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Service Manual

GOLDONI

an ARBOS Company

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1.1 Reading this manual

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1.1.1 Introduction

The purpose of this workshop manual is to provide all the essential information necessary, explain operating principles and describe the settings which must be made to the different parts and assemblies of our tractors.

The information and disassembly sequences given in this manual are not exhaustive as the manual itself is intended for use by technical service personnel who have attended training courses on the product. As a result, the theoretical knowledge and practical experience acquired during the training course are required in order to follow the instructions given in this manual.

To prevent the risk of operator error or distraction which could put the technical personnel working in the service centre at risk, the section "2- Safety rules" must be read before reading any other part of this manual.

The information contained in this manual is up to date at the time of publication. Goldoni S.p.A. reserves the right to modify its products without notification. If any discrepancies are noted or for any other queries, contact your area dealer or importer.

1.1.2 Structure of this manual

This manual is subdivided into chapters, which are subdivided in turn into sections.

Pages are numbered from 1 at the start of each chapter, with the page number indicated after the chapter number.
Example: For example, 3-9 indicates page 9 of chapter 3.

Figures are numbered from 1 at the start of each chapter, with the figure number indicated after the chapter number.
Example: For example, 8.16 indicates figure 16 of chapter 8.

The special tools deemed necessary to disassemble, reassemble and adjust the respective parts and assemblies are indicated at the end of each chapter.

The main tightening torques for assembling the parts of the tractor correctly are indicated at the end of each chapter. For all unspecified tightening torque values, refer to the section "Tightening Torques" in chapter "1-Introduction"

1.1.3 Identifying the tractor

Always cite the identification details of the machine when contacting the Technical Support Service or ordering a part from the Spare Parts Warehouse. Specifically, the following information is needed:

- Commercial name;
- Production series;
- Machine type;
- Variant/Version;
- Identification number (serial number).

All the aforementioned details are stamped on a metal plate fixed to the machine in an easily accessible place for reference whenever needed.

1 - Commercial name
2 - Category
3 - EU Homologation
4 - Identification number (serial number)

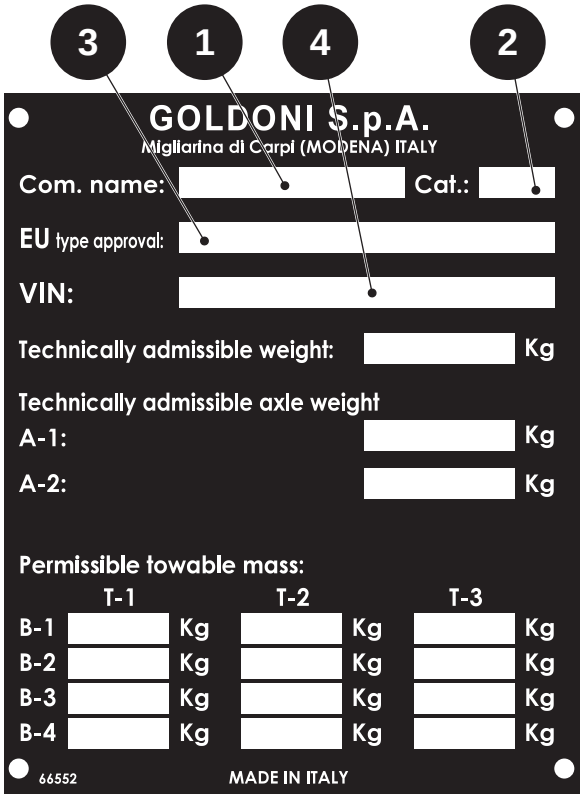

Fig. 1.1

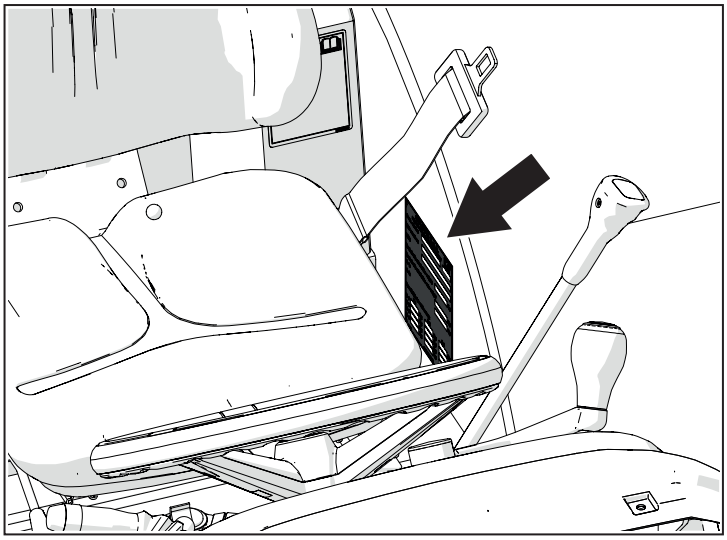

Fig. 1.2

The chassis number is also stamped on the chassis itself.

The identification data is punched onto the front right hand side of the tractor.

Note

See the workshop manual provided by the respective manufacturer for instructions on identifying the engine installed in the tractor.

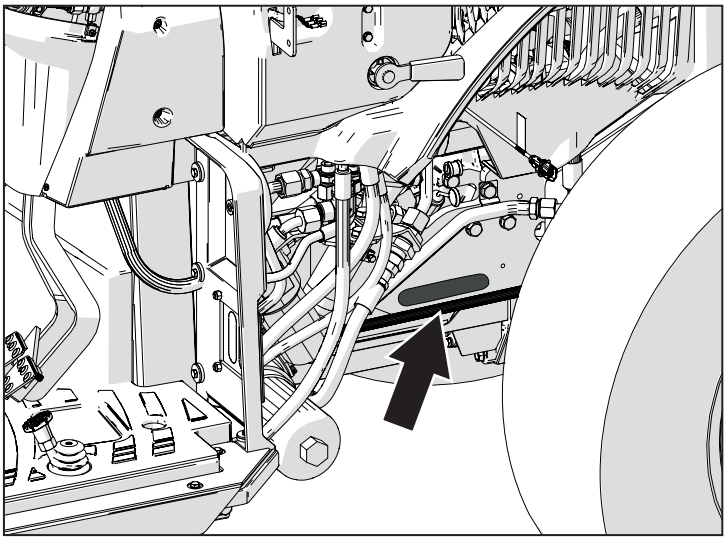

Fig. 1.3

1 - Constructor brand code

2 - Production series

3 - Variant
- Y1/Y2- Engine power
- Y3- Protective structure

4 - Version
- Y4- Speed
- Y5- Engine emissions compliance stage
- Y6- Brand

5 - Chassis number (serial number)

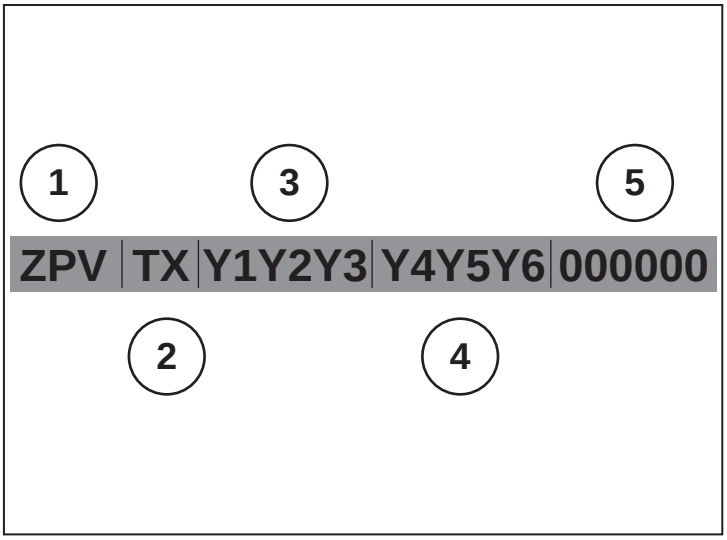

Fig. 1.4

1.2 Safety rules

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1.2.1 Essential preventive guidelines

The premises, installations and equipment of the repair workshop must all be compliant with applicable work safety legislation to ensure the health and safety of all persons working in the workshop.

While clearly not exhaustive, the safety rules given in this section provide important information for workers on the hazards they may encounter while carrying out their jobs.

Your own safety and the safety of others must always be the first priority when working on any machine of any type.

To work in complete safety, it is essential that personnel understand the nature of the work to be done, use the right tools and materials for the job correctly, and act with good common sense. Read all the safety messages in this introduction of this manual and take note of all "**Caution**", "**Warning**" and "**Danger**" notices in this document.

	This symbol means: **NOTE!** This symbol is used to draw attention to specific methods or procedures which must be applied in order to perform maintenance on the tractor correctly.

	This symbol means: **WARNING** This symbol is used to draw attention to operations which must be performed with particular caution as they may put the structure of the tractor or its components at risk.

	This symbol means: **ATTENTION!** This symbol is used to draw attention to safety related information. Read these messages with particular care. Make sure that you have fully understood what may cause potentially dangerous or fatal accidents.

	This symbol means: **DANGER!** This symbol is used to identify a situation of danger for yourself and for others. Read these messages with particular care. Make sure that you have fully understood what may cause potentially dangerous or fatal accidents.

1.2.1.1 General rules

1.2.1.1.1 Preliminary guidelines

- always follow the directions given by your superiors;
- always comply with safety signs;
- do not use machines or installations without the proper authorisation and do not attempt to perform any operation that you are not authorised or qualified to do;
- use all safety and protection devices and measures properly;
- notify your superiors of any defective or missing safety and protection devices, and of any hazardous situations that come to your attention;
- do not remove or modify any safety or protection devices unless specifically authorised to do so;
- notify your superiors immediately of any injury sustained by yourself or others, describing the situation as clearly and completely as possible;
- keep your work space clean and tidy, keep the floor clear of any materials or objects not directly required for your job and avoid spilling greasy or oily products (clean any spillage immediately with appropriate absorbent cleaning products).

Fig. 1.5

1.2.1.1.2 Work Garments

- Do not wear loose-fitting garments or garments with loose or hanging elements which may become tangled in moving parts. Only wear garments with tight-fitting cuffs;
- do not wear necklaces, rings, bracelets or other jewellery;
- do not clean garments with flammable or harmful substances or with compressed air;
- do not wear sandals, flip-flops, clogs or high-heeled footwear;
- use the required personal protective devices at all times (eyewear - face shield - gloves - shoes etc.).

1.2.1.1.3 Machines and Installations

- Before starting work, check that the protective devices and guards are fitted correctly in place and in proper working order, and that all safety devices are working correctly;
- check that any fume extraction and/or ventilation systems in place are working correctly;
- the protective guards and safety devices of machines and installations must never be removed except when strictly necessary for a specific task and only with prior authorisation from your superiors, who will inform you of the substitute safety measures to adopt;
- protective guards and safety devices must be refitted correctly and reactivated as soon as the reason for their temporary removal no longer exists;
- never clean, oil or grease the moving parts of machines and installations by hand;
- never work on or adjust moving parts.

1.2.1.1.4 Lifting and transporting

By hand

- keep your back straight when lifting loads;
- hold the load as safely as possible using the most accessible and comfortable grip points;
- do not carry loads with oil or grease on your hands;
- hand trolleys with no tow bar must always be pushed and not pulled;
- do not place loads near staircases, firefighting installations, first aid stations and transit areas.

When working with motorised machinery,

- comply with load limits and drive at an appropriately safe speed in relation to the route taken and the load carried and to be sure that the machine can be stopped safely;
- ensure that loads are fastened safely with straps and securely attached;
- do not drive with a suspended load in places where a falling load may constitute a hazard - if this is unavoidable, ensure that all persons in the area are adequately warned of your manoeuvres or keep persons out of the area;

1.2.1.1.5 Driving in indoor spaces

Persons

- use permitted and designated walkways (pedestrian crossings, walkways etc.);
- do not run;
- do not walk or stand under suspended loads and keep out of areas which may be subject to the risk of falling loads;
- do not ride on transport or lifting machinery intended for handling materials only.

Vehicles

drive at moderate speed and take all precautions necessary for the route taken - observe all company regulations and signage.

1.2.1.1.6 Electricity

- Do not make makeshift connections. In particular, never make a connection by inserting the bare ends of wires into socket holes;
- always disconnect a plug from the socket by gripping the outer casing of the plug itself, never pull the cord;
- avoid twisted wires;
- take care not to damage the insulating sheath of wires and the insulated housings of electrical equipment, and check frequently that they are undamaged;
- report any damage to electrical devices and, in particular, to earth conductors;
- never open electrical cabinets or the casings of electrical equipment and do not attempt to perform maintenance on electrical cabinets and electrical equipment unless trained and authorised to do so;
- take all precautions to avoid contact with overhead power lines when manoeuvring or working in the vicinity.

1.2.1.1.7 Fire

In areas and in operations subject to the risk of fire due to the proximity or use of flammable substances:

- do not smoke;
- do not use equipment involving naked flames and do not handle incandescent materials;
- keep flammable materials away from sources of heat;
- do not place materials in front of extinguishers and fire hydrants.

1.2.1.1.8 Dangerous substances and products

When using dangerous chemical products (fire hazard, explosion hazard, irritant, caustic burn hazard, burn hazard or poisoning hazard), always observe the following precautions:

- keep recipients containing dangerous products open only for the time strictly necessary to use them;
- do not use or transfer dangerous products into containers not intended for use with them or without the necessary labelling indicating the contents and safety markings;
- when using chemical products, follow the instructions given on the respective labels.

1.2.1.1.9 Protection against exposure to harmful gas, fumes and dust:

- check that any fume extraction systems in place are working correctly;
- use personal protective devices;
- place mobile extractor ducts as close as possible to the source of emissions;
- avoid closing using doors which will obstruct the air flow carrying emissions generated by the extractor system.

1.2.1.1.10 Biological agents

- in case of fermentation (due to proliferation of algae), avoid direct contact and use appropriate protective measures to eliminate the problem;
- only enter areas subject to anaerobic fermentation producing harmful gases (e.g. ammonia) with appropriate protective breathing equipment.

1.2.1.1.11 Guidelines for choosing the correct fire extinguishing measures

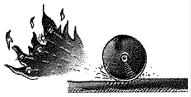
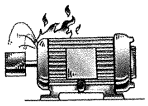
Agente estinguente					
Classe di fuoco	Acqua	Polvere	CO^2	Schiuma	Polveri speciali
combustibili solidi ordinari	✓	✓	✓ Solo per incendi di piccole dimensioni	✓	✗
liquidi infiammabili	✗ Tranne che utilizzando attrezzature adatte	✓	✓	✓	✗
gas infiammabili	✗	✓	✓	✗	✗
 metalli combustibili	✗ Possono reagire con l'acqua	✗	✗	✗	✓
 Apparecchiature elettriche	✗	✓	✓	✗	✗

Fig. 1.6

1.2.1.2 Implements

Makeshift, unsuitable and faulty tools can cause problems and accidents. Never use the wrong tools, as these may put you at risk and compromise the work done.

Only use the special tools recommended by the manufacturer to disassemble, service and refit the components of the tractor.

Using the correct specific tools will make work less tiring and quicker, letting you save costs while being sure that the job has been done correctly.

Never use:

- A hammer with a loose head or a damaged handle.
- Pliers or pieces of metal instead of a hammer;
- Drill bits or screws instead of pin punches;
- Worn wrenches or wrenches repaired with welds;
- A steel hammer to tap bearings or heat-treated components (use a bronze or brass hammer).

Certain procedures on components of the tractor require the engine to be separated from the gearbox and the separation of the front and rear transmission casings. These operations are facilitated and made safer by using the specific separator trolley kit.

When lifting heavy parts, make sure that all chains, brackets, hooks, cables and ropes used for lifting are compliant with EC standards. Unless specified otherwise, an adjustable hoisting bracket must be used when lifting all heavy parts.

All chains and cables used must be parallel to each other and maintained as close as possible to vertical with respect to the object lifted.

1.2.1.3 First Aid

Mechanics are exposed to a number of risks in the workplace.

Treat injuries with disinfectant products and sterile materials, which must be kept in a specific first aid box equipped in accordance with applicable legislation.

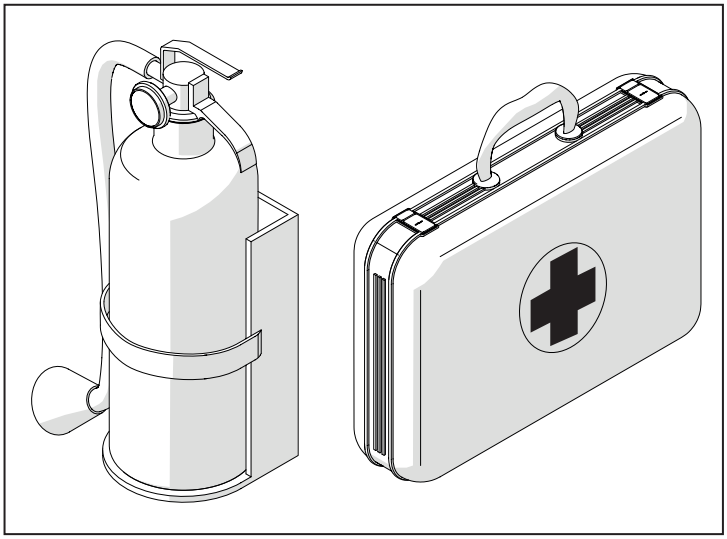


Fig. 1.7

1.2.1.4 Safety rules regarding the tractor

Attention
Read the use and maintenance manually thoroughly before boarding the tractor, and follow the instructions given precisely.

1.2.1.4.1 Start

- Never run the engine in an enclosed space without adequate ventilation or extraction systems for evacuating the exhaust gas.
- Keep your head, body, limbs, feet, hands and fingers away from rotating fans and belts at all times.

1.2.1.4.2 Engine

- Unscrew the radiator cap very slowly before removing to release pressure from the system.

  Only top up with coolant with the engine off or, if still hot, idling.
- To prevent the risk of fire caused by spilt fuel, never refuel the machine while the engine is running, especially if the engine is hot.
- Never attempt to check or adjust the tension of fan belts while the engine is running. Do not adjust the fuel injection pump settings while the engine is running.
- Do not lubricate the machine while the engine is running.

1.2.1.4.3 Electrical system

- If it is necessary to use an auxiliary battery, connect the cable terminals correctly: connect (+) to (+) and connect (-) to (-). Never short-circuit the terminals.

Danger
The gas released by batteries is highly flammable.

When charging a battery, leave the battery compartment uncovered to ensure more effective ventilation. Never check battery charge by jumpering the terminals with a metal object. Avoid sparks and flame in the vicinity of batteries. Do not smoke - explosion hazard!

- Check for fuel leaks before starting any work, and rectify any leaks found before continuing.
- Never charge batteries in an enclosed space: ensure that the area is adequately ventilated to prevent the risk of explosion caused by the build-up of gas released by the batteries during charging.
- Always disconnect the battery before starting any work on the electrical system.
- If the electrolyte in the battery freezes, the battery may explode if you attempt to charge the battery or push-start the vehicle. Keep the battery fully charged at all times to prevent the electrolyte from freezing.
- Batteries release corrosive fumes and flammable gases. Sparks, naked flame and incorrectly connected cables may cause explosions.

1.2.1.4.4 Hydraulic system

- Pressurised hydraulic fluid escaping from a very small hole may be practically invisible and yet be projected with sufficient force to penetrate the skin. use a piece of cardboard or wood to search for leaks. **Never search for leaks with your hands**. in the event of skin contact with the fluid, seek immediate medical assistance. Failure to treat a fluid injection injury immediately may lead to severe infection or skin disease.
- Use specific instruments to check the pressure of the system.

1.2.1.4.5 Disassembly and reassembly

- Lift and handle all heavy parts with lifting equipment of sufficient capacity. Use appropriate straps and hooks to secure parts when lifting. Use the specific hoisting eye-bolts. Be aware of any persons in the vicinity of the load being lifted.
- Handle all parts with extreme caution. Never place your hands or fingers between two parts. Wear approved accident prevention garments and equipment such as safety eyewear, gloves and shoes.
- Do not allow chains or metal cables to twist. Always wear safety gloves when handling cables or chains.

1.2.2 Using the tractor safely

You need to be suitably qualified and authorised to operate an agricultural tractor safely. To be qualified to use this tractor, you must also have read and understood the complete contents of the use and maintenance manual and observe the instructions given precisely.

You must be aware of and understand all applicable work safety regulations. Note that in certain countries, persons under the age of 18 years are not permitted to operate a tractor.

It is your responsibility to learn these regulations and apply them in the workplace. These regulations include the following instructions for using the tractor safely.

ATTENTION
The operator must not consume alcohol or take drugs which could impair concentration and/or coordination.

Observe the following precautions

- Never let minors or unqualified persons drive the tractor.
- Fasten the seat belt if the tractor is equipped with an ROPS safety roll bar.
- If possible, avoid using the tractor near excavation sites or large ditches.
- Reduce speed when steering and when driving across hilly, uneven, slippery or muddy terrain.
- Keep away from steep slopes as they are dangerous.
- Always watch where you are going, especially during headland turns and around trees.
- Never allow anyone to climb onto the tractor or implement.
- Use the tractor calmly, avoiding rushed or sudden manoeuvres. do not steer, start or stop suddenly.
- Only use the drawbar or other specific hitching points to tow. Never attach a towed load above the centreline of the rear axle.
- Engage the parking brake when the tractor is parked.
- Do not modify or remove any part of component of the original equipment of the tractor.
- Keep others out of your work area.
- Do not use hitching or towing devices that are not intended for your tractor.

1.2.2.1 ROPS

The tractor may be equipped with an ROPS safety roll bar and a seat belt. If the ROPS structure has been removed, the tractor must be equipped with a new ROPS and seat belt. The ROPS reduces the risk of injury in the event of a roll-over. A roll-over without the ROPS roll bar may cause serious damage and injury.

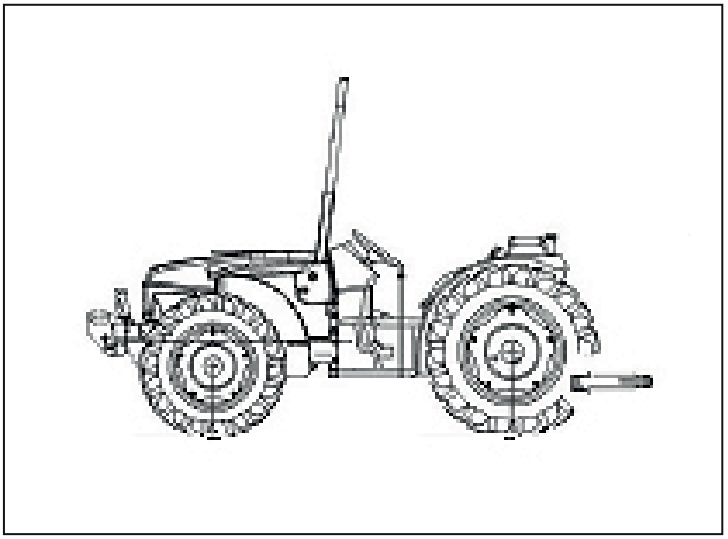


Fig. 1.8

Usage

- Before using the tractor, make sure that the ROPS is not damaged and is fastened correctly to the tractor.

- Never attach chains, cables etc. to the ROPS or cab to tow a load, as this may cause the tractor to overturn: always use the drawbar to tow.

- Always fasten your seat belt. Do not use the seat belt if the tractor is not equipped with an ROPS safety roll bar.

- Check the seat belt for damage. Replace the seat belt if damaged.

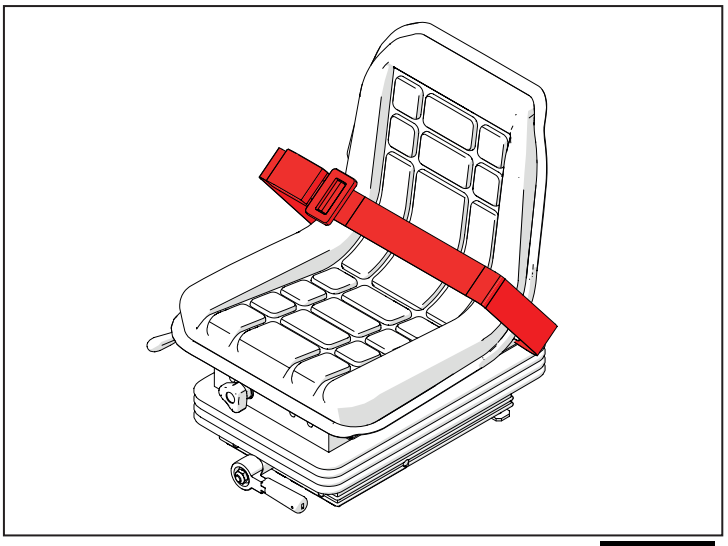


Fig. 1.9

Damage to ROPS safety roll bar

If the tractor has rolled over or if the ROPS safety roll bar has been damaged (e.g. due to collision with a bridge), it must be replaced to ensure the same degree of safety originally offered by the tractor.

After an accident, check that the ROPS safety roll bar, the driver seat, the seat belt and the seat belt anchor points. Replace all damaged parts before using the tractor again.

Do not weld, drill, bend or straighten the ROPS safety roll bar or parts of the cab: these actions will compromise the original safety of the tractor.

Precautions for working safely

- Protect yourself against injury

- Wear appropriate protective garments and use the personal protective devices required for the task.

- Do not take risks.

Use the following personal protective equipment and garments (Fig. 1.10):

- A safety helmet;

- Safety glasses or a protective face mask;

- Hearing defenders;

- A protective breathing mask or filter;

- Appropriate garments to protect against bad weather;

- Reflective garments;

- Heavy work gloves (in neoprene for handling chemical products, in leather for heavy duty work).

- Safety footwear.

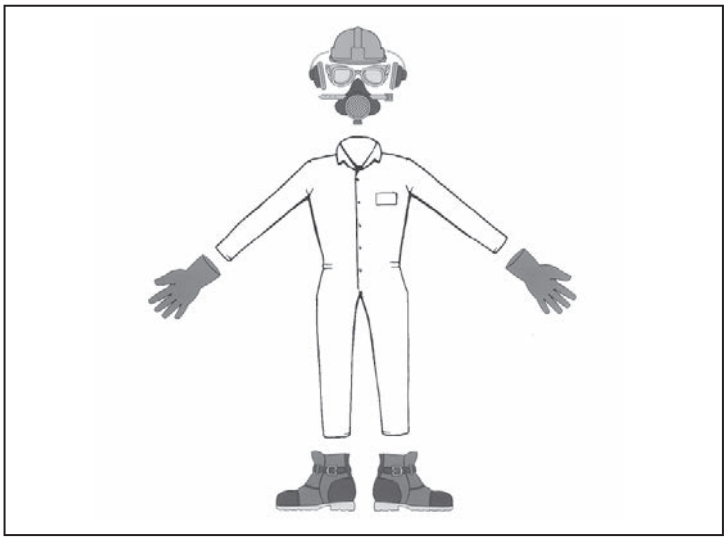


Fig. 1.10

1.2.2.2 Cab safety

- The safety cab is specifically designed to be installed on this series of tractors and is compliant with all safety and noise requisites of applicable legislation.
- The safety cab is conformant with international safety standards. Never drill or modify the cab to install accessories or implements.
- Do not attempt to repair damaged parts of the cab by welding.
- Never attach chains or cables to the main chassis of the cab for towing loads.

1.3 General

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1.3.1 Spare parts

If it is necessary to replace a part, ask for and make sure that you use original spare parts only

Using non-original spare parts will void the warranty.

Always provide the following information when ordering spare parts:

- Tractor model and commercial name;
- Chassis number;
- Order code of required part (this can be found in the Spare Parts Catalogue).

1.3.2 Specific tools

The tools and equipment specified and illustrated in this manual have been developed specifically by the manufacturer to make working on the tractor quicker, simpler and more effective.

These tools and equipment will ensure the best results possible with minimum operator strain, and let you avoid any operations which could compromise the successful outcome of the job.

Note
The wear limits indicated are recommended only and not mandatory. The indications “front”, “rear”, “right” and “left” are with respect to the operator facing towards the front of the vehicle and seated in the drive seat.

1.3.3 Oil seals for rotating shafts

Observe the following precautions and instructions to ensure that oil seals are installed correctly:

- Clean the shaft thoroughly and check that the contact surfaces of the shaft itself are undamaged.
- Fit with the seal lip facing towards the fluid; when fitting hydrodynamic lip seals, the grooves must be oriented correctly in relation to the direction of rotation of the shaft so that they will carry fluid towards the interior of the seal.
- Spread a film of lubricant (preferably use oil and not grease) on the seal lip and, with double lip seals, fill the gap between the oil seal lip and the dust seal lip with grease;
- Install the oil seal in its seat with a flat tipped punch; never hit the seal directly with a hammer.
- While installing the seal, make sure that the oil seal remains perpendicular relative to its seat. Once the seal is installed, where applicable, check that it fits completely against the relative shoulder.
- To prevent the shaft from damaging the seal lip, place suitable protection between the two parts during assembly.

1.3.4 Adjuster shims

Each time an adjustment with shims is necessary, measure each adjuster shim with a micrometer and assemble a pack of the required thickness on the basis of the values measured.

Note
Do not rely on the measurement of the assembled pack and do not base your calculations on the measurements indicated on each shim, as they may be incorrect.

1.3.5 O-ring seals

Lubricate O-rings before fitting in their respective seats to prevent them from twisting and seating incorrectly, compromising the integrity of the seal itself.

1.3.6 Sealants used

A number of different sealants must be used during assembly, with specific characteristics to suit different applications.

Sealants

LOCTITE 518 mastic sealant must be used where a hermetic seal is required between two or more components.

Usage:

- Remove any encrusted residue from both mating surfaces with a wire brush.
- Degrease the surfaces thoroughly with one of the following cleaners: trichloroethylene, petroleum spirit, acetone or a solution of hot water and caustic soda.
- Spread the product evenly onto just one of the contact surfaces and assemble.

Thread lock compound

LOCTITE 243 and LOCTITE 270 thread lock compounds are used when it is necessary to impede a screw or nut from loosening.

Usage:

- Clean as described previously.
- Spread one or two drops of the product onto the thread of the screw or in the threaded hole.
- Fit the screw or nut and tighten.

1.3.7 Spring pins

When fitting split spring pins, ensure that the split in the pin itself is facing in the same direction as the force exerted on the pin.

Coiled spring pins can be fitted in any orientation.

1.4 Technical characteristics

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1.4.1 Engine

Tractor		Q90	Q100	Q110
Manufacturer		VM	VM	VM
Model		R754 IE417	R754 IE417	R754 IE417
Emissions compliance		Stage 3B	Stage 3B	Stage 3B
Cylinders/Capacity	No./ cm^3	4/2970	4/2970	4/2970
Bore	mm	94	94	94
Stroke	mm	107	107	107
Intake		Turbocharged, intercooled line - Air filter (dry)		
Injection system		Common Rail direct injection with high pressure pump		
Valves		8	8	8
Rated power (ECE R120)	kW (HP)	59 (80,2)	67 (91,1)	76 (102)
Idle speed	rpm	800	800	800
Rated speed	rpm	2300	2300	2300
Maximum torque	N·m	340	380	380
Engine speed at maximum torque	rpm	1100	1100	1100
Torque rise		37%	34%	21%
Cooling		Liquid	Liquid	Liquid
Fuel system		Direct diesel injection	Direct diesel injection	Direct diesel injection
Specific fuel consumption (at max. torque engine speed)	g/kWh	217	212	212
Maximum continuous longitudinal inclination angle	Degrees	30° (with flywheel on uphill side) 35° (with flywheel on downhill side)		
Maximum continuous transverse inclination angle	Degrees	30°	30°	30°
Oil change quantities, inclusive of filter (standard sump)	l (kg)	9,8 (8,7)	9,8 (8,7)	9,8 (8,7)
Tank capacity	l	70	70	70
Dry weight	kg	260	260	260
Engine hood		SMC	SMC	SMC

1.4.2 Transmission

Transmission type		Mechanical transmission, four wheel drive
Gearbox type		24+12 synchronised
Shift control system		Mechanical with lateral levers
Clutch		Single plate dry clutch, 11" diameter
Clutch control		Mechanical with pedal
Reverse shuttle type		Mechanical, synchronised
Reverse shuttle control		Lever
Rear differential lock		Electrohydraulic
Front axle		4WD, selectable without disengaging drive
4WD engagement control		Electrohydraulic
Front wheel drive clutch		Multiplate wet clutch
Front differential lock		NO-SPIN (Automatic)
Front axle swing angle	Degrees	12°
Minimum speed	km/h	0.4
Maximum speed (homologated)	km/h	40

1.4.3 Brakes

Rear brake type		Hydraulically operated multi-disc wet brakes
Front brake type		IST (simultaneous 4WD engagement under braking)
Emergency and parking brake		Independently and mechanically controlled. Braking action on rear wheels.
Hydraulic trailer braking		Hydraulically operated by pressure pulse in main circuit
Trailer brake mechanical lever mount		Type CUNA

1.4.4 Steering wheel

Steering type		Hydrostatic with load sensing valve
Steering angle		57°

1.4.5 Rear power take off

Type		Single shaft, independent and synchronised
PTO speed independent of ground speed	rpm	540-750
Ground speed synchronised		Yes
Direction of rotation (looking at PTO)		Clockwise
Profile		1-3/8" with 6 splines
Clutch		Independent, mechanical dry clutch
Clutch control		Mechanical with lever
Safety		PUSH & START device on PTO selector

1.4.6 Front Power Take Off

Type		Single shaft, independent
PTO speed independent of ground speed	rpm	1000
Direction of rotation (looking at PTO)		Anticlockwise
Profile		1-3/8" with 6 splines
Clutch		Electrohydraulic
Clutch control		Electric

1.4.7 Rear lift

Type		Hydraulic with position and draft control
Lift capacity at lower link ends	kg	2500
3-point linkage category		Category 1 and 2
Mechanical top link arm		Category 1 and 2
Hydraulic top link arm		Category 1 and 2 / 1 and 2 with quick hitch
Lower link arm type		Telescopic with quick hitches
Right hand tie-rod type		Hydraulic

1.4.8 Front lift

Type		up / down
Lift capacity at lower link ends	kg	1200
3-point linkage category		Category 1 and 1N

1.4.9 Hydraulic System

Type		Open-centre
Pump delivery	l/min	38 + 61 with dual pumps
Rear hydraulic distributors		3 in single block
Front hydraulic distributors		Maximum 3 modular plus 1
Free oil return coupling		1/2 NPTF quick coupler

1.4.10 Electrical system

Battery		12V 850A 95Ah
Safety		Battery master switch
Instrument		Digital / analogue
1-pole socket	Volts	12
7 pole socket	Volts	12
Rear work light		Adjustable
Rotating beacon		Orange

1.4.11 Driver zone

Platform	Full size, suspended
Platform carrier	Silicone variable deformation silent-blocks
Front mudguards	Integrated in bodywork
Rear mudguard protection	Rubber profile
Front mudguard protection	Rubber profile
ROPS	Central, fully foldable
Standard cab	Goldoni Overview
Low profile cab	Goldoni LowProfile
Left and right hand rear view mirrors	Adjustable
Seat	With elastic suspension, seat belts and OPS
Seat adjustment	Fore/aft, up/down and driver weight
Toolbox	Yes
Use and maintenance manual	Yes

1.4.12 Cab

Type	Standard profile	Low profile
ROPS homologation	Type GL	Type SG
Lateral doors	With door pull handle, gas strut and key-operated lock	With door pull handle, gas strut and key-operated lock
Cab air pollen filter	Paper	Paper
Front screen	Opening	Fixed, athermic
Rear screen	Opening	Opening
Windscreen wiper	1 speed	1 speed
Rear wiper	1 speed	-
Windscreen washer	0.5 litres	-
Right/left hand rear view mirrors	Adjustable and folding	-
Front sun shade	With height adjustment	-
Provision for rotating beacon	Switch in cab and external bayonet fitting	-
Ventilation and heating system	With electric blower fan	With electric blower fan
Air conditioning system	Condenser with electric blower fan on cab roof	Condenser with electric blower fan on cab roof
Front work light	2	-
Rear work light	2	2
Provision for audio system	Audio head unit housing and mountings for speakers	-

1.4.13 Towing devices

Rear towing hitch	Category EEC/EEC-X/EEC-Y, adjustable
SLIDER rear towing hitch	Category EEC/EEC-X/EEC-Y, sliding and with adjustable height
Front towing hitch	Fixed
Drawbar	Swinging drawbar, category EEC/EEC-X

Vertical loads

	Maximum permitted vertical load on hitch (Kg)		max permitted h of hitch (mm)	
	Roll-Bar	Cab	Roll-Bar	Cab
X314 type hitch	1500	1500	334.58	283.05
Y314 type hitch	1780	1650	233.03	231.09
Y277 type hitch	1920	1765	262.06	262.36
X277F type hitch	1500	1500	412.32	357.43
GTF30 064 type hitch	1500	1500	412.32	357.43
023 type hitch	1500	1500	383.68	330.03

1.4.14 Towable masses

Category R and S vehicle brake systems	Drawbar	Rigid drawbar	Centreline
Unbraked	1020 kg	1020 kg	1020 kg
Inertia braking	6000 kg	6000 kg	6000 kg
Hydraulic braking	kg	kg	kg
AIr braking	kg	kg	kg

1.4.15 Ballast weights

Front	204 kg, in 6 suitcase weights of 34 kg each
Water ballast in tyre	With air / water valve

1.4.16 Weights and dimensions

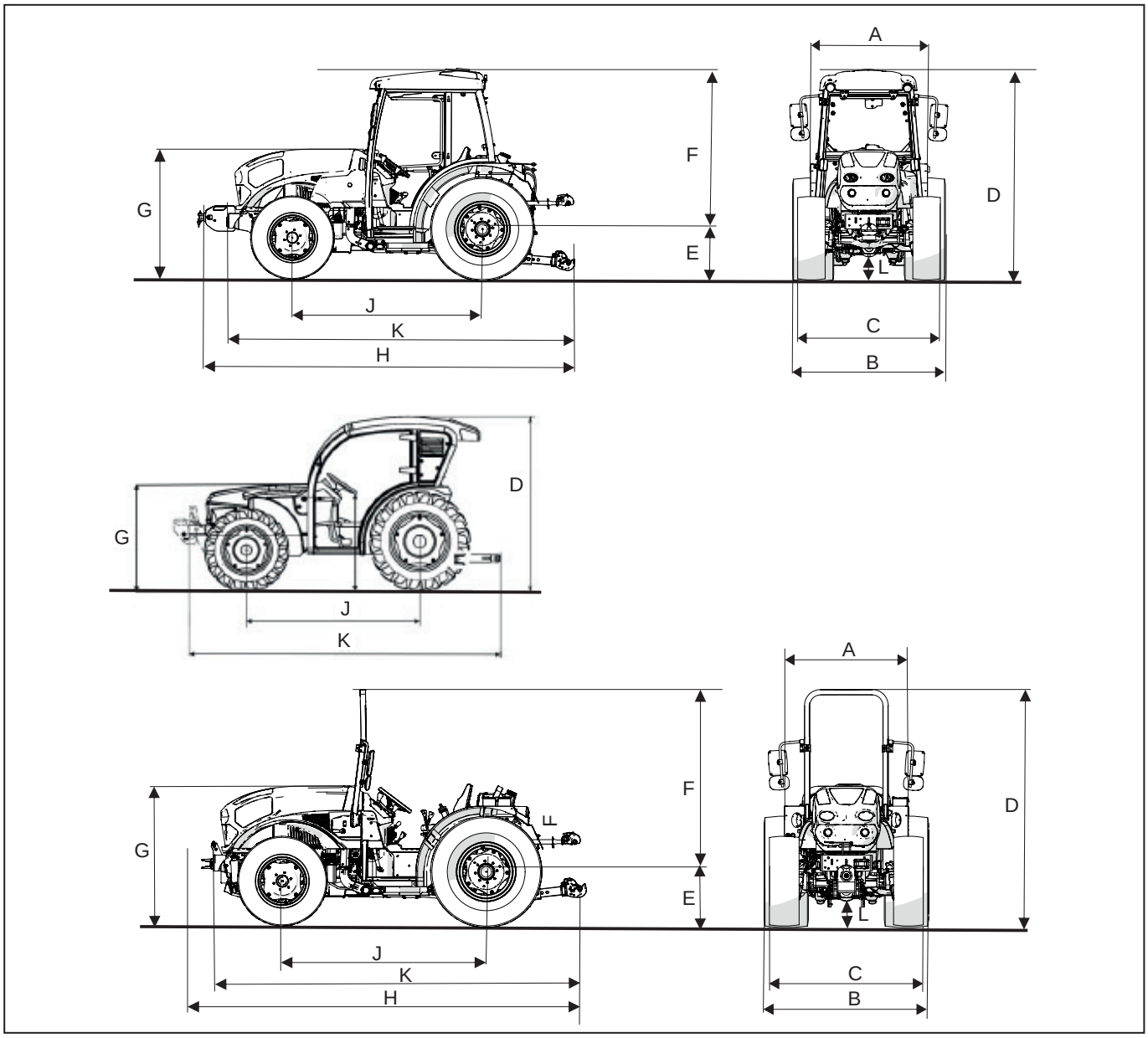

Fig. 1.11

Values given are for tractor with 320/70-R24" rear tyres and 280/70-R20" front tyres

Model		Q90	Q100	Q110
Weight, Roll Bar version	kg	2275	2275	2275
Weight, version with GL11 cab	kg	2425	2425	2425

Maximum permitted axle weights		
Front	kg	1800
Rear	kg	2800
Total	kg	3700

Model		Q90 Q100 Q110
A	Width at mudguards, without extensions	1170 mm
A	Width at mudguards, with extensions	1400 mm
B	Width at rear wheels	1368-1878 mm
C	Width at front wheels	1370-1788 mm
D	Height, GL cab version	2075 mm (min) 2150 mm (max)
D	Height, SG1 cab version	1804 mm (min) 1879 mm (max)
D	Height, ROPS version	2170 mm (min) 2245 mm (max)
E	ETRTO tyre radius	450 mm (min) 525 mm (max)
F	Overall vehicle height at rear axle midline - GL cab version	1625 mm
F	Overall vehicle height at rear axle midline - SG1 cab version	1354 mm
F	Overall vehicle height at rear axle midline - ROPS frame version	1720 mm
G	Cowl height	1250 mm (min) 1325 mm (max)
H	Length with ballast weights	3681-3781 mm
K	Length without ballast weights	3421-3521 mm
J	Wheelbase	1923 mm
L	Ground clearance	172 mm (min) 247 mm (max)

1.4.16.1 Maximum axle loads

Low version

Axle	Tyres	Rolling radius (mm)	Tyre classification		Maximum axle load (kg)	Load capacity (kg)	
						Minimum	Maximum
Front	280/70 R18	410	114	A8	1800	1171	1449
Rear	320/85 R20	500	119	A8	2800	1131	1431
Front	280/70 R18	410	114	A8	1800	1171	1449
Rear	360/70 R20	500	120	A8	2800	1104	1458
Front	280/70 R18	410	114	A8	1800	1171	1449
Rear	380/70 R20	525	122	A8	2800	1104	1458
Front	320/65 R18	410	109	A8	1800	1171	1449
Rear	420/65 R20	500	125	A8	2800	1134	1458
Front	280/70 R16	390	112	A8	1800	1163	1457
Rear	340/65 R20	450	124	A8	2800	1104	1458
Front	260/70 R16	360	109	A8	1800	1163	1457
Rear	340/65 R20	450	119	A8	2720	1104	1458
Front	400/55 17.5	425	108	A8	1800	1354	1354
Rear	560/45 22.5	525	125	A8	2800	1280	1280
Front	250/80 - 16	390	125	A8	1800	1130	1490
Rear	320/70 R20	475	113	A8	2300	1131	1431
Front	280/70 R20	425	116	A8	1800	1122	1508
Rear	320/70 R24	525	116	A8	2500	1048	1428
Front	300/65 R18	410	116	A8	1800	1181	1459
Rear	420/65 R20	500	125	A8	2800	1134	1458

1.4.17 Lubricants

Original lubricants

Arbor Alfatech Synt 10W-40 oil	
Viscosity at 100°C	14 mm2/s
Viscosity grade	158
Flash point V.A.	200°C
Pour point	-33°C
Volumetric Mass at 15° C	0.875 kg/l

Arbor Universal 15W-40 oil	
Viscosity at 40°C	110 mm2/s
Viscosity at 100°C	14 mm2/s
Viscosity at -15°C	3450 mPa.s
Viscosity grade	135
Flash point V.A.	220°C
Pour point	-36°C
Volumetric Mass at 15° C	0.886 kg/l

Arbor TRW 90 oil	
Viscosity at 40°C	135 mm2/s
Viscosity at 100°C	14.3 mm2/s
Viscosity at -26°C	108000 mPa.s
Viscosity grade	104
Flash point V.A.	220°C
Pour point	-27°C
Volumetric Mass at 15° C	0.895 kg/l

Arbor MTA oil	
Viscosity at -40°C	28000 mPa.s
Viscosity at 40°C	35.5 mm2/s
Viscosity at 100°C	7.5 mm2/s
Viscosity grade	160
Flash point V.A.	200°C
Pour point	-40°C
Volumetric Mass at 15° C	0.870 kg/l
Colour	Red

Arbor MP Extra grease	
NLGI consistency number	2
Worked penetration (60)	285 dmm
Dropping point	190°C
4-ball weld load	300 kg
Viscosity of oil at 40° C	200 mm2/s

Original protective fluids

PARAFLU 11 antifreeze fluid	
Density at 15° C	1.135 g/cm3
pH	7.7, diluted to 50%
Reserve alkalinity	16 ml HCl 0.1 N
Boiling point	-38° C diluted to 50%
Foam at 88°C	50 cc

1.4.18 Speed

Speeds with following tyre type/s: 340/65 R 20"

Radius: 450 mm	Rolling circumference: 2.83 m

			Engine speed (rpm)									
Mode	Range	Gear	800	1000	1200	1400	1600	1800	2000	2100	2200	2300
Forward - Hi (normal)	L	1	0.17	0.21	0.25	0.29	0.33	0.37	0.41	0.44	0.46	0.48
	L	2	0.27	0.34	0.41	0.48	0.55	0.61	0.68	0.72	0.75	0.79
	L	3	0.48	0.60	0.73	0.85	0.97	1.09	1.21	1.27	1.33	1.39
	L	4	0.63	0.78	0.94	1.09	1.25	1.41	1.56	1.64	1.72	1.80
	M	1	0.59	0.73	0.88	1.03	1.17	1.32	1.47	1.54	1.62	1.69
	M	2	0.97	1.21	1.45	1.69	1.93	2.18	2.42	2.54	2.66	2.78
	M	3	1.71	2.14	2.57	3.00	3.00	3.85	4.28	4.49	4.71	4.92
	M	4	2.22	2.77	3.32	3.88	4.43	4.98	5.54	5.82	6.09	6.37
	V	1	3.10	3.88	4.65	5.43	6.20	6.98	7.75	8.14	8.53	8.92
	V	2	5.11	6.38	7.66	8.94	10.21	11.49	12.77	13.40	14.04	14.68
	V	3	9.04	11.30	13.56	15.82	18.08	20.34	22.60	23.73	24.86	25.99
	V	4	11.70	14.62	17.55	20.47	23.40	26.32	29.25	30.71	32.17	33.63
Forward - Lo (20% underdrive ratios)	L	1	0.13	0.16	0.19	0.22	0.26	0.29	0.32	0.34	0.35	0.37
	L	2	0.21	0.26	0.32	0.37	0.42	0.48	0.53	0.56	0.58	0.61
	L	3	0.37	0.47	0.56	0.66	0.75	0.84	0.94	0.98	1.03	1.08
	L	4	0.48	0.61	0.73	0.85	0.97	1.09	1.21	1.27	1.33	1.39
	M	1	0.46	0.57	0.68	0.80	0.91	1.02	1.14	1.19	1.25	1.31
	M	2	0.75	0.94	1.12	1.31	1.50	1.69	1.87	1.97	2.06	2.15
	M	3	1.33	1.66	1.99	2.32	2.65	2.99	3.32	3.48	3.65	3.81
	M	4	1.72	2.15	2.58	3.00	3.43	3.86	4.29	4.51	4.72	4.94
	V	1	2.40	3.00	3.61	4.21	4.81	5.41	6.01	6.31	6.61	6.91
	V	2	3.96	4.95	5.94	6.93	7.92	8.90	9.89	10.39	10.88	11.38
	V	3	7.01	8.76	10.51	12.26	14.01	15.76	17.52	18.39	19.27	20.14
	V	4	9.07	11.33	13.60	15.87	18.13	20.40	22.67	23.80	24.93	26.07
Reverse	L	1	0.14	0.18	0.22	0.25	0.29	0.33	0.36	0.38	0.40	0.42
	L	2	0.24	0.30	0.36	0.42	0.48	0.54	0.59	0.62	0.65	0.68
	L	3	0.42	0.53	0.63	0.74	0.84	0.95	1.05	1.11	1.16	1.21
	L	4	0.55	0.68	0.82	0.95	1.09	1.23	1.36	1.43	1.50	1.57
	M	1	0.55	0.69	0.83	0.97	1.11	1.24	1.38	1.45	1.52	1.59
	M	2	0.91	1.14	1.37	1.59	1.82	2.05	2.28	2.39	2.50	2.62
	M	3	1.61	2.02	2.42	2.82	3.22	3.63	4.03	4.23	4.43	4.64
	M	4	2.09	2.61	3.13	3.65	4.17	4.69	5.22	5.48	5.74	6.00
	V	1	2.70	3.38	4.05	4.73	5.41	6.08	6.76	7.10	7.43	7.77
	V	2	4.45	5.56	6.67	7.79	8.90	10.01	11.12	11.68	12.24	12.79
	V	3	7.88	9.85	11.82	13.79	15.76	17.73	19.69	20.68	21.66	22.65
	V	4	10.19	12.74	15.29	17.84	20.39	22.94	25.49	26.76	28.03	29.31

Speeds with following tyre type/s: 380/70 R 20"

Radius: 525 mm	Rolling circumference: 3.30 m

			Engine speed (rpm)									
Mode	Range	Gear	800	1000	1200	1400	1600	1800	2000	2100	2200	2300
Forward - Hi (normal)	L	1	0.19	0.24	0.29	0.34	0.39	0.44	0.48	0.51	0.53	0.56
	L	2	0.32	0.40	0.48	0.56	0.64	0.72	0.80	0.84	0.88	0.92
	L	3	0.56	0.71	0.85	0.99	1.13	1.27	1.41	1.48	1.55	1.62
	L	4	0.73	0.91	1.09	1.28	1.46	1.64	1.82	1.92	2.01	2.10
	M	1	0.69	0.86	1.03	1.20	1.37	1.54	1.71	1.80	1.88	1.97
	M	2	1.13	1.41	1.69	1.97	2.26	2.54	2.82	2.96	3.10	3.24
	M	3	2.00	2.50	3.00	3.50	3.99	4.49	4.99	5.24	5.49	5.74
	M	4	2.58	3.23	3.88	4.52	5.17	5.82	6.46	6.78	7.11	7.43
	V	1	3.62	4.52	5.43	6.33	7.24	8.14	9.05	9.50	9.95	10.40
	V	2	5.96	7.45	8.94	10.43	11.92	13.40	14.89	15.64	16.38	17.13
	V	3	10.55	13.18	15.82	18.46	21.09	23.73	26.37	27.69	29.01	30.32
	V	4	13.65	17.06	20.47	23.88	27.30	30.71	34.12	35.83	37.53	39.24
Forward - Lo (20% underdrive ratios)	L	1	0.15	0.19	0.22	0.26	0.30	0.34	0.37	0.39	0.41	0.43
	L	2	0.25	0.31	0.37	0.43	0.49	0.56	0.62	0.65	0.68	0.71
	L	3	0.44	0.55	0.66	0.77	0.87	0.98	1.09	1.15	1.20	1.26
	L	4	0.57	0.71	0.85	0.99	1.13	1.27	1.41	1.48	1.56	1.63
	M	1	0.53	0.66	0.80	0.93	1.06	1.19	1.33	1.39	1.46	1.53
	M	2	0.87	1.09	1.31	1.53	1.75	1.97	2.19	2.30	2.40	2.51
	M	3	1.55	1.93	2.32	2.71	3.10	3.48	3.87	4.06	4.26	4.45
	M	4	2.00	2.50	3.00	3.51	4.01	4.51	5.01	5.26	5.51	5.76
	V	1	2.80	3.51	4.21	4.91	5.61	6.31	7.01	7.36	7.71	8.06
	V	2	4.62	5.77	6.93	8.08	9.23	10.39	11.54	12.12	12.70	13.27
	V	3	8.17	10.22	12.26	14.30	16.35	18.39	20.44	21.46	22.48	23.50
	V	4	10.58	13.22	15.87	18.51	21.15	23.80	26.44	27.77	29.09	30.41
Reverse	L	1	0.17	0.21	0.25	0.30	0.34	0.38	0.42	0.44	0.46	0.48
	L	2	0.28	0.35	0.42	0.49	0.56	0.62	0.69	0.73	0.76	0.80
	L	3	0.49	0.61	0.74	0.86	0.98	1.11	1.23	1.29	1.35	1.41
	L	4	0.64	0.80	0.95	1.11	1.27	1.43	1.59	1.67	1.75	1.83
	M	1	0.65	0.81	0.97	1.13	1.29	1.45	1.61	1.69	1.77	1.86
	M	2	1.06	1.33	1.59	1.86	2.12	2.39	2.66	2.79	2.92	3.05
	M	3	1.88	2.35	2.82	3.29	3.76	4.23	4.70	4.94	5.17	5.41
	M	4	2.43	3.04	3.65	4.26	4.87	5.48	6.08	6.39	6.69	7.00
	V	1	3.15	3.94	4.73	5.52	6.31	7.10	7.88	8.28	8.67	9.07
	V	2	5.19	6.49	7.79	9.08	10.38	11.68	12.98	13.63	14.28	14.93
	V	3	9.19	11.49	13.79	16.08	18.38	20.68	22.98	24.13	25.27	26.42
	V	4	11.89	14.87	17.84	20.81	23.79	26.76	29.73	31.22	32.71	34.19

Speeds with following tyre type/s: 360/70 R 20", 420/65R20"

Radius: 500 mm	Rolling circumference: 3.14 m

			Engine speed (rpm)									
Mode	Range	Gear	800	1000	1200	1400	1600	1800	2000	2100	2200	2300
Forward - Hi (normal)	L	1	0.18	0.23	0.28	0.32	0.37	0.41	0.46	0.48	0.51	0.53
	L	2	0.30	0.38	0.46	0.53	0.61	0.68	0.76	0.80	0.83	0.87
	L	3	0.54	0.67	0.81	0.94	1.07	1.21	1.34	1.41	1.48	1.54
	L	4	0.70	0.87	1.04	1.22	1.39	1.56	1.74	1.82	1.91	2.00
	M	1	0.65	0.82	0.98	1.14	1.31	1.47	1.63	1.71	1.79	1.88
	M	2	1.07	1.34	1.61	1.88	2.15	2.42	2.69	2.82	2.95	3.09
	M	3	1.90	2.38	2.85	3.33	3.80	4.28	4.76	4.99	5.23	5.47
	M	4	2.46	3.08	3.69	4.31	4.92	5.54	6.15	6.46	6.77	7.08
	V	1	3.45	4.31	5.17	6.03	6.89	7.75	8.62	9.05	9.48	9.91
	V	2	5.67	7.09	8.51	9.93	11.35	12.77	14.18	14.89	15.60	16.31
	V	3	10.05	12.56	15.07	17.58	20.09	22.60	25.11	26.37	27.62	28.88
	V	4	13.00	16.25	19.50	22.75	26.00	29.25	32.50	34.12	35.75	37.37
Forward - Lo (20% underdrive ratios)	L	1	0.14	0.18	0.21	0.25	0.29	0.32	0.36	0.37	0.39	0.41
	L	2	0.24	0.29	0.35	0.41	0.47	0.53	0.59	0.62	0.65	0.68
	L	3	0.42	0.52	0.62	0.73	0.83	0.94	1.04	1.09	1.14	1.20
	L	4	0.54	0.67	0.81	0.94	1.08	1.21	1.35	1.41	1.48	1.55
	M	1	0.51	0.63	0.76	0.89	1.01	1.14	1.26	1.33	1.39	1.45
	M	2	0.83	1.04	1.25	1.46	1.67	1.87	2.08	2.19	2.29	2.39
	M	3	1.47	1.84	2.21	2.58	2.95	3.32	3.69	3.87	4.05	4.24
	M	4	1.91	2.38	2.86	3.34	3.82	4.29	4.77	5.01	5.25	5.48
	V	1	2.67	3.34	4.01	4.67	5.34	6.01	6.68	7.01	7.35	7.68
	V	2	4.40	5.50	6.60	7.70	8.79	9.89	10.99	11.54	12.09	12.64
	V	3	7.78	9.73	11.68	13.62	15.57	17.52	19.46	20.44	21.41	22.38
	V	4	10.07	12.59	15.11	17.63	20.15	22.67	25.18	26.44	27.70	28.96
Reverse	L	1	0.16	0.20	0.24	0.28	0.32	0.36	0.40	0.42	0.44	0.46
	L	2	0.26	0.33	0.40	0.46	0.53	0.59	0.66	0.69	0.73	0.76
	L	3	0.47	0.59	0.70	0.82	0.94	1.05	1.17	1.23	1.29	1.35
	L	4	0.61	0.76	0.91	1.06	1.21	1.36	1.51	1.59	1.67	1.74
	M	1	0.61	0.77	0.92	1.08	1.23	1.38	1.54	1.61	1.69	1.77
	M	2	1.01	1.26	1.52	1.77	2.02	2.28	2.53	2.66	2.78	2.91
	M	3	1.79	2.24	2.69	3.13	3.58	4.03	4.48	4.70	4.93	5.15
	M	4	2.32	2.90	3.48	4.06	4.64	5.22	5.79	6.08	6.37	6.66
	V	1	3.00	3.75	4.50	5.26	6.01	6.76	7.51	7.88	8.26	8.63
	V	2	4.94	6.18	7.42	8.65	9.89	11.12	12.36	12.98	13.60	14.21
	V	3	8.75	10.94	13.13	15.32	17.51	19.69	21.88	22.98	24.07	25.17
	V	4	11.33	14.16	16.99	19.82	22.65	25.49	28.32	29.73	31.15	32.56

1.4.19 Conversion tables

1 mm	= 3.28 ft
1 cm	= 0.39 in
1 mm	= 0.039 in
1 km	= 0.62 ml
1 Km/h	= 0.62 mph
1 l	= 0.21 UK gal
1 l	= 0.26 US gal lqd
1 kg	= 2.20 lb
1 hp	= 735.49 W
1 hp	= 0.98 hp
1 kW	= 1.35 hp
1 bar	= 14.50 psi
1 bar	= 100 kPa
1 psi	= 6.89 kPa

1.5 Tightening torques and sealants

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1.5.1 Tightening torques for nuts

Type	N·m	kg·m
M 8x8	30	3
M 10x10	50	5
M 10x10 self-locking	50	5
M 12x1.25x12 (fastening gearbox selector forks)	80	8
M 12x1.5x8	80	8
M 12x10	90	9
M 12x12	90	9
M 12x12 self-locking	80	8
M 12x14	90	9
M 12x18	90	9
M 12x14.6	90	9
M 12x1.25x8 (fastening hydraulic pump gear)	50	5
M 12x1.25x8	90	9
M 14x14	120	12
M 16x1.5x8 (fastening gearbox selector forks)	80	8
M 16x1.5x14	140	14
M 16x16	120	12
M 16x16	100	10
M 18x15	180	18
M 20x1.5x9	65	6.5
M 30x1.25x10	250	25

1.5.2 Tightening torques for ring nuts

Type	N·m	kg·m
M 20x1.5	35	3.5
M 20x1x9	80	8
M 25x1.5 (PTO)	35	3.5
M 25x1.5 (steering cylinder)	130	13
M 30x1.5x10	240-250	24-25
M 30x1.5x10	160	16
M 30x1.5	150	15
M 35x1.5x10	200	20
M 40x1.5	150	15
M 50x1.5	250	25

1.5.3 Tightening torques for hex head screws

Type	N·m	kg·m
M 6	13	1.3
M 8	30	3
M 10	60	6
M 10 x 1.25	70	7
M 12	90	9
M 14	120	12
M 14 (front track chain leaf spring carrier)	180	18
M 18 x 1.5	250	25
M 16	130	13
M 16 x 1.5	130	13

1.5.4 Tightening torques for stud bolts

Type	N·m	kg·m
M 10	30	3
M 12	40	4
M 14	50	5
M 16	60	6
M 18	70	7
M 20	80	8

1.5.5 Tightening torques for tapered plugs

Type	N·m	kg·m
1/2"	30	3

1.5.6 Loctite sealant types

	Description	Type	Usage
Thread lock	Weak thread lock	Loctite 222	Weak thread lock and sealing action for screws and adjuster screws
	Medium strength thread lock	Loctite 243 (replaces 242)	Medium strength thread lock and sealing action for threaded parts in general.
	High strength thread lock	Loctite 271 (replaces 270)	High strength thread lock and sealing action for stud bolts, nuts and screws.
	Penetrating thread lock adhesive	Loctite 290	Thread locking and sealant action achieved by wicking between previously assembled parts. Micro-porosity sealant.
Assembling parts	Locking adhesive	Loctite 603 (replaces 601)	High bonding strength retaining compound.
	Retaining compound	Loctite 641	Medium strength retaining compound for bushes, bearings etc. . Permits disassembly with normal tools.
	High strength retaining compound	Loctite 638	Rapid, heat resistant, high strength retaining compound for cylindrical parts. For dynamic applications.
	High temperature retaining compound	Loctite 648	Rapid, heat resistant, high strength retaining compound for cylindrical parts.
Thread sealant	Hydraulic and pneumatic	Loctite 542	For sealing threaded connectors of hydraulic or pneumatic lines up to 3/4" in diameter.
	Slow curing	Loctite 572	For sealing threaded connectors in general.
Liquid gaskets	Dense gasketing compound for surfaces	Loctite 510	Sealing surfaces. Applied manually.
	Gasketing compound for surfaces	Loctite 573	Sealing precise surfaces. Applied manually or with screen printing system.
Cleaning	Cleaner/degreaser	Loctite 7063	Prepares components for application of an adhesive sealant.
	Gasket remover	Loctite 7200	Removes all residue of sealants and gaskets.

1.6 General assembly instructions

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1.6.1 Oil seals

1.6.1.1 General instructions and guidelines

Normally, one gasket is sufficient to ensure seal tightness. The seal lip must face towards the fluid retained or the pressurised side.

Do not allow mechanical parts to come into contact with the seal lip as this would compromise seal tightness and significantly reduce the lifespan of the gasket.

Lubricate the seal ring thoroughly before installing to prevent the seal from operating dry during the first revolutions of the shaft.

Grooved seal rings must be lubricated with oil and not grease, as grease would fill the grooves and render them ineffective.

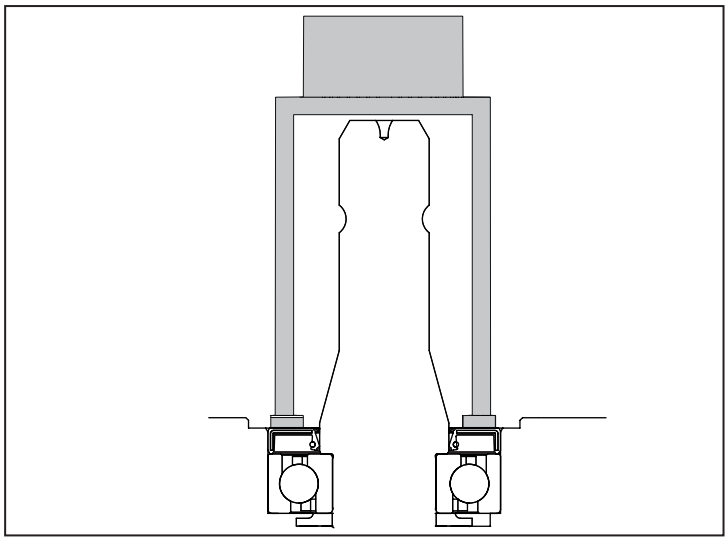

Fig. 1.12

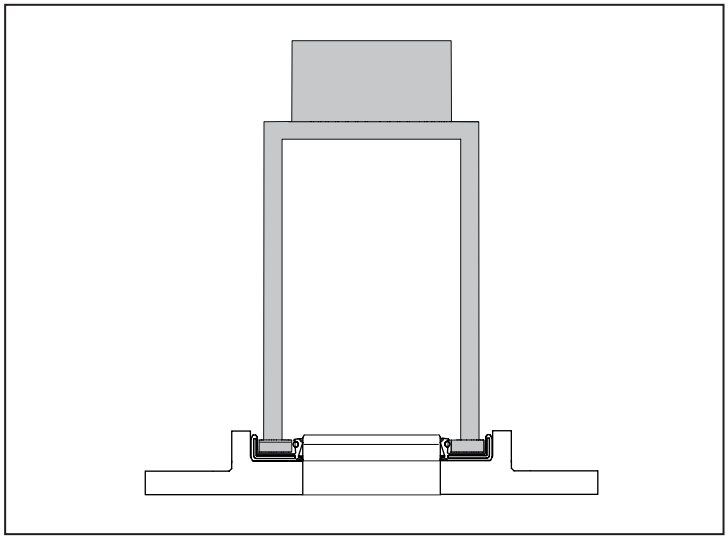

Fig. 1.13

1.6.1.2 Assembly

1 - When fitting gaskets on the shaft, check that there is a bevelled guide edge on the shaft.

2 - Protect the seal lip against damage caused by threads, recesses, sharp edges, keying slots etc; cover these parts of the shaft appropriately when fitting the gasket.

3 - Preferably use a hydraulic or mechanical press to install the gasket in its seat.

4 - The installing force must be applied as closely as possible to the outer diameter of the gasket, ensuring that the gasket itself remains perfectly perpendicular to the hole during installation.

5 - Do not use adhesive to fix the gasket in its seat. Even if all possible precautions are taken, there is a risk of adhesive fouling the seal lip, causing damage to the gasket and fluid leakage even from the first revolutions of the shaft.

1.6.1.3 Replacement

When servicing an assembly, replace all seal rings on rotating shafts and all gaskets in general.

Make sure that the seal lip of the new ring does not run against the same surface on the shaft as the previous ring.

1.6.2 O-Rings

1.6.2.1 Assembly

1 - Do not force O-rings over sharp edges, threads or splines. In cases where, due to construction constraints, this cannot be avoided, use a conical installation bush or an equivalent solution.

2 - Before fitting an O-ring, check that it is the correct type specified for the application. Clean the seat of the O-ring very carefully. Any remaining contaminants could damage both the O-ring and the sliding surfaces.

3 - To facilitate installation and ensure effective lubrication immediately after fitting, immerse the O-ring in the same type of oil with which it will be in contact, or apply a light film of grease compatible with the material from which the O-ring itself is made.

4 - Take care not to twist the O-ring when installing in its seat.

5 - Take care not to damage the O-ring when assembling components.

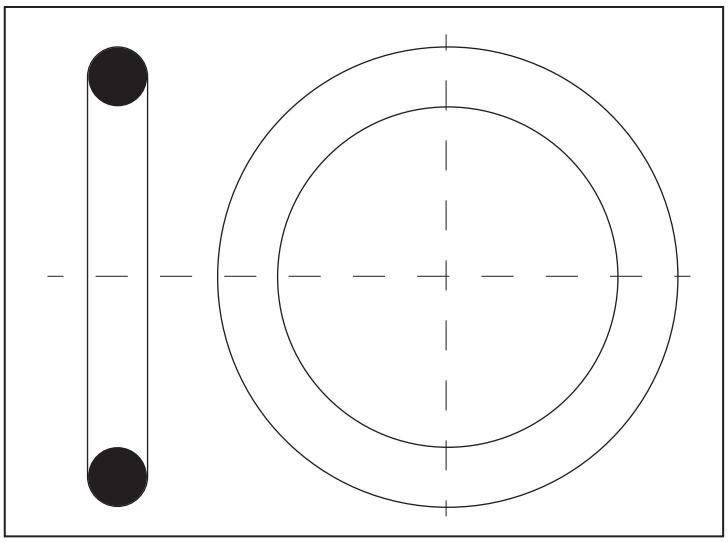

Fig. 1.14

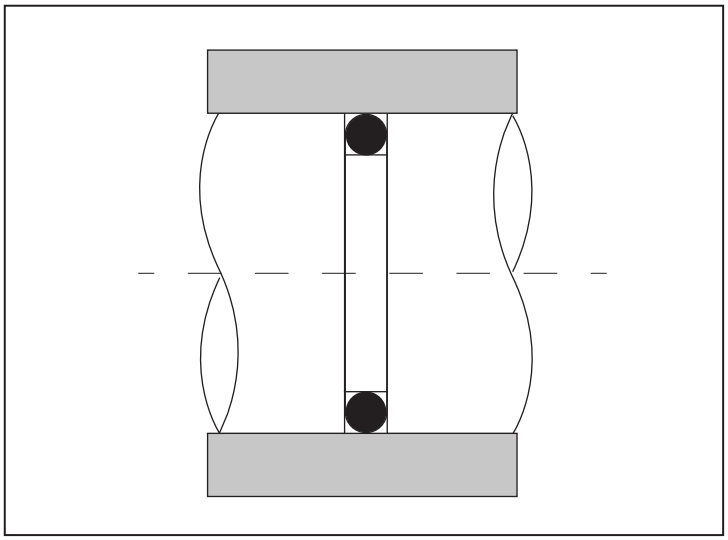

Fig. 1.15

1.6.3 Bearings

1.6.3.1 Introduction

Expertise and maintaining cleanliness are the two most important factors when installing bearings to ensure that the bearings function correctly and to prevent premature bearing failure. Bearings should be installed in a dust-free, dry place away from machining tools or machines which produce dust.

1.6.3.2 Preparing for assembly

1 - Before installing a bearing, ensure that all the parts, tools and equipment needed are at hand, and that all parts are arranged in the same order in which they will be installed, as indicated in the instructions or drawings.

2 - All parts involved in the installation of a bearing (seats, shafts etc.) must be thoroughly cleaned to remove all machining residue. The unfinished inner surfaces of cast iron housings must be free of any casting sand residue. Before installation, check the dimensions and forms of all bearing-related components. Bearings will only work correctly if the specified tolerances are observed.

3 - To prevent contamination with foreign objects, only remove bearings from the original packaging immediately before fitting.

4 - Usually, the anti-corrosion coating applied to the cylindrical outer surface and the inner hole of new bearings before they leave the factory must be removed before installing

If it is necessary to lubricate a bearing with a special grease for very high or very low temperatures, wash and dry the bearing before application to prevent any loss in the temperature resistant properties of the grease used.

5 - Any bearings contaminated by improper handling (damaged packaging etc.) must also be washed and dried before installing. Bearings which are coated in a thick and greasy layer of corrosion inhibitor product when removed from their original packaging must be washed and dried before installation, as this coating has been applied with a hot-dip bath (a method still used for large bearings in particular).

Bearings shipped ready-lubricated and with sealed or protective shielding on both sides must NOT be washed before installation.

1.6.3.3 Assembly

1 - Never hit the shell, race or rotating elements of a bearing directly during installation, as this will damage the bearing itself. Never apply pressure to one bearing shell to facilitate installation of another bearing shell. Lubricate the surfaces of the bearing seats lightly with oil before installing bearings.

Never hit the shell, race or rotating elements of a bearing directly during installation, as this will damage the bearing itself. Never apply pressure to one bearing shell to facilitate installation of another bearing shell. Lubricate the surfaces of the bearing seats lightly with oil before installing bearings.

2 - As a guideline, install the bearing shell with the greatest interference first. Smaller bearings with only a small degree of assembly interference may be seated by tapping gently into place using a mallet and a soft punch or, preferably, a piece of pipe placed with its end against the circumference of the bearing shell. Tap uniformly around the entire circumference of the bearing shell to ensure that it remains perfectly perpendicular relative to its seat. The cup tool illustrated in Fig. 1.16 ensures that force is applied perfectly perpendicularly and distributed evenly around the entire circumference of the bearing shell. Mechanical or hydraulic presses are generally used to install bearings on the production line.

3 - When installing a non-disassemblable bearing on the shaft and in its respective seat simultaneously, place a disc (Fig.) between the bearing and the tubular tool to distribute the installation force even more evenly over the circumferences of the two bearing shells. This method is recommended in particular for swivelling bearings to prevent misalignment of the outer shell relative to the seat. As a alternative, a cup tool with two contact surfaces (one for the inner shell and one for the outer shell) may be used (Fig.): these two surfaces must be coplanar.

4 - The inner and outer shells of disassemblable bearings may be installed separately. this significantly facilitates assembly, especially in cases where both shells must be forced into their seats. When mating two parts of a bearing that have already been installed in their seats, ensure that the two rings of rotating bearing elements remain perpendicularly aligned, as the bearing races may be damaged if they are misaligned.

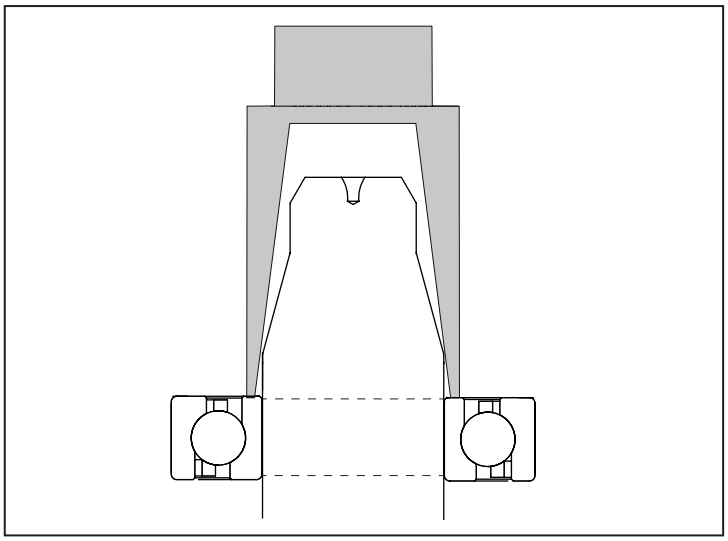

Fig. 1.16

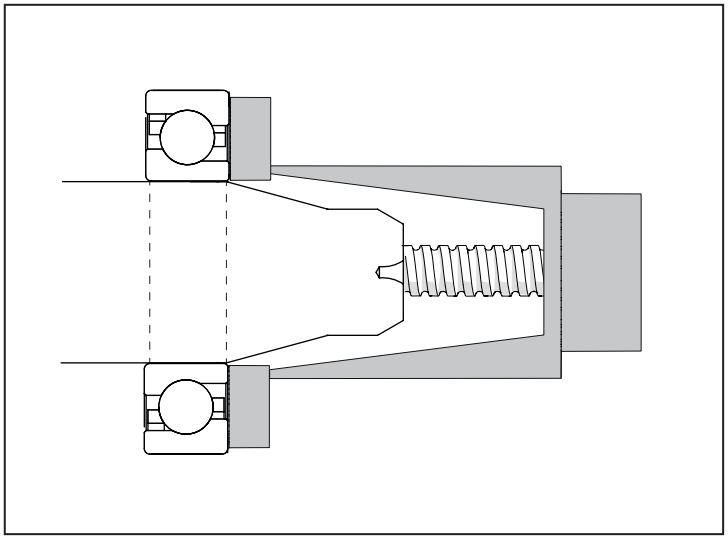

Fig. 1.17

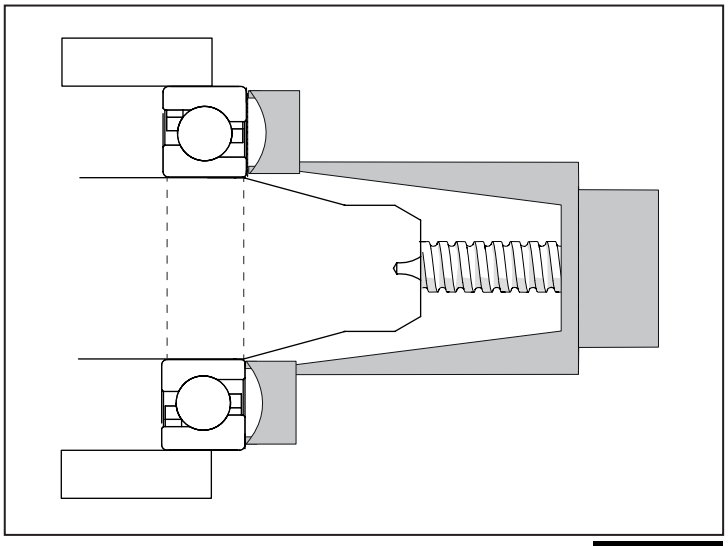

Fig. 1.18

- It may not be possible to install larger bearings onto the shaft or in their seats without heating, as the force necessary to install a bearing increases with its size. In this case, bearings, bearing shells and bearing mounts (hubs etc.) must be heated before installing.
- The temperature difference necessary between the bearing shell and the receiving component depends on the degree of interference required and the diameter of the bearing seat.
- Heat bearings in an oil bath or muffle furnace. if using electrical heating plates, turn the bearings over several times to ensure that they are heated uniformly.

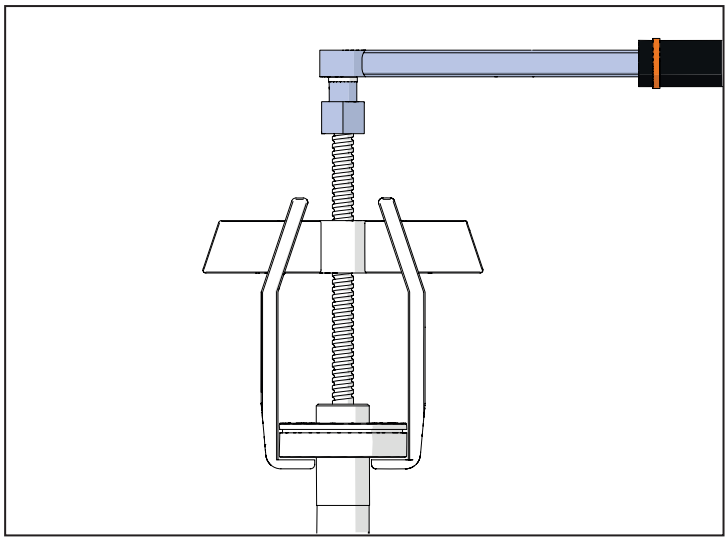

Fig. 1.19

Warning

Do not heat bearings to above 125°C, as this may alter the structure of the material, causing variations in dimension and a loss of hardness.

Avoid localised heating of a bearing.

Warning

Bearings with protective shielding and sealed bearings must not be heated before installation as this may compromise the properties of the lubricant.

1.6.3.4 Disassembly

- If a bearing is to be used, do not apply force via the revolving bearing elements to remove. In the case of non-disassemblable bearings, detach the bearing shell with the least assembly interference first. Depending on the type and size of the bearing itself, the tools and equipment described as follows must be used to extract bearing shells with a high degree of assembly interference.
- Smaller bearings may be removed from their seats with:
  - A mallet and a punch in soft metal;
    Tap gently around the entire circumference of the bearing shell.
  - A mechanical puller tool;
    Apply the puller tool directly onto the bearing shell to be removed, or to an adjacent component.

  Removal will be significantly facilitated if the shoulders of the shaft and bearing seat include notches for the grippers of a puller tool or threaded holes for extractor screws.
- To remove the inner shells of cylindrical roller bearings with no lip or with only one small lip, special tools have been developed which heat the bearing shells rapidly before the shaft has sufficient time to heat significantly and expand.

2 : Engine

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2.1 Safety rules

Attention
Never fill the engine with lubricant oil beyond the marking on the dipstick as this may damage the engine.
To prevent damage to the engine, if the lubrication system has been drained, lubricate the rocker pins and the camshaft before starting the engine.
Only use these engines for their specifically intended applications. Do not modify the technical characteristics of the engine.
Clean any spilt fuel. Materials contaminated with fuel must be moved away to a safe place.
Unless absolutely necessary, do not pour fuel into the tank while the engine is running.
Do not clean, add oil to or adjust the engine while it is running unless you are specifically trained to do so. even if you are specifically trained, use the utmost caution to prevent accidents.
Do not attempt to make adjustments that you do not understand.
Do not run the engine in a place in which harmful emissions may accumulate.
Keep all persons not involved in the task at a safe distance while the engine or any ancillary equipment are running.
Do not run the engine with any of the protective guards removed.
Disconnect the battery terminals before performing any repair work on the electrical system.
The engine must only be operated from the control panel or driver area.
Check that the gear lever is in neutral before starting the engine.
Dispose of used oil correctly to prevent the risk of contaminating the enviroN·ment.
Work with the utmost caution when performing emergency repairs in difficult conditions.
Never clean the engine while it is running. Using cold cleaning products on a hot engine may damage a number of components.
Use only original spare parts.

Danger
Do not smoke when refuelling.
The combustible materials used for certain components of the engine (such as seals, for example) may produce extremely dangerous substances when burnt. Avoid all contact between burnt materials and the skin or eyes.
Never remove the coolant system filler cap while the engine is hot and the coolant is under pressure, as this may cause boiling liquid to escape violently from the filler.
Seek immediate medical assistance in the event of skin contact with pressurised fuel. Diesel and lubricant oil (especially if used) may be harmful to the skin. Protect the hands with gloves or with specific protective cream. Do not wear garments contaminated with lubricant oil. Do not put materials contaminated with lubricant oil in your pockets.
Avoid contact between compressed air and the skin. Seek immediate medical assistance in the event of compressed air breaking or penetrating the skin.
Keep away from moving parts while the engine is running. Danger! Some moving parts are not clearly visible when the engine is running.
Keep loose clothing and long hair well away from moving parts.
Turbochargers operate at high speed and high temperature. Keep fingers, tools and other objects away from the inlet and outlet ports of the turbocharger and avoid contact with hot surfaces.
Avoid sparks and naked flame in the vicinity of batteries (especially when charging), as the gas released by electrolyte is extremely flammable. Battery fluid is dangerous for the skin and extremely dangerous for the eyes.
The gas contained in the air conditioning system is harmful to the health. Open the doors and ventilate the area adequately once the procedure is complete.

Lifting the engine safely

Danger
Ensure that there are no persons in the vicinity of the load being handled.
The engine is very heavy. Work with due caution and observe all safety rules.

Attention
Always use an approved engine hoist of adequate load capacity to lift the engine.
Preferably use the hoisting equipment recommended by the manufacturer.
Check that the hoisting brackets used are undamaged and are securely fastened before lifting the engine.
Check that there is sufficient clear space between the lift hooks and the rocker cover to prevent damage to the rocker cover.
Use appropriate lifting equipment or work with the assistance of another mechanic to lift heavy engine components such as the cylinder block, cylinder head, flywheel housing, crankshaft and flywheel.

2.1.1 Replacing parts

To avoid the risk of voiding the engine warranty and of damaging the engine itself, only use original spare parts specified by the manufacturer.

Attention
When working on the electrical and injection systems, it is extremely important that are components are installed correctly and securely fastened. Any poorly fastened components of these systems may cause electrical sparking and fuel leakage from the injection system, which may result in fire due to the ignition of fuel vapour.

2.1.2 Cleaning and caring for the engine

The engine produced by VM Motori consists of parts with machined, honed, polished and lapped surfaces with tolerances measurable in hundredths of a mm. Working with the utmost care and maintaining absolute cleanliness are vital when servicing any component.

Maintaining adequate cleanliness and protecting machined surfaces and areas subject to fretting must be standard procedure whenever performing any repair work. These measures must be taken always, even if not specifically stated.

Whenever components are removed, keep them in the correct order and number them for identification. When refitting, components must be installed in their original positions with the same mating surfaces in contact as before.

The apertures of the exhaust and induction system are subject to the risk of ingress of foreign objects and contamination throughout the entire repair procedure. These apertures must be covered and protected adequately to prevent contamination or foreign objects from causing damage to the engine when it is started. All clamps removed during regular maintenance must be replaced with components of the same length and stiffness.

The tensile strength of bolts and nuts with metric threads is indicated by numbers on the head of the screw or on the surface of the nut. The tensile strength of bolts with American threads is indicated by radial lines, whereas the majority of nuts with American threads bear no reference markings. Using the wrong fastener clamps may cause engine malfunction or damage. Any clamps removed must be refitted correctly in the original position, if reused. If a fastener clamp is not in good enough condition for reuse, it must be replaced with a clamp with the same characteristics.

Never work on or underneath a suspended engine. During repair work, the engine must be secured to the original carrier or to a suitable trolley or, if necessary, lowered to the ground.

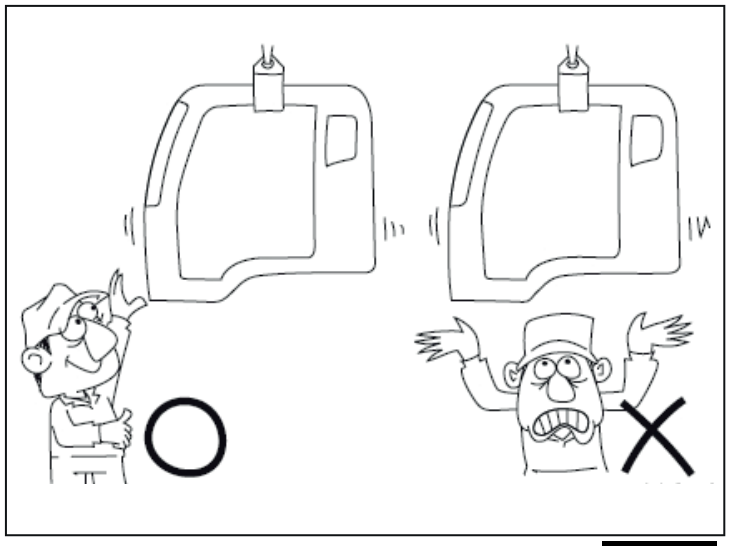

Fig. 2.1

2.1.3 Precautions for electrical circuits

2.1.3.1 Electronic engine control unit

OBSERVE THE FOLLOWING PRECAUTIONS TO PREVENT DAMAGE TO THE ELECTRONIC ENGINE CONTROL UNIT:

Attention

NEVER DISCONNECT THE ELECTRICAL POWER SUPPLY TO THE ENGINE WHILE THE ENGINE IS RUNNING

Attention

AFTER SWITCHING OFF THE ENGINE, WAIT AT LEAST 30 SECONDS BEFORE DISCONNECTING ELECTRICAL POWER WITH AN ELECTRICAL DEVICE (SWITCH, DISCONNECTOR ETC.) TO ALLOW THE ELECTRONIC CONTROL UNIT TO COMPLETE THE "AFTER-RUN" PROCEDURE

Attention

DO NOT USE BOOSTERS OR QUICK STARTERS TO START THE ENGINE

When working on the engine, always bear in mind that the currents and voltages involved in the electrical system may cause violent, damaging short circuits and dangerous electric shocks. Note that there is a risk of accidentally grounding electric terminals when performing any procedure on the engine. As a general precaution, always disconnect the battery cables before starting any work.

Disconnect the negative cable (–) from the battery before starting any work on the electrical system to prevent the risk of short circuit.

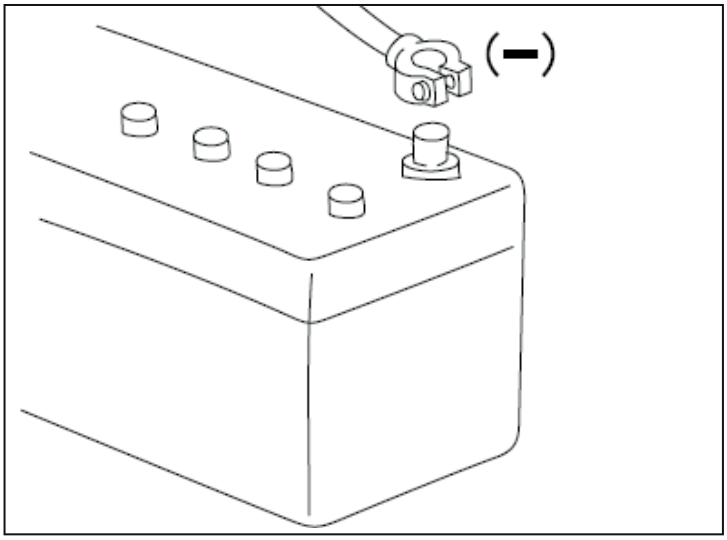

Fig. 2.2

Caution

Make sure that the ignition switch and lights switches are turned to OFF before disconnecting or connecting the battery cable.

Failure to do so may cause damage to components containing semiconductors.

Grip the connectors and the cables securely when separating connectors. To separate connectors with lock tabs, press the tabs and then pull in the direction indicated by the arrows. To reconnect, push the connectors together until they audibly click.

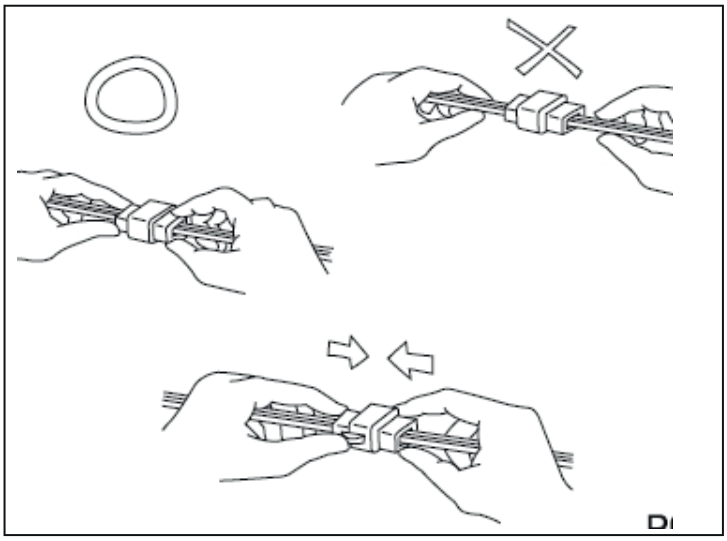

Fig. 2.3

Cover electrical parts to keep them dry before washing the engine (use plastic sheeting or other similar materials). Keep water away from the wiring harness, connectors and sensors and dry or wipe off any remaining water immediately.

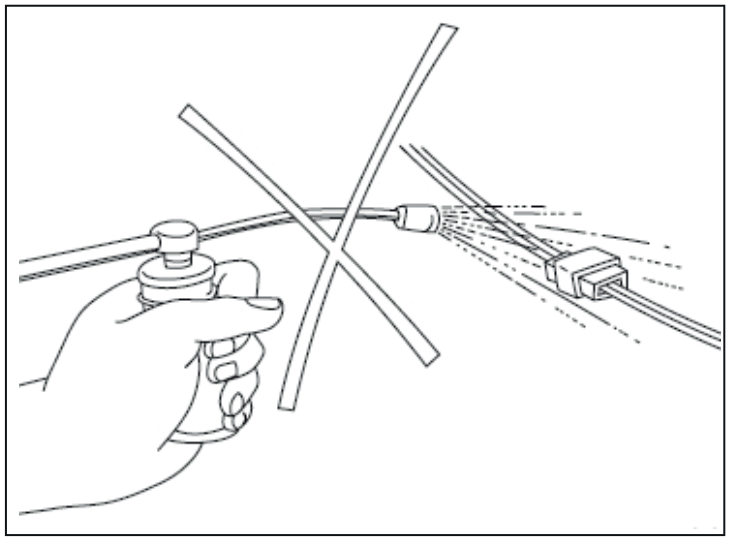

Fig. 2.4

When applying voltage to a circuit to test it, check that the (+) and (–) cables are connected properly and increase the voltage gradually from zero. NEVER exceed the specified voltage.

Bear in mind that ECUs and sensors may not necessarily operate at battery voltage only.

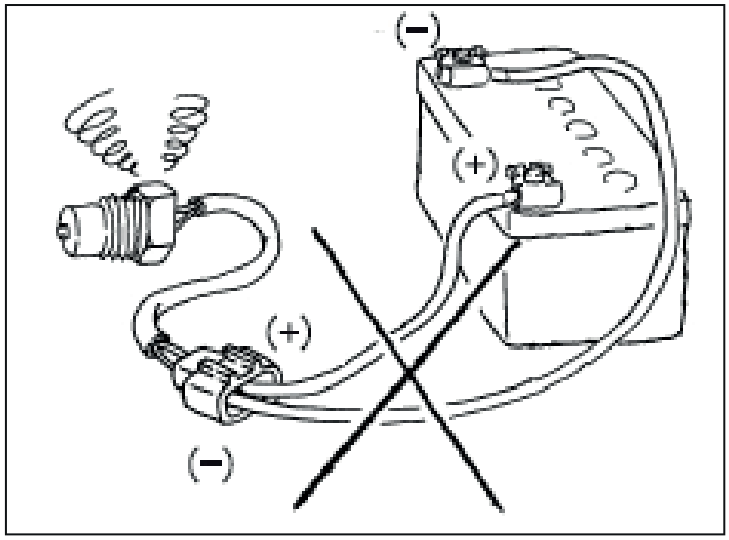

Fig. 2.5

Caution

Do not perforate the insulation with probe tips or clips when performing electrical tests.

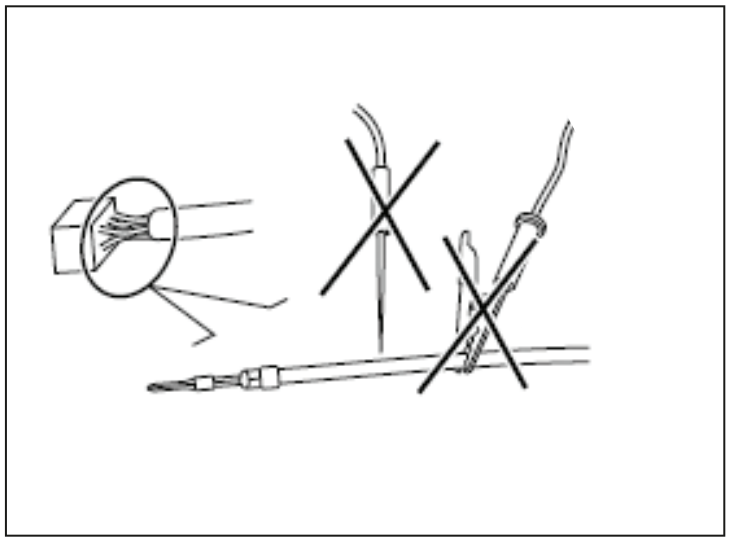

Fig. 2.6

2.1.3.2 Inspecting wiring harness

2.1.3.2.1 Inspecting with connected connectors

Waterproof connectors

Connect a test wiring harness and a connector A between the connectors of the circuit being tested. Test by applying a test probe C to the connectors of the test wiring harness. Do not push the probe C into the sides where the wires enter the connector as this will damage the waterproofing of the connector itself.

Caution

Connect the test wiring harness BETWEEN the connectors (1).

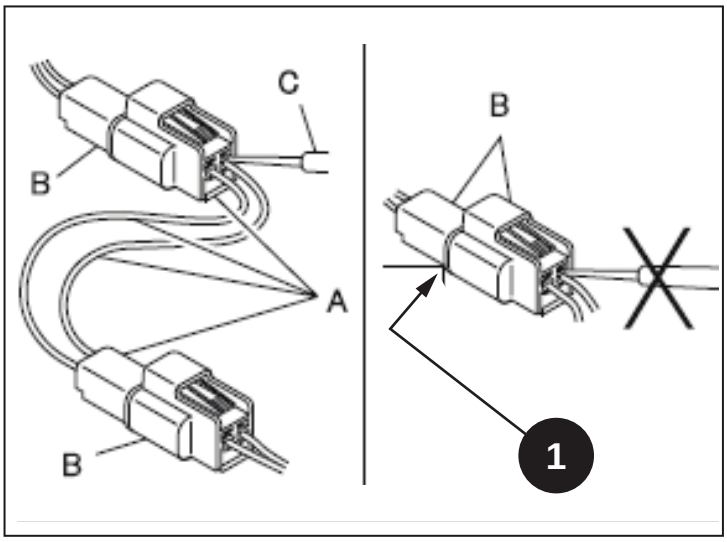

Fig. 2.7

Non-waterproof connectors

Test by inserting a probe C into the interior of the connector. A narrower probe must be used to test the engine control unit connectors, which are narrower than other connector types. Do not try to force a larger probe into the aperture of an engine control unit connector, as this will cause damage to the system.

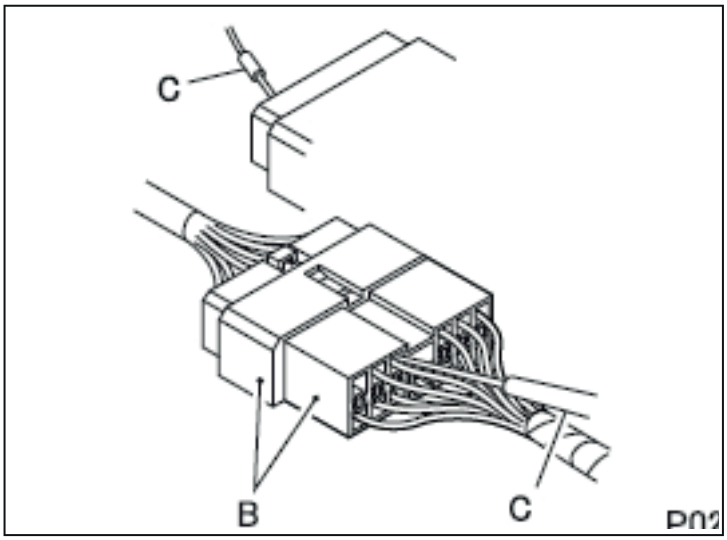

Fig. 2.8

2.1.3.2.2 Testing disconnected connectors

Testing female terminal

Test by inserting a test probe carefully into the terminals. Do not force the prove into the terminals as this will bend the terminals and result in poor connection.

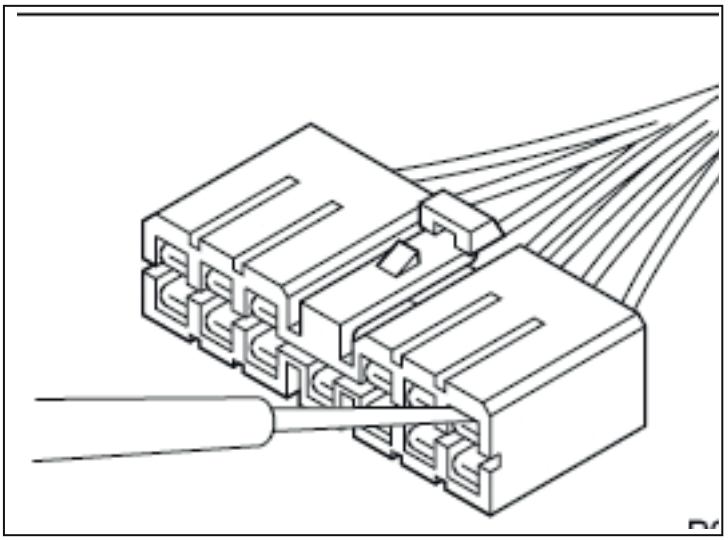

Fig. 2.9

Testing male terminal

Test by touching a test probe directly onto the pins.

> **Caution**
>
> Take care not to short circuit pins with the test probe. Short circuiting the pins of an electronic control unit connector may cause internal damage to the electronic control unit.

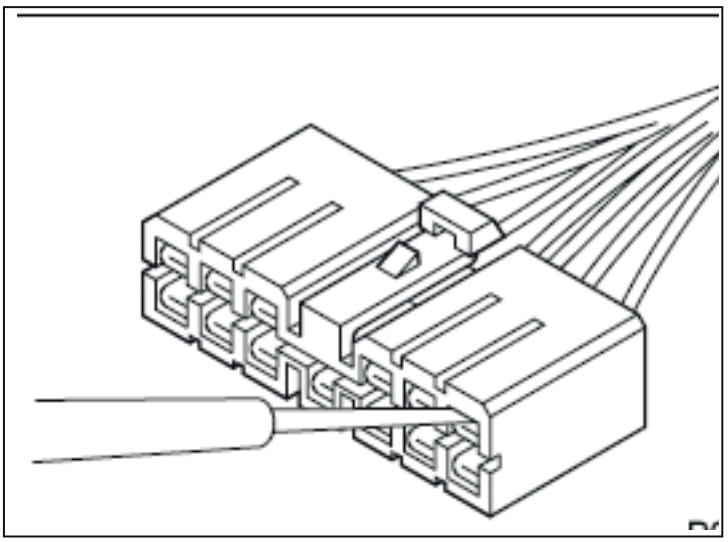

Fig. 2.10

When using a multimeter to test for electrical continuity, take care that the probe does not accidentally touch any terminals other than those tested.

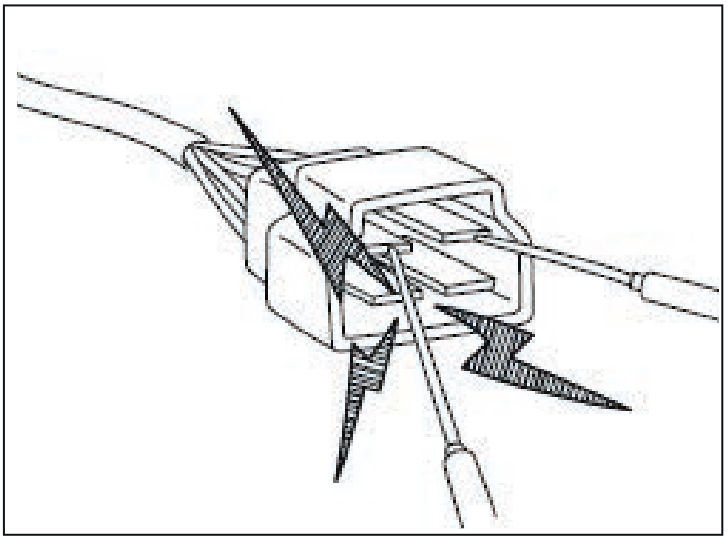

Fig. 2.11

2.1.3.3 Inspecting connectors

Visual inspection

Check that the connectors are securely connected together.

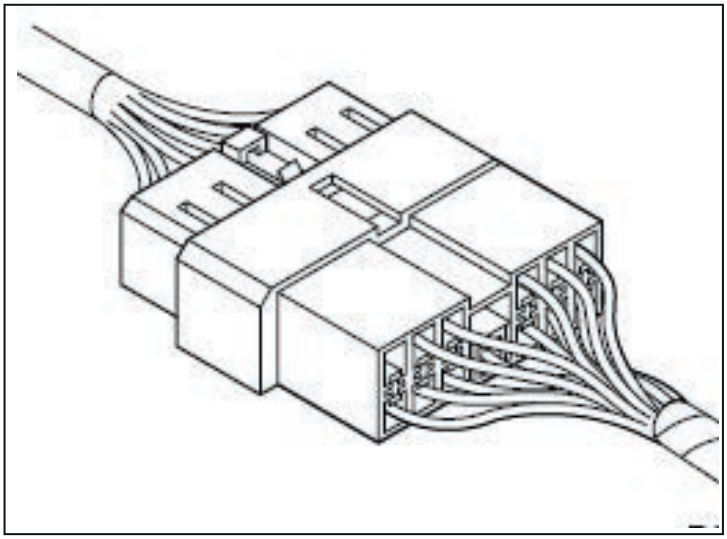

Fig. 2.12

Check if any wires are detached from their respective terminals. Wires may be detached if the connector is disconnected by pulling the respective cable

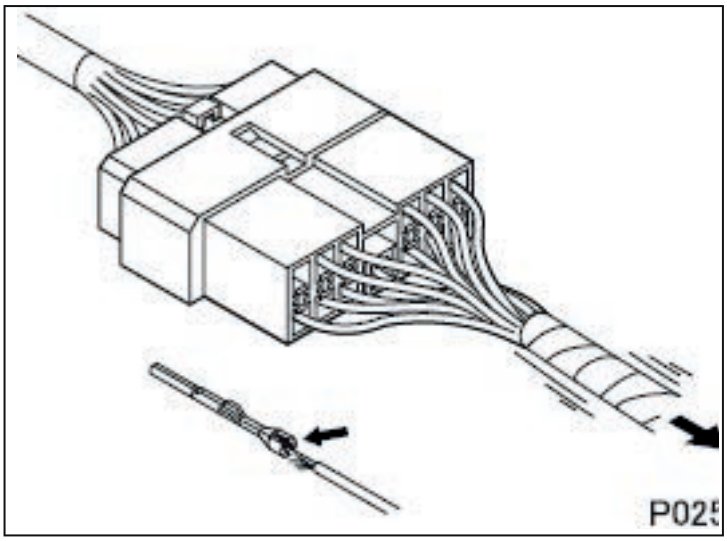

Fig. 2.13

Check that male and female terminals are securely connected

Check for poor connections caused by loosened terminals, corrosion on terminals or contamination of the terminals by foreign matter

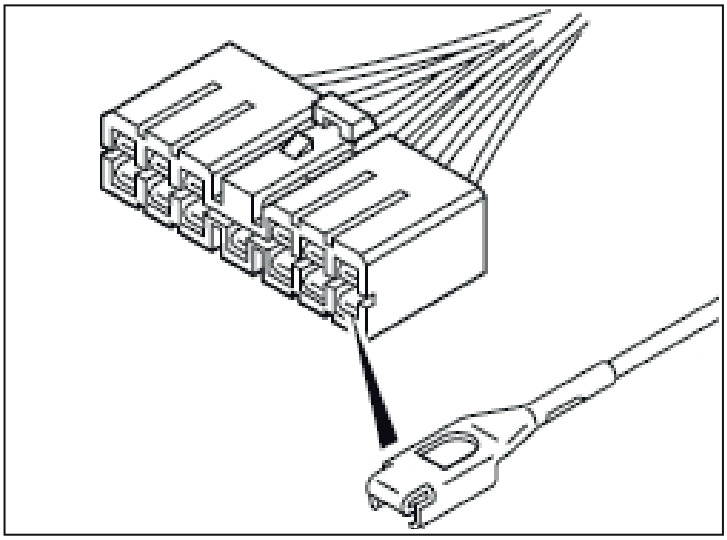

Fig. 2.14

Checking for loose terminals (spurious contact)

If the lugs of pins are damaged, the male and female terminals may not form a correct connection when the connector housings are coupled together. Pull each wire with care and check if any of the terminals come out of the connector.

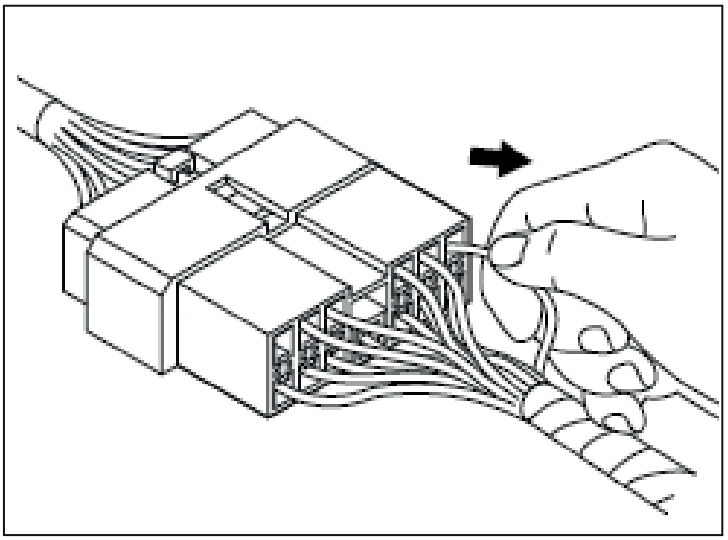

Fig. 2.15

2.1.4 Precautions for arc welding

Checking for loose terminals (spurious contact)

If the lugs of pins are damaged, the male and female terminals may not form a correct connection when the connector housings are coupled together. Pull each wire with care and check if any of the terminals come out of the connector.

PREFERABLY REMOVE THE ENGINE CONTROL UNIT FROM THE VEHICLE

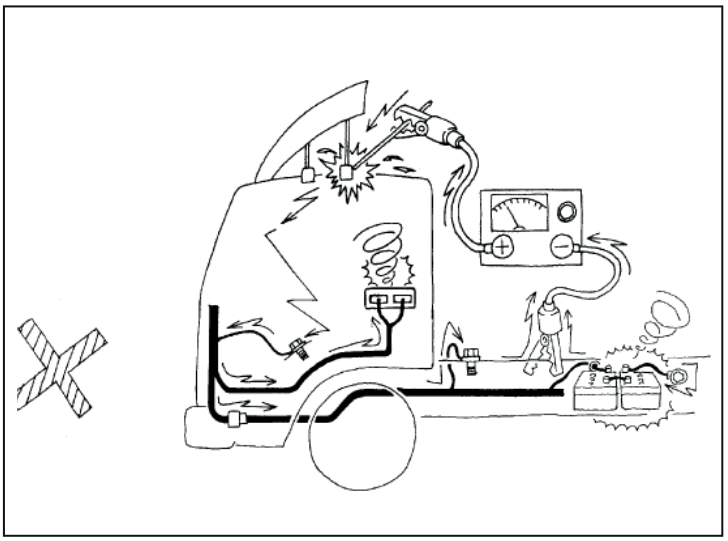

Fig. 2.16

Any electrical device in the vicinity of the point where the negative cable (–) of the welder is connected may be damaged.

Current flows back from the electrode to the negative connection as shown in this figure

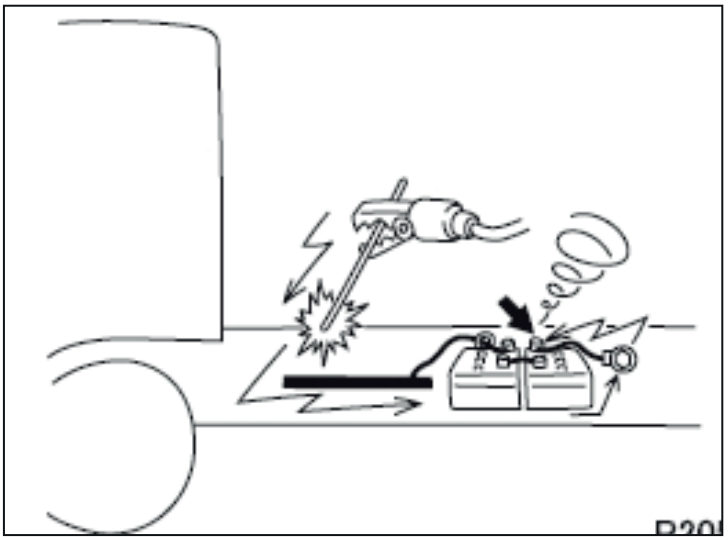

Fig. 2.17

From the negative cable of the battery (–)

To prevent damage to the battery and to any electrical devices connected to the battery, always disconnect the negative cable of the battery (–).

Procedure

1 - Disconnect the negative cable of the battery (–).

2 - Disconnect the negative cable of the battery (–).

3 - Cover all parts of the vehicle which may be damaged by the electric arc.

4 - Connect the negative cable of the welder (–) to the vehicle as closely a possible to the zone being welded. Do not connect the negative cable of the welder (–) to the cab when welding the chassis, and do not connect to the chassis when welding the cab.

5 - Set the current of the welder appropriately for the parts being welded.

2.2 General information

2.2.1 Engine serial number and identification plate

2.2.1.1 Engine serial number

1 - VM engine serial number punched on crankcase
P) - Engine serial number punched on crankcase
q) - Engine code
r) - Production serial number

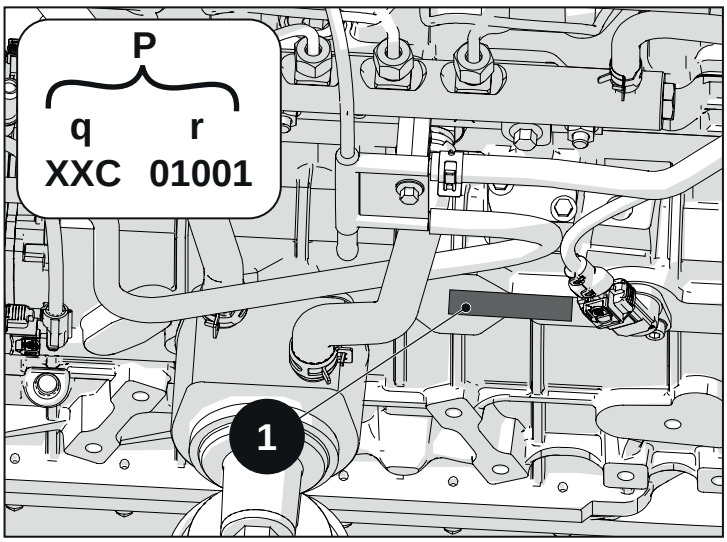

Fig. 2.18

This table may be used to identify the engine model from the engine code.

56C	R754EU4
79C	R756EU4
79C	R756IE3
05D	R754EU5
06D	R756EU5
20D	R754IE3
34D	R754IE4
39D	R754ISE4
45D	R754TE4
50D	R753IE4
60D	R754EU6
61D	R756EU6

2.2.1.2 Identification plate

A) - Manufacturer identification
B) - Engine serial number
C) - Dry weight
D) - Engine Type
E) - Family
F) - Model
G) - Version
H) - Max. power [kW]
L) - Max. rpm
M) - Homologation
N) - Characteristics of engine lubricant oil

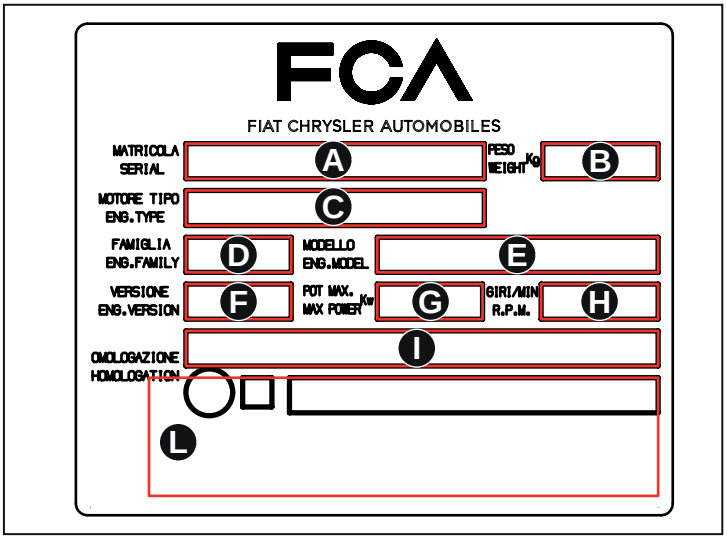

Fig. 2.19

Flywheel side

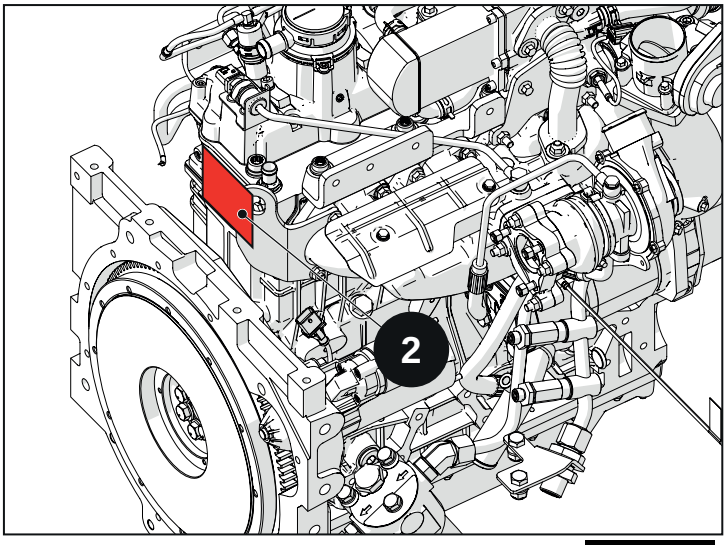

Fig. 2.20

Timing side

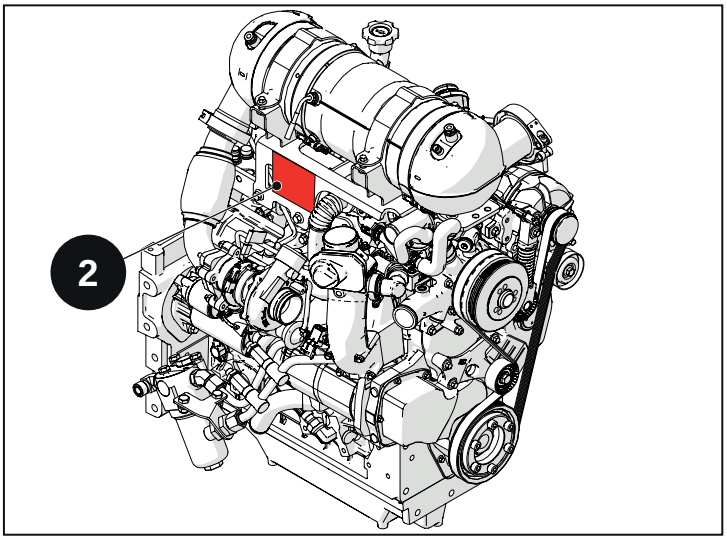

Fig. 2.21

2.3 Maintenance

2.3.1 Engine specifications

General specifications

Engine Type		Inline, 4-cylinders
Cylinder	Bore	94 mm
	Stroke	107 mm
Firing order		1 - 3 - 4 - 2
Displacement		2,970 litres
Compression ratio		17,5 ± 0.5 : 1
Injection system type		Common Rail direct injection
Cooling system type		Forced circulation water-cooled
Induction system type		Turbocharged with intercooler
Max. power - (HP)		(108.8) @ 2600 rpm
Max. torque		420 N·m @ 1100 rpm
Crankshaft direction of rotation (viewed from flywheel side)		anticlockwise
Idle speed		800 ± 50
Dry weight		260 kg
Maximum continuous longitudinal inclination angle (with flywheel on uphill side)		30°/57%
Maximum continuous longitudinal inclination angle (with flywheel on downhill side)		35°/70%
Maximum continuous transverse inclination angle		30°/57%
Valve clearance - intake and exhaust		Hydraulic
Max. difference in compression pressure between cylinders		500 kPa (72 PSI)

Fuel

Fuel	Specifications	The engine is designed to run with standard fuels available throughout Europe (compliant with DIN EN 590/2004 specifications). BIODIESEL (compliant with the specifications of UNI EN 14214) may be used in proportions up to 7% mixed in a standard fuel type available in Europe (as defined by the standard DIN EN 590). Use low-sulphur content fuel (not exceeding 10-50 ppm) for R750 models

Injection system

Low pressure line	Pump type	Gear
	Flow rate	
	Pressure	5 bar
	Fuel filter	Filtration efficiency compliant with Bosch specification KM 45 110 004_ en / Water separation compliant with ISO 16332
High pressure line	Pump type	piston
	Pump flow rate/speed	
	Common Rail pressure	
	Injection pressure	max 1800 bar
	Injector type	with solenoid

Engine oil

Specifications	SAE 10W40
	ACEA E6 - API CJ4
Oil sump capacity STANDARD SUMP	9.8 L (8.7 Kg)
Oil change (with filter) LARGE CAPACITY SUMP	model R754IE4.05A - 13L (11.5Kg)
Oil sump capacity ENGINE VERSION WITH COUNTER-ROTATING WEIGHTS	/
Oil pump type	Rotor
Oil thermostat	
Maximum consumption	0.2 g/KWh
Max temperature (alarm)	135°
Oil pressure (with engine warmed to 80°C)	2 bar (engine idle speed)
	4 bar (max engine speed, 2600 rpm)

Coolant

Operating temperature	80-85°C
Thermostat	starts opening at 80 ± 2 °C / fully open at 90°C
Capacity	5 litres (without radiator and pipes)
Cooling circuit pressure	1.0 - 1.1 bar
Specifications	ASTM D 3306 type 1

Induction system

Induction system	max 30 mbar - with new air filter
Air consumption m3/h	

Exhaust system

Max. backpressure	250 mbar with new, cleaned or regenerated DPF (diesel particulate filter)
Exhaust temperature after turbo	616°C @ 2600 rpm

Electrical system

Battery	12 V (CCA) 950 A EN Capacity 140 Ah
Alternator	14V - 2.3 kW - 110 A
Starter motor	12V, 2.5 kW

2.4 External views of engine

2.4.1 View from exhaust side

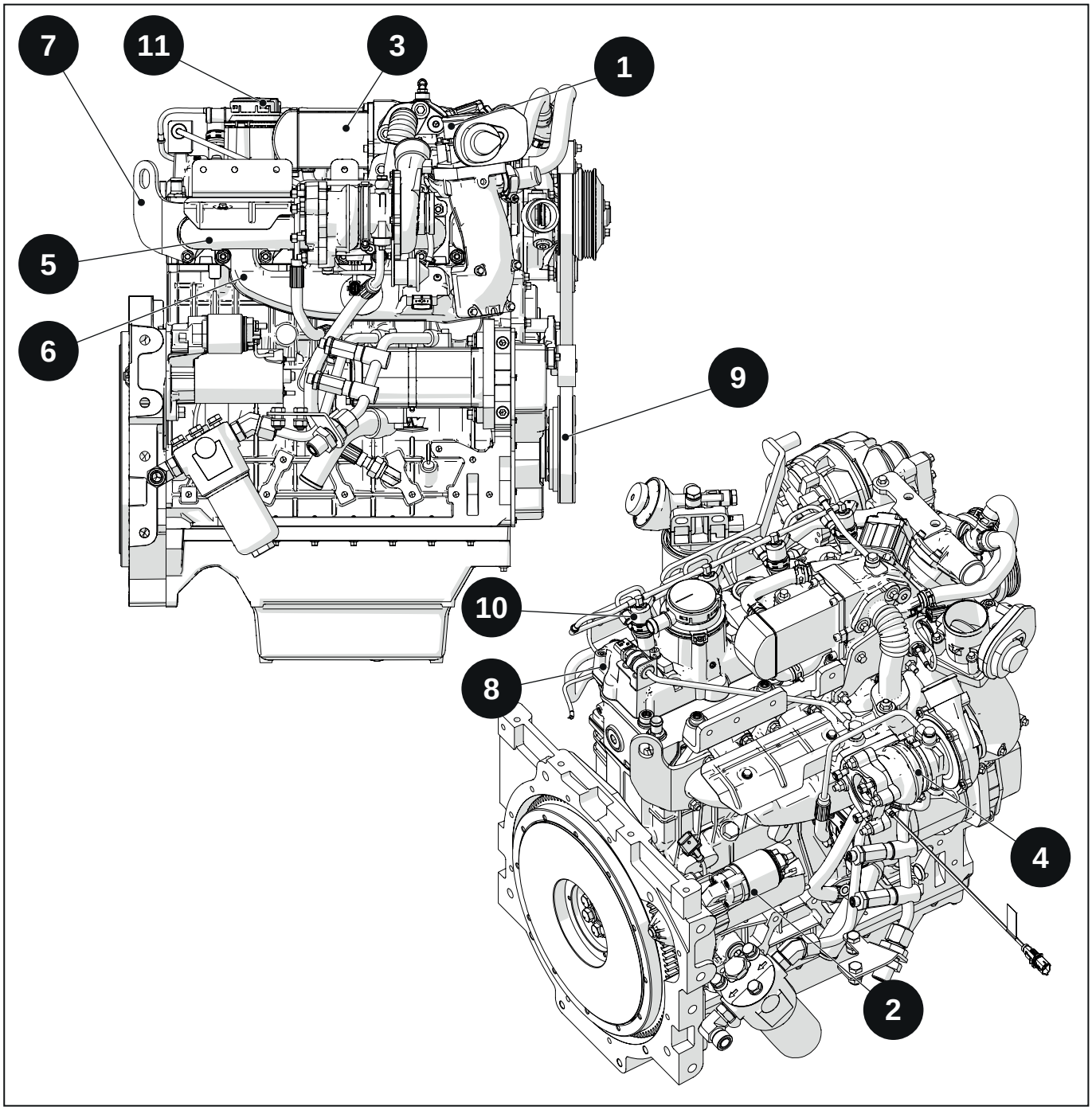

Fig. 2.22

1 - Electric throttle valve (TVA)
2 - Starter motor
3 - Exhaust gas heat exchanger
4 - Turbocharger
5 - Exhaust manifold
6 - Intake manifold
7 - Rear engine lifting lug
8 - Rocker cover
9 - Crankshaft pulley
10 - Injector
11 - Engine oil vapour separator

1 - Exhaust gas pressure sensor
2 - Exhaust gas temperature sensor
3 - exhaust recirculation system temperature sensor

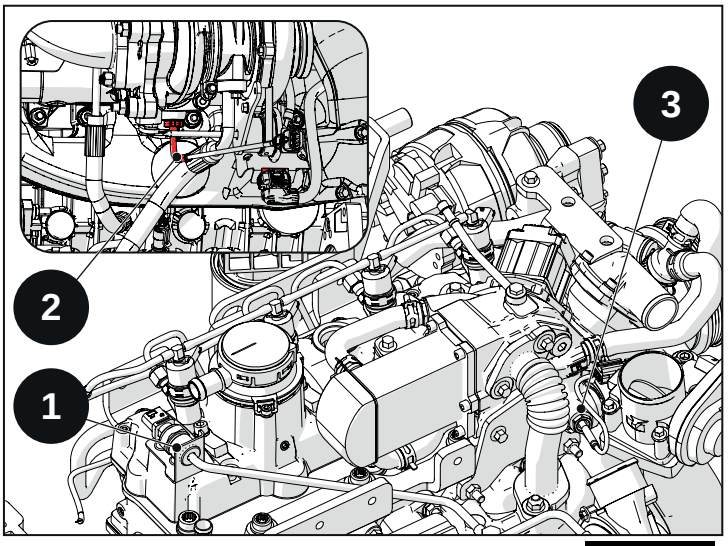

Fig. 2.23

2.4.2 View from timing side

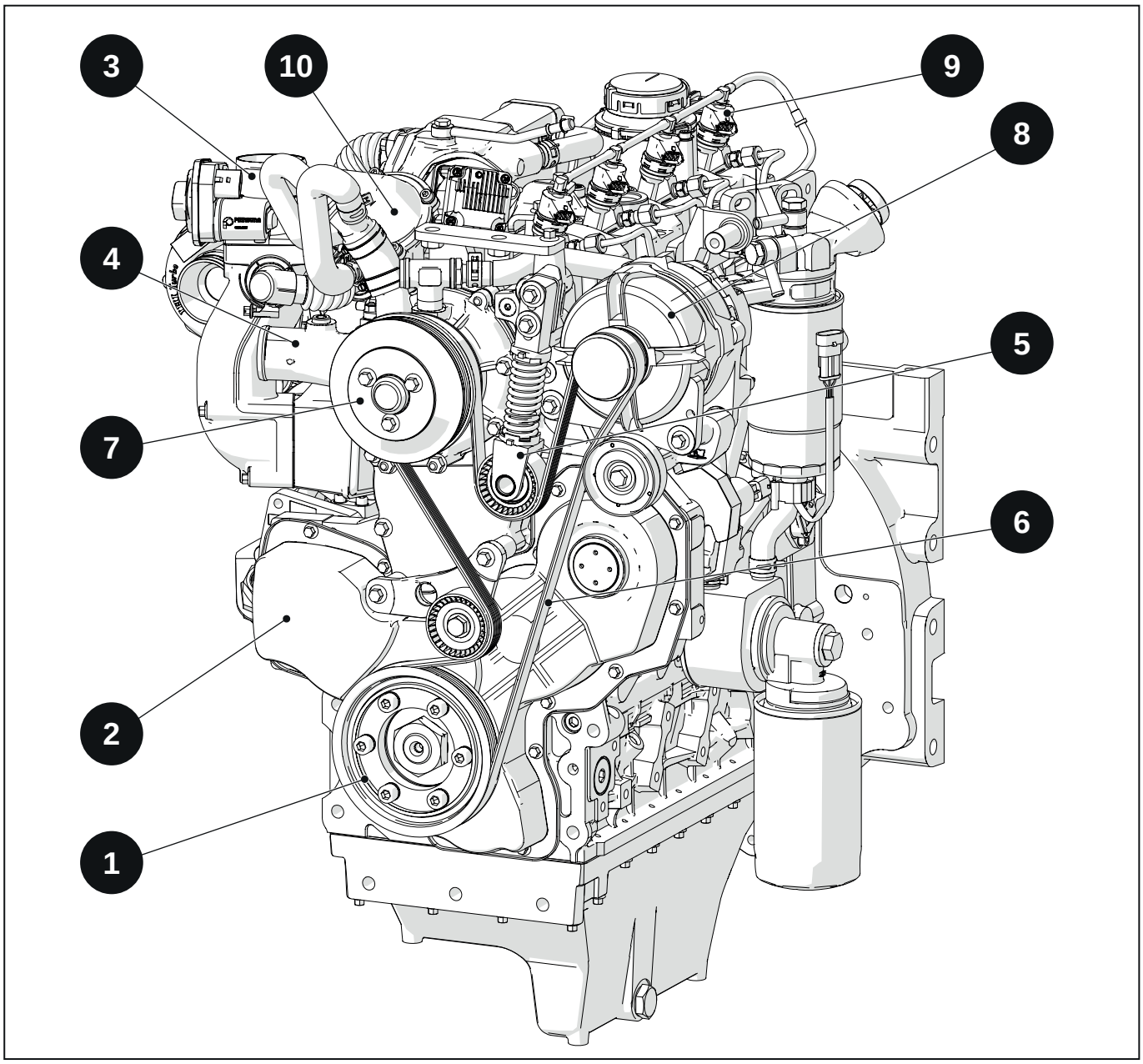

Fig. 2.24

1 - Crankshaft pulley
2 - Timing cover
3 - Electric throttle valve (TVA)
4 - Water pump
5 - Poly-V belt tensioner
6 - Alternator Poly-V belt
7 - Water pump pulley
8 - Alternator
9 - Injector
10 - Thermostat valve cover

2.4.3 View from injection side

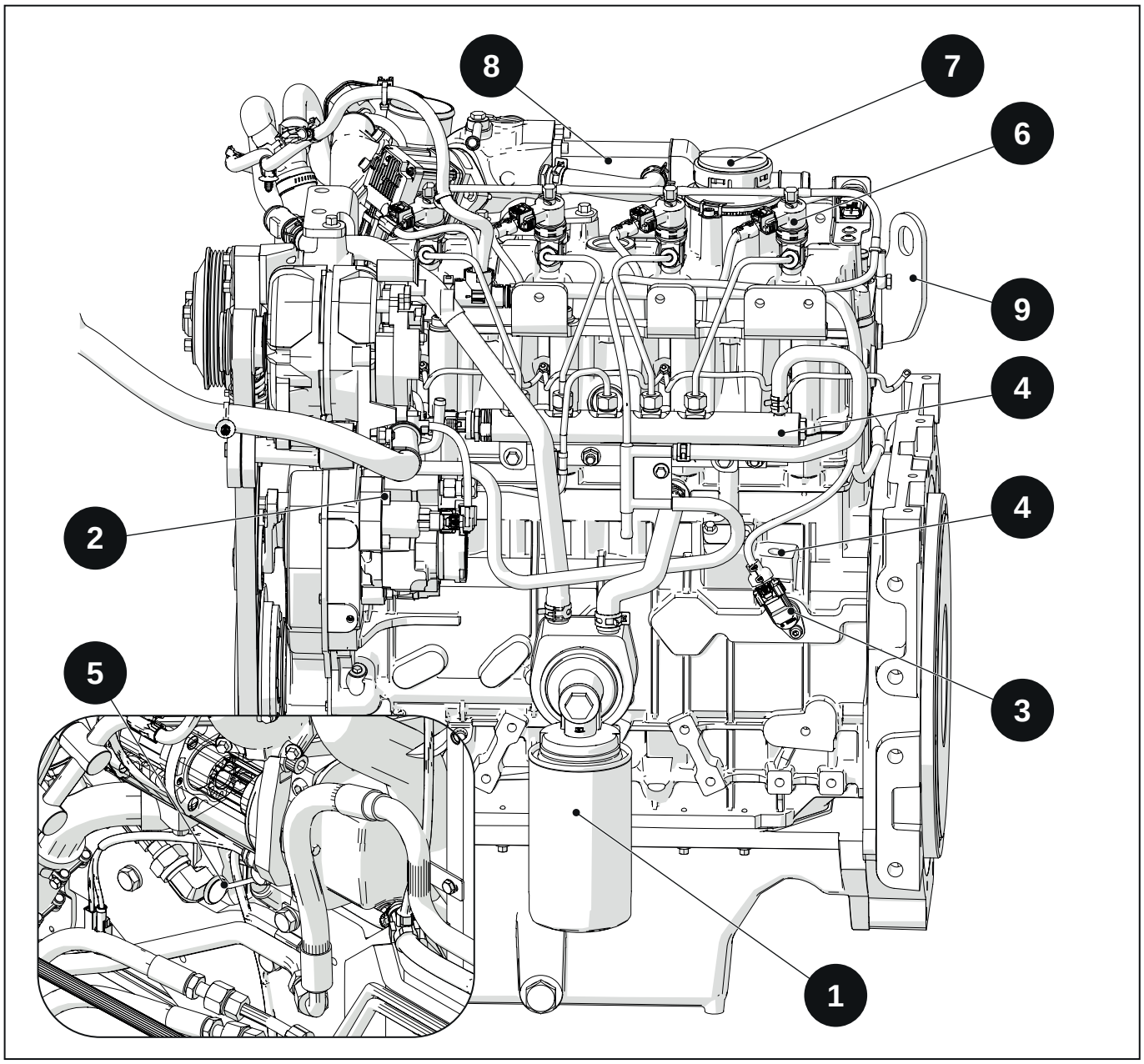

Fig. 2.25

1 - Oil filter
2 - High pressure injection pump
3 - Camshaft timing sensor
4 - Rail
5 - Oil level
6 - Injector
7 - Oil separator
8 - Exhaust gas heat exchanger (EGR cooler)
9 - Rear lifting lug

2.4.4 Top view

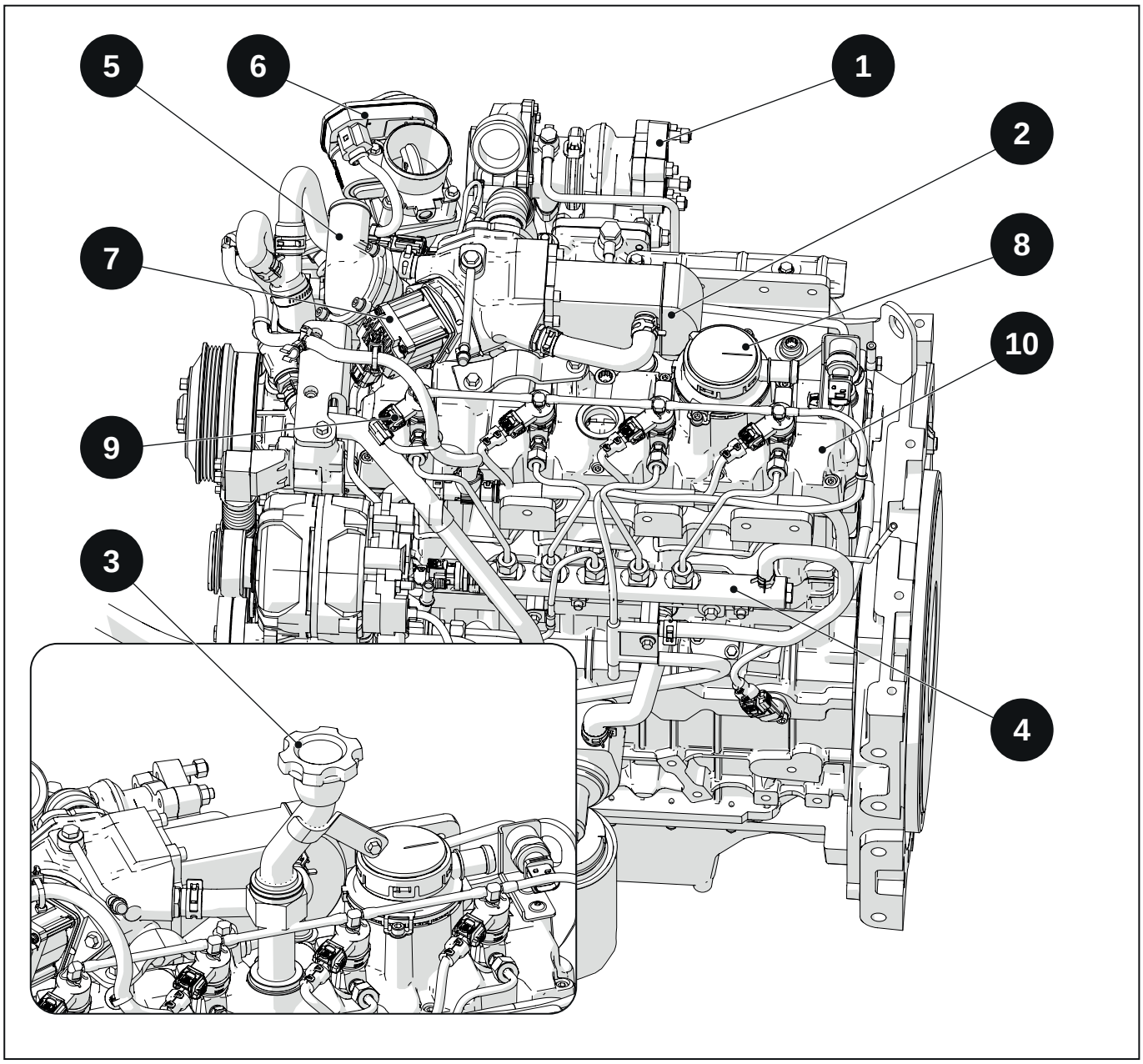

Fig. 2.26

1 - Turbocharger
2 - Exhaust gas heat exchanger (EGR cooler)
3 - Engine oil filler cap
4 - Rail
5 - Thermostat valve cover
6 - Electric throttle valve (TVA)
7 - Electrical EGR (exhaust gas recirculation) valve
8 - Oil separator
9 - Injector
10 - Valve-rocker cover

2.5 Engine oil

2.5.1 Specifications

To ensure the best possible performance and protection, only engine oil meeting ACEA-SAE-API specifications must be used. GOLDONI recommends the following engine oil specifications:

SAE	10W - 40 (semi synthetic)

R750 EU5 / EU6 - R750TE4, IE4, ISE4	
ACEA	E6, E9
API	CJ-4

Warning

the engine oil specifications for the R750 EU5 / EU6 engine are also applicable for R750EU4 engines.

