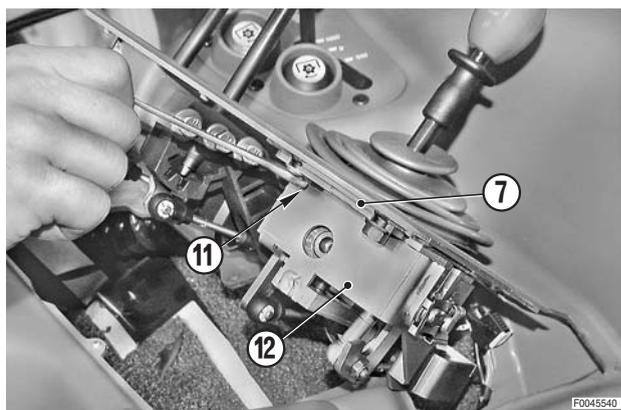
2.2 Removal of the individual service valve control levers

1 - Remove the yokes (13) securing the outer cables and disconnect the inner cables (14). ※ 1
   ★ Label the cables to avoid confusion on reconnection.
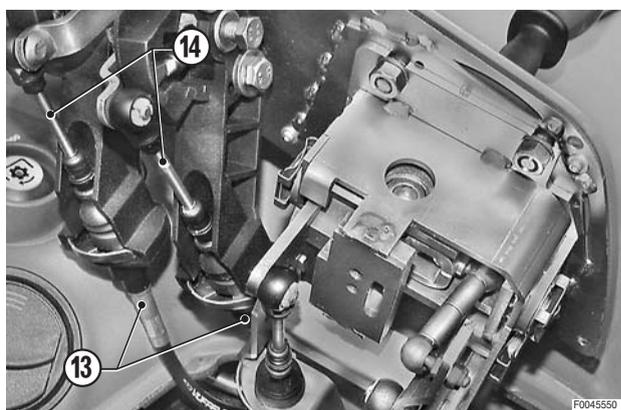
2 - Unscrew and remove bolts(15) with their washers and remove the levers (16) and the lever pivot supports (17).
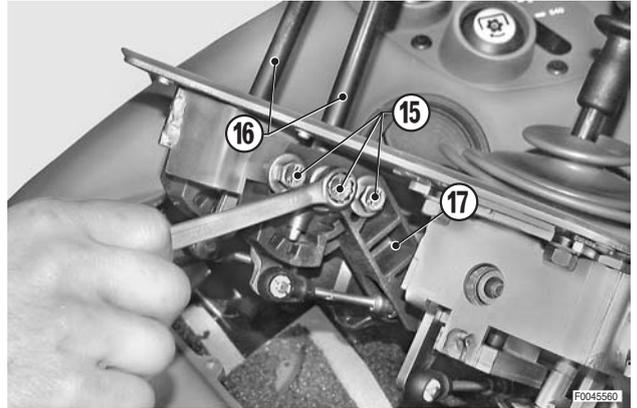
2.3 Removal of the PTO control panel

1 - Unscrew and remove the screws (18).

2 - Lift the control panel (19) and unplug the connectors (20).

   ★ Label the connectors to avoid confusion on reconnection.

3 - Remove the yoke (21) securing the outer cable (22), disconnect the cable (23) and remove the assembly (19).   ※1
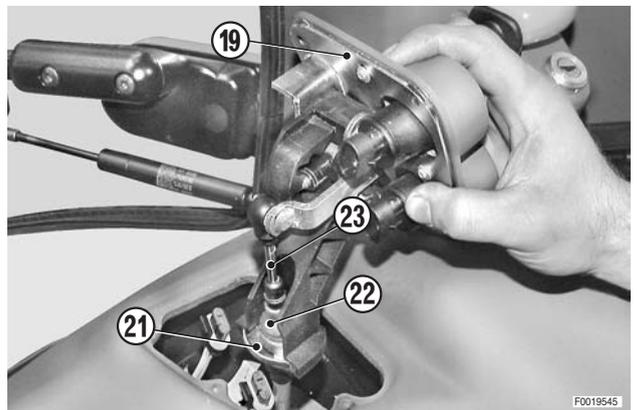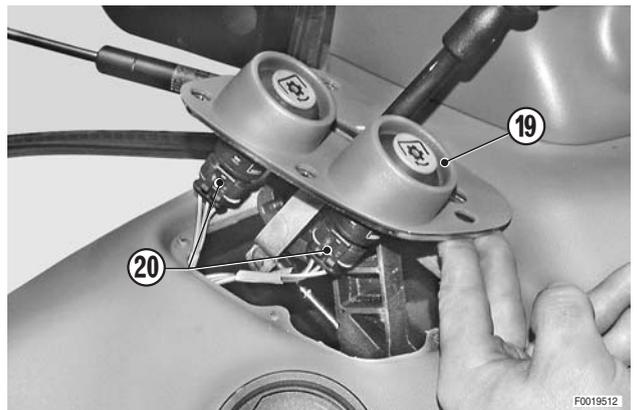
2.4 Removal of the lift control assembly and the hand throttle

1 - Unscrew and remove the two outer fixing screws (24) of the assembly (25).
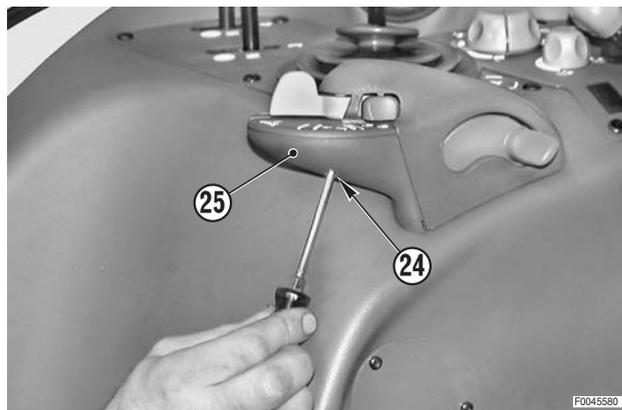
2 - Release the right-hand console (26) from its fixings and tilt it towards the centre of the cab in order to remove the inner screws (27) and unplug the connectors (28).

   ★ (For details, see «REMOVAL OF THE RIGHT-HAND CONSOLE»).

3 - Remove the lift control assembly. 　※ 2
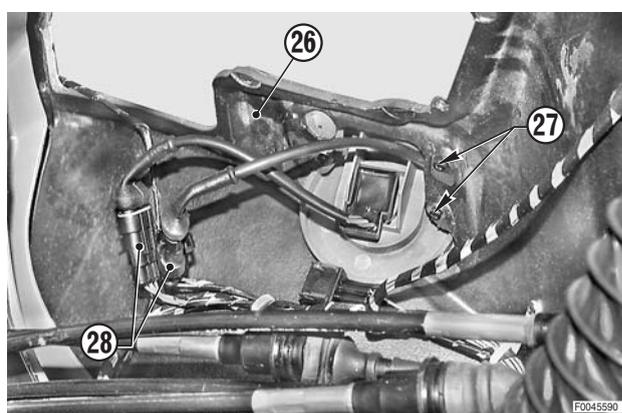
REFITTING THE CONTROL PANELS AND LEVERS OF THE AUXILIARY SERVICE VALVES AND THE PTO

• 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).
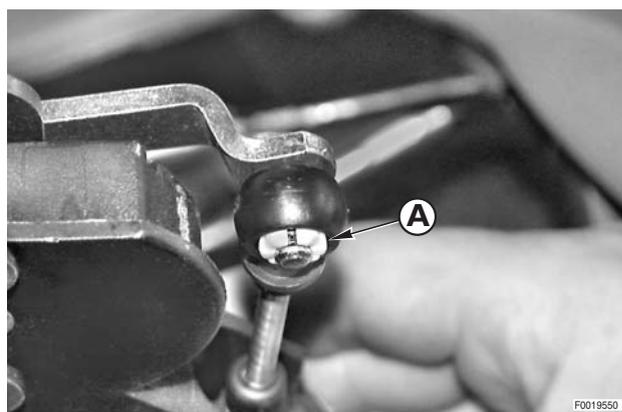
RENEWAL OF THE PTO ENGAGEMENT AND SELECTION CONTROL CABLES

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).
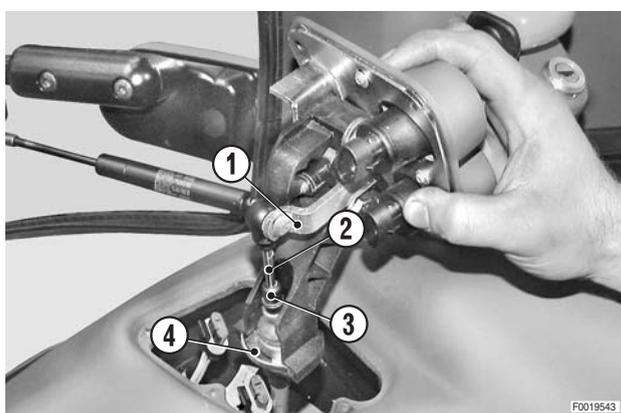
3 - Remove the front floor mat and remove the plate (5) of the cab guide (6) in order to release the outer cable to be renewed.
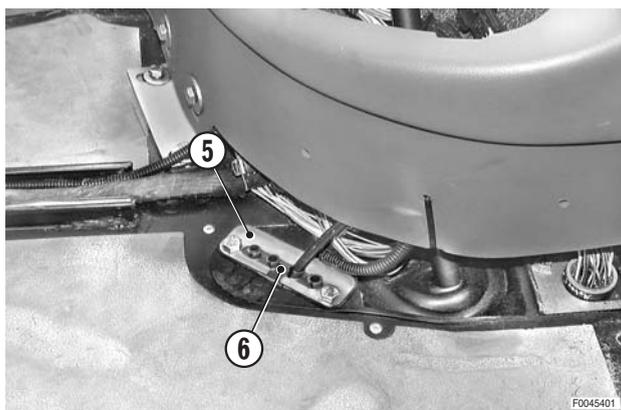
4 - Loosen the fixing screw (7) of the gear lever gaiter (8).

5 - Raise the gaiter (8), unplug the connector (9) and withdraw the control cable to be renewed.

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6 - Disconnect the control cable end (11) from the lever (10) ; remove the outer cable retaining yoke and remove the controlcable.
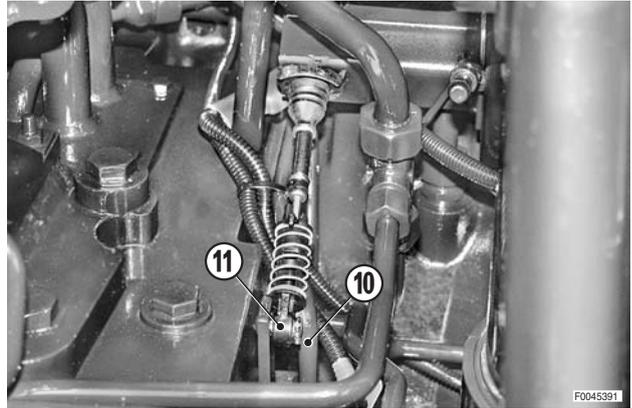
REFITTING

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).
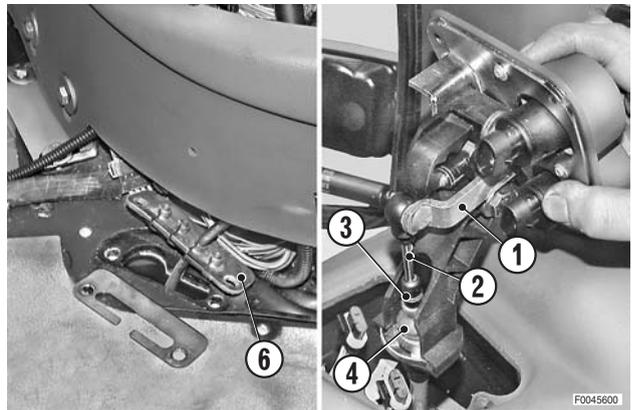
3 - Fissare il gruppo leva (12) sulla consolle destra.

4 - Move lever (13) to the position corresponding to the position of lever (10).
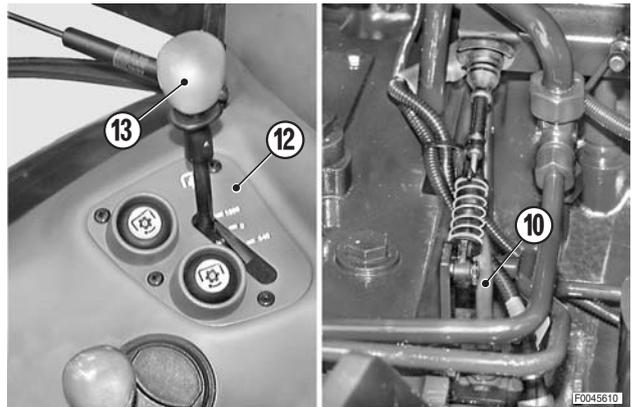
5 - Secure the outer cable with the yoke.

6 - Stretch the cable slightly to connect it to the fitting on the lever (10), making sure that the lever on the console is still in the correct position.
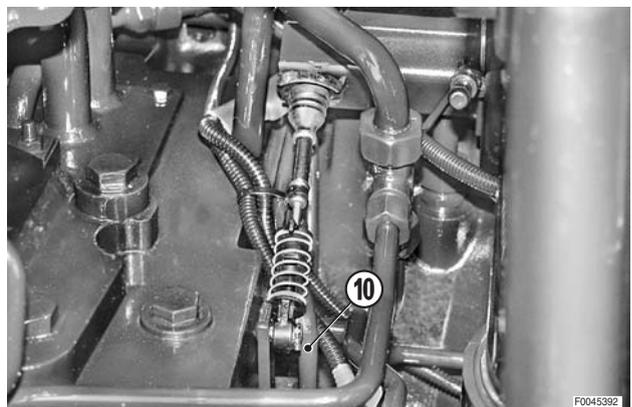
7 - Move the lever (13) in the cab and make sure that the selector lever on the transmission moves through its full travel distance and effects the gear change.

★ Check that the travel of the new lever (13) is properly centred relative to the symbols stamped on the console.
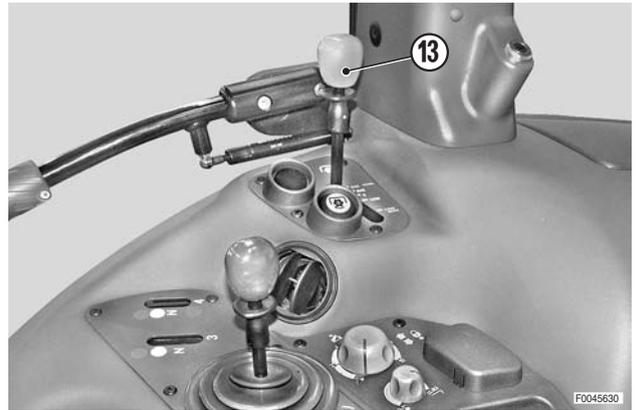
8 - Secure the outer cable with the yoke.

9 - Stretch the cable slightly to connect it to the fitting on the lever (10), making sure that the lever on the console is still in the correct position.
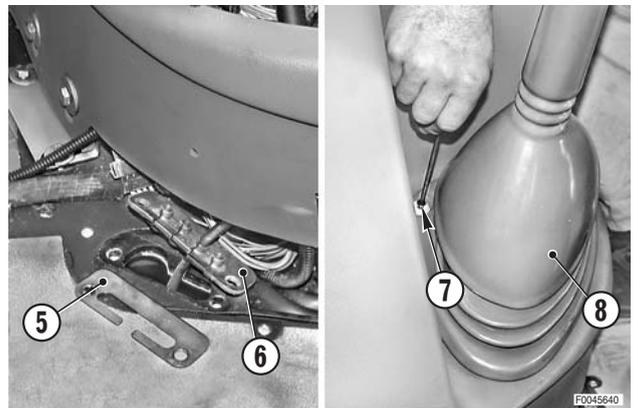
RENEWAL OF THE AUXILIARY SERVICE VALVE CONTROL CABLES

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»).
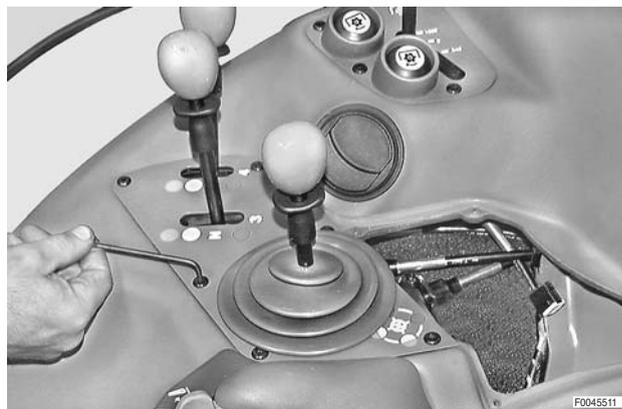
3 - Detach the right-hand console (1) from the cab, but do not unplug any of the connectors.
(For details, see «OPENING AND REMOVAL OF THE RIGHT-HAND CONSOLE»).
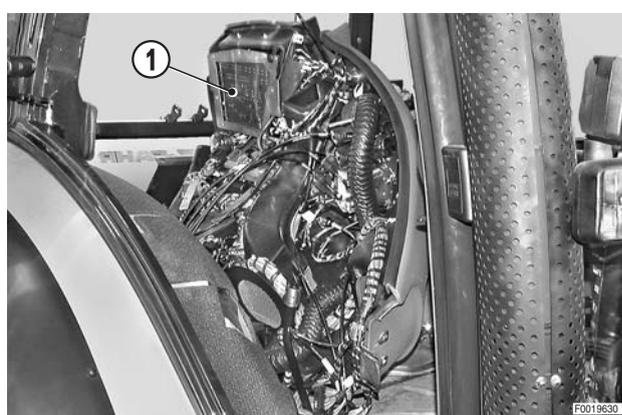
4 - Disconnect the outer cables (2) and inner cables (3) from the control valve assembly.
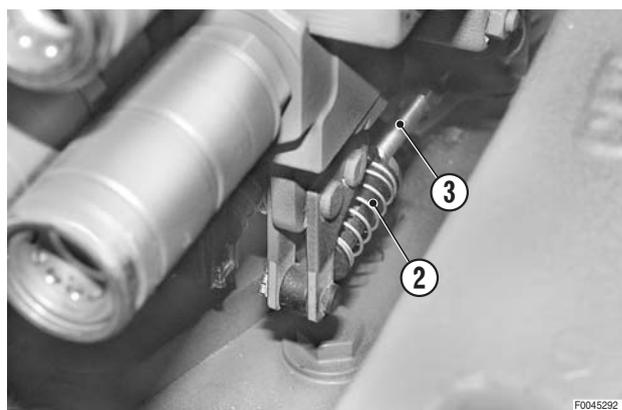
5 - Remove the screws and remove the plate (4) securing the bulkhead gasket (5).
Release the control cables (6) from the bulkhead fitting and withdraw them towards the rear of the tractor.
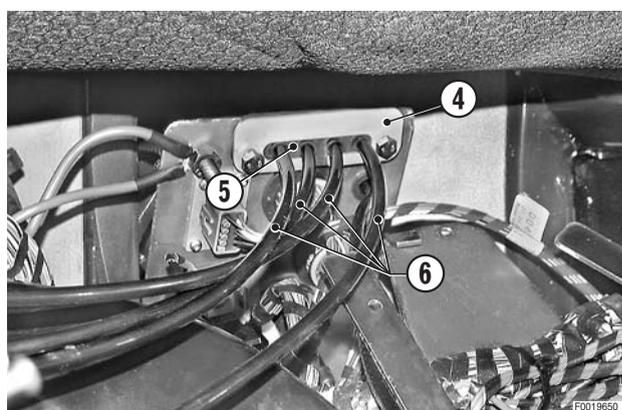
REFITTING THE AUXILIARY SERVICE VALVE CONTROL CABLES

- 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.
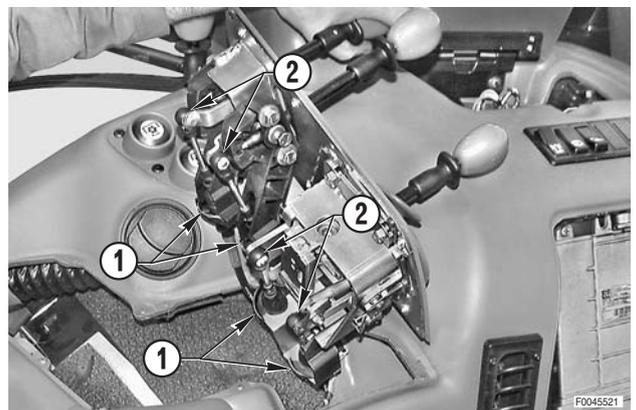
4 - With the control lever in neutral position, lift the retaining bush (3) and, while keeping the cable under slight tension, insert the end in the fitting (4).
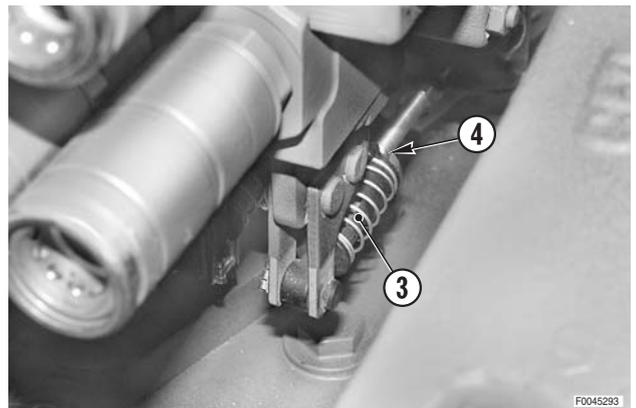
5 - Lower the retaining bush (3); check that the control valve spool travels through its full stroke and that the control lever is positioned centrally in its slot when the control valve is in neutral.

   ★ 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).

F0045660
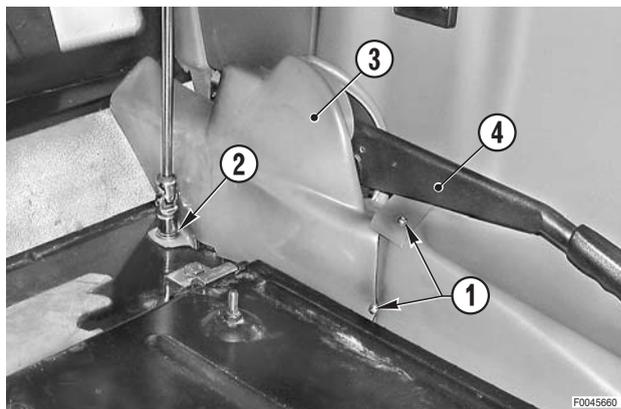
2 - Operate the lever (4) repeatedly to eliminate any play in the mechanism.

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).

F0045670
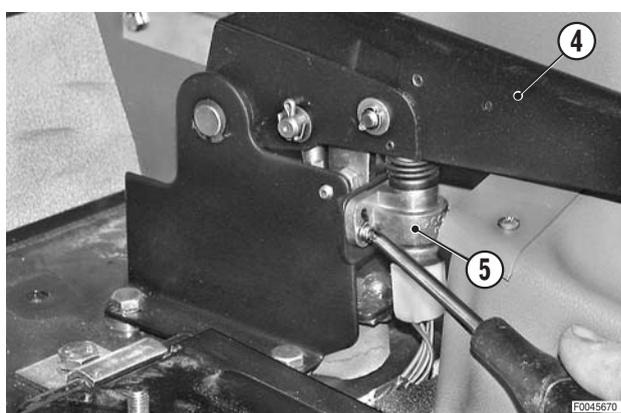
REMOVAL OF THE CLIMATE CONTROL PANEL

⚠ 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).
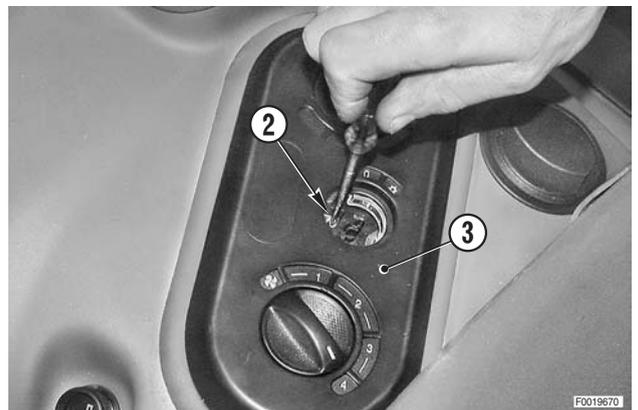
3 - Detach the control panel (3) by pressing the spring clips (4) securing it to the left-hand console.
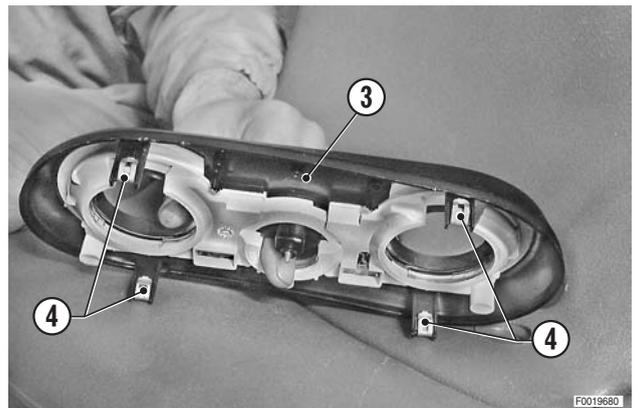
4 - Lift the panel (3), disconnect the connectors (4) and (5), the wiring (6), and the heater control cable (7).

REFITTING THE CLIMATE CONTROL PANEL

• Refitting is the reverse of removal.
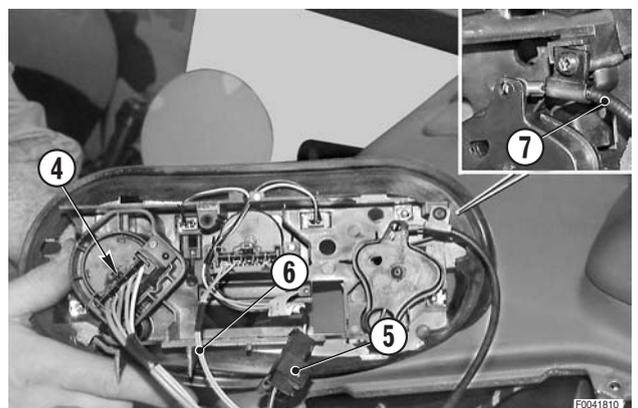
RENEWAL OF THE HEATER VALVE

1.   Removal

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

1 - Drain the coolant from the engine cooling system.

⬙ Coolant:

Mod.	80	85	90	100	105
ℓ	15,5	15,5	15,5	15,5	17,5
US.gall.	4.10	4.10	4.10	4.10	4.62

2 - Disconnect the inner control cable (2) and the outer cable (3) from the valve (1).   ※ 1

F0021560
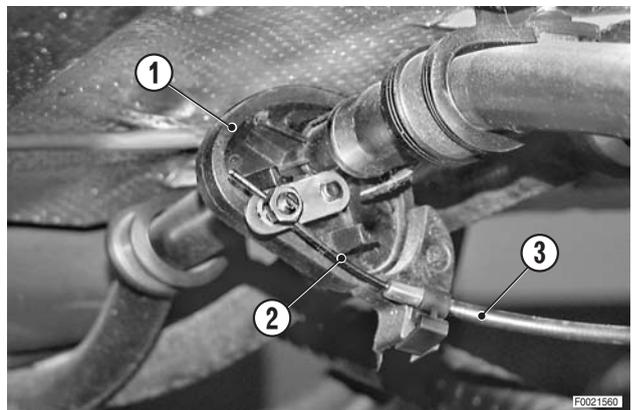
3 - Loosen the retaining straps (4) and remove the valve (1).

F0045840
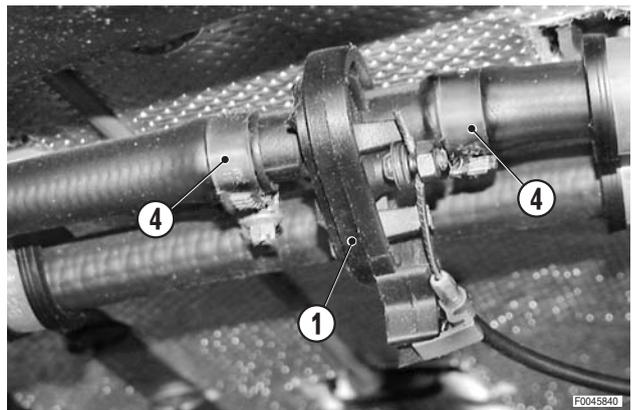
2.   Refitting and adjustment of the control cable.

• Refitting is the reverse of removal.

※ 1

★ 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).

D0004730
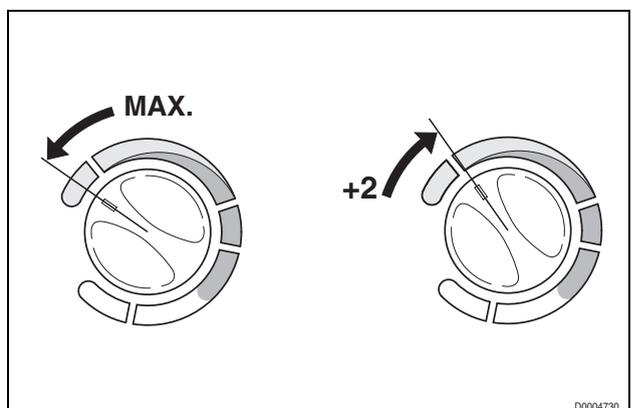
2 - Turn the lever (5) of the heater valve (1) up to to the stop (6).

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).
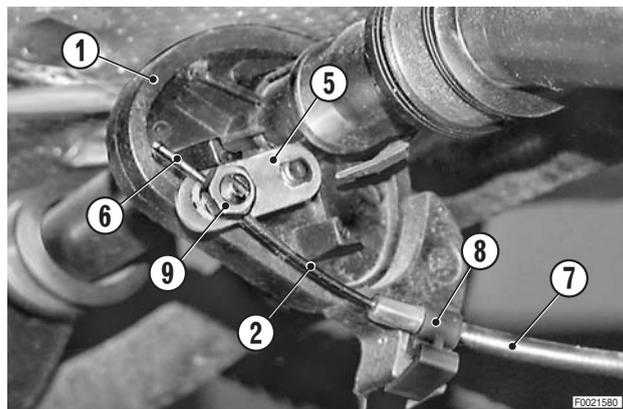
1 - Fill the cooling system.

Coolant:

Mod.	80	85	90	100	105
ℓ	15,5	15,5	15,5	15,5	17,5
US.gall.	4.10	4.10	4.10	4.10	4.62

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 - Loosen the grub screw, remove the accelerator pedal (1) and remove the front floor mat (2).
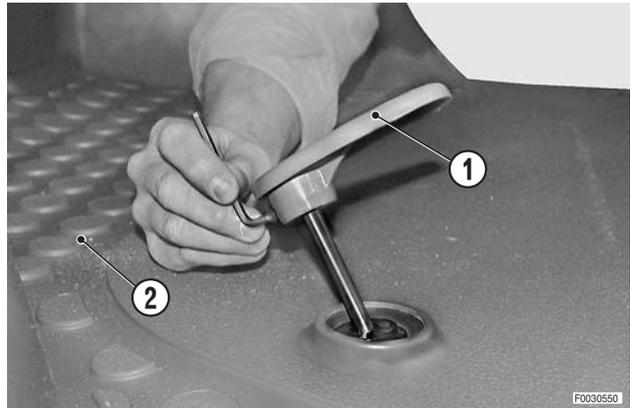
3 - Remove the rear floor mat (3).
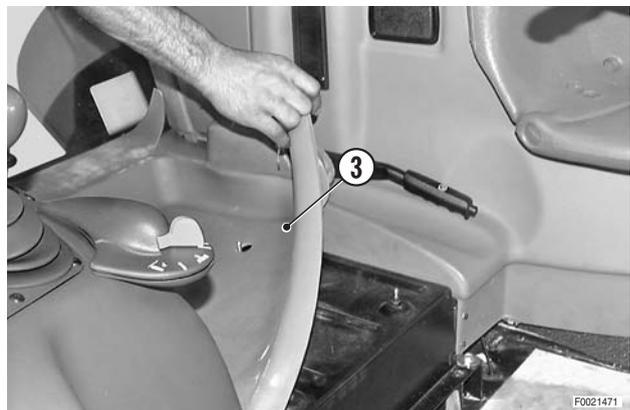
4 - Remove the retaining strap (4) and the air hose (5).
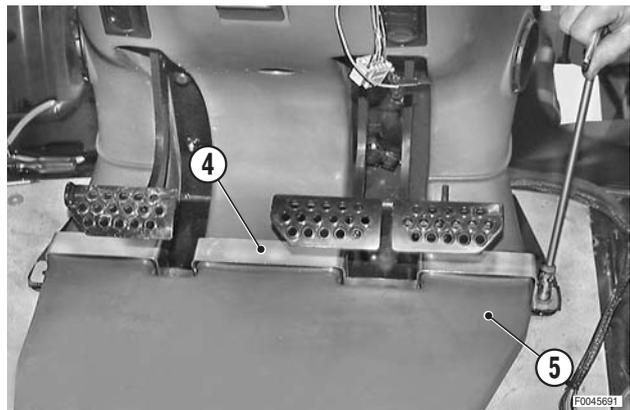
5 - Remove the bolts and lift the seat support (6).

6 - Remove the bolts and remove the upper cover (7) of the air conditioning assembly.
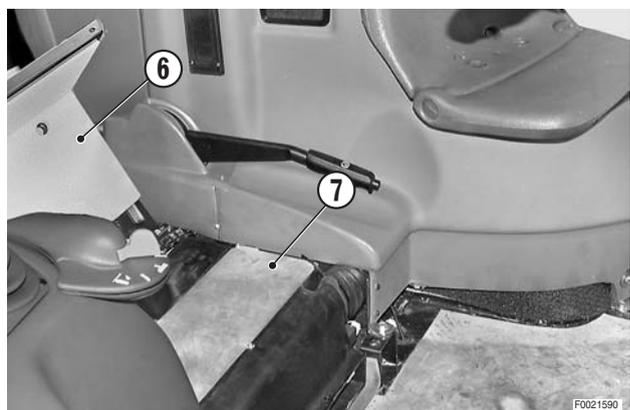
7 - Turn the heater control knob to the MAX position (red section).
Drain the coolant from the engine and the heater matrix by disconnecting the pipes (8).

Coolant:

Mod.	80	85	90	100	105
ℓ	15,5	15,5	15,5	15,5	17,5
US.gall.	4.10	4.10	4.10	4.10	4.62

★ After draining the system, reconnect the pipes (8).
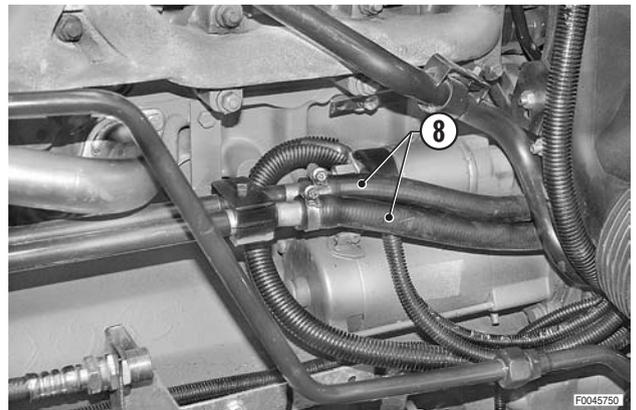
8 - Remove the evaporator.
(For details, see «REMOVAL OF THE AIR CONDITIONING EVAPORATOR»).

9 - Remove the hose clamp (9) and disconnect the vertical return hose (10) from the matrix.
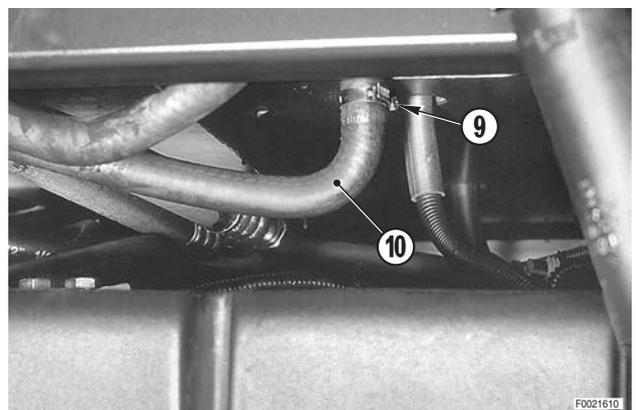
10 - Remove the hose clamp and disconnect the horizontal delivery pipe (11) from the matrix.
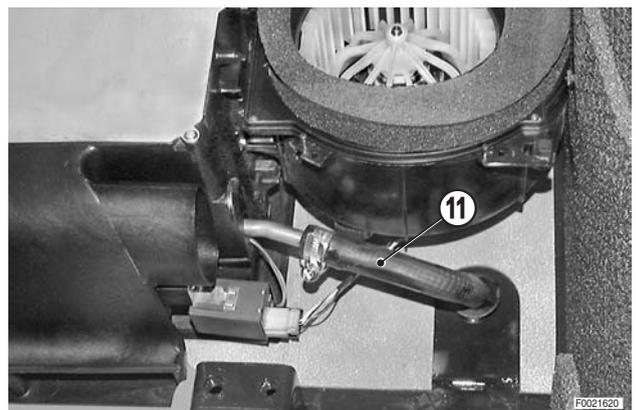
11 - Remove the matrix (12) by lifting the right side vertically and then rotating it towards the rear of the tractor.

30-177
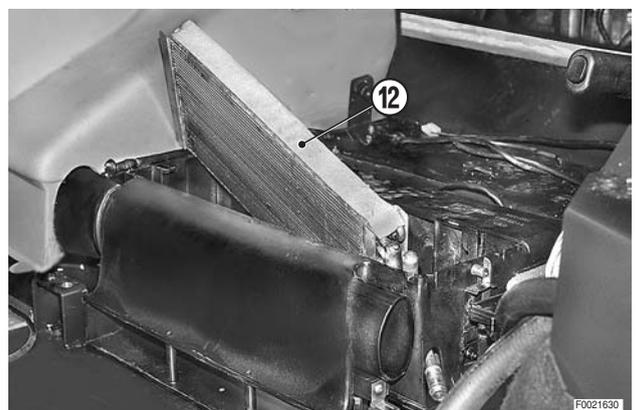
REFITTING THE HEATER MATRIX

- Refitting is the reverse of removal.

1 - Fill the cooling system.

Coolant:

Mod.	80	85	90	100	105
ℓ	15,5	15,5	15,5	15,5	17,5
US.gall.	4.10	4.10	4.10	4.10	4.62

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 - Loosen the grub screw, remove the accelerator pedal (1) and remove the front floor mat (2).

3 - Remove the rear floor mat (3).
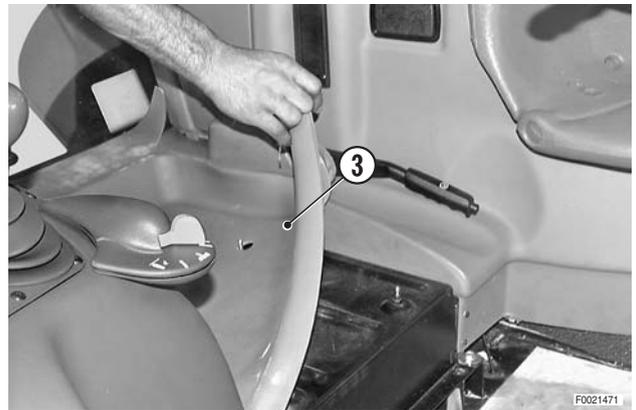
4 - Connect the quick-fit couplers of the high (R) and low (S) pressure pipes to the refrigerant (R134A) charging, testing and recovery machine.
Set the machine for recovery operation and start it; allow the machine to run until all the refrigerant has been recovered, then disconnect it. ※ 1

★ Measure the quantity of oil recovered and consequently to be reintroduced into the system.
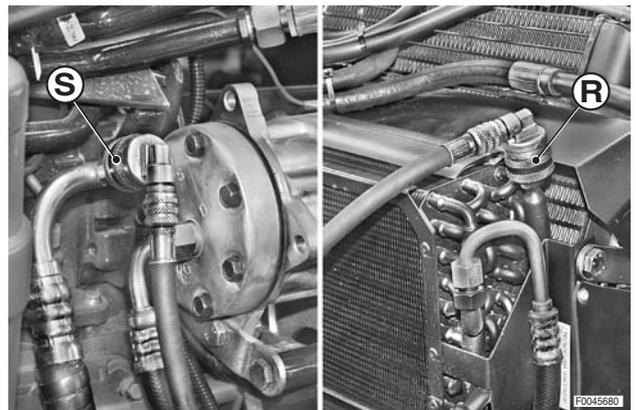
5 - Remove the hose clamp (4) and the air hose (5).
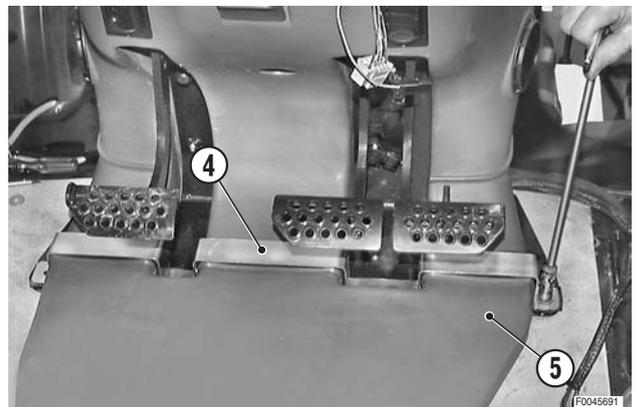
6 - Remove the bolts and lift the seat support (6).

7 - Remove the screws and remove the cover (7) of the air conditioning assembly.
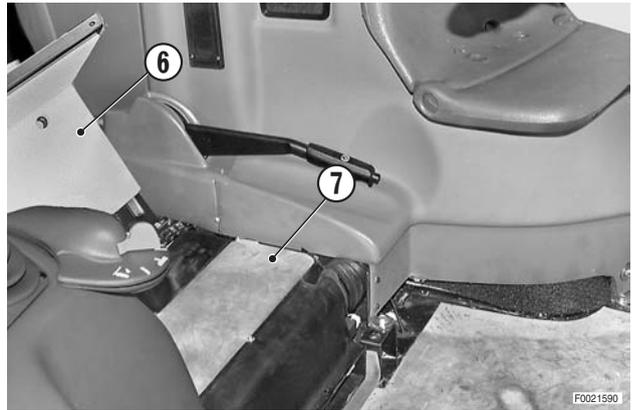
8 - Disconnect the inlet (8) and outlet (9) pipes from the evaporator.

<div style="text-align:center">※ 2</div>

⚠ 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).
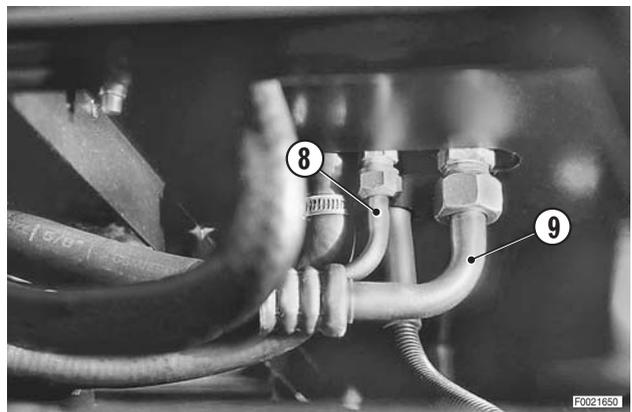
10 - Lift up the evaporator (11); remove the temperature sensor (12) and place it on one side. ※ 3

11 - Remove the evaporator (11).
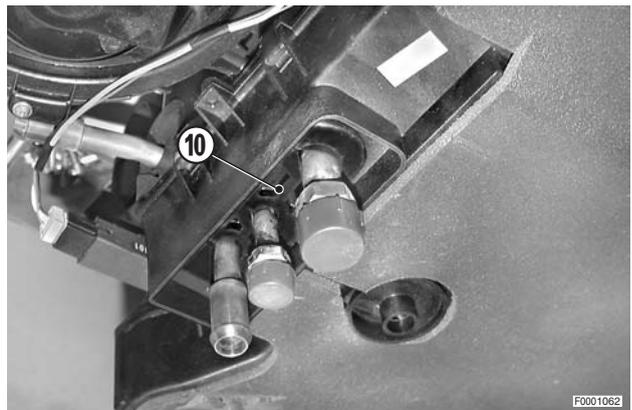
REFITTING THE EVAPORATOR

• Refitting is the reverse of removal.

※ 1

★ Quantity of R134a: 1600 g (56.4 oz.)

★ 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).
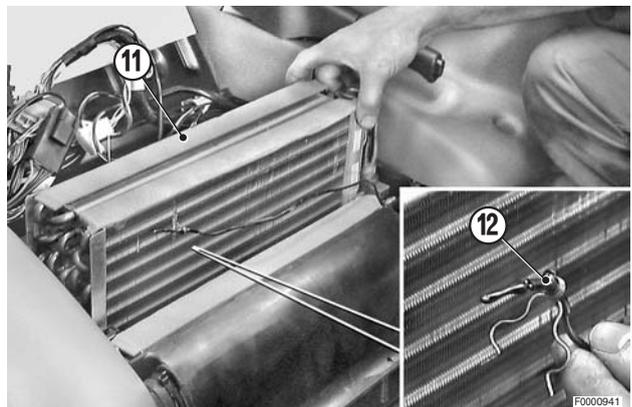
REMOVAL OF THE RIGHT-HAND AIR CONDITIONING FAN

⚠ 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.
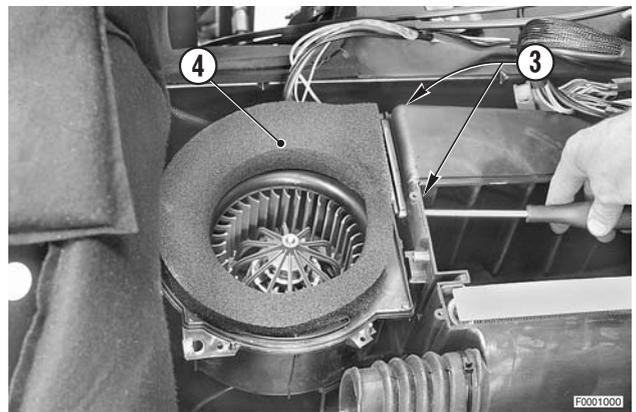
8 - Unplug the connectors (5) and (6). ※ 1

⚠ If a new fan is to be fitted, the support block (7) should also be renewed.
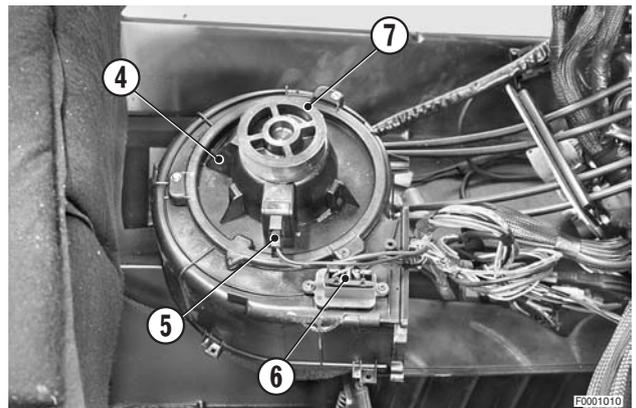
REFITTING THE RIGHT-HAND AIR CONDITIONING FAN

• 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.
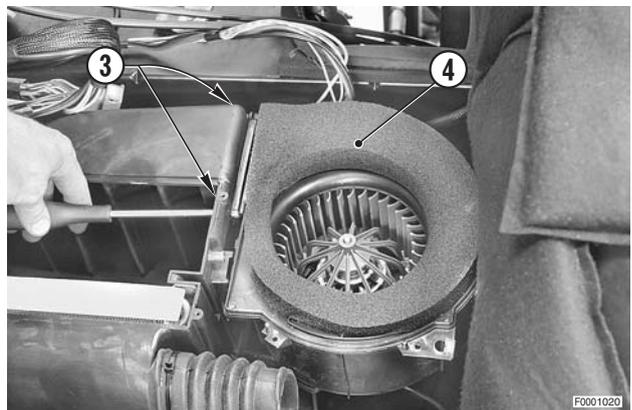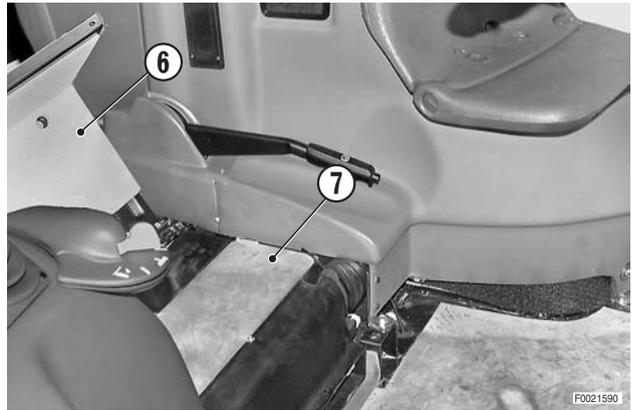
7 - Unplug the connectors (5) and (6).　⊡ 1

⚠ If a new fan is to be fitted, the support block (7) should also be renewed.
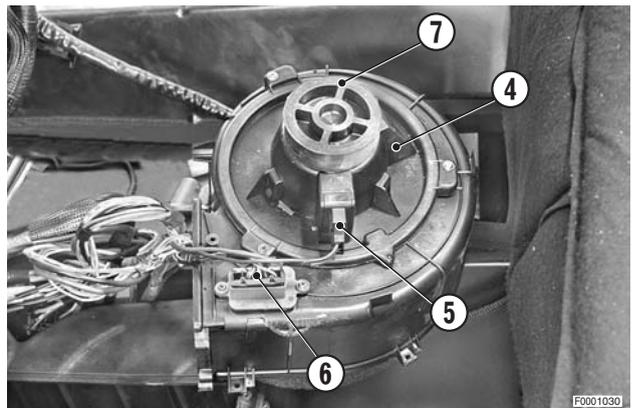
REFITTING THE LEFT-HAND AIR CONDITIONING FAN

• 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.)
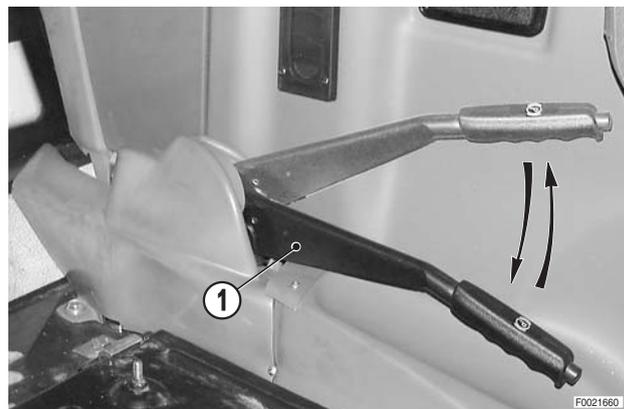
3 - If the force is outside these limits, screw out the nut (2) with the least clearance and screw in the nut (3) with most clearance.

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.).
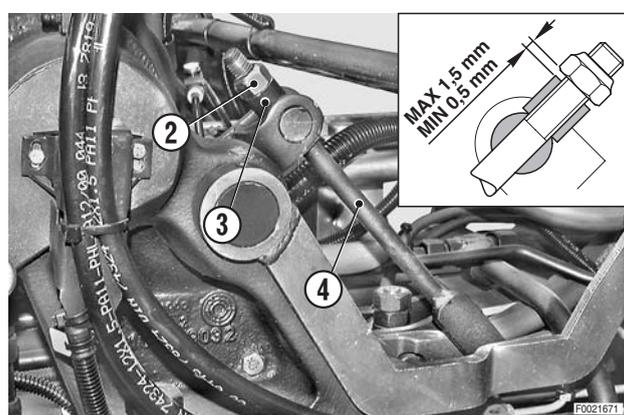
5 - Take the tractor to straight section of apshalted road at least 50 m (97 yard) in length.

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.

10 - Check that parking lever travel is within the normal limits.

★ Lever travel: max. 5 notches

If adjustment is required, turn the two nuts (2) by equal amounts.

RENEWAL OF CAB DOOR CABLE

1 - Unscrew and remove the four screws (1) securing the two halves of the handle (2).
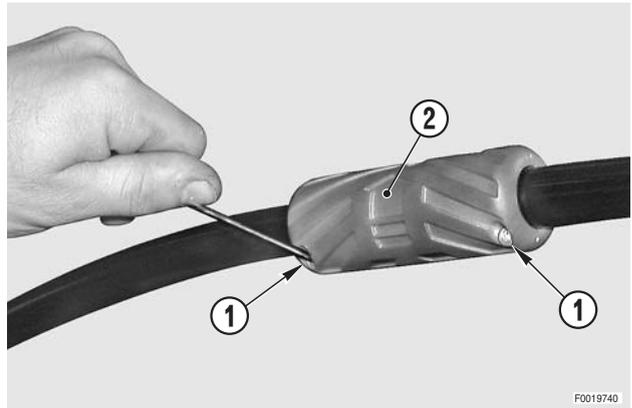
2 - Remove the two halves of the handle and recover the bushes (3) and the pin (4).
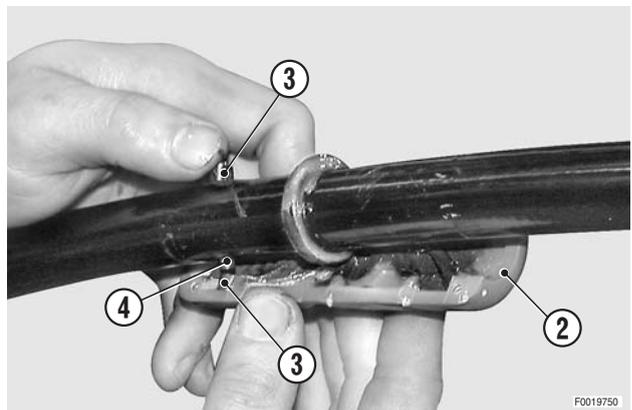
3 - Unscrew and remove the fixing screws (5) of the door lock cover (6).
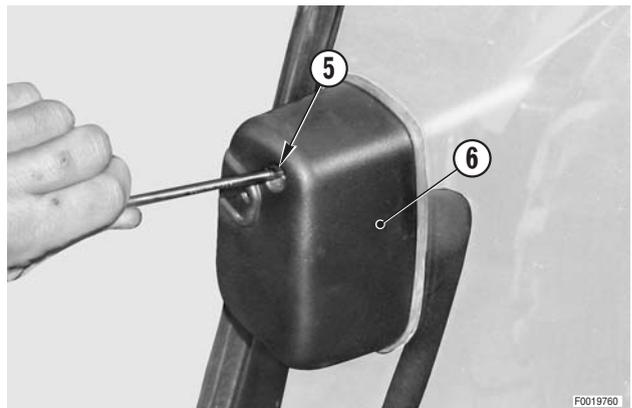
4 - Loosen the clamp nut (7) and withdraw the cable (8).
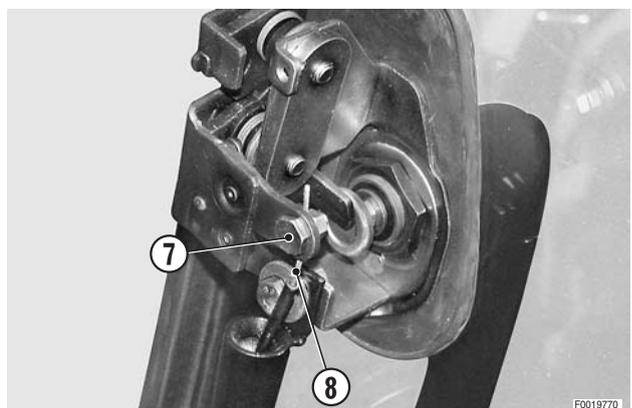
5 - Feed the new cable starting from the handle side; engage it with the pin (4) and the clamp nut (7).
With the cable under slight tension, tighten down the clamp nut.
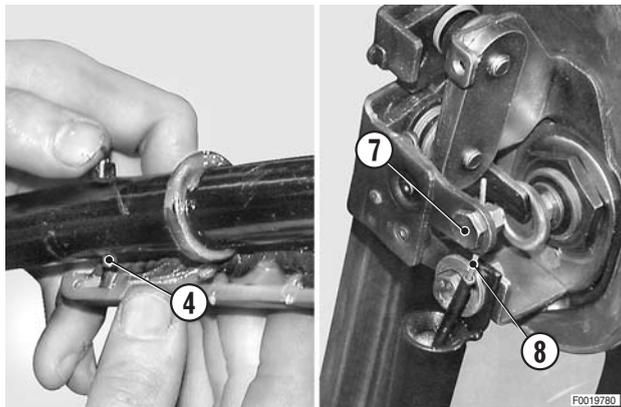
6 - Lubricate the bushes (3) and the slide ways for the handle; fit the bushes to the pin and refit the handle (2).

  Slide ways and bushes: Molikote

7 - Check that the door opens correctly and complete the refitting procedure.
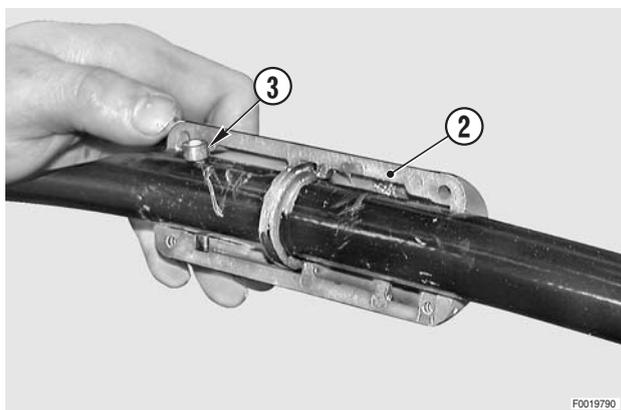
REMOVAL OF THE TRAILER BRAKING AIR PRESSURE GAUGE

⚠ Remove the key from the ignition.

