DEUTZ FAHR

SAME DEUTZ-FAHR Agrarsysteme GmbH

WORKSHOP MANUAL

AGROTRON TTV 1130
AGROTRON TTV 1145
AGROTRON TTV 1160

INTRODUCTION

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

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

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

SAFETY NOTES

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

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

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

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

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

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

GENERAL SAFETY RULES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

HOW THE MANUAL IS STRUCTURED

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

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

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

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

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

ATTENTION!

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

Engine DEUTZ 1012 - 1013	**0297 9771**	**Italian English French German**
Transmission ZF ECCOM 1.5	**–**	**–**
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.

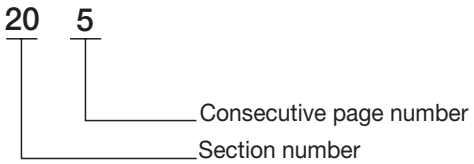
HOW TO USE AND UPDATE THE MANUAL

1. UPDATING THE MANUAL

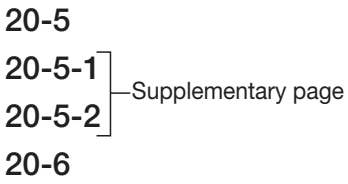
All additions, corrections or amendments to the manual will be sent to the Authorised Service Centres.
Before starting any repair or overhaul operations, check that you have the most recent updates as these may contain supplementary data not present in previous issues.

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:

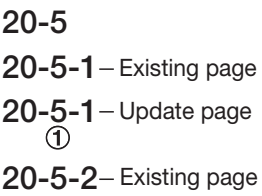


2 - **Supplementary pages:** indicated with a hyphen (-) and consecutive number after the page number. Example:



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

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

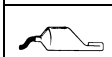


NOTE. All supplementary and updated pages are indicated in the manual page list; a revised page list is sent with each update and supersedes the previous list.

3. SYMBOLS USED IN THE MANUAL

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

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

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

SAFETY PRECAUTIONS FOR REMOVAL AND REFITTING OPERATIONS

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

1. Precautions for removal operations

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

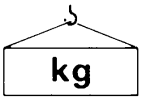
2. Precautions for refitting operations

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

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

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

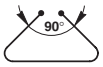
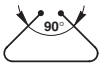
LIFTING INSTRUCTIONS



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

WIRE ROPES - SLINGS

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

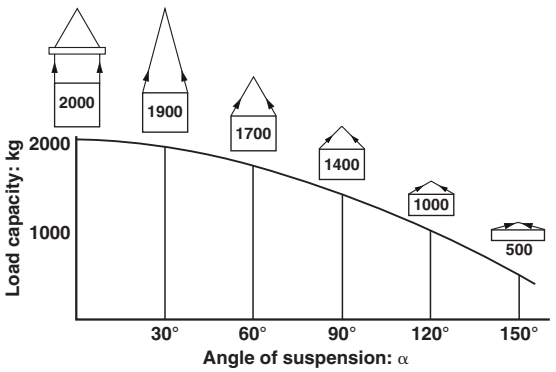
WIRE ROPES (standard twisted «S» or «Z» type)				POLYESTER SLINGS (eye-and-eye - simple loop)				
Ø rope mm	Capacity (kg)			Width (mm)	Capacity (kg)			
								
8	650	620	500	25	500	400	860	700
10	1000	1740	1420	50	1000	800	1730	1410
12	1450	2500	2050	62	1250	1000	2160	1760
14	2000	3460	2820	75	1400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

NOTE. Lifting capacities are calculated with a safety coefficient.

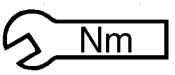
- The lifting hook should be attached to the central part of the rope or sling; if the hook is attached near the ends of the rope/sling, this could cause the load to slip during lifting.
- Never lift a heavy load using a single rope; always use two or more symmetrically arranged ropes.

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

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



STANDARD TIGHTENING TORQUES FOR NUTS AND BOLTS



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

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

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

THREADLOCKERS, ADHESIVES, SEALANTS AND LUBRICANTS

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

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

SPECIAL TOOLS

SYMBOL	CODE	DESCRIPTION	PAGES
T1	5.9030.480.0	High pressure seal replacer	30-80; 30-81
T2	5.9030.743.1	Multimeter sensor test adapter	30-108
T3	5.9030.839.0	PTO lifting tool	30-206
T4	5.9030.859.0	Special wrench for removal/refitment of brake damper	30-210
T5	5.9030.840.0	Shaft restrainer for fitment-removal of lock nut	30-211
T6	5.9030.882.0	Dummy gear	30-247
T7	5.9030.841.0	Adapter for removal-refitment of pinion lock nut	30-262; 30-265
T8	5.9030.842.0	Pinionshaft bearing remover	30-262; 30-264
T9	5.9030.740.0	SERDIA installation disk	20-4
T10	5.9030.741.0	Adapter cable	
T11	5.9030.740.2	Level III interface	

CONVERSION FACTORS

CONVERSION FROM BRITISH TO METRIC UNITS

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

CONVERSION FROM METRIC TO BRITISH UNITS

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

Example:

42 mm →???? inch

42x0.0394= 1.6548 inch

42 inch →???? mm

42x25.4=1066.8 mm

SECTION 10

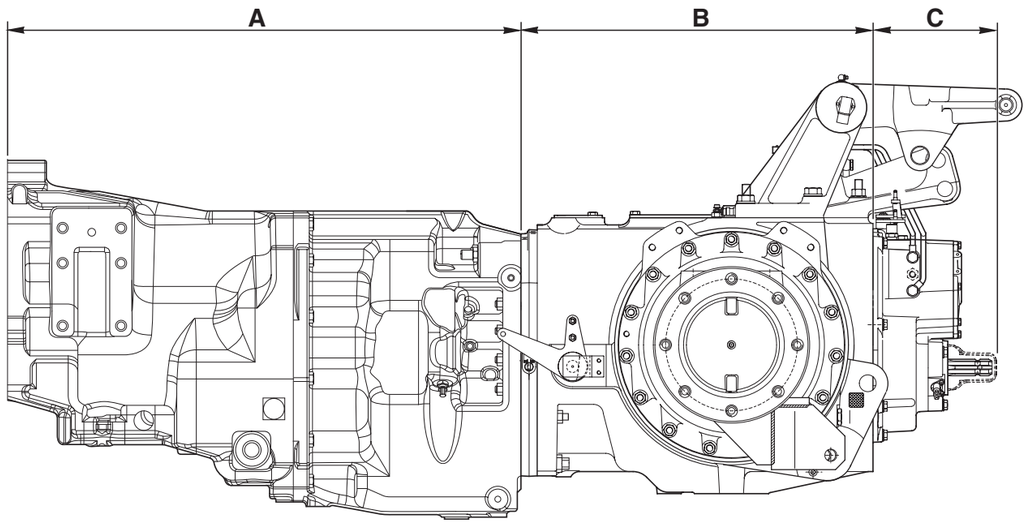
CONTENTS

1. TRANSMISSION

INTRODUCTION

- Machines of the AGROTON TTV series are supplied to the customer with a POWER SPLIT continuously variable hydrostatic/mechanical transmission.
  The main feature of this transmission is its capacity to monitor and control the ground speed of the tractor from 0 to 50 km/h in response to the demands of the operator and to the draft force acting on the machine.
  The transmission management system is fully automatic and governed by an electronic control unit.

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



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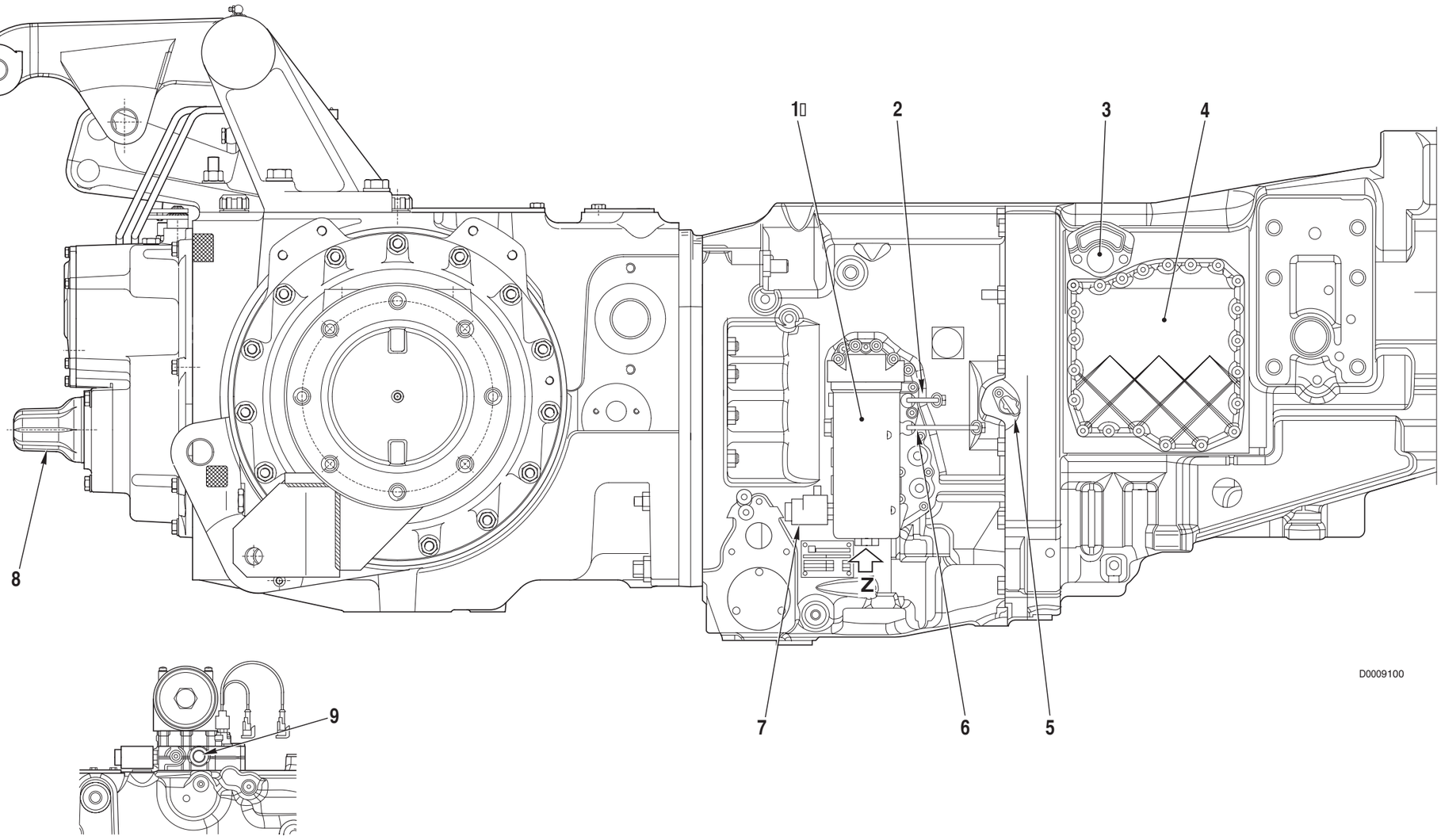
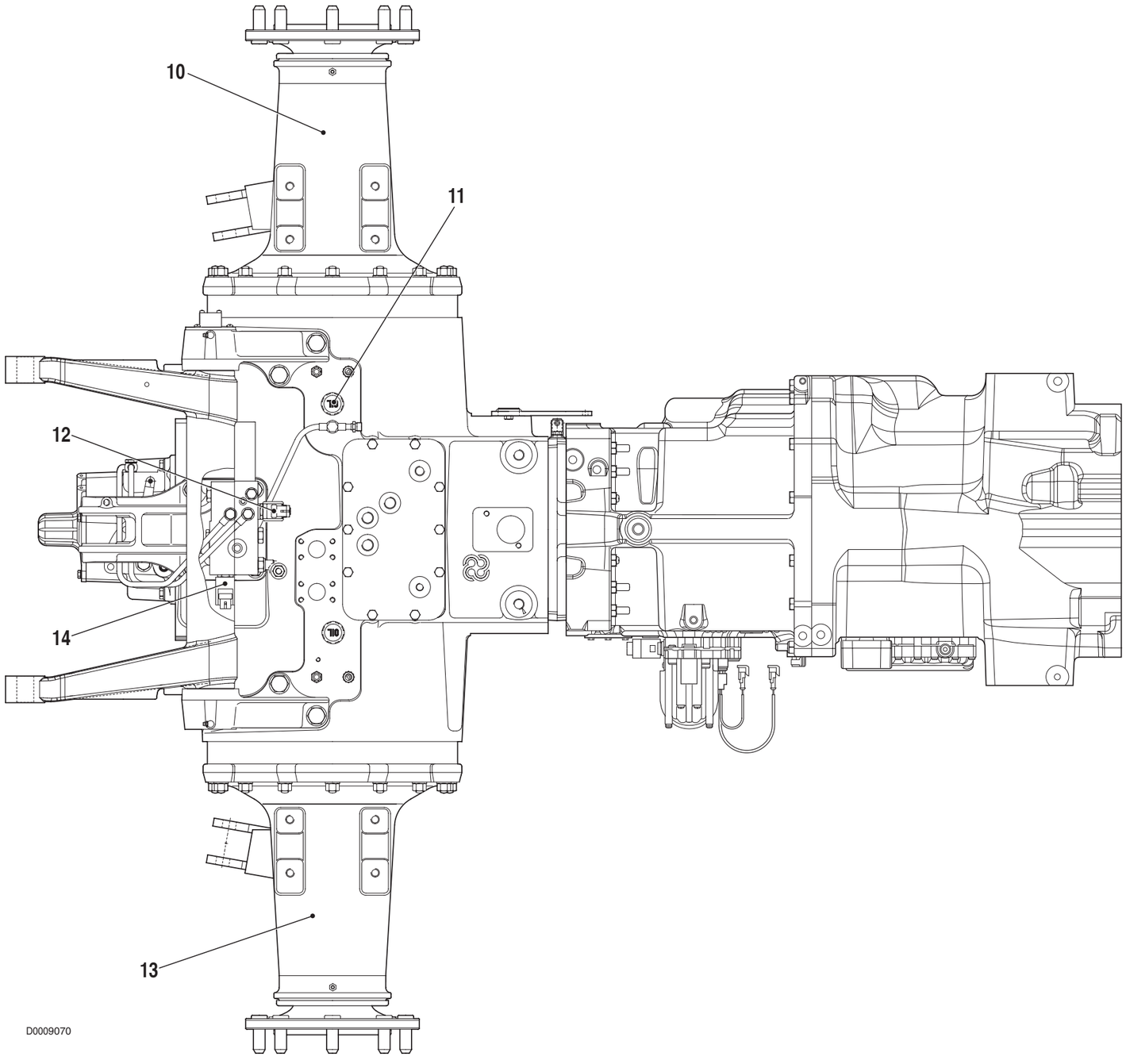
1.1 TRANSMISSION

1.1.1 MAIN COMPONENTS

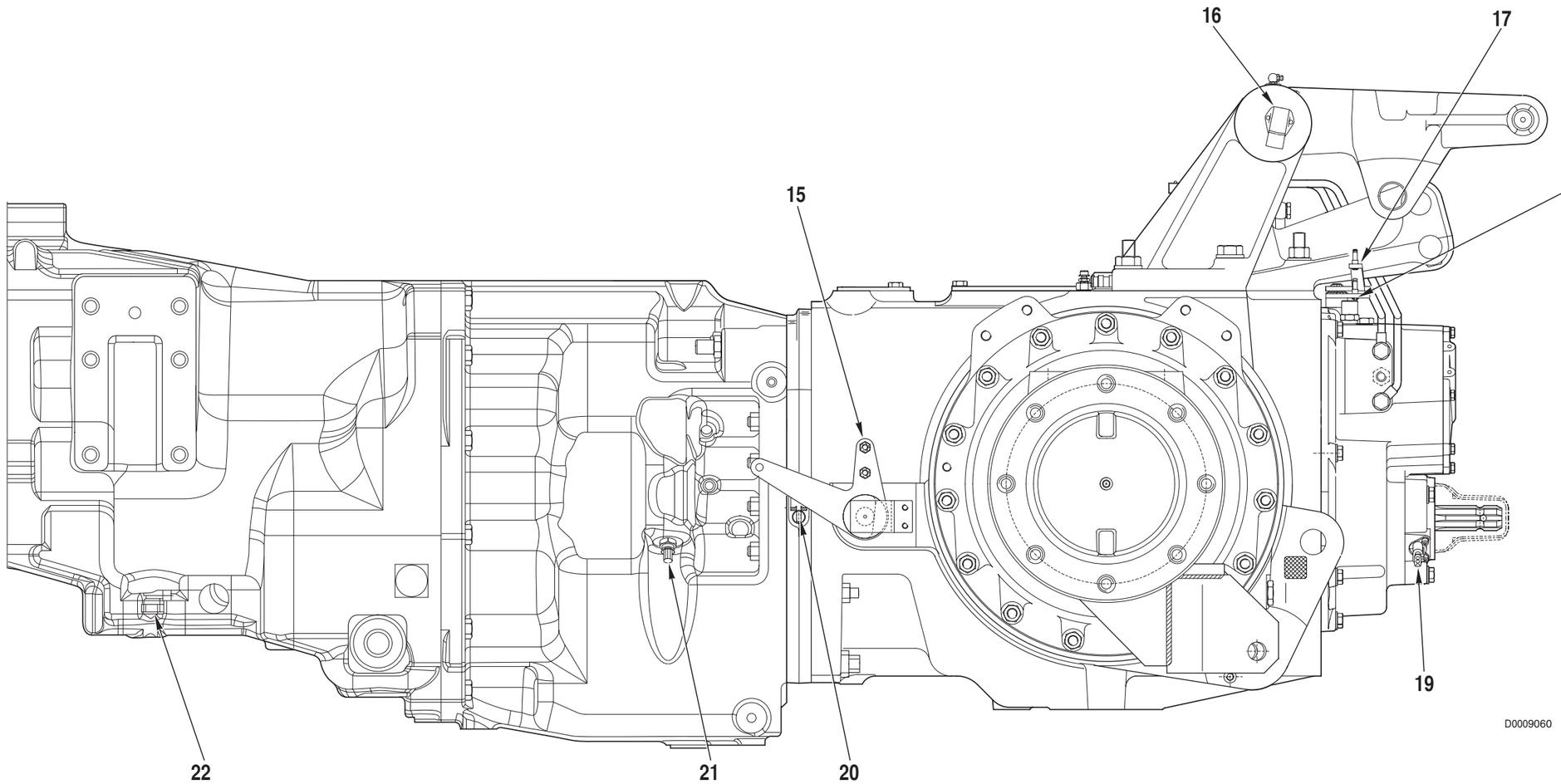


View Z

1. Transmission oil filter
2. Transmission oil filter clogging sensor
3. Main transmission connector (SV ASSEMBLY)
4. Hydraulic shift directional control valve
5. Odometer speed sensor (nAb)
6. Transmission oil low pressure sensor
7. Four-wheel drive clutch solenoid valve
8. Rear power take-off
9. Power beyond pressure port for PTO and differential lock control valve



10. L.H. trumpet housing
11. Oil filler
12. Rear PTO clutch solenoid valve
13. R.H. trumpet housing
14. Differential lock actuator solenoid valve

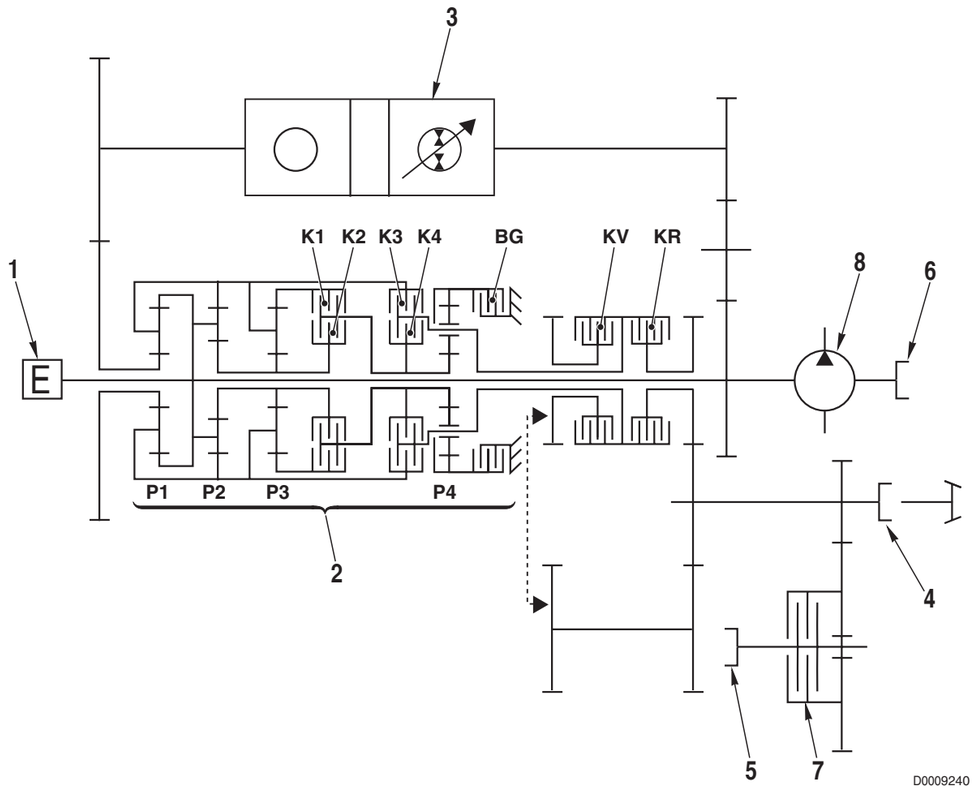


15. Parking brake linkage lever
16. Lift position sensor
17. PTO mode selection lever (ECO - Standard)
18. PTO speed selection lever (540 - 1000 rev/min)
19. Rear PTO speed sensor
20. Transmission lock shaft
21. Crankshaft speed sensor (nMotor)
22. Hydrostatic drive speed and direction of rotation sensor (nHyd)

1.1.2 GEARBOX

DESCRIPTION

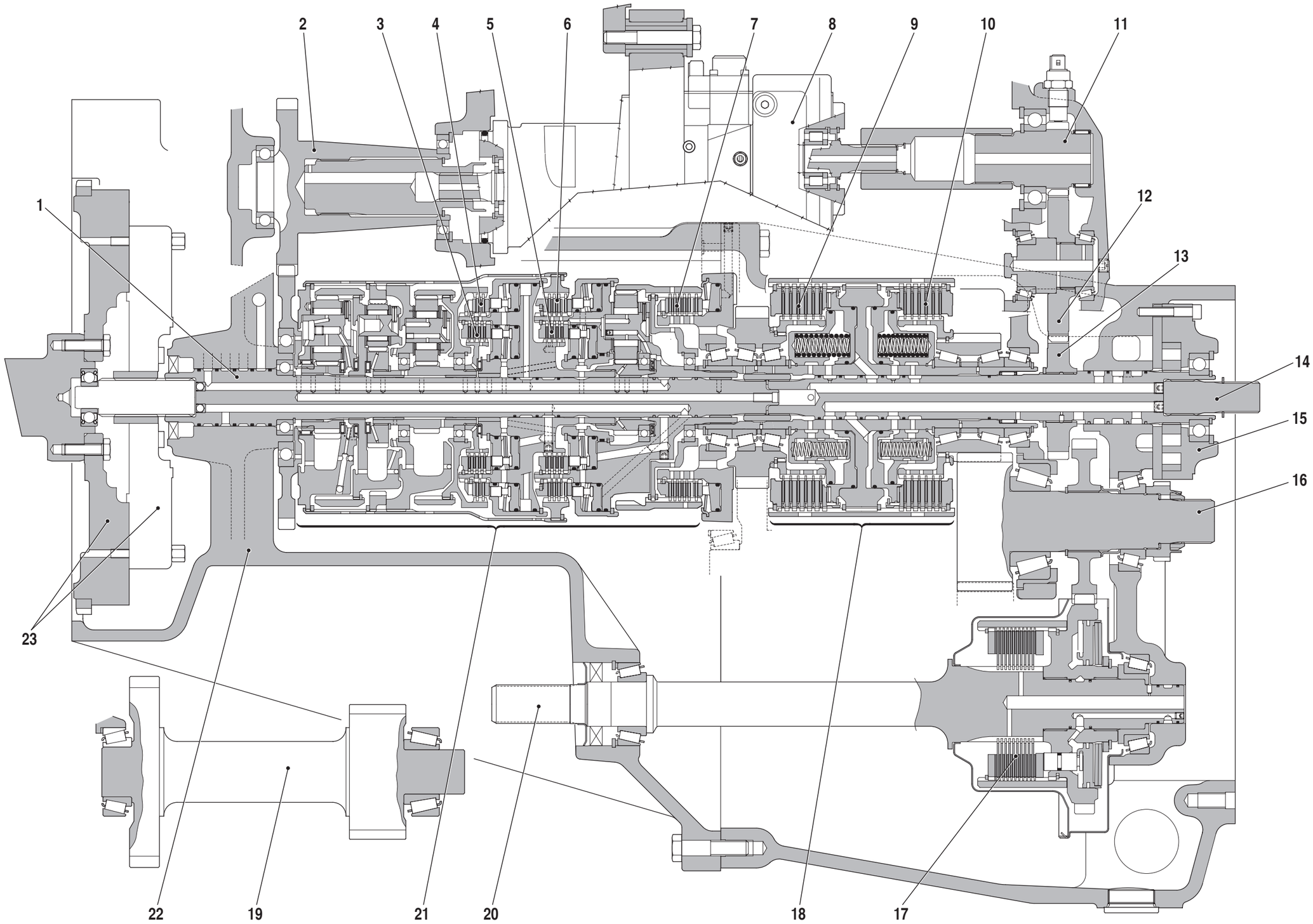
- The POWER SPLIT gearbox is coupled to the engine (1) and transmits rotation from the crankshaft through four epicyclic trains (2) and the hydrostatic drive (3) to the rear axle bevel pinion (4), and by way of a first power take-off (5) to the front axle.
  A second power take-off (6) transmits drive to the rear PTO and to two pumps serving the power steering system and the auxiliary hydraulic services.



COMPONENTS

1. Engine
2. Epicyclic gears
3. Hydrostatic drive
4. Pinion
5. Power take-off to front axle
6. Power take-off to hydraulic pumps and rear PTO
7. 4WD clutch
8. Transmission oil pump

GEARBOX COMPONENTS



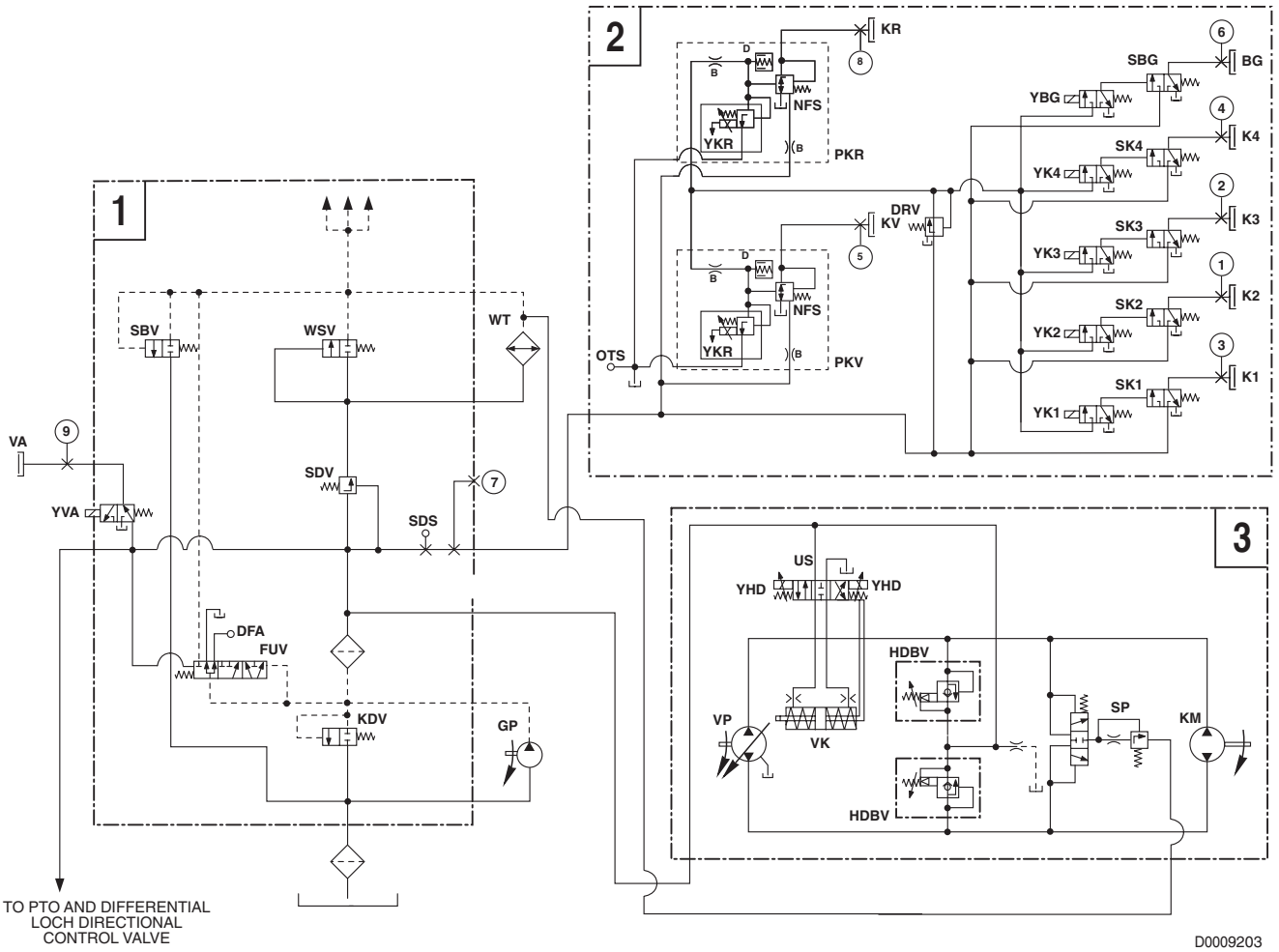
1. Input shaft
2. Output shaft, hydrostatic drive
3. Clutch **K2**
4. Clutch **K1**
5. Clutch **K3**
6. Clutch **K4**
7. Clutch **BG**
8. Hydrostatic drive
9. Clutch **KV**
10. Clutch **KR**
11. Input shaft, hydrostatic drive
12. Idle gear
13. Driving gear, hydrostatic drive
14. Drive shaft, rear PTO and hydraulic pumps
15. Transmission oil pump
16. Gearbox output shaft
17. 4WD clutch
18. Shuttle assembly
19. Intermediate shaft
20. Front axle power take-off
21. Epicyclic gears
22. Transmission housing
23. Flywheel and damper

1.1.3 TRANSMISSION HYDRAULIC SYSTEM

The transmission is equipped with a hydraulic system served by a gear pump driven directly from the transmission input shaft. The transmission hydraulic system is made up of three main components:

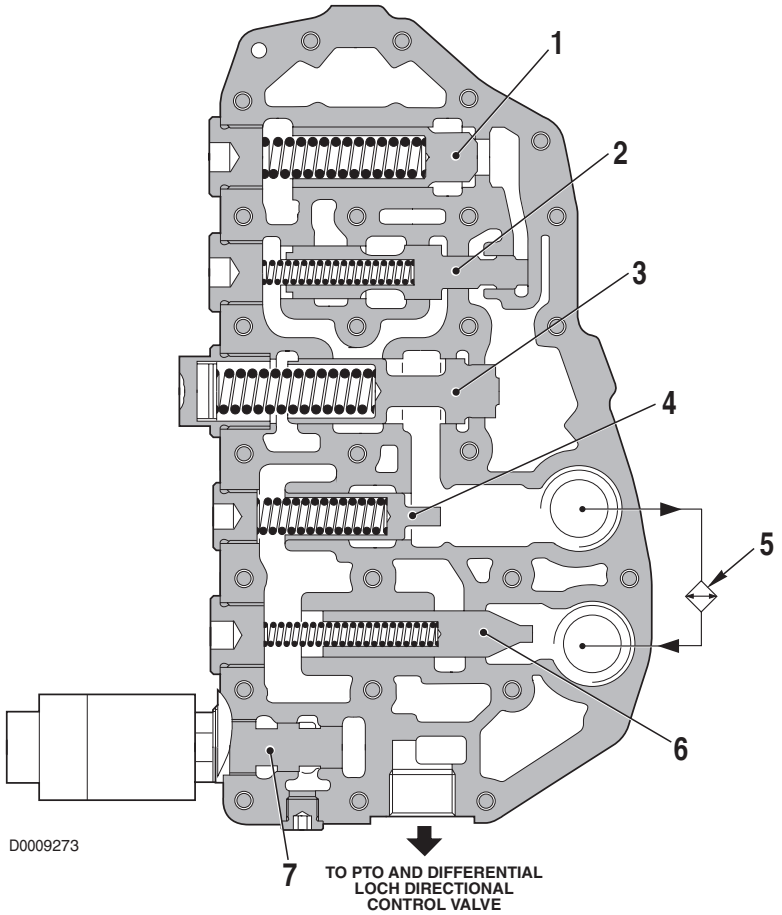
- pressure control unit (1);
- directional control valve operating powershift clutches (2);
- hydrostatic drive (3).

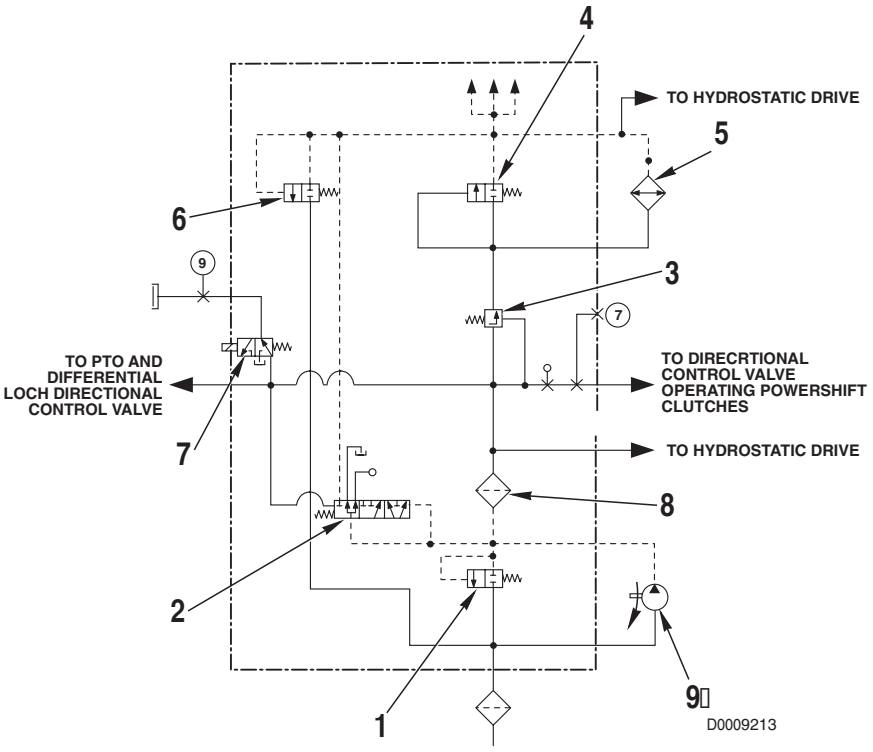
This hydraulic system also supplies oil under pressure to the directional control valve operating the PTO and differential lock.



PRESSURE CONTROL UNIT

- The pressure control unit receives oil from the transmission pump and directs it to the hydraulic components at the required pressure.



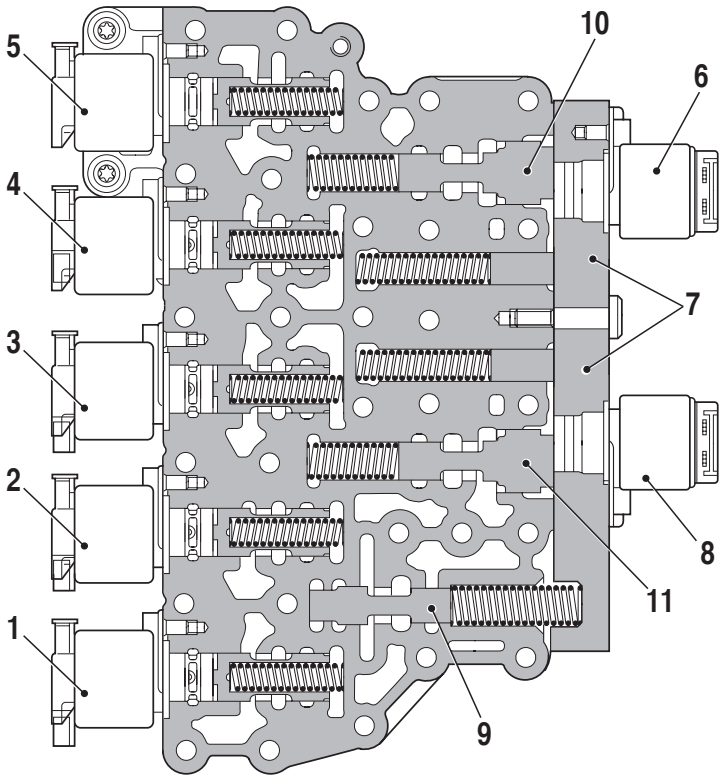


COMPONENTS

1. Cold start safety valve
2. Pressurized filter by-pass valve
3. System pressure control valve
4. Cooler by-pass valve
5. Cooler
6. Lube pressure control valve
7. 4WD solenoid valve
8. Pressurized filter
9. Transmission pump

POWERSHIFT DIRECTIONAL CONTROL VALVE

- The function of this directional control valve is to engage the different powershift clutches when selected by the operator.
  The clutches are engaged in two ways:
  - direct (clutches BG, K1, K2, K3, K4);
  - proportional (clutches KV, KR).



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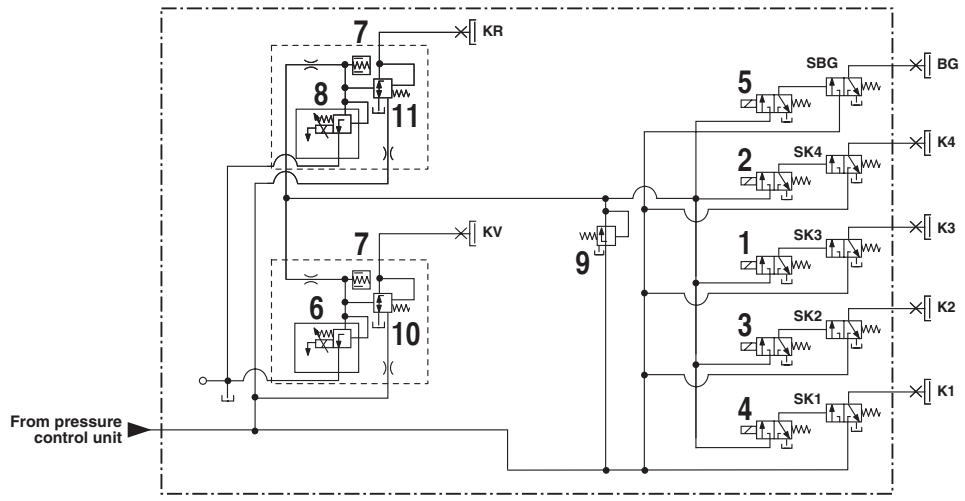

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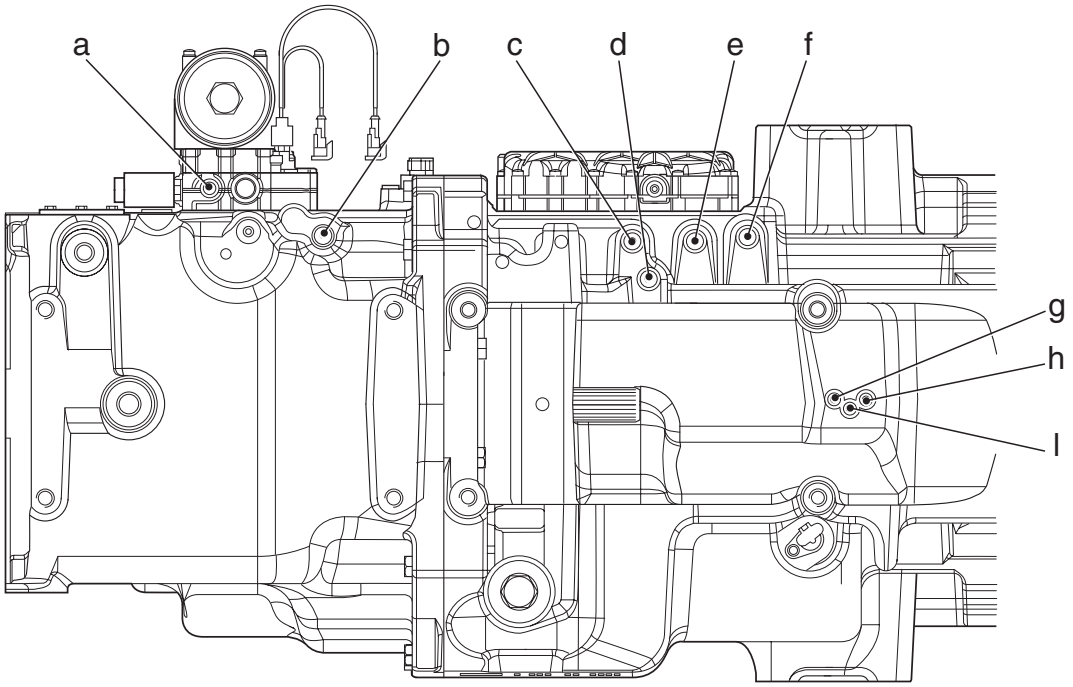
COMPONENTS

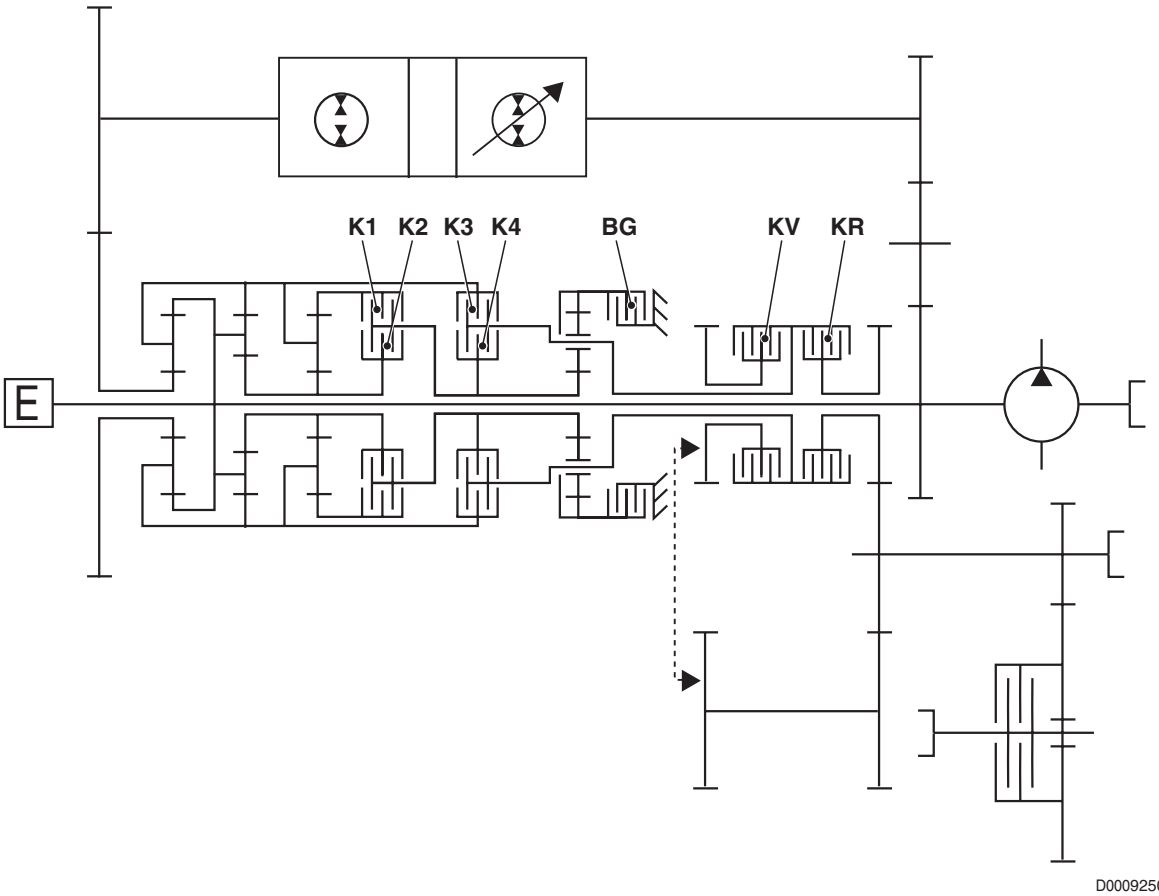
1. Solenoid valve, clutch K3
2. Solenoid valve, clutch K4
3. Solenoid valve, clutch K2
4. Solenoid valve, clutch K1
5. Solenoid valve, clutch BG
6. Proportional solenoid valve, clutch KV
7. Damper pilot valve
8. Proportional solenoid valve, clutch KR
9. Pressure reducing valve
10. Control valve, clutch KV
11. Control valve, clutch KR

PRESSURE TEST POINTS



Ref	Function	Thread
a.	Pressure, clutch **VA**	M10x1
b.	Pressure, clutch **BG**	M14x1.5
c.	Pressure, clutch **KR**	M14x1.5
d.	System pressure	M14x1.5
e.	Pressure, clutch **KV**	M14x1.5
f.	Pressure, clutch **K4**	M14x1.5
g.	Pressure, clutch **K1**	M10x1
h.	Pressure, clutch **K2**	M10x1
l.	Pressure, clutch **K3**	M10x1

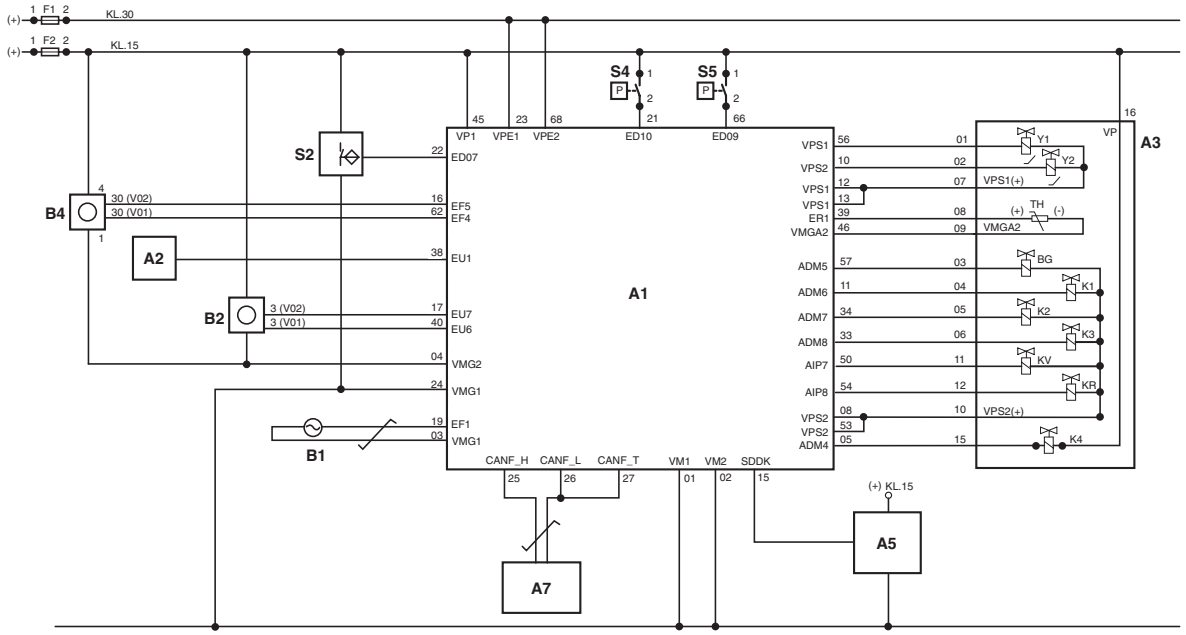
1.1.4 POWERSHIFT CLUTCH ENGAGEMENT AND SOLENOID VALVE OPERATION



ENGAGEMENT OF CLUTCHES

	Speed	K1	K2	K3	K4	BG	KV	KR
Forward	I	●				●	●	
	II		●			●	●	
	III		●	●			●	
	IV		●		●		●	
Reverse	I	●				●		●
	II		●			●		●
	III		●	●				●
	IV		●		●			●

1.1.5 TRANSMISSION ELECTRONIC SYSTEM



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COMPONENTS

A1 EST-39 electronic control unit
A2 HPSA control unit
A3 Main transmission valve assembly
A5 Diagnostics
A7 CAN interface
B1 Crankshaft speed sensor (nMot)
B2 Hydrostatic drive output speed sensor (nHyd)
B4 Transmission output speed and direction of rotation sensor
B7 Transmission oil temperature sensor
F1 Fuse 8A
F2 Fuse 8A
S2 Clutch proximity switch
S4 Pressurized filter clogging sensor
S5 Transmission oil low pressure sensor

1.2 REAR AXLE

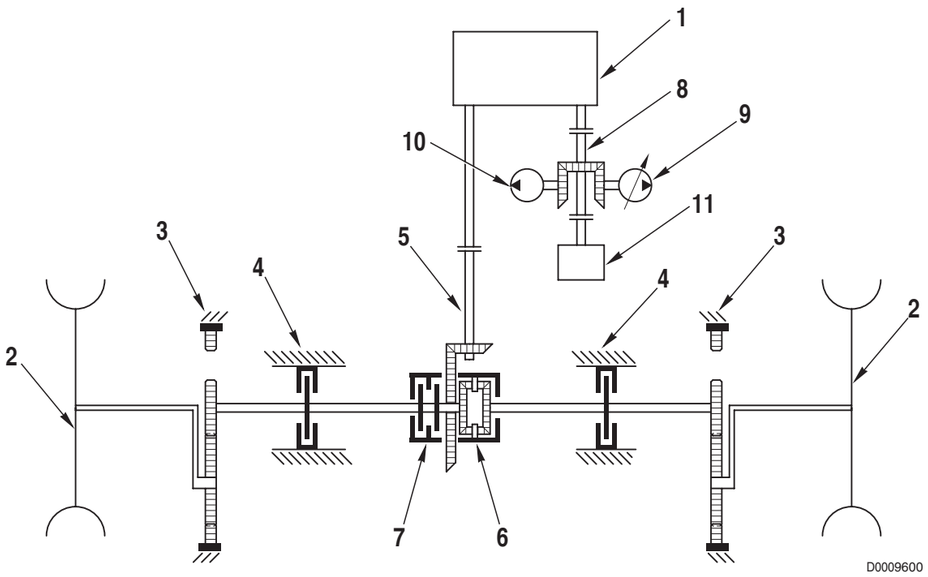
DESCRIPTION

The rear axle is coupled to the transmission (1), from which rotation is transmitted through the crown wheel and pinion (5), differential (6) and epicyclic final drives (3) to the rear wheels (2).

The rear axle is equipped with an electrohydraulically operated differential lock (7) and two hydraulically operated brake assemblies (4).

Also associated with the rear axle are two power take-offs coupled to a second shaft (8) and driving two hydraulic pumps (9) and (10).

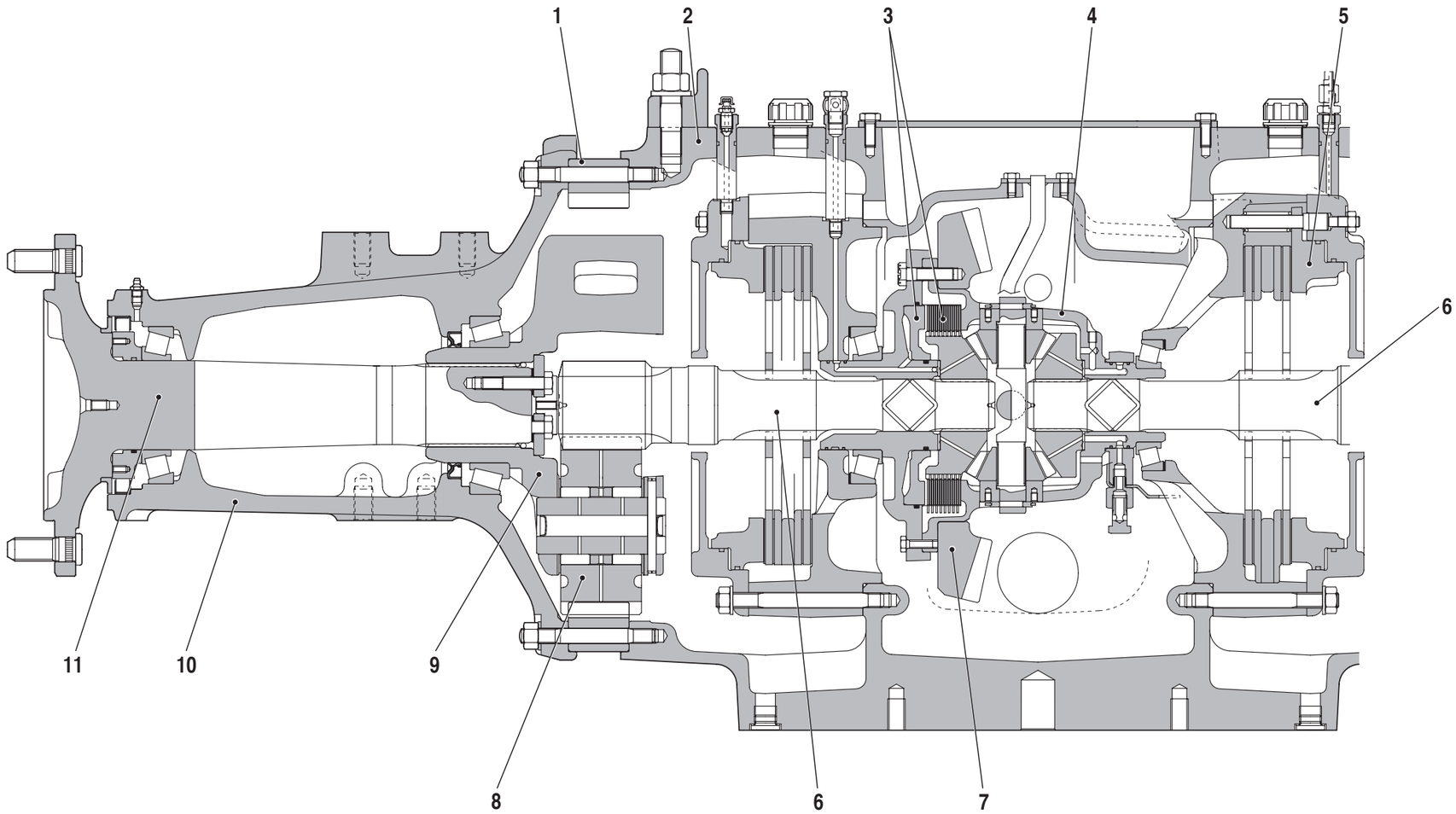
This same shaft (8) also drives the rear PTO (11).



COMPONENTS

1. Transmission
2. Wheels
3. Epicyclic final drive
4. Brake assembly
5. Pinion
6. Differential
7. Differential lock
8. Shaft driving power take-offs
9. Variable displacement hydraulic pump
10. Hydraulic gear pump
11. Rear PTO

COMPONENTS



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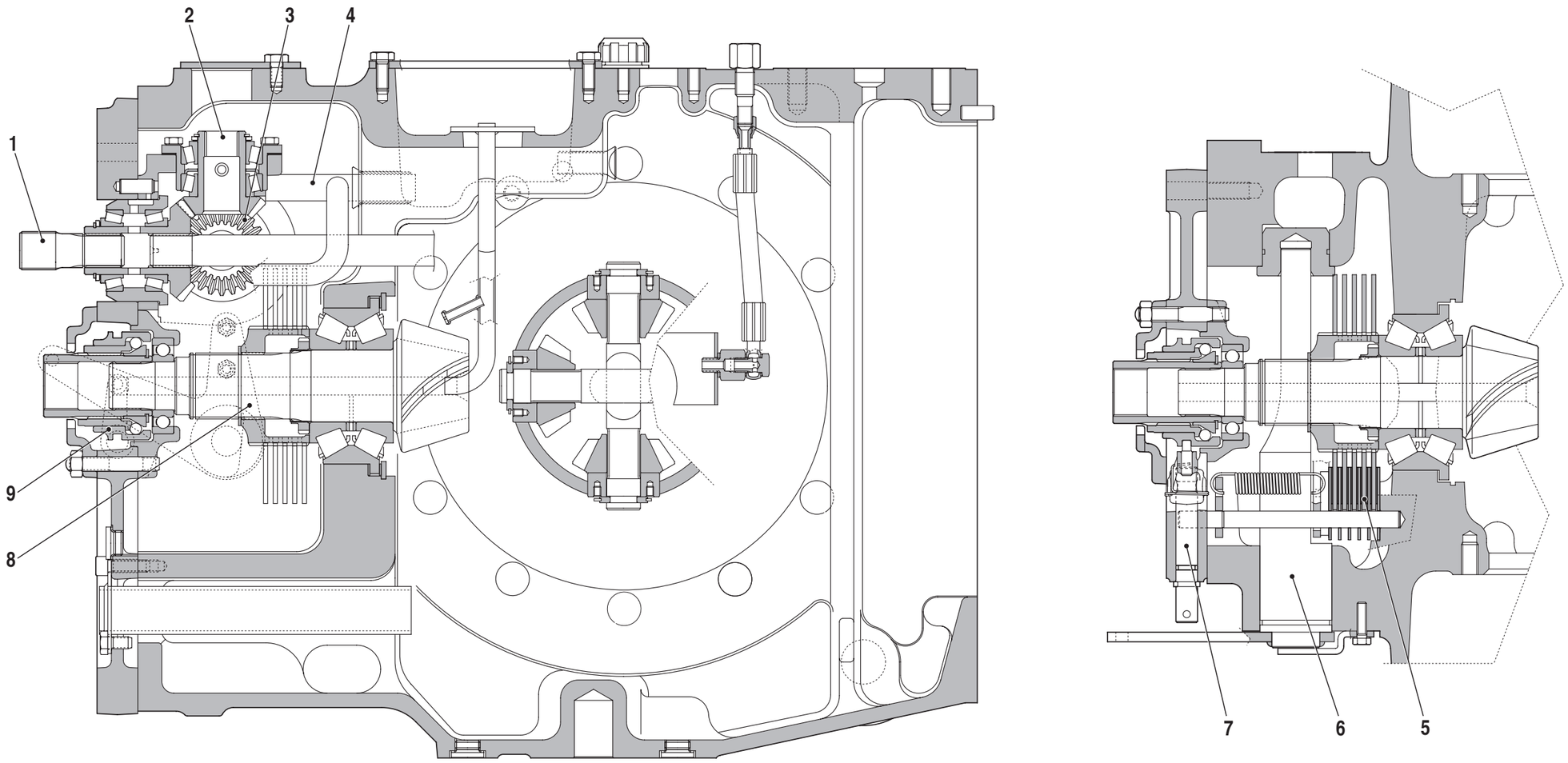
1. Ring gear
2. Main axle housing
3. Differential lock
4. Differential
5. Brake assembly
6. Half-shaft
7. Crown wheel
8. Planet gear
9. Planet carrier
10. Trumpet housing
11. Hub

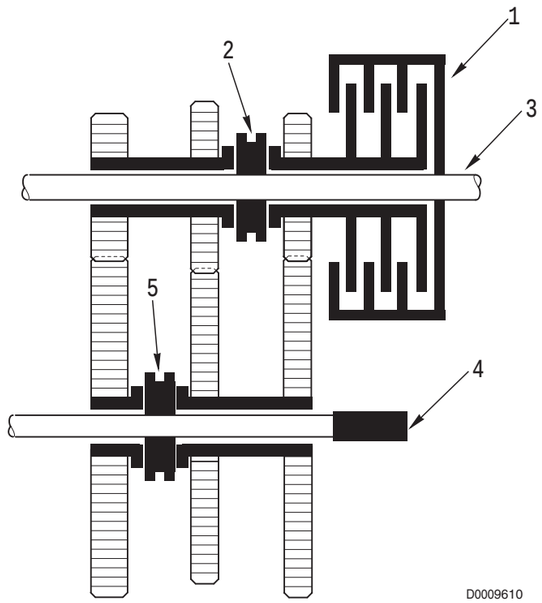


1. Pump power take-offs and rear PTO drive shaft
2. Drive gear, steering pump
3. Drive gear, auxiliary services pump
4. Rear PTO drive shaft
5. Parking brake discs
6. Parking brake cam shaft
7. Transmission lock shaft
8. Pinion
9. Transmission lock

1.3 REAR PTO

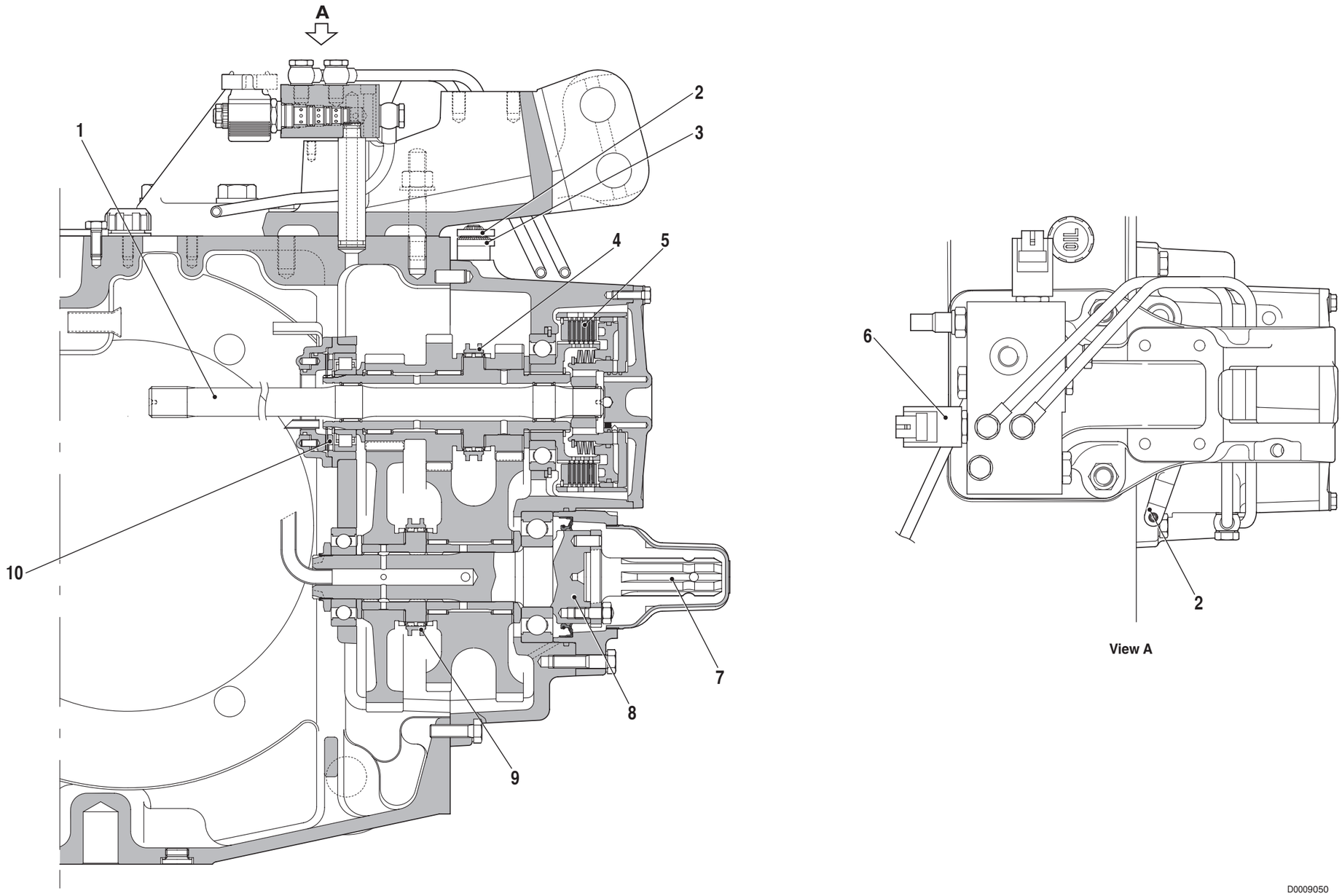
DESCRIPTION

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 4-speed gearbox with manual speed selection.
The PTO is engaged by way of an electro-hydraulically controlled clutch.



1. Clutch
2. Synchronizer 1
3. PTO input shaft
4. PTO output shaft
5. Synchronizer 2

COMPONENTS



1. PTO input shaft
2. ECO/STD mode selector lever
3. 540/1000 selector lever
4. ECO/STD mode synchronizer
5. PTO clutch
6. PTO brake solenoid valve
7. Rear power take-off
8. PTO output shaft
9. 540/1000 synchronizer
10. PTO brake

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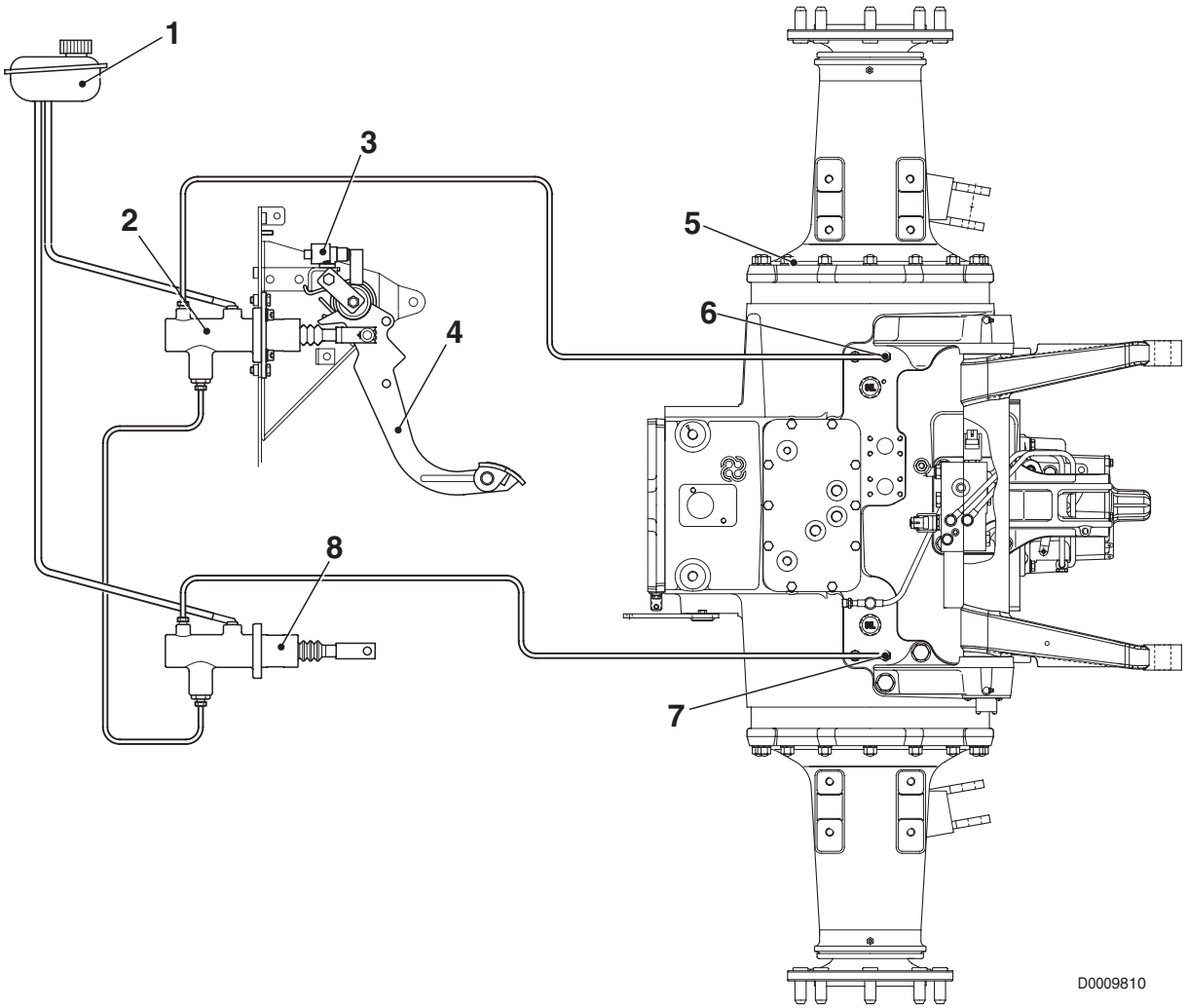
2. BRAKING SYSTEM

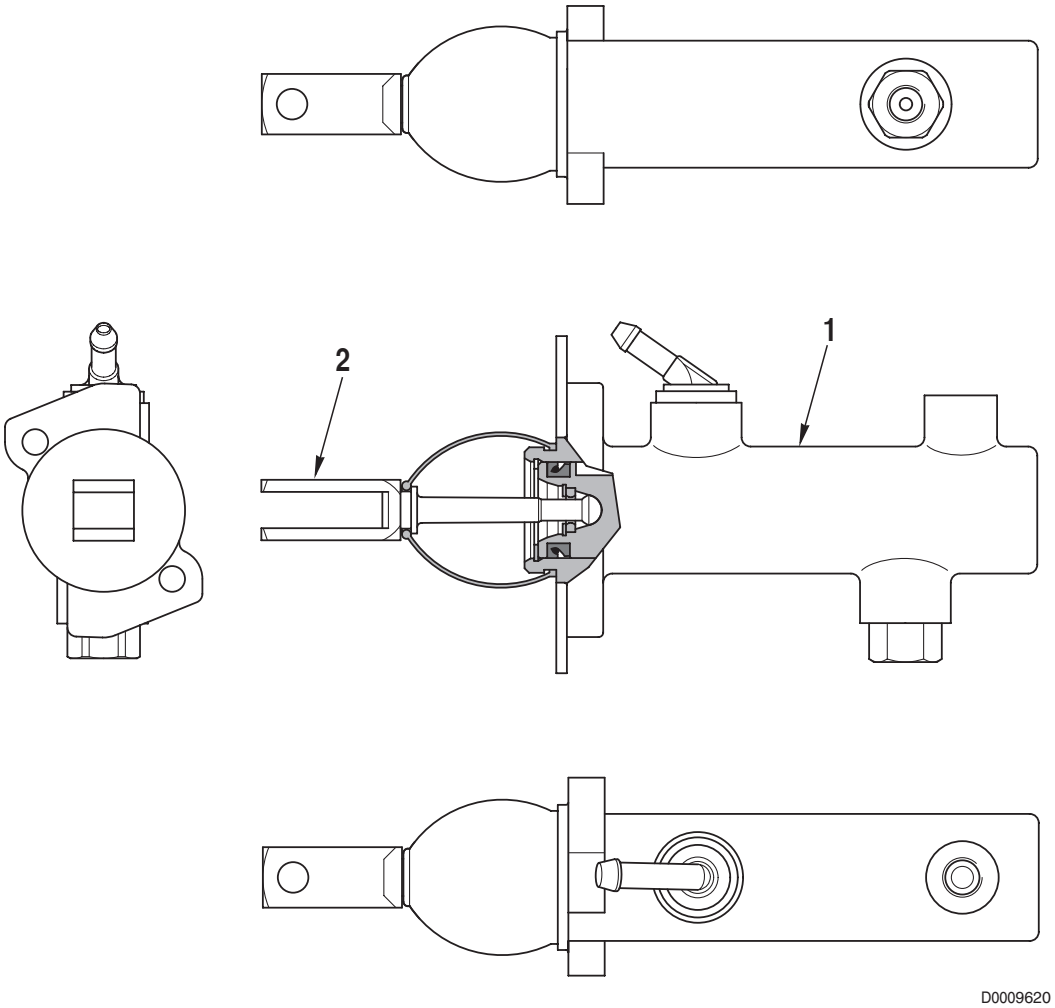
DESCRIPTION

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



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

2.1 BRAKE MASTER CYLINDER



1. Barrel
2. Push-rod

TECHNICAL DATA

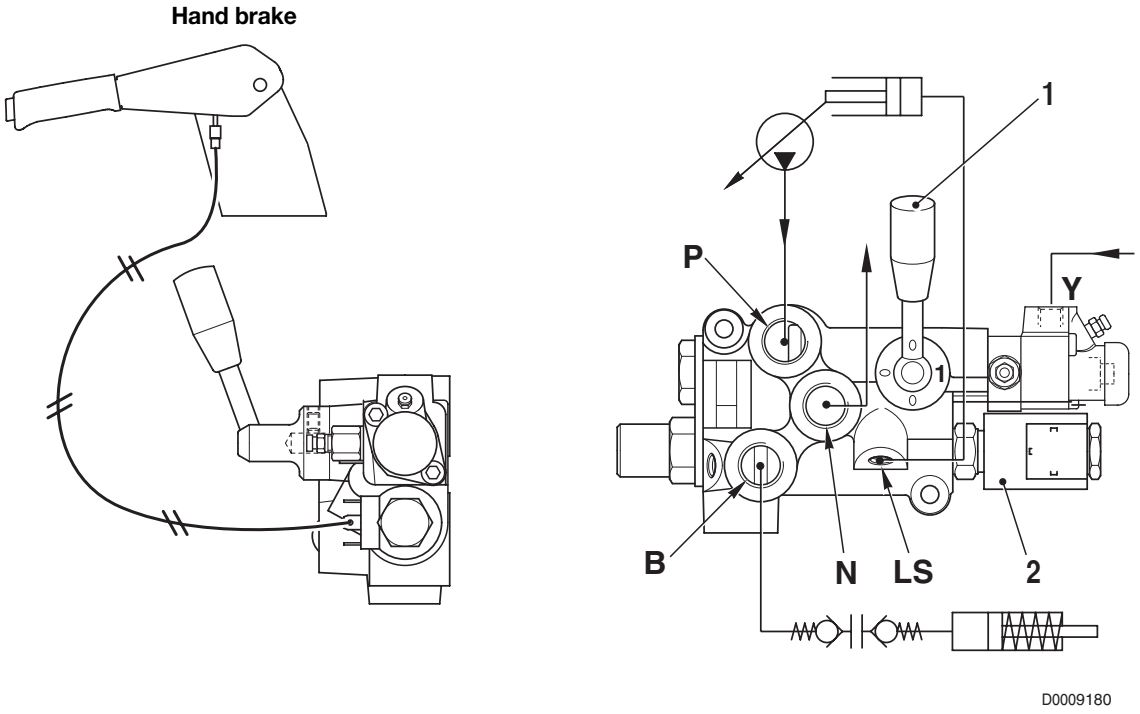
Piston diameter: 31.75 mm (1.251 in.)
Piston stroke: 36 mm (1.418 in.)
Maximum operating pressure: 150 bar (2175 psi)

2.2 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)

2.2.1 HYDRAULIC TRAILER BRAKING (ITALY VERSION)

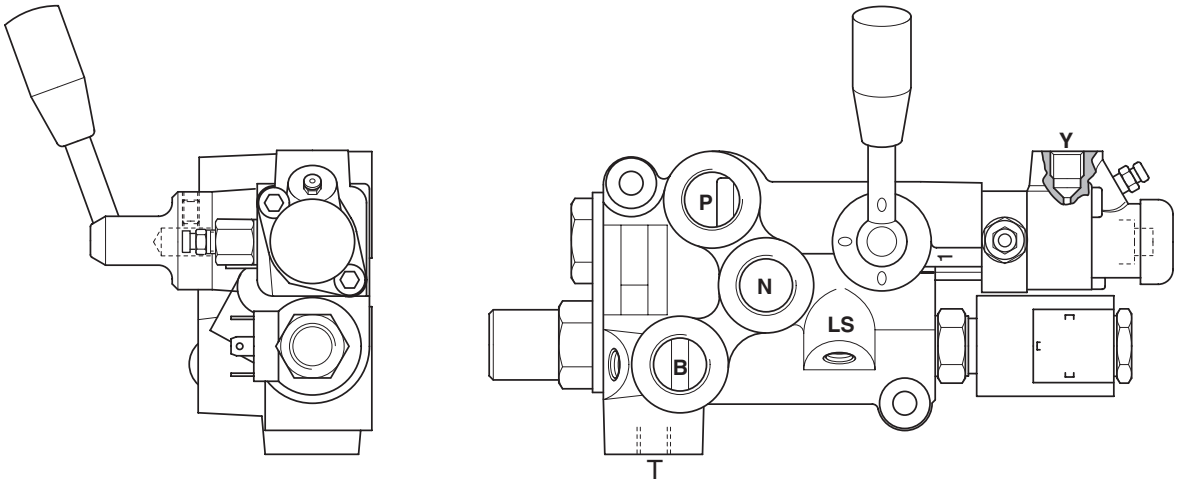


1. Valve activation lever in position "1"

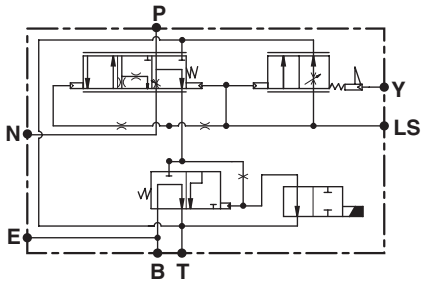
- When the lever (1) is in position "1" (valve activated) and the brake pedals are not pressed, a pressure of 12.5 bar (181.3 psi) is available at port **B**.
- This pressure is supplied constantly to the trailer to release the parking brake.
- When the operator engages the parking brake, the solenoid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

2. Valve activation lever in position "O"

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



HYDRAULIC DIAGRAM



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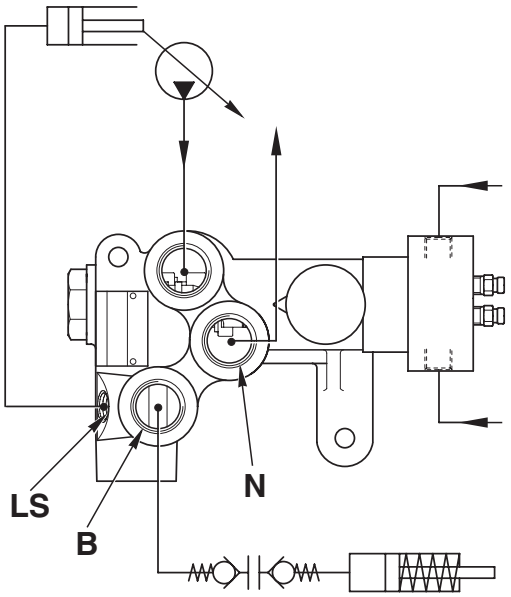
FUNCTION

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

TECHNICAL DATA

- Maximum pressure at port N:
  210 bar (3046 psi)
- Minimum constant pressure at port B:
  12.5±2 bar (181.3±29 psi)
- Maximum pressure at port B:
  135 º 5 bar (1957.5 º 72.5 psi)
- Feed flow rate:
  20–80 ℓ/min (5.3 – 21.14 US.gpm)

2.2.2 HYDRAULIC TRAILER BRAKING (EXPORT VERSION)



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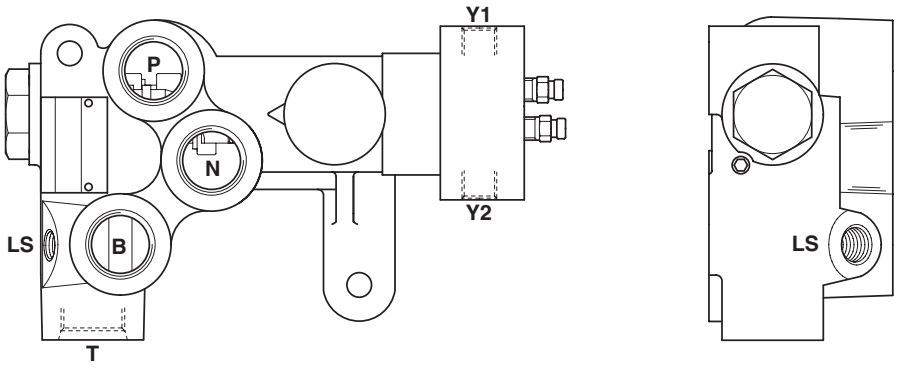
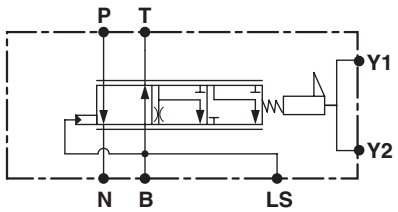
- When the brakes are not operated the pressure at port **B** is null.
- When the operator applies the tractor brakes, the pressure in the circuit pilots the braking valve and the pressure at port **B** increases proportionally to the pressure in the tractor braking circuit.



HYDRAULIC DIAGRAM



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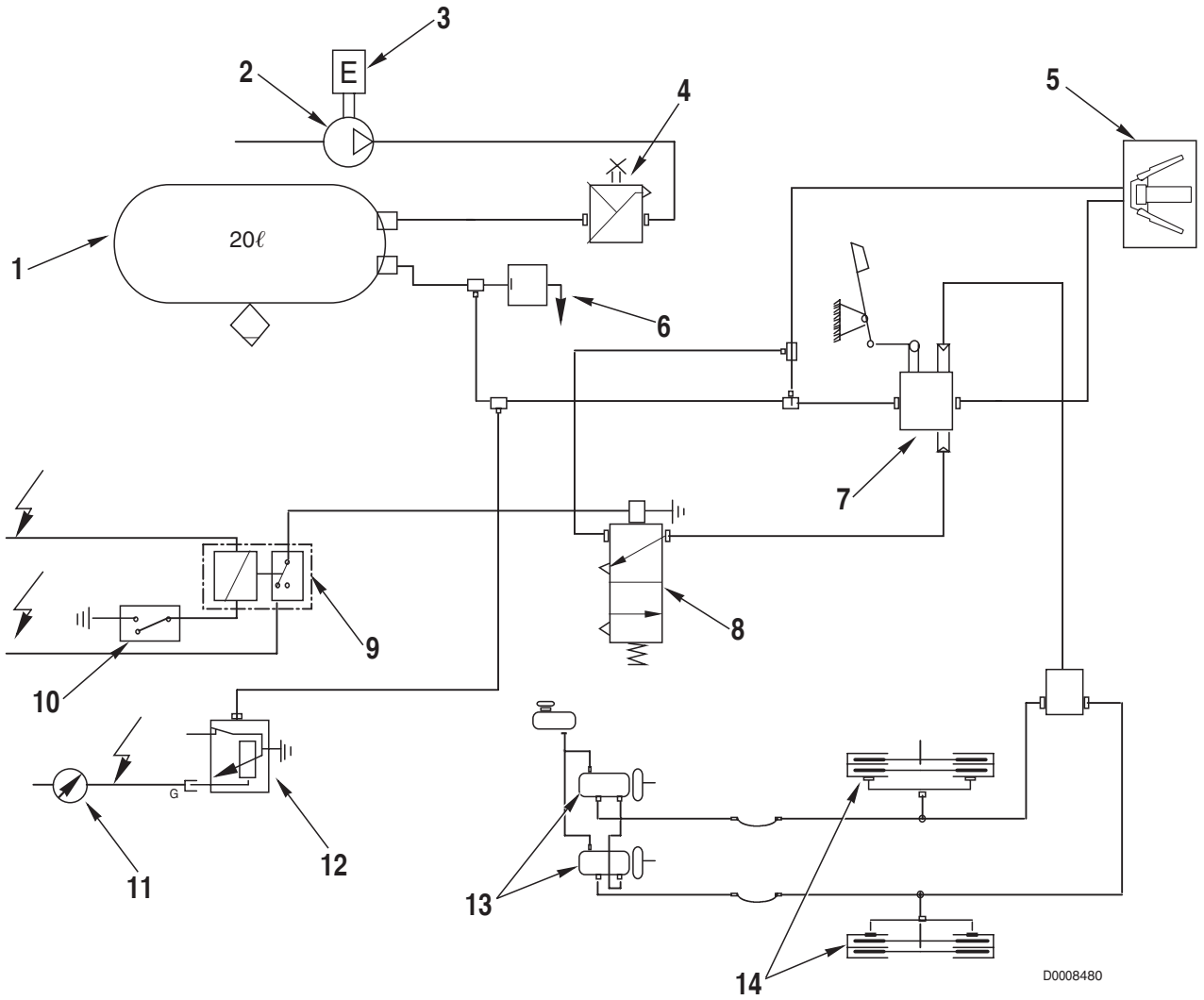
Port P - Valve feed
Port N - To lubrication line
Port B - To trailer brake
Port T - Drain
Port Y - Connection to tractor braking system
Port LS - Load Sensing signal

TECHNICAL DATA

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

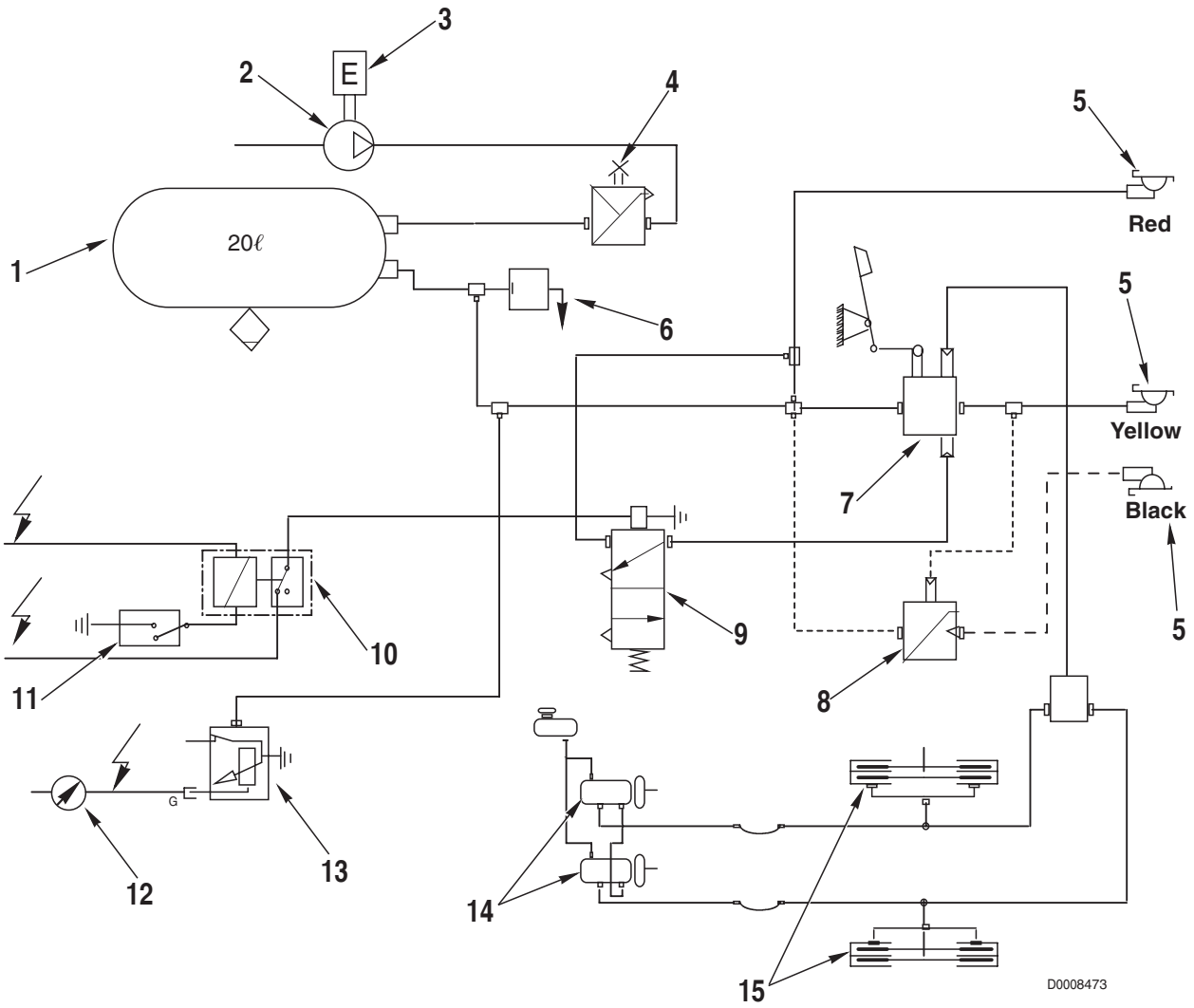
2.2.3 AIR TRAILER BRAKING (ITALY VERSION)



COMPONENTS

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

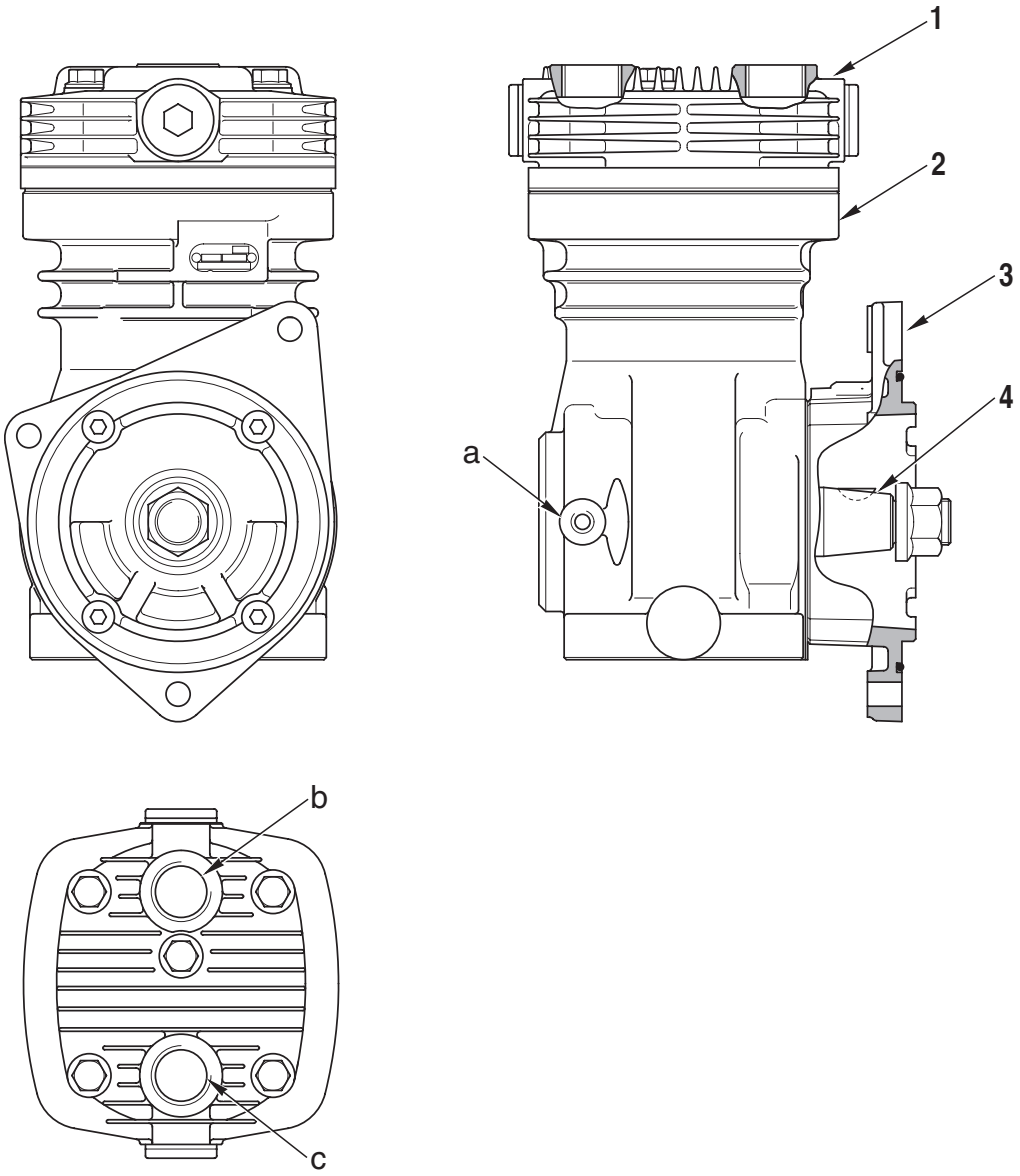
2.2.4 AIR TRAILER BRAKING (EXPORT VERSION)



COMPONENTS

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

COMPRESSOR



D0004620

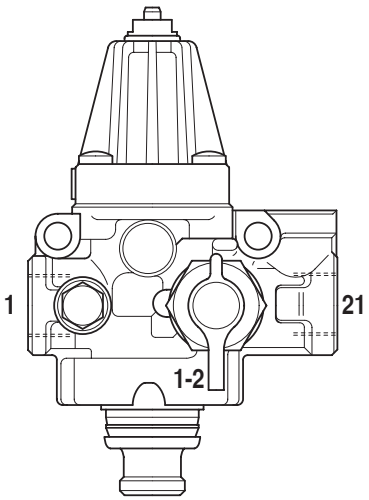
a. Port 0.1 - Compressor lubrication
b. Port 0
c. Port 2 - Compressed air delivery

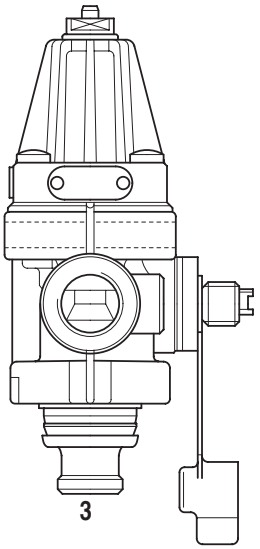
1. Cylinder head
2. Cylinder
3. Flange
4. Crankshaft

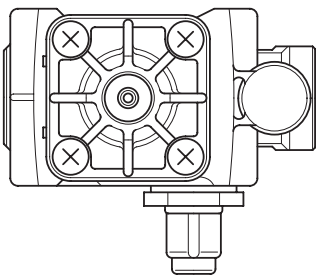
TECHNICAL DATA

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

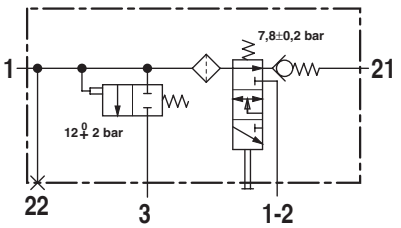
PRESSURE LIMITING VALVE







DIAGRAM



D0004690

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

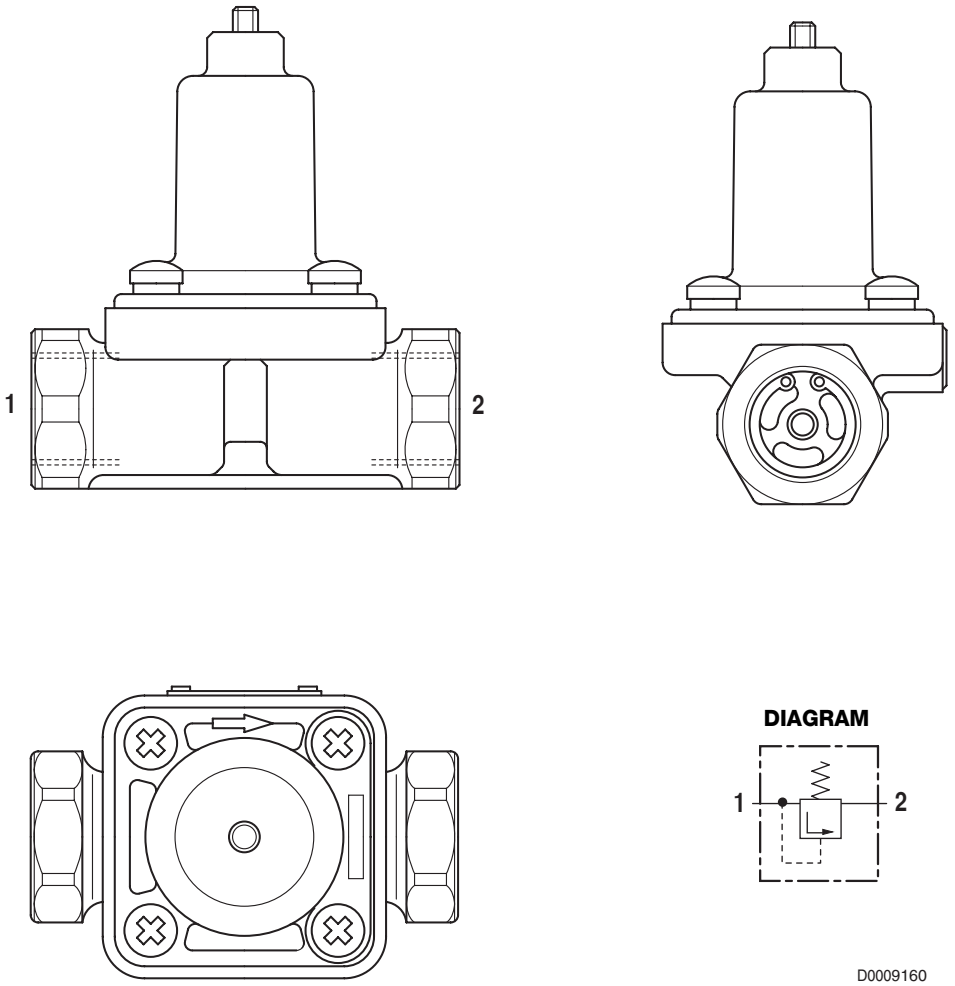
TECHNICAL DATA

Cut-out pressure: 7.8±0.2 bar (113±2.9 psi)
Cut-in pressure: 0.6–1 bar (8.7 – 14.5 psi)
Relief valve setting: 12 0 2 bar (174 0 29 psi)

CAB SUSPENSION FEED VALVE

FUNCTION

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

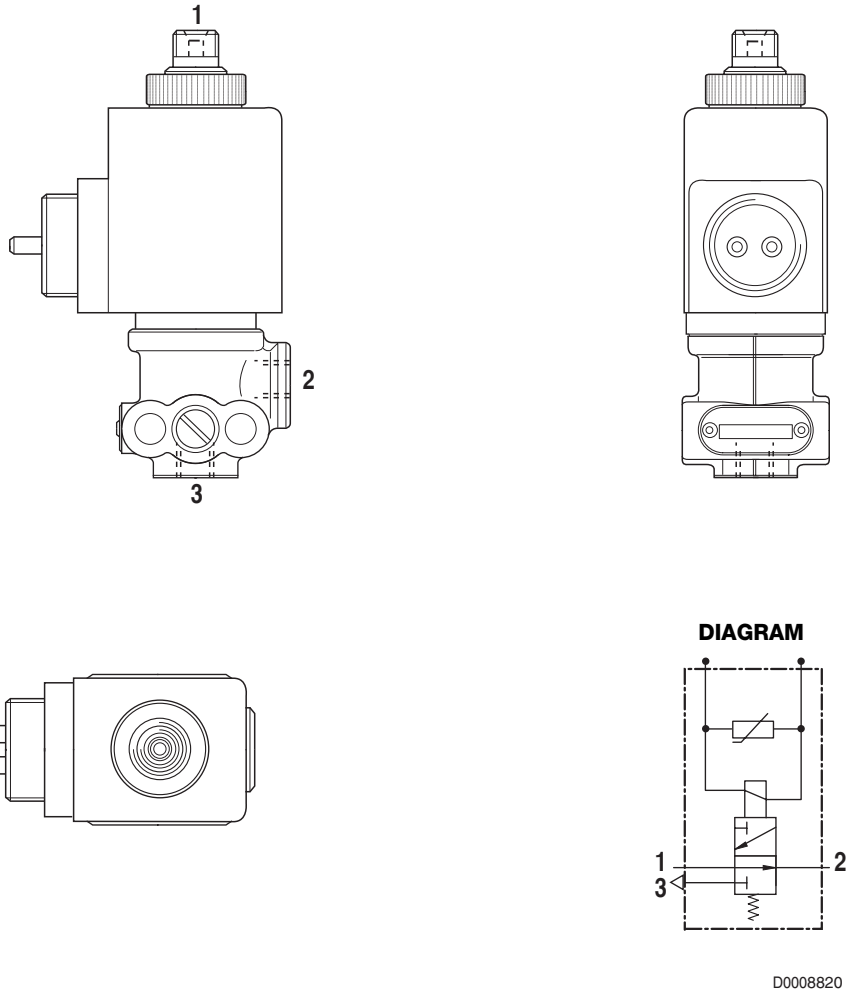


TECHNICAL DATA

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

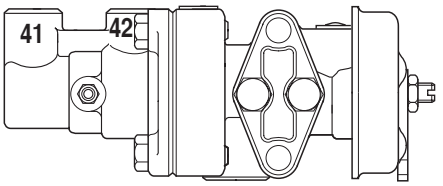
Maximum operating pressure: 13 bar (188 psi)

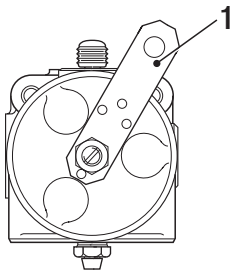
BRAKE APPLY SOLENOID VALVE

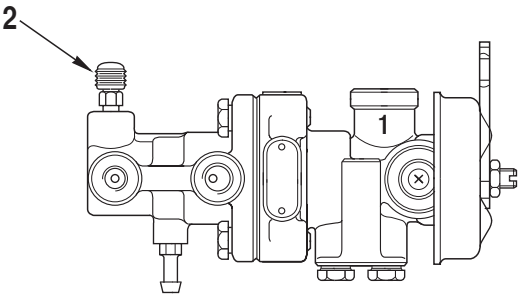


Port 1 - From compressed air reservoir
Port 2 - To trailer braking valve
Port 3 - Air exhaust

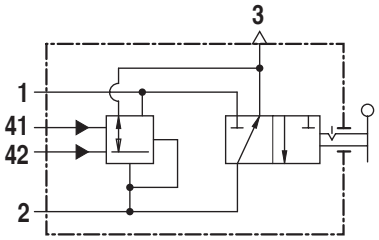
TRAILER BRAKING VALVE (2-WAY)

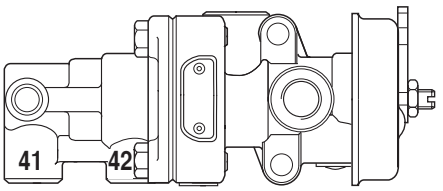


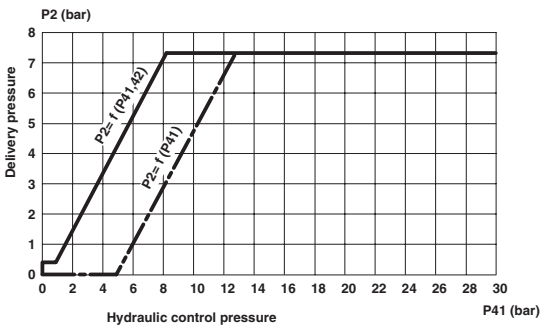


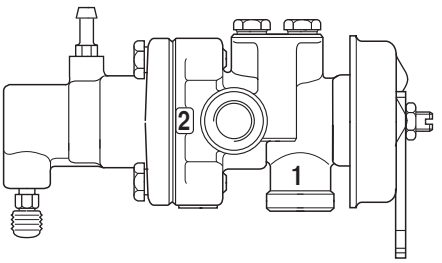


DIAGRAM







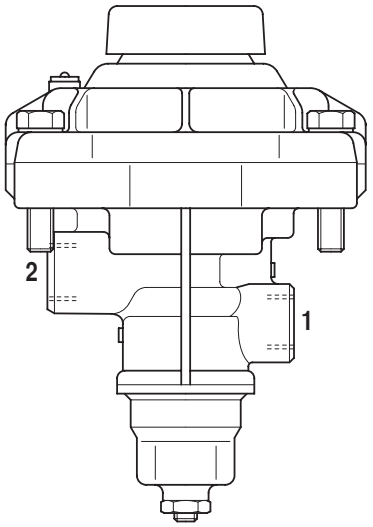


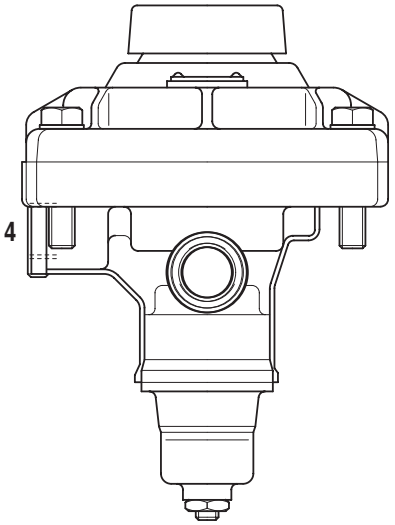
D0008493

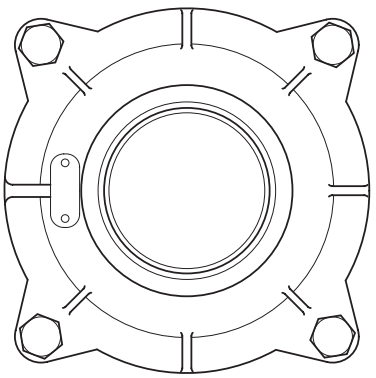
1. Parking brake actuating lever
2. Bleed screw

Port 1 - From compressed air reservoir
Port 2 - To trailer brake
Port 41 - From L.H. brake assembly
Port 42 - From R.H. brake assembly

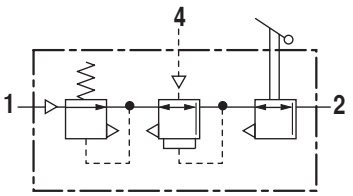
TRAILER BRAKING VALVE (1-WAY)







DIAGRAM



D0009170

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

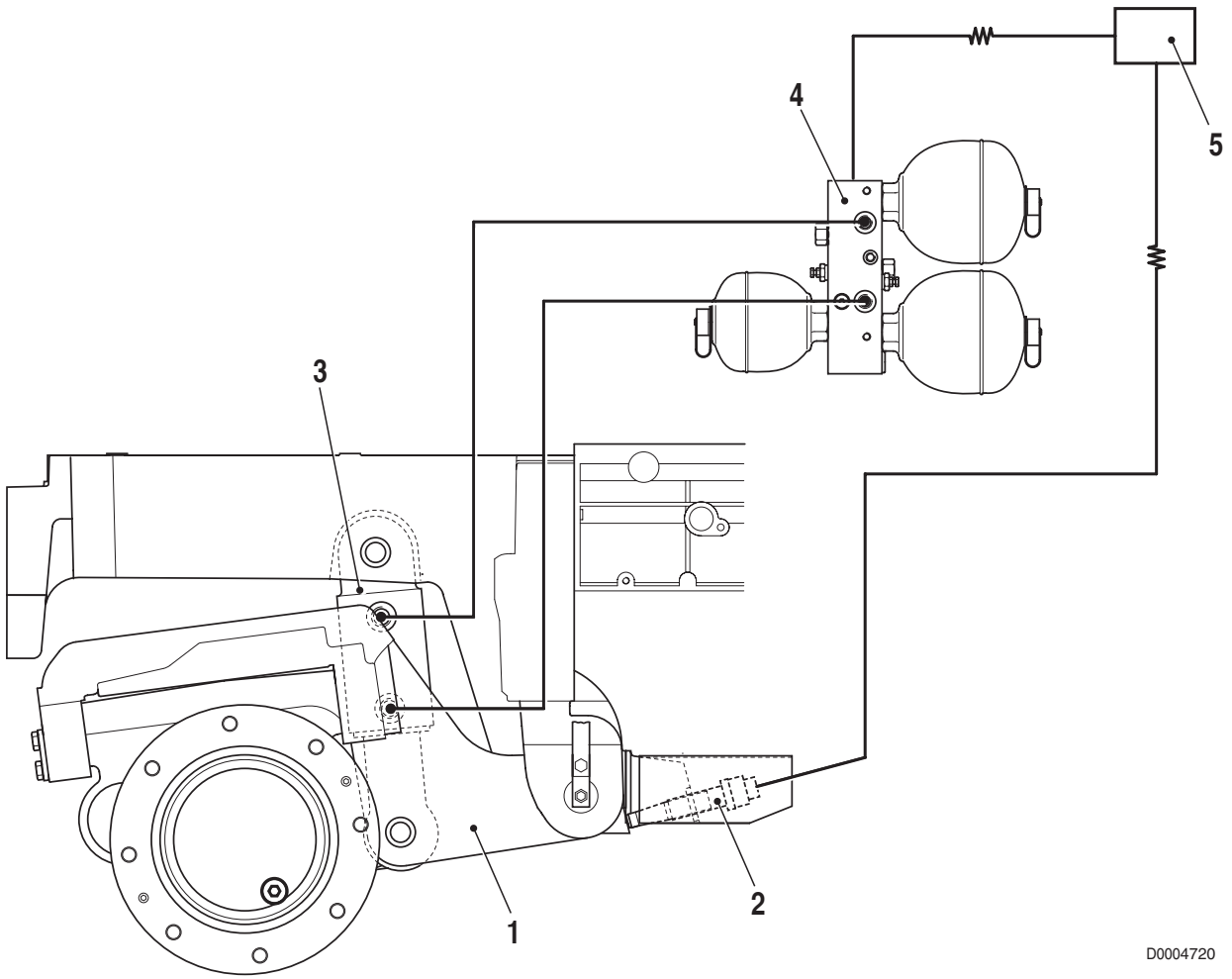
3. HYDRAULIC FRONT AXLE SUSPENSION

DESCRIPTION

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

The system comprises:

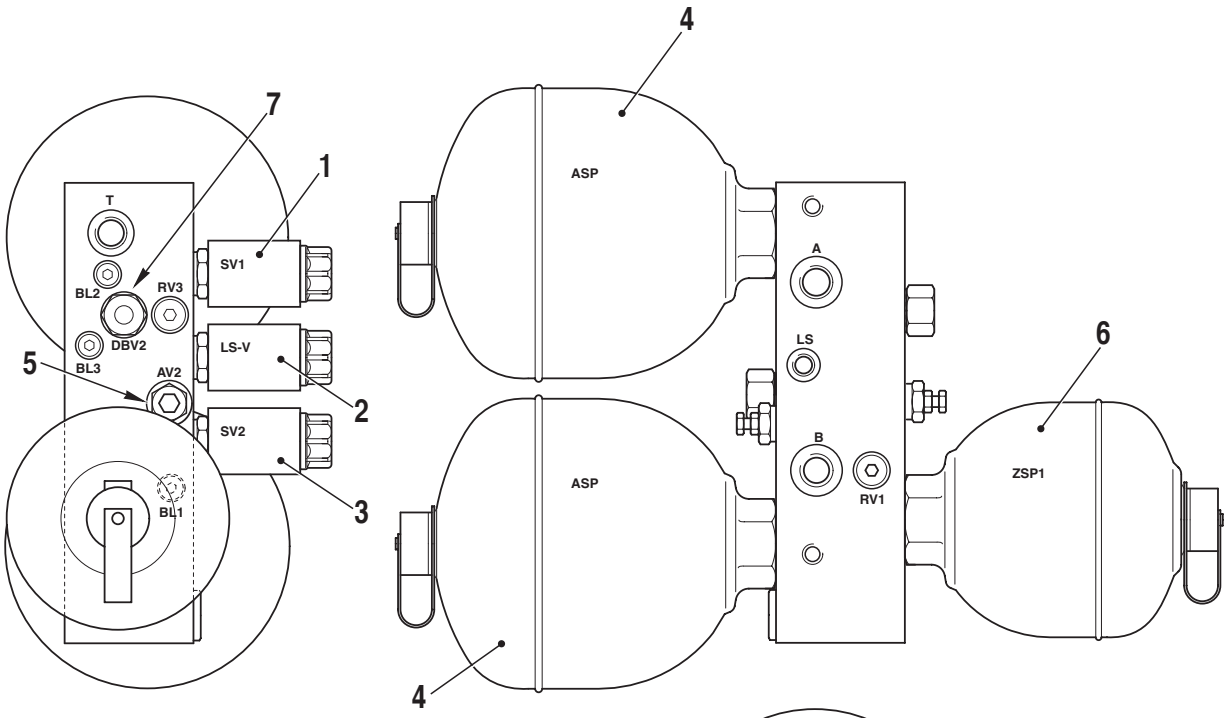
- swinging axle support arm (1)
- position sensor (2)
- 2 suspension cylinders (3)
- front suspension control valve (4)
- electronic control unit (5)



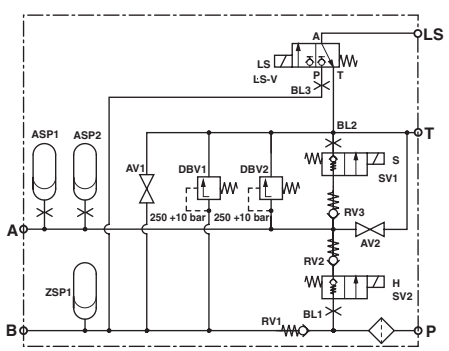
3.1 FRONT SUSPENSION CONTROL VALVE

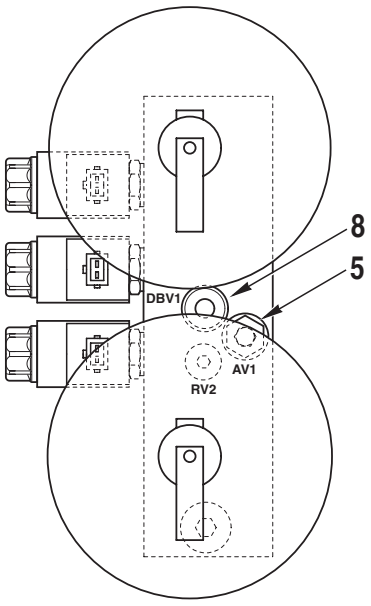
FUNCTION

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



DIAGRAM



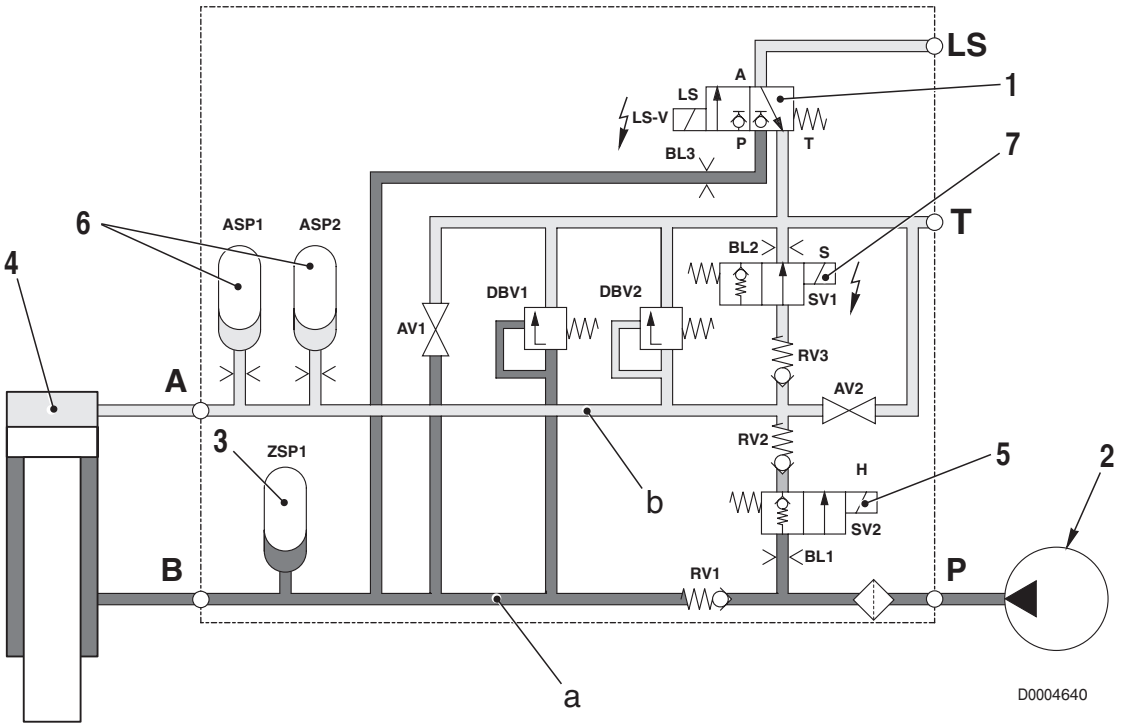


D0004750

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

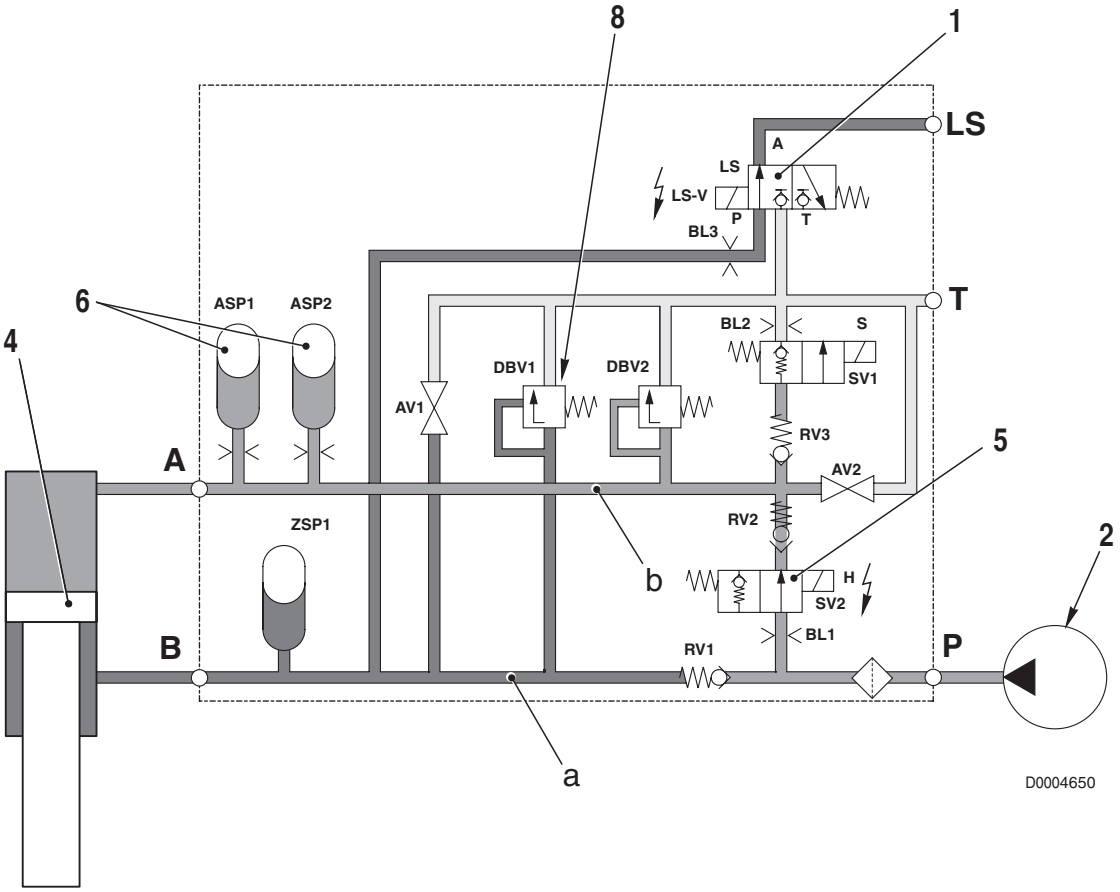
OPERATION

1. When the suspension is deactivated



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

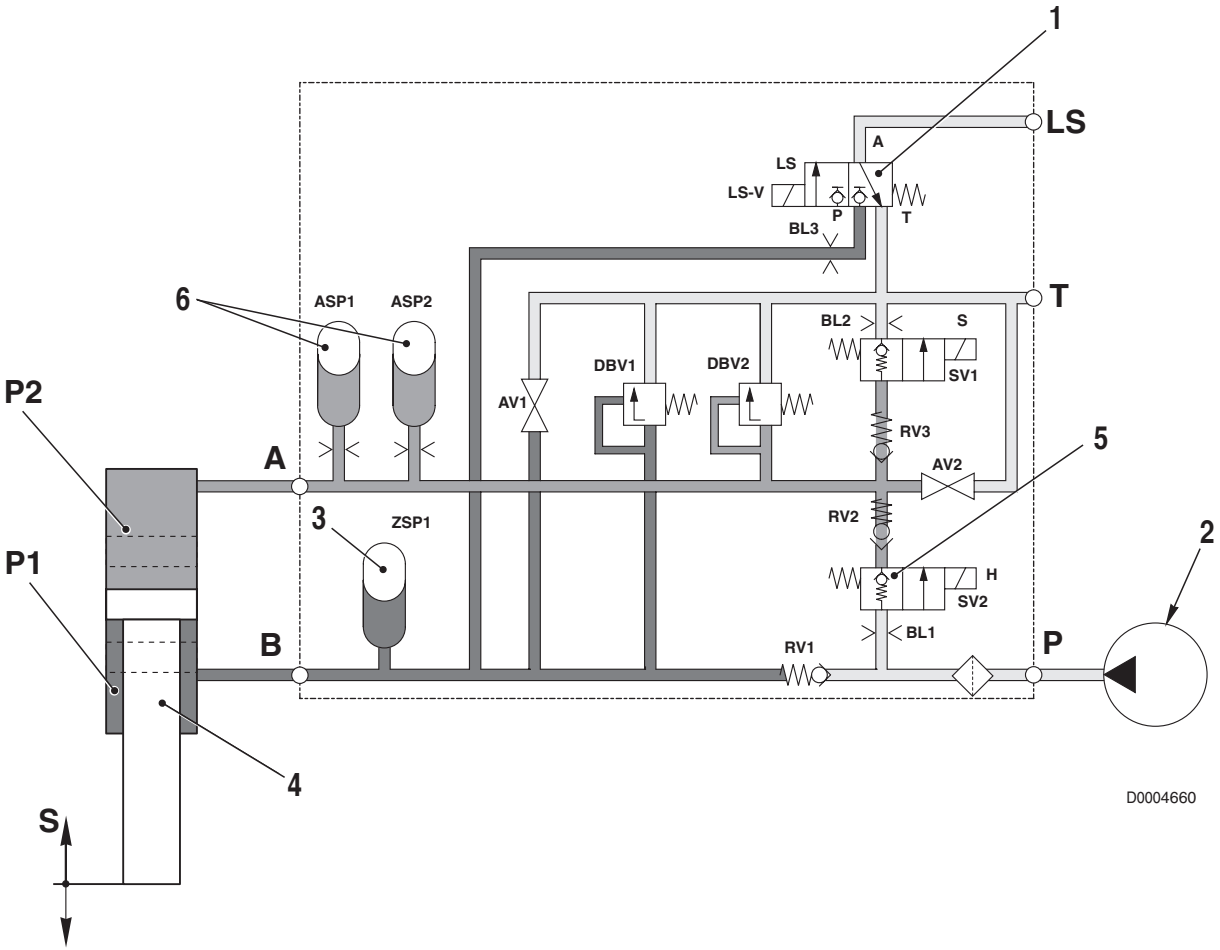
2. When the operator activates the system

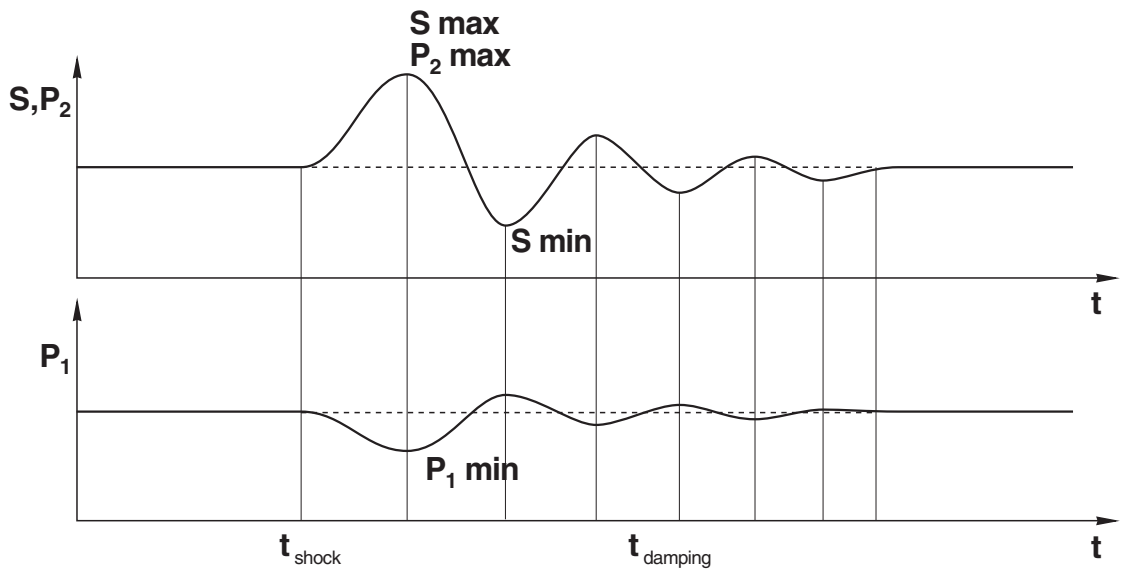


- When the operator presses the switch to activate the suspension, the electronic control unit energises the solenoids (1) and (5).
- This allows the pressurised oil from the pump (2) to flow to line **b** and thus start to push the piston (4) downwards.
- At the same time, the oil compresses the membranes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

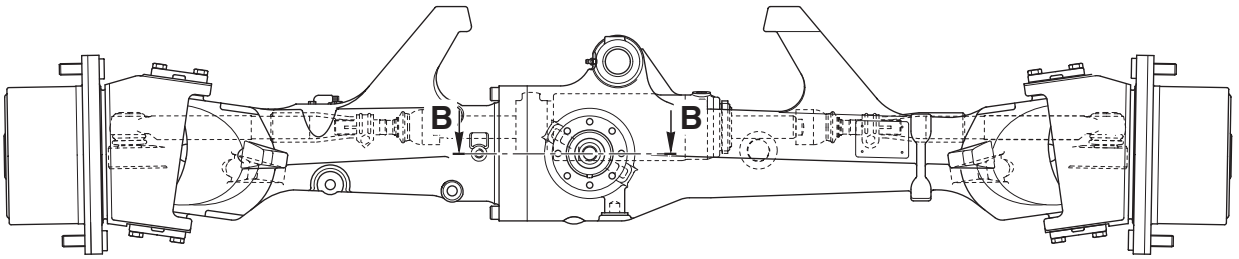
3. When the system is active

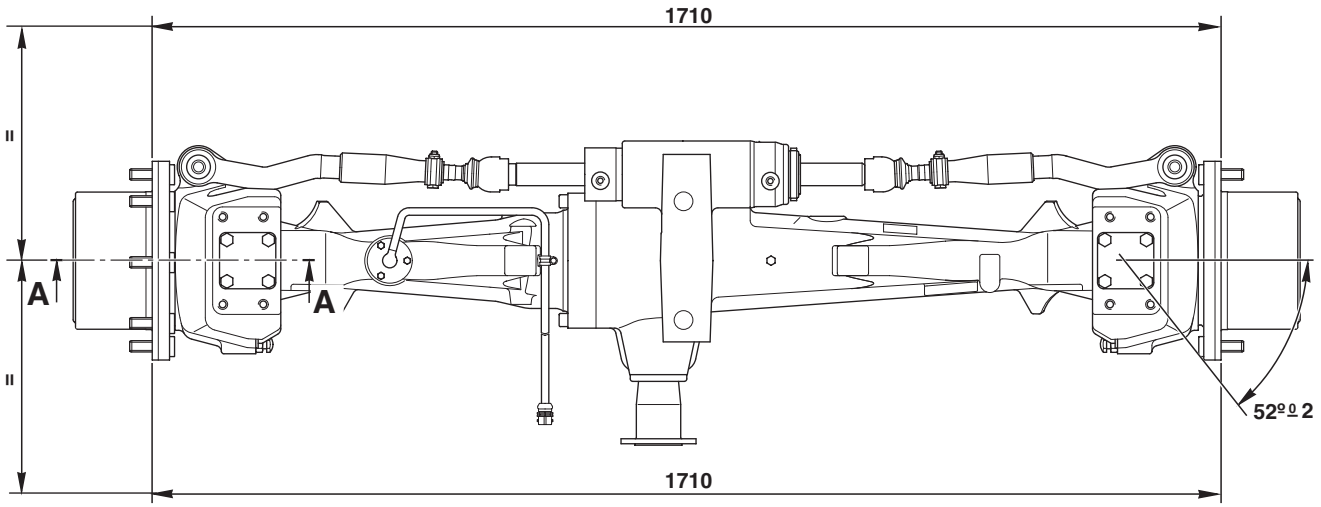
- When the tractor is in motion and the wheels encounter an obstacle, the front axle is pushed upwards.
- This causes the pressure P2 to increase (the accumulators 6 are compressed) while the pressure P1 decreases (accumulator 3 is decompressed).
- The pressure balance is thus altered and the system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





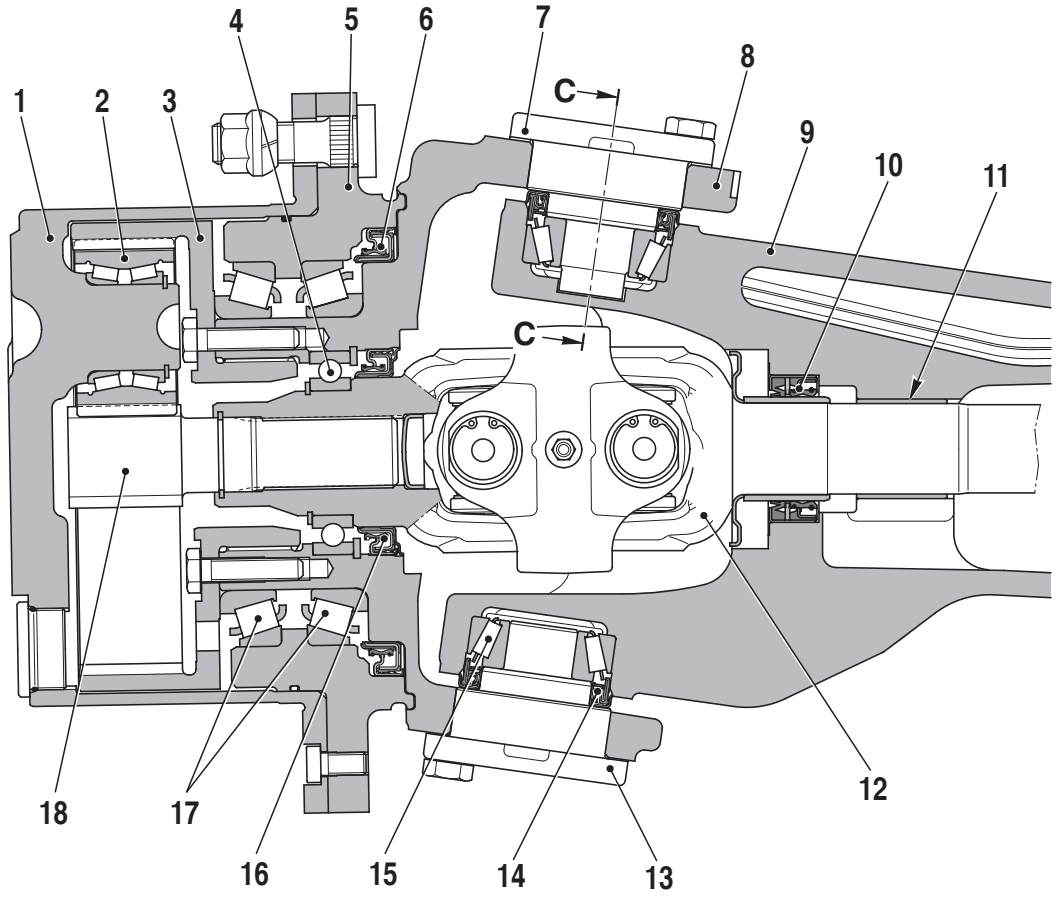
4. FRONT AXLE



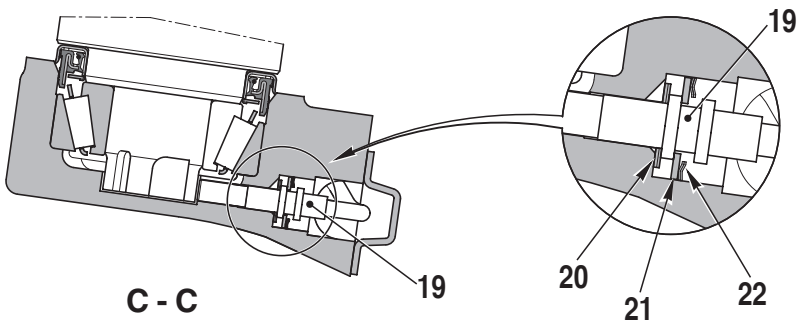


D0004780

4.1 HUB CARRIER AND FINAL REDUCTION UNIT



B - B



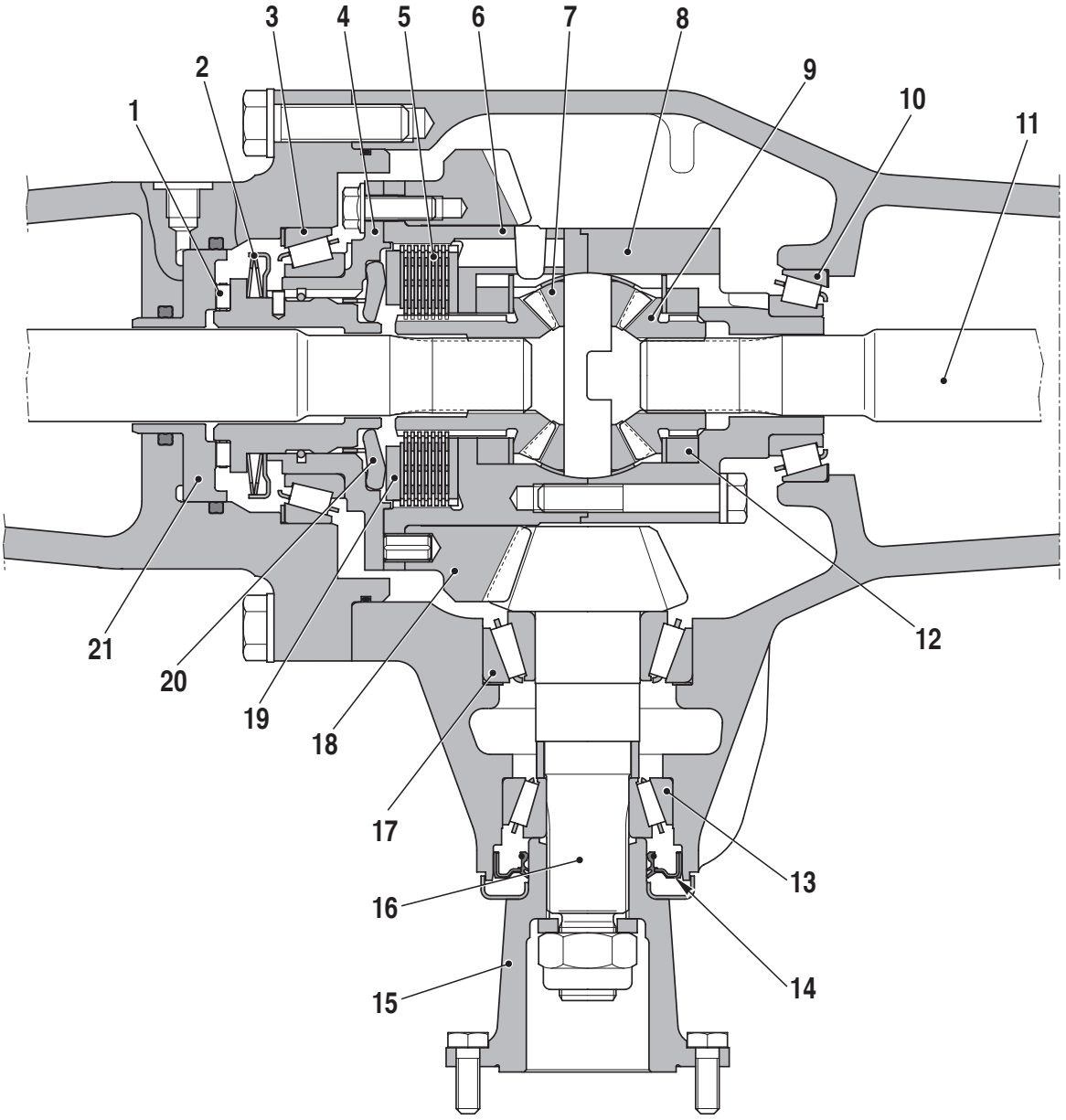
C - C

D0004800

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

4.2 DIFFERENTIAL

VERSION WITH 100% HYDRAULIC LOCKING



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

5. HYDRAULIC SYSTEM

DESCRIPTION

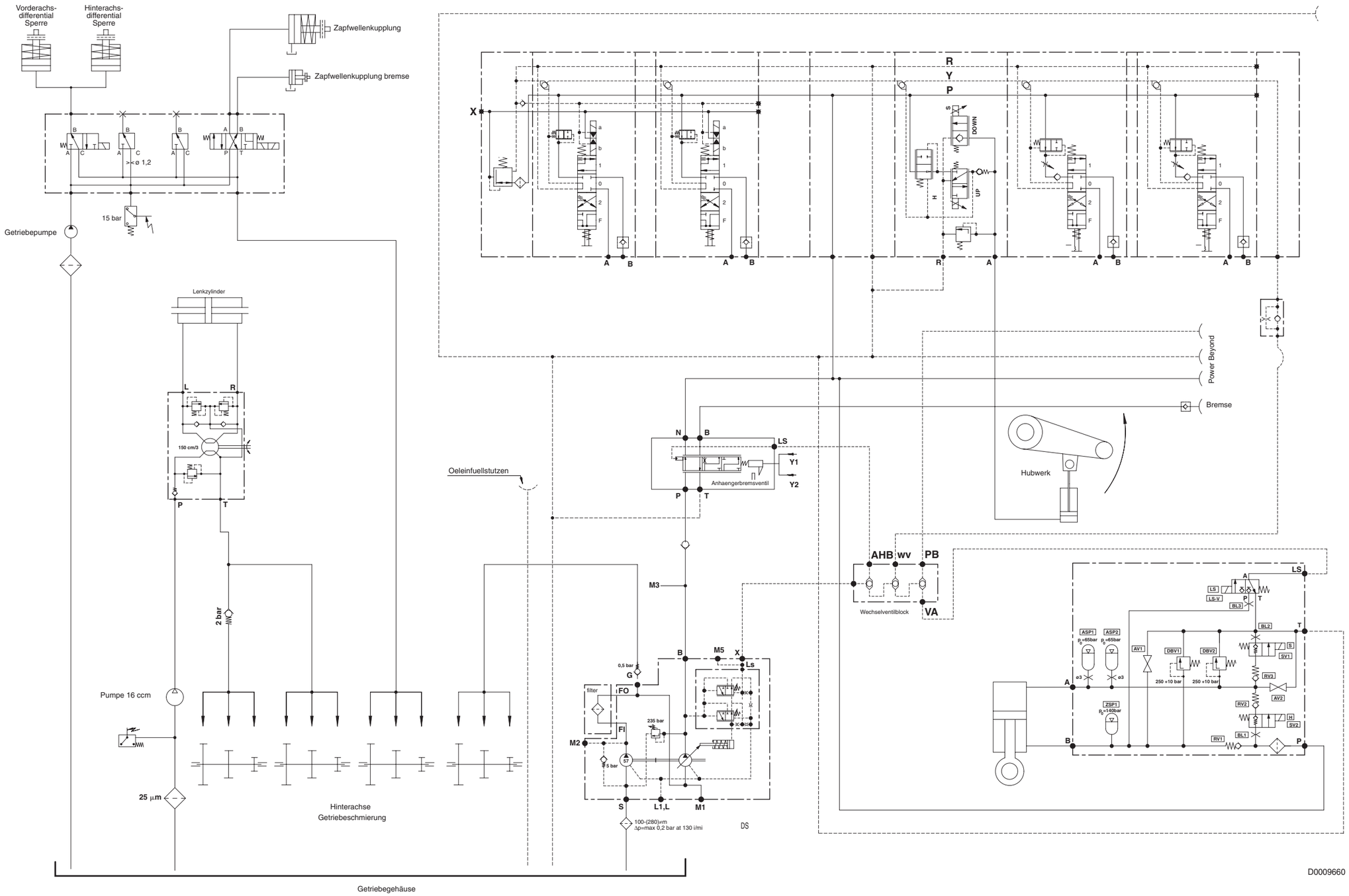
Machines of the AGROTON TTV series have a dual hydraulic system: Load Sensing with variable displacement pump for auxiliary services (spool valves, hydraulic trailer brake, etc.) and fixed displacement for the steering circuit.

The LS hydraulic circuit utilizes a variable displacement piston pump capable of supplying oil for services in response to the actual demand.

This means that when the engine is running at top speed and no hydraulic services are in operation, any oil circulated by the pump is in effect only residual flow from internal leakage occurring in the devices connected to the system (just a few litres per minute), thereby saving energy (and reducing fuel consumption).

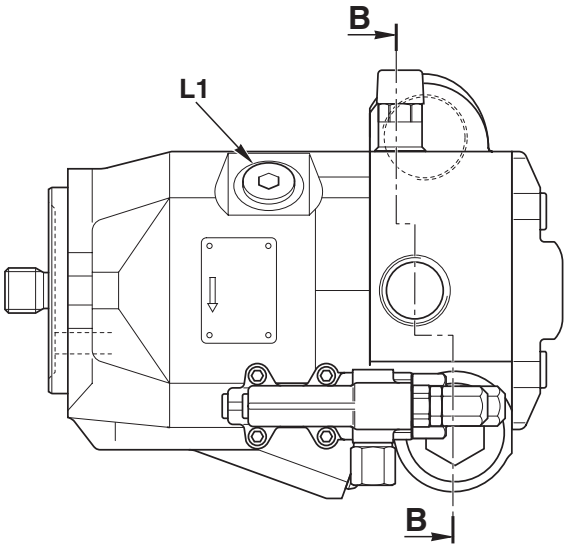
In addition, the displacement of the variable piston pump is greater than the potential demand of any single service, so that there will always be sufficient flow to satisfy several services simultaneously.

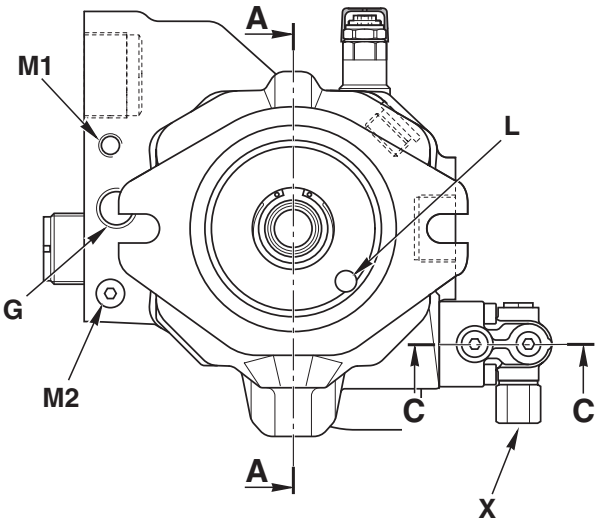
HYDRAULIC SYSTEM



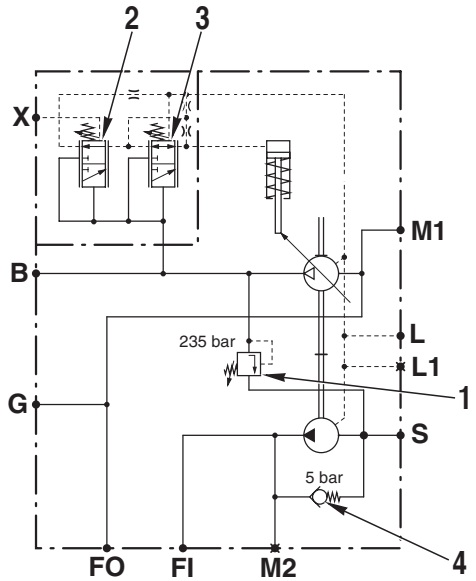
D0009660

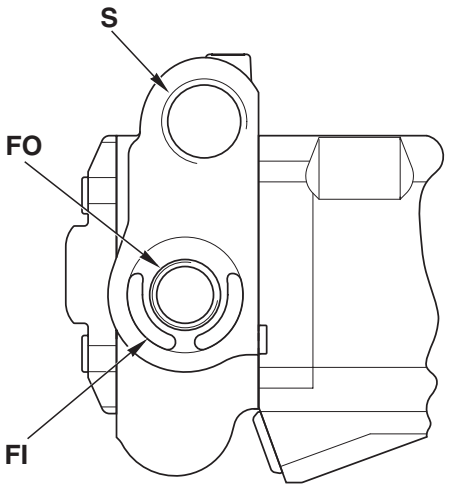
5.1 VARIABLE DISPLACEMENT PUMP





HYDRAULIC DIAGRAM





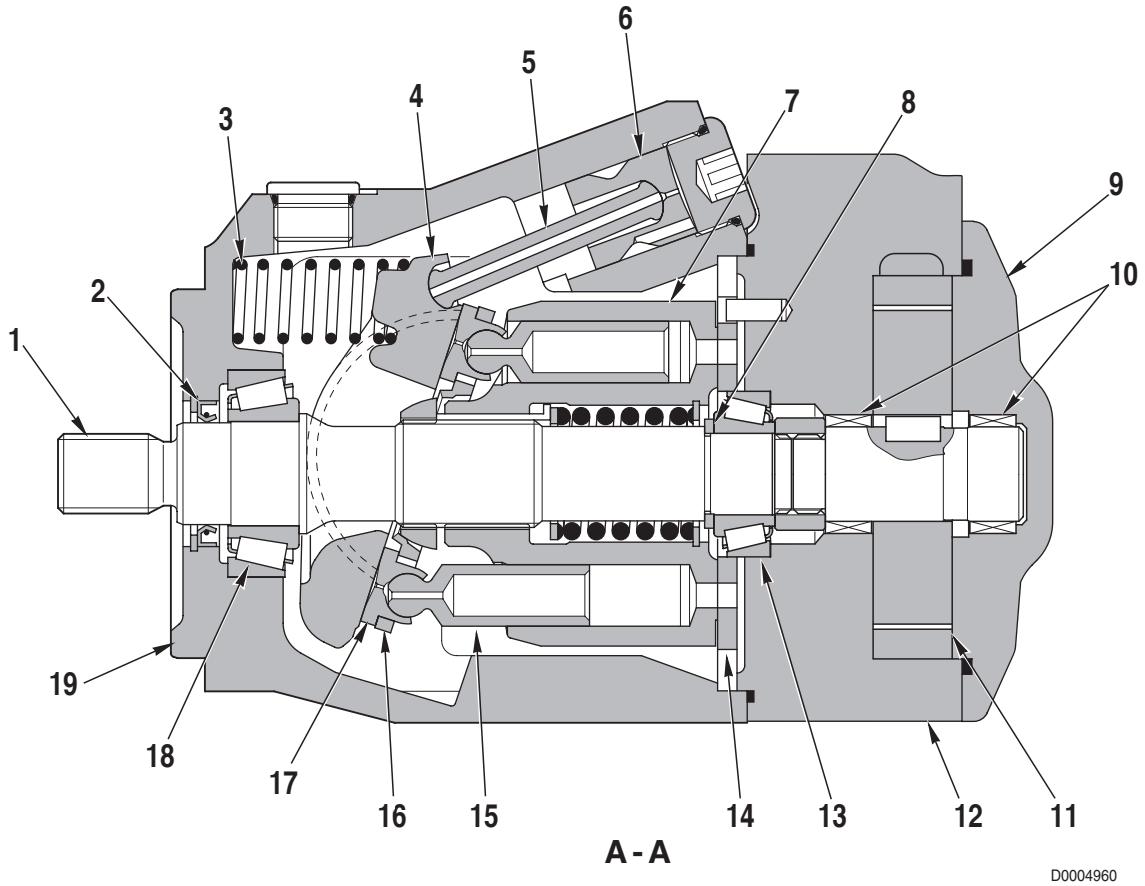
D0004900

FUNCTION

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

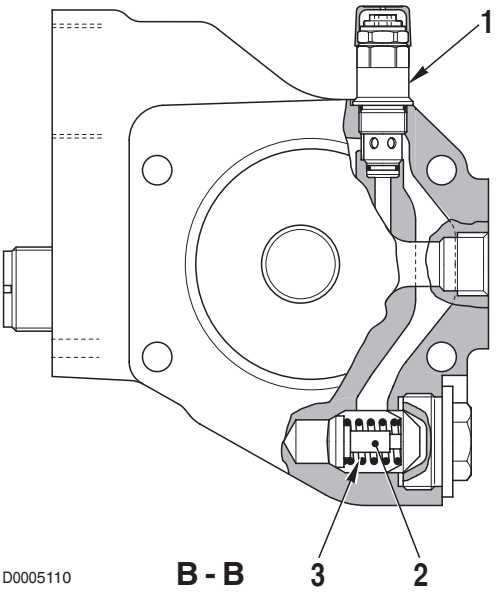
COMPONENTS

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



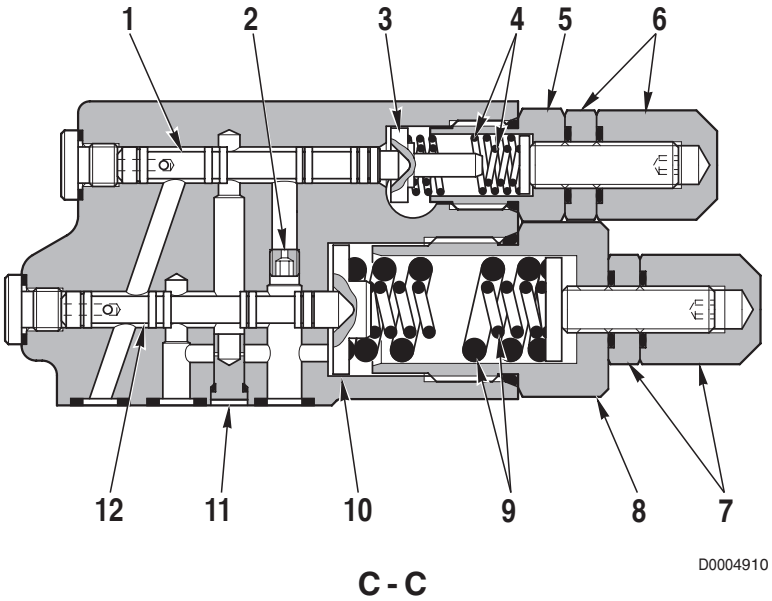
COMPONENTS

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



COMPONENTS

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



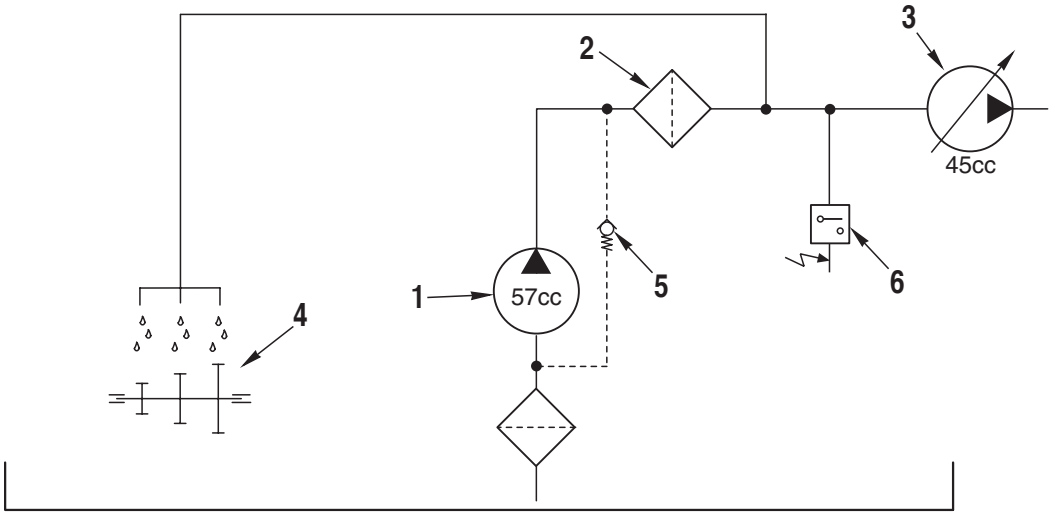
COMPONENTS

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

5.1.1 BOOST PUMP

FUNCTION

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



D0004820

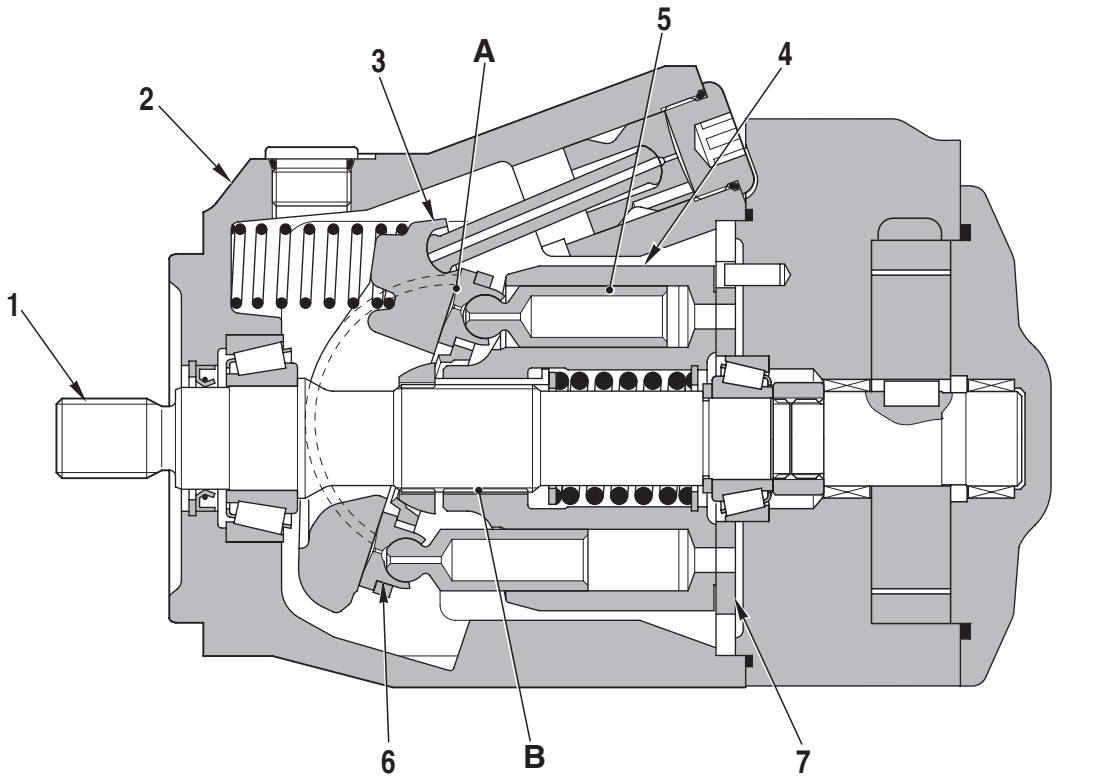
OPERATION

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

5.1.2 HYDRAULIC PUMP

FUNCTION

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



STRUCTURE

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

OPERATION

1. Pump operation

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

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

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

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

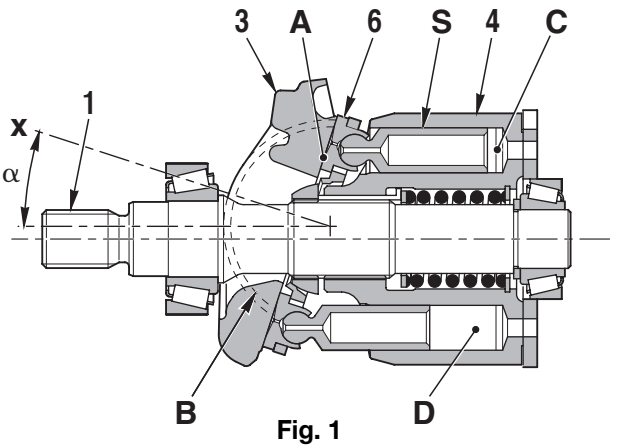


Fig. 1

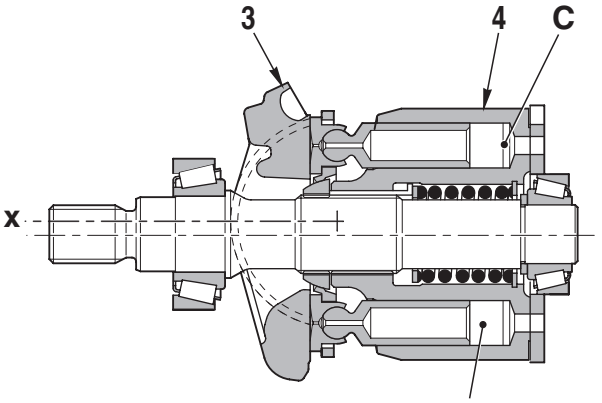


Fig. 2

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2. Controlling the requirement of oil

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

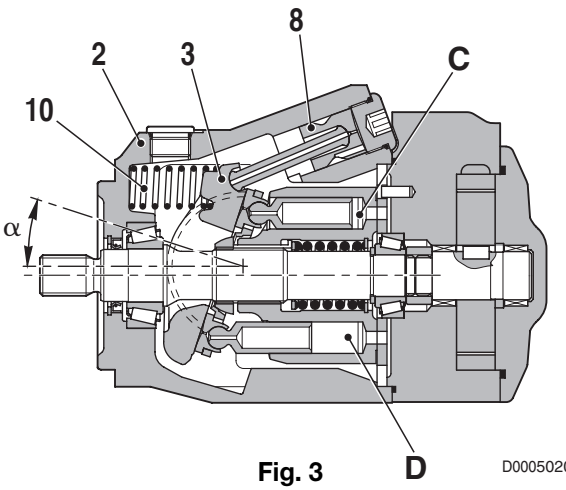

Fig. 3

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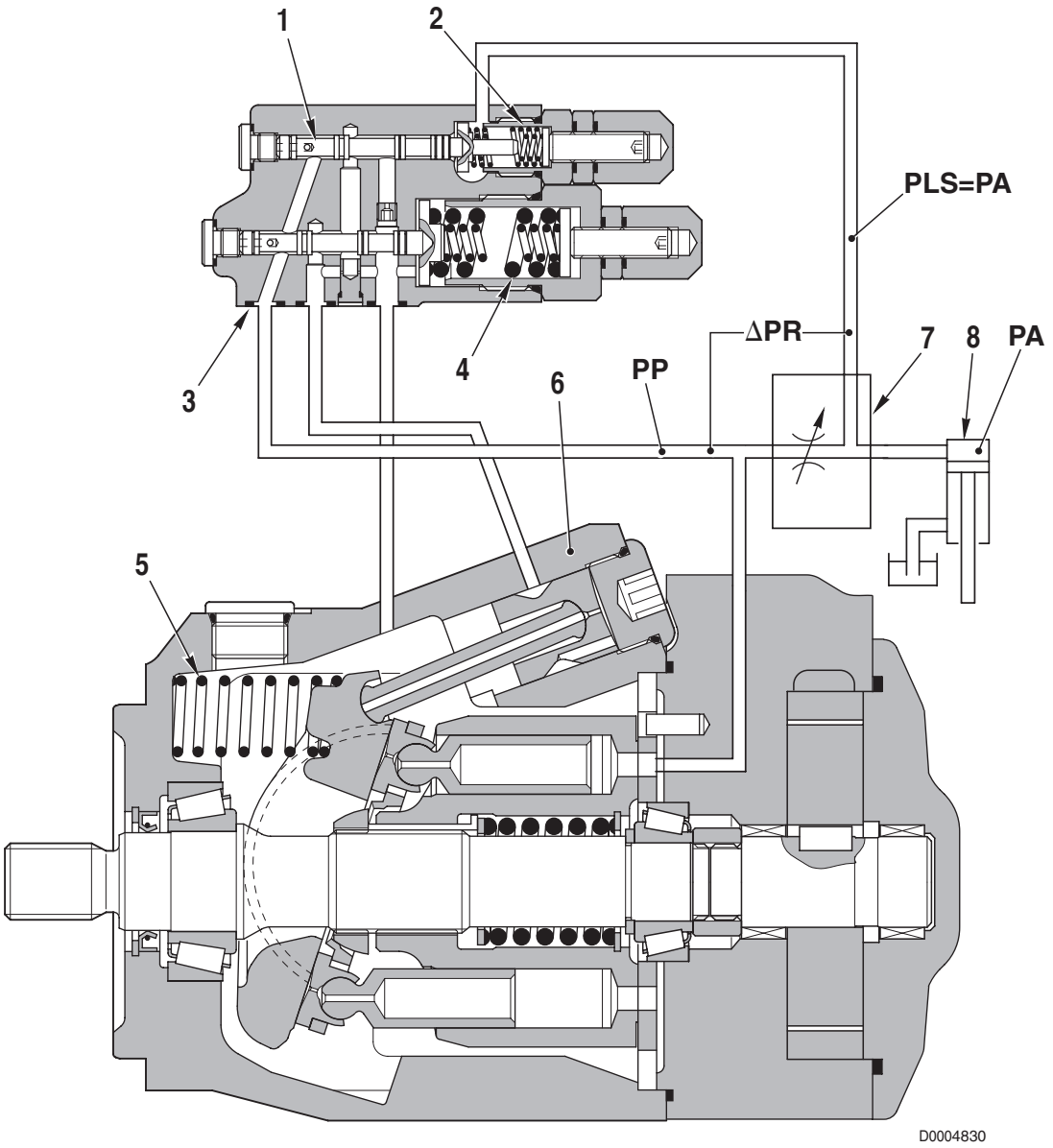
5.1.3 LOAD SENSING VALVE, PRESSURE CUT-OFF VALVE



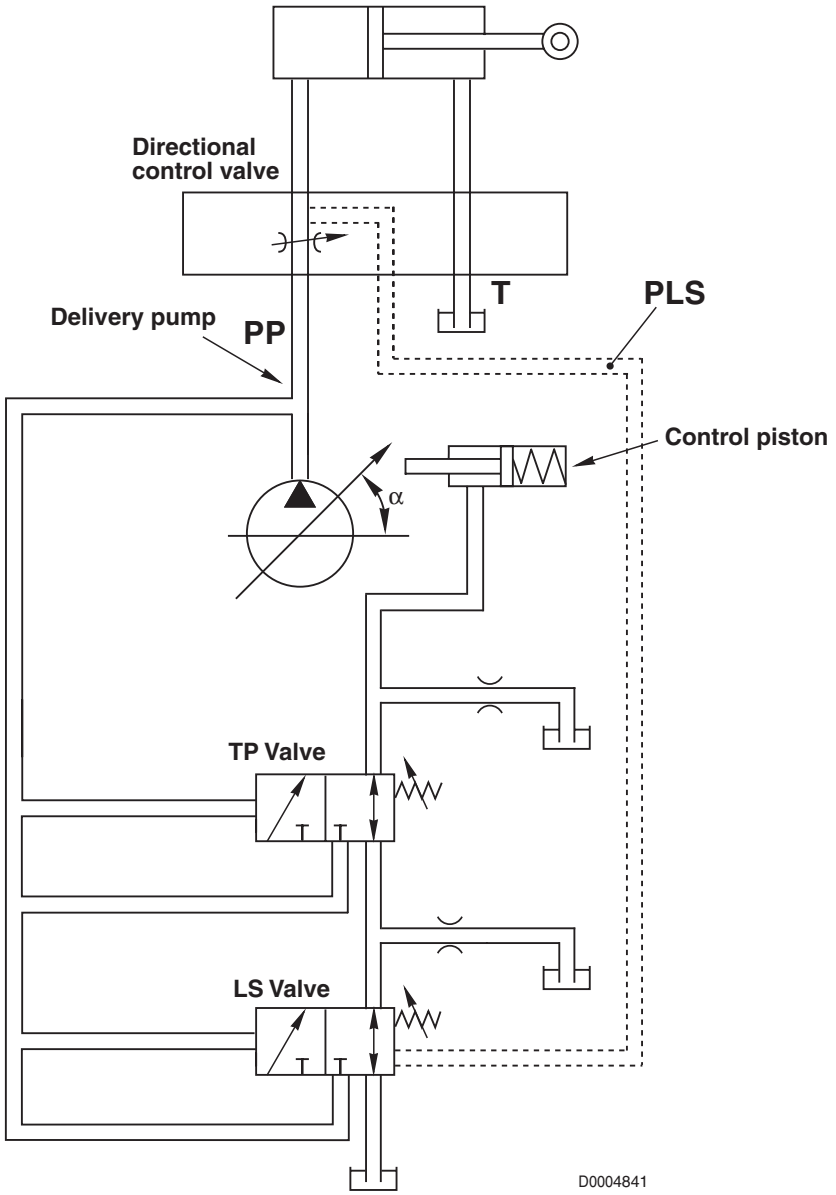
COMPONENTS

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

OPERATING PRINCIPLE

Swash-plate angle control

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



LOAD SENSING (LS) VALVE
FUNCTION

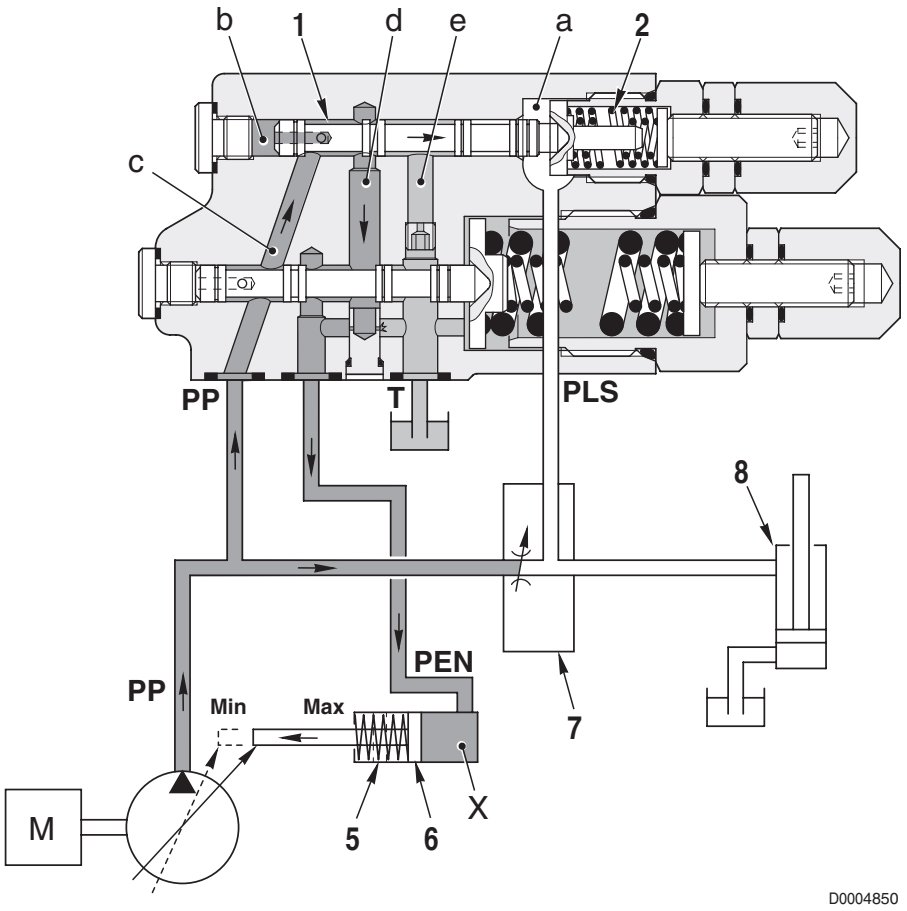
- The **LS** valve regulates the pump delivery in accordance with the position of the control lever of the directional control valve i.e. in accordance with the demand from the loads.
- The **LS** valve senses the demand from the loads by way of the pressure difference ∆**PR** between the pump delivery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

OPERATION

Pump operation can be divided into four stages:

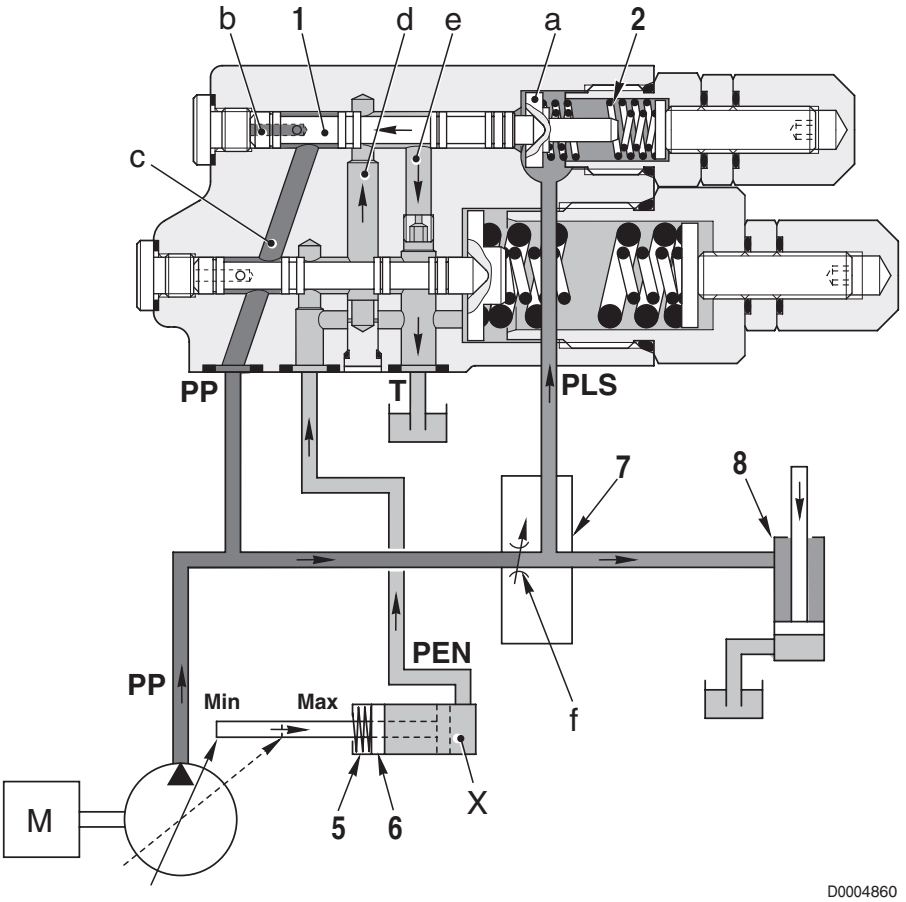
a. When the directional control valve is in neutral position
b. When a control lever is operated
c. When the flow rate stabilises
d. When the system enters “saturation” condition

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



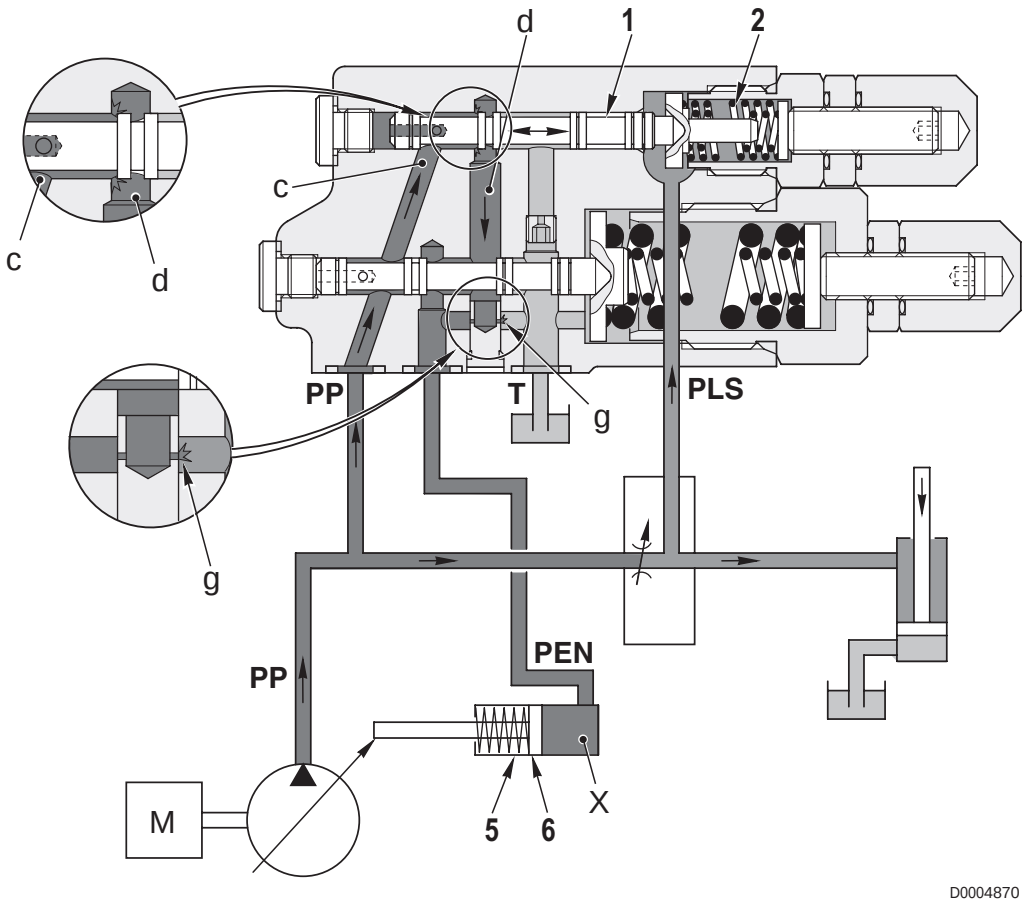
- The pressure **PLS** of the **LS** signal from the control valve outlet port, enters the chamber **a** of the **LS** valve; the pump delivery pressure **PP** enters the chamber **b** on the opposite side.
- The shift in the position of the spool (1) is determined by the combination of the force exerted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

b. When a control lever is operated



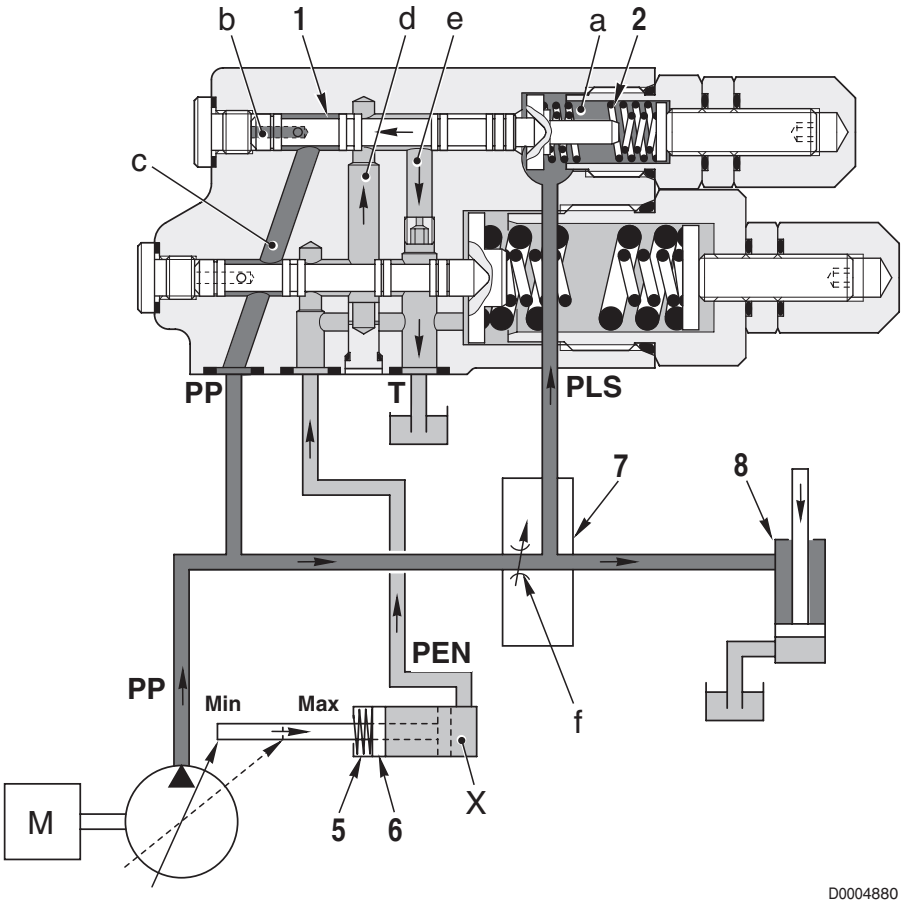
- When a control lever is moved from the NEUTRAL position, this generates an **LS** signal corresponding to the load delivery pressure **PLS**.
- The **LS** signal pressure in chamber **a** causes the spool to shift to the left, thereby connecting the passages **d** and **e**. The chamber **X** is depressurised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

c. When the flow rate stabilises



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

d. When the system enters “saturation” condition

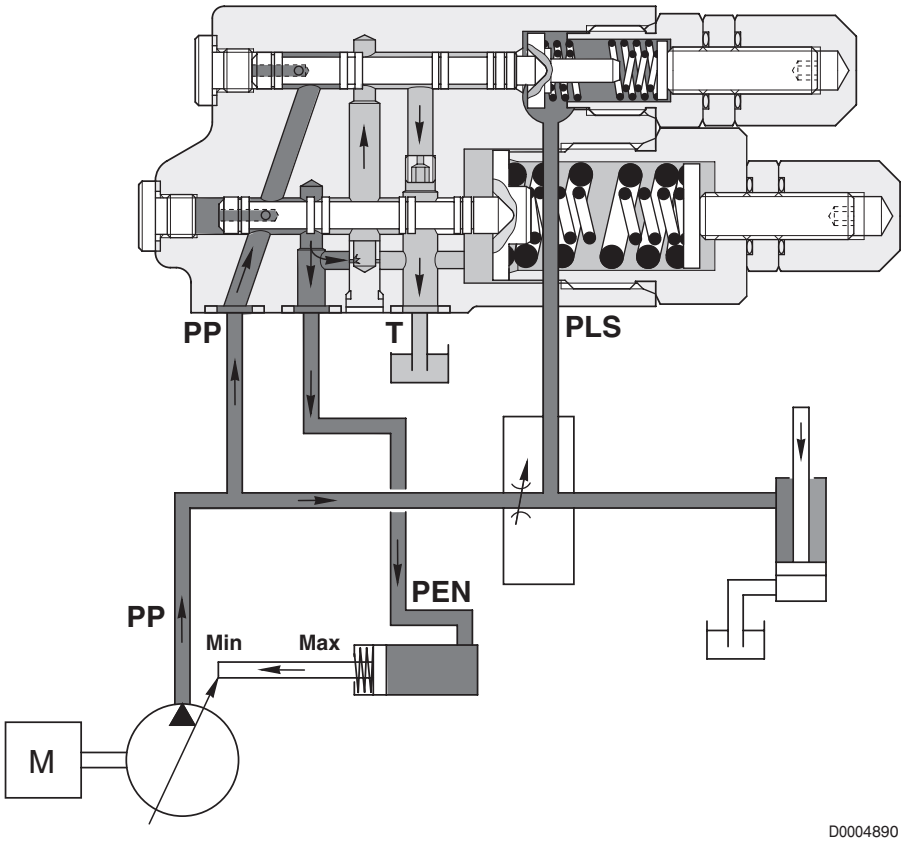


- If the engine speed is reduced during the operation of one or more loads, there will be a corresponding reduction in the flow from the pump. It follows that the pump will compensate for this by altering the swash plate angle.
- When the pump reaches its maximum displacement, and thus can no longer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

PRESSURE CUT-OFF VALVE (TP)

FUNCTION

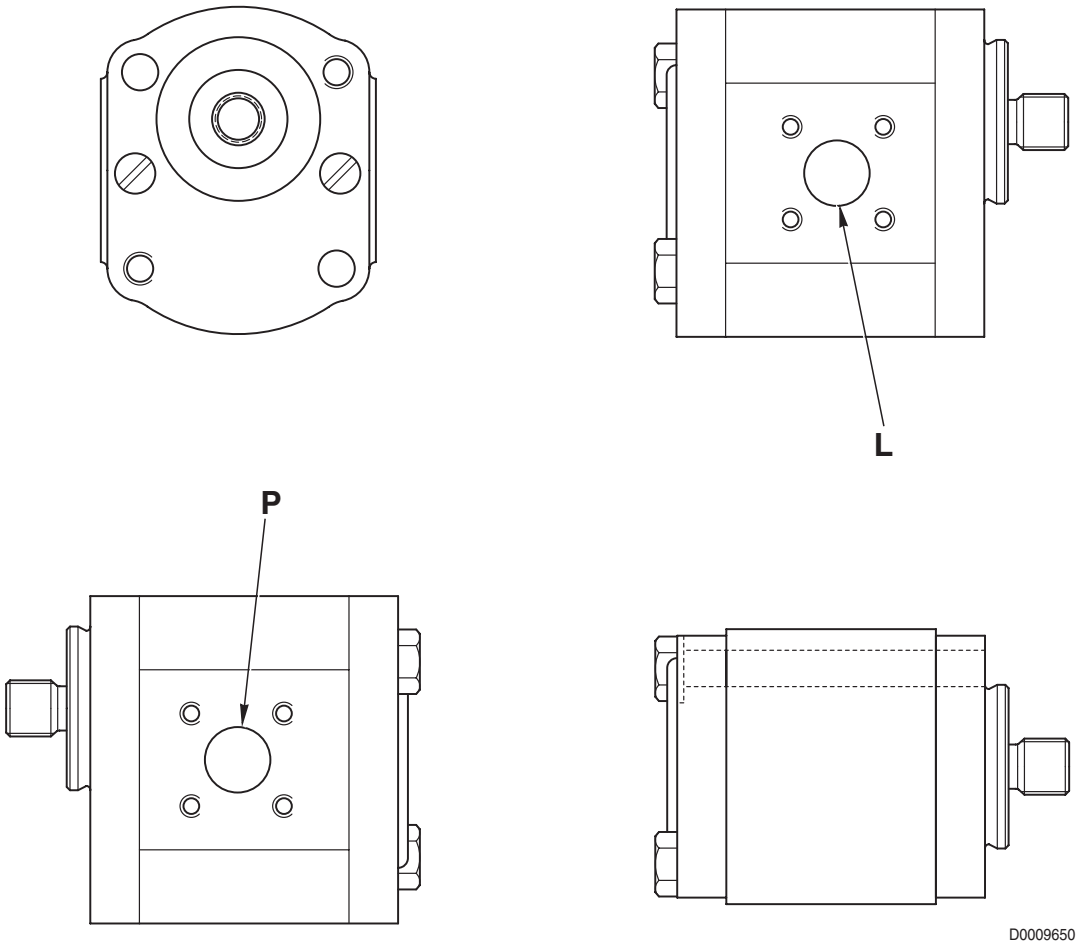
- The pressure cut-off valve regulates the pump delivery on reaching maximum pressure.



OPERATION

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

5.2 HYDRAULIC SERVICES GEAR PUMP



FUNCTION

Port L: suction

Port P: delivery

TECHNICAL DATA

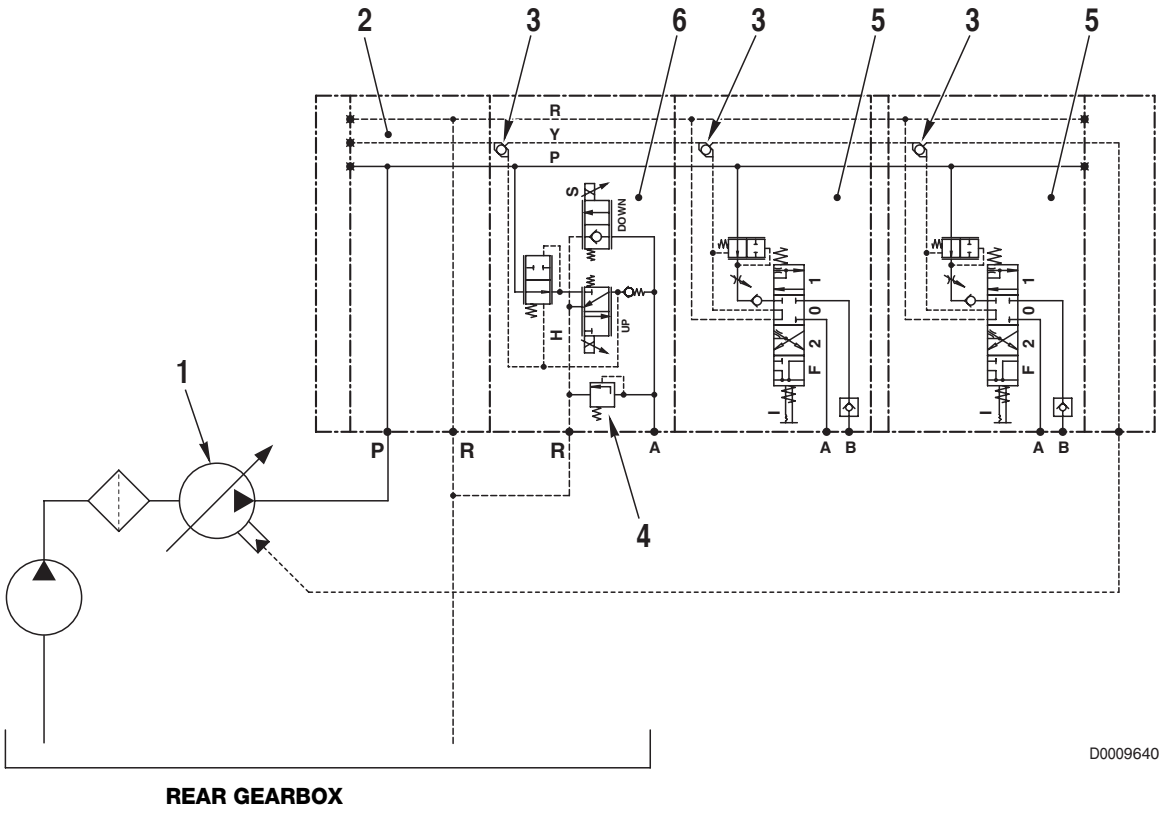
Displacement: 16 cc/giro

Maximum pressure: 180 bar (2610 psi)

5.3 AUXILIARY SERVICES CONTROL VALVE

FUNCTION

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



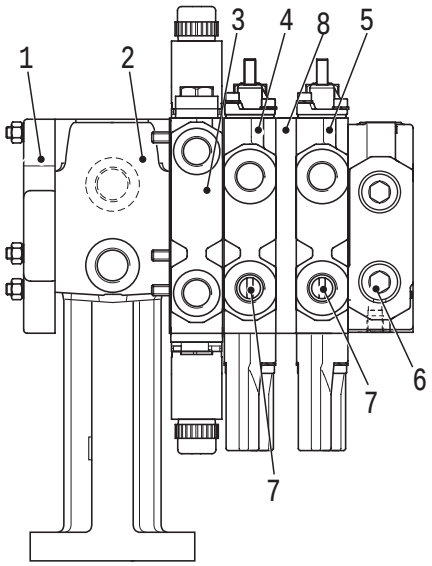
REAR GEARBOX

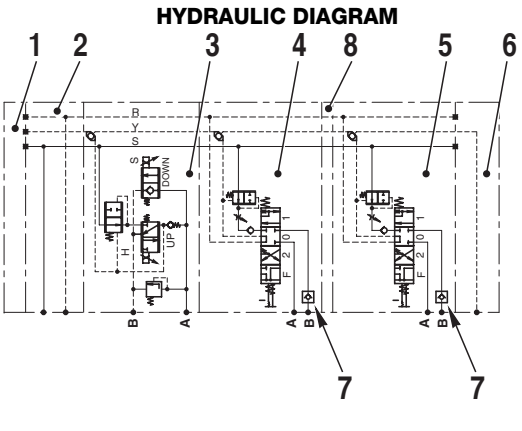
DESCRIPTION

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

5.3.1 TYPES OF SPOOL VALVE (LS)

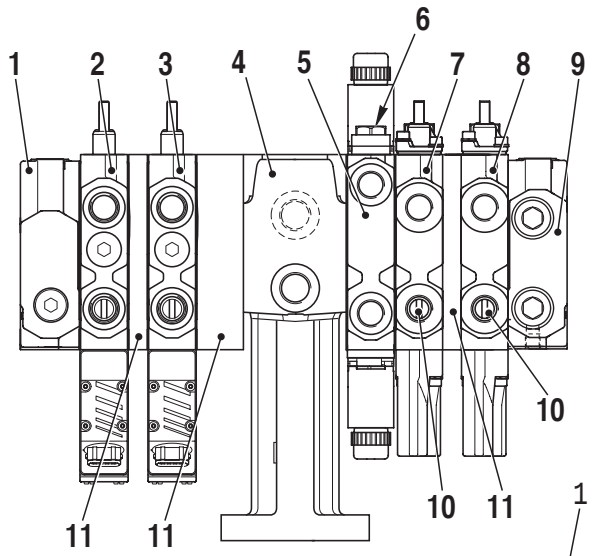
4-WAY VERSION

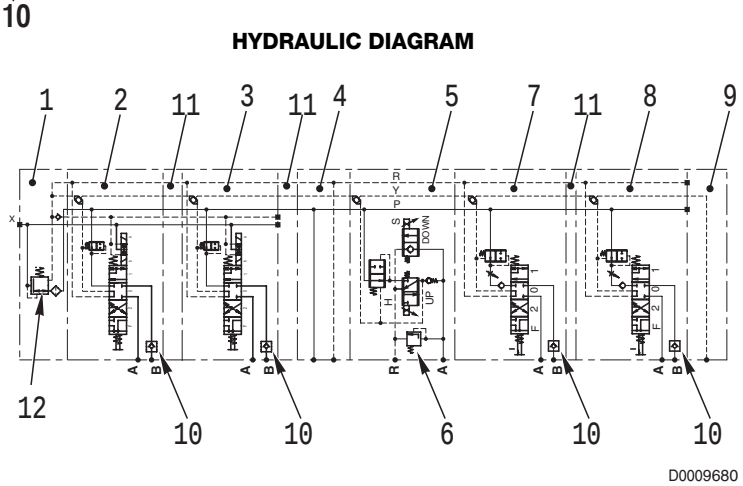




1. L.H. end cover
2. Manifold
3. Lift control section
4. n° 3 valve section
5. n° 4 valve section
6. R.H. end cover with LS signal outlet
7. Check valve (mechanically operated)

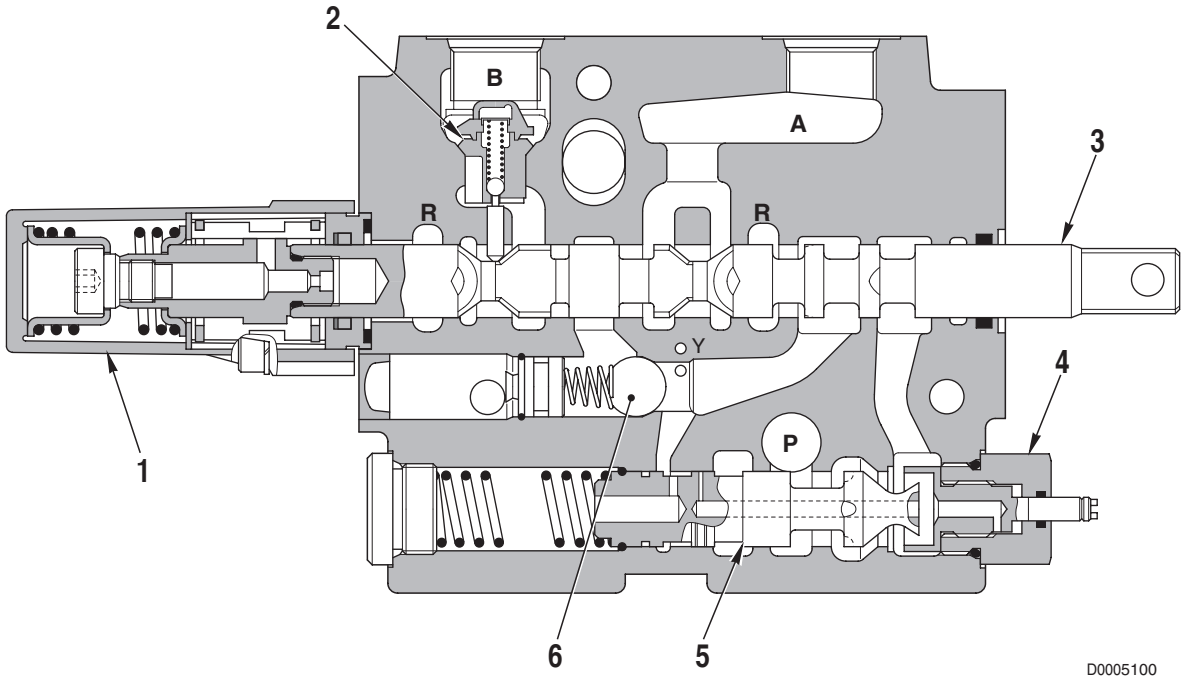
8-WAY VERSION





1. L.H. end cover with pilot valve for electrically operated sections
2. n°1electrically operated section
3. n° 2 electrically operated section
4. Manifold
5. Lift control section
6. Shock valve
7. n° 3 valve section
8. n° 4 valve section
9. R.H. end cover with LS signal outlet
10. Check valve (mechanically operated)
11. Spacer
12. Pilot valve for electrically operated sections

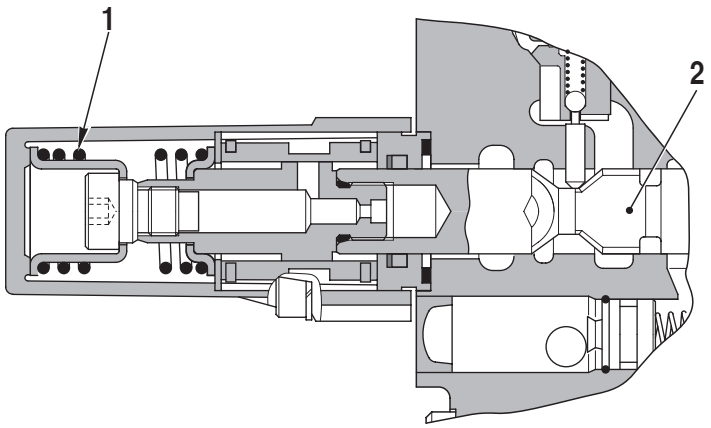
5.3.2 SERVICES CONTROL VALVE SECTION



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

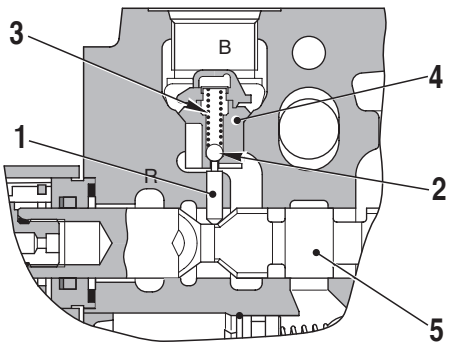
5.3.3 DESCRIPTIONS OF COMPONENTS

SPOOL RETURN DEVICE



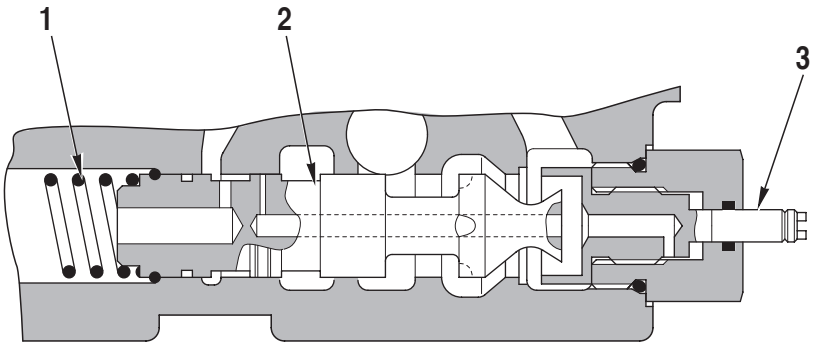
1. Spool return spring
2. Spool

CHECK VALVE (NR)



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

FLOW CONTROL VALVE



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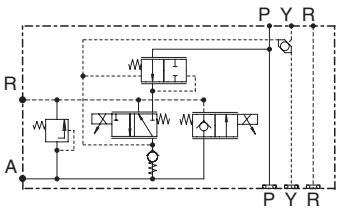
1. Spring
2. Flow control spool
3. Control shaft

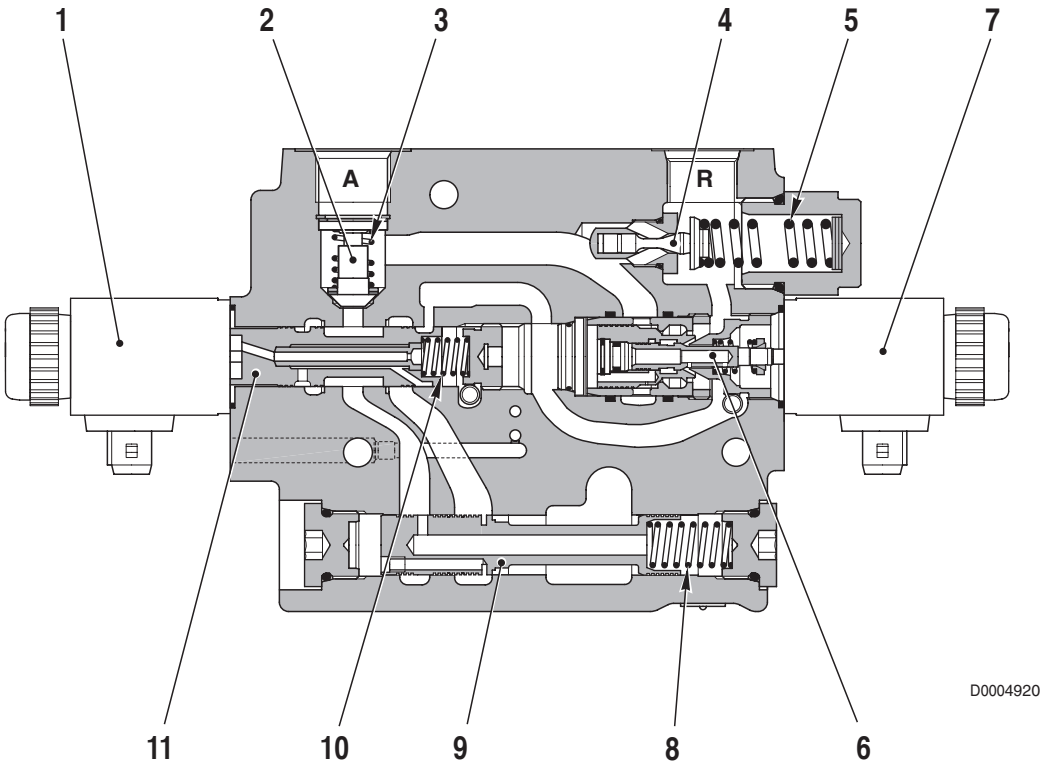
5.3.4 LIFT CONTROL VALVE SECTION

DESCRIPTION

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

HYDRAULIC DIAGRAM





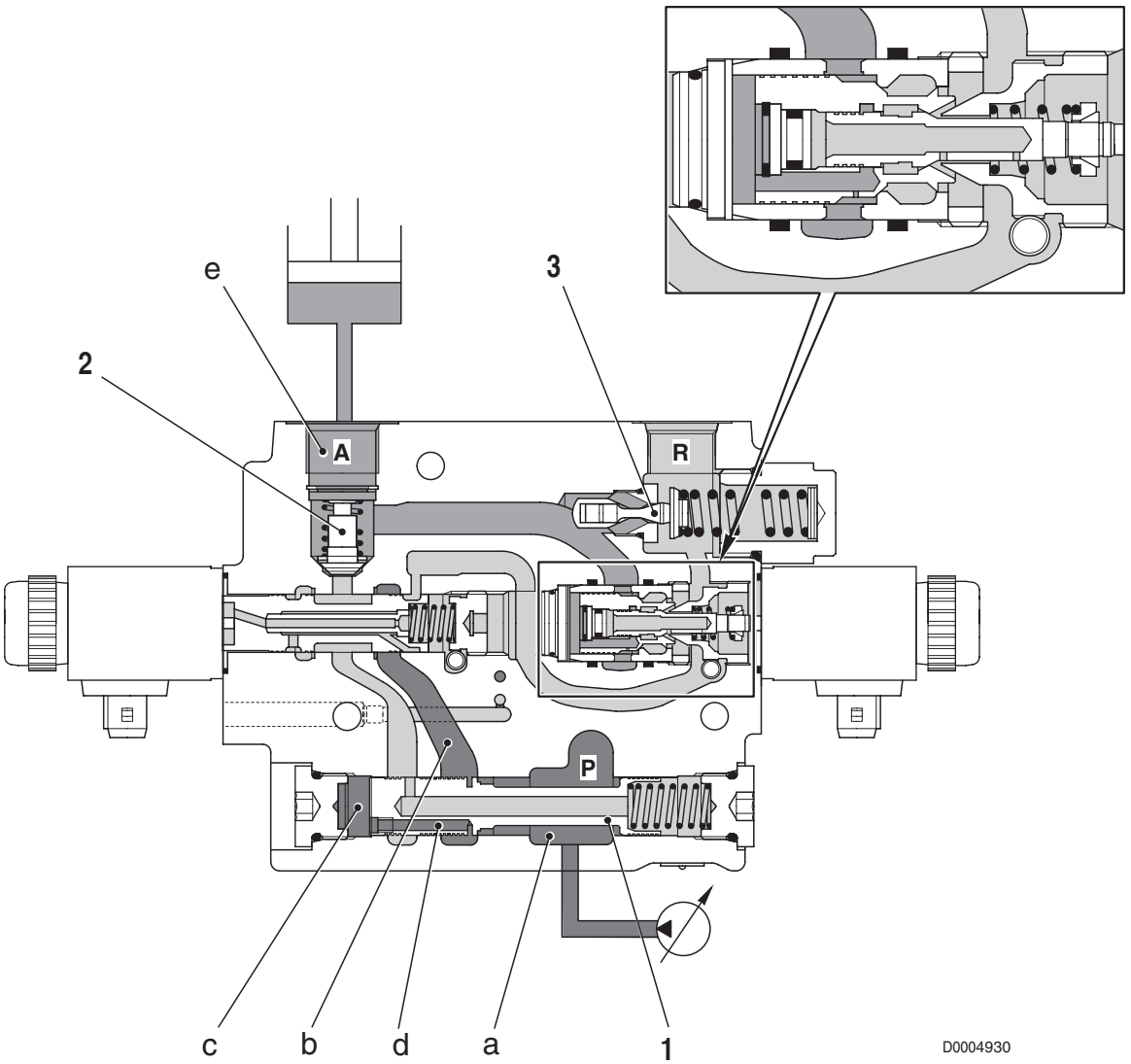
COMPONENTS

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

OPERATION

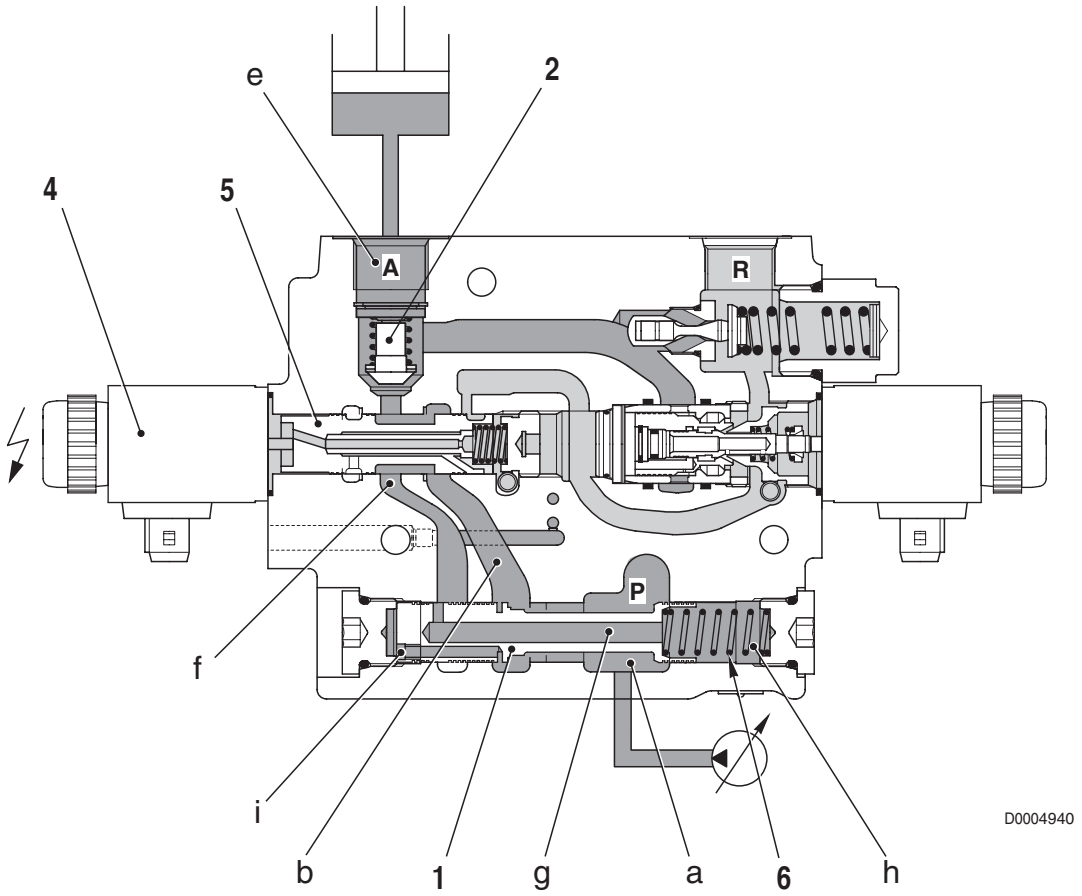
1. When the lift control is in neutral position

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



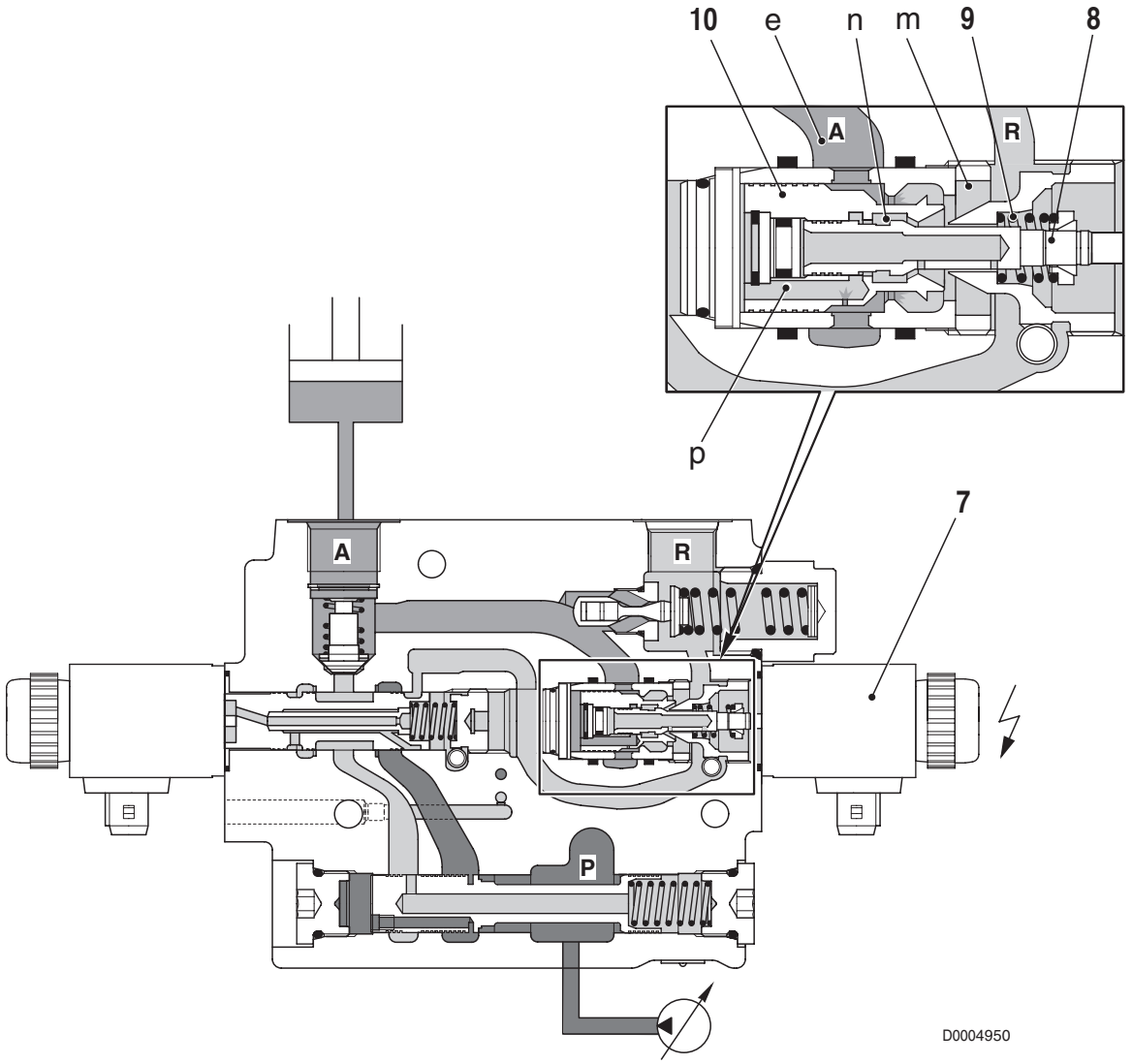
2. When the lift is raised

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



3. When the lift is lowered

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

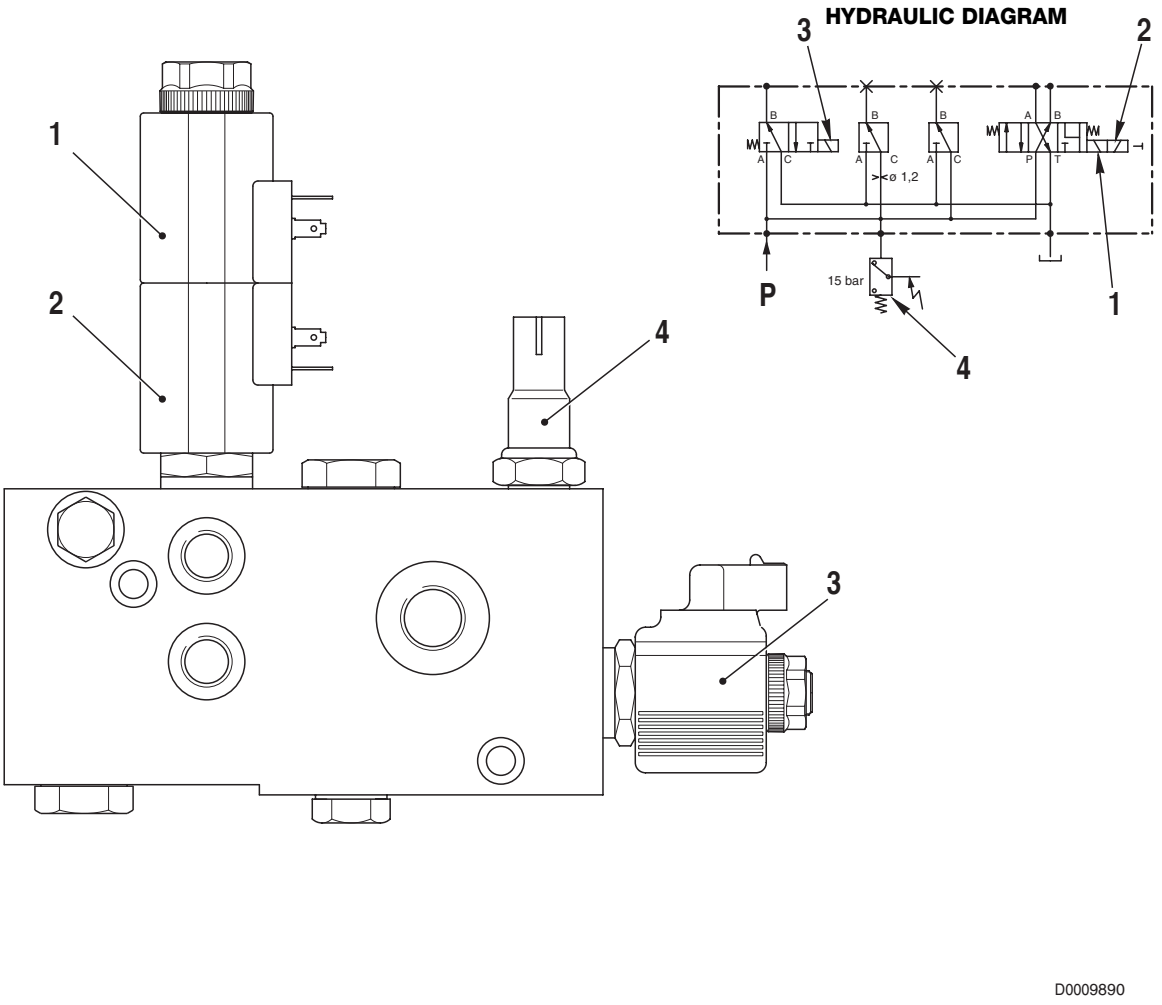


5.4 PTO AND DIFFERENTIAL LOCK CONTROL VALVE

FUNCTION

The function of this directional valve is to control the actuators engaging the differential lock and applying the rear PTO brake.