2.5.2 Engine oil level

Warning

R750 engines may be equipped with two (2) different types of oil sump with different oil capacities. See the section “Engine Technical Specifications” for the relative oil capacity.

When changing oil, fill with the smallest quantity of oil needed to reach the MIN level on the oil dipstick. If the oil level does not reach the MIN marking, add 100 - 200 ml of oil at a time until the correct level is reached. Now add 100-200 ml of oil at a time until the level reaches the MAX marking.

Caution

ENVIRON·mENTAL POLLUTION HAZARD! Pollution caused by oil spillage or by the incorrect disposal of used oil is prohibited by law. When repairing the engine, do not contaminate the enviroN·ment with spilt oil or by incorrectly disposing of used oil. Keep and store new and used oil in accordance with applicable legislation.

Overfilling the engine to beyond the maximum level marking may cause fluctuations in oil pressure or a loss of oil pressure. If the engine is run with an excessive oil level, the oil in the sump will be agitated by the crankshaft, causing aeration of the oil. Aeration causes loss lost oil performance and increased overpressure in the crankcase. Extreme overfilling may cause oil to be aspirated into the induction system. Check the engine oil level carefully. The oil level must be maintained between the minimum and maximum markings on the dipstick. To be sure that the oil level reading is correct, follow these guidelines before checking the level.

Make sure that the vehicle or engine is in a stable position on a level surface.

If the engine has just been switched off or if oil has just been added, wait 5 minutes to allow the oil to drain into the sump.

2.5.3 Check

Warning

The oil level must be checked at the intervals indicated in the maintenance schedule.

Check the engine oil level every day before starting the engine.

Attention

Take care not to damage the dipstick and internal components of the engine. Never remove the dipstick when the engine is running. Switch off the engine and wait for it to come to a complete stop before removing or inserting the engine oil dipstick.

- Switch off the engine if it is running. Wait approximately 5 minutes to allow the oil to drain into the sump.
- Pull out the dipstick. Wipe it clean and push it completely into its tube.
- Pull out the dipstick and check the level. The level of the engine oil must be between the MIN and MAX markings on the dipstick.
- Add oil if necessary to reach the maximum level, but never fill beyond the MAX marking on the dipstick.

A - engine oil dipstick
B - engine oil dipstick tube

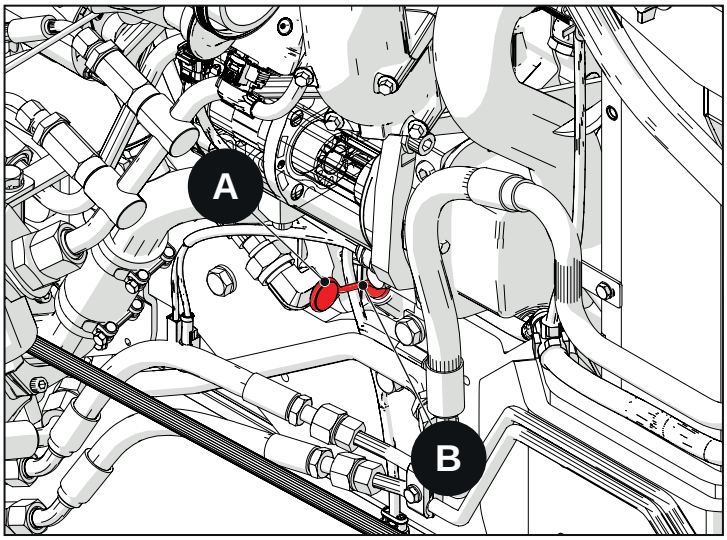

Fig. 2.27

Note

Refer to the section Engine Specifications - Engine oil capacity for engine oil quantities and specifications.

Warning

R750 engines may be equipped with two (2) different types of oil sump with different oil capacities. See the section “Engine Technical Specifications” for the relative oil capacity.

When changing oil, fill with the smallest quantity of oil needed to reach the MIN level on the oil dipstick. If the oil level does not reach the MIN marking, add 100 - 200 ml of oil at a time until the correct level is reached. Now add 100-200 ml of oil at a time until the level reaches the MAX marking.

2.5.4 Filling

Warning

Never fill beyond the MAX marking on the engine oil dipstick. Refer to the section Engine Specifications - Engine oil capacity for engine oil quantities and specifications.

R750 engines may be equipped with two (2) different types of oil sump with different oil capacities. See the section “Engine Technical Specifications” for the relative oil capacity. When changing oil, fill with the smallest quantity of oil needed to reach the MIN level on the oil dipstick. If the oil level does not reach the MIN marking, add 100 - 200 ml of oil at a time until the correct level is reached. Now add 100-200 ml of oil at a time until the level reaches the MAX marking.

- Remove the engine oil filler cap.
- Add oil if necessary to reach the maximum level, but never fill beyond the MAX marking on the dipstick
- Refit and tighten the engine oil filler cap.

A - Engine oil filler cap

Note

Always use the dipstick to determine the quantity of oil to be added.

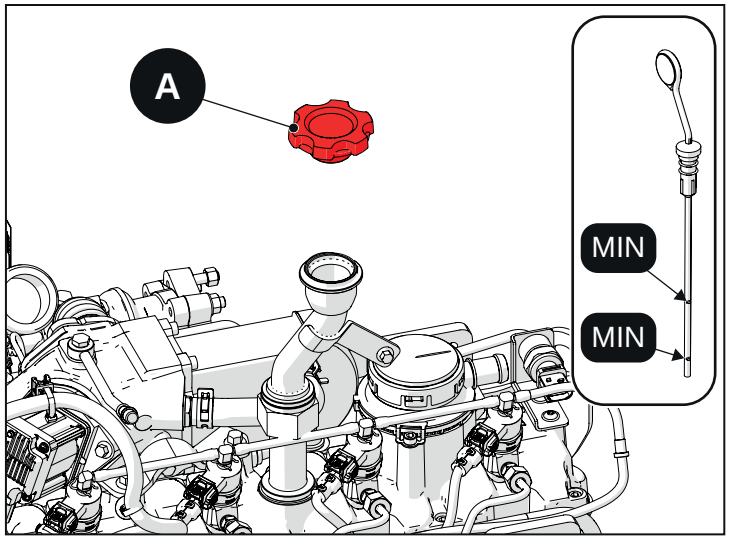

Fig. 2.28

2.5.5 Changing the engine oil

See the paragraph "scheduled maintenance" for the engine oil change intervals.

Attention

On R750EU5/EU6 - R750IE4 engines, the oil dilution calculation function must be reset after each engine oil change (see the following paragraph ENGINE OIL DILUTION).

Attention

If the error code 252F “engine oil critical mass” is generated, change the engine oil even if the oil change interval specified in the maintenance schedule has not been reached.

Attention

Change the oil with a hot engine, after the engine has been running. Hot oil flows more quickly, carrying much more contamination with it. Only use engine oils with the recommended specifications (see the paragraph Engine Specifications - Engine oil/Specifications).

Threaded plug at bottom of sump: 78.5 N·m

A - Engine oil filler cap
B - Threaded plug at bottom of sump

- Start the engine and wait for it to reach normal operating temperature.
- Stop the engine and wait approximately 10 minutes to allow the oil to drain into the sump.
- Pull out the oil dipstick and unscrew the oil filler cap
- Remove the threaded plug at the bottom of sump.
- Refit and tighten the threaded plug at the bottom of sump, fitting a new seal.

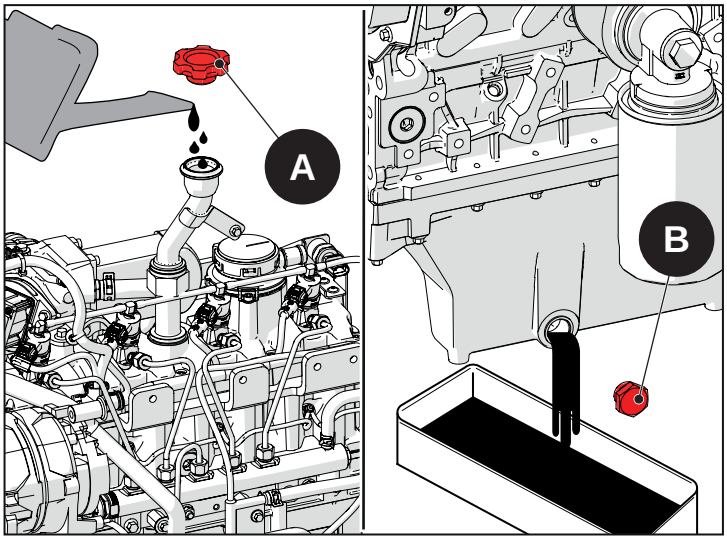

Fig. 2.29

- Use a commercially available tool to loosen the oil filter cartridge.
- Remove the oil filter cartridge.
- Dispose of the old cartridge correctly.
- Fit a new O-ring. Apply lubricant to the O-ring.
- Fit the new oil filter.

Warning

Overtightening will deform the filter and cause oil leakage.

Oil filter cartridge: 12.7 N·m

A - Commercially available tool
B - O-ring
C - Oil filter cartridge

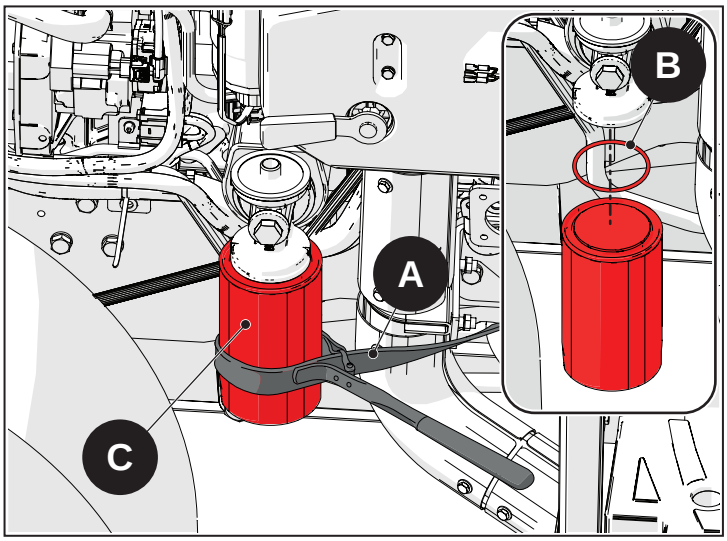

Fig. 2.30

- Hand-tighten the cartridge to bring the surface of the filter with the O-ring into contact with the base of the oil filter.
- Tighten the cartridge onto the respective base using a commercially available tool.
- Dispose of the old cartridge correctly.
- Fill the engine will new engine oil.
  See the paragraph “Filling”.
- Start the engine and check for oil leaks

Warning
ENVIRON·mENTAL POLLUTION HAZARD! During operation and maintenance, take all precautions necessary to prevent enviroN·mental pollution with substances such as oil, and dispose of these substances correctly in accordance with applicable legislation.

2.5.6 Engine oil dilution

During the DPF filter regeneration cycle, additional fuel is introduced as multiple post-injection quantities to increase the temperature of the exhaust.

The additional fuel dilutes the oil in the sump, reducing the viscosity and lubricating properties of the oil. This means that it may be necessary to change the oil after a DPF service regeneration cycle.

As a general rule, changing the engine oil after a service regeneration cycle is recommended if the engine operating hour count since the last oil change is greater than 80% of the scheduled oil change interval.

Always remember to reset the oil dilution algorithm after each engine oil change using the diagnostic tool, as the degree of oil dilution is calculated by the engine ECU and not measured directly.

The **“Oil dilution calculation”** parameter must be reset after every oil change.

Note
The Oil dilution calculation function may be reset with the electronic diagnostic tool.

The function is reset with the diagnostic tool.

CHECK: If the procedure has been performed successfully, the low engine oil pressure warning lamp flashes three times with a flash duration of 1 second and intervals of 0.5 seconds. This procedure is not possible with certain tractor configurations.

2.6 Coolant

2.6.1 Specifications

Warning
Antifreeze products containing propylene glycol, ethyl alcohol or methanol may not be used in the cooling system. When not using a prediluted antifreeze product, use only deionised or distilled water to dilute to the correct concentration.

Diesel engines have high compression ratios and generate high operating temperatures. The cooling system and engine must be kept as clean as possible to ensure the effective cooling. Adequate cooling performance can only be ensured by using a specific antifreeze product diluted in water. GOLDONI recommends filling the cooling system with a low silicate ethylene glycol based product diluted in deionised or distilled water. Low silicate formulas prevent separation of the antifreeze liquid, which causes the formation of silica gel.

This gel obstructs the passages of the coolant circuit, causing the engine to overheat.

When not using a premixed coolant, the system must be filled with a solution of antifreeze and deionised or distilled water, mixed before adding to the circuit. Normal tap water, even if a water softener is used, contains minerals which may form deposits in the circuit, reducing the efficacy of the cooling system. The cooling system must be topped up at least once a year with a correct mixture of water and antifreeze product. Do not drain the cooling circuit before putting the machine into storage, as this may cause corrosion within the cooling system itself. If the engine is exposed to very cold temperatures, make sure that the cooling circuit is filled with a mixture of appropriate low temperature antifreeze and water to ensure adequate protection for the engine and the cooling circuit itself.

Warning
the coolant mixture must consists of a low silicate ethylene glycol based antifreeze product diluted in deionised or distilled water. Using any other coolants may cause damage to the heat exchangers and lead to engine overheating. Do not mix different types of antifreeze product, or top the circuit up with a different type of antifreeze than the product already in the circuit, unless you are certain that they are compatible with each other. Always refer to the instructions provided by the manufacturer of the antifreeze product.

GOLDONI approves the use of coolants consisting as follows:

Mixture	50% antifreeze + 50% deionised or distilled water	The antifreeze used must comply with the following specifications: ASTM D 3306 type 1.

Refer to the maintenance schedule to determine the correct coolant replacement intervals.

See the paragraph Engine specifications - cooling circuit capacity to determine the capacity of the cooling system/ circuit

Note
In September 2011, the antifreeze used previously was replaced by a new antifreeze denominated Petronas Paraflu Up (red), with an ethylene glycol based formula containing OAT (organic acid technology) corrosion inhibitors. The specifications of this antifreeze are analogous to those of the product used previously.

2.6.2 Checking coolant level

Attention
Take all precautions necessary to prevent scalding. No not loosen the filler cap when the engine is hot. The coolant may release hot steam when the cap is opened.

Note
Check the coolant level before starting the engine, while the engine itself is still cold.

- Wait for the engine to cool.
- Remove the filler cap on the expansion tank and check the level.
- The level must not exceed the base of the filler neck onto which the radiator filler cap is fitted. On vehicles with an expansion tank, the level must always be between the MAX and MIN markings. Refer to the user manual provided by the manufacturer of the vehicle.
- If the level is correct, refit and tighten the filler cap.
- If the level is low, top up with the coolant mixture specified.
- Refer to the section Filling - cooling circuit capacity to determine the capacity of the cooling system/circuit.
- Refit and tighten the filler cap.

A - Filler cap
B - Radiator

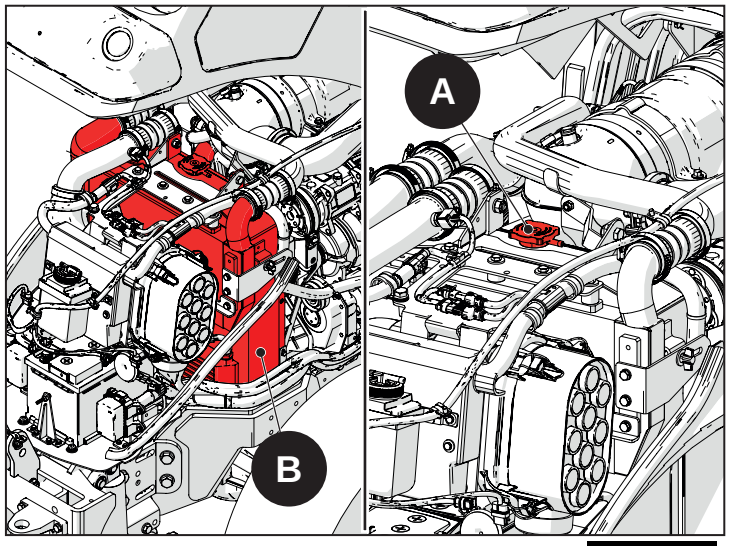

Fig. 2.31

2.6.3 Filling the cooling circuit

- Only remove the filler cap when the engine is cold.

Warning
Use only the specified coolant (see the specifications for coolant)

- If it is necessary to change the coolant or if the coolant level is too low, add the specified coolant mixture slowly to reach the correct level as described in the section “Checking coolant level”.

Warning
Overheating due to insufficient coolant will cause engine damage. Check that the coolant level is sufficient every day before starting the engine.

- Do not fit the filler cap. Start the engine and run at accelerated idle speed (1500-1800 rpm). Add coolant if necessary to keep the coolant in the system at the correct level indicated previously.

Warning
When refitting the filler cap, tighten securely to prevent the risk of coolant leakage.

- Only fit the filler cap once the engine has reached normal operating temperature (thermostat valve fully open) and the level has stabilised correctly, as indicated previously (see the section Engine specifications).
- Test the engine while it is running. Monitor the operating temperature and check for any coolant leaks. If the indicated temperature is too high or if any leaks are noted, stop the engine immediately and identify the cause of the problem.
- Wait for the engine to cool.
- Remove the filler cap and add coolant mixture to reach the correct level (see the section “Checking coolant level”).
- Refit the filler cap and tighten securely.

2.6.4 Draining the cooling circuit

Warning

ENVIRON·mENTAL POLLUTION HAZARD! During operation and maintenance, take all precautions necessary to prevent enviroN·mental pollution with substances such as coolant, and dispose of these substances correctly in accordance with applicable legislation.

Attention

Take all precautions necessary to prevent scalding. No not loosen the filler cap when the engine is hot. The coolant may release hot steam when the cap is opened.

- Wait for the engine to cool.
- Remove the filler cap on the expansion tank or on the radiator.

Note

Drain the coolant into a container. Dispose of the drained coolant correctly.

- Loosen the radiator drain plug or cock. If neither of these are available, loosen the fastener clamp of the lowest pipe on the radiator.

A - Filler cap
B - Drain plug

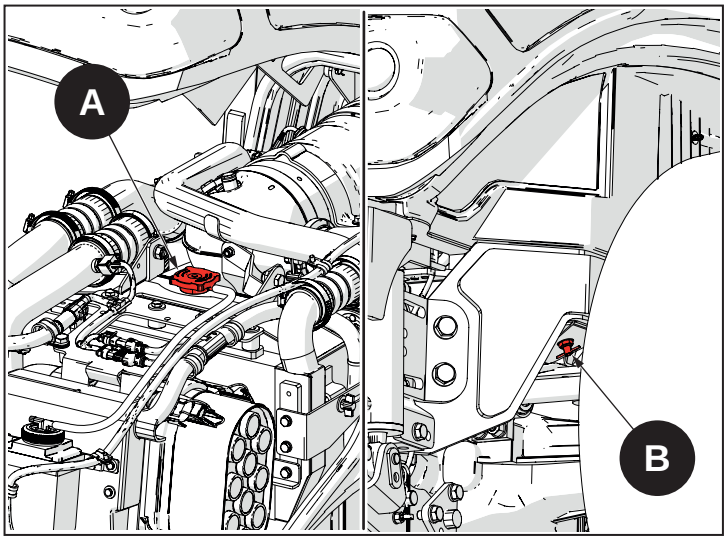

Fig. 2.32

- Once all the coolant has drained, refit the drain plug, close the drain cock or retighten the fastener clamp of the pipe loosened previously on the radiator. Tighten the drain plug or cock securely.
- Clean the cooling circuit if necessary. See the section “Cleaning the cooling circuit”.
- Fill the circuit with the coolant mixture specified. See the section "Filling the cooling circuit".

2.6.5 Cleaning the cooling circuit

The cooling system must be cleaned at the intervals specified in the maintenance schedule or whenever a loss in cooling system performance is noted.

2.7 Air filter

Note

To clean the air filter, refer to the instructions given in the user manual provided by the manufacturer of the vehicle.

Cleaning and replacing the air filter

Attention

Stop the engine and wait until it has cooled down before starting any maintenance procedure.

Note

The filter clogging indicator lamp is situated on the dashboard instrument.

This lamp illuminates to indicate that the air filter is clogged and must be serviced or replaced.

- Release the clips (1) and remove the cover (2).
- Remove the main filter cartridge (3) and clean with compressed air directed outwards from the inner side of the cartridge.
- Check the state of wear of the cartridge (3) and replace if necessary.
- Remove the safety cartridge (4) and clean both the cartridge and in the interior of the housing with compressed air.
- Check the state of wear of the cartridge (4) and replace if necessary.
- Refit the cartridge (4).
- Refit the cartridge (3) and the cover (2).

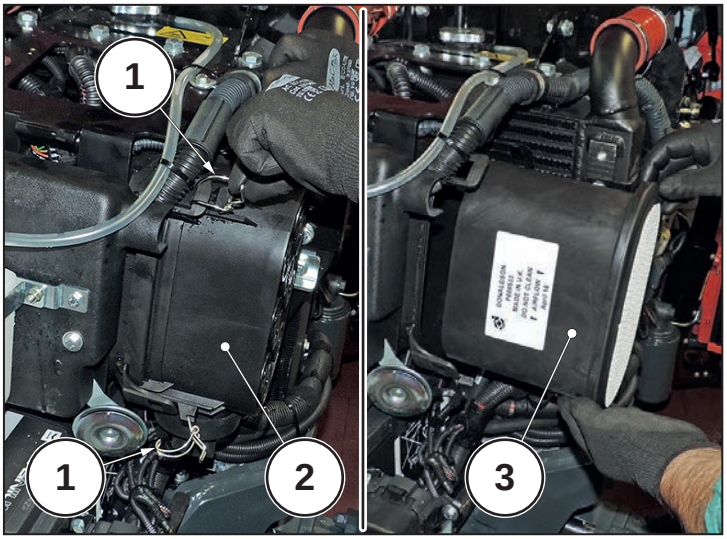

Fig. 2.33

Warning

Also replace the safety cartridge (4) every second or third time that the main cartridge (3) is replaced.

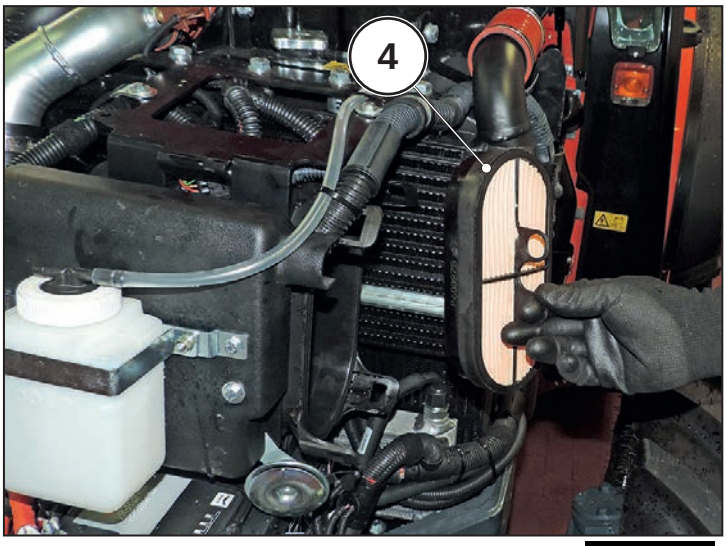

Fig. 2.34

2.8 Injection system

2.8.1 General information

Attention

To prevent the risk of fire or explosion, always disconnect the battery cable terminal clamps before starting repair work.

Attention

EXPLOSION AND/OR FIRE HAZARD: fuel leaks from any part of the injection system may initiate a fire or explosion, causing severe or even fatal injury. The entire injection system must be thoroughly inspected on a regular bases and, in particular, if the vehicle has been in storage. Check all components for leaks, softening, hardening, swelling and signs of corrosion. Replace any component with any signs of deterioration before starting the engine.

Attention

Using incorrect, unsuitable or contaminated fuel will damage the engine. The use of unsuitable fuel constitutes improper usage of the engine. Any damage resulting from the use of nonconformant fuel will not be covered by the warranty.

2.8.2 Fuel specifications

The engine is designed to run with standard fuels available throughout Europe (compliant with DIN EN 590 specifications). BIODIESEL (compliant with the specifications of UNI EN 14214) may be used in proportions up to 7% mixed in a standard fuel type available in Europe (as defined by the standard DIN EN 590). Use low-sulphur content fuel (not exceeding 10-50 ppm) for R750 engine models.

2.8.3 Using the engine at low temperatures

UN·modified diesel fuel thickens and gels at very low temperatures unless specific additives are used. Practically all diesel fuels are already climate-modified to permit their usage in the specific region of sale during winter. If further fuel treatment is necessary, the owner and/or operator of the vehicle are responsible for adding an appropriate standard, commercially available additive to the diesel fuel, in accordance with the instructions of the producer of the additive.

GOLDONI cannot be held responsible for any engine malfunction or damage caused by using fuel additives. Any engine damage resulting from the use of fuel additives will not be covered by the warranty.

2.9 Fuel filter

2.9.1 Draining

The water and particles separated/filtered from the fuel may be drained from the fuel filter by unscrewing the drain plug at the bottom of the filter itself.

Attention
Open the drain plug every day before starting the engine. The drain plug must only be opened in cool conditions, to prevent the risk of fire or explosion. In very cold conditions, which may cause the separated water in the filter to freeze, drain the filter at the end of the working day.

Note
Place a container under the filter to collect the fuel.

- After placing a container under the filter, open the drain plug situated at the bottom of the filter.
- Drain the filter until the fuel draining from the plug is clear and clean.
- Retighten the plug.
- If the filter has been drained completely, refill it with fuel. See the section "Filling".

A - Filter
B - Water drain plug

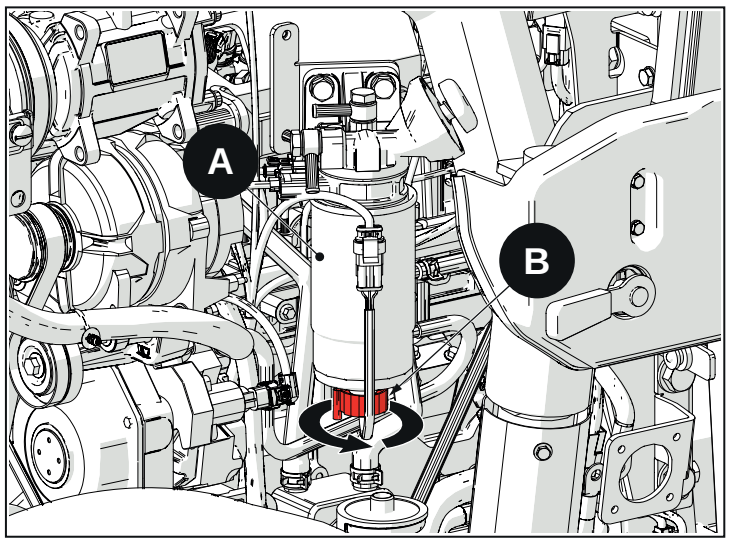

Fig. 2.35

2.9.2 Filling and bleeding

Follow this procedure after installing a new filter or if the filter has been emptied completely when draining water.

Note

The filter is equipped with a hand-operated plunger for priming the filter itself with fuel.

- Loosen the bleed screw on the filter housing.
- Push the plunger up and down repeatedly. The filter is filled correctly and contains no air when no air bubbles can be seen in the fuel escaping from the bleed screw.
- Tighten the bleed screw.
- Start the engine and check for leaks. Stop the engine immediately if any leaks are noted. Check that the filter is fitted correctly.

Warning

Make sure that there are no leaks before closing the bonnet of the vehicle.

A - Bleed valve
B - Plunger

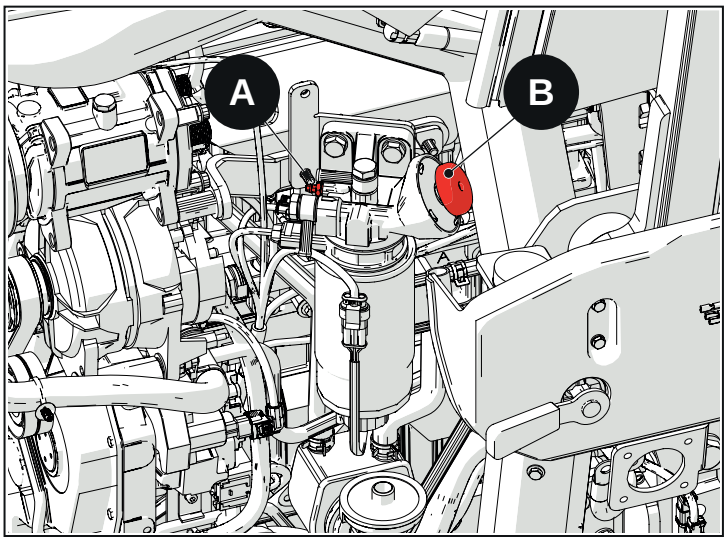

Fig. 2.36

2.9.3 Replacement

Warning

As the injection pumps and injectors are very sensitive components, extreme cleanliness must be maintained when working on the injection system. Even the most minuscule particles of dirt or quantities of water may damage the injection system.

- Disconnect both battery cables.
- Disconnect the cable of the water in filter sensor from the bleed plug.

A - Water drain plug
B - Water in fuel sensor

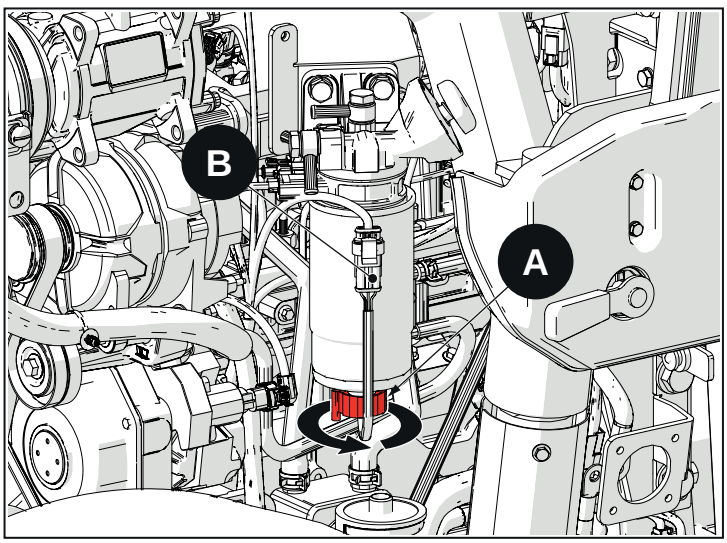

Fig. 2.37

Warning

replace the filter with a new component after removal; the filter cannot be cleaned and/or reused.

- Loosen the fastener ring if applicable. If there is no fastener ring, remove the filter by hand or using a commercially available tool.

A - Fuel filter
B - Fastener ring

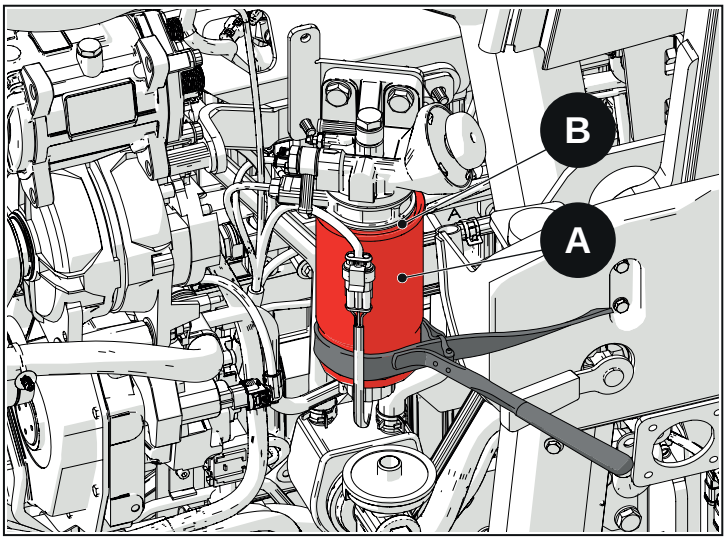

Fig. 2.38

2.9.4 Installation

- Lubricate the filter gasket with engine oil
- Fill the new fuel filter with clean diesel fuel
- Align the filter correctly with its housing. Hand-tighten the fastener ring or the filter cartridge. Use a commercially available tool if necessary. Fill and bleed the filter. See the section "Filling and bleeding"
- Connect the cable to the water in filter sensor and connect the battery cables disconnected previously.
- Start the engine and check for leaks. If any leaks are noted, stop the engine immediately and identify and rectify the problem, repeating the procedure to fit the filter if necessary.

2.10 Alternator Poly-V belt

2.10.1 Inspection

Check that the belt tension is correct and also check for:

- Excessive wear
- Cracks
- Cuts

⚠ Warning
Minor, transverse cuts or cracks (across the width of the belt) may be acceptable. Longitudinal cuts or cracks (along the length of the belt) intersecting transverse cracks or cuts are not acceptable.

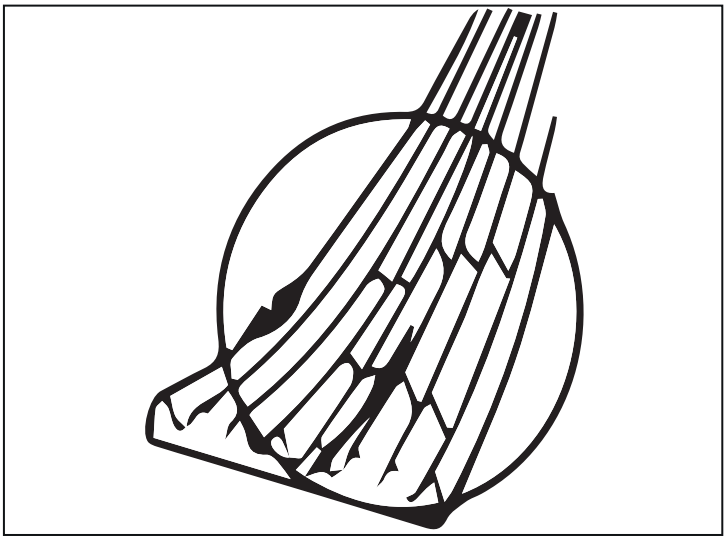

Fig. 2.39

2.10.2 Replacement/installation (with Hutchinson TS 21 linear tensioner)

2.10.2.1 Procedure used on assembly line

- Fit the tensioner, leaving the screws X untightened.
- Fit the belt.

> **Warning**
>
> To align the belt correctly, it must be seated in the innermost grooves of the alternator pulley.

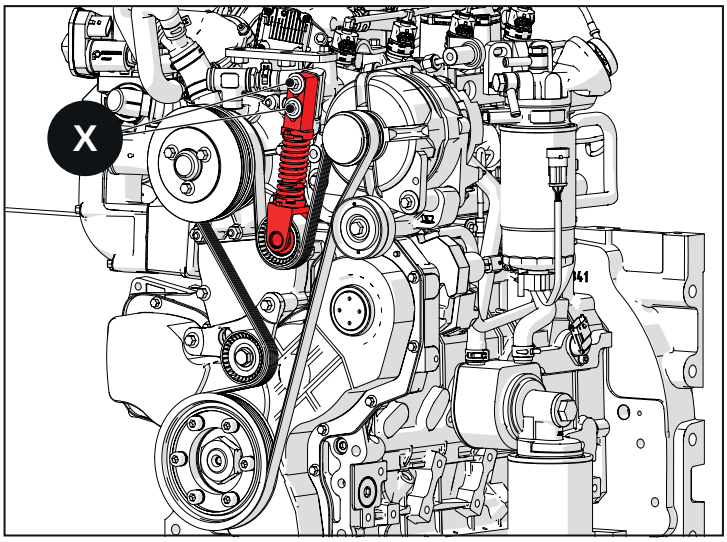

Fig. 2.40

A - alternator pulley
A1 - alternator pulley - remaining outer grooves

- Bring the pulley of the tensioner into contact with the belt.
- Tighten the screws X of the tensioner.

Screws X: 32.4 N·m

Remove the retainer Y from the tensioner with a screwdriver.

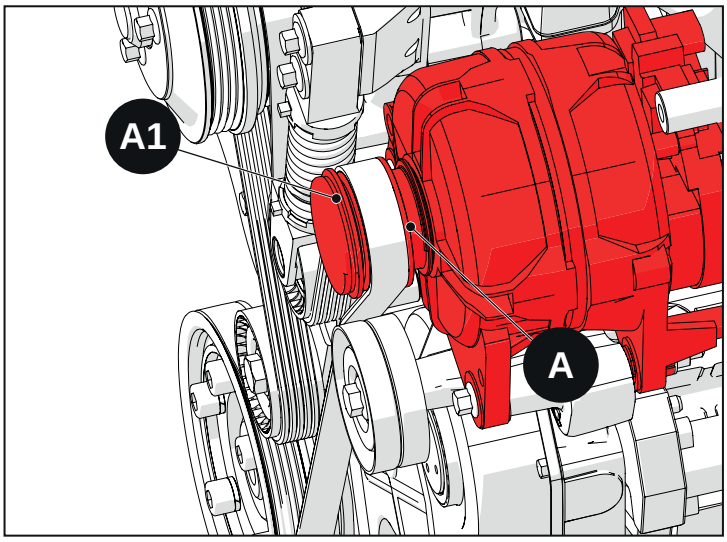

Fig. 2.41

2.10.2.2 Replacement procedure for service network

- Rotate the special tool (1) anticlockwise to compress the tensioner (2) (2.42).
- Fit the retainer bracket (3) as shown in the photo (2.42).
- Remove the belt.
- Install the new belt, routing correctly as shown in the photo (2.40).
- Rotate the special tool (1) anticlockwise to compress the tensioner (2) and remove the retainer bracket (3)

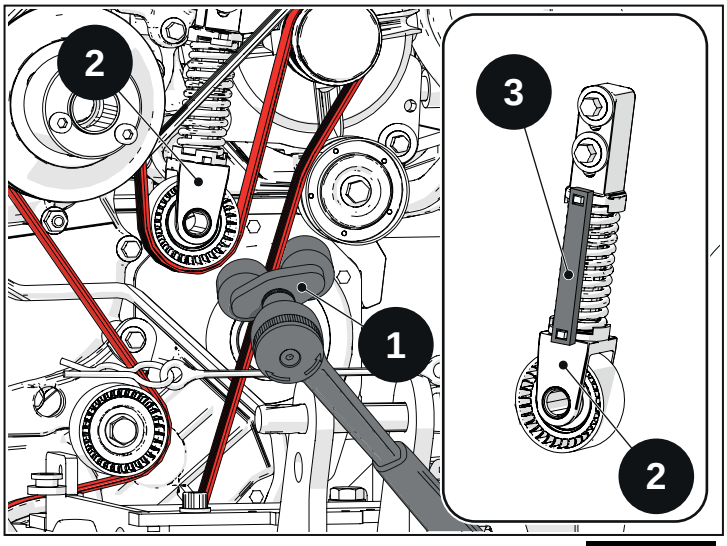

Fig. 2.42

If it is difficult to remove the belt with the special tool applied to the belt, another tool may be applied to the tensioner

- Fit the tool (1) on the tensioner
- Tighten the screw (2) until the retainer bracket (3) can be fitted
- Remove the belt.

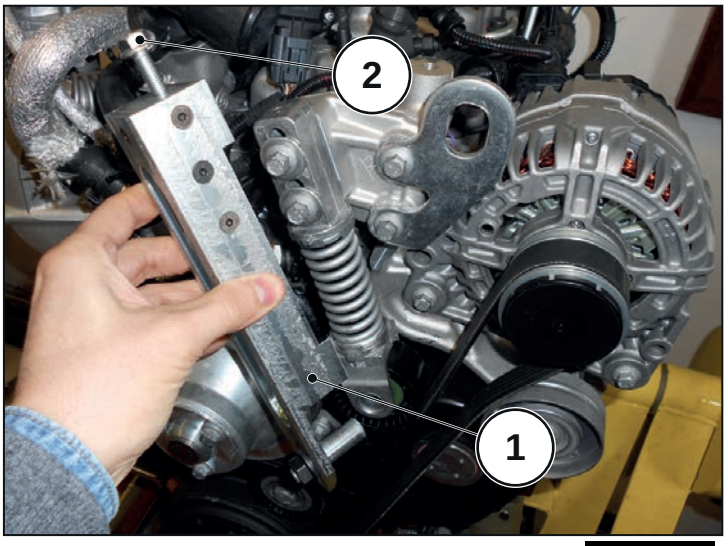

Fig. 2.43

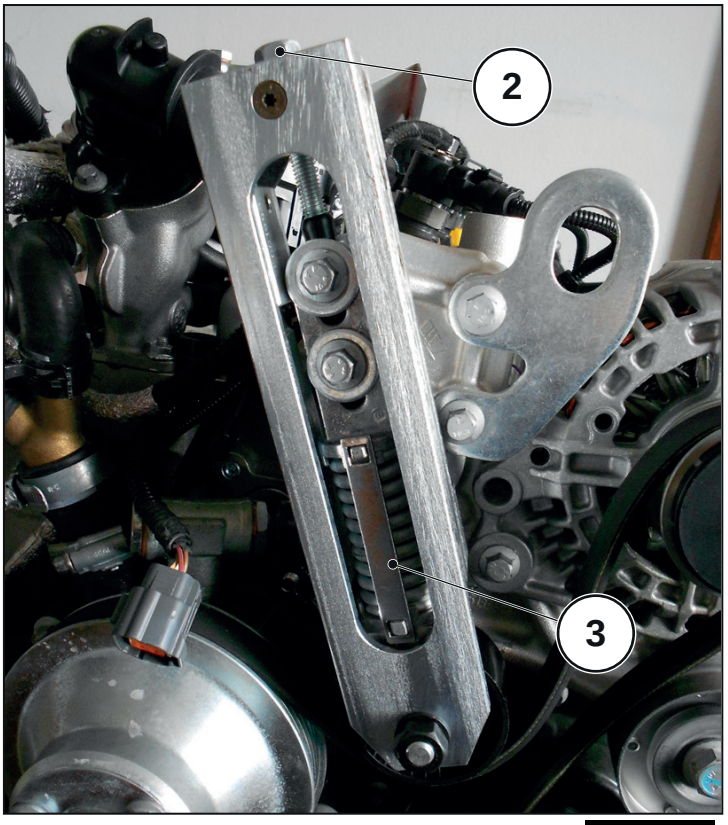

Fig. 2.44

2.11 Diesel particulate filter (DPF)

Diesel particulate filters capture the particulate and inorganic ash contained in exhaust gas. In normal operating conditions, the filter burns off accumulated particulate with regeneration cycles. The inorganic ash produced by the combustion of engine oil does not burn, however, and will slowly build up in the filter. This ash must be removed from the filter periodically with a specific cleaning process.

2.11.1 Maintenance intervals

See the intervals indicated in the maintenance schedule. In certain cases, such as on vehicles with older engines, more frequent maintenance may be necessary.

An indicator lamp or alarm on the instrument panel notifies the user of the vehicle when the DPF filter is excessively clogged.

2.11.2 Diesel particulate filter regeneration and cleaning

Warning
before starting a DPF regeneration cycle, clean the pipes between the differential pressure sensor and the DPF filter.

Clean the pipes as follows:

- mark each pipe (the pipes differ in diameter)
- disconnect the pipes
- blow compressed air through the pipes (blow towards the DPF filter - correct direction is indicated by the arrows)

The DPF filter must be regenerated to remove accumulated particulate and cleaned to remove ash:

- every 1500 hours or 50,000 km, during scheduled maintenance services, using compressed air or an electric furnace (see the specific procedures applicable).
- whenever error 2463 (soot max) is generated in the ECU engine control unit, using compressed air and performing the service regeneration cycle with the diagnostic tool (see the specific procedures applicable).

Warning
Ash must be disposed of in accordance with local law and regulations.

2.11.3 Process for cleaning filter with compressed air to remove ash

2.11.3.1 Safety equipment

Cleaning process with “COMPRESSED AIR”:

- A compressed air supply (80-100 psi / 5.5-7 bar) with a standard compressed air gun
- Dust mask, gloves, protective eyewear
- An industrial extractor system or a device for collecting dust/ash.

Mark the "exhaust out" side of the filter before removing the central filter canister. Remove the central filter canister.

With an extractor on the exhaust "in" side to collect the ash and holding the compressed air gun at a distance of approximately 10 cm, blow compressed air (5.5-7 bar) through the cells of the filter core from the exhaust "out" side. To ensure effective results, move the compressed air gun slowly and direct the air through all the cells in the core.

Continue for approximately 30-40 minutes. Do not allow the compressed air gun to come into contact with the cells of the filter core.

Refit the central filter canister the opposite way around relative to its original position with respect to the direction of flow of the exhaust: the exhaust "out" side marked before removal must now be the exhaust "in" side.

Do not clean with steam and/or cleaning products. Cleaning products may damage the filter.

2.11.4 DPF filter regeneration process with electric furnace

Clean the DPF filter with compressed air (see the procedure “Process for cleaning filter with compressed air").

Mark the "exhaust out" side of the filter before removing the central filter canister. Place the central canister in the furnace.

Perform a heating cycle with the steps indicated in this table:

STEP	TEMPERATURE °C	DURATION (min)	TEMPERATURE RAMP	
start	ambient temperature in furnace	/	/	increase
1	0 - 200	60 min	linear	10°C / min
2	200 - 500	120 min	linear	5°C / min
3	500 - 600	30 min	linear	2°C / min
4	600	360 min	constant	
5	600 - 500	30 min	linear	
6	500 - 200	120 min	linear	
7	200 - 120	60 min	linear	
8	120	60 min	constant	
9	shut-off	/	/	

Fig. 2.45

Remove the central filter canister from the furnace.

Refit the central filter canister the opposite way around relative to its position before removal with respect to the direction of flow of the exhaust:

the exhaust "out" side marked before removal must now be the exhaust "in" side.

Do not clean with steam and/or cleaning products. Cleaning products may damage the filter.

Tightening torque for diesel particulate filter clamp screws: 30 N·m

Warning

The filter requires no maintenance other than normal regeneration and cleaning. If the filter clogs, the central canister must be cleaned, regenerated and, if necessary, replaced.

The engine service intervals indicated in the maintenance schedule must be observed to ensure that the filter functions correctly.

Excessive engine oil consumption will increase the frequency at which cleaning and regeneration are needed.

ALWAYS replace the fastener clamps and spacer rings with new components after removing the central filter canister.

Attention

In certain situations, such as in the case of rapid accumulation of ash causing the filter to clog, it may be necessary to service the filter before the next scheduled service. The rapid accumulation of ash may be caused by a faulty engine component (e.g. EGR valve stuck open) or in certain engine operating conditions, such as continuous use at low engine load, prolonged operation at idle speed etc.

In this case, the indicator lamp on the instrument panel will illuminate to notify the operator.

Attention
The filter may clog more quickly if the pneumatic outlets or electrical connections of the throttle valve and the EGR valve are swapped (see the paragraph “Throttle valve”). Mark the connections on the aforementioned components for subsequent identification before disconnecting.

2.11.5 Disposing of ash

Ash must be disposed of in accordance with applicable legislation in the country of use.

2.11.6 Cleaning and regeneration process with diagnostic tool - Error 242F "SOOT MAX"

Warning
Do not launch the DPF regeneration cycle unless the DPF filter has been cleaned beforehand with compressed air (see the procedure for cleaning with compressed air).

Warning
before starting a DPF regeneration cycle, clean the pipes between the differential pressure sensor and the DPF filter. Clean the pipes as follows: mark each pipe (the pipes differ in diameter) disconnect the pipes blow compressed air through the pipes (blow towards the DPF filter - correct direction is indicated by the arrows)

Launch the regeneration cycle from the diagnostic tool.

Follow the instructions shown on the display of the diagnostic tool. The engine speed is increased to 1700 rpm during the regeneration cycle. After approximately 60 minutes, the regeneration cycle ends and the engine returns to normal idle speed.

Cancel the errors stored in the engine control unit.

Warning
The regeneration cycle may be interrupted automatically at any time by the safety system In an emergency, the cycle may be stopped manually by the operator by switching off the engine.

2.11.7 Diesel particulate filter regeneration

The DPF filter must be regenerated to remove accumulated particulate:

- every 4000 hours, during scheduled engine services.
- when the error 242F (soot max) is generated in the ECU engine control unit - in this case, the process is usually denominated 'service regeneration cycle'

A) PROCEDURE every 4000 hours

- 1- Connect the diagnostic tool to the engine control unit and check for errors.
  - Do not start the service regeneration procedure if there are any errors in the ECU memory. Launching the regeneration cycle while there are active errors may result in damage to the engine or exhaust system due to faulty or malfunctioning components.
  - Identify and rectify the causes of any errors before launching the regeneration cycle.
- 2- Tilt the DPF and check that no loose particulate falls out of either end before starting the service regeneration procedure.
  - Check for particulate residue in the exhaust pipe. If any residue is found, inspect the exhaust pipe. Particulate found at the outlet side of the DPF filter is indicative of a significant loss in filtration performance.
  - Do not start the service regeneration procedure if any particulate is found at the outlet side of the DPF. Replace the filter and reset the particulate count parameter in the ECU using the diagnostic tool.
- 3- Use compressed air to clean the pipes connecting the differential pressure sensor to the DPF.

Warning

before starting a DPF regeneration cycle, clean the pipes between the differential pressure sensor and the DPF filter.

Clean the pipes as follows:

mark each pipe (the pipes differ in diameter)

disconnect the pipes

blow compressed air through the pipes (blow towards the DPF filter - correct direction is indicated by the arrows)

- 4- Warm the engine to above 70°C

Warning

During the service regeneration cycle, the exhaust pipe may reach temperatures exceeding 550°C (1022°F). Ensure that all personnel remains at a safe distance from the exhaust pipe.

The cycle must be performed outdoors with the vehicle standing on a heat resistant surface.

- 5- Select service regeneration
- 6- Follow the instructions shown on the display of the diagnostic tool. Engine speed is increased to 1700 rpm during the regeneration cycle. After approximately 15 minutes, the regeneration cycle ends and the engine returns to normal idle speed.

Warning

The service regeneration cycle may be interrupted automatically at any time by the engine safety system.

In an emergency, the cycle may be stopped manually by the operator by switching off the engine.

- 7- Repeat steps 5 and 6

Note

the procedure is complete once 2 consecutive regeneration cycles are completed successfully.

- 8- Remove the filter from the vehicle.
- 9- Clean the filter with compressed air. See the section “Cleaning process with compressed air”.

B) PROCEDURE in case of error 242F “soot max”

- Connect the diagnostic tool to the ECU engine control unit and check for error codes
  - Reset the particulate count parameter from the diagnostic tool.
  - Identify and rectify the causes of any errors before launching the regeneration cycle.
- Tilt the DPF and check that no loose particulate falls out of either end before starting the service regeneration procedure.
  - Check for particulate residue in the exhaust pipe. If any residue is found, inspect the exhaust pipe. Particulate found at the outlet side of the DPF filter is indicative of a significant loss in filtration performance.
  - Do not start the service regeneration procedure if any particulate is found at the outlet side of the DPF. Replace the filter and reset the particulate count parameter in the ECU using the diagnostic tool.
- Use compressed air to clean the pipes connecting the differential pressure sensor to the DPF.

Warning

before starting a DPF regeneration cycle, clean the pipes between the differential pressure sensor and the DPF filter.

Clean the pipes as follows:

mark each pipe (the pipes differ in diameter)

disconnect the pipes

blow compressed air through the pipes (blow towards the DPF filter - correct direction is indicated by the arrows)

- Warm the engine to above 70°C

Warning

During the service regeneration cycle, the exhaust pipe may reach temperatures exceeding 550°C (1022°F). Ensure that all personnel remains at a safe distance from the exhaust pipe.

The cycle must be performed outdoors with the vehicle standing on a heat resistant surface.

- Select service regeneration
- Follow the instructions shown on the display of the diagnostic tool.
  Engine speed is increased to 1700 rpm during the regeneration cycle. After approximately 15 minutes, the regeneration cycle ends and the engine returns to normal idle speed.
- Check engine oil dilution.
  Engine speed is increased to 1700 rpm during the regeneration cycle. After approximately 15 minutes, the regeneration cycle ends and the engine returns to normal idle speed.

Warning

The service regeneration cycle may be interrupted automatically at any time by the engine safety system.

In an emergency, the cycle may be stopped manually by the operator by switching off the engine.

2.12 Diesel particulate filter (DPF)

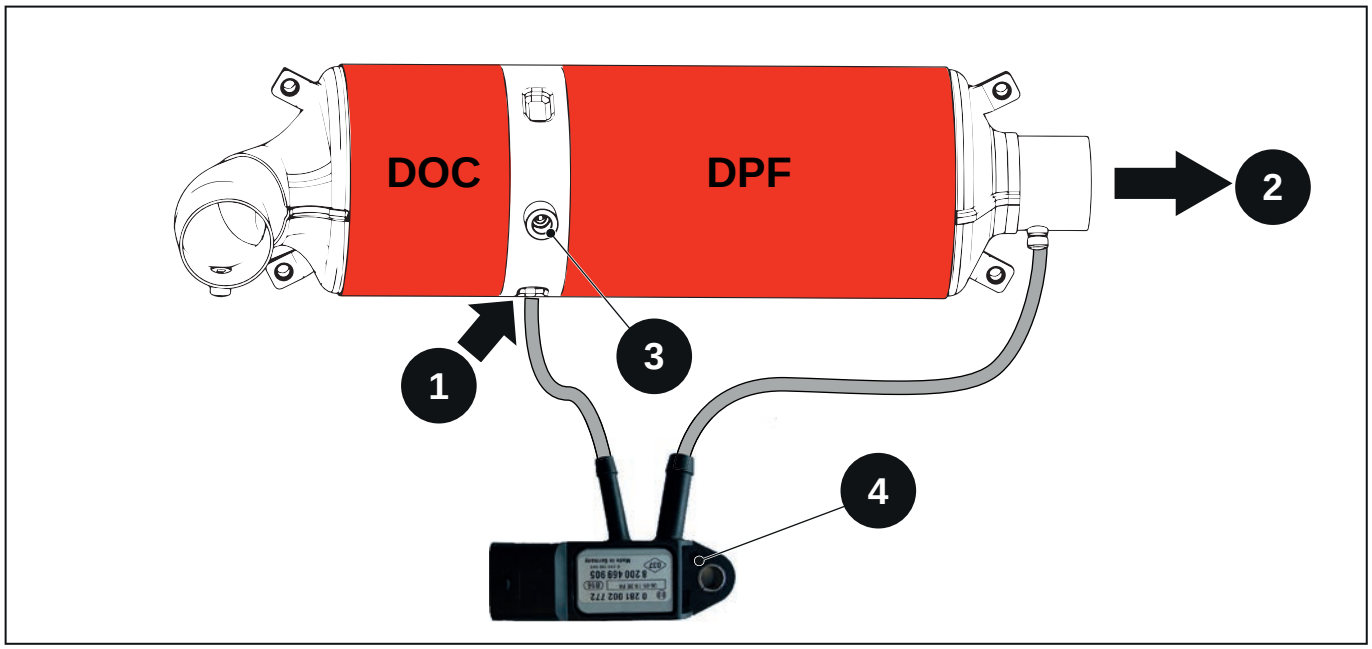

Fig. 2.46

1 - Exhaust In
2 - Exhaust out
3 - Exhaust gas temperature sensor
4 - Exhaust differential pressure sensor (Delta P)

Warning
The DPF filter is not an inspectable component.

Control strategies/signals from engine control unit for DPF diesel particulate filter regeneration:

- Physical model / map in engine control unit for determining particulate map (DPF filter DeltaP - differential pressure - sensor)
- Engine operating time 75 h

Regeneration target:

- DOC inlet side temperature > 300°C
- DPF inlet side temperature = 630°C

Regeneration time:

- 10-25 minutes if cycle is launched in accordance with physical model in engine ECU for determining particulate mass
- 15 minutes if cycle is launched in accordance with engine operating time intervals

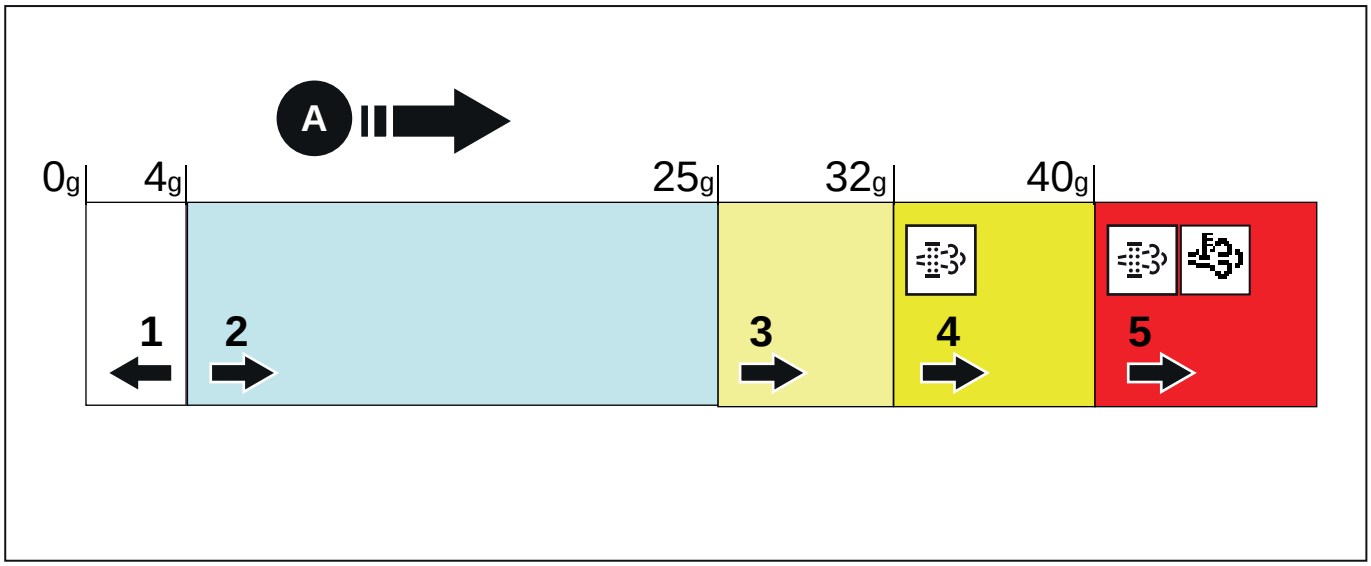

Fig. 2.47

- A- Particulate mass (g)
- 1- Regeneration
  - DPF indicator lamp off
- 2- Particulate model
- 3- Request for DPF regeneration
- 4- DPF indicator lamp on
  - drive the vehicle to permit regeneration
  - Manually launched service regeneration cycle
- 5- P242F- max accumulation
  - Engine warning lamp on
  - Performance limiting
  - Service regeneration launched from diagnostic tool

DPF filter regeneration - DPF filter regeneration request threshold value: 25g

DPF indicator lamp - indicator lamp on threshold value: 32g

- continuous engine operating time at idle speed: regeneration cannot be completed.
- The DPF indicator lamp lights to prompt the operator to drive the vehicle at medium/high engine load (75-100 %) to permit regeneration, and extinguishes once this is no longer required.

Regeneration may also be launched with the following manual method (in the case of a manually launched service regeneration cycle): Manual service regeneration cycle button.

Max. permissible particulate level - threshold value: 40g

- In this case, the DPF has reached the maximum permissible particulate content and, in the majority of cases, only service regeneration is permitted: Service regeneration launched from diagnostic tool

2.12.1 Manually launched service regeneration cycle

Purpose

when the DPF indicator lamp illuminates, the operator must drive the vehicle at medium/high engine load (75-100 %) to permit regeneration.

Alternatively, regeneration may be launched manually by pressing a specific button in the vehicle. The constructor of the vehicle is responsible for including this button.

Manually launched service regeneration cycle - Procedure:

- engine coolant temperature > 65°C
- stop the vehicle in a safe location, with the engine running at idle speed: make sure that there is no flammable material (e.g. dry leaves, bushes) underneath or near the vehicle
- engage the parking brake
- press and hold the manual service regeneration button for 3 seconds. Engine speed increases to 2000 rpm. The regeneration cycle lasts approximately 20-30 minutes. Engine speed returns to normal idle speed once the cycle is complete
- The procedure MUST be performed under the constant supervision of the operator
- Once the regeneration cycle is complete, the vehicle may be used as normal
- If the button is kept pressed for more than 2 minutes or in the event of a short circuit, the system generates a specific error code, stops the regeneration cycle and disables the button itself.

2.13 Removal and installation

2.13.1 Engine lifting lugs

Attach a hoisting device as shown in the figure.

Loosen the screws (A) and remove the mounts (B).

Carry the engine to the installation area.

More information is available in the engine use and maintenance manual.

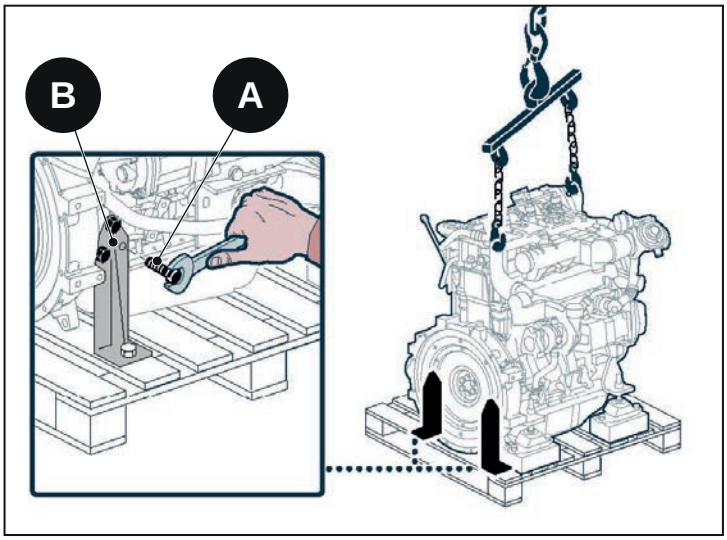

Fig. 2.48

A- front hoisting lug - screws (front side)

screw (A): 27.5 N·m

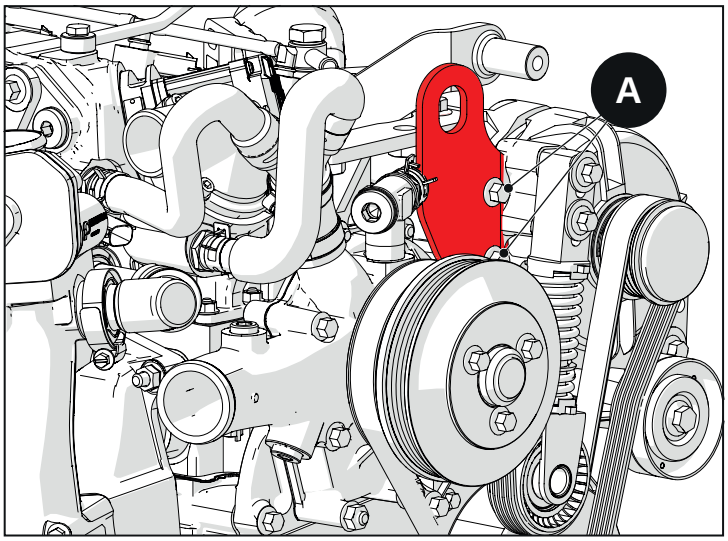

Fig. 2.49

B- rear hoisting lug (rear side)

see procedure for tightening exhaust manifold fasteners

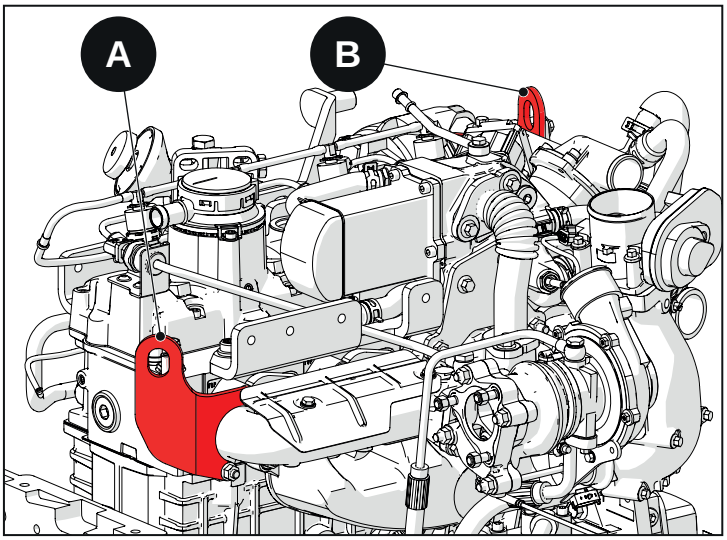

Fig. 2.50

2.14 Tightening torques

COMPONENT	N·m	SYSTEM
CENTRAL MAIN JOURNAL BEARING - SCREW	44,1	CRANKCASE
MAIN JOURNAL BEARING OIL DELIVERY FITTINGS	53,9	CRANKCASE
CAMSHAFT FLANGE	27,5	CRANKCASE
PISTON COOLING OIL JET VALVE - SCREW	12,7	CRANKCASE
IDLER GEAR (BETWEEN CRANKSHAFT AND CAMSHAFT) - SCREW	32,4	TIMING SIDE
IDLER GEAR (BETWEEN CAMSHAFT AND INJECTION PUMP) - SCREW	SEE PROCEDURE	TIMING SIDE
OIL PUMP - SCREW	27,5	TIMING SIDE
WATER PUMP - SCREW	32,4	TIMING SIDE
FRONT CRANKSHAFT HUB	SEE PROCEDURE	TIMING SIDE
FRONT CRANKSHAFT PULLEY - SCREW	45,1	TIMING SIDE
RAIL - SCREW	SEE PROCEDURE	INJECTION SIDE
RAIL MOUNTING BRACKET - SCREW	SEE PROCEDURE	INJECTION SIDE
INJECTOR - CLAMP SCREW	SEE PROCEDURE	INJECTION SIDE
HIGH PRESSURE INJECTION PUMP - NUT	27,5	INJECTION SIDE
HIGH PRESSURE INJECTION PUMP GEAR - NUT	86,3	INJECTION SIDE
ENGINE OIL EXCHANGER (INSTALLED ON HEAT EXCHANGER CASING) - BOLT	60.1	INJECTION SIDE
OIL FILTER MOUNT - BOLT	39,2	INJECTION SIDE
WATER MANIFOLD - SCREW	11,8	INJECTION SIDE
ROCKER LUBRICATION PIPE - FITTING ON HEAD	14	INJECTION SIDE
ROCKER LUBRICATION PIPE - FITTING ON CRANKSHAFT	23,5	INJECTION SIDE
EXHAUST MANIFOLD - NUT	SEE PROCEDURE	EXHAUST SIDE
INTAKE MANIFOLD - NUT	SEE PROCEDURE	EXHAUST SIDE
TURBOCHARGER - NUT	32,4	EXHAUST SIDE
OIL DELIVERY PIPE TO TURBO - FITTING ON TURBO	24,5	EXHAUST SIDE
OIL DELIVERY PIPE TO TURBO - NUT ON CRANKCASE	32,4	EXHAUST SIDE

EGR HEAT EXCHANGER (INSTALLED ON HEAT EXCHANGER CASING) - SCREW	14.7	EXHAUST SIDE
EGR HEAT EXCHANGER (INSTALLED ON CRANKCASE) - SCREW	32,4	EXHAUST SIDE
EGR HEAT EXCHANGER CASING (INSTALLED ON EXHAUST MANIFOLD) - NUT	32,4	EXHAUST SIDE
EGR UNIT AND INTAKE THROTTLE VALVE - SCREW	10,8	EXHAUST SIDE
EGR VALVE (R754IE4-TE4-ISE4)	13.7	EXHAUST SIDE
EGR UNIT AND INTAKE THROTTLE VALVE ELBOW UNION - SCREW	10,8	EXHAUST SIDE
VACUUM PUMP OIL DELIVERY FITTING (ON CRANKCASE)	27,5	ELECTRICAL SYSTEM SIDE
ALTERNATOR - NUT	45,1	ELECTRICAL SYSTEM SIDE
ALTERNATOR PULLEY (IDLER)	80 ± 5	ELECTRICAL SYSTEM SIDE
STARTER MOTOR - SCREW	83,4	ELECTRICAL SYSTEM SIDE
VACUUM PUMP OIL DELIVERY FITTING (ON VACUUM PUMP)	27,5	ELECTRICAL SYSTEM SIDE
REAR MOUNT - NUT	24,5	FLYWHEEL SIDE
FLYWHEEL HOUSING - SCREW	68,6	FLYWHEEL SIDE
FLYWHEEL	SEE PROCEDURE	FLYWHEEL SIDE
OIL FILTER	12,7	MAINTENANCE
CONNECTING ROD - SCREW	SEE PROCEDURE	BASE ENGINE
HEAD	SEE PROCEDURE	BASE ENGINE
ROCKER - NUT	29	BASE ENGINE
GLOW PLUG OR PLUG INSTALLED ON HEAD	14,2	BASE ENGINE
ALTERNATOR BRACKET - SCREW	68,6	REMOVAL AND INSTALLATION
FRONT HOISTING LUG (INSTALLED ON ALTERNATOR BRACKET)	27,5	REMOVAL AND INSTALLATION
REAR HOISTING LUG (INSTALLED ON EXHAUST MANIFOLD)	SEE PROCEDURE	EXHAUST SIDE

2.15 Wiring harness connector kit

	33002164
engine control unit	O
differential pressure sensor	O
EGR/TVA valve vacuum modulator	/
electrical power feed for TVA valve	O
electrical power feed for EGR valve	O
fuel temperature sensor	O
fuel heater	O
alternator	/
water in fuel sensor	O
EGR/TVA control signal output	/
diagnostic EOBD	O
foot throttle pedal	O
exhaust gas temperature sensor (pre-DPF)	/
exhaust gas temperature sensor (pre-DOC)	/
DPF exhaust gas temperature sensor	O
T3 exhaust gas temperature sensor (exhaust manifold)	/
exhaust gas pressure sensor	/
EGR cooler outlet side exhaust gas temperature sensor	/
LAMBDA probe	/
ambient temperature sensor	/
flow meter	/
CAN-BUS for SCR system	/
TENNECO DCU box (14 pin)	/
urea level and temp. sensor	/
SCR inlet side temperature sensor	/
DOC inlet side NOx sensor	/
DOC outlet side NOx sensor	/
urea injector	/
heated lines	/
urea tank heater	/
Tenneco ACU (62 pin)	/

O - Present
/ - Not present

2.16 Timing side

2.16.1 Overall views

Timing side

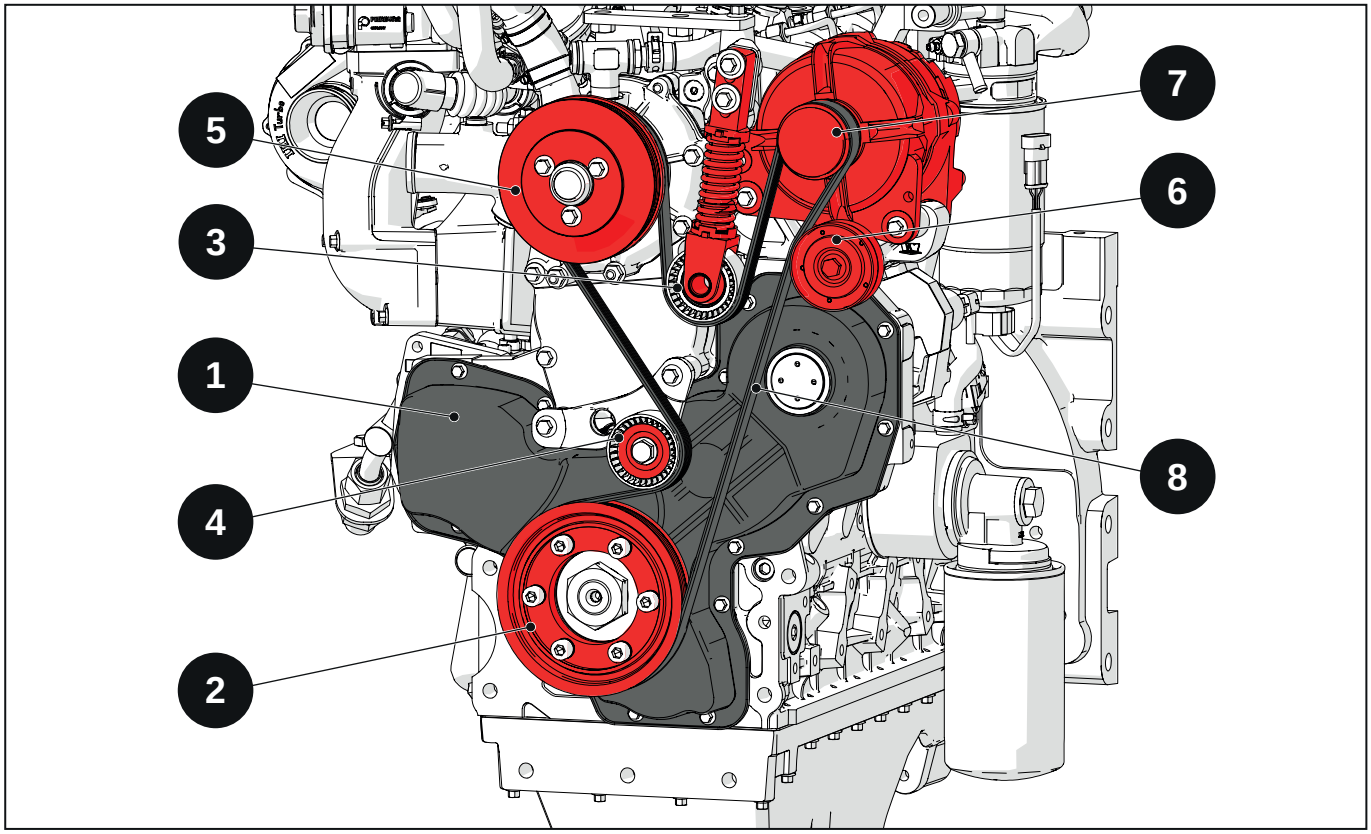

Fig. 2.51

1 - Timing cover (metal)
2 - Crankshaft pulley
3 - Automatic tensioner
4 - Plastic idler pulley
5 - Water pump pulley
6 - Metal idler pulley
7 - Alternator
8 - Alternator Poly-V belt

Timing gears

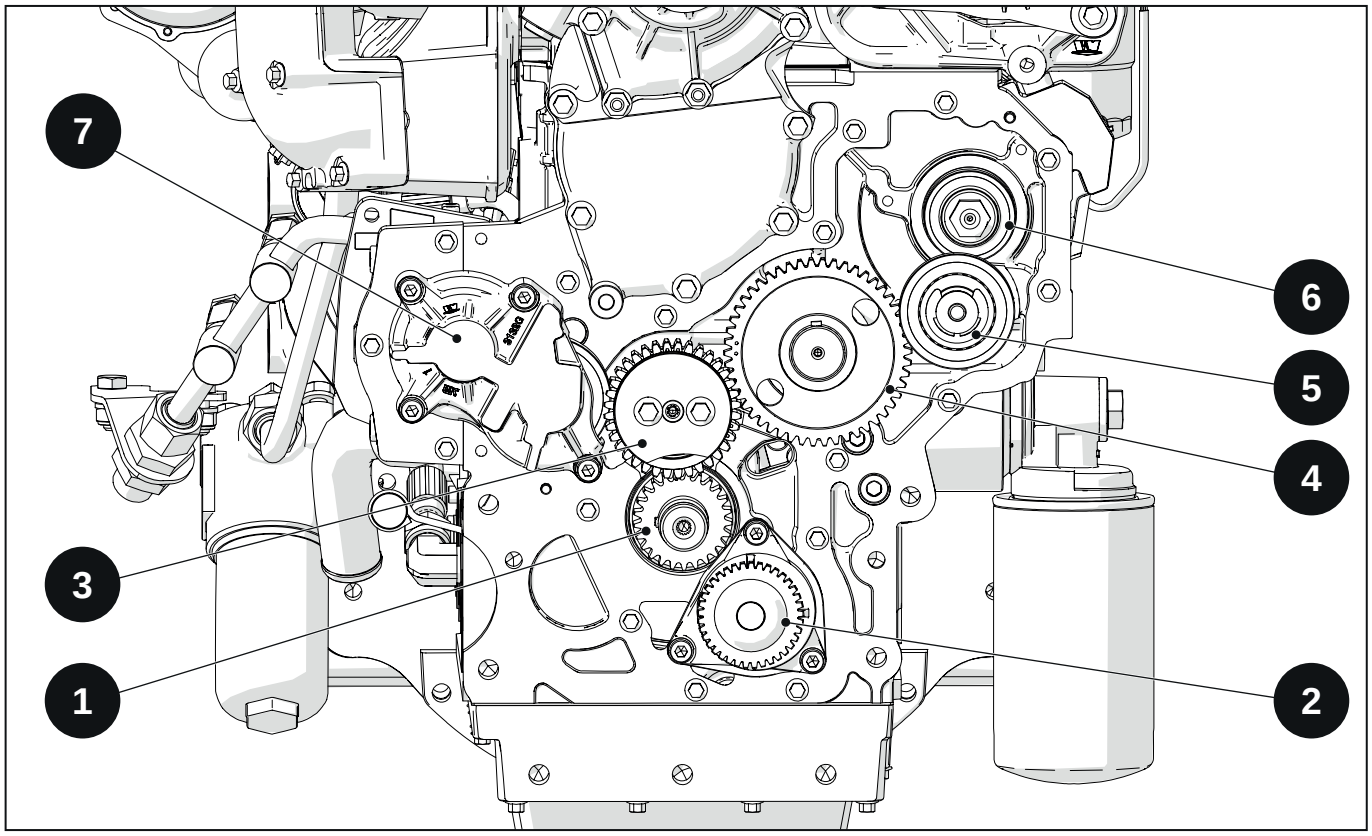

Fig. 2.52

1 - Crankshaft gear
2 - Oil pump
3 - Idler
4 - Camshaft gear
5 - Idler
6 - Injection pump gear
7 - Hydraulic pump

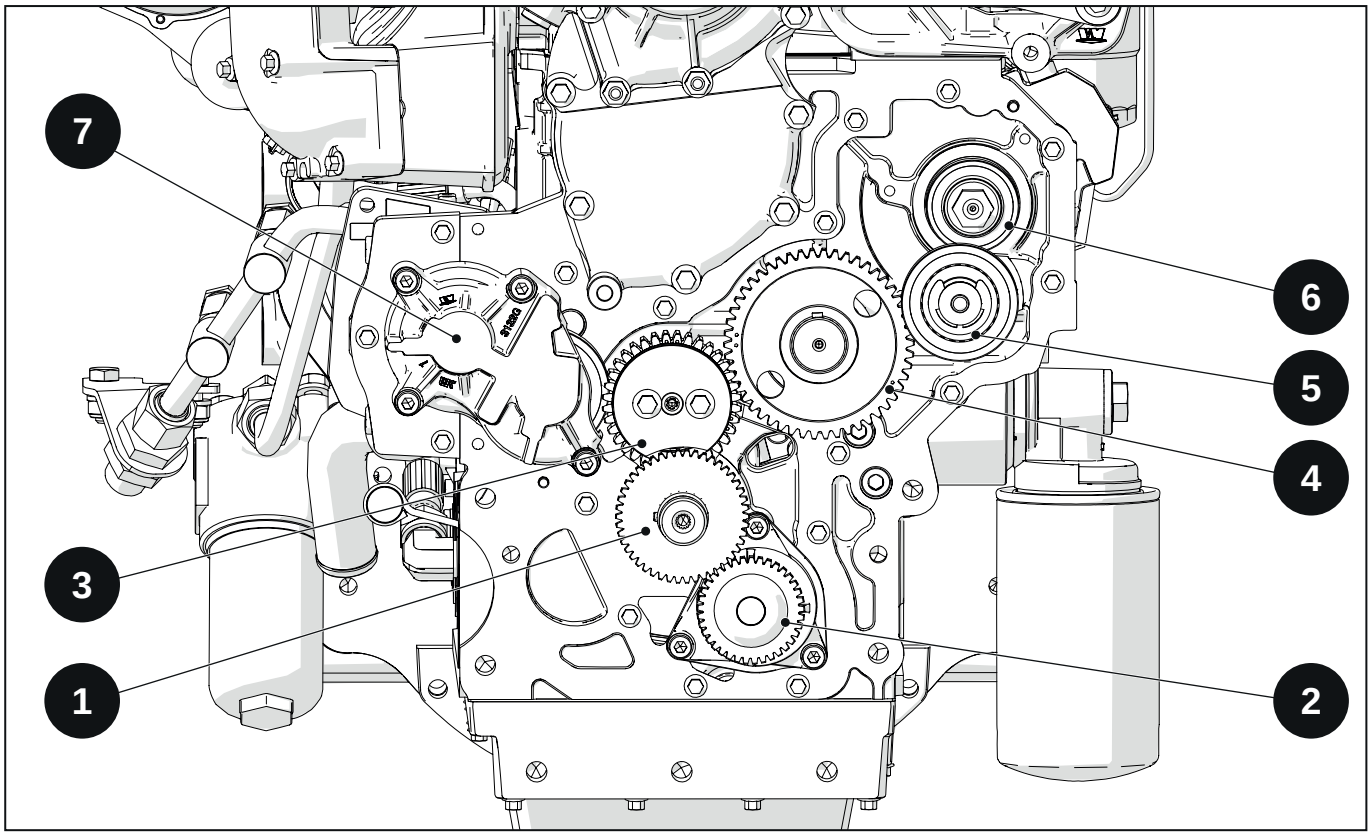

Fig. 2.53

1 - Oil pump drive gear (crankshaft gear not visible)
2 - Oil pump
3 - Idler
4 - Camshaft gear
5 - Idler
6 - Injection pump gear
7 - Hydraulic pump

Timing gears aligned with piston 1 at TDC on ignition stroke

1 - Hydraulic pump gear
2 - Idler
3 - Crankshaft gear
4 - Camshaft gear
5 - Reference markings

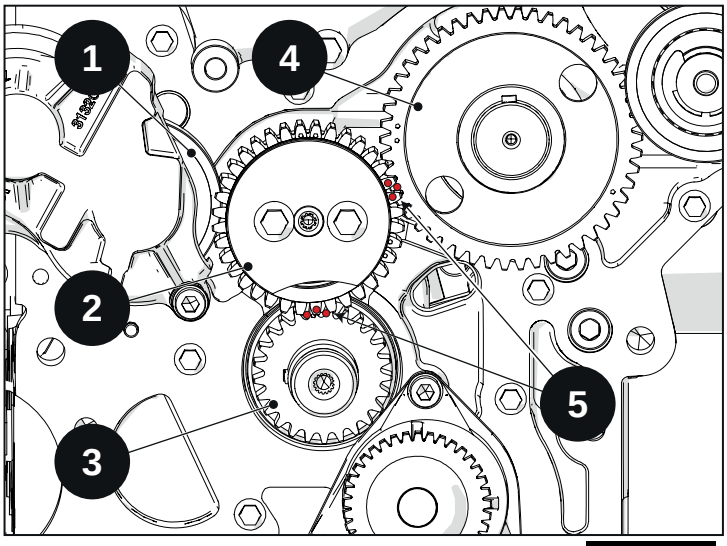

Fig. 2.54

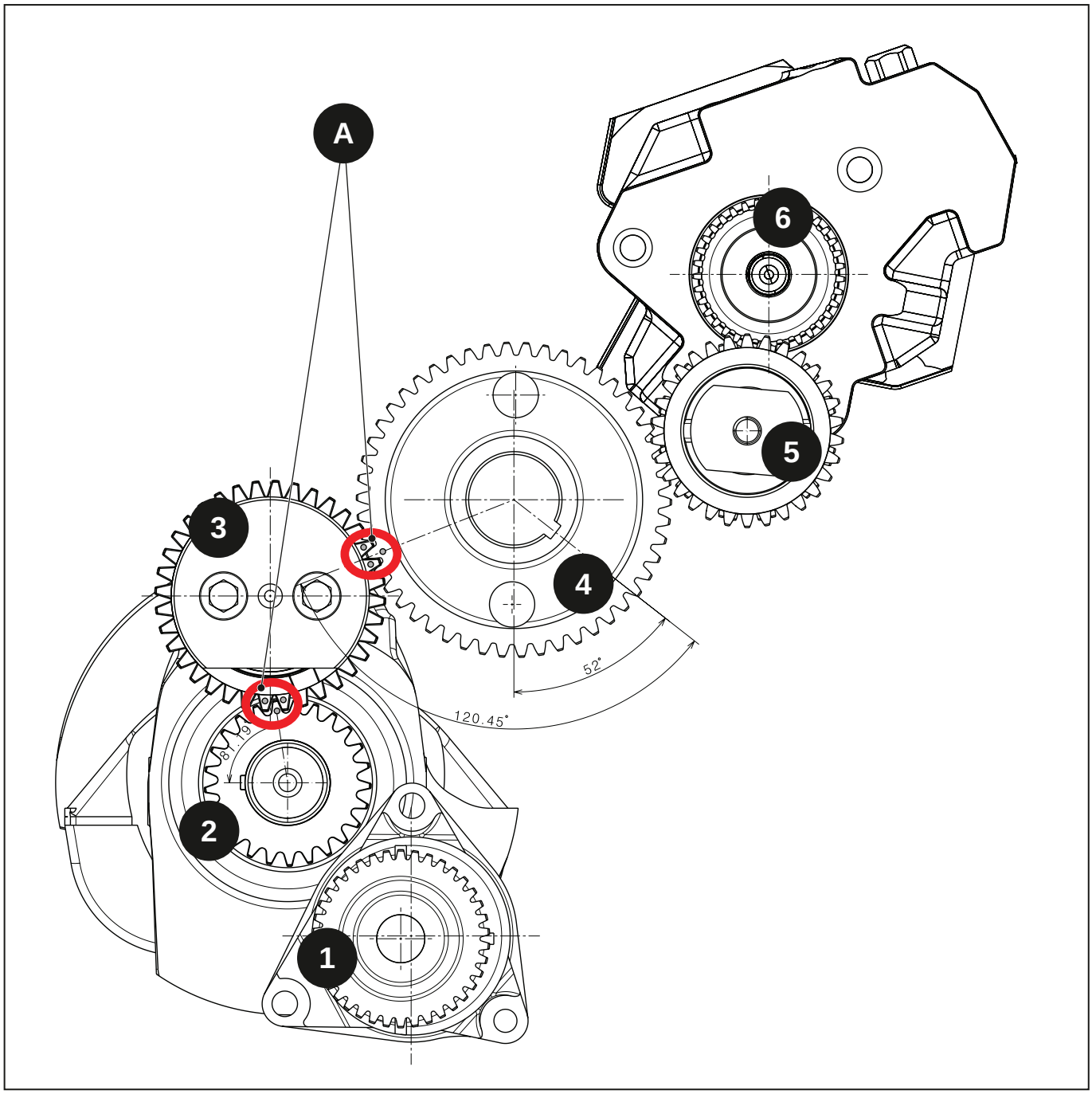

Fig. 2.55

A - timing reference markers - dots punched onto gears
1 - Oil pump gear
2 - Crankshaft gear
3 - Idler gear
4 - Camshaft gear
5 - Idler gear
6 - High pressure injection pump gear

2.17 Oil pump

2.17.1 Removal

Remove the oil pump drive gear

Remove the 3 screws together with the gaskets (note the positions of the screws).

A - Oil pump drive gear
B - oil pump and respective gear
C - screws with gaskets

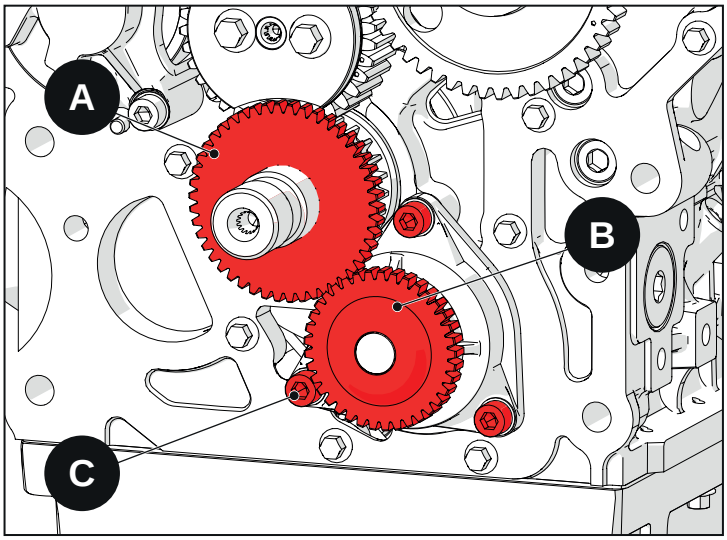

Fig. 2.56

2.17.2 Cleaning

1 - Dismantle all parts and clean with solvent.

2 - Place the parts on a surface and dry with compressed air.

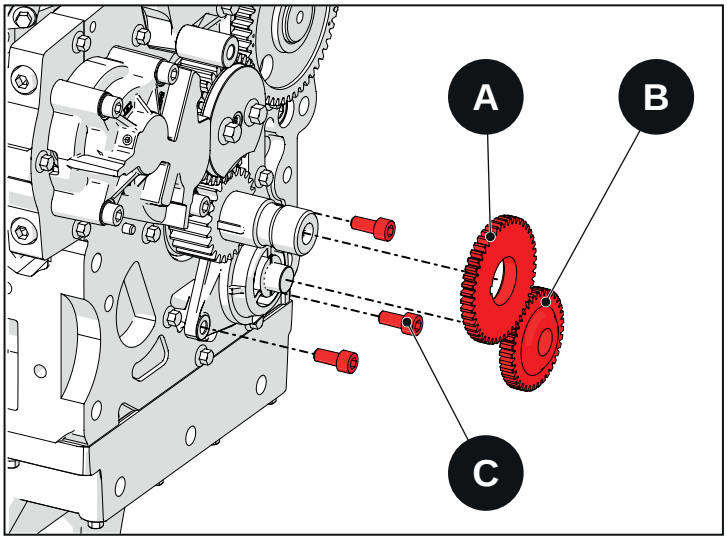

Fig. 2.57

2.17.3 Inspection

1 - Inspect the pump shaft, the rotors and the pump casing to check for excessive wear or damage. Replace the complete oil pump if damaged or excessively worn.

2 - Measure the clearance between the internal rotor and the external rotor.

3 - Measure the clearance between the external rotor and the casing.

4 - Measure the recession of the external rotor relative to the internal rotor (recession of external rotor relative to pump casing)

5 - If the values measured exceed the specified limits, the complete pump unit must be replaced.

6 - Check the fastening torque between the rotor and the gear.

2.17.4 Specifications

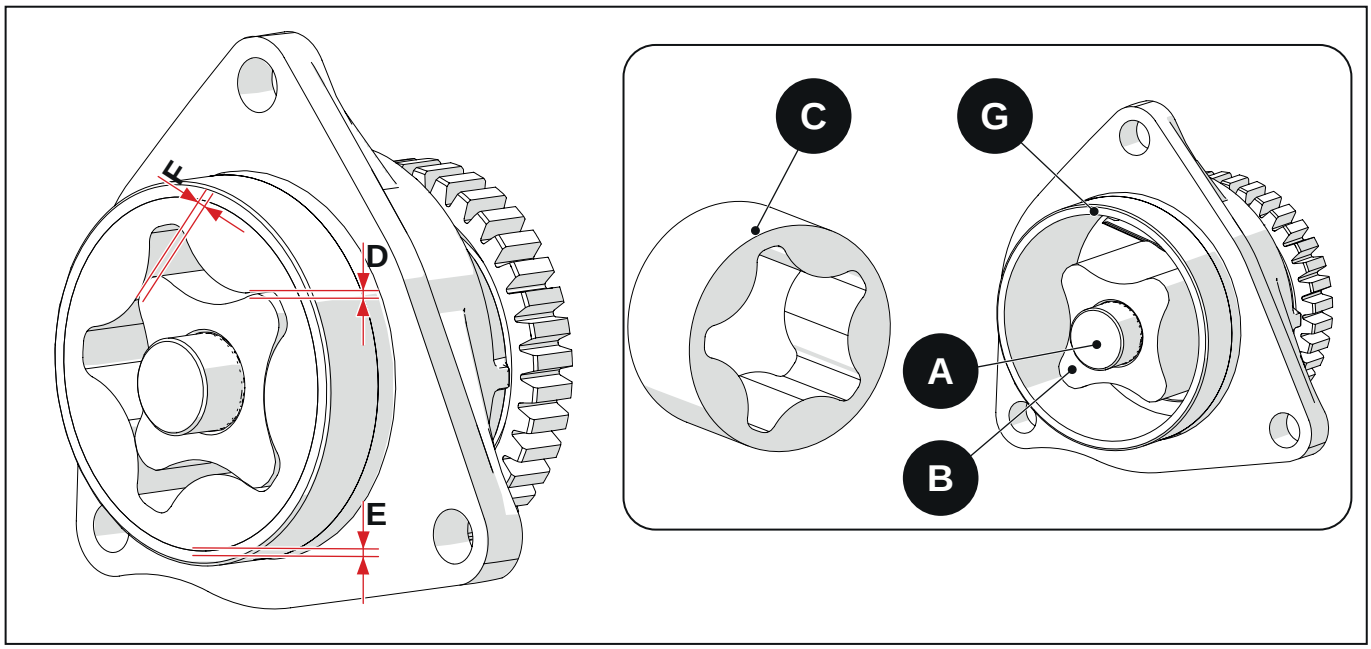

Fig. 2.58

A - Shaft
B - Internal rotor
C - External rotor
D - Clearance between rotors (see external rotor)
E - Clearance between casing and external rotor (see oil pump casing)
F - Recession of external rotor relative to internal rotor (recession of external rotor relative to pump casing - see figure below)
G - Oil pump casing

1 - Oil pump gear
2 - Housing
3 - External rotor
4 - Internal rotor
5 - Shaft

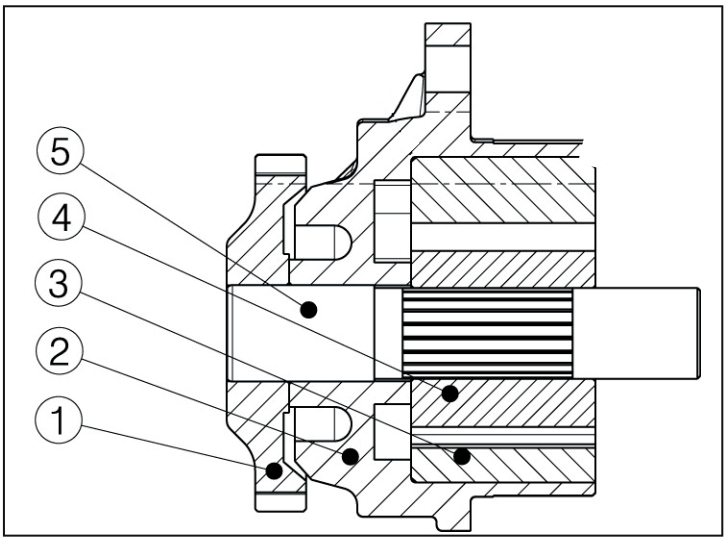

Fig. 2.59

Endfloat between gear and casing	0.150 - 0.250 mm
Fastening torque between rotor and gear	9 kg·m
Recession of the external rotor relative to the internal rotor	0.030 - 0.087 mm

2.17.5 External rotor

a	57.95 - 58 mm
b	49.3 - 49.4 mm
c- Clearance between rotors	0.07 - 0.20 mm
Rotor length	32.483 - 32.5 mm

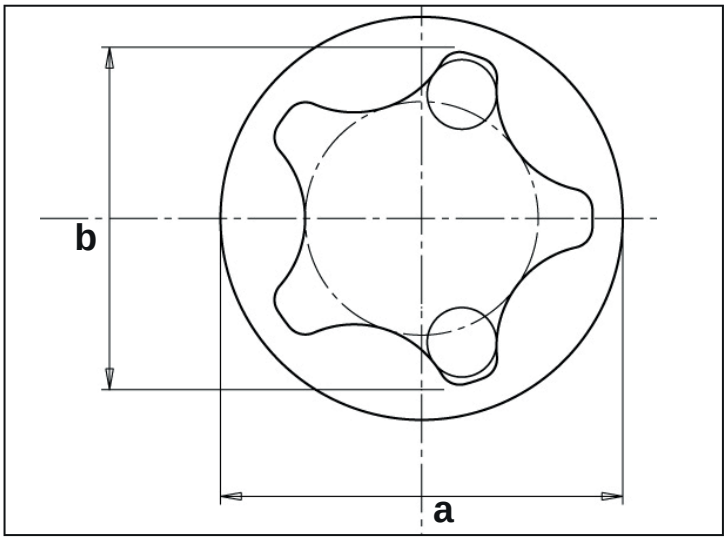

Fig. 2.60

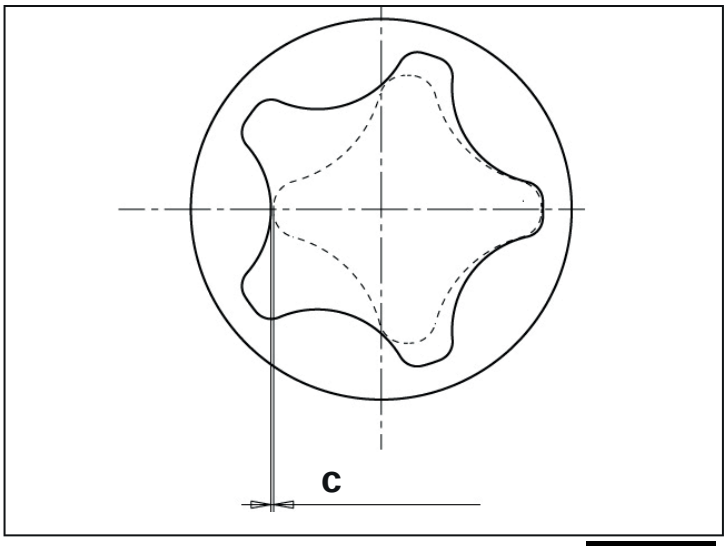

Fig. 2.61

2.17.6 Internal rotor

a	25.92 - 25.97 mm
b	41.12 - 41.15 mm
c	32.045 - 32.075 mm
Rotor length	32.483 - 32.5 mm

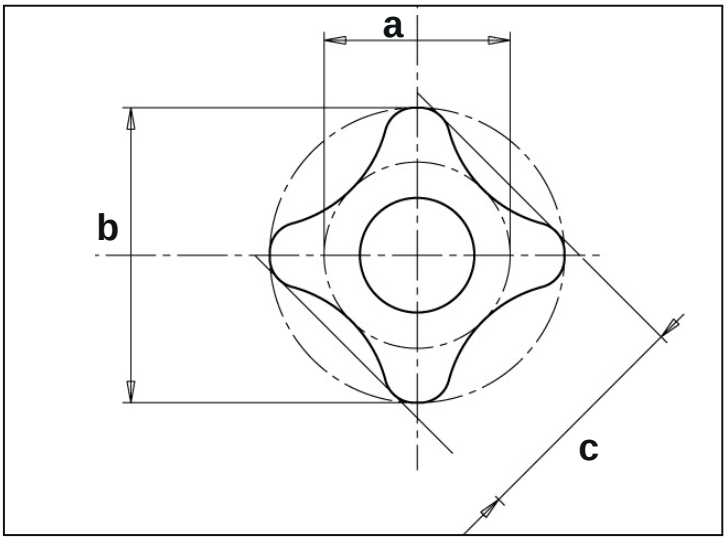

Fig. 2.62

2.17.7 Oil pump casing

a - Internal diameter of casing	58.13 - 58.18 mm
Clearance between casing and external rotor	0.13 - 0.23 mm
b - Depth of seat in casing	32.53 - 32.57 mm
c - depth	22.06 - 22.10 mm

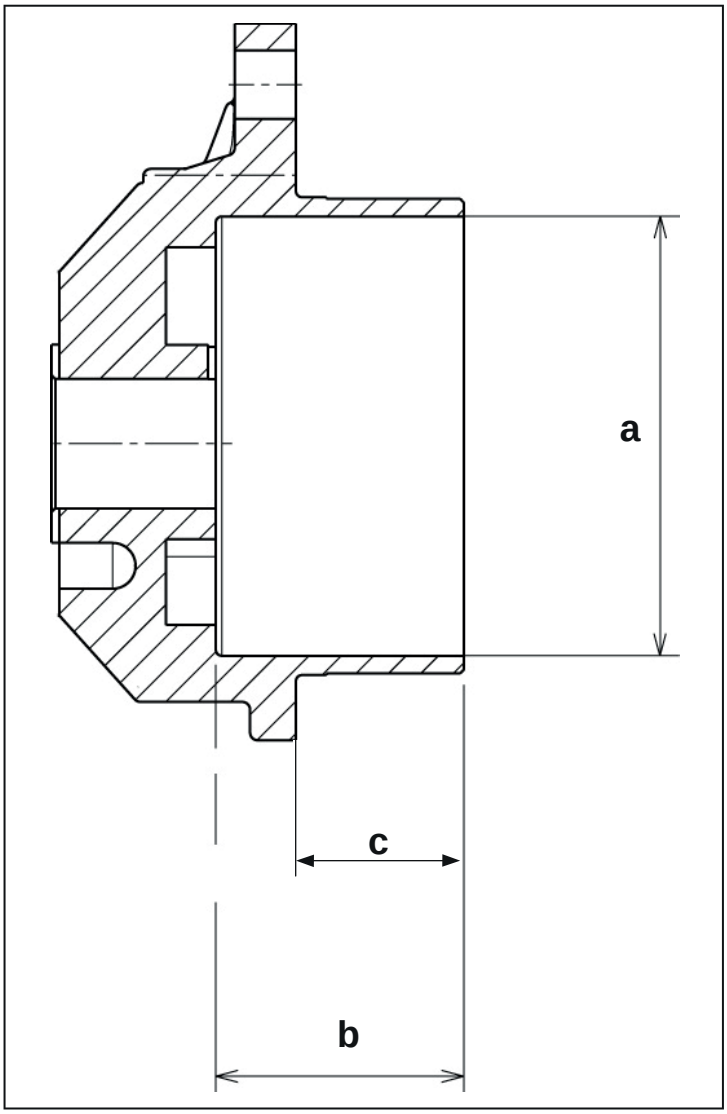

Fig. 2.63

2.17.8 Oil pump seat in crankcase

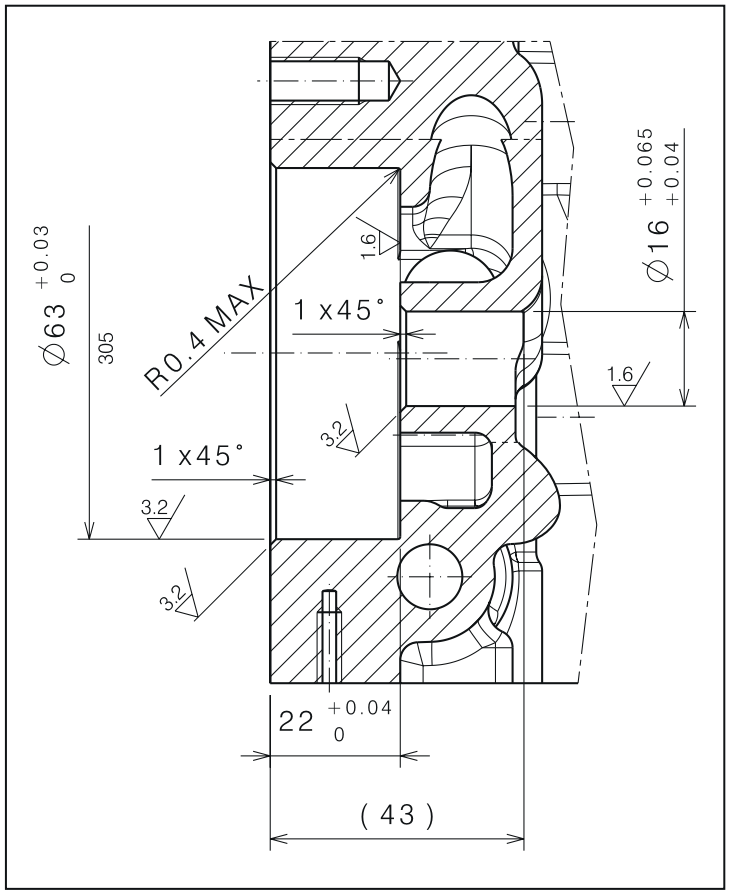

Fig. 2.64

2.17.9 Installation

- Lubricate the casing and the internal and external rotors with engine oil.
- Install the external rotor with the bevelled side facing towards the seat in the casing (interior).
- Install the pump in the cylinder block, fitting the 3 screws and washers into the holes on the pump.
- Tighten the 3 screws in a crossed pattern.

  Oil pump screws: 27.5 N·m

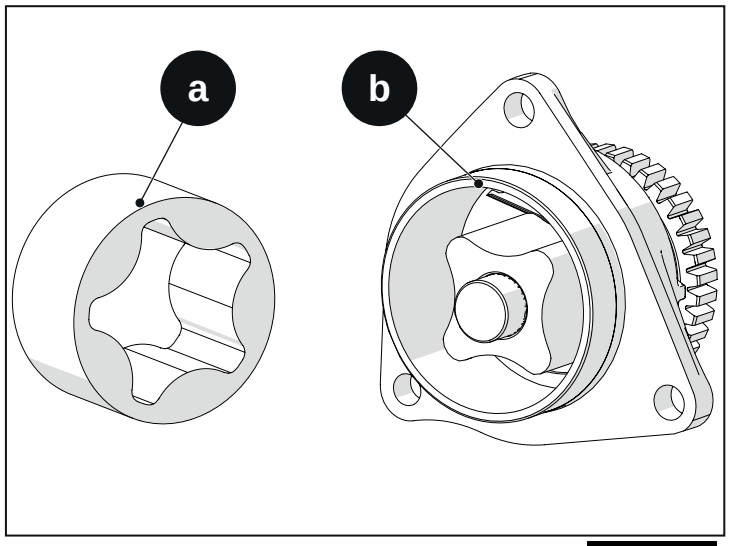

Fig. 2.65

1 - Install the oil pump drive gear, aligning the key seat in the gear with the key on the crankshaft, and with the side with the flange facing towards the crankshaft gear (inwards relative to engine). The flat surface must face outwards relative to the engine.

2 - Check that the oil pump gear is free to turn by checking that there is backlash between the teeth of the crankshaft gear and the teeth of the oil pump gear. Check that the parts have been installed correctly if there is no backlash between the teeth of the gears.

3 - Fit the timing cover.

4 - Complete assembly of the engine

5 - Start the engine and check the oil pressure and for oil leaks.

a - Bevelled side of rotor
b - Pump casing
c - Oil pump screws
d - Flanged side
e - Key seat

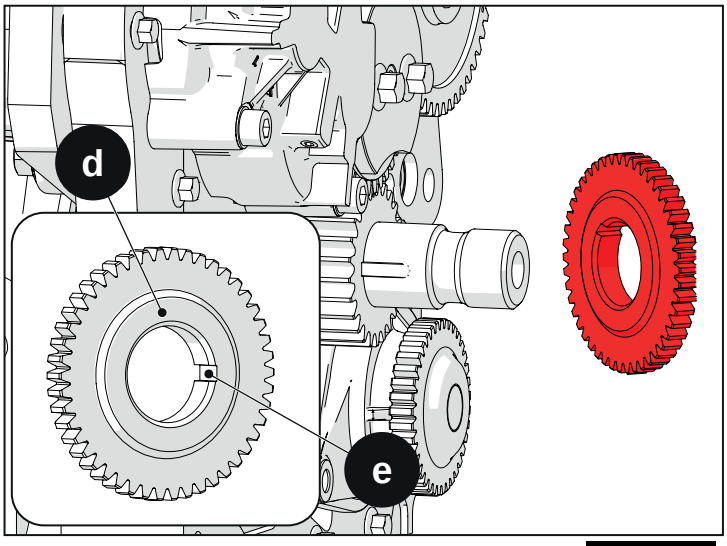

Fig. 2.66

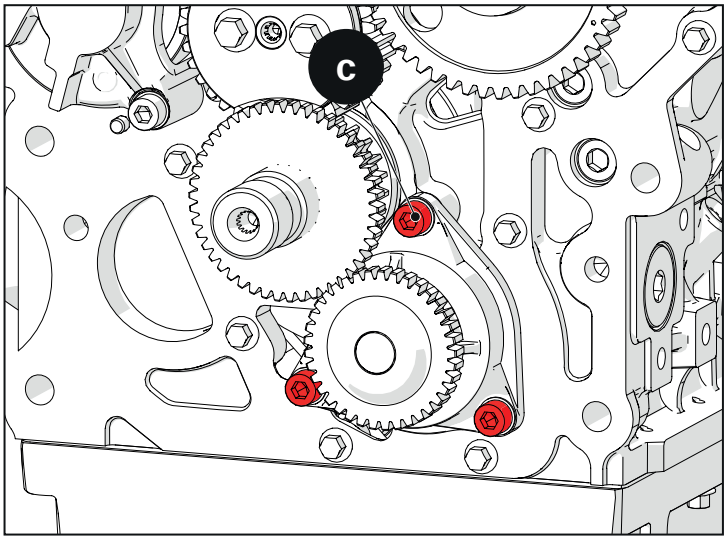

Fig. 2.67

2.18 Crankshaft gear

2.18.1 Removal

Note
Only replace the timing cover if it is damaged.

Before removing the gear, mark corresponding teeth on the gear itself and on the idler gear with a marker pen to facilitate synchronisation of the gears during reassembly

Remove the oil pump drive gear. Remove the oil pump and, if necessary, the idler gear.

Fit the puller tool onto the gear as shown in the photo. Tighten the 4 screws of the puller tool securely. Tighten the rod of the puller tool to remove the gear.

A - puller tool with 4 screws
B - crankshaft gear

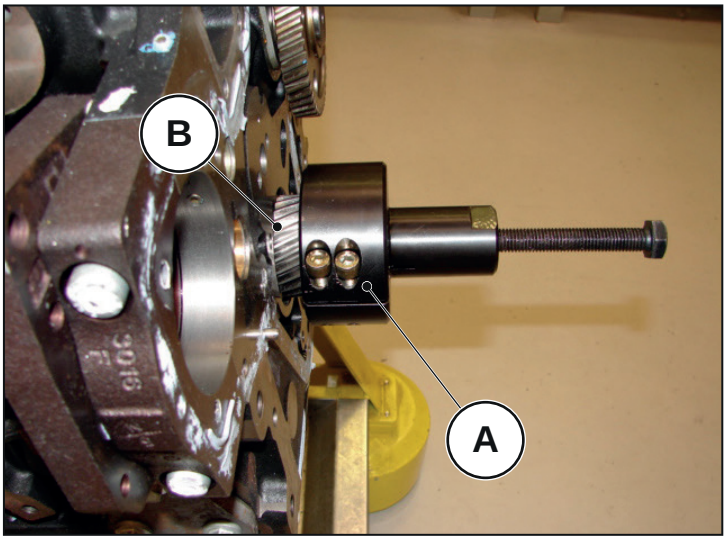

Fig. 2.68

2.18.2 Installation

Install the gear, aligning the seat key with the key on the shank of the crankshaft.

Copy the reference marking made previously on the replaced gear onto the new gear and align with the marking on the idler gear. If this is not possible, synchronise the crankshaft gear, idler gear and camshaft gear correctly (see “Timing gears aligned with piston 1 at TDC on ignition stroke”).

Note
Heat the crankshaft gear to 70°C and install on the crankshaft, pushing completely into its seat and holding in place for at least 10 seconds.

2.19 Hydraulic pump idler gear (between crankshaft and camshaft gears)

2.19.1 Removal

- Remove the 2 screws fastening the idler gear bush.
- Before removing the gear, make reference markings on all 3 gears (crankshaft, idler and camshaft gears), or align the 3 gears as shown in the photo, with the timing reference dots stamped onto each gear aligned correctly.
- Remove the bush and the idler gear together as a complete assembly.
- Separate the bush from the idler gear.

Note

TIMING GEARS ALIGNED WITH PISTON 1 AT TDC ON IGNITION STROKE

REFERENCE MARKERS ON GEARS COVERED WITH DOT OF WHITE MARKER INK APPLIED DURING ASSEMBLY.

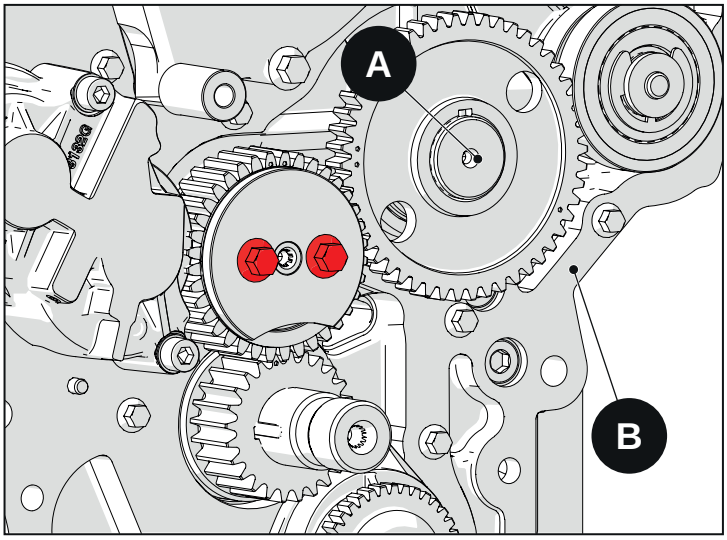

Fig. 2.69

A - idler gear bush
B - idler gear (assembly)
C - Idler gear fastener screws
D - reference markers aligned on crankshaft and idler gear (marks punched onto gears)
E - reference markers aligned on idler gear and camshaft gear (marks punched onto gears)
F - reference markers punched onto gears (facing outwards)

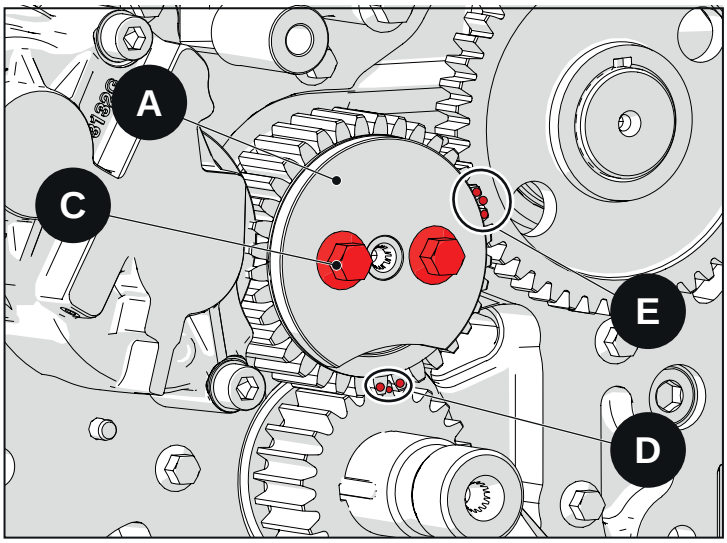

Fig. 2.70

2.19.2 Installation

- Lubricate the idler gear assembly (bearing, bush and shim C).
- Install the bush in the idler gear. Check that the bush rotates freely.
- Make sure that the reference markers on the gears are facing outwards and not inwards (towards centre of cylinder block).
- Install the idler gear assembly. Make sure that the punched markers on the adjacent gears (crankshaft and camshaft gears) are aligned correctly, or that the markings made previously are aligned correctly.
- To permit correct installation of the oil pump drive gear, the cut-out in the circumference of the bush must face towards the crankshaft gear.
- Ensure that the bevelled part C1 of the shim C faces towards the gear (inwards, towards the engine).
- Tighten the 2 fastener screws.

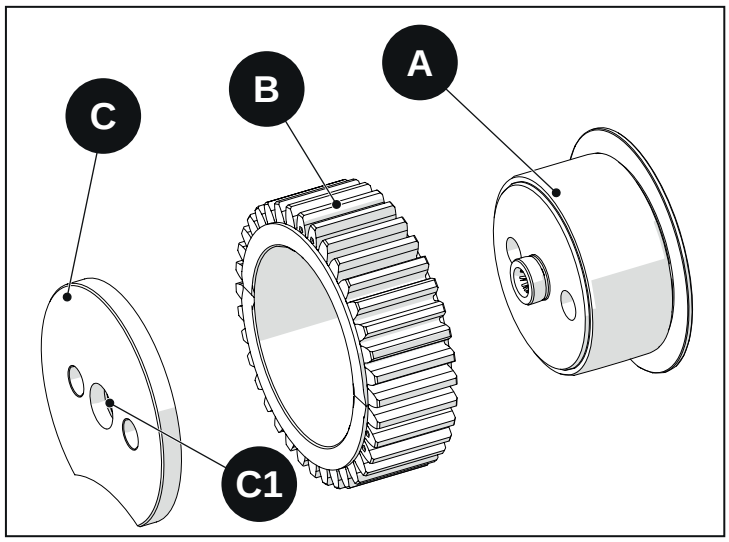

Fig. 2.71

x = idler gear fastener screws (32.4 N·m)

X - idler gear fastener screws
A - bush
B - idler gear
C - shim
C1 - bevelled part of shim

Specifications - old type

Internal diameter of bush	53.465 - 53.480 mm
Internal diameter of gear bearing	53.500 - 53.519 mm
Free play after initial assembly	0.02 - 0.054 mm
Wear limit	0.2 mm

Specifications - new type

Internal diameter of bush	53.445 - 53.475 mm
Internal diameter of gear bearing	53.500 - 53.519 mm
Free play after initial assembly	0.025 - 0.074 mm
Wear limit	0.2 mm

X - idler gear fastener screws
A - bush
B - idler gear
C - shim (on EU5 and EU6 engines)
C1 - bevelled part of shim (on EU5 and EU6 engines)
F - reference markers punched onto gear (facing outwards)
G - cut-out portion of bush circumference facing towards crankshaft gear.
H - oil pump drive gear

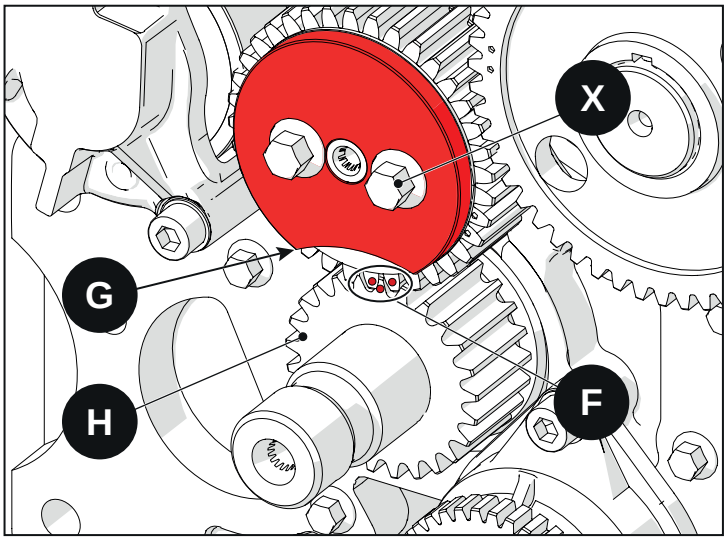

Fig. 2.72

2.20 high pressure pump idler gear (between camshaft gear and injection pump gear)

2.20.1 Removal

Remove the screw fastening the idler gear, situated underneath the injection pump.

A - Idler gear (between injection pump and camshaft gears)
B - Camshaft gear
C - Injection pump gear
D - High pressure injection pump
E - Idler gear fastener screw

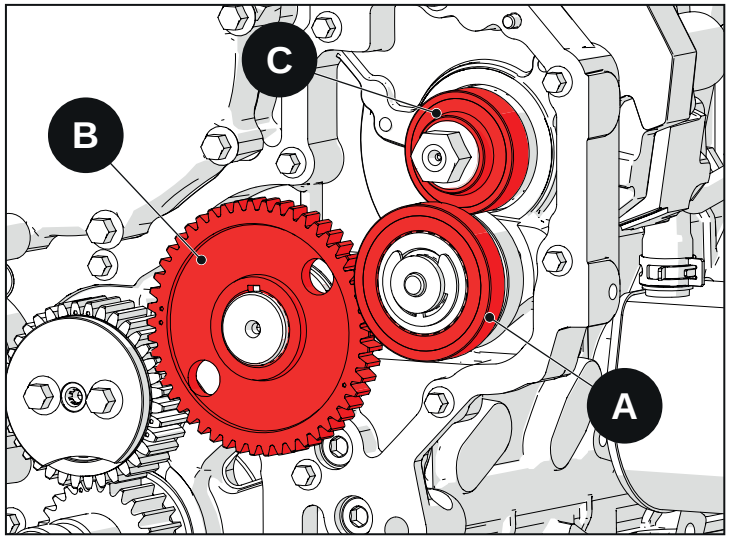

Fig. 2.73

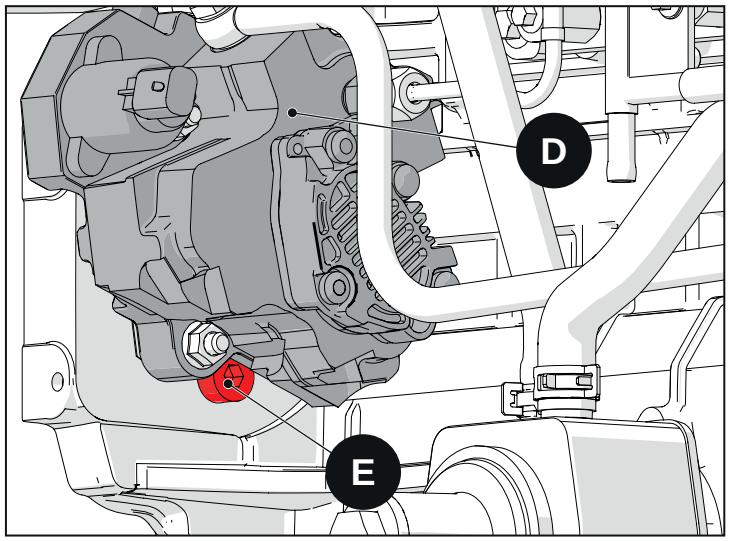

Fig. 2.74

2.20.2 Installation

Install the idler gear between camshaft and injection pump gears.

Note
The idler gear does NOT require synchronisation with the other gears.

Fit and hand-tighten the screw with a new O-ring, and lubricate with Molykote 111. Tighten the screw definitively with the following procedure:

Step 1 - tighten to	**35 N·m**
Loosen the screw by an angle between	**30 and 90°**
Step 2 - retighten to	**35 N·m**

F - O-ring
G - Idler gear fastener screw

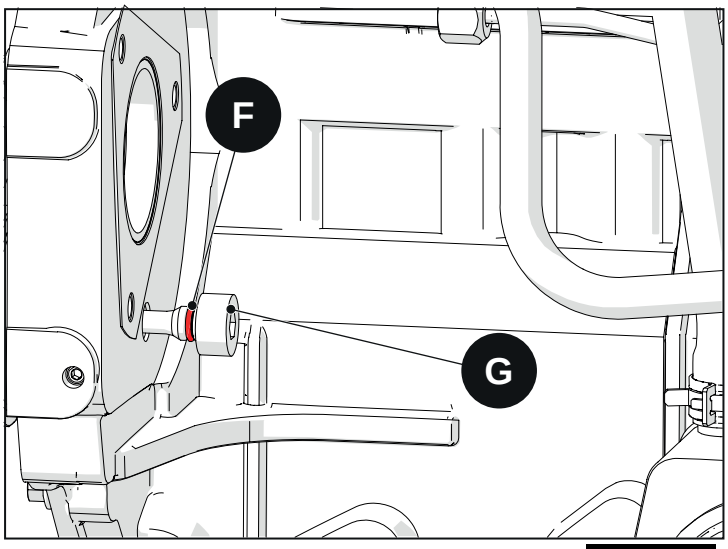

Fig. 2.75

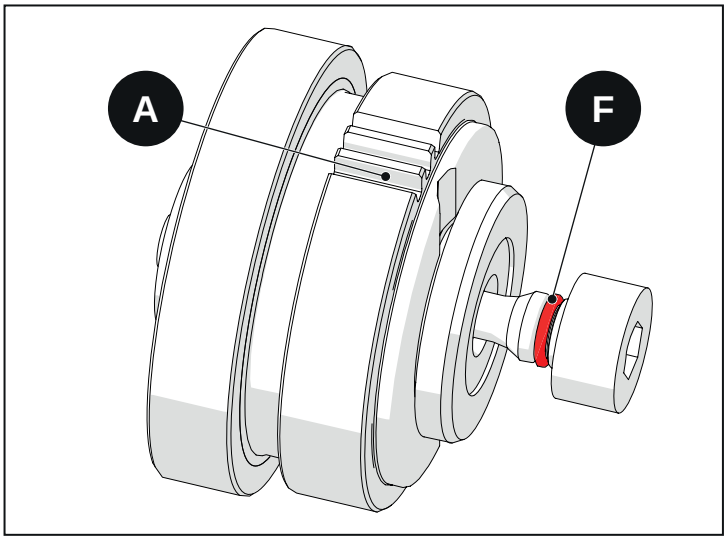

Fig. 2.76

2.21 Hydraulic pump gear

2.21.1 Removal

Loosen the rear screws and remove the rear flange.

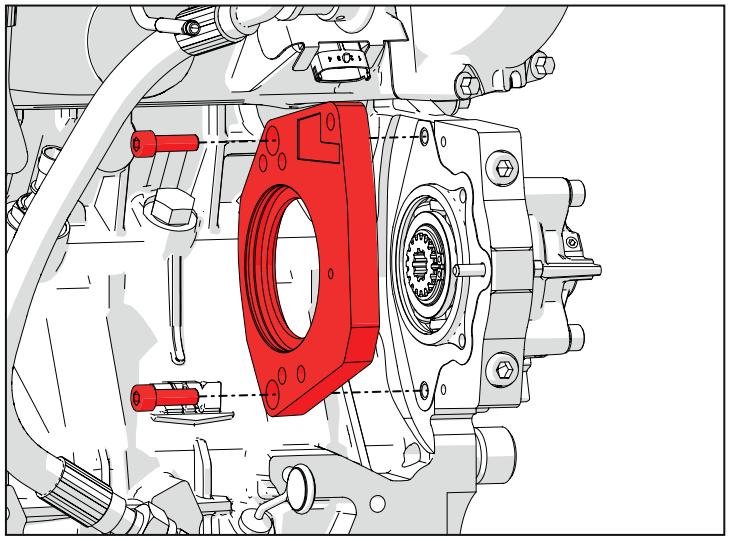

Fig. 2.77

Loosen the front screws and remove the cover.

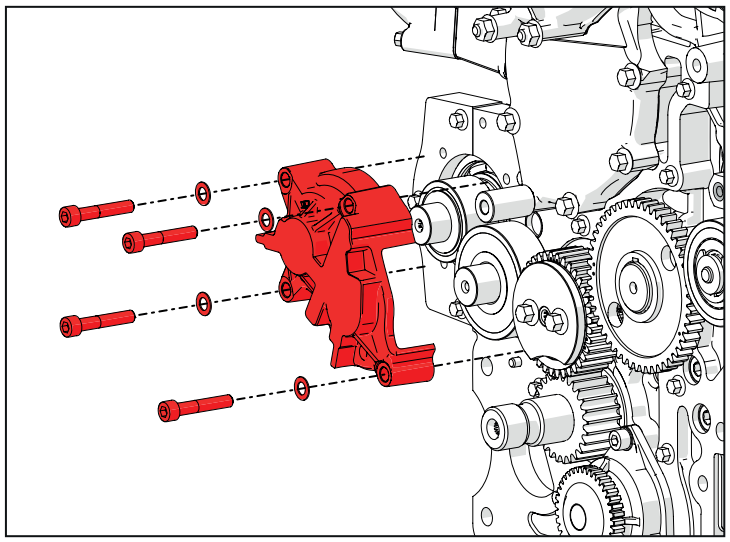

Fig. 2.78

Remove the complete hydraulic pump drive gear assembly (gear + ball bearing)

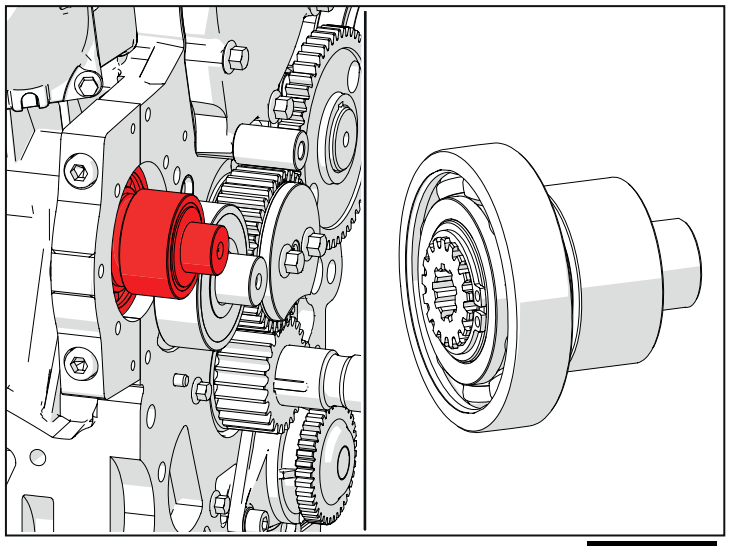

Fig. 2.79

Remove the hydraulic pump drive gear idler gear

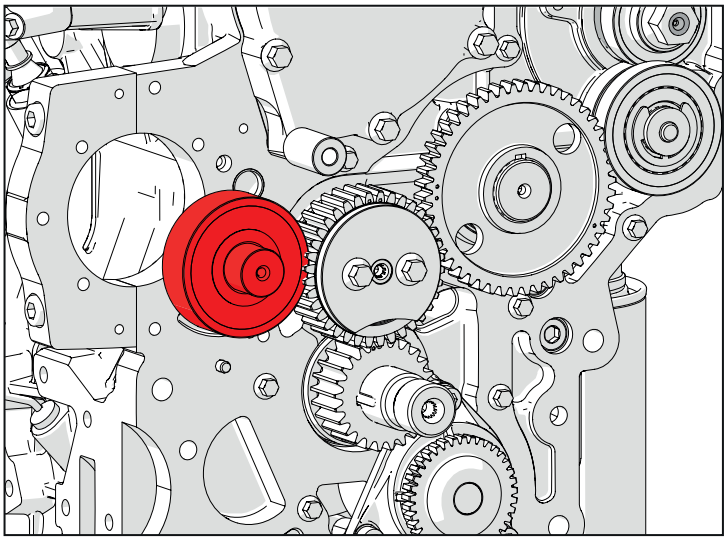

Fig. 2.80

2.21.2 Installation

- Install the idler on the crankcase.
- Oil the idler pin.
- The notch must face towards the crankcase.
  a - notch

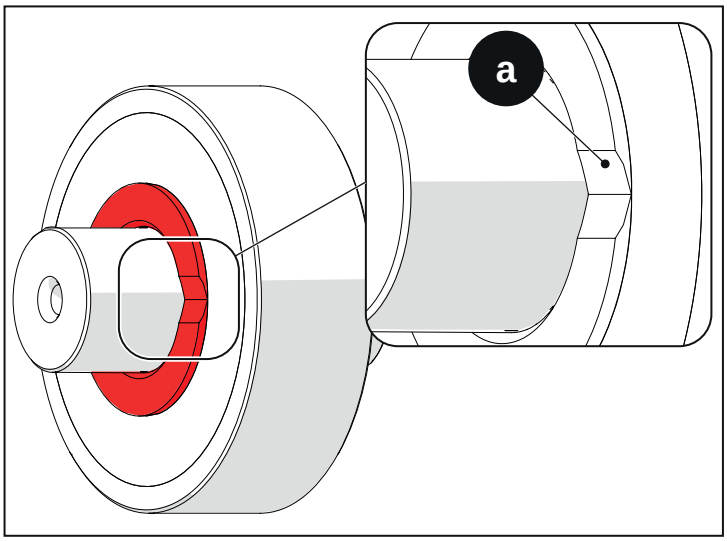

Fig. 2.81

- Install the complete hydraulic pump drive gear assembly (gear + ball bearing) on the crankcase.
- Oil the outer surface of the ball bearing.