1 - Unscrew and remove fixing screws (1) of the upper cover (2); remove the cover.
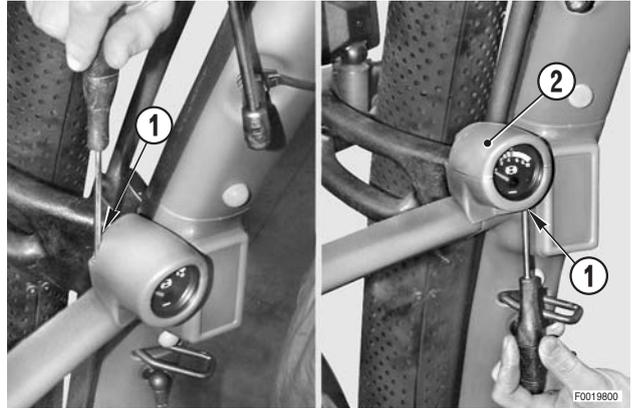
2 - Remove the gauge (3); if a new gauge is to be fitted, unplug the connectors (4) and (5).

★ Label the connectors (5) to avoid confusion on re-connection.
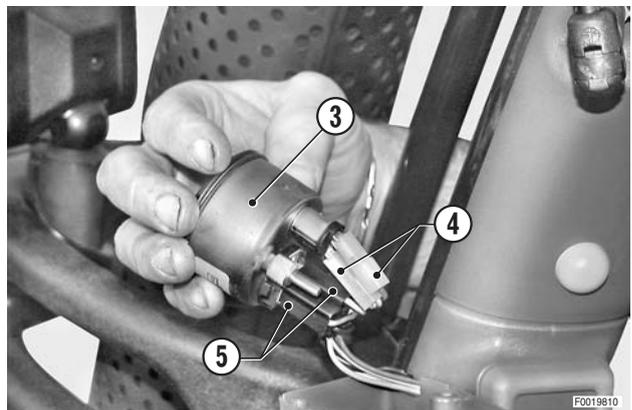
3 - To replace the bulb, unplug the connectors (4) and withdraw the bulb holder (6).

REFITTING THE TRAILER BRAKING AIR PRESSURE GAUGE

• Refitting is the reverse of removal.

REMOVAL OF THE TRANSMISSION 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).
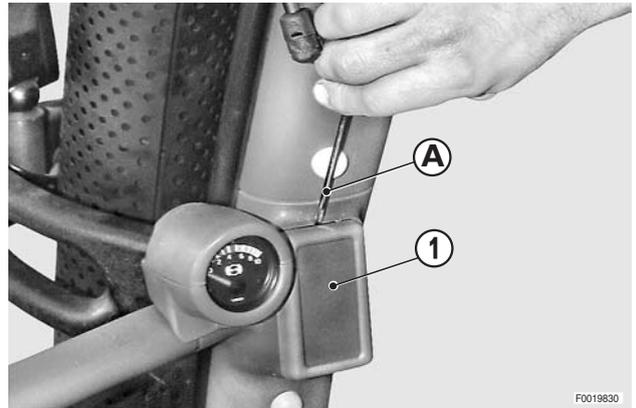
3 - Unplug the connector (2).
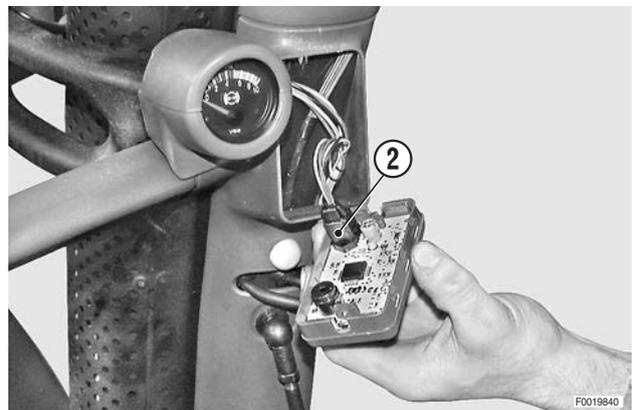
REFITTING THE TRANSMISSION STATUS DISPLAY

• 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).
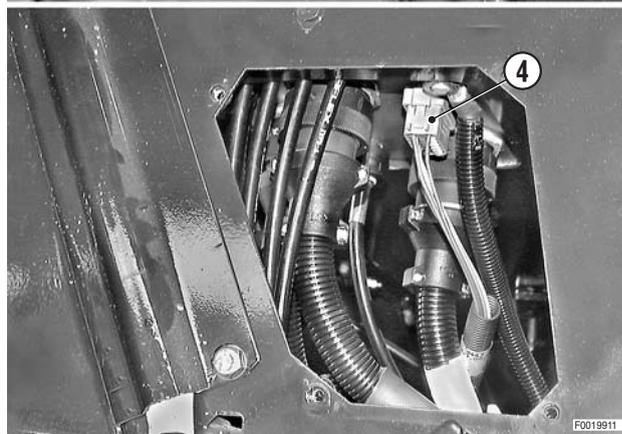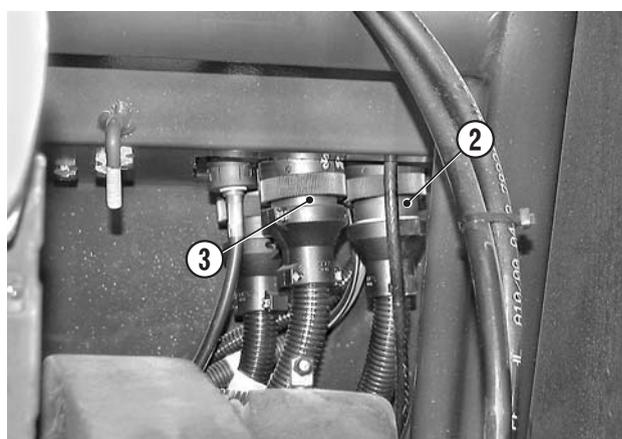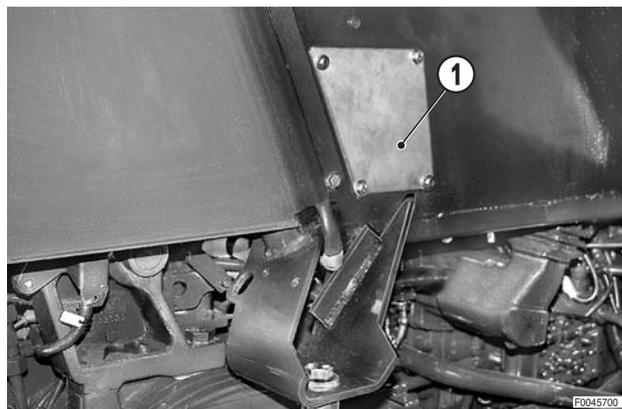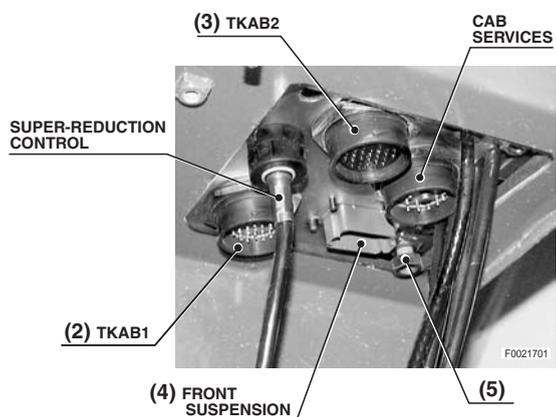
4 - Disconnect from the front bulkhead plate the connector (6) and the connector (7) of the engine wiring.

5 - Remove the bolts and nuts (8) of the gear lever (9).
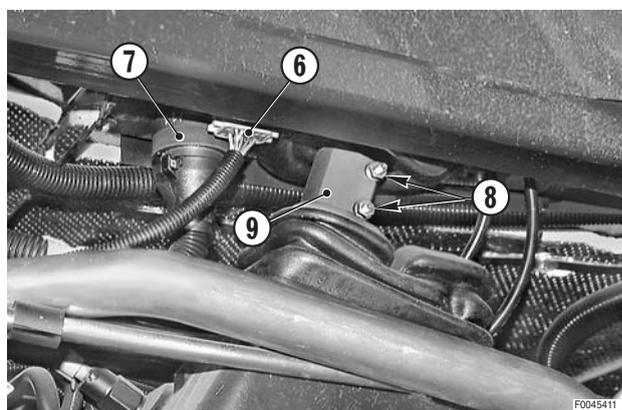
6 - Remove the gear lever gaiter (10), unplug the connector (11) and remove the complete lever assembly (12).
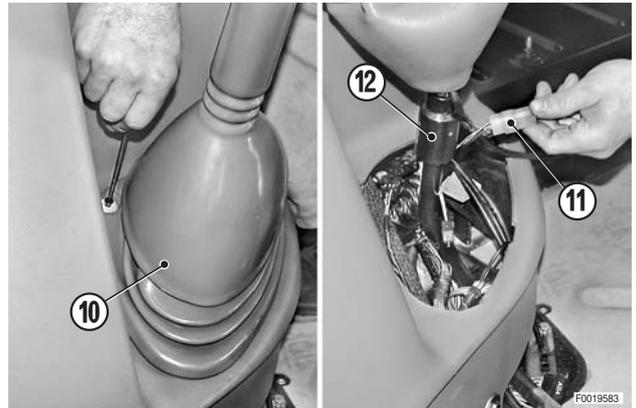
7 - Disconnect the control cables (13) from the auxiliary service control valves.
   ★ Label the cables to avoid confusion on reconnection.
   ★ Disconnect also the outer cables.
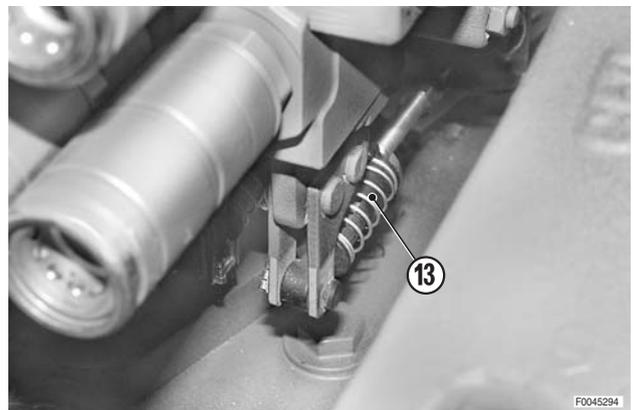
8 - Disconnect the control cable (15) from the PTO speed and operating mode selector lever (14).
   ★ Disconnect also the outer cables.
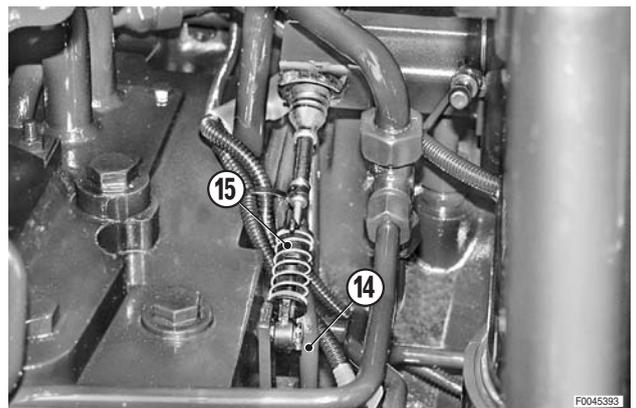
9 - Disconnect the control cable (16) from the creeper control lever (17).
   ★ Disconnect also the outer cable.
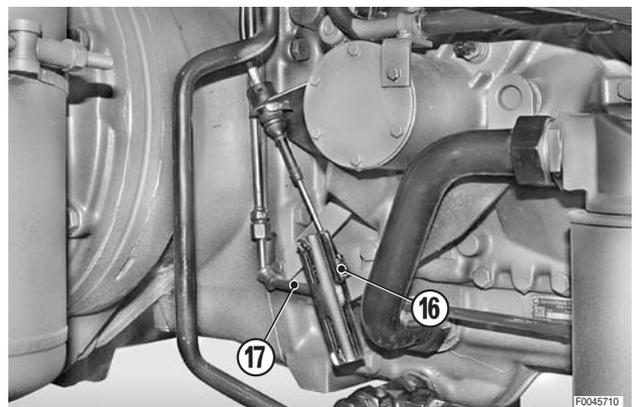
10 - Remove the cab access steps (18).

11 - Remove the fuel tank.
(For details, see «REMOVAL OF THE FUEL TANK»).

12 - Disconnect the system feed wire from the positive terminal (19) (+) of the battery (20).
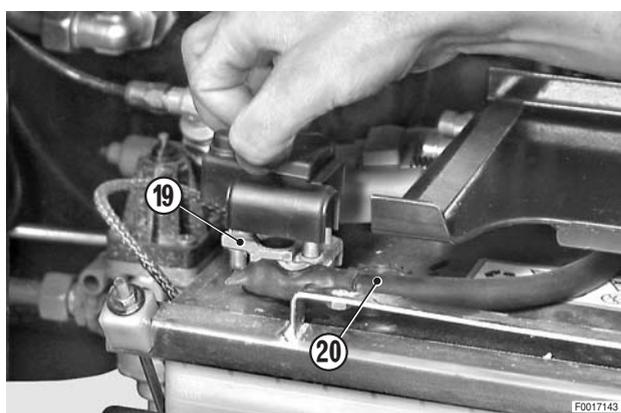
13 - Disconnect the earth leads (21) from the engine.
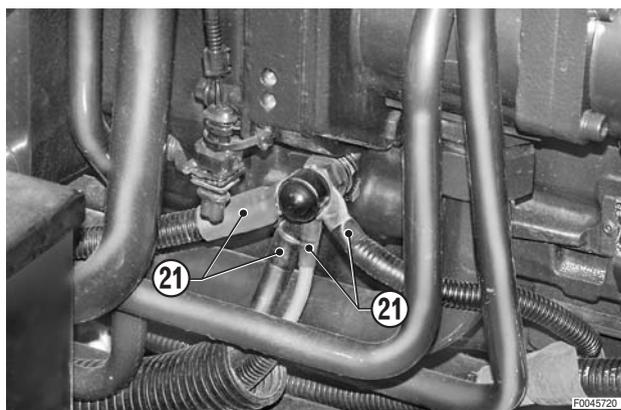
14 - Draw the fluid out of the brake fluid reservoir (22); disconnect the suction pipes (23) and remove the panel (24).
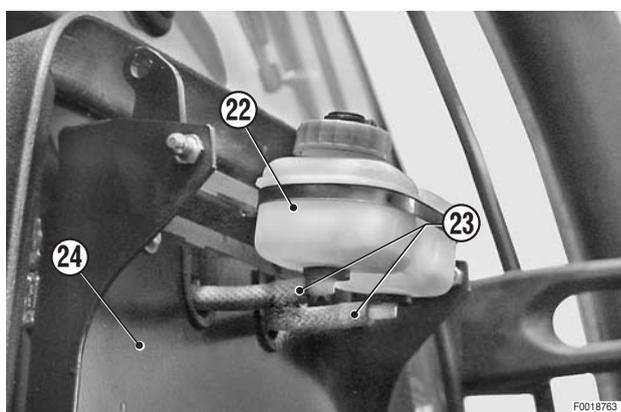
15 - Disconnect the delivery pipes (25) of the brake cylinders (26) and remove them by disconnecting the lower coupling.
  ★ Plug the ends of the pipes to prevent the entry of contaminants.
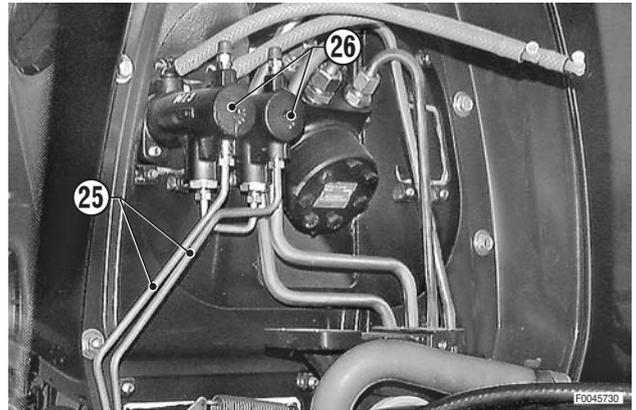
16 - Disconnect the five pipes (27) from the power steering unit (28).
  ★ Plug the ends of the pipes to prevent the entry of contaminants.

17 - Remove the bracket (29) and bend the pipes towards the front of the tractor.
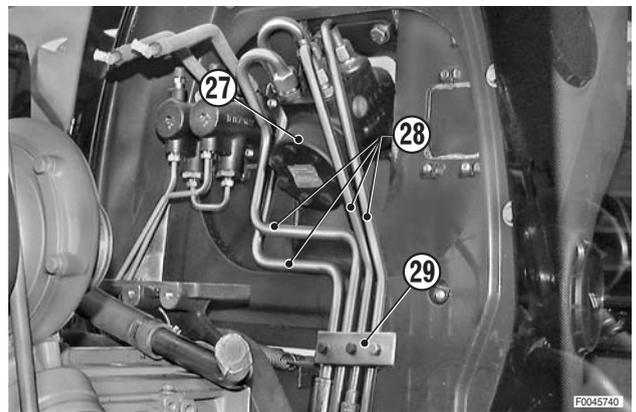
18 - Drain the engine cooling system.

  Coolant:

Mod.	80	85	90	100	105
ℓ	15,5	15,5	15,5	15,5	17,5
US.gall.	4.10	4.10	4.10	4.10	4.62

19 - Disconnect the cab heating pipes (30).
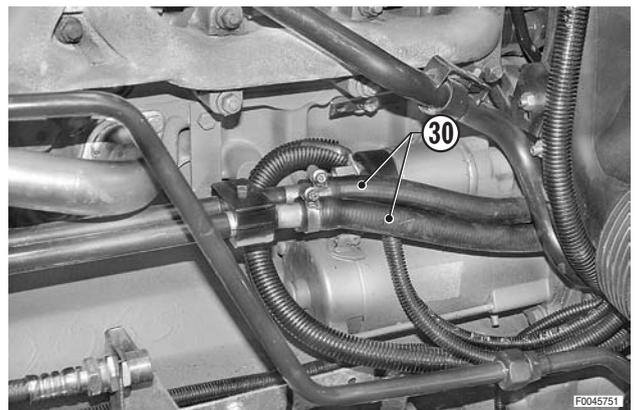
20 - Disconnect the inlet pipe (31) and the outlet pipe (32) of the air conditioning compressor. ⌧ 1
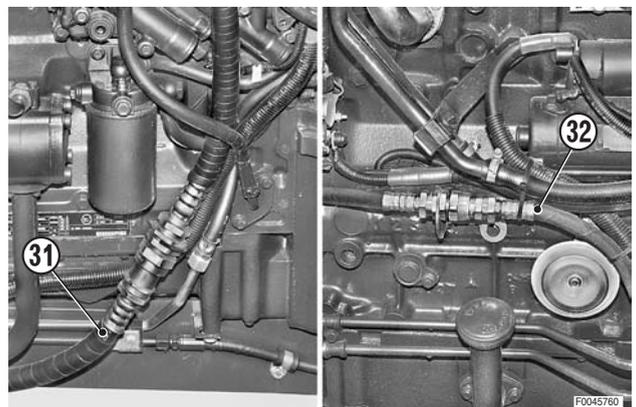
21 - Disconnect the control cable (33) from the parking brake lever (34).

   ★ Disconnect also the outer cable from the support (35).
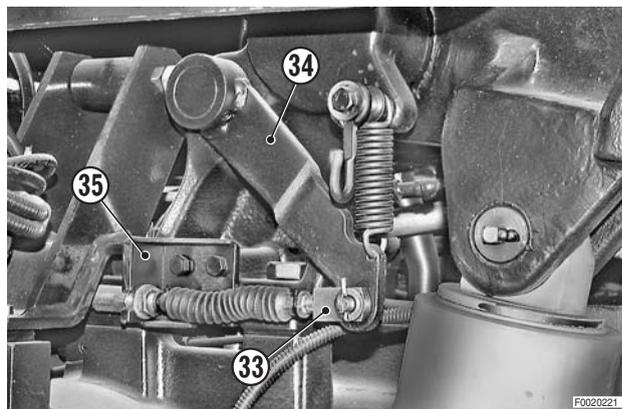
22 - Remove the exhaust pipe end fitting (36) from the cab. (For details, see «REMOVAL OF THE EXHAUST PIPE»).

23 - Remove the cover of the rear screen wiper and unplug the connector (37) and the screen wash pipe (38).
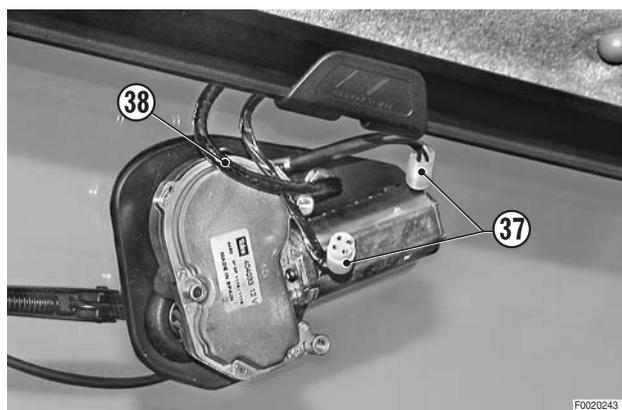
24 - Disconnect the gas springs (40) from the rear window (39); lower the window (39).

25 - While supporting the rear window, remove the hinge pins (41) with a pin punch.

26 - Remove the complete rear window assembly (39).
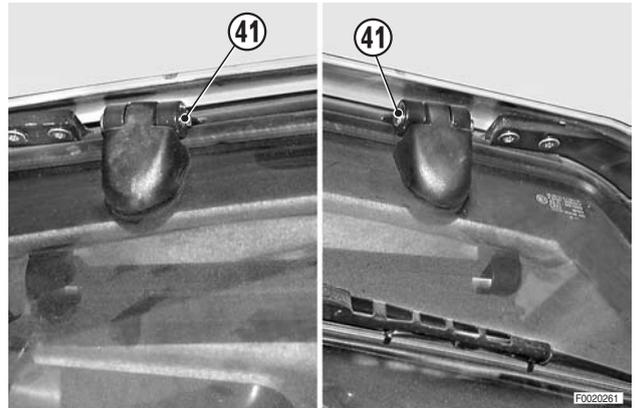
27 - Remove the front centre screws fixing the cab to the vibration damping mountings (43).
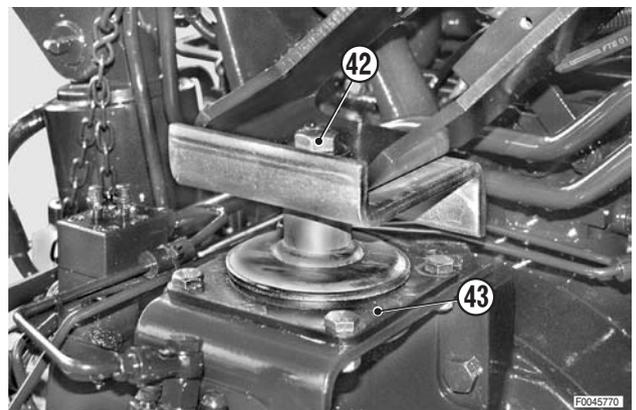
28 - Remove the covers (44), nuts (45) and front fixing bolts (46) of the cab.
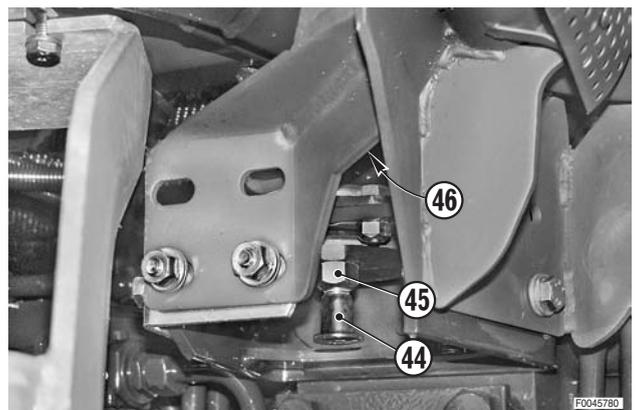
29 - Fold the rearview mirrors (47) against the cab windows.

30 - 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 (48) for the work lights and direction indicators.
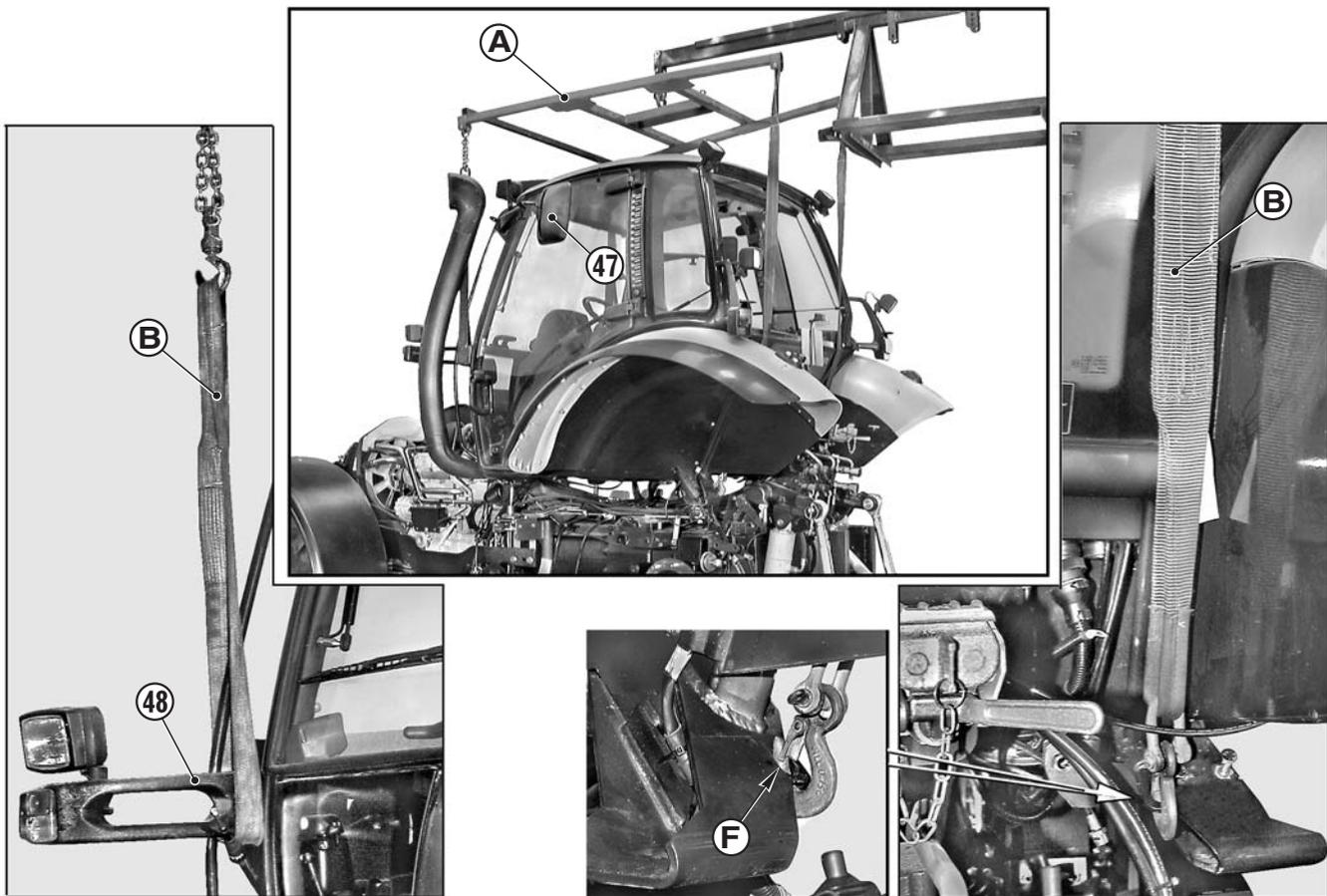
F0020292

31 - Slowly raise the cab by about 15 cm and check that all the lower cables and connection pipes are disconnected.

⬜ kg Complete cab assembly:
approx 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.

✳ 1

∿ Nm 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.)

1 - Fill the engine cooling system.

🛢 Coolant:

Mod.	80	85	90	100	105
ℓ	15,5	15,5	15,5	15,5	17,5
US.gall.	4.10	4.10	4.10	4.10	4.62

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»).

SEPARATING THE ENGINE AND 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 pipelines, complete with mounting bracket
- Front PTO assembly
- Front axle - swinging support
- Front carrier
- Exhaust pipe
- Cab access steps
- Battery support - air reservoir for trailer braking system (if specified)
- Air conditioning compressor
- Silencer
- Air cleaner

For detailed instructions, refer to the corresponding sections in this manual.

1 - Position and tighten a jack "**A**" with non-slip block under the centre of the gearbox.
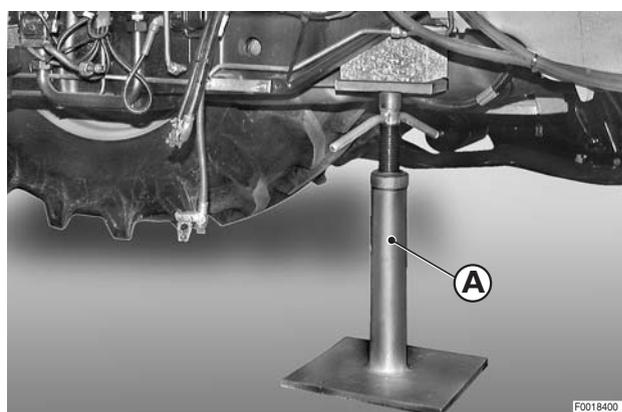
2 - Unplug the connectors (1) of the brake fluid level sensor.

3 - Draw the fluid out of the brake fluid reservoir (2); disconnect the pipes (3) from the reservoir and plug them.

※ 1
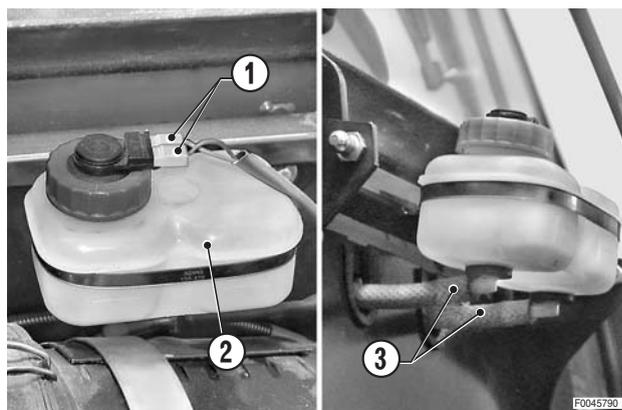
4 - Remove the air cleaner mounting plate (4).
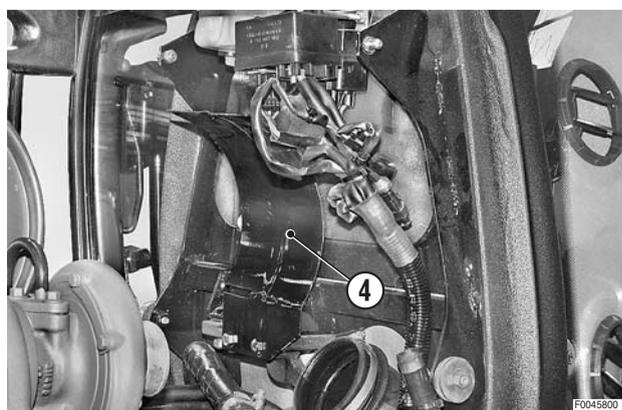
5 - Loosen the nuts (5) and disconnect the relays (6), (7).
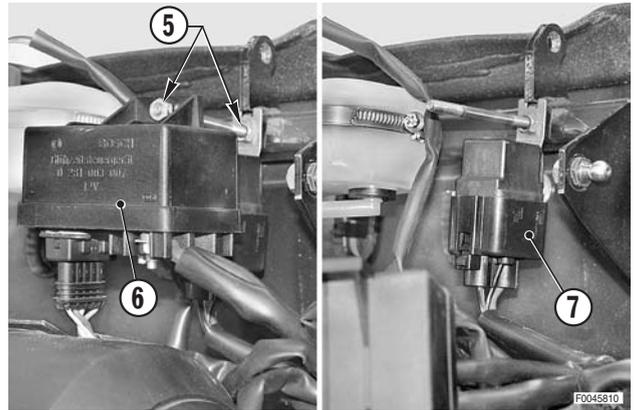
6 - Loosen the clamp (8) securing the flexible intake manifold (9); disconnect the manifold from the intake pipe.

7 - Remove the bracket retaining bolts (10) and remove the complete manifold assembly (11).
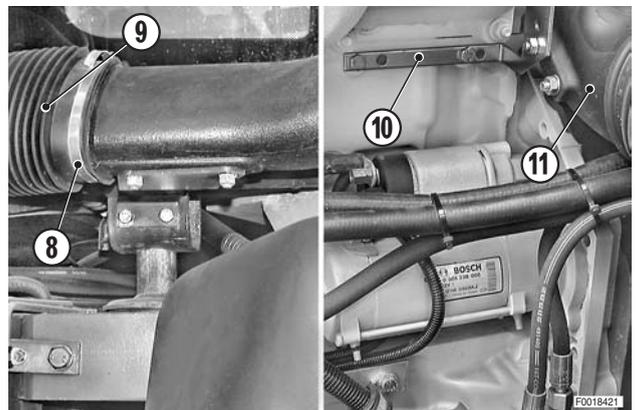
8 - Release the fuel return pipe (12) from the retaining clips and reposition the pipe so that it is directed towards the rear of the tractor.
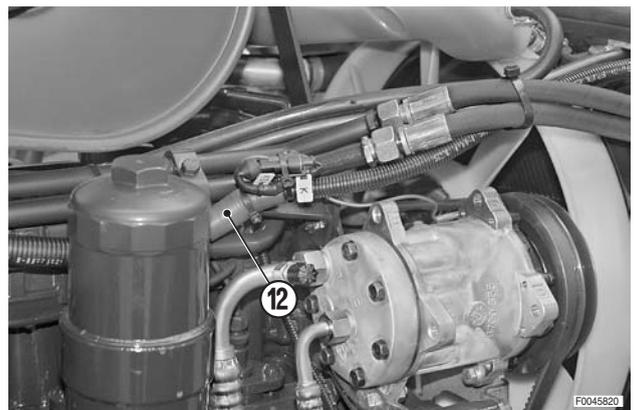
9 - Disconnect the suction pipe (13) of the air conditioning compressor.
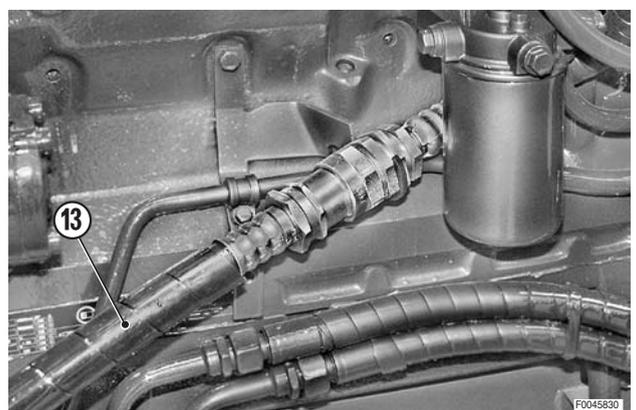
10 - Unplug the connector and remove the air conditioning compressor (14).
(For details see «REMOVAL OF THE AIR CONDITION-ING COMPRESSOR»).
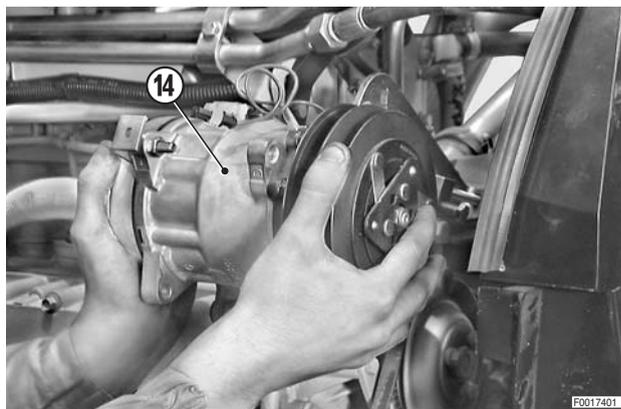
11 - Remove the lube oil delivery and return pipes (15), (16) for the air compressor (if present).
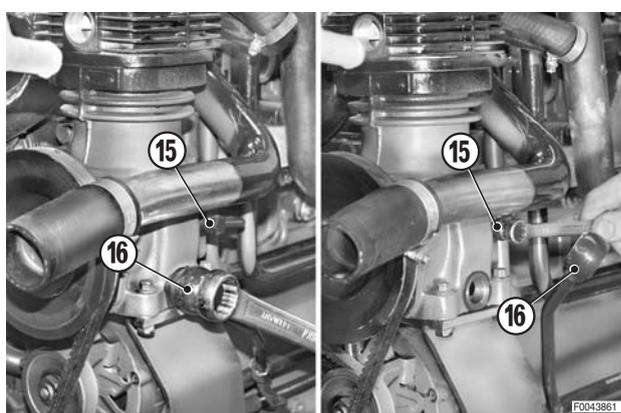
12 - Disconnect the discharge pipe (18) from the air compressor (17).

13 - Disconnect and remove the compressor suction pipe (19).
★ Plug the ports of the compressor to prevent impurities getting in.
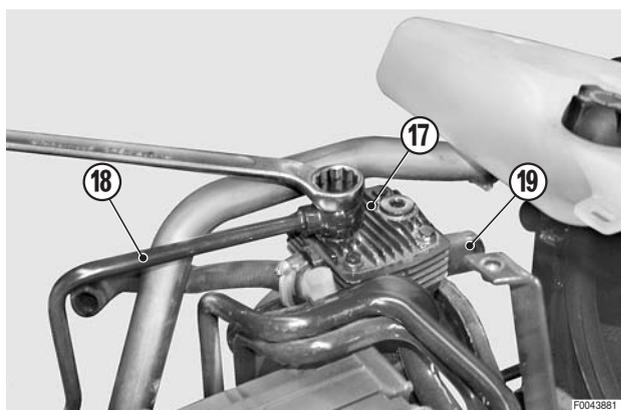
14 - Remove the fuel filter (20), disconnect the suction pipe (21) from the fuel pump.

15 - Remove the clip (22), the rigid pipe (23) and the support (24).
★ Plug ports to prevent impurities getting in and plug tubes to prevent fuel spillage.
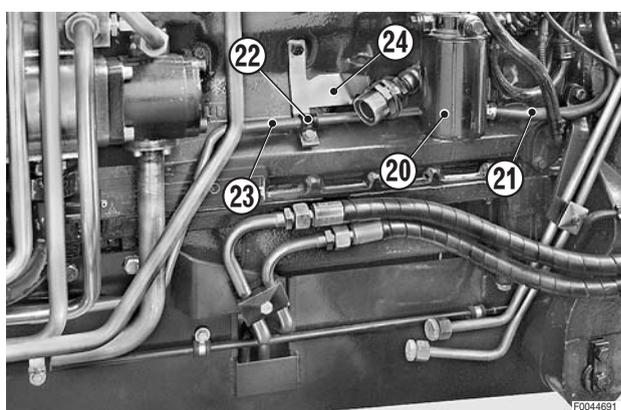
16 - Remove the retaining clips and remove the pipes (25), (26), (27) for gearbox oil delivery and return to the cooler and the differential lock.

★ Plug the pipes and ports to prevent impurities getting in.
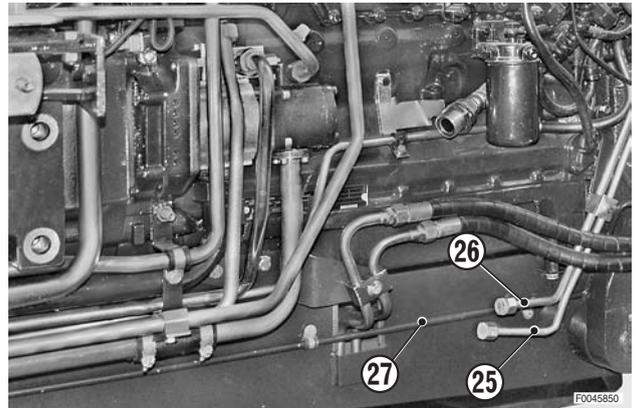
17 - Remove the suction pipe (28) of the gearbox oil pump (29).

18 - Remove the suction pipe (30) of the services pump (31) and power steering pump (32).

19 - Disconnect the delivery pipes (33) and (34) from the pumps (31), (32).

★ Plug the pipes and pump ports to prevent impurities getting in.
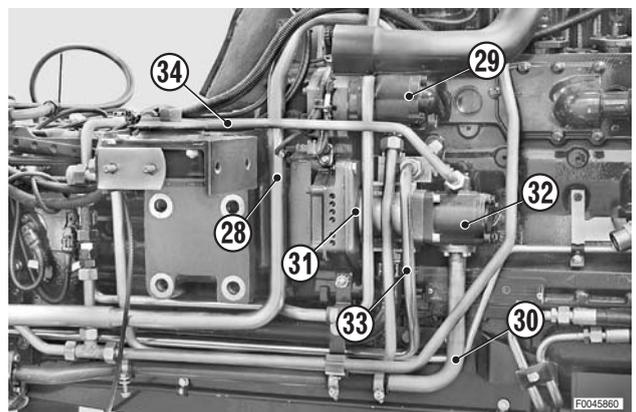
20 - Disconnect the earth lead (35) of the cylinder head.

21 - Remove the nut cover (36).
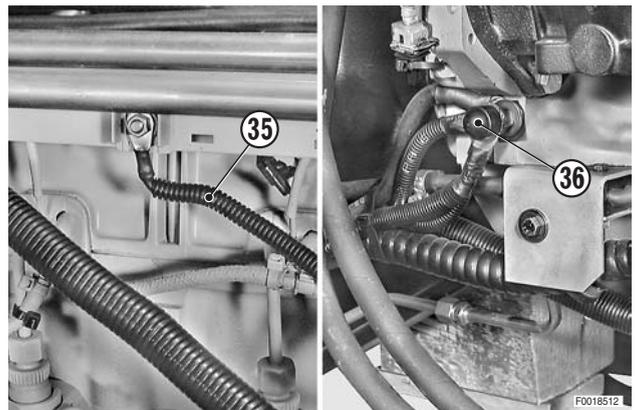
22 - Remove the nut (37) retaining the earth cables (38) and separate the terminals from the stud (39)

23 - Remove the nut (40) and remove the earth lead (41) from the battery.

30-199
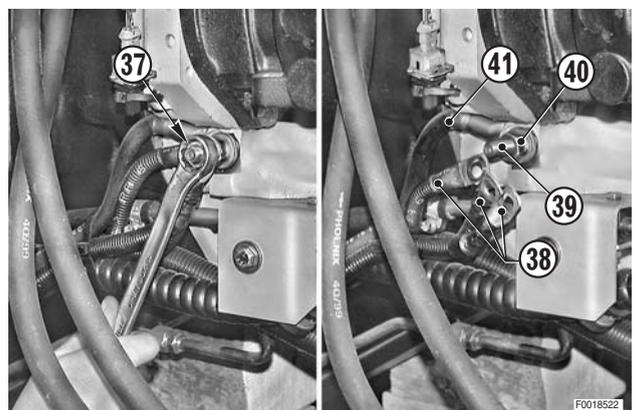
24 - Cut the cable ties and unplug the engine ECU connector (42).

★ Turn the ringnut anticlockwise.

25 - Unplug the connector (43) of the coolant temperature sensor.
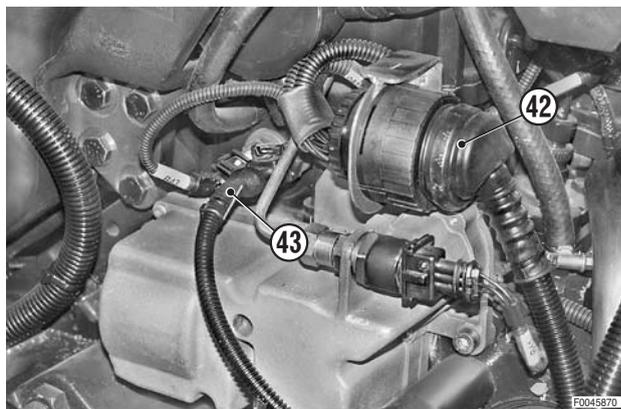
26 - Remove the coolant pipe (44).

27 - **For models with intercooler only:** remove the pipe (45) from the turbocharger to the intercooler.
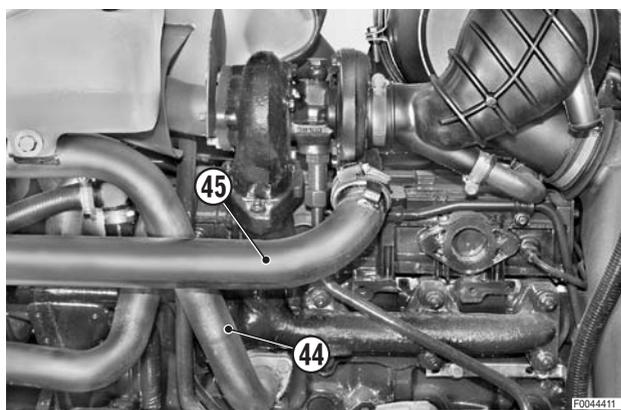
28 - **For models with intercooler only:** remove the connection pipe (46) between the intercooler and the engine intake.

29 - Remove the clips (47) and the steering pipes (48) and (49).
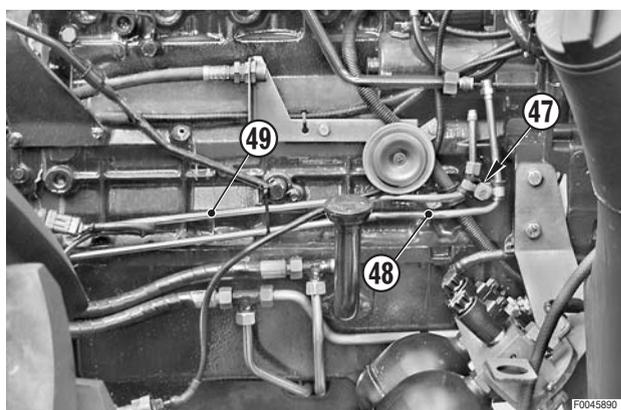
30 - Remove the front suspension solenoid valve block (50).
(For details see «REMOVAL OF THE FRONT SUSPENSION SOLENOID VALVES»).
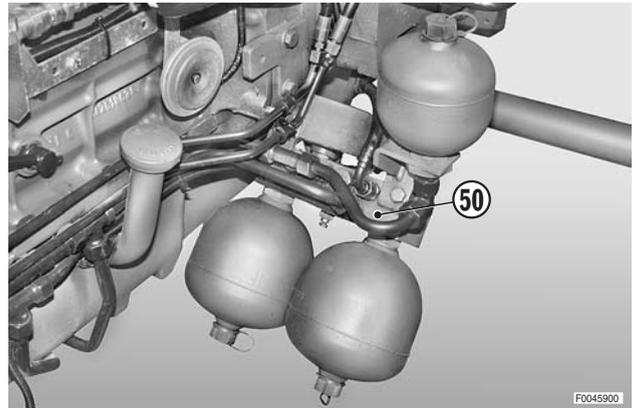
31 - Disconnect the front delivery pipe (51) of the air conditioning compressor.

32 - Remove the bolts and remove the bracket (52) after having removed the cable tie.

33 - Disconnect the feed wire (53) from the horn.
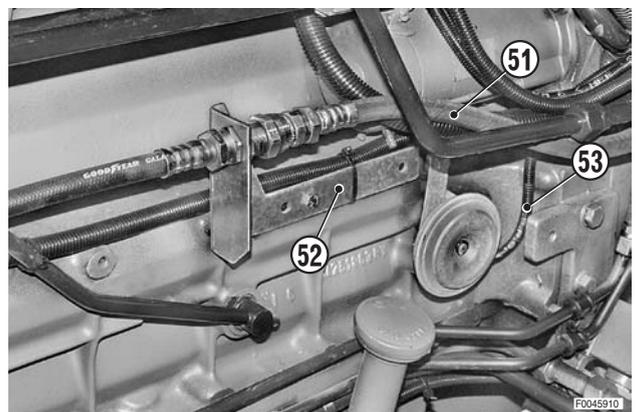
34 - Disconnect the cab heating delivery and return hoses (54) and (55).
   ★ Mark the hoses to avoid error when reconnecting.
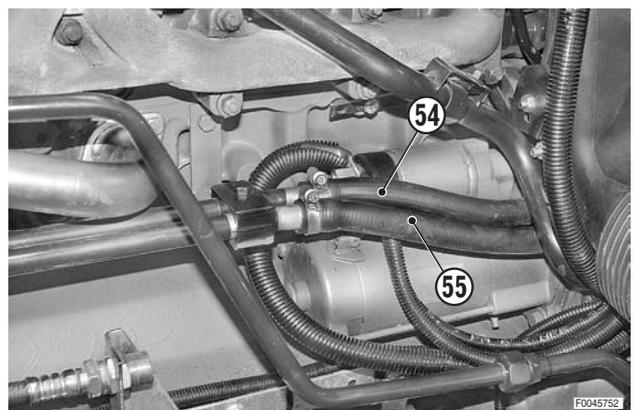
35 - Unplug the leads from the alternator (56) and the starter motor (57).
(For details see «REMOVAL OF THE STARTER MOTOR - REMOVAL OF THE ALTERNATOR»).
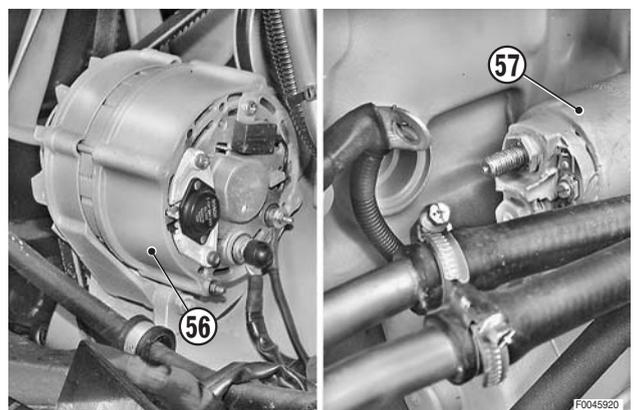
36 - Loosen the hose clamp and remove the intake hose (58).

37 - Remove the bolts and remove the hood support (59).
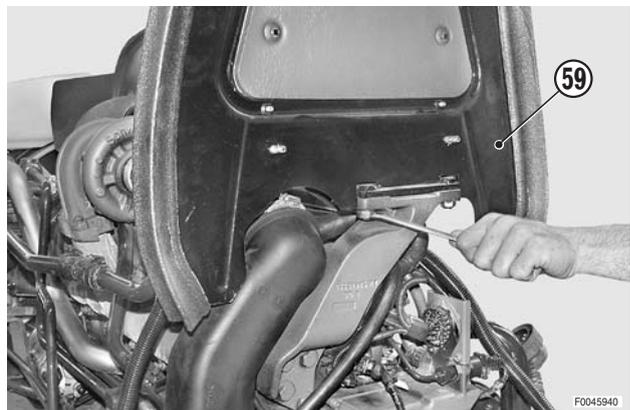
38 - Remove the bolts and remove the hood support bracket (60); using the same holes, bolt on an engine lifting bracket "**B** ".
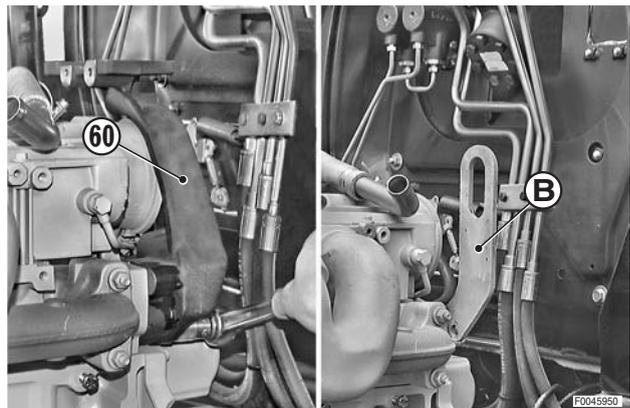
39 - Sling the engine (61) to a hoist, using the permanent front lifting point and the temporary bracket attached in step 38.
Tension the lifting chains or ropes.
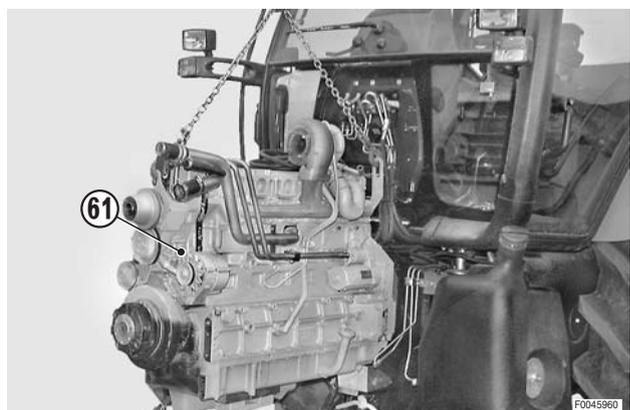
40 - Unscrew and remove the nuts (62), (63) and (64) and the bolts (65) securing the engine (61).　　※ 2

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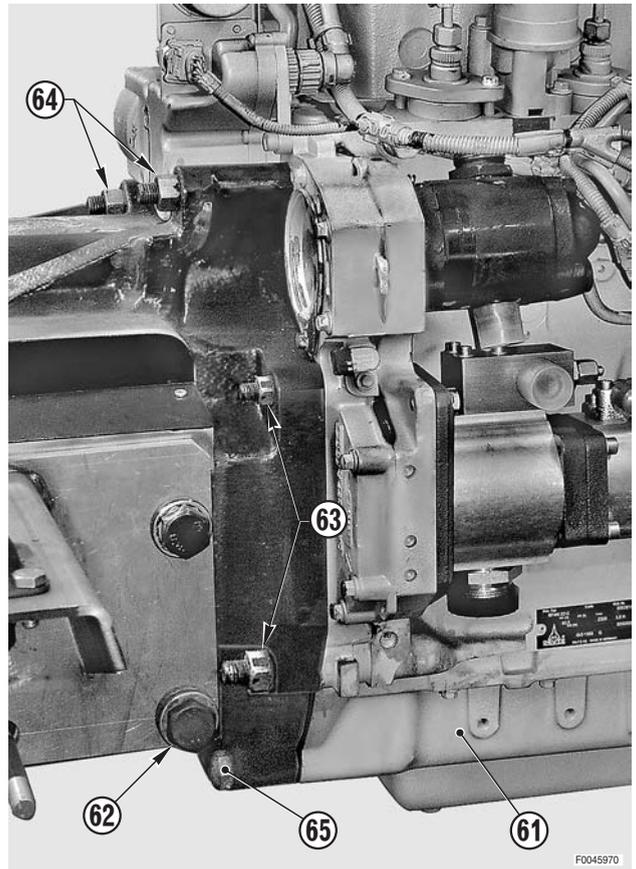
41 - Separate the engine (61) from the transmission (66), using a lever if necessary .　　※ 3

F0045980
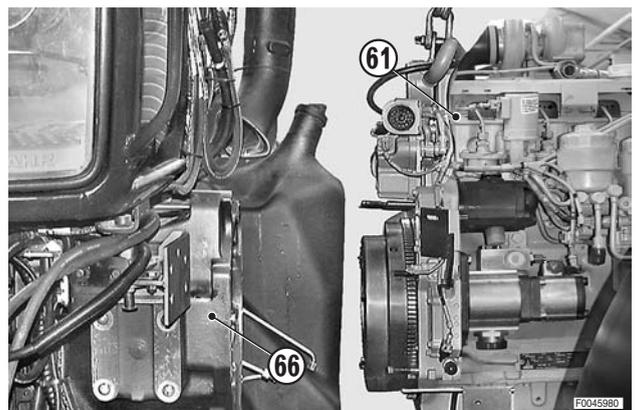
ASSEMBLY OF ENGINE - TRANSMISSION

• Refitting is the reverse of removal.

❋ 1

★ Bleed the braking system.
(For details, see «BLEEDING THE BRAKE SYS-
TEM»).

❋ 2

&Nm M12 nuts and bolts:
110±10% Nm (81±10% lb.ft.)

&Nm M16 nuts and bolts:
260±10% Nm (191.7±10% lb ft.)

★ First tighten the nuts, then the bolts, proceeding
in diagonal sequence.