The valve also incorporates a sensor monitoring low pressure in the hydraulic circuit of the transmission system.



1. PTO clutch engagement solenoid valve
2. PTO clutch release solenoid valve
3. Differential lock solenoid valve
4. NC pressure switch (setting 15 bar (217.5 psi))

SECTION 20

CONTENTS

OPERATOR'S MANUAL

SERDIA (LEVEL III)

1. ENTRY AND COMMUNICATION

1.1 OVERVIEW

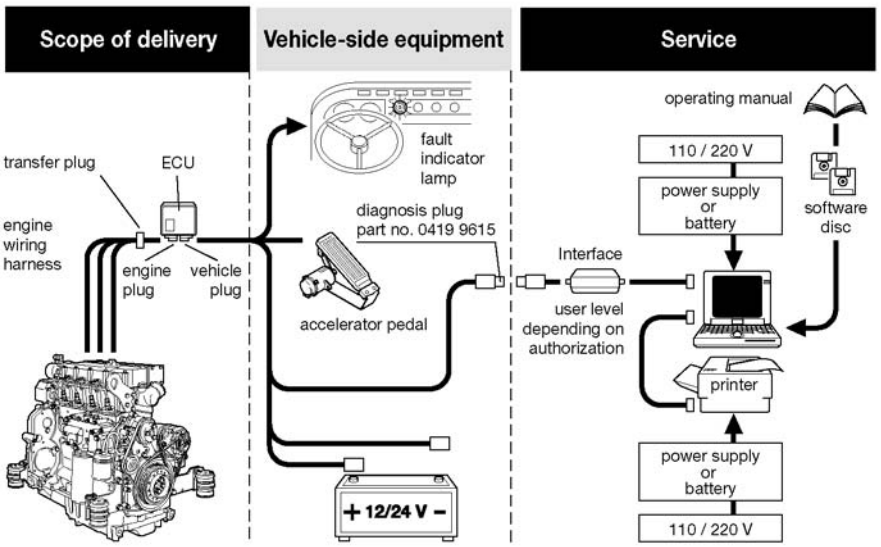
Digital electronic engine ECUs have become a normal part of modern engine technology.
These ECUs are designed, at the very least, to fulfil the functions of comparable mechnical modules (e.g. governors), as well as to provide additional functionality. SERDIA is required in order to make communication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

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

b) a commercially available notebook (or PC),

SERDIA forms a special tool

.



1.1.1 INTRODUCTION

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

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

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

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

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

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

The menu points listed below are available:

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

1.1.2 HARDWARE AND SOFTWARE

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

Hardware:

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

ECUs (engine):

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

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

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

Software:

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

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

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

1.2 ORDERING

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

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

Viale F. CASSANI, 15

24047 TREVIGLIO (BG) - ITALIA

1.2.1 FIRST-TIME USERS

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

Scope of supply:

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

1.2.2 ORDERING SINGLE PARTS

Ser. No.	Part	Competence level	Re-order No.
T9	Installation diskette		5.9030.740.0
T10	Adapter		5.9030.741.0
T11	Interface level III	Major overhaul	5.9030.740.2

1.2.3 Adapter

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

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

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

DEUTZ Part No. 5.9030.741.0

1.3 SWITCH ON NOTEBOOK AND INSTALL SOFTWARE

1.3.1 INSTALLING MS WINDOWS®

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

1.3.2 INSTALLING SERDIA

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

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

TO INSTALL:

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

With Windows 3.11 (3.1):

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

With Windows 95 (98):

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

1.3.3 SERDIA UPDATES

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

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

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

1.4 USER LEVEL, ACCESS AUTHORIZATION

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

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

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

1.5 MAKING A CONNECTION BETWEEN ECU (ENGINE) AND NOTEBOOK

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

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

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

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

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

ATTENTION!

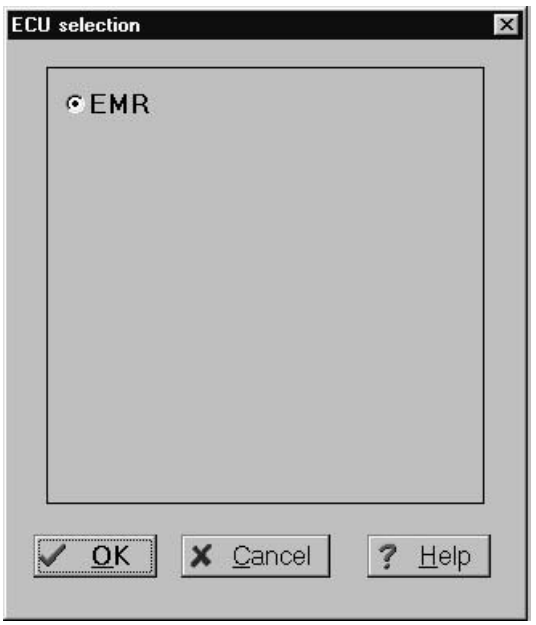
On PCs, the COM1 interface may sometimes be occupied by the mouse. If this is the case, you should connect the interface to the second serial interface (COM2). This must then be configured (see Chapter 8, What should you do if...?).

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

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

1.6 PROGRAM START

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

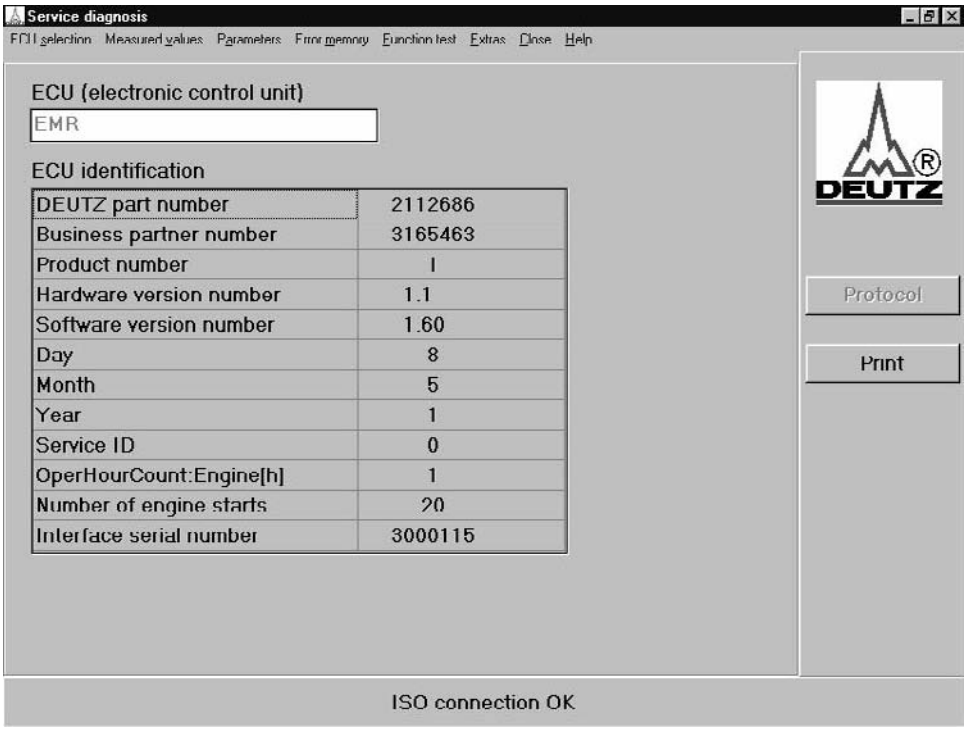


1.6.1 ESTABLISHING COMMUNICATION WITH THE ECU

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

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

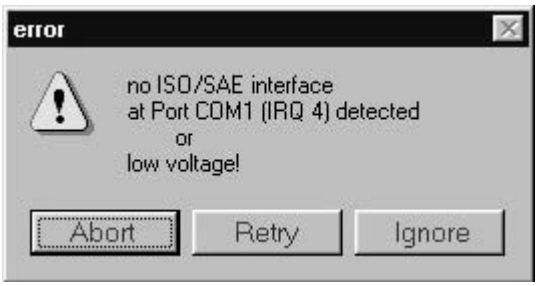
Once communication has been successfully established, the main screen "Diagnostics service" is displayed with the fields "ECU (electronic control unit)" and "ECU identification". This main screen contains a predefined selection menu.



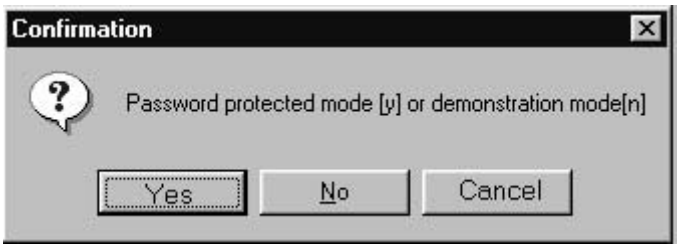
1.7 OFFLINE MODE

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

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



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



1.7.1 PASSWORD-PROTECTED MODE

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

1.7.2 DEMO MODE (TRAINING WITHOUT ECU)

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

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

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

ATTENTION!

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

1.8 WORKING WITH THE PROGRAM

Brief description:

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

1.8.1 MAIN SCREEN, MENU SELECTION

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

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

1.8.2 MENU POINT "ECU SELECTION”

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

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

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

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

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

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

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

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

displayed by:

- designation
- value
- unit

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

1.8.4 MENU POINT "PARAMETERS"

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

- custonner requiremenis
- abaptation to locai requirements
- replacement installation

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

1.8.5 MENU POINT "ECU SELECTION”

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

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

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

1.8.6 MENU POINT "FUNCTION TEST"

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

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

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

Before doing so, the engine must be shut down!

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

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

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

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

1.8.7 MENU POINT "EXTRAS"

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

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

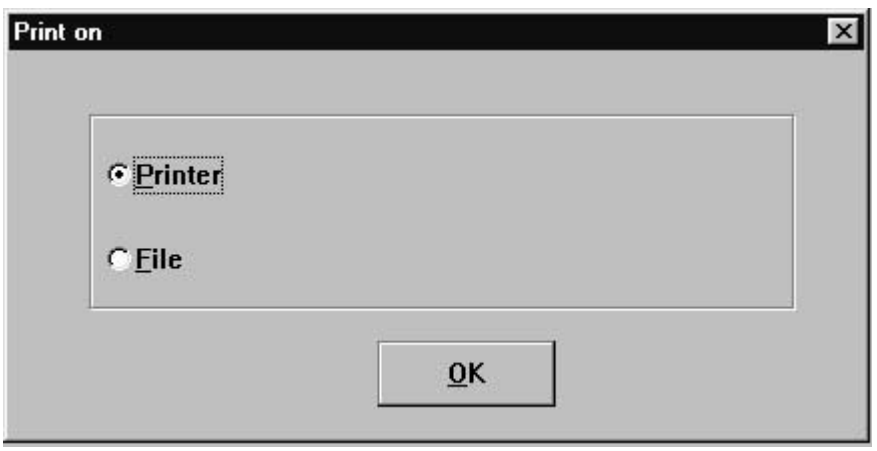
For more information, please see Chapter 7, Extras.

1.8.8 Help

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

1.9 PRINT (OUTPUT)

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



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

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

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

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

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

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

1.10 PROTOCOL (PROTOKOLL)

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

1.11 END COMMUNICATION

1.11.1 PROGRAM END

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

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

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

1.11.2 DISCONNECTING THE ECU

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

2. ECU SELECTION

2.1 GENERAL

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

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

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

Possible ECUs:

EMR (Electronic Engine Governor)

MVS (Magnetic Valve System)

EMS (Engine-Monitoring System)

2.2 RECOGNITION OF ECUS

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

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

2.3 IDENTIFICATION DATA

2.3.1 EMR IDENTIFICATION

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

3 MEASURED VALUES

3.1 ACTUAL MEASURED VALUES (GENERAL)

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

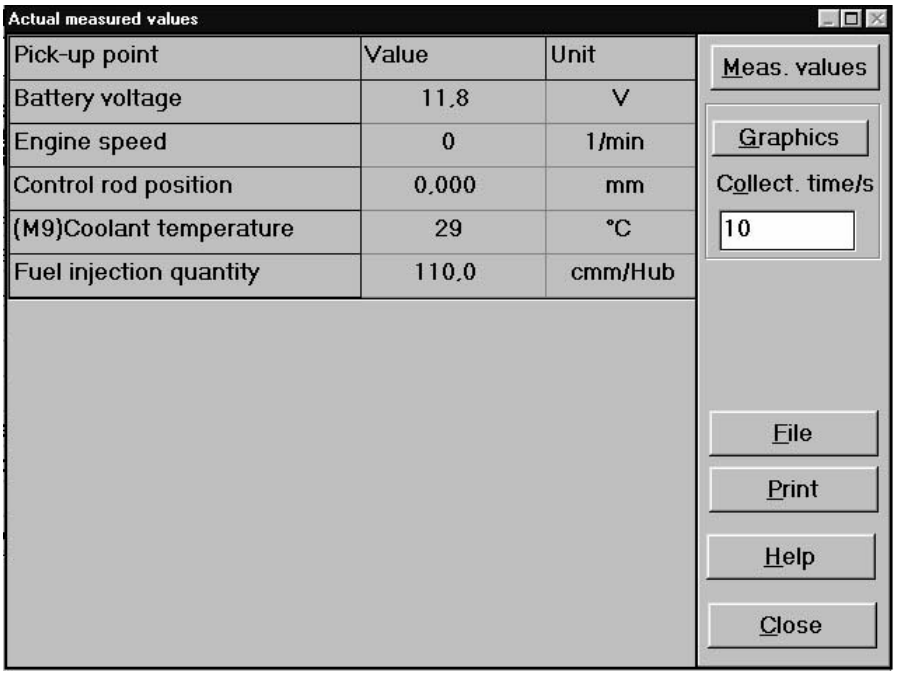


Figure: Current measured values of the EMR

ATTENTION!

Values beyond the sensor measuring range are underlayed in colour:

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

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.

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

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

A measurement duration of 10 s gives

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

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

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

Print: The displayed measured values are printed.

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

3.1.1 MEASURED VALUE SELECTION

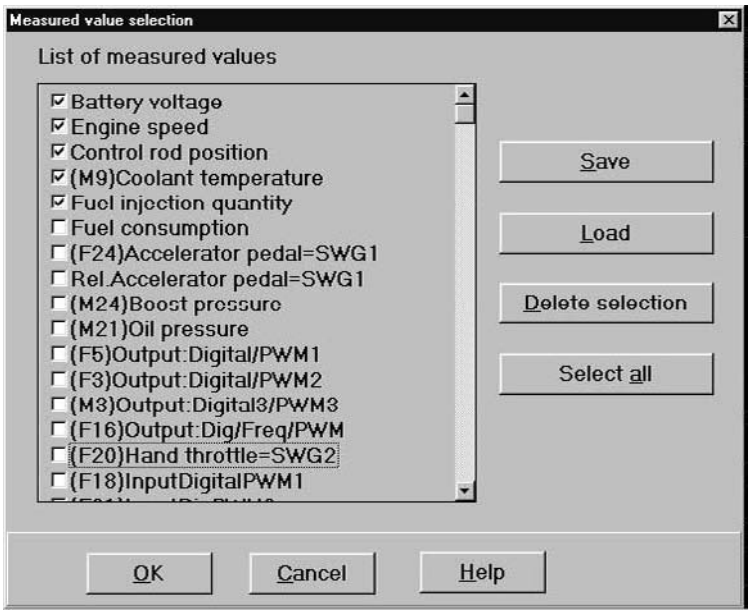


Figure: Measured value selection EMR

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

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

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

Delete selection: All measured values are deactivated for display.

Select all: All measured values are activated for display.

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

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

3.1.1.1 MEASURED VALUES EMR

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

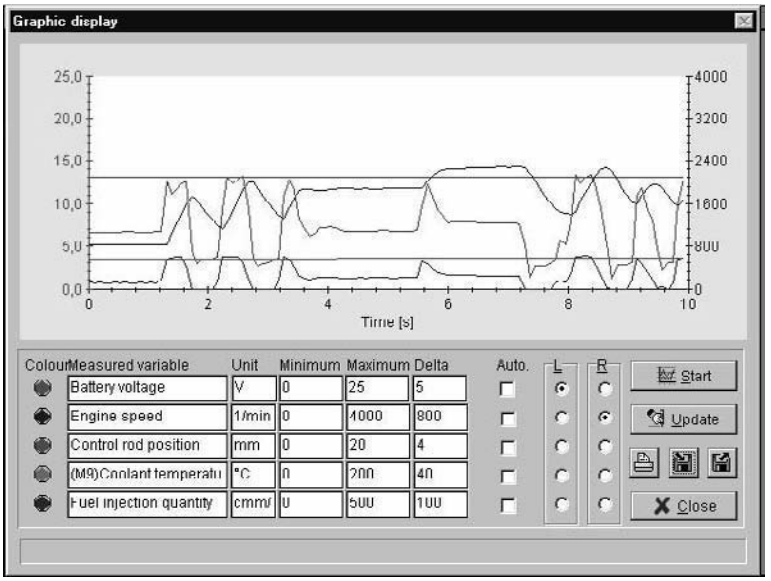
Measured value selection

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

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

3.1.2 GRAPHICS

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



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

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

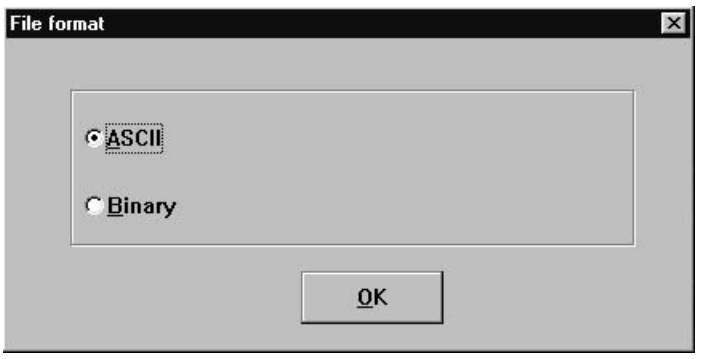
EXPLANATION OF THE FUNCTION SWITCHES:

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

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

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

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



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

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

3.2 RAM VALUES

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

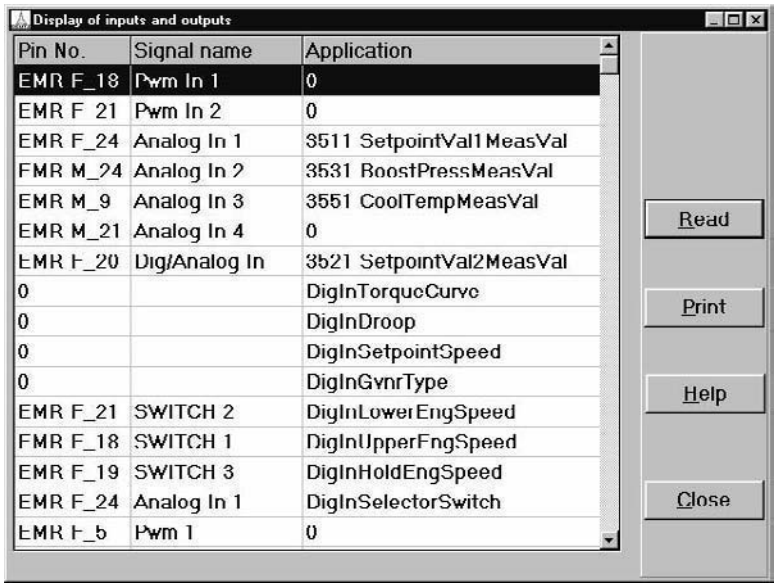
3.3 DATA LOGGER (ONLY EMS)

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

3.4 INPUT/OUTPUT ASSIGNMENT

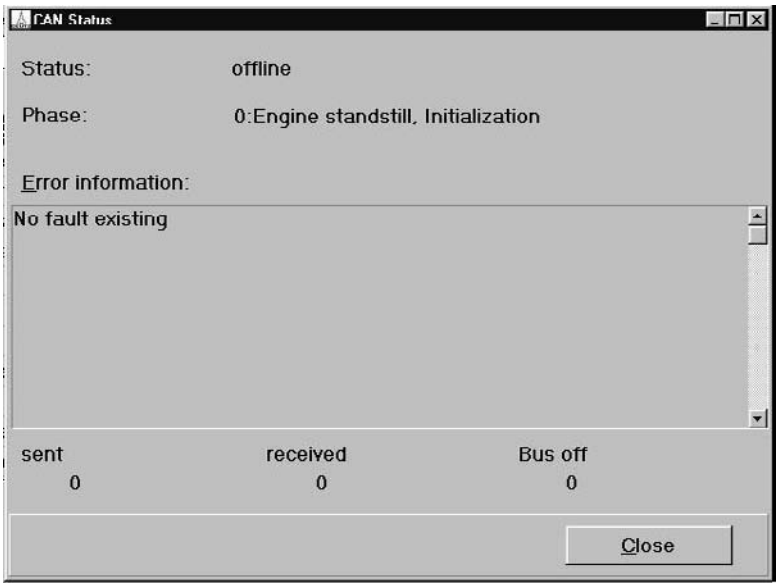
Inputs and outputs can be configured. This item in the menu displays the current input and output status.

Restriction: Only applies for EMS and EMR ECUs.



3.5 CAN-Status

This window displays the CAN bus activities of the EMR.



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

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

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

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

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

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

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

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

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

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

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

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

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

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

3.6 EXAMPLE OF A DISPLAYED ERROR INFORMATION:

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

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

4. PARAMETERS

4.1 CONFIGURATION

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

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

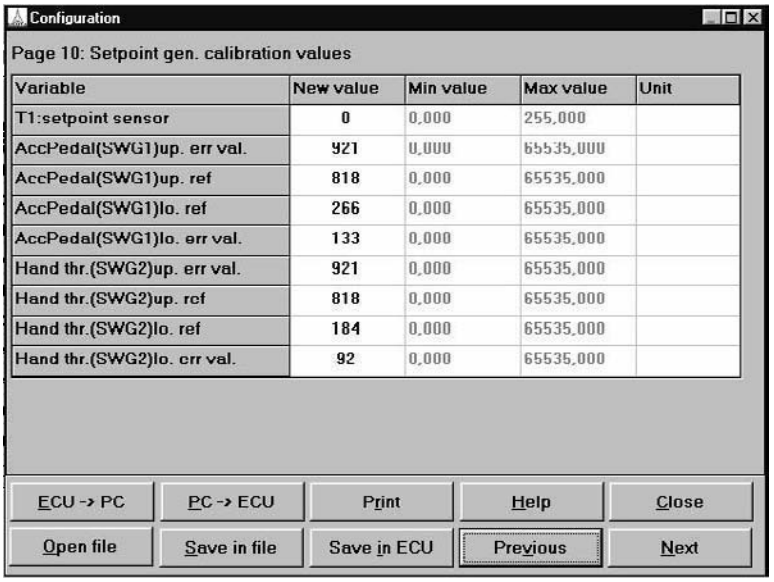


Figure: Example of a choice of configuration parameters.

EXPLANATION OF THE FUNCTION SWITCH

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

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

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

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

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

ATTENTION!

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

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

Next: Displays data for the next screen page.

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

4.1.1 EMR

.

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

EMR PARAMETERS CONFIGURABLE WITH LEVEL III

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

		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

		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

		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)

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

		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	

		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	

		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	

		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	

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

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

4.2 OVERALL PROGRAMMING

ATTENTION!

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

Saving data contained in the ECU:

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

Complete programming of ECU:

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

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

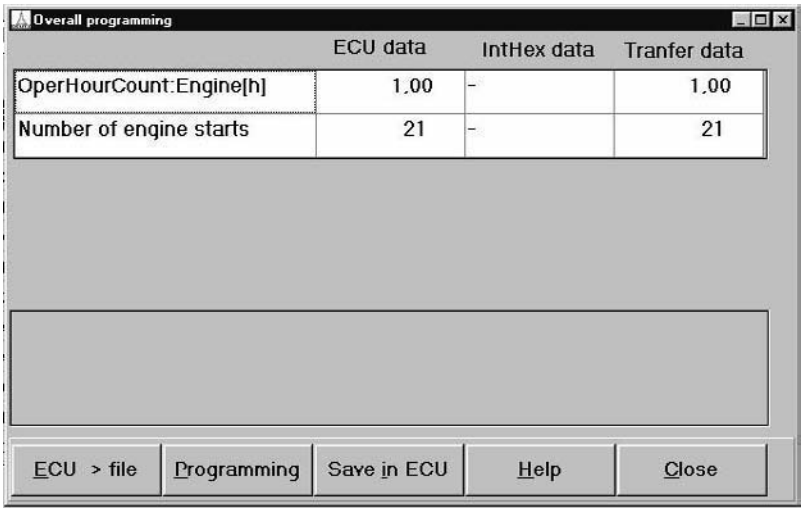


Figure: Menu complete programming (“Overal programming”)

EXPLANATION OF FUNCTION[SWITCH:

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

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

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

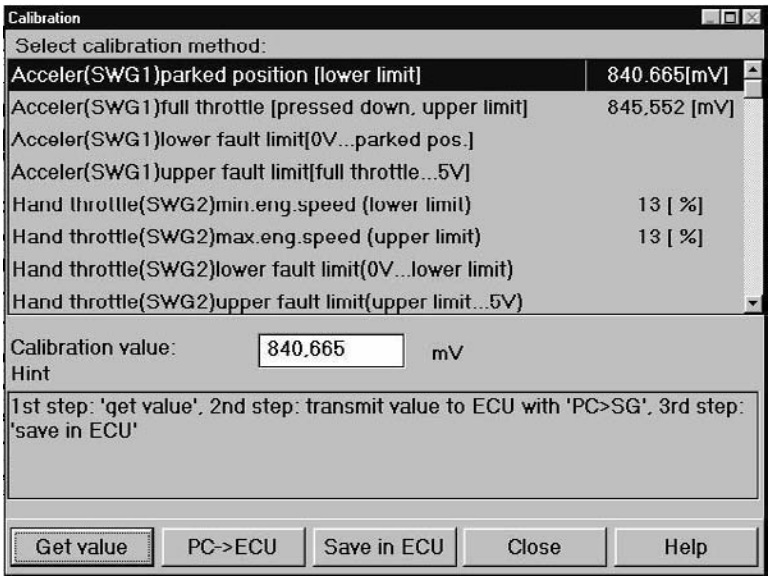
Restriction: Only applies for EMR and EMS.

4.3 CALIBRATION

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

Important prerequisites:

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



TERMINOLOGY EXPLANATIONS:

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

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

GENERAL PROCEDURE DURING CALIBRATION PROCESS:

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

EXPLANATION OF FUNCTION SWITCH:

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

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

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

5. ERROR MEMORY

5.1 GENERAL

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

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

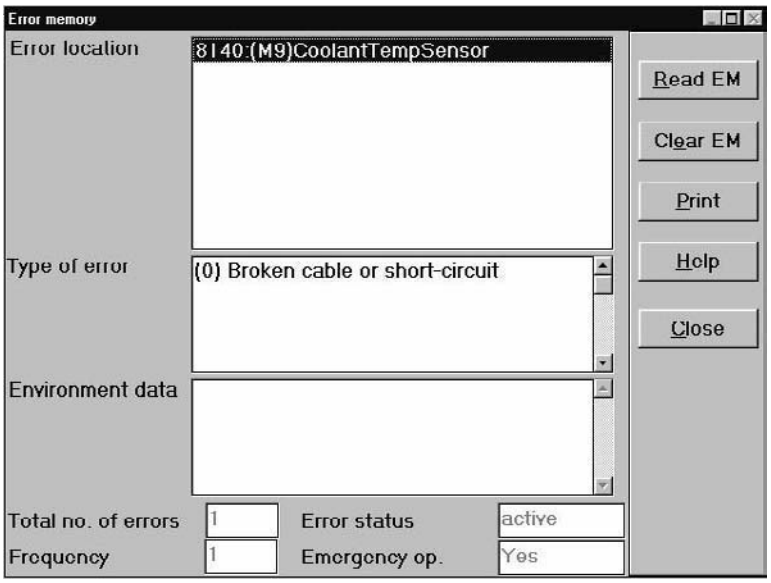


Figure: Example of an error memory output.

DESCRIPTION OF THE FIELDS:

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

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

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

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

Frequency: Frequency of occurrence of the error location selected.

Error status: Selected error active or passive.

EXPLANATION OF THE FUNCTION SWITCHES:

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

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

5.1.1 ERROR MEMORY (EMR)

List of possible error locations of the EMR:

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

The possible types of error are:

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

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

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

ERROR MESSAGES, CAUSES AND REMEDIES

Error pilot lamp	Error messages (only readable with SERDIA)		Possible causes	n. O.K	Remedy
	Type of error	Error location			
Permant light (Engine operation restricted)	(0) Broken cable or short-circuit	• 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 ↓** Faulty configuration (e.g. overrun cond. OFF) Actuator defective	 → → →	 Check coolant Check oil level Check data in SERDIA menu "Configuration" and change if necessary Replace actuator
Engine start not 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 ↓** Plug-in contacts contaminated or corroded **OK ↓** Actuator defective **OK ↓** Cable harness defective	→ → → →	Restore plug-in connection Clean connector and replace if necessary Replace actuator Check cable harness and replace if necessary
	(5) Shutoff limit exceeded/ fallen below	• 8405: Actuator (positioner, travel meter, fuel rack)	Actuator defective	→	Replace actuator

[1] Switch to SWG 2 (if SWG 2 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.

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 measur-ment	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 =310Ω $V_{ACpeak} \cong 40mV$ 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.

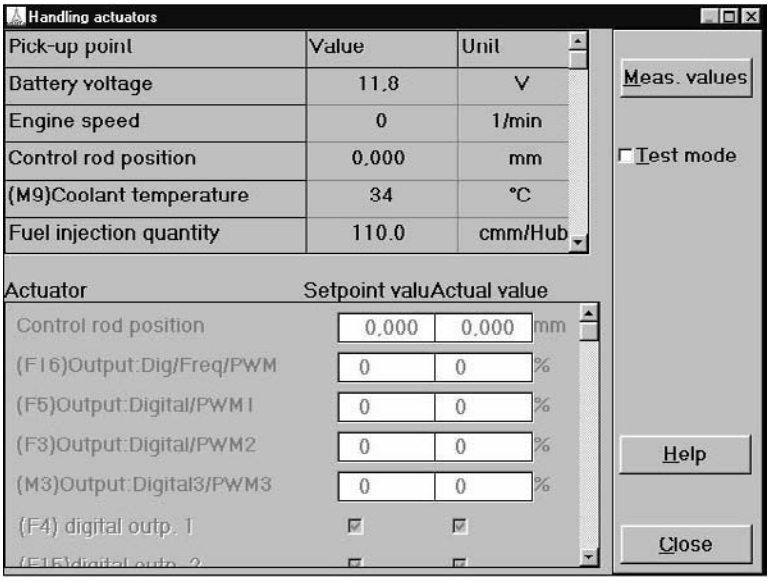


Figure: Menu for function test of EMR actuator

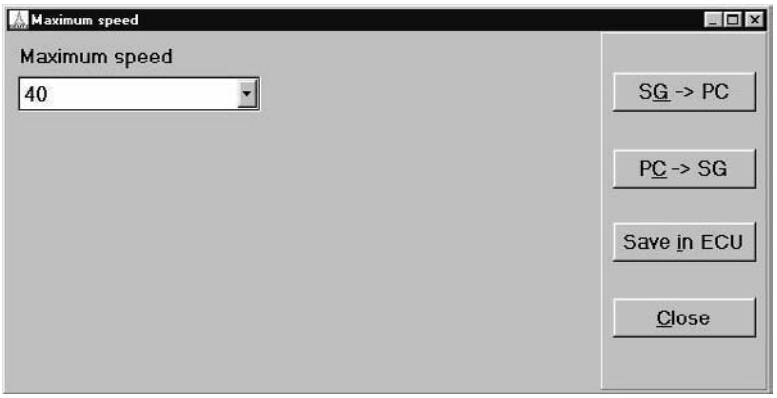
STRUCTURE OF THE DISPLAY WINDOW

- 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.**

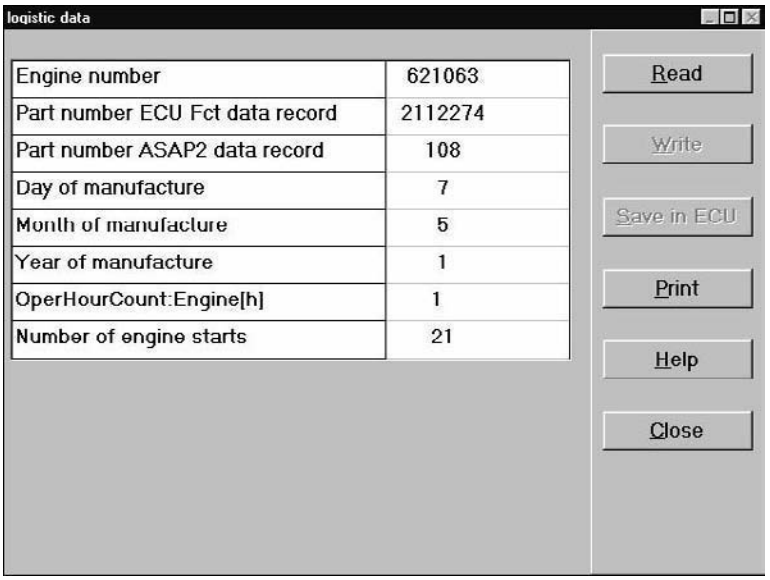


Figure: Logistic data of the EMR

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.

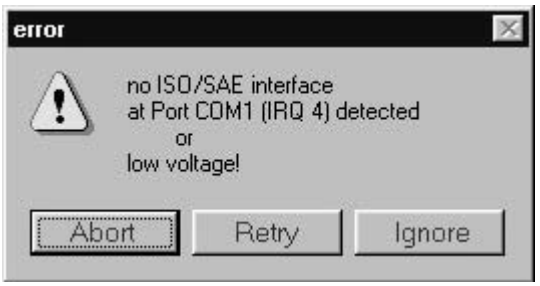
Restriction: Only applies for EMS

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:



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.**

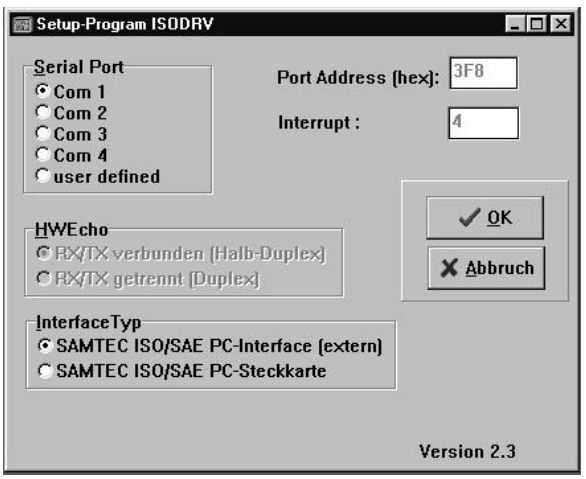


Figure: Help file screen from SETUP.EXE

8.1.3 ACCESS CONFLICTS UNDER WINDOWS 3.1

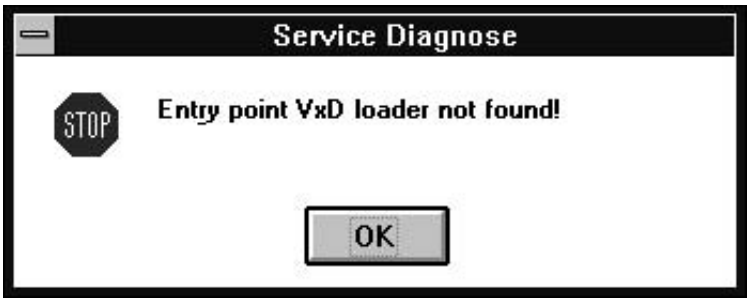
The interface driver ISODRV.386 can only be loaded statically. You enter the driver ISODRV.386 in Windows file SYSTEM.INI under section [386Enh] (at the same time specifying your current directory). This can result in problems with other application programs occurring that also access the serial interface.

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

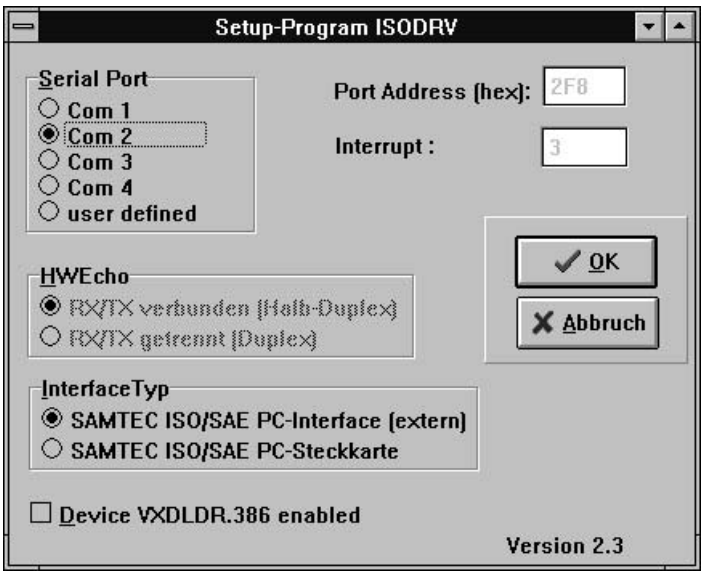
When you start up SERDIA under Windows 3.11, you may receive the following error message:



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.

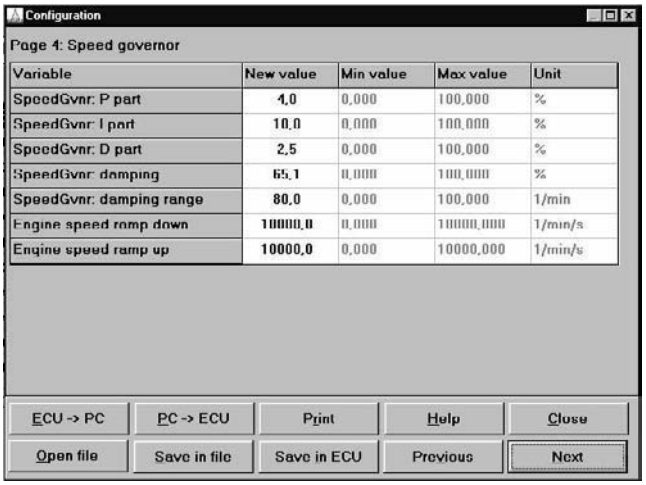
GOVERNOR ADJUSTMENT:

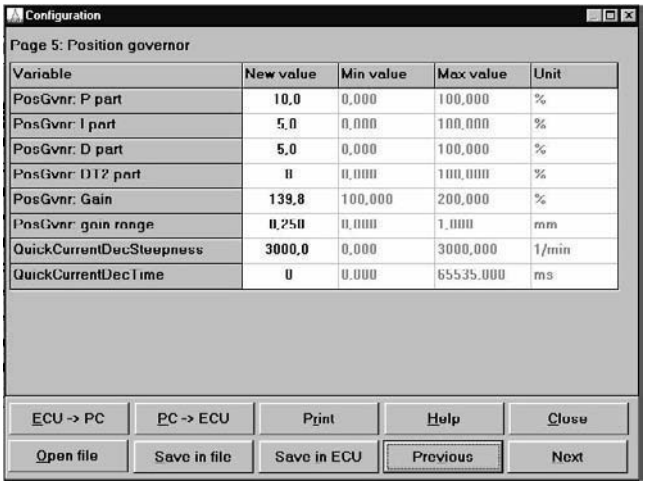
Governor adjustment applies primarily for new applications. It must be thoroughly tested and **documented** with the system (engine and equipment) under all operating conditions.

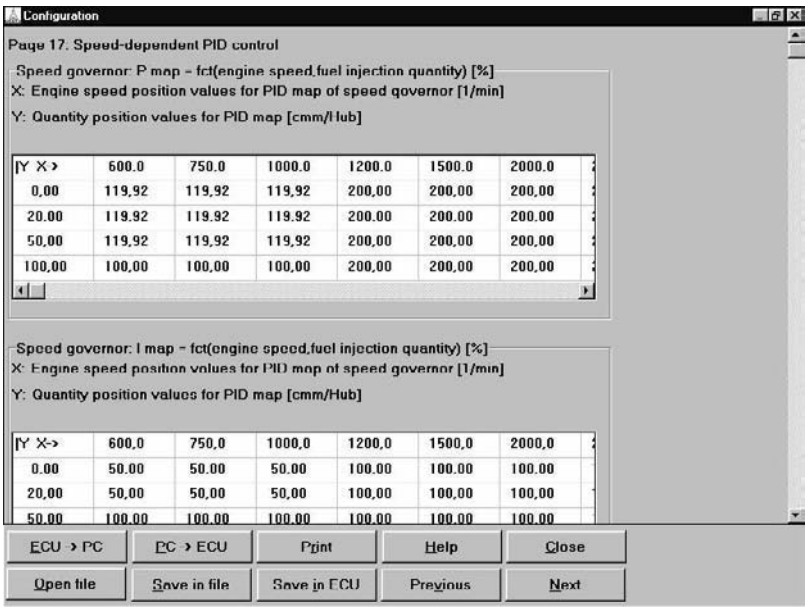
When the new application has been concluded and cleared, you must notify head office of the governor parameters pertaining to the application. For subsequent engines with the same application no further adaptation is necessary as a rule.

MENU ENTRY:

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







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
	[mV]	[digits]	[mV]	5V = 1023 digits	
				[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.**

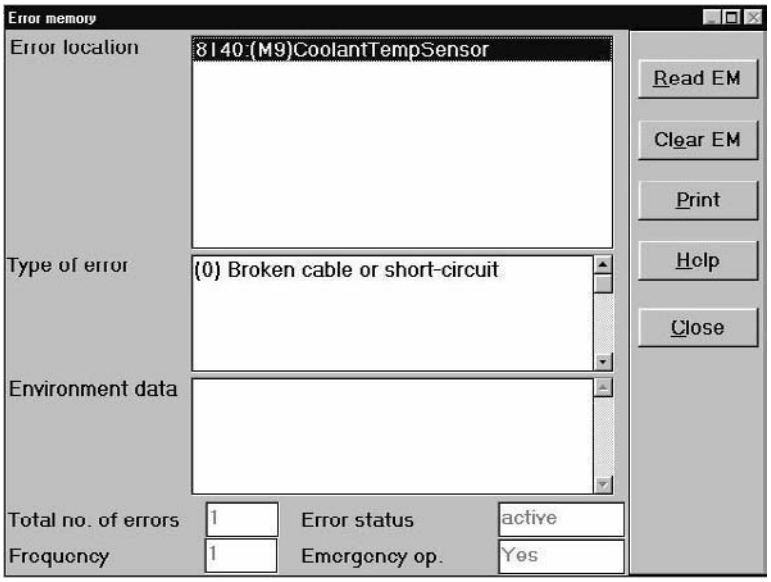
It is the aim that the ECU be informed of the limit values of the two stops "Potentiometer stop LI speed" as lower reference point and "Potentiometer stop rated speed" as upper reference point. Depending on the two reference points, the "Upper error value" (+5% of the upper reference point) and the "Lower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

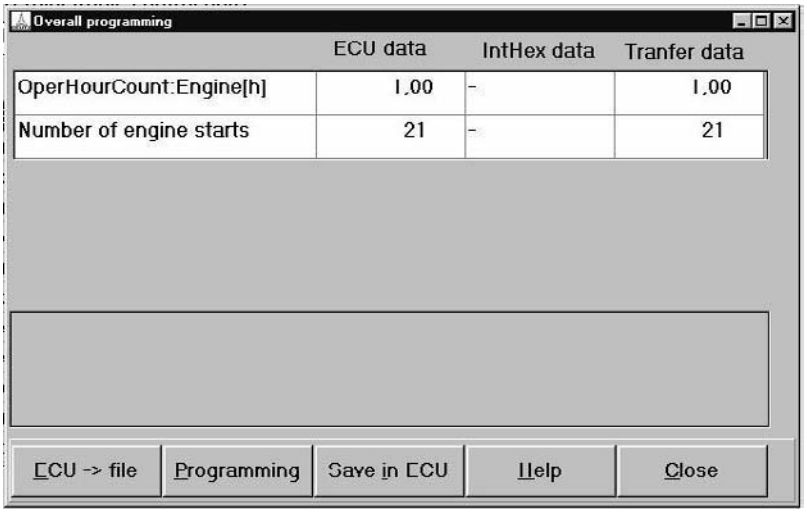
8.2.8 REPLACING THE EMR ECU

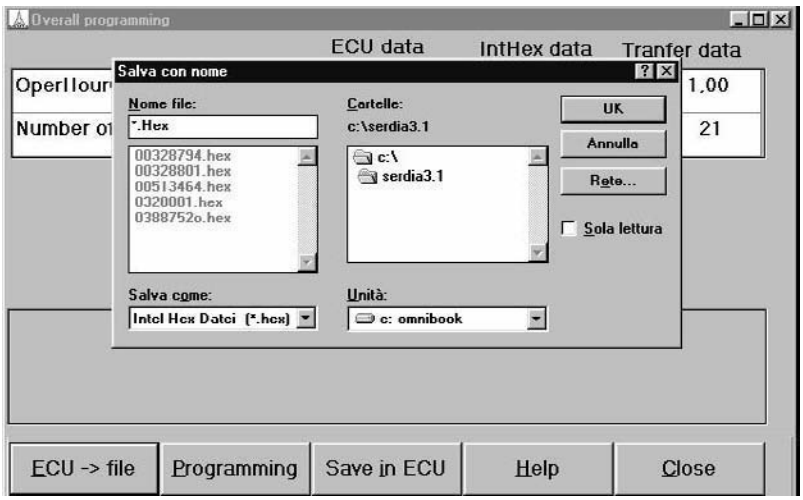
The ECU can be replaced in two ways:

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.

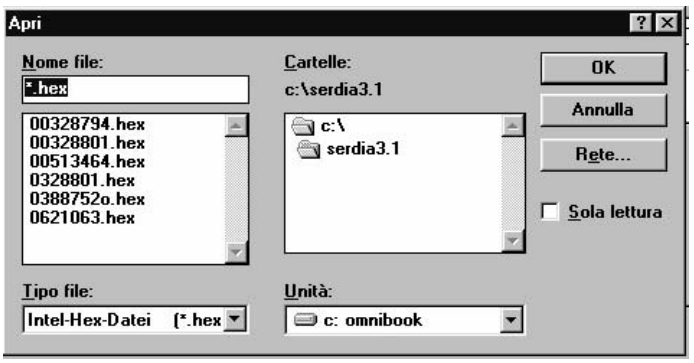
2nd step: Replace ECU:

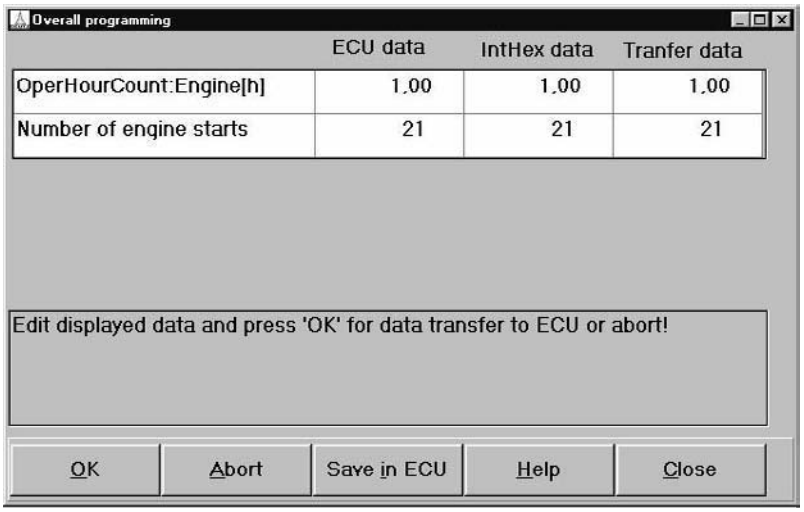
You must check the compatibility of the ECUs by referring to the following table (same part number). You should also check and ensure the compatibility of the ECU with the actuator.

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

ATTENTION!

- **i.e. if you do not notify DEUTZ AG of any corrections to the engine settings, these cannot be taken into account when a new ECU is programmed.**

- Switch off ignition/power supply,
- Release the two plugged connections on the old ECU.
- Connect the ECU to the engine and the vehicle plug (both 25 pole).
- Switch on ignition/power supply.
- Call SERDIA program.
- Delete error memory in the menu "Error memory".
- Start engine and check for satisfactory running.

8.2.9 Error when entering configuration data

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

9. SERDIA UPGRADE FROM VERSION 2.5 TO VERSION 3.1

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

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

SERDIA 3.1 solves some of these problems.

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

It is absolutely essential to disable ACPI.

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

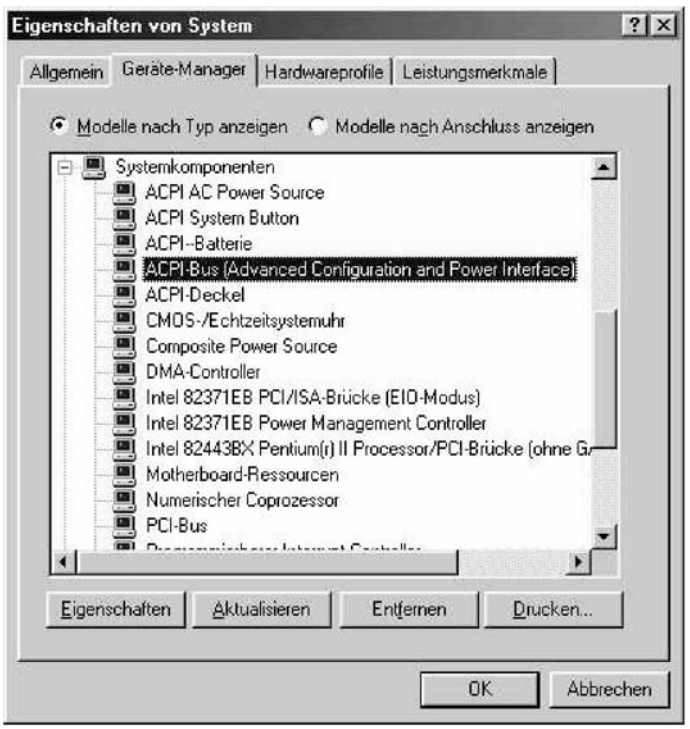
SERDIA 3.1 therefore includes files with which you can disable the ACPI function and reactivate the “old” APM (Advanced Power Management) function (as in Windows 95).

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

Your manual assistance is therefore needed.

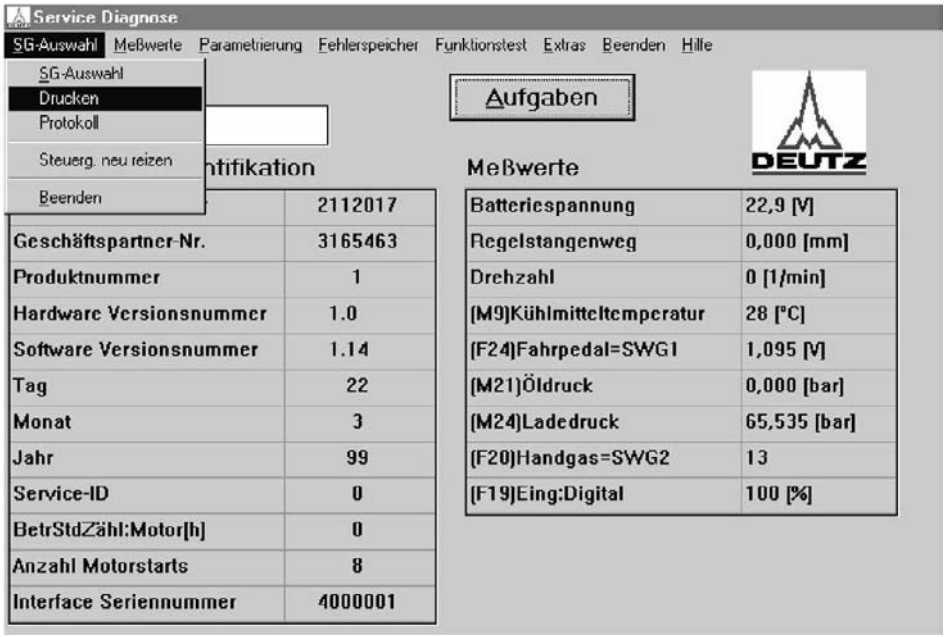
What can you do in such a case?

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



Example with ACPI enabled

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



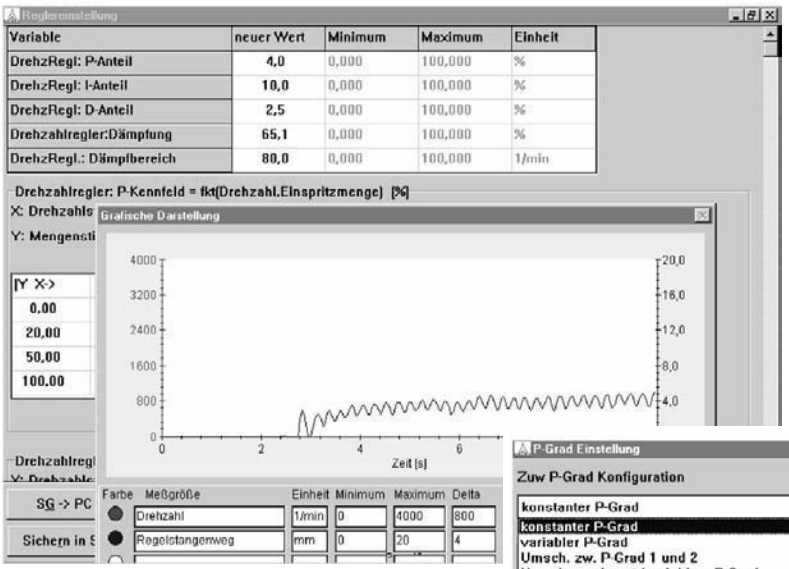
Innovations individually

- 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

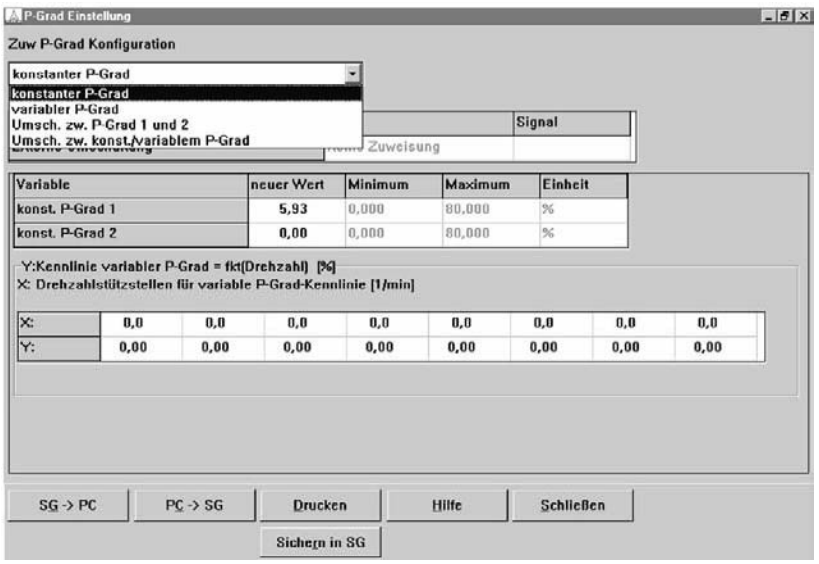
9.3 NEW SWITCH “JOBS“ FOR PERFORMING SELECTED SERVICING OPERATIONS, E.G. ADJUSTING CONTROLLER OR ADJUSTING OFFSET

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)

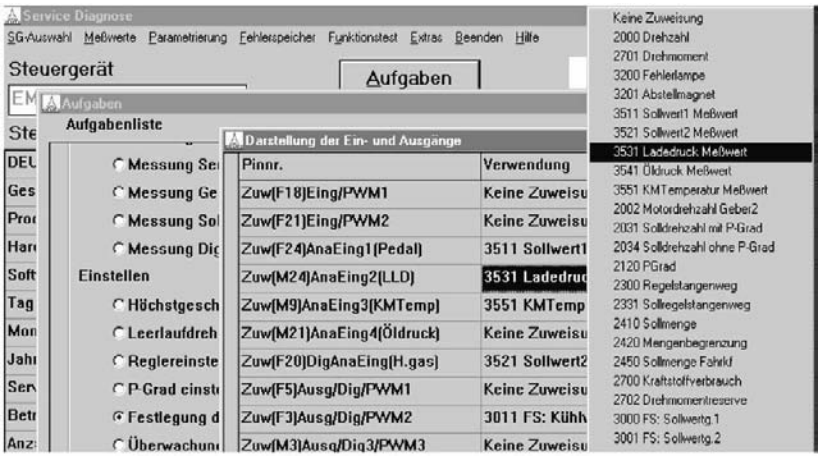


Example: "Adjusting offset“ (P-Grad Einstellung)



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

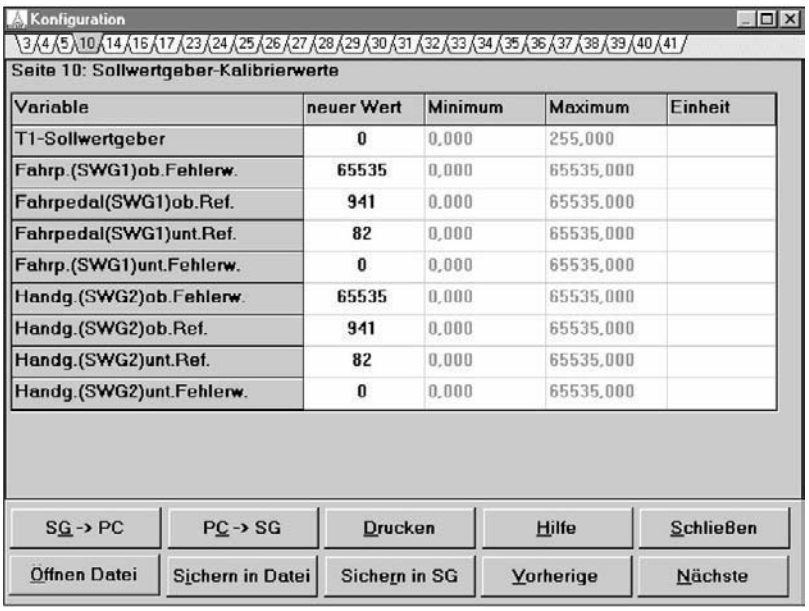
With the "Jobs“ switch the possible assignments are now displayed in "Specification of in- and outputs“ (right mouse-click) and assigned (left mouse-click). From the same mask the switch-selectable functions can also be assigned and the measured values for all in- and outputs displayed.
This configuration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

ALL ROUND TESTER MANUAL - AGROTRON TTV SERIES TRACTORS

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®.

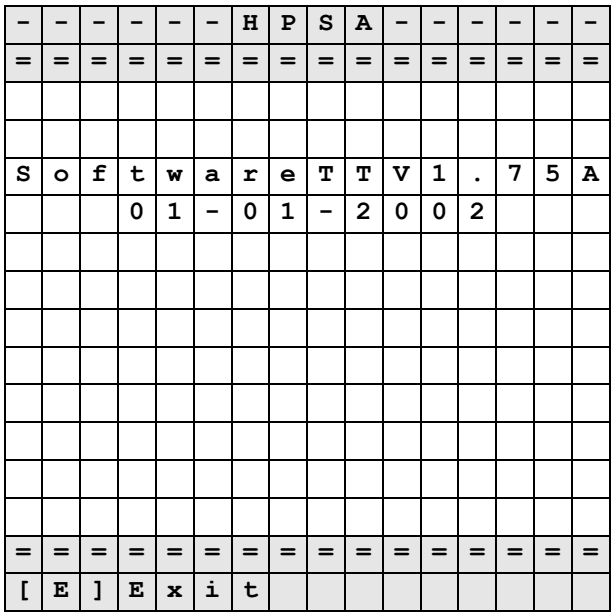
This device can be used to:

- Display alarm codes
- Carry out calibration and setting operations
- Display machine 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 a connection between the ART® and the diagnostics and communication socket on the right hand console.

To illustrate the programming steps for the particular machine, the setting procedures that can be performed with the ART®, and the listing of alarms diagnosed by the control units, the manual shows all of the screens for the different control units with an explanation of the captions displayed by the ART®.

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

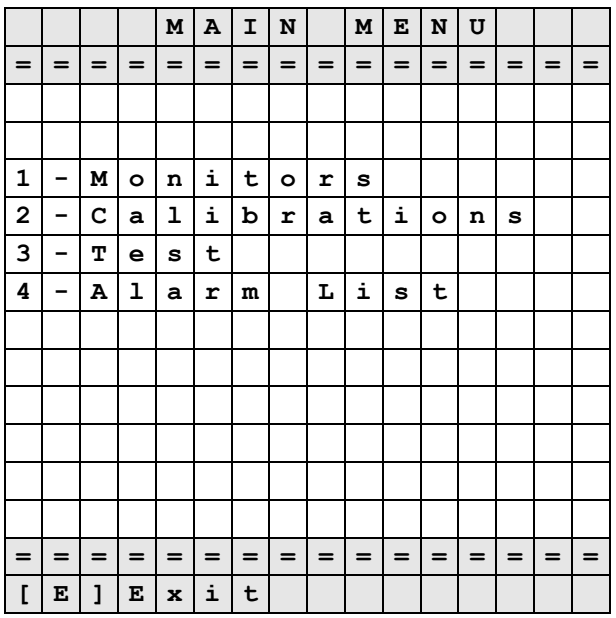


OPENING SCREEN

Software version.

Release date.

Press [E] to continue.



MAIN MENU

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

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

3 - Test:
used to display information relative to the input signals returned by sensors (display of raw data).

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

		M	O	N	I	T	O	R		E	N	U			
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
	1	-	T	R	A	S	M	I	S	S	I	O	N		
	2	-	P	T	O										
	3	-	A	S	M										
	4	-	L	i	f	t									
	5	-	S	u	s	p	e	n	s	i	o	n			
	6	-	I	n	f	o	r	m	a	t	i	o	n		
	7	-	C	.	A	.	N	.							
	8	-	T	C	U		Di	g	i	t	a	l	s		
	9	-	D	i	s	t	r	i	b	u	t	o	r		
	A	-	E	N	G	I	N	E							
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

1. MONITOR

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

		T	R	A	N	S	M	I	S	S	I	O	N		
M	O	D	E	:					M	A	N	U	A	L	
		S	P	E	E	D		(	r	p	m	)			
	d	e	s				I	N		r	e	a	l		
	8	0	0				|				7	8	6	
							O	U	T						
	4	4	0				|				4	3	0	
			D	I	R	E	C	T	I	O	N				
	>	N	<				|	N	e	u	t	r	a	l
R	A	T	I	O		I	N	C	H		A	C	C	E	L
	0	.	3	4	0			0				3	5	%	
	(	b	a	r	)		O	I	L			(	C	)	
		1	9									+	3	5	
E	R	R	O	R				0	0						
[	E	]	E	x	i	t									

1.1 TRANSMISSION

- **MODE**
  Transmission operating mode.
  - **Manual**: manual mode.
  - **Auto**: automatic mode.
- **SPEED (rpm)**
  Two columns are displayed (**req:** required speed - **act:** actual speed detected by sensors).
  - **IN**: crankshaft speed
    (valid range for actual speed: 0÷2400)
  - **OUT**:transmission output speed (valid range for actual speed 0÷4500)
- **DIRECTION**
  Drive direction.
  Two columns are displayed (**req:** required direction - **actual:** actual direction).
  Required values:
  >N< : neutral
  >A<: forward
  >I<: reverse
  Actual values:
  ERROR:control unit has sensed a fault
  NEUTRAL: neutral
  FORWARD:forward drive
  REVERSE: reverse drive

		T	R	A	N	S	M	I	S	S	I	O	N		
M	O	D	E	:					M	A	N	U	A	L	
		S	P	E	E	D		(	r	p	m	)			
	d	e	s				I	N		r	e	a	l		
	8	0	0				|					7	8	6	
							O	U	T						
	4	4	0				|					4	3	0	
			D	I	R	E	C	T	I	O	N				
	>	N	<				|	N	e	u	t	r	a	l	
R	A	T	I	O	C	L	U	T	C	H	A	C	C	E	L
	0	.	3	4	0			0				3	5	%	
	(	b	a	r	)		O	I	L			(	C	)	
		1	9									+	3	5	
E	R	R	O	R				0	0						
[	E	]	E	x	i	t									

- **RATIO**
  Overall transmission ratio.
  Valid range 0,000÷2,000; with the engine running and the tractor stationary, the ratio must be 0,000.
- **CLUTCH**
  Percentage travel of clutch pedal.
  Valid range between 0 and 100.
  The "✻" symbol preceding the value indicates that the clutch pedal has been intercepted by the proximity sensor.
- **ACCEL**
  Percentage acceleration of tractor.
  Valid range between 0 and 100.
  If automatic operating mode is selected, the value is calculated by the control unit, whereas in manual mode the value is selected by the operator using the relative potentiometer.
- **(bar)**
  Pressure in transmission hydraulic circuit.
  (0÷20 bar).
- **OIL**
  Condition of transmission oil filter.

							: filter in good order
D	I	R	T	Y			: filter dirty

- **(C)**
  Temperature in transmission hydraulic circuit.
  Value "ERR" indicates that the control unit has detected a fault affecting the sensor or the wiring.
- **ERROR**
  This field shows transmission error codes currently active, displayed sequentially.
  Value "00" means there are no errors active currently.

						P	T	O							
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
F	r	o	n	t		S	w	i	t	c	h		O	F	F
R	e	a	r			S	w	i	t	c	h		O	F	F
A	u	t	.			S	w	i	t	c	h		O	F	F
B	r	a	k	e		S	w	i	t	c	h		O	F	F
C	o	n	s	.		S	w	i	t	c	h		O	F	F
E	x	t	.			S	w	i	t	c	h		O	F	F
E	n	g	i	n	e							0	r	p	m
R	e	a	r		P	t	o					0	r	p	m
F	r	o	n	t		V	a	l	v	e			O	F	F
R	e	a	r			V	a	l	v	e			O	F	F
B	r	a	k	e		V	a	l	v	e			O	F	F
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

1.2 PTO

- **Front Switch:** Status of front PTO button (ON-OFF)
- **Rear Switch:** Status of rear PTO button (ON-OFF)
- **Aut. Switch:** Status of automatic PTO button (ON-OFF)
- **Brake Switch:** Status of PTO brake button (ON-OFF)
- **Cons. Switch:** Status of PTO enable button (ON-OFF)
- **Ext. Switch:** Status of PTO button on fender (ON-OFF)
- **Engine:** Crankshaft speed (0-2400 rpm)
- **RearPto:** Rear PTO speed of rotation (0-1200 rpm)
- **Front Valve:** Status of Front PTO solenoid valve (ON-OFF)
- **Rear Valve:** Status of Rear PTO solenoid valve (ON-OFF)
- **Brake Valve:** Status of PTO brake solenoid valve (ON-OFF)

NOTE

ON: button depressed or valve energized

OFF: button released or valve de-energized

						A	S	M							
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
D	i	f	f		S	w	i	t	c	h		O	F	F	
A	S	M			S	w	i	t	c	h		O	F	F	
4	W	D			S	w	i	t	c	h		O	F	F	
L	e	f	t			B	r	a	k	e			O	N	
R	i	g	h	t		B	r	a	k	e			O	N	
B	r	a	k	e		L	i	g	h	t		O	F	F	
E	V		4	W	D							O	F	F	
E	V		D	i	f	f						O	F	F	
S	t	e	e	r		A	n	g	l	e			1	5	#
A	S	M	W	/	s	l	i	p				O	F	F	
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

1.3 ASM

- **Diff Switch:** Status of differential lock button (ON-OFF)
- **ASM Switch:** Status of ASM button (ON-OFF)
- **4WD Switch:** Status of four wheel drive button (ON-OFF)
- **Left Brake:** Status of left side brake sensor (ON-OFF)
- **Right Brake:** Status of right side brake sensor (ON-OFF)
- **Brake Lights:** Status of brake lights sensor (ON-OFF) Status must be OFF only with L.H. brake and R.H. brake simultaneously in “ON” status
- **EV 4WD:** Status of four wheel drive solenoid valve (ON-OFF)
- **EV Diff:** Status of differential lock solenoid valve (ON-OFF)
- **Steer Angle:** Steering angle
  Values displayed:
  0 wheels centred
  15 wheels steered at 15°
  25 wheels steered at 25°
  30 wheels steered at 30°
  The **#** symbol before or after the value indicates left or right. Value **????** indicates that the control unit has detected a fault affecting the sensor or the wiring.
- **ASMW/slip:** ASM wheelslip function activated.
  Value ON is displayed only when “ASMbutton” registers “ON” status and the differential lock button is depressed.
  NOTE: this value can change only if RADAR is installed and enabled.

						L	I	F	T	H					
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
	S	t	a	t	u	s	.	.	.	T	R	S	P	T	
	M	i	n		P	o	s	'	n			M	a	x	
		0	%			0	.	0	%			0	%		
		L	t		D	r	a	f	t		R	t			
	0	.	0	0		0	.	0	%		0	.	0	0	
			W	h	e	e	l	s	l	i	p				
	R	e	f	:		O	F	F		1	0	0	%		
			R	a	d	a	r		k	m	h	-	-	-	-
			W	h	e	e	l		k	m	h	0	.	0	
			M	o	d	e				D	R	A	F	T	
	U	p		S	V							O	F	F	
	D	o	w	n		S	V					O	F	F	
	P	w	m		0							0	m	A	
[	E	]	E	x	i	t									

1.4 LIFT

- **Status....:** Status of lift system
  Values displayed:
  TRSPT: in transport mode
  STOP: lift inactive
  CTRL: lift in control condition (e.g. when ploughing)
  FLOAT: lift in float condition
- **Min Pos. Max:** Lift position
  Three columns are displayed
  Min: setting selected with the minimum height potentiometer (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 potentiometer (values between 0 and 100).
- **Lt Draft Rt**: Draft response, right and left.
  Three columns are displayed:
  Lt: 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.
  Rt: signal (in volts) generated by the right side draft sensor.
- **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)

- **Wheel:** 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.

						L	I	F	T	H					
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
	S	t	a	t	u	s	.	.	.	T	R	S	P	T	
	M	i	n		P	o	s	`	n			M	a	x	
		0	%			0	.	0	%			0	%		
		L	t		D	r	a	f	t		R	t			
	0	.	0	0		0	.	0	%		0	.	0	0	
			W	h	e	e	l	s	l	i	p				
	R	e	f	:		O	F	F		1	0	0	%		
			R	a	d	a	r		k	m	h	-	-	-	-
			W	h	e	e	l		k	m	h	0	.	0	
	M	o	d	e						D	R	A	F	T	
	U	p		S	V							O	F	F	
	D	o	w	n		S	V					O	F	F	
	P	w	m		0							0	m	A	
[	E	]	E	x	i	t									

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

NOTE

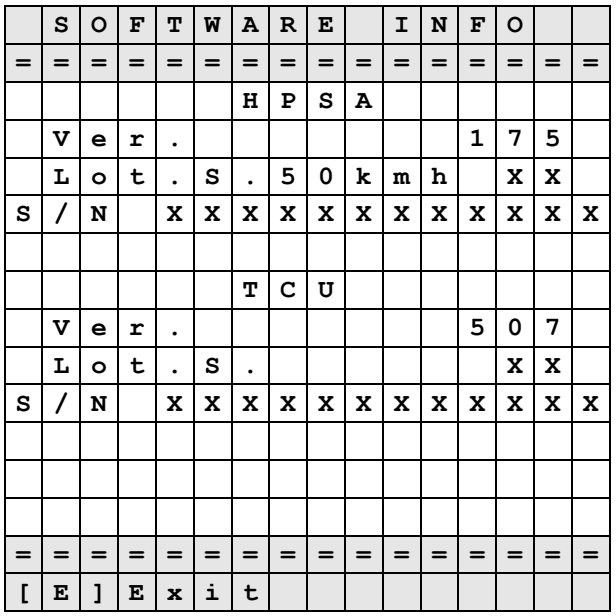
"Up SV" and "Dw SV" must not register "**ON**" status at one and the same time.

- **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

			S	U	S	P	E	N	S	I	O	N			
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
P	o	s	i	t	i	o	n			2	.	0	0	V	
E	V	-	U	p								O	F	F	
E	V	-	D	o	w	n						O	F	F	
E	V		S	e	n	s	e					O	F	F	
S	u	s	p	.	S	w	i	t	c	h		O	F	F	
L	e	f	t		B	r	a	k	e				O	N	
R	i	g	h	t		B	r	a	k	e			O	N	
E	V		4	W	D							O	F	F	
C	o	n	t	r	o	l						O	F	F	
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

1.5 SUSPENSION

- **Position:** Suspension position sensor.
  Values displayed: 2.00 - 4.00 V.
- **EV-Up:** Status of raise solenoid valve (ON-OFF).
- **EV-Down:** Status of lower solenoid valve (ON-OFF).
- **EV Sense:** Status of Load Sensing solenoid valve (ON-OFF).
- **Susp.Switch:** Status of suspension activating button (ON-OFF).
- **Left Brake:** Status of left brake pedal (ON-OFF).
- **Right Brake:** Status of right brake pedal (ON-OFF).
- **EV 4WD:** Status of four wheel drive solenoid valve (ON-OFF).
  Value "**OFF**" must be displayed only when "L.H. brake" and "R.H. brake" are both "**ON**".
- **Control:** Status of axle suspension (ON-OFF).
  Status is "**ON**" during activation or deactivation of the system, or when the suspension responds with the tractor moving and the system activated.

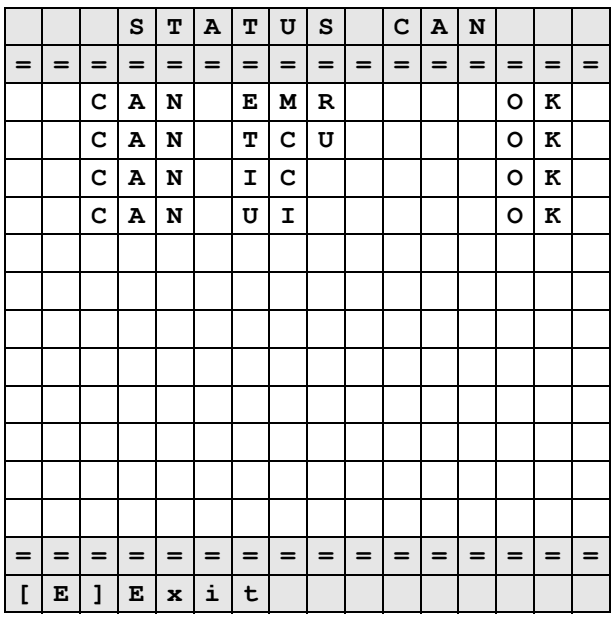


1.6 SOFTWARE INFO

- HPSA software version
- HPSA configuration
- HPSA serial number
- Version of transmission control unit software
- Transmission control unit configuration
- Transmission control unit serial number

NOTE

If the calibration and configuration operations for the HPSA and TCU control units have been carried out correctly, the **S/N** values (indicated by XXXX) must be identical.



1.7 CAN STATUS

- Engine CAN status (OK-FAULT)
- Transmission CAN status (OK-FAULT)
- Instrument CAN status (OK-FAULT)
- Armrest CAN status (OK-FAULT)

NOTE

The **FAULT** value indicates a problem affecting a control unit or a connector of the control units, or in the wiring.

		T	R	A	N	S	M	I	S	S	I	O	N		
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
C	l	u	t	c	h		S	w	i	t	c	h		O	N
O	i	l		P	r	e	s	s	u	r	e		O	F	F
F	i	l	t	e	r		g	o	o	d			O	N	
C	l	u	t	c	h		B	G					O	F	F
C	l	u	t	c	h		K	1					O	F	F
C	l	u	t	c	h		K	2					O	F	F
C	l	u	t	c	h		K	3					O	F	F
C	l	u	t	c	h		K	4					O	F	F
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

1.8 TRANSMISSION

- **Clutch Switc:** Status of clutch pedal proximity sensor (ON-OFF).
  Values displayed:
  ON pedal released.
  OFF pedal depressed.
- **Oil pressure:** Status of transmission oil pressure switch. Value "**OFF**" must be displayed only with the engine off.
- **Filter good:** Status of transmission oil filter (ON-OFF).
  Values displayed:
  ON with engine running, indicates that filter is dirty
  OFF with engine running, indicates that filter is in good order.
  Value "**OFF**" must also be displayed with the engine off.
- **Clutch BG:** Status of BG clutch (ON-OFF)
- **Clutch K1:** Status of K1 clutch (ON-OFF)
- **Clutch K2:** Status of K2 clutch (ON-OFF)
- **Clutch K3:** Status of K3 clutch (ON-OFF)
- **Clutch K4:** Status of K4 clutch (ON-OFF)

		S	P	O	O	L		V	A	L	V	E	S		
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
M	o	d	e					1		N	E	U	T	.	
F	l	o	w					1					0		
T	i	m	e					1		0	0		s	e	c
M	o	d	e					2		N	E	U	T	.	
F	l	o	w					2					0		
T	i	m	e					2		0	0		s	e	c
M	o	d	e					3		N	E	U	T	.	
F	l	o	w					3					0		
M	o	d	e					4		N	E	U	T	.	
F	l	o	w					4					0		
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

1.9 SPOOL VALVES

- **Mode X:** Operating mode of spool valves 1, 2, 3, 4.
  Values displayed:
  NEUT. spool valve not active
  AB spool valve directing oil to port A
  BA spool valve directing oil to port B
  FLOAT spool valve set for float operation
- **Flow X:** Control signal sent to solenoid of spool valves 1, 2, 3, 4.
- **Time**: Spool valve activation time set with spool valve energize duration potentiometer.
  Values displayed:
  0 - 60 from 0 to 60 seconds
  TOGGLE infinite

	E	N	G	I	N	E		M	O	N	I	T	O	R	
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
S	p	e	e	d								0	r	p	m
T	u	r	b	o		p						0	k	P	a
P	e	d	a	l										0	%
T	e	m	p	.									4	0	C
O	i	l		P								0	k	P	a
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

1.10 ENGINE

- **Speed:** crankshaft speed (0-2400 rpm).
- **Turbo P:** engine supercharge pressure.
- **Pedal:** percentage travel of accelerator pedal (0-100%).
- **Temp.:** engine coolant temperature
- **Oil P:** engine oil pressure

		C	A	L	I	B	R	.		M	E	N	U		
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
1	-	L	i	f	t										
2	-	T	r	a	n	s	m	i	s	s	i	o	n		
3	-	S	p	e	e	d		S	e	t	t	i	n	g	
4	-	C	o	n	f	i	g	u	r	a	t	i	o	n	
5	-	S	e	a	t		S	e	n	s	o	r			
6	-	D	i	s	t	r	i	b	u	t	o	r			
7	-	M	a	i	n	t	e	n	a	n	c	e			
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

2. CALIBRATION MENU

1 - Lift:
access to lift system calibrations

2 - Transmission:
access to transmission system calibrations

3 - Speed Setting:
access to speed constant calibrations

4 - Configuration:
access to vehicle configuration

5 - Seat sensor:
access to seat sensor calibrations

6 - Distributor:
access to hydraulic spool valve calibrations

7 - Maintenance:
access to routine maintenance

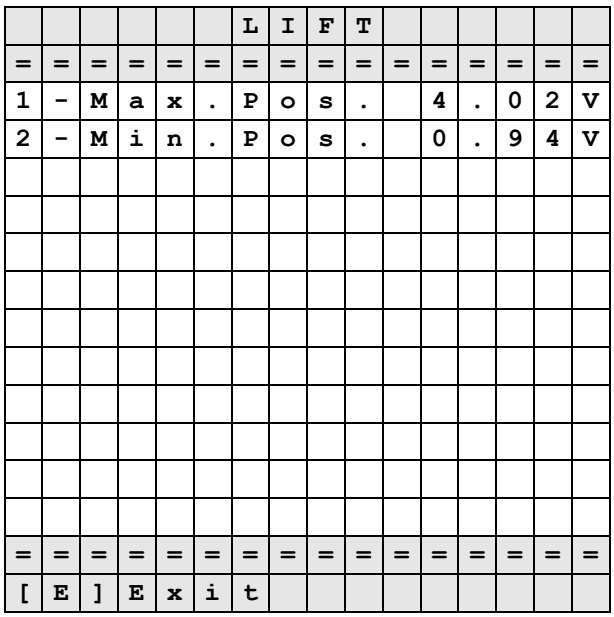
		C	A	L	I	B	R	.		M	E	N	U		
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
1	-	L	i	f	t										
2	-	T	r	a	n	s	m	i	s	s	i	o	n		
3	-	S	p	e	e	d		S	e	t	t	i	n	g	
4	-	C	o	n	f	i	g	u	r	a	t	i	o	n	
5	-	S	e	a	t		S	e	n	s	o	r			
6	-	D	i	s	t	r	i	b	u	t	o	r			
7	-	M	a	i	n	t	e	n	a	n	c	e			
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

2.1 CHANGE CONFIGURATION PARAMETERS

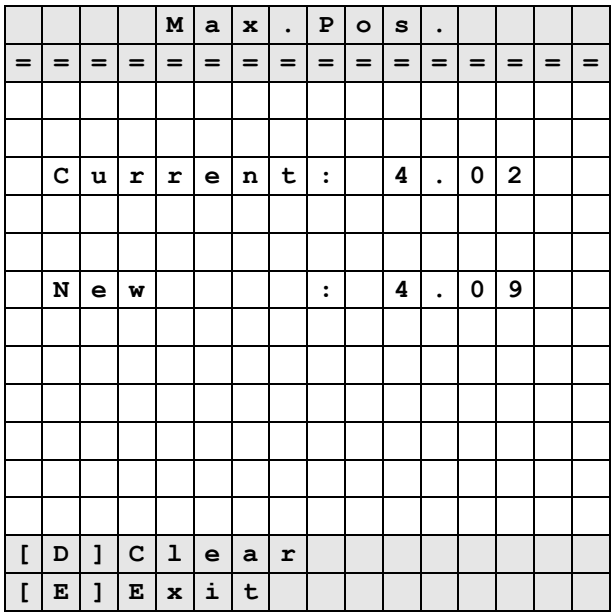
These screens appear after selecting the system and the component to be calibrated, and can be used to enter new parameters.
The procedure is illustrated in the following examples.

Example: calibration of maximum lift height

- From the calibration menu, select option 1 .



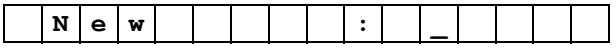
- from the lift system menu, select [1] .

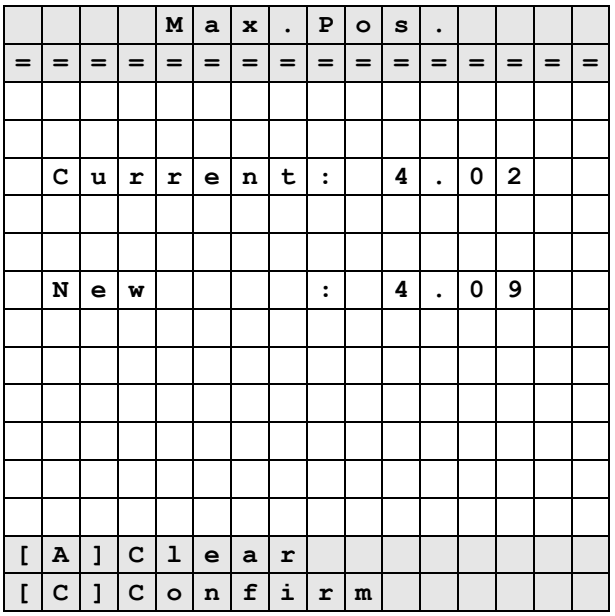


- Raise the lift links to the upper travel limit using the Up control, then press [E] .

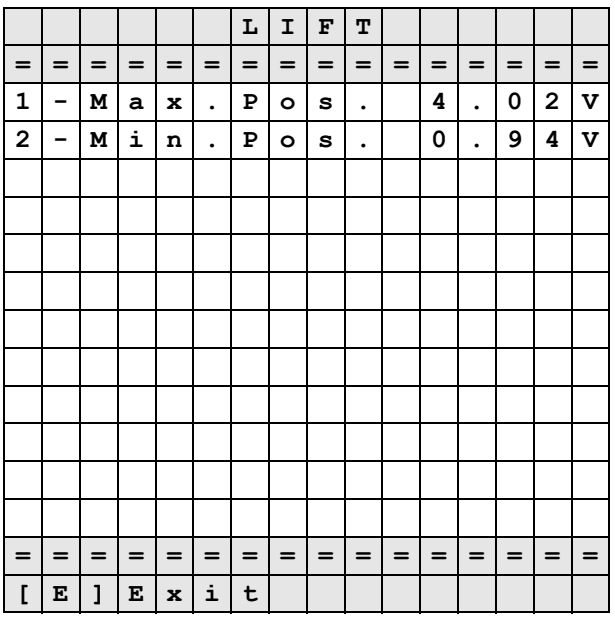
NOTE

For certain settings (like wheel diameter, radar constant) the value must be entered using the keys of the ART.
These parameters are displayed as follows:





- Pressing [A] (clear) cancels the operation, whereas pressing [C] confirms the new value.



2.2 CALIBRATION OF LIFT SYSTEM

1 - **Max Pos:** maximum height at which lift links can be positioned

2 - **Min Pos:** minimum height at which lift links can be positioned

		T	R	A	N	S	M	I	S	S	I	O	N		
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
M	i	n	.												
2	-	H	a	n	d	G	a	s			1	0	0	0	
3	-	T	h	r	o	t	t	l	e		1	.	1	0	V
4	-	C	l	u	t	c	h				0	.	9	9	V
M	a	x	.												
7	-	H	a	n	d	G	a	s						0	
8	-	T	h	r	o	t	t	l	e		3	.	7	5	V
9	-	C	l	u	t	c	h				4	.	0	0	V
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

2.3 CALIBRATION OF TRANSMISSION SYSTEM SENSORS

2 - HandGas: hand throttle setting with engine on idle.

3 - Throttle: accelerator setting with pedal released.

4 - Clutch: clutch setting with pedal released.

7 - HandGas: hand throttle setting at max crankshaft rpm

8 - Throttle: accelerator setting at full pedal travel.

9 - Clutch: clutch setting with pedal fully depressed.

NOTE

- The value of parameter 3 must be less than that of parameter 8.
- The value of parameter 4 must be less than that of parameter 9.
- The value of parameter 2 must be greater than that of parameter 7.
  The value of parameters 2 and 7 is purely numerical and read by the CANBUS line

	S	P	E	E	D		S	E	T	T	I	N	G		
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
1	-	W	h	e	e	l		c	.			5	3	7	2
2	-	P	t	o										2	7
3	-	R	a	d	a	r							1	3	0
4	-	L	i	f	t	.	L	o	c	k	.			2	0
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

2.4 CONFIGURATION OF SPEED CONSTANTS

1 - Wheel c.: wheel circumference
Values: from 4000 to 6000 mm

2 - Pto: PTO output shaft (values 0-1020)

3 - Radar: radar constant
Values: 100 pulses per metre
130 pulses per metre (UK version)

4 - Lift Lock: speed at which lift is locked with tractor moving.
Values: 0 to 30

M	E	N	U		C	O	N	F	I	G	U	R	A	T	
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
1	-	L	a	n	g	u	a	g	e				I	T	A
2	-	F	r	o	n	t		P	T	O			O	F	F
3	-	S	u	s	p	e	n	s	.					O	N
4	-	E	x	t	.	S	e	n	s	.			O	F	F
5	-	I	n	v	.	L	e	v	e	r			O	F	F
6	-	R	a	d	a	r								O	N
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

2.5 MENU CONFIGURATION

1 - Language: language used on Infocenter.

2 - Front PTO: machine with front power take-off.

3 - Suspens.: machine with active suspension system.

4 - Ext sens.: enable external lift sensor.

5 - Inv. Lever: machine with shuttle control lever on steering column.

6 - Radar: machine with radar.

			S	E	A	T		S	E	N	S	O	R		
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
1	-	S	e	a	t						1	.	6	6	V
2	-	N	o		s	e	a	t			3	.	3	3	V
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

2.6 CALIBRATION OF SEAT SENSOR

1 - Seat: sensor setting with driver seated

2 - No seat: sensor setting with seat empty.

NOTE
The value of parameter 1 must be less than that of parameter 2.

		D	I	S	T	R	I	B	U	T	O	R	S		
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
1	-	T	i	m	e	M	i	n						0	S
2	-	T	i	m	e	M	a	x					6	0	S
3	-	D	i	s	t	r	3	M	i	n					0
4	-	D	i	s	t	r	3	M	e	d			5	0	0
5	-	D	i	s	t	r	3	M	a	x		1	0	0	0
6	-	D	i	s	t	r	4	M	i	n					0
7	-	D	i	s	t	r	4	M	e	d			5	0	0
8	-	D	i	s	t	r	4	M	a	x		1	0	0	0
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

2.7 CALIBRATION OF DISTRIBUTORS

1 - TimeMin : minimum spool valve timing

2 - TimeMax: maximum spool valve timing

3 - Dist3Min: calibration of optional joystick control, minimum position (NOT ENABLED)

4 - Dist3Med: calibration of optional joystick control, neutral position (NOT ENABLED)

5 - Dist3Max: calibration of optional joystick control, maximum position (NOT ENABLED)

6 - Dist4Min: calibration of optional joystick control, minimum position (NOT ENABLED)

7 - Dist4Med: calibration of optional joystick control, neutral position (NOT ENABLED)

8 - Dist4Max: calibration of optional joystick control, maximum position (NOT ENABLED)

			M	A	I	N	T	E	N	A	N	C	E		
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
1	-	E	n	a	b	l	e								1
T	r	a	n	s	m	i	s	s	i	o	n				
2	-	F	i	l	t	e	r					8	8	4	h
3	-	O	i	l								8	8	4	h
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

2.8 MAINTENANCE

1 - Enable: enable communication of maintenance schedule advice by way of Infocenter.
Values displayed: **0**= disabled - **1**=enabled

TRANSMISSION

2 - Filter: transmission oil filter last serviced (number of hours)

3 - Oil: transmission oil last changed (number of hours)

			T	E	S	T		M	E	N	U				
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
1	-	A	n	a	l	o	g		T	r	a	n	s		
2	-	D	i	g	i	t	a	l		T	r	a	n	s	
3	-	A	S	M											
4	-	A	n	a	l	o	g		L	i	f	t			
5	-	D	i	g	i	t	a.	l		L	i	f	t		
6	-	S	u	s	p	e	n	s	i	o	n				
7	-	P	T	O											
8	-	V	a	r	i	o	u	s							
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

3. TEST MENU

1 - Analog trans: displays tests on analog sensors of the transmission system.

2 - Digital trans: displays tests on digital sensors of the transmission system.

3 - ASM: displays tests on ASM sensors.

4 - Analog lift: displays tests on analog sensors of lift system.

5 - Digital lift: displays tests on digital sensors of lift system.

6 - Suspension: displays tests on sensors of suspension system.

7 - PTO: displays tests on PTO sensors

8 - Various: displays tests on other sensors

		A	N	A	L	O	G		T	R	A	S	M	.	
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
C	l	u	t	c	h						0	.	0	0	V
T	h	r	o	t	t	l	e				0	.	0	0	V
B	r	a	k	e							0	.	0	0	V
S	u	p	p	l	y	R	e	f	.		4	.	9	5	V
F	N	R		I	n	p	u	t			0	.	0	0	V
H	a	n	d		G	a	s					1	0	0	0
A	c	c	e	l	.								5	0	0
S	u	p	p	l	y	R	e	f	.		4	.	9	5	V
S	e	a	t		S	e	n	.			4	.	9	7	V
F	N	R		N	e	u	t				0	.	0	0	V
F	N	R		F	d	w					0	.	0	0	V
F	N	R		R	e	v					0	.	0	0	V
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

3.1 TESTS ON TRANSMISSION ANALOG SENSORS

- **Clutch:** signal from clutch pedal sensor (0-5V)
- **Throttle:** signal from accelerator pedal sensor (0-5V)
- **Brake:** signal from brake pedal sensor (pressure) (0-5V)
- **SupplyRef:** sensor input voltage (0-5V)
- **FNR Input:** limp-home signal from armrest (0-5V)
- **Hand Gas:** position of hand throttle (0-1000) (purely numerical value read by CANBUS line)
- **Accel.:** position of acceleration potentiometer (0-1000) (purely numerical value read by CANBUS line)
- **SupplyRef:** sensor input voltage (0-5V)
- **Seat Sen:** signal from seat sensor (0-5V)
- **FNR Neut:** signal from shuttle lever in neutral (0-5V)
- **FNR Fdw.:** signal from shuttle lever with forward drive selected (0-5V)
- **FNR Rev:** signal from shuttle lever with reverse drive selected (0-5V)

	D	I	G	I	T	A	L		T	R	A	S	M	.	
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
S	w	i	t	c	h	:									
N	e	u	t	r	a	l							O	F	F
F	o	r	w	a	r	d	s						O	F	F
B	a	c	k	w	a	r	d	s					O	F	F
S	e	c	u	r	i	t	y						O	F	F
S	l	o	w	e	r								O	F	F
F	a	s	t	e	r								O	F	F
M	a	x		m	e	m	.						O	F	F
M	i	n		m	e	m	.						O	F	F
T	c		M	o	d	e							O	F	F
C	r	u	i	s	e								O	F	F
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

3.2 TESTS ON TRANSMISSION DIGITAL BUTTONS

SWITCH:

- **Neutral:** status of Neutral button (ON-OFF)
- **Forwards:** status of forward drive button (ON-OFF)
- **Backwards:** status of reverse drive button (ON-OFF)
- **Security:** status of shuttle safety button (ON-OFF)
- **Slower:** status of speed decrease button (ON-OFF)
- **Faster:** status of speed increase button (ON-OFF)
- **Max Mem.:** status of maximum rpm memory button (ON-OFF)
- **Min Mem.:** status of minimum rpm memory button (OFF) (NOT ENABLED)
- **Tc Mode:** status of operating mode select button (ON-OFF)
- **Cruise:** status of cruise speed memory button(ON-OFF)

						A	S	M							
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
S	t	e	e	r		r	e	f			7	.	8	4	V
S	w	i	t	c	h	:									
D	i	f	f	.	L	o	c	k					O	F	F
A	S	M											O	F	F
4	W	D											O	F	F
S	t	e	e	r		1	5						O	F	F
S	t	e	e	r		3	0						O	F	F
L		B	r	a	k	e							O	F	F
R		B	r	a	k	e						.	O	F	F
B	r	a	k	e		L	i	g	h	t			O	N	
E	V		D	i	f	f				1	0	0	0	m	A
E	V		4	W	D					1	6	5	0	m	A
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

3.3 TESTS ON ASM SENSORS

- **Steer ref:** steering sensors input voltage. (7.5 - 8.5V)

SWITCH:

- **Diff Lock:** status of differential lock button (ON-OFF)
- **ASM:** status of ASM button (ON-OFF)
- **4WD:** status of four wheel drive button (ON-OFF)
- **Steer 15:** status of 15° steering sensor (ON-OFF) (with wheels centred at 0°, sensor status is **OFF**)
- **Steer 30:** status of 30° steering sensor (ON-OFF) (with wheels centred at 0°, sensor status is **OFF**)
- **L brake:** status of left brake pedal sensor (**ON** = pedal fully depressed - **OFF**= pedal released)
- **R brake:** status of right brake pedal sensor (**ON** = pedal fully depressed - **OFF**= pedal released)
- **Brake light:** status of sensor (ON-OFF) Status must be OFF only with L.H. brake and R.H. brake status simultaneously “ON”
- **EV Diff :** current drawn by differential lock valve solenoid (0-2000mA)
- **EV 4WD:** current drawn by four wheel drive valve solenoid (0-2000mA) (**0** = 4WD engaged - **1600-1700** = 4WD disengaged)

			A	N	A	L	O	G		L	I	F	T		
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
D	r	a	f	t		L					4	.	0	0	V
D	r	a	f	t		R					4	.	0	0	V
D	r	a	f	t	R	e	f	.			7	.	8	4	V
P	o	s	i	t	i	o	n				0	.	0	0	V
P	o	s	.		r	e	f	.			4	.	9	5	V
E	x	t	.		p	o	s	.			0	.	0	0	V
E	x	t	.		r	e	f	.			7	.	8	4	V
D	e	p	t	h										0	
H	e	i	g	h	t									0	
L	o	w		s	p	e	e	d						0	
I	n	t	e	r	m	i	x							0	
W	h	e	e	l	s	l	i	p						0	
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

3.4 TESTS ON LIFT SYSTEM ANALOG SIGNALS

- **Draft L:** signal from left draft sensor (2-6V) (without implement, approx 4V)
- **Draft R:** signal from right draft sensor (2-6V) (without implement, approx 4V)
- **Draft Refer.:** draft sensors input voltage (7,5-8,5V)
- **Position:** signal from position sensor (0.5-4.5V)
- **Pos ref:** position sensor input voltage (5±0.5V)
- **Ext pos:** signal from external sensor (0-8V) (without sensors, value is 0)
- **Ext ref:** external sensor input voltage (7.5-8.5V)
- **Depth:** position of depth potentiometer (0-1000) (purely numerical value read by CANBUS line)
- **Height:** position of maximum height potentiometer (0-1000) (purely numerical value read by CANBUS line)
- **Low speed:** position of minimum rate-of-drop sensor (0-1000) (purely numerical value read by CANBUS line)
- **Intermix:** position of control potentiometer (0-1000) (purely numerical value read by CANBUS line)
- **Wheelslip:** position of wheelslip potentiometer (0-1000) (purely numerical value read by CANBUS line)

		D	I	G	I	T	A	L		L	I	F	T		
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
S	w	i	t	c	h	:									
E	x	t	.		R	a	i	s	e				O	F	F
E	x	t	.		L	o	w	e	r				O	F	F
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

3.5 TESTS ON LIFT SYSTEM DIGITAL LIFHT

SWITCH:

- **Ext Raise:** status of Up button on fender (ON-OFF)
- **Ext Lower:** status of Down button on fender (ON-OFF)

			S	U	S	P	E	N	S	I	O	N			
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
P	o	s	i	t	i	o	n				0	.	0	0	V
P	o	s	.		r	e	f	.			7	.	8	4	V
S	u	s	p	.	S	w	i	t	c	h			O	F	F
E	V		r	a	i	s	e						0	m	A
E	V		f	a	l	l	.						0	m	A
E	V		L	.	S	.							0	m	A
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

3.6 TESTS ON SUSPENSION

- **Position:** signal from suspension position sensor (2-4V)
- **Pos ref:** suspension position sensor input voltage (7.5-8.5V)
- **Susp. switch:** status of suspension activating button (ON-OFF)
- **EV Raise:** current drawn by Raise control valve solenoid (0-2000mA)
- **EV fall:** current drawn by Lower control valve solenoid (0-2000mA)
- **EV L.S.:** current drawn by Load Sensing valve solenoid (0-2000mA)

						P	T	O							
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
S	w	i	t	c	h	:									
F	r	o	n	t									O	F	F
A	u	t	.										O	F	F
R	e	a	r										O	F	F
B	r	a	k	e									O	F	F
C	o	n	s	.		S	w	i	t	c	h		O	F	F
P	u	l	s	.		E	x	t	.				O	F	F
E	V		r	e	a	r							0	m	A
E	v		f	r	o	n	t						0	m	A
E	V		B	r	a	k	e						0	m	A
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

3.7 TESTS ON PTO

SWITCH:

- **Front:** status of front PTO button (ON-OFF)
- **Aut.:** status of automatic PTO button (ON-OFF)
- **Rear:** status of rear PTO button (ON-OFF)
- **Brake:** status of PTO brake button (ON-OFF)
- **Cons. Switch:** status of PTO enable button (ON-OFF)
- **Puls. Ext.:** status of PTO button on fender (ON-OFF)
- **EV rear:** current drawn by rear PTO control valve solenoid (0-2000mA)
- **EV front:** current drawn by front PTO control valve solenoid (0-2000mA)
- **EV brake:** current drawn by PTO brake valve solenoid (0-2000mA)

3.8 OTHER

		M	I	S	C	E	L	L	A	N	E	O	U	S	
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
	B	A	T	T	E	R	Y			1	1	.	8	4	V
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

◀ Battery voltage (0-16V)

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

4.ALARM MENU

1 - HPSA ACTIVE: displays list of active alarms generated by HPSA control unit

2 - HPSA PASSIVE: displays list of passive alarms generated by HPSA control unit

3 - ENGINE ACTIVE: displays list of active alarms generated by engine control unit (EMR)

4 - ENGINE PASSIVE: displays list of passive alarms generated by engine control unit (EMR)

5 - TRASM ACTIVE: displays list of active alarms generated by transmission control unit (TCU)

6 - TRASM PASSIVE: displays list of passive alarms generated by transmission control unit (TCU)

7 - ARMREST ACTIV: displays list of active alarms generated by armrest control unit

8 - ARMREST PASSIV: displays list of passive alarms generated by armrest control unit

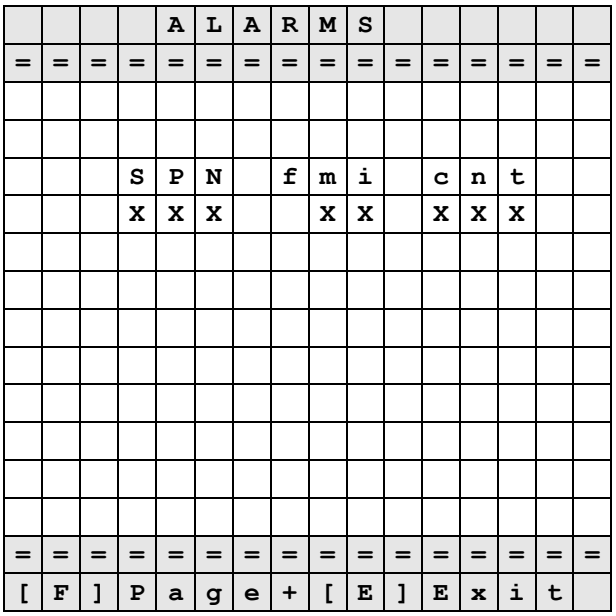
9 - ERASE ALARMS: displays clear alarms menu

				A	L	A	R	M	S						
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
S	P	N		f	m	i		c	n	t			h	r	s
X	X	X		X	X			X	X	X		X	X	X	X
[	F	]	P	a	g	e	+	[	E	]	E	x	i	t	

4.1 ALARMS GENERATED BY HPSA CONTROL UNIT

- **SPN:** identification n° of device triggering the alarm.
- **fmi:** failure mode identification n°
- **CNT:** number of times the fault has occurred
- **hrs:** n° of hours clocked by engine when error last occurred

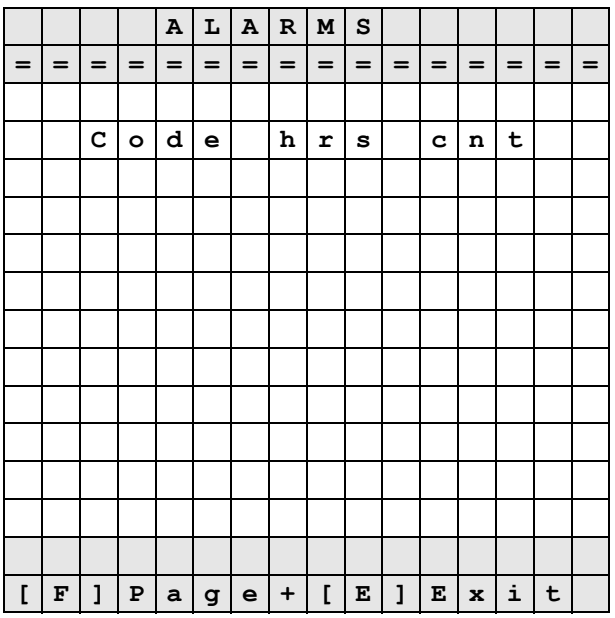
For a description of the alarms see heading 4.6.



4.2 ALARMS GENERATED BY ENGINE AND ARMREST CONTROL UNITS

- **SPN:** identification n° of device triggering the alarm.
- **fmi:** failure mode identification n°
- **cnt:** number of times the fault has occurred

For a description of the alarms see heading 4.6.



4.3 ALARMS GENERATED BY TRANSMISSION CONTROL UNIT

- **Code:** alarm identification code
- **hrs:** n° of hours clocked by engine when error last occurred.
- **cnt:** number of times the event has occurred

For a description of the alarms see heading 4.7.

		L	O	E	S	C	H	U	N	G		A	L	.	
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
1	-	H	P	S	A					A	L	A	R	M	
2	-	E	N	G	I	N	E			A	L	A	R	M	
3	-	T	R	A	N	S				A	L	A	R	M	
4	-	A	R	M	R	E	S	T		A	L	A	R	M	
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									

← Clear HPSA alarms
← Clear engine alarms
← Clear transmission alarms
← Clear armrest alarms

4.4 CLEAR PASSIVE ALARMS

The following message confirms that the alarms have been cleared:

	A	L	A	R	M		A	R	E		B	E	E	N	
					E	R	A	S	E	D					

				A	L	A	R	M	S						
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
S	P	N		f	m	i		c	n	t			H	r	s
5	4	0				4			1	0		1	8	6	0
[	F	]	P	a	g	e	+	[	E	]	E	x	i	t	

4.5 LIST OF ALARMS GENERATED BY HPSA, ENGINE AND ARMREST CONTROL UNITS

This heading lists the devices that may trip an alarm (table 1, “SPN” column) and the causes of the alarms (table 2, “fmi” column).

EXAMPLE OF ERROR IDENTIFICATION (HPSA alarm)

- **SPN**=540: draft pin, left side
- **fmi**=4: voltage too low or short-circuit to earth
- **cnt**=10: alarm has been tripped 10 times
- **hrs**=1860: the last time the alarm was tripped, the engine was registering 1860 hours operation.

TABLE 1: List of devices

SPN	PARAMETER	ECU
51	Accelerator pedal	HPSA
63	Shuttle Lever	HPSA
91	Accelerator pedal	EMR
100	Oil pressure	EMR
102	Turbo pressure	EMR
110	Engine coolant temperature	EMR
158	Battery voltage	HPSA
171	Internal temperature sensor	EMR
190	Engine speed sensor	EMR
200	Actuator position sensor	EMR
201	Hand throttle	EMR
202	Automatic calibration error	EMR
203	CAN message	EMR
204	PWM input 1	EMR
205	PWM input 2	EMR
206	Internal memory	EMR
207	CAN message	EMR
208	elettrostop ??? fuel cutoff solenoid ???	EMR
209	Actuator position sensor	EMR
210	Calibration data lost	EMR
520	Acceleration potentiometer	HPSA
521	Shuttle and cruise control joystick	HPSA
522	Brake light sensor	HPSA
530	Park-lock sensor	HPSA
531	Park-lock solenoid valve	HPSA
540	Draft pin, left	HPSA
541	Draft pin, right	HPSA
550	Rear PTO solenoid valve	HPSA
551	Front PTO solenoid valve	HPSA
552	4WD solenoid valve	HPSA
560	External lift sensor	HPSA
561	Hand throttle	HPSA
562	Clutch pedal	HPSA
600	Lift control lever	HPSA
601	Lift position sensor	HPSA
602	Lift Up solenoid valve	HPSA
603	Lift Down solenoid valve	HPSA
604	Implement depth control	HPSA

SPN	PARAMETER	ECU
605	Maximum lift height control	HPSA
606	Rate-of-drop control	HPSA
607	Draft/position control	HPSA
620	Suspension position sensor	HPSA
621	Suspension raise solenoid valve	HPSA
622	Suspension lower solenoid valve	HPSA
623	Suspension load sensing solenoid valve	HPSA
624	Brake pressure sensor	HPSA
625	Seat sensor	HPSA
626	Seat sensor (operating error)	HPSA
627	Software incompatible	HPSA
628	Hardware incompatible	HPSA
629	PTO brake solenoid valve	HPSA
630	Power outputs	HPSA
631	CAN error, armrest	HPSA
632	CAN error, transmission	HPSA
633	CAN error, engine	HPSA
634	Internal Error	ARMREST
635	Potentiometer, spool valve 3	ARMREST
636	Potentiometer, spool valve 4	ARMREST
637	Max flow potentiometer, spool valve 1	ARMREST
638	Time set potentiometer, spool valve 1	ARMREST
639	Max flow potentiometer, spool valve 2	ARMREST
640	Time set potentiometer, spool valve 2	ARMREST
641	Max flow potentiometer, spool valve 3	ARMREST
642	Max flow potentiometer, spool valve 4	ARMREST
643	Lift console	ARMREST
644	Voltage 12V	ARMREST
645	Voltage 6V	ARMREST
646	Voltage 5V	ARMREST
647	Voltage 5V, spool valves	ARMREST
648	Memory group 0 configuration	ARMREST
649	Memory group 1	ARMREST
650	Memory group 2	ARMREST
651	Memory group 3	ARMREST
652	Memory group 4	ARMREST
653	Differential lock solenoid valve	HPSA
654	Sensor input voltage 8V	HPSA
655	Sensor input voltage 5V	HPSA

SPN	PARAMETER	ECU
656	Radar sensor	HPSA
657	FNR analog input	HPSA
658	Clutch pedal sensor signals	HPSA
659	Steering column lever	HPSA
660	Free power output	HPSA
661	Block memory	HPSA
662	Block memory, tcr	HPSA
663	Block memory, asm	HPSA
664	Block memory, pto	HPSA
665	Block memory, sus	HPSA
666	Block memory, ops	HPSA
667	Block memory, dis	HPSA
668	Block memory, sds	HPSA
669	Block memory, tphoption	HPSA
670	Block memory, tphslipcfg	HPSA
671	Block memory, tphdraftcfg	HPSA
672	Block memory, tphab	HPSA
673	Block memory, tphpos	HPSA
674	Block memory, tphslip	HPSA
675	Block memory, tphdraft	HPSA
676	Block memory, tphpwm	HPSA
677	Block memory, tphctrl	HPSA
678	Block memory, tphcal	HPSA
679	Block memory, dismsg	HPSA
680	Block memory, cnf	HPSA
681	Block memory, acf	HPSA
682	Block memory, tphservice	HPSA

TABLE 2: List of failure modes

fmi	Description
2	Wrong data
3	Voltage too high or battery short circuit
4	Voltage too low or short circuit to earth
5	Current low
6	Current high
7	Mechanical error
8	Period frequency or pulse abnormal
11	Error not identifiable
12	Device faulty

4.6 LIST OF TRANSMISSION SYSTEM ALARMS

ABBREVIATIONS

Abbrev	Description
LU	Open circuit
KM	Short circuit to earth
KP	Battery short circuit
VPS	Valve power supply
N	Neutral
F	Forward
R	Reverse
	“OFF” warning light
	“ON” warning light
	Locked
	Open
	Inching “OFF”
X	No influence
------	No reaction from system

Abbrev	Description
NM	Not possible
NE	Not detachable
KV/KR	Reverse clutches
K1…K4	Powershift clutches
BG	Powershift group
PT	Transmission
FS	Direction selector
WL	Warning light
L	Speed – low
H	Speed – high
N_{ab}	Speed signal, output
N_{am}	Speed signal, input
N_{Hyd}	Speed signal, hydrostatic unit output
TCUs	TCU shut down

SYMBOLS DENOTING REACTION OF SYSTEM TO FAULT

Symbol	Description
	No reaction from system (normal)
	Operation limited
	Transmission in neutral and control suspended
	TCU shut down

SYMBOLS DENOTING NECESSARY ACTION AFTER FAULT

Symbol	Action required
	No action necessary
	Ignition
	Limp home
	Direction selector
	Tow away / inform Customer Service

LIST OF ALARMS

Ref.	System status					System reaction								Alternative function / Comment
	Fault	Direction	Gear selected	Inching	Speed	Transmission error code with CAN	Fault memory (hex)	Warning light (not utilized)	Forward drive clutch solenoid valves	Reverse clutch solenoid valves	Inching -	Operating mode	Corrective action	
	ROM failure	X	X	X	X			------	------	------	------	○	↑	Ignition test: in event of failure, no outputs will activate and machine cannot be driven
	Quartz watchdog fault	X	X	X	X			------	------	------	------	○	↑	Ignition test: in event of failure, no outputs will activate and machine cannot be driven
	RAM failure	X	X	X	X			------	------	------	------	○	↑	Ignition test: in event of failure, no outputs will activate and machine cannot be driven
OD1	KM, BG clutch solenoid valve	X	1 : 2	X	X	101	0X65	⊗	------	------	------	◔	🚜	Gears 3, 4 unavailable
OD2	KM, BG clutch solenoid valve	X	3 ; 4	X	H	101	0X65	✳			------	○	! 🚜	Gears 3, 4 no low speed
OD4	LU, BG clutch solenoid valve	F ; R	1 : 2	↘	L	85	0X55	✳			------	○	↑	For other system statuses, see Ref. #OD5
OD5	LU, BG clutch solenoid valve	X	1 : 2	X	X	85	0X55	✳			------	○	↑	
OD6	LU, BG clutch solenoid valve	X	3 ; 4	X	X	85	0X55	⊗	------	------	------	◔	🚜	Selection of gears 2,1: transmission in neutral and TCUs
OD8	KP, BG clutch solenoid valve	F ; R	1 : 2	↘		117	0X75	✳			------	○	↑	For other system statuses, see Ref. #OD9
OD9	KP, BG clutch solenoid valve	X	1 : 2	X	X	117	0X75	✳			------	○	↑	
OD11	KP, BG clutch solenoid valve	X	3 ; 4	X	X		NE	------	------	------	------	●	🚜	Fault not detectable with this system status, but in this situation there is no impact. Fault detectable during ignition diagnosis with VPS or in gears 1, 2
OD12	KM, K1 clutch solenoid valve	X		X	X	97	0X61	⊗	------	------	------	◔	🚜	Gears 2 - 4 unavailable
OD15	KM, K1 clutch solenoid valve	X	2 - 4	X	X	97	0X61	✳			------	○	↑	

Ref.	System status					System reaction								Alternative function / Comment
	Fault	Direction	Gear selected	Inching	Speed	Transmission error code with CAN	Fault memory (hex)	Warning light (not utilized)	Forward drive clutch solenoid valves	Reverse clutch solenoid valves	Inching -	Operating mode	Corrective action	
OD17	LU, K1 clutch solenoid valve	**F ; R**	**1**		**L**	**81**	**0X51**				------			For other system statuses, see Ref. #OD18
OD18	LU, K1 clutch solenoid valve	**X**	**1**	**X**	**X**	**81**	**0X51**				------			
OD19	LU, K1 clutch solenoid valve	**X**	**2 - 4**	**X**	**X**	**81**	**0X51**		------	------	------			Selection of gear 1: transmission in neutral and TCUs
OD21	KP, K1 clutch solenoid valve	**F ; R**	**1**		**L**	**113**	**0X71**				------			For other system statuses, see Ref. #OD22
OD22	KP, K1 clutch solenoid valve	**X**	**1**	**X**	**X**	**113**	**0X71**				------			
OD24	KP, K1 clutch solenoid valve	**X**	**2 - 4**	**X**	**X**		**NE**	------	------	------	------			Fault not detectable with this system status, but in this situation there is no impact. Fault detectable during ignition diagnosis with VPS or in gear 1
OD25	KM, K2 clutch solenoid valve	**X**	**2 - 4**	**X**	**X**	**98**	**0X62**		------	------	------			Selection of gear 1: transmission in neutral and TCUs
OD28	KM, K2 clutch solenoid valve	**X**	**1**	**X**	**X**	**98**	**0X62**				------			
OD30	LU, K2 clutch solenoid valve	**F ; R**	**2 - 4**		**L**	**82**	**0X52**				------			For other system statuses, see Ref. #OD31
OD31	LU, K2 clutch solenoid valve	**X**	**2 - 4**	**X**	**X**	**82**	**0X52**				------			
OD32	LU, K2 clutch solenoid valve	**X**	**1**	**X**	**X**	**82**	**0X52**		------	------	------			Gears 2 - 4 unavailable
OD34	KP, K2 clutch solenoid valve	**F ; R**	**2 - 4**		**L**	**114**	**0X72**				------			For other system statuses, see Ref. #OD35

Ref.	System status					System reaction								Alternative function / Comment
	Fault	Direction	Gear selected	Inching	Speed	Transmission error code with CAN	Fault memory (hex)	Warning light (not utilized)	Forward drive clutch solenoid valves	Reverse clutch solenoid valves	Inching -	Operating mode	Corrective action	
OD35	KP, K2 clutch solenoid valve	**X**	**2 - 4**	**X**	**X**	**114**	**0X72**				------			
OD37	KP, K2 clutch solenoid valve	**X**	**1**	**X**	**X**		**NE**	------	------	-------	------			Fault not detectable with this system status,but in this situation there is no impact. Fault detectable during ignition diagnosis with VPS or in gears 2-4
OD38	KM, K3 clutch solenoid valve	**X**	**3**	**X**	**X**	**99**	**0X63**		------	------	------			Gear 4 unavailable; if gear 1 or 2 selected, transmission in neutral and TCUs
OD39	KM, K3 clutch solenoid valve	**X**	**1;2;4**	**X**	**H**	**99**	**0X63**				------			Gear 3, no low speed
OD40	LU, K3 clutch solenoid valve	**X**	**3**	**X**	**H**	**83**	**0X53**				------			Gear 3, no low speed
OD41	LU, K3 clutch solenoid valve	**X**	**1;2;4**	**X**	**X**	**83**	**0X53**		------	------	------			Gear 3 unavailable; if gears shifted from 4 to 3, transmission in neutral and TCUs
OD42	KP, K3 clutch solenoid valve	**X**	**3**	**X**	**H**	**115**	**0X73**				------			Gear 3, no low speed
OD44	KP, K3 clutch solenoid valve	**X**	**1;2;4**	**X**	**X**		**NE**	------	------	-------	------			Fault not detectable with this system status,but in this situation there is no impact. Fault detectable during ignition diagnosis with VPS or in gear 3
OD45	KM, K4 clutch solenoid valve	**X**	**4**	**X**	**X**	**100**	**0X64**		------	------	------			If gear 1, 2 or 3 selected: transmission in neutral and TCUs
OD46	KM, K4 clutch solenoid valve	**X**	**1 - 3**	**X**	**H**	**100**	**0X64**				------			Gear 4, no low speed
OD47	LU, K4 clutch solenoid valve	**X**	**4**	**X**	**H**	**84**	**0X54**				------			Gear 4, no low speed
OD48	LU, K4 clutch solenoid valve	**X**	**1 - 3**	**X**	**X**	**84**	**0X54**		------	------	------			Gear 4 unavailable
OD49	KP, K4 clutch solenoid valve	**X**	**4**	**X**	**H**	**116**	**0X74**				------			Gear 4, no low speed

Ref.	System status					System reaction								Alternative function / Comment
	Fault	Direction	Gear selected	Inching	Speed	Transmission error code with CAN	Fault memory (hex)	Warning light (not utilized)	Forward drive clutch solenoid valves	Reverse clutch solenoid valves	Inching -	Operating mode	Corrective action	
OD51	KP, K4 clutch solenoid valve	**X**	**1 - 3**	**X**	**X**		**NE**	------	------	-------	------	○		Fault not detectable with this system status,but in this situation there is no impact. Fault detectable during ignition diagnosis with VPS or in gear 4
OD52	KM on WL	**X**	**X**	**X**	**X**	**96**	**0X60**		------	------	------	●		Before failure, WL is OFF
OD53	KM on WL	**X**	**X**	**X**	**X**		**NE**		------	------	------	●		When WL is ON before fault occurs, fault is not detectable
0D54	LU on WL	**X**	**X**	**X**	**X**	**80**	**0X50**		------	------	------	●		Before failure, WL is OFF
OD55	LU on WL	**X**	**X**	**X**	**X**		**NE**		------	------	------	●		When WL is ON before fault occurs, fault is not detectable
OD57	KP on WL	**X**	**X**	**X**	**X**		**NE**		------	------	------	●		When WL is ON before fault occurs, fault is not detectable
OD58	KP on WL	**X**	**X**	**X**	**X**	**112**	**0X70**		------	------	------	●		Before failure, WL is OFF
OA2	KM, Lift pos solenoid valve	**F ; R**	**X**		**L**	**104**	**0X68**		Ⓞ		------	○		If machine is stationary, reverse clutch valves open; for other system statuses, see Ref. #0A3
OA3	KM, Lift pos solenoid valve	**X**	**X**	**X**	**X**	**104**	**0X68**		Ⓞ	Ⓞ	------	○		
OA5	LU, Lift pos solenoid valve	**F ; R**	**X**		**L**	**88**	**0X58**		Ⓞ		------	○	!	If machine is stationary, reverse clutch valves open; for other system statuses, see Ref. #0A6
OA6	LU, Lift pos solenoid valve	**X**	**X**	**X**	**X**	**88**	**0X58**		Ⓞ	Ⓞ	------	○	!	
OA8	KP, Lift pos solenoid valve	**F ; R**	**X**		**L**	**120**	**0X78**		Ⓞ		------	○	!	If machine is stationary, reverse clutch valves open; for other system statuses, see Ref. #0A9

Ref.	System status					System reaction								Alternative function / Comment
	Fault	Direction	Gear selected	Inching	Speed	Transmission error code with CAN	Fault memory (hex)	Warning light (not utilized)	Forward drive clutch solenoid valves	Reverse clutch solenoid valves	Inching -	Operating mode	Corrective action	
OA9	KP, Lift pos solenoid valve	**X**	**X**	**X**	**X**	**120**	**0X78**				------			
OA11	KM, Lift neg solenoid valve	**F ; R**	**X**		**L**	**105**	**0X69**				------			If machine is stationary, reverse clutch valves open; for other system statuses, see Ref. #0A12
OA12	KM, Lift neg solenoid valve	**X**	**X**	**X**	**X**	**105**	**0X69**				------			
OA14	LU, Lift neg solenoid valve	**F ; R**	**X**		**L**	**89**	**0X59**				------			If machine is stationary, reverse clutch valves open; for other system statuses, see Ref. #0A15
OA15	LU, Lift neg solenoid valve	**X**	**X**	**X**	**X**	**89**	**0X59**				------			
OA17	KP, Lift neg solenoid valve	**F ; R**	**X**		**L**	**121**	**0X79**				------			If machine is stationary, reverse clutch valves open; for other system statuses, see Ref. #018
OA18	KP, Lift neg solenoid valve	**X**	**X**	**X**	**X**	**121**	**0X79**				------			
OA20	KM, KV clutch solenoid valve	**X**	**X**	**X**	**X**	**106**	**0X6A**				------			
OA21	LU, KV clutch solenoid valve	**R**	**X**	**X**	**X**	**90**	**0X5A**		------	------	------			If forward gear selected: transmission control suspended
OA23	LU, KV clutch solenoid valve	**X**	**X**	**X**	**X**	**90**	**0X5A**				------			On detection of fault, warning light is ON and powershift clutch valves open briefly. Reverse drive can still be selected.
OA24	KP, KV clutch solenoid valve	**R**	**X**	**X**	**X**	**122**	**0X7A**		------	------	------			If forward gear selected: transmission control suspended
OA26	KP, KV clutch solenoid valve	**X**	**X**	**X**	**X**	**122**	**0X7A**				------			On detection of fault, warning light is ON and powershift clutch valves open briefly. Reverse drive can still be selected.

Ref.	System status					System reaction								Alternative function / Comment
	Fault	Direction	Gear selected	Inching	Speed	Transmission error code with CAN	Fault memory (hex)	Warning light (not utilized)	Forward drive clutch solenoid valves	Reverse clutch solenoid valves	Inching -	Operating mode	Corrective action	
OA28	KM, KR clutch solenoid valve	**X**	**X**	**X**	**X**	**107**	**0X6B**	⊗	O	O	------	○		
OA29	LU, KR clutch solenoid valve	**F**	**X**	**X**	**X**	**91**	**0X5B**	⊗	------	------	------	◔		If reverse gear selected: transmission control suspended
OA31	LU, KR clutch solenoid valve	**X**	**X**	**X**	**X**	**91**	**0X5B**	⊗	O	O	------	◑		On detection of fault, warning light is ON and powershift clutch valves open briefly. Forward drive can still be selected.
OA32	KP, KR clutch solenoid valve	**F**	**X**	**X**	**X**	**123**	**0X7B**	⊗	------	------	------	◔		If reverse gear selected: transmission control suspended
OA34	KP, KR clutch solenoid valve	**X**	**X**	**X**	**X**	**123**	**0X7B**	⊗	O	O	------	◑		On detection of fault, warning light is ON and powershift clutch valves open briefly. Forward drive can still be selected.
SE1	KM, $N_{an\ sensor}$	**F ; R**	**X**		**X**	**48**	**0X30**	⊗	------	------	**NM**	◔		If PT partially or completely open: transmission in neutral with control suspended, and error message on CAN signal indicating prop shaft speed; for other system statuses, see Ref. #SE2
SE2	KM, $N_{an\ sensor}$	**X**	**X**	**X**	**X**	**48**	**0X30**	⊗	O	O	**NM**	◑	!	Error message on CAN signal indicating prop shaft speed
SE3	KP or LU, $N_{an\ sensor}$	**F ; R**	**X**		**X**	**56**	**0X38**	⊗	------	------	**NM**	◔		If PT partially or completely open: error message on CAN signal indicating prop shaft speed, transmission in neutral with control suspended; for other system statuses, see Ref. #SE4
SE4	KP or LU, $N_{an\ sensor}$	**X**	**X**	**X**	**X**	**56**	**0X38**	⊗	O	O	**NM**	◑	!	Error message on CAN signal indicating prop shaft speed
SP1	Logic error, $Nan_{\ sensor}$	**F ; R**	**X**		**X**	**64**	**0X40**	⊗	------	------	**NM**	◔		If PT partially or completely open: error message on CAN signal indicating prop shaft speed, transmission in neutral with control suspended; for other system statuses, see Ref. #SE2

Ref.	System status					System reaction								Alternative function / Comment
	Fault	Direction	Gear selected	Inching	Speed	Transmission error code with CAN	Fault memory (hex)	Warning light (not utilized)	Forward drive clutch solenoid valves	Reverse clutch solenoid valves	Inching -	Operating mode	Corrective action	
SP2	Logic error, $N_{an\ sensor}$	**X**	**X**	**X**	**X**	**64**	**0X40**	⊗	Ø	Ø	**NM**	◐	!	Error message on CAN signal indicating prop shaft speed
SP3	N_{an} speed signal does not match CAN N_{an} signal	**F ; R**	**X**	↘	**X**	**72**	**0X48**	⊗	------	------	**NM**	◔		Verified only when CAN reception signal is available. In event of disparity and if PT partially or completely open: error message on CAN signal indicating prop shaft speed, transmission in neutral with control suspended; for other system statuses, see Ref. #SP4
SP4	N_{an} speed signal does not match CAN N_{an} signal	**X**	**X**	**X**	**X**	**72**	**0X48**	⊗	Ø	Ø	**NM**	◐	!	Verified only when CAN reception signal is available. Error message on CAN signal indicating prop shaft speed.
WA2	$N_{an} > N_{an}$ grz	**X**	**X**	**X**	**X**	**154**	**0X9A**	⊗	------	------		◔		
SE5	KM, Nab $_{1\ sensor}$	**X**	**X**	**X**	**X**	**49**	**0X31**	⊗	------	------	------	◔		$N_{ab}2$ sensor OK; if PT partially or completely open and N_{ab} registers zero: error message on CAN signal indicating prop shaft speed, transmission in neutral with control suspended
SE6	KM, Nab $_{1\ sensor}$	**F ; R**	**X**	↘	**X**	**49**	**0X31**	⊗	------	------	**NM**	◔		$Nab_{2\ sensor\ fault;}$ if PT partially or completely open: error message on CAN signal indicating prop shaft speed, transmission in neutral with control suspended
SE7	KM, Nab $_{1\ sensor}$	**X**	**X**	**X**	**X**	**49**	**0X31**	⊗	Ø	Ø	**NM**	◐	↑	$Nab_{2\ sensor\ fault:}$ error message on CAN signal indicating prop shaft speed; for other system statuses, see Ref. #SE6
SE9	KP or LU, N_{ab} 1 sensor	**X**	**X**	**X**	**X**	**57**	**0X39**	⊗	------	------	------	◔		$N_{ab}2$ sensor OK; if PT partially or completely open and N_{ab} registers zero: error message on CAN signal indicating prop shaft speed, transmission in neutral with control suspended
SE10	KP or LU, N_{ab} 1 sensor	**F ; R**	**X**	↘	**X**	**57**	**0X39**	⊗	------	------	**NM**	◔		$N_{ab}2$ sensor fault; if PT partially or completely open: error message on CAN signal indicating prop shaft speed, transmission in neutral with control suspended
SE11	KP or LU, N_{ab} 1 sensor	**X**	**X**	**X**	**X**	**57**	**0X39**	⊗	Ø	Ø	**NM**	◐	↑	$N_{ab}2$ sensor fault: error message on CAN signal indicating prop shaft speed; for other system statuses, see Ref. #SE10

Ref.	System status					System reaction								Alternative function / Comment
	Fault	Direction	Gear selected	Inching	Speed	Transmission error code with CAN	Fault memory (hex)	Warning light (not utilized)	Forward drive clutch solenoid valves	Reverse clutch solenoid valves	Inching -	Operating mode	Corrective action	
SP5	Logic error, N_{ab} 1 sensor	**X**	**X**	**X**	**X**	**65**	**0X41**	⊗	------	------	------	◔		N_{ab}2 sensor OK; if PT partially or completely open and N_{ab} registers zero: error message on CAN signal indicating prop shaft speed, transmission in neutral with control suspended
SP6	Logic error, N_{ab} 1 sensor	**F ; R**	**X**		**X**	**65**	**0X41**	⊗	------	------	**NM**	◔		N_{ab}2 sensor fault; if PT partially or completely open: error message on CAN signal indicating prop shaft speed, transmission in neutral with control suspended
SP7	Logic error, N_{ab} 1 sensor	**X**	**X**	**X**	**X**	**65**	**0X41**	✸	Ⓞ	Ⓞ	**NM**	◐		N_{ab}2 sensor fault: error message on CAN signal indicating prop shaft speed; for other system statuses, see Ref. #SP6
SP13	Number of teeth on N_{ab} 1 less than N_{ab} 2	**X**	**X**	**X**	**X**	**73**	**0X49**	⊗	------	------	------	◔		If PT partially or completely open and N_{ab} registers zero: error message on CAN signal indicating prop shaft speed, transmission in neutral and TCUs
SE14	KM, N_{ab} 2 sensor	**X**	**X**	**X**	**X**	**51**	**0X33**	⊗	------	------	------	◔		N_{ab} 1 sensor OK; if PT partially or completely open and N_{ab} registers zero: error message on CAN signal indicating prop shaft speed, transmission in neutral with control suspended
SE15	KM, N_{ab} 2 sensor	**F ; R**	**X**		**X**	**51**	**0X33**	⊗	------	------	**NM**	◔		N_{ab}1 sensor fault; if PT partially or completely open: error message on CAN signal indicating prop shaft speed, transmission in neutral with control suspended
SE16	KM, N_{ab} 2 sensor	**X**	**X**	**X**	**X**	**51**	**0X33**	✸	Ⓞ	Ⓞ	**NM**	◐		N_{ab}1 sensor fault: error message on CAN signal indicating prop shaft speed; for other system statuses, see Ref. #SE15
SE18	KP or LU, N_{ab} 2 sensor	**X**	**X**	**X**	**X**	**59**	**0X3B**	⊗	------	------	------	◔		N_{ab}1 sensor OK; if PT partially or completely open and N_{ab} registers zero: error message on CAN signal indicating prop shaft speed, transmission in neutral with control suspended. This message also appears when the power supply to the sensor is defective.
SE19	KP or LU, N_{ab} 2 sensor	**F ; R**	**X**		**X**	**59**	**0X3B**	⊗	------	------	**NM**	◔		N_{ab}1 sensor fault; if PT partially or completely open: error message on CAN signal indicating prop shaft speed, transmission in neutral with control suspended. This message also appears when the power supply to the sensor is defective.

Ref.	System status					System reaction								Alternative function / Comment
	Fault	Direction	Gear selected	Inching	Speed	Transmission error code with CAN	Fault memory (hex)	Warning light (not utilized)	Forward drive clutch solenoid valves	Reverse clutch solenoid valves	Inching -	Operating mode	Corrective action	
SE20	KP or LU, N_{ab} 2 sensor	**X**	**X**	**X**	**X**	**59**	**0X3B**				**NM**			N_{ab}1 sensor fault: error message on CAN signal indicating prop shaft speed; for a special system status, see one line above. This message also appears when the power supply to the sensor is defective. For other system statuses, see Ref. #SE19
SP9	Logic error, N_{ab} 2 sensor	**X**	**X**	**X**	**X**	**67**	**0X43**		------	------	------			N_{ab} 1 sensor OK; if PT partially or completely open and N_{ab} registers zero: error message on CAN signal indicating prop shaft speed, transmission in neutral with control suspended
SP10	Logic error, N_{ab} 2 sensor	**F ; R**	**X**		**X**	**67**	**0X43**		------	------	**NM**			N_{ab}1 sensor fault; if PT partially or completely open: error message on CAN signal indicating prop shaft speed, transmission in neutral with control suspended
SP11	Logic error, N_{ab} 2 sensor	**X**	**X**	**X**	**X**	**67**	**0X43**				**NM**			N_{ab}1 sensor fault: error message on CAN signal indicating prop shaft speed; for other system statuses, see Ref. #SP10
SP22	Number of teeth on N_{ab} 2 less than N_{ab} 1	**X**	**X**	**X**	**X**	**75**	**0X4B**		------	------	------			If PT partially or completely open and N_{ab} registers zero: error message on CAN signal indicating prop shaft speed, transmission in neutral and TCUs
SE37	N_{ab} 1 phase shift not compatible with N_{ab} 2 phase shift	**X**	**X**	**X**	**X**	**62**	**0X3E**		------	------	------			
WA1	$N_{ab} > N_{ab}$ *grz*	**N**	**X**	**X**	**H**	**155**	**0X9B**		------	------	------			When F or R is required: increase Irex to max value; engage the shuttle clutches as appropriate
SP14	The 3 speeds of the system do not correspond	**F ; R**	**X**		**X**	**77**	**0X4D**				------		!	Possible reason: clutch slipping or wrongly connected, mechanical defect at speed sensor
SP16	Drive direction does not correspond to reverse clutch valves status	**F ; R**	**X**		**X**	**77**	**0X4D**				------		!	Possible reason: clutch slipping or wrongly connected, mechanical defect at speed sensor
SP18	One clutch seized	**N**	**X**		**X**	**78**	**0X4E**				------		!	Possible reason: clutch seized or wrongly connected,mechanical defect at speed sensor

Ref.	System status					System reaction								Alternative function / Comment
	Fault	Direction	Gear selected	Inching	Speed	Transmission error code with CAN	Fault memory (hex)	Warning light (not utilized)	Forward drive clutch solenoid valves	Reverse clutch solenoid valves	Inching -	Operating mode	Corrective action	
SE23	KM, N_{Hyd} 1 sensor	**X**	**X**	**X**	**X**	**50**	**0X32**	⊗	------	------	**NM**	◕		N_{Hyd} 2 sensor OK; possible delay when N_{Hyd} registers zero. If inching selected, “corrective action”: sel. dir.
SE24	KM, N_{Hyd} 1 sensor	**F ; R**	**X**	↘	**X**	**50**	**0X32**	⊗	------	------	**NM**	◕		N_{Hyd} 2 sensor fault; possible delay when N_{Hyd} registers zero. If PT partially or completely open: transmission in neutral with control suspended; for other system statuses, see Ref. #SE25
SE25	KM, N_{Hyd} 1 sensor	**X**	**X**	**X**	**X**	**50**	**0X32**	✸	Ⓞ	Ⓞ	**NM**	◐	!	N_{Hyd} 2 sensor fault
SE26	KP or LU, N_{Hyd} 1 sensor	**X**	**X**	**X**	**X**	**58**	**0X3A**	⊗	------	------	**NM**	◕		N_{Hyd} 2 sensor OK; possible delay when N_{Hyd} registers zero. If inching selected, “corrective action”: sel. dir.
SE27	KP or LU, N_{Hyd} 1 sensor	**F ; R**	**X**	↘	**X**	**58**	**0X3A**	⊗	------	------	**NM**	◕		N_{Hyd} 2 sensor fault; possible delay when N_{Hyd} registers zero. If PT partially or completely open: transmission in neutral with control suspended; for other system statuses, see Ref. #SE28
SE28	KP or LU, N_{Hyd} 1 sensor	**X**	**X**	**X**	**X**	**58**	**0X3A**	✸	Ⓞ	Ⓞ	**NM**	◐	!	N_{Hyd} 2 sensor fault
SP19	Logic error, N_{Hyd} 1 sensor	**X**	**X**	**X**	**X**	**66**	**0X42**	⊗	------	------	**NM**	◕		N_{Hyd} 2 sensor OK; possible delay when N_{Hyd} registers zero. If inching selected, “corrective action”: sel. dir.
SP20	Logic error, N_{Hyd} 1 sensor	**F ; R**	**X**	↘	**X**	**66**	**0X42**	⊗	------	------	**NM**	◕		N_{Hyd} 2 sensor fault; possible delay when N_{Hyd} registers zero. If PT partially or completely open: transmission in neutral with control suspended; for other system statuses, see Ref. #SP21
SP21	Logic error, N_{Hyd} 1 sensor	**X**	**X**	**X**	**X**	**66**	**0X42**	✸	Ⓞ	Ⓞ	**NM**	◐	!	N_{Hyd} 2 sensor fault
SE29	Number of teeth on N_{Hyd} 1 less than N_{ab} 2	**X**	**X**	**X**	**X**	**74**	**0X4A**	⊗	------	------	**NM**	◕		Possible delay when N_{Hyd} registers zero. If inching selected, “corrective action”: sel. dir. N_{Hyd} 1 sensor deactivated until ignition Off/On

Ref.	System status					System reaction								Alternative function / Comment
	Fault	Direction	Gear selected	Inching	Speed	Transmission error code with CAN	Fault memory (hex)	Warning light (not utilized)	Forward drive clutch solenoid valves	Reverse clutch solenoid valves	Inching -	Operating mode	Corrective action	
SE30	KM, N_{Hyd} 2 sensor	**X**	**X**	**X**	**X**	**52**	**0X34**	⊗	------	------	**NM**	◔		N_{Hyd} 1 sensor OK; possible delay when N_{Hyd} registers zero. If inching selected, “corrective action”: sel. dir.
SE31	KM, N_{Hyd} 2 sensor	**F ; R**	**X**		**X**	**52**	**0X34**	⊗	------	------	**NM**	◔		N_{Hyd} 1 sensor fault; possible delay when N_{Hyd} registers zero. If PT partially or completely open: transmission in neutral with control suspended; for other system statuses, see Ref. #SE32
SE32	KM, N_{Hyd} 2 sensor	**X**	**X**	**X**	**X**	**52**	**0X34**	✳⊗	Ⓞ	Ⓞ	**NM**	◑	!	N_{Hyd} 1 sensor fault
SE33	KP or LU, N_{Hyd} 2 sensor	**X**	**X**	**X**	**X**	**60**	**0X3C**	⊗	------	------	**NM**	◔		N_{Hyd} 1 sensor OK; possible delay when N_{Hyd} 1 registers zero. If inching selected, “corrective action”: sel. dir. This message also appears when the power supply to the sensor is defective, so that Ref #SP25 occurs as well.
SE34	KP or LU, N_{Hyd} 2 sensor	**F ; R**	**X**		**X**	**60**	**0X3C**	⊗	------	------	**NM**	◔		N_{Hyd} 1 sensor fault; possible delay when N_{Hyd} registers zero. If PT partially or completely open: transmission in neutral with control suspended. This message also appears when the power supply to the sensor is defective, so that Ref #SP26 occurs as well. For other system statuses, see Ref. #SE35
SE35	KP or LU, N_{Hyd} 2 sensor	**X**	**X**	**X**	**X**	**60**	**0X3C**	✳⊗	Ⓞ	Ⓞ	**NM**	◑	!	N_{Hyd} 1 sensor fault This message also appears when the power supply to the sensor is defective, so that Ref #SP25 occurs as well.
SP22	Logic error, N_{Hyd} 2 sensor	**X**	**X**	**X**	**X**	**68**	**0X44**	⊗	------	------	**NM**	◔		N_{Hyd} 1 sensor OK; possible delay when N_{Hyd} registers zero. If inching selected, “corrective action”: dir. sel.
SP23	Logic error, N_{Hyd} 2 sensor	**F ; R**	**X**		**X**	**68**	**0X44**	⊗	------	------	**NM**	◔		N_{Hyd} 1 sensor fault; possible delay when N_{Hyd} registers zero. If PT partially or completely open: transmission in neutral with control suspended; for other system statuses, see Ref. #SP22
SP24	Logic error, N_{Hyd} 2 sensor	**X**	**X**	**X**	**X**	**68**	**0X44**	✳⊗	Ⓞ	Ⓞ	**NM**	◑	!	N_{Hyd} 1 sensor fault

Ref.	System status					System reaction								Alternative function / Comment
	Fault	Direction	Gear selected	Inching	Speed	Transmission error code with CAN	Fault memory (hex)	Warning light (not utilized)	Forward drive clutch solenoid valves	Reverse clutch solenoid valves	Inching -	Operating mode	Corrective action	
SP36	Number of teeth on N_{Hyd} 2 less than N_{ab} 1	F ; R	X		X	76	0X4C		------	------	NM			Possible delay when N_{Hyd} registers zero. If inching selected, “corrective action”: dir. sel. N_{Hyd} 2 sensor deactivated until ignition Off/On
SP38	N_{Hyd} 1 phase shift not compatible with di N_{Hyd} 2 phase shift	X	X	X	X	79	0X4F		------	------	------			
SP25	Hydrostatic unit current does not correspond to speed	F ; R	X		L	79	0X4F				NM			Possible reason: mechanical defect at N_{am} or N_{Hyd} speed sensors, hydrostatic unit defective: for other system statuses, see Ref. #SP26
SP26	Hydrostatic unit current does not correspond to speed	X	X	X	X	79	0X4F				NM			Possible reason: mechanical defect at N_{am} or N_{Hyd} speed sensors, hydrostatic unit defective.
IA1	KM, oil temperature sensor c_getr	X	X	X	X	24	0X18		------	------	------			If wrong, temperature will always rise when system is started up, error code in CAN transmission oil temperature signal.
IA2	KP or LU, oil temperature sensor c_getr	X	X	X	X	40	0X28		------	------	------			KP or LU, ER1. If wrong, temperature will always rise when system is started up, error code in CAN transmission oil temperature signal.
IA5	KM or LU, LHS sensor	X	X	X	X	28	0X1C				------			KM or LU, EU1
IA6	KP, LHS sensor	X	X	X	X	44	0X2C				------			KP, EU1
IA11	LHS voltage not within specified range	X	X	X	X	23	0X17		------	------	------			No action in normal driving modes. During transition to LIMP HOME, transmission control suspended and WL.. During Limp home: TCUs and WL
PV3	Battery power high (>16V)	X	X	X	X	128	0X80				------			System reaction after delay
PV6	Battery power low (<9V)	X	X	X	X	129	0X81				------			System reaction after delay or at <7V

Ref.	System status					System reaction								Alternative function / Comment
	Fault	Direction	Gear selected	Inching	Speed	Transmission error code with CAN	Fault memory (hex)	Warning light (not utilized)	Forward drive clutch solenoid valves	Reverse clutch solenoid valves	Inching -	Operating mode	Corrective action	
PV7	KP, power supply to sensors	**X**	**X**	**X**	**X**	**130**	**0X82**	⊗	------	------	------	◐		Reaction comparable with reaction to most critical failure of part connected to the particular supply.
PV8	KM, power supply to sensors	**X**	**X**	**X**	**X**	**131**	**0X83**	⊗	------	------	------	◐		Reaction comparable with reaction to most critical failure of part connected to the particular supply.
PV10	Plausibility error, VPS1	**X**	**X**	**X**	**X**	**132**	**0X84**	✸	Ⓞ	Ⓞ	------	○		KM fault; KP and LU can be detected only during ignition diagnosis. LU fault detected with AD,AIP diagnosis.
PV11	Plausibility error, VPS2	**X**	**X**	**X**	**X**	**133**	**0X85**	✸	Ⓞ	Ⓞ	------	○		KM fault; KP and LU can be detected only during ignition diagnosis. LU fault detected with AD, AIP diagnosis.
UE2	Hardware not compatible with software	**X**	**X**	**X**	**X**	**136**	**0X88**	✸	Ⓞ	Ⓞ	------	○		
UE3	Eeprom read/write error	**X**	**X**	**X**	**X**	**137**	**0X89**	⊗	------	------	------	●		
UE5	Application data not compatible with software	**X**	**X**	**X**	**X**	**138**	**0X8A**	✸	Ⓞ	Ⓞ	------	○		
UE7	TCU on wrong connector	**X**	**X**	**X**	**X**	**140**	**OX8C**	✸	Ⓞ	Ⓞ	------	●	!	
WA7	Transmission temperature rise	**X**	**X**	**X**	**X**	**152**	**0X98**	⊗	------	------	------	●		
WA3	Calibration error while driving with data	**X**	**X**	**X**	**X**	**153**	**0X99**	⊗	------	------	------	●		
WA4	Transmission too cold, heat from engine	**X**	**X**	**X**	**X**	**156**	**0X9C**	✸	Ⓞ	Ⓞ	------	◔		Wait until warm-up sequence is finished
WA6	Less lubricating oil due to N_Ab being too high with N_An too low	**X**	**X**	**X**	**X**	**158**	**0X9E**	⊗	------	------	**NM**	◔		tbd: increase N_{an}
ME1	Filter dirty or electrical fault at sensor	**X**	**X**	**X**	**X**	**176**	**0XBO**	⊗	------	------	------	●		No fault detection if transmission oil temperature sensor is electrically defective

Ref.	System status					System reaction								Alternative function / Comment
	Fault	Direction	Gear selected	Inching	Speed	Transmission error code with CAN	Fault memory (hex)	Warning light (not utilized)	Forward drive clutch solenoid valves	Reverse clutch solenoid valves	Inching -	Operating mode	Corrective action	
ME2	System pressure or electrical fault at sensor	X	X	X	X	177	0XB1	⊗	------	------	------	●		Detection possible only if N_{an} > 900 rev/min; no fault detection if transmission oil temperature sensor is electrically defective
ME5	CAN status data measured via EMR indicates that engine is not reacting to CAN signals	X	X	X	X	180	0XB4	⊗	ⓞ	ⓞ	------	◔		Reaction from system only when driving mode = FIELD AUTOMATIC. Driving in MANUAL mode still possible.
CM1	Timeout message CANEEC1 (message from EMR)	X	X	X	X	160	OXAO	⊗	------	------	------	◔		
CM2	Timeout message CAN PTCTL1 (message from EMR)	X	X	X	X	161	0XA1	⊗	ⓞ	ⓞ	------	◔	!	
CM3	Timeout message CAN PTCTL2 (message from EMR)	X	X	X	X	162	OXA2	⊗	------	------	------	◔		
CM6	Timeout message CAN ENGTEMP (message from engine)	X	X	X	X	165	0XA5	⊗	------	------	------	◔		
CM8	Timeout message CAN ECMDAT (message from EMR)	X	X	X	X	167	0A7	⊗	------	------	------	◔		
CS3	CAN M_{MOT} signal defective (engine torque current from EMR)	X	X	X	X	194	0XC2	⊗	------	------	------	●		
CS5	CAN n_{MOT} signal defective (engine torque current from EMR)	X	X	X	X	196	OXC4	⊗	------	------	------	◔		When fault and sensor signal are wrong and transmission is partially or completely open: transmission in neutral and TCUs
CS8	CAN N_{ab} SOLL signal defective(drive shaft speed required by user CU)	X	X	X	X	199	0XC7	⊗	ⓞ	ⓞ	------	◐	!	No reaction from system when signal not available and driving mode = FIELD AUTOMATIC
CS10	CAN PTCTL1_DTOA signal defective (transmission output acceleration required by user CU)	X	X	X	X	200	OXC8	⊗	------	------	------	◔		No acceleration control possible by way of UC

Ref.	System status					System reaction								Alternative function / Comment
	Fault	Direction	Gear selected	Inching	Speed	Transmission error code with CAN	Fault memory (hex)	Warning light (not utilized)	Forward drive clutch solenoid valves	Reverse clutch solenoid valves	Inching -	Operating mode	Corrective action	
CS12	CAN INCH_SOLL signal defective (inching effect required by user CU)	**X**	**X**	**X**	**X**	**201**	**0XC9**	⊗	------	------	------	◔		
CS12a	CAN INCH_SOLL signal defective (inching required by user CU)	**X**	**X**	**X**	**X**	**202**	**0XCA**	⊗	------	------	**NM**	◑	!	For other system statuses, see Ref. #CS12
CS20	CAN IREZ_SOLL signal defective (reciprocal ratio required by user CU)	**X**	**X**	**X**	**X**	**203**	**OXCB**	⊗	------	------	**NM**	◑	!	No reaction from system when signal not available and driving mode = FIELD AUTOMATIC
CS24	CAN FR_SOLL signal defective (drive direction required by user CU)	**X**	**X**	**X**	**X**	**204**	**OXCC**	✳	ⓞ	ⓞ	------	◑	!	
CS27	CAN S_BP signal defective (brake pedal signal from user CU)	**X**	**X**	**X**	**X**	**205**	**OXCD**	✳	ⓞ	ⓞ	------	●		
C37	CAN N_AN_MAX signal defective (maximum engine speed range required by user CU)	**X**	**X**	**X**	**X**	**208**	**0XD0**	✳	ⓞ	ⓞ	------	◑	!	
CS39	CAN N_AN_MIN signal defective (minimum engine speed range required by user CU)	**X**	**X**	**X**	**X**	**209**	**0XD1**	✳	ⓞ	ⓞ	------	◑	!	
CS53	CAN PTCTL2_LHDL signal defective (Limp Home direction lever from user CU)	**X**	**X**	**X**	**X**	**210**	**0XD2**	⊗	------	------	------	●		When defective in Limp Home, analog direction selector is used
CS56	CAN PTCTL2_CAL signal defective (signal for selection of settable data sets or preset data sets transmitted by user CU)	**X**	**X**	**X**	**X**	**211**	**OXD3**	⊗	------	------	------	●		When defective, CU can select preset data
CS59	CAN EC_CANSTAT signal defective (CAN status data measured by way of EMR)	**X**	**X**	**X**	**X**	**221**	**0XDD**	✳	ⓞ	ⓞ	------	●		

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5. CALIBRATING THE TRANSMISSION

This operation is carried out generally following a repair on the transmission or after replacing the transmission control unit.

During the course of the procedure, the control unit runs calibration tests on the clutches in order to re-establish the optimum operating conditions.

Before proceeding with the calibration:

- position the tractor on a level surface;
- leave the engine running at around 1500 rev/min;
- using the hand throttle, put the transmission in neutral;
- release the brake, clutch and accelerator pedals and the hand brake;
- make certain there is at least 5 m clear space to the front and rear of the tractor.

NOTE

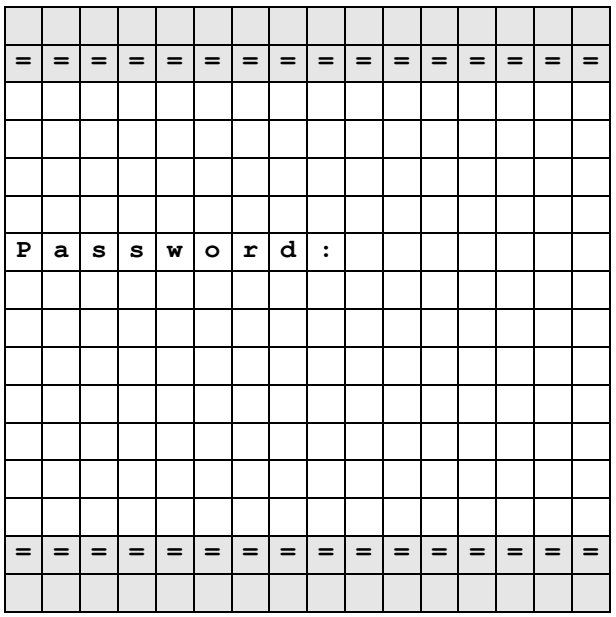
In the event that the electronic control unit of the transmission is replaced, contact the Technical Help Service for details of the configuration.

IMPORTANT!

Do not perform any operation other than those described in this heading.

- From the opening screen, press the “0” key twice to access the password screen.

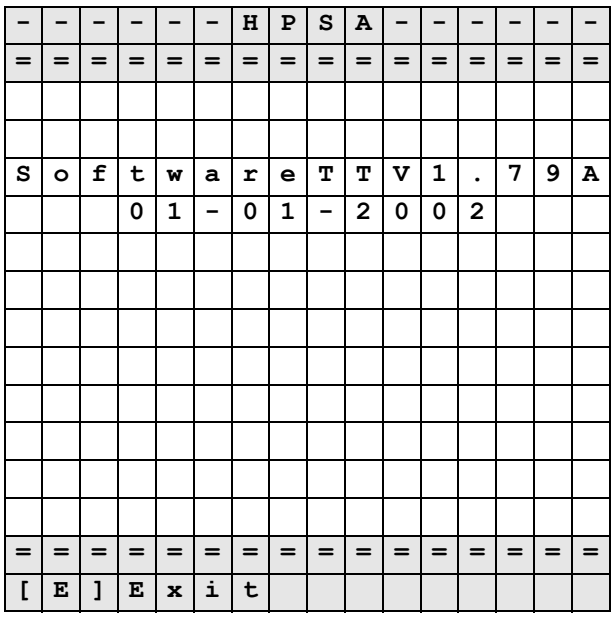
-	-	-	-	-	-	H	P	S	A	-	-	-	-	-	-
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
S	o	f	t	w	a	r	e	T	T	V	1	.	7	9	A
			0	1	-	0	1	-	2	0	0	2			
=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
[	E	]	E	x	i	t									



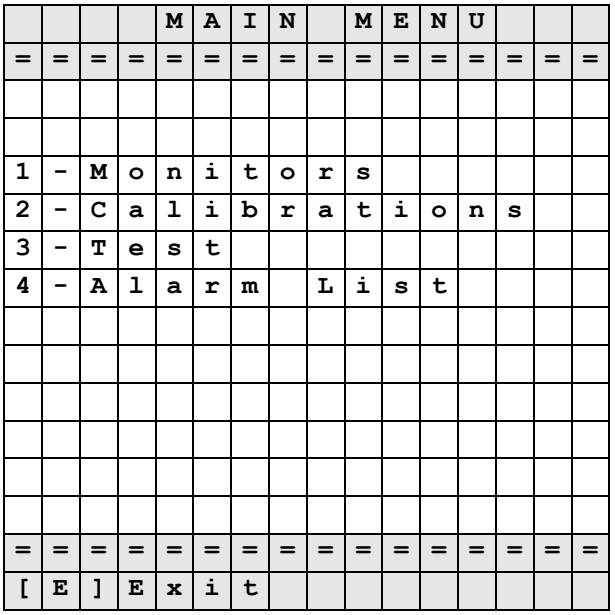
- Enter the password:

A	B	A	C	0	C

- Confirm by pressing [E] .

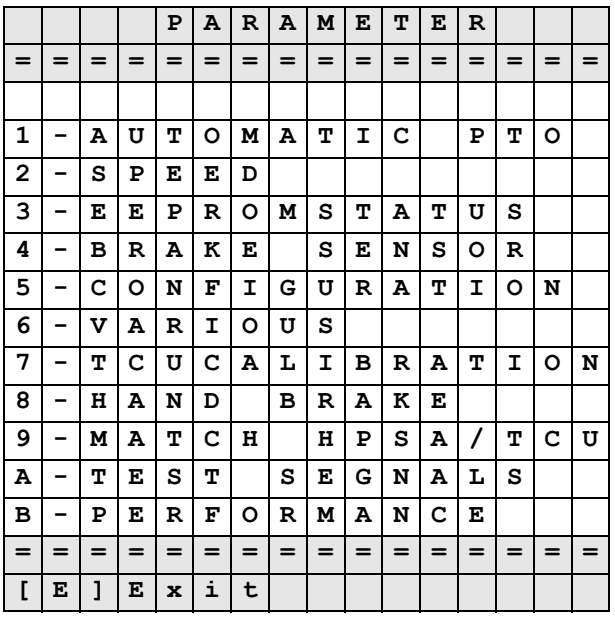


- Press [E] to access the main menu.



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

- Press 0 to access the hidden menu.



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

- Press 7 to start the calibration procedure.

SECTION 30

CONTENTS

METHOD FOR REMOVAL AND REFITTING OF RIGID PIPES AND WIRING

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

2 - For particularly complex removal operations, number the pipes in the order in which they are removed, label any intermediate connections and the positions of the intermediate retaining clamps. Refit the pipes in reverse order to removal.

3 - After having repositioned the pipes in their original locations, tighten the fittings by hand and locate the retaining clamps and intermediate fixings.

4 - First tighten the fittings using also a holding wrench to the torques specified in the tables in Section 00, and then tighten the pipe clamps.

5 - To enable the operator to determine the correct routes for the rigid pipes and the wiring harnesses on the tractor frame, we have provided photographs showing the original routes for the two versions of the tractor with additional oil flow obtained by gear pumps and a variable displacement pump, both of which are equipped with air trailer braking.

IMPORTANT

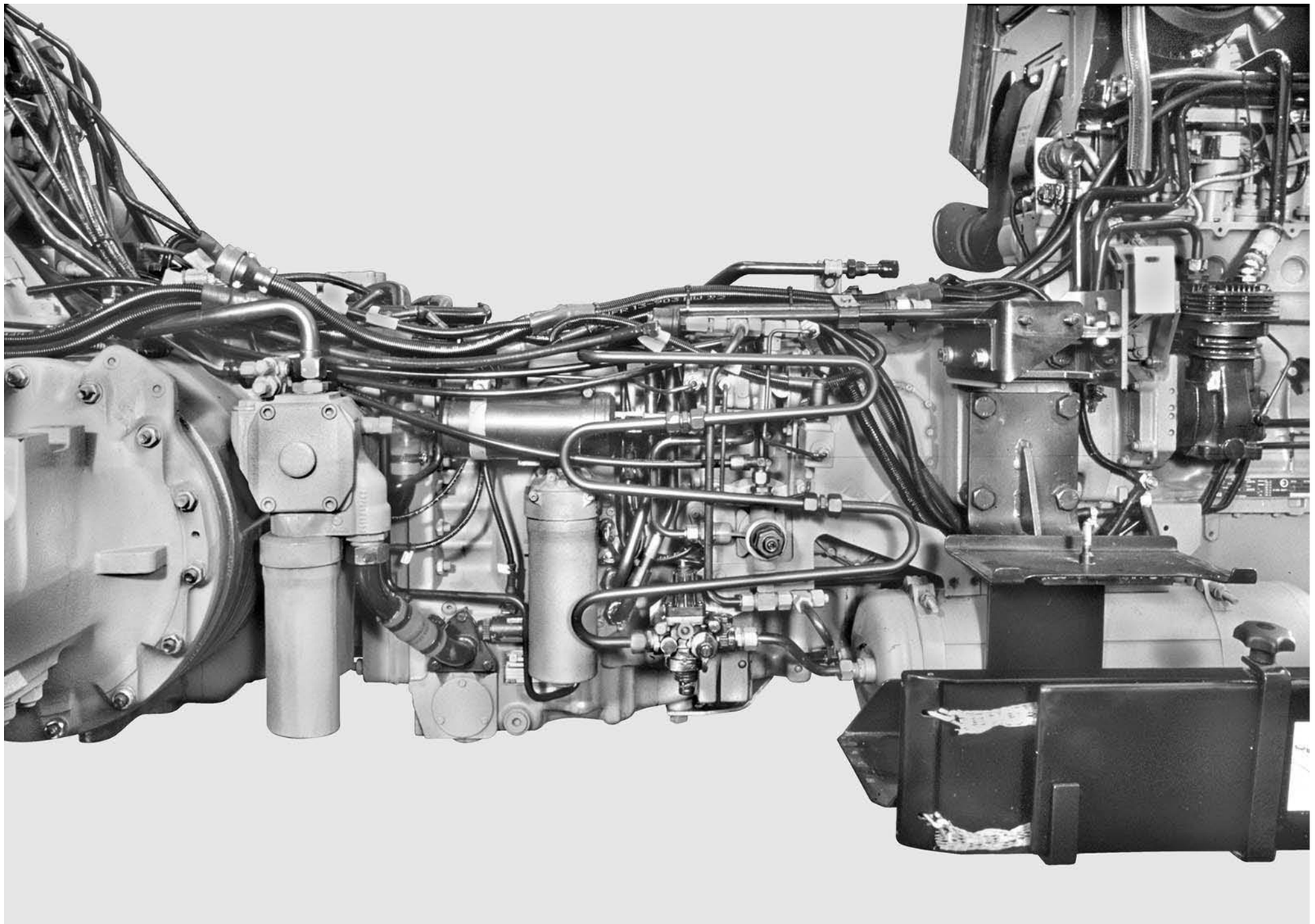
1 - After removing pipes, immediately plug the ends of the pipes and the open fittings on the components from which they were disconnected in order to prevent the entry of contaminants.

2 - After disconnecting electrical connectors, protect them against oil, dust and other contaminants by covering them in bags made of waterproof material and attach the bags to the wiring with insulating tape.

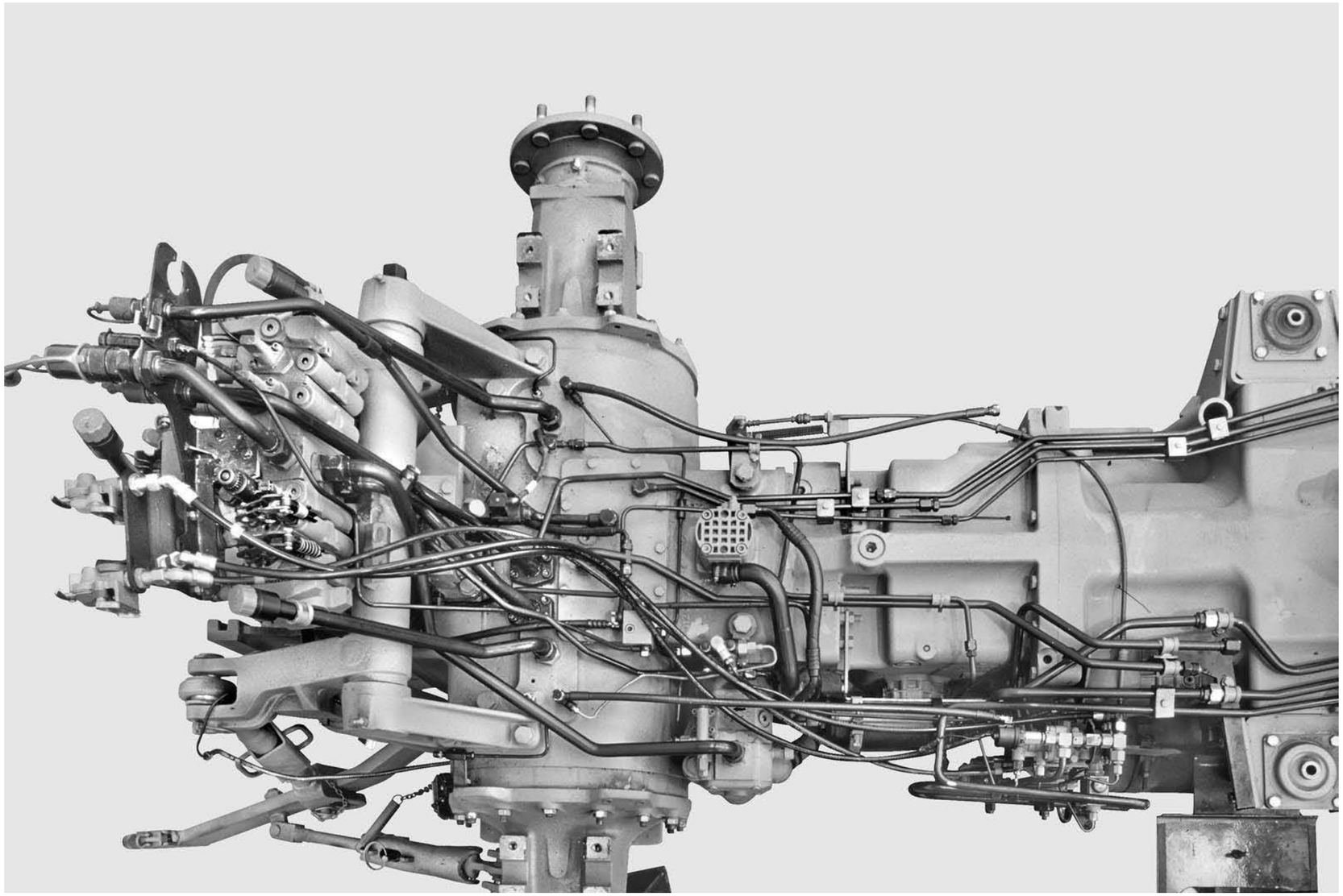
3 - Should any oil, coolant, moisture or water come into contact with the connectors, clean them with compressed air at low pressure (max. 2 bar) and clean the wires and contacts with isopropyl alcohol or a specific water-repellent product.

4 - Check wiring fixings carefully; these must not impinge on the connectors and must be positioned at regular intervals of about 30 cm to prevent vibration that could cause an interruption in current flow or signal loss.

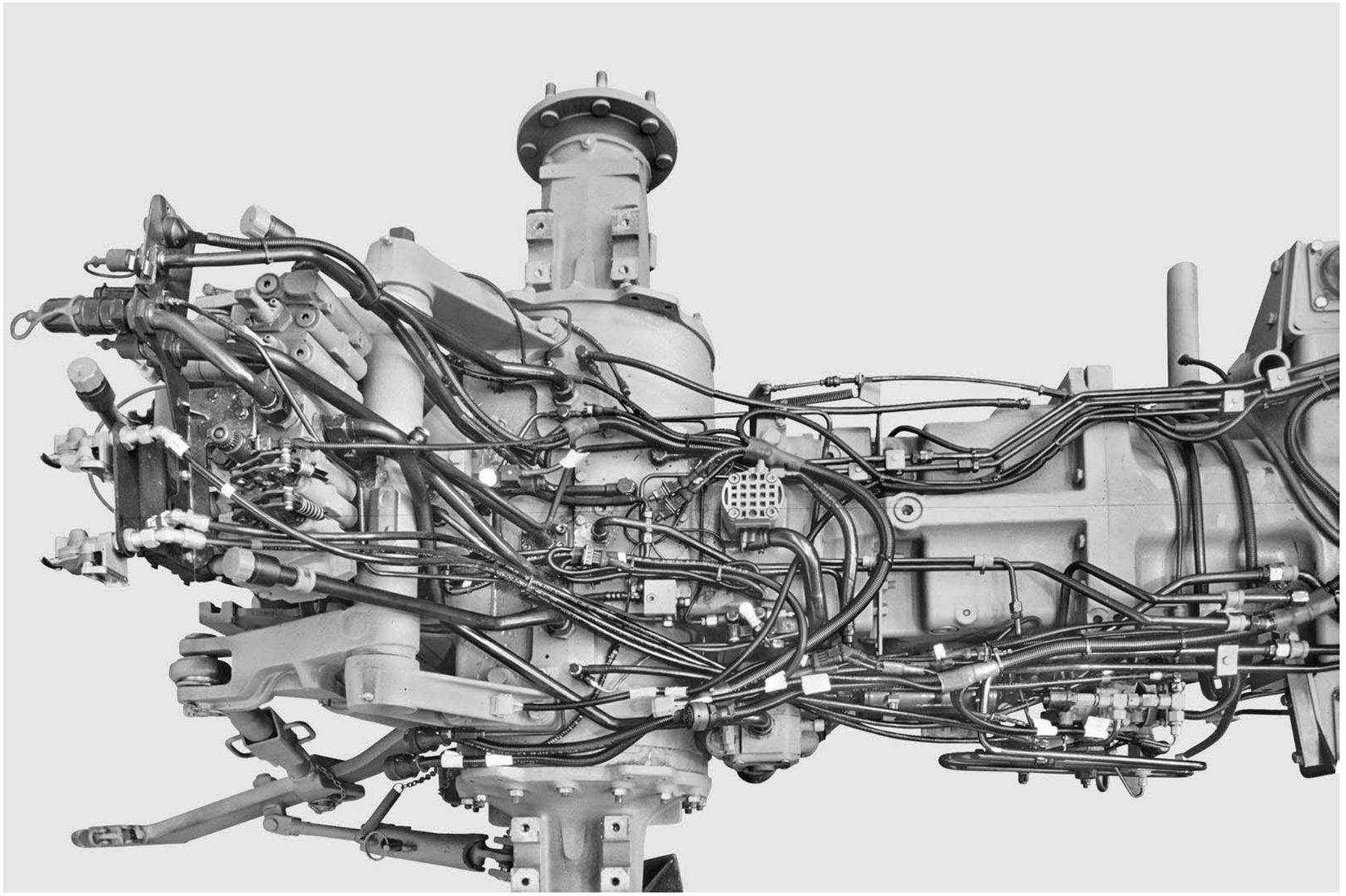
HYDRAULIC AND WIRING SYSTEMS - PUMP SIDE



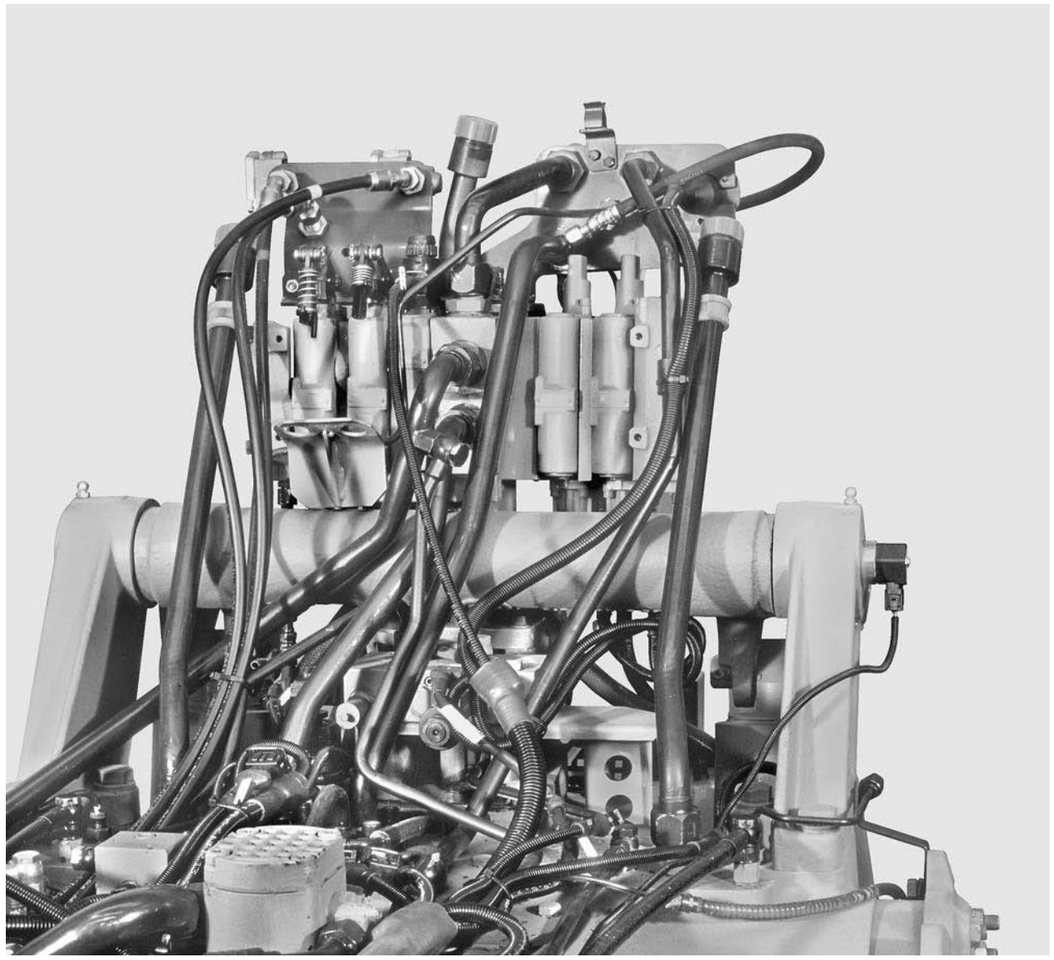
HYDRAULIC SYSTEMS (TOP VIEW)

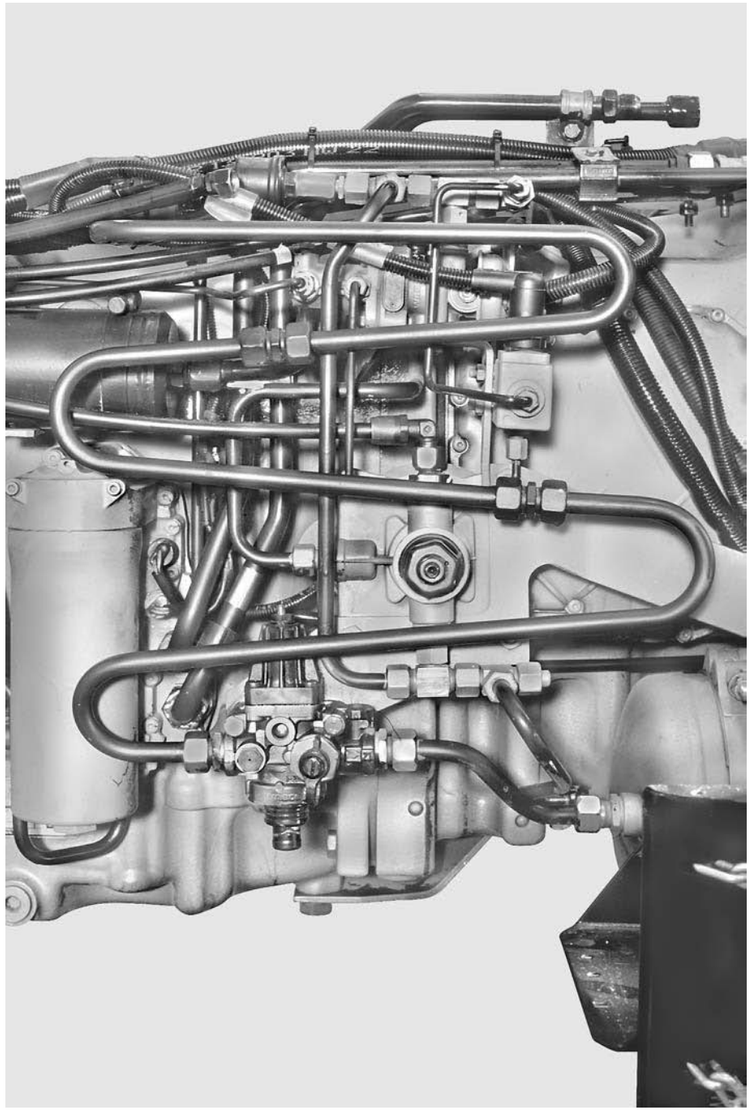


HYDRAULIC SYSTEMS AND WIRING (TOP VIEW)



AUXILIARY HYDRAULIC SYSTEMS AND COUPLERS - TRAILER AIR BRAKE VALVES





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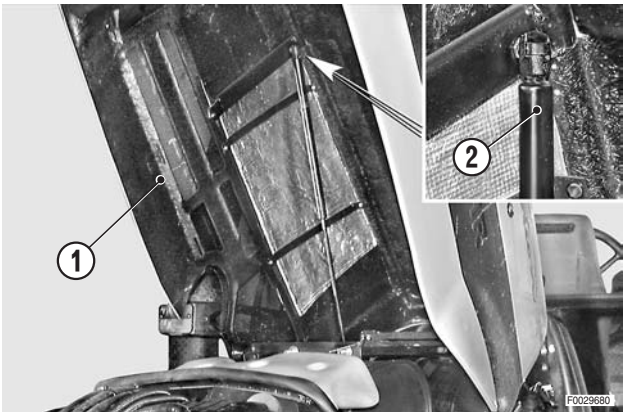
REMOVAL AND ADJUSTMENT OF ENGINE HOOD - REMOVAL OF LAMP ASSEMBLIES

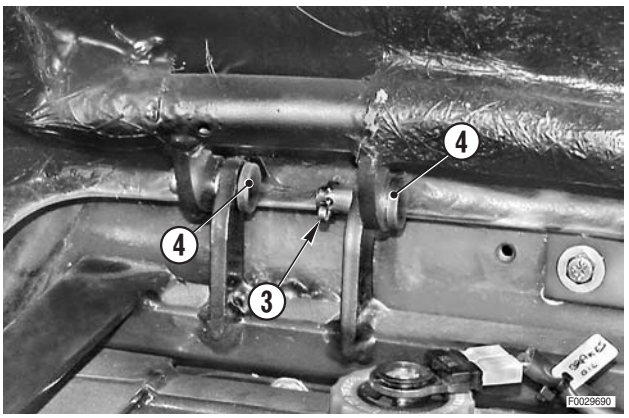
1. Removal of hood

1 - Open the hood (1).

2 - Keeping the hood raised, disconnect the gas spring struts (2).



3 - Remove the linch pins (3) and hinge pivots (4), and lift the hood clear.

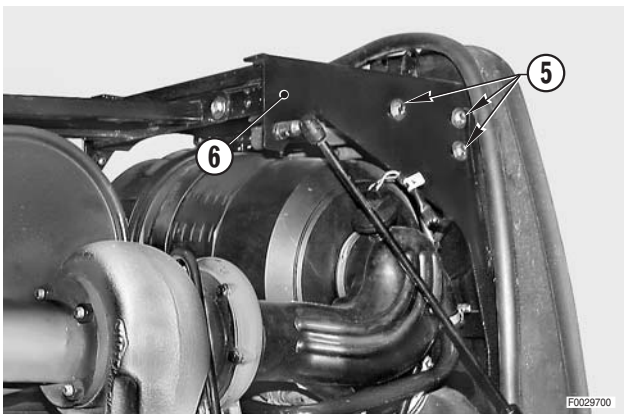


1.1 Refitting hood

- Refitting is the reverse of removal.

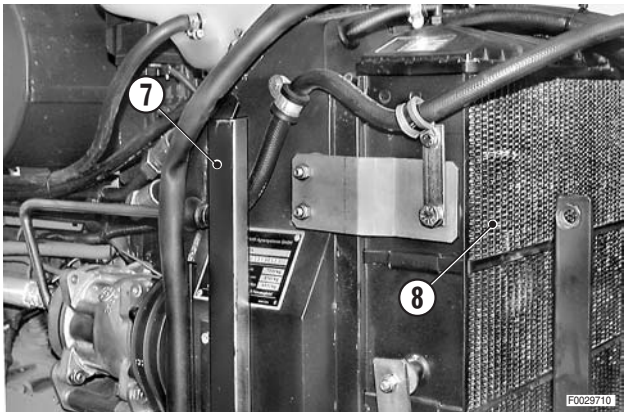
1.2 Adjustment of hood position and latch

1 - Loosen the bolts (5) securing the hood bracket (6).

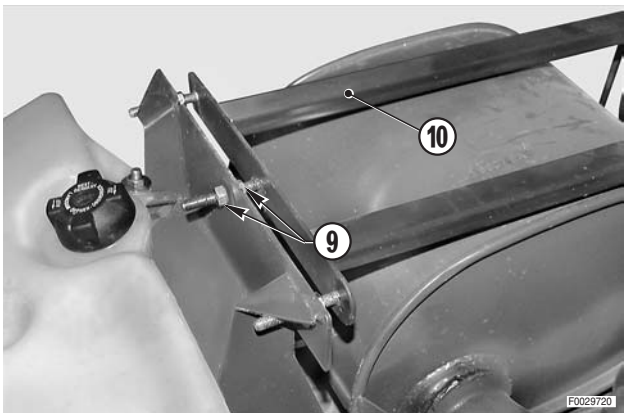


2 - Lower the hood slowly and check that it meets the front alignment stops (7) attached to the radiator/cooler assembly (8).

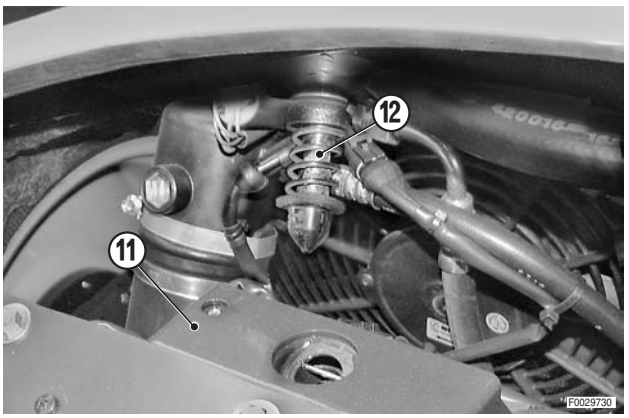
★ Support the hood from the front during this operation, checking for correct alignment without forcing sideways.



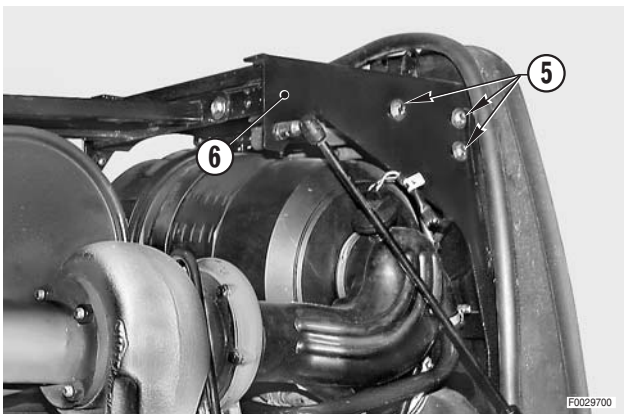
3 - If necessary, adjust the position of the R.H. and L.H. nuts and lock nuts (9) on the frame (10) to obtain the correct lateral alignment.



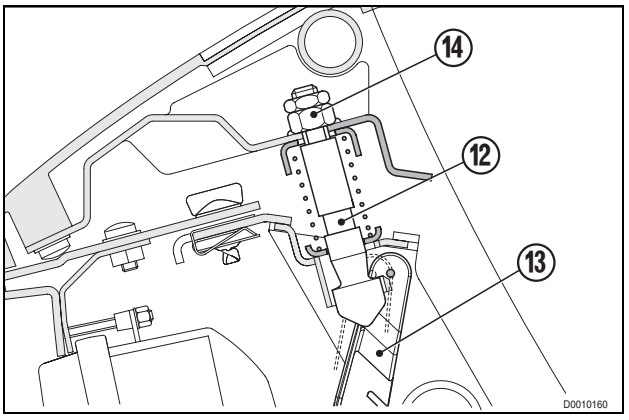
4 - Close the hood completely, checking that the front end meets the nose bracket (11) correctly and that the latch plunger (12) is aligned with the corresponding socket.
Correct alignment is obtained (as for lateral alignment) by adjusting the nuts and lock nuts (9) on the frame (10).



5 - Lock the hood bracket (6) in position by retightening the bolts (5).

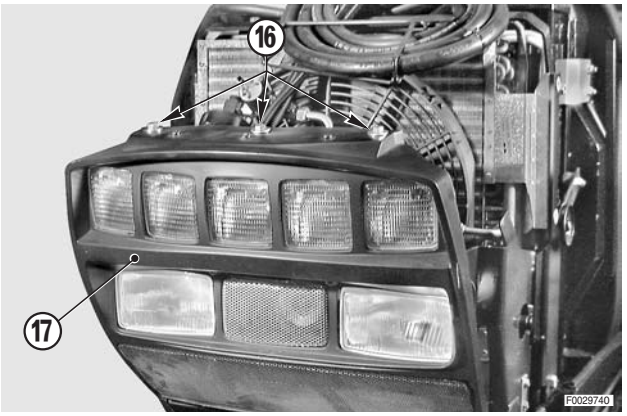


6 - Close the hood fully and make certain that the latch lever (13) engages the profile offered by the plunger (12). If necessary, adjust the position of the plunger (12) by turning the nut (14).



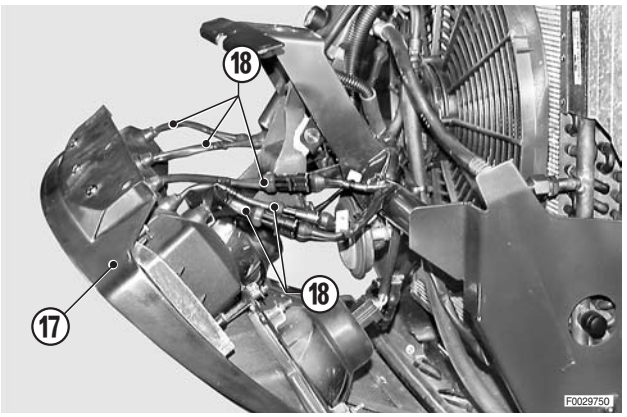
1.3 Removal of lamp assemblies

1 - Loosen and remove the bolts (16) securing the nose (17).



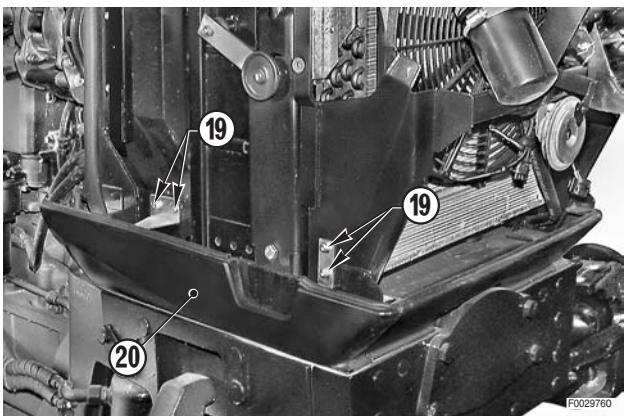
2 - Disconnect the leads of the wiring harness (18) from each of the lamps and remove the entire nose (17).

★ Before disconnecting the leads, make a note of the positions so as to avoid error when the connections are remade.



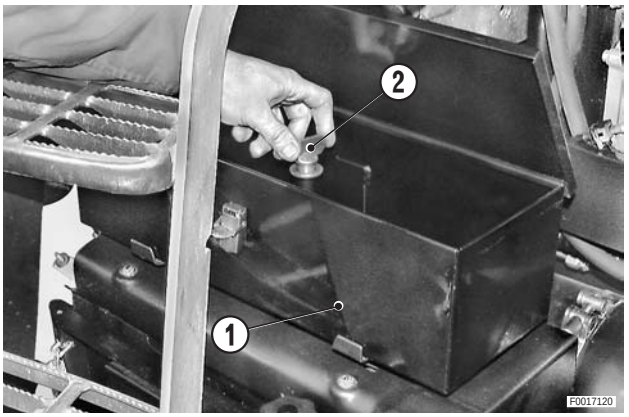
1.4 Removal of side panels

1 - Undo the fixing bolts (19) and remove the panels (20).

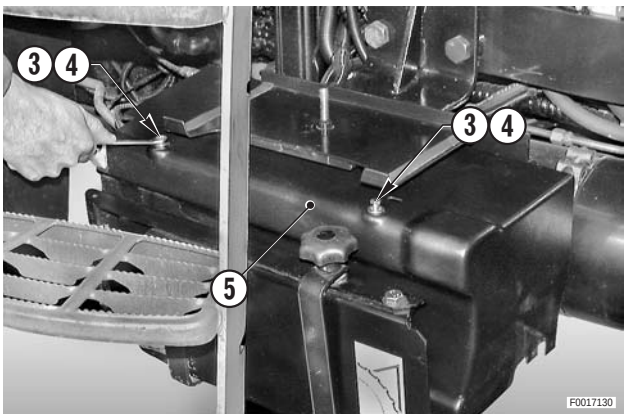


REMOVAL OF THE BATTERY

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

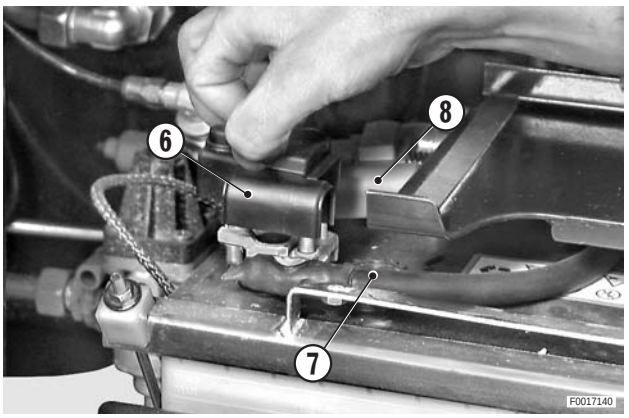


2 - Remove the bolts (3) with their washers (4) and remove the battery cover (5).

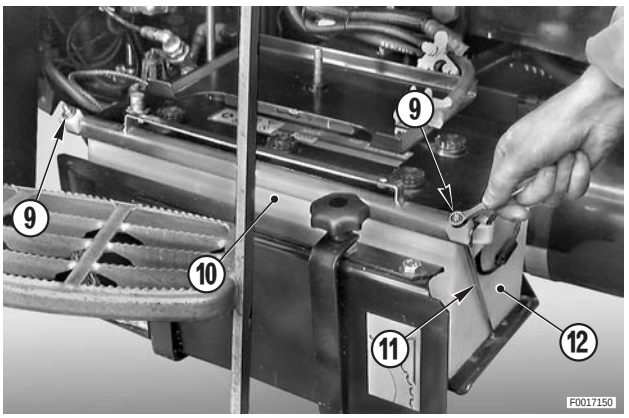


3 - Remove the terminal covers (6) and disconnect the leads (7) and (8). ⁘ 1

⚠ Always disconnect the negative lead (–) before the positive lead (+).

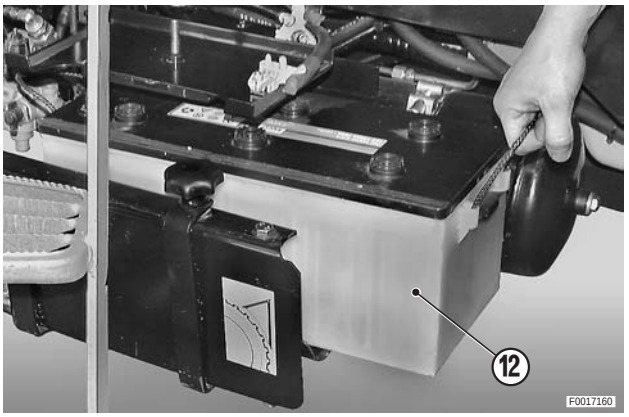


4 - Loosen off the nuts (9) sufficiently to tilt and remove the battery (12) securing clamp (10) and rods (11).



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

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



REFITTING THE BATTERY

- Refitting is the reverse of removal.

1

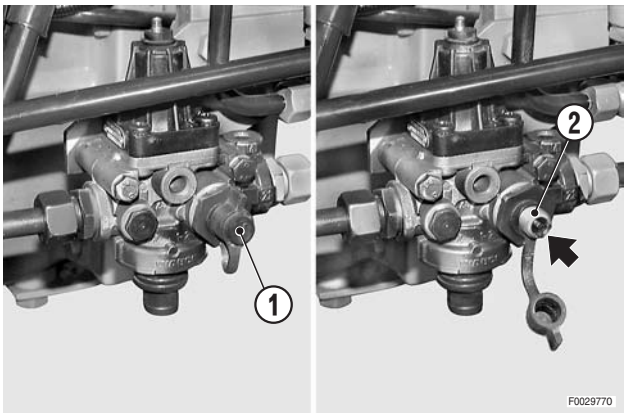
⚠ Always re-connect the positive lead (+) before the negative lead (–).

REMOVAL OF AIR RESERVOIR AND BATTERY SHELF

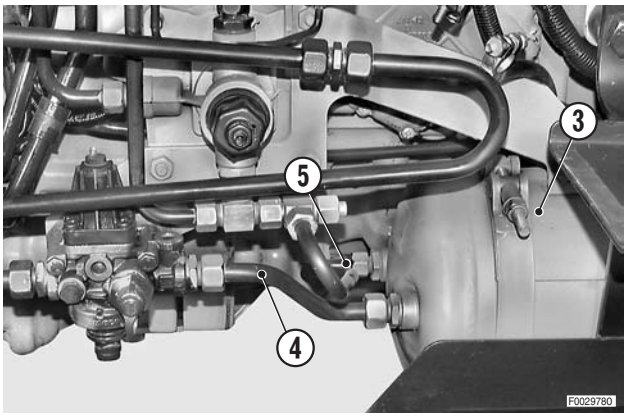
(Version with trailer air braking system only)

⚠ Vent residual pressure from the reservoir by removing the cap (1) and pressing the button (2).

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

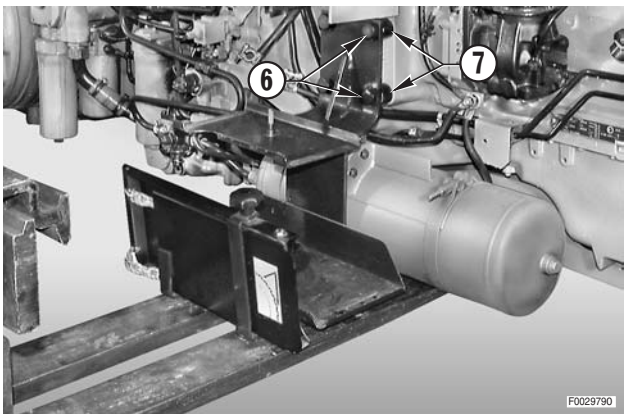


2 - Disconnect the pipes (4) and (5) from the reservoir (3).



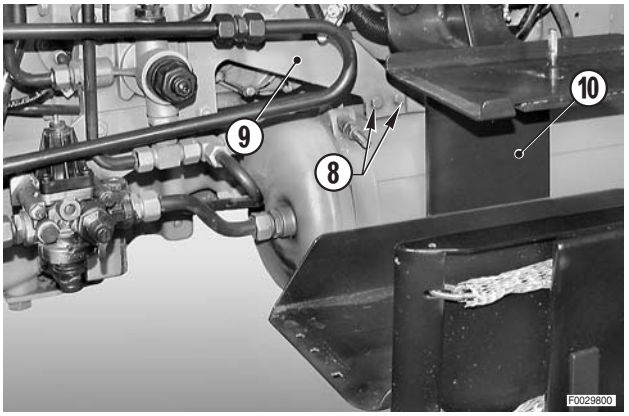
3 - Support the assembly using suitable lifting equipment; loosen and remove the bolts (6) and the spacers (7).

★ Note that if the machine is equipped with a front lift, the thicker spacers are located uppermost under the bracket.



4 - Remove the bolts (8) securing the bracket (9).

5 - Lower the assembly (10); distance the battery leads and remove the entire assembly.

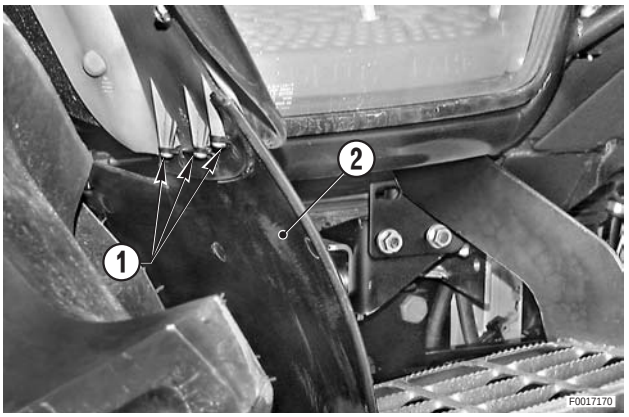


REFITTING AIR RESERVOIR AND BATTERY SHELF

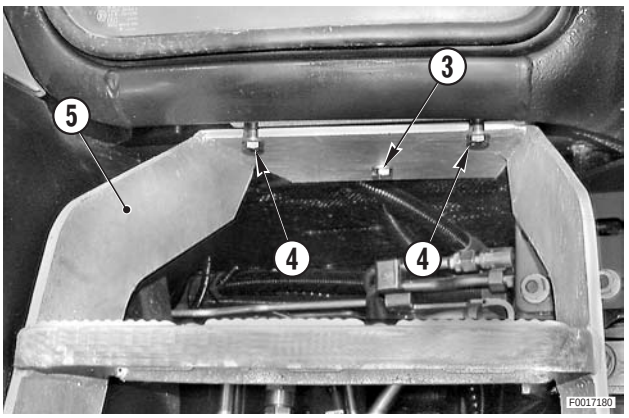
- Refitting is the reverse of removal.

REMOVAL OF THE CAB ACCESS STEPS

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



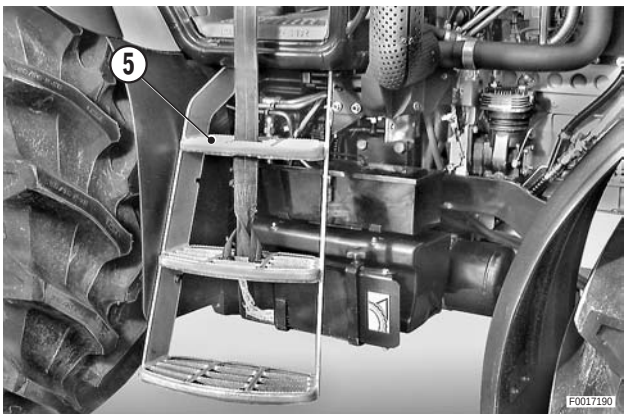
2 - Loosen the bolts (3) and (4) securing the steps (5).
★ For safety reasons, do not remove the bolts yet.



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.



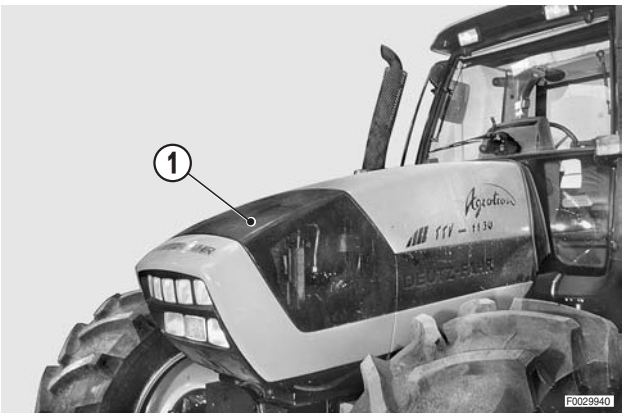
REFITTING THE CAB ACCESS STEPS

- Refitting is the reverse of removal.

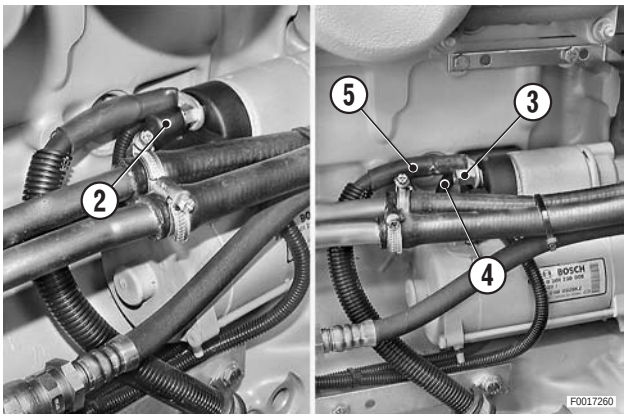
REMOVAL OF THE STARTER MOTOR

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

1 - Raise the hood (1).

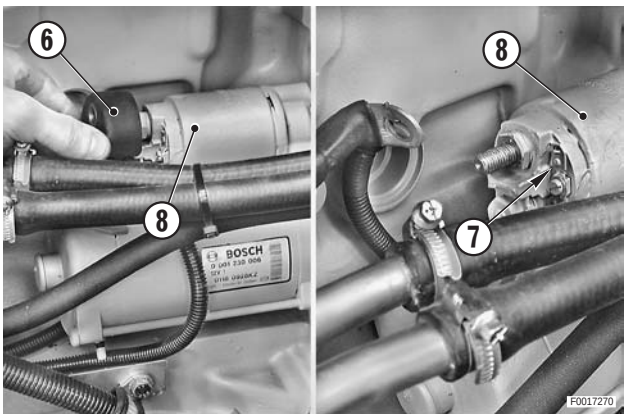


2 - Remove the terminal protector (2) and the nut (3) securing leads (4) and (5).



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

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



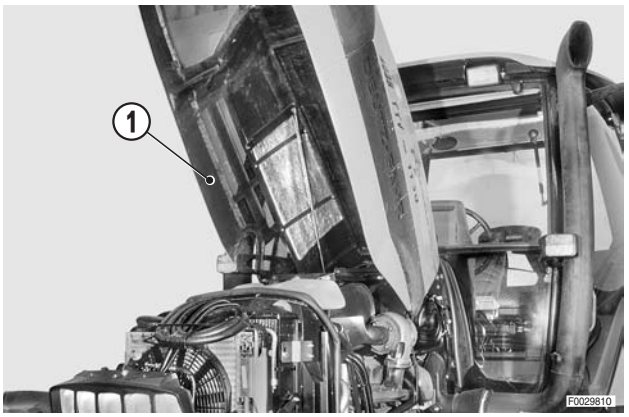
REFITTING THE STARTER MOTOR

- Refitting is the reverse of removal.

REMOVAL AND RENEWAL OF THE ALTERNATOR

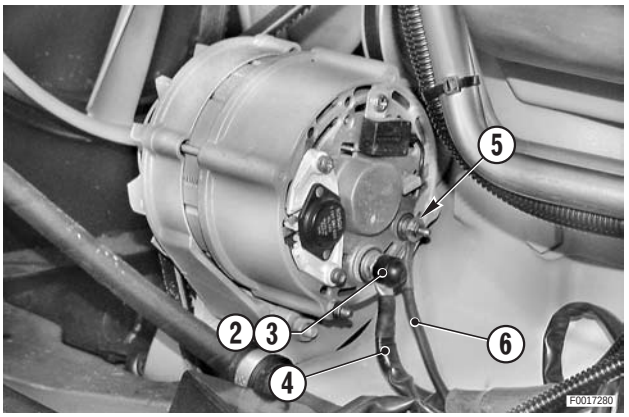
⚠ Remove the battery cover and disconnect the negative battery lead (–).

1 - Raise the hood (1).



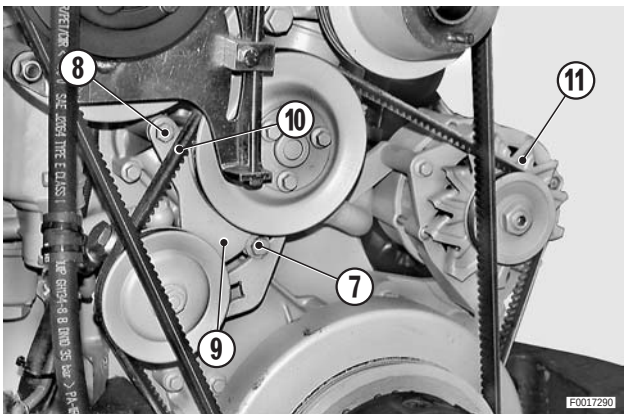
2 - Remove the terminal protector (2), remove the nut (3) and disconnect the lead (4).

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



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

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



REFITTING THE ALTERNATOR

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

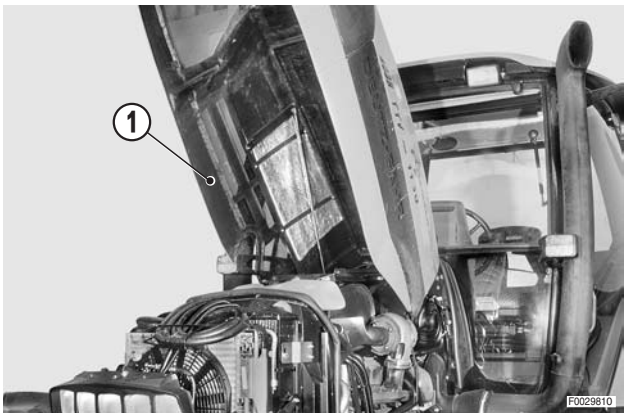
RENEWAL AND TENSIONING OF THE ALTERNATOR DRIVEBELT

★ The drivebelt must be renewed at the first sign of wear. Check for fraying, cracks and separation of the belt plies.

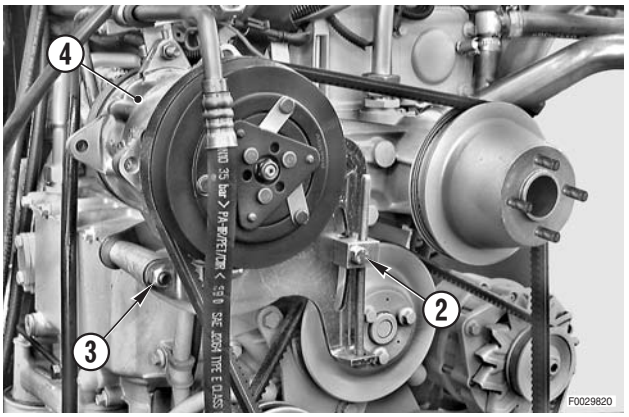
★ Some of the operations described below refer only to models equipped with front PTO and cab air conditioning.
For machines not equipped with these items, these operations should be ignored.

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

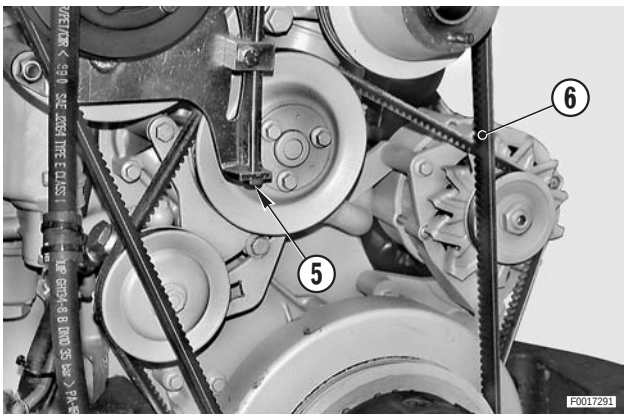
1 - Raise the hood (1).



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

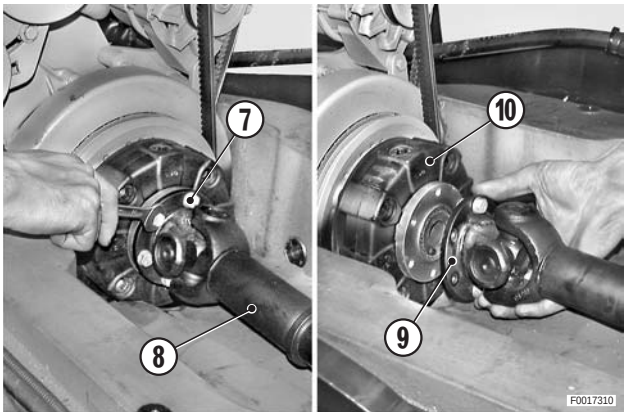


3 - Unscrew the threaded rod (5) of the tensioner to slacken off the fan drivebelt (6).
★ Loosen the drivebelt sufficiently to be able to slip it off the compressor pulley.