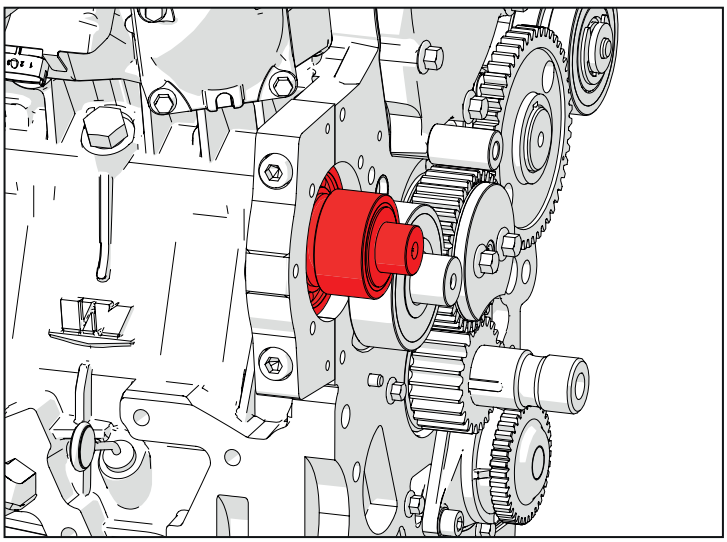

Fig. 2.82

- Install the cover, aligning the pins with the holes in the crankcase.
- Apply Loctite 572 to the threads of the screws and then tighten the screws.

Front cover fastener screw 24.5 N·m

a - pin
b - front cover fastener screws

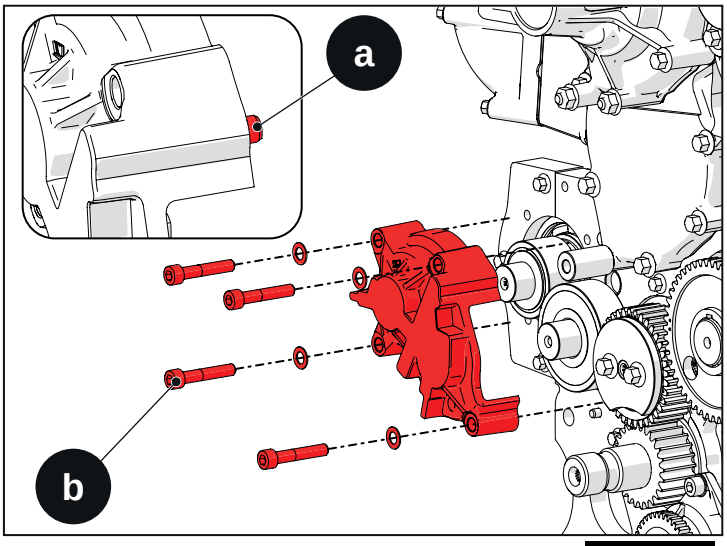

Fig. 2.83

- Install the rear flange
- Apply Loctite 572 to the threads of the screws and then tighten the screws.

rear flange screws 19.6 N·m

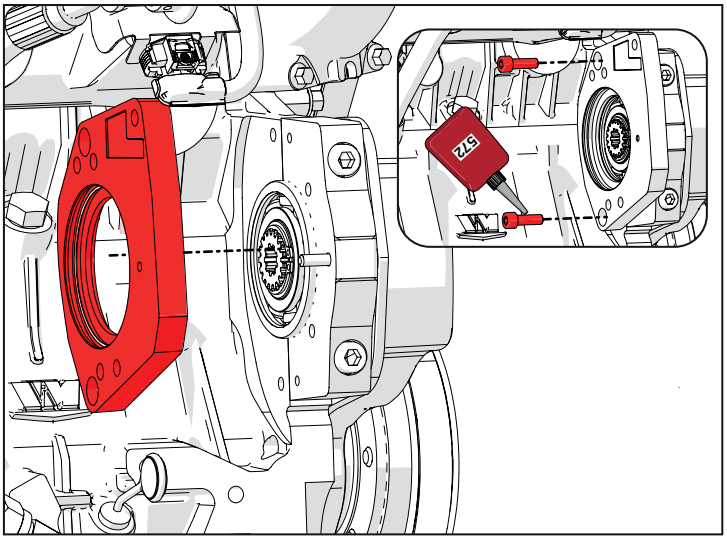

Fig. 2.84

Note

Fit the gasket with the cut side in the position shown in the figure

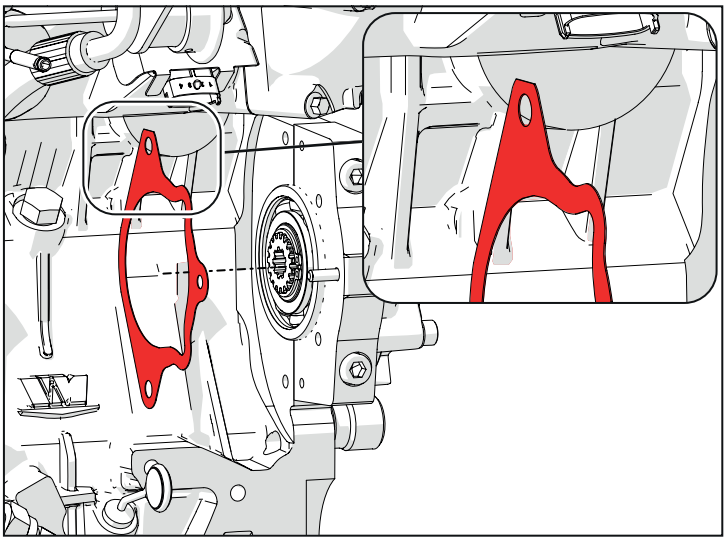

Fig. 2.85

2.22 Idler pulley

2.22.1 Removal

- Remove the alternator belt (see the section Alternator Belt)
- Remove the LH screw of the metal idler pulley.

A - metal pulley

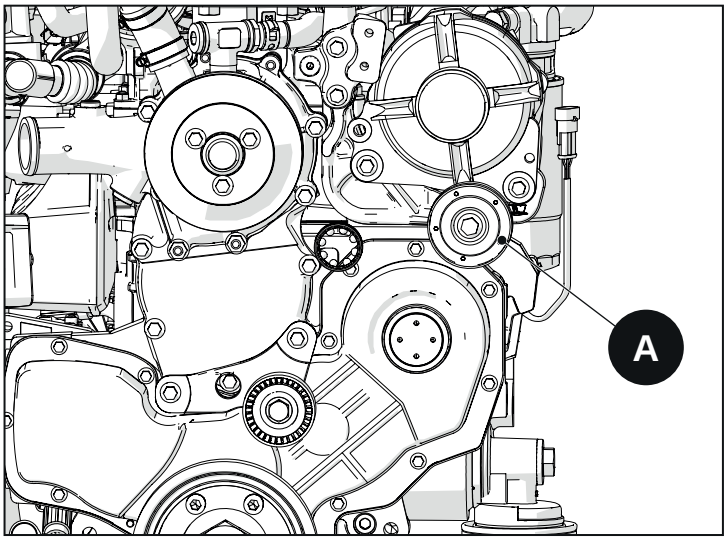

Fig. 2.86

2.22.2 Installation

- Fit and tighten the LH screw

C - Plastic pulley

LH screw of metal idler pulley 53 N·m

LH screw of idler pulley 53 N·m

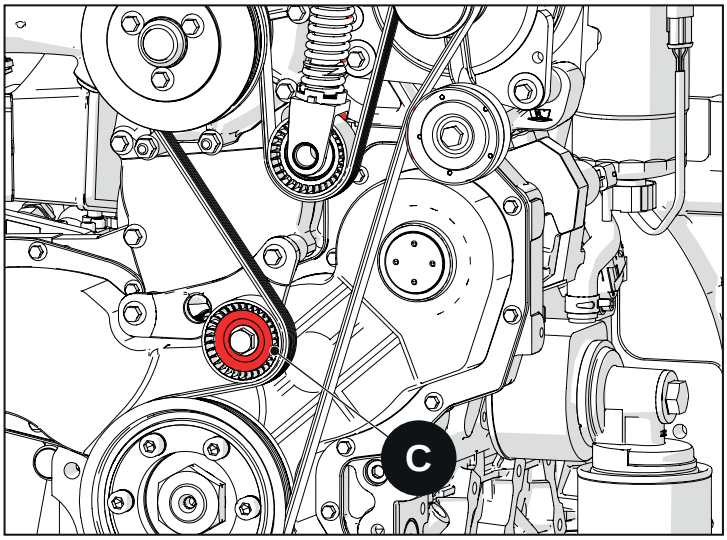

Fig. 2.87

2.23 Crankshaft hub and pulley

2.23.1 Removal

- Remove the alternator belt (see the section Alternator Belt).
- Install the special tool for immobilising the crankshaft (fitted in place of the starter motor).
- Remove the 6 screws of the pulley and remove the pulley.
- Use a 46 mm socket bit to remove the LH nut of the crankshaft pulley.

Note

The hub may also be removed together with the pulley as an assembly without separating the pulley from the hub.

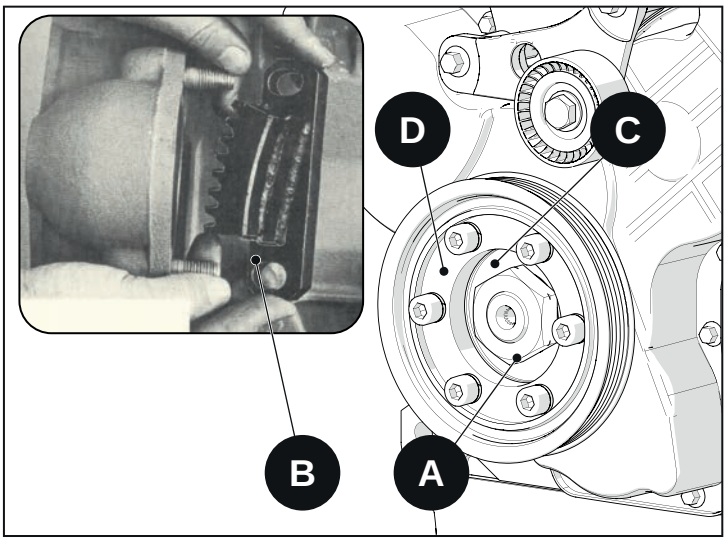

Fig. 2.88

A - crankshaft hub nut
B - crankshaft pulley
C - crankshaft hub
D - special tool

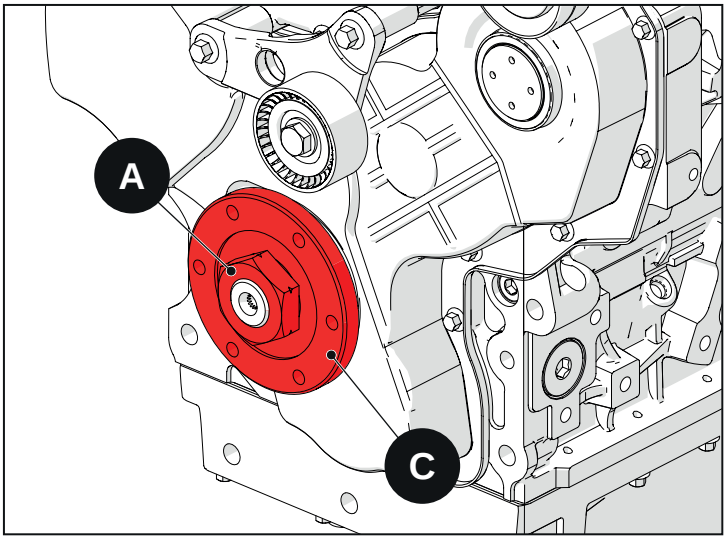

Fig. 2.89

Assembled hub and pulley.

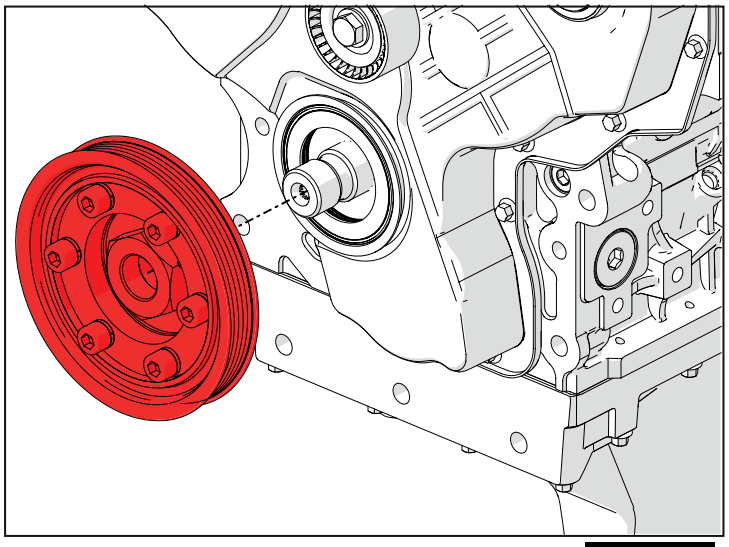

Fig. 2.90

If the pulley has been separated from the hub, install the hub onto the pulley as shown in the photo.

The raised edge of the pulley must face outwards.

A - crankshaft pulley
B - crankshaft hub
C - raised edge of pulley

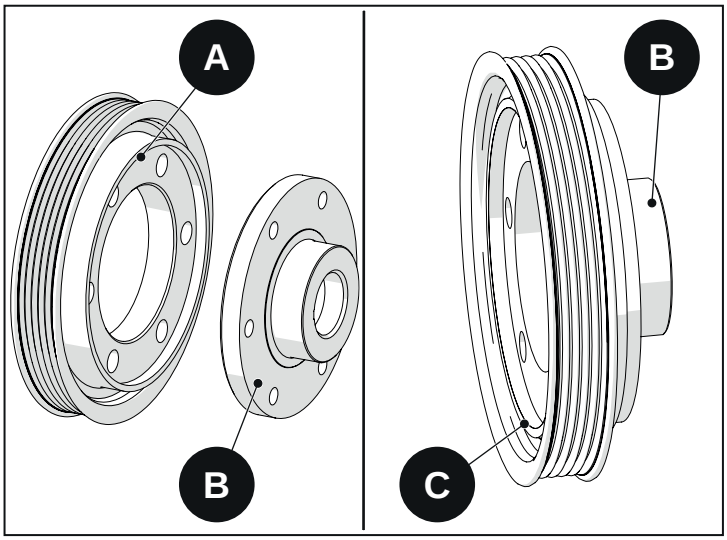

Fig. 2.91

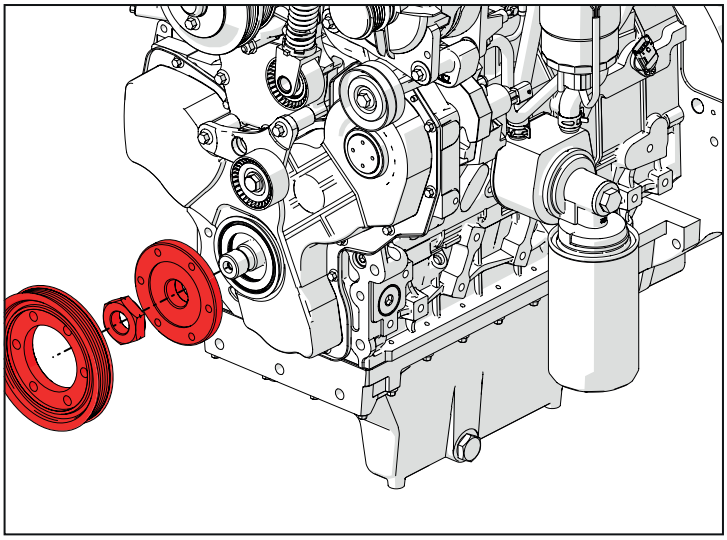

Fig. 2.92

- Clean the mating surfaces between the hub and the nut with solvent and dry with compressed air.
- Clean the thread of the crankshaft.
- Clean the surface of the hub in contact with the oil pump idler gear.
- If the front oil seal has been removed in order to be replaced, clean the oil seal seat in the cover.

The front oil seal and the lip of the oil seal may be damaged by natural skin oil if handled with bare hands, or by dirt transferred from gloves. Damage to the oil seal or lip may cause an oil leak. Do not touch the oil seal or lip when installing or replacing the crankshaft hub.

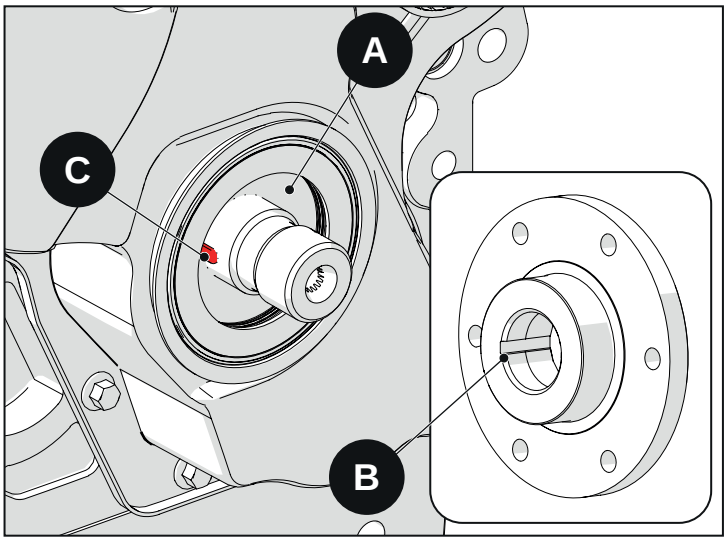

Fig. 2.93

- Install the tool for immobilising the crankshaft (fitted in place of the starter motor).
- Apply “Molykote G Rapid Plus Paste” grease to the left-handed thread of the crankshaft hub nut and to the surface of the hub which will be in contact with the nut
- Align the key seat on the hub with the key on the crankshaft and hand-tighten the nut

Attention

The flanged side of the nut must face towards the crankshaft gear (inwards, towards engine)

Tightening procedure

- Tighten the nut to 400 N·m.
- Loosen the nut and retighten to 600 N·m.

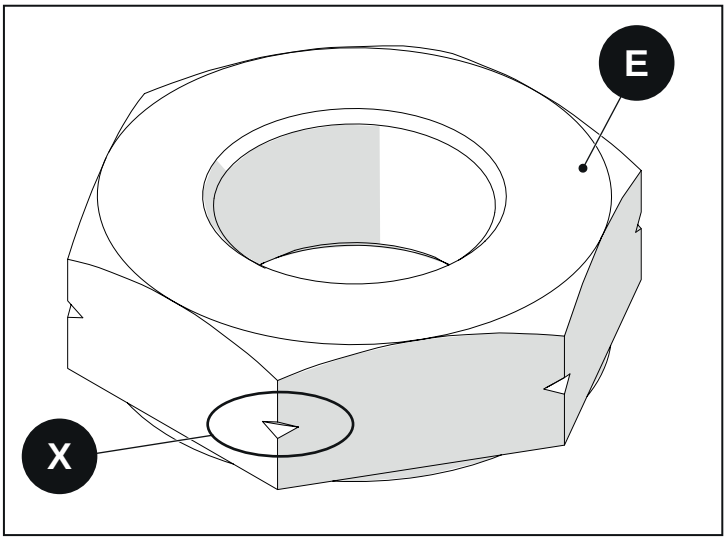

Fig. 2.94

- Fit the 6 screws with the respective washers and tighten to fasten the crankshaft pulley.

Crankshaft pulley screw 45.1 N·m

- Remove the tool for immobilising the crankshaft (fitted in place of the starter motor).

A - contact surface of hub with oil pump drive gear
B - key seat on hub
C - key on crankshaft
D - contact surface of hub with nut
E - crankshaft hub fastener nut (flanged side)
X - UNI marking identifying nut with left-handed thread

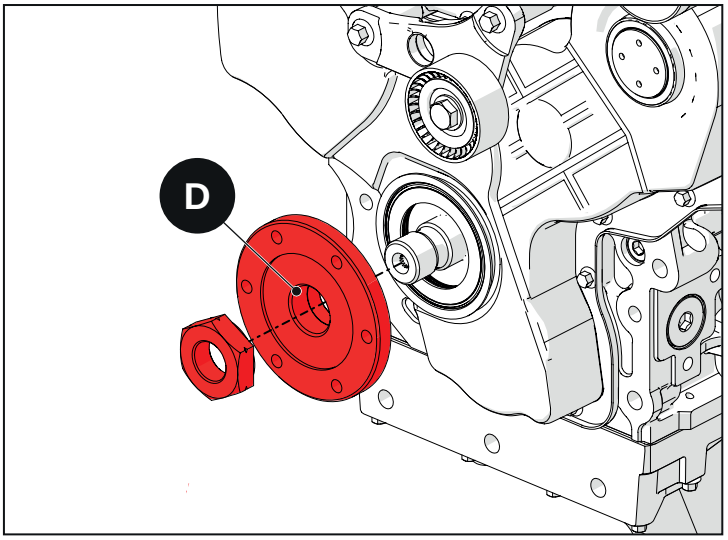

Fig. 2.95

2.24 Water pump and pulley

2.24.1 Removal

- Disconnect all pipes or hoses from the pump.
- Remove the alternator belt (see the section Alternator Belt).
- Remove the water pump pulley screws or the screws of the water pump casing in order to remove the water pump assembly.
- Remove the old gasket from the pump. Take care not to damage the sealing surface.

A - water pump casing
B - water pump casing screws
C - water pump pulley screws

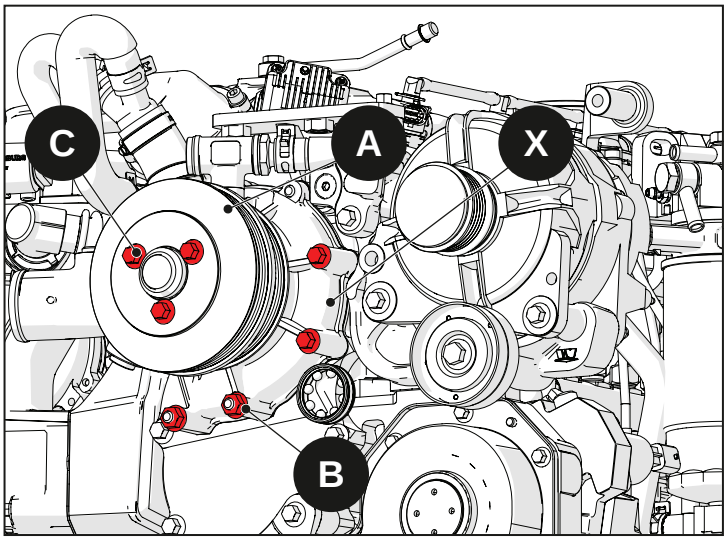

Fig. 2.96

2.24.2 Installation

- Inspect the water pump casing for signs of seizing, cracks, corrosion or other damage.
- Inspect the rotor for signs of cracks, corrosion or other damage.
- Inspect the rotor shaft and bushes to check for excessive endfloat, abnormal noise or wear.
- Inspect the pulley to check for warping, cracks, corrosion, excessive eccentricity or other defects/damage.
- Apply Loctite sealant to both sides of the new pump
- Install a new gasket.
- Tighten the fastener screws following the correct procedure indicated.
- Tighten the screws of the water pump pulley.

X - water pump in high mounting position

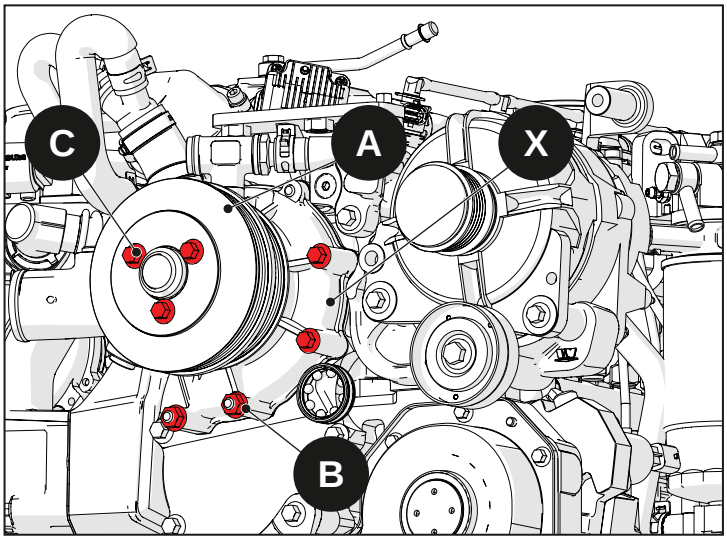

Fig. 2.97

Pretightening torque for screws 1-3-6-4-2-5 (1-3-6-4-2-5-14-13 for water pump in high mounting position)	6 N·m
Final tightening torque for screws 1-3-6-4-2-5 (1-3-6-4-2-5-14-13 for water pump in high mounting position)	32.4 N·m
Pretightening torque for screws 7-9-12-10-8-11	6 N·m
Final tightening torque for screws 7-9-12-10-8-11	32.4 N·m
Water pump pulley fastener screw	27.5 N·m

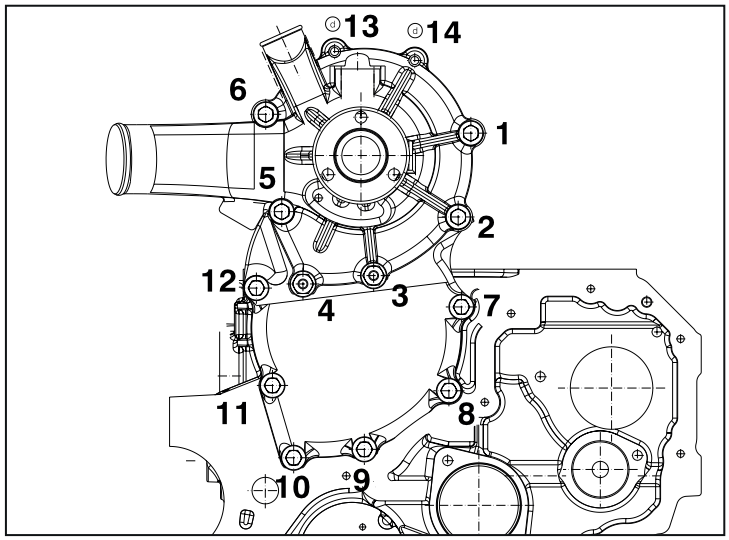

Fig. 2.98

2.25 Timing cover

2.25.1 Removal

- Remove any components impeding removal of the cover.
- Remove the screws fastening the cover.
- Use a knife or cutter blade to cut the silicone sealant. Separate the cover from the crankcase, taking care not to bend it.

2.25.2 Installation

- Check the condition of the front oil seal installed on the cover. Replace if necessary. (see the section Front Oil Seal).
- Remove the old silicone sealant from the crankcase and the cover. Take care not to damage the sealing surfaces.
- Apply a uniform bead of sealant (Dow Corning 7091 silicone) as shown in the photo around the perimeter of the cover, in the grooves and around the inner sides of the holes for the cover fastener screws.
- Align the cover with the pins fitted into the crankcase.

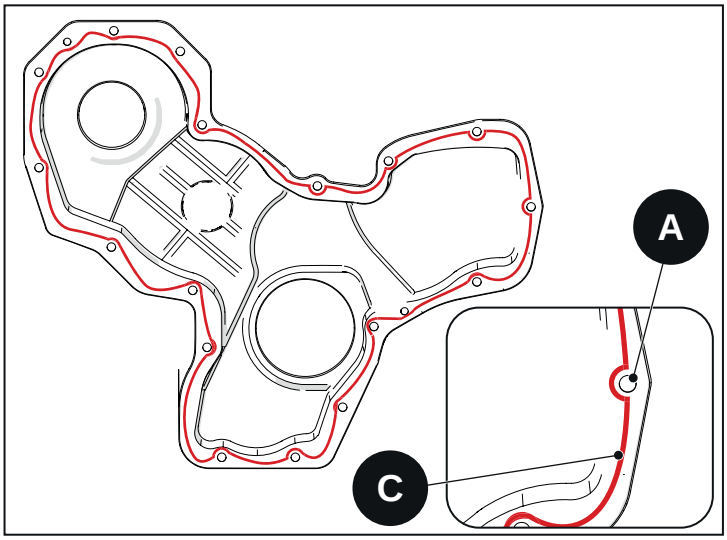

Fig. 2.99

- Tighten the screws in a crossed pattern:

  Timing cover screws: 12.7 N·m

Warning
wait at least 20 minutes before starting the engine to allow the silicone to cure

A - holes
B - grooves
C - bead of silicone sealant

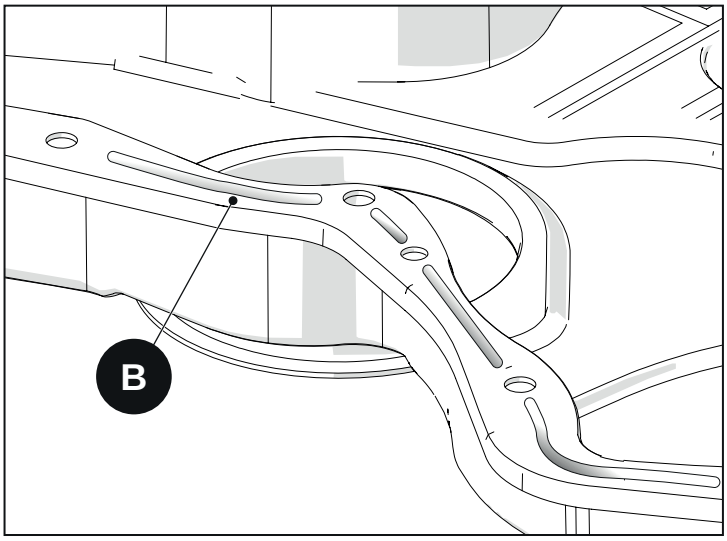

Fig. 2.100

2.26 Front oil seal

2.26.1 Removal

Warning

The front oil seal and the lip of the oil seal may be damaged by natural skin oil if handled with bare hands, or by dirt transferred from gloves. Damage to the oil seal or to the lip of the seal may cause an oil leak. When fitting or replacing an oil seal, do not touch the oil seal or the lip of the oil seal with bare hands or dirty gloves.

The oil seal consists of special components; do not touch or handle the lip of the oil seal. Do not use a hammer or a punch to attempt to drive the oil seal into its seat. This may cause damage to the oil seal or timing cover.

- Lubricate the outer perimeter of the oil seal. Do not touch or handle the lip of the oil seal.
- Fit a new oil seal in the special tool.

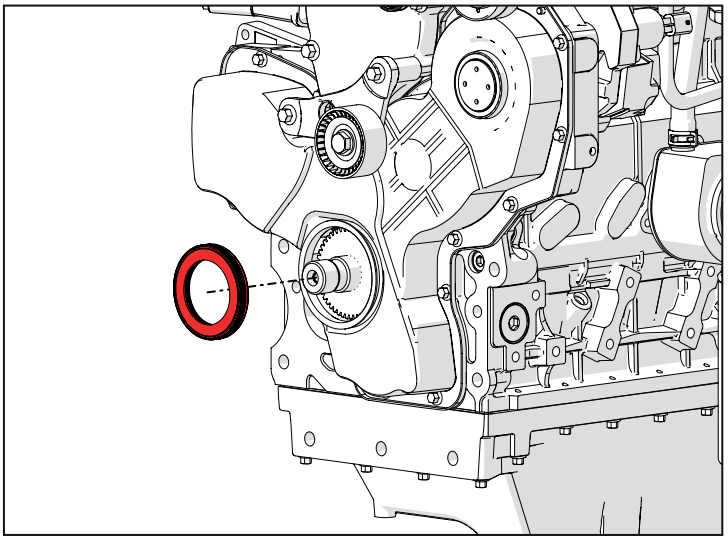

Fig. 2.101

- Tighten the screw of the special tool.
- The oil seal stops and will go no further once it is installed correctly in its seat.

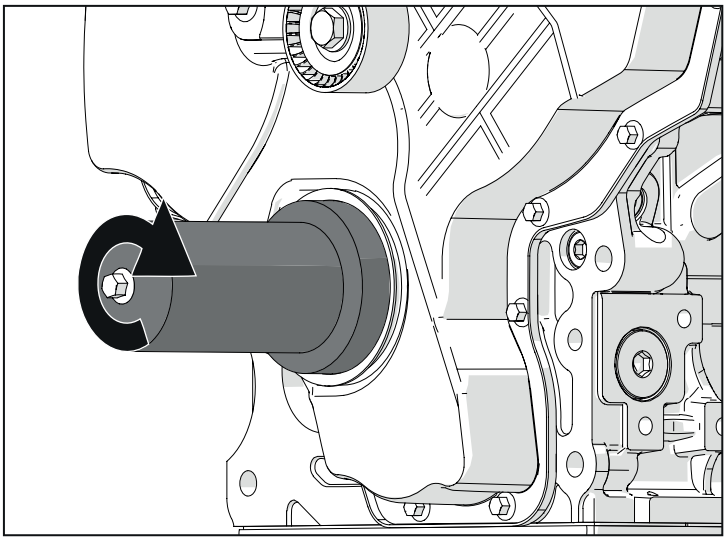

Fig. 2.102

2.27 Turbocharger

2.27.1 Removal

Warning

In the event of turbocharger failure resulting in an oil leak from the exhaust side, the diesel particulate filter must also be cleaned (see the section “Maintenance - Diesel particulate filter”).

- Loosen the turbo oil delivery line connector.
- Loosen the clamp fastening the turbo oil drain line.
- Remove the nuts fastening the turbo.
- Remove the old gasket.

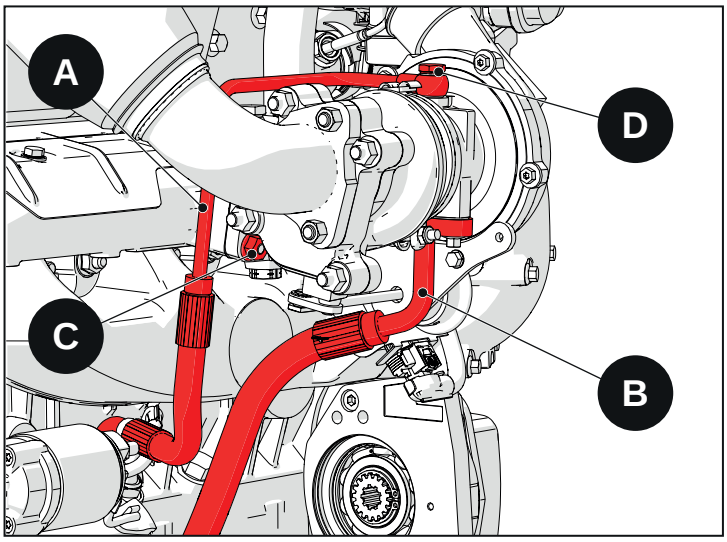

Fig. 2.103

A - turbo oil delivery line
B - turbo oil drain line
C - turbo fastener nuts
D - turbo oil delivery line connector
E - connector for oil delivery line to turbo from crankcase
F - connector for oil drain line from turbo to crankcase

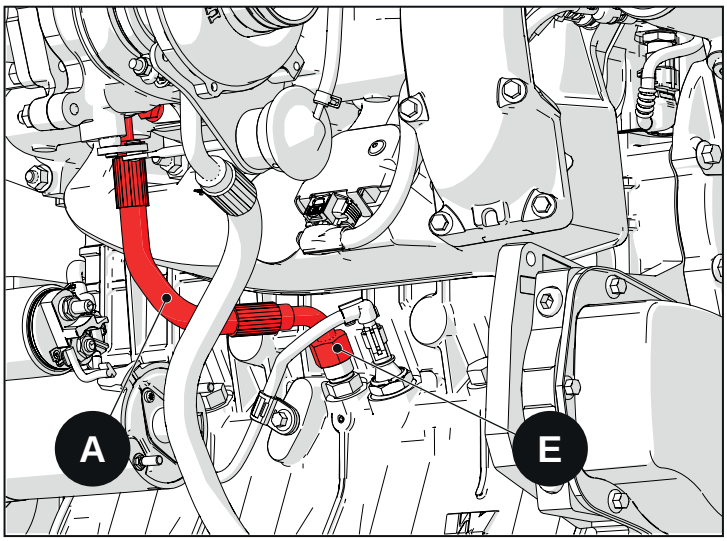

Fig. 2.104

2.27.2 Installation

- Install a new gasket between the exhaust manifold and the turbo.
- Install the turbo and tighten the nuts in alternating order in a diagonal pattern.
- Install the turbo oil drain line.
- Hand tighten the oil delivery line connectors onto the turbo and onto the crankcase, fitting new washers.
- Definitively tighten both connectors.

Turbo oil delivery line connector (D): 24.5 N·m

Connector for oil delivery line to turbo from crankcase (E): 32.4 N·m

Connector for oil drain line from turbo to crankcase (F): 49 N·m

Turbo exhaust flange (G): 32.4 N·m

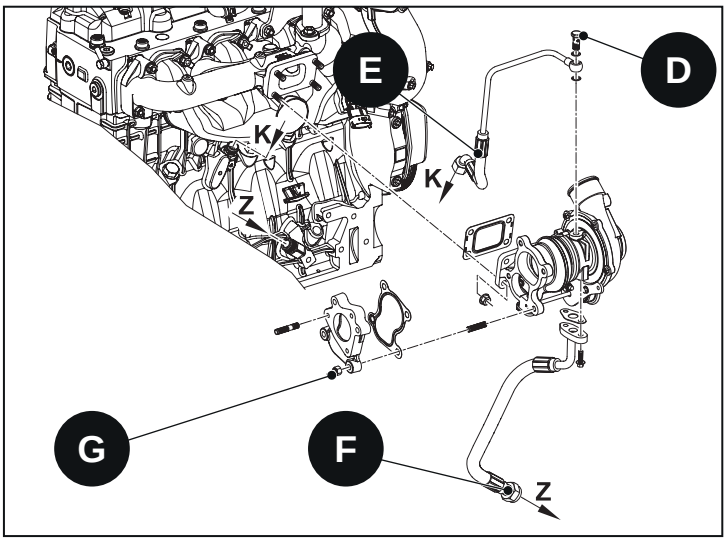

Fig. 2.105

2.28 EGR heat exchanger

2.28.1 Removal

- Loosen the clamps of the hoses and disconnect the hoses.
- Loosen and remove the screws fastening the EGR heat exchanger unit and remove the EGR heat exchanger unit and the relative gasket.

1 - screw fastening EGR heat exchanger
2 - EGR heat exchanger
3-6 - EGR heat exchanger hoses

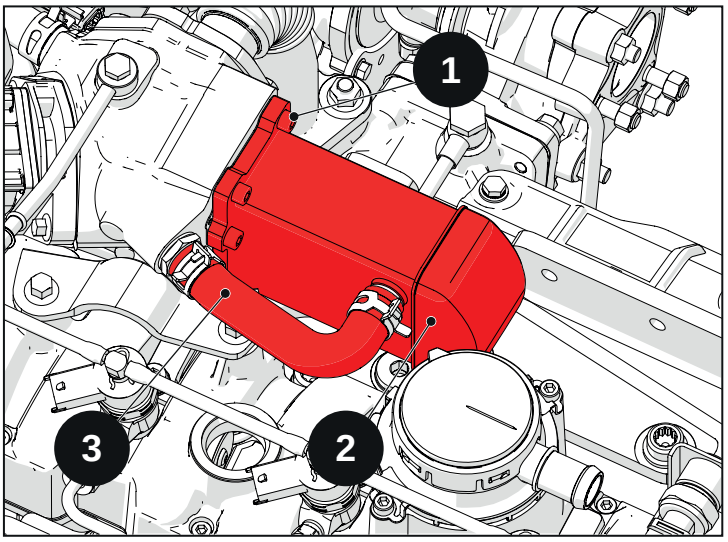

Fig. 2.106

Warning

Do not use alkaline products to clean, as this will corrode the aluminium. Never use brushes which could damage the fins or sealing surfaces.

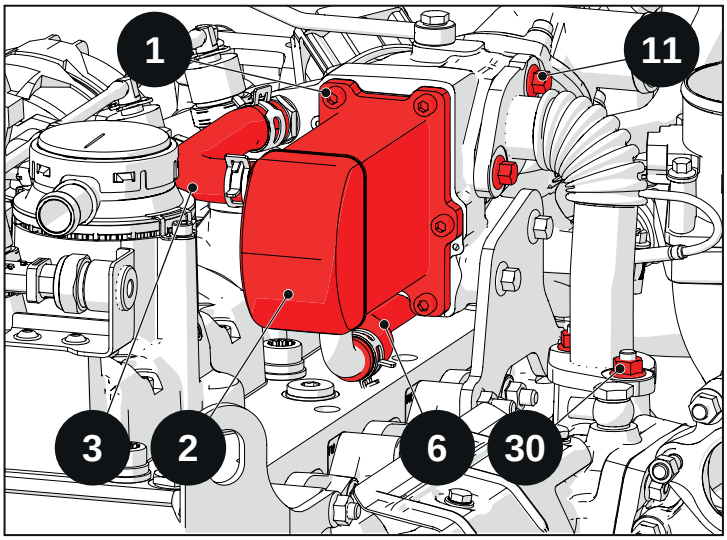

Fig. 2.107

2.28.2 Installation

- Fit the EGR heat exchanger, using a new gasket.
- Connect the hoses and fasten the respective clamps.

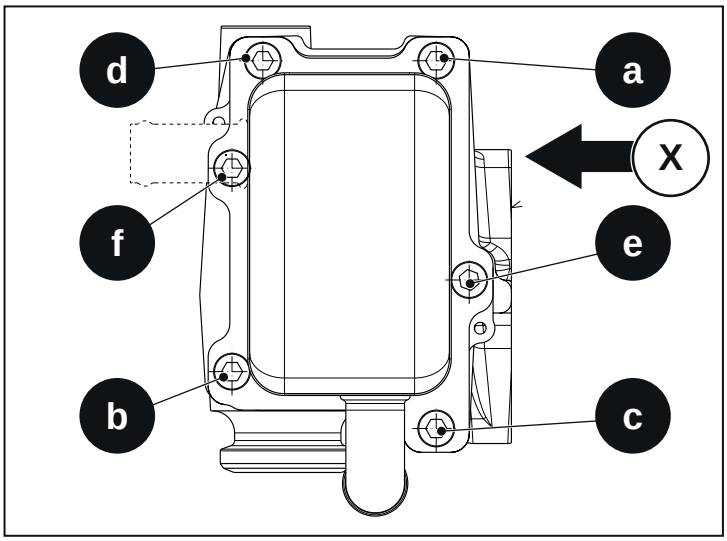

Fig. 2.108

- 1 = screw fastening EGR heat exchanger
  - **pre-tightening torque (tightening order: a, b, c, d, e, f): 5 N·m**
  - **definitive tightening torque (tightening order: a, b, c, d, e, f): 14.7 N·m**
-
  - **11, 30 = EGR pipe nut and screw 32.4 N·m**
  - **12 = EGR heat exchanger unit 32.4 N·m**

X - Exhaust manifold side

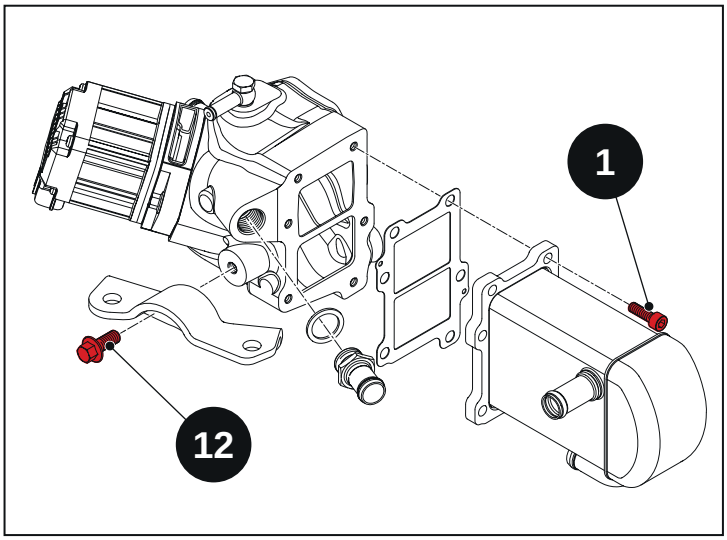

Fig. 2.109

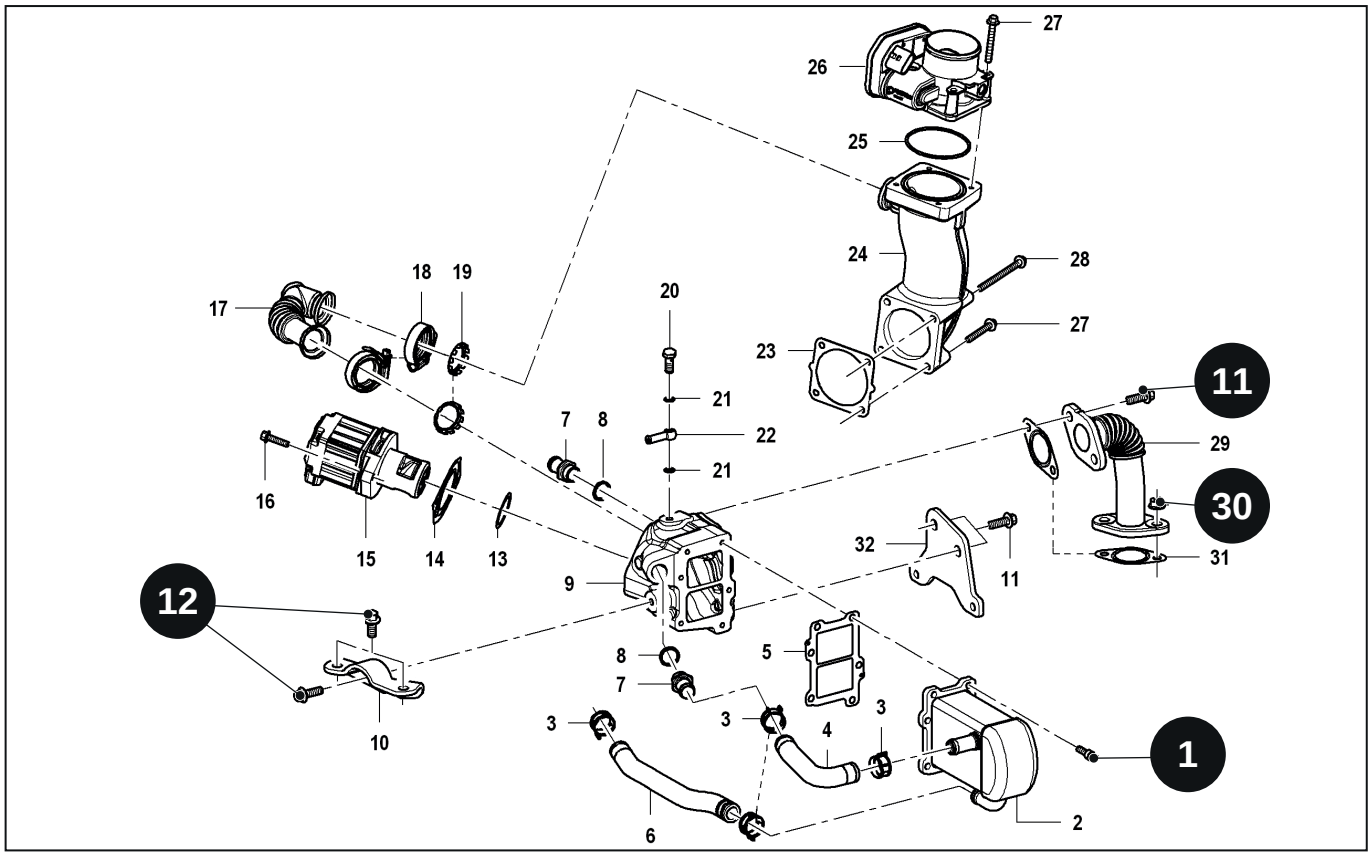

Fig. 2.110

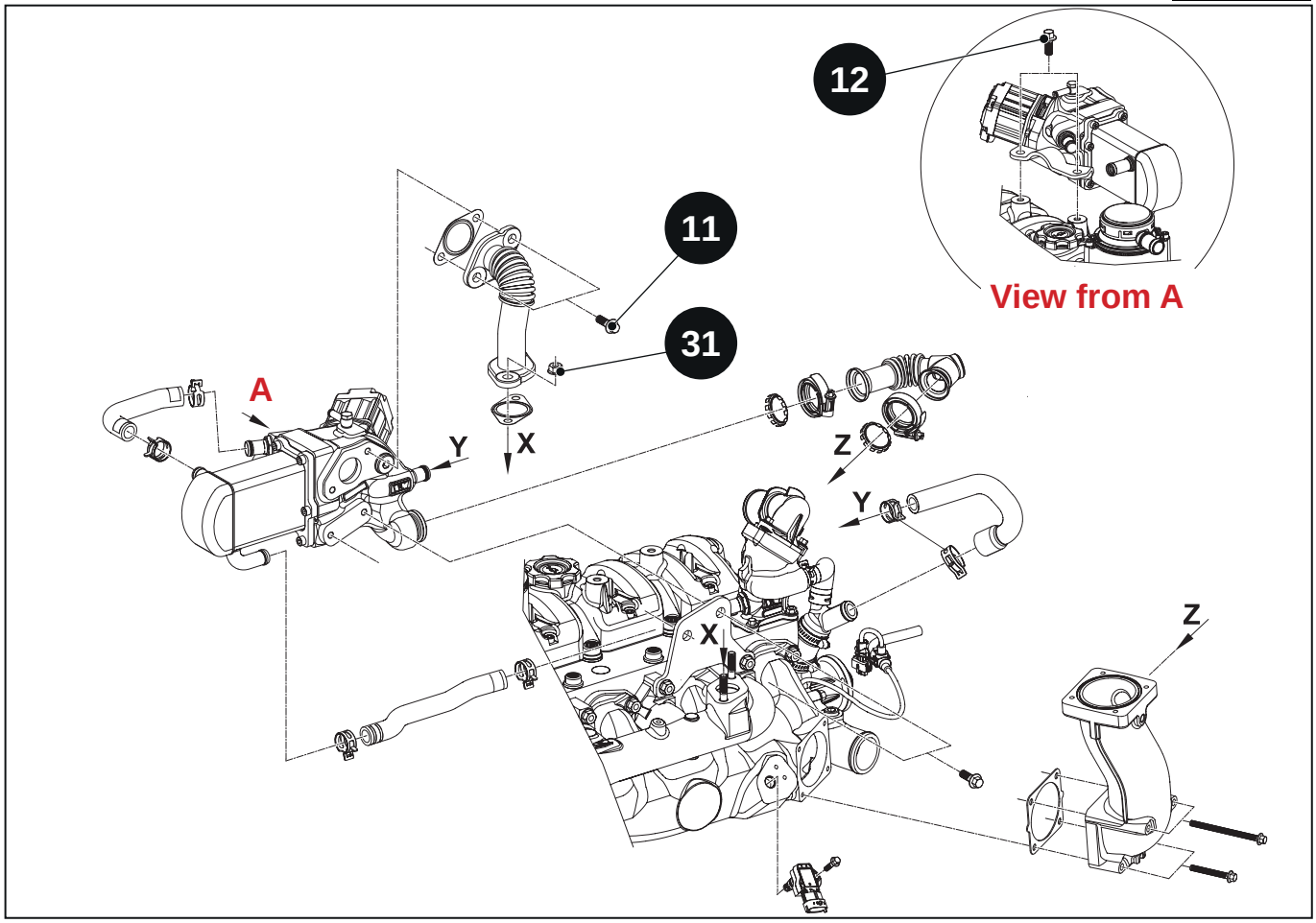

Fig. 2.111

2.29 Exhaust gas temperature and pressure sensors

Warning

handle with care. The ends of the temperature sensors “A” and “B” are made from ceramic material.

- Fit the sensor A on the EGR heat exchanger.
  - **A - tightening torque for temperature sensor: 24.5 N·m**
- Fit the sensor B on the exhaust manifold
  - **B - tightening torque for temperature sensor: 45.1 N·m**

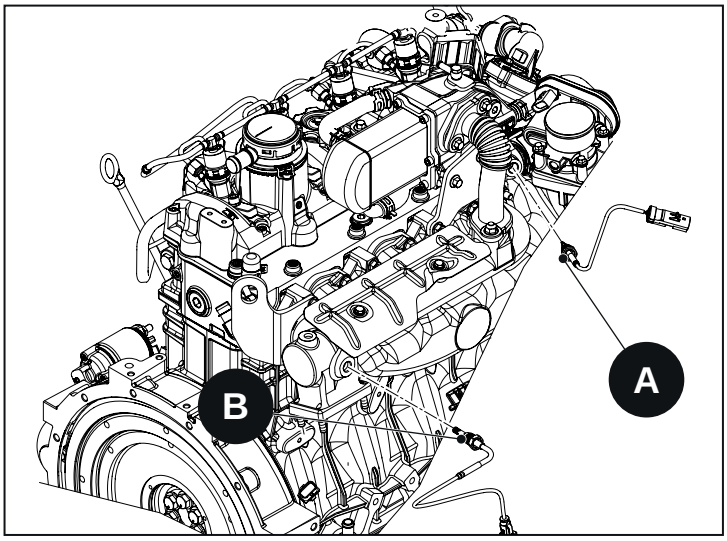

Fig. 2.112

Warning

follow the tightening sequence indicated for the exhaust gas pressure sensor (12).

To assemble correctly, pre-fit the union and the relative seals onto the banjo bolt of the pipe: spread ORAPI HT 900 anti-seize paste on the thread of the union and position the pipe correctly by hand-tightening the union to bring it towards the manifold and hand-tightening the screws fastening the pipe bracket to bring the bracket towards the rocker cover. Now tighten definitively in the following sequence to the torque values indicated:

1- Screws (13)	10.8 N·m
2- Union (15)	27.5 N·m
3- Sensor (12)	14 N·m

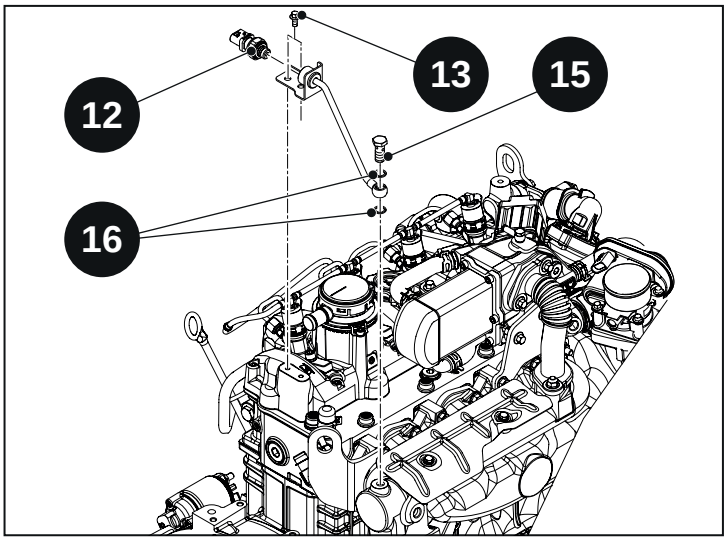

Fig. 2.113

2.30 Throttle valve

The throttle valve installed on R750TE4-IE4-ISE4 engines is an electric unit controlled by the engine control unit.

2.30.1 Removal

Remove the bolts fastening the valve to the intake duct. Replace the O-ring.

24 - intake duct
25 - throttle valve O-ring
26 - throttle valve
27 - bolts fastening the valve to the intake duct

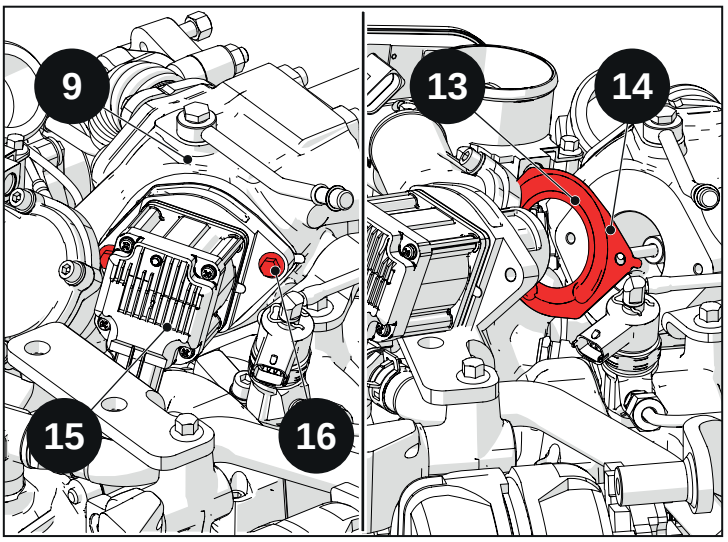

Fig. 2.114

2.30.2 Installation

- Fitting new gaskets, install the valve onto the EGR heat exchanger casing.
- Tighten the screws
  - **16 = screw fastening the EGR valve: 13.7 N·m**

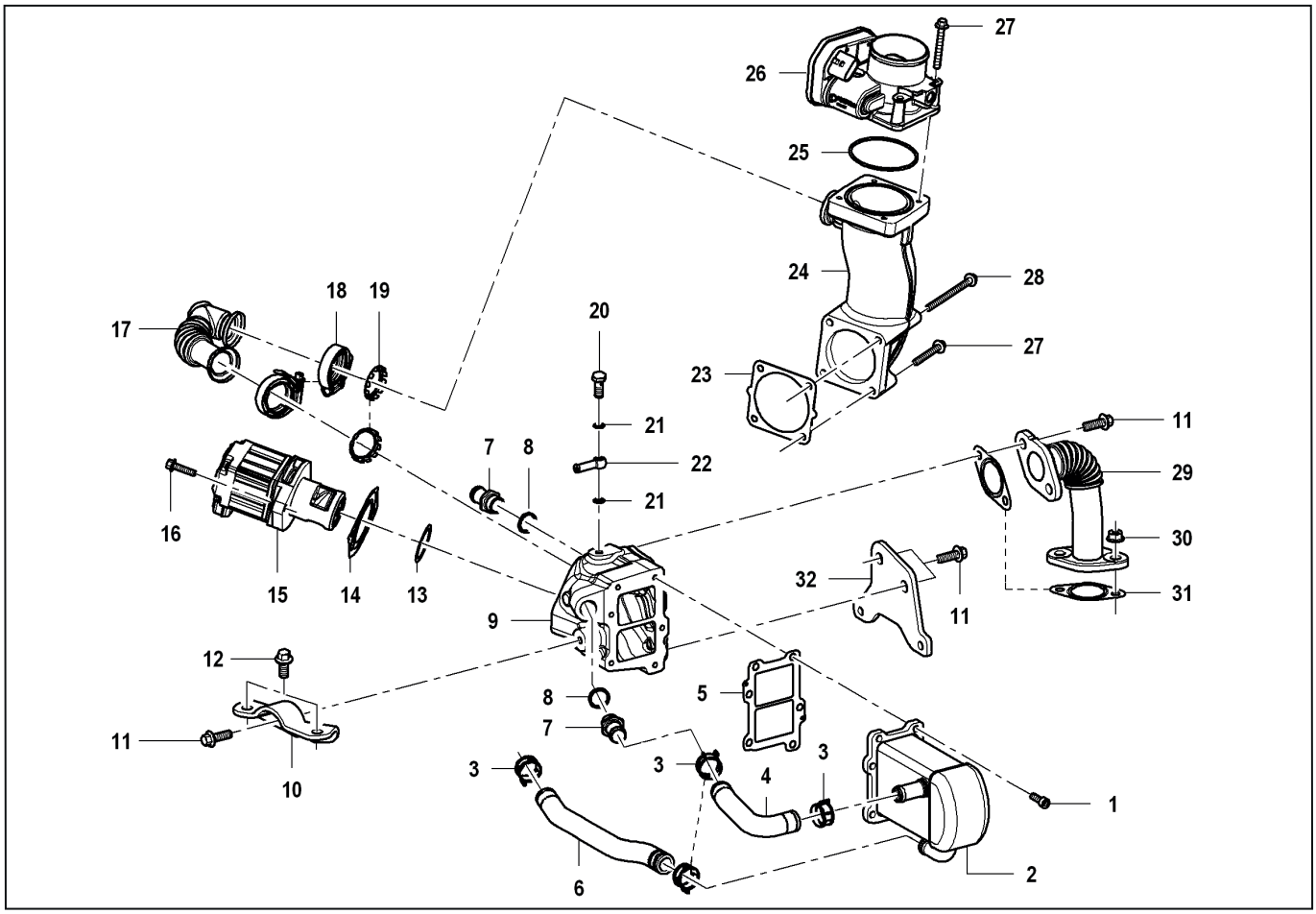

Fig. 2.115

2.31 Exhaust manifold

2.31.1 Removal

- Loosen the 2 screws fastening the heat shield and remove the heat shield.
- Remove any components impeding replacement of the turbocharger.
- Loosen and remove the fastener nuts.
- Remove any spacers installed on the stud bolts and remove the exhaust manifold and each individual gasket.

A - heat shield
B - exhaust manifold fastener nuts
C - spacer

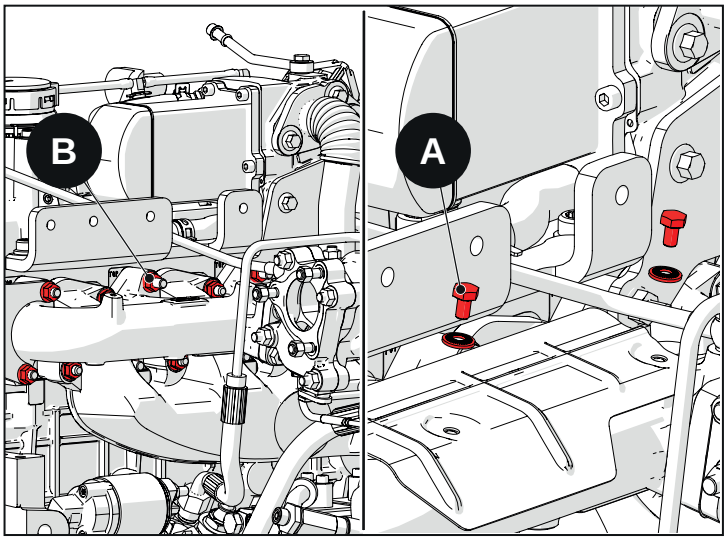

Fig. 2.116

2.31.2 Installation

- Fit new individual gaskets on the stud bolts.
- Fit the spacers on the stud bolts and install the exhaust manifold.
- Fit the fastener nuts and tighten with the following procedure.

Exhaust manifold fastener nuts	
tightening order 1, 2, 3, 4, 5, 6, 7, 8 - pre-tightening torque	36 N·m
tightening order 1, 2, 3, 4, 5, 6, 7, 8 - definitive tightening torque	36 N·m

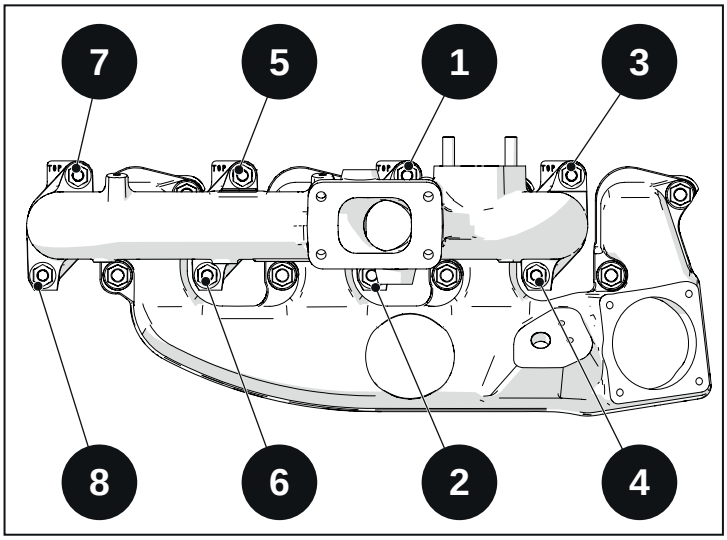

Fig. 2.117

2.32 Intake manifold

2.32.1 Removal

- Remove the exhaust manifold and any other components impeding removal of the intake manifold.
- If necessary, remove the EGR valve/throttle valve unit.
- Remove the nuts fastening the intake manifold and detach the intake manifold.
- Replace the manifold gasket if necessary.

A - intake manifold fastener nut

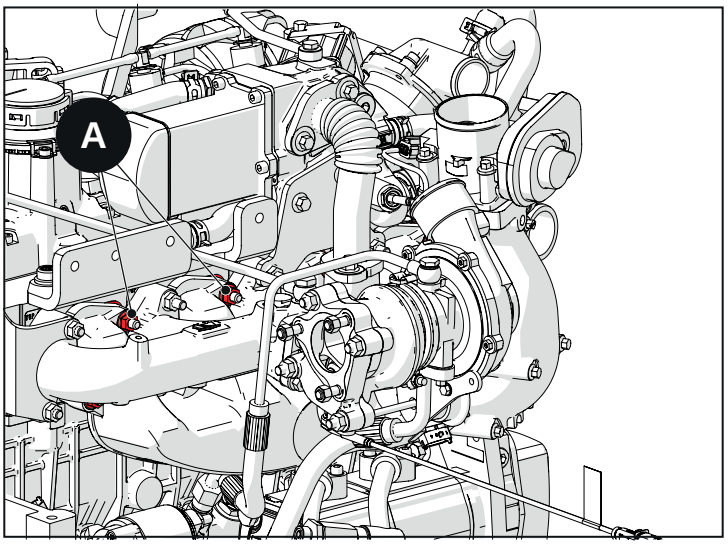

Fig. 2.118

2.32.2 Installation

- Fit a new gasket if necessary.
- Fit the nuts fastening the manifold and tighten in a cross pattern as indicated.

intake manifold fastener nuts	
tightening order 1, 2, 3, 4, 5, 6, 7, 8 - pre-tightening torque	27.5 N·m
tightening order 1, 2, 3, 4, 5, 6, 7, 8 - definitive tightening torque	27.5 N·m

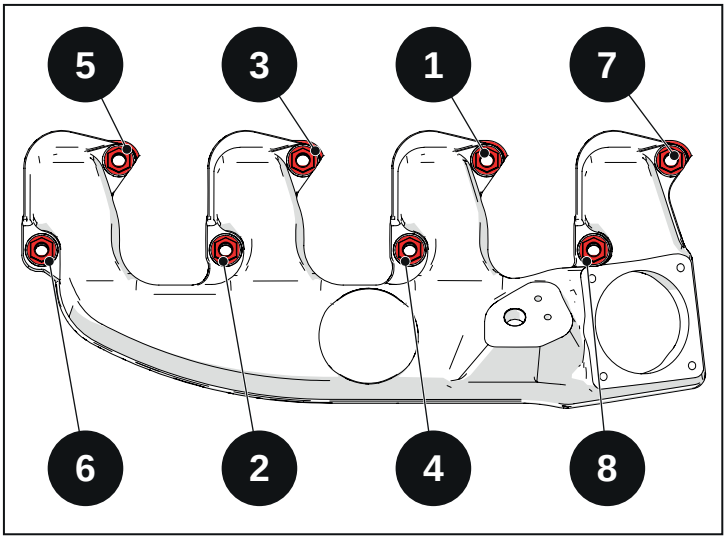

Fig. 2.119

2.33 Crankshaft endfloat

- Install the flywheel. See the section Engine Flywheel.
- Install a dial gauge on the crankshaft to measure the endfloat of the crankshaft once it is installed.
- Measure by placing the probe of the dial gauge against a crank web or against the outer face of the flywheel.
- Apply leverage to push the crankshaft towards the flywheel. Note the value measured.
- Apply leverage to push the crankshaft towards the timing side. Note the value measured.
- Calculate the difference between the measurements by subtraction to determine the endfloat of the crankshaft.

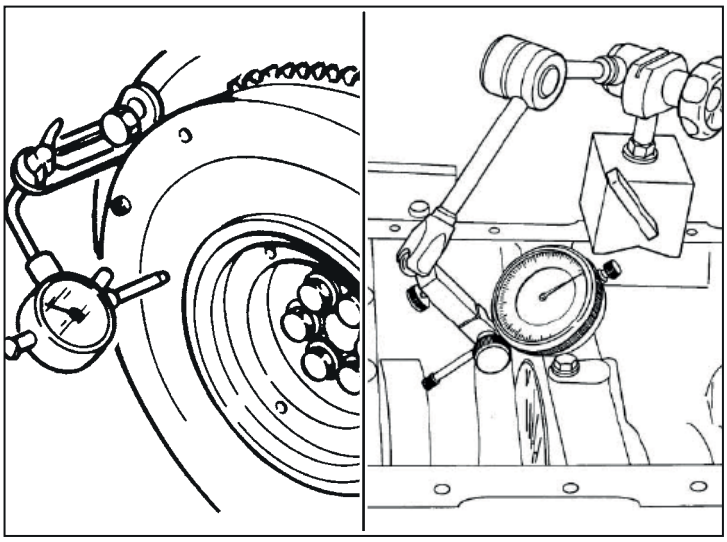

Fig. 2.120

Crankshaft endfloat: 0.080 - 0.230mm

If the endfloat of the crankshaft is incorrect, calculate the thickness of the rear shim necessary to correct the value.

- Replace the rear shim on the rear crankshaft bearing with the corrective shim and measure the endfloat of the crankshaft again.
- See the section “Rear Crankshaft Bearing” for the correct rear shim thicknesses.
- Repeat the steps described above as necessary until the endfloat is correct.

2.34 Engine flywheel

2.34.1 Removal

- Measure and note the crankshaft endfloat before removing the flywheel. (see the section Crankshaft Endfloat).
- Remove the starter motor and fit the special tool for immobilising the crankshaft.
- Remove 2 screws from the flywheel and fit 2 pins in their place (see the section Special Tools).
- Remove the remaining screws fastening the flywheel.
- Remove the flywheel and the special tool immobilising the crankshaft

A - flywheel fastener screws
B - flywheel

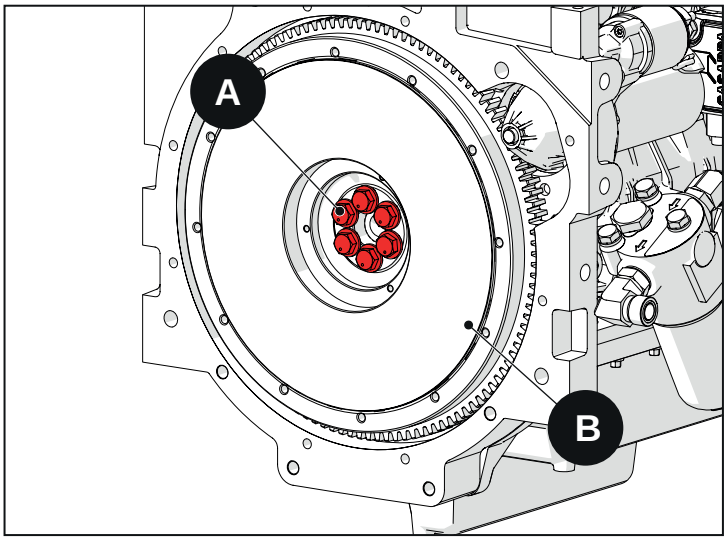

Fig. 2.121

- When removing the flywheel, check if a separate spacer is fitted.
- If there is no separate spacer, the spacer is incorporated in the casting of the flywheel. In this case, check that the O-ring is fitted correctly.

A - separate spacer (NOT incorporated in flywheel casting)
B - rear oil seal
C - seat for spacer O-ring

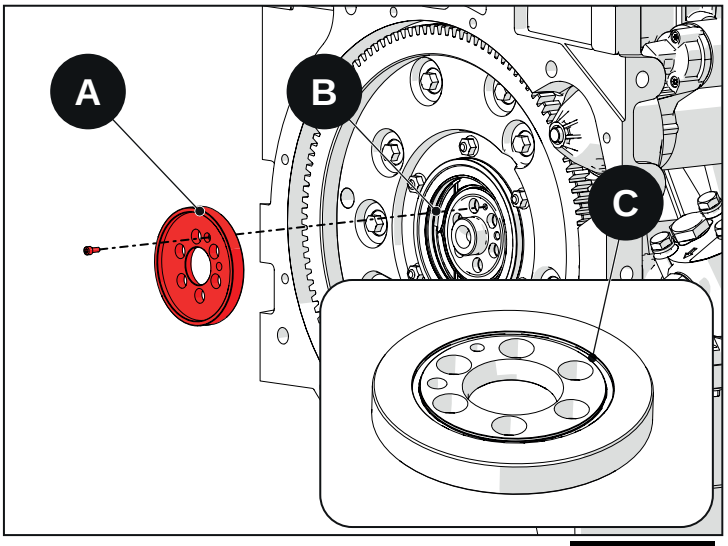

Fig. 2.122

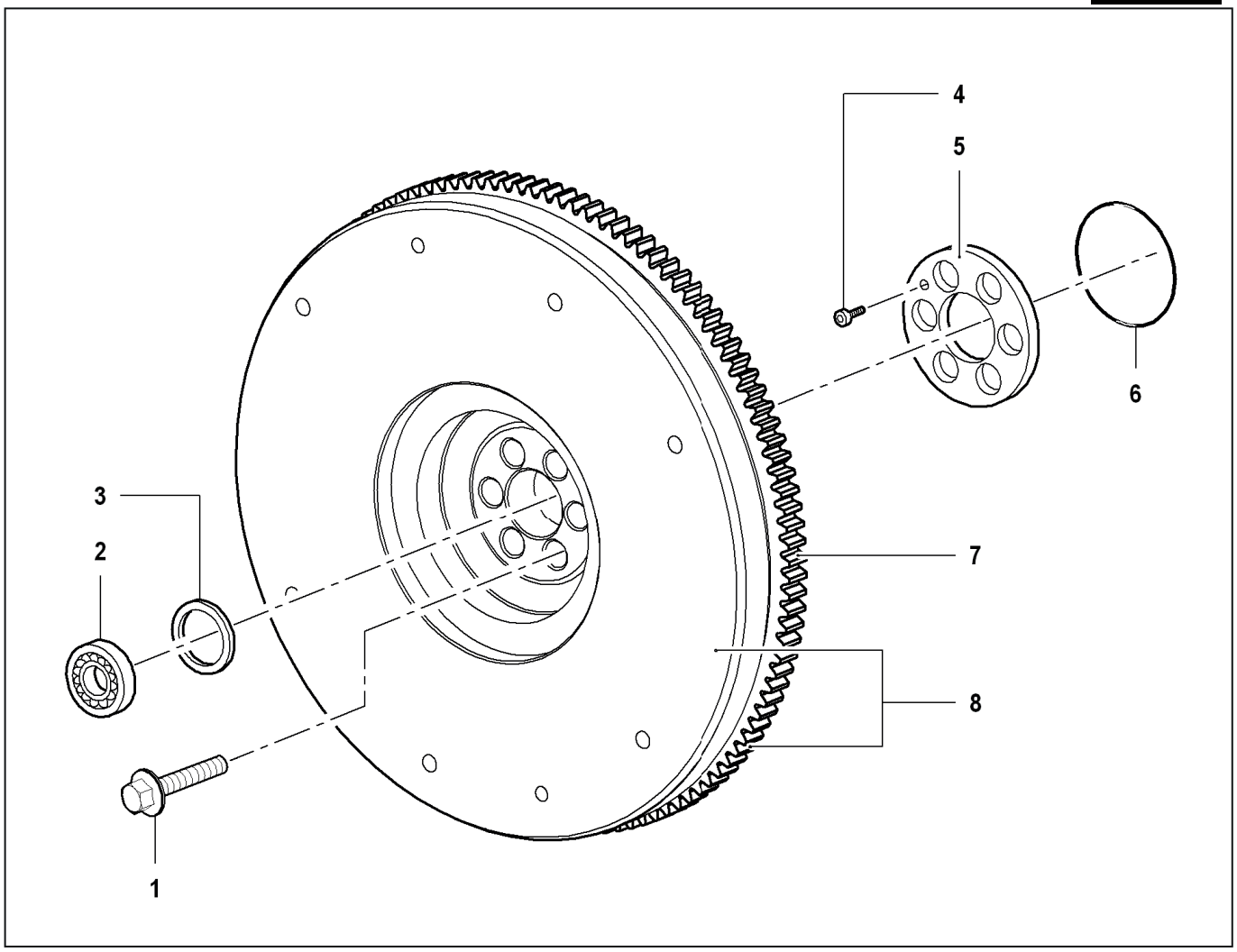

Fig. 2.123

2.34.2 Installation

- Fit a new O-ring on the spacer. A little grease may be used to keep the O-ring in place on the spacer during installation. Replace the O-ring each time the flywheel is removed.
- Install the spacer with the new O-ring, with the O-ring facing towards the crankshaft.
- Check that there are no signs of scratching, scoring, cracks or seizing on the mating surface of the flywheel.
- Only minor scratches, scoring, cracks or signs of seizing may be removed. Replace the flywheel if damaged.
- When installing the flywheel, do not touch or handle the lip of the rear oil seal. Check that the oil seal is in good condition. Replace if in any doubt. (See the section “Rear Crankshaft Bearing”).
- Check that the rear shims are not damaged or worn and are installed correctly in the rear bearing
- Replace if in any doubt (see the section “Rear Crankshaft Bearing”).
- Fit the 2 guide pins on the rear shank of the crankshaft to facilitate installation of the flywheel.
- Install the flywheel (on flywheels with spacer incorporated in the casting, install the O-ring in its seat).

Note

Preferably replace the screws with new components after removal. Replace with new components if in any doubt whether they can be reused. When reusing the same screws, lubricate the threads and underneath the heads of the screws with engine oil. Do NOT lubricate new screws.

- Fit and hand-tighten 4 of the 6 screws.
- Remove the flywheel assembly guide pins and fit the remaining screws.
- Remove the starter motor and fit the special tool for immobilising the crankshaft.
- Tighten the screws in a crossed pattern to 50 N·m.
- Loosen the screws completely one at a time and then retighten in a cross pattern to 20 N·m + 75°.

Note

Measure the crankshaft endfloat. See the section “Crankshaft Endfloat” for the procedure for determining endfloat.

- Remove the special tool for immobilising the crankshaft and fit the starter motor.

2.34.3 Flywheel specifications

a	70 mm
b	58.75 - 60.25 mm

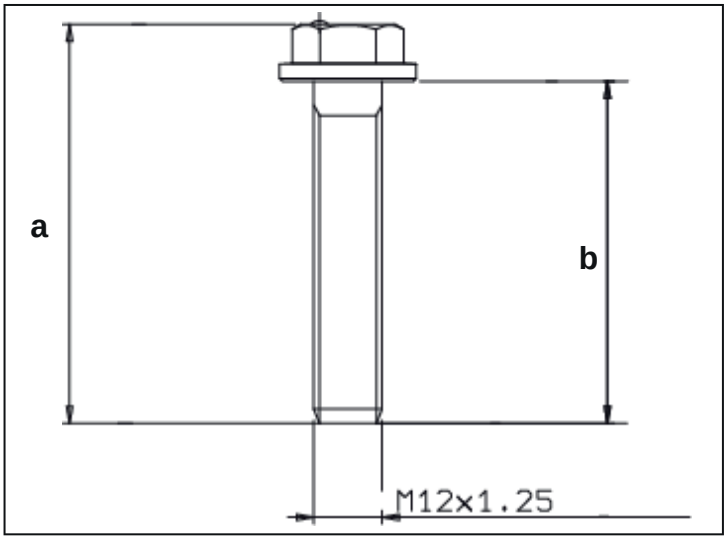

Fig. 2.124

2.35 Engine flywheel ring gear

- Heat the flywheel ring gear with a blow torch held on the engine side of the ring gear.
- Once heated, tap the ring gear to detach it from the flywheel. Take care not to hit the flywheel when removing the ring gear.

Warning

Some components are made from steel treated to increase hardness.

Applying excessive heat to treated steel will alter its hardness and weaken the component. Do not heat any part of any component in treated steel, such as the flywheel ring gear, to above 210°C.

- Heat the new ring gear for 20 minutes in an oven preheated to 190 - 210° C, or heat uniformly with other means until the ring gear has expanded enough to fit onto the flywheel. Do not overheat the ring gear.

Warning

Install the ring gear with the bevelled side facing towards the engine side of the flywheel.

- Install the ring gear. The ring gear must be seated correctly against the abutment on the flywheel. Any gap between the ring gear and the abutment on the flywheel must not exceed 0.50 mm.

1 - flywheel
2 - ring gear
3 - protective cap
4 - meshing point for starter motor (bevelled edge)

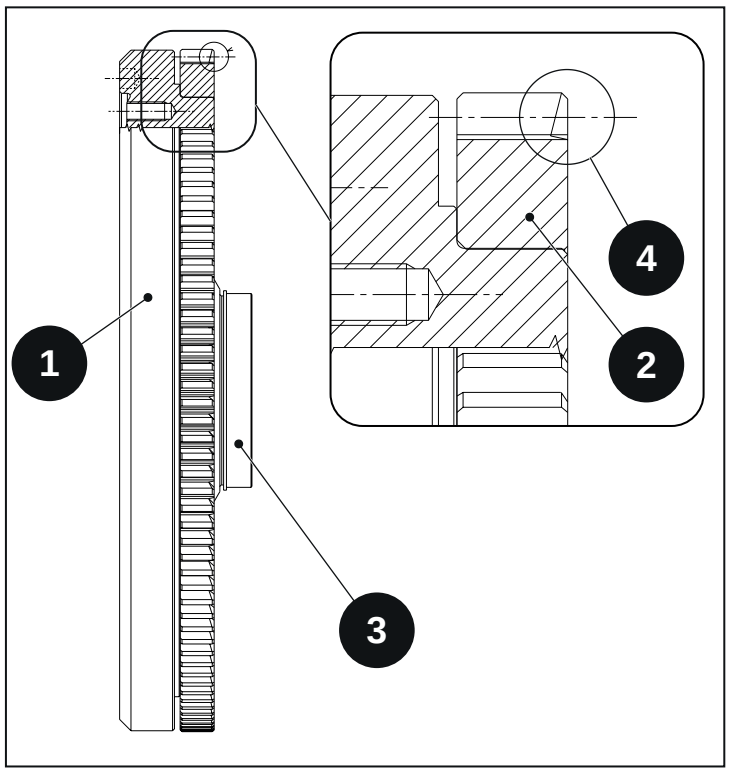

Fig. 2.125

2.36 Flywheel housing

2.36.1 Removal

- Remove the flywheel housing (see the section “Flywheel”).
- Remove the spacer from the flywheel, if fitted
- Remove the screws fastening the housing.
- Tap around the perimeter of the housing with a rubber mallet. This will detach the flywheel, complete with rear crankshaft bearing, from the crankcase.
- When removing the housing, do not touch or handle the oil seal lip and take care not to damage the O-ring of the rear bearing.

A - housing fastener screws
B - rear oil seal
C - rear shim rings

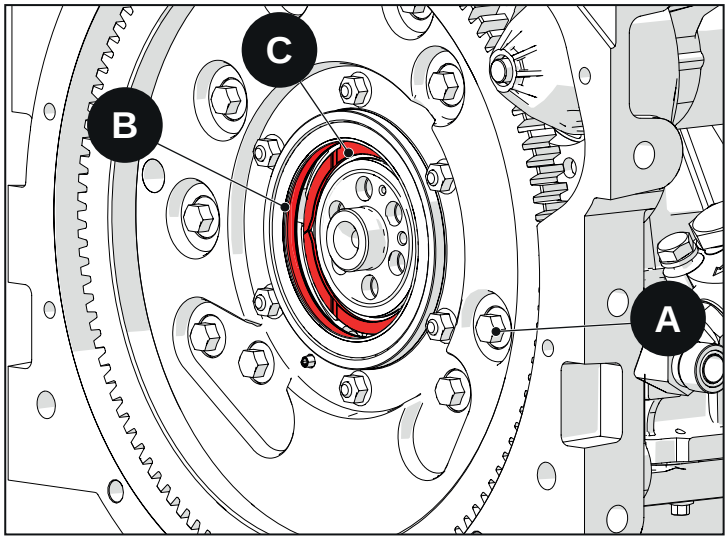

Fig. 2.126

A - O-ring in seat on housing
B - Seat
C - Clutch housing

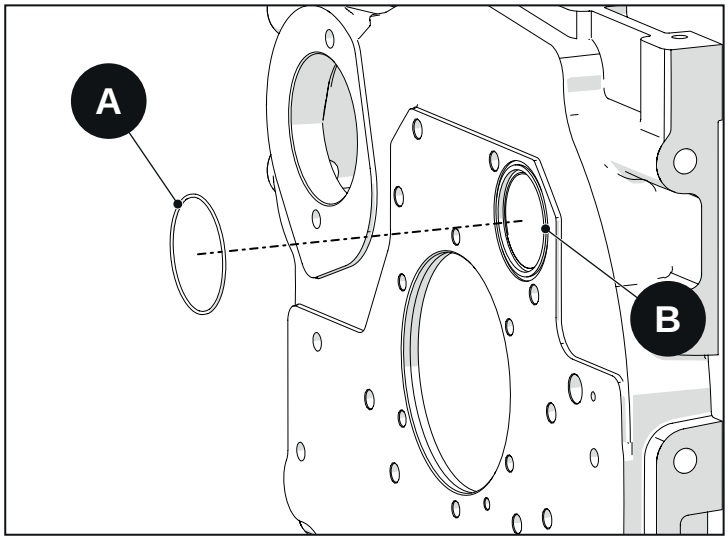

Fig. 2.127

A - nuts fastening the rear bearing to the housing
B - Housing after removal of rear bearing
C - Rear bearing

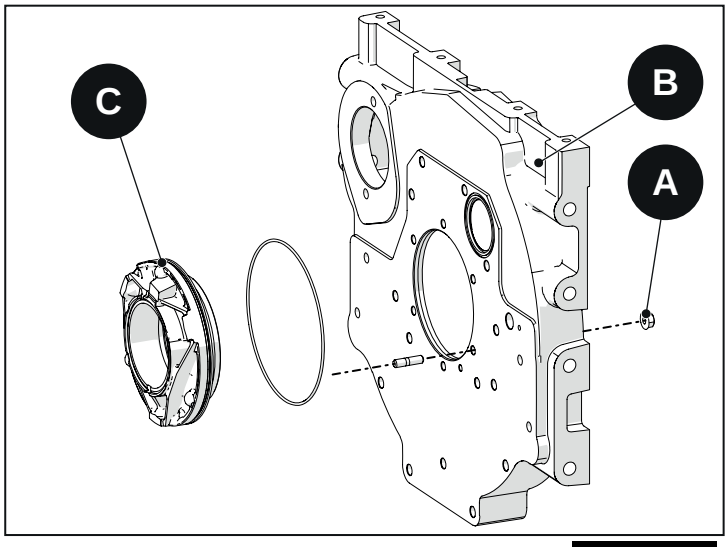

Fig. 2.128

2.36.2 Installation

Warning
Replace all the O-rings whenever the flywheel or housing are removed.

- Check that the rear shim is not damaged or worn and that it is seated correctly in the rear bearing.
- Replace the rear shim if in any doubt (see the section “Rear bearing”).
- Apply Dow Corning 7091 silicone in the O-ring seat on the housing (fig.2.129).
- Fit a new O-ring in the seat on the housing.

A - O-ring

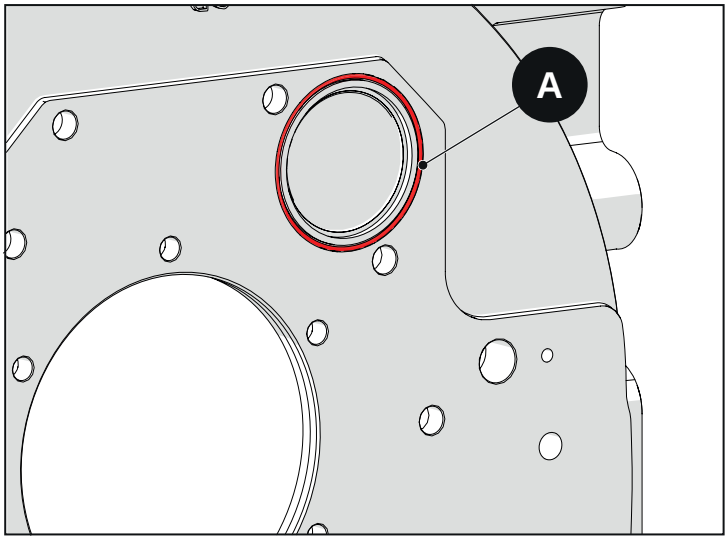

Fig. 2.129

- Apply a 2 mm thick bead of silicone sealant around the O-ring as shown in fig.2.130.
- Fit a new O-ring in the seat around the outer circumference of the rear bearing.
- Apply a 2 mm thick bead of silicone sealant around the O-ring as shown in fig.2.131.

B - Bead of silicone sealant

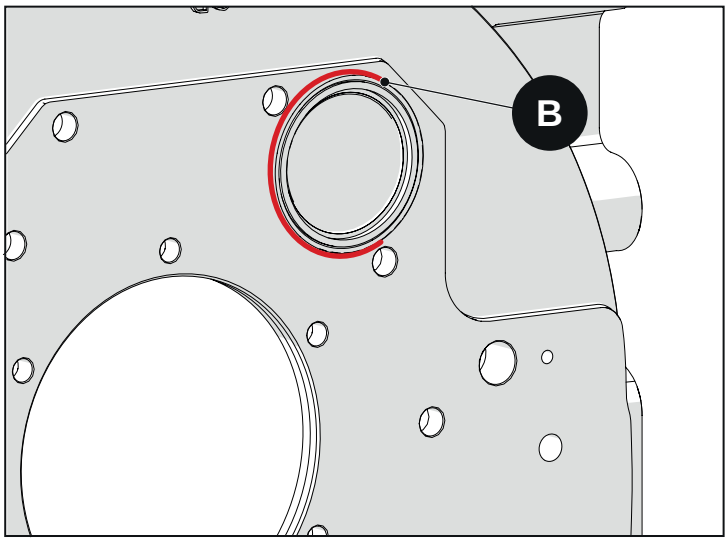

Fig. 2.130

- Lubricate the rear shank of the crankshaft and the bush of the rear bearing (main bearing bush).
- Fit the housing and tighten the screws fastening it in a crossed pattern.

C - Bead of silicone sealant

housing fastener screws: 68.6 N·m

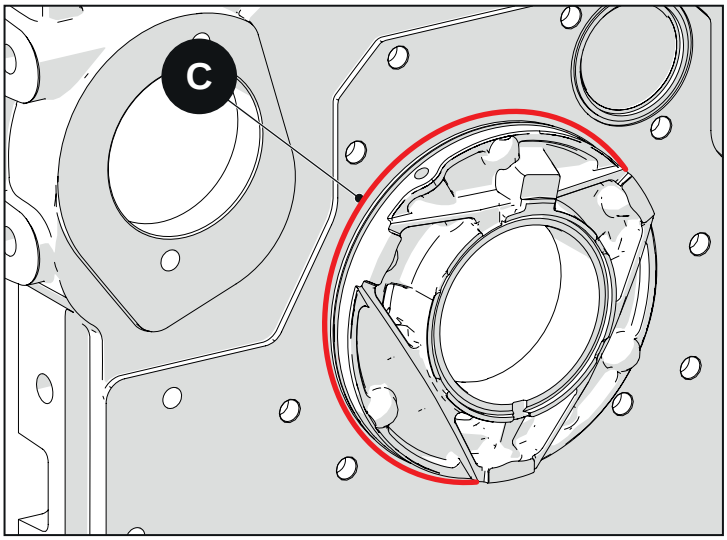

Fig. 2.131

2.37 Rear crankshaft bearing

2.37.1 Removal

- Remove the flywheel and the housing. (See the respective section).
- Separate the bearing from the housing, removing the nuts fastening the bearing itself

2.37.2 Installation

- Check the condition of the rear shim and that it is seated correctly on the bearing.
- Replace the rear shim if in any doubt.
- Fit a new O-ring around the outer circumference of the rear bearing and apply silicone sealant (see the section Flywheel Housing).
- Align the housing with the pin installed in the rear bearing.
- Fit and tighten the nuts fastening the rear bearing.

Rear bearing fastener nuts: 24.5 N·m

A - Rear bearing fastener nuts
B - Pin installed in the rear bearing

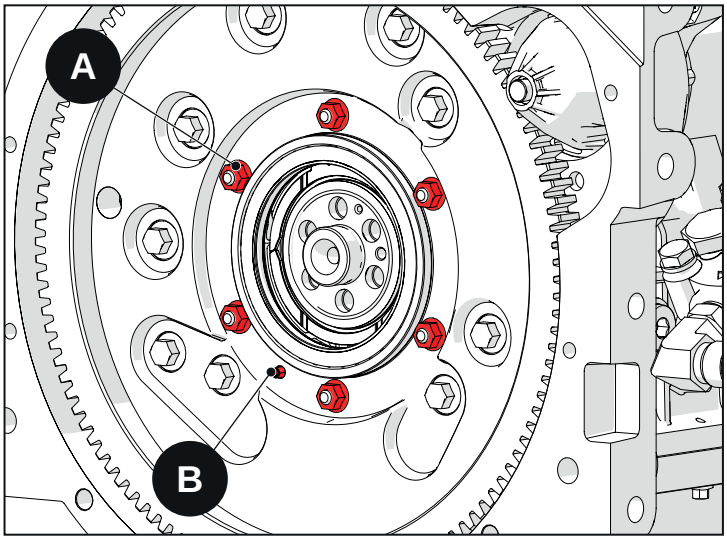

Fig. 2.132

2.38 Shim

2.38.1 Removal

- Using a commercially available tool, carefully prise out and remove the 2 half-rings of the rear shim. Take care not to damage the rear bearing and the rear oil seal.

2.38.2 Installation

- Ensure that the 2 half-rings are installed correctly in the rear bearing and that the oil passages face outward, as shown in the figure. Engage the lug on one of the two half-rings in the seat in the rear bearing.
- Press the 2 half-rings simultaneously into the bearing.

A - lug
B-C - 2 half-rings
D - oil passages (grooves)

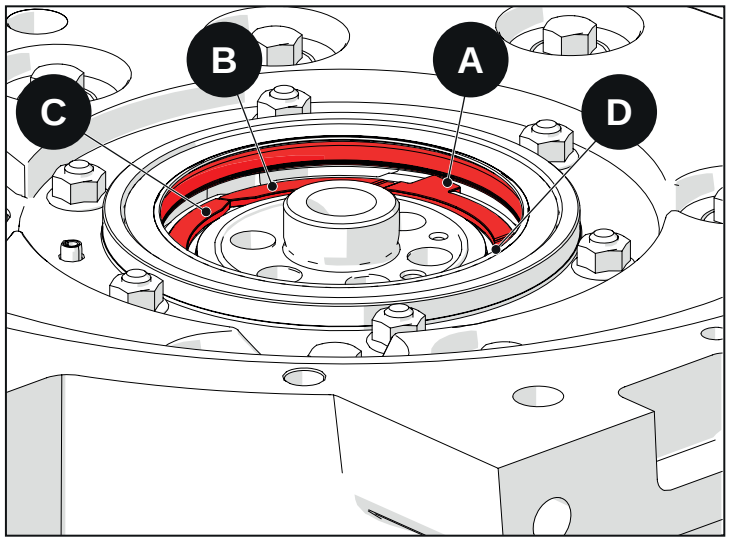

Fig. 2.133

2.38.3 Specifications

Rear shim	
Standard	2.310 - 2.360 mm
1st oversized class (+0.1)	2.410 - 2.460 mm
2nd oversized class (+0.2)	2.510 - 2.560 mm

2.39 Rear main bearing bush

2.39.1 Removal

- Drive the bush out from the bearing with a press.

2.39.2 Installation

- Align the hole in the new main bearing bush with the oil passage hole in the rear bearing and press the new bush into the bearing.

A - Lubrication oil passage

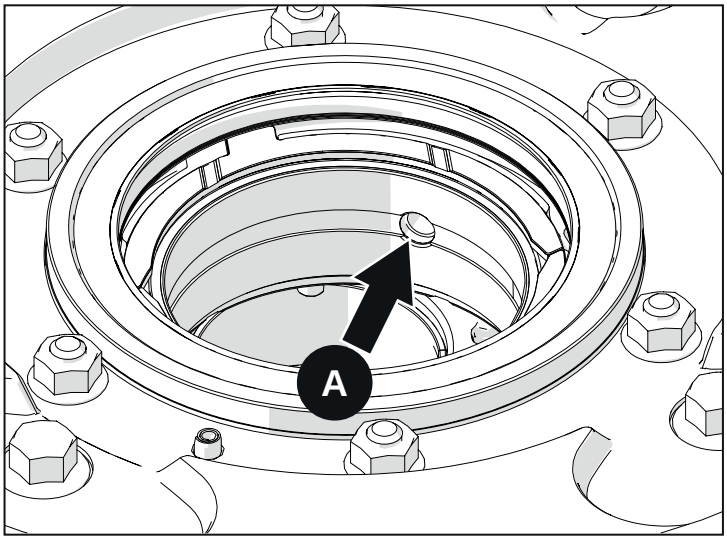

Fig. 2.134

2.39.3 Specifications

Internal diameter of bush (installed in bearing)	80.045 - 80.07 mm
1st bush size reduction class	0.25 mm

Warning
See the section Crankshaft for the procedure for determining the correct free play between the rear main bearing bush and the rear crankshaft bearing.

2.40 Rear oil seal

2.40.1 Removal

Using a commercially available tool, carefully prise out and remove the oil seal. Take care not to damage the rear shim and the main bearing bush.

2.40.2 Installation

Warning
The rear oil seal consists of special components; do not touch or handle the lip of the oil seal. Do not use a hammer to attempt to drive the rear oil seal into its seat. This may cause damage to the oil seal or to the rear bearing.

Lubricate the outer circumference of the oil seal. Do not touch the lip of the oil seal.

Install the new oil seal in the rear bearing using the special tool. The rear oil seal is seated correctly once the tool stops and can go no further.

2.41 Tone wheel

2.41.1 Removal

- Remove the engine flywheel and the flywheel housing complete with rear bearing.
- Loosen and remove the 3 screws fastening the tone wheel.

A - Tone wheel

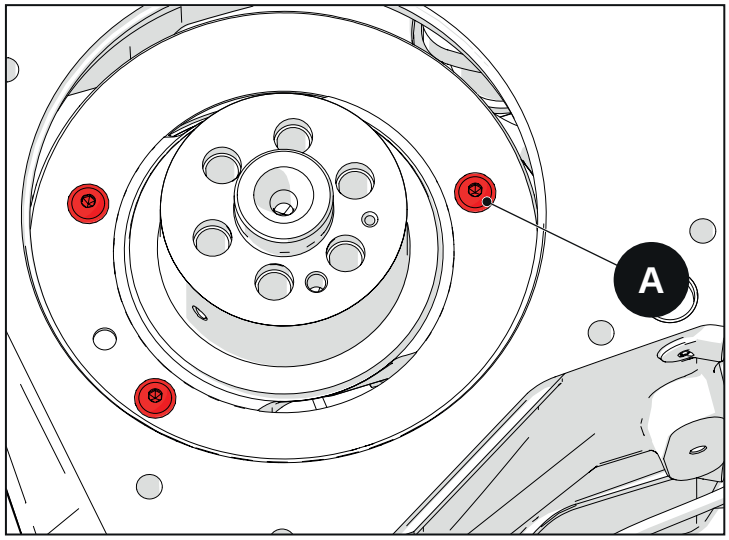

Fig. 2.135

2.41.2 Installation

- Replace the screws with new components, or, if possible, reuse the same screws, applying Loctite 510 to the threads.
- Fit the screws and tighten them

tone wheel fastener screws: 14.7 N·m

2.42 Head gasket - Piston-to-head clearance

Warning
When the heads are removed for servicing and the pistons and cylinder sleeves are not removed, when reassembling, use a head gasket of the same thickness as the component removed. See the section Head gasket identification

Follow the procedure described below when reassembling a complete engine or if the pistons and cylinder liners have been removed.

- Use a dial gauge and a mounting block (special tool) (see the section Special Tools) to measure the piston protrusion relative to the top deck of the cylinder block/crankcase at TDC.
- Place the block with the dial gauge on the top deck of the cylinder block/crankcase and set the dial gauge needle to zero.
- Slide the mounting block towards the piston at TDC as shown in the figure. Note the value measured.
- Repeat the procedure to measure the protrusion of the other pistons. Calculate the average of the values measured for all cylinders to determine the head gasket thickness necessary.

A - special tool - block
B - dial gauge
C - piston

Piston protrusion - AVERAGE	Required gasket thickness
0.60 - 0.72 mm	1.42 mm
0.73 - 0.82 mm	1.52 mm
0.83 - 0.95 mm	1.62 mm

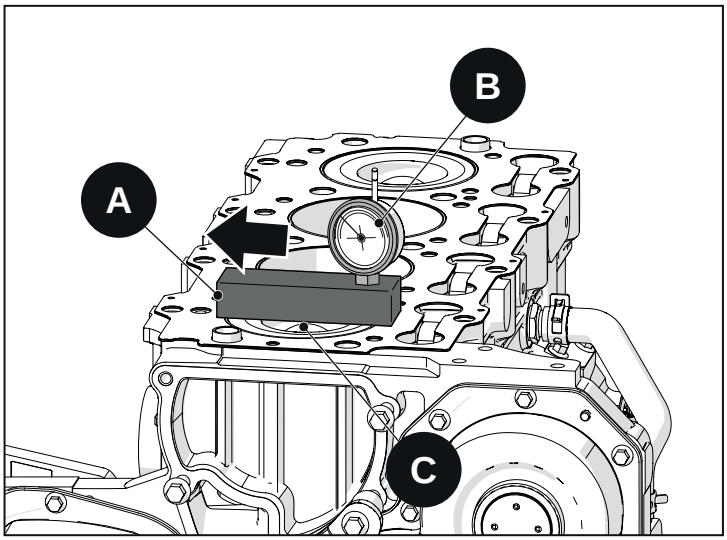

Fig. 2.136

After determining the gasket thickness required, identify and select the appropriate gasket.

Note the identification markings (notches or holes) in the corner of the gasket, as shown in the figure.

No markings indicate a thickness of:	1.42 mm
2 markings indicate a thickness of:	1.52 mm
1 marking indicates a thickness of:	1.62 mm

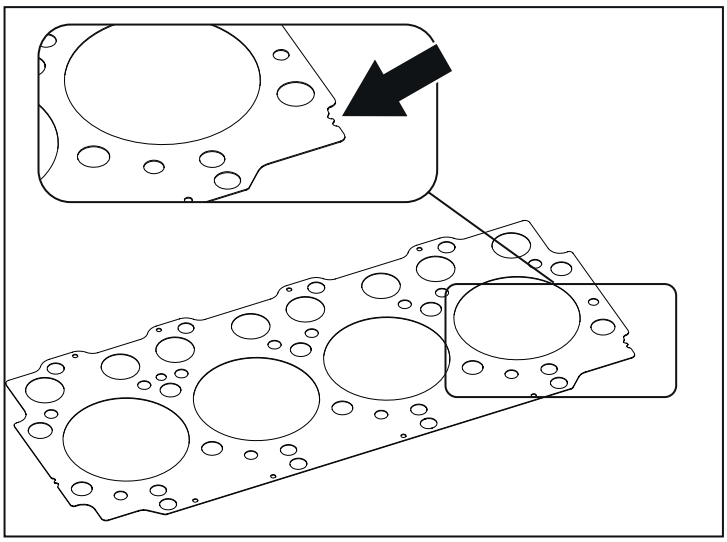

Fig. 2.137

2.43 Head - single head for all cylinders

2.43.1 Installation

- Clean the threaded holes in the cylinder block/crankcase into which the head fastener screws will be tightened.
- Clean the mating surfaces between the cylinder block/crankcase and the head.

Warning
Always replace the bolts with new components after removal

Warning
Do not lubricate new screws as they are pre-coated with anti-friction lubricant by the manufacturer.

Warning
Reusing the same screws is not recommended: however, if using the same screws, lubricate the threads and under the heads of all the M12 (12 mm) lateral screws and all the M14 (14 mm) central screws with Molykote G Rapid Plus grease.

Warning
The head gasket must be installed as it is, with no additional sealant or adhesive applied to the gasket itself.

- Place the head gasket on the cylinder block/crankcase.
- Fit the centring pins (see Special Tools) into the holes for the M12 lateral screws of each cylinder. These pins align the gasket correctly with the head.
- Fit the M12 screws and the M14 central screws and hand-tighten them all.
    - a = single head
    - b = lateral screw
    - c = central screw

2.43.1.1 Tightening screws

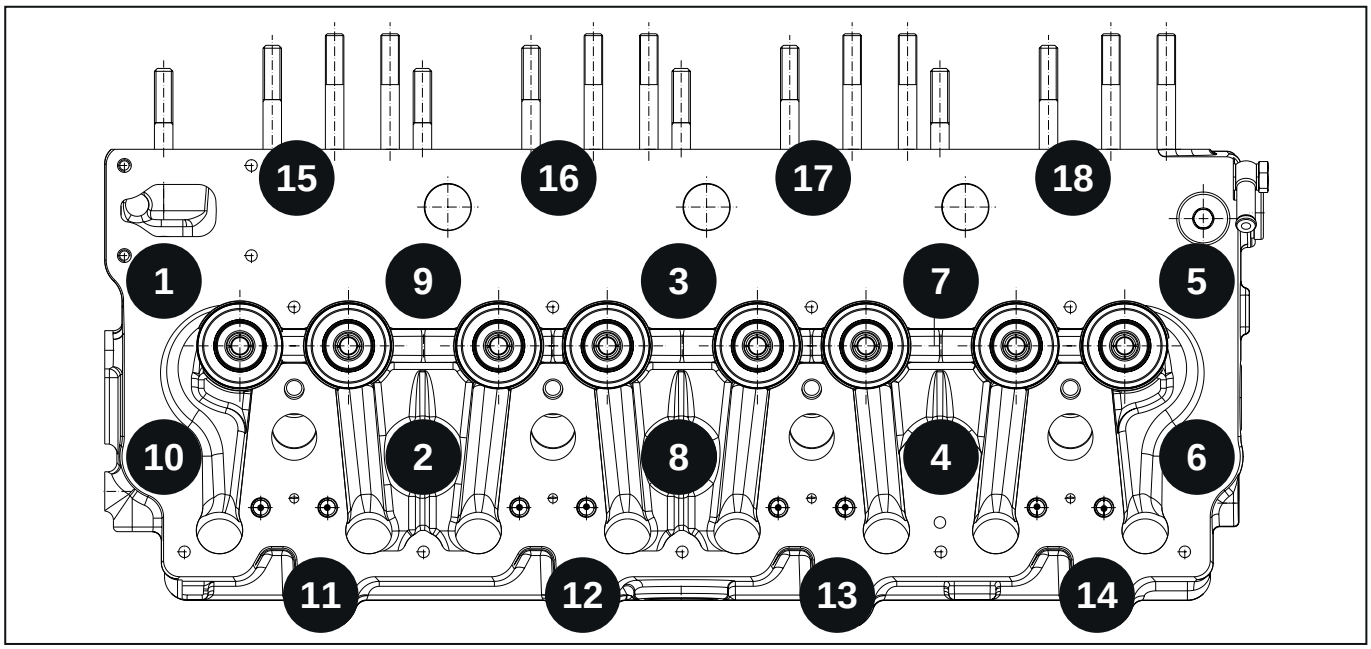

Fig. 2.138

Central screws

- a.: Tightening torque - 30 N·m
  - Order: 3-2-1-4-5-8-9-10-7-6
- b. : Additional tightening angle + 65°
  - Order: 1-2-3-4-5-6-7-8-9-10
- c. : Additional tightening angle + 65°
  - Order: 1-2-3-4-5-6-7-8-9-10

Now tighten the lateral screws in the order indicated, following steps a, b, c and d.

Lateral screws

- a.: Tightening torque - 30 N·m
  - Order 11, 12, 13, and 14
- b. : Additional tightening angle + 85°
  - Order 11, 12, 13, and 14
- c. : Tightening torque - 30 N·m
  - Order 15, 16, 17, and 18
- d. : Additional tightening angle + 85°
  - Order 15, 16, 17, and 18

1 - lubrication hole
2 - oil drain hole from rockers

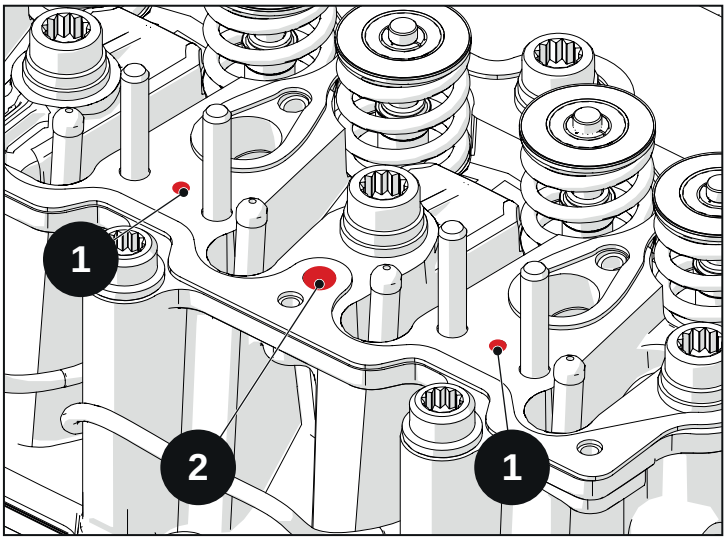

Fig. 2.139

1 - oil delivery hole to rockers
2 - oil drain hole from rockers
3 - water ducts

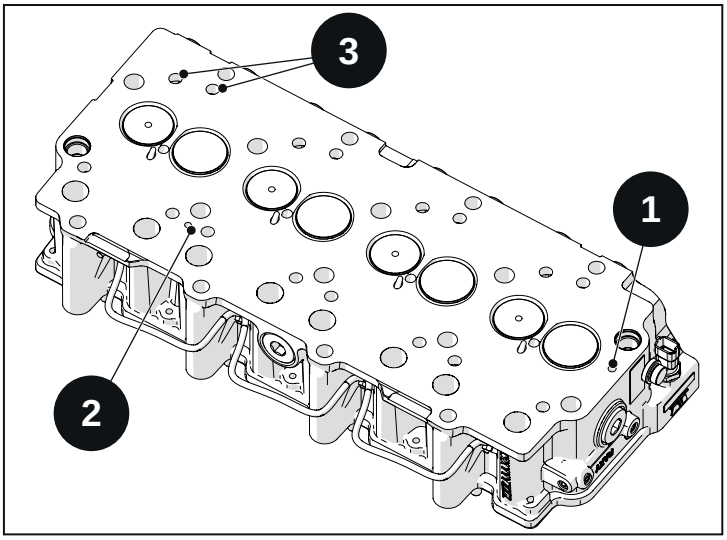

Fig. 2.140

2.44 Retightening heads

Warning
The procedure to retighten the heads must be performed whenever the head or heads are removed and irrespective of the type of head installed on the engine

Warning
A specific retightening procedure must be performed whenever the heads are replaced or removed. Retighten the head fasteners as indicated after the first 20-30 minutes of operation, with a cold engine.

- Run the engine at accelerated idle speed for one minute and then run at 1/3 maximum engine speed for approximately 20-30 minutes, until the coolant temperature reaches operating temperature (70-80 °C).
- Switch off the engine and wait for it to cool to a temperature below 40°C, measured on cylinder head 1.
- Follow the steps in the procedure one by one, loosening each M14 central bolt and retightening as indicated.

Central screws - M14

Working on one screw at a time, loosen each screw completely and retighten to 30 N·m + 120° (or 60°+60°) in the order indicated below.

- Loosening order
    - 1-2-3-4-5-6-7-8-9-10
    - Torque 30 N·m + additional angle of 120° (or 60°+60°)
- Tightening order
    - 1-2-3-4-5-6-7-8-9-10

Lateral screws - M12

Note
the retightening procedure is not required for the M12 lateral screws from number 11 to 18 (4 cylinder engines) or from number 15 to 26 (6 cylinder engines). If necessary, check the M12 lateral screws with a torque wrench set to the indicated torque value.

- Torque wrench setting for checking tightness 90 N·m
- Checking order
    - 11-12-13-14-15-16-17-18

2.45 Valve guides

- Inspect the valve guides to check for chipping or cracks.
- Inspect the valve guides to check for signs of seizing, carbon deposits or scoring.
- Check the height of the valve guides
- Remove the oil seals from the valve stems.
- Install a new valve in the guide.
- Measure valve guide free play as follows:
  - Mount a dial gauge on the surface of the head. Place the probe of the dial gauge against a point on the valve stem close to the valve guide.
  - While holding the top end of the valve approximately 2 mm outside the guide, push the stem backwards and forwards in as shown by the arrows. Compare the valve stem free play against the values indicated in the following specifications.
  - Measure the inner diameter of the valve guide. If the free play measured is not within the permitted range specified, replace the valve guide.

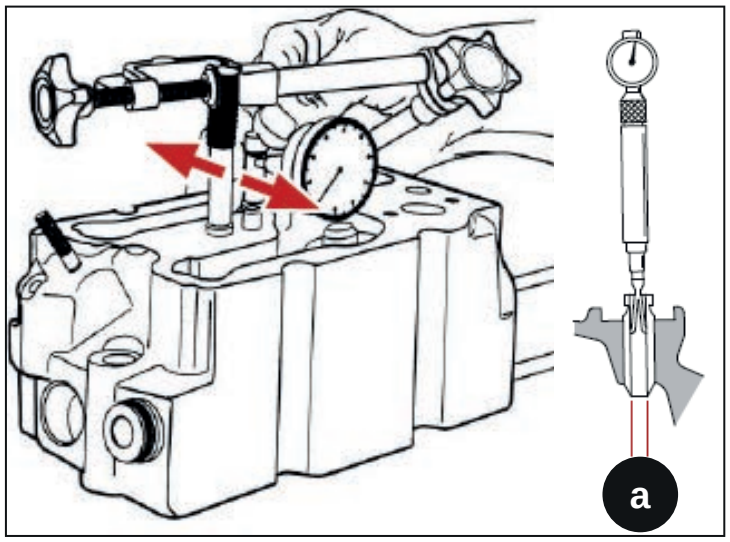

Fig. 2.141

2.45.1 Specifications

Valve stem - diameter (see chapter “Valves”)	
Exhaust	7.921 - 7.939 mm
Intake	7.94 - 7.96 mm

Valve stem free play - production specifications	
Exhaust	(0.04 - 0.073) mm
Intake	(0.03 - 0.065) mm

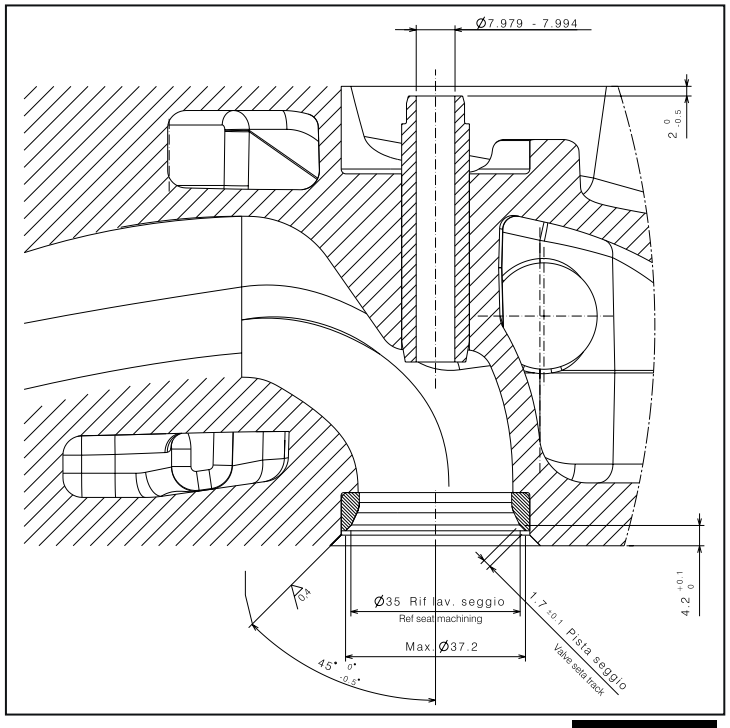

Fig. 2.142

Inner valve guide diameter - production specifications.	
Exhaust	7.979 - 7.994 mm
Intake	7.99 - 8.005 mm

Valve guide height	
Exhaust	54.75 - 55.25 mm
Intake	54.75 - 55.25 mm

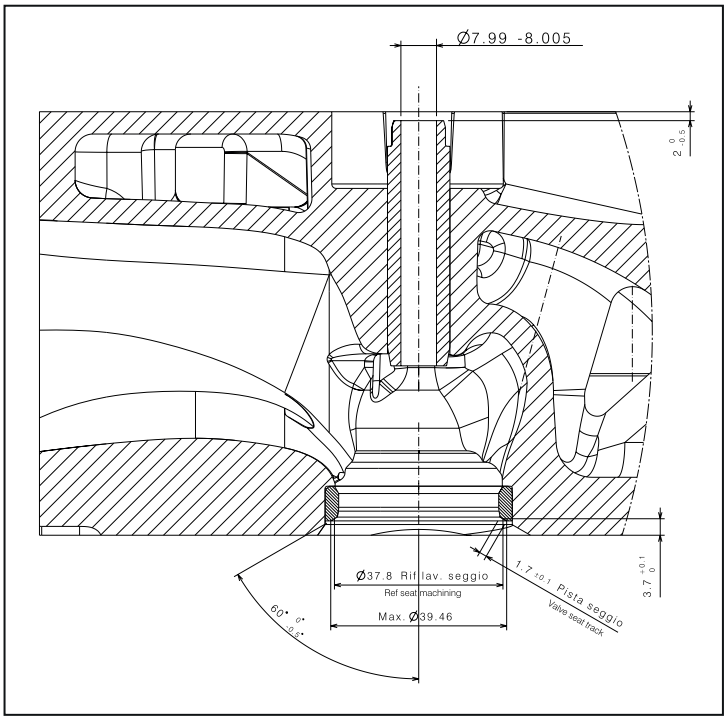

Fig. 2.143

2.45.2 Replacement

Warning

The heads are manufactured from aluminium. This material may warp or melt if heated inappropriately.

Using a blow torch will heat an aluminium head excessively and unevenly. Never use a blow torch to heat a cylinder head. Use a specific workshop oven for heating mechanical components to heat an aluminium cylinder head in order to replace a valve guide or valve seat.

- Remove the oil seal.
- Heat the head in an oven to 85°C (185°F).
- Remove the old guide.
- With the head heated to 85°C (185°F), press the new guide into the head to attain the measurement specified.

A - Valve guide protrusion (relative to upper surface of head) (EXHAUST/INTAKE)

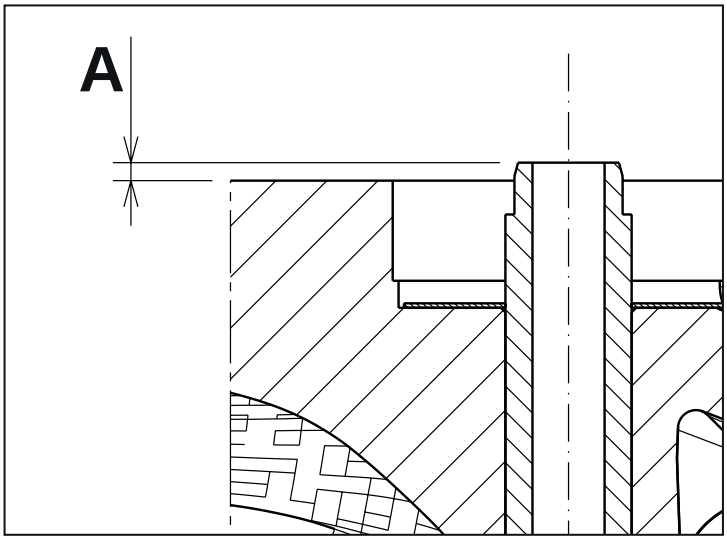

Fig. 2.144

A	1.5 - 2 mm
b (for R754IE4- TE4-ISE4-R754EU6 engines with single head for all cylinders)	1.5 - 2 mm

Warning

If the valve guide has been removed, both the valves and the valve guides must be replaced as sets.

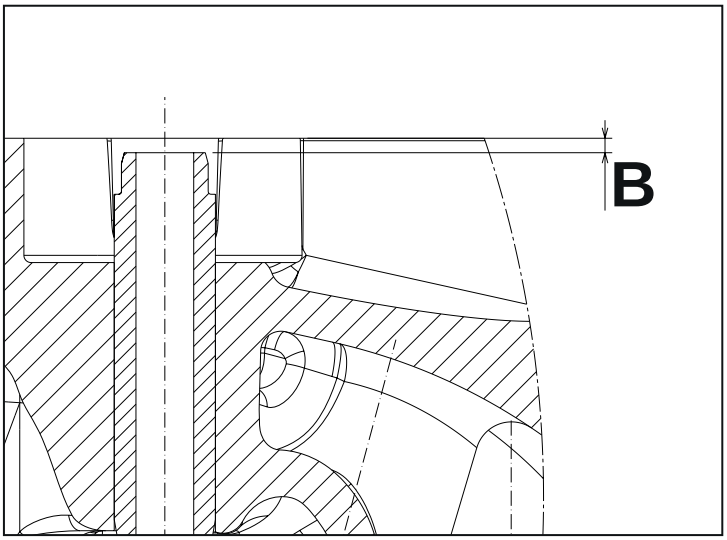

Fig. 2.145

2.46 Valve seat

- Inspect the valve seats to check for excessive wear.
- Measure the valve seats. See the specifications for the valve seats.
- If the values measured are not within specifications, recondition the seats. If the valve seats can no longer be reconditioned, the head must be replaced. See the section Repair - Reconditioning Valve Seats.

Measurements

A - Valve recession
B - Inner diameter

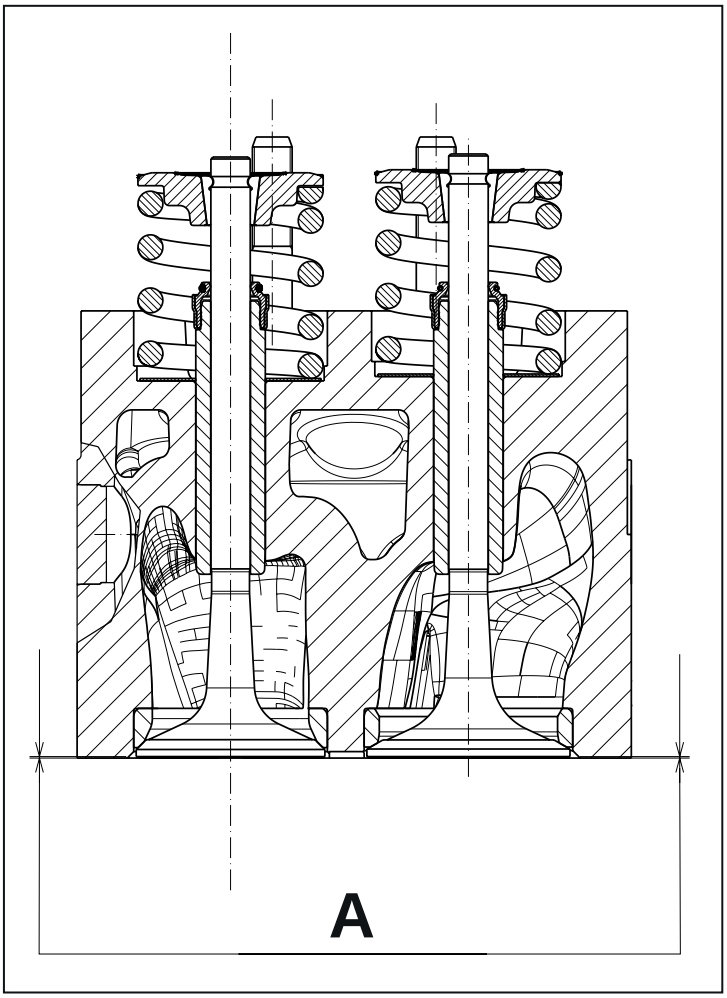

Fig. 2.146

Valve recession (service limit) (A)	
Exhaust	0 - 0.3 mm
Intake	0 - 0.3 mm

Inner diameter (B)	
Exhaust	38.964 - 38.988 mm
Intake	41.962 - 41.985 mm

Height (B1)	
Exhaust	11 - 11.1 mm
Intake	11 - 11.1 mm

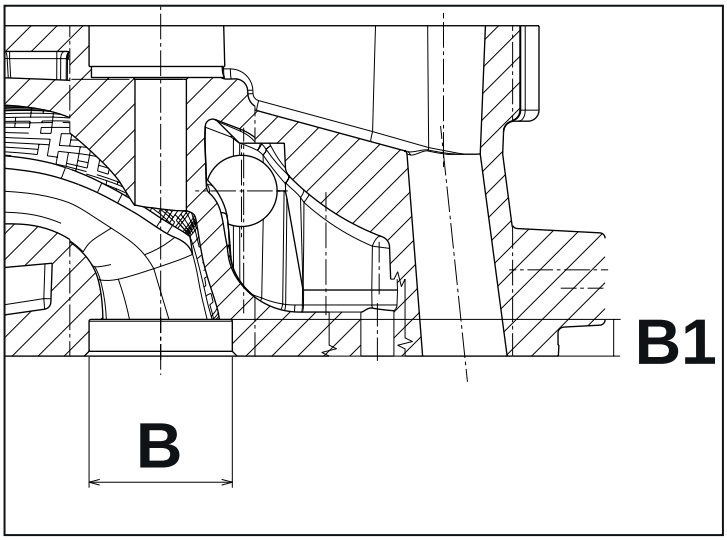

Fig. 2.147

Exhaust

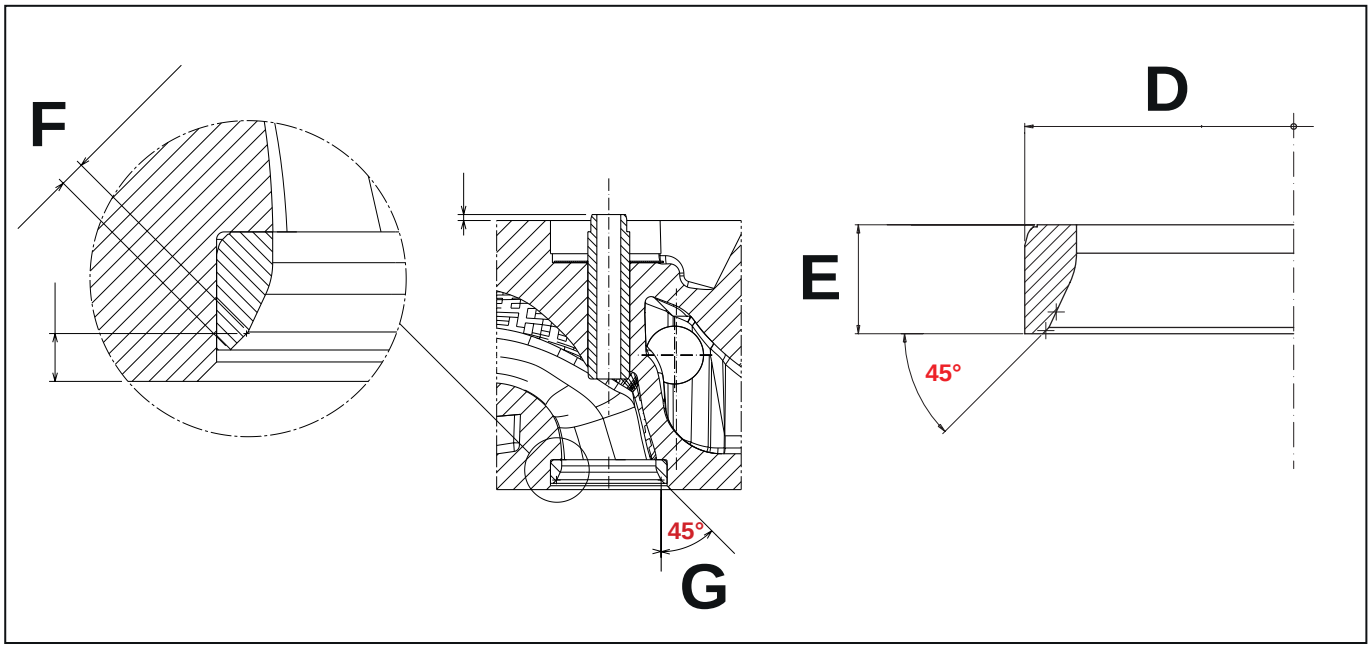

Fig. 2.148

External diameter of seat (D)	39.050 - 39.066 mm
Seat height (E)	7.85 - 7.95 mm
Seat bevel (F)	1.6 - 1.8 mm

Intake

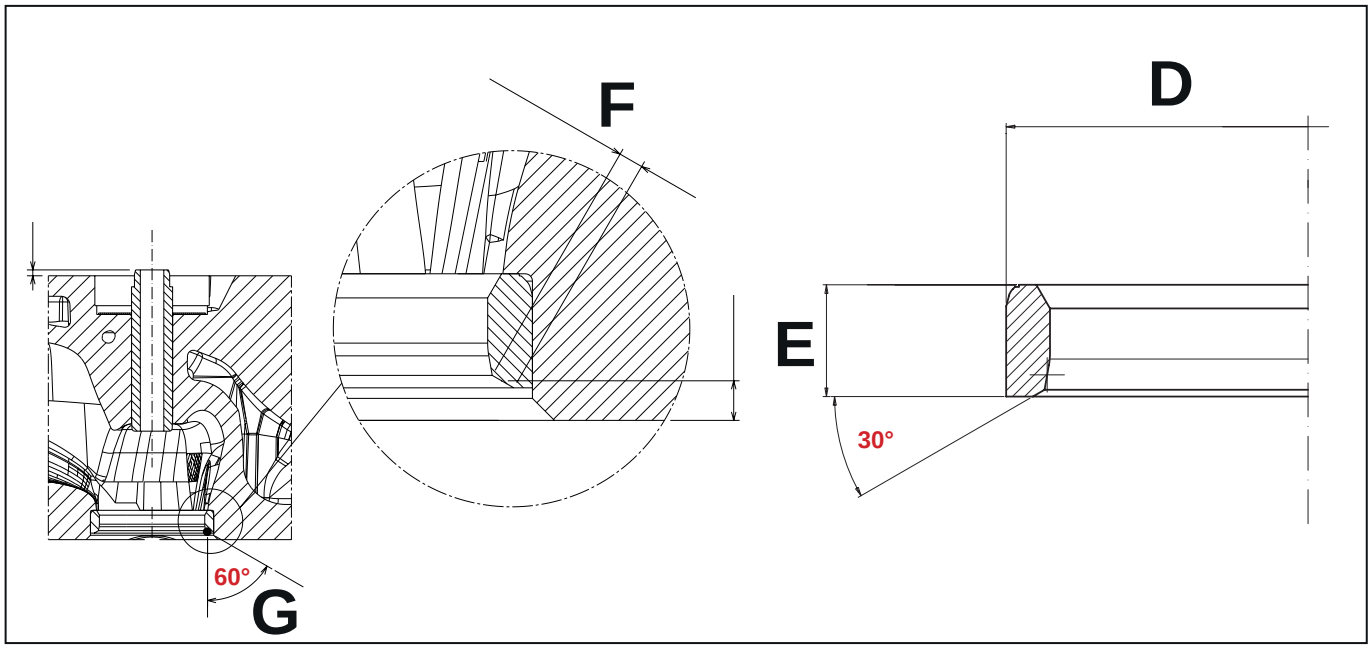

Fig. 2.149

External diameter of seat (D)	42.070 - 42.086 mm
Seat height (E)	7.73 - 7.83 mm
Seat bevel (F)	1.6 - 1.8 mm

2.46.1 Reconditioning valve seats

Note

A number of different products are available for reconditioning valve seats.

To ensure the best possible results, follow the instructions given by the manufacturer of the product used precisely.

Warning

It is imperative that the valve seats are completely clean and not fouled with any carbon residue to ensure that the valve, the valve guide and the respective seat are aligned precisely and ensure correct concentricity of the components when reconditioning the valve seats.

The original bevel angle must be maintained when reconditioning valve seats.

If reconditioning removes excessive material and thickness from the seats themselves, causing excessive valve recession, or results in an excessively large bevelled surface, replace the valve seat with a new component. During replacement, take particular care not to damage the inner diameter of the bore in the head in which the seat is installed.

Before installing the seat, heat the head to 150°C in an oven or cool the seat to -170°C in liquid nitrogen.

If the conditions for installation described above are met correctly, the seat will fit directly into the head without requiring any force.

2.47 Valves

- Inspect the valves to check for signs of damage and/or deformation. Replace if necessary.
- Measure the valves. Recondition the valves if the values measured are not within the specified limits. See the section Reconditioning Valves. Replace the valves if they cannot be repaired/reconditioned.