❋ 3

★ Clean mating faces thoroughly; lubricate sur-
faces 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

CONTENTS

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 trouble-shooting 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

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		

INDICES — 2.1 COMPONENT DESCRIPTION INDEX

B

4.2 ENGINE START

0442.9937.4

0443.7846 / 0443.7847

C

COMPONENTS — 3.2 COMPONENT TECHNICAL DATA

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	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

Starter switch
2 Starter enable switch (green)
3 Control relay for engine starting
4 Preheating control unit
5 Alternator
6 Starter motor

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	32	0442.9936.4		Infocenter (2)
START	10	0443.7847 0.012.3639.4	0441.6066	Start enable switch (green)

G

COMPONENTS — 3.1 CONNECTOR LAYOUTS

10	11	12
13	14	15
16	17	18

E

ENGINE WIRING

CONNECTORS LOCATION — ENGINE

12

START

0443.7847/20

F

ENGINE WIRING (120–165CV) (1/2) — 0443.7847/20

ENGINE WIRING (120–165 CV) (1/2)

START

0443.7847/20

FRONT PTO Front PTO solenoid valve
K Air conditioning compressor
L Air cleaner clogged sensor
MS1 To front console line
MS2 To front console line
P Engine oil pressure switch
START Start enable switch (Green)
T Coolant temperature sensor
X6 To clutch sensor line
X44 To internal combustion engine
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
X55 Air conditioning pressure switch
X56 Alternator
X57 Front right headlamp
X58 Front left headlamp
X97 Steering system pressure switch

0443.7847/20

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 HARNESSES

DESCRIPTION	CODE	PAGE
Cab power supply wiring	0443.7846	40-107
Armrest wiring	0443.7354.4	40-167
Clean Fix wiring	0.012.3496.4	40-87
Front console wiring	0.012.8894.4	40-125
Side console wiring	0.012.8732.4/30	40-131
Lights selector wiring	0443.8656	40-163
Display wiring	0443.7875	40-149
Rotating beacon wiring	0441.4780	40-155
Trailer braking wiring (Export)	0443.7355.4	40-100
Trailer braking wiring (Italy)	0443.7356.4	40-99
Engine wiring (KHD)	0419.9808	40-69
Air conditioning system wiring	0.010.2562.2	40-143
Worklights wiring	0442.4189	40-156
Number plate light wiring	0441.4114	40-120
Engine wiring	0.012.8670.4 0.012.8671.4	40-75 40-77
Fender wiring	0442.9835	40-119
Front axle suspension wiring	0.012.8673.4	40-113
Front axle suspension (cab line) wiring	0443.7850/10	40-103
Roof wiring	0443.7851/10	40-153
Transmission wiring	0.012.8672.4	40-89
Fuses-relays control unit	0441.9533.4	40-169

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)

Chapter "3.2 Description of components" shows the wiring diagrams for certain switches and buttons. The following symbols are used for ease of identification:

SYMBOL	DESCRIPTION
●—●	Contact between CLOSED pins (stable position of switch)
○—○	Contact between CLOSED pins (non-stable position of switch)
●⊷●	Indicator LED
●⊗●	Indicator lamp

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 applicances 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 oxidisation 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 togther, 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 connectorsi; 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 or ISO 8820 standards and in particular:
  - fuse F1 (100A) DIN 72581/2
  - bayonet fuse (F2, F3, etc.) DIN 72581/3C
  - fuse F51 (100A) ISO 8820

  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 tne 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**"

3 -   **All Round Tester**

1.5 WIRE COLOUR CODES

COLOUR CODES	
A	Light blue
B	White
C	Orange
G	Yellow
H	Grey
L	Dark blue

COLOUR CODES	
M	Brown
N	Black
R	Red
S	Pink
V	Green
Z	Purple

2. INDICES
2.1 COMPONENT DESCRIPTION INDEX

Description	Code	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)
4WD switch	0441.1496.4	29	8	17
Accelerator pedal position sensor	2.7099.740.0	40	X39	4
Actuator	0211.2684	42	Y3	4
Air cleaner clogged sensor	0441.9014		L	9
Air conditioning compressor	0443.7338		K	12
Air conditioning control panel illumination connector			X112	12
Air conditioning on/off switch	0.010.2532.0		X110	12
Air conditioning pressure switch	0442.3185		X55	12
Air conditioning thermostat	0.010.2537.1		X111	12
Alternator B+	0117.8607		B+ D+	2-3-9-19
Armrest	0443.8670.4		X41	4-16-18
ASM switch	0441.1498	33	6	17
Auxiliary power socket (Earth)	0114.3529		X67	10
Auxiliary power socket (Positive)	0114.3529		X68	10
Auxiliary power supply connector (in cab)			X80	10
Axle suspension position sensor	0439.1530	5	X6	15
Brake fluid level sensor			X45	13
Brake lights fuse (15 Amp)			X82	13
Cab roof worklights switch	0441.1496.4	27	3	5-7
Camshaft speed sensor (Pick-Up)	0419.9792	24	B40	4
CB power connector			X20	11
Cigar lighter	0441.2338		X91	6
CleanFix compressor	0445.0263/10		X47	20
CleanFix control switch	2.7659.229.0	41	X70	20
CleanFix fuse			X66	20
CleanFix relay			X48	20
CleanFix solenoid valve	0445.0262/10		X63	20
Clock	0441.2337		X32	6
Clutch pedal depressed proximity sensor	0442.4165	10	X62	16
Clutch pedal position sensor	0443.2708	14	X61	16
Compressed air pressure gauge	0442.5709	11	X94	14
Compressed air pressure gauge light			X95	14
Compressed air pressure sensor	0.011.9428.0	1	X8	14
Diagnostics connector			X81	4-15-16-18
Diff lock solenoid valve	0442.3824		EV DF	17
Diff lock switch	0441.1498	34	7	17

Description	Code	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)
Direction indicator electronic flasher unit	0441.9531		X85	5
Direction indicator electronic flasher unit (Black)	0441.9531		X84	5
Direction indicator electronic flasher unit (Red)	0441.9531		X83	5
Door open warning signal switch	0441.4097		X37	6
Driver's seat air suspension compressor			X87	6
Engine boost pressure sensor	0419.9552	23	B41	4
Engine control unit	0211.2691		MX1 - MX2	2-3-4-10-16
Engine coolant temperature sensor	0419.9260	2	T	9
Engine coolant temperature sensor	0419.9809	43	B43	4
Engine oil pressure switch	0118.1232		P	9
Engine speed keypad	0443.7505		X42	4
Engine speed sensor	0443.8438		NLSE	16
Engine starting relay			X50	2-3
Engine stop coil			Y1	4
Fan speed selector switch	0.010.2528.1		X108	12
Field/road selection solenoid valve	0.010.3343.0		EV F/S	16
Field/road sensor	0441.6157		F/S SWITCH	16
Four wheel drive (4WD) clutch solenoid valve	0443.1661	12	EV DT	13-14-17
Front axle suspension control unit	0.012.6113.4		JX3-JX4	10-15
Front axle suspension Down solenoid valve	0442.3803		S	15
Front axle suspension Up solenoid valve			H	15
Front left worklight	0442.5599.4		X22	5-7
Front PTO pushbutton (in cab)	0441.1533	20	X76	19
Front PTO solenoid valve			FRONT PTO	19
Front right worklight	0442.5599.4		X21	5-7
Front suspension control pushbutton	0442.2763	32	5	15
Front upper worklights relay			X35	7
Front windscreen washer pump	0441.4105		FP	8
Fuel level sensor	0441.1109	39	FUEL	9
Fuel temperature sensor	0419.9809	44	B37	4
Fuse F50 (30 Amp)			X79	12
Gear change solenoid valves	0441.6685		EV GROUP	16
Gearbox control lever	0445.0961.4		F/S LEVER-X74	16
Gearbox output shaft speed sensor	0443.8449	17	NLSA	16
Handbrake switch	0439.1395	4	X90	13-14
Hazard warning lights switch	0442.9401	36	X114	5
Horn	0116.9304		X49	5
Infocenter (Type 2)	0443.7487/10		ST1-ST2	3-4-5-9-10-13-14-16-18-19

Description	Code	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)
Infocenter (Type 3)	0443.7488/10		ST1-ST2	3-4-5-9-10-13-14-16-18-19
Interior roof light	0442.6316		X23	6
ISO4 socket (power supply to implements)	0442.2323.4		ISO4	10
ISO7 socket (implement connection)	0442.2324.4		ISO7	10-19
Left brake pedal switch	0439.1395	3	X60	13-15-17
Left front loudspeaker	0.012.1725.0		X29	11
Left heater fan	0.010.2537.0		X105	12
Left heater fan resistor	0.010.2535.1		X104	12
Left rear loudspeaker	0.012.1726.0		X31	11
LH 'down' button for rear lift	0441.2688	7	DW SX	18
LH front sidelight and direction indicator	0441.1920.4		X25	5-7
LH headlamp	0443.5915		X58	5
LH headlamp (UK)	0443.5913.4		X58	5
LH rear lower worklights	0442.4195.4		X3 SX	7
LH rear PTO control button (on fender)	0441.1533	6	PTO SX	19
LH rear sidelight and direction indicator	0442.9833.4		X4 SX	5-13
LH rear upper worklights	0442.4195.4		X99 SX	7
LH 'up' button for rear lift	0441.2688	7	UP SX	18
Lift control panel	0441.9425.4		EHR-X78	4-18
Lift draft sensor (left)	0441.5586.4	45	LEFT DRAFT	18
Lift draft sensor (Right)	0441.5586.4	45	RIGHT DRAFT	18
Lift lowering solenoid valve			EV DW	18
Lift raising solenoid valve			EV UP	18
Load Sensing control solenoid valve front axle suspension	0442.7164		X15	15
Lower worklights switch	0441.1496.4	28	3A	7
Number plate light	0441.4115		X92	5
Preheating control unit	0117.9712		X51-X52-X56	2-3-20
Preheating glow plugs	0118.0898		X46	3
Preheating indicator lamp relay			X65	3
Proportional solenoid valve	0443.4425	15	EV PROP	16
PTO AUTO switch	0441.1496.4		X98	19
Radar	0443.8654	18	RADAR	18
Radar (UK)	0443.8655	19	RADAR	18
Radar control switch	0441.4584		X73	18
Radio			X33-X34	11

Description	Code	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)
Rear lift control unit	0.012.6115.4		JX1-JX2	10-13-15-17-18-19
Rear lift position sensor	0443.8667.0	38	POS SENS	18
Rear PTO pushbutton (in cab)	0441.1533	21	X77	19
Rear PTO solenoid valve	0.010.2628.2		EV PTO	19
Rear PTO speed sensor	0443.8352		PTO SEN	19
Rear screen washer pump	0441.4105		RP	8
Rear screen wiper motor	0441.3192		X27	8
Rear screen wiper switch	0441.9283	37	X69	8
Rear worklights switch	0441.1496.4	31	X72	7
Relay for 1st fan speed and air conditioning on			X109	12
Relay for 3rd heater fan speed			X102	12
Relay for 4th heater fan speed			X103	12
RH front sidelight and direction indicator	0441.1921.4		X24	5-7
RH headlamp	0443.5915		X57	5
RH headlamp (UK)	0443.5913.4		X57	5
RH lift 'down' button for rear lift	0441.2688	7	DW DX	18
RH rear lower worklights	0442.4195.4		X3 DX	7
RH rear PTO control button (on fender)	0441.1533	6	PTO DX	19
RH rear sidelight and direction indicator	0442.9834.4		X4 DX	5-13
RH rear upper worklights	0442.4195.4		X99 DX	7
RH 'up' button for rear lift	0441.2688	7	UP DX	18
Right brake pedal switch	0439.1395	3	X59	13-15-17
Right front loudspeaker	0.012.1725.0		X28	11
Right heater fan	0.010.2535.0		X106	12
Right heater fan resistor	0.010.2535.1		X107	12
Right rear loudspeaker	0.012.1726.0		X30	11
Rotating beacon	0441.4773		X100	7
Rotating beacon control switch	0441.1496.4	30	X71	7
Shuttle control lever	0.012.6472.4	26	X113	16
Side console courtesy light	0441.2616		X36	6
Sidelights switch	0441.1497	35	1	5-7
Speed sensor for odometer	0443.8450	16	NAB	16
Start enable switch	0441.6066	8	START	2-16
Starter motor	0118.0928		+30 +50	2-3
Starter switch	0441.1512.4	25	X86	2-3-4-5-6-7-8-9-10-11-12-13-14-15-16-17-18-19-20

Description	Code	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)
Steering angle sensor	0441.5266		X53	17
Steering circuit pressure switch			X97	9
Steering column switch unit	0443.8656		AS4-X96-X113-X114	5-8-16
Trailer parking brake pressure switch			X10	14
Trailer parking brake solenoid valve			X9	14
Trailer socket (for lights and auxiliary power)	0442.4116		X38	5-10-13
Transmission display	0441.9280.4		X93	16
Transmission ECU	0443.8083/10		ECU LS	16
Transmission oil low pressure switch (green)	0441.6706	13	PRESS. SWITCH	16
Transmission oil temperature sensor	0441.6649	9	TEMP	16
Transmission speed sensor	0.010.3342.2		NHK	16
Windscreen wiper motor	0441.3192		X26	8
Wiring configuration connector			LS/PS - PS	16

2.2 COMPONENT CODE INDEX

Code	Description	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)
0.010.2528.1	Fan speed selector switch		X108	12
0.010.2532.0	Air conditioning on/off switch		X110	12
0.010.2535.0	Right heater fan		X106	12
0.010.2535.1	Left heater fan resistor		X104	12
0.010.2535.1	Right heater fan resistor		X107	12
0.010.2537.0	Left heater fan		X105	12
0.010.2537.1	Air conditioning thermostat		X111	12
0.010.2628.2	Rear PTO solenoid valve		EV PTO	19
0.010.3342.2	Transmission speed sensor		NHK	16
0.010.3343.0	Field/road selection solenoid valve		EV F/S	16
0.011.9428.0	Compressed air pressure sensor	1	X8	14
0.012.1725.0	Right front loudspeaker		X28	11
0.012.1725.0	Left front loudspeaker		X29	11
0.012.1726.0	Right rear loudspeaker		X30	11
0.012.1726.0	Left rear loudspeaker		X31	11
0.012.6113.4	Front axle suspension control unit		JX3-JX4	10-15
0.012.6115.4	Rear lift control unit		JX1-JX2	10-13-15-17-18-19
0.012.6472.4	Shuttle control lever	26	X113	16
0114.3529	Auxiliary power socket		X67-X68	10
0116.9304	Horn		X49	5
0117.8607	Alternator		B+ D+	2-3-9-19
0117.9712	Preheating control unit		X51-X52-X56	2-3
0118.0898	Preheating glow plugs		X46	3
0118.0928	Starter motor		+30 +50	2-3
0118.1232	Engine oil pressure switch		P	9
0211.2684	Actuator	42	Y3	4
0211.2691	Engine control unit		MX1-MX2	2-3-4-10-16
0419.9260	Engine coolant temperature sensor	2	T	9
0419.9552	Engine boost pressure sensor	23	B41	4
0419.9792	Camshaft speed sensor (Pick-Up)	24	B40	4
0419.9809	Fuel temperature sensor	44	B37	4
0419.9809	Engine coolant temperature sensor	43	B43	4
0439.1395	Right brake pedal switch	3	X59	13-15-17

Code	Description	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)
0439.1395	Left brake pedal switch	3	X60	13-15-17
0439.1395	Handbrake switch	4	X90	13-14
0439.1530	Axle suspension position sensor	5	X6	15
0441.1109	Fuel level sensor	39	FUEL	9
0441.1496.4	Cab roof worklights switch	27	3	5-7
0441.1496.4	Lower worklights switch	28	3A	7
0441.1496.4	4WD switch	29	8	17
0441.1496.4	Rotating beacon control switch	30	X71	7
0441.1496.4	Rear worklights switch	31	X72	7
0441.1496.4	PTO AUTO switch		X98	19
0441.1497	Sidelights switch	35	1	5-7
0441.1498	ASM switch	33	6	17
0441.1498	Diff lock switch	34	7	17
0441.1512.4	Starter switch	25	X86	2-3-4-5-6-7-8-9-10-11-12-13-14-15-16-17-18-19-20
0441.1533	RH rear PTO control button (on fender)	6	PTO DX	19
0441.1533	LH rear PTO control button (on fender)	6	PTO SX	19
0441.1533	Front PTO pushbutton (in cab)	20	X76	19
0441.1533	Rear PTO pushbutton (in cab)	21	X77	19
0441.1920.4	LH front sidelight and direction indicator		X25	5-7
0441.1921.4	RH front sidelight and direction indicator		X24	5-7
0441.2337	Clock		X32	6
0441.2338	Cigar lighter		X91	6
0441.2616	Side console courtesy light		X36	6
0441.2688	RH rear lift 'down' button	7	DW DX	18
0441.2688	LH rear lift 'down' button	7	DW SX	18
0441.2688	RH rear lift 'up' button	7	UP DX	18
0441.2688	LH rear lift 'up' button	7	UP SX	18
0441.3192	Windscreen wiper motor		X26	8
0441.3192	Rear screen wiper motor		X27	8
0441.4097	Door open warning signal switch		X37	6
0441.4105	Front windscreen washer pump		FP	8

Code	Description	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)
0441.4105	Rear screen washer pump		RP	8
0441.4115	Number plate light		X92	5
0441.4584	Radar control switch		X73	18
0441.4773	Rotating beacon		X100	7
0441.5266	Steering angle sensor		X53	17
0441.5586.4	Lift draft sensor (left)	45	LEFT DRAFT	18
0441.5586.4	Rear lift draft sensor (Right)	45	RIGHT DRAFT	18
0441.6066	Start enable switch	8	START	2-16
0441.6157	Field/road sensor		F/S SWITCH	16
0441.6649	Transmission oil temperature sensor	9	TEMP	16
0441.6685	Gear change solenoid valves		EV GROUP	16
0441.6706	Transmission oil low pressure switch (Green)	13	PRESS. SWITCH	16
0441.9014	Air cleaner clogged sensor		L	9
0441.9280.4	Transmission display		X93	16
0441.9283	Rear screen wiper switch	37	X69	8
0441.9425.4	Lift control panel		EHR-X78	4-18
0441.9531	Direction indicators flasher unit (Red)		X83-X84	5
0441.9531	Direction indicator electronic flasher unit		X85	5
0442.2323.4	ISO4 socket (power supply to implements)		ISO4	10
0442.2324.4	ISO7 socket (implement connection)		ISO7	10-19
0442.2763	Front suspension control pushbutton	32	5	15
0442.3185	Air conditioning pressure switch		X55	12
0442.3803	Front axle suspension Down solenoid valve		S	15
0442.3824	Diff lock solenoid valve		EV DF	17
0442.4116	Trailer socket (lights and auxiliary power)		X38	5-10-13
0442.4165	Clutch pedal depressed proximity sensor	10	X62	16
0442.4195.4	LH rear lower worklights		X3 SX	7
0442.4195.4	RH rear lower worklights		X3 DX	7
0442.4195.4	LH rear upper worklights		X99 SX	7
0442.4195.4	RH rear upper worklights		X99 DX	7
0442.5599.4	Front right worklight		X21	5-7
0442.5599.4	Front left worklight		X22	5-7
0442.5709	Compressed air pressure gauge	11	X94	14
0442.6316	Interior roof light		X23	6

Code	Description	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)
0442.7164	Front axle suspension Load Sensing solenoid valve		X15	15
0442.9401	Hazard warning lights switch	36	X114	5
0442.9833.4	LH rear sidelight and direction indicator		X4 SX	5-13
0442.9834.4	RH rear sidelight and direction indicator		X4 DX	5-13
0443.1661	Four wheel drive (4WD) clutch solenoid valve	12	EV DT	13-14-17
0443.2708	Clutch pedal position sensor	14	X61	16
0443.4425	Proportional solenoid valve	15	EV PROP	16
0443.5913.4	RH headlamp (UK)		X57	5
0443.5913.4	LH headlamp (UK)		X58	5
0443.5915	RH headlamp		X57	5
0443.5915	LH headlamp		X58	5
0443.7338	Air conditioning compressor		K	12
0443.7487/10	Infocenter (Type 2)		ST1-ST2	3-4-5-9-10-13-14-16-18-19
0443.7488/10	Infocenter (Type 3)		ST1-ST2	3-4-5-9-10-13-14-16-18-19
0443.7505	Engine speed keypad		X42	4
0443.8083/10	Transmission ECU		ECU LS	16
0443.8352	Rear PTO speed sensor		PTO SEN	19
0443.8438	Engine speed sensor		NLSE	16
0443.8449	Gearbox output shaft speed sensor	17	NLSA	16
0443.8450	Speed sensor for odometer	16	NAB	16
0443.8654	Radar	18	RADAR	18
0443.8655	Radar	19	RADAR	18
0443.8656	Steering column switch unit		X96	5
0443.8667.0	Rear lift position sensor	38	POS SENS	18
0443.8670.4	Armrest		X41	4-16-18
0445.0262/10	CleanFix solenoid valve		X63	20
0445.0263/10	CleanFix compressor		X47	20
0445.0961.4	Gearbox control lever		X74	16
2.7099.740.0	Accelerator pedal position sensor	40	X39	4
2.7659.229.0	CleanFix control switch	41	X70	20

2.3 CONNECTOR INDEX

Connector	Type	Wiring code	Connection wiring or component code	Component description
+30		0.012.8670.4	0118.0928	Starter motor
		0.012.8671.4		
+50		0.012.8670.4	0118.0928	Starter motor
		0.012.8671.4		
1	28	0.012.8894.4	0441.1497	Sidelights switch
3	28	0.012.8894.4	0441.1496.4	Cab roof worklights switch
3A	28	0.012.8894.4	0441.1496.4	Lower worklights switch
4	28	0.012.8894.4		Not utilised
5	28	0.012.8894.4	0442.2763	Front suspension control pushbutton
6	28	0.012.8894.4	0441.1498	ASM switch
7	28	0.012.8894.4	0441.1498	Diff lock switch
8	28	0.012.8894.4	0441.1496.4	4WD switch
APS	28	0.012.8732.4		Not utilised
AS1	20	0.012.8732.4	0.012.8894.4	
AS2	19	0.012.8732.4	0.012.8894.4	
AS3	18	0.012.8732.4	0.012.8894.4	
AS4	20	0.012.8732.4	0443.8656	Steering column switch unit
AS5	14	0.012.8732.4	0443.7875	
AS6	15	0.012.8732.4	0.012.8894.4	
B1	12	0419.9869		Not utilised
B6	13	0419.9869		Not utilised
B37		0419.9869	0419.9809	Fuel temperature sensor
B40	12	0419.9869	0419.9792	Camshaft speed sensor (Pickup)
B41	13	0419.9869	0419.9552	Engine boost pressure sensor
B42	12	0419.9869		Not utilised
B43		0419.9869	0419.9809	Coolant temperature sensor
B+		0.012.8670.4	0117.8607	Alternator
		0.012.8671.4		
D+		0.012.8670.4	0117.8607	Alternator
		0.012.8671.4		
DS1	20	0.012.8732.4	0443.7851	
DW DX	3	0442.9835	0441.2688	RH rear lift 'down' button

Connector	Type	Wiring code	Connection wiring or component code	Component description
DW SX	3	0442.9835	0441.2688	LH rear lift 'down' button
ECU LS	45	0.012.8732.4	0443.8083/10	Transmission ECU
EHR	3	0.012.8732.4	0443.7354.4	
	3	0.012.8732.4	0441.9425.4	Lift control panel
EMR	3	0.012.8732.4	0443.7354.4	
	3	0.012.8732.4	0441.9425.4	Lift control panel
EV DF	12	0.012.8672.4	0442.3824	Diff lock solenoid valve
EV DT	12	0.012.8672.4	0443.1661	Four-wheel drive control solenoid valve (4WD)
SV DW	12	0.012.8672.4		Lift 'down' solenoid valve
EV F/S	12	0.012.8672.4	0.010.3343.0	Field/road selection solenoid valve
EV GROUP	11	0.012.8672.4	0441.6685	Gear change solenoid valves
EV PROP	12	0.012.8672.4	0443.4425	Proportional solenoid valve
EV PTO	12	0.012.8672.4	0.010.2628.2	Rear PTO solenoid valve
SV UP	12	0.012.8672.4		Lift 'up' solenoid valve
F30	12	0419.9869		Not utilised
F/S LEVER	1	0.012.8732.4		Gearbox control lever
F/S SWITCH		0.012.8672.4	0441.6157	Field/road sensor
FE1	16	0.012.8732.4	0443.7850	
FE2		0.012.8673.4	0443.7850	
FP	2	0.012.8672.4	0441.4105	Front windscreen washer pump
FRONT PTO	2	0.012.8670.4		Front PTO solenoid valve
		0.012.8671.4		
FUEL	2	0.012.8672.4	0441.1109	Fuel level sensor
H	12	0.012.8673.4		Front axle suspension Up solenoid valve PTO
ISO4	24	0.012.8732.4	0442.2323.4	ISO4 socket (power supply to implements)
ISO7	25	0.012.8732.4	0442.2324.4	ISO7 socket (implement connection)
J1	9	0.012.8732.4		
J2	9	0.012.8732.4		
J3	9	0.012.8732.4		
JX1	31	0.012.8732.4	0.012.6115.4	Rear lift control unit
JX2	31	0.012.8732.4	0.012.6115.4	Rear lift control unit
JX3	31	0443.7850	0.012.6113.4	Front axle suspension control unit

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Connector	Type	Wiring code	Connection wiring or component code	Component description
JX4	31	0443.7850	0.012.6113.4	Front axle suspension control unit
K		0.012.8670.4	0443.7338	Air conditioning compressor
		0.012.8671.4		
L		0.012.8670.4	0441.9014	Air cleaner clogged sensor
		0.012.8671.4		
LEFT DRAFT	13	0.012.8672.4	0441.5586.4	Lift draft sensor (left)
LS		0.012.8672.4		Not utilised
LS/PS		0.012.8672.4		Wiring configuration connector
MS1	38	0.012.8732.4	0.012.8670.4	
			0.012.8671.4	
MS2	29	0.012.8894.4	0.012.8670.4	
			0.012.8671.4	
MX1	44	0.012.8732.4	0211.2691	Engine control unit
MX2	44	0.012.8732.4	0211.2691	Engine control unit
NAB	3	0.012.8672.4	0443.8450	Speed sensor for odometer
NEUTRAL LS	2	0.012.8672.4		Not utilised
NHK	3	0.012.8672.4	0.010.3342.2	Transmission speed sensor
NLSA	3	0.012.8672.4	0443.8449	Gearbox output shaft speed sensor
NLSE	3	0.012.8672.4	0443.8438	Engine speed sensor
P	12	0.012.8670.4	0118.1232	Engine oil pressure switch
		0.012.8671.4		
P1		0.012.8732.4		
P2	14	0.012.8732.4		
P3	22	0.012.8732.4		
P4		0.012.8732.4		
P5	22	0.012.8732.4		
P6	16	0.012.8732.4		
POS SENS	3	0.012.8672.4	0443.8667.0	Lift position sensor Installer for rear PTO oil seal
PRESS. SWITCH	2	0.012.8672.4	0441.6706	Transmission oil low pressure switch (green)
PS		0.012.8672.4		Wiring configuration connector
PTO DX	3	0442.9835	0441.1533	RH rear PTO control button (on fender)
PTO SEN	3	0.012.8672.4	0443.8352	Rear PTO speed sensor
PTO SX	3	0442.9835	0441.1533	LH rear PTO control button (on fender)

Connector	Type	Wiring code	Connection wiring or component code	Component description
RADAR	13	0.012.8672.4	0443.8654	Radar
			0443.8655	Radar (UK)
RIGHT DRAFT	13	0.012.8672.4	0441.5586.4	Rear lift draft sensor (Right)
RP	2	0.012.8672.4	0441.4105	Rear screen washer pump
S	12	0.012.8673.4	0442.3803	Front axle suspension Down solenoid valve PTO
ST1	17	0.012.8894.4	0443.7487/10	Infocenter (Type 2)
			0443.7488/10	Infocenter (Type 3)
ST2	21	0.012.8894.4	0443.7487/10	Infocenter (Type 2)
			0443.7488/10	Infocenter (Type 3)
START	2	0.012.8670.4	0441.6066	Start enable switch
		0.012.8671.4		
T	12	0.012.8670.4	0419.9260	Coolant temperature sensor
		0.012.8671.4		
TEMP	12	0.012.8672.4	0441.6649	Transmission oil temperature sensor
TKAB1	43	0.012.8732.4	0.012.8672.4	
TKAB2	38	0.012.8732.4	0.012.8672.4	
TKAB3		0.012.8732.4	0443.7846	
UP DX	3	0442.9835	0441.2688	RH rear lift 'up' button
UP SX	3	0442.9835	0441.2688	LH rear lift 'up' button
X1	37	0443.7846	0442.9835	
X2	37	0443.7846	0442.9835	
X3 SX	1	0442.9835	0442.4195.4	LH rear lower worklights
X3 DX	1	0442.9835	0442.4195.4	RH rear lower worklights
X4 SX		0442.9835	0442.9833.4	LH rear sidelight and direction indicator
X4 DX		0442.9835	0442.9834.4	RH rear sidelight and direction indicator
X5		0442.9835	0441.4114	
X6	13	0.012.8673.4	0439.1530	Axle suspension position sensor
X7	4	0.012.8672.4	0443.7355.4	
			0443.7356.4	
X8		0443.7355.4	0.011.9428.0	Compressed air pressure sensor
		0443.7356.4		

Connector	Type	Wiring code	Connection wiring or component code	Component description
X9	35	0443.7356.4		Trailer parking brake solenoid valve
X10		0443.7356.4		Trailer parking brake pressure switch
X11	1	0443.7851	0442.4189	
X12	1	0443.7851	0442.4189	
X13		0443.7851	0441.4780	
X15	12	0.012.8673.4	0442.7164	Front axle suspension Load Sensing solenoid valve
X19	2	0.012.8670.4		Not utilised
		0.012.8671.4		
X20	6	0443.7851		CB power connector
X21	5	0443.7851	0442.5599.4	Front right worklight
X22	5	0443.7851	0442.5599.4	Front left worklight
X23		0443.7851	0442.6316	Interior roof light
X24	5	0443.7851	0441.1921.4	RH front sidelight and direction indicator
X25	5	0443.7851	0441.1920.4	LH front sidelight and direction indicator
X26	6	0443.7851	0441.3192	Windscreen wiper motor
X27	5	0443.7851	0441.3192	Rear screen wiper motor
X28	1	0443.7851	0.012.1725.0	Right front loudspeaker
X29	1	0443.7851	0.012.1725.0	Left front loudspeaker
X30		0443.7851	0.012.1726.0	Right rear loudspeaker
X31		0443.7851	0.012.1726.0	Left rear loudspeaker
X32	10	0443.7851	0441.2337	Clock
X33	23	0443.7851		Radio (brown)
X34	23	0443.7851		Radio (grey)
X35		0443.7851		Front upper work lights relay
X36		0443.7851	0441.2616	Side console courtesy light
X37		0443.7851	0441.4097	Door open warning signal switch
X38	27	0.012.8672.4	0442.4116	Trailer socket (for lights and auxiliary power)
X39	30	0.012.8894.4	2.7099.740.0	Accelerator pedal position sensor
X41	39	0443.7354.4	0443.8670.4	Armrest
X42	42	0.012.8732.4	0443.7354.4	
			0443.7505	Engine speed keypad
X43	33	0.012.8732.4	0443.7354.4	

Connector	Type	Wiring code	Connection wiring or component code	Component description
X44	40	0.012.8670.4	0419.9869	
		0.012.8671.4		
X45		0.012.8670.4		Brake fluid level sensor
		0.012.8671.4		
X46		0.012.8670.4	0118.0898	Preheating glow plugs
		0.012.8671.4		
X47	2	0.012.3496.4	0445.0263/10	CleanFix compressor
X48		0.012.3496.4		CleanFix relay
X49		0.012.8670.4	0116.9304	Horn
		0.012.8671.4		
X50		0.012.8670.4		Engine starting relay
		0.012.8671.4		
X51		0.012.8670.4	0117.9712	Preheating control unit
		0.012.8671.4		
X52	41	0.012.8670.4	0117.9712	Preheating control unit
		0.012.8671.4		
X53	4	0.012.8670.4	0441.5266	Steering angle sensor
		0.012.8671.4		
X54	3	0.012.8670.4	0.012.3496.4	
		0.012.8671.4		
X55	2	0.012.8670.4	0442.3185	Air conditioning pressure switch
		0.012.8671.4		
X56		0.012.8670.4	0117.9712	Preheating control unit
		0.012.8671.4		
X57		0.012.8670.4	0443.5915	RH headlamp
		0.012.8671.4	0443.5913.4	RH headlamp (UK)
X58		0.012.8670.4	0443.5915	LH headlamp
		0.012.8671.4	0443.5913.4	LH headlamp (UK)
X59	36	0.012.8894.4	0439.1395	Right brake pedal switch
X60	36	0.012.8894.4	0439.1395	Left brake pedal switch
X61	30	0.012.8894.4	0443.2708	Clutch pedal position sensor
X62	13	0.012.8894.4	0442.4165	Clutch pedal depressed proximity sensor
X63	3	0.012.3496.4	0445.0262/10	CleanFix solenoid valve
X64	1	0.012.8732.4		Not utilised
X65		0.012.8732.4		Preheating indicator lamp relay

Connector	Type	Wiring code	Connection wiring or component code	Component description
X66		0.012.3496.4		CleanFix fuse
X67		0.012.8732.4	0114.3529	Auxiliary power socket (Earth)
X68		0.012.8732.4	0114.3529	Auxiliary power socket (Positive)
X69	28	0.012.8732.4	0441.9283	Rear screen wiper switch
X70	28	0.012.8732.4	2.7659.229.0	CleanFix control switch
X71	28	0.012.8732.4	0441.1496.4	Rotating beacon control switch
X72	28	0.012.8732.4	0441.1496.4	Rear worklights switch
X73		0.012.8732.4	0441.4584	Radar control switch
X74	34	0.012.8732.4	0445.0961.4	Gearbox control lever
X74b	1	0.012.8732.4		Not utilised
X75	12	0.012.8732.4		Not utilised
X76	3	0.012.8732.4	0441.1533	Front PTO button (in cab)
X77	3	0.012.8732.4	0441.1533	Rear PTO button (in cab)
X78	26	0.012.8732.4	0441.9425.4	Lift control panel
X79		0.012.8732.4		Fuse F50 (30 Amp)
X80	1	0.012.8732.4		Auxiliary power supply connector (in cab)
X81	8	0.012.8732.4		Diagnostics connector
X82		0.012.8732.4		Brake lights fuse (15 Amp)
X83		0.012.8732.4	0441.9531	Direction indicators flasher unit (red)
X84		0.012.8732.4	0441.9531	Direction indicators flasher unit (black)
X85		0.012.8732.4	0441.9531	Direction indicators flasher unit
X86	7	0.012.8732.4	0441.1512.4	Starter switch
X87	1	0.012.8732.4		Driver's seat air suspension compressor
X88	32	0.012.8732.4	0.010.2562.2	
X89		0.012.8732.4	0.010.2562.2	
X90		0.012.8732.4	0439.1395	Handbrake switch
X91	1	0.012.8732.4	0441.2338	Cigar lighter
X92		0441.4114	0441.4115	Number plate light
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		0.012.8894.4	0443.8656	Steering column switch unit

Connector	Type	Wiring code	Connection wiring or component code	Component description
X97		0.012.8670.4		Steering circuit pressure switch
		0.012.8671.4		
X98	28	0.012.8732.4	0441.1496.4	PTO AUTO switch
X99 SX		0442.4189	0442.4195.4	LH rear upper worklights
X99 DX		0442.4189	0442.4195.4	RH rear upper worklights
X100		0441.4780	0441.4773	Rotating beacon
X102		0.010.2562.2		Control relay for 3rd heater fan speed
X103		0.010.2562.2		Control relay for 4th speed heater fans
X104		0.010.2562.2	0.010.2535.1	Left heater fan resistor
X105		0.010.2562.2	0.010.2537.0	Left heater fan
X106		0.010.2562.2	0.010.2535.0	Right heater fan
X107		0.010.2562.2	0.010.2535.1	Right heater fan resistor
X108		0.010.2562.2	0.010.2528.1	Fan speed selector switch
X109		0.010.2562.2		Relay for 1st fan speed and air conditioning on
X110		0.010.2562.2	0.010.2532.0	Air conditioning on/off switch
X111		0.010.2562.2	0.010.2537.1	Air conditioning thermostat
X112		0.010.2562.2		Air conditioning control panel illumination connector
X113		0443.8656	0.012.6472.4	Shuttle control lever
X114		0443.8656	0442.9401	Hazard warning lights switch
Y1	12	0419.9869		Engine stop coil
Y3		0419.9869	0211.2684	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
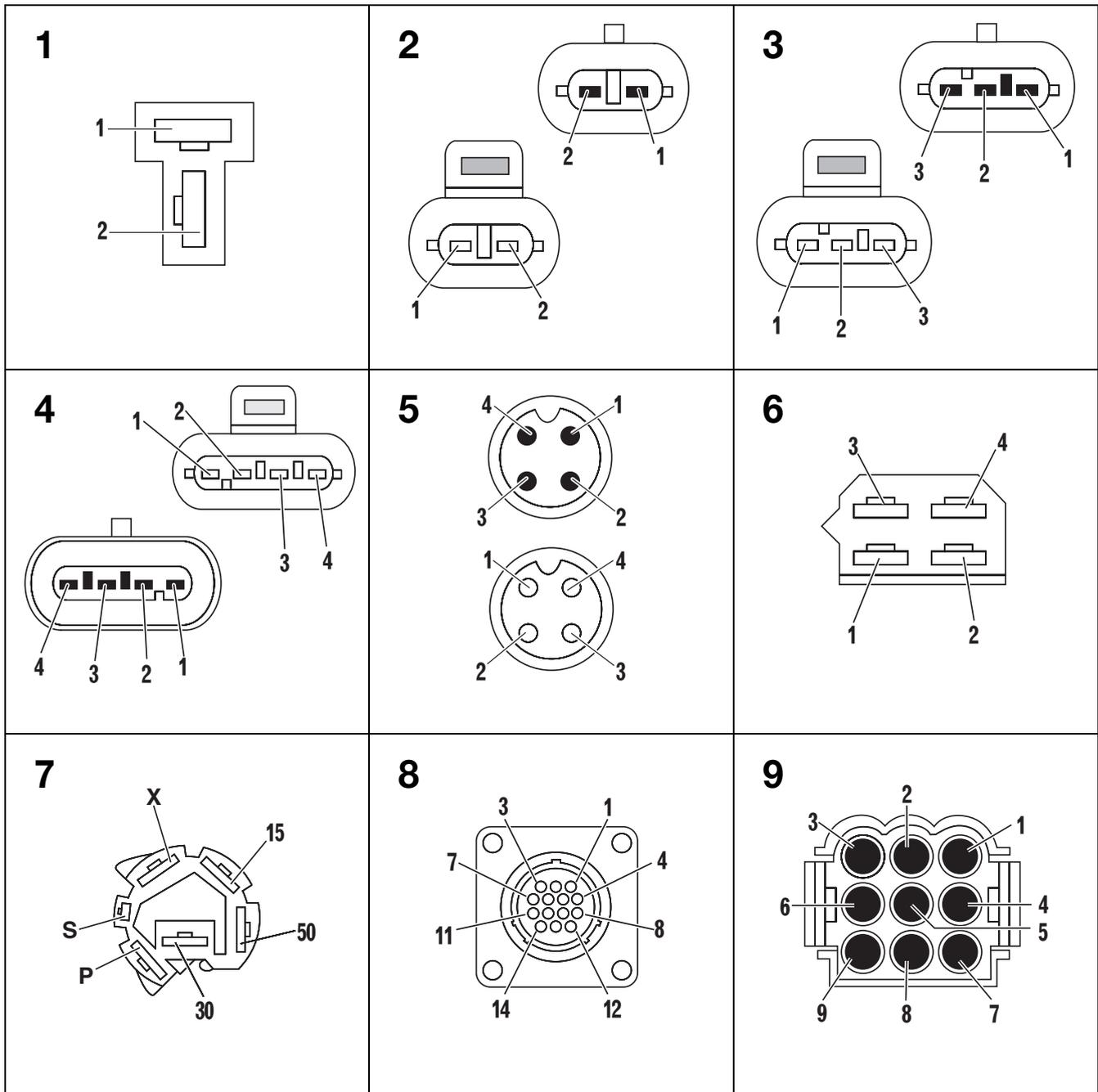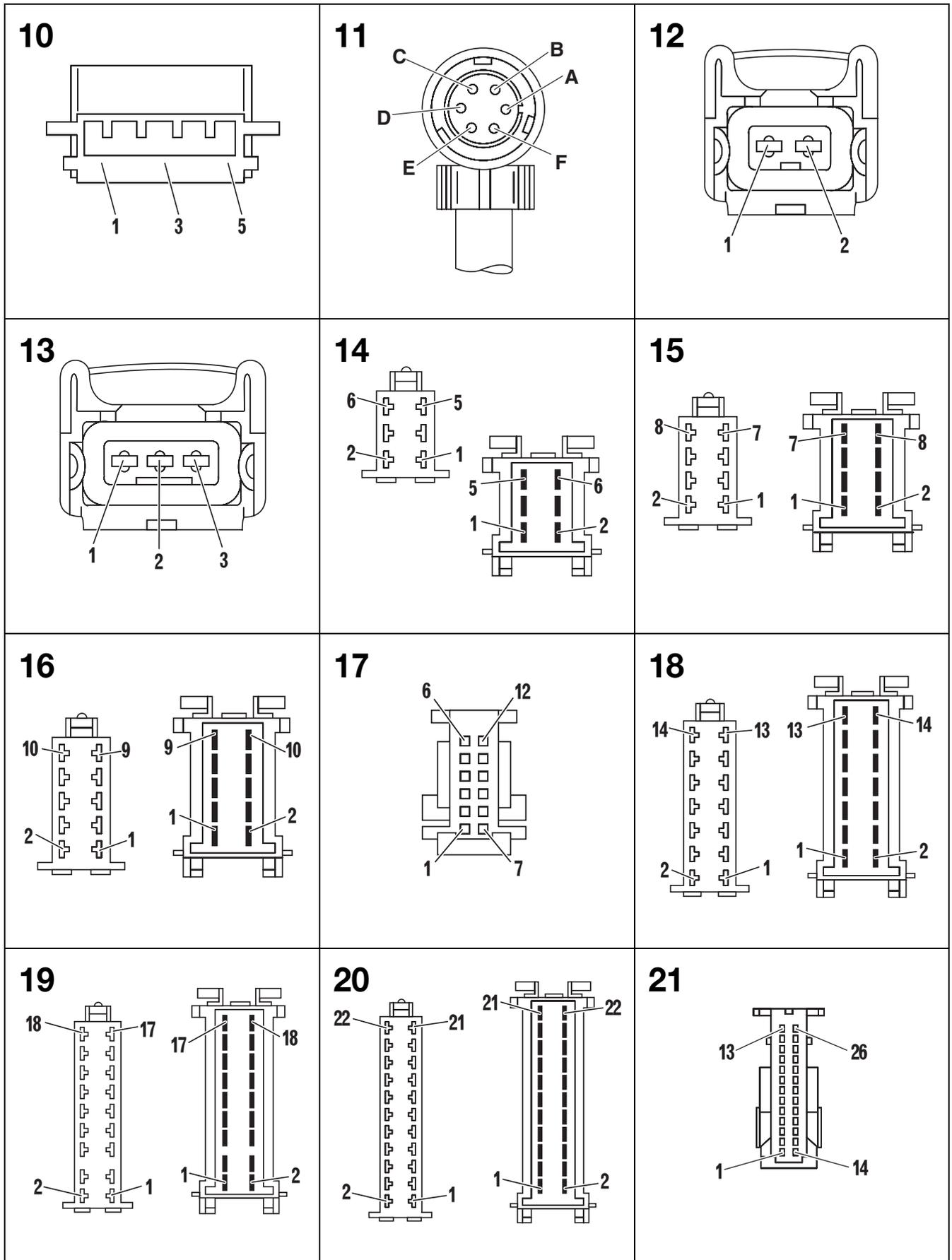
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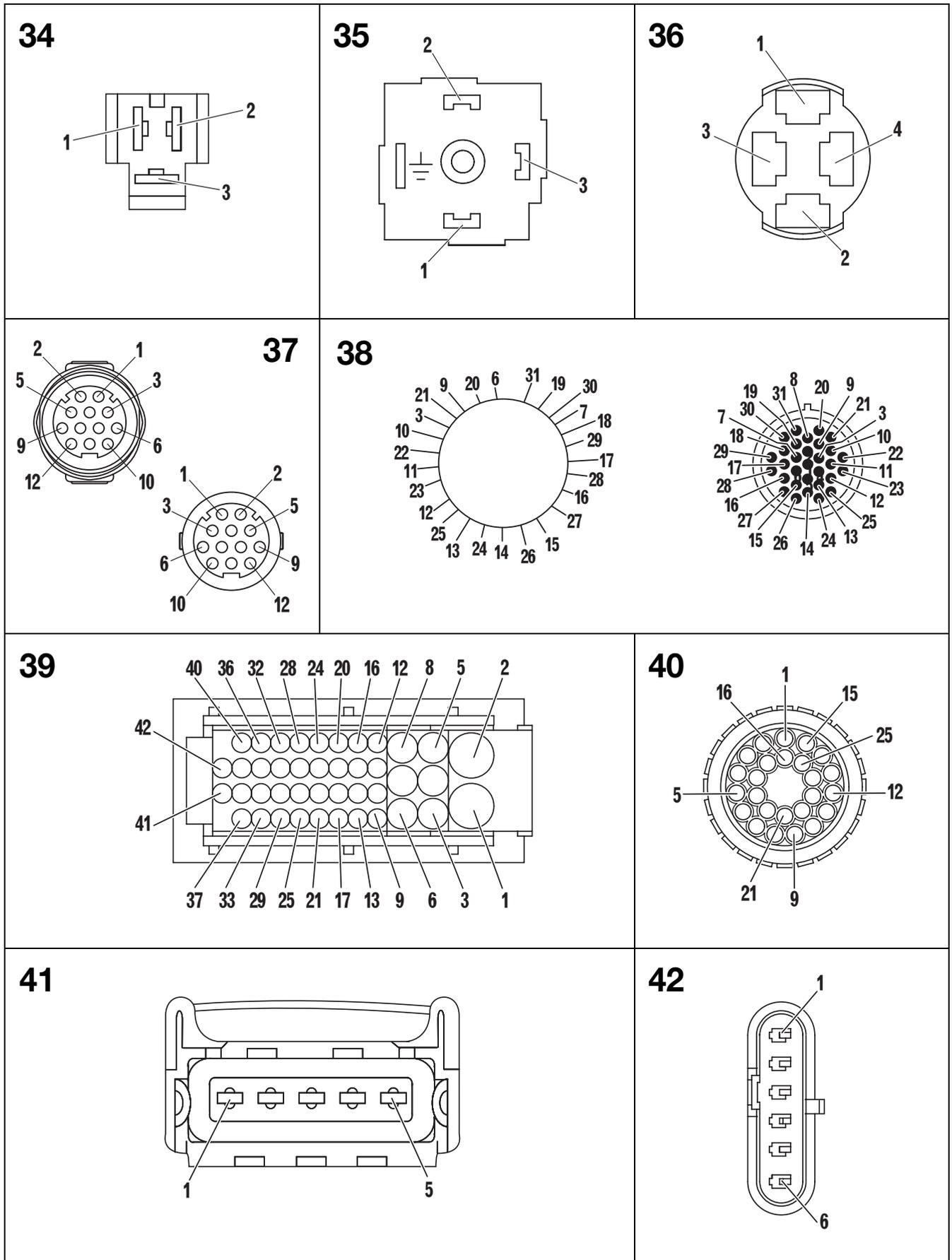
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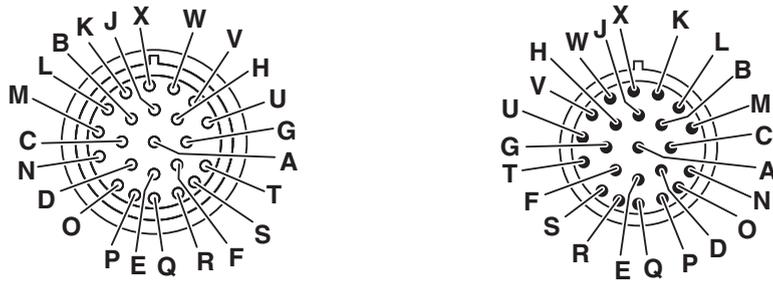
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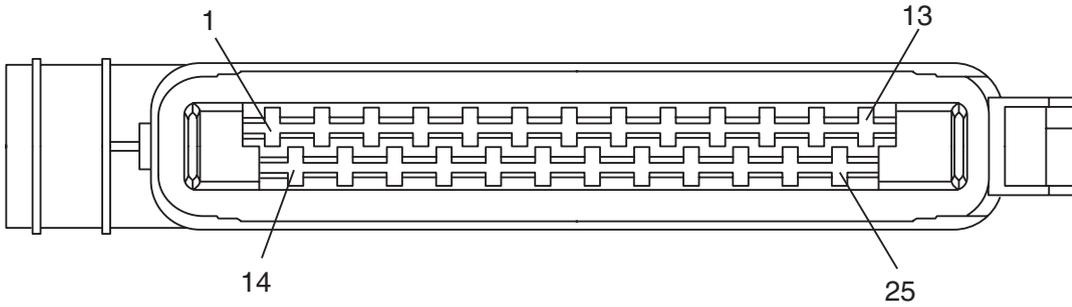
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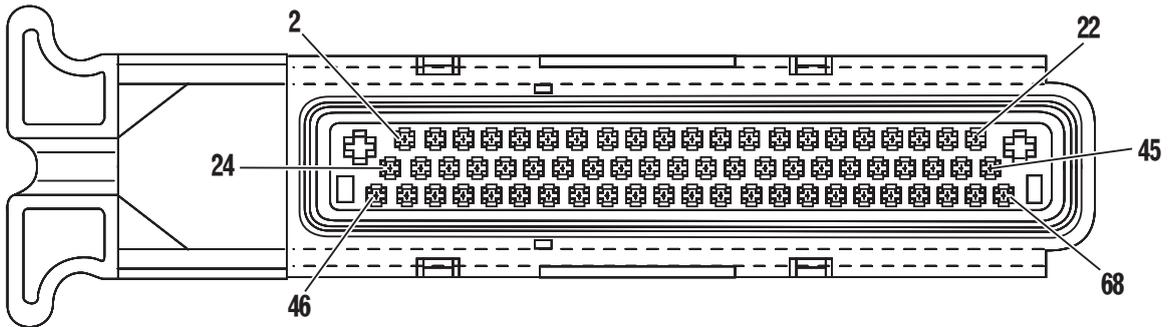
3.2 COMPONENT TECHNICAL DATA

N°	Description	Code	Characteristics	Notes
1	Trailer braking air pressure sensor	0.011.9428.0	12 Vdc power Resistance at 0 bar 10-13 Ohm Resistance at 6 bar 119-129 Ohm	X8
2	Engine coolant temperature sensor	0419.9260	Resistance at 20 °C 1138±140 Ohm Resistance at 90 °C 83.3±7 Ohm	T
3	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
4	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
5	Front axle suspension position sensor	0439.1530	Pin1 = earth Pin2 = analogue signal Pin3 = 8V DC power 1.8 +0.1V output (cylinders fully retracted)	X6
6	Rear PTO pushbutton (on fender)	0441.1533	Resistance between pin 1 and pin 2 with switch depressed: ~160 Ohm Diode test between pin 1 (positive) and pin 3 (negative)	PTO
7	Rear lift pushbutton	0441.2688	Normally open switch (NO)	DW UP
8	Start enable switch	0441.6066	Normally closed switch (NC) resistance with contact closed 3.9 Ohm	START
9	Transmission oil temperature sensor	0441.6649	5Vdc power Output at 0 °C approx. 2.8V Output at 100 °C approx. 1.8V	TEMP
10	Clutch pedal depressed proximity sensor	0442.4165	Normally closed sensor (NC) Pin1 = earth Pin2 = analogue signal Pin3 = 12V power	X62
11	Compressed air pressure gauge	0442.5709	Pin G = input from sensor Pin + = 12V power Pin - = earth	X94
12	Four-wheel drive control solenoid valve	0443.1661	Pin1 = earth Pin2 = power Resistance between pin 1 and pin 2: 10 Ohm	EVDT
13	Transmission oil low pressure switch	0441.6706	Normally closed (NC) pressure switch Opening pressure 12 bar	PRESS. SWITCH
14	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
15	Proportional solenoid valve	0443.4425	Pin1 = earth Pin2 = power Resistance between pin1 and pin 2: approx. ~ 5 Ohm	EV PROP

N°	Description	Code	Characteristics	Notes
16	Speed sensor for odometer	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	NAB
17	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	PTO SEN
18	Radar	0443.8654	Pin1 = earth; Pin2 = pulse signal (130 pulses/metre); Pin3 = 12V power supply. With the radar on, voltage at pin 2 must vary when you pass your hand in front of the detector. Frequency 24125 GHz	RADAR
19	Radar (UK)	0443.8655	Pin1 = earth; Pin2 = pulse signal (130 pulses/metre); Pin3 = 12V power supply. With the radar on, voltage at pin 2 must vary when you pass your hand in front of the detector. Frequency 24300 GHz	RADAR
20	Front PTO pushbutton (in cab)	0441.1533	Resistance between pin 1 and pin 2 with switch pressed: ~160 Ohm Diode test between pin 1 (positive) and pin 3 (negative)	X76
21	Rear PTO pushbutton (in cab)	0441.1533	Resistance between pin 1 and pin 2 with switch pressed: ~160 Ohm Diode test between pin 1 (positive) and pin 3 (negative)	X77
22	Steering angle sensor	0441.5266	Pin1 = sensor 1 signal Pin2 = 8V power Pin3 = earth Pin4 = sensor 2 signal (see tables below)	X53
23	Engine boost pressure sensor	0419.9552	Pin1 = earth Pin2 = analogue signal Pin3 = 5V power Signal with pressure of 0.5 bar: approx. 0.5 V Signal with pressure of 4 bar: approx. 4.5 V Resistance between pin 1 and pin 2: 58 kOhm Resistance between pin 1 and pin 3:13 kOhm Resistance between pin 2 and pin 3: 58 kOhm	B41
24	Camshaft speed sensor (Pickup)	0419.9792	Resistance: 336 ± 34 Ohm Inductance: 128.8 ± 13 mH	B40

Tables for N° 22 (Steering angle sensor):

PIN	Steering angle			
	0°÷ 15°	15°÷ 25°	25°÷ 30°	> 30°
1	0V	8 V	8 V	8 V
4	0 V	0 V	8V	8 V

PIN	Steering to right			
	0°÷ 15°	15°÷ 25°	25°÷ 30°	> 30°
1	0V	8 V	8 V	8 V
4	0 V	8 V	8V	0 V

N°	Description	Code	Characteristics	Notes
25	Starter switch	0441.1512.4		X86
26	Shuttle Lever	0.012.6472.4		X113
27	Cab roof worklights switch	0441.1496.4		3

Component 25 — Starter switch:

Pos \ Pin	30	15	50	75	83
0	●————————————●				
1	●——●——●				
2	○——○——○				

Component 26 — Shuttle Lever:
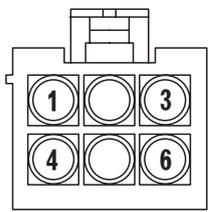
Pos \ Pin	1	2	3	4	5	6
Forward	●——————●					
Neutral			●——●			
Reverse		●——●				

NOTE: The resistance must be 3.9 Ohm in all position

Component 27 — Cab roof worklights switch:

Pos \ Pin	1	2	3	4	5	6	7	8
0								
1	●————————●							

N°	Description	Code	Characteristics	Notes
28	Lower worklights switch	0441.1496.4		3A
29	4WD switch	0441.1496.4		8
30	Rotating beacon control switch	0441.1496.4		X71

N°	Description	Code	Characteristics	Notes
31	Rear work lights switch	0441.1496.4	 | Pin Pos	1	2	3	4	5	6	7	8 | | 0 | | 1 | ●——————● (pins 1–5)	X72
32	Front suspension switch	0442.2763	 | Pin Pos	1	2	3	4	5	6	7	8 | | 0 | | 1 | ○——————○ (pins 1–5)	5
33	ASM switch	0441.1498	 | Pin Pos	1	2	3	4	5	6	7	8 | | 0 | (pins 6–8, 5–7) ●——● ●——● | 1 | (pins 1–5, 2–6) ●——● ●——●	6

N°	Description	Code	Characteristics	Notes
34	Diff lock switch	0441.1498		7
35	Sidelights switch	0441.1497		1

N°	Description	Code	Characteristics	Notes
36	Hazard warning lights switch	0442.9401		X114
37	Rear screen wiper switch	0441.9283		X69
38	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 links fully Up) 4.5V DC output (lift links fully Down)	POS SENS
39	Fuel level sensor	0441.1109	Resistance with tank empty: 0-3 Ohm Resistance with tank full: 178-192 Ohm	FUEL
40	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)	X39

N°	Description	Code	Characteristics	Notes
41	Clean Fix control switch	2.7659.229.0	Pin/Pos table: Pos 0 — (no connection); Pos 1 — pins 1 and 5 connected	X70
42	Actuator	0211.1926	Measured across pin 3 and pin 4: Resistance: 8 Ohm Inductance with engine off: 27 mH Inductance with engine at max rpm: 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
43	Engine coolant temperature sensor	0419.9809	Resistance at 21.5 °C: ~2.3 kOhm	B43
44	Fuel temperature sensor	0.419.9809	Resistance at 21.5 °C: ~2.3 kOhm	B37
45	Lift draft sensor	0441.5586.4	Pin1 = earth Pin2 = analogue signal Pin3 = 8V power Signal with no implement hitched: 4V ± 0.2 V	RIGHT DRAFT LEFT DRAFT