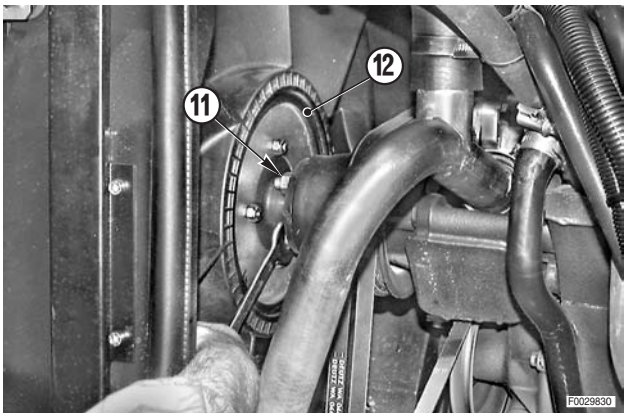
4 - **Models with front PTO only:**
loosen and fully unscrew the six bolts (7) securing the flange of the cardan shaft (8).

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

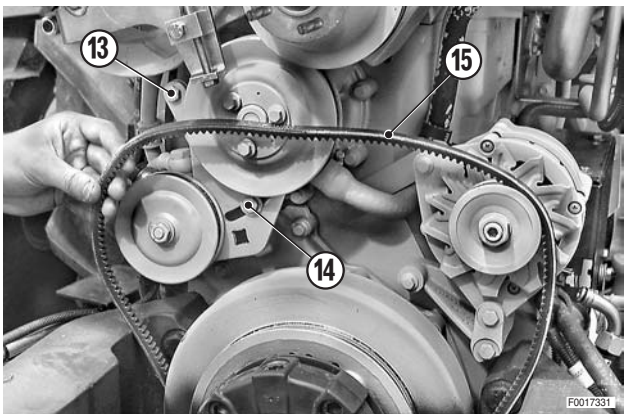


6 - Remove the nuts (11) securing the fan (12) to the pulley.

7 - Shift the radiator/cooler assembly and fan toward the front of the machine. (For details, see «REMOVAL OF FAN»).

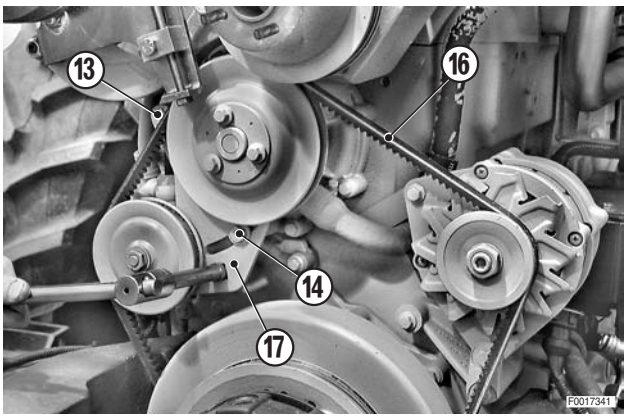


8 - Loosen the bolts (13), (14) securing the fuel pump, slip off the alternator drivebelt (15) and remove it by passing it between the crankshaft pulley and the front carrier.



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 (17).

10 - To tension the drivebelt, turn the bar clockwise and tighten the bolts (13) and (14).

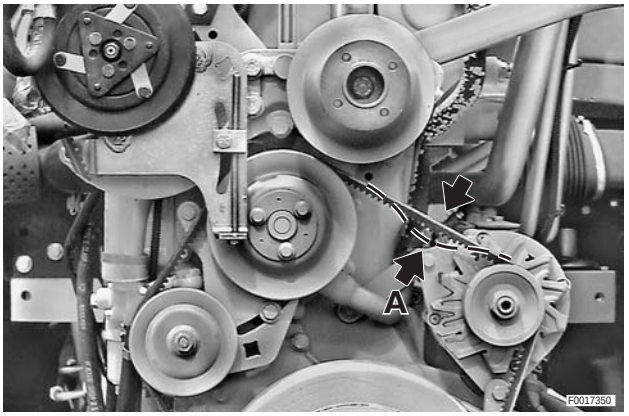


11 - The tension is to be checked using the tool and procedure indicated in the engine manual (code 0297 9771).

★ Static deflection "**A**" on first fitting:
13 mm belt: 550±50 N
15 mm belt: 15 mm: 650±50 N

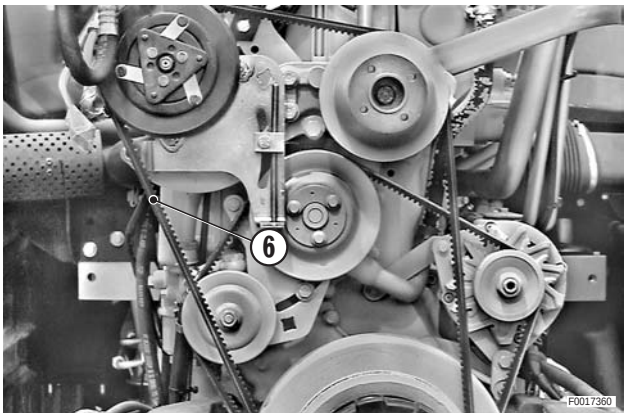
★ Static deflection "**A**" after 15 minutes:
13 mm belt: 400±50 N
15 mm belt: 500±50 N

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



12 - Fit the fan belts (6) and tension as described under «REMOVAL OF AIR CONDITIONING COMPRESSOR».

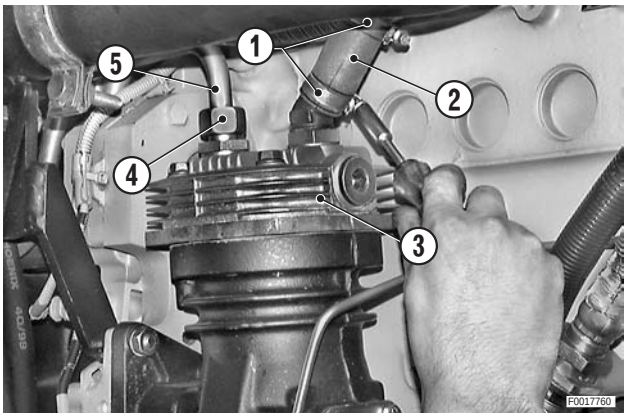
13 - Complete the refitment by following the initial steps of the removal procedure described previously, in reverse order.



REMOVAL OF THE AIR COMPRESSOR (for air trailer braking)

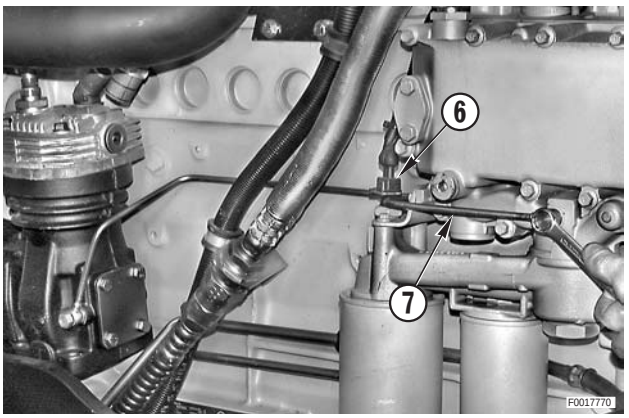
1 - Loosen the hose clamp (1) and disconnect the hose (2) from the compressor (3).

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



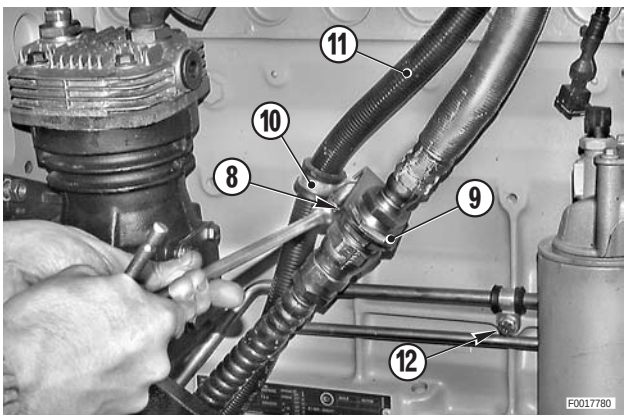
3 - Disconnect the connector (6) of the engine oil filter clogging sensor and remove the compressor lube pipe (7).

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

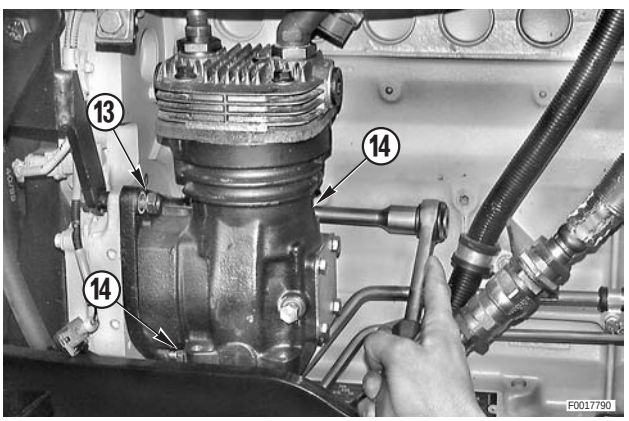


4 - Remove the bolt (8) securing the bracket (9) and the retaining strap (10) for the wiring (11).

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



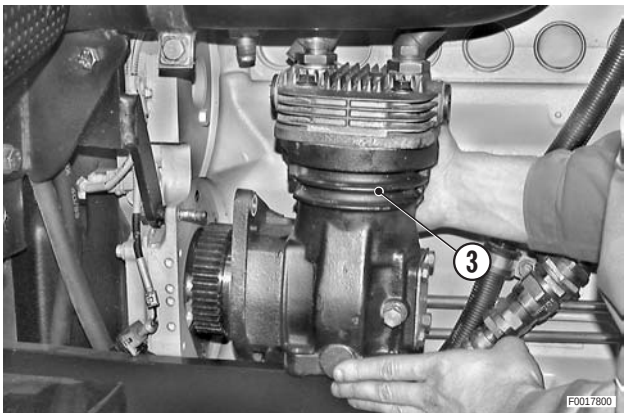
6 - Unscrew and remove the nut (13) and the two bolts (14).



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

※ 1

kg Compressor: 12 kg (26.4 lb.)

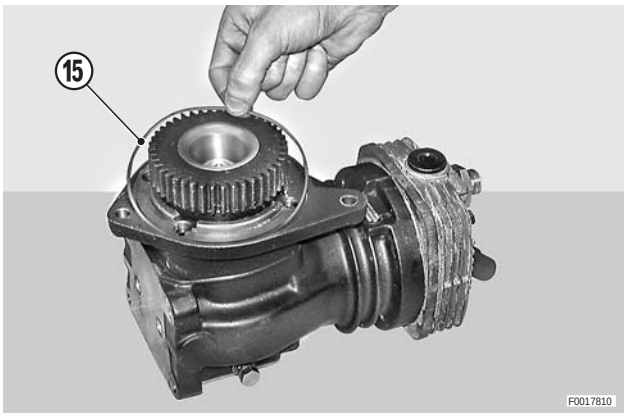


REFITTING THE AIR COMPRESSOR

- Refitting is the reverse of removal.

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

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



※ 1

★ Check the condition of the O-ring (15).

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

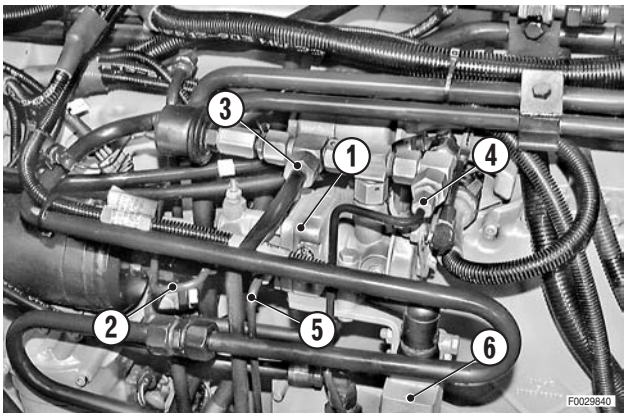
REMOVAL OF TRAILER PARKING AND SERVICE AIR BRAKE CONTROL VALVES

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

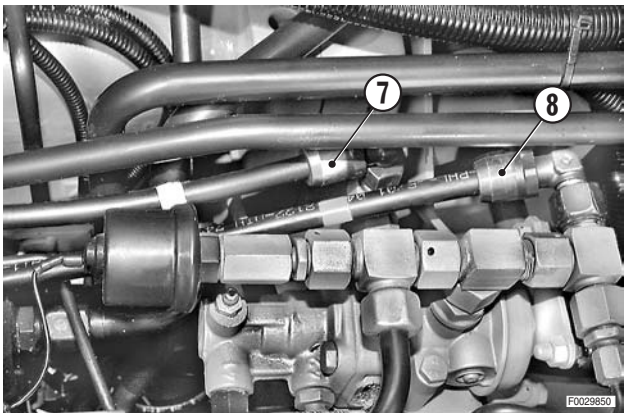
Vent residual pressure fully from the trailer air braking circuit.

PARKING BRAKES
(Versions with air braking system)

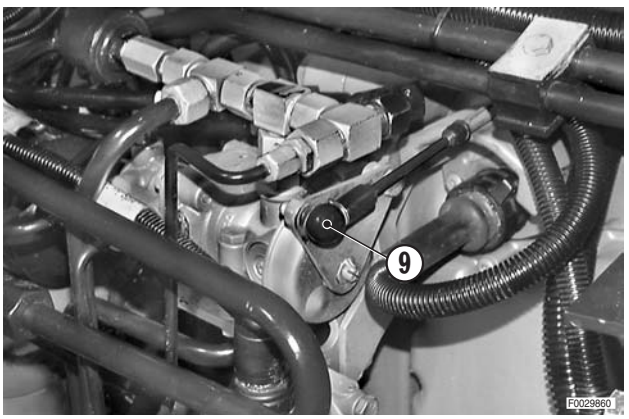
1 - Disconnect the hydraulic brakes pipe (2), the air line (3) and the solenoid valve inlet and pressure pipelines (4) and (5) from the valve (1).



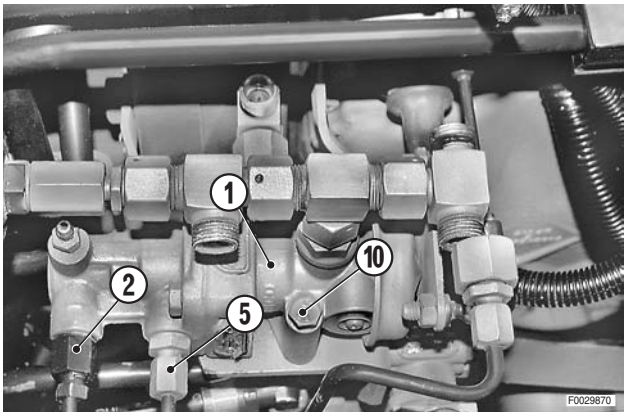
2 - Disconnect the trailer air pressure lines (7) and (8).



3 - Disconnect the pivot end (9) of the trailer parking brake linkage rod. ※ 1

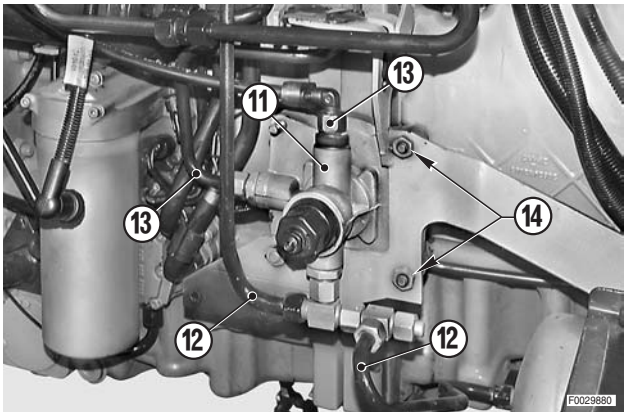


4 - Remove the bottom nuts and the two bolts (10); remove the valve (1).

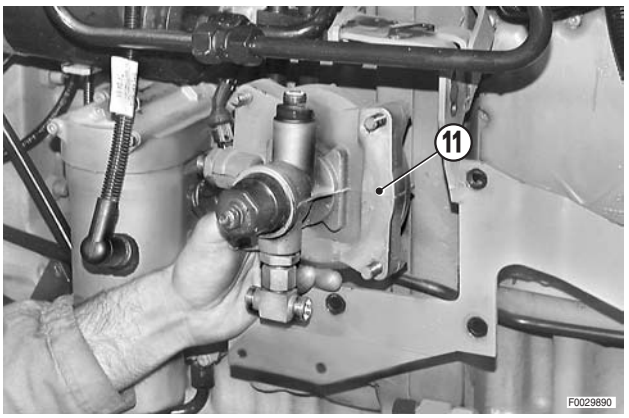


SERVICE BRAKES (EXPORT F version)

1 - Disconnect the brake inlet and pressure pipelines (12) and (13) from the valve (11).



2 - Remove the four nuts (14) and detach the valve (11).



REFITTING TRAILER PARKING AND SERVICE AIR BRAKE CONTROL VALVES

- Refitting is the reverse of removal.

1 - Start the engine and wait for the air braking circuit to pressurize.

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»).

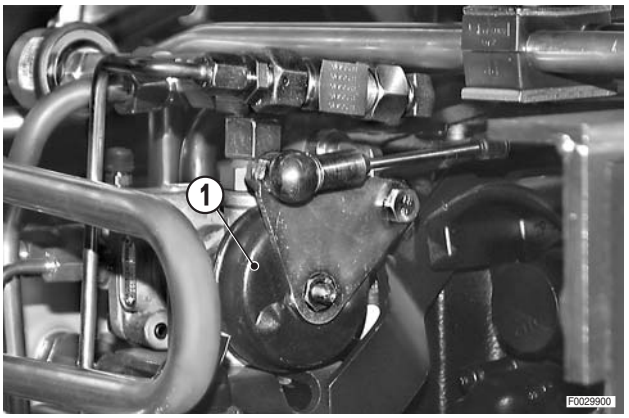
4 - Check that the parking brake valve is operated by the relative lever at the correct moment, adjusting the length of the cable if necessary.

Adjusting the length of the linkage rod

1

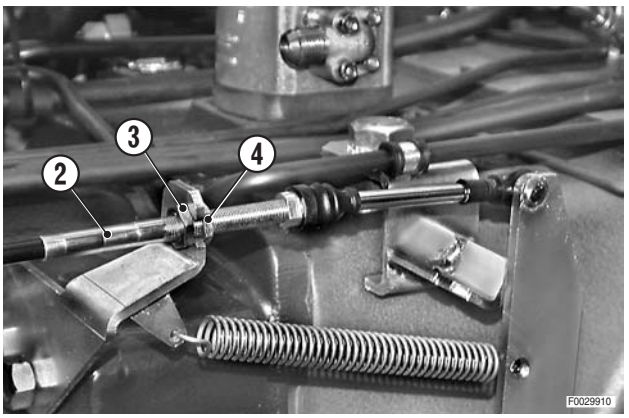
★ Check that the parking brakes are perfectly adjusted, and released.

1 - Lifting the parking brake lever slowly up to the first click, the parking brake valve (1) should be clearly audible as it comes into operation.



2 - If this is not the case, adjust the length of the cable (2) by repositioning the nuts (3) and (4).
★ Adjust by trial and error until the click coincides exactly with the opening of the valve.

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



REMOVAL OF PRESSURE TRANSDUCER AND PRESSURE SWITCH

(Version with air braking system)

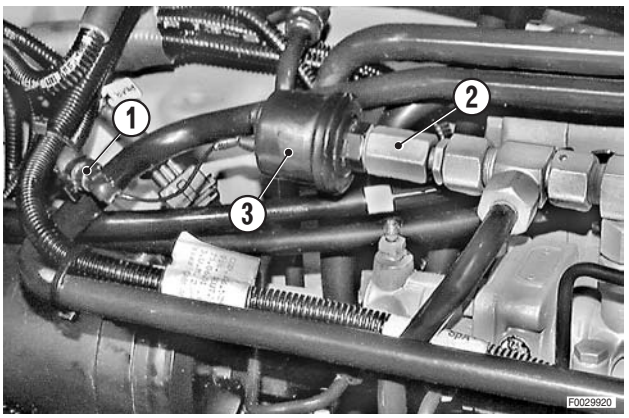
Switch off the engine and remove the key from the ignition.

Vent residual pressure fully from the trailer air braking circuit.

1. Transducer

1 - Disconnect the connector (1).

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

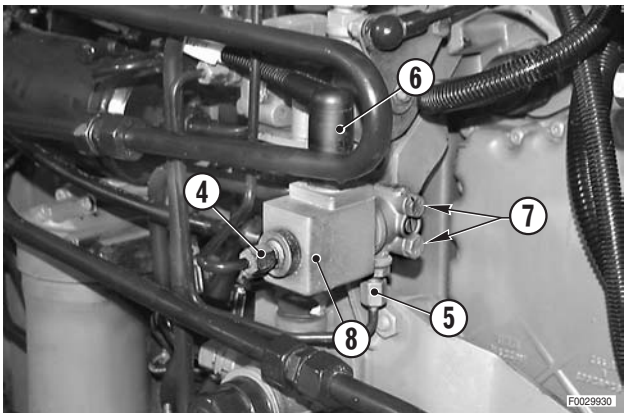


2. Pressure switch

1 - Disconnect the pipelines (4) and (5).

2 - Disconnect the lead (6).

3 - Undo the screws (7) and remove the pressure switch (8).



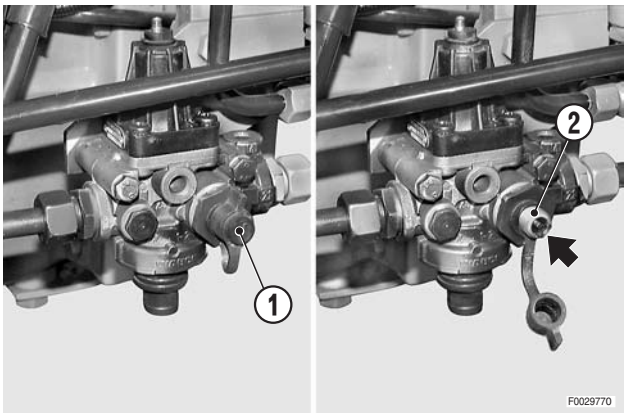
REFITTING PRESSURE TRANSDUCER AND PRESSURE SWITCH

- Refitting is the reverse of removal.

REMOVAL OF CAB LIFT AIR PRESSURE CONTROL/REDUCING VALVE

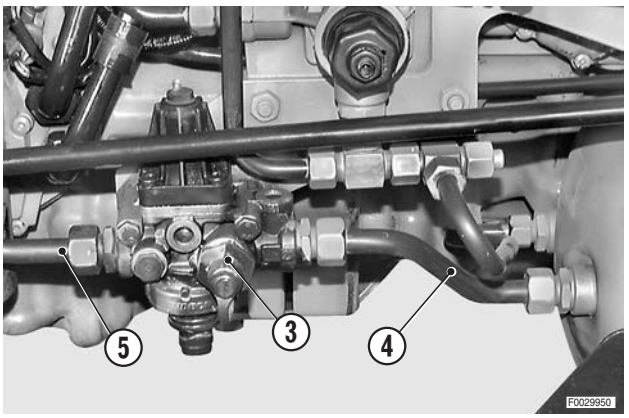
Switch off the engine and remove the key from the ignition.

Vent residual pressure fully from the reservoir by removing the cap (1) and pressing the button (2).



1 - Disconnect the pipelines (4) and (5) from the pressure control valve.

2 - Remove the valve (3).



REFITTING CAB LIFT AIR PRESSURE CONTROL/ REDUCING VALVE

- Refitting is the reverse of removal.

1 - Start the engine and wait for the circuit to pressurize.

2 - Check the seals for leaks using a soapy solution.

REMOVAL AND REPLACEMENT OF TRAILER AIR BRAKES COUPLING VALVE

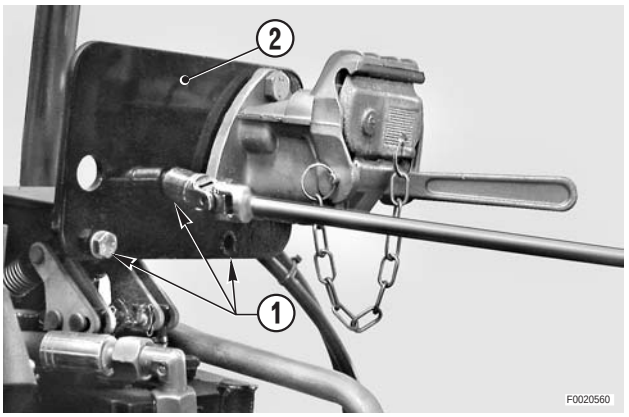
Italy version

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

1. Removal

★ The valve complete with its mounting must be removed only when removing the entire control valve assembly.

1 - Remove the three bolts (1) of the mounting (2) and set the assembly to one side.

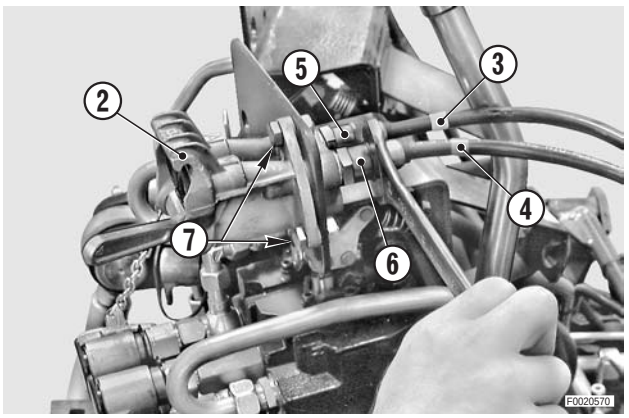


2. Replacement

1 - Mark the pipelines (3), (4) and the fittings (5), (6) to avoid confusion when refitting.

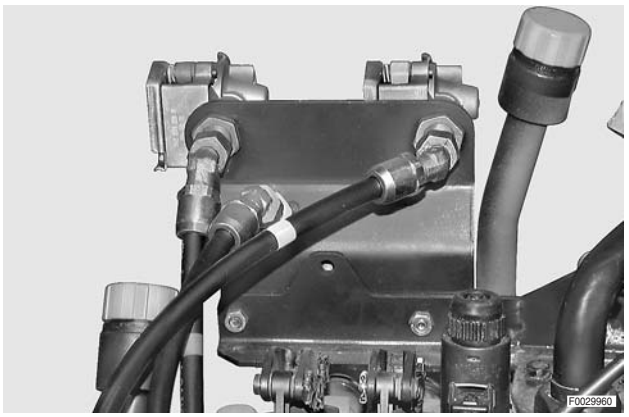
2 - Disconnect the pipelines (3) and (4) from the valve (2).

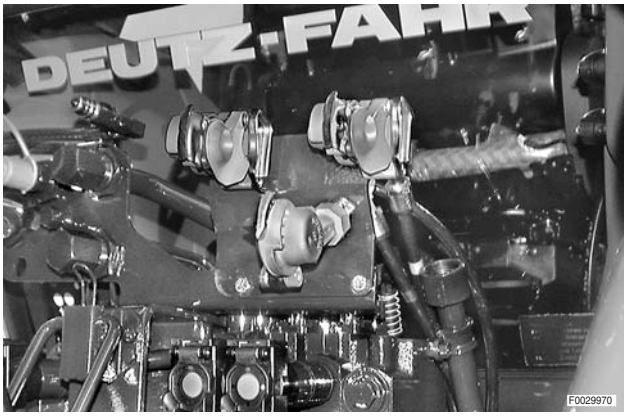
3 - Remove the three retaining nuts and bolts (7), and detach the valve (2).



Export version

★ The operations are the same as for the Italy version, the only difference being that there are three pipelines and fittings.





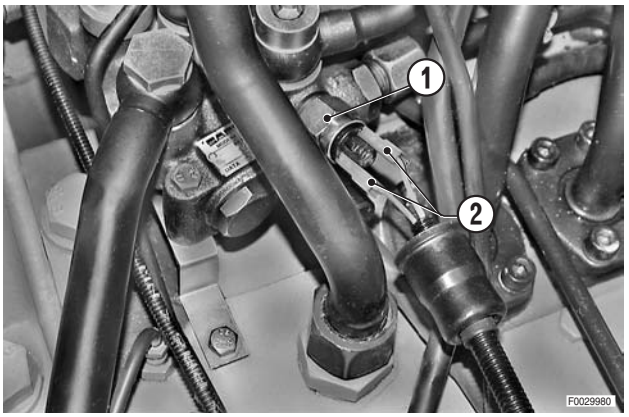
REMOVAL OF HYDRAULIC BRAKING VALVE

Italy version

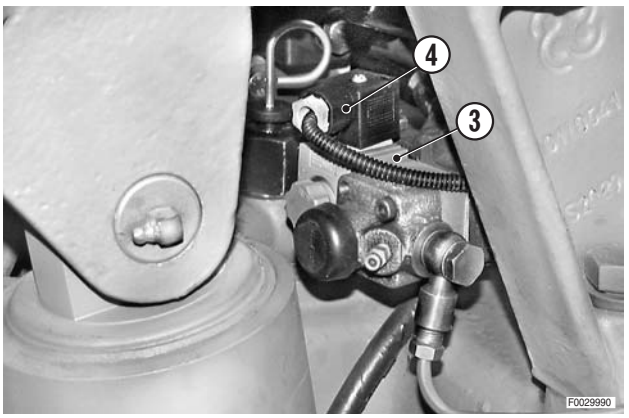
1 - Station the machine on firm, level ground.

2 - Apply the parking brake and remove the key from the ignition.

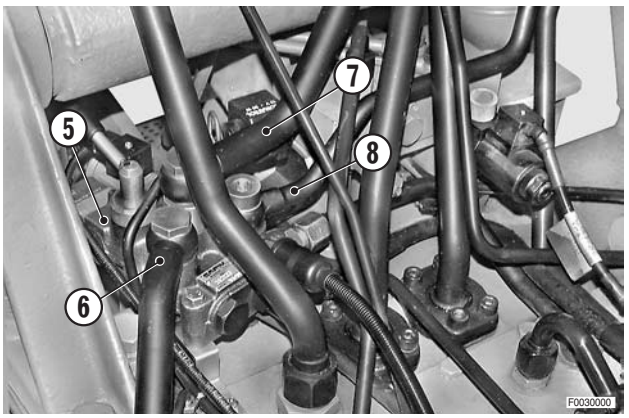
3 - Detach the connectors (2) from the pressure switch (1).



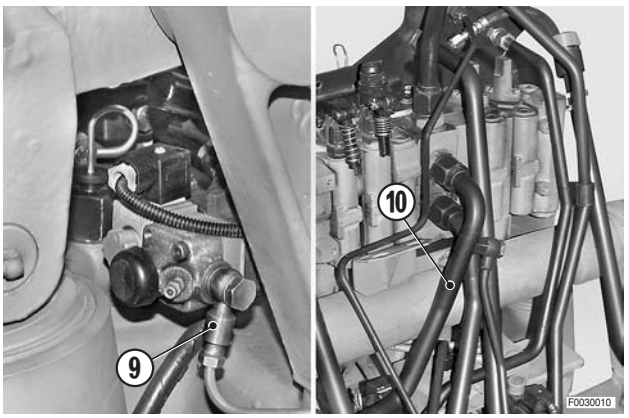
4 - Detach the connector (4) from the solenoid valve (3).



5 - Disconnect the top pipelines (6), (7) and (8) from the valve (5).



6 - Disconnect the pipeline (9) coming from the flow divider, and the power beyond line (10).



7 - Loosen and remove the two securing bolts (11) and remove the valve (5).

Export F version

★ Removal operations are the same as for the Italy version, except that there are no electrical connections on the Export F version.

REFITTING HYDRAULIC BRAKING VALVE

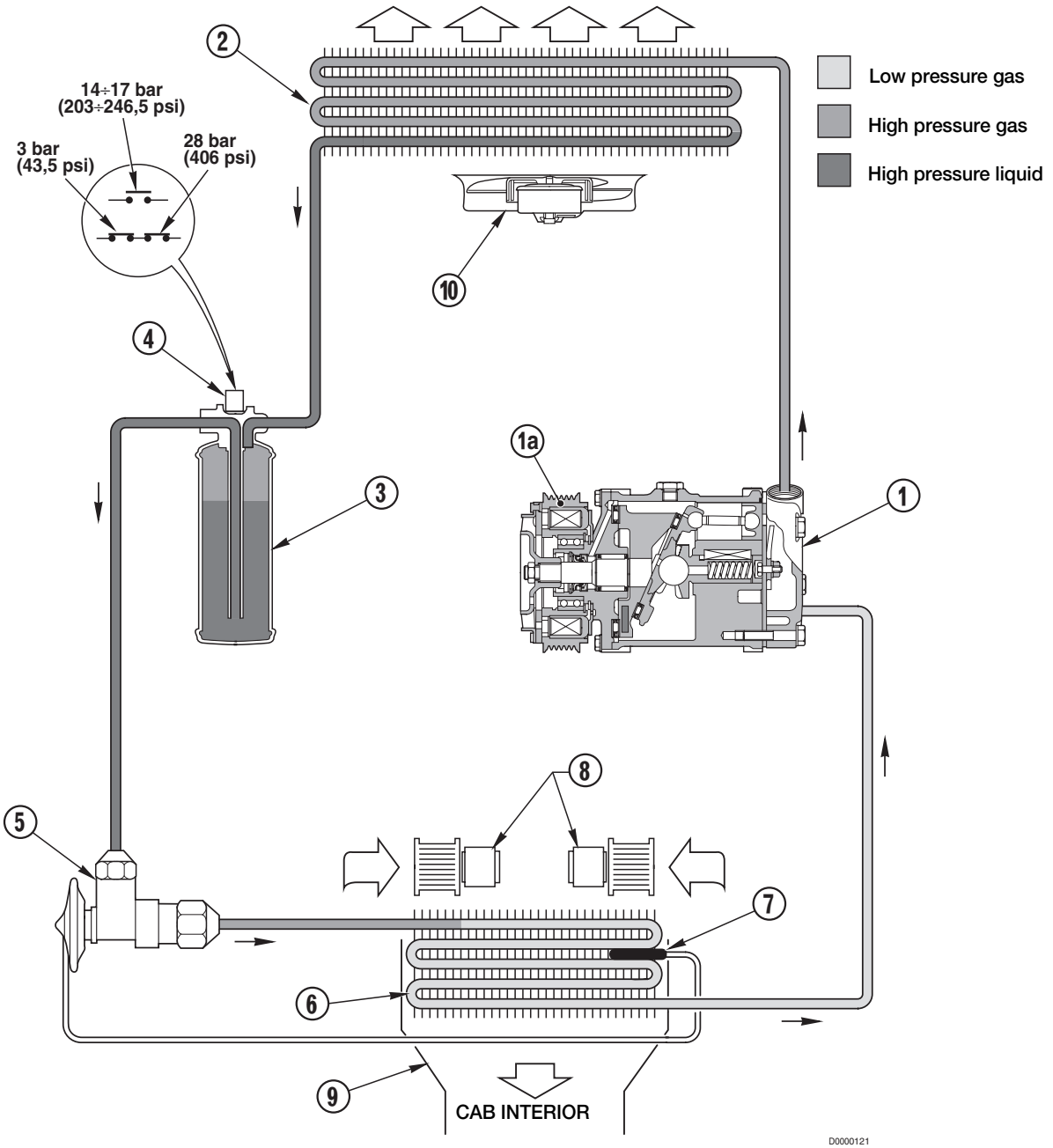
(Italy version)

- Refitting is the reverse of removal.

1 - Bleed the brake circuits of air.
(For details, see «BLEEDING THE BRAKE SYSTEM»).

2 - Start the engine, then move the lift links fully up and down a few times to remove air from the circuits and test for leaks.

AIR CONDITIONING SYSTEM



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

TECHNICAL SPECIFICATIONS

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

Mod.	1130	1145	1160
g (oz.)	1700 (60)	1700 (60)	1700 (60)

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

FUNCTIONING OF AIR CONDITIONING SYSTEM

he 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).

A further contact activates and deactivates the fan (10) of the condenser (2) so as to maintain normal operating pressures between 16–20 bar (232 –290 psi).

The refrigerant (in vapour state) is drawn in by the compressor where it is compressed, causing the temperature of the vapour to rise; the refrigerant flows to the condenser (2), where its heat is radiated to the air flow and it is thus cooled to the point where it condenses to high-pressure liquid.
On leaving the condenser, the liquefied refrigerant flows to the receiver-drier (3) which performs three main functions: to filter out any impurities, to absorb any water in the circuit, and finally, to act as a storage reservoir.
On leaving the receiver-drier, the clean, dry liquid passes to the evaporator (6) through an expansion valve (5), which meters the flow of refrigerant into the evaporator to ensure optimum evaporation.
In the evaporator, the refrigerant is heated and expands to the point of evaporation with an ambient temperature of around – 8°C (17.6°F).

The temperature of the air flow over the evaporator (6) generated by the centrifugal blowers (8) is significantly higher than – 8°C (17.6°F), and therefore it gives up its heat to the refrigerant, causing it to boil and evaporate.
On leaving the evaporator (6), the refrigerant returns to the compressor (1) to repeat the cycle.
The removal of heat from the ambient air flowing over the evaporator causes the moisture in the air to condense, and the air is thus dehumidified; the moisture condenses on the fins of the evaporator, where, if it is not maintained at temperature above 0°C (32°F), it will freeze and comprise the efficiency of the evaporator.
The task of maintaining the evaporator at a temperature above 0°C (32°F) (and within the optimum temperature for efficient heat exchange), is performed by an electronic temperatures sensor (7); this sensor disengages the compressor clutch (1a) when the temperature falls to the lower limit and engages the clutch (1a) when the evaporator temperature reaches an upper limit.

The condensate that forms on the evaporator fins contains dust, pollen and other particles suspended in the air; continuous condensation thus has the effect of purifying the air, and the drips of condensate are conveyed out of the vehicle via two ducts.
A fixed quantity of moisture-free oil is added to the circuit in order to lubricate all the mechanical components of the system; a certain percentage of this oil continuously circulates in the form of an oil mist, thereby lubricating the compressor (pistons and bearings) and the expansion valve.

MAINTENANCE OF THE AIR CONDITIONING SYSTEM

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

1 - Checking the tension and condition of the compressor drivebelt.

2 - Discharging, flushing and recharging of the system using a specific servicing machine and R134a refrigerant.

3 - Removal and renewal of the compressor.

4 - Inspection and renewal of the electromagnetic clutch pulley (to be carried out at a specialised service centre).

5 - Removal and renewal of the receiver-drier.

6 - Removal and renewal of the condenser.

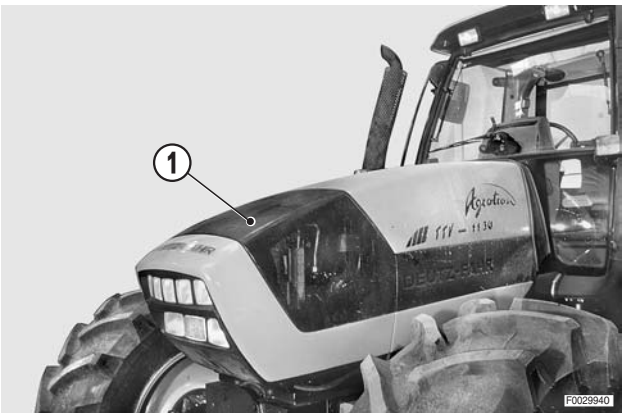
7 - Removal of the evaporator and the electronic temperature sensor.
(For these operations see «REMOVAL OF THE AIR CONDITIONING EVAPORATOR»).

ADJUSTING THE TENSION OF THE COMPRESSOR DRIVEBELT

★ Before adjusting the tension, carefully examine the drivebelt for signs of wear.
The belt must be renewed immediately at the first sign of cracking, fraying or separation of the plies.

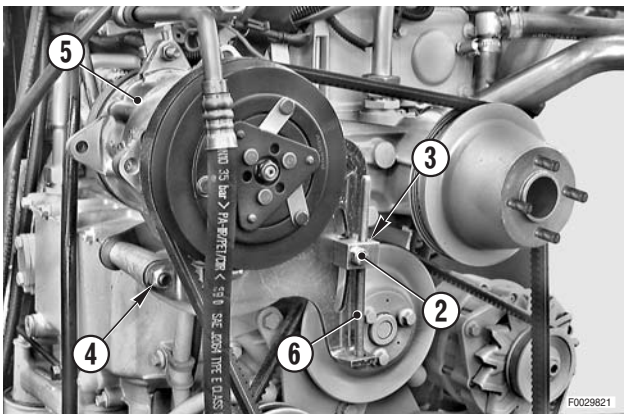
⚠ If a new belt is fitted, re-adjust the tension after approx. 15 operating hours.

1 - Raise the hood (1).



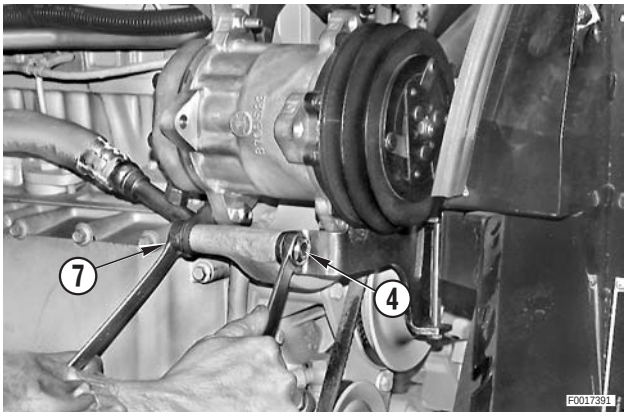
2 - Loosen the screw (2) of the tensioner block (3) and loosen the nut (4) securing the compressor (5).

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 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.

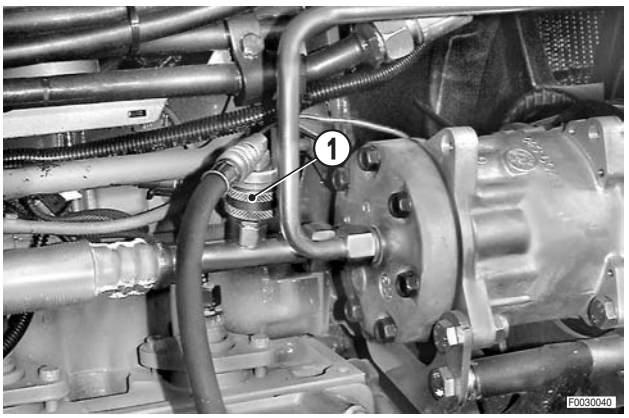
e - Recharging the system with exactly the same amounts of refrigerant and oil as those recovered.

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.

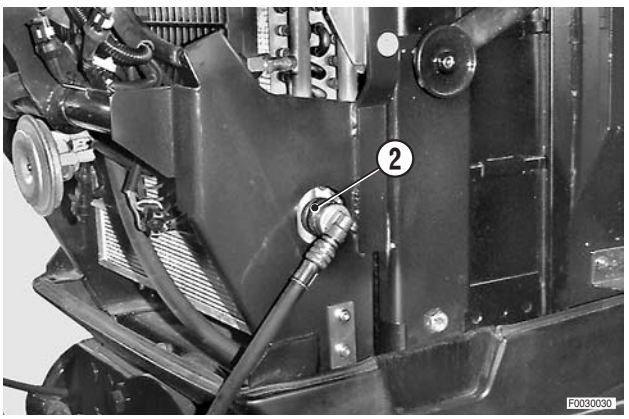
★ For the flushing and recharging operations, the service machine must be connected to the high (1) and low (2) pressure service valves.

⚠ 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):

Mod.	1130	1145	1160
g (oz.)	1700 (60)	1700 (60)	1700 (60)



Quantity of oil: the quantity recovered.

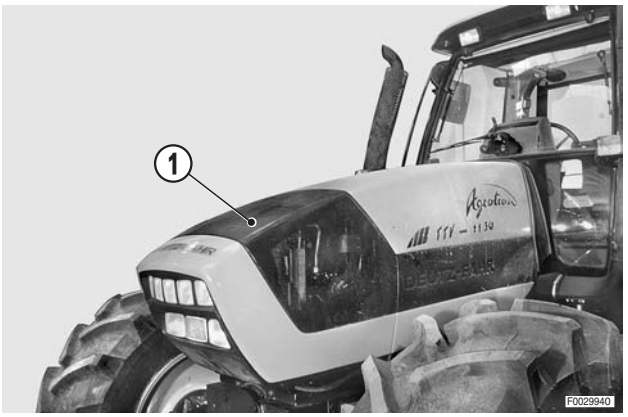
⚠ If the system has to be discharged and flushed in order to renew a system component, the quantity of oil in the replaced component must be measured and the same amount of new oil must added to that recovered with the refrigerant.

⚠ For details of the oil and refrigerant recharging procedure, refer to the instructions supplied with the service machine.

REMOVAL OF AIR CONDITIONING COMPRESSOR

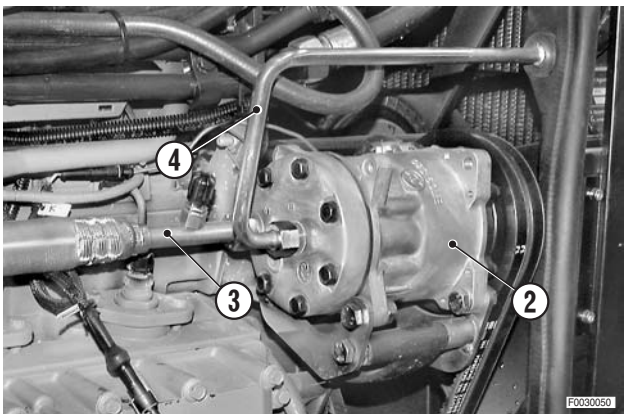
1 - Recover the refrigerant from the system.
(For details, see «MAINTENANCE OF AIR CONDITIONING SYSTEM»).

2 - Raise the hood (1).

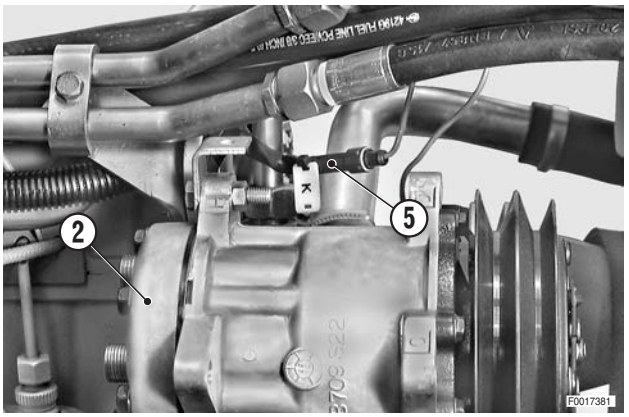


3 - Disconnect the inlet (3) and delivery (4) pipelines from the compressor (2).

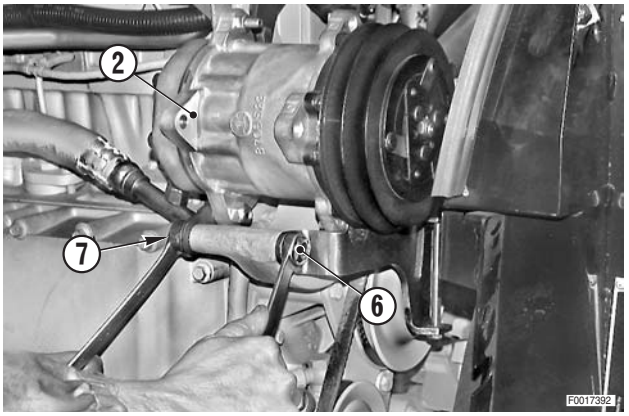
★ Plug the open ends of the pipes immediately to prevent moisture getting into the circuit. ⁘ 1



4 - Cut the clip from the wiring harness and detach the connector (5) of the electromagnetic clutch control unit.

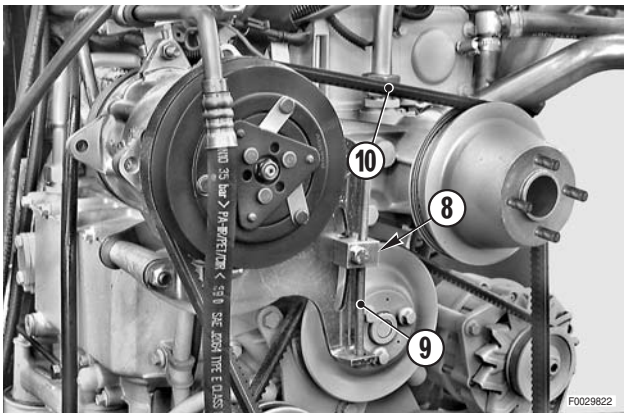


5 - Loosen the lock nut (6) on the pivot bolt (7) supporting the compressor (2).

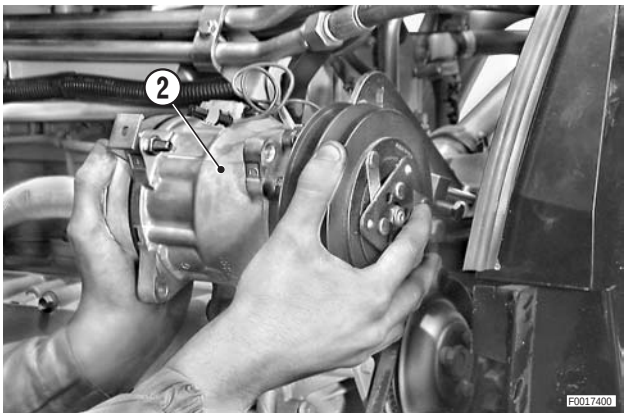


6 - Loosen the bolt on the tensioner (8).

7 - Unscrew the threaded tensioning rod (9) to slacken the fan and compressor drive belts (10).
★ Loosen the belts to the point that they can be slipped off the compressor pulley.



8 - Remove the pivot bolt and lift the entire compressor (2) clear.



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.

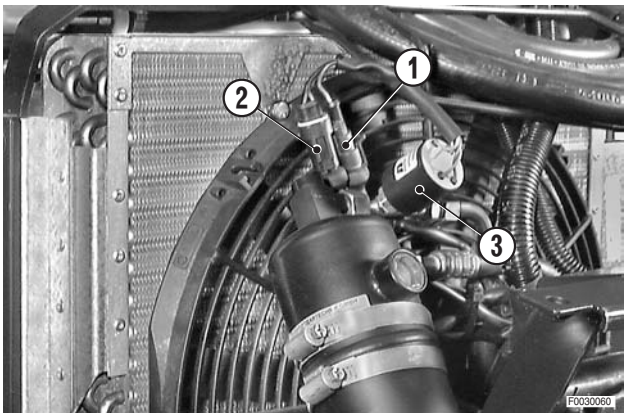
1 - Adjust the tension of the compressor/fan drivebelt.
(For details see «ADJUSTING THE TENSION OF THE COMPRESSOR DRIVEBELT»).

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 CONDITIONING SYSTEM»).

2 - Disconnect the connectors (1) and (2) of the pressure switch (3).

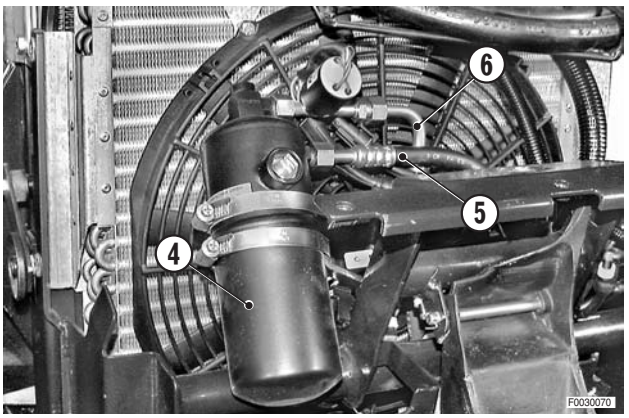


3 - Disconnect the inlet (5) and outlet (6) pipes from the receiver-drier (4).

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

4 - Loosen the filter retaining clamp (7) and remove the unit.

⚠ If a new receiver-drier is to be installed, measure the quantity of oil contained in the old unit in order to determine the quantity of oil to be added to the system.



REFITTING THE RECEIVER-DRIER

- Refitting is the reverse of removal.

※ 1

★ Remove the plugs and connect the pipes immediately, fully tightening the fittings, to prevent the entry of moisture.

★ Check the condition of the O-rings and replace them if damaged.

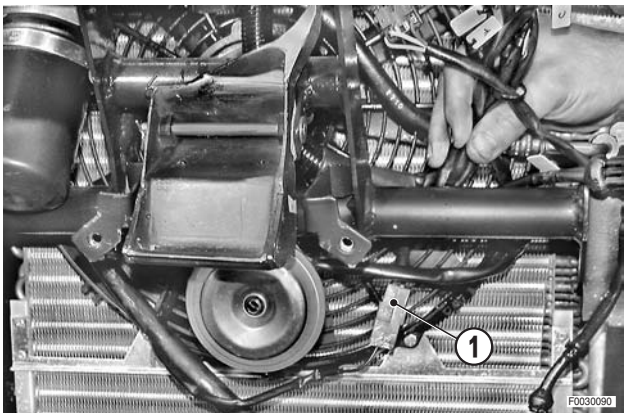
1 - Flush and recharge the system.
(For details see «DISCHARGING, FLUSHING AND RECHARGING THE AIR CONDITIONING SYSTEM»).

REMOVAL OF CONDENSER FAN

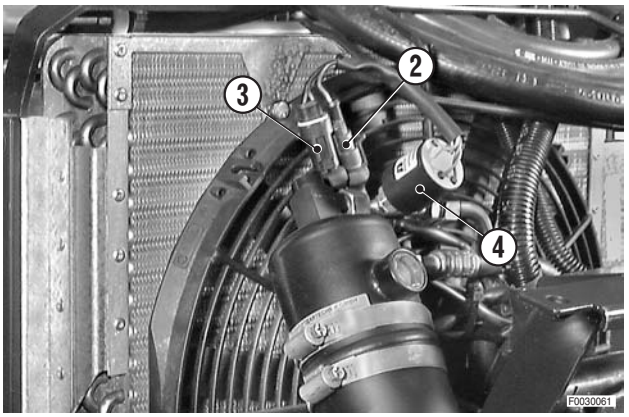
⚠ Remove the key from the ignition.

★ Remove the lamp assemblies.
(For details, see «REMOVAL OF LAMP ASSEMBLIES»).

1 - Unplug the connector (1).



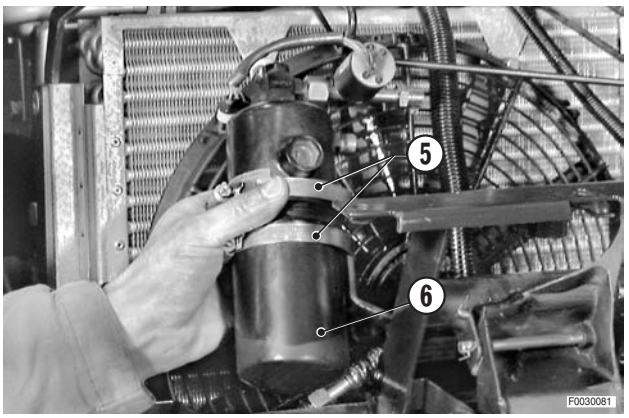
2 - Detach the connectors (2) and (3) of the pressure switch (4).



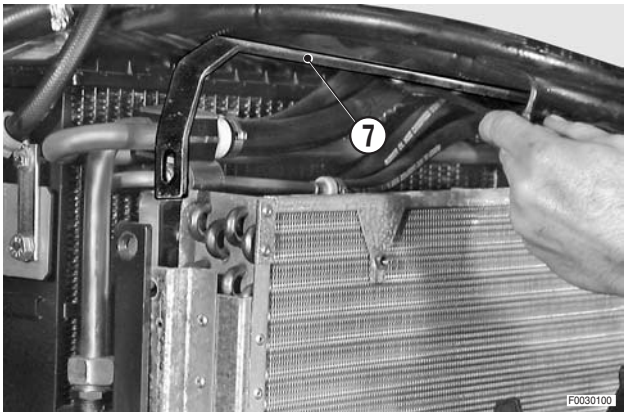
3 - Loosen the clips (5) of the dehydration filter (6) and position the canister in front of the bracket.

4 - Free the wiring secured to the front bracket from the clips.

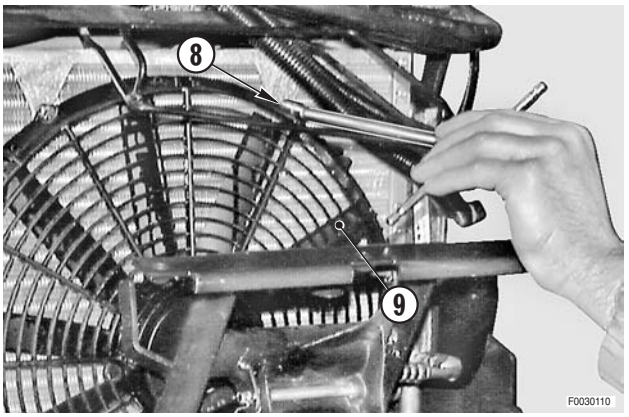
5 - Shift the radiator/cooler connecting pipelines to the rear, and secure temporarily.



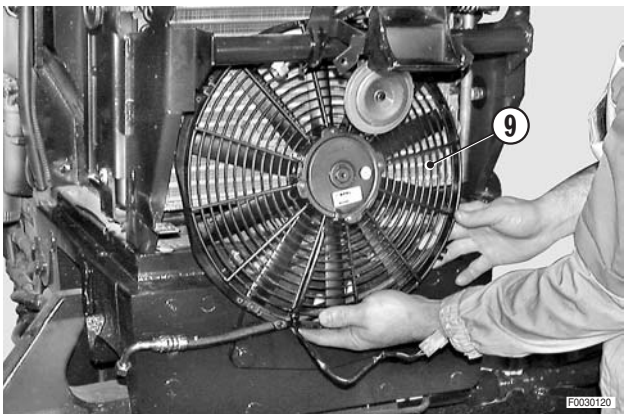
6 - Remove the hoop (7) supporting the radiator/cooler pipelines.
★ This step is required only for machines with front PTO and/or lift.



7 - Remove the screws (8) securing the fan (9).



8 - Remove the fan (9) by lowering and easing out from the bottom (machine without front PTO and/or lift). In the case of machines with front PTO and/or lift, the fan (9) must be taken out from above.



REFITTING CONDENSER FAN

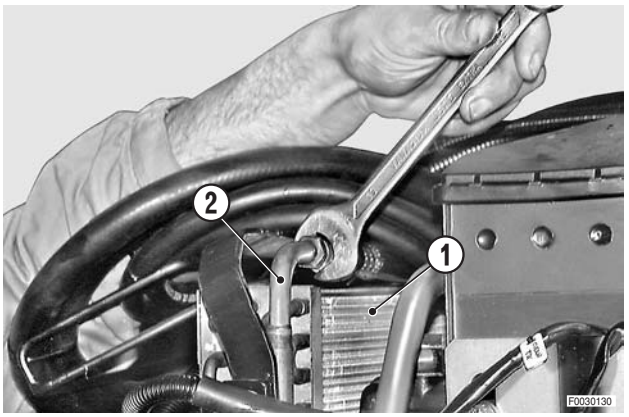
- Refitting is the reverse of removal.

REMOVAL OF CONDENSER

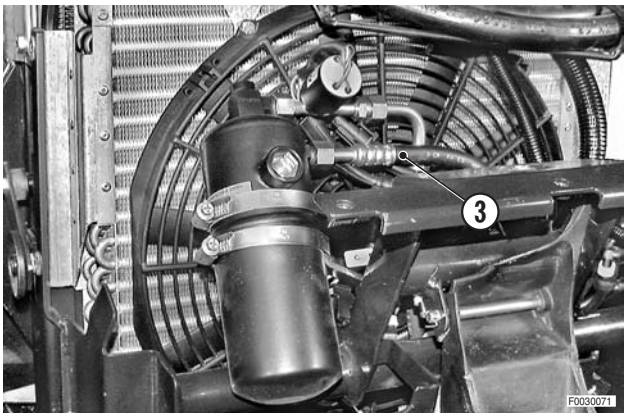
1 - Remove the condenser cooling fan.
(For details, see «REMOVAL OF CONDENSER COOLING FAN»)

2 - Recover the refrigerant from the air conditioning system.
(For details, see «EMPTYING, PURGING AND RECHARGING THE AIR CONDITIONING SYSTEM»).

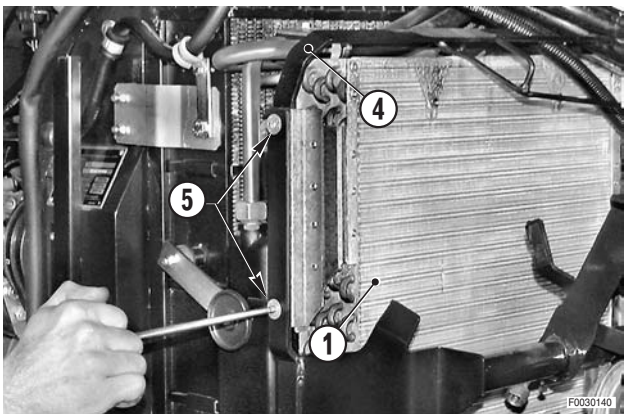
3 - Disconnect the pipe (2) from the condenser (1).



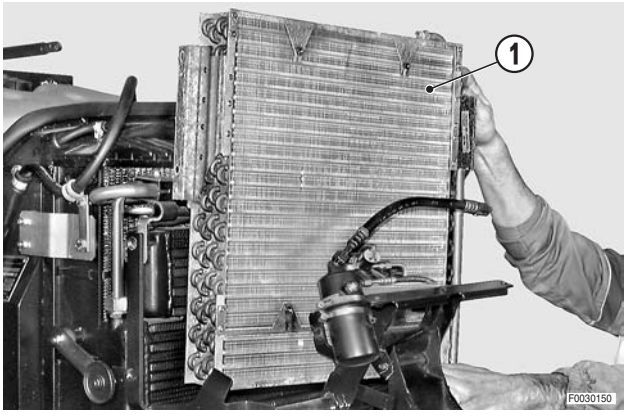
4 - Disconnect the pipe (3) from the dehydration filter.
※ 1
★ Plug the open ends of the pipes immediately to prevent moisture getting into the circuit.



5 - Remove the hoop (4) supporting the radiator/cooler pipelines, and the bolts (5) securing the condenser (1).



6 - Remove the condensing unit (1), lifting out from above.
★ Take particular care not to damage the fins.



REFITTING CONDENSER

- Refitting is the reverse of removal.

※1

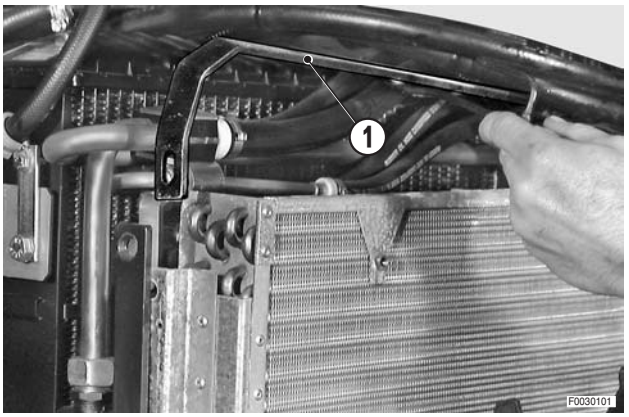
★ Remove the plugs and reconnect the pipelines straight away, tightening fully to ensure moisture does not get into the system.

★ Inspect the O-rings and renew if damaged.

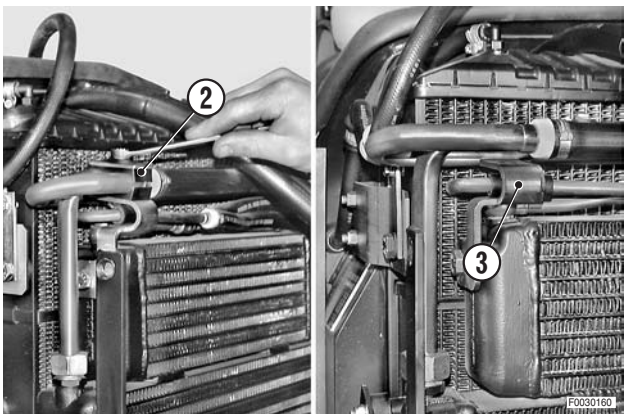
1 - Purge and recharge the air conditioning system. (For details, see «EMPTYING, PURGING AND RECHARGING THE AIR CONDITIONING SYSTEM»).

REMOVAL OF THE GEARBOX OIL/FUEL COOLERS

1 - Remove the hoop (1) supporting the radiator/cooler pipelines.



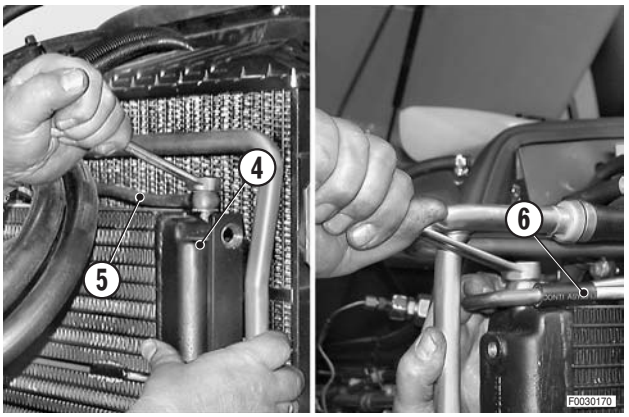
2 - Remove the clamp (2) and the bracket (3).



3 - Disconnect the pipes (5) and (6) from the fuel cooler (4).

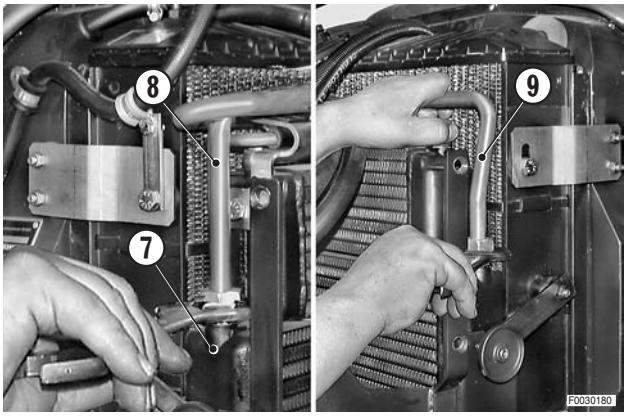
★ Plug the pipes and the open fittings on the cooler to prevent the entry of contaminants.

★ Renew the gaskets on refitting.

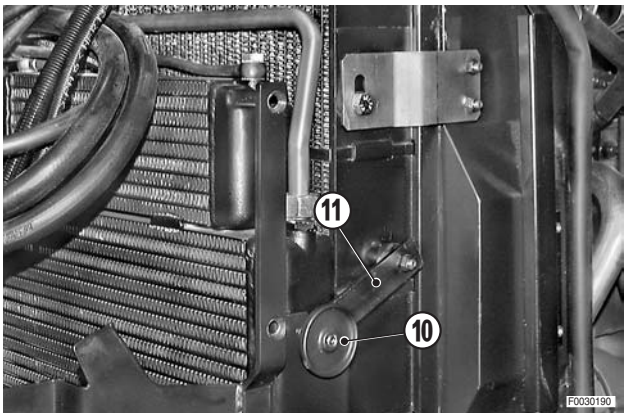


4 - Disconnect the pipes (7) and (8) from the gearbox oil cooler (9).

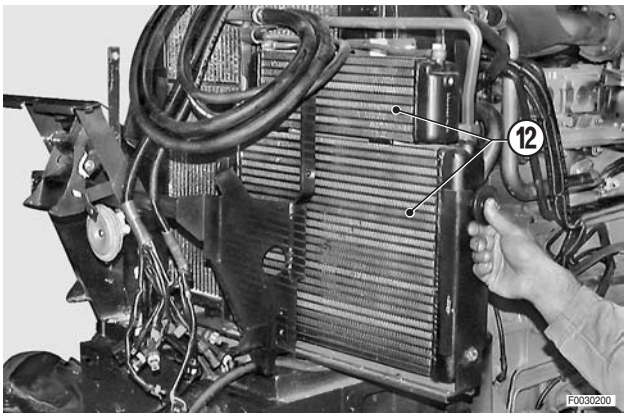
★ Plug the pipes and the open fittings on the cooler to prevent the entry of contaminants.



5 - Unscrew the knobs (10) and move the mounting brackets (11) to the vertical position.



6 - Remove the coolers assembly (12) by withdrawing it towards the left.



REFITTING THE GEARBOX OIL/ FUEL COOLERS

- Refitting is the reverse of removal.

1 - Start the engine and allow the gearbox oil and fuel to circulate for about 5 minutes to fill the coolers; check the seals and fittings for leaks.

2 - Stop the engine and check the gearbox oil level; top up, if necessary.

⚠ This operation is essential if new coolers have been fitted.

REMOVAL OF THE RADIATOR

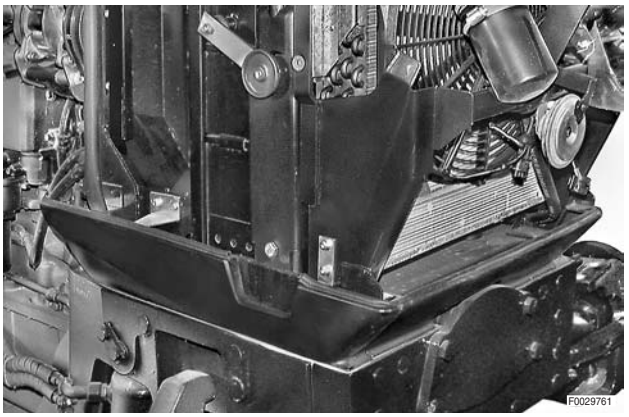
⚠ Remove the battery cover and disconnect the negative battery lead (–).

1 - Remove the side panels.

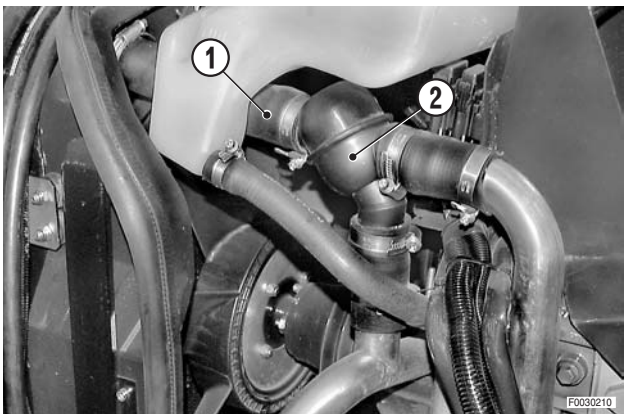
2 - Drain off the engine coolant.

Coolant: approx. 21 ℓ (5.5 US.gall.)

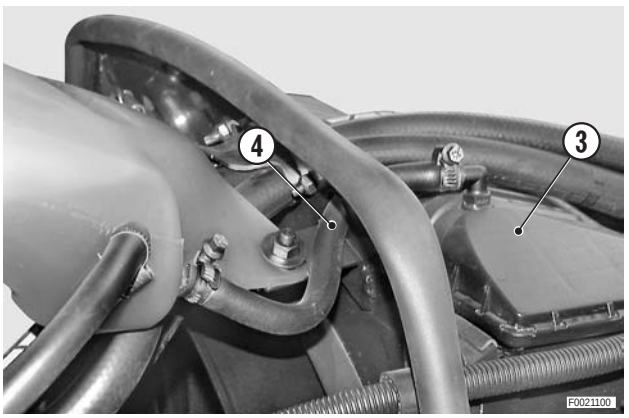
3 - Remove the gearbox oil/ fuel coolers.
(For details, see «REMOVAL OF THE GEARBOX OIL/ FUEL COOLERS»).



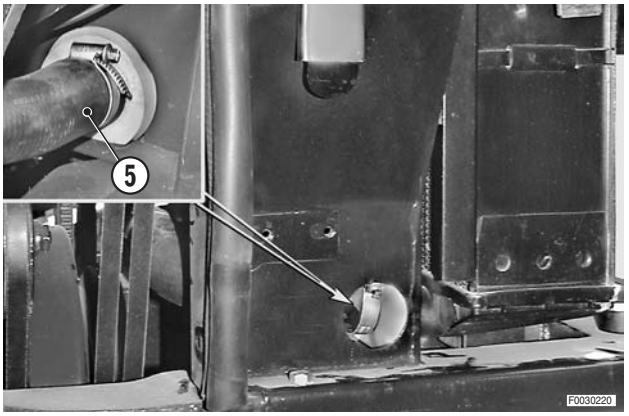
4 - Detach the hose (1) connected to the thermostat (2).



5 - Disconnect the expansion tank connection pipe (4) from the radiator (3).

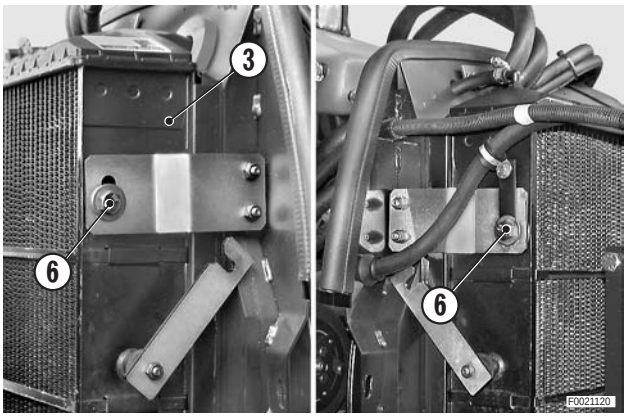


6 - Disconnect the lower hose (5) from the radiator.



7 - Remove the bolts (6) and remove the radiator (3) by moving it forwards and lifting it upwards.

kg Radiator: 18.4 kg (40.5 lb.)



REFITTING RADIATOR

- Refitting is the reverse of removal.

1 - Fill the engine cooling system.

Coolant: 21 ℓ (5.5 US.gall.)

2 - Start the engine and run for a few minutes to allow the coolant to circulate; check the system for leaks.

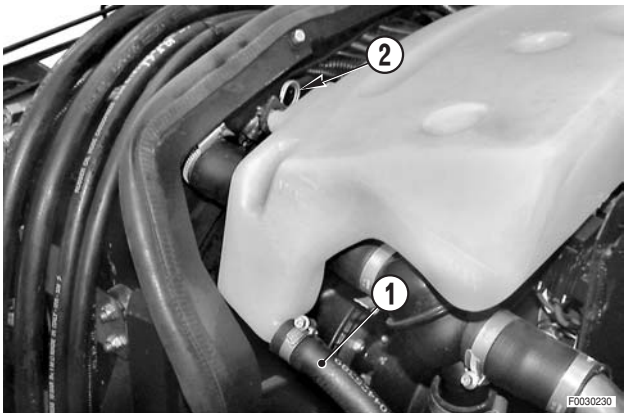
3 - Stop the engine, check the coolant level in the expansion tank and top up if necessary.

REMOVAL OF EXPANSION TANK

1 - Drain off part of the engine coolant.

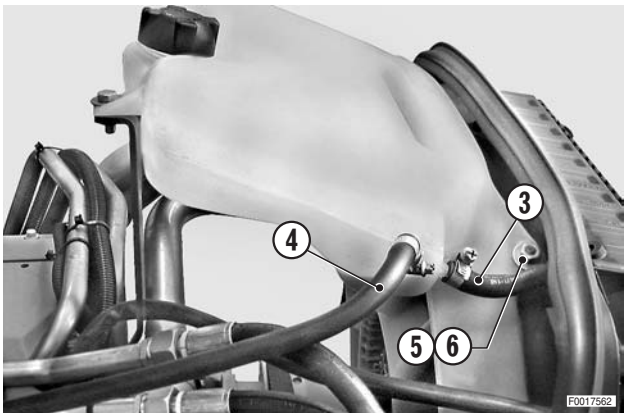
Coolant: approx. 15 ℓ (4 US. gall.)

2 - Disconnect the hose (1) on the left hand side and remove the linch pin (2).



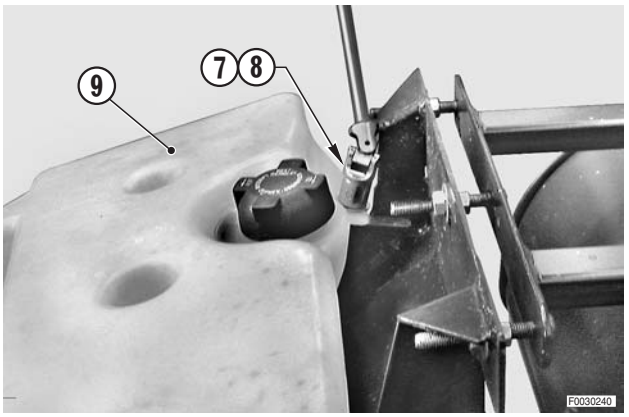
3 - Disconnect the pipes (3) and (4) on the right-hand side.

4 - Unscrew and remove the nut (5) and washer (6).



5 - Unscrew and remove the bolt (7) and washer (8).

6 - Remove the expansion tank (9).



REFITTING THE EXPANSION TANK

- Refitting is the reverse of removal.

1 - Fill the engine cooling system.

Coolant: approx 15 ℓ (4 US. gall.)

2 - Start the engine and run for a few minutes to allow the coolant to circulate.

3 - Stop the engine, check the level in the expansion tank and top up if necessary.

REMOVAL OF THE FAN

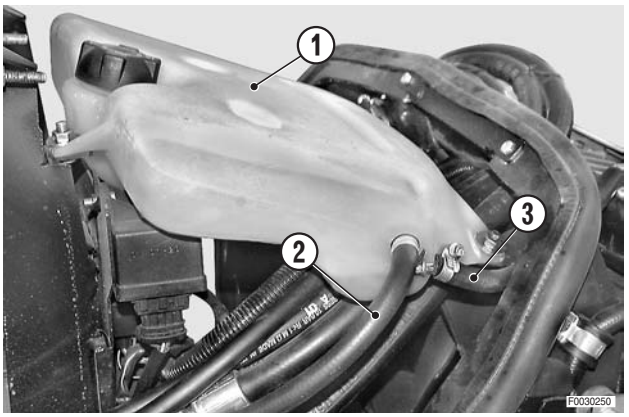
⚠ Remove the battery cover and disconnect the negative battery lead (–).

1 - Remove the hood, the lamp assemblies and the bottom panel.
(For details, see «REMOVAL OF HOOD»).

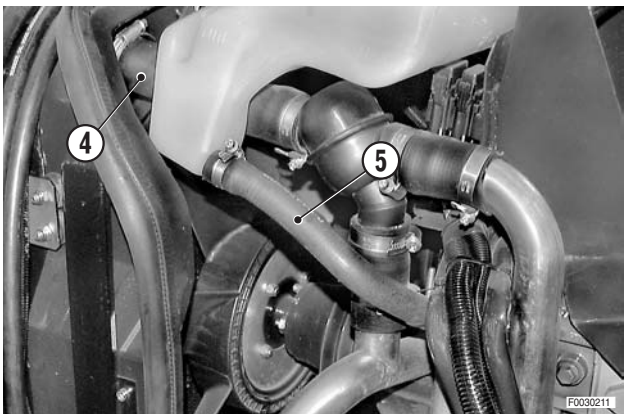
2 - Drain the engine cooling system.

Coolant: approx. 21 ℓ (5.5 US.gall.)

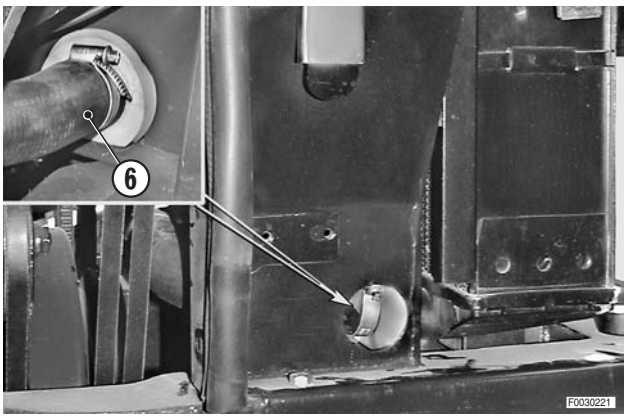
3 - Disconnect the expansion tank (1) from the pipes (2), (3) on the right-hand side.



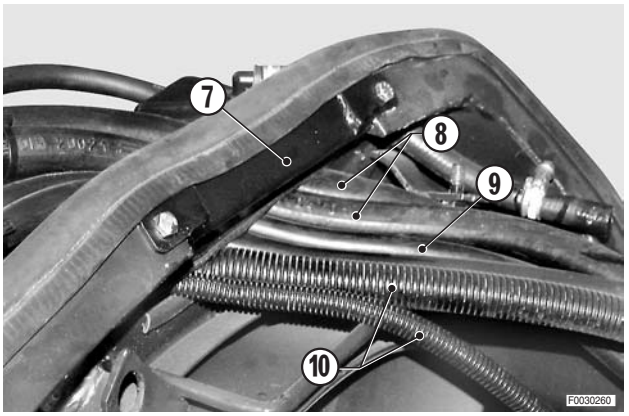
4 - Disconnect the upper hoses (4) and the hoses (5) from the radiator assembly.



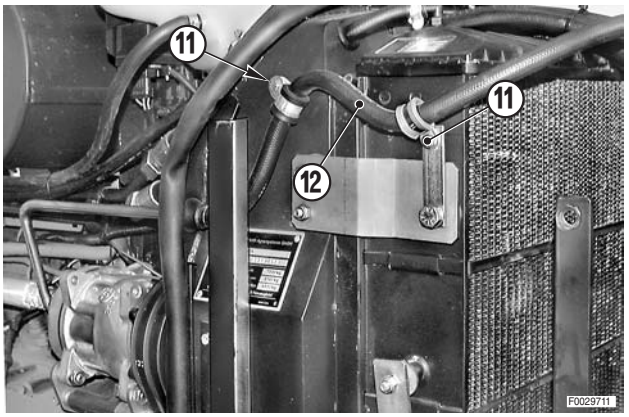
5 - Disconnect the lower hose (6) from the radiator assembly.



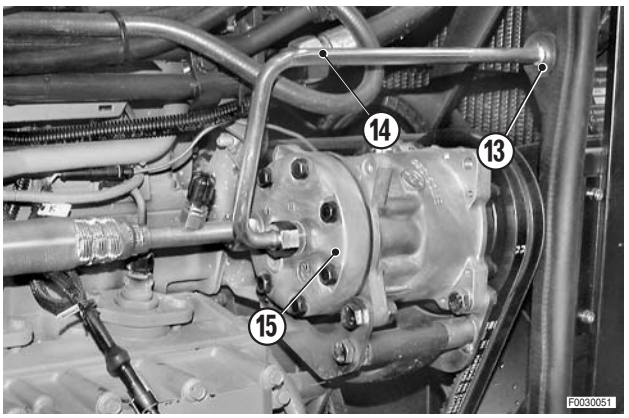
6 - Undo the bolts and remove the bar (7) restraining the pipelines (8), (9) and wiring harnesses (10).



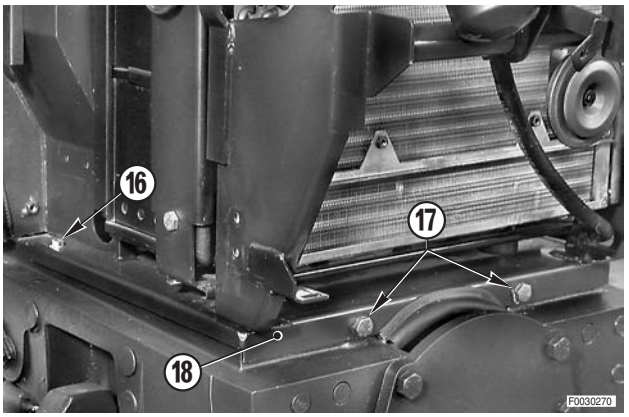
7 - Loosen the bolts (11) and free the clips holding the outlet pipeline (12) coming from the air conditioning compressor.



8 - Push the bulkhead fitting (13) along the steel pipe (14) connected to the outlet of the compressor (15).

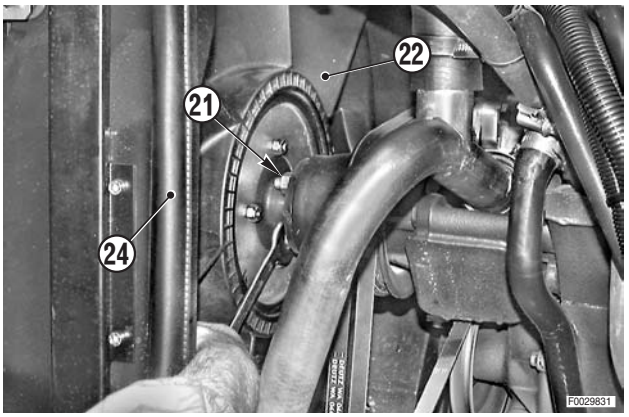


9 - Loosen and remove the rear and front bolts (16) and (17) securing the frame (18), then lift the entire assembly and shift forward as far as possible.

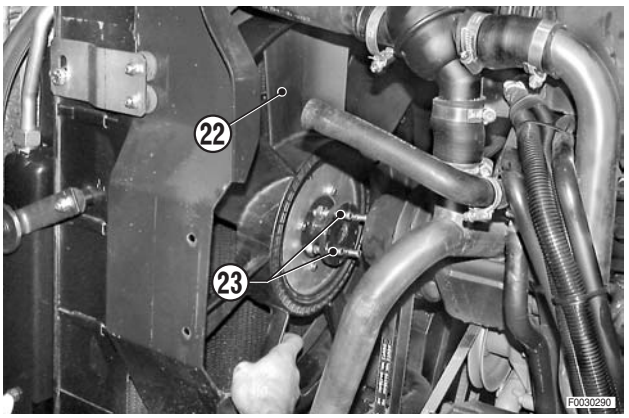


10 - Remove the hood alignment stop (19) on the left hand side, together with the relative clamp bracket (20).

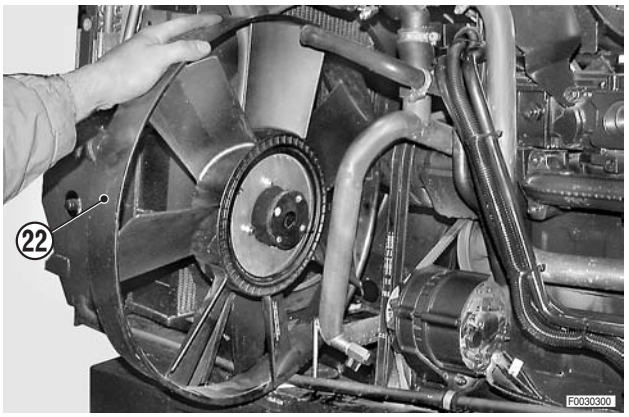
11 - Loosen and remove the nuts (21) securing the fan (22).



12 - Separate the fan (22) from the studs (23).



13 - Remove the fan (22) by drawing out sideways, having first detached a length of the adjacent seal (24).



REFITTING FAN

- Refitting is the reverse of removal.

1 - Fill the engine cooling system.

Coolant: approx. 21 ℓ (5.5 US.gall.)

2 - Start the engine and run for a few minutes to circulate the coolant.

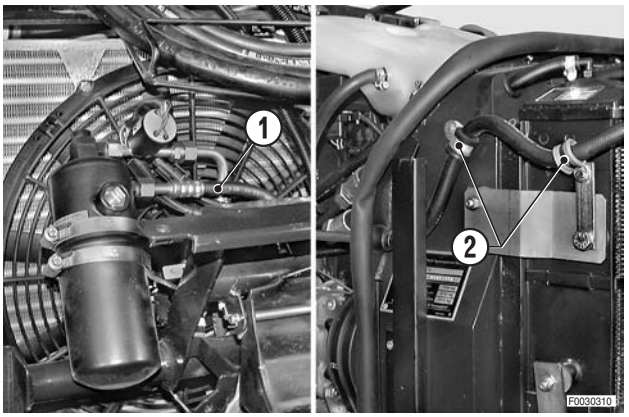
3 - Stop the engine, check the coolant level in the expansion tank and top up if necessary.

REMOVAL OF COMPLETE RADIATOR/COOLERS ASSEMBLY

1 - Remove the hood, the lamp assemblies and the side panels.

2 - Recover the refrigerant from the air conditioning system.
(For details, see «MAINTENANCE OF AIR CONDITIONING SYSTEM»).

3 - Disconnect the air conditioning compressor inlet pipeline (1) from the dehydration filter.
Remove the screws from the clips (2). ※1
★ Plug the pipe and the filter immediately to prevent moisture getting in.

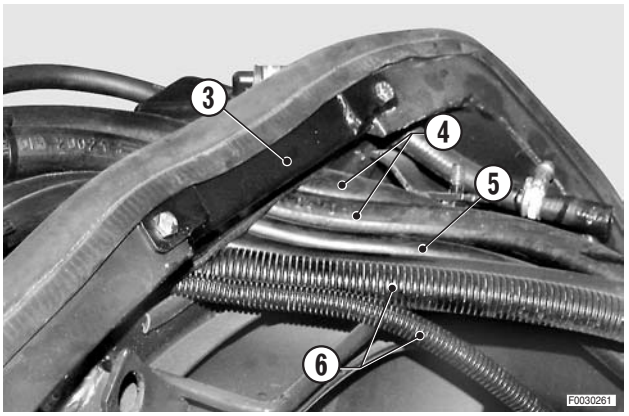


4 - Drain the coolant from the engine.

Coolant: approx. 21 ℓ (5.5 US.gall.)

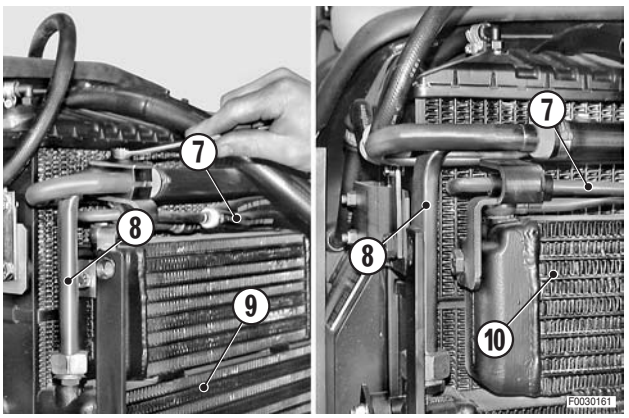
5 - Undo the bolts and remove the bar (3) restraining the pipelines and wiring harnesses.

6 - Free the pipelines (4), (5) and wiring conduits (6) from the clips.

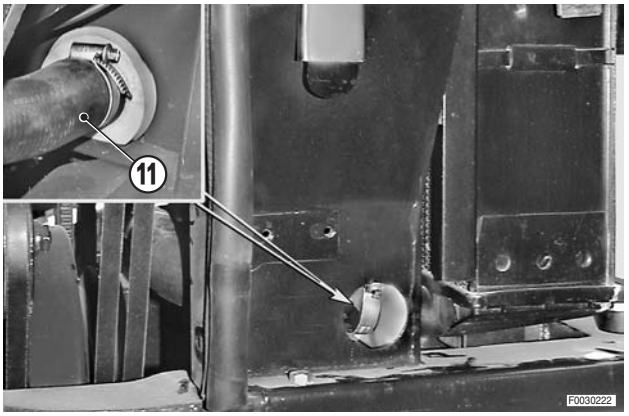


7 - Disconnect the pipelines (7) and (8) from the oil and fuel coolers (9) and (10), having first marked their positions.
★ Plug the pipes and cores to prevent impurities getting in.

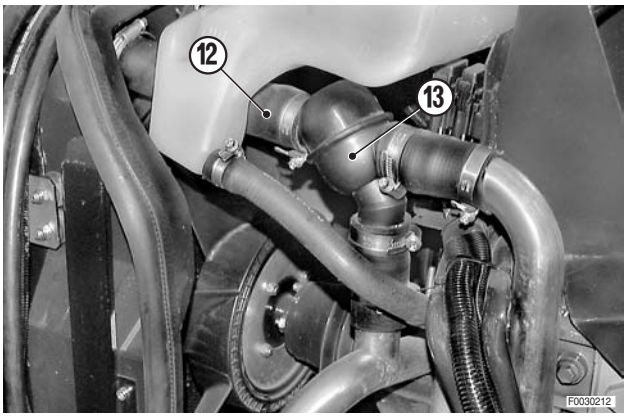
8 - Remove the expansion tank.
(For details, see «REMOVAL OF EXPANSION TANK»).



9 - Disconnect the bottom hose (11) from the radiator.

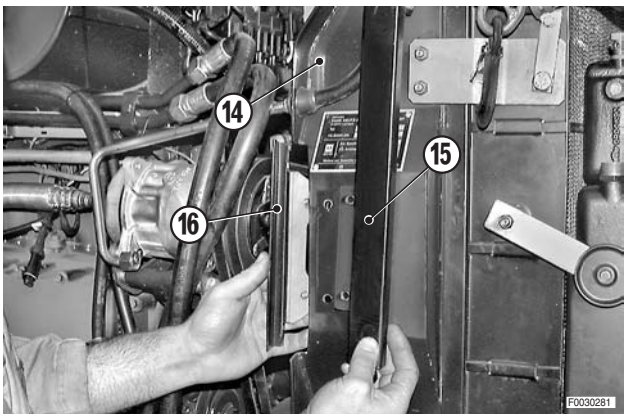


10 - Disconnect the thermostat hose (12) from the radiator, leaving it connected to the thermostat (13); recover the bulkhead washer.



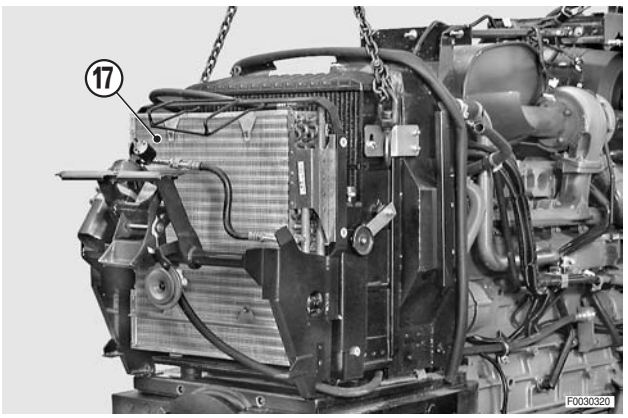
11 - Route the cooler pipelines and wiring harnesses through the opening in the frame (14) toward the rear of the machine.

12 - Remove the hood alignment stops (15) together with the clamp brackets (16).



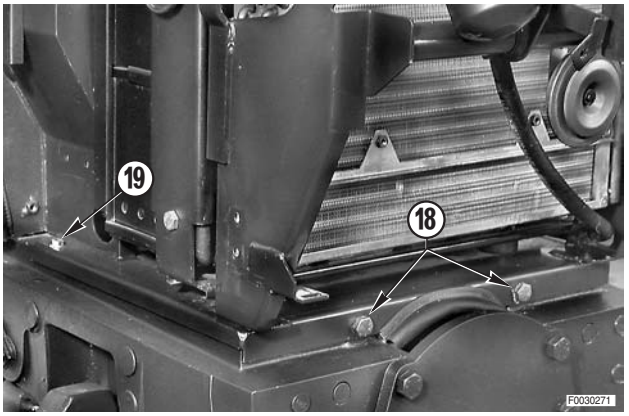
13 - Sling the complete assembly (17) to a hoist.

kg Assembly: 69 kg (152 lb.)



14 - Remove the front bolts (18) and rear bolts (19).

15 - Shift the radiator/coolers assembly toward the front of the machine, and proceed to lift clear.



REFITTING RADIATOR/COOLERS ASSEMBLY

- Refitting is the reverse of removal.

※1

★ Remove the plugs and reconnect the pipelines straight away, tightening fully to ensure moisture does not get in.

★ Inspect the seals and renew if damaged.

1 - Purge and recharge the air conditioning system. (For details, see «EMPTYING, PURGING AND RECHARGING THE AIR CONDITIONING SYSTEM»).

2 - Fill the engine cooling system.

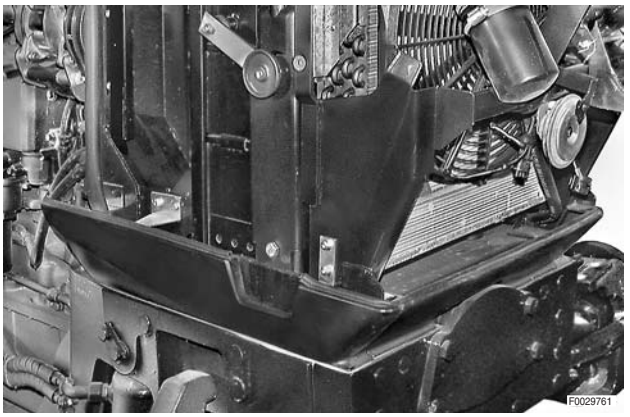
Coolant: approx. 21 ℓ (5.5 US.gall.)

3 - Start the engine and run for a few minutes to circulate the coolant, then check for leaks.

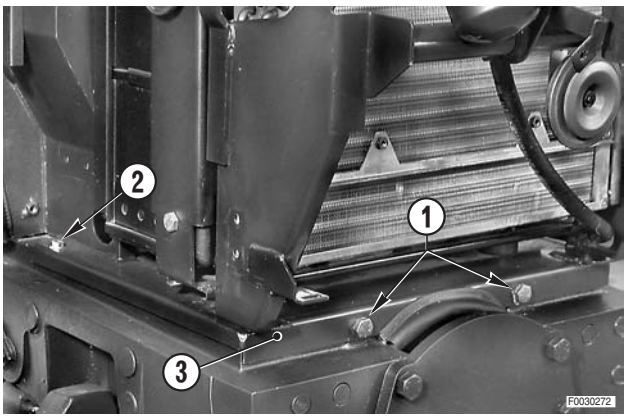
4 - Stop the engine, check the coolant level in the expansion tank and top up if necessary.

REPLACEMENT OF FRONT PTO FLEXIBLE COUPLING

1 - Raise the hood and remove the side panels. (For details, see «REMOVAL OF HOOD»).



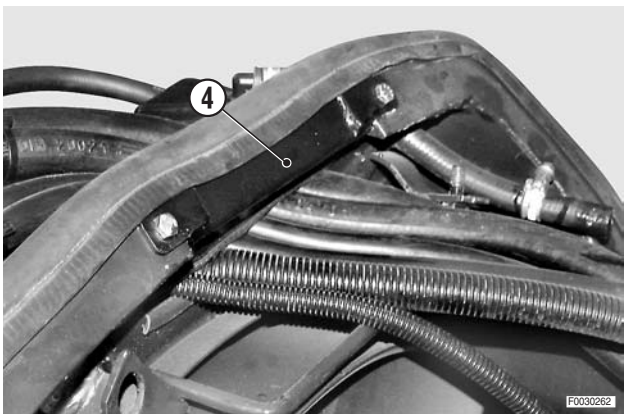
2 - Remove the front bolts (1) and the rear bolts (2) securing the radiator/cooler frame (3).



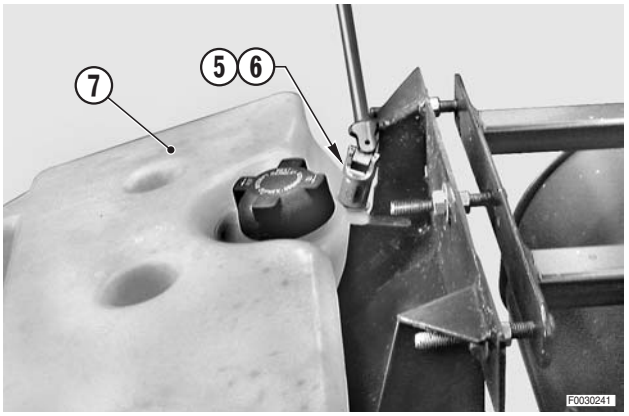
3 - Remove the bar (4) restraining the pipelines and wiring.

4 - Drain off part of the engine coolant.

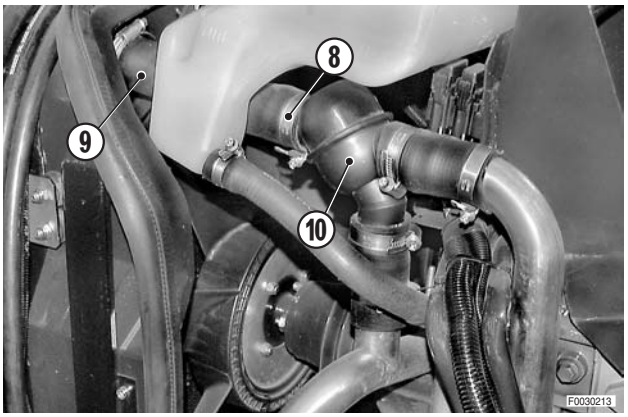
Coolant: approx. 15 ℓ (4 US. gall.)



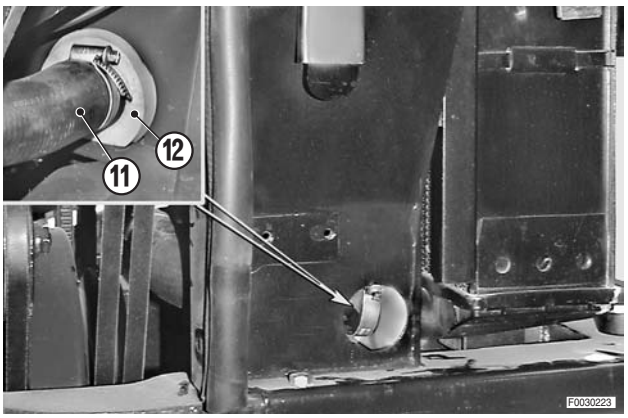
5 - Remove the bolt (5) and washer (6) from the rear fixing point of the expansion tank (7).



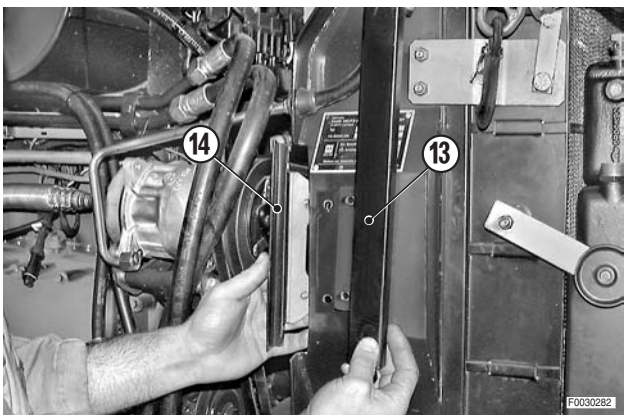
6 - Loosen the clip (8) and detach the hose (9) from the thermostat (10).
★ Recover the bulkhead washer.



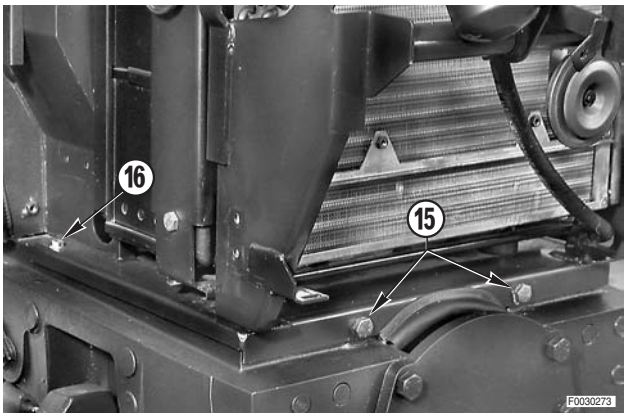
7 - Disconnect the bottom hose (11) from the radiator.
★ Recover the bulkhead washer (12).



8 - Remove the hood alignment stops (13) together with the relative clamp brackets (14).

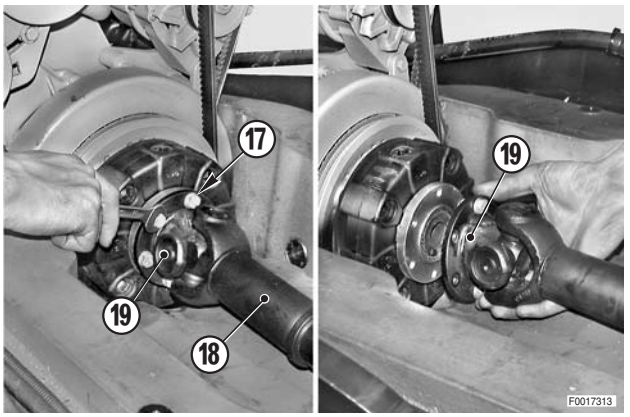


9 - Loosen and remove the front and rear bolts (15) and (16) and shift the radiator/coolers assembly forward on the machine. ⁘ 1

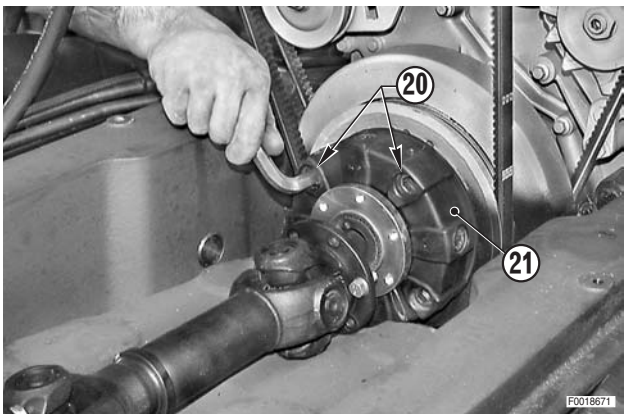


10 - Fully loosen the bolts (17) securing the flange of the drive shaft (18).

11 - Disengage the drive shaft (18) by pushing the flange (19) toward the front of the machine.



12 - Loosen and take out the securing bolts (20), and remove the coupling (21). ※ 2



REFITTING FRONT PTO FLEXIBLE COUPLING

- Refitting is the reverse of removal.

※ 1

Nm Bolts: 34 Nm (25 lb.ft.)

※ 2

Bolts: Loctite 243

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

1 - Fill the engine cooling system.

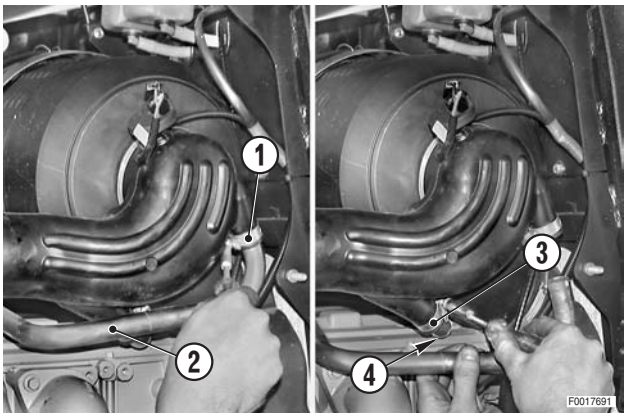
Coolant: approx. 15 ℓ (4 US. gall.)

REMOVAL OF THE TURBOCHARGER

1 - Remove the silencer.
(For details, see «REMOVAL OF THE SILENCER»).

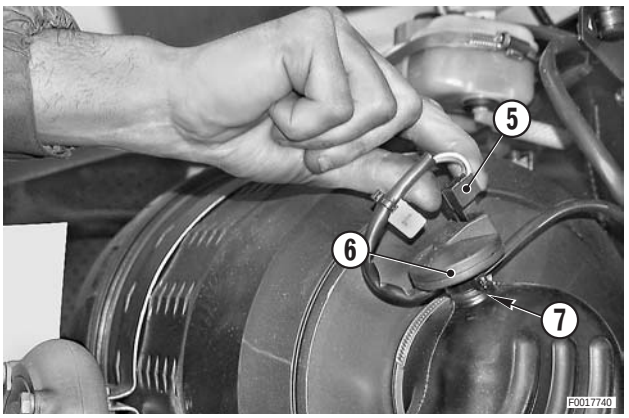
2 - Loosen the clamp (1) and disconnect the inlet pipe (2) of the air compressor for the trailer braking system.

3 - Loosen the clamp (3) and disconnect the oil vapour pipe (4).



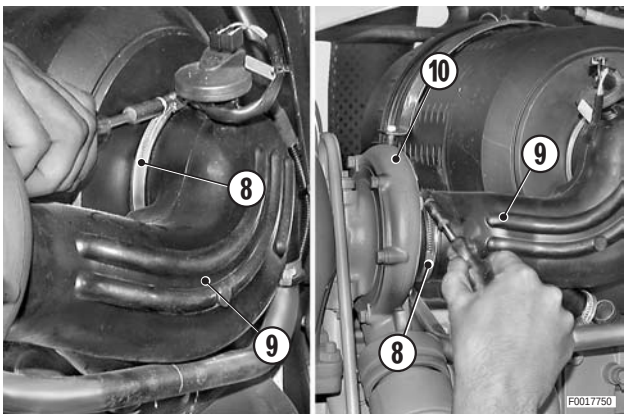
4 - Unplug the connector (5) of the filter clogging sensor (6).

★ Release the wiring from the strap (7).



5 - Loosen the clamp (8) securing the filter – turbocharger (10) connection hose (9); remove the hose (9).

6 - Remove the turbocharger (10) following the instructions in the «ENGINE WORKSHOP MANUAL».



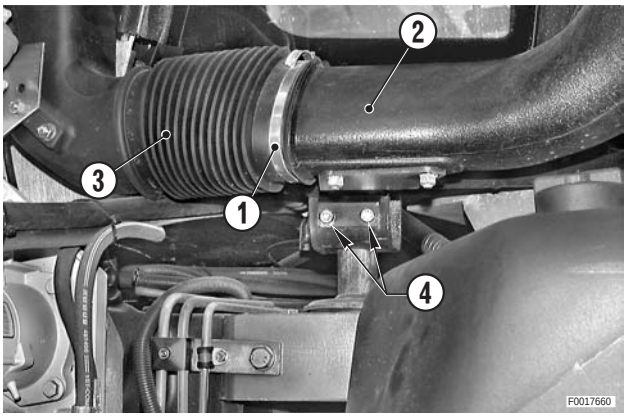
REFITTING THE TURBOCHARGER

- Refitting is the reverse of removal.

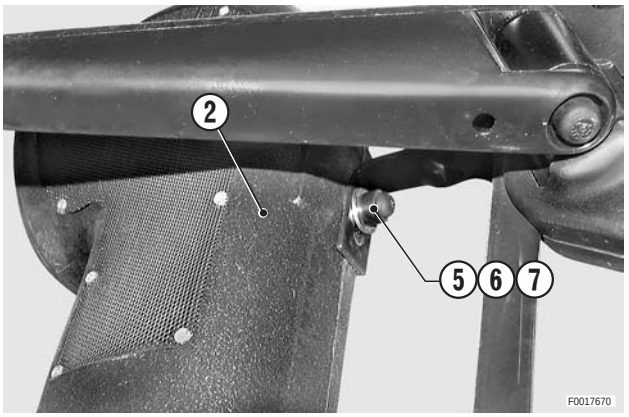
REMOVAL OF THE AIR INLET PIPE

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

2 - Unscrew and remove the bolts (4).



3 - Remove the nut cover (5) and, while supporting the pipe (2), remove the upper retaining nut (6) and washer (7).

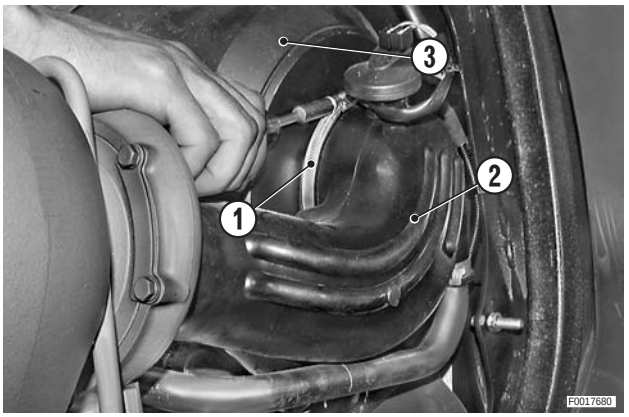


REFITTING THE AIR INLET PIPE

- Refitting is the reverse of removal.

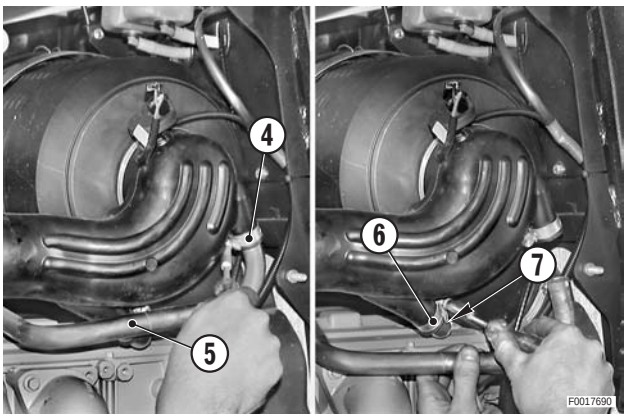
REMOVAL OF THE AIR CLEANER

1 - Loosen the hose clamp (1) securing the turbocharger inlet hose (2); disconnect the hose from the air cleaner (3).



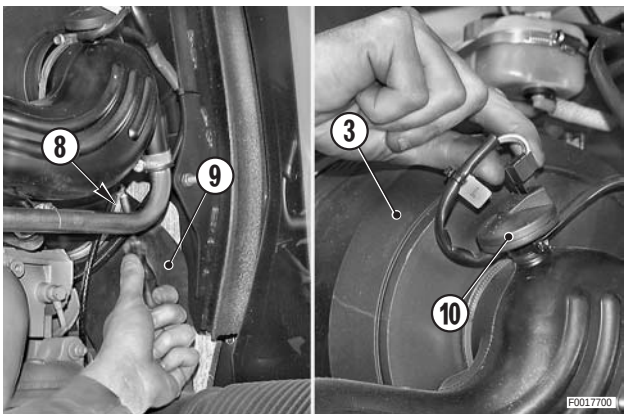
2 - Loosen the hose clamp (4) and disconnect the inlet pipe (5) of the air compressor for trailer braking.

3 - Loosen the clip (6) and disconnect the oil vapour pipe (4).



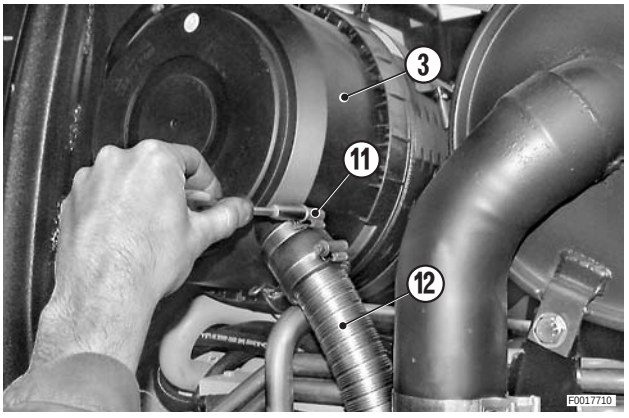
4 - Loosen the hose clamp (8) and disconnect the inlet hose (9) from the air cleaner (3).

5 - Unplug the connector of the filter clogging sensor (10).



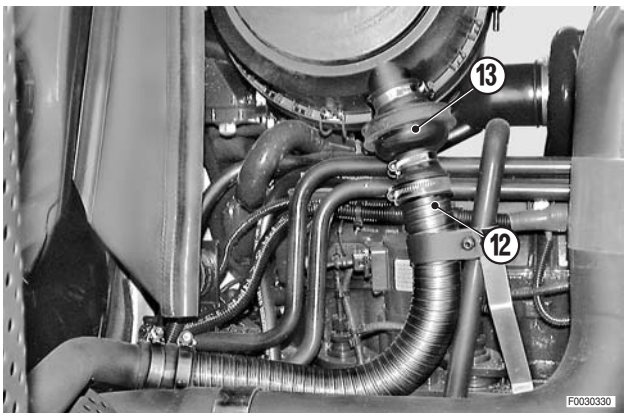
Versions without anti-backflow valve only

6 - Loosen the clip (11), and disconnect the dust unloader hose (12) from the air cleaner (3).

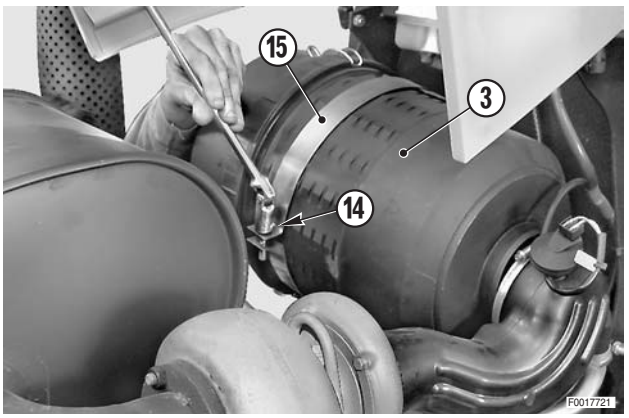


Versions with anti-backflow valve only

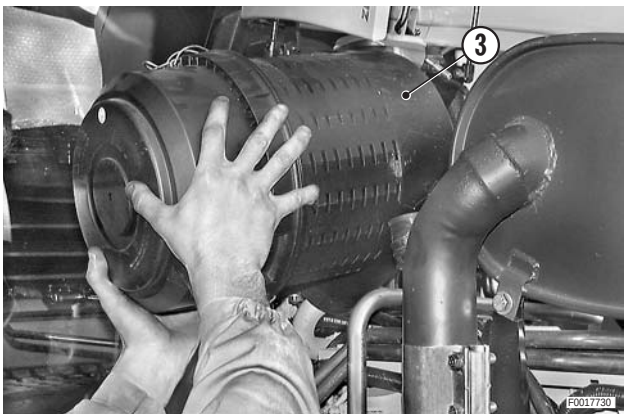
6a - Disconnect the hose (12) from the valve (13).



7 - Loosen the screw (14) of the strap (15) holding the air cleaner (3).



8 - Remove the air cleaner (3).



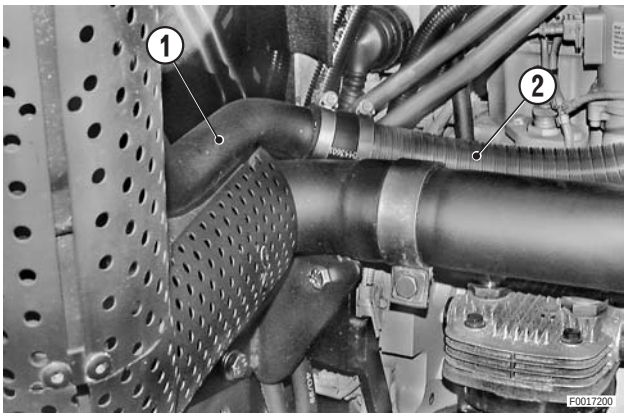
REFITTING THE AIR CLEANER

- Refitting is the reverse of removal.
  - ★ Check that all the hose clamps are fully tightened.

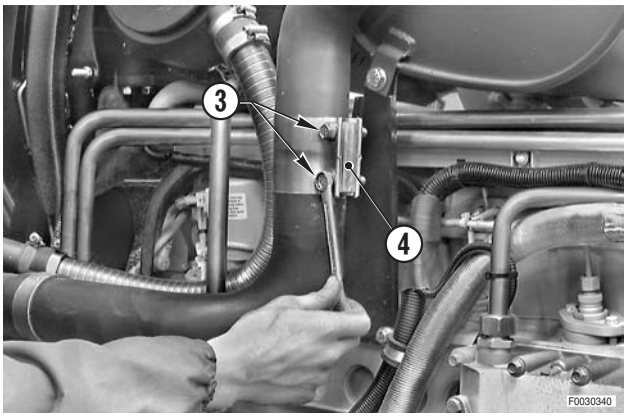
REMOVAL OF THE EXHAUST PIPE

⚠ Remove the key from the ignition.

1 - Disconnect the dust exhauster pipe (2) from the exhaust pipe (1).



2 - Unscrew the bolts (3) and move the clamp (4) joining the exhaust and the silencer.



3 - Attach a hoist to the exhaust pipe (1) and put the lifting sling under slight tension.

kg Exhaust pipe: 23 kg (50.7 lb.)

4 - Remove the bolts (5), (6) and the nuts (7).

5 - Remove the exhaust pipe (1).

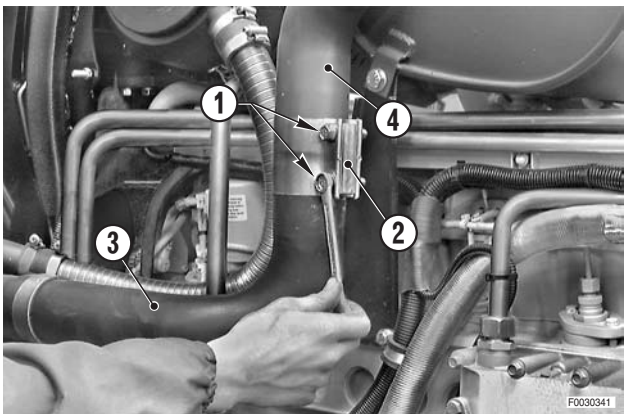
REFITTING THE EXHAUST PIPE

- Refitting is the reverse of removal.

REMOVAL OF THE SILENCER

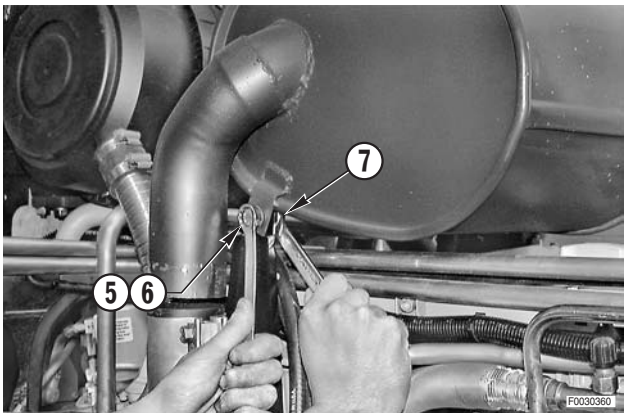
⚠ Remove the key from the ignition switch.

1 - Loosen the bolts (1) and move the clamp (2) joining the exhaust pipe (3) to the silencer (4).



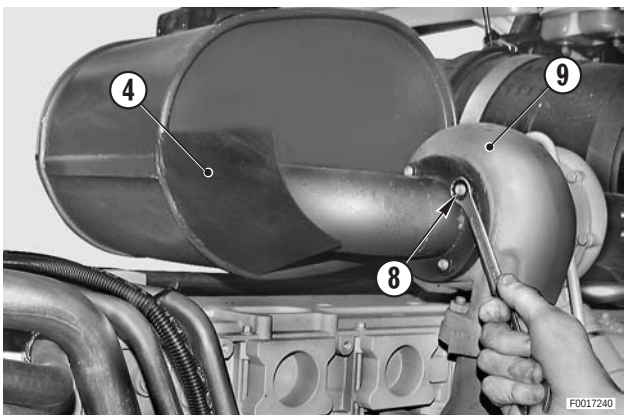
2 - Position supports between the cylinder head and the silencer.

3 - Unscrew and remove the bolt (5), washer (6) and nut (7).



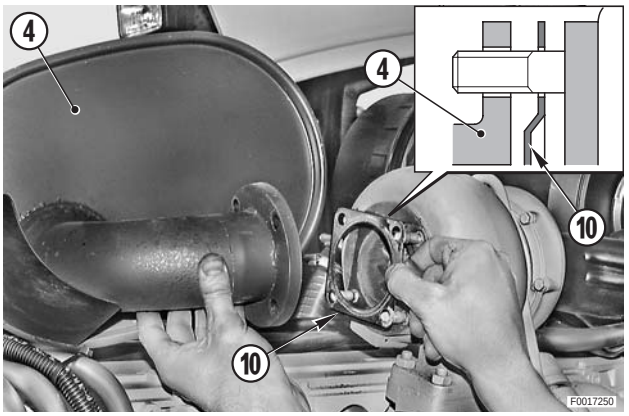
4 - Remove the nuts (8) securing the silencer to the turbocharger (9) and remove the silencer (4).

kg Silencer: approx. 15 kg (33 lb.)



5 - Remove the gasket (10).

★ Note which way round it is fitted.



REFITTING THE SILENCER

- Refitting is the reverse of removal.

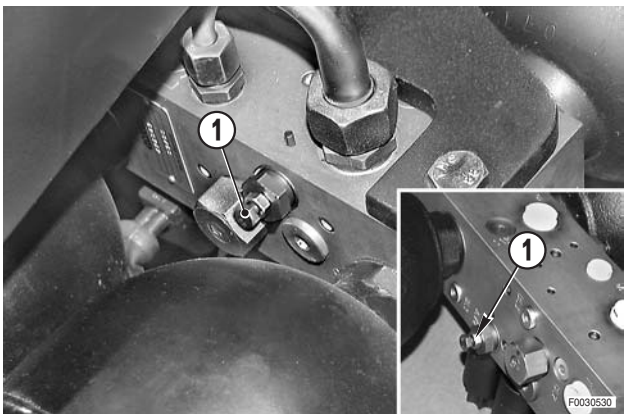
REMOVAL OF THE 4WD PROPELLER SHAFT

(Version with front suspension)

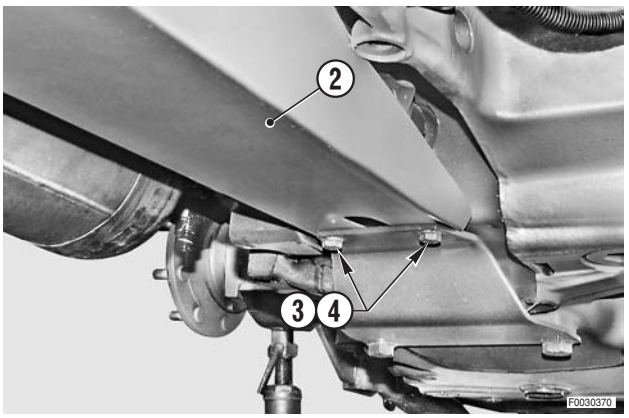
⚠ Before switching off the engine, disengage the front suspension by pressing the push button in the cab for at least 20 seconds.

Vent residual pressure from the suspension system by unscrewing the front and rear valves (1) approximately two full turns.

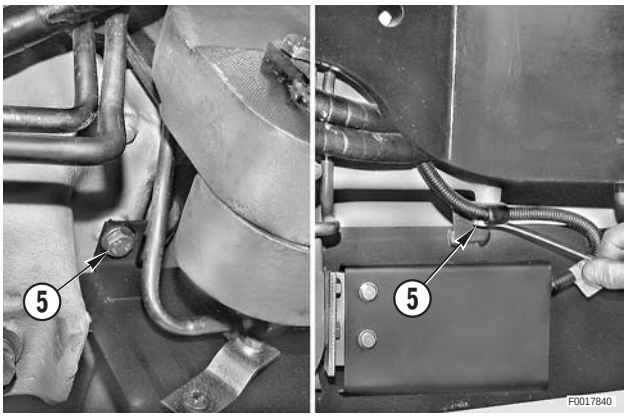
★ Once the pressure has been released, wait a few minutes and then close the valves.



1 - Keeping the bottom guard (2) supported, remove the bolts (3) and washers (4).



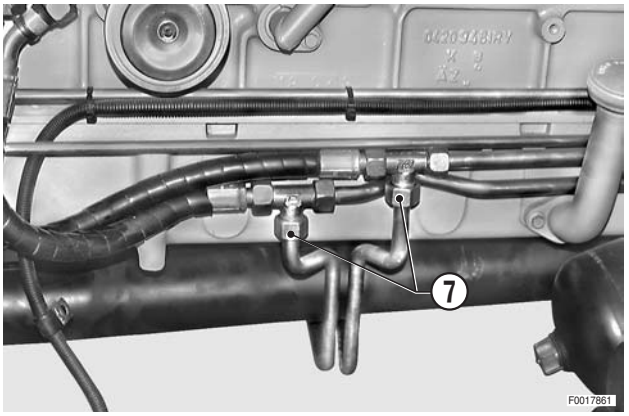
2 - Remove the front bolts (5) and remove the lower guard (2).



3 - Disconnect the pipes (7) of the left-hand suspension cylinder.

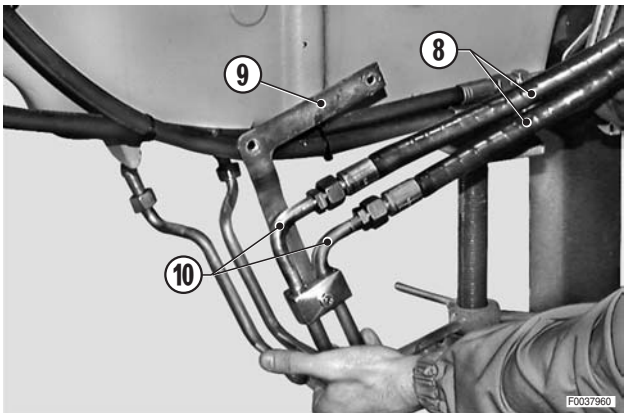
★ Plug the ends of the pipes to prevent the entry of contaminants.

Loosen the fittings of the flexible hoses by a few turns and, before removing them, push them to detach them from the couplers and thereby discharge any residual pressure from the system.



4 - Disconnect the rigid pipes (9) from the hoses (8).
★ Label the pipes to avoid confusion on refitting.
★ Plug the pipes and the open fittings to prevent the entry of contaminants.

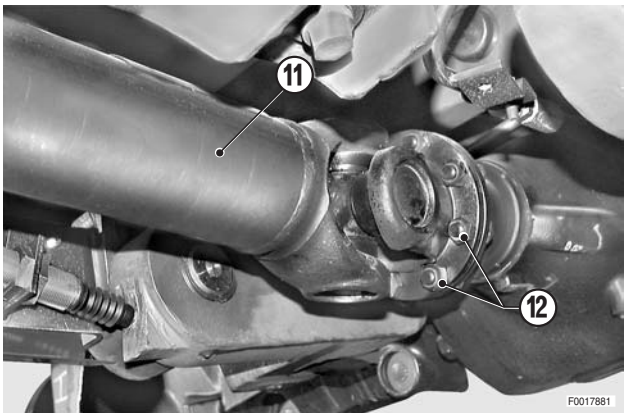
5 - Remove the bracket (10) and remove the pipes.



6 - Position a jack "**A**" under the shaft (11) and remove the flange bolts and lock nuts (12).

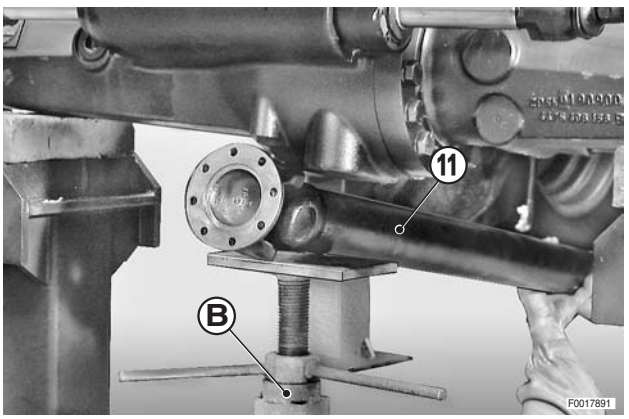
※ 1

★ To enable removal of the bolts, start the engine, make certain four wheel drive is disengaged, and rotate the drive shaft manually by moving the front wheels.



7 - Disconnect the flange, lower the jack "**A**" and withdraw the shaft (11) towards the front of the tractor.

※ 2



REFITTING THE 4WD PROPELLER SHAFT

- Refitting is the reverse of removal.

※1

Nm 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 BRAKE MASTER CYLINDERS

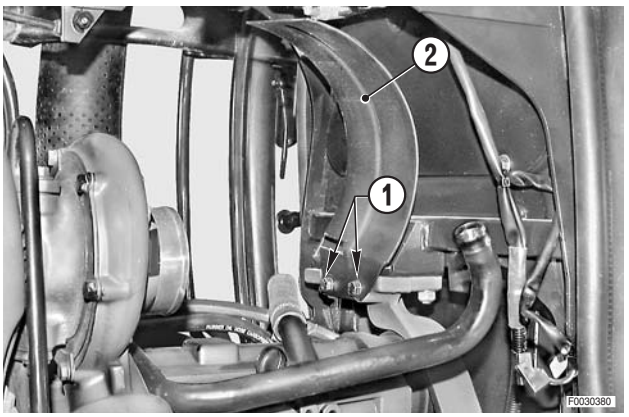
⚠ Remove the battery cover and disconnect the negative battery lead (–).

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

2 - Remove the engine hood.
(For details, see «REMOVAL AND ADJUSTMENT OF ENGINE HOOD»).

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

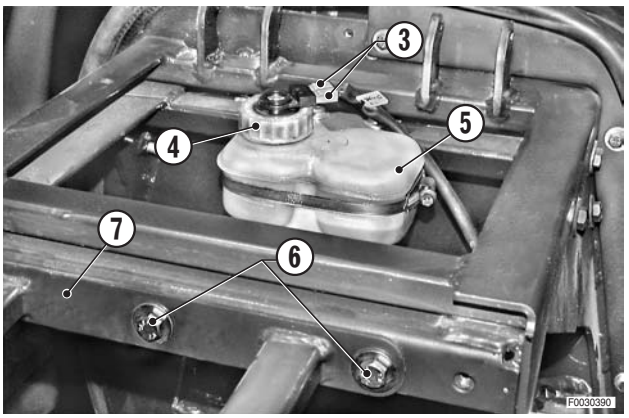
4 - Undo the bolts (1) and remove the air cleaner bracket (2).



5 - Unplug the connectors (3) of the brake fluid level warning light.

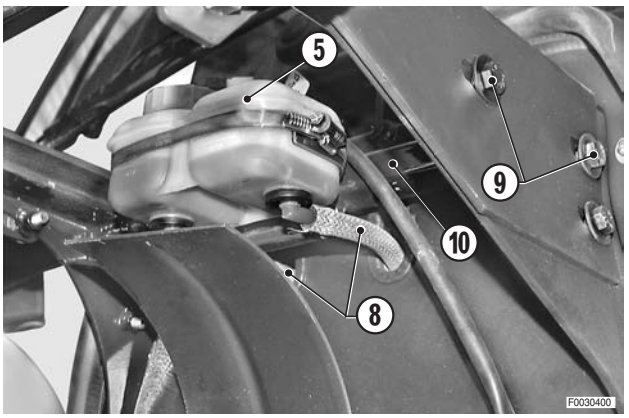
6 - Remove the cap (4) and pump out the fluid contained in the brake fluid reservoir (5).

7 - Loosen and remove the three bolts (6) and the relative washers on the hood adjuster frame (7).

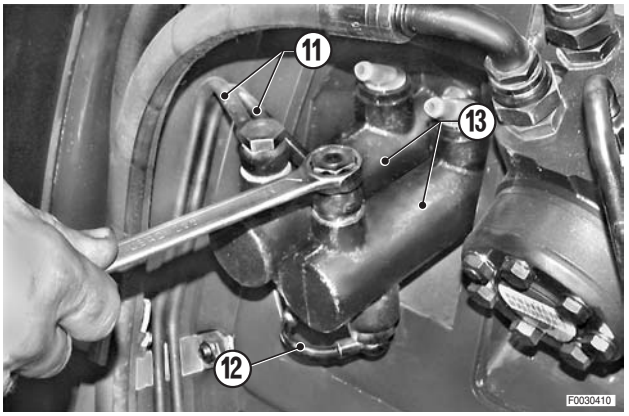


8 - Disconnect the inlet hoses (8) from the reservoir (5).

9 - Undo the bolts (9) and remove the bracket (10) complete with the brake fluid reservoir.



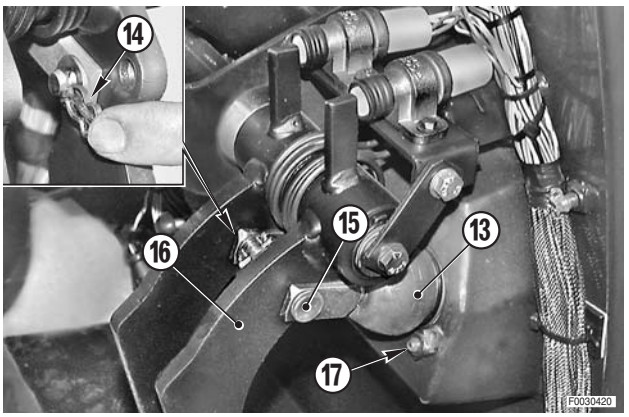
10 - Disconnect the pressure pipelines (11), and the bypass (12) line interconnecting the cylinders (13).



11 - Unclip the cotter pins (14) and remove the pivots (15) connecting the pedals (16) and the cylinders (13).

12 - Loosen the bolts (17) and remove, with the washers, and proceed to detach the master cylinders (13).

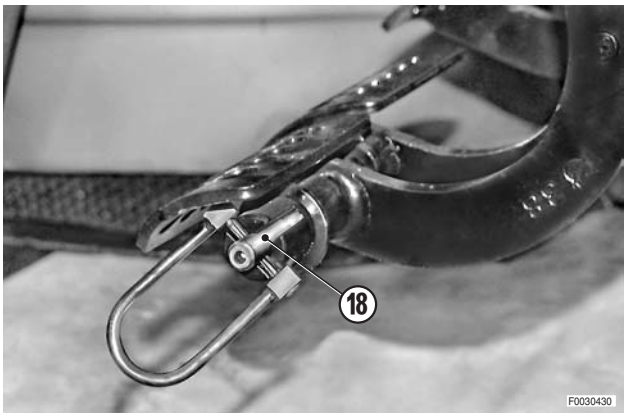
★ Recover and note the mounting position of any washers fitted between cylinder and cab to bring about alignment of the pedals.



REFITTING BRAKE MASTER CYLINDERS

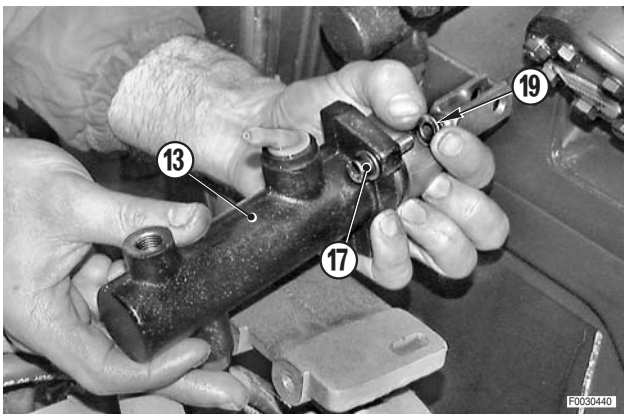
- Refitting is the reverse of removal.

1 - Check the alignment of the pedals by inserting the latch pin (18).



If necessary

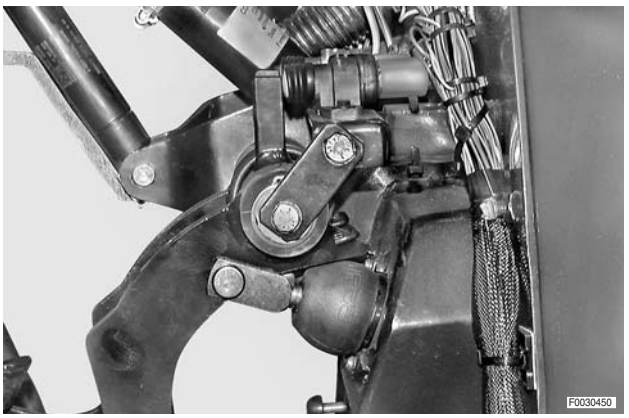
★ Where one pedal is higher than the other, locate shim washers (19) between the relative master cylinder (13) and the cab until the latch pin (18) is able to slide freely.



2 - Fill the brake fluid reservoir to the maximum level.

3 - Check the position of the microswitches.
(For details, see «ADJUSTMENT OF BRAKE LIGHT MICROSWITCHES»).

4 - Bleed the brake circuits of air.
(For details, see «BLEEDING THE BRAKE SYSTEM»).



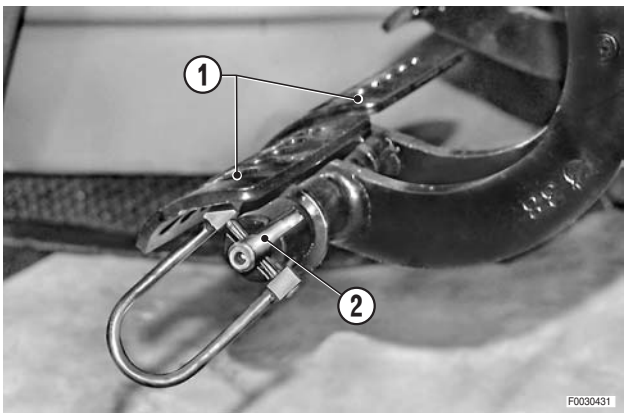
BLEEDING THE BRAKING SYSTEM

1 - Disconnect the two brake pedals (1) by disengaging the latch pin (2).

2 - Bleed the left rear brake.

3 - Bleed the right rear brake.

4 - **For tractors with hydraulic or air trailer braking only:** bleed the trailer brake valve before bleeding the service brake system



Brake bleeding procedure

During brake bleeding operations, ensure that the fluid in the brake fluid reservoir is always above the minimum level.

1 - Remove the dust cap and attach a transparent tube "**A**" to the bleed screw (1) of the left hand brake cylinder, through which to collect the brake fluid.

2 - Fully depress the brake pedal corresponding to the brake to be bled.

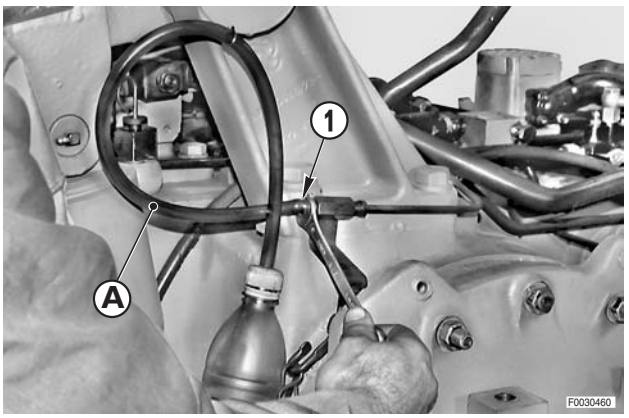
3 - Slowly open the bleed screw (1) and allow the fluid and air to flow throughout the entire pedal travel.

4 - While holding the pedal fully depressed, tighten the bleed screw.

5 - Repeat the sequence of steps until the fluid flowing from the bleed screw is entirely free of air bubbles.

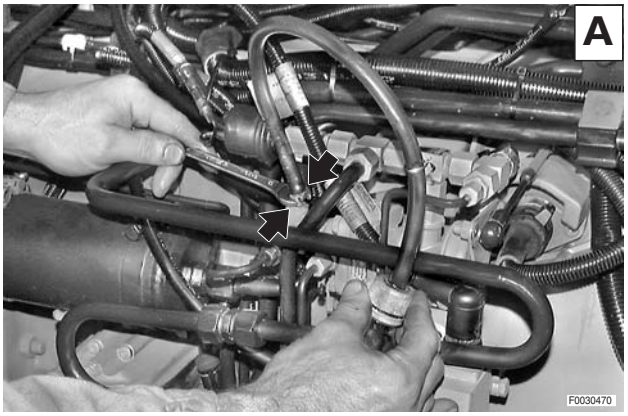
6 - Repeat the procedure for the other brake cylinder.

7 - After bleeding, replace the bleed screw (1) dust caps



8 - Bleed the braking valve at the bleed screws (1) (protected by caps) using the method indicated for the pumps and choosing from among the following versions:

A - Pneumatic parking brake control valve.



B - Pilot valve.

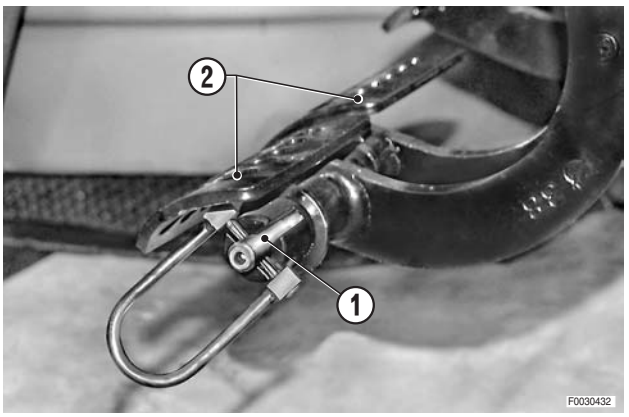
C - Hydraulic braking valve (CUNA).

D - Hydraulic braking valve (EXPORT).

ADJUSTMENT OF THE BRAKE LIGHT SWITCHES

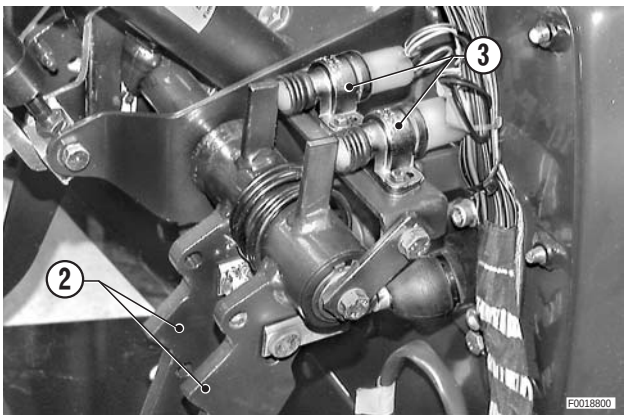
★ The switch for each pedal is adjusted separately.

1 - Check that the pedal latch pin (1) slides freely to connect and disconnect the two pedals (2).

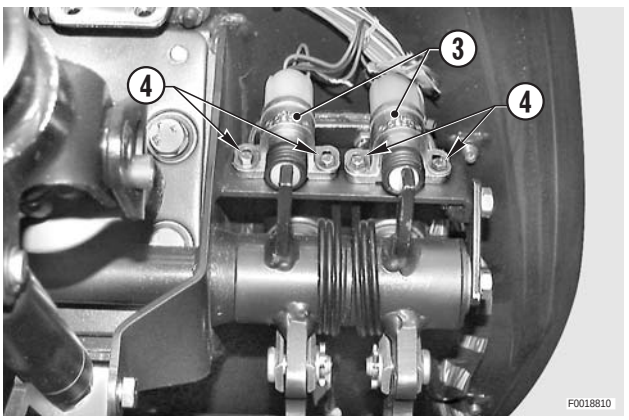


2 - Force the pedals (2) upwards and check that the brake light switches (3) have an extra opening travel of 1±0.2 mm (0.04±0.008 in.).

★ This extra travel protects the switches from impacts at the end of travel caused by sudden release of the pedals.



3 - If the switches (3) do not have this extra travel, loosen the screws (4) so that they just grip the switch; move the switch towards the front of the tractor and tighten down the screws (4) to fix it in position.



CHECKING THE POWER STEERING UNIT

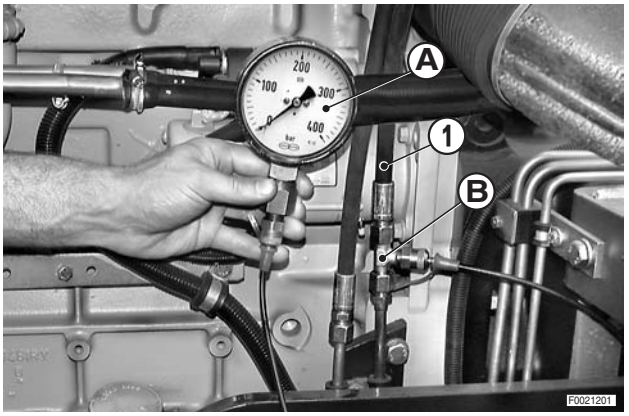
1. Testing

1 - Disconnect one of the steering pipelines (1) and couple a Tee "**B**" with a 400 bar pressure gauge "**A**" attached.

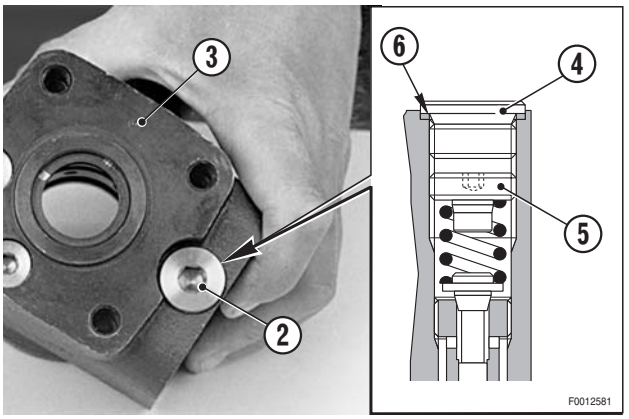
2 - Start the engine, and steer full lock on each side a few times to eliminate any air from the system.

3 - Force the steering to full lock on the side opposite to that on 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 is outside the specified range, adjust the pressure relief valve (2) of the power steering unit (3).



2. Setting

1 - Remove the plug (4).

2 - Using a 4 mm hex key, proceed to adjust the relief pressure by positioning the setscrew (5).

- To INCREASE, turn the screw CLOCKWISE.
- To REDUCE, turn the screw ANTICLOCKWISE.

3 - Refit the plug (4), checking that the seal (7) is correctly seated.

Nm Plug: 50±10 Nm (36.8±7.4 lb.ft.)

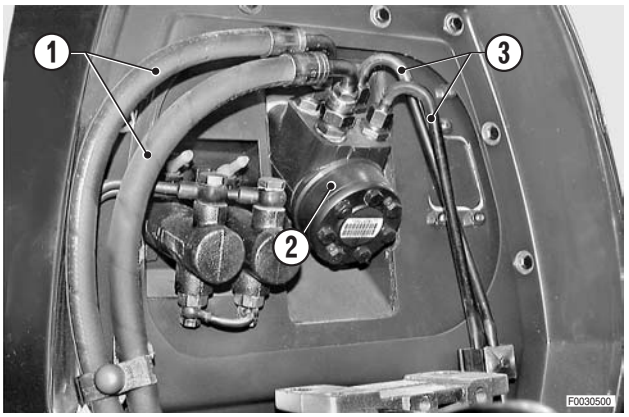
REMOVAL OF POWER STEERING UNIT

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

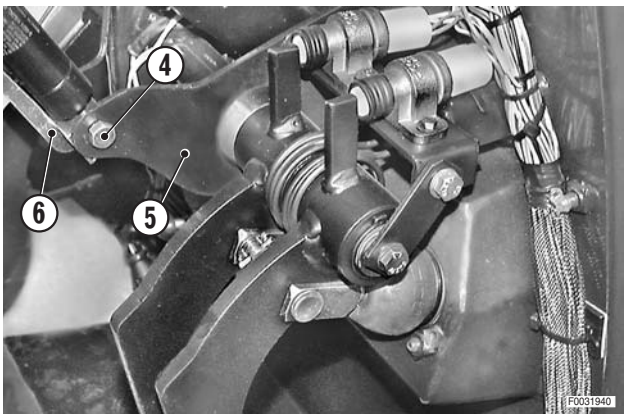
2 - Mark the hoses (1) and disconnect them from the power steering unit (2), disconnect the two pipes (3).

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

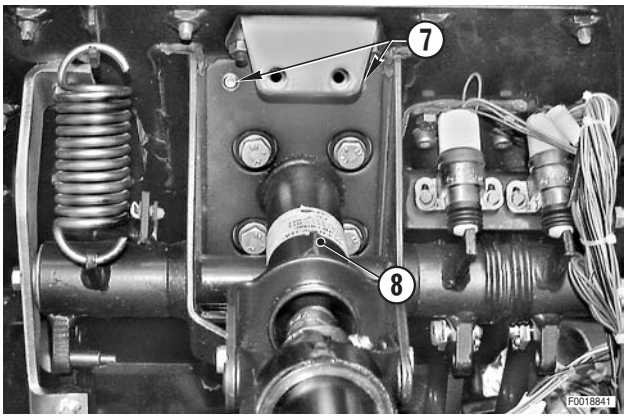
※ 1



3 - Remove the bolts (4) and the internal spacers, and disconnect the release mechanism (6) from the pedal bracket (5).



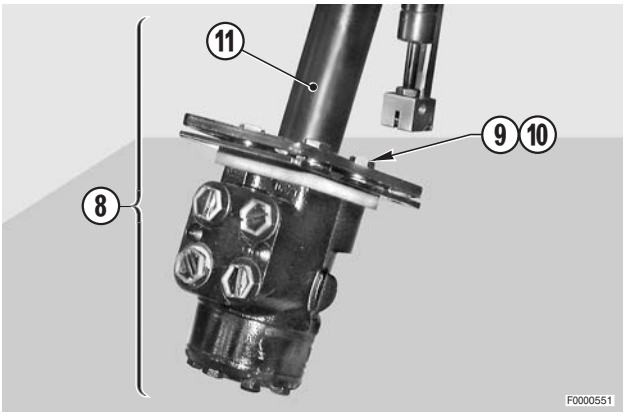
4 - Remove the four bolts (7) securing the steering unit and column assembly (8).



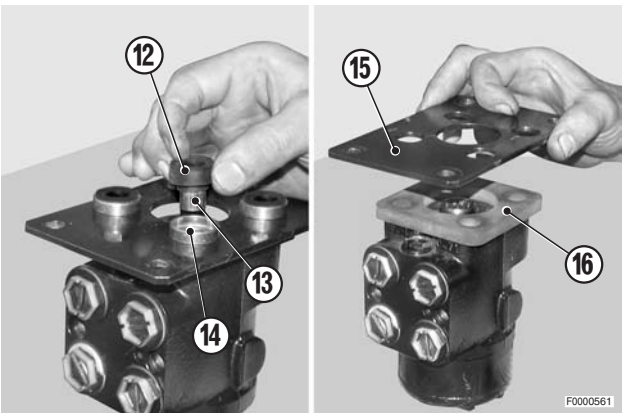
5 - Remove the entire steering unit and column assembly (8).

6 - Remove the bolts (9), washers (10) and column (11).

※ 2



7 - Remove the rubber antivibration mounts (12), the spacers (13), the antivibration sockets (14), the plate (15) and the rubber pad 16).



REFITTING POWER STEERING UNIT

- To refit, repeat the above steps in reverse order.

1

Nm Pipe fittings: 60 Nm (44.2 lb.ft.)

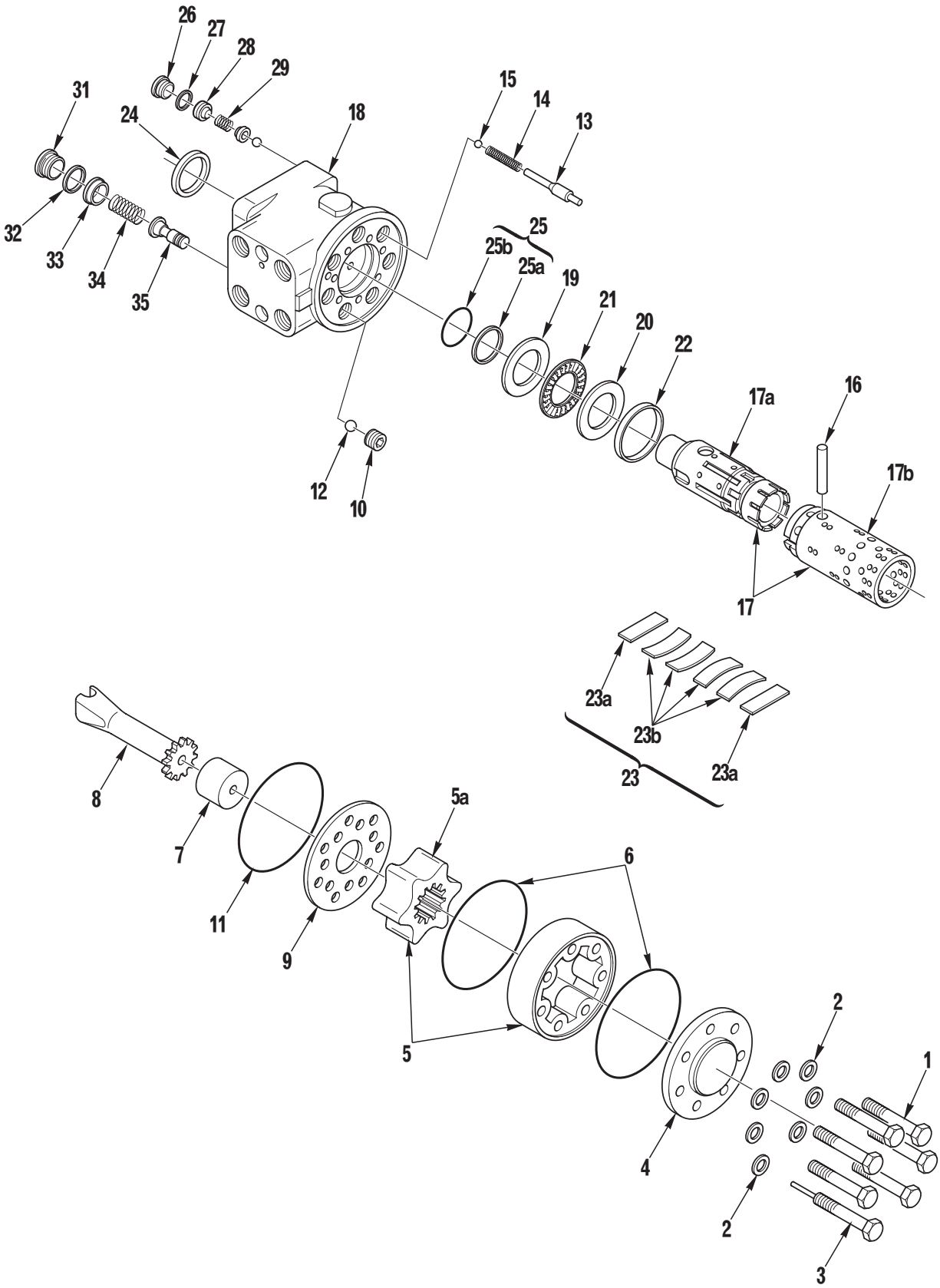
2

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

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.

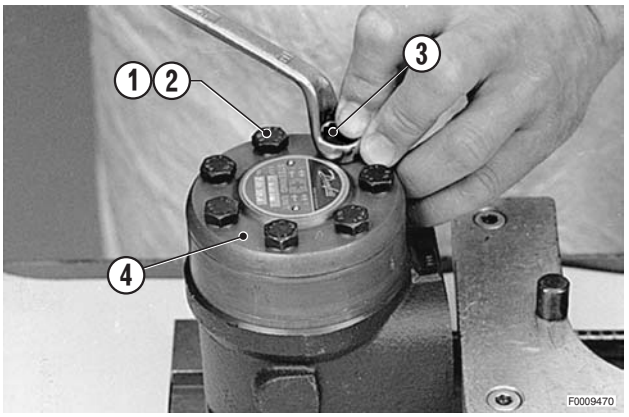
DISMANTLING THE POWER STEERING UNIT



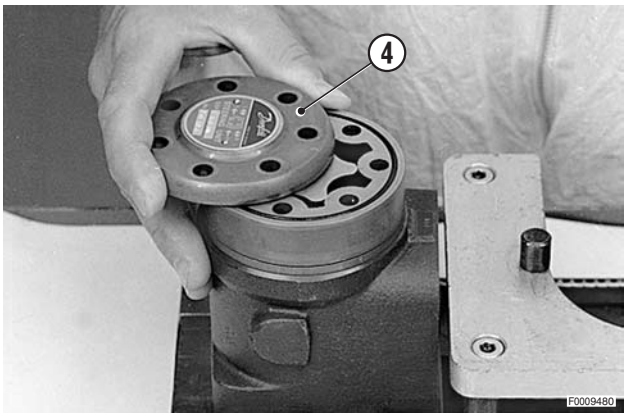
D0001200

Dismantling the power steering unit

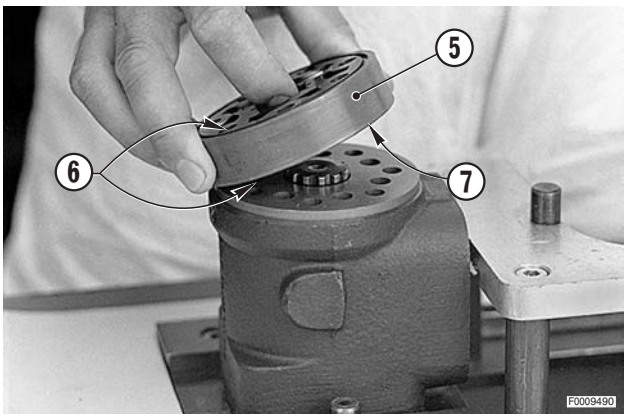
1 - Loosen and remove the screws (1) and (3) and washers (2) securing the cover (4) (6 bolts plus 1 special screw).



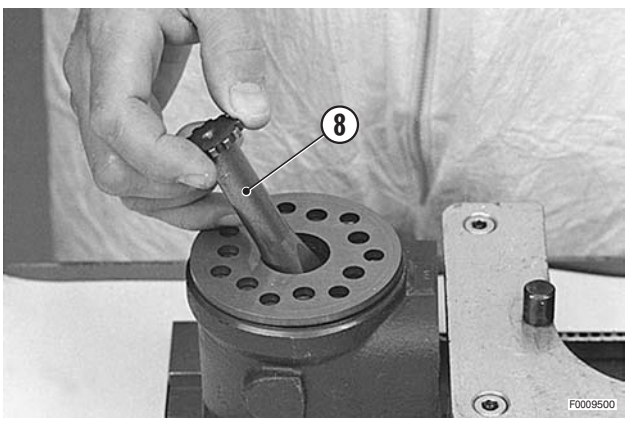
2 - Remove the cover (4) by sliding it off sideways.



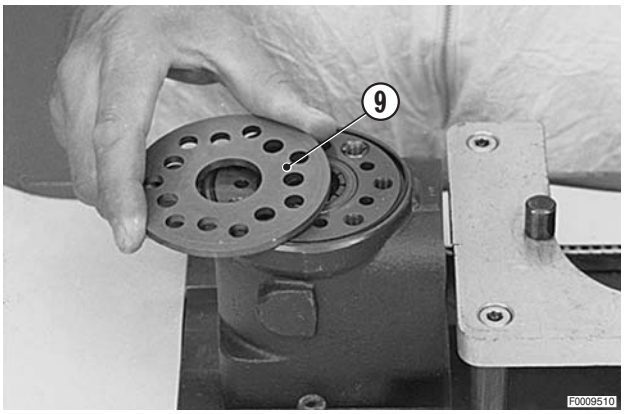
3 - Lift off the rotor assembly (5) complete with O-rings (6) and distance piece (7).



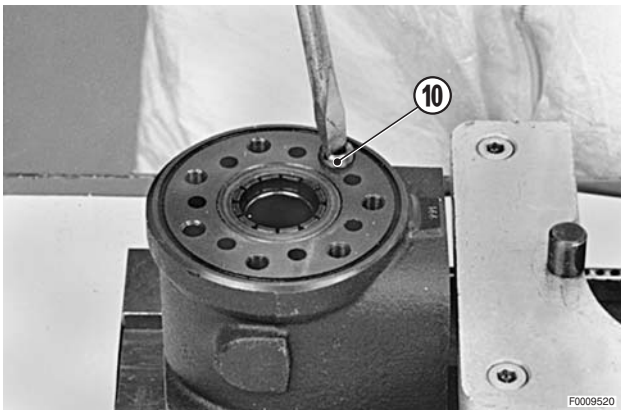
4 - Remove the shaft (8).



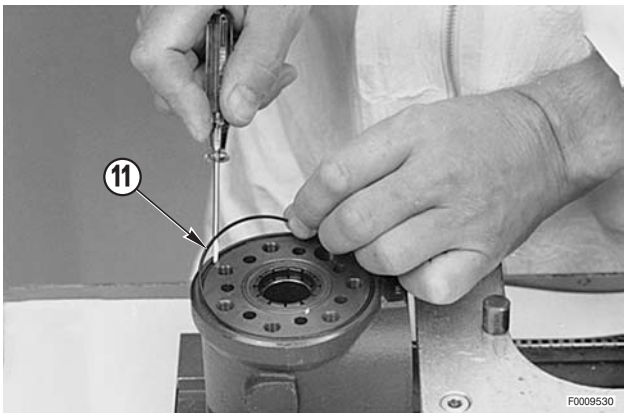
5 - Remove the distributor plate (9).



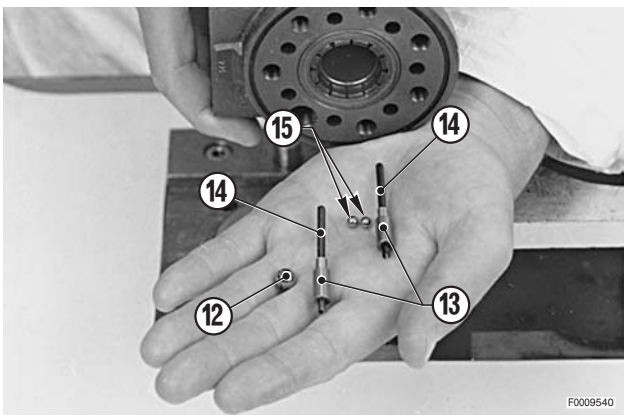
6 - Remove the stop bushing (10) of the safety valve.



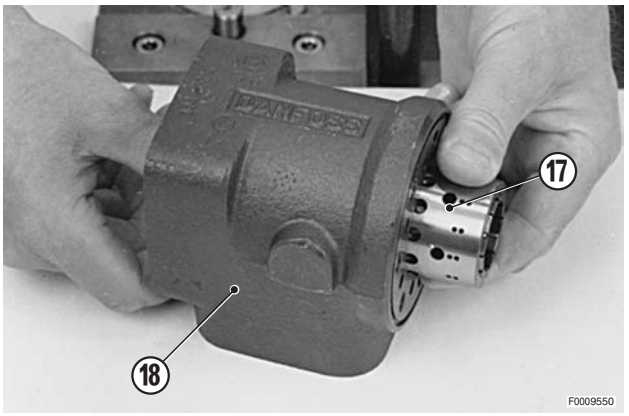
7 - Remove the O-ring (11).



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.

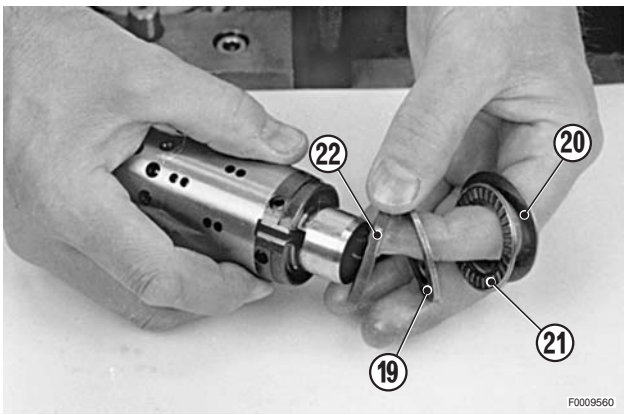


9 - Checking through the central hole of the spool valve, ensure that the pin (16) connecting the inner and outer sleeves of the spool is positioned horizontally.
Push the entire spool assembly (17) and the bearing out of the steering unit housing (18).



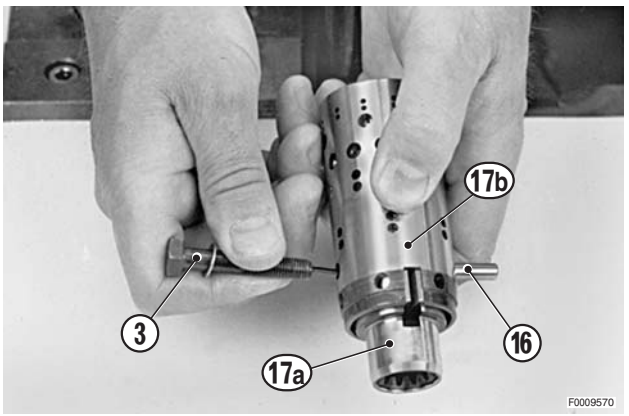
10 - Remove the outer thrust washer (19), the inner thrust washer (20) and the needle roller bearing (21) from the spool; remove also ring (22).

★ The inner thrust washer (20) (thin) can sometimes remain inside the housing; check that it is removed.

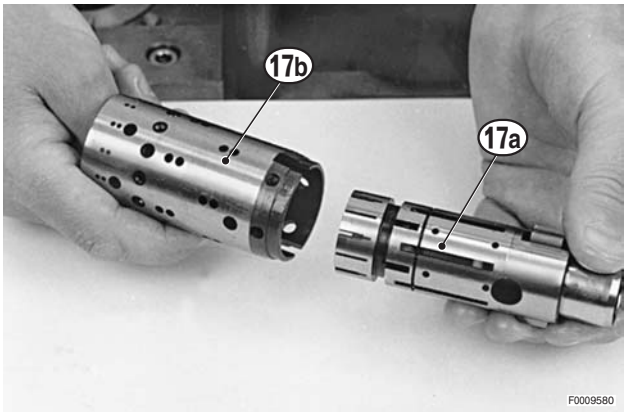


11 - Remove the trim spin (16), outer sleeve (17b) and the inner sleeve (17a).

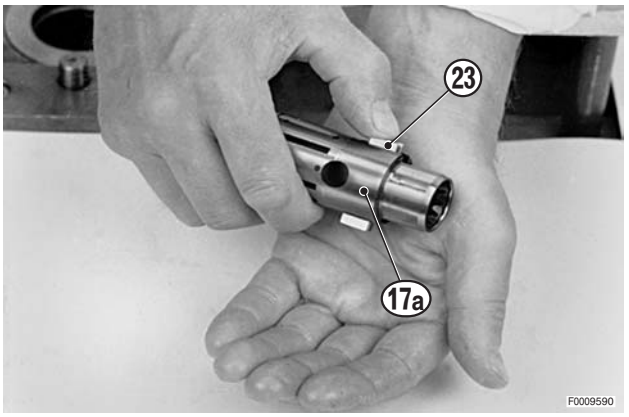
★ Use the special cover bolt (3).



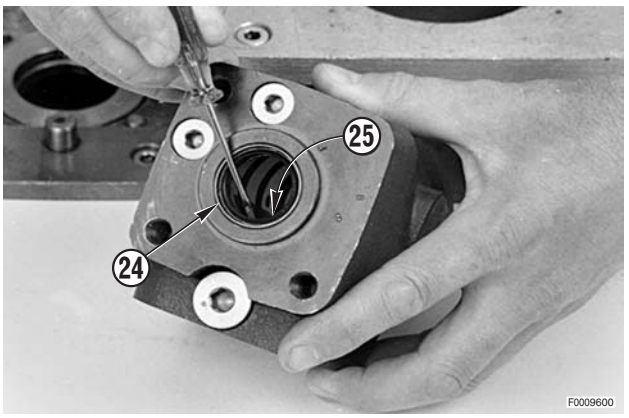
12 - Carefully slide the inner sleeve (17a) out of the outer sleeve (17b).



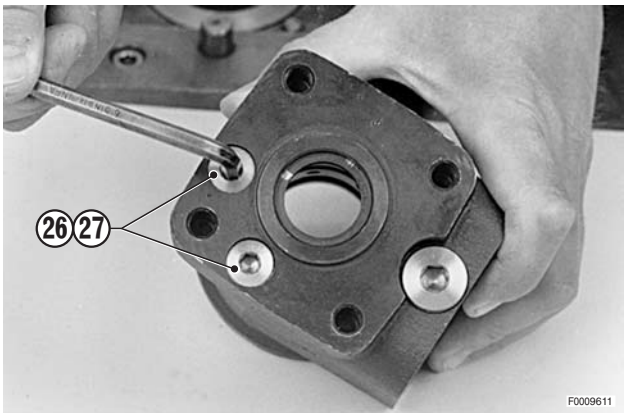
13 - Push the springs (23) into the neutral position and withdraw them from the inner sleeve (17a).



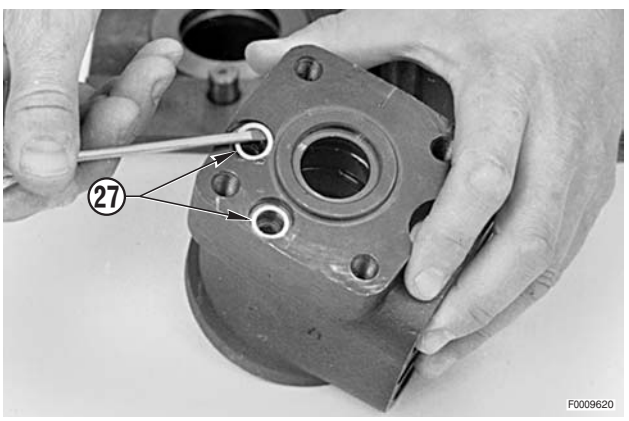
14 - Remove the dust seal (24) and the composite seal (25) (O-ring + gasket).



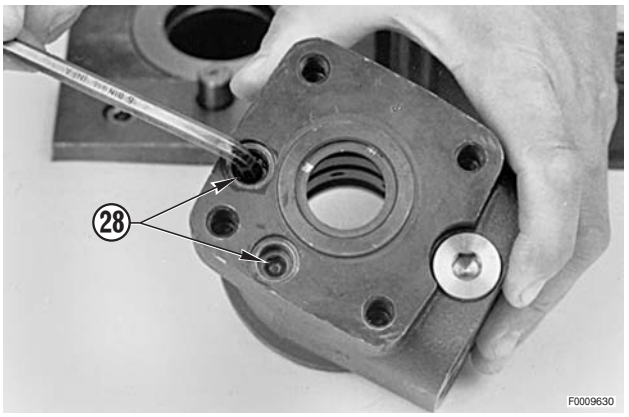
15 - Remove the plugs (26) of the anti-shock valve.



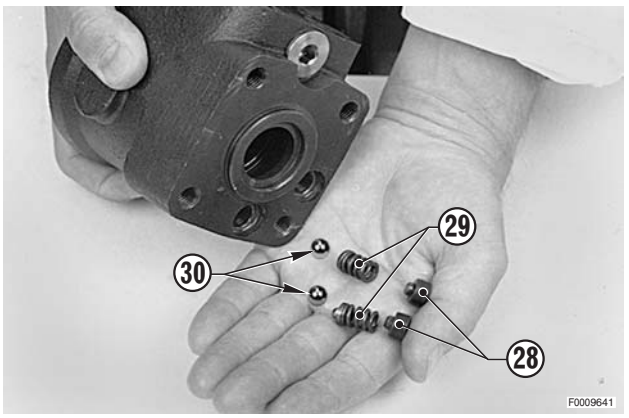
16 - Remove the seals (27).



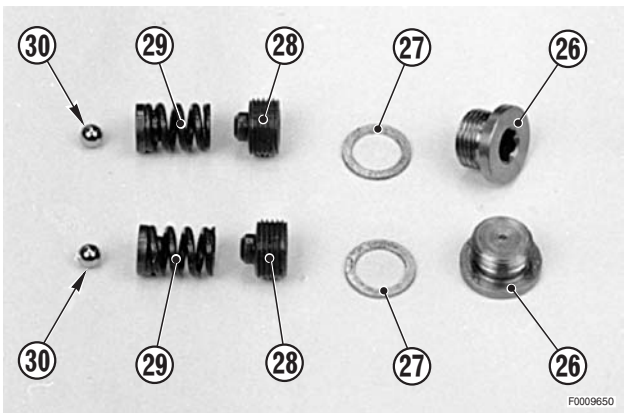
17 - Remove the calibration screws (28).



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

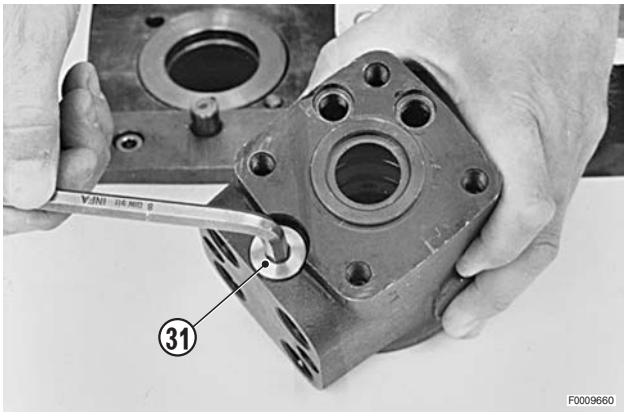


19 - Check that all the valve parts are present as show in the photo.

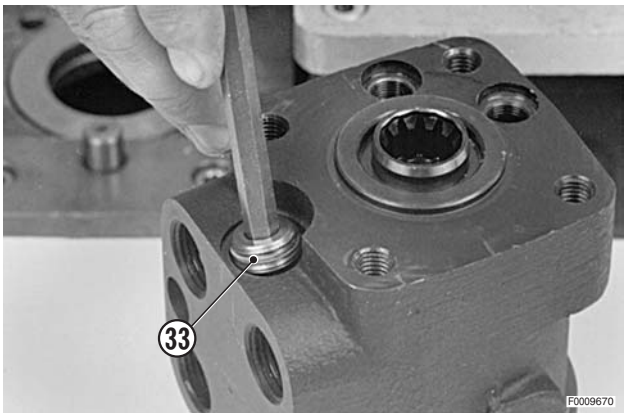


Removal of the safety valve

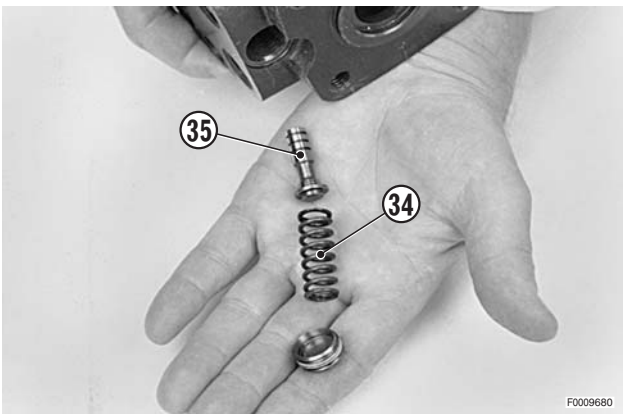
20 - Remove the plug (31) and the relative seal.



21 - Remove the maximum pressure adjustment screw (33).



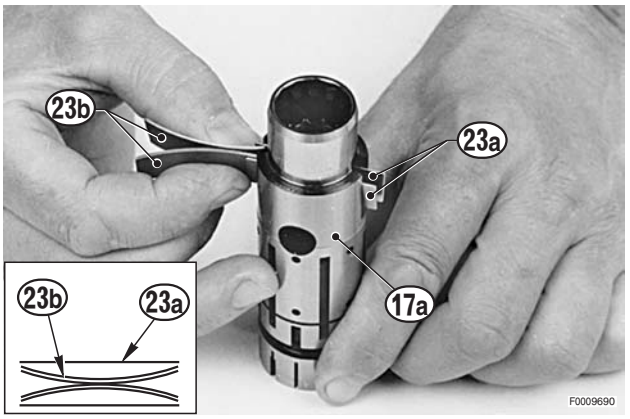
22 - Turn the power steering unit upside down and remove the spring (34) and valve (35).
★ The valve seat is a force fit in the power steering housing and cannot be removed.



ASSEMBLY OF THE POWER STEERING UNIT

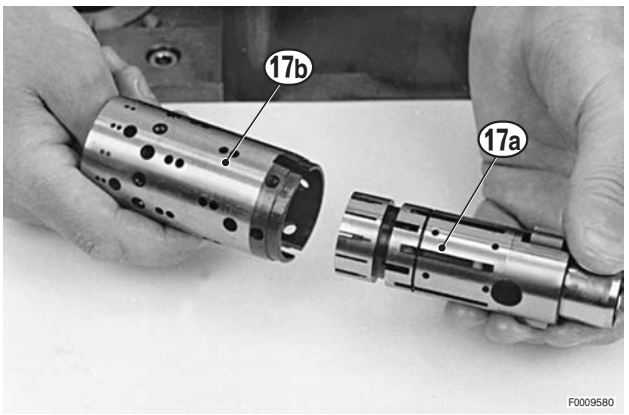
★ Before assembly, lubricate all components with gearbox oil.

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.

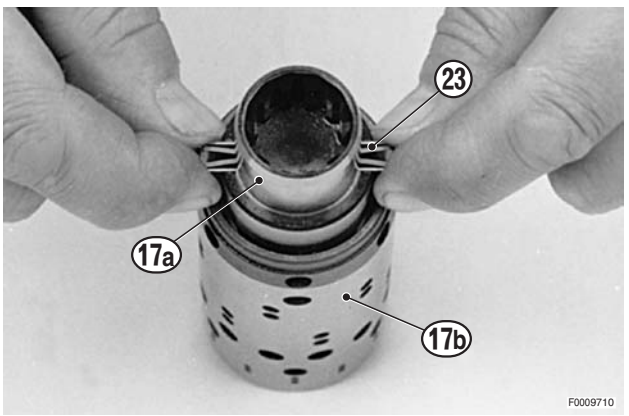


2 - Align the springs (23).

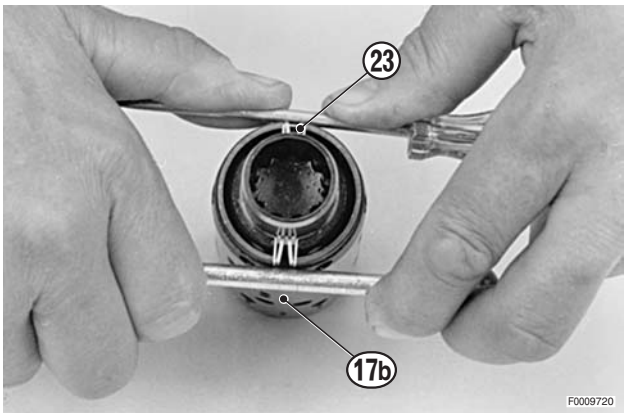
3 - Insert the inner sleeve (17a) in outer sleeve (17b).
★ Check that the relative positions of the inner and outer sleeve are as described in stage 1.



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

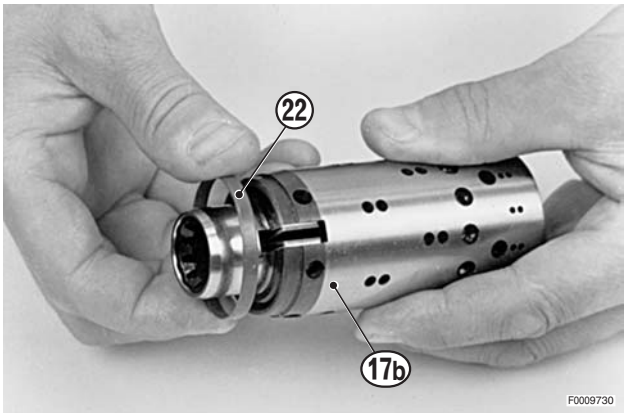


5 - Align the springs (23) and position them centrally relative to the diameter of the outer sleeve (17b).

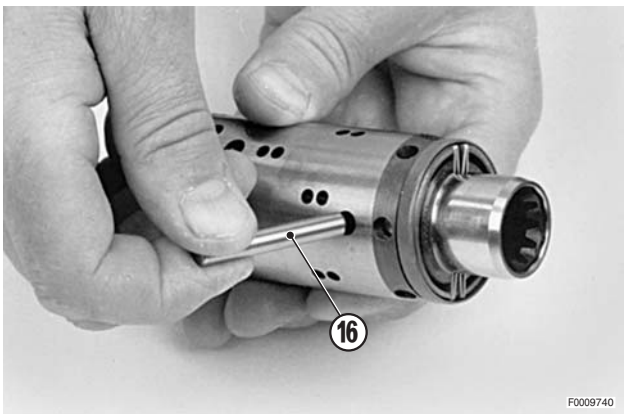


6 - Fit the ring (22) on to its seating on the outer sleeve (17b).

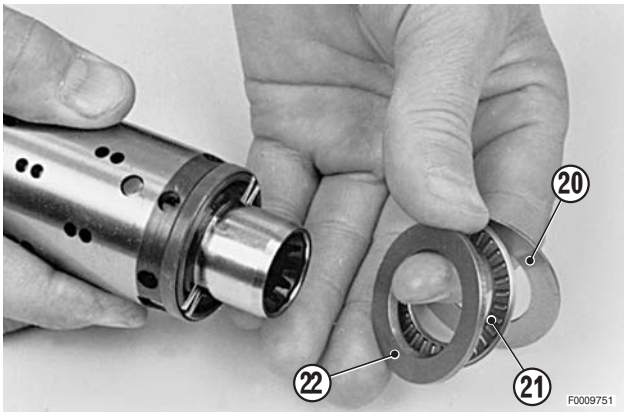
★ The ring (22) must rotate freely without interference with the springs (23).



7 - Insert the trim pin (16).

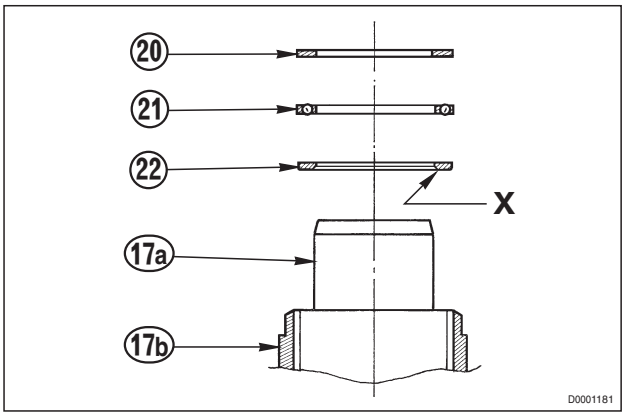


8 - Fit the thrust bearing parts in the order indicated in the assembly diagram in point 9.

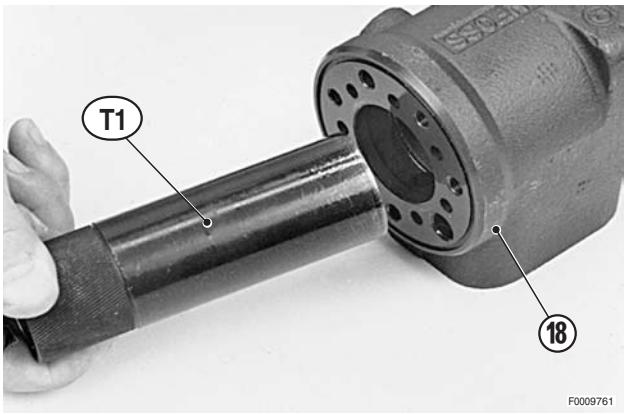


9 - Bearing assembly diagram
17a -Inner sleeve
17b -Outer sleeve
21- Needle roller bearing
20 -Inner thrust washer
22 -Outer thrust washer

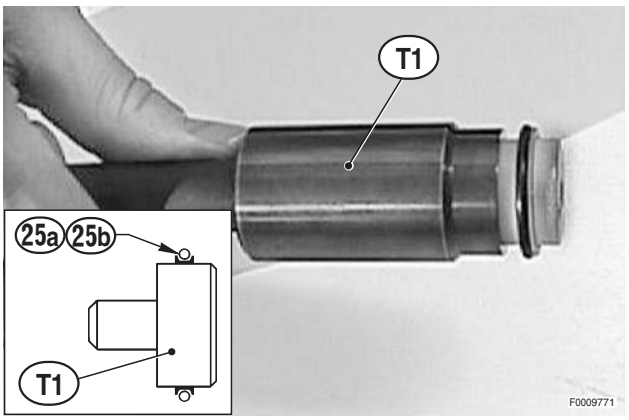
⚠ The chamfer "**X**" of the outer thrust washer must be oriented towards the shoulder on the inner sleeve.



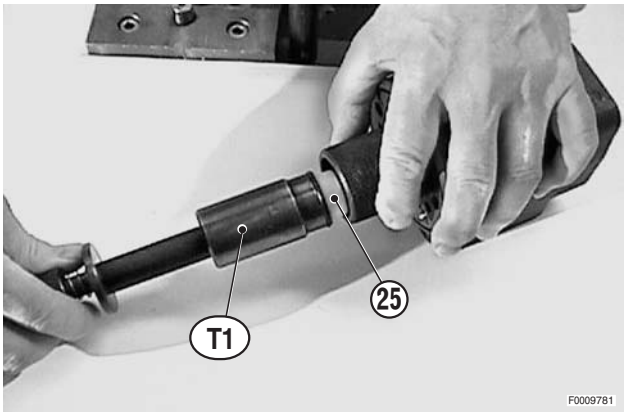
10 - Position the steering unit (18) so that the central bore is horizontal.
Insert the guide of tool **T1** (code 5.9030.480.0) into the bore of the inner/outer sleeve assembly.



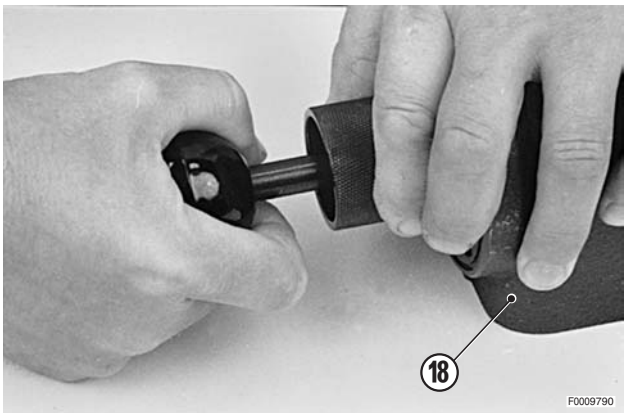
11 - Oil the seal (25a) and O-ring (25b) and fit them on the plunger of tool **T1** (code 5.9030.480.0).



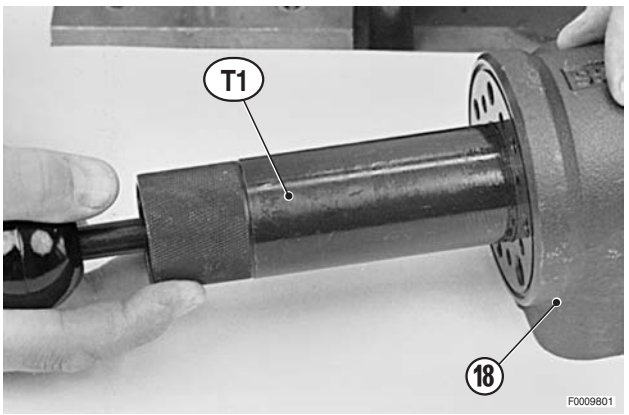
12 - Assemble tool **T1** (code 5.9030.480.0) and insert it in the guide previously inserted in the central bore of the power steering unit.



13 - Push the seal (25) into the seating in the power steering unit (18), turning it slightly to ensure correct positioning.

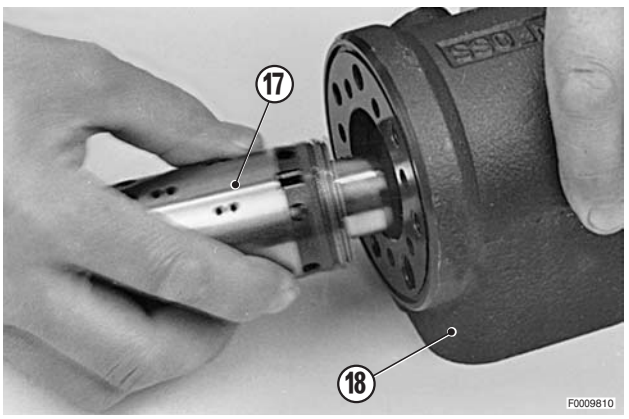


14 - Withdraw the tool **T1** (code 5.9030.480.0) and the guide from the steering unit housing, leaving the seal installer plunger in place.

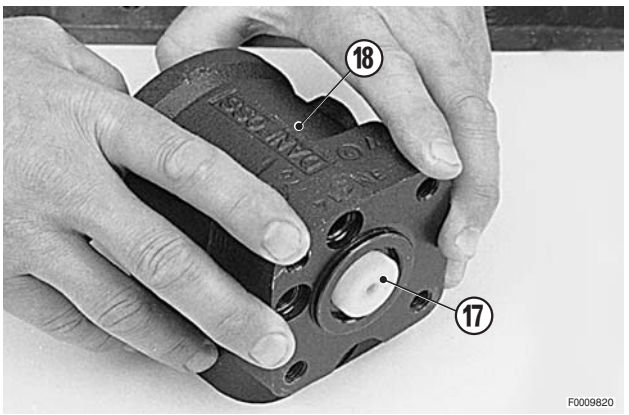


15 - Insert the spool assembly (17) in the bore of the power steering unit (18), turning its slightly to assist insertion.

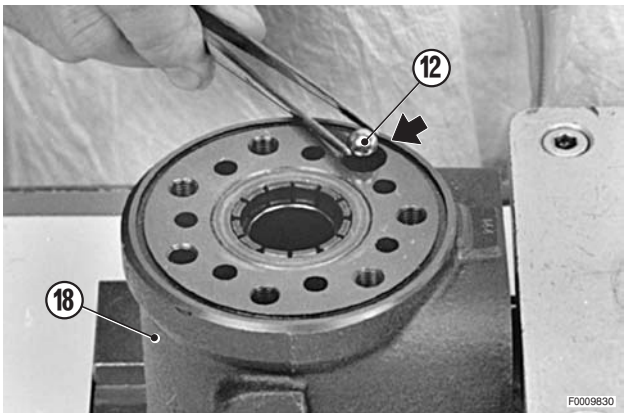
★ Insert the assembly while keeping the trim pin in a horizontal position.



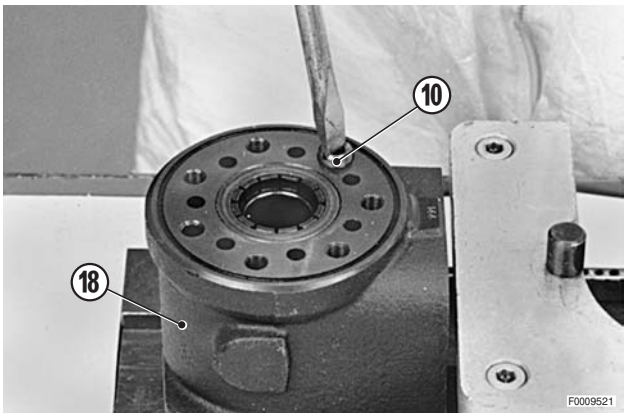
16 - Push the spool assembly (17) fully home in order to expel the seal installer plunger left in the bore in step 14.



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.

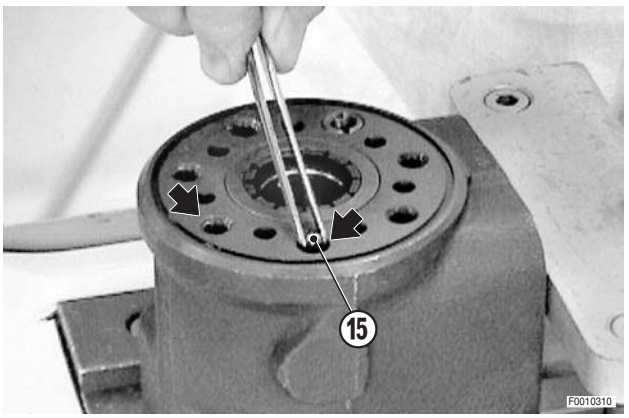


18 - Screw the stop bush (10) into the safety valve hole.
★ The top of the bush must be positioned lower than the face of the steering unit housing (18).

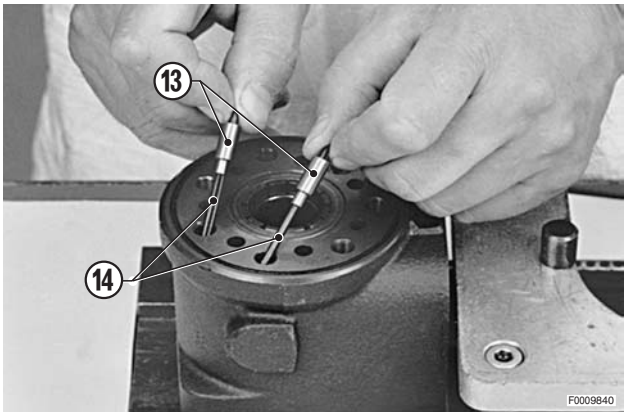


Assembly of the anti-cavitation valve

19 - Insert the balls (15) into the two holes indicated by the arrows.

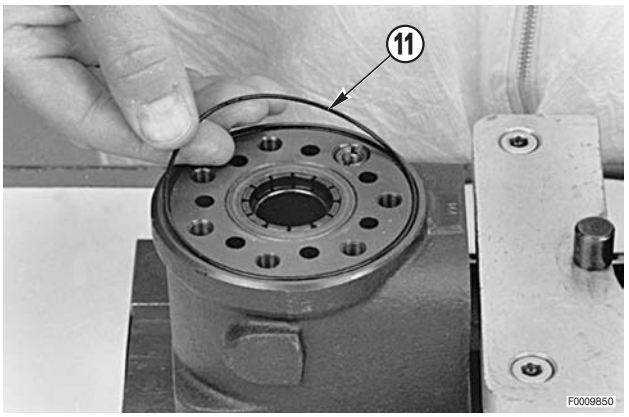


20 - Insert the valve stems (13) complete with springs (14) into the same holes.

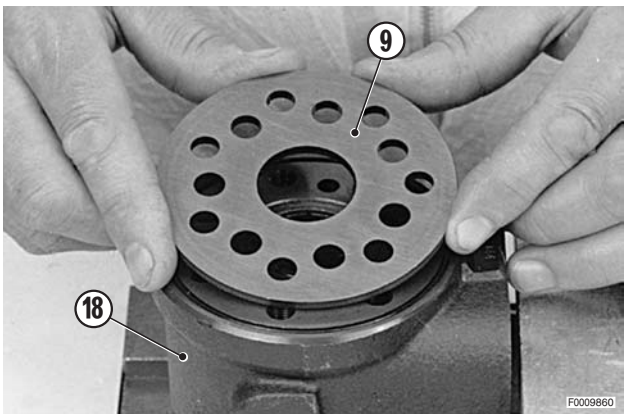


21 - Oil the O-ring (11) and fit it in its seat.

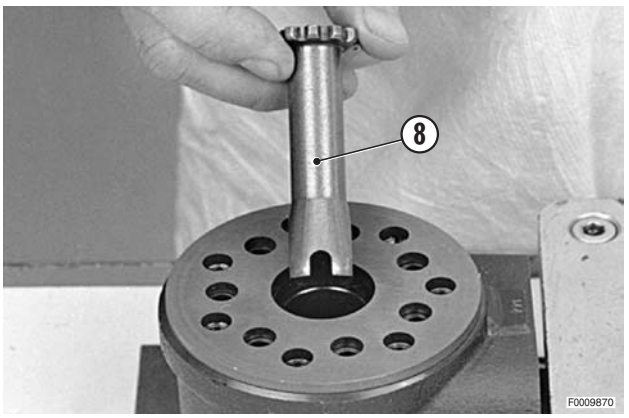
O-ring: gearbox oil



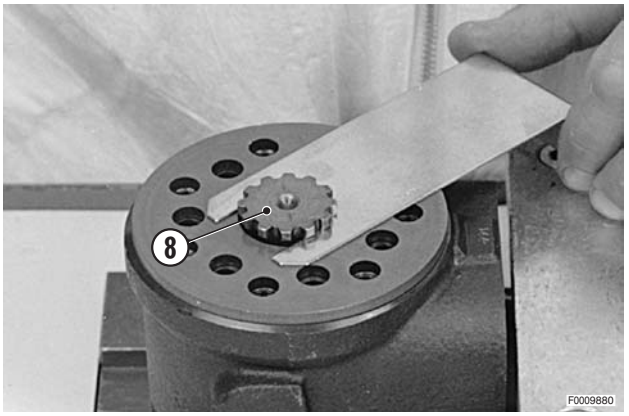
22 - Position the distributor plate (9) so that its holes are aligned with those in the power steering housing (18).



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.

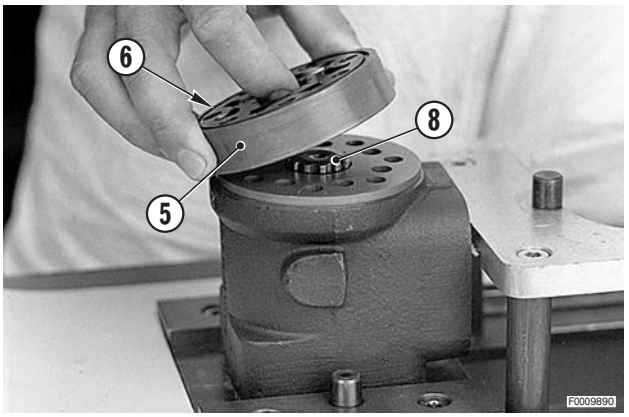


24 - Position the shaft vertically and hold it in place using the specific tool.

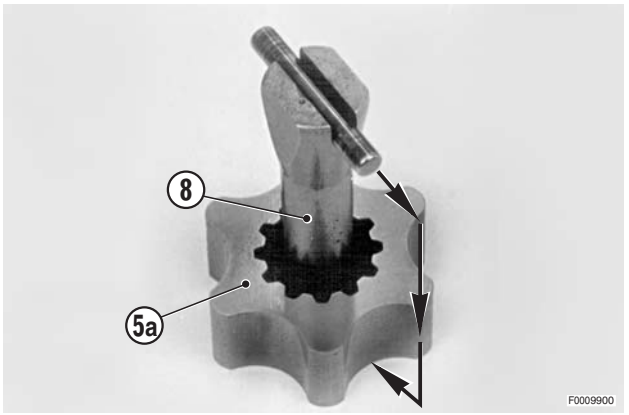


25 - Oil the two O-rings (6) and install them in the two seats in the rotor assembly (5).

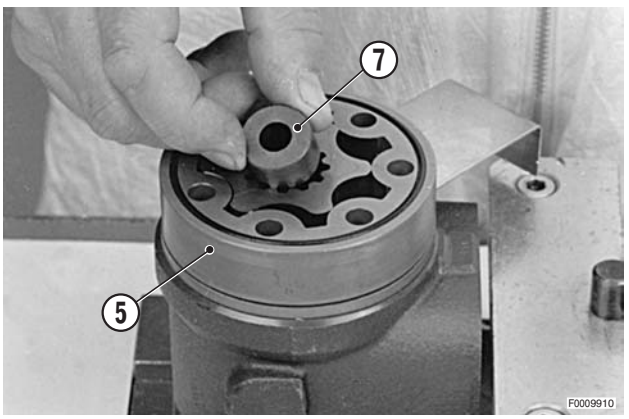
O-rings: gearbox oil



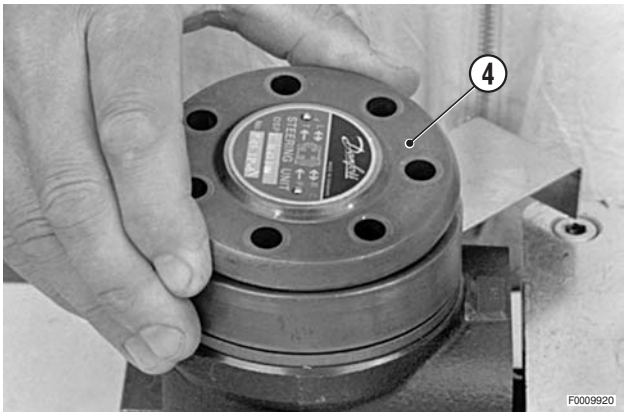
Fit the inner rotor (5a) on the shaft (8) so that the lowest part between two lobes of the rotor is aligned with the trim pin groove on the shaft. The rotate the outer rotor (5) to align the fixing holes.



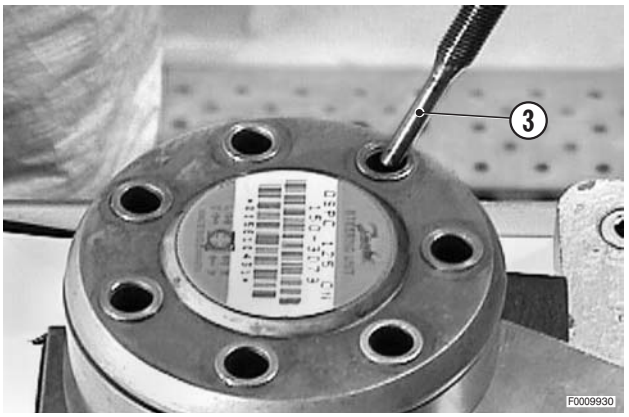
26 - Fit the distance piece (7).



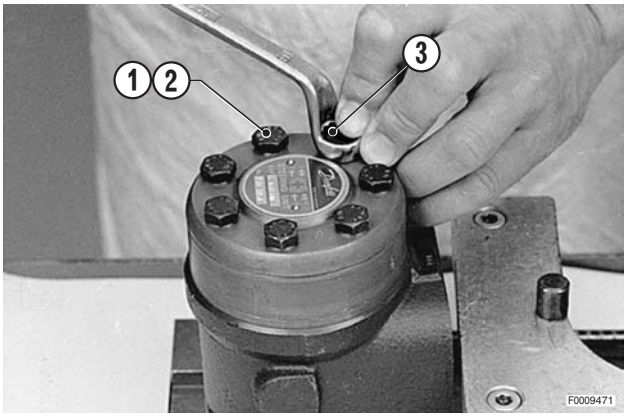
27 - Fit the cover (4).



28 - Insert the special screw (3) complete with washer (2) in the hole shown in the photo.

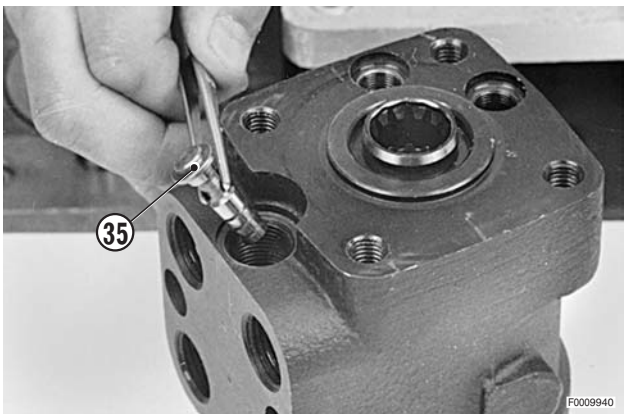


29 - Insert the six screws (1) with washers (2).
Tighten the screws(1) and (3) in crosswise pattern to a torque of 30±6 Nm (22.1±4.4 lb.ft.).

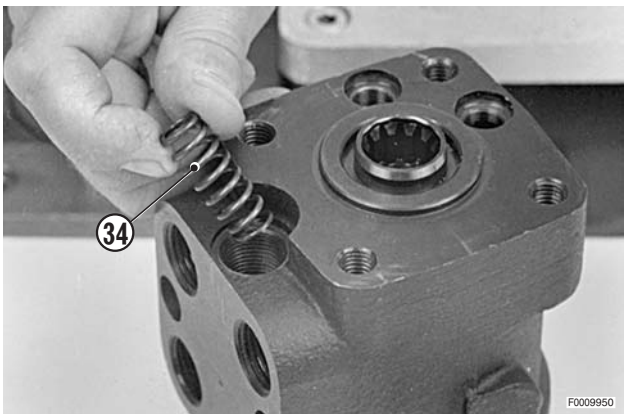


Assembly of the pressure relief valve

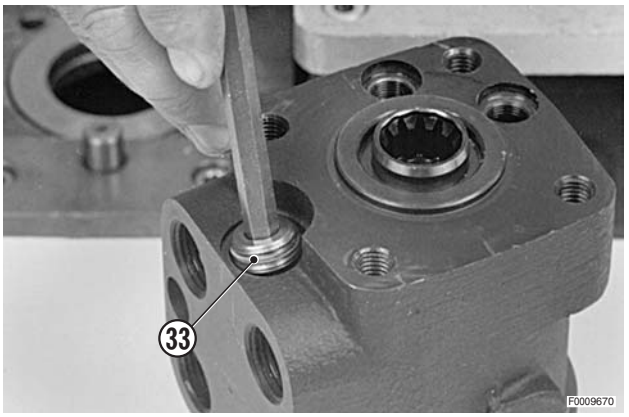
30 - Insert the valve (35).



31 - Insert the spring (34).

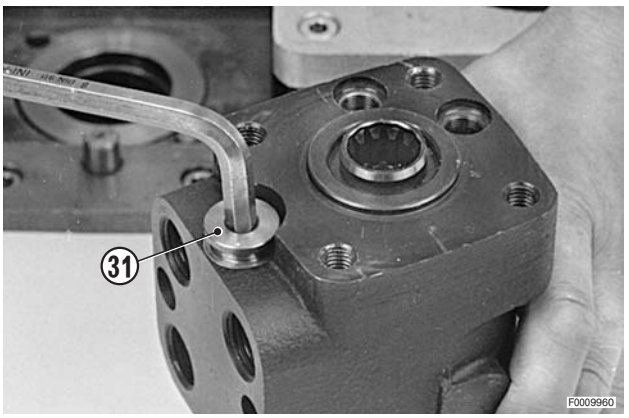


32 - Fit the pressure adjuster screw (33).
★ Set the maximum operating pressure on a test bench.
★ Pressure: 150±5 bar (2175.5±72.5 psi)

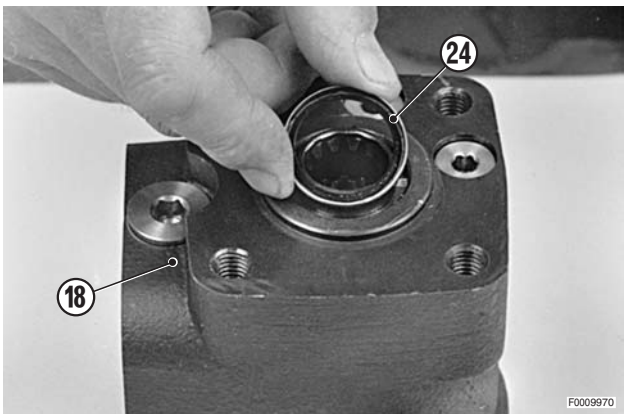


33 - Fit plug (31) complete with seal.

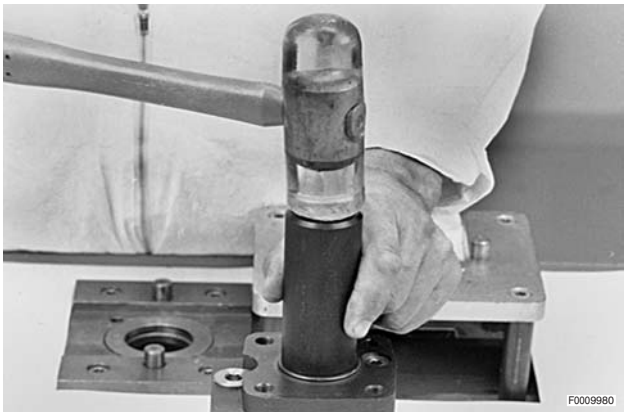
Nm Plug: 50±10 Nm (36.8±7.4 lb.ft.)