	Intake (mm)	Exhaust (mm)
A - Valve stem diameter valve (production, new)	7.94 - 7.96	7.921 - 7.939
F - Face width (production, new)	3.57 - 3.85	2.640 - 2.992
D - Margin (production, new)	1.82	1.73
Service limit	1.30	1.30
E - Angle (production, new)	29 deg. 30 min.	44 deg. 30 min.
B - Head diameter (production, new)	40.8 - 41	37.9 - 38.1

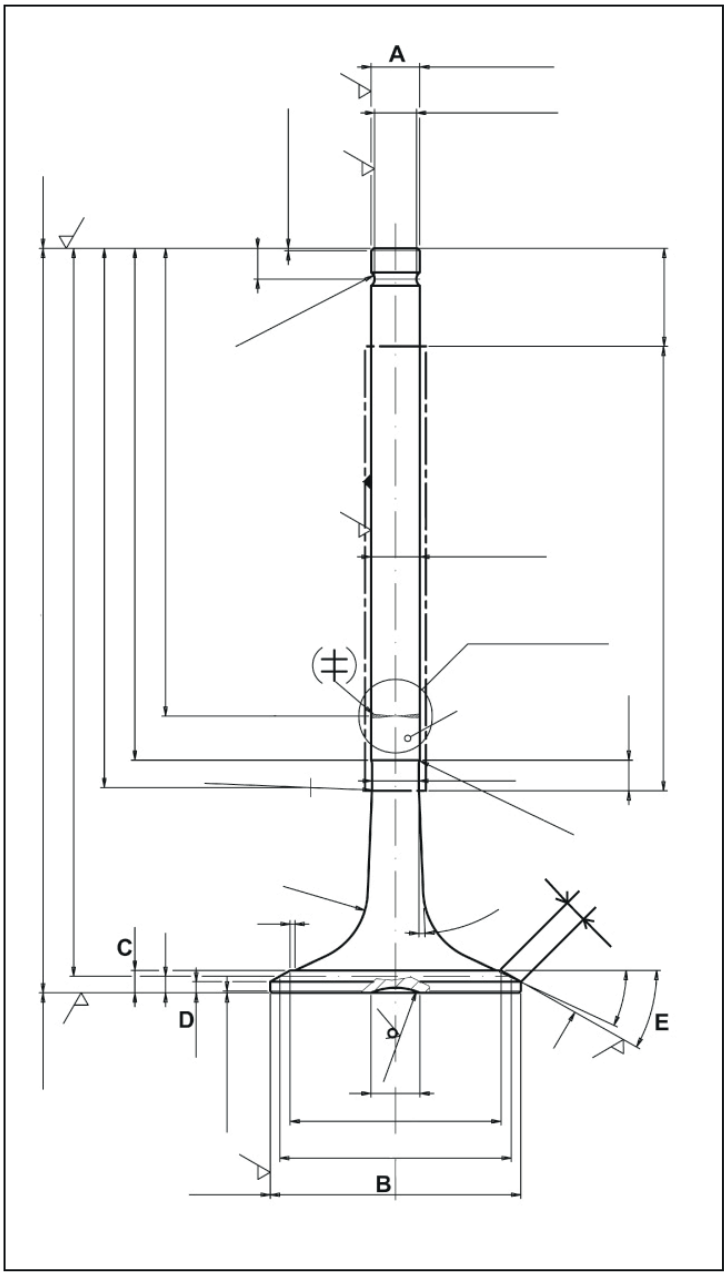

Fig. 2.150

2.47.1 Reconditioning valves

Pitted valves may be reconditioned to restore the correct angle with a valve refacer machine, which ensures the correct ratio/angle between the mating surfaces of the valve seat and the valve.

- Replace valves with excessively worn stems or which are excessively deformed.
- Measure the valves after refacing, and replace if not within specifications.
- Reface work or pitted valves to the correct .

Note
When refacing valves, ensure that the margin does not exceed 1.30 mm.

Measure the margin after refacing. If excessive material has been removed from the valve, resulting in a margin exceeding the specified limit, replace the valve.

2.47.2 Assembly

Note
Oil seals are fitted on both valves.

- Lubricate the valve guides and the valve stems with engine oil.
- Refit each valve in its original position
- Fit the oil seal on the stem and push down to bring it into contact with the guide.
- Fit the bottom collar, the spring, the split cones and the upper spring retainer cap.
- Compress the spring with a commercially available tool.

A - oil seal
B - oil seal seated against guide

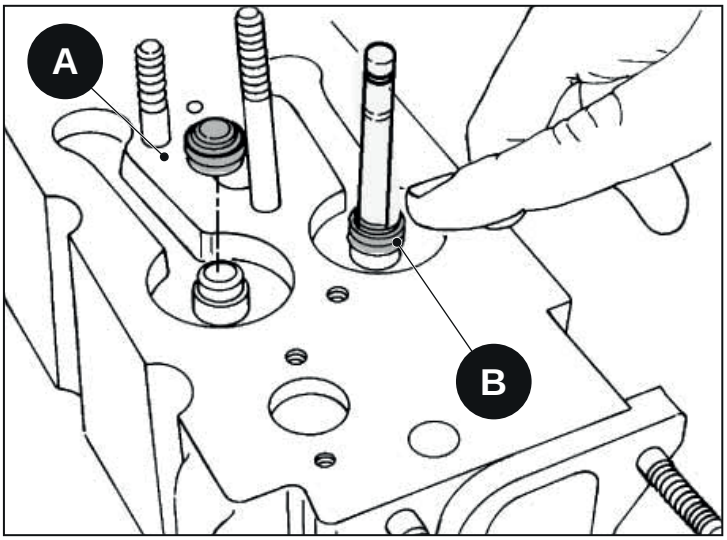

Fig. 2.151

Note
Lubricant may be used to hold the split cones in place when releasing the valve compressor tool.

- Grease the split cones to hold them in place.
- Install the split cones.
- Slowly release the valve compressor tool, ensuring that the split cones seat correctly in the groove on the valve stem.

A - Lower collet
B - Valve spring
C - Upper spring retainer cap
D - Split cones

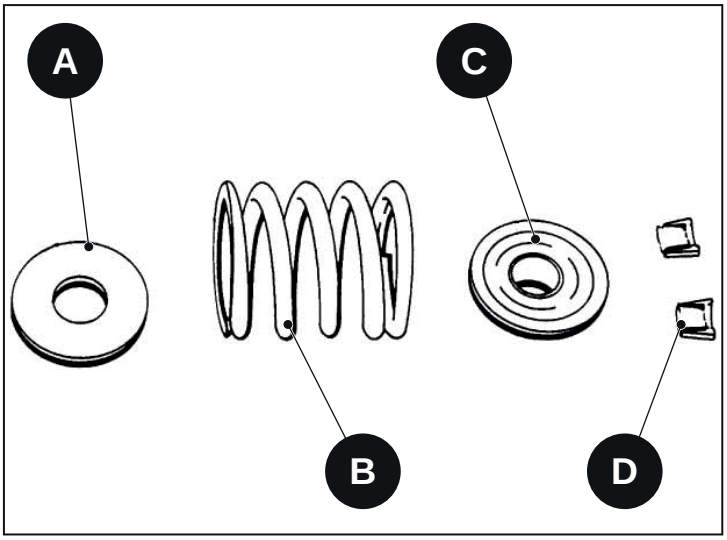

Fig. 2.152

2.48 Valve spring

- Inspect the springs to check for signs of discolouration caused by overheating.
- Inspect the split cones, the bottom collars, the upper retainer caps and the springs for wear, deformation or cracks.
- Measure the free length of each valve. Replace the valve if the value measured is not within specifications.
- Measure the distortion angle. Replace the valve if the value measured exceeds the specified limit.

Free length (A)	Intake - Exhaust	48 mm
Distortion angle (B)	Intake - Exhaust	Service limit 2 mm

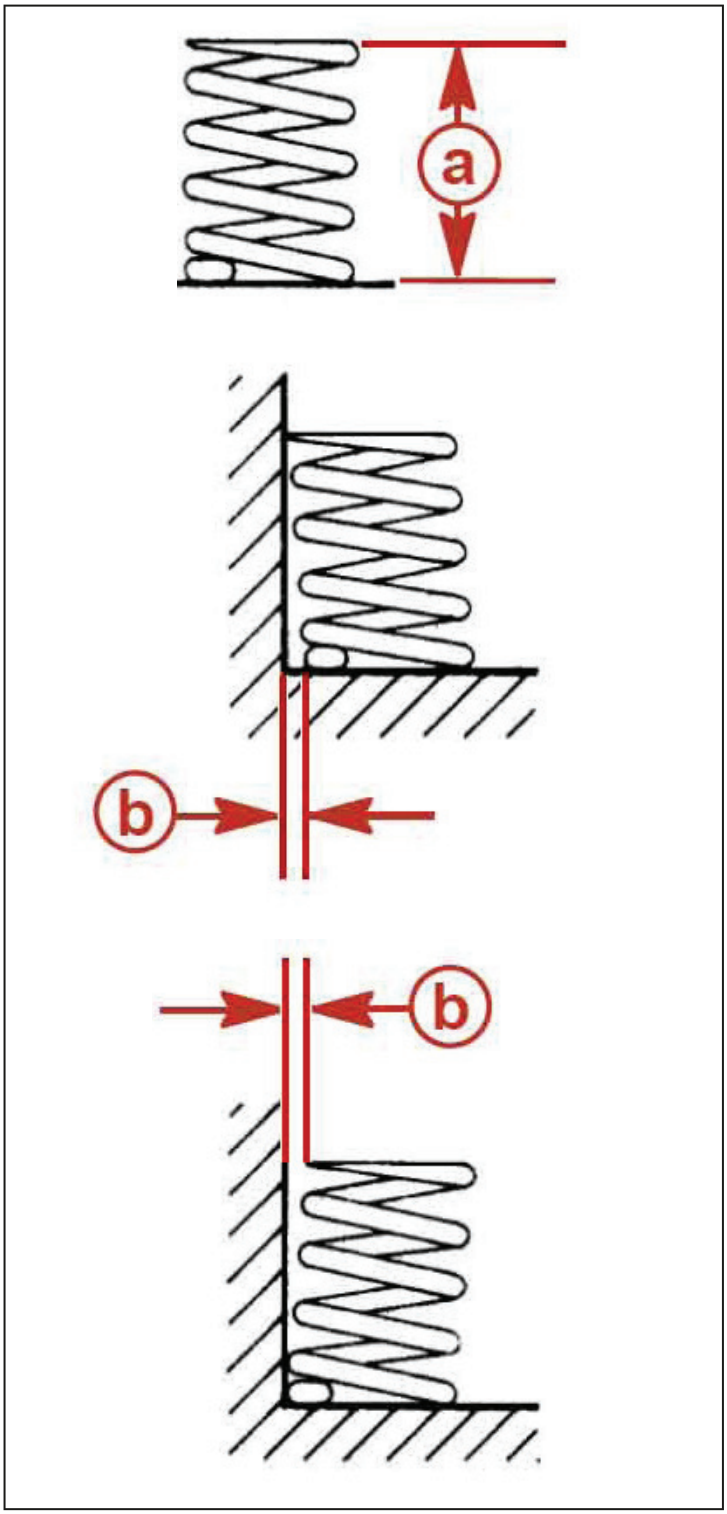

Fig. 2.153

Valve open

a - pressure applied
b - height

Pressure applied: 294 N ± 6%

Height: 38.5 mm

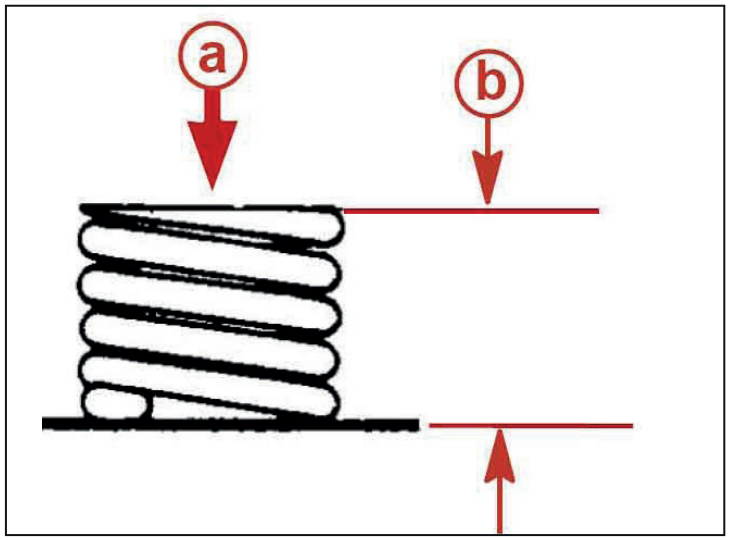

Fig. 2.154

Valve closed

a - pressure applied
b - height

Pressure applied: 635 N ± 4%

Height: 28.2 mm

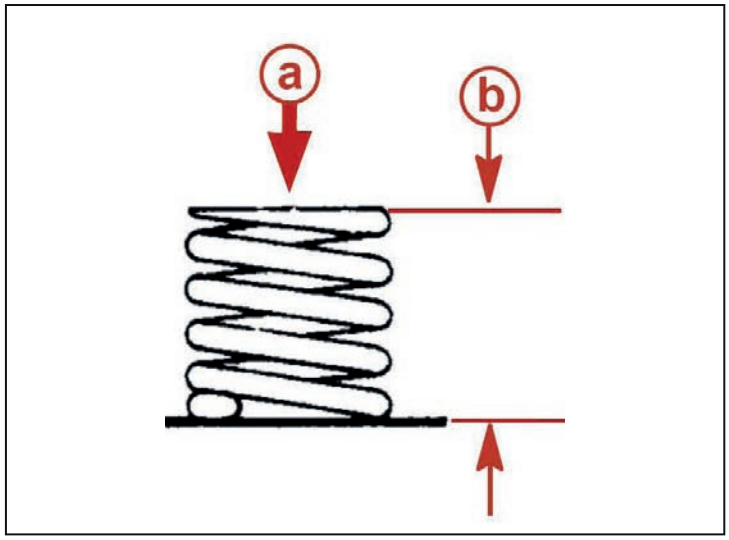

Fig. 2.155

2.49 Rockers

2.49.1 Removal

- Remove the rocker cover.

Warning
During removal, mark the components or keep them the order of removal to ensure that they are refitted correctly in the original positions.

- Remove the rocker assemblies and rocker rods. Number the components according to their original positions in the engine, or mark them appropriately, to ensure that they are refitted correctly in their original positions.

2.49.2 Cleaning

- Clean the components with solvent.
- Dry with compressed air.

2.49.3 Inspection

- Inspect the components to check for excessive wear, cracks or other damage.

Note
An oil passage is drilled through the entire length of the rocker rods to deliver oil to each rocker assembly.

- Visually inspect each rod to check for wear and deposits. Check that the oil passages in the rods are not obstructed or restricted.
- Roll each rod on a flat surface to check if it is bent.
- Replace any damaged parts.
- Use a micrometer to measure the outer diameter of the rocker pins.
- Replace the rocker carrier if the outer diameter is not within the following limits.

Outer diameter of rocker carrier (a)	21.979 - 22 mm

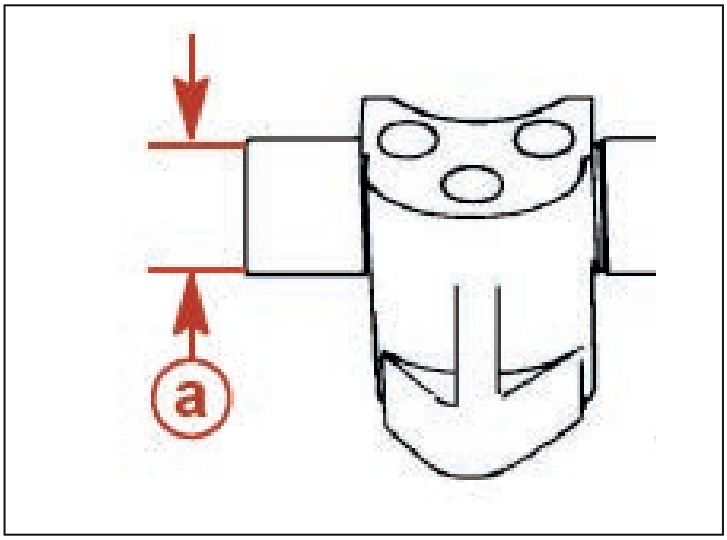

Fig. 2.156

Use a micrometer to measure the inner diameter of the rocker bush.

Inner diameter (production) (a)	22.03 - 22.05 mm
Free play after initial assembly	0.030 - 0.071 mm
Wear limit	

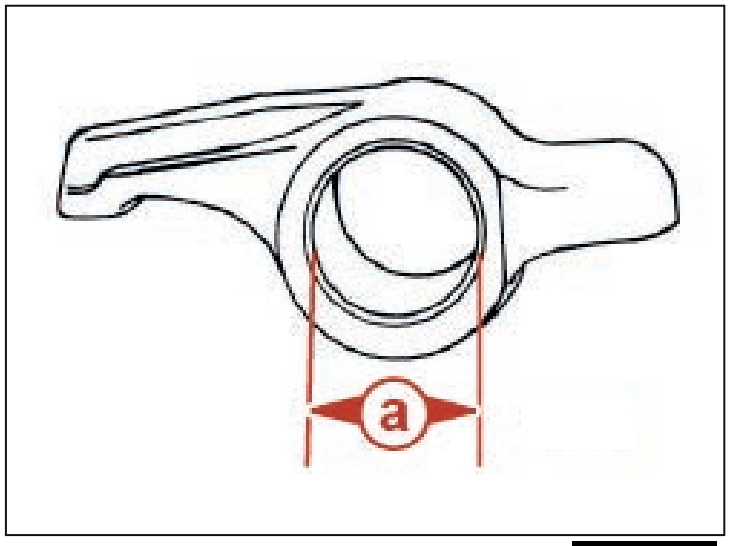

Fig. 2.157

2.49.4 Assembly

1 - Rocker carrier pin
2 - Exhaust rocker
3 - Intake rocker
4 - Stop washer
5 - Screw
6 - Wear pad
7 - Rocker bush

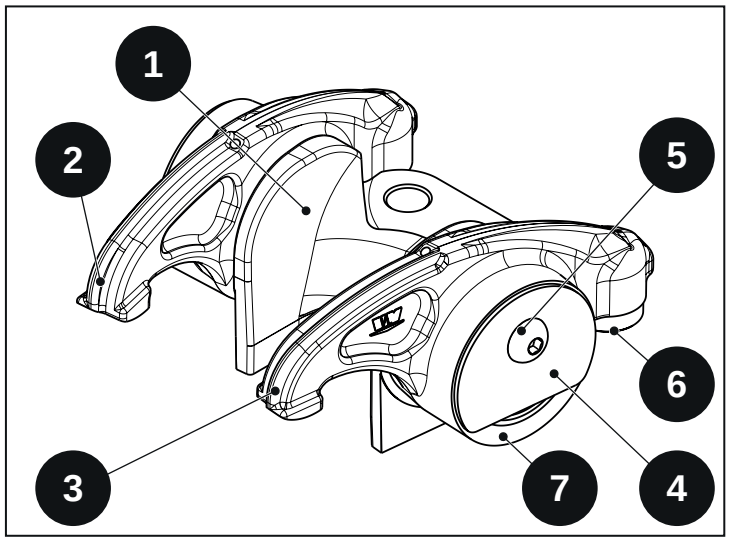

Fig. 2.158

1 - Rocker carrier pin
2 - Exhaust rocker
3 - Intake rocker
4 - Stop washer
5 - Screw
6 - Wear pad
7 - Rocker bush

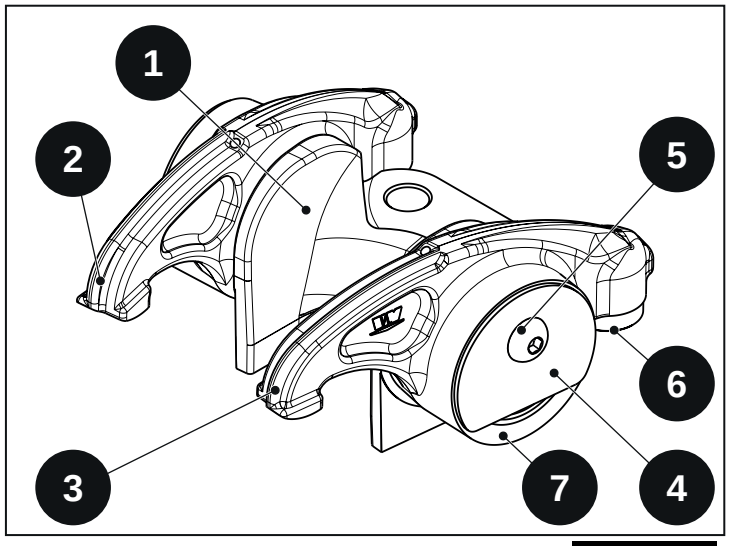

Fig. 2.159

Warning

Drain all residual oil from the tappets via the drain holes on the tappets themselves before assembling the rocker assembly, using the special tool (see the section Hydraulic Tappets) to compress the tappet.

- Lubricate the rocker bushes and the rocker carrier pins with engine oil.
- Install the rocker pins on the rocker carrier. Install the parts in the positions shown in the figure.
- Install the stop washer as shown in the figure and tighten the screw.
- Lubricate the outer surfaces and ends of the rocker rods.
- Fit the rods in their original positions. Ensure that the rods are installed correctly in the seats of the hydraulic tappets.
- Lubricate the contact surfaces of the rocker assembly.
- Lubricate the threads of the rocker assembly mounting stud bolts.
- Fit the rocker assembly on the stud bolts. Align the rods with the rocker seats while installing the assembly on the stud bolts.
- Fit both nuts fastening the rocker assembly. Tighten the nuts.
  rocker carrier fastener nuts: 29 N·m

X - rocker carrier fastener nuts
Y - rocker carrier

Warning

valve clearance is adjusted automatically when the complete rocker assembly is installed and fastened correctly.

Repeat the steps indicated for the rocker assembly of each cylinder.

No valve clearance adjustment is necessary.

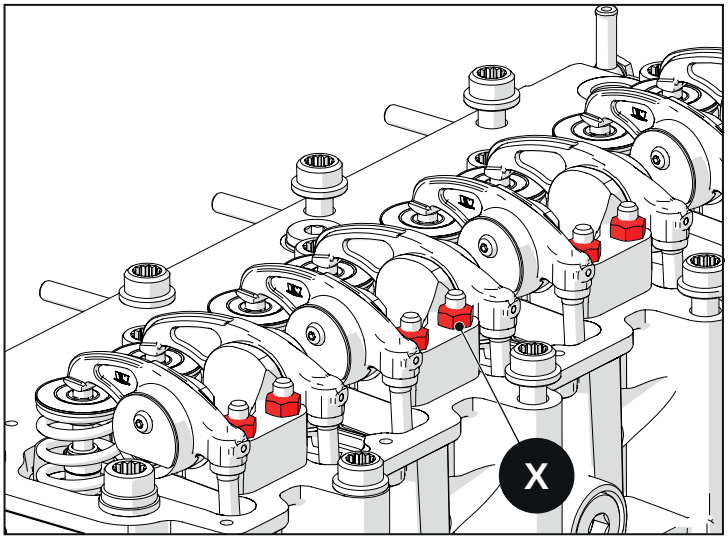

Fig. 2.160

2.50 Hydraulic tappets

Warning

The camshafts and tappets cause mutual wear to each other during operation of the engine.

Refitting a worn camshaft and worn tappets without matching them correctly in the original positions, or using worn components together with new components may cause accelerated, excessive wear and engine damage. Whenever it is necessary to replace any component, the camshaft and tappets must all be replaced together as a set with new components.

The hydraulic tappets are held in position and prevented from rotating by a special bracket. Each cylinder has its own individual bracket. Take particular care when installing these brackets to ensure that the flat surface of the tappet is engaged correctly in the anti-rotation bracket.

Warning

when installing the brackets, make sure that the flat surface of the tappet is engaged correctly in the anti-rotation bracket, and that the drain hole facing towards the engine.

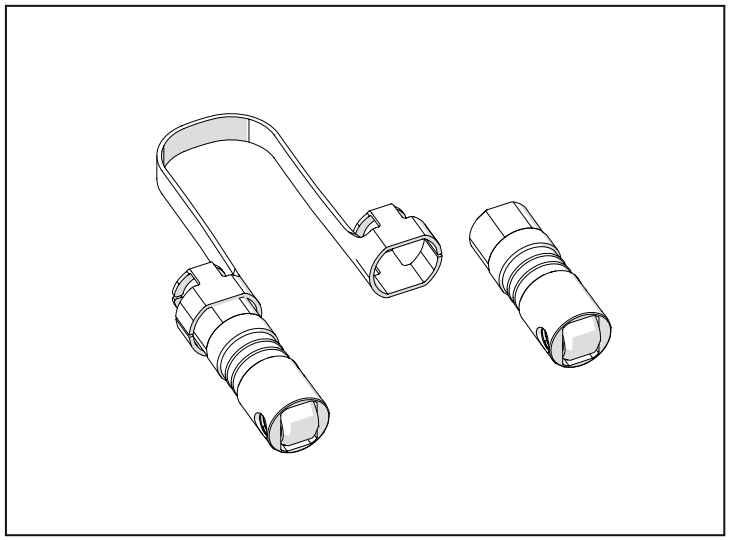

Fig. 2.161

2.50.1 Removal

- Remove the rocker cover.

Warning

keep the components of each individual rocker assembly in separate containers, marking them appropriately, to ensure that all the parts are reinstalled correctly in their original positions.

- Remove the rocker assemblies and the rods. Mark all components appropriately for identification.

Warning

tappets must be refitted in their original positions so that the tappet roller rotates in the same direction and against the same camshaft lobe, if the previous camshaft is reused.

- Make assembly reference markings on all the brackets and tappets to clearly identify the relative positions and orientation of the components in the seat on the cylinder block/crankcase.
- Raise the brackets into a vertical position, without disturbing the positions of or removing the tappets.
- Fit the special tool on the tappet. Compress the inner spring of the tappet, rotate by 90° and lift the tappet.
- Remove the remaining tappets, numbering them and keeping them in order of removal to ensure that they are reinstalled in the correct positions.

a - rocker rod
b - anti-rotation bracket
c - tappet
d - roller
e - drain hole
f - special tool

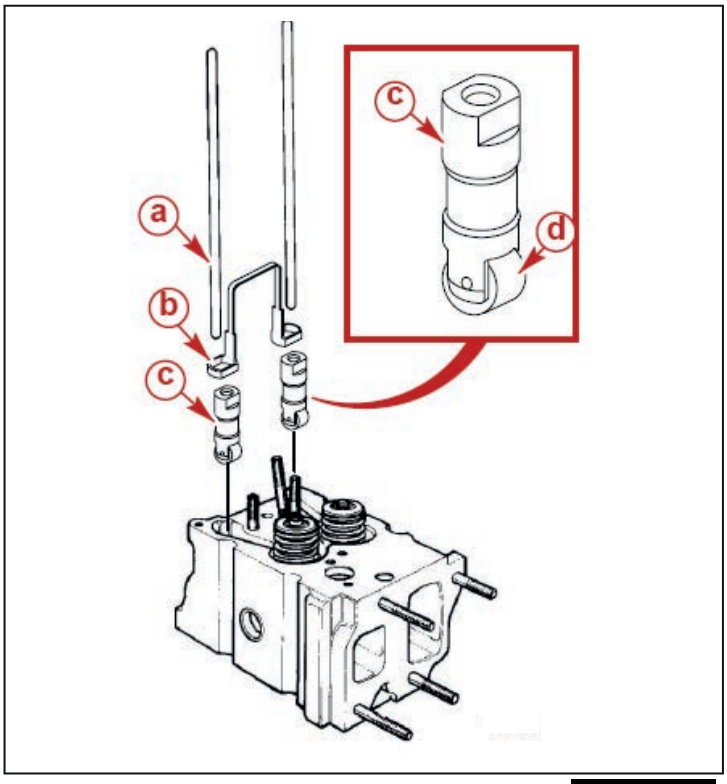

Fig. 2.162

a - drain hole
b - special tool

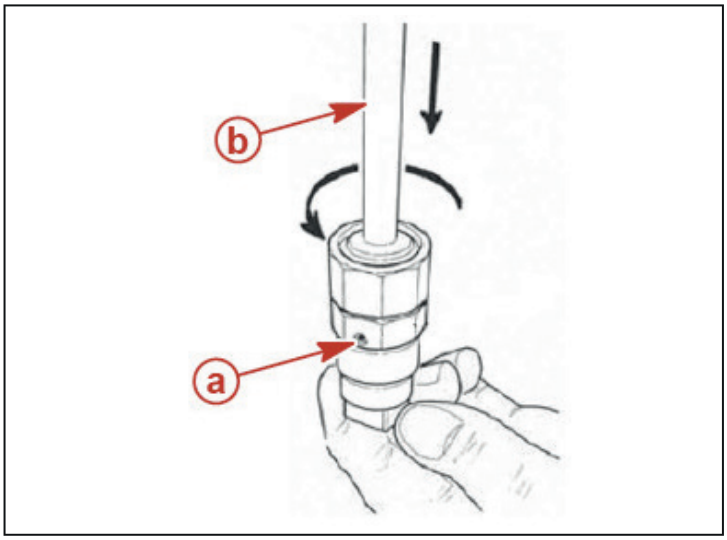

Fig. 2.163

2.50.2 Cleaning

- Inspect the contact surface with the rod A. If the seat is worn, also inspect the rods. Check that the seat shows no signs of seizing or pitting.
- Inspect the outer surface of the tappet. If the surface is worn or scratched, inspect the tappet seating bores in the cylinder block/ crankshaft.
- Inspect the tappet roller. If the roller is worn or scratched, also inspect the camshaft lobes.
- Measure the outer diameter of the tappet B. Replace the tappet if the value measured is below the specified limit.
  Outer diameter: 22.195 - 22.212 mm
- Inspect all parts carefully. If any parts are damaged or worn, the entire tappet must be replaced

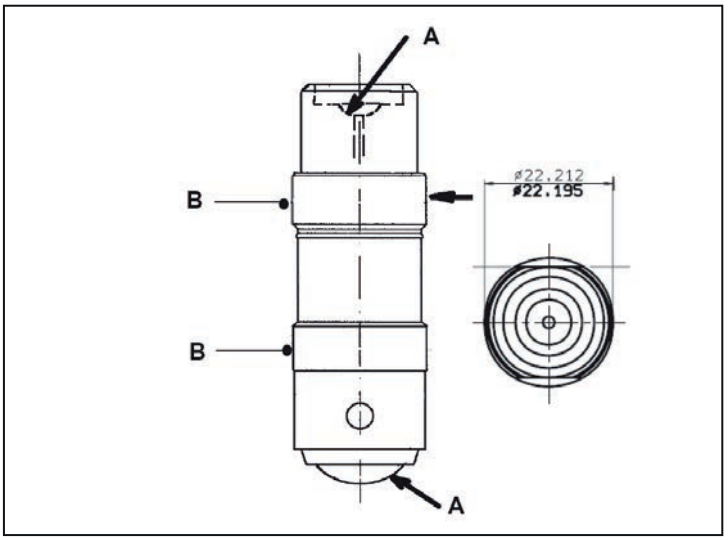

Fig. 2.164

2.50.3 Installation

Warning

The camshafts and tappets cause mutual wear to each other during operation of the engine.

Refitting a worn camshaft and worn tappets without matching them correctly in the original positions, or using worn components together with new components may cause accelerated, excessive wear and engine damage. Whenever it is necessary to replace any component, the camshaft and tappets must all be replaced together as a set with new components.

Warning

Lubricate each tappet completely before installing the hydraulic tappets. When installing a new camshaft and tappets, pour engine oil over the tappet rollers and the camshaft lobes.

Warning

Drain all residual oil from the tappets via the drain holes on the tappets themselves before assembling the rocker assembly, using the special tool to compress the tappet.

Install the tappets in the cylinder block/crankcase in order of removal, using the special tool. Align the assembly reference markings made between removal. Make sure that the oil drain hole of the tappet is facing towards the crankshaft.

Install the anti-rotation brackets, ensuring that the flattened surfaces of the brackets engage correctly with the flattened surfaces of the tappets to prevent the tappets themselves from rotating.

A - bracket (flattened surface)
B - tappet (flattened surface)
C - tappet

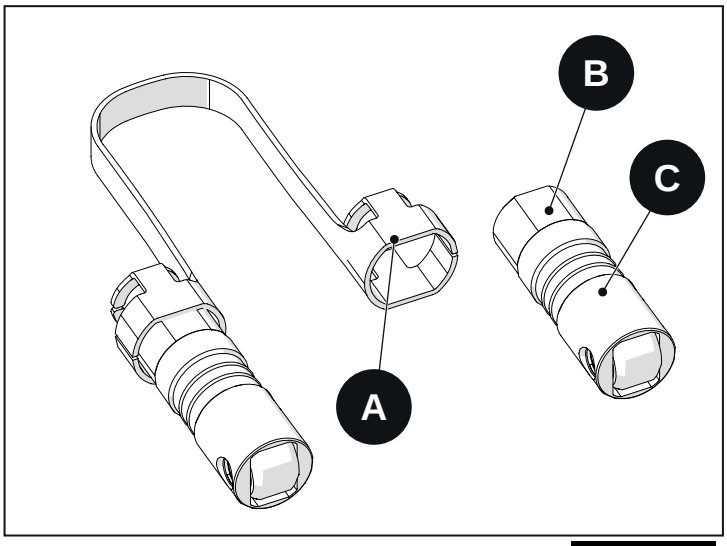

Fig. 2.165

Lubricate and install the rocker rods. Ensure that the rods engage correctly with the seats on the tappets.

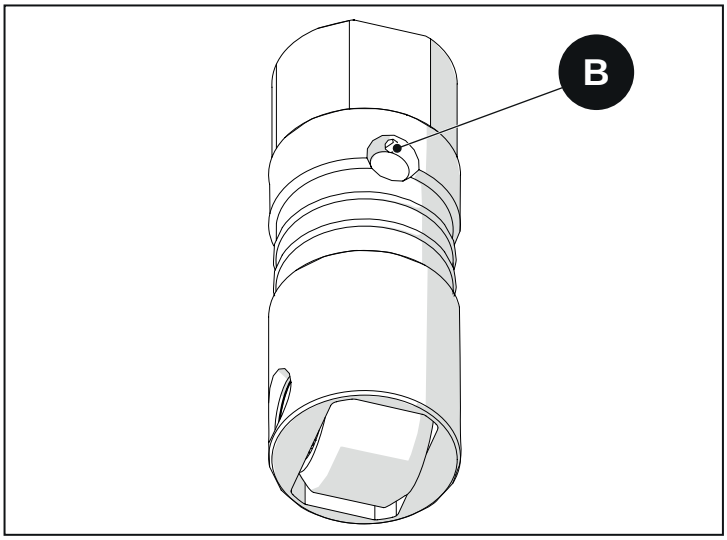

Fig. 2.166

2.51 Rocker rods

2.51.1 Removal

- Removing the rocker cover.
- Remove the rocker assemblies.
- Remove the rocker rods.

Warning

Number the rocker rods and the respective rods to ensure that they are reinstalled in the original positions.

A - Rocker rods
B - Rocker seat (not visible)

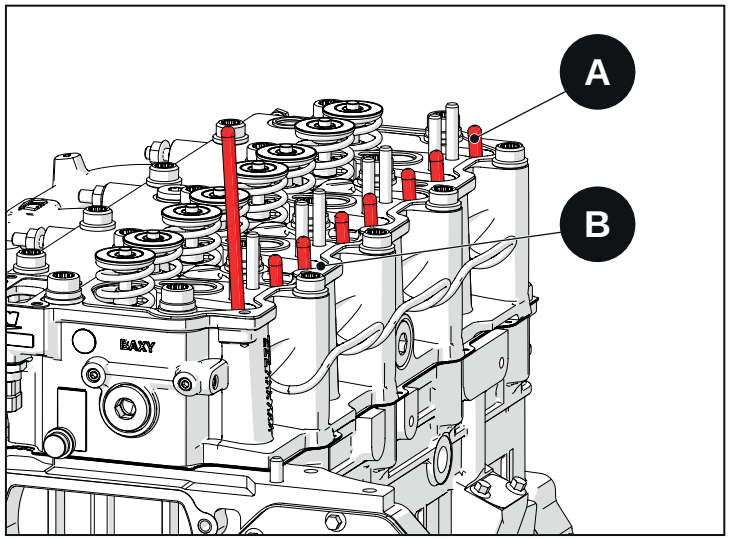

Fig. 2.167

2.51.2 Cleaning

- Clean the rocker assemblies and the rods.
- Clean the rods and the relative through holes for lubricating the rockers.
- Dry with compressed air.

2.51.3 Inspection

- Inspect all the contact surfaces to check for excessive wear or signs of incipient seizing.
- Check that the through holes in the rods for lubricating the rockers are not obstructed or restricted.
- Roll the rods on a flat surface to check that they are not bent.
- Replace any damaged parts.

2.51.4 Installation

Warning

Drain all residual oil from the tappets via the drain holes on the tappets themselves before assembling the rocker assembly, using the special tool to compress the tappet.

- Lubricate the outer surfaces and ends of the rods.
- Install the rods in their original positions
  Ensure that the ends of the rods engage correctly with the seats on the tappets.
- Fit the rocker assemblies.

2.52 Fracture-split connecting rod

2.52.1 Removal

Warning

Each connecting rod-cap assembly must be reinstalled in its original position.

Mark or identify each connecting rod-cap assembly to ensure that it is reinstalled in the original position and in the same cylinder. Keep the cap and bushes together with the connecting rod-piston assembly. Do not mix components from different assemblies.

Remove the connecting rod bushes. Keep the bushes together with the original connecting rod and cap.

Warning

Connecting rods may cause damage to the crankpins, cylinder sleeves and oil jets. Take care not to damage any other components when removing the connecting rods.

Taking adequate measures to protect the crankpins, cylinder sleeves and oil jets, push the piston and the connecting rod out of the cylinder.

Warning

As the fracture split process creates a unique mating surface pattern for each individual connecting rod shank/cap assembly, connecting rod shanks and caps from different assemblies cannot be swapped. To avoid damage, never set a connecting rod shank or cap down on its mating surface.

2.52.2 Disassembly

- Secure the connecting rod in a vice.
- Use a commercially available tool to compress and remove the 1st and 2nd compression rings and the oil scraper ring.
- Remove the circlip retaining the piston pin. Push the piston pin out from the connecting rod and the piston.
- Note the orientation of the piston bowl and of the valve recesses relative to the orientation of the identification paint dot on the connecting rod shank and the connecting rod shank/cap identification number.

X - oil jet

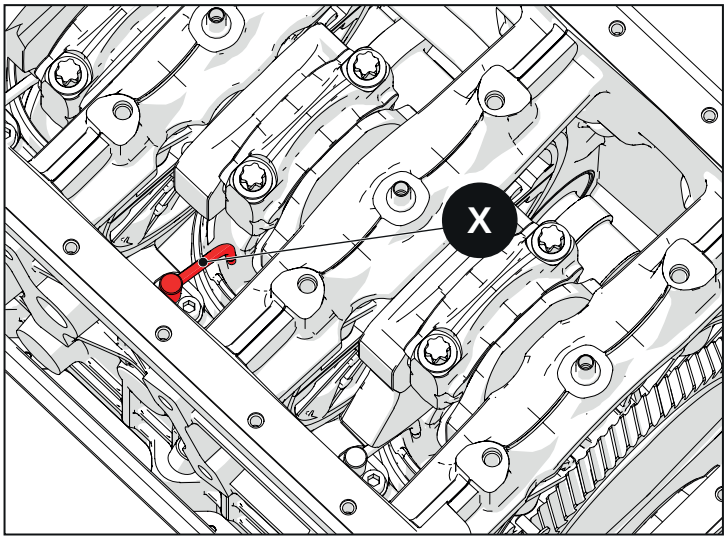

Fig. 2.168

X - piston bowl
X1 - piston identification number
B - connecting rod identification number
B1 - connecting rod identification number
C - dot

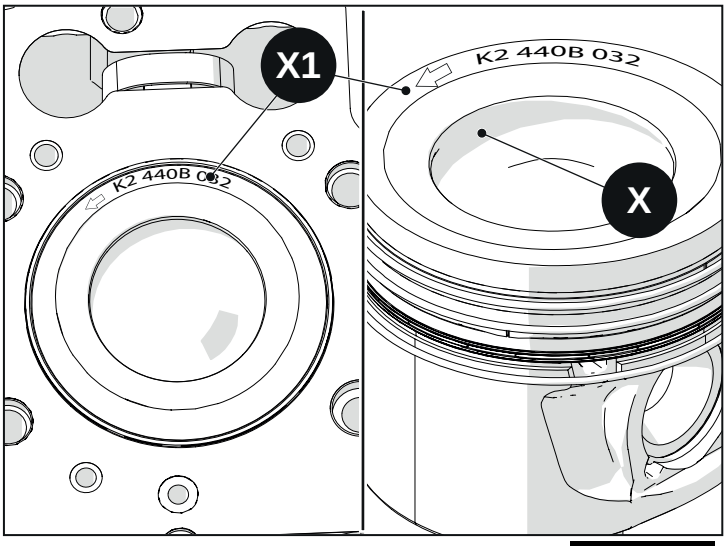

Fig. 2.169

b - Connecting rod identification number

Example: 1st line, AI0712

- AI= supplier
- 07= week of production
- 12= year of production

2nd line, 1996

- 1996= production serial number

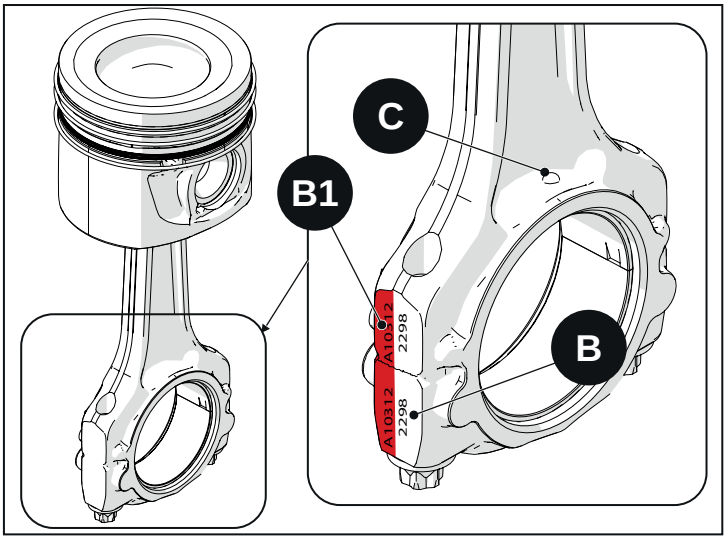

Fig. 2.170

b1 - Connecting rod identification number

Example: 1st line: C3

- **Example: 1st line: C3**
  - C3: C= seat diameter / 3= weight class
- **2nd line, 2057F**
  - 2057F= VM code

2.52.3 Fracture-split connecting rod

Warning

All measurements must be made with the components at ambient temperature.

Warning

The weight class of the connecting rod is identified by paint markings on the shank. Check that the colour of the paint dot on the shank is the same on all the connecting rods. Replace any connecting rods with a paint dot of a different colour than the other connecting rods or with no paint dot on the shank. Note that if it is necessary to replace a connecting rod, all the connecting rods in the engine must be replaced together as a set.

Check the connecting rods for signs of twisting or bending. In case of any doubt, test all the connecting rods with the Magnaflux magnetic particle testing system.

Tighten the connecting rod screws temporarily to 88 N·m (see CONNECTING ROD ASSEMBLY for the correct tightening procedure and tightening torques).

Warning

Tighten the connecting rod screws temporarily to 88 N·m (see CONNECTING ROD ASSEMBLY for the correct tightening procedure and tightening torques).

IDENTIFICAZIONE BIELLE IN FUNZIONE
DELLA SELEZIONE PESI
Connecting rods identification
in function of masses selection

≥gr.990	>gr.1004.9	>gr.1019.9	>gr.1034.9
↓	↓	↓	↓
≤gr.1004.9	≤gr.1019.9	≤gr.1034.9	≤gr.1050
VERDE Green	BLU Blue	BIANCO White	GIALLO Yellow

Fig. 2.171

Parallelism/deviation between connecting rod small and big ends	0.15 mm
x - length	162.975 - 163.025 mm

Use a dial bore gauge to measure the inner diameter of the big end.

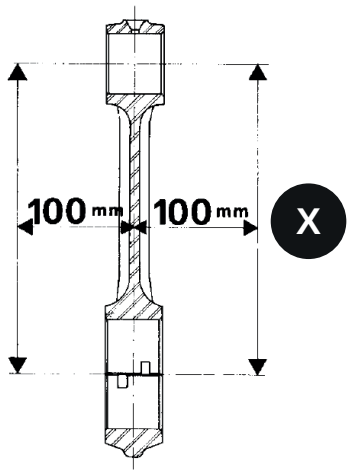

Fig. 2.172

a - Inner diameter of big end

Inner diameter (without bushes)	57.563 - 57.582 mm
Maximum wear	0.02 mm

Warning

See the section “Crankshaft” for the procedure for determining free play between the crankpin and the big end bushes.

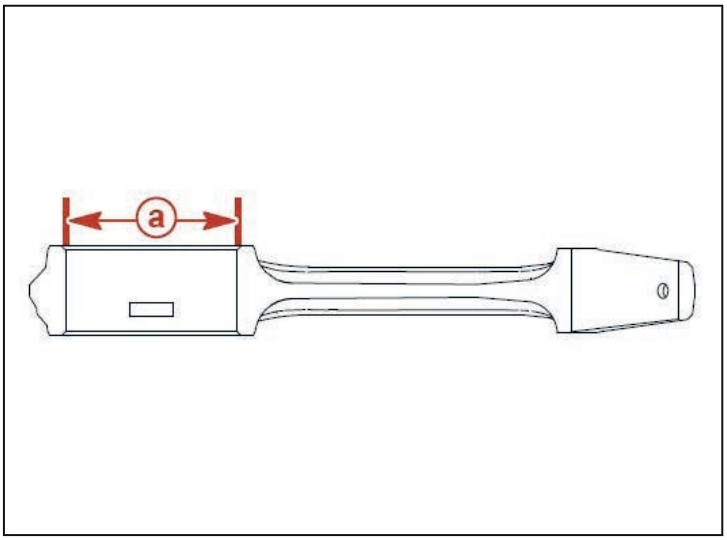

Fig. 2.173

Inspect the big end bushes and the connecting rod cap screws for damage. Measure the inner diameter of the small end bush and the outer diameter of the piston pin. Replace the bush if the free play exceeds the specified limits.

a - Internal diameter of bush

b - Outer diameter of piston pin

Warning

When replacing the piston pin bush during servicing, the new bush must be bored to the correct diameter after installation in the connecting rod. Install the bush with the engine oil passage hole in the bush for lubrication aligned with the hole in the connecting rod.

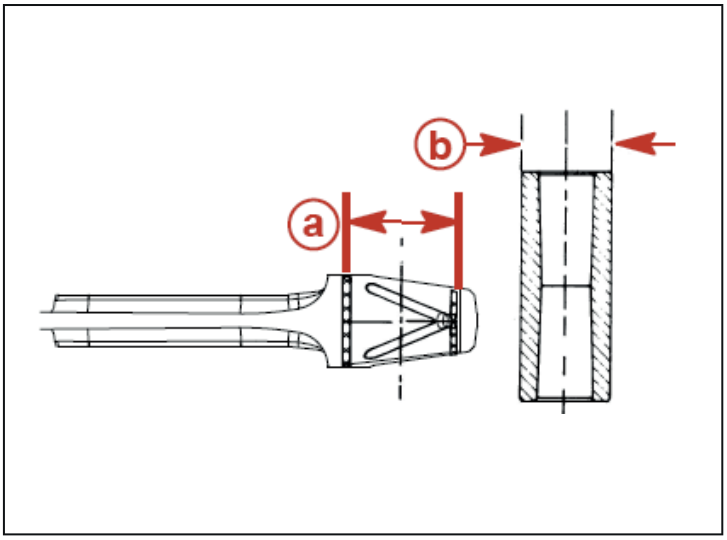

Fig. 2.174

Internal diameter of bush	30.035 - 30.050 mm
Outer diameter of piston pin	29.992 - 29.996 mm
Bush seat in small end of connecting rod	34 - 34.025 mm
Maximum wear	0.01 mm
Free play after initial assembly	0.039 - 0.058 mm

2.52.4 Assembly (fracture-split connecting rod)

Lubricate the small end bush, the small end and the piston pin with engine oil.

Assemble the piston and connecting rod, with the piston bowl, the valve recesses, the paint marking on the shank identifying the weight class and the connecting rod shank/cap identification numbers oriented as shown in the figure.

Assemble the piston and the connecting rod with the valve recesses facing towards the respective intake and exhaust sides of the engine, and with the connecting rod shank/cap identification numbers oriented as shown in the figure. Fit the piston pin with the respective circlip.

Install the connecting rod/piston assembly in the cylinder, taking care not to damage the cylinder sleeve and the crankpin.

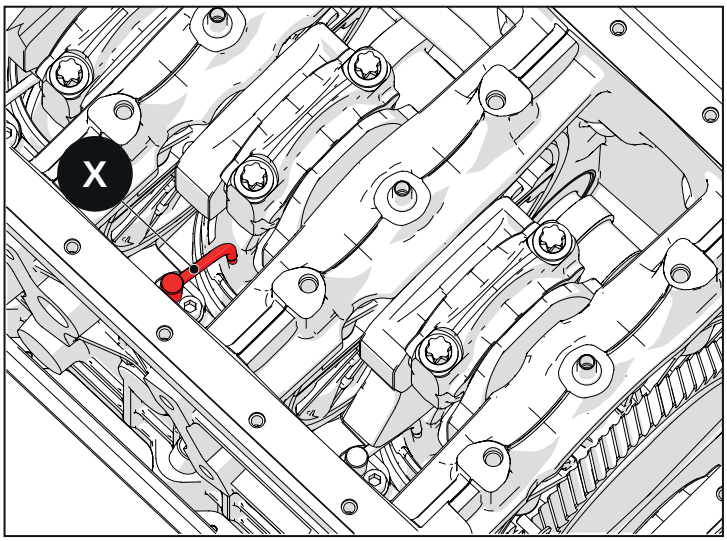

Fig. 2.175

Warning

Connecting rods may cause damage to the crankpins, cylinder sleeves and oil jets. Take care not to damage any other components when installing the connecting rods.

X - oil jet

Align the connecting rod with the crankpin and press the piston into the cylinder to bring the connecting rod shank and the relative bushes into contact with the crankpin. Make sure that the assembly reference markings made on the connecting rod shank and cap are matched correctly, and that the connecting rod shank/cap identification numbers face towards the injection/camshaft side.

X - piston bowl
X1 - piston identification number
B - connecting rod identification number
B1 - connecting rod identification number
C - dot

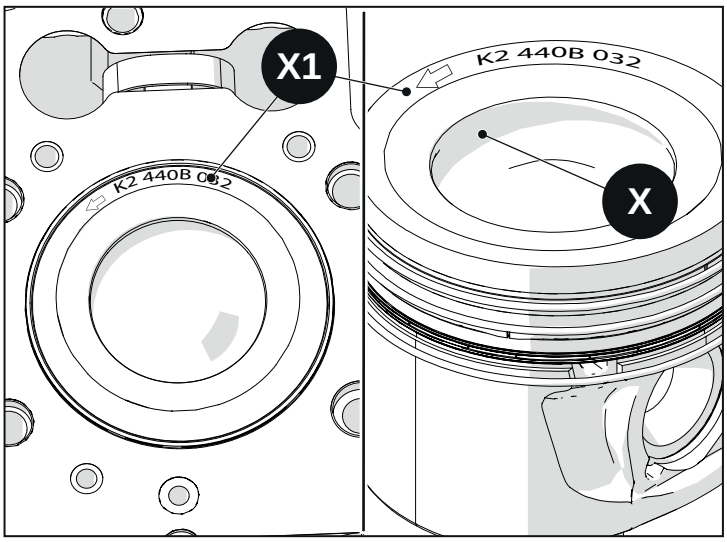

Fig. 2.176

b - Connecting rod identification number

Example: 1st line, AI0712

- AI= supplier
- 07= week of production
- 12= year of production

2nd line, 1996

- 1996= production serial number

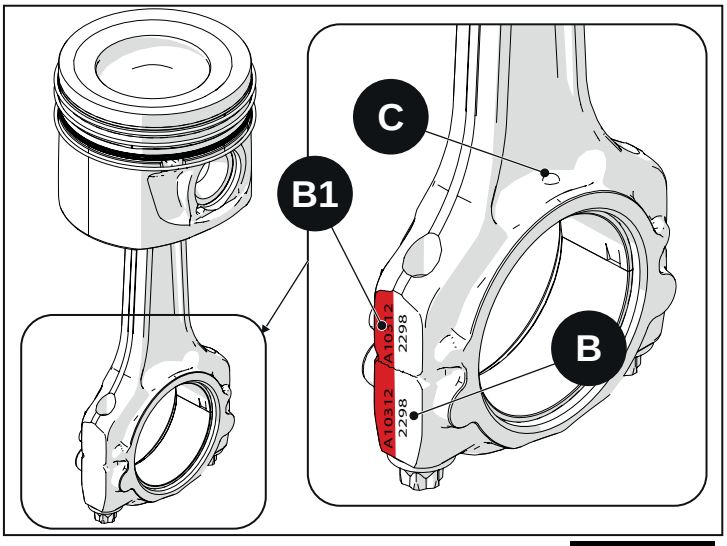

Fig. 2.177

b1 - Connecting rod identification number

Example: 1st line: C3

- **Example: 1st line: C3**
  - C3: C= seat diameter / 3= weight class
- **2nd line, 2057F**
  - 2057F= VM code

Warning
Do not lubricate new connecting rod cap screws, as they have an anti-friction coating applied by the manufacturer. The screws must usually be replaced: however, if the threads of the screws have not stretched and there are no signs of damage on the head and under the head, the screws may be reused. When reusing the screws, lubricate the thread and under the heads with engine oil.

- Lubricate the heads and under the heads with engine oil only when reusing the original screws. New screws do not need to be lubricated.
- Apply engine oil to the crankpins and the connecting rod bushes.
- Fit the connecting rod cap.
- Fit and hand-tighten the connecting rod cap screws, and then tighten definitively as follows:

Connecting rod cap screws - fracture-split connecting rod

Step 1	10 N·m

Connecting rod cap screws - fracture-split connecting rod

Step 2	30 N·m
Final step (angle)	+ 40°

Using a torque wrench set to the value indicated in the following table, check that the screws are tightened correctly. Do not tighten the screws any further while checking the tightening torque.

Torque for checking tighten connecting rod cap screw tightness	88 N·m

Check that there is the correct degree of lateral free play between the crankshaft assembly and the crankpins.

Warning

See the section “Crankshaft” for the procedure for determining the free play between the crankpins and the connecting rod bushes with the connecting rods assembled with the crankshaft.

Install the remaining piston and connecting rod assemblies

2.52.5 Connecting rod cap screws - specifications (fracture-split connecting rod)

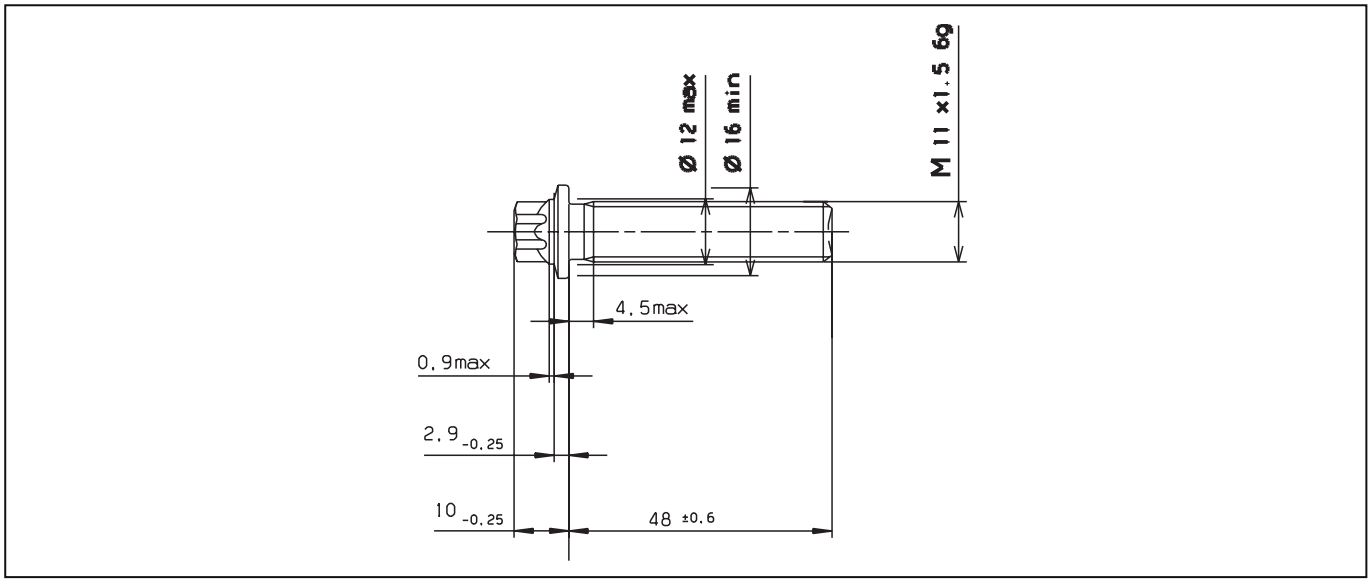

Fig. 2.178

2.53 Piston

2.53.1 Disassembly

- Secure the connecting rod in a vice.
- Use a commercially available tool to compress and remove the 1st and 2nd compression rings and the oil scraper ring.
- Remove the circlip retaining the piston pin. Push the piston pin out from the connecting rod and the piston.
- Note the orientation of the piston bowl and of the valve recesses relative to the orientation of the identification paint dot on the connecting rod shank (for fracture-split connecting rods only) and the connecting rod shank/cap identification number. (See the section “Connecting rod”).

2.53.2 Cleaning

Warning
Do not clean any part of the piston with a brush.

- Wash the components with solvent.
- Clean the piston skirt and the piston pin with solvent.
- Clean the piston ring seats on the piston.
- Clean the oil passages of the piston.
- Dry with compressed air.

2.53.3 Inspection

Inspect the piston to check for signs of damage or cracking on the piston ring seats and skirt. Replace any piston with signs of damage or excessive wear.

Note
The first piston ring as a keystone cross section. The upper and lower surfaces of this ring have specific profiles. These profiles are reflected in the shape of the seat for the first compression ring. The second compression ring and the oil scraper ring have conventional profiles and are similar to the components used by other manufacturers.

A - First compression ring
B - Seat for first compression ring
C - Outer edge of first compression ring

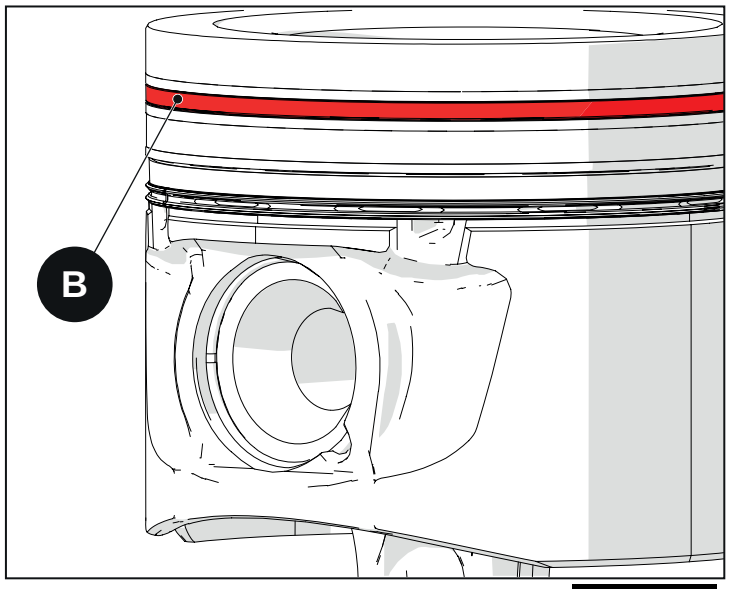

Fig. 2.179

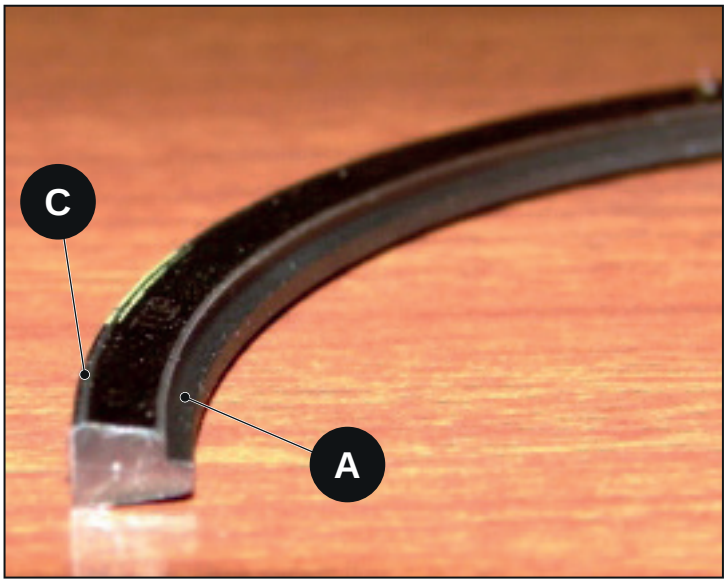

Fig. 2.180

Measure the piston skirt in a position 17 mm from the bottom edge of the skirt itself and at 90° around the circumference of the piston relative to the piston pin. Replace the piston if the value measured is not within specifications

a - Measurement position

Diameter	
Wear limit	0.10 mm

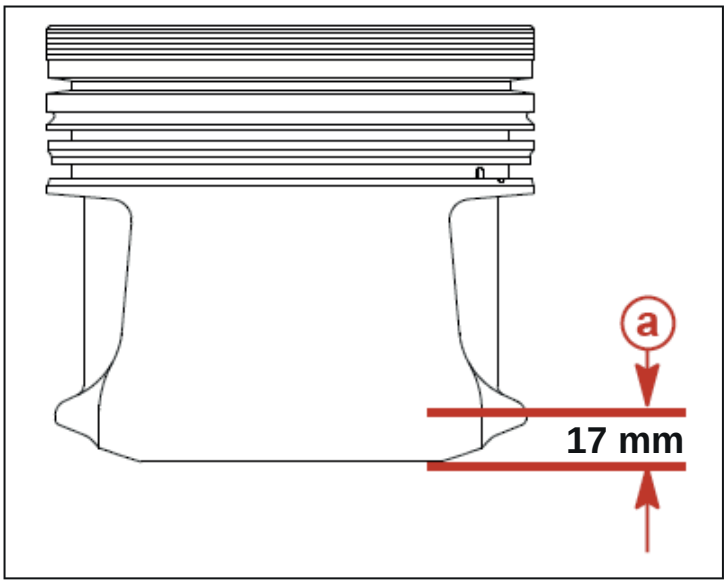

Fig. 2.181

Fit the respective rings in the second and third ring seats on the piston, and rotate them to check that they are free to turn. If any resistance to rotation or sticking is noted at any position around the circumference, identify the cause.

1 - If the ring cannot turn freely because the ring itself is distorted, try a different ring and check again.

2 - If the ring cannot turn freely because of a defect of the piston ring seat, file the piston ring seat carefully to eliminate the cause.

Warning
Take care not to file too much material from the ring seat. Measure the dimensions with a gauge and compare against the specifications.

Measure the thickness of the piston rings. Replace all the piston rings as a set if any are not within specifications.

First compression ring

Piston ring thickness (production)

First piston ring " X"	2.575 - 2.595 mm
Second piston ring	0.10 mm
Oil scraper ring	2.97 - 2.99 mm

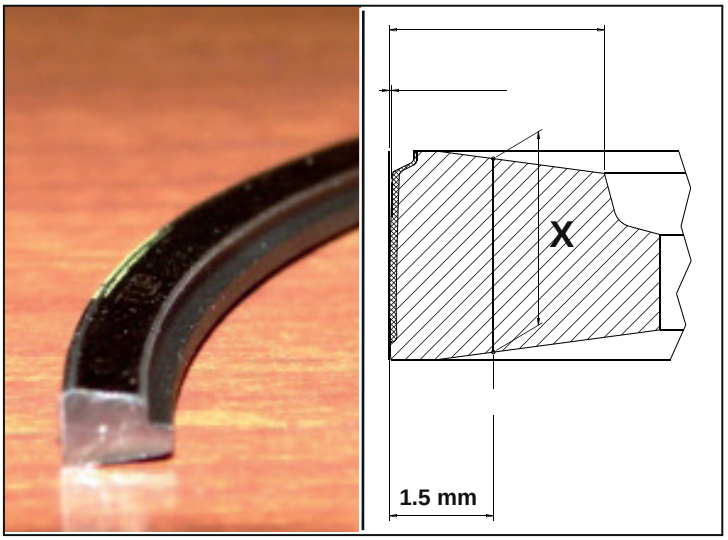

Fig. 2.182

Second compression ring

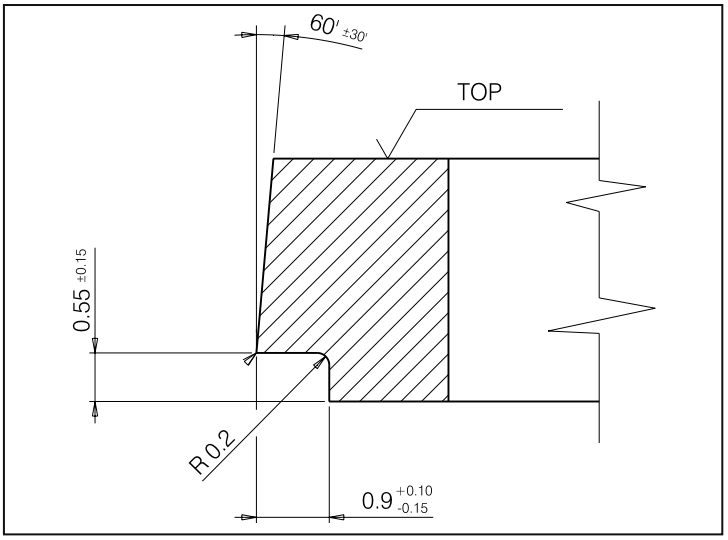

Fig. 2.183

Measure the height of the piston ring seats

Piston ring seat height (production)	
First compression ring	3 mm (nominal)
Second compression ring	2.06 - 2.08 mm
Oil scraper ring	3.03 - 3.05 mm

Measure the free play between the second compression ring and oil scraper ring relative to the respective seats in several positions around the circumference of the piston. Replace the piston if any of the values measured exceed the specified limits.

Piston ring seats (free play)	
First piston ring	Not measurable
Second piston ring	0.07 - 0.11 mm
Oil scraper ring	0.04 - 0.08 mm

2 - Not measurable - First compression ring and respective seat
3 - Second compression ring and respective seat
4 - Oil scraper ring and respective seat

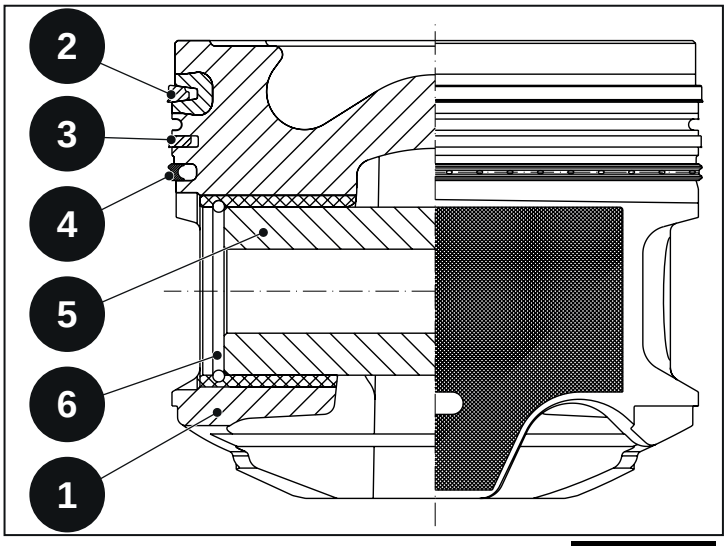

Fig. 2.184

Measure the size of the piston ring gap:

- Fit the piston ring to be checked in the cylinder.
- Measure the gap between the ends of the piston ring with a feeler gauge.

Note

Measure the gap with the piston ring in a perfectly level position in the cylinder. Push the piston ring 6 mm into the cylinder.

Piston ring gap (production)	
First piston ring	0.30 - 0.42 mm
Second piston ring	0.65 - 0.85 mm
Oil scraper ring	0.30 - 0.60 mm

Piston ring gap	
First piston ring	0.5 mm maximum
Second piston ring	0.9 mm maximum
Oil scraper ring	0.7 mm maximum

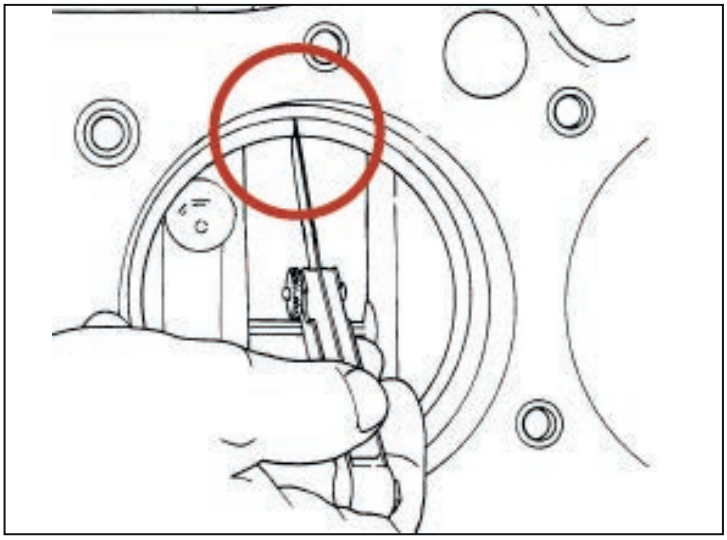

Fig. 2.185

- If the gap measured exceeds the specified limit, replace the segment with a different component. If a gap within the specified limit cannot be attained even if new piston rings are used, check the cylinder sleeve. See the section “Cylinder sleeves”.
- Fit each segment in the cylinder in which it is to be installed.

2.53.4 Assembly

- Lubricate the interior of the piston pin bush and the piston pin.
- Assemble the piston onto the connecting rod. (See the section “Connecting rod”).
- Fit the piston pin in the piston and fit the circlip.
- Secure the assembled connecting rod and piston in a vice

Warning

Always fit the piston rings with any identification codes or markings (“CTOP”, “PIP” or a reference dot) facing towards the top of the piston.

A - identification codes or markings on piston rings
B - First compression ring

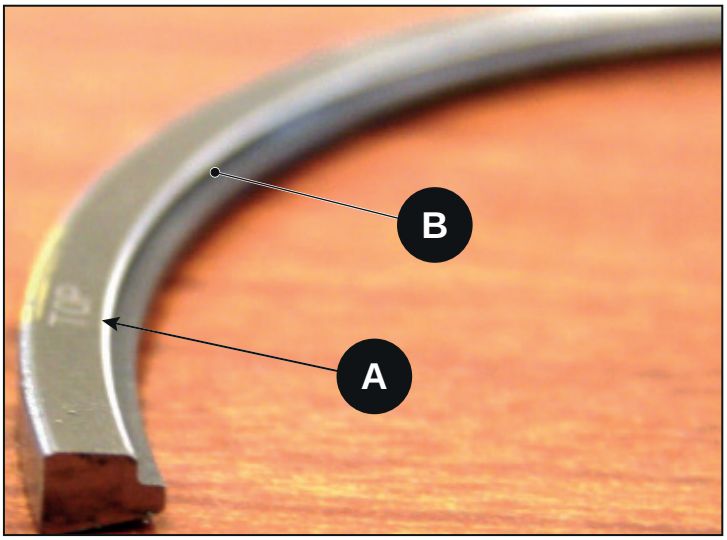

Fig. 2.186

- Install the oil scraper ring in the bottom seat on the piston.
- Use a commercially available tool to install the oil scraper ring.
- Press the ring by hand to fit it correctly in the seat, and rotate the ring to check that it turns freely without sticking.
- Use the same tool to fit the second compression ring in the middle seat. The shorter end of the bevel must face towards the bottom of the piston.
- Press the ring by hand to fit it correctly in the seat, and rotate the ring to check that it turns freely without sticking. 10. Use the same tool to fit the first compression ring in the top seat.
- Press the ring by hand to fit it correctly in the seat, and rotate the ring to check that it turns freely without sticking.

A - identification codes or markings on piston rings
B - Second compression ring

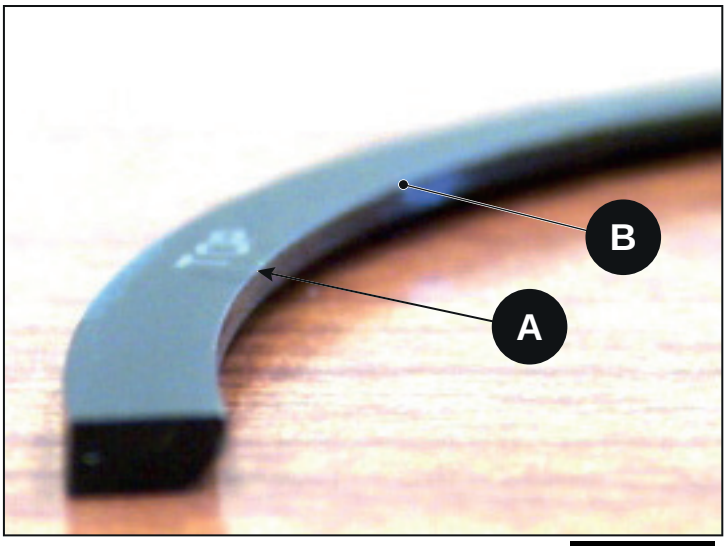

Fig. 2.187

A - identification codes or markings on piston rings
B - Oil scraper ring

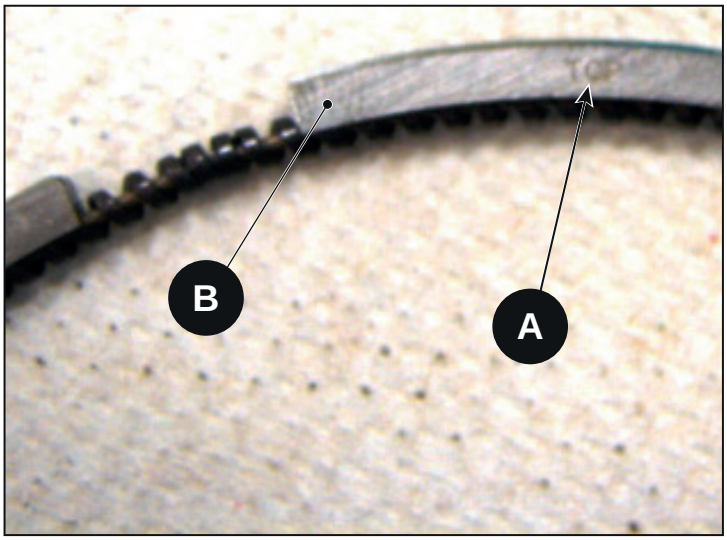

Fig. 2.188

2.53.5 Installation

Before installing the pistons in the cylinders, rotate the rings to orient the gaps in the positions shown in the figure:

a - Gap in first piston ring
b - Gap in second piston ring
c - Gap in oil scraper ring

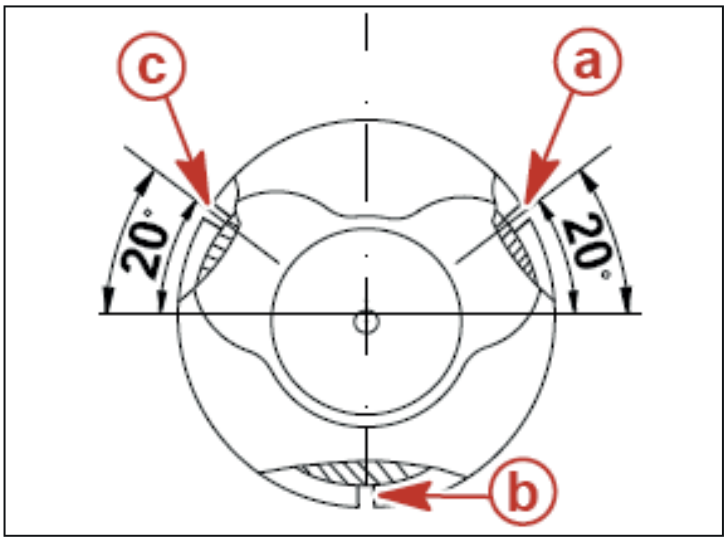

Fig. 2.189

- Rotate the crankshaft to move the crankpins away from the cylinders, so that the connecting rods do not damage the cylinders during installation.
- Using a commercially available piston ring compression tool, install the piston in the cylinder by tapping the crown gently with a plastic punch tool.
- Fit the connecting rod bushes. Lubricate the connecting rod bushes and the crankpins with engine oil.

Z - arrow on piston indicating side which must face towards timing side

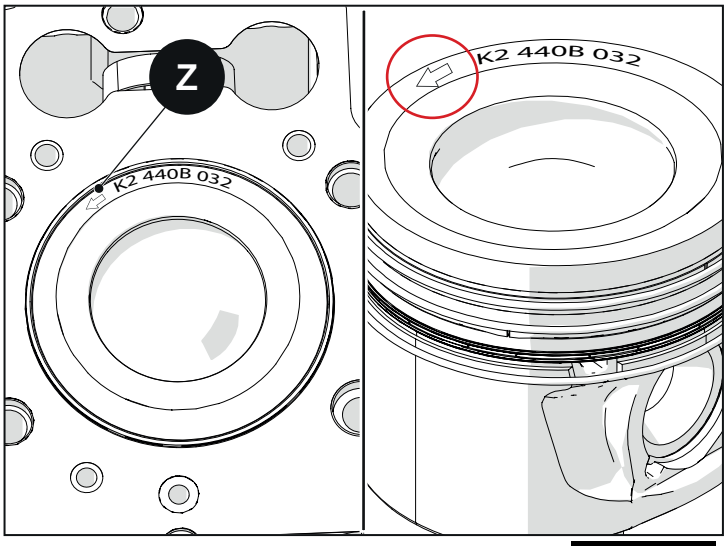

Fig. 2.190

Warning
The connecting rods may damage the crankpins, cylinders and oil jets during installation. Work carefully to ensure that no components are damaged when installing connection rods.

- Align the connecting rod with the crankpin and tap the piston crown to bring the connecting rod shank bush into contact with the relative crankpin.
- Fit the connecting rod cap.
- Fit and tighten the connecting rod cap screws. (See the section “Connecting rod”)

2.54 Engine oil sump and transmission pipe

2.54.1 Removal

- Drain the engine oil. See the section “Maintenance”.
- Remove the oil sump screws.
- Cut the silicone sealant around the sump, taking care not to bend the edges of the sump itself.
- Remove the sump.

A - tool
B - mallet
C - oil sump

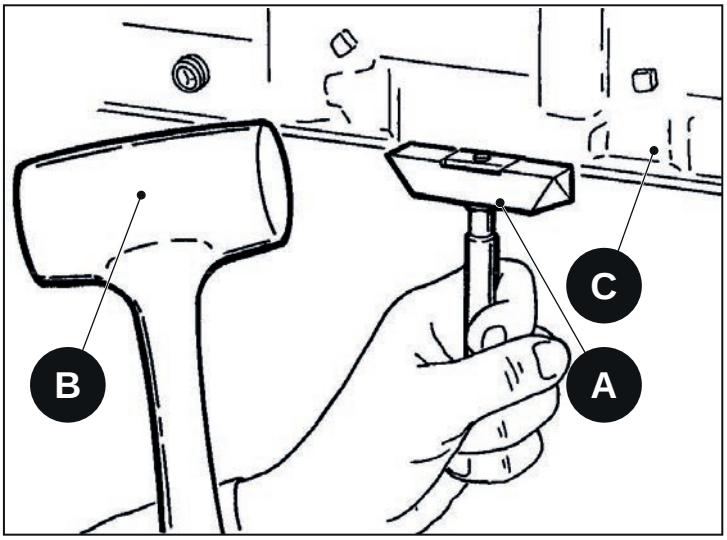

Fig. 2.191

2.55 Oil suction pipe

2.55.1 Removal

- Remove the screws of the oil suction pipe.
- Remove the pipe.
- Replace the O-ring of the oil suction pipe

A - oil suction pipe
B - screws fastening oil suction pipe
C - filter on pipe

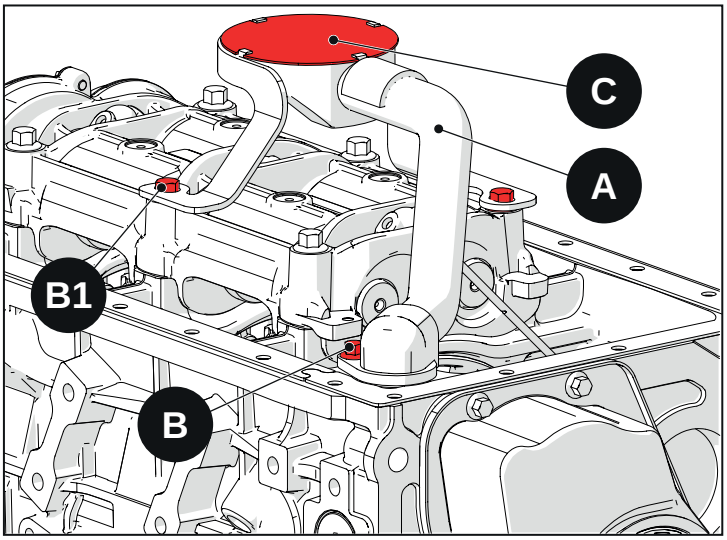

Fig. 2.192

2.55.2 Installation

- Replace the O-ring of the oil suction pipe, lubricate the ring and fit the pipe in the crankcase.
- Fit and tighten the screws:
  screws fastening oil suction pipe (B): 12.7 N·m
  screws fastening oil suction pipe (B1): 32.4 N·m

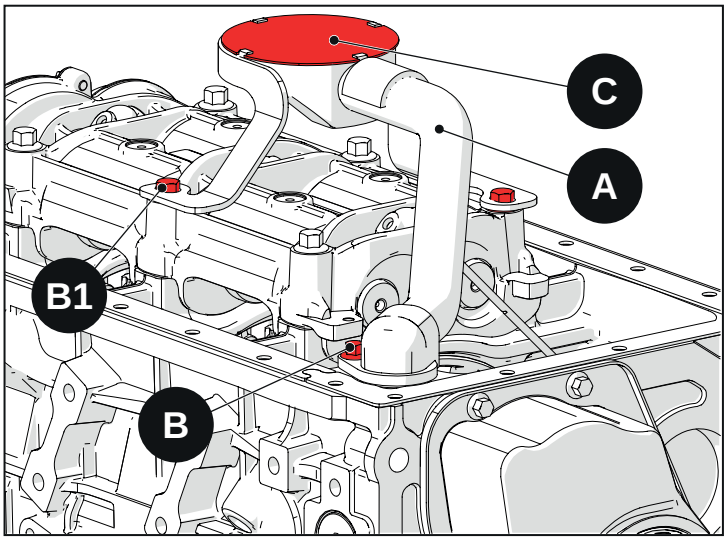

Fig. 2.193

- Clean the mating surfaces between the crankcase and the oil sump to remove all excess oil and foreign material. Degrease the surfaces before applying the silicone sealant.
- Apply a uniform bead of Dow Corning 7091 silicone around the perimeter of the sump flange, passing around the inner sides of the holes, as shown in the figure.
- Fit the sump.
- Fit the screws and tighten in a crossed pattern.
  Oil sump screws: 12.7 N·m

A - oil sump flange
B - uniform bead of sealant

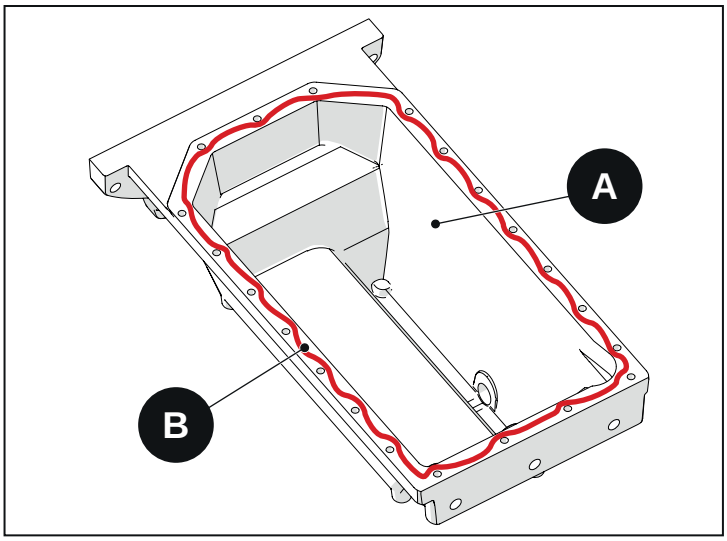

Fig. 2.194

2.56 Engine oil pressure relief valve

The engine oil pressure relief valve (engine oil pressure regulator valve) is installed in a vertical position at the bottom of the crankcase.

2.56.1 Removal

- Remove the oil sump.
- Remove all residue of sealant from the surface around the pressure relief valve.
- If removing the valve and spring or the springs only: follow the procedure described for removal. Take all the precautions indicated and follow the entire procedure with the exception of step 1

To remove the entire pressure relief valve:

- unscrew the complete valve from the crankcase using a commercially available tool. The tool must engage in the 2 slots.
- Remove the valve from the crankcase.
- Follow the procedure described for disassembly.

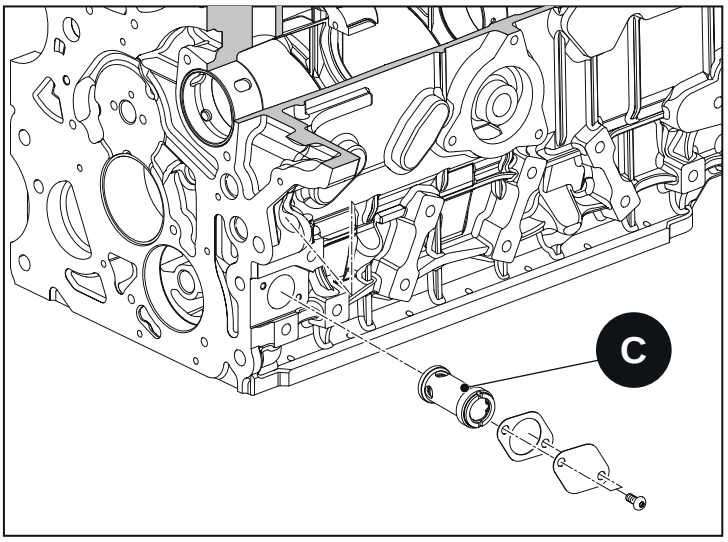

Fig. 2.195

2.56.2 Disassembly

Warning

The plate of the pressure relief valve and the inner spring are held in place by a circlip. If released suddenly, the spring may be projected from the valve with sufficient force to cause injury.

Take particular care when removing or refitting the circlip.

Wear safety eyewear.

- Secure the valve in a vice, if the overpressure valve has been removed from the engine.
- Push the plate against the spring and hold in this position. Remove the circlip.
- Release the spring gradually.

A - plate
B - circlip
C - valve housing

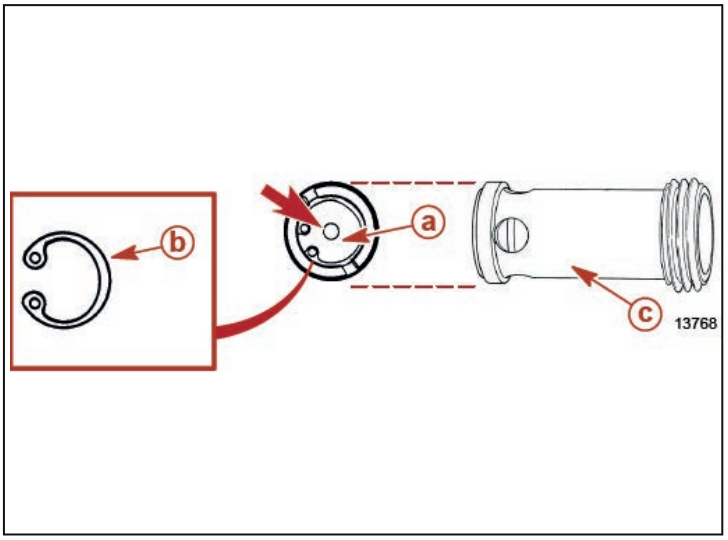

Fig. 2.196

- Remove the plate, the springs and the valve from the valve housing cylinder.

Note

Some pressure relief valves have one internal spring only.

A - Plate
B - Spring (innermost - if applicable)
C - Spring (outermost - if applicable)
D - Valve

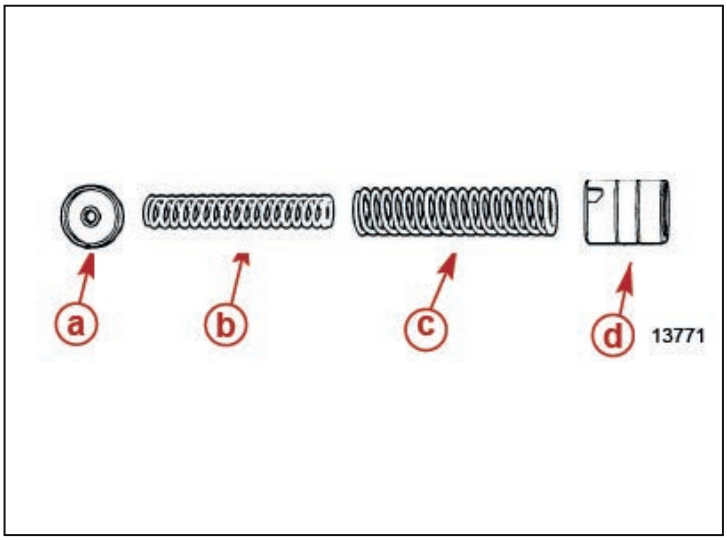

Fig. 2.197

2.56.3 Cleaning

- Clean the crankcase and oil sump to remove all residue of sealant.
- Clean the components with solvent.
- Dry with compressed air.

2.56.4 Inspection

- Replace the entire valve if the spring is broken.
- Replace the entire valve if the spring is worn or seized.
- If necessary to restore pressure tightness, the valve may be lapped with lapping compound.
- Check that the valve slides freely in its seat and the housing once lubricated with oil.

a - Valve
b - Spring - (innermost - if applicable)
c - Spring - (outermost - if applicable)
d - Plate
e - Circlip
f - Valve seat and housing

2.56.5 Assembly

- Lubricate the interior of the seat and the cylinder of the housing with engine oil.
- Assemble the spring and the plate. Install the parts in the valve seat and housing.
- Push the plate against the spring and hold in this position.
- Fit the circlip.

2.56.6 Installation

- If installing the valve and spring only: see the section Assembly.

  Take all the precautions indicated and follow all the steps described with the valve housing installed in the crankcase.
- If installing the complete valve:
  - Apply Loctite 510 to the thread of the valve housing when replacing the complete valve. Tighten the valve into the crankcase.
  - Use a suitable tool to tighten the complete valve into the crankcase.

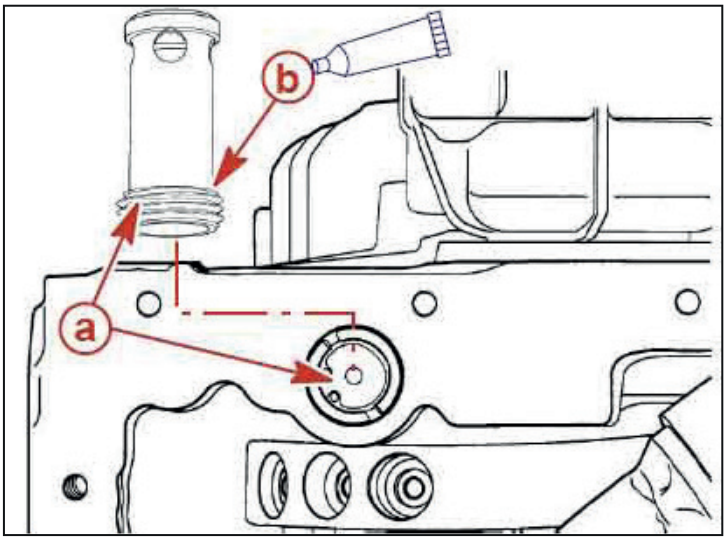

Fig. 2.198

Complete valve: 53.9 N·m

A - Complete valve
B - Thread

Valve cover: 5.9 N·m

Warning
Apply Loctite 510 to both surfaces of the gasket “D”.

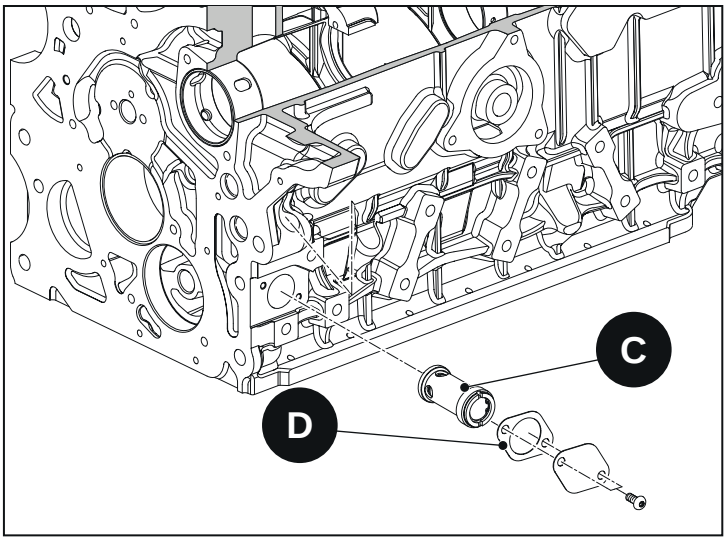

Fig. 2.199

2.57 Separator oil drain valve

The engines of this series are equipped with a valve for draining oil from the separator, installed in the crankcase.

The complete valve consists of a housing and a valve.

Valve screws: 14 N·m

A - valve housing
A1 - valve

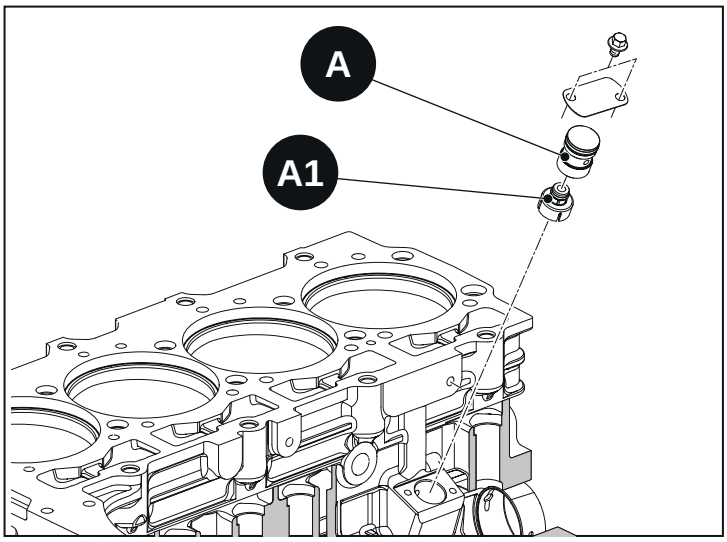

Fig. 2.200

A - valve housing
A1 - valve

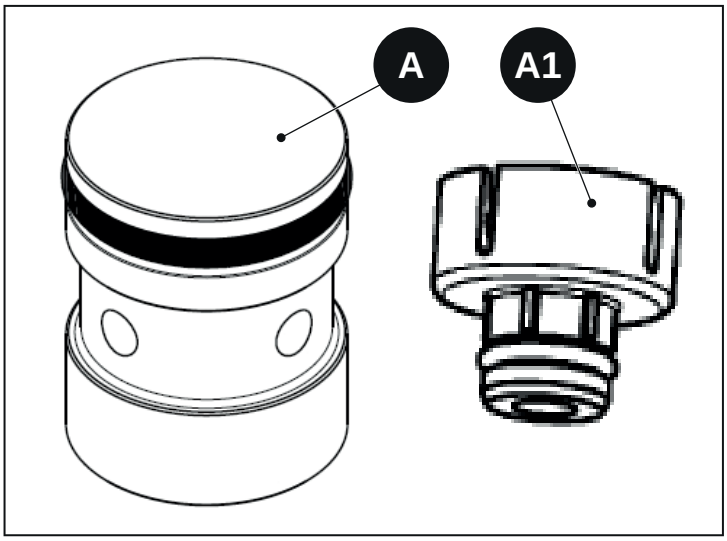

Fig. 2.201

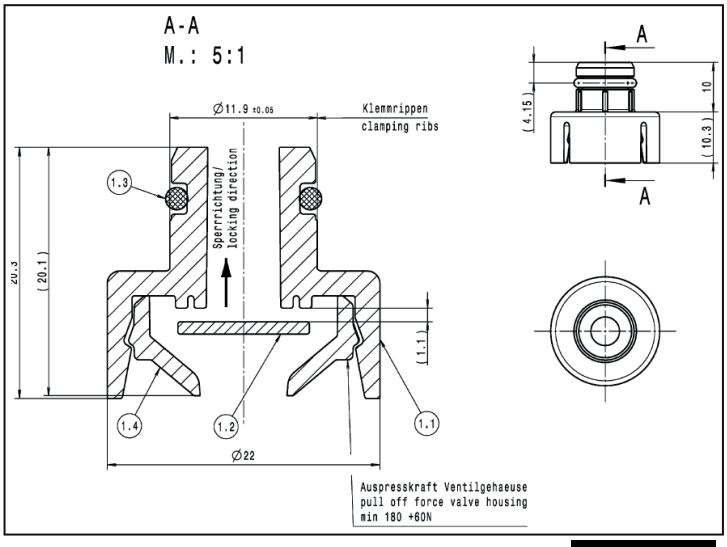

Fig. 2.202

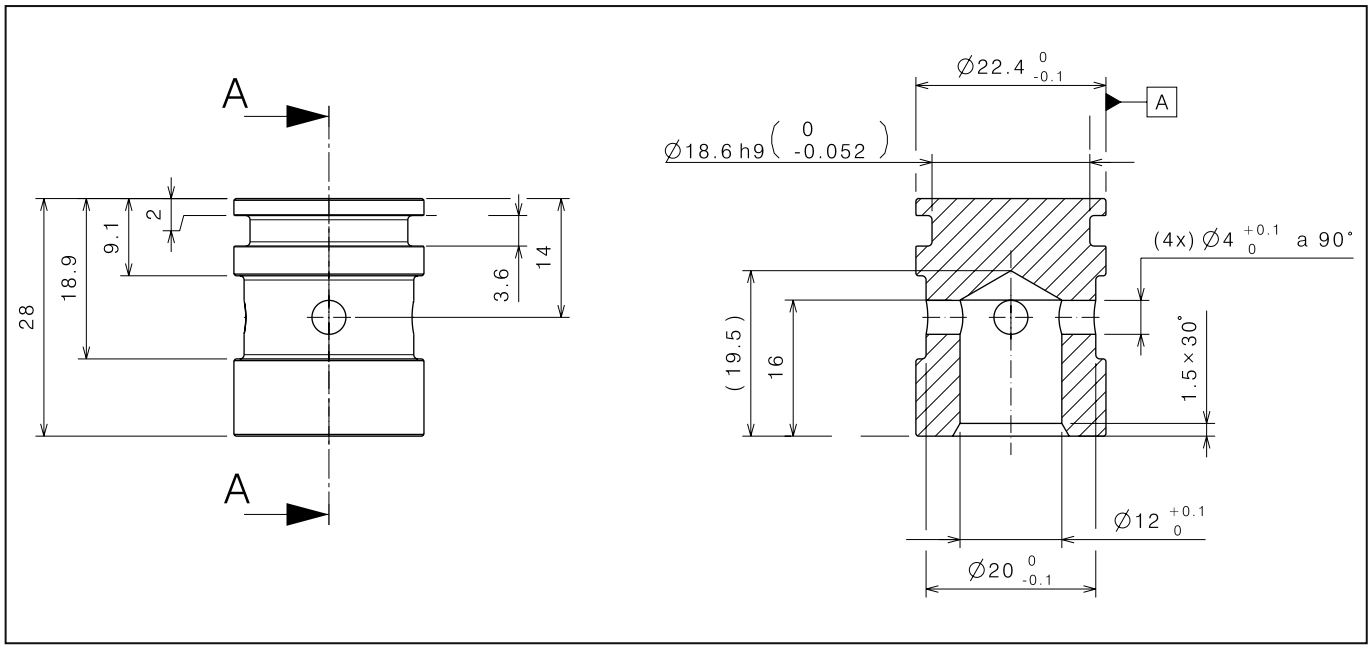
A
A
28
18.9
9.1
2
3.6
14
Ø22.4 0 -0.1
A
Ø18.6 h9 (0 -0.052)
(4x) Ø4 +0.1 0 a 90°
(19.5)
16
1.5×30°
Ø12 +0.1 0
Ø20 0 -0.1

Fig. 2.203

2.58 Crankshaft balancer weights

2.58.1 Removal

> **Warning**
>
> bring piston 1 to TDC before removing or installing the counter-rotating counterweights. In this position, the special tool 68480013F (B) may be fitted to immobilise the counterweights (A): the pins of the tool must be engaged in the holes (A) of the counterweights to prevent then from rotating.

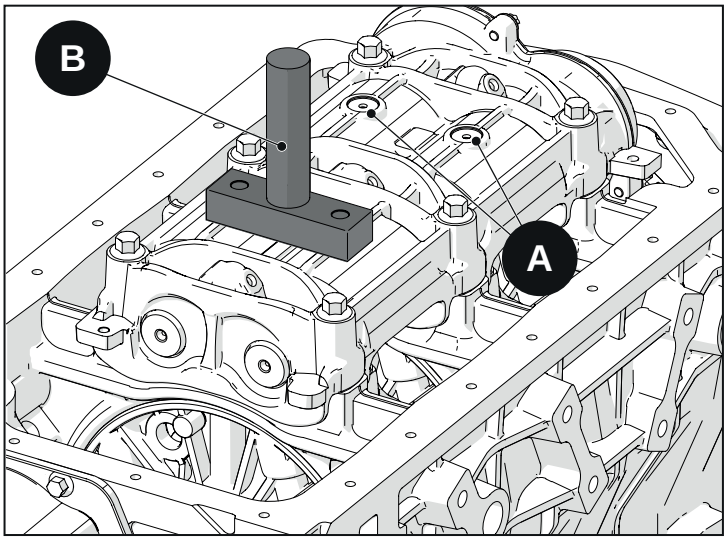

Fig. 2.204

Undo the bolts fastening the counterweights and remove the counterweights themselves, taking care not to damage the O-rings on the guides (C) carrying lubricant oil to the counterweights.

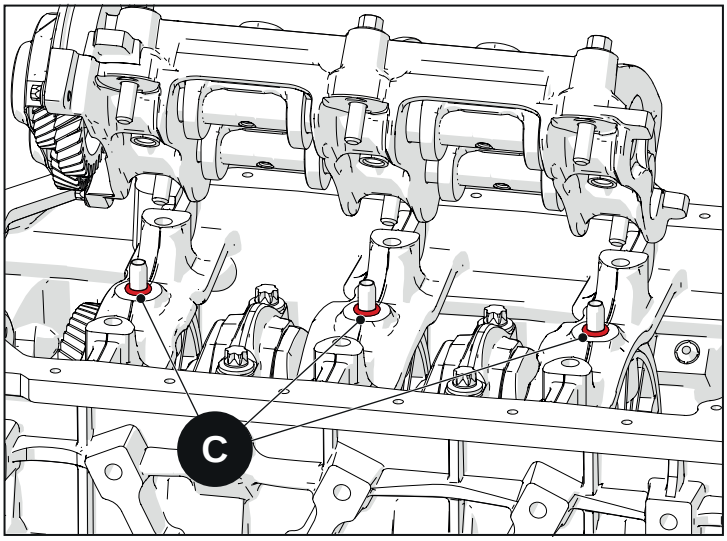

Fig. 2.205

2.58.2 Installation

- Bring piston 1 to TDC.
- Align the counterweights (d) as shown in the figure, and engage the pins of the special tool 68480013F in the holes of the counterweights (A): **The counterweights must NOT be visible.**
- With the counterweights in this position, the special tool 68480013F (B) may be fitted to immobilise the counterweights (A): the pins of the tool must be engaged in the holes (A) of the counterweights to prevent then from rotating.
- With the special tool in place, install the counterweights in the cylinder block, taking care not to damage the O-rings on the guides (C) carrying lubricant oil to the counterweights.
- Remove the special tool and tighten the bolts of the counterweights
  Counterweight fastener bolts: 32.4 N·m

COUNTERWEIGHTS ALIGNED INCORRECTLY (counterweights visible)

A - counter-rotating counterweights
D - counterweights visible

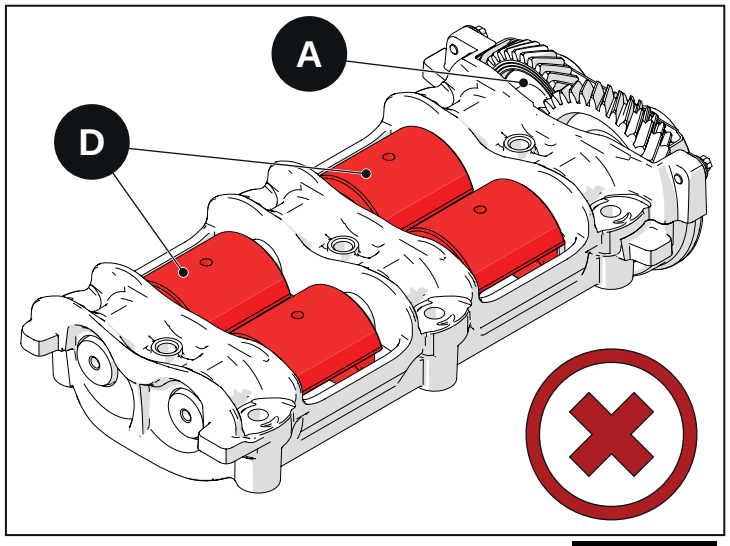

Fig. 2.206

COUNTERWEIGHTS ALIGNED CORRECTLY (counterweights NOT visible)

A - counter-rotating counterweights
B - special tool
D - counterweights NOT visible

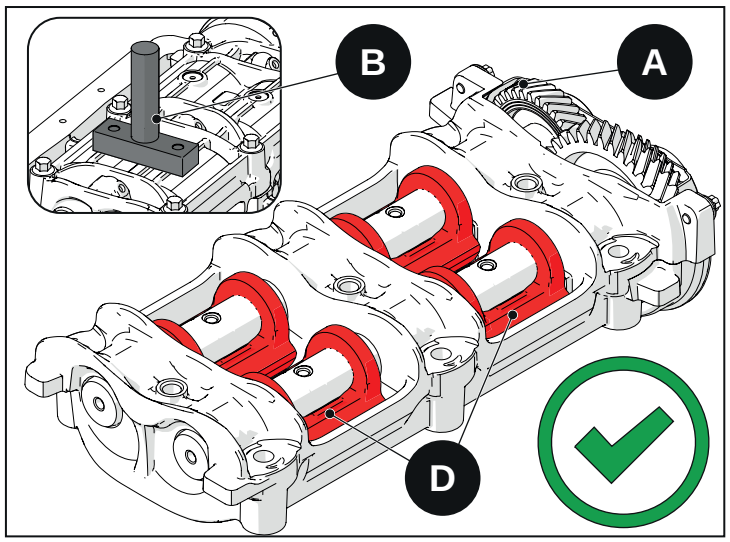

Fig. 2.207

2.59 Crankcase

When overhauling the engine or removing the oil sump, check that the plugs sealing the lubrication holes for the counter-rotating counterweights (on engines with counter-rotating counterweights) are correctly in place and have been punched to prevent loosening.

2.59.1 Inspection

Certain engine versions may not be equipped with counter-rotating counterweights. The lubrication holes for the counter-rotating counterweights situated in the crankcase are sealed with plugs.

A - Plugs

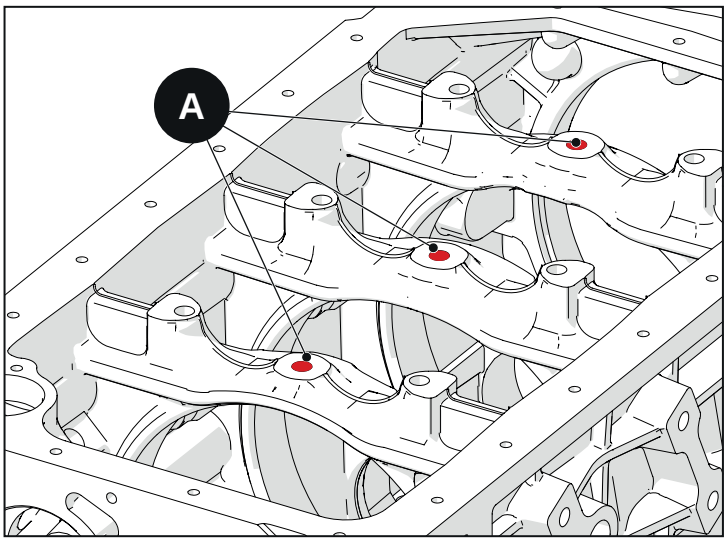

Fig. 2.208

When overhauling the engine, check that the plugs have been chamfered correctly (see figure 2.211).

In the example shown in figure 2.209, the plug “B” is either working free from the crankcases or has not been installed correctly. This plug must be refitted correctly and punched (see figure 2.211) to prevent it from loosening.

B - Plug working loose from crankcase or not installed correctly

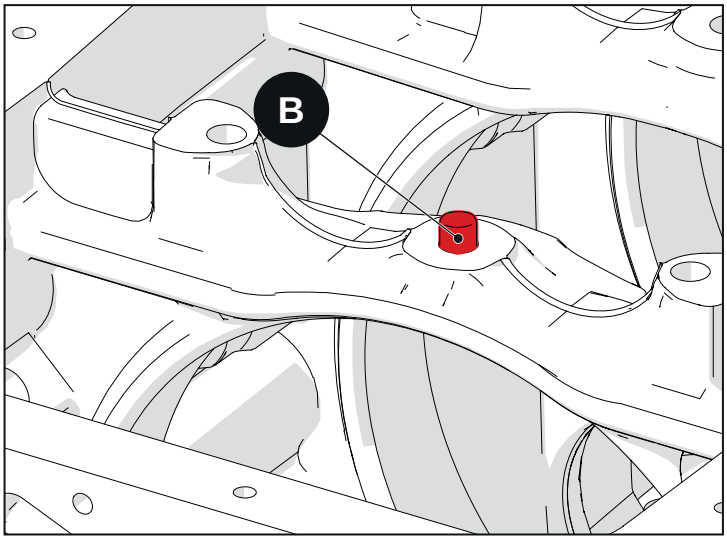

Fig. 2.209

Warning

punch the all the plugs to prevent them from loosening - tighten the plug until it is flush with the surface of the crankcase and then punch in opposing positions at 180°.. See the photo 2.211

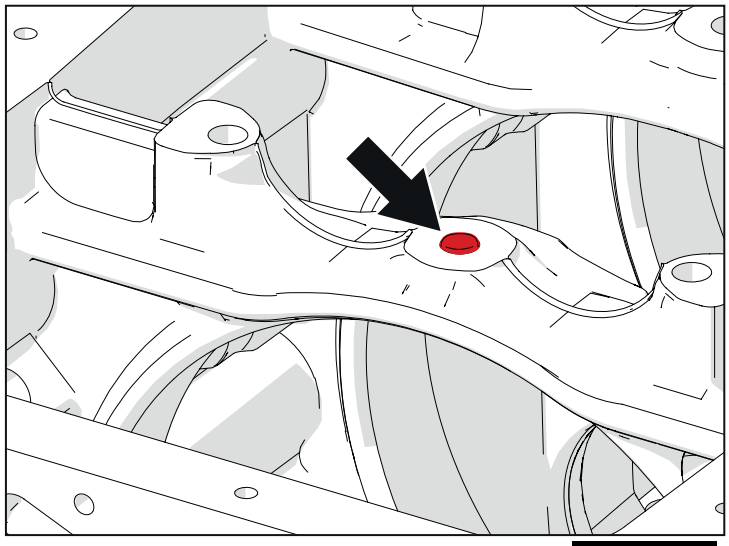

Fig. 2.210

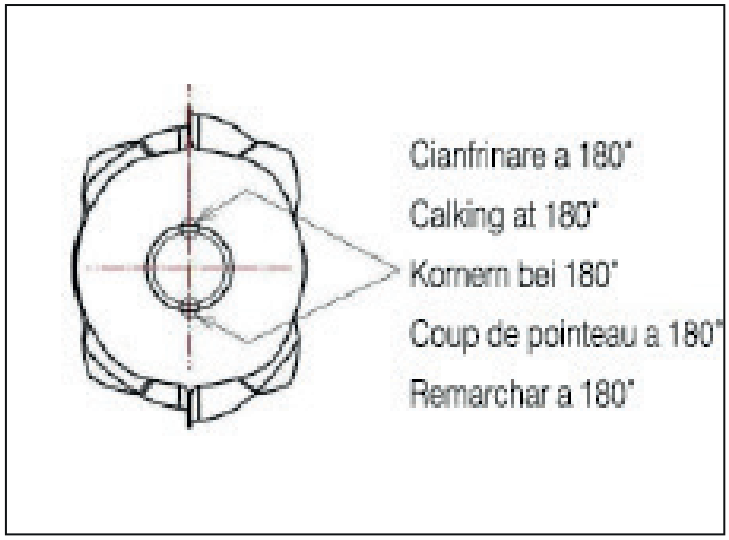

Fig. 2.211

2.59.2 Rocker lubrication

There are two oil passages in the crankcase: a delivery passage feeding lubricant oil to the rockers and an oil return passage from the rockers.

A - oil drain from rockers
B - oil delivery to rockers
C - Flywheel side
D - Timing side

Also see the section BASE ENGINE - CYLINDER HEAD

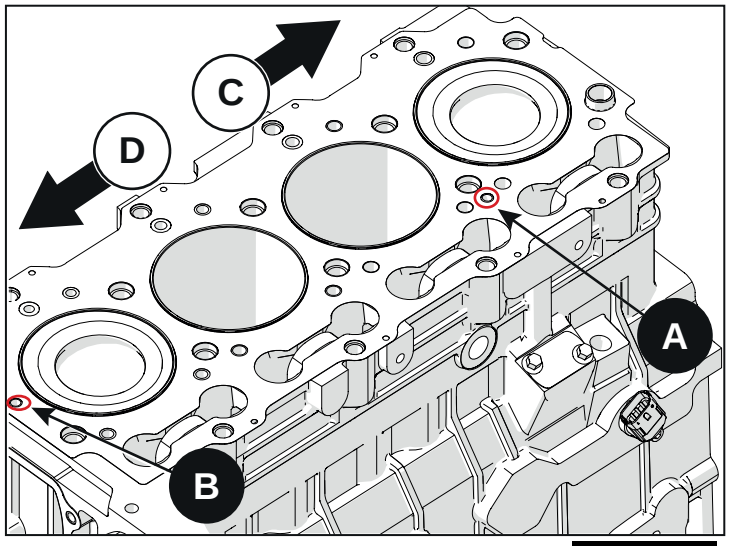

Fig. 2.212

2.60 Cylinder sleeve

2.60.1 Removal

- Remove the sleeves with the special tool.
- Remove all components impeding removal of the sleeves, including the pistons.
- Remove the oil jets.
- Remove the disc from the special tool.

A - special tool
B - plate

Warning

To prevent mismatching the cylinder sleeves with the pistons during reassembly, mark the cylinder sleeves during removal to identify their original positions in the cylinder block/crankcase.

- Install the tool in the cylinder sleeve and fit the disc onto the tool at the bottom of the cylinder sleeve.
- Tighten the nut of the tool to pull the cylinder sleeve out from the cylinder. Note the positions of the O-rings at the bottom of the cylinder sleeve.

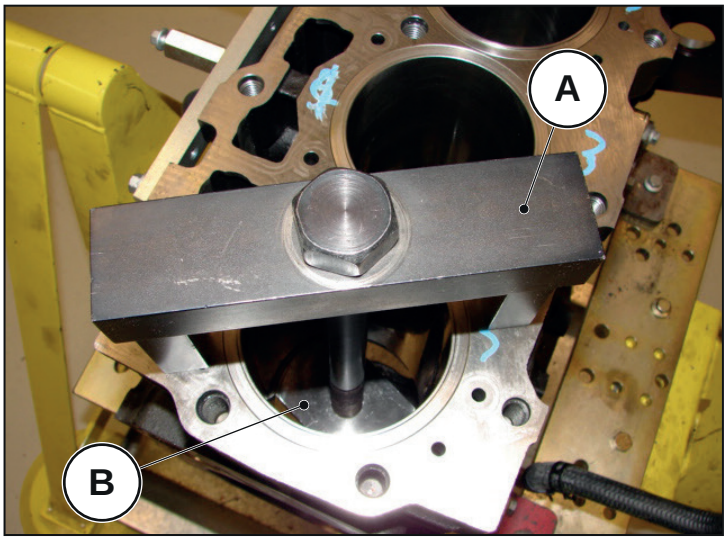

Fig. 2.213

2.60.2 Specifications

- Remove all residue of old sealant from the cylinder sleeve.
- Clean the cylinder sleeves, especially in the area shown and in the areas where the O-rings are installed.
- Wash the cylinder sleeve with solvent.
- Dry with compressed air.
- Inspect the cylinder sleeves to check for abnormal wear or cracking.
- Measure the cylinder sleeve with a bore gauge to check for conicity. Replace the cylinder sleeve if worn beyond the specified limits.

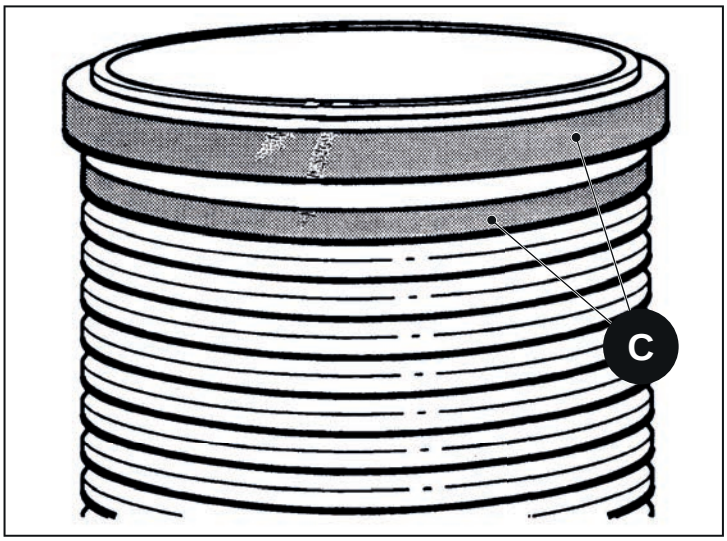

Fig. 2.214

Note

Move the bore gauge very carefully up and down the cylinder sleeve to check for conicity.

- Measure in three different positions along the length of the cylinder sleeve and on opposite sides. Rotate the bore gauge into different positions around the circumference of the cylinder sleeve to check cylindricity.

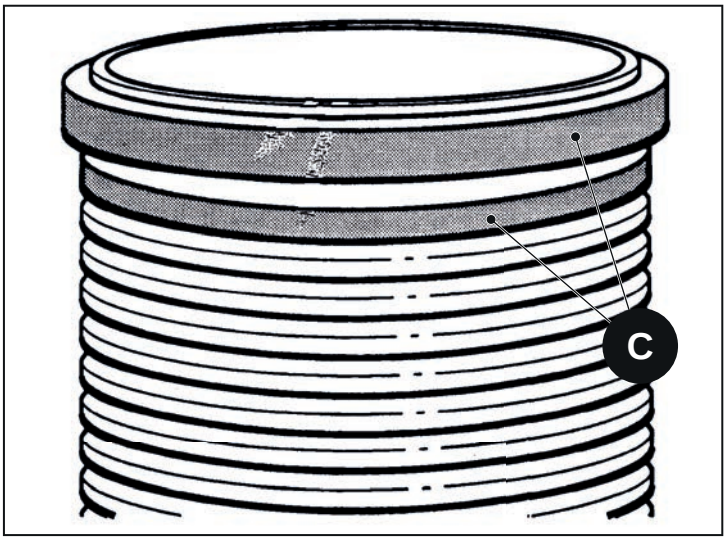

Fig. 2.215

Maximum measurement depth: 108 mm below cylinder sleeve collar.

Cylinder sleeve	
Inner diameter	93.995 - 94.015 mm
Wear limit	0.10
Conicity - Cylindricity	0.008 mm
Maximum conicity - Cylindricity	0.10 mm

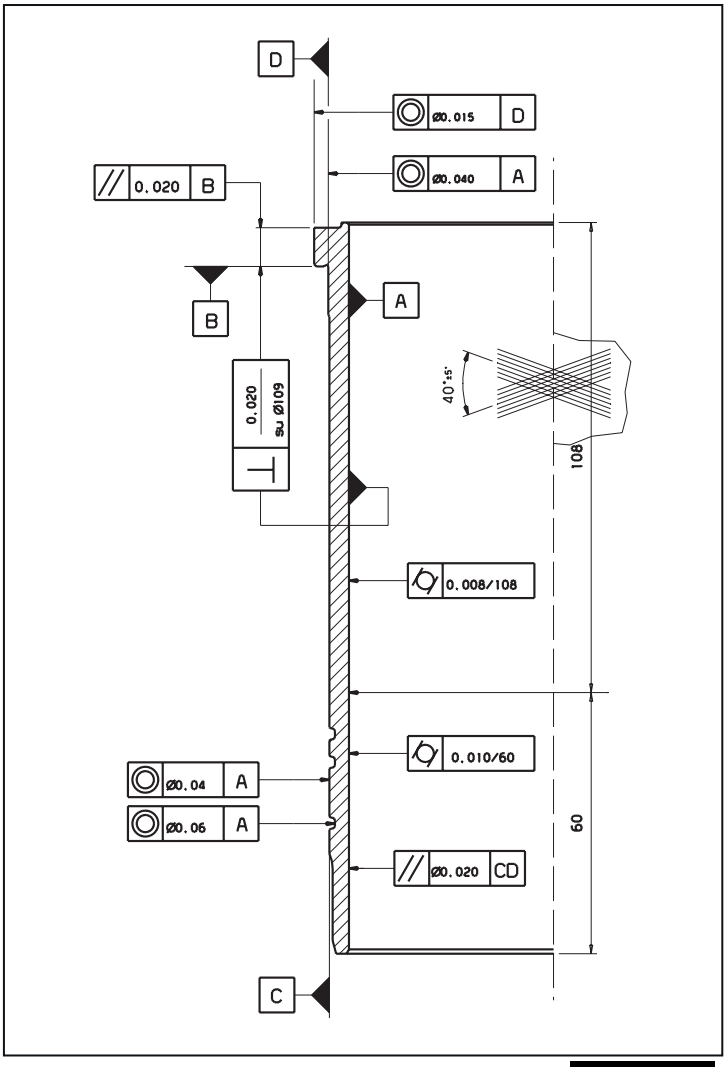

Fig. 2.216

2.60.3 Installation

Warning

The protrusion of the cylinder sleeve from the cylinder block/crankcase must only be measured with the cylinder sleeve installed correctly in the cylinder block/crankcase.

Measuring this value incorrectly may cause a loss in engine performance or severe engine damage. Make sure that the cylinder sleeves are installed correctly in the cylinder block/crankcase before measuring protrusion.

Note

Before measuring, check that the cylinder sleeve can turn freely in the cylinder block/crankcase.

a. If not replacing the cylinder sleeves with new components, the cylinder sleeves must be refitted in their original positions **without the O-rings.**

O-rings. b. Use a dial gauge to measure protrusion (the depth/protrusion of the top of the cylinder sleeve relative to the top deck of the cylinder block/crankcase) for each cylinder sleeve, and note the value measured.

a - protrusion
b - cylinder sleeve
c - cylinder block/crankcase
d - top deck of cylinder block/crankca-
se - head mating surface

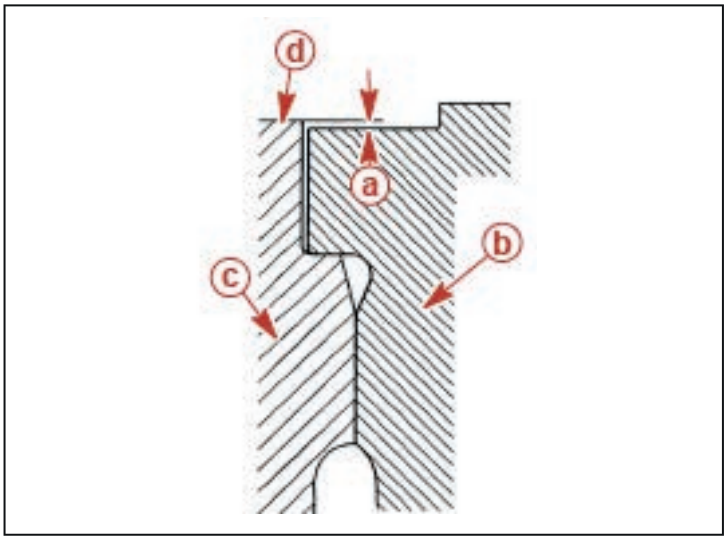

Fig. 2.217

- Use a dial gauge and the special tool to measure protrusion
- Place the tool, complete with dial gauge, so that the probe of the dial gauge is in contact with the cylinder block/crankcase.
- Set the dial gauge needle to zero (0).
- Move the tool towards the cylinder sleeve collar. Note the value measured.
- Measure the protrusion of all the cylinder sleeves
- Check that the protrusion measured for each cylinder sleeve is within the specified limits: **Cylinder sleeve protrusion - 0.01 ÷ + 0.07 mm**

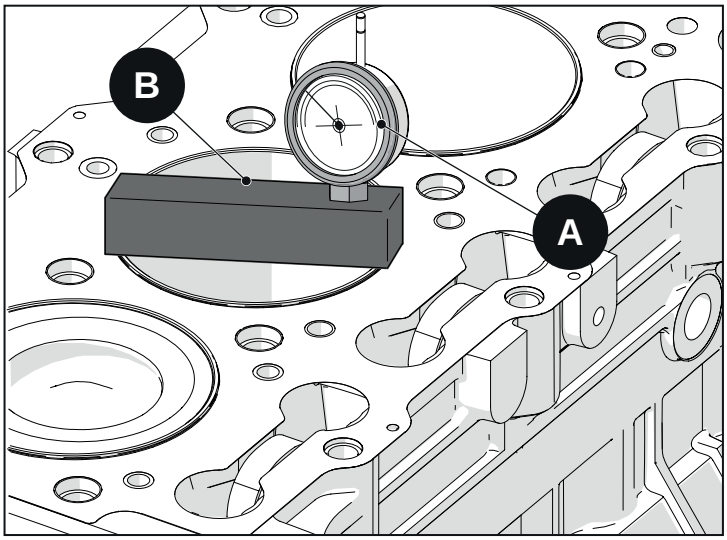

Fig. 2.218

If the protrusion measured is not within specifications, remove the cylinder sleeve and install a different sleeve.

If the value measured is correct, install all the cylinder sleeves as follows:

- Fit the 2 coloured O-rings of the same colour in the second and third lowest seats on the cylinder sleeve, and fit the differently coloured O-ring in the bottom seat (see photo).
- Lubricate the collars in the cylinder block/crankcase (zone where the O- rings seal against the collar of the cylinder block/crankcase) with lubricant.
- Apply LOCTITE 986 to the surface indicated in the figures.

Warning

the first two O-rings are different in thickness and colour from the third O-ring. Do not swap the O-rings.

Warning

Do not lubricate the upper part of the cylinder block/crankcase, where LOCTITE 986 will be applied in the next step in the procedure (step 9).

X - 2 O-rings of the same colour installed in second and third lowest seats on the cylinder sleeve
Y - O-ring installed in bottom seat on cylinder sleeve (with different colour than the other 2 O-rings)

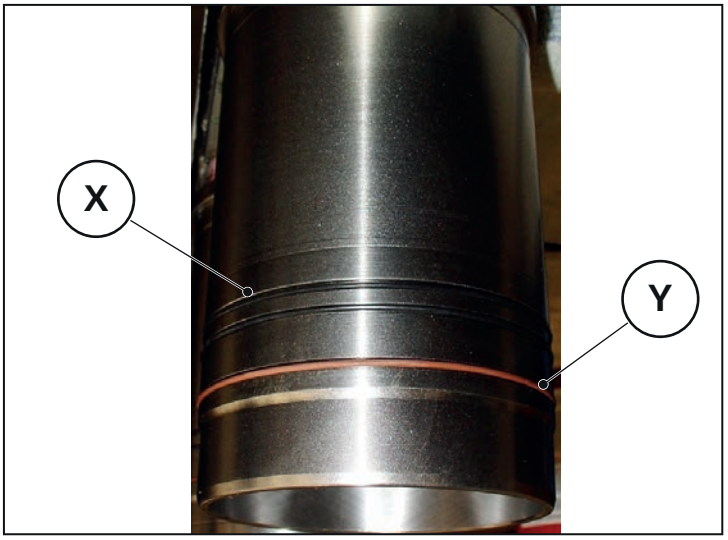

Fig. 2.219

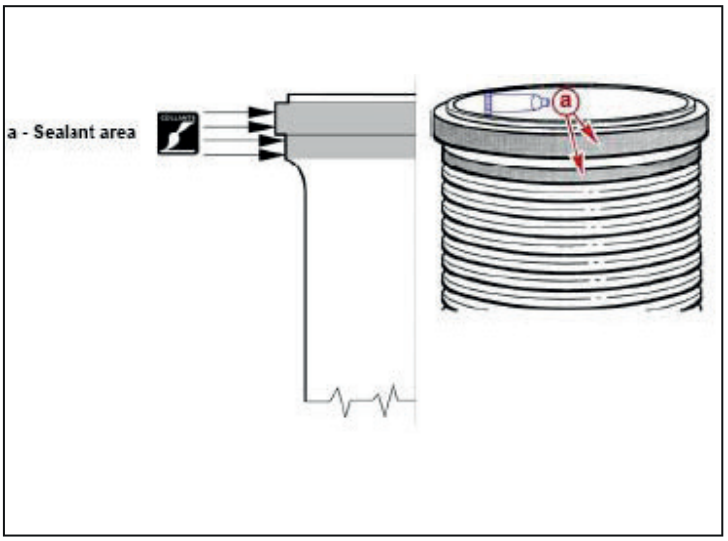

Fig. 2.220

- Install the cylinder sleeves in the cylinder block/crankcase, taking care not to damage the O-rings.
- After installing the cylinder sleeves, secure in place with the bolts and spacers
- Tighten the bolts temporarily to allow the Loctite adhesive to cure.

A - Cylinder sleeves
B - bolt
C - spacers

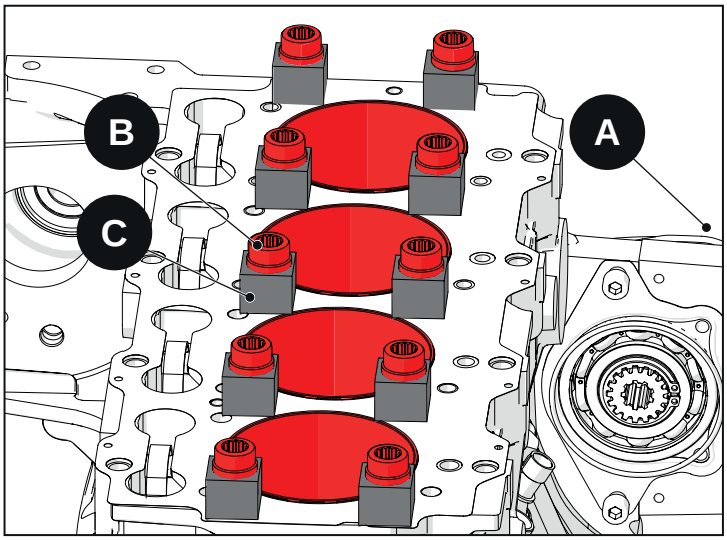

Fig. 2.221

Warning

If the heads are not installed within 1 hour, the cylinder sleeves must be kept secured by the bolts and spacers for 8 hours to allow the Loctite adhesive to cure. After 8 hours, the bolts and the relative spacers may be removed and the heads may be installed.

- Once the Loctite adhesive has cured, check the cylinder sleeve protrusion as described previously
- If the protrusion is correct, continue with assembly of the engine.

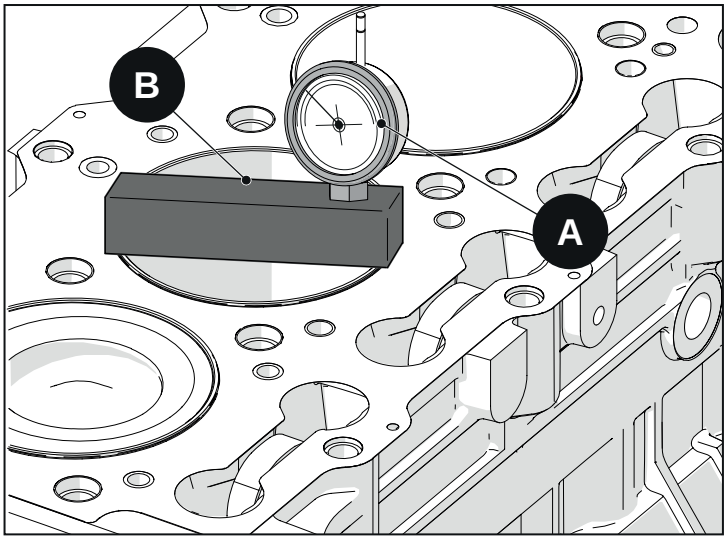

Fig. 2.222

2.61 Camshaft

2.61.1 Test - Measuring lobes

- Remove the rocker assemblies.
- Mount a dial gauge on the head, with the probe of the dial gauge taking the place of the rocker rod.
- Rotate the crankshaft to bring the lobe into rest position.
- Set the dial gauge needle to zero (0).
- Rotate the crankshaft by 2 complete turns while reading the dial gauge.
- Follow the same procedure to measure all the camshaft lobes.

Warning
The camshaft must be replaced if the any of the lobe lift values measured are more than 0.05 mm below the following values.

Lobe lift

Exhaust	7.303 mm
Intake	6.850 mm
Wear limit	0.05 mm

2.61.2 Lobe diameter

- Measure the total height of the lobe (base circle + lobe lift). Subtract the base circle of the lobe from the total height. The difference is the lobe lift. The camshaft must be replaced if the lobe lift is less than the values specified below.