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3.3 PINOUTS AND DESCRIPTIONS OF ELECTRONIC CONTROL UNITS

3.3.1 ENGINE CONTROL UNIT

CONNECTOR MX1			
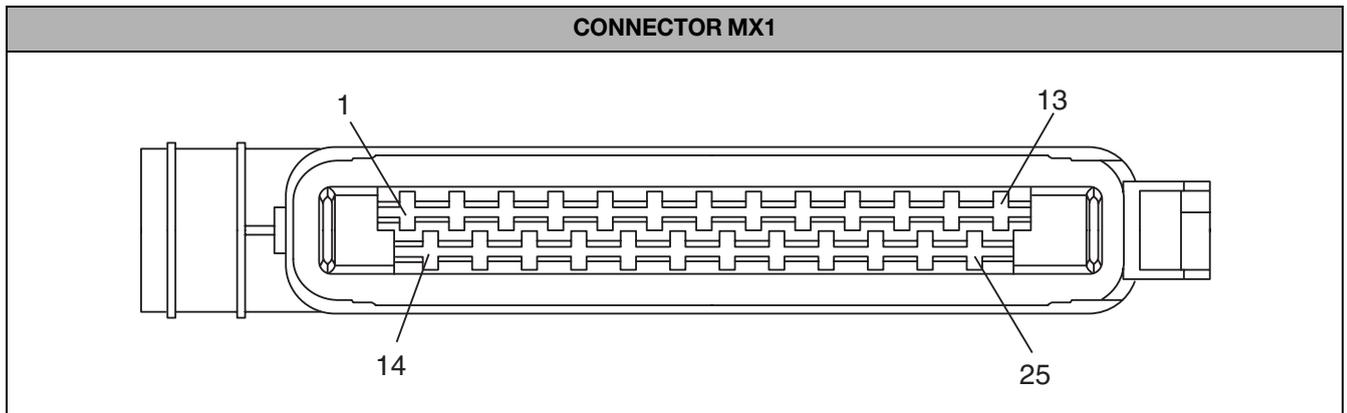
Pin	Volts.	Abbreviation	Description
1			Earth, stop magnet
2			Digital output, stop magnet
3			Not utilised
4			Not utilised
5			Analogue input, fuel temperature sensor
6			Not utilised
7			Not utilised
8	0V	GND	Reference voltage for signal, pin 4 and pin 9
9			Analogue input, coolant temperature sensor
10	0V	– 31	Battery negative
11			Not utilised
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	Analog input, measurement coil signal
20			Not utilised
21			Not utilised
22			Not utilised
23	0V	GND	Reference voltage for signal on pin 24
24			Analog input, boost pressure sensor signal
25	+5V	+5V LDA	5V reference voltage for signal on pin 24

	CONNECTOR MX2		
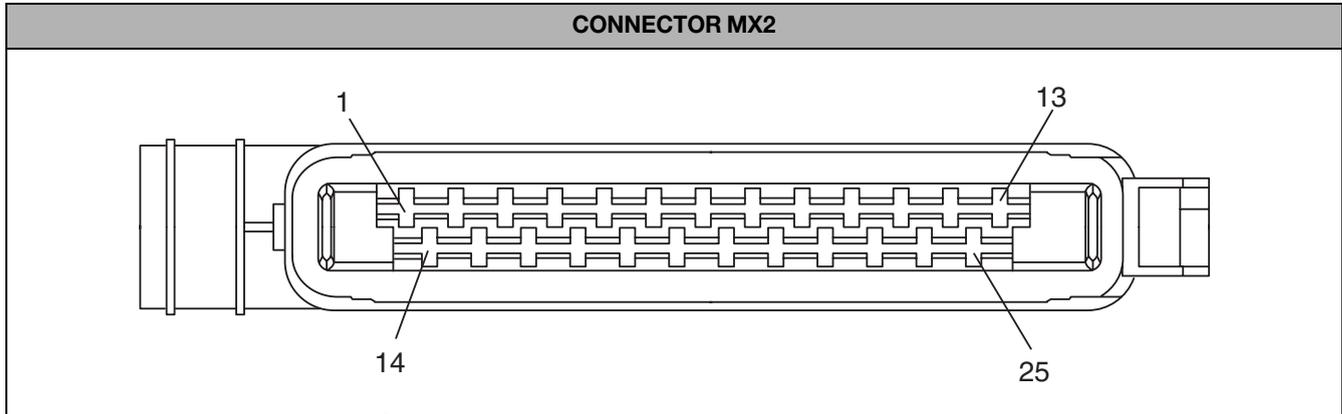
Pin	Volts.	Abbreviation	Description
1	0V	– 31	Battery negative
2	0V	– 31	Battery negative
3			Output, preheating control light
4			Not utilised
5			Not utilised
6			Input, gearbox in neutral
7			Input, speed signal
8			Not utilised
9			Not utilised
10		L	ISO 9141 serial interface (Diagnostics connector)
11		K	ISO 9141 serial interface (Diagnostics connector)
12		CAN_H	CAN_H
13		CAN_L	CAN_L
14	+12V	+15	Battery positive (15+)
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

3.3.2 TRANSMISSION CONTROL UNIT

CONNECTOR E.C.U. (PS)			
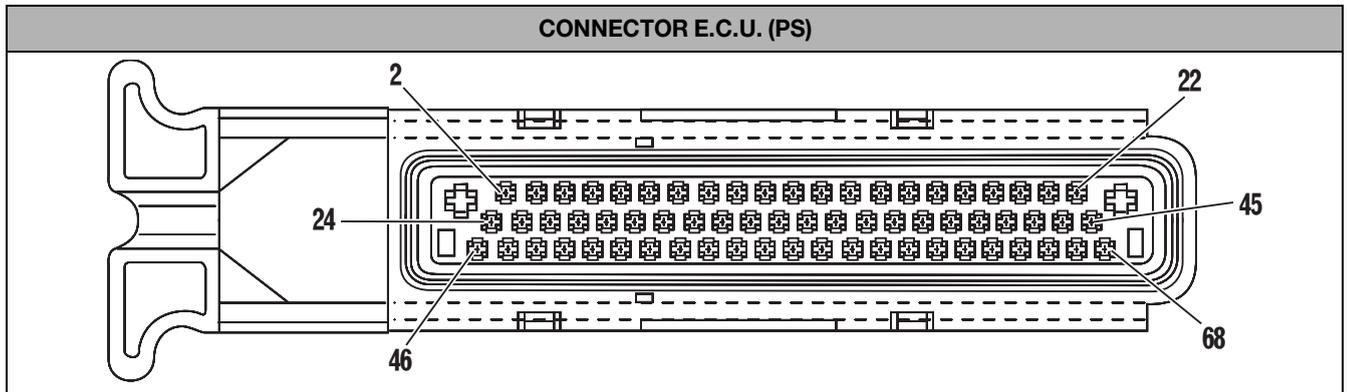
Pin	Volts.	Abbreviation	Description
1	0V	VM1	Battery negative
2	0V	VM2	Battery negative
3	0V	VMG1	Reference voltage for signal on pins 16, 17, 40 and 62
4	0V	VMG2	Reference voltage for signal on pin 44
5		ADM4	Output for fault warning light
6			Not utilised
7			Not utilised
8		VPS2	Power (+) common solenoid valves Y1, Y2, Y3, Y4, Y5
9			Not utilised
10			Not utilised
11		ADM6	Power, solenoid valve Y2
12			Not utilised
13	+12V	VPS1	Power (+), proportional solenoid valve and solenoid valves Y6, Y7
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		CAN H	CAN H
26		CAN L	CAN L
27		CAN RES	CAN RES
28			Not utilised
29		ED11	Analogue input, low transmission oil pressure signal
30			Not utilised

Pin	Volts.	Abbreviation	Description
31		EDM1	Signal, mechanical gearbox neutral
32		AIP3	Power, solenoid valve Y6
33		ADM8	Not utilised
34		ADM7	Not utilised
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	Not utilised
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 INFOCENTER 2 AND 3
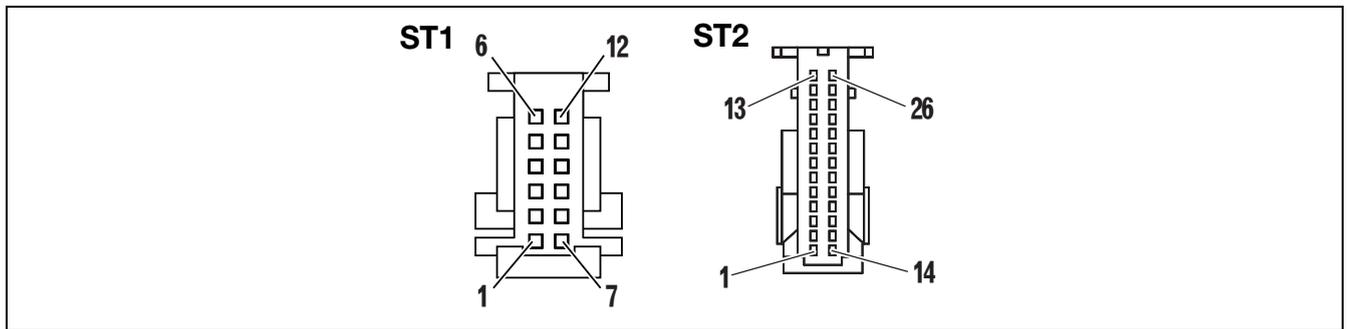
	CONNECTOR ST1		
Pin	Volts.	Abbreviation	Description
1		TXD	Diagnostics interface transmission
2	+12V	KL15-ST	+15 key
3		KL31	Lamps earth
4	+12V	KL58	+58 lights
5		GROUT	Actual vehicle speed output (radar)
6		RPOUT	Rear PTO speed output
7		GETOEL	Transmission oil pressure
8		HANDBR	Handbrake on and brake fluid 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.	Abbreviation	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		HML DOWN	
6		HML UP	
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.	Abbreviation	Description

16		FERNL	Main beam warning light
17		HYDRA	Hydraulic system oil filter clogged
18			Not utilised
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 (Italy)
24			Not utilised
25		EMR	Not utilised
26			Not utilised

3.3.4 POWER LIFT CONTROL UNIT

CONNECTOR JX1 (WHITE)			
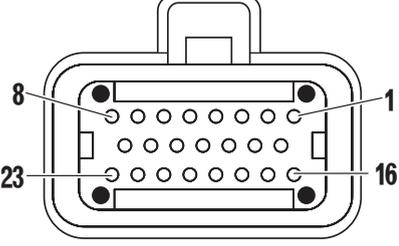
Pin	Volts.	Abbreviation	Description
1			Raising solenoid valve
2			Lowering solenoid valve
3	8V		Power for draft sensors
4	12V		Control unit power (F34)
5	12V		Control unit power (F34)
6			Control lever: Transport 5.5 V
			Stop: 3.8 V
			Control: 2.1 V
			Float: 1.7 V
7	0.3–8.0V		Depth potentiometer
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			Not utilised
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 (± 0.1V) low position: 4.5V (± 0.1V)

	CONNECTOR JX2 (BLACK)
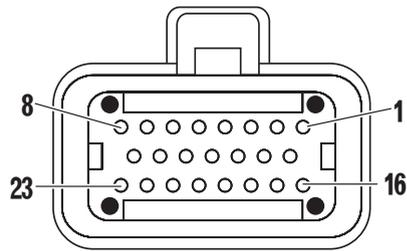
Pin	Volts.	Abbreviation	Description
1			Not utilised
2			Differential output
3			Input, radar (130 pulses per metre)
4			Not utilised
5			Not utilised
6			Not utilised
7			Not utilised
8			4WD output
9	8V		Power for external sensor (ISO4 socket)
10	8V		Power for steering sensors
11			Input, ASM AUTO
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			Not utilised
22			ISO9141 L Line
23	0V		Earth for steering sensors

3.3.6 FRONT SUSPENSION CONTROL UNIT
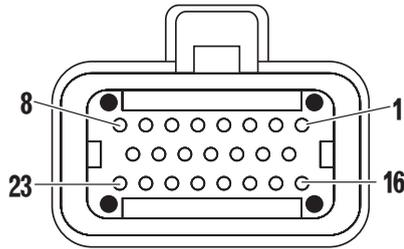
CONNECTOR JX3 (BLACK)			
Pin	Volts.	Abbreviation	Description
1			Output, raising solenoid valve
2			Output, lowering solenoid valve
3			Not utilised
4	+12 V		+12 V
5	+12 V		+12 V
6–19			Not utilised
20	0V		Control unit earth
21–23			Not utilised
CONNECTOR JX4 (WHITE)			
Pin	Volts.	Abbreviation	Description
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

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4. SYSTEMS

4.1 EARTH POINTS
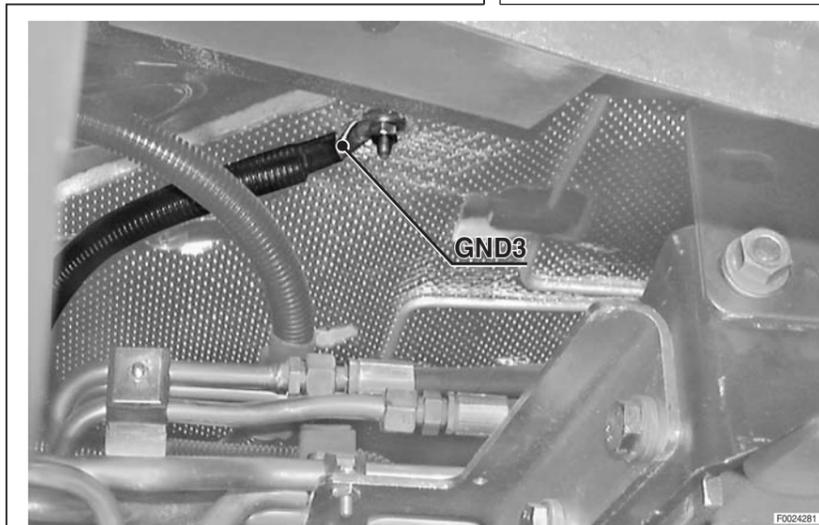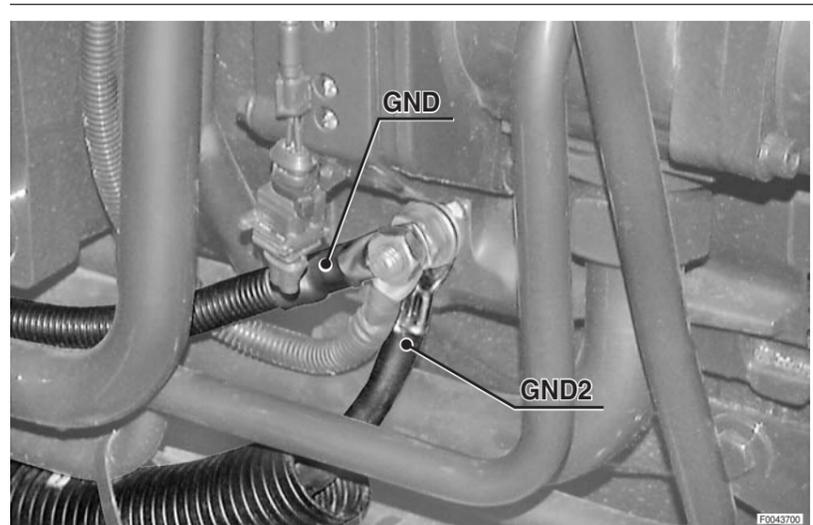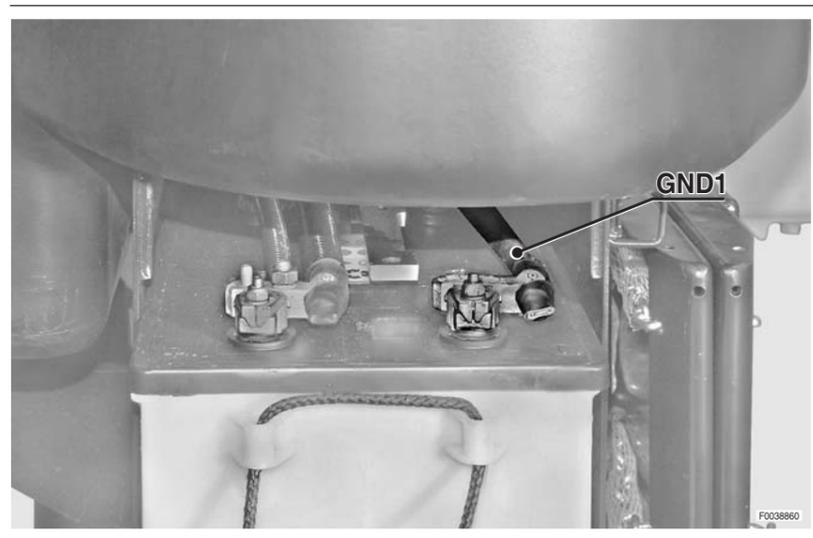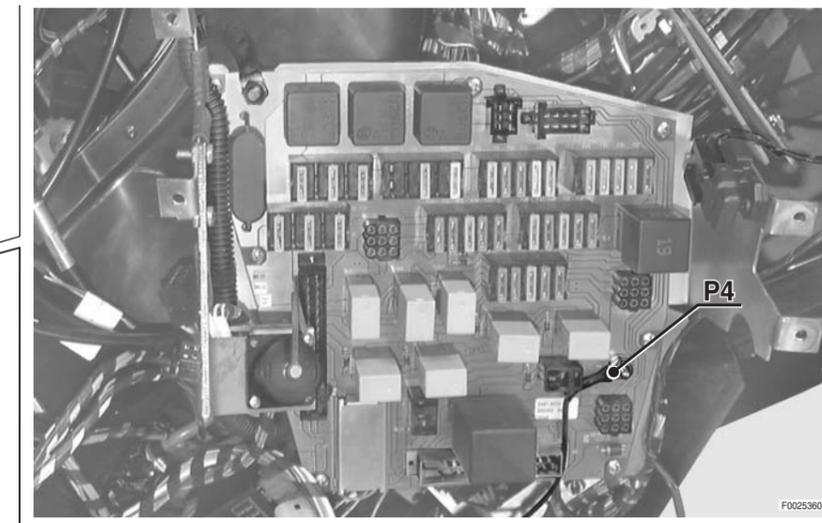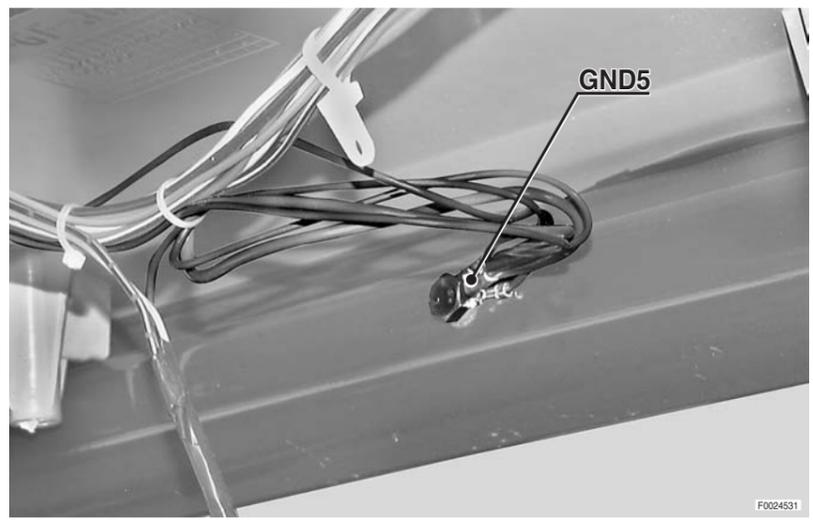
4.2 STARTING
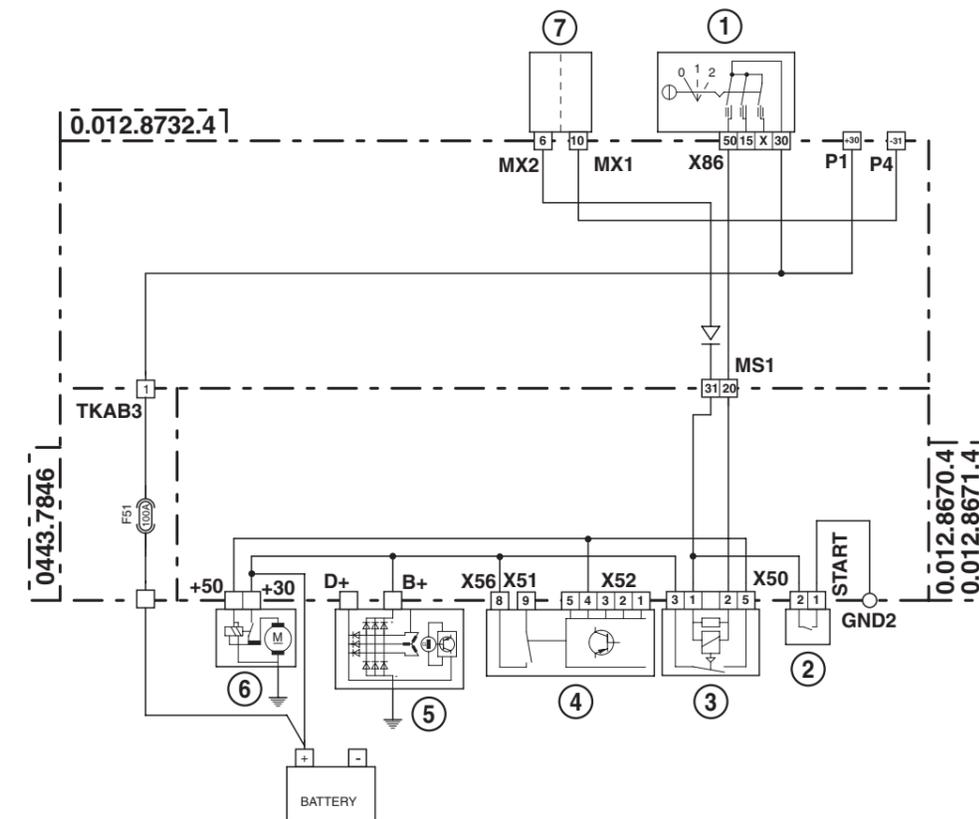
1 Starter switch
2 Start enable switch
3 Engine starting relay
4 Preheating control unit
5 Alternator
6 Starter motor
7 Engine control unit

4.3 PREHEATING
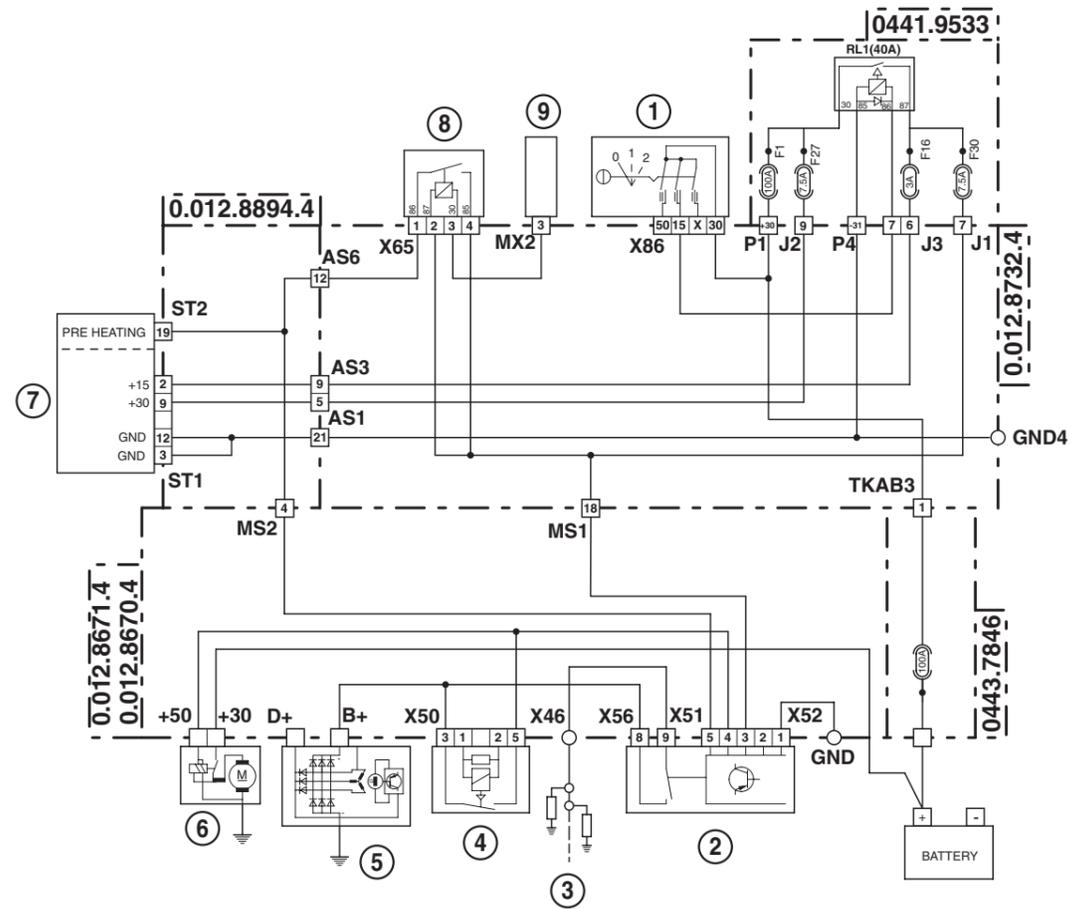
1   Starter switch
2   Preheating control unit
3   Preheating glow plugs
4   Engine starting relay
5   Alternator
6   Starter motor
7   Infocenter
8   Preheating indicator lamp relay
9   Engine control unit

4.4 ELECTRICAL ENGINE CONTROL
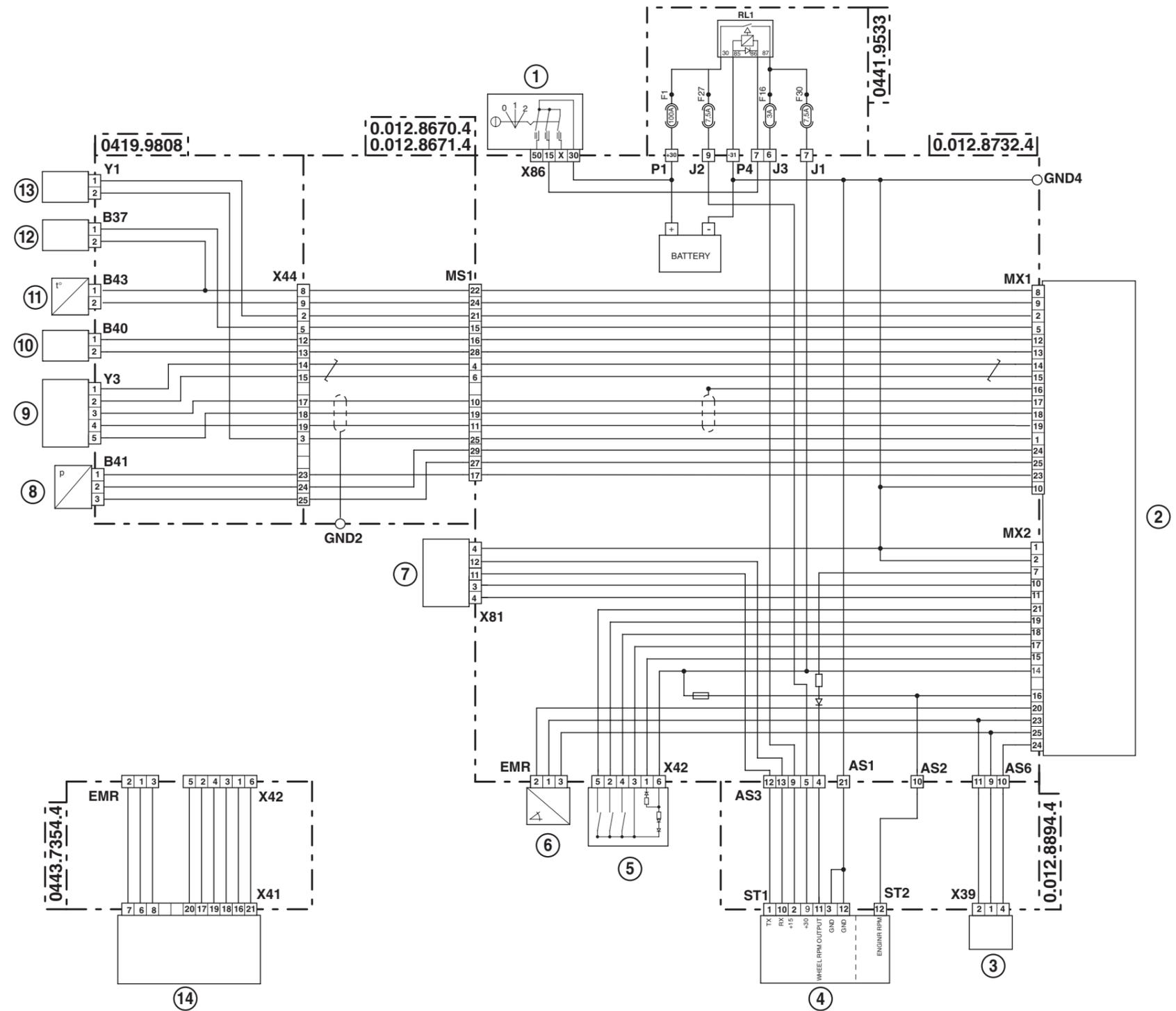
1	Starter switch	8	Engine boost pressure sensor
2	Engine control unit	9	Actuator
3	Accelerator pedal position sensor	10	Camshaft speed sensor (Pick-Up)
4	Infocenter	11	Engine coolant temperature sensor
5	Engine speed keypad	12	Fuel temperature sensor
6	Lift control panel	13	Engine stop coil
7	Diagnostics connector	14	Armrest

40-50

D0012800

4.5 LIGHTS - STEERING COLUMN SWITCH UNIT
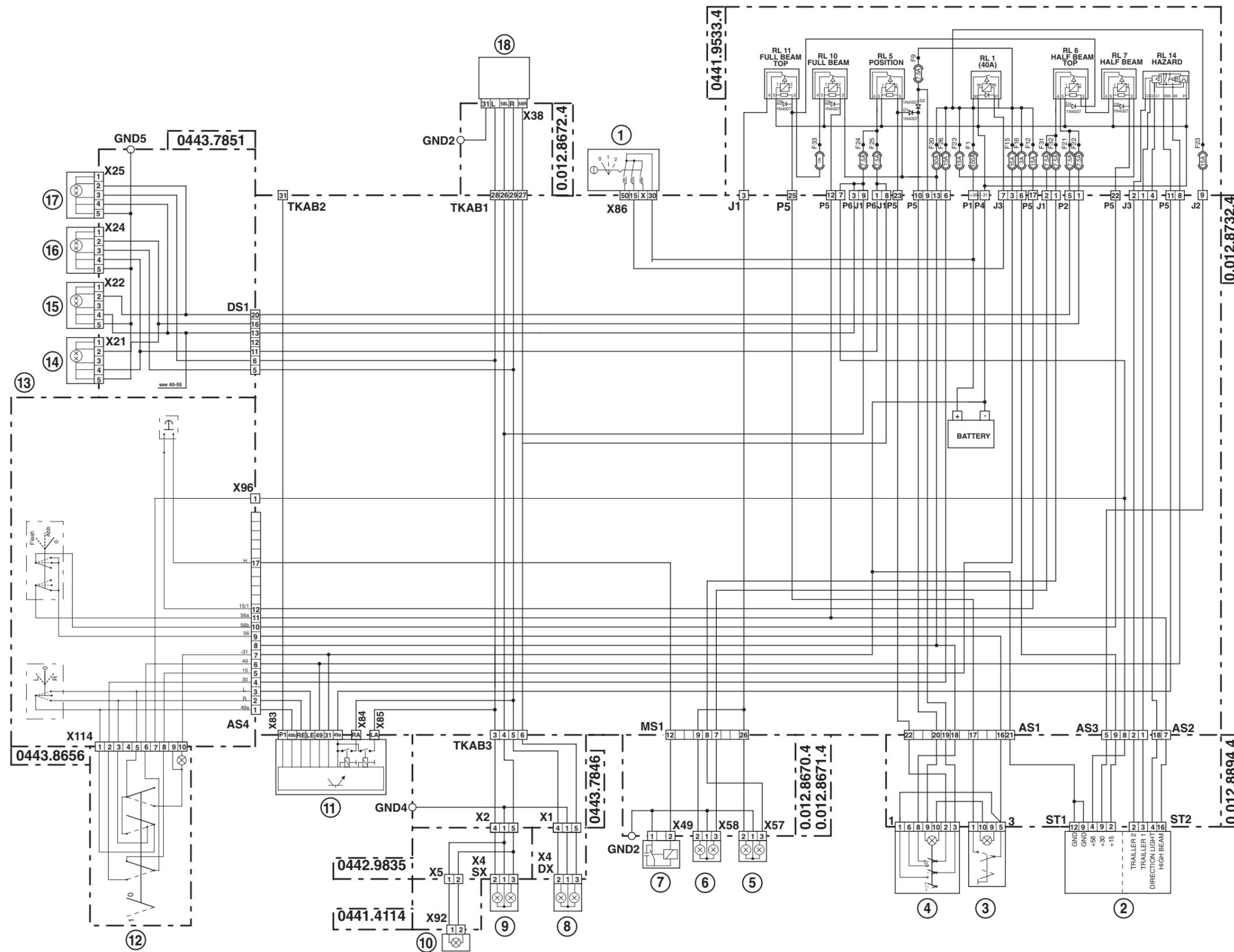
1 Starter switch
2 Infocenter
3 Cab roof worklights switch
4 Sidelights switch
5 RH headlamp
6 LH headlamp
7 Horn
8 RH rear sidelight and direction indicator
9 LH rear sidelight and direction indicator
10 Number plate light
11 Direction indicator electronic flasher unit
12 Hazard warning lights switch
13 Steering column switch unit
14 Front right worklight
15 Front left worklight
16 RH front sidelight and direction indicator
17 LH front sidelight and direction indicator
18 Trailer socket (for lights and auxiliary power)

4.6 CAB ACCESORIES
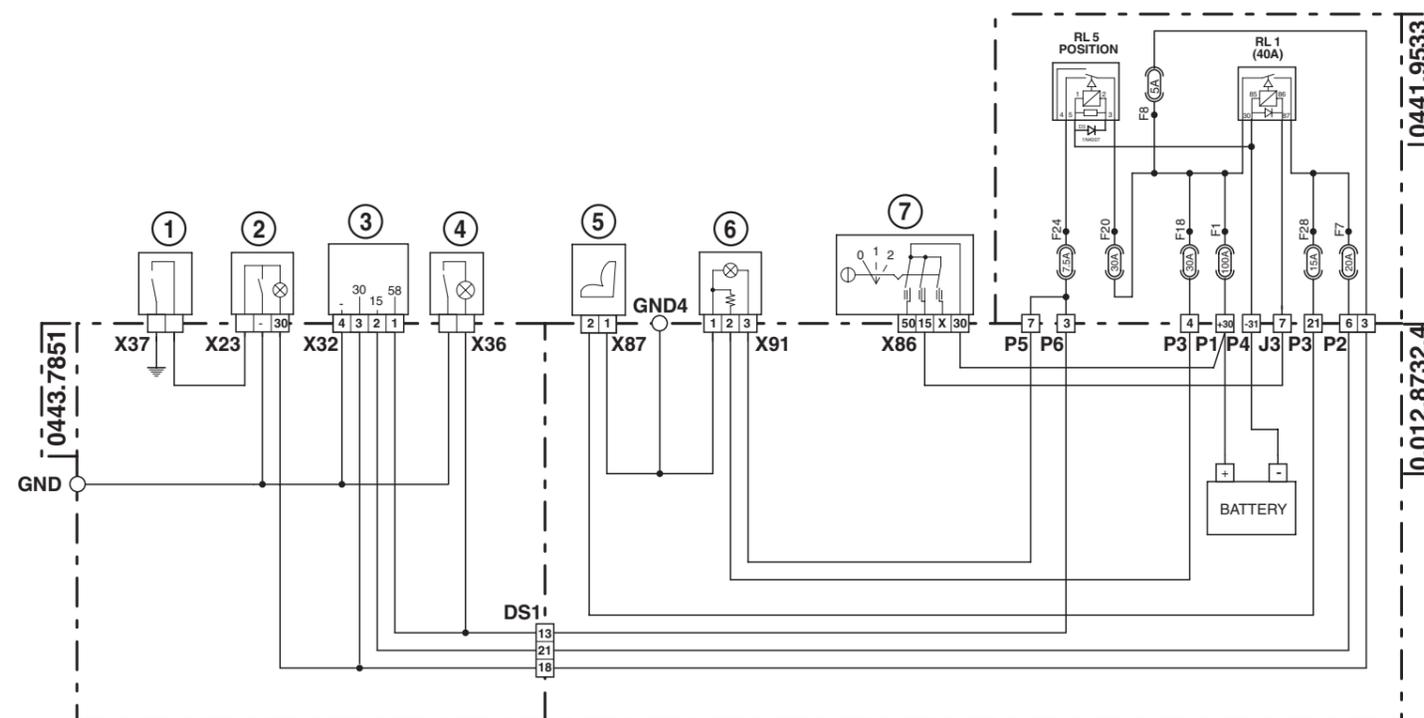
1 Door open warning signal switch

2 Interior roof light

3 Clock

4 Side console courtesy light

5 Driver's seat air suspension compressor

6 Cigar lighter

7 Starter switch

D0005831
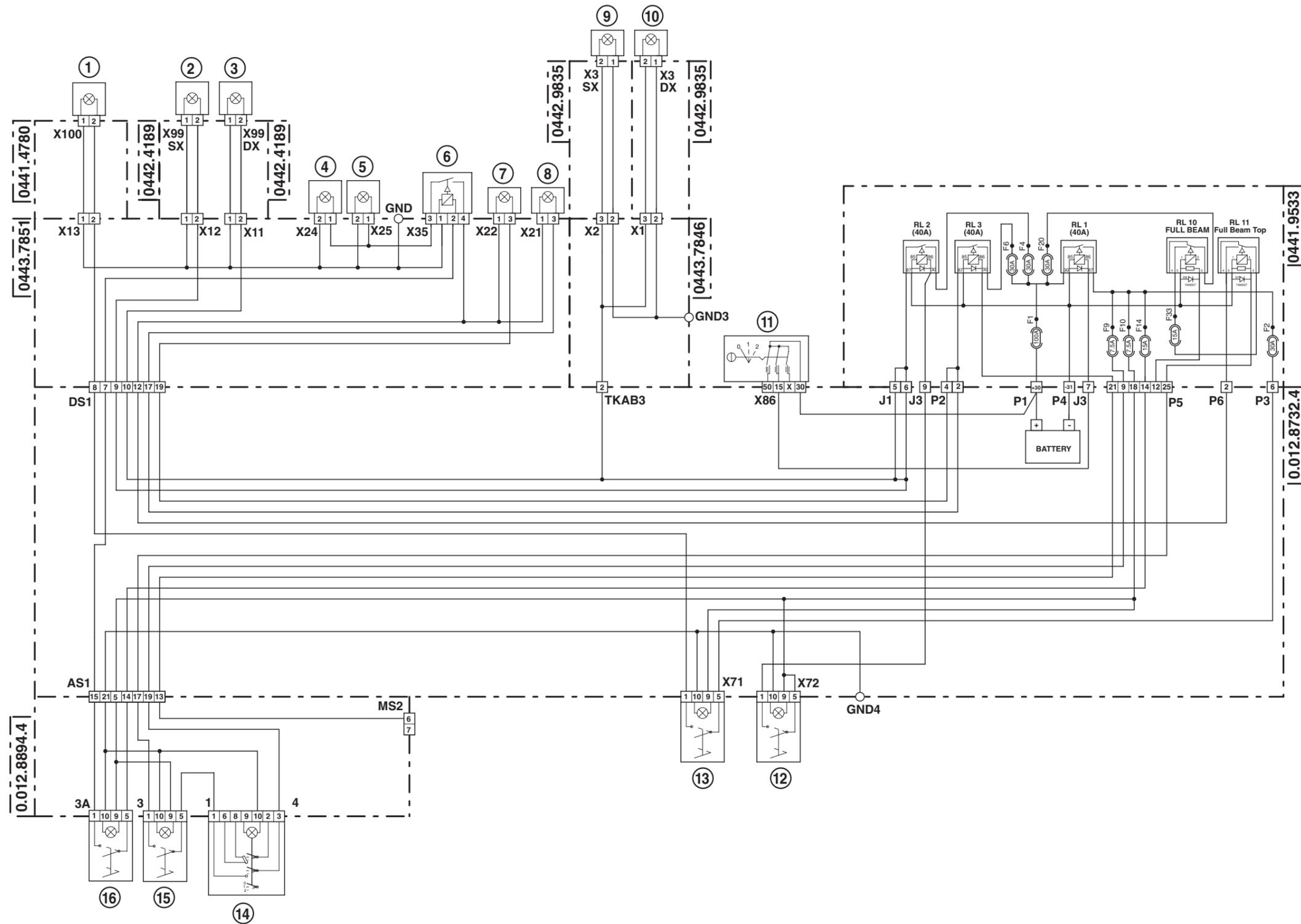
4.7 WORKLIGHTS

1	Rotating beacon
2	LH rear upper worklights
3	RH rear upper worklights
4	RH front sidelight and direction indicator
5	LH front sidelight and direction indicator
6	Front upper worklights relay
7	Front left worklight
8	Front right worklight
9	LH rear lower worklights
10	RH rear lower worklights
11	Starter switch
12	Rear worklights switch
13	Rotating beacon control switch
14	Sidelights switch
15	Cab roof worklights switch
16	Lower worklights switch

4.8 WINDSCREEN WIPERS
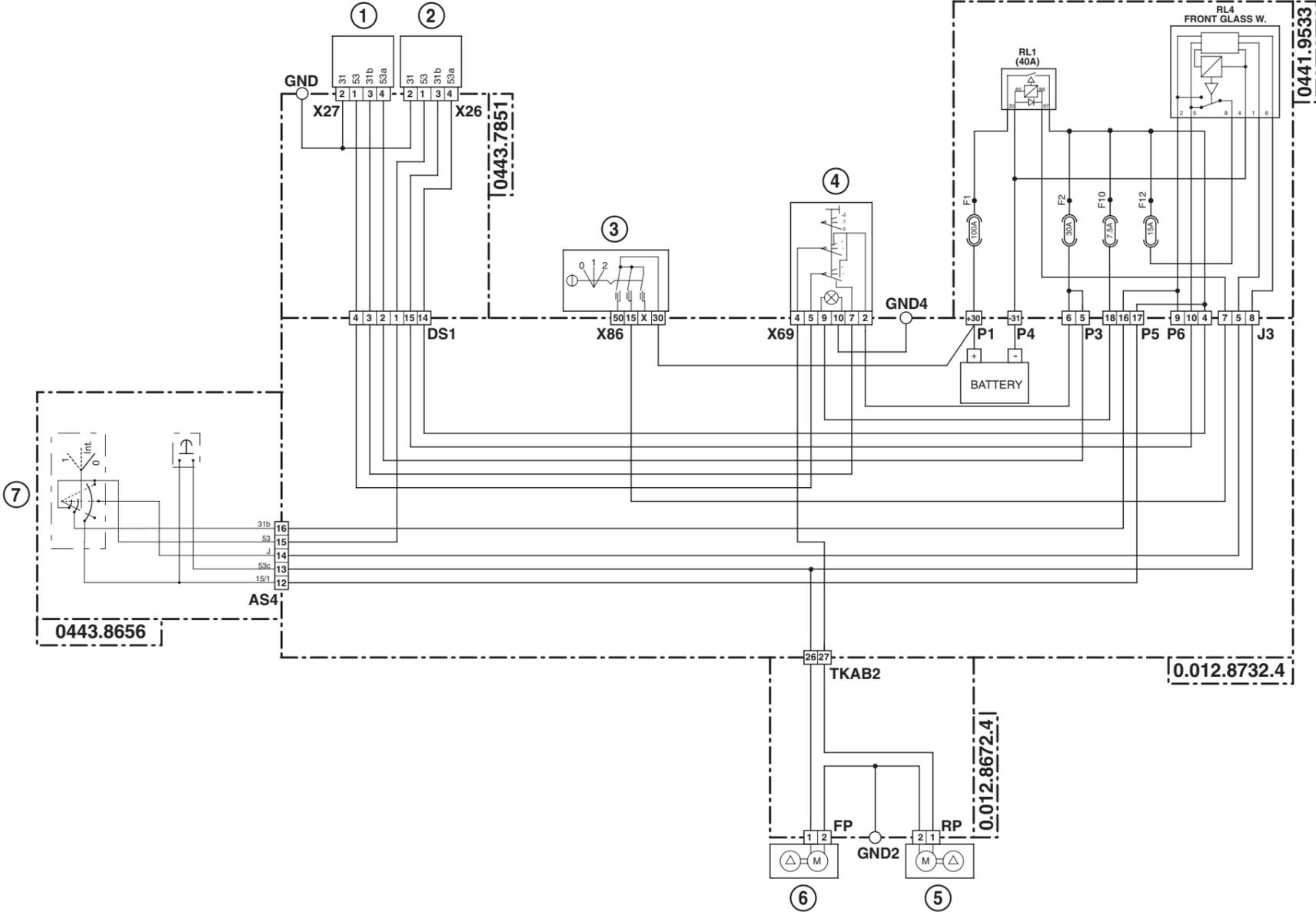
1   Rear screen wiper motor

2   Front screen wiper motor

3   Starter switch

4   Rear screen wiper switch

5   Rear screen washer pump

6   Front windscreen washer pump

7   Steering column switch unit

4.9 INFOCENTER
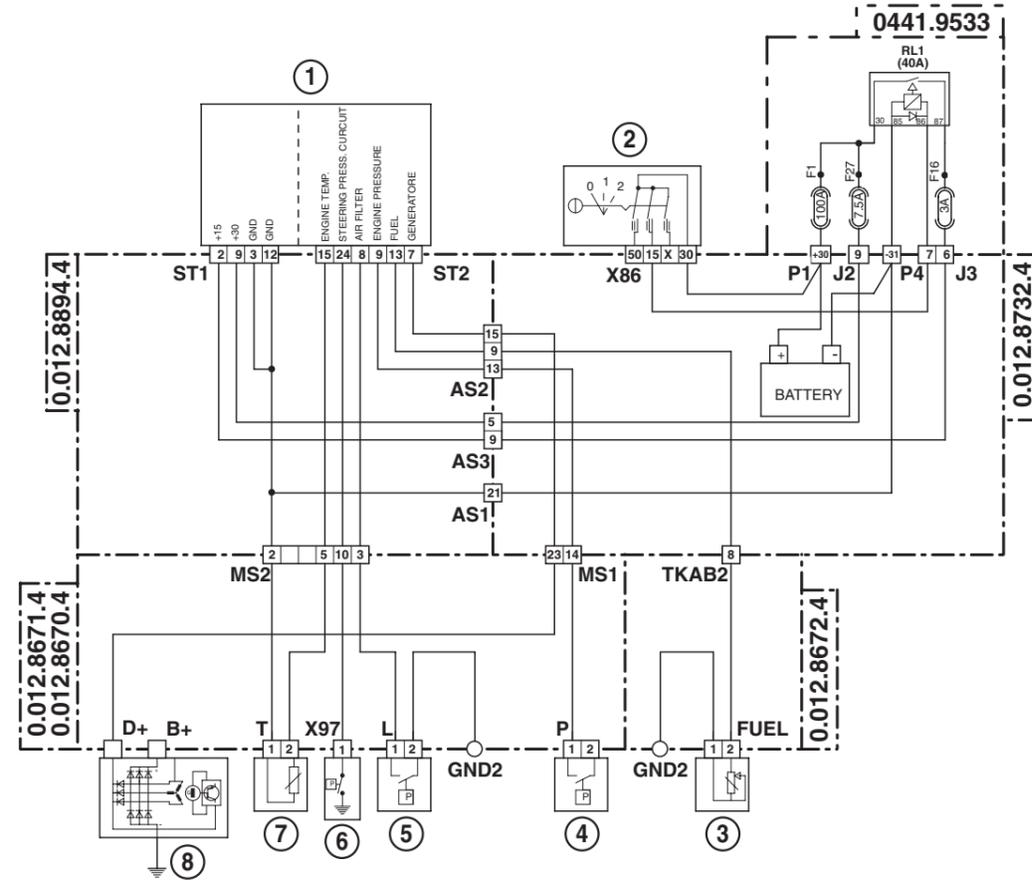
1 Infocenter
2 Starter switch
3 Fuel level sensor
4 Engine oil pressure switch
5 Air cleaner clogged sensor
6 Steering circuit pressure switch
7 Engine coolant temperature sensor
8 Alternator

4.10 POWER OUTLET SOCKETS
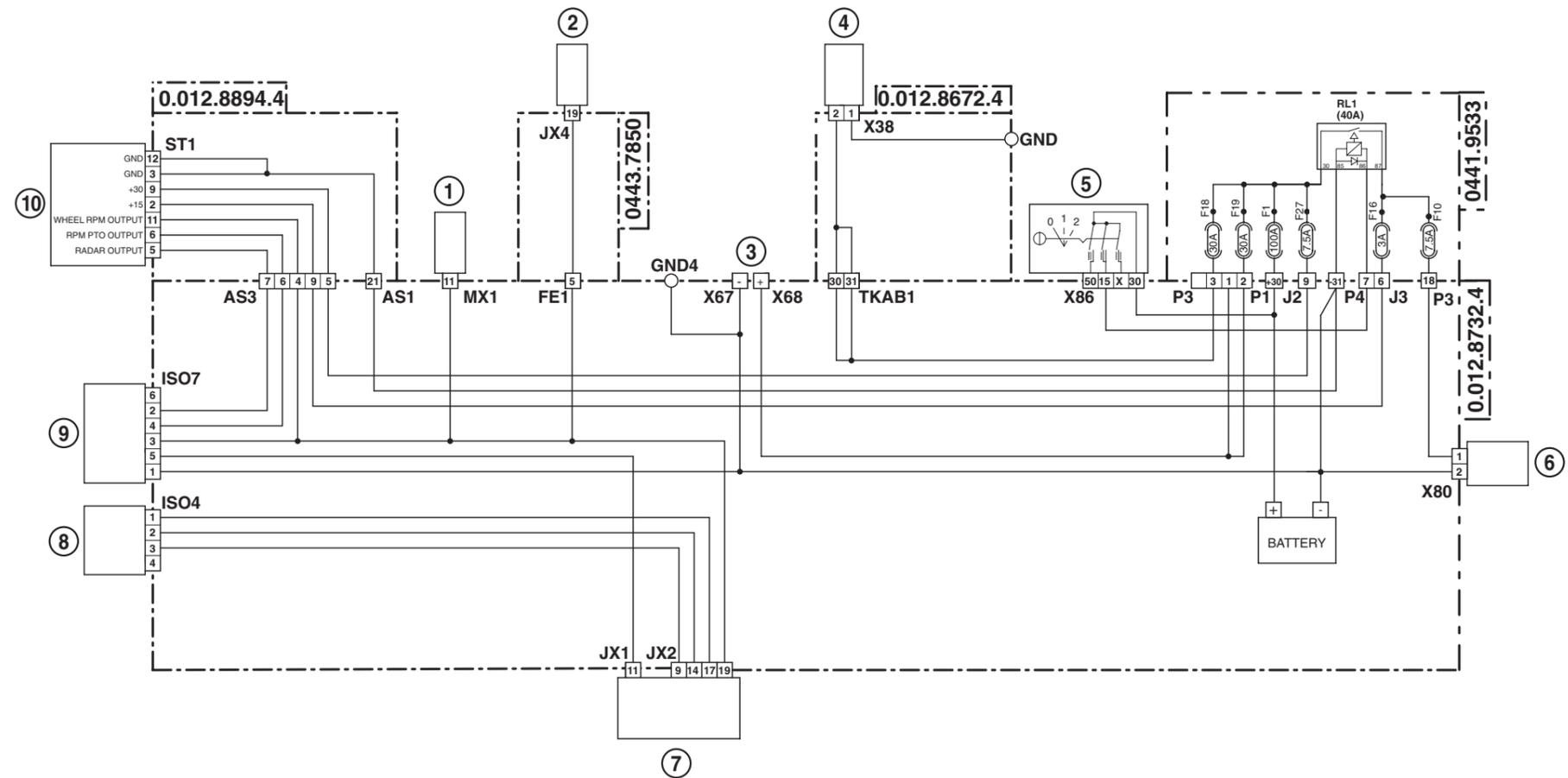
1   Engine control unit

2   Front axle suspension control unit

3   Auxiliary power socket

4   Trailer socket (for lights and auxiliary power)

5   Starter switch

6   Auxiliary power supply connector (in cab)

7   Rear lift control unit

8   ISO4 socket (power supply to implements)

9   ISO7 socket (implement connection)

10   Infocenter

4.11 RADIO - CB
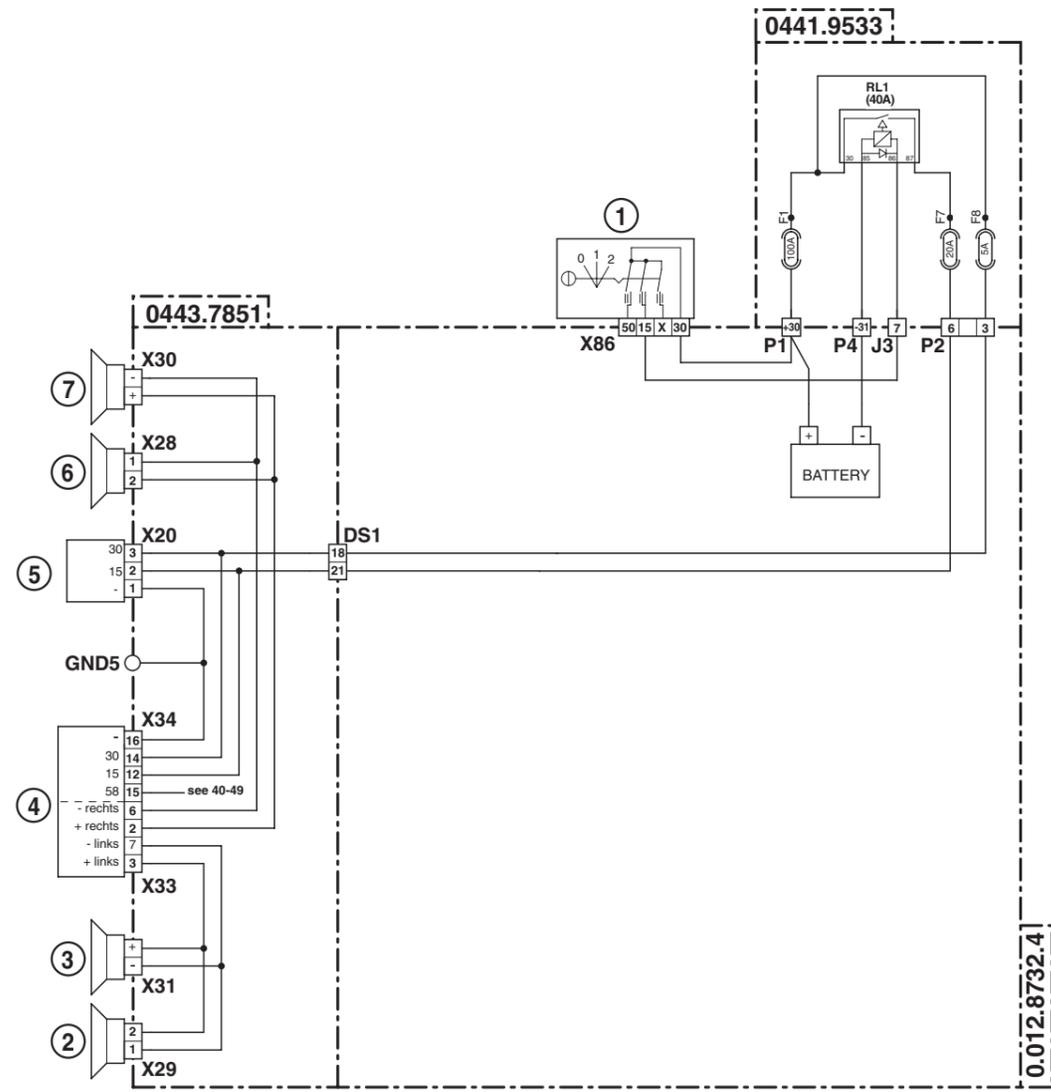
1   Starter switch
2   Left front loudspeaker
3   Left rear loudspeaker
4   Radio
5   CB power connector
6   Right front loudspeaker
7   Right rear loudspeaker

4.12 AIR CONDITIONING - HEATER FANS
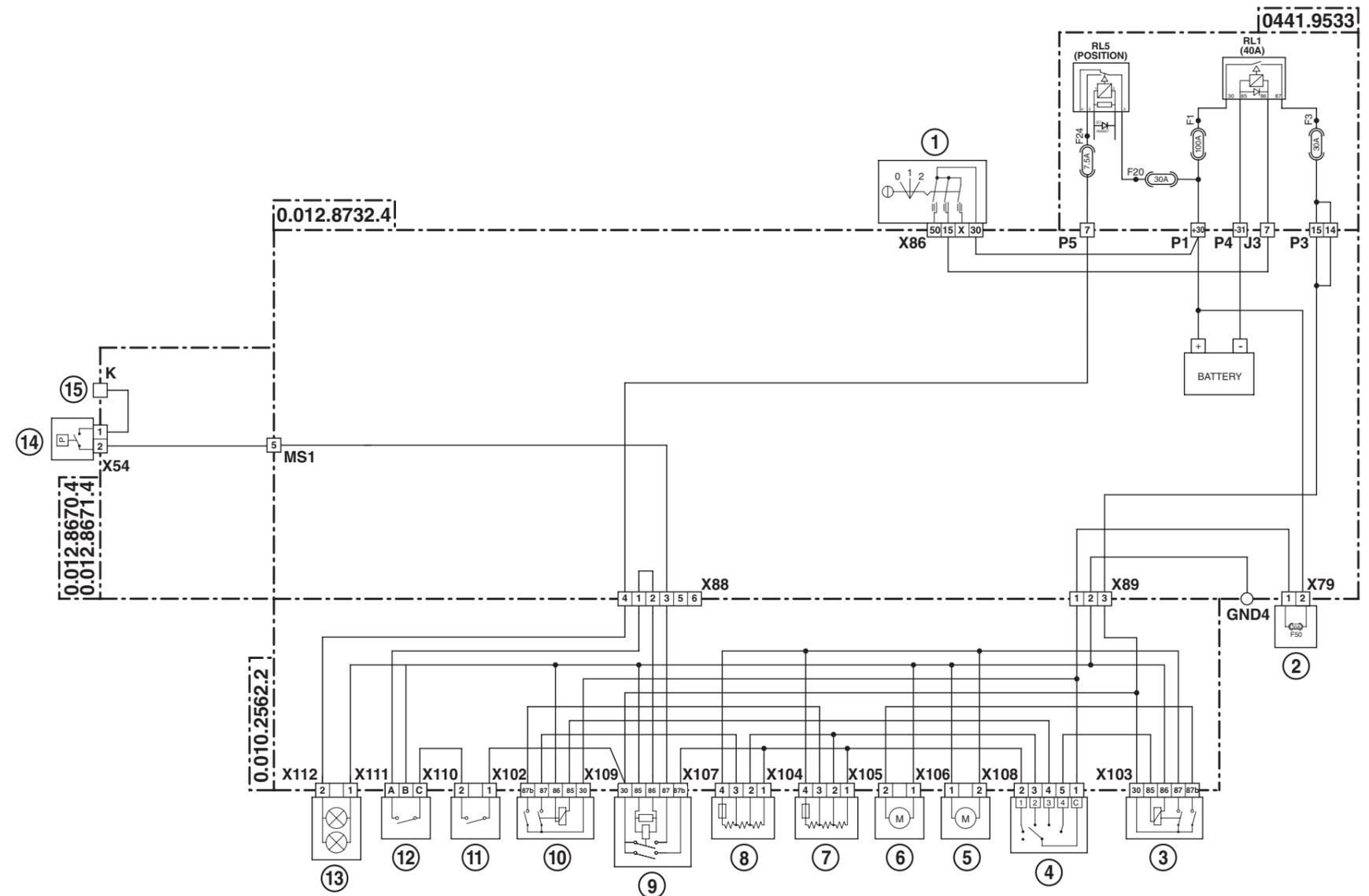
1	Starter switch	**10**	Relay for 3rd heater fan speed
2	Fuse F50 (30 Amp)	**11**	Air conditioning on/off switch
3	Relay for 4th heater fan speed	**12**	Air conditioning thermostat
4	Fan speed selector switch	**13**	Air conditioning control panel illumination connector
5	Right heater fan	**14**	Air conditioning pressure switch
6	Left heater fan	**15**	Air conditioning compressor
7	Left heater fan resistor		
8	Right heater fan resistor		
9	Relay for 1st fan speed and air conditioning on		