34 - Position the dust seal (24) in the power steering unit housing (18).

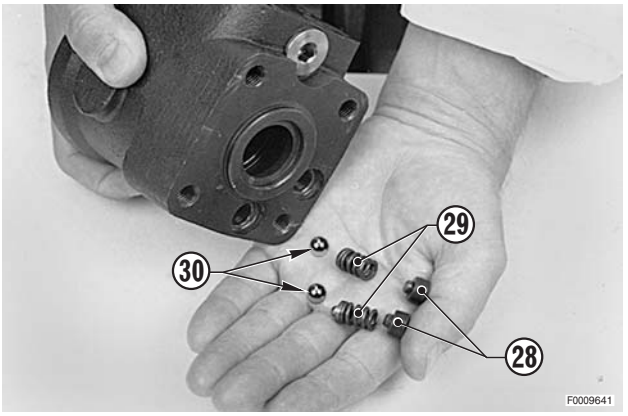


35 - Drive the dust seal (24) into its seating using a suitable drift and a plastic mallet.

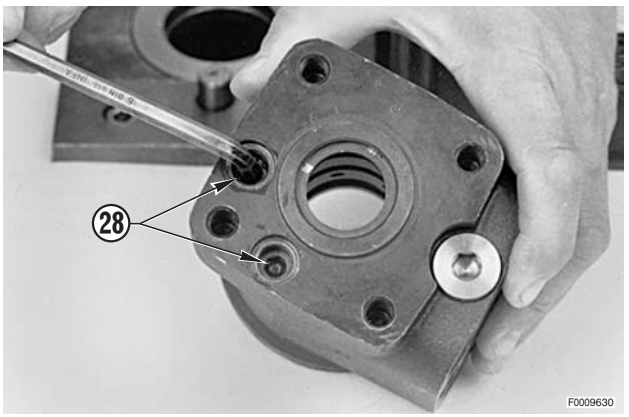


Assembly of shock valves

36 - Insert the balls (30), springs (29) and setscrews (28) in their sockets.

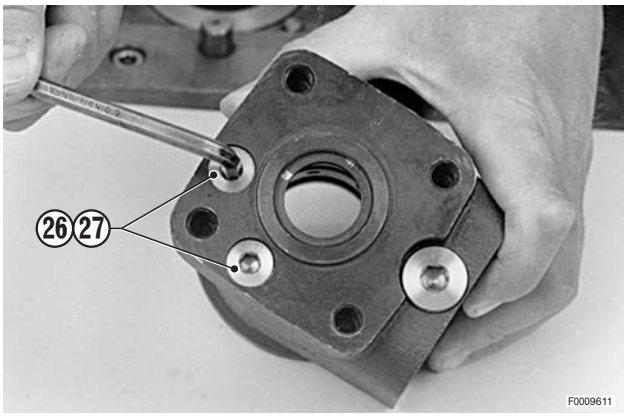


37 - Lock the setscrews (28) in their seats.



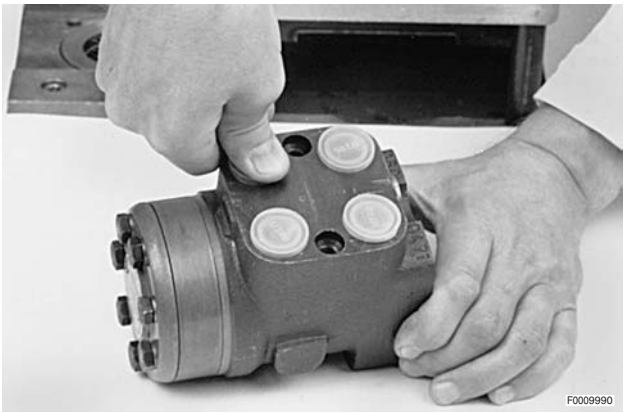
38 - Fit the seals (27) and screw in the plugs (26).

Nm 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 trunnion mounting.**

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**".

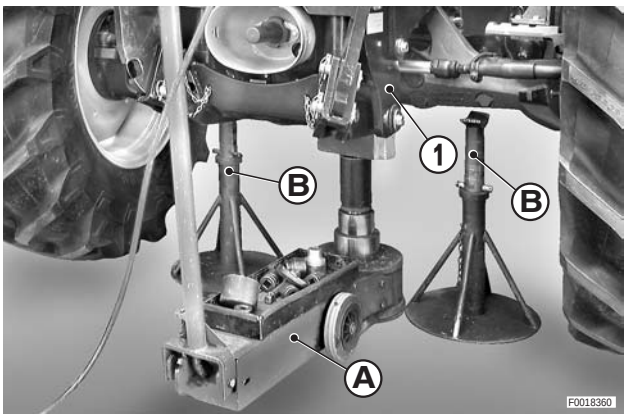
★ Capacity of axle stands "**B** ": 2 tonnes min

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

Nm 4WD wheel nuts: 350 Nm (258 lb.ft.)

★ Tighten the wheel nuts gradually in a crosswise sequence.

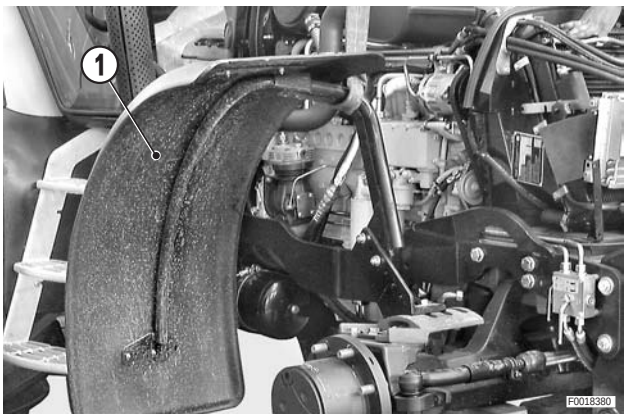
REMOVAL OF THE FRONT FENDERS

★ 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.

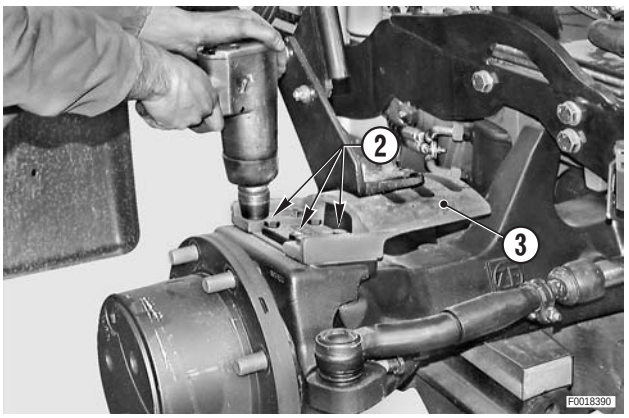
1 - Remove the front wheels.
(For details, see, «REMOVAL OF THE FRONT WHEELS»).

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

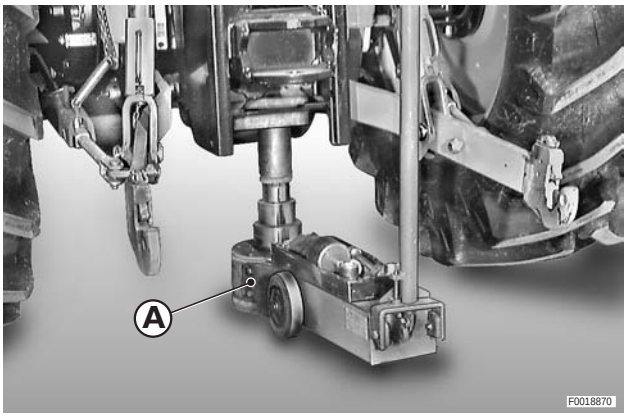
- Refitting is the reverse of removal.

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.

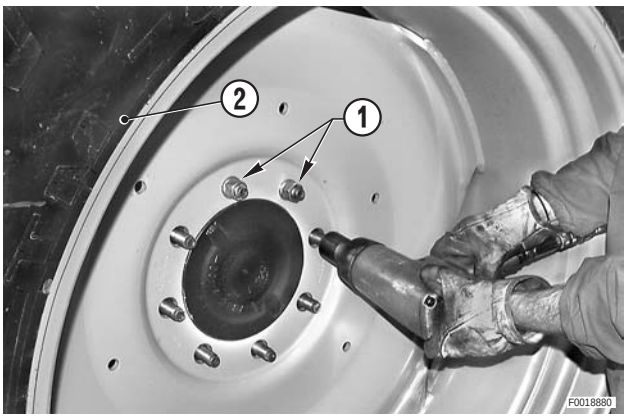
2 - Elevate the tractor until the tyre of the front wheel to be removed just clears the ground.



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).

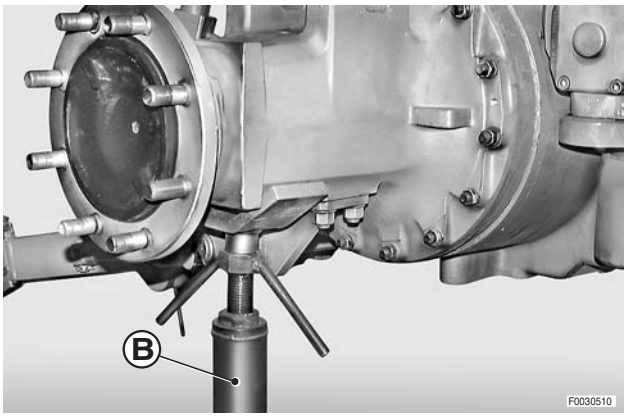


5 - Position under the rear axle an axle stand "**B**" with lateral retaining wings for safety and lower the trolley jack until the axle is resting on the axle stand.

★ Axle stand load capacity: 3 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

Nm Wheel nuts:
M18x1.5: 370 Nm± 10%(273 lb.ft.±10%)
M20x1.5: 600 Nm±10% (442 lb.ft.±10%)

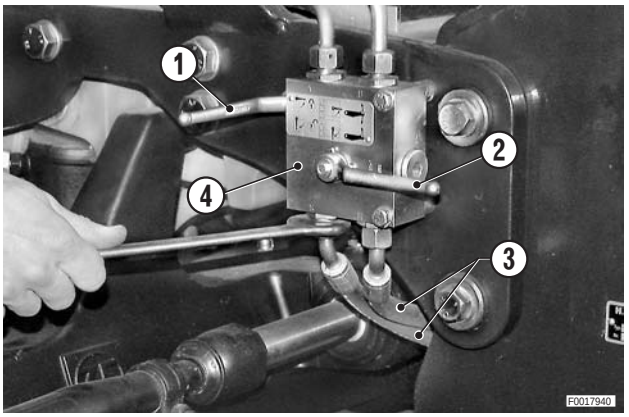
★ Tighten the wheel nuts gradually in a crosswise sequence.

REMOVAL OF THE LIFT VALVE BLOCK

⚠ Fully lower the lift and switch off the engine.

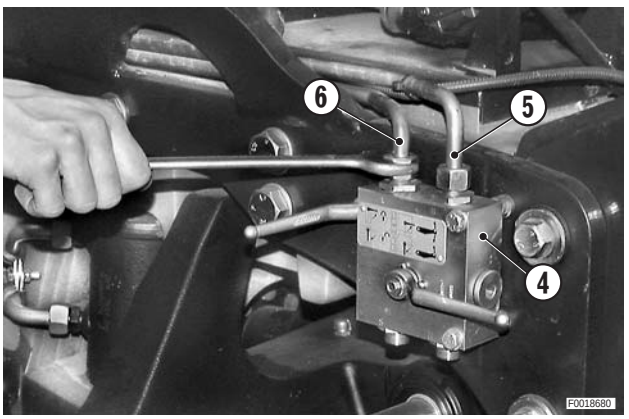
1 - With the control levers (1), (2) in the horizontal position, label the lower pipes (3) and disconnect them from the valve block (4).

★ Label the pipes to avoid confusion on reconnection.

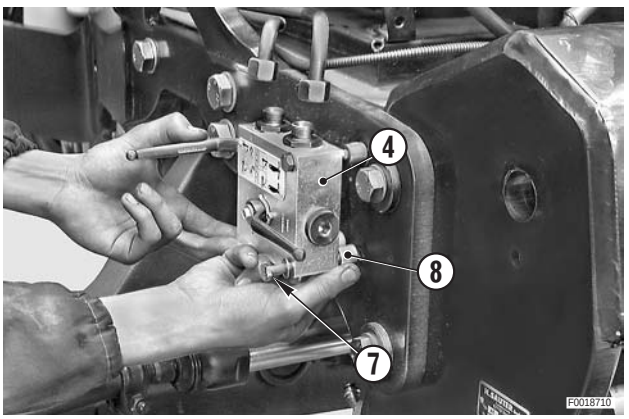


2 - Disconnect the rigid upper pipes (5), (6).

★ Plug the ends of the pipes to prevent the entry of contaminants.



3 - Unscrew the bolts (7) and remove the valve block (4) with the rear spacers (8).



REFITTING THE LIFT VALVE BLOCK

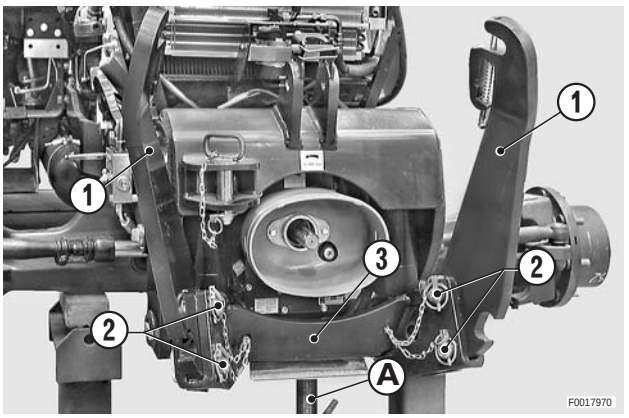
- Refitting is the reverse of removal.

REMOVAL OF THE FRONT LIFT CYLINDERS

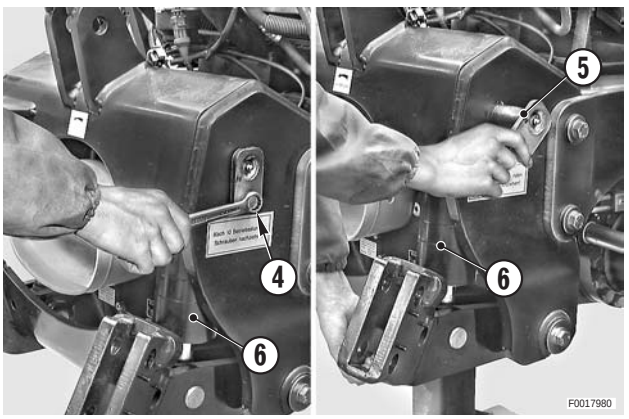
★ Raise the lift to its full height and switch off the engine.

1 - Remove the lift arms (1) and the pivot pins (2) along with their retaining chains.

2 - Position under the lift assembly (3) a jack "**A**" which can be lowered at least 10 cm (4 in.).



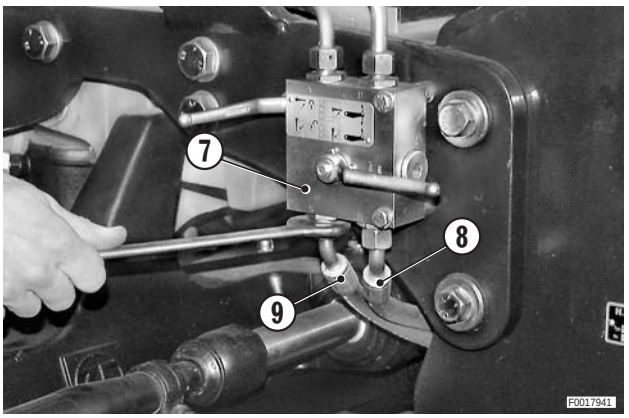
3 - Remove the bolts (4) and remove the upper pins (5) of the cylinders (6).



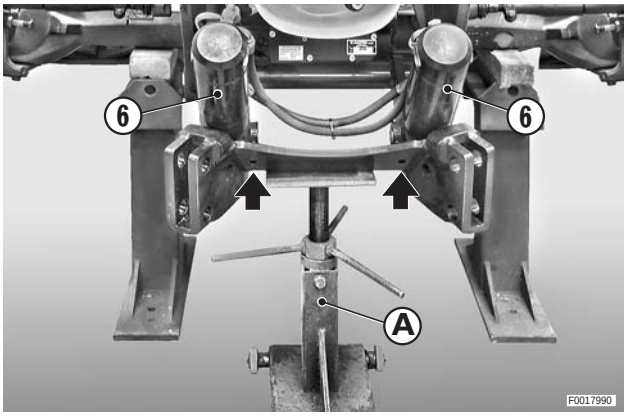
4 - Disconnect the cylinder feed pipes (8), (9) from the valve block (7).

Loosen the fitting by a few turns, but before fully disconnecting them, push them to detach them from the couplers and release any residual pressure in the system.

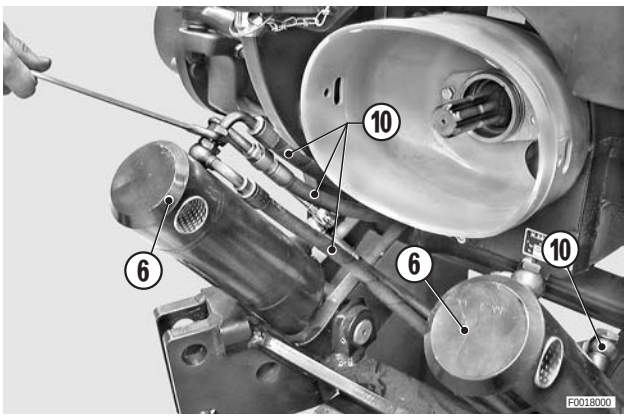
★ Label the pipes to avoid confusion on reconnection.



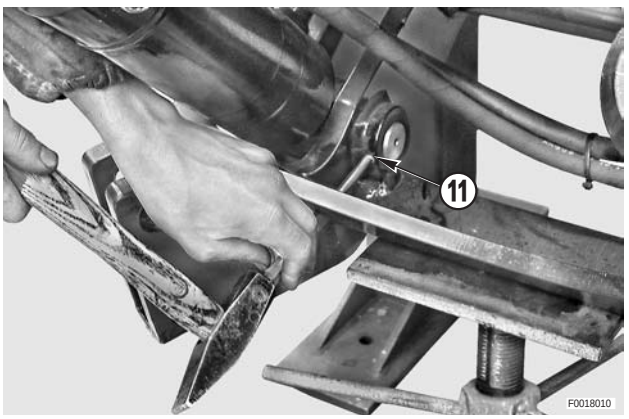
5 - Lower the jack "**A**" until the cylinders (6) can be tilted outwards in order to access the connection pipes and to align the hole provided for removal of the spring pins securing the lower pivot pins of the cylinders.



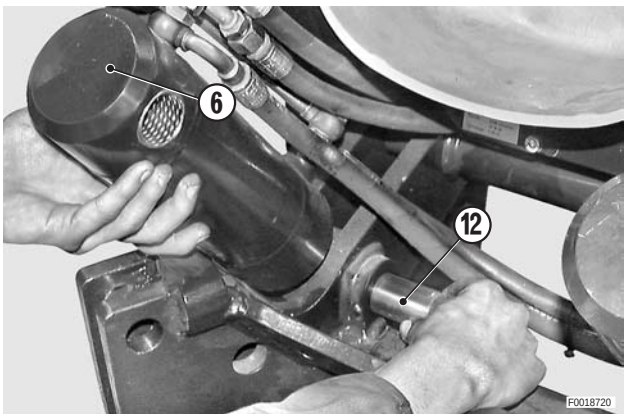
6 - Disconnect the four pipes (10) from the cylinders (6).
★ Label the pipes to avoid confusion on reconnection.



7 - Using a pin punch, remove the spring pins (11) securing the lower cylinder pivot pins.



8 - Withdraw the pivot pins (12) and remove the cylinders (6).



REFITTING OF THE FRONT LIFT CYLINDERS

- Refitting is the reverse of removal.

1 - Start the engine and repeatedly raise and lower the lift to the limit of its travel in order to bleed the system and check for leaks.

2 - Stop the engine, check the gearbox oil level and top up if necessary.

REMOVAL OF THE FRONT LIFT ASSEMBLY

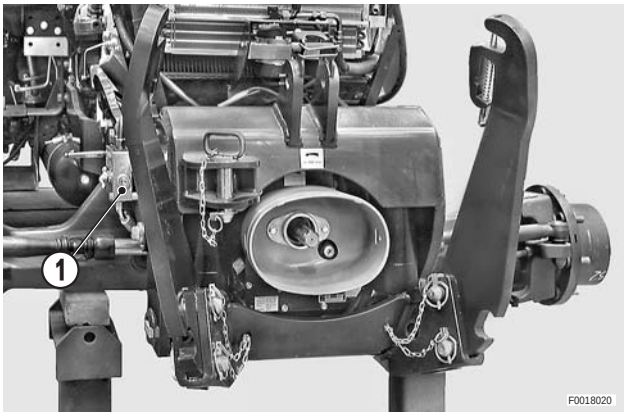
★ Raise the lift arms to the maximum height and stop the engine.

1 - Disconnect the lower pipes from the valve block (1).

Loosen the fitting by a few turns, but before fully disconnecting them, push them to detach them from the couplers and release any residual pressure in the system.

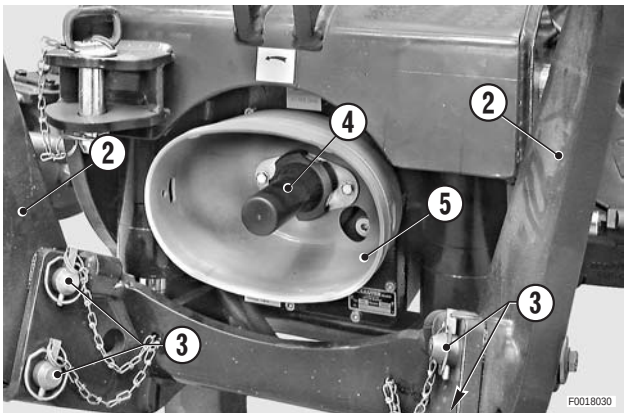
★ Label the pipes to avoid confusion on reconnection.

★ Plug the ends of the pipes and the open fittings on the valve block to prevent the entry of contaminants.

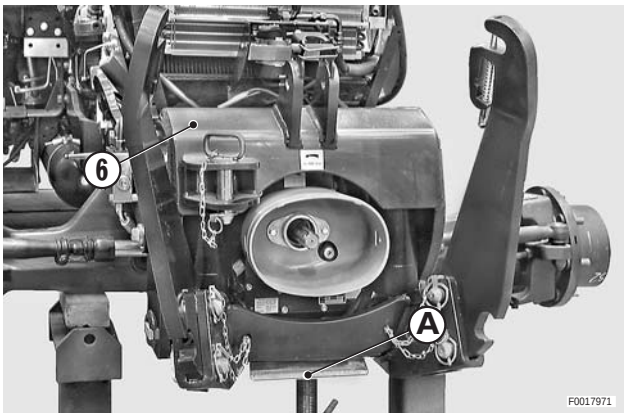


2 - Remove the lift arms (2) and the pivot pins (3) complete with their retaining chains.

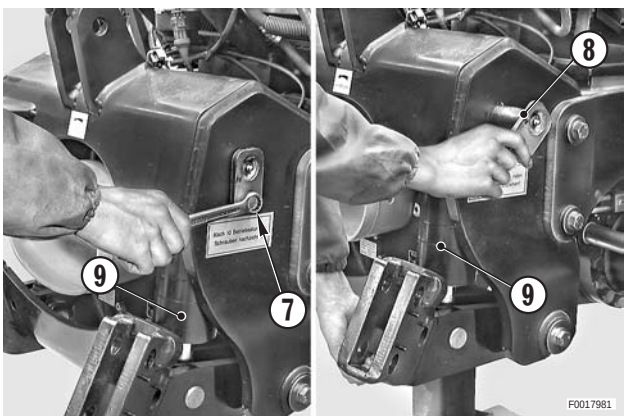
3 - Remove the shaft end cover (4) and the shield (5).



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

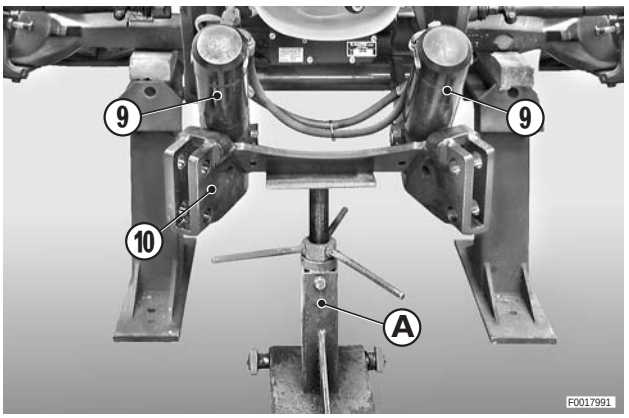


5 - Remove the bolts (7) and remove the upper pivot pins (8) of the cylinders (9).



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

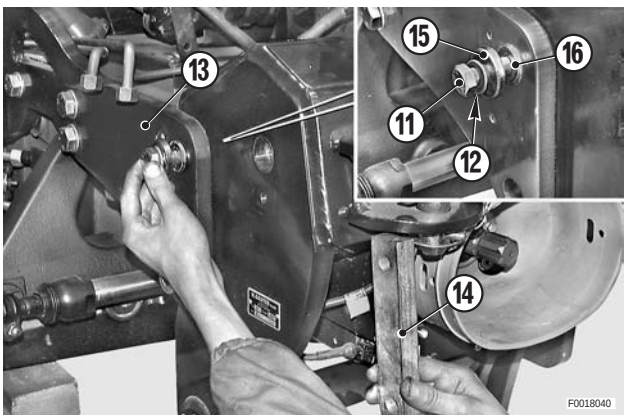
7 - Remove the jack "**A**" and guide the rocker assembly (10) to the vertical position.



8 - Unscrew and remove the bolts (11) and washers (12) securing the brackets (13); recover the inner brackets (14).

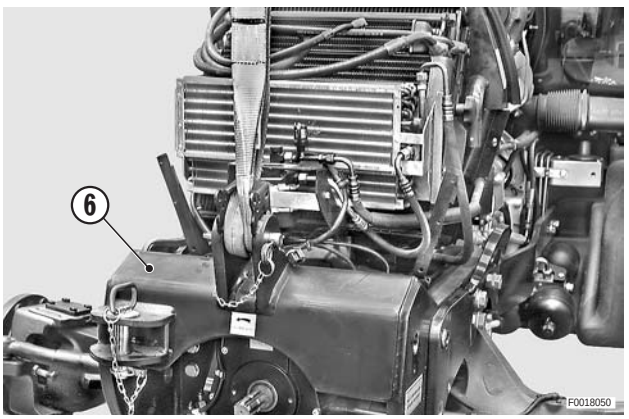
9 - Remove the spacer (15) and the lower bushes (16).

★ Do not remove the upper bushes yet for safety.



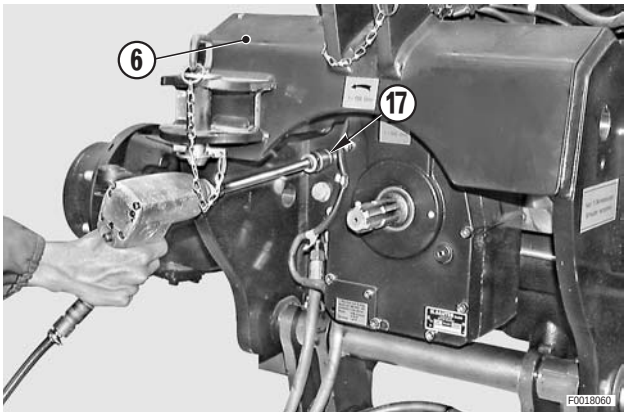
10 - Attach a hoist to the lift assembly (6) and put the lifting slings under slight tension.

kg Lift: 80 kg (176 lb.)

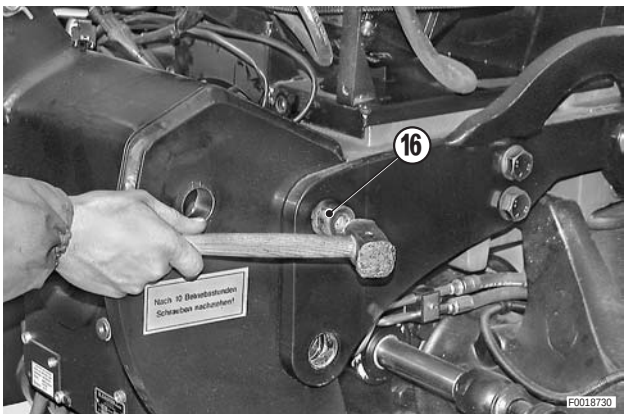


11 - Unscrew and remove the ten bolts (17) and washers securing the lift (6) to the front carrier.

※ 1



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

Nm Bolts M16: 214 Nm (158 lb.ft.)
Bolts M20: 455 Nm (355 lb.ft.)

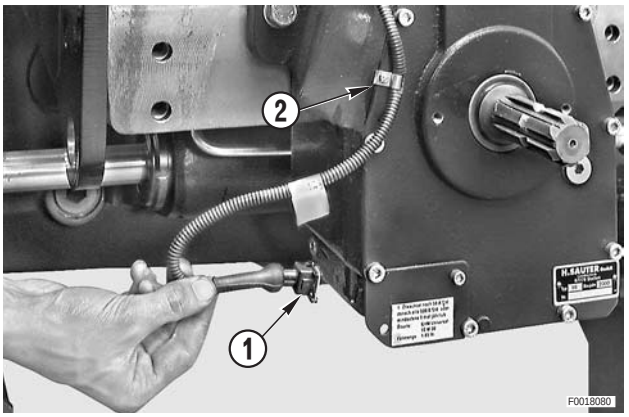
1 - Start the engine, repeatedly raise and lower the lift to its maximum travel to bleed the system and check for leaks.

2 - Stop the engine, check the gearbox oil level and top up if necessary.

REMOVAL OF THE FRONT PTO ASSEMBLY

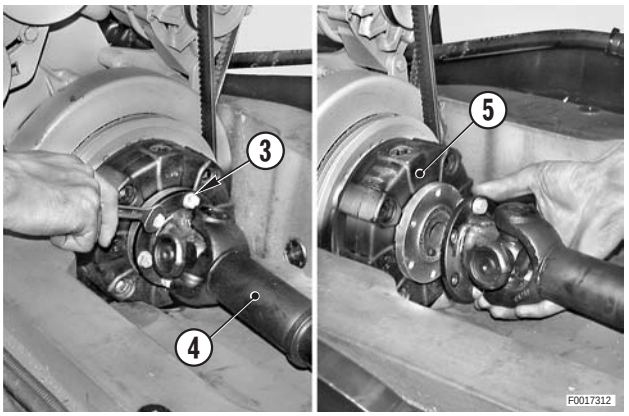
1 - Remove the front lift assembly.
(For details, see «REMOVAL OF THE FRONT LIFT ASSEMBLY»)

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



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

※ 1



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

★ Leave the two upper bolts in position for safety.

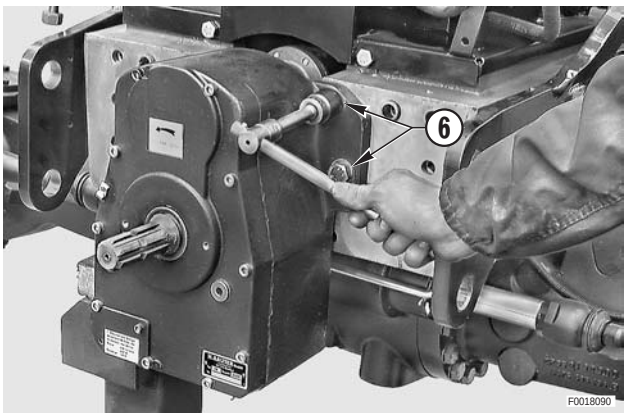
※ 2

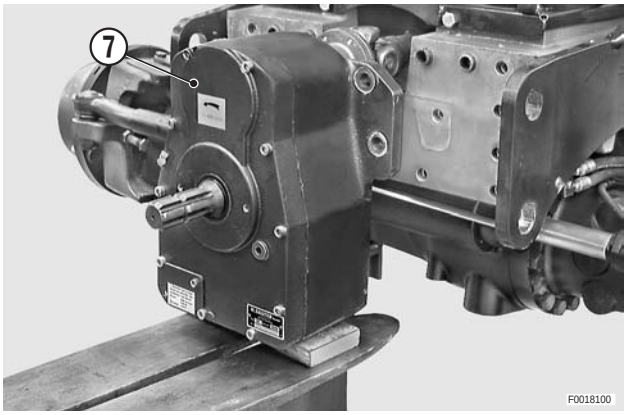
5 - Fit a non-slip block to a trolley jack; position the non-slip block under the PTO assembly.

6 - Remove the two upper bolts previously left for safety and remove the PTO assembly (7) while supporting the cardan shaft (4).

★ If necessary, use a lever to help separate the assembly from the tractor.

kg PTO: 70 kg (154 lb.)





REFITTING THE FRONT PTO ASSEMBLY

- Refitting is the reverse of removal.

※ 1

Nm Screws: 34 Nm (25 lb.ft.)

※ 2

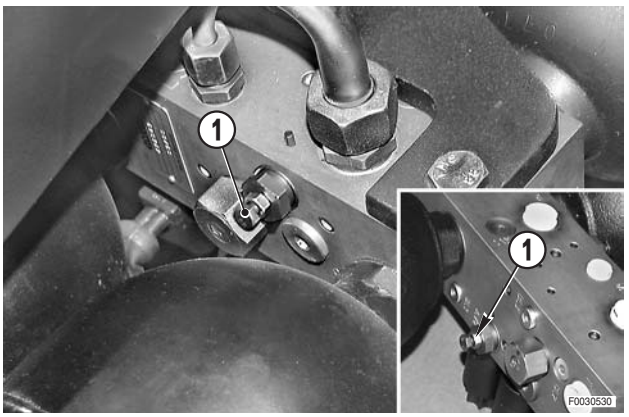
Nm Screws:214 Nm (157.7 lb.ft.)

REMOVAL OF THE FRONT SUSPENSION CYLINDERS
(Where fitted)

1 - Remove the front wheels.
(For details, see «REMOVAL OF FRONT WHEELS»).

2 - **Only if fitted.**
Remove the front lift reinforcing side members. (For details, see «REMOVAL OF REINFORCING SIDE MEMBERS»).

3 - Position a jack "**A**" with a non-slip block "**B**" under the front frame, under the front lift or under the front weight; elevate the front end and remove the stands from under the front axle.

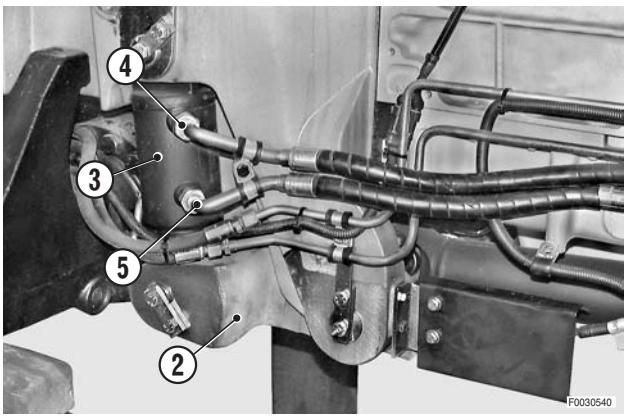


1 - Before switching off the engine, disengage the front suspension by pressing the push button in the cab for at least 20 seconds.

2 - Apply the parking brake.

Discharge the residual pressure from the suspension system by unscrewing the valves (1) about two full turns.

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



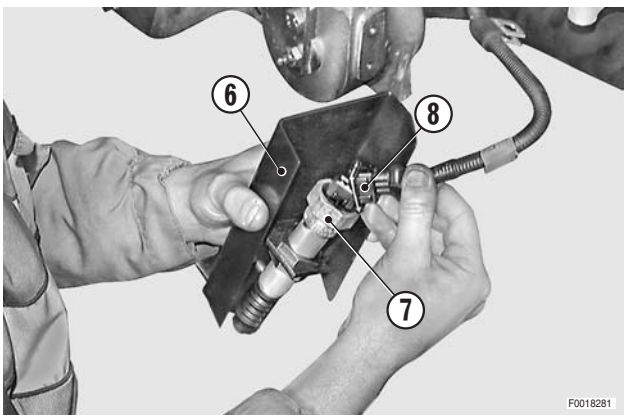
4 - Support the swinging support (2) with a jack that can be lowered through 10-15 cm.(4-6 in.).

5 - Disconnect the pipes (4), (5) from the left cylinder (3).

First loosen the fittings by a few turns, then, before disconnecting the pipes, push them to detach them from the couplers and release any residual pressure.

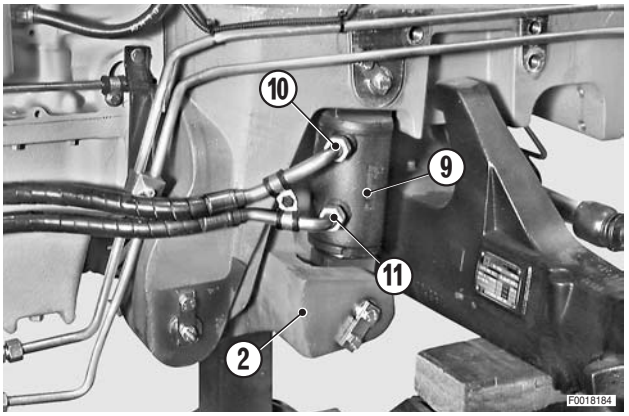
★ Plug the ends of the pipes to prevent the entry of contaminants.

6 - Remove the mounting bracket (6) of the position sensor (7) and unplug the connector (8). ⁘ 1

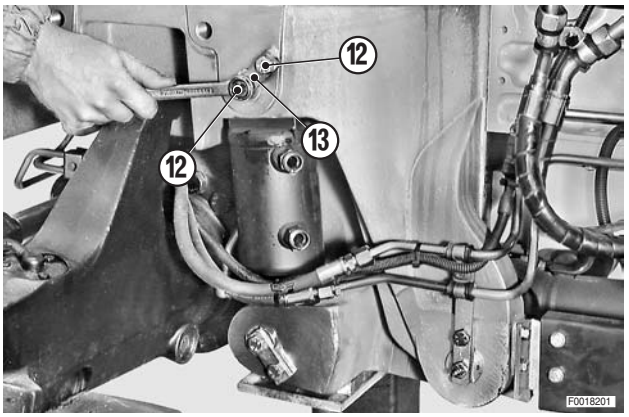


7 - Disconnect the pipes (10), (11) from the right cylinder (9).

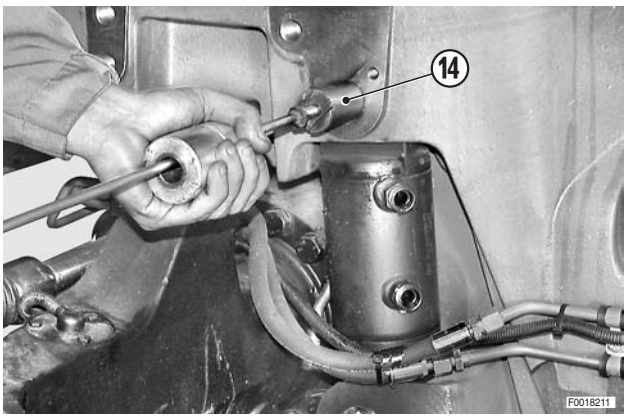
★ Plug the ends of the pipes to prevent the entry of contaminants.



8 - Remove the bolts (12) and the plates (13) securing the upper cylinder pivot pins.



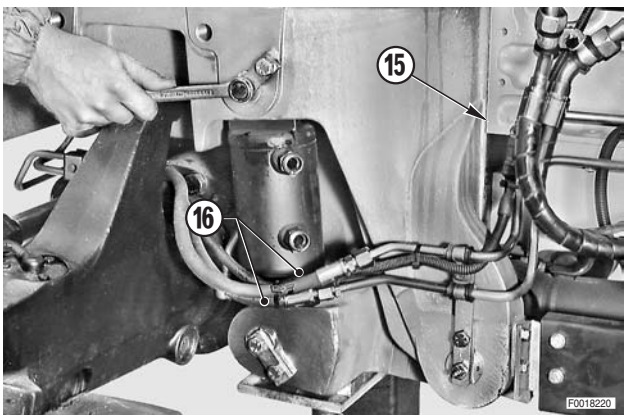
9 - Using a slide hammer puller, remove the upper pivot pins (14).



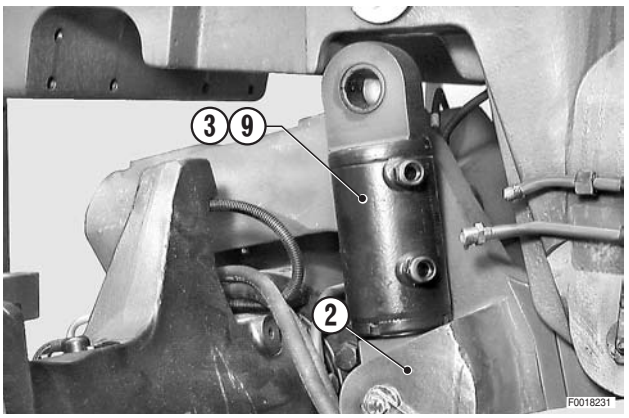
10 - Unplug the steering sensor connector (15) and release the wiring from the straps.

11 - Disconnect the steering cylinder pipes (16).

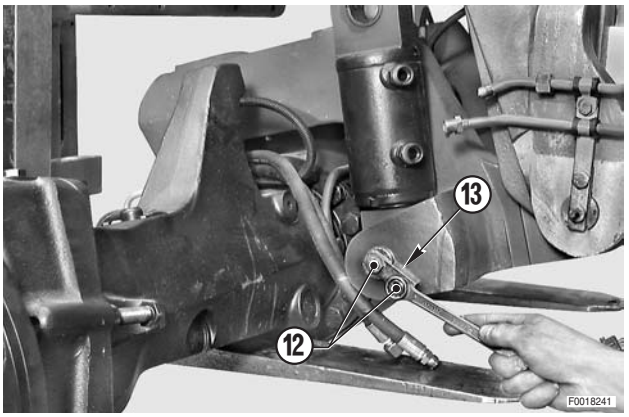
★ Plug the ends of the pipes to prevent the entry of contaminants.



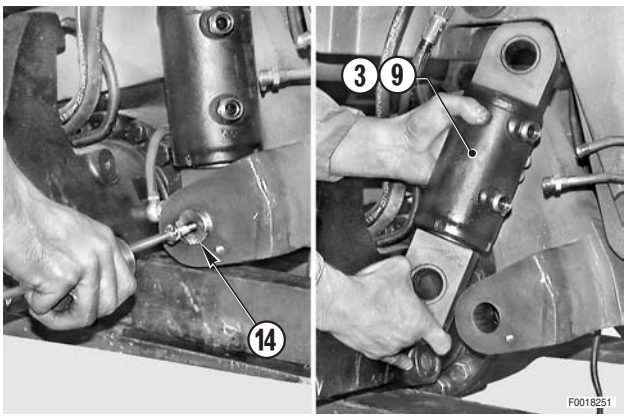
12 - Lower the support (2) to disengage the upper mountings of the cylinders (3), (9).



13 - Remove the bolts (12) and the plates (13) of the lower pivot pins.



14 - Using the slide hammer puller, remove the lower pivot pins (14) and the cylinders (3), (9).



REFITTING THE FRONT SUSPENSION CYLINDERS

- Refitting is the reverse of removal.

※1

★ Check the calibration of the position sensor. (For details, see «REMOVAL AND POSITIONING OF FRONT SUSPENSION POSITION SENSOR»)

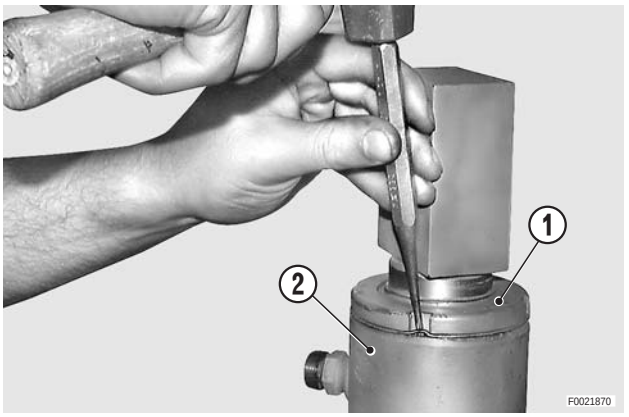
1 - Start the engine and turn the steering wheel repeatedly to full lock in both directions. Activate and deactivate the suspension a number of times to expel air from the system and check for leaks.

2 - Stop the engine, check the gearbox oil level and top up if necessary.

DISASSEMBLY AND ASSEMBLY OF THE FRONT SUSPENSION CYLINDERS

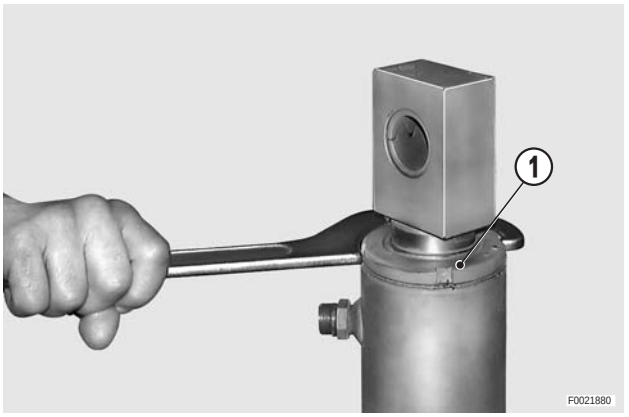
1. Disassembly

1 - Relieve the staking on the lock washer located between the end cap (1) and the cylinder (2).



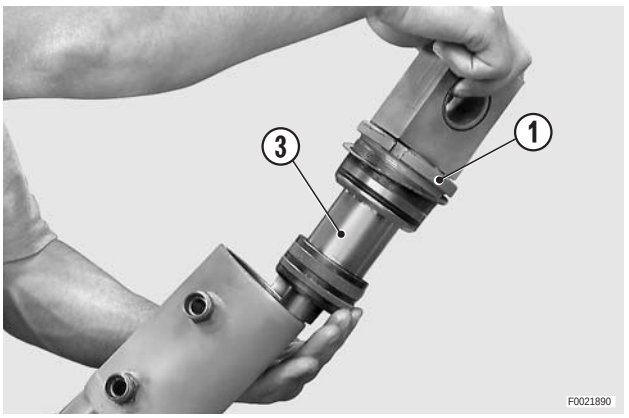
2 - Using a pin wrench, unscrew the end cap (1).

※ 1



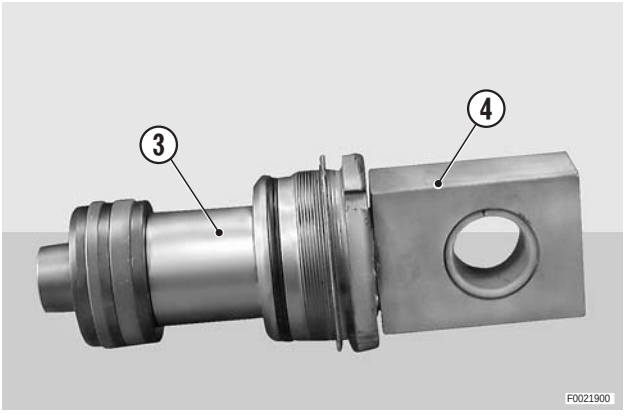
3 - Withdraw the rod (3) complete with end cap (1) and seals.

※ 2



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



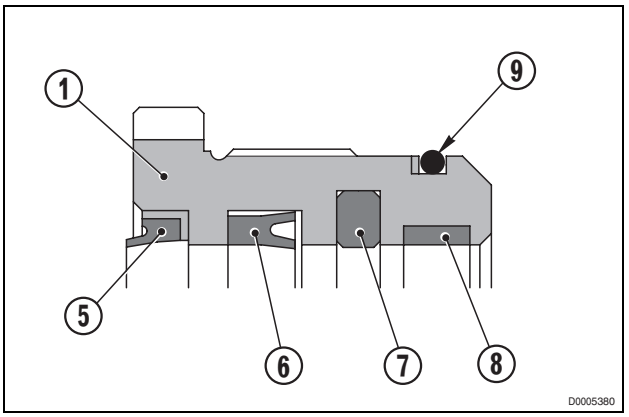
5 - Withdraw the end cap (1) from the rod and remove in order the rod wiper (5), the seals (6), (7) and the guide (8).

※ 2

★ Take care not to damage the seatings of the seals.

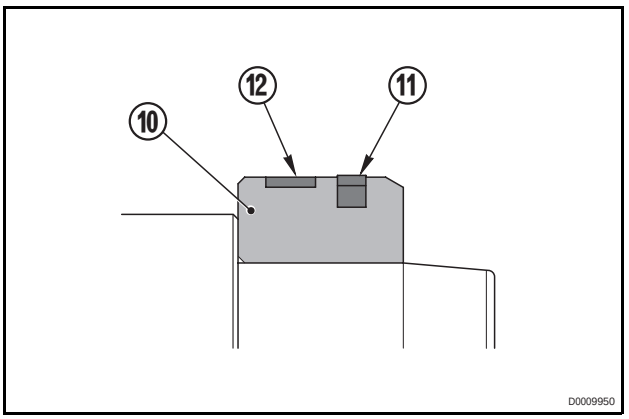
6 - Remove the O-ring seal (9).

★ Note which way round the seals are fitted.



7 - Remove the seal (11) and the guide (12) from the piston (10).

★ Take care not to damage the seal seating.



2. Assembly

- Assembly is the reverse of disassembly.

※ 1

Nm End cap: 320–370 Nm (236–273 lb.ft.)

※ 2

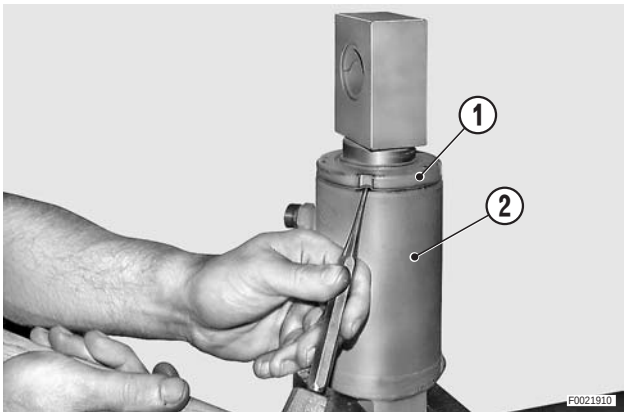
Seals: Gearbox oil

※ 3

Piston eye: Loctite 638

Nm Piston eye: 50–70 Nm (37–52 lb.ft.)

1 - Stake the lock washer tabs into the notch on the cylinder (2) and into one of the notches on the end cap (1).



REMOVAL OF THE FRONT AXLE AND SWINGING SUPPORT

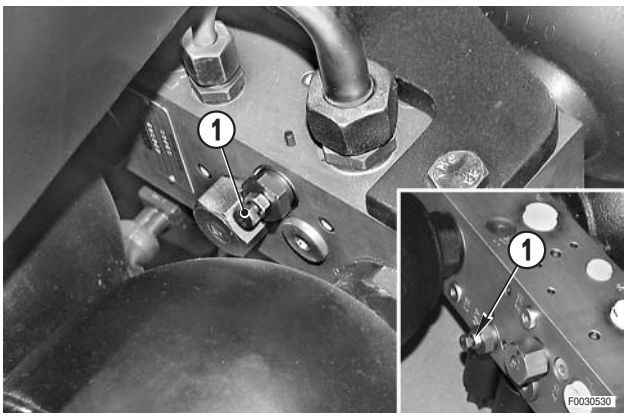
(Versions with front suspension)

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

2 - Apply the parking brake.

Discharge the residual pressure from the suspension system by unscrewing the valve (1) about two full turns.

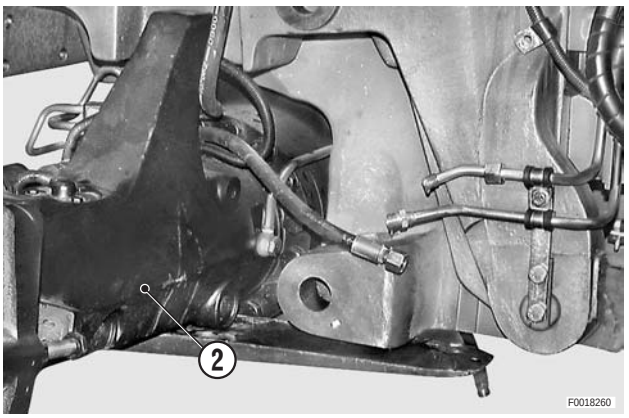
★ Wait a few minutes after discharging the pressure, then re-close the valve.



1 - Remove the front suspension cylinders.
(For details, see «REMOVAL OF THE FRONT SUSPENSION CYLINDERS»).

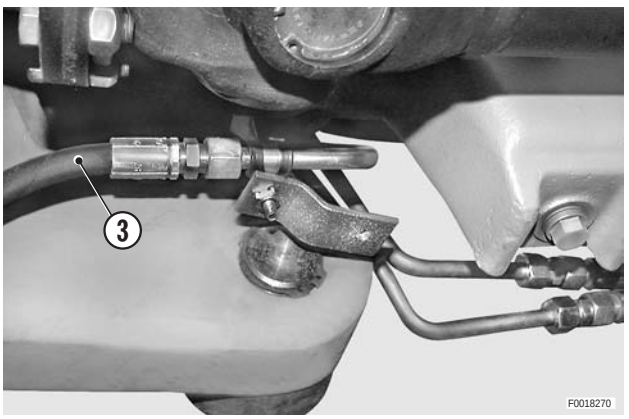
2 - Position a trolley jack under the axle (2) and the swinging support; raise the jack until it supports both the assemblies.

kg Group assembly: 455 kg (1002 lb.)

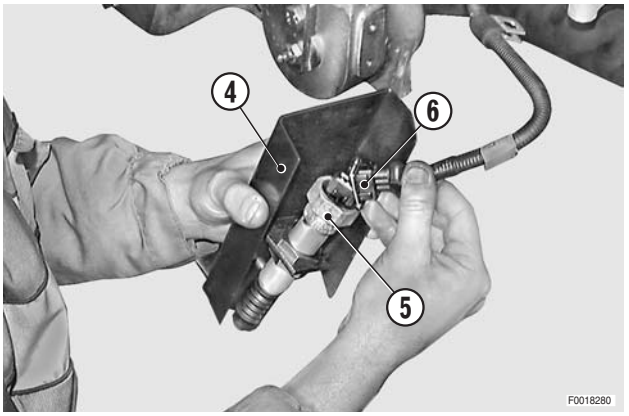


3 - Remove the cover and the 4WD shaft.
(For details see «REMOVAL OF THE 4WD PROPELLER SHAFT»).
Disconnect the differential lock pipe (3).

★ Plug the ends of the pipes to prevent the entry of contaminants.

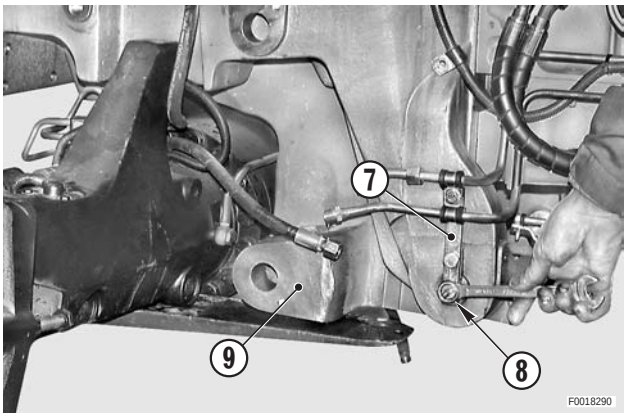


4 - Remove the support (4) of the position sensor (5) and unplug the connector (6). ⁘ 1



5 - Remove the plates (7) securing the pivot pins (8) of the swinging axle support (9).

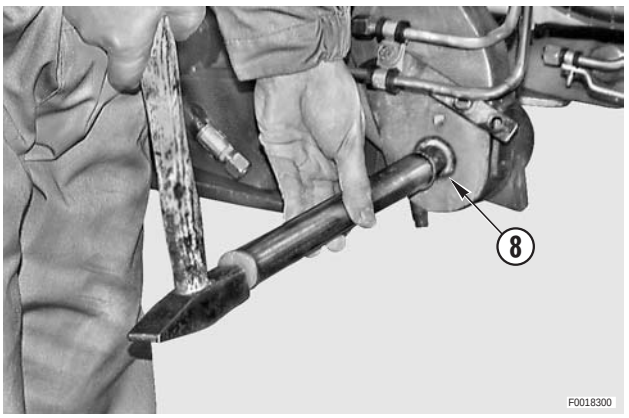
6 - Loosen the screw of the clips for the rigid steering pipes and rotate the plate (7) to the left to release the pivot pin (8).



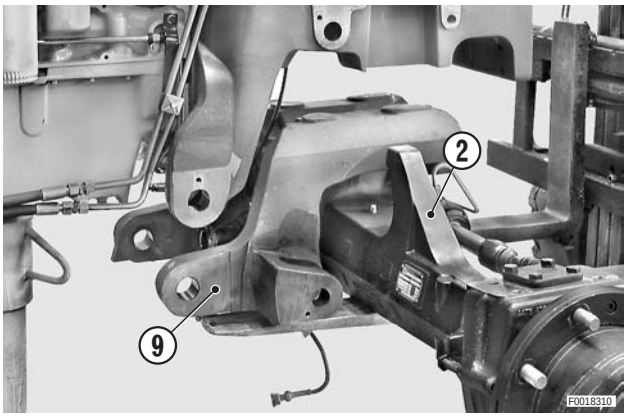
7 - Using a suitable drift made of soft material (aluminium, copper, etc.,), remove the pivot pins (8).

⁘ 2

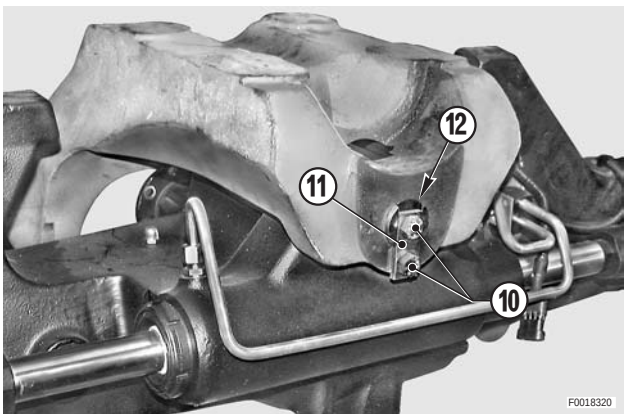
★ Take care not to damage the grease nipple.



8 - Slowly lower the jack and remove the swinging support (9) complete with the axle (2).

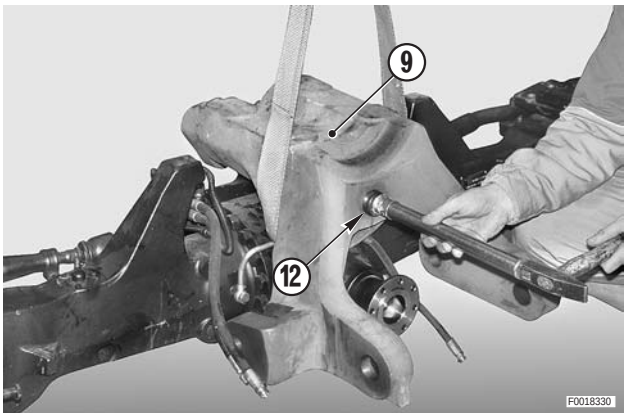


9 - Remove the screws (10) and remove the plate (11) securing the axle pivot pin (12).



10 - Attach the swinging support (9) to lifting slings and attach the slings to a hoist; put the slings under slight tension.

11 - Using a suitable drift made of soft material (aluminium, copper, etc.,), drive out the axle pivot pin (12) and remove the swinging support. ※ 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 SENSOR).

※ 2

Pivot pin and plain bearings: grease

1 - On starting the engine, bleed the systems as follows:

a - turn the steering wheel repeatedly to full lock in both directions;

b - repeatedly activate and deactivate the suspension;

c - repeatedly engage and disengage the differential lock.

2 - Stop the engine, check the gearbox oil level and top up if necessary.

3 - Lubricate the pivot and trunnion thoroughly.

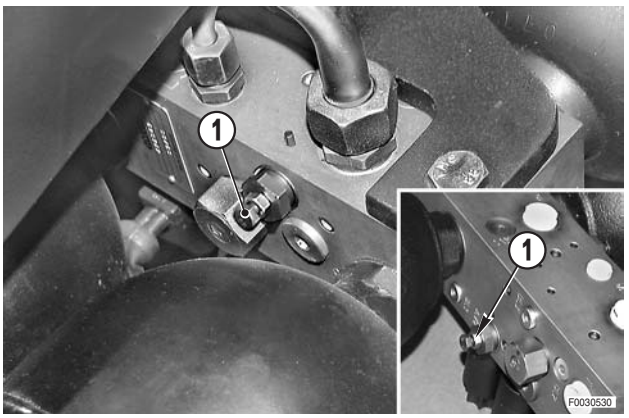
REMOVAL OF THE FRONT SUSPENSION VALVES

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

2 - Apply the parking brake.

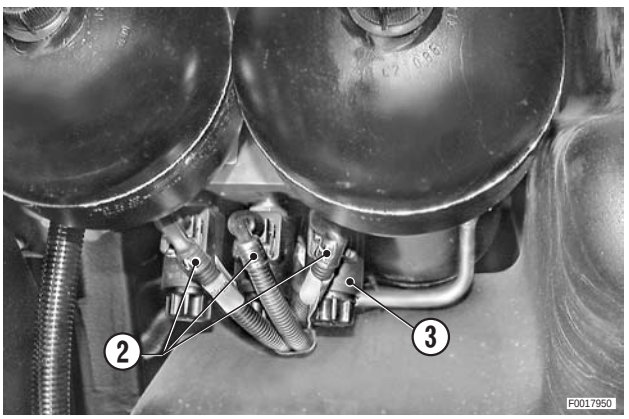
Discharge the residual pressure from the suspension system by unscrewing the valves (1) about two full turns.

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



1 - Unplug the connectors (2) from the solenoid valves (3).

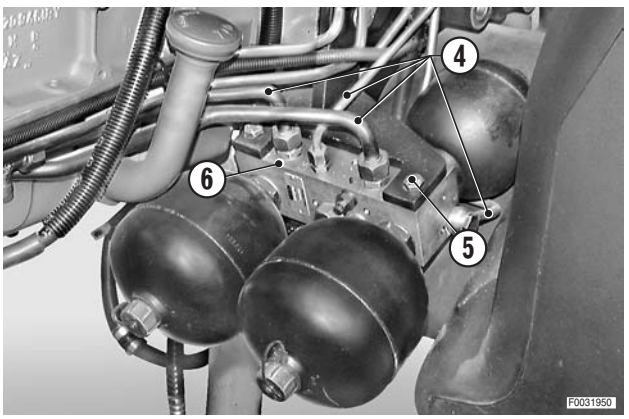
★ Label the connectors and solenoid valves to avoid confusion on reconnection.



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.

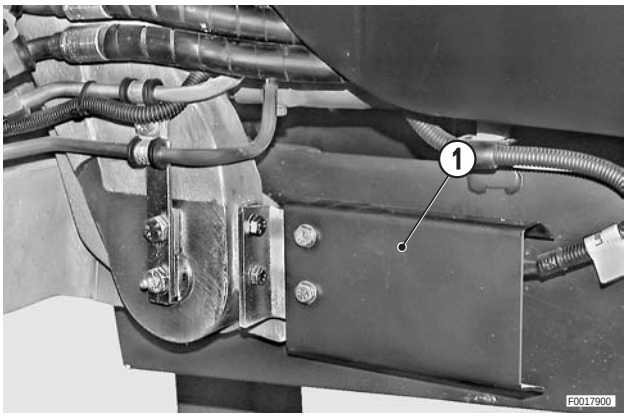
1 - Start the engine and repeatedly activate and deactivate the front suspension in order to expel any air from the system and check for leaks.

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).

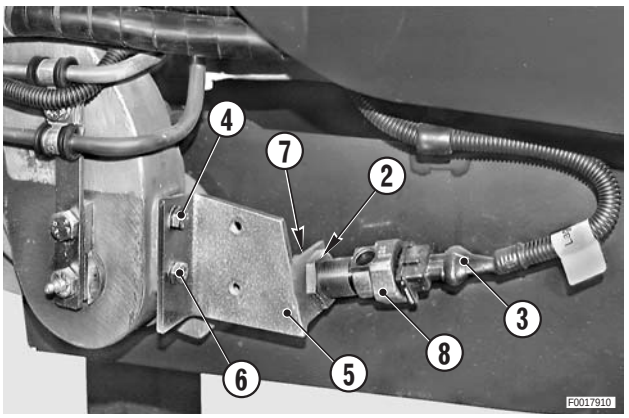


2 - Loosen the rear nut (2).

3 - Unplug the connector (3).

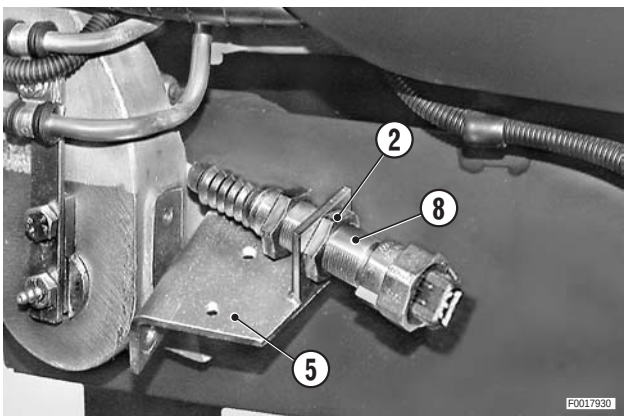
4 - Unscrew and remove the upper retaining bolt (4) of the support (5) and loosen the lower bolt (6); rotate the support (5).

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.

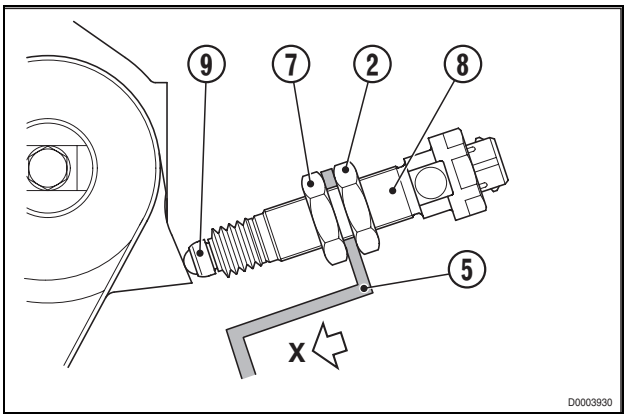
3 - Keeping the pin in this position, screw in the rear nut (2) right up to the support (5).

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.

Nm Nuts: 30±6 Nm (22.1±4.4 lb.ft.)



3. Testing

1 - Connect the test lead **T2** (cod. 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**

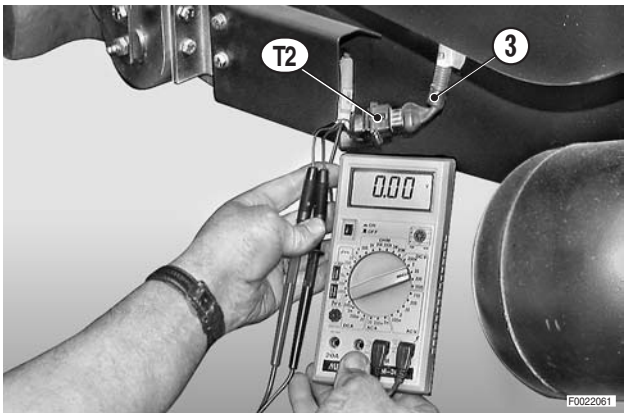
Fully retract the cylinders and check the voltage.

★ **Voltage with cylinders retracted = 1.90–1.95V**

★ The voltage is measured between the terminals of the brown (earth) and blue (signal) wires

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).



REMOVAL OF THE REINFORCING SIDE MEMBERS

(For versions with front lift only)

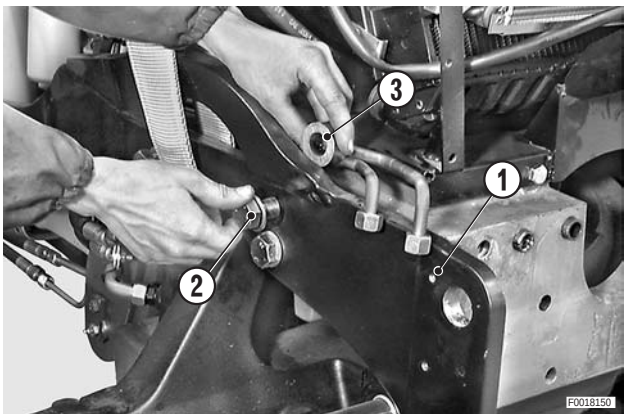
1 - Remove the front lift valve block.
(For details, see «REMOVAL OF THE VALVE BLOCK»).

2 - Remove the air reservoir and the battery support.
(For details, see «REMOVAL OF THE AIR RESERVOIR AND BATTERY SUPPORT»)

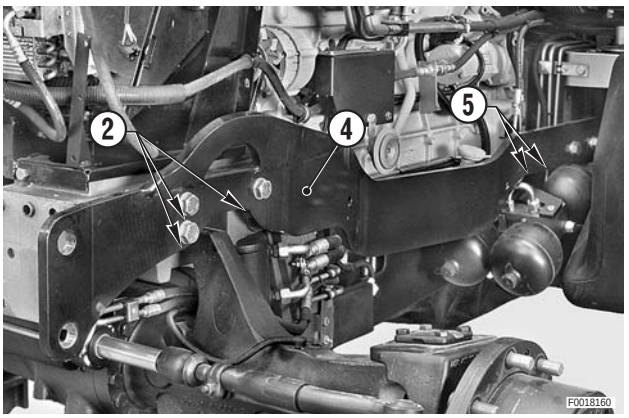
3 - Attach a hoist to the side member to be removed and put the lifting sling under slight tension.

kg Side member: 45 kg (99 lb.)

4 - **Right side member (1):** Unscrew and remove the front bolts (2) complete with their washers and recover the spacers (3). ※ 1



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



REFITTING THE SIDE MEMBERS

- Refitting is the reverse of removal.

※ 1

Nm Bolts: M16: 214 Nm (158 lb.ft.)
Bolts: M20: 455 Nm (335 lb.ft.)

REMOVAL OF THE FRONT CARRIER

(Versions with front suspension)

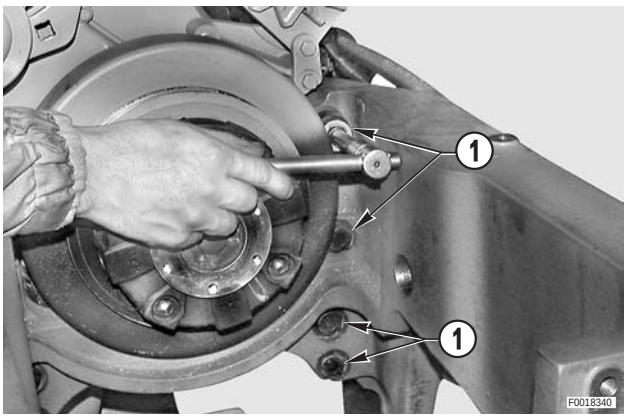
⚠ Before stopping the engine, deactivate the front suspension by pressing the relative button in the cab.

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

1 - Remove:
- the radiator/coolers assembly;
- the alternator and air conditioning compressor drivebelts;
- the reinforcing side members;
- the lift assembly;
- the front PTO (if present);
- the front suspension cylinders;
- the front axle and swinging support.

(For details, see the corresponding headings).

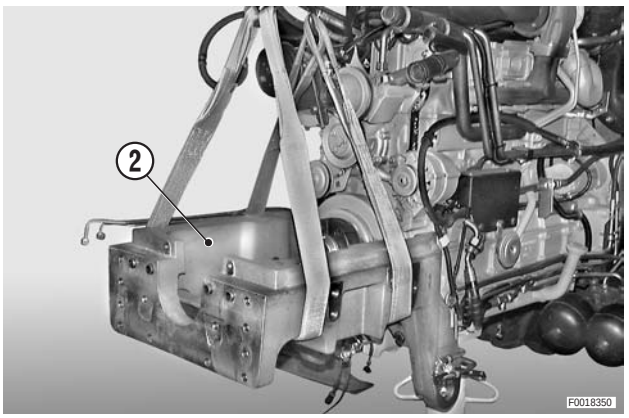
2 - Loosen the bolts (1) to eliminate the tightening torque. ※ 1



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.



REFITTING THE FRONT CARRIER

- Refitting is the reverse of removal.

※ 1

Nm Bolts: 260±10% Nm (191.6±10% lb.ft.)

※ 2

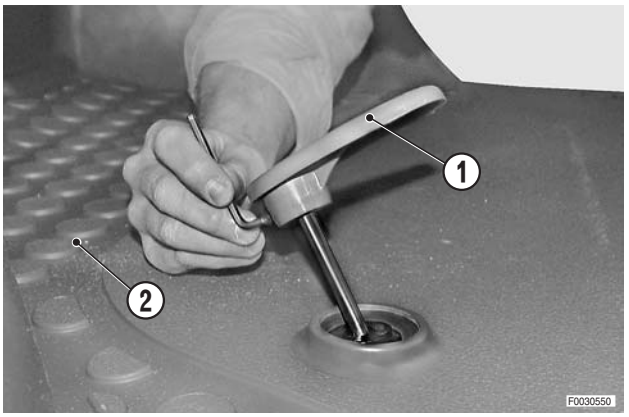
Locating dowels: grease

1 - Start the engine and operate the controls to expel air from the various systems.

REPLACEMENT OF ACCELERATOR POTENTIOMETER

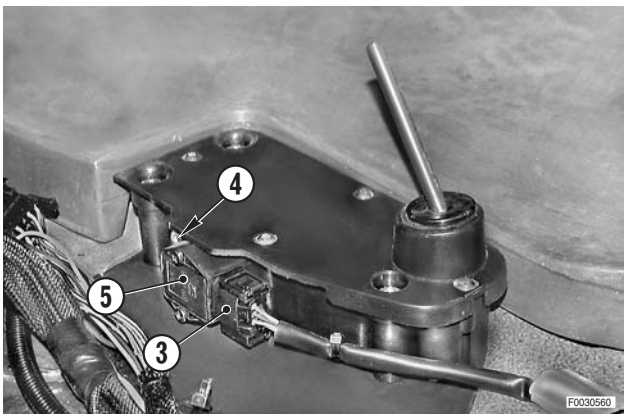
⚠ Remove the battery cover and disconnect the negative battery lead (–).

1 - Remove the accelerator pedal (1) and take up the front floor mat (2).



2 - Unplug the connector (3).

3 - Undo the screws (4) and remove the potentiometer (5).



REFITTING ACCELERATOR POTENTIOMETER

- To refit, repeat the above steps in reverse order.

1 - When fitting a replacement potentiometer, check the engine speed settings with the programming/diagnostics tester.

REMOVAL OF FUEL TANK

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

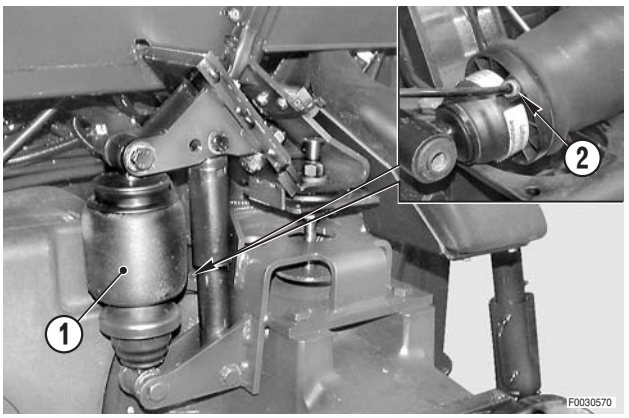
1 - Remove the left rear wheel.
(For details, see «REMOVAL OF REAR WHEELS»)

2 - Vent all the compressed air from the cab suspension system.

For machines equipped with air trailer braking, release all the compressed air from the brake circuit.

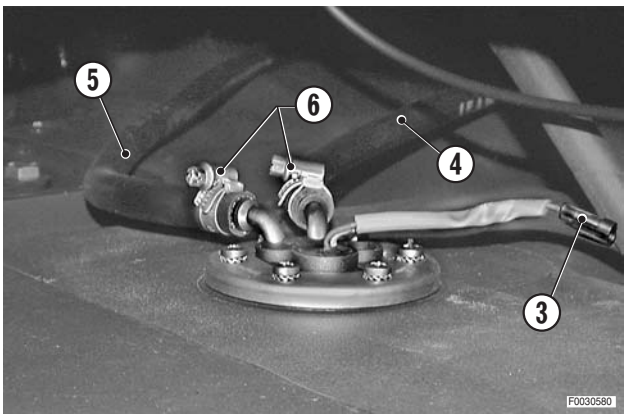
3 - Disconnect the air inlet line (2) from the R.H. cab suspension piston (1).

※ 1



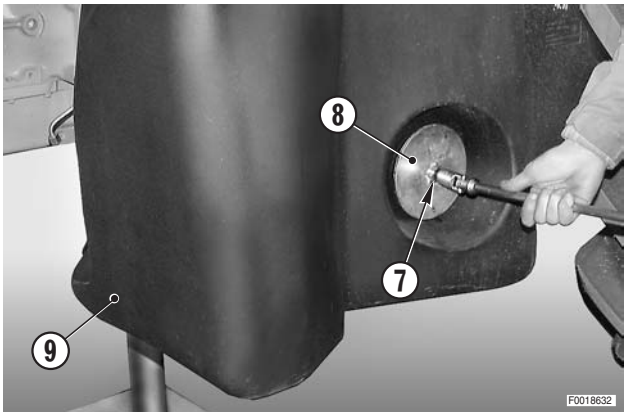
4 - Unplug the connector (3) of the fuel level sender.

5 - Mark the fuel feed and return lines (4) and (5).
Loosen the clips (6) and disconnect the hoses.



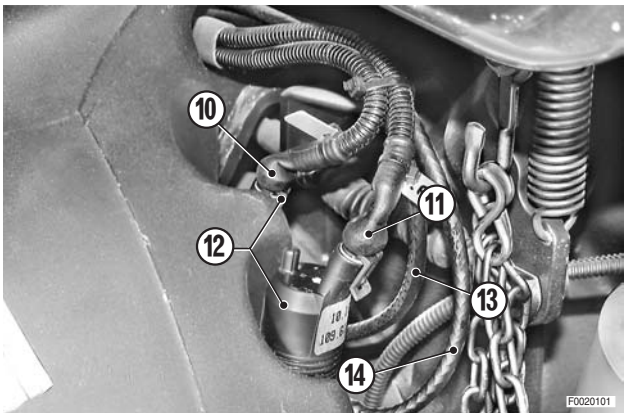
6 - Undo the bolts (7) and remove the alignment washers (8) by which the tank (9) is retained.

★ Mark the washers so as to avoid error when refitting the tank.

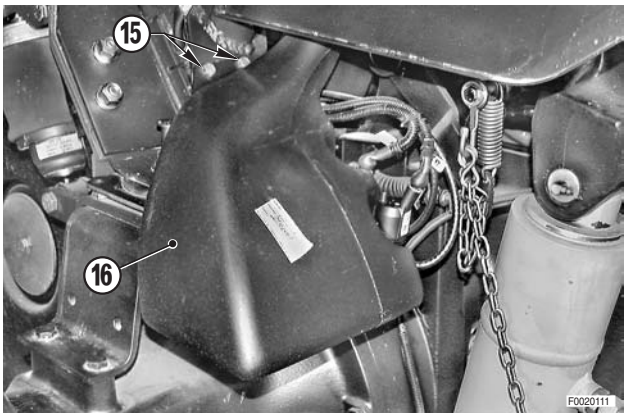


7 - Empty the screenwash bottle.
Mark the connectors (10) and (11) and detach them from the pumps (12).

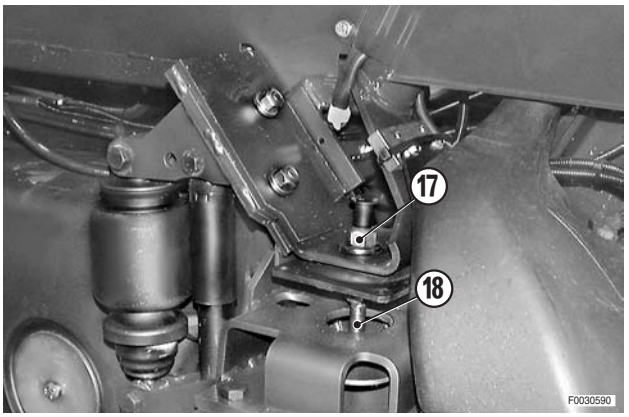
8 - Mark the screenwash hoses (13) and (14) and disconnect them from the pumps (12).



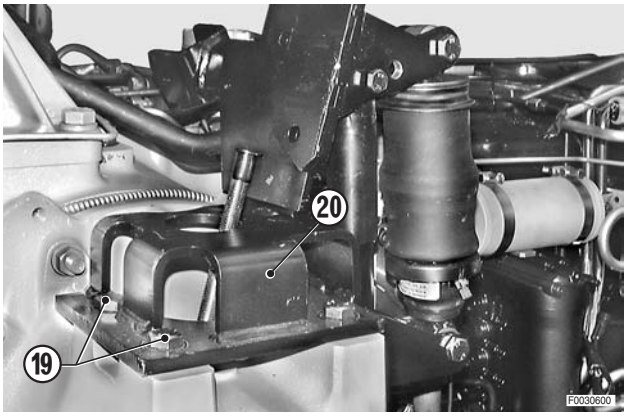
9 - Undo the bolts (15) and remove the screenwash bottle (16).



10 - Remove the central nut (17) of the cab travel limiter rod (18).

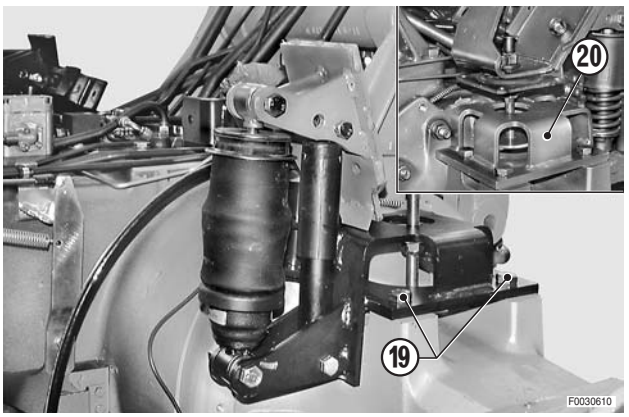


11 - Loosen and remove the bolts (19) securing the mounting (20) to the trumpet housing.

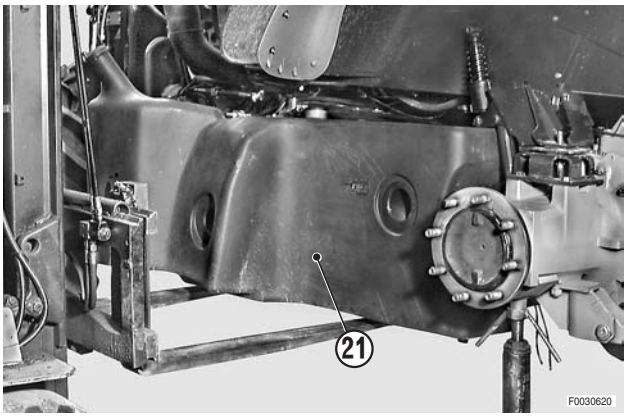


12 - Using suitable lifting equipment, elevate the cab to the point at which the mounting (20) can be rotated 180° to free the tank.

13 - In the interests of safety, engage the mounting bolts (19) and lower the cab.



14 - Support the fuel tank (21) with lifting equipment and separate it from the guide rails.

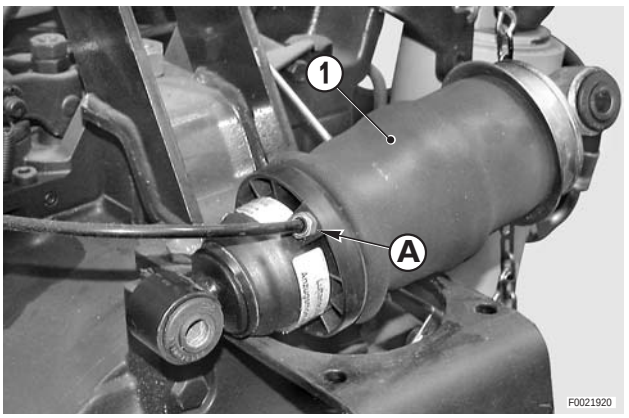


REFITTING FUEL TANK

- To refit, repeat the above steps in reverse order.

1

Nm Fittings "**A**": 3 Nm (2.2 lb.ft.)



TEST FOR CORRECT OPERATION OF AUXILIARY SERVICES PUMP

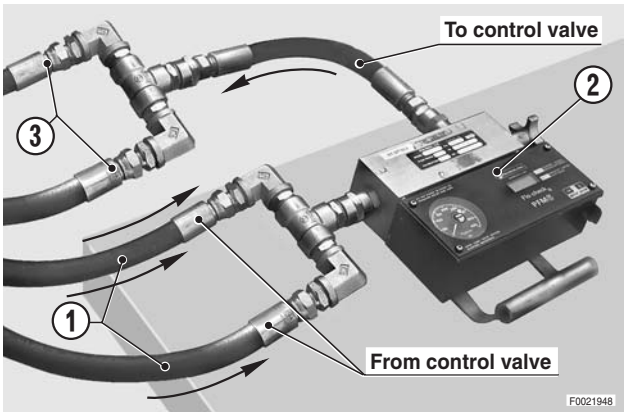
★ Test conditions:
- Engine at normal running temperature
- Hydraulic fluid: 60- 70 °C (140–158 °F)
- Handbrake on
- Transmission in neutral

NOTE - The exact number of engine revolutions must be checked with a precision tachometer.

1. Flowmeter connection

1 - Connect the pressure lines (1) from the top ports of two auxiliary spool valve sections to the flowmeter (2).
★ Make certain the valve sections are set for maximum flow.

2 - Connect the return lines (3) from the flow meter to the bottom ports of the same two spool valve sections.



2. Measuring flow rate

1 - Start the engine and throttle to a crankshaft speed of 1000 rpm.

2 - Operate the levers of the spool valves connected to the flowmeter.

3 - Set the outlet pressure to 50 bar (725 psi) and verify the pump flow rate.

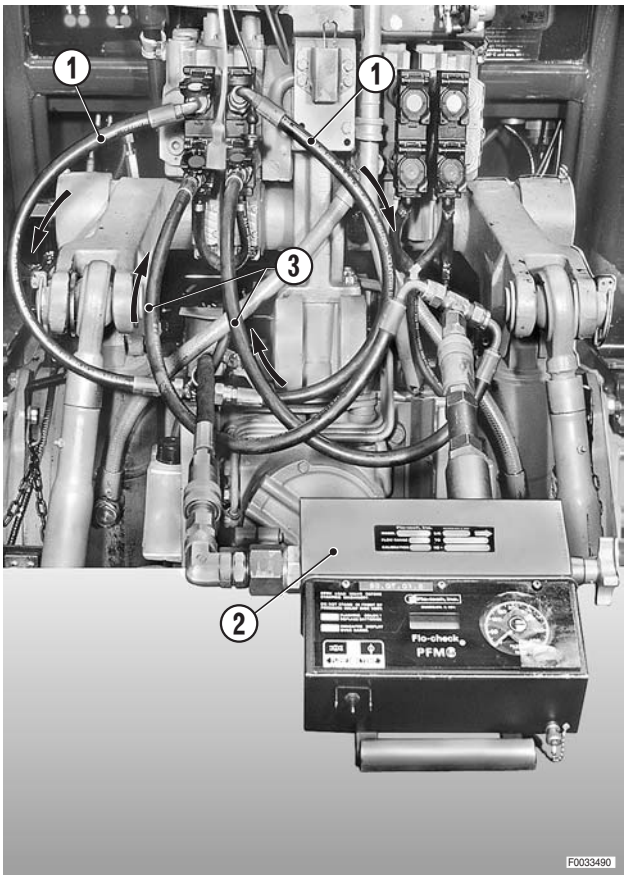
4 - Release the levers and repeat the operation a number of times.

5 - Repeat steps 2, 3 and 4 at pressures of 100 bar (1450.3 psi) and 150 bar (2175.5 psi).

6 - Throttle the engine to 2300 rpm and repeat steps 2, 3, 4 and 5 in the same way at this higher speed.

7 - Check the measurements against the values in the table below.

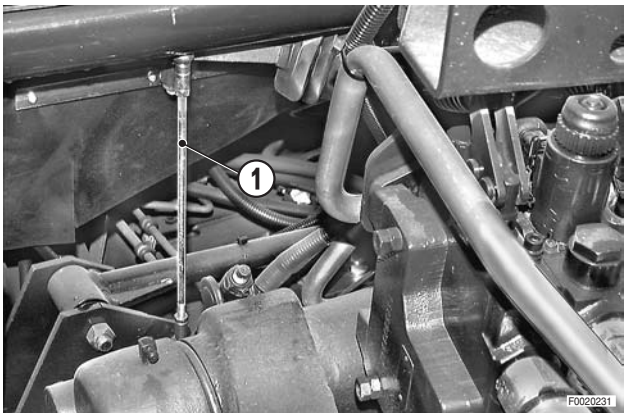
Pressure bar (psi)	Flow rate at 1000 rpm ℓ/min (US.gpm)	Flow rate at 2300 rpm ℓ/min (US.gpm)
50 (725)	44.5 (11.76)	107 (28.27)
100 (1450.3)	44.0 (11.62)	106 (28.00)
150 (2175.5)	43.0 (11.36)	104 (27.48)



REMOVAL OF POWER STEERING GEAR PUMP

★1 - If the cab has pneumatic suspension, operate the height adjustment rod (1) to give maximum elevation; maintain the cab in this position by propping up with blocks of non-slip material.

2 - If the cab is suspended on mechanical springs, elevate to maximum height using a hoist or other lifting equipment; maintain the cab in this position by propping up with blocks of non-slip material.

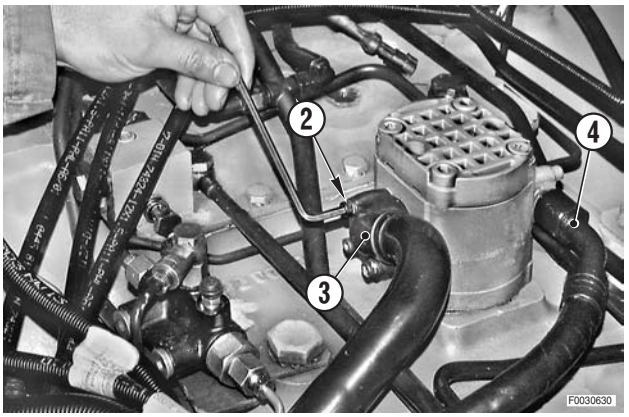


⚠ With the cab raised, switch off the engine, remove the key from the ignition and apply the parking brakes.

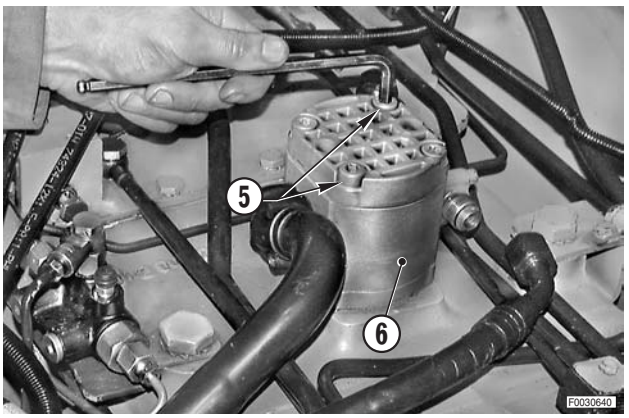
★ Remove the right rear wheel. (For details, see «REMOVAL OF REAR WHEELS»).

1 - Loosen and remove the securing bolts (2) of the inlet flange (3).

2 - Disconnect the pressure pipeline (4).



3 - Loosen and remove the two bolts (5) securing the pump (6).

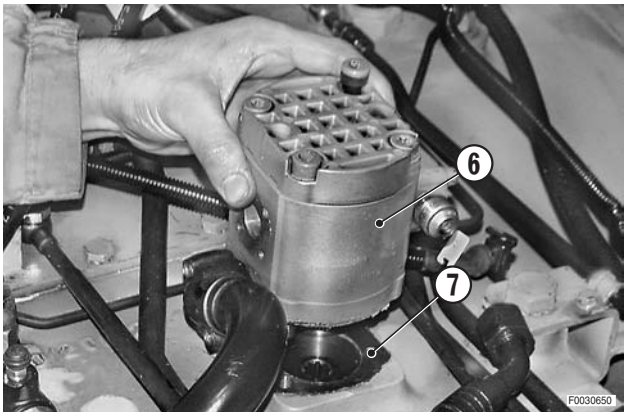


4 - Dislodge the pump by tapping with a plastic hammer; remove the pump (6) and the relative gasket (7).

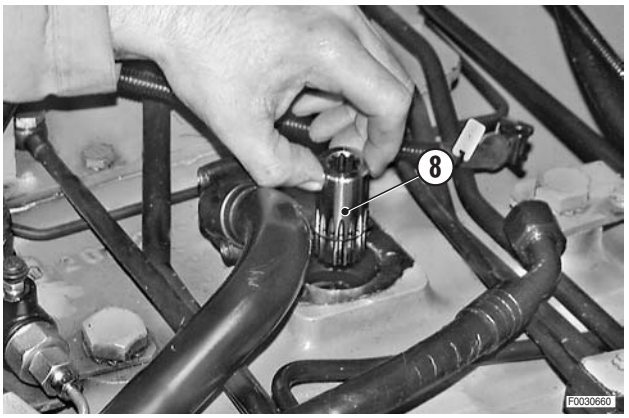
※ 1

★ Take particular care that the inlet flange O-ring does not drop accidentally into the transmission housing.

★ Renew the gasket every time the pump is removed.



5 - Take out the drive coupling (8) and inspect for possible wear that could indicate the need for replacement.



REFITTING GEAR PUMP

- To refit, repeat the above steps in reverse order.

1

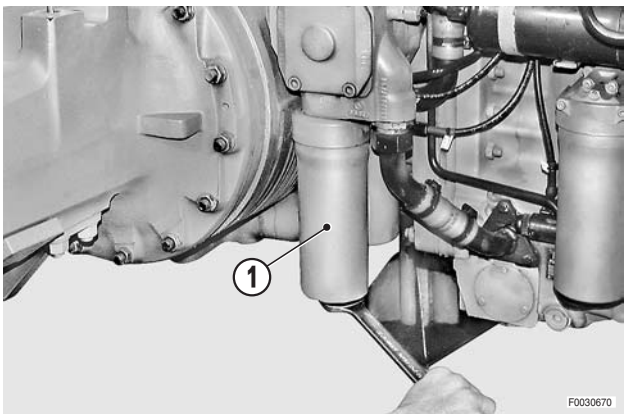
★ To keep the O-ring in place, smear the seat with grease.

REMOVAL OF VARIABLE DISPLACEMENT PUMP

⚠ Switch off the engine, remove the key from the ignition and apply the parking brakes.

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

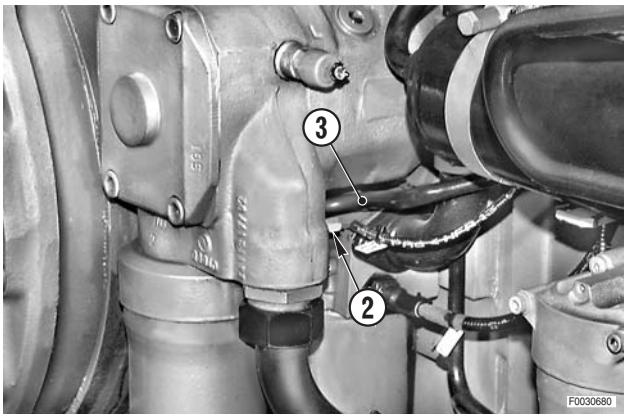
1 - Remove the filter (1).



2 - Detach the connector (2) of the filter clogging sensor.

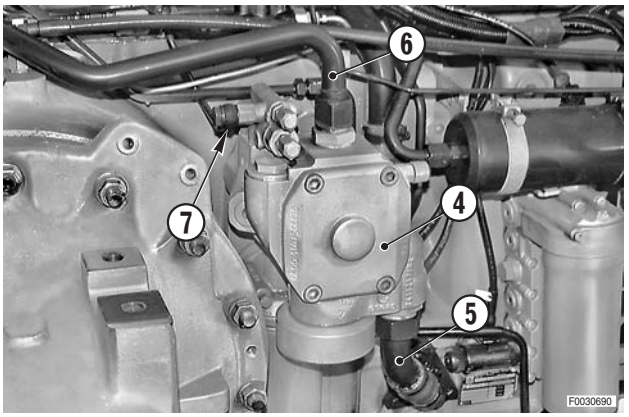
3 - Loosen the fitting of the pump case drain pipeline (3); allow the oil to run off, then disconnect the pipe.

★ Plug the pipe to prevent impurities getting in.

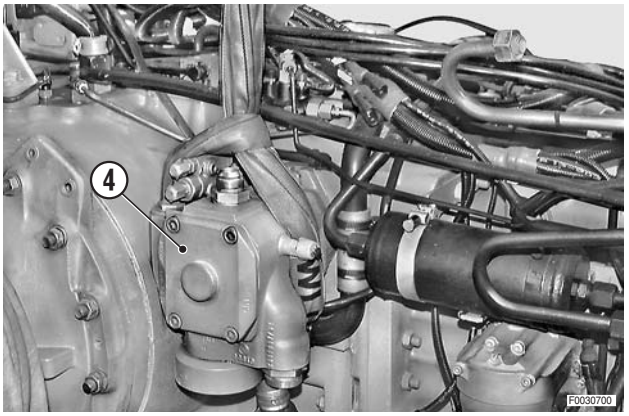


4 - Disconnect the inlet pipeline (5), the pressure line (6) and the Load Sensing line (7) from the pump (4).

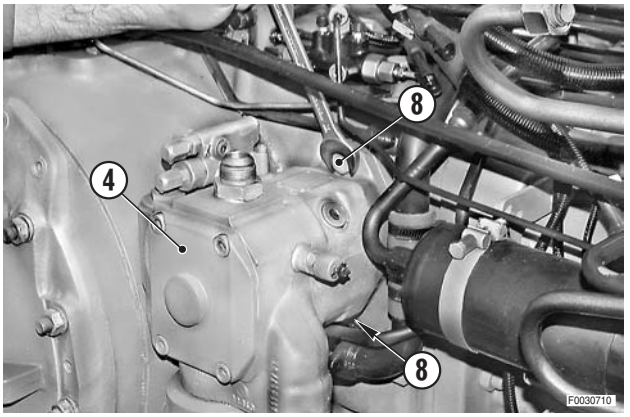
★ Plug the pipes to prevent impurities getting in.



5 - Sling the pump (4) to a hoist and tension sufficiently to take the weight.

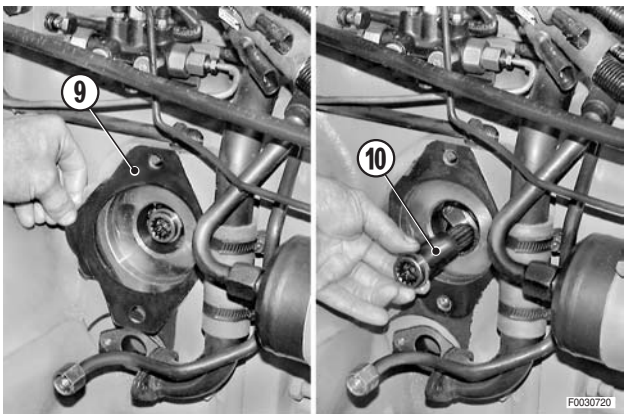


6 - Loosen and remove the bolts (8) and washers, and detach the pump.



7 - Remove the gasket (9).
★ Renew the gasket every time the pump is removed.

8 - Take out the drive coupling (10) and inspect for possible wear that could indicate the need for replacement.



REFITTING VARIABLE DISPLACEMENT PUMP

- To refit, repeat the above steps in reverse order.

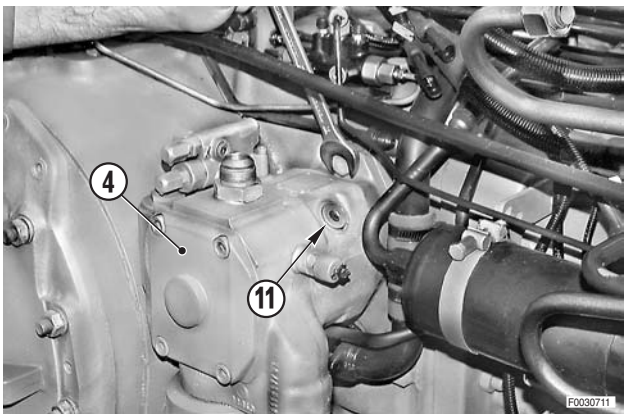
※ 1

After connecting the pipes, remove the plug (11) and fill the pump case (4) with oil.

Oil: approx. 1 kg (2 lb.)

1 - Check the level of oil in the transmission and top up if necessary.

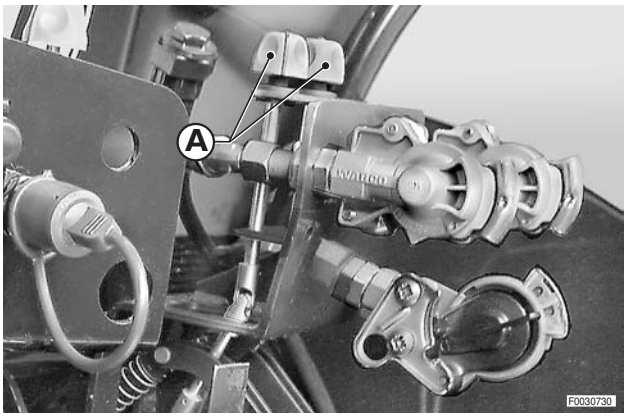
2 - Start the engine, then move the lift links fully up and down a few times to remove air from the circuits, and test for leaks.



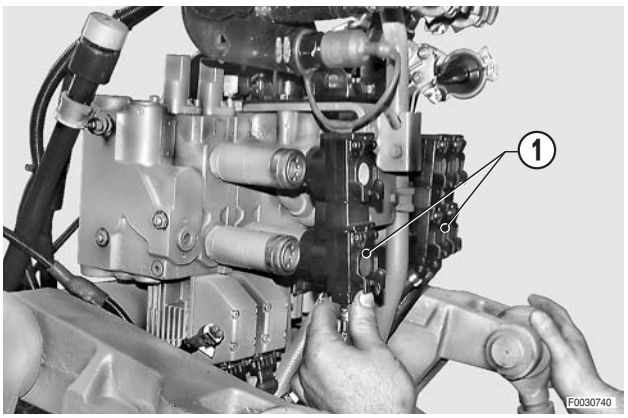
REMOVAL OF DIRECTIONAL CONTROL VALVES

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

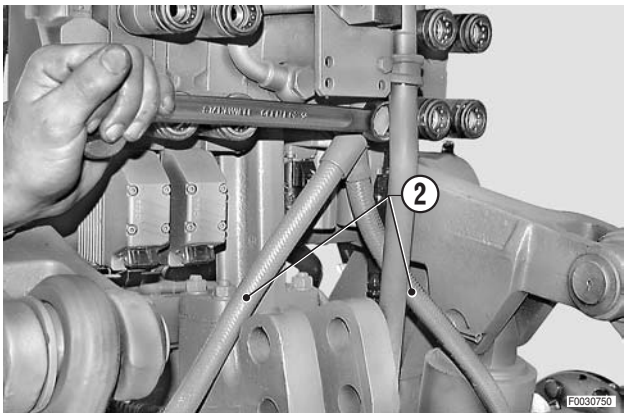
★ **Only if fitted**
Remove the optional flow divider controls "**A**" associated with the directional control valve stack.



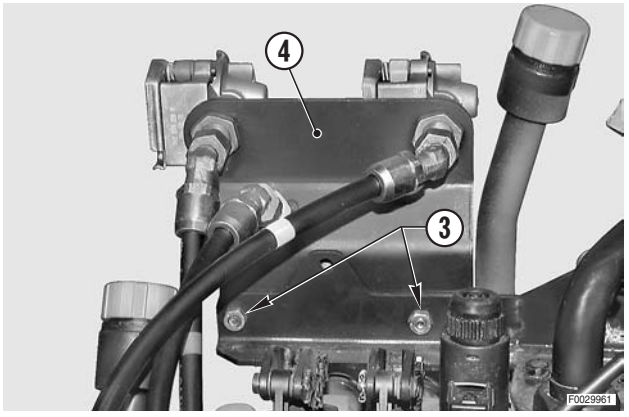
1 - Remove the oil catchers (1) from the spool valve pressure and return ports.



2 - Disconnect the pipelines (2) from the lift control valve.

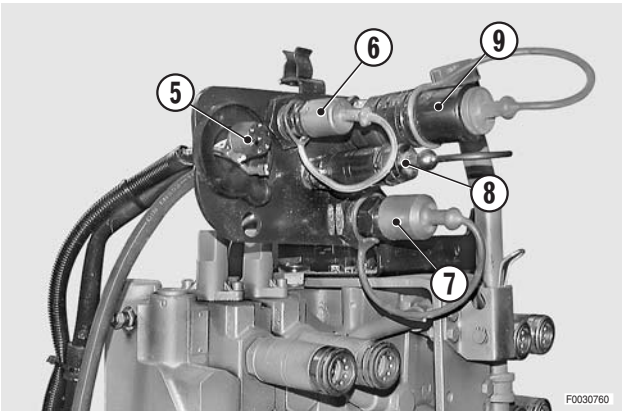


3 - Undo the bolts (3) and remove the bracket (4) carrying the trailer brake couplers; set to one side.



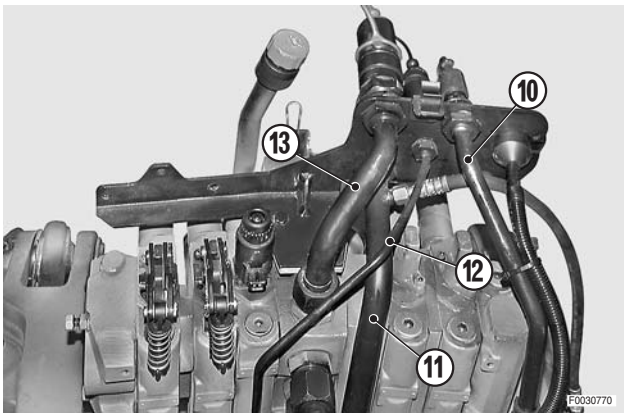
4 - Disconnect the trailer socket wiring (5) and remove the quick couplers serving the pressure line (6) and return line (7), and the Load Sensing signal (8), for implements with independent controls.

★ Leave the power-beyond quick coupler (9) in place.

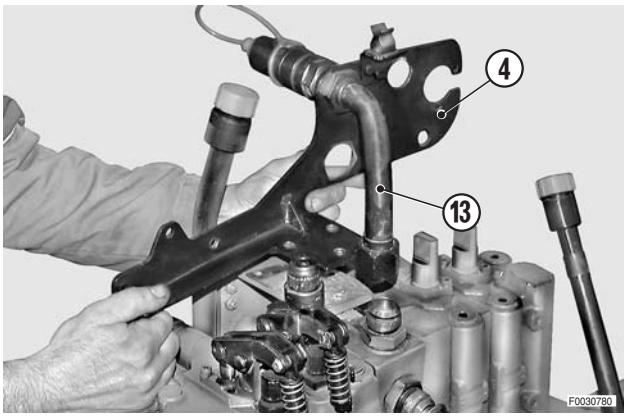


5 - Loosen and remove the back nuts, and remove the pipelines (10), (11) and (12).

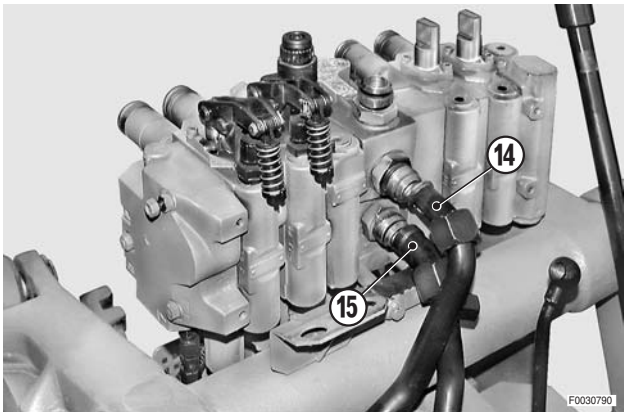
★ Leave the power-beyond pipe (13) in place.



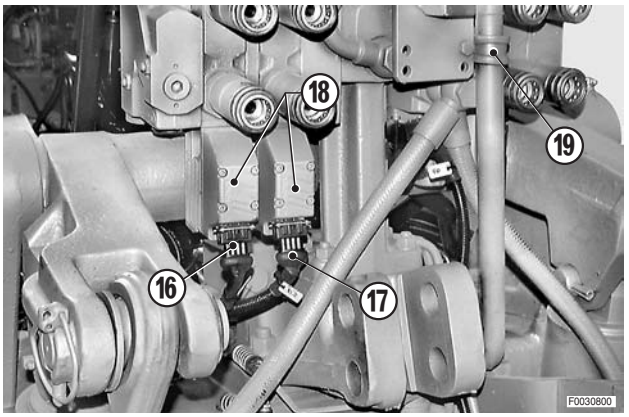
6 - Disconnect the power-beyond pipe (13) from the valve stack and lift the bracket (4) clear.



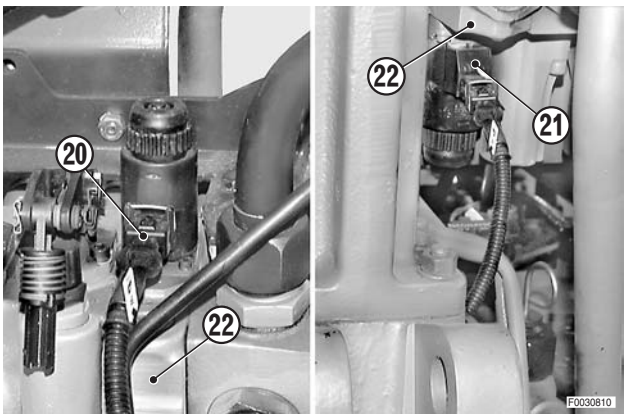
7 - Disconnect the pressure and return pipelines (14) and (15) from the valve stack.



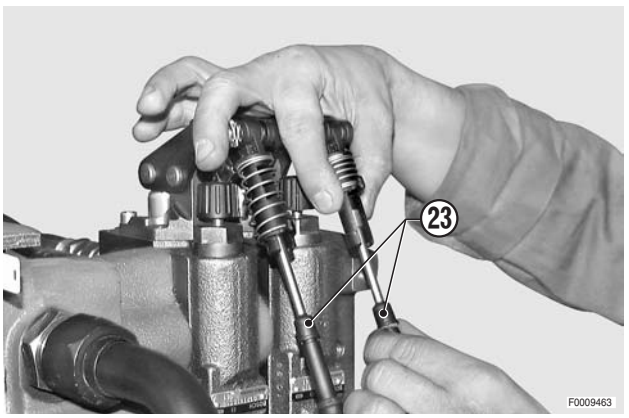
8 - Detach connectors **D1** (16) and **D2** (17) from the solenoid operated valves (18), and remove the clip (19).
⁘ 1



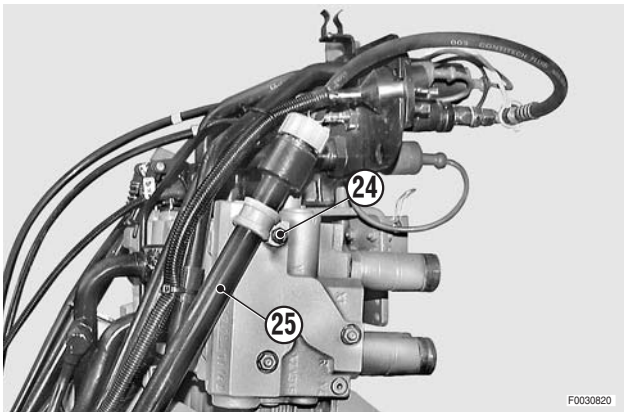
9 - Detach the connectors **DW** (20) and **UP** (21) from the lift control valve (22).
⁘ 2



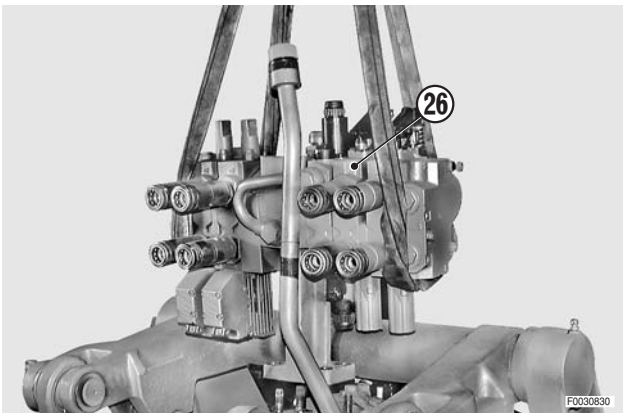
10 - Disconnect the Bowden cables (23) from the rear implement control spool valves.
★ Mark the positions so as to avoid error during refitment.



11 - **Only if fitted:** remove the nuts (24) and rotate the rear axle oil fillers (25) away from the valves.
★ Loosen the fittings slightly on the transmission housing to allow movement of the fillers.

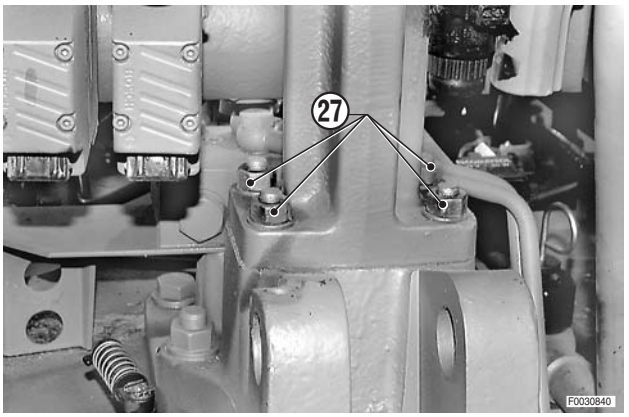


12 - Sling the valve stack (26) to a hoist and tension the rope sufficiently to take the weight.



13 - Loosen and remove the nuts (27) and relative washers.

14 - Remove the entire valve stack.



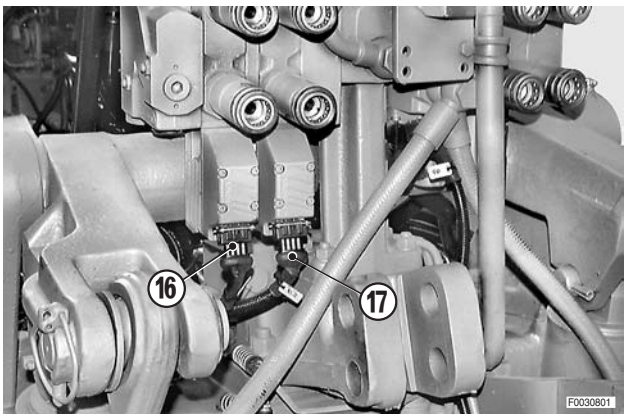
REFITTING DIRECTIONAL CONTROL VALVES

- To refit, repeat the above steps in reverse order.

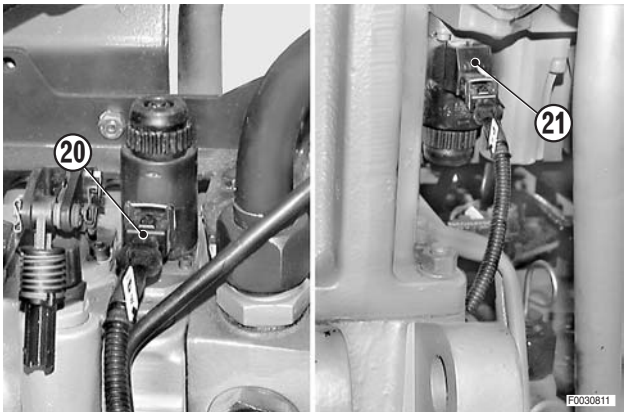
※ 1

★ Attach the connectors to the solenoid operated valves:
D1 (16) R.H. valve
D2 (17) L.H. valve

★ Attach the connectors to the solenoids of the lift control valve:
DW top (20)
UP bottom (21)

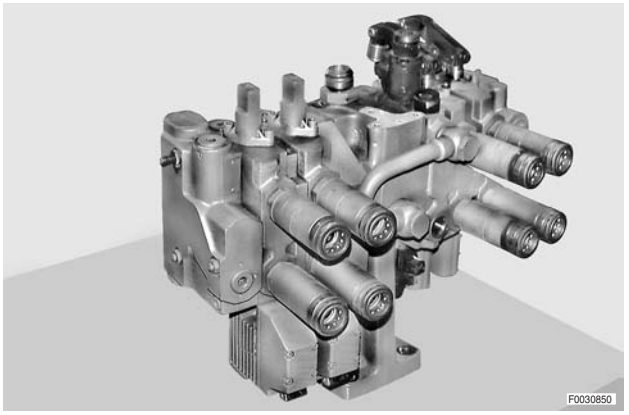


1 - Start the engine, then move the lift links fully up and down a few times to remove air from the circuits, and test for leaks.



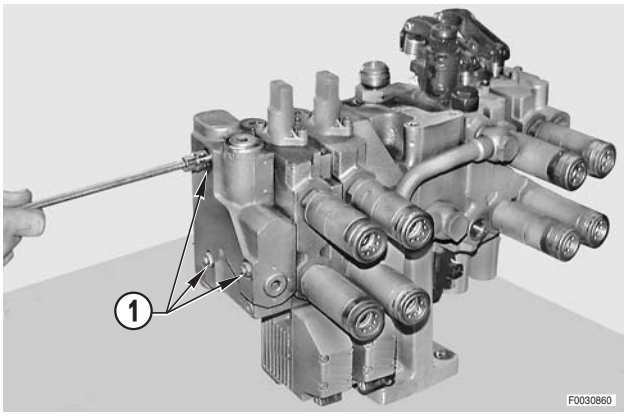
DISASSEMBLY OF AUXILIARY SPOOL VALVE STACK

★ The spool valves are assembled in stacks, which should only ever be stripped down if a component needs to be replaced; overhauls should be carried out by the Manufacturer or by an Approved Service Centre.



1 - Loosen and remove the nuts (1) securing the valve sections to be removed.
★ Loosen the nuts gradually and sequentially to accommodate the expansion of the seals between the sections.

※ 1



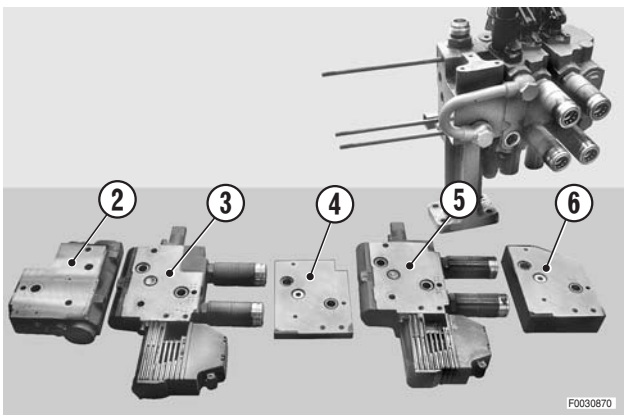
Left hand stack

2 - First remove the end cover (2), then the first solenoid operated valve section **RP** (3), the spacer (4), the second solenoid operated valve section **FP** (5) and the sub-plate (6).

※ 1 ※ 2

⚠ Recover the distance washers located between the sections, and make a note of their positions. (For details, see assembly operations).

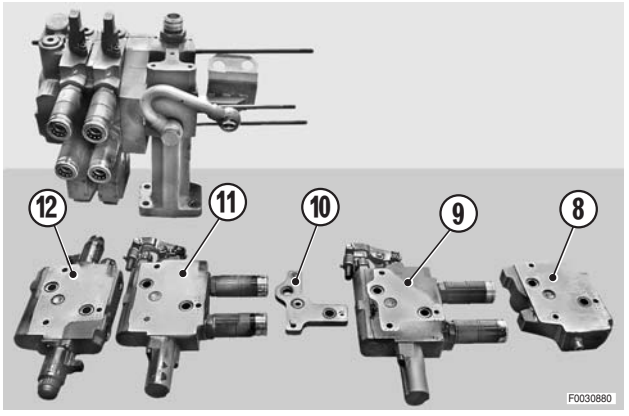
※ 3



Right hand stack

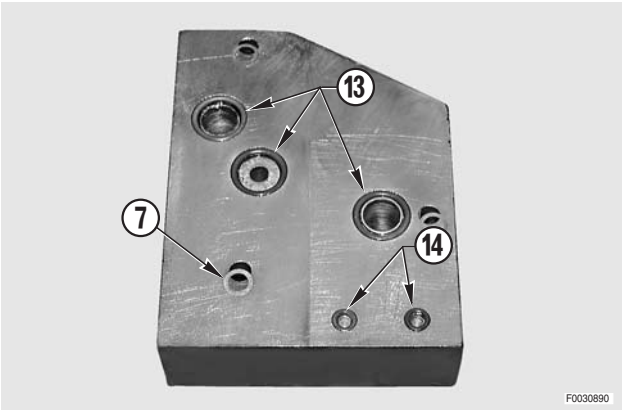
3 - Repeat the steps as described for the left hand stack. (Parts 8-9-10-11-12)

※ 1 ※ 2 ※ 3



ASSEMBLY OF AUXILIARY SPOOL VALVE STACK

- To reassemble, repeat the above steps in reverse order.



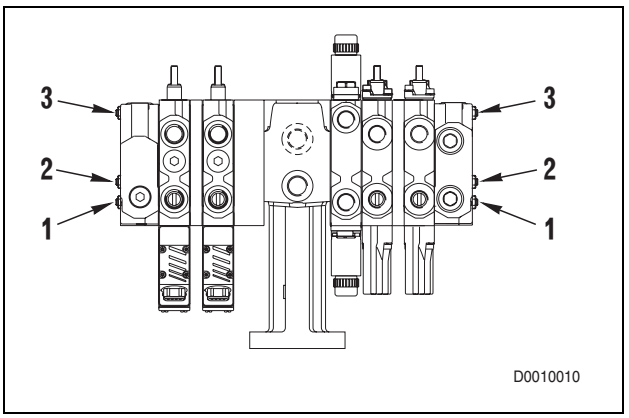
※ 1

★ Before bringing the valve sections, spacers and plates together, make certain that the O-rings (13) and (14) are correctly positioned.
★ To keep the O-rings in place, smear the seats with grease.
★ Be careful not to confuse the position of the O-rings with that of the distance washers.

※ 2

Nm Tightening torque for nuts:
30 ± 3 Nm (22 ± 2.2 lb.ft.)

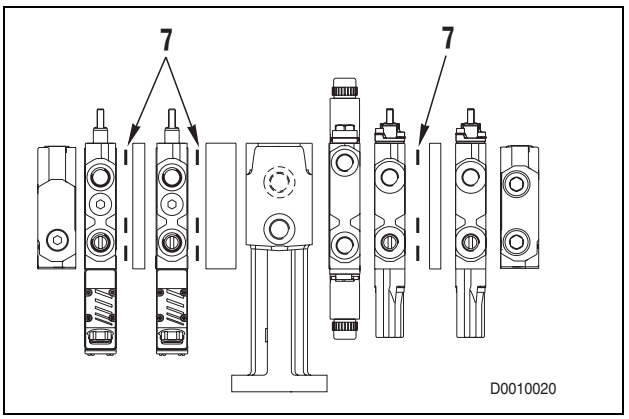
★ Nut tightening sequence:
1 - 2 - 3 (see drawing)
★ Tighten the nuts a little at a time, observing the prescribed sequence.

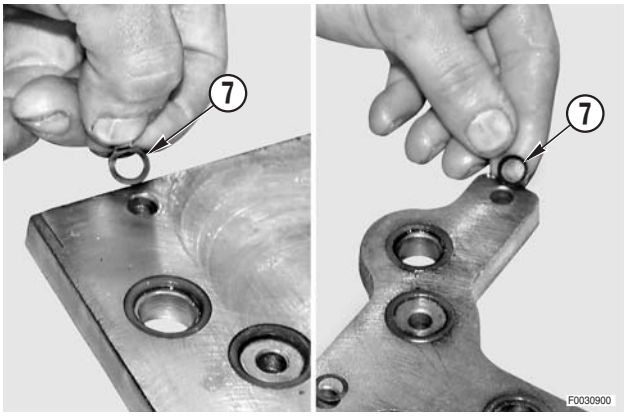


※ 3

★ Locate the distance washers (7) as illustrated.

⚠ The distance washers (7) must be located only between the surfaces of sections with no markings.

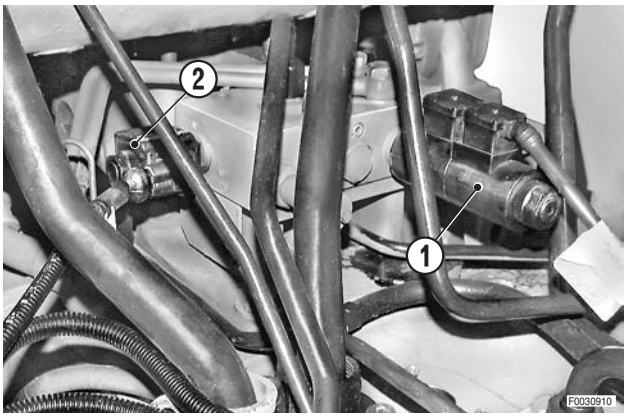




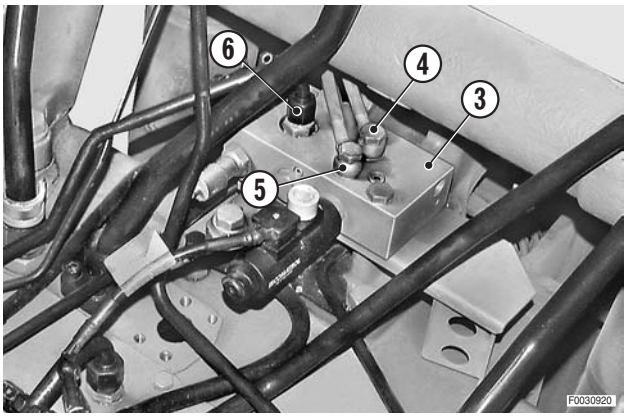
REMOVAL OF PTO CLUTCH AND DIFFERENTIAL LOCK CONTROL VALVE

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

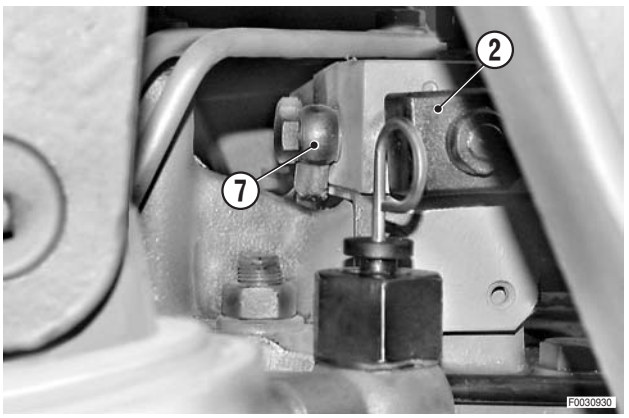
1 - Unplug the connectors from the solenoid valves (1) and (2).



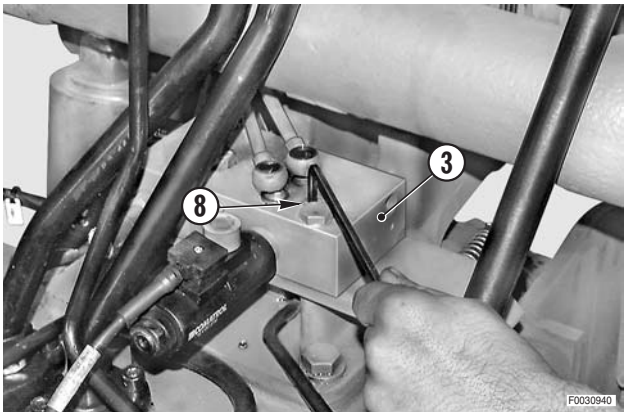
2 - Disconnect the circuit pipelines (4) and (5) and the Load Sensing line (6) from the top face of the control valve (3).



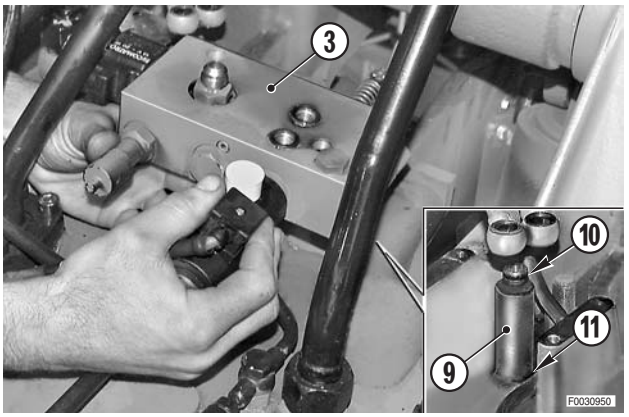
3 - Disconnect the pipeline (7) from the left hand side of the valve.



4 - Loosen and remove the holding down bolts (8) from the valve (3).



5 - Raise the valve (3) until disengaged from the fitting (9) and lift clear.
★ Renew the O-rings (10) and (11) every time the valve is removed.



REFITTING PTO CLUTCH AND DIFFERENTIAL LOCK CONTROL VALVE

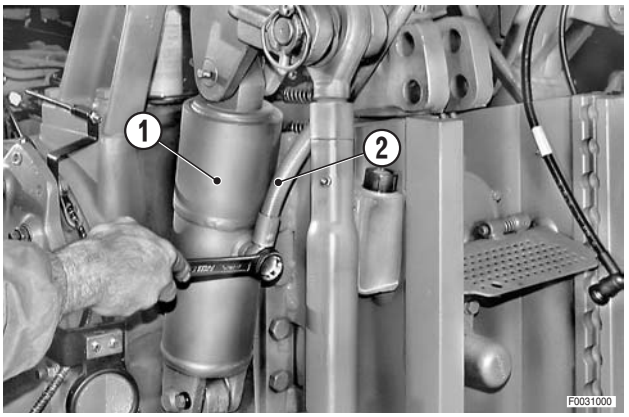
- To refit, repeat the above steps in reverse order.

1 - Start the engine, and operate the PTO clutch and differential lock a number of times to remove air from the circuits.

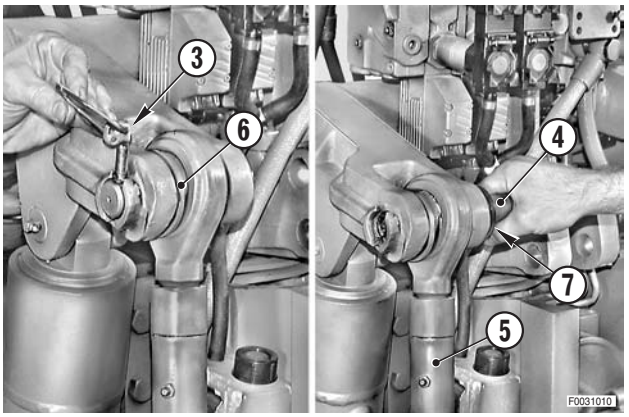
REMOVAL OF LIFT CYLINDERS

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

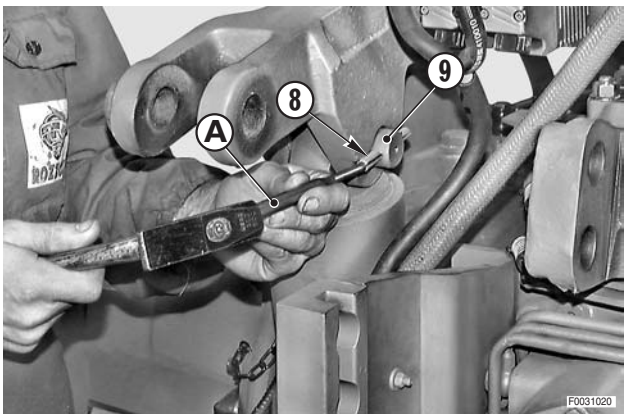
1 - Disconnect the pipelines (2) from the cylinders (1).
★ Plug the pipes to prevent impurities getting in.



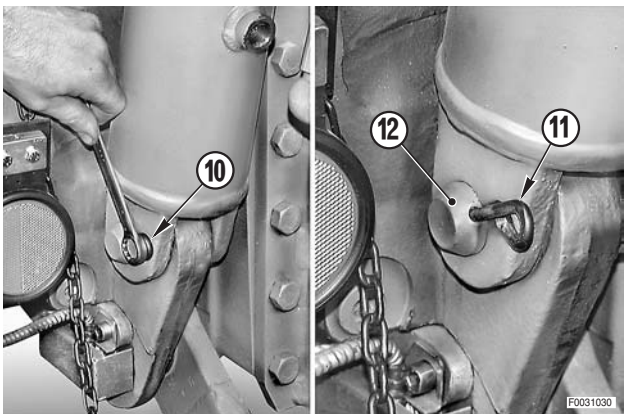
2 - Remove the linch pins (3) and the rod end pivots(4); tilt the lift rods (5) away to the rear.
★ Recover the spacers (6) and washers (7), making a note of the positions.



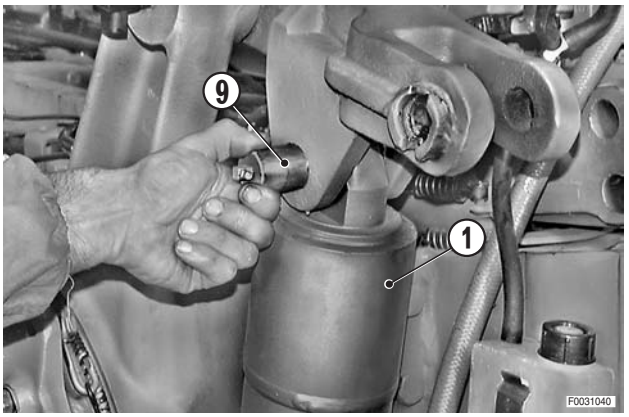
3 - Using a pin punch "**A**", remove the spring pin (8) securing the upper pivot pin (9).



4 - Remove the screws (10) and remove the bracket (11) securing the lower pivot pin (12).



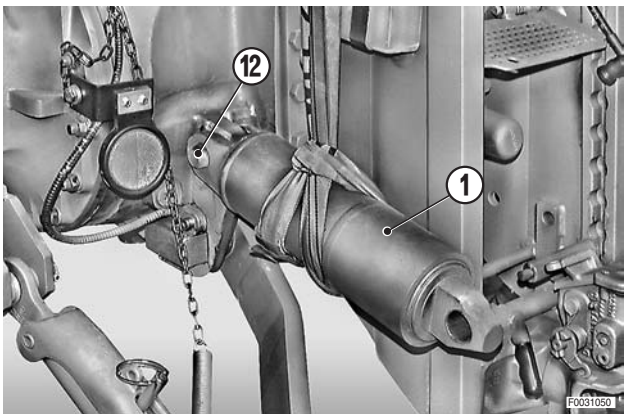
5 - Support the cylinder (1) being removed, and proceed to remove the top pivot (9). ※ 1



6 - Lower the cylinder (1) into a horizontal position and sling up to a hoist.

kg Cylinder: approx 55 kg (121.2 lb.)

7 - Remove the bottom pivot (12) and hoist the cylinder clear. ※ 1



REFITTING LIFT CYLINDERS

- To refit, repeat the above steps in reverse order.

※ 1

★ Lubricate the pivots.

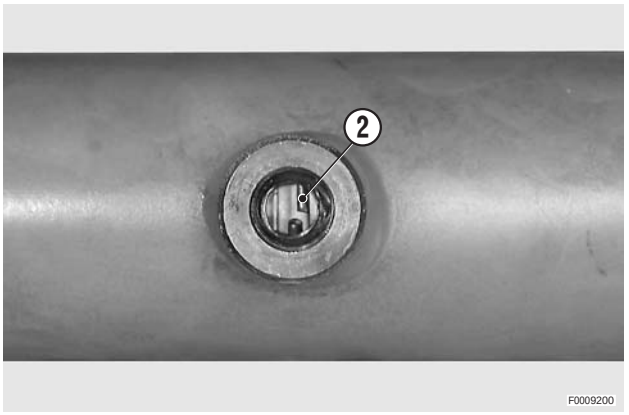
1 - Start the engine, and extend the cylinders fully a number of times to remove air from the system.

DISASSEMBLY AND ASSEMBLY OF THE LIFT CYLINDERS

1. Disassembly

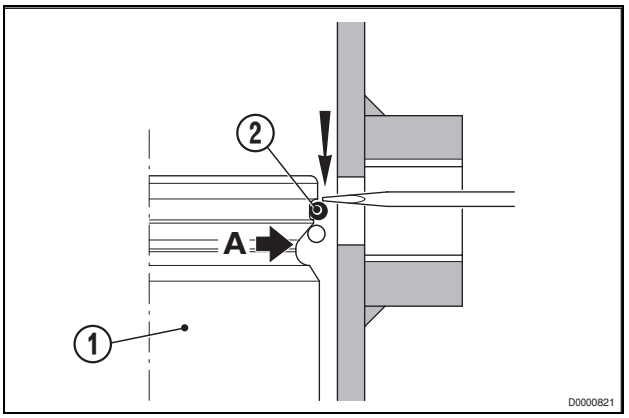
1 - Withdraw the piston (1) to the point where the circlip (2) is visible through the hole of the delivery pipe fitting.

2 - Rotate the rod so that the gap in the circlip (2) is visible.



3 - Using a screwdriver through the delivery line hole, push one end of the circlip (2) towards the groove "**A**" in the piston (1) while simultaneously rotating the piston (1) in order to release the circlip (2).

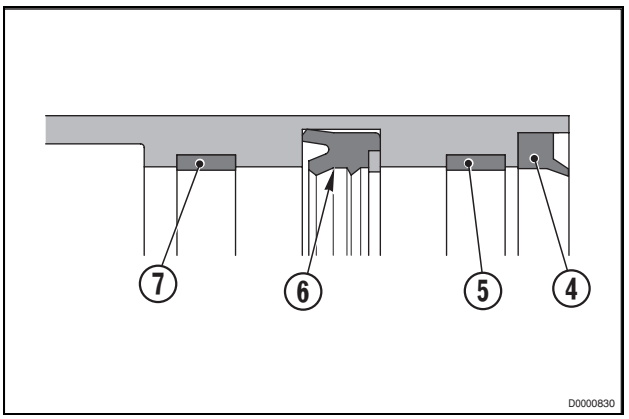
4 - Withdraw the complete piston assembly (1).



5 - Remove in sequence the wiper seal (4), the guide (5), the seal (6) and the second guide (7).

※ 1 ※ 2

★ Note which way round the seal is fitted.



2. Assembly

- Assembly is the reverse of disassembly.

※ 1

Seal and guides: Gearbox oil.

※ 2

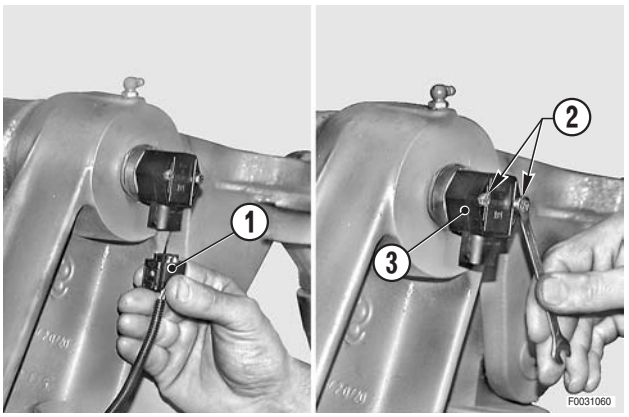
★ Before inserting the piston, check that the guides are correctly positioned in the seatings in the cylinder.

REPLACEMENT OF LIFT POSITION SENSOR

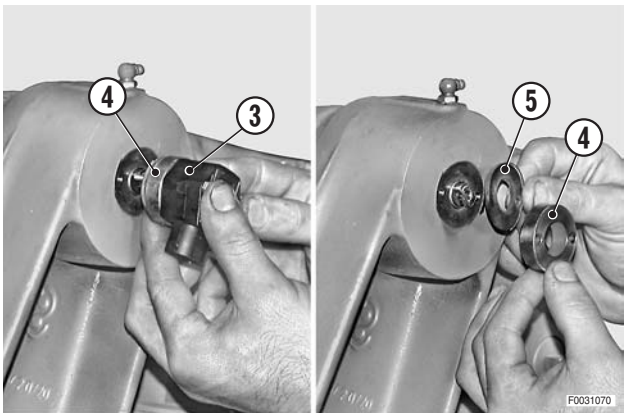
⚠ Switch off the engine and remove the key from the ignition.

1 - Unplug the connector (1).

2 - Loosen the screws (2) holding the sensor (3) in place.



3 - Remove the sensor (3) complete with spacer (4) and gasket (5).

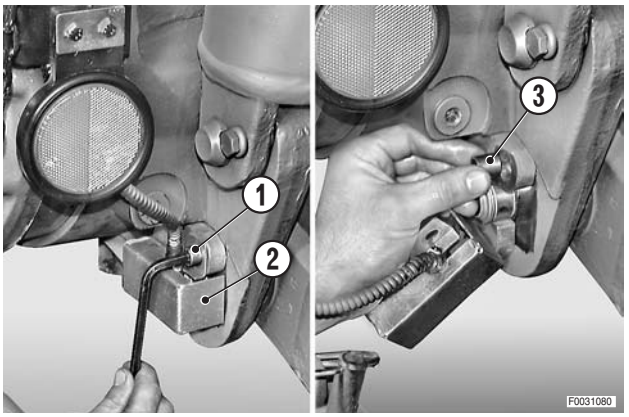


REFITTING SENSOR

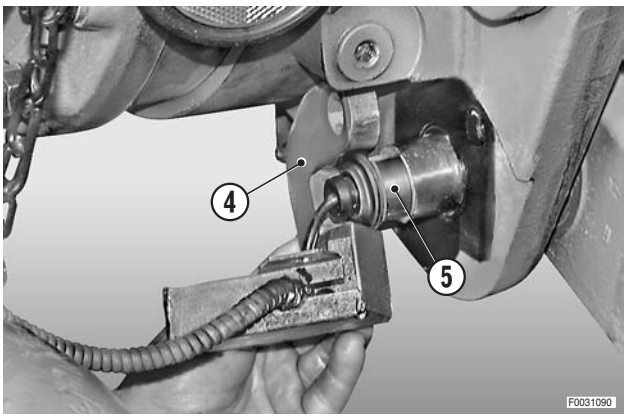
- To refit, repeat the above steps in reverse order.

REMOVAL OF THE LIFT DRAFT SENSOR

1 - Remove the screws (1) and remove the cover (2) and the spacers (3).

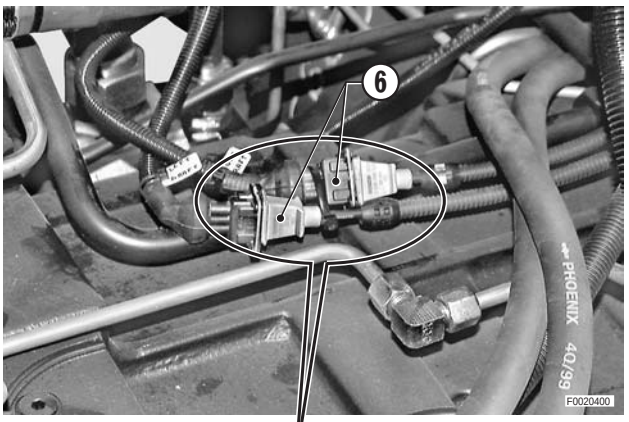


2 - Support the lever and remove the bracket (4) and then the sensor (5).



3 - Release the wiring from the retaining straps and unplug the sensor connector (6).

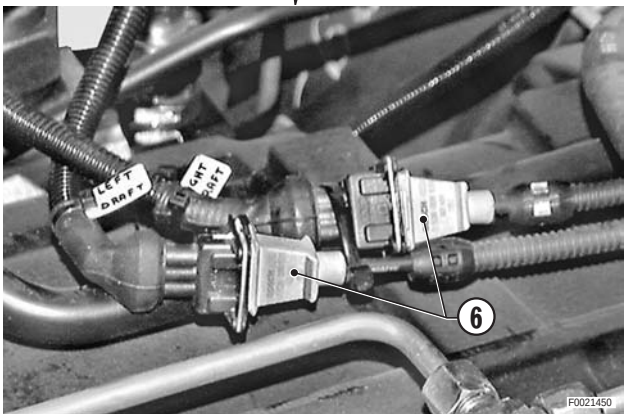
★ The connectors are located under the cab and can be accessed from the left-hand side of the tractor.



REFITTING THE LIFT DRAFT SENSOR

- Refitting is the reverse of removal.

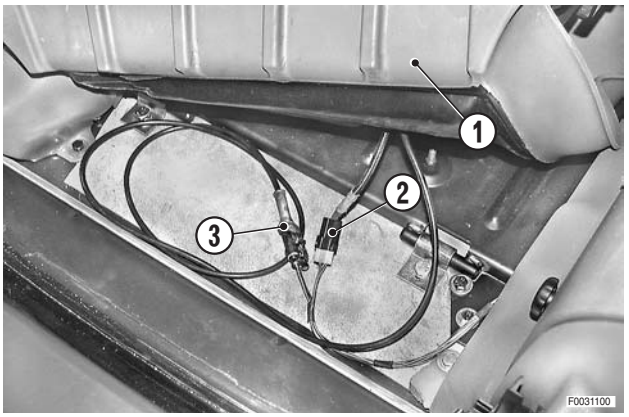
★ Make sure the sensor is installed the right way round.



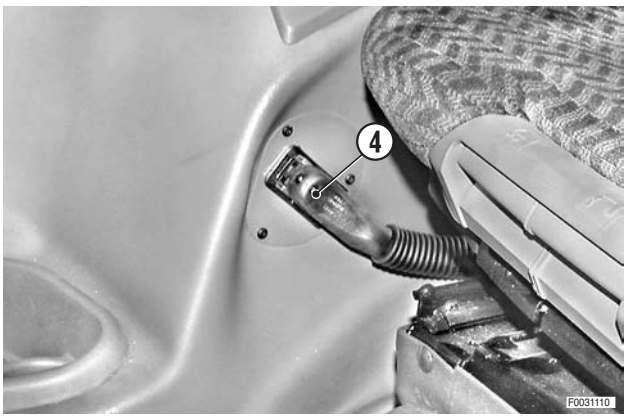
REMOVAL OF DRIVER'S SEAT

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

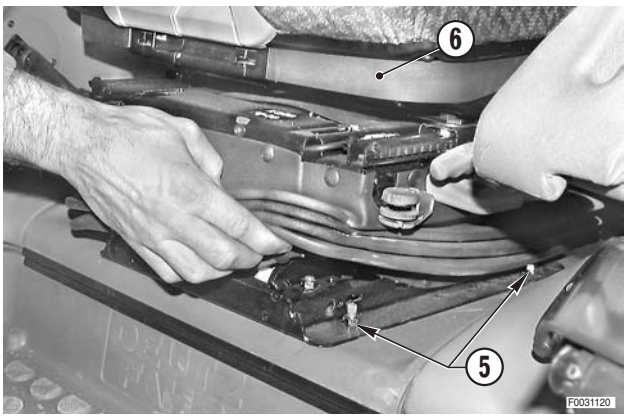
1 - Lift the rear floor mat (1) to expose the seat compressor power supply cable (2) and the seat occupant sensor lead (3).



2 - Unplug the connector (4) of the multifunction armrest console.



3 - Remove the four nuts (5) and lift the seat (6) clear, complete with the armrest console.



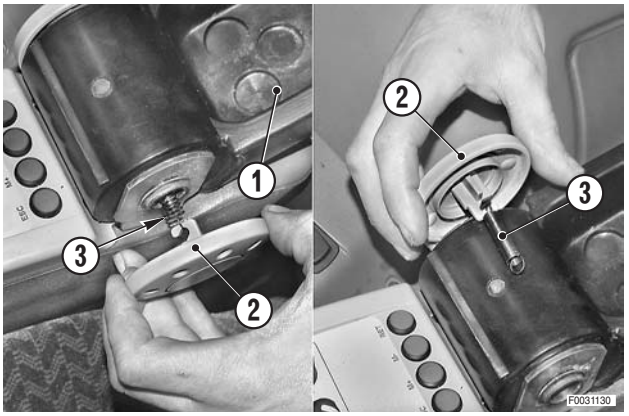
REFITTING THE DRIVER'S SEAT

- To refit, repeat the above steps in reverse order.

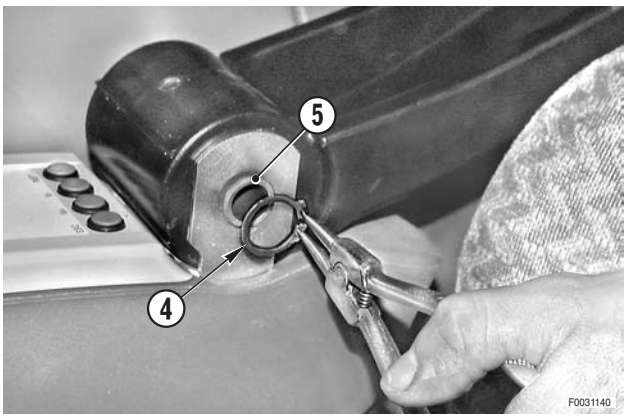
REMOVAL OF ARMREST CONTROL PANELS

1. Multifunction control panel

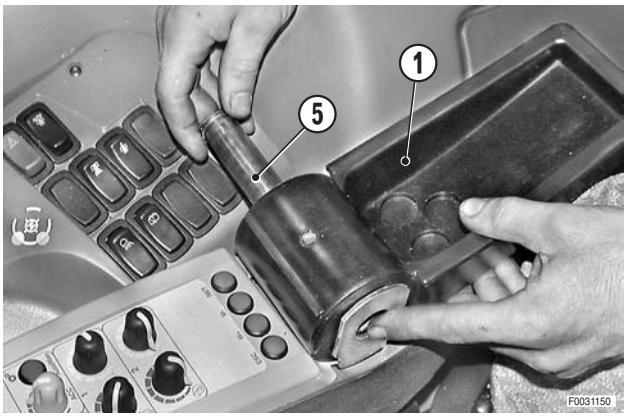
1 - Open the guard (1).
Detach one cover (2), release the spring (3) and remove the two covers.



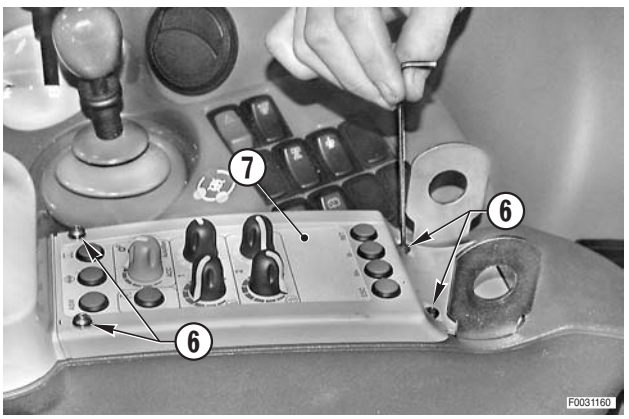
2 - Remove the circlip (4) retaining the pivot (5).



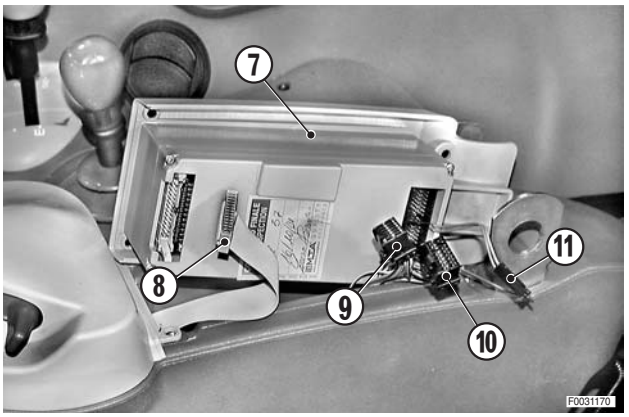
3 - Draw out the pivot (5) and remove the guard (1).



4 - Loosen and remove the four screws (6) securing the panel (7).



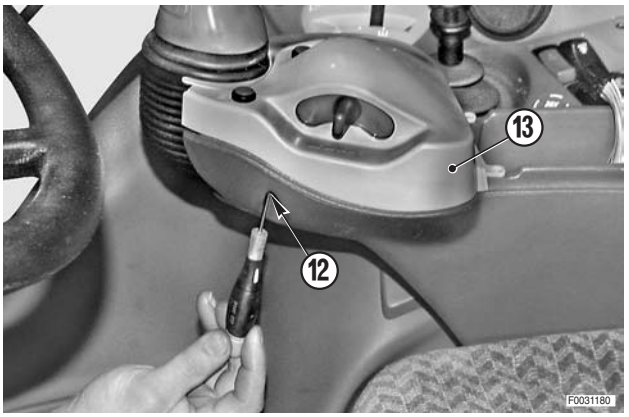
5 - Lift out the panel (7) and unplug the connectors (8), (9), (10) and (11).



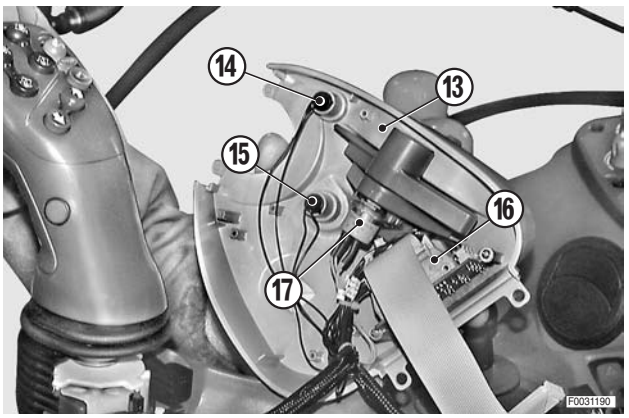
2. Hand throttle panel

1 - Remove the multifunction control panel (7).

2 - Loosen and remove the three securing screws (12).



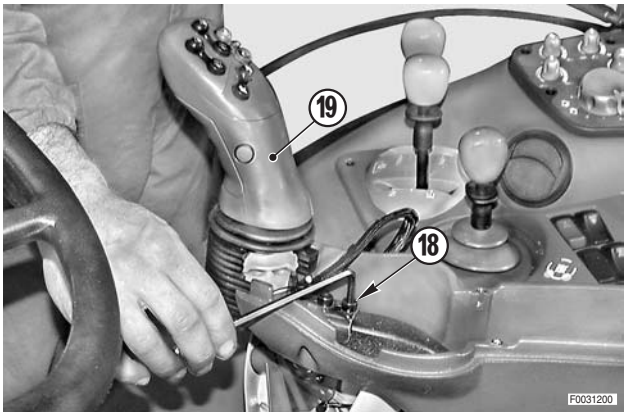
3 - Remove the hand throttle panel (13) and unplug the connectors (14), (15), (16) and (17).



3. Joystick

1 - Remove the hand throttle panel (13).

2 - Loosen and remove the securing screws (18) and detach the joystick (19).



REFITTING THE ARMREST CONTROL PANEL

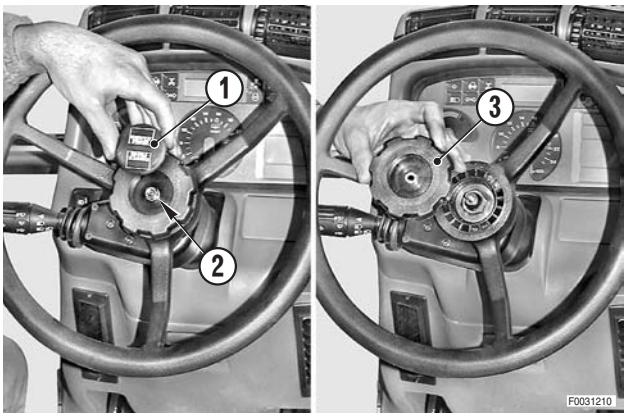
- To refit, repeat the above steps in reverse order.

REMOVAL OF THE STEERING WHEEL, STEERING COLUMN SWITCH UNIT AND INSTRUMENT PANEL

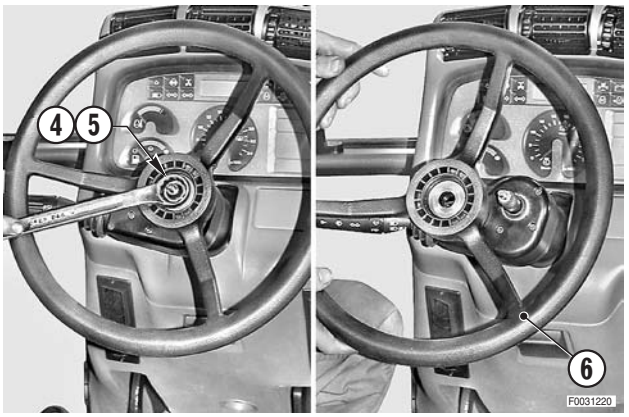
⚠ Remove the battery cover and disconnect the negative battery lead (–).

1 - Remove the centre cover (1) and remove the nut (2) with its washer.

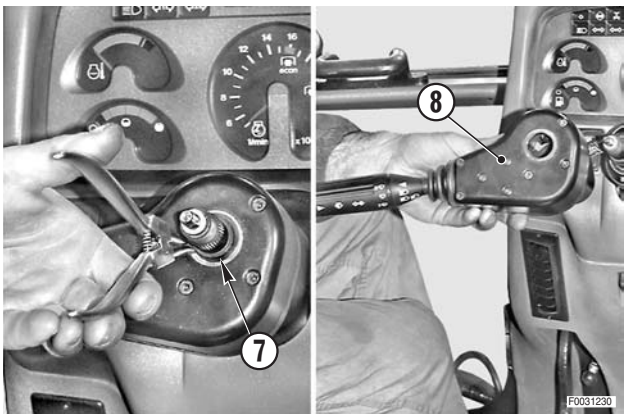
2 - Remove the locknut (3) for telescopic adjustment of the steering wheel.



3 - Remove the nut (4), the toothed washer (5) and remove the steering wheel (6). ※ 1

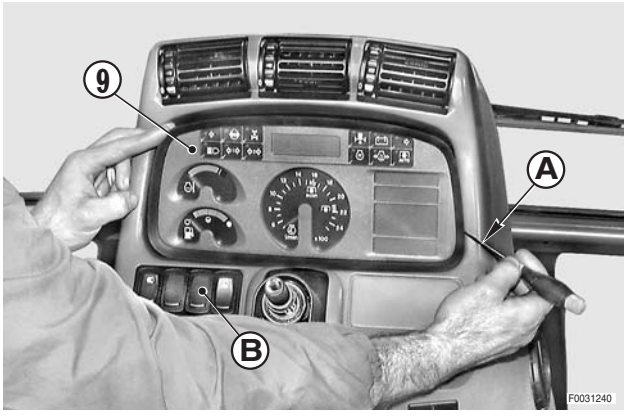


4 - Remove the circlip (7) and remove the steering column switch unit (8) from the steering column.

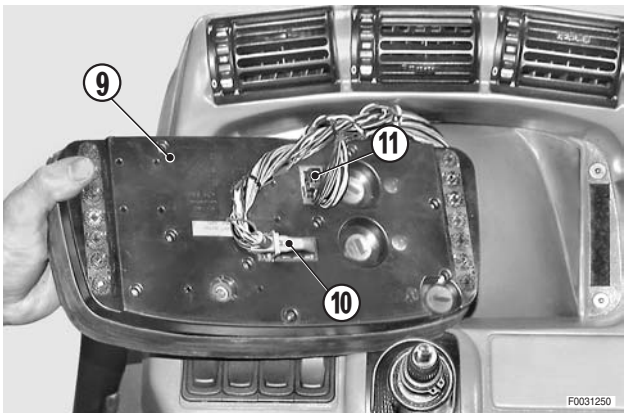


5 - Insert a thin blade "**A**" under the gasket and prise off the instrument panel (9).

★ 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.)

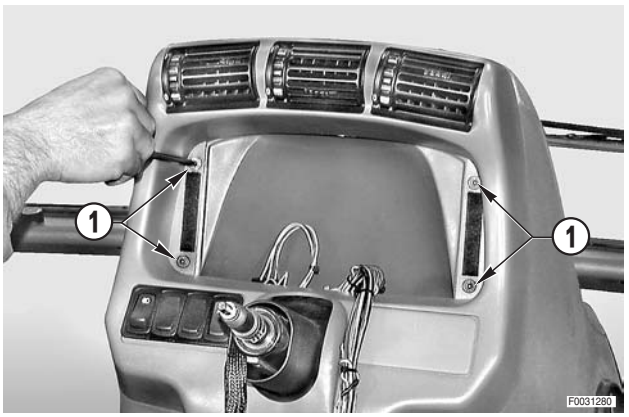
REMOVAL OF CENTRE CONSOLE, STEERING COLUMN SWITCH ASSEMBLY AND SHROUD

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

1 - Remove the seat.
(For details, see «REMOVAL OF DRIVER'S SEAT»).

2 - Remove the steering wheel and steering column switch assembly.
(For details, see «REMOVAL OF STEERING WHEEL, STEERING COLUMN SWITCH ASSEMBLY AND INSTRUMENT PANEL»).

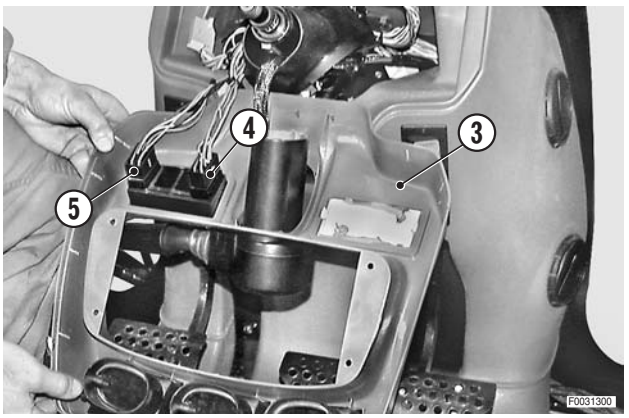
3 - Unscrew and remove the screws (1).



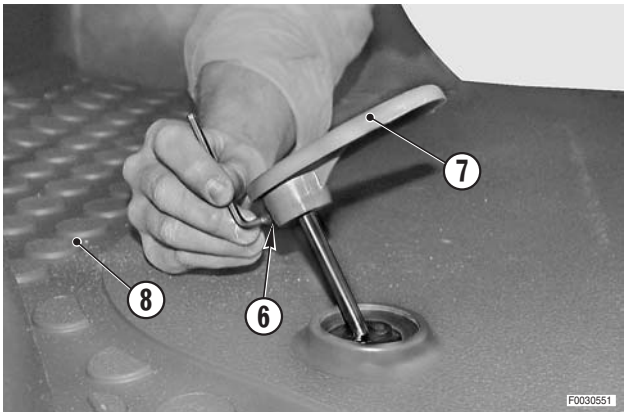
4 - Remove the upper centre console (2) by lifting clear.

5 - Tilt the console (3) backwards and unplug the connectors (4) and (5).

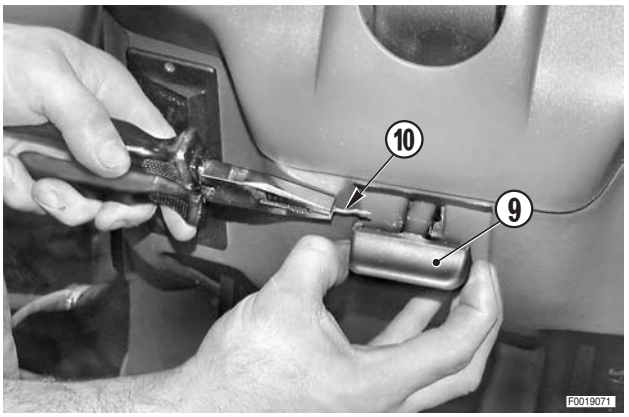
★ The unmarked pushbutton is wired to the relative connector **only on models equipped with a front lift.**



6 - Loosen the grub screw (6) and remove the accelerator pedal (7), then remove the floor mat (8).

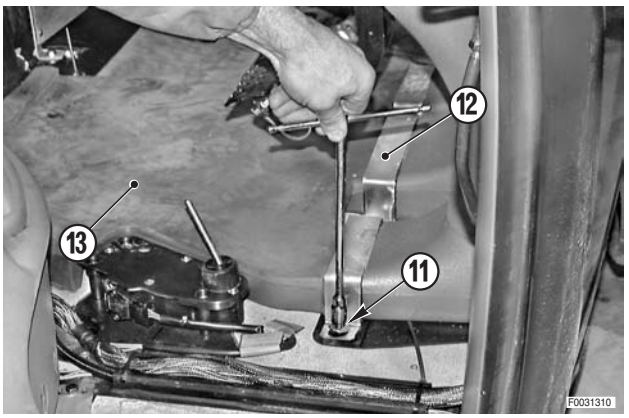


7 - Fully lower the steering column.
Pull outwards the lock handle (9) of the steering tilt adjustment; remove the cotter pin (10) and remove the handle.
★ Renew the cotter pin at each reassembly.

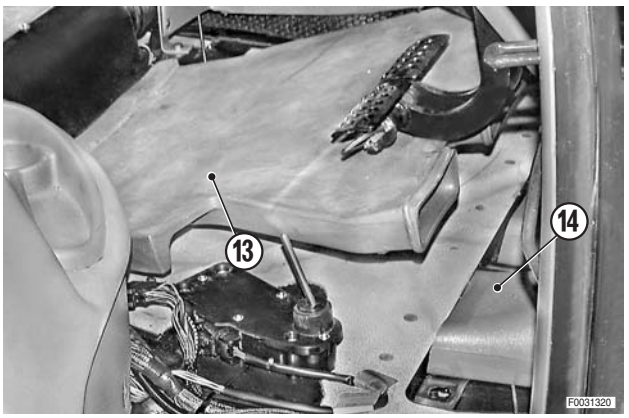


8 - Unscrew and remove the retaining screws (11) of the air duct (13).

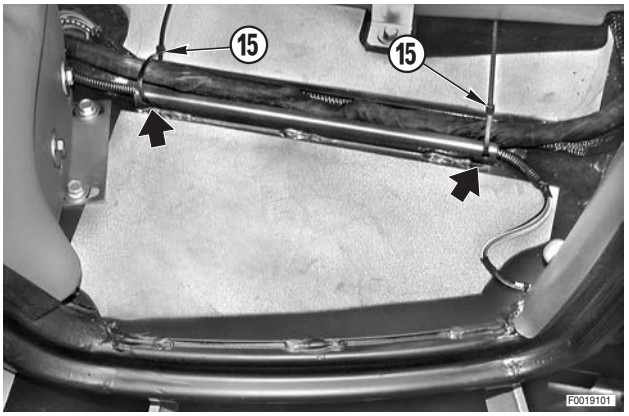
※ 1



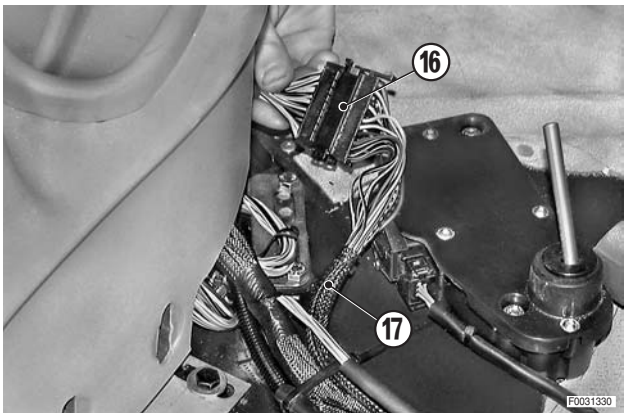
9 - Detach the air duct (13) from the centre shroud (14) and remove it.



10 - 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.

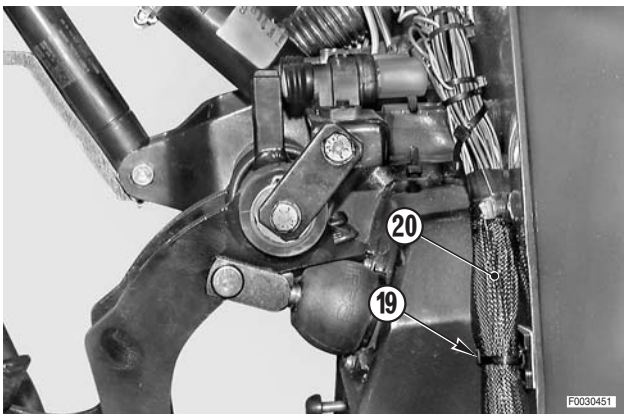


11 - Withdraw the wiring (17) from the right-hand console (16).



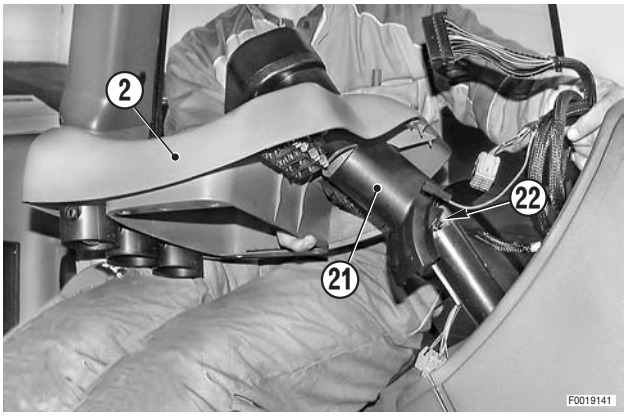
12 - Release the wires of the push button connectors from the cable ties (18).

13 - Release the vertical wiring (20) from the cable tie (19); withdraw the complete wiring harness through the aperture exposed by tilting the console forwards.

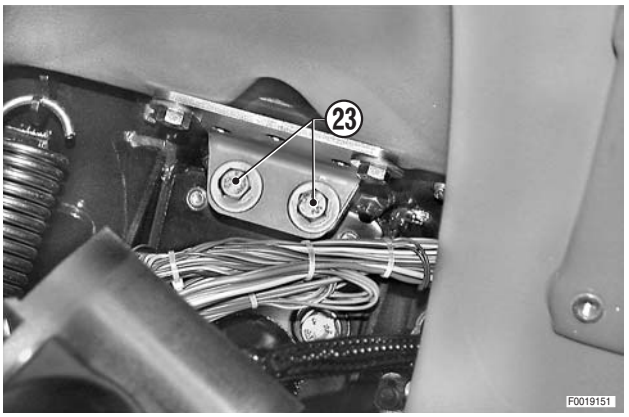


14 - Rotate the shroud (21) to align the rotation lock key with the spring (22); remove the shroud (21).

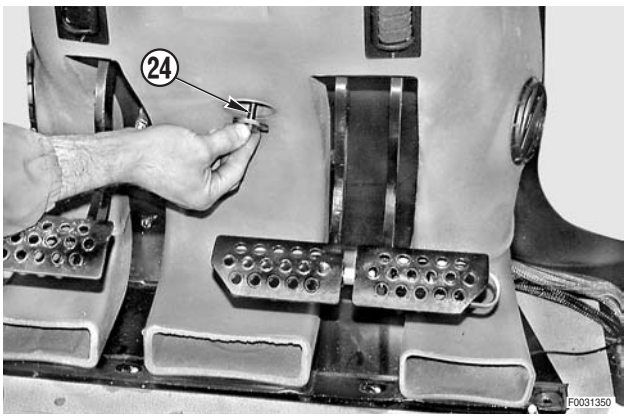
15 - Remove the complete console assembly (2).



16 - Remove the top bolts (23).



17 - Remove the central bolt (24).



18 - Lift the console shroud (14) and tilt backwards to disengage it from the brake and clutch pedals.

REFITTING STEERING COLUMN SWITCH ASSEMBLY, CENTRE CONSOLE AND SHROUD

- To refit, repeat the above steps in reverse order.

※ 1

★ Check the condition of the fascia seal and renew if damaged.

OPENING AND REMOVAL OF RIGHT-HAND CONSOLE

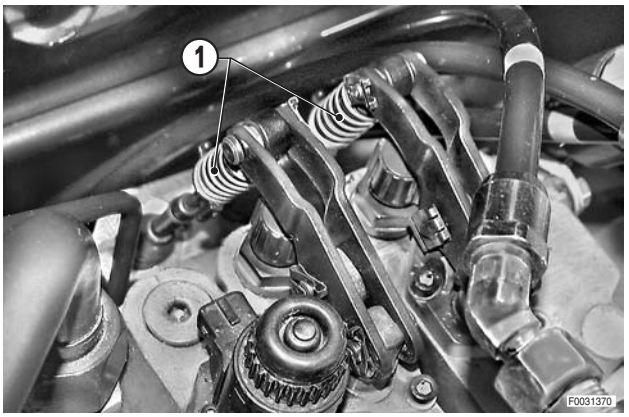
- The right-hand console can be opened partially to enable inspection of the wiring for the air conditioning fan.

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

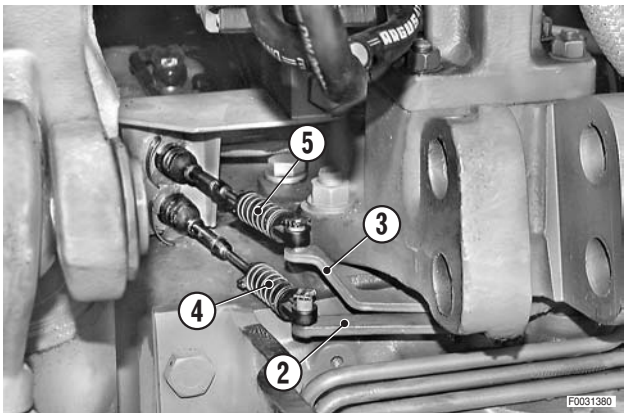
1 - Remove the seat and the floor mats.
(For details, see «REMOVAL OF DRIVER'S SEAT»).

2 - **Removal only:** disconnect the Bowden cables (1) from the auxiliary spool valves. ⁘ 1

★ Mark the positions so as to avoid error during refitment.

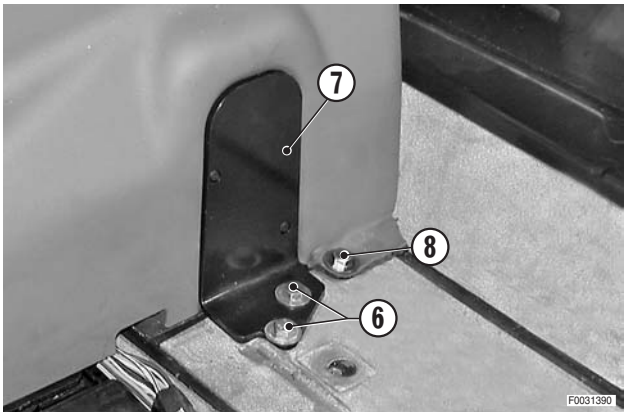


4 - Disconnect the cables (4) and (5) from the PTO speed selector lever (2) or standard/economy mode selector lever (3).

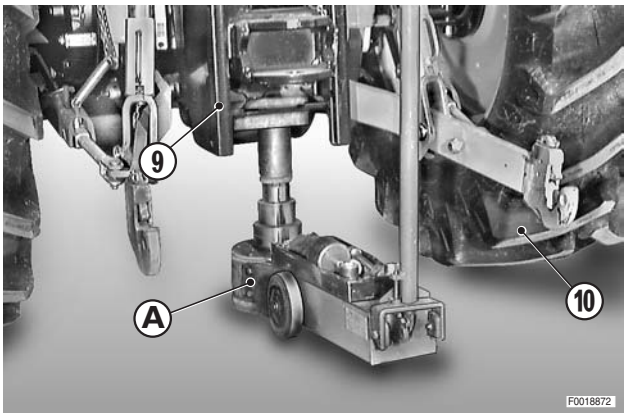


5 - Remove the bolts (6) and distance the bracket (7) from the console.

6 - Remove the fixing bolt (8) of the right hand console.



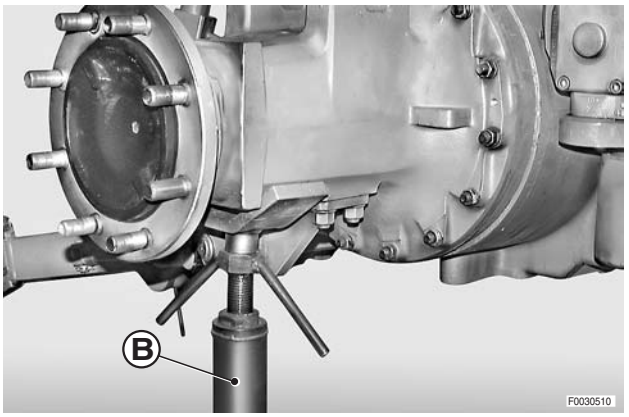
7 - Position a hydraulic jack "**A**" with a non-slip block under the tow hook (9) so that it is inclined towards the right-hand wheel; raise the tractor so that the right wheel is off the ground (10).



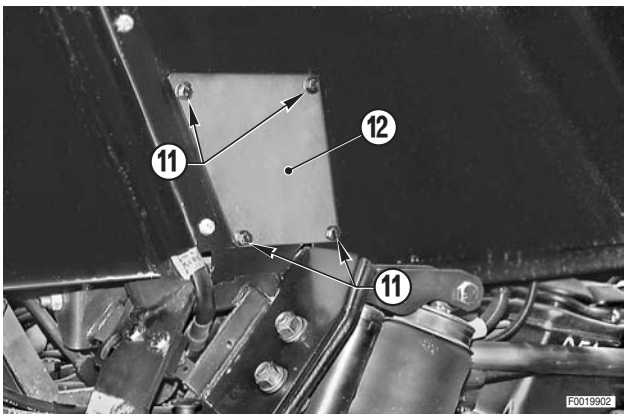
8 - Position an axle stand "**B**" with a safety cradle support under the right axle assembly; remove the right wheel and lower the machine onto the stand.

1

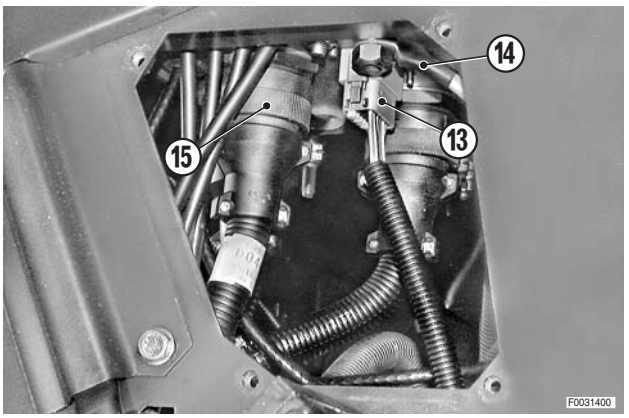
★ Axle stand capacity: 3 tonnes minimum



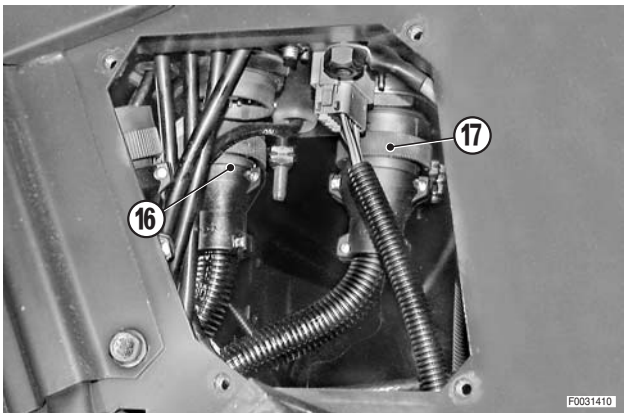
9 - **In case of console removal only**:
Remove the four screws (11) and remove the cover plate (12).



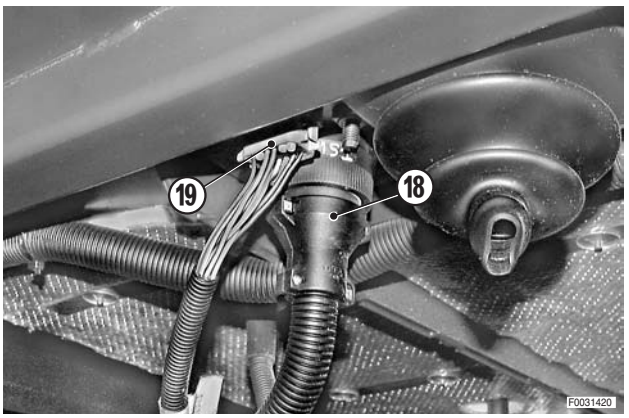
10 - **Removal of console only:** separate the front suspension line connector (13), the earth cable (14) and the TKAB3 cab power connector (15) from the bulkhead assembly.



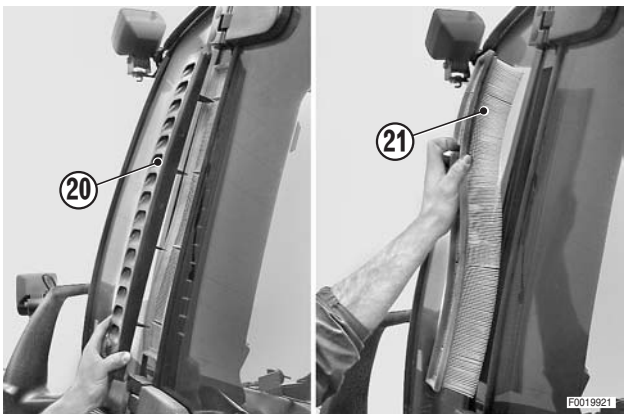
10a - Detach the transmission and lift harness connectors (16) (TKAB1) and (17) (TKAB2).



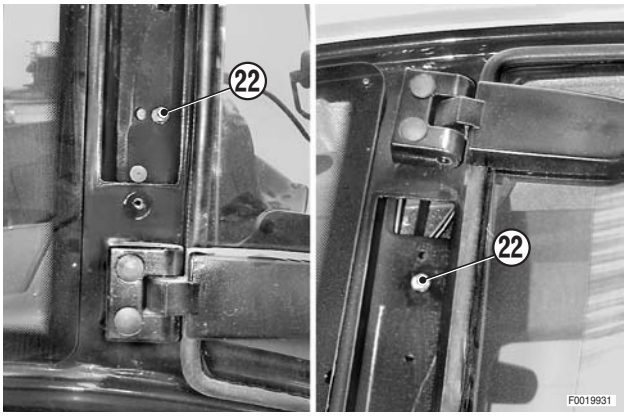
11 - Disconnect the engine line connector (18) and the connector (19) from the bulkhead fitting.



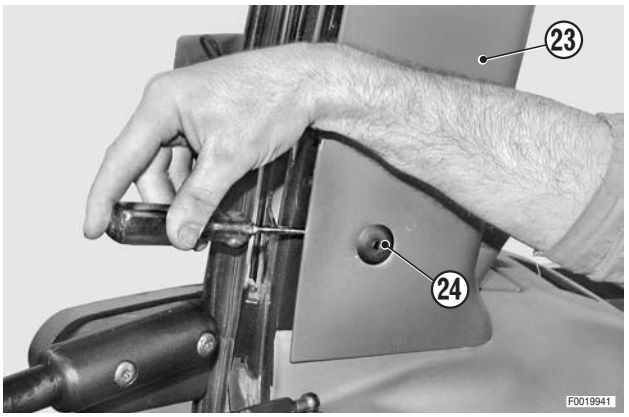
12 - Remove the grille (20) and the filter (21) from the right-hand cab pillar.



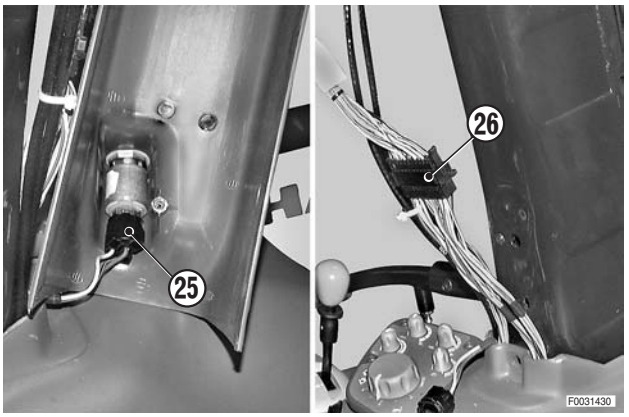
13 - Unscrew and remove the interior trim panel retaining screws (22).



14 - Insert a thin blade between the cab pillar and the interior trim (23) and detach the clips (24) from the pillar and the trim.
Remove the trim.

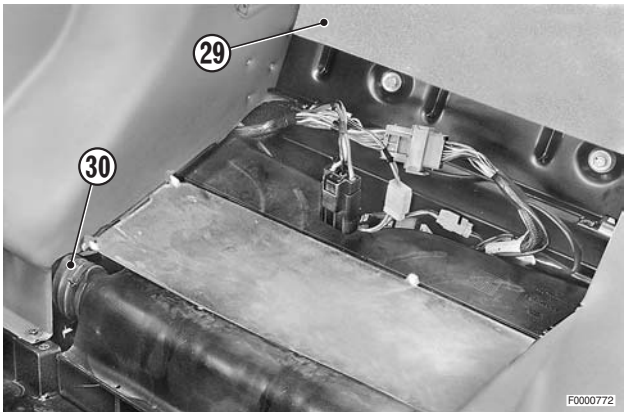


15 - Unplug the ignition key connector (25), and the connector (26) on the power lines to equipment mounted on the cab roof.

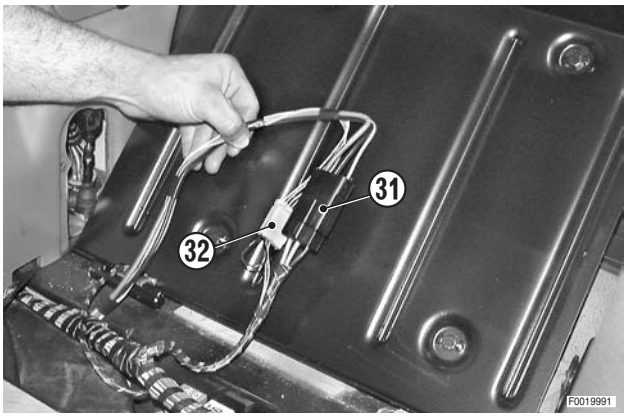


16 - Disconnect the gas spring (27) of the right-hand door and remove the mounting pin (28).

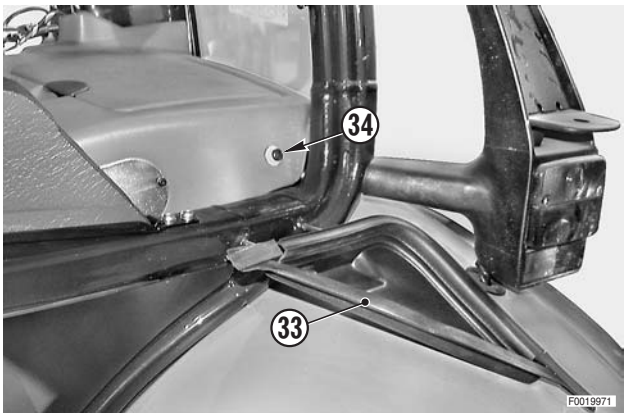
17 - Remove the bolts, lift the seat support (29) and disconnect the hose (30).



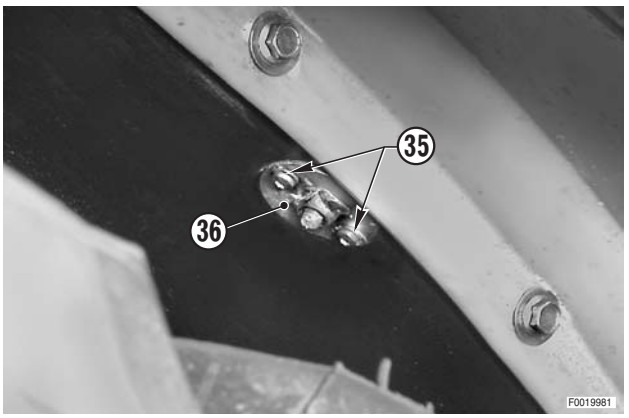
18 - **In case of console removal only**: unplug the connectors (31) and (32).



19 - Open the rear right cable hatch (33) to access the screw (34).



20 - Remove the screws (35) and remove the flanged nut (36) located under the right fender.



21 - Loosen and remove the bolt (37).

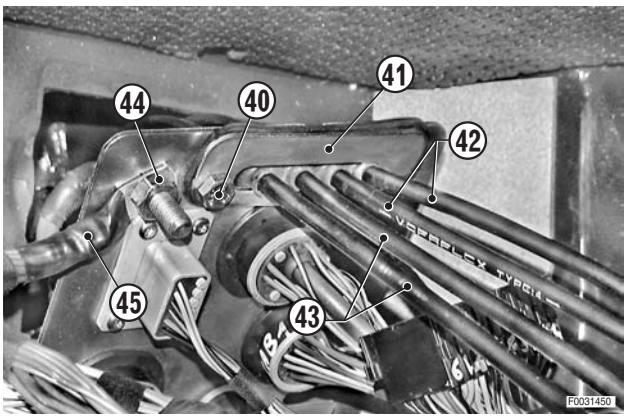
22 - Unscrew and remove the front retaining screws (38).

23 - Raise the front of the right-hand console (39) and distance it from the side of the cab.

24 - **Removal only:** loosen and remove the bolts (40) retaining the bulkhead plate (41) for the Bowden cables (42) and (43).

25 - Remove the bolt (44) and disconnect the cable (45).

★ When removing the console, support the wiring harnesses and Bowden cables.



REFITTING THE RIGHT-HAND CONSOLE

- To refit, repeat the above steps in reverse order.

※ 1

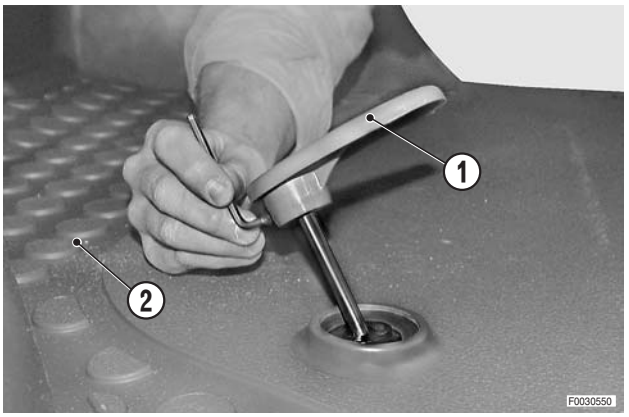
★ Connect the Bowden cables following the operations described under the headings «REFITMENT OF AUXILIARY SPOOL VALVE CABLES» and «REFITMENT OF PTO OPERATING MODE AND SPEED SELECTOR CABLES».

REMOVAL OF THE LEFT-HAND CONSOLE

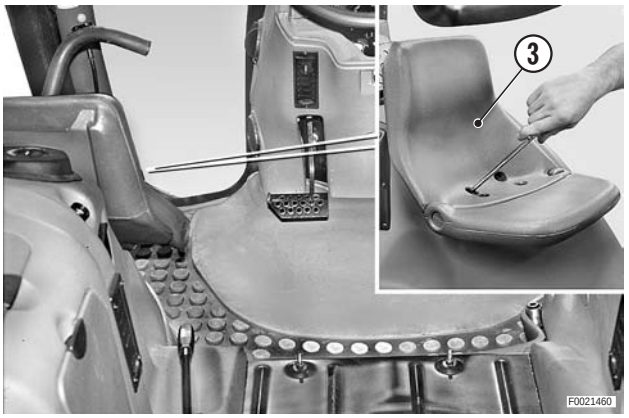
⚠ Remove the battery cover and disconnect the negative battery lead (–).

1 - Remove the seat. (For details, see «REMOVAL OF THE DRIVER'S SEAT»).

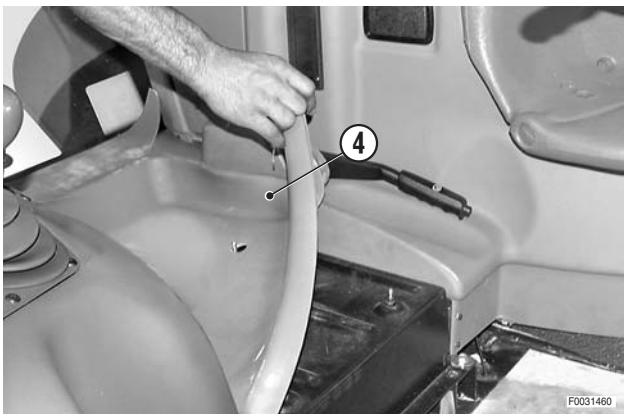
2 - Remove the accelerator pedal (1) and remove the front floor mat (2).



3 - **Only where fitted.**
Remove the passenger seat (3).

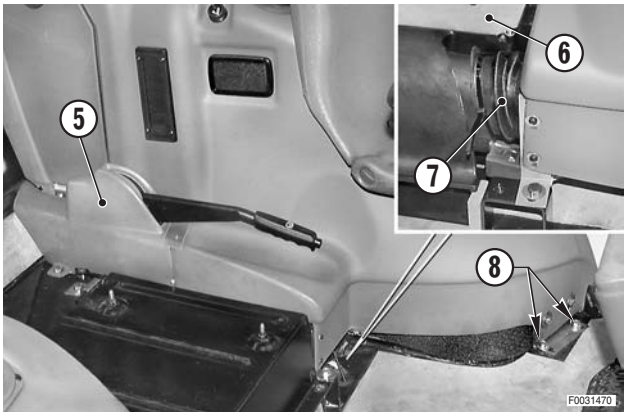


4 - Remove the rear floor mat (4).



5 - Remove the parking brake cover (5).

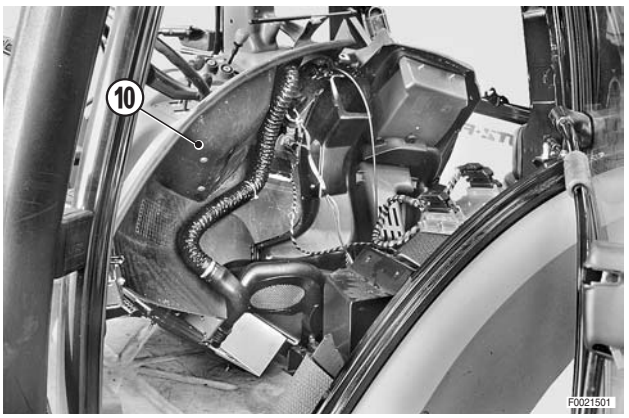
6 - Remove the seat support (6) and remove the strap to disconnect the hose (7).
Remove the screw (8).



7 - Remove the interior trim (9) 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»).

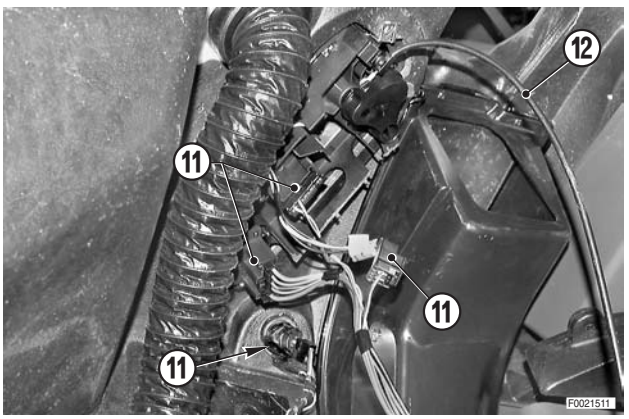
9 - Remove the fixing screws and move the left-hand console (10) away from the side of the cab.



10 - Unplug the four connectors (11).

11 - Disconnect the heating valve control cable (12).

12 - Remove the left-hand console (10).



REFITTING THE LEFT-HAND CONSOLE

- Refitting is the reverse of removal.

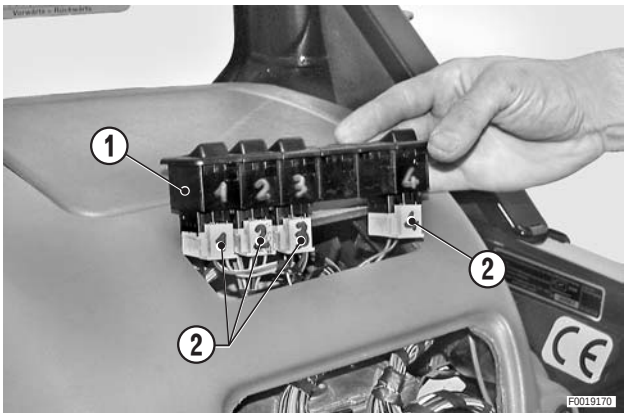
REMOVAL OF HYDRAULIC LIFT, FRONT SUSPENSION AND TRANSMISSION ELECTRONIC CONTROL UNITS

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

1 - Remove the rear hatch of the right-hand console.

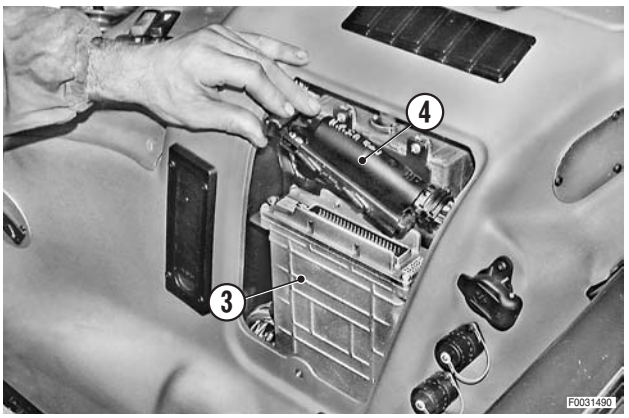
2 - **If fitted:** take out the switch assembly (1).
★ Mark the switches and connectors to avoid error during refitment.

3 - Unplug the connectors (2) from the switches (1).

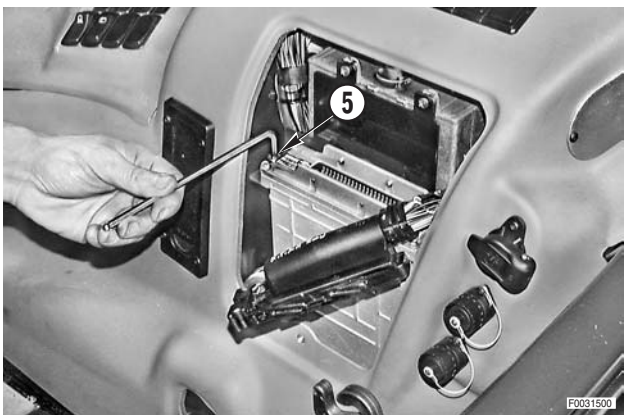


1. Multifunction control unit (HPSA)

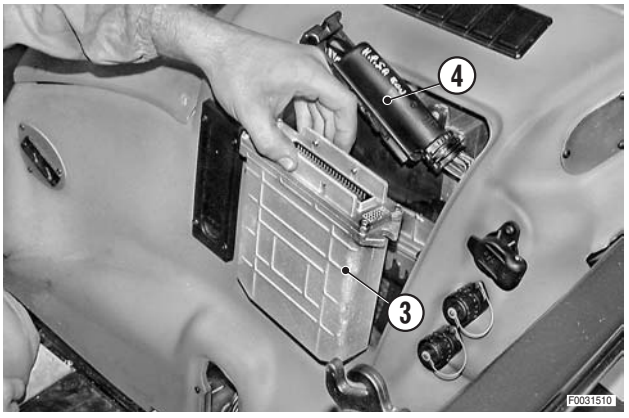
1 - Unplug the connector (4) from the control unit (3).



2 - Loosen and remove the screws (5) securing the lift control unit and, if fitted, that of the front suspension.



3 - Take out the ECU (3).

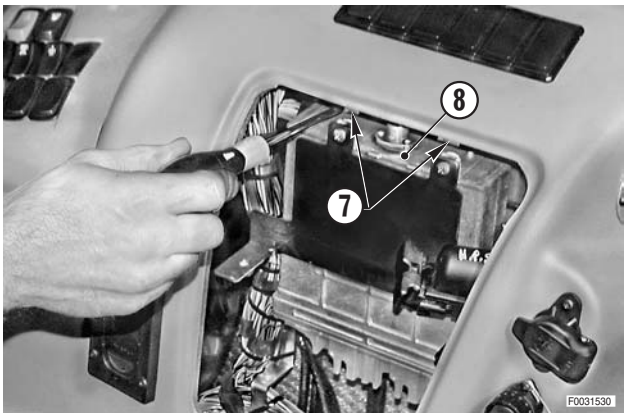


2. Transmission control unit

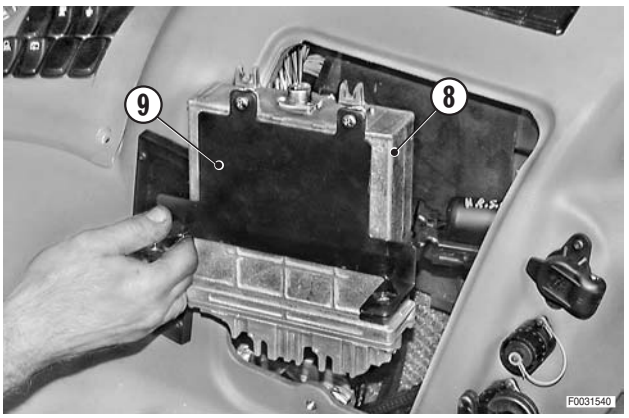
1 - Remove the HPSA unit.
(See previous heading).

2 - Unplug the connector (6).

3 - Loosen and remove the screws (7) securing the transmission control unit (8).



4 - Remove the control unit (8) complete with the bracket (9).



REFITTING HYDRAULIC LIFT, FRONT SUSPENSION AND TRANSMISSION ELECTRONIC CONTROL UNITS

- To refit, repeat the above steps in reverse order.

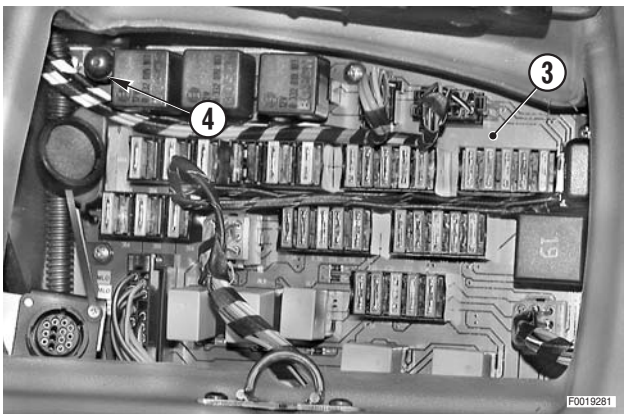
REMOVAL OF FUSE AND RELAY BOARD

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

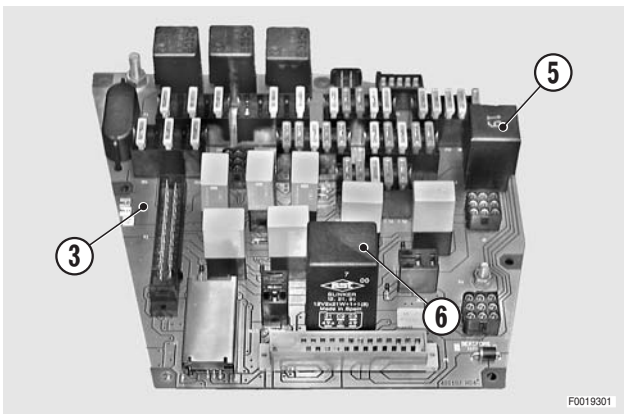
1 - Remove the bracket (1) of the diagnostics socket (2) and set to one side.

2 - Unplug connectors (P2), (P6), (P3), (P5), (J1), (J2) and (J3) from the fuse/relay board (3).
★ The connectors are marked with the same symbols as the sockets on the circuit board.

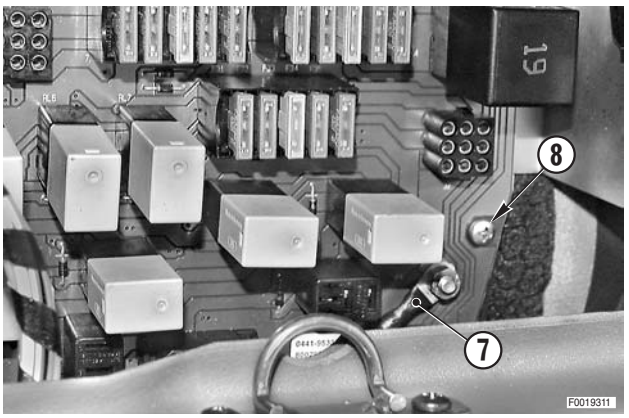
3 - Remove the cover and disconnect the power cable (4) (P1).



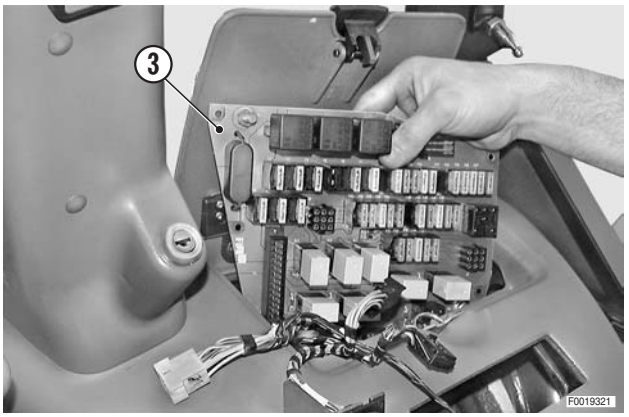
4 - Unplug the relays (3) liable to obstruct the removal of the board:
RL4 - Front windscreen wiper (5)
RL14- Direction indicators (6)



5 - Disconnect the earth cable (7) (P4) and remove the five fixing screws (8).



6 - Remove the board (3).



REFITTING THE FUSE AND RELAY BOARD

- To refit, repeat the above steps in reverse order.

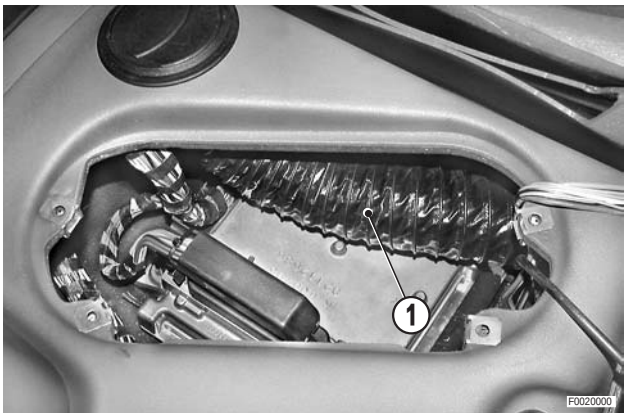
REMOVAL OF THE ENGINE ECU

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

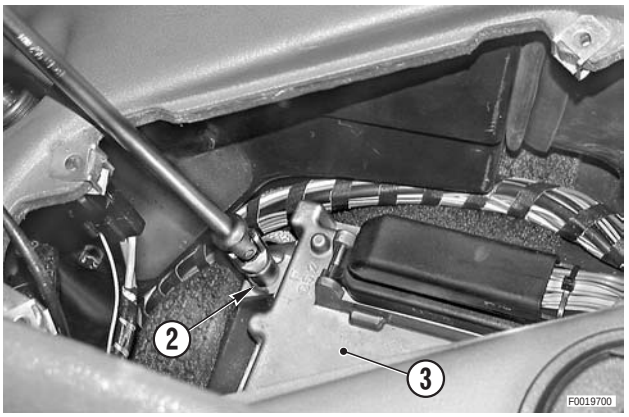
1 - Remove the ventilation and heater control panel. (For details, see «REMOVAL OF CLIMATE CONTROL PANEL»).

2 - Disconnect the air hose (1) from the outlet vent and position it to one side.

※ 1

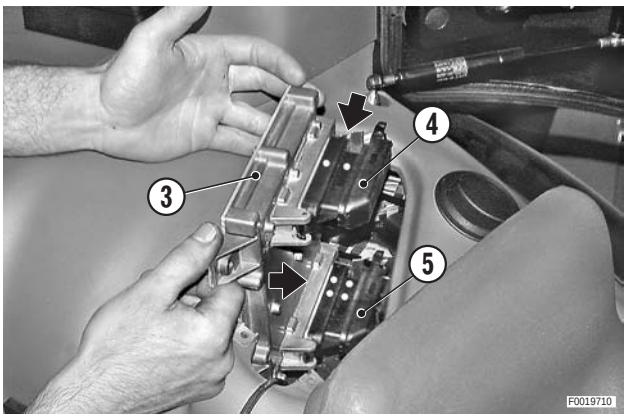


3 - Loosen the fixing screws (2) and partially withdraw the ECU (3).



4 - Label and unplug the connectors (4) and (5).

5 - Remove the ECU (3).



REFITTING THE ENGINE ECU

- Refitting is the reverse of removal.