Lobe diameter

Exhaust	38.550 - 38.650 mm
Intake	39.450 - 39.550 mm
Wear limit	0.05 mm

a - Lobe lift
b - Lobe diameter
c - Lobe lift

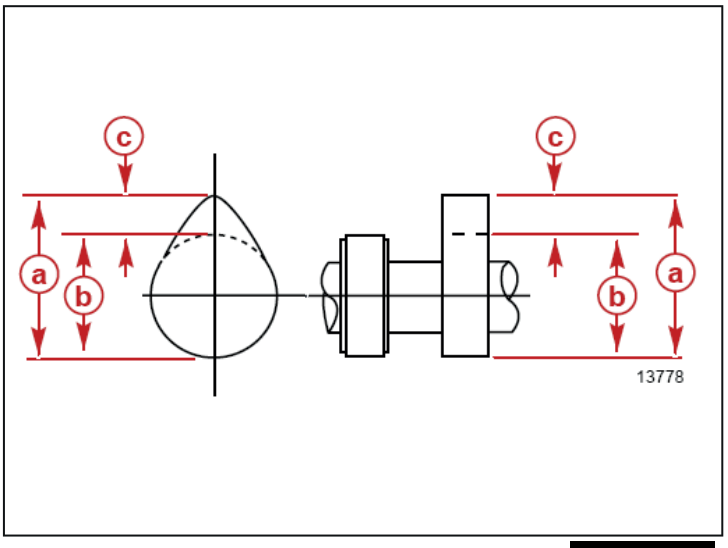

Fig. 2.223

2.61.3 Pin diameter

- Use a micrometer to measure each pin in the 2 directions (“X-X”) and (“Y-Y”). Replace the camshaft if the value measures is less than the specified limit.

Note

0.250 mm bushes are available as a first size reduction class. See the section “Camshaft bushes" for the procedure to determine the free play between the camshaft pins and the relative bushes.

Camshaft	Pin diameter
Front	53.495 - 53.510 mm
Centre	53.450 - 53.470 mm
Rear	53.480 - 53.500 mm
Wear limit	0.200 m

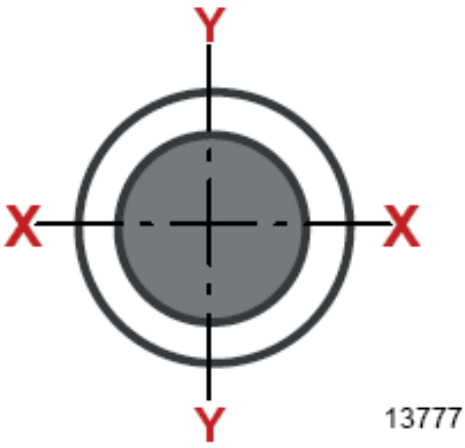

Fig. 2.224

2.61.4 Free play between camshaft and flange

- Measure the free play between the flange and the camshaft.
  - **Free play between flange and camshaft: 0.030-0.095 mm**

Warning

The camshaft gear is press-fit onto the shaft. If it is necessary to replace the gear, heat the gear in the oven at 180-200°C (360-390°F) for 10 minutes and then install it onto the shaft with a press. Fit the flange and the key, and then press the gear onto the shaft to bring it into contact with the abutment of the flange.

- If the value measured exceeds the specified limits, remove the flange and measure its thickness in 4 positions spaced by 90°. Replace the flange if the free play is less than the specified limit.
  - **Flange thickness (S): 3.95 - 4.05mm**

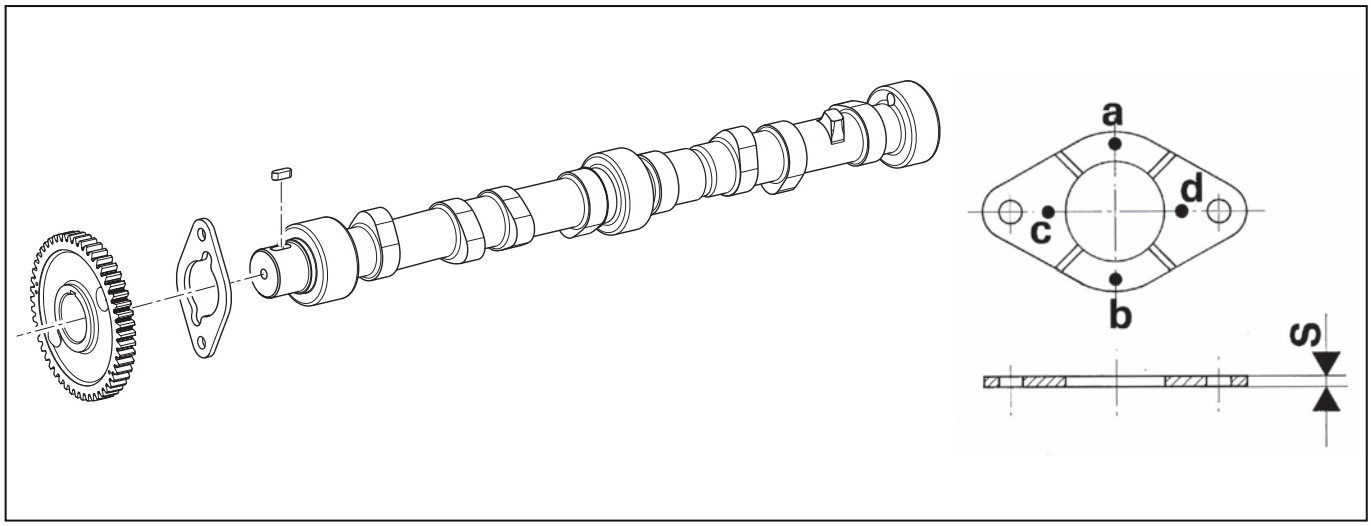

Fig. 2.225

s - flange thickness
a,b,c,d, -flange thickness measured in 4 positions spaced by 90°

e - flange
f - Camshaft gear

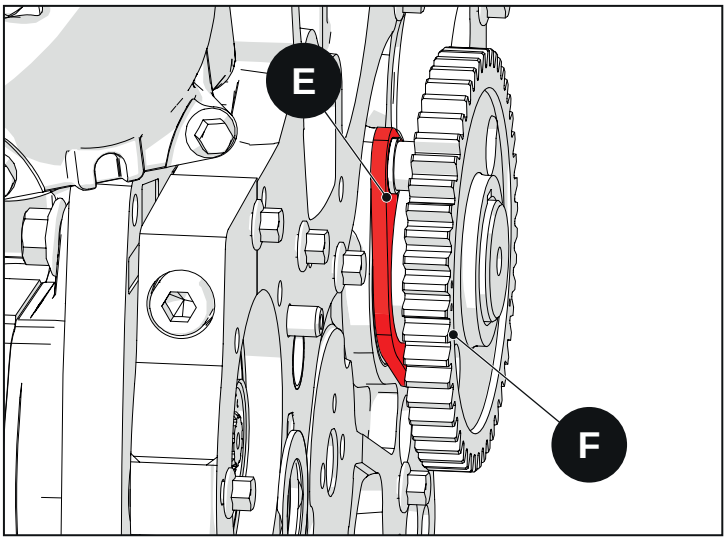

Fig. 2.226

2.61.5 Removal

- Turn the crankshaft to bring the piston of cylinder 1 to its ignition stroke, aligning the reference markers on the camshaft gear and the idler gear as shown in the figure.

Warning
Keep the rocker assemblies, rocker rods and tappets in order of removal and number the parts to facilitate reassembly in the original positions.

- Remove the rocker assemblies, rocker rods and tappets.
- Remove the heads.
- Remove the engine oil dipstick.
- Remove the screws fastening the camshaft flange.
- Remove the camshaft carefully. Do not damage the camshaft bushes.

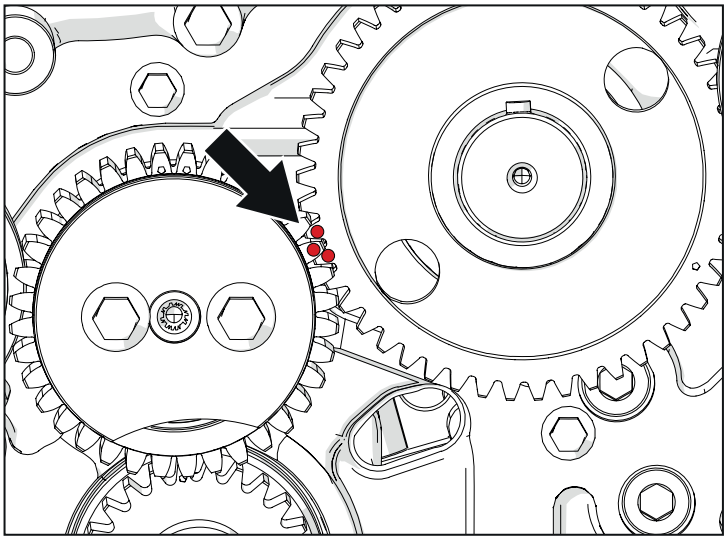

Fig. 2.227

A - screws fastening the camshaft flange
B - camshaft flange
C - Camshaft gear

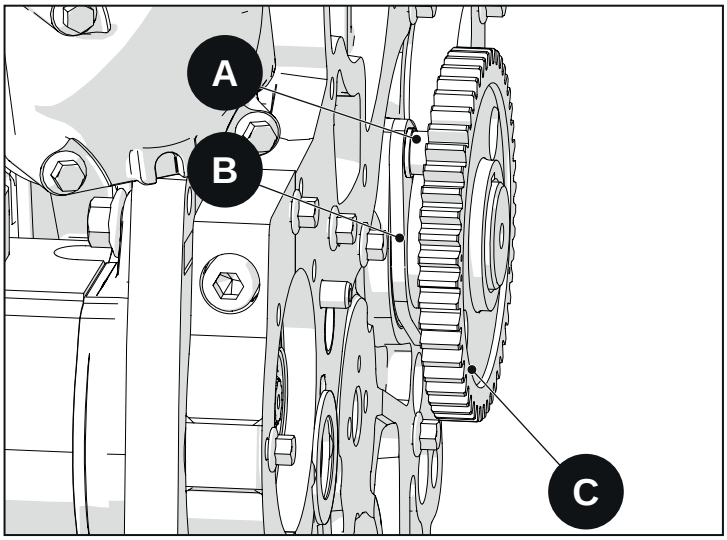

Fig. 2.228

2.61.6 Installation

- Lubricate the camshaft lobes with engine oil.
- Lubricate the camshaft bushes.
- Fit the camshaft. Do not damage the bushes.
- Align the reference markers stamped on the idler and camshaft gears as shown previously.
- Fit the screws and the relative washers. Tighten the screws.
  - **screws fastening camshaft flange: 27.5 N·m**

2.62 Camshaft bushes

2.62.1 Inspection

- Remove the camshaft.
- Inspect the bushes. Replace the bushes if damaged or worn.
- Measure the inner diameters of the camshaft bushes and compare against the diameters of the pins. Calculate the free play.

Warning
When replacing the front camshaft bearing bush during servicing, the new bush must be bored to the correct diameter after installation in its seat in the cylinder block/crankshaft. Install the bush with the engine oil passage hole in the cylinder block/crankshaft for lubrication aligned with the hole in the bush. See the figure for the correct angle.

2.62.2 Specifications

Front camshaft bush

Inner diameter (bush bored in cylinder block/crankshaft)	53.59 - 53.62 mm
Bush-pin free play	0.08 - 0.125

Centre and rear camshaft bushes

Internal diameter of bush (installed in bearing)	53.550 - 53.600 mm
Free play (centre bush)	0.08 - 0.15
Free play (rear bush)	0.05 - 0.12
1st bush size reduction class	0.25 mm

A - camshaft seat
B - idler gear seat
C - crankshaft seat
D - oil pump seat

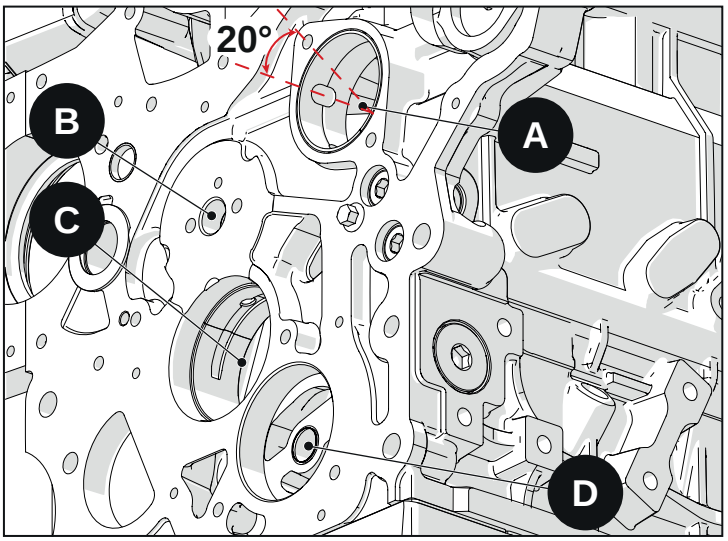

Fig. 2.229

2.63 Front camshaft bush

- Fit a new bush on the special tool.
- Align the oil passage hole in the cylinder block/crankcase with the hole in the bush.
- Install the front bush with the special tool.

Note

To facilitate installation, hold the 2 half bearings on the special tool with an elastic band or another equivalent solution.

A - special tool
B - Front camshaft bush (new)

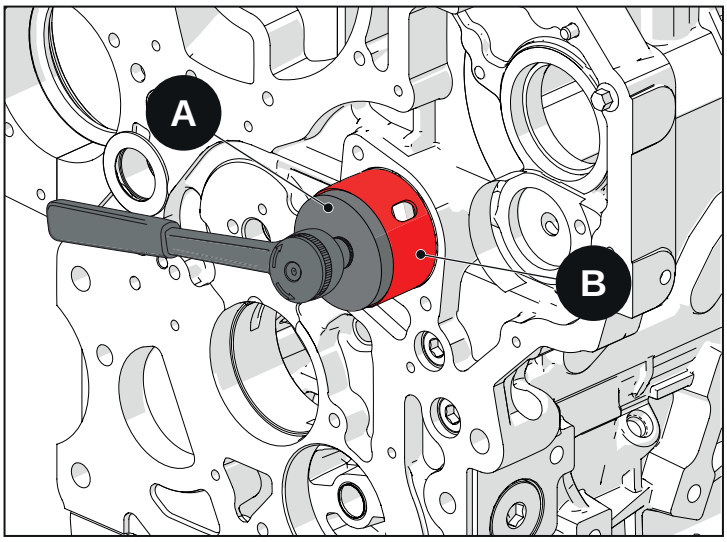

Fig. 2.230

- Apply Loctite 601 to the outer surface of the bush.
- Tighten the nut on the special tool to drive the old bush out of the cylinder block/crankcase.

Warning

When removing an old bush or fitting a new bush (front camshaft bush or front crankshaft bush), make sure that the oil passage hole for lubricating the bush is oriented correctly. The hole in the bush must be aligned with the hole in the cylinder block/crankcase to ensure correct lubrication.

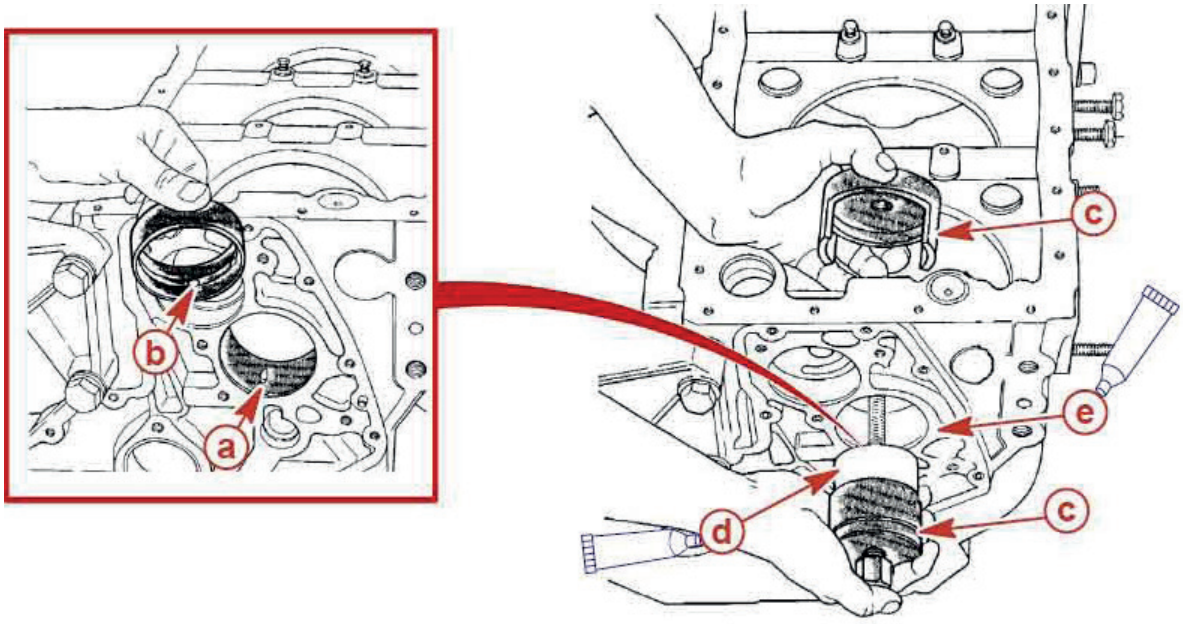

Fig. 2.231

A - Oil passage in cylinder block/crankcase
B - Oil passage in bush
C - Front camshaft bush and special tool
D - 2 half bearings (on tool)
E - bush seat bore in cylinder block/crankcase

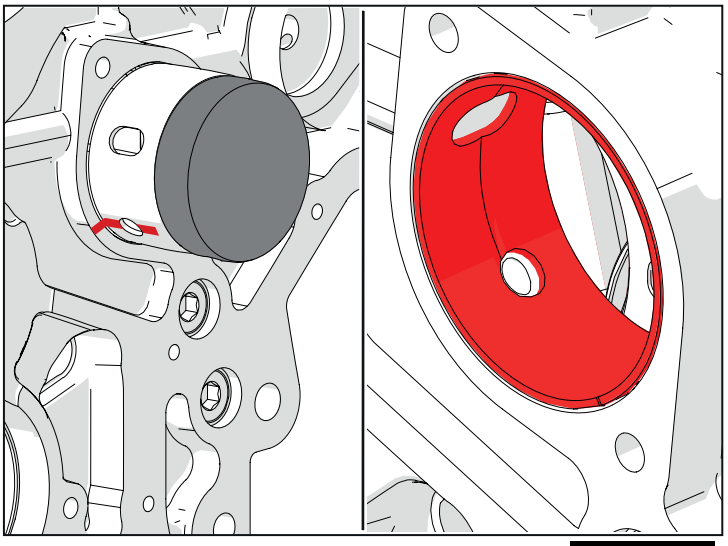

Fig. 2.232

2.64 Piston cooling oil jets

The oil jets cool and lubricate the pistons and other engine components. Incorrectly installed oil jets may cause engine damage. Make sure that the oil jets are clean and correctly installed.

- Remove the oil jets near the bottom of the cylinder sleeve.
- Replace the O-ring on the jet valve.

A - Oil jet valve
B - Nozzle
C - Flange
D - Screw

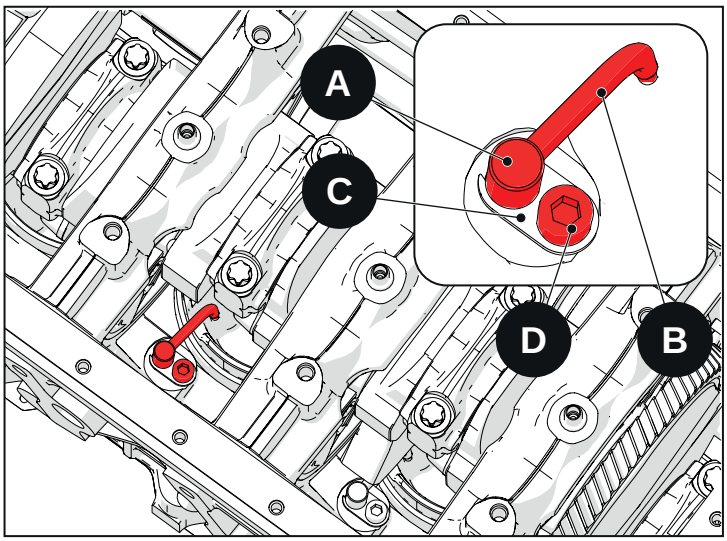

Fig. 2.233

- Check that the ball moves freely against the spring in the valve.
- Check the oil jet for cracks and check if the delivery pipe or nozzle are bent.

X - Spring
Y - Ball valve

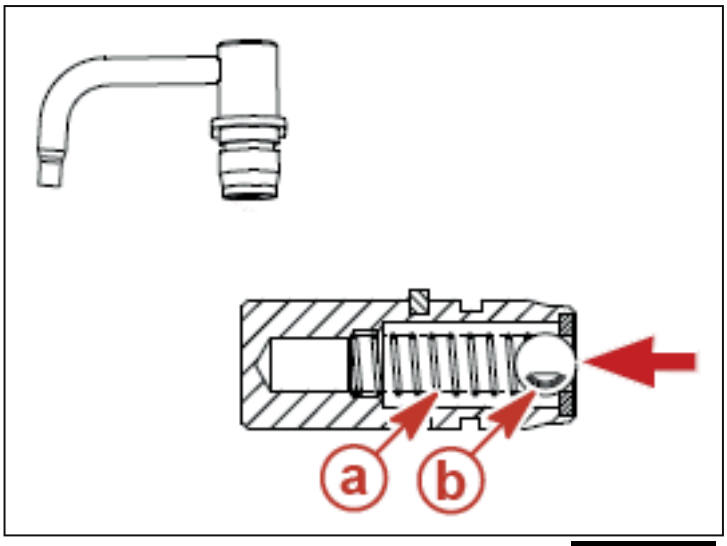

Fig. 2.234

- Fit and lubricate a new O-ring in the jet valve
- Fit the jet valve in the cylinder block/crankcase.
- Check that it is fitted in the correct position.
- Apply sealant to the thread of the screw.
- Fit and tighten the screw.
  - **Screw fastening oil jet valve: 12.7 N·m**

2.65 Crankshaft

2.65.1 Removal

- Remove the banjo bolts fastening the central main bearing journals and delivering oil to lubricate the crankshaft bushes.

A - Banjo bolt - standard
B - Special banjo bolt (delivers oil to turbo)
C - Rocker lubrication pipe

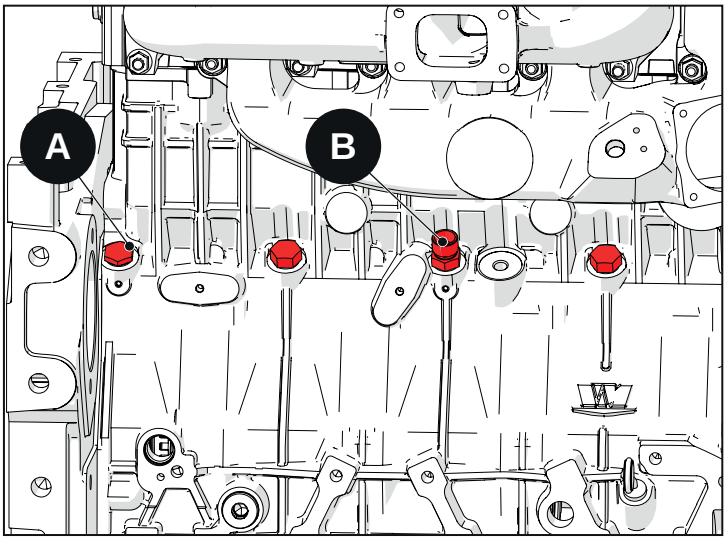

Fig. 2.235

- Fit the special tool on the crankshaft gear to protect the front crankshaft bush.

D - special tool
E - Crankshaft gear

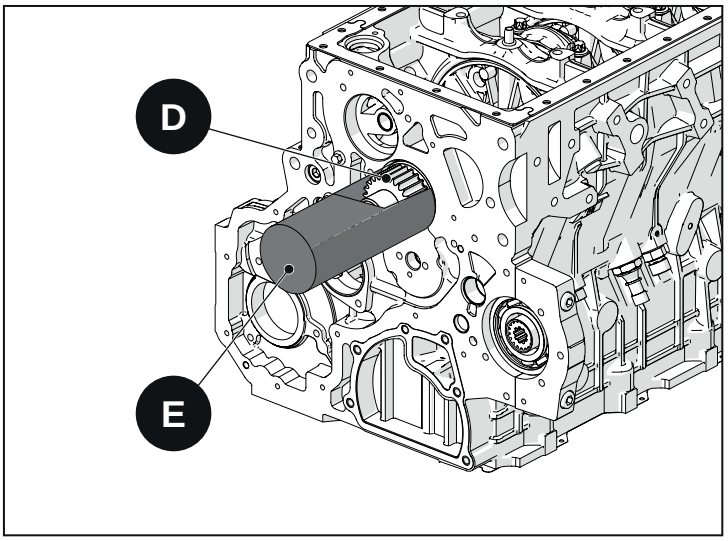

Fig. 2.236

Warning

Before removing the crankshaft from the crankcase, number or mark the centre bearings to identify the respective main journals with which they are matched. Make reference markings on the half-bearings to ensure correct reassembly.

Warning

Do not damage the oil jets when removing the crankshaft. Remove the oil jets beforehand. (See the section “Piston cooling oil jets”)

X - assembly reference markings on half bearings
Y - reference markings on all centre bearings (between centre bearing and crankshaft)
Z - number all the centre bearings to identify the main journals they are matched with.

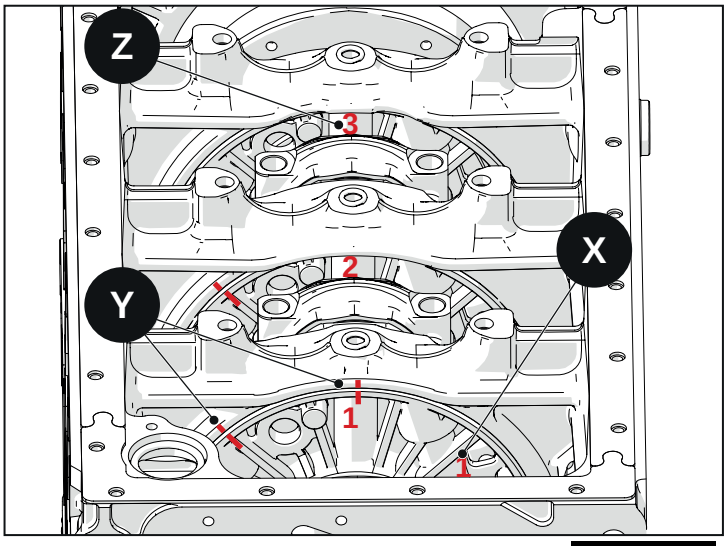

Fig. 2.237

Gently lift the crankshaft to detach all the central main bearing journals from their seats. Once they are detached, remove the crankshaft completely from the crankcase.

W - central main bearing journals detached from respective seats in crankcase

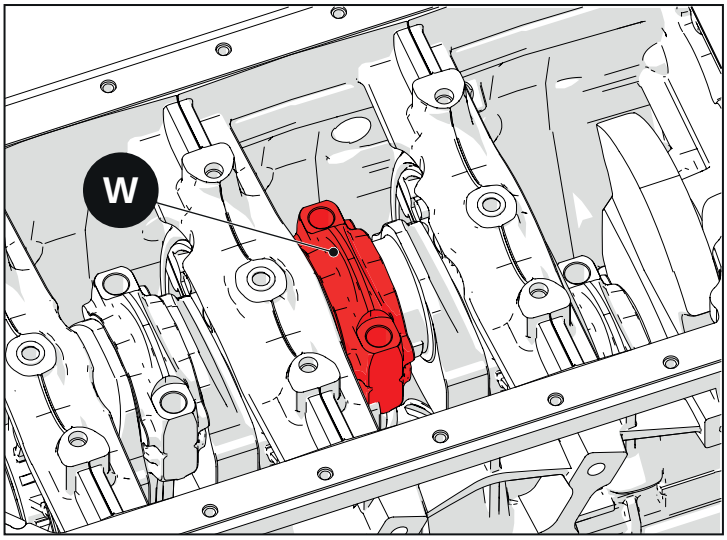

Fig. 2.238

2.65.2 Inspection

- Inspect the shaft to check for scoring, scratching, pitting or irregular wear.
- Inspect the rear journal for signs of seizing or damage.
- Inspect the lubrication oil passages to check for restriction.
- Inspect the threaded holes to check for damage.
- Inspect the key and the key seat of the front shank.
- If the crankshaft has been seized or overheated or has been ground, it must be checked for surface cracks with a Magnaflux magnetic particle testing system.

After grinding, the crankshaft must be treated with a “SURSULF” bath (to attain a surface hardness of HV 587 with a test load of 500 g. equivalent to HRc 53). After the “SURSULF” treatment, lap all surfaces to attain a roughness of Ra 0.18 / 0.22. IMPORTANT: Never attempt to straighten the crankshaft after application of the SURSULF treatment. Do not remove any material, either by hand or with a grinding machine, from the surfaces of the rear shims and from the rear shank of the shank, which the shims come into contact with. Replace the crankshaft if the machined surfaces of the front and rear shanks or the area with the threaded holes are not within the permitted tolerance for cylindricity or if they are worn or damaged.

- Measure the main journals to determine if replacement or grinding is necessary.

2.65.3 Specifications

Length (4 cylinder)	595.1 mm
Length (6 cylinder)	819.1 mm
Front shank - diameter	62.985 - 63.005 mm
1st size reduction class for front crankshaft bush	0.25 mm
Centre main journals - diameter	63.005 - 63.02 mm
1st size reduction class for centre main bearing bush	0.25 mm
Rear shank - diameter	79.985 - 80 mm
1st size reduction class for rear crankshaft bush	0.25 mm
Main journals - diameter	53.940 - 53.955 mm
1st size reduction class for connecting rod bush	0.25 mm
Wear limit	0.10 mm
Free play between front shank and front main journal bush	0.023 - 0.083 mm
Free play between centre main journal and main journal bearing bush	0.008 - 0.051 mm
Free play between rear shank and rear main journal bearing bush	0.045 - 0.085 mm
Free play between crankpin and connecting rod bush	0.012 - 0.066 mm

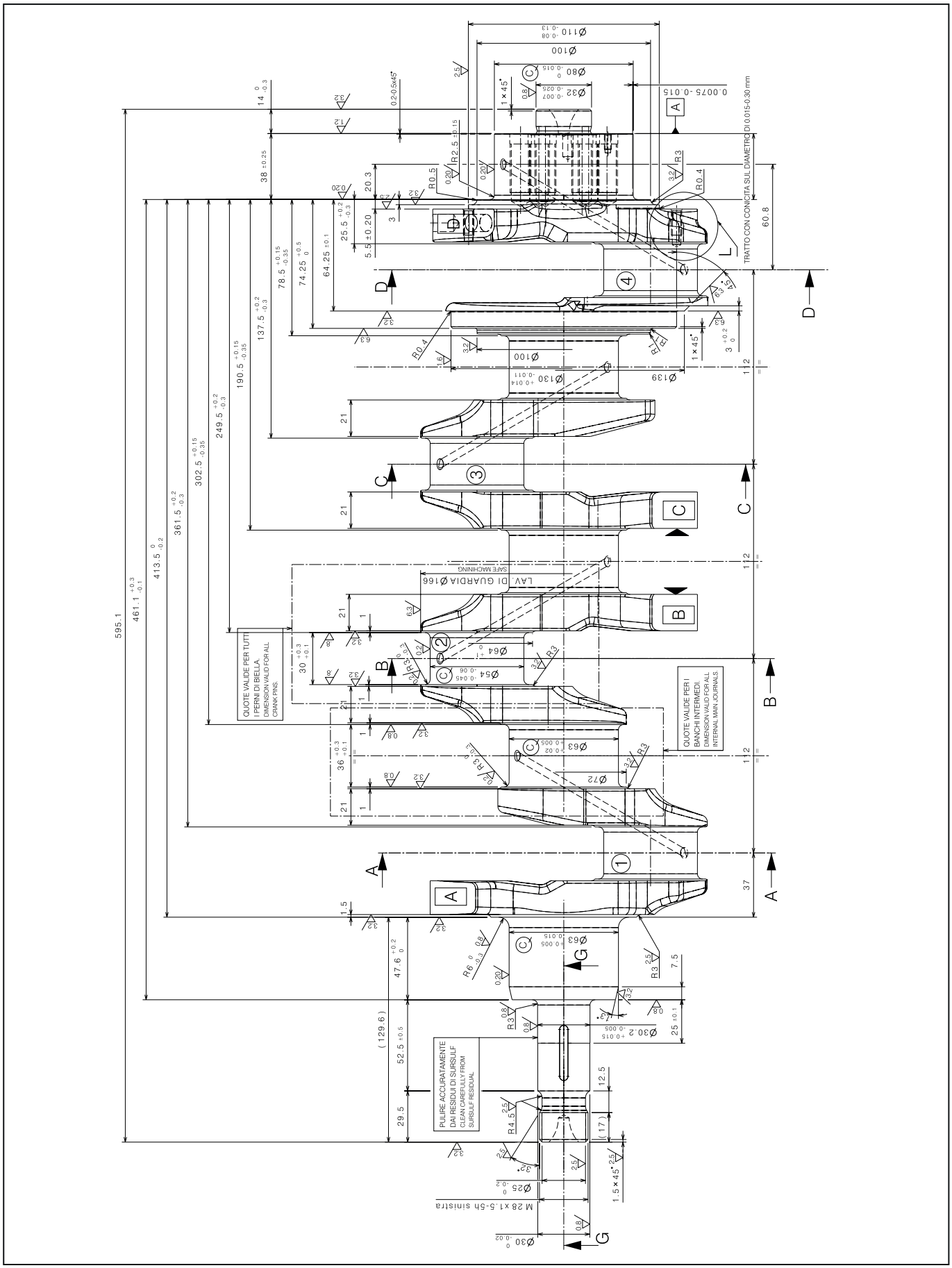
QUOTE VALIDE PER TUTTI I PERNI DI BIELLA
DIMENSION VALID FOR ALL CRANK PINS.
QUOTE VALIDE PER I BANCHI INTERMEDI
DIMENSION VALID FOR ALL INTERNAL MAIN JOURNALS.
PULIRE ACCURATAMENTE DAI RESIDUI DI SURSULF
CLEAN CAREFOLLY FROM SURSULF RESIDUAL
TRATTO CON CONICITÀ SUL DIAMETRO DI 0.015÷0.30 mm
SAFE MACHINING
M 28 x1.5-5h sinistra

Fig. 2.239

2.65.4 Installation

Lubricate the seats of the bearings in the crankcase or grease the outer surfaces of the centre bearings. Fit the respective centre bearings on the main journals in their original positions, referring to the marks made during disassembly, or to the identification markings applied on one side by the manufacturer.

Ensure that all the centre bearings are oriented with the front side of the bearing itself facing towards the timing side after installation on the respective main journals.

Lubricate the threads and under the heads of the screws with MOLYguard LMP 180 grease and tighten the screws.

centre main journal bearing screw: 44.1 N·m

a - brush with grease
b - bearing seats in crankcase

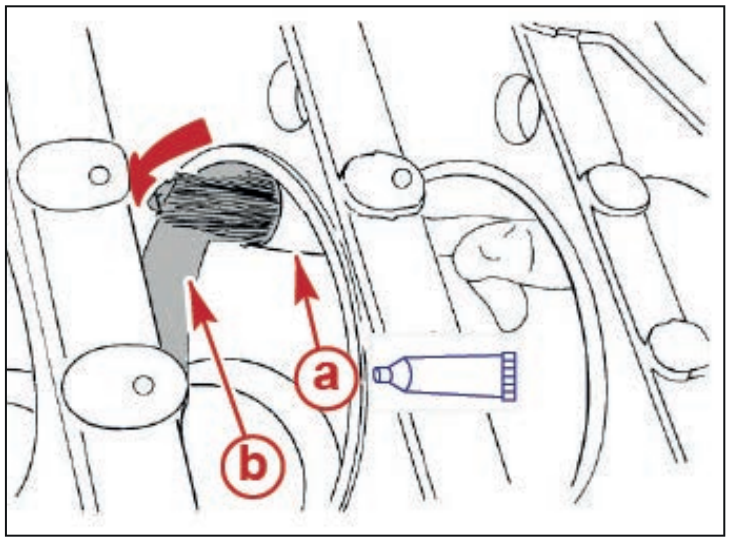

Fig. 2.240

A - reference mark applied by manufacturer or applied during disassembly
B - reference marker identifying the front side of the centre main journal bearing, which must face towards the timing side.
C - crankshaft gear (timing side)

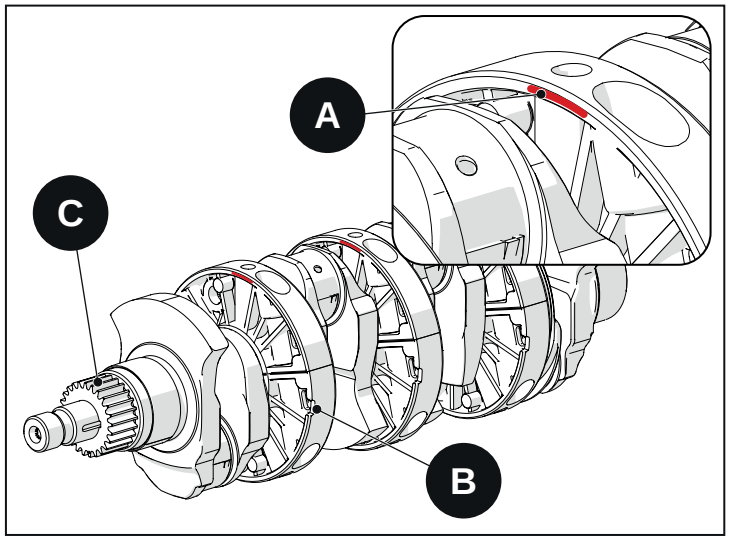

Fig. 2.241

- Fit the special tool on the crankshaft gear to prevent damage to the front crankshaft bush.
- Install the crankshaft carefully, with the central main journal bearings fastened to the crankshaft itself.

A - crankshaft complete with central main journal bearings
B - central main journal bearing during insertion into crankcase

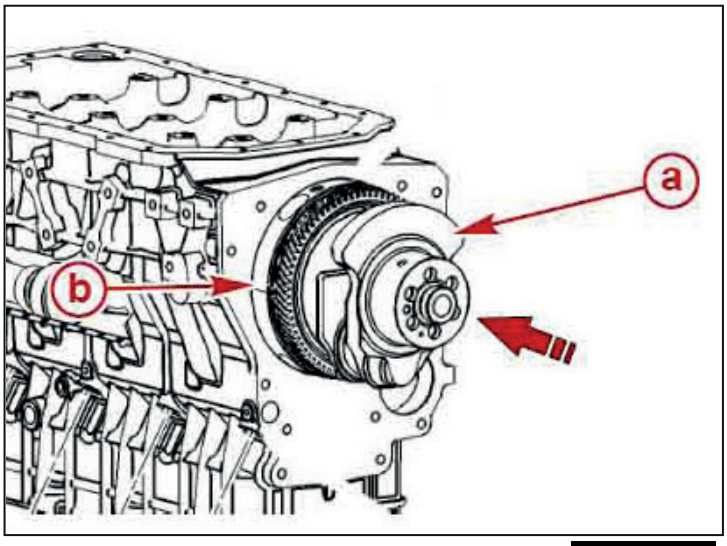

Fig. 2.242

- Turn the centre main journal bearings to align them with the reference markings made during disassembly; if there are no reference markings, turn the bearings so that the hole faces towards the oil sump.

X - assembly reference markings on half bearings
Y - bearing/crankcase assembly reference markings
Z - holes in bearings

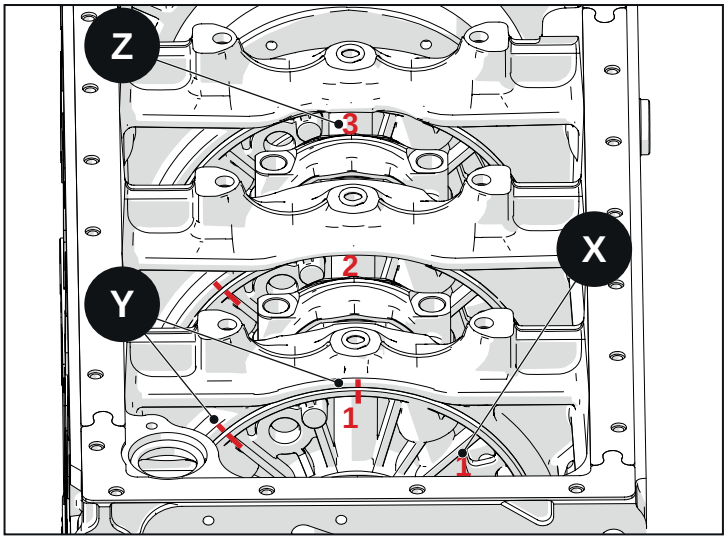

Fig. 2.243

- Fit the banjo bolts.
- To prevent damage to the threads, hand-tighten the banjo bolts into the crankcase.
- Tighten the banjo bolts.

A - banjo bolt - standard
B - banjo bolt - standard

Banjo bolt: 53.9 N·m

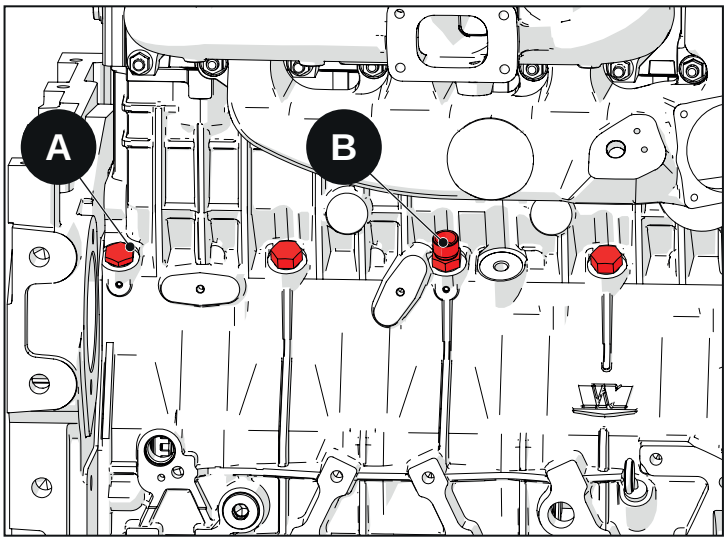

Fig. 2.244

2.66 Front crankshaft bush

- Fit a new bush on the special tool.
- Align the oil passage holes in the crankcase with the hole in the new bush.

Note

To facilitate installation, hold the 2 half bearings on the special tool with an elastic band.

- Fit the tool, complete with the new bush, into the crankshaft as shown in the figure.

A - special tool
B - front crankshaft bush

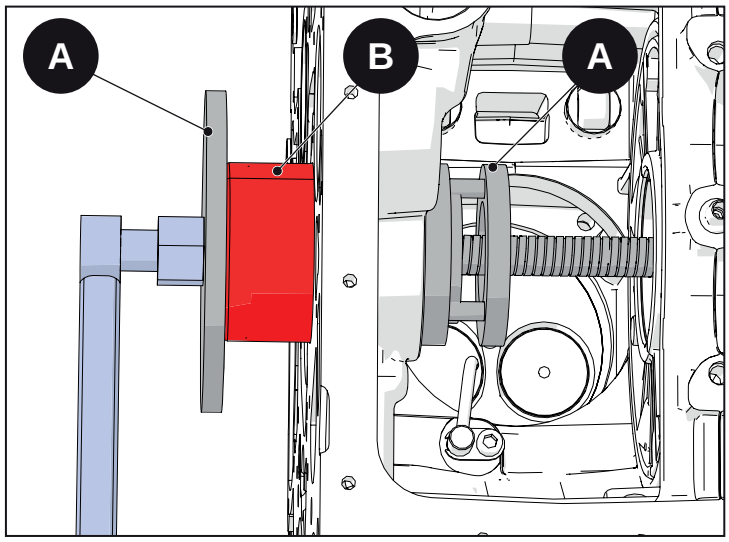

Fig. 2.245

- Apply Loctite 601 to the outer surface of the new bush.
- Tighten the nut on the tool to simultaneously install the new bush correctly in its seat and push out the old bush.

Warning

When removing a bush or installing a new bush, make sure that the oil passage hole of the bush is oriented correctly. The oil passage hole in the bush must be aligned with the hole in the cylinder block/crankcase.

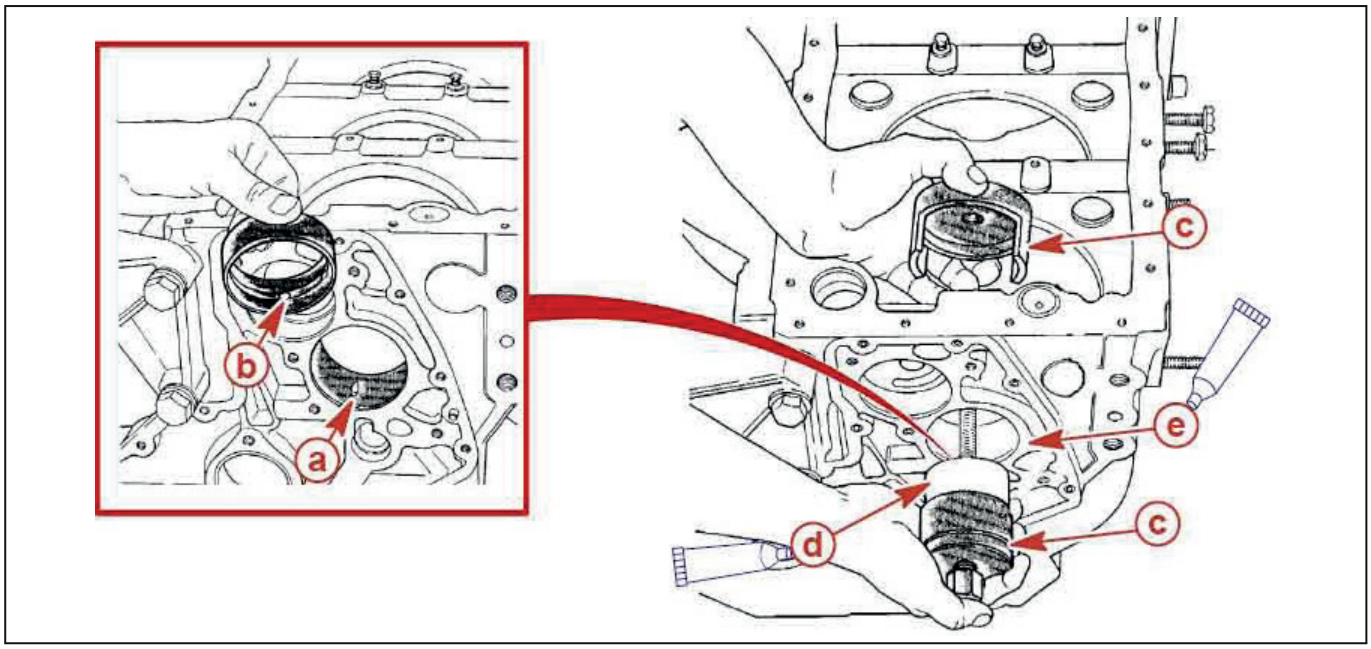

Fig. 2.246

A - Oil passage in cylinder block/crankcase
B - Oil passage in bush
C - Front camshaft bush and special tool
D - 2 half bearings (on tool)
E - bush seat bore in cylinder block/crankcase

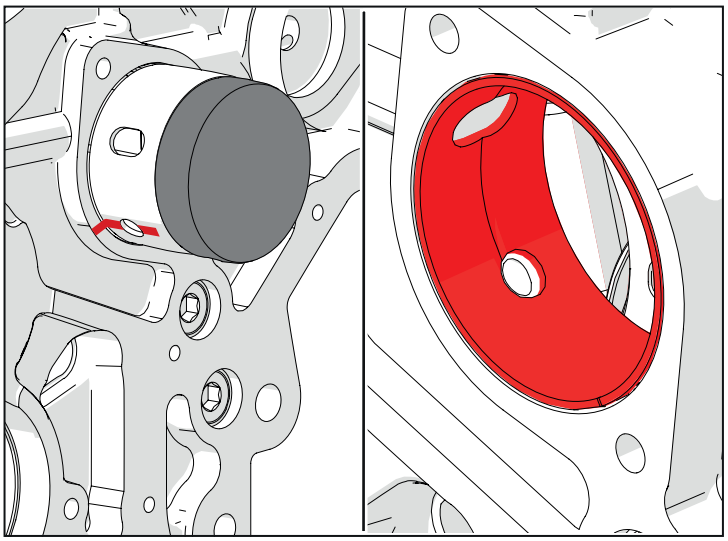

Fig. 2.247

2.67 Injection system

2.67.1 Layout

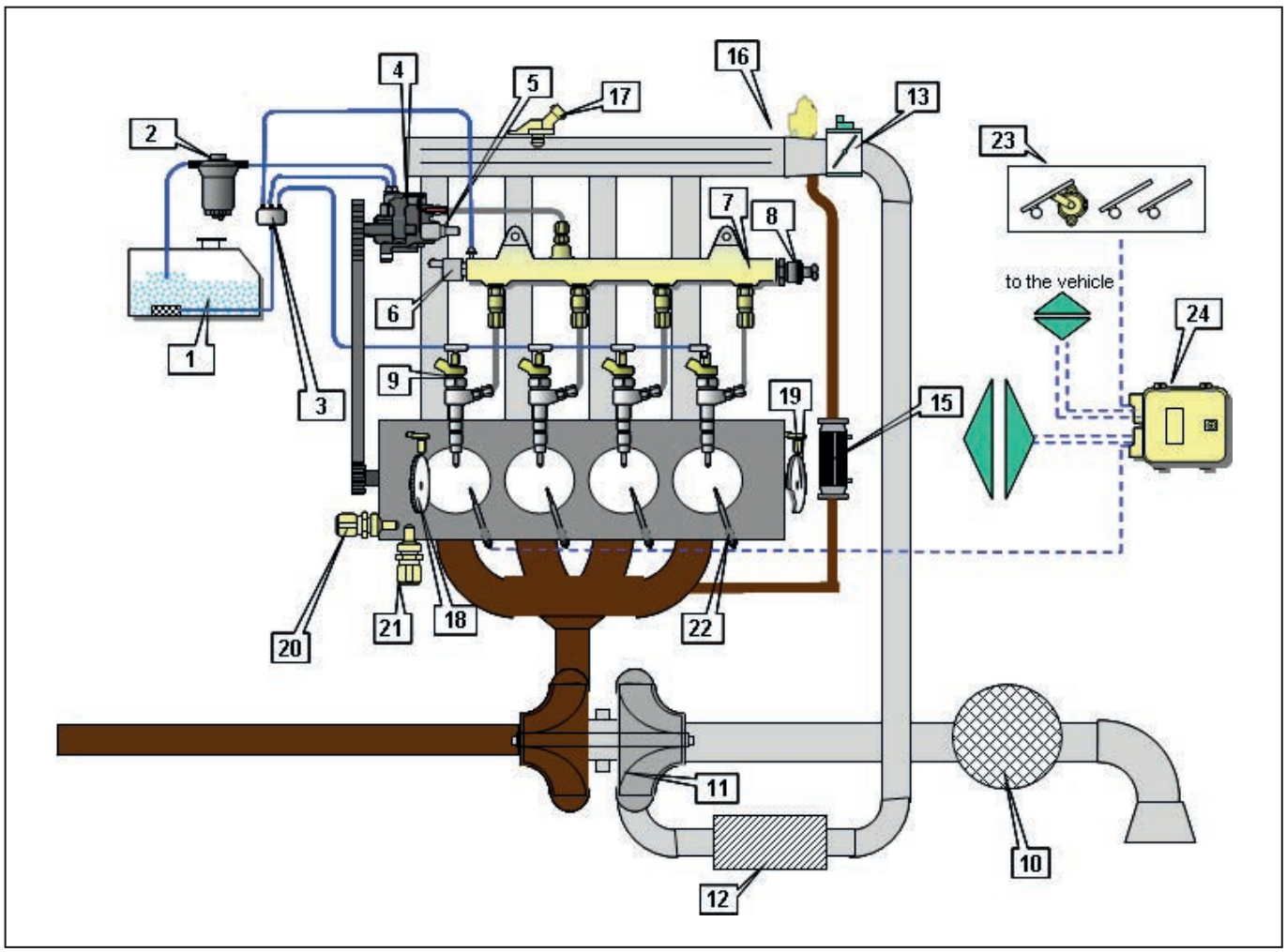

Fig. 2.248

1 - Fuel tank
2 - Fuel filter
3 - Fuel return valve block
4 - High pressure injection pumps
5 - Fuel pressure regulator valve
6 - Rail fuel pressure regulator valve
7 - Pressure accumulator (rail)
8 - Rail pressure sensor
9 - Injectors
10 - Air filter
11 - Turbocharger
12 - Intercooler
13 - Throttle valve
14 - EGR Valve
15 - EGR heat exchanger
16 - EGR manifold
17 - Intake manifold/intake air pressure sensor
18 - Crankshaft position/speed sensor
19 - Camshaft timing sensor
20 - Coolant temperature sensor
21 - Engine oil pressure and temperature sensor
22 - Glow plugs
23 - Foot throttle pedal
24 - Engine control unit

2.68 Low pressure injection system - Specifications

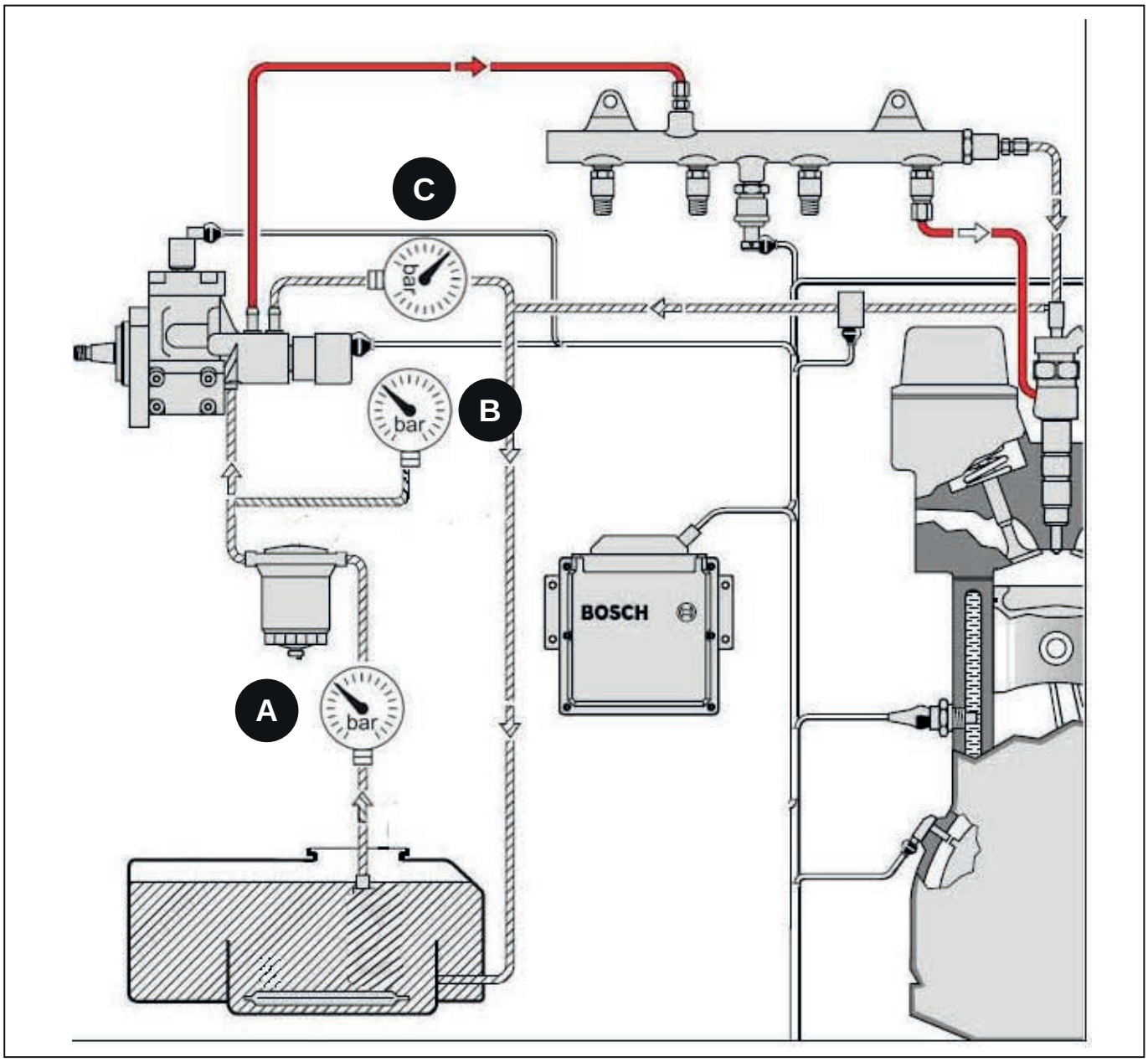

Fig. 2.249

A - Vacuum at fuel filter inlet - 0.4 bar
B - Vacuum at fuel filter outlet
B - Maximum vacuum
Difference between A and B - (max. bar)
C - Fuel return from high pressure injection pump
C - ≤ 0.6 bar

2.69 High pressure pump

2.69.1 Removal

- Release the clamp and disconnect the fuel delivery pipe from the pump.
- Loosen and remove the fuel return pipe from the pump.
- Loosen and remove the fuel delivery pipe to the rail.
- Loosen and remove the 3 nuts fastening the pump.
- Remove the pump. Replace the gasket fitted on the stud bolts.

A - fuel delivery pipe (clamp)
B - fuel return pipe to pump with relative banjo bolt
C - rail delivery pipe
D - nut fastening high pressure pump

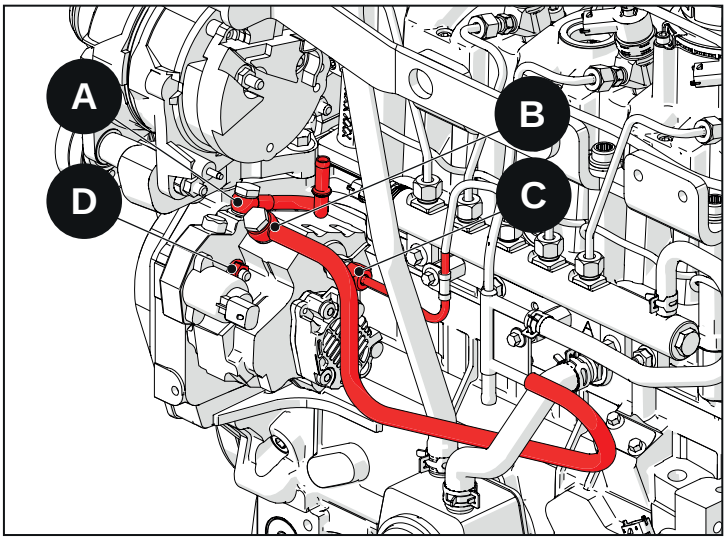

Fig. 2.250

- Loosen one of the nuts fastening the pump gear and use a commercially available puller tool to remove the pump gear.
- Remove the collar from the pump without damaging the pump housing. The new replacement pump is supplied complete with a new collar.

E - collar

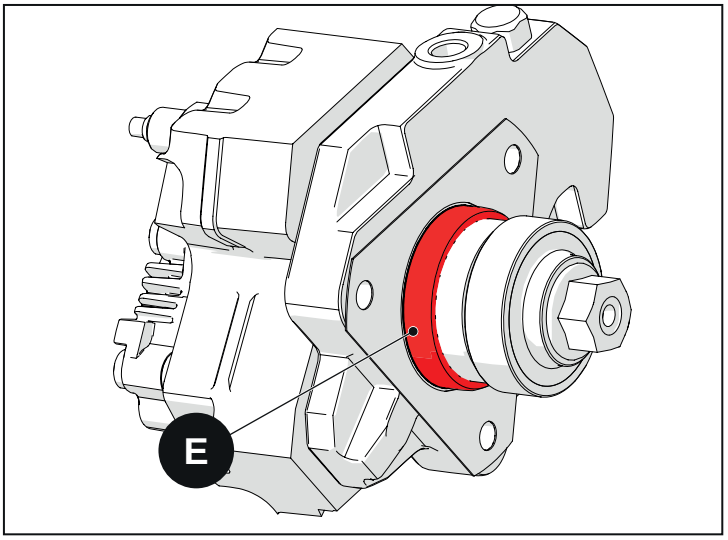

Fig. 2.251

2.69.2 Installation

- Fit the collar with the bevelled side facing outward.
- Press the collar into place to bring it into contact with the pump housing.

A - bevel

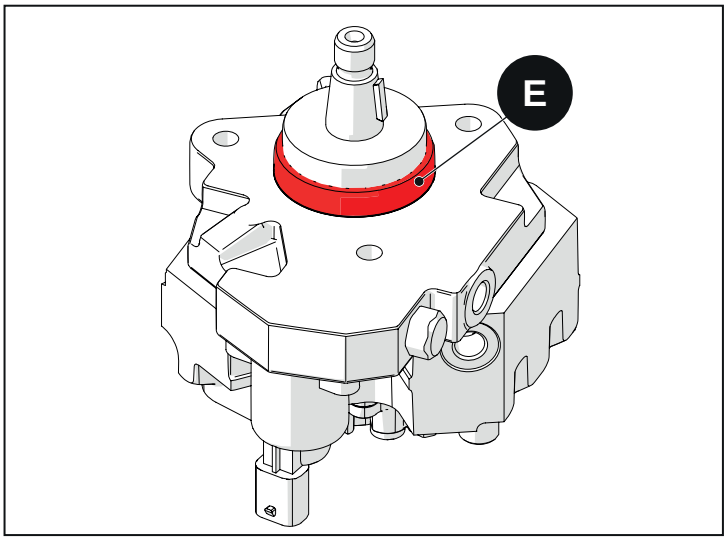

Fig. 2.252

- Fit the gear on the pump shaft.
- Fit and tighten the nut.
  - **nut: 86.4 N·m**

B - key seat on injection pump shaft

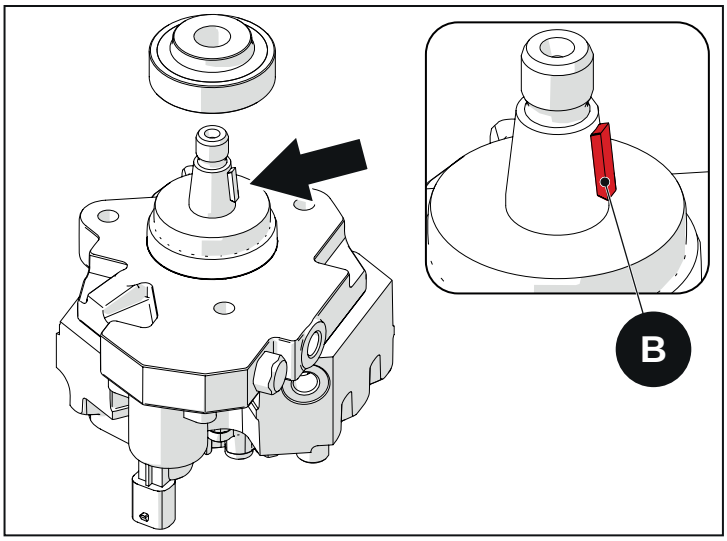

Fig. 2.253

- Fit a new gasket on the stud bolts.
- Fit the pump on the stud bolts, and then fit and tighten the 3 flanged nuts.
  - **flanged injection pump fastener nut: 27.5 N·m**

C - key seat on injection pump shaft

D - key seat on injection pump shaft

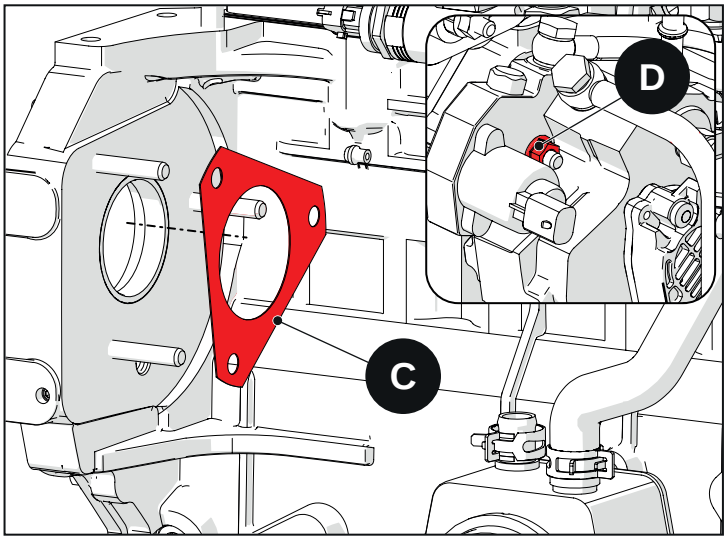

Fig. 2.254

- Fit the banjo bolt and the relative pump fuel return pipe onto the pump.
- Fit the banjo bolt and the relative pump fuel return pipe onto the pump.
  - **delivery pipe - banjo bolt: 27.5 N·m**
  - **fuel return pipe - banjo bolt: 27.5 N·m**

X - delivery pipe - banjo bolt
Y - fuel return pipe - banjo bolt

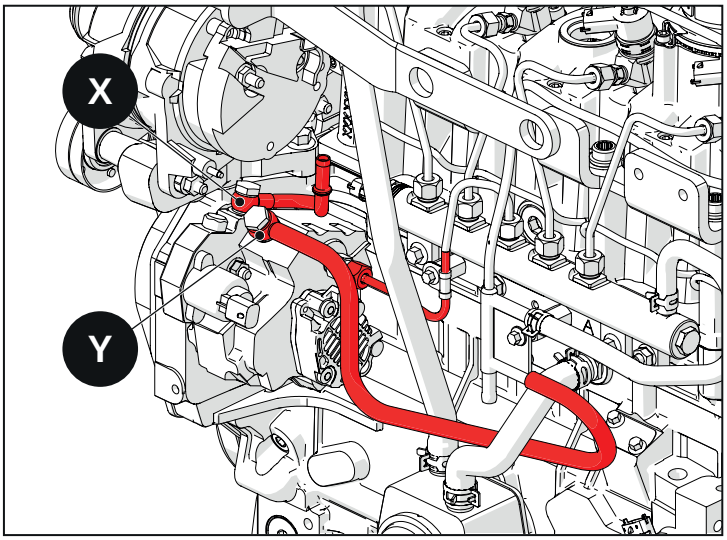

Fig. 2.255

Warning

When the pump has been removed, a specific procedure must be carried out to ensure that the high pressure fuel pipes are refitted correctly.

A specific procedure must be carried out before fitting the high pressure pipes from the pump to the rail and from the rail to the injectors. (See section High pressure injection system components - Tightening procedure)

Note

Whenever any of the high pressure injection system components (high pressure pump, electro-injectors and rail) and/or any of the high pressure pipes (pipe from pump to rail and pipe from rail to injectors) are removed, a specific procedure must be carried out to prevent fuel leakage from the high pressure pipes

(SEE SECTION HIGH PRESSURE INJECTION SYSTEM COMPONENT - TIGHTENING PROCEDURE)

2.69.3 Synchronising the high pressure injection pump gear

Place the pump on the specific servicing tool with the shaft in a vertical position. Clean the cone and the thread with degreaser.

Mark the position of the key seat (1) with a marker pen so that the position can be identified once the gear is installed on the pump.

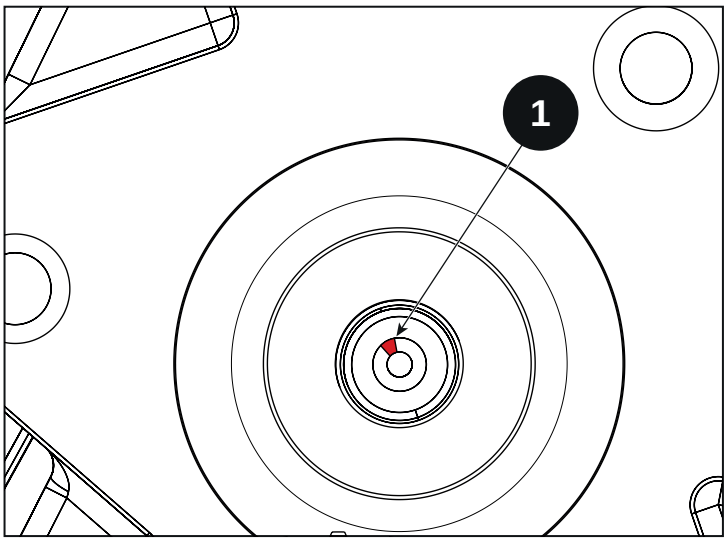

Fig. 2.256

Fit the gear on the pump. Mark the two teeth (2) immediately before the radial position of the key seat.

Pre-tighten the fastener nut (3) to a torque not exceeding 10 N·m. Tighten the nut definitively to a torque of 86.3 N·m.

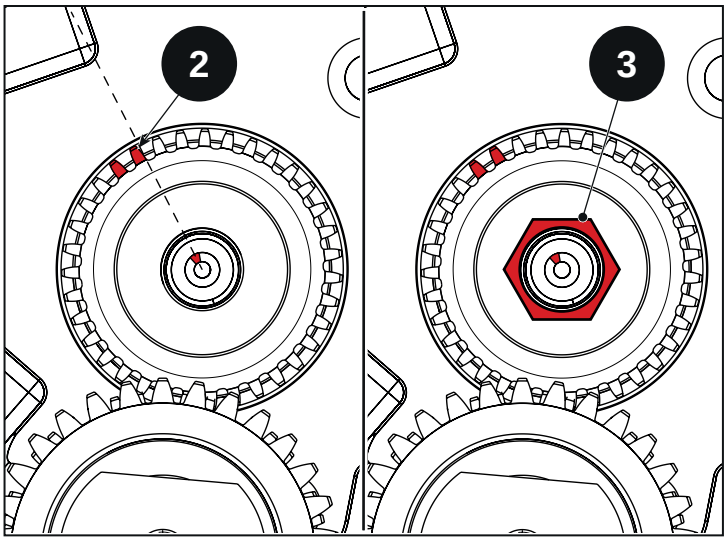

Fig. 2.257

Bring cylinder 1 to TDC, ensuring that the centreline between the two teeth marked previously is vertical (4).

Fasten the pump and install the remaining components.

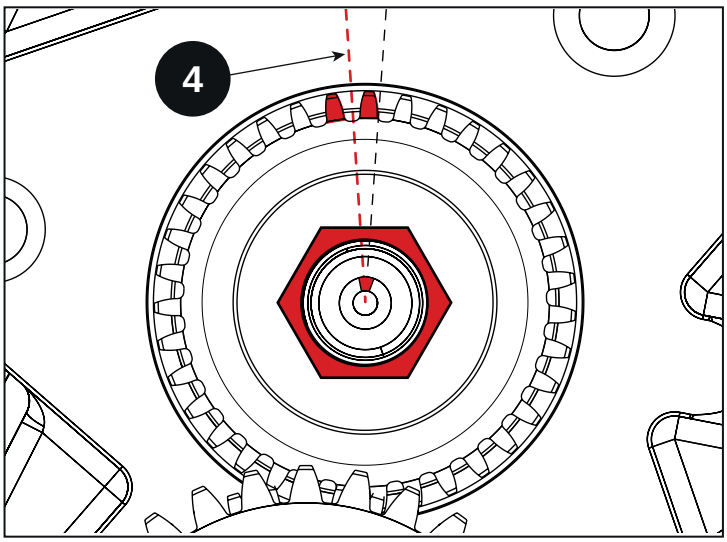

Fig. 2.258

2.70 Injectors

2.70.1 Removal

Warning

Whenever the injectors are removed, keep them in the correct order of removal and number them for identification. Injectors must always be reinstalled in their original positions as each injector has a unique IMA code will not function correctly in a different position.

- Loosen the screw fastening the injector and remove the clamp.
- Loosen and remove the pipe from the rail to the injector.

A - screw and clamp fastening the injector
B - clip fastening the injector fuel return pipe
C - nut fastening the injector pipe (from rail to injector)

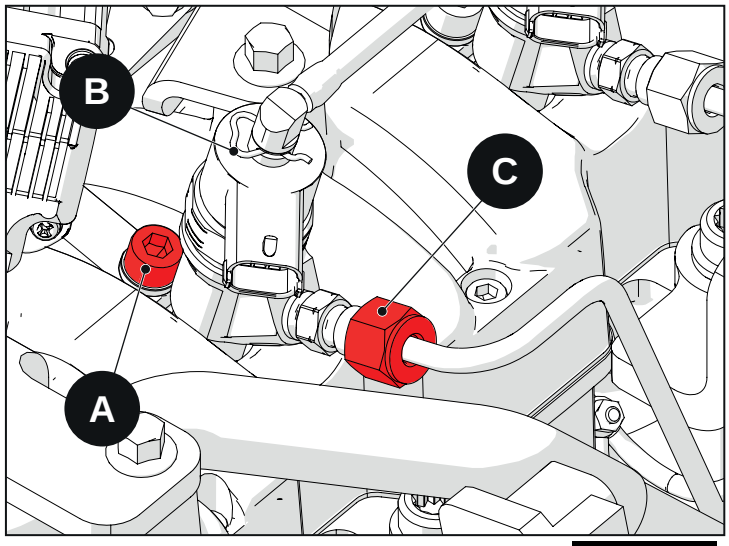

Fig. 2.259

Warning

When loosening the injector pipe on the injector, restrain the fitting on the injector with a 13 mm wrench to prevent it from turning.

- Press the tab to release and remove the injector fuel return line
- Remove the injector.

B - clip fastening the injector fuel return pipe
E - nut fastening the injector pipe (from rail to injector)

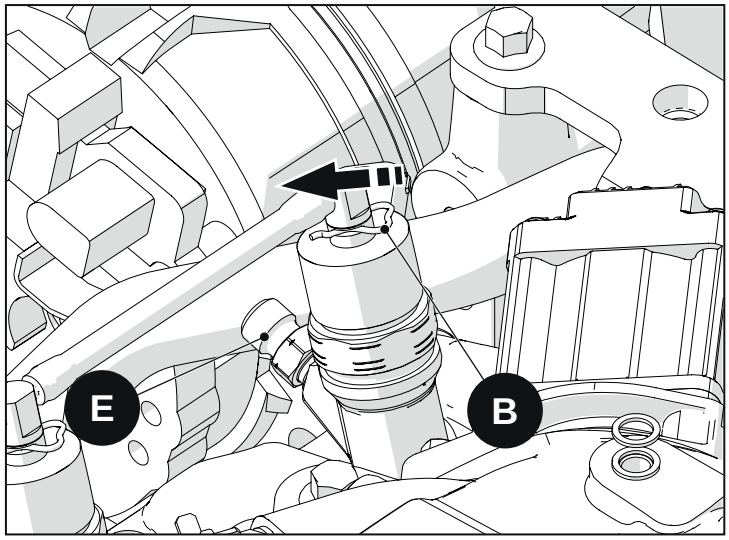

Fig. 2.260

Warning

The IMA code for R750EURO 5/6 engines consists of 7 characters.

D - IMA code

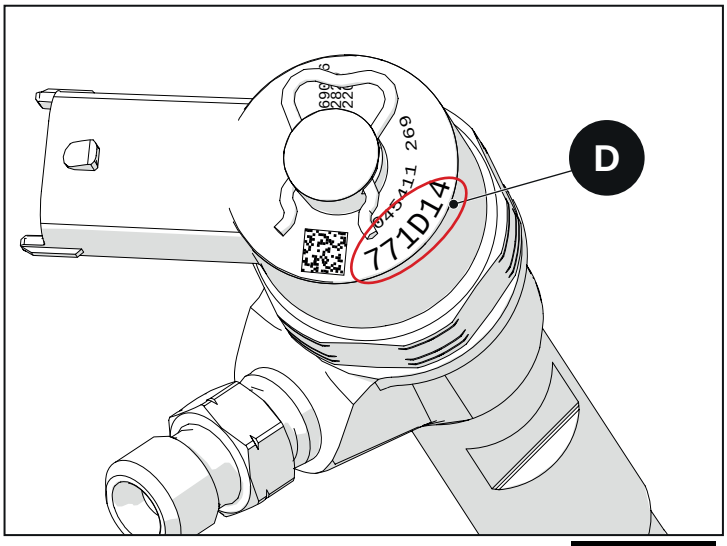

Fig. 2.261

2.70.2 Installation

- Check that the injector seat in the head is clean.
- Install a new O-ring in the seat on the injector and apply Molykote P 1500 grease to the O-ring as shown in the figure.
- Check that the shim at the bottom end of the injector is installed correctly.
- Fit the injector in the head.
- Fit the clamp and the screw with the respective spherical washer, installing correctly as shown in the figure

A - injector clamp
B - injector shim
C - screw with spherical washer
E - injector O-ring with Molykote P 1500 grease
F - injector seat
G - IMA code

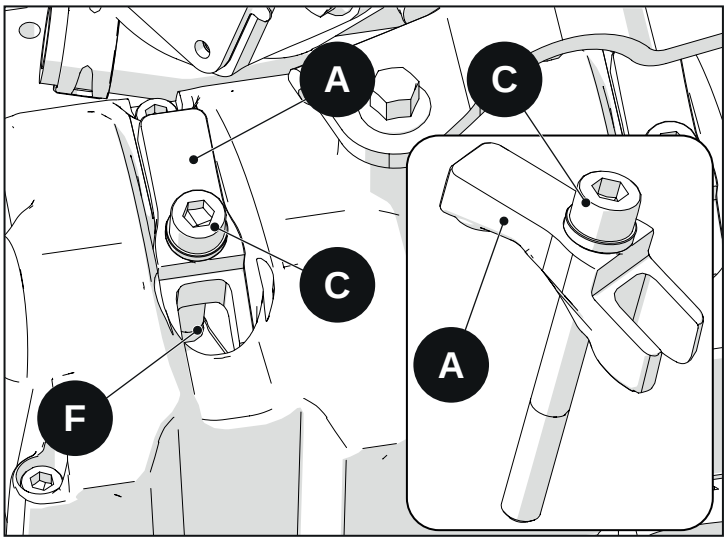

Fig. 2.262

- Hand-tighten the screw fastening the injector and then tighten definitively.
  - **injector fastener screw: 21 - 25 N·m**

Warning

When an injector has been removed, a specific procedure must be carried out to ensure that the high pressure fuel pipes are refitted correctly.

A specific procedure must be carried out before fitting the high pressure pipes from the rail to the injectors. (See section High pressure injection system components - Tightening procedure)

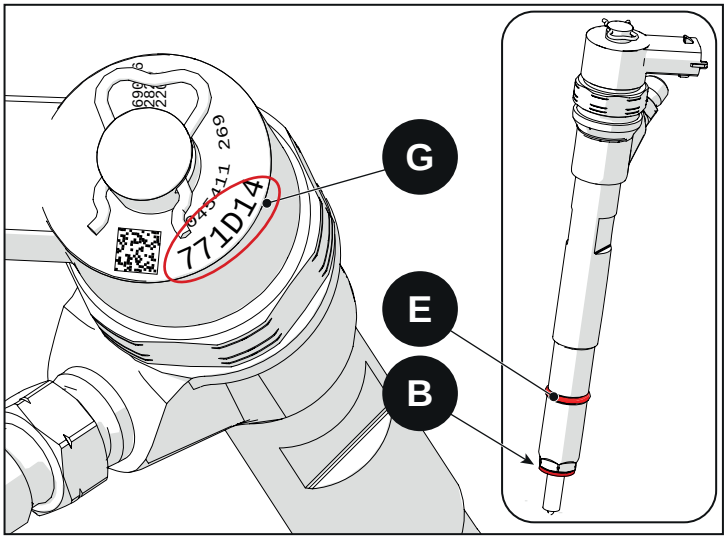

Fig. 2.263

Note

Whenever any of the high pressure injection system components (high pressure pump, electro-injectors and rail) and/or any of the high pressure pipes (pipe from pump to rail and pipe from rail to injectors) are removed, a specific procedure must be carried out to prevent fuel leakage from the high pressure pipes

(SEE SECTION HIGH PRESSURE INJECTION SYSTEM COMPONENT - TIGHTENING PROCEDURE)

Warning

Whenever one or all of the injectors are replaced, the new IMA code/s must be written in the electronic control unit memory using the diagnostic tool.

2.71 Rail

2.71.1 Removal

- Remove any components impeding removal of the rail.
- Remove the high pressure injection pipes from the rail to the injectors and from the pump to the rail.
- Remove the screws fastening the rail to the rail bracket.
- Remove the rail.

A - high pressure injection pipes (from rail to injectors)
B - high pressure injection pipes (from pump to rail)
C - screws fastening rail to bracket

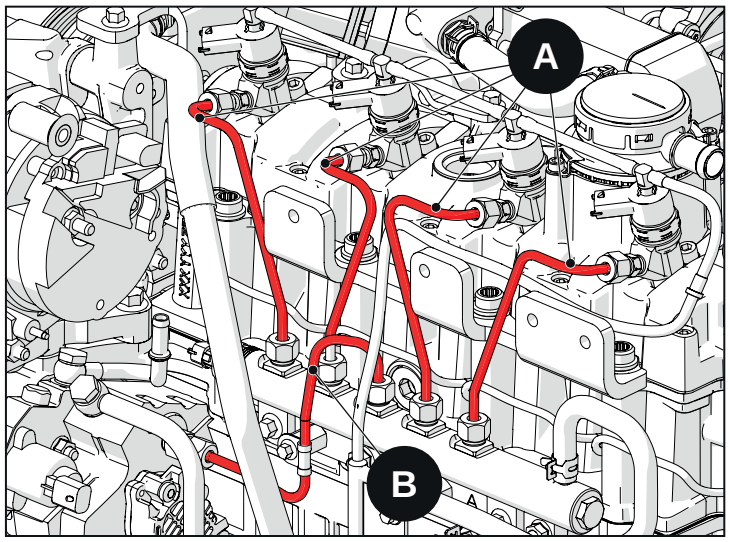

Fig. 2.264

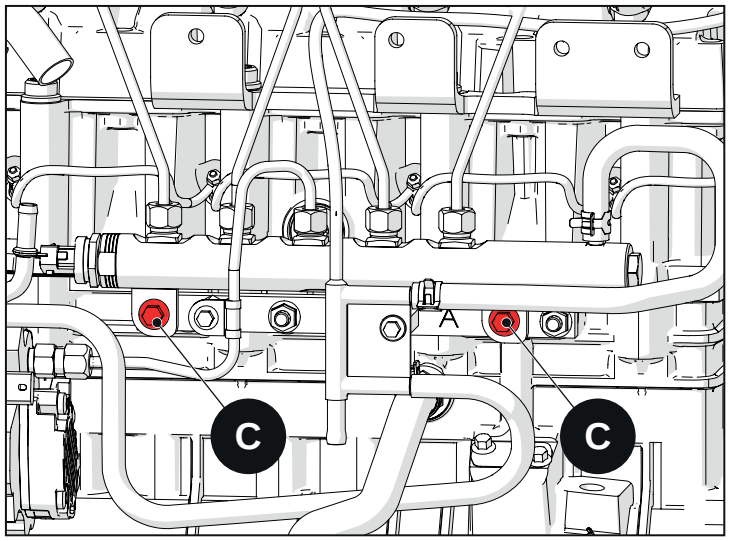

Fig. 2.265

2.71.2 Installation

Warning

When the rail has been removed, a specific procedure must be carried out to ensure that the high pressure fuel pipes are refitted correctly.

A specific procedure must be carried out before fitting the high pressure pipes from the pump to the rail and from the rail to the injectors. (See section High pressure injection system components - Tightening procedure)

Note

Whenever any of the high pressure injection system components (high pressure pump, electro-injectors and rail) and/or any of the high pressure pipes (pipe from pump to rail and pipe from rail to injectors) are removed, a specific procedure must be carried out to prevent fuel leakage from the high pressure pipes

(SEE SECTION HIGH PRESSURE INJECTION SYSTEM COMPONENT - TIGHTENING PROCEDURE)

2.72 High pressure injection system components - Tightening procedure

Note

Whenever any of the high pressure injection system components (high pressure pump, electro-injectors and rail) and/or any of the high pressure pipes (pipe from pump to rail and pipe from rail to injectors) are removed, a specific procedure must be carried out to prevent fuel leakage from the high pressure pipes. This procedure is necessary to ensure that the high pressure pipes are aligned correctly and prevent the possibility of leaks caused by misalignment.

Warning

Whenever any of the high pressure injections pipes (pipe from high pressure pump to rail and pipes from rail to injectors) is removed, it must be replaced with a new pipe to prevent the risk of fuel leaks from the high pressure injection system.

- Check that the injectors are fastened correctly. (See section “Injectors”).
- Check that the high pressure pump is fastened correctly. (See section “High pressure pump”).
- Even if tightened previously, the following screws must also be loosened:
    - screws fastening the rail to the relative bracket
    - screws fastening the rail bracket to the cylinder block/crankcase.
- Hand-tighten all the nuts of the high pressure injection pipes simultaneously and completely.
- Fit the clamp on the pipe from the rail to the high pressure pump and hand-tighten the screw.
- Tighten the nut of pipe No. 3 (for 4 cylinder engines) or pipe No. 4 (for 6 cylinder engines) on the **RAIL SIDE 19 ± 2 N·m**
- Tighten the remaining nuts of the pipes on the **RAIL SIDE** (No. 1, 2, 4 and 5 for 4 cylinder engines and No. 1, 2, 3, 5, 6 and 7 for 6 cylinder engines) **19 ± 2 N·m**
- Tighten the nuts of the pipes on the **INJECTOR SIDE** (No. 1, 2, 3 and 4 for 4 cylinder engines and No. 1, 2, 3, 4, 5 and 6 for 6 cylinder engines) **27 ± 2 N·m**
- Tighten the nut of the high pressure pipe on the **HIGH PRESSURE PUMP 20.5 ± 2.5 N·m**
- Tighten the screw of the clamp fastening the pipe from the rail to the high pressure pump **14.7 ± 2 N·m**
- Tighten the screws fastening the rail to the bracket and the screws fastening the bracket to the cylinder block/crankcase **33 ± 2 N·m**

A - nut of pipe No. 3 (for 4 cylinder engines) or pipe No. 4 (for 6 cylinder engines) on RAIL SIDE
B - nuts of pipes on INJECTION SIDE
C - nut of high pressure pipe on HIGH PRESSURE PUMP
D - screw of clamp fastening pipe from rail to high pressure pump
E - screws fastening rail to bracket and screws fastening bracket to cylinder block/crankcase

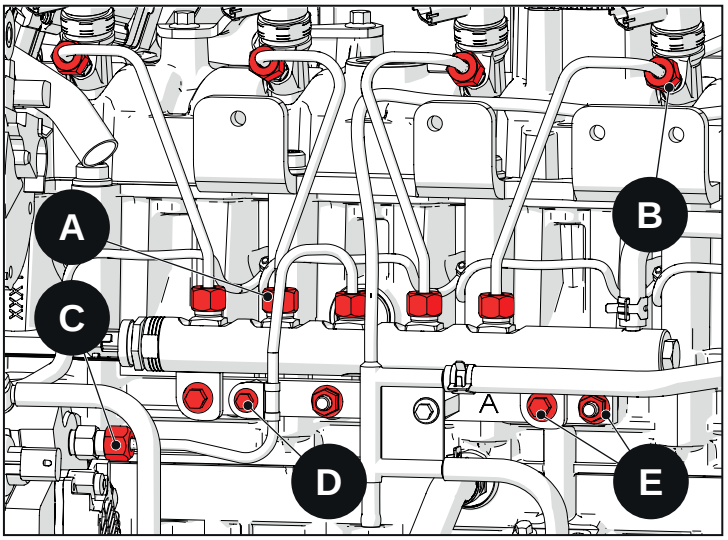

Fig. 2.266

2.73 Oil filter housing

2.73.1 Removal

- See the section "Maintenance" for the procedure to remove the oil filter cartridge.
- Loosen the bolt fastening the oil filter assembly (filter cartridge and oil filter housing) to the heat exchanger.
- Remove the oil filter assembly.
- Loosen the special bolt fastening the heat exchanger to the cylinder block/crankcase. Loosen the clamp fastening the rubber hose to the heat exchanger.

A - bolt fastening oil filter assembly to heat exchanger.
B - special bolt fastening heat exchanger to cylinder block/crankcase.

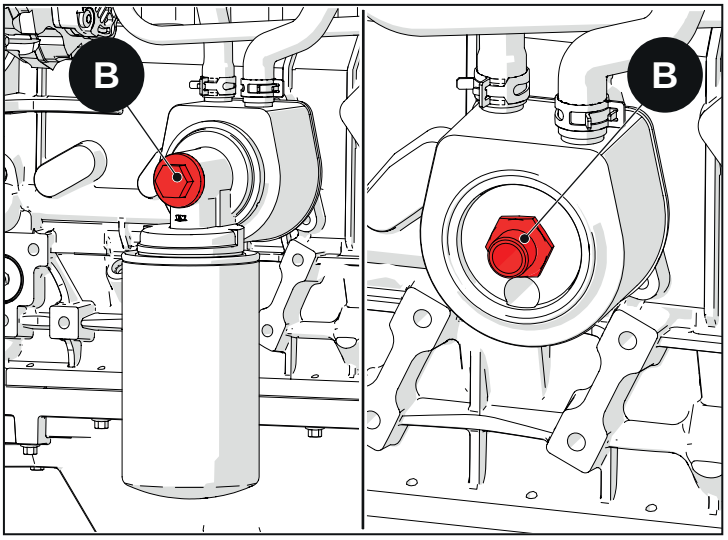

Fig. 2.267

2.73.2 Installation

- Replace the old O-ring installed in the seat of the heat exchanger with a new O-ring. Grease the O-ring with Molykote 111.
- Fit the heat exchanger and tighten the special fastening the heat exchanger to the cylinder block/crankcase
  - "B" special bolt fastening heat exchanger to cylinder block/crankcase. 60 N·m
- Replace the old O-ring installed in the seat on the oil filter assembly with a new O-ring. Grease the O-ring with Molykote 111.
- Replace the O-ring in the seat of the bolt fastening the oil filter assembly and grease the new O-ring with Molykote 111.
- Tighten by hand and then with a torque wrench.
  - "A" Bolt fastening oil filter assembly 39.2 N·m

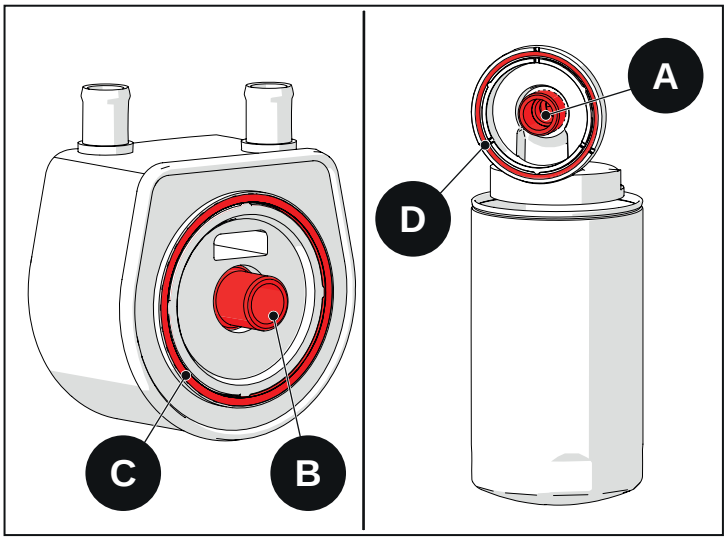

Fig. 2.268

C - O-ring in seat on heat exchanger
D - O-ring in seat on oil filter assembly
E - O-ring in seat of bolt fastening oil filter assembly to heat exchanger.

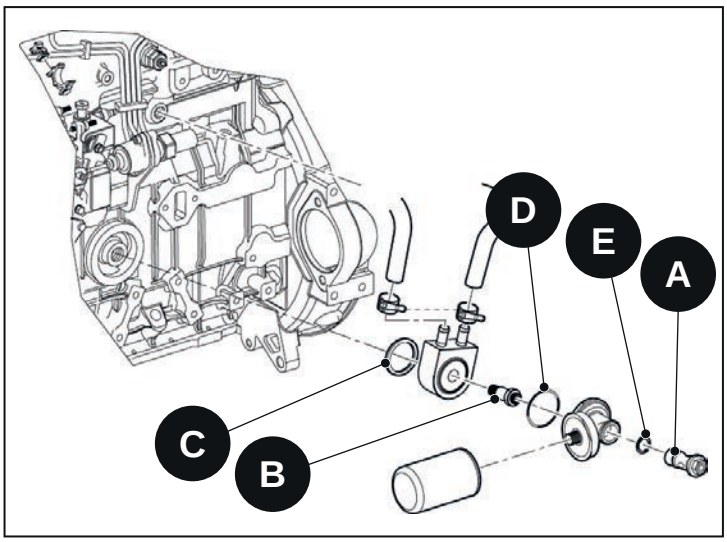

Fig. 2.269

2.74 Rocker cover

2.74.1 Removal

- Remove any components impeding removal of the cover.
- Loosen and remove the screws fastening the cover
- Remove the gasket

A - cover fastener screws

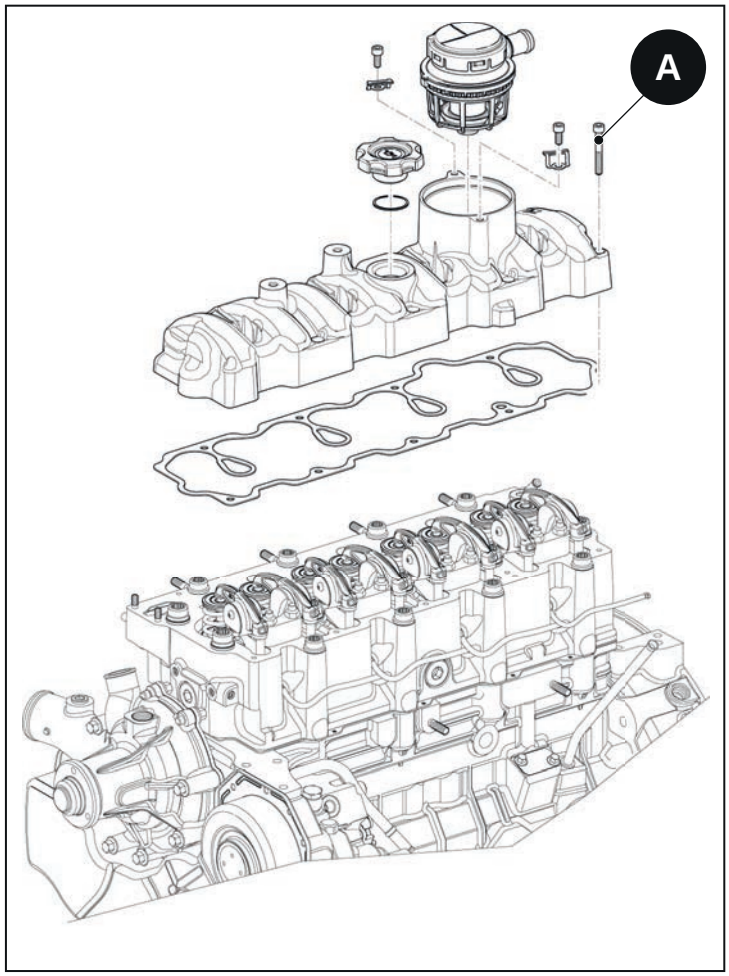

Fig. 2.270

2.74.2 Installation

- Fit a new gasket if necessary.
- Fit the cover and tighten the screws in a crossed pattern
  - **cover fastener screws: 11.8 N·m**

2.75 Thermostat valve

2.75.1 Removal

- Remove the screws of the thermostat valve cover.

X - thermostat valve cover screws
Y - thermostat valve

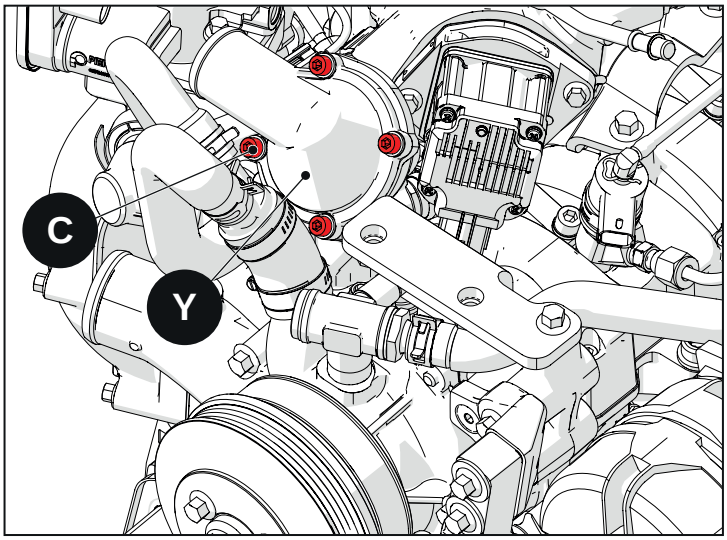

Fig. 2.271

2.75.2 Installation

> **Warning**
> The thermostat valve is supplied as an assembled unit.

- **screw (A): 11.8 N·m**
- **nut (b): 11.8 N·m**
- **screw (c): 13.7 N·m**

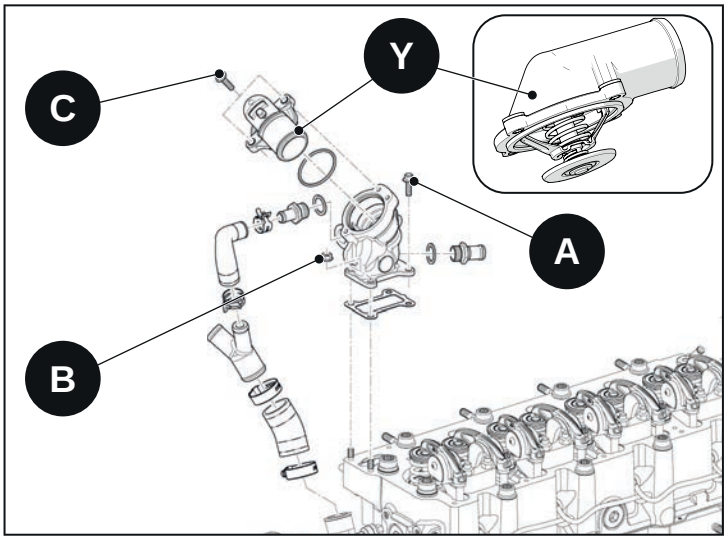

Fig. 2.272

2.76 Alternator

2.76.1 Removal

- Remove the alternator drive belt.
- Disconnect the electrical connectors from the alternator.
- Disconnect any pipes connected to the vacuum pump
- Loosen and remove the screws fastening the alternator.

A - Alternator
C - alternator fastener screws

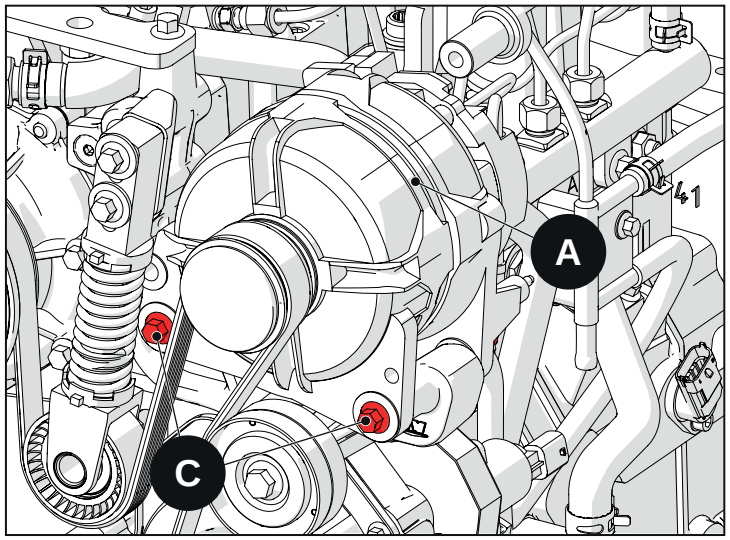

Fig. 2.273

2.76.2 Installation

- Fit the alternator on the alternator bracket.
- Fit the bolts into the alternator and tighten the nuts fastening the alternator.
  - **Alternator fastener nuts: 45.1 N·m**

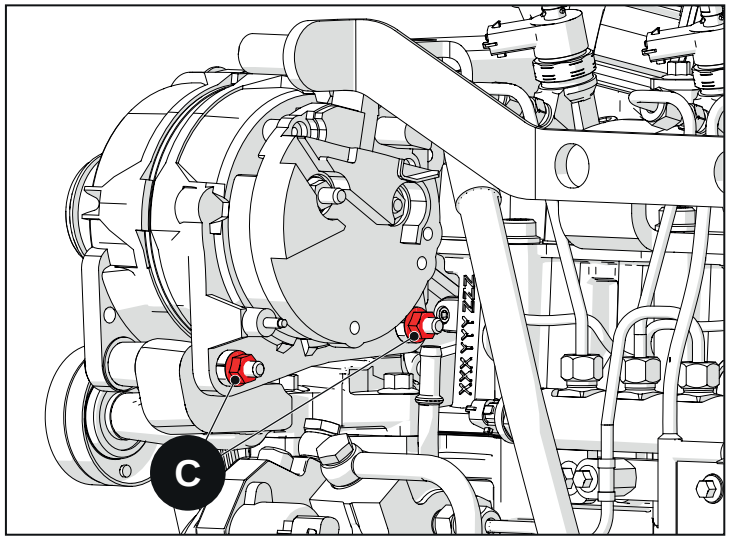

Fig. 2.274

2.77 Alternator pulley

2.77.1 Removal

- If a protective cover is fitted, the engine is equipped with idler alternator pulley and the special tool 68420022F must be used for removal.
- Remove the cover, fit the special tool 68420022F and remove the pulley.

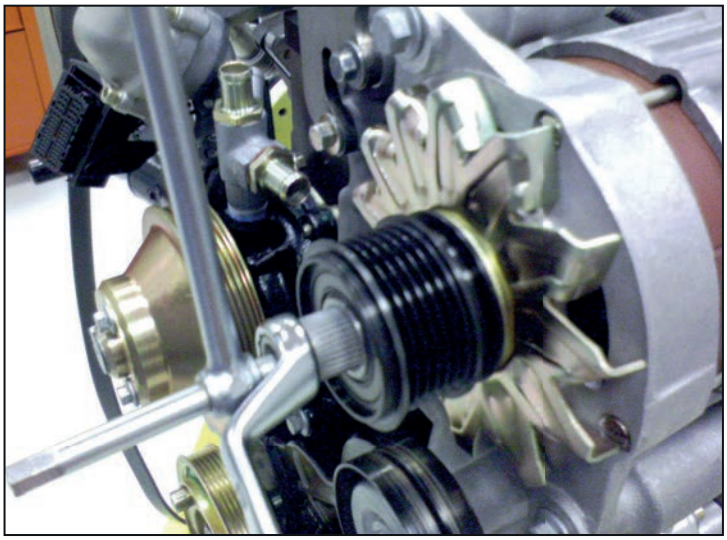

Fig. 2.275

2.77.2 Assembly

- Hand-tighten the pulley onto the alternator shaft.
- Tighten the pulley definitively.
  - **Alternator pulley: 80 ± 5 N·m**

Warning

Fit the alternator fan with the arrow stamped on the fan pointing in the correct direction as shown in the photo

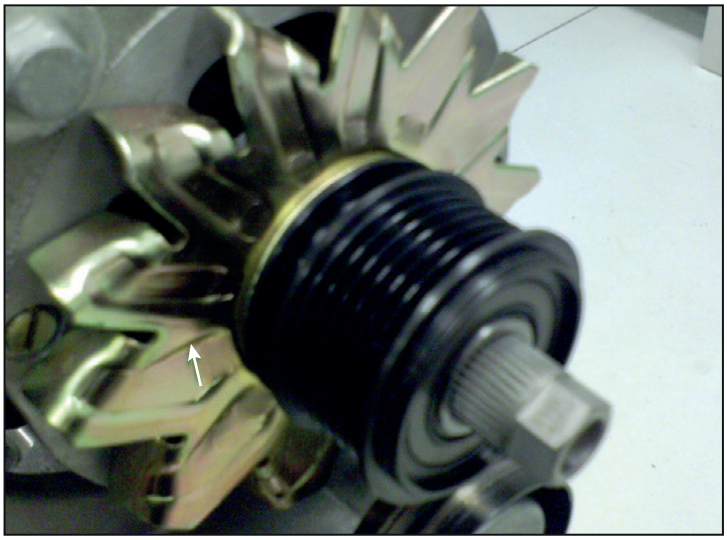

Fig. 2.276

2.77.3 Test

W - output current
D+ - battery charging / battery charge indicator lamp

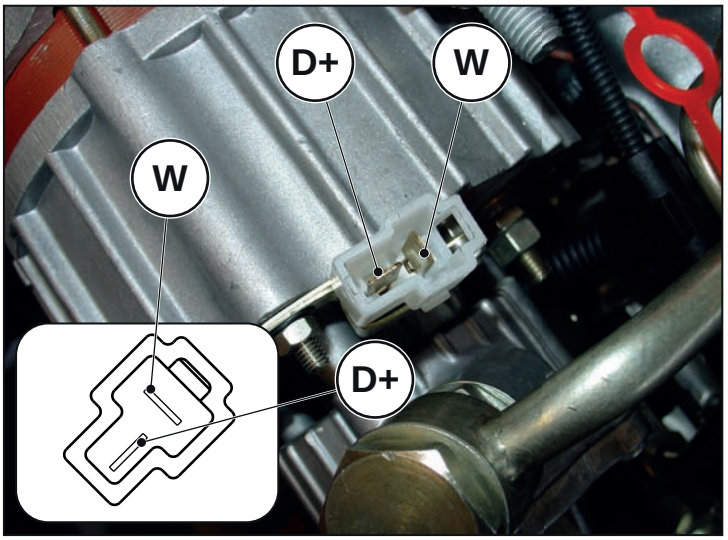

Fig. 2.277

Wiring diagram for testing alternator

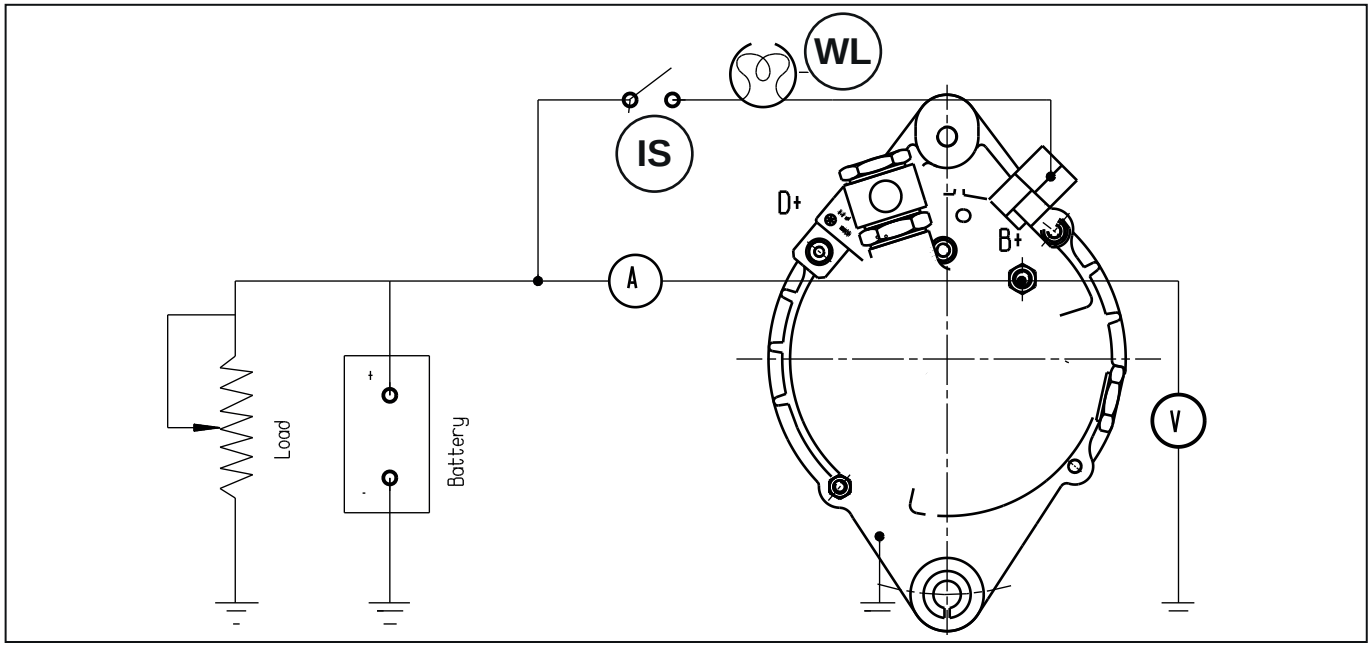

Fig. 2.278

WL - Alternator charge indicator lamp, 2 to 4 W, 12 V
IS - Ignition switch

Electrical wiring diagram

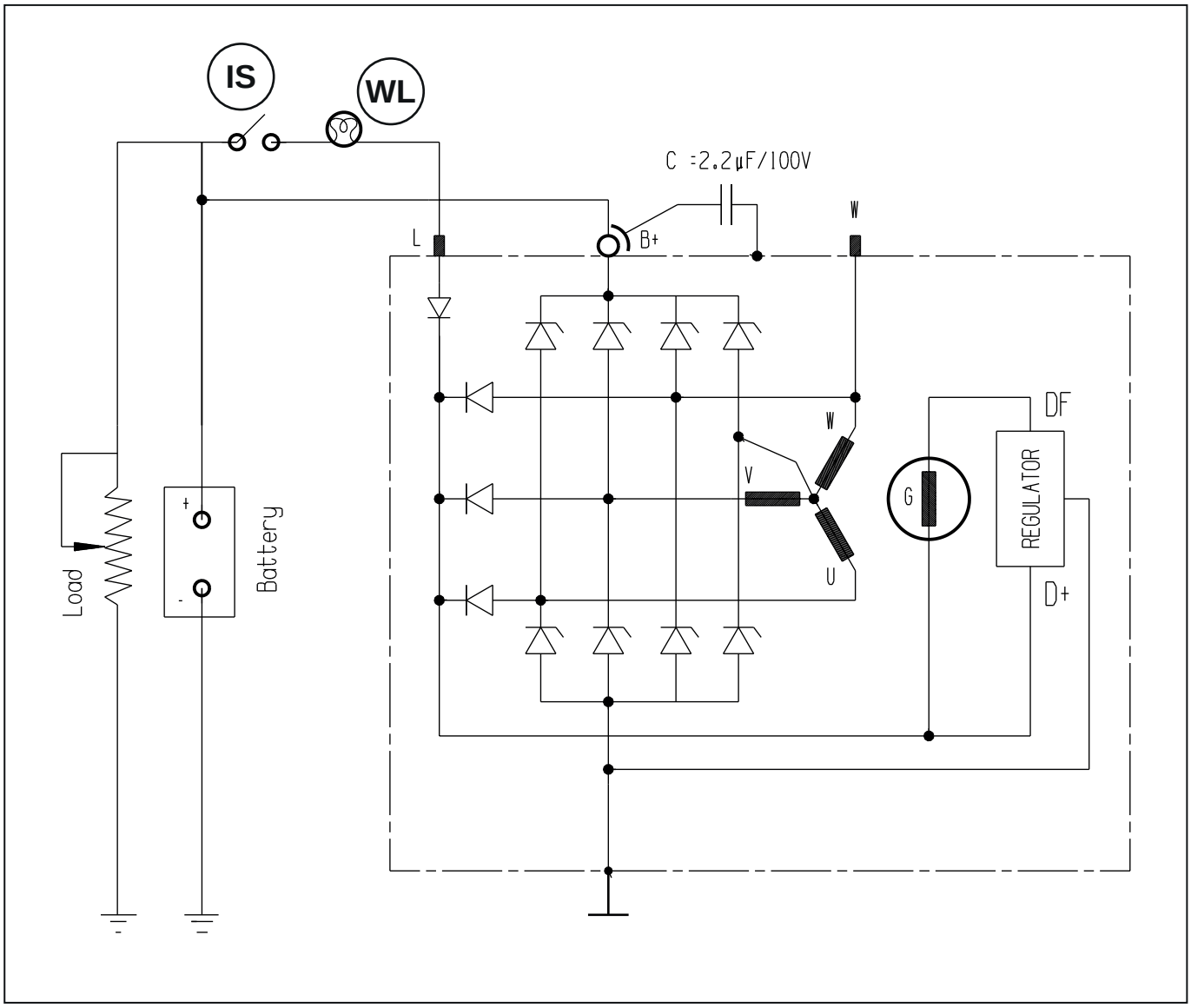

Fig. 2.279

WL - Alternator charge indicator lamp, 2 to 4 W, 12 V
IS - Ignition switch

A - alternator speed (rpm)
B - Output current

Crankshaft pulley/alternator pulley ratio = 2.63

Constant voltage	Amperes	Alternator rpm
13.5V	0 Amps	1000 rpm
	23 Amps	1500 rpm
	105 Amps	6000 rpm

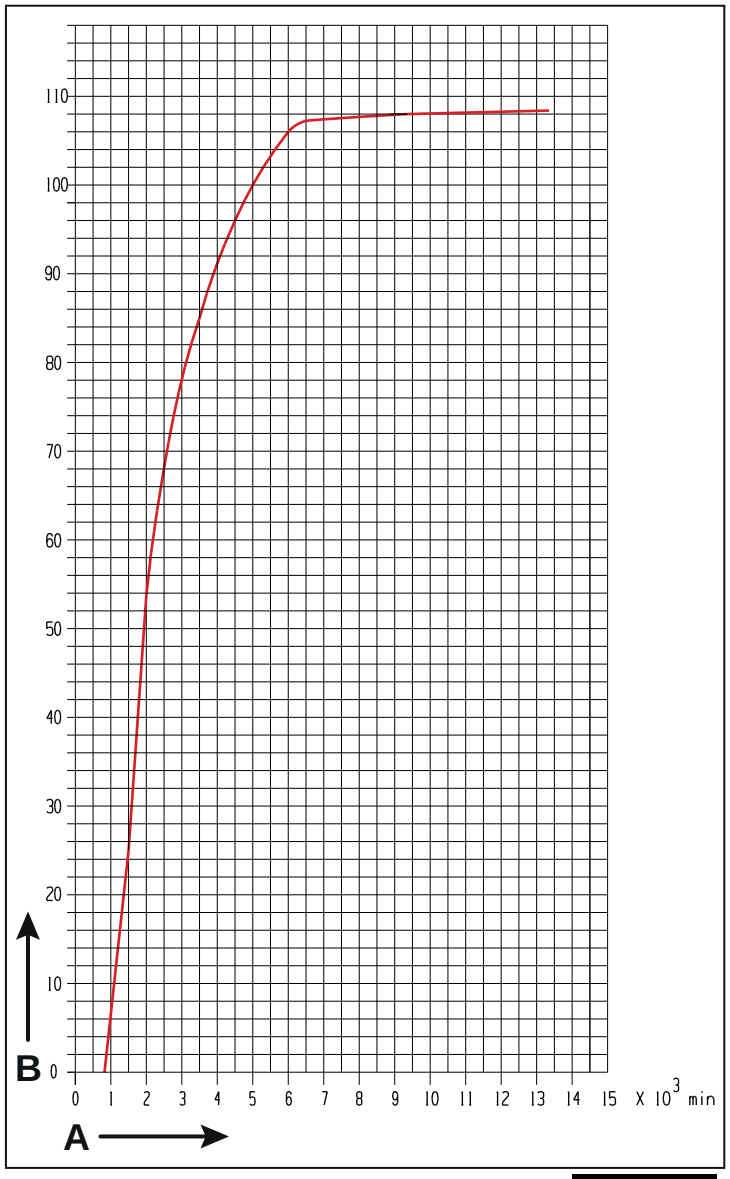

Fig. 2.280

2.78 Alternator regulator

2.78.1 Removal

- Remove the alternator from the engine.
B - regulator fastener screws
C - alternator regulator

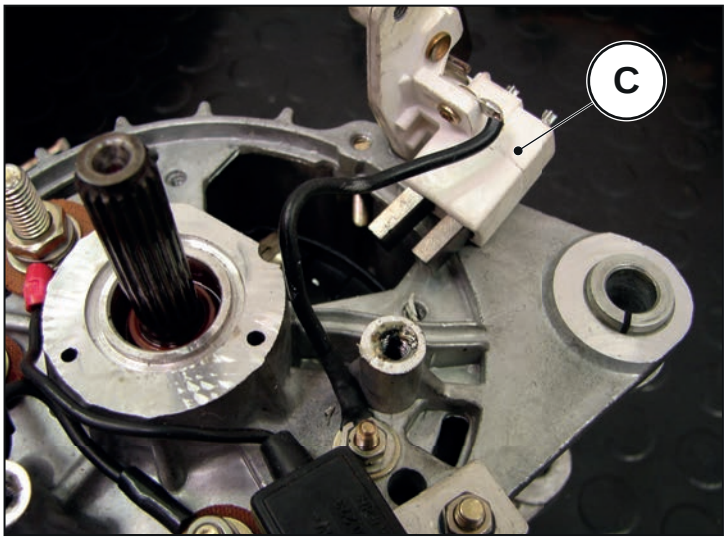

Fig. 2.281

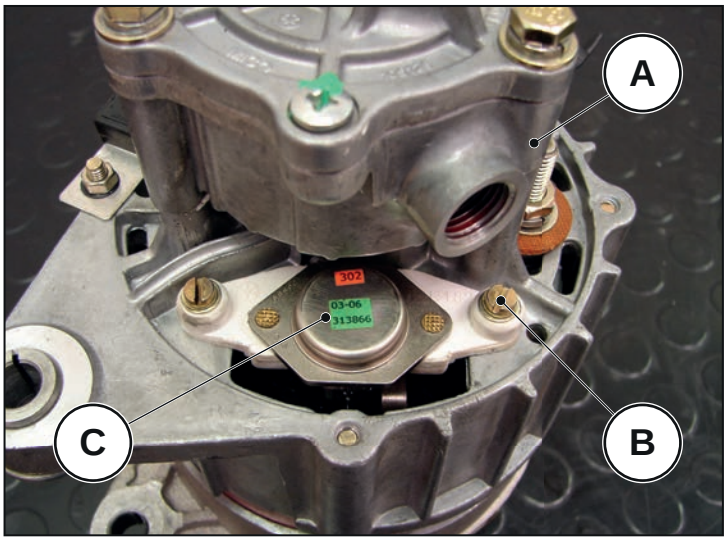

Fig. 2.282

2.79 Alternator bracket

2.79.1 Removal

- Undo the bolts of the alternator bracket.
- Remove the bracket

A - alternator bracket fastener bolts

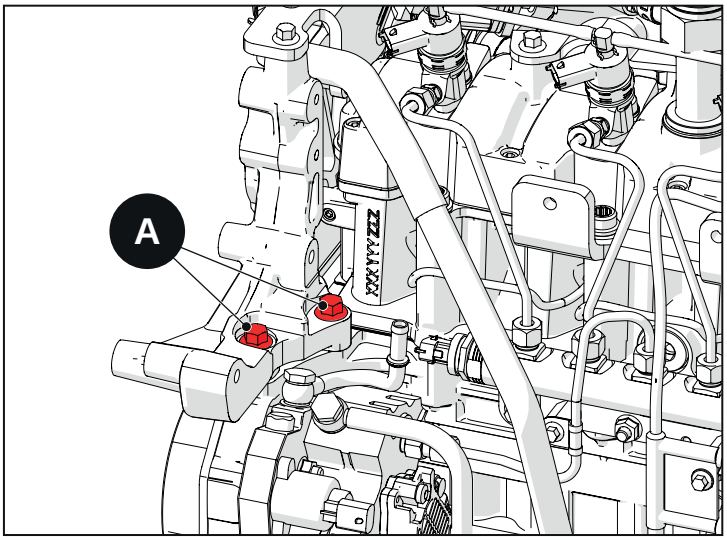

Fig. 2.283

2.79.2 Installation

- Fit the bracket on the cylinder block/crankcase
- Fit and tighten the bolts.
  - **Alternator bracket bolts: 68.6 N·m**

2.80 Starter motor

2.80.1 Removal

- Undo the bolts fastening the starter motor.
- Remove the starter motor

A - starter motor fastener bolts

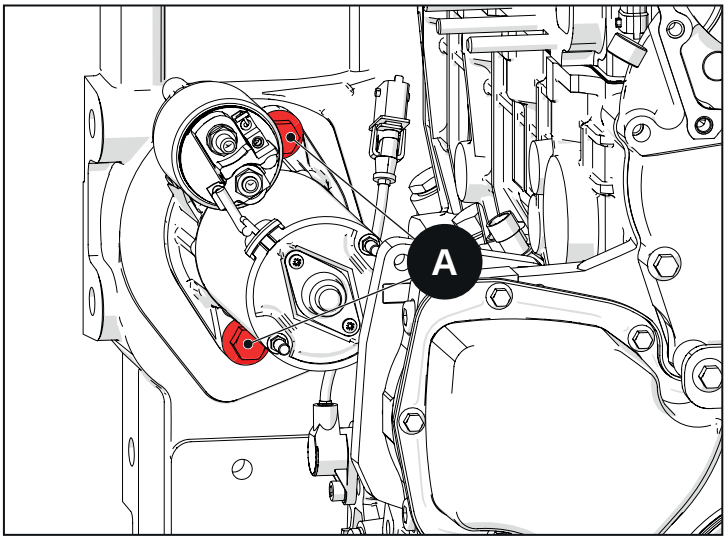

Fig. 2.284

2.80.2 Installation

- Fit the starter motor in the flywheel housing
- Fit and tighten the bolts.
  - **starter motor bolts: 83.4 N·m**

2.81 Electric sensors

2.81.1 Positions

1 - Fuel pressure regulator valve
2 - Camshaft / timing sensor

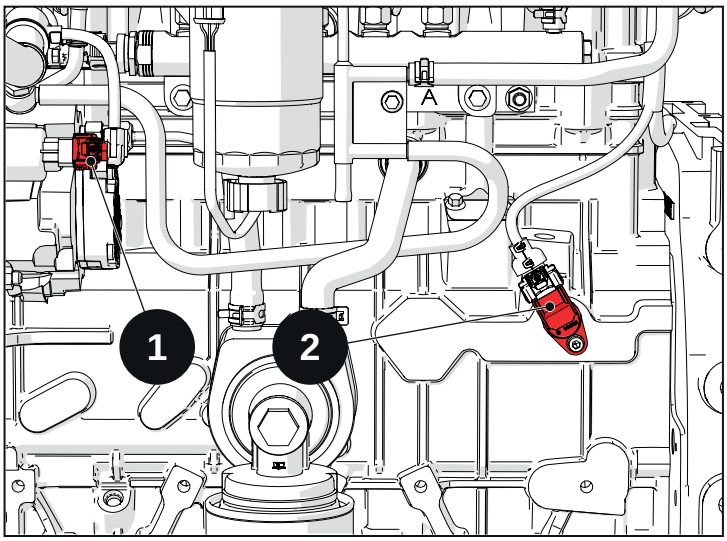

Fig. 2.285

3 - Engine position / speed sensor
4 - Engine oil pressure sensor (34.3 N·m)
5 - Intake air pressure / temperature sensor

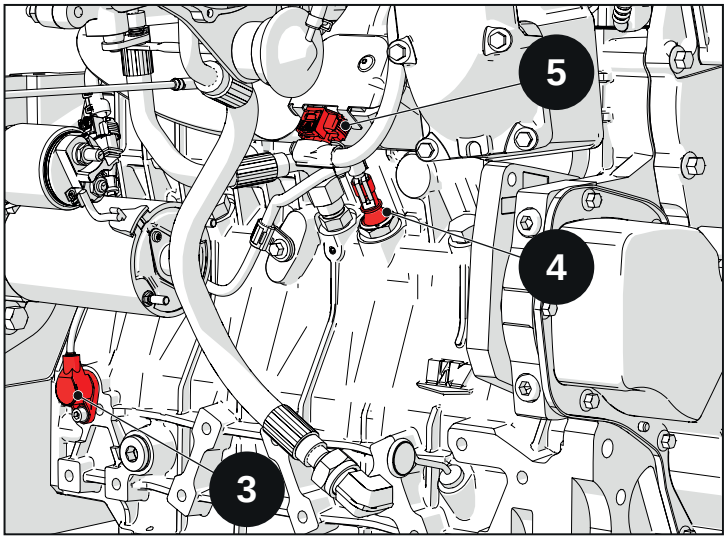

Fig. 2.286

6 - Engine coolant temperature sensor

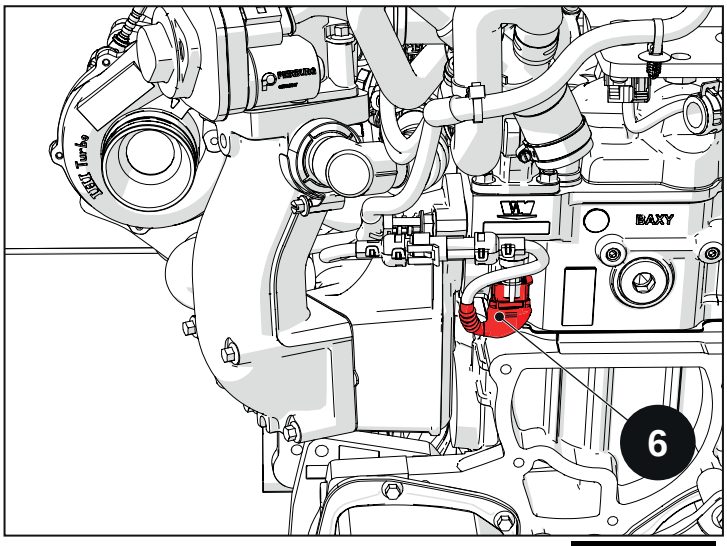

Fig. 2.287

7 - P3 exhaust gas pressure sensor
Exhaust manifold

A- 27.5 N·m

B- 14 N·m

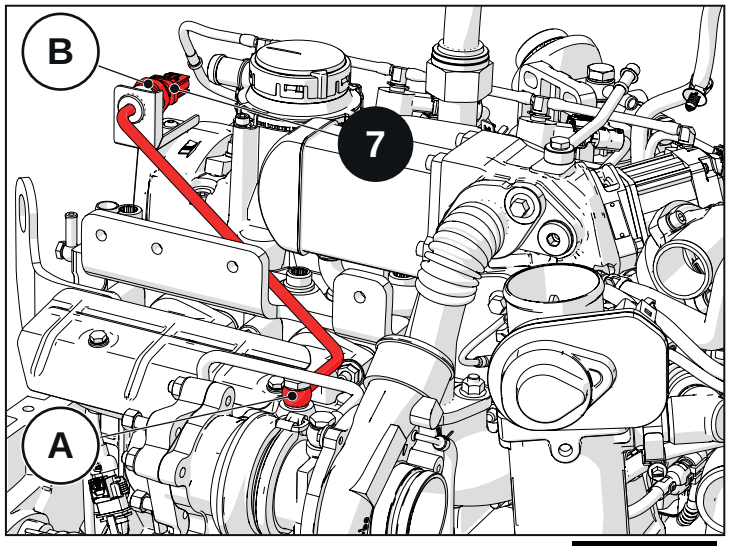

Fig. 2.288

8 - EGR valve exhaust gas temperature sensor (24.5 N·m)

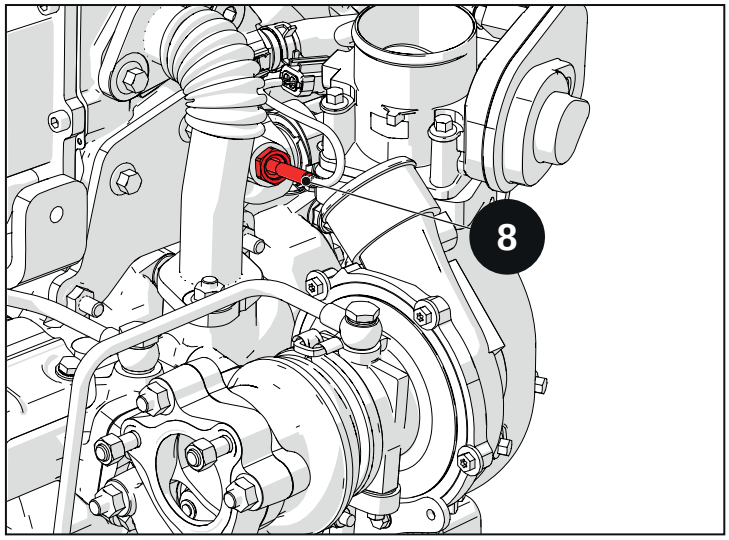

Fig. 2.289

9 - T3 exhaust gas temperature sensor - Exhaust manifold (45.1 N·m)

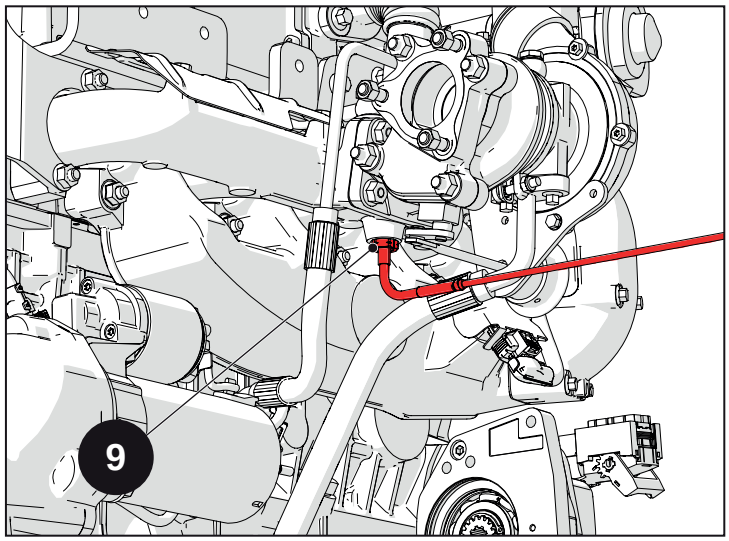

Fig. 2.290

2.81.2 Crankshaft speed and position sensor

This sensor is used to measure engine speed and determine the position of the crankshaft or of the pistons. See figure “cross section of engine speed sensor”.

The sensor (separated from the tone wheel by an air gap) is mounted directly on the tone wheel . See figure “inductive speed sensor, magnetic flux”. The sensor consists of a soft ferrite core (pole pin), around which a coil is wound. The pole is connected to a permanent magnet. The magnetic flux flows through the pole and impinges on the tone wheel. The magnetic flux through the coil varies depending on whether there is a gap or a tooth of the tone wheel in front of the sensor.

As a tone wheel teeth and gaps pass through the magnetic field dispersed by the magnet, As a tone wheel teeth and gaps pass through the magnetic field dispersed by the magnet, they effect a change in this flux. The flux in the coil increases when a tooth passes in front of the sensor and weakens when a gap passes in front of the sensor.

Cross section of engine speed sensor.

1 - Magnet
2 - Housing
3 - Coil
4 - Permanent magnet
5 - Cable
6 - Sensor casing
7 - Soft ferrite core

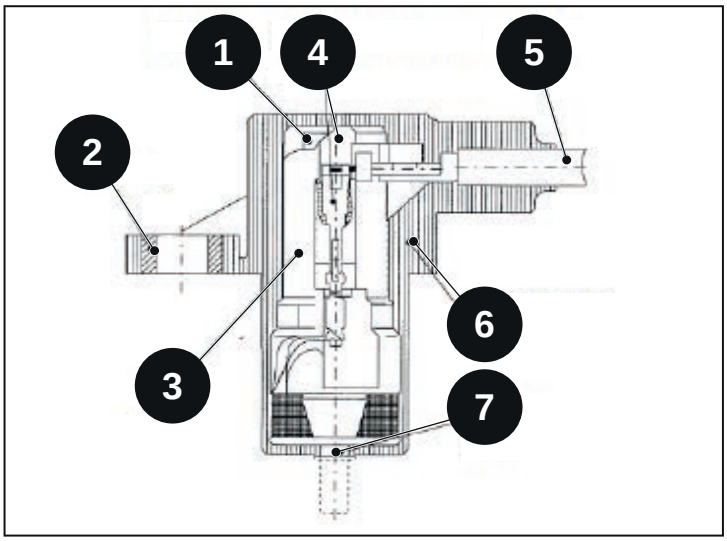

Fig. 2.291

This variation in magnetic flux induces a sinusoid voltage in the coil proportional to the rate of change of the flux and, therefore to the engine speed (see the figure “engine speed sensor signal acquisition”).

The amplitude of this voltage increases with increasing engine speed (from a few mV to over 100 V).

A sufficient amplitude for signal acquisition is reached at an engine speed of 30 rpm.

Inductive speed sensor, magnetic flux

1 - Effective flux
2 - Dispersed flux
3 - permanent magnet
4 - element conducting flux
5 - end of pole
6 - coil
7 - gap
8 - tone wheel

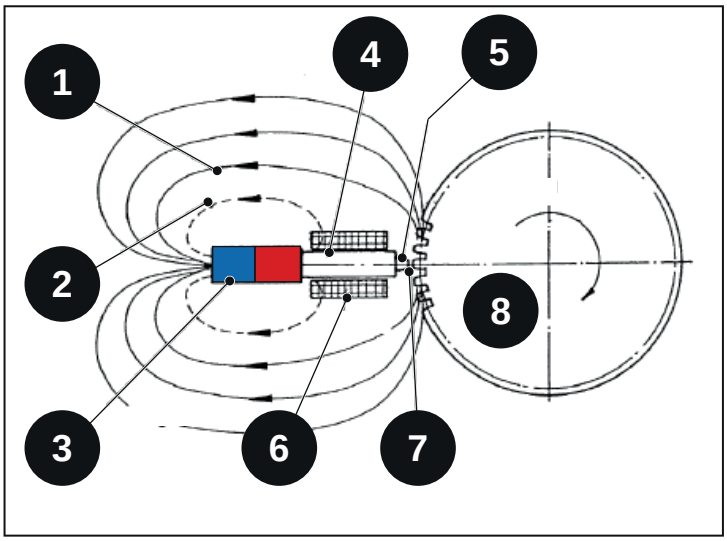

Fig. 2.292

The number of teeth of the tone wheel depends on the engine application. For engines with solenoid valve management, a 60 tooth tone wheel with a gap formed by two missing teeth is used.

This means that the tone wheel has 60 - 2 = 58 teeth in all. The gap is used a reference point assigned to a specific crankshaft position. The sensor is used for synchronisation by the engine control unit.