D0012830

4.13 BRAKING SYSTEM
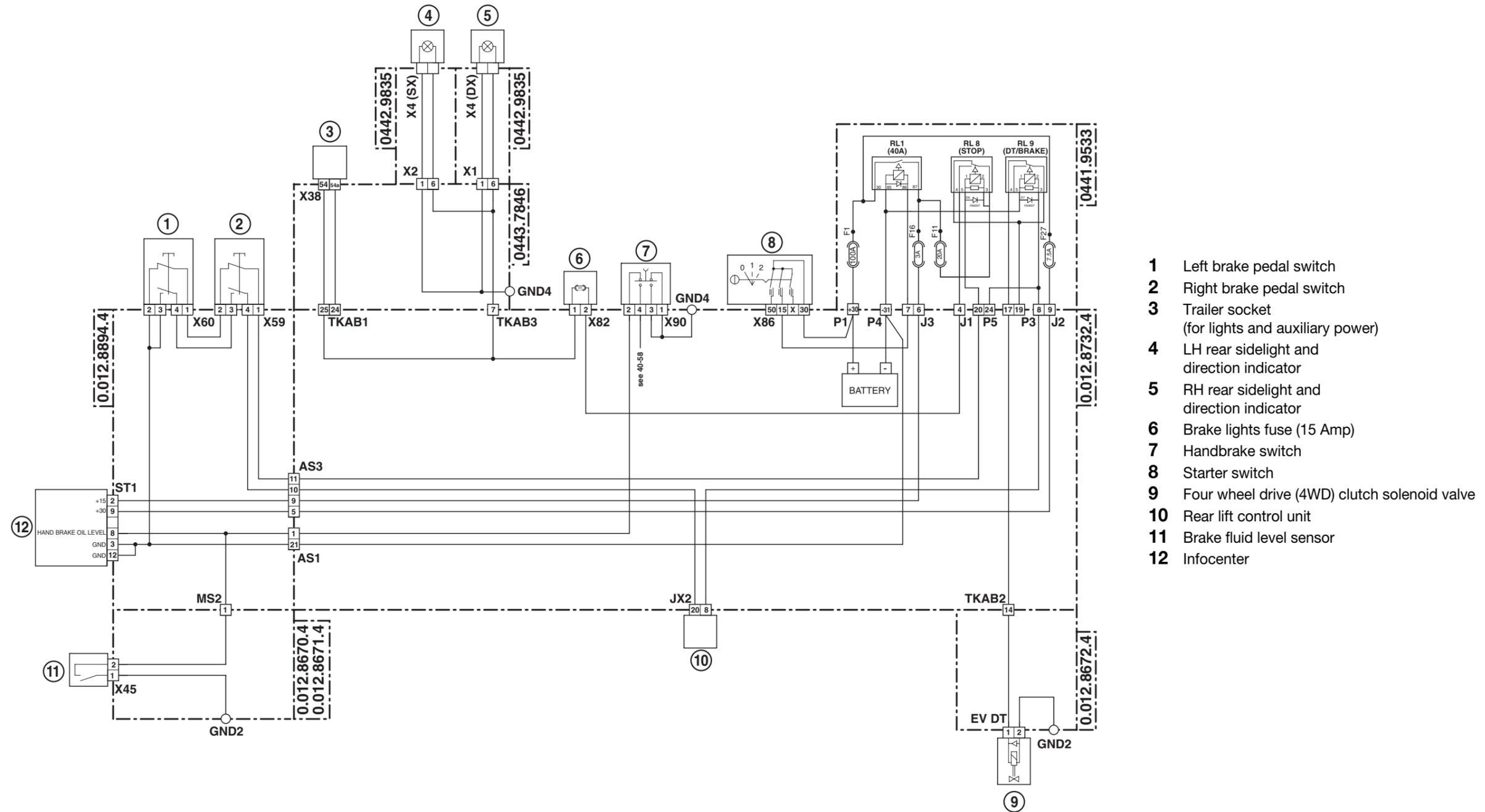
1   Left brake pedal switch
2   Right brake pedal switch
3   Trailer socket
    (for lights and auxiliary power)
4   LH rear sidelight and
    direction indicator
5   RH rear sidelight and
    direction indicator
6   Brake lights fuse (15 Amp)
7   Handbrake switch
8   Starter switch
9   Four wheel drive (4WD) clutch solenoid valve
10 Rear lift control unit
11 Brake fluid level sensor
12 Infocenter

4.14 TRAILER BRAKES

1. Compressed air pressure gauge
2. Handbrake switch
3. Infocenter
4. Trailer parking brake pressure switch
5. Trailer parking brake solenoid valve
6. Compressed air pressure sensor
7. Starter switch
8. Four wheel drive (4WD) clutch solenoid valve
9. Compressed air pressure gauge light

D0012840

40-60
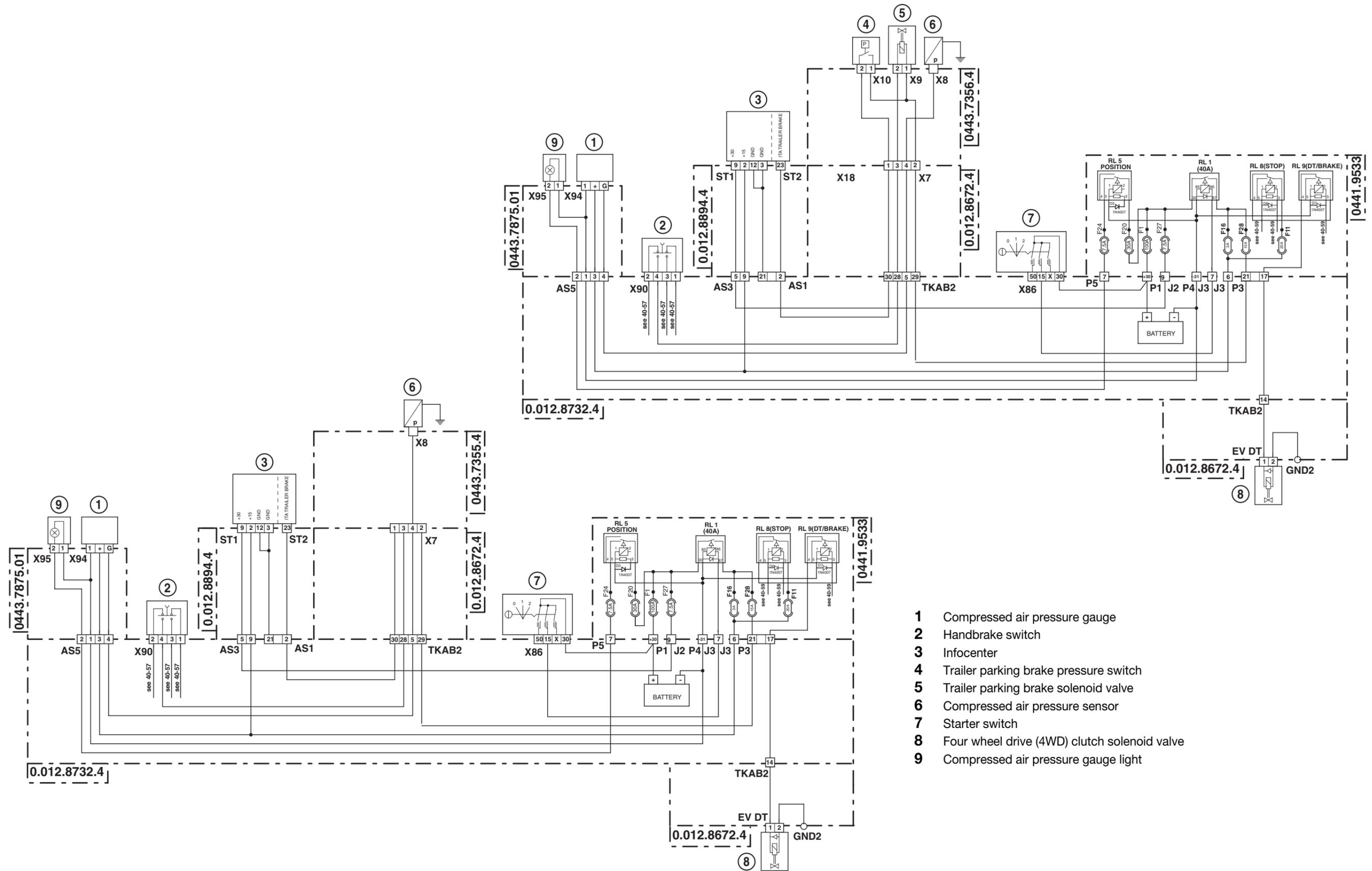
4.15 FRONT AXLE SUSPENSION
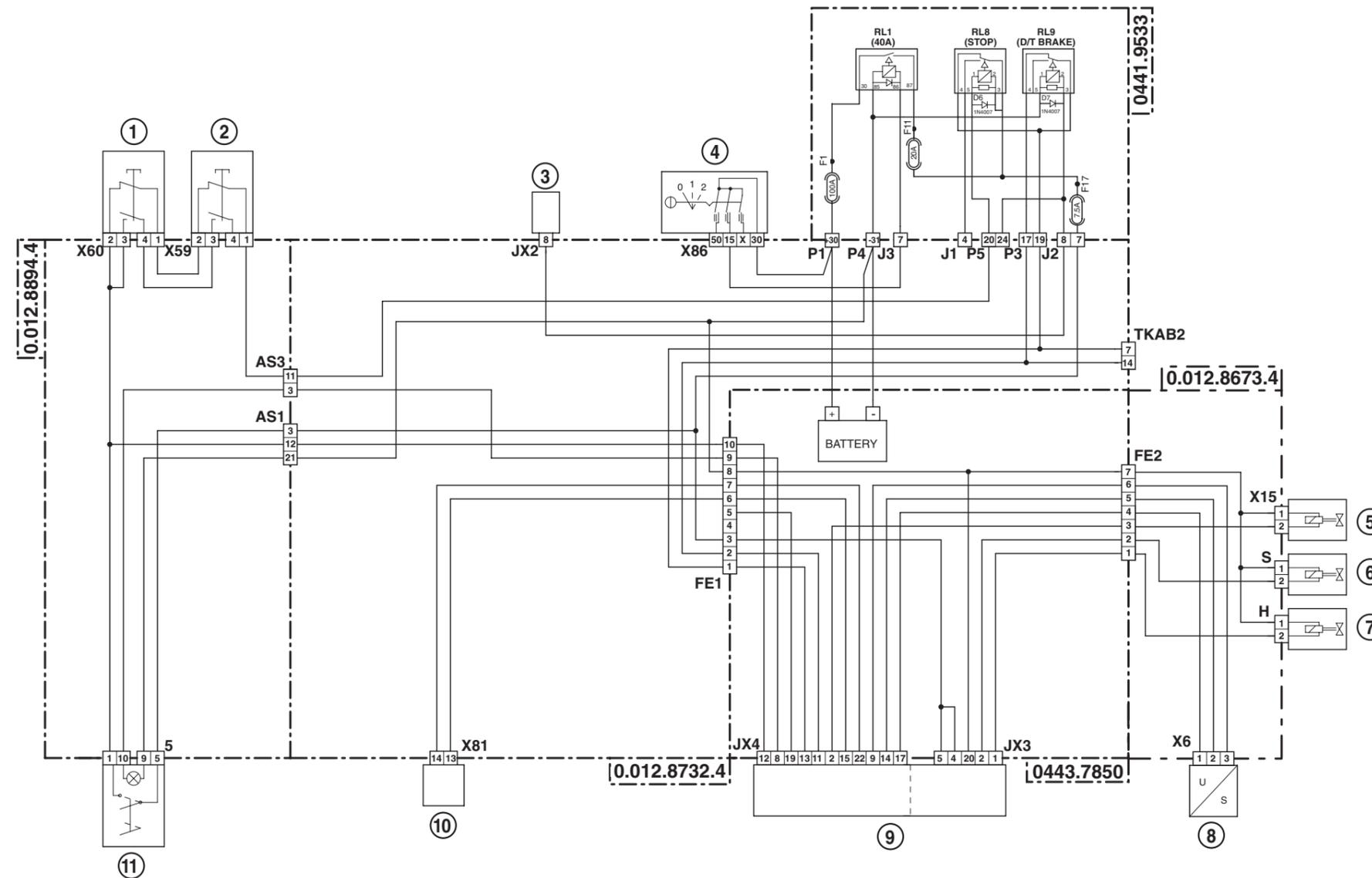
1 Left brake pedal switch

2 Right brake pedal switch

3 Rear lift control unit

4 Starter switch

5 Load Sensing control solenoid valve front axle suspension

6 Front axle suspension Down solenoid valve

7 Front axle suspension Up solenoid valve

8 Axle suspension position sensor

9 Front axle suspension control unit

10 Diagnostics connector

11 Front suspension control pushbutton

4.16 TRASMISSION
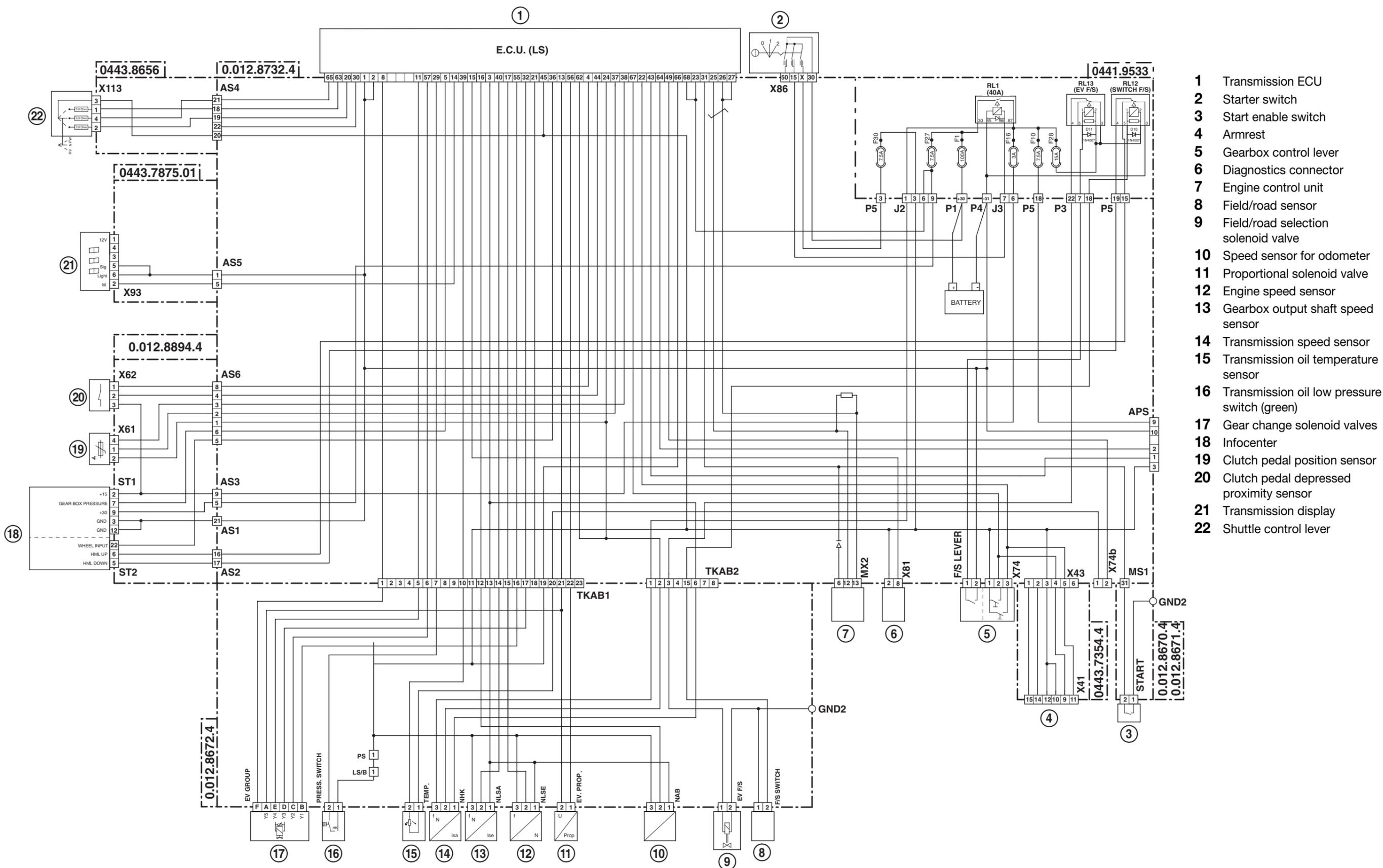
1	Transmission ECU
2	Starter switch
3	Start enable switch
4	Armrest
5	Gearbox control lever
6	Diagnostics connector
7	Engine control unit
8	Field/road sensor
9	Field/road selection solenoid valve
10	Speed sensor for odometer
11	Proportional solenoid valve
12	Engine speed sensor
13	Gearbox output shaft speed sensor
14	Transmission speed sensor
15	Transmission oil temperature sensor
16	Transmission oil low pressure switch (green)
17	Gear change solenoid valves
18	Infocenter
19	Clutch pedal position sensor
20	Clutch pedal depressed proximity sensor
21	Transmission display
22	Shuttle control lever

4.17 ASM - 4WD - DIFFERENTIAL
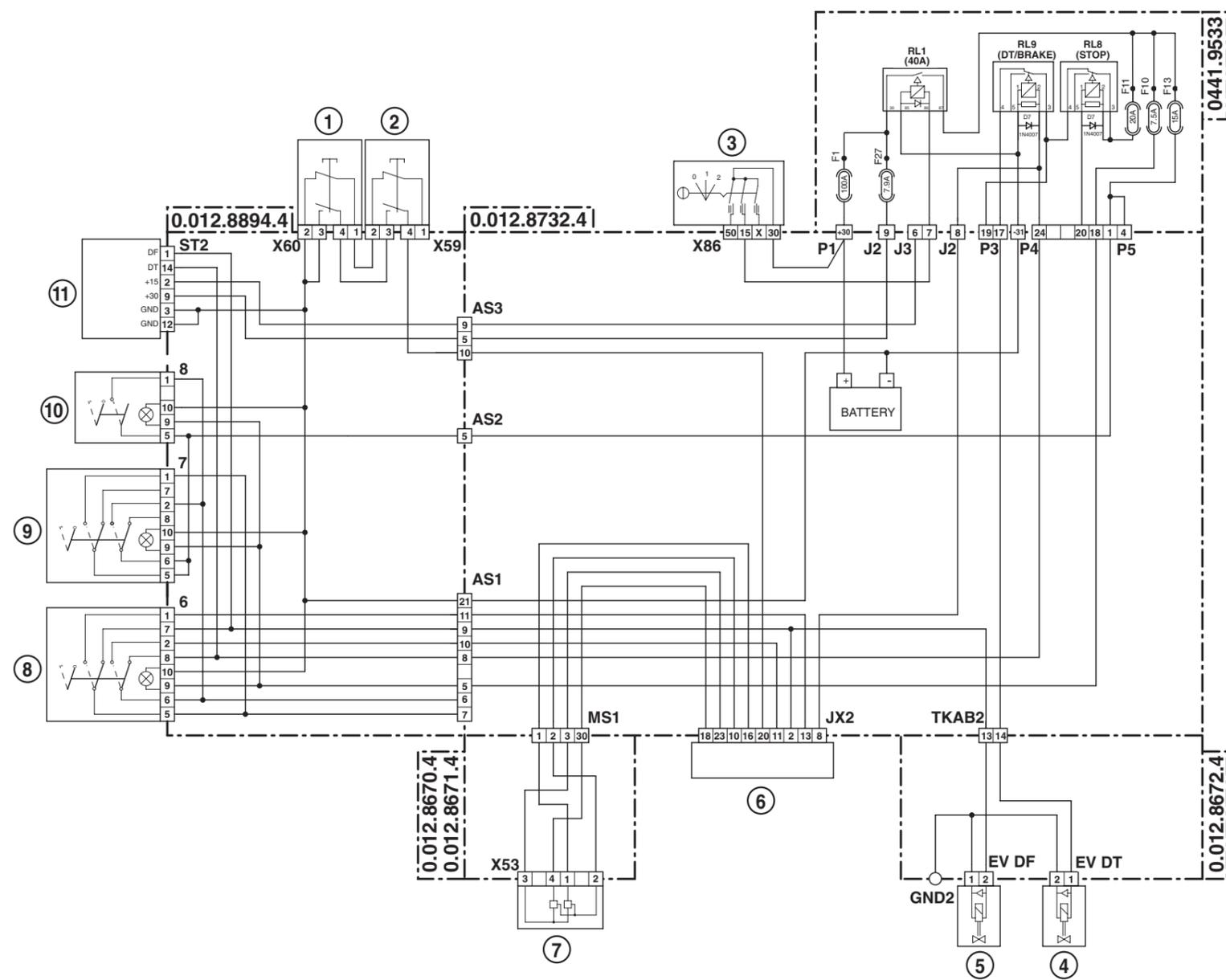
1	Left brake pedal switch	**7**	Steering angle sensor
2	Right brake pedal switch	**8**	ASM switch
3	Starter switch	**9**	Diff lock switch
4	Four-wheel drive control solenoid valve (4WD)	**10**	4WD switch
5	Diff lock solenoid valve	**11**	Infocenter
6	Rear lift control unit		

4.18 ELECTRONIC LIFT
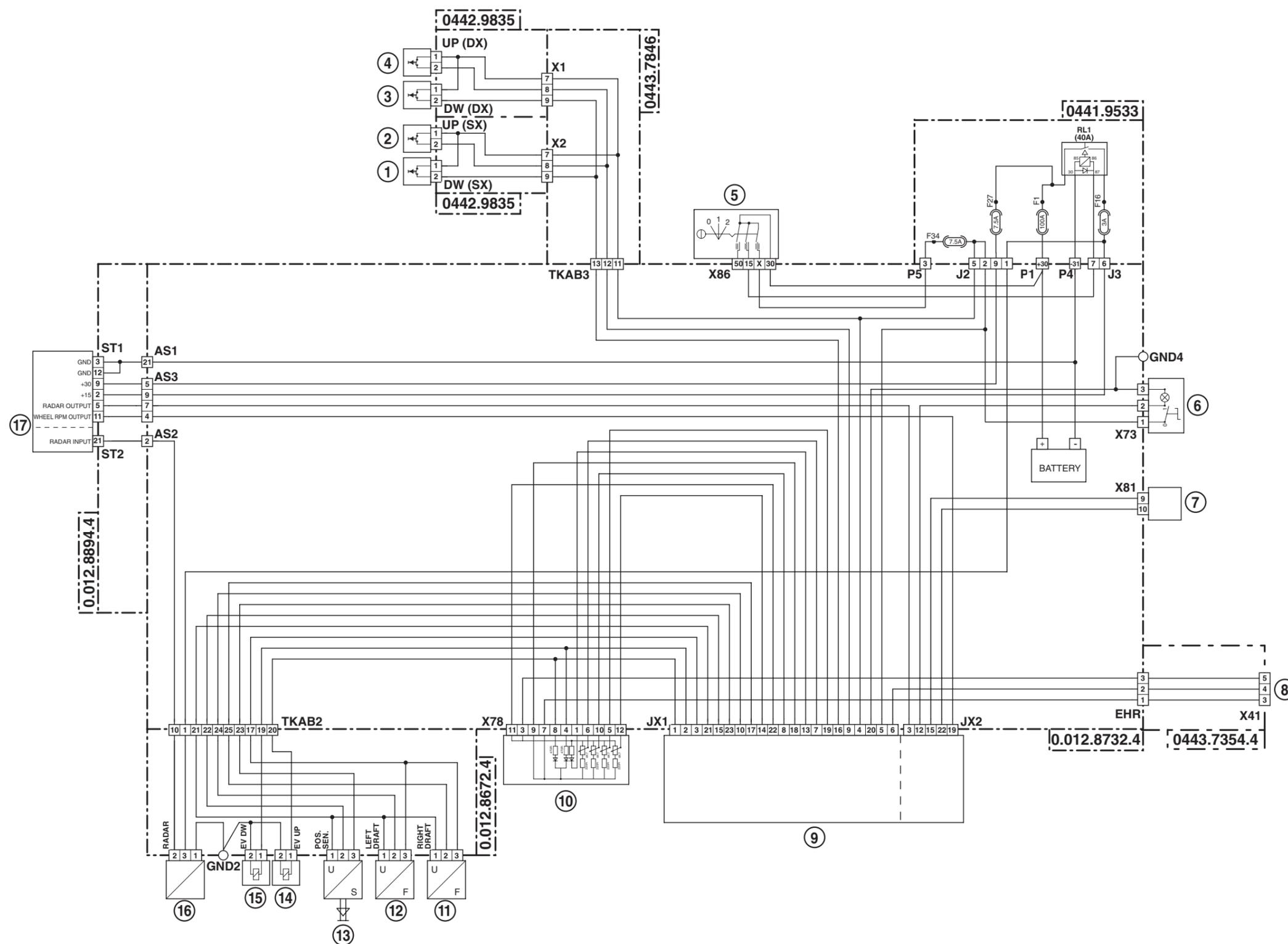
1 LH 'down' button for rear lift
2 LH 'up' button for rear lift
3 RH lift 'down' button for rear lift
4 RH 'up' button for rear lift
5 Starter switch
6 Radar control switch
7 Diagnostics connector
8 Armrest
9 Rear lift control unit
10 Lift control panel
11 Lift draft sensor (Right)
12 Lift draft sensor (left)
13 Rear lift position sensor
14 Lift raising solenoid valve
15 Lift lowering solenoid valve
16 Radar
17 Infocenter

4.19 FRONT AND REAR PTO
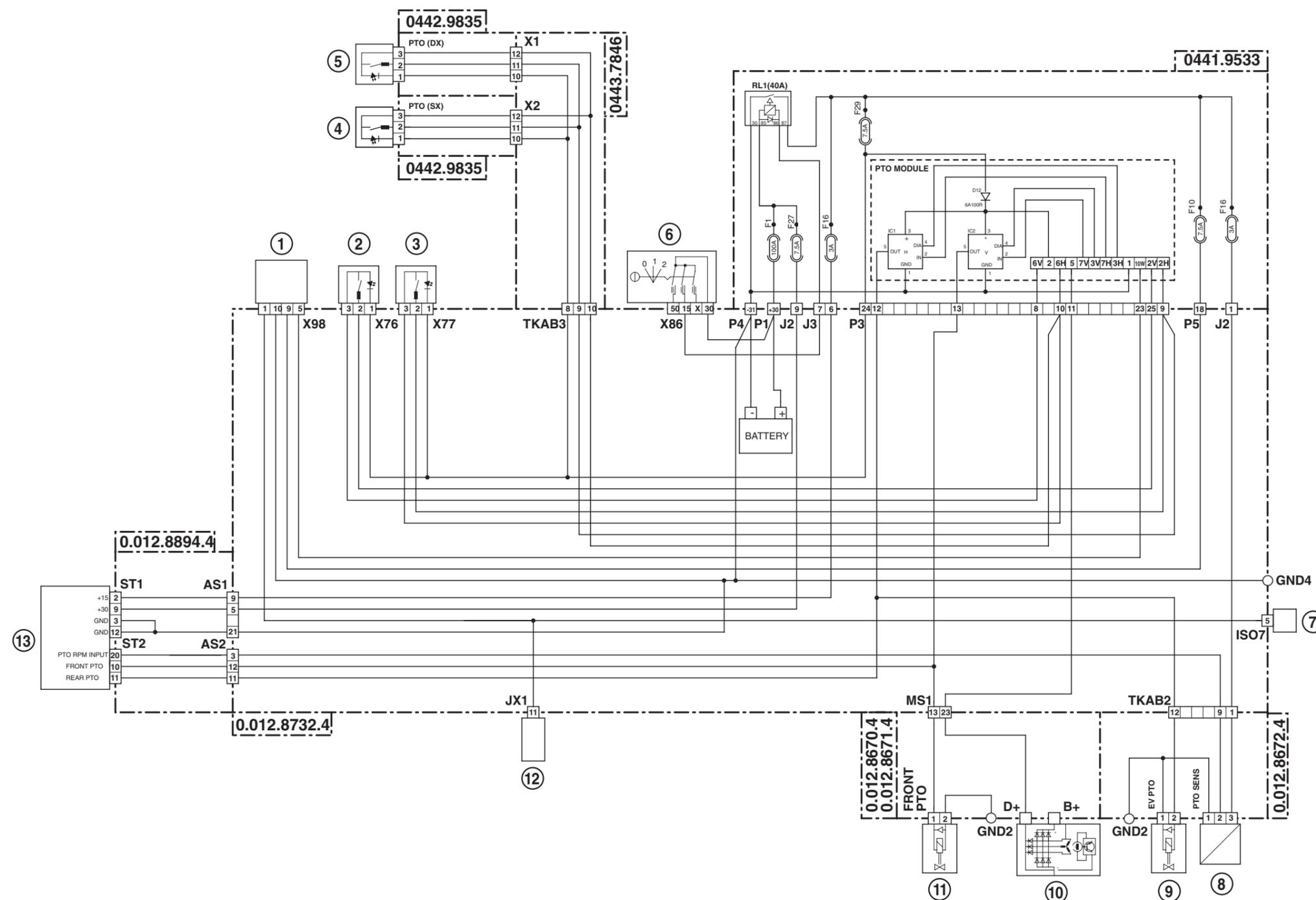
1	PTO AUTO switch	**8**	Rear PTO speed sensor
2	Front PTO pushbutton (in cab)	**9**	Front PTO solenoid valve
3	Rear PTO pushbutton (in cab)	**10**	Alternator
4	LH rear PTO control button (on fender)	**11**	Rear PTO solenoid valve
5	RH rear PTO control button (on fender)	**12**	Rear lift control unit
6	Starter switch	**13**	Infocenter
7	ISO7 socket		
	(implement connection)		

4.20 CLEANFIX
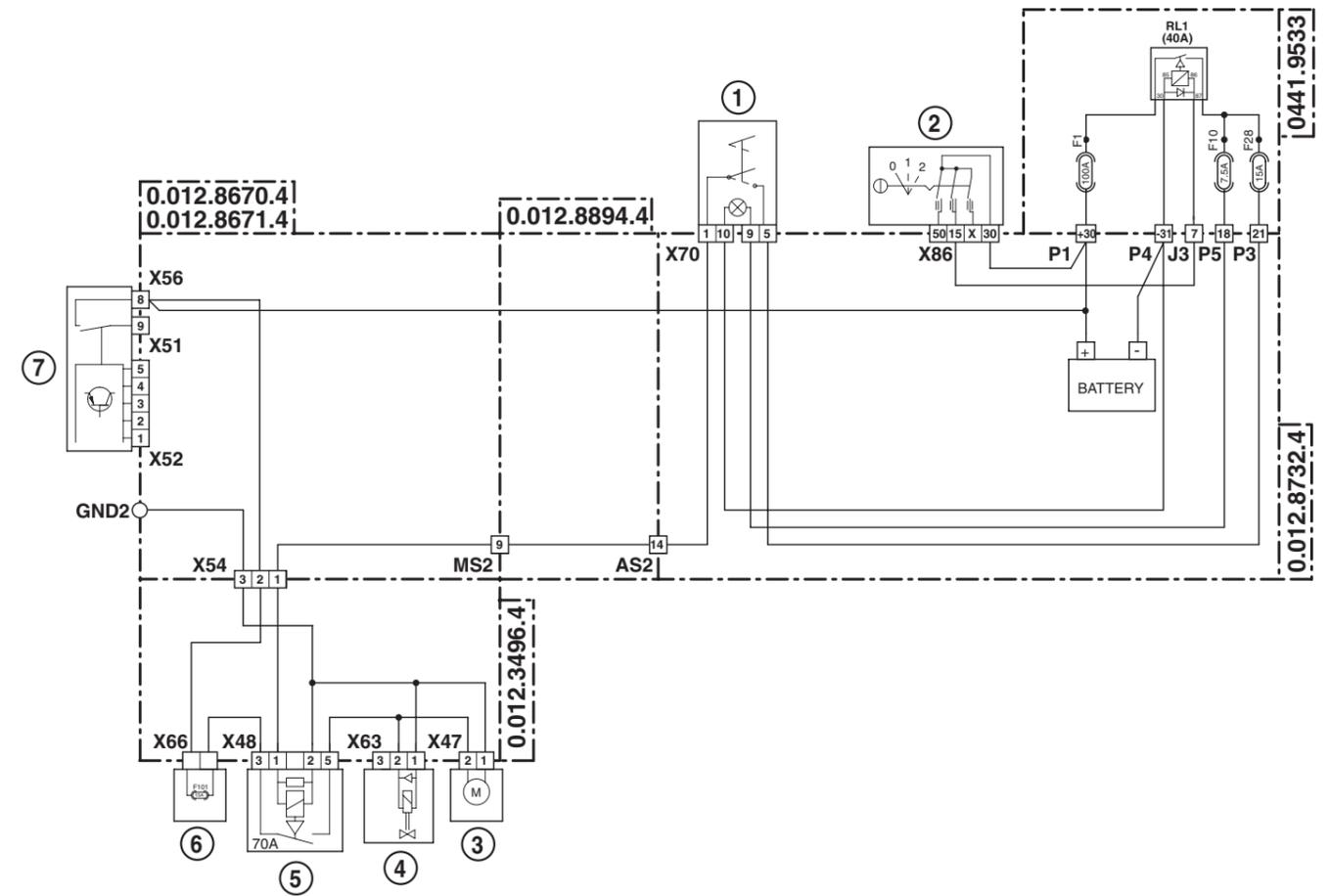
1   CleanFix control switch
2   Starter switch
3   CleanFix compressor
4   CleanFix solenoid valve
5   CleanFix relay
6   CleanFix fuse
7   Preheating control unit

5. LAYOUTS, ELECTRICAL WIRING DIAGRAMS, CONNECTOR POSITIONS

WIRING DIAGRAM	CODE	PAGE
AIR CONDITIONING SYSTEM WIRING	0.010.2562.2	40-143
ARMREST WIRING	0443.7354.4	40-167
CAB POWER SUPPLY WIRING	0443.7846	40-107
CLEAN FIX WIRING	0.012.3496.4	40-87
DISPLAY WIRING	0443.7875	40-149
ENGINE WIRING	0.012.8670.4 0.012.8671.4	40-75 40-77
ENGINE WIRING (KHD)	0419.9808	40-69
FENDER WIRING	0442.9835	40-119
FRONT AXLE SUSPENSION (CAB LINE) WIRING	0443.7850/10	40-103
FRONT AXLE SUSPENSION WIRING	0.012.8673.4	40-113
FRONT CONSOLE WIRING	0.012.8894.4	40-125
FUSES-RELAYS CONTROL UNIT	0441.9533.4	40-169
LIGHTS SELECTOR WIRING	0443.8656	40-163
NUMBER PLATE LIGHT WIRING	0441.4114	40-120
ROOF WIRING	0443.7851/10	40-153
ROTATING BEACON WIRING	0441.4780	40-155
SIDE CONSOLE WIRING	0.012.8732.4/30	40-131
TRAILER BRAKING WIRING (EXPORT)	0443.7355.4	40-100
TRAILER BRAKING WIRING (ITALY)	0443.7356.4	40-99
TRANSMISSION WIRING	0.012.8672.4	40-89
WORKLIGHTS WIRING	0442.4189	40-156

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ENGINE WIRING (KHD) (1/2)

Y1   B6

B42

TO 0.012.8670.4
0.012.8671.4
X44

Y3

F30

B40   B1

B41

B37
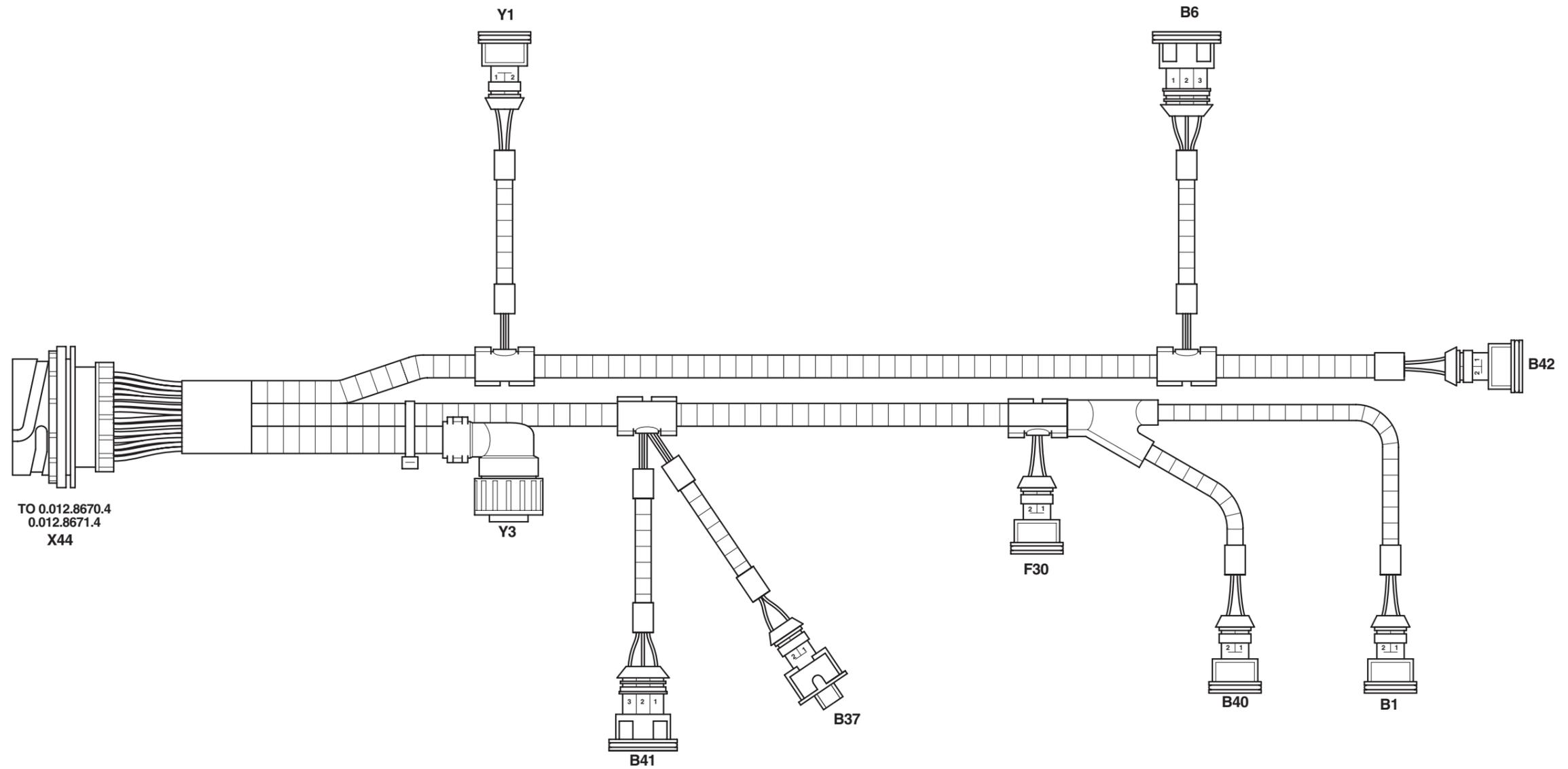
B1 Not used

B6 Not used

B37 Fuel temperature sensor

B40 Camshaft speed sensor (Pick-Up)

B41 Engine boost pressure sensor

B42 Not used

B43 Engine coolant temperature sensor

F30 Not used

X44 To engine wiring

Y1 Engine stop coil

Y3 Actuator

0419.9869

ENGINE WIRING (KHD) (2/2)

D0005672

CONNECTORS LOCATION

1

2

3

ENGINE WIRING (KHD)

4

B40

F0024700

5

B1

F0043290

6

Bei Anbau Hubmag-
net Abstellhebel in
Stoppstellung halten.
When fitting sole -
noid keep stop lever
in stop position.

Y1

F0024710

F0043280

ENGINE WIRING (4 CYLINDERS) (1/2)

+30	Starter motor	MS1	To side console wiring	X45	Brake fluid level sensor	X54	To Clean Fix wiring
+50	Starter motor	MS2	To front console wiring	X46	Preheating glow plugs	X55	Air conditioning pressure switch
B+	Alternator B+	P	Engine oil pressure switch	X49	Horn	X56	Preheating control unit
D+	Alternator D+	START	Start enable switch	X50	Engine starting relay	X57	RH headlamp
FRONTPTO	Front PTO solenoid valve	T	Engine coolant temperature sensor	X51	Preheating control unit	X58	LH headlamp
K	Air conditioning compressor	X19	Not used	X52	Preheating control unit	X97	Steering circuit pressure switch
L	Air cleaner clogged sensor	X44	To engine wiring (KHD)	X53	Steering angle sensor		

0.012.8670.4

ENGINE WIRING (4 CYLINDERS) (2/2)

TABELLA COLORI / COLOURS TABLE			
M	Marrone/Brown	C	Arancio/Orange
V	Verde/Green	A	Azzurro/Blue
Z	Viola/Violet	B	Bianco/White
N	Nero/Black	L	Blu/Dark Blue
S	Rosa/Pink	G	Giallo/Yellow
R	Rosso/Red	H	Grigio/Gray

0.012.8670.4

ENGINE WIRING (6 CYLINDERS) (1/2)

+30 Starter motor	**MS2** To front console wiring	**X46** Preheating glow plugs	**X56** Preheating control unit
+50 Starter motor	**P** Engine oil pressure switch	**X49** Horn	**X57** RH headlamp
B+ Alternator B+	**START** Start enable switch	**X50** Engine starting relay	**X58** LH headlamp
D+ Alternator D+	**T** Coolant temperature sensor	**X51** Preheating control unit	**X97** Steering circuit pressure switch
FRONTPTO Front PTO solenoid valve	**X19** Not used	**X52** Preheating control unit	
K Air conditioning compressor	**X44** To engine wiring (KHD)	**X53** Steering angle sensor	
L Air cleaner clogged sensor	**X45** Brake fluid level sensor	**X54** To Clean Fix wiring	
MS1 To side console wiring		**X55** Air conditioning pressure switch	

0.012.8671.4

ENGINE WIRING (6 CYLINDERS) (2/2)

TABELLA COLORI / COLOURS TABLE			
M	Marrone/Brown	C	Arancio/Orange
V	Verde/Green	A	Azzurro/Blue
Z	Viola/Violet	B	Bianco/White
N	Nero/Black	L	Blu/Dark Blue
S	Rosa/Pink	G	Giallo/Yellow
R	Rosso/Red	H	Grigio/Gray

0.012.8671.4

CONNECTORS LOCATION

1

2

3

4

GND2

F0043340

5

X46

Bei Anbau Hubmag-
net Abstellhebel in
Stoppstellung halten
When fitting sole-
noid keep stop lever
in stop position

F0043350

6

X49

F0043360

7

F0043370

8

X53

F0043380

9

X55

X54

X57

F0043390

10

X58

F0043400

11

D+

B+

F0043410

12

K

FRONT PTO

F0043420

13

F0043430

14

F0043440

15

F0043450

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ENGINE WIRING

16

17
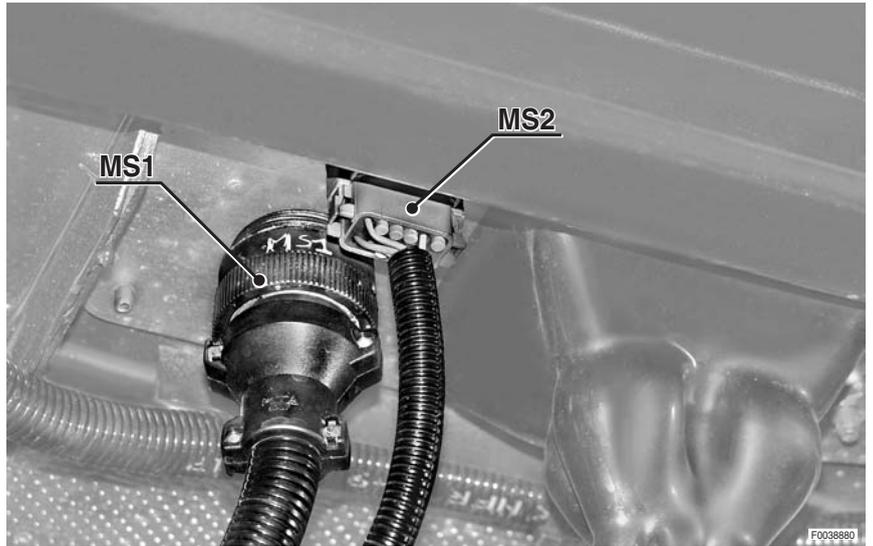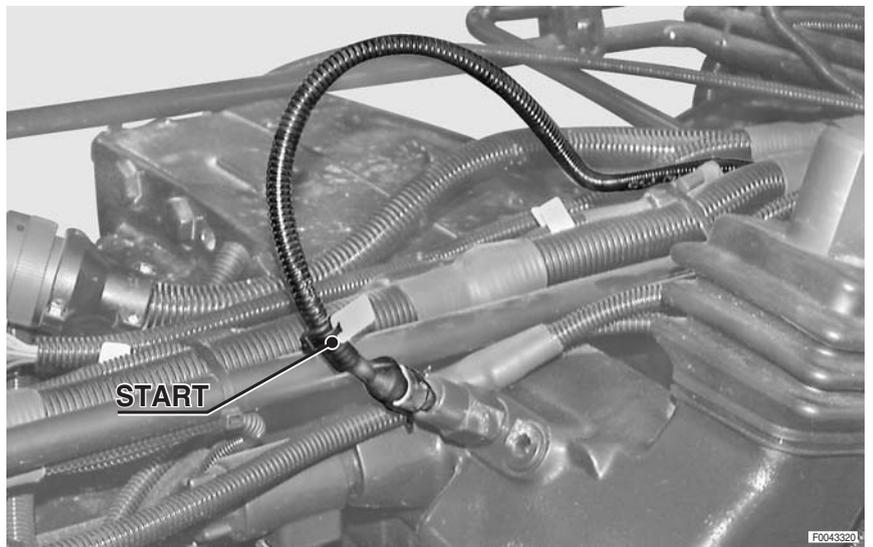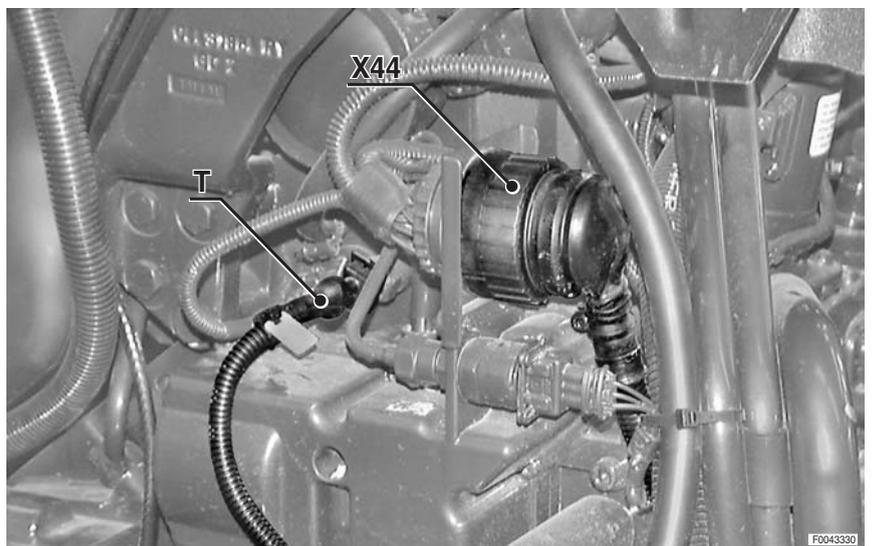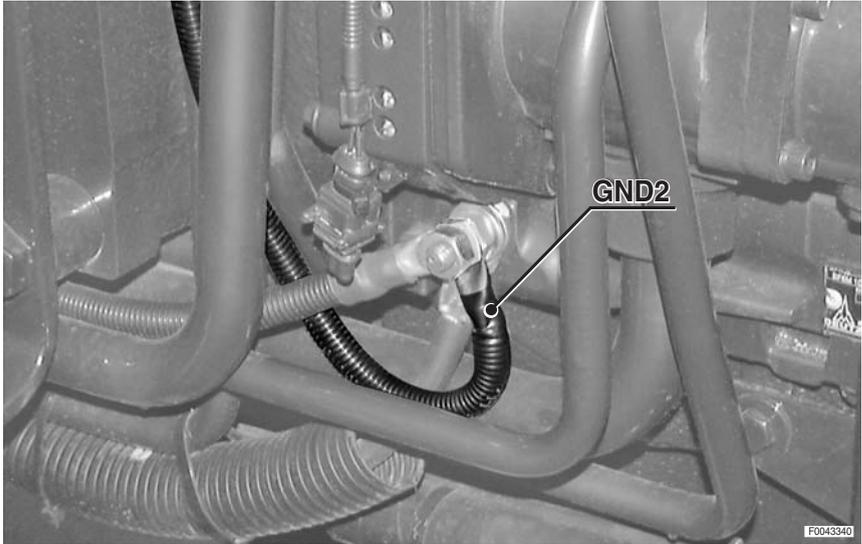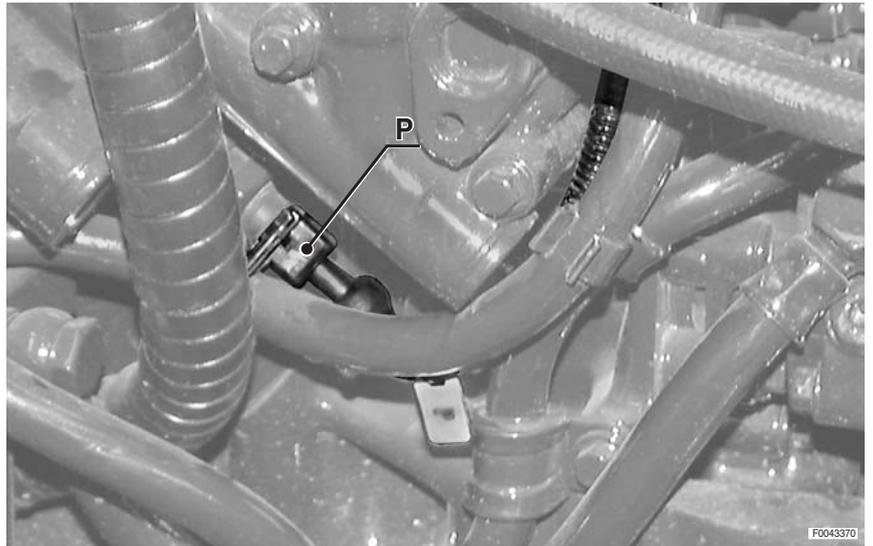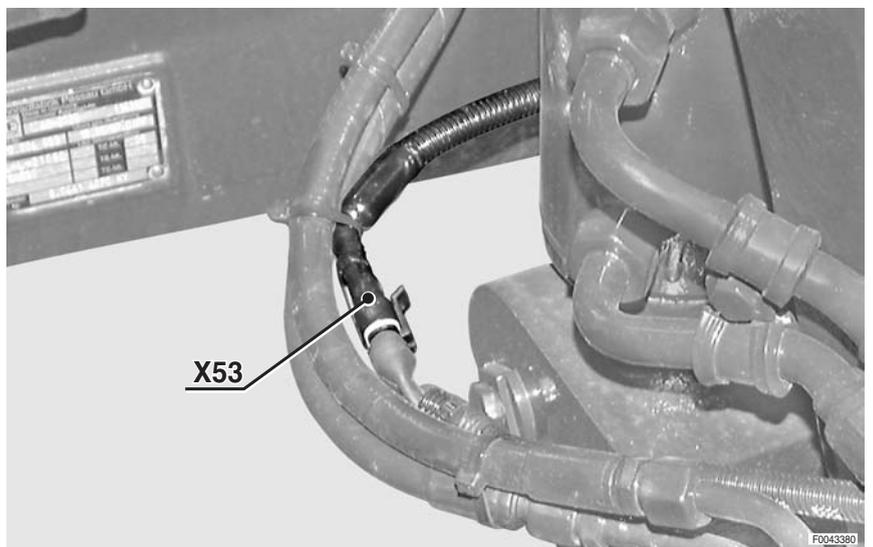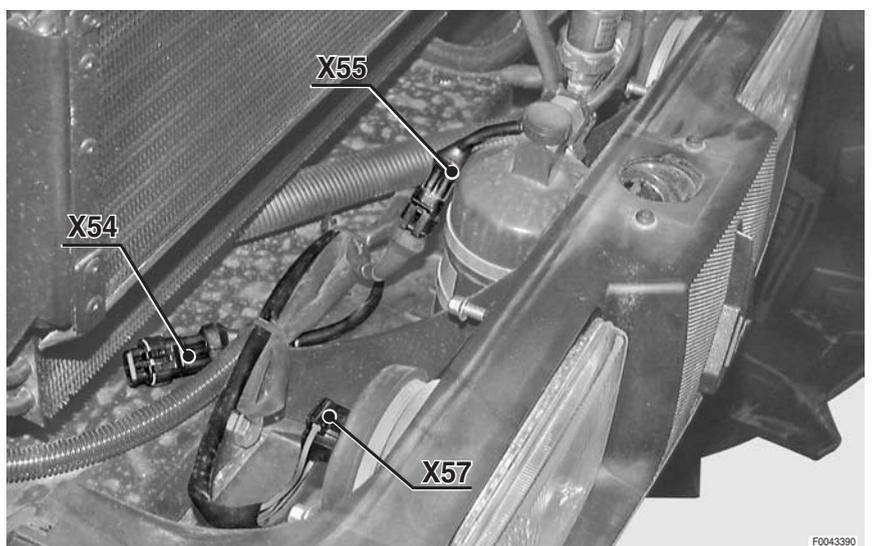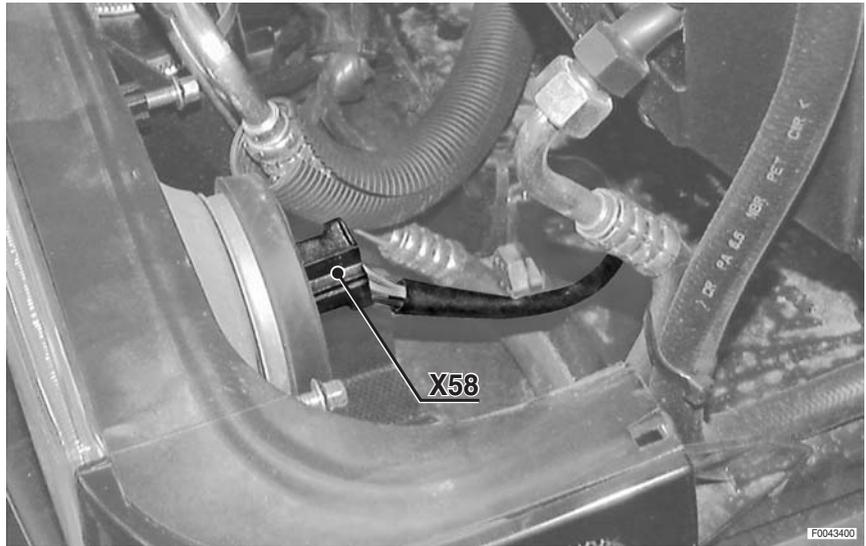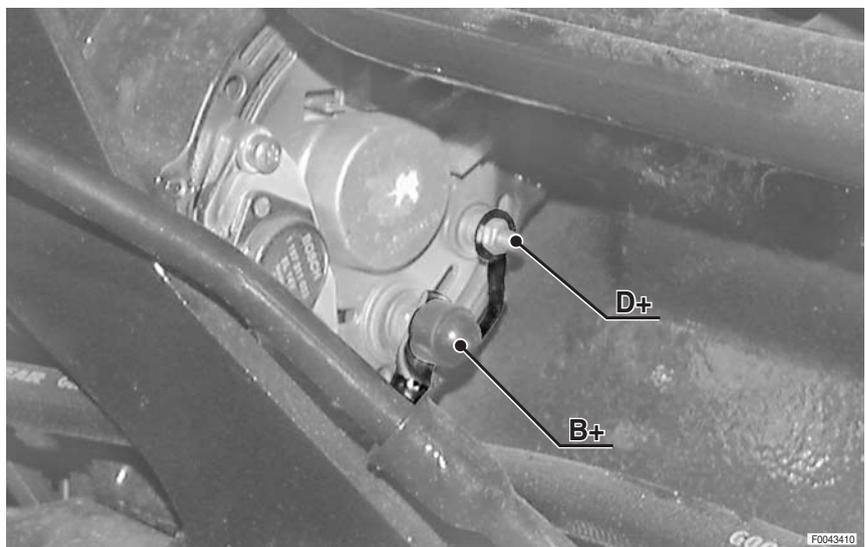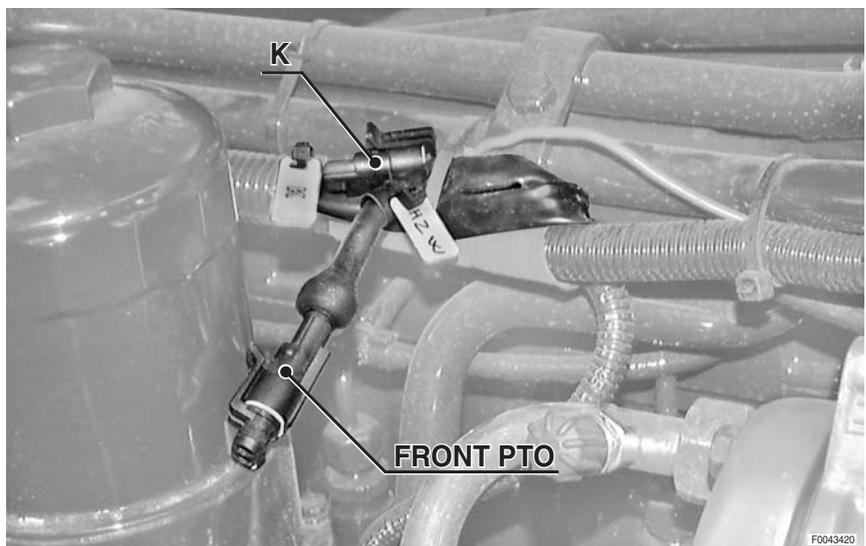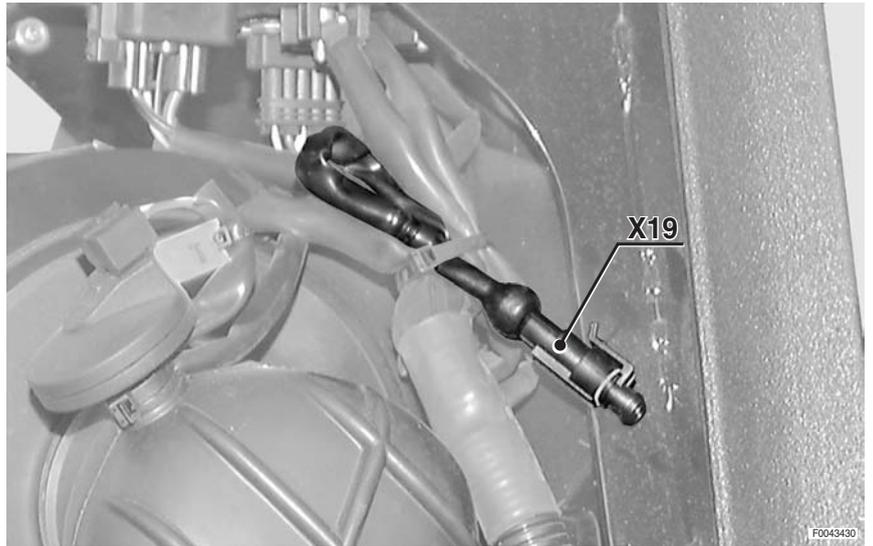
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CLEAN FIX WIRING