※ 1

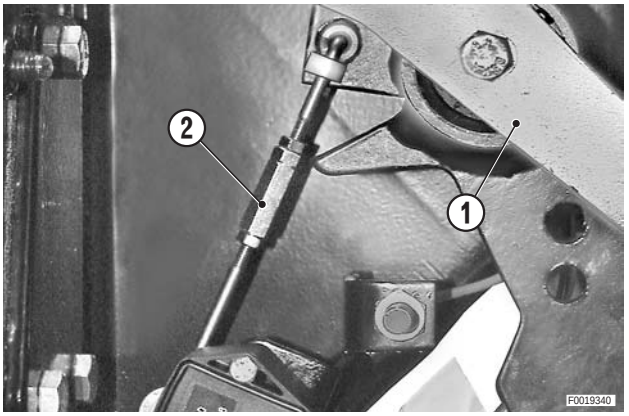
- The air hose must be routed over the top of the ECU between the two connectors.

CLUTCH PEDAL AND RELATED DEVICES

1. Removal of the potentiometer

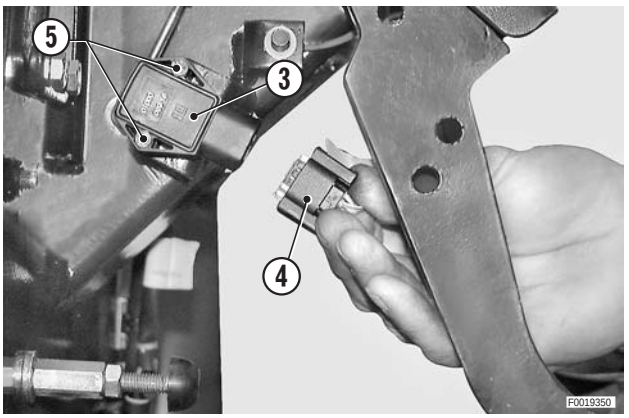
1 - Remove the centre console and console shroud. (For details, see «REMOVAL OF THE CENTRE CONSOLE AND SHROUD»).

2 - Disconnect the tie-rod (2) from the clutch pedal (1).



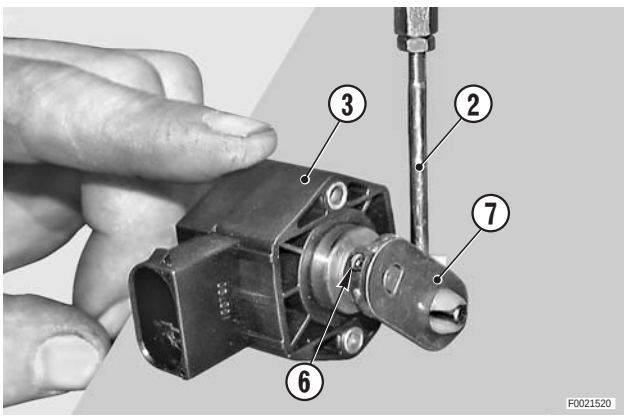
3 - Unplug the connector (4) from the potentiometer (3).

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 Refitment of potentiometer

- To refit, repeat the above steps in reverse order.

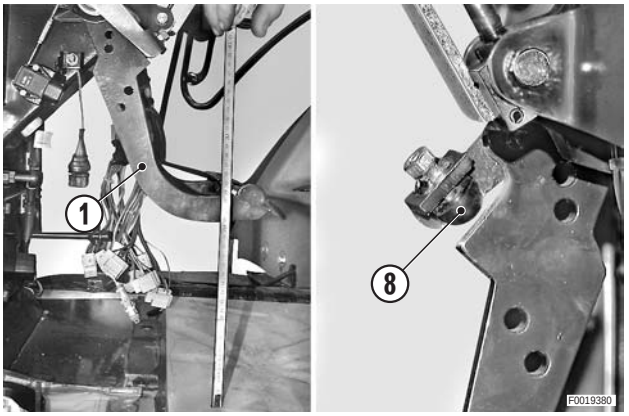
  After refitting the potentiometer, check the position and travel of the pedal, then check the settings with the programming/diagnostics tester.

  NOTA. 1 - After adjusting the height of the clutch pedal, check using the HPSA program (see section 20) that the potentiometer output voltage registers between 4 and 4.3 V with the pedal depressed, and between 0.9 and 1 V with the pedal released. If necessary, adjust the length of the linkage rod (2) to bring the values within the specified limits.

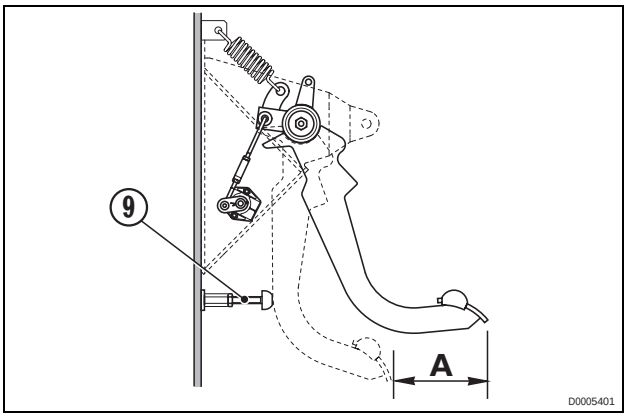
  2 - Tests are conducted using the ART (All Round Tester).

2. Adjustment of the clutch pedal position and travel

1 - Check that the distance between the top edge of the clutch pedal and floor is the same as that of the brake pedals.
If necessary, adjust the pedal height by adjusting the buffer (8).



2 - Adjust the stop (9) so that the pedal travel "**A**" will be sufficient to generate the voltage indicated (4– 4.3 V).

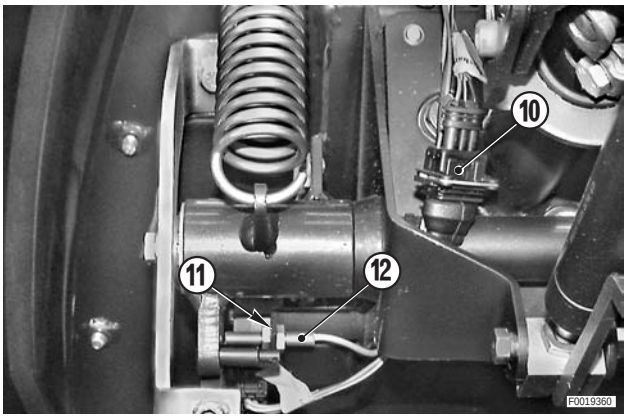


3. Renewal of the proximity sensor

1 - Unplug the connector (10).

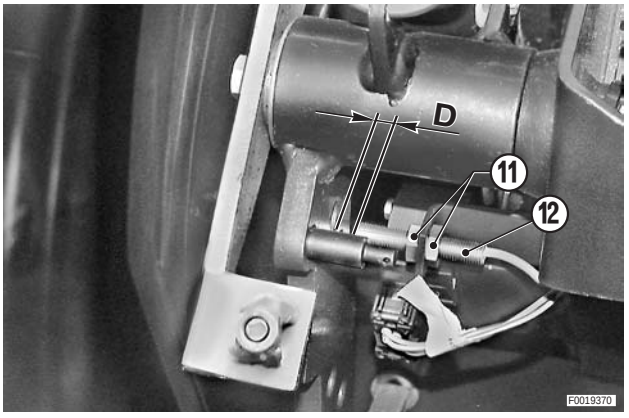
2 - Unscrew the nut (11) sufficiently to disengage it from the sensor (12).

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.

5 - 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.)

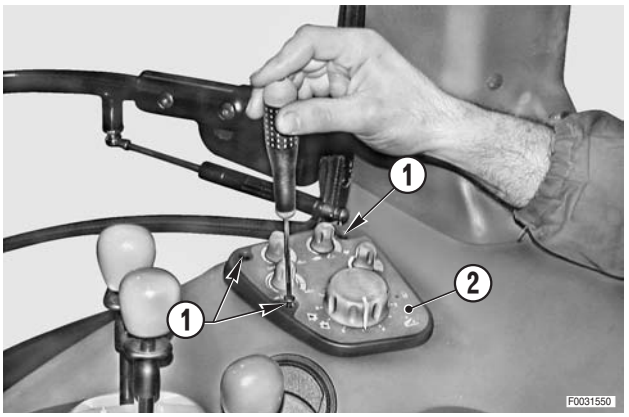


REMOVAL OF RIGHT-HAND CONSOLE CONTROLS

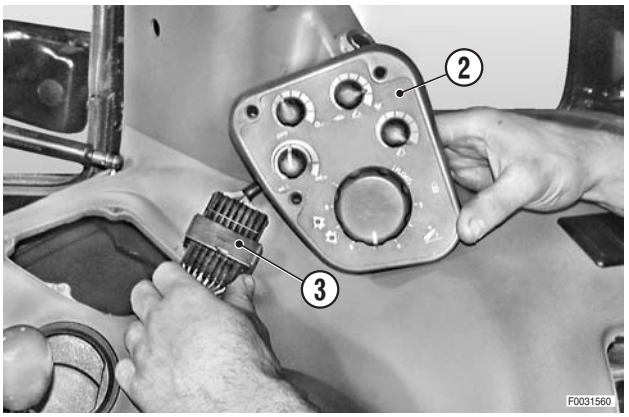
⚠ Remove the battery cover and disconnect the negative battery lead (–).

1. Removal of lift control panel

1 - Loosen and remove the screws (1) of the lift control panel (2).

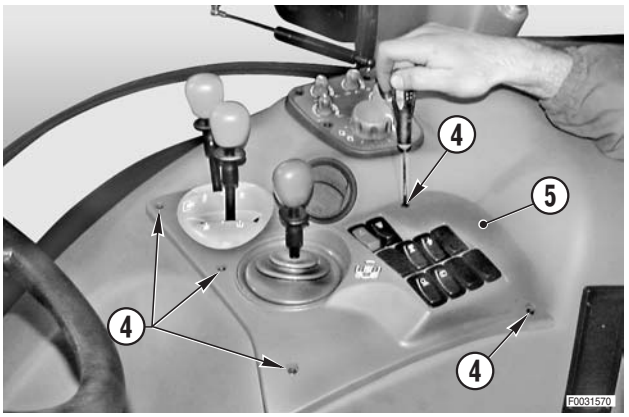


2 - Draw out the panel assembly (2) and unplug the connector (3).



2. Removal of directional valves and PTO control panel

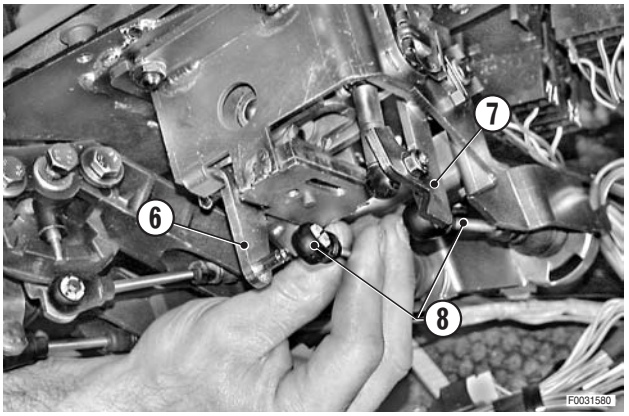
1 - Loosen and remove the screws (4) securing the panel (5).



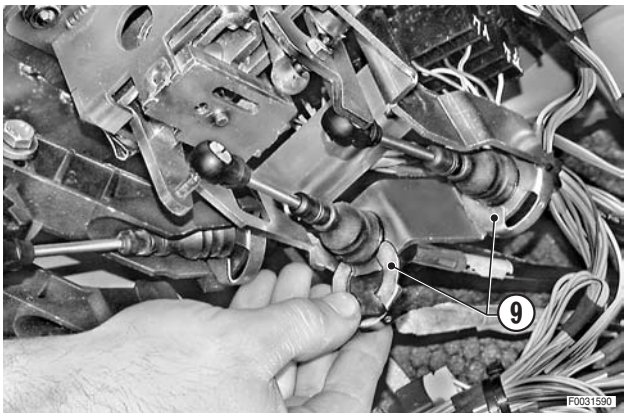
2- Lift the entire assembly (5) and disconnect the levers (6) and (7) and Bowden cables (8) operating the valves and the PTO speed and mode selector linkages.

※ 1

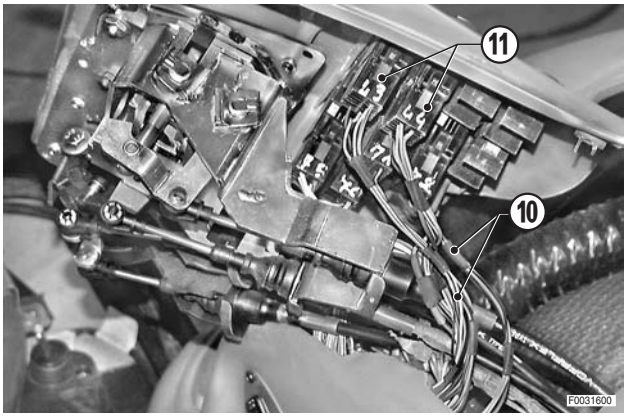
★ Mark the cables and the relative couplings so as to avoid error during refitment.



3 - Remove the yokes (9) and disconnect the sleeves.

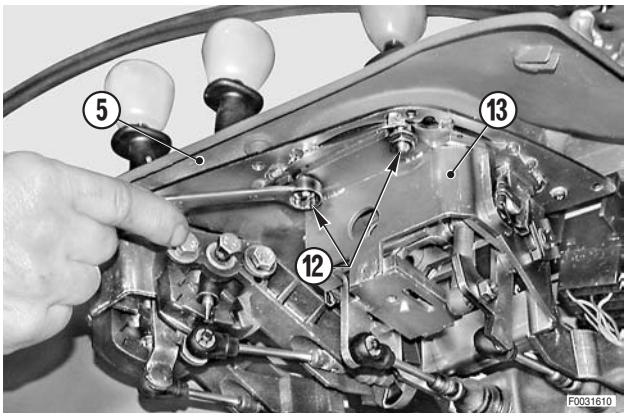


4 - Disconnect the harnesses (10) from the switches (11).
★ Make certain the switches and harnesses are marked so as to avoid error during reassembly.



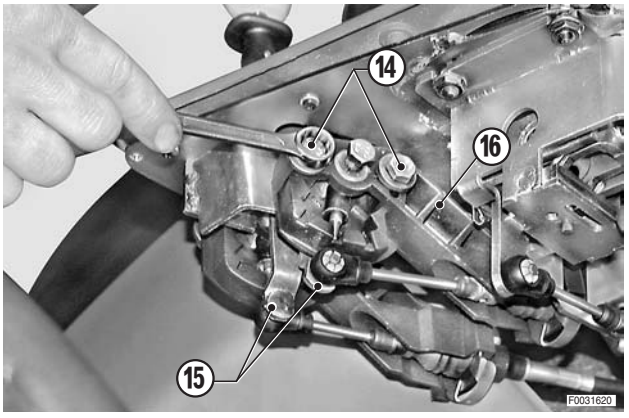
3. Removal of joystick control lever assembly

1 - Loosen and remove the nuts (12) and lock washers; separate the lever assembly (13) from the panel (5).



4. Removal of single PTO control levers

1 - Loosen and remove the nuts (14) and the relative washers, and remove the levers (15) and the pivot brackets (16).



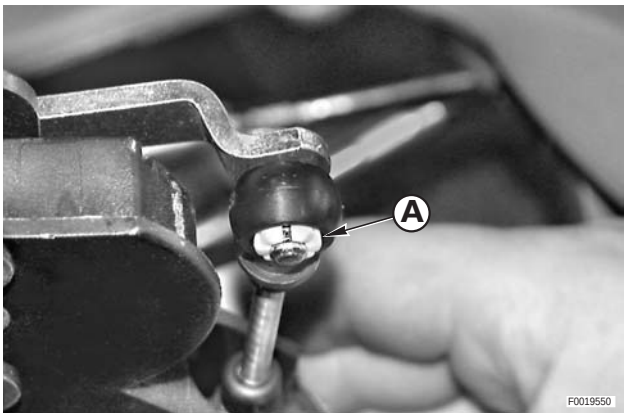
REFITTING THE RIGHT-HAND CONSOLE CONTROLS

- To refit, repeat the above steps in reverse order.

※ 1

★ The slotted bush "**A**" securing the cable must be oriented towards the outer end of the coupling pin.

1 - Adjust the length of the Bowden cables.
(For details, see «REPLACEMENT OF BOWDEN CABLES»).



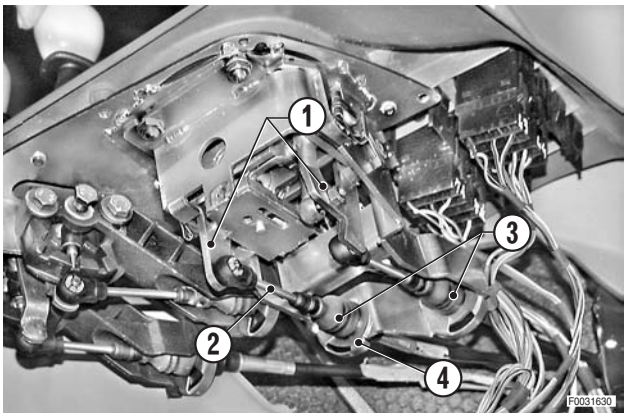
REPLACEMENT OF BOWDEN CABLES

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

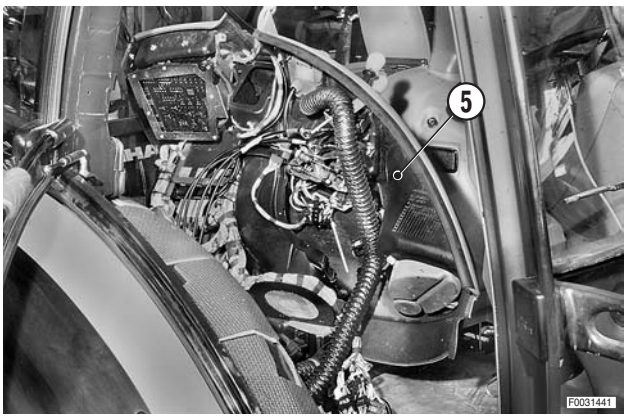
1. Removal

1 - Remove the control levers assembly.
(For details, see «REMOVAL OF RIGHT-HAND CONSOLE CONTROLS»).

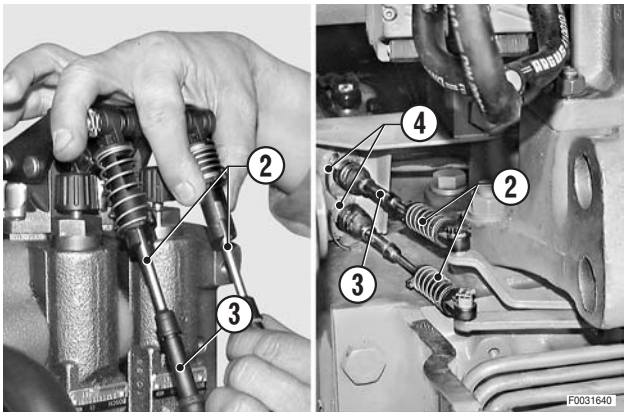
2 - Disconnect the Bowden cable (2) from the control lever (1), separate the yoke (4) and remove the sleeve (3).



3 - Detach the right hand console (5) from the cab without unplugging the connectors of the front end harnesses and the air conditioning unit.
(For details, see «REMOVAL OF RIGHT-HAND CONSOLE»).
★ Do not remove the centre console.



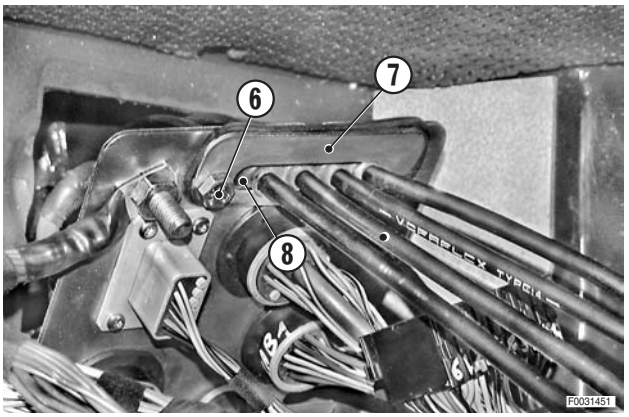
4 - Having identified the Bowden cable (2) to be replaced, remove from the control valve or the PTO lever, separate the yoke (4) and disconnect the sleeve (3).



5 - Loosen and remove the bolts (6) of the bulkhead assembly (7).

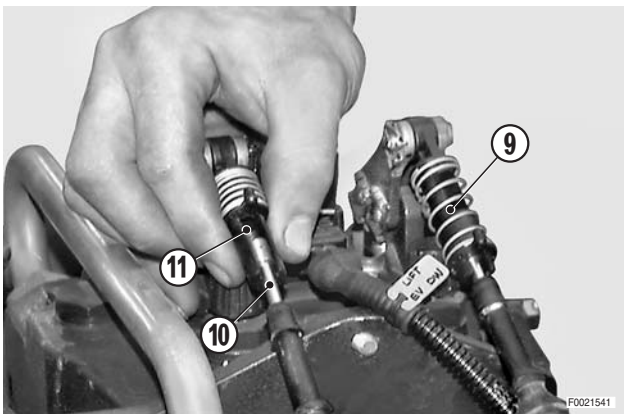
6 - Remove the top plate and the spacer gasket (8).

7 - Draw out the cable to be replaced.



REFITTING THE BOWDEN CABLES

- To refit, repeat the above steps in reverse order.
  ★ Do not connect the control valves and PTO levers at this stage.



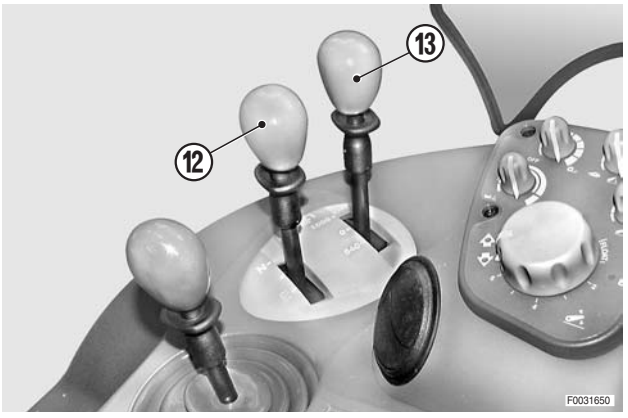
1. Adjustment of spool valve cable

1 - Maintaining the lever and valve spool in the neutral position, lift the retaining bush (9) and, keeping the cable (10) slightly tensioned, insert the end in the fitting (11).

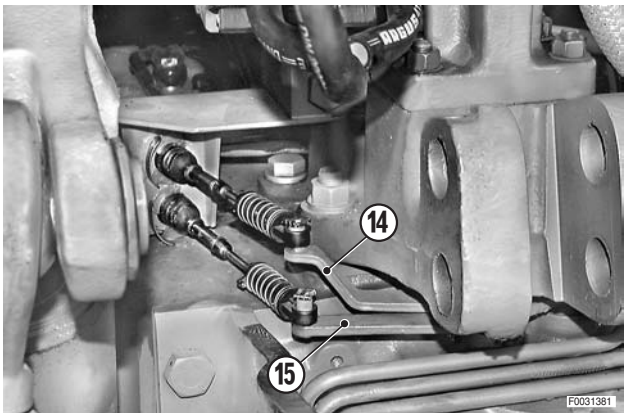
2 - Lower the retaining bush (9) and then work the lever, checking that the spool completes its full travel in both directions, and that the lever is correctly recentred with the valve in the neutral position.

2. Adjustment of PTO lever cables

1 - Set the clutch control lever (12) and the speed selector lever (13) in the neutral position.



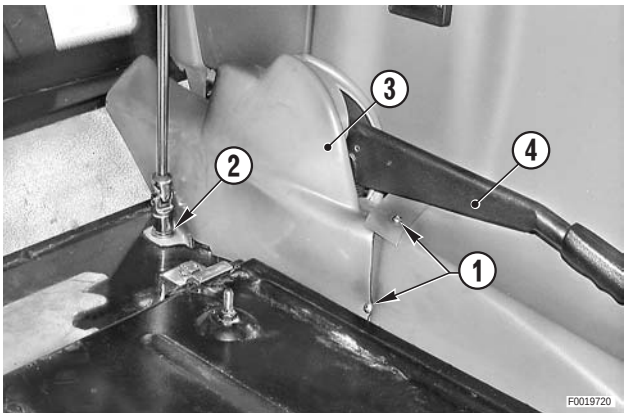
2 - Tension the cables slightly and connect the ends to the linkage levers (14) and (15), ensuring that the handles (12) and (13) are still in the neutral position on the console.



3 - Work the handles (12) and (13) inside the cab, checking that the speed and clutch selector levers complete their full travel.

ADJUSTMENT OF THE PARKING BRAKE SWITCH

1 - Remove the screws (1) and (2) and remove the shroud (3).

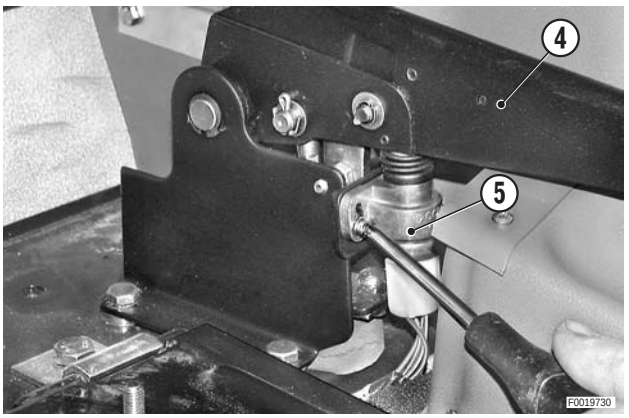


2 - Operate the lever (4) repeatedly to eliminate any play in the mechanism.

3 - With the lever (4) fully lowered, adjust the height of the microswitch (5) by raising it to its maximum height and then lowering it to obtain the correct amount of residual travel.

★ Residual travel: 1 mm (0.04 in.)

4 - Replace the shroud (3).



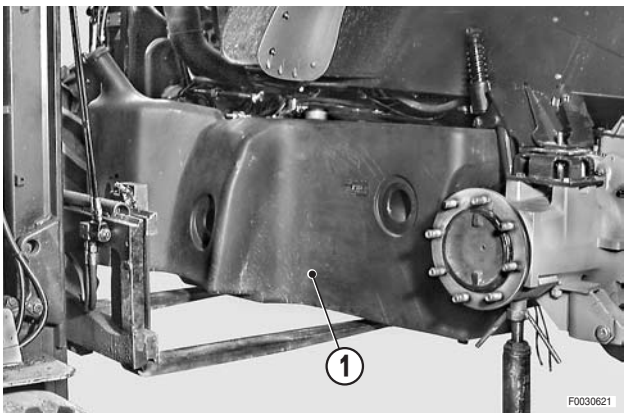
REPLACEMENT OF PARKING BRAKE CONTROL LINKAGE

⚠ 1 - Station the machine on firm, level ground and chock the rear wheels.

2 - Remove the key from the ignition.

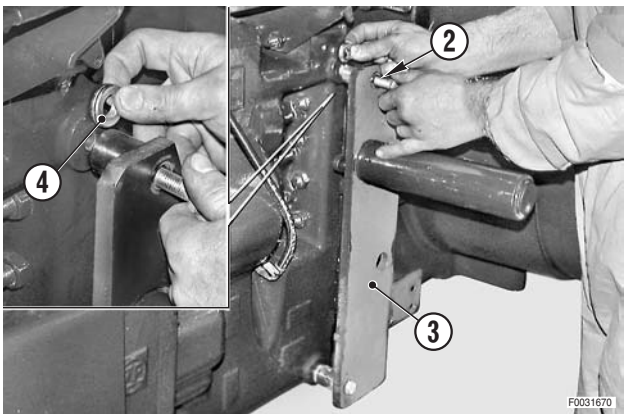
1. Removal

1 - Remove the fuel tank (1).
(For details, see «REMOVAL OF FUEL TANK»).



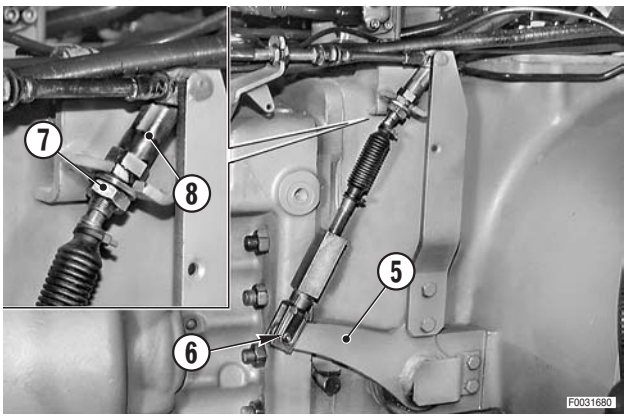
2 - Loosen and remove the bolts (2) and detach the rear bracket (3) of the tank.

★ Recover any shim washers (4).

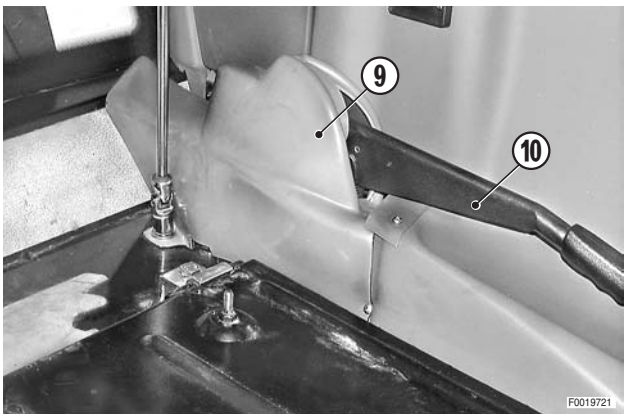


3 - Disconnect the clevis (6) from the lever (5) of the brake linkage.

4 - Loosen the top nut (7) and free the sleeve of the Bowden cable (8).

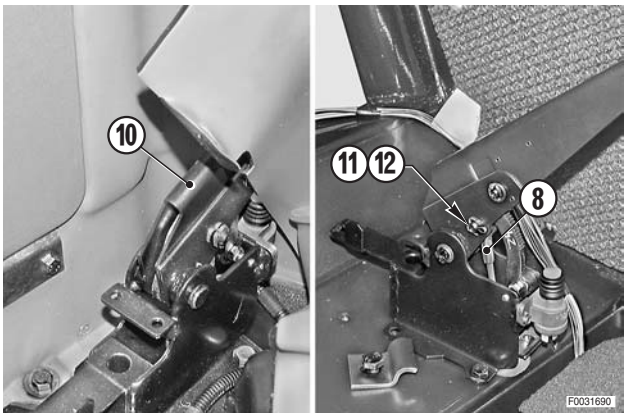


5 - Remove the cover trim (9) from the parking brake lever (10).



6 - Raise the lever (10) partially and remove the cotter pin (11).
★ Renew the cotter pin every time it is removed.

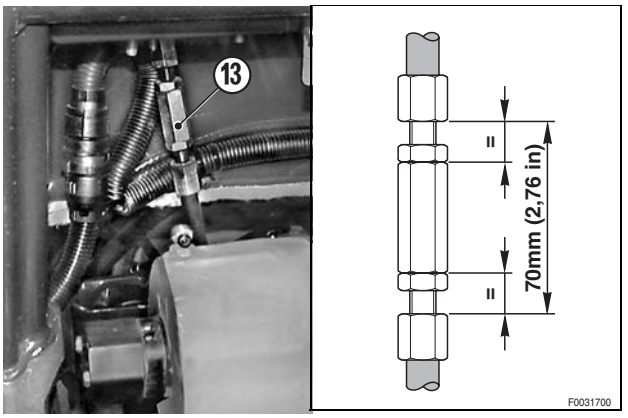
7 - Remove the anchor pin (12) and detach the brake cable.



2. Replacement

1 - Check that the intermediate tensioner (13) is adjusted so as to give a clearance between the sleeves as indicated alongside.
★ The sleeves must be separated from the tensioner by identical distances.
★ Make certain the nuts are locked tight.

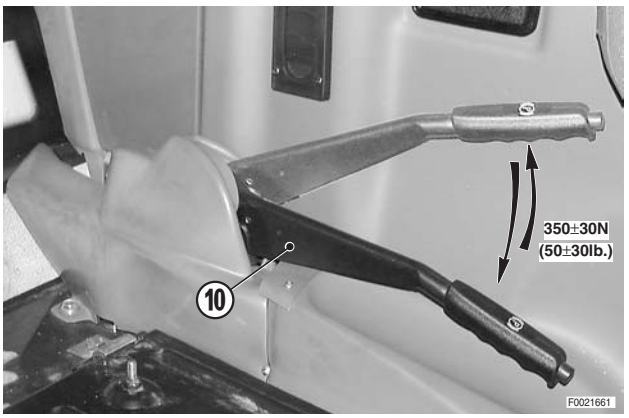
2 - Connect the parking brake hand lever and linkage lever to the cable, repeating the steps indicated above in reverse order.



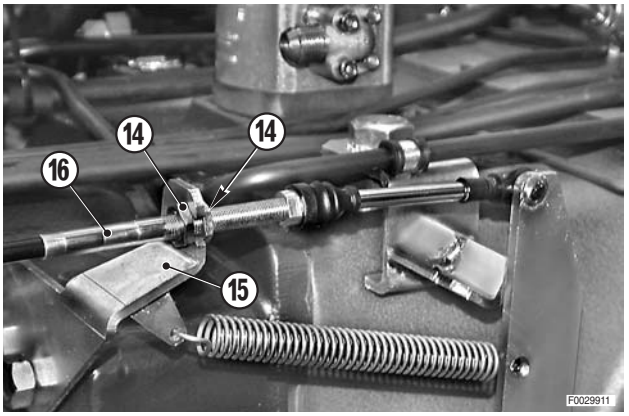
3. Initial adjustment

1 - Before making any adjustment, work the brake lever (10) fully up and down a number of times to eliminate any free travel and check that the cable slides freely.

2 - Apply a dynamometer of 500 Nm (100 ft lb) full scale to the handgrip, and raise the lever to the first notch; check that the force applied at the first click is within the normal limits.
★ Normal force 350±30 N



3 - **Air trailer braking only.**
Loosen the nuts (14), and separate the sleeve (16) of the trailer parking brake control valve linkage from the anchor bracket (15).

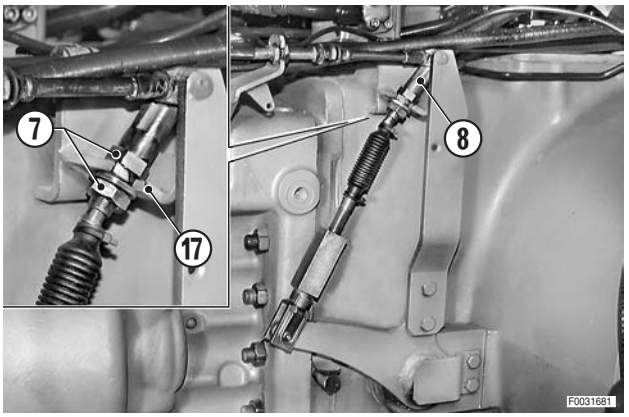


4 - Adjust the length of the sleeve (8) by loosening or tightening the nuts (7) behind the bracket (17).
Tension the sleeve (8) so as to produce the permitted number of clicks when operating the lever (10) in the cab.

★ Normal n° of clicks: 4
Permissible n° of clicks: 6

⚠ 1 - When the handbrake linkage slackens to the point that the lever begins engaging the maximum number of clicks, it must be adjusted as described in heading 4 below.

2 - If the parking brake still does not operate correctly after being adjusted, check the state of the friction pads (For details, see «INSPECTION AND OVERHAUL OF PARKING BRAKE»).



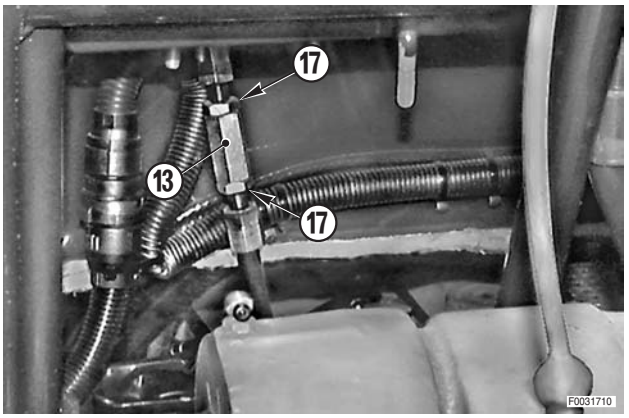
5 - Anchor the sleeve (16) of the trailer parking brake control valve linkage; tension the cable to the point at which the parking brake valve comes into operation as the handbrake lever (10) in the cab reaches the first click.

4. Adjustment to correct brake wear or elongation of cable

1 - Loosen the nuts (17) a few turns and tighten the intermediate tensioner turnbuckle (13) so as to restore the permitted number of clicks (see heading 3 above).

2 - **Air trailer braking only.**
Check that the trailer braking valve comes into operation at the first click when the handbrake lever (10) is raised.

★ Adjust the sleeve if necessary (see heading 3 above).



5. Final operations

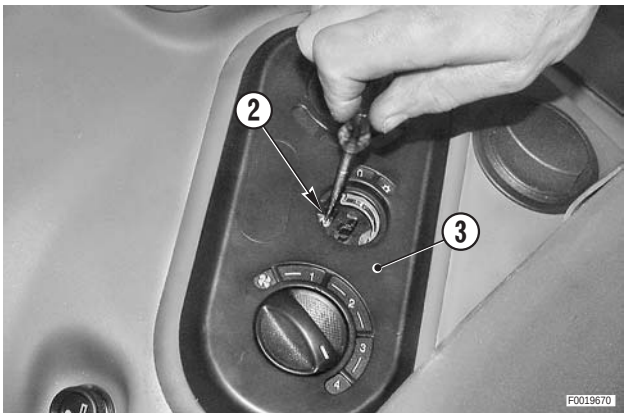
1 - Refit the rear fuel tank bracket, and the fuel tank.
(For details, see «REFITMENT OF FUEL TANK»).

REMOVAL OF THE CLIMATE CONTROL PANEL

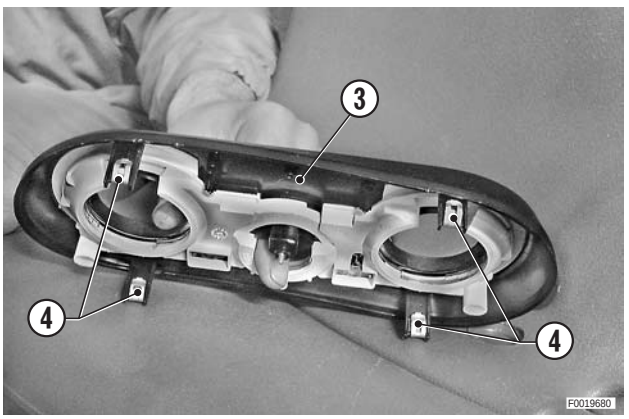
⚠ Remove the battery cover and disconnect the negative battery lead (–).

1 - Pull off the air conditioning on/off knob (1).

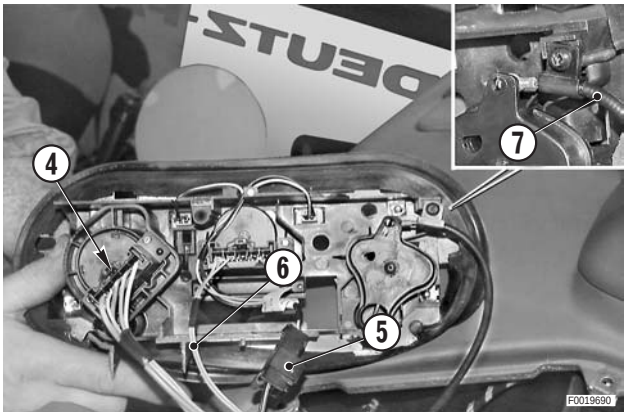
2 - Unscrew and remove the fixing screws (2) of the control panel (3).



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

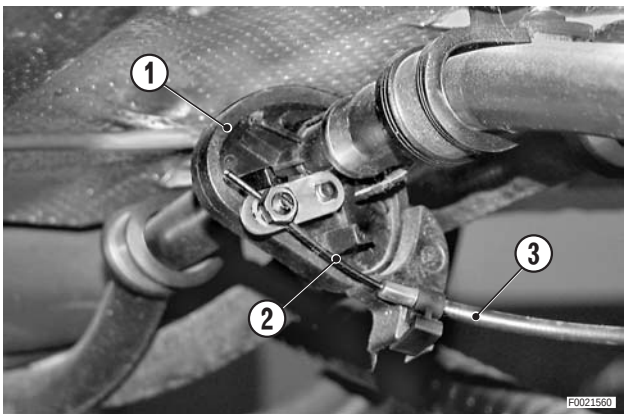
1. Removal

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

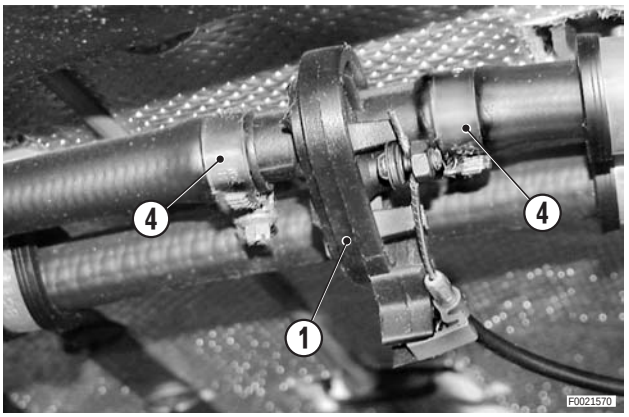
1 - Drain the coolant from the engine cooling system.

Coolant: approx. 21 ℓ (5.5 US.gall.)

2 - Disconnect the inner control cable (2) and the outer cable (3) from the valve (1). ※1



3 - Loosen the retaining straps (4) and remove the valve (1).



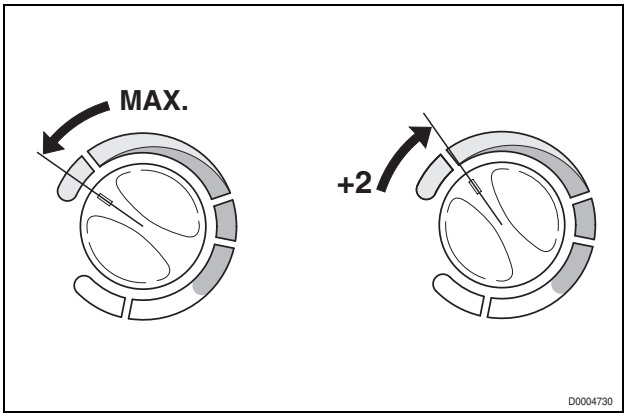
2. Refitting and adjustment of the control cable.

- Refitting is the reverse of removal.

※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).



2 - Turn the lever (5) of the heater valve (1) up to the stop (6).

3 - Fix the outer part (7) of the control cable (2) with the spring clip (8) and the inner cable (2) with the screw (9).

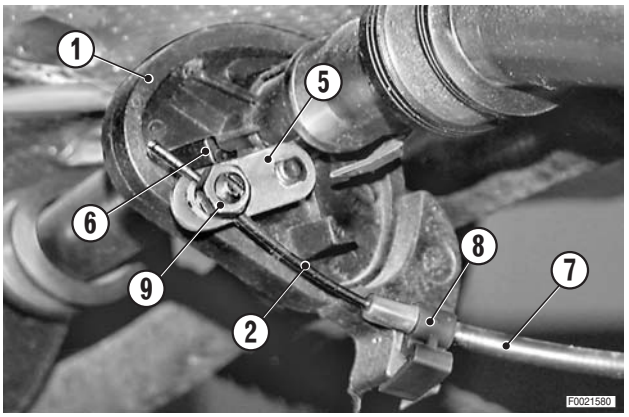
1 - Fill the cooling system.

Coolant: approx 21 ℓ (5.5 US.gall.)

2 - Fully open the heater valve.

3 - Start the engine: allow the coolant to circulate and check for leaks.

4 - Stop the engine and top up the coolant level.

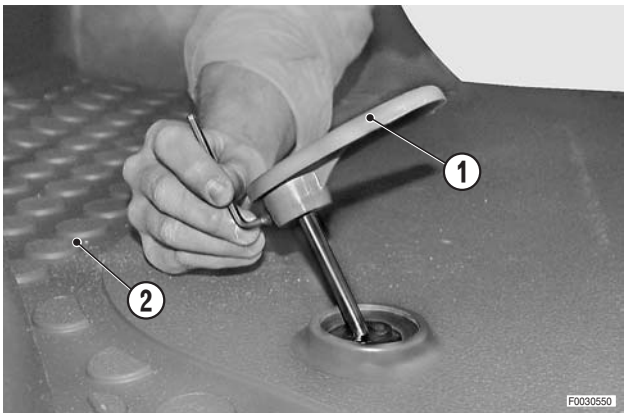


REMOVAL OF THE HEATER MATRIX

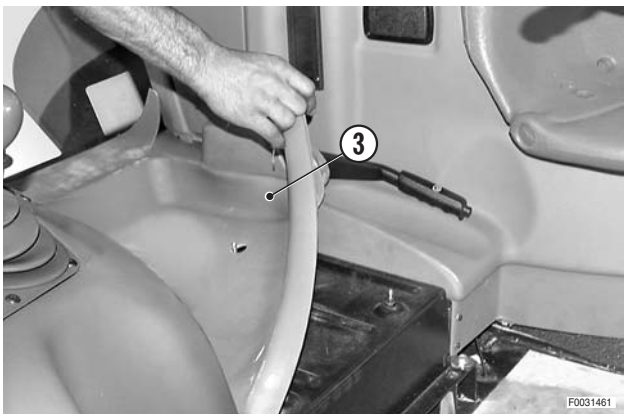
Remove the battery cover and disconnect the negative battery lead (–).

1 - Remove the seat. (For details, see «REMOVAL OF THE DRIVER'S SEAT»).

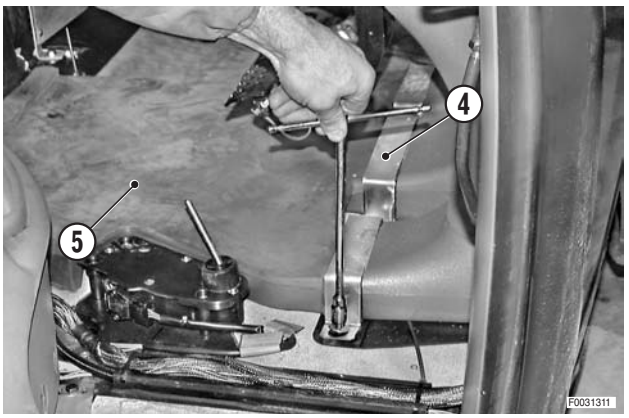
2 - Remove the accelerator pedal (1) and remove the front floor mat (2).



3 - Remove the rear floor mat (3).

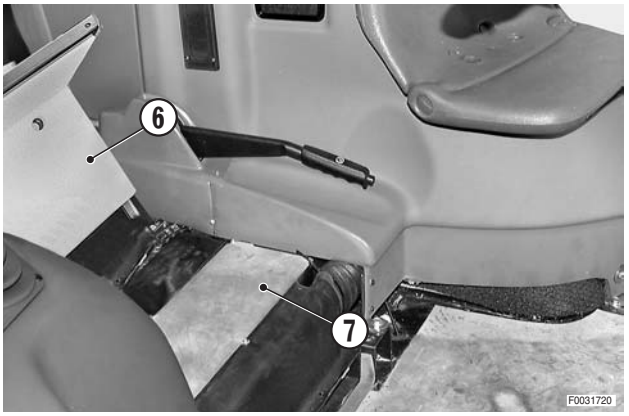


4 - Remove the retaining strap (4) and the air hose (5).



5 - Remove the bolts and lift the seat support (6).

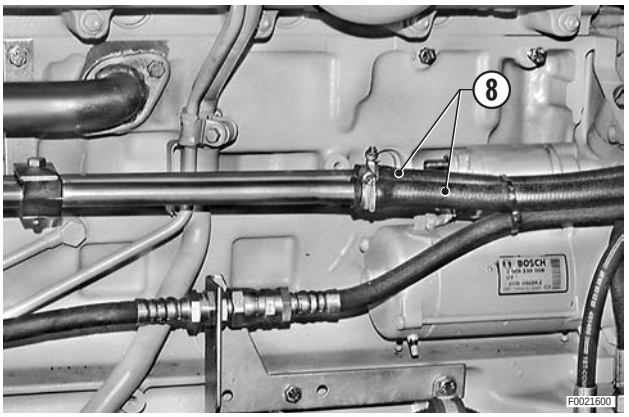
6 - Remove the bolts and remove the upper cover (7) of the air conditioning assembly.



7 - Turn the heater control knob to the MAX position (red section).
Drain the coolant from the engine and the heater matrix by disconnecting the pipes (8).

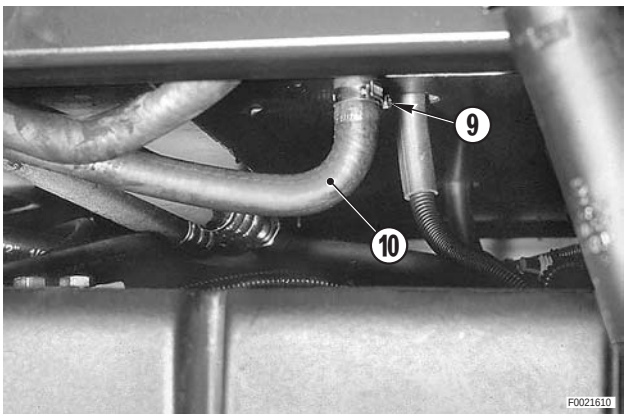
Coolant: approx. 21 ℓ (5.5 US.gall.)

★ After draining the system, reconnect the pipes (8).

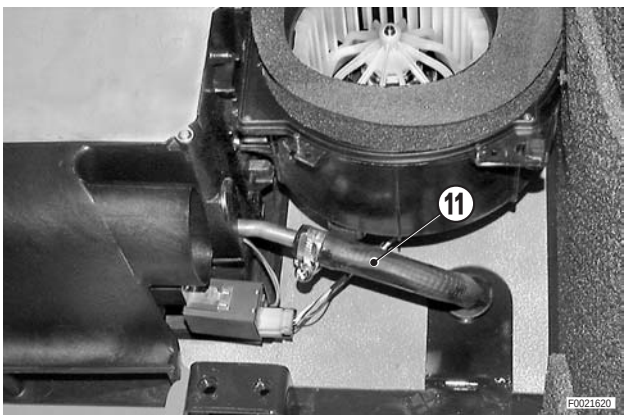


8 - Remove the evaporator.
(For details, see «REMOVAL OF THE AIR CONDITIONING EVAPORATOR»).

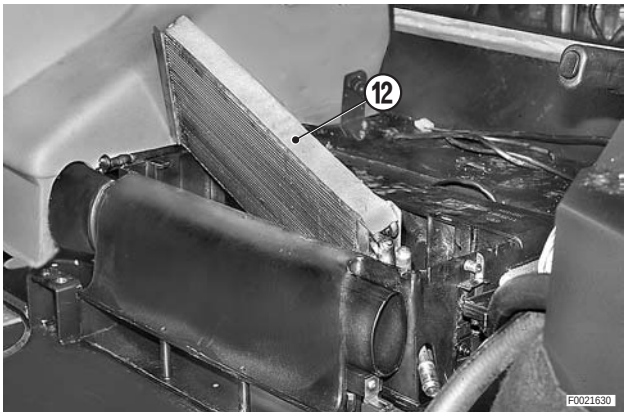
9 - Remove the hose clamp (9) and disconnect the vertical return hose (10) from the matrix.



10 - Remove the hose clamp and disconnect the horizontal delivery pipe (11) from the matrix.



11 - Remove the matrix (12) by lifting the right side vertically and then rotating it towards the rear of the tractor.



REFITTING THE HEATER MATRIX

- Refitting is the reverse of removal.

1 - Fill the cooling system.

Coolant: approx. 21 ℓ (5.5 US.gall.)

2 - Start the engine: allow the coolant to circulate and check for leaks.

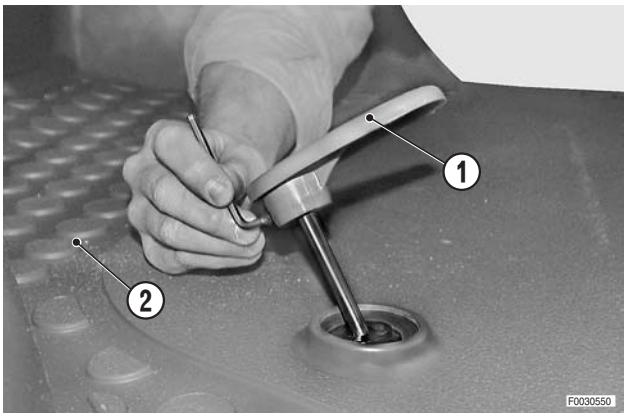
3 - Stop the engine and top up the coolant level.

REMOVAL OF THE AIR CONDITIONING EVAPORATOR

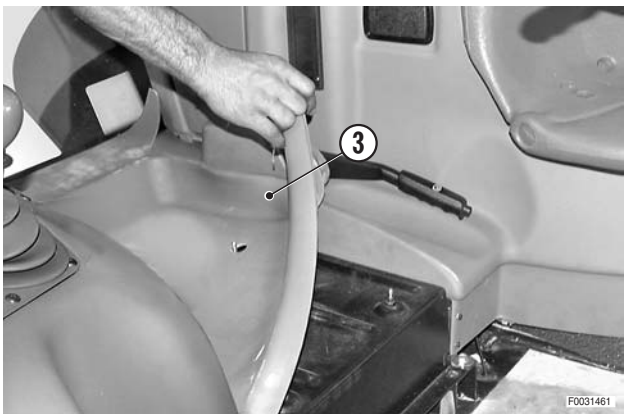
⚠ Remove the battery cover and disconnect the negative battery lead (–).

1 - Remove the seat. (For details, see «REMOVAL OF THE DRIVER'S SEAT»).

2 - Remove the accelerator pedal (1) and remove the front floor mat (2).

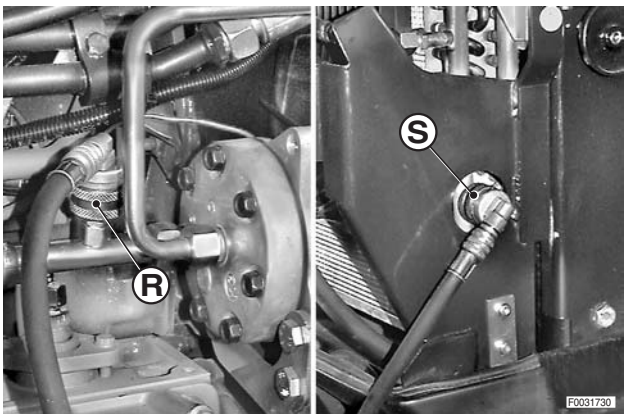


3 - Remove the rear floor mat (3)

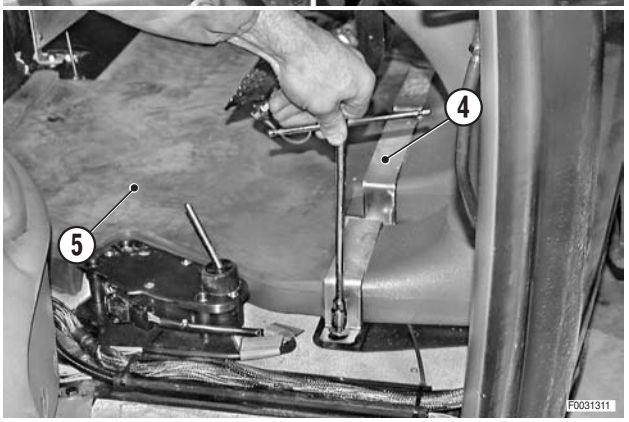


4 - Connect the quick-fit couplers of the high (**R**) and low (**S**) pressure pipes to the refrigerant (R134A) charging, testing and recovery machine.
Set the machine for recovery operation and start it; allow the machine to run until all the refrigerant has been recovered, then disconnect it. ※ 1

★ Measure the quantity of oil recovered and consequently to be reintroduced into the system.

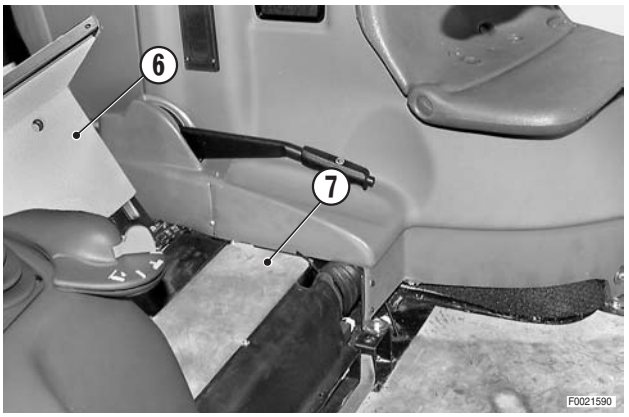


5 - Remove the hose clamp (4) and the air hose (5).



6 - Remove the bolts and lift the seat support (6).

7 - Remove the screws and remove the cover (7) of the air conditioning assembly.



8 - Disconnect the inlet (8) and outlet (9) pipes from the evaporator.

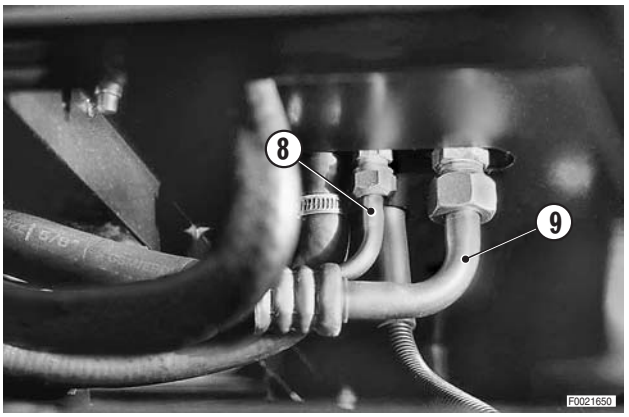
※ 2

⚠ Immediately seal the ends of the pipes (8) and (9) to prevent atmospheric moisture from getting into the air conditioning system.

9 - Release the rubber diaphragm (10).

10 - Lift up the evaporator (11); remove the temperature sensor (12) and place it on one side. ※ 3

11 - Remove the evaporator (11).



REFITTING THE EVAPORATOR

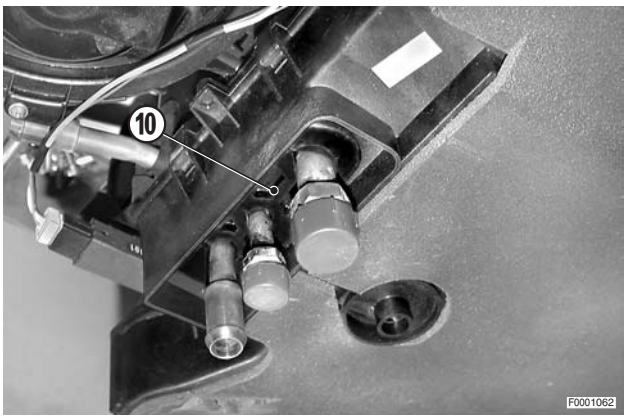
- Refitting is the reverse of removal.

※ 1

★ Quantity of R134a:

Mod.	1130	1145	1160
g (oz.)	1700 (60)	1700 (60)	1700 (60)

★ After recharging the system, check the seals on the pipes (**R** and **S**) and throughout the system using a leak detector.



※ 2

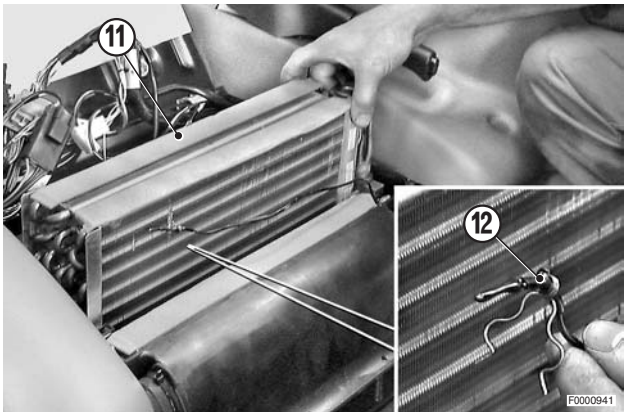
Nm High pressure fitting (5/8' - 18UNF): 13.6 – 20.3 Nm (10 – 15 lb.ft.)

Nm 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

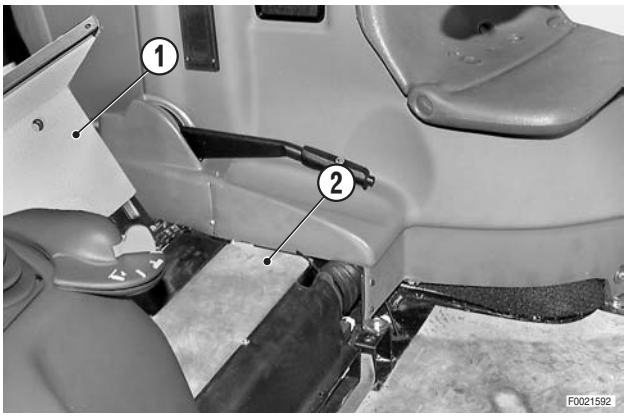
⚠ Remove the battery cover and disconnect the negative battery lead (–).

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»).

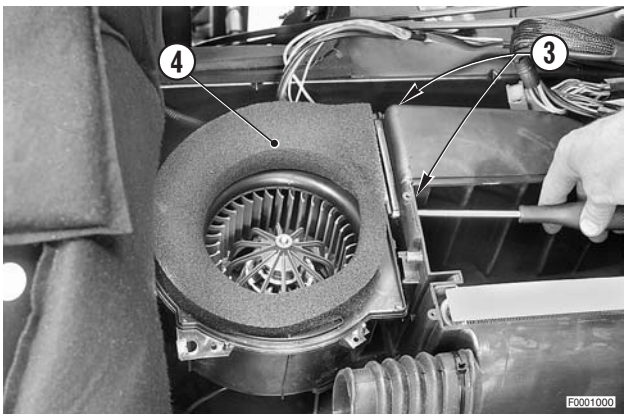
4 - Remove the seat support (1) and upper cover (2) of the air conditioning assembly.



5 - Remove the evaporator. (For details, see «REMOVAL OF THE EVAPORATOR»)

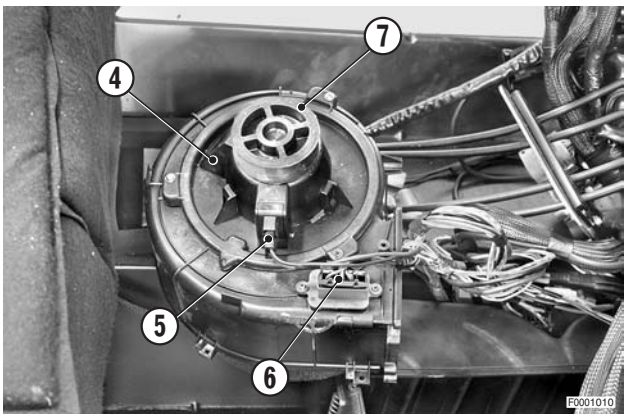
6 - Remove four bolts (3) securing the fan (4).

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»).

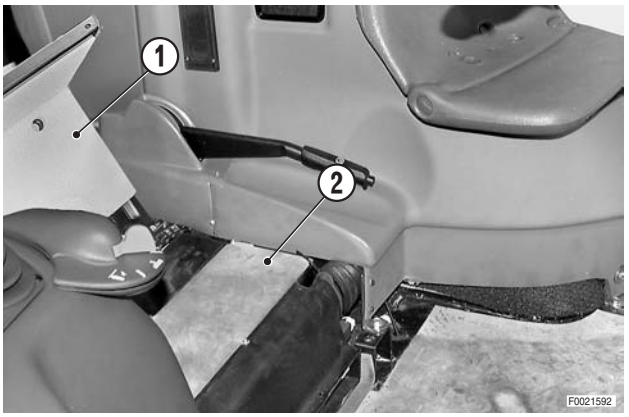
2 - Remove the left-hand console without disconnecting the control cable of the heater valve. (For details, see «REMOVAL OF THE LEFT-HAND CONSOLE»).

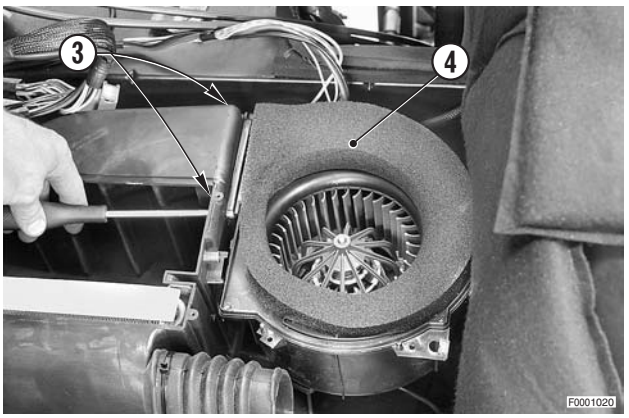
3 - Remove the seat support (1) and the upper cover (2) of the air conditioning assembly

4 - Withdraw the evaporator. (For details, see «REMOVAL OF THE EVAPORATOR).

5 - Remove the four screws (3) securing the fan (4).

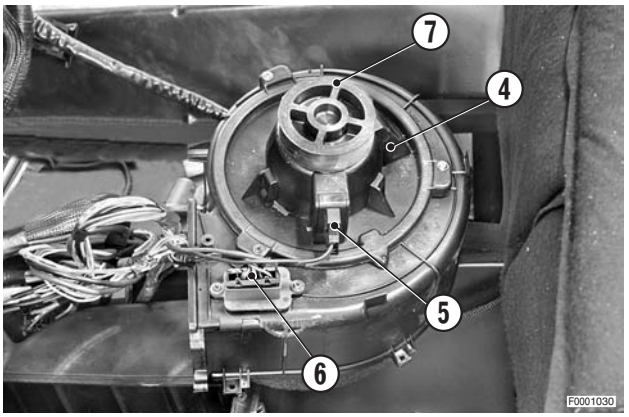
6 - Remove the fan (4) and turn it over.





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

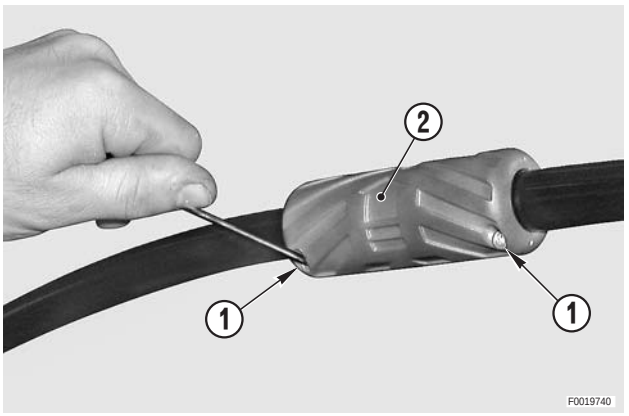
★ Stick the block to the fan screw before positioning the fan.

Block: Loctite 401

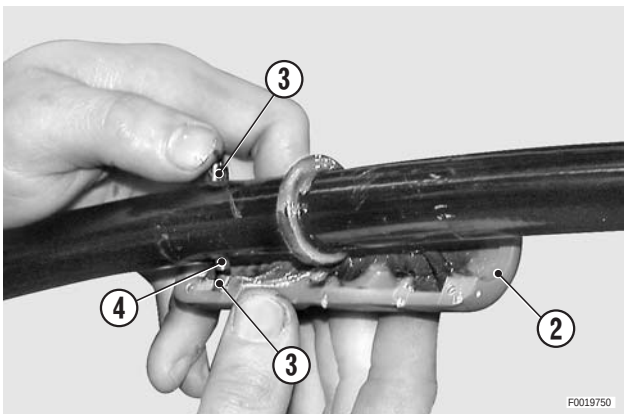
1 - Carefully check the seal around the upper cover.

RENEWAL OF CAB DOOR CABLE

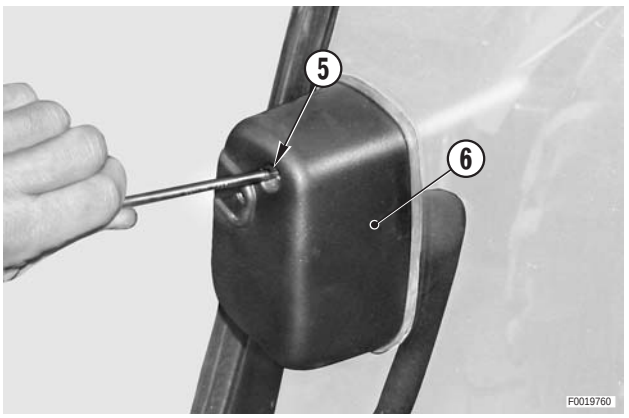
1 - Unscrew and remove the four screws (1) securing the two halves of the handle (2).



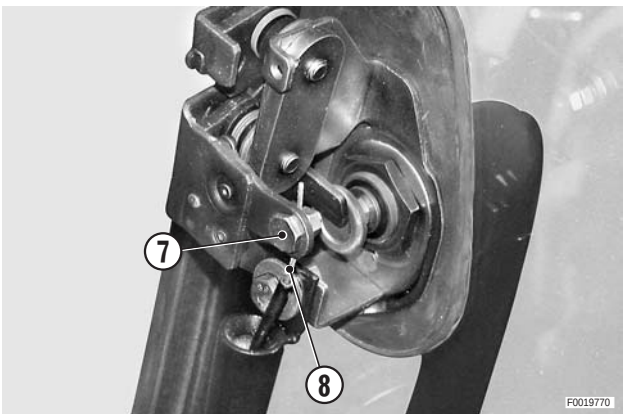
2 - Remove the two halves of the handle and recover the bushes (3) and the pin (4).



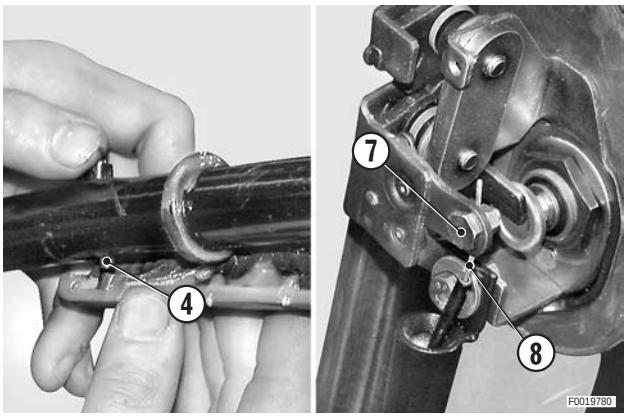
3 - Unscrew and remove the fixing screws (5) of the door lock cover (6).



4 - Loosen the clamp nut (7) and withdraw the cable (8).



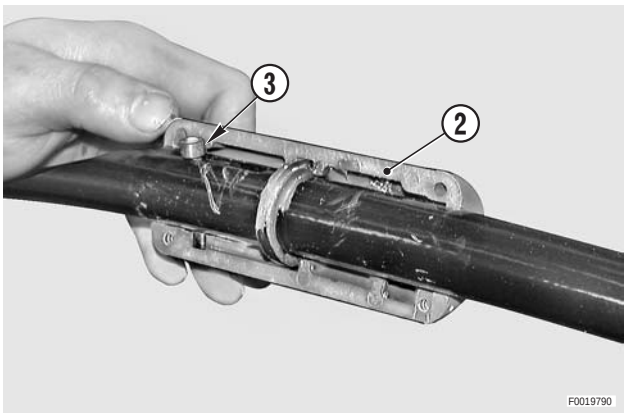
5 - Feed the new cable starting from the handle side; engage it with the pin (4) and the clamp nut (7).
With the cable under slight tension, tighten down the clamp nut.



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.



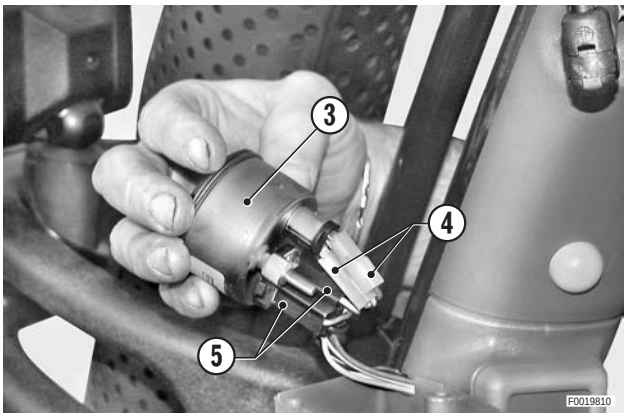
REMOVAL OF THE TRAILER BRAKING AIR PRESSURE GAUGE

⚠ 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

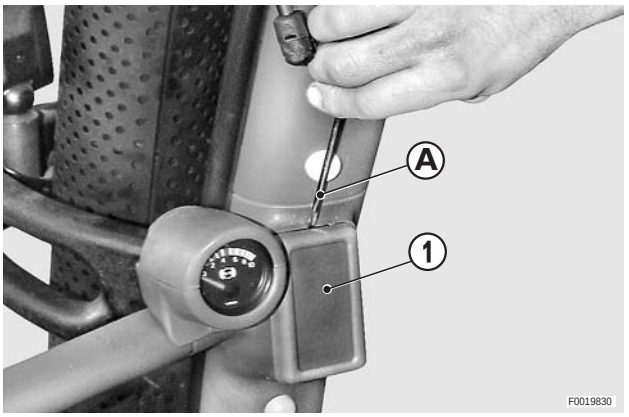
- Refitting is the reverse of removal.

REMOVAL OF TRANSMISSION OPERATING STATUS DISPLAY

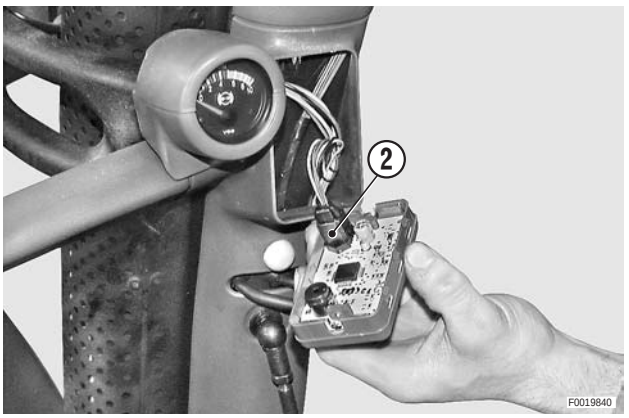
⚠ Remove the key from the ignition.

1 - Insert a thin blade "**A**" between the cab pillar and the display unit (1).

2 - Prise off the display (1) from the middle.



3 - Unplug the connector (2).



REFITMENT OF TRANSMISSION OPERATING STATUS DISPLAY

- To refit, repeat the above steps in reverse order.

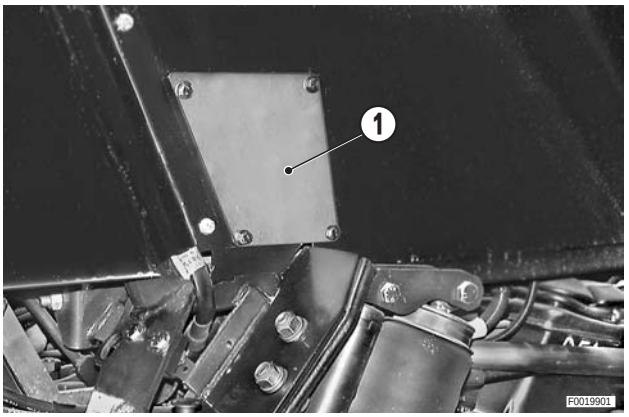
REMOVAL OF THE CAB

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

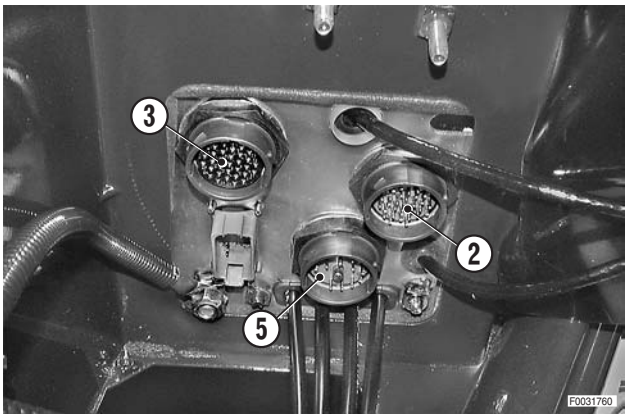
Discharge any residual pressure from the trailer braking air reservoir and the cab suspension system.

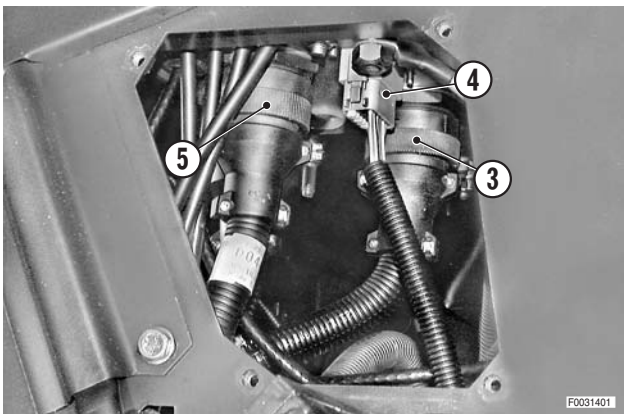
1 - Remove the rear wheels.
(For details, see «REMOVAL OF THE REAR WHEELS»).

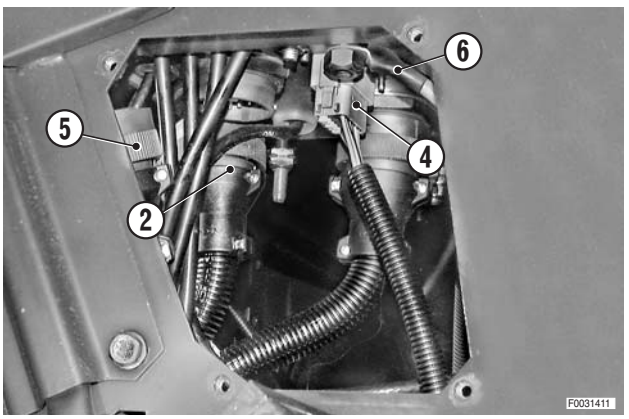
2 - Remove the air cleaner.
(For details, see «REMOVAL OF THE AIR FILTER»).



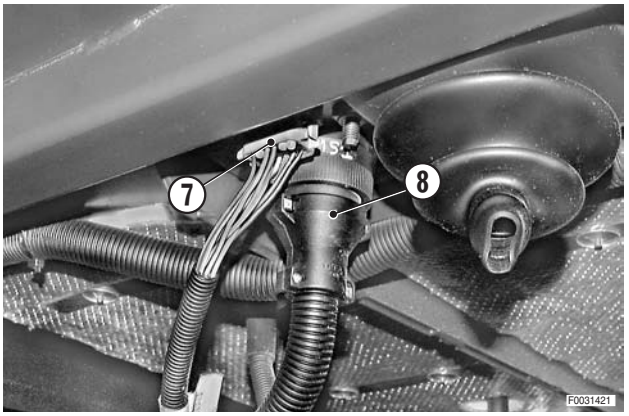
3 - Remove the cover plate (1) and disconnect from the bulkhead fitting the connectors of the electrical leads of the transmission (2) (**TKAB1**), the lift (3) (**TKAB2**) and the connector (4) and power supply lead (5) for the front axle (if present).



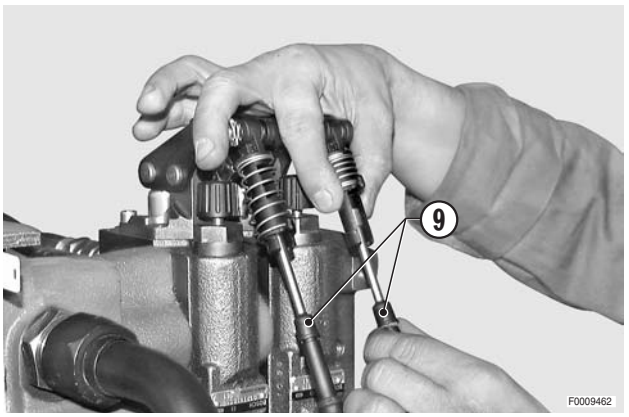




4 - Disconnect from the front bulkhead plate the connector (6) and the connector (7) of the engine wiring.

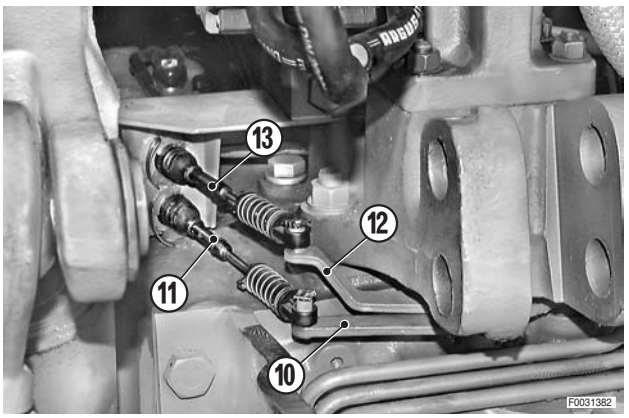


5 - Disconnect the Bowden cables (9) and the relative sleeves from the auxiliary spool valves.
★ Mark the positions so as to avoid error during refitment.

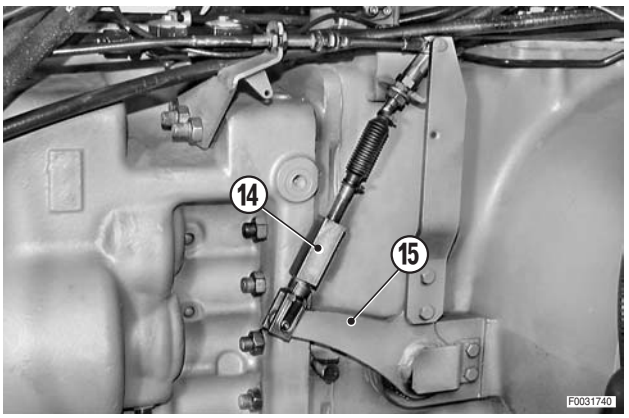


6 - Disconnect the Bowden cable (11) from the PTO speed selector lever (10).

7 - Disconnect the Bowden cable (13) from the PTO operating mode selector lever (12).
★ Mark the positions so as to avoid error during refitment.
★ Disconnect the sleeves as well as the cables.

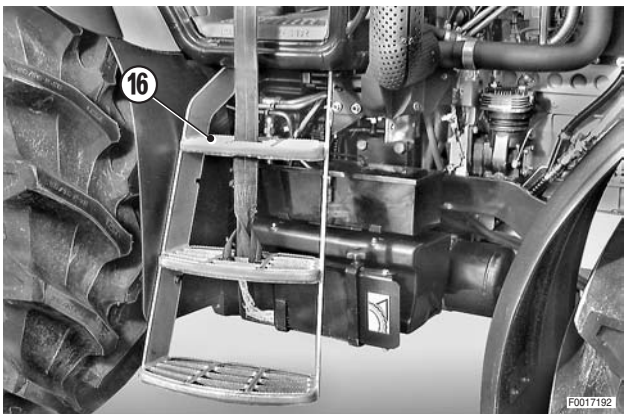


8 - Remove the fuel tank bracket and disconnect the Bowden cable (14) from the parking brake lever (15).

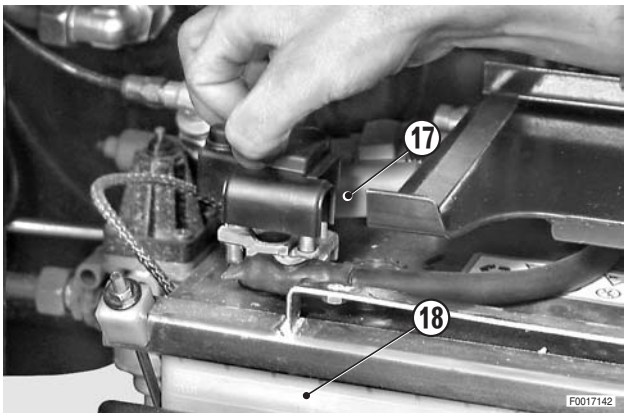


9 - Remove the cab access steps (16).

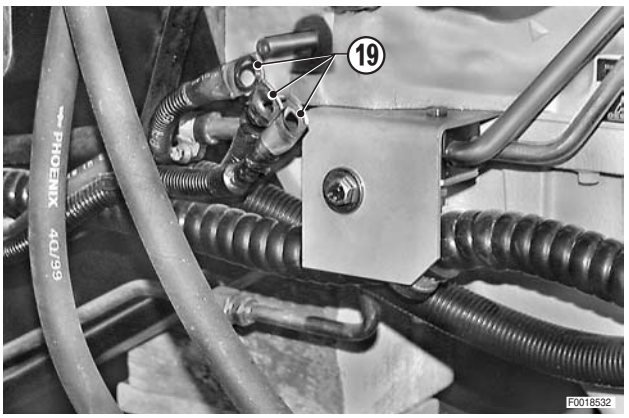
10 - Remove the fuel tank.
(For details, see «REMOVAL OF FUEL TANK»).



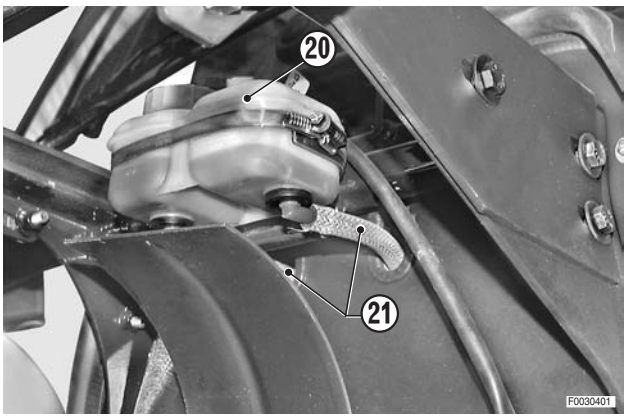
11 - Disconnect the system power cable from the positive terminal (17) (+) of the battery (18).



12 - Disconnect the earth leads (19) from the engine.



13 - Pump out the fluid from the brake master cylinder reservoir (20); disconnect the inlet pipeline (21).



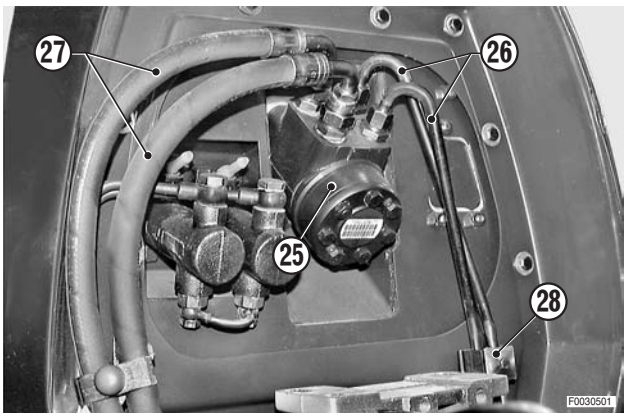
14 - Disconnect the steel pressure pipelines (22) from the brake hoses (23).

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

NOTE The right hand brake hose (23) must be disconnected from the pressure sensor (24), whereas the left hand brake hose (23) is coupled directly to the pipe (22).

15 - Disconnect the four oil lines (26) and (27) from the power steering unit (25).
- ★ Mark the hoses (27) to avoid error when reconnecting.
- ★ Plug the pipes and ports to prevent impurities getting in.

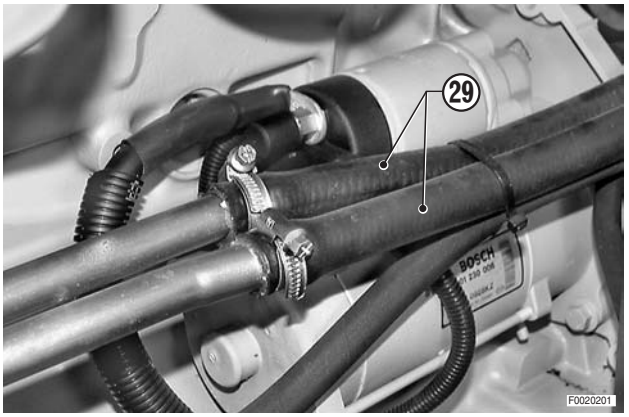
16 - Remove the bracket (28) and bend the pipes toward the front of the machine.



17 - Drain off the engine coolant.

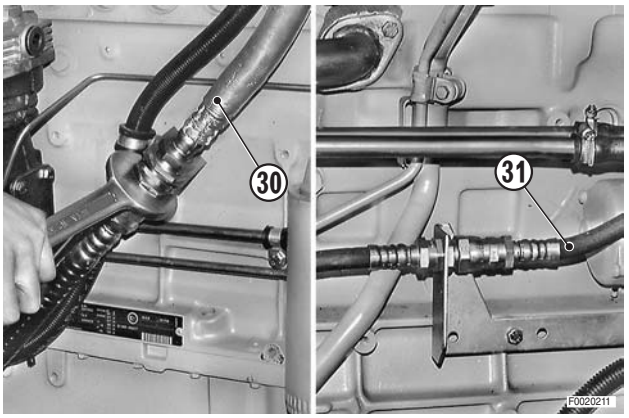
Coolant: approx 21 ℓ (5.5 US.gall.)

18 - Disconnect the cab heater hoses (29).
- ★ Mark the hoses to avoid error when reconnecting.



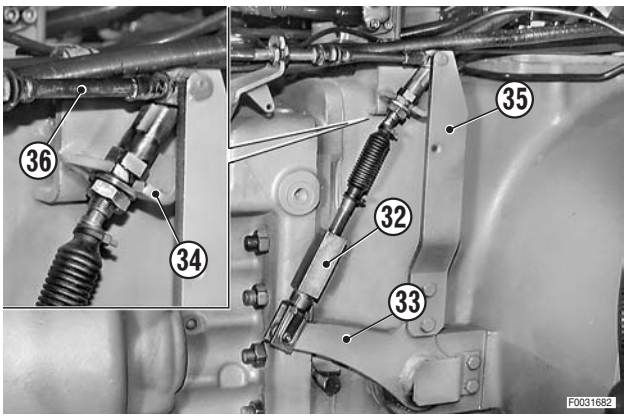
19 - Disconnect the air-conditioning compressor inlet pipeline (30) and the pressure pipeline (31).

1



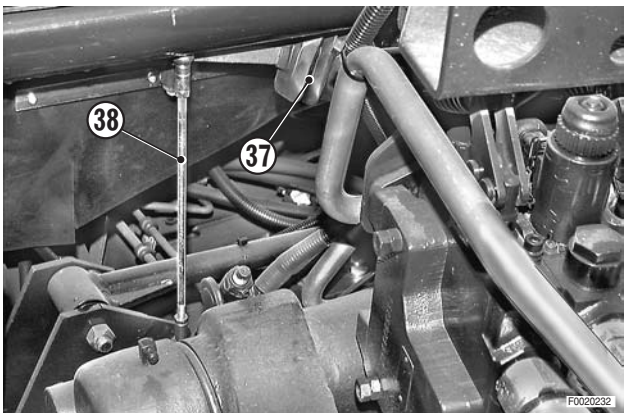
20 - Disconnect the Bowden cable (32) from the parking brake linkage lever (33).
- ★ Disengage the sleeve from the bracket (34).

21 - Disconnect the Bowden cable (36) operating the air trailer braking valve from the lever (35).



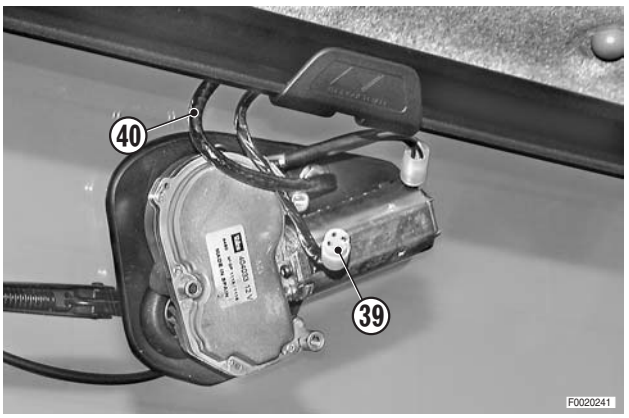
Cab with pneumatic suspension only

22 - Detach the cab lift rod (38) from the control valve (37).
2

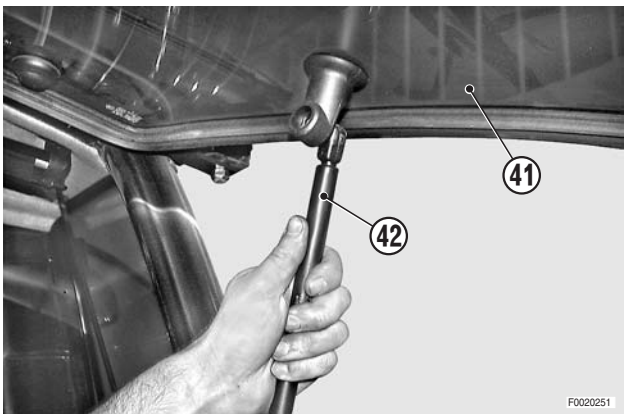


23 - Remove the end section of the exhaust pipe from the cab. (For details, see «REMOVAL OF EXHAUST PIPE»).

24 - Remove the cover of the rear screen wiper and unplug the connector (39) and the screenwash tube (40).

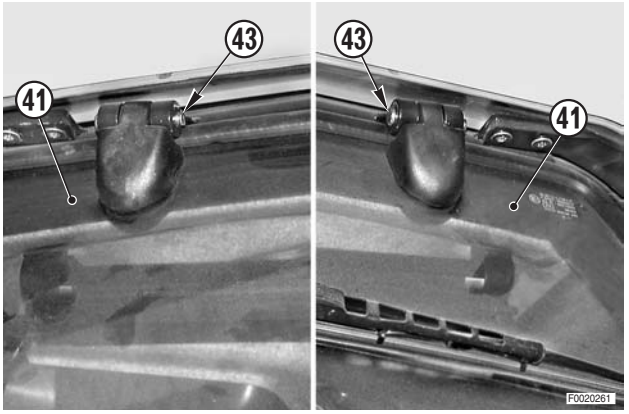


25 - Disconnect the gas spring struts (42) from the rear window (41); lower the window (41).

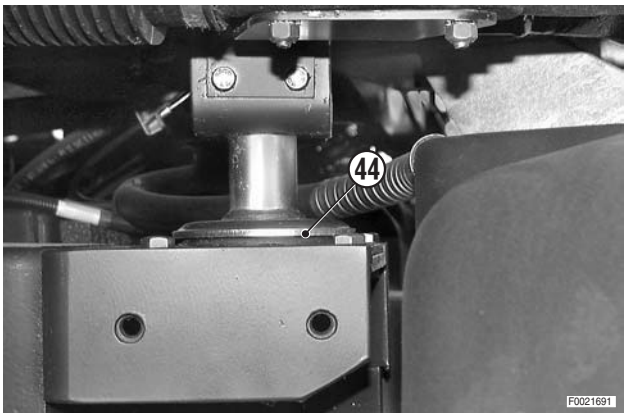


26 - Make certain the rear window is supported, then punch out the hinge pins (43).

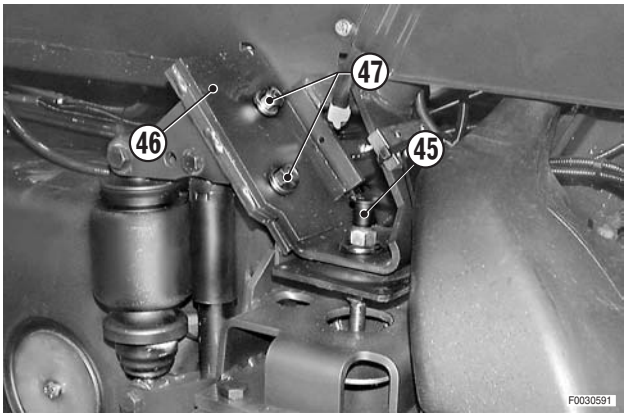
27 - Remove the entire rear window assembly (41).



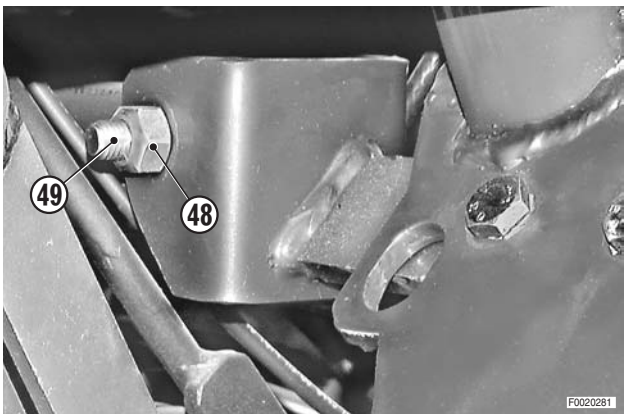
28 - Remove the bolts at the front centre by which the cab is anchored to the antivibration mountings (44).



29 - Remove the centre bolts (45) of the rear antivibration mountings (46), and the cab fixing bolts (47).

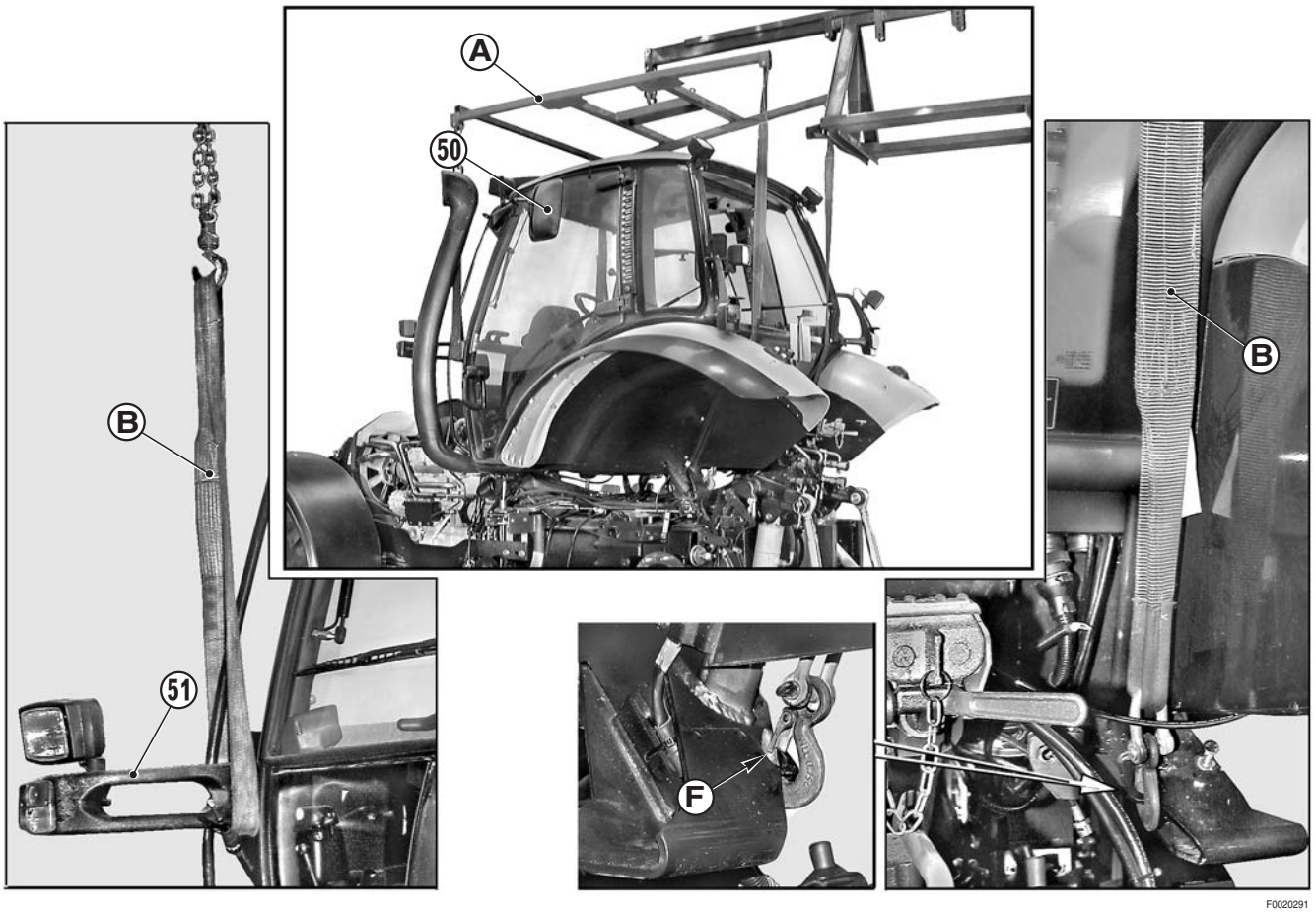


30 - Remove the nut (48) and disengage the rear stabilizer bar (49).



31 - Fold the rear view mirrors (50) against the cab windows.

32 - Suspend the special cab lift frame "**A**" from a hoist. Attach slings "**B**" of suitably dissimilar length to the cab, using the holes "**F**" provided in the rear mountings and in the work light and direction indicator brackets (51).



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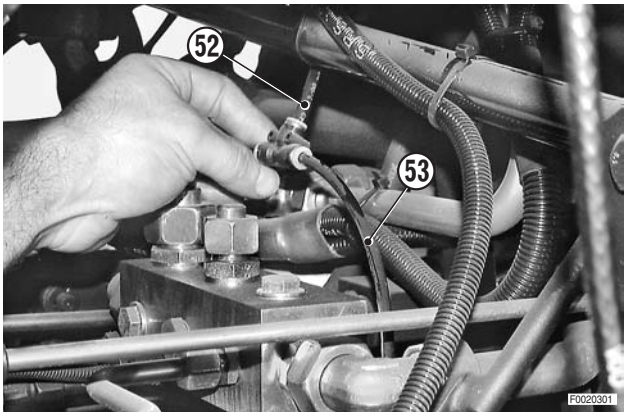
Cab with pneumatic suspension only

33 - Raise the cab slowly by about 15 cm to expose the line (52) connecting the cab suspension valve and the line (53) from the reservoir, and disconnect both at the Tee.

kg Complete cab assembly: 780 kg (1718 lb.)

34 - Release all harnesses from the relative clips and lift the cab clear, guiding the pipes and Bowden cables.



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REFITMENT OF CAB

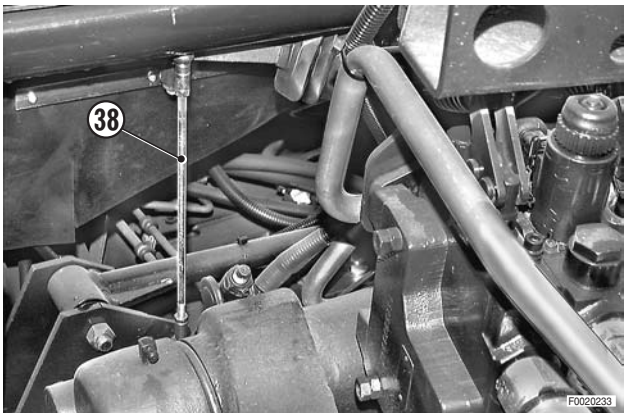
- To refit, repeat the above steps in reverse order.

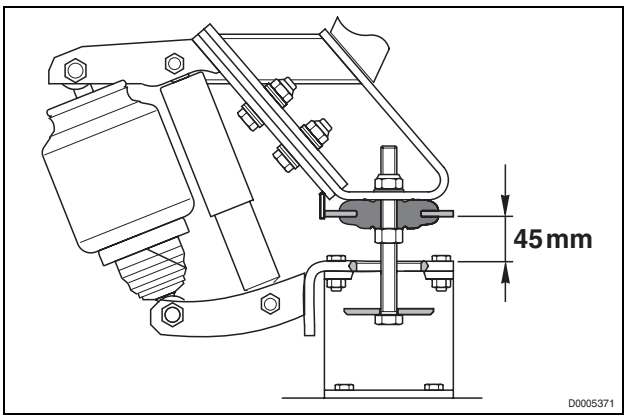
※1

Nm Air conditioning pipe fittings:
delivery (5/8" - 18UNF):13.6–20.3 Nm (10–15 lb.ft.)
inlet (7/8" - 14UNF): 35.3–42 Nm (26–31 lb.ft.)

※2

★ Check that the length of the rod (38) is adjusted to give the specified cab lift height, without operator.
Lift height: 45 mm





1 - Fill the engine cooling system.

Coolant: approx 21 ℓ (5.5 US.gall.)

2 - Turn the cab heating on at maximum.

3 - Start the engine and check the hydraulic, pneumatic and heating systems for leaks.

4 - Turn the steering wheel full lock a few times on both sides to remove any air from the power steering circuits.

5 - Stop the engine; check the level of the coolant and top up if necessary.

6 - Bleed the hydraulic brake circuits.
(For details, see «BLEEDING THE BRAKE SYSTEM»).

SEPARATION OF THE ENGINE -TRANSMISSION

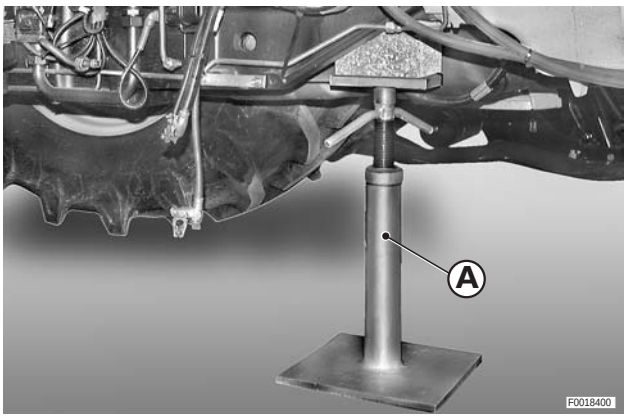
★ This operation does not require the removal of the cab.

⚠ Make sure that the parking brake is applied.

★ Remove the following components, in sequence:
- Front wheels
- Front fenders
- Engine hood adjustment mounting, complete
- Radiator - coolers - condenser assembly
- Front lift assembly and relative pipelines, complete with mounting bracket
- Front PTO assembly
- Front axle and trunnion mounting
- Front carrier
- Exhaust pipe
- Cab access steps
- Battery shelf - 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.

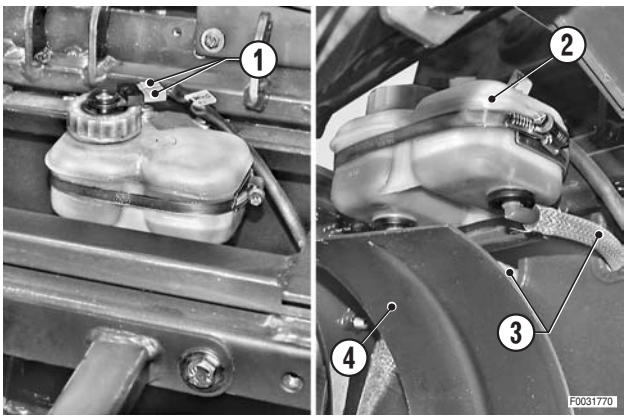
1 - Position a jack "**A**" with non-slip block under the centre of the gearbox and raise the jack to support the load.



2 - Unplug the connectors (1) of the brake fluid level sensor.

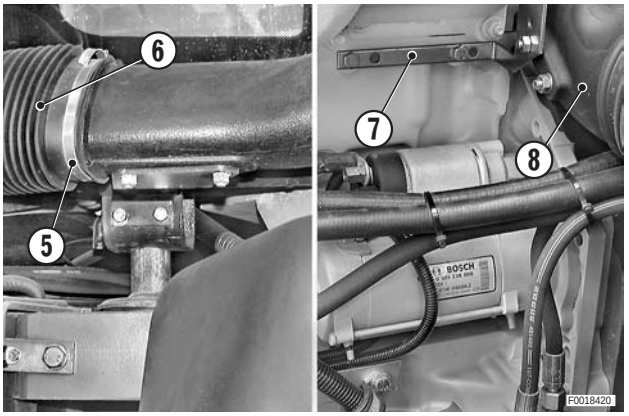
3 - Draw off the fluid from the brake fluid reservoir (2); disconnect the pipes (3) from the reservoir and plug the open ends. ⁘ 1

4 - Remove the air cleaner mounting plate (4).

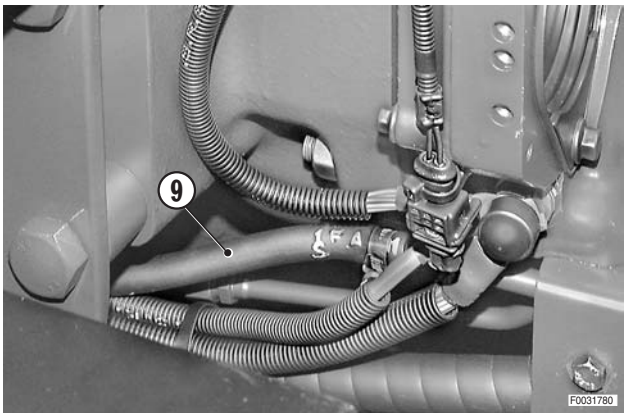


5 - Loosen the clamp (5) securing the inlet manifold (6); disconnect the manifold from the inlet hose.

6 - Remove the bracket screws (7) and remove the complete manifold assembly (8).

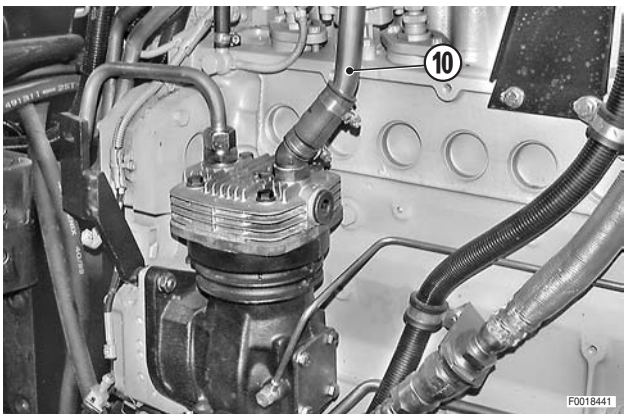


7 - Release the fuel return pipe (9) from the clips and direct the pipe toward the rear of the tractor.



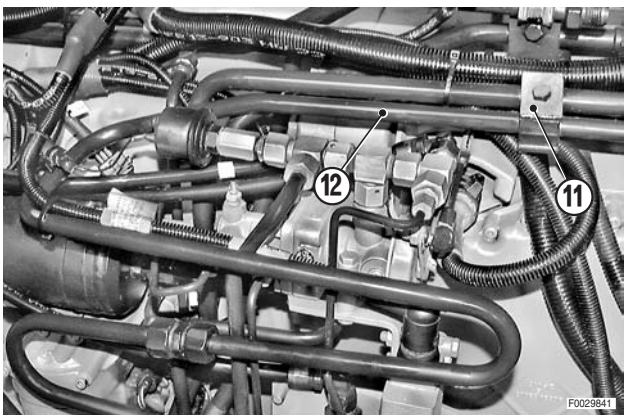
8 - Disconnect the inlet pipeline (12) from the compressor and remove.

★ Plug the ports of the compressor to prevent impurities getting in.

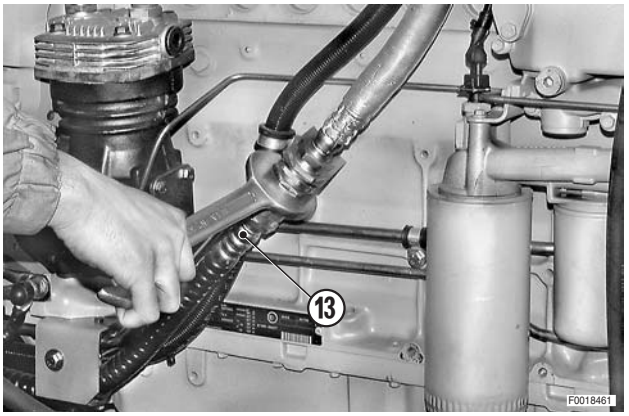


9 - Remove the clamp (11); disconnect the air compressor delivery pipe (12) and remove.

★ Plug the pipe and fitting to prevent impurities getting in.

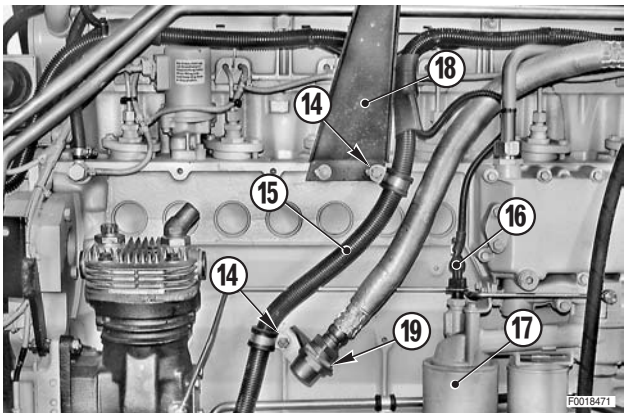


10 - Disconnect the inlet pipeline (13) of the air conditioning compressor.



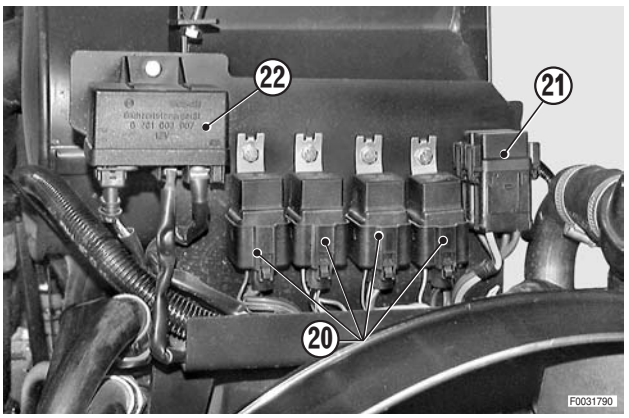
11 - Remove the fixing screws (15) from the clips of the engine wiring harness (16) and unplug the connector (16) of the filter clogging sensor (17).

12 - Remove the mounting (18) and the bracket (19) holding the inlet pipe of the air conditioning compressor.

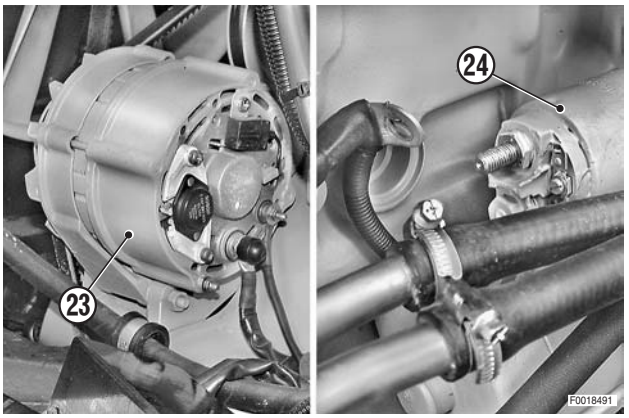


13 - Unplug the connectors (20) of the relays, fuses (21) and preheat control unit (22).

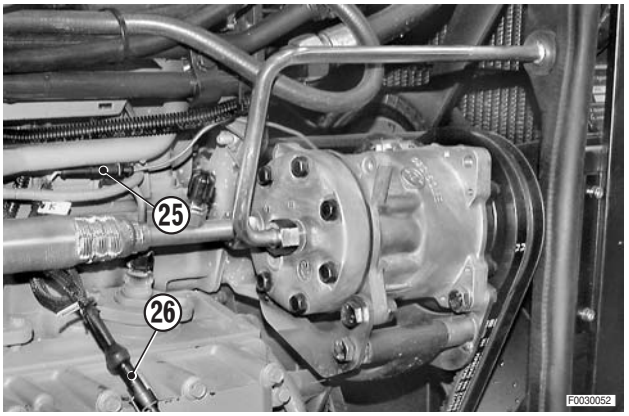
★ Mark the positions of the central relays so as to avoid error during reassembly.



14 - Disconnect the wires from the alternator (23) and the starter motor (24).
(For details, see «REMOVAL OF STARTER MOTOR - REMOVAL OF ALTERNATOR»).

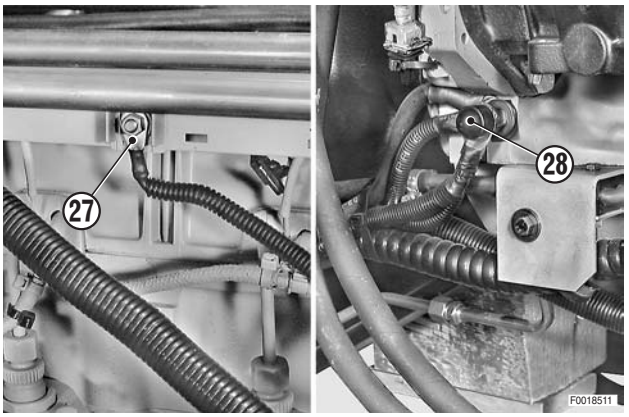


15 - Detach the connectors (25) and (26) of the clutch for the air conditioning compressor pulley, and the wiring for the front PTO clutch (if installed).



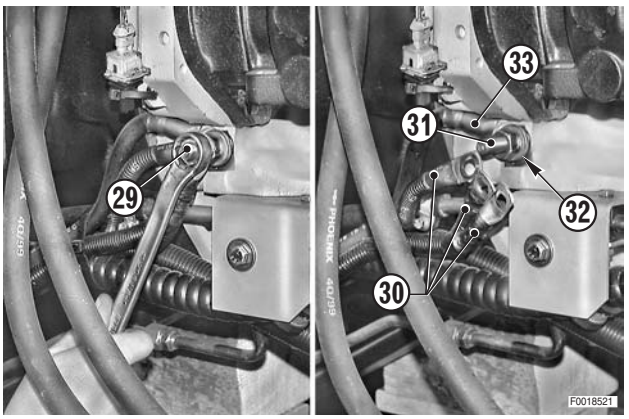
16 - Detach the earth cable (27) from the engine cylinder head.

17 - Remove the nut cap (28).

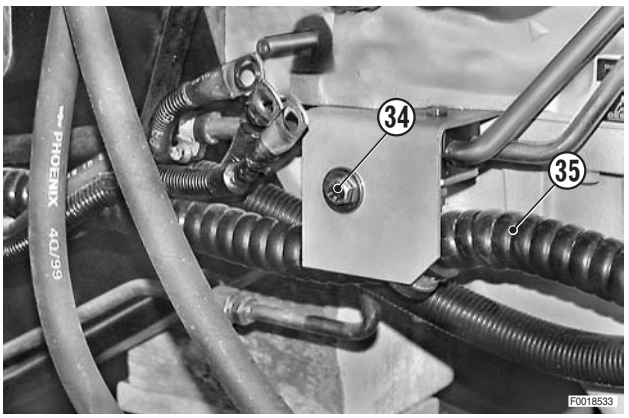


18 - Remove the nut (29) retaining the earth cables (30) and separate the terminals from the stud (31).

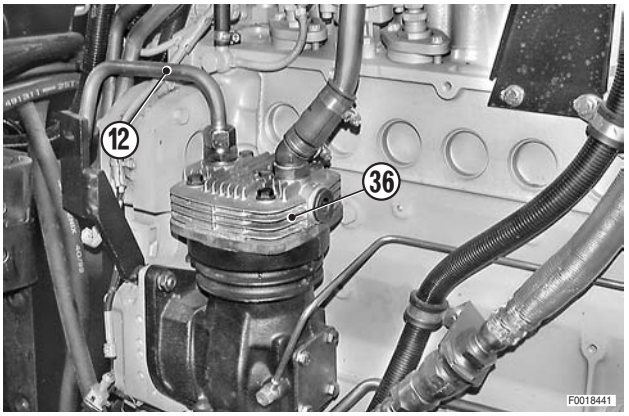
19 - Remove the nut (32) retaining the earth lead (33) from the battery and free the terminal.



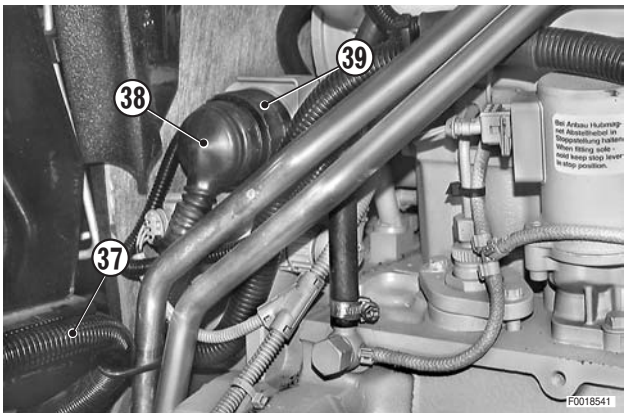
20 - Remove the bolt (34) from the clamp securing the inlet pipe (35) of the air conditioning compressor.



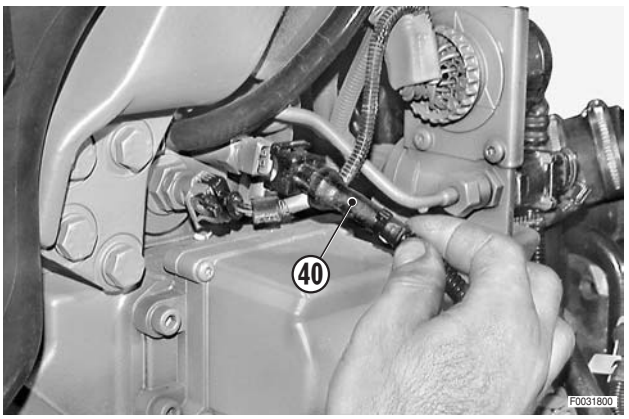
21 - Disconnect the delivery pipe (12) from the air compressor (36).



22 - Free the harness (37) from the quick-release straps and unplug the connector (38) of the engine control unit.
★ Turn the ringnut (39) anticlockwise.

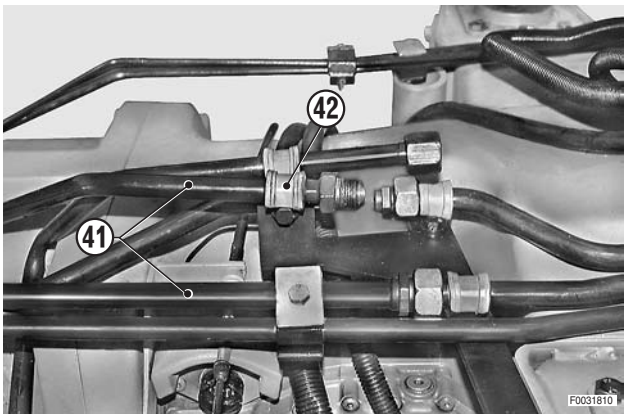


23 - Unplug the connector (40) of the engine coolant temperature sensor.
★ Free the entire harness from the quick-release straps, and direct tidily toward the rear of the machine.



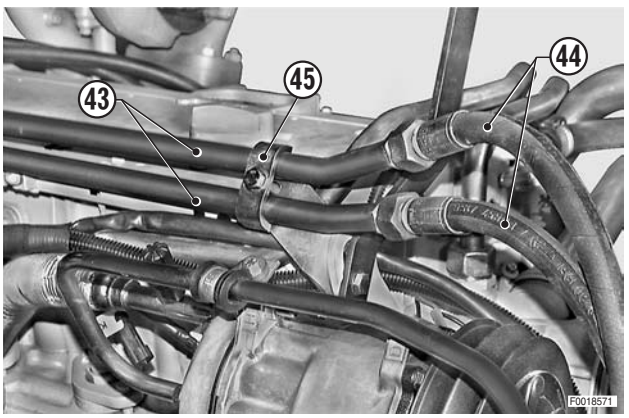
24 - Disconnect the inlet and outlet pipelines (41) of the transmission oil cooler from the fittings.
★ Plug the pipes and fittings to prevent impurities getting in.

25 - Remove the clamp (42).

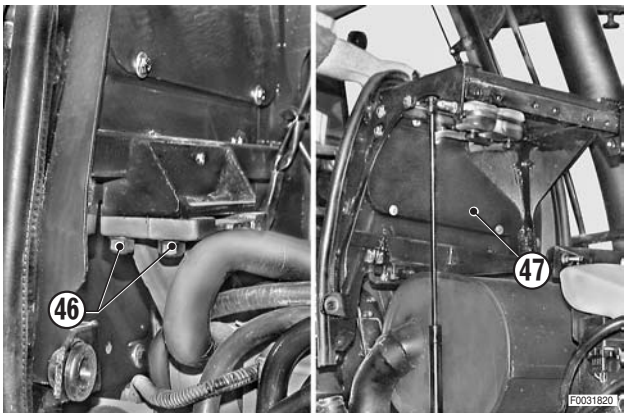


26 - Disconnect the hoses (44) from the rigid pipes (43) and remove.
★ Mark the positions so as to avoid error during reassembly.

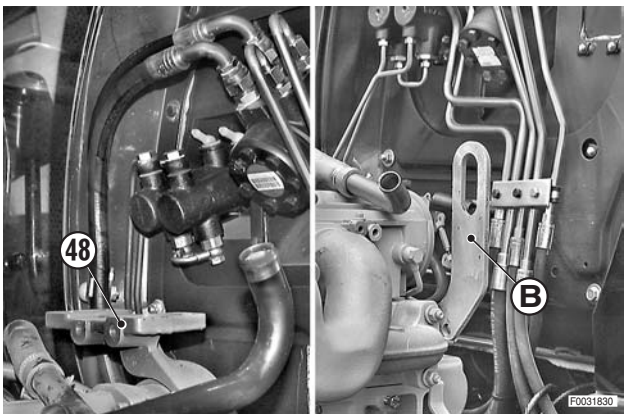
27 - Detach the bracket (45) and remove the pipes.



28 - Loosen and remove the nuts (46) and detach the hood mounting (47) complete with the brake fluid reservoirs.

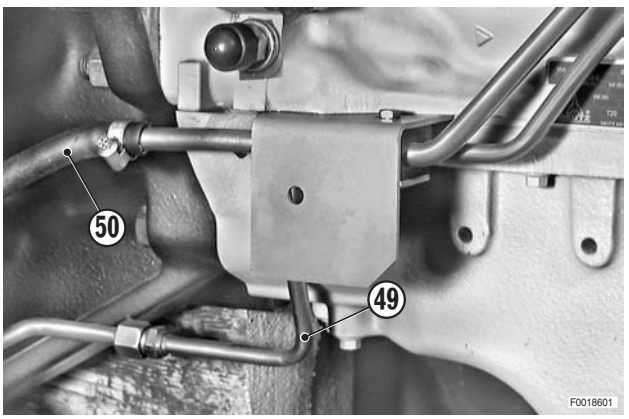


29 - Remove the bracket (48) from the hood mounting and, using the same fixing holes, attach a bracket "**B**" from which to hoist the engine.

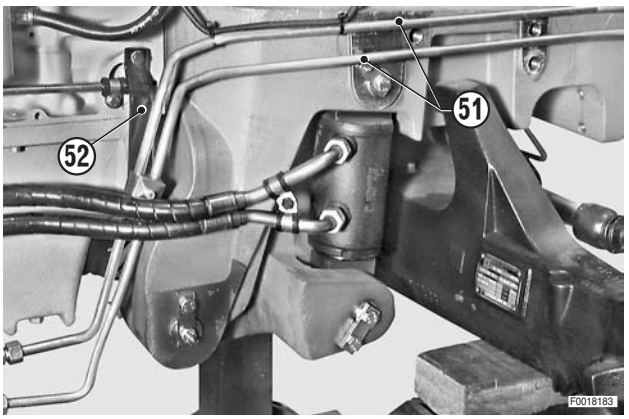


30 - Disconnect the differential lock pipeline (49) and the fuel feed pipe (50).

★ Plug the pipes to prevent impurities getting in.



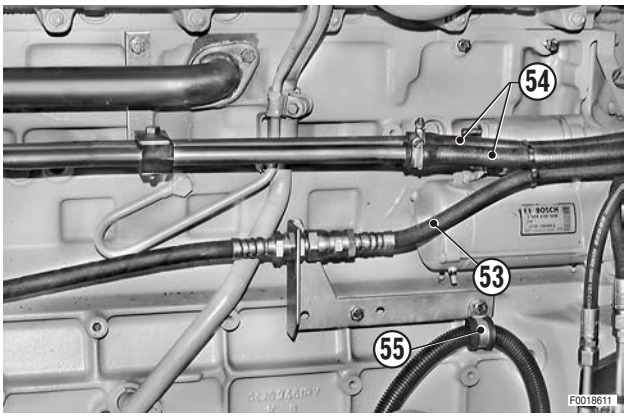
31 - Remove the lift system pipelines (51) together with the relative bracket (52).



32 - Disconnect the pressure pipe (53) from the air conditioning compressor.

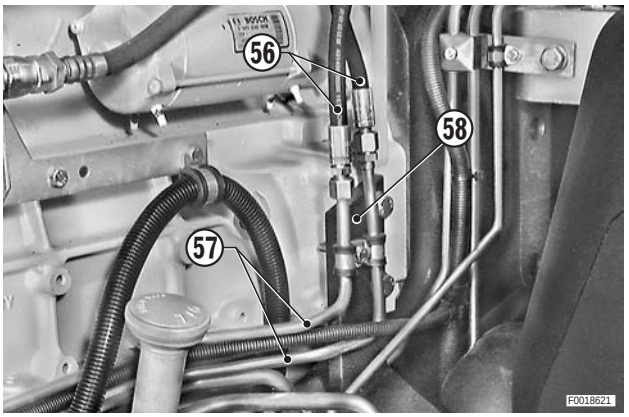
33 - Disconnect the cab heater hoses (54).

34 - Disconnect the wiring harness clip (55).

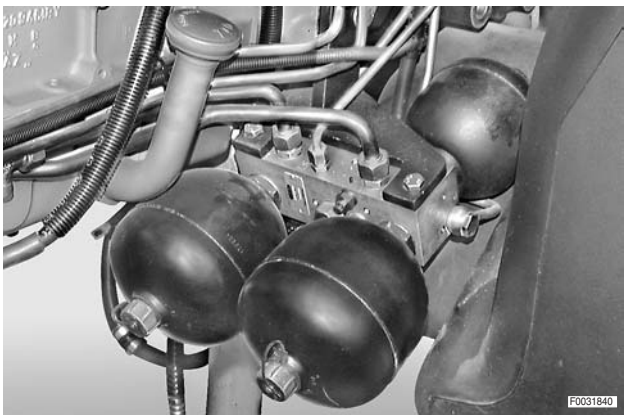


35 - Disconnect the steering system hoses (56).

36 - Remove the rigid pipelines (57) complete with the bracket (58).



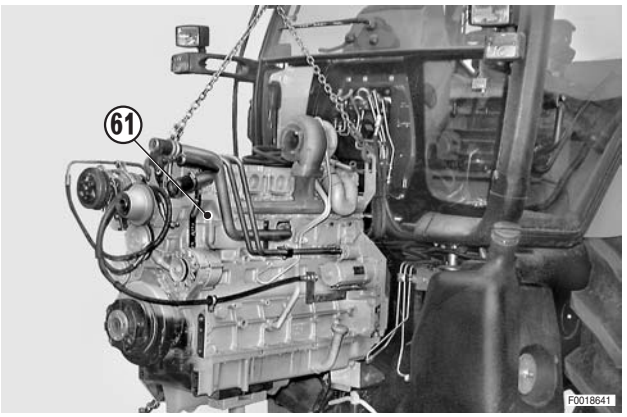
37 - Remove the front suspension accumulators assembly.
(For details, see «REMOVAL OF FRONT SUSPENSION ACCUMULATORS»).



38 - Undo the bolt and remove the front retaining flange (59) of the fuel tank; loosen the bolt of the rear flange by about 20 mm.

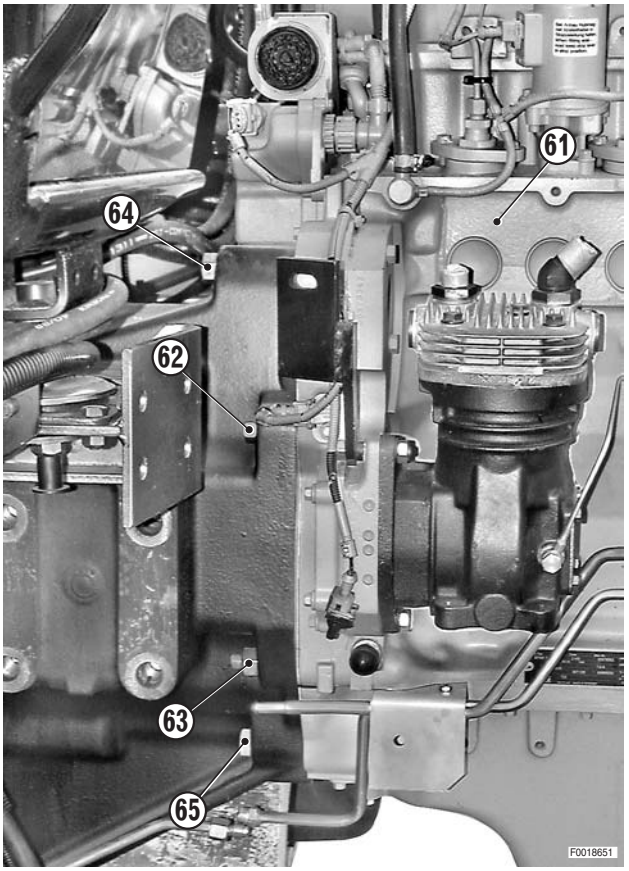
39 - Shift the fuel tank (60) sideways so as to gain access to the bottom bolt and the top nuts securing the engine.

40 - Sling the engine (61) to a hoist, using the permanent front lifting point and the temporary bracket attached previously (step 29).
Tension the chains or ropes.



41 - Loosen and remove the bottom nuts (62), (63) and the bolts (64), (65) securing the engine (61). ※ 2

42 - Separate the engine (61) from the transmission (66), using a lever if necessary. ※ 3



ASSEMBLY OF ENGINE - TRANSMISSION

- To reassemble, repeat the above steps in reverse order.

※ 1

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

※ 2

Nm Nuts and bolts: M12:
110±10% Nm (81±10% lb.ft.)

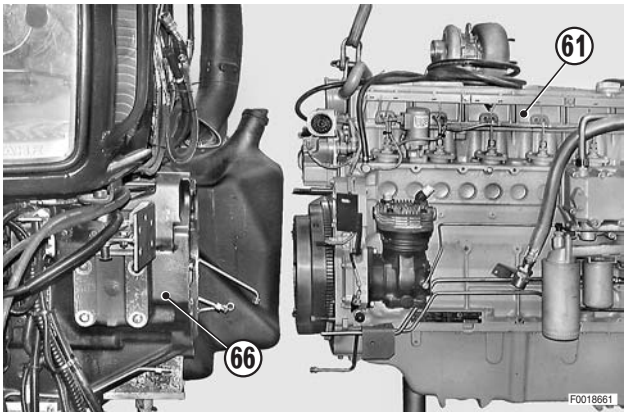
Nm Nuts and bolts: M16:
260±10% Nm (191.7±10% lb ft.)

★ First tighten the nuts, then the bolts, proceeding in diagonal sequence.

※ 3

★ Clean mating faces thoroughly; lubricate surfaces and locating dowels.

Locating dowels: Engine oil



1 - Fill the various systems with oil, coolant, etc. Start the engine and run for a few minutes to circulate the fluids, then check for leaks.

2 - Bleed the air from the hydraulic circuits by operating the services a number of times.

3 - Stop the engine, check all fluid levels and top up if necessary.

SEPARATION OF THE TRANSMISSION AND REAR AXLE

★ Remove the following components, in sequence:
- Rear wheels
- Cab
- Fuel tank

(For details, see corresponding removal instructions).

★ Drain the oil from the transmission

Gear oil:

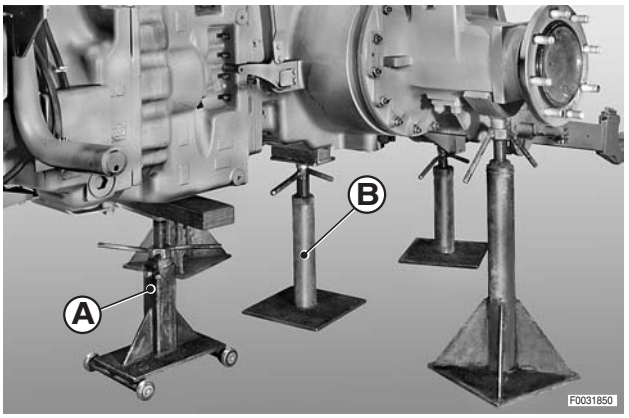
Mod.	1130	1145	1160
ℓ **(US. gall.)**	140 (37)	140 (37)	140 (37)

※ 1

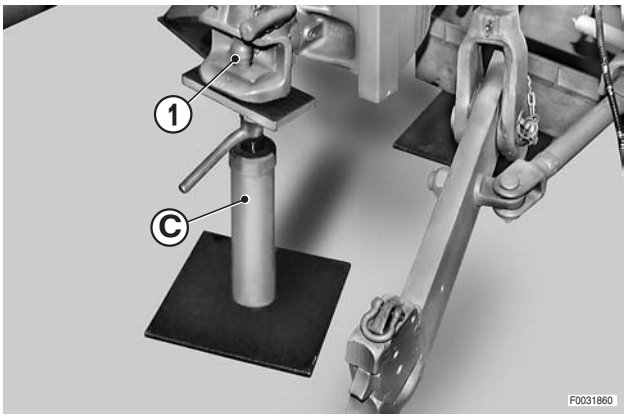
1 - Locate a jack "**A**" with wheels and a non-slip block under the transmission, and elevate the machine.

★ Straighten the front wheels.

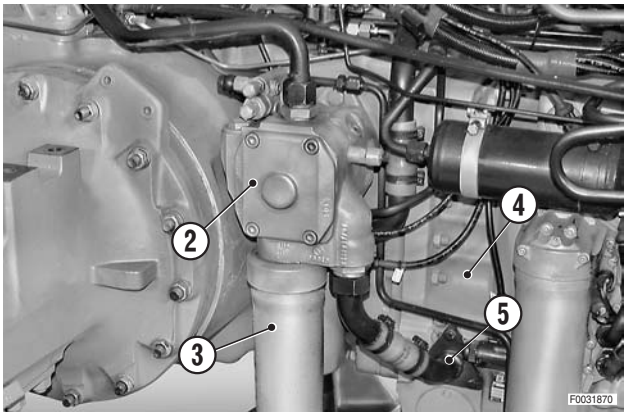
2 - Position a jack "**B**" with a non-slip block tight under the rear axle.



3 - Place a further jack (1) "**C**" with non-slip block under the rear towing hitch, to prevent the machine from toppling over.



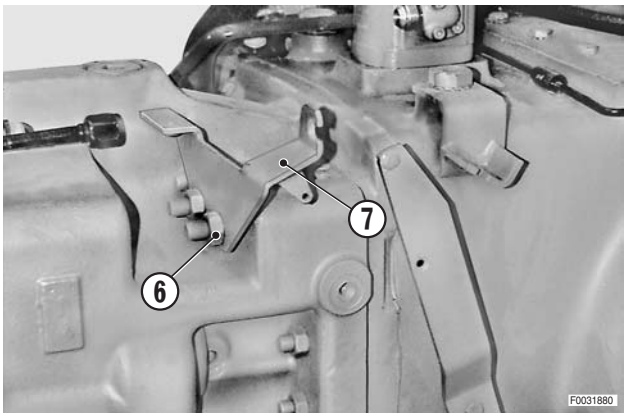
4 - Remove the filter (3) and disconnect the inlet pipeline from the piston pump (2) and from the transmission (4).



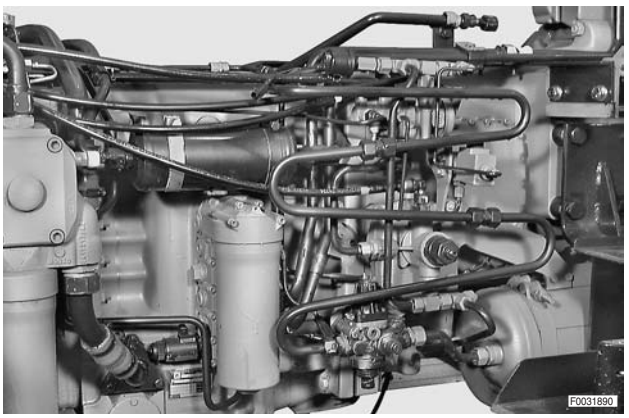
5 - Detach the wiring harnesses connected to the two sections being split, and tilt them forward.

6 - Disconnect and remove all pipelines and components that pass through or across the transmission/rear axle interface, or which in any event can impede the movement of tools (resonator, brake hoses, pipelines serving the front suspension if any, or the power steering or trailer braking system, etc.). ⁘ 2

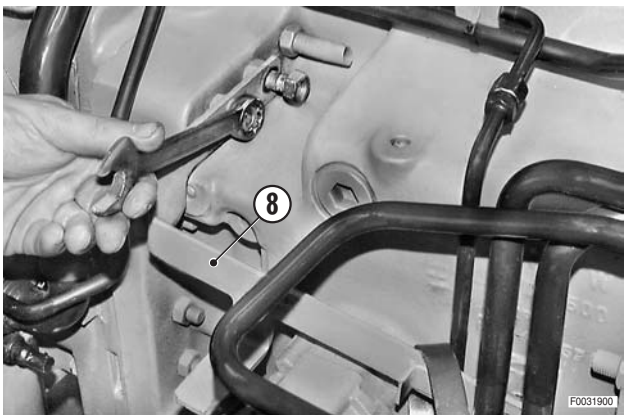
7 - Loosen and remove the nuts (6) and the bracket (7) for the Bowden cable operating the air trailer parking brake control valve.



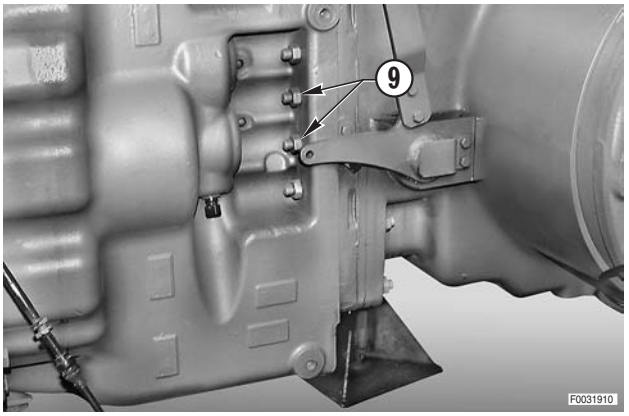
8 - Loosen and remove the air brake valves.
(For details, see «REMOVAL OF TRAILER PARKING AND SERVICE AIR BRAKE CONTROL VALVES»).



9 - Remove the bracket (8) supporting the resonator and the air valves.



10 - Loosen and remove the nuts (9) securing the transmission to the rear axle housing; slacken off gently so as to relieve the tightening torque, but leave in place the nut (10) attached to the middle stud of the top three on each side, right and left. ⁘ 3

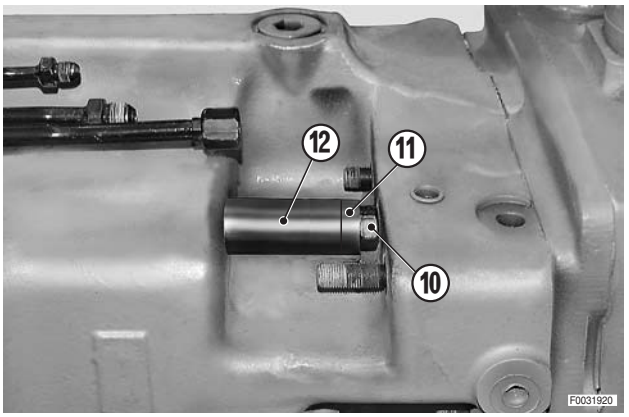


11 - Apply a deep washer (11) and a spacer (12) to each of the central studs.

12 - Unscrew the nut (10) to the point of locking the spacer (12) and the washer (11) against the opposing surface of the housing.

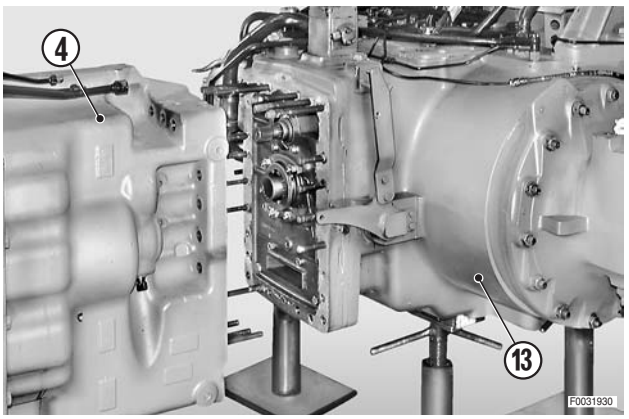
13 - Now unscrew the nuts alternately so as to force the two housings apart by about 2 mm.

14 - Return the nuts (10) to the former position, remove the spacer (12) and the washer (11), and finally remove the nuts (10) themselves.



15 - Detach the transmission housing (4) from the rear axle housing (13).

※ 4



ASSEMBLY OF TRANSMISSION AND REAR AXLE

- To refit, repeat the above steps in reverse order.

※ 1

★ Fill the transmission housing with the prescribed oil.

Gear oil:

Mod.	1130	1145	1160
ℓ (US. gall.)	140 (37)	140 (37)	140 (37)

★ Type of oil: AKROS MULTI VT
(SAE 15W30 - API GL4 - SDGF OT 1801-B
ZF TE - ML O6B, 07, 12)

※ 2

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

※ 3

Nm Interface nuts: 210 Nm (154.8 lb.ft.)

★ Tighten the middle nuts first, then proceed with the others in diagonal sequence.

※ 4

★ Clean mating faces thoroughly; lubricate surfaces and locating dowels.

Locating dowels: Engine oil

Surfaces: Loctite Gasket Eliminator 518

1 - Fill the various systems with oil, coolant, etc. Start the engine and run for a few minutes to circulate the fluids, then check for leaks.

2 - Bleed the air from the hydraulic circuits by operating the services a number of times; check all fittings and circuits for leaks during this step.

3 - Stop the engine, check all fluid levels and top up if necessary.

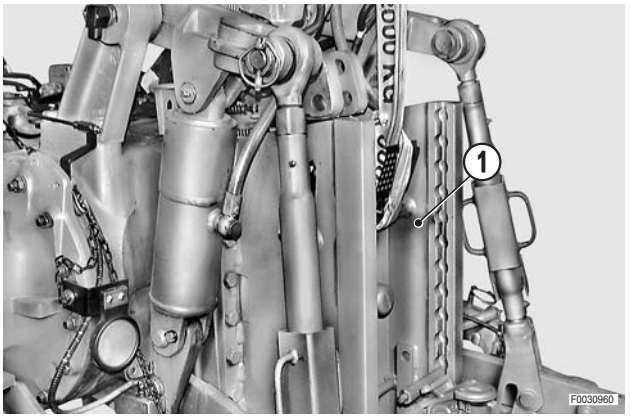
4 - Check the position of the lever when the trailer parking brake comes into operation, and if necessary adjust the length of the cable.
(For details, see «REFITMENT OF TRAILER PARKING AND SERVICE AIR BRAKE CONTROL VALVES»).

REMOVAL AND OVERHAUL OF PTO CLUTCH

1. Removal of cover

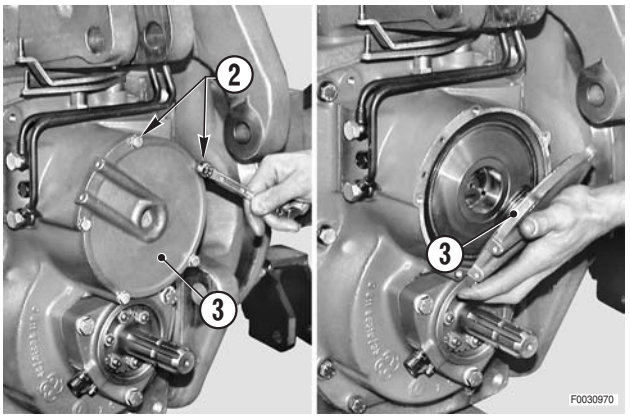
1 - Remove the towing hitch (1). ※ 1

kg Towing hitch: 83 kg (183 lb.)



2 - Unscrew and remove the five bolts (2) and washers retaining the cover (3).

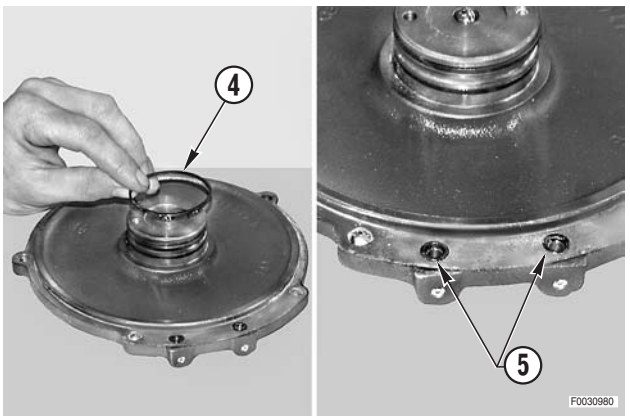
3 - Dislodge the cover (3), tapping with a plastic hammer, and remove. ※ 2



4 - Remove the two sealing rings (4) from the cover. ※ 3

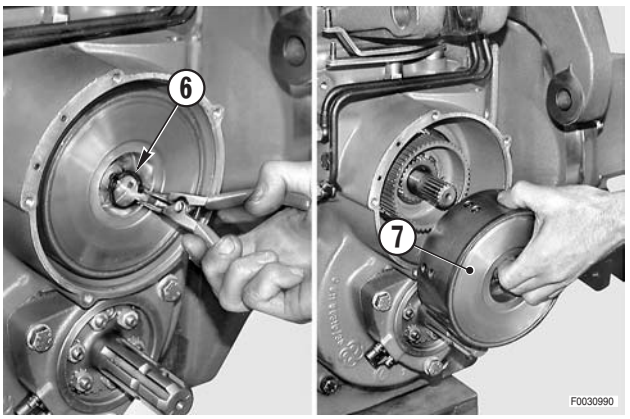
5 - Remove the O-rings (5).

★ Renew the O-rings every time they are removed.

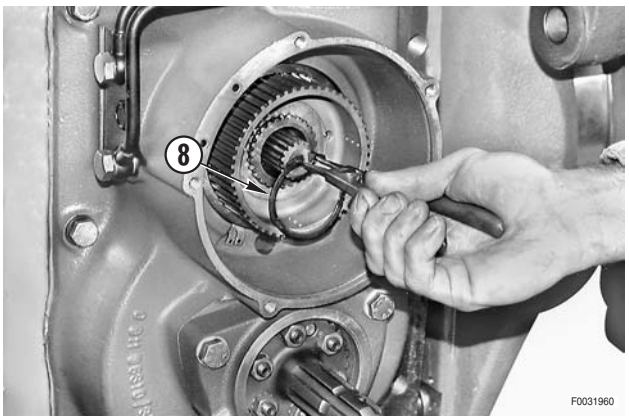


2. Removal of clutch

1 - Remove the circlip (6) and take out the clutch assembly (7).

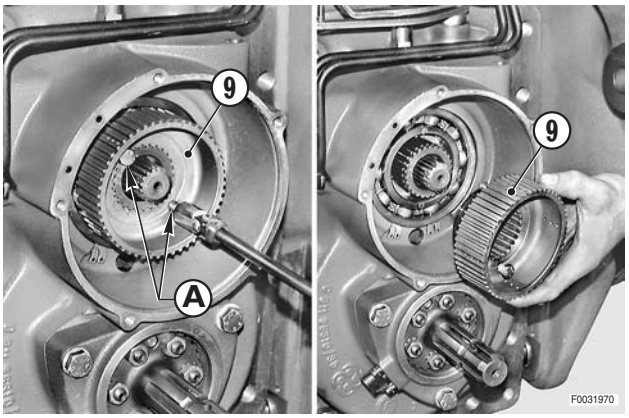


2 - Remove the circlip (8) retaining the hollow coupling gear.



3 - Insert two jacking screws "**A**" into the holes of the hollow gear (9).

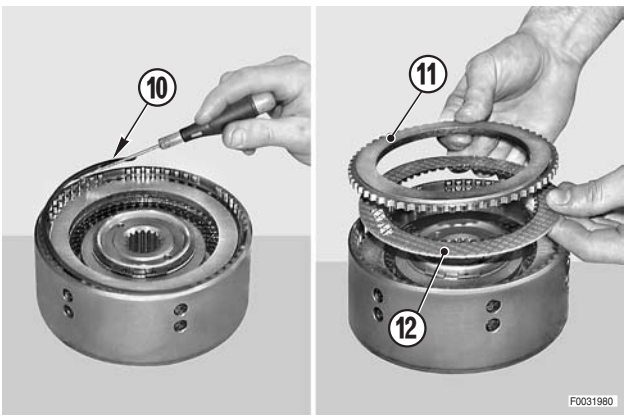
4 - Drive the bolts "**A**" alternately, one turn at a time, until the hollow gear (9) is free.



3. Disassembly of clutch

1 - Remove the circlip (10) retaining the clutch discs.

2 - Remove the spacer (11) and the first friction disc (12).



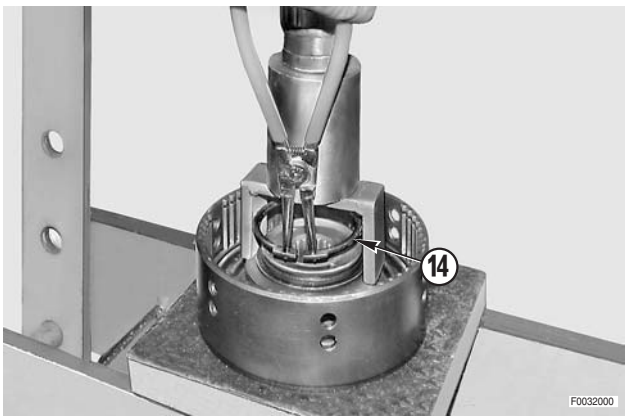
3 - Proceed in this manner until the last steel disc (13) has been removed.

★ If the discs are not going to be replaced, avoid switching the original positions.

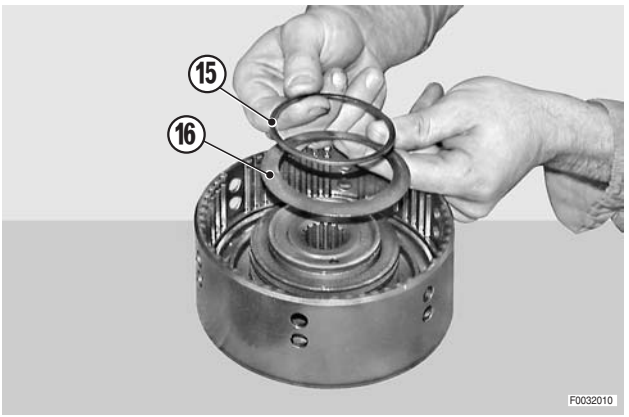
★ Check that the thickness of the friction discs is still greater than the minimum permissible.

★ Minimum thickness: 2 mm (0.0788 in.)

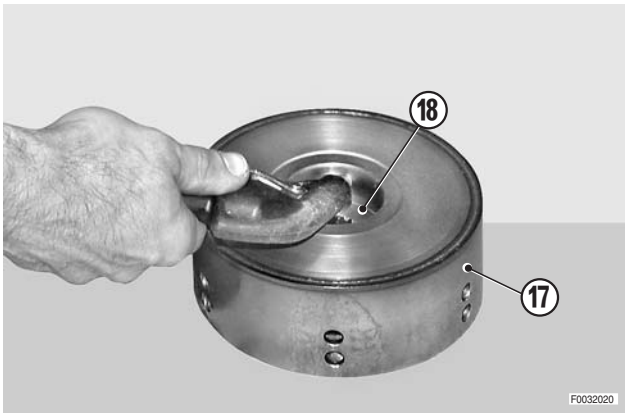
4 - Using a press and a suitable adapter, compress the springs so that the circlip (14) can be removed.



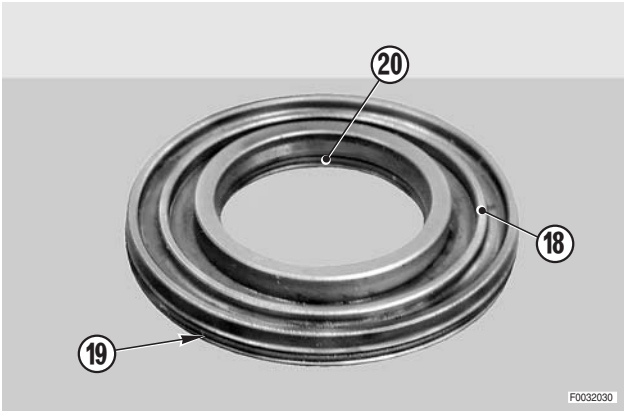
5 - Remove the spacer ring (15) and the Belleville springs (16).
★ Make a note of which way round the springs are assembled.



6 - Up-end the clutch housing (17) and remove the piston (18) by forcing out with a low pressure blast of compressed air.



7 - Remove the O-rings (19) and (20) from the piston (18).
★ Renew the O-rings every time they are removed.
⁘ 2



ASSEMBLY AND REFITMENT OF PTO CLUTCH ASSEMBLY

- Assemble and refit by following the disassembly and removal steps in reverse order.

1

Towing hitch bolts: 450 Nm (332 lb.ft.)

2

Cover locating surface: Loctite 510

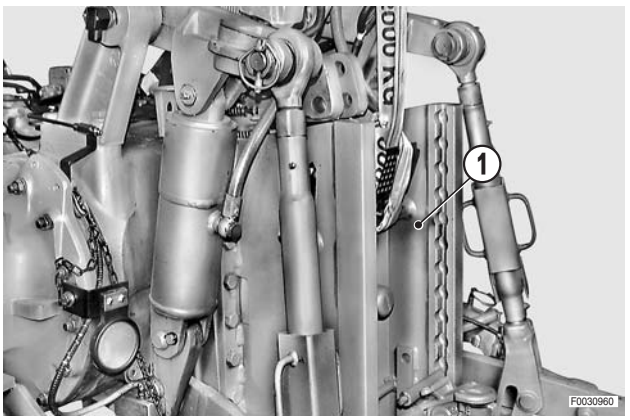
3

Sealing rings and O-rings: gear oil

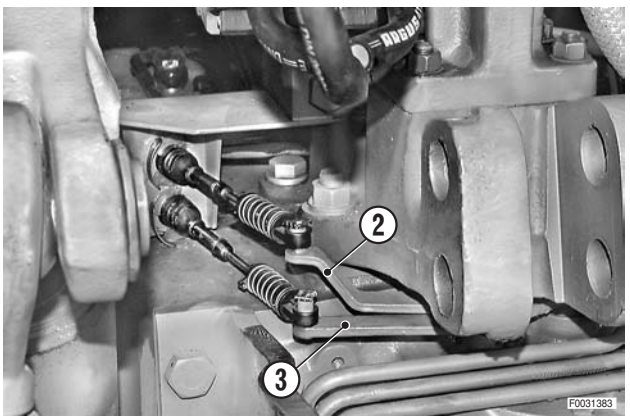
REMOVAL OF PTO ASSEMBLY

1 - Remove the towing hitch (1). 1

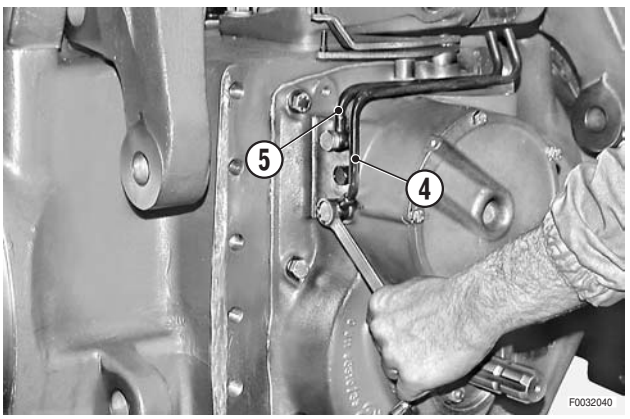
kg Towing hitch: 83 kg (183 lb)



2 - Disconnect the Bowden cables from the levers (2) and (3).

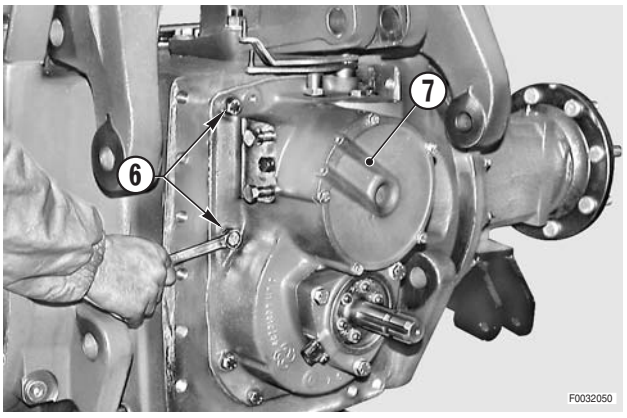


3 - Remove the PTO clutch and brake oil lines (4) and (5).



4 - Loosen and remove the bolts (6) and the relative washers securing the PTO assembly (7).

★ As a safety precaution, leave one loosened bolt in place on each side.

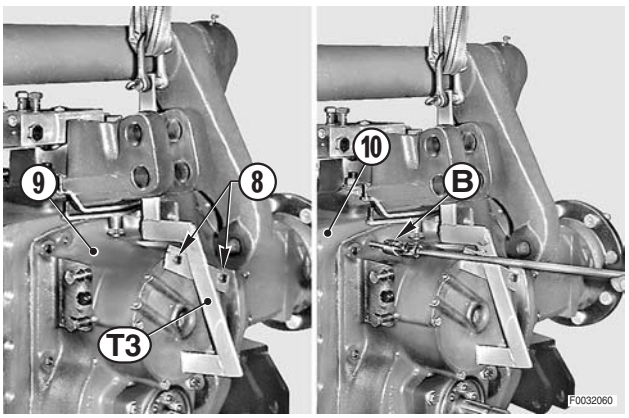


5 - Remove the two top right bolts (8) of the PTO clutch cover (9) and fit the special lifting tool **T3** (code 5.9030.839.0).

6 - Connect the tool **T3** (code 5.9030.839.0) to a hoist and tension the rope slightly.

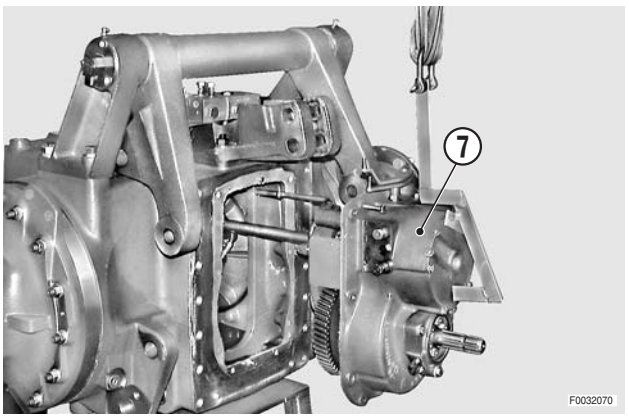
kg PTO assembly: 90 kg (198 lb.)

7 - Screw two M10x60 bolts "**B**" into the jacking holes. Drive the two bolts "**B**" alternately, one half-turn at a time, until the entire PTO assembly (7) is detached from the differential housing (10). ※ 2



8 - Remove the PTO assembly (7) and set down on a work top.

9 - Remove all traces of sealant from the mating surfaces.



REFITMENT OF PTO ASSEMBLY

- To refit, repeat the above steps in reverse order.

※ 1

Nm Towing hitch bolts: 450 Nm (332 lb.ft.)

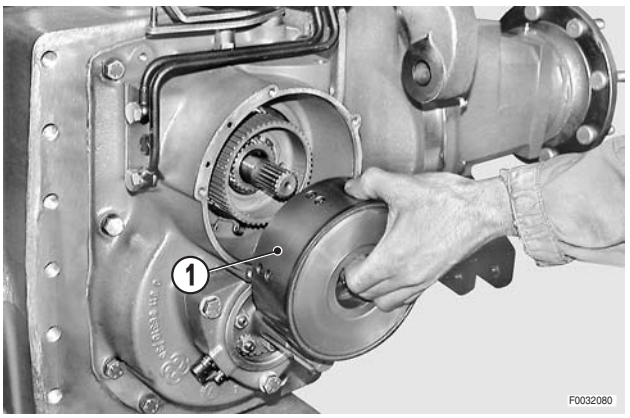
★ Tighten the bolts alternately and in diagonal sequence, starting from the middle.

※ 2

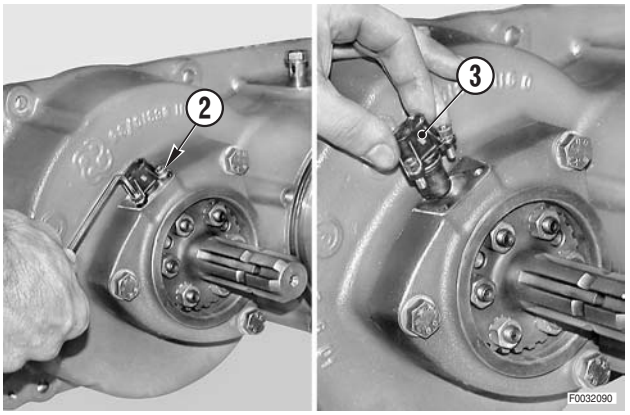
PTO assembly locating surfaces: Loctite 510

DISASSEMBLY OF PTO

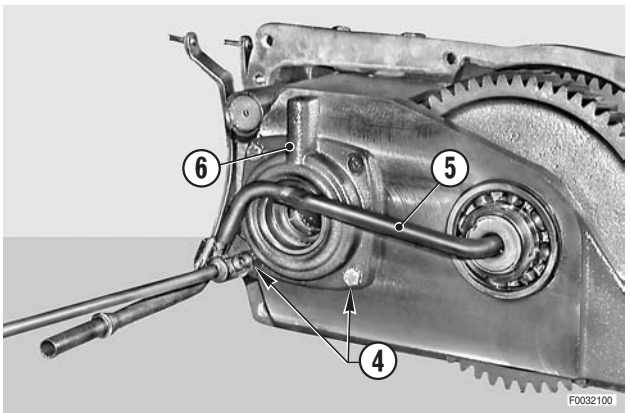
1 - Remove the clutch assembly (1).
(For details, see «REMOVAL AND OVERHAUL OF PTO CLUTCH»).



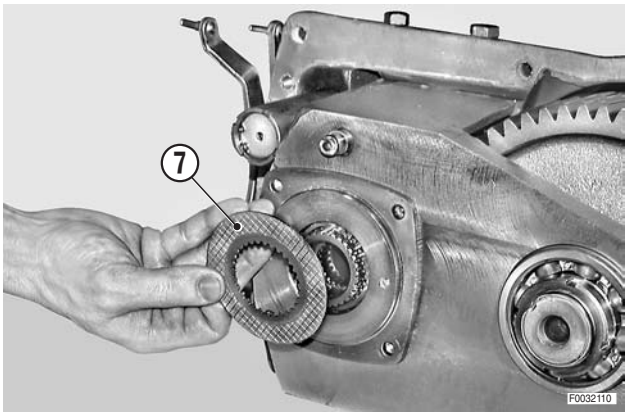
2 - Undo the screws (2) and remove the PTO rotation sensor (3).



3 - Loosen and remove the screws (4), then remove the lube pipe (5) and the cylinder (6).

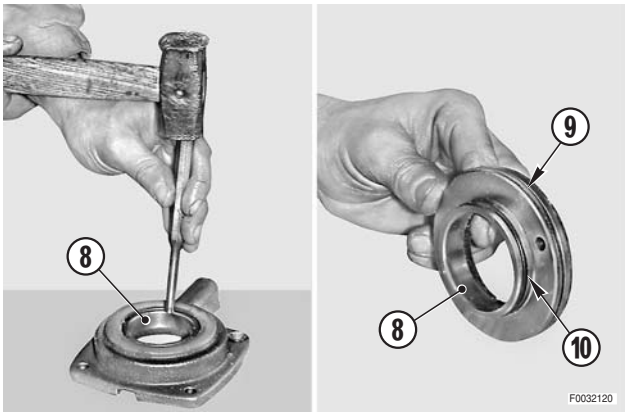


4 - Remove the friction disc (7).

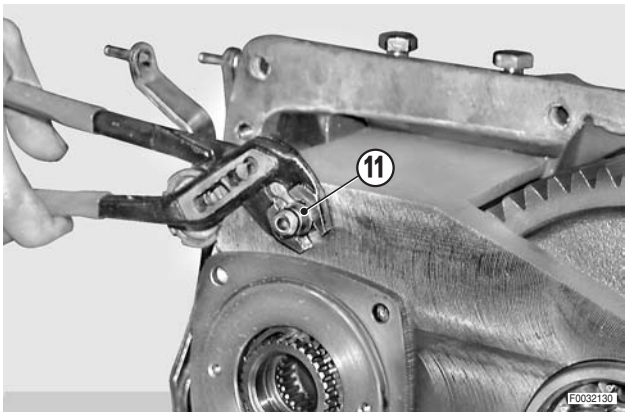


5 - Using a drift made of soft material (aluminium, plastic) and a hammer, drive out the piston (8).
★ Tap lightly around the entire circumference.

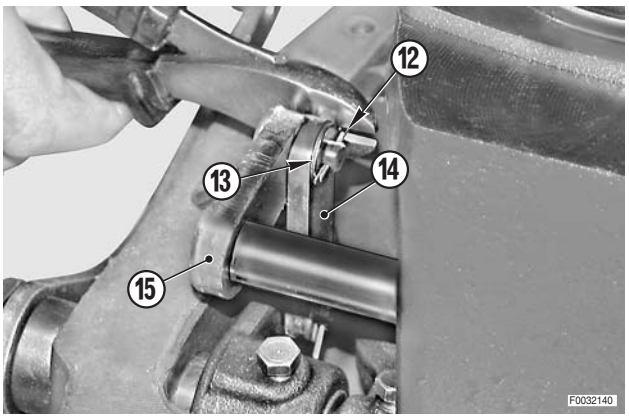
6 - Remove the O-rings (9) and (10) from the piston (8).
★ Renew the O-rings every time they are removed.



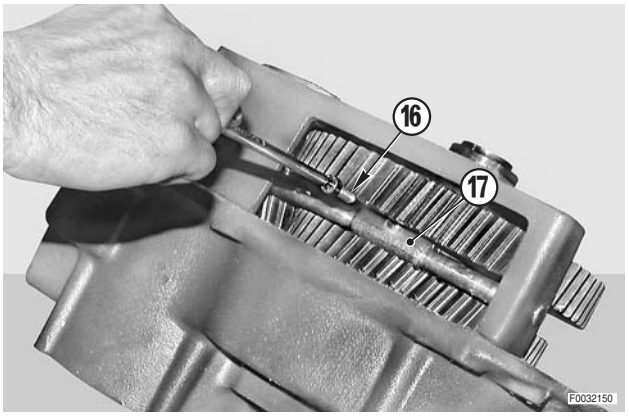
7 - Remove the fitting (11).
★ Take care not to damage the O-ring seats.
★ Renew the O-rings every time they are removed.



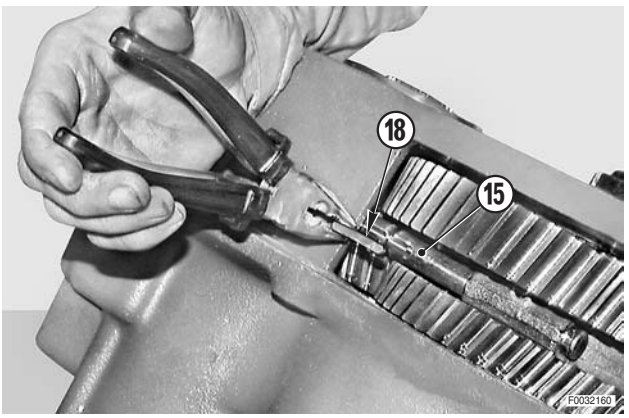
8 - Remove the cotter pin (12) and washer (13), and disconnect the linkage lever (14) from the operating lever (15).



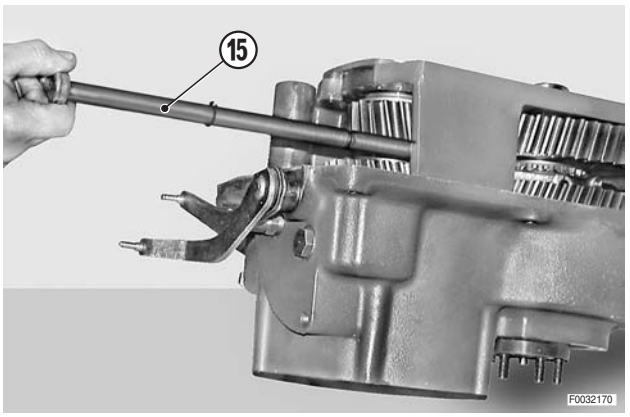
9 - Loosen and remove the screw (16) clamping the fork (17).



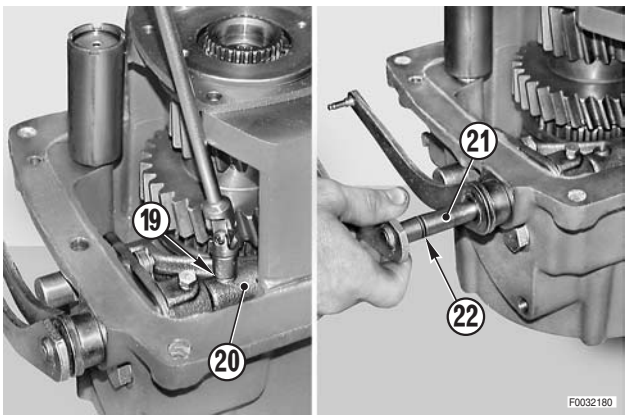
10 - Draw out the lever (15) to the point of freeing the key (18).
Remove the key.



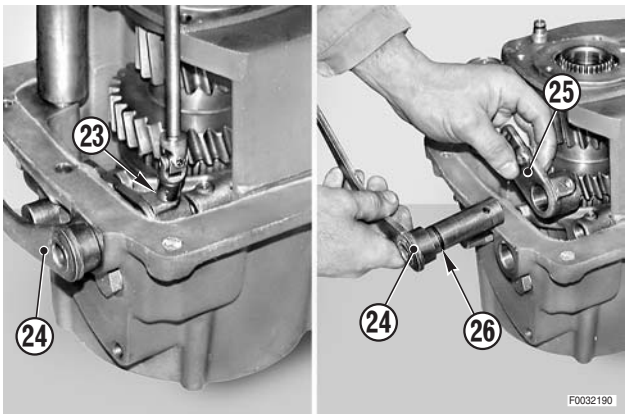
11 - Remove the operating lever (15).
★ The fork remains in the housing and will be removed later.



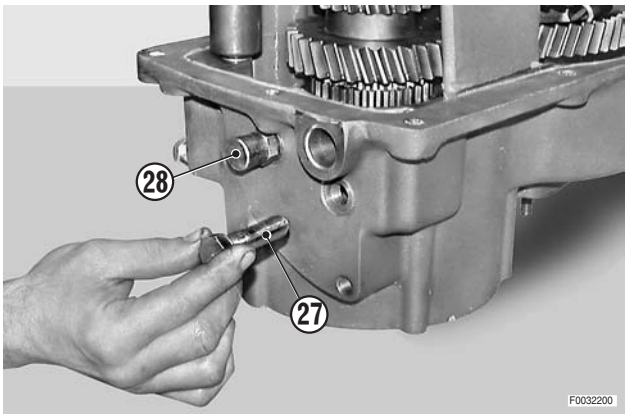
12 - Loosen and remove the bolt (19) securing the fork (20), and pull out the lever (21).
★ Replace the O-ring (22) every time the lever is removed.



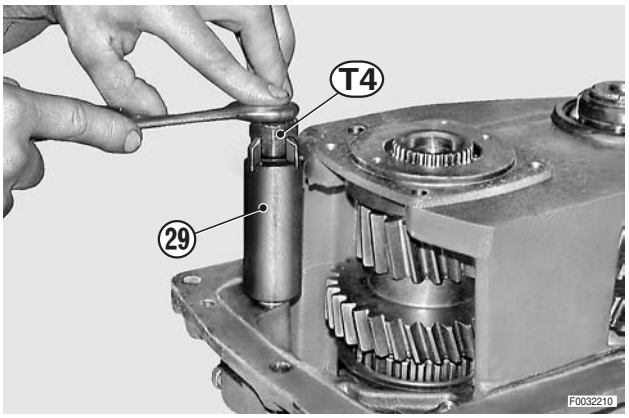
13 - Loosen and remove the bolt (23), pull out the lever (24) and recover the coupler (25).
★ Replace the O-ring (26) every time the lever is removed.



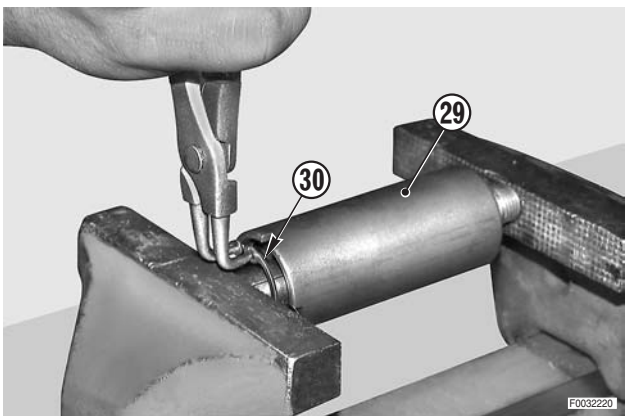
14 - Loosen and remove the flexible plungers (27) and (28).
★ Make a note of the positions.



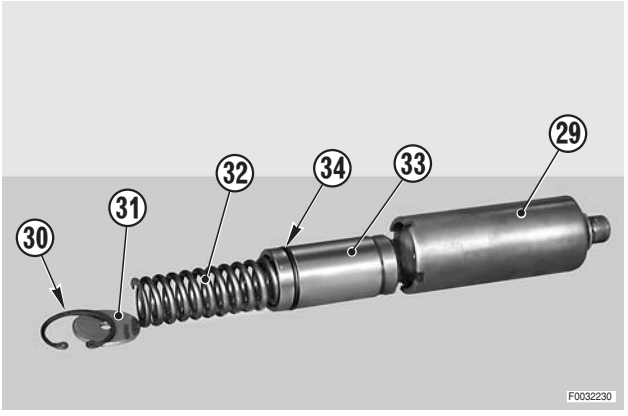
15 - Using special tool **T4** (code 5.9030.859.0), remove the damper assembly (29).



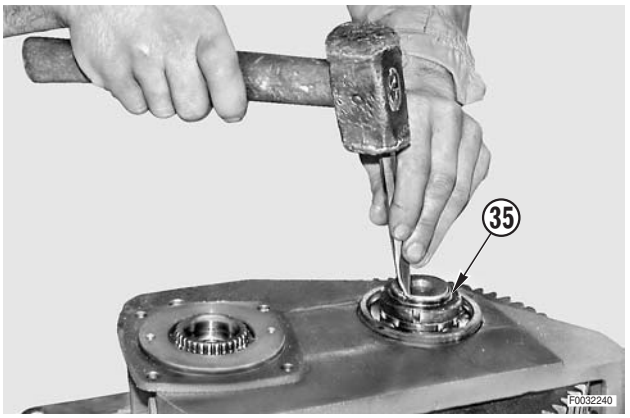
16 - Compress the spring assembly of the damper (29) and remove the circlip (30).



17 - Release the assembly and remove the thrust washer (31), spring (32) and piston (33) complete with O-ring (34).
★ Replace the O-ring (34) every time the piston is removed.

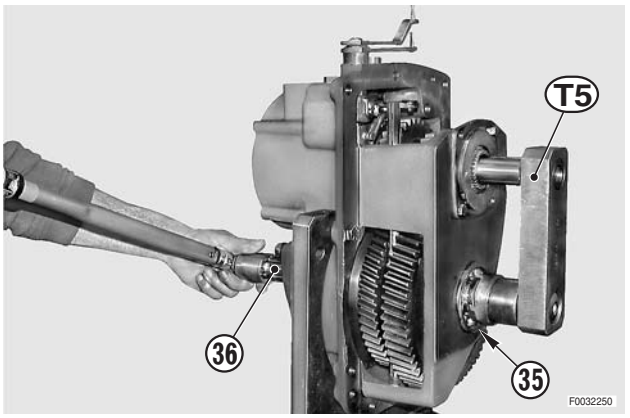


18 - Unstake the lock nut (35).



19 - Fit special tool **T5** (code 5.9030.840.0) with a socket of appropriate size coupled to the lock nut (35).

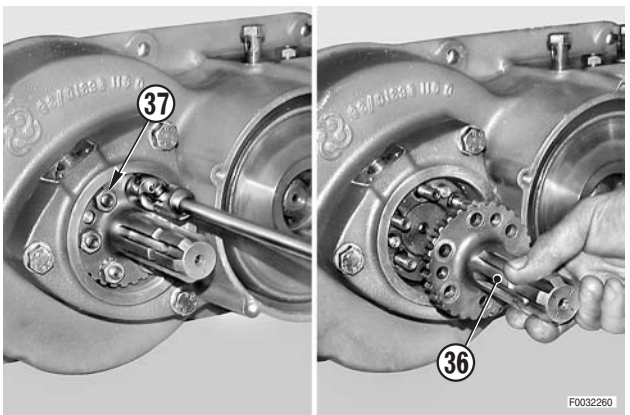
20 - Using a wrench in combination with special tool **T5** (code 5.9030.840.0), rotate the PTO shaft (36) anti-clockwise and remove the lock nut (35). ※ 1



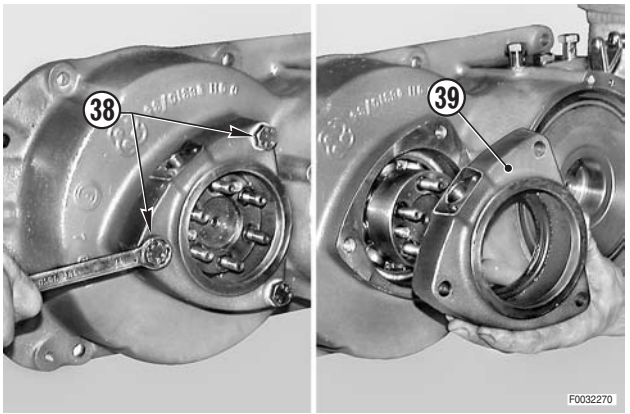
21 - Loosen and remove the nuts (37) and lock washers retaining the PTO shaft (36).

22 - Remove the shaft (36).

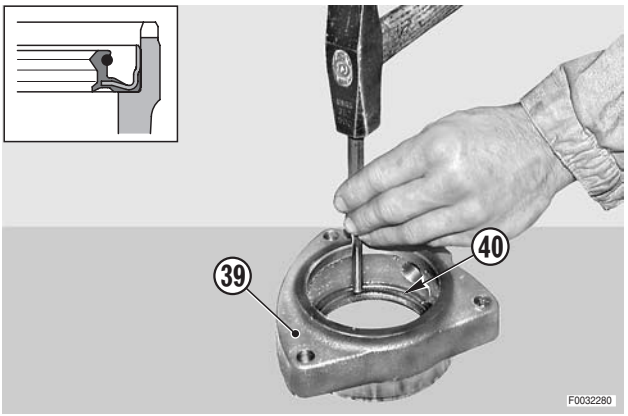
⚠ The studs are secured with Loctite 554.



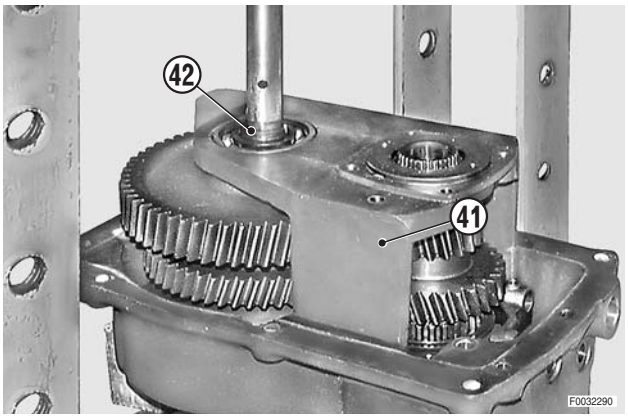
23 - Undo the bolts (38) and remove the flange (39). ※ 2



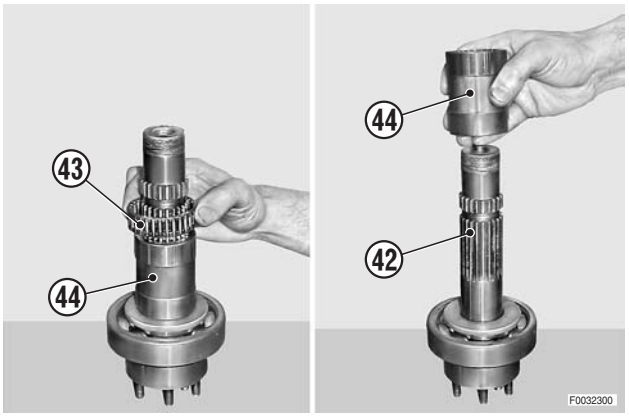
24 - Make a careful inspection of the seal (40) to verify for wear; if in need of replacement, drive out as illustrated.
★ Note which way round the seal is fitted.



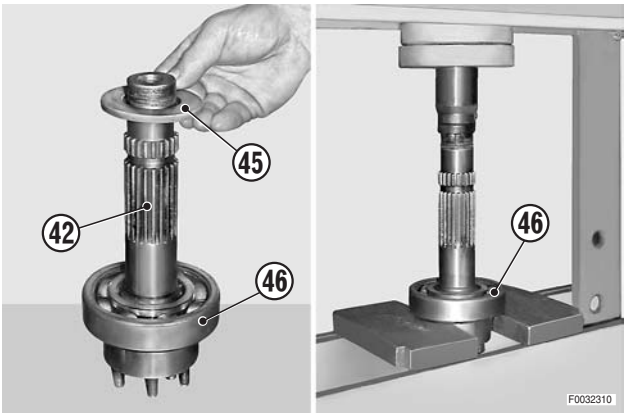
25 - Position the PTO assembly (41) under a press and, using a suitable driver, remove the shaft (42).



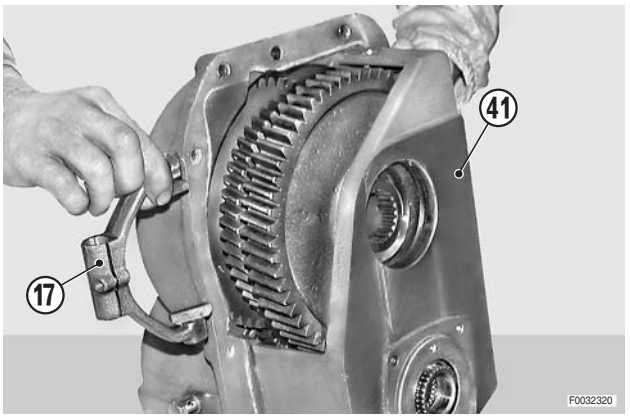
26 - Remove the needle bearing (43) and the spacer (44) from the shaft (42).



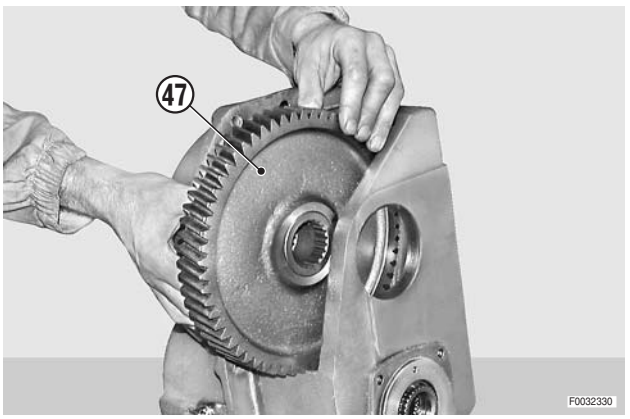
27 - Take off the washer (45) and, using a press, remove the bearing (46).



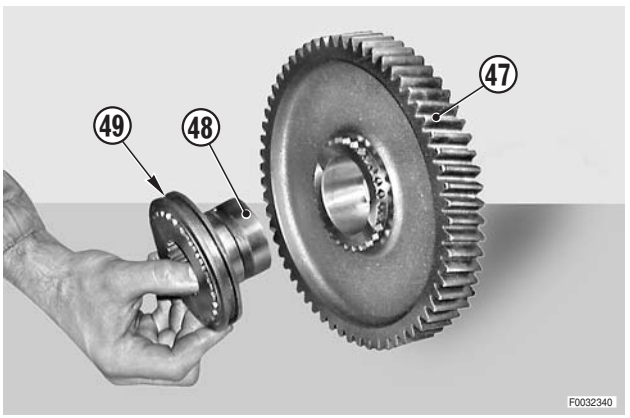
28 - Up-end the PTO assembly (41) and remove the fork (17).
★ Make a careful inspection of the shoes, and replace if worn or scorched.



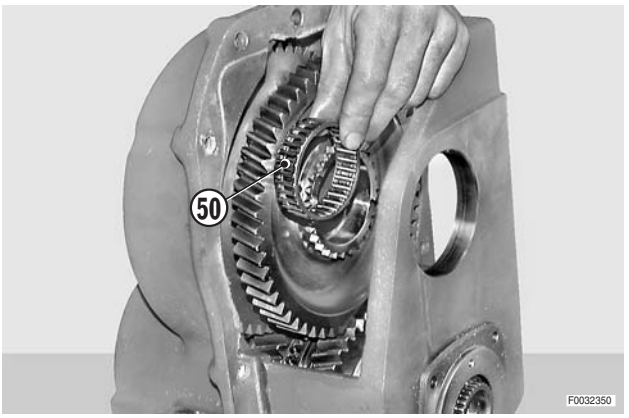
29 - Remove the complete driven gear (47) from the PTO housing.



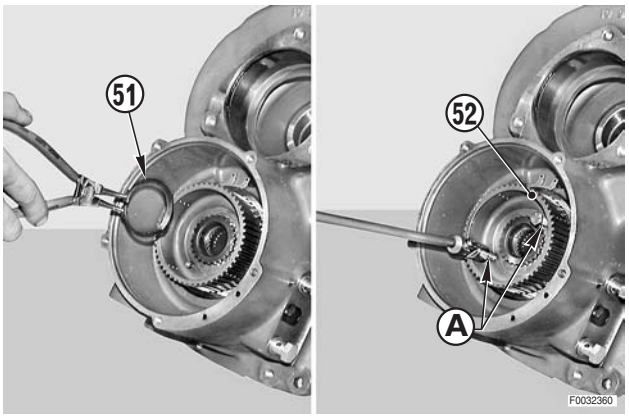
30 - Remove the bushing (48) and the sliding coupler (49) from the gear (47).



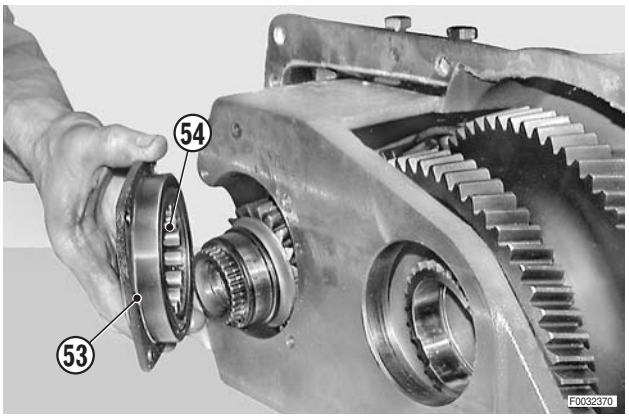
31 - Remove the needle bearing (50).



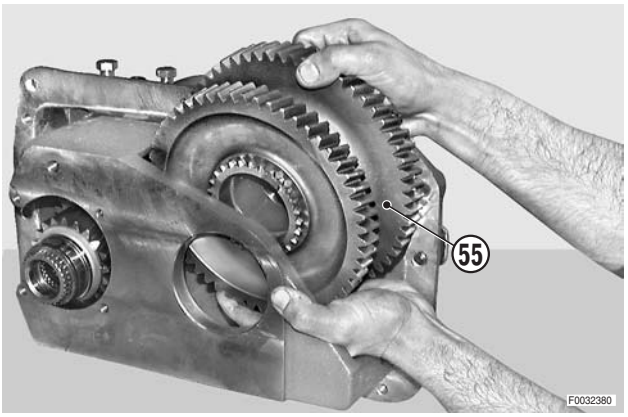
32 - Remove the circlip (51) and, with the aid of two jacking screws "**A**", unseat the ring gear (52).
(For details, see «REMOVAL AND OVERHAUL OF PTO CLUTCH»).



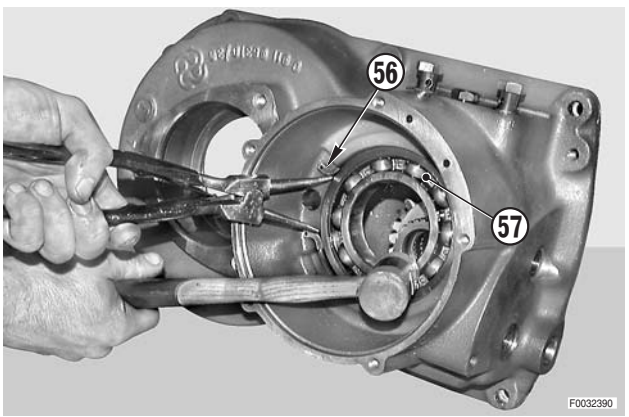
33 - Remove the flange (53) complete with the outer ring of the roller bearing (54).



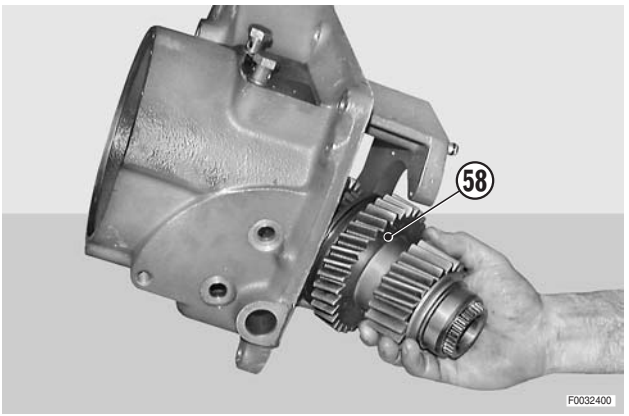
34 - Lift the double gear (55) out of the PTO housing.



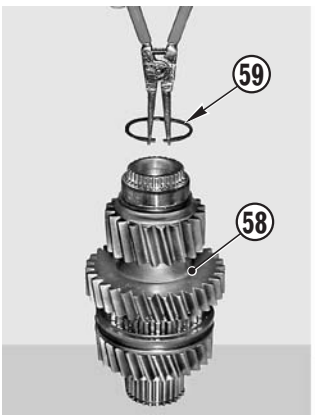
35 - Spread the ends of the bearing circlip (56) with the appropriate pliers and, using a hammer with a plastic head, dislodge and remove the bearing (57).

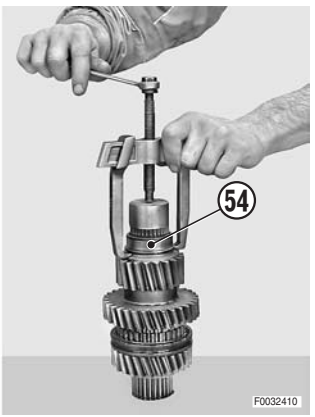


36 - Remove the shaft and driving gears assembly (58) from the PTO housing.

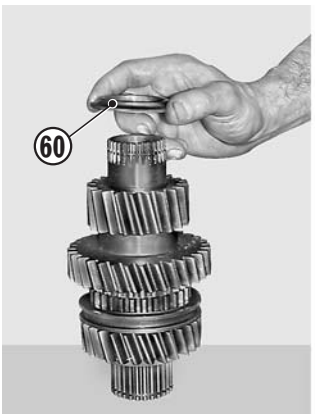


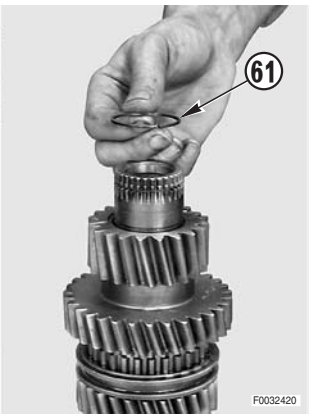
37 - Remove the circlip (59) and, using a puller, unseat the inner ring of the bearing (54).





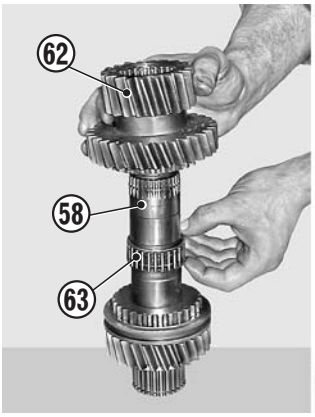
38 - Remove the spacer (60) and the circlip (61).

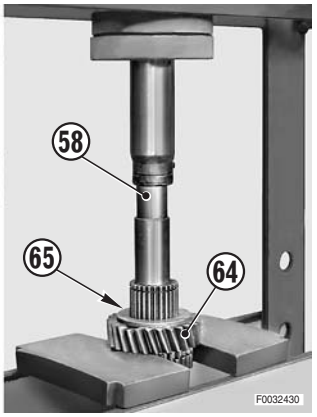




39 - Remove the gear (62) and needle bearings (63) from the shaft (58).

40 - Using a press, remove the gear (64) and the spacer (65) from the shaft (58).





ASSEMBLY OF PTO

- To assemble, follow the disassembly steps in reverse order.

※ 1

Lock nut: Loctite 270

Lock nut: 300 Nm (221 lb.ft.)

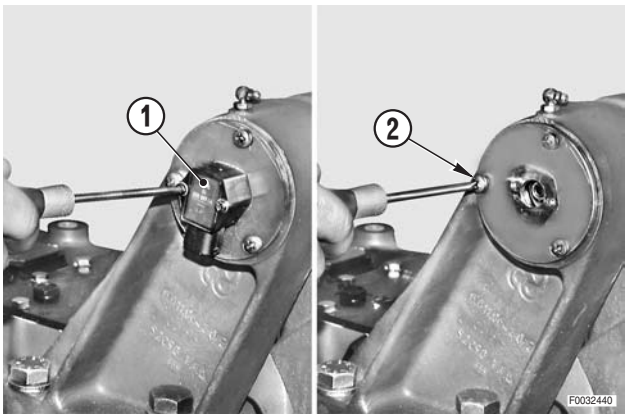
※ 2

Bolts: Loctite 242

REMOVAL OF REAR LIFT AND TOP LINK

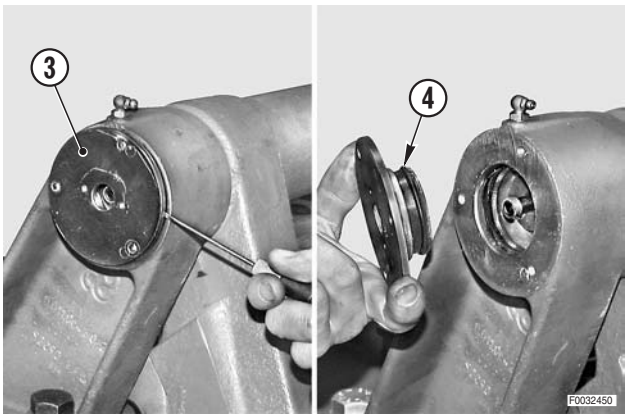
1 - Remove the position sensor (1).

2 - Loosen and remove the screws (2) retaining the alignment cover of the position sensor.



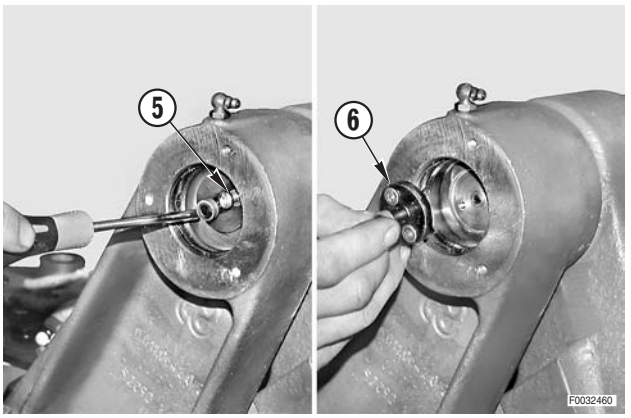
3 - Remove the cover (3).

★ Make a careful inspection of the O-ring (4).



4 - Undo the screws (5) and remove the drive bushing (6).

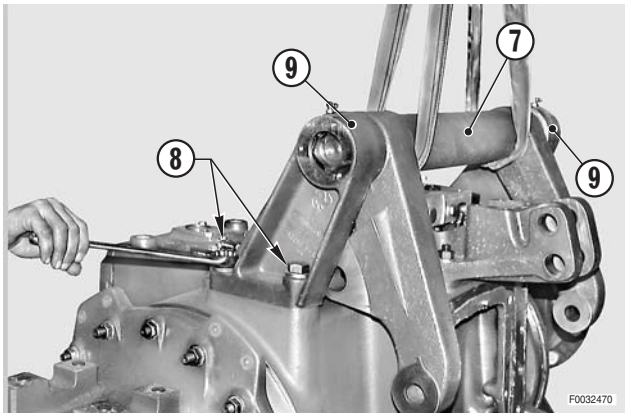
★ Note that the bushing has an eccentric bore determining its position when assembled.



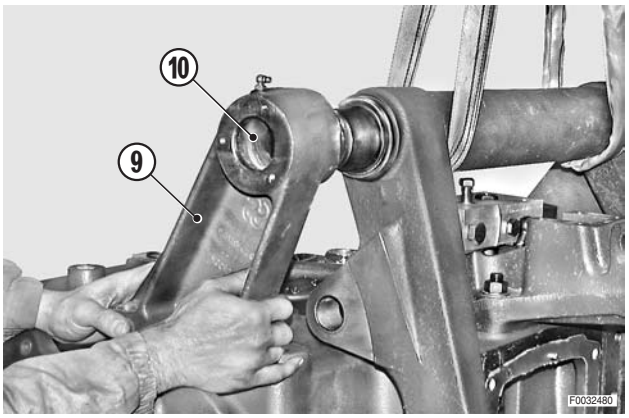
5 - Sling the cross-arm (7) of the hydraulic lift to a hoist, and tension the rope sufficiently to take the weight.

kg Cross-arm: 81 kg (178.5 lb.)

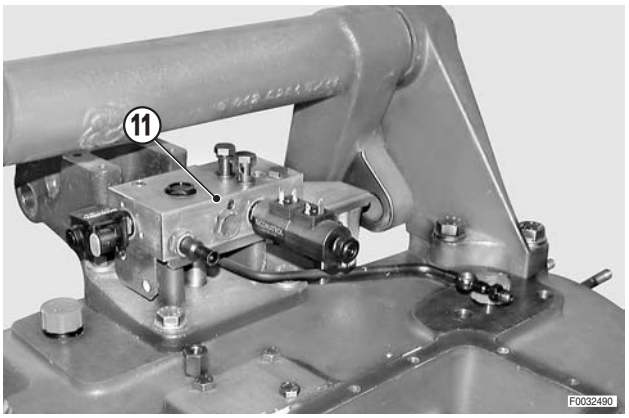
6 - Loosen and remove the bolts (8) and washers securing the bearing pedestals (9). ※1



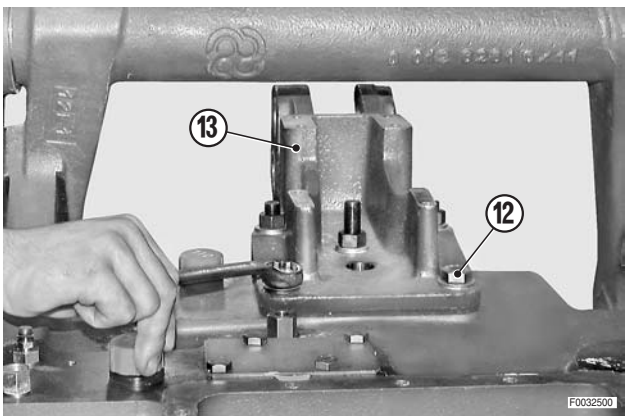
7 - Remove the bearing pedestals (9).
★ Make a careful inspection of the journal bearings (10), which should be replaced if the internal surface is scored or deformed.
★ Always replace both bearings. ※ 2



8 - Remove the differential lock and PTO clutch solenoid valve assembly (11).
(For details, see «REMOVAL OF PTO CLUTCH AND DIFFERENTIAL LOCK ASSEMBLY»).



9 - Loosen and remove the nuts(12) and bolts securing the top link bracket (13), and remove the bracket. ※ 3



REFITMENT OF REAR LIFT

- To refit, repeat the above steps in reverse order.

※ 1

Nm Pedestal bolts: 300 Nm (221 lb.ft.)

※ 2

★ Following installation, lubricate the pivots.

Pivots: Lithium grease

※ 3

Nm Nuts and bolts: 250 Nm (184 lb.ft.)

OVERHAUL OF BRAKE ASSEMBLIES

1. Preparation of machine for disassembly operations

⚠ Complete the overhaul on one side of the machine before starting on the other.

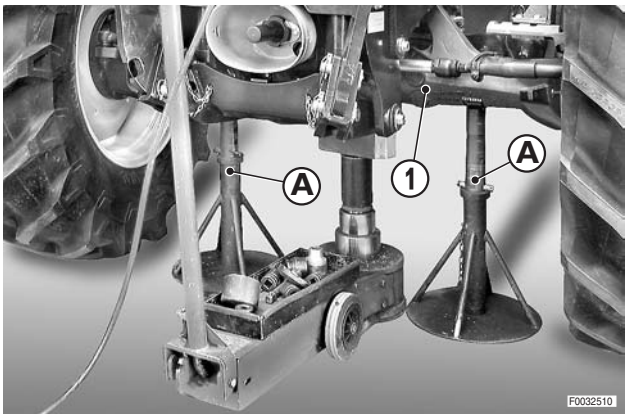
1 - **Machines with front suspension only:** lower the suspension completely and stop the engine.

2 - Drain the oil from the transmission.

Gear oil: 30 ℓ (7.9 US.gal)

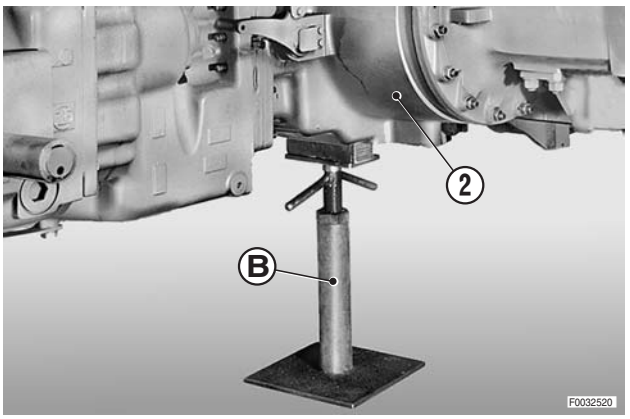
⚠ Vent pressure from the air trailer braking system reservoir.

3 - Locate two axle stands "**A**" tightly under the front axle (1).



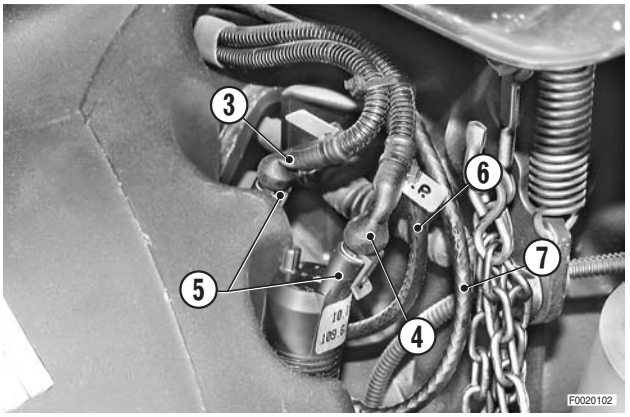
4 - Position a jack under the towing hitch and elevate the machine until the rear wheels clear the ground, then place an axle stand "**B**" with a non-slip block under the centre of the rear axle (2).

5 - Remove the rear wheel on the side to be overhauled first.
(For details, see «REMOVAL OF REAR WHEELS»)

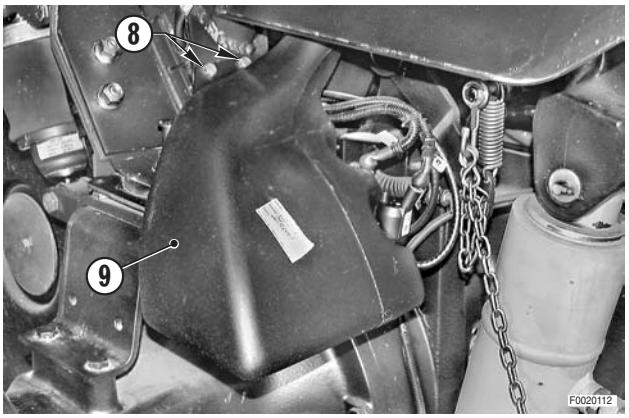


6 - **Left-hand side only:** empty the screenwash bottle.
★ Mark the connectors (3) and (4) and detach them from the pumps (5).

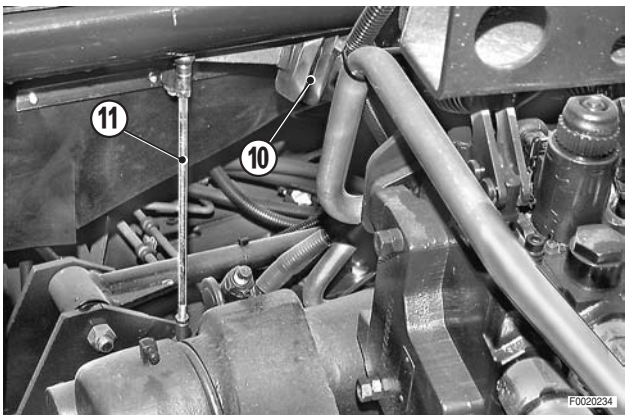
7 - Disconnect the screenwash hoses (6) and (7) from the pumps (5).
★ Mark the hoses to avoid error when reconnecting.