Engine speed sensor signal acquisition

1 - Damage
2 - gap between teeth
- tone wheel with 60 – 2 teeth
- amplitude error due to damaged tooth
- signal from section with damaged teeth similar to missing tooth signal

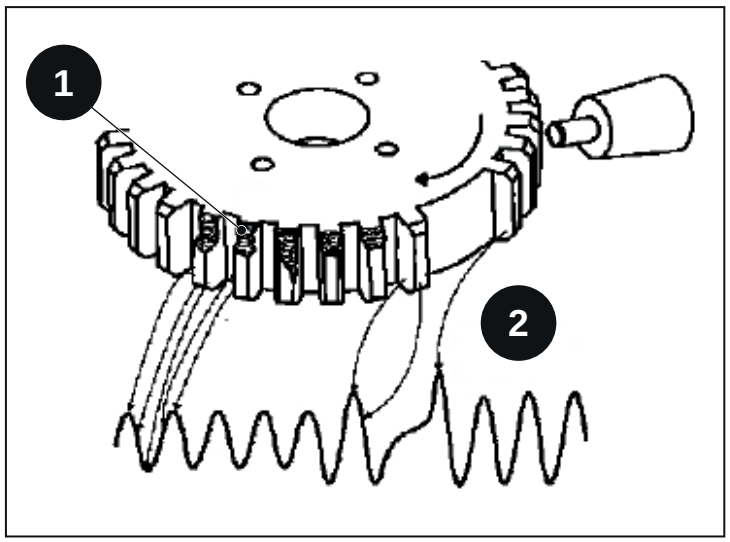

Fig. 2.293

Typical waveform of the engine speed sensor

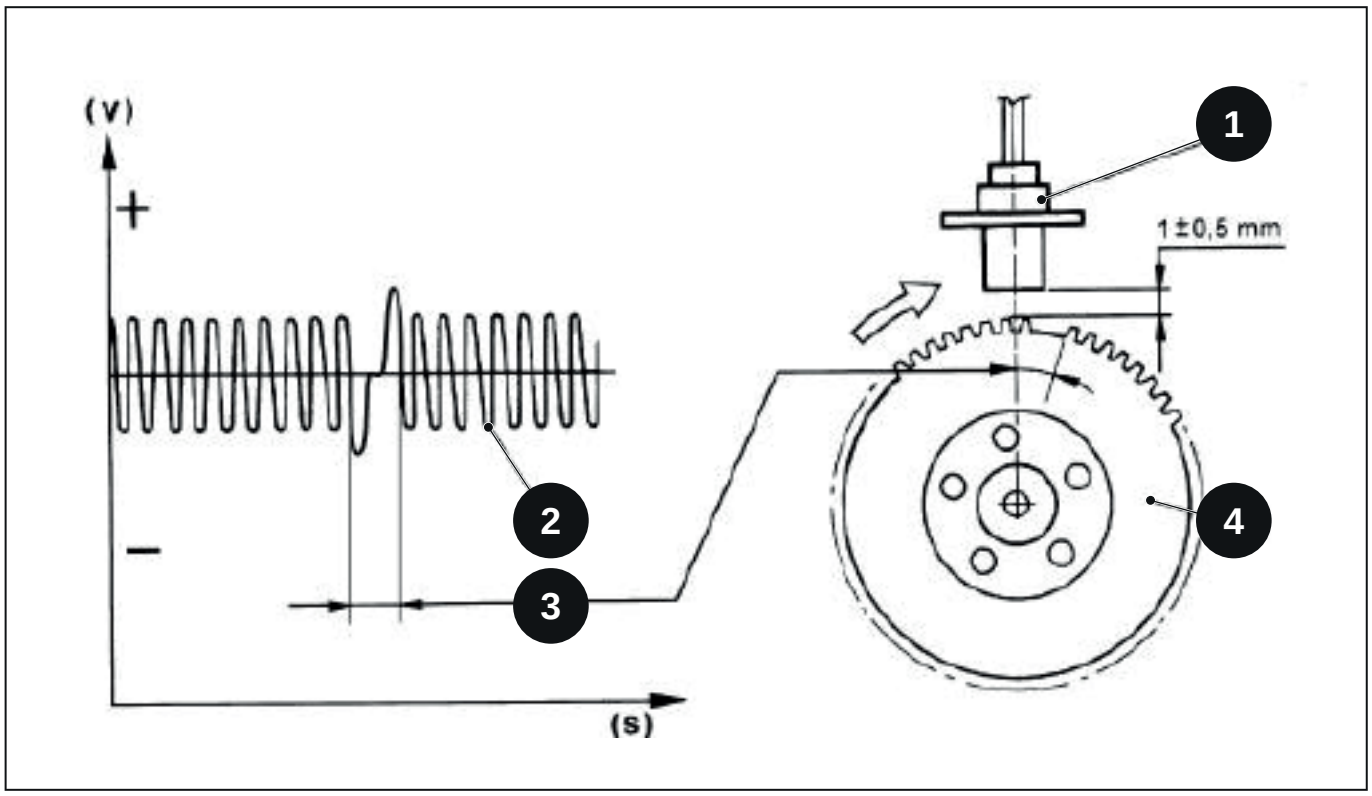

Fig. 2.294

1 - speed sensor
2 - waveform
3 - signal corresponding to zone with two missing teeth
4 - tone wheel

Incorrect speed sensor waveform

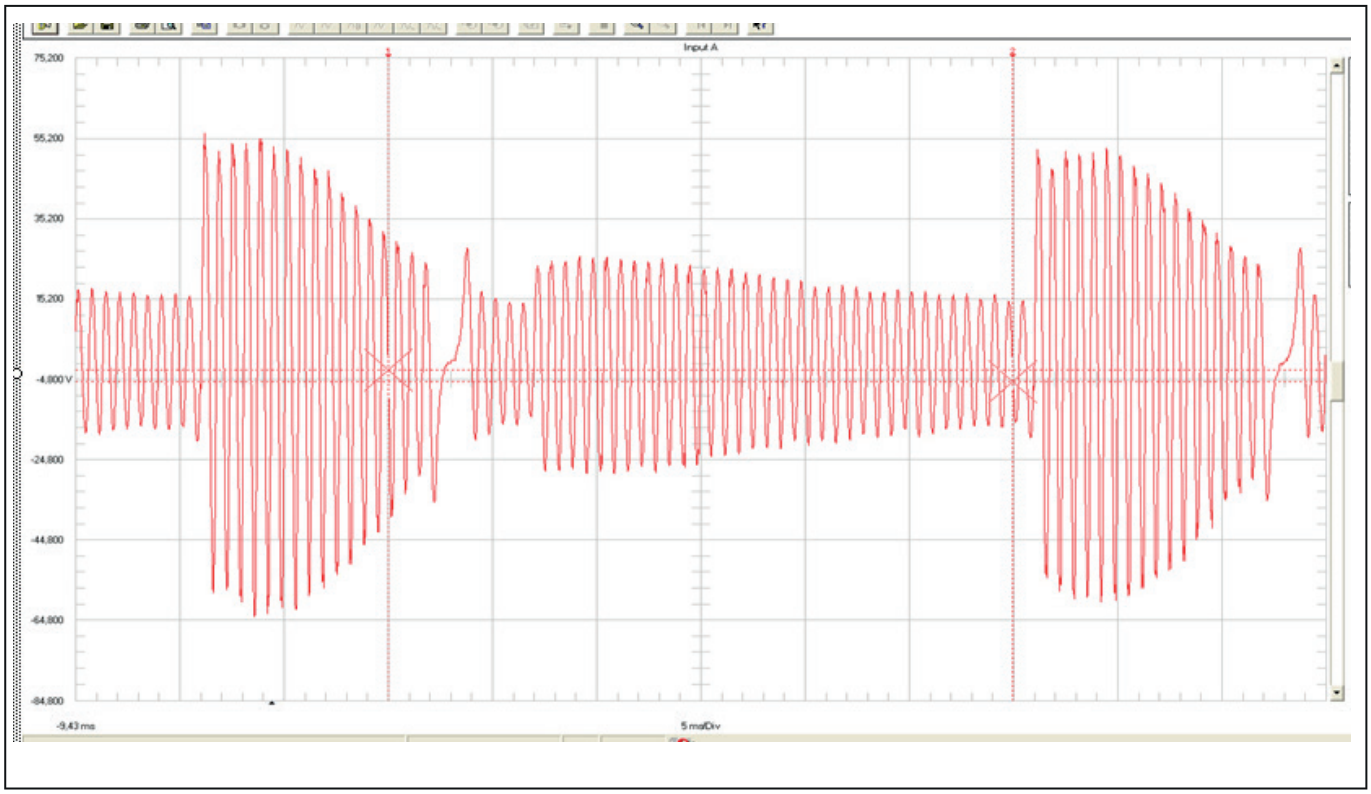

Fig. 2.295

2.81.3 Camshaft timing sensor

The rotational speed ratio between the crankshaft and the camshaft is 1:2. The function of this sensor is to identify whether a piston moving towards TDC is on the compression stroke or the exhaust stroke. The sensor acquires this information from the camshaft and provides it to the ECU.

This is a Hall effect sensor (see the figure Hall effect principle).

When a semiconductor layer carrying a current is traversed by a magnetic field with force lines perpendicular to the direction of the current, this produces a difference in voltage (known as the "Hall" voltage) across the semiconductor layer itself T.

If the current remains constant, the voltage generated depends solely on the intensity of the magnetic field; periodical variations in the intensity of the magnetic field alone are therefore sufficient to produce a modulated electrical signal, the frequency of which is proportional to the rate at which the magnetic field changes.

This variation in magnetic field is achieved by varying the distance between the sensor and a tooth on the camshaft. This distance varies as the tooth rotates, generating a high voltage signal at the position corresponding to the reference notch.

A tooth on the camshaft rotates together with the camshaft itself.

The sensor is situated between the tooth on the camshaft and a permanent magnet contained within the housing of the sensor itself. The permanent magnet produces a magnetic field perpendicular to the Hall element.

When the tooth passes in front of the semiconductor element of the sensor, this alters the intensity of the magnetic field perpendicular to the Hall element. This produces a greater deviation, at right angles to the direction of the current, of the electrons guided by the longitudinal stress applied to the element.

This generates a voltage signal (Hall voltage), measurable in millivolts and independent of relative speed between the sensor and the tooth. The electronic circuit integrated in the Hall element of the sensor processes this voltage to produce a square wave signal.

Uh - Hall voltage
Is - feed current
B - magnetic field
t - Hall element thickness
Rh - Hall constant

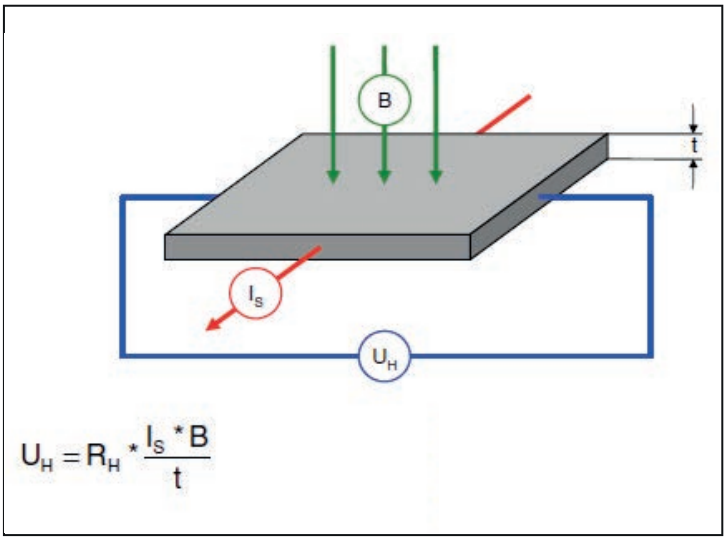

Fig. 2.296

Typical waveform of the timing sensor

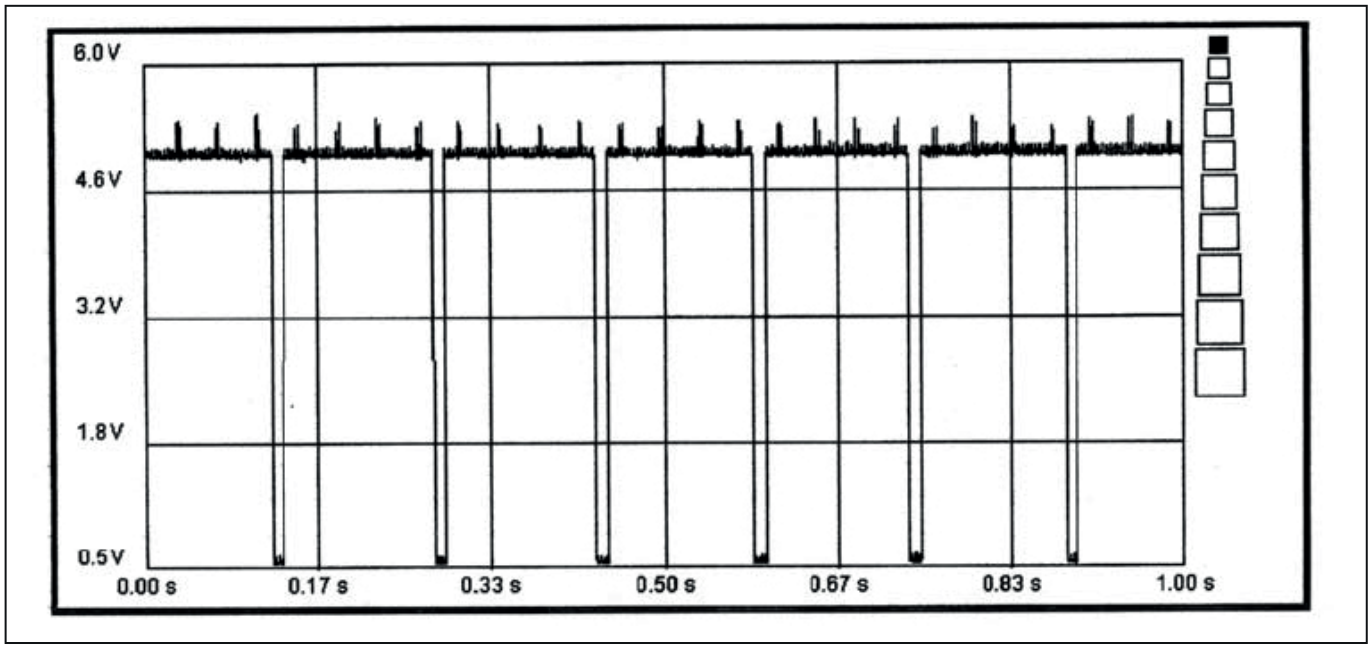

Fig. 2.297

Engine speed sensor error, engine will not start

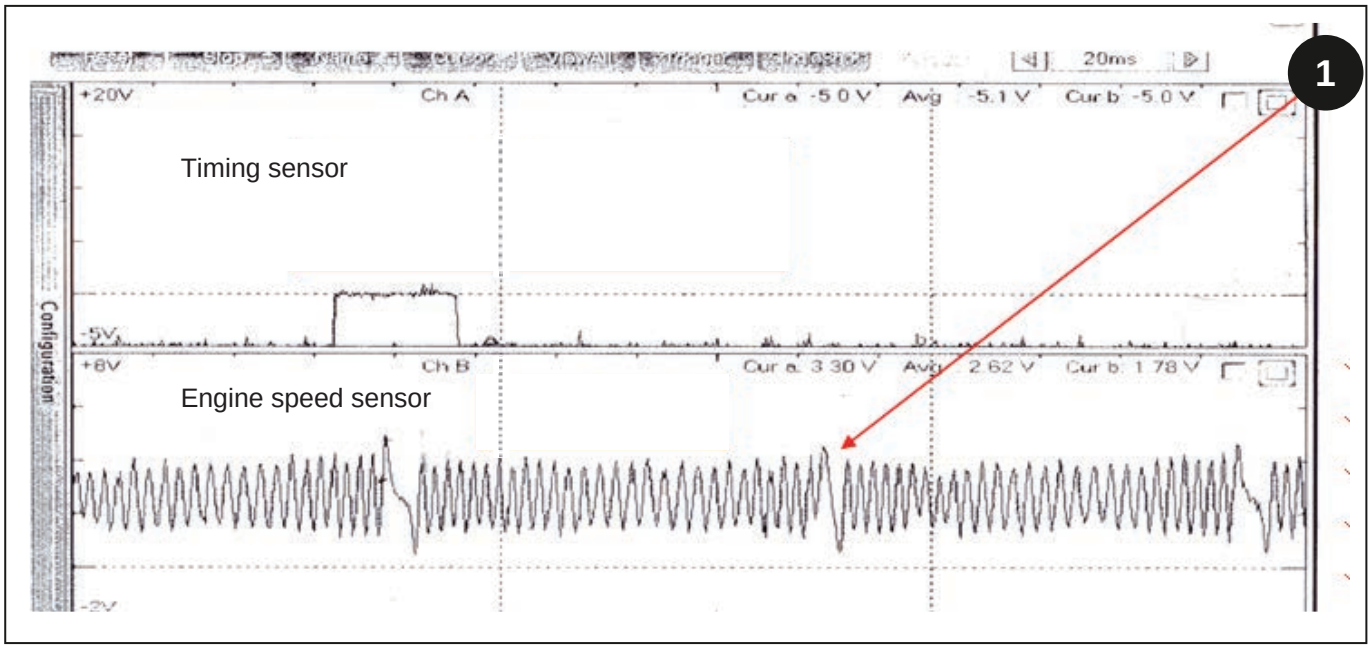

Fig. 2.298

1 - damaged tooth

2.82 Special tools

2.82.1 Special tools

code	Description	Quantity
07008422	Cylinder sleeve puller tool	1
07008423	Tool for installing/removing camshaft and crankshaft bushes	1
07008424	Crankshaft installation tool	1
07008425	Tool for removing/installing hydraulic tappets	1
07008426 07008427	XZN wrench for lateral head screws (12 mm) XZN wrench for centre head screws (14 mm)	1
07008428	Tool for angular wrench	1
07008429	Head alignment pins	1
07008430	Crankshaft immobiliser tool (installed in place of starter motor)	1
07008431	Cylinder sleeve height measurement tool	1
07008432	Flywheel alignment pins	1
07008433	Crankshaft gear extractor tool (for crankshafts with conical front shank)	1
07008434	Tool for installing front crankshaft oil seal	1
07008435 07008436 07008437 07008438 07008439	Injector puller tool (complete) Housing Pin Fork R750 EURO 4 / IE3 Fork R750 EURO 5	1
07008440	Tool for installing rear crankshaft oil seal	1
07008441	Tool for synchronising counter-rotating counterweights (only for engine versions with counter-rotating counterweights)	1
07008442 07008443	Plate for testing hydraulic seal tightness of heads Plate for testing hydraulic seal tightness of heads complete with O-rings	1
07008444	Tool for removing alternator idler pulley	1
07008445	**FOR EURO 4 ENGINES ONLY** Furnace for cleaning diesel particulate filter 3kW - 220V	1
07008446 07008447 07008448 07008449	Engine test wiring harness R750EU4-EU5 / TE3 / IE3 / TE4/ ISE4/IE4 (without throttle potentiometer and engine control unit) (with throttle potentiometer and without engine control unit) (with throttle potentiometer and with engine control unit) Engine test wiring harness R750EU6	1
07008450	Adapter for engine compression testing	1
 07008451 07008452	**Break out box** (without jumpers) (complete with jumpers)	1

	Oscilloscope (recommended type “PicoScope”) Tool usable for viewing waveform of timing and crankshaft position sensor signals	1
07008453	Belt installation tool (to be applied onto belt) (R750IE4-TE4-ISE4- R754EU6) A: setting belt tension B: restraining tensioner spring	1
07008454	Belt installation tool (to be applied onto tensioner) (R750IE4-TE4-ISE4- R754EU6)	1

3 : Clutch housing

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3.1 Safety rules

These safety precautions and warnings given in this paragraph must be observed at all times to prevent the risk of operator injury. However, the safety measures indicated in the use and maintenance manual and in chapter 1 of this manual must also be applied at all times.

Danger
All other persons must keep at a safe distance from the danger area.

Danger
Lift and handle all heavy parts with lifting equipment of adequate load capacity. Hoisting straps and hooks must be positioned safely on the load. When lifting loads, all personnel must keep at a safe distance from the load itself and remain within safe areas.

Danger
Do not allow the chains or metal cables used for hoisting to twist. Always wear safety gloves when handling cables or chains.

Danger
Use appropriate tools to align the holes correctly. NEVER USE YOUR HANDS OR FINGERS.

Danger
Handle all parts with extreme caution. Never place your hands or fingers between two parts.

Danger
When removing assemblies which could fall, always leave two screws in opposite positions in place for safety until the assembly is secured. Only remove these screws after securing the assembly to a hoist or after fitting support blocks in place.

Danger
If any of the screws fastening the frame or cab are loosened, or if the frame or cab is removed, ensure that all parts are refitted correctly at the end of the procedure to ensure that the driver is protected.

Attention
Beware of sharp edges and corners at the top of the gearbox housing.

Attention
Used oils must be collected and disposed of in compliance with applicable legislation.

3.2 General introduction

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3.2.1 Assembly drawing

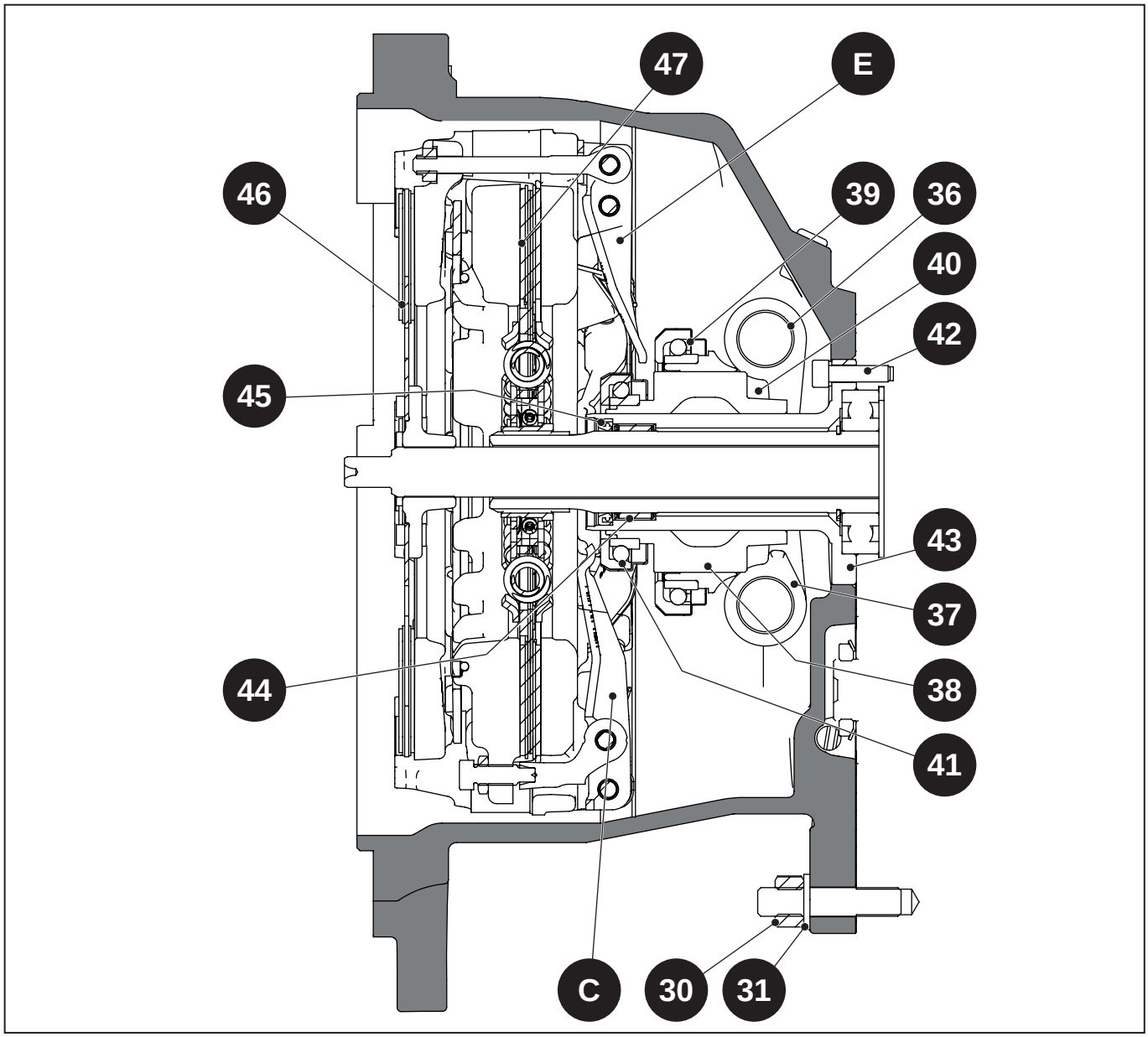

Fig. 3.1

30 - Nut
31 - Washer
36 - Transmission clutch lever
37 - PTO clutch lever
38 - Sleeve
39 - Bearing
40 - Sleeve
41 - Bearing
42 - Screw
43 - Sleeve guide cover
44 - Roller bearing cage
45 - Oil seal
46 - PTO clutch plate
47 - Transmission clutch plate
C - PTO clutch lever
E - Transmission clutch lever

3.3 Technical characteristics

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3.3.1 Technical characteristics

Clutch Type

Transmission	Single plate dry clutch, 11" diameter
Power Take Off	Independent, mechanical dry clutch

Clutch control

Transmission	Mechanical with pedal
Power Take Off	Mechanical with lever

3.4 Disassembly

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3.4.1 Preliminary operations.....3-8

3.4.2 Removing the Clutch 3-15

3.4.1 Preliminary operations

The main operations necessary to access the assembly are indicated as follows.

Attention
Always make sure that the assemblies are completely disconnected before separation to prevent damage to components.

- Removing the platform (see chapter "13-Platform")

  Removing the cab (see chapter "14-Cab")

Danger
Secure the assemblies to lifting equipment of adequate load capacity before disassembly. If suitable lifting equipment is not available, assemblies may be secured with a support stand.

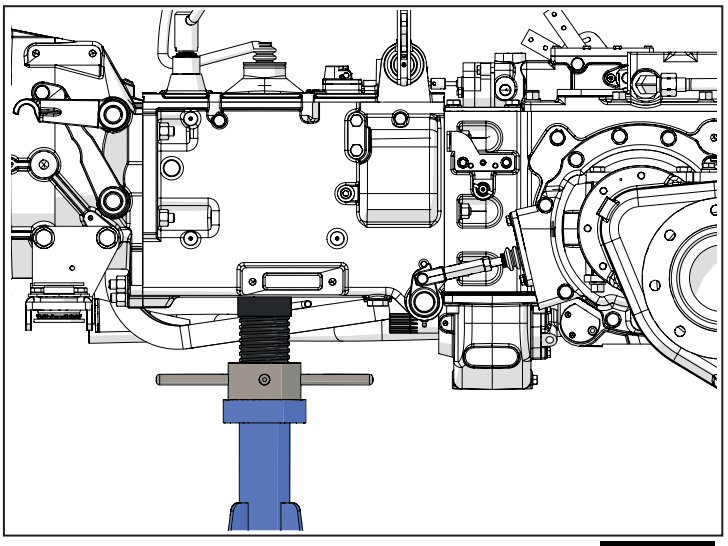

Fig. 3.2

Remove the screws and washers fastening the transfer shaft (1) guard.

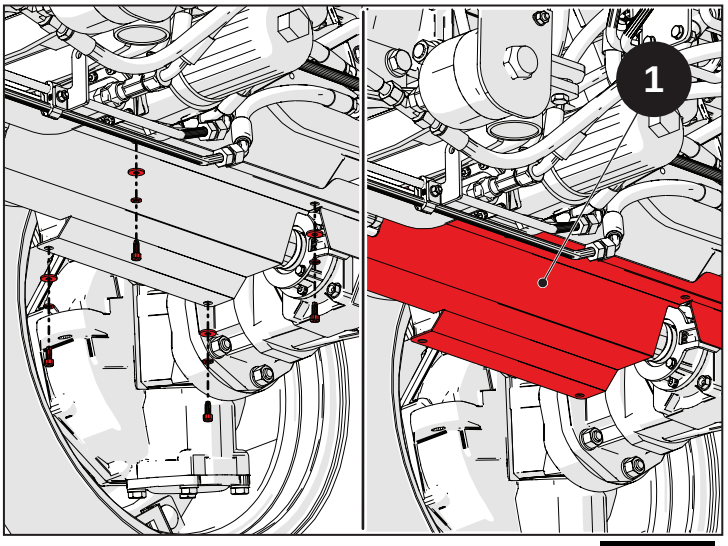

Fig. 3.3

Pull back the sleeve (2) to disengage the transfer shaft from the front axle.

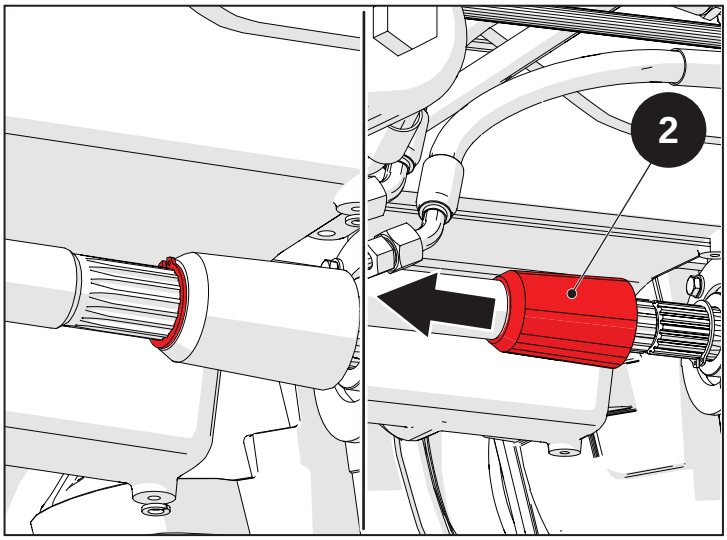

Fig. 3.4

Undo the nut (13) to disengage the clutch spring (14), and then release the spring tension.

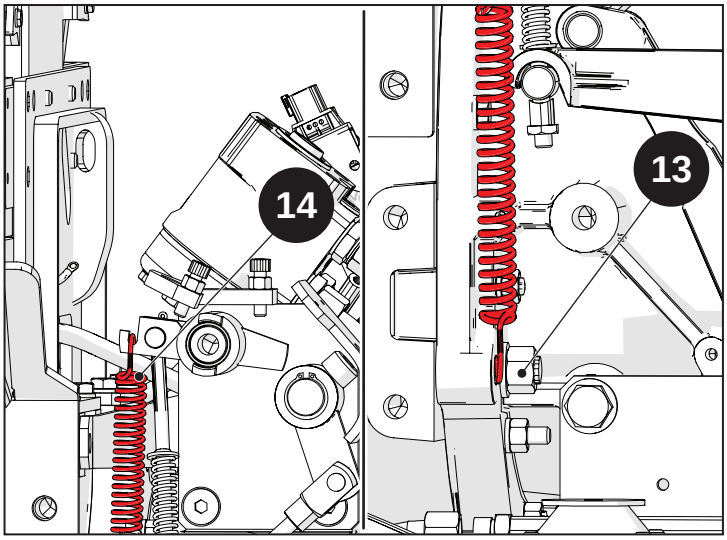

Fig. 3.5

Remove the split pin.

Remove the pins and the link rod (15).

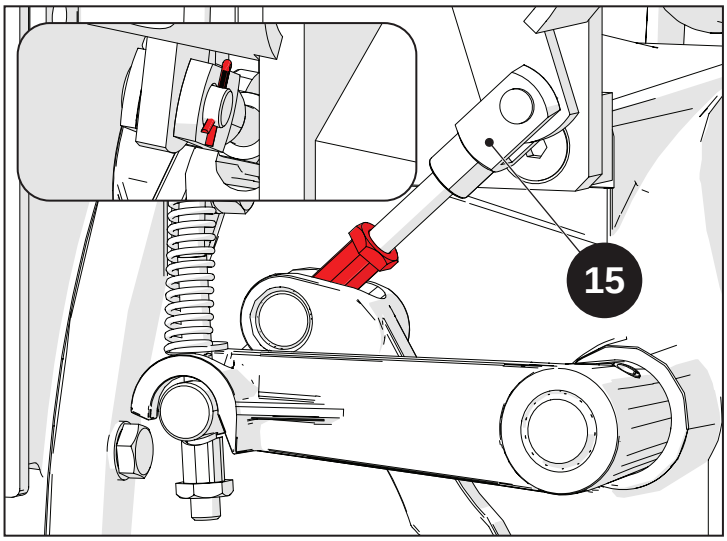

Fig. 3.6

Warning

Drain the oil from the gearbox.

Undo the clamps and remove the hose connector (16).

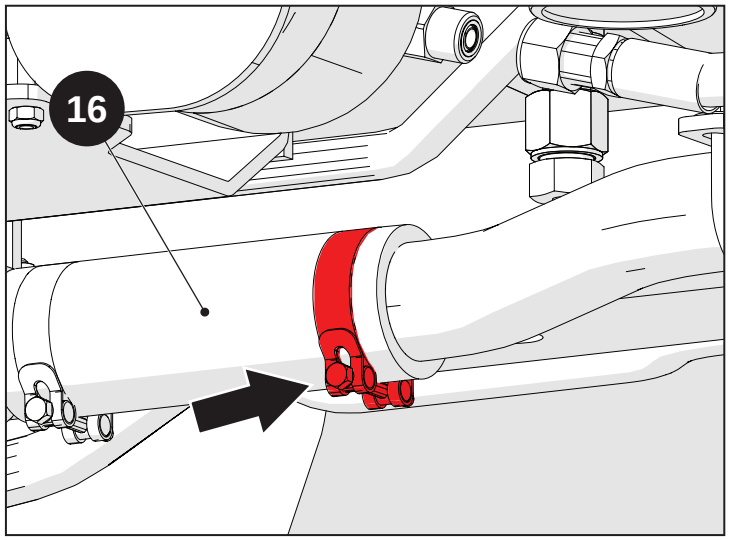

Fig. 3.7

Undo and disconnect the connectors of the hydraulic pipes (22) and (23).

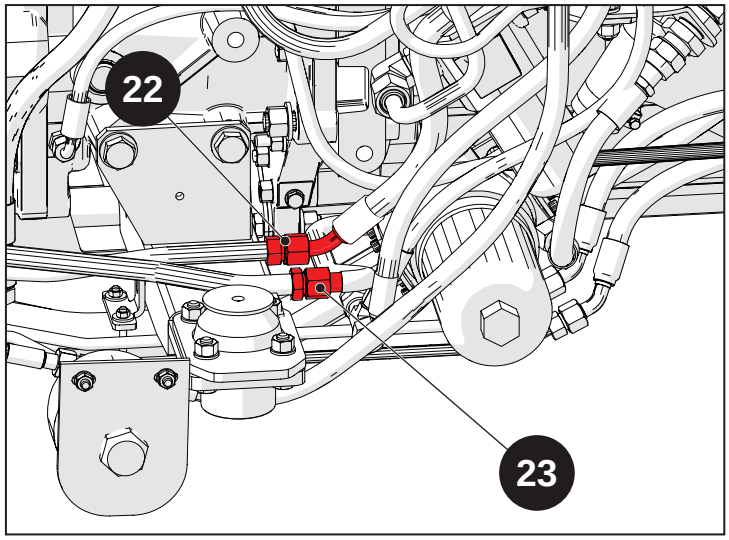

Fig. 3.8

Undo and disconnect the connectors of the lubrication pipes (24) and (25).

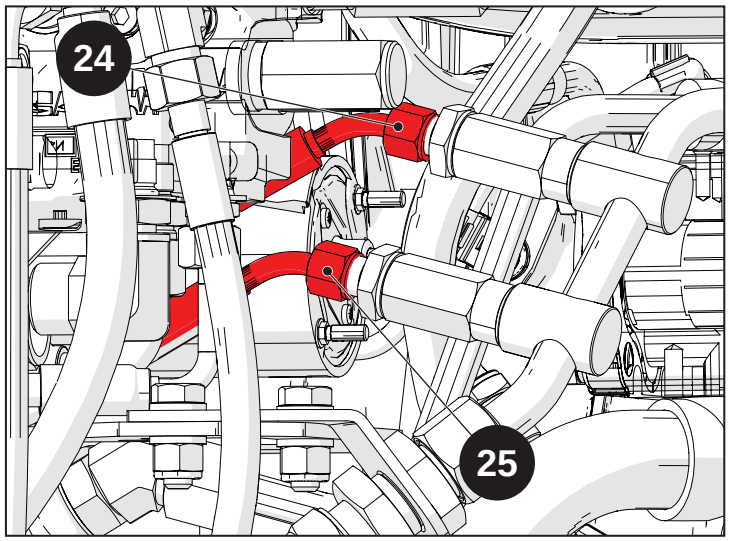

Fig. 3.9

Undo and disconnect the connector (26) of the accumulator.

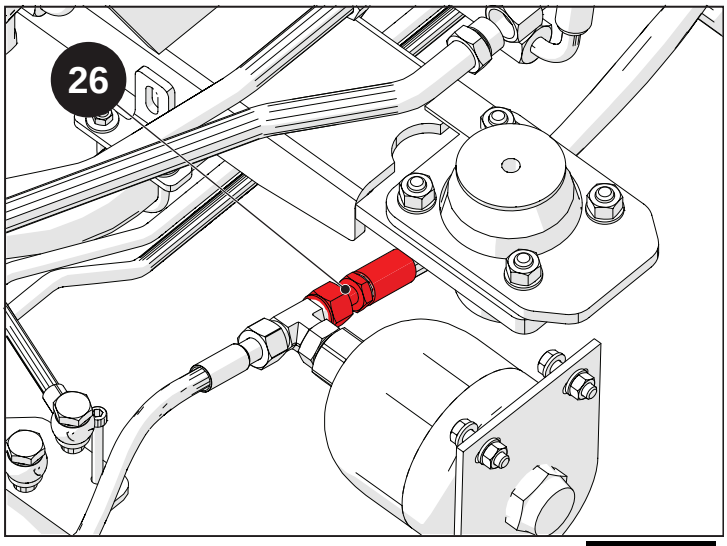

Fig. 3.10

Undo the hydraulic connectors of the hydraulic steering unit.

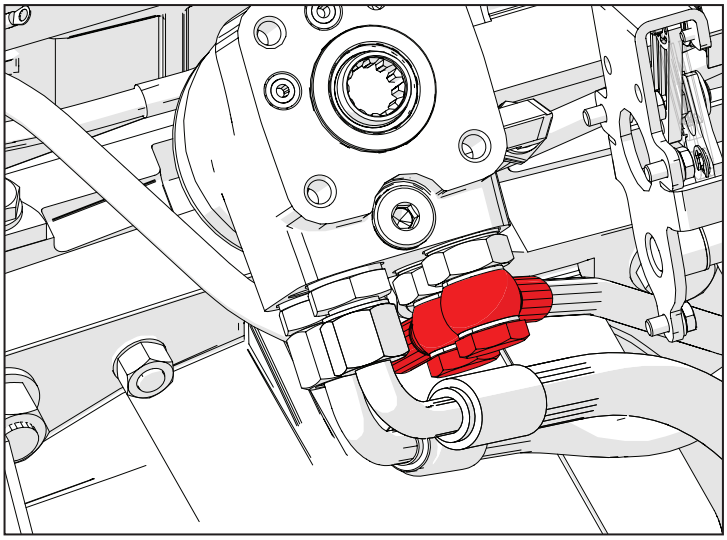

Fig. 3.11

Undo and disconnect the connectors (28) and (29).

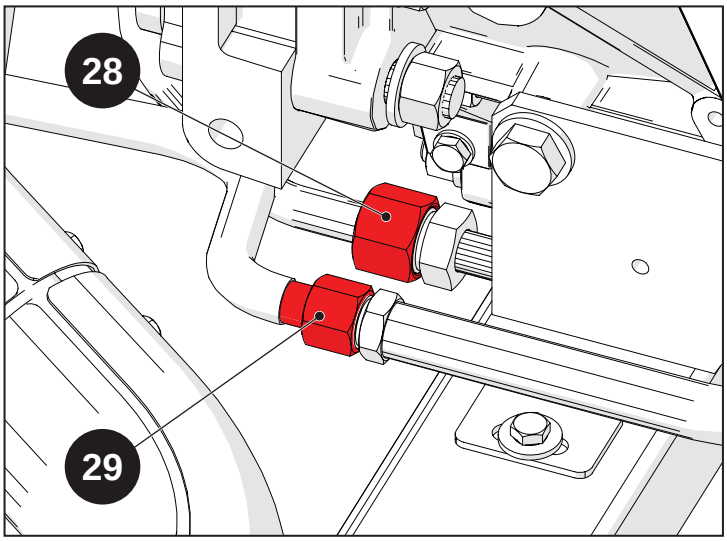

Fig. 3.12

Remove the rollbar lock handle (3).

Remove the screws (4) and washers (5).

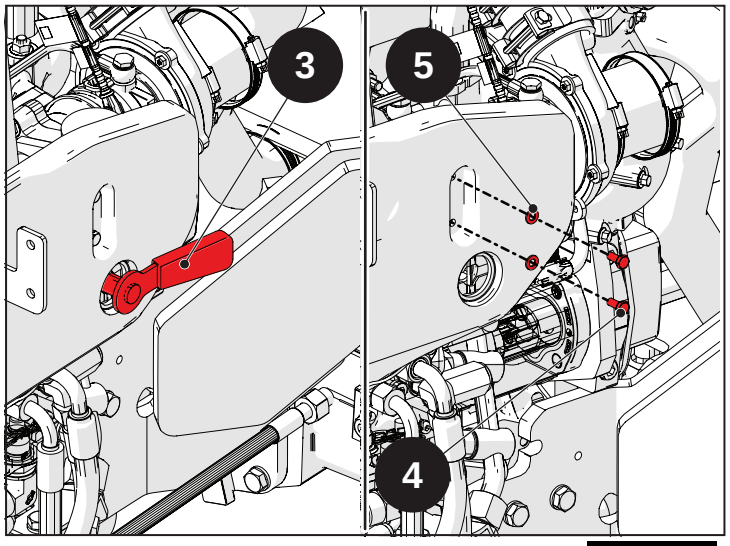

Fig. 3.13

Remove the guard (6).

Perform the same procedure on the other side.

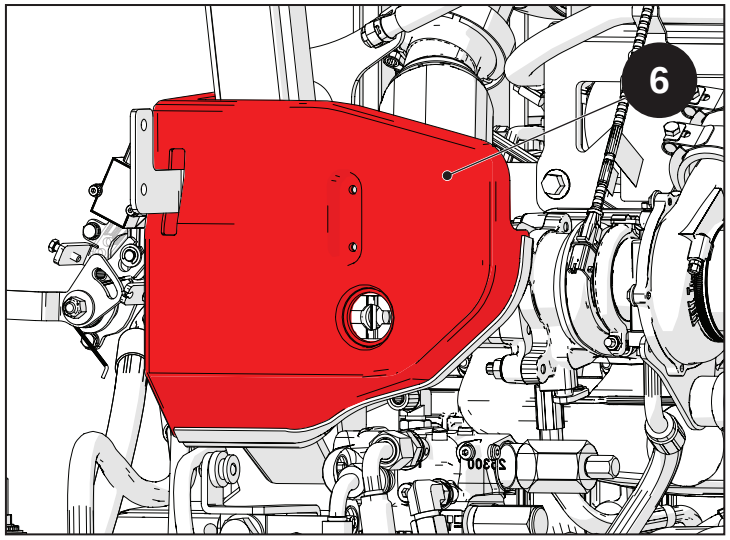

Fig. 3.14

Remove the hex socket head cap screws (27), the nuts and the washers.

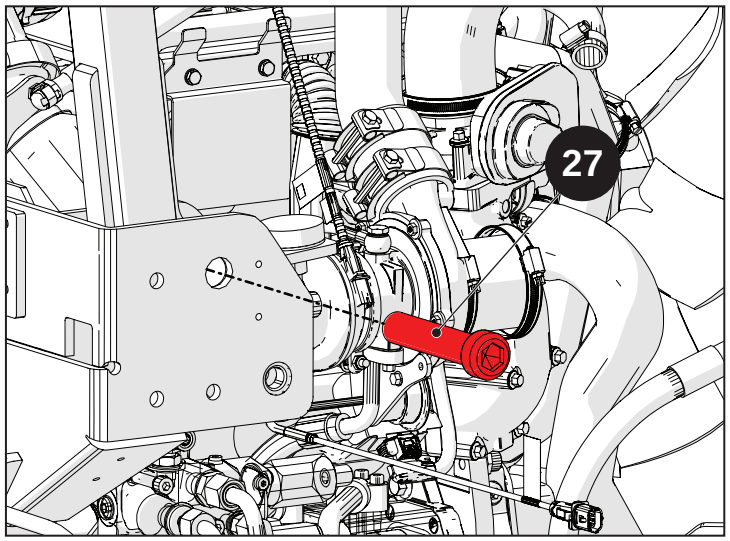

Fig. 3.15

Remove the roll bar.

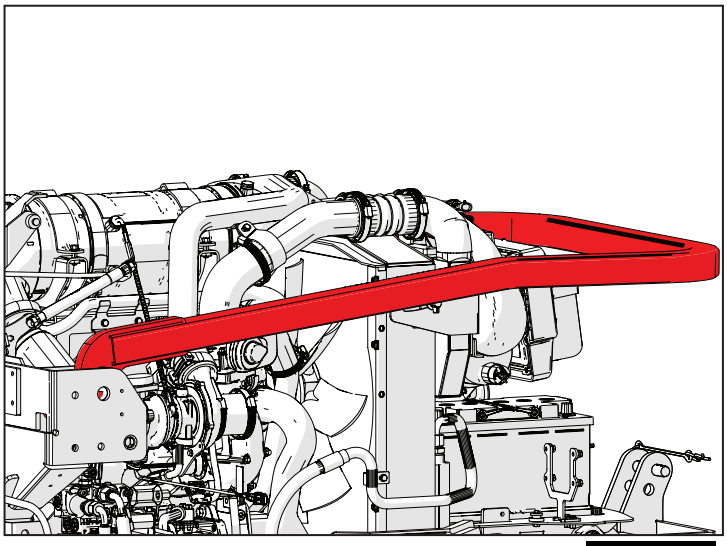

Fig. 3.16

Remove the connection with the bonnet mount.

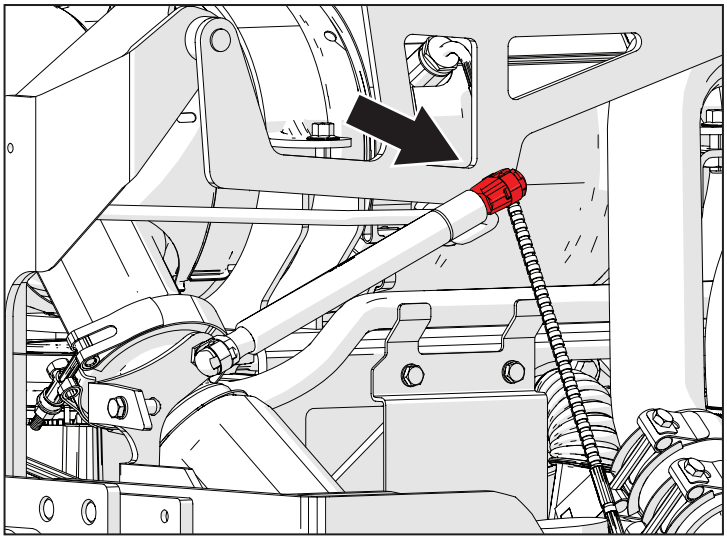

Fig. 3.17

Fit and tighten 2 hoisting eye bolts and use the lifting beam tool (A-p/n 07000245) to keep the engine assembly under tension.

Danger
Pull the parking brake lever as an additional safety measure.

Fig. 3.18

Remove the screws and nuts fastening the clutch housing.

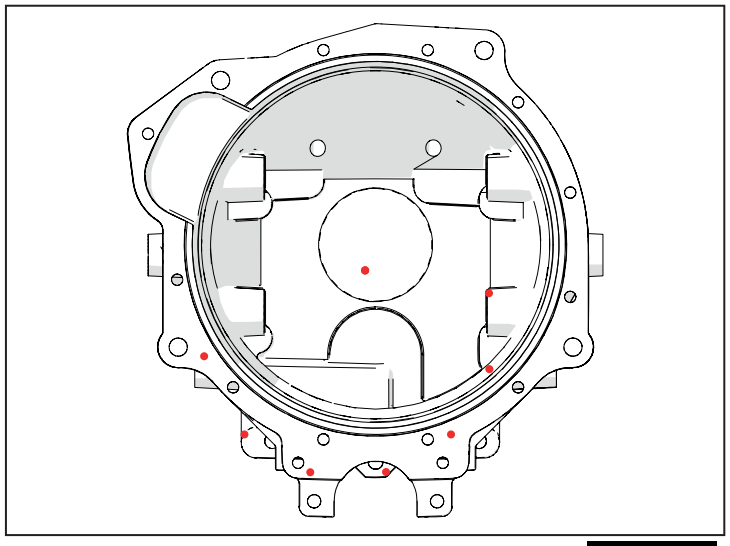

Fig. 3.19

Separate the assemblies.

Danger

Lift and handle all heavy parts with a hoist of adequate load capacity. Ensure that the lift straps and hooks are applied and positioned safely. When lifting loads, all personnel must keep at a safe distance from the load itself and remain within safe areas. Secure the assemblies to lifting equipment of adequate load capacity before disassembly.

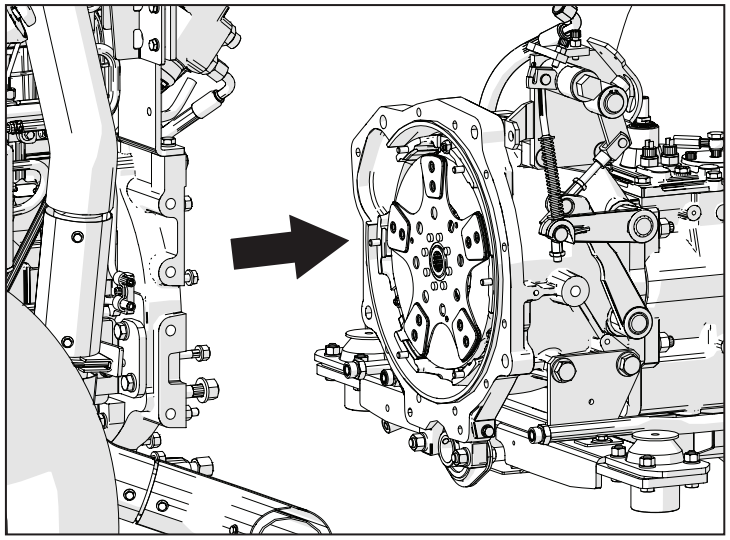

Fig. 3.20

3.4.2 Removing the Clutch

Fit the tool (B-07007171) and secure the clutch assembly safely with a hoist.

Undo the screws fastening the clutch.

Remove the complete clutch assembly.

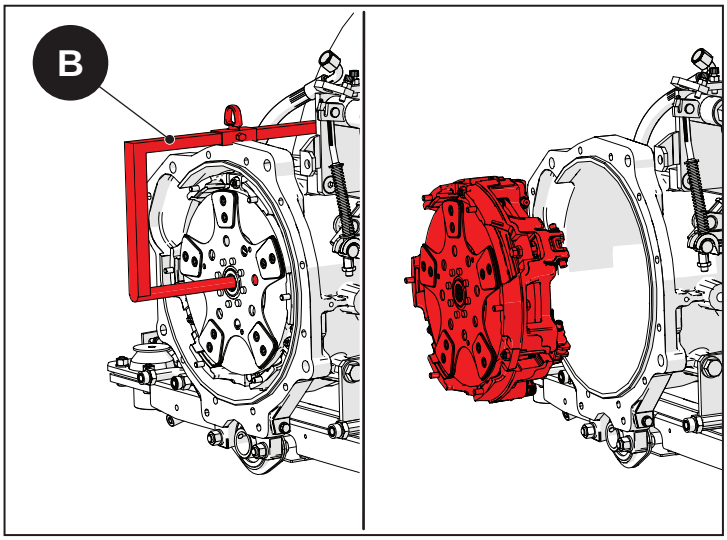

Fig. 3.21

Remove the levers of the transmission clutch (36) and the PTO clutch (37) from the housing, complete with rods, levers and springs.

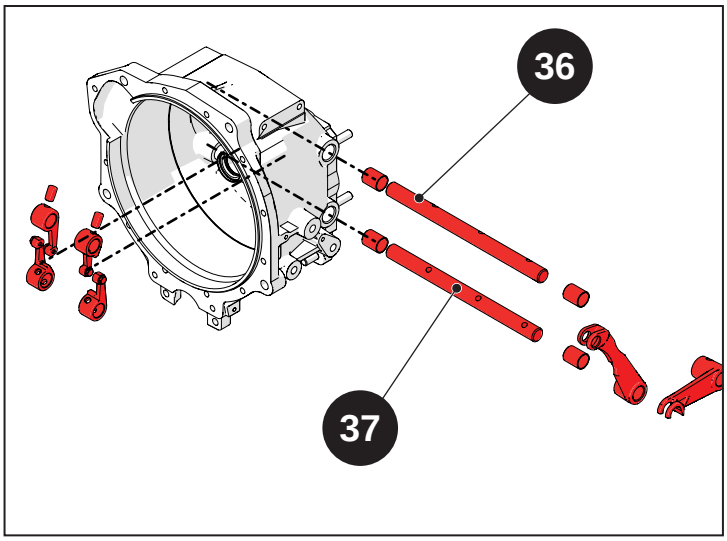

Fig. 3.22

Remove the transmission clutch control sleeve (38) and bearing (39).

Remove the PTO clutch control sleeve (40) and bearing (41).

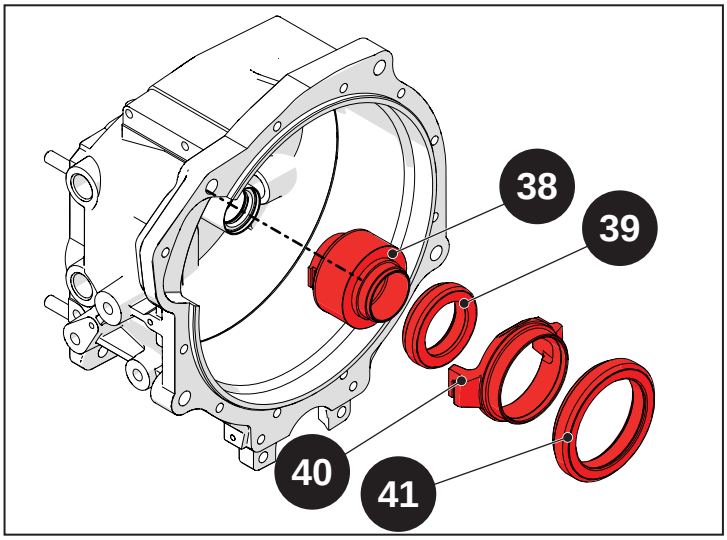

Fig. 3.23

Undo the screws (42) and the sleeve guide cover (43).

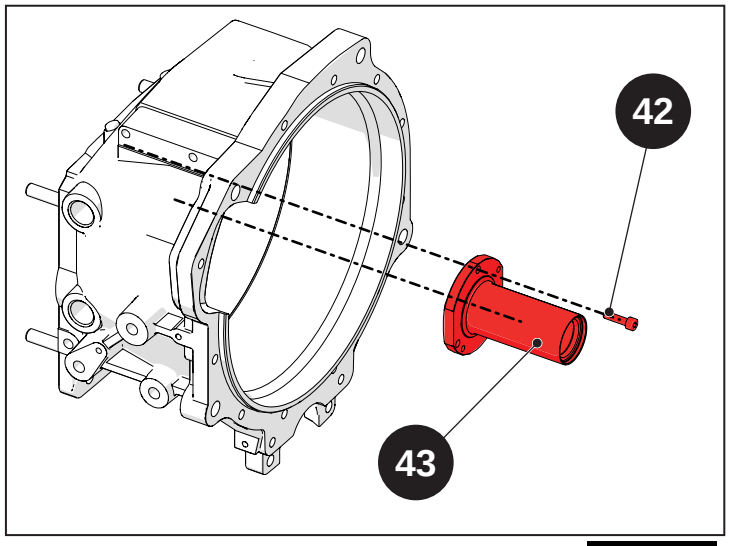

Fig. 3.24

Remove the roller bearing cage (44) and the oil seal (45) from the sleeve guide cover.

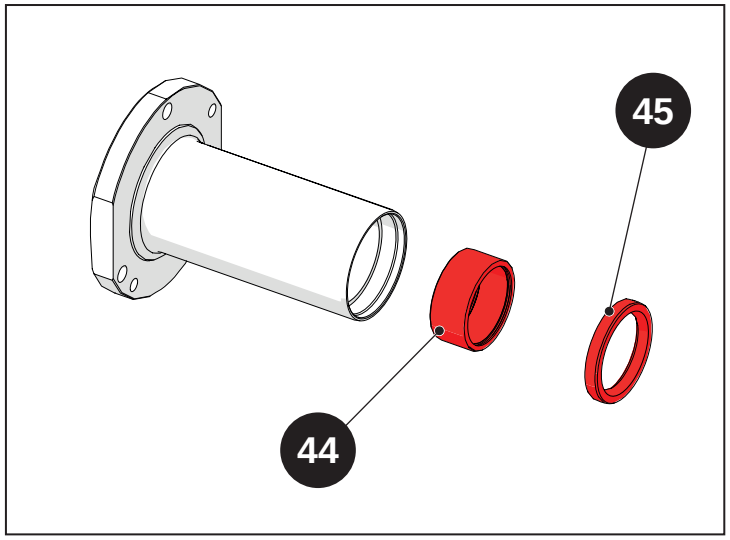

Fig. 3.25

3.5 Main inspection, reassembly and adjustment procedures

Index

3.5.1 Main inspection, reassembly and adjustment procedures.....3-18

3.5.1 Main inspection, reassembly and adjustment procedures

Warning
Read the instructions in chapter "1-Introduction" and, in particular, the sections concerning the installation of O-rings, oil seals and bearings, with particular care before reassembling, and follow these instructions precisely when working. Apply the correct tightening torques when tighten the fasteners of components. Where tightening torques are not specified, refer to the table in chapter "1-Introduction". Use the specified sealant products during reassembly. Where the sealant required is not specified, refer to the table in chapter "1-Introduction".

Inspecting and checking clutch components

The thrust plate rings must be in good condition for the clutches to work correctly. Check that the rings show no signs of scoring or overheating. If any scoring or signs of overheating are found, the thrust surfaces of the rings must be reground.

Grind 0.5 mm of material from the thrust surfaces of the rings.

If it is necessary to grind more material, remove the same amount from the clutch mating surface on the flywheel.

Warning
Do not remove more than 1 mm in total. If more material must be removed to rectify wear, replace the assembly.

Warning
Mark the components before removing to make sure that they are reassembled in their original positions.

The wear thickness limits of the discs are listed as follows:

Transmission: X= 10.3 to 6.3 mm

Power Take Off: Y= 8.7 to 5.7 mm

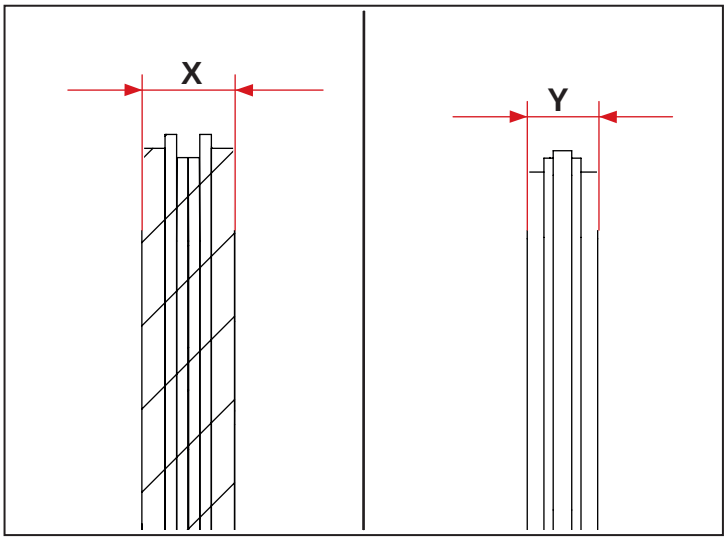

Fig. 3.26

Check that the length of the spring in relaxed state is 11.7 ±0.1 mm:

If not, the spring must be replaced as it will not exert the correct thrust against the clutch plate.

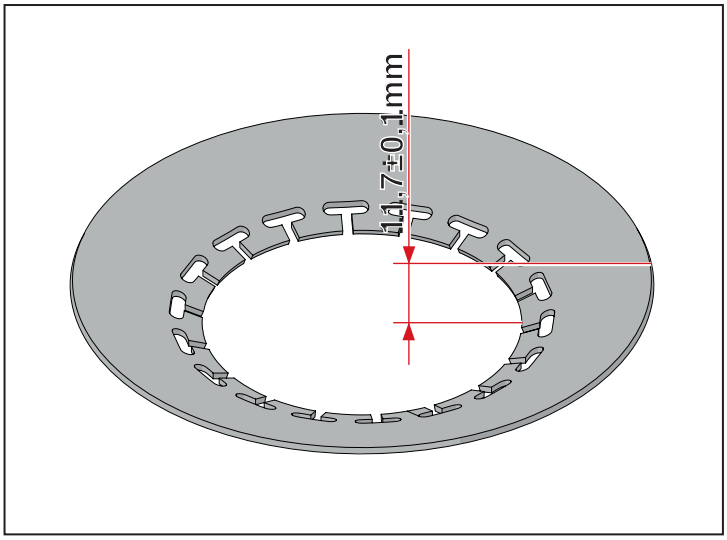

Fig. 3.27

Adjusting the clutch levers

For the clutches to engage correctly and controllably, the levers of the transmission clutch (36) and the PTO clutch (37) must be adjusted correctly.

To set the transmission clutch correctly, adjust the levers (C) to obtain a measurement X of 25 mm.

Loosen the check nuts and tighten or loosen the nuts (D) as necessary to obtain a measurement X of 25 mm.

Tighten the check nuts after adjusting.

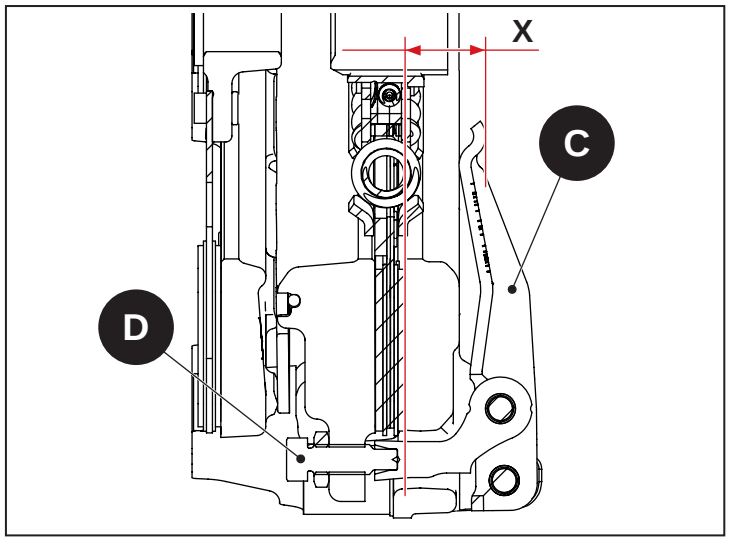

Fig. 3.28

To set the PTO correctly, adjust the levers (E) to obtain a measurement Y of 50 mm.

Tighten or loosen the nuts (F) as necessary to obtain a measurement Y of 50 mm.

After adjusting, press the edge of the nut with a clinching wrench and apply a dot of colour to mark the nut.

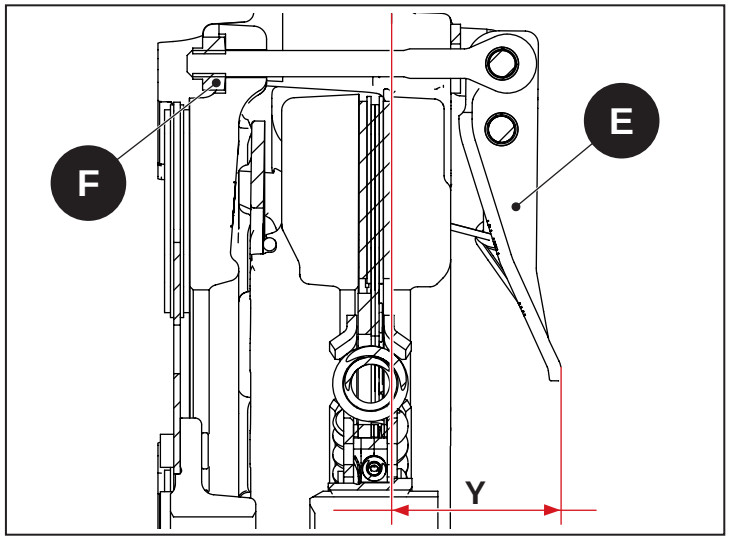

Fig. 3.29

Check that the maximum clearance between the clutch thrust plates and the clutch housing is within the correct operating range.

Measure the values A and B.

Calculate the clearance X with the formula: X = A - B.

X must be between 0.3 mm and 0.8 mm

Measure and calculate the values for both clutches.

Warning
Replace the clutch assembly if X is not within the specified range.

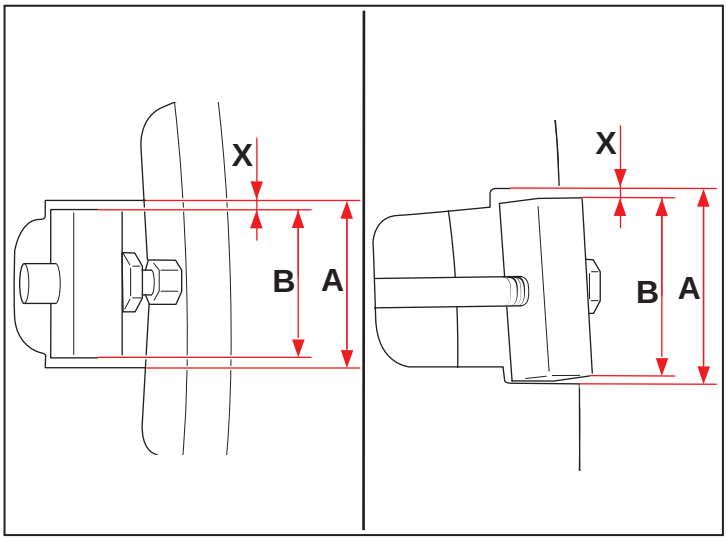

Fig. 3.30

Refitting the clutch

Using a bearing race punch tool of suitable diameter, install the roller bearing cage (44) in the sleeve guide cover.

Apply a layer of mastic sealant on the outer perimeter of the oil seal (45), and use a punch tool of suitable diameter to install it in the sleeve guide cover.

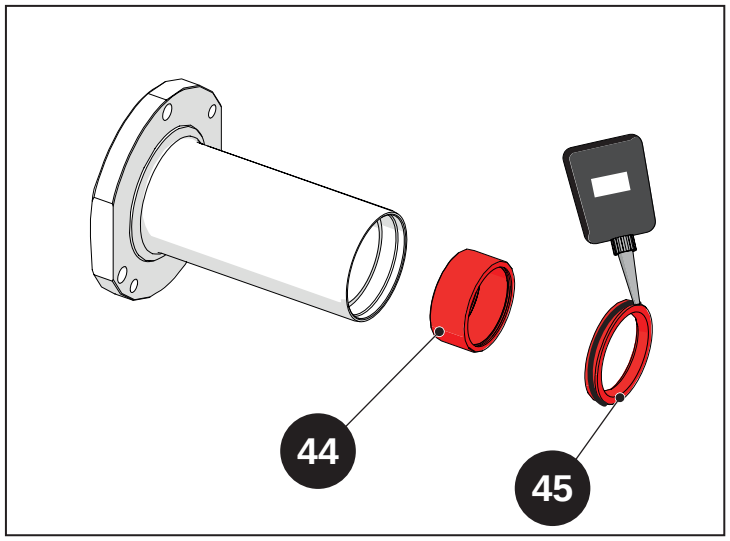

Fig. 3.31

Using a bearing race punch tool of suitable diameter, install the bearing (41) on the sleeve (40).

Using a bearing race punch tool of suitable diameter, install the bearing (39) on the sleeve (38).

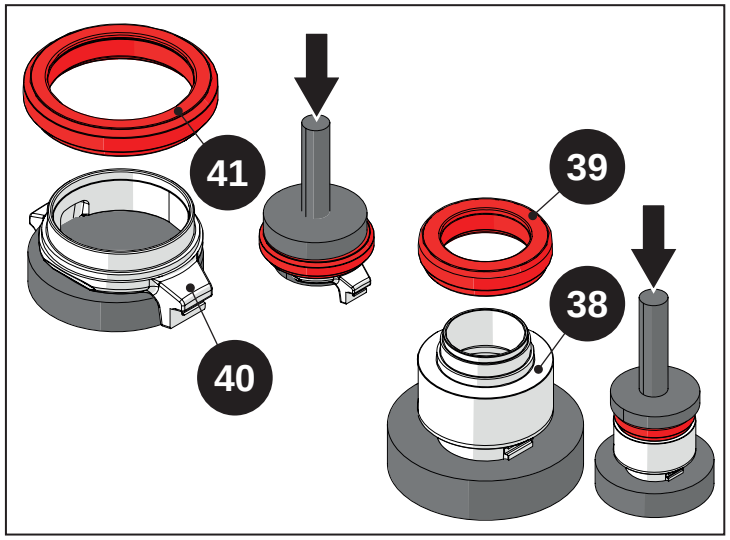

Fig. 3.32

Install the transmission clutch lever (36) and the PTO clutch lever (37), complete with rods, levers and springs.

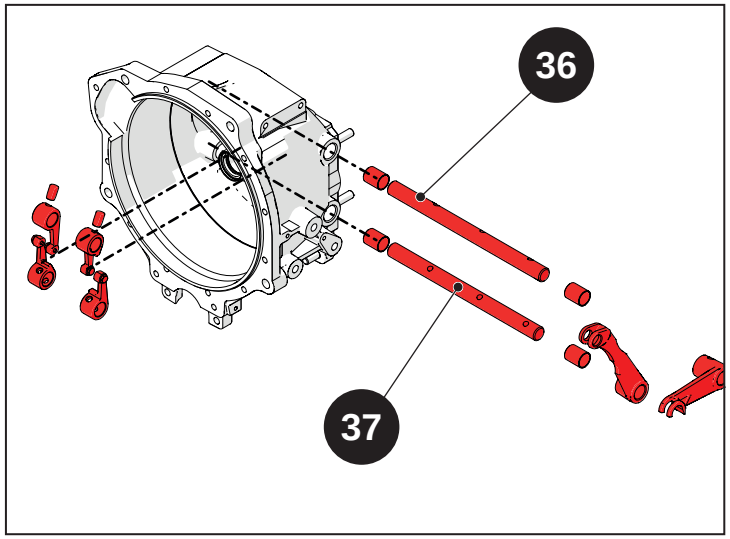

Fig. 3.33

Fit the tool (B-07007171) and lift the clutch assembly with a hoist.

Fasten the clutch assembly to the engine, tightening the screws to a torque of 40 N·m (4 kg·m).

Warning
Use new M8 screws at each reassembly

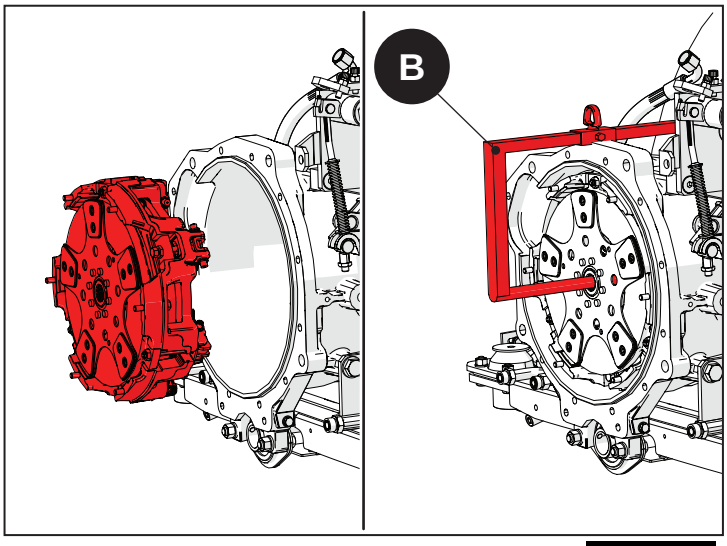

Fig. 3.34

Mate the two assemblies

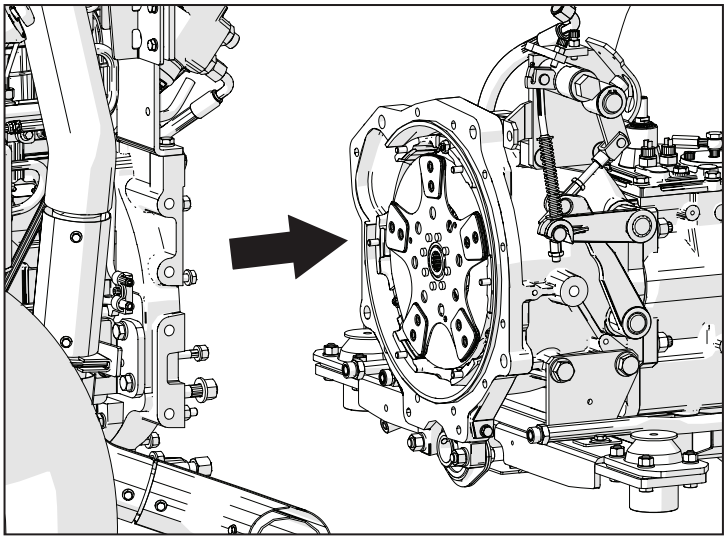

Fig. 3.35

Tighten the screws and nuts fastening the housing to the engine to the following tightening torques:

M10 = 50 N·m (5 kg·m)

M16 = 212 N·m (21.2 kg·m)

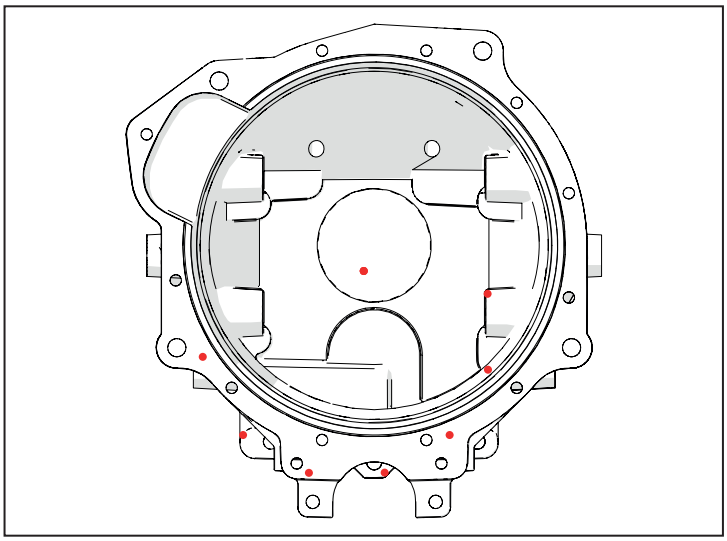

Fig. 3.36

Reassemble by following the procedure for disassembly in reverse order.

Clutch pedal adjustment

The clutch pedal travel must be set correctly for the transmission clutch to engage and disengage correctly.

Warning

The clutch assembly must be reassembled completely onto the gearbox and engine before adjusting the clutch pedal.

- Tighten or loosen the adjuster nut (1) to adjust the dead zone of the pedal.
- Tighten or loosen the screw (2) to adjust the start of travel position.
- Tighten or loosen the screw (3) to adjust the end of travel position.

Note

The left hand front lateral panel must be removed to allow access to the clutch pedal end stop screws (see chapter 13 - "Platform").

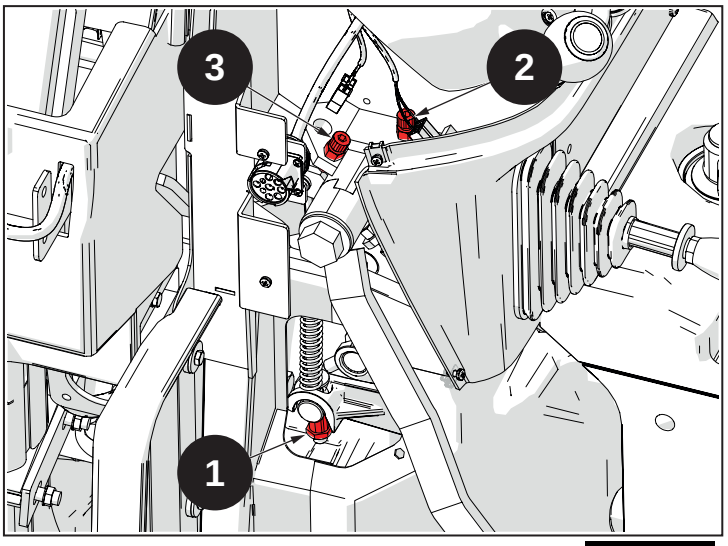

Fig. 3.37

Attention

After fastening the base assembly and before refitting the platform, check that the clutch works correctly by pressing the clutch with four gear selected and checking that the tractor moves when pushed. Also check that the PTO clutch works correctly, by engaging the PTO and turning the rear shaft by hand.

Dimensions, roll bar and SG1/1 cab versions

Pedal in rest position (A)	245 mm
Kiss point (B)	270 mm
End of travel (C)	384 mm

Dimensions, GL11 cab version

Pedal in rest position (A)	165 mm
Kiss point (B)	205 mm
End of travel (C)	364 mm

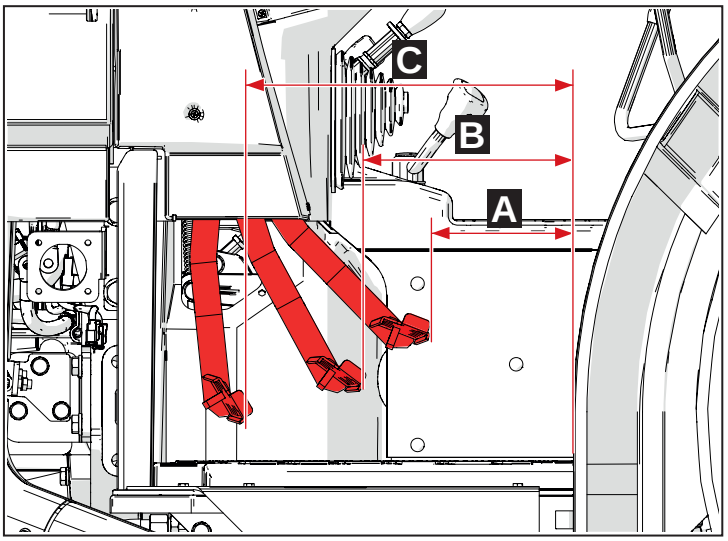

Fig. 3.38

3.6 Tightening torques

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3.6.1 Tightening torques 3-26

3.6.1 Tightening torques

The main tightening torques are listed as follows. For all other tightening torques, see chapter "1- Introduction".

Tightening torque	N·m	kg·m
Screw fastening clutch to engine flywheel M8x90	40	4
Nut fastening engine flange - clutch housing M10x12.5	60	6
Primary shaft sleeve fastener screw M8x20	35	3.5
Dashboard mount fastener screw M12x35	80	8
Screw fastening engine flange - clutch housing	80	8

3.7 Tools necessary

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3.7.1 Tools necessary.....3-28

3.7.1 Tools necessary

p/n	Description	Quantity
07000245	Tractor separation support frame	1
07007171	STAR clutch plate alignment pin	1

4 : Gearbox

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4.1 Safety rules

These safety precautions and warnings given in this paragraph must be observed at all times to prevent the risk of operator injury. However, the safety measures indicated in the use and maintenance manual and in chapter 1 of this manual must also be applied at all times.

Danger.
All other persons must keep at a safe distance from the danger area. Avoid vibration when loosening screws.

Danger.
Lift and handle all heavy parts with lifting equipment of adequate load capacity. Hoisting straps and hooks must be positioned safely on the load. When lifting loads, all personnel must keep at a safe distance from the load itself and remain within safe areas.

Danger.
Do not allow the chains or metal cables used for hoisting to twist. Always wear safety gloves when handling cables or chains.

Danger.
Use appropriate tools to align the holes correctly. NEVER USE YOUR HANDS OR FINGERS.

Danger.
Handle all parts with extreme caution. Never place your hands or fingers between two parts.

Danger.
When removing assemblies which could fall, always leave two screws in opposite positions in place for safety until the assembly is secured. Only remove these screws after securing the assembly to a hoist or after fitting support blocks in place.

Danger.
If any of the screws fastening the frame or cab are loosened, or if the frame or cab is removed, ensure that all parts are refitted correctly at the end of the procedure to ensure that the driver is protected.

Caution
Beware of sharp edges and corners at the top of the gearbox housing.

Caution
Used oils must be collected and disposed of in compliance with applicable legislation.

4.2 General introduction

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4.2.1 Assembly drawing 4-4

4.2.1 Assembly drawing

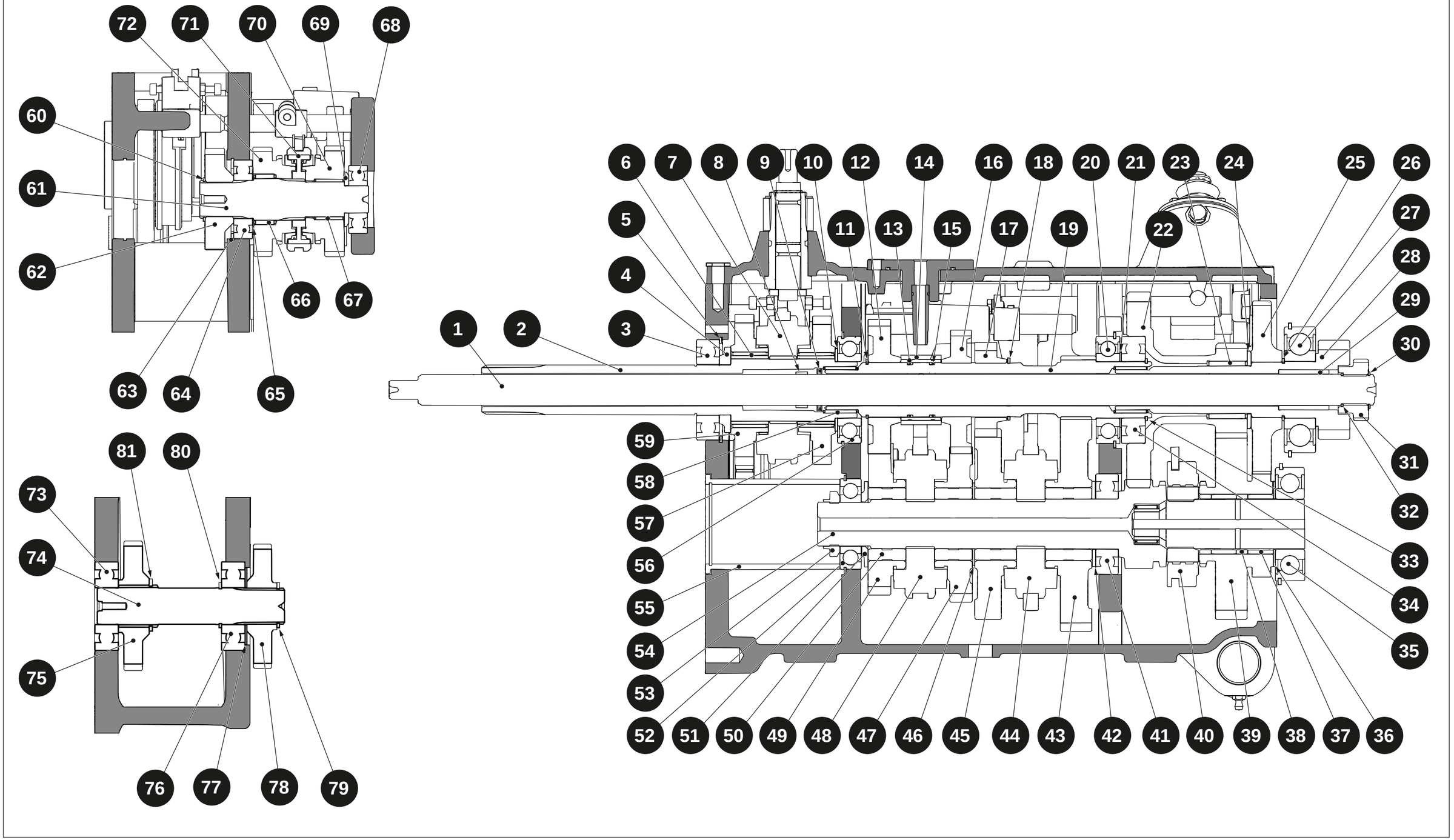

Fig. 4.1

1 - PTO primary shaft
2 - Front gearbox primary shaft
3 - Bearing
4 - Spacer
5 - Circlip
6 - Roller bearing cage
7 - Synchroniser
8 - Bush
9 - Oil seal
10 - Shim
11 - Circlip
12 - 4th speed primary gear
13 - Lubrication bush
14 - Lubrication tube
15 - O-ring
16 - 3rd speed primary gear
17 - 2nd speed primary gear
18 - Circlip
19 - Central primary shaft
20 - Bearing
21 - Spacer
22 - Gear
23 - Roller bearing cage
24 - Spacer
25 - Gear
26 - Circlip
27 - Bearing
28 - Front primary shaft
29 - Bush
30 - Circlip
31 - PTO gear
32 - Circlip
33 - Circlip
34 - Bearing
36 - Spacer
37 - Roller bearing cage
38 - Spacer
39 - Gear
40 - Selector sleeve
41 - Bearing
42 - Spacer
43 - 1st speed gear
44 - Synchroniser
45 - 2nd speed gear
46 - Spacer
47 - 3rd speed gear
48 - Synchroniser
49 - 4th speed gear
50 - Bush
51 - Spacer
52 - Bearing
53 - Threaded ring
54 - Secondary shaft
55 - Sleeve
56 - Bearing
57 - H/L gear
58 - Roller bearing cage
59 - Reverse shuttle gear
60 - Circlip
61 - H/L intermediate shaft
62 - H/L driven gear
63 - Circlip
64 - Bearing
65 - Shim
66 - Roller bearing cage
67 - Roller bearing cage
68 - Bearing
69 - Spacer
70 - High gear
71 - Synchroniser
72 - Low gear
73 - Bearing
74 - Reverse shuttle shaft
75 - Driven gear
76 - Bearing
78 - Drive gear
79 - Circlip
80 - Circlip
81 - Circlip

4.3 Technical characteristics

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4.3.1 Technical characteristics

Type	Dual Power, 24+12, synchronised
Operation	Mechanical

4.4 Disassembly

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4.4.1 Preliminary operations

Carry out the following procedures to access the gearbox assembly:

1 - Removing the platform (see chapter "13-Platform")

Removing the cab (see chapter "14-Cab")

2 - Separating Clutch (see chapter "3 - Clutch housing")

3 - Separating Rear differential/Gearbox (see chapter "5 - Rear differential")

Secure the clutch housing to a hoist.

Undo the nuts (82) fastening the clutch housing to the engine, removing the washers (83).

Tools
07000245: Tractor separation support frame.
07000215: Gearbox assembly support stand - base.

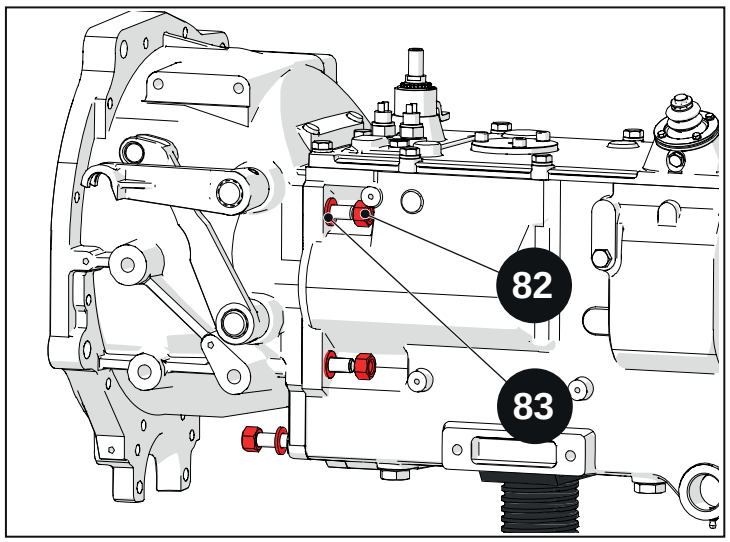

Fig. 4.2

Remove the clutch housing assembly and retrieve the paper gaskets (84).

Note
The paper gasket (84) protects the gearbox from the heat of the clutch.

Tools
07000246: Gearbox casing support.
07000215: Gearbox assembly support stand - base.

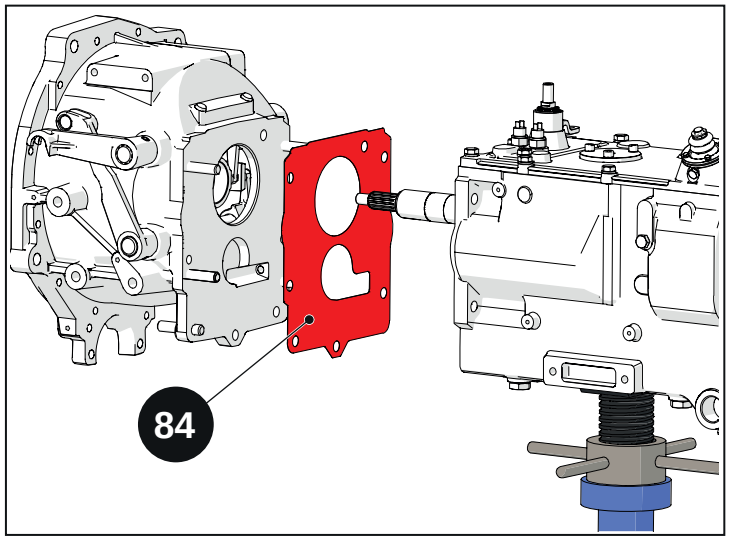

Fig. 4.3

4.4.2 Removing the gearbox assembly

Undo the screws (85) fastening the cover, removing the washers (86).

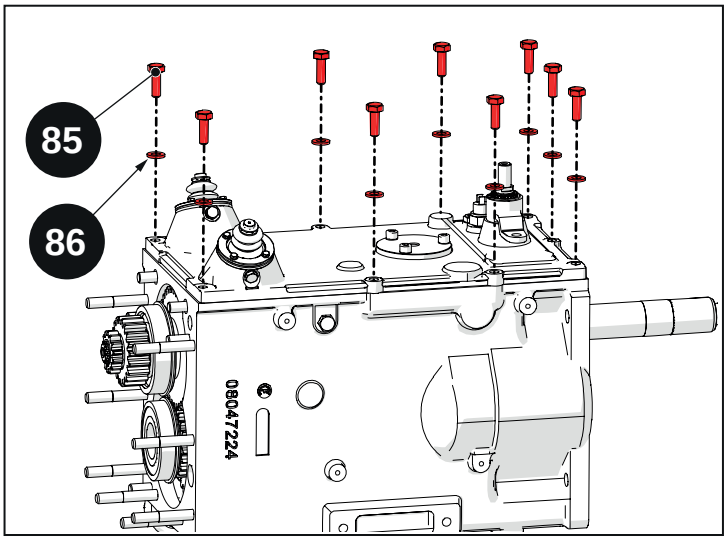

Fig. 4.4

Remove the complete cover (87).

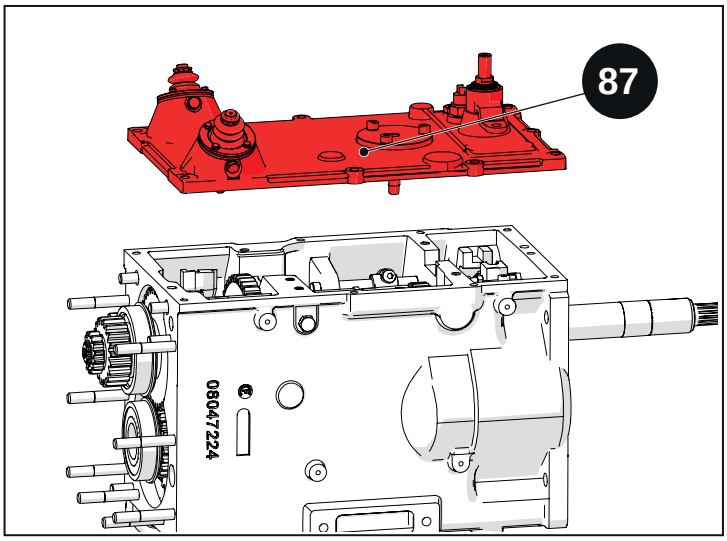

Fig. 4.5

Remove the springs (88) and the balls (89).

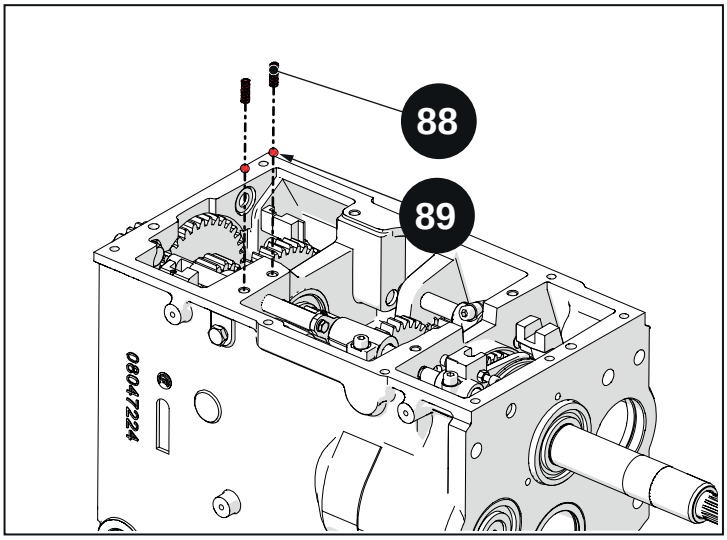

Fig. 4.6

Remove the PTO primary shaft (1) with the gear (31), the snap ring (32) and the circlip (30).

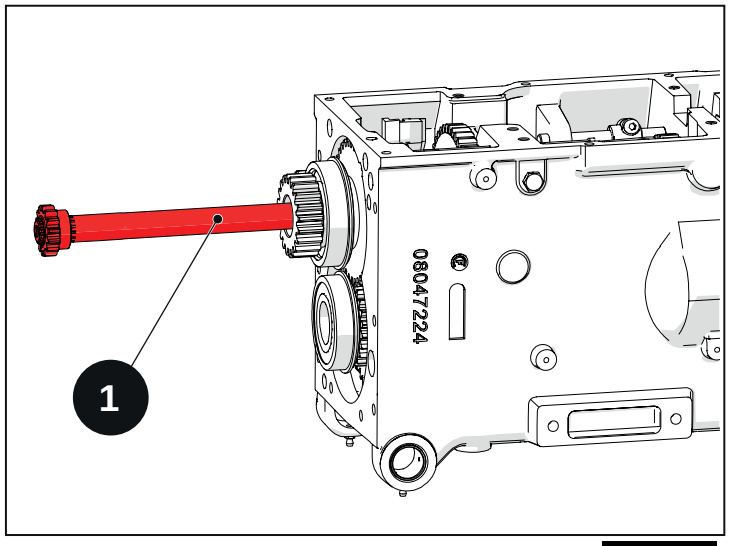

Fig. 4.7

Undo the screws (90) and remove the washers (91) and the sleeve (92).

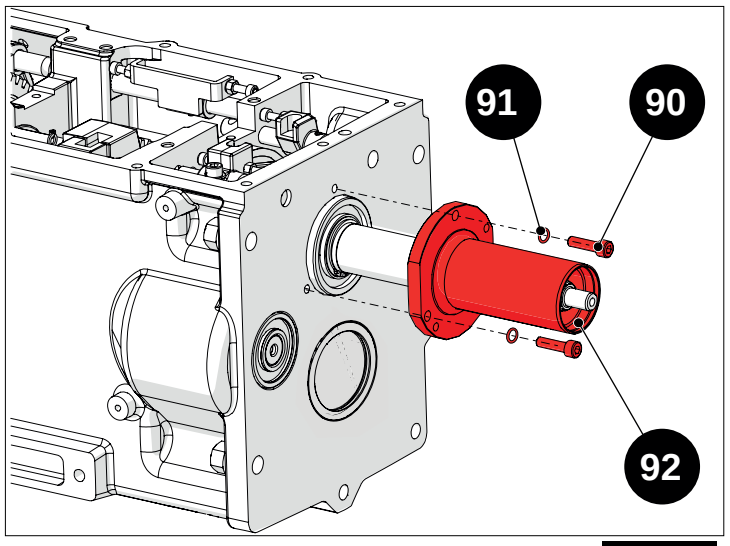

Fig. 4.8

Remove the rod (94) and fork of the reverse shuttle (93).

Note

Loosen the screws on the heads of the forks to disengage from the relative rods.

Danger

When removing the rod (94), keep the hole in which the selector spring and ball are seated closed as the spring and ball may be projected out forcefully and cause injury.

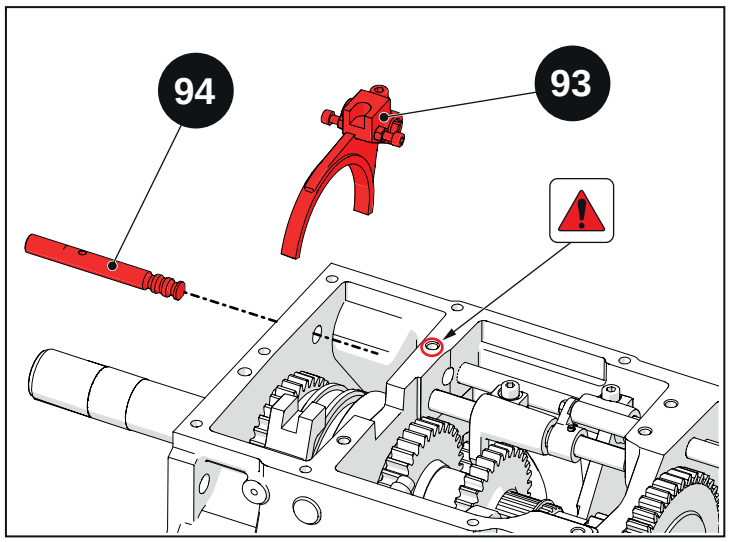

Fig. 4.9

Remove the spring (96) and the ball (95).

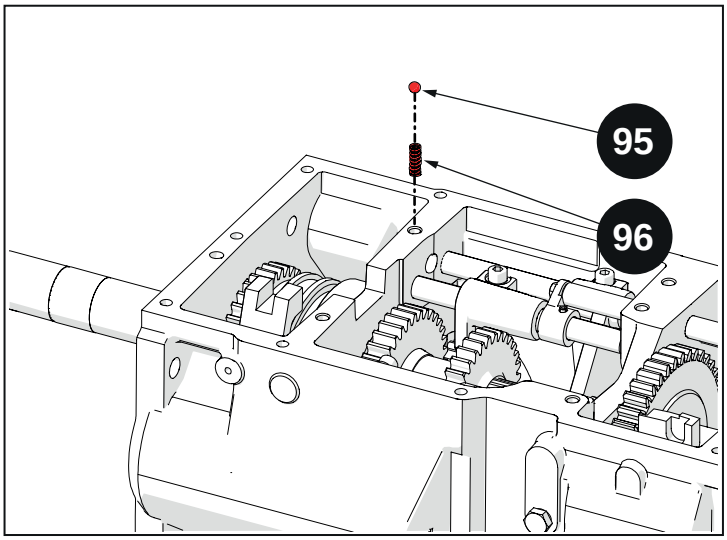

Fig. 4.10

Undo the screw (97) and remove the washer (98) and the control rod (99).

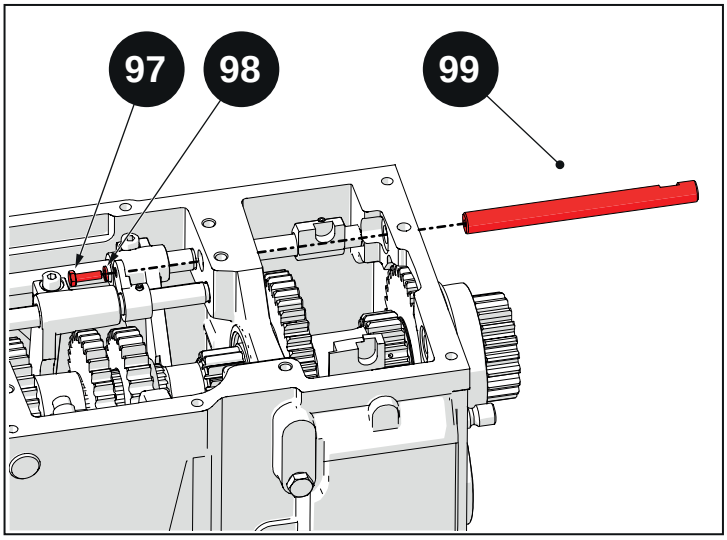

Fig. 4.11

Remove the fastener pin (100).

Note

The pin (100) will remain in the gearbox casing. Retrieve the pin before continuing.

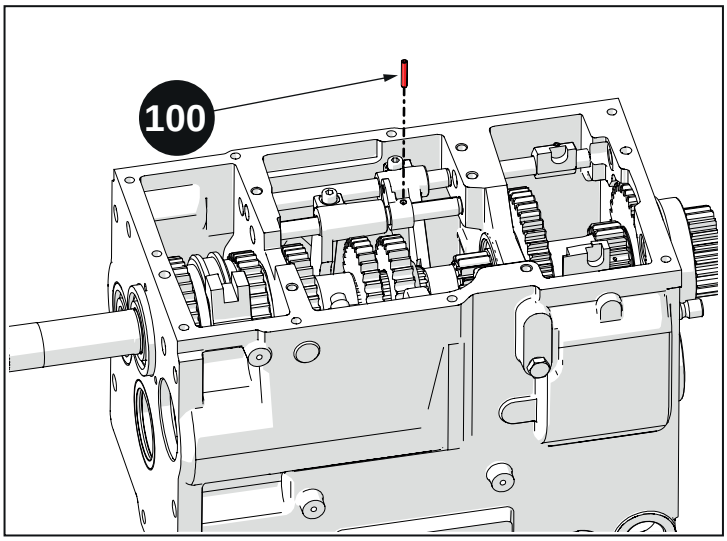

Fig. 4.12

Undo the plug (101) with the washer (102), and then remove the spring (103) and the ball (104).

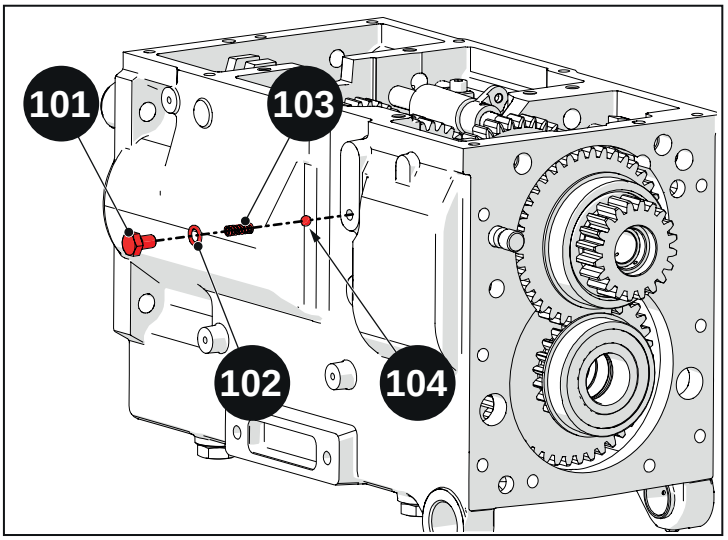

Fig. 4.13

Remove the pin (108).

> **Note**
>
> The pin (108) will remain in the gearbox casing. Retrieve the pin before continuing.

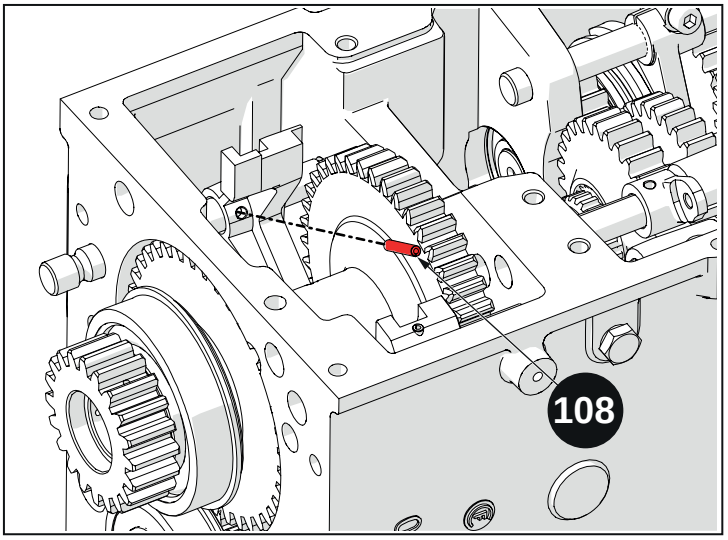

Fig. 4.14

Remove the rod (105) and selector fork of the underdrive gear (106).

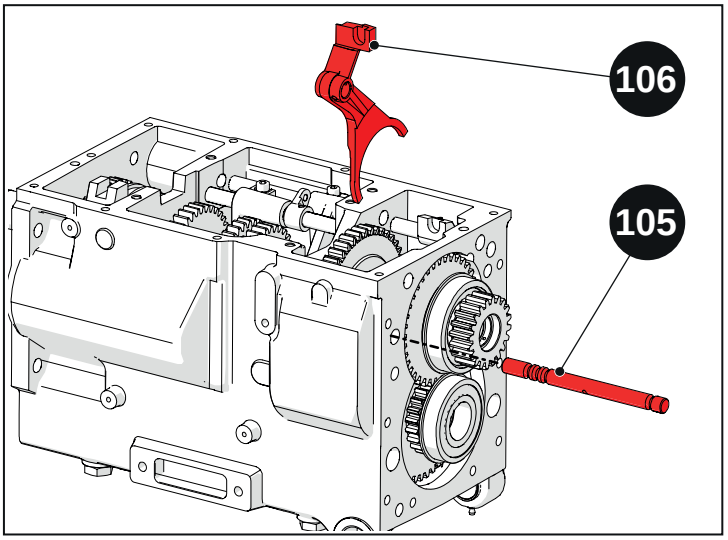

Fig. 4.15

Remove the pin (107).

Note

The pin (107) will remain in the gearbox casing. Retrieve the pin before continuing.

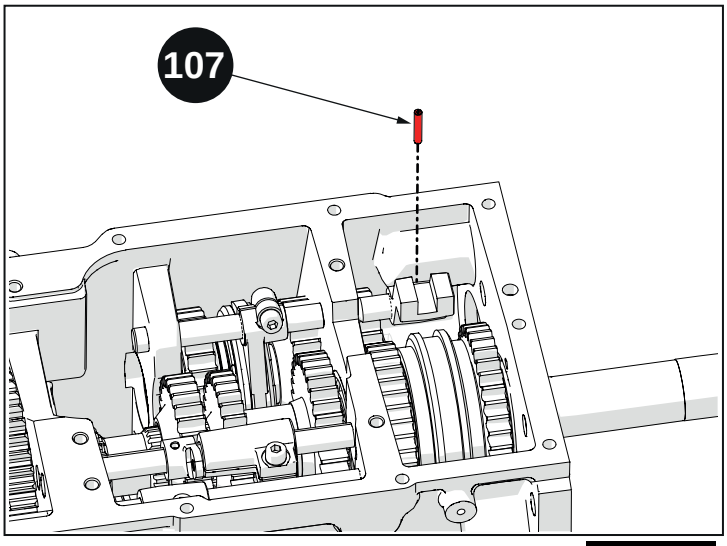

Fig. 4.16

Remove the rod (109), the fork (110) and the selector block (111).

Note

The screw on the head of the fork must be loosened in order to disengage the fork (110) from the rod (109).

Danger

When removing the rod (109), keep the hole in which the selector spring and ball are seated closed as the spring and ball may be projected out forcefully and cause injury.

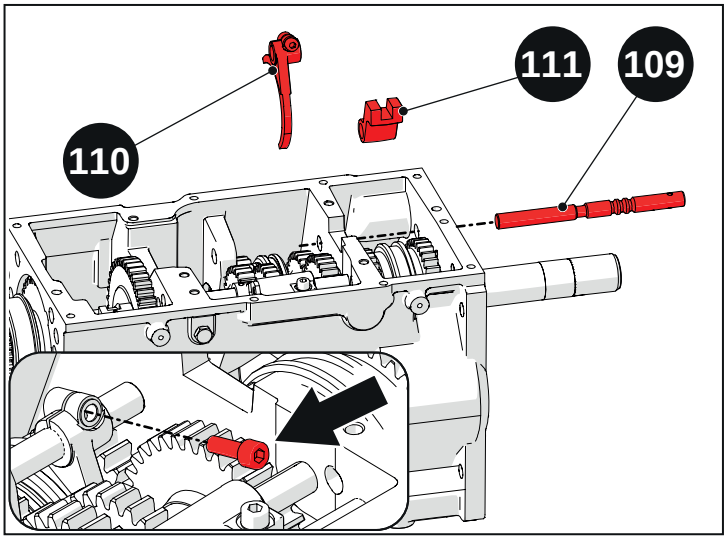

Fig. 4.17

Remove the spring (112) and the ball (113).

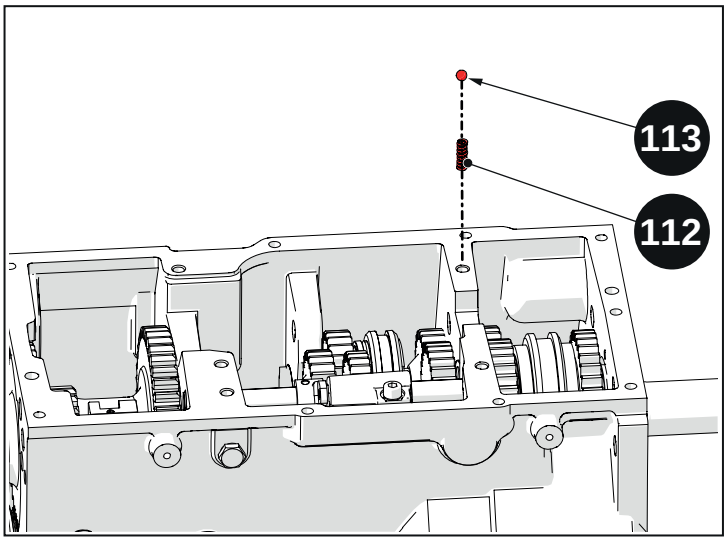

Fig. 4.18

Remove the fastener pin (114).

> **Note**
>
> The pin (114) will remain in the gearbox casing. Retrieve the pin before continuing.

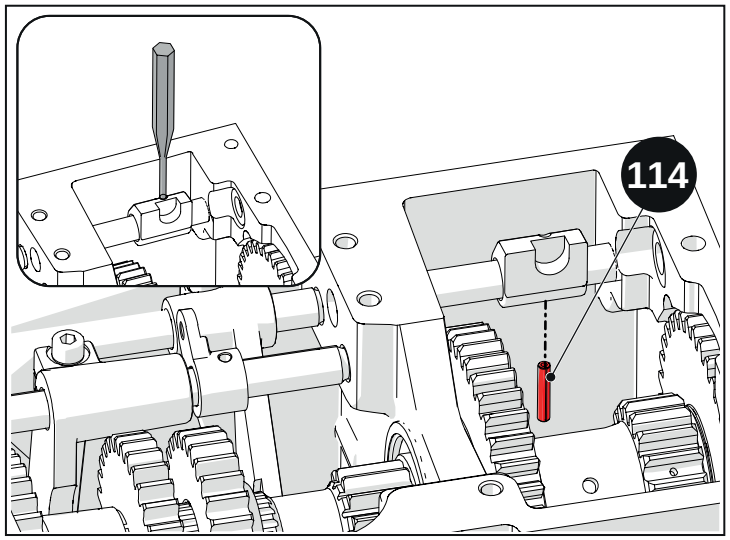

Fig. 4.19

Undo the position retainer screw on the fork.

Remove the rod (115) and the selector block (116).

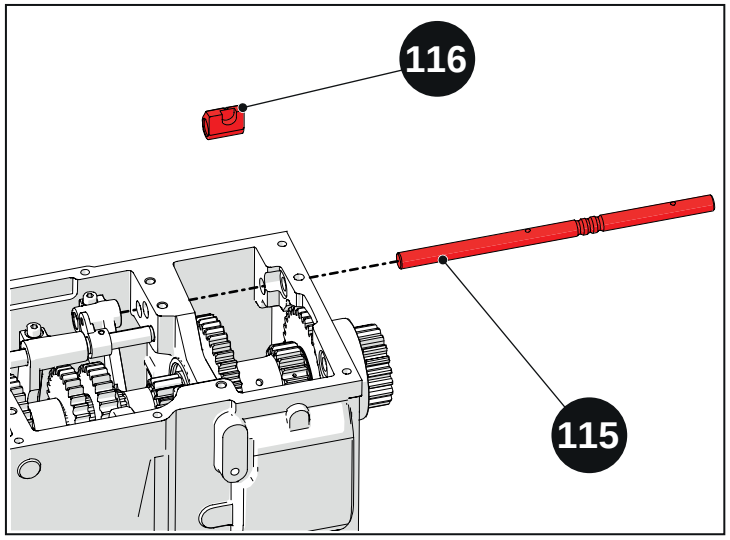

Fig. 4.20

Remove the complete assembly, consisting of the following components, from the gearbox casing:

- End part of primary shaft (28);
- Anti-friction bush (29);
- Bearing (27);
- Circlip (26);
- Gear (25);
- Spacer (24);
- Bush (23);

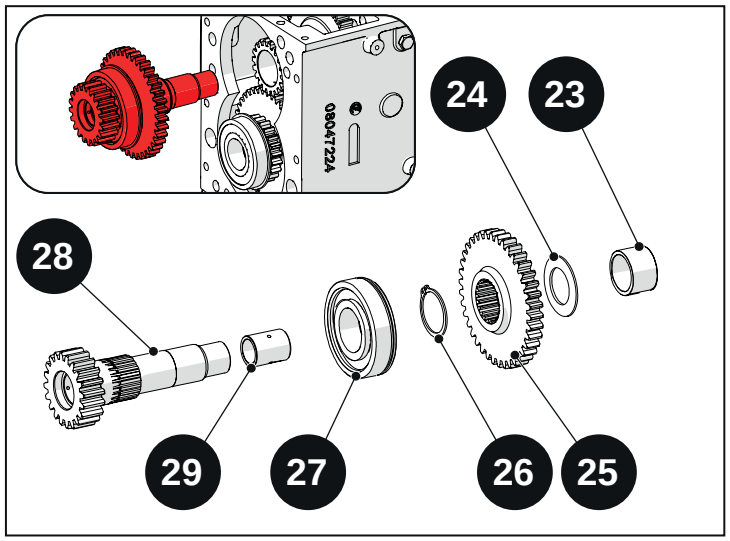

Fig. 4.21

Remove the end part of the secondary shaft complete with:

- Bearing (35);
- Spacer (36);
- Gear (39);
- Spacers (38);
- Roller bearing cages (37);
- Selector sleeve (40);

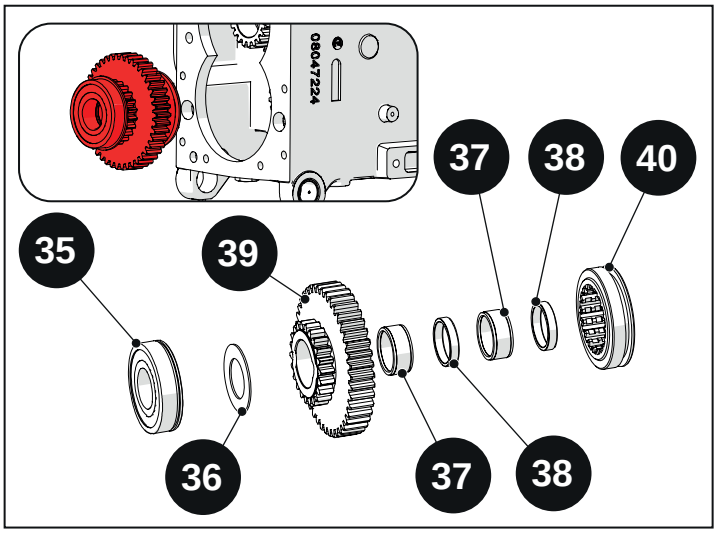

Fig. 4.22

Remove the gear (22).

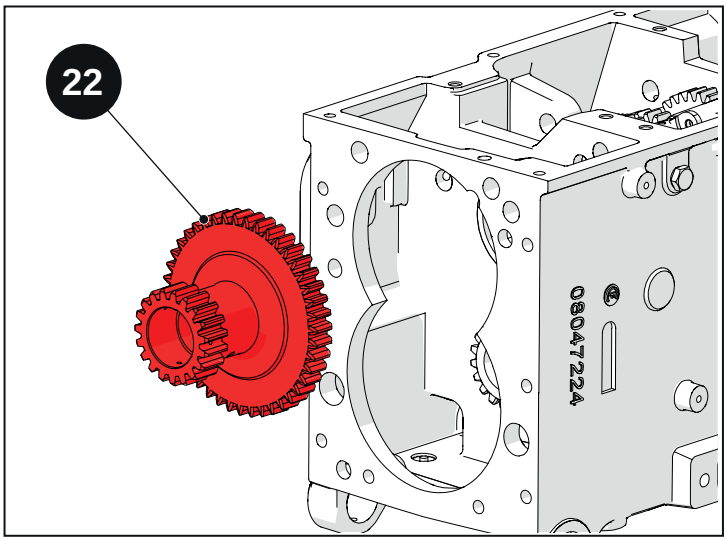

Fig. 4.23

Undo the position retainer screw on the fork.

Remove the rod (117) and the sleeve (118).

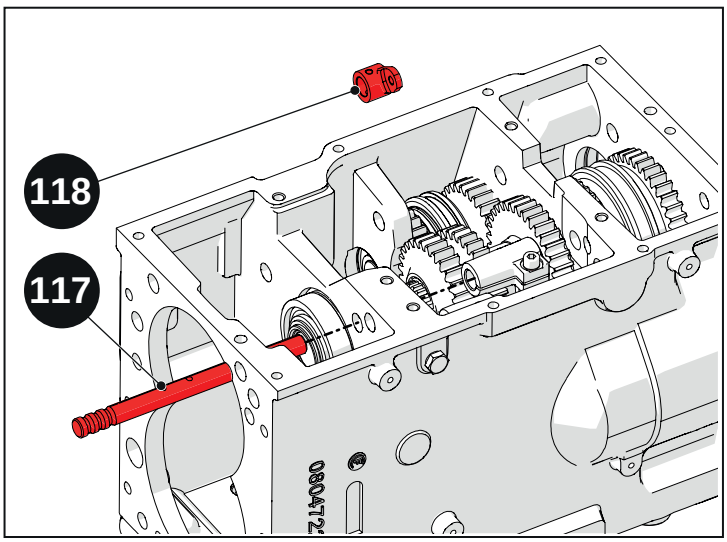

Fig. 4.24

Remove the front primary gearbox shaft (2) complete with bearing (3), spacer (4), roller bearing cage (6), bush (8) and oil seal (9).

Note

The bush (8) and the oil seal (9) will remain in the shaft.

Remove the circlip (5) and the roller bearing cage (58) left in the gear assembly.

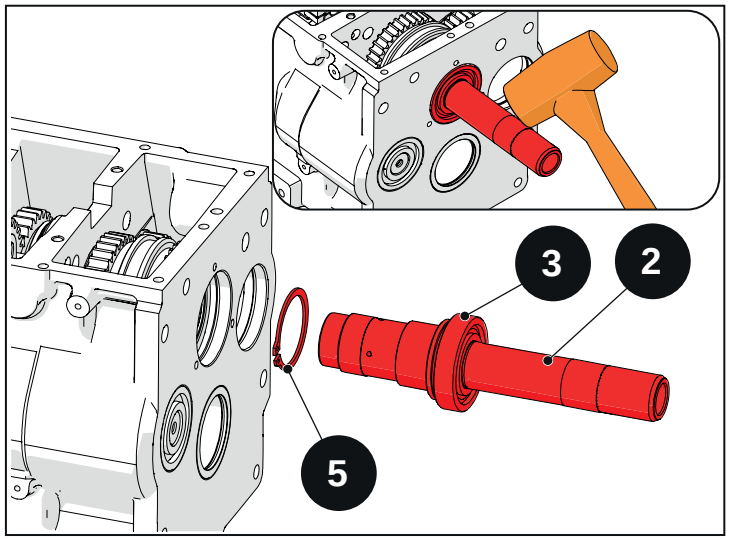

Fig. 4.25

Remove the circlip (33).

the bearing (34), the spacer (21) and the bearing (20).

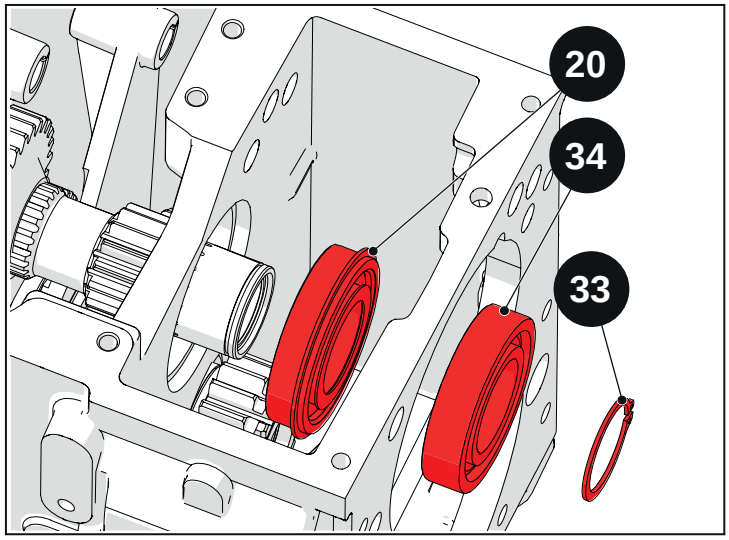

Fig. 4.26

Remove the circlip (18) from its seat to allow greater freedom of movement for the centre part of the primary shaft.

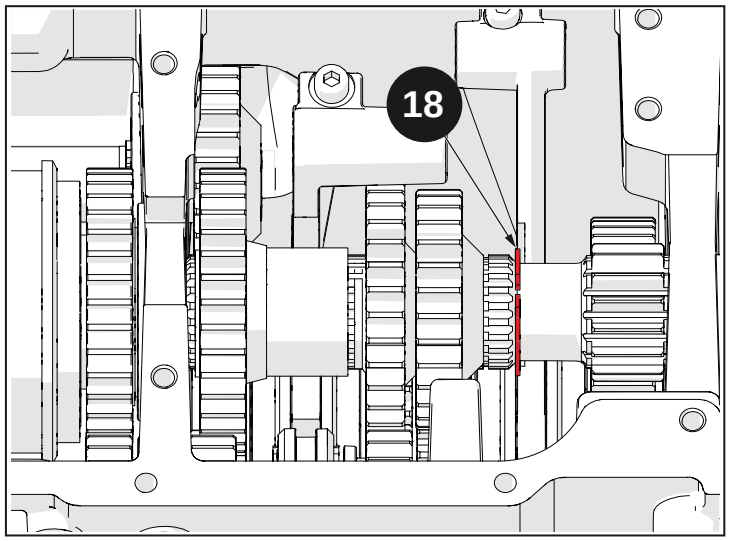

Fig. 4.27

Remove the reverse shuttle gear assembly, consisting of the following components:

- Reverse shuttle gear (59);
- Synchroniser (7);
- Gear (57);
- Shim (10);

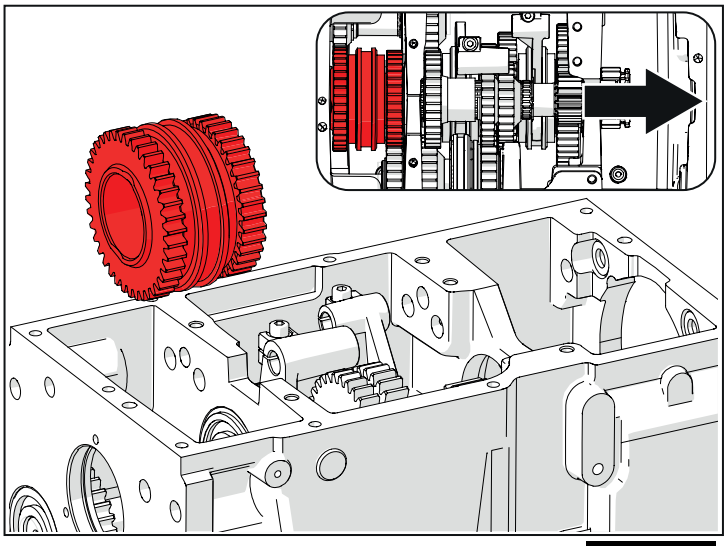

Fig. 4.28

Remove the bearing (56).

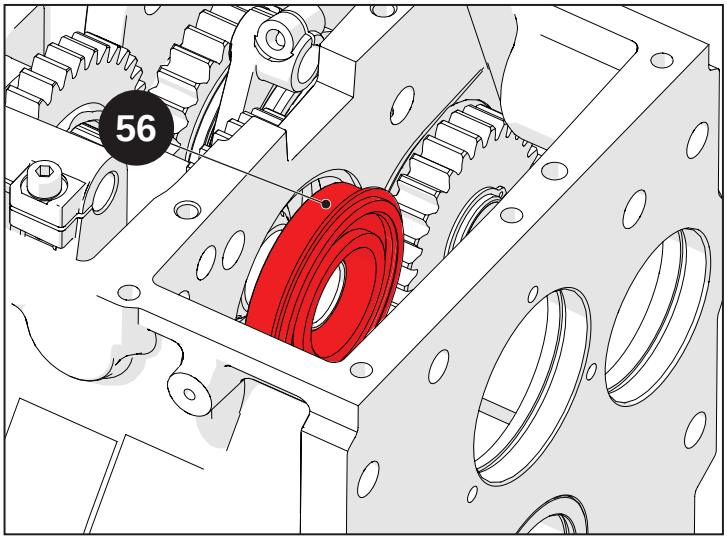

Fig. 4.29

Remove the centre part of the primary shaft (19), together with the circlip (18) and the gears.

The gear assembly consists of the following:

- Gear (12);
- Lubrication tube (14);
- Lubrication bush (13);
- Gear (16);
- Gear (17);
- Circlip (11);

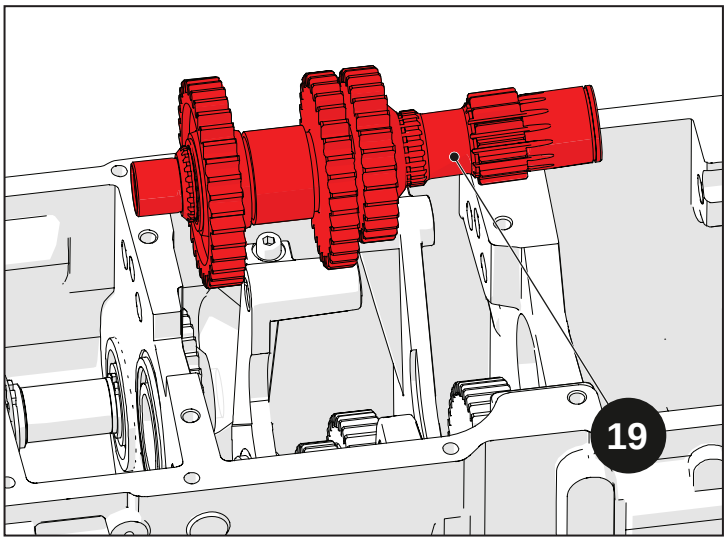

Fig. 4.30

Remove the fork (119) and the fork (120).

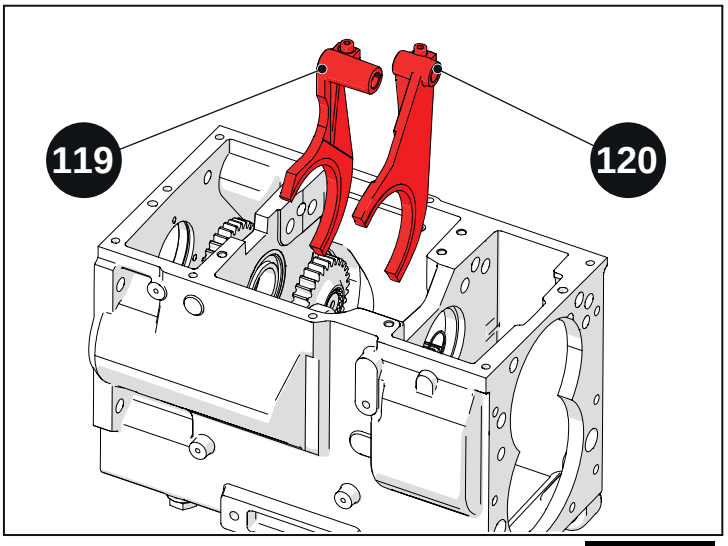

Fig. 4.31

Remove the circlip (60).

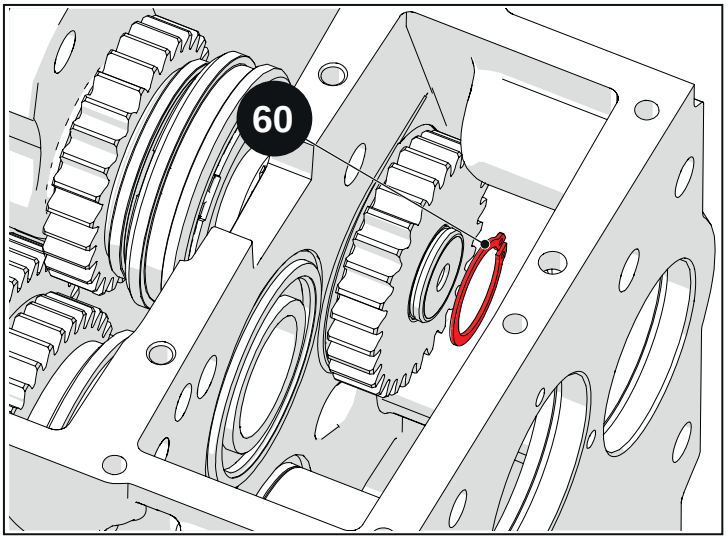

Fig. 4.32

Remove the gear (62).

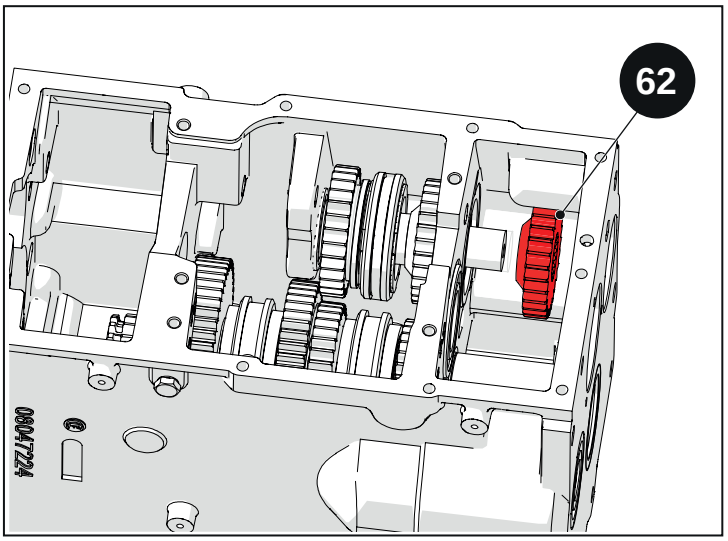

Fig. 4.33

Remove the circlip (63) retaining the bearing (64) in the gearbox casing.

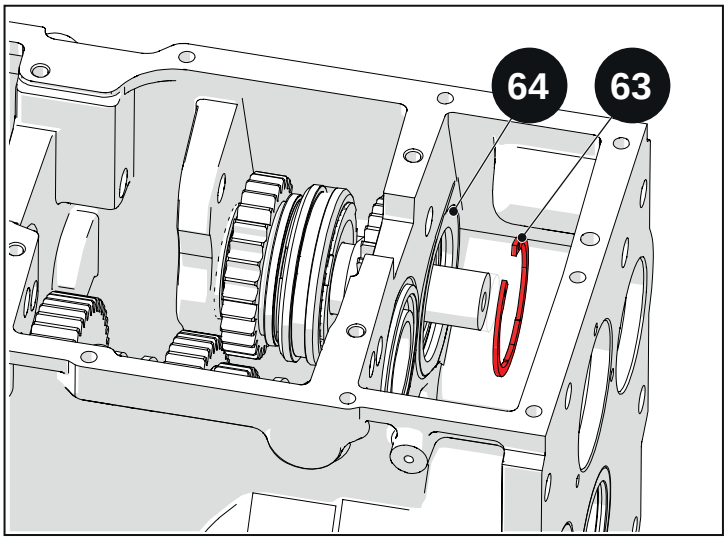

Fig. 4.34

Fit the puller tool to the intermediate shaft (61) and pull the shaft out from the casing together with the bearing (64) and the shim (65).

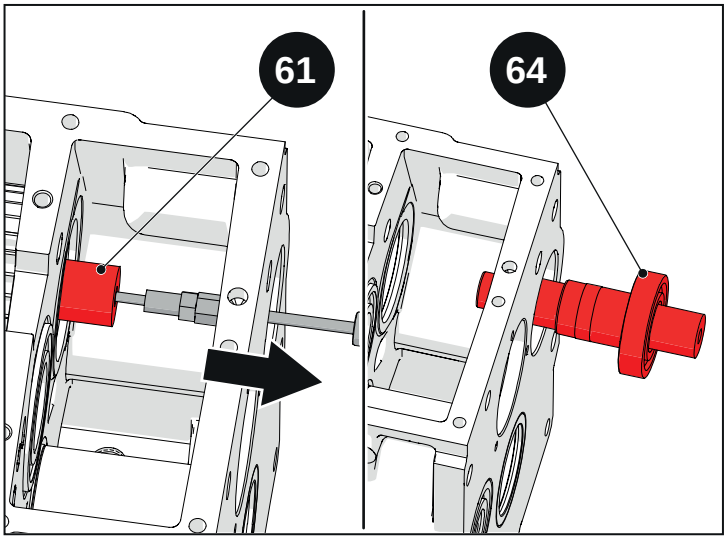

Fig. 4.35

The intermediate shaft gear assembly, consisting of the following components, may now be removed:

- Low gear (72);
- Roller bearing cage (66);
- Synchroniser (71);
- Roller bearing cage (67);
- High gear (70);
- Spacer (69);

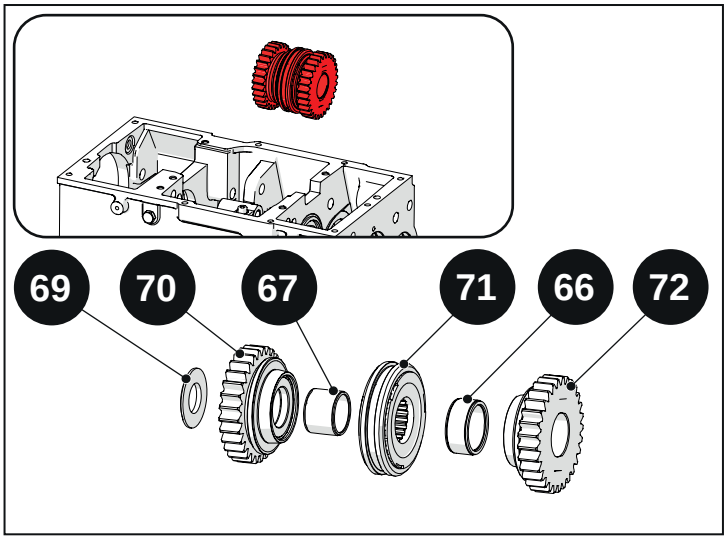

Fig. 4.36

Remove the bearing from its seat (68).