X54
TO 0.012.8670.4
0.012.8671.4
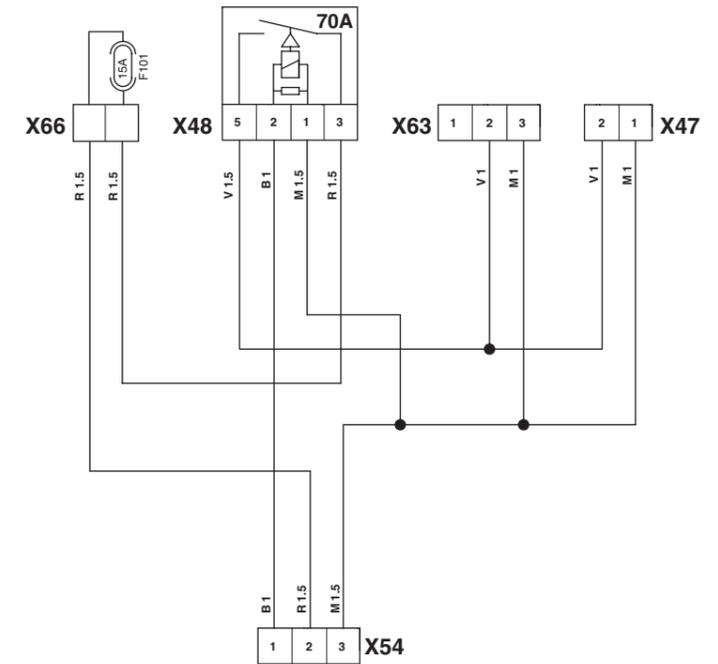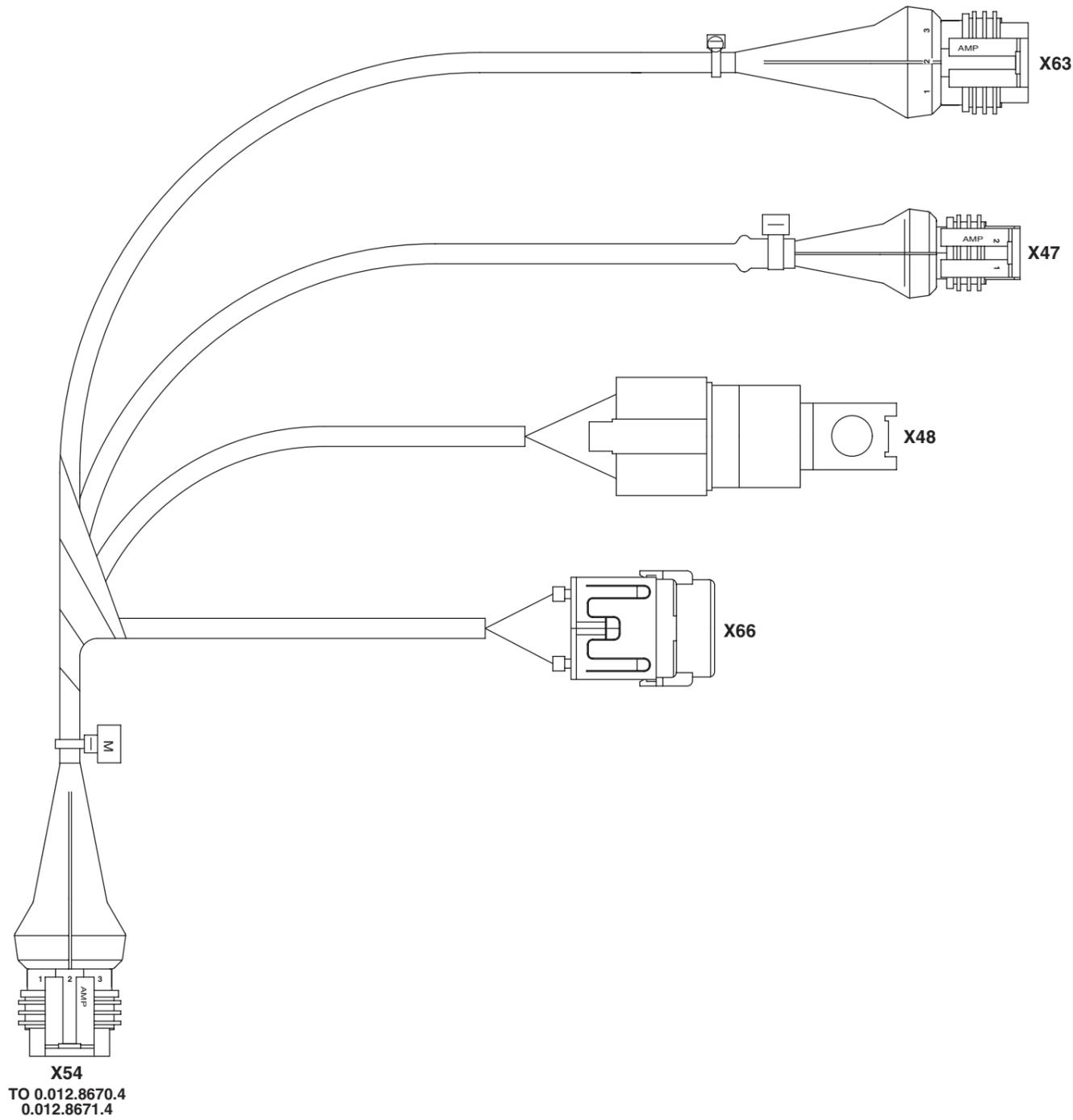
X47 CleanFix compressor
X48 CleanFix relay
X54 To engine wiring
X63 CleanFix solenoid valve
X66 CleanFix fuse

0.012.3496.4

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TRANSMISSION WIRING (1/2)
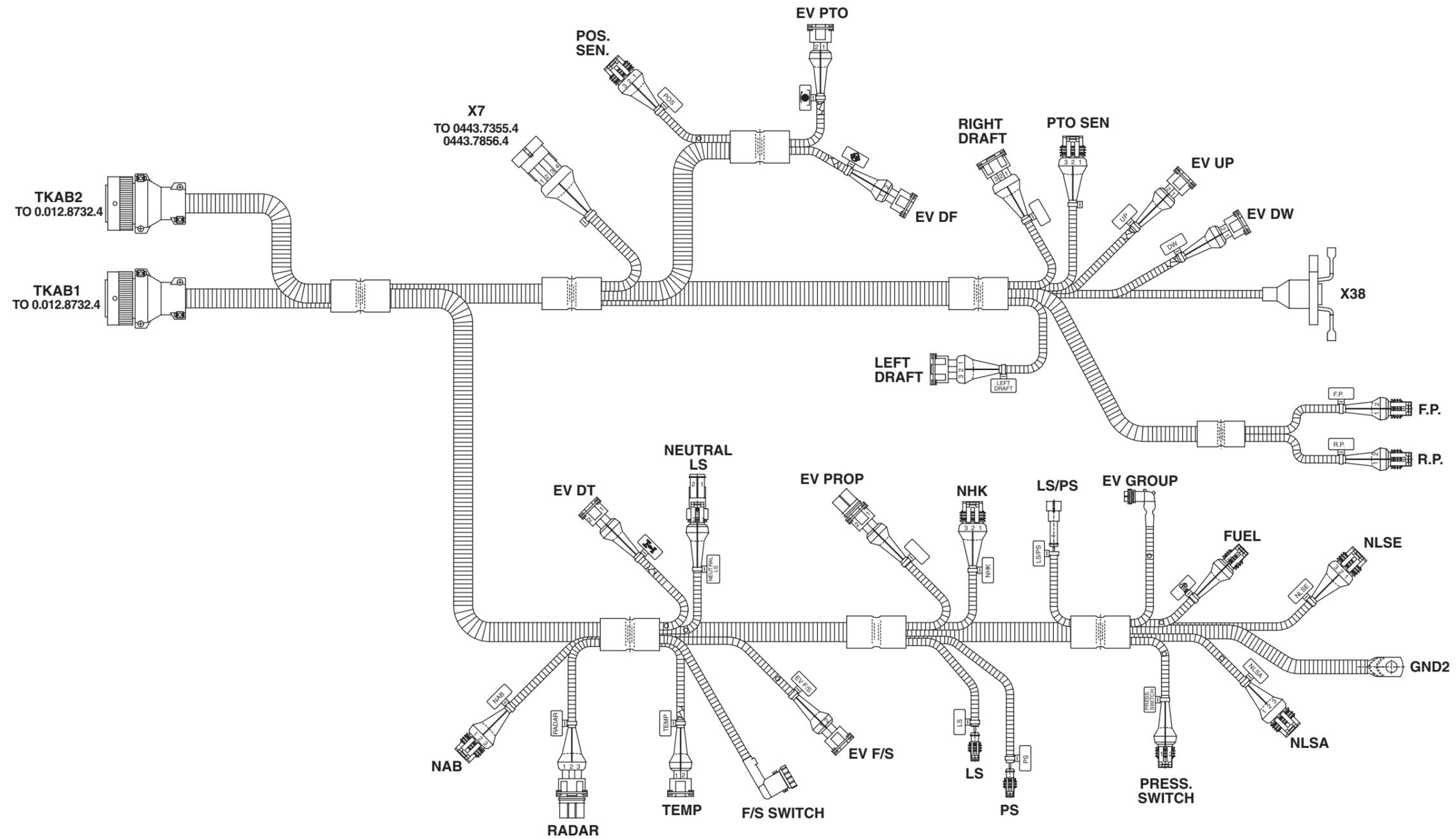
EV DF Diff lock solenoid valve
EV DT Four-wheel drive control solenoid valve (4WD)
EV DW Lift 'down' solenoid valve
EV F/S Field/road selection solenoid valve
EV GROUP Gear change solenoid valves
EV PROP Proportional solenoid valve
EV PTO Rear PTO solenoid valve
EV UP Lift 'up' solenoid valve
F/S SWITCH Field/road sensor
FP Front windscreen washer pump
FUEL Fuel level sensor

LEFT DRAFT Lift draft sensor (left)
LS Not used
LS/PS Wiring configuration connector
NAB Speed sensor for odometer
NEUTRAL LS Not used
NHK Transmission speed sensor
NLSA Gearbox output shaft speed sensor
NLSE Engine speed sensor
POS SENS Lift position sensor Installer for rear PTO oil seal
PRESS. SWITCH Transmission oil low pressure switch (green)

PS Wiring configuration connector
PTO SEN Rear PTO speed sensor
RADAR Radar
RIGHT DRAFT Rear 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 (for lights and auxiliary power)

0.012.8672.4

TRANSMISSION WIRING (2/2)
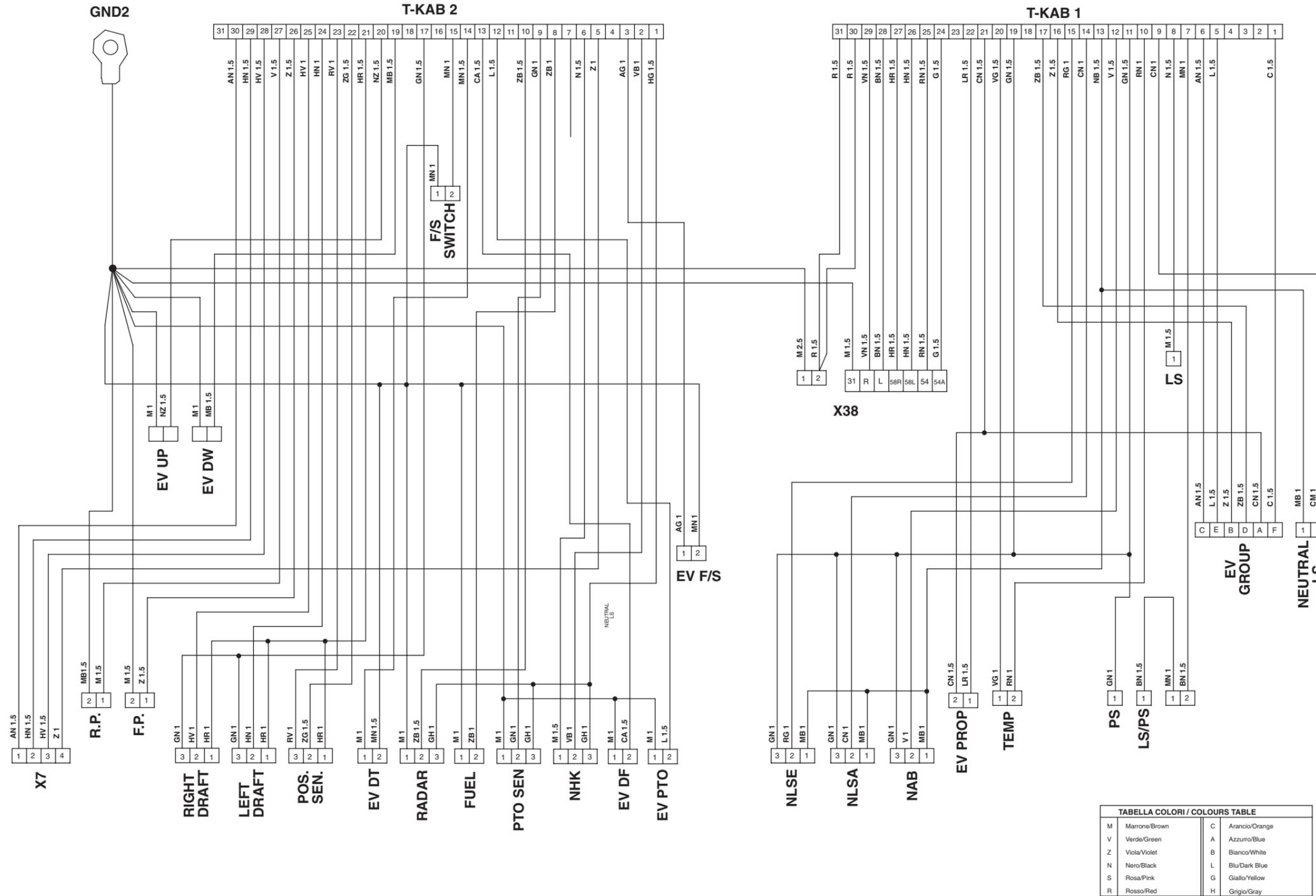
CONNECTORS LOCATION
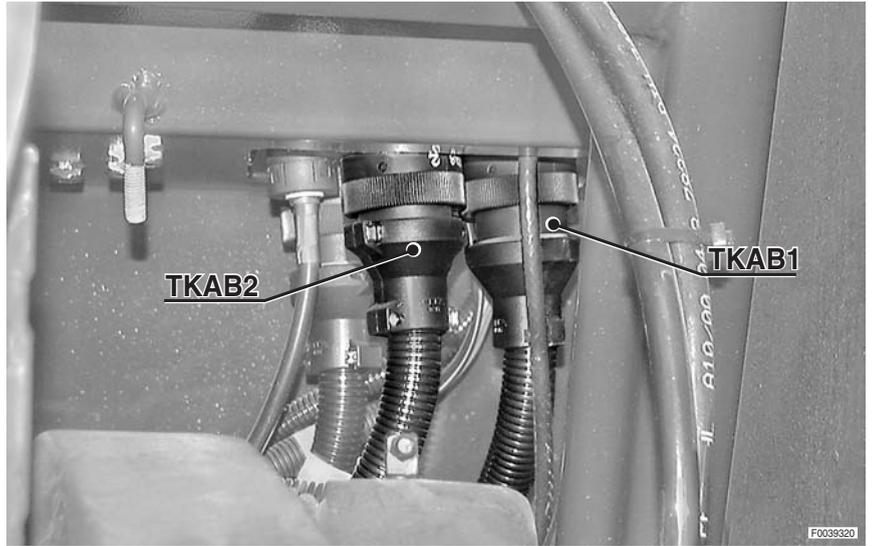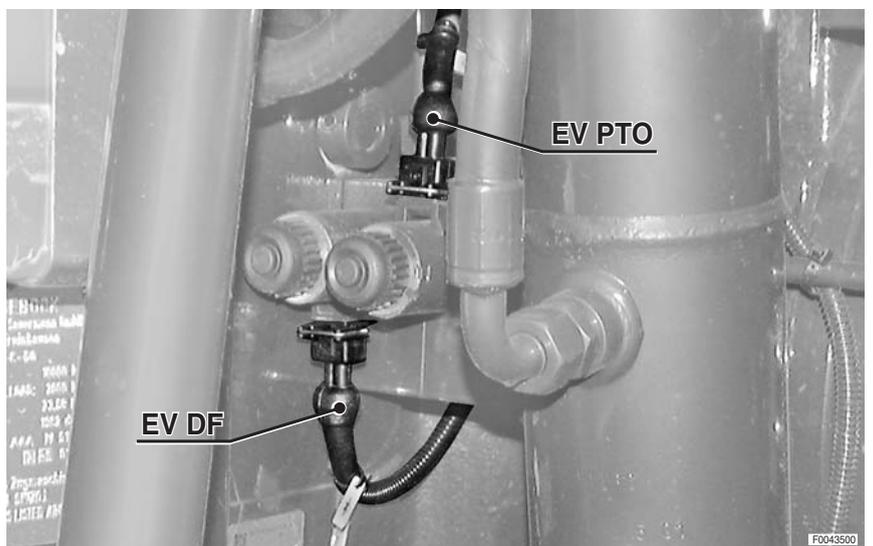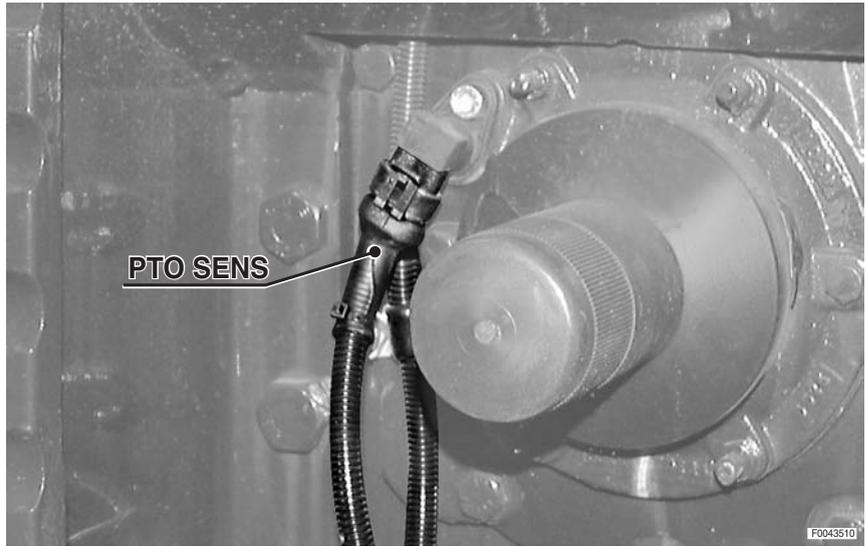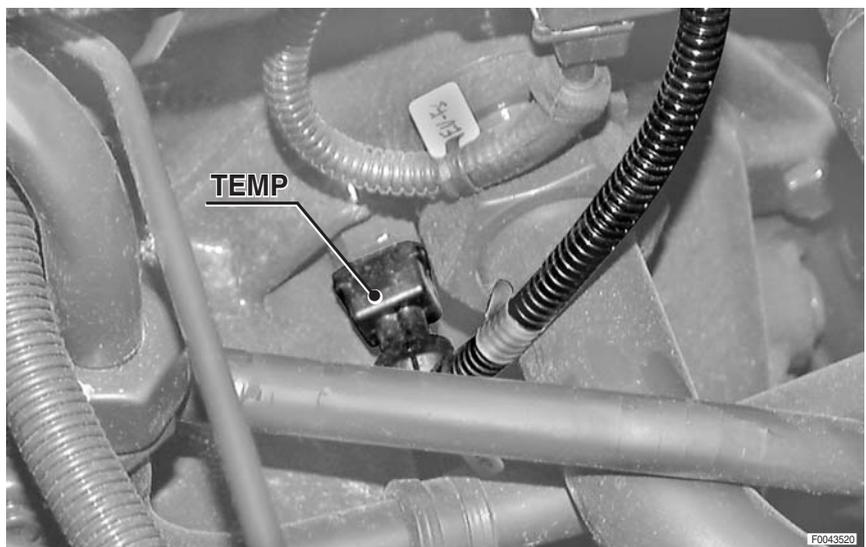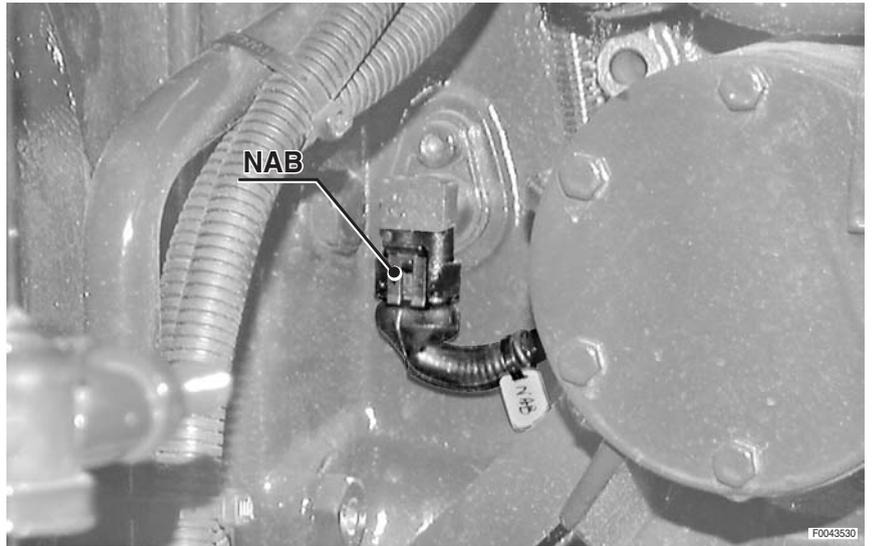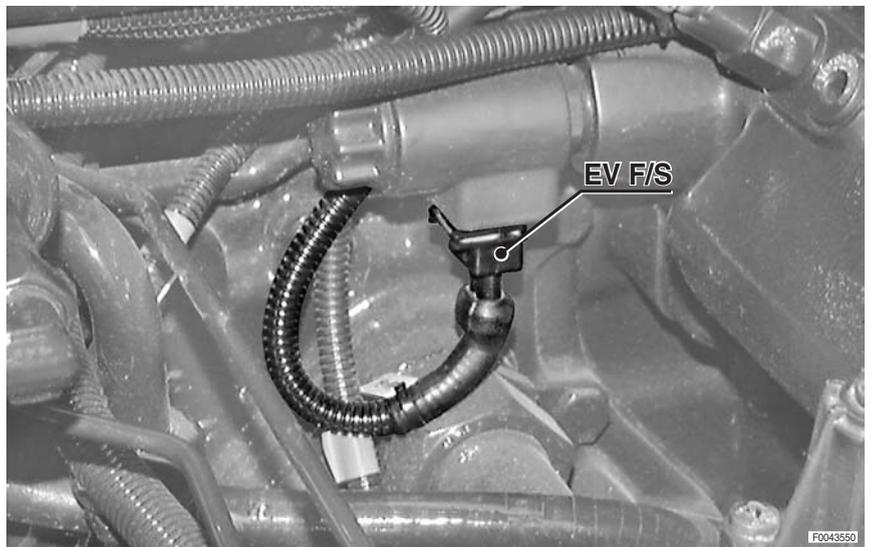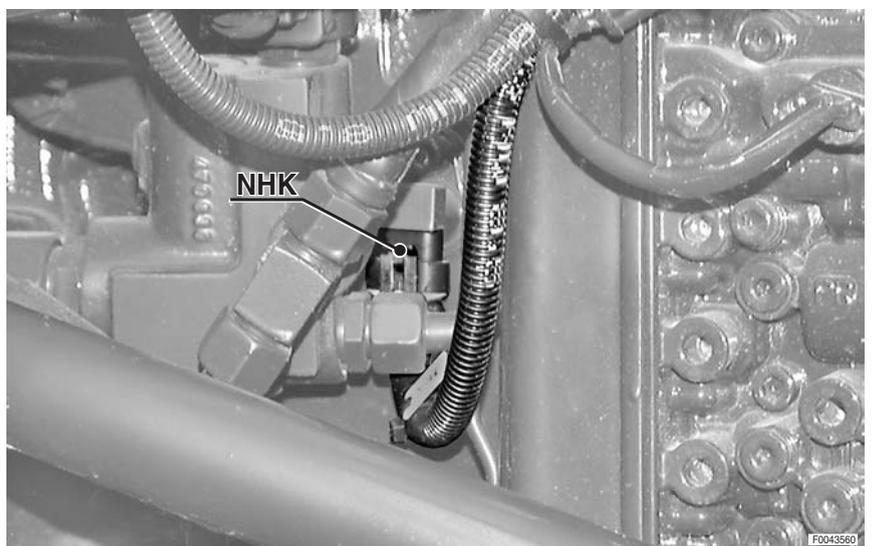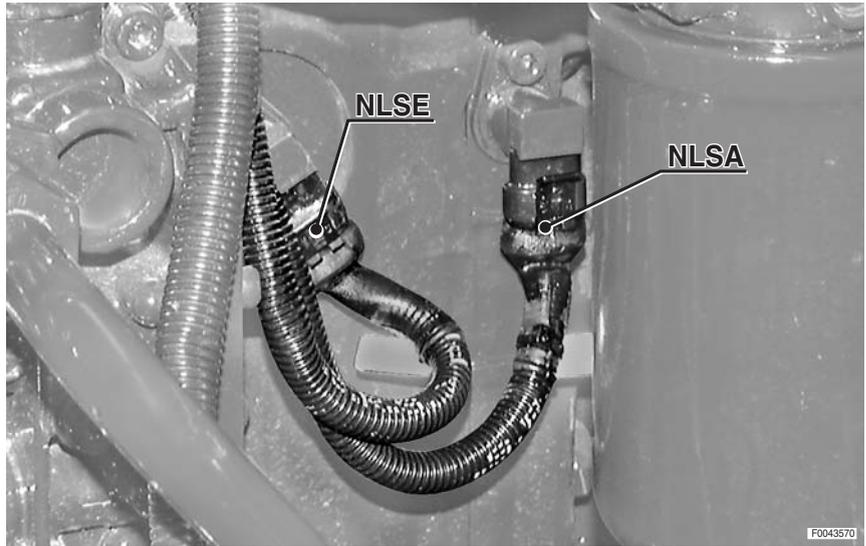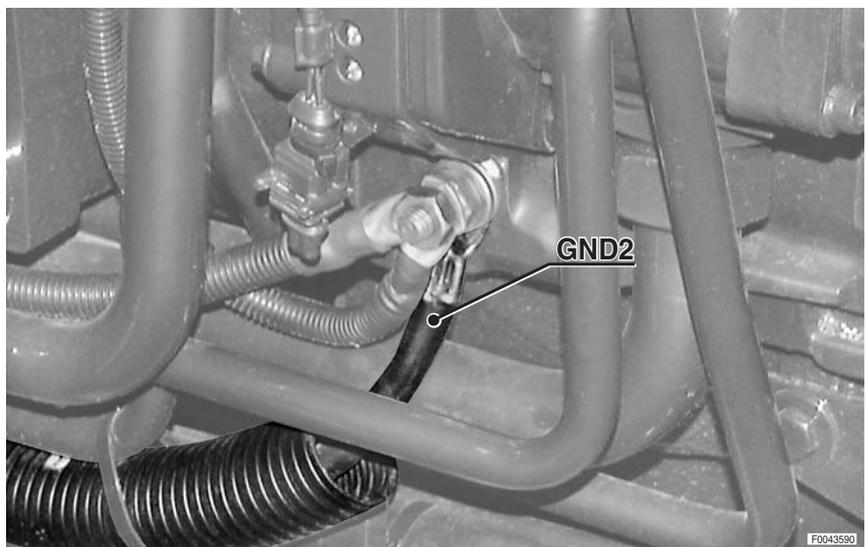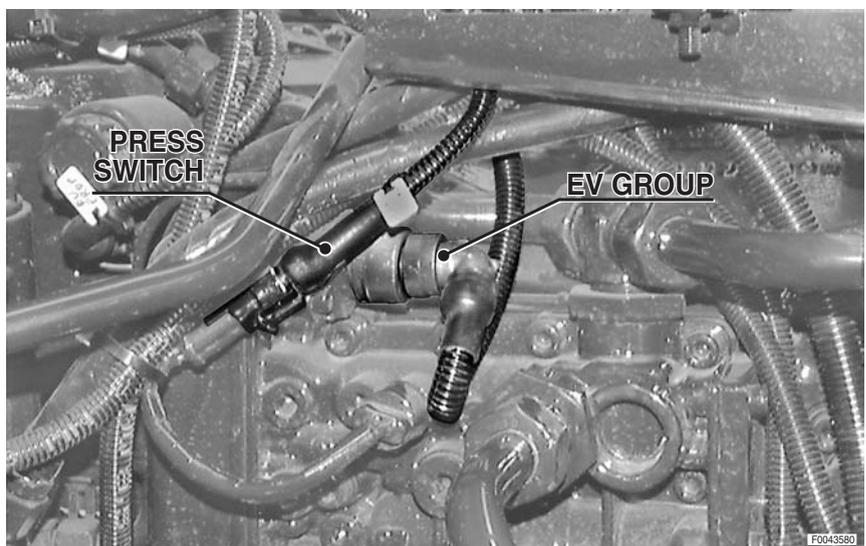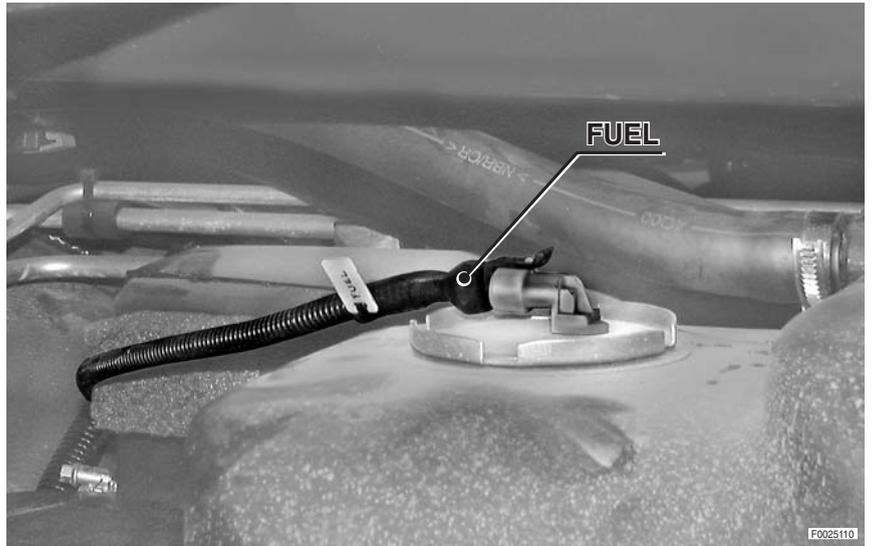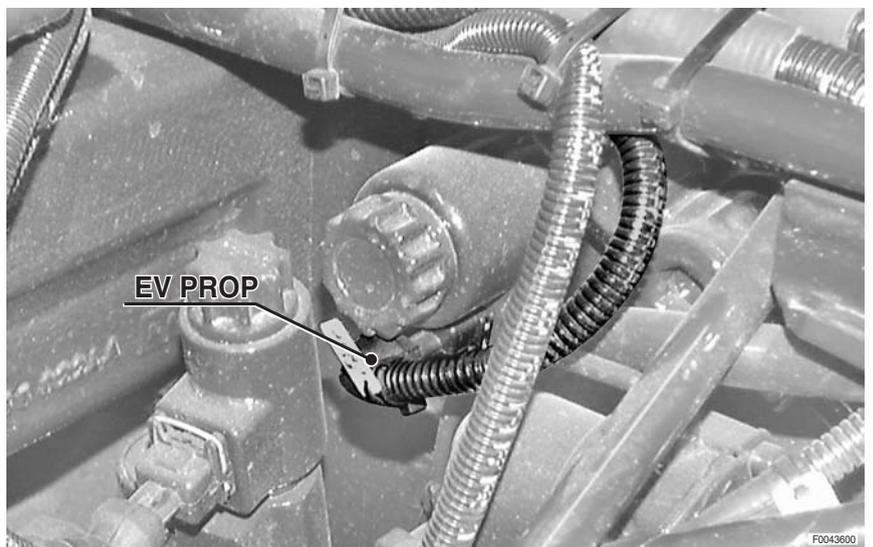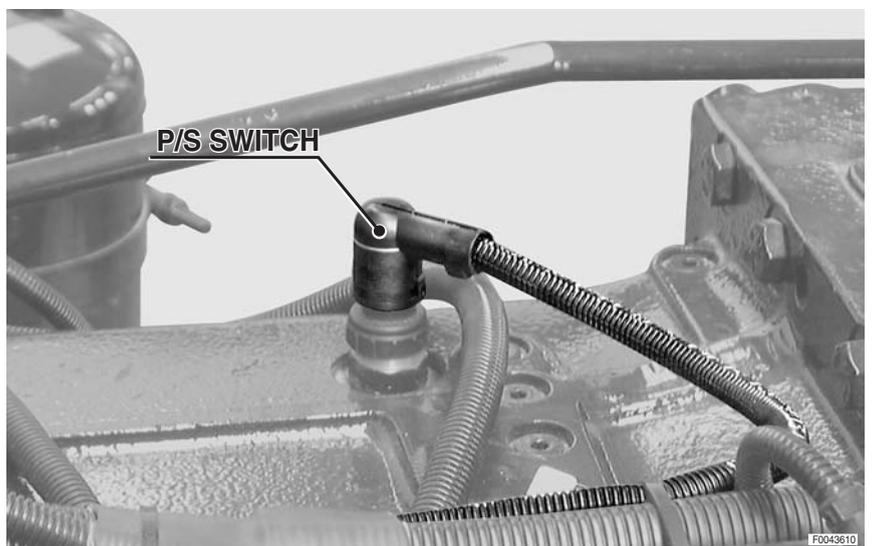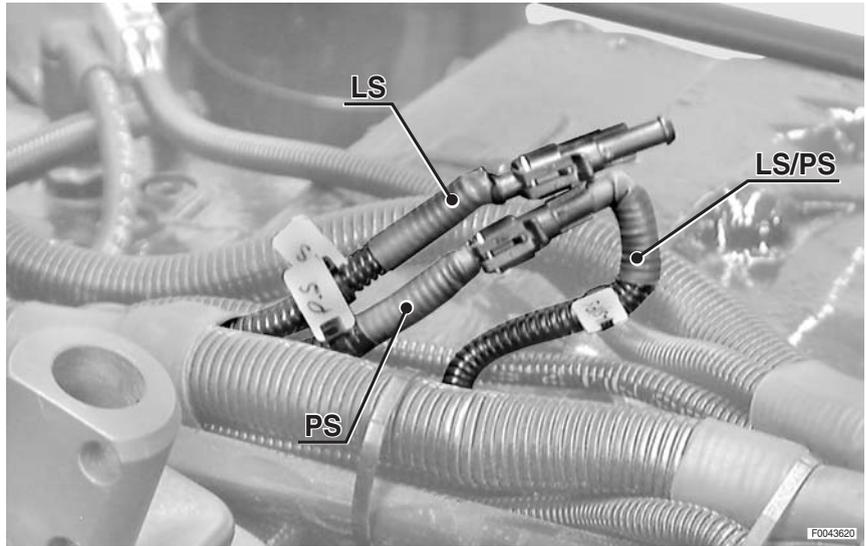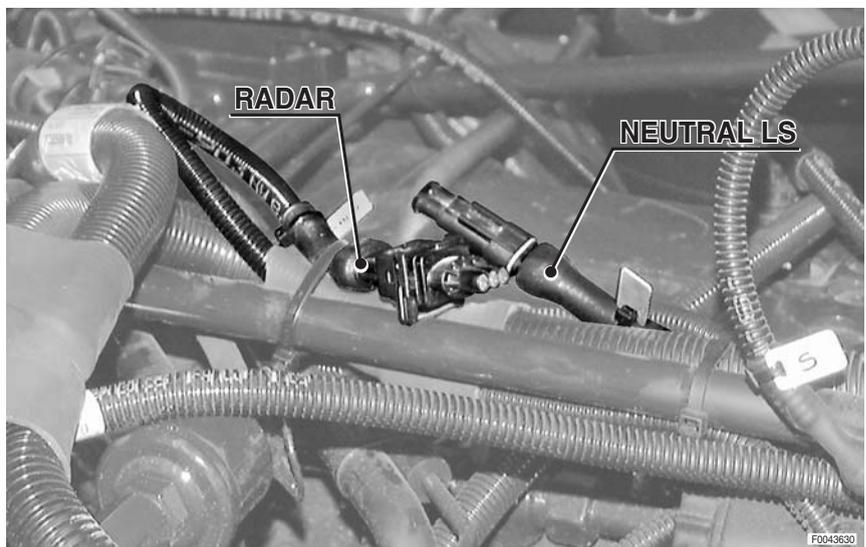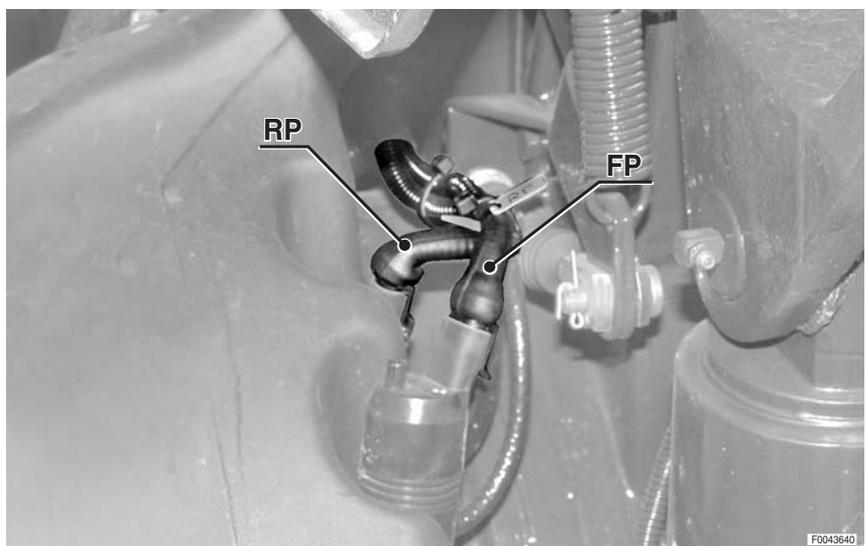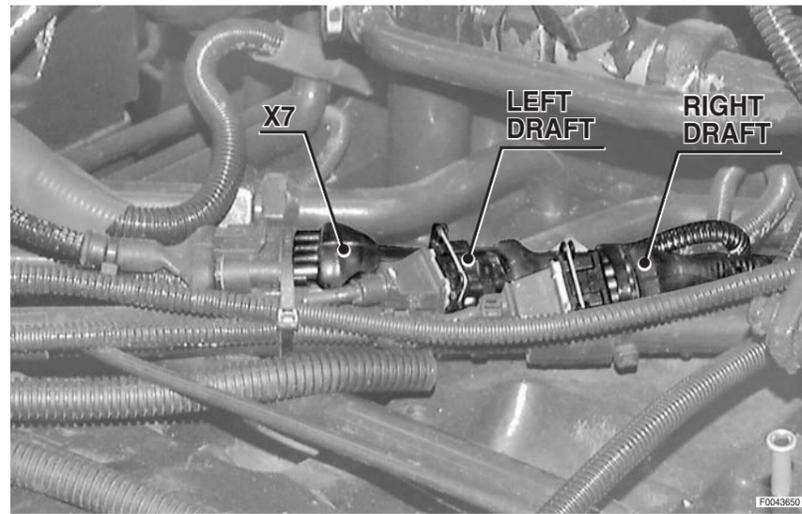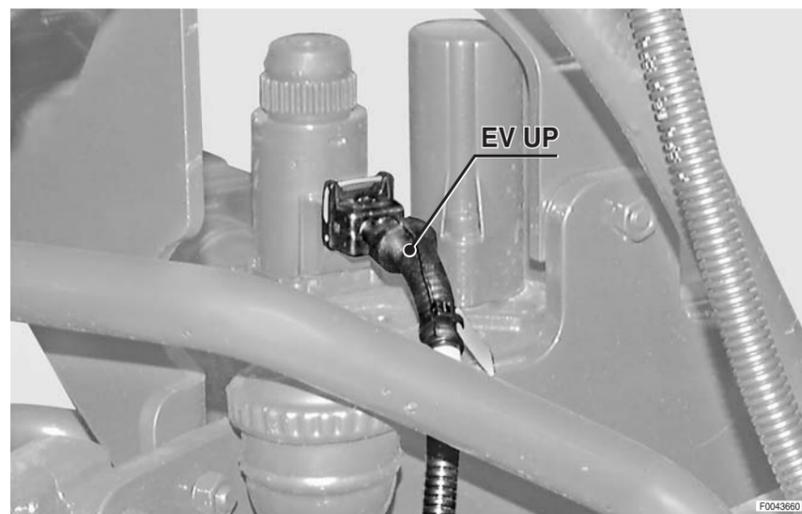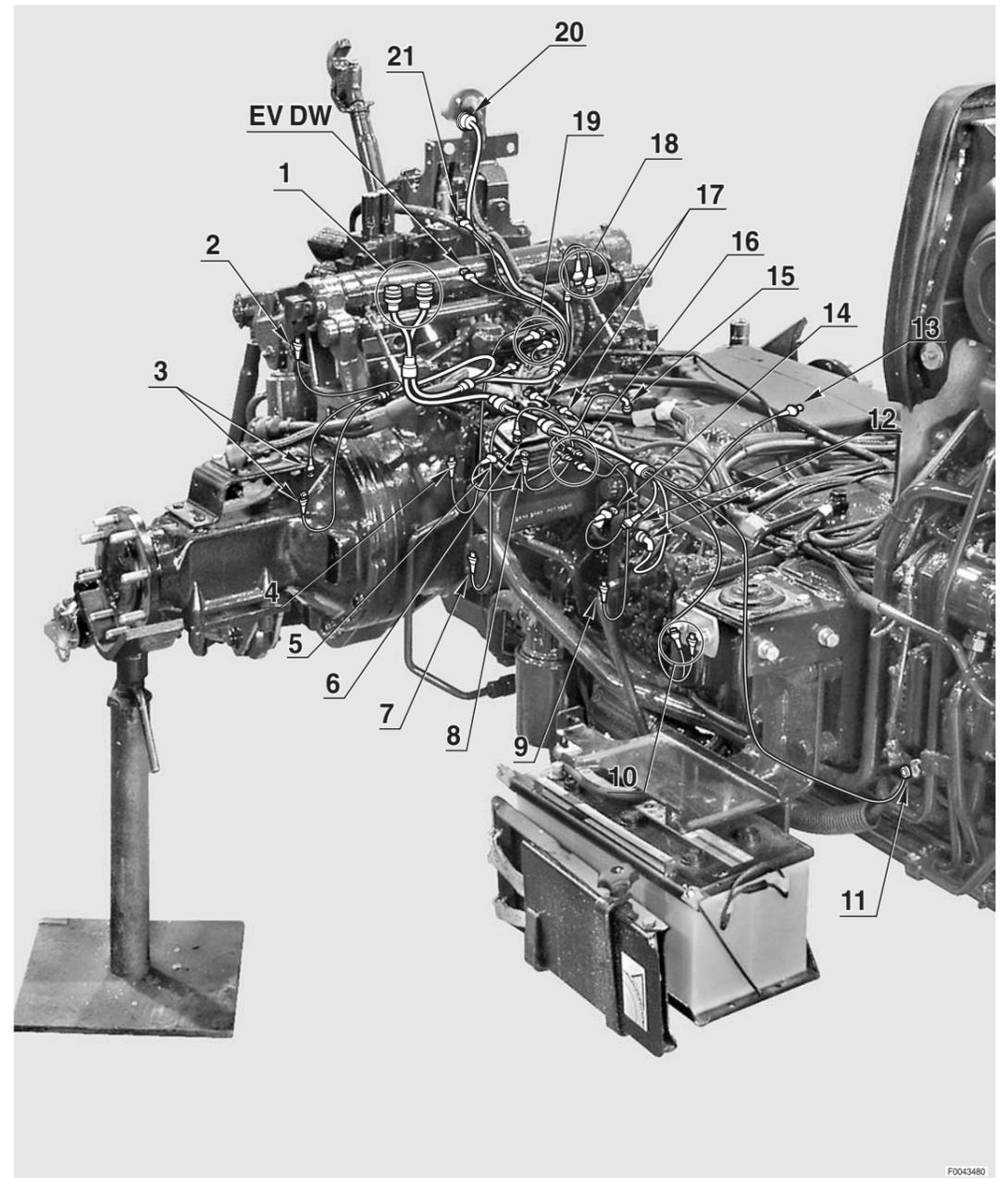
1

TKAB2   TKAB1

F0039320

2

POS SEN

F0043490

3

EV PTO

EV DF

F0043500

4

PTO SENS

F0043510

5

TEMP

F0043520

6

EV DT

F0043540

7

NAB

F0043530

8

EV F/S

F0043550

9

NHK

F0043560

10

11

12

13

FUEL

F0025110

14

EV PROP

F0043600

15

P/S SWITCH

F0043610

16

17

18

TRANSMISSION WIRING

19

LEFT DRAFT RIGHT DRAFT X7

F0043650

20

X38

F0043670

21

EV UP

F0043660

21 20 EV DW 19 18 17 16 15 14 13 1 2 3 4 5 6 7 8 9 10 11 12

F0043480

0.012.8672.4

40-97

TRAILER BRAKING WIRING (ITALY)

X8

X7
TO 012.8672.4

X9

X10

X7

1	2	3	4

AN 1

HN 1.5

HV 1.5

Z 1.5

AN1

HN 1

HN 1.5

X10

HN 1.5

HV 1.5

Z 1.5

X9

X8
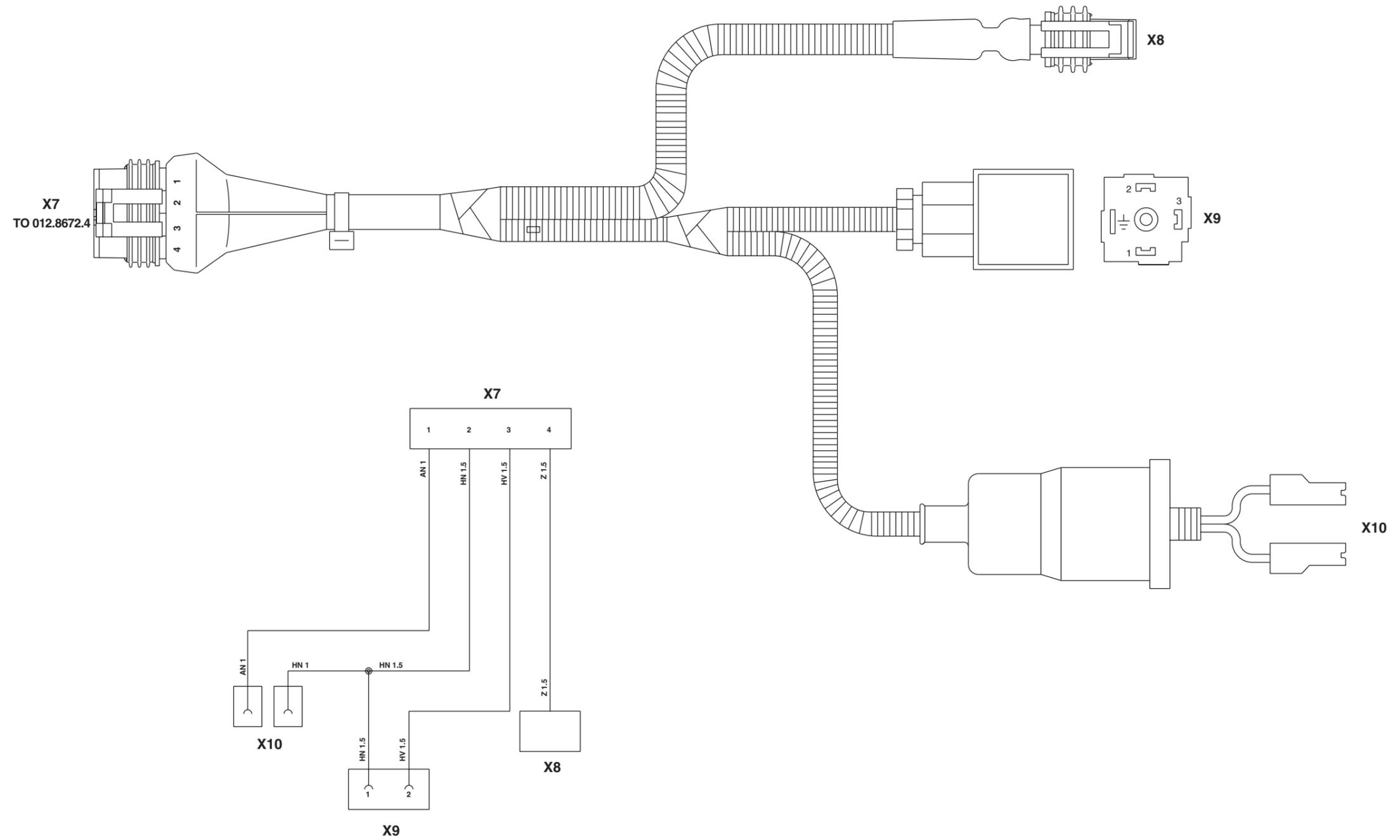
X7 To transmission wiring

X8 Compressed air pressure sensor

X9 Trailer parking brake solenoid valve

X10 Trailer parking brake pressure switch

0443.7356.4

TRAILER BRAKING WIRING (EXPORT)

X7
TO 012.8672.4

X8

X7

X8
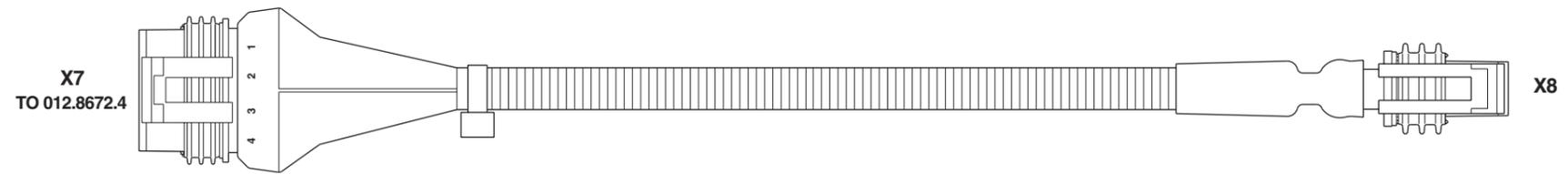
X7 To transmission wiring

X8 Compressed air pressure sensor

CONNECTORS LOCATION

1

F0043680

2

F0043300

3

F0043310

TRAILER BRAKING WIRING

EXPORT

F0043270

ITALY

F0043270

0443.7355.4 - 0443.7356.4

FRONT AXLE SUSPENSION (CAB LINE) WIRING

FE1
TO 0.012.8732.4

FE2
TO 0.012.8673.4

JX3

JX4

JX3

JX4

TABELLA COLORI / COLOURS TABLE

M	Marrone/Brown	C	Arancio/Orange
V	Verde/Green	A	Azzurro/Blue
Z	Viola/Violet	B	Bianco/White
N	Nero/Black	L	Blu/Dark Blue
S	Rosa/Pink	G	Giallo/Yellow
R	Rosso/Red	H	Grigio/Gray

FE1

FE2

FE1 To side console wiring

FE2 To front axle suspension wiring

JX3 Front axle suspension control unit

JX4 Front axle suspension control unit

0443.7850

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CONNECTORS LOCATION

FRONT AXLE SUSPENSION (CAB LINE) WIRING

1

FE2

F0024440

2

JX4

JX3

F0039360

3

FE1

F0024380

0443.7850

CAB POWER SUPPLY WIRING

X1
TO 0.442.9835

X2
TO 0.442.9835

GND3

F51 100 A

TKAB3
TO 0.012.8732.4

+12 BATTERY (30)

GND4

GND2

1	H 16
2	GV 2.5
3	BN 1.5
4	HN 1
5	VN 1.5
6	HR 1
7	RN 1.5
8	BL 1
9	LR 1
10	RG 1
11	L 1
12	H 1
13	BR 1
14	

F51
(100 A)   +12 BATTERY (30)

TKAB3

TKAB3 To side console wiring

X1 To fender wiring

X2 To fender wiring

M 5   GND2

M 5
M 5   GND3

M 5   GND4

	M 1.5	M 1.5	GV 1.5	BN1.5	HN1	RN1.5	L 0.5	H 0.5	BR 0.5	BL 0.5	LR 0.5	RG 0.5
	1	2	3	4	5	6	7	8	9	10	11	12

X2

	M 1.5	M 1.5	GV 1.5	BN1.5	HR1	RN1.5	L 0.5	H 0.5	BR 0.5	BL 0.5	LR 0.5	RG 0.5
	1	2	3	4	5	6	7	8	9	10	11	12

X1

TABELLA COLORI / COLOURS TABLE			
M	Marrone/Brown	C	Arancio/Orange
V	Verde/Green	A	Azzurro/Blue
Z	Viola/Violet	B	Bianco/White
N	Nero/Black	L	Blu/Dark Blue
S	Rosa/Pink	G	Giallo/Yellow
R	Rosso/Red	H	Grigio/Gray