8 - Undo the bolts (8) and remove the screenwash bottle (9).



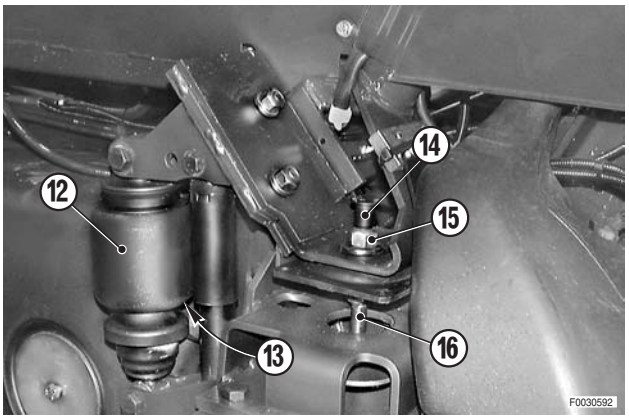
9 - **Cab with pneumatic suspension only:**
detach the cab lift rod (10) from the control valve (11).



10 - **Cab suspension only.**
Disconnect the compressed air pipeline (2) from the L.H. cab suspension cylinder (12).

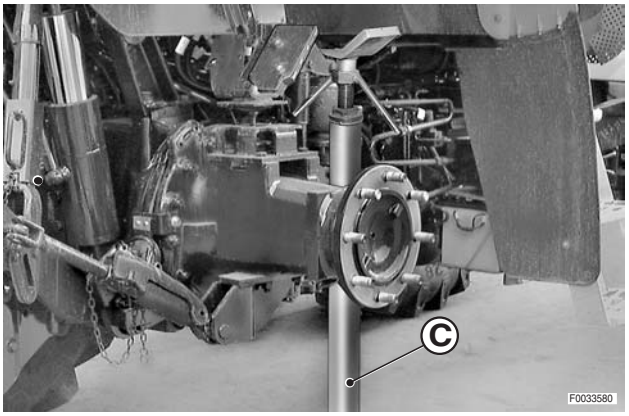
1

11 - Remove the protective rubber terminal (14) and the nut (15) from the central rod (16).

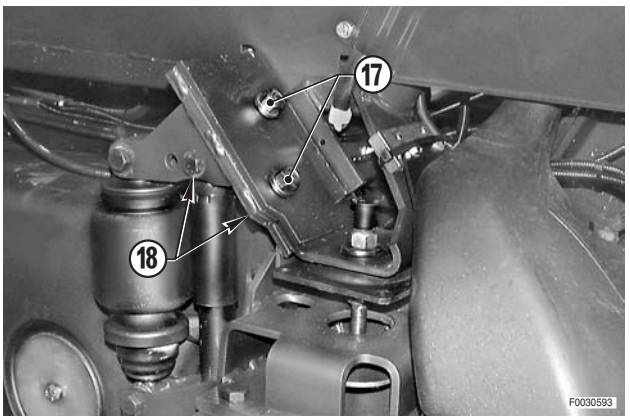


12 - Position a height-adjustable stand "**C**" tight under the longitudinal member of the cab (near the variable piston pump).

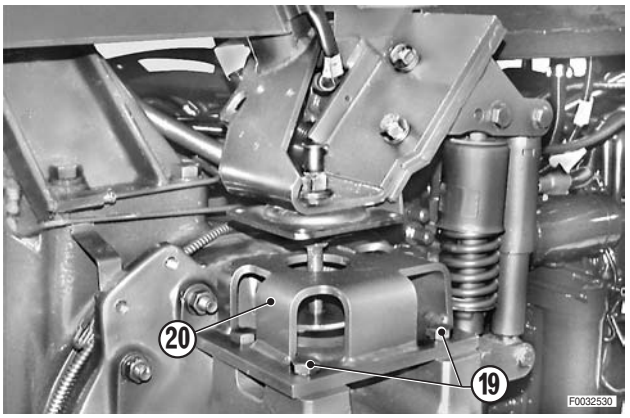
★ On the left hand side, wedge non-slip blocks between tank and cab.



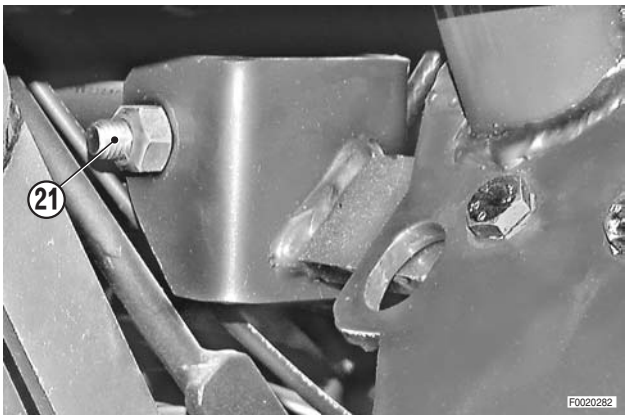
13 - Loosen and remove the nuts (17) and bolts (18) anchoring the cab.



14 - Remove the four bolts (19) and detach the mounting (20) complete with damper and piston.



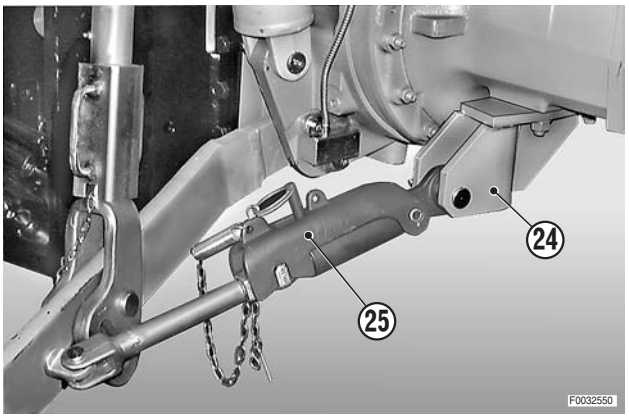
15 - **Removal of L.H. mounting only:** disconnect the cab stabilizer bar (21).



16 - Disconnect the brackets (22) and pipelines (23) of the brake system.

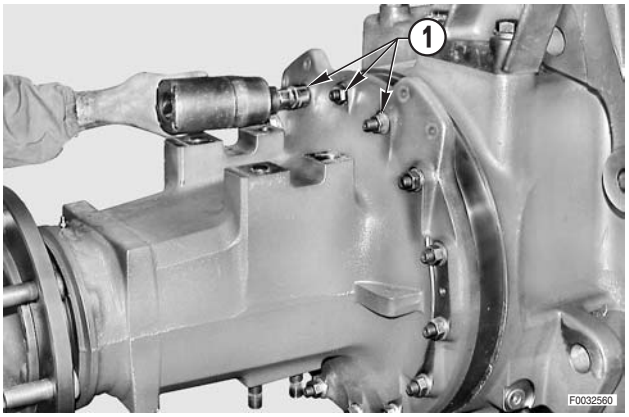
★ Plug ports and protect the ends of pipelines to prevent impurities getting into the circuit.

17 - Remove the bracket (24) of the lift link stabilizer and set to one side.



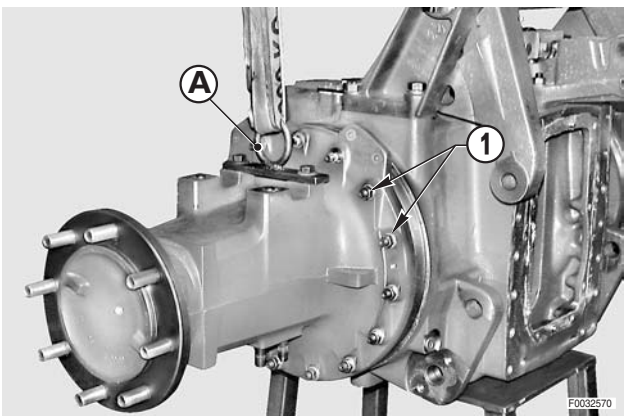
2. Removal of trumpet housings

1 - Loosen and remove the three topmost nuts (1) and washers.

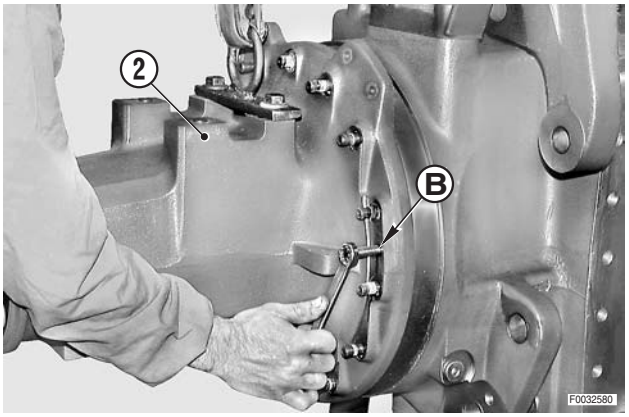


2 - Bolt a lifting bracket "**A**" to the flats on the housing.

3 - Sling the bracket to a hoist and tension the rope sufficiently to take the weight of the housing; loosen and remove the remaining nuts (1) and washers.

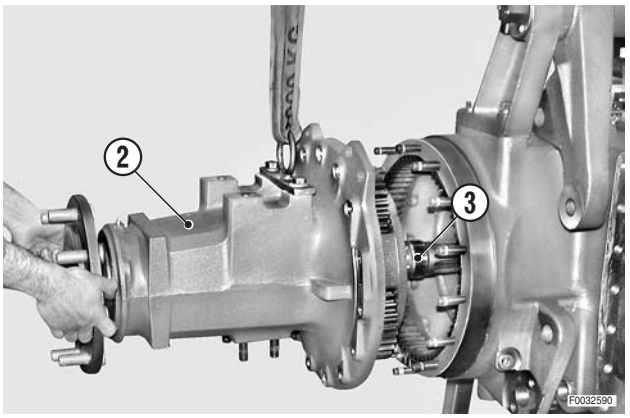


4 - Insert two bolts "**B**" into the jacking holes and drive alternately until the entire housing (2) has been dislodged. ⁂ 1



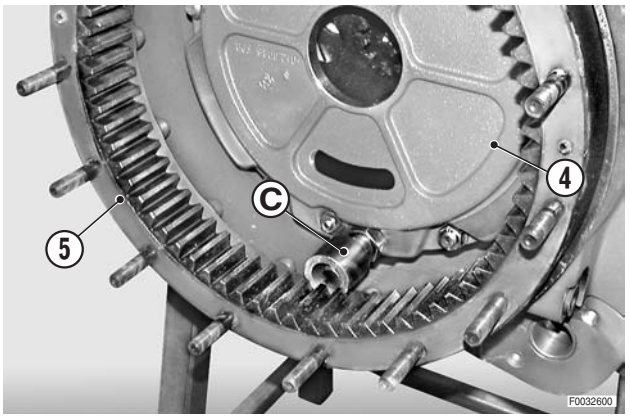
5 - Remove the trumpet housing (2).
★ Support the half-shaft, which might otherwise slide out and fall.

6 - Take out the half-shaft (3).

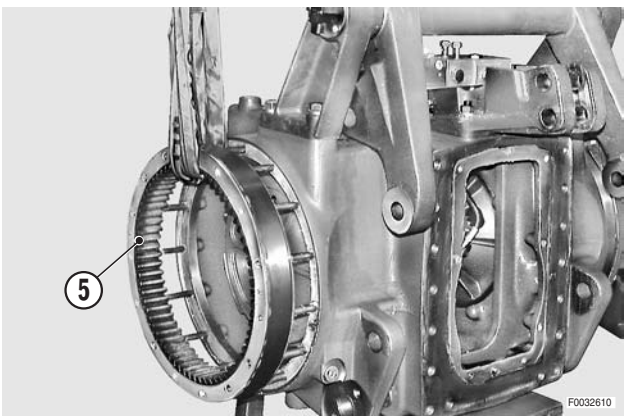


7 - Prepare a jacking spacer "**C**" with a bolt screwed fully into one end.
Locate the spacer between the teeth of the ring gear and the brake cylinder (4).

8 - Unscrew the bolt to shift the spacer "**C**" and dislodge the ring gear (5). ※ 1

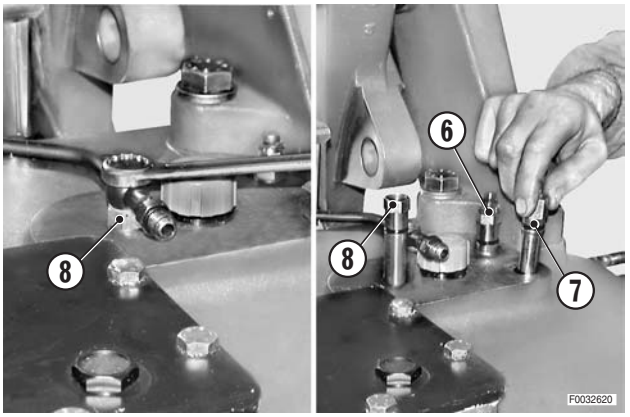


9 - Sling the ring gear (5) to a hoist and remove.
★ Use a lever to assist removal.

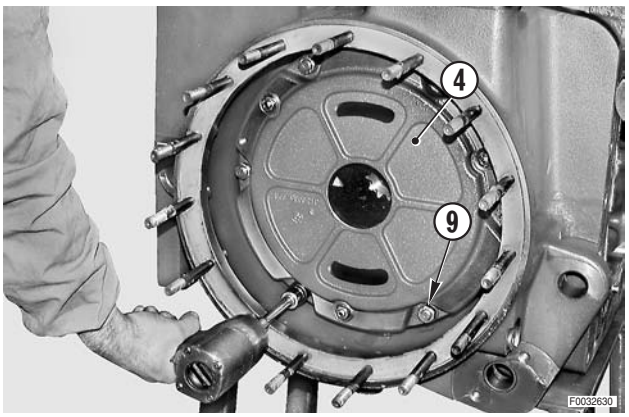


3. Removal of brake assembly

10 - Loosen and detach the brake bleed fitting (6), the differential lock fitting (7) and the brake line fitting (8).
★ Renew the O-rings every time the fittings are removed.

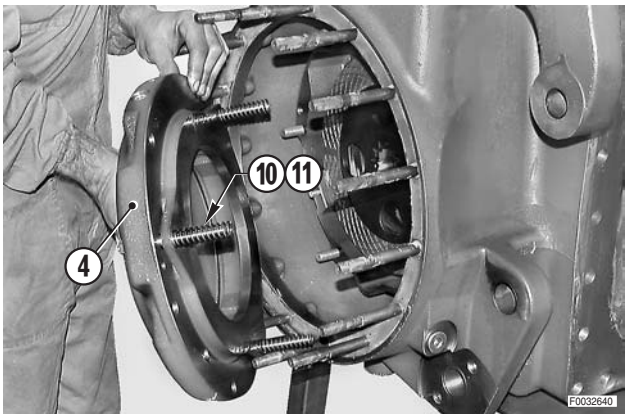


11 - Loosen and remove the nuts (9) and washers retaining the slave cylinder (4).



12 - Draw out the cylinder (4), complete with guide rods (10) and springs (11).

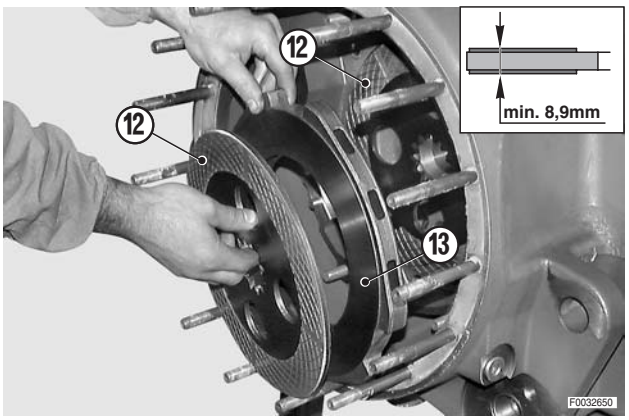
13 - Remove the springs (11).



14 - Remove the first friction disc (12), the intermediate disc (13) and the second friction disc (12).

★ Check carefully that the thickness of the friction discs is still greater than the minimum permissible. If the thickness is almost down to the permissible minimum, the discs must be replaced.

★ Minimum thickness of discs: 8.9 mm (0.35 in.)



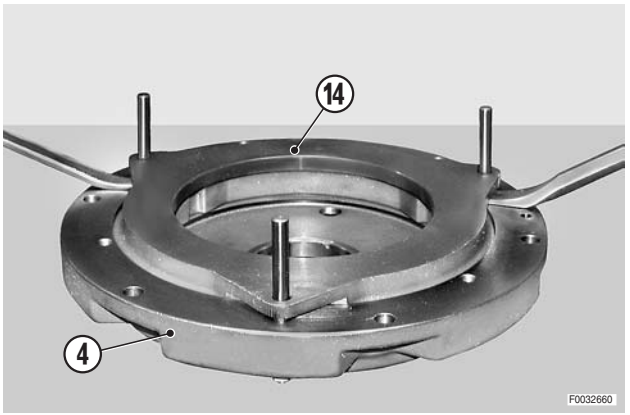
4. Adjustment of brake clearances and assembly

⚠ 1 - The brake discs cannot be adjusted without removing the entire brake assembly from the rear axle housing.

2 - It is good policy, before proceeding with other servicing operations (worn or scorched discs, loss of pressure, etc.), to replace the slave cylinder O-rings.
In particular, the O-rings need to be renewed if the brake fluid reservoir has been emptying repeatedly, or if the brake pedals offer no resistance when operated but can be depressed to full travel, without any leakage occurring along the brake pipelines.

3 - Having decided whether or not the discs need replacing, the steps involved in renewing the O-rings and taking up clearances are as described below.

1 - Using a pair of levers, separate the piston (14) from the cylinder (4).

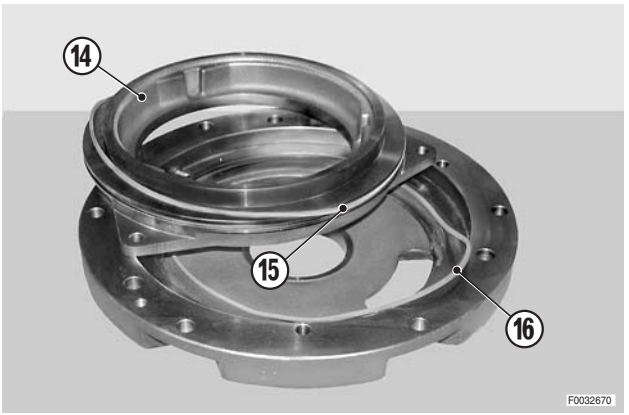


2 - Remove the O-rings (15) and (16) from the piston (14) and the cylinder, respectively.

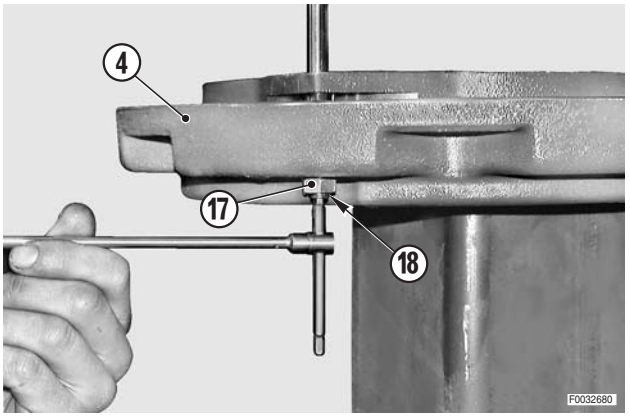
3 - Replace the seals and lubricate them.

★ Stretch the cylinder O-ring out uniformly to facilitate correct positioning.

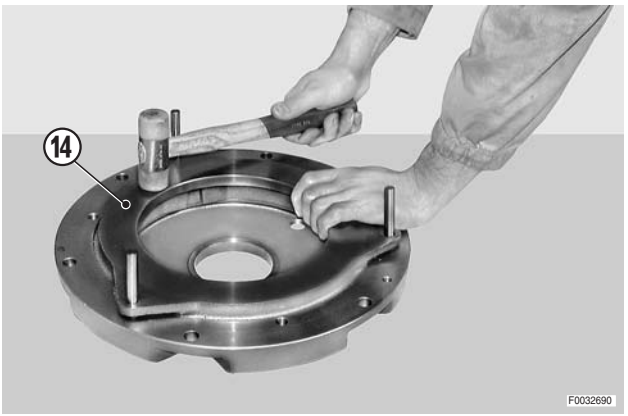
O-rings: brake fluid



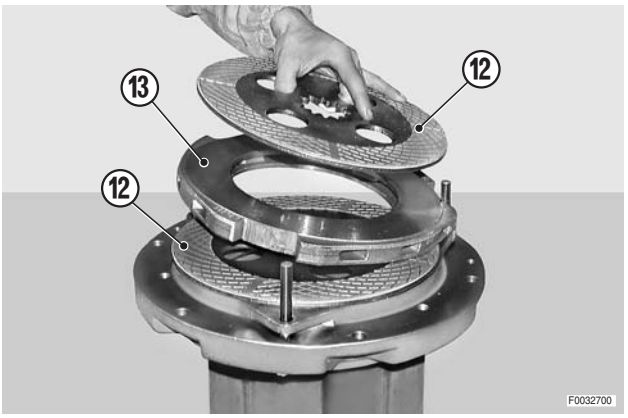
4 - Position the cylinder on a block; loosen the nuts (17) and back off the set screws (18) until inside the cylinder.



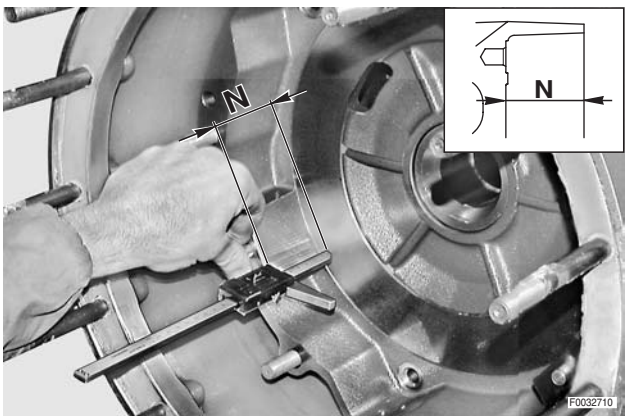
5 - Reassemble the piston (14) and seat at full travel, with the aid of a plastic-headed hammer.
★ Tap lightly around the entire circumference.



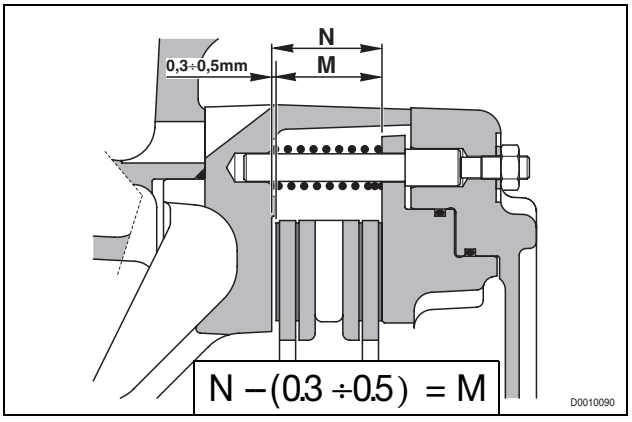
6 - Add the first friction disc (12), the intermediate disc (13) and the second friction disc (12) to the piston.



7 - Using a precision depth gauge, measure the distance "**N**" between the locating surface offered by the cylinder and the operating surface of the friction disc.

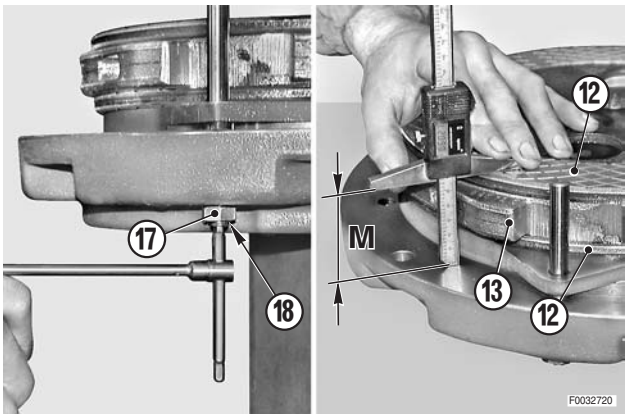


8 - Establish the permissible clearance needed to obtain measurement "**M**", which is the thickness of the friction discs plus the intermediate disc, and subtract from measurement "**N**".
★ Permissible clearance: 0.3–0.5 mm



10 - Turn the set screws (18) until measurement "**M**" is obtained at the points where the screws are located.

11 - Lock the set screws with the nuts (17), being careful to maintain the angular position.



5. Refitment of trumpet housings

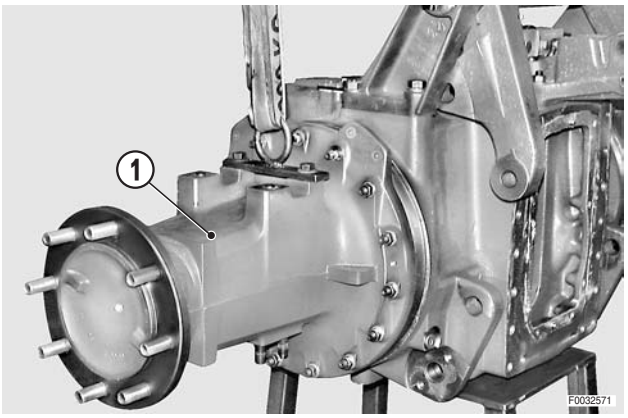
- To refit, repeat the above steps in reverse order, having thoroughly cleaned and degreased the mating surfaces.

※ 1

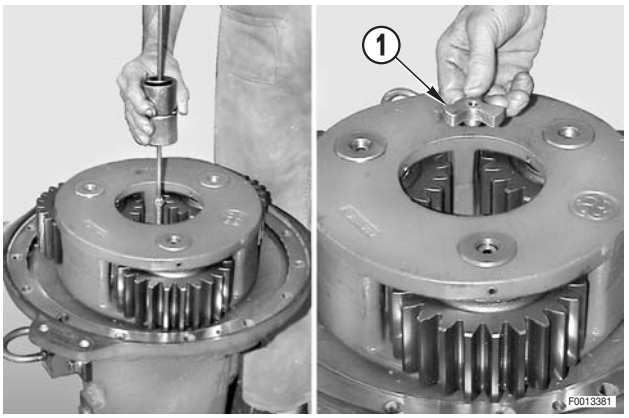
Mating surfaces: Loctite 510

DISASSEMBLY OF TRUMPET HOUSING

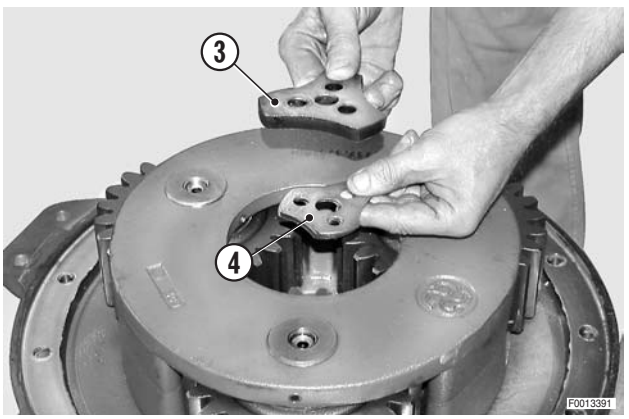
1 - Remove the trumpet housing (1).
(For details, see «OVERHAUL OF BRAKE ASSEMBLIES»).



2 - Using a slide hammer puller, remove the thrust plate (1) of the halfshaft.

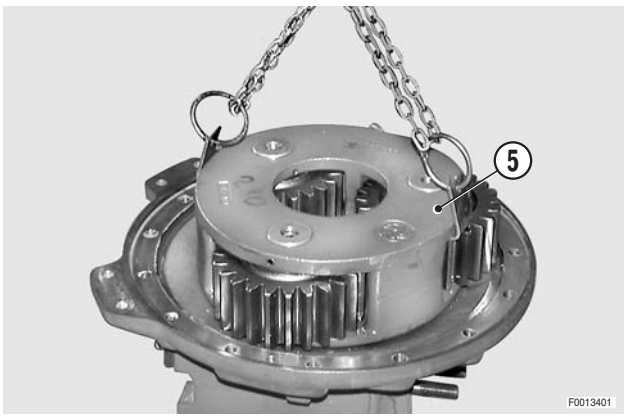


3 - Unscrew the bolts and remove the flange (3) and the spacers (4).



4 - Attach the planet carrier assembly (5) to a hoist and lift it clear.

kg Planet carrier: approx. 75 kg (165 lb).

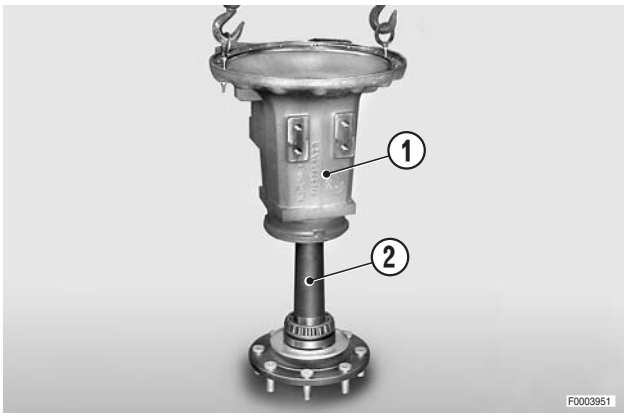


5 - Remove the outer race of bearing (6).

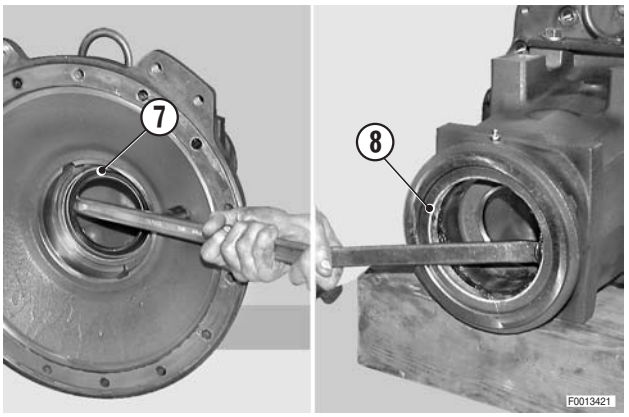
★ If necessary, use a puller with the legs inserted in the slots provided.

6 - Attach a hoist to the axle casing and lift the casing (1) clear of the hub (2); rest the axle casing on a work bench.

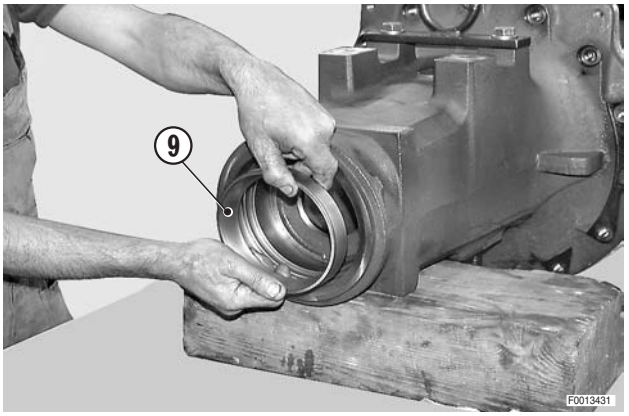
kg Axle casing: approx. 112 kg (247 lb).



7 - Using a lever, remove the oil seal (7) and the dust seal (8) on the wheel side of the casing.

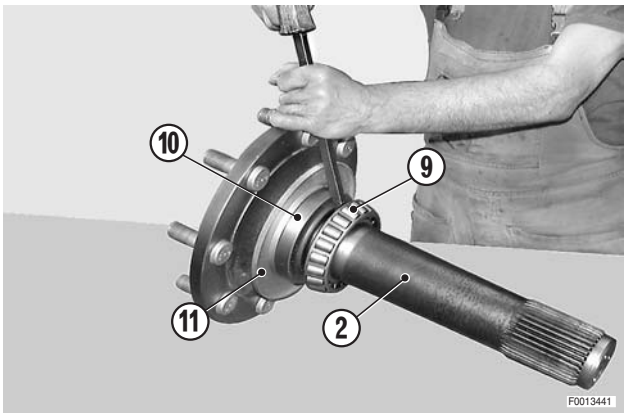


8 - Remove the outer race of the bearing (9).

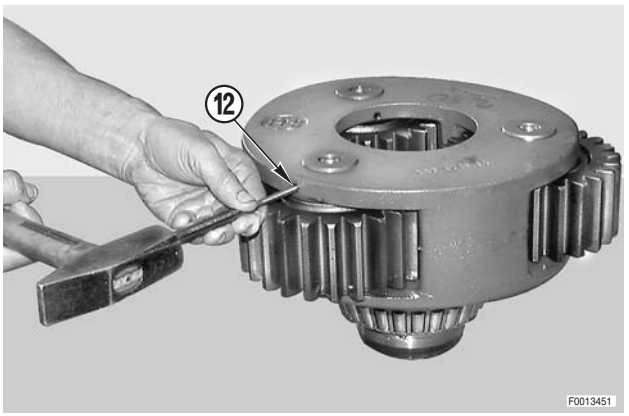


9 - Using a punch and a mallet, remove the inner race of bearing (9) from the hub (2).

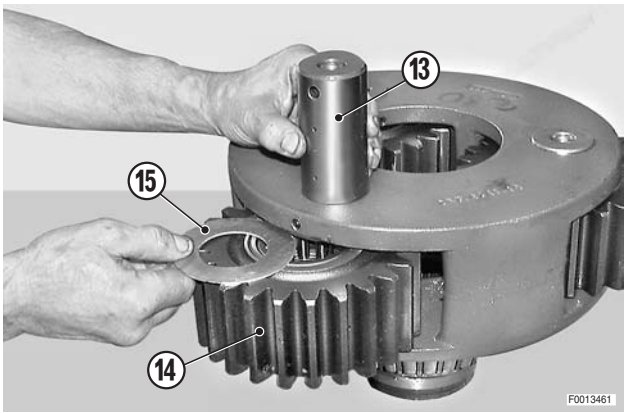
10 - **Only if necessary.** Remove the spacer (10) and the cover (11) from the hub (2).



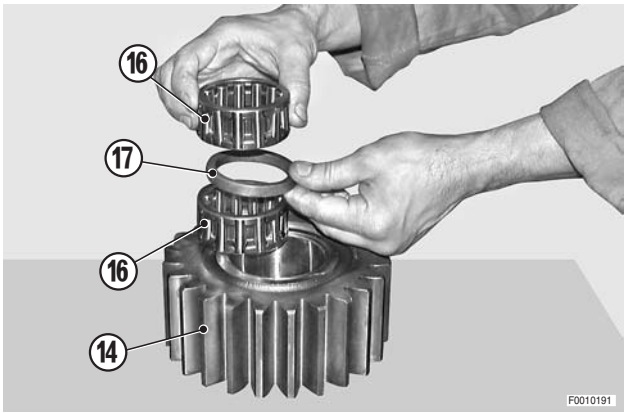
11 - Using a pin punch, drive out the spring pins (12).



12 - Remove the planet pins (13), the planet pinions (14) and the shims (15).

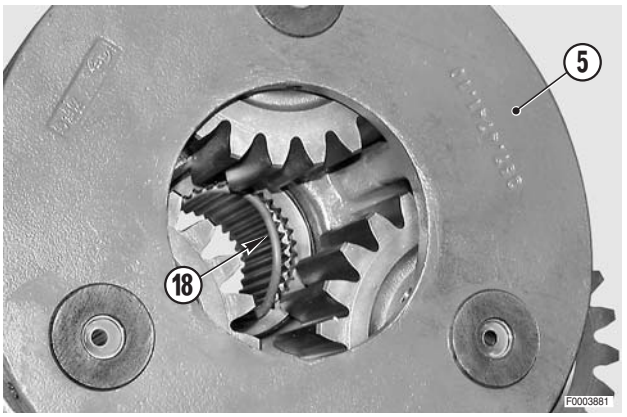


13 - Remove the roller cages (16) and the spacers (17) from the planet pinions (14).



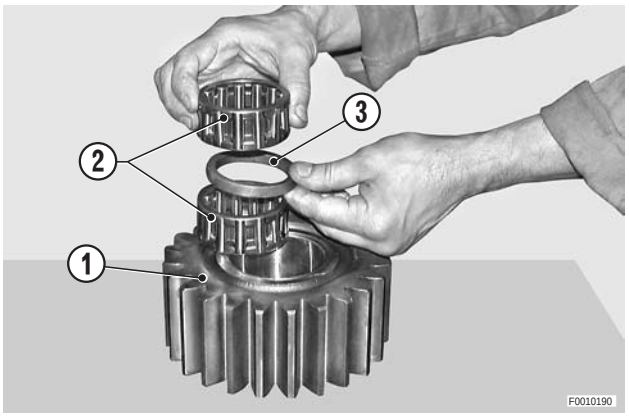
14 - Remove the O-ring (18) from the planet carrier (5).

15 - Using a puller in the slots provided, remove the inner race of bearing.



ASSEMBLY OF TRUMPET HOUSING

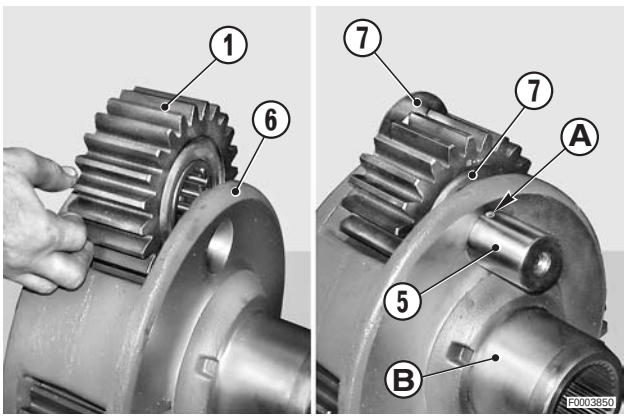
1 - Fit the roller cages (2), spacers (3) and second roller cages (2) in the planet pinions (1).



2 - Fit the planet pinion assemblies (1) in the planet carrier (6).

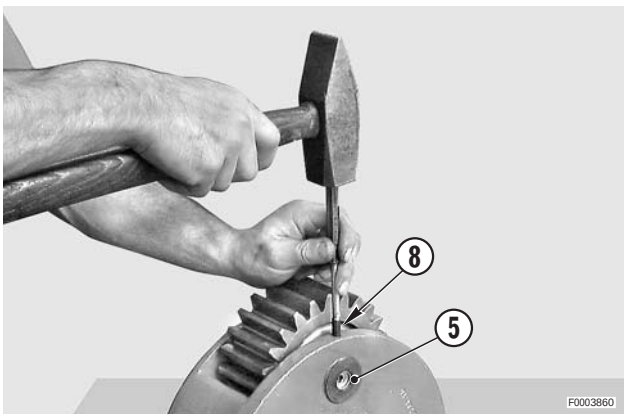
3 - Insert the shims (7) on each side and insert the planet pin (5).

★ The hole "**A**" must be facing the opposite side to the planet carrier hub "**B**".

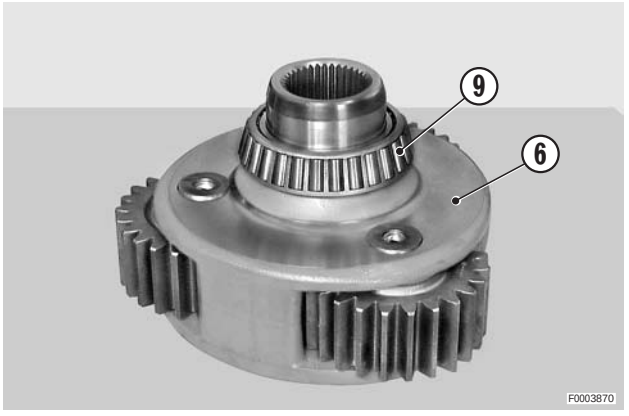


4 - Secure the pins (5) by inserting the spring pins (8).

★ Drive the pins flush with the edge of the planet carrier.

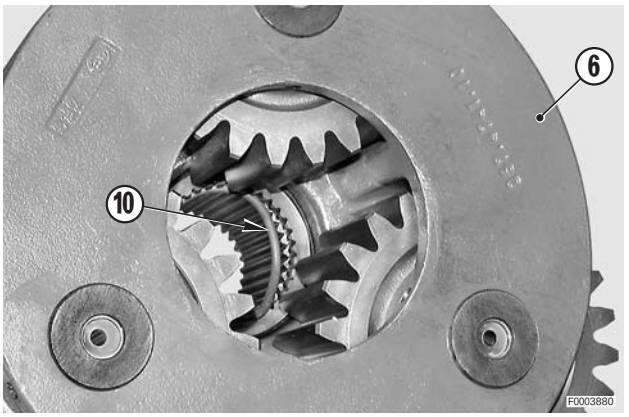


5 - Heat the inner race of bearing (9) to about 100 °C (212 °F) and fit it to the planet carrier (6).



6 - Fit the O-ring (10) in the planet carrier (6).
★ Ensure that the O-ring is correctly seated in its slot and apply grease.

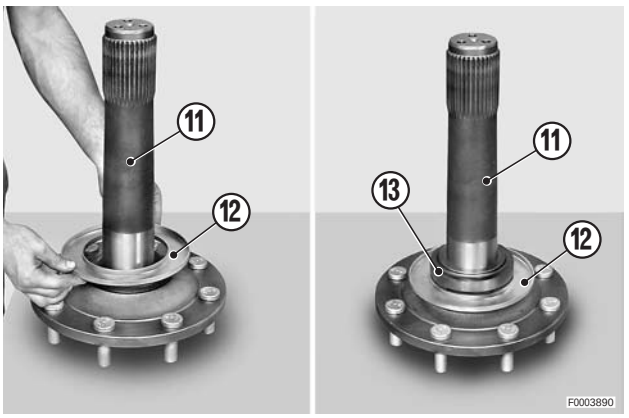
O-ring: Grease.



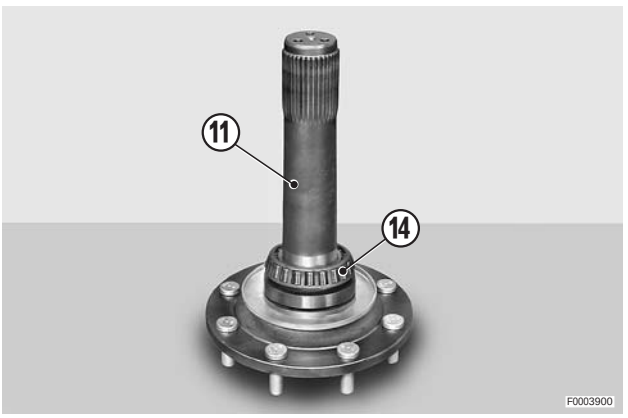
2. Preparation of the halfshafts

1 - Fit the cover (12) on the hub (11) and push it fully home.
★ Take care not to deform the cover.

2 - Heat the spacer (13) and fit it on the hub (11).
★ The threaded holes must be facing downwards.

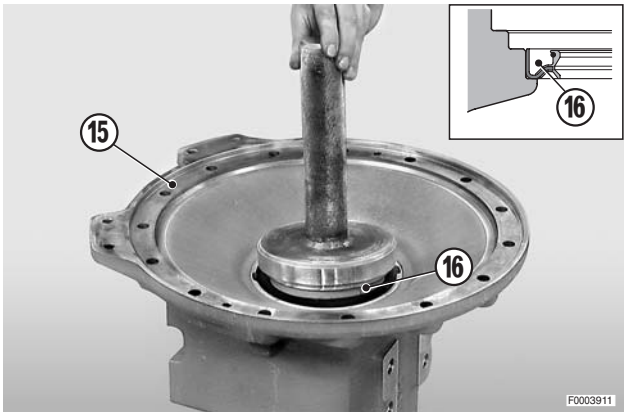


3 - Heat the inner race of bearing (14) to about 100 °C (212 °F) and fit it to the hub (11).

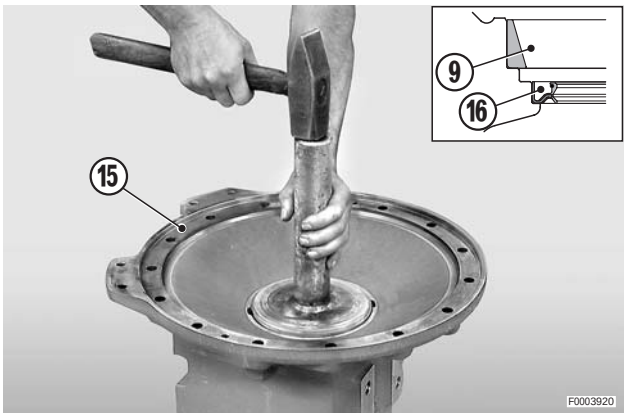


3. Assembly of the axle casing

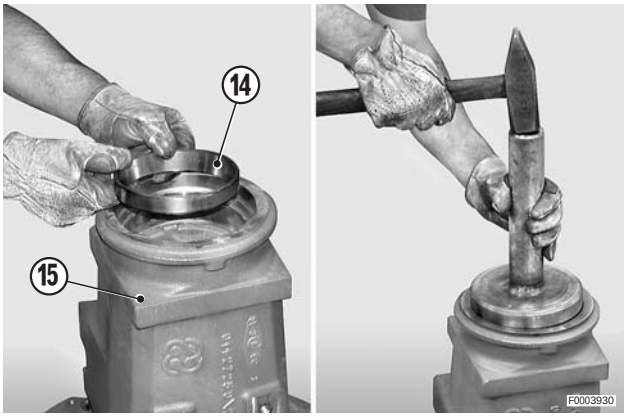
1 - Using a suitable drift, fit the oil seal (16) in the axle casing (15).
★ Check that the seal is installed the right way round.



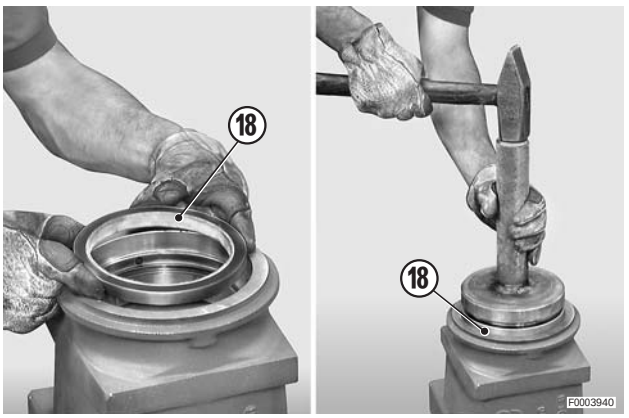
2 - Using a suitable drift, fit the outer race of bearing (9) in the axle casing (15).
★ Check that the race is installed the right way round.



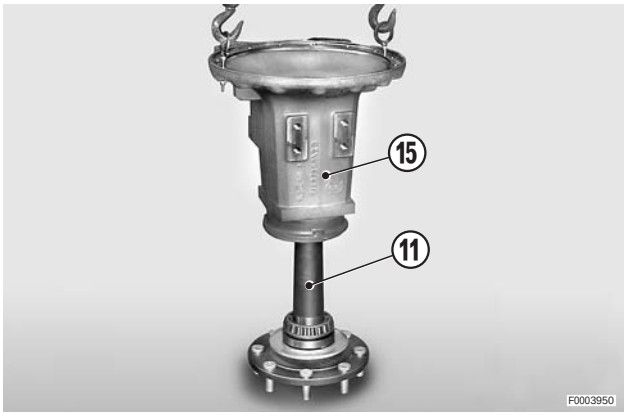
3 - Turn the axle casing (15) over and, using a suitable drift, fit the outer race of bearing (14).
★ Check that the race is installed the right way round.



4 - Using a suitable drift, fit the felt seal (18) in the axle casing (15).

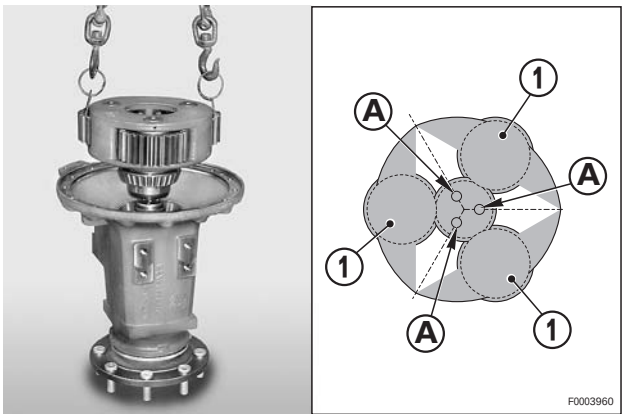


5 - Attach a hoist to the axle casing (15) and lower it slowly onto the hub (11).
★ During assembly, check that the seals and bearings are correctly aligned with the hub shaft.



6 - Attach a hoist to the planet carrier (6) and lower it onto the hub (11).

★ Take great care that the planet pinions (11) are correctly oriented relative to the holes in the halfshaft.



7 - Fit the triangular flange (19) and bolts (20).

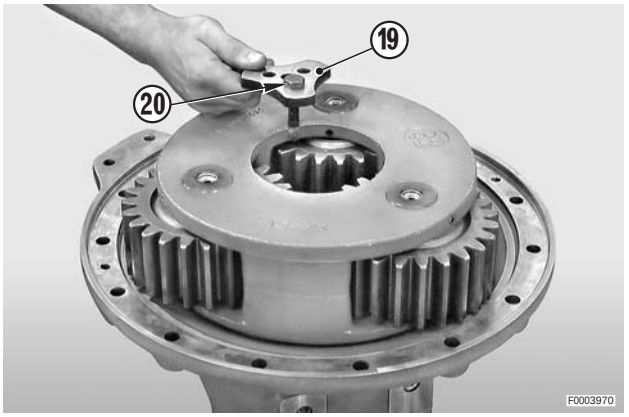
Bolts: Loctite 242

★ New bolts are supplied already treated.

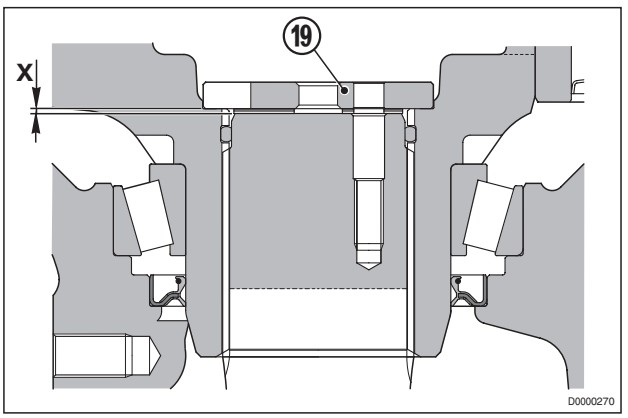
Nm Bolts: 29.4 Nm (21.7 lb.ft.)

8 - Rotate the casing through at least ten turns in order to seat the bearings.

9 - Re-check the tightening torque and then rotate the casing a further ten times.



10 - Remove the flange (19) and, with a depth gauge, measure the distance "**X**" between the end face of the halfshaft and the flange contact surface on the planet carrier.

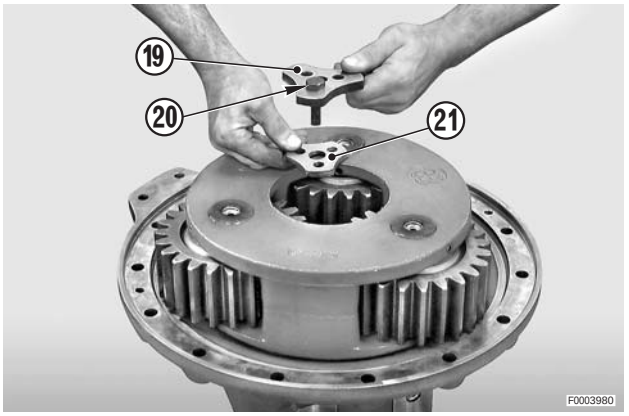


11 - Form a shim pack (21) of thickness "**X**" ±0.02 mm (0.0008 in.)

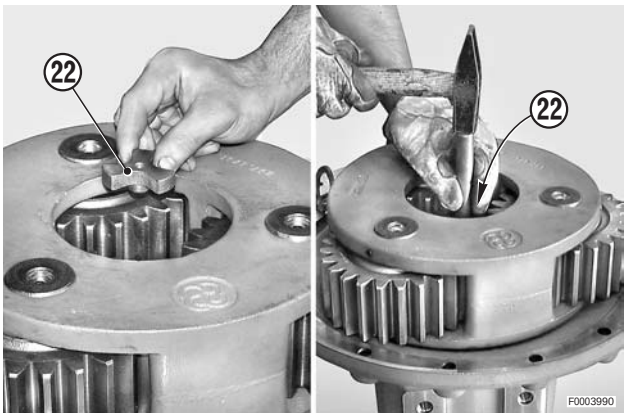
12 - Position the shims (21) under the flange (19). Tighten down with bolts (20).

Nm Bolts: 112±6 Nm (82.5±4.4 lb.ft.)

Bolts: Loctite 270

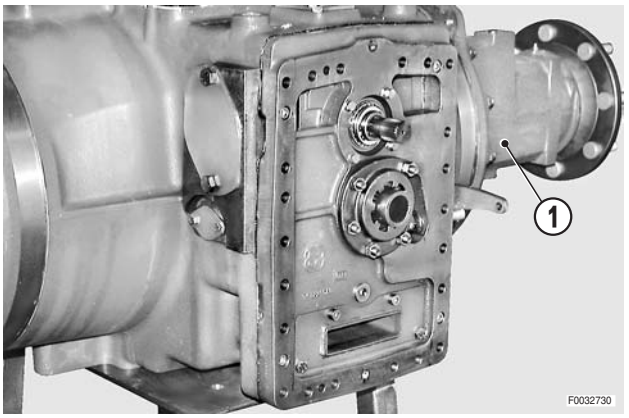


13 - Position the halfshaft thrust plate (22) to retain bolts (20) and, using a suitable drift, drive it up against the flange (19).
★ Take care not to damage the threads of the extractor hole.

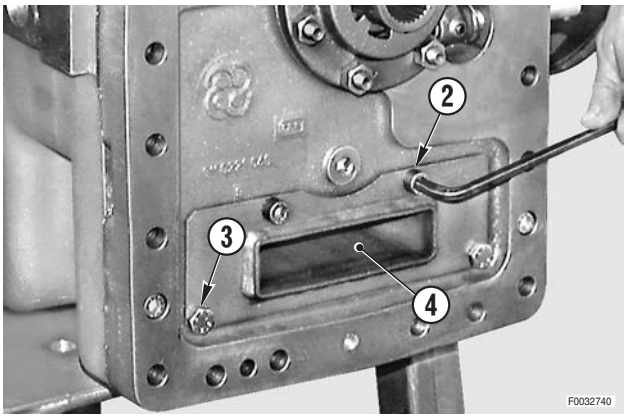


REMOVAL OF PUMP DRIVE SPACER FLANGE

1 - Remove the rear axle (1).
(For details, see «SPLITTING THE TRANSMISSION AND REAR AXLE»).

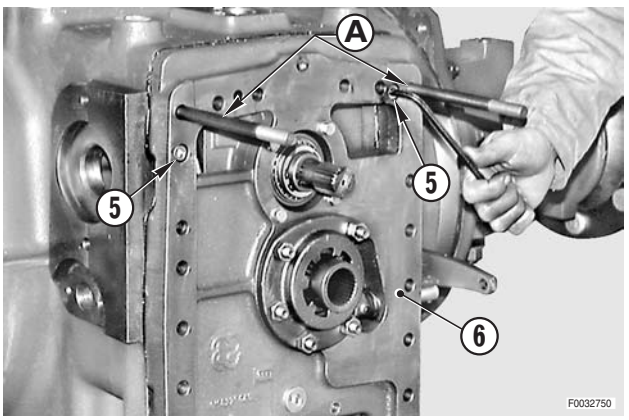


2 - Loosen and remove the bolts (2) and (3) remove the oil duct (4).



3 - Insert two safety studs "**A**" in the top holes.

4 - Loosen and remove the screws (5) securing the spacer flange (6).

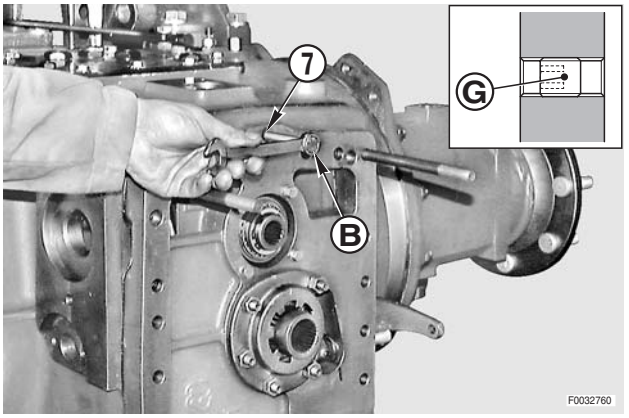


5 - Remove the grub screws "**G**" from the top and bottom jacking holes (7) and insert two bolts "**B**".

※ 1

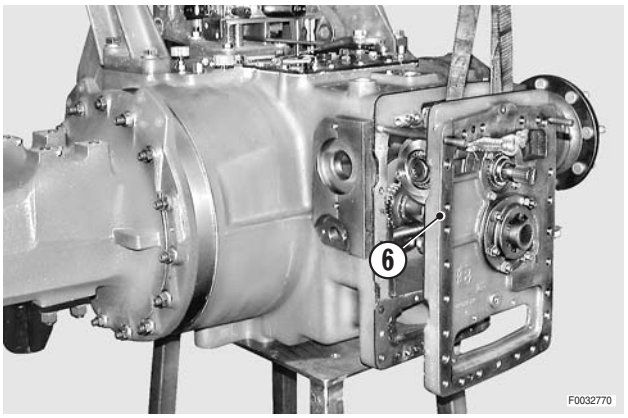
6 - Drive the bolts in alternation until the flange (6) is freed from the dowels.

※ 2



7 - Sling the spacer flange assembly (6) to a hoist and remove.

kg Spacer flange: 60 kg (132 lb.)



REFITMENT OF PUMP DRIVE SPACER FLANGE

- To refit, repeat the above steps in reverse order.

1

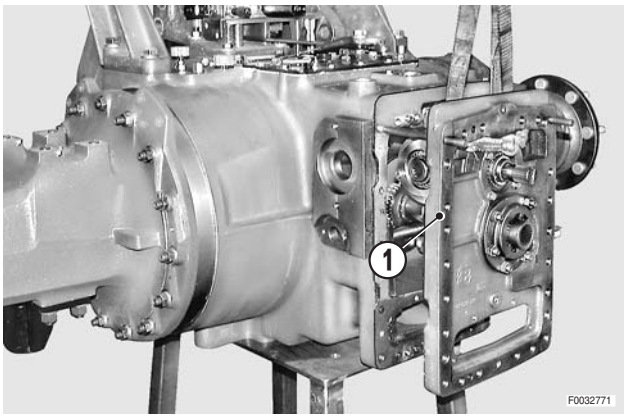
Grub screws: Loctite 242

2

Mating surfaces: Loctite 518

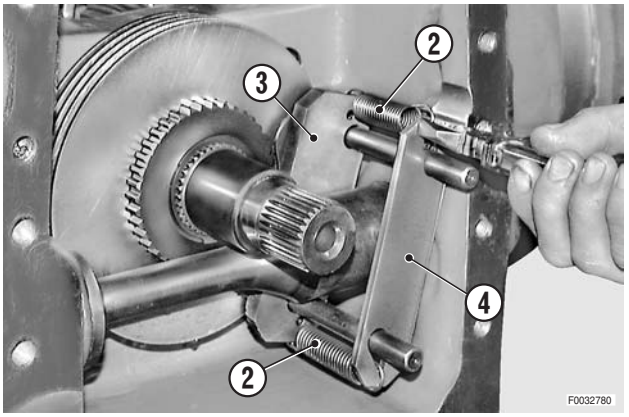
INSPECTION AND OVERHAUL OF PARKING BRAKE

1 - Remove the pump drive spacer flange (1).
(For details, see «REMOVAL OF PUMP DRIVE SPACER FLANGE»).

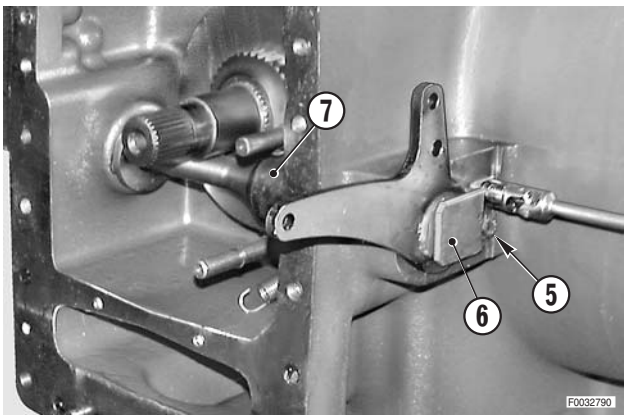


1. Disassembly

2 - Release the return springs (2) attached to the thrust plate (3), and remove the reaction plate (4).

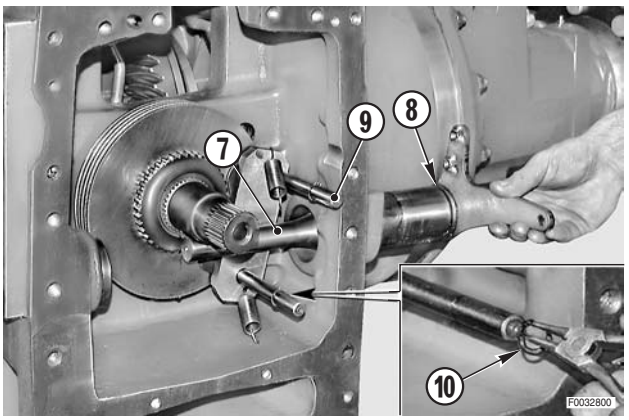


3 - Loosen and remove the bolts (5) and remove the plate (6) retaining the cam (7).

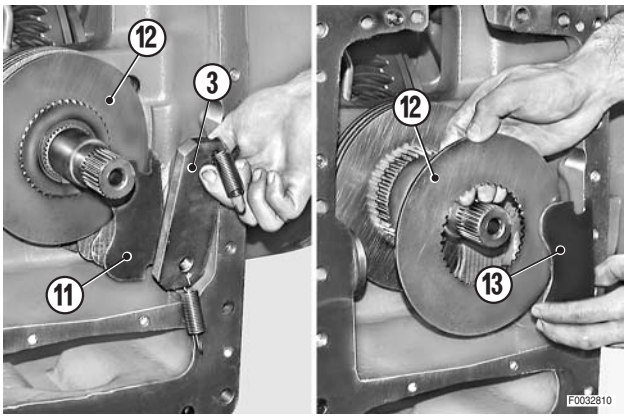


4 - Draw out the cam (7) complete with O-ring (8).
★ Replace the O-ring every time the cam is removed.

5 - Unseat the circlip (10) from the guide rods (9) and remove the rods.



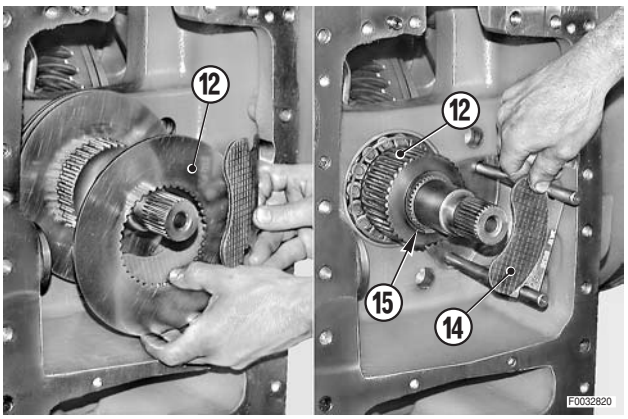
6 - Remove the following components in sequence:
- thrust plate (3);
- external pad (11);
- brake disc (12);
- intermediate pad (13);
- brake disc (12).



7 - Remove all parts down to the internal pad (14).

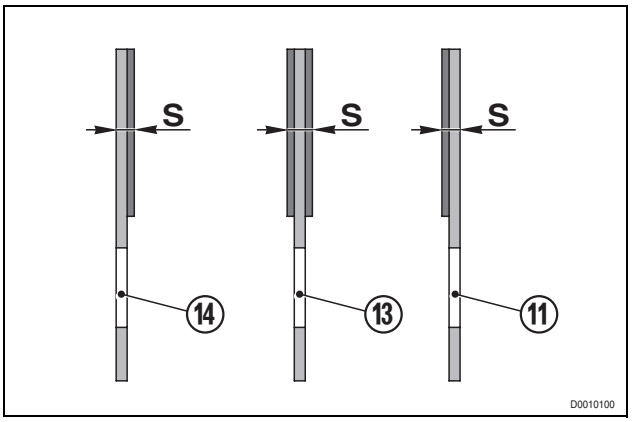
★ If the brake is reassembled without any parts being replaced, avoid switching the original positions of the intermediate discs and pads.

8 - **Only if necessary:** remove the circlip (15) and the drive hub (16).



9 - Check that the wear on the pads is within permissible limits.

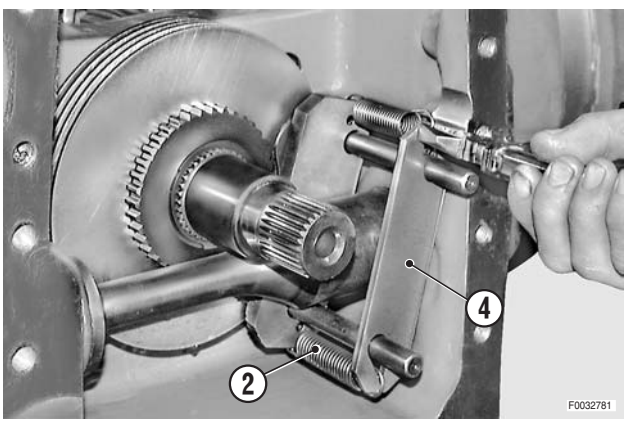
★ Minimum permissible thickness "**S**":
Outer pads (11) and (14): 2.9 mm (0.1143 in.)
Intermediate pads (13): 4.2 mm (0.1655 in.)



2. Assembly

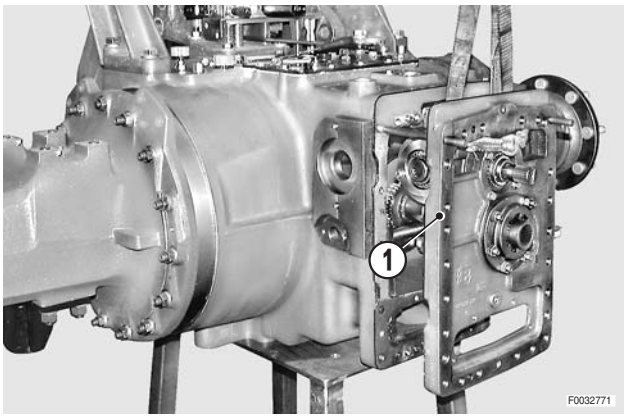
- To assemble, follow the disassembly steps in reverse order.

★ Before refitting the reaction plate (4), fit the circlips (10) to the guide rods.



OVERHAUL OF PUMP DRIVE UNIT

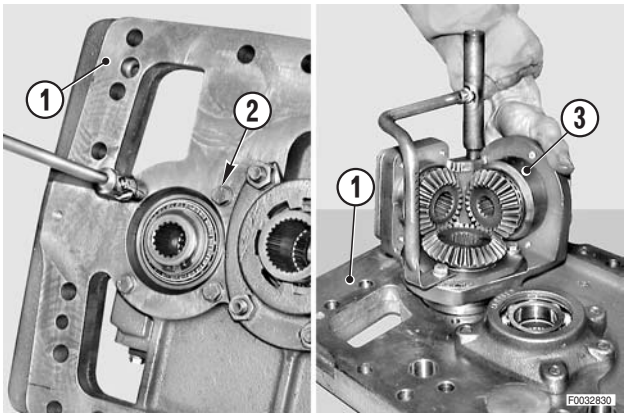
1 - Remove the pump drive spacer flange (1).
(For details, see «REMOVAL OF PUMP DRIVE SPACER FLANGE»).



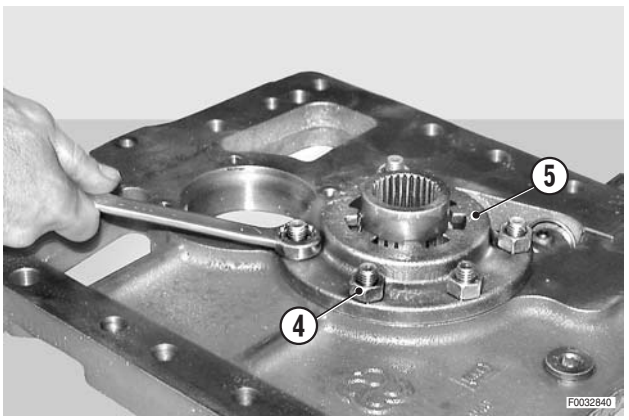
1. Disassembly of unit

2 - Loosen and remove the bolts (2) and washers retaining the unit (3).

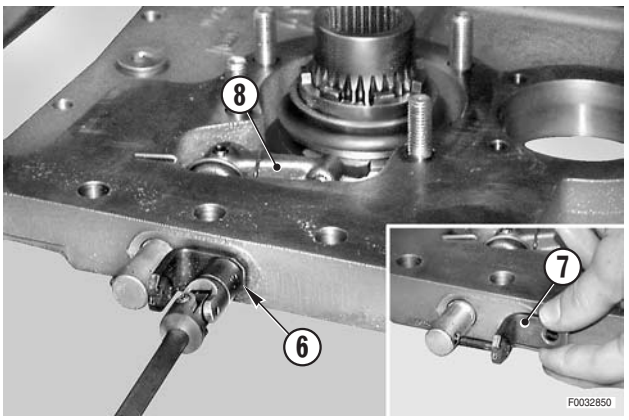
3 - Remove the unit (3) from the spacer flange (1).



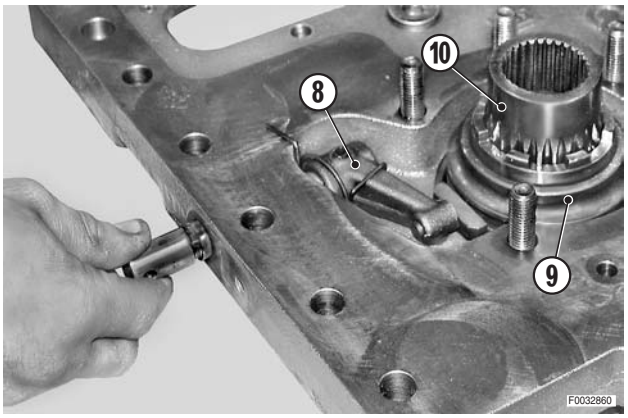
4 - Loosen and remove the nuts (4) and the cover (5).



5 - Loosen the screw (6) and remove the anchor pin (7) from the coupling lever (8).

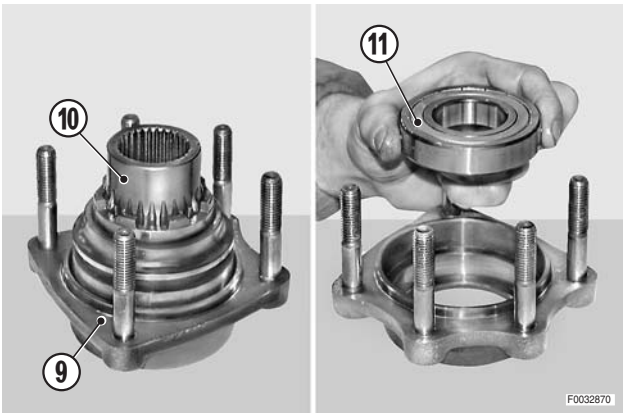


6 - Disengage the lever (8) and remove the entire ball coupler (10) from its housing (9).

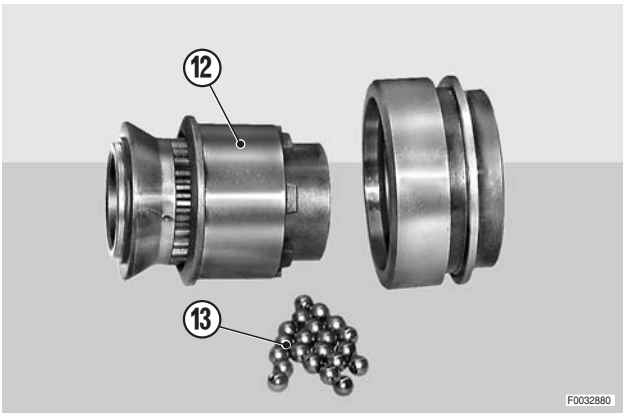


7 - Remove the ball coupler (10) and bearing (11) from the housing (9).

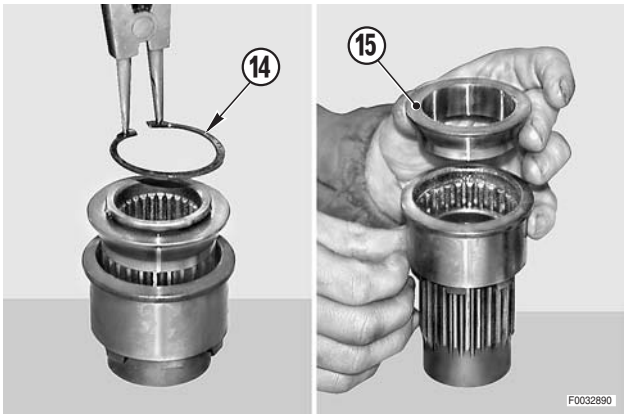
★ Make a note of which way round the bearing is fitted.



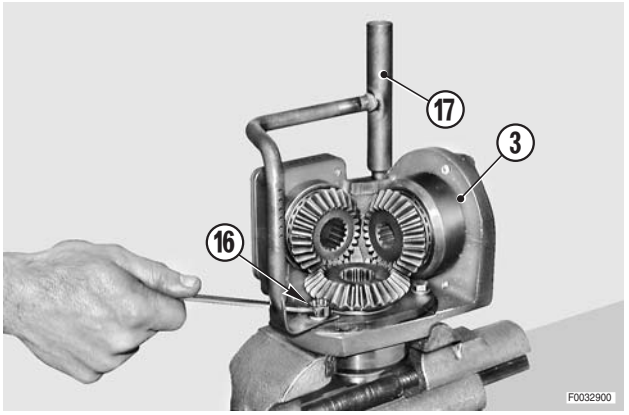
8 - Draw out the sleeve (12) and recover the 21 balls (13).



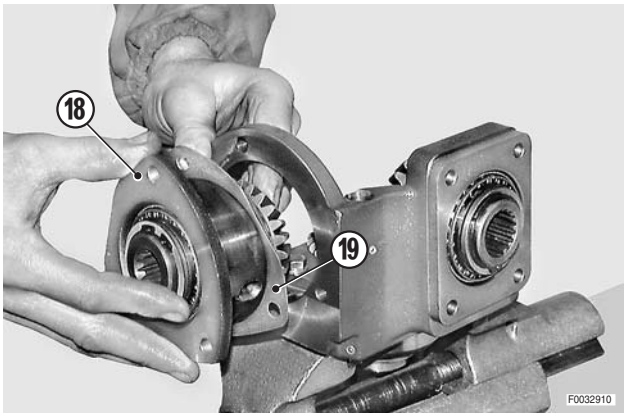
9 - Remove the circlip (14) and separate the reaction bushing (15).



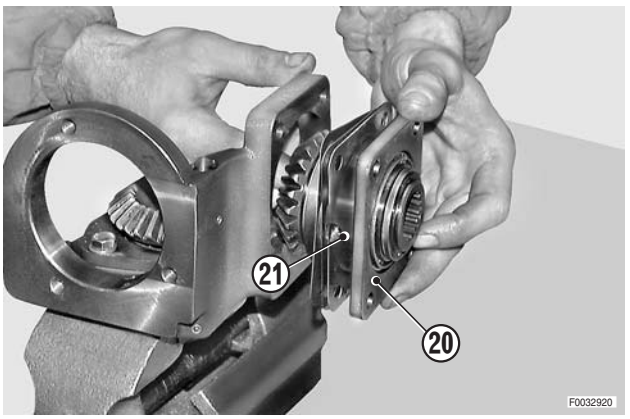
10 - Remove the bolt (16) and washer; separate the lube pipe (17) from the unit (3).



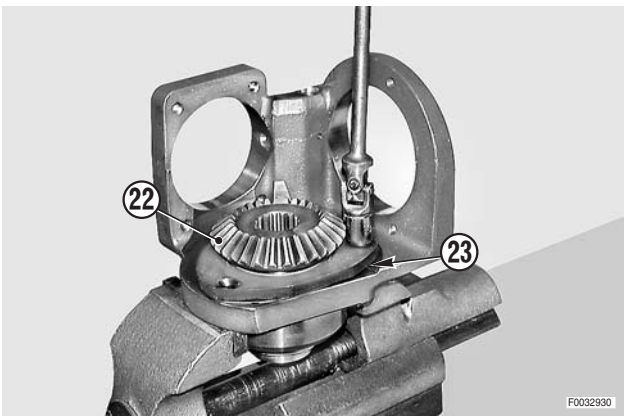
11 - Loosen and remove the bolts and washers and separate the piston pump drive (18), together with the backlash adjustment shims (19).



12 - Loosen and remove the bolts and washers and separate the gear pump drive (20), together with the backlash adjustment shims (21).



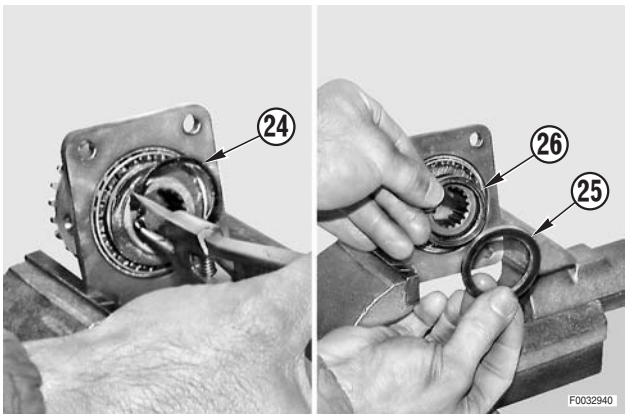
13 - Loosen and remove the bolts and washers and separate the pinion assembly (22), together with the backlash adjustment shims (23).



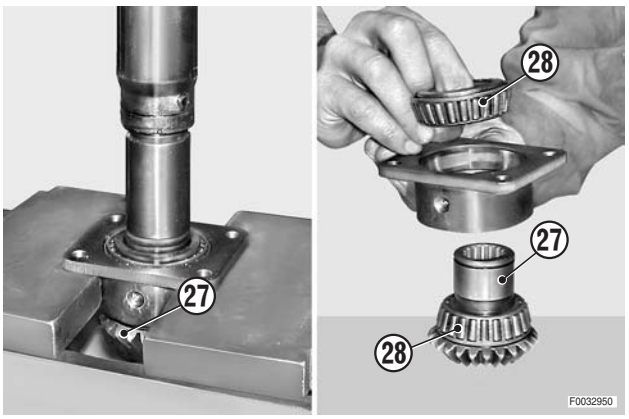
2. Replacement of taper roller bearings

NOTE -The following sequence of steps is to be carried out on the two pump drives, and on the pinion assembly.

1 - Unseat the circlip (24) and remove the spacer (25) and the shims (26).

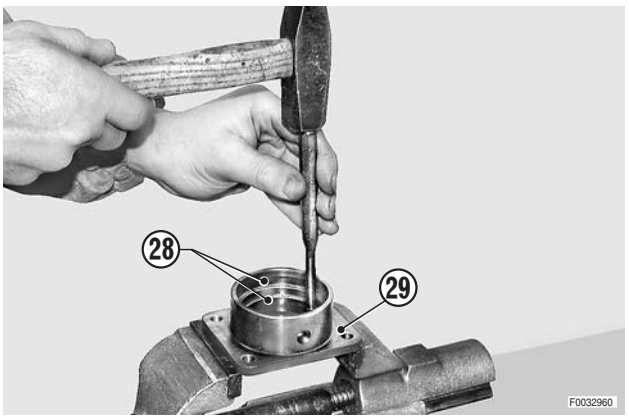


2 - Using a press and a suitable driver, remove the gear (27) with the inner ring of the taper roller bearing (28) attached.



3 - Drive the outer rings of the bearings (28) from the housing (29).

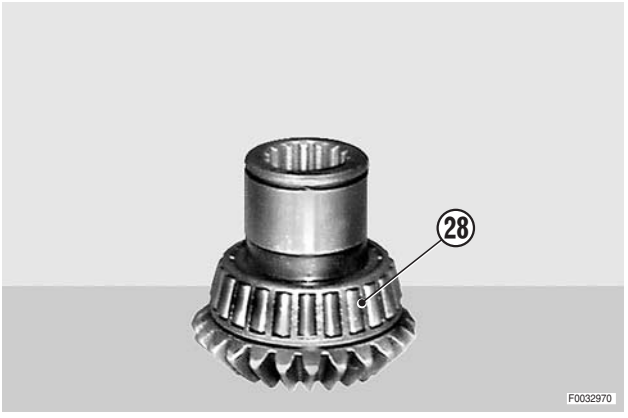
★ Tap lightly around the entire circumference until the rings are completely free.



4 - Remove the inner ring of the head bearing (28).

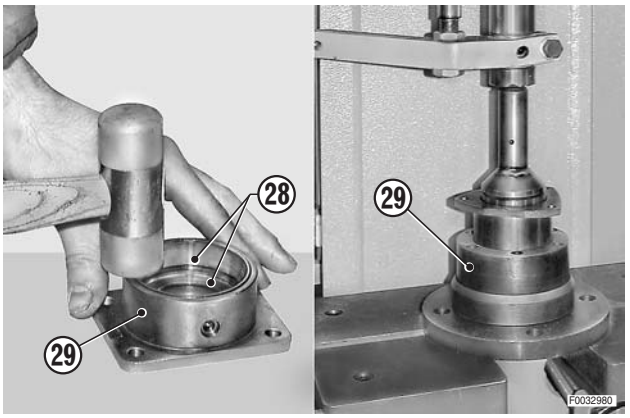
★ This bearing **must be** replaced.

⚠ If the ring is removed without using a specific taper roller bearing driver, be certain to eliminate any trace of marring from the surface of the gear.



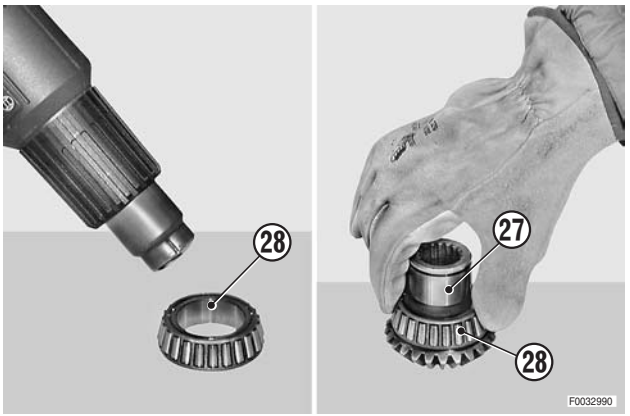
5 - Locate the outer rings (28) of the taper roller bearings in the housing (29) and force completely home using a press and a suitable driver.

⚠ In the case of the gear pump drive only, locate the lube oil seal between the two outer bearing rings, positioned with the lips directed toward the head bearing.

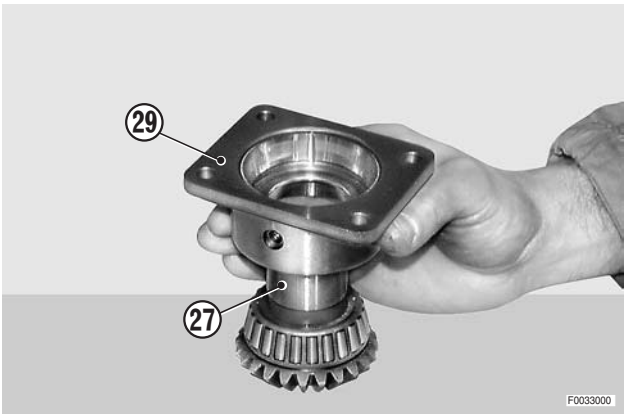


6 - Heat the inner ring (28) of the head bearing to 90 °C (194 °F) approx, and locate on the pinionshaft (27).

★ Apply constant pressure until the ring has shrunk onto the shaft.

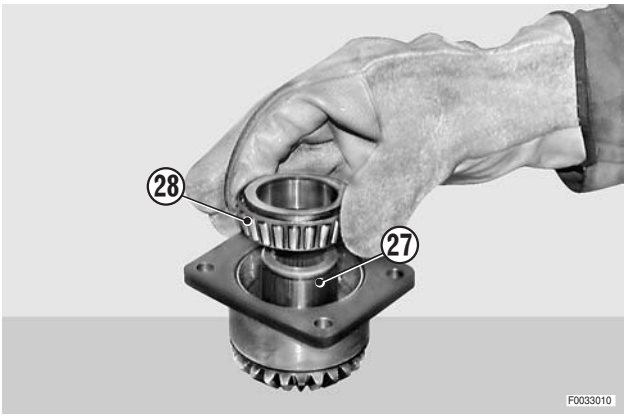


7 - Up-end the housing (29) complete with the outer bearing rings, and locate on the pinionshaft (27).

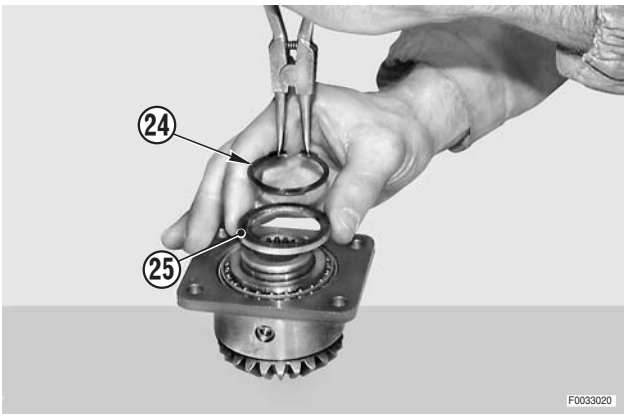


8 - Heat the inner ring (28) of the second bearing to 90 °C (194 °F) approx, and locate on the pinionshaft (27).

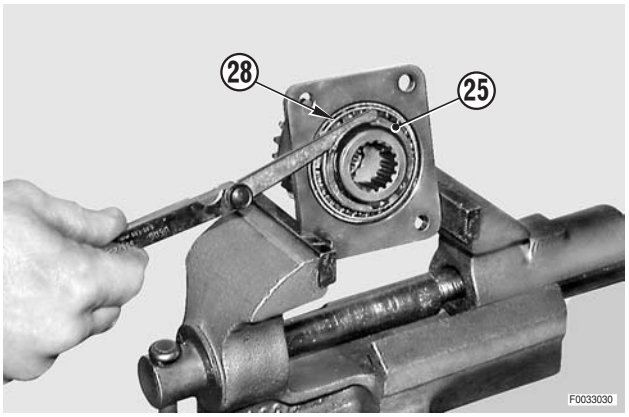
★ Apply constant pressure until the ring has shrunk onto the shaft.



9 - Fit the spacer (25) and the circlip (24).

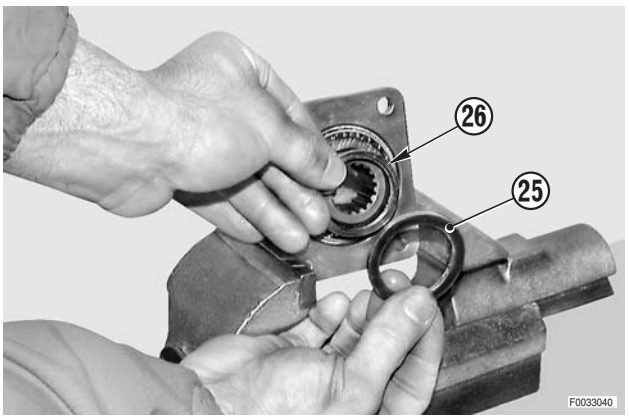


10 - Using a feeler gauge, check the clearance between the spacer (25) and the inner ring of the bearing (28).



11 - Remove the circlip (24), assemble the pack of shims (26) needed to take up the end float, and locate between the spacer (25) and the bearing (28).

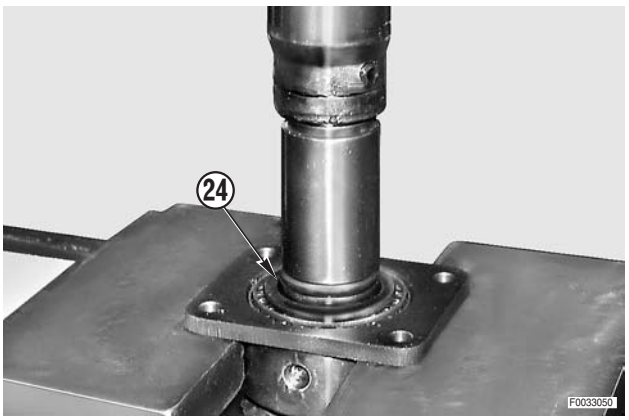
★ Select the shims from the range available, fitting the thinnest next to the bearing.



12 - Refit the circlip (24).

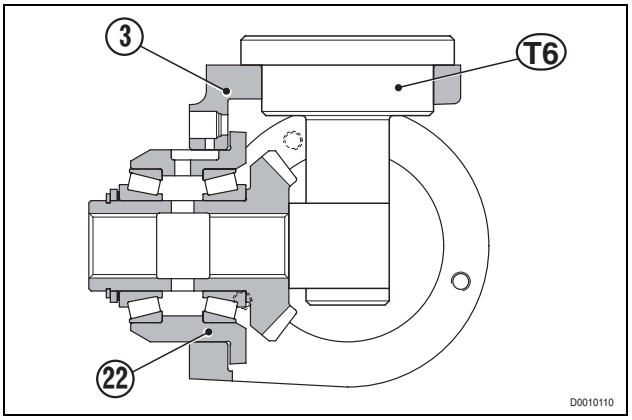
★ If the circlip is difficult to seat, assist by forcing the assembled parts with a press and driver.

★ Check that the final end float is less than 0.05 mm (0.00197 in).



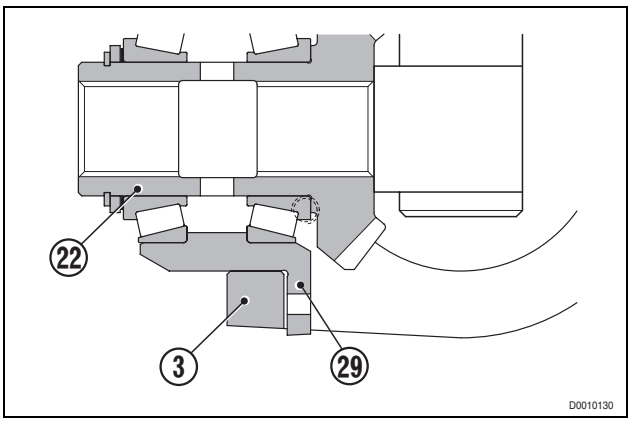
3. Assembly of drive unit

1 - Position special tool **T6** (code 5.9030.882.0) in the drive mounting (3) together with the pinion assembly (22).

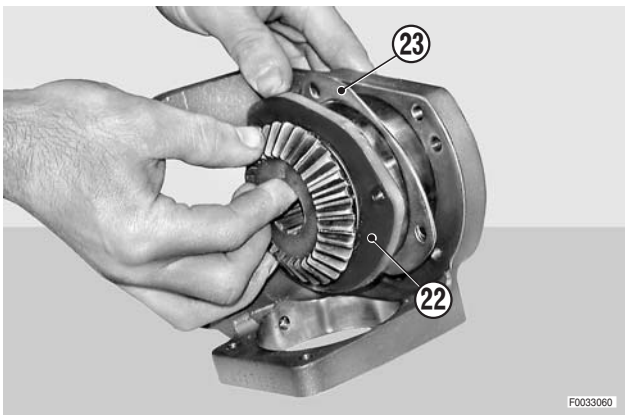


2 - Applying constant pressure to the pinion assembly (22), measure the clearance between the flange (29) and the mounting (3) with a feeler gauge.

★ Take particular care over this measurement, since the maximum permissible end float must be between 0–0.05 mm (0–0.00197 in).

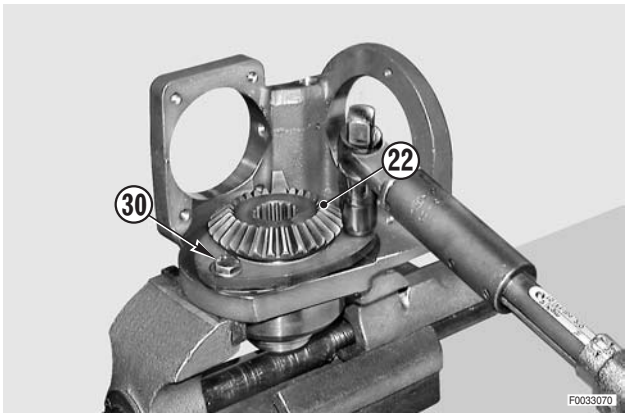


3 - Assemble the pack of shims (23) from the sizes available and locate under the flange of the pinion assembly (22).

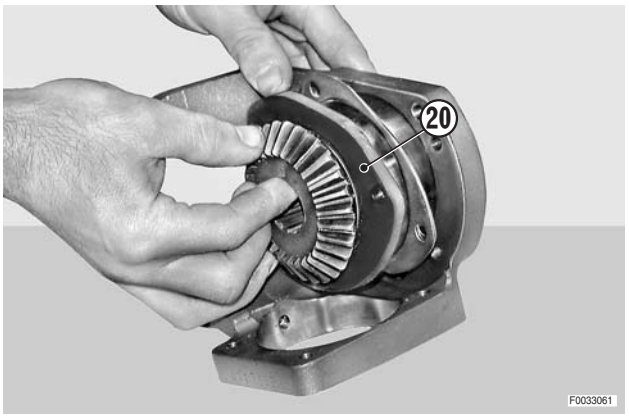


4 - Remove special tool **T6** (code 5.9030.882.0) and secure the pinion assembly (22) with the bolts (30) and washers.

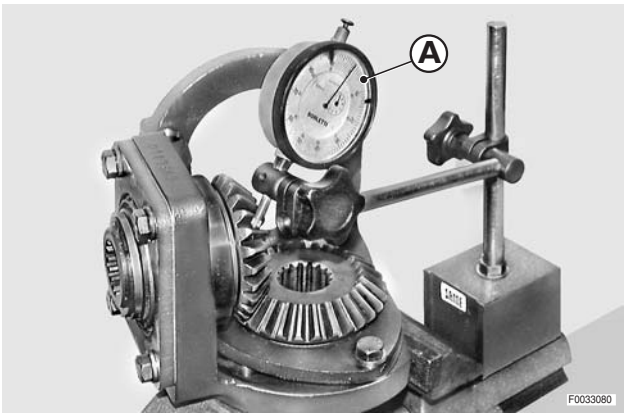
Nm Bolts: 20 Nm (14.7 lb.ft.).



5 - Locate shims (approx 1 mm (0.0394 in.) under the flange of the gear pump drive (20).



6 - Position a dial gauge "**A**" on a magnetic stand with the tip offered perpendicularly to the outer end of one tooth.



7 - Move the gear of the pump drive (20) back and forth slowly, and measure the backlash between the meshing teeth.

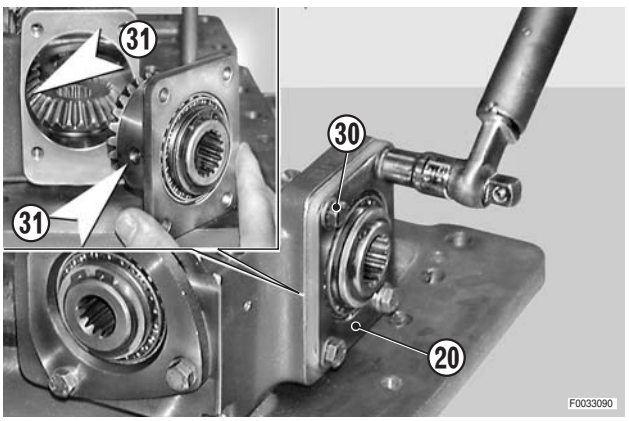
★ Permissible backlash:
0.08 –0.13 mm (0.00315–0.00512 in.)

8 - Add or take away shims to bring the backlash within the prescribed tolerance.

9 - Secure the flange of the gear pump drive (20) with the bolts (30) and washers.

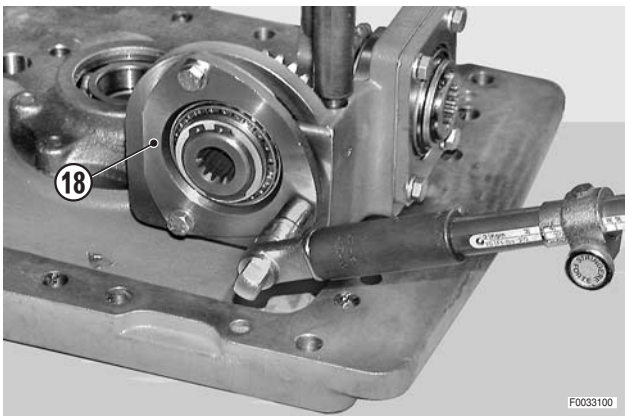
★ Check that the flange is positioned to ensure correct alignment of the lube hole (31).

Nm Bolts: 20 Nm (14.7 lb.ft.)



10 - Check the backlash again before proceeding.

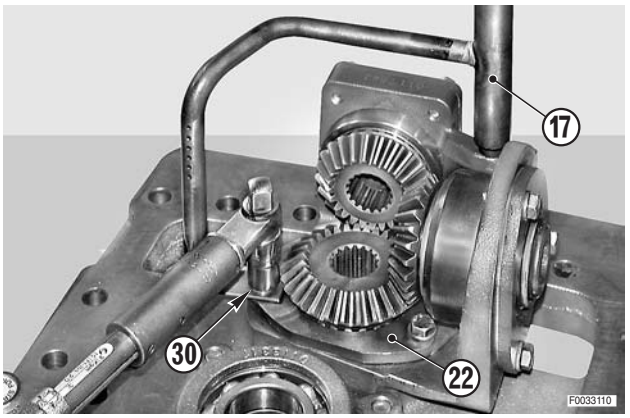
11 - Repeat steps 5 to 10 for the piston pump drive (18).



12 - Remove the bottom fixing bolt (30) of the pinion flange (22) and fit the lube pipe (17).

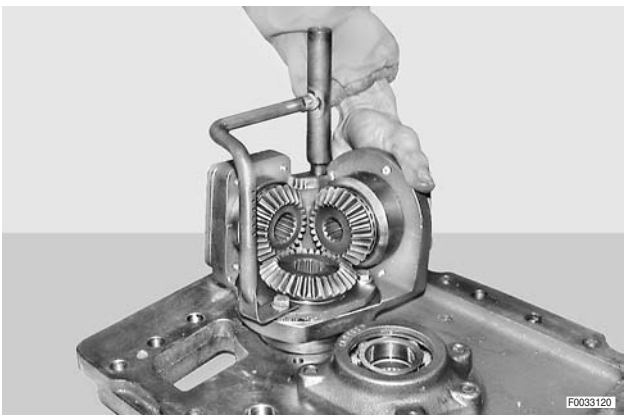
13 - Retighten the bolt.

Nm Bolt: 20 Nm (14.7 lb.ft.)



4. Assembly of pump drive unit

- To assemble, follow the disassembly steps of heading 1 above in reverse order.



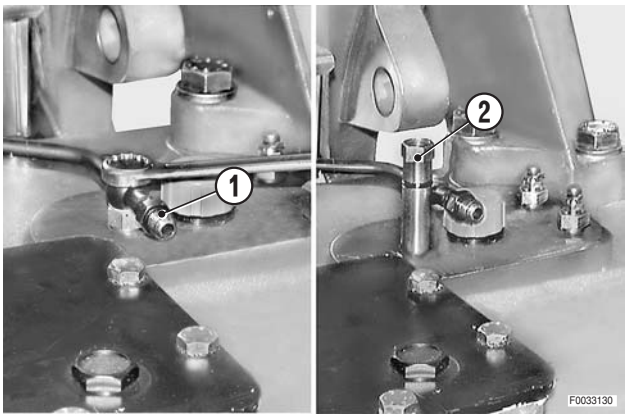
REMOVAL AND DISASSEMBLY OF DIFFERENTIAL

1 - Separate the rear axle.
(For details, see «SPLITTING THE TRANSMISSION AND REAR AXLE»).

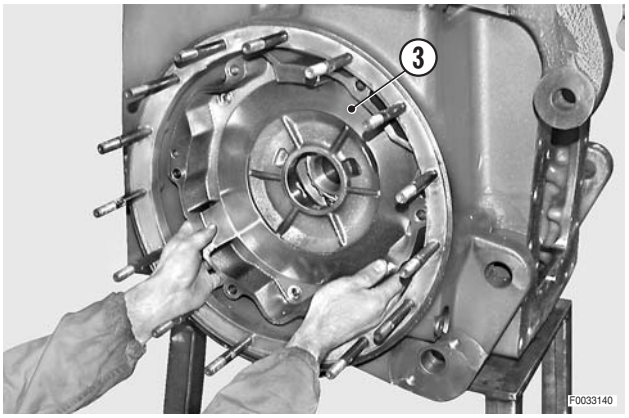
2 - Remove the right hand trumpet housing and the relative brake assembly.
(For details, see «OVERHAUL OF BRAKE ASSEMBLIES»).

3 - Remove the PTO unit.
(For details, see «REMOVAL OF PTO UNIT»).

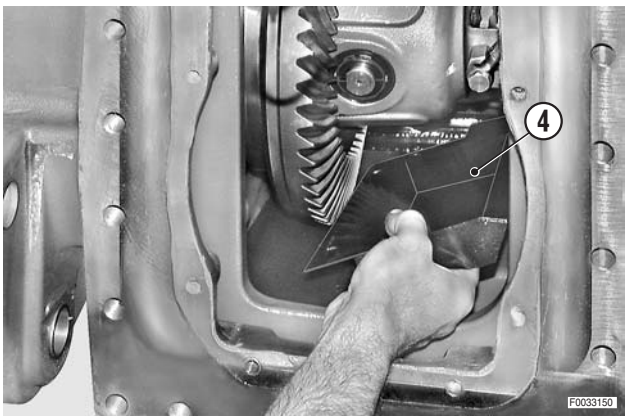
4 - Disconnect and remove the differential lock oil pipe (1) and fitting (2).



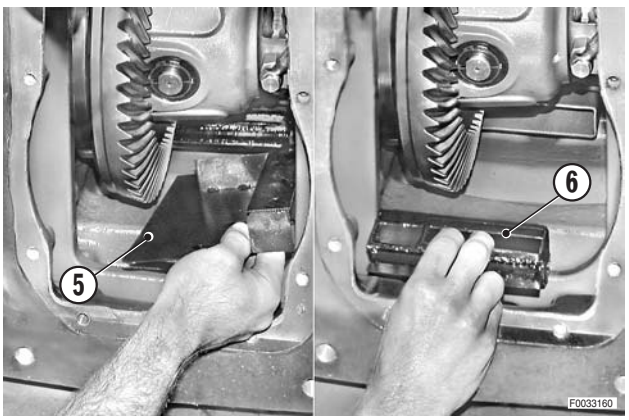
5 - Undo the bolts and remove the right hand flange (3).



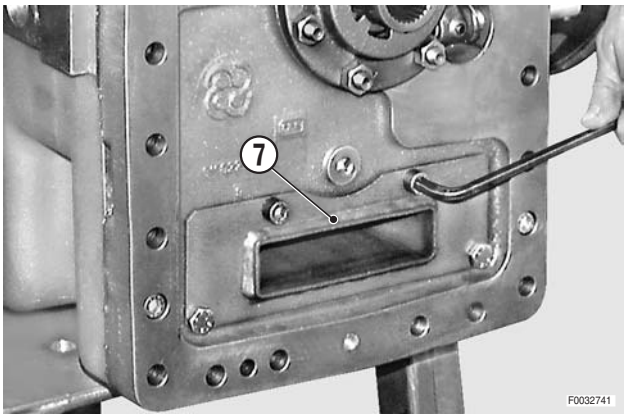
6 - Undo the three bolts and remove the oil baffle plate (4).



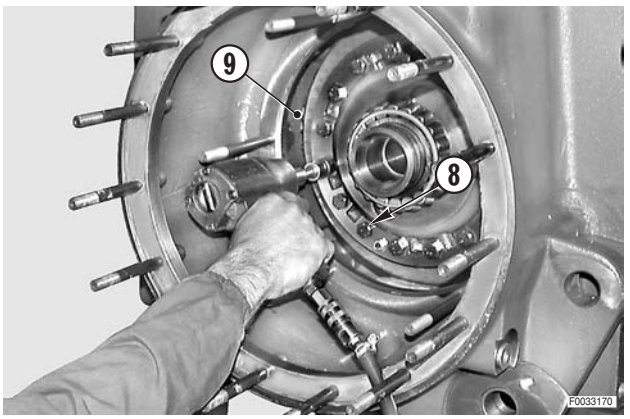
7 - Remove the baffle plate mounting (5) and the inlet (6) of the oil transfer duct.



8 - Remove the oil duct (7).



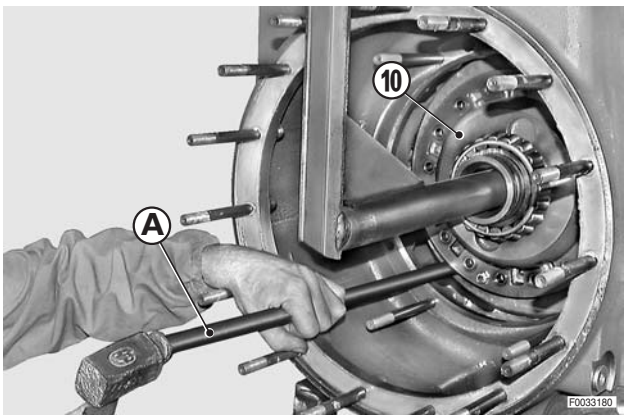
9 - Loosen and remove the bolts (8) securing the crown wheel (9).



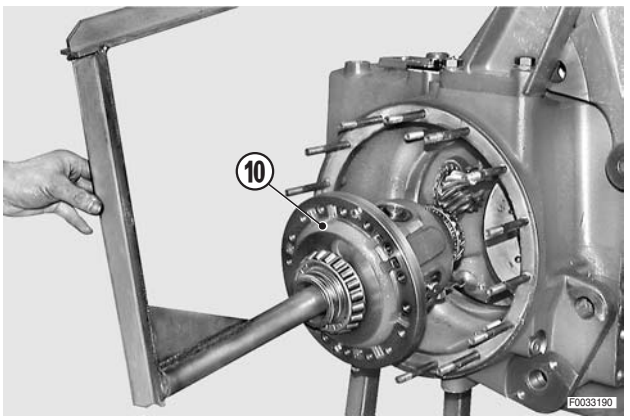
10 - Insert the hoisting attachment and lift the differential (10) until suspended freely in a horizontal position.

11 - Using a copper punch "**A**" and hammer, separate the crown wheel from the differential unit.

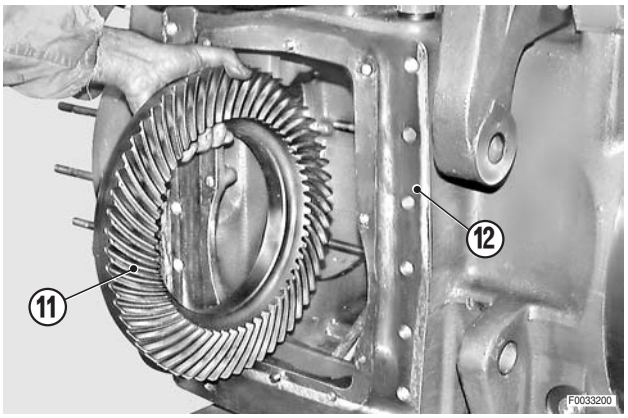
★ Rotate the differential unit during this step so as to distribute the impact around the entire circumference.



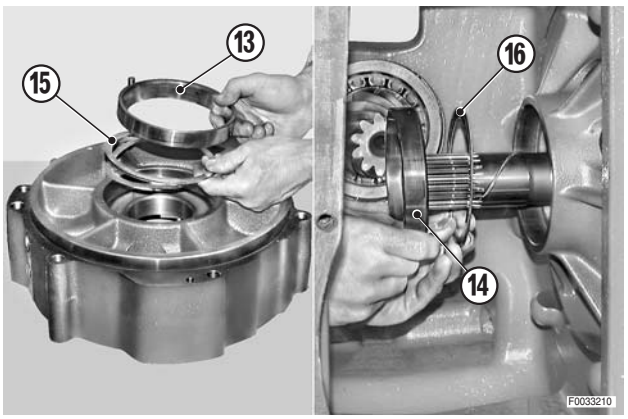
12 - Remove the differential unit (10).



13 - Remove the crown wheel (11) from the housing (12).

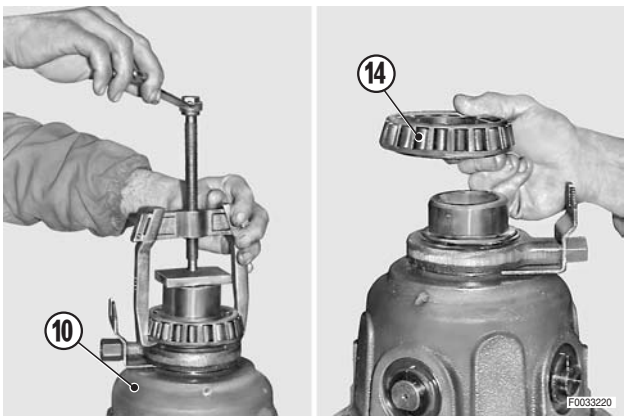


14 - Remove the outer bearing rings (13) and (14) and the relative shims (15) and (16) from the R.H. and L.H. flanges.

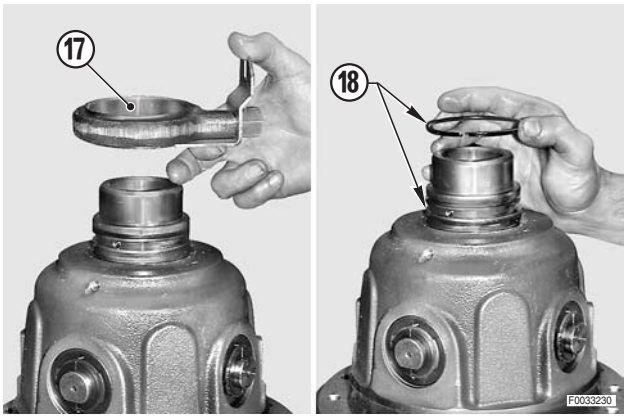


1. Disassembly

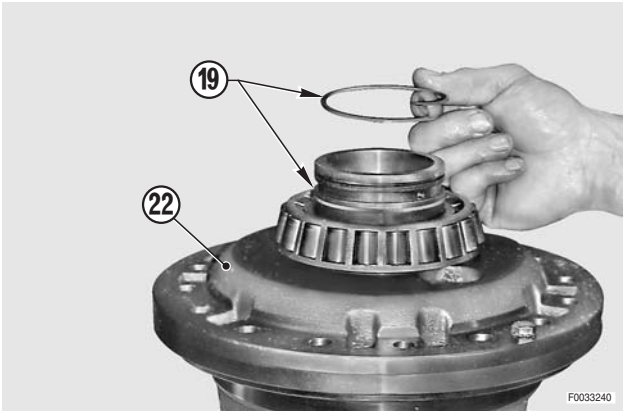
1 - Using a puller, remove the inner bearing ring (14) from the differential (10).



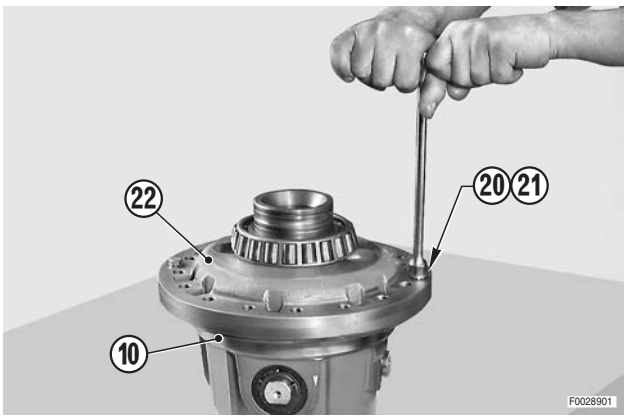
2 - Remove the manifold (17) and the sealing rings (18).



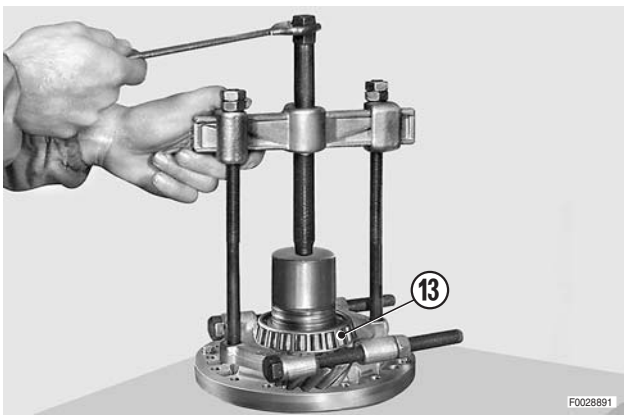
3 - Up-end the differential (10) and remove the sealing rings (19).



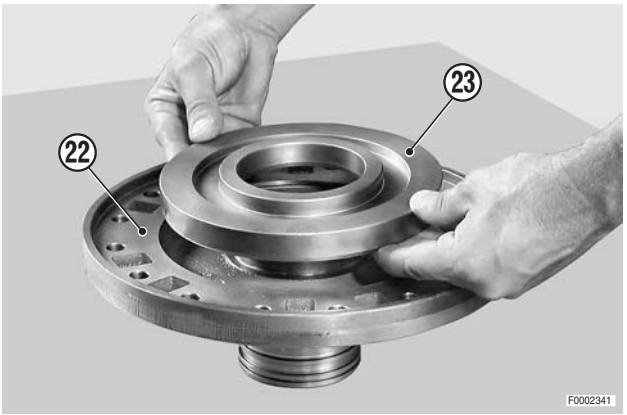
4 - Remove the bolts (20) and washers (21); separate the cylinder assembly (22) from the differential (10).



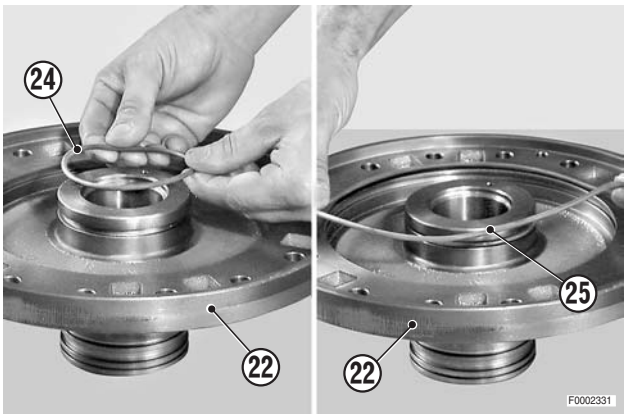
5- Using a puller, remove the bearing (13) from the cylinder.



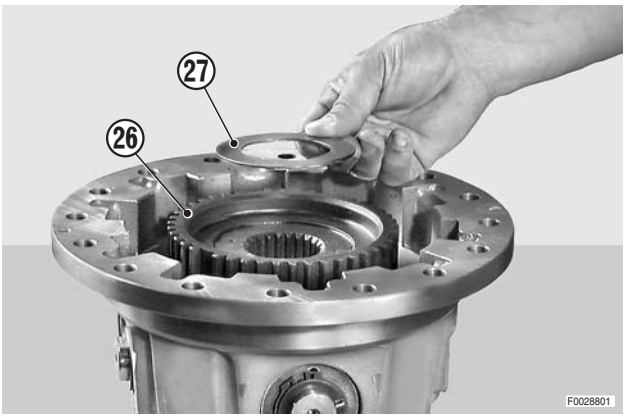
6 - Force the piston (23) from the cylinder (22) with a low pressure blast of compressed air.



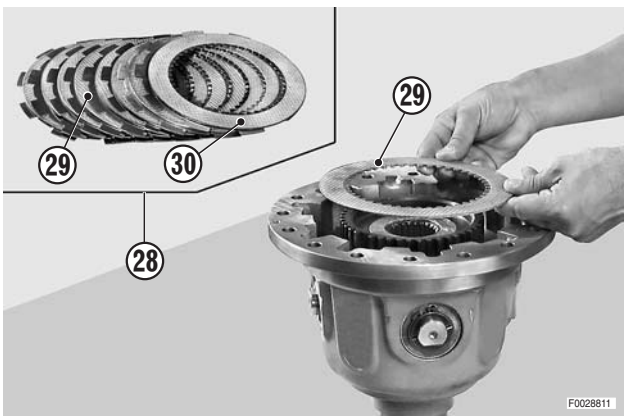
7 - Remove the O-rings (24) and (25) from the cylinder (22).
★ Renew the O-rings every time they are removed.



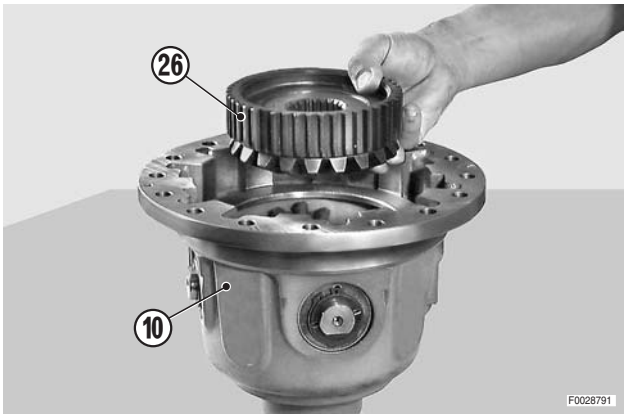
8 - Remove the thrust washer (27) from the side gear (26).



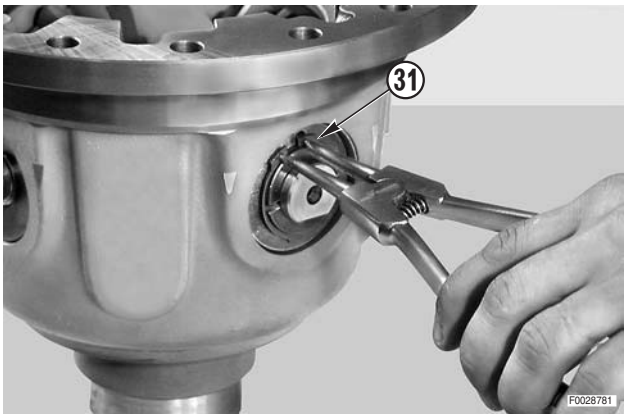
9 - Remove the discs (28) of the differential lock.
★ If the discs do not need to be replaced, avoid switching the original positions.
★ Check that the thickness of the friction discs is still greater than the minimum permissible.
★ Minimum thickness: 1.9 mm (0.0749 in.).



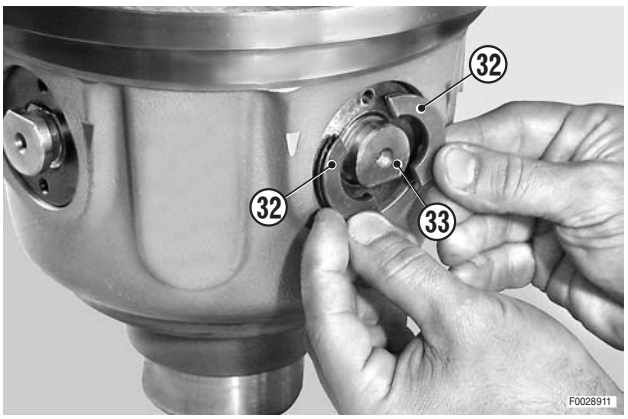
10 - Remove the side gear (26).



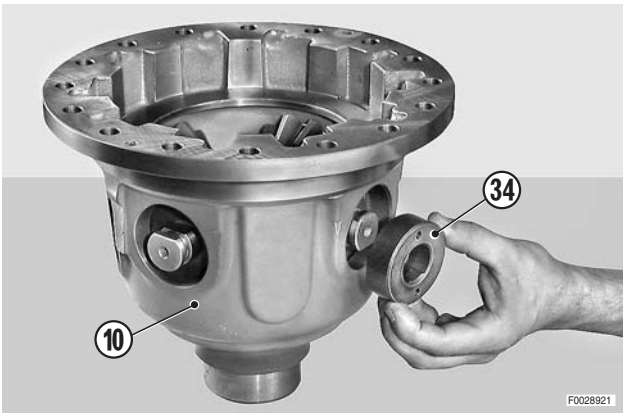
11 - Remove the circlip (31).



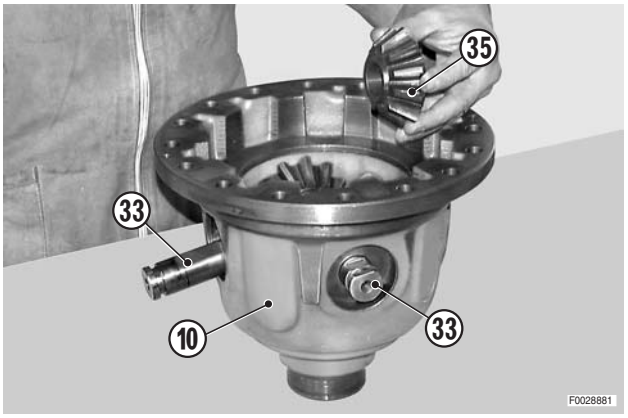
12 - Remove the thrust washers (32) from the grooves in the planet shafts (33).



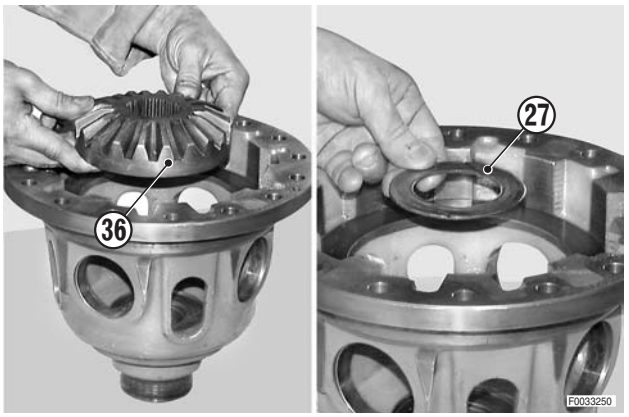
13 - Remove the spacers (34) from the planet carrier (10).



14 - Remove the planet shafts (33) and the planet pinions (35).



15 - Remove the side gear (36) and the relative thrust washer (27).

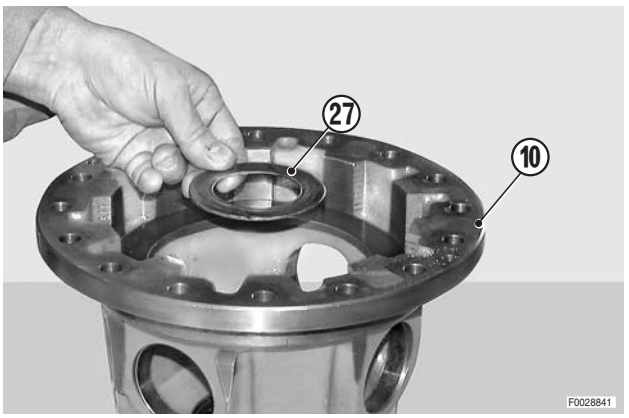


2. Assembly

1 - Locate the thrust washer (27) in the planet carrier (10).

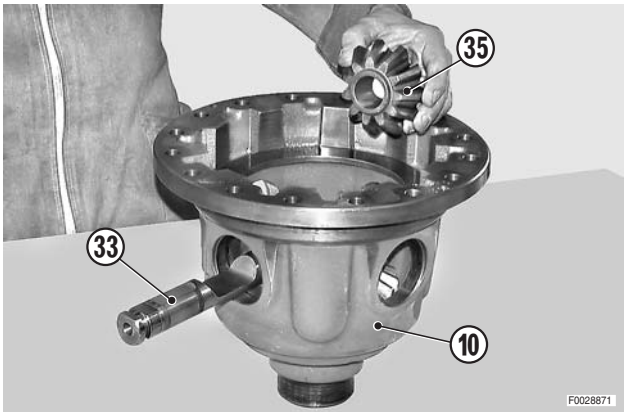
Thrust washer: Grease

★ The oil grooves must be directed upwards.

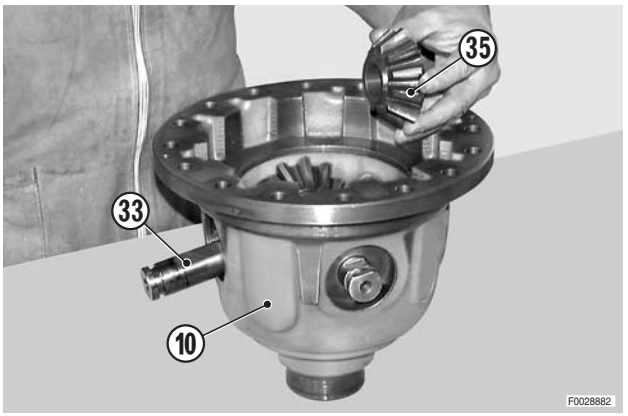


2 - Fit the first side gear (36).

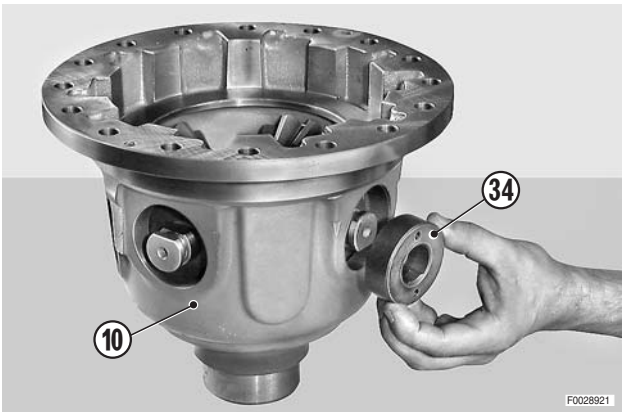
3 - Locate the first planet pinion (35), the planet shaft (33) and the second planet pinion (35).



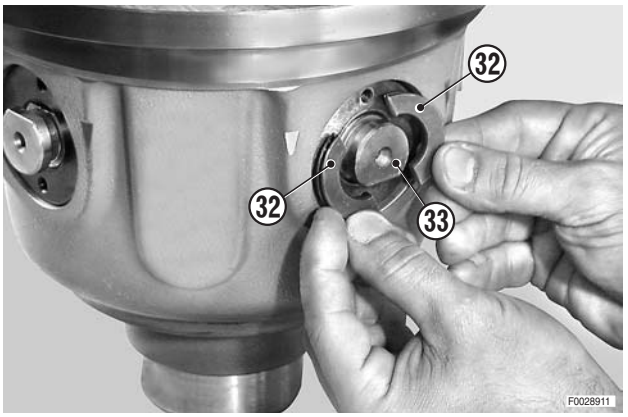
4 - Repeat the operation of step 3 for the remaining planet shaft (33).



5 - Fit the spacers (34).

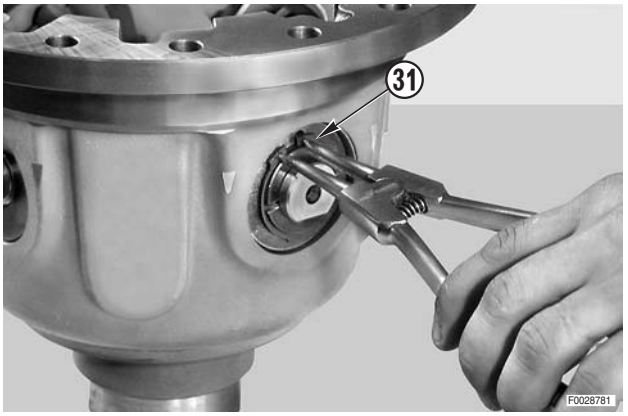


6 - Fit the thrust washers (32), making certain that they locate in the grooves of the planet shafts (33).

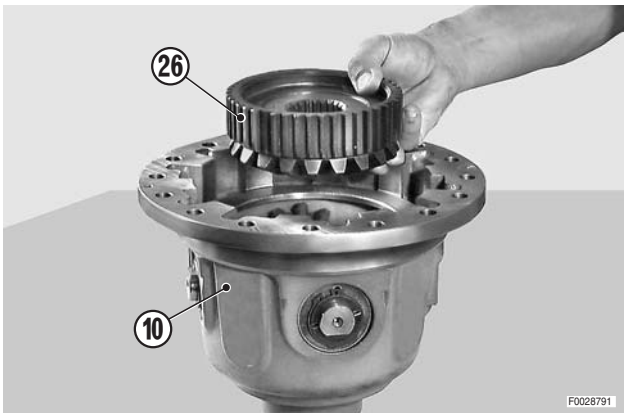


7 - Secure the thrust washers with the circlips (31).

★ The gap in the circlip (31) must be positioned at 90° relative to the joint line of the split thrust washers (32).



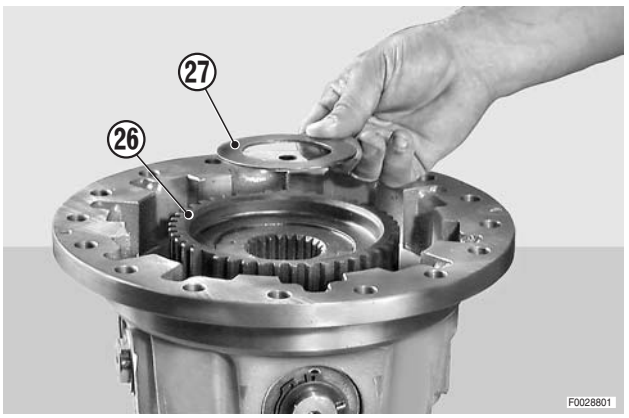
8 - Fit the second side gear (26).



9 - Locate the thrust washer (27) on the side gear (26).

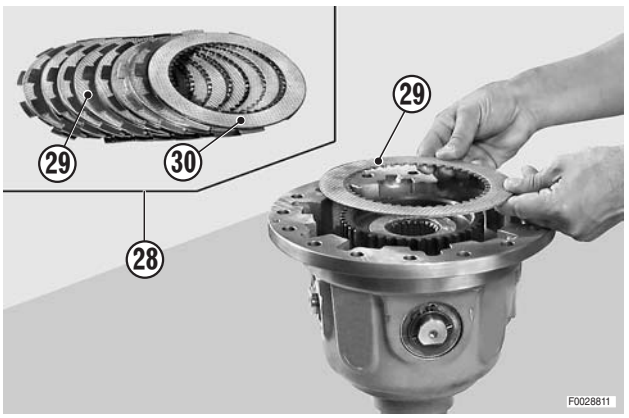
Thrust washer: Grease

★ The oil grooves must be directed toward the side gear.

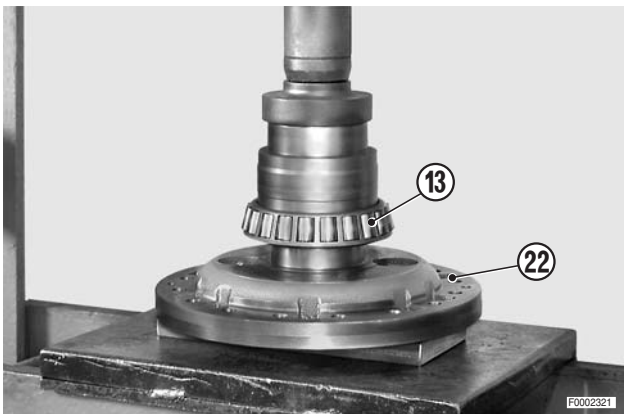


10 - Assemble the pack of 8 + 8 friction discs (28).

★ Start with one friction disc (29) followed by one steel disc (30).
Continue in similar fashion until all the discs are assembled, finishing with a steel disc (30).

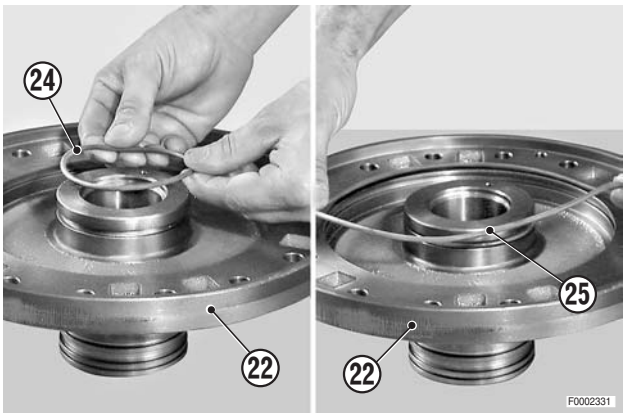


11 - Using a press and a suitable driver, fit the inner bearing ring (13) on the cylinder (22).

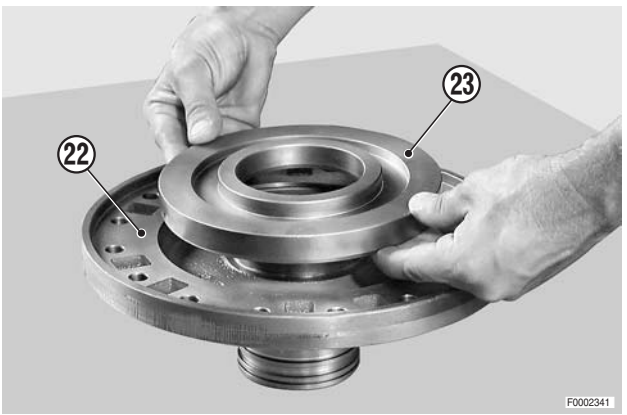


12 - Up-end the cylinder and fit the O-rings (24) and (25).
★ Stretch the O-ring (25) uniformly so that it remains seated.

O-rings: Grease



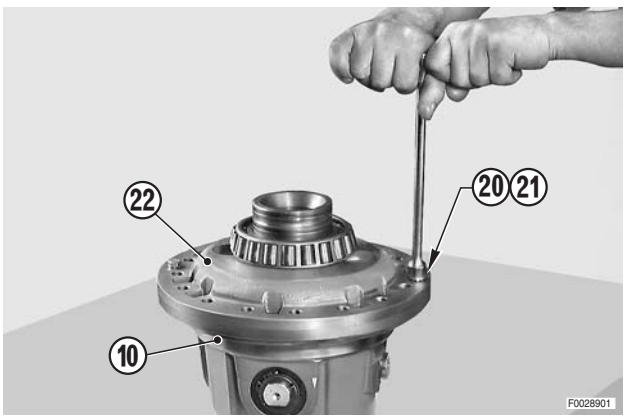
13 - Insert the piston (23) to its full stroke limit.
★ Take particular care not to damage the O-rings (24) and (25).
★ Ease the piston into place using a plastic hammer, tapping around the entire circumference.



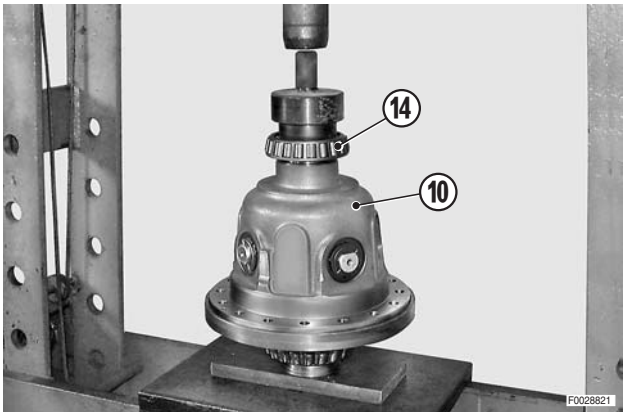
14 - Position the cylinder (22) on the planet carrier (10) and secure with the two bolts (20) and lock washers (21).

Bolts: Loctite 242

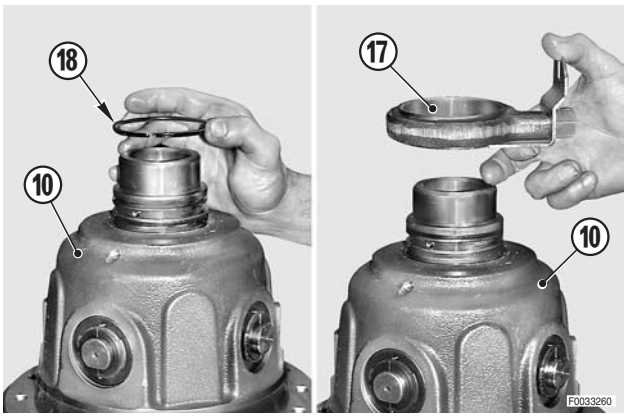
★ During assembly, tap lightly with a plastic hammer around the entire circumference.



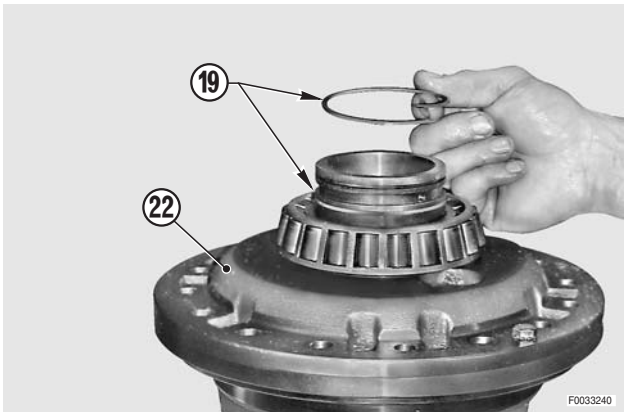
15 - Using a press and a suitable adapter, fit the inner ring of the bearing (14) on the planet carrier (10).



16 - Lubricate the sealing rings (18) and the manifold (17) and fit to the planet carrier.



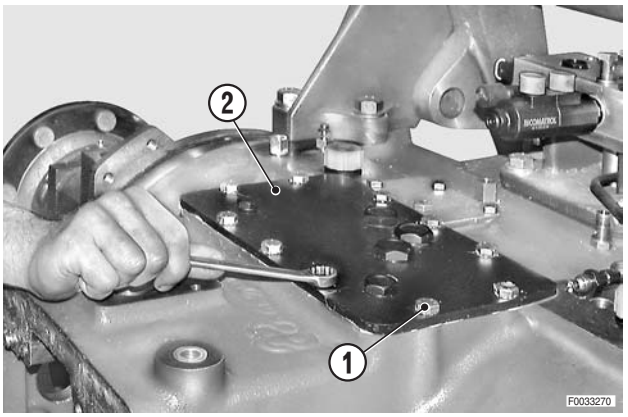
17 - Lubricate the sealing rings (19) and fit to the cylinder (22).



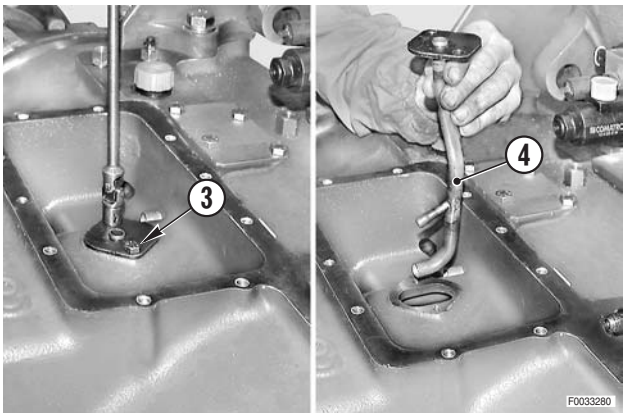
REMOVAL OF BEVEL PINION

1 - Remove the pump drive spacer flange.
(For details, see «REMOVAL OF PUMP DRIVE SPACER FLANGE»).

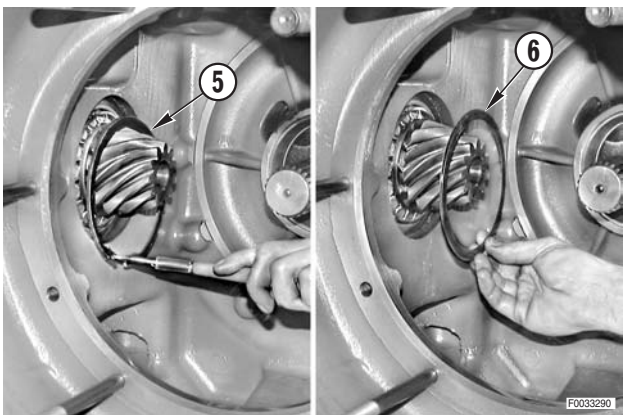
2 - Undo the bolts (1) and remove the cover (2).



3 - Undo the bolts (3) and remove the lube pipe (4) serving the pinion and ball coupler.

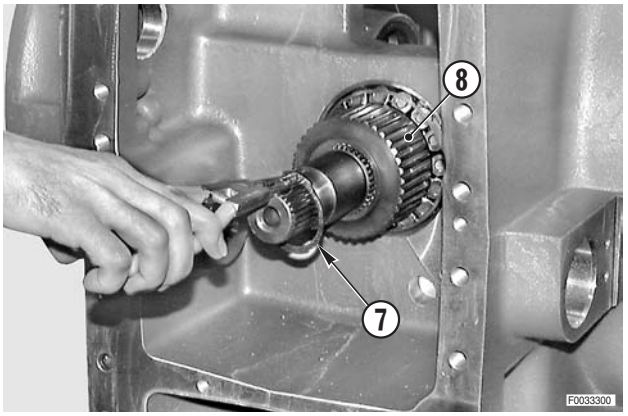


4 - Remove the circlip (5) and shims (6).

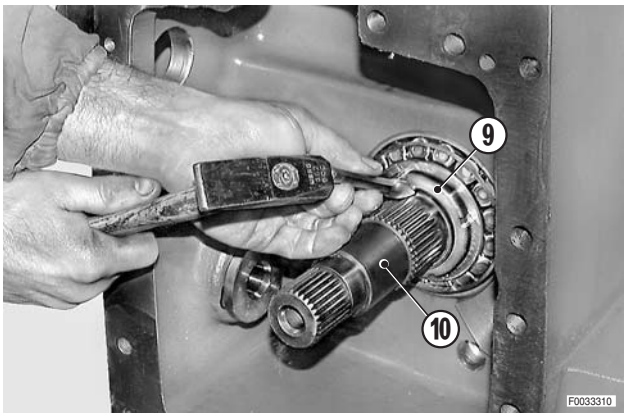


5 - Remove the parking brake assembly.
(For details, see «INSPECTION AND OVERHAUL OF PARKING BRAKE»).

6- Unseat the circlip (7) and remove the hub (8) of the parking brake.

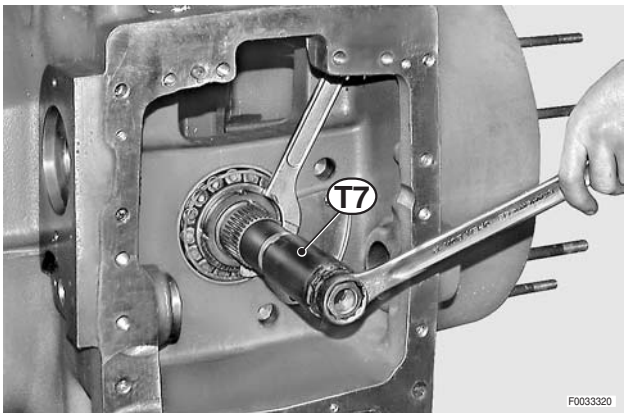


7- Unstake the lock nut (9) securing the pinion (10).



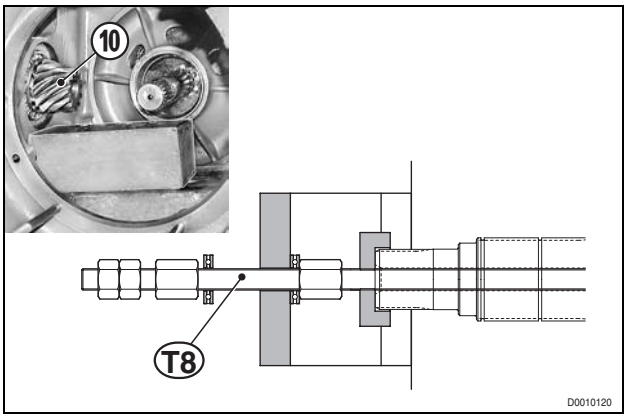
8- Apply a pin wrench to the lock nut (9) and fit special tool **T7** (code 5.9030.841.0) to the pinion (10).

9 - Loosen the lock nut (9) to the point of freeing the staked area.



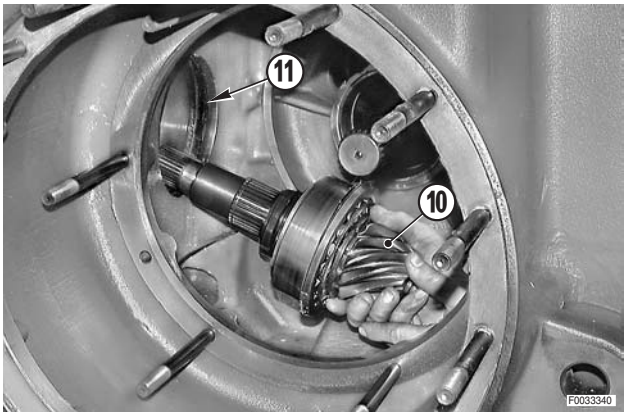
10 - Position a block under the pinion (10).

11 - Fit special tool **T8** (code 5.9030.842.0) and drive the pinion assembly until the bearing is disengaged from the differential housing.

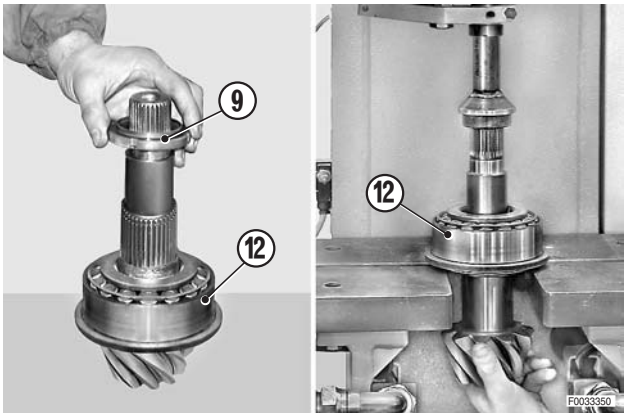


12 - Remove the pinion assembly (10) and recover the shims (11).

★ Set the shims (11) to one side so they can be used to calculate the thickness that will be needed in the event of the crown wheel and pinion or the pinion head bearing being replaced.



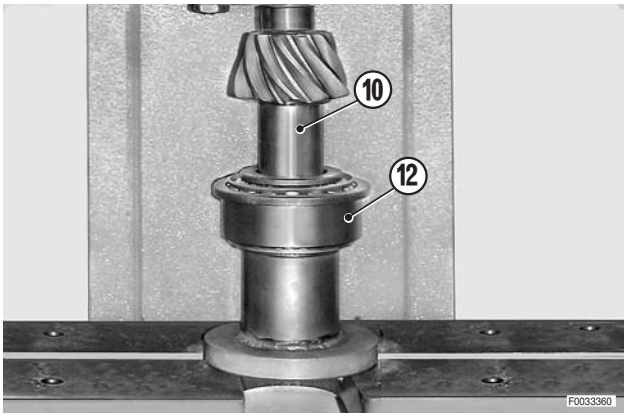
13 - Remove the lock nut (9), and press the bearing (12) from the pinionshaft.
★ Make a note of which way round the bearing is fitted.



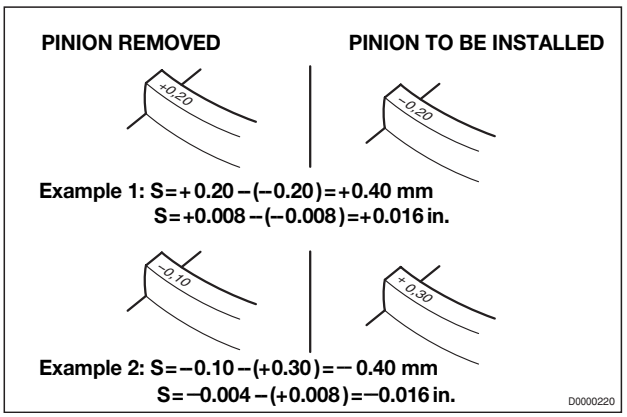
ASSEMBLY AND ADJUSTMENT OF CROWN WHEEL AND PINION

1 - Lubricate the pinionshaft (10) and press the bearing (12) onto the shaft.

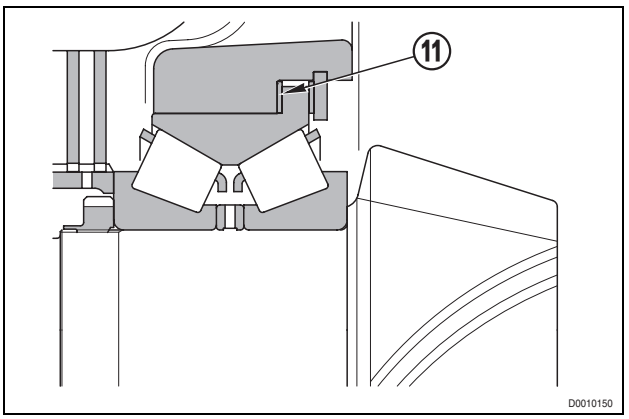
Pinion: gear oil



2 - Establish the thickness "**S**" to be added or taken away from the shims removed previously, which will be located under the flanged outer ring of the bearing (12). The thickness "**S**" is obtained by calculating the difference between the values stamped on the tooth of the pinion removed and on the tooth of the pinion to be installed.



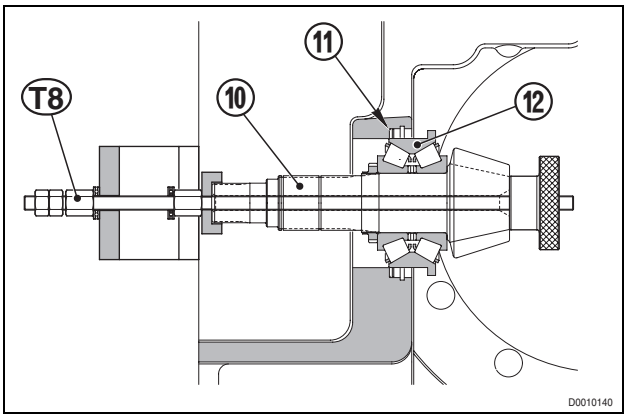
3 - The pack of shims recovered must be increased by a thickness of 0.4 mm (0.016 in.) in the case of a positive difference (Example 1), or reduced by 0.4 mm (0.016 in.) in the case of a negative difference (Example 2). This procedure will determine the thickness of the shims (11).



4 - Having made the appropriate calculation, fit the pack of shims (11) to the bearing (12), then lubricate the pinionshaft (10) and bearing (12) and fit using special tool **T8** (code 5.9030.842.0).

★ To keep the shims in place during assembly, smear lightly with grease.

Bearing: gear oil

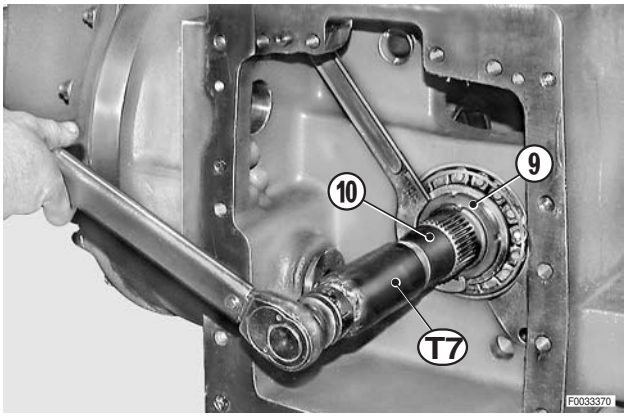


5 - Smear the lock nut (9) with threadlocker and screw onto the pinionshaft (10).

Lock nut: Loctite 242

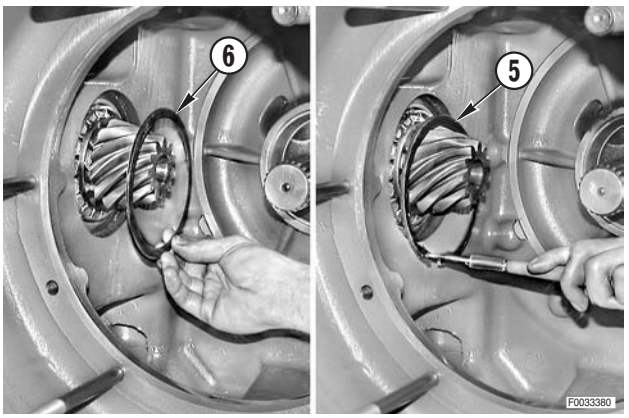
6 - Apply the pin wrench and special tool **T7** (code 5.9030.841.0), and tighten the lock nut (9).

Lock nut: 550 Nm (405 lb.ft.)



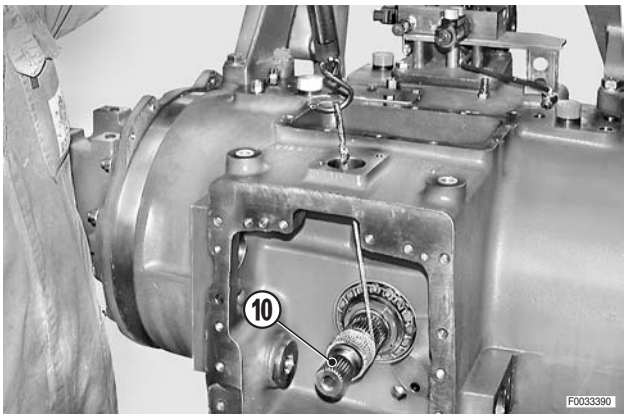
7 - Prepare a pack of shims (6) made up from the thicknesses available and fit on the other side of the bearing, then add the circlip (5).

Select the shims with care, as the circlip must locate in the relative seat with zero clearance.



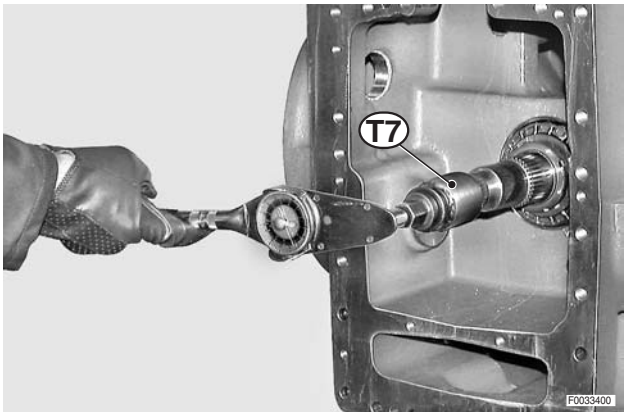
8 - Turn the pinion (10) through several revolutions in both directions to settle the bearing, then measure continuous rolling torque using a calibrated spring dynamometer and a rope wound around the cylindrical part of the pinionshaft (10).

★ Continuous rotation force "**W1**": 4.1–25 kg



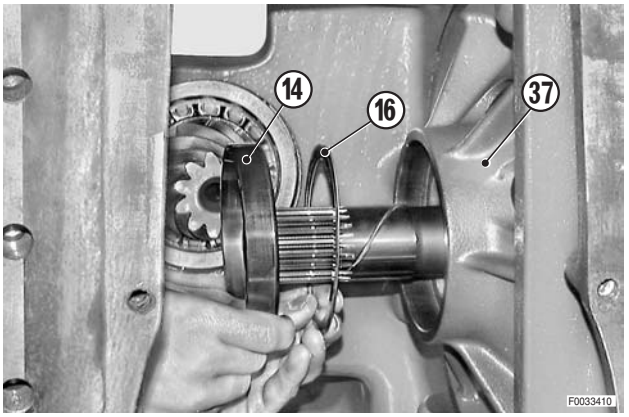
NOTE. If a torsiometer is available, apply special tool **T7** (code 5.9030.841.0) to the pinion and measure the rolling torque.

★ Continuous torque "**W**": 1–6 Nm (0.74 – 4.4 lb.ft).

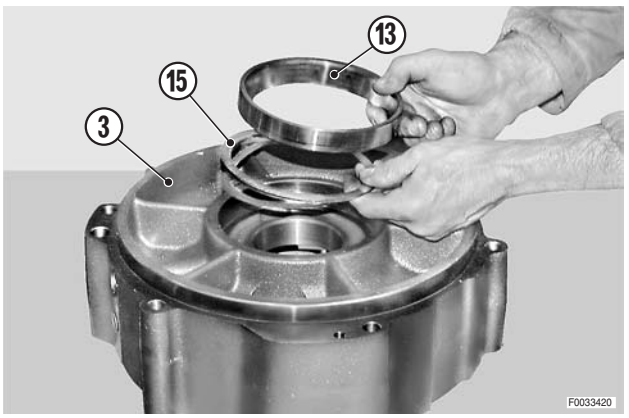


ASSEMBLY OF DIFFERENTIAL AND CLEARANCE ADJUSTMENTS

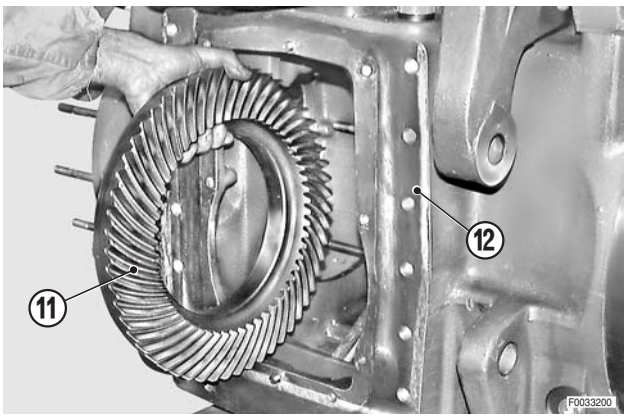
1 - Fit an initial pack of shims (16) 1.7 mm thick in the L.H. flange (37); make up the pack using several shims of 0.15 mm and 0.20 mm.
   ★ Position the thinner shims nearer to the flange (37).
   ★ To keep the shims in place during assembly, smear lightly with grease.
2 - Fit the outer ring of the bearing (14).



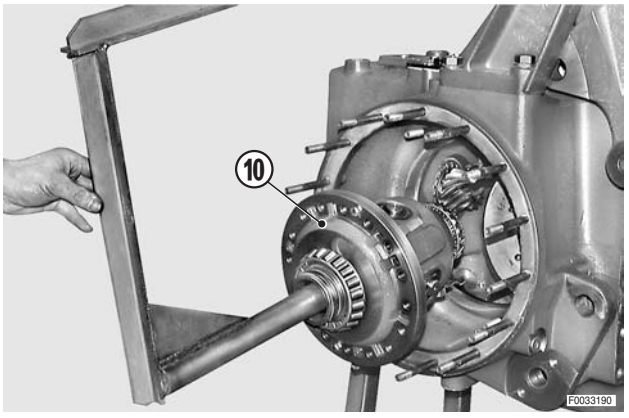
3 - Prepare the R.H. flange (3), fitting an initial pack of shims (15) 2 mm thick assembled by the same method as indicated in step 1.
4 - Fit the outer ring of the bearing (13).



5 - Locate the crown wheel (11) in the housing (12).



6 - Use the hoisting attachment to locate the differential unit (10), with manifold fitted.
   ★ Locate the restraint in the R.H. flange.

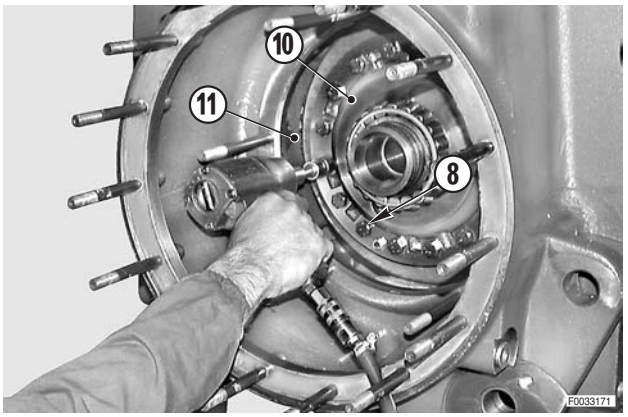


7 - Using a copper-headed hammer, drive the crown wheel (11) fully onto the differential unit (10), tapping lightly around the entire circumference.

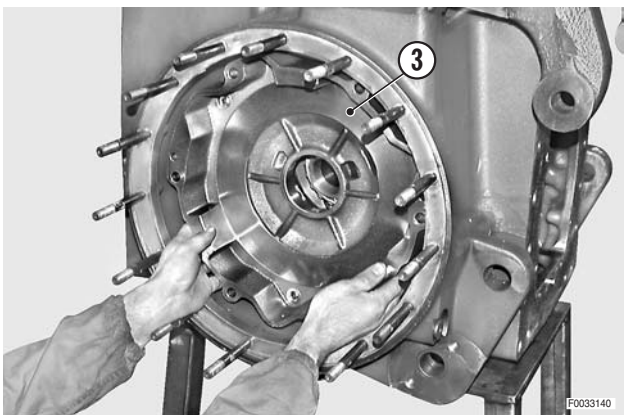
8 - Secure the crown wheel (11) with the bolts (8), tightening to the prescribed torque.

Nm Crown wheel bolts: 108±10% Nm

★ Tightening the bolts a little at a time, proceeding in diagonal sequence.



9 - Fit the R.H. flange (3) and secure in place.



10 - Calculate the increase in rolling torque attributable to the crown wheel and pinion, using the following formulae:

Cr = W1 + I with calibrated spring dynamometer
Cr = W + I with torsiometer

where: **I = 8.3–10.6 kg** for calibrated spring dynamometer

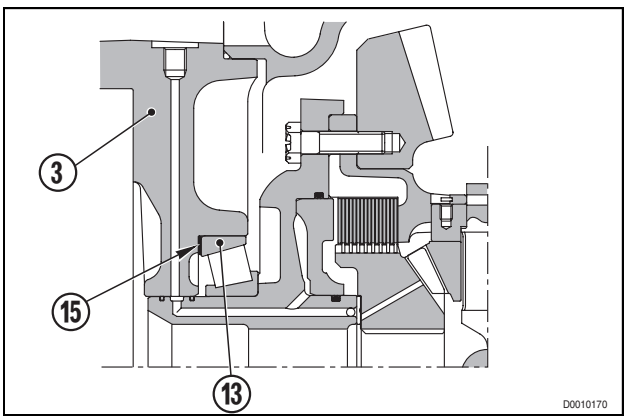
I = 2–4 Nm for torsiometer

Admissible measuring range:

a - with calibrated spring dynamometer:
4.1–25 kg + 8.3–16.6 kg = 12.4–41.6 kg

b - with torsiometer:
1–6 Nm + 2–4 Nm = 3–10 Nm

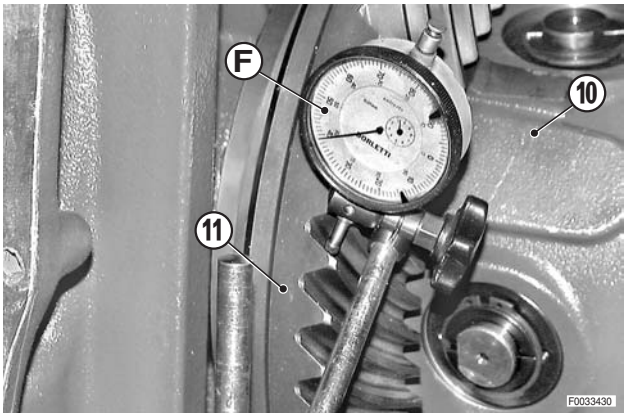
11 - If overall rolling torque (crown wheel and pinion) is not within the measuring range, remove the right hand flange (3) and the outer ring of the bearing (13), and add or take away shims (15) until the optimum torque value is obtained.



12 - Position a dial gauge "**F**" on a magnetic stand with the tip offered perpendicular to a tooth flank on the crown wheel (11), at the external diameter.
Preload the gauge by approx 4 mm (0.158 in) and reset; rotate the planet carrier (10) back and forth and check the backlash "**Z**" between pinion and crown wheel.

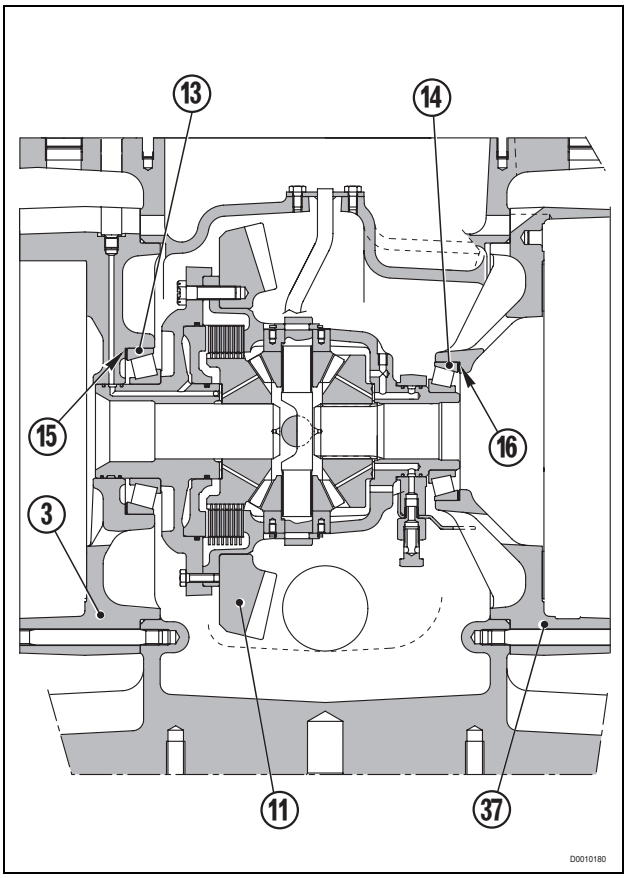
★ Normal backlash "**Z**":
0.25–0.33 mm (0.010–0.013 in.).

★ Take four measurements 90° apart and calculate the average.



13 - If backlash "**Z**" is less than 0.25 mm (0.010 in), remove one shim (15) from the outer ring of the right hand bearing (13) and add one shim (16) of the same thickness to the outer ring of the left hand bearing (14).
If backlash "**Z**" is more than 0.33 mm (0.013 in.), remove one shim (16) from the outer ring of the left hand bearing (14), and add one shim (15) of the same thickness to the outer ring of the right hand bearing (13).

★ The addition or removal of one shim measuring 0.1 mm (0.04 in) will produce a variation in backlash "**Z**" of approx 0.07 mm (0.002 in).

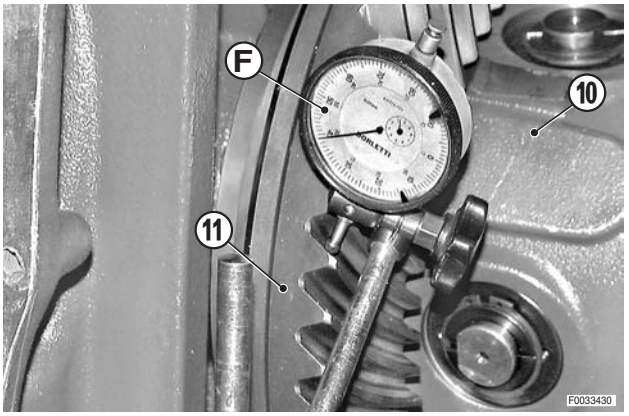


14 - To transfer shims, remove the flange (3) on the right, remove the crown wheel (11) from the differential, and take out the differential (10) so that the outer ring of the left hand bearing can be removed.

★ Place the thinnest of the shims nearer to the flanges (3) and (37).

15 - Reassemble and check the backlash "**Z**".

★ Repeat the step of transferring shims (15) and (16) from one side to the other until backlash registers within the permissible range of values.



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 troubleshooting and repairs, and the instruments required for troubleshooting.

2. Indices

Contains the indices arranged by connector name, by component code and by component description.

3. Components

Contains the layouts of the connectors used in the electrical system, descriptions of the components installed on the tractor,the technical data necessary for functional testing and the pinouts of the electronic control units.

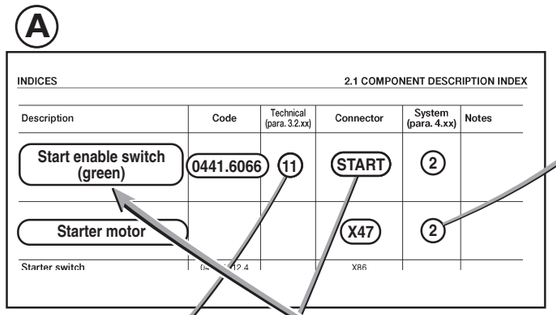
4. Systems

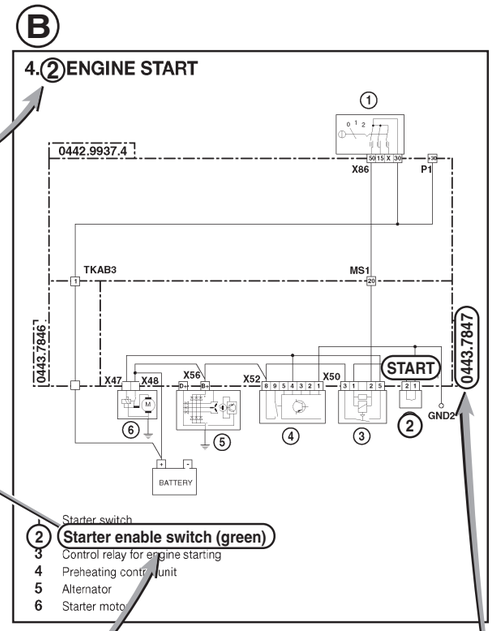
Contains the electrical diagrams of the tractor's systems.

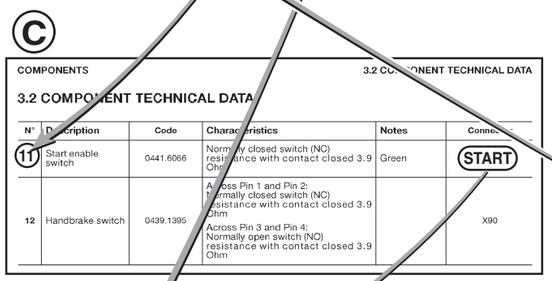
5. Wiring harnesses

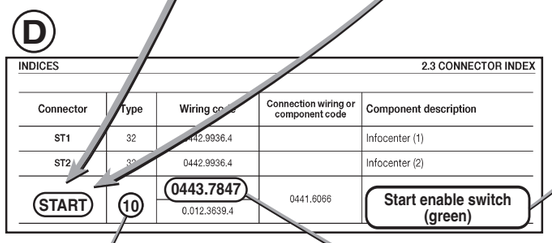
Contains the layouts, the wiring diagrams and the positioning of connectors on the tractor.

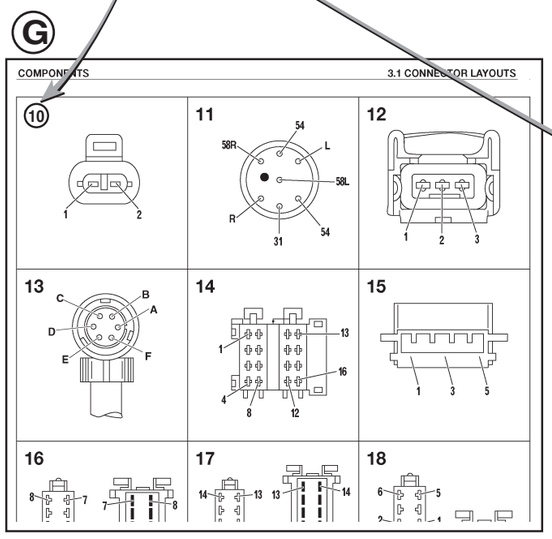
HOW TO CONSULT THE UNIT

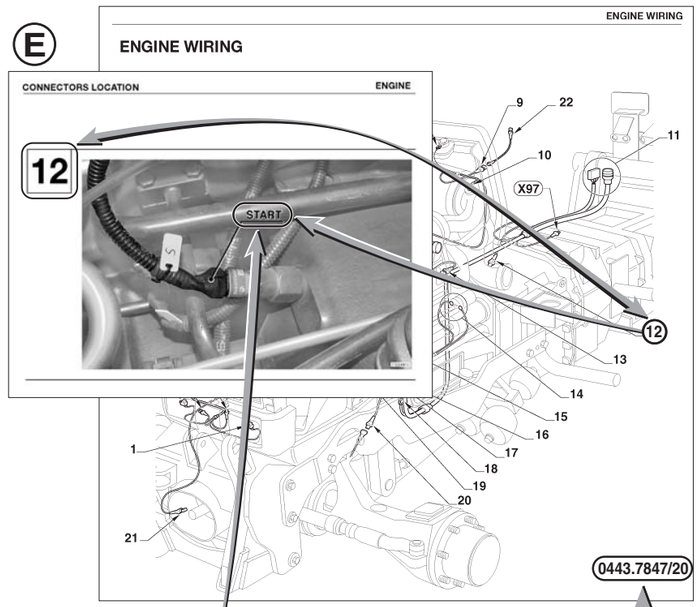


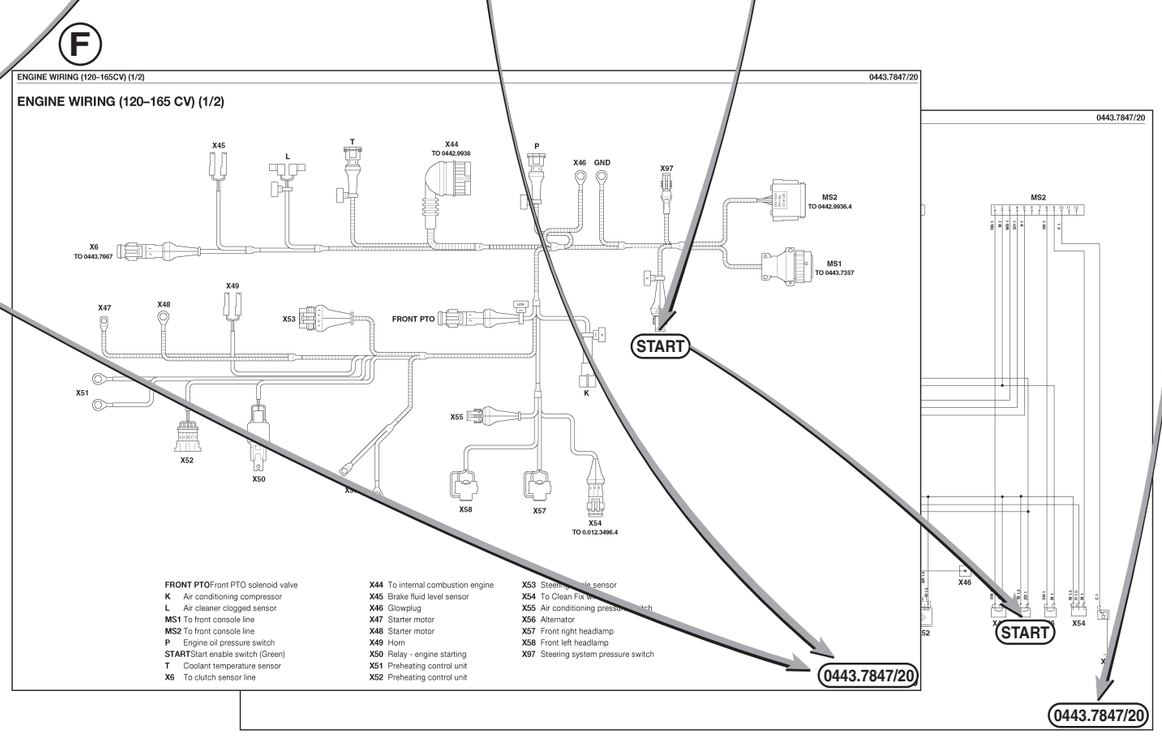












How to consult the table

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

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.

1.3.1MODIFICATION 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 standards and in particular:

  - fuse F1 (100A) DIN 72581/2

  - bayonet fuse (F2, F3, etc.) DIN 72581/3C

  The fitting of replacement fuses that do not comply with these standards will invalidate the warranty with immediate effect and release the manufacturer from any liability.
- When replacing relays, make sure that the new relay conforms to the standards marked on the original relay.

1.4 DIAGNOSTIC INSTRUMENTS

For the correct diagnosis of any faults in 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)	Notes
50S lights switch	0.012.5943.4	33	4	7	
Accelerator pedal position sensor	0442.9390	13	X59	4-18	
Actuator	0211.2684	1	Y3	4	
Air braking solenoid valve	0440.0055		X94	15-16	
Air cleaner clogging sensor	0441.9015		L	9	
Air conditioning compressor	0443.7338		K	13	
Air conditioning compressor and auxiliary fan pressure switch	0442.6492	26	X66 - X84	13	
Air conditioning control thermostat	010.2537.1		X109	13	
Air conditioning on/off switch	010.2532.0		X108	13	
Air conditioning power on and 1st speed switch relay			X107	13	
Air conditioning control panel illumination connector			X110	13	
Air suspension seat compressor			X13	6	
Alternator	0117.8607		PLUS-X74-X75	2-3-7-9-13	
Armrest	0.012.4463.4		X14	12-18-20-21	2 solenoid-operated valves
	0.012.4462.4		X14	12-18-20-21	4 solenoid-operated valves
Auxiliary air conditioning fan switch relay			X77	13	
Auxiliary air conditioning fan	0442.6490		X85	13	
Auxiliary air conditioning fan fuse (F100-30A)			X76B	13	
Auxiliary power socket	0114.3529		X2	10	
Auxiliary power supply connector (in cab)			X6	10	
Auxiliary services spool valve N° 1	2.3729.540.0		D1	22	
Auxiliary services spool valve N° 2	2.3729.540.0		D2	22	
Beacon	0441.4773		X44	7	
Beacon on/off switch	0.012.5945.4	35	X21	7	
Brake fluid level sensor			X72	14	
Braking system pressure switch	0.012.1507.4	23	X58	18	
Cab roof work lights switch	0.012.5941.4	31	3	5-7	
Camshaft speed sensor (Pick-up)	0419.9792	22	B40	4	
CANBUS socket			CAN	12	
CB power connector			X40	11	
Cigar lighter	0441.2338		X8	6	
Clean Fix on/off switch			X16		Not utilised
Clock			X50	6	

Description	Code	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)	Notes
Clutch pedal depressed proximity sensor	0442.4165	18	X63	18	
Clutch pedal position sensor	0443.2708	14	X62	18	
Compressed air pressure gauge	0442.5709	7	X98	15-16	
Compressed air pressure gauge light			X97	15-16	
Diagnostics connector			X7	4-18	
Differential lock solenoid valve	0.010.2831.1	3	EV DF	19	
Door open alarm switch	0441.4097		X41	6	
Driver seated weight sensor			X12	18	
Engine control unit			MX1-MX2	4-12-18	
Engine coolant temperature sensor	0419.9809	21	B43	4	
Engine oil pressure switch	0118.1232		P	9	
Engine speed sensor	0.010.3293.1		ENGINE SPEED	18	
Engine start relay			X80	2-3	
Engine supercharge pressure sensor	0419.9552	20	B41	4	
Fan speed selector switch	010.2528.1		X106	13	
Four wheel drive (4WD) clutch solenoid valve	0443.1661	4	EV DT	19	
Front axle suspension Lower solenoid valve	0442.3803		S	17	
Front axle suspension position sensor	0439.1530	16	X33	17	
Front axle suspension Raise solenoid valve	0442.3803		H	17	
Front axle suspension Load Sensing solenoid valve	0442.3803		X34	17	
Front centre work light	2.8039.160.3		X88	7	
Front intermediate and centre work lights relay, main beam			X78	7	
Front L.H. intermediate work light	2.8039.160.3		X89	7	
Front L.H. outer work light	2.8039.160.3		X90	7	
Front L.H. work light	0442.5599.4		X46	5-7	
Front outer work lights relay, main beam			X79	7	
Front PTO button (in cab)	0.012.5951.4	40	X17	21	
Front PTO solenoid valve			FZW	21	
Front R.H. intermediate work light	2.8039.160.3		X87	7	
Front R.H. outer work light	2.8039.160.3		X86	7	
Front R.H. work light	0442.5599.4		X55	5-7	
Front screen wiper motor	0441.1868.4		X49	8	
Front screenwash pump	0441.4105		FP	8	
Front upper work lights relay, main beam			X45	7	
Front work lights fuse, main beam (F90-30A)			X76A	7	

Description	Code	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)	Notes
Fuel cutoff coil	0419.9902	2	Y1	4	
Fuel level sensor	0443.7945	12	X56	9	
Glowplug	0118.0898		X67	3	
Handbrake switch	0439.1395	5	X9	14-15-16	
Hazard lights control unit			X26	5	
Hazard warning lights switch	0.012.5944.4	34	X25	5	
Heater fans 3rd speed switch relay			X100	13	
Heater fans 4th speed switch relay			X101	13	
Heater power supply fuse (F99-30 Amp)			X5	13	
Horn	0116.9304		X91	5	
HPSA control unit	0.012.5955.4		HPSA ECU	4-12-14-17-18-19-20-21-22	
Hydraulic oil filter clogging pressure switch	0118.0413		VARIABLE PUMP	9	
Hydrostatic drive speed sensor	0.010.3291.2		HYDROSTATIC SPEED	18	
Infocenter (2)	0443.3422.4		ST1 - ST2	3-5-7-9-12-14-15-16	
Interior roof light	0441.2616		X42	6	
ISO4 socket (power supply to implements)	0442.2323.4		X1	12	
ISO7 socket (power supply to implements)	0442.2324.4		X3	12	
L.H. brake pedal switch	0439.1395	6	X61	14-15-16-19	
L.H. front loudspeaker	0.012.1725.0		X43	11	
L.H. headlamp	0.012.6138.0		X65	5-7	Europe
L.H. headlamp	0.012.6139.0		X65	5-7	UK
L.H. heater fan	010.2537.0		X103	13	
L.H. heater fan resistor	010.2535.1		X102	13	
L.H. rear lift Down button	0441.2688	9	DW (SX)	20	
L.H. rear lift Up button	0441.2688	9	UP (SX)	20	
L.H. rear loudspeaker	0.012.1726.0		X38	11	
L.H. rear PTO button (on fender)	0441.1533	24	PTO (SX)	21	
L.H. side-light and direction indicator	0441.1920.4		X47	5-7	
L.H. tail-light and direction indicator	0442.9833.4		X30 (SX)	5-14	
Lift control console	0.012.4489.4		X15	20	
Lift Down solenoid valve	2.3729.490.0		EV DW	20	
Lift Up solenoid valve	2.3729.490.0		EV UP	20	
Lights selector switch	0443.8656		AS4	5-7-8	
Lower work lights switch	0.012.5942.4	32	3A	7	
Number plate light	0441.4115		X32	5	
Power shift solenoid valves			EV GROUP	18	
Preheat control unit	0117.9712		X81-X82-X83	2-3	

Description	Code	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)	Notes
PTO AUTO button	0.012.5948.4	37	X23	21	
PTO brake solenoid valve	0.010.3140.2		PTO BRAKE	21	
PTO brake switch			X22	21	Not utilised
PTO ENABLE button	0.012.5949.4	38	X24	21	
R.H. brake pedal switch	0439.1395	6	X60	14-15-16-19	
R.H. front loudspeaker	0.012.1725.0		X54	11	
R.H. headlamp	0.012.6138.0		X64	5-7	Europe
R.H. headlamp	0.012.6139.0		X64	5-7	UK
R.H. heater fan	010.2535.0		X104	13	
R.H. heater fan resistor	010.2535.1		X105	13	
R.H. rear lift Down button	0441.2688	9	DW (DX)	20	
R.H. rear lift Up button	0441.2688	9	UP (DX)	20	
R.H. rear loudspeaker	0.012.1726.0		X35	11	
R.H. rear PTO button (on fender)	0441.1533	24	PTO (DX)	21	
R.H. side-light and direction indicator	0441.1921.4		X48	5-7	
R.H. tail-light and direction indicator	0442.9834.4		X30 (DX)	5-14	
Radar	0443.8654	10	RADAR	20	
	0443.8655	11	RADAR	20	UK
Radio (brown)			X52	11	
Radio (grey)			X51	11	
Rear L.H. lower work light	0442.4195.4		X29 (SX)	7	
Rear lift draft sensor (Left)	0440.2650	19	LEFT DRAFT	20	
Rear lift draft sensor (Right)	0440.2650	19	RIGHT DRAFT	20	
Rear lift position sensor	2.7099.740.0	15	POS	20	
Rear PTO button (in cab)	0.012.5950.4	39	X18	21	
Rear PTO solenoid valve	0.010.3140.2		EV PTO	21	
Rear PTO speed sensor	0.010.1214.4	29	PTO SEN	21	
Rear R.H. lower work light	0442.4195.4		X29 (DX)	7	
Rear screen wiper motor	0441.1868.4		X37	8	
Rear screen wiper switch	0.012.5946.4	36	X20	8	
Rear screenwash pump	0441.4105		RP	8	
Rear work lights switch	0.012.5954.4	41	X19	7	
Shuttle Lever	0.012.6472.4		X113	18	
Side console courtesy light			X53	6	
Side-lights switch	0.012.5940.4	30	1	5-6-7-8-11-13-15-16-21	
Starter motor	0118.0928		X70-X71	2-3	
Starter switch	0441.1512.4	42	X4	2-3	
Steering angle sensor	0441.5266		X73	19	
Steering circuit filter clogging pressure switch	2.7099.660.0/10	27	STEERING PUMP	9	
Trailer braking air pressure sensor	0.011.9428.0	17	X93	15-16	

Description	Code	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)	Notes
Trailer braking low pressure switch	2.7099.430.0	25	X95	15	
Trailer parking brake solenoid valve			X96	15	Italy version
Trailer socket (lights and auxiliary power)	0442.4116		X57	5-10-14-15-16	
Transmission control unit	0442.9917		TTV ECU	12-18	
Transmission display	0443.3421		X99	12-18	
Transmission oil filter clogging pressure switch	0441.6706	28	S4	18	
Transmission oil low pressure switch	0443.1690	8	S5	18	
Transmission speed sensor	0.010.3291.2		GEARBOX SPEED	18	
Work light, main beam			X36	7	
Work light, main beam			X39	7	

2.2 COMPONENT CODE INDEX

Code	Description	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)	Notes
0.010.1214.4	Rear PTO speed sensor	29	PTO SEN	21	
0.010.2831.1	Differential lock solenoid valve	3	EV DF	19	
0.010.3140.2	PTO brake solenoid valve		PTO BRAKE	21	
0.010.3140.2	Rear PTO solenoid valve		EV PTO	21	
0.010.3291.2	Transmission speed sensor		GEARBOX SPEED	18	
0.010.3291.2	Hydrostatic drive speed sensor		HYDROSTATIC SPEED	18	
0.010.3293.1	Engine speed sensor		ENGINE SPEED	18	
0.011.9428.0	Trailer braking air pressure sensor	17	X93	15-16	
0.012.1507.4	Braking system pressure switch	23	X58	18	
0.012.1725.0	R.H. front loudspeaker		X54	11	
0.012.1725.0	L.H. front loudspeaker		X43	11	
0.012.1726.0	R.H. rear loudspeaker		X35	11	
0.012.1726.0	L.H. rear loudspeaker		X38	11	
0.012.4462.4	Armrest		X14	12-18-20-21	4 solenoid-operated valves
0.012.4463.4	Armrest		X14	12-18-20-21	2 solenoid-operated valves
0.012.4489.4	Lift control console		X15	20	
0.012.5940.4	Side-lights switch	30	1	5-6-7-8-11-13-15-16-21	
0.012.5941.4	Cab roof work lights switch	31	3	5-7	
0.012.5942.4	Lower work lights switch	32	3A	7	
0.012.5943.4	50S lights switch	33	4	7	
0.012.5944.4	Hazard warning lights switch	34	X25	5	
0.012.5945.4	Beacon on/off switch	35	X21	7	
0.012.5946.4	Rear screen wiper switch	36	X20	8	
0.012.5948.4	PTO AUTO button	37	X23	21	
0.012.5949.4	PTO ENABLE button	38	X24	21	
0.012.5950.4	Rear PTO button (in cab)	39	X18	21	
0.012.5951.4	Front PTO button (in cab)	40	X17	21	
0.012.5954.4	Rear work lights switch	41	X19	7	

Code	Description	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)	Notes
0.012.5955.4	HPSA control unit		HPSA ECU	4-12-14-17-18-19-20-21-22	
0.012.6138.0	R.H. headlamp		X64	5-7	Europe
0.012.6138.0	L.H. headlamp		X65	5-7	Europe
0.012.6139.0	R.H. headlamp		X64	5-7	UK
0.012.6139.0	L.H. headlamp		X65	5-7	UK
0.012.6472.4	Shuttle Lever	43	X113	17	
010.2528.1	Fan speed selector switch		X106	13	
010.2532.0	Air conditioning on/off switch		X108	13	
010.2535.0	R.H. heater fan		X104	13	
010.2535.1	R.H. heater fan resistor		X105	13	
010.2535.1	L.H. heater fan resistor		X102	13	
010.2537.0	L.H. heater fan		X103	13	
010.2537.1	Air conditioning control thermostat		X109	13	
0114.3529	Auxiliary power socket		X2	10	
0116.9304	Horn		X91	5	
0117.8607	Alternator		PLUS-X74-X75	2-3-7-9-13	
0117.9712	Preheat control unit		X81-X82-X83	2-3	
0118.0413	Hydraulic oil filter clogging pressure switch		VARIABLE PUMP	9	
0118.0898	Glowplug		X67	3	
0118.0928	Starter motor		X70-X71	2-3	
0118.1232	Engine oil pressure switch		P	9	
0211.2684	Actuator	1	Y3	4	
0419.9552	Engine supercharge pressure sensor	20	B41	4	
0419.9792	Camshaft speed sensor (Pick-up)	22	B40	4	
0419.9809	Engine coolant temperature sensor	21	B43	4	
0419.9902	Fuel cutoff coil	2	Y1	4	
0439.1395	Handbrake switch	5	X9	14-15-16	
0439.1395	R.H. brake pedal switch	6	X60	14-15-16-19	
0439.1395	L.H. brake pedal switch	6	X61	14-15-16-19	
0439.1530	Front axle suspension position sensor	16	X33	17	
0440.0055	Air braking solenoid valve		X94	15-16	
0440.2650	Rear lift draft sensor (Right)	19	RIGHT DRAFT	20	

Code	Description	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)	Notes
0440.2650	Rear lift draft sensor (Left)	19	LEFT DRAFT	20	
0441.1512.4	Starter switch	42	X4	2-3	
0441.1533	R.H. rear PTO button (on fender)	24	PTO (DX)	21	
0441.1533	L.H. rear PTO button (on fender)	24	PTO (SX)	21	
0441.1868.4	Front screen wiper motor		X49	8	
0441.1868.4	Rear screen wiper motor		X37	8	
0441.1920.4	L.H. side-light and direction indicator		X47	5-7	
0441.1921.4	R.H. side-light and direction indicator		X48	5-7	
0441.2338	Cigar lighter		X8	6	
0441.2616	Interior roof light		X42	6	
0441.2688	R.H. rear lift Down button	9	DW (DX)	20	
0441.2688	L.H. rear lift Down button	9	DW (SX)	20	
0441.2688	R.H. rear lift Up button	9	UP (DX)	20	
0441.2688	L.H. rear lift Up button	9	UP (SX)	20	
0441.4097	Door open warning signal switch		X41	6	
0441.4105	Front screenwash pump		FP	8	
0441.4105	Rear screenwash pump		RP	8	
0441.4115	Number plate light		X32	5	
0441.4773	Beacon		X44	7	
0441.5266	Steering angle sensor		X73	19	
0441.6706	Transmission oil filter clogging pressure switch	28	S4	18	
0441.9015	Air cleaner clogging sensor		L	9	
0442.2323.4	ISO4 socket (power supply to implements)		X1	12	
0442.2324.4	ISO7 socket (power supply to implements)		X3	12	
0442.3803	Front axle suspension Lower solenoid valve		S	17	
0442.3803	Front axle suspension Load Sensing solenoid valve		X34	17	
0442.3803	Front axle suspension Raise solenoid valve		H	17	
0442.4116	Trailer socket (lights and auxiliary power)		X57	5-10-14-15-16	
0442.4165	Clutch pedal depressed proximity sensor	18	X63	18	

Code	Description	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)	Notes
0442.4195.4	Rear R.H. lower work light		X29 (DX)	7	
0442.4195.4	Rear L.H. lower work light		X29 (SX)	7	
0442.5599.4	Front R.H. work light		X55	5-7	
0442.5599.4	Front L.H. work light		X46	5-7	
0442.5709	Compressed air pressure gauge	7	X98	15-16	
0442.6490	Auxiliary air conditioning fan		X85	13	
0442.6492	Air conditioning compressor and auxiliary fan pressure switch	26	X66 - X84	13	
0442.9390	Accelerator pedal position sensor	13	X59	4-18	
0442.9833.4	L.H. tail-light and direction indicator		X30 (SX)	5-14	
0442.9834.4	R.H. tail-light and direction indicator		X30 (DX)	5-14	
0442.9917	Transmission control unit		TTV ECU	12-18	
0443.1661	Four wheel drive (4WD) clutch solenoid valve	4	EV DT	19	
0443.1690	Transmission oil low pressure switch	8	S5	18	
0443.2708	Clutch pedal position sensor	14	X62	18	
0443.3421	Transmission display		X99	12-18	
0443.3422.4	Infocenter		ST1 - ST2	3-5-7-9-12-14-15-16	
0443.7338	Air conditioning compressor		K	13	
0443.7945	Fuel level sensor	12	X56	9	
0443.8654	Radar	10	RADAR	20	
0443.8655	Radar	11	RADAR	20	UK
0443.8656	Lights selector switch		AS4	5-7-8	
2.3729.490.0	Lift Down solenoid valve		EV DW	20	
2.3729.490.0	Lift Up solenoid valve		EV UP	20	
2.3729.540.0	Auxiliary services spool valve N° 1		D1	22	
2.3729.540.0	Auxiliary services spool valve N° 2		D2	22	
2.7099.430.0	Trailer braking low pressure switch	25	X95	15	
2.7099.660.0/10	Steering circuit filter clogging pressure switch	27	STEERING PUMP	9	
2.7099.740.0	Rear lift position sensor	15	POS	20	
2.8039.160.3	Front centre work light		X88	7	
2.8039.160.3	Front R.H. outer work light		X86	7	
2.8039.160.3	Front L.H. outer work light		X90	7	

Code	Description	Technical (para. 3.2.xx)	Connector	System (para. 4.xx)	Notes
2.8039.160.3	Front R.H. intermediate work light		X87	7	
2.8039.160.3	Front L.H. intermediate work light		X89	7	

2.3 CONNECTOR INDEX

Connector	Type	Wiring code	Connection wiring or component code	Component description
1	27	0.012.5956.4	0.012.5940.4	Side-lights switch
3	27	0.012.5956.4	0.012.5941.4	Cab roof work lights switch
3A	27	0.012.5956.4	0.012.5942.4	Lower work lights switch
4	27	0.012.5956.4	0.012.5943.4	50S lights switch
AS1	25	0.012.5957.4	0.012.5956.4	
AS2	26	0.012.5957.4	0.012.5956.4	
AS3	17	0.012.5957.4	0.012.5956.4	
AS4	25	0.012.5957.4	0443.8656	Lights selector switch
AS5	21	0.012.5957.4	0.012.5958.4	
AS6	17	0.012.5957.4	0.012.5956.4	
B1		0419.9808		Not utilised
B6		0419.9808		Not utilised
B40		0419.9808	0419.9792	Camshaft speed sensor (Pick-up)
B41		0419.9808	0419.9552	Engine supercharge pressure sensor
B43		0419.9808	0419.9809	Engine coolant temperature sensor
CAN		0.012.5956.4		CANBUS socket
D1	32	0.012.5959.4	2.3729.540.0	Auxiliary services spool valve N° 1
D2	32	0.012.5959.4	2.3729.540.0	Auxiliary services spool valve N° 2
D3-D4	3	0.012.5959.4		Not utilised
DS1	25	0.012.5957.4	0443.7851	
DW (SX)	9	0.012.2010.4 0442.9835	0441.2688	L.H. rear lift Down button
DW (DX)	9	0.012.2010.4 0442.9835	0441.2688	R.H. rear lift Down button
ENGINE SPEED	6	0.012.5959.4	0.010.3293.1	Engine speed sensor
EV DF	10	0.012.5959.4	0.010.2831.1	Differential lock solenoid valve
EV DT	6	0.012.5959.4	0443.1661	Four wheel drive (4WD) clutch solenoid valve
EV DW	6	0.012.5959.4	2.3729.490.0	Lift Down solenoid valve
EV GROUP		0.012.5959.4		Power shift solenoid valves
EV PTO	10	0.012.5959.4	0.010.3140.2	Rear PTO solenoid valve
EV TRAILER	10	0.012.5959.4	0.012.6404.4 0443.6174	
EV UP	6	0.012.5959.4	2.3729.490.0	Lift Up solenoid valve

Connector	Type	Wiring code	Connection wiring or component code	Component description
FE2	14	0.012.5957.4	0.012.6061.4	
FP	10	0.012.5959.4	0441.4105	Front screenwash pump
FZW	10	0.012.6062.4		Front PTO solenoid valve
GEARBOX SPEED	3	0.012.5959.4	0.010.3291.2	Transmission speed sensor
H		0.012.6061.4	0442.3803	Front axle suspension Raise solenoid valve
HPSA ECU	35	0.012.5957.4	0.012.5955	HPSA control unit
HYDROSTATIC SPEED	3	0.012.5959.4	0.010.3291.2	Hydrostatic drive speed sensor
J1	23	0.012.5957.4	0441.9533	Relays/fuses control unit
J2	23	0.012.5957.4	0441.9533	Relays/fuses control unit
J3	23	0.012.5957.4	0441.9533	Relays/fuses control unit
K		0.012.6062.4	0443.7338	Air conditioning compressor
L		0.012.6062.4	0441.9015	Air cleaner clogging sensor
LEFT DRAFT	11	0.012.5959.4	0440.2650	Lift draft sensor (Left)
MS1	34	0.012.5957.4	0.012.6062.4	
MS2	3	0.012.5956.4	0.012.6062.4	
MX1	36	0.012.5957.4		Engine control unit
MX2	36	0.012.5957.4		Engine control unit
P	6	0.012.6062.4	0118.1232	Engine oil pressure switch
P1		0.012.5957.4	0441.9533	Relays/fuses control unit
P2	18	0.012.5957.4	0441.9533	Relays/fuses control unit
P3	20	0.012.5957.4	0441.9533	Relays/fuses control unit
P4		0.012.5957.4	0441.9533	Relays/fuses control unit
P5	20	0.012.5957.4	0441.9533	Relays/fuses control unit
P6	21	0.012.5957.4	0441.9533	Relays/fuses control unit
PLUS		0.012.6062.4	0117.8607	Alternator
POS	15	0.012.5959.4	2.7099.740.0	Rear lift position sensor
PTO (DX)	9	0.012.2010.4	0441.1533	R.H. rear PTO button (on fender)
		0442.9835		
PTO (SX)	9	0.012.2010.4	0441.1533	L.H. rear PTO button (on fender)
		0442.9835		
PTO BRAKE	10	0.012.5959.4	0.010.3140.2	PTO brake solenoid valve
PTO SEN	9	0.012.5959.4	0.010.1214.4	Rear PTO speed sensor
RADAR	11	0.012.5959.4	0443.8654	Radar
			0443.8655	Radar (UK)

Connector	Type	Wiring code	Connection wiring or component code	Component description
RIGHT DRAFT	11	0.012.5959.4	0440.2650	Lift draft sensor (Right)
RP	10	0.012.5959.4	0441.4105	Rear screenwash pump
S		0.012.6061.4	0442.3803	Front axle suspension Lower solenoid valve
S4	10	0.012.5959.4	0441.6707	Transmission oil filter clogging pressure switch
S5	10	0.012.5959.4	0443.1690	Transmission oil low pressure switch
ST1	28	0.012.5956.4	0443.3422.4	Infocenter (1)
ST2	29	0.012.5956.4	0443.3422.4	Infocenter (2)
STEERING PUMP		0.012.5959.4	2.7099.660.0/10	Steering circuit filter clogging pressure switch
T	6	0.012.6062.4		Engine coolant temperature sensor (Not utilised)
TKAB1	34	0.012.5957.4	0.012.5959.4	
TKAB2	34	0.012.5957.4	0.012.5959.4	
TKAB3		0.012.5957.4	0443.7846	
TRAILER PRESSURE	3	0.012.5959.4	0.012.6404.4	
			0443.6174/20	
TTV ECU	35	0.012.5957.4	0442.9917	Transmission control unit
UP (SX)	9	0.012.2010.4	0441.2688	L.H. rear lift Up button
		0442.9835		
UP (DX)	9	0.012.2010.4	0441.2688	R.H. rear lift Up button
		0442.9835		
VARIABLE PUMP		0.012.5959.4	0118.0413	Hydraulic oil filter clogging pressure switch
X1		0.012.5957.4	0442.2323.4	ISO4 socket (power supply to implements)
X2		0.012.5957.4	0114.3529	Auxiliary power socket
X3		0.012.5957.4	0442.2324.4	ISO7 socket (Connection of implements)
X4	19	0.012.5957.4	0441.1512.4	Starter switch
X5		0.012.5957.4		Heater power supply fuse (F99-30 Amp)
X6	1	0.012.5957.4		Auxiliary power connector (in cab)
X7	24	0.012.5957.4		Diagnostics connector
X8	1	0.012.5957.4	0441.2338	Cigar lighter
X9	22	0.012.5957.4	0439.1395	Handbrake switch
X10		0.012.5957.4	0.010.2562.2	
X11		0.012.5957.4	0.010.2562.2	

Connector	Type	Wiring code	Connection wiring or component code	Component description
X12	9	0.012.5957.4		Driver seated weight sensor
X13	1	0.012.5957.4		Air suspension seat compressor
X14		0.012.5957.4	0.012.4463.4	Armrest (2 solenoid operated valves)
			0.012.4462.4	Armrest (4 solenoid operated valves)
X15		0.012.5957.4	0.012.4489.4	Lift control console
X16	27	0.012.5957.4		Clean Fix on/off switch
X17	27	0.012.5957.4	0.012.5951.4	Front PTO button (in cab)
X18	27	0.012.5957.4	0.012.5950.4	Rear PTO button (in cab)
X19	27	0.012.5957.4	0.012.5954.4	Rear work lights switch
X20	27	0.012.5957.4	0.012.5946.4	Rear screen wiper switch
X21	27	0.012.5957.4	0.012.5945.4	Beacon on/off switch
X22	27	0.012.5957.4		PTO brake switch
X23	27	0.012.5957.4	0.012.5948.4	PTO AUTO button
X24	27	0.012.5957.4	0.012.5949.4	PTO ENABLE button
X25	27	0.012.5957.4	0.012.5944.4	Hazard warning lights switch
X26		0.012.5957.4		Hazard lights control unit
X27	30	0443.7846	0.012.2010.4	
			0442.9835	
X28	30	0443.7846	0.012.2010.4	
			0442.9835	
X29 (SX)		0.012.2010.4	0442.4195.4	Rear L.H. lower work light
		0442.9835		
X29 (DX)		0.012.2010.4	0442.4195.4	Rear R.H. lower work light
		0442.9835		
X30 (SX)		0.012.2010.4	0442.9833.4	L.H. tail-light and direction indicator
		0442.9835		
X30 (DX)		0.012.2010.4	0442.9834.4	R.H. tail-light and direction indicator
		0442.9835		
X31	10	0.012.2010.4	0.012.2018.4	
		0441.4114	0442.9835	
X32		0.012.2018.4	0441.4115	Number plate light
		0441.4114		
X33	11	0.012.6061.4	0439.1530	Front axle suspension position sensor
X34	6	0.012.6061.4	0442.3803	Front axle suspension Load Sensing solenoid valve

Connector	Type	Wiring code	Connection wiring or component code	Component description
X35		0443.7851	0.012.1726.0	R.H. rear loudspeaker
X36	1	0443.7851		Work light, main beam
X37		0443.7851	0441.1868.4	Rear screen wiper motor
X38		0443.7851	0.012.1726.0	L.H. rear loudspeaker
X39	1	0443.7851		Work light, main beam
X40	5	0443.7851		CB power connector
X41		0443.7851	0441.4097	Door open warning signal switch
X42		0443.7851	0441.2616	Interior roof light
X43	1	0443.7851	0.012.1725.0	L.H. front loudspeaker
X44		0443.7851	0441.4773	Beacon
X45		0443.7851		Front upper work lights relay, main beam
X46	4	0443.7851	0442.5599.4	Front L.H. work light
X47	4	0443.7851	0441.1920.4	L.H. side-light and direction indicator
X48	4	0443.7851	0441.1921.4	R.H. side-light and direction indicator
X49	5	0443.7851	0441.1868.4	Front screen wiper motor
X50	13	0443.7851		Clock
X51	12	0443.7851		Radio (grey)
X52	12	0443.7851		Radio (brown)
X53		0443.7851		Side console courtesy light
X54	1	0443.7851	0.012.1725.0	R.H. front loudspeaker
X55	4	0443.7851	0442.5599.4	Front R.H. work light
X56		0.012.5959.4	0443.7945	Fuel level sensor
X57		0.012.5959.4	0442.4116	Trailer socket (lights and auxiliary power)
X58		0.012.5959.4	0.012.1507.4	Braking system pressure switch
X59	15	0.012.5956.4	0442.9390	Accelerator pedal position sensor
X60	22	0.012.5956.4	0439.1395	R.H. brake pedal switch
X61	22	0.012.5956.4	0439.1395	L.H. brake pedal switch
X62	15	0.012.5956.4	0443.2708	Clutch pedal position sensor
X63	11	0.012.5956.4	0442.4165	Clutch pedal depressed proximity sensor
X64	2	0.012.6062.4	0.012.6138.0	R.H. headlamp (Europe)
			0.012.6139.0	R.H. headlamp (UK)
X65	2	0.012.6062.4	0.012.6138.0	L.H. headlamp (Europe)
			0.012.6139.0	L.H. headlamp (UK)
X66	10	0.012.6062.4	0442.6492	Compressor and condenser fan pressure switch

Connector	Type	Wiring code	Connection wiring or component code	Component description
X67		0.012.6062.4	0118.0898	Glowplug
X68		0.012.6062.4	0419.9808	
X69		0.012.6062.4		Steering system pressure switch
X70		0.012.6062.4	0118.0928	Starter motor
X71		0.012.6062.4	0118.0928	Starter motor
X72		0.012.6062.4		Brake fluid level sensor
X73	3	0.012.6062.4	0441.5266	Steering angle sensor
X74		0.012.6062.4	0117.8607	Alternator
X75		0.012.6062.4	0117.8607	Alternator
X76A		0.012.6062.4		Front work lights fuse, main beam (F90-30A)
X76B		0.012.6062.4		Auxiliary air conditioning fan fuse (F100-30A)
X77		0.012.6062.4		Auxiliary air conditioning fan switch relay
X78		0.012.6062.4		Front intermediate and centre work lights relay, main beam
X79		0.012.6062.4		Front outer work lights relay, main beam
X80		0.012.6062.4		Engine start relay
X81	8	0.012.6062.4	0117.9712	Preheat control unit
X82		0.012.6062.4	0117.9712	Preheat control unit
X83		0.012.6062.4	0117.9712	Preheat control unit
X84	10	0.012.6062.4	0442.6492	Compressor and condenser fan pressure switch
X85	1	0.012.6062.4	0442.6490	Auxiliary air conditioning fan
X86	10	0.012.6062.4	2.8039.160.3	Front R.H. outer work light
X87	10	0.012.6062.4	2.8039.160.3	Front R.H. intermediate work light
X88	10	0.012.6062.4	2.8039.160.3	Front centre work light
X89	10	0.012.6062.4	2.8039.160.3	Front L.H. intermediate work light
X90	10	0.012.6062.4	2.8039.160.3	Front L.H. outer work light
X91		0.012.6062.4	0116.9304	Horn
X92	9	0.012.6062.4		Not utilised
X93		0.012.6404.4	0.011.9428.0	Trailer braking air pressure sensor
		0443.6174		
X94	31	0.012.6404.4	0440.0055	Air braking solenoid valve
		0443.6174		
X95		0.012.6404.4	2.7099.430.0	Trailer braking low pressure switch
X96	7	0.012.6404.4		Trailer parking brake solenoid valve

Connector	Type	Wiring code	Connection wiring or component code	Component description
X97		0.012.5958.4		Compressed air pressure gauge light
X98		0.012.5958.4	0442.5709	Compressed air pressure gauge
X99		0.012.5958.4	0443.3421	Transmission display
X100		0.010.2562.2		Heater fans 3rd speed switch relay
X101		0.010.2562.2		Heater fans 4th speed switch relay
X102		0.010.2562.2	010.2535.1	L.H. heater fan resistor
X103		0.010.2562.2	010.2537.0	L.H. heater fan
X104		0.010.2562.2	010.2535.0	R.H. heater fan
X105		0.010.2562.2	010.2535.1	R.H. heater fan resistor
X106		0.010.2562.2	010.2528.1	Fan speed selector switch
X107		0.010.2562.2		Air conditioning power on and 1st speed switch relay
X108		0.010.2562.2	010.2532.0	Air conditioning on/off switch
X109		0.010.2562.2	010.2537.1	Air conditioning control thermostat
X110		0.010.2562.2		Air conditioning control panel light connector
X111		0443.8656		Not utilised
X112		0443.8656		Not utilised
X113	33	0443.8656	0.012.6472.4	Shuttle Lever
Y1		0419.9808	0419.9902	Fuel cutoff coil
Y3		0419.9808	0211.2684	Actuator