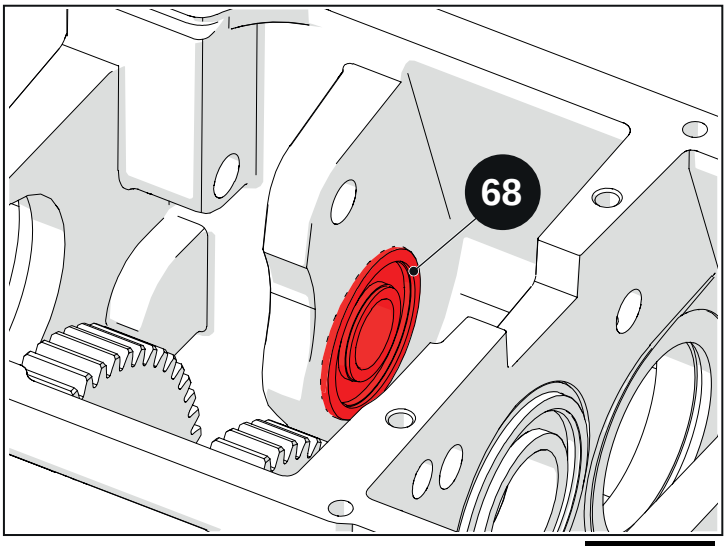

Fig. 4.37

Remove the circlip (79).

Remove the circlip (81) and the circlip (80) retaining the bearing (76) from their seats to free the reverse shuttle shaft.

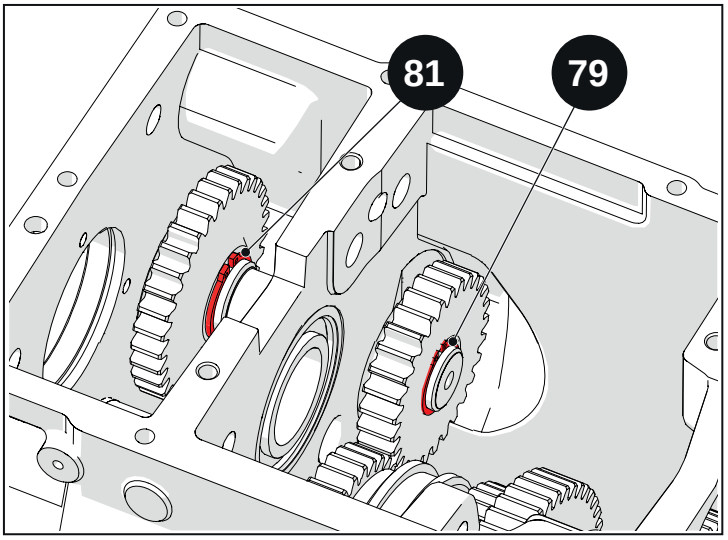

Fig. 4.38

Use the puller tool to remove the shaft (74) together with the bearing (73).

Remove the gear (78).

Remove the gear (75), the circlip (81) and the circlip (80).

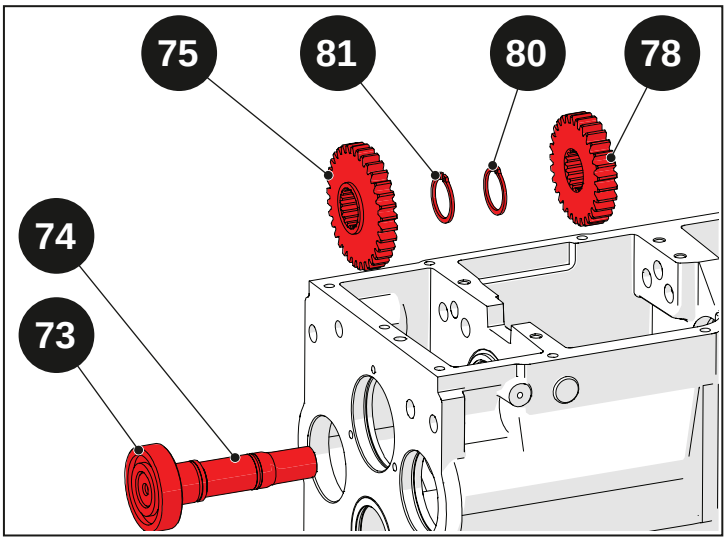

Fig. 4.39

Remove the bearing from its seat (76).

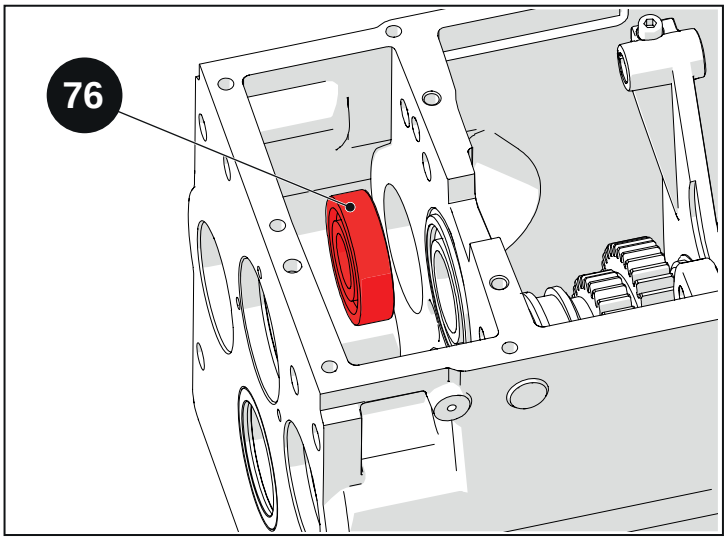

Fig. 4.40

Remove the bearing from its seat (56).

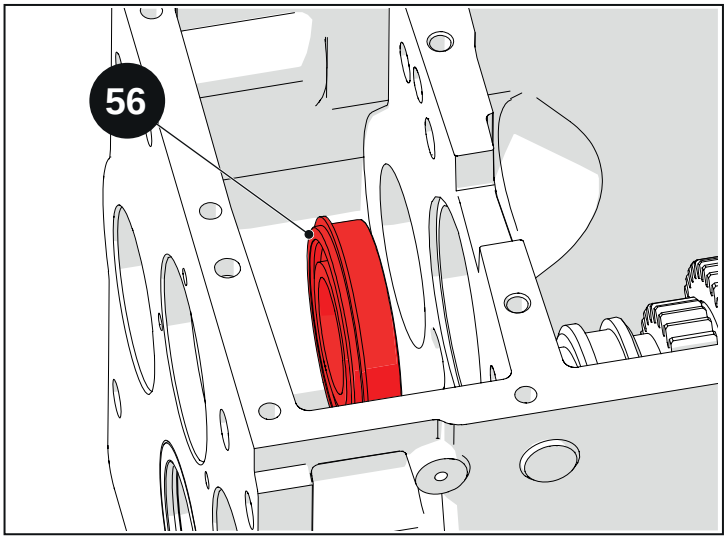

Fig. 4.41

Remove the spacer (55).

Note

To facilitate removal, tap the rear end of the secondary shaft with a punch tool in soft material and a mallet.

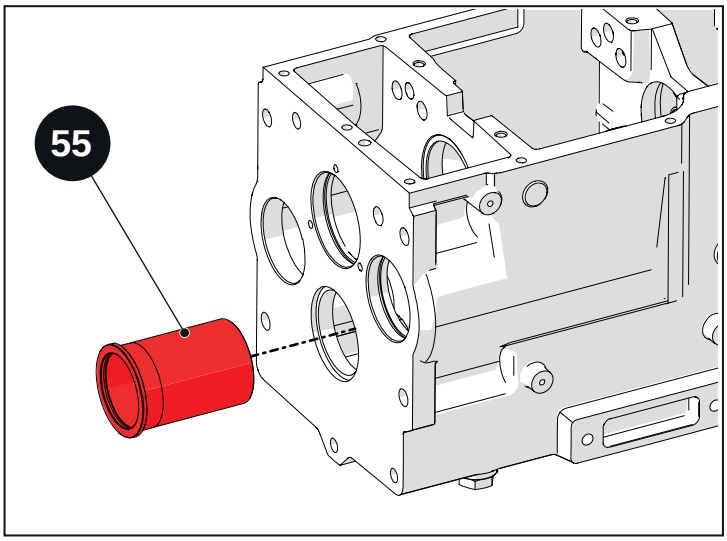

Fig. 4.42

Use the tool (A-07007955) to immobilise the secondary shaft (54).

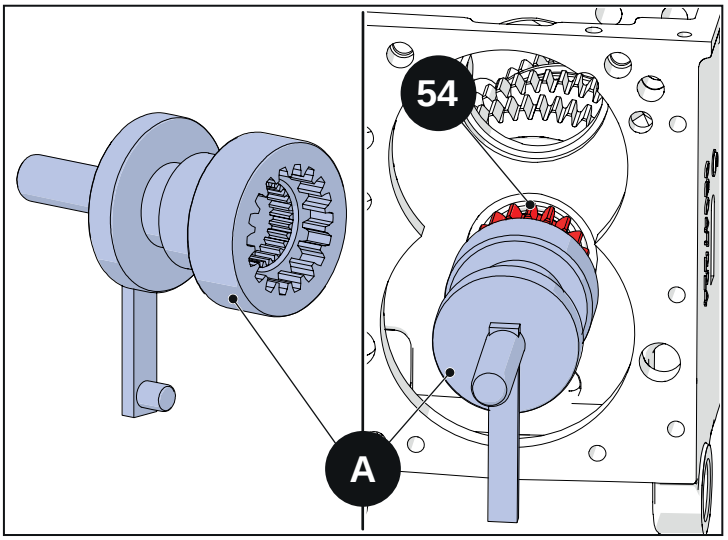

Fig. 4.43

Use the tool (F-07000240) to undo and remove the ring nut (53)

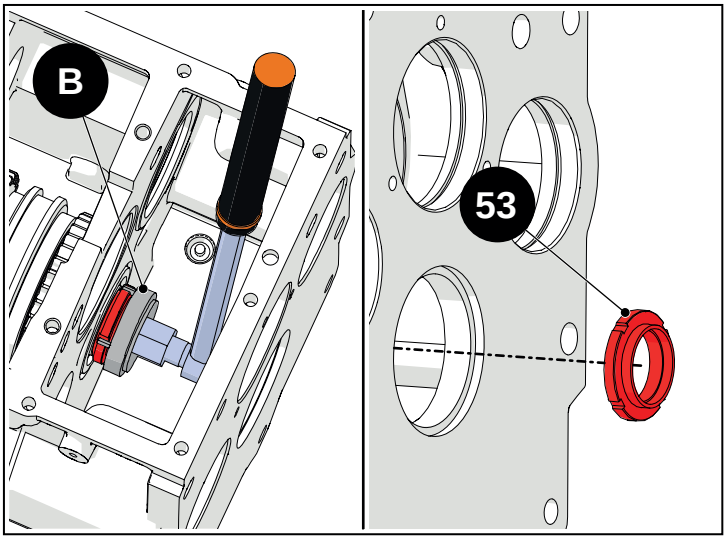

Fig. 4.44

Remove the secondary shaft (54) with the bearing (52).

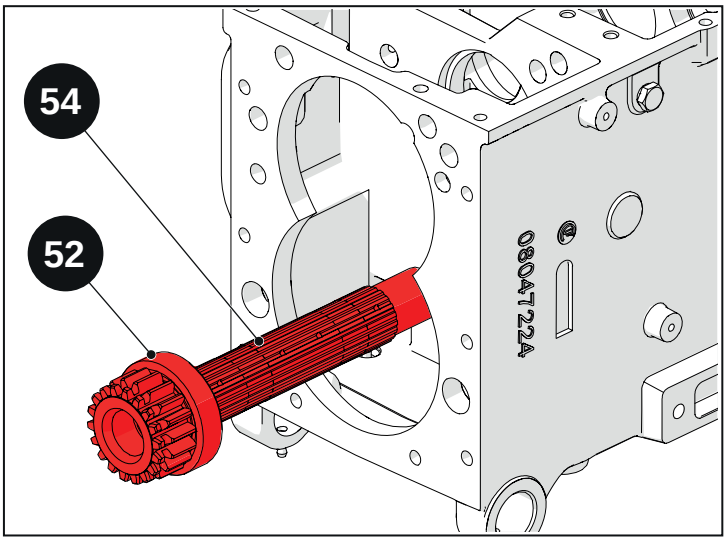

Fig. 4.45

Remove the entire gear assembly of the secondary shaft:

- Spacer (51);
- Lubrication bush (50);
- 4th speed gear (49);
- Synchroniser (48);
- 3rd speed gear (47);
- Spacer (46);
- 2nd speed gear (45);
- Synchroniser (44);
- 1st speed gear (43);
- Spacer (42);

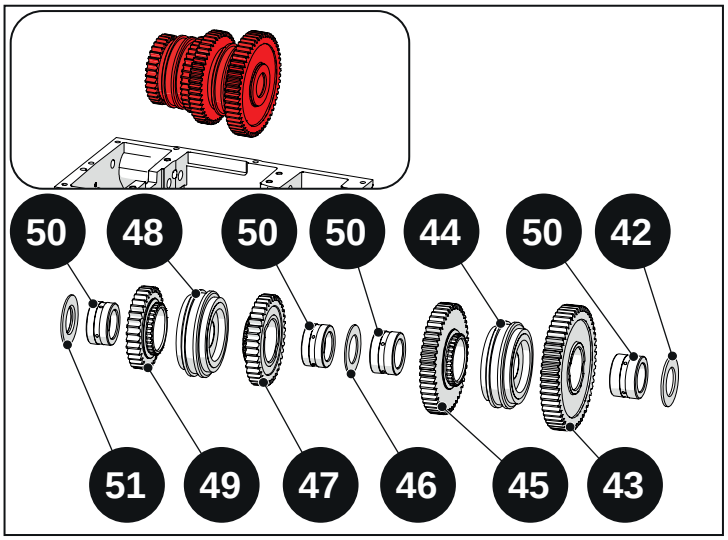

Fig. 4.46

Remove the bearing from its seat (41).

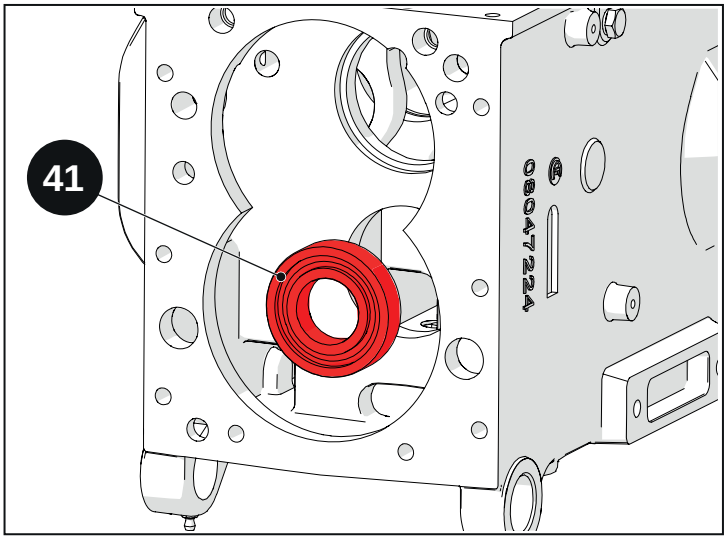

Fig. 4.47

Unscrew and remove the plug (121) with the washer (122), and then remove the impediment pin (123).

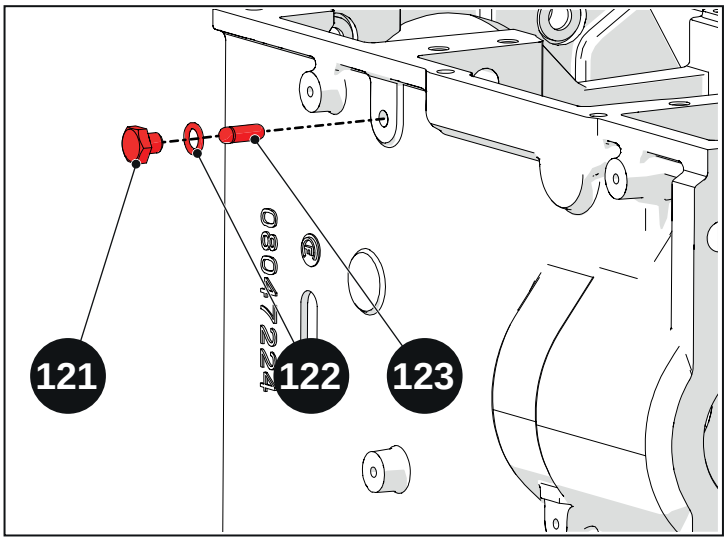

Fig. 4.48

4.5 Main inspection, reassembly and adjustment procedures

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4.5.1 Main inspection, reassembly and adjustment procedures.....4-28

4.5.1 Main inspection, reassembly and adjustment procedures

Warning

Read the instructions in chapter "1-Introduction" and, in particular, the sections concerning the installation of O-rings, oil seals and bearings, with particular care before reassembling, and follow these instructions precisely when working.

Apply the correct tightening torques when tighten the fasteners of components. If no specific tightening torques are indicated, refer to the relative table in chapter "1-Introduction".

Use the specified sealant products during reassembly. If no specific sealant products are indicated, refer to the relative table in chapter "1-Introduction".

Fit the impediment pin (123), the washer (122) and the plug (121).

Warning

Apply a layer of SILICONE sealant to the sealing perimeter of the plug (121).

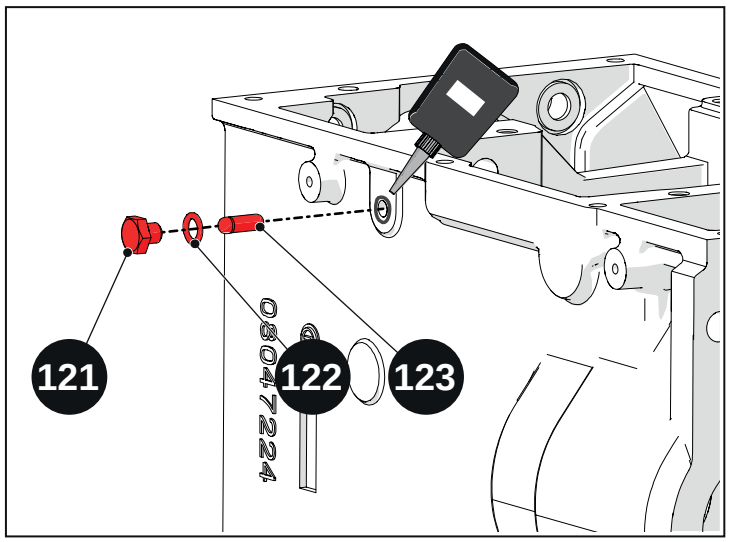

Fig. 4.49

Use the tool (D-07007954) to restrain the synchronisers in order to fit the 2 complete gear assemblies correctly without them accidentally dismantling.

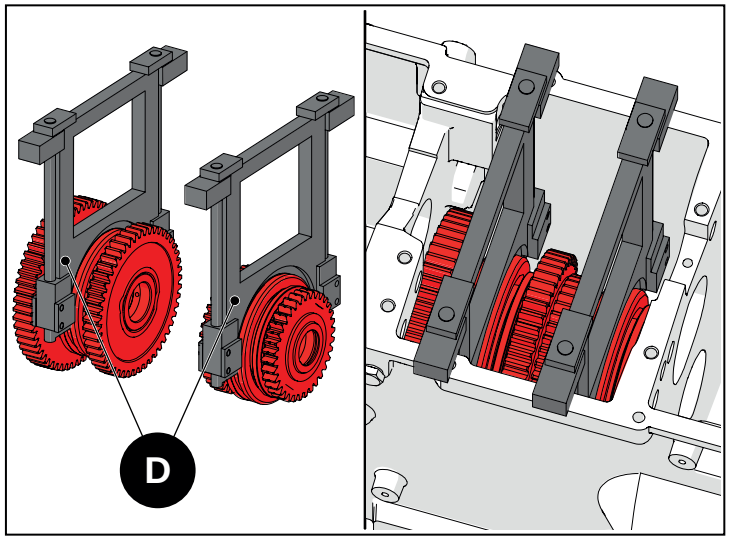

Fig. 4.50

Use the tool (E-07007957) to fit the spacer (46) between the two gear assemblies without dropping it.

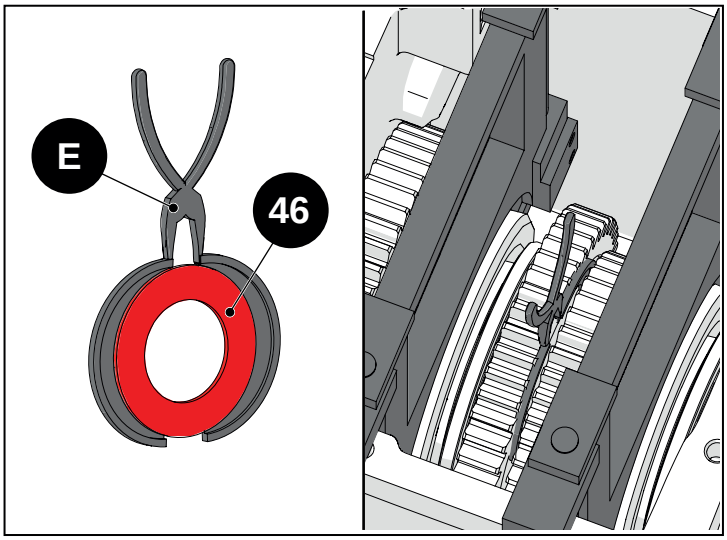

Fig. 4.51

Fit the secondary shaft (54) complete with the bearing (52) and the spacer (42).

Use the tool (F-07007956) to facilitate fitment of the shaft (54) into the gearbox casing.

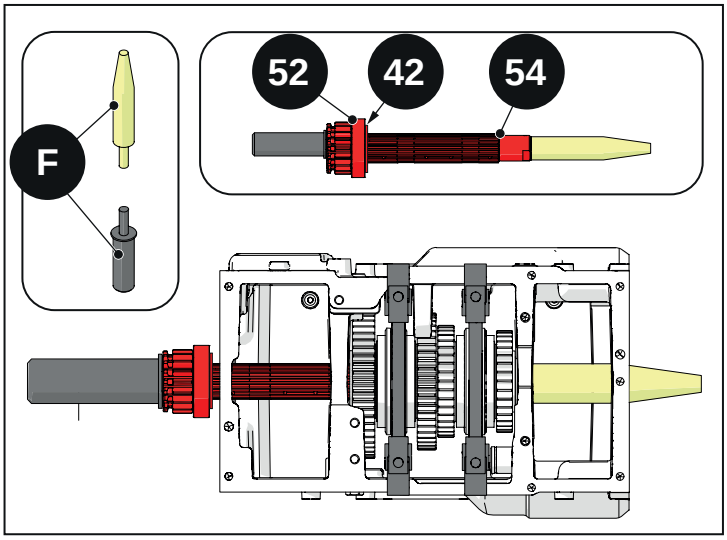

Fig. 4.52

Fit the spacer (51) and the bearing (41).

Warning

Make sure that the spacer (51) is fitted the right way around.

The recessed side must face towards the bearing to permit lubrication.

Warning

Use a punch tool of suitable diameter to drive the bearing (41) into its seat.

As the shaft (54) can move, fit a suitable spacer on the side opposite the bearing to immobilise it.

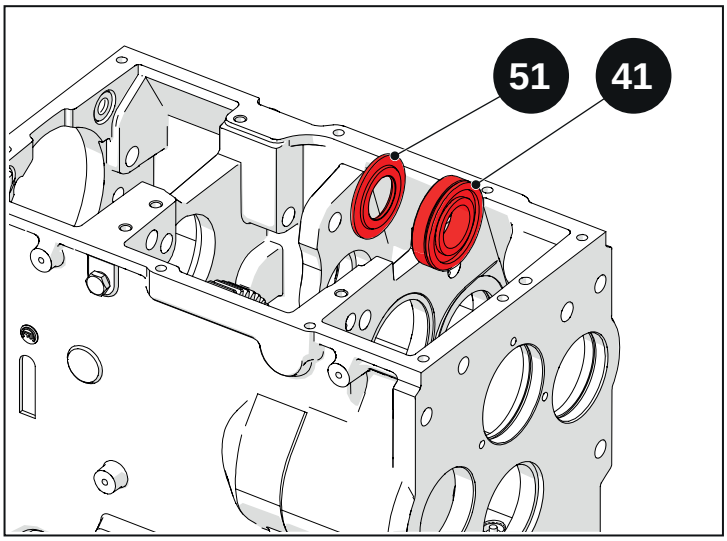

Fig. 4.53

The tools (D) and (E) may be removed once the shaft (54) has been fitted correctly into the gears.

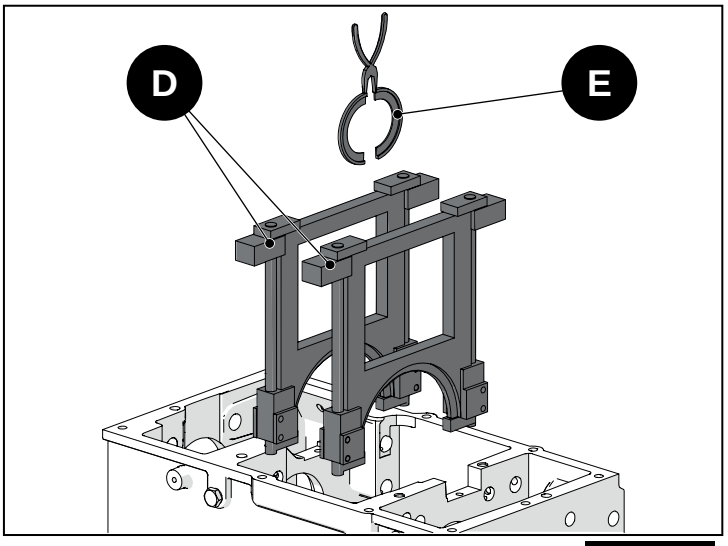

Fig. 4.54

Use the tool (A-07007955) to immobilise the secondary shaft (30).

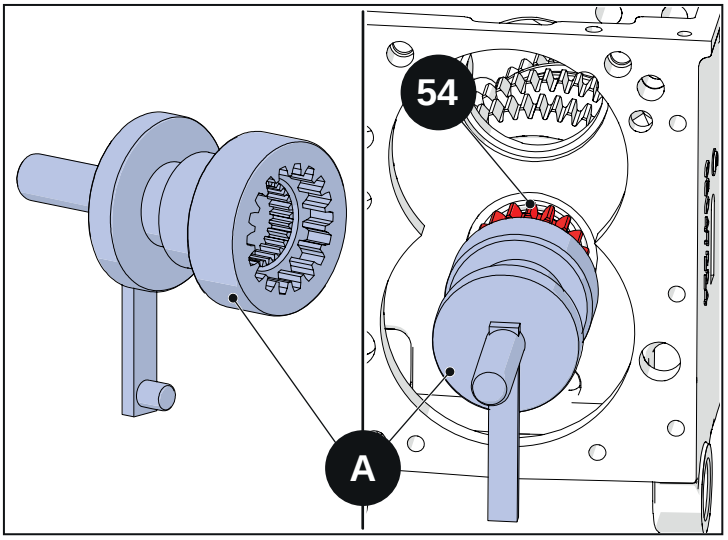

Fig. 4.55

Fit the ring nut (53).

Use the tool (B-07000240) to tighten the ring nut (53) to a torque of 100 N·m.

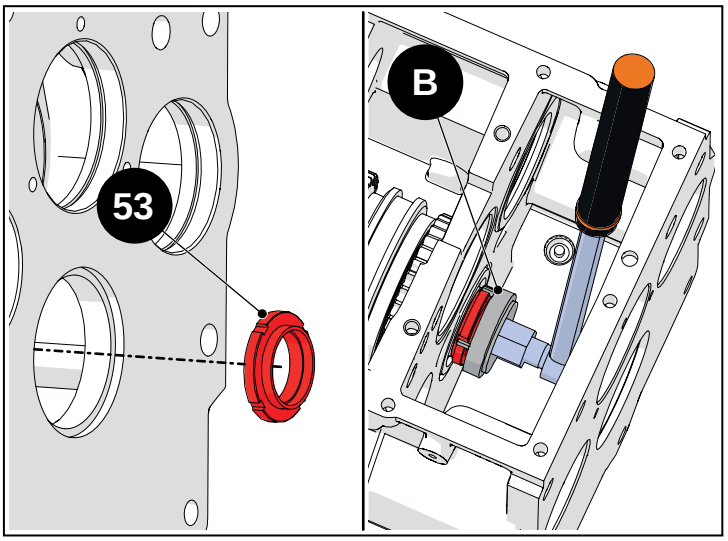

Fig. 4.56

Punch the edge of the ring nut (53) to bend it into the notch on the secondary shaft.

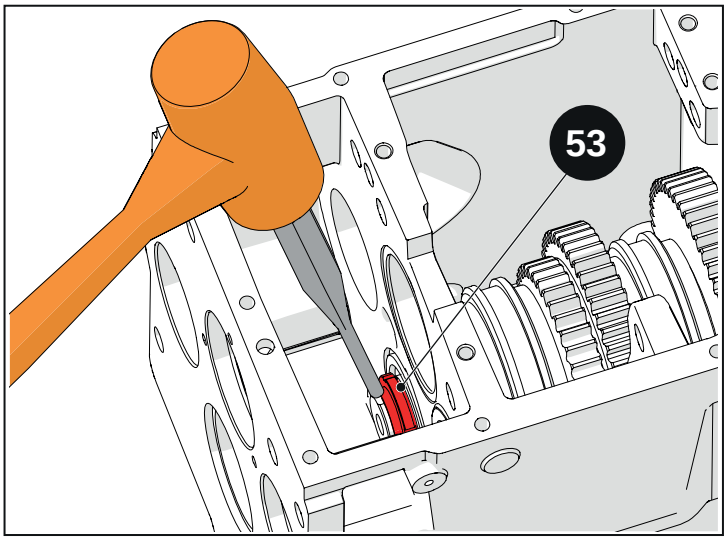

Fig. 4.57

Fit the bearing (56) in its seat with a bearing punch tool of suitable diameter.

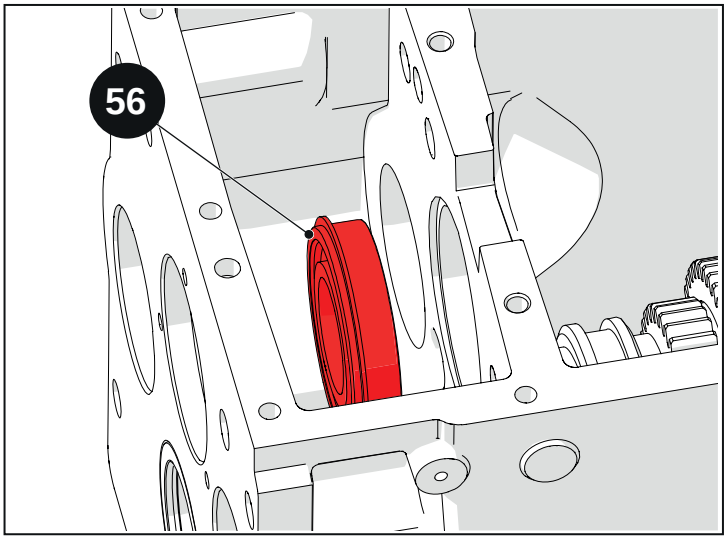

Fig. 4.58

Fit the bearing (76)

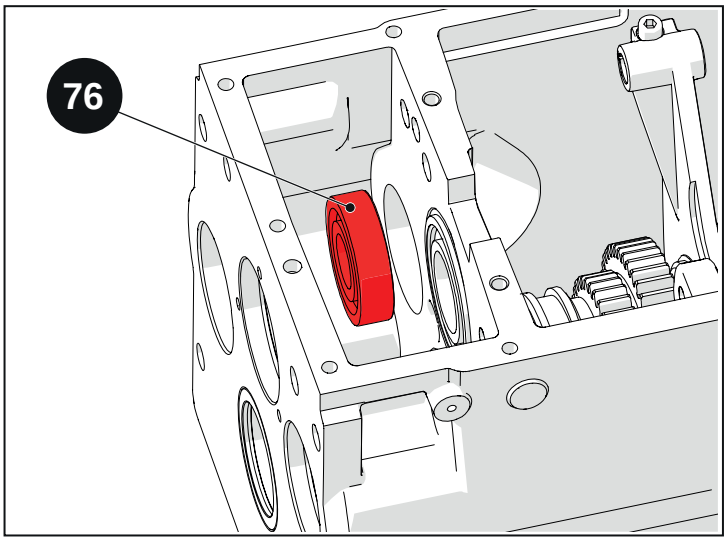

Fig. 4.59

Fit the gear (75), the circlip (81) and the circlip (80) in the gearbox casing.

Install the reverse shuttle shaft (74) complete with bearing (73).

Fit the circlip (81) and the circlip (80) in the respective seats.

Attention

Fit the gear (75) in the gearbox casing with the face with the chamfered top teeth edges facing towards the rear.

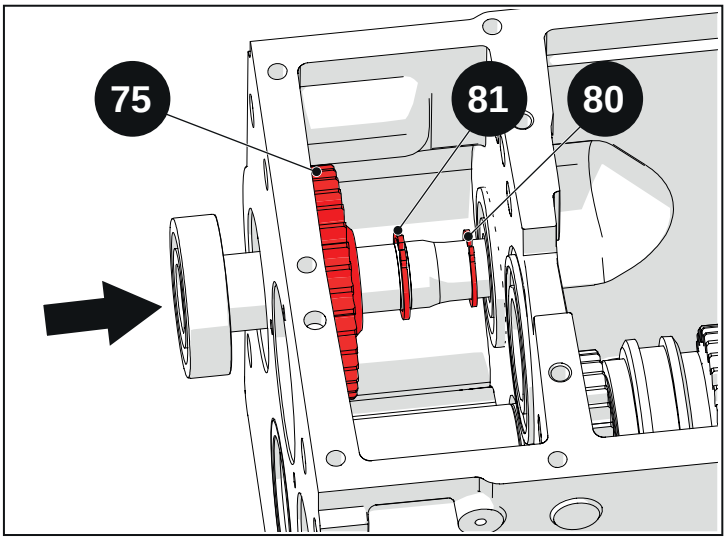

Fig. 4.60

Fit the gear (78), and then fit the circlip (79) to secure it in place.

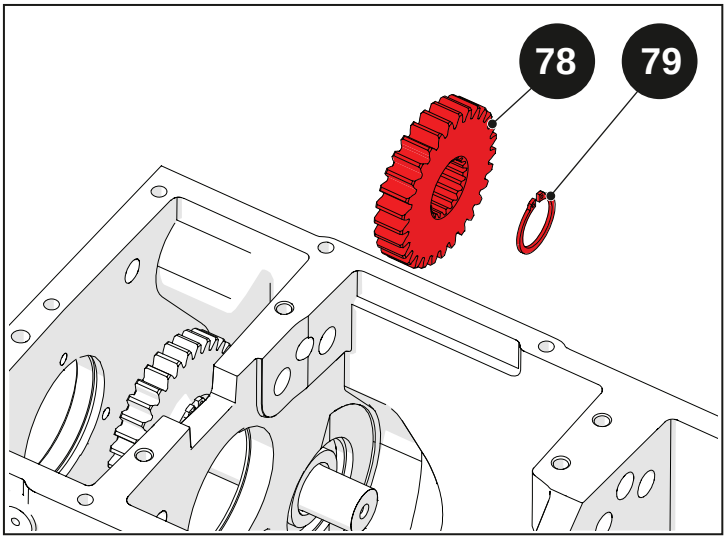

Fig. 4.61

Fit the bearing (68).

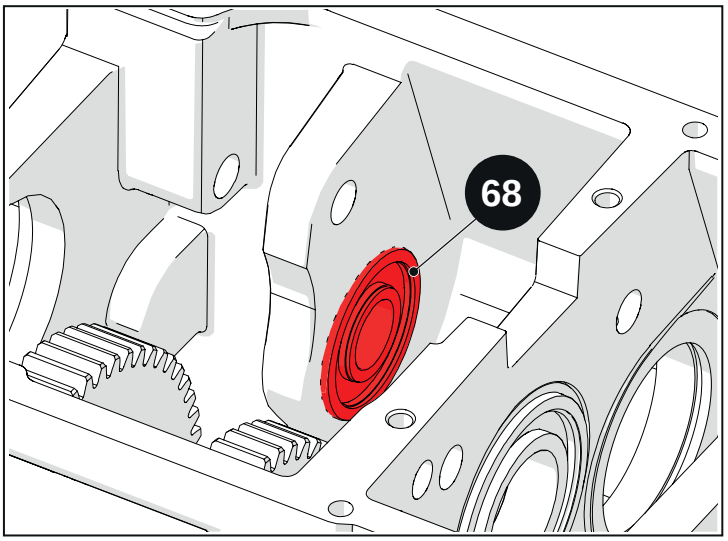

Fig. 4.62

Fit the gear assembly of the intermediate shaft.

Simultaneously, fit the intermediate shaft (61) complete with the bearing (64) and the shim (65).

Use a punch tool of suitable diameter in soft material and a mallet to drive the bearing (64) into its seat.

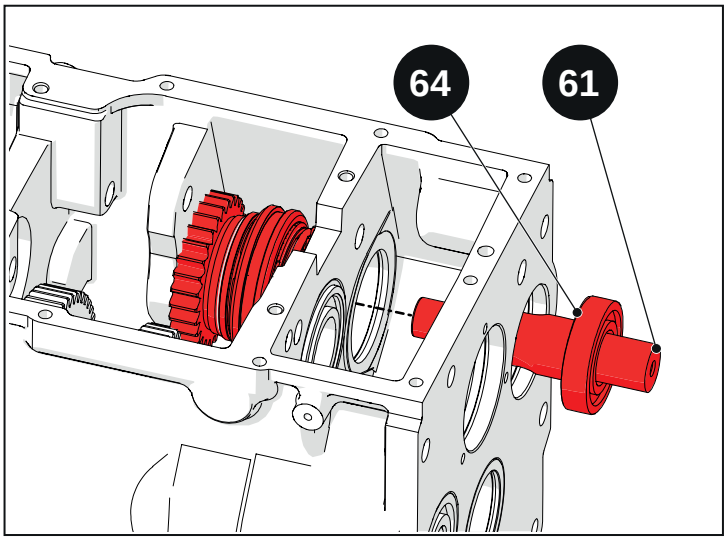

Fig. 4.63

Fit the circlip (63) to secure the bearing (64) in the gearbox casing.

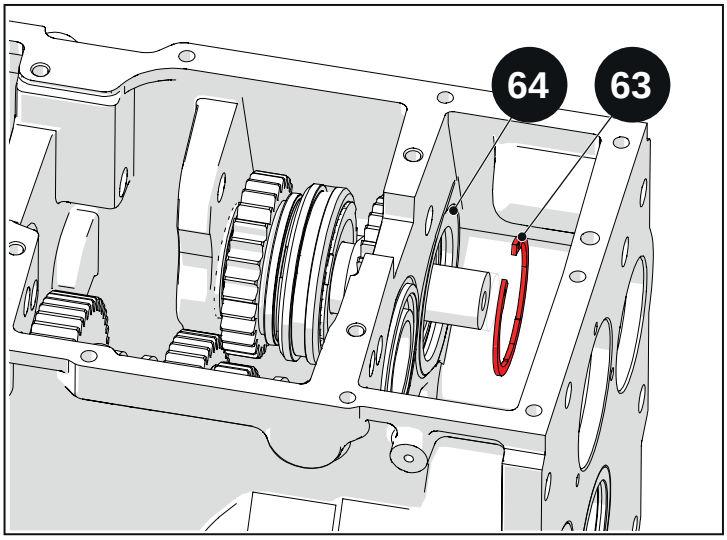

Fig. 4.64

Fit the gear (62).

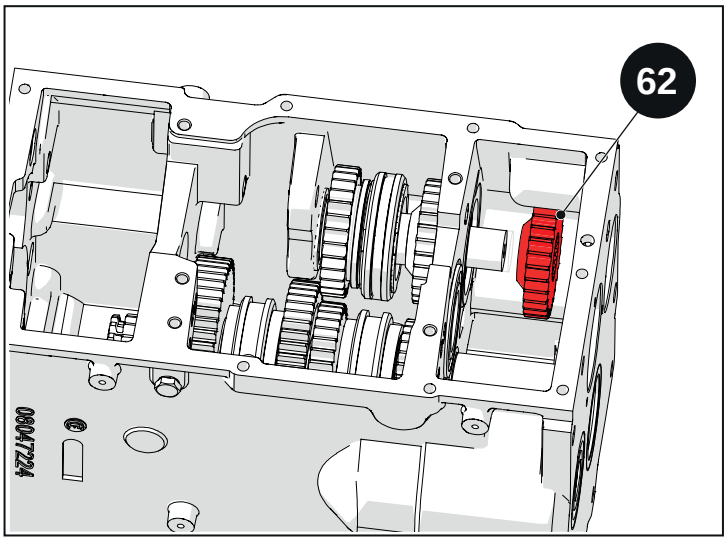

Fig. 4.65

Fit the circlip (60).

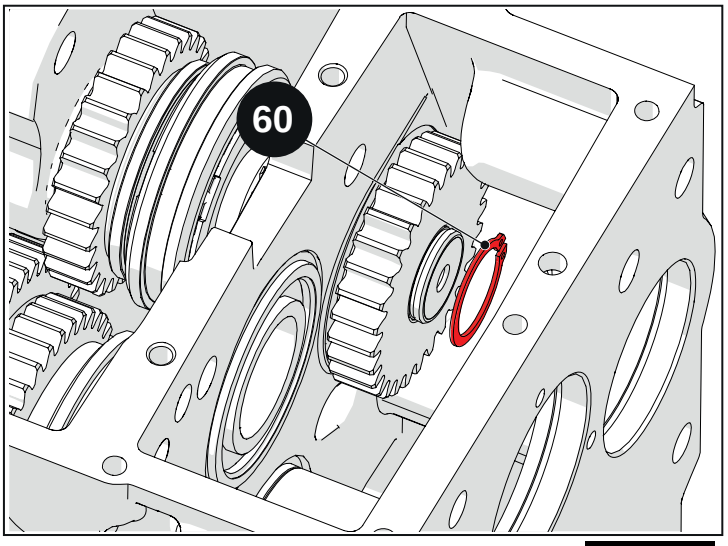

Fig. 4.66

Fit the fork (119) and the fork (120).

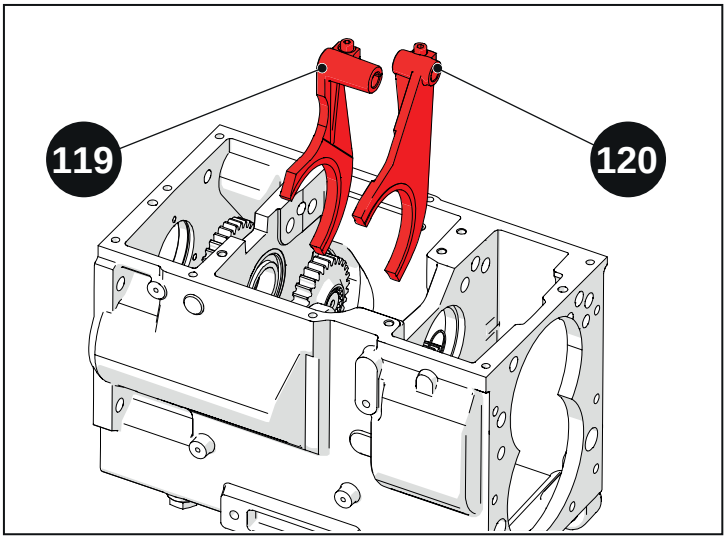

Fig. 4.67

Fit the circlip (18), the gear (17) and the gear (16) on the primary shaft (19).

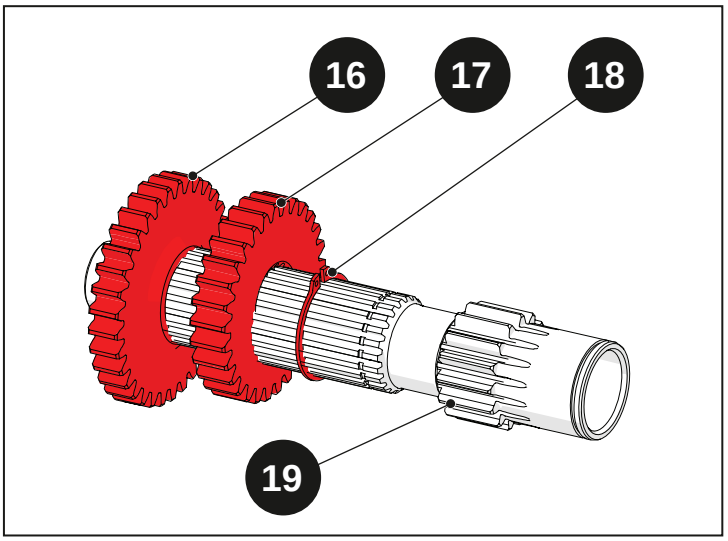

Fig. 4.68

Replace the O-rings (15).

Grease the O-rings (15) and then fit the lubrication bush (13), taking care not to damage the O-rings and the bush seal.

Complete assembly of the primary shaft (19) with the following components:

- Lubrication tube (14);
- Gear (12);
- Circlip (11);

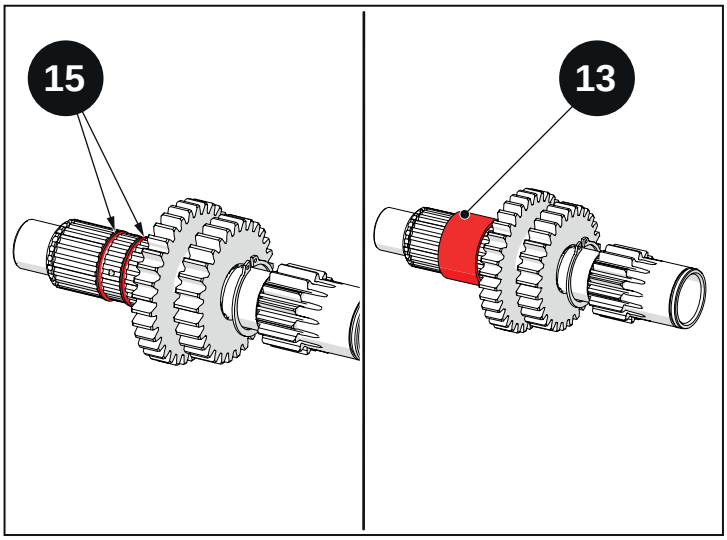

Fig. 4.69

Fit the completely assembled shaft (19) in the gearbox casing.

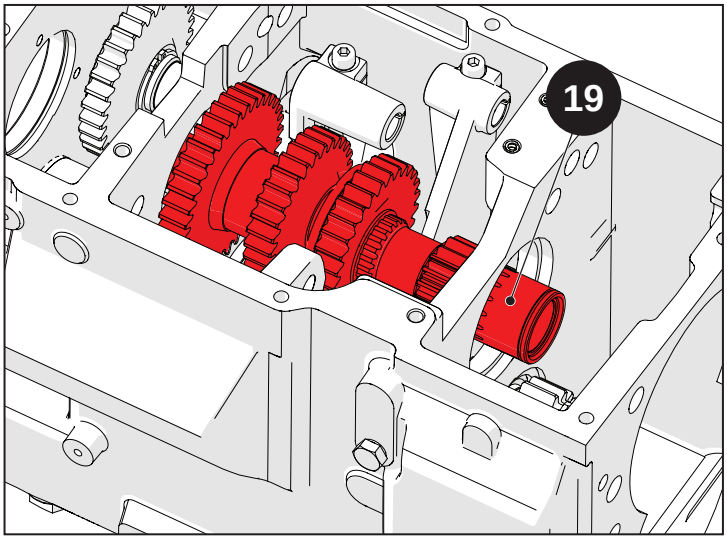

Fig. 4.70

Fit the bearing (56) in its seat.

Use a punch tool of suitable diameter in soft material and a mallet to drive the bearing (56) into its seat.

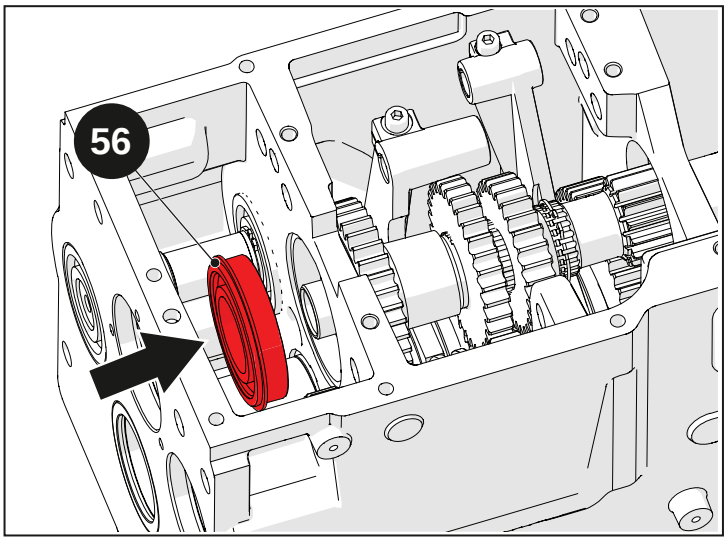

Fig. 4.71

Push the shaft (19) back to permit installation of the reverse shuttle and dual power gear assemblies.

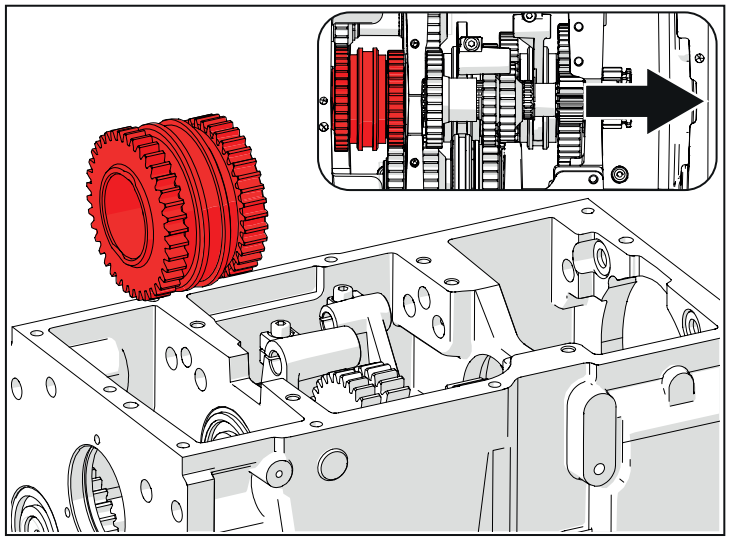

Fig. 4.72

Fit the bearings (20) and (34), with the spacer (21) in between, and drive into the seat with a suitable bearing punch tool.

Fit the circlip (33).

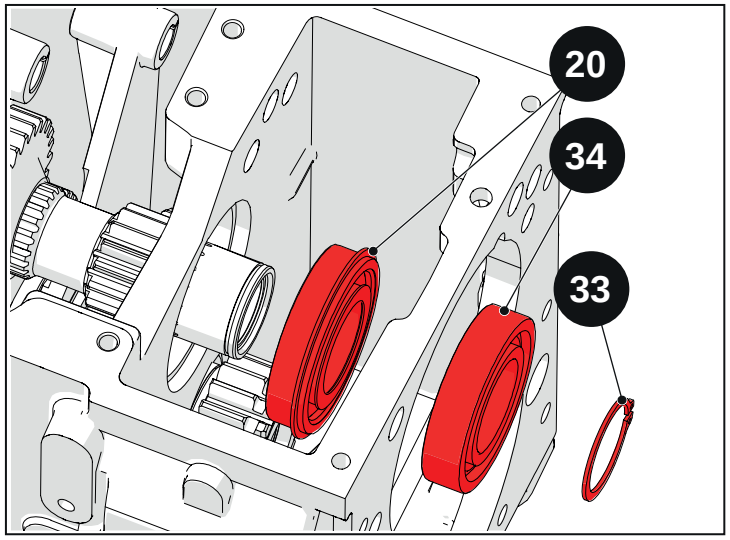

Fig. 4.73

Fit the circlips (18) and (11) to secure the gears in place on the shaft (19).

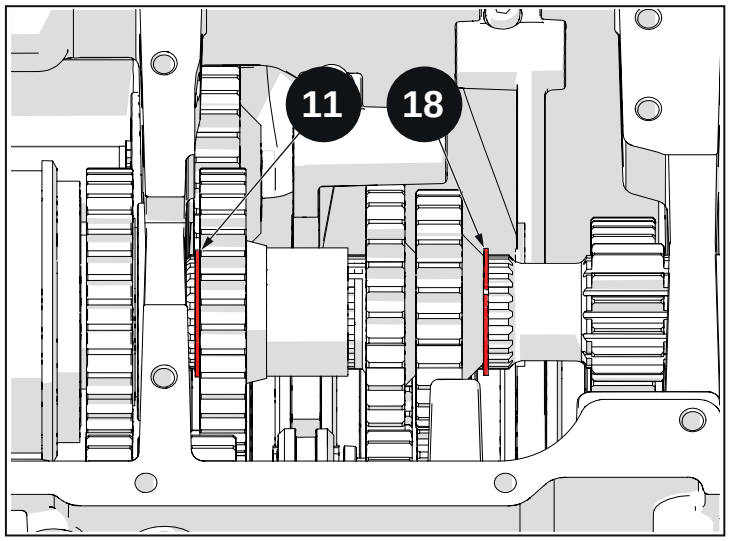

Fig. 4.74

Fit the circlip (5) in the gearbox casing and fit the roller bearing cage (58) in the primary shaft.

Note

Grease the seat of the roller bearing cage (58) before installing.

Fit the front primary gearbox shaft (2) complete with bearing (3), spacer (4), roller bearing cage (6), bush (8) and oil seal (9).

Tap the shaft (2) with a soft mallet to drive the bearing (3) completely into its seat.

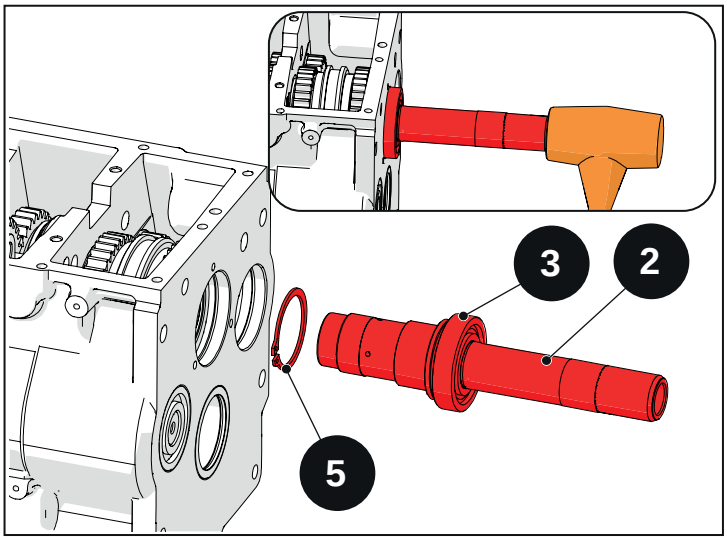

Fig. 4.75

Fit the spring (112) and the ball (113).

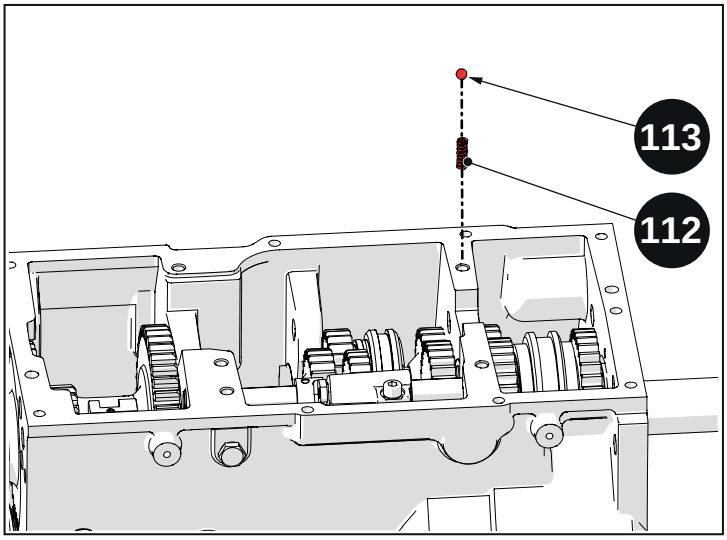

Fig. 4.76

Push and hold the spring (112) and ball (113) down with a pin punch or a drift, and simultaneously fit the rod (109), pushing it through the fork (110) and the selector block (111).

Slide the rod (109) in to align the groove with the fork (110), and then tighten the screw on the head of the fork to a torque of 35 N·m.

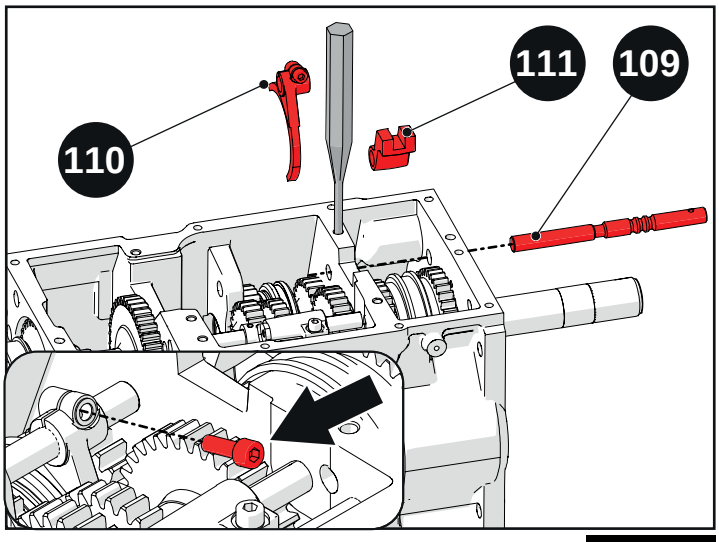

Fig. 4.77

Fasten the selector block (111) with the pin (107).

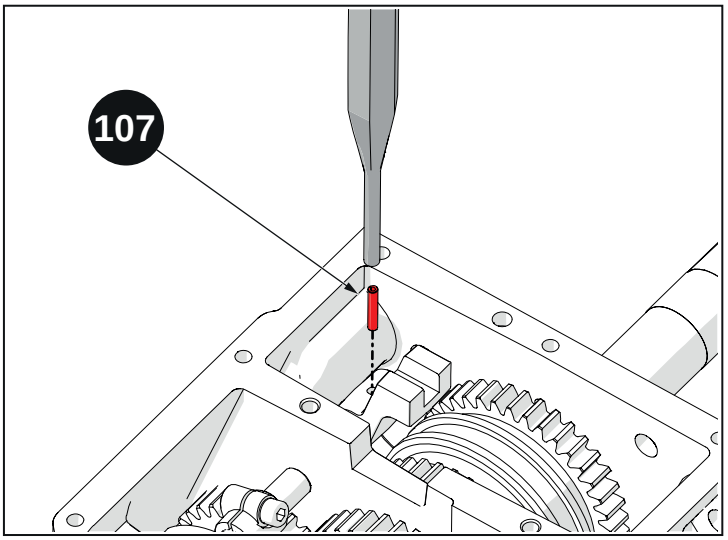

Fig. 4.78

Fit the spring (96) and the ball (95).

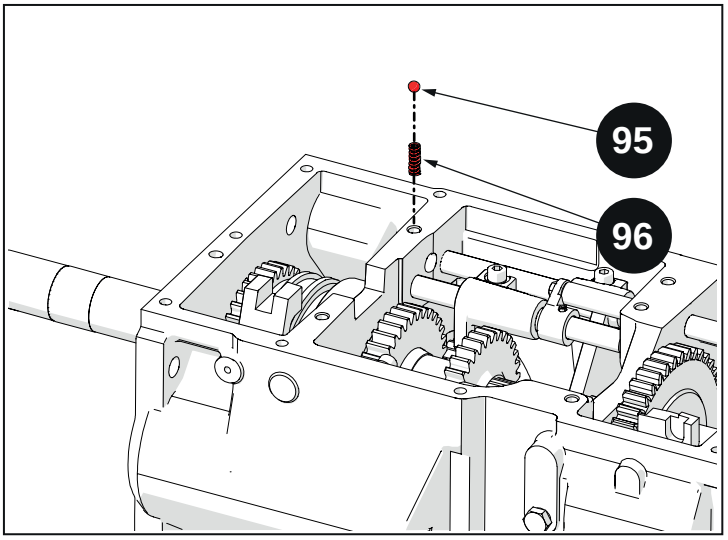

Fig. 4.79

Fit the rod (94) and the fork (93).

Push and hold the spring (96) down with a pin punch or a drift, and simultaneously push the rod (94) to drive the ball (95) into its seat.

Tighten the screw on the head of the fork (93) to a torque of 35 N·m to secure the rod (94).

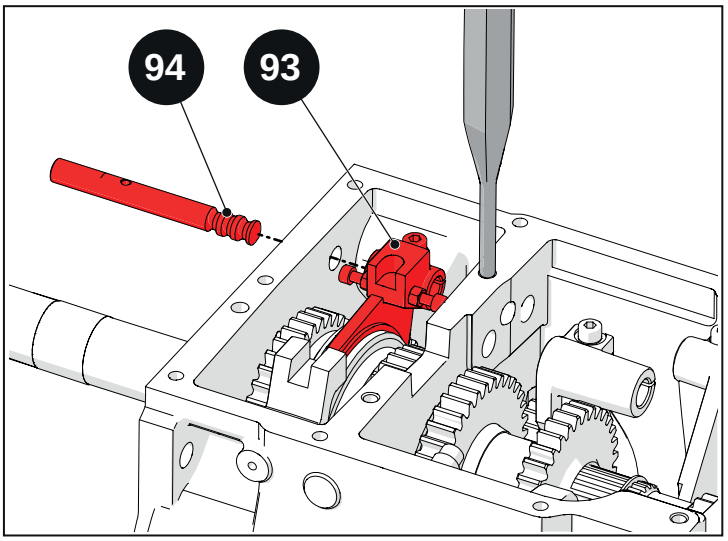

Fig. 4.80

Fit the rod (117) and the sleeve (118).

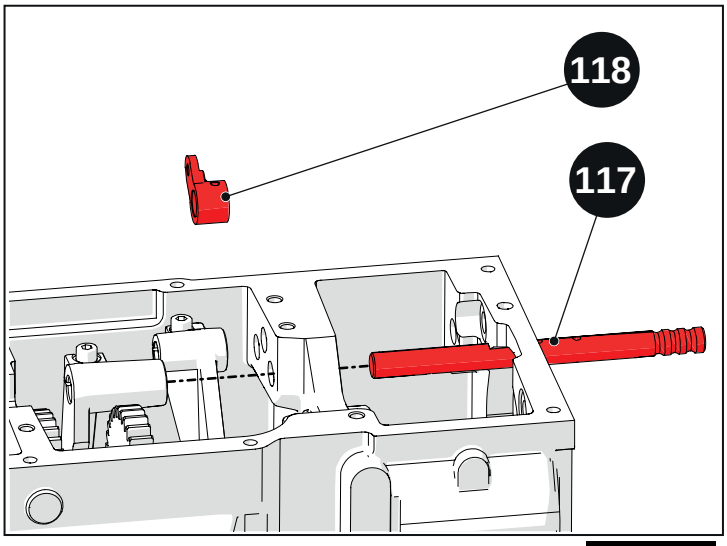

Fig. 4.81

Secure the sleeve (118) with the fastener pin (100).

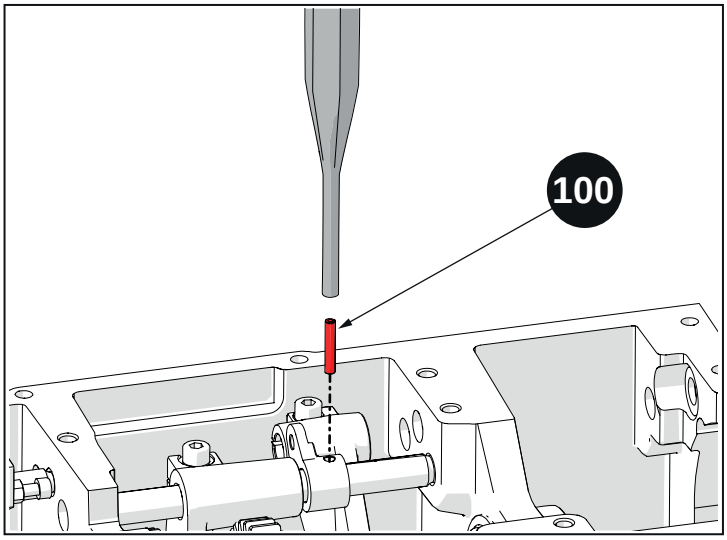

Fig. 4.82

Fit the control rod (99) and then secure in place by fitting the washer (98) and the screw (97).

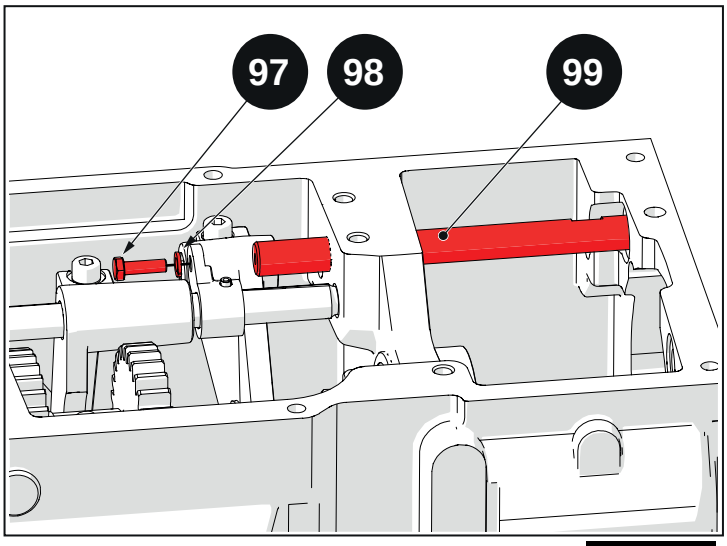

Fig. 4.83

Fit the rod (115) and the selector block (116).

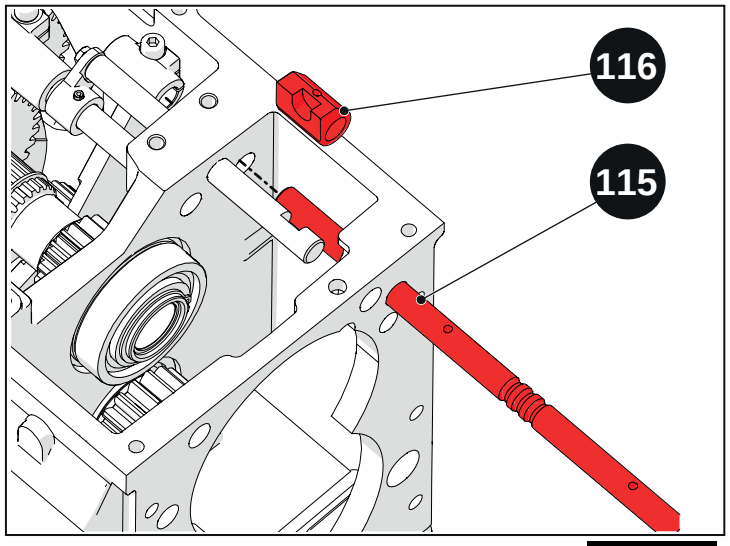

Fig. 4.84

Fit the pin (107) to secure the selector block (116) in place.

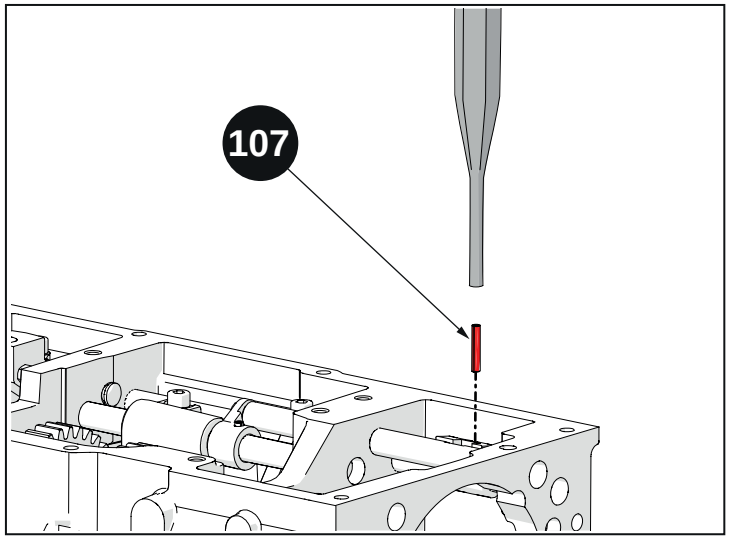

Fig. 4.85

Fit the selector (40).

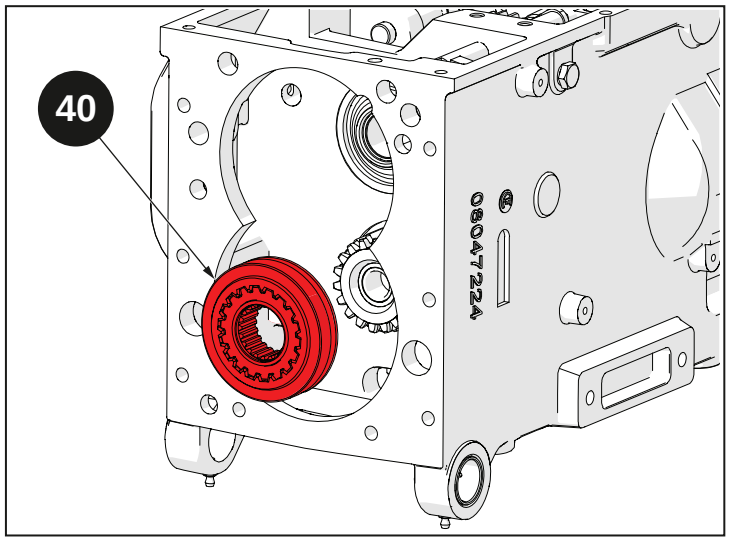

Fig. 4.86

Fit the rod (105) and selector fork of the underdrive gear (106).

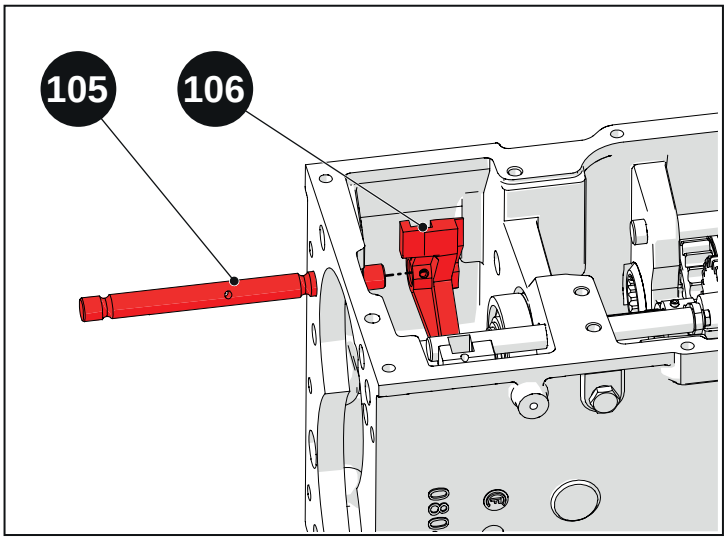

Fig. 4.87

Fit the gear (22).

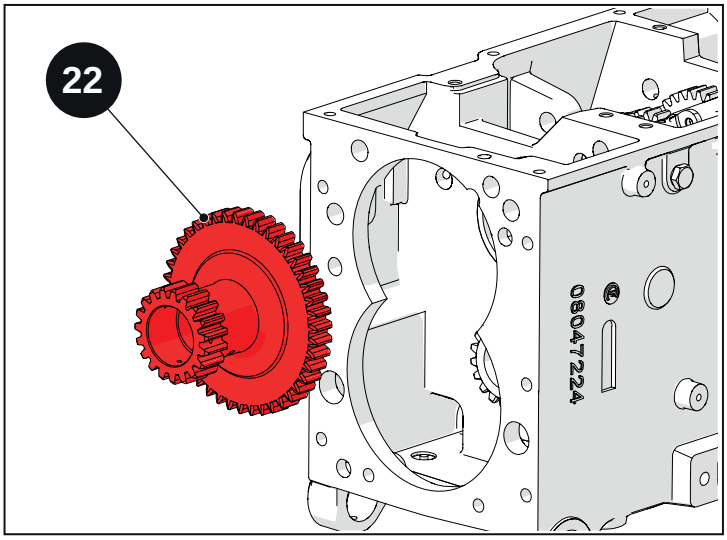

Fig. 4.88

Fit the end part of the secondary shaft complete with:

- Spacer (36);
- Gear (39);
- Spacers (38);
- Roller bearing cages (37);

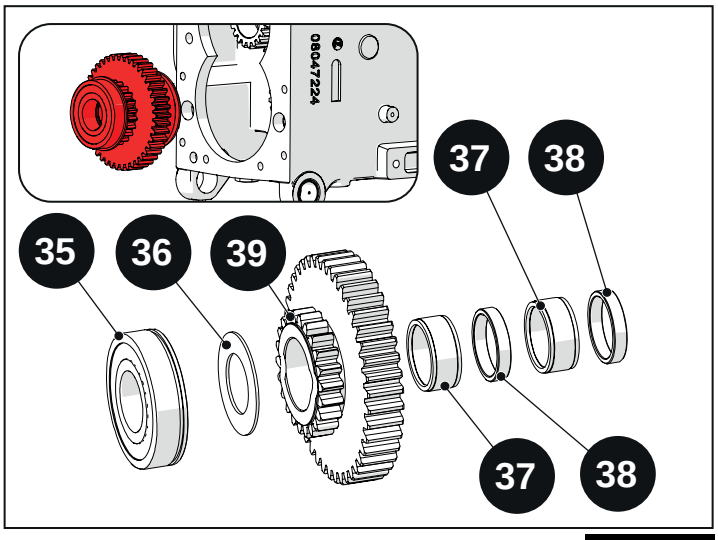

Fig. 4.89

Fit the complete assembly, consisting of the following components, in the gearbox casing:

- End part of primary shaft (28);
- Anti-friction bush (29);
- Bearing (27);
- Circlip (26);
- Gear (25);
- Spacer (24);
- Bush (23);

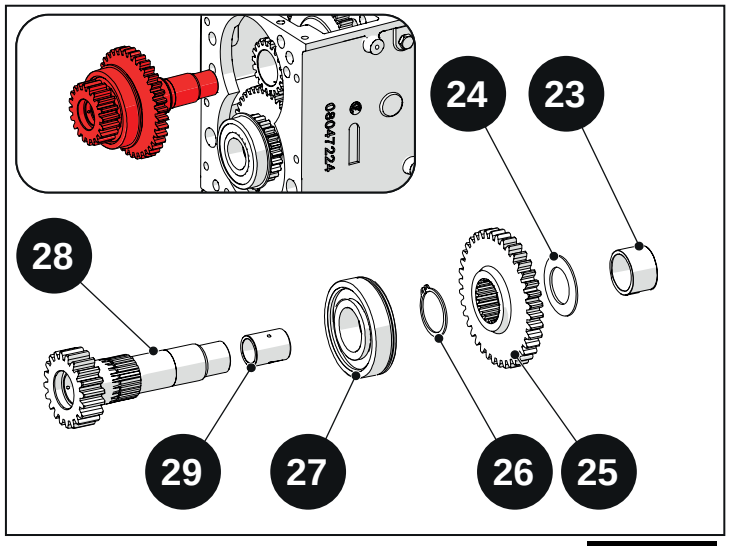

Fig. 4.90

Fit the pin (108) to secure the fork (106) in place.

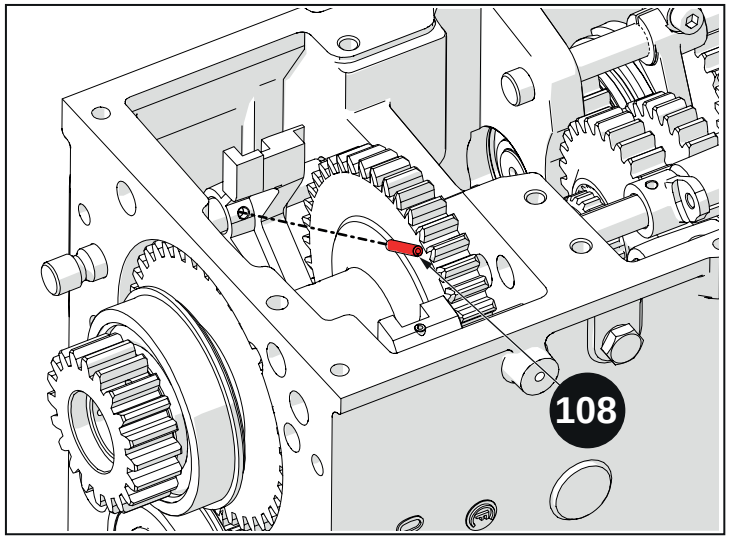

Fig. 4.91

Fit the PTO primary shaft (1) with the gear (31), the snap ring (32) and the circlip (30).

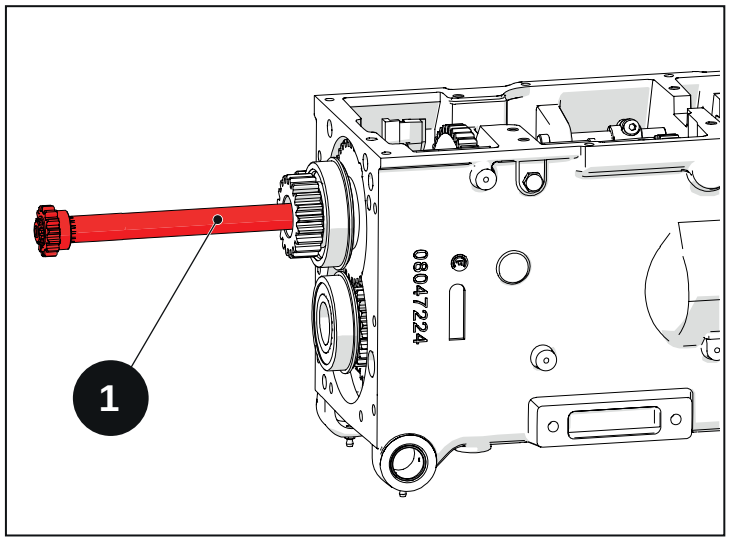

Fig. 4.92

Apply a layer of SILICONE sealant to the mating surface of the sleeve (92).

Fit the sleeve (92) and the washers (91) and tighten the screws (90) to a torque of 30 N·m (3 kg·m).

Apply a coating of Teflon or silicone to the threads of the screws (90).

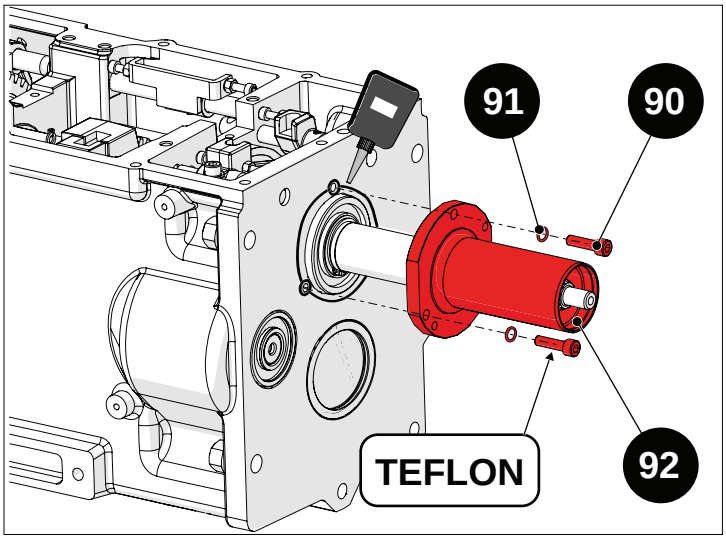

Fig. 4.93

Adjusting the gear lever end of travel

To ensure correct gear selection, the gear levers must be adjusted so that the fork is situated exactly at the mid point between the two gears.

Set the fork in the neutral position and check that it is equally spaced from both gears.

Tighten the screw to secure the position of the fork.

Warning

Select a gear and use a small screwdriver to check that the synchroniser ring under the fork can move slightly. If the ring cannot move, the fork is fastened in a position too close to the engaged gear.

Check in both gear engagement positions of the synchroniser.

Warning

Check all the gearbox selector forks with the same procedure.

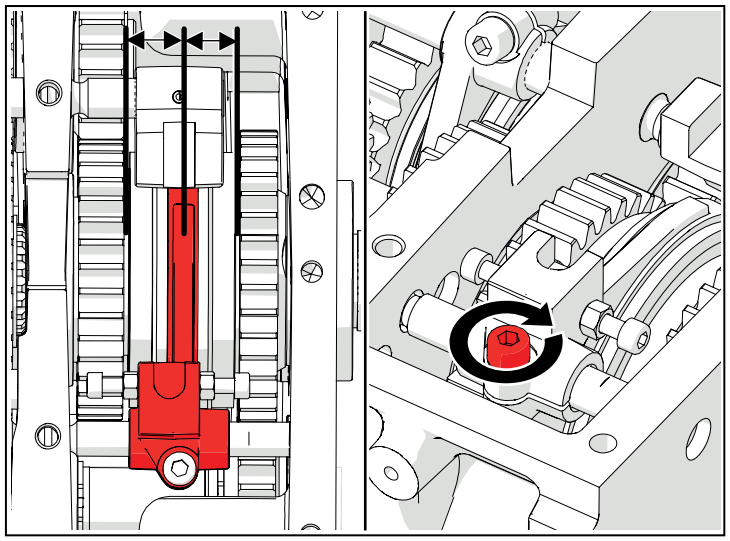

Fig. 4.94

Engage the reverse shuttle.

Set the adjuster screw to a distance of 0.5 to 1 mm from the casing.

Tighten the nut to secure the adjuster screw in this position.

Carry out the same adjustment procedure for the intermediate shaft.

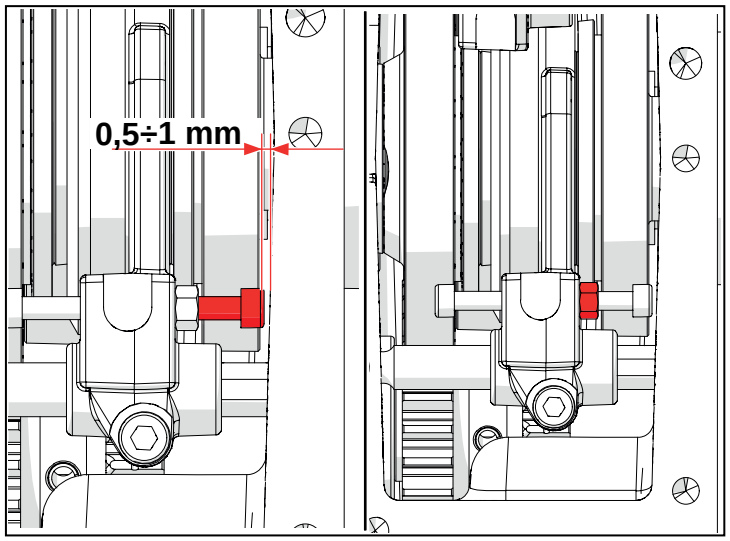

Fig. 4.95

Remove the springs (88) and the balls (89).

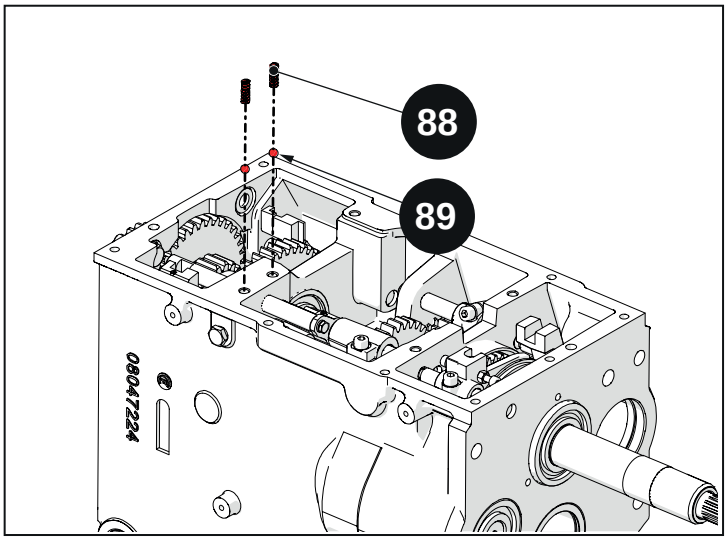

Fig. 4.96

Fit the complete cover (85), aligning the forks with the levers.

> **Warning**
>
> Apply a coating of silicon around the cover mating perimeter.

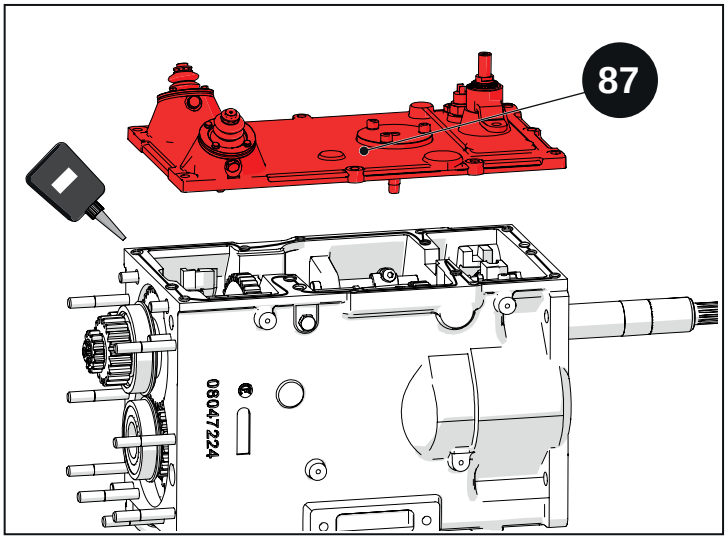

Fig. 4.97

Fit the washers (86) and tighten the fastener screws (85) of the cover to a torque of 54 N·m (5.4 kg·m).

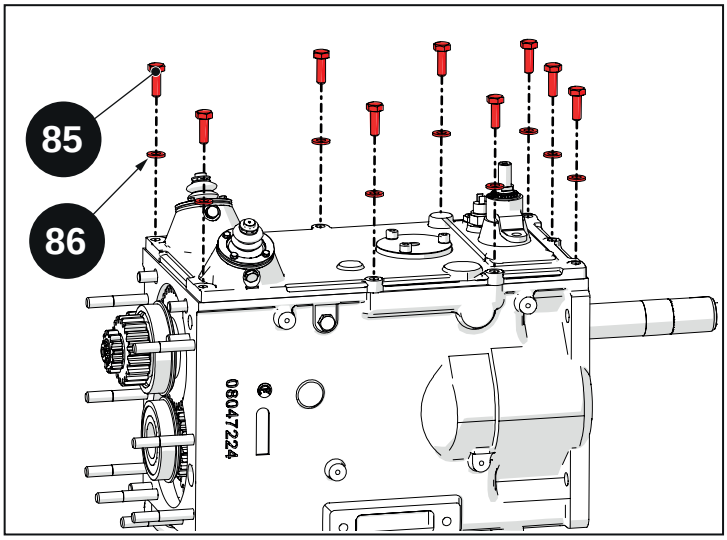

Fig. 4.98

Fit the stud bolts on the gearbox casing, and tighten fully into their respective threaded holes.

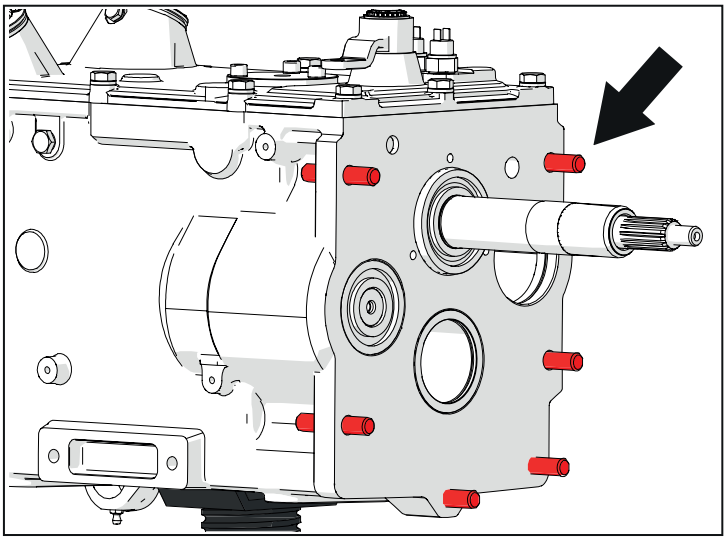

Fig. 4.99

Apply a layer of SILICONE sealant on the gearbox mating surface with the clutch housing.

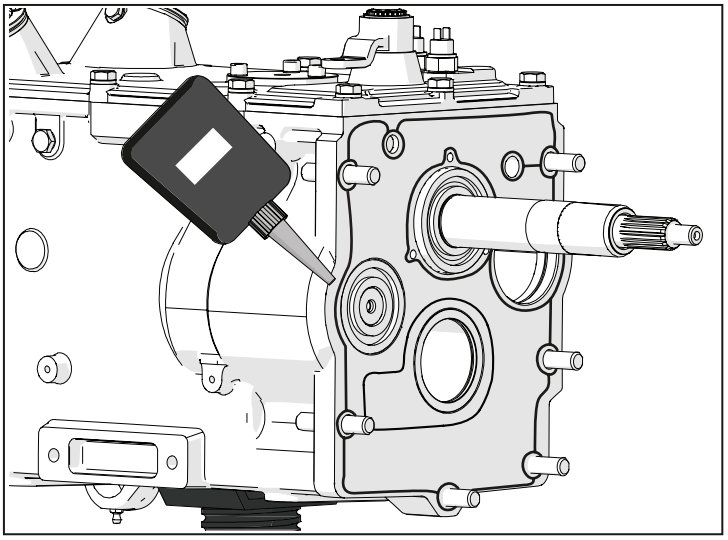

Fig. 4.100

Fit the paper gasket (84) and apply an additional coating of silicon sealant on the gasket.

Warning
Replace the paper gasket (84) after each disassembly.

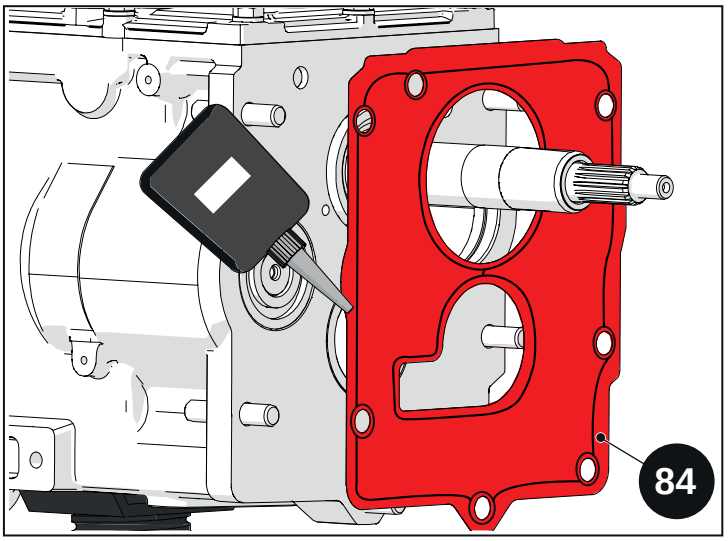

Fig. 4.101

Mate the clutch housing with the gearbox assembly.

Fit the washers (83) and the nuts (82) and tighten the nuts to a torque of 80 N·m (8 kg·m).

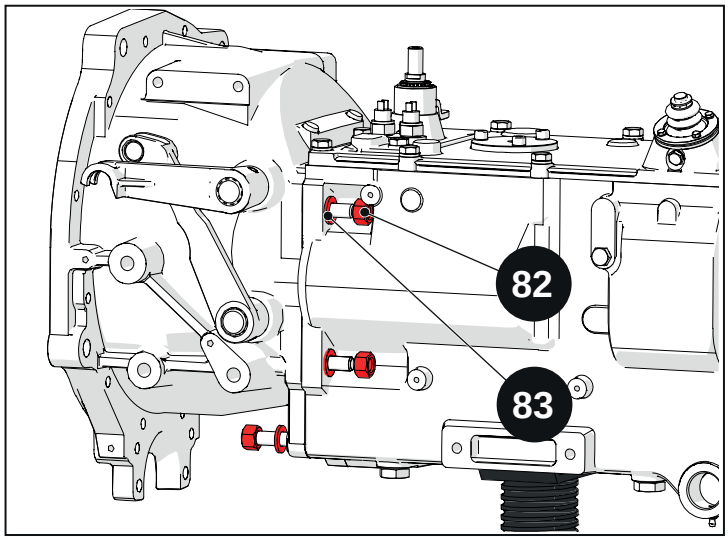

Fig. 4.102

4.6 Tightening torques

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4.6.1 Tightening torques 4-50

4.6.1 Tightening torques

The main tightening torques are listed as follows. For all other tightening torques, see chapter "1-Introduction".

Tightening torque	N·m	kg·m
Screw fastening gearbox cover M10x30	54	5,4
Transfer shaft fastener ring nut M35x1.5	100	10
Screw fastening primary shaft cover M8x30	30	3
Screw fastening engine flange - clutch housing	100	10
Screw fastening fork onto rod	35	3.5

4.7 Tools necessary

Index

4.7.1 Tools necessary.....4-52

4.7.1 Tools necessary

p/n	Description	Quantity
07007955	Secondary shaft immobiliser tool	1
07000240	Ring gear removal/installation tool	1
07007954	Synchroniser immobiliser tool	1
07007957	Spacer installation tool	1
07007956	Tool for installing shaft in gearbox	1
07000215	Gearbox assembly support stand - base	1
07000245	Tractor separation support frame	1
07000246	Gearbox casing support	1

5 : Rear differential

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5.1 Safety rules

These safety precautions and warnings given in this paragraph must be observed at all times to prevent the risk of operator injury. However, the safety measures indicated in the use and maintenance manual and in chapter 1 of this manual must also be applied at all times.

Danger.
All other persons must keep at a safe distance from the danger area. Avoid vibration when loosening screws.

Danger
Lift and handle all heavy parts with lifting equipment of adequate load capacity. Hoisting straps and hooks must be positioned safely on the load. When lifting loads, all personnel must keep at a safe distance from the load itself and remain within safe areas.

Danger.
Do not allow the chains or metal cables used for hoisting to twist. Always wear safety gloves when handling cables or chains.

Danger.
Use appropriate tools to align the holes correctly. NEVER USE YOUR HANDS OR FINGERS.

Danger.
Handle all parts with extreme caution. Never place your hands or fingers between two parts.

Danger.
When removing assemblies which could fall, always leave two screws in opposite positions in place for safety until the assembly is secured. Only remove these screws after securing the assembly to a hoist or after fitting support blocks in place.

Danger.
If any of the screws fastening the frame or cab are loosened, or if the frame or cab is removed, ensure that all parts are refitted correctly at the end of the procedure to ensure that the driver is protected.

Attention
Beware of sharp edges and corners at the top of the gearbox housing.

Attention
Used oils must be collected and disposed of in compliance with applicable legislation.

5.2 General introduction

Index

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5.2.1 Assembly drawing

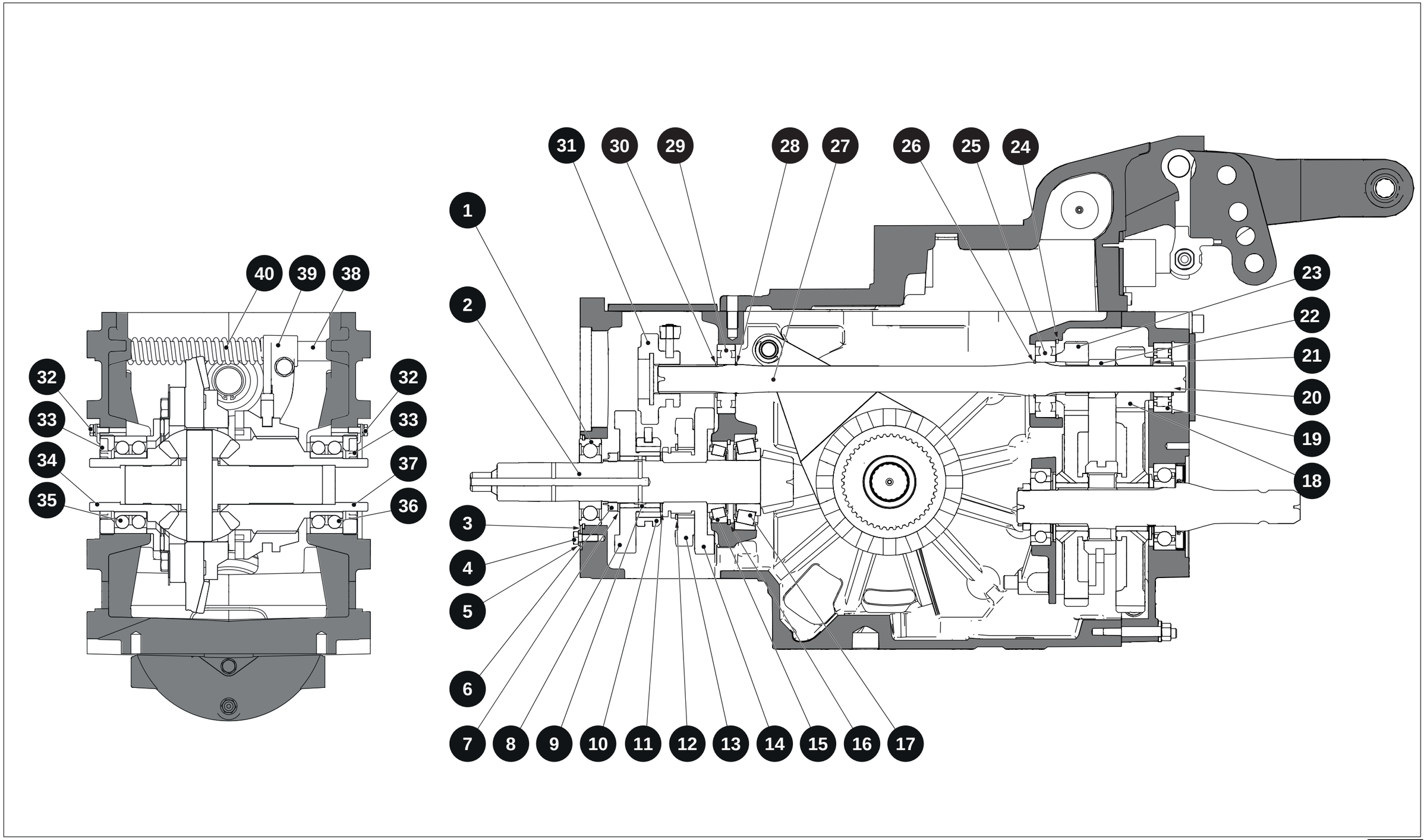

Fig. 5.1

1 - Bearing
2 - Pinion
3 - Retainer plate
4 - Retainer screw
5 - Washer
6 - Ring nut
7 - Spacer
8 - Gear
9 - Bush
10 - Selector sleeve
11 - Spacer
12 - Circlip
13 - PTO gear
14 - Drive gear
15 - Bearing
16 - Circlip
17 - Bearing
18 - Gear
19 - Bearing
20 - Circlip
21 - Spacers
22 - Bush
23 - Gear
24 - Circlip
25 - Bearing
26 - Circlip
27 - Internal PTO shaft
28 - Circlip
29 - Bearing
30 - Circlip
31 - PTO selector gear
32 - Ring nut retainer
33 - Ring nut
34 - Sun gear
35 - Bearing
36 - Bearing
37 - Sun gear
38 - Differential lock rod
39 - Differential lock fork
40 - Differential lock spring

5.3 Technical characteristics

Index

5.3.1 Technical characteristics.....5-8

5.3.1 Technical characteristics

Operation	Electrohydraulic
Free play between pinion and ring gear	0.07 to 0.15 mm

5.4 Disassembly

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5.4.2 Disassembly.....5-15

5.4.2.1 Disassembling/Assembling the differential crown wheel 5-24

5.4.1 Preliminary operations

The main operations necessary to access the rear differential assembly are indicated as follows.

Attention

Always make sure that the assemblies are completely disconnected before separation to prevent damage to components.

- Removing the platform (see chapter "13-Platform")

  Removing the cab (see chapter "14-Cab")

Danger

Before disassembly, secure the rear differential assembly and the gearbox assembly with a hoist of adequate capacity.

If suitable lifting equipment is not available, assemblies may be secured with a support stand.

Tools

07000245: Tractor separation support frame.

07000215: Gearbox assembly support stand - base.

07000247: Rear differential case support stand.

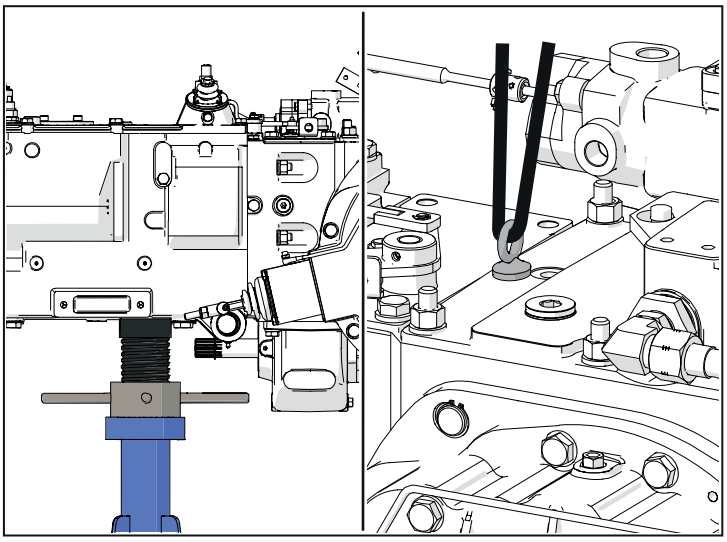

Fig. 5.2

Undo the screws (41) and remove the washers (42).

Undo the screws (43) and remove the washers (44).

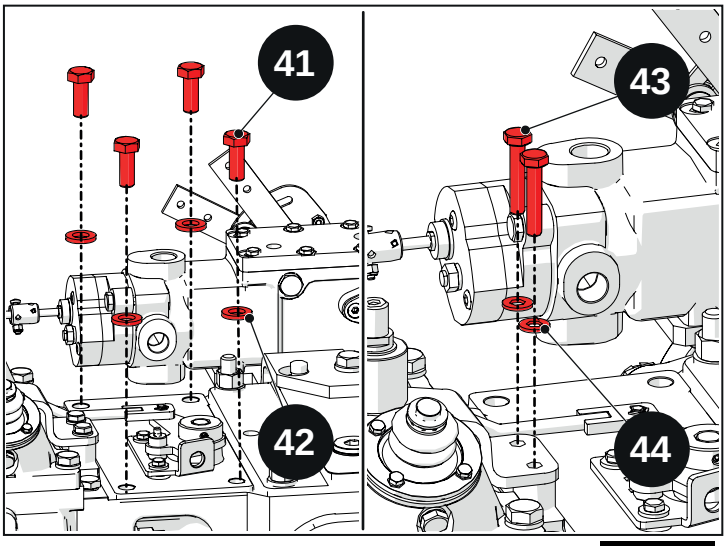

Fig. 5.3

Remove the cover (45)

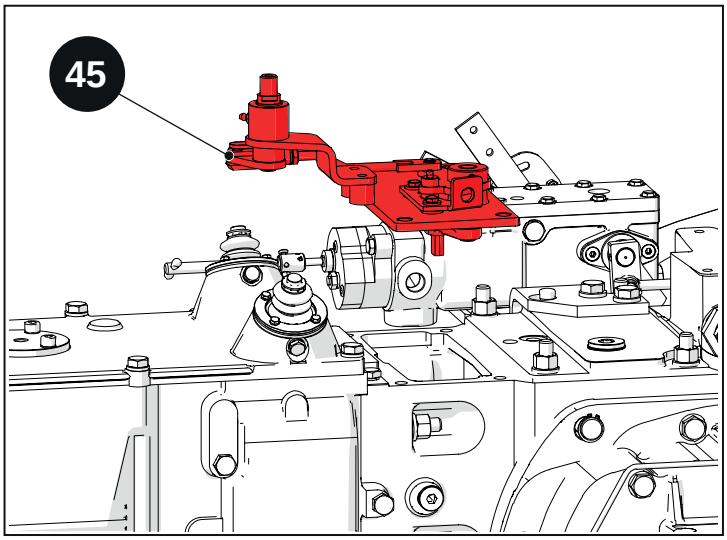

Fig. 5.4

Undo and remove the screws with the washers.

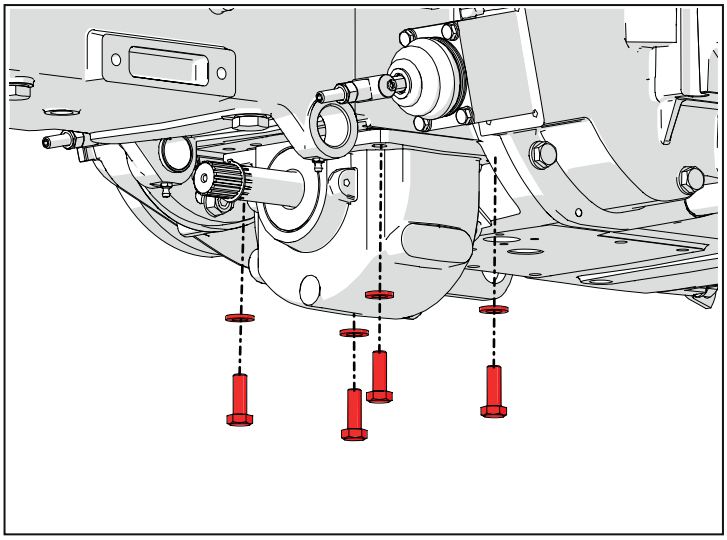

Fig. 5.5

Remove the complete 4WD transfer case assembly.

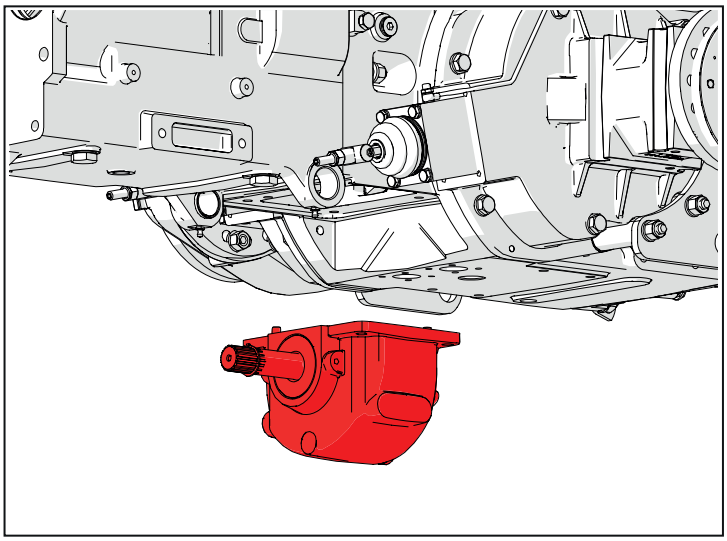

Fig. 5.6

Undo the self-locking nuts.

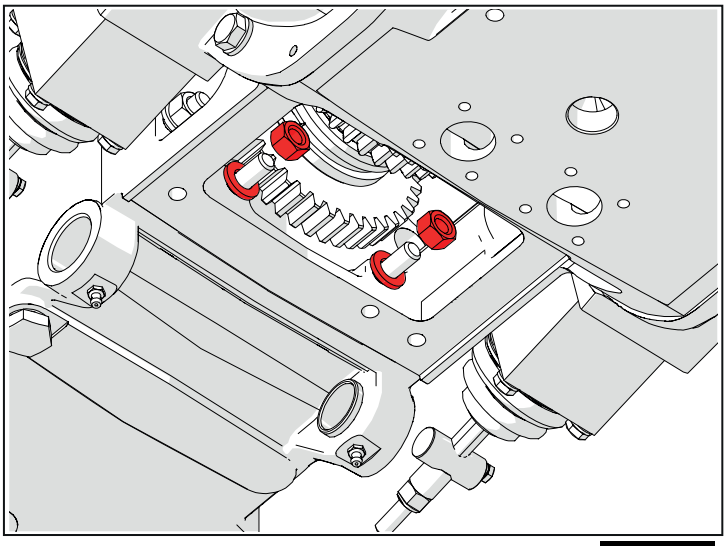

Fig. 5.7

Undo and remove the screws with the washers, and then remove the gearbox casing cover.

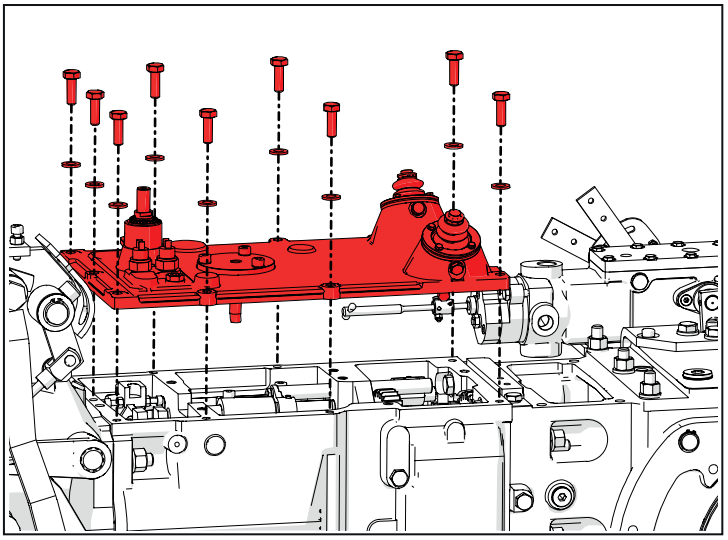

Fig. 5.8

Undo and remove the screws and washers fastening the gearbox casing to the rear differential assembly.

Attention

It may be necessary to move the rods slightly to allow access to remove the screws.

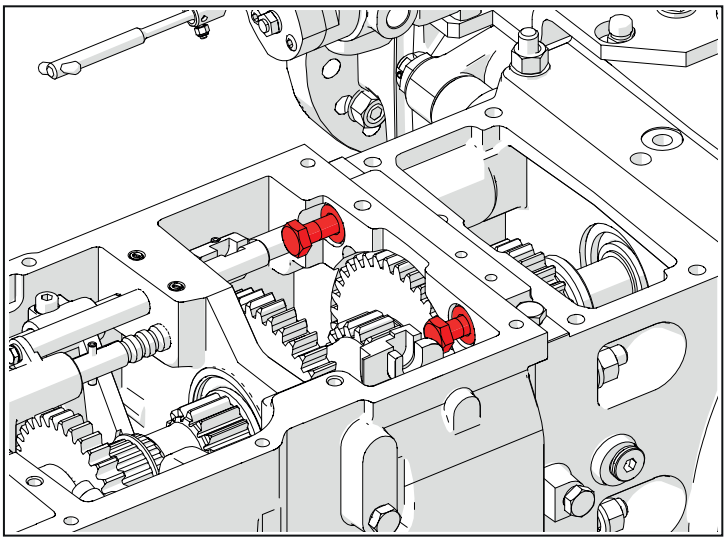

Fig. 5.9

Undo and remove the nuts (46) and washers (47) fastening the gearbox casing to the rear differential assembly.

Remove the pins (48) from the brake link rods.

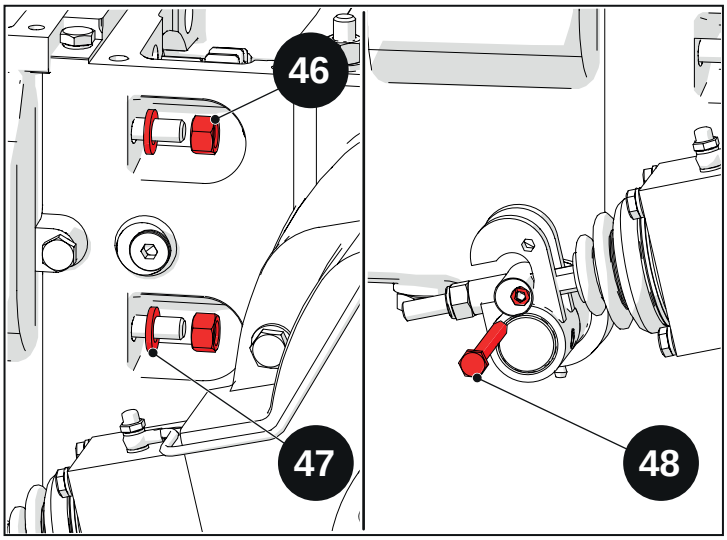

Fig. 5.10

Separate the assemblies.

Danger

Lift and handle all heavy parts with a hoist of adequate load capacity. Ensure that the lift straps and hooks are applied and positioned safely. When lifting loads, all personnel must keep at a safe distance from the load itself and remain within safe areas. Before disassembly, secure the rear differential assembly and the gearbox assembly with a hoist of adequate capacity.

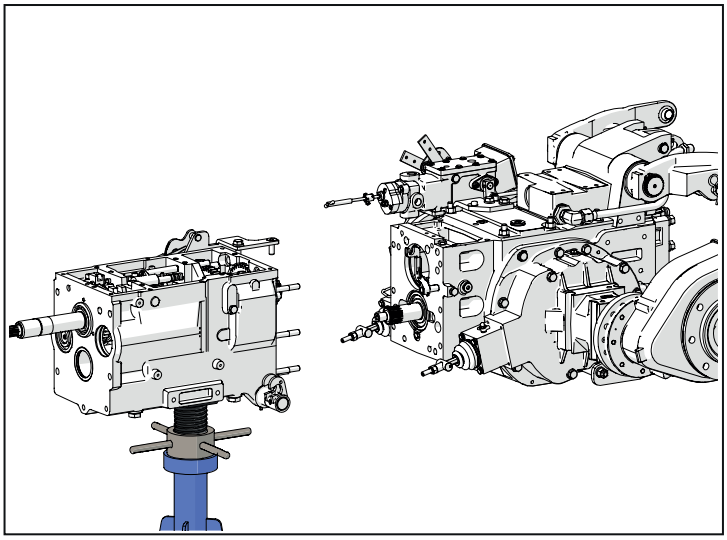

Fig. 5.11

Note

Make sure that the stud bolts connecting the gearbox and differential casings remain on the gearbox side.

Danger

Secure the lift to a hoist of suitable load capacity.

Undo and remove the nuts (49) and washers (50) fastening the lift to the rear differential assembly.

Lift and remove the rear lift assembly (51).

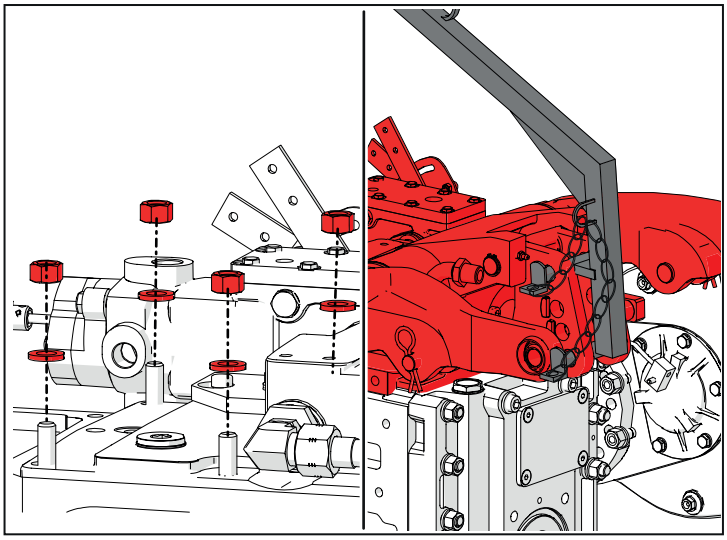

Fig. 5.12

Remove the subassemblies from the rear differential with the following procedures:

1 - Removing the final drive reduction gear units (see chapter "6 - Rear final drive units")

2 - Removing the rear PTO (see chapter "9 - Rear PTO")

5.4.2 Disassembly

Undo the screw (4) and remove the washer (5) and the retainer (3).

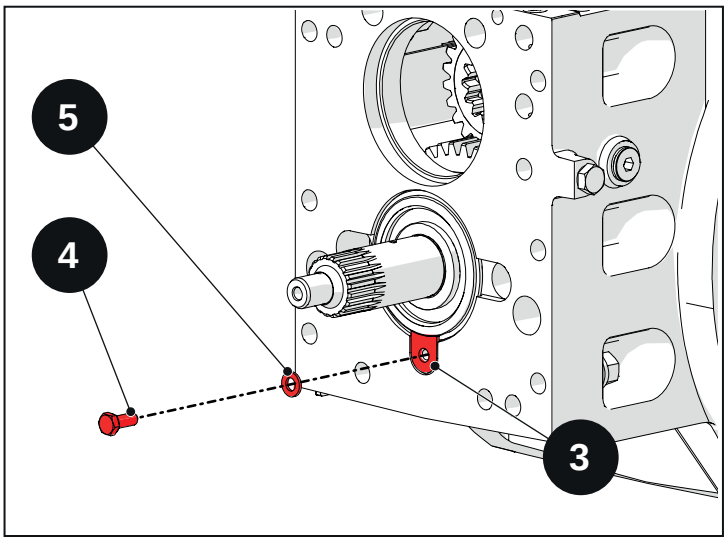

Fig. 5.13

Use a bearing extractor tool to remove the bearing (1).

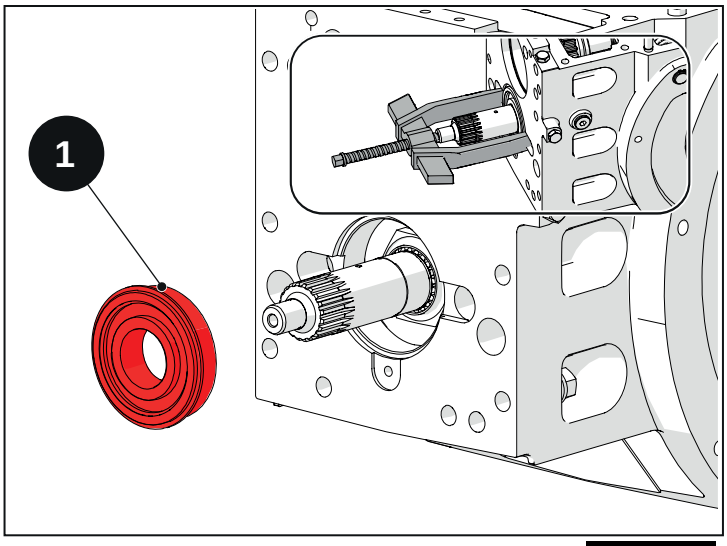

Fig. 5.14

Remove the pin (52) of the differential lock.

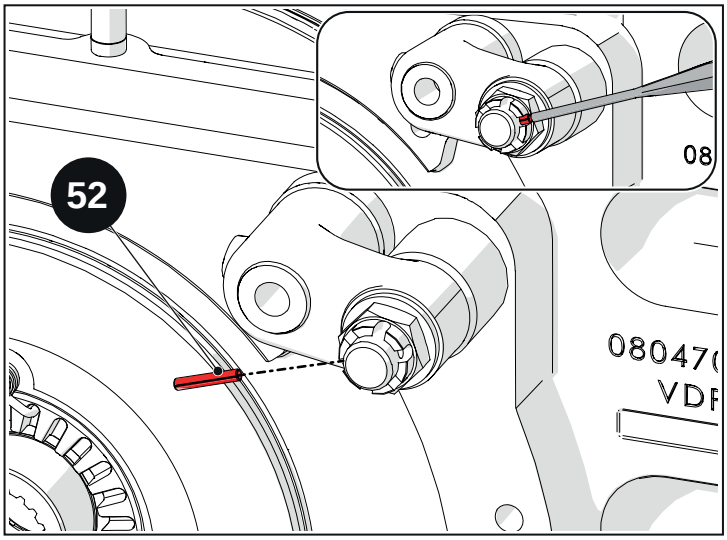

Fig. 5.15

Remove the nut (53) and the washer (54).

Remove the cylinder from the lever (55) and the spacer (56).

> **Note**
>
> The cylinder contains a piston (57) and a retainer circlip (58).

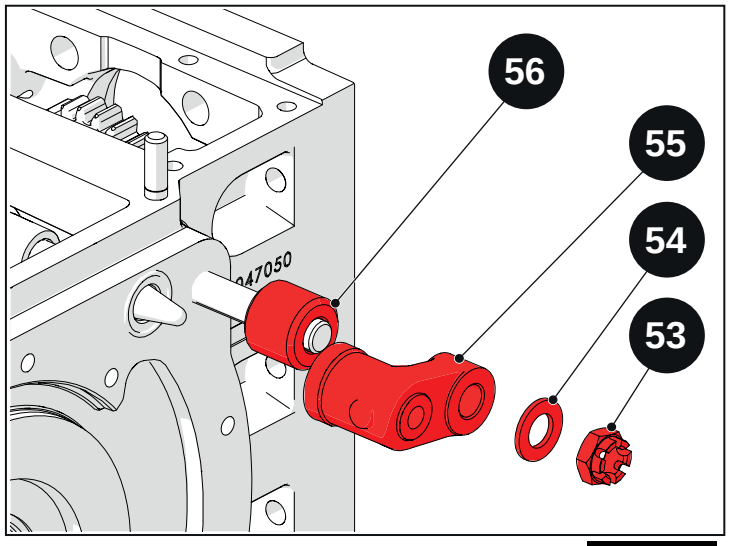

Fig. 5.16

Undo the screw (59) and remove the washer (60) from the differential lock fork.

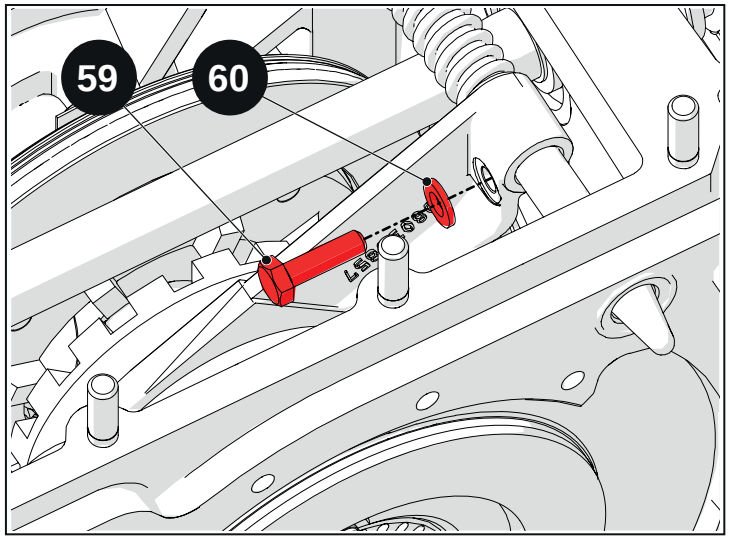

Fig. 5.17

Remove the rod (38), the spring (40) and the fork (39) of the differential lock.

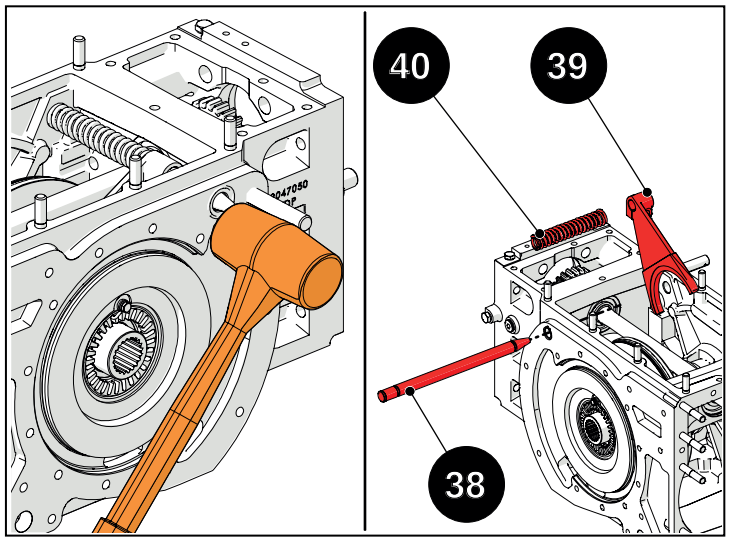

Fig. 5.18

Remove the circlip (61) and the O-rings (62) from the differential lock rod (38).

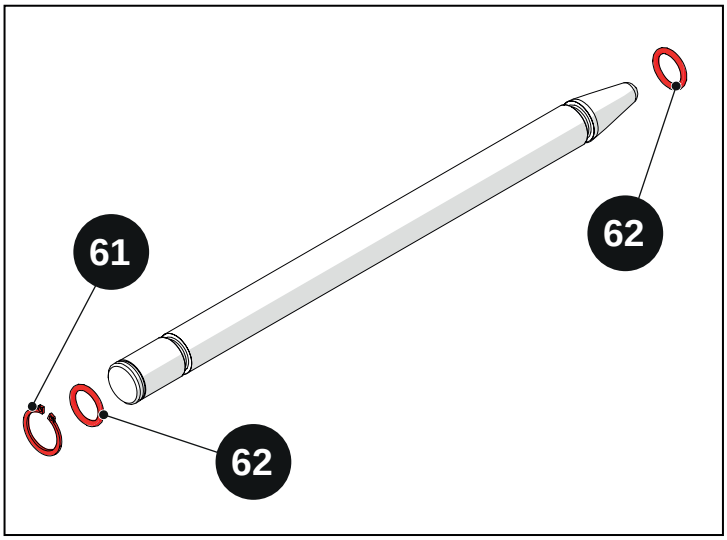

Fig. 5.19

Remove the circlip (20).

Using an extractor tool, remove the bearing (19), the spacers (21) and the gear (18) from the shaft.

Remove the spacer (22) and the gear (23).

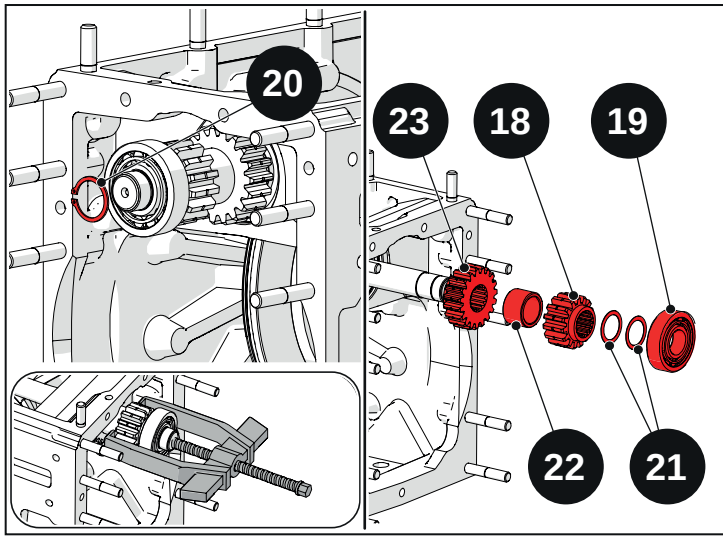

Fig. 5.20

Remove the gear (31).

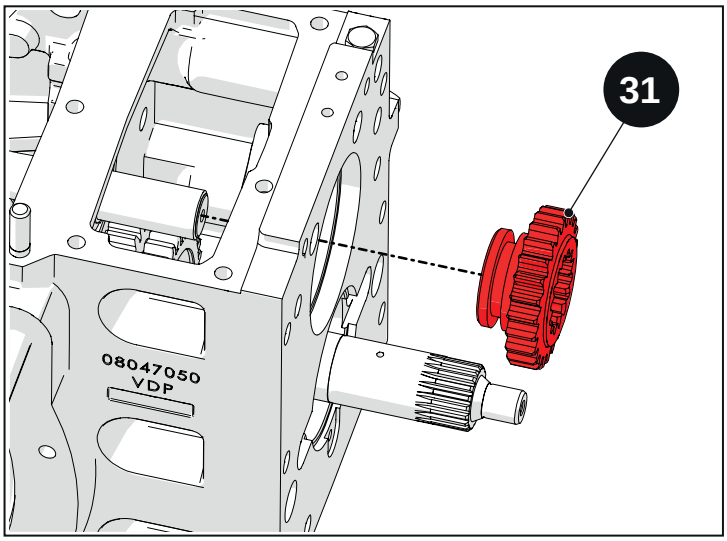

Fig. 5.21

Remove the circlip (24).

Tap the shaft (27) on the opposite end to disengage it together with the bearings (25) and (29).

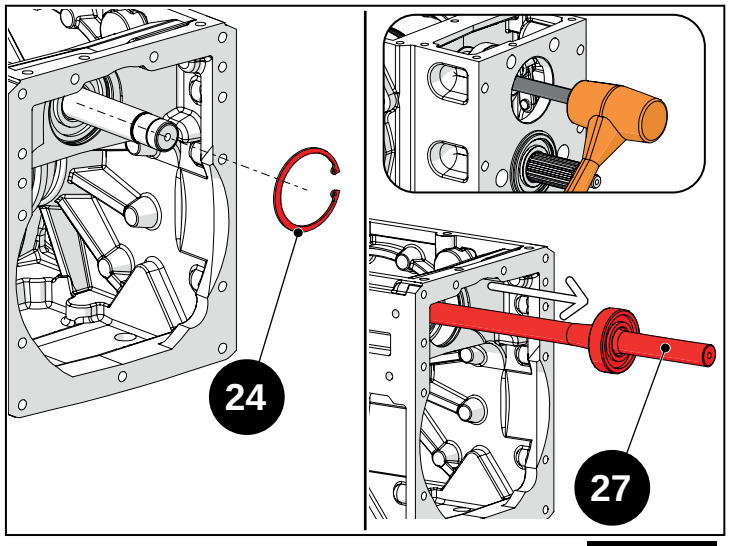

Fig. 5.22

Use a bearing extractor tool to remove the bearing (25).

The shaft (27), complete with bearing (29) and the circlips (26), (28) and (30) may now be removed from the differential casing.

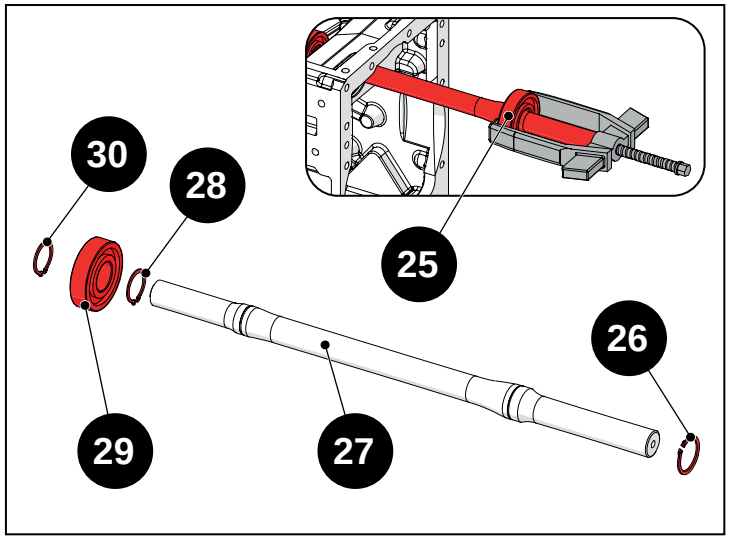

Fig. 5.23

Remove the ring nut retainers (32) on both sides.

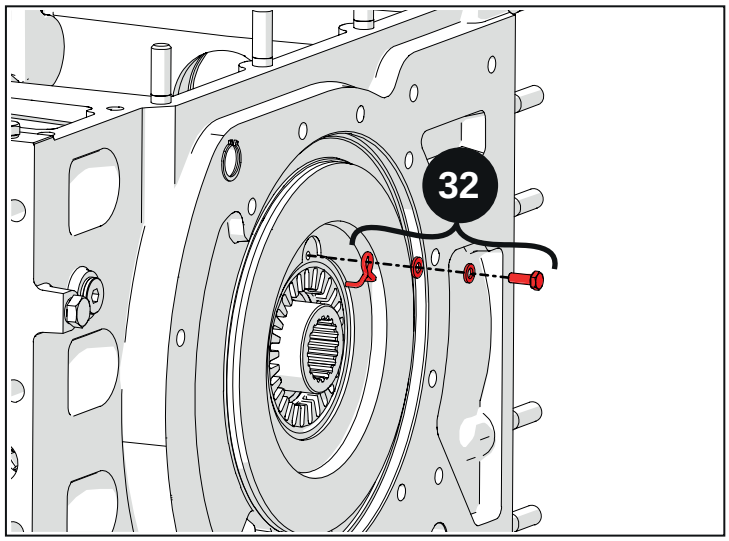

Fig. 5.24

Undo and remove the ring nuts (33) on both sides.