0443.7846/20

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CONNECTORS LOCATION

1

X1

F0024260

2

TKAB3

GND4

F0024271

3

X2

F0024300
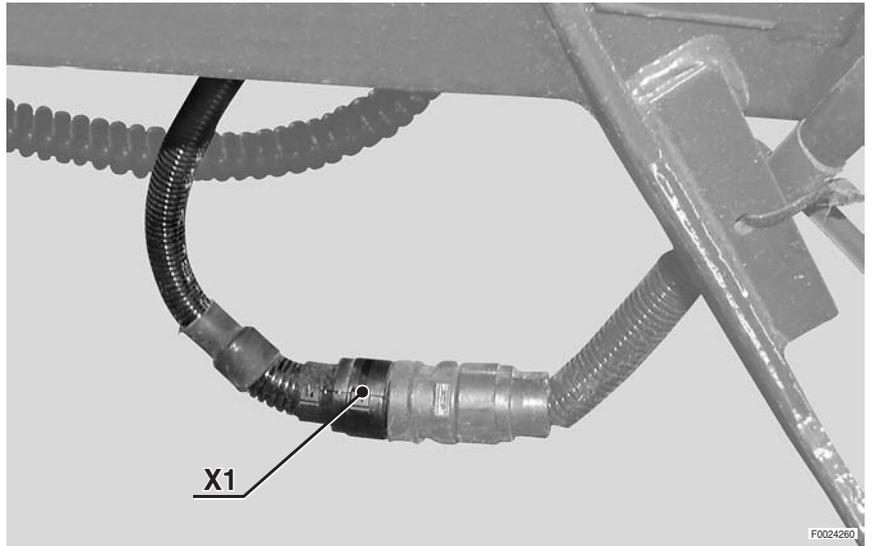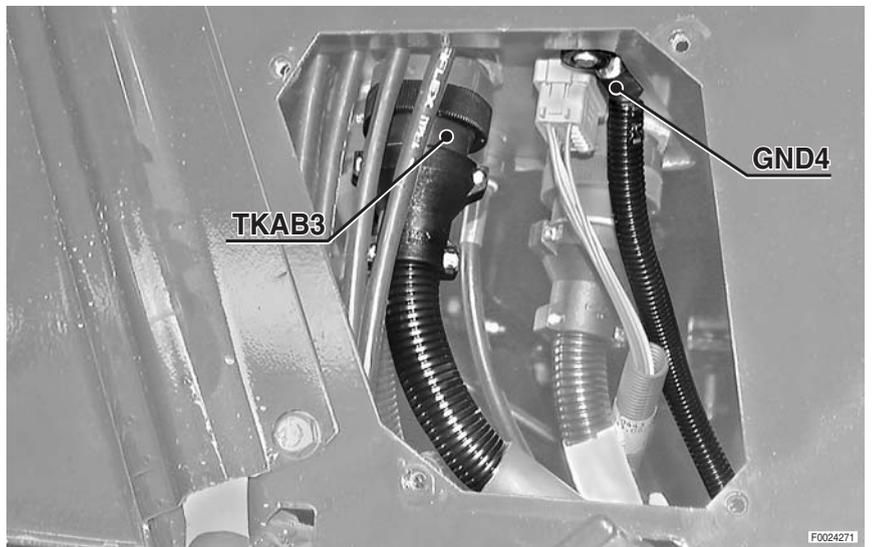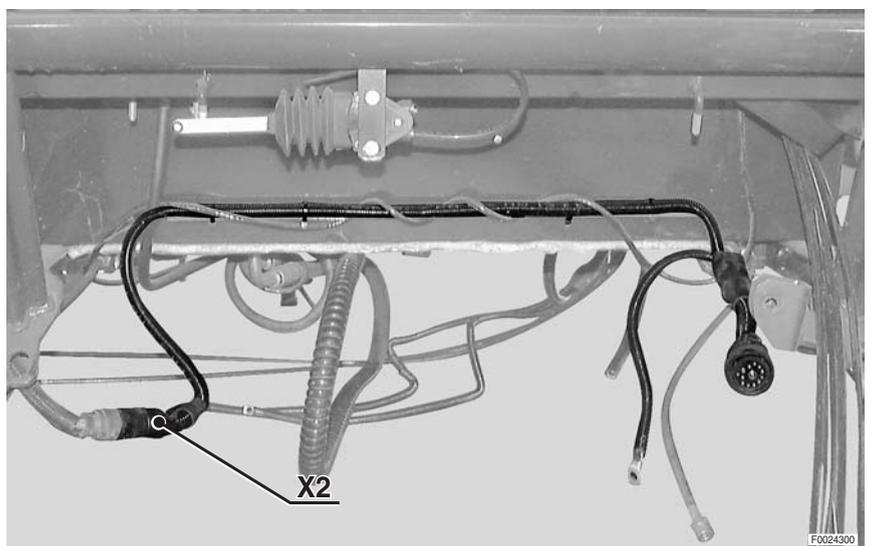
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CAB POWER SUPPLY WIRING

4

GND3

F0024281

5

GND2

F0093370

6

+12 BATTERY (30)

F0024291

F0043220

0443.7846/20

40-111
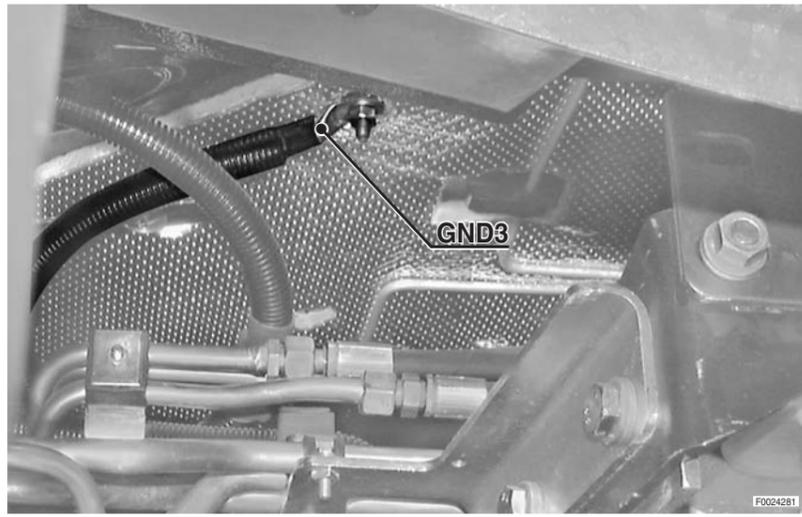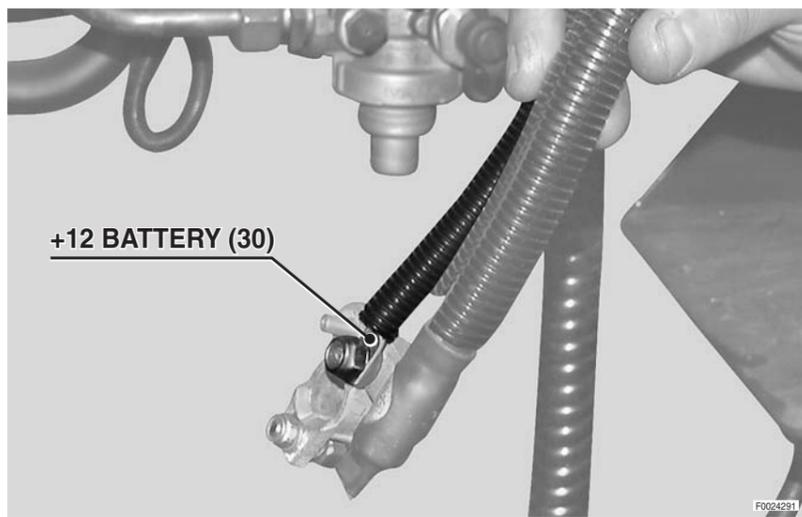
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FRONT AXLE SUSPENSION WIRING
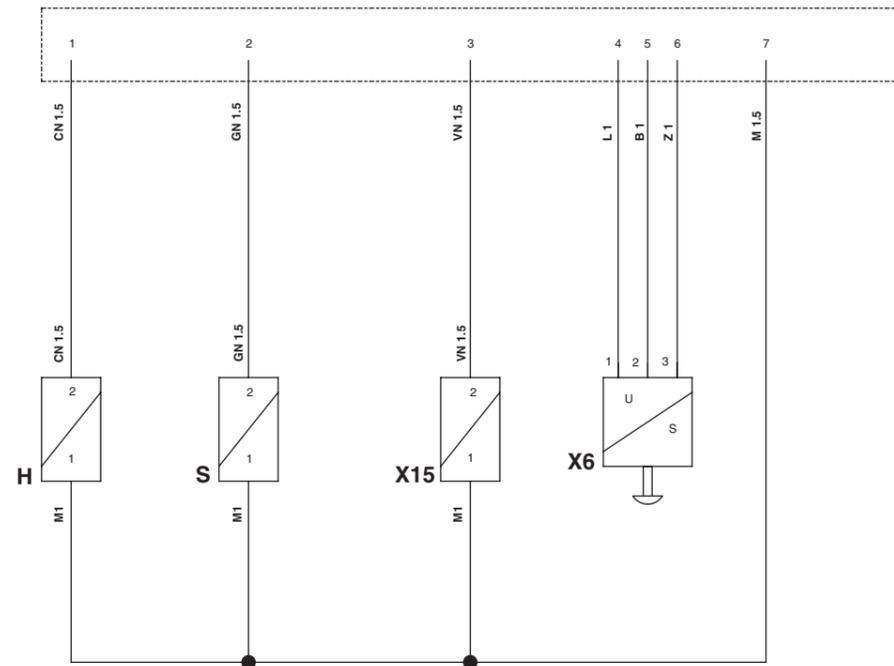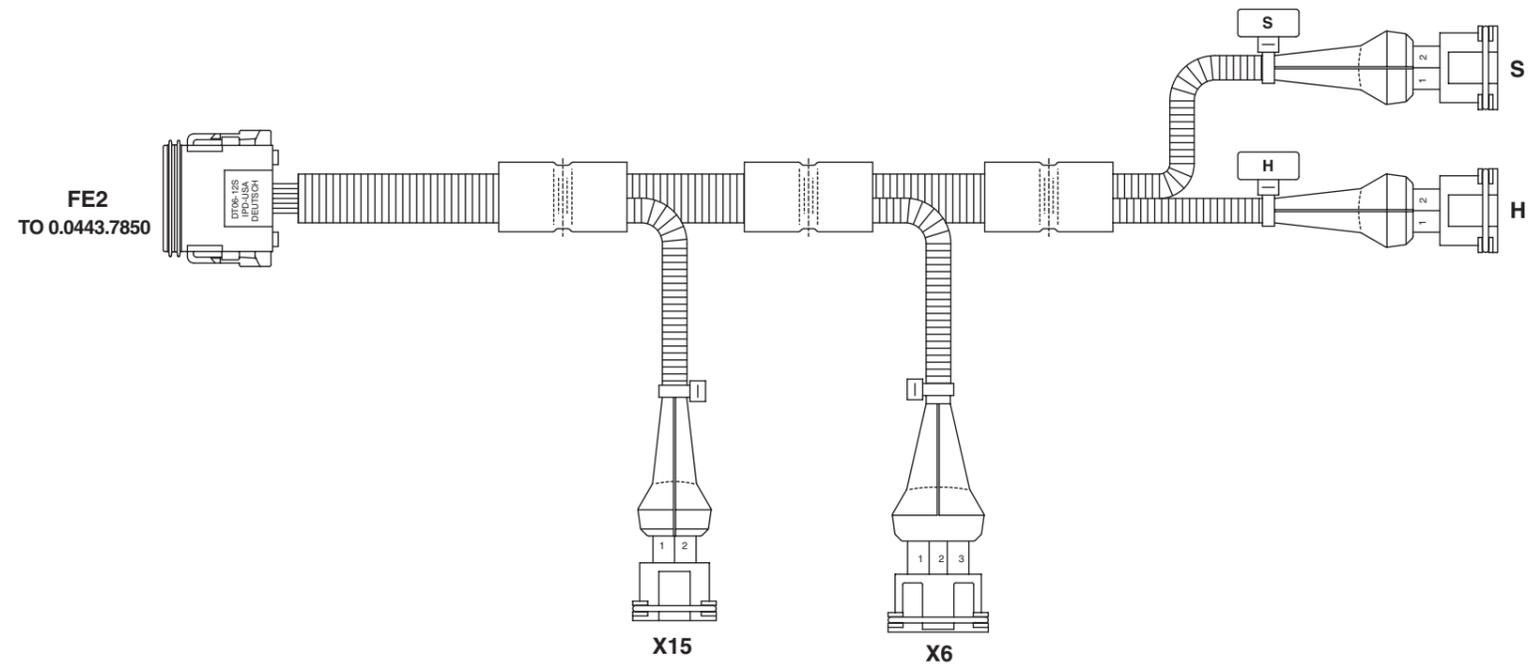
FE2
TO 0.0443.7850

S

H

X15

X6

H

S

X15

X6

U

S

TABELLA COLORI / COLOURS TABLE

M	Marrone/Brown	C	Arancio/Orange
V	Verde/Green	A	Azzurro/Blue
Z	Viola/Violet	B	Bianco/White
N	Nero/Black	L	Blu/Dark Blue
S	Rosa/Pink	G	Giallo/Yellow
R	Rosso/Red	H	Grigio/Gray

FE2 To front axle suspension control unit wiring

H Front axle suspension Up solenoid valve PTO

S Front axle suspension Down solenoid valve PTO

X6 Axle suspension position sensor

X15 Front axle suspension Load Sensing solenoid valve

0.012.8673.4

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CONNECTORS LOCATION

1

FE2

F0039410

2

X15

F0043240

3

S

H

F0043250
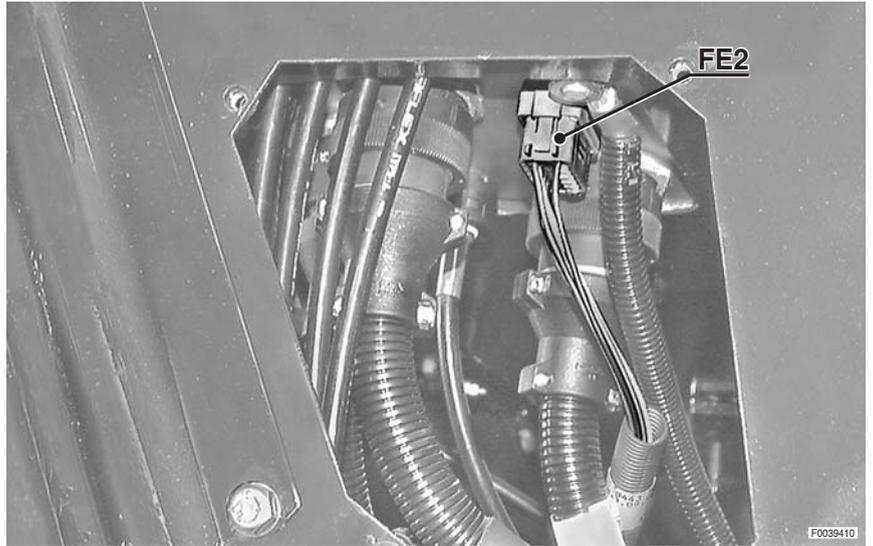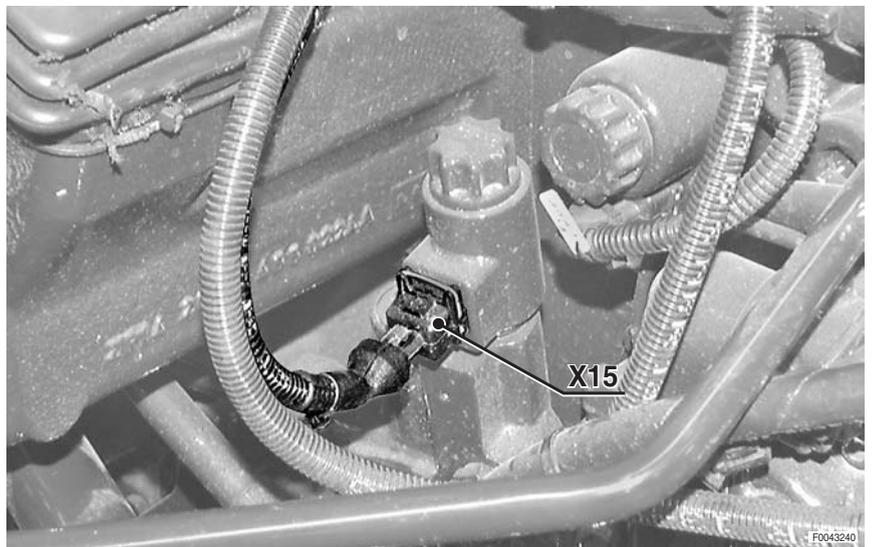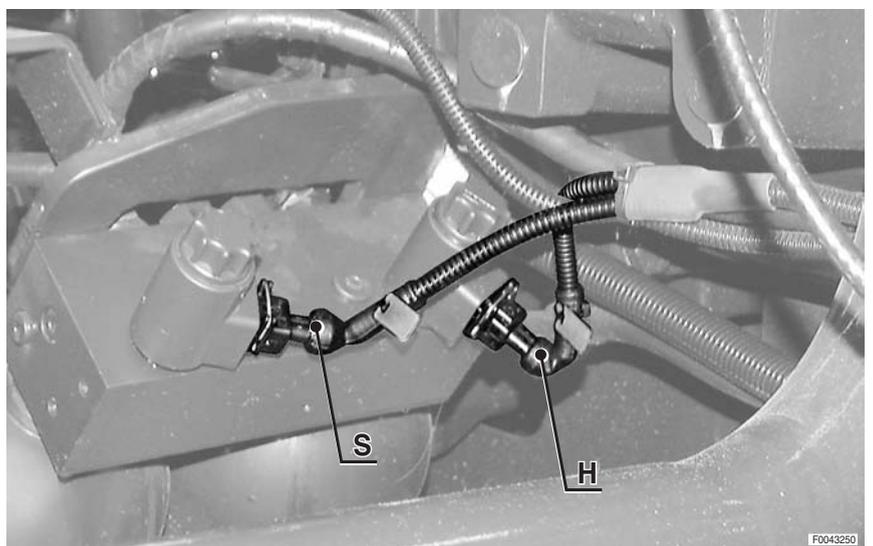
CONNECTORS LOCATION

4

F0043260

FRONT AXLE SUSPENSION WIRING

F0043230
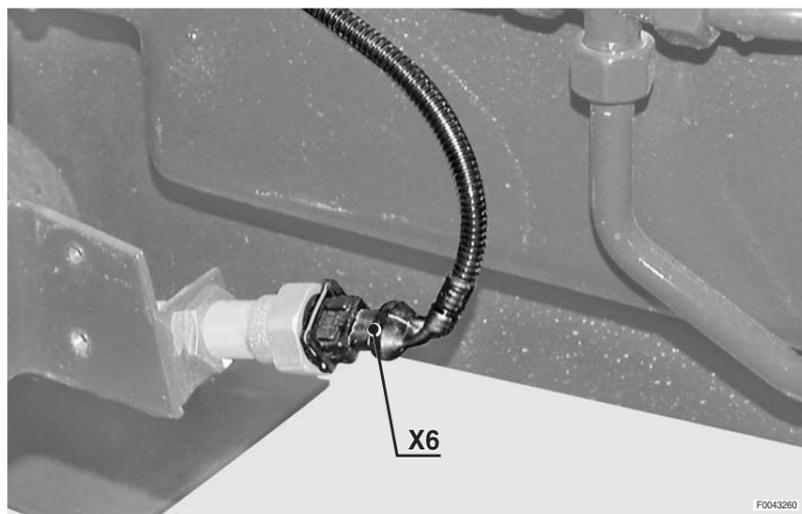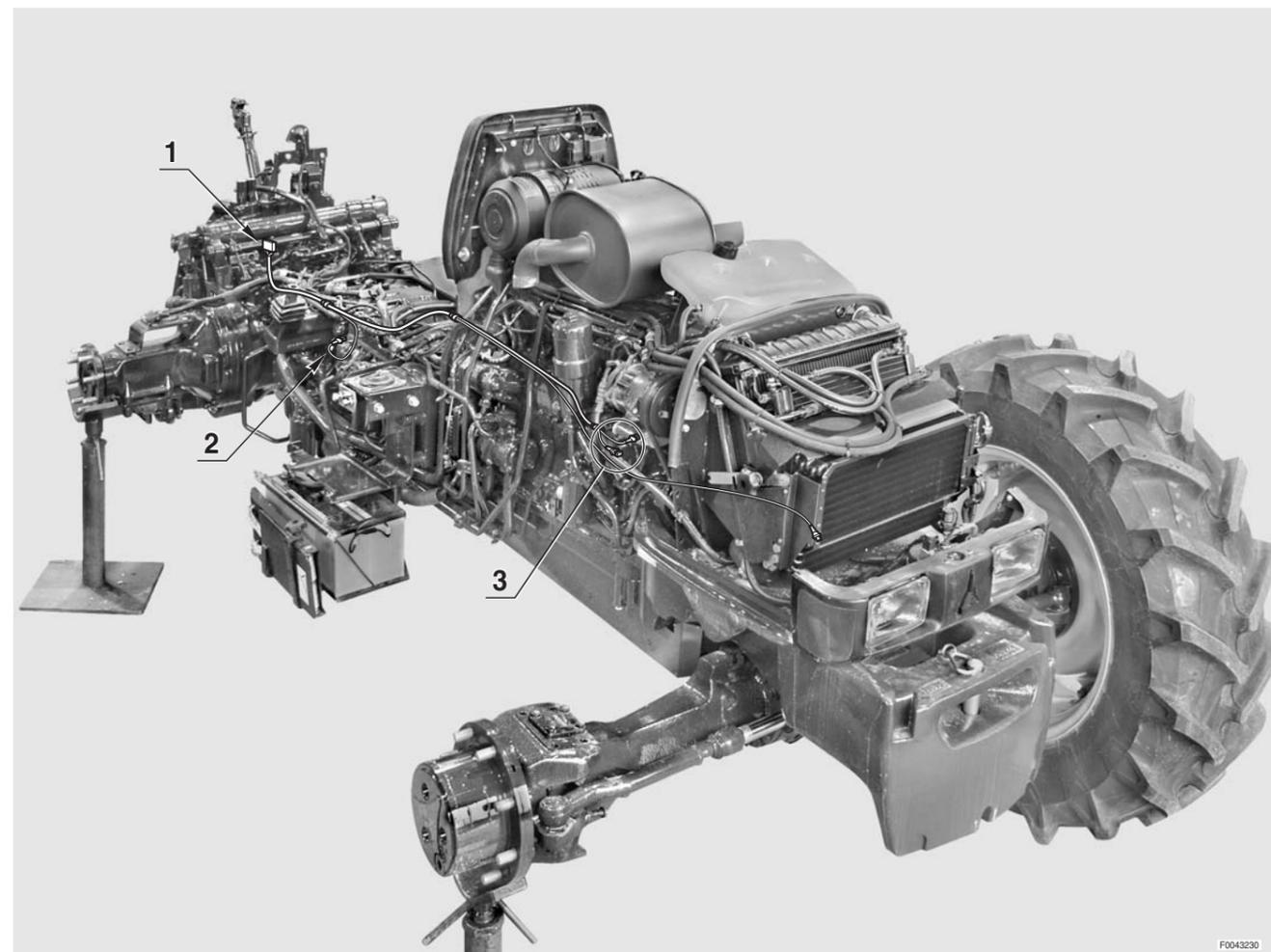
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FENDER WIRING
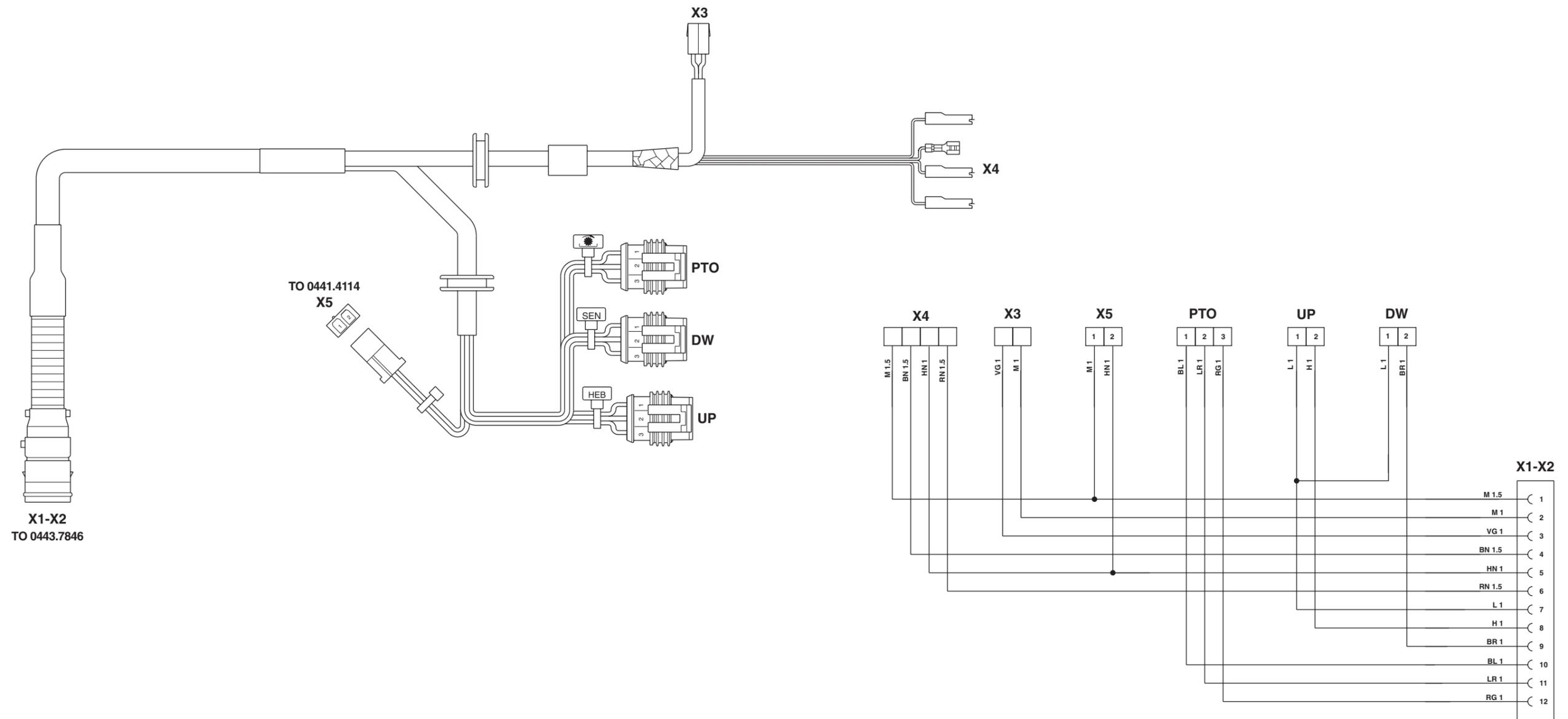
DW Rear lift 'down' button
PTO Rear PTO control button (on fender)
UP Rear lift 'up' button
X1 To cab power supply wiring
X2 To cab power supply wiring
X3 Rear lower worklights
X4 Rear sidelight and direction indicator
X5 To number plate light wiring

0443.9835

NUMBER PLATE LIGHT WIRING

X92

X5
TO 0442.9835

X92 ⊗ M 1 ———————— 1   **X5**
         HN 1 ———————— 2
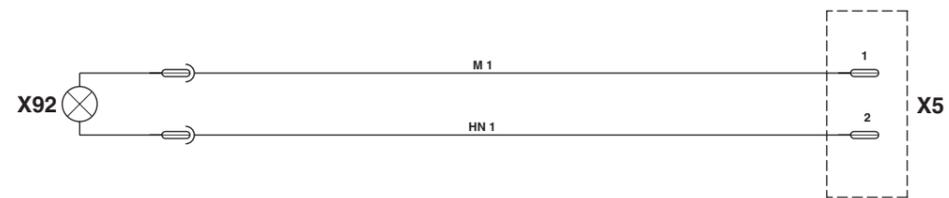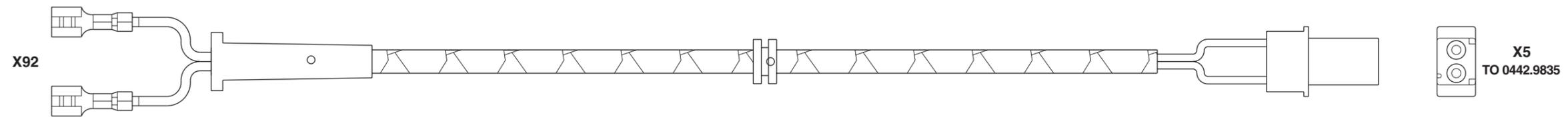
X5 To fender wiring
X92 Number plate light

0441.4114

CONNECTORS LOCATION

1

2

3
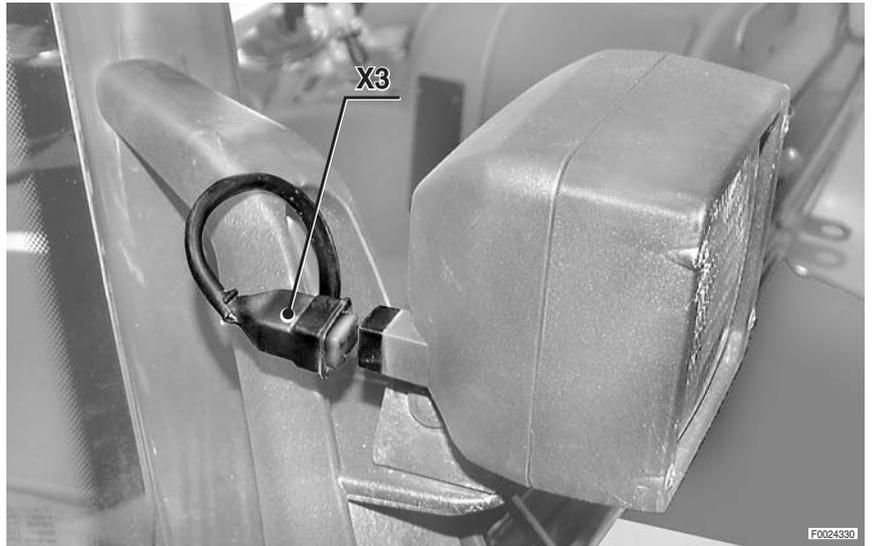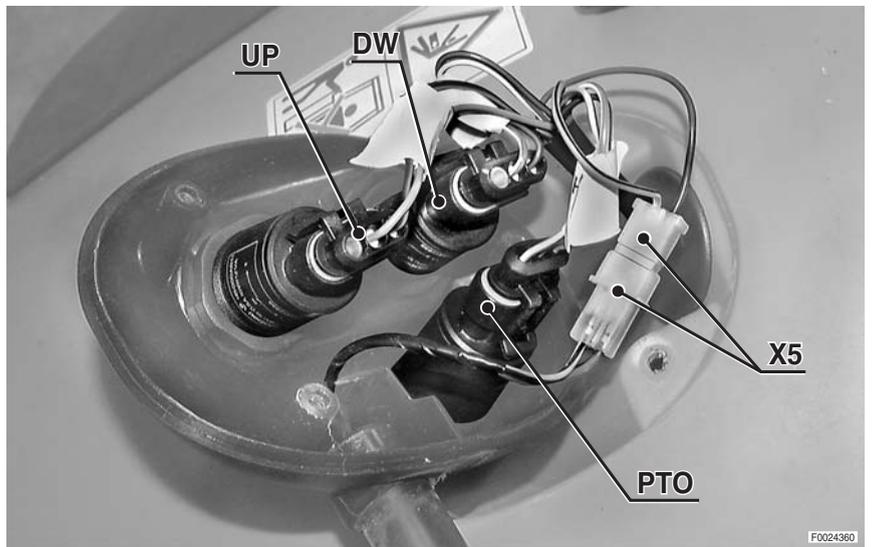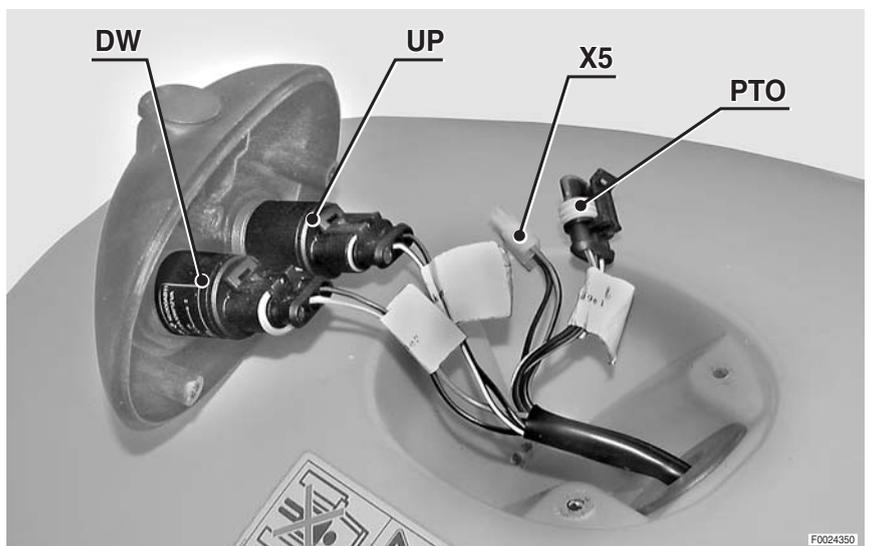
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FENDER - NUMBER PLATE LIGHT WIRING

4

X1-X2

F0024340

5

X4

F0024320

6

X92

F0024200

1

1

2

3

4

5

4

6
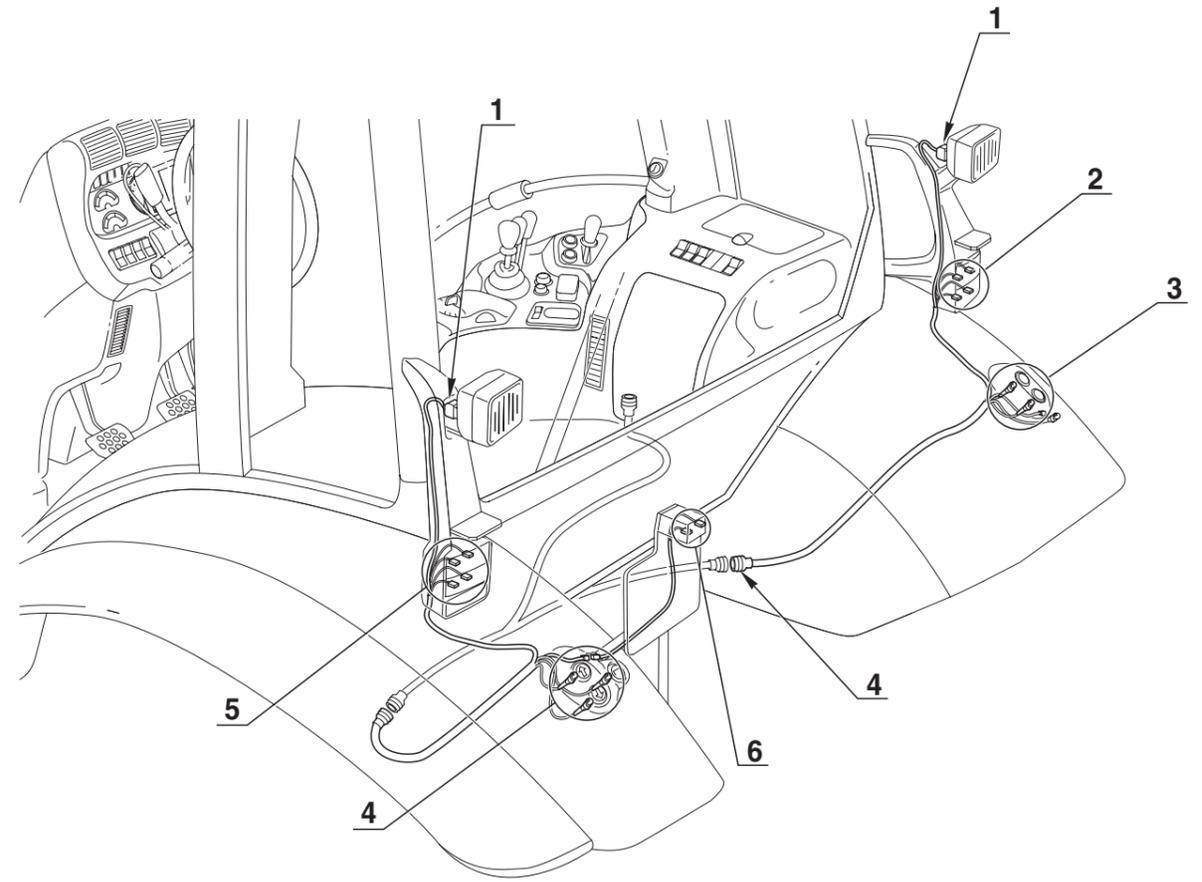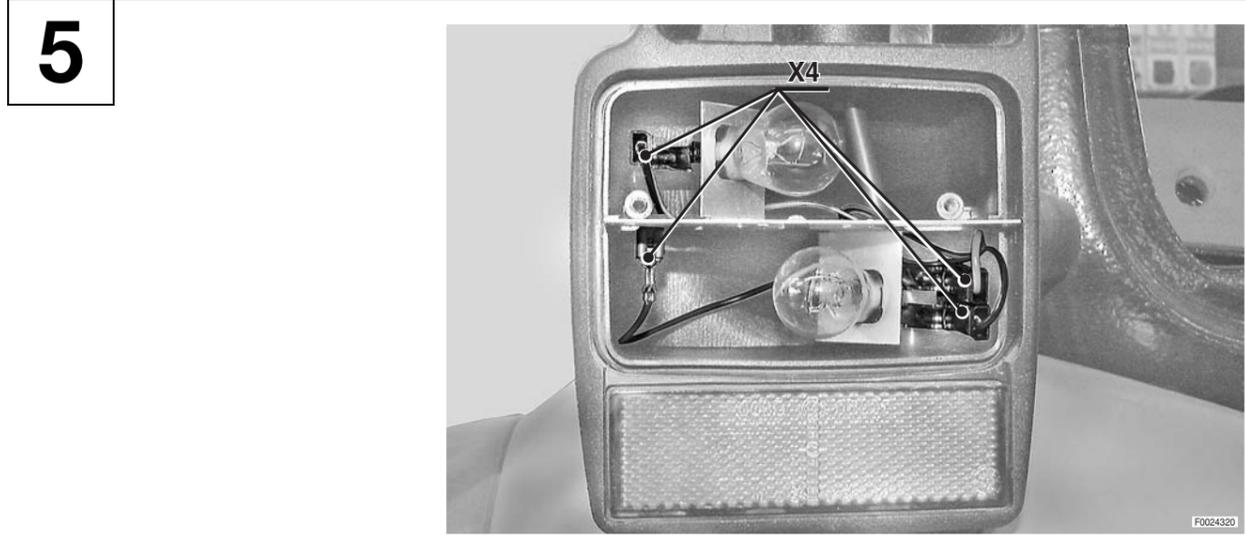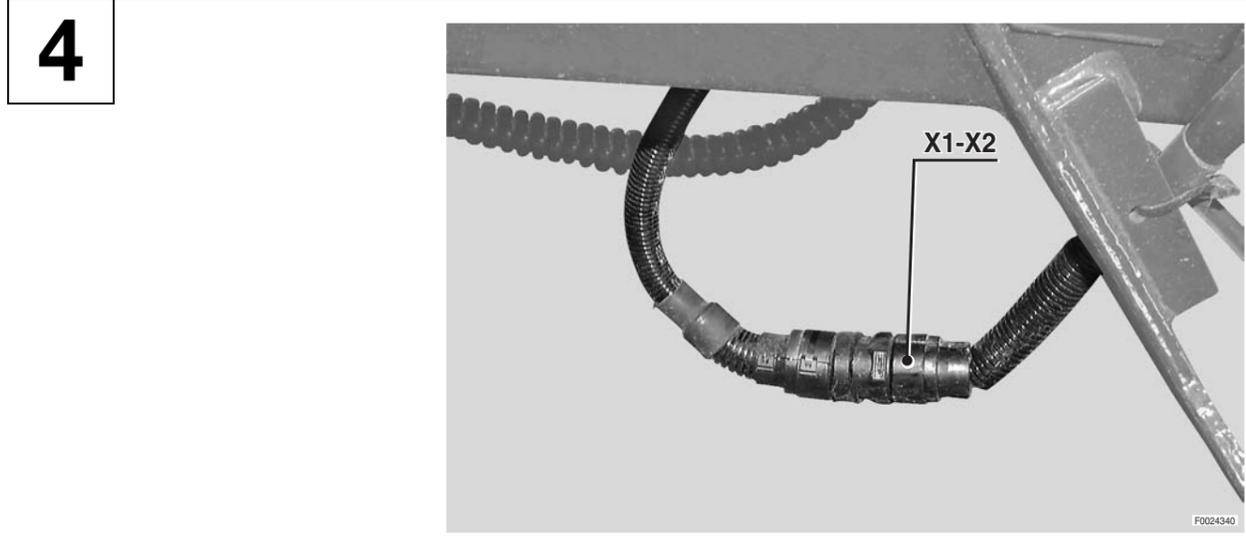
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FRONT CONSOLE WIRING (1/2)
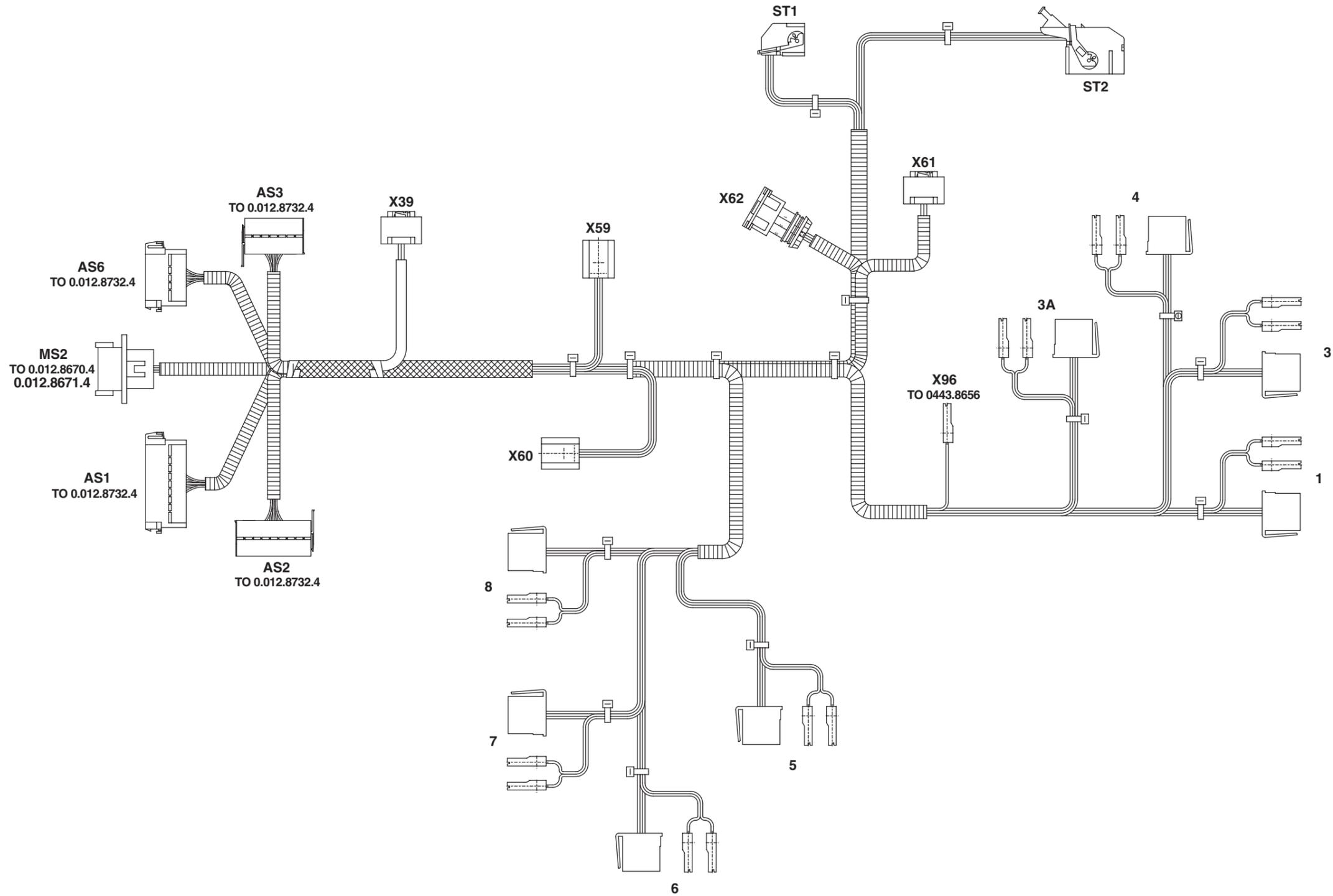
1	Sidelights switch	**8**	4WD switch	**ST2**	Infocenter
3	Cab roof worklights switch	**AS1**	To side console wiring	**X39**	Accelerator pedal position sensor
3A	Lower worklights switch	**AS2**	To side console wiring	**X59**	Right brake pedal switch
4	Not used	**AS3**	To side console wiring	**X60**	Left brake pedal switch
5	Front suspension control pushbutton	**AS6**	To side console wiring	**X61**	Clutch pedal position sensor
6	ASM switch	**MS2**	To engine wiring	**X62**	Clutch pedal depressed proximity sensor
7	Diff lock switch	**ST1**	Infocenter	**X96**	Steering column switch unit

0.012.8894.4

FRONT CONSOLE WIRING (2/2)

0.012.8894.4

CONNECTORS LOCATION

1

2

3

4

A0025060

5

MS2

A0025080

6

AS1

AS6

AS3

AS2

A0025090

FRONT CONSOLE WIRING

X39

F0039451

X60

X59

A0025070

4

3

2

1

8

7

6

5

0.012.8894.4
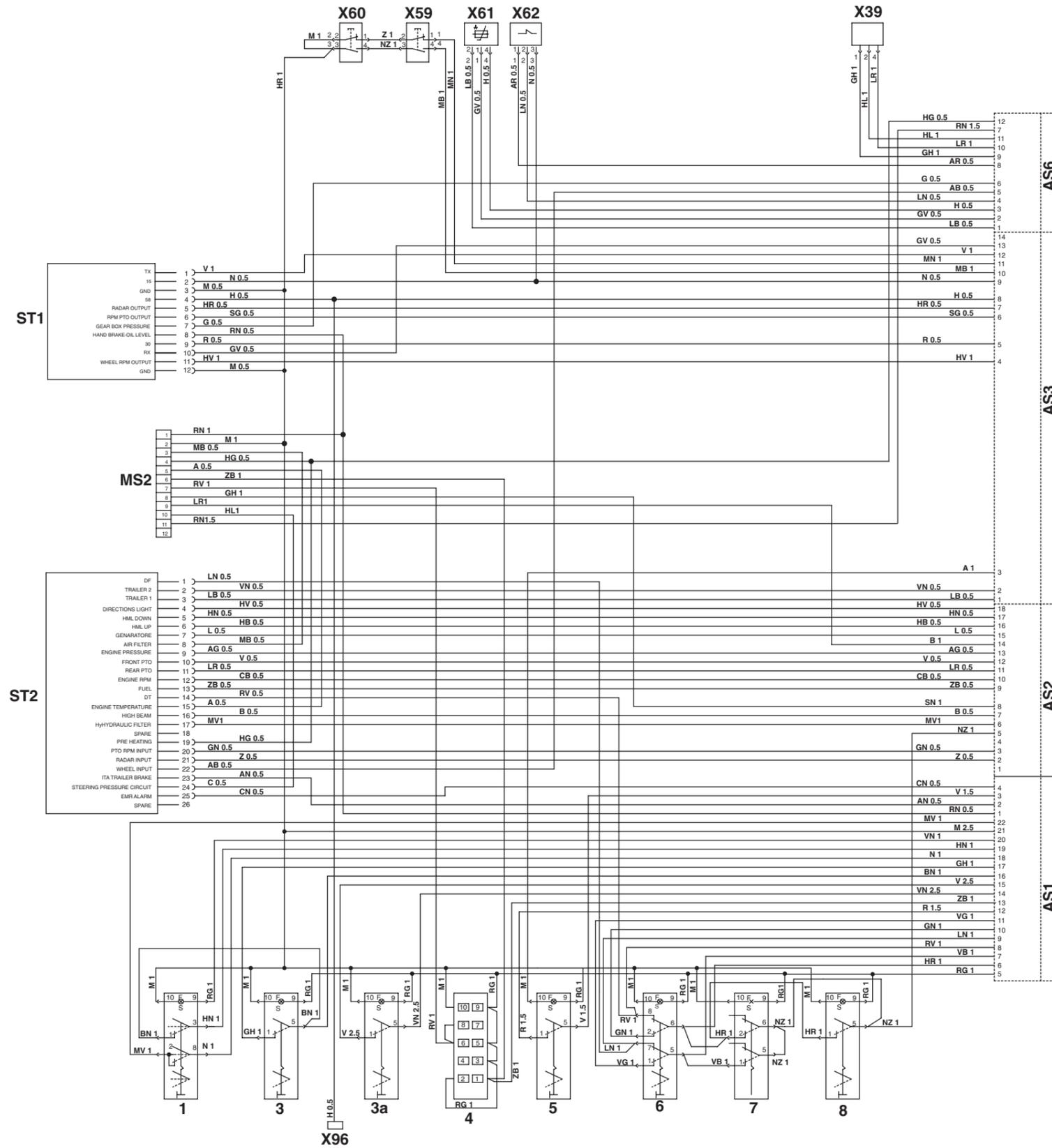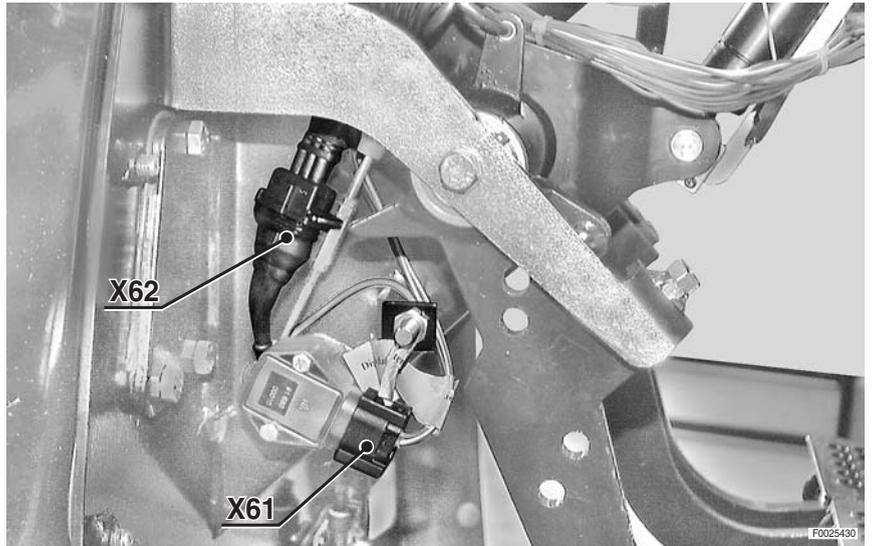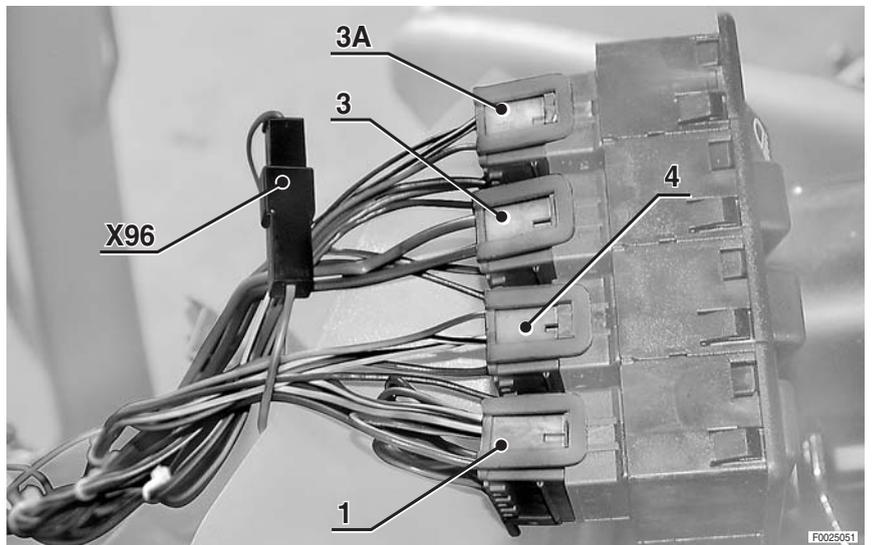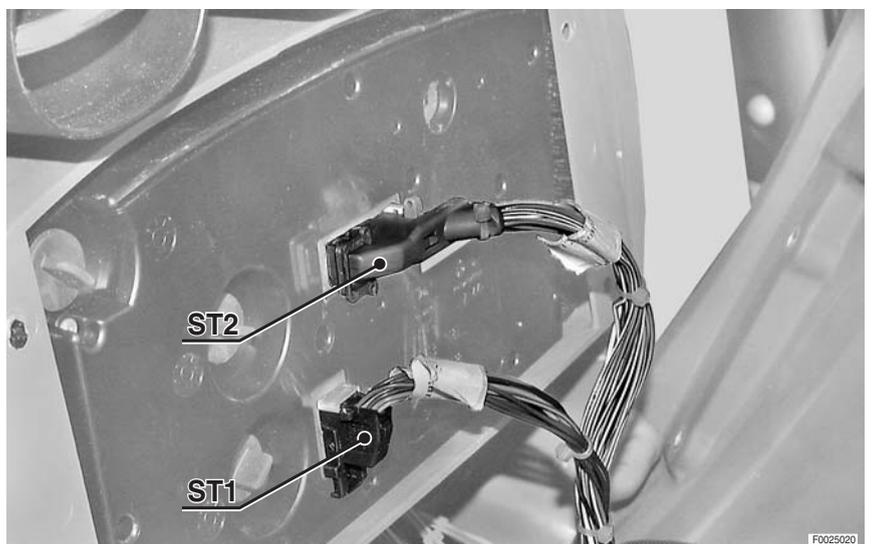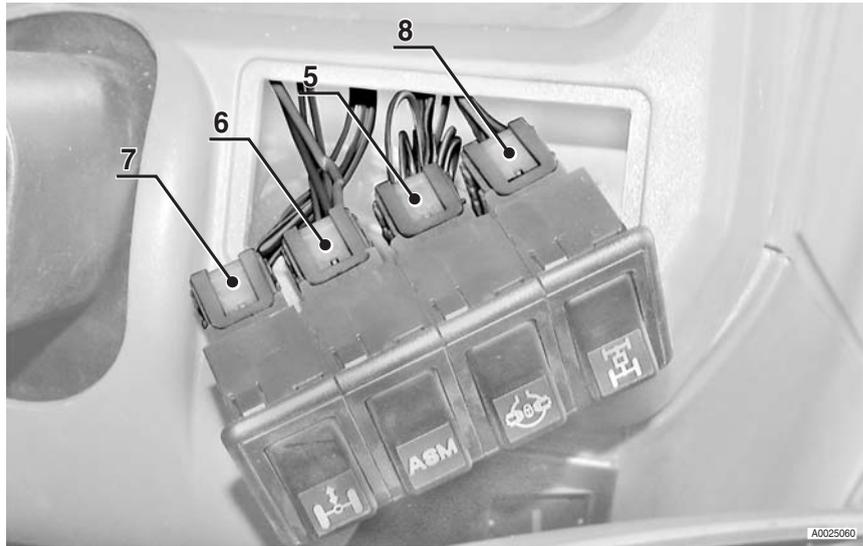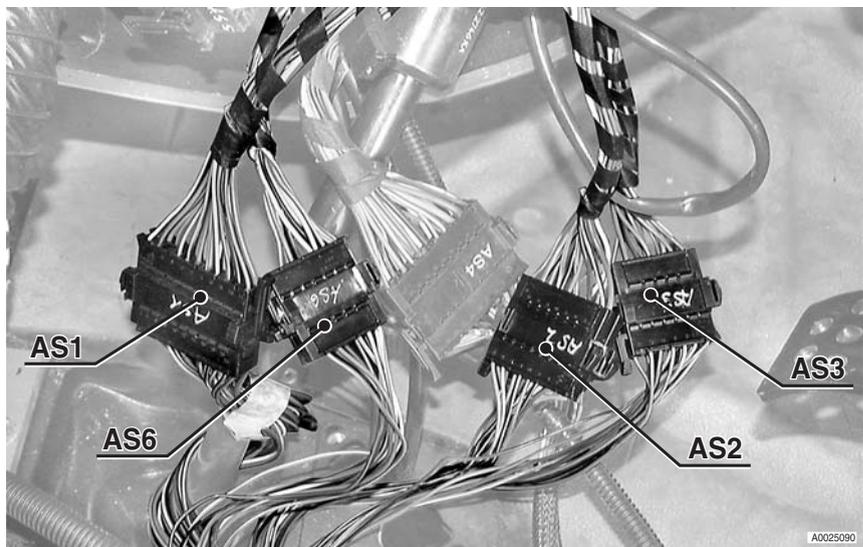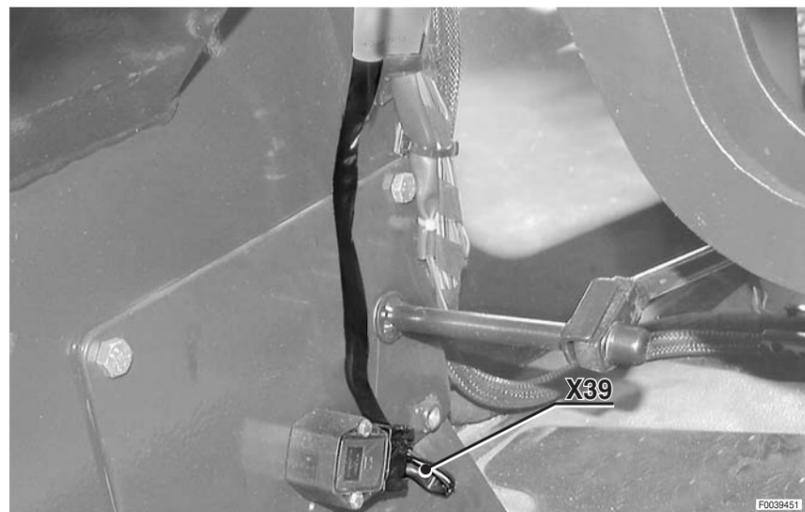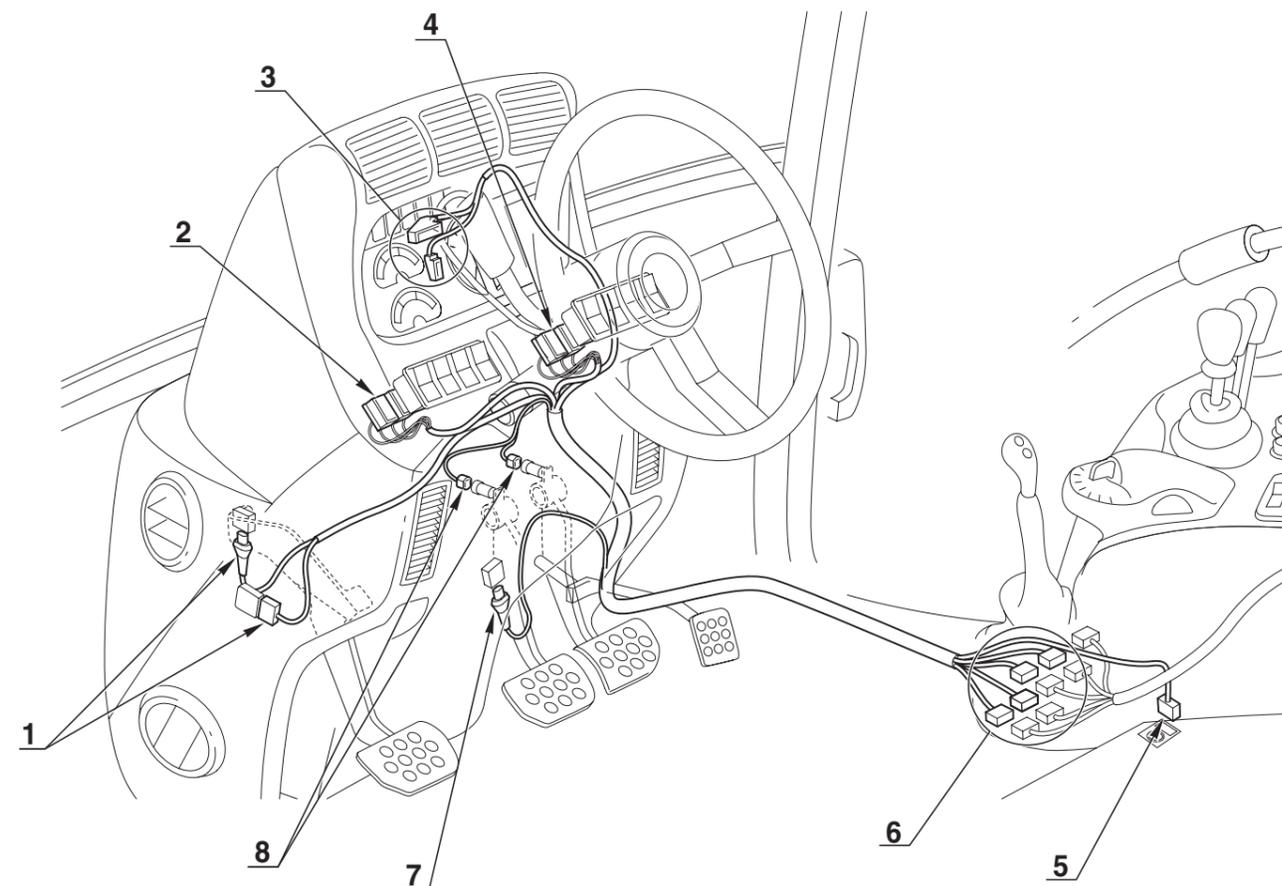
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SIDE CONSOLE WIRING (1/3)