3. COMPONENTS

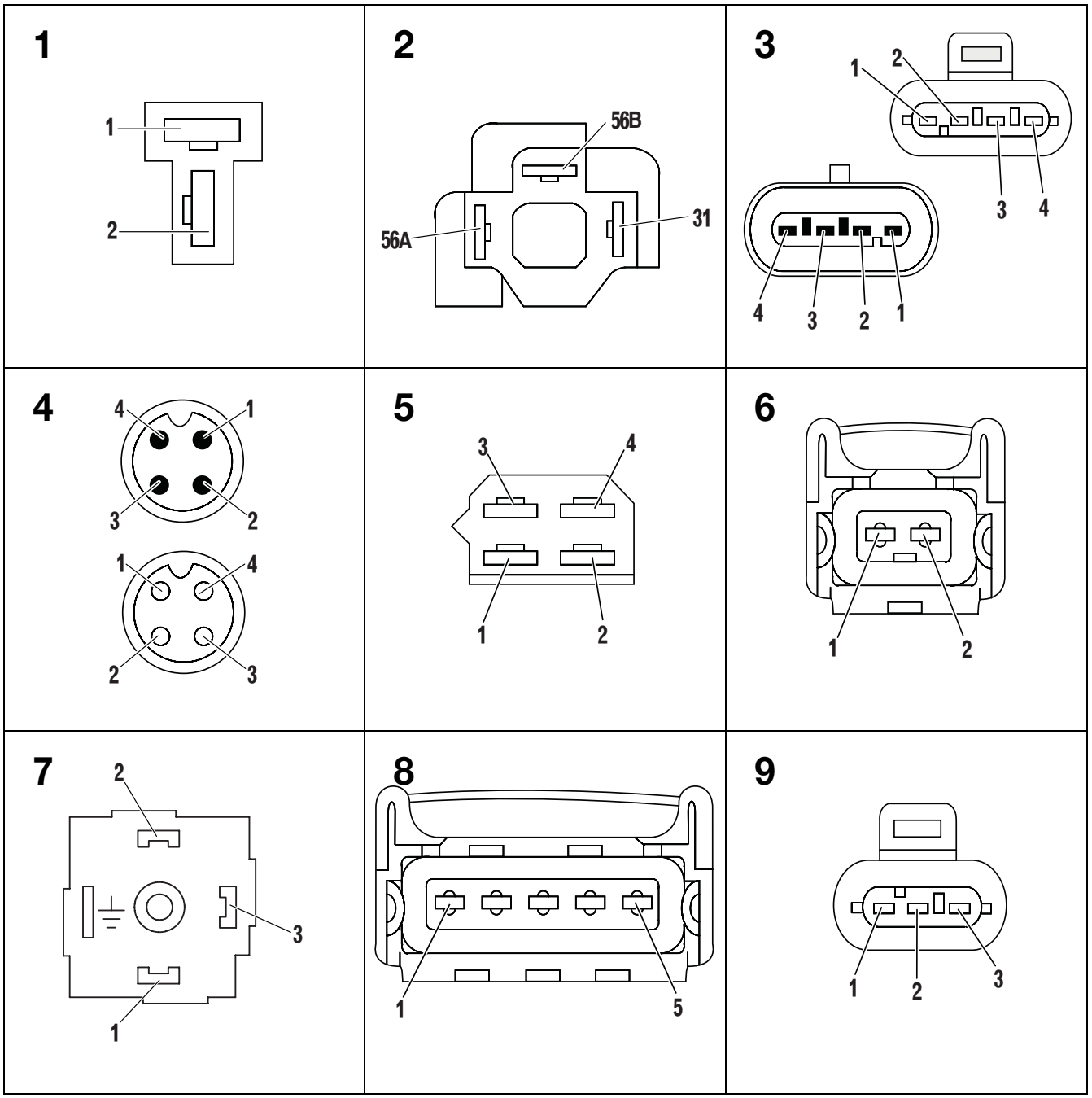
This chapter contains:

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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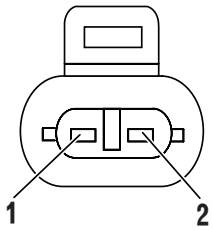

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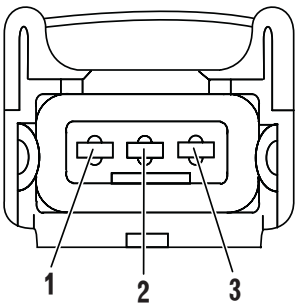

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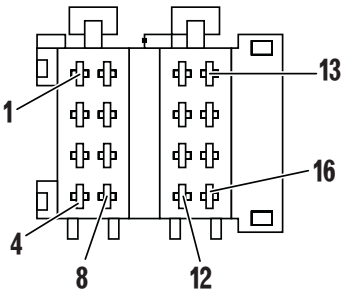

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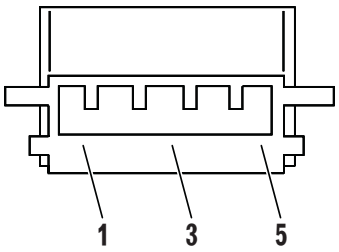

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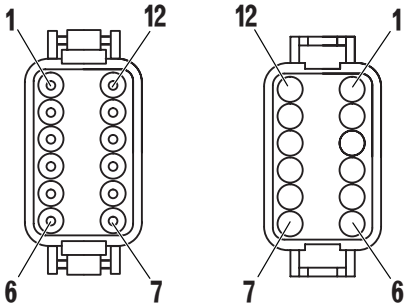

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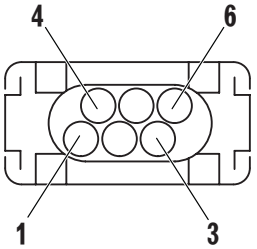

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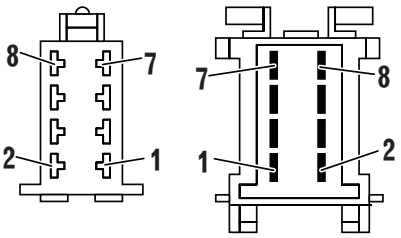

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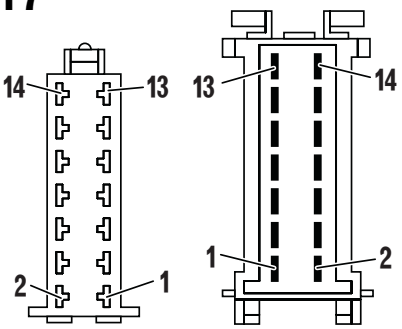

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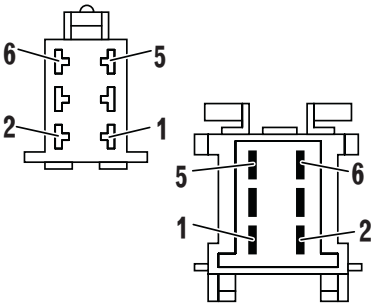

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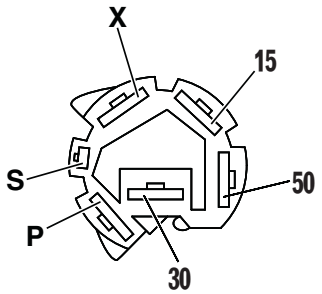

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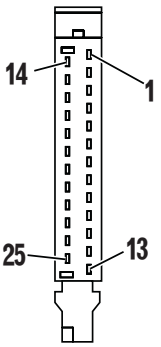

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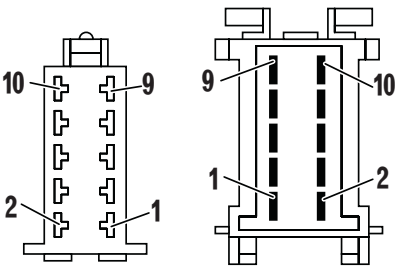

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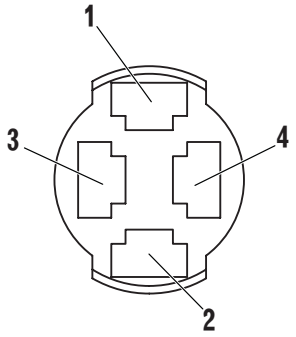

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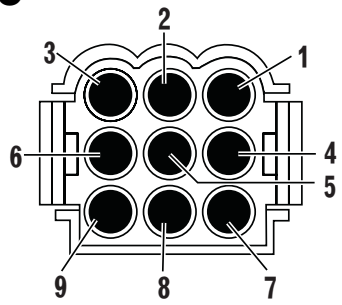

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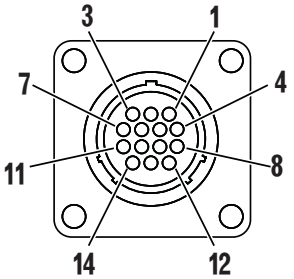

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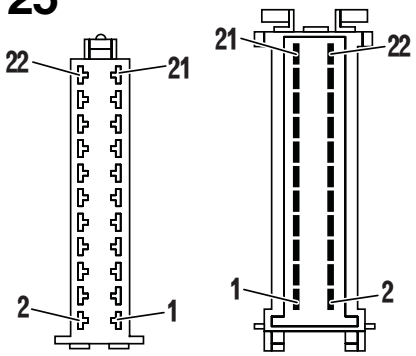

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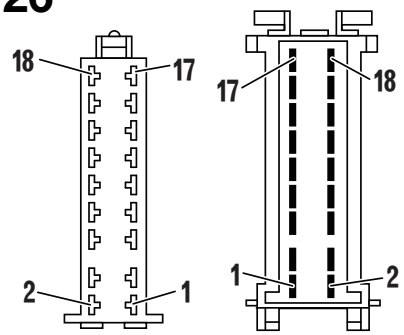

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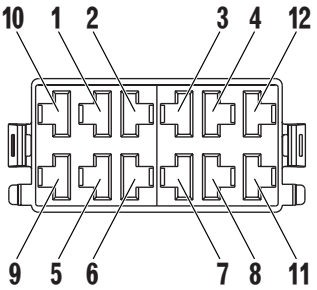

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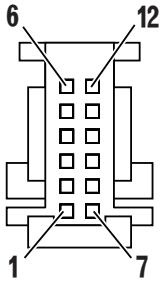

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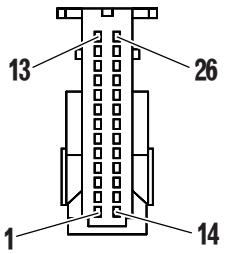

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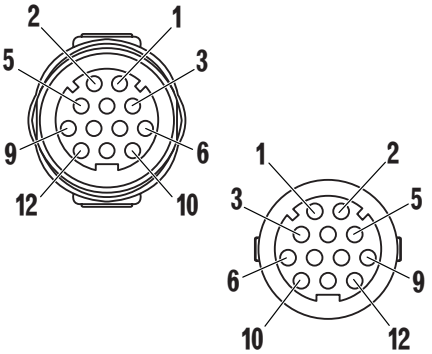

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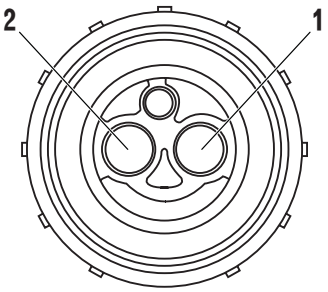

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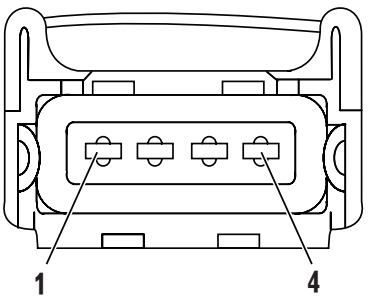

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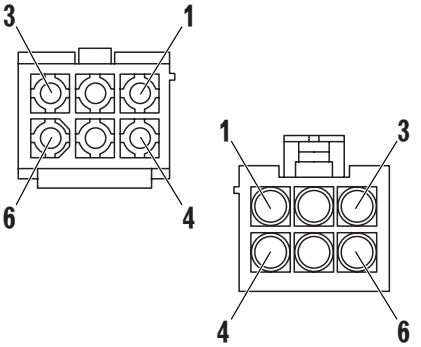

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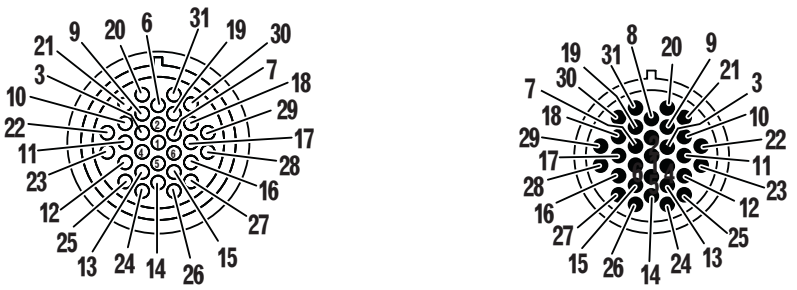
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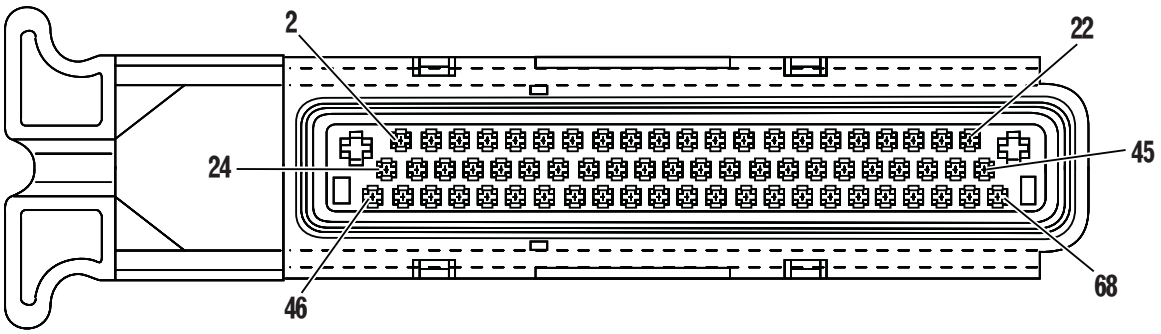
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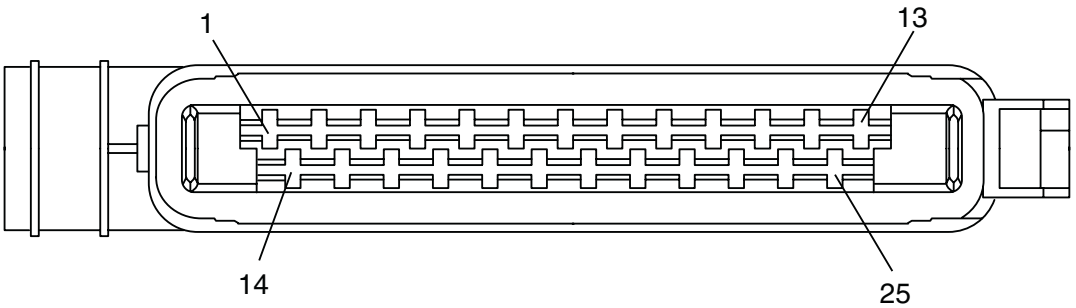
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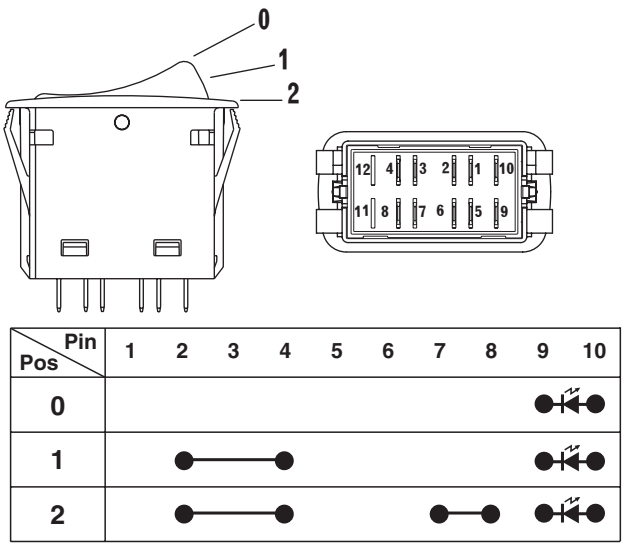
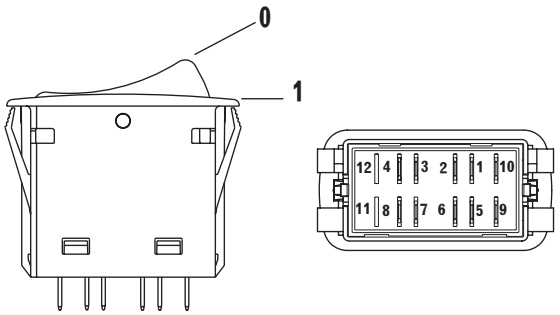
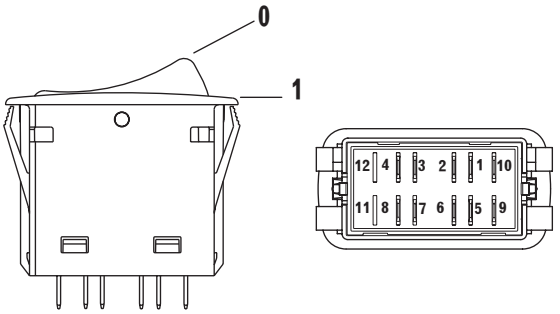
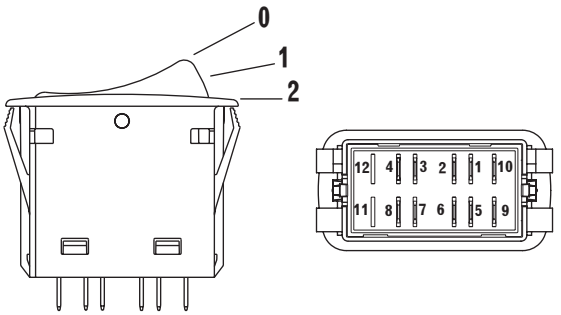
3.2 COMPONENT TECHNICAL DATA

N°	Description	Code	Characteristics	Notes
1	Actuator	0211.2684	Measured between pin 3 and pin 4: Resistance: 8 Ohm Inductance with engine off: 27 mH Inductance with engine at max rpm: 6mH Measured between pin 3 and pin 5: Resistance: 8 Ohm Inductance: 12 mH Measured between pin 1 and pin 2: Resistance: 8 Ohm Inductance: 8 mH	Y3
2	Fuel cutoff coil	0419.9902	Pin1 = earth Pin2 = 12V power Resistance between pin 1 and pin 2: 4 Ohm	Y1
3	Differential lock solenoid valve	0.010.2831.1	Pin1 = earth Pin2 = power Resistance between pin 1 and pin 2: 8 Ohm	EV DF
4	Four wheel drive clutch solenoid valve	0443.1661	Pin1 = earth Pin2 = power Resistance between pin 1 and pin 2: 10 Ohm	EV DT
5	Handbrake switch	0439.1395	Between Pin 1 and Pin 2: Normally closed switch (NC) Between Pin 3 and Pin 4: Normally open switch (NO)	X9
6	Brake pedal switch	0439.1395	Between Pin 1 and Pin 2: Normally closed switch (NC) Between Pin 3 and Pin 4: Normally open switch (NO)	X60 - X61
7	Compressed air pressure gauge	0442.5709	Pin G = input from sensor Pin + = 12V power Pin - = earth	X98
8	Transmission oil low pressure switch (Red)	0443.1690	Normally open (NO) pressure switch closing pressure 18 bar	S5
9	Rear lift button	0441.2688	Normally open switch (NO)	DW (SX)-DW (DX)- UP (SX)-UP (DX)
10	Radar	0443.8654	Pin1 = earth Pin2 = square wave signal (100 pulses per metre) Pin3 = 12V power	RADAR
11	Radar	0443.8655	Pin1 = earth Pin2 = square wave signal (100 pulses per metre) Pin3 = 12V power	RADAR
12	Fuel level sensor	0443.7945	Resistance with tank empty: 3-6 Ohm Resistance with tank full: 180-200 Ohm	X56
13	Accelerator pedal position sensor	0442.9390	Pin1 = 5.0V DC power Pin2 = earth Pin4 = analog signal 0,5V DC output (pedal fully released) 4.5V DC output (pedal fully depressed)	X59

N°	Description	Code	Characteristics	Notes
14	Clutch pedal position sensor	0443.2708	Pin1 = 5.0V DC power Pin2 = earth Pin4 = analog signal 0,5V DC output (pedal fully released) 4.5V DC output (pedal fully depressed)	X62
15	Rear lift position sensor	2.7099.740.0	Pin1 = earth Pin2 = 4.5-6.5V DC power (nominal 5.5V) Pin3 = analog signal 0.6V DC output (lift links fully Up) 4.5V DC output (lift links fully Down)	POS
16	Front axle suspension position sensor	0439.1530	Pin1 = earth Pin2 = analog signal Pin3 = 8V DC power 1.8 +0.1V output (cylinders fully retracted)	X33
17	Trailer braking air pressure sensor	0.011.9428.0	12V DC power Resistance at 0 bar 10-13 Ohm Resistance at 6 bar 119-129 Ohm	X93
18	Clutch pedal depressed proximity sensor	0442.4165	Pin1 = earth Pin2 = analog signal: 0 Volt with sensor covered by metal 12 Volt with sensor exposed Pin3 = 12V power	X63
19	Lift draft sensor	0440.2650	Pin1 = earth Pin2 = analog signal Pin3 = 8V power Signal with no implement hitched: 4V ± 0.2 V	RIGHT DRAFT LEFT DRAFT
20	Engine supercharge pressure sensor	0419.9552	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 Input voltage: 5V DC Output voltage at 1083 mbar: ~ 1.083 V	B41
21	Engine coolant temperature sensor	0419.9809	Resistance at 21.5 °C: ~2,3 kOhm	B43
22	Camshaft speed sensor (Pick-up)	0419.9792	Resistance: 310 Ohm Inductance: 140mH Peak voltage: 40mV	B40
23	Braking system pressure switch	0.012.1507.4	Pin1 = 5.0V DC power Pin2 = earth Pin3 = analog signal 0.5V DC output (0 bar) 4.5V DC output (40 bar)	X58
24	Rear PTO button (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 (L.H.)	PTO (DX)
25	Trailer braking low pressure switch	2.7099.430.0	Normally open switch	X95

N°	Description	Code	Characteristics	Notes
26	Air conditioning compressor and auxiliary fan pressure switch	0442.6492	Connector X66: normally open contact - with pressure increasing: contact closed at 2.4 bar max contact open at 28.5±1.5 bar - with pressure decreasing: contact closed at 19.5±1.5 bar contact open at 1.2±0.3 bar Connector X84: normally open contact - with pressure increasing: contact closed at 20±1 bar - with pressure decreasing: contact open at 16±1 bar	X66 - X84
27	Steering circuit filter clogging pressure switch	2.7099.660.0/10	Normally open switch	STEERING PUMP
28	Hydraulic oil filter clogging pressure switch	0441.6706	Normally closed (NC) pressure switch opening pressure 12 bar	S4
29	Rear PTO speed sensor	0.010.1214.4	Pin1 = earth Pin2 = analog signal: 0 Volt with sensor covered by metal 12 Volt with sensor exposed Pin3 = 12V power	PTO SEN
30	Side-lights switch	0.012.5940.4		1

N°	Description	Code	Characteristics	Notes
31	Cab roof work lights switch	0.012.5941.4	 Pin / Pos: 1 2 3 4 5 6 7 8 9 10 0: ● ● ● ● 1: ● ● ● ●	3
32	Lower work lights switch	0.012.5942.4	 Pin / Pos: 1 2 3 4 5 6 7 8 9 10 0: ● ● ● 1: ● ● ● ●	3A
33	50S lights switch	0.012.5943.4	 Pin / Pos: 1 2 3 4 5 6 7 8 9 10 0: ● ● ● ● ● 1: ● ● ● ● ● ● 2: ● ● ● ● ● ●	4

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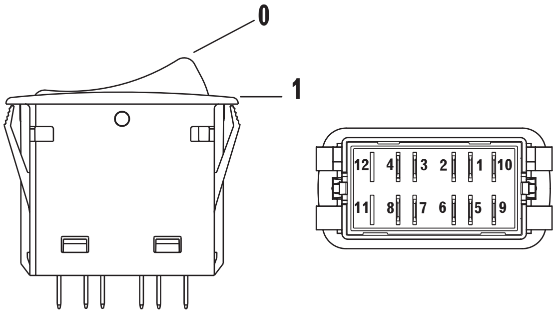

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<tr><td>1</td><td></td><td>●—</td><td>—</td><td>—●</td><td></td><td>●—</td><td>—</td><td>—●</td><td>●—LED</td><td>—●</td></tr>
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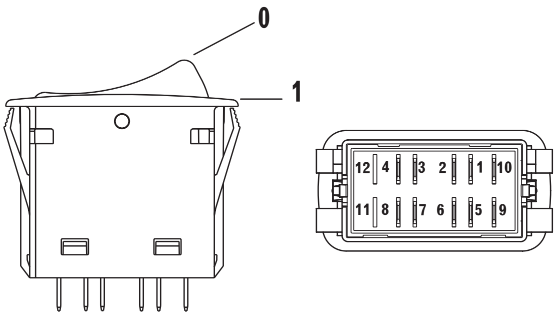

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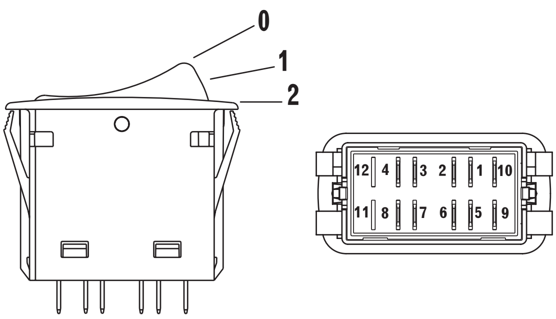

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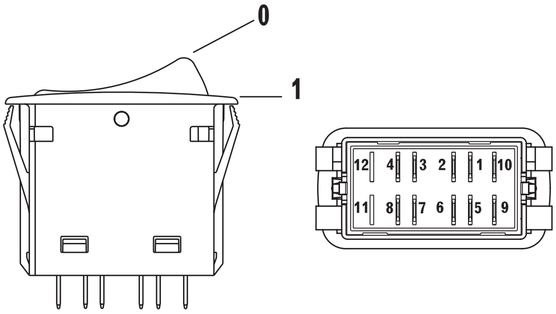
<tr><td>37</td><td>PTO AUTO button</td><td>0.012.5948.4</td><td> 

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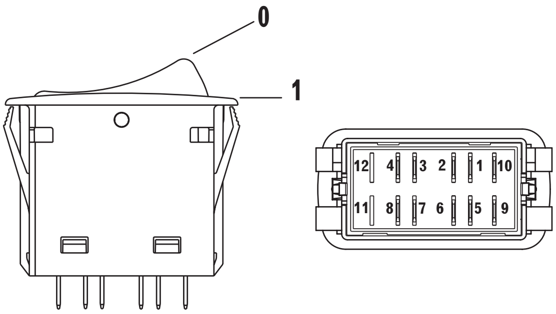
<tr><td>38</td><td>PTO ENABLE button</td><td>0.012.5949.4</td><td> 

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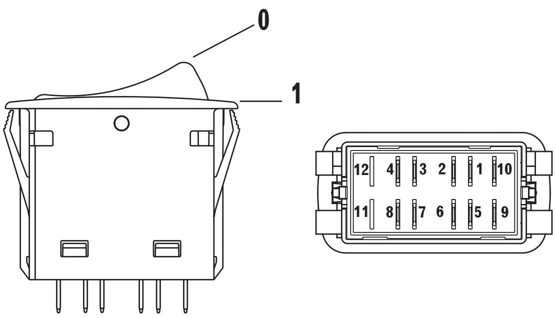
<tr><td>39</td><td>Rear PTO button
(in cab)</td><td>0.012.5950.4</td><td> 

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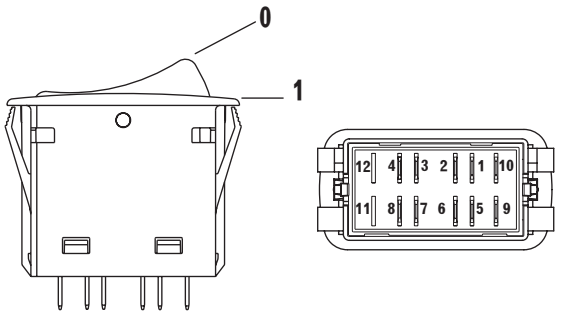
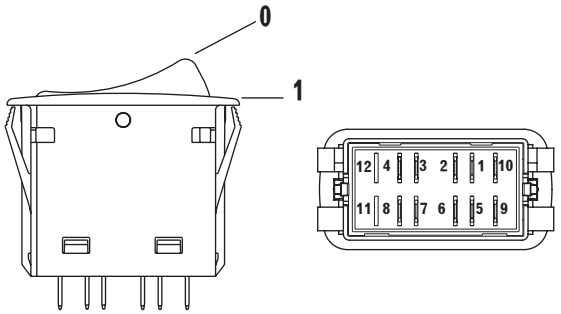
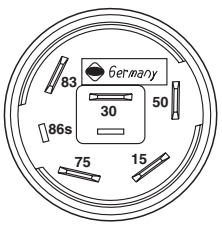
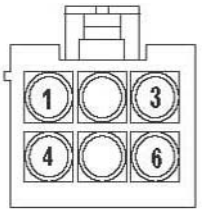
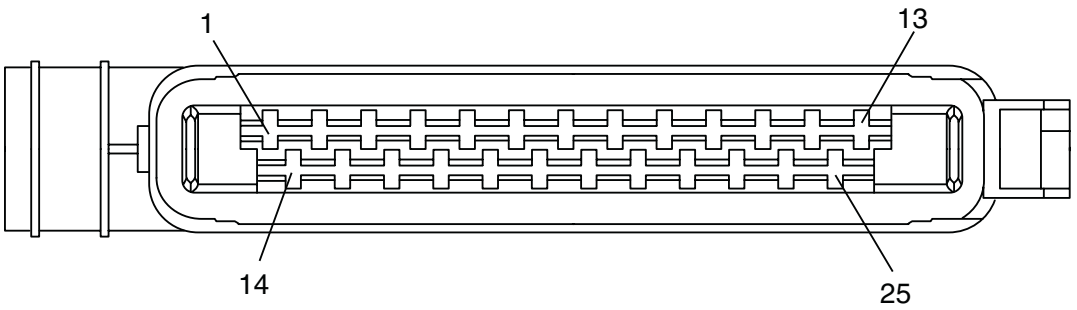
N°	Description	Code	Characteristics	Notes
40	Front PTO button (in cab)	0.012.5951.4	 Pin / Pos: 1 2 3 4 5 6 7 8 9 10 0: ●—● 1: ○—○ ●—●	X17
41	Rear work lights switch	0.012.5954.4	 Pin / Pos: 1 2 3 4 5 6 7 8 9 10 0: ●—● 1: ●—●	X19
42	Starter switch	0441.1512.4	 Pin / Pos: 30 15 50 75 83 0: ●—● 1: ●—●—● 2: ○—○—○	X4

N°	Description	Code	Characteristics	Notes
43	Shuttle Lever	0.012.6472.4	 Pin / Pos: 1 2 3 4 5 6 **Forward** ● — ● (3–1) **Neutral** ● — ● (4–3) **Reverse** ● — ● (4–1) **NOTE:** In every position the resistance must be 3.9 Ohm	

3.3 PINOUTS AND DESCRIPTIONS OF ELECTRONIC CONTROL UNITS

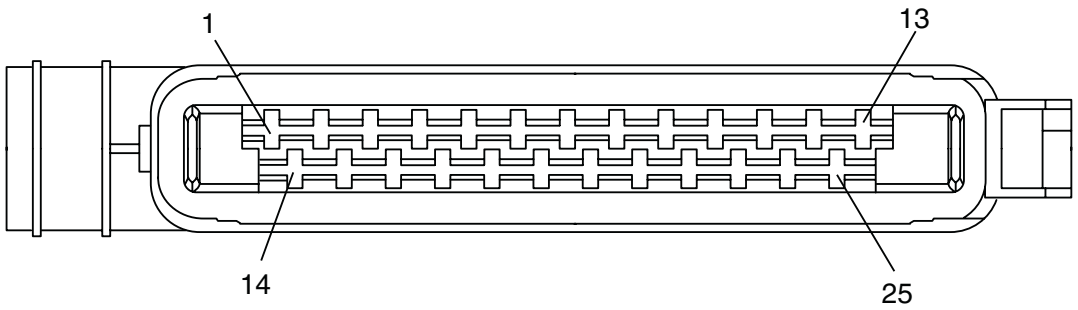
3.3.1 ENGINE CONTROL UNIT

CONNECTOR MX1



Pin	Volts	Code	Description
1			Not utilised
2			Digital output, cutoff solenoid
3			Not utilised
4			Not utilised
5			Not utilised
6			Not utilised
7			Not utilised
8	0V	GND	Reference voltage for signal on pin 9
9			Analog input, engine coolant temperature sensor
10	0V	GND	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 to actuator solenoid
15		STG+	PWM output, signal to actuator solenoid
16			Screen shielding rack position sensor (for pins 17, 18 and 19)
17		RF-	Common connection for measurement and reference coils
18		RF REF	Analog input, reference coil signal
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, supercharge air pressure sensor signal
25	+5V	+5V LDA	+5V reference voltage for signal on pin 24

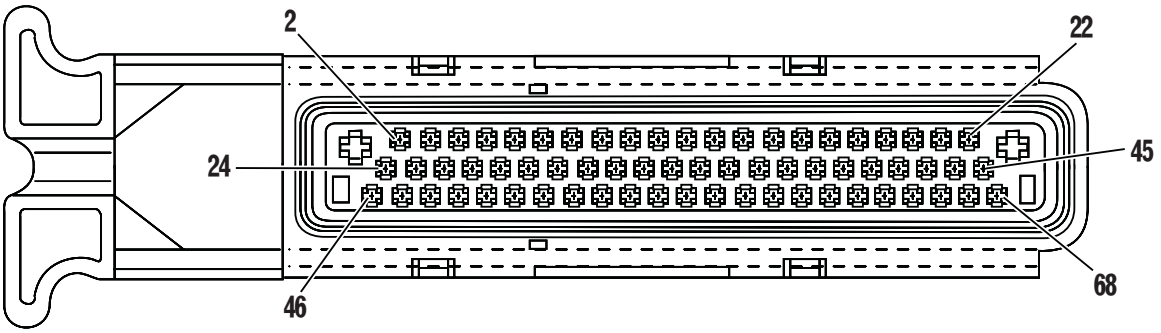
CONNECTOR MX2



Pin	Volts	Code	Description
1	0V	+31	Battery negative
2	0V	+31	Battery negative
3			Not utilised
4			Not utilised
5			Not utilised
6			Not utilised
7			Not utilised
8			Not utilised
9			Not utilised
10		L	ISO 9141 serial interface (Diagnostics connector)
11		K	ISO 9141 serial interface (Diagnostics connector)
12		CAN_H	CAN_H
13		CAN_L	CAN_L
14	+12V	+15	Battery positive (15+)
15			Not utilised
16			Not utilised
17			Not utilised
18			Not utilised
19			Not utilised
20			Not utilised
21			Not utilised
22			Not utilised
23	0V	GND	Reference voltage for signal on pin 24
24			Analog input, accelerator pedal sensor signal (SWG)
25	+5V	+5V REF	+5V reference voltage for signal on pin 24

3.3.2 TRANSMISSION CONTROL UNIT

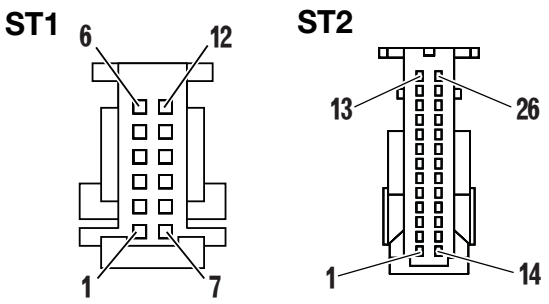
CONNECTOR TTV ECU



Pin	Volts	Code	Description
1	0V	VM1	Battery negative
2	0V	VM2	Battery negative
3		VMG1	Earth for sensors
4		VMG2	Earth for sensors
5		ADM4	Power input to solenoid valve K4
6			Not utilised
7			Not utilised
8		VPS2	Power common, solenoid valves BG, K1, K2, K3, KR
9			Not utilised
10		AIP2	Power - solenoid valve Y2
11		ADM6	Power input to solenoid valve K1
12		VPS1	Power common, solenoid valves Y1, Y2
13		VPS1	Power common, solenoid valves Y1, Y2
14			Not utilised
15		SDDK	Diagnostics connector
16		EF5	Input, transmission output speed sensor
17		EF7	Input, hydrostatic drive output speed sensor
18			Not utilised
19		EF1	Input, crankshaft speed sensor (on transmission)
20			Not utilised
21		ED10	Digital input, transmission oil filter clogging sensor pressure switch
22		ED7	Input, clutch pedal position sensor
23	+12V	VPE1	Battery positive (30+)
24		VMGA1	HPSA control unit earth
25		CANF-H	CAN_H
26		CANF-L	CAN_L
27		CANF-T	CAN_RES
28			Not utilised
29			Not utilised
30			Not utilised
31			Not utilised
32			Not utilised

Pin	Volts	Code	Description
33		ADM8	Power input to solenoid valve K3
34		ADM7	Power input to solenoid valve K2
35			Not utilised
36			Not utilised
37			Not utilised
38		EU1	Input, forward-reverse drive
39		ER1	Analog input, transmission temperature sensor
40		EF6	Input, hydrostatic drive speed sensor
41			Not utilised
42			Not utilised
43			Not utilised
44			Not utilised
45	+12V	VPI	Battery positive (15+)
46		VMGA2	Power input to transmission temperature sensor
47			Not utilised
48			Not utilised
49			Not utilised
50		AIP7	Power input to solenoid valve KV
51			Not utilised
52			Not utilised
53		VPS2	Power common, solenoid valves BG, K1, K2, K3, KR
54		AIP8	Power input to solenoid valve KR
55			Not utilised
56		AIP1	Power - solenoid valve Y1
57		ADM5	Power input to solenoid valve BG
58			Not utilised
59			Not utilised
60			Not utilised
61			Not utilised
62		EF4	Input, transmission output speed sensor
63			Not utilised
64			Not utilised
65			Not utilised
66		ED9	Digital input, transmission oil filter low pressure switch
67			Not utilised
68	+12V	VPE2	Battery positive (30+)

3.3.3 INFOCENTER 2 AND 3



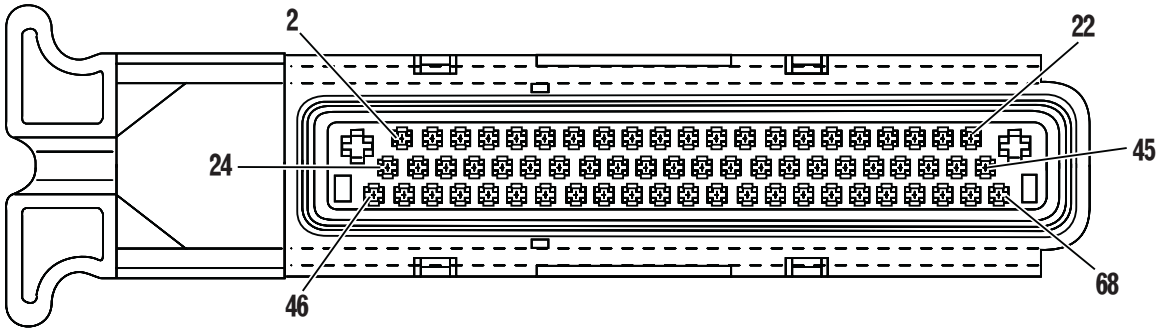
CONNECTOR ST1			
Pin	**Volts**	**Code**	**Description**
1			Not utilised
2		KL 49	KL 49
3		RA	Relay-output, 9A current carrying capacity
4			Not utilised
5		KL 49A	Connected voltage of turn signal relay
6		KL49 A	Connected voltage of turn signal relay
7		LA	Relay-output, 9A current carrying capacity
8		LA	Relay-output, 9A current carrying capacity
9		KL49 B	Lamp output, 12V 1.5W
10		KL49 A	Connected voltage of turn signal relay
11		KL49 A	Connected voltage of turn signal relay
12		RA	Relay-output, 9A current carrying capacity

CONNECTOR ST2			
Pin	**Volts**	**Code**	**Description**
1		BLINK2	2nd trailer flasher indicator light
2		BLINK1	1st trailer flasher indicator light
3		BL_IN_LI	Input, L.H. arrow signal
4		BL_IN_RE	Input, R.H. arrow signal
5	0V	KL31	Battery negative
6	+12V	KL 58	+58 lights
7		LADEK	Battery charging indicator light
8		LUFTF	Air cleaner clogged
9		ÖLDRUCK	Engine oil pressure warning light
10		TRAILER	Input, trailer braking indicator light
11		CAN_RES	CAN_RES
12	+12V	KL15	Battery positive (15+)
13		TANK	Input, fuel level sensor
14		CAN_H	CAN_H
15		CAN_L	CAN_L
16		FERNL	Main beam indicator light

17		HYDR	Hydraulic system oil filter clogged
18		HANDBR	Handbrake on warning light
19		VORGL	Glowplugs test
20		RXD	Diagnostic interface reception
21	+12V	KL30	Battery positive (30+)
22		TXD	Diagnostics interface transmission
23		ESCERA	Input to ESC button
24		RETMEN	Input to RET button
25		MEN+	Input to M+ button
26		MEN-	Input to M- button

3.3.4 HPSA CONTROL UNIT

CONNECTOR HPSA ECU



Pin	Volts	Code	Description
1	0V	GND	Battery negative
2	0V	GND	Battery negative
3		A_IN1	Input, accelerator pedal position sensor
4		A_IN5	Analog input, forward drive
5		A_IN6	Analog input, reverse drive
6		A_IN8	Analog input, axle suspension position sensor
7		A_IN13	Analog input, forward-reverse drive (from armrest)
8		A_IN14	Power input to spool valve N°3
9		SA2	Digital input, steering sensor N°2
10		SA1	Digital input, steering sensor N°1
11		ELB	Digital input, lift Down button
12			Not utilised
13			Not utilised
14			Not utilised
15		RPTOSPC	Input, rear PTO speed sensor
16		MONOUT	ISO11786 Monitor out signal
17		RADAROUT	ISO11786 Radar speed signal
18		PWM1	Power input to spool valve N°1
19			Not utilised
20		DL	Power input to differential lock solenoid valve
21		SUSL	Power input front axle Down solenoid valve
22		FPTO	Power input to front PTO solenoid valve
23	+12V	+12V	Battery positive (15+)
24	0V	GND	GND Power
25			Not utilised
26			Not utilised
27	+8V	+8V	Power input to sensors (+8V)
28	+5V	+5V	Power input to sensors (+5V)
29		9141K	ISO 9141 K serial interface

Pin	Volts	Code	Description
30		CAN_H	CAN_H
31		CAN_L	CAN_L
32			Not utilised
33	0V	GND	Earth for external sensors
34	0V	GND	Earth for external sensors
35		CFG0	Digital input, rear PTO button
36		CFG1	Digital input, brake fluid level
37		CFG2	Digital input, Rear PTO brake button
38		PTOSPD	Rear PTO output speed
39		LINKAGE	Signal output, lift draft sensors
40	0V	GND	Earth for external sensors
41		4WDRELAIY	Power input to solenoid valve 4WD
42		SPARED02A2	Power input to rear PTO brake solenoid valve
43	0V	COM_PWM	Earth, power supply to lift solenoid valves
44	+12V	+12V	Battery positive (15+)
45	+12V	+12V	Battery positive (15+)
46		A_IN2	Analog input, clutch pedal position sensor
47		A_IN3	Analog input, driver seated weight sensor
48		A_IN4	Analog input, lift position sensor
49		A_IN7	Analog input, transmission neutral
50		A_IN9	Analog input, external lift sensor
51		A_IN10	Analog input, R.H. draft sensor
52		A_IN11	Analog input, L.H. draft sensor
53		A_IN12	Analog input, braking pressure
54		PWM4	Power input to spool valve N°4
55		ERB	Digital input, lift Up button
56		BLIT	Digital input, brake lights
57		LBRK	Digital input, L.H. brake pedal
58		RBRK	Digital input, R.H. brake pedal
59		RADAR	Input, actual ground speed (radar)
60		INDSPD	Wheel speed output
61		FNROUT	Analog output, forward-reverse direction
62		PWM2	Power input to spool valve N°2
63			Not utilised
64		SUSLD	Power input to front axle suspension Load Sensing solenoid valve
65		SUSR	Power input to front axle Up solenoid valve
66		RPTO	Power input to rear PTO solenoid valve
67		HL	Power input to lift Down solenoid valve
68		HR	Power input to lift Up solenoid valve

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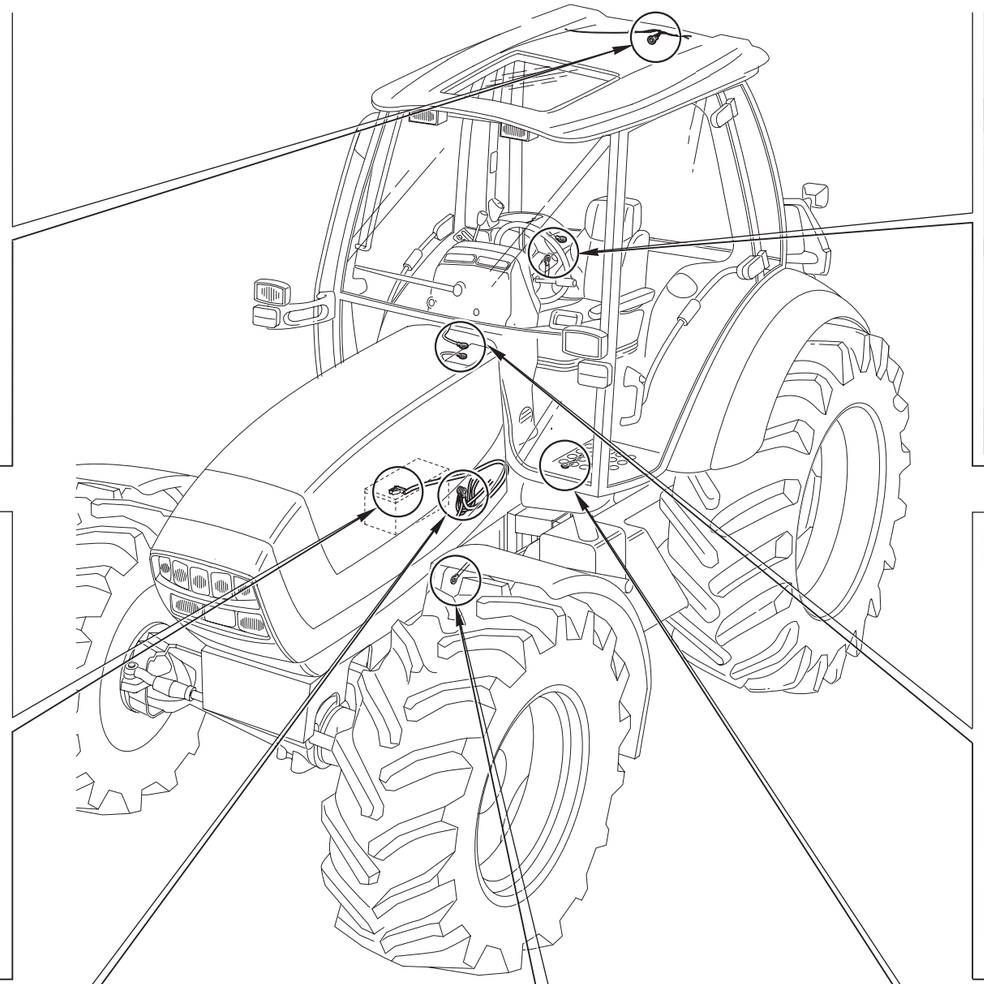
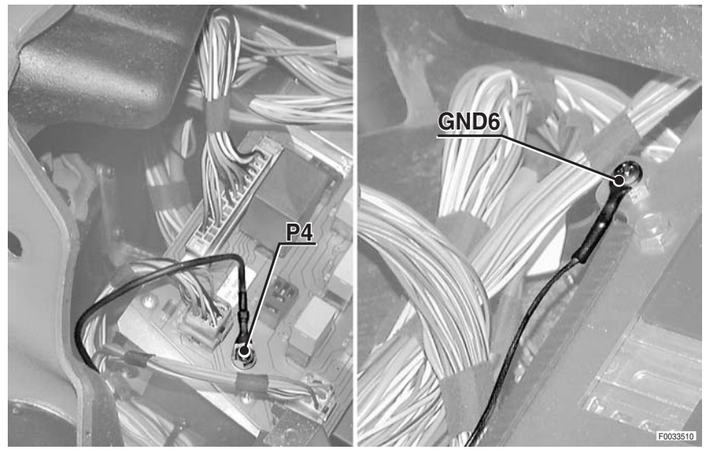
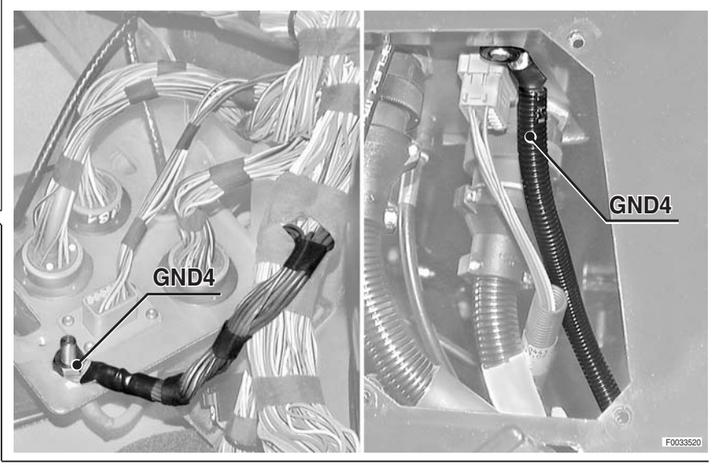
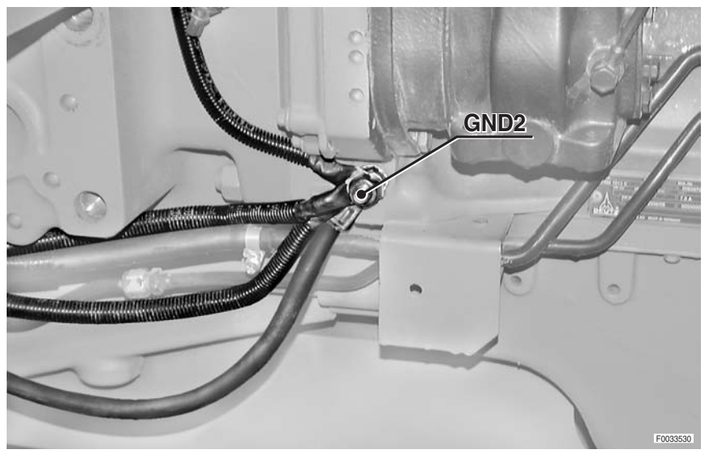
4. SYSTEMS

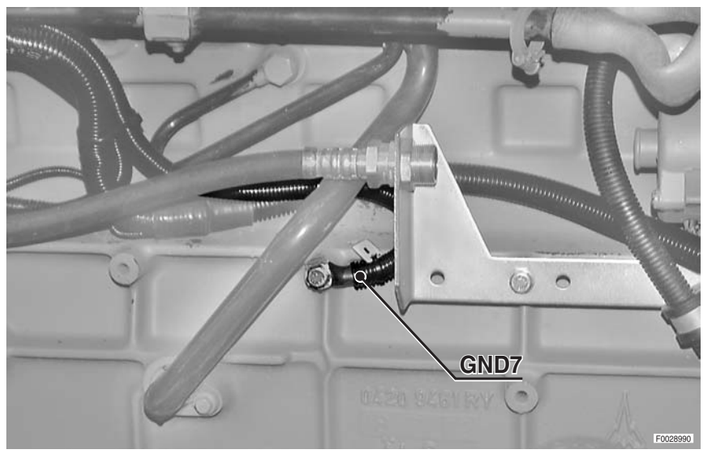
4.1 GROUND POINTS

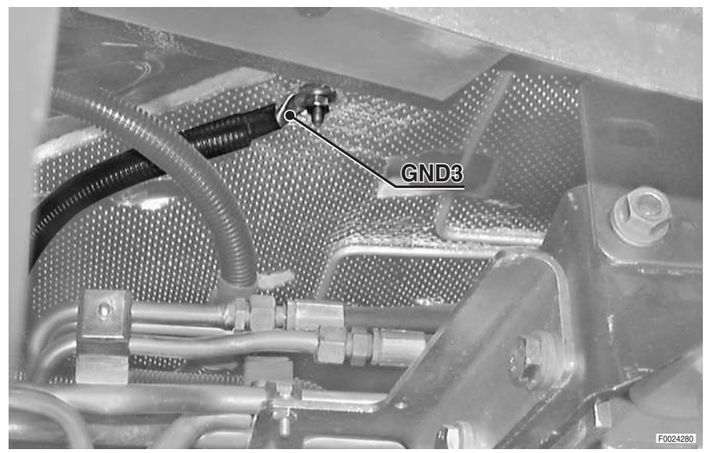




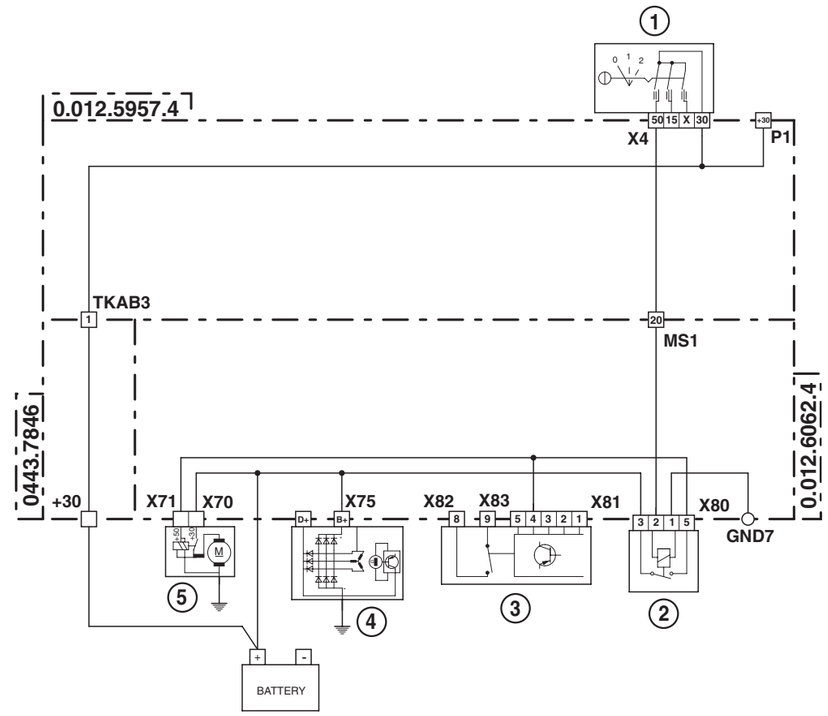






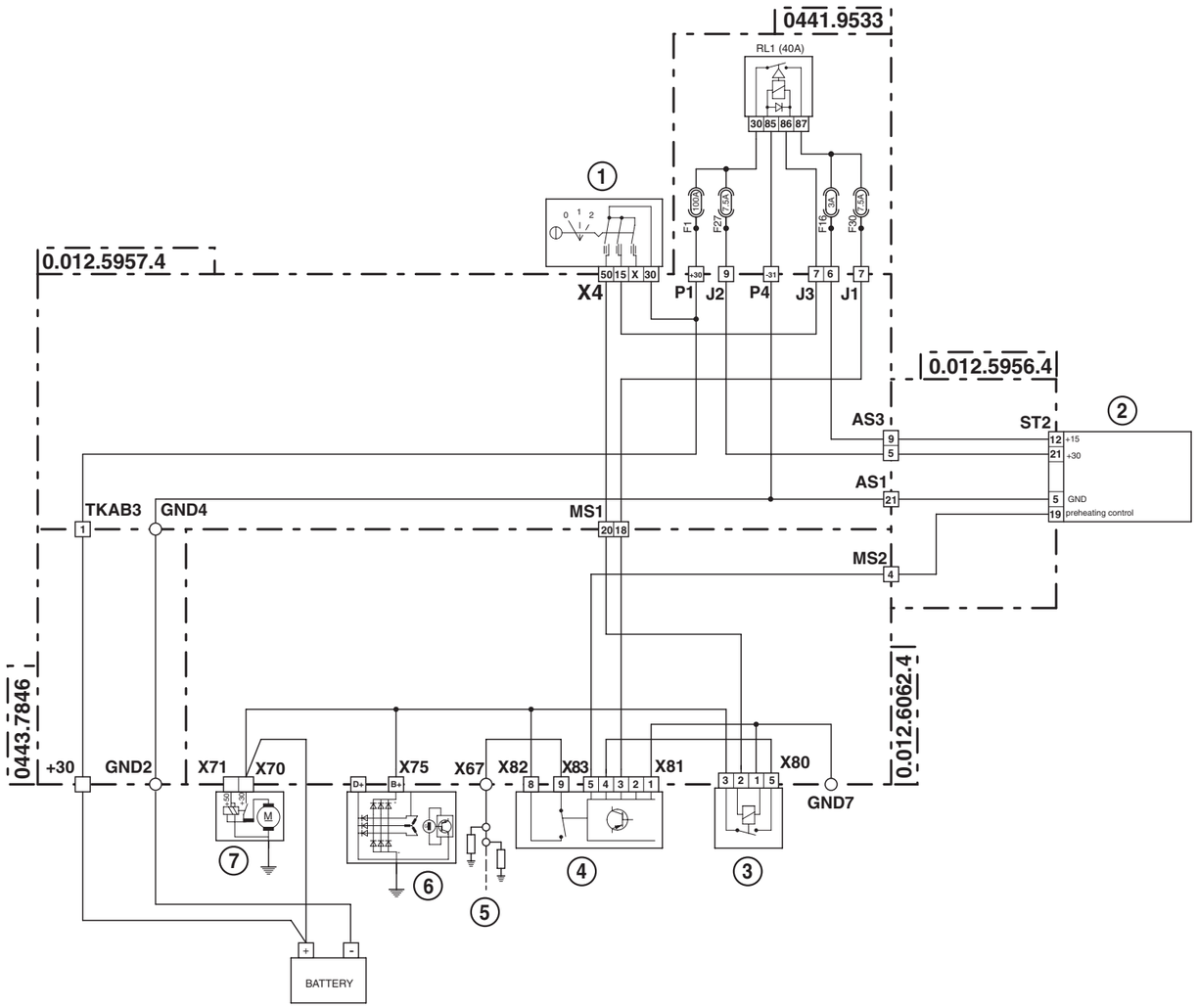


4.2 ENGINE START



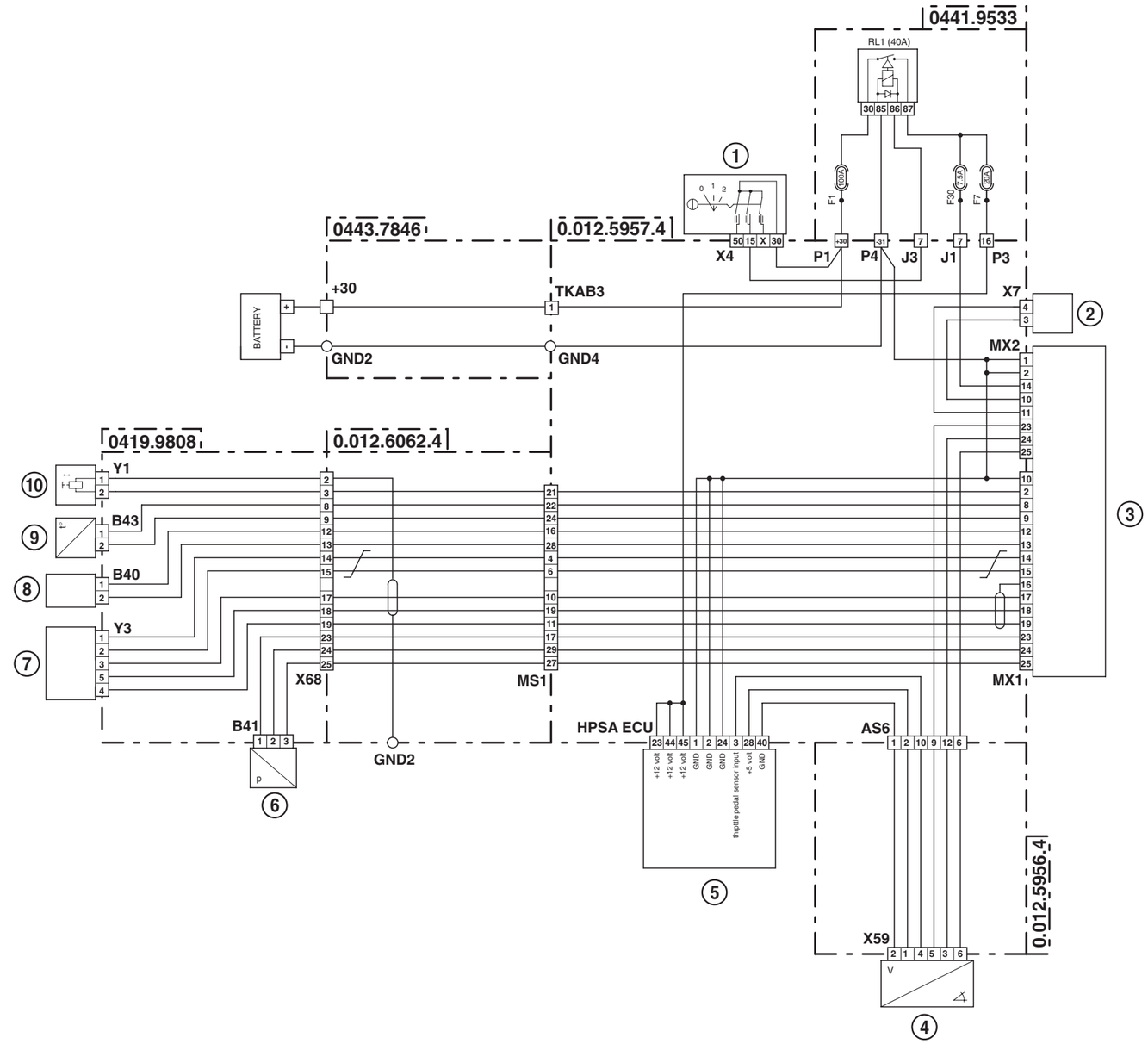
1 Starter switch
2 Engine start relay
3 Preheat control unit
4 Alternator
5 Starter motor

4.3 PREHEATING



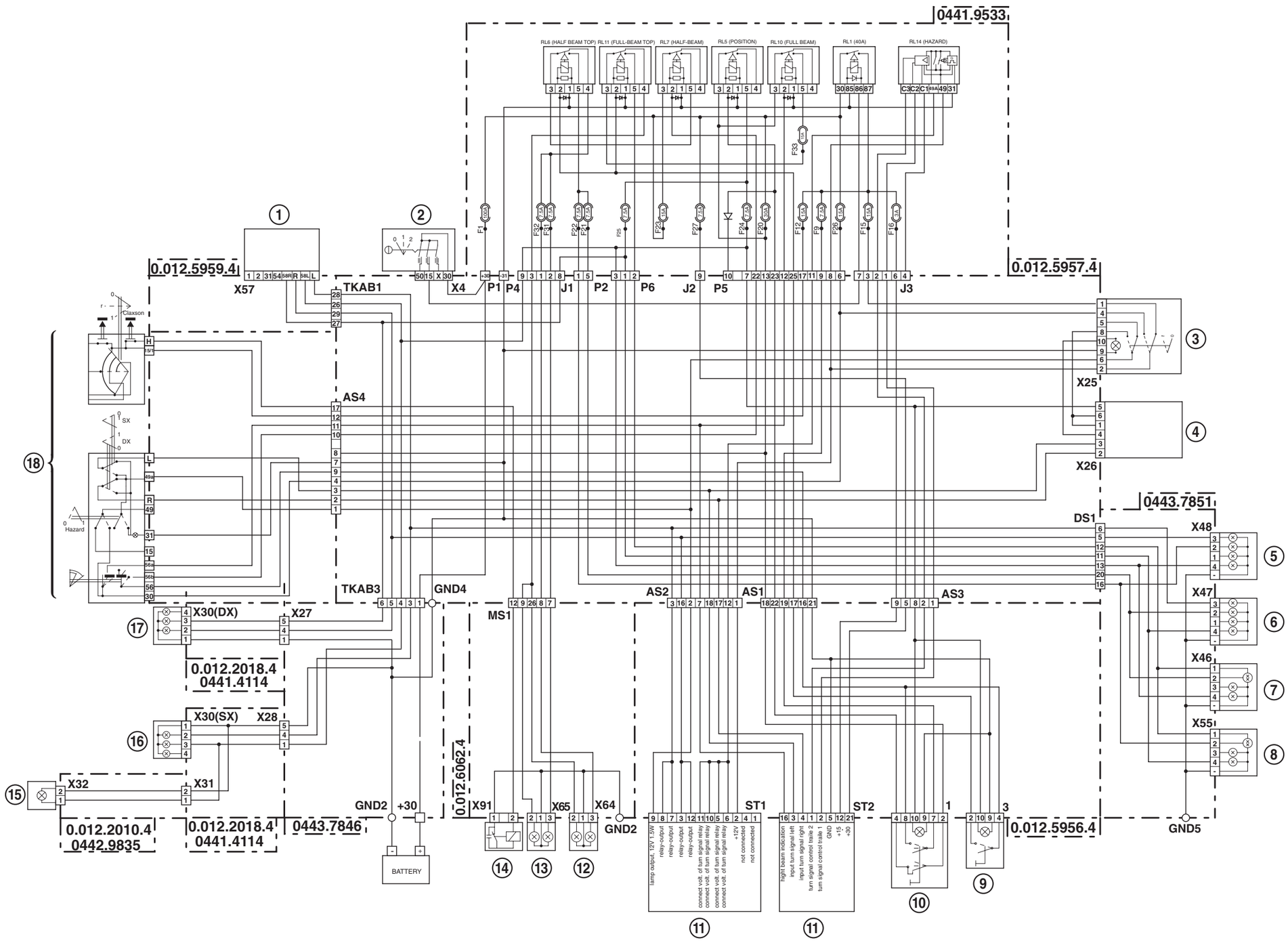
1 Starter switch
2 Infocenter
3 Engine start relay
4 Preheat control unit
5 Glowplug
6 Alternator
7 Starter motor

4.4 ELECTRICAL ENGINE CONTROL



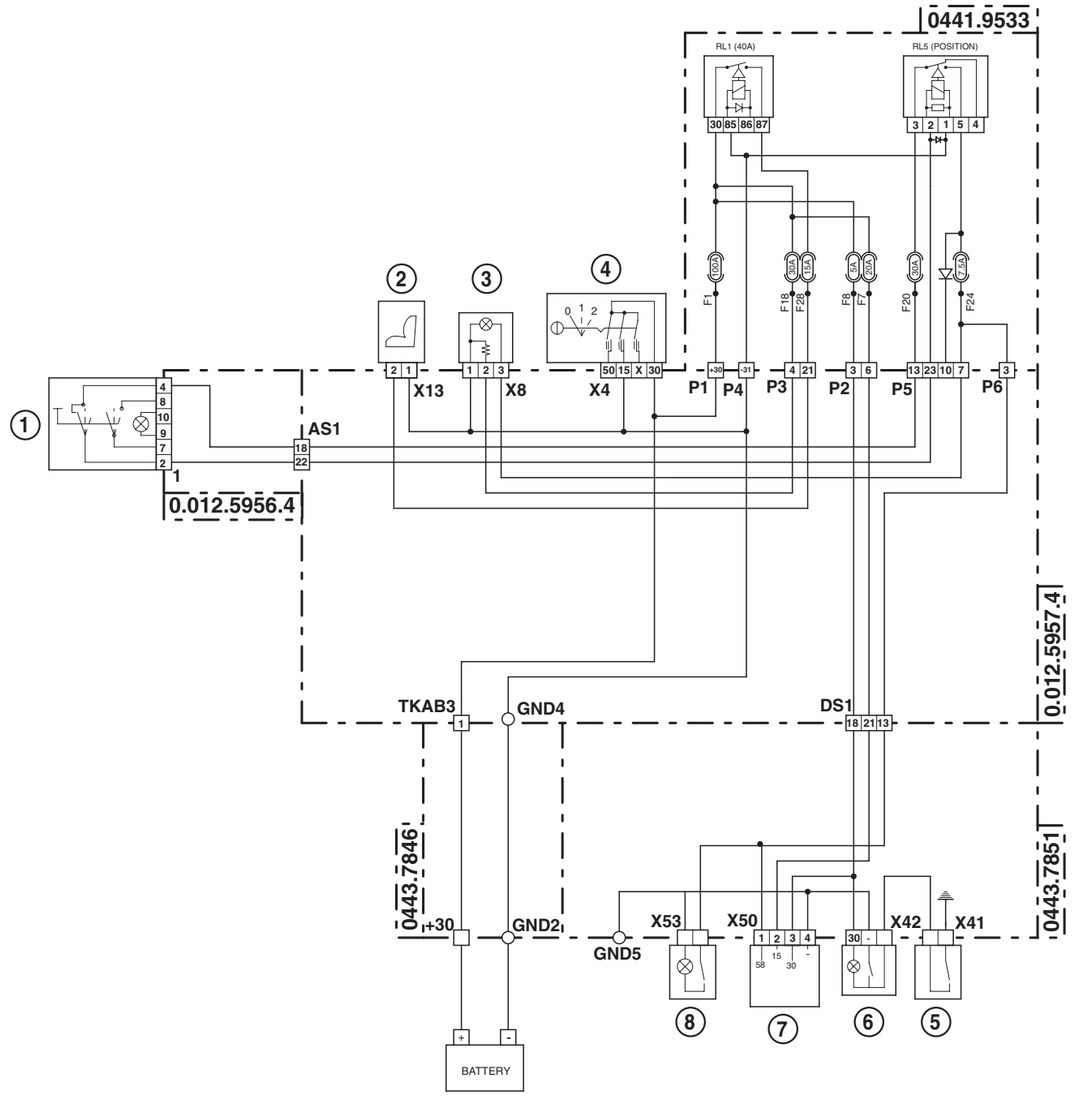
1 Starter switch
2 Diagnostics connector
3 Engine control unit
4 Accelerator pedal position sensor
5 HPSA control unit
6 Engine supercharge pressure sensor
7 Actuator
8 Camshaft speed sensor (Pick-up)
9 Engine coolant temperature sensor
10 Fuel cutoff coil

4.5 LIGHTS - LIGHT SELECTOR SWITCH



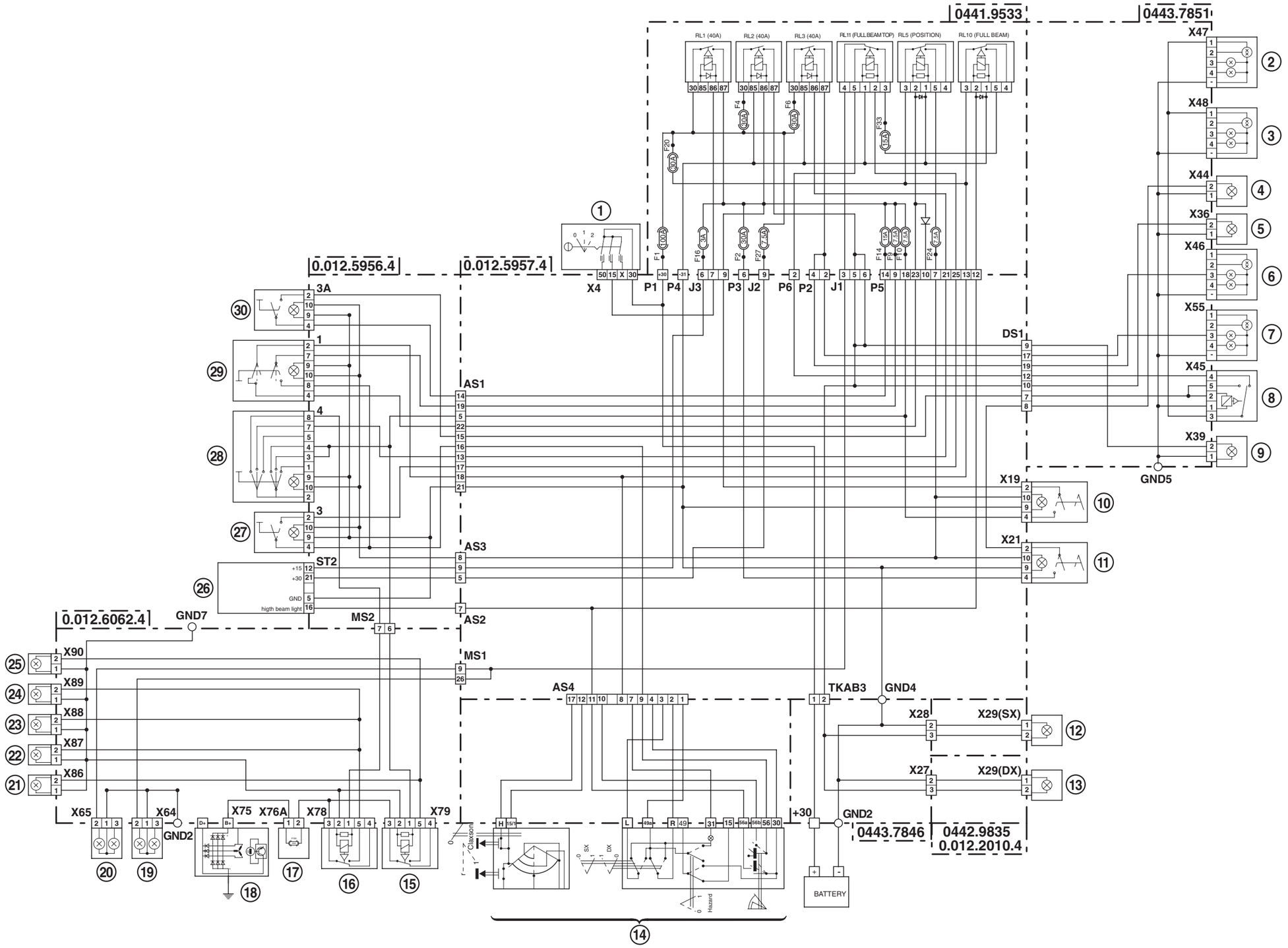
1 Trailer socket (lights and auxiliary power)
2 Starter switch
3 Hazard warning lights switch
4 Hazard lights control unit
5 R.H. side-light and direction indicator
6 L.H. side-light and direction indicator
7 Front L.H. work light
8 Front R.H. work light
9 Cab roof work lights switch
10 Side-lights switch
11 Infocenter
12 R.H. headlamp
13 L.H. headlamp
14 Horn
15 Number plate light
16 L.H. tail-light and direction indicator
17 R.H. tail-light and direction indicator
18 Lights selector switch

4.6 CAB ACCESSORY



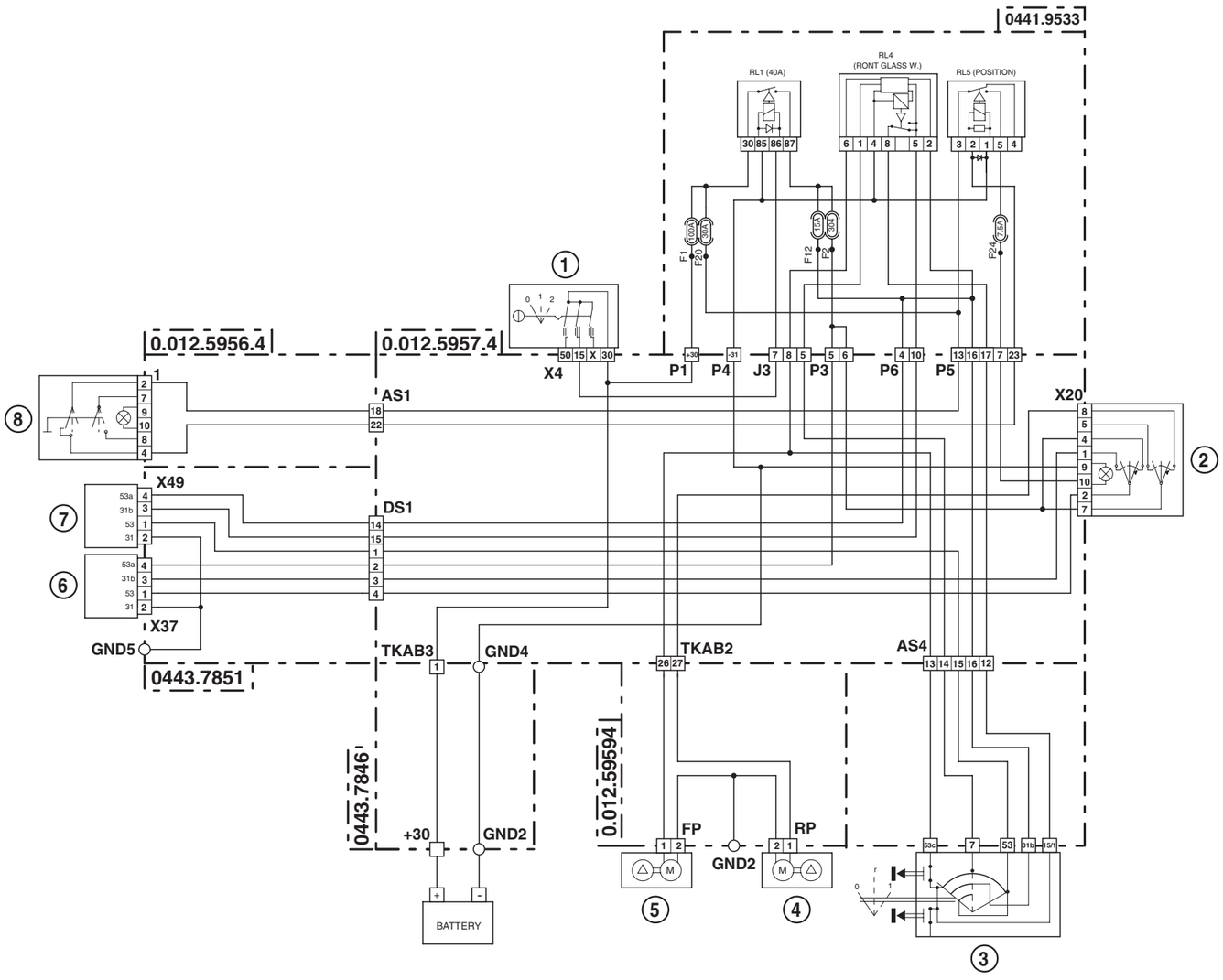
1 Side-lights switch
2 Air suspension seat compressor
3 Cigar lighter
4 Starter switch
5 Door open alarm switch
6 Interior roof light
7 Clock
8 Side console courtesy light

4.7 WORKING LIGHTS



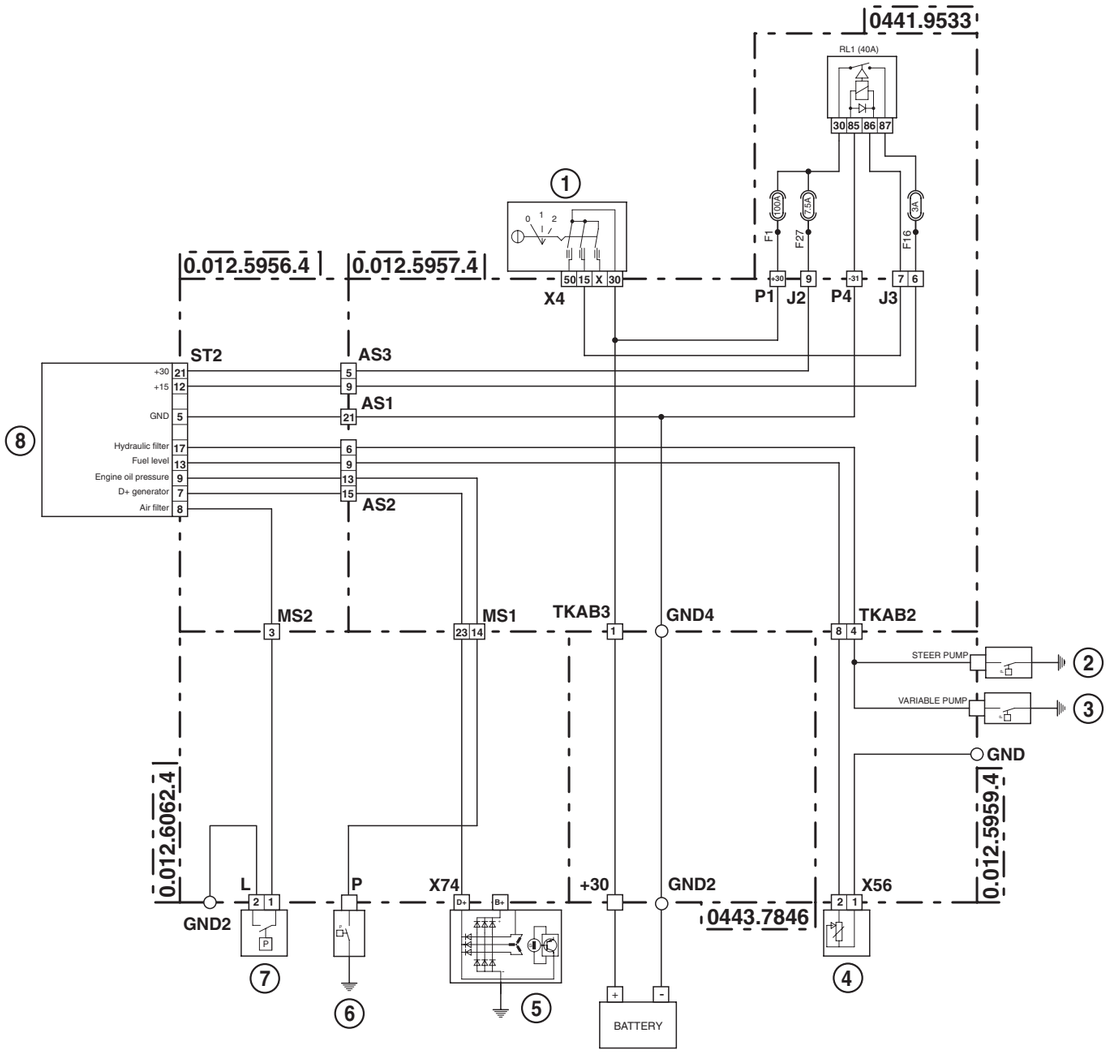
1 Starter switch
2 L.H. side-light and direction indicator
3 R.H. side-light and direction indicator
4 Beacon
5 Work light, main beam
6 Front L.H. work light
7 Front R.H. work light
8 Front upper work lights relay, main beam
9 Work light, main beam
10 Rear work lights switch
11 Beacon on/off switch
12 Rear L.H. lower work light
13 Rear R.H. lower work light
14 Lights selector switch
15 Front outer work lights relay, main beam
16 Front intermediate and centre work lights relay, main beam
17 Front work lights fuse, main beam (F90-30A)
18 Alternator
19 R.H. headlamp
20 L.H. headlamp
21 Front R.H. outer work light
22 Front R.H. intermediate work light
23 Front centre work light
24 Front L.H. intermediate work light
25 Front L.H. outer work light
26 Infocenter
27 Cab roof work lights switch
28 50S lights switch
29 Side-lights switch
30 Lower work lights switch

4.8 WINDSCREEN WIPER



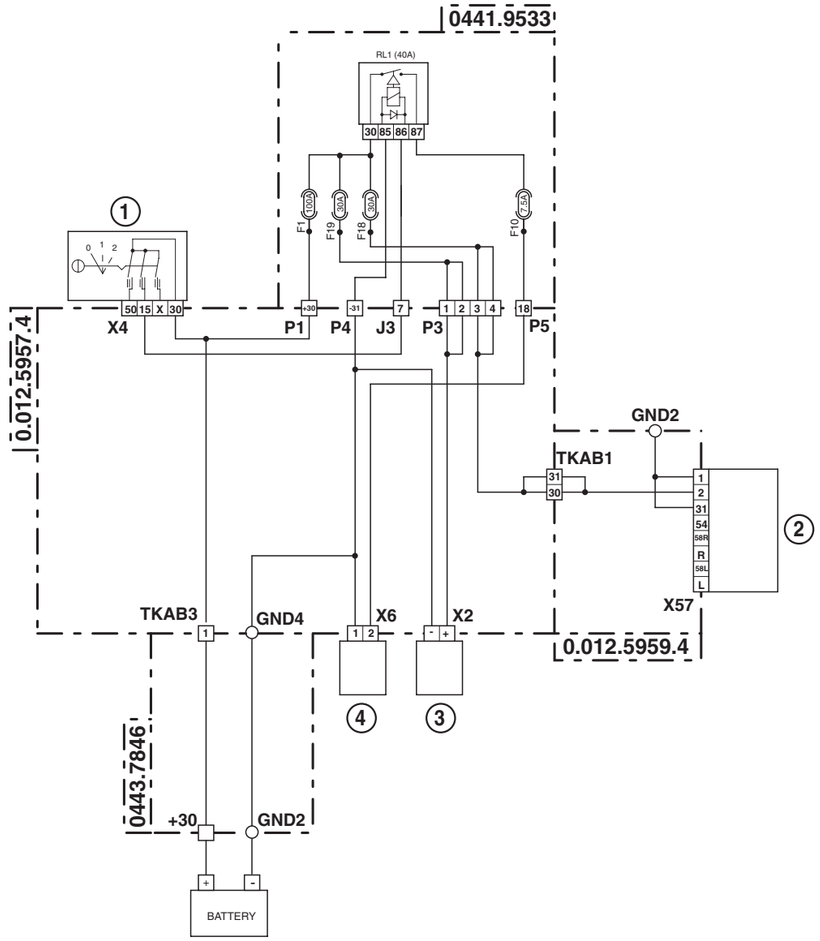
1 Starter switch
2 Rear screen wiper switch
3 Lights selector switch
4 Rear screenwash pump
5 Front screenwash pump
6 Rear screen wiper motor
7 Front screen wiper motor
8 Side-lights switch

4.9 INFOCENTER



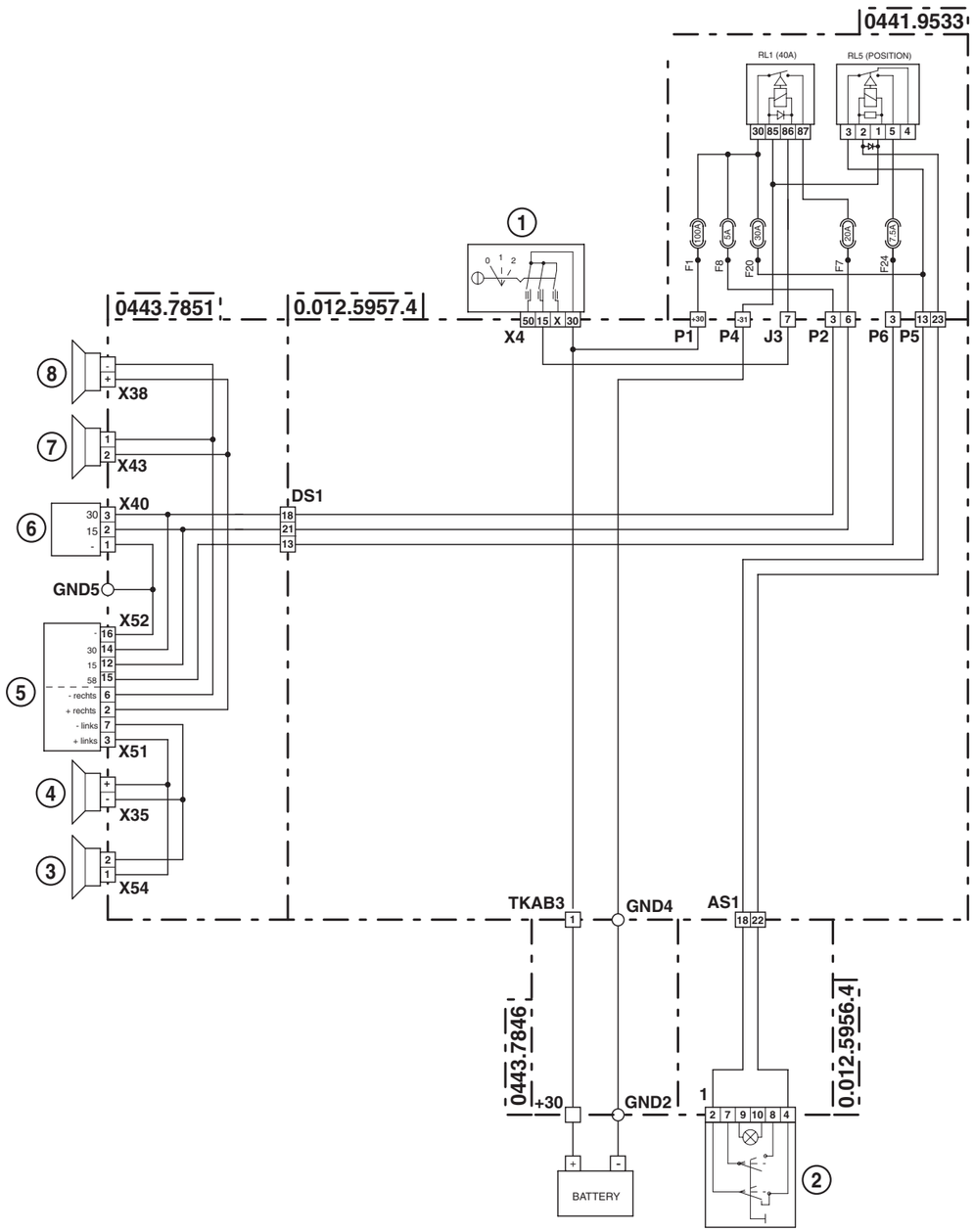
1 Starter switch
2 Steering circuit filter clogging pressure switch
3 Hydraulic oil filter clogging pressure switch
4 Fuel level sensor
5 Alternator (D+)
6 Engine oil pressure switch
7 Air cleaner clogging sensor
8 Infocenter

4.10 ELECTRICAL POWER SUPPLY



1 Starter switch
2 Trailer socket (lights and auxiliary power)
3 Auxiliary power socket
4 Auxiliary power supply connector (in cab)

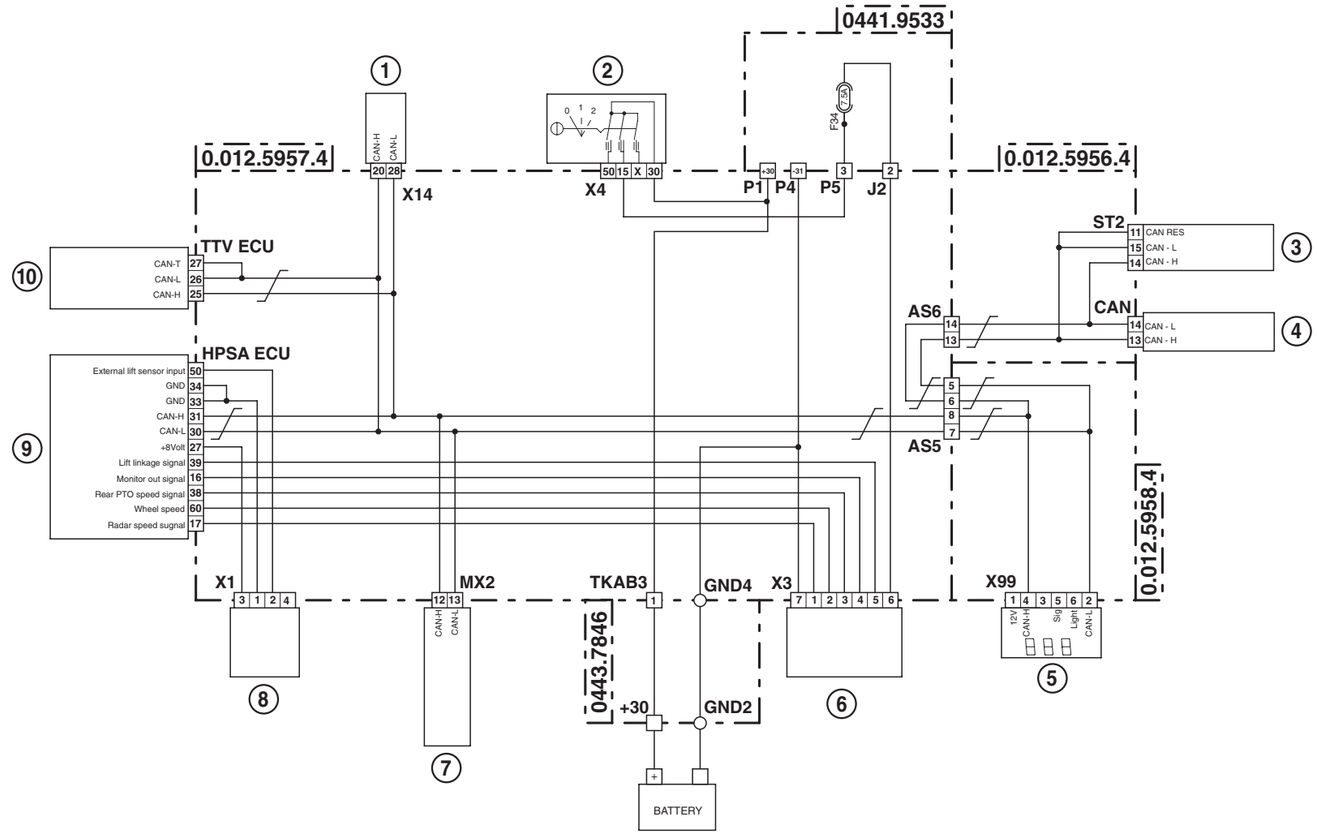
4.11 AUTORADIO - CB



1 Starter switch
2 Side-lights switch
3 R.H. front loudspeaker
4 R.H. rear loudspeaker
5 Radio
6 CB power connector
7 L.H. front loudspeaker
8 L.H. rear loudspeaker

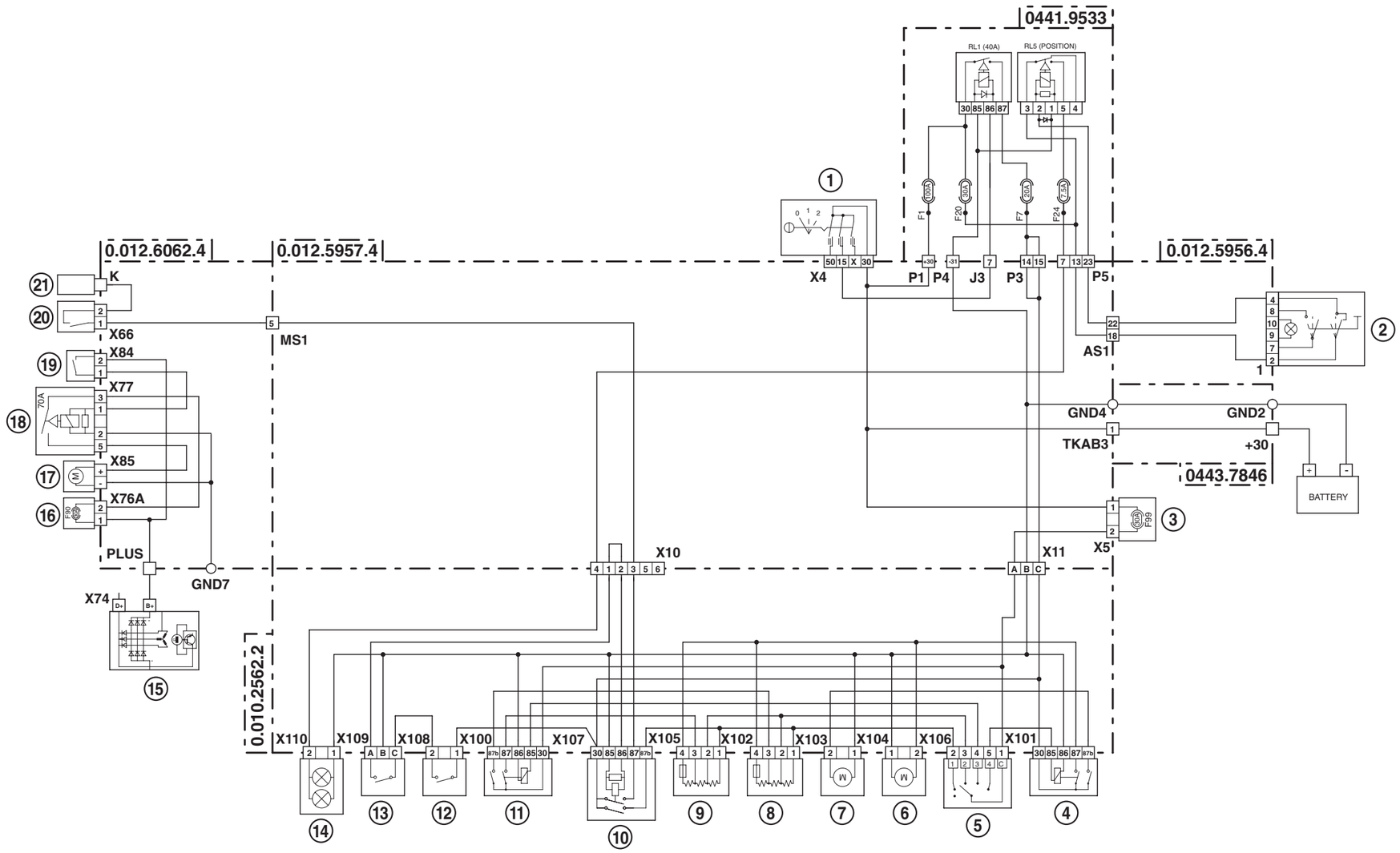
D0009450

4.12 DIAGNOSTIC SOCKET - CANBUS



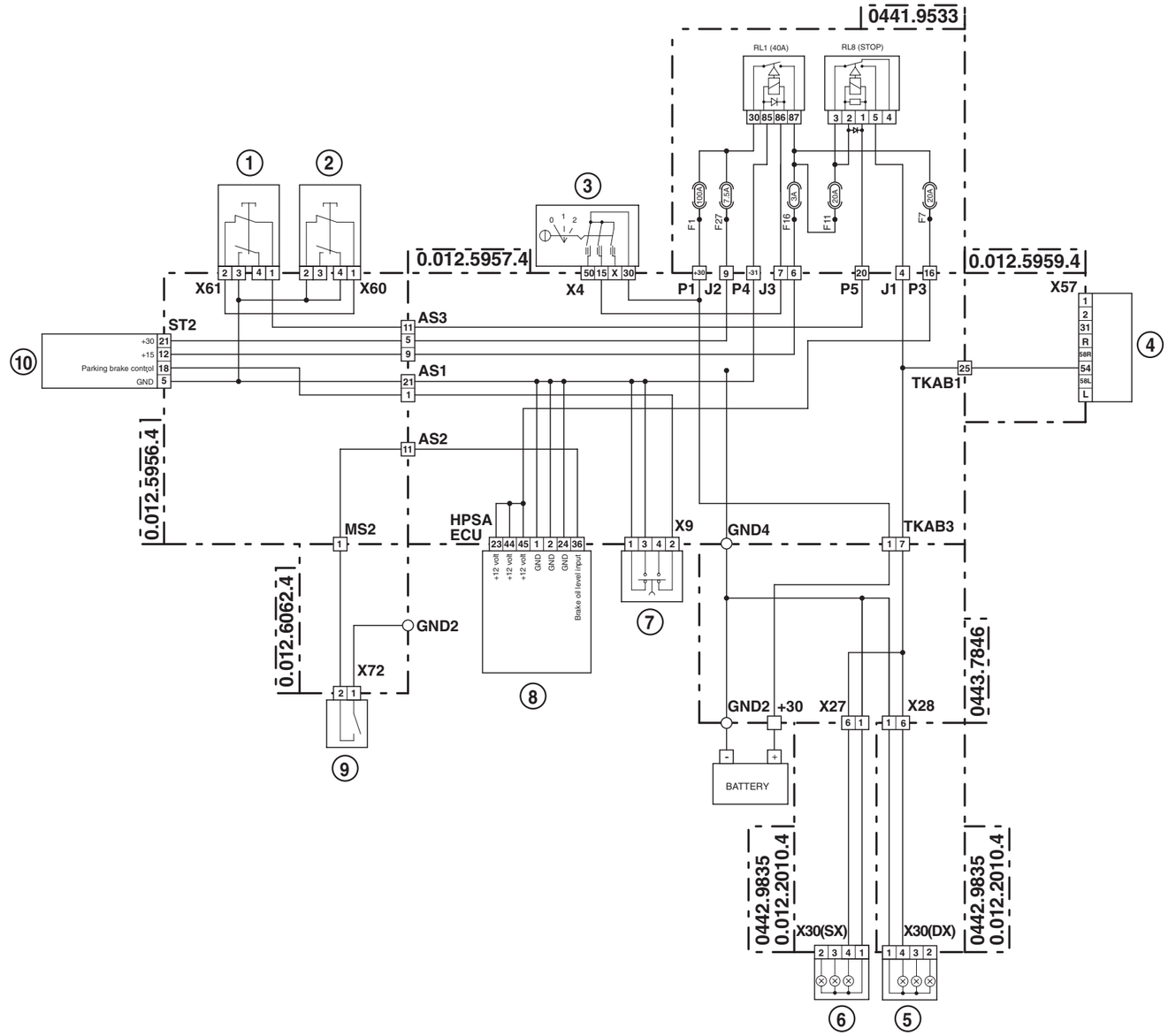
1 Armrest
2 Starter switch
3 Infocenter
4 CANBUS socket
5 Transmission display
6 ISO7 socket (power supply to implements)
7 Engine control unit
8 ISO4 socket (power supply to implements)
9 HPSA control unit
10 Transmission control unit

4.13 AIR CONDITIONING - HEATING FAN



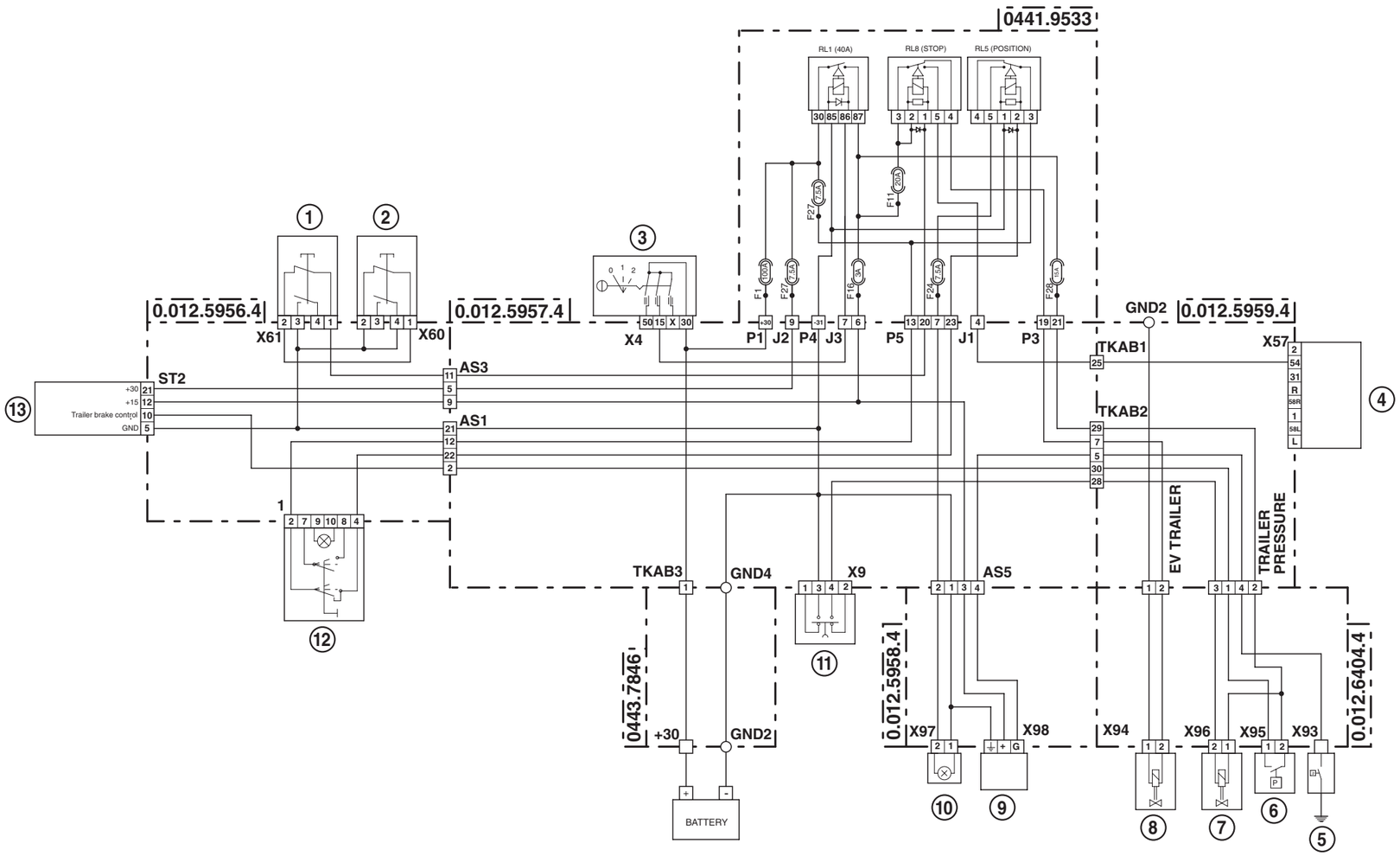
1 Starter switch
2 Side-lights switch
3 Heater power supply fuse (F99-30 Amp)
4 Heater fans 4th speed switch relay
5 Fan speed selector switch
6 R.H. heater fan
7 L.H. heater fan
8 L.H. heater fan resistor
9 R.H. heater fan resistor
10 Air conditioning power on and 1st speed switch relay
11 Heater fans 3rd speed switch relay
12 Air conditioning on/off switch
13 Air conditioning control thermostat
14 Air conditioning control panel illumination connector
15 Alternator
16 Auxiliary air conditioning fan fuse (F100-30A)
17 Auxiliary air conditioning fan
18 Auxiliary air conditioning fan switch relay
19 Air conditioning compressor and auxiliary fan pressure switch
20 Air conditioning pressure switch
21 Air conditioning compressor

4.14 BRAKES



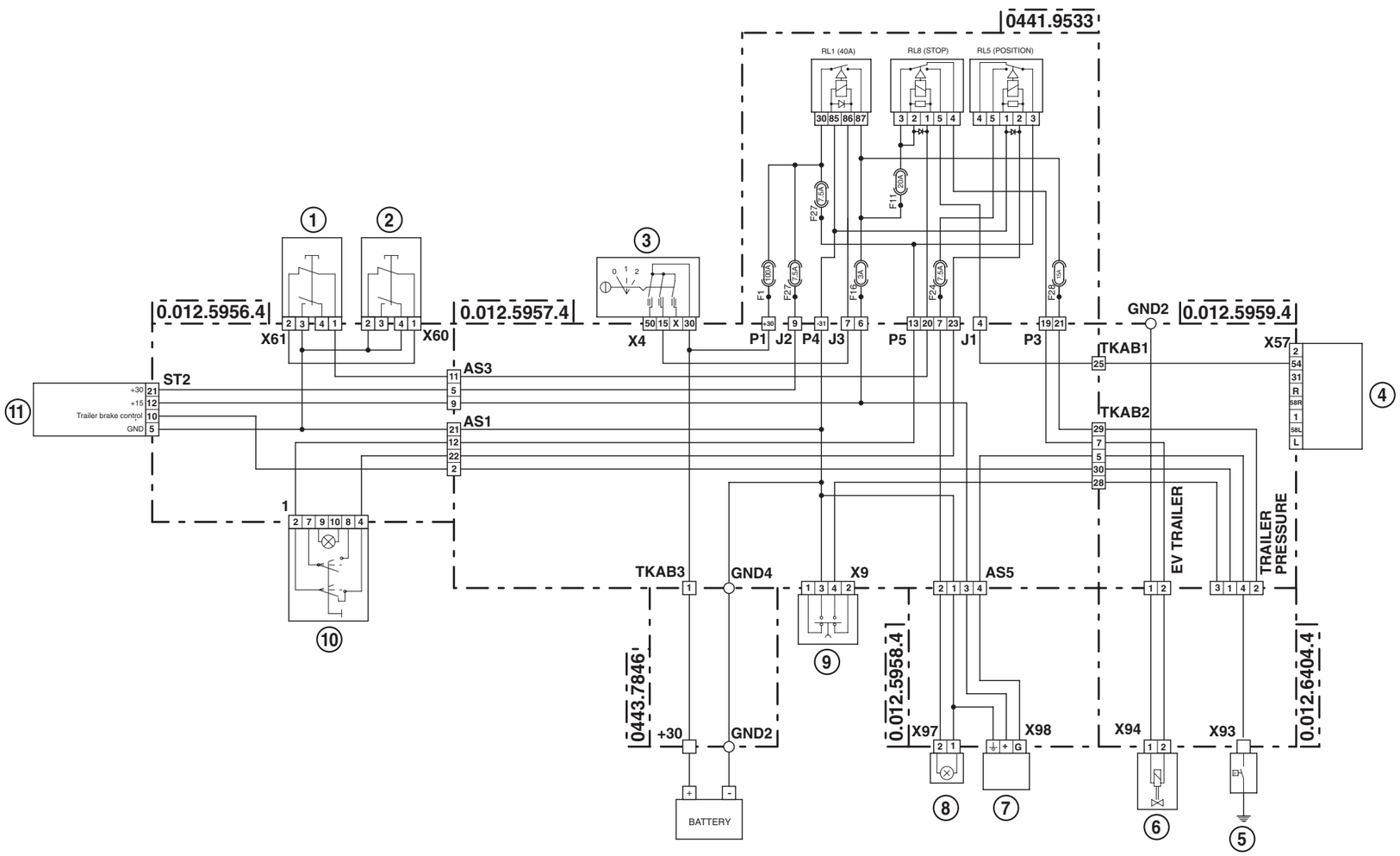
1 L.H. brake pedal switch
2 R.H. brake pedal switch
3 Starter switch
4 Trailer socket (lights and auxiliary power)
5 L.H. tail-light and direction indicator
6 R.H. tail-light and direction indicator
7 Handbrake switch
8 HPSA control unit
9 Brake fluid level sensor
10 Infocenter

4.15 TRAILER BRAKES (ITALY VERSION)



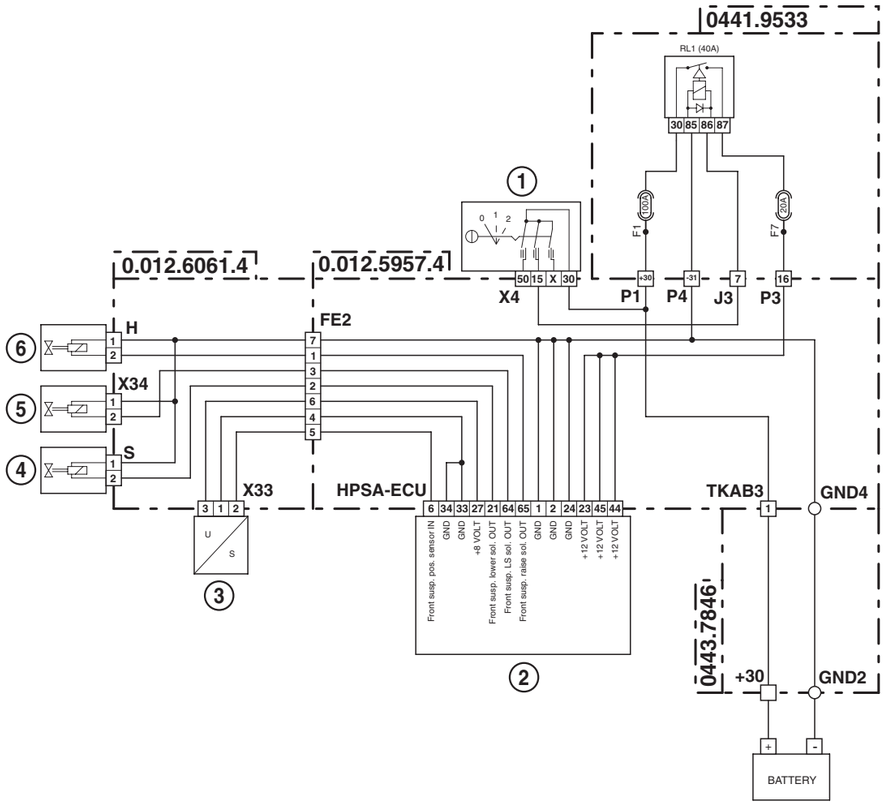
1 L.H. brake pedal switch
2 R.H. brake pedal switch
3 Starter switch
4 Trailer socket (lights and auxiliary power)
5 Trailer braking air pressure sensor
6 Trailer braking low pressure switch
7 Trailer parking brake solenoid valve
8 Air braking solenoid valve
9 Compressed air pressure gauge
10 Compressed air pressure gauge light
11 Handbrake switch
12 Side-lights switch
13 Infocenter

4.16 TRAILER BRAKES (EXPORT F VERSION)



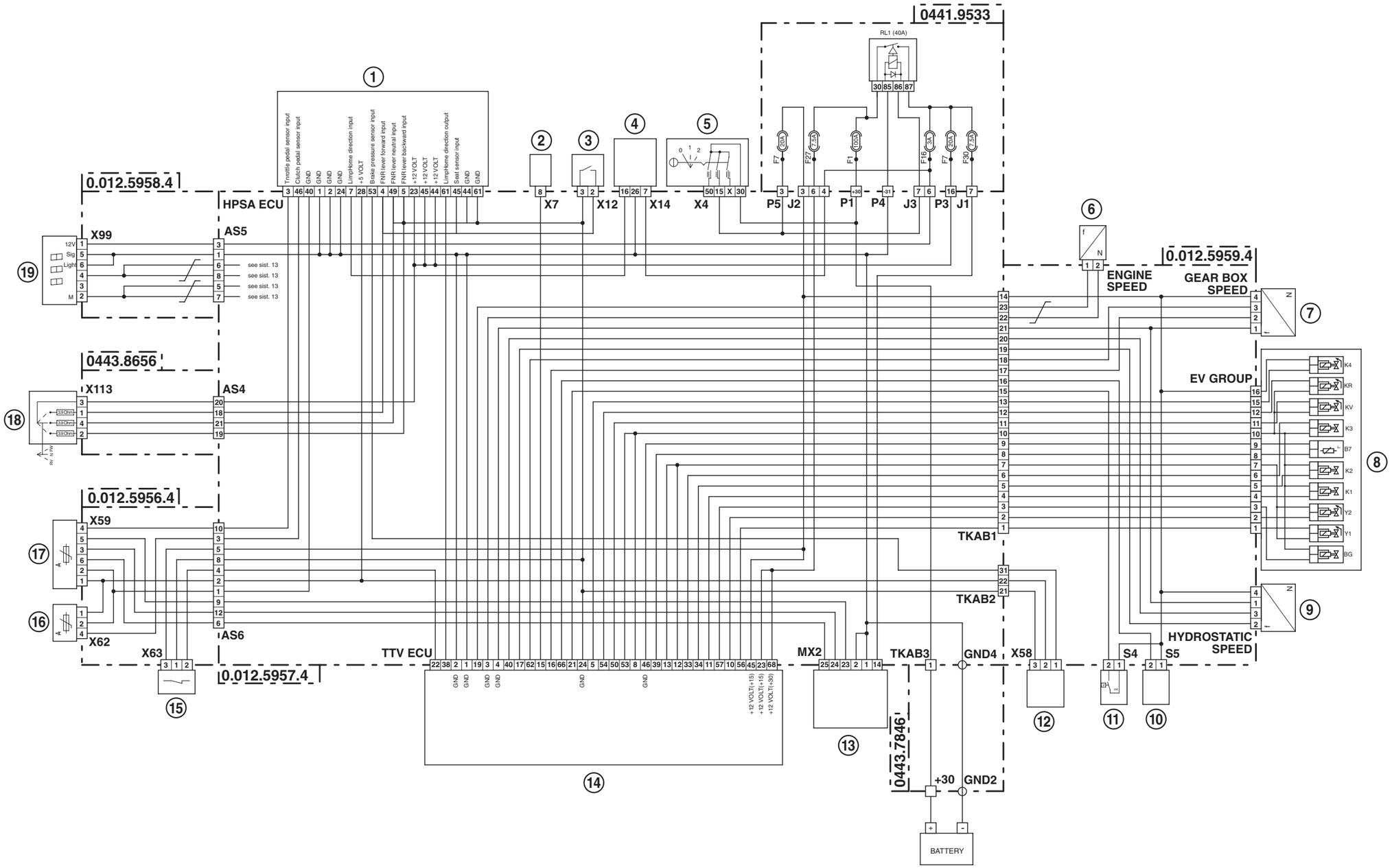
1 L.H. brake pedal switch
2 R.H. brake pedal switch
3 Starter switch
4 Trailer socket (lights and auxiliary power)
5 Trailer braking air pressure sensor
6 Air braking solenoid valve
7 Compressed air pressure gauge
8 Compressed air pressure gauge light
9 Handbrake switch
10 Side-lights switch
11 Infocenter

4.17 FRONT AXLE SUSPENSION



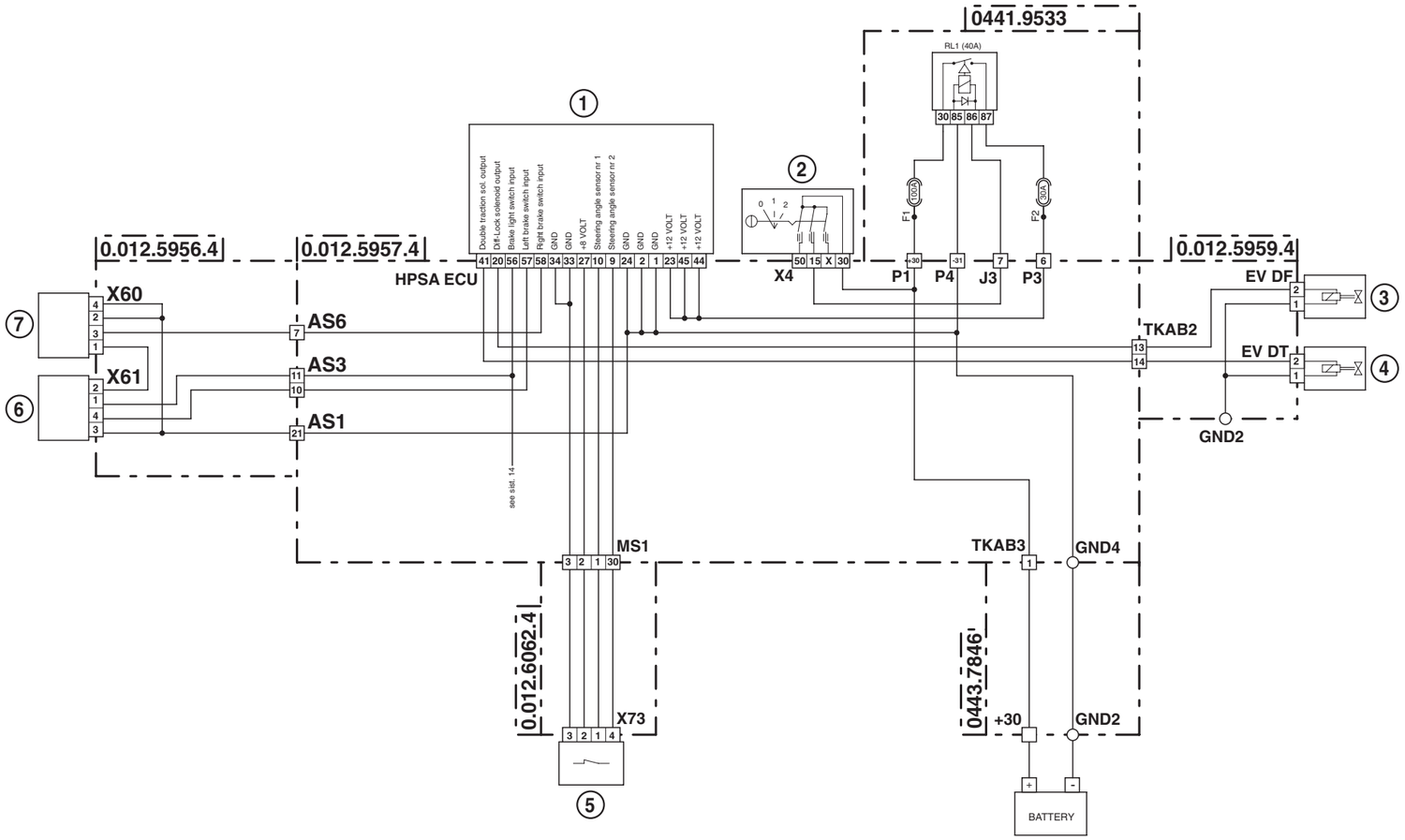
1 Starter switch
2 HPSA control unit
3 Front axle suspension position sensor
4 Front axle suspension Lower solenoid valve
5 Front axle suspension Load Sensing solenoid valve
6 Front axle suspension Raise solenoid valve

4.18 TRANSMISSION



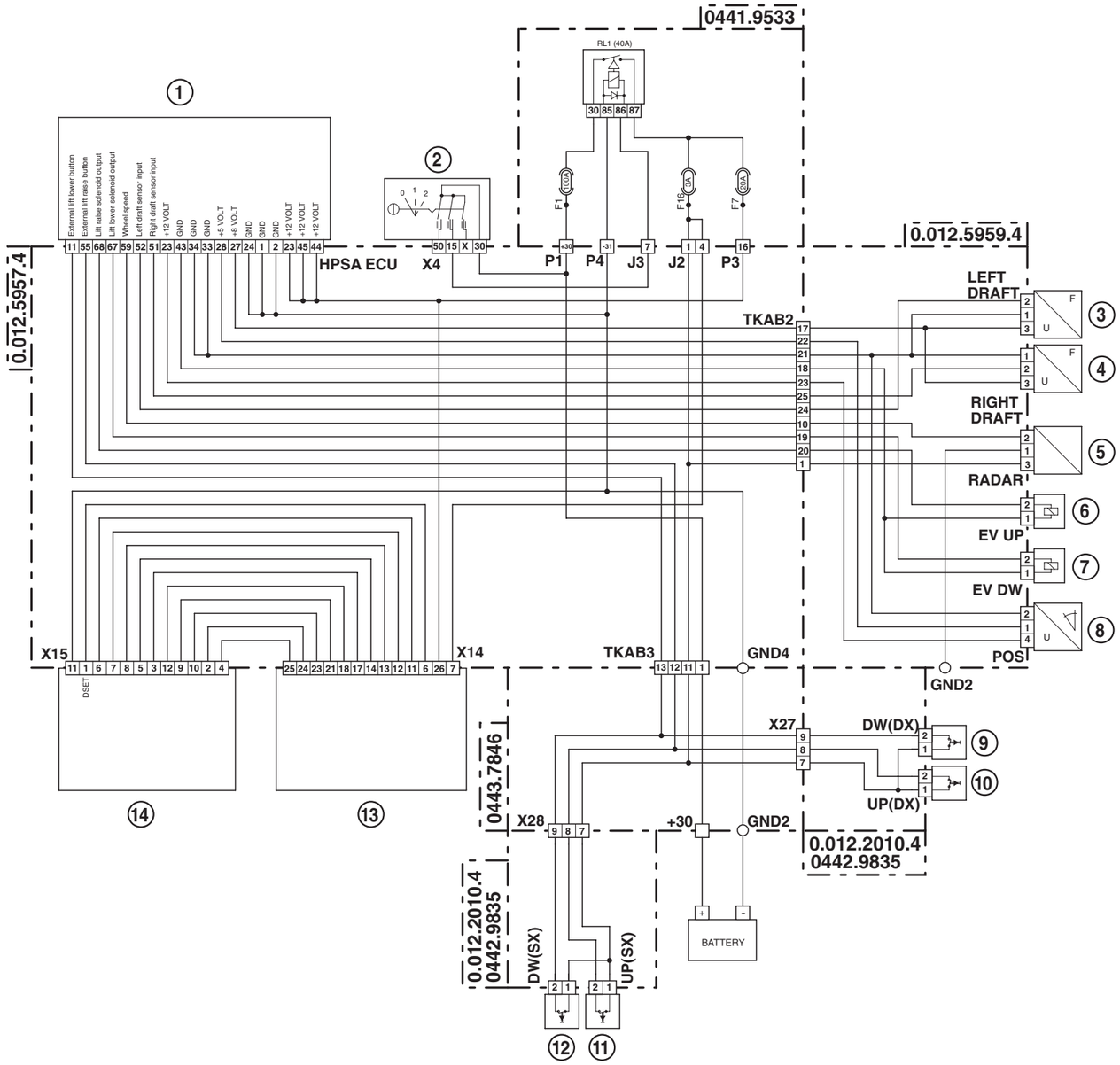
1 HPSA control unit
2 Diagnostics connector
3 Driver seated weight sensor
4 Armrest
5 Starter switch
6 Engine speed sensor
7 Transmission speed sensor
8 Power shift solenoid valves
9 Hydrostatic drive speed sensor
10 Transmission oil low pressure switch
11 Transmission oil filter clogging pressure switch
12 Braking system pressure switch
13 Engine control unit
14 Transmission control unit
15 Clutch pedal depressed proximity sensor
16 Clutch pedal position sensor
17 Accelerator pedal position sensor
18 Shuttle Lever
19 Transmission display

4.19 ASM - 4WD - DIFFERENTIAL



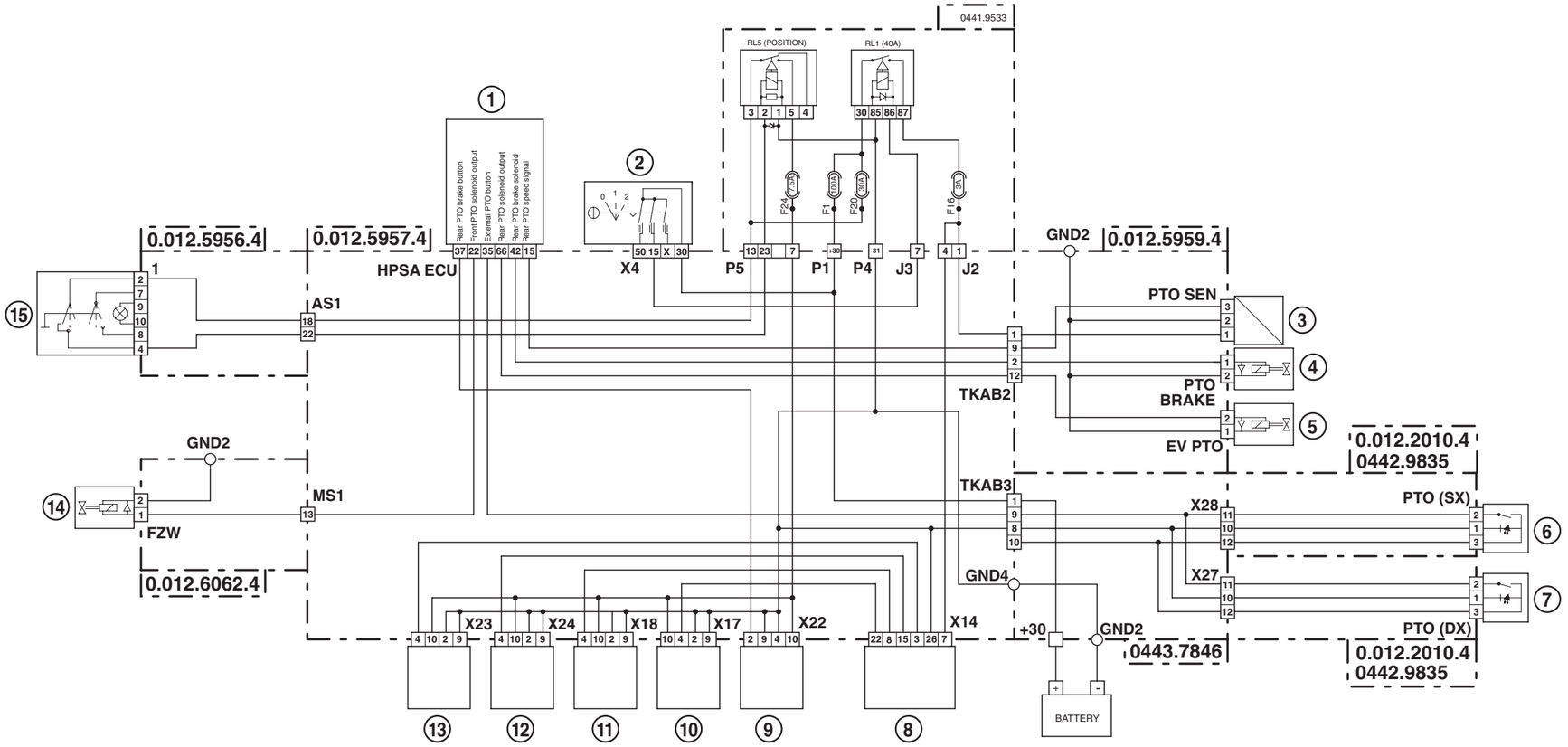
1 HPSA control unit
2 Starter switch
3 Differential lock solenoid valve
4 Four wheel drive (4WD) clutch solenoid valve
5 Steering angle sensor
6 L.H. brake pedal switch
7 R.H. brake pedal switch

4.20 REAR LIFTER



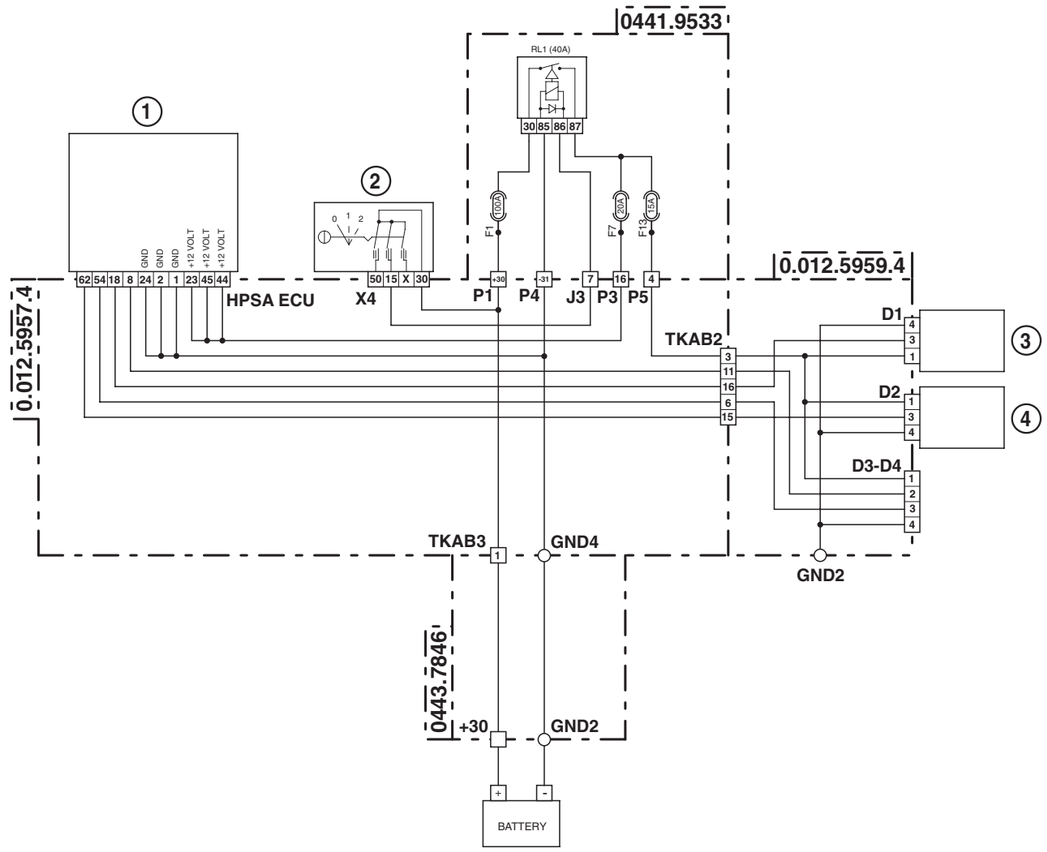
1 HPSA control unit
2 Starter switch
3 Rear lift draft sensor (Left)
4 Rear lift draft sensor (Right)
5 Radar
6 Lift Up solenoid valve
7 Lift Down solenoid valve
8 Rear lift position sensor
9 R.H. rear lift Down button
10 R.H. rear lift Up button
11 L.H. rear lift Up button
12 L.H. rear lift Down button
13 Armrest
14 Lift control console

4.21 FRONT AND REAR PTO



1 HPSA control unit
2 Starter switch
3 Rear PTO speed sensor
4 PTO brake solenoid valve
5 Rear PTO solenoid valve
6 L.H. rear PTO button (on fender)
7 R.H. rear PTO button (on fender)
8 Armrest
9 PTO brake switch
10 Front PTO button (in cab)
11 Rear PTO button (in cab)
12 PTO ENABLE button
13 PTO AUTO button
14 Front PTO solenoid valve
15 Side-lights switch

4.22 ELECTRIC CONTROL VALVE



1 HPSA control unit
2 Starter switch
3 Auxiliary services spool valve N° 1
4 Auxiliary services spool valve N° 2

5. PLANIMETRY, WIRING DIAGRAM AND CONNECTORS LOCATION

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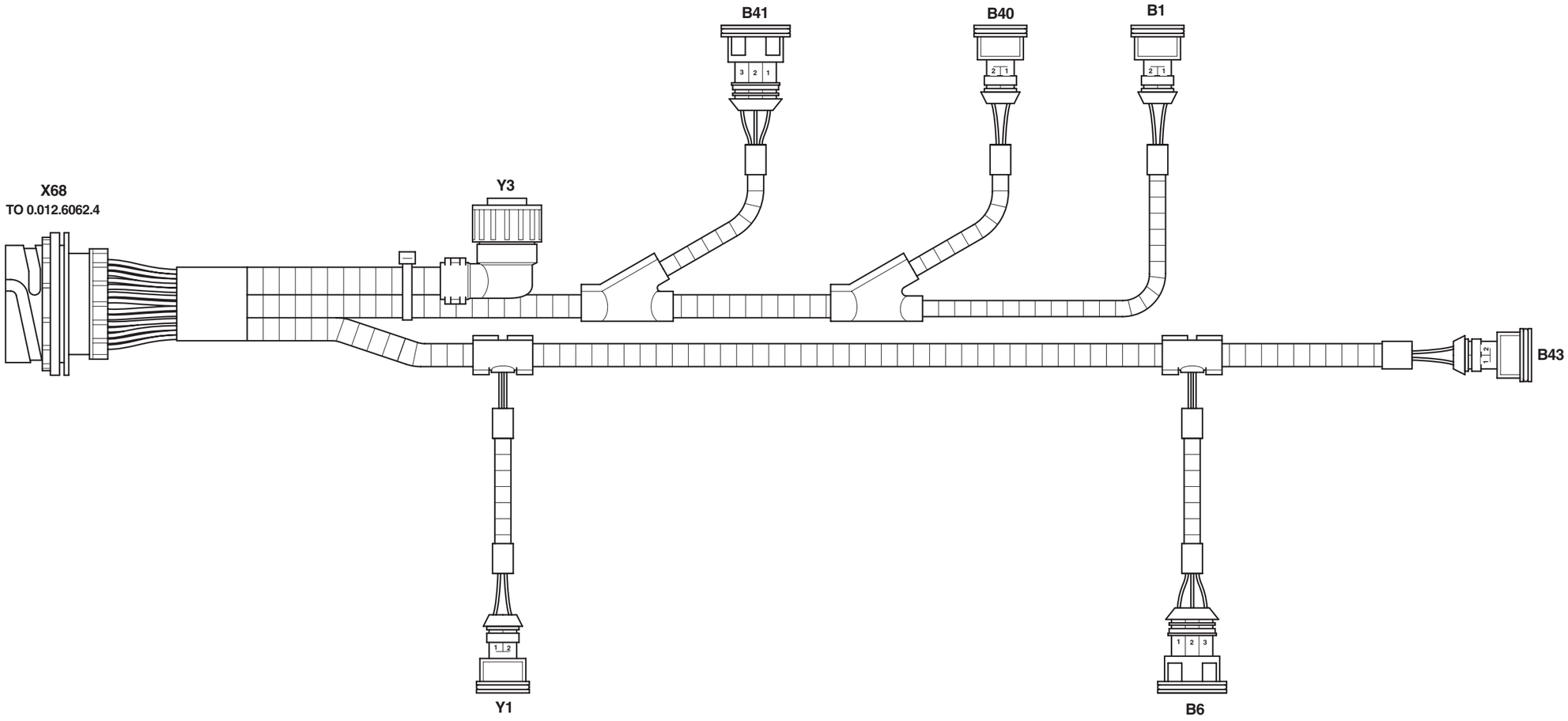
INTERNAL COMBUSTION ENGINE WIRING (1/2)



B1 Not utilised
B40 Camshaft speed sensor (Pick-up)
B41 Engine supercharge pressure sensor
B43 Engine coolant temperature sensor
B6 Not utilised
X68 To engine wiring
Y1 Fuel cutoff coil
Y3 Actuator

INTERNAL COMBUSTION ENGINE WIRING (2/2)

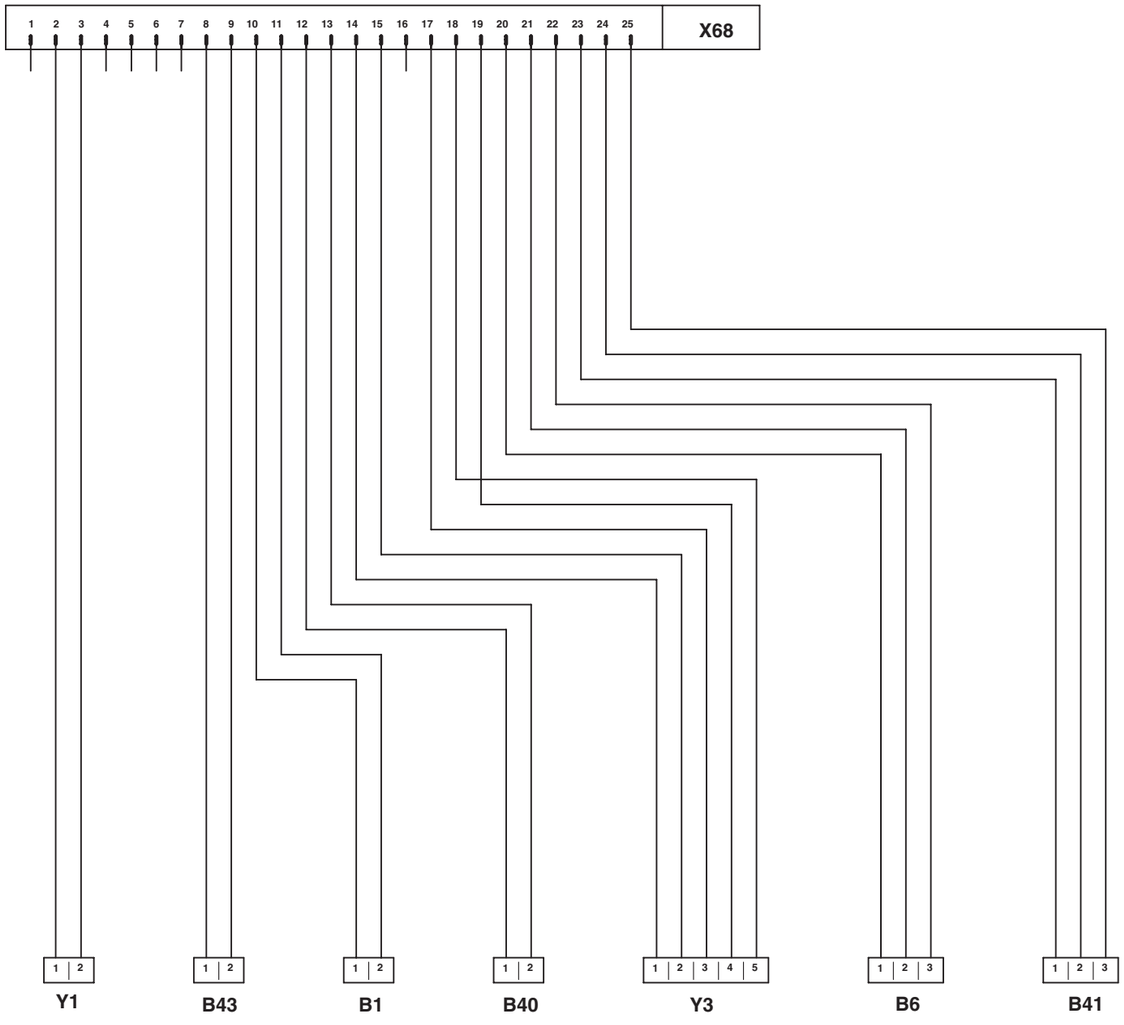
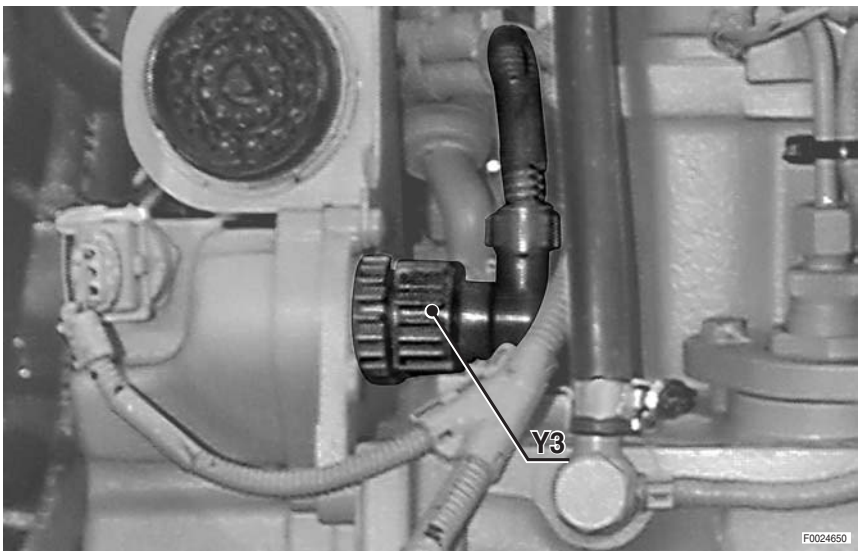


TABELLA COLORI / COLOURS TABLE			
M	Marrone/Brown	C	Arancio/Orange
V	Verde/Green	A	Azzurro/Blue
Z	Viola/Violet	B	Bianco/White
N	Nero/Black	L	Blu/Dark Blue
S	Rosa/Pink	G	Giallo/Yellow
R	Rosso/Red	H	Grigio/Gray

INTERNAL COMBUSTION ENGINE CONNECTORS LOCATION

1

2



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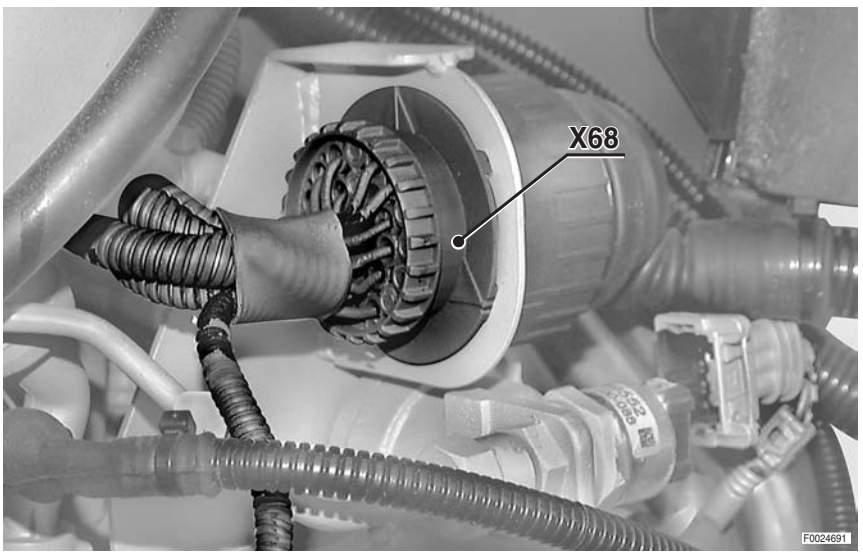

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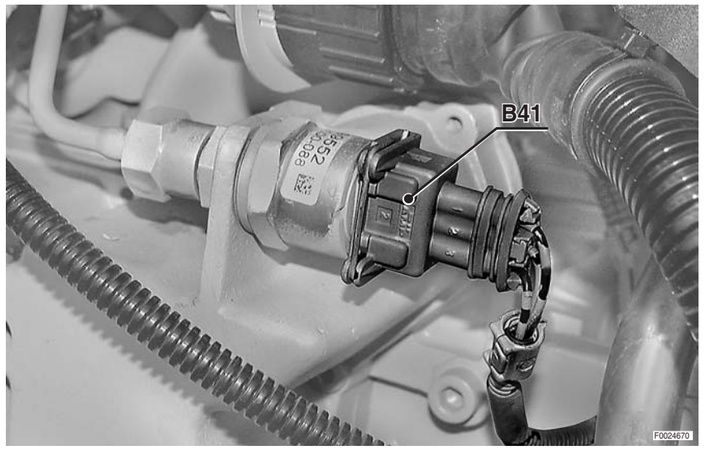
INTERNAL COMBUSTION ENGINE WIRING

4



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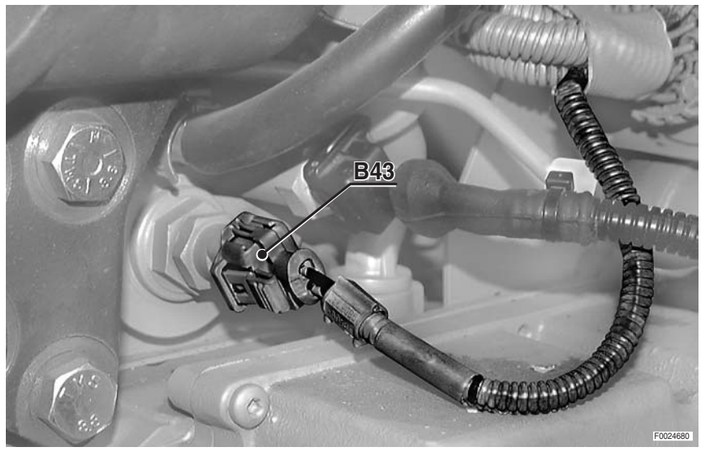

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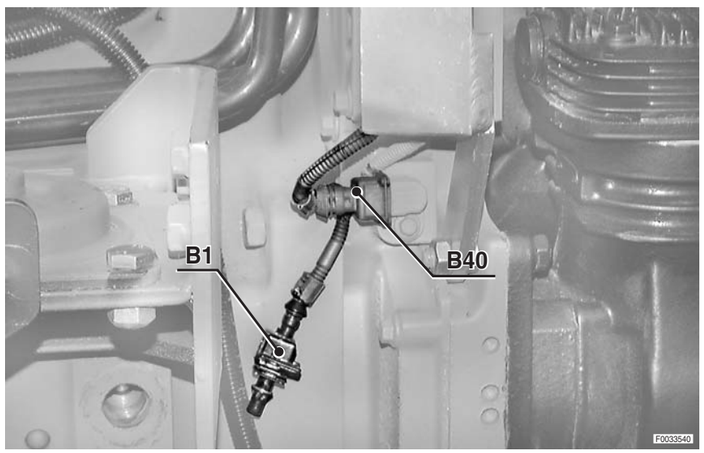

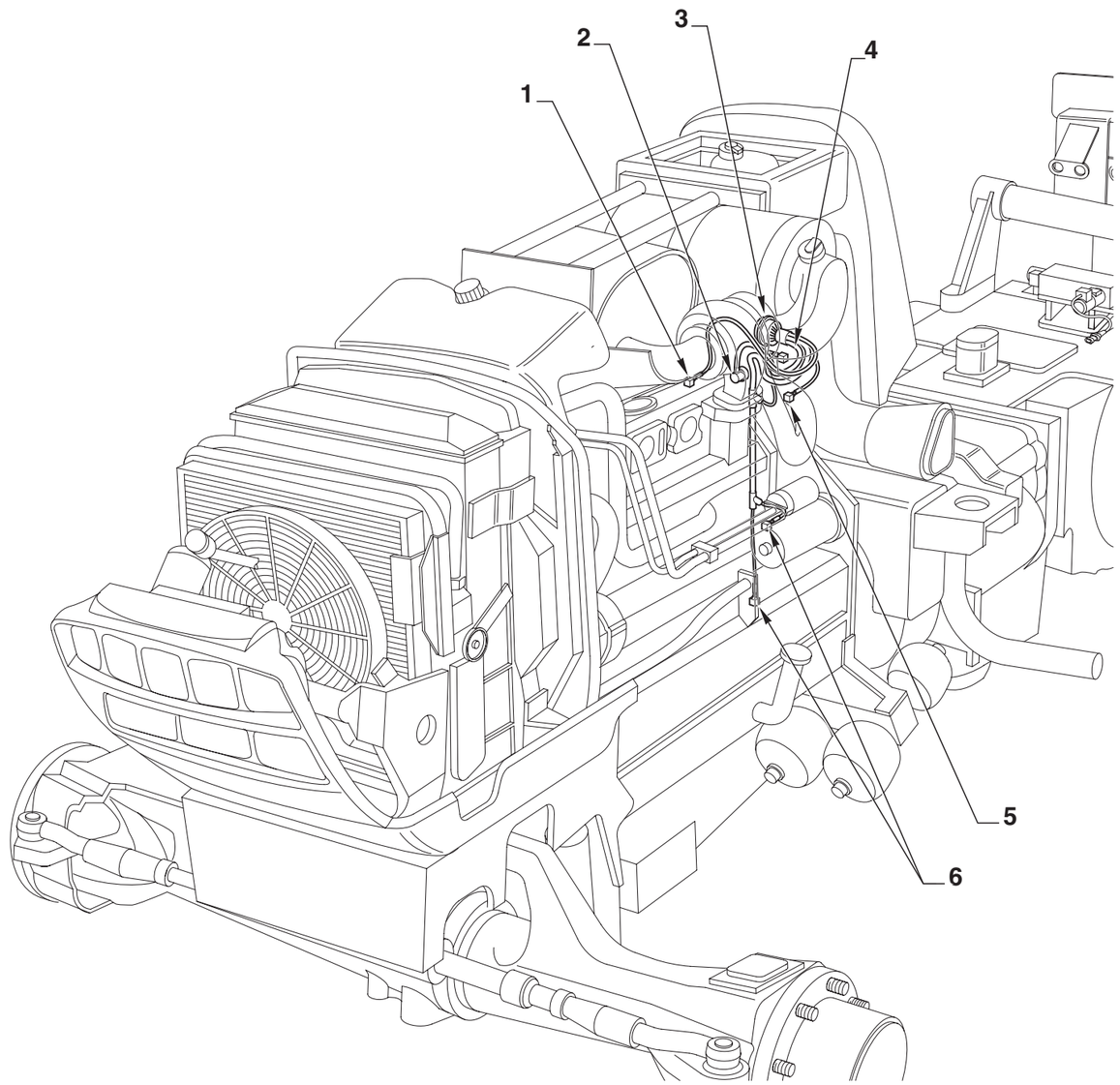

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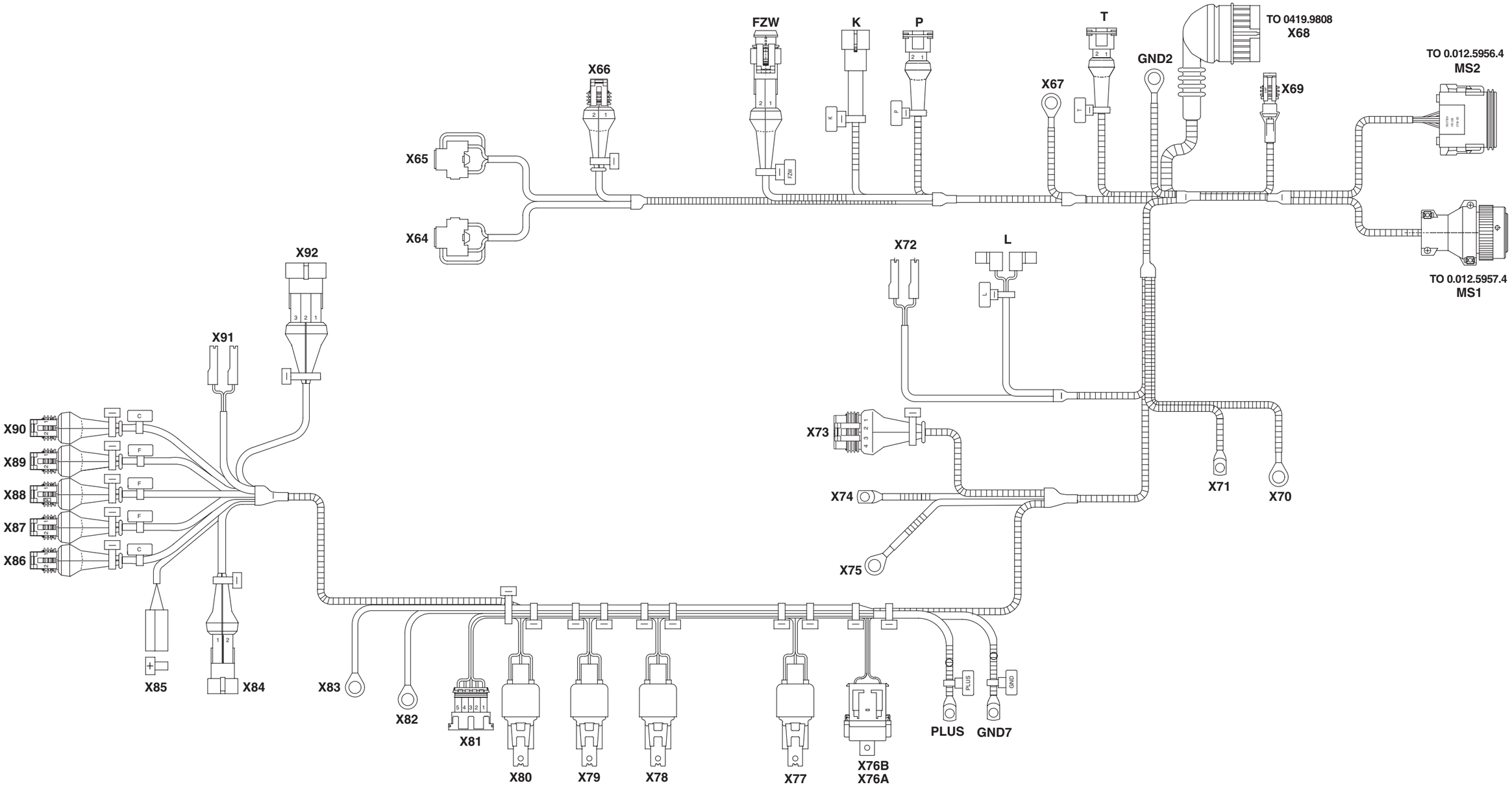
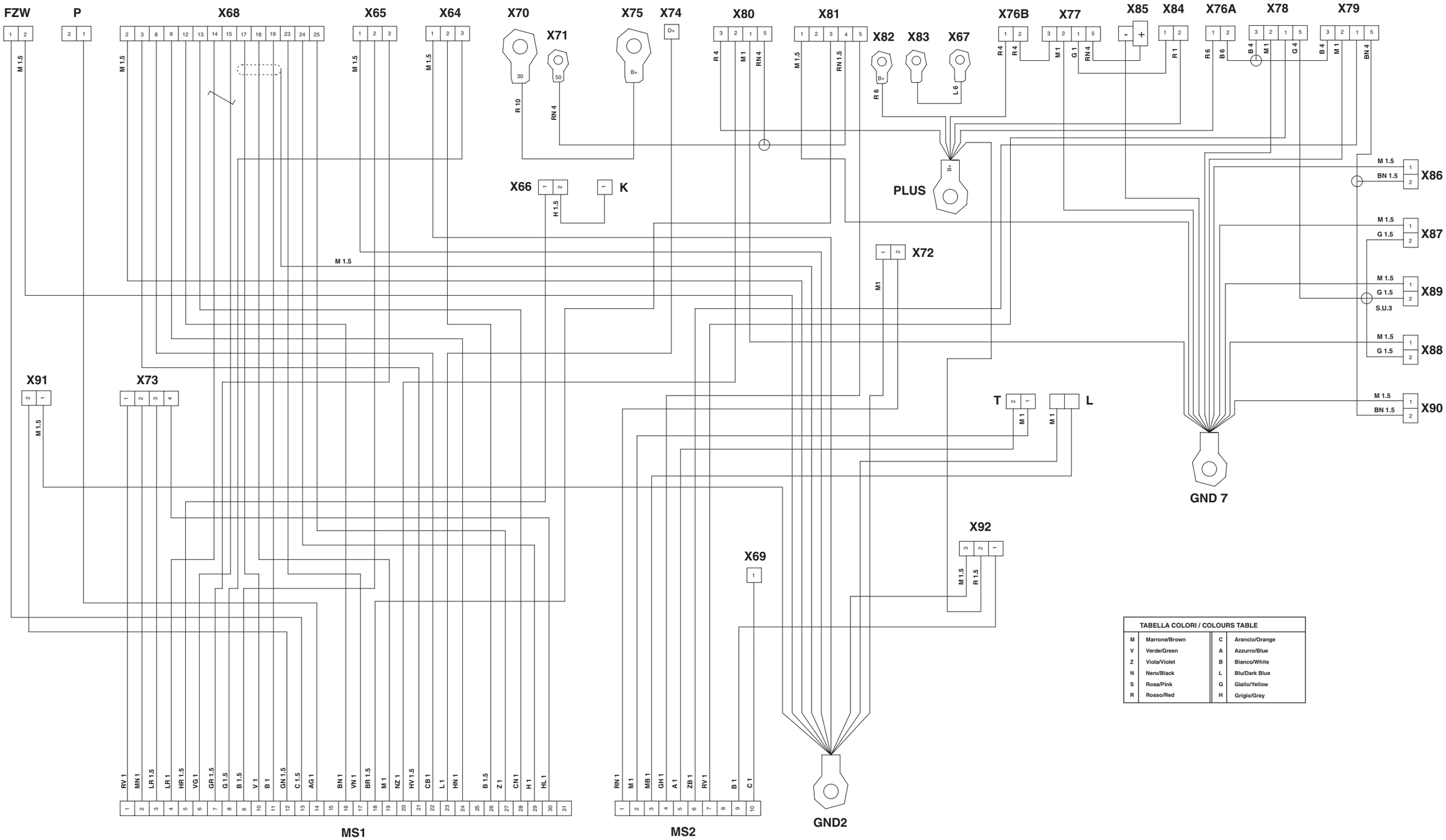
ENGINE WIRING (1/2)



FZW Front PTO solenoid valve
K Air conditioning compressor
L Air cleaner clogging sensor
MS1 To side console wiring
MS2 To front console wiring
P Engine oil pressure switch
PLUS Alternator (B+)
T Engine coolant temperature sensor (Not utilised)
X64 R.H. headlamp
X65 L.H. headlamp
X66 Compressor and condenser fan pressure switch
X67 Glowplug
X68 To internal combustion engine wiring
X69 Steering system pressure switch (Not utilised))
X70 Starter motor
X71 Starter motor
X72 Brake fluid level sensor
X73 Steering angle sensor
X74 Alternator (D+)
X75 Alternator (B+)
X76A Front work lights fuse, main beam (F90-30A)
X76B Auxiliary air conditioning fan fuse (F100-30A)
X77 Auxiliary air conditioning fan switch relay
X78 Front intermediate and centre work lights relay, main beam
X79 Front outer work lights relay, main beam
X80 Engine start relay
X81 Preheat control unit
X82 Preheat control unit
X83 Preheat control unit
X84 Compressor and condenser fan pressure switch
X85 Auxiliary air conditioning fan
X86 Front R.H. outer work light N° 1
X87 Front R.H. intermediate work light N° 2
X88 Front centre work light N° 3
X89 Front L.H. intermediate work light N° 4
X90 Front L.H. outer work light N° 5
X91 Horn
X92 Not utilised

ENGINE WIRING (2/2)



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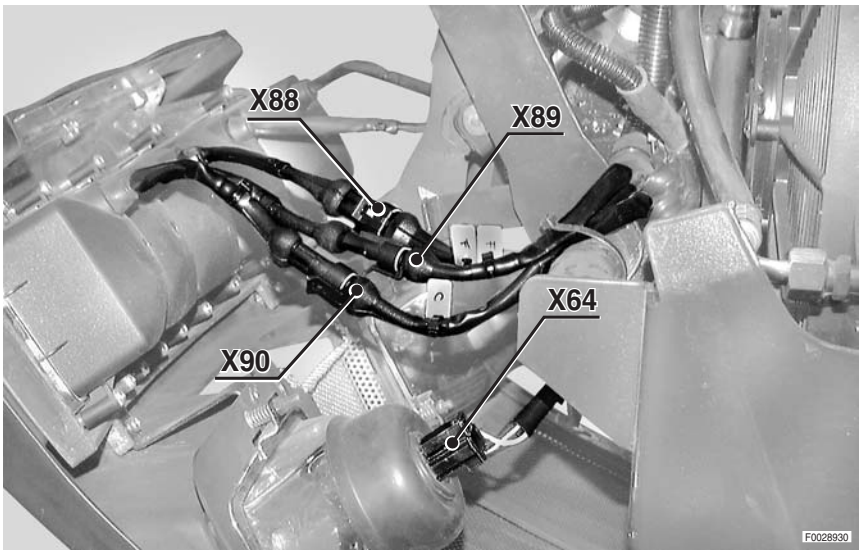
S	Rosa/Pink	G	Giallo/Yellow
R	Rosso/Red	H	Grigio/Gray

0.012.6062.4/10

ENGINE CONNECTORS LOCATION

1



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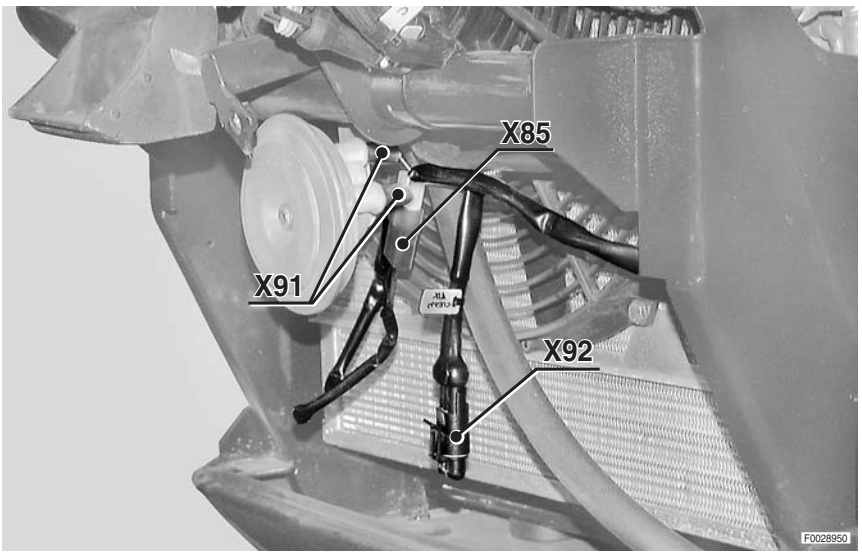

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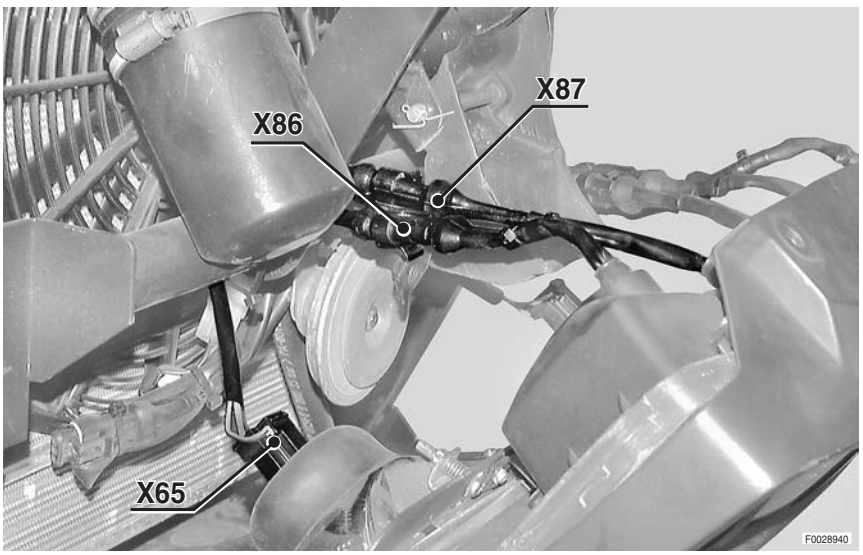

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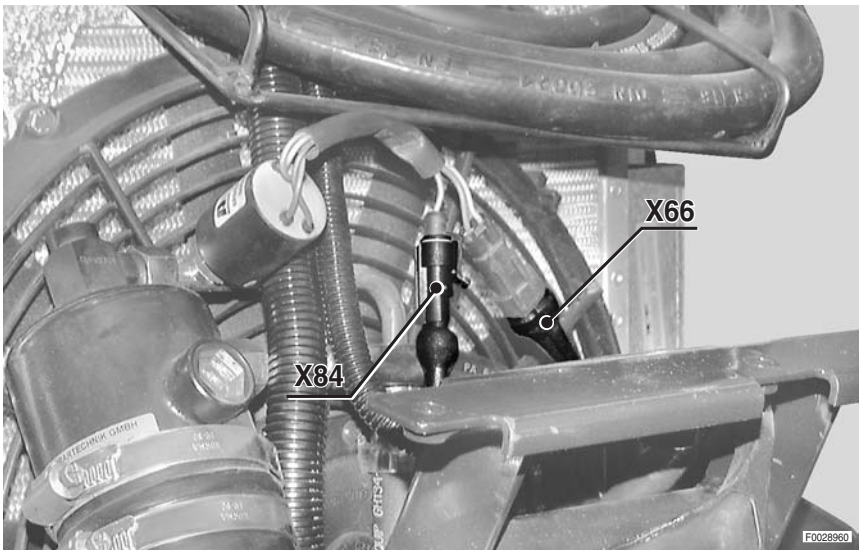

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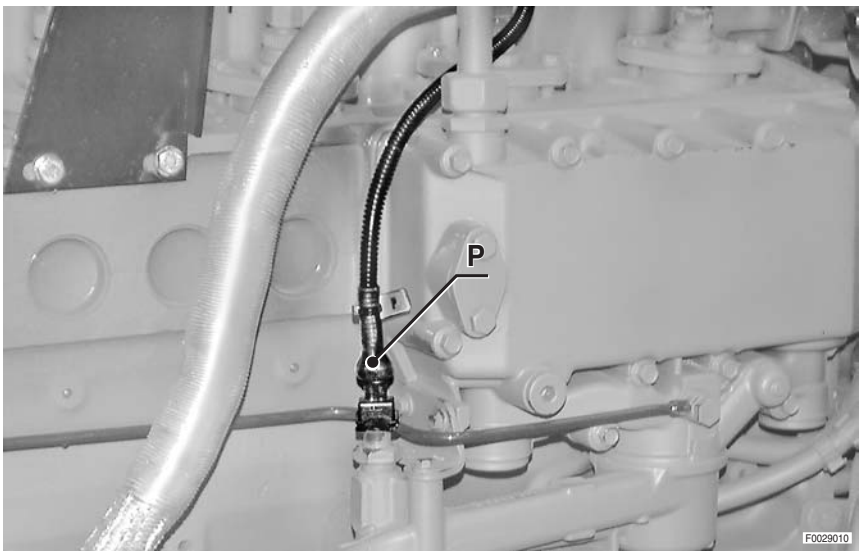

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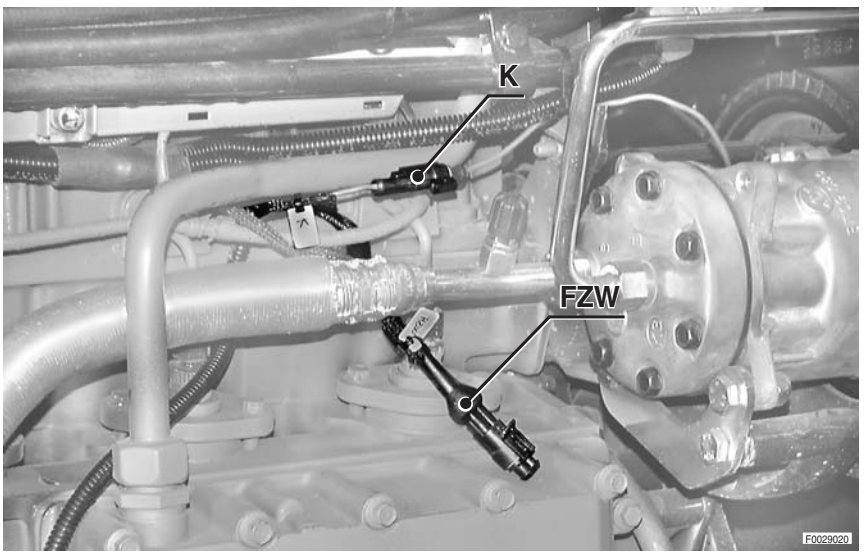

7


X76A-X76B
X81
X82
X83
F0029090

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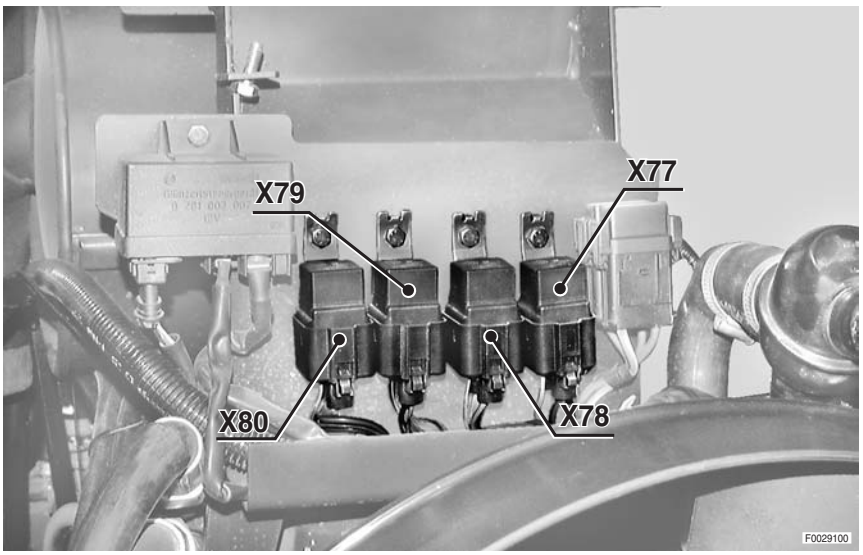
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X77
X80
X78
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X67
F0029000

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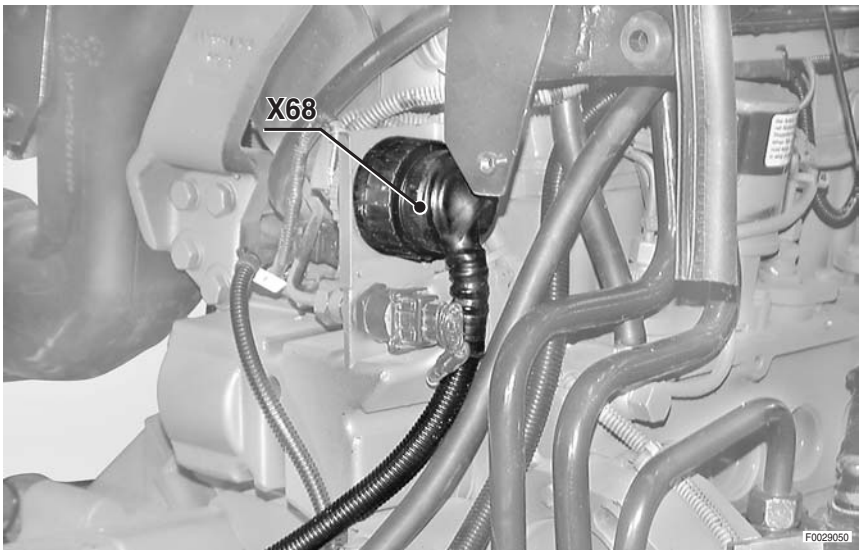

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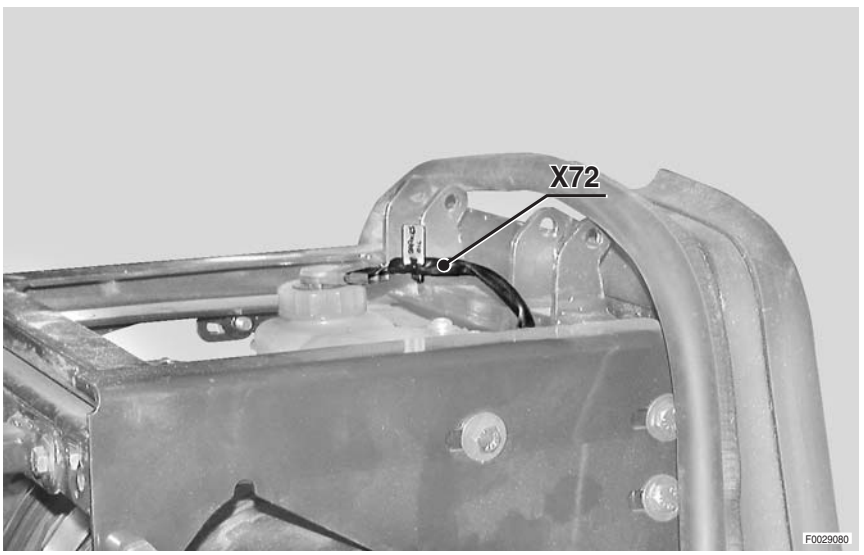

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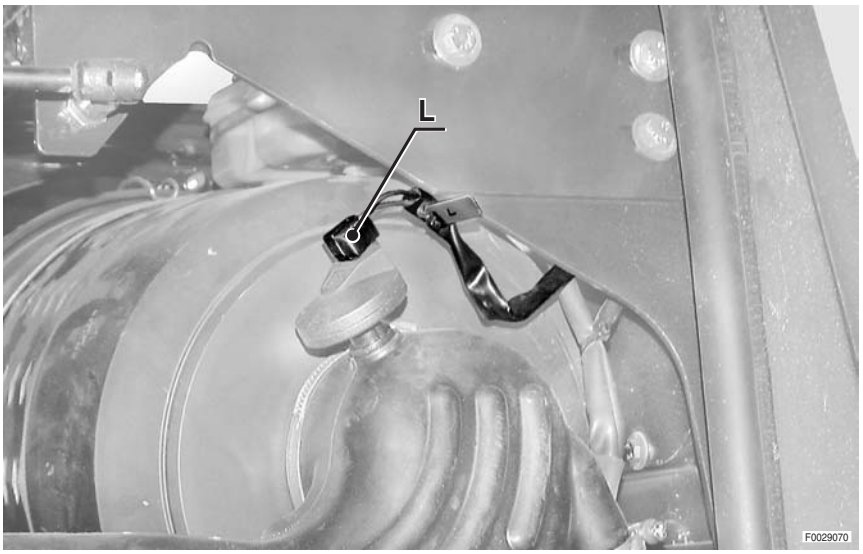

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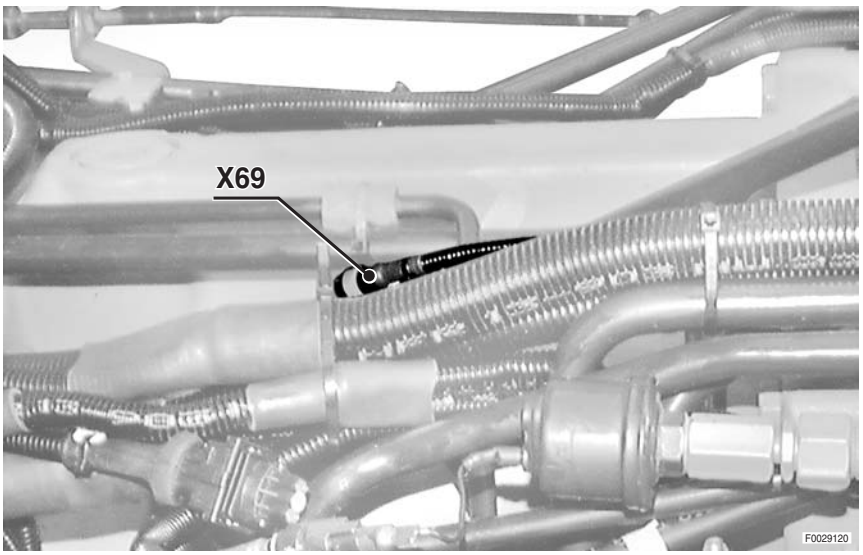

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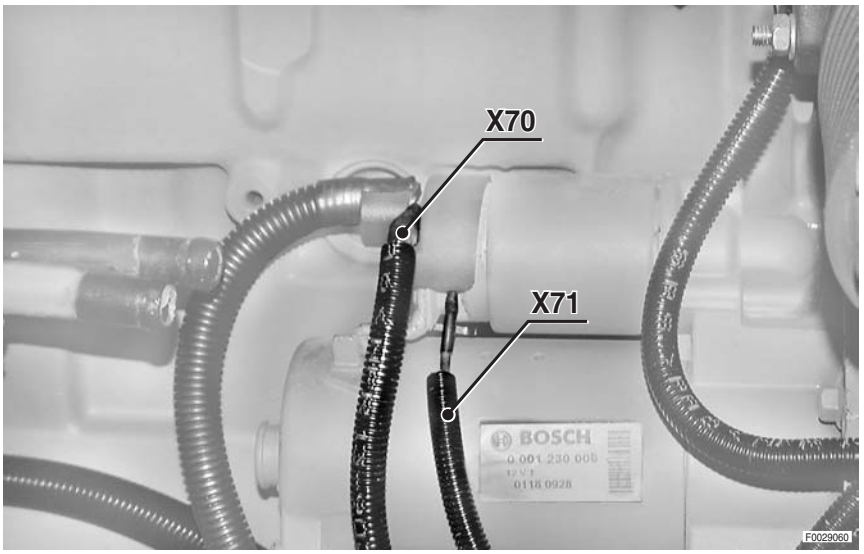

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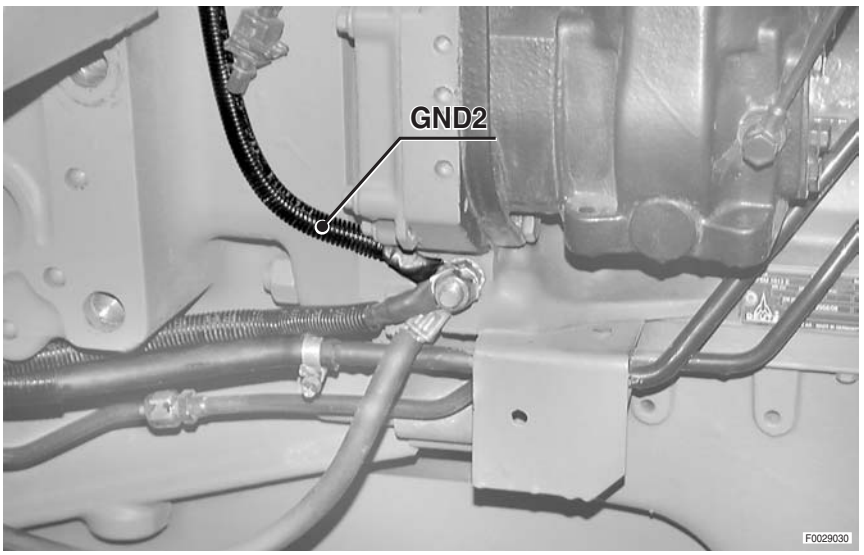

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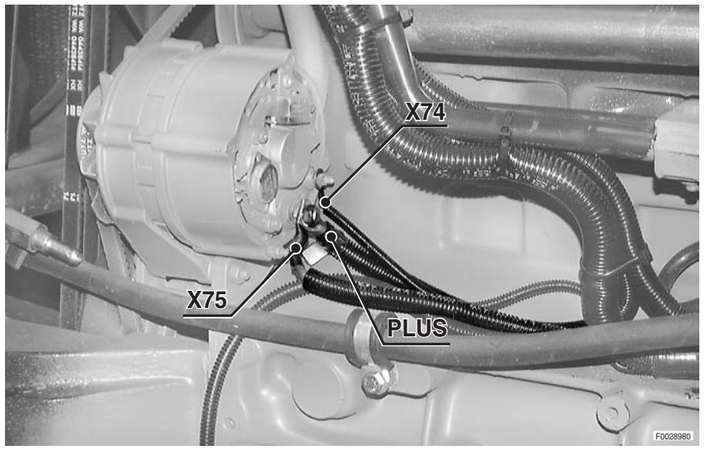

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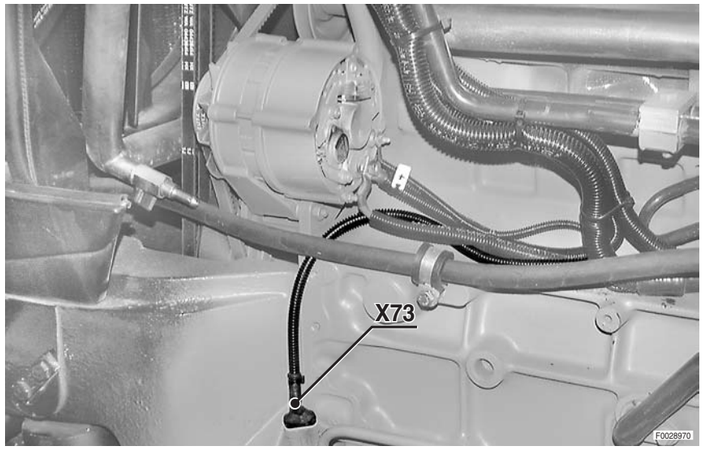
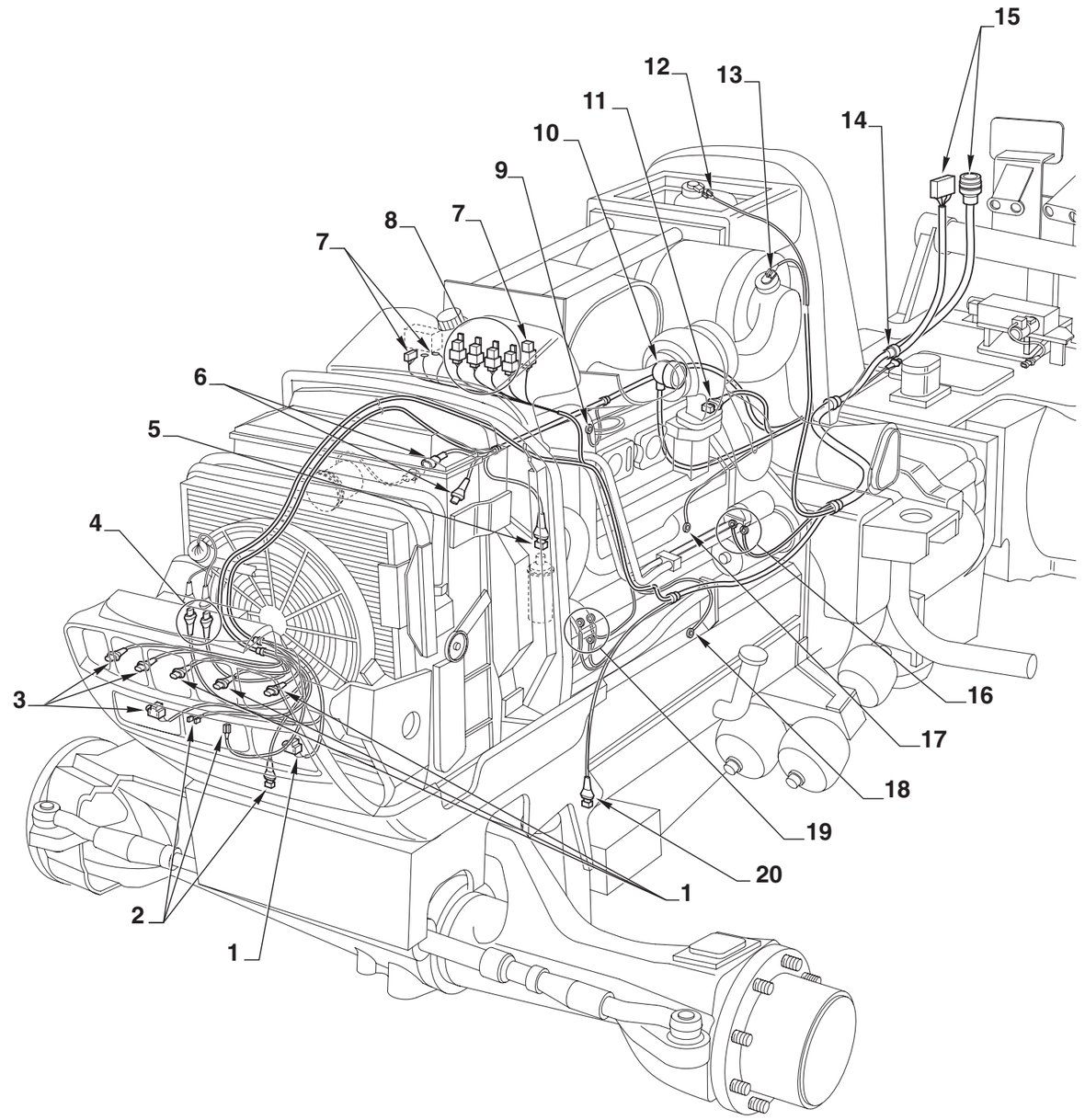


ENGINE WIRING



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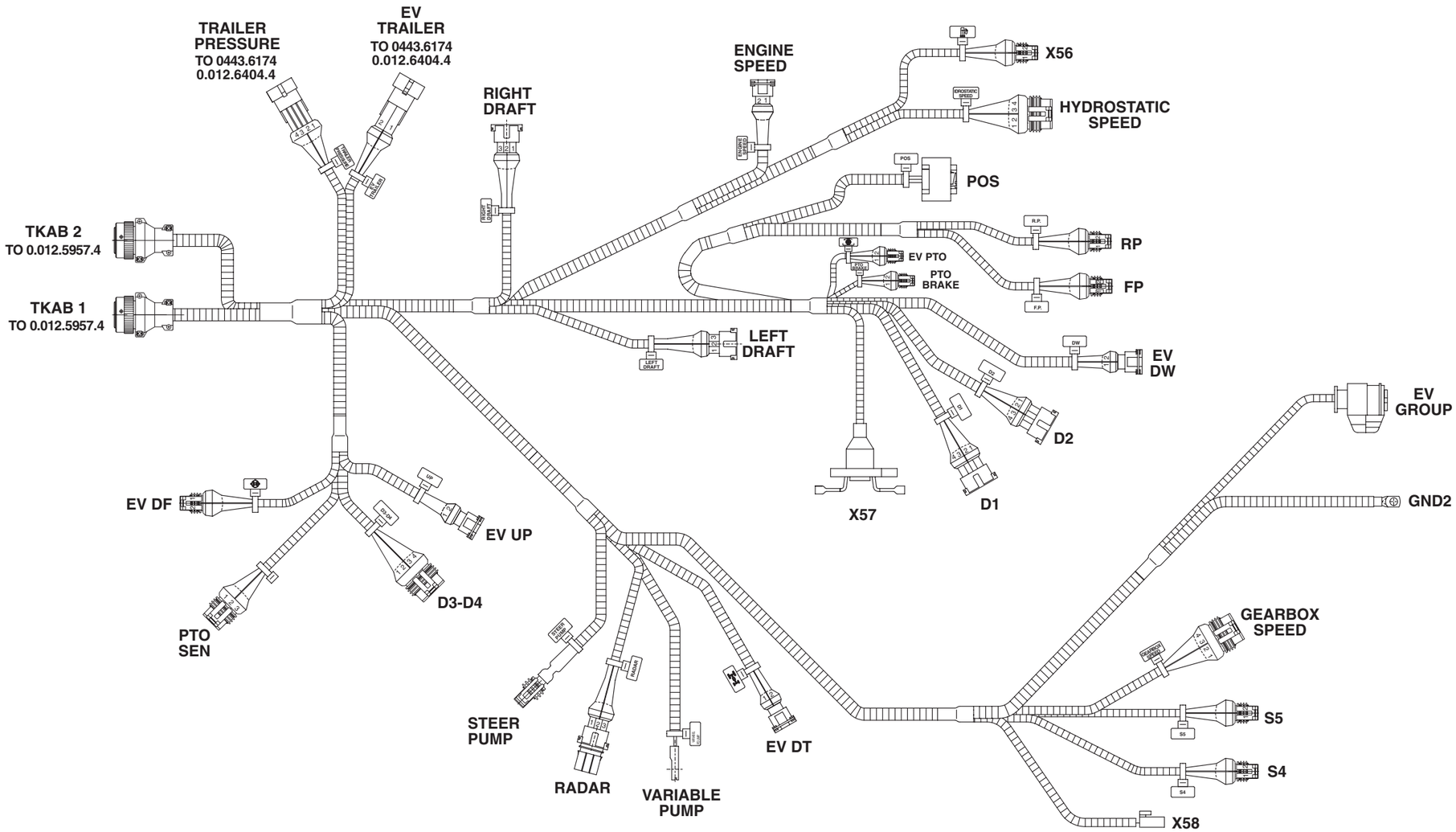
TRANSMISSION WIRING (1/2)

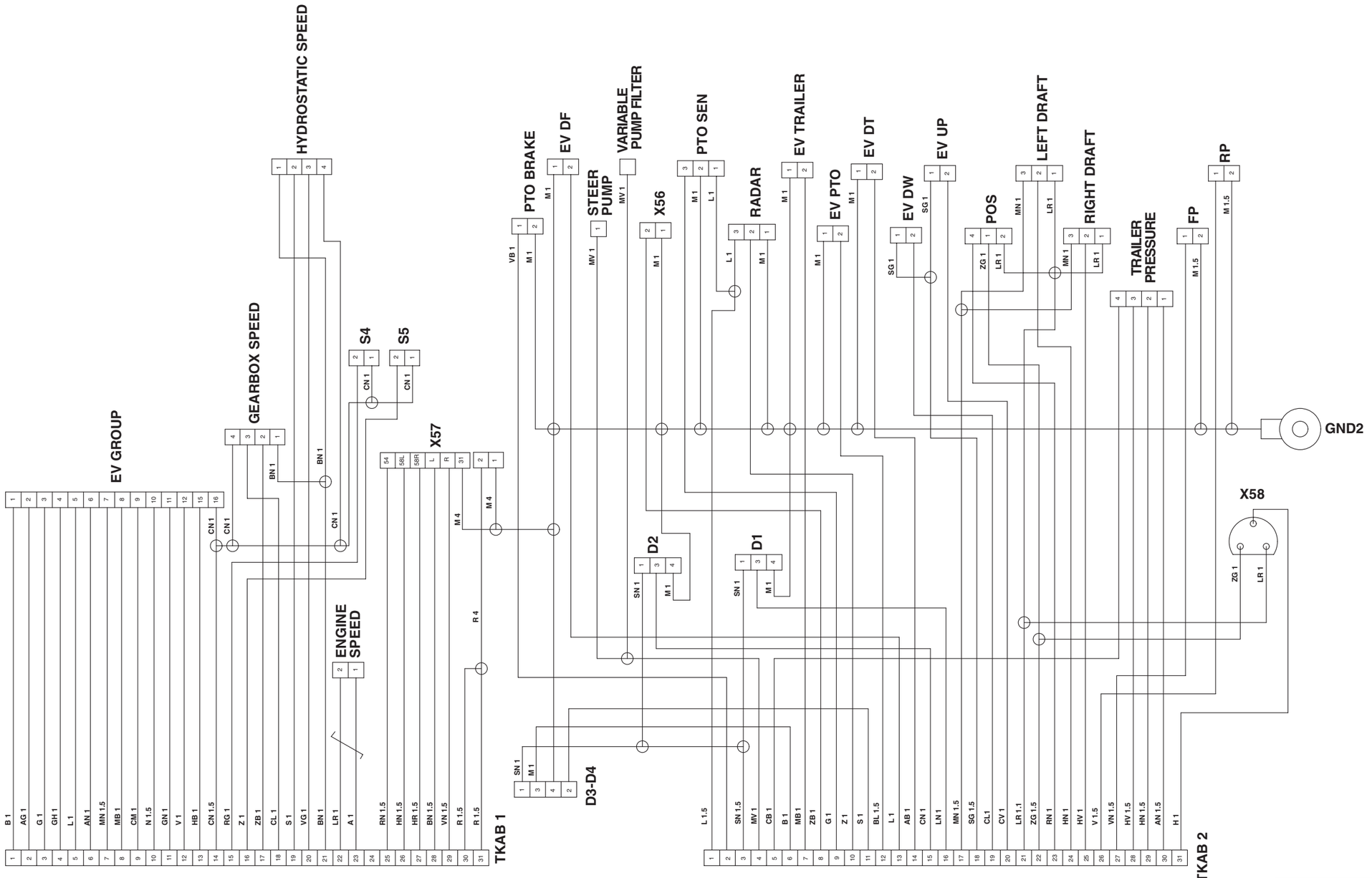


D1 Auxiliary services spool valve N° 1
D2 Auxiliary services spool valve N° 2
D3-D4 Not utilised
ENGINE SPEED Engine speed sensor
EV DF Differential lock solenoid valve
EV DT Four wheel drive (4WD) clutch solenoid valve
EV DW Lift Down solenoid valve
EV GROUP Power shift solenoid valves
EV PTO Rear PTO solenoid valve
EV TRAILER To trailer braking system wiring
EV UP Lift Up solenoid valve

FP Front screenwash pump
GEARBOX SPEED Transmission speed sensor
HYDROSTATIC SPEED Hydrostatic drive speed sensor
LEFT DRAFT Lift draft sensor (Left)
POS Rear lift position sensor
PTO BRAKE PTO brake solenoid valve
PTO SEN Rear PTO speed sensor
RADAR Radar
RIGHT DRAFT Lift draft sensor (Right)
RP Rear screenwash pump
S4 Transmission oil filter clogging pressure switch

S5 Transmission oil low pressure switch
STEER PUMP Steering circuit filter clogging pressure switch
TKAB1 To side console wiring
TKAB2 To side console wiring
TRAILER PRESSURE To trailer braking system wiring
VARIABLE PUMP Hydraulic oil filter clogging pressure switch
X56 Fuel level sensor
X57 Trailer socket (lights and auxiliary power)
X58 Braking system pressure switch

TRANSMISSION WIRING (2/2)



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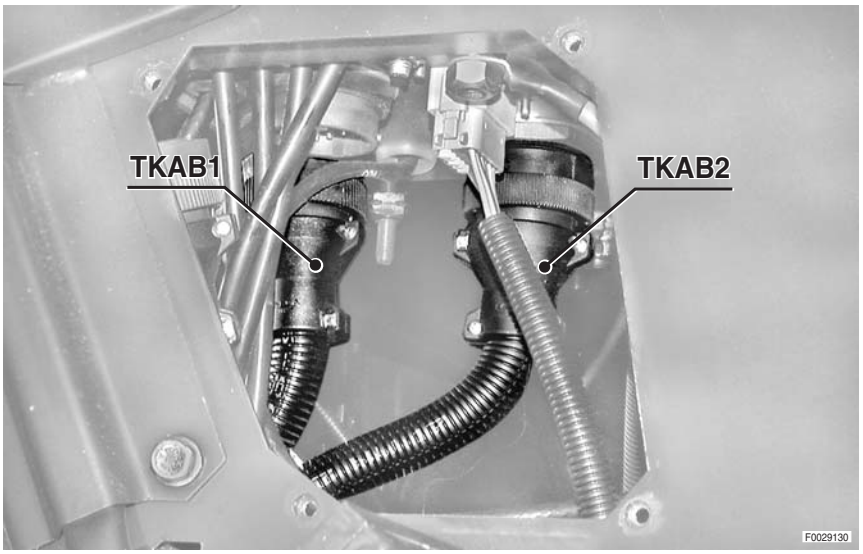
S	Rosa/Pink	G	Giallo/Yellow
R	Rosso/Red	H	Grigio/Gray

0.012.5959.4/10

TRANSMISSION CONNECTORS LOCATION

1



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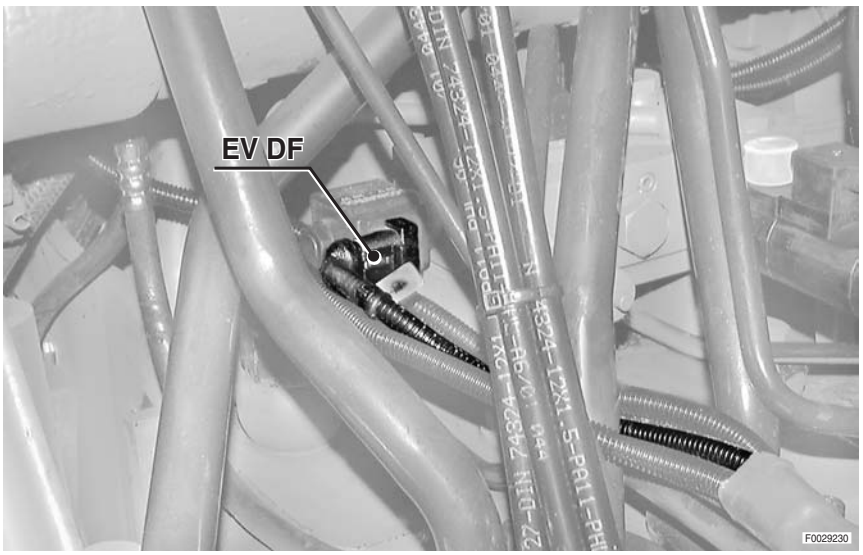

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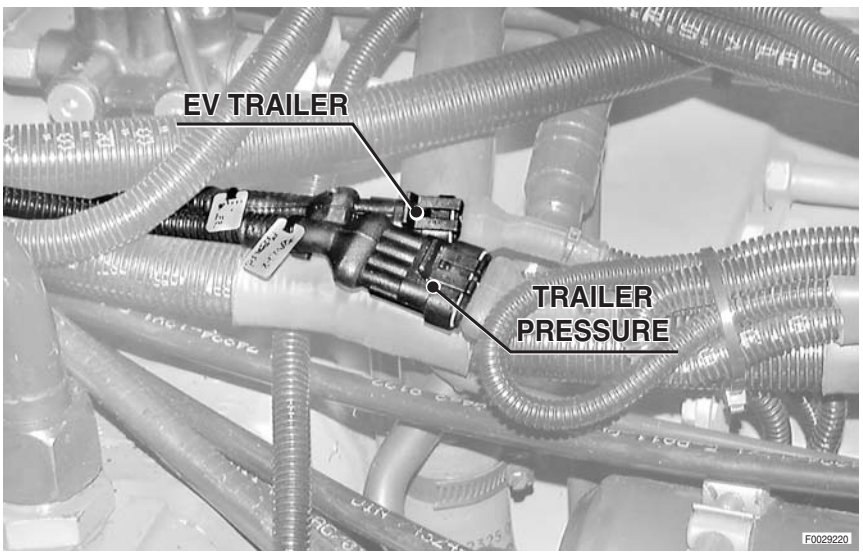

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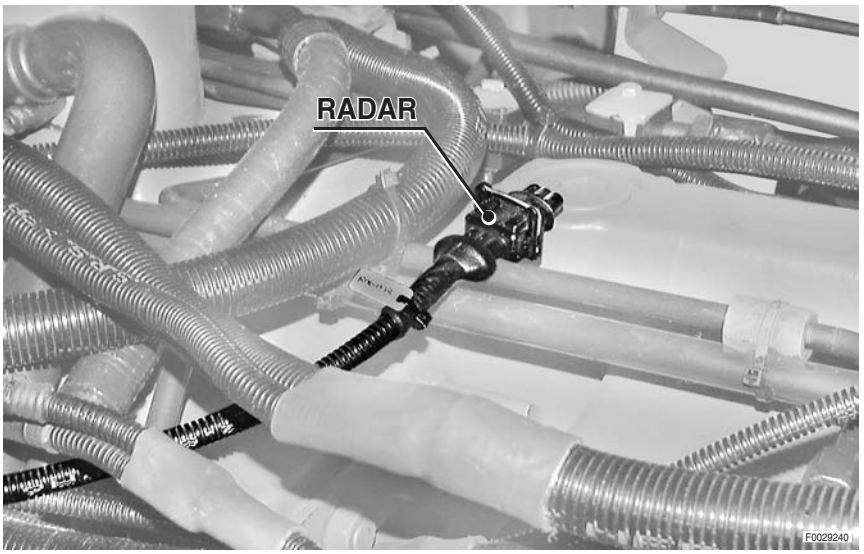
RADAR
F0029240

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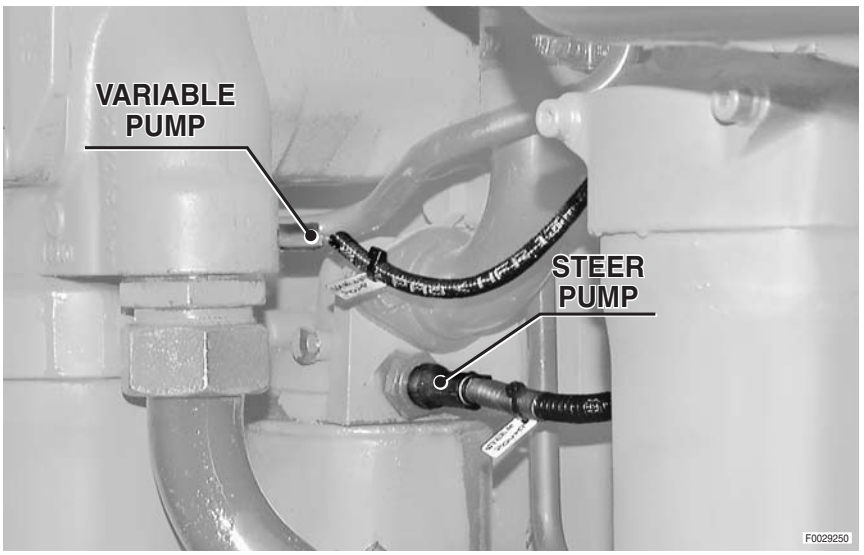
VARIABLE PUMP
STEER PUMP
F0029250

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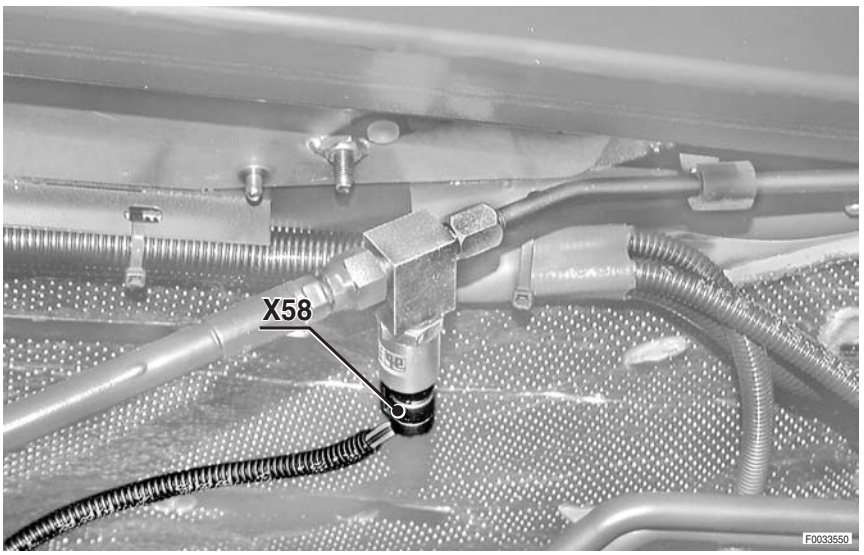
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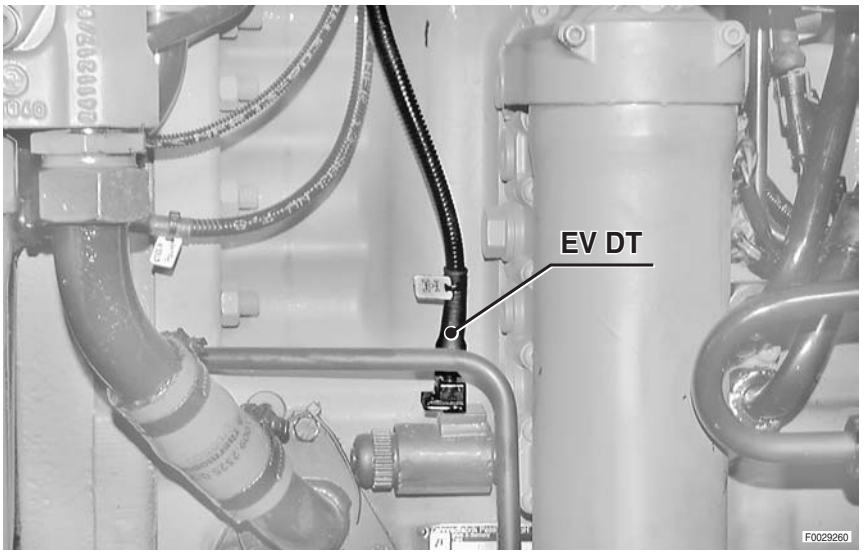

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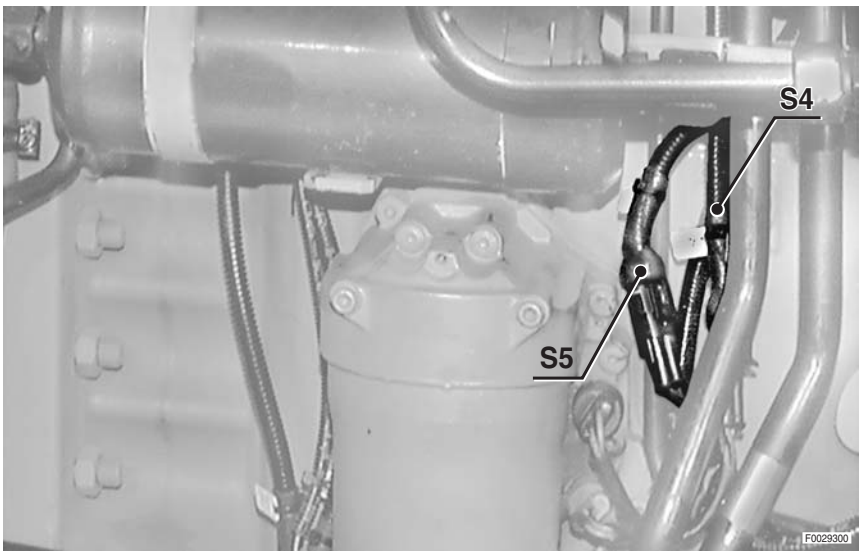

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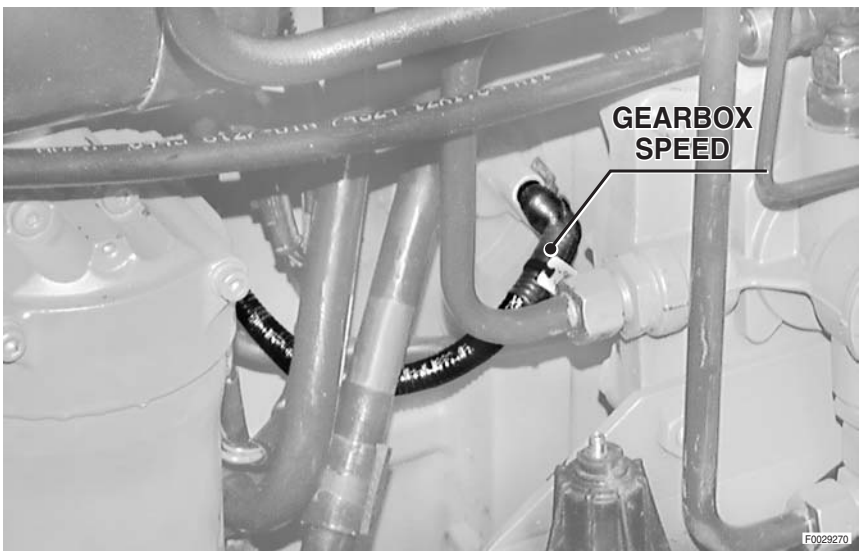

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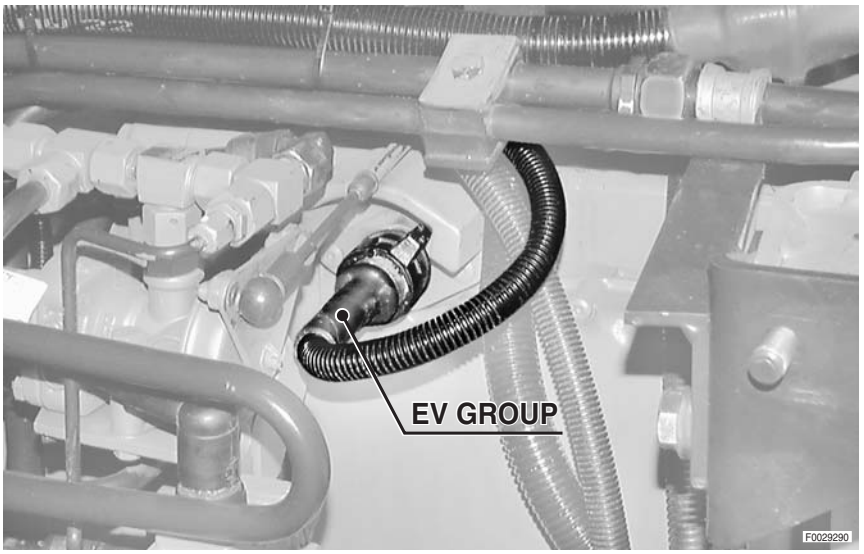
EV GROUP
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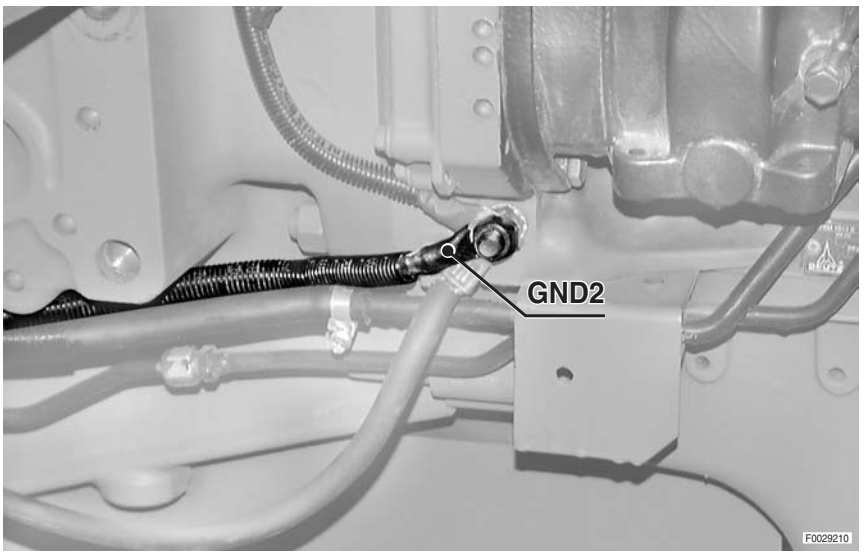
GND2
F0029210