P2
TO 0441.9533

X85   X84
BLACK

P6
TO 0441.9533

FE1
TO 0443.7850

X83
RED

DS1
TO 0443.7851

TKAB2
TO 0.012.4426.4

TKAB3
TO 0.012.4419.4

TKAB1
TO 0.012.4426.4

X87   X90

X75

GND4

X89
TO 0.010.2562.2

X91

X80

X42
TO 0443.7354

MS1
TO 0.012.8670.4
0.012.08671.4

X88
TO 0.010.2562.2

SCHEDA

X81

P5
TO 0441.9533

YELLOW

P3
TO 0441.9533

BLACK

AS6
TO 0.012.8894.4

AS1
TO 0.012.8894.4

AS5
TO 0443.7875

J1
TO 0441.9533

X79

AS3
TO 0.012.8894

F/S
LEVER

X76   X77

MX2   MX1

X86

P1
TO 0441.9533

AS4
TO 0443.8656

AS2
TO 0.012.8894.4

X65

EHR
TO 0443.7354

JX1
WHITE

APS

X43
TO 0443.7354

X74B X74

EMR
TO 0443.7354

E.C.U. (PS)

JX2
BLACK

X72

X73

X78

X67 X68 ISO7

X64

P4
TO 0441.9533

X82

ISO4

J3
TO 0441.9533

J2
TO 0441.9533

X69

X71

X70

X98

APS Not used
AS1 To front console wiring
AS2 To front console wiring
AS3 To front console wiring
AS4 To lights selector wiring
AS5 To display wiring
AS6 To front console wiring

DS1 To roof wiring
ECU LS Transmission ECU
EHR Lift control panel
EHR To armrest wiring
EMR Lift control panel
EMR To armrest wiring
F/S LEVER Gearbox control lever

FE1 To front axle suspension control unit wiring
ISO4 ISO4 socket (power supply to implements)
ISO7 ISO7 socket (implement connection)
J1 To fuses control unit
J2 To fuses control unit
J3 To fuses control unit
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 control unit
P2 To fuses control unit
P3 To fuses control unit

P4 To fuses control unit
P5 To fuses control unit
P6 To fuses control unit
TKAB1 To transmission wiring
TKAB2 To transmission wiring
TKAB3 To cab power supply wiring
X42 Engine speed keypad
X42 To armrest wiring
X43 To armrest wiring
X64 Not used
X65 Preheating indicator lamp relay
X67 Auxiliary power socket (Earth)
X68 Auxiliary power socket (Positive)
X69 Rear screen wiper switch
X70 CleanFix control switch
X71 Rotating beacon control switch
X72 Rear worklights switch
X73 Radar control switch
X74 Gearbox control lever
X74b Not used
X75 Not used
X76 Front PTO button (in cab)
X77 Rear PTO button (in cab)
X78 Lift control panel
X79 Fuse F50 (30 Amp)
X80 Auxiliary power supply connector (in cab)
X81 Diagnostics connector
X82 Brake lights fuse (15 Amp)
X83 Direction indicators flasher unit (red)
X84 Direction indicators flasher unit (black)
X85 Direction indicators flasher unit
X86 Starter switch
X87 Driver's seat air suspension compressor
X88 To air conditioning system wiring
X89 To air conditioning system wiring
X90 Handbrake switch
X91 Cigar lighter
X98 PTO AUTO switch

0.012.8732.4

SIDE CONSOLE WIRING (2/3)

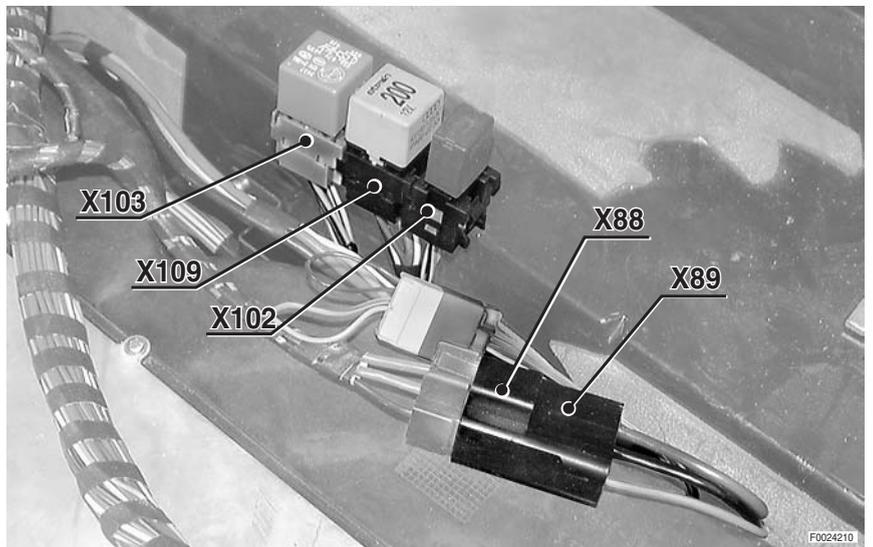| TABELLA COLORI / COLOURS TABLE			
M	Marrone/Brown	C	Arancio/Orange
V	Verde/Green	A	Azzurro/Blue
Z	Viola/Violet	B	Bianco/White
N	Nero/Black	L	Blu/Dark Blue
S	Rosa/Pink	G	Giallo/Yellow
R	Rosso/Red	H	Grigio/Gray

SIDE CONSOLE WIRING (3/3)
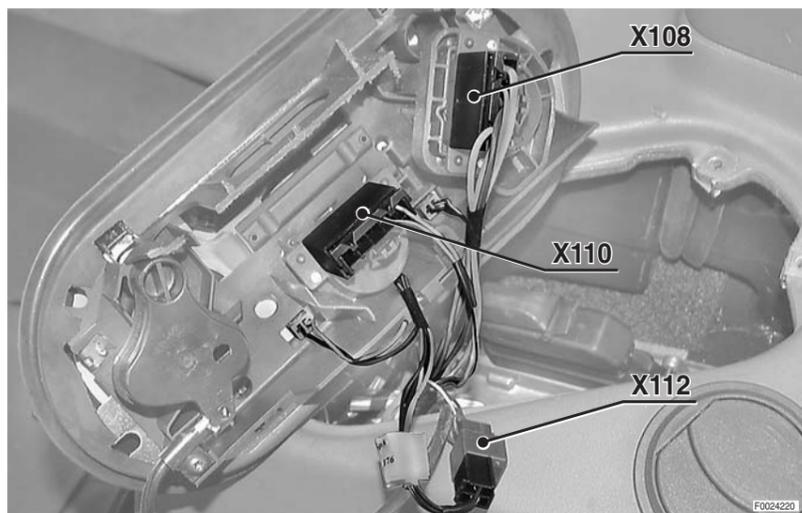
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CONNECTORS LOCATION

1

2

3

4

X87

F0022220

5

X88

X89

F0022230

6

TKAB2

TKAB3

TKAB1

GND4

F0022241

7

X75

F0022250

8

X83

X84

X85

X80

X82

FE1

F0022260

9

E.C.U. (PS)

BOSCH

F0022271

10

X67

X68

ISO7

ISO4

F0022280

11

X42

X86

F0022290

12

DS1

F0022300

13

MS1

F0022310

17

18

19

SIDE CONSOLE WIRING

20

X74

✳X74b

X74b: NOT USED

F0022380

0.012.8732.4

AIR CONDITIONING SYSTEM WIRING

X105

X104

X103

X102

X89
TO 0.012.8732.4

X88
TO 0.012.8732.4

X106

X107

X108

X109

X110

X111

X112

TABELLA COLORI / COLOURS TABLE			
M	Marrone/Brown	C	Arancio/Orange
V	Verde/Green	A	Azzurro/Blue
Z	Viola/Violet	B	Bianco/White
N	Nero/Black	L	Blu/Dark Blue
S	Rosa/Pink	G	Giallo/Yellow
R	Rosso/Red	H	Grigio/Gray

X88 To side console wiring
X89 To side console wiring
X102 Control relay for 3rd heater fan speed
X103 Control relay for 4th speed heater fans
X104 Left heater fan resistor
X105 Left heater fan
X106 Right heater fan

X107 Right heater fan resistor
X108 Fan speed selector switch
X109 Relay for 1st fan speed and air conditioning on
X110 Air conditioning on/off switch
X111 Air conditioning thermostat
X112 Air conditioning control panel illumination connector

0.010.2562.2

CONNECTORS LOCATION

1

X107

X106

F0024240

2

X103

X109

X102

X88

X89

F0024210

3

X105

X104

F0024250
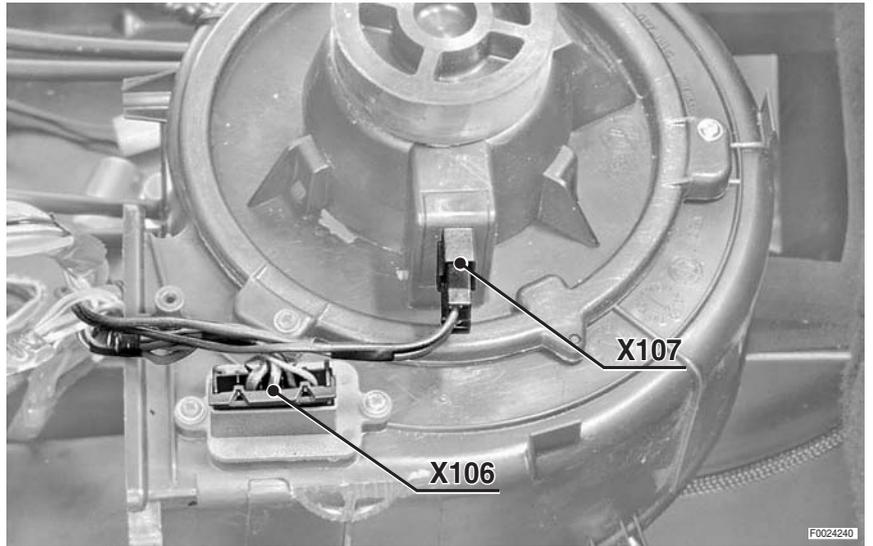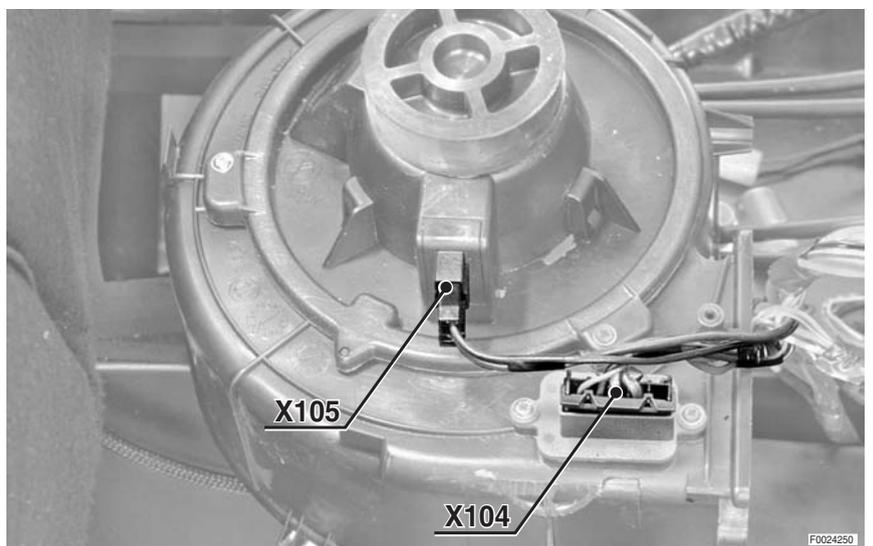
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AIR CONDITIONING SYSTEM WIRING

4

X111

F0024250

5

X108

X110

X112

F0024220

5

4   3   2   1
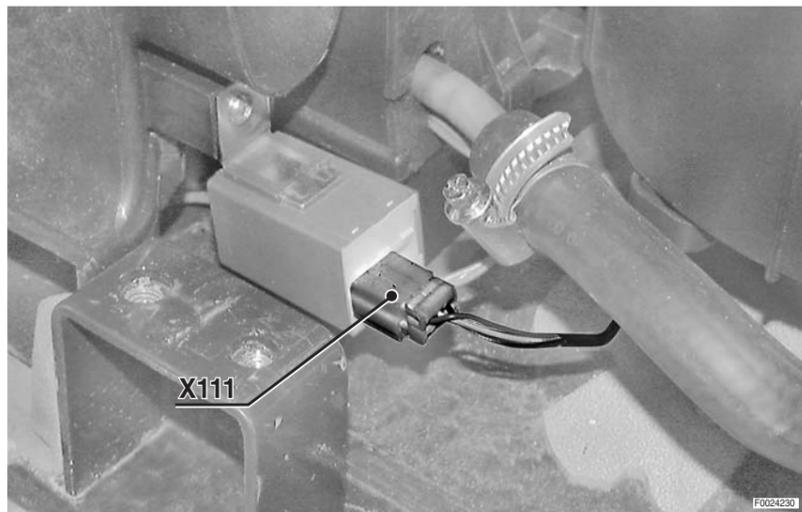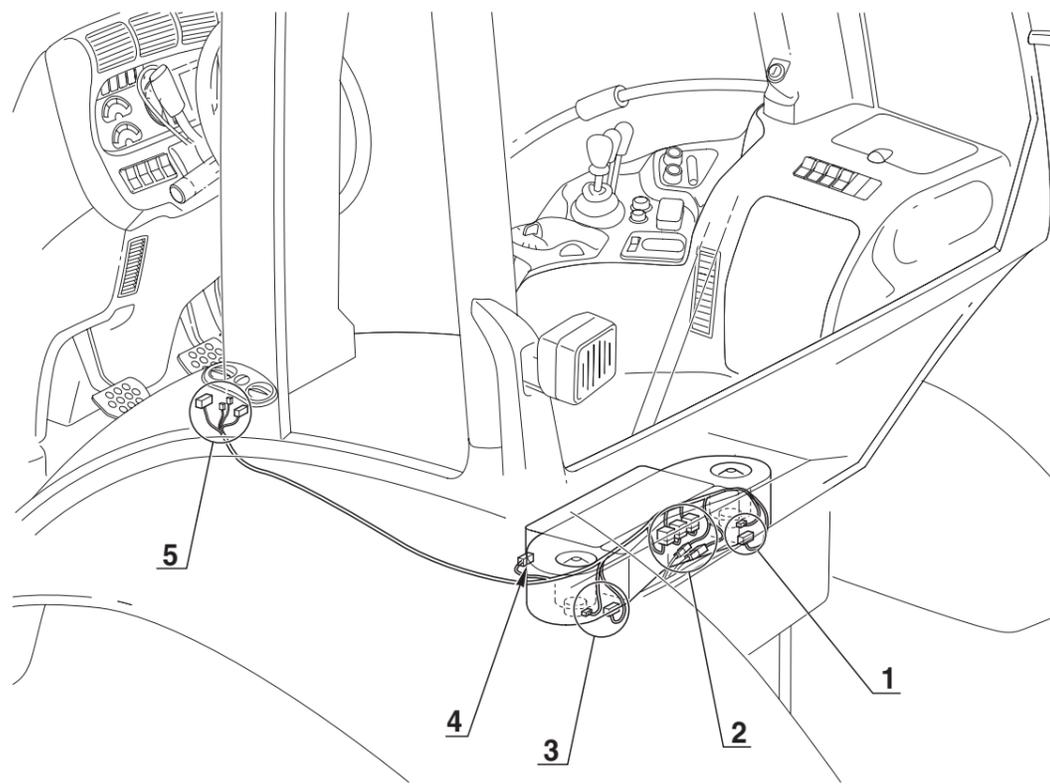
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DISPLAY WIRING

AS5
TO 0.012.8732.4

X95

X94

X93

X95   X94   X93

Light   Light

M 1   H 1   M 1   N 1   CB 1   12V   M   Sig   Light
        H 1   N 1   01 02 03 04 05 06
                                          N 0.5 B 0.5 H 0.5 M 0.5 M 0.5

06
B 0.5   05
CB 1   04   AS5
N 1   03
H 1   02
M 1   01
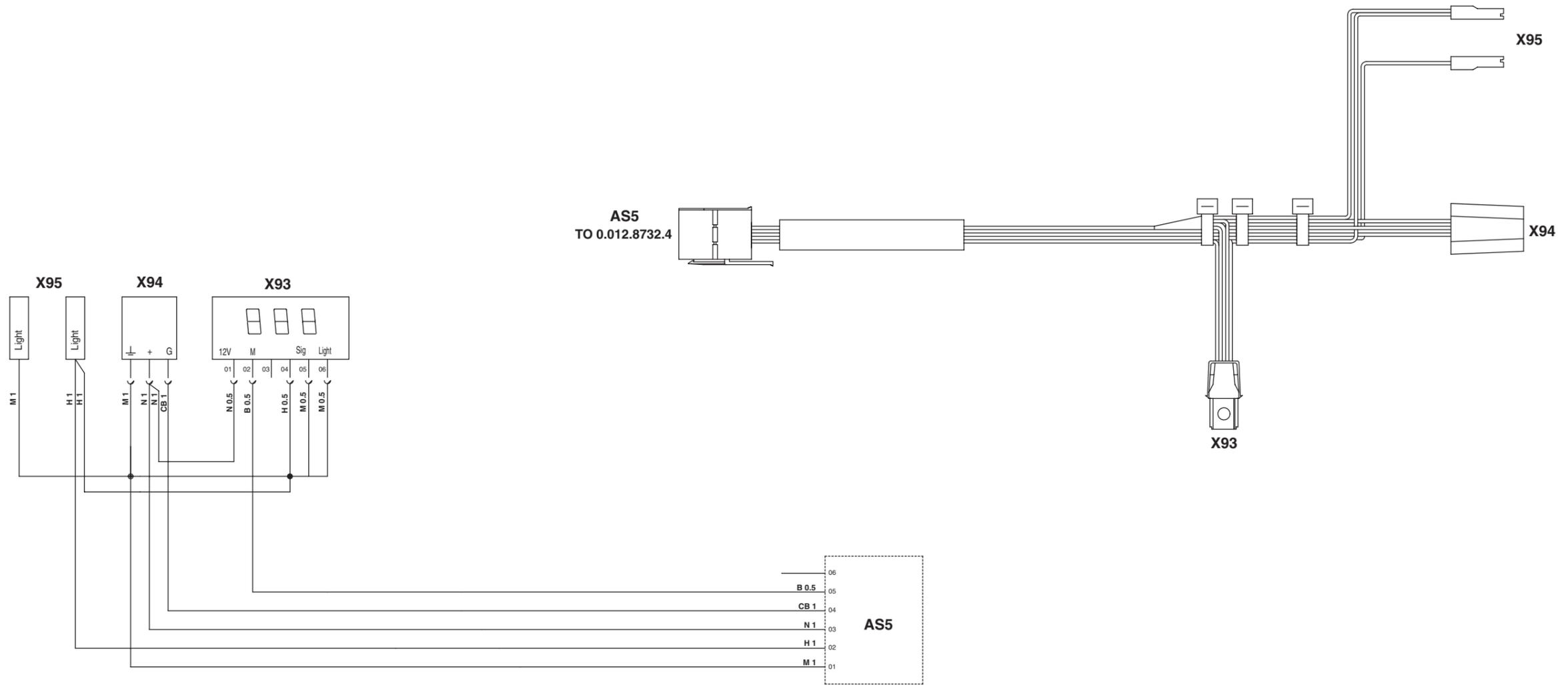
AS5 To side console wiring

X93 Transmission display

X94 Compressed air pressure gauge

X95 Compressed air pressure gauge light

0443.7875.01

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CONNECTORS LOCATION

DISPLAY WIRING

1

X95

X94

F0024460

2

X93

F0024470

3

AS5

F0024450

1

2

3

0443.7875.01
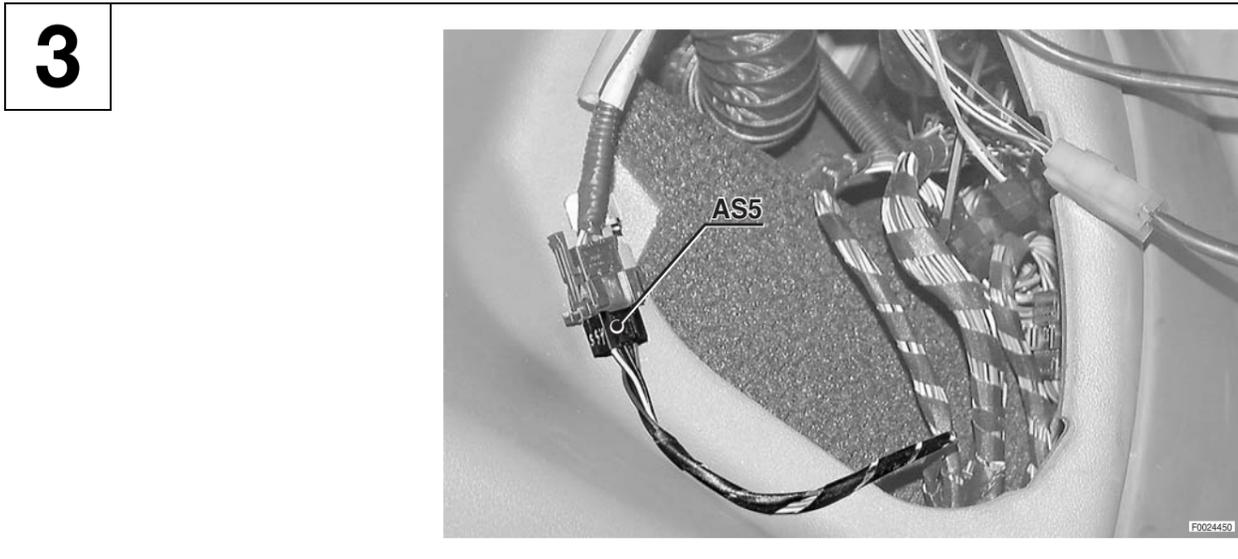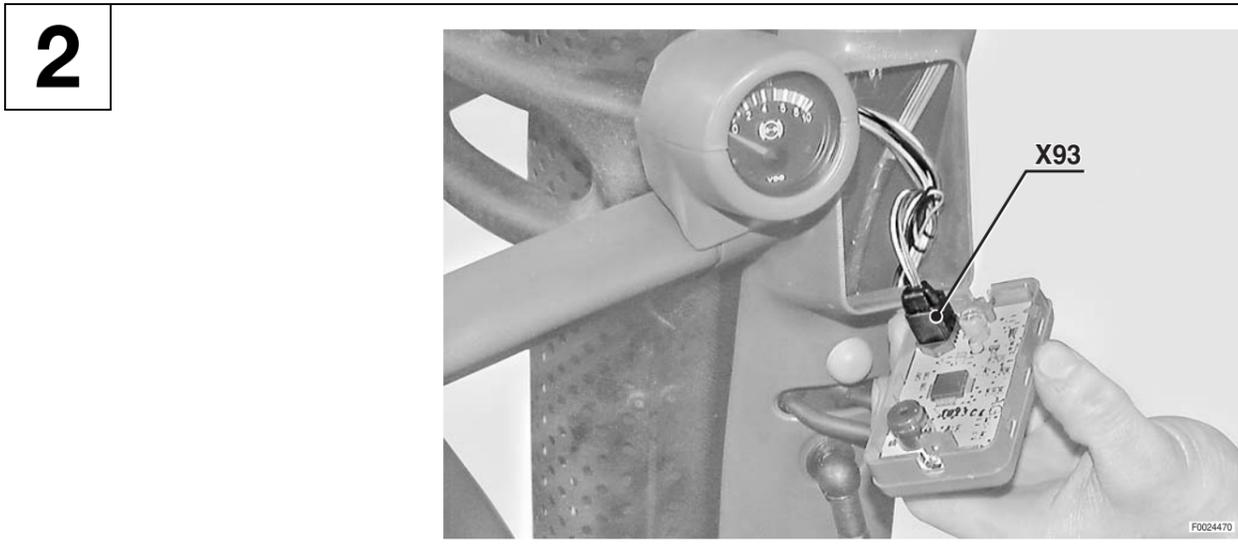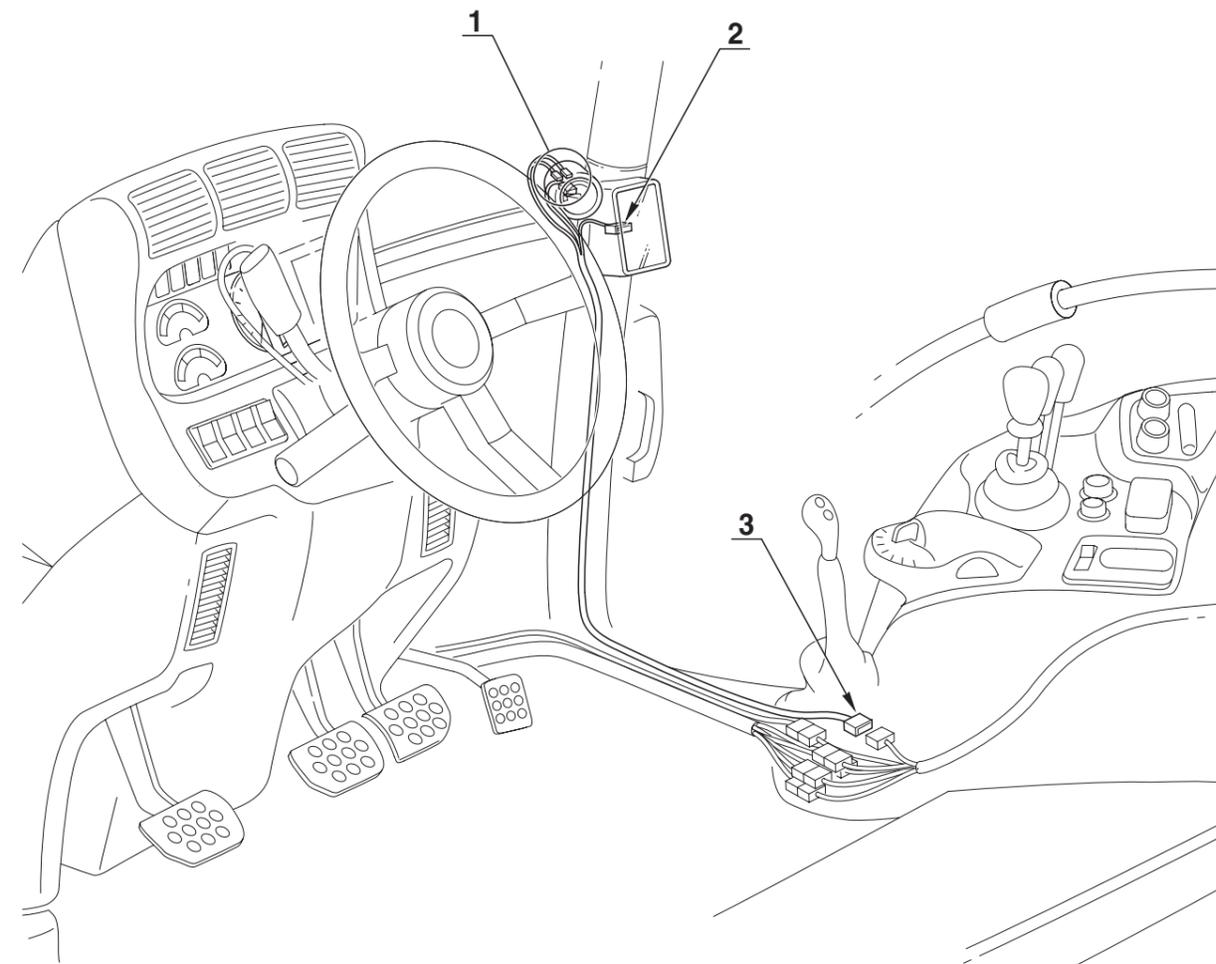
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ROOF WIRING (1/2)
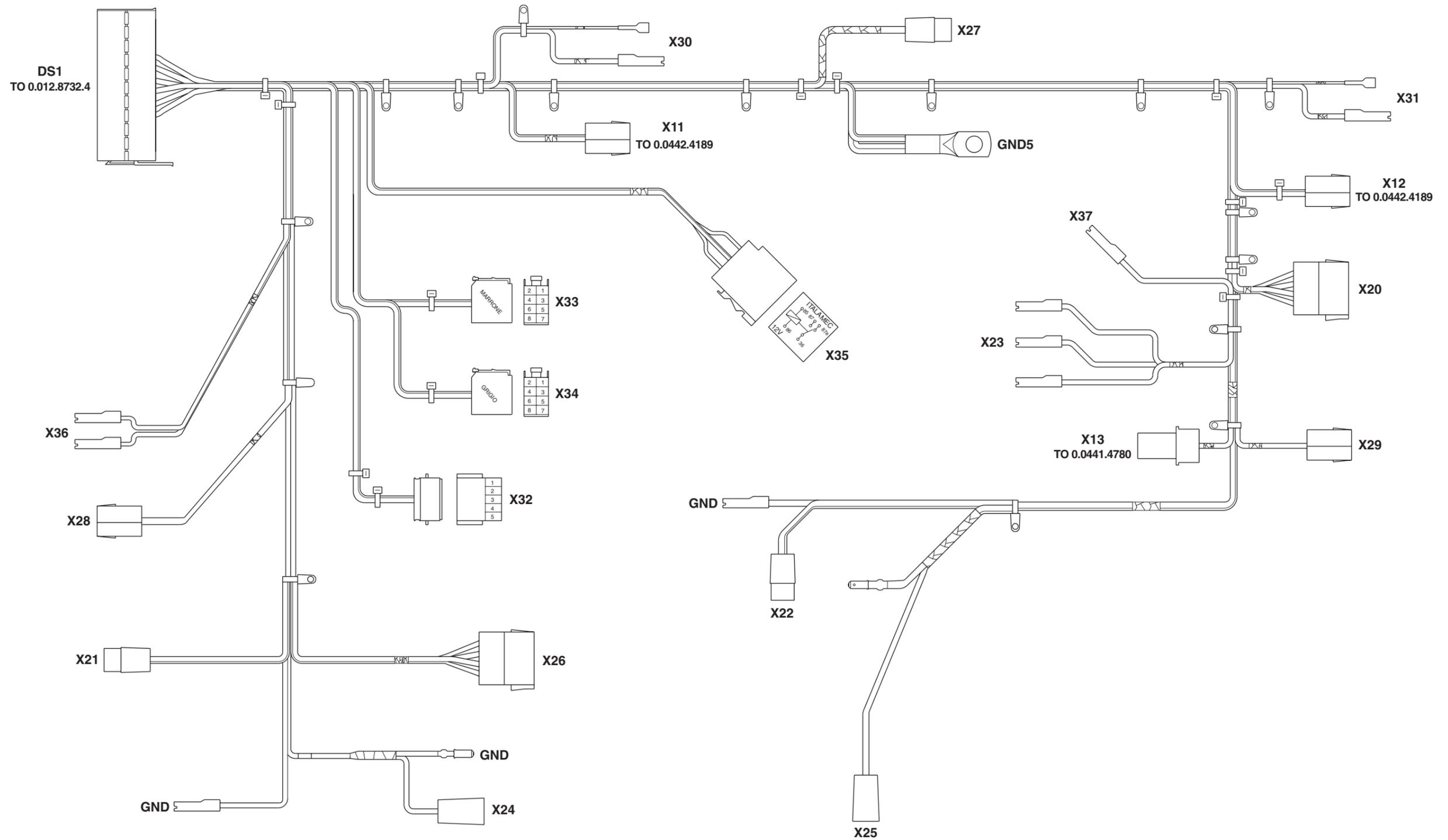
DS1 To side console wiring	**X24** RH front sidelight and direction indicator	**X30** Right rear loudspeaker
X11 To worklights wiring	**X25** LH front sidelight and direction indicator	**X31** Left rear loudspeaker
X12 To worklights wiring	**X26** Windscreen wiper motor	**X32** Clock
X13 To rotating beacon wiring	**X27** Rear screen wiper motor	**X33** Radio (brown)
X20 CB power connector	**X28** Right front loudspeaker	**X34** Radio (grey)
X21 Front right worklight	**X29** Left front loudspeaker	**X35** Front upper work lights relay
X22 Front left worklight		**X36** Side console courtesy light
X23 Interior roof light		**X37** Door open warning signal switch

ROOF WIRING (2/2)

HIGH BEAM LIGHTS/LOW WORK LIGHTS SWITCH OVER (AS)
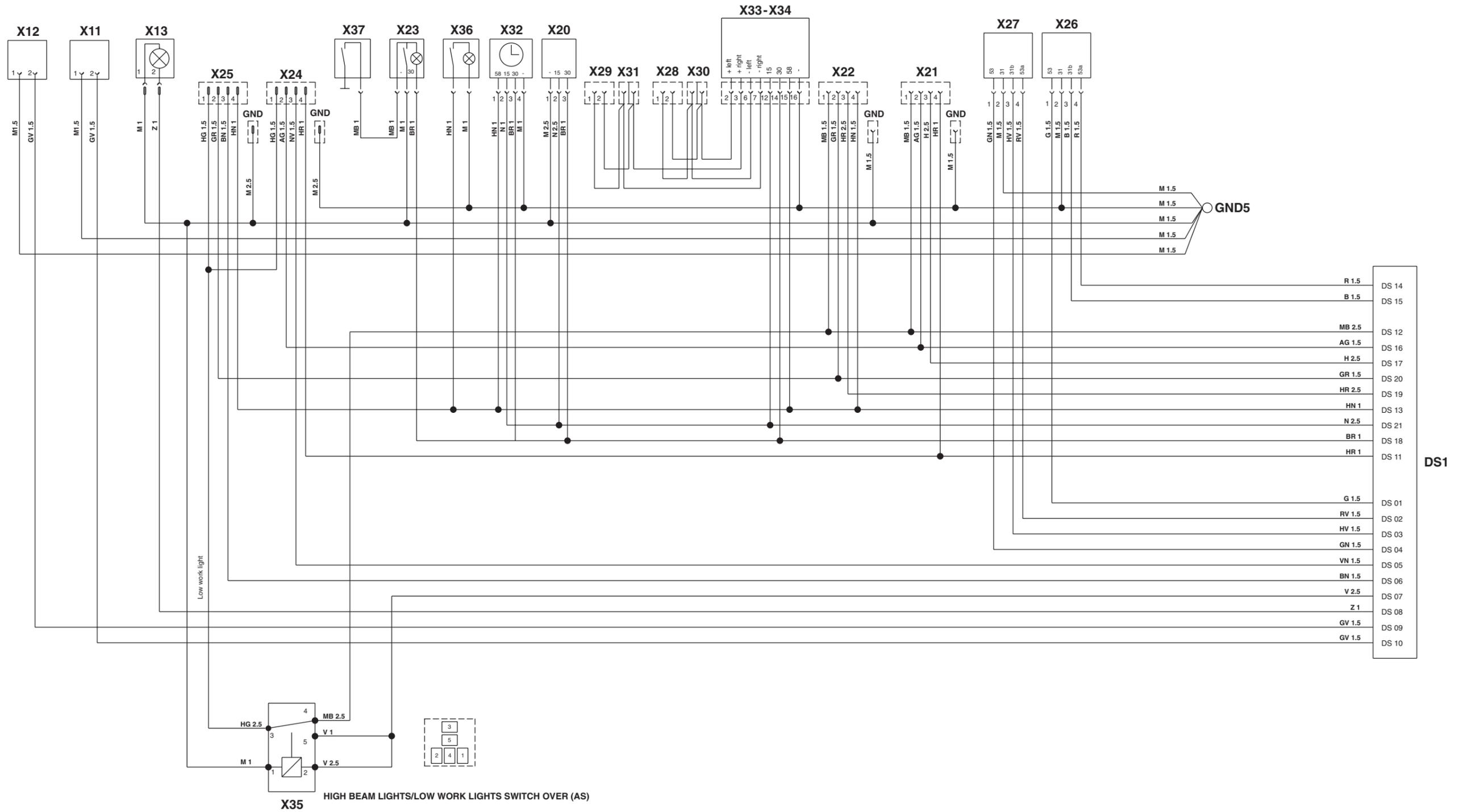
ROTATING BEACON WIRING

X13

X100

X13
2   Z 1
X100
1   M 1
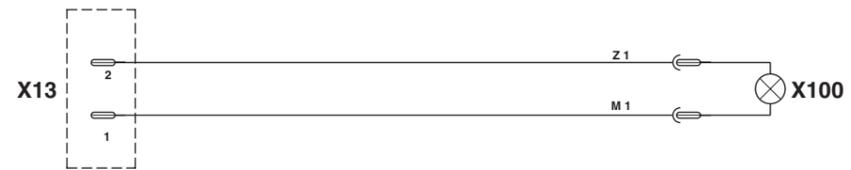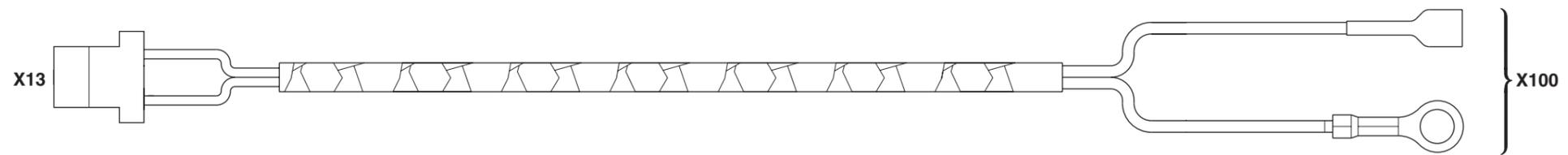
X13 To roof wiring
X100 Rotating beacon

0441.4780
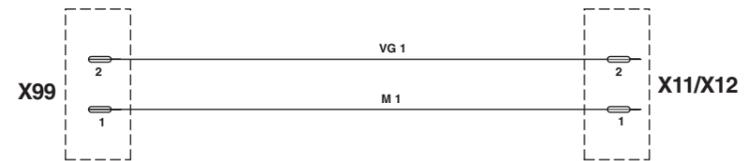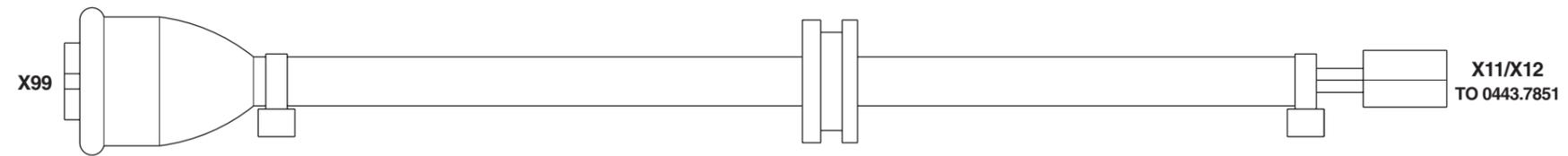
WORKLIGHTS WIRING

X11 To roof wiring

X12 To roof wiring

X99 Rear upper worklights

0441.4189

D0012770

CONNECTORS LOCATION

1

F0024500

2

F0024560

3

F0024540

4

X20

X11-X12

F0024570

5

X21

X26

F0024550

6

X36

F0024580

7

F0024510

8

F0024530

9

F0024490

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ROOF WIRING

10

X27

F0024520

11

DS1
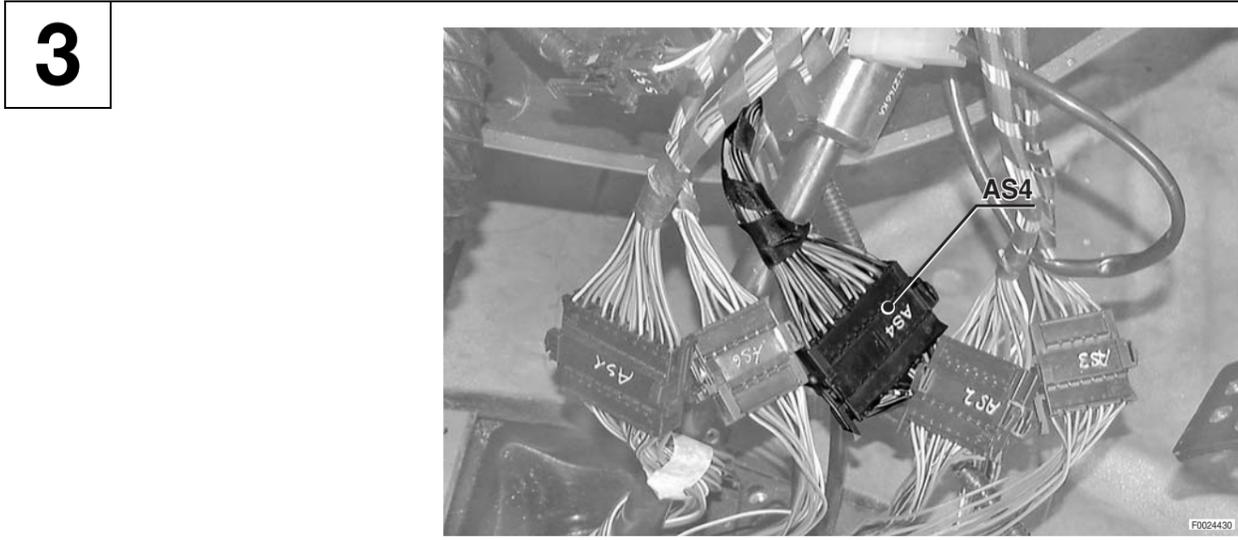
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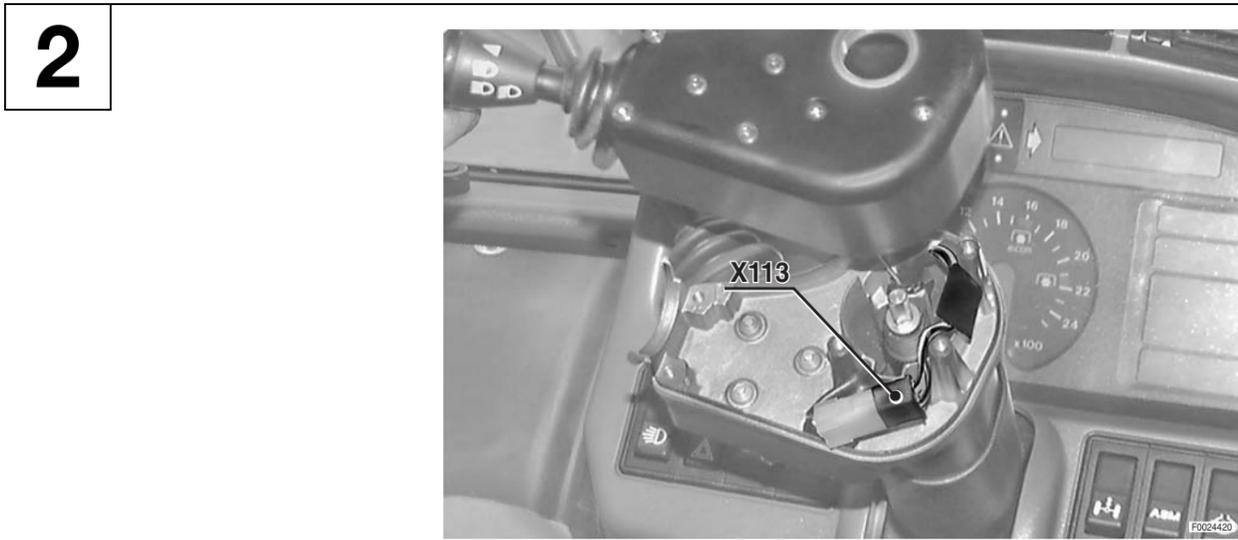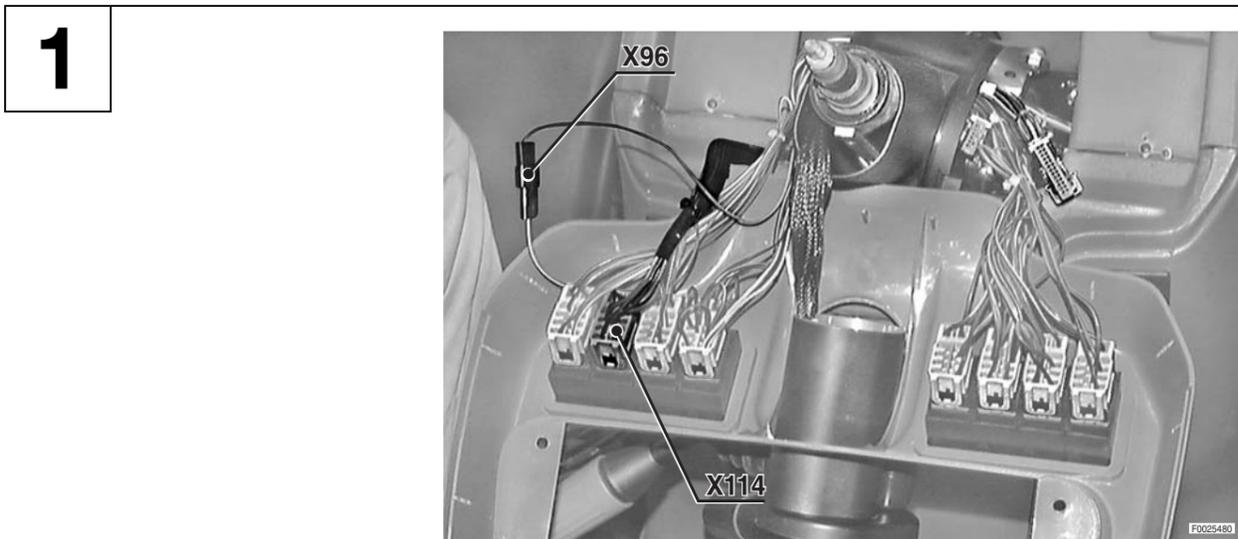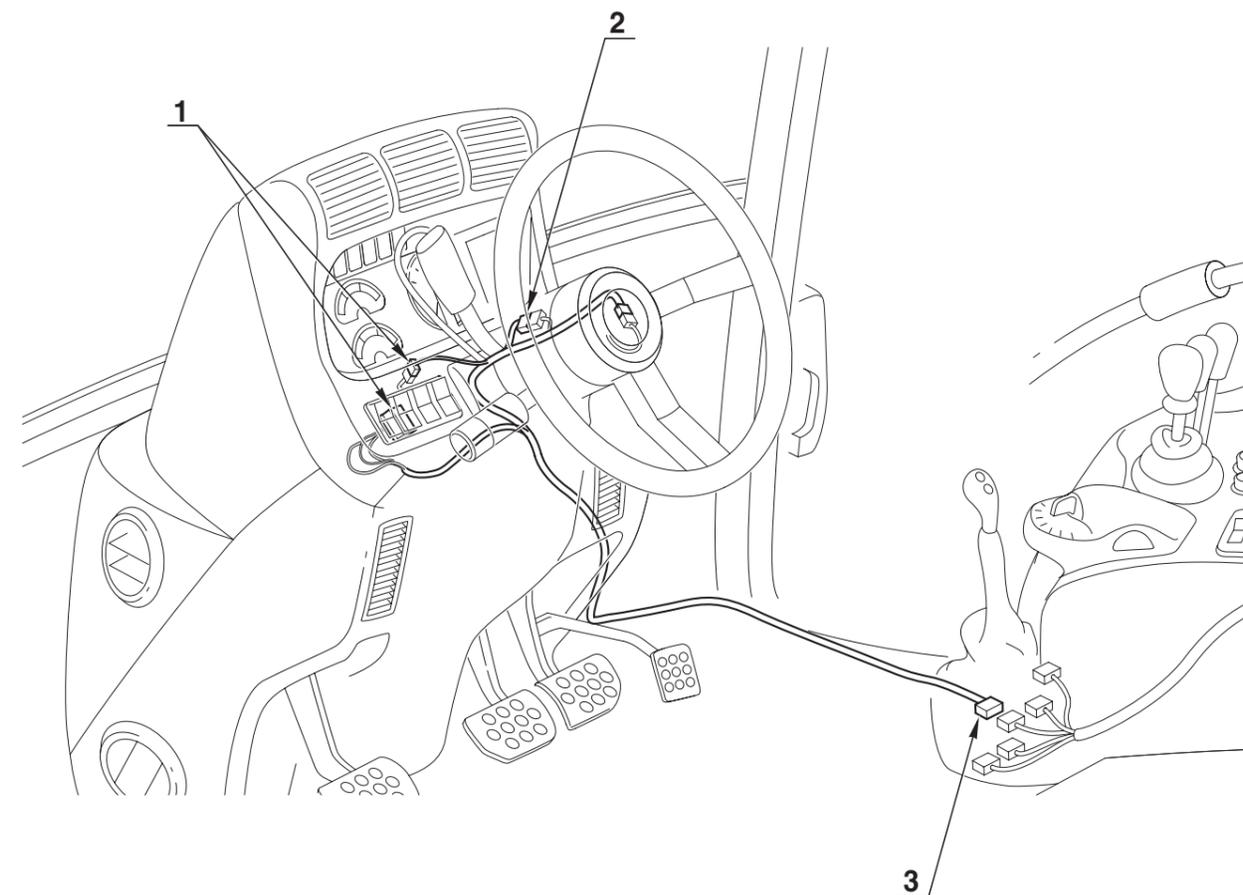PAGE INTENTIONALLY
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LIGHTS SELECTOR WIRING

AS4 To side console wiring
X96 To side console wiring
X113 Shuttle control lever
X114 Hazard warning lights switch

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CONNECTORS LOCATION

LIGHTS SELECTOR WIRING

1

2

3

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ARMREST WIRING

TABELLA COLORI / COLOURS TABLE			
M	Marrone/Brown	C	Arancio/Orange
V	Verde/Green	A	Azzurro/Blue
Z	Viola/Violet	B	Bianco/White
N	Nero/Black	L	Blu/Dark Blue
S	Rosa/Pink	G	Giallo/Yellow
R	Rosso/Red	H	Grigio/Gray

EHR To side console wiring
EMR To side console wiring
X41 Armrest
X42 To side console wiring
X43 To side console wiring

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CONTROL UNIT - FUSES - RELAYS (1/2)
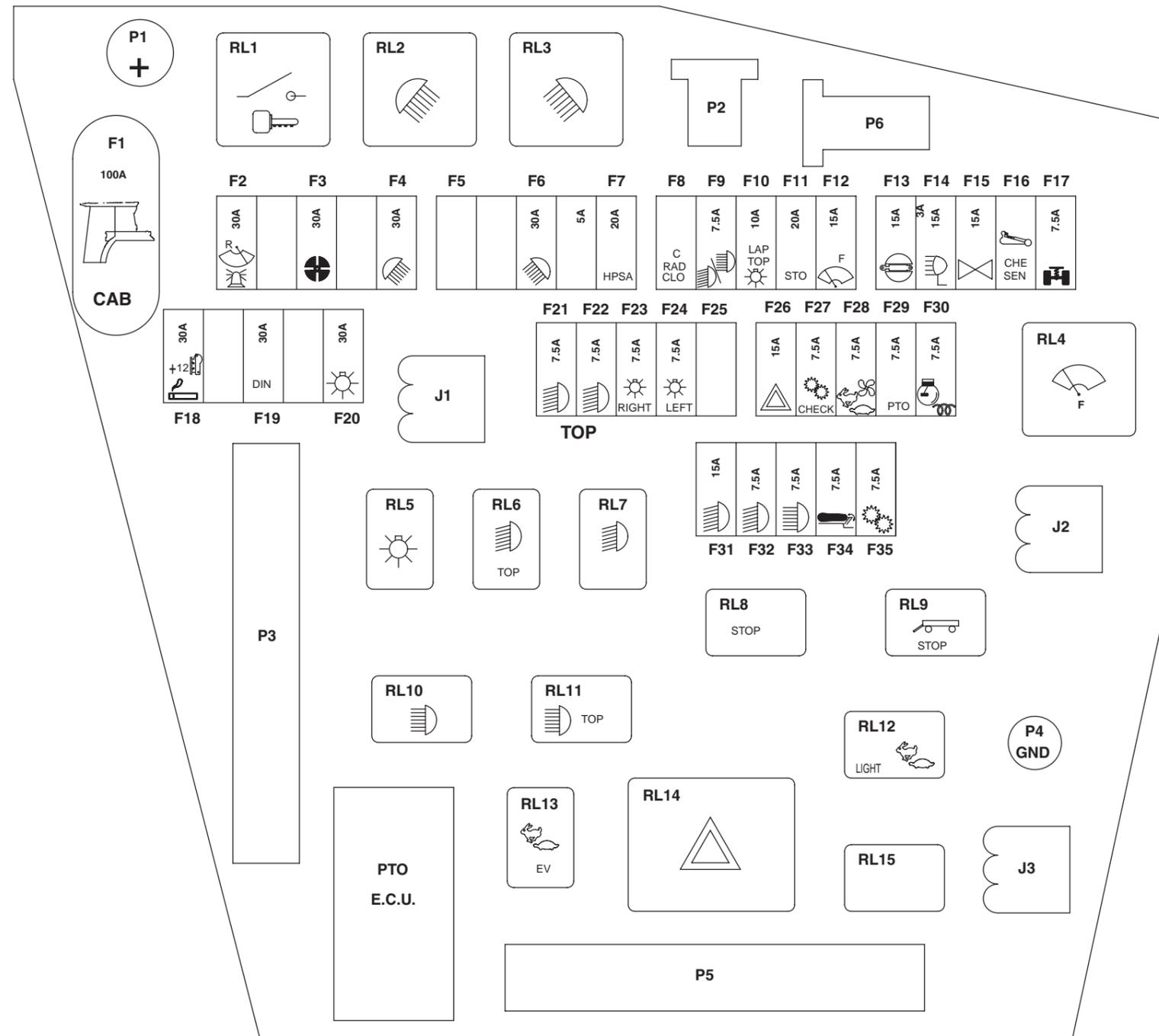
FUSES

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
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)	**RL9**	4WD solenoid valve (10A)
RL2	Rear worklights (40A)	**RL10**	High lights
RL3	Front worklights (40A)	**RL11**	High lights(10A)
RL4	Front screen wiper (10A)	**RL12**	Field/road indicator (10A)
RL5	Lights (10A)	**RL13**	4WD solenoid valve (10A)
RL6	Upper and lower lower beacon (10A)	**RL14**	Direction indicators - emergency lights (10A)
RL7	Lower beacon (10A)	**RL15**	High lights commutator (10A)
RL8	Stop lights - 4WD (10A)		

CONNECTORS

J1	To side console wiring	**P3**	To side console wiring
J2	To side console wiring	**P4**	To side console wiring
J3	To side console wiring	**P5**	To side console wiring
P1	To side console wiring	**P6**	To side console wiring
P2	To side console wiring		

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CONTROL UNIT - FUSES - RELAYS (2/2)