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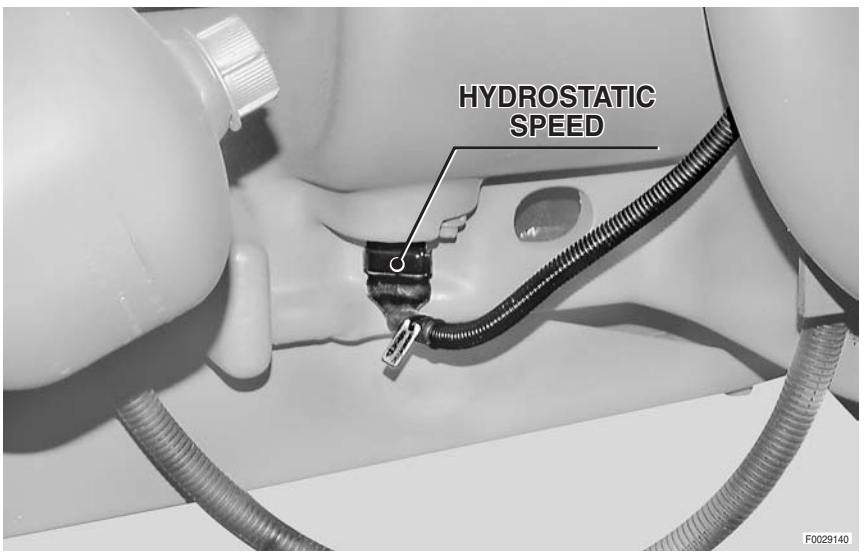
HYDROSTATIC
SPEED
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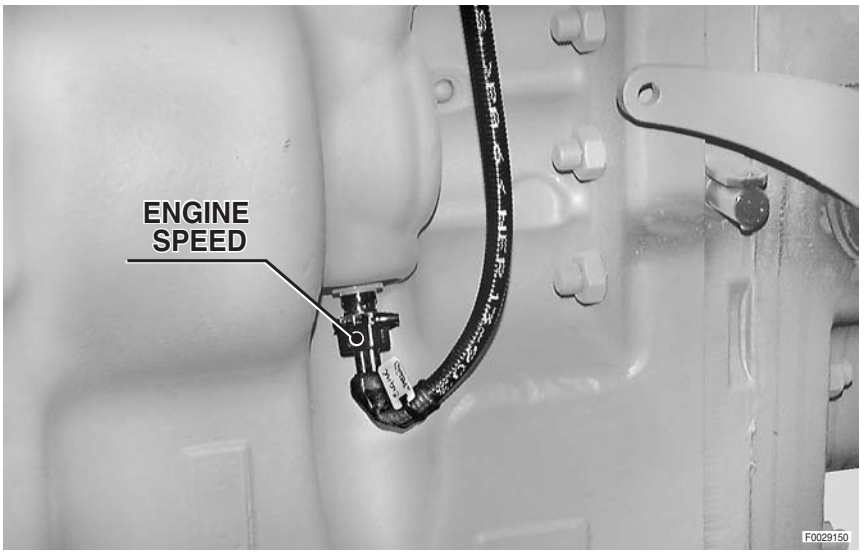
ENGINE
SPEED
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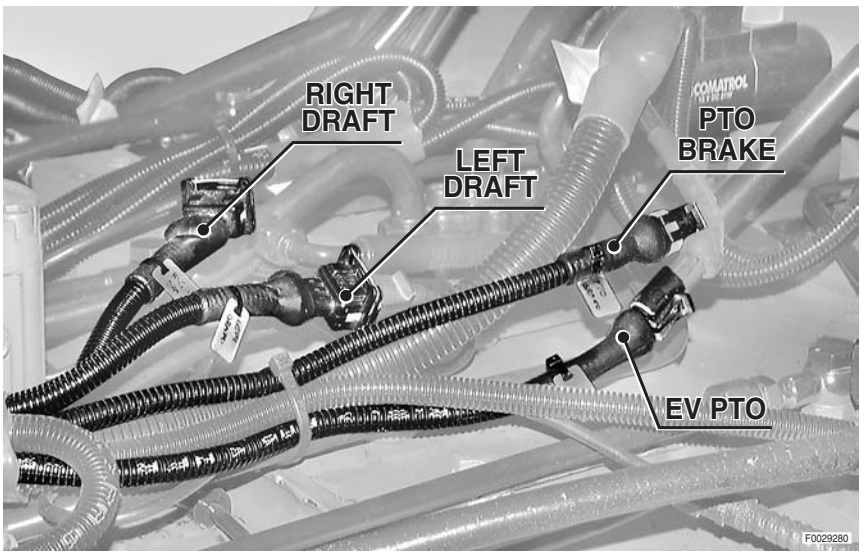
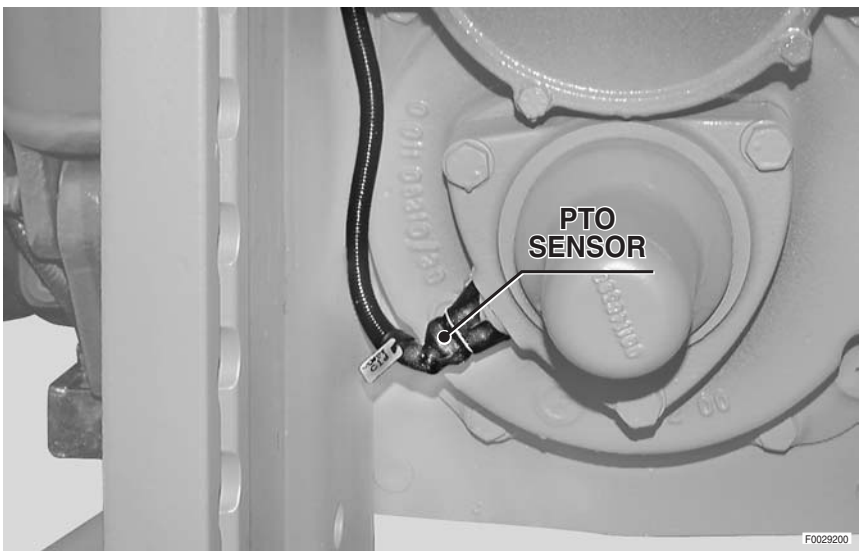

RIGHT
DRAFT
LEFT
DRAFT
PTO
BRAKE
EV PTO
F0029280

15


PTO
SENSOR
F0029200

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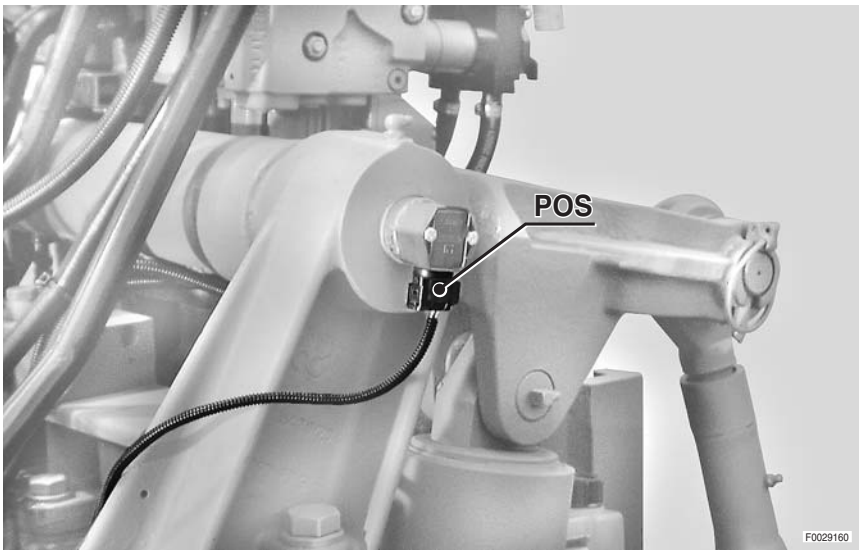

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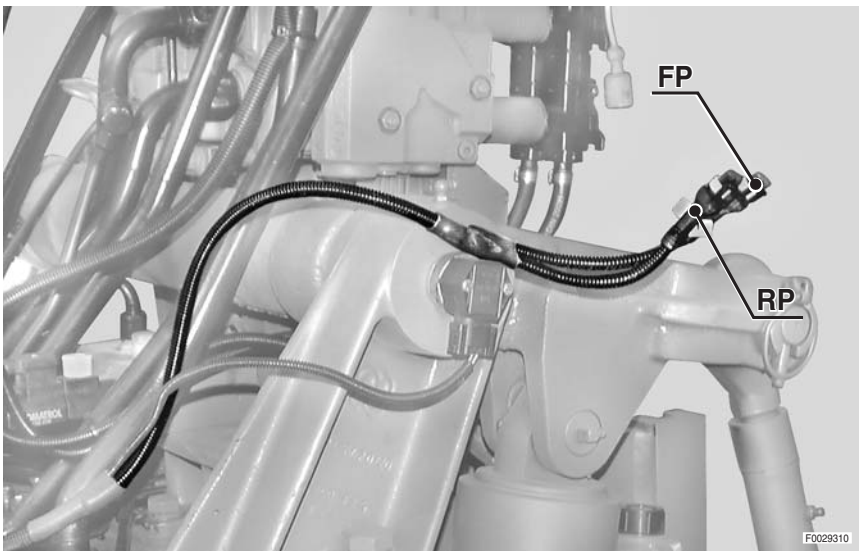

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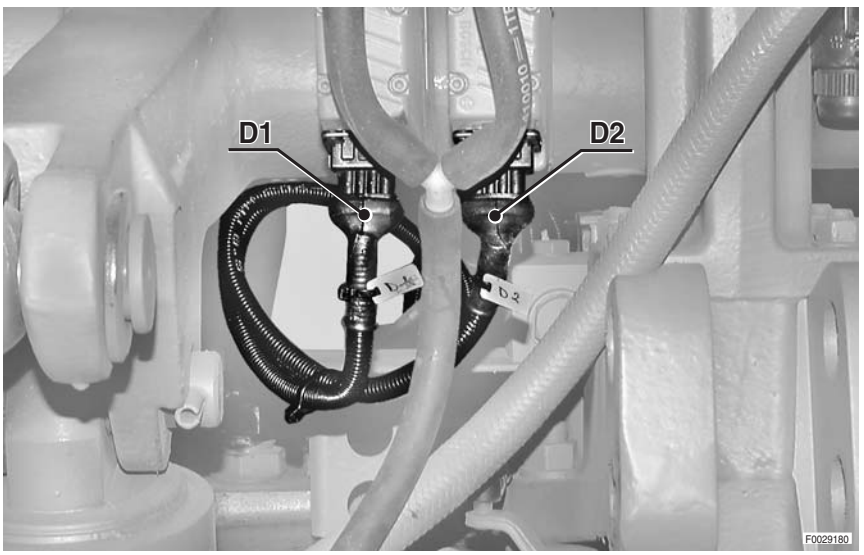

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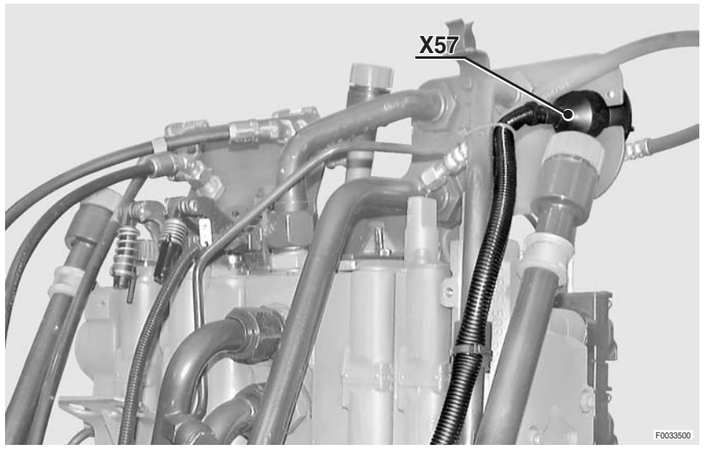

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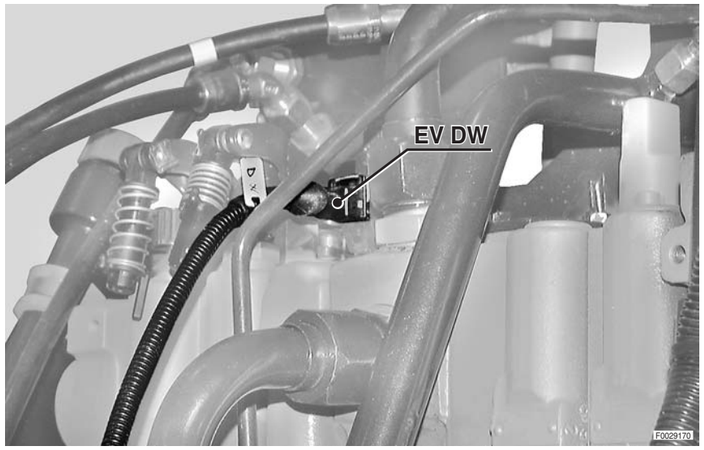

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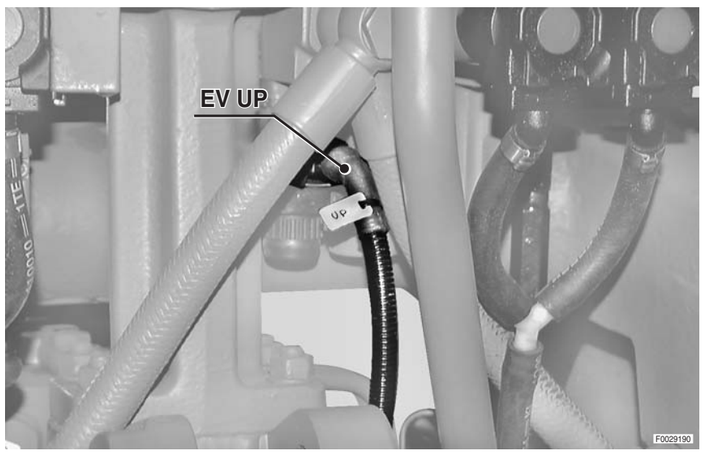
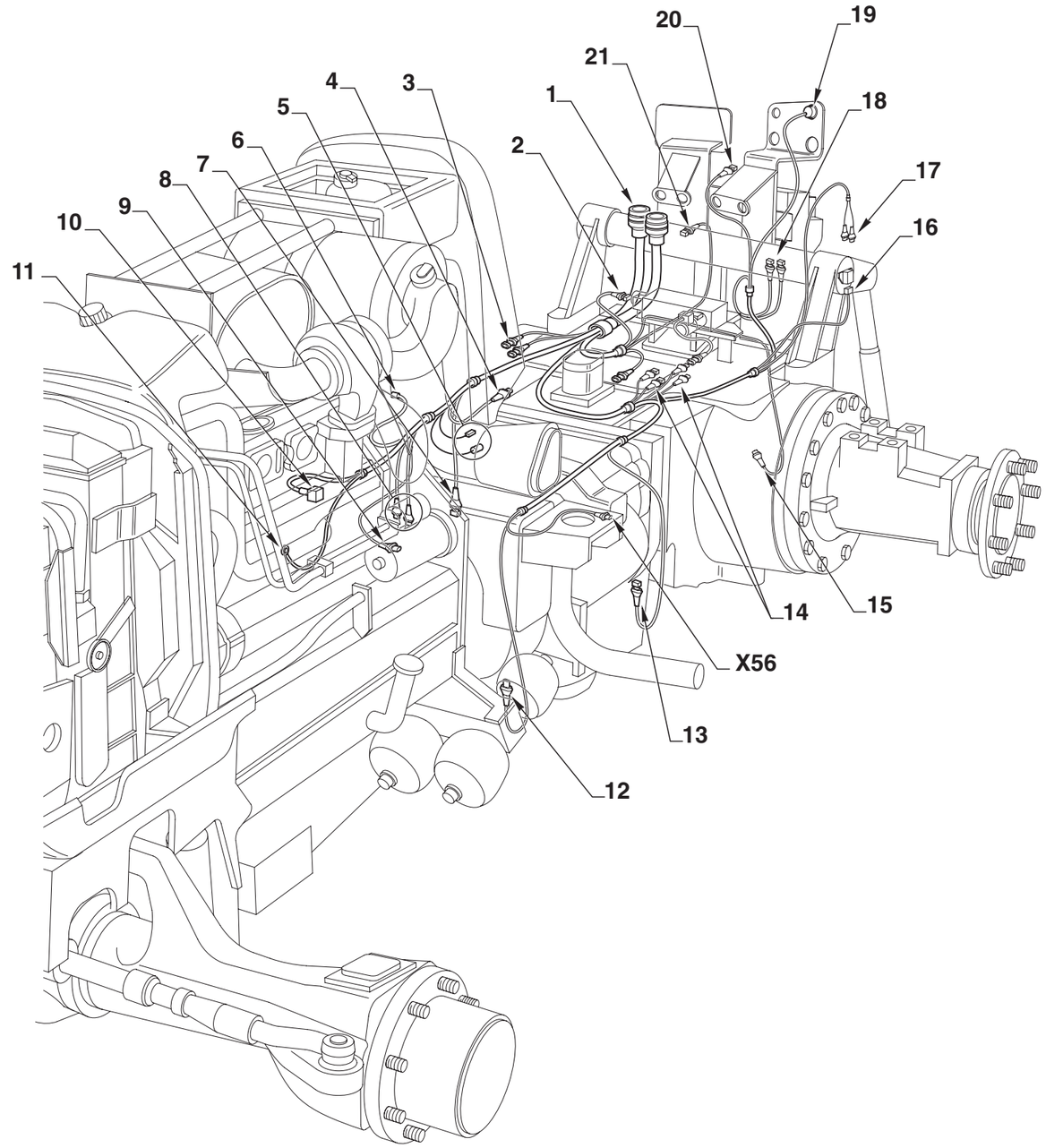


TRANSMISSION WIRING



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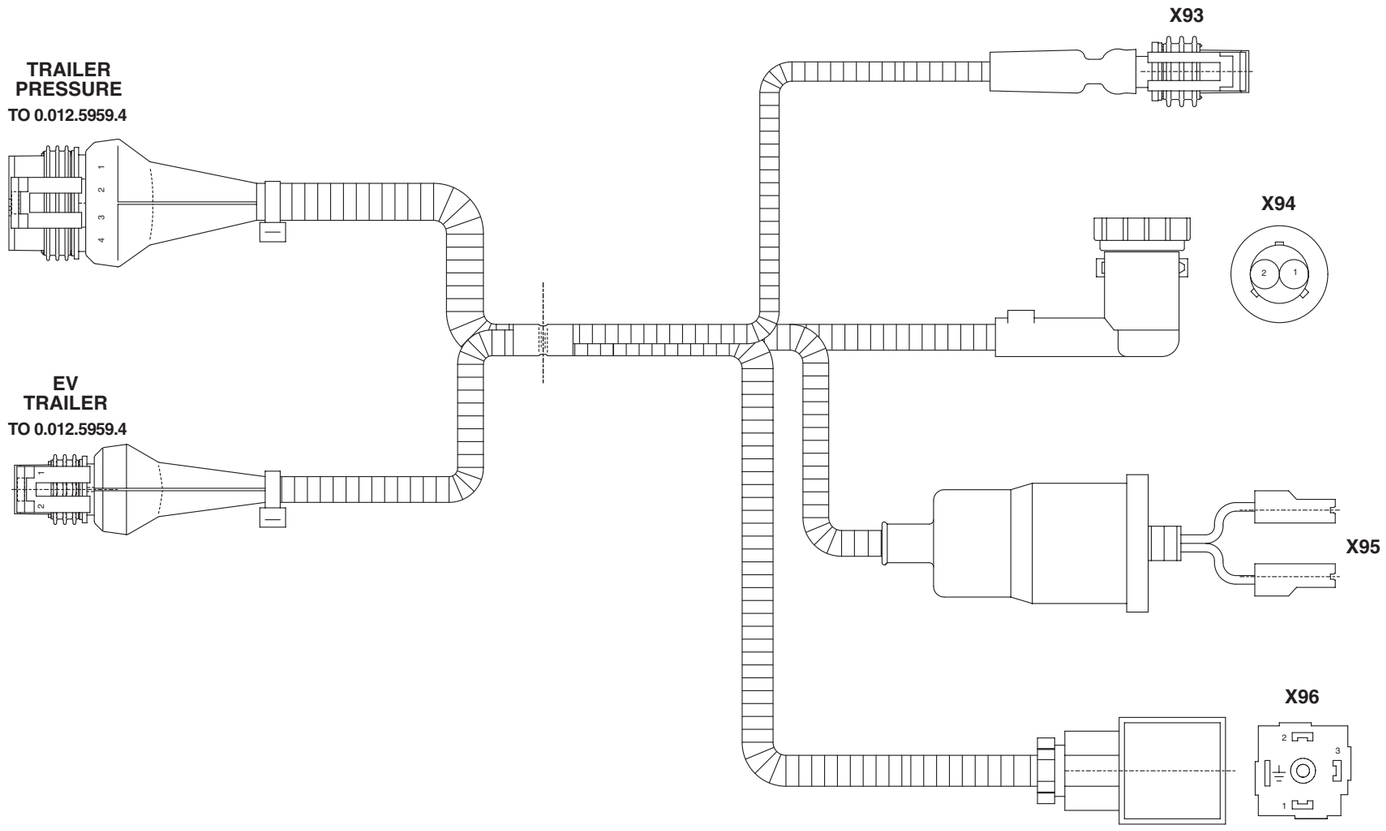
HYDRAULIC AND AIR TRAILER BRAKING SYSTEM WIRING (ITALY)



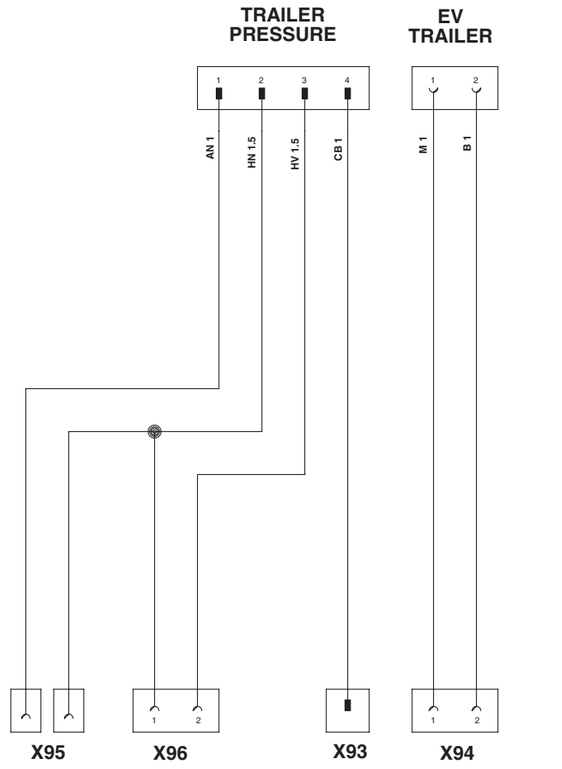
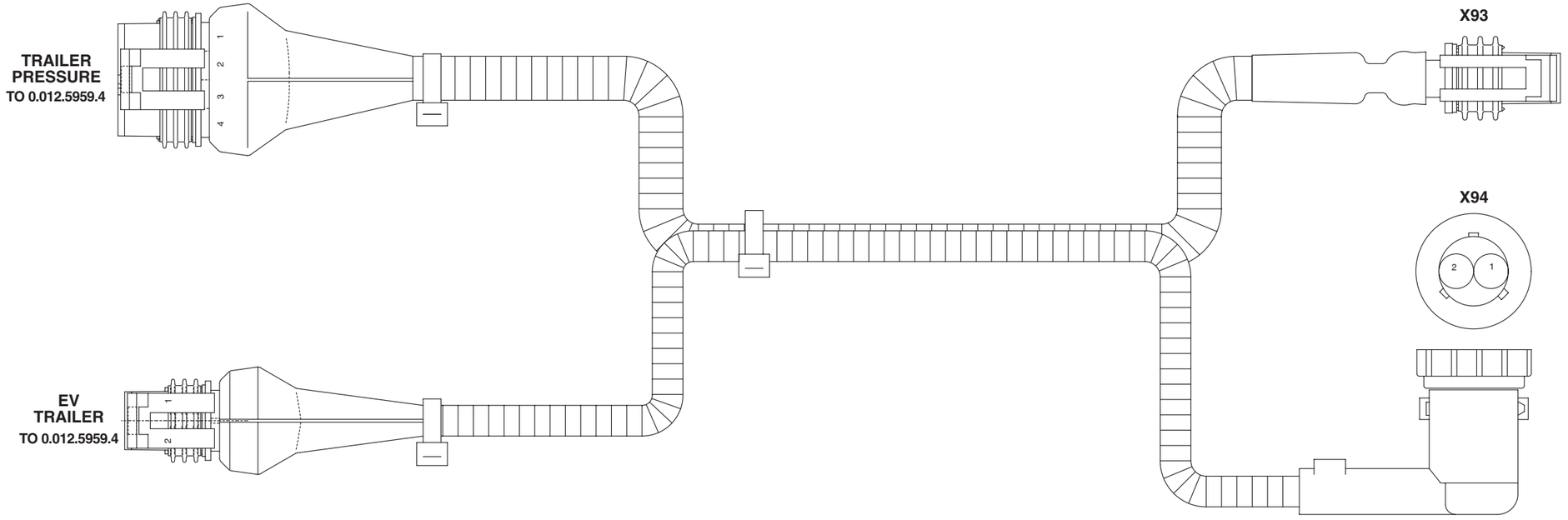


TABELLA COLORI / COLOURS TABLE			
M	Marrone/Brown	C	Arancio/Orange
V	Verde/Green	A	Azzurro/Blue
Z	Viola/Violet	B	Bianco/White
N	Nero/Black	L	Blu/Dark Blue
S	Rosa/Pink	G	Giallo/Yellow
R	Rosso/Red	H	Grigio/Gray

EV TRAILER To transmission wiring
TRAILER PRESSURE To transmission wiring
X93 Trailer braking air pressure sensor
X94 Air braking solenoid valve
X95 Trailer braking low pressure switch
X96 Trailer parking brake solenoid valve

AIR TRAILER BRAKING SYSTEM WIRING



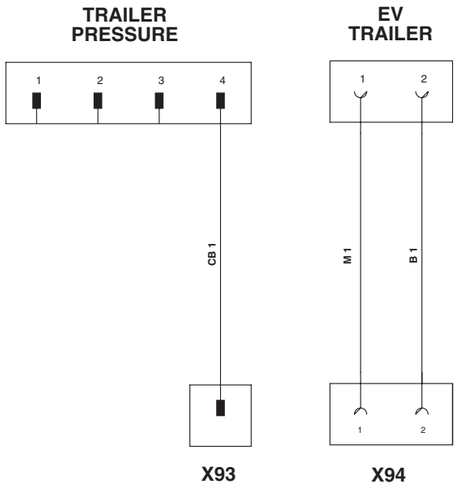


TABELLA COLORI / COLOURS TABLE			
M	Marrone/Brown	C	Arancio/Orange
V	Verde/Green	A	Azzurro/Blue
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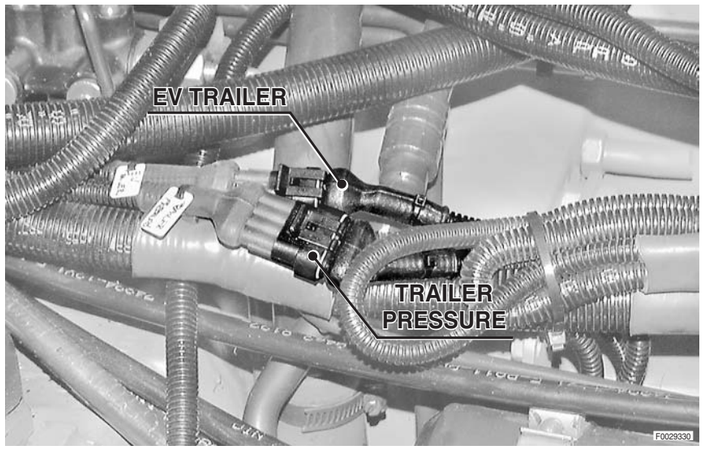
R	Rosso/Red	H	Grigio/Gray

EV TRAILER To transmission wiring
TRAILER PRESSURE To transmission wiring
X93 Trailer braking air pressure sensor
X94 Air braking solenoid valve

1



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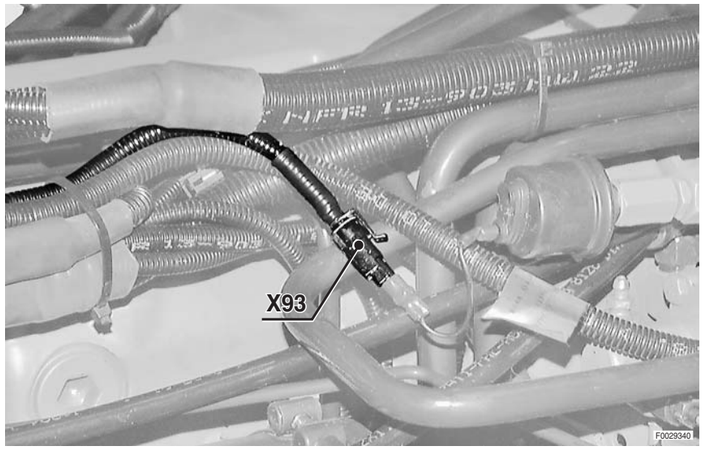

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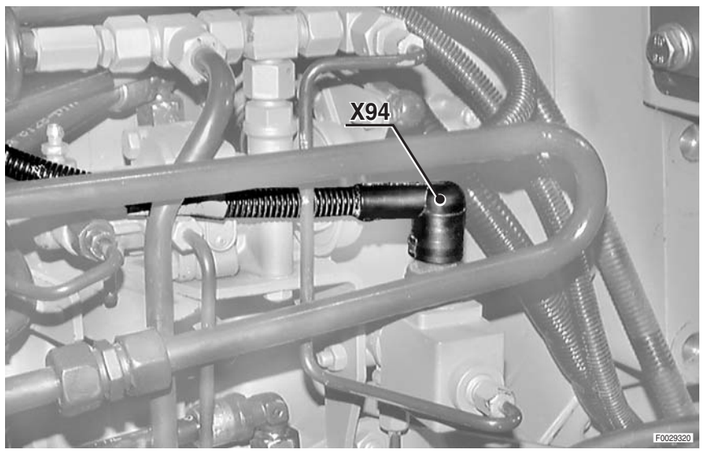
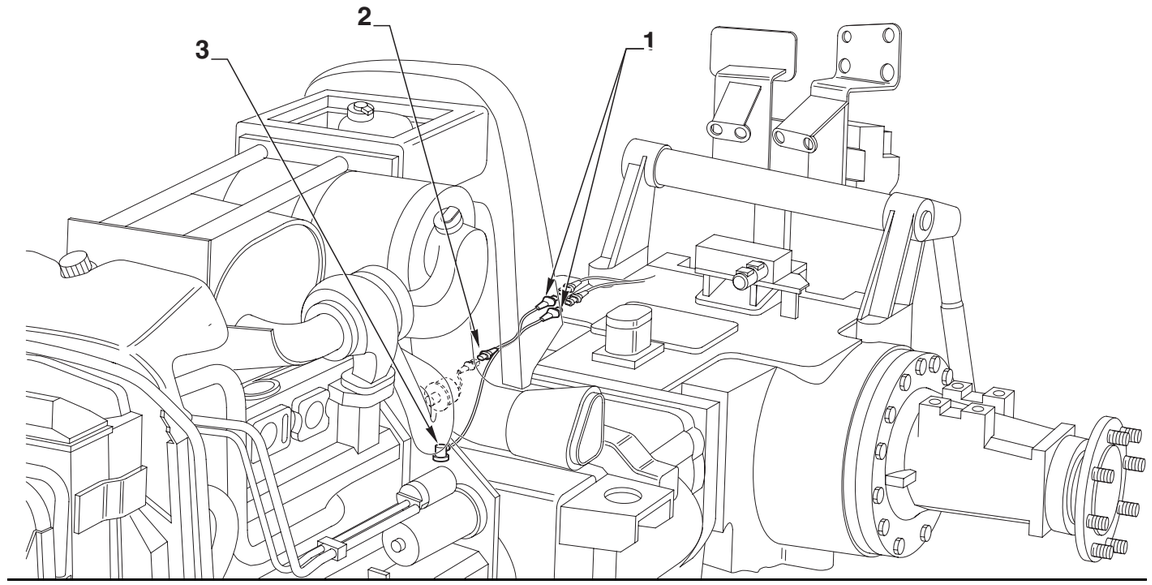
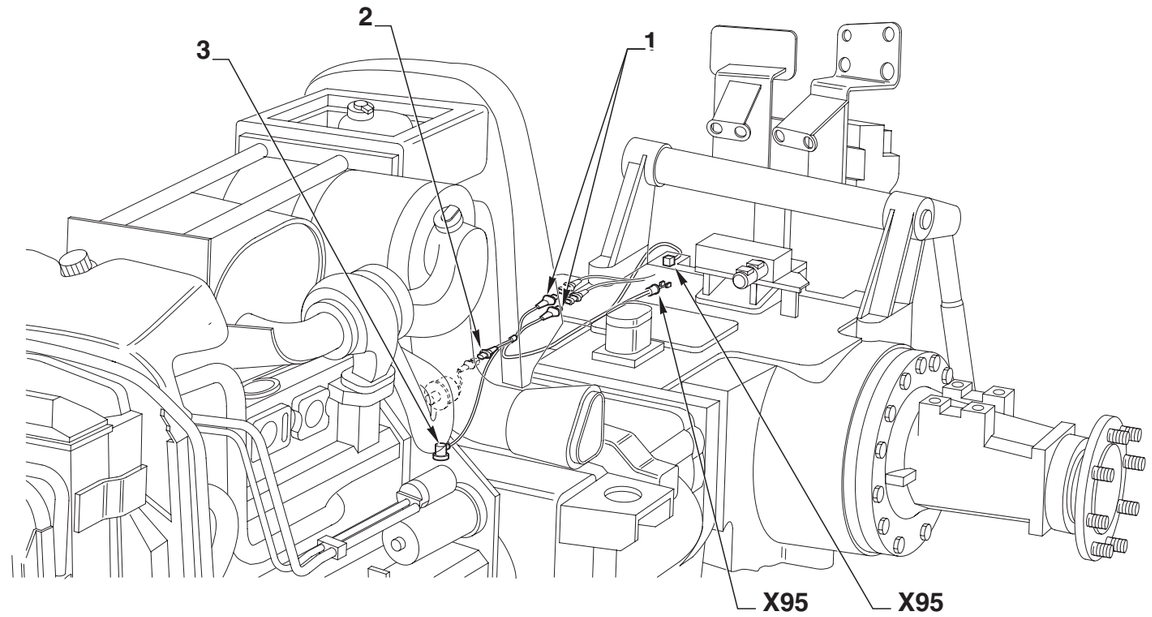


TRAILER BRAKING SYSTEM WIRING

AIR TRAILER BRAKING SYSTEM



HYDRAULIC AND AIR TRAILER BRAKING SYSTEM (ITALY)



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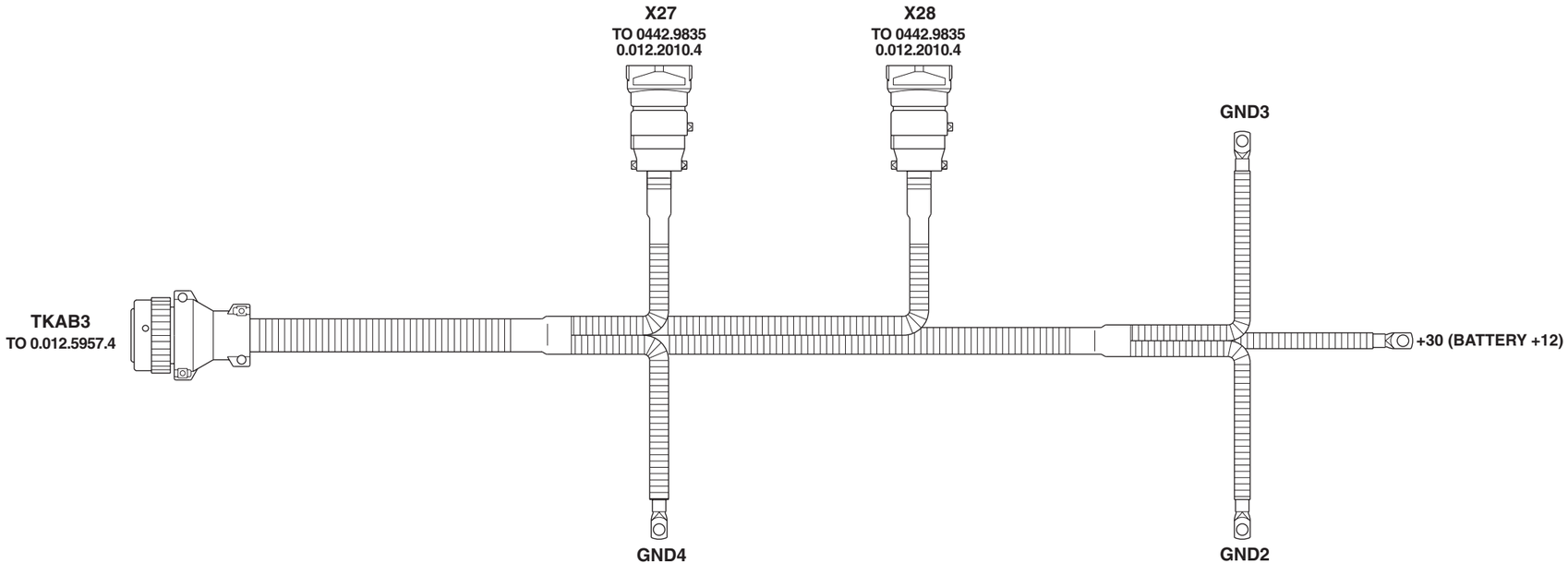
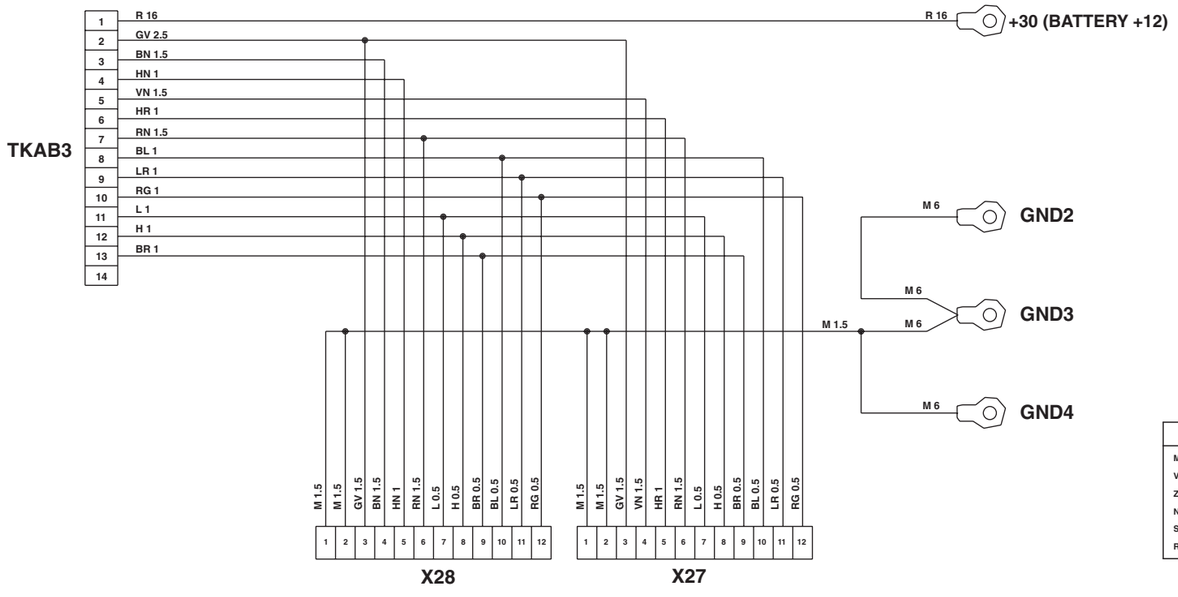
CAB POWER SUPPLY WIRING





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M	Marrone/Brown	C	Arancio/Orange Azzurro/Blue
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S	Rosa/Pink	G	Giallo/Yellow
R	Rosso/Red	H	Grigio/Gray

TKAB3 To side console wiring
X27 To fender wiring
X28 To fender wiring

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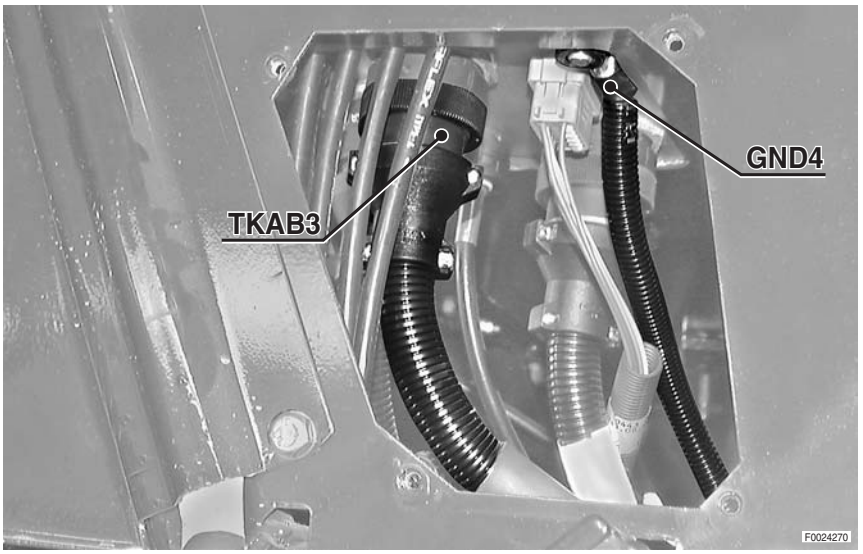
CAB POWER SUPPLY CONNECTORS LOCATION

1



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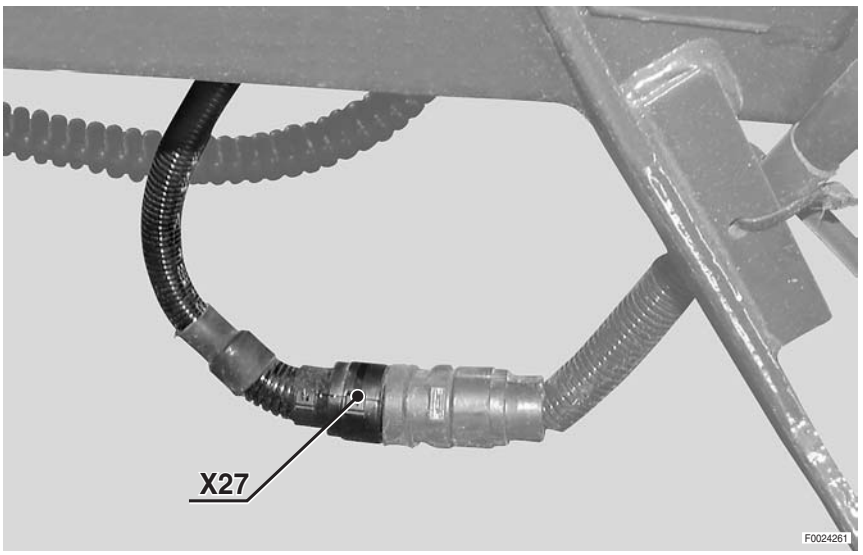

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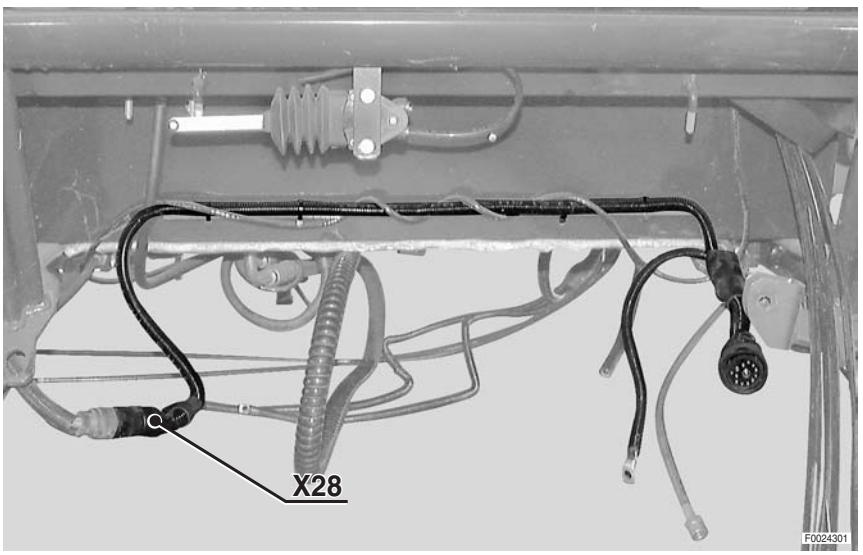

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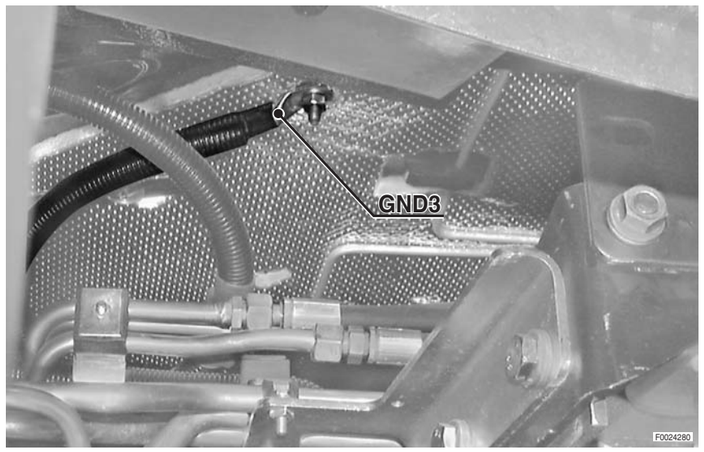
CAB POWER SUPPLY WIRING

4



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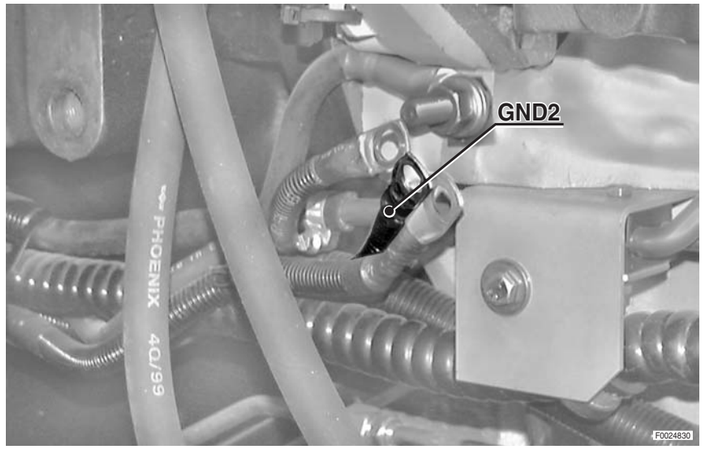

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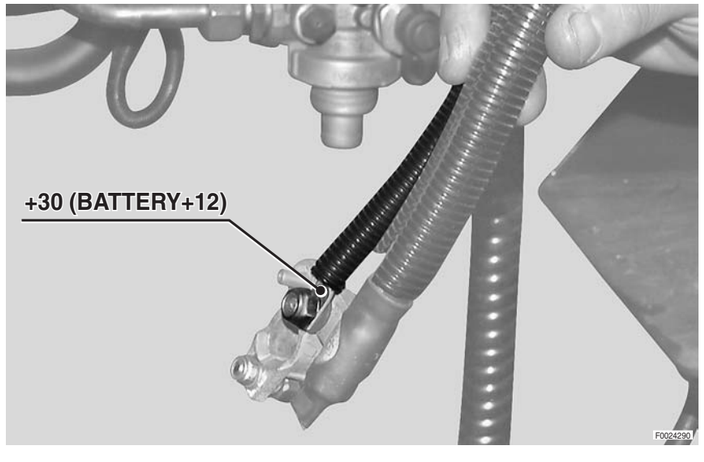

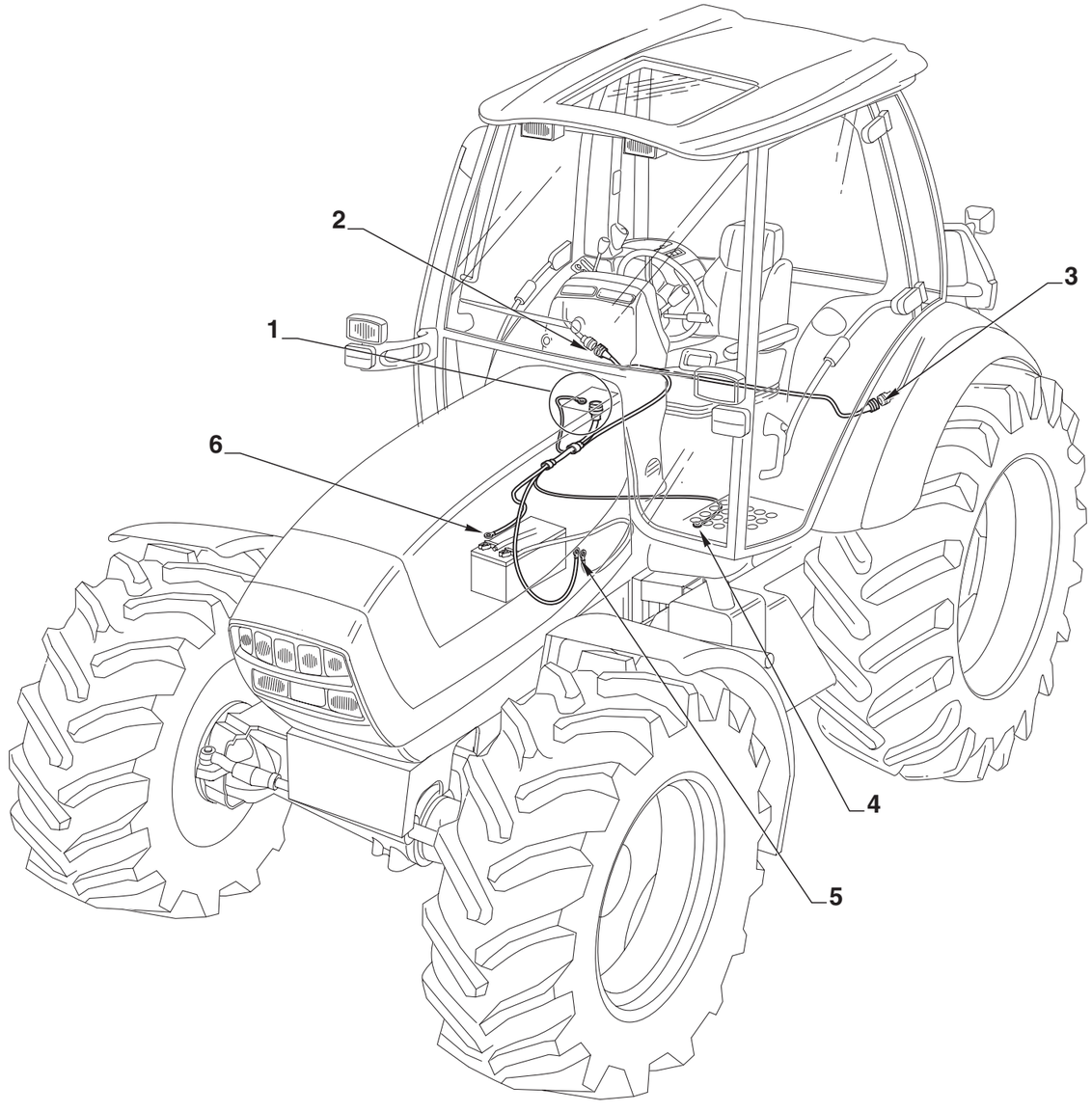

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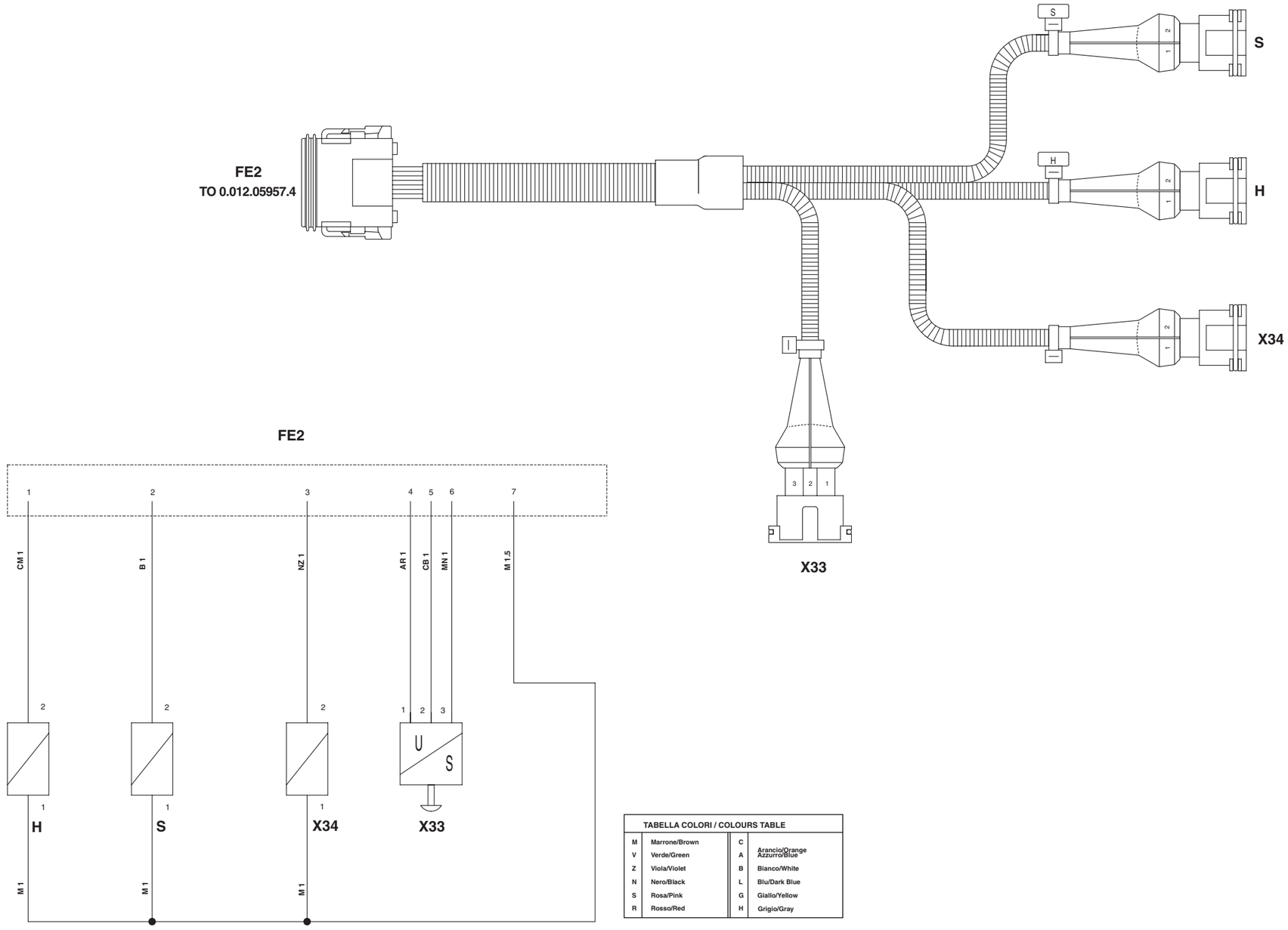
FRONT AXLE SUSPENSION WIRING



FE2 To front axle suspension control unit wiring
H Front axle suspension Raise solenoid valve
S Front axle suspension Lower solenoid valve
X33 Front axle suspension position sensor
X34 Front axle suspension Load Sensing solenoid valve

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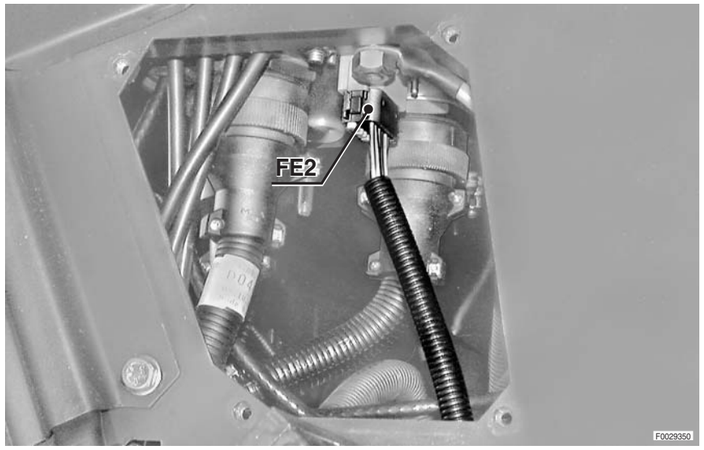
FRONT AXLE SUSPENSION WIRING

1



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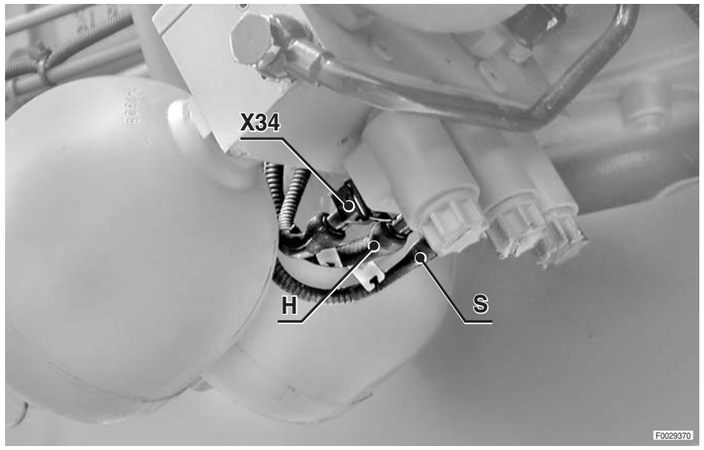

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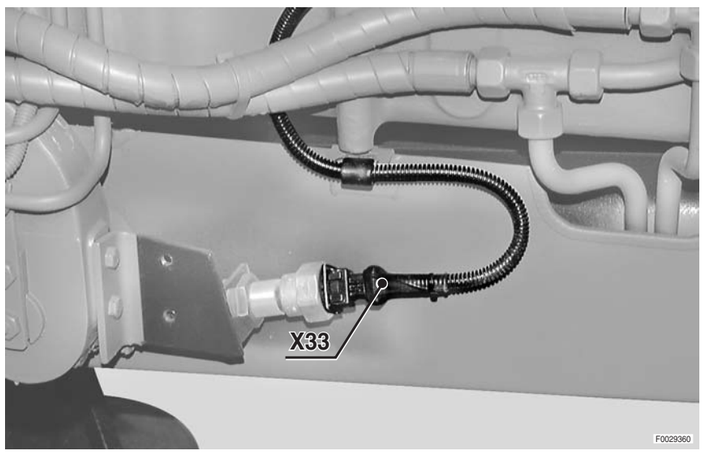

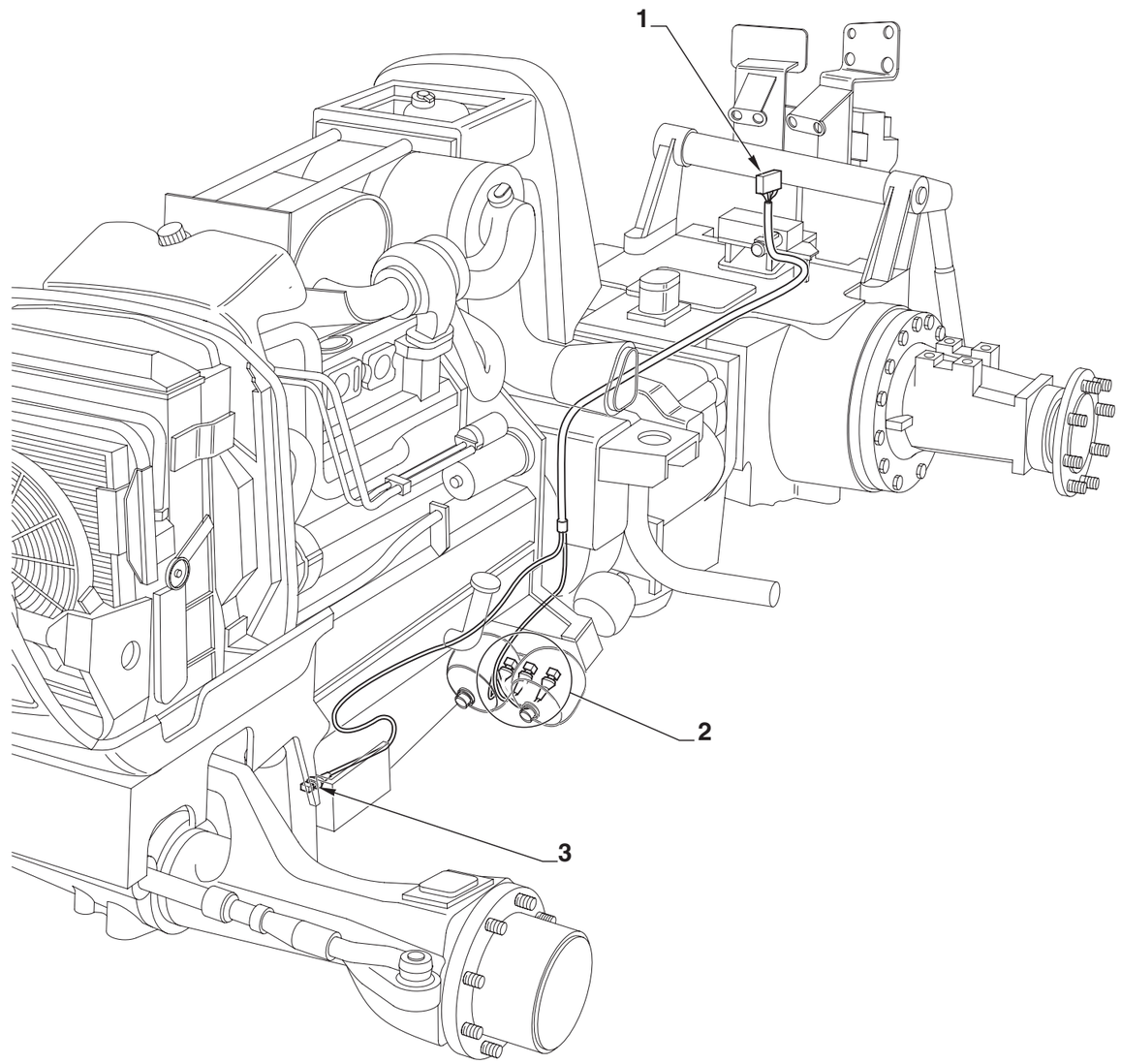

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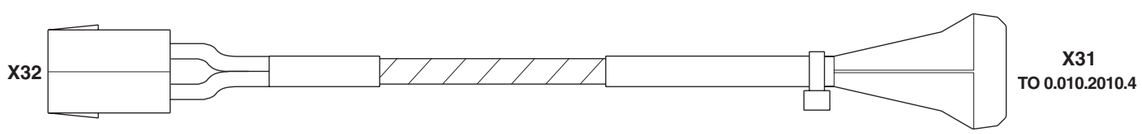
NUMBER PLATE LIGHT WIRING



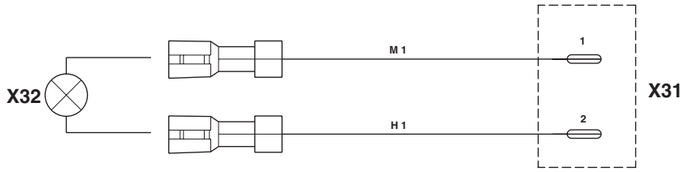


TABELLA COLORI / COLOURS TABLE			
M	Marrone/Brown	C	Arancio/Orange
V	Verde/Green	A	Azzurro/Blue
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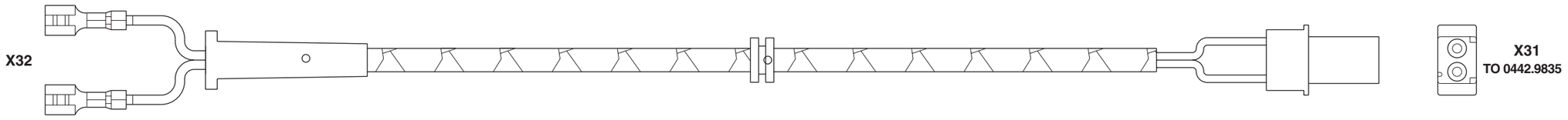
S	Rosa/Pink	G	Giallo/Yellow
R	Rosso/Red	H	Grigio/Gray

X31 To fender wiring
X32 Number plate light

NUMBER PLATE LIGHT WIRING



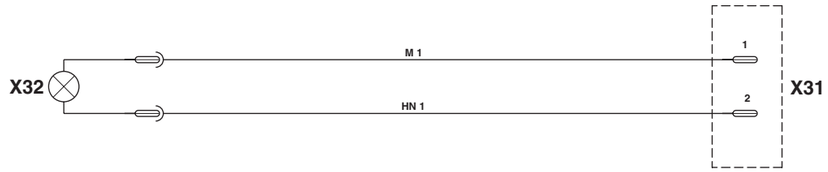


TABELLA COLORI / COLOURS TABLE			
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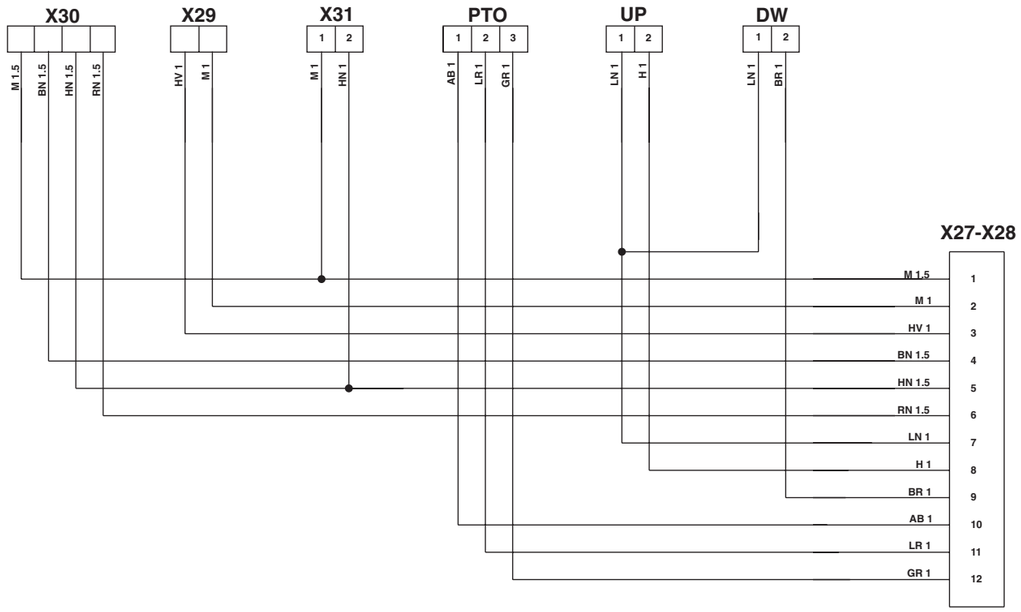
S	Rosa/Pink	G	Giallo/Yellow
R	Rosso/Red	H	Grigio/Gray

X31 To fender wiring
X32 Number plate light

FENDER WIRING



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M	Marrone/Brown	C	Arancio/Orange
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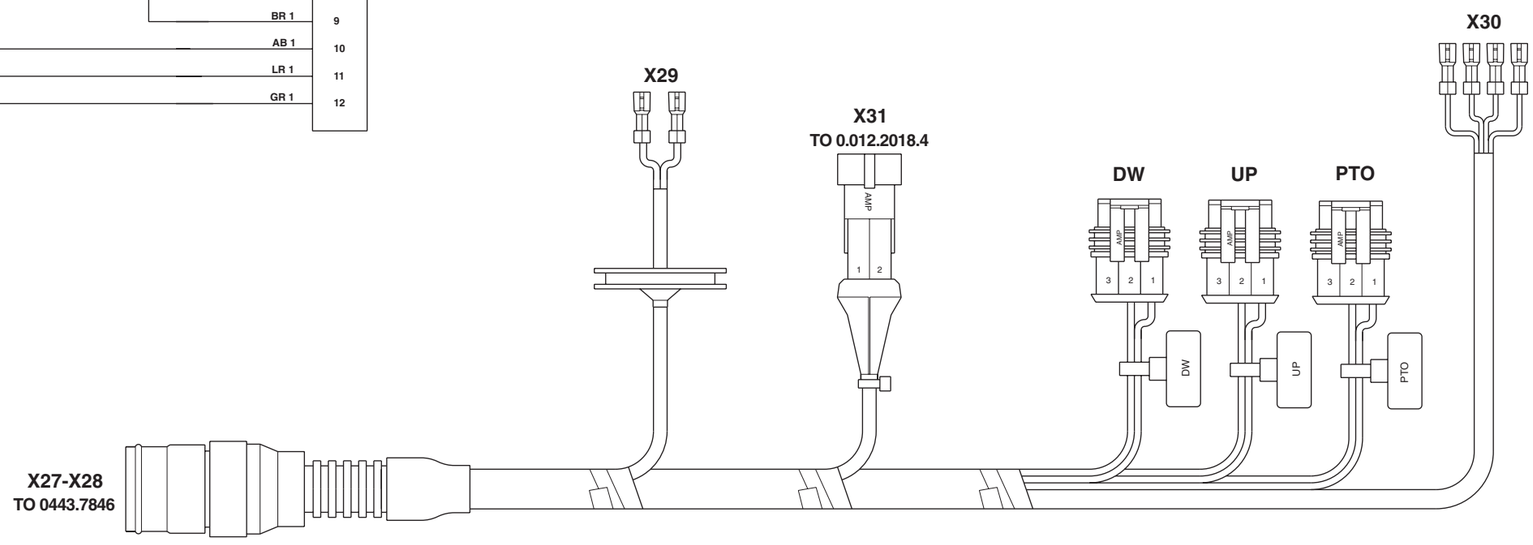
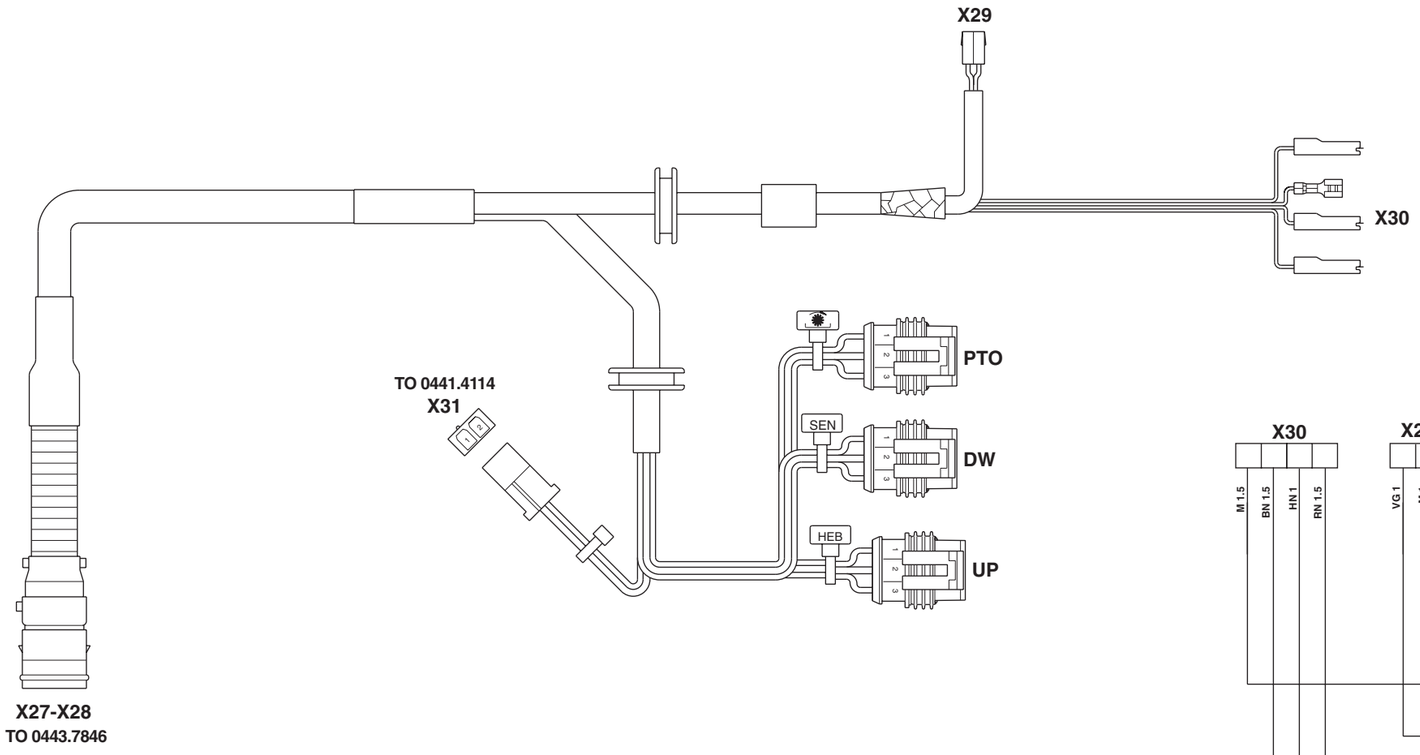
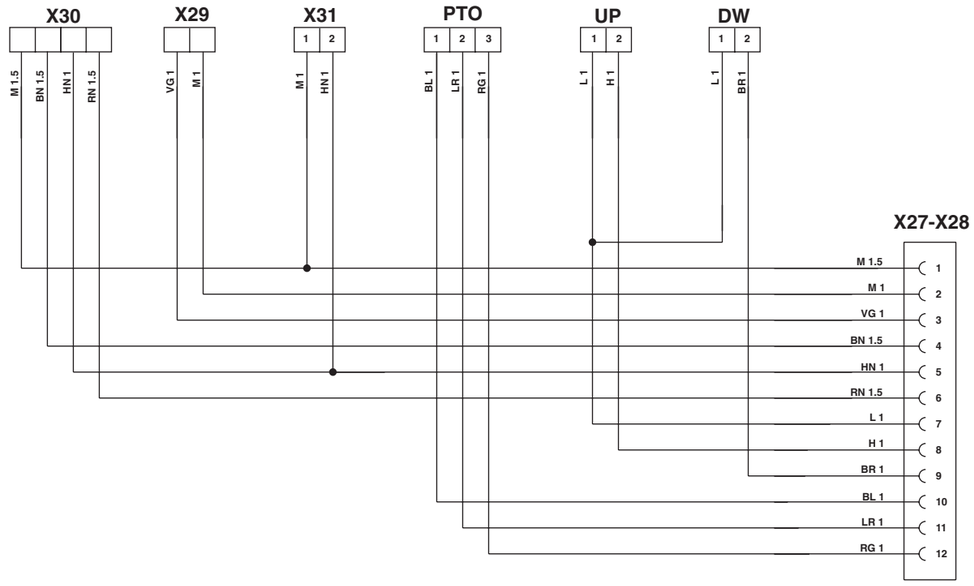


DW Rear lift Down button
PTO Rear PTO button
UP Rear lift Up button
X27 To cab power supply wiring
X28 To cab power supply wiring
X29 Rear lower work light
X30 Tail-light and direction indicator
X31 To number plate light wiring

FENDER WIRING



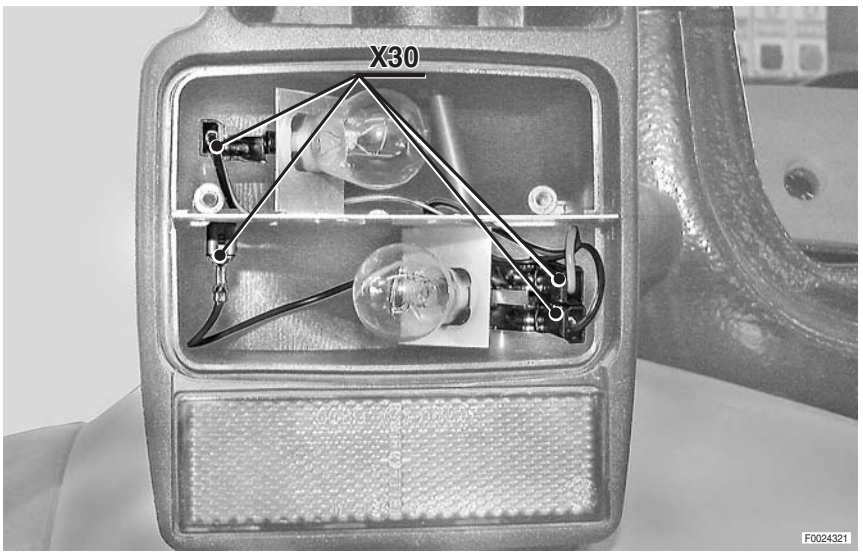


DW Rear lift Down button
PTO Rear PTO button
UP Rear lift Up button
X27 To cab power supply wiring
X28 To cab power supply wiring
X29 Rear lower work light
X30 Tail-light and direction indicator
X31 To number plate light wiring

FENDER AND NUMBER PLATE LIGHT CONNECTORS LOCATION

1

2



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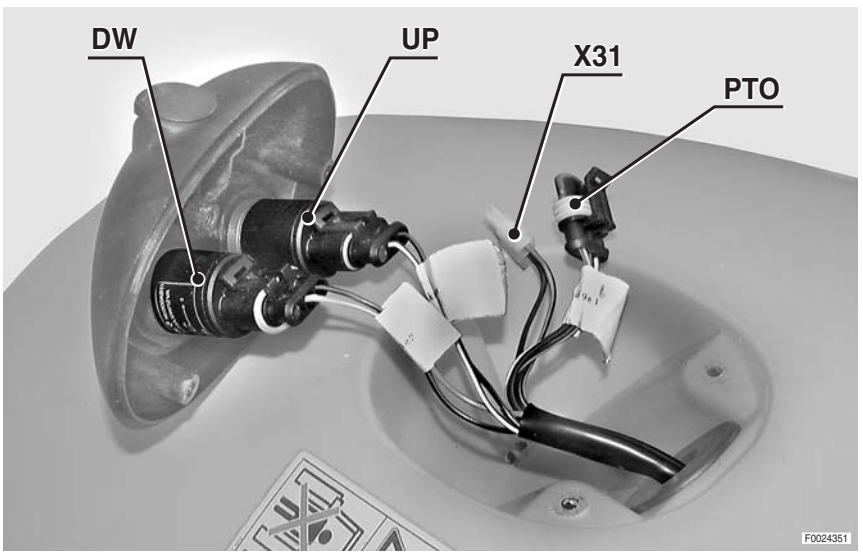

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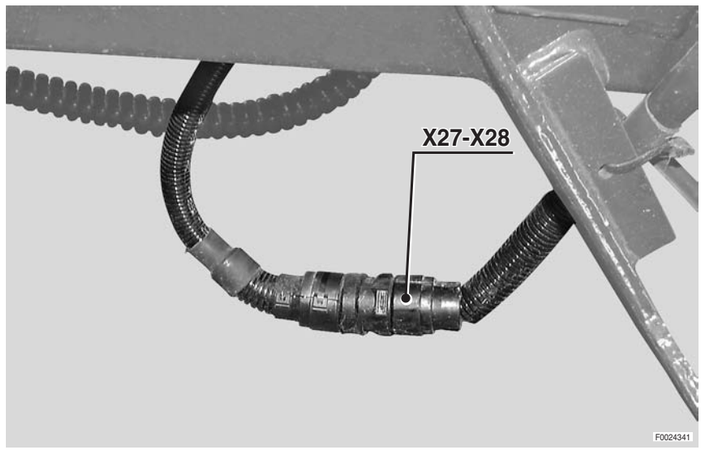

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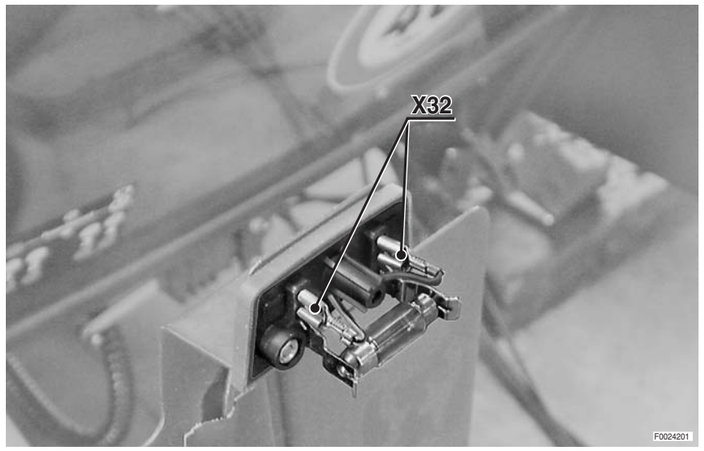

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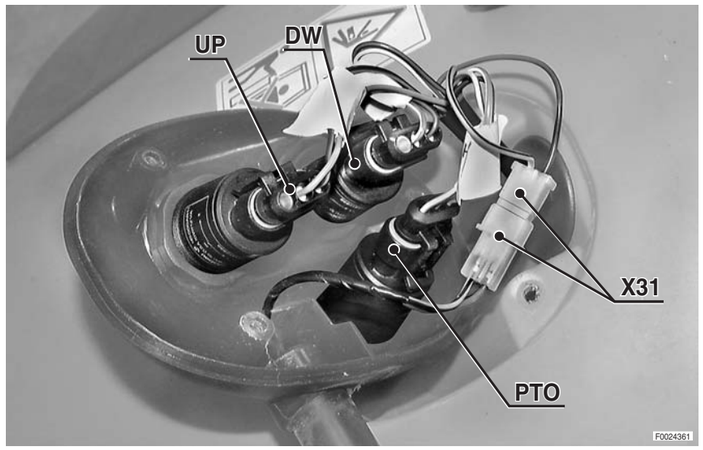
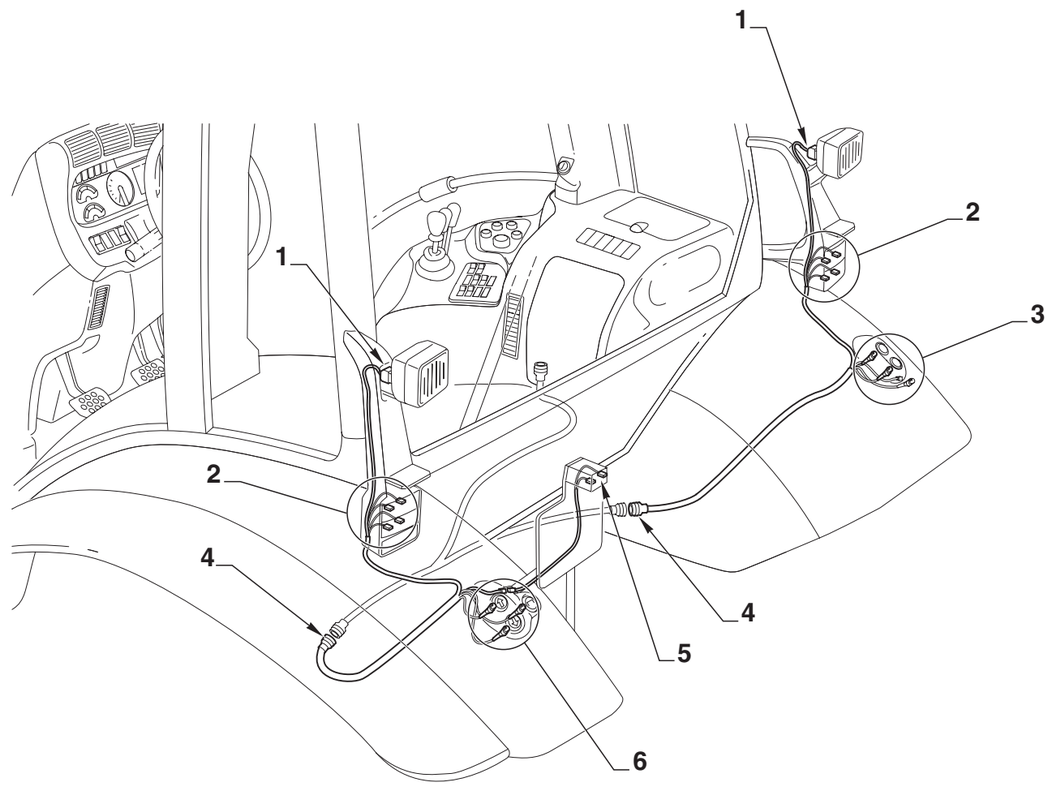


FENDER AND NUMBER PLATE LIGHT WIRING



FENDER	NUMBER PLATE LIGHT
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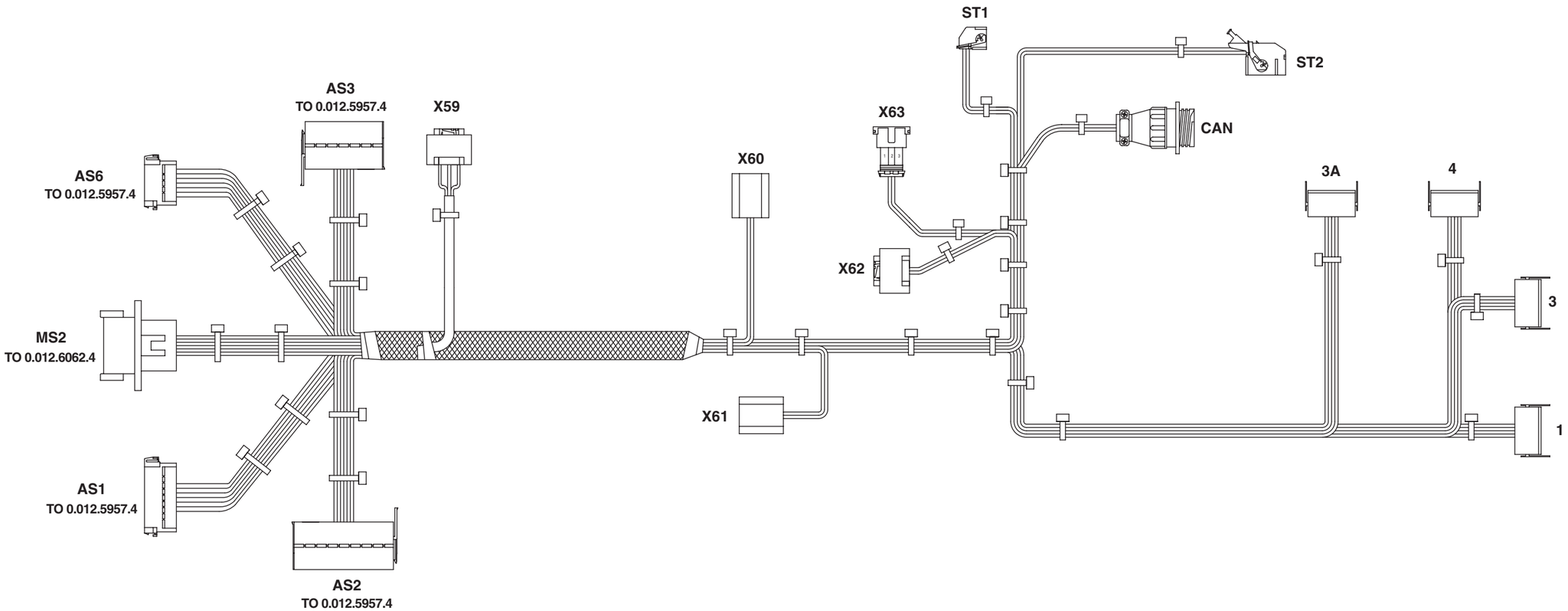
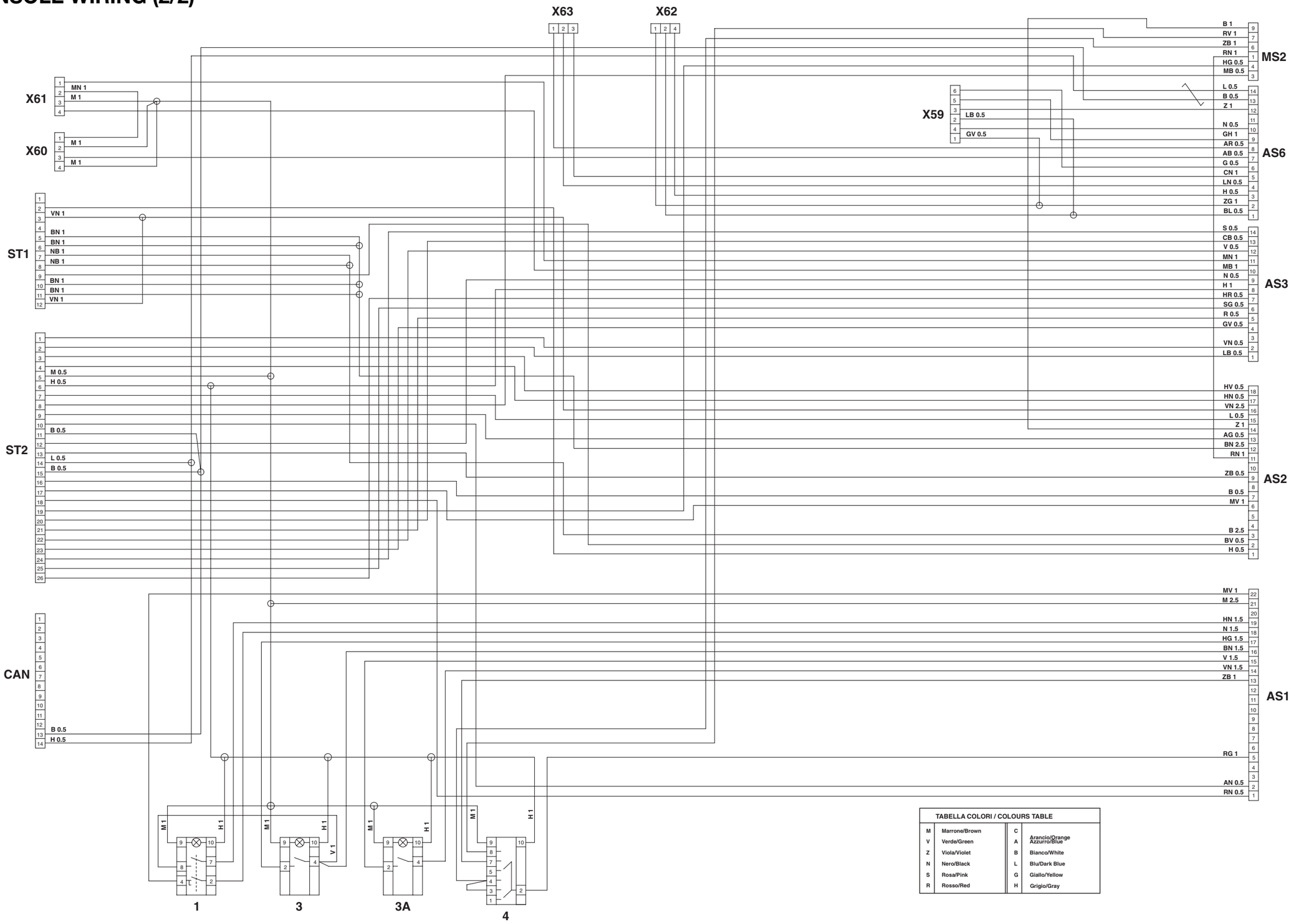
FRONT CONSOLE WIRING (1/2)



1 Side-lights switch
3 Cab roof work lights switch
3A Lower work lights switch
4 50S lights switch
AS1 Al cablaggio linea cruscotto laterale
AS2 Al cablaggio linea cruscotto laterale
AS3 Al cablaggio linea cruscotto laterale
AS6 Al cablaggio linea cruscotto laterale
CAN CANBUS socket
MS2 Al cablaggio linea motore
ST1 INFOCENTER 1
ST2 INFOCENTER 2
X59 Accelerator pedal position sensor
X60 R.H. brake pedal switch
X61 L.H. brake pedal switch
X62 Clutch pedal position sensor
X63 Clutch pedal depressed proximity sensor

FRONT CONSOLE WIRING (2/2)



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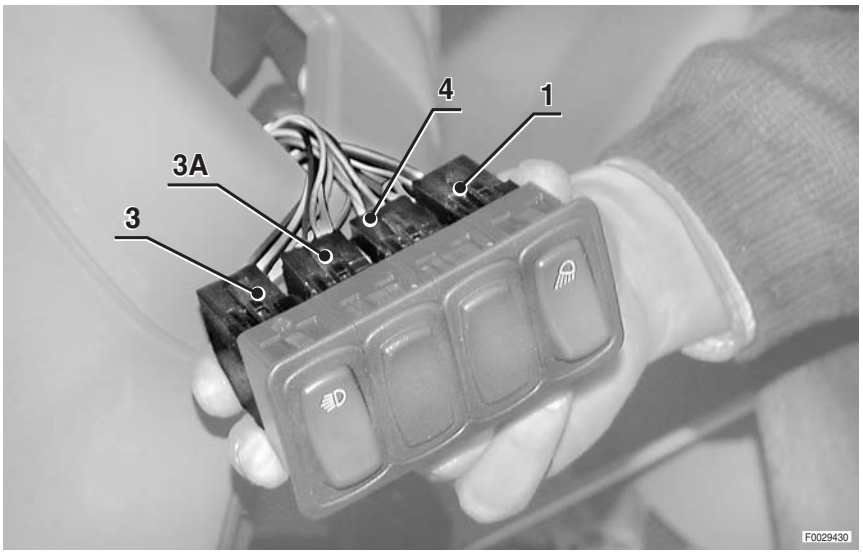
FRONT CONSOLE CONNECTORS LOCATION

1



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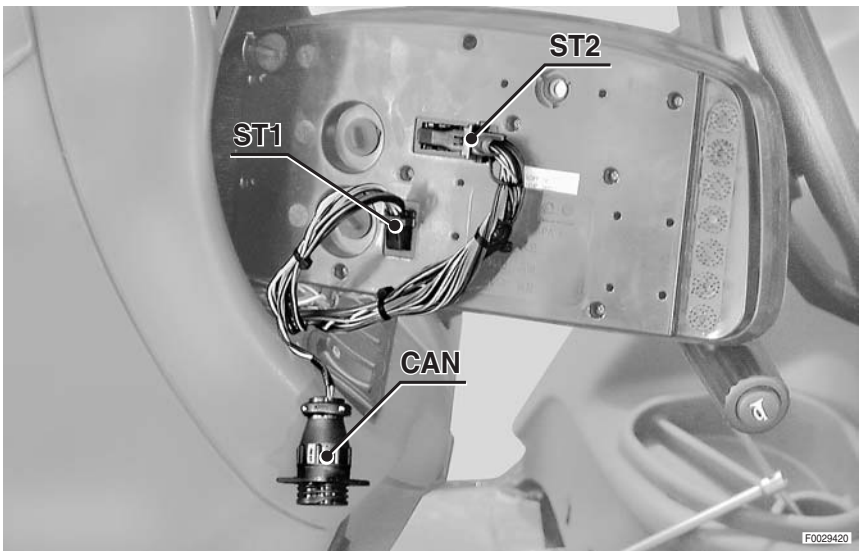

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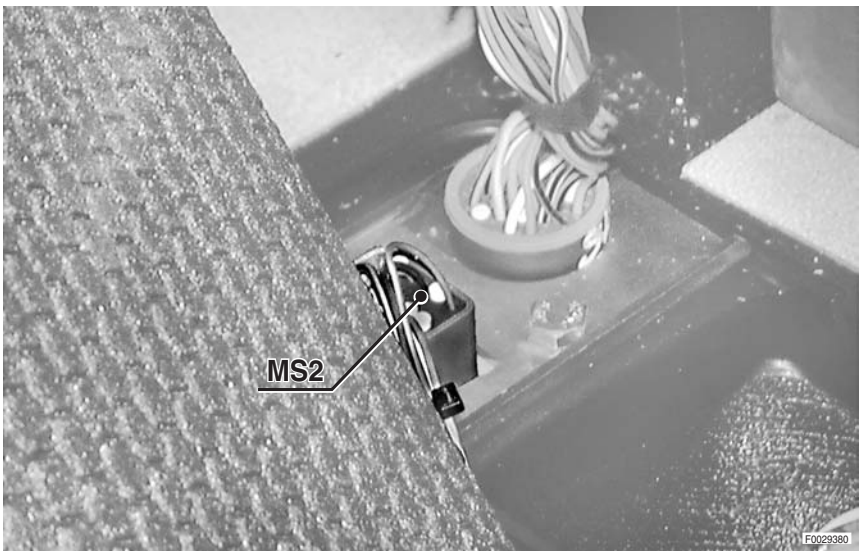

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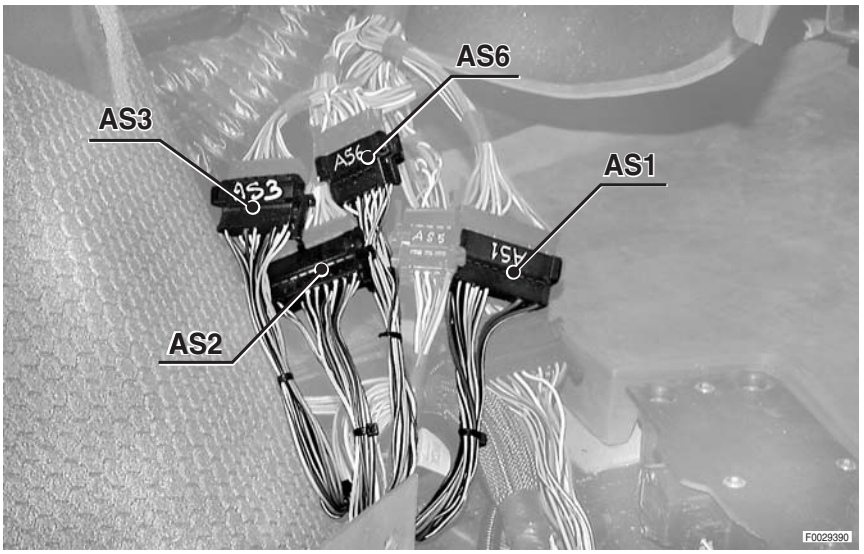

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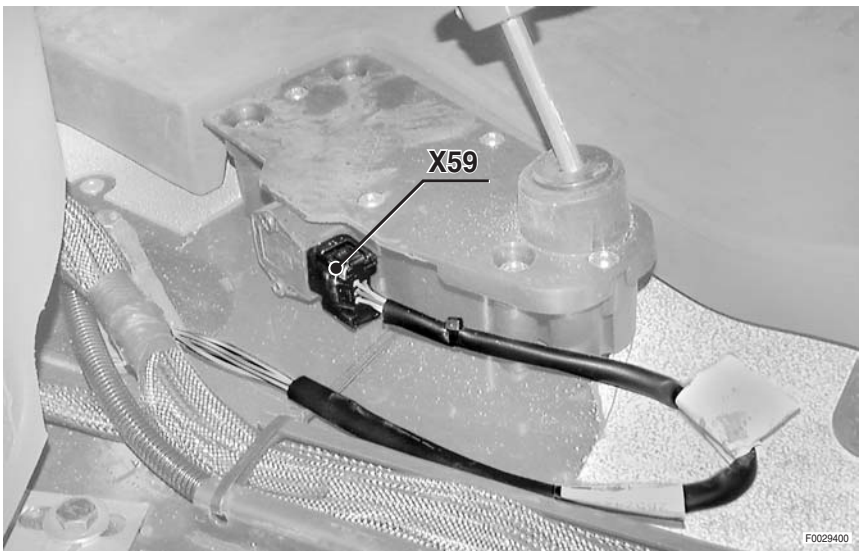

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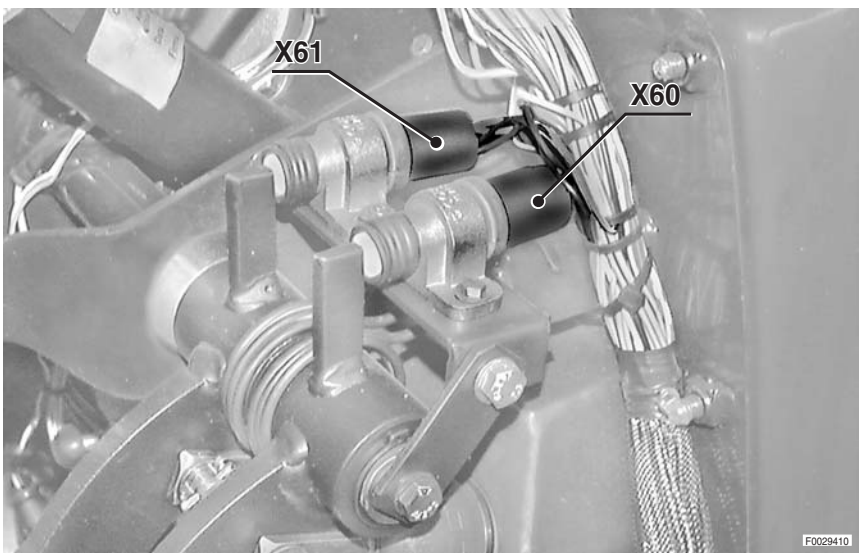

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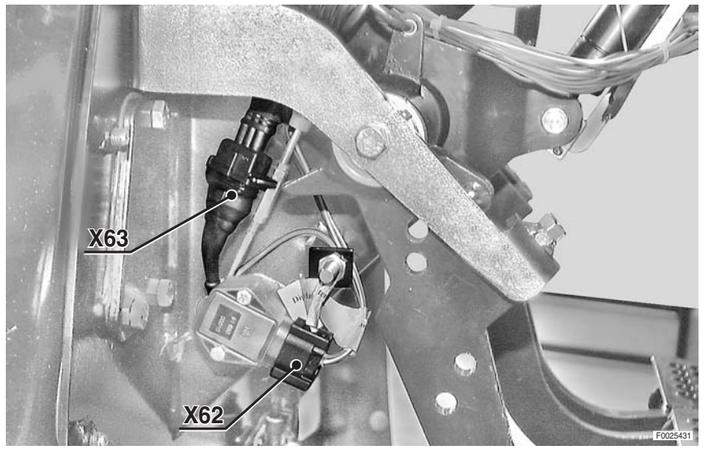
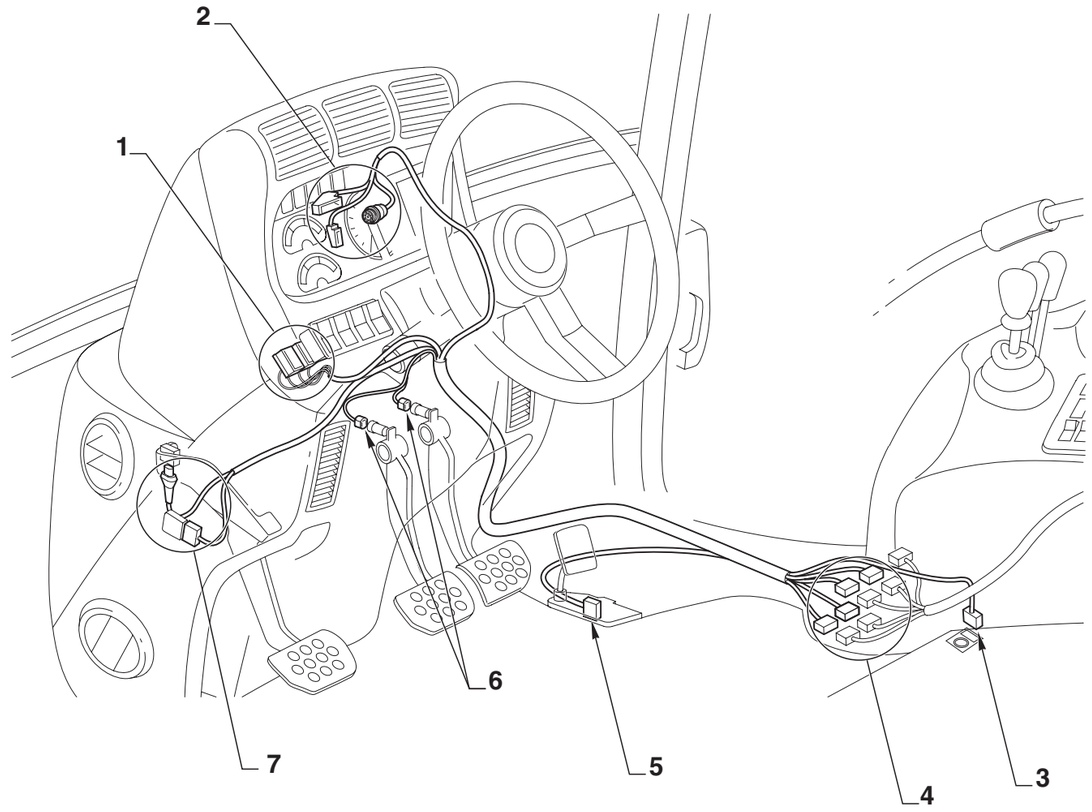


FRONT CONSOLE WIRING



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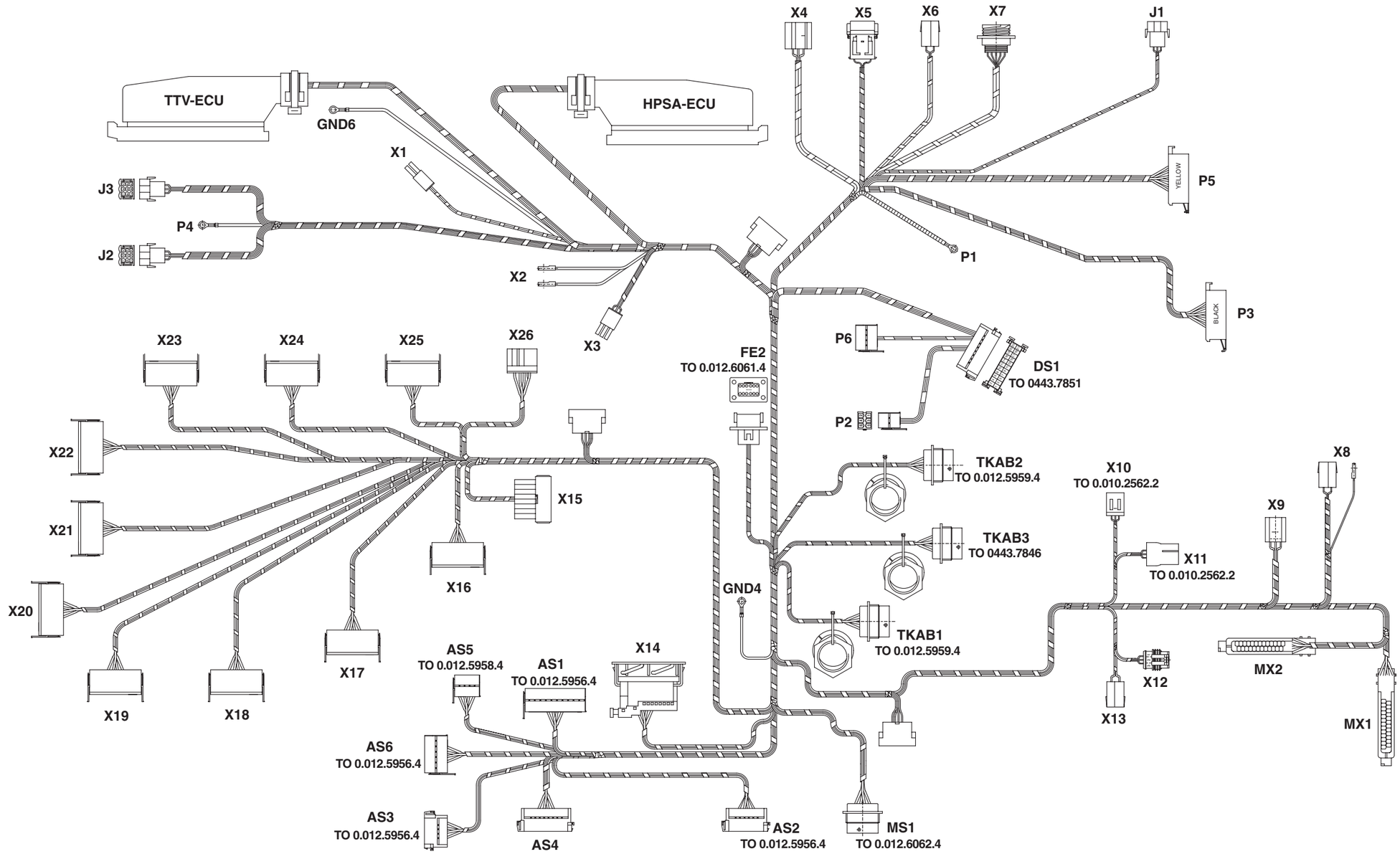
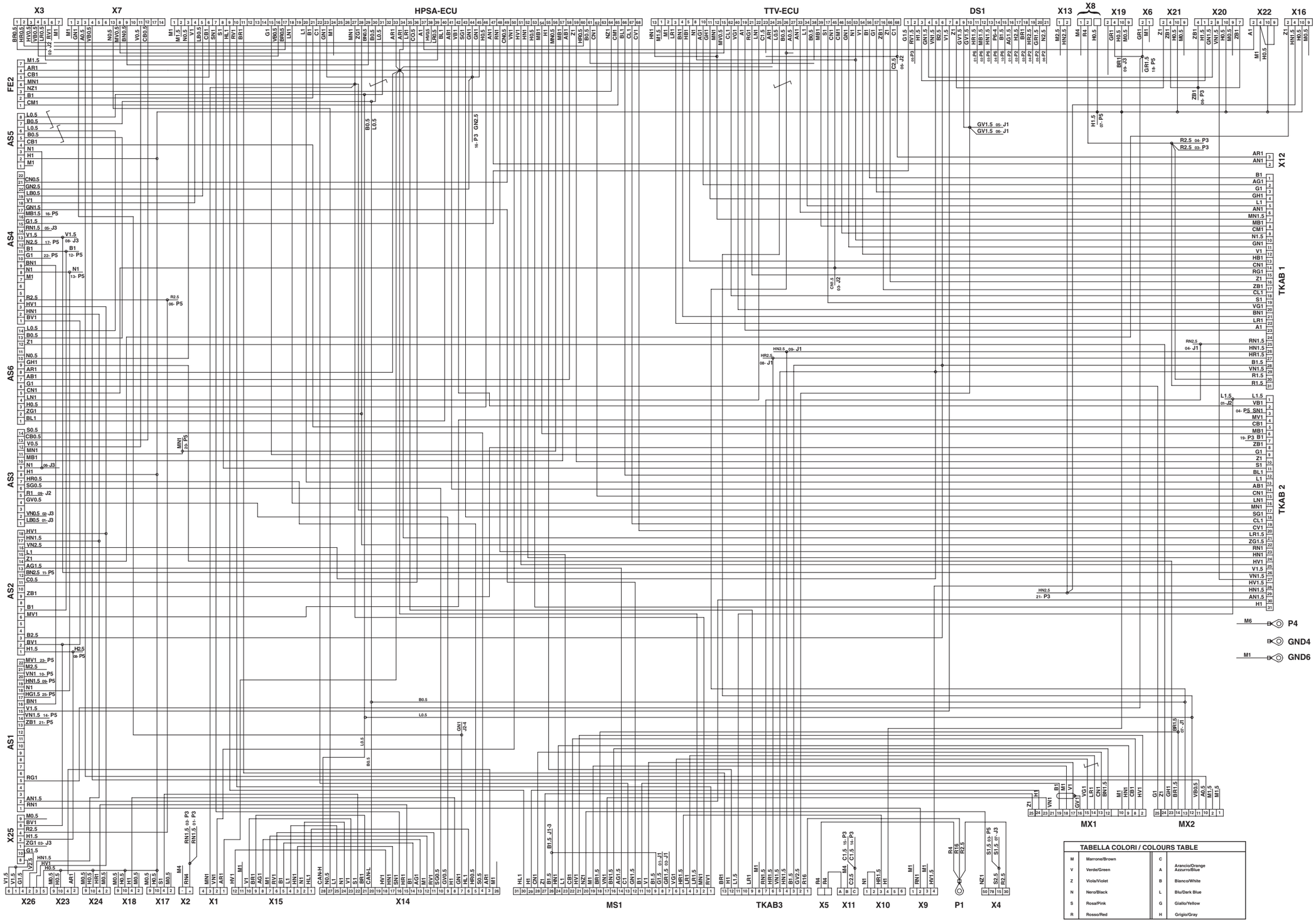
SIDE CONSOLE WIRING (1/2)



AS1 To front console wiring
AS2 To front console wiring
AS3 To front console wiring
AS4 Lights selector switch
AS5 To display wiring
AS6 To front console wiring
DS1 To roof wiring
FE2 To front axle suspension control unit wiring
HPSA ECU HPSA control unit
J1 Relays/fuses control unit
J2 Relays/fuses control unit
J3 Relays/fuses control unit
MS1 To engine wiring
MX1 Engine control unit
MX2 Engine control unit
P1 Relays/fuses control unit
P2 Relays/fuses control unit
P3 Relays/fuses control unit
P4 Relays/fuses control unit
P5 Relays/fuses control unit
P6 Relays/fuses control unit
TKAB1 To transmission wiring
TKAB2 To transmission wiring
TKAB3 To cab power supply wiring
TTV ECU Transmission control unit
X1 ISO4 socket (power supply to implements)
X2 Auxiliary power socket
X3 ISO7 socket (Connection of implements)
X4 Starter switch
X5 Heater power supply fuse (F99-30 Amp)
X6 Auxiliary power connector (in cab)
X7 Diagnostics connector
X8 Cigar lighter
X9 Handbrake switch
X10 To air conditioning system wiring (cab)
X11 To air conditioning system wiring (cab)
X12 Driver seated weight sensor
X13 Air suspension seat compressor
X14 Armrest
X15 Lift control console
X16 Clean Fix on/off switch
X17 Front PTO button (in cab)
X18 Rear PTO button (in cab)
X19 Rear work lights switch
X20 Rear screen wiper switch
X21 Beacon on/off switch
X22 PTO brake switch
X23 PTO AUTO button
X24 PTO ENABLE button
X25 Hazard warning lights switch
X26 Hazard lights control unit

D0008450

SIDE CONSOLE WIRING (2/2)



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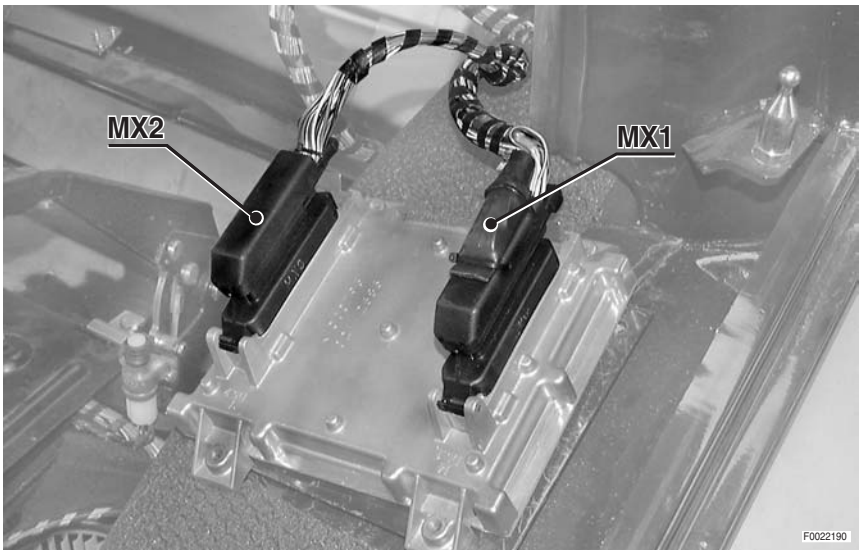
SIDE CONSOLE CONNECTORS LOCATION

1



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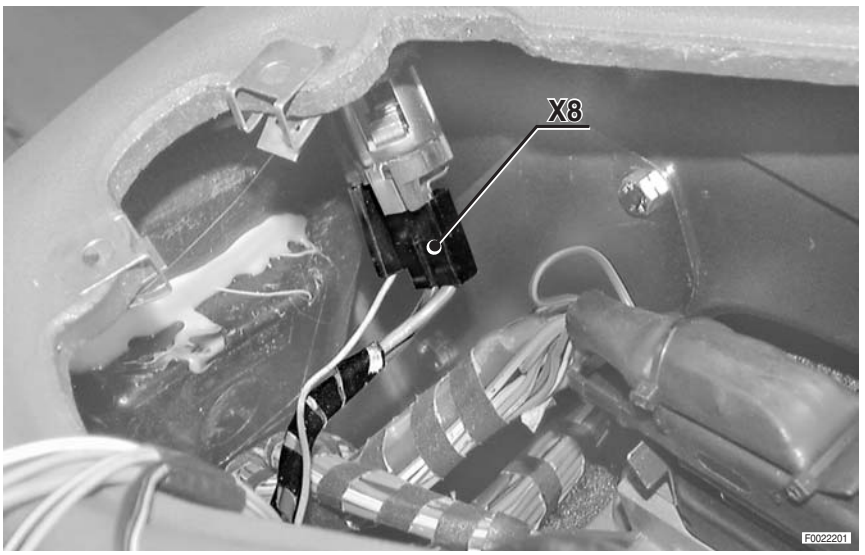

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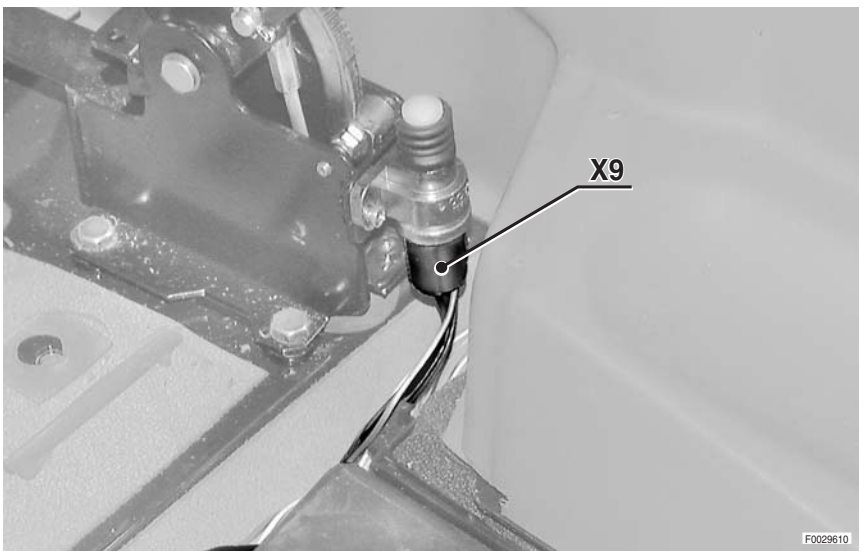

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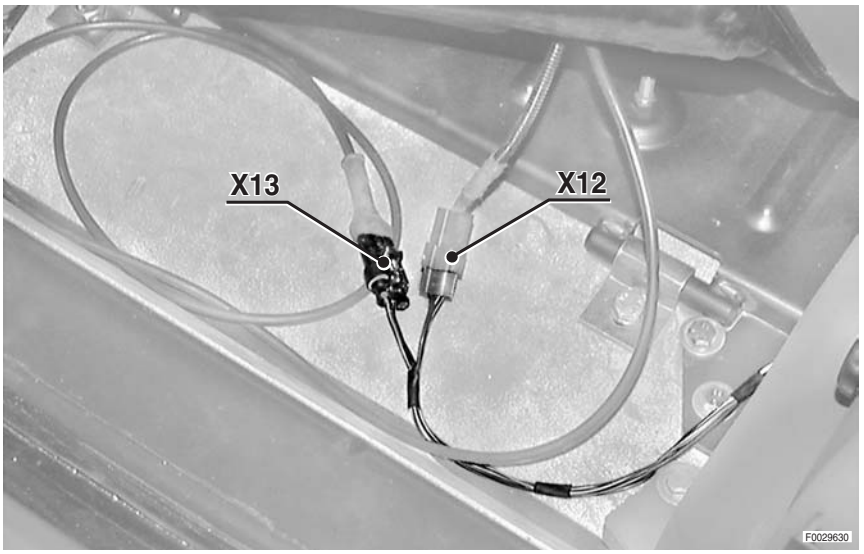
X13
X12
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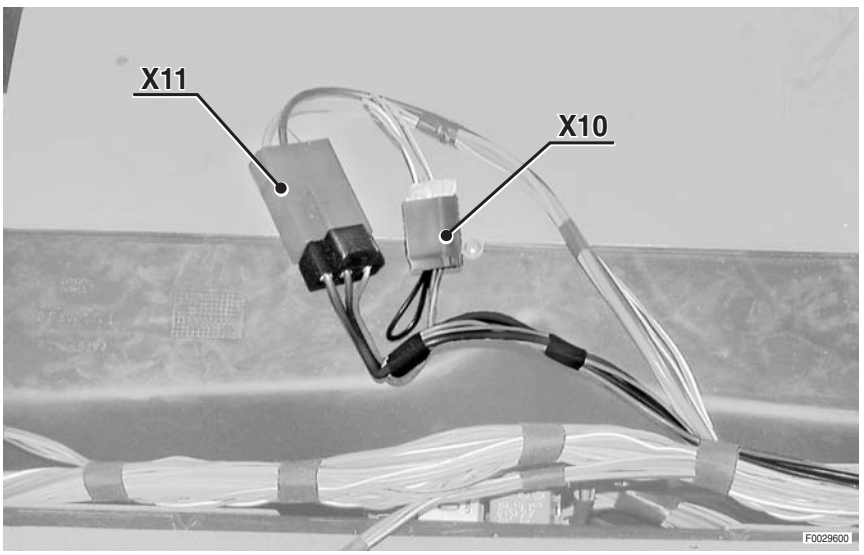
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X10
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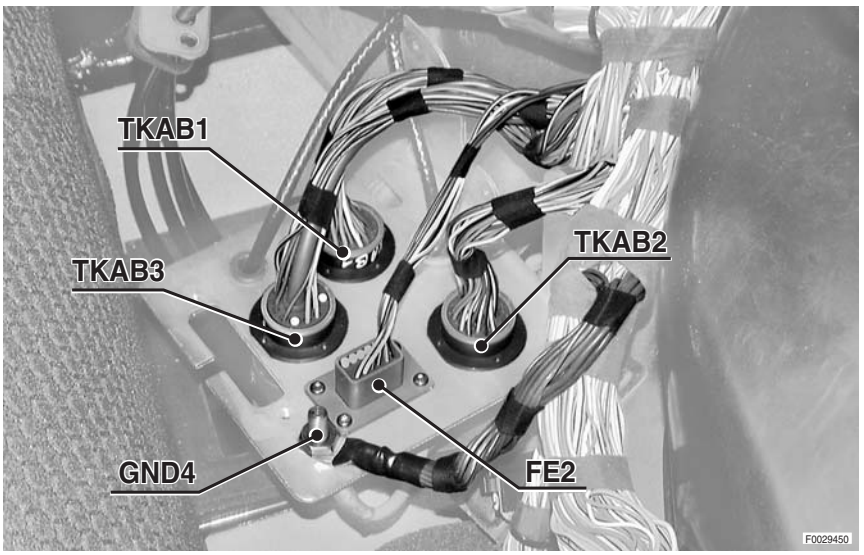
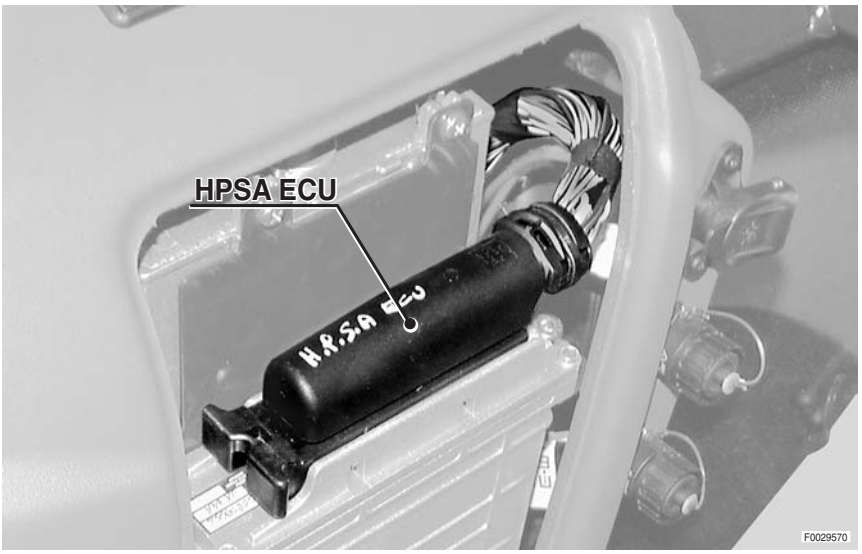

TKAB1
TKAB2
TKAB3
GND4
FE2
F0029450

7



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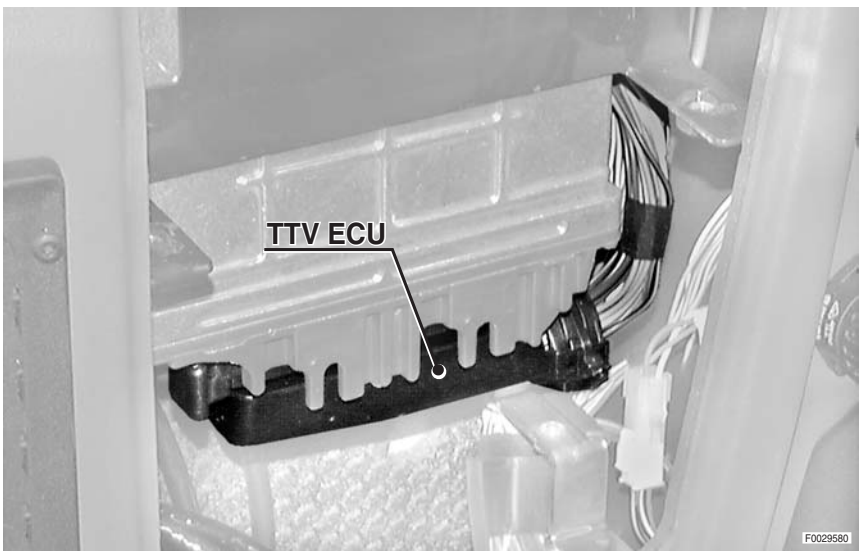

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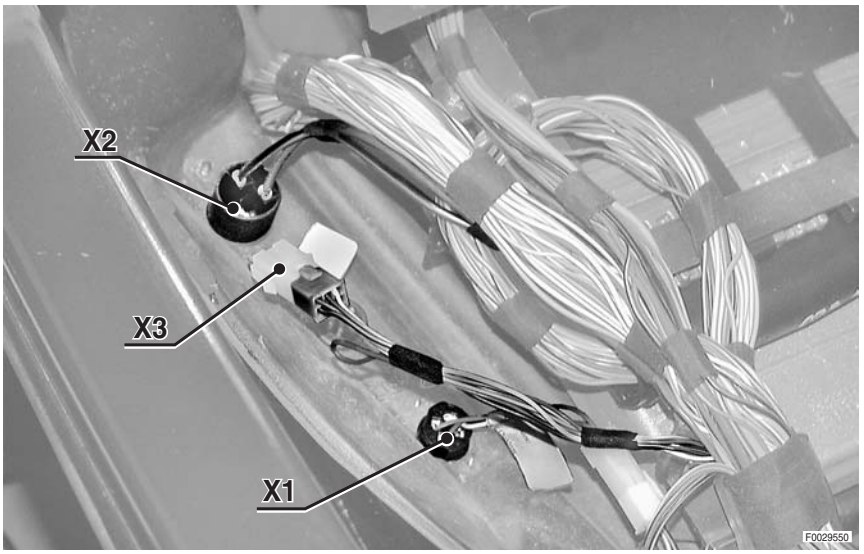

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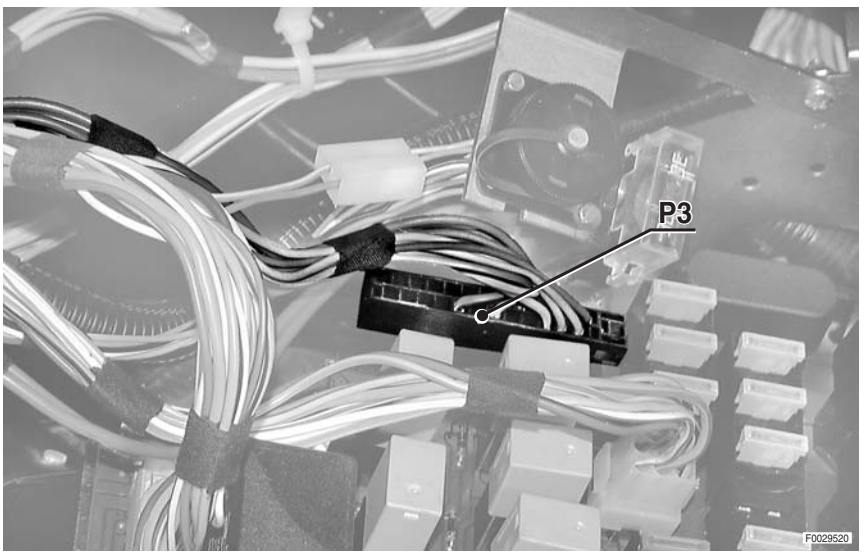

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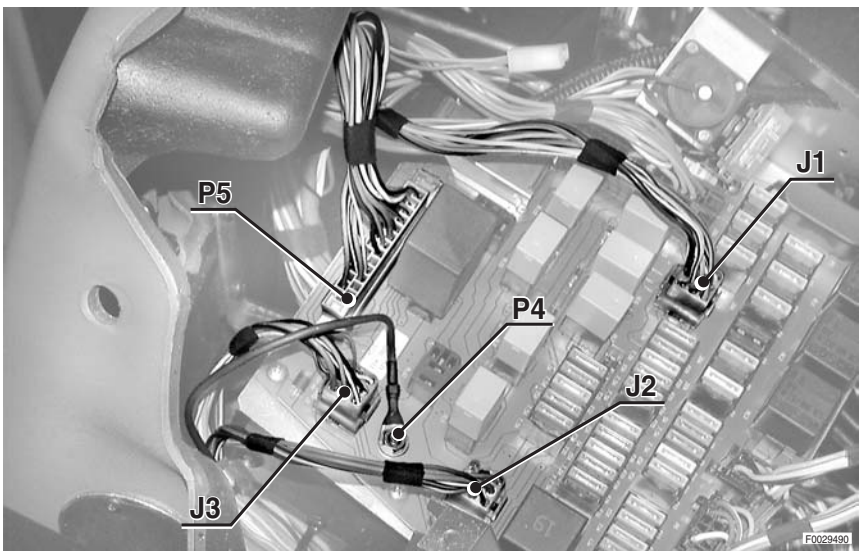

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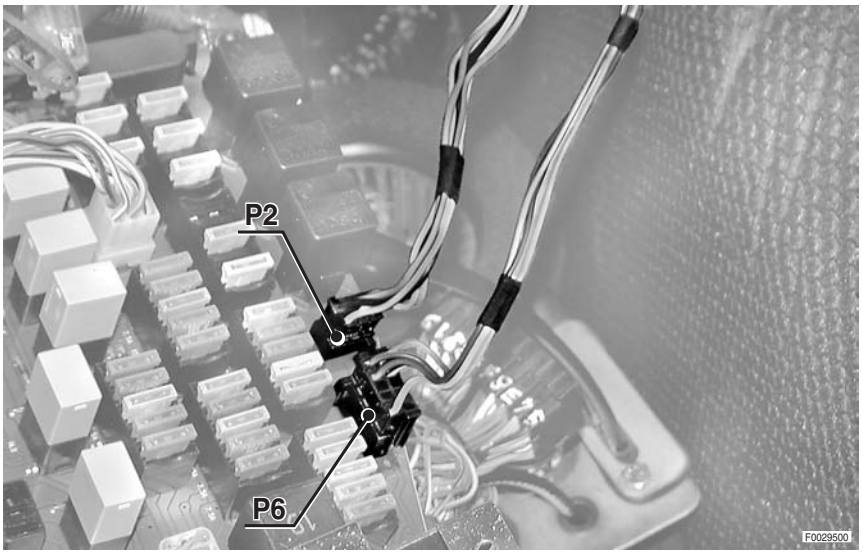

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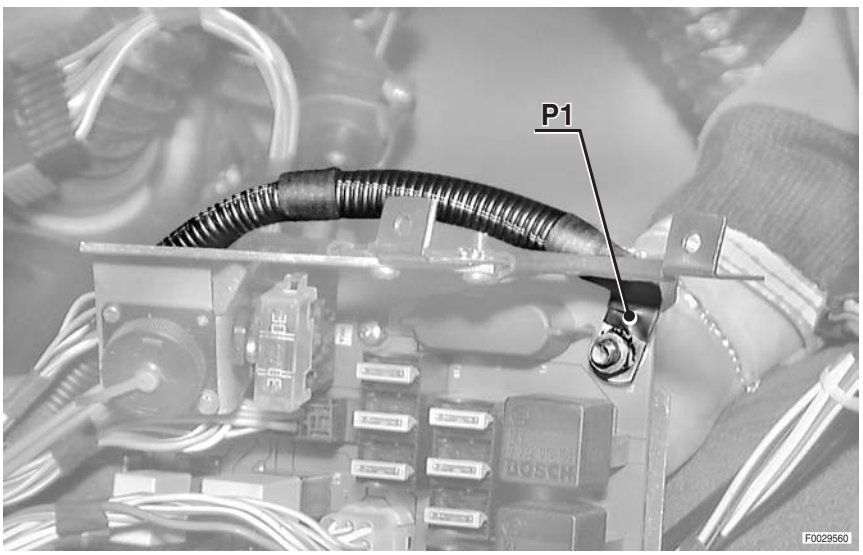

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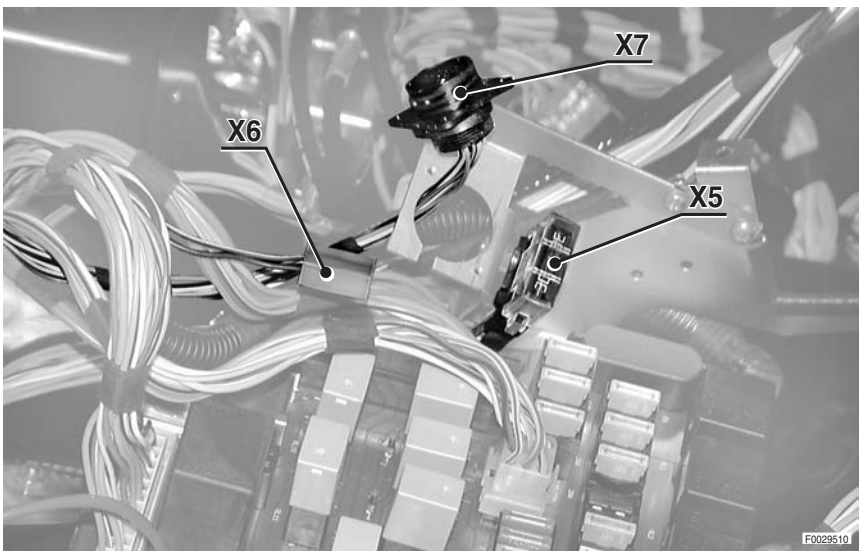

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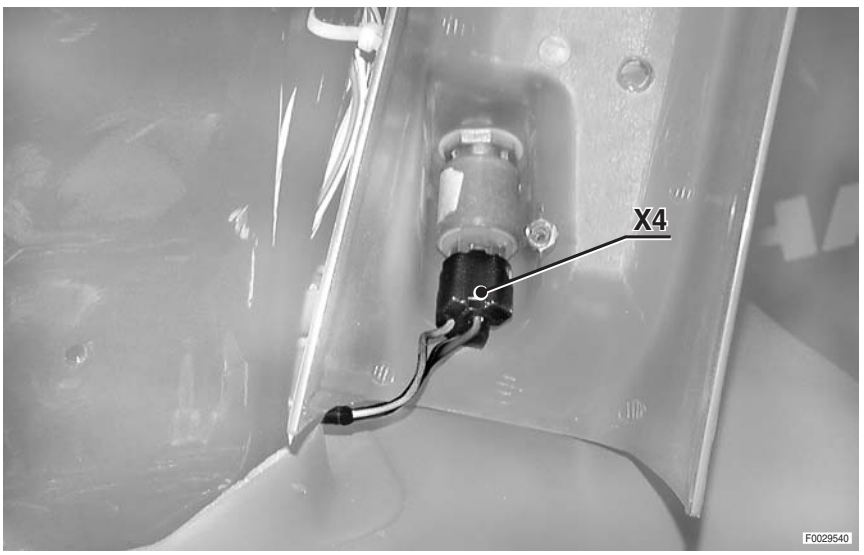

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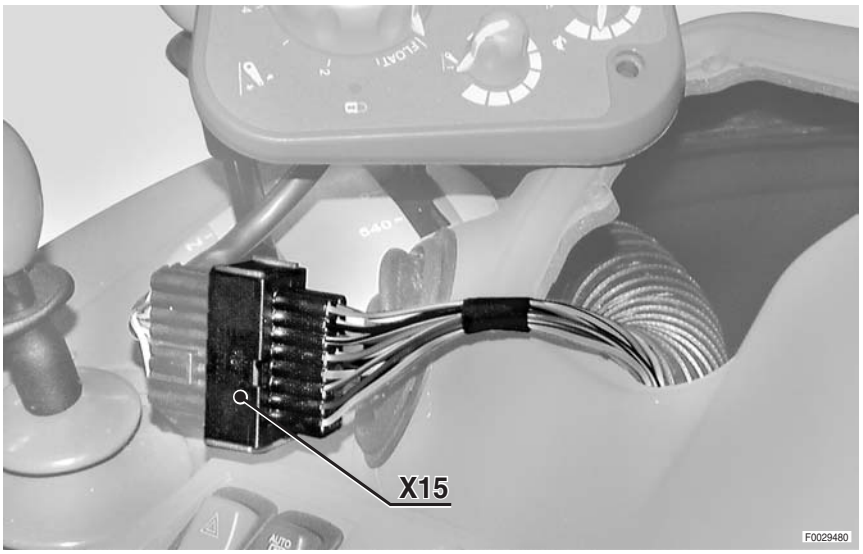
X15
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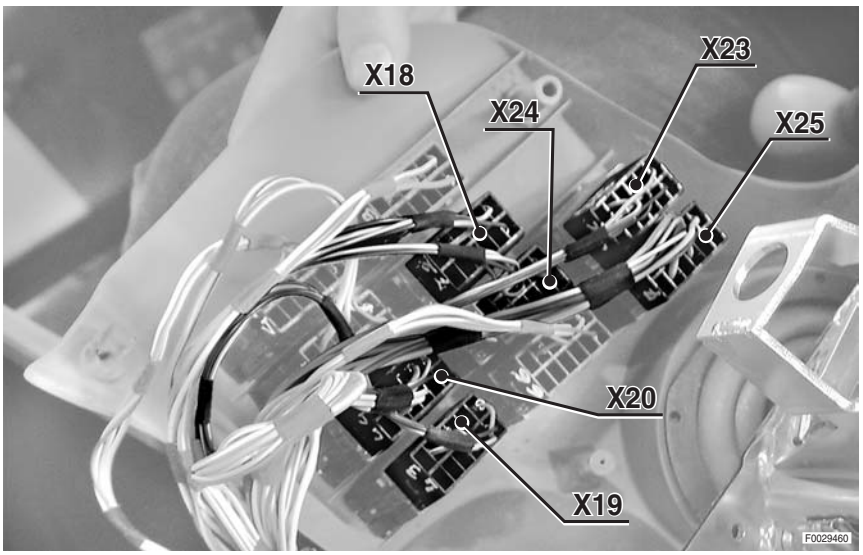
X18
X24
X23
X25
X20
X19
F0029460

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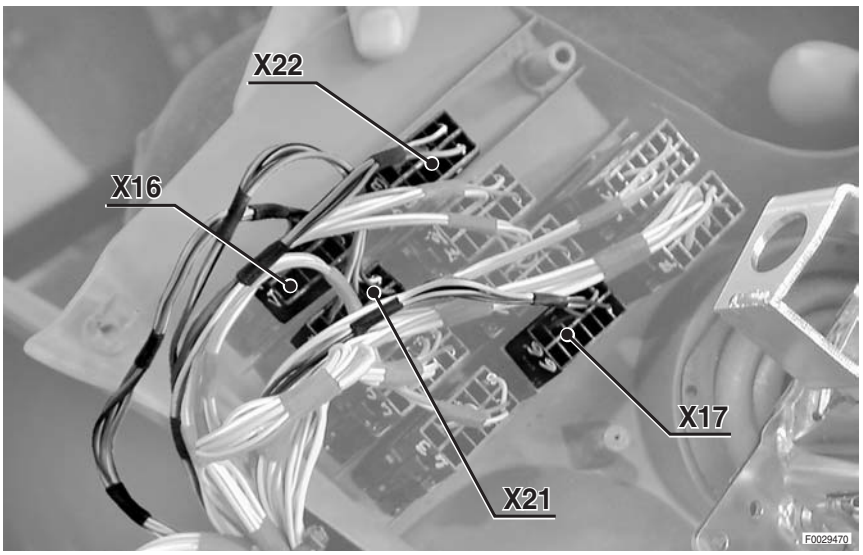
X22
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X17
X21
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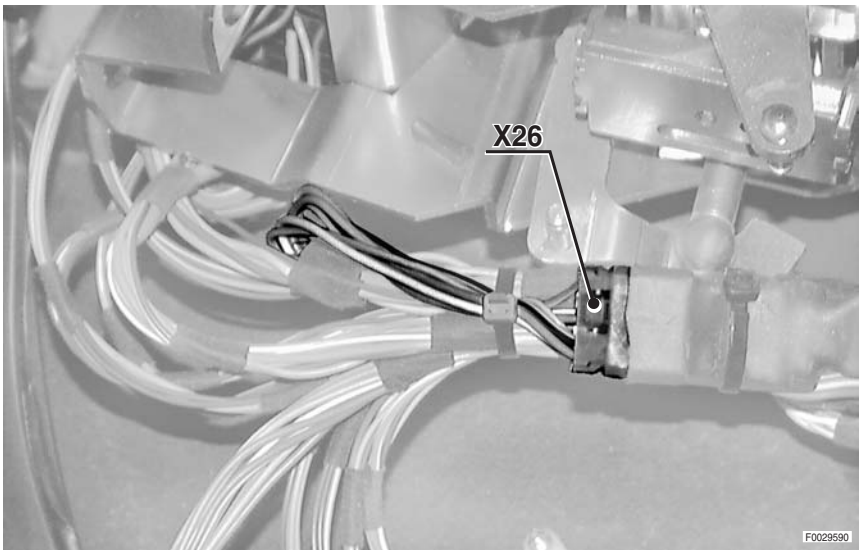

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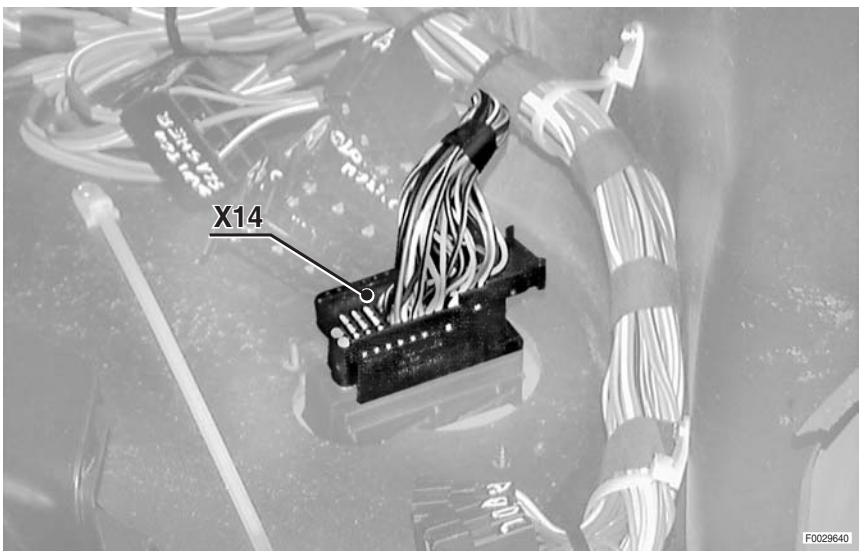

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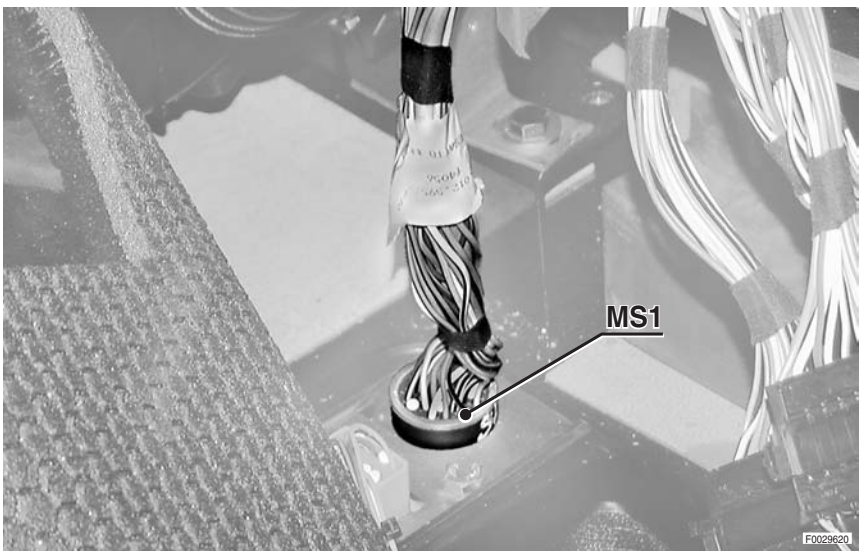

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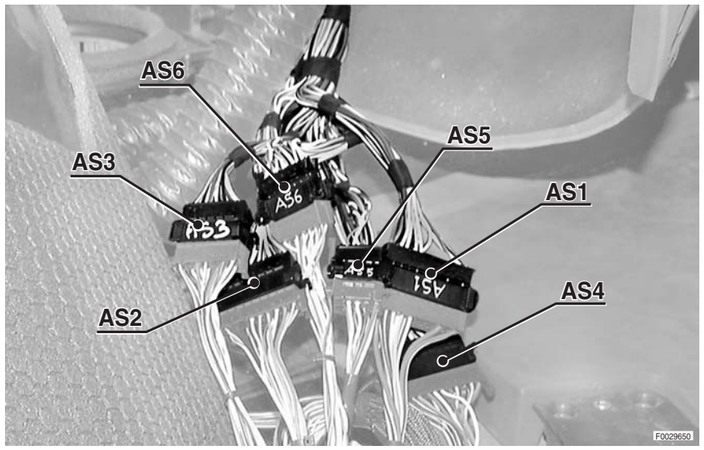
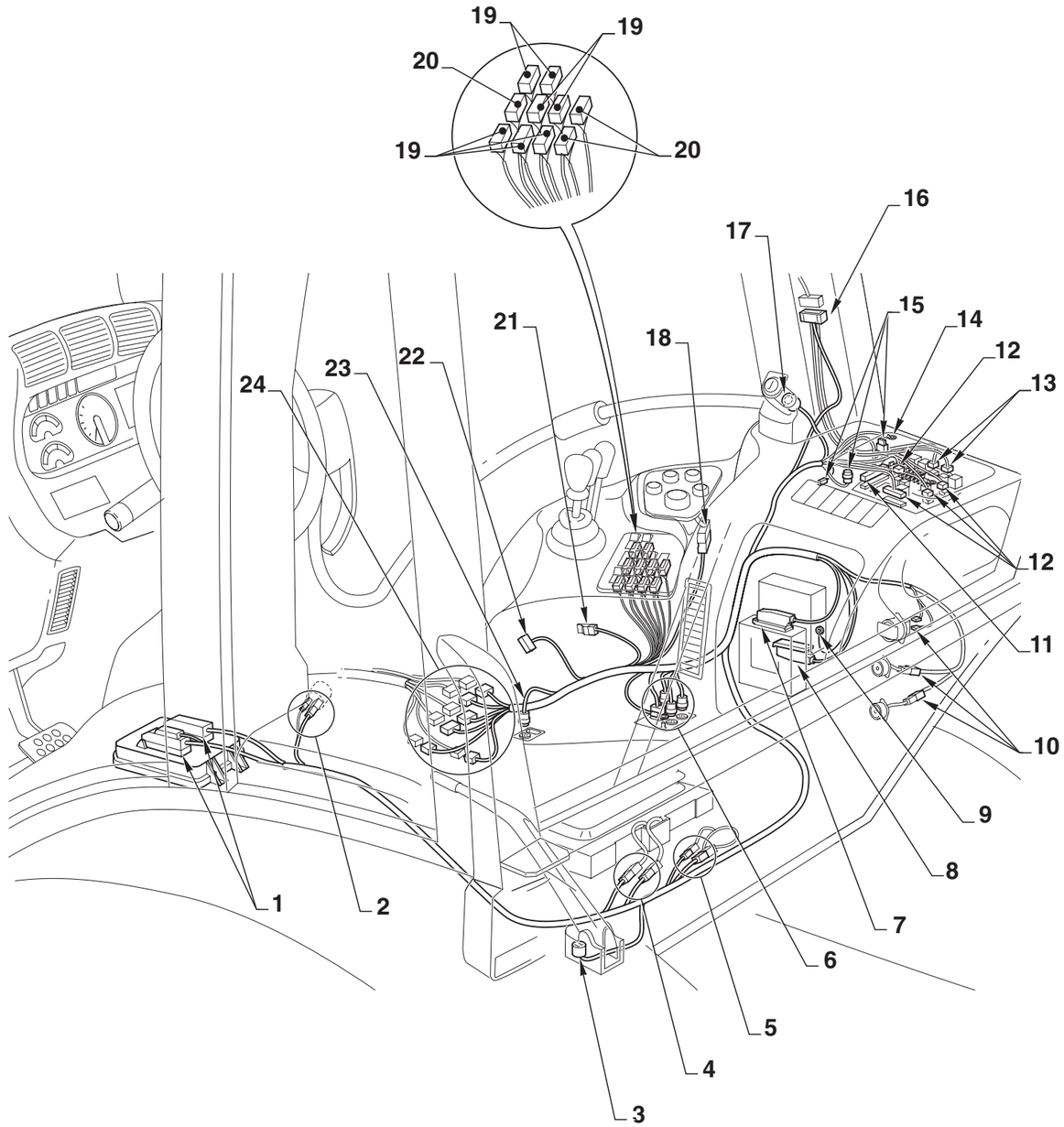


SIDE CONSOLE WIRING



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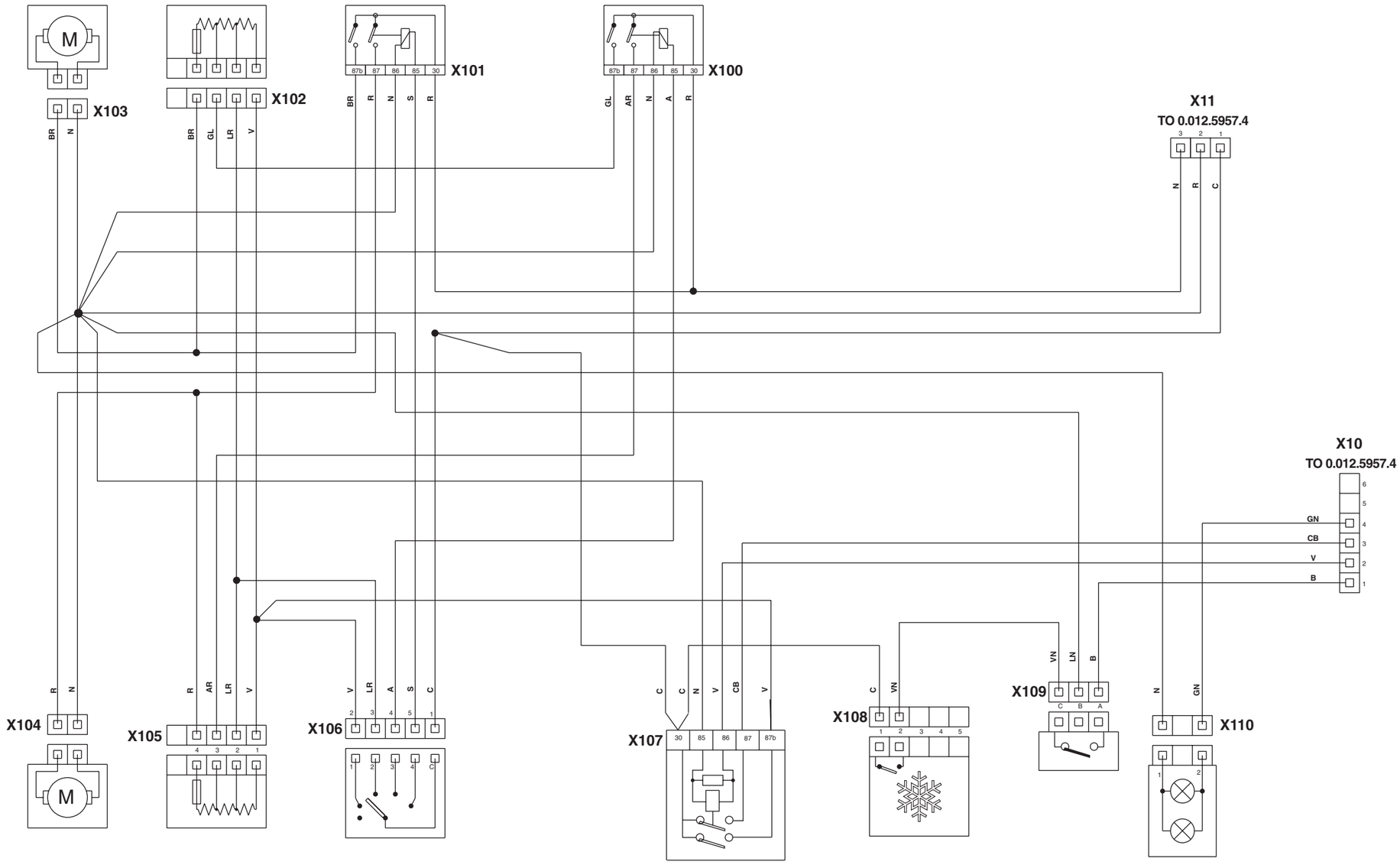
AIR CONDITIONING SYSTEM WIRING (CAB)



X10 To side console wiring
X11 To side console wiring
X100 Heater fans 3rd speed switch relay
X101 Heater fans 4th speed switch relay
X102L.H. heater fan resistor
X103L.H. heater fan
X104R.H. heater fan
X105R.H. heater fan resistor
X106 Fan speed selector switch
X107 Air conditioning power on and 1st speed switch relay
X108 Air conditioning on/off switch
X109 Air conditioning control thermostat
X110 Air conditioning control panel light connector

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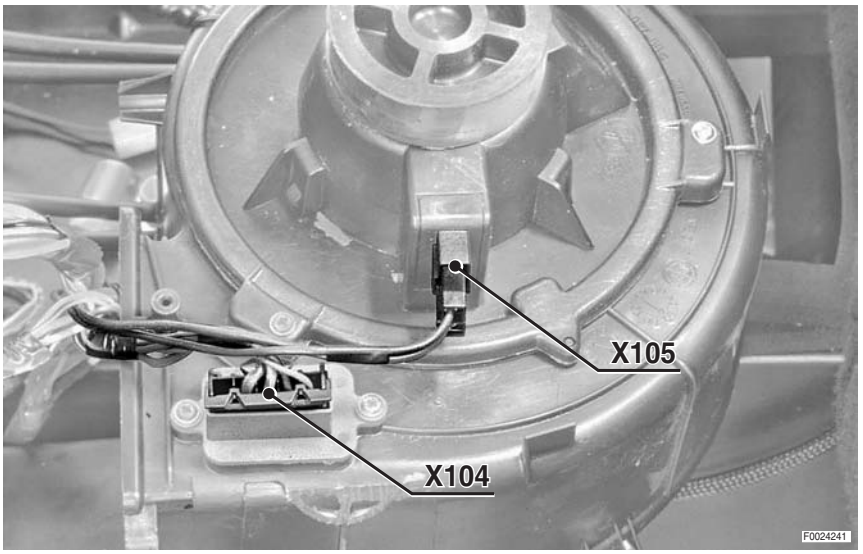
AIR CONDITIONING SYSTEM CONNECTORS LOCATION

1



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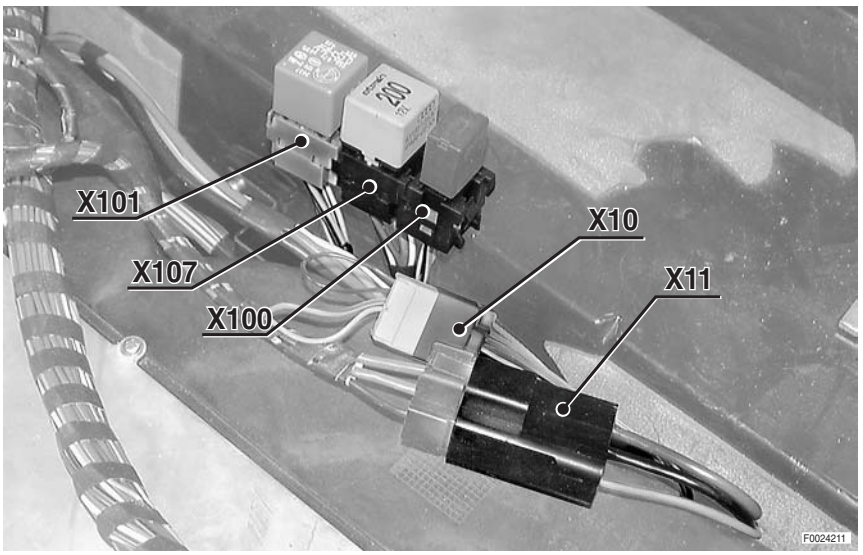

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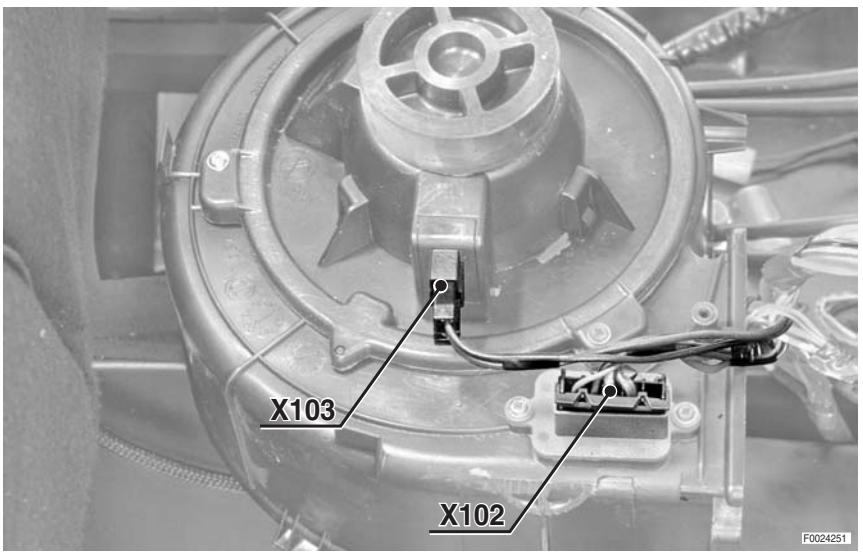

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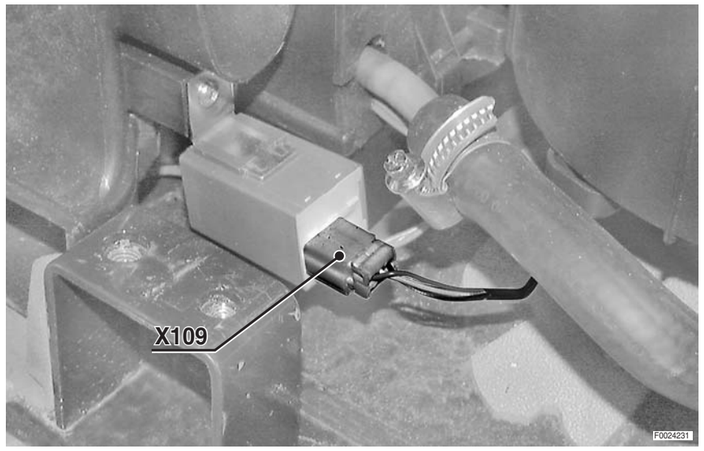

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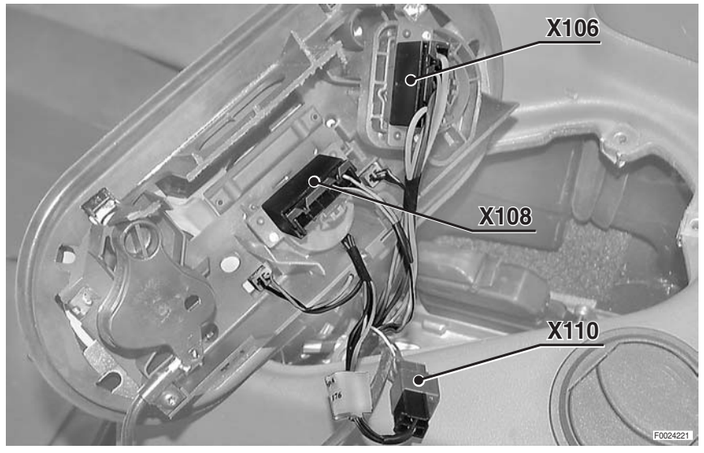
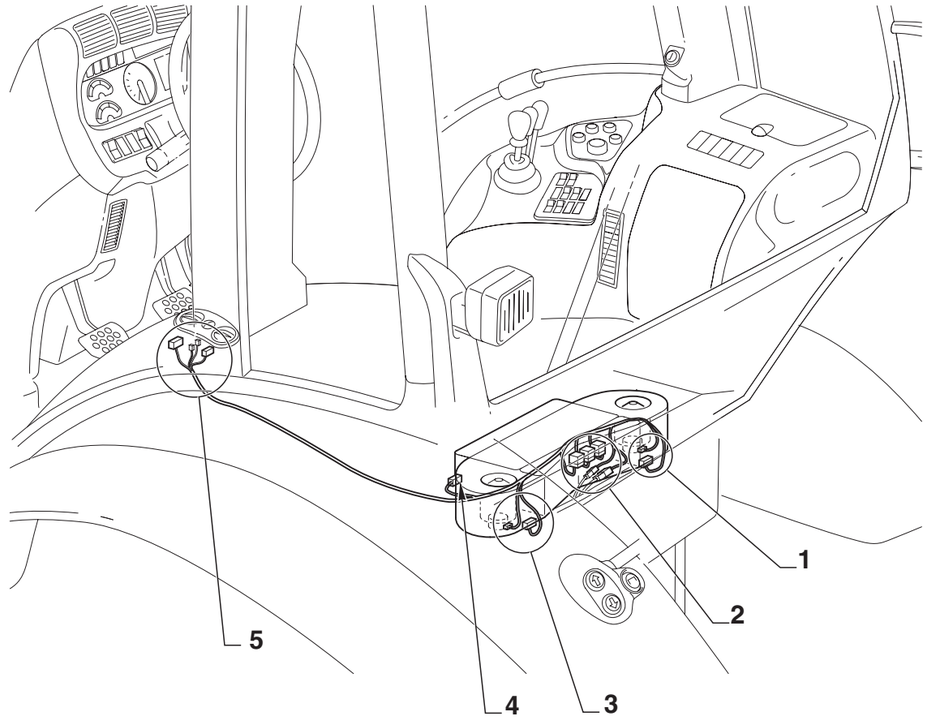


AIR CONDITIONING SYSTEM WIRING



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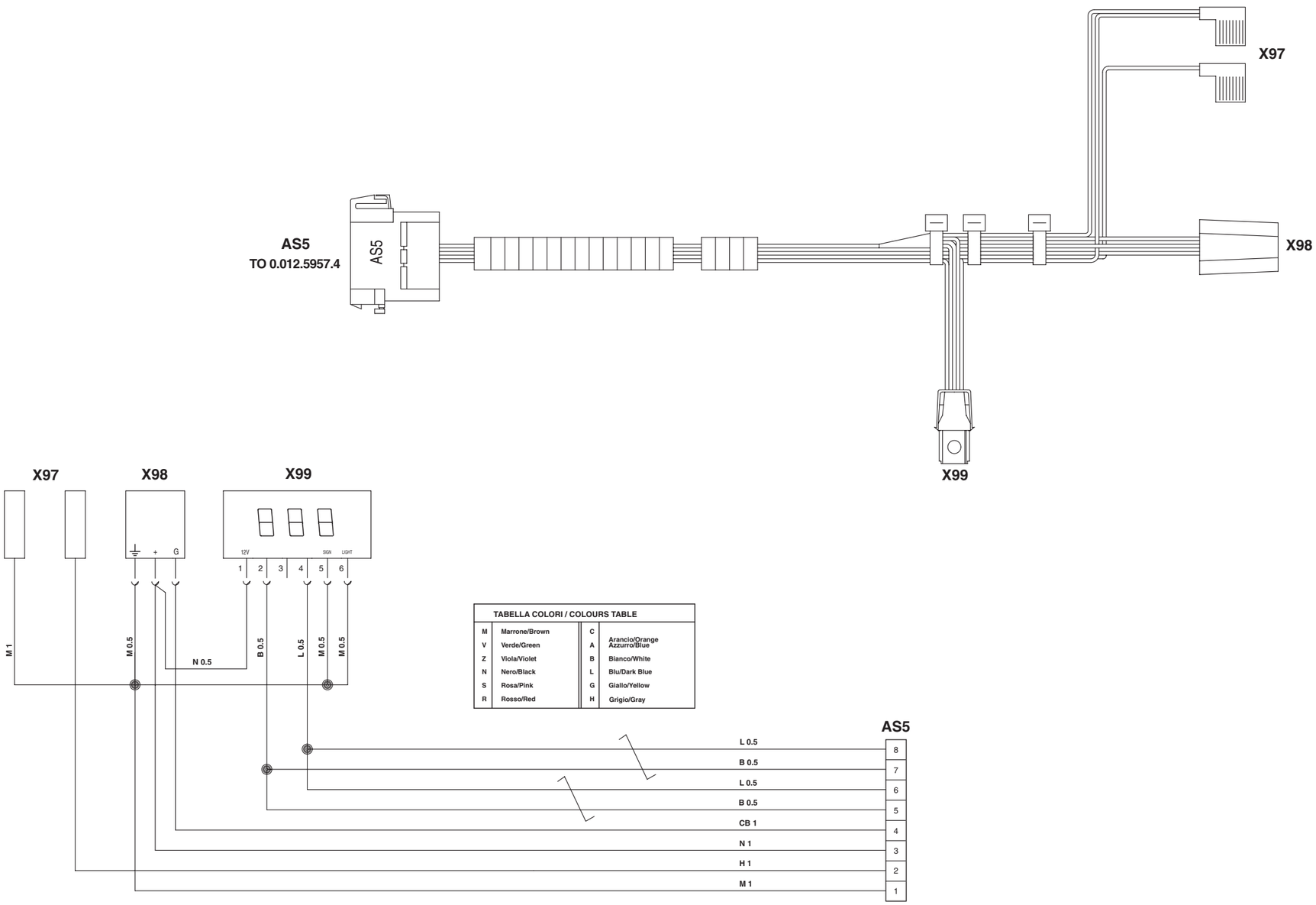
DISPLAY WIRING



AS5 To display wiring
X97 Compressed air pressure gauge light
X98 Compressed air pressure gauge
X99 Transmission display

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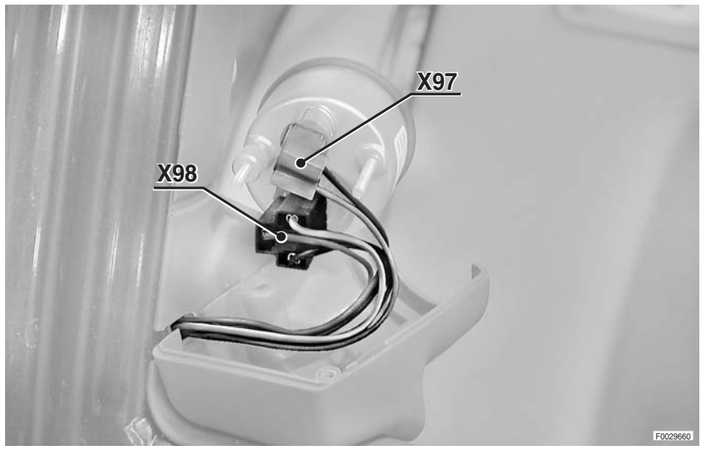
DISPLAY WIRING

1



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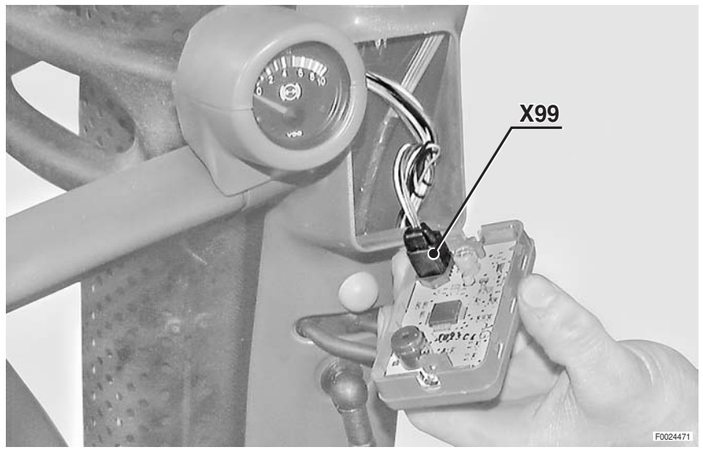

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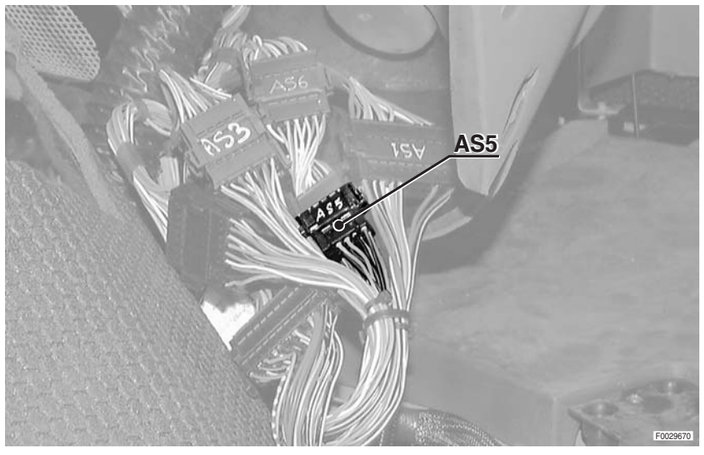

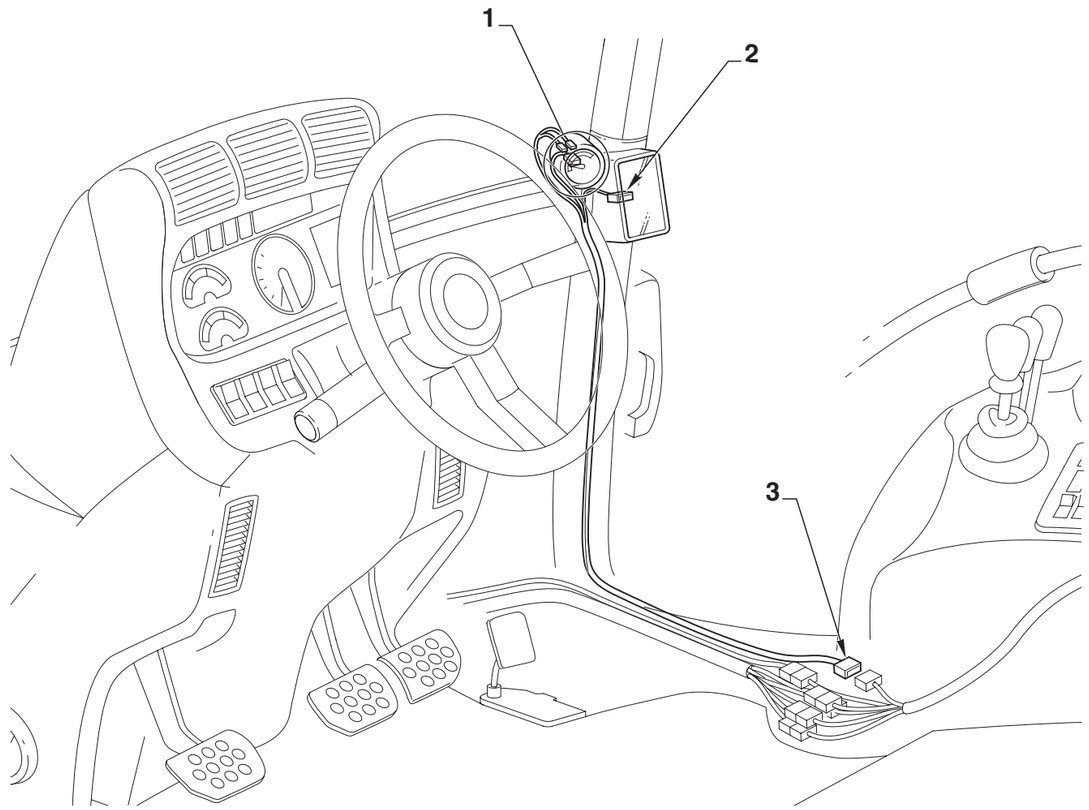

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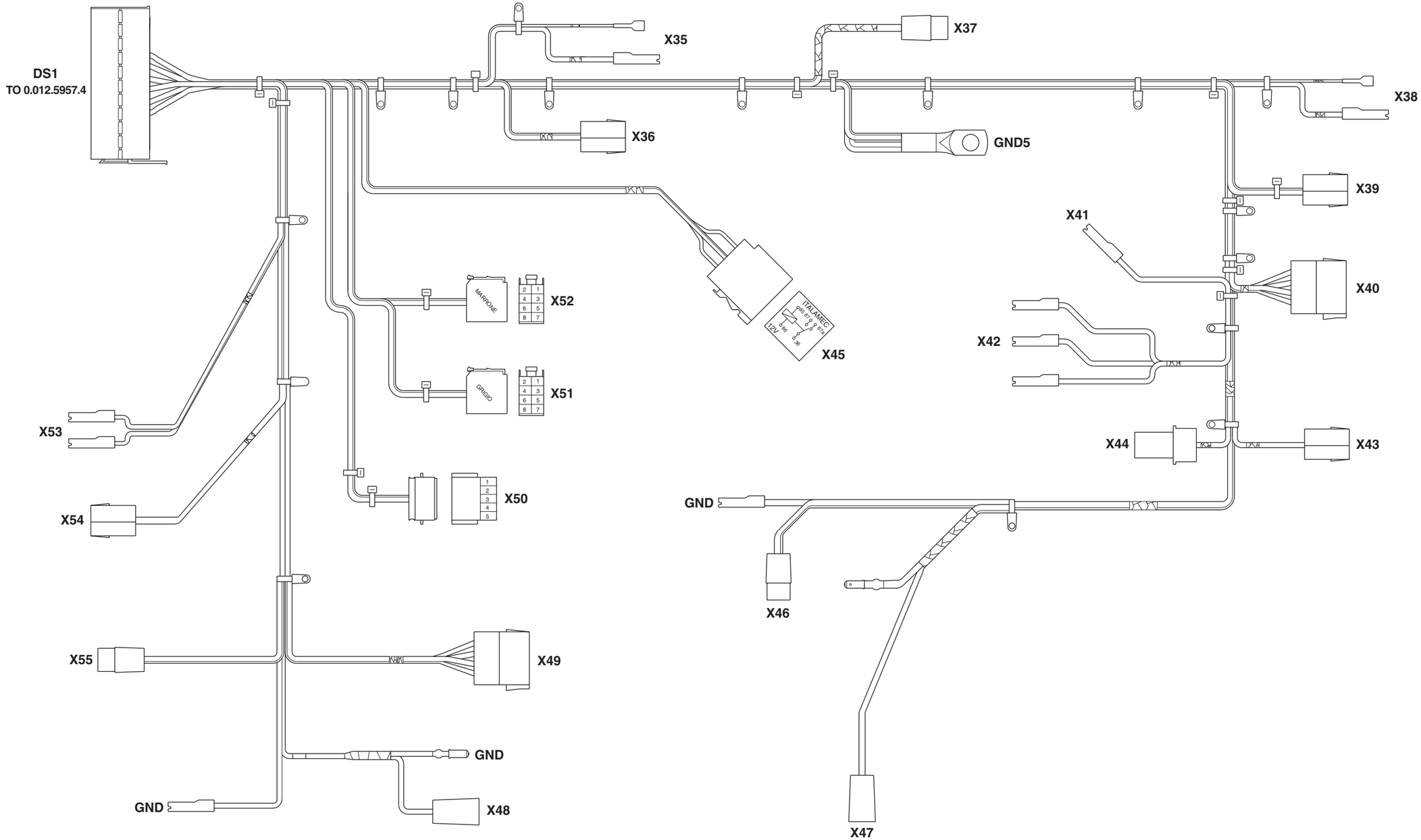
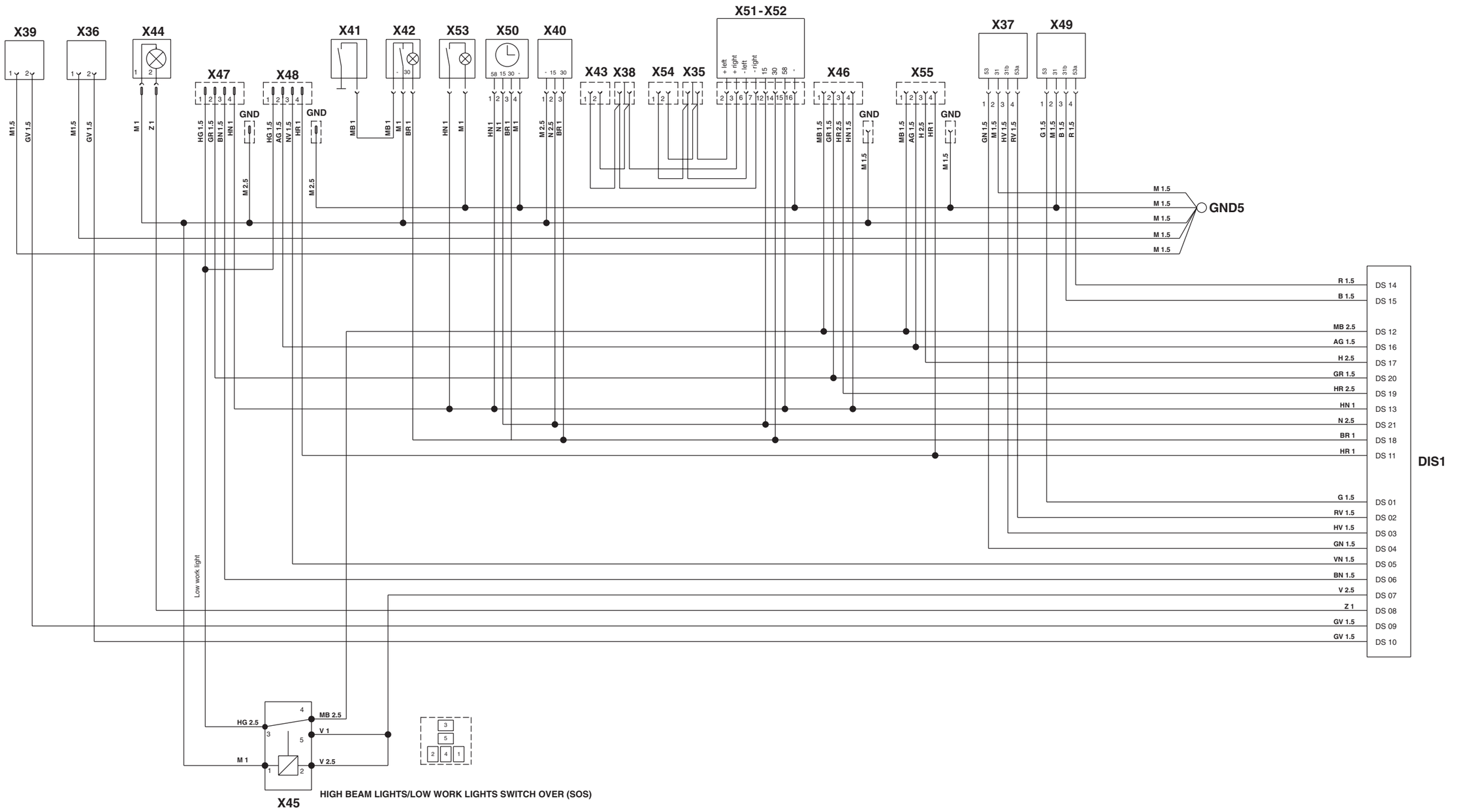
ROOF WIRING (1/2)



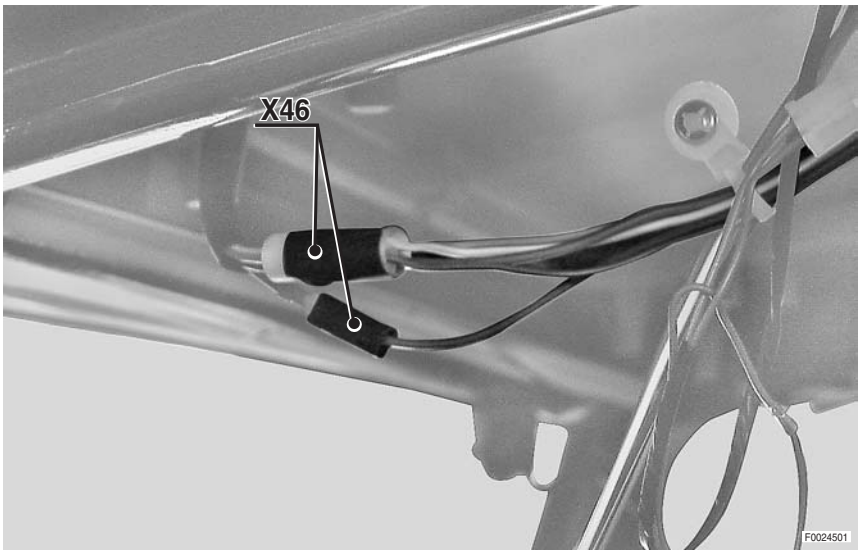
DS1 To side console wiring
X35 R.H. rear loudspeaker
X36 Work light, main beam
X37 Rear screen wiper motor
X38 L.H. rear loudspeaker
X39 Work light, main beam
X40 CB power connector
X41 Door open warning signal switch
X42 Interior roof light
X43 L.H. front loudspeaker
X44 Beacon
X45 Front upper work lights relay, main beam
X46 Front L.H. work light
X47 L.H. side-light and direction indicator
X48 R.H. side-light and direction indicator
X49 Front screen wiper motor
X50 Clock
X51 Radio (grey)
X52 Radio (brown)
X53 Side console courtesy light
X54 R.H. front loudspeaker
X55 Front R.H. work light

ROOF WIRING (2/2)



ROOF CONNECTORS LOCATION

1



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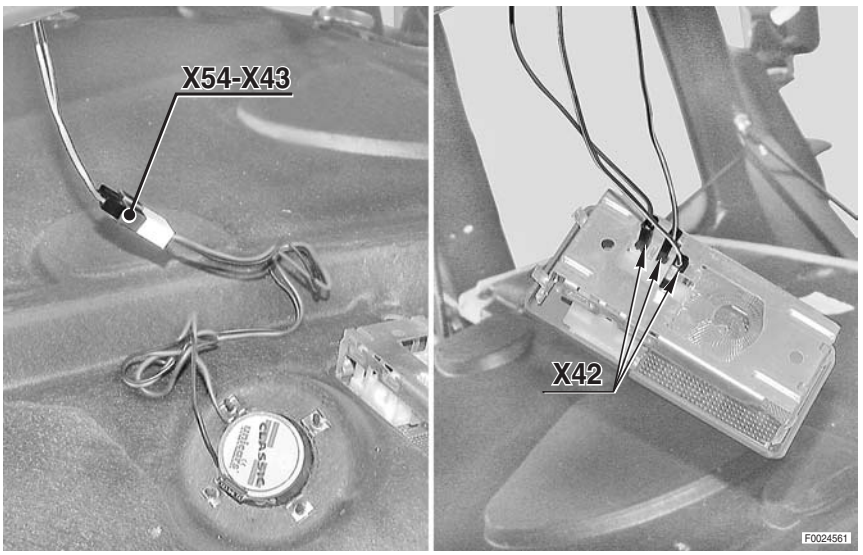

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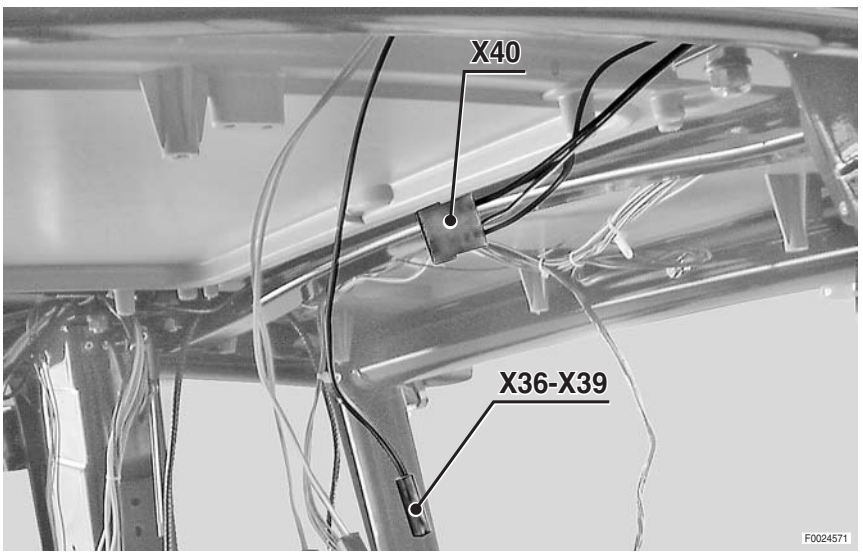

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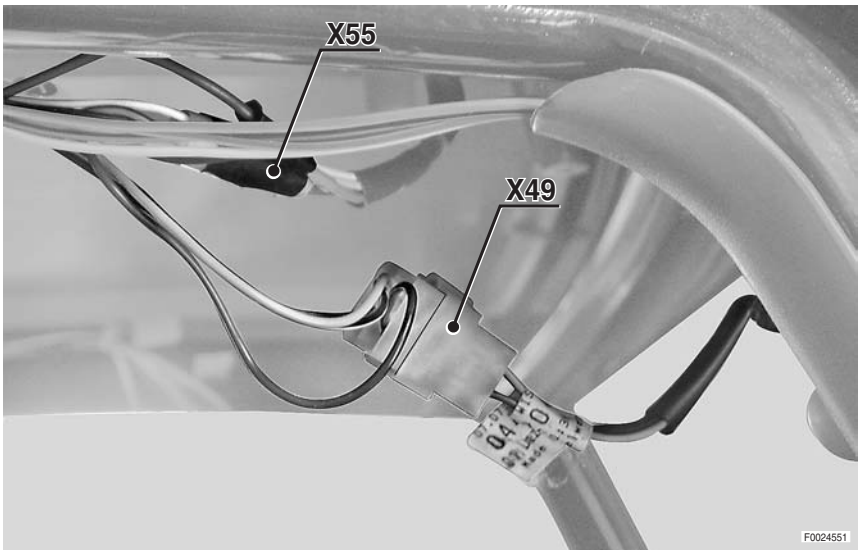

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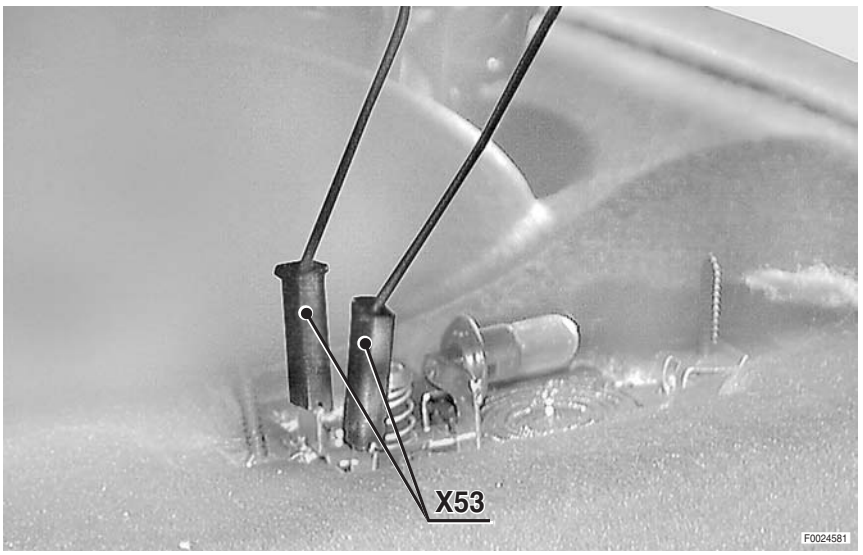

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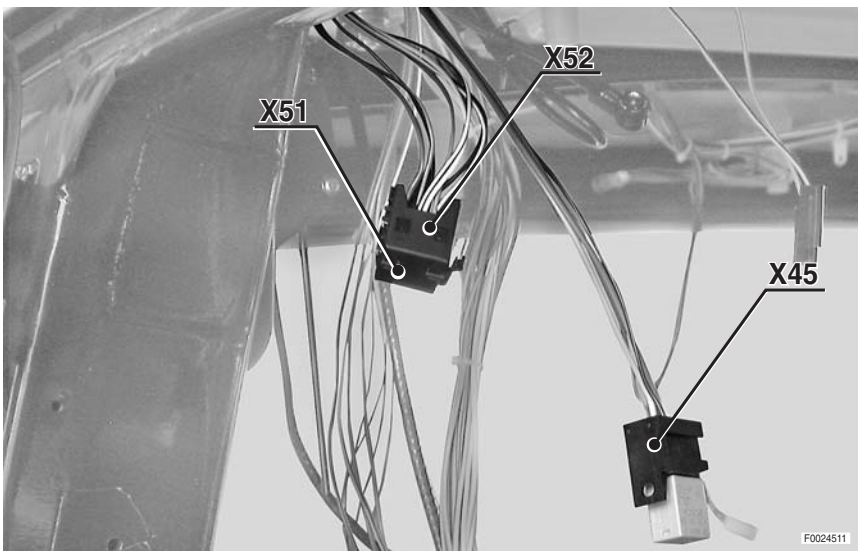

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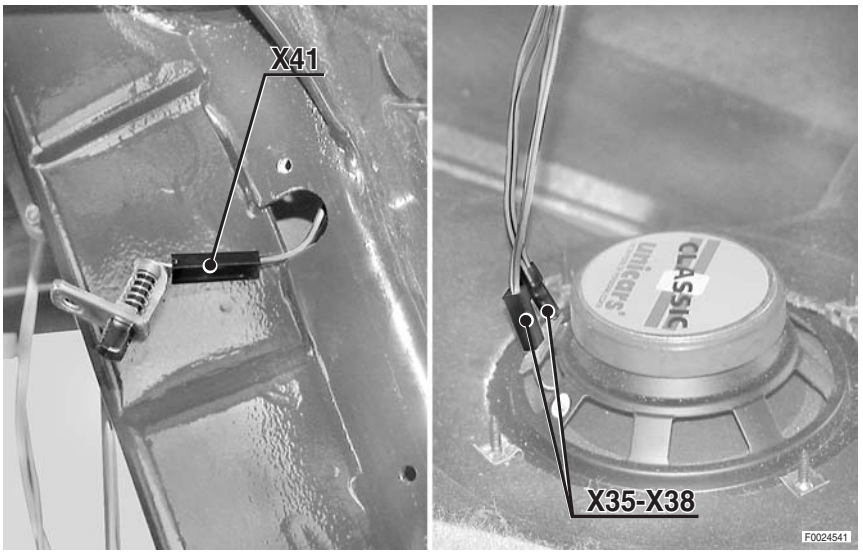

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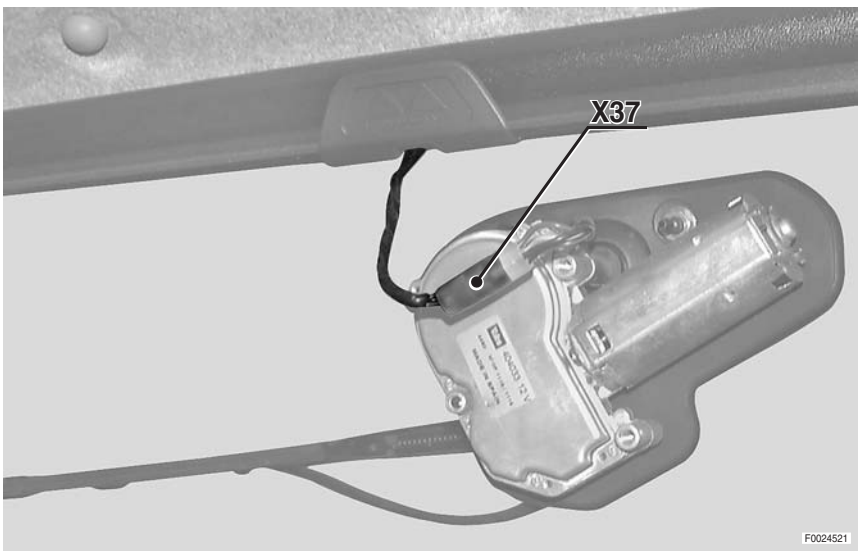
9



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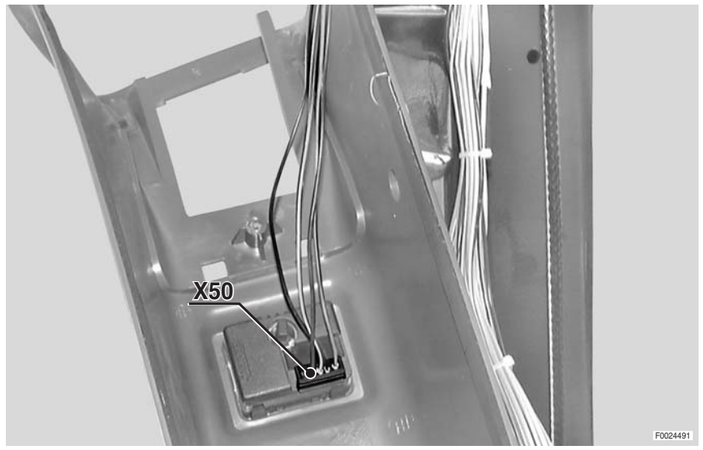

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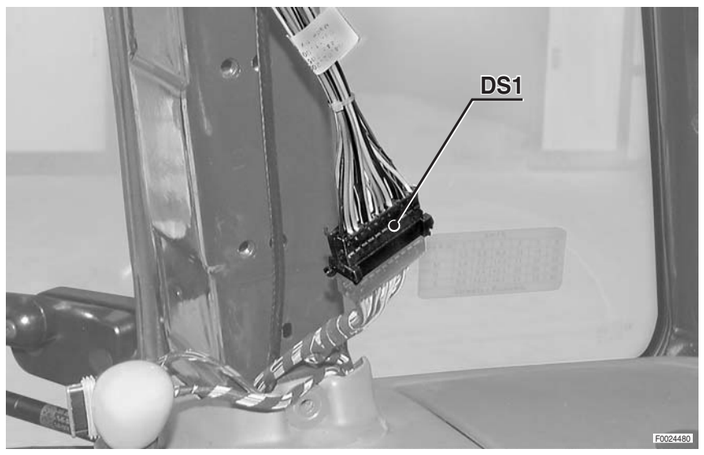
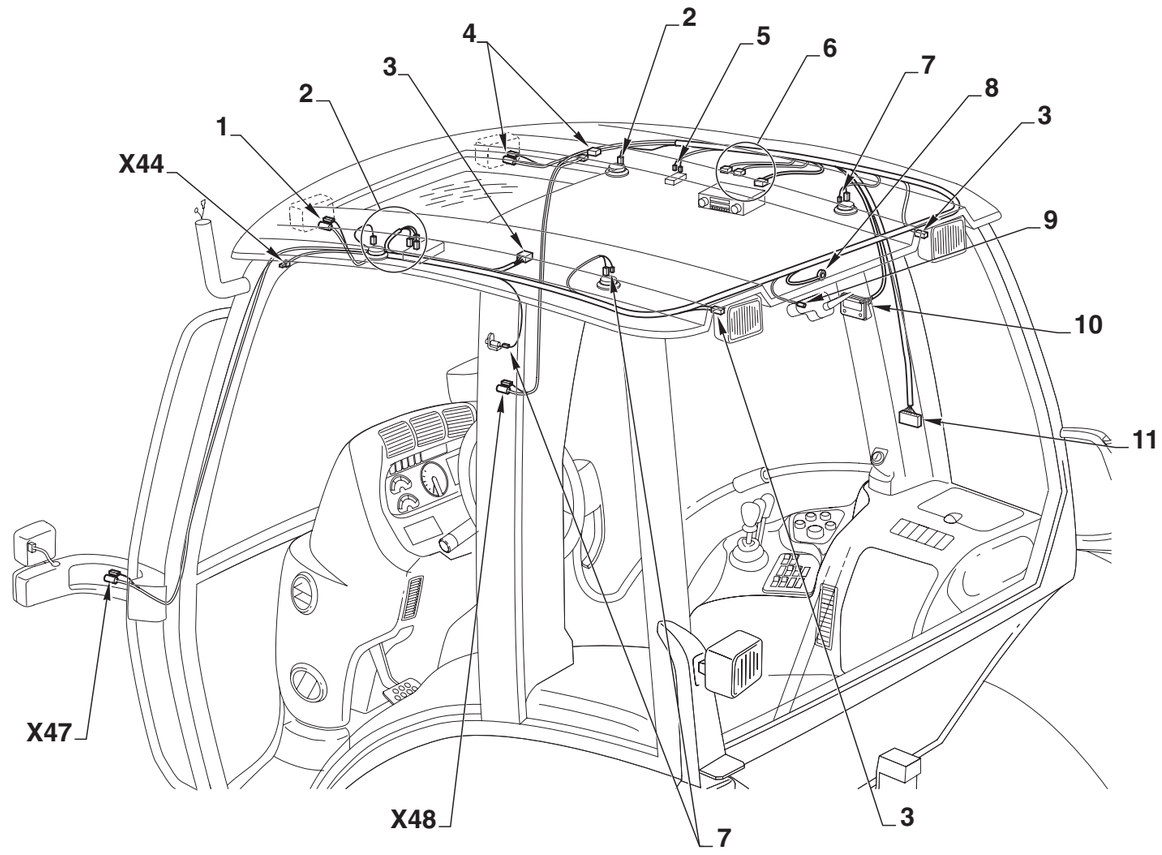


ROOF WIRING



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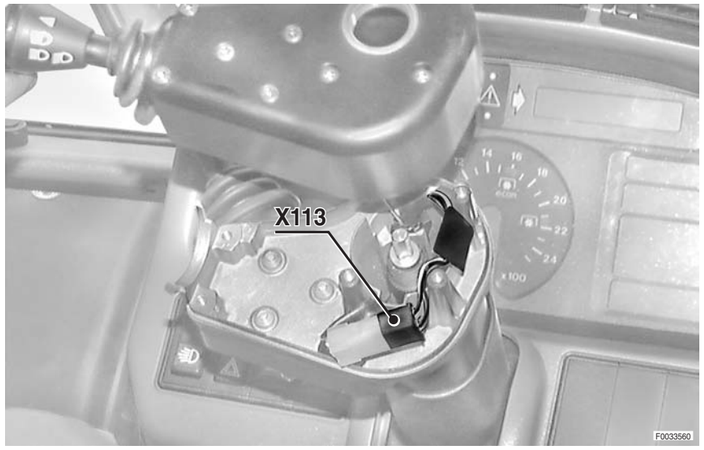
1



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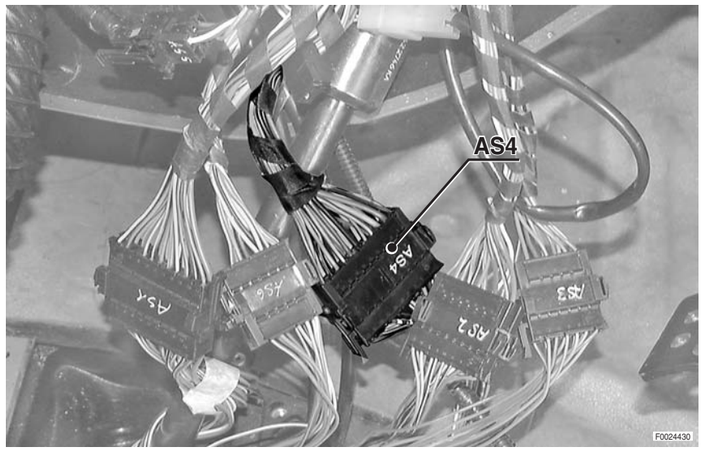
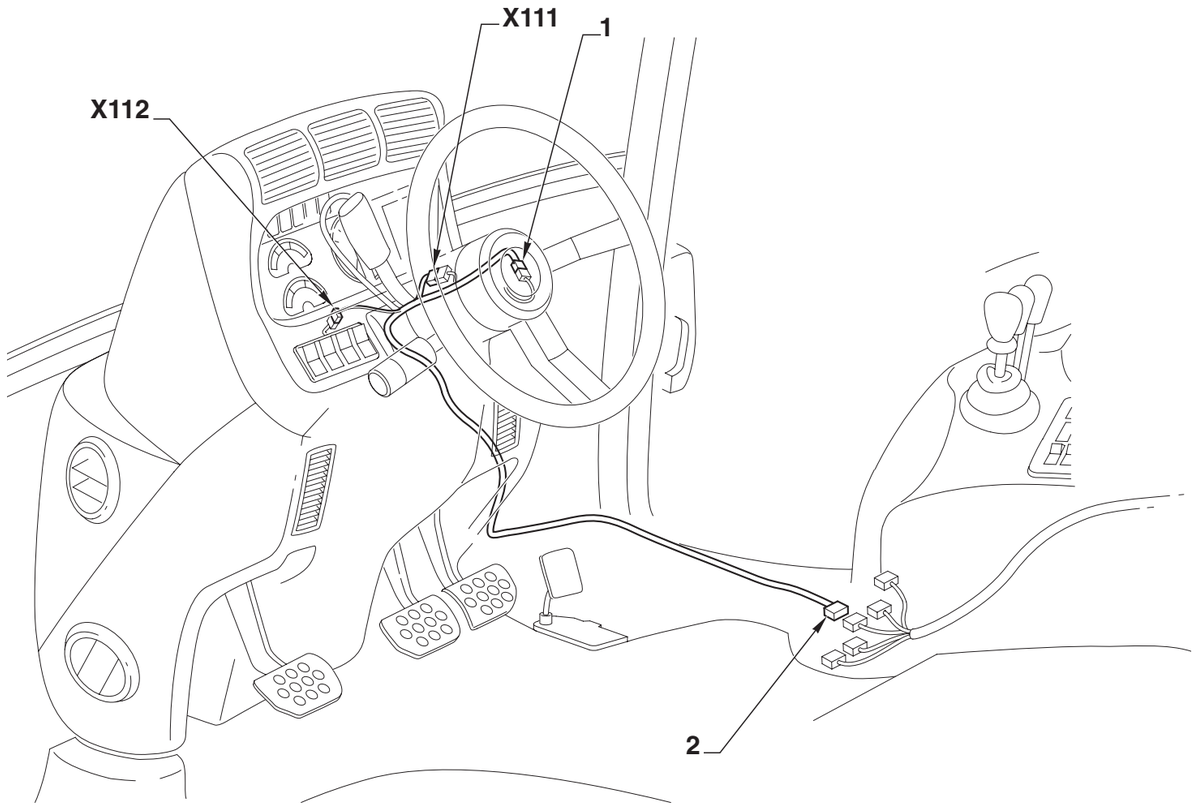


LIGHTS SELECTOR SWITCH WIRING



AS4 To side console wiring
X111 Not utilised
X112 Not utilised
X113 Shuttle Lever

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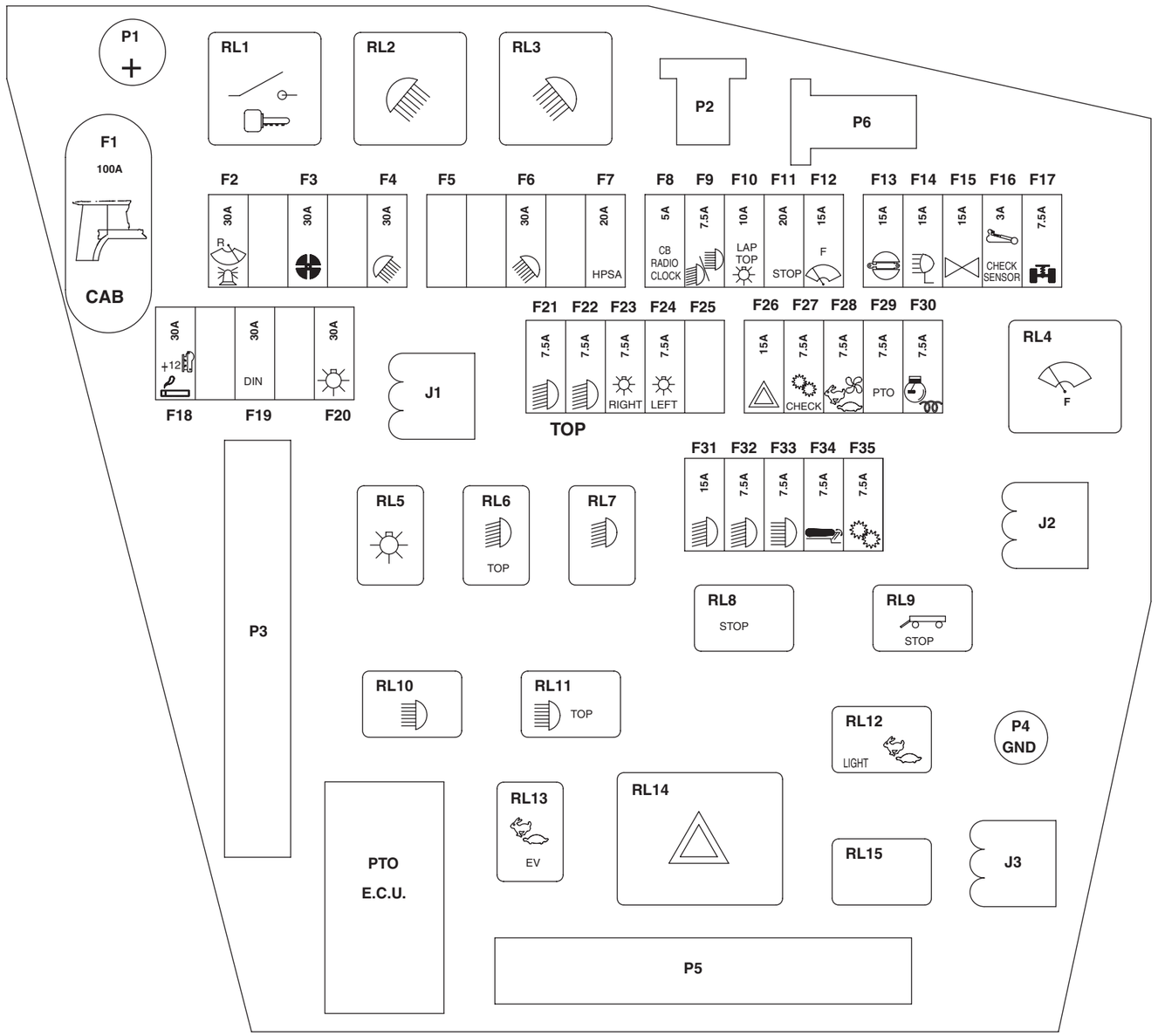
CONTROL UNIT - FUSES - RELAYS (1/2)



D0005450

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)
- **RL2** Rear worklights (40A)
- **RL3** Front worklights (40A)
- **RL4** Front screen wiper (10A)
- **RL5** Lights (10A)
- **RL6** Upper and lower lower beacon (10A)
- **RL7** Lower beacon (10A)
- **RL8** Stop lights - 4WD (10A)
- **RL9** 4WD solenoid valve (10A)
- **RL10** High lights
- **RL11** High lights(10A)
- **RL12** Field/road indicator (10A)
- **RL13** 4WD solenoid valve (10A)
- **RL14** Direction indicators - emergency lights (10A)
- **RL15** High lights commutator (10A)

CONNECTORS

- **J1** To side console wiring
- **J2** To side console wiring
- **J3** To side console wiring
- **P1** To side console wiring
- **P2** To side console wiring
- **P3** To side console wiring
- **P4** To side console wiring
- **P5** To side console wiring
- **P6** To side console wiring

CONTROL UNIT - FUSES - RELAYS (2/2)