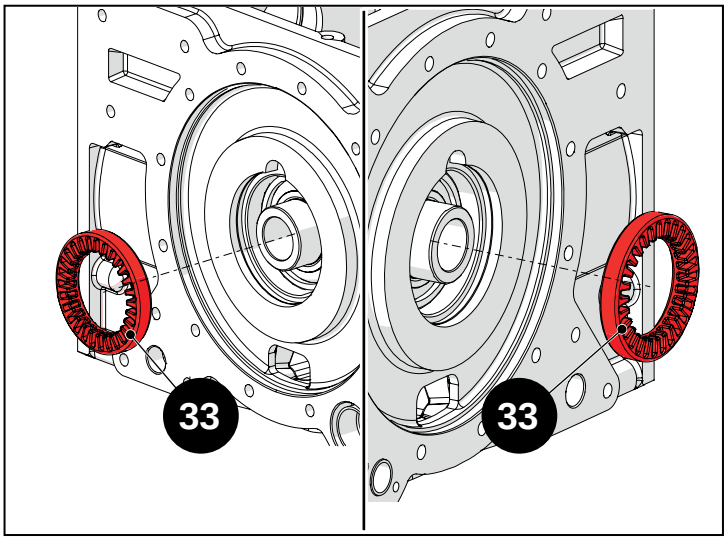

Fig. 5.25

Remove the planetary gear assemblies (34) and (37), with the bearings (35) and (36), from the openings in the sides of the casing.

Use an extractor tool to remove the bearings from the planetary gear assemblies.

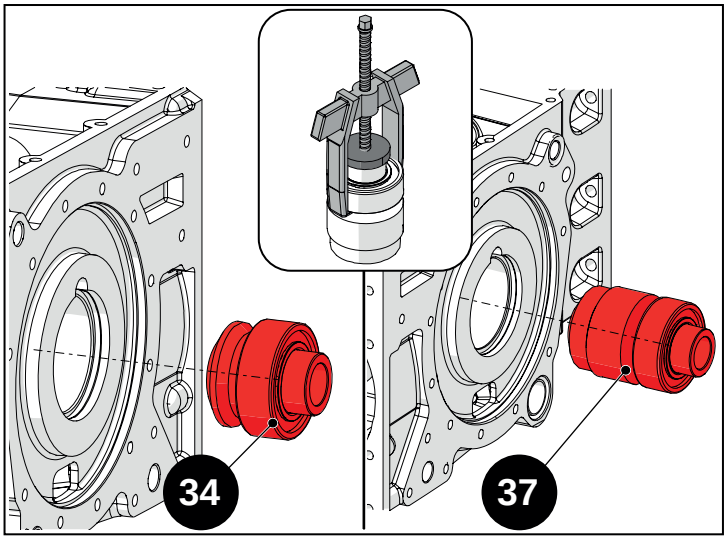

Fig. 5.26

Remove the complete crown wheel from the rear differential case from above.

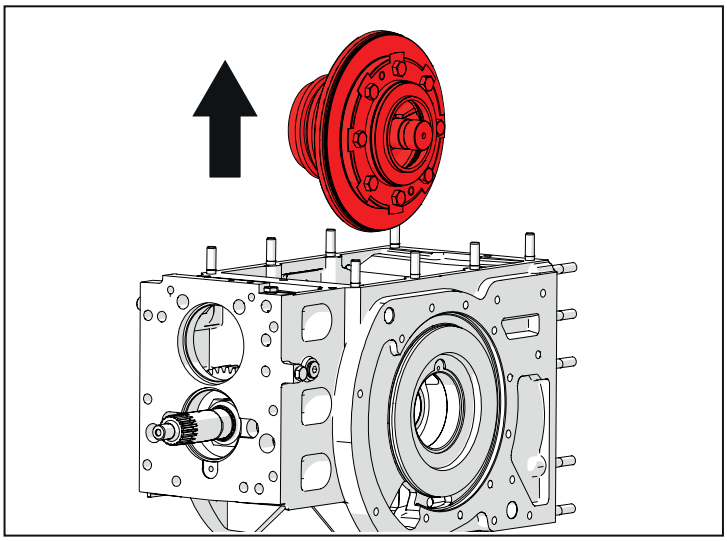

Fig. 5.27

Remove the plug (63) and the washer (64).

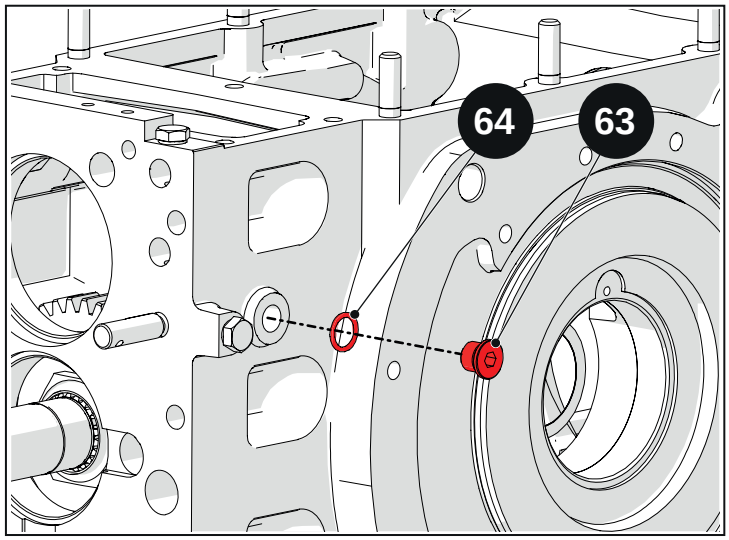

Fig. 5.28

The passage is now clear, allowing the pin (65) to be removed.

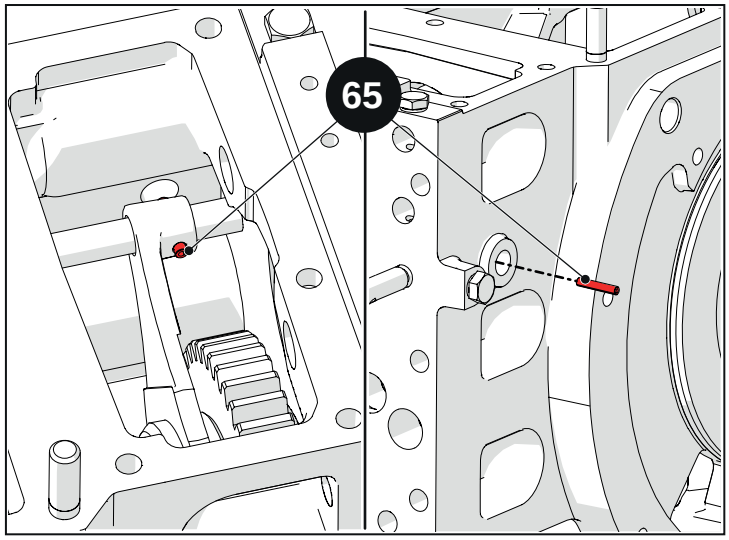

Fig. 5.29

Remove the plug (68) with the washer (69), and then remove the spring (70) and the ball (71).

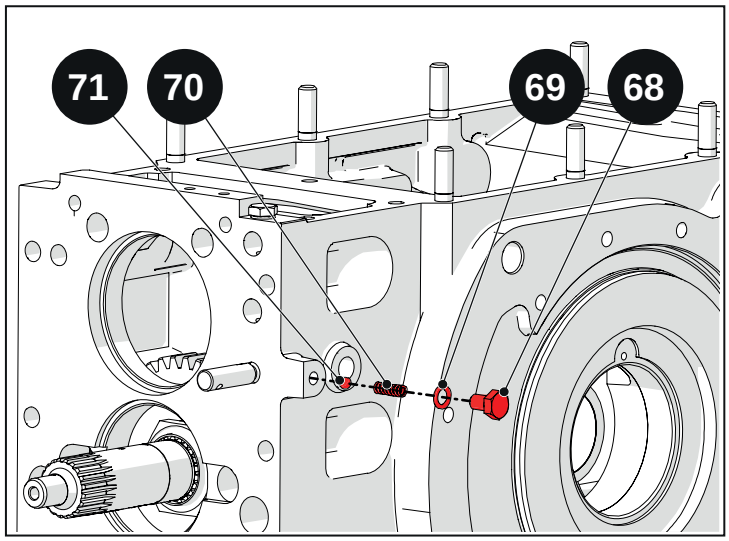

Fig. 5.30

Remove the rod (66) and selector fork of the underdrive gear (67).

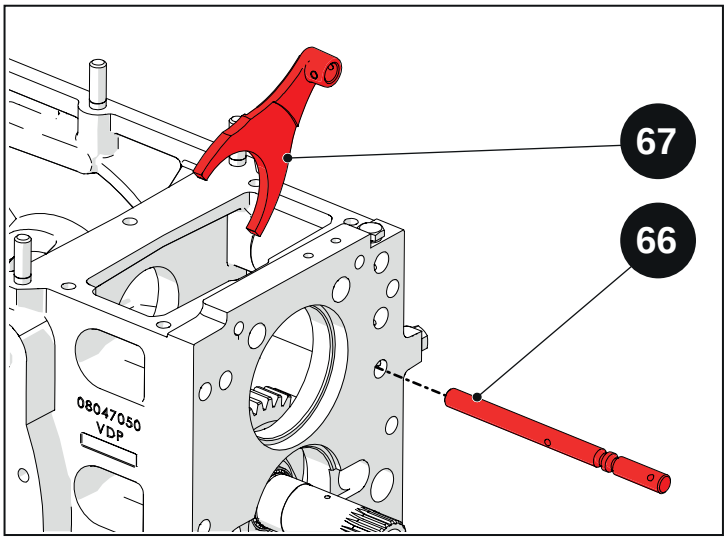

Fig. 5.31

Remove the plug (72) and the washer (73).

Remove the impediment pin (74).

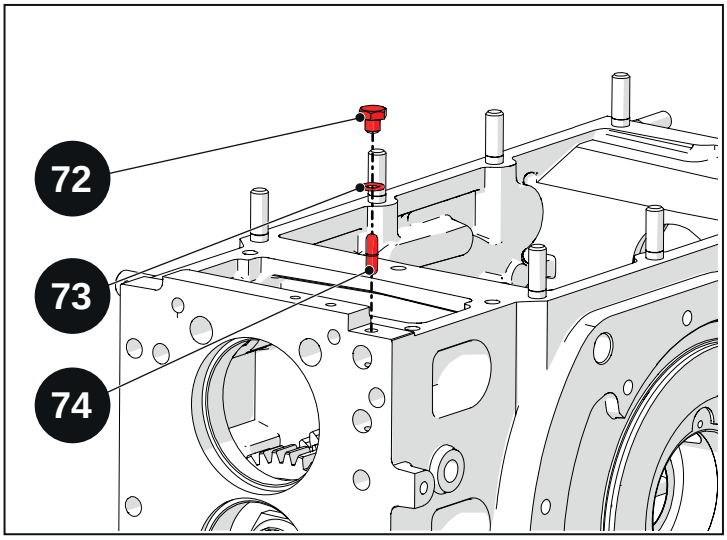

Fig. 5.32

Restrain the ring nut (6) with the tool (B- P/N 07000239).

Use the tool (A) to turn the pinion clockwise (2) and undo the ring nut (6).

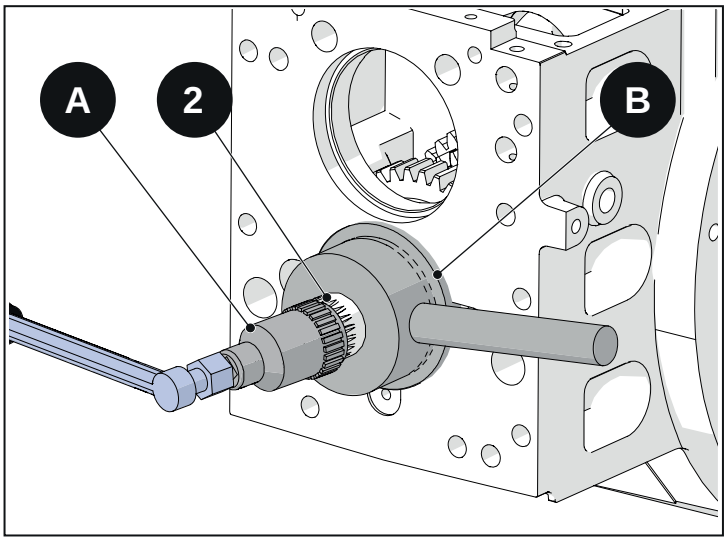

Fig. 5.33

Now remove the ring nut (6) and the spacer (7).

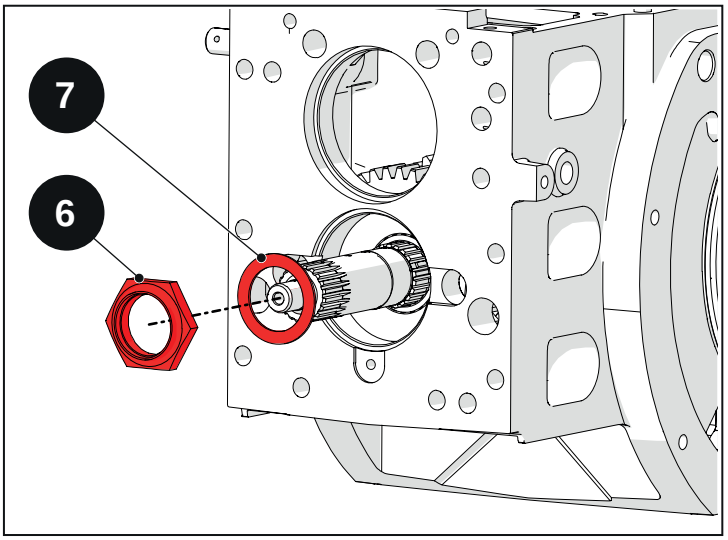

Fig. 5.34

The pinion (2) may no be tapped to drive it out from the opposite side, together with the external race of the bearing (15).

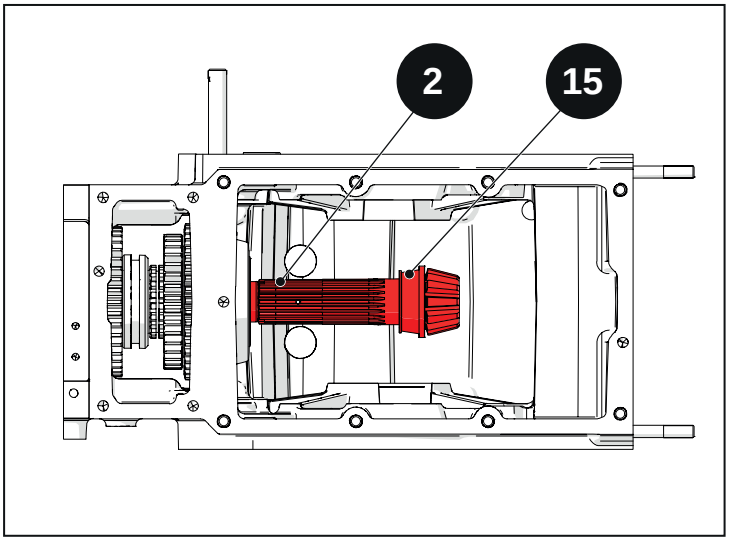

Fig. 5.35

Remove the following components from the differential casing:

- 3rd range gear (8);
- Selector sleeve (10);
- Lubrication bush (9);
- Spacer (11);
- Circlip (12);
- PTO gear (13);
- 4WD gear (14);

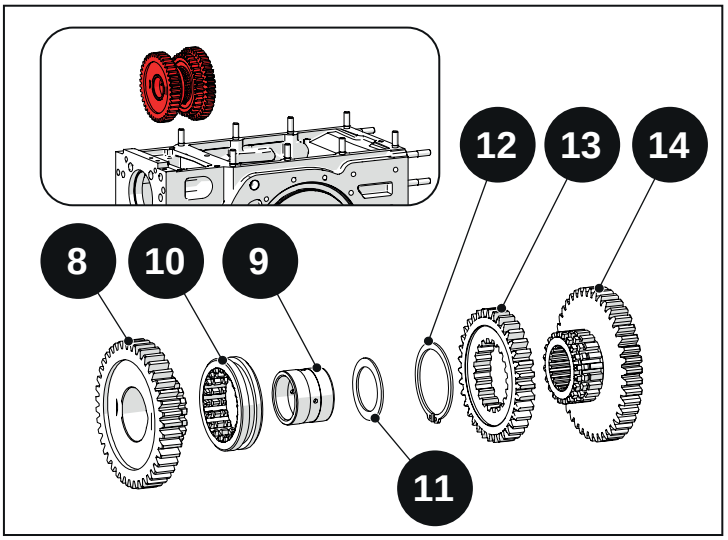

Fig. 5.36

Remove the bearing (17), the outer race of the bearing (15), the circlip (16) and the spacer (77).

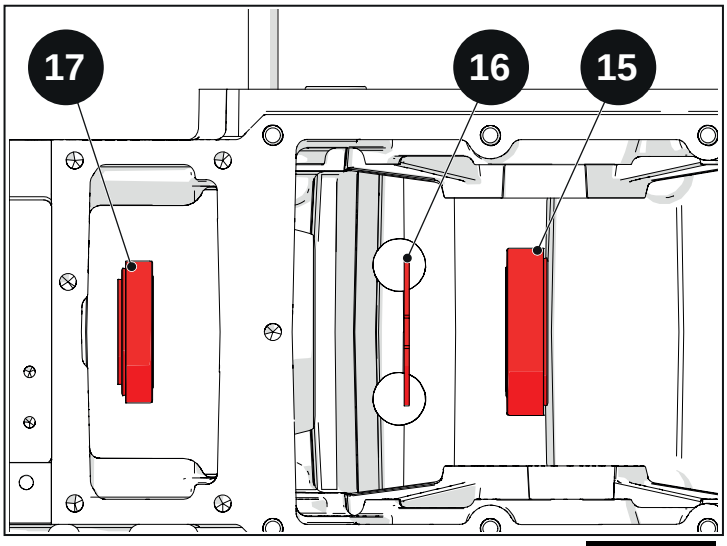

Fig. 5.37

5.4.2.1 Disassembling/Assembling the differential crown wheel

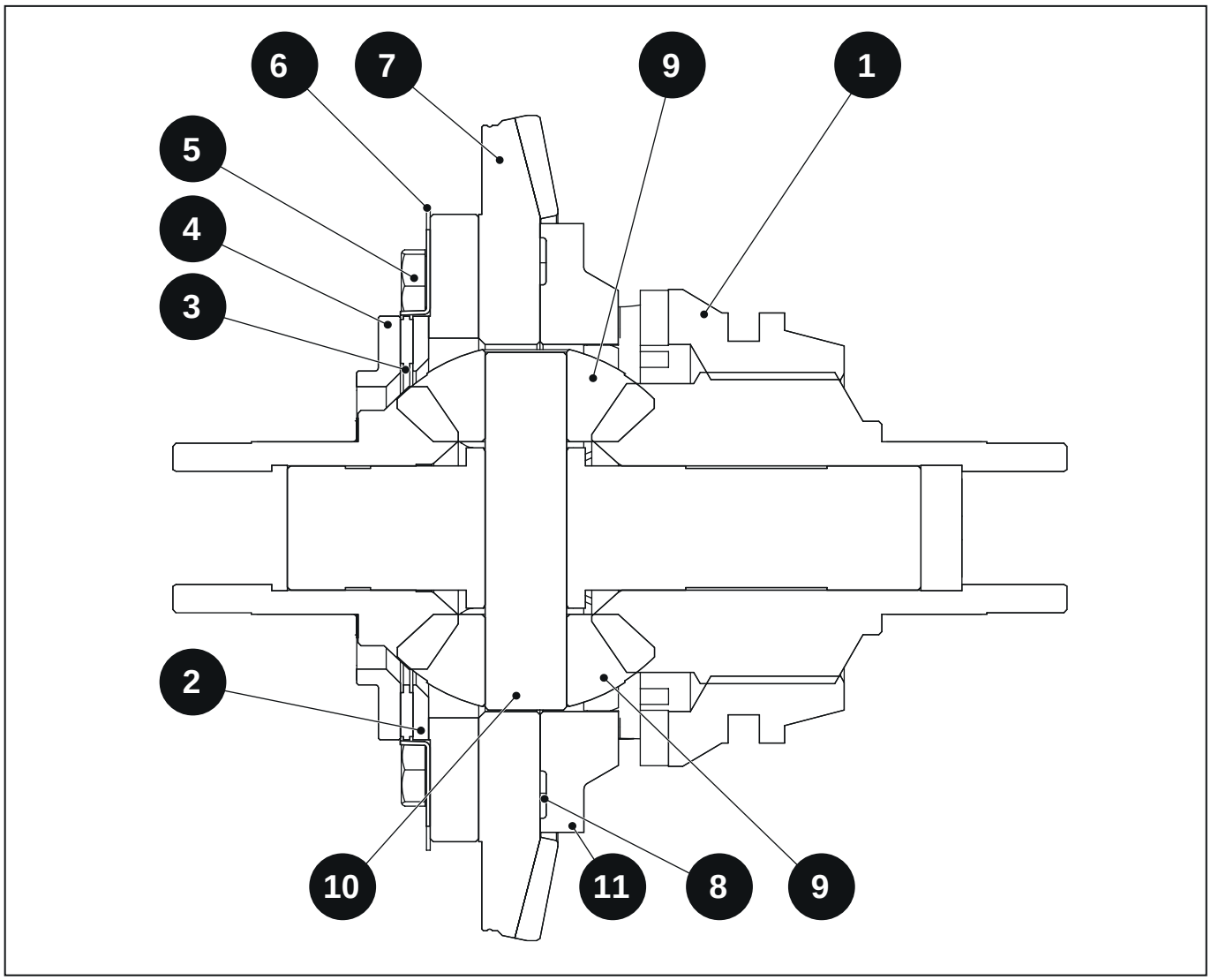

Fig. 5.38

1 - Differential lock pinion
2 - Spacer
3 - Roller bearing cage
4 - Spacer
5 - Screw
6 - Plate
7 - Crown wheel
8 - Pin
9 - Planet gear
10 - Differential centre shaft
11 - Differential lock fixed ring

Disassembly

Remove the pinion (1) and the fixed ring (11) of the differential lock.

Remove the spacer (2), the roller bearing cage (3) and the spacer (4).

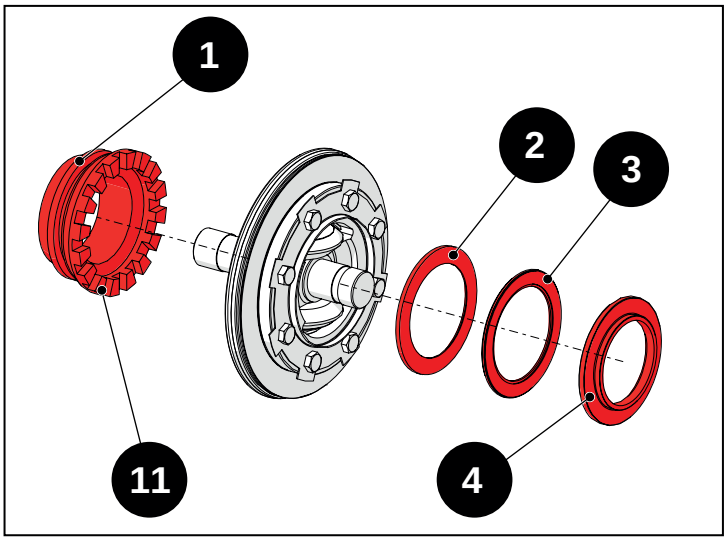

Fig. 5.39

Use a chisel to bend back the plate (6) and free the screws (5).

Undo the screws (5) and remove the plate (6).

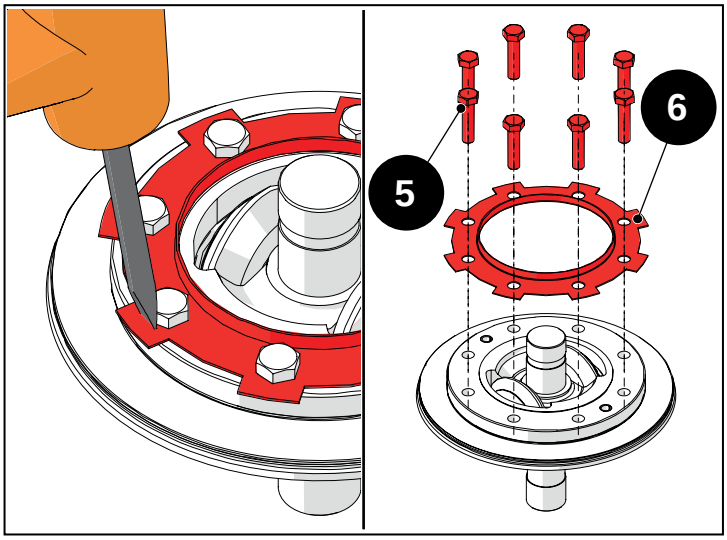

Fig. 5.40

Remove the crown wheel (7).

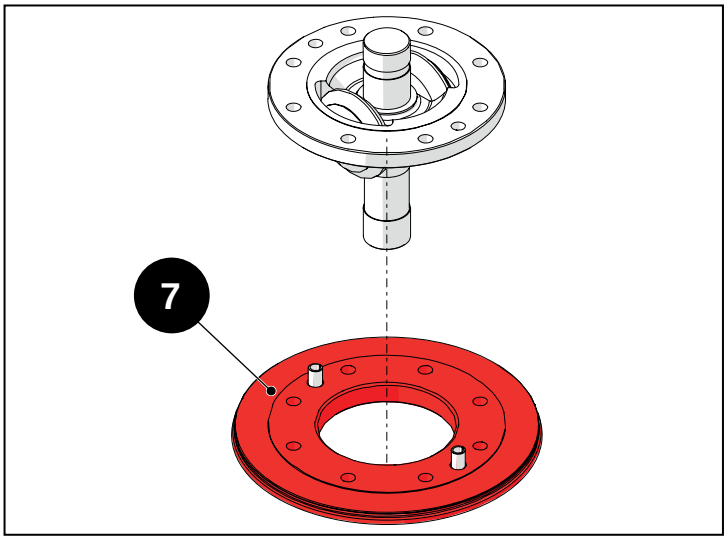

Fig. 5.41

Remove the pins (8) from the crown wheel (7).

Remove the planet gears (9) and the centre shaft (10) of the differential.

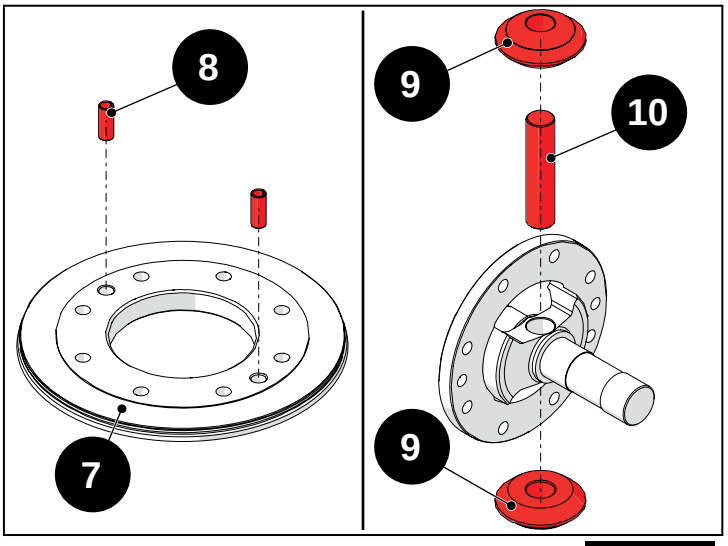

Fig. 5.42

Assembly

Fit the planet gears (9) and the centre shaft (10) of the differential.

Fit the pins (8) on the crown wheel (7).

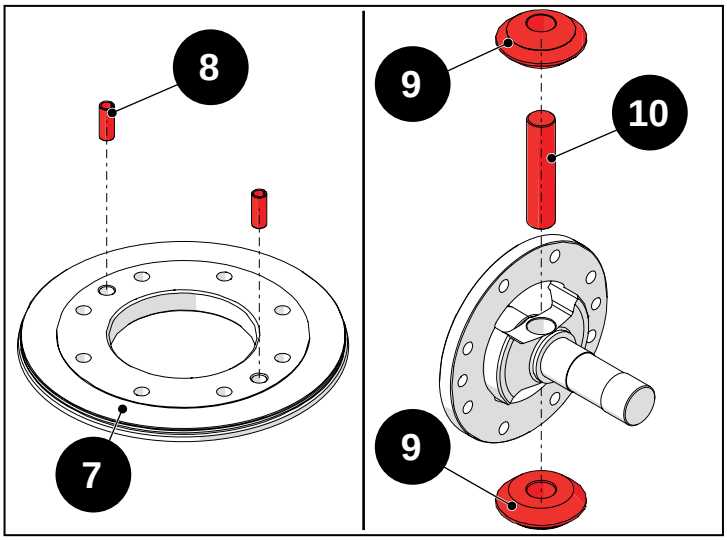

Fig. 5.43

Fit the two assemblies together, aligning the pins (8).

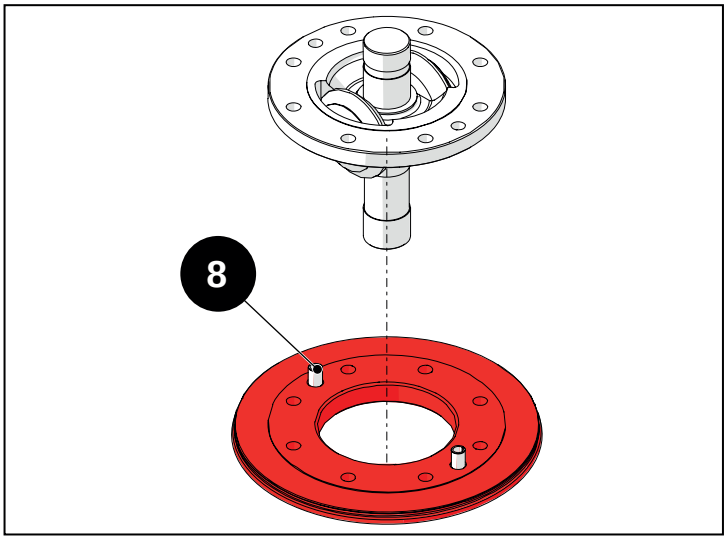

Fig. 5.44

Fit the plate (6).

Tighten the screws (5) to a torque of 90 N·m (9 kg·m).

Use a hammer and a chisel to bend up the ends of the plate against the heads of the screws (5).

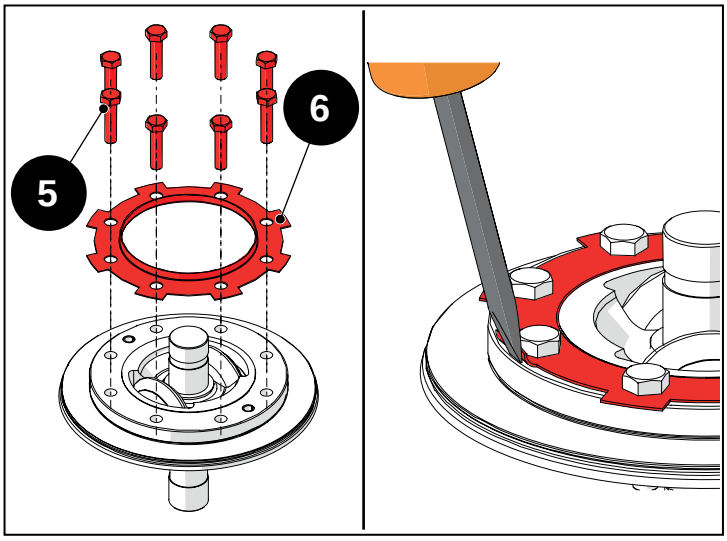

Fig. 5.45

5.5 Main inspection, reassembly and adjustment procedures

Index

5.5.1 Main inspection, reassembly and adjustment procedures.....5-30

5.5.1 Main inspection, reassembly and adjustment procedures

Warning

Read the instructions in chapter "1-Introduction" and, in particular, the sections concerning the installation of O-rings, oil seals and bearings, with particular care before reassembling, and follow these instructions precisely when working.

Apply the correct tightening torques when tighten the fasteners of components. Where tightening torques are not specified, refer to the table in chapter "1-Introduction".

Use the specified sealant products during reassembly. If no specific sealant products are indicated, refer to the relative table in chapter "1-Introduction".

Fit the bearing (17), the outer race of the bearing (15), the circlip (16) and the spacer (77).

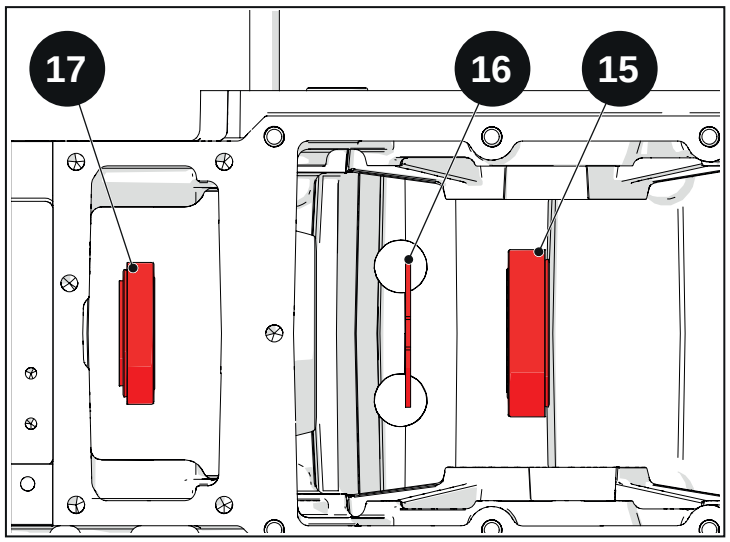

Fig. 5.46

Fit the following components from the differential casing:

- 3rd range gear (8);
- Selector sleeve (10);
- Lubrication bush (9);
- Spacer (11);
- Circlip (12);
- PTO gear (13);
- 4WD gear (14);

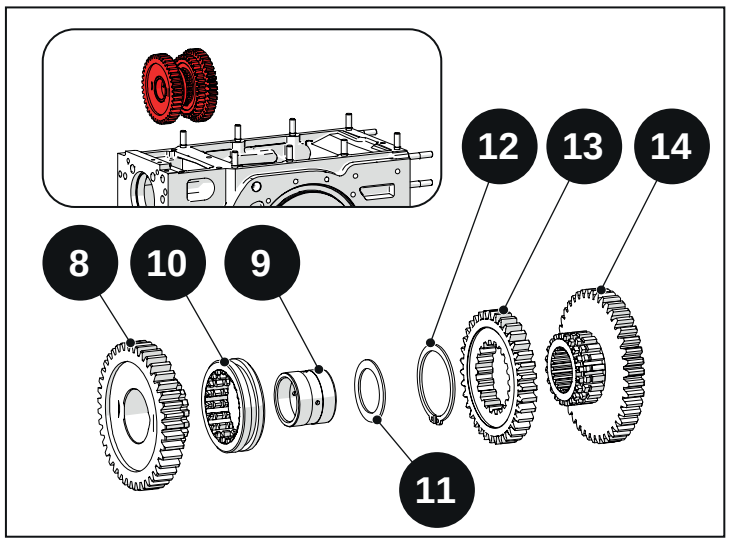

Fig. 5.47

Fit the pinion (2) together with the outer race of the bearing (15).

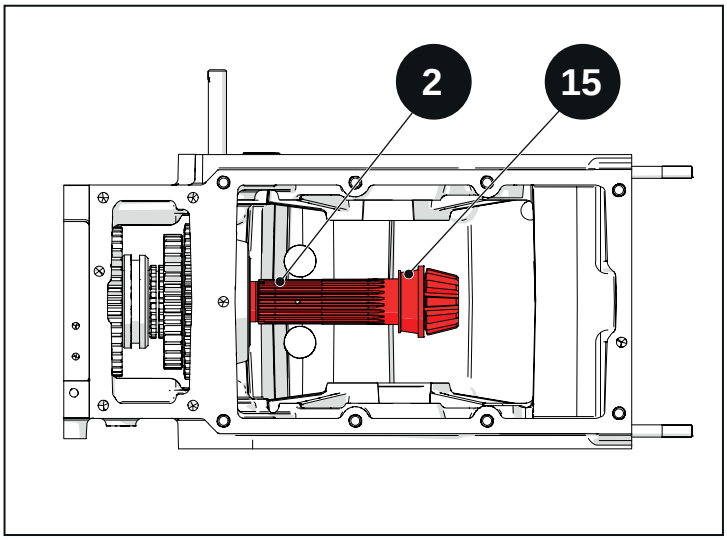

Fig. 5.48

Now fit the spacer (7) and the ring nut (6).

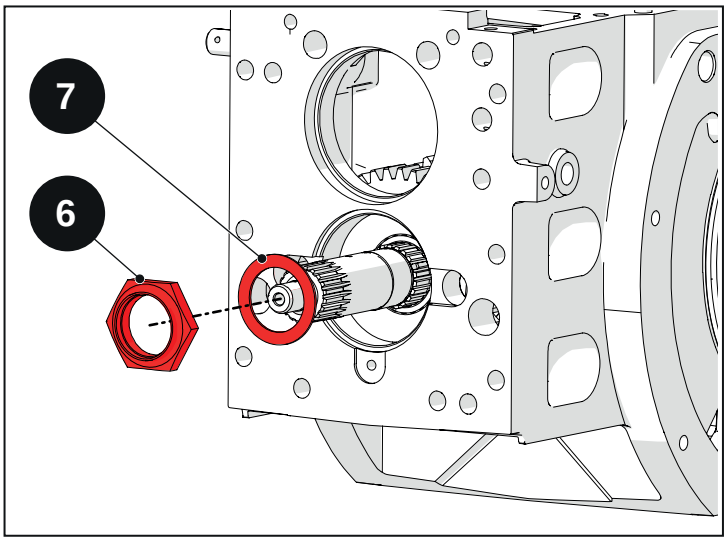

Fig. 5.49

Restrain the ring nut (6) with the tool (B- P/N 07000239).

Use the tool (A) to turn the pinion (2) anticlockwise and tighten the ring nut (6) to a torque of 40 N·m.

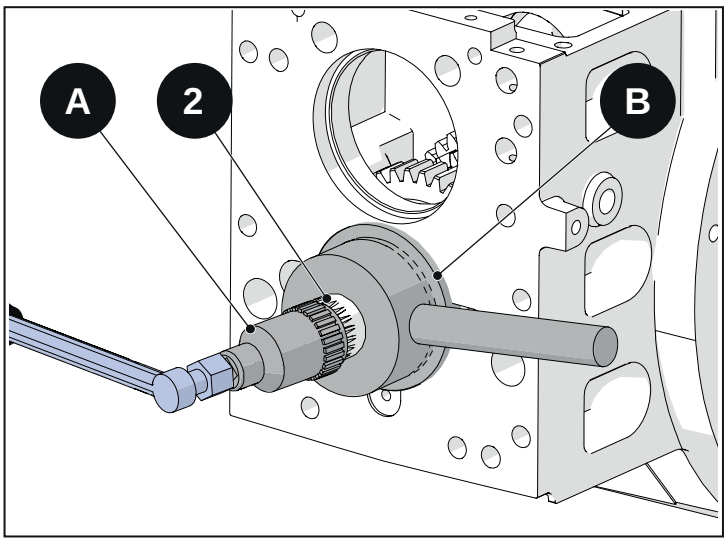

Fig. 5.50

Fit the impediment pin (74).

Fit the plug (72) and the washer (73).

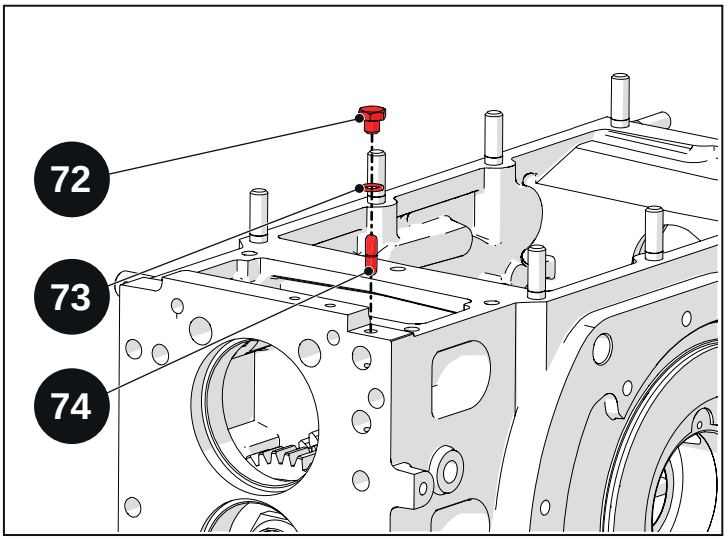

Fig. 5.51

Fit the rod (66) with selector fork (67) of the underdrive gear.

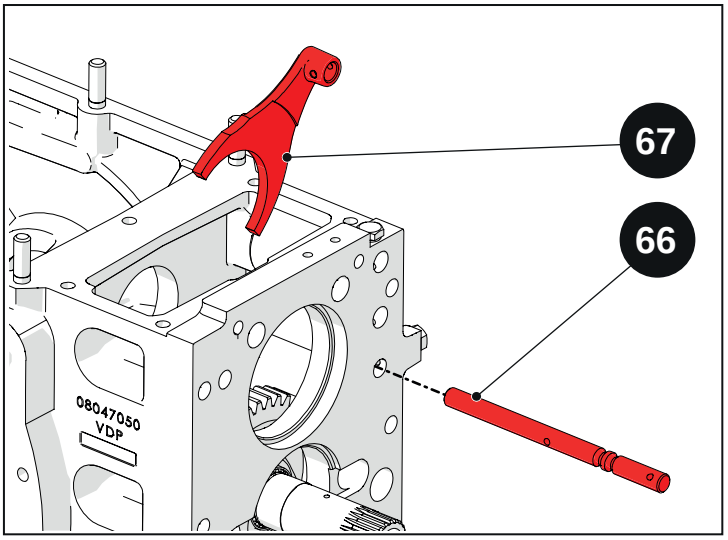

Fig. 5.52

Fit the spring (70) and the ball (71) and then fit the plug (68), with the washer (69), and tighten.

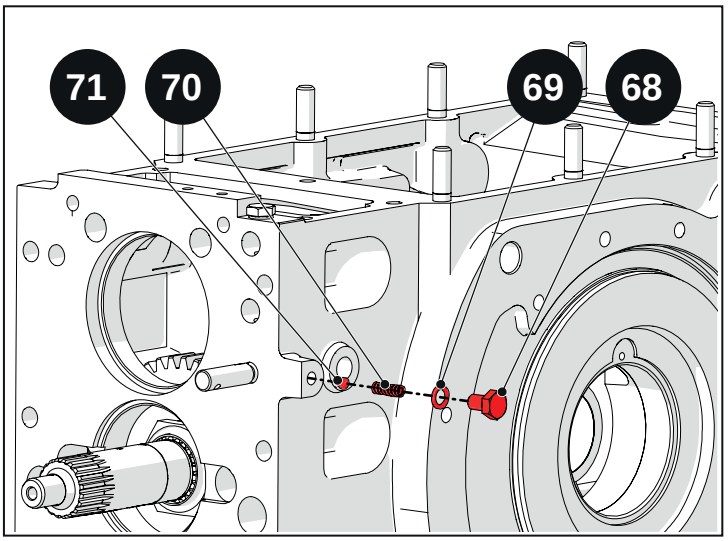

Fig. 5.53

Fit the pin (65).

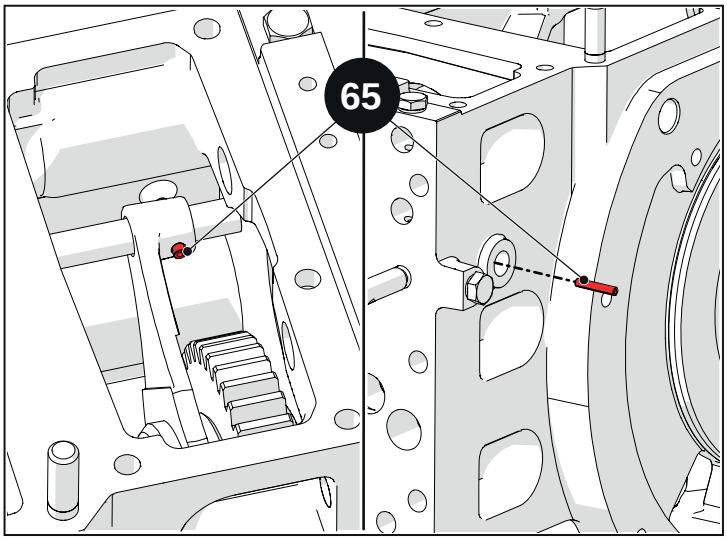

Fig. 5.54

Fit the plug (63), with the washer (64), and tighten.

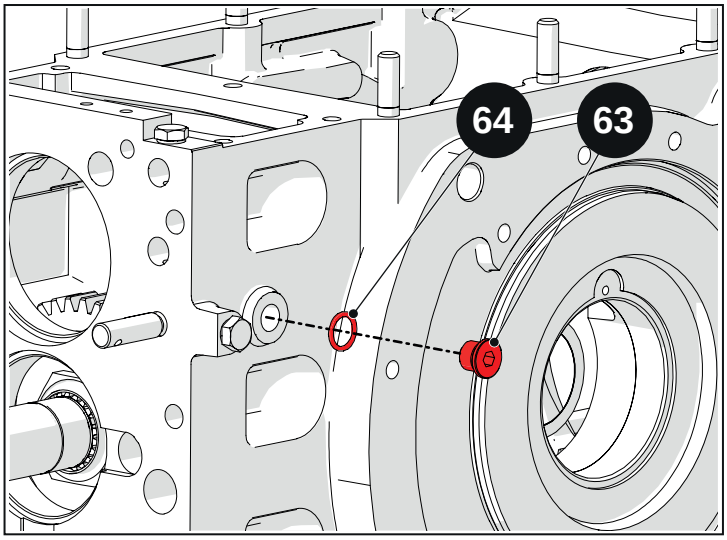

Fig. 5.55

Adjusting free play between pinion and ring gear

Fit the complete crown wheel in the rear differential case from above.

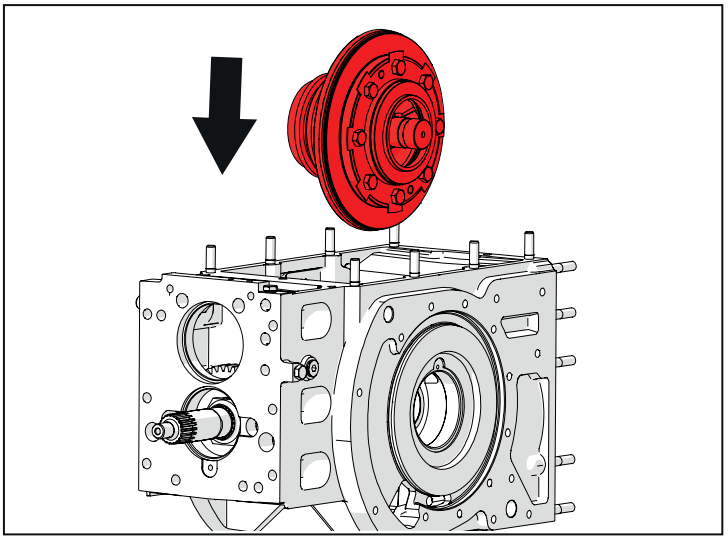

Fig. 5.56

Fit the planetary gear assemblies (34) and (37).

Fit the bearings (35) and (36), and drive them completely into their seats with the bearing punch (E-cod.07006226).

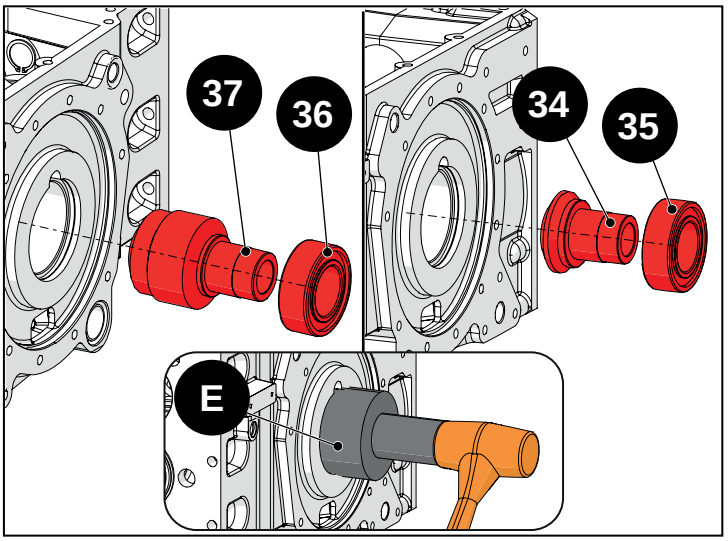

Fig. 5.57

Use the tool (F-p/n 07000237) to tighten the left hand ring nut (33) completely and eliminate the free play between the pinion and the crown wheel.

Attention
Align any of the slots on the ring nut with the hole for fitting the ring nut retainer.

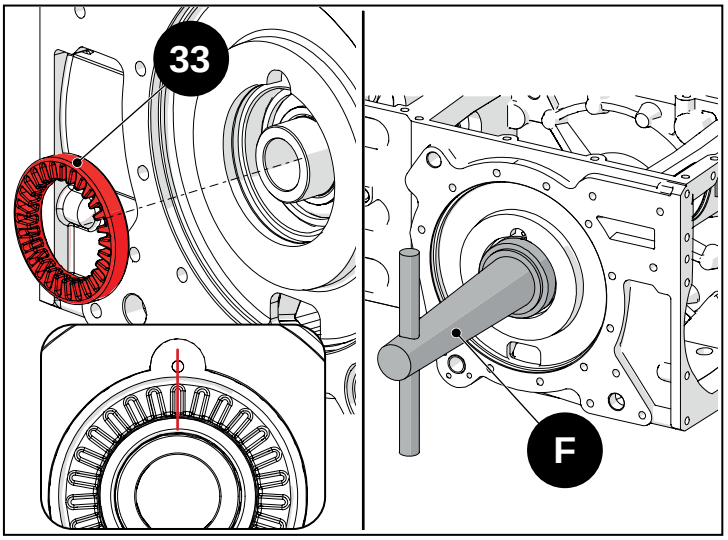

Fig. 5.58

Loosen the ring nut by 3 splines, using the ring nut retainer hole as reference.

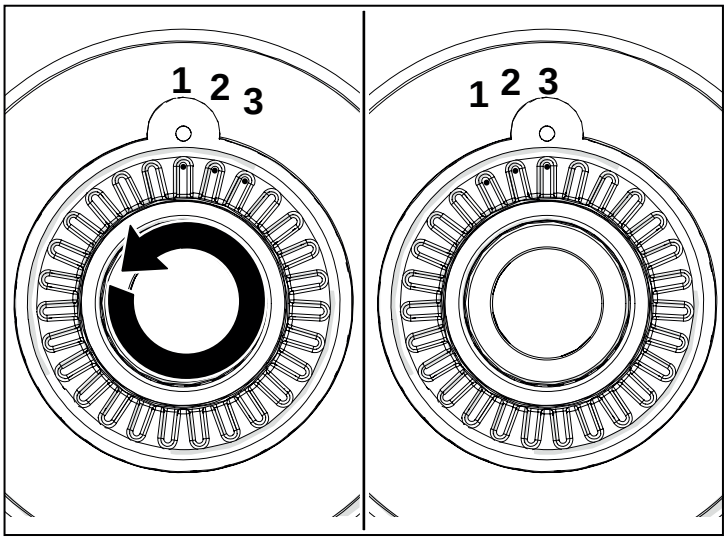

Fig. 5.59

Use the tool (F-p/n 07000237) to tighten the right hand ring nut (33) completely, applying a torque of 20 N·m (2 kg·m).

Attention

Align any of the slots on the ring nut with the hole for fitting the ring nut retainer.

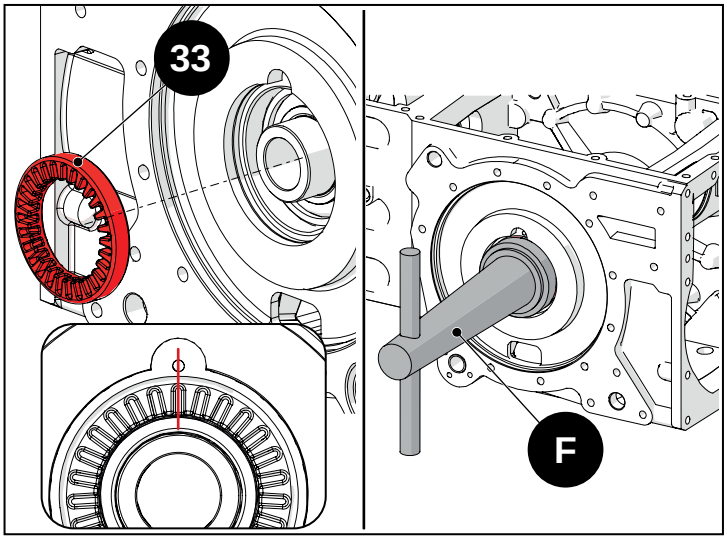

Fig. 5.60

Now measure the free play produced by loosening the left hand ring nut.

Place a dial gauge with magnetic base (G) on a tooth of the ring gear and reset the gauge.

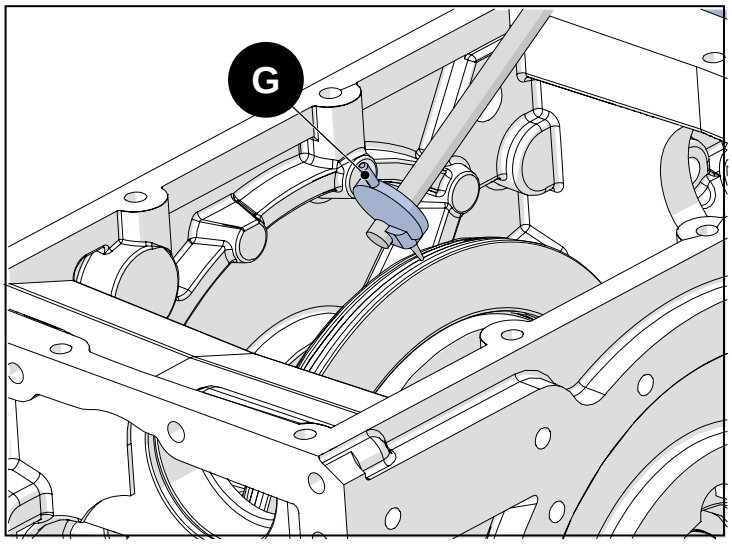

Fig. 5.61

Move the crown wheel gently to measure the backlash relative to the pinion teeth.

The free play between the teeth of the crown wheel and the pinion must be 0.07 to 0.15 mm.

Attention

Measure in at least 4 different positions on the crown wheel.

Note

If the backlash is not within the indicated range, tighten or loosen the crown wheel side ring nut (33).

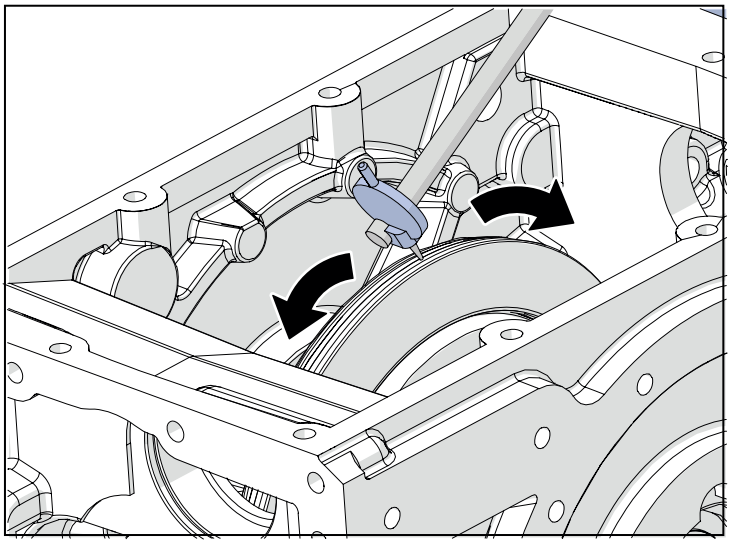

Fig. 5.62

Use the tool (F-p/n 07000237) to tighten the right hand ring nut (33) completely.

Now loosen the ring nut (turning anticlockwise) by 5 splines, using the ring nut retainer hole as reference.

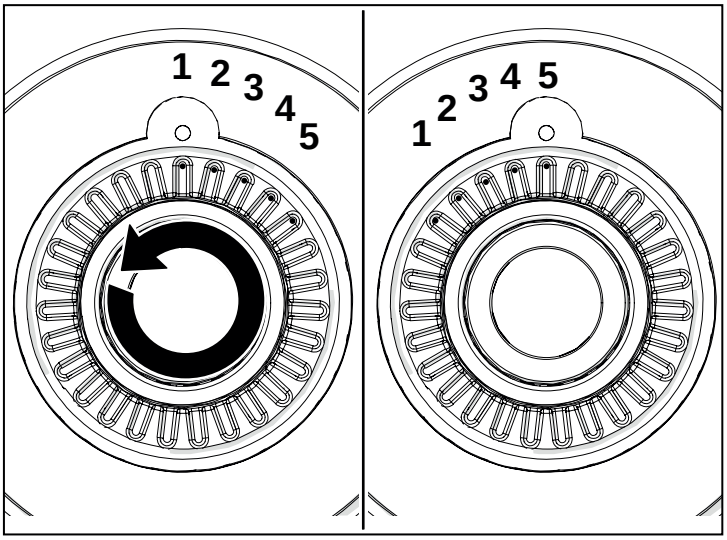

Fig. 5.63

To check that the preload is correct on both sides, tap the planetary gear assembly (75) mounted on the crown wheel with a mallet.

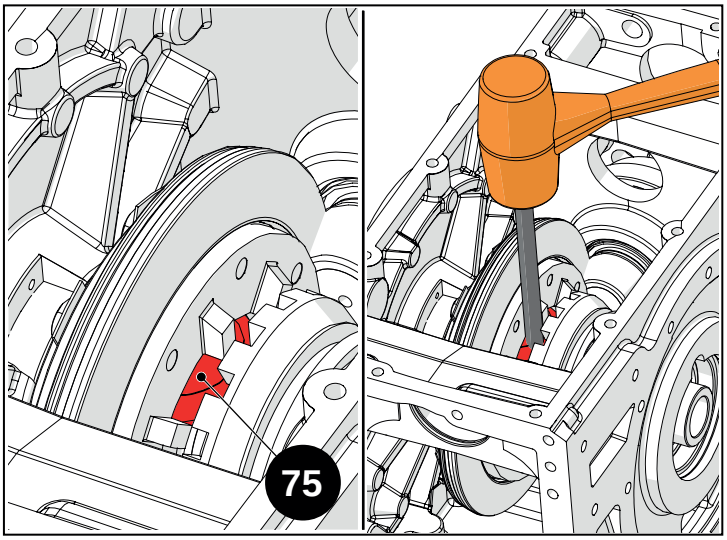

Fig. 5.64

Press the planet gear (75), try to turn the sun gear (34) or (37), and check that there is no free play between the pinion and crown wheel teeth is zero while trying to turn the sun gear.

If any free play between the teeth is noted, adjust the right hand ring nut.

Attention
Check both sun gears.

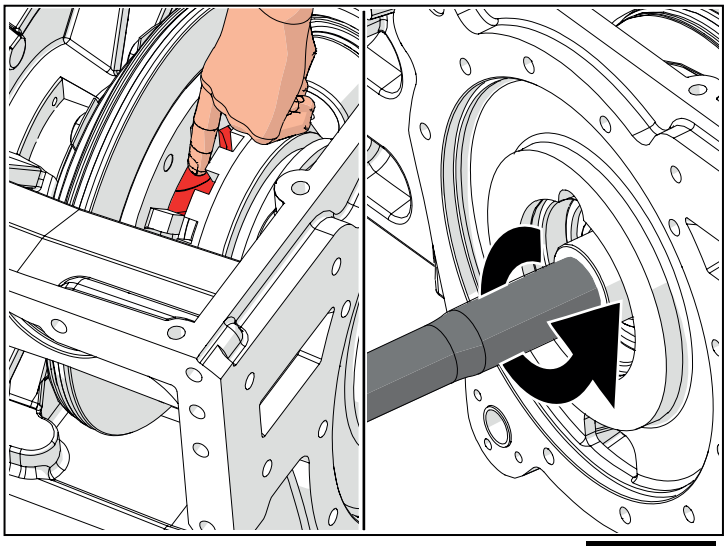

Fig. 5.65

Tighten the ring gear retainer (32).

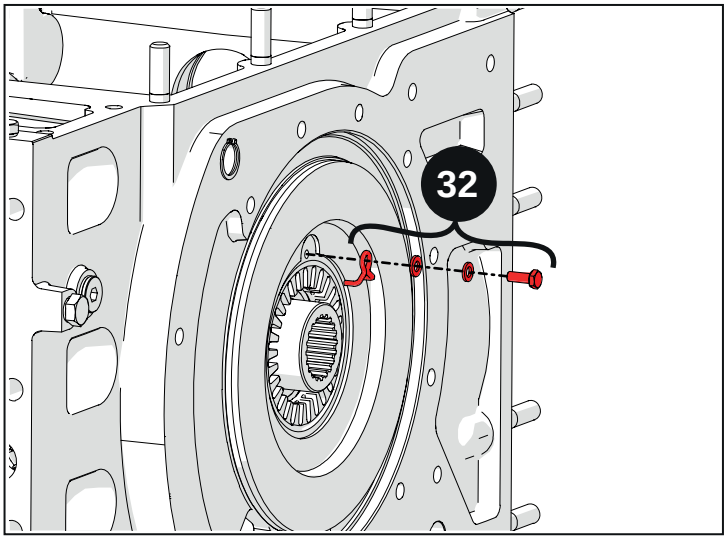

Fig. 5.66

Git the circlip (28) on the PTO shaft (27), and then fit the bearing (29), driving it completely into its seat with a bearing punch tool of suitable diameter.

Attention
Fit the circlip (28) the other way around to facilitate disassembly. Take care not to bend the circlip when fitting the bearing.

Fit the circlips (30) and (26).

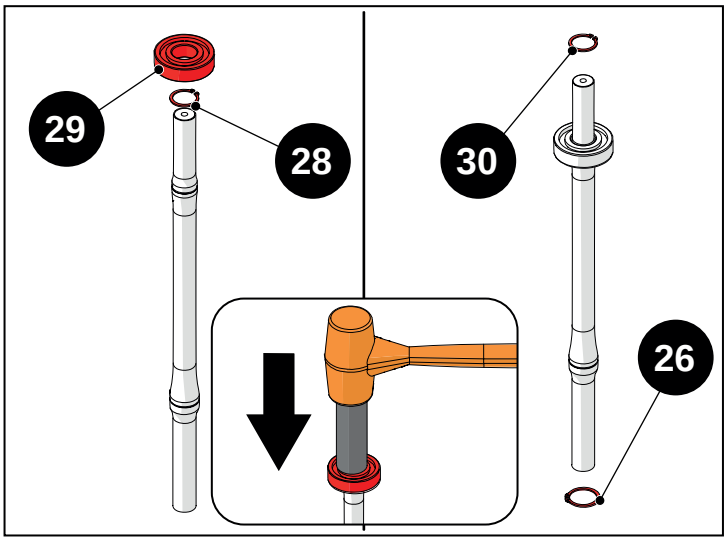

Fig. 5.67

Fit the complete shaft (27) in the differential casing.

Fit the bearing (25) and bring it against the circlip (26) with a suitable punch.

Attention

Tap the shaft (27) with a soft mallet to drive the bearing (29) completely into its seat.

Attention

Take care not to bend the circlip when fitting the bearing.

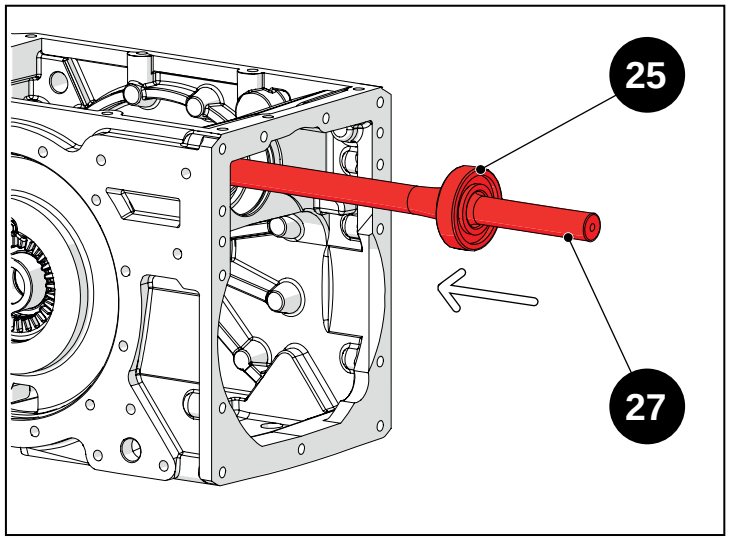

Fig. 5.68

Fit the circlip (24).

Fit the following components in the order indicated:

- gear (23);
- spacer (22);
- gear (18);
- spacers (21) - (one 0.2 mm spacer and one 0.4 mm spacer);
- Bearing (19)

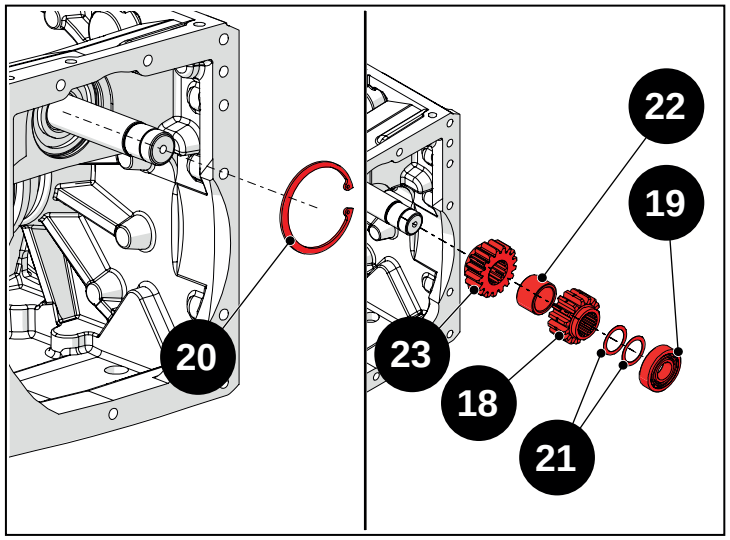

Fig. 5.69

Fit the circlip (20).

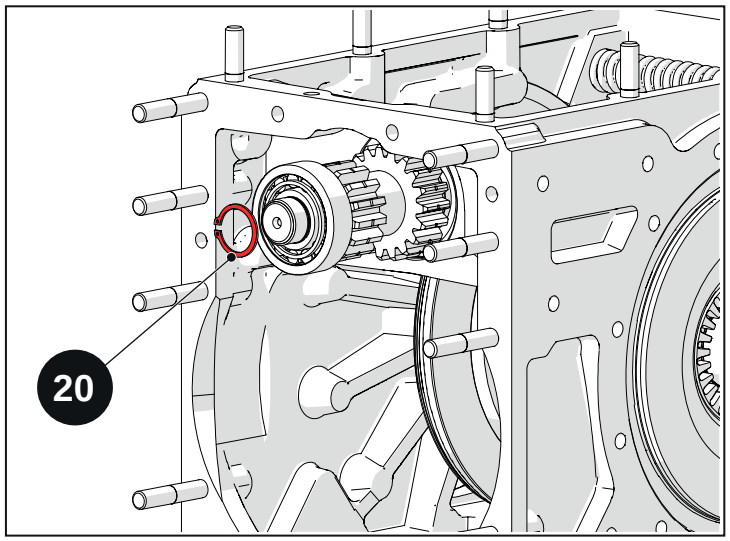

Fig. 5.70

Fit the gear (31).

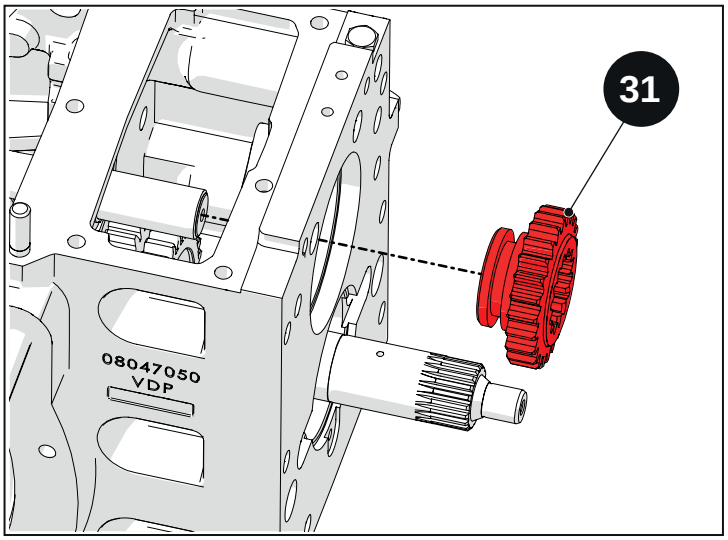

Fig. 5.71

Preassemble the rod (38) with the O-rings (62) and the circlip (61).

Fit the rod (38), the spring (40) and the fork (39) in the differential casing.

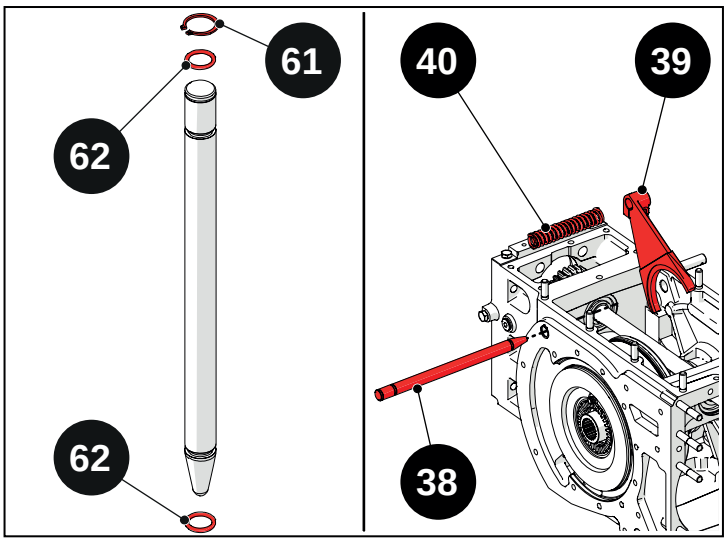

Fig. 5.72

Tighten the screw (59) with the washer (60) onto the differential lock fork.

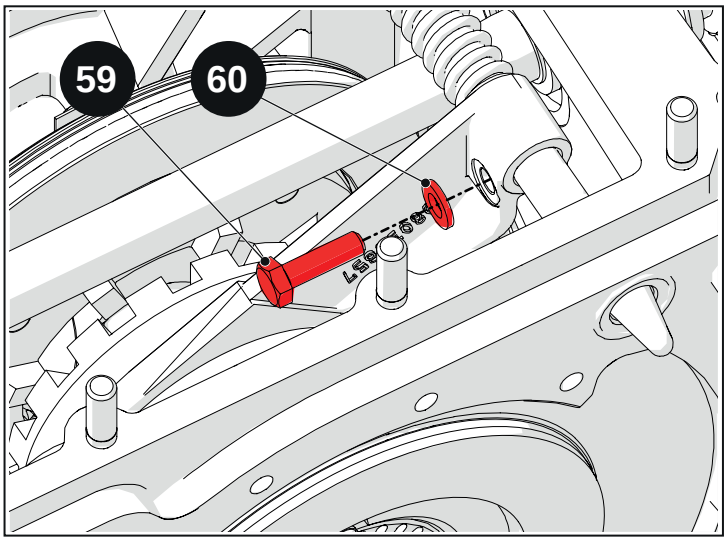

Fig. 5.73

Fit the snap rings (76) on the piston (57).

Apply a layer of grease to the lever cylinder (55), and then fit the piston.

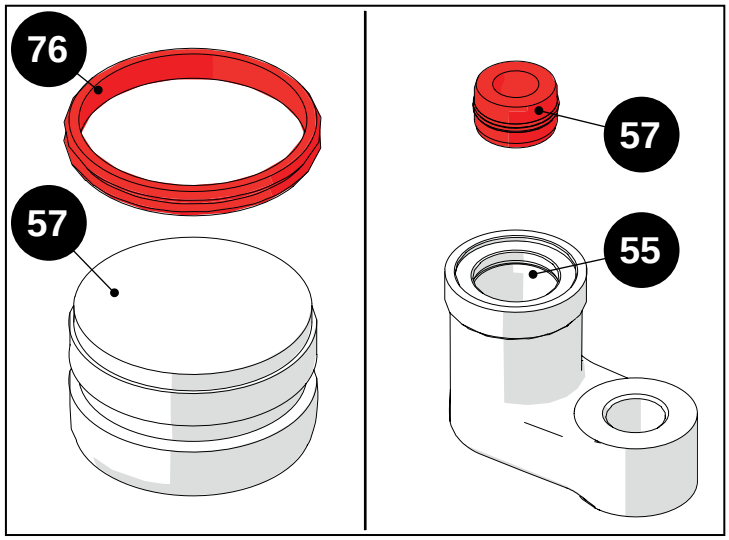

Fig. 5.74

Push the piston fully into the cylinder and fit the circlip (58) in its seat.

Check that the piston moves inside the cylinder without impediment, blowing compressed air through the hole to push the piston against the circlip (58).

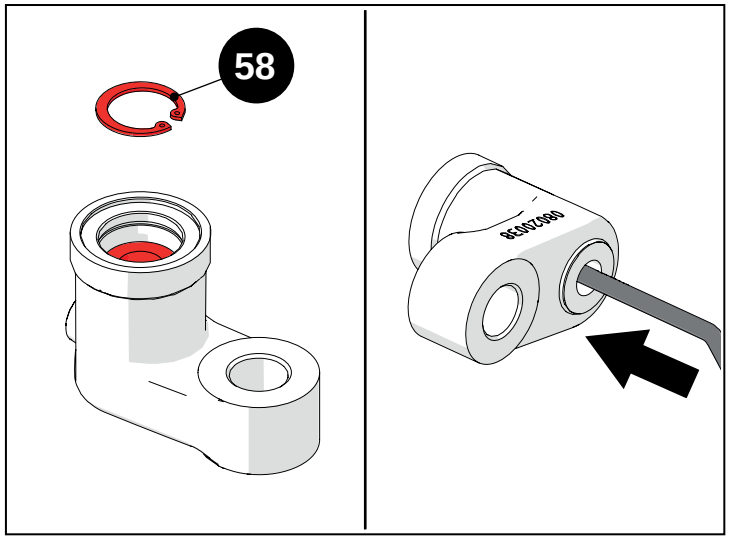

Fig. 5.75

Tighten the tool (H-07007183) onto the cylinder to keep the piston pressed against the circlip (58).

Fit the spacer (56) and the lever cylinder (55), and then fit the washer (54) and the nut (53).

Tighten the nut (53).

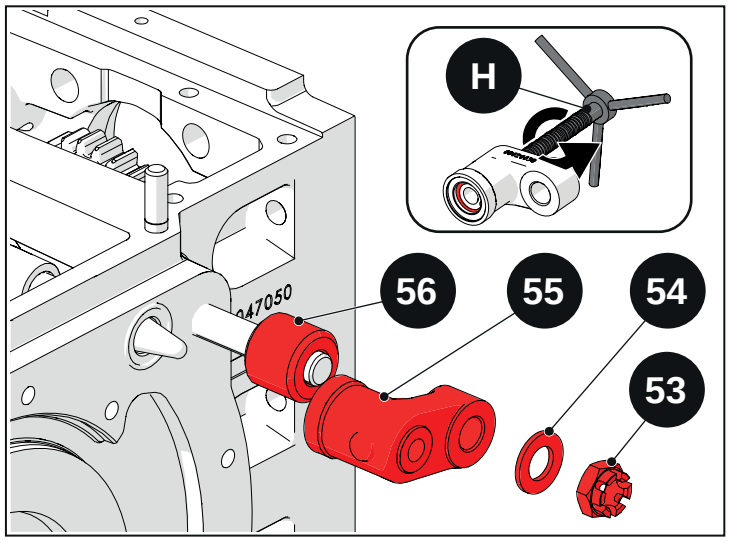

Fig. 5.76

Fit the pin (52) of the differential lock.

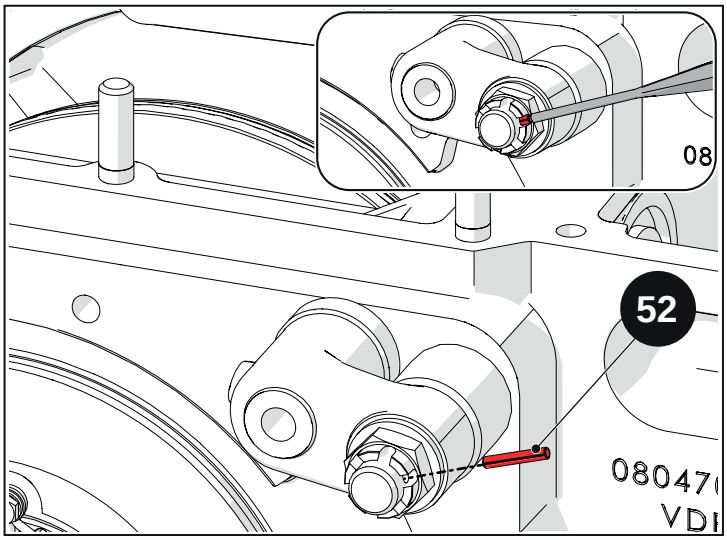

Fig. 5.77

After fitting differential lock lever, check that the fork travel is adjusted correctly by checking that there is a space of 1.5 to 2.0 mm left between the differential lock ring and the teeth of the crown wheel.

Loosen the screw (59) partially.

Tighten the tool (H-07007183) into the hole again to push the piston (57) and, as a result, the rod (38).

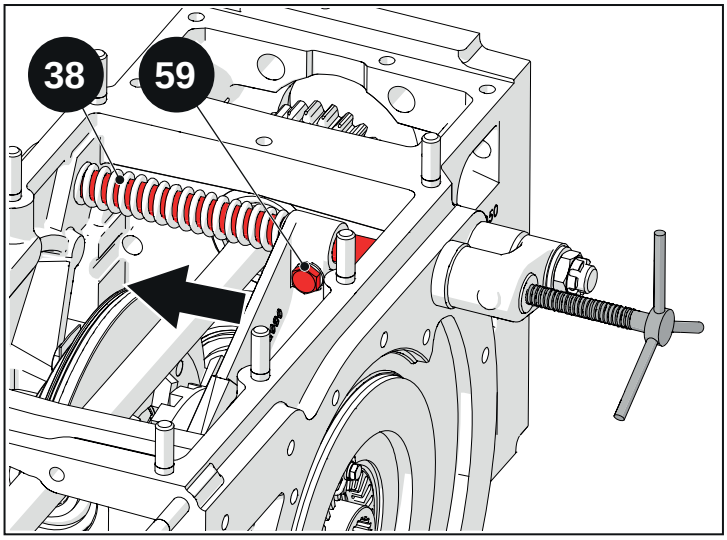

Fig. 5.78

Use a small lever to push the fork (39) and compress the spring (40).

Push the rod (38) to bring it into contact with the piston (57).

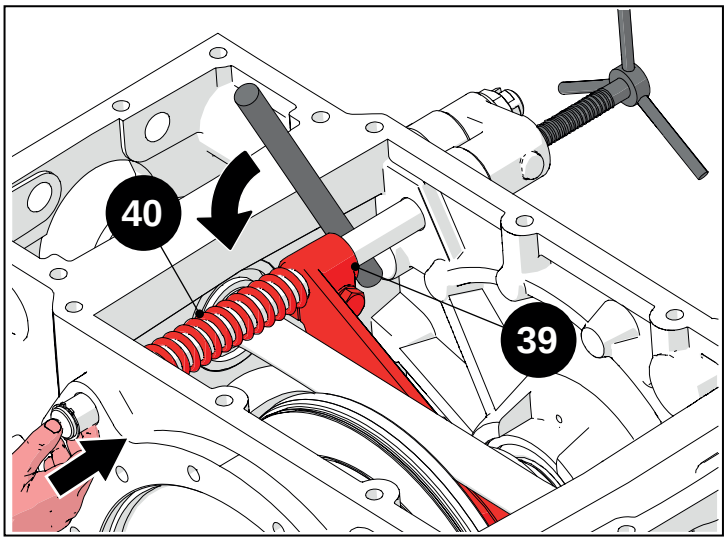

Fig. 5.79

Release the spring (40) by the amount necessary to move the fork (39) through a travel of 1.5 to 2.0 mm.

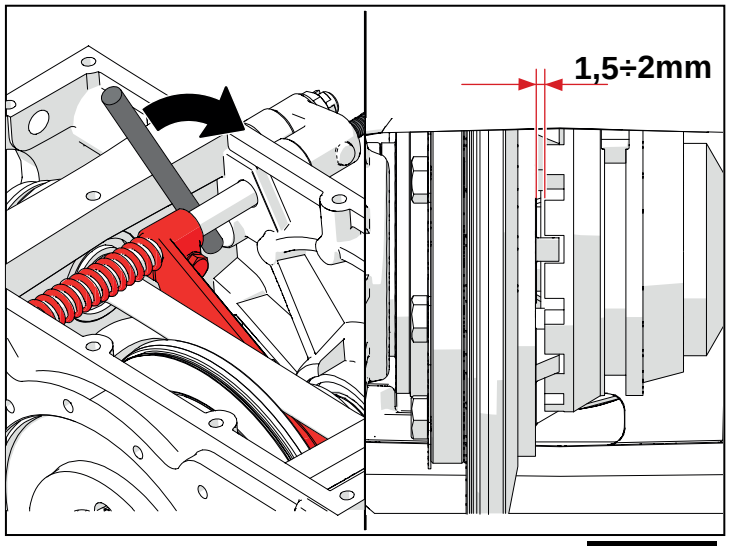

Fig. 5.80

Tighten the retainer screw (59) of the fork (39) .

Undo the tool (H) and release the spring (40) completely.

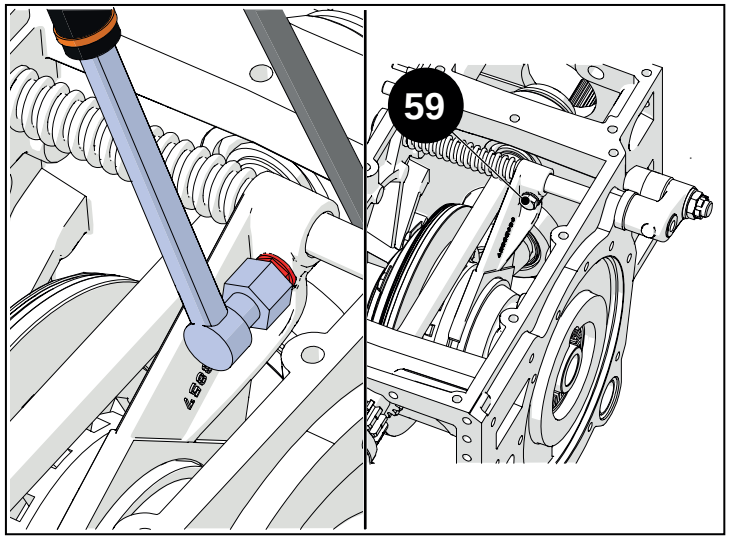

Fig. 5.81

Fit the retainer (3) and the washer (5) and tighten the screw (4).

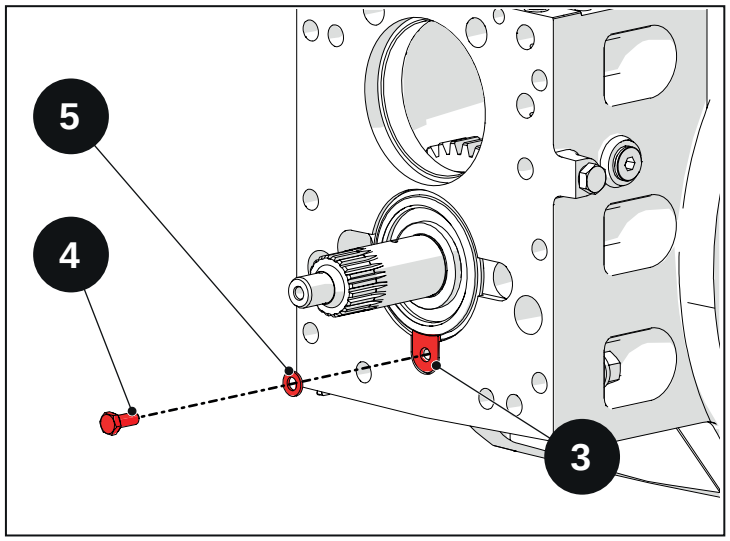

Fig. 5.82

Apply a coating of Teflon to the parts of the stud bolt threads tightened into the through holes to prevent oil leakage.

Apply a coating of silicone to the mating surface between the gearbox and the differential.

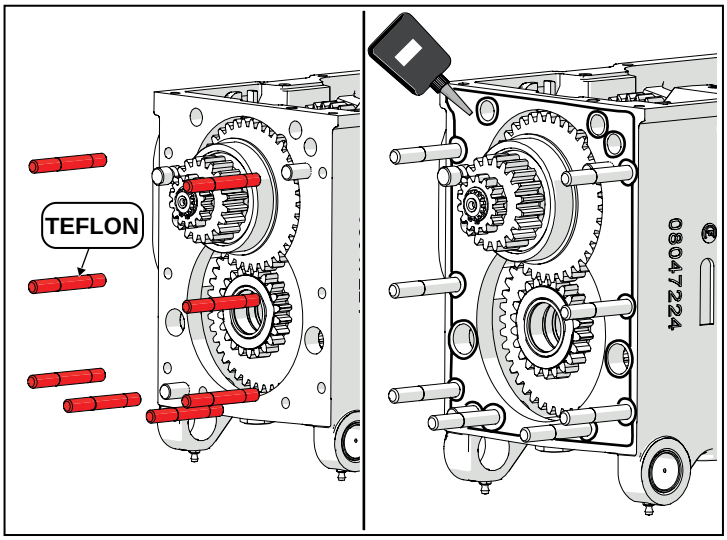

Fig. 5.83

Mate the gearbox with the differential.

Attention

Engage the gears to facilitate connection of the two assemblies.

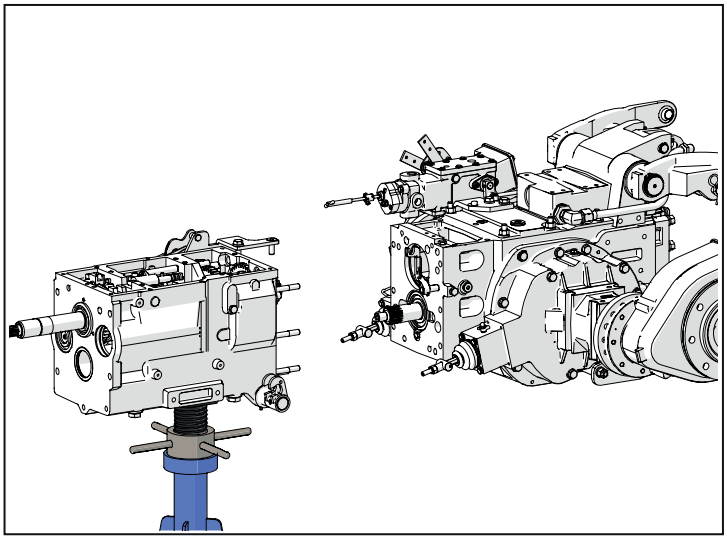

Fig. 5.84

Fit the washers and tighten the screws to a torque of 160 N·m (16 kg·m).

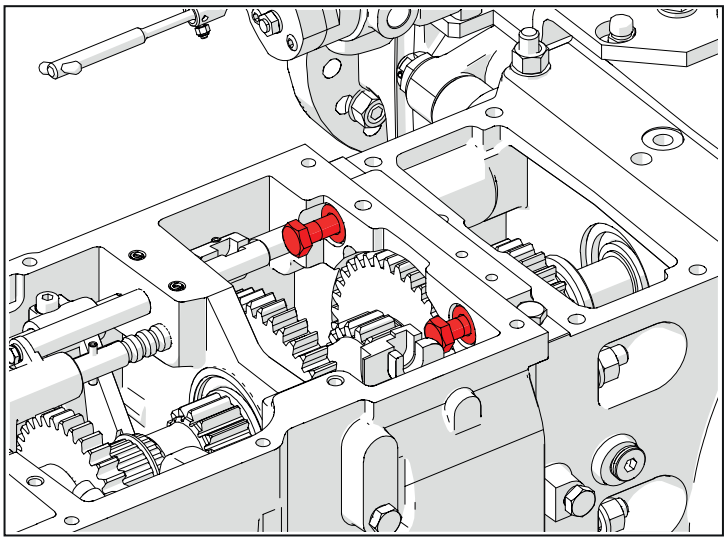

Fig. 5.85

Tighten the two self-locking nuts.

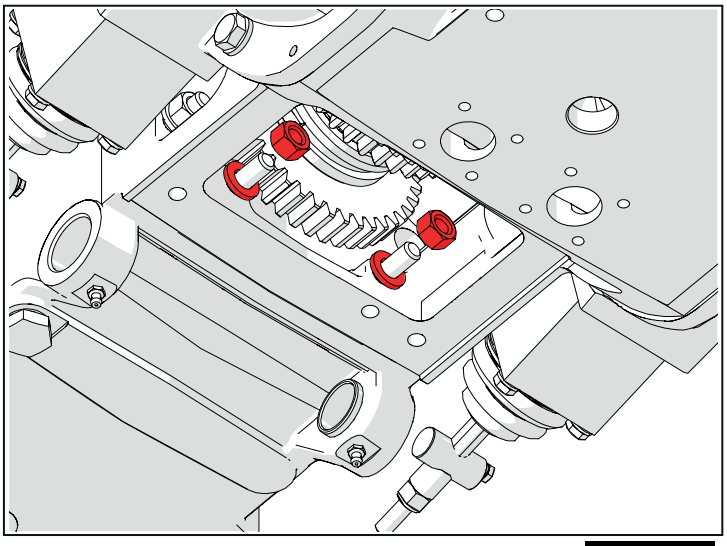

Fig. 5.86

Fit the washers (47) and tighten the nuts (46) to a torque of 85 N·m (8.5 kg·m).

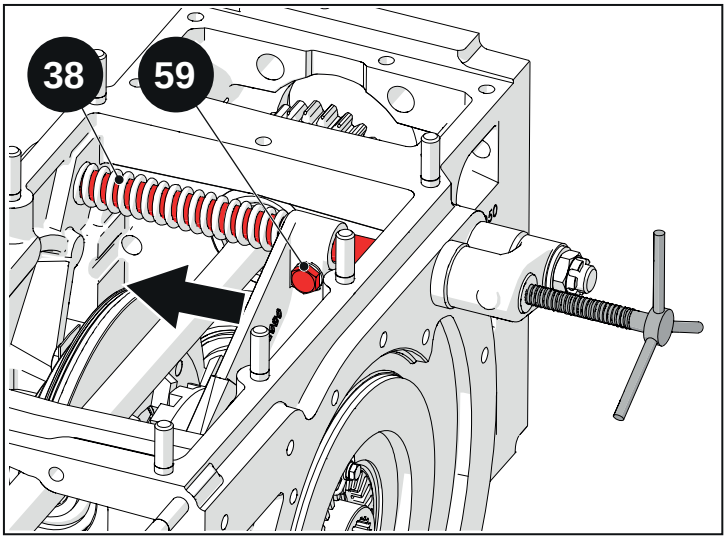

Fig. 5.87

Apply a coating of silicone sealant to the mating surfaces.

Fit the complete 4WD transfer case assembly.

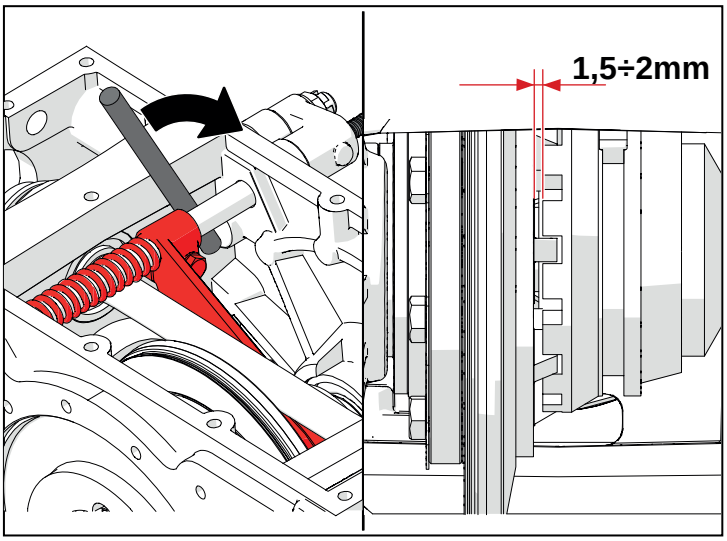

Fig. 5.88

Fit the washers and tighten the screws to a torque of 85 N·m (8.5 kg·m).

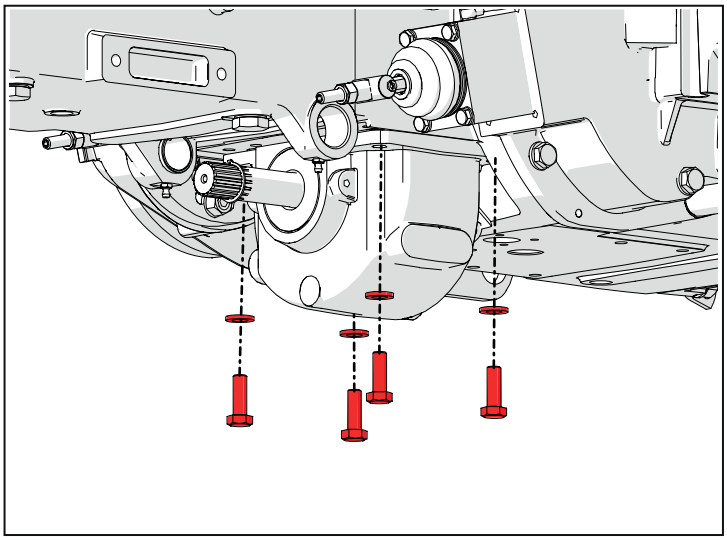

Fig. 5.89

5.6 Tightening torques

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5.6.1 Tightening torques

The main tightening torques are listed as follows. For all other tightening torques, see chapter "1- Introduction".

Tightening torque	N·m	kg·m
Differential casing - gearbox fastener nut M12x12	85	8.5
Differential casing - gearbox fastener screw M18x15	160	16
Differential casing - lift fastener nut M12x12	85	8.5
Rear axle cover fastener screw M12x30	85	8.5
Differential casing - rear PTO cover fastener nut M12x12	85	8.5
Differential casing - hub fastener screw M12x40	85	8.5
Differential casing - 4WD transfer case carrier fastener screw M12x35	85	8.5
Bevel crown wheel fastener screw M12x50	90	9
Differential lock control fork fastener screw M10x35	55	5.5
Ring nut fastening bevel pinion	40	4
Differential fastener ring nut	20	2
PTO shaft fastener ring nut	25	2.5

5.7 Tools necessary

Index

5.7.1 Tools necessary.....5-50

5.7.1 Tools necessary

p/n	Description	Quantity
07000237	Wrench for ring nut 1363	1
07000239	Tool 1363/20 - 1363	1
07000247	Differential stand	1
07006223	Punch for installing differential tapered roller bearing	1
07006224	Punch for installing bevel pinion tapered roller bearing	1
07006226	Punch for installing differential sun gear bearing	1
07007183	Rear differential lock cylinder installation tool	1
07000215	Gearbox assembly support stand - base	1
07000245	Tractor separation support frame	1
07000247	Rear differential case support stand	1

6 : Rear final drive units

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6.6.1 Tools necessary.....6-24

6.1 Safety rules

These safety precautions and warnings given in this paragraph must be observed at all times to prevent the risk of operator injury. However, the safety measures indicated in the use and maintenance manual and in chapter 1 of this manual must also be applied at all times.

Danger
All other persons must keep at a safe distance from the danger area.

Danger
Lift and handle all heavy parts with lifting equipment of adequate load capacity. Hoisting straps and hooks must be positioned safely on the load. When lifting loads, all personnel must keep at a safe distance from the load itself and remain within safe areas.

Danger
Do not allow the chains or metal cables used for hoisting to twist. Always wear safety gloves when handling cables or chains.

Danger
Use appropriate tools to align the holes correctly. NEVER USE YOUR HANDS OR FINGERS.

Danger
Handle all parts with extreme caution. Never place your hands or fingers between two parts.

Danger
When removing assemblies which could fall, always leave two screws in opposite positions in place for safety until the assembly is secured. Only remove these screws after securing the assembly to a hoist or after fitting support blocks in place.

Danger
If any of the screws fastening the frame or cab are loosened, or if the frame or cab is removed, ensure that all parts are refitted correctly at the end of the procedure to ensure that the driver is protected.

Attention
Beware of sharp edges and corners at the top of the gearbox housing.

Attention
Used oils must be collected and disposed of in compliance with applicable legislation.

6.2 General introduction

Index

6.2.1 Assembly drawing 6-4

6.2.1 Assembly drawing

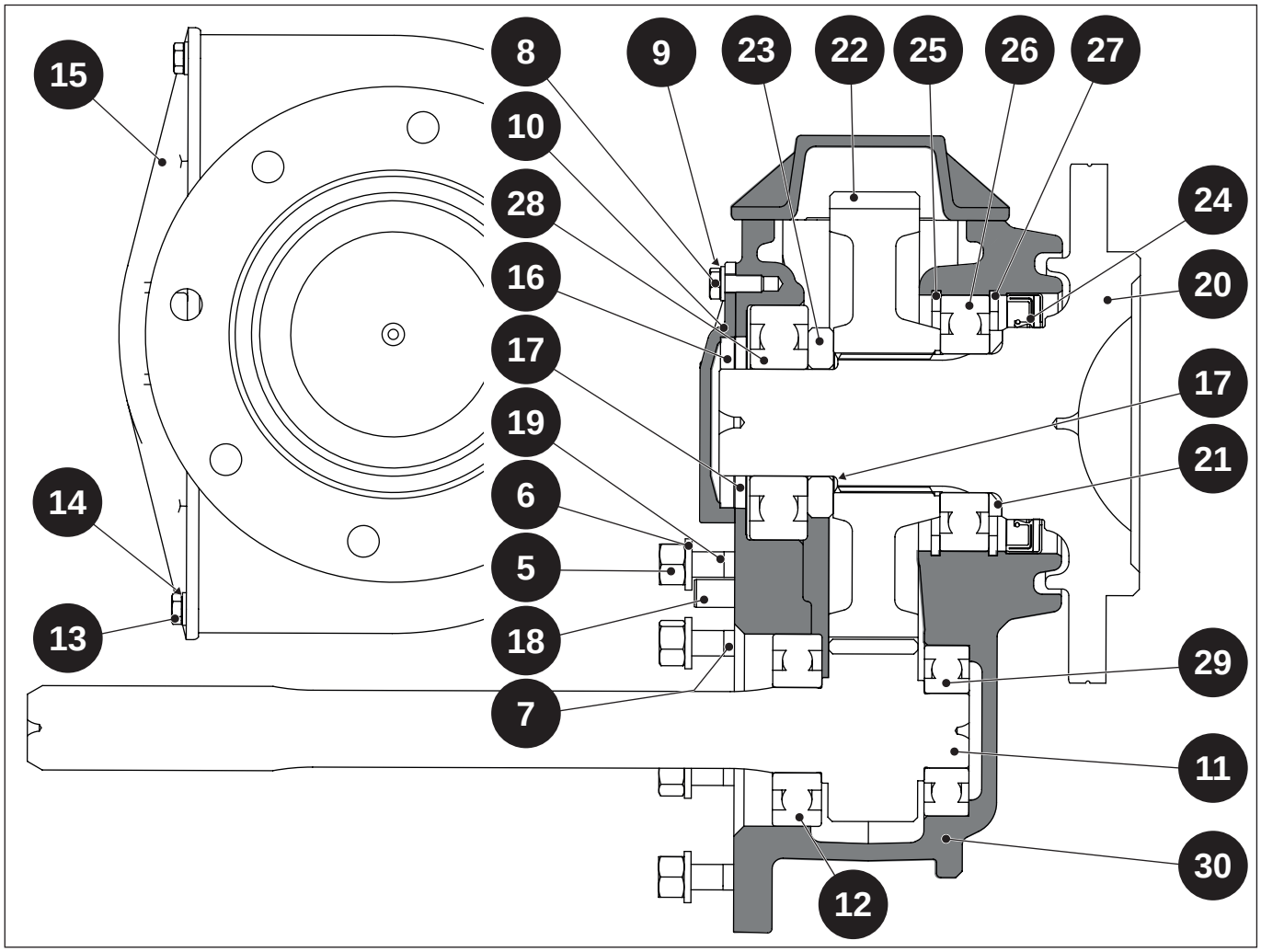

Fig. 6.1

5 - Nut
6 - Washer
7 - Plate
8 - Screw
9 - Washer
10 - Cover
11 - Pinion
12 - Bearing
13 - Screw
14 - Washer
15 - Cover
16 - Ring nut
17 - Stop washer
18 - Centring pin
19 - Stud bolt
20 - Half-axle
21 - Spacer
22 - Reduction gear
23 - Spacer
24 - Oil seal
25 - Circlip
26 - Bearing
27 - Circlip
28 - Bearing
29 - Bearing
30 - Rear final drive unit casing

6.3 Disassembly

Index

6.3.1 Disassembly.....6-6

6.3.1 Disassembly

Attention

The following instructions are applicable for both final drive units. Note however that the ring nut (16) on the left hand final drive unit has a left handed thread while the ring nut on the right hand final drive unit has a right handed thread. The left hand axle shaft (20) is also shorter than the right hand axle shaft.

Undo the plugs (31).

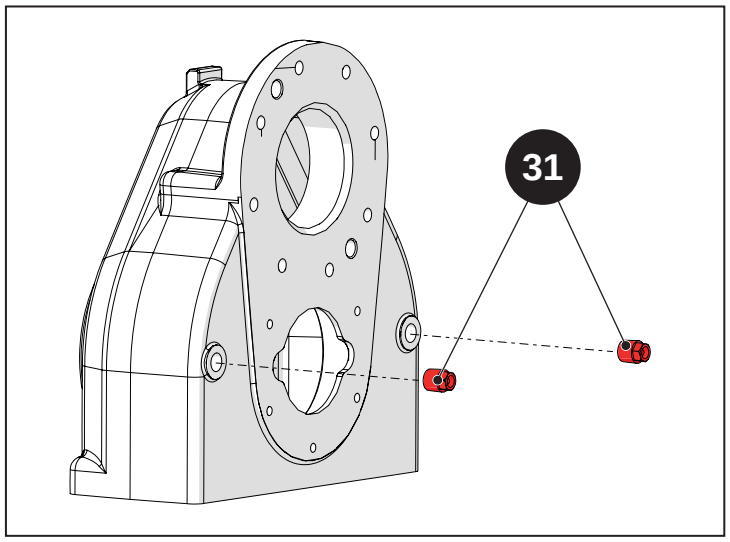

Fig. 6.2

Use a mallet and a chisel to free the nuts.

Undo the nuts (5) and remove the washers (6).

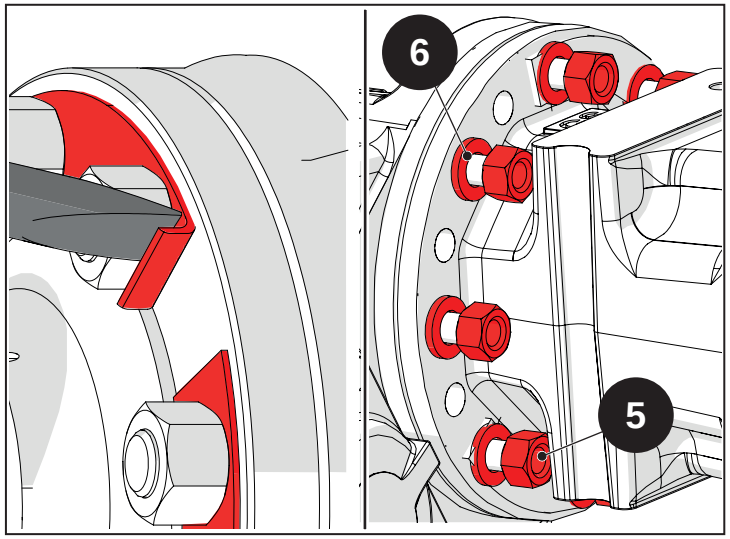

Fig. 6.3

Remove the plates (7).

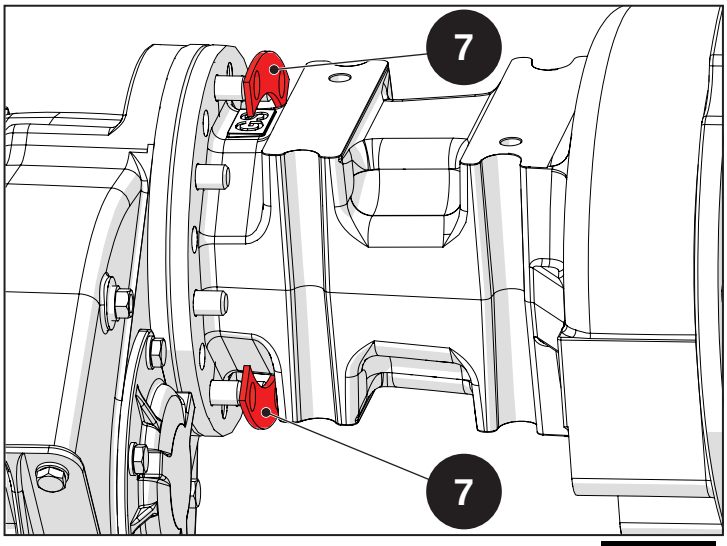

Fig. 6.4

Remove the complete final drive unit from the rear half axle.

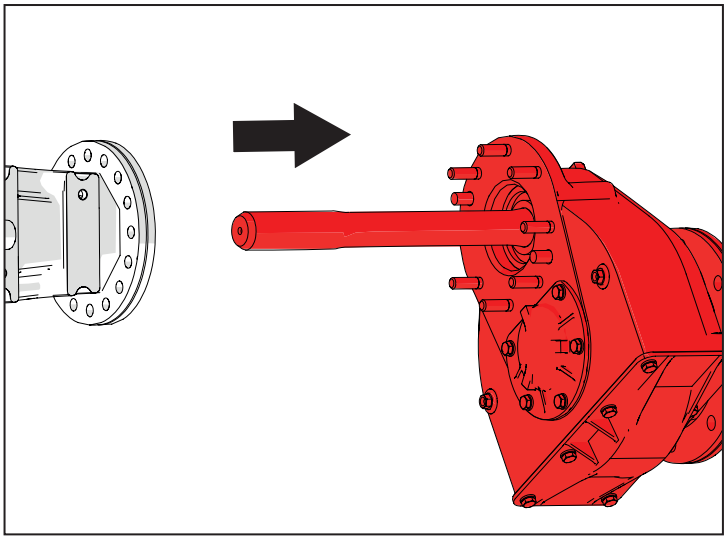

Fig. 6.5

Undo the screws (8) and remove the washers (9) and the cover (10).

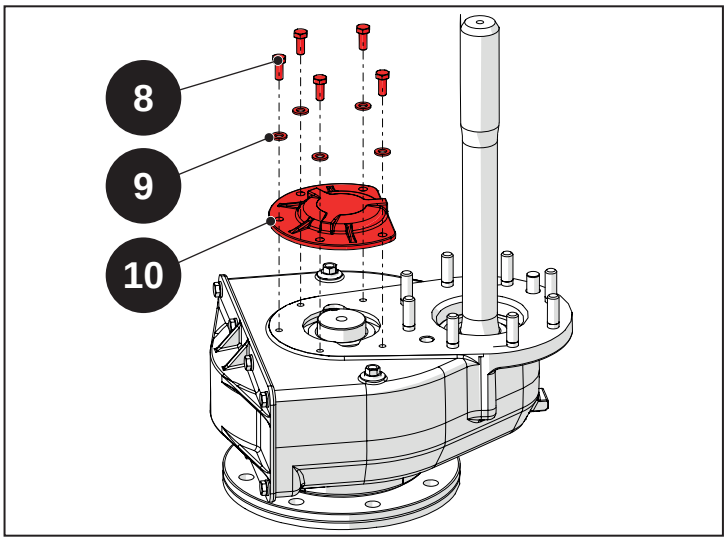

Fig. 6.6

Remove the pinion (11) from the final drive unit.

Remove the bearing (12) from the pinion (11).

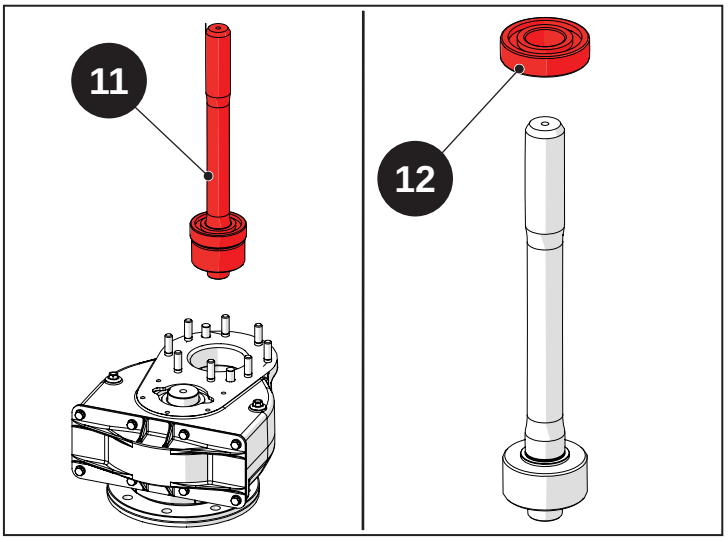

Fig. 6.7

Undo the screws (13) and remove the washers (14) and the cover (15).

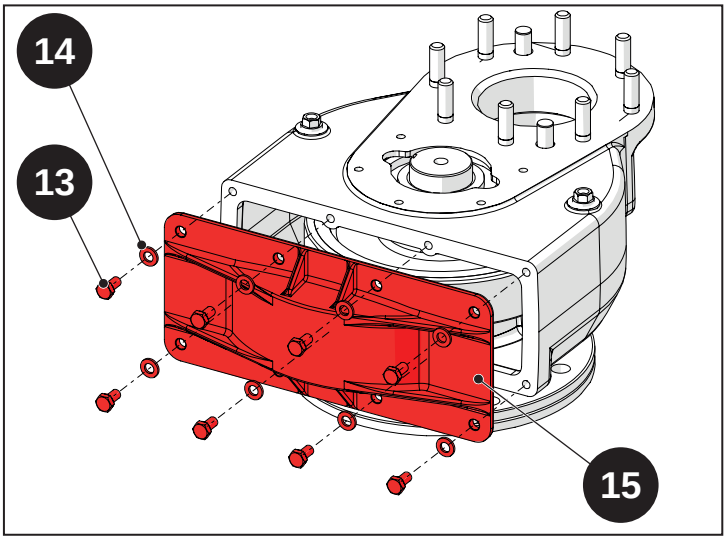

Fig. 6.8

Use the tool (A-p/n 07000227) to remove the ring nut (16).

Remove the retainer washer (17).

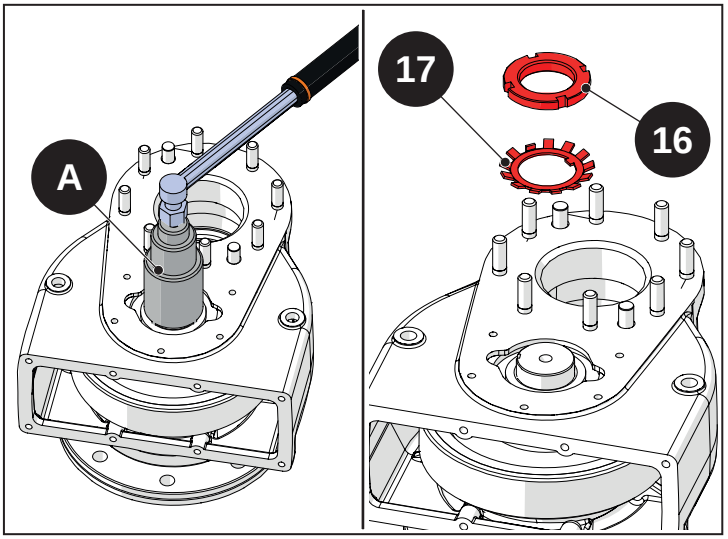

Fig. 6.9

Remove the rear half axle (20) from the casing and then remove the spacer (21).

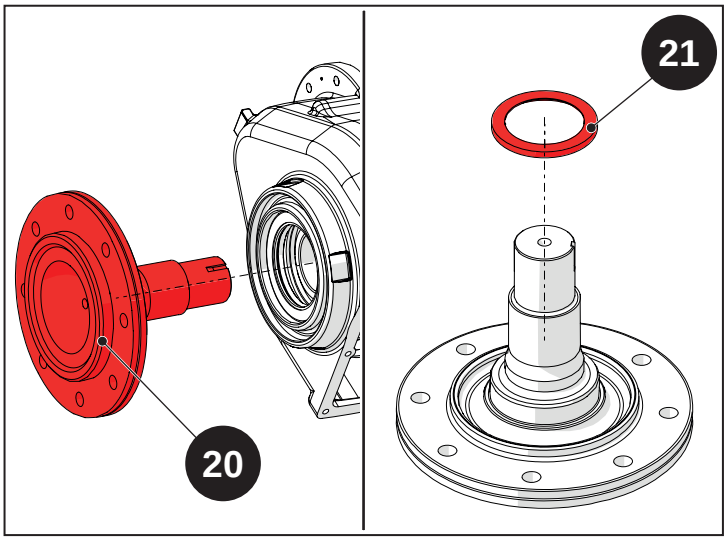

Fig. 6.10

Remove the final drive reduction gear (22) and the spacer (23) from the rear final drive unit casing.

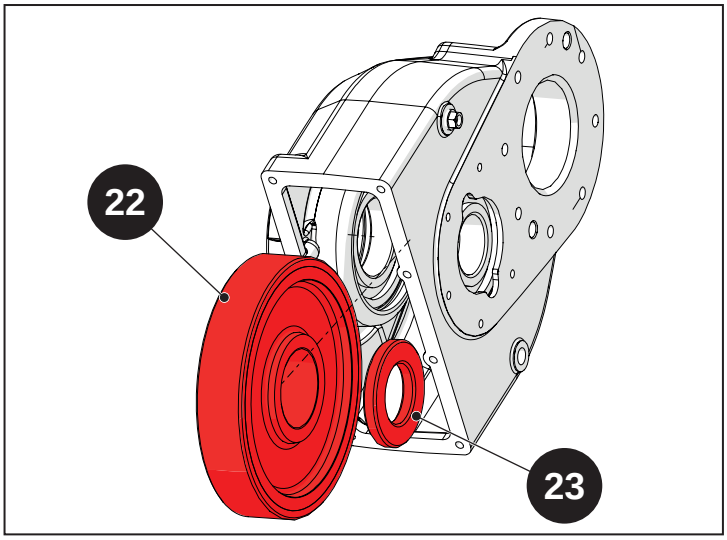

Fig. 6.11

Remove oil seal (24).

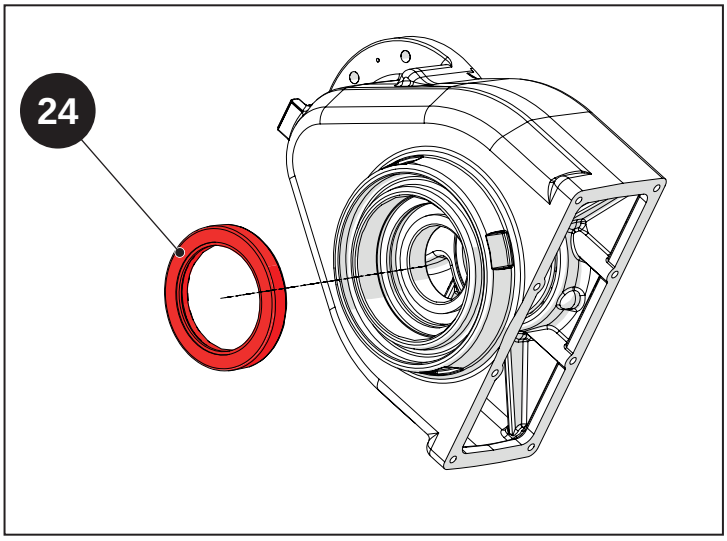

Fig. 6.12

Remove the circlip (25) and the bearing (26).

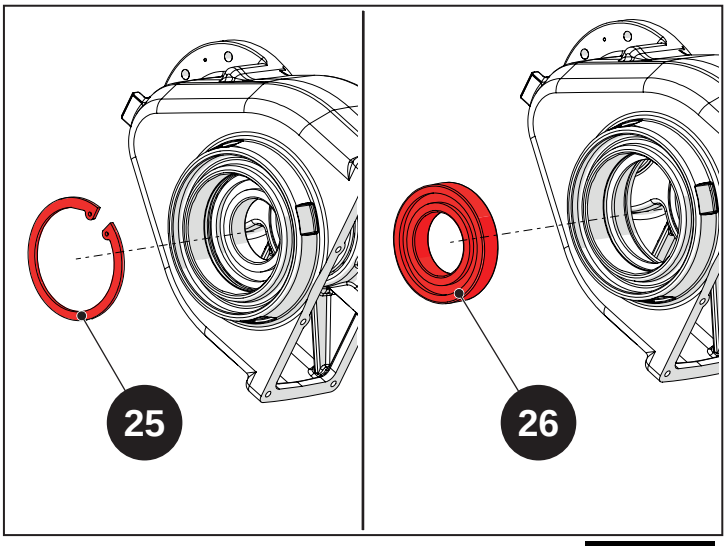

Fig. 6.13

Remove the circlip (27).

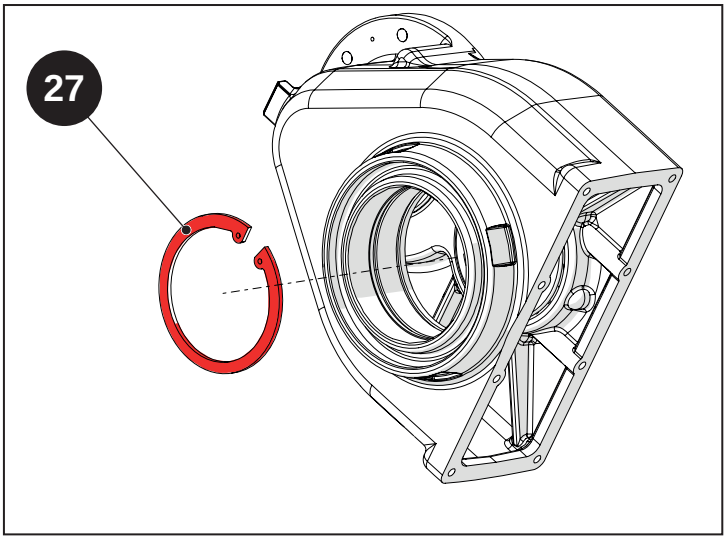

Fig. 6.14

Remove the bearing (28).

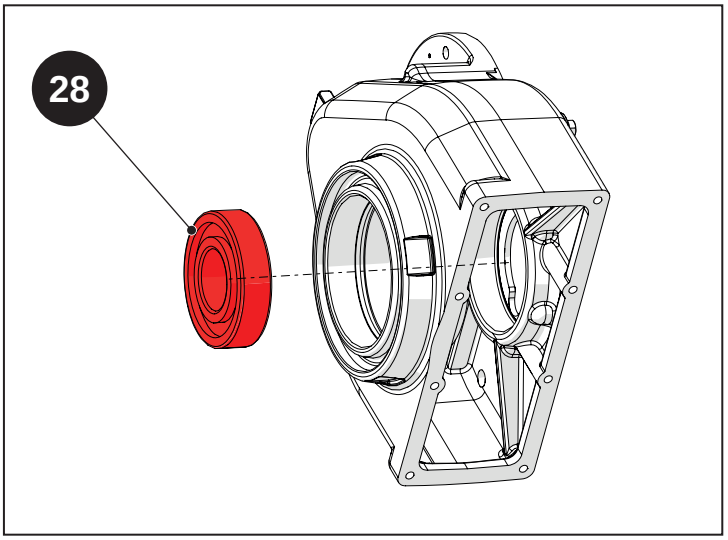

Fig. 6.15

Remove the bearing (29).

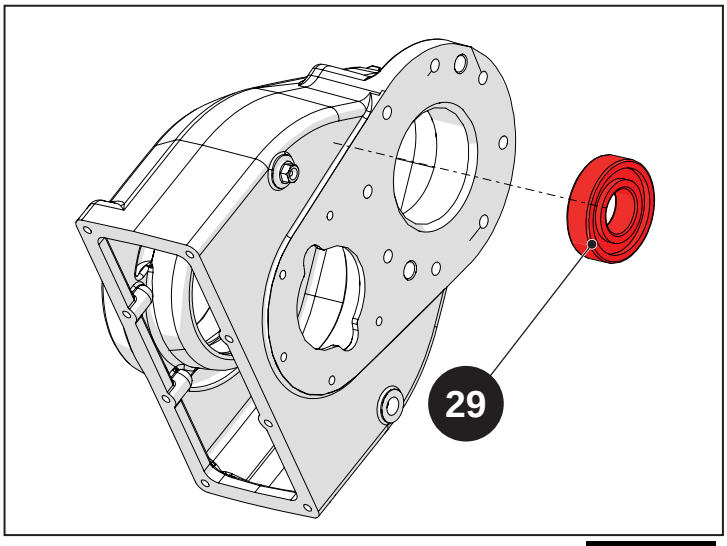

Fig. 6.16

6.4 Main inspection, reassembly and adjustment procedures

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6.4.1 Main inspection, reassembly and adjustment procedures

Warning

Read the instructions in chapter "1-Introduction" and, in particular, the sections concerning the installation of O-rings, oil seals and bearings, with particular care before reassembling, and follow these instructions precisely when working.

Apply the correct tightening torques when tighten the fasteners of components. Where tightening torques are not specified, refer to the table in chapter "1-Introduction".

Use the specified sealant products during reassembly. Where the sealant required is not specified, refer to the table in chapter "1-Introduction".

Apply a coating of silicone sealant to the threads and then fit and tighten the plugs (31).

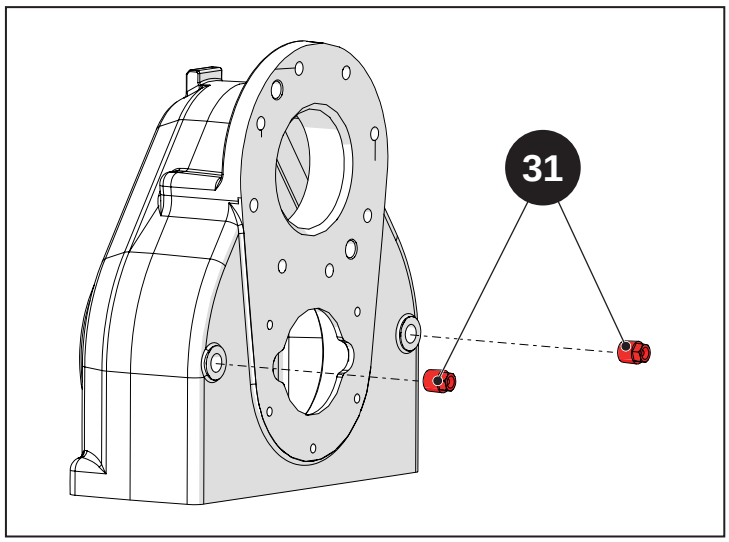

Fig. 6.17

Use a bearing punch tool of suitable diameter to drive the bearing (29) into the rear final drive unit casing.

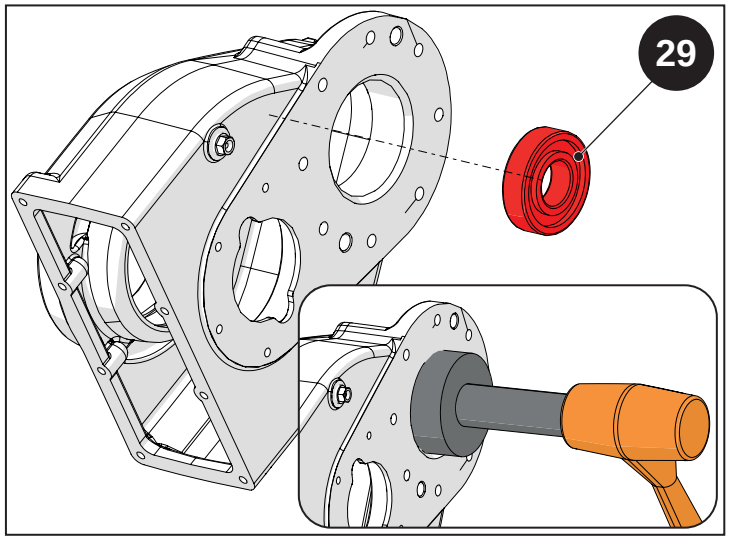

Fig. 6.18

Use a bearing punch tool of suitable diameter to drive the bearing (28) into the rear final drive unit casing.

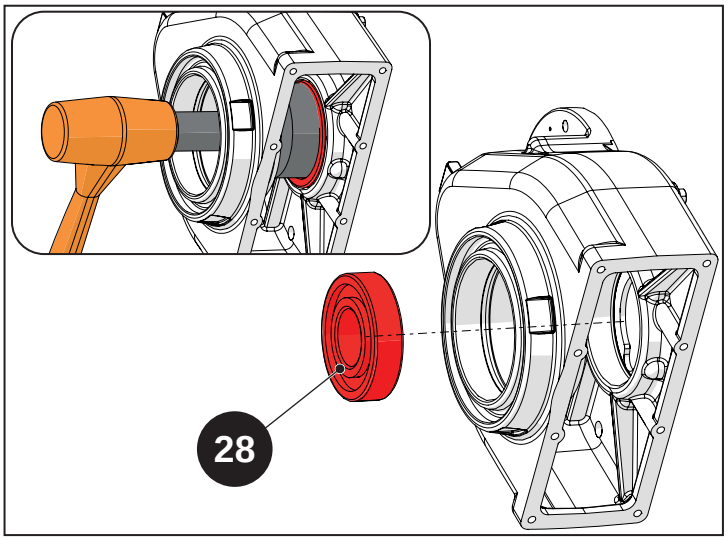

Fig. 6.19

Fit the circlip (27).

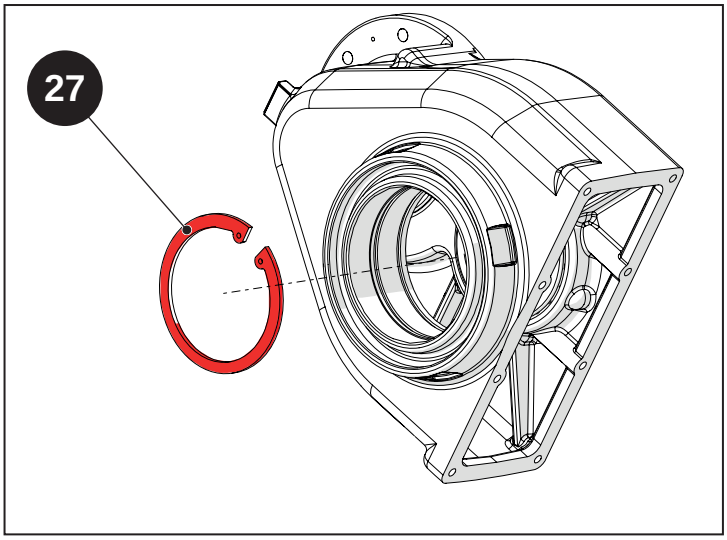

Fig. 6.20

Fit the bearing (26) and then the circlip (25).

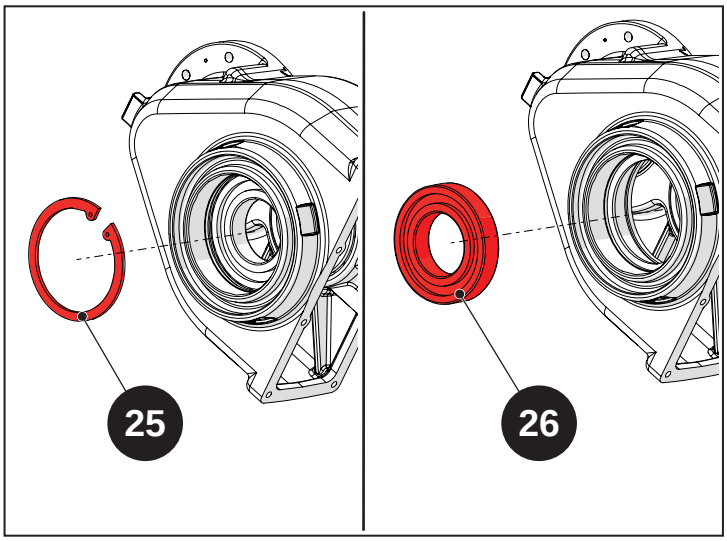

Fig. 6.21

Fit the oil seal (24) in its seat using a punch tool of suitable diameter.

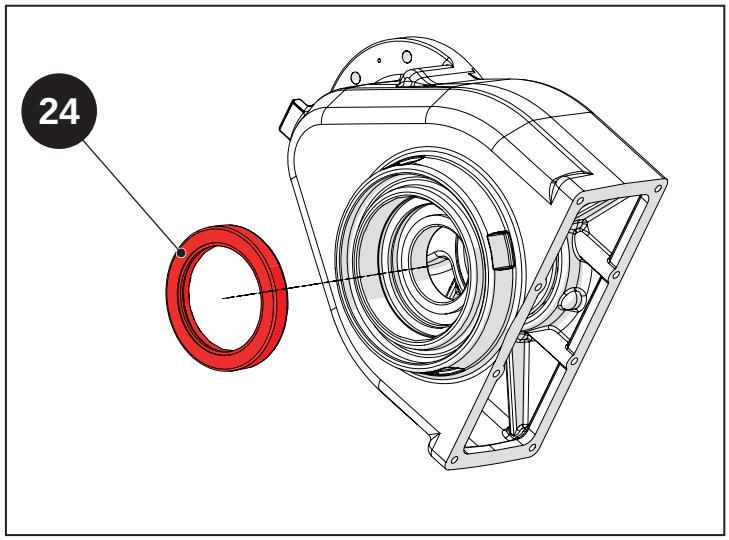

Fig. 6.22

Fit the final drive reduction gear (22) and the spacer (23) in the rear final drive unit casing.

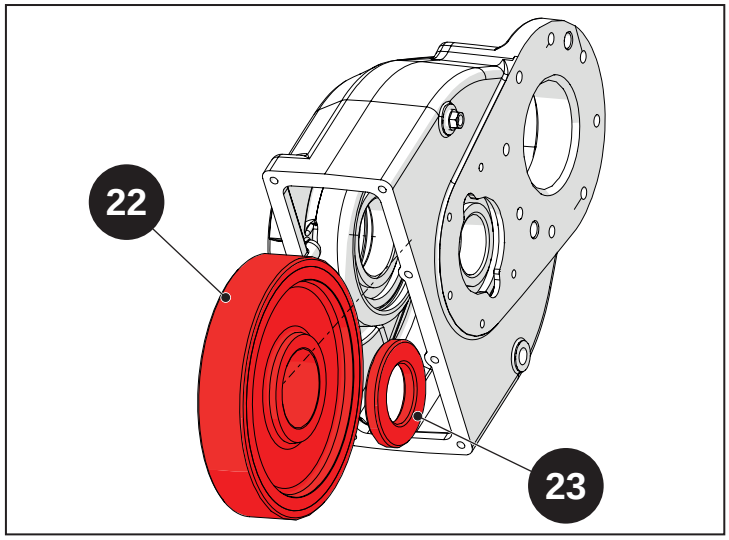

Fig. 6.23

Fit the spacer (21) on the rear half axle (20) and fit the complete assembly in the casing.

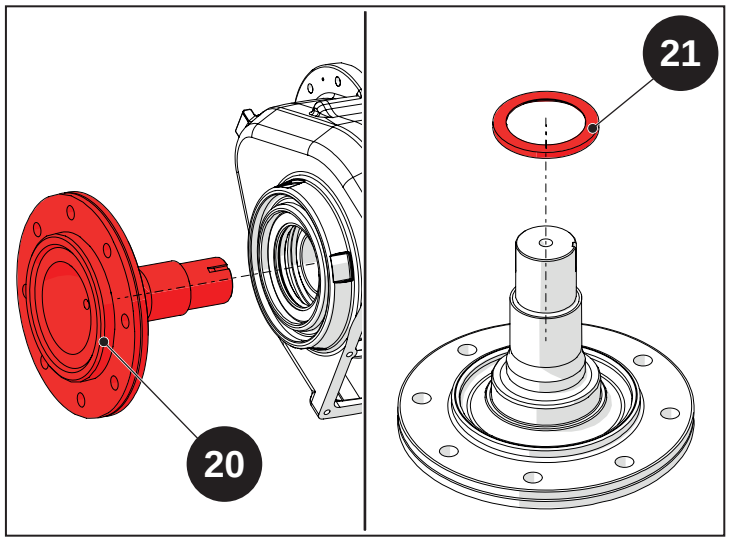

Fig. 6.24

Use a punch tool of suitable diameter to drive the bearing (28) into its seat.

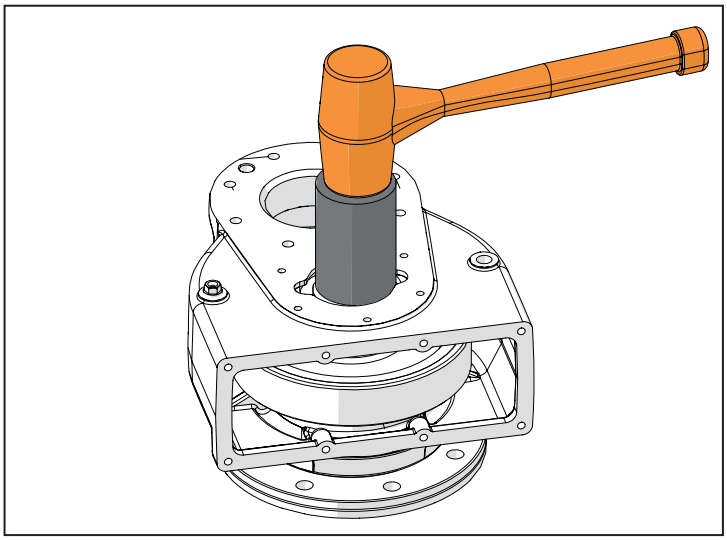

Fig. 6.25

Fit the pins (18) and tighten the stud bolts (19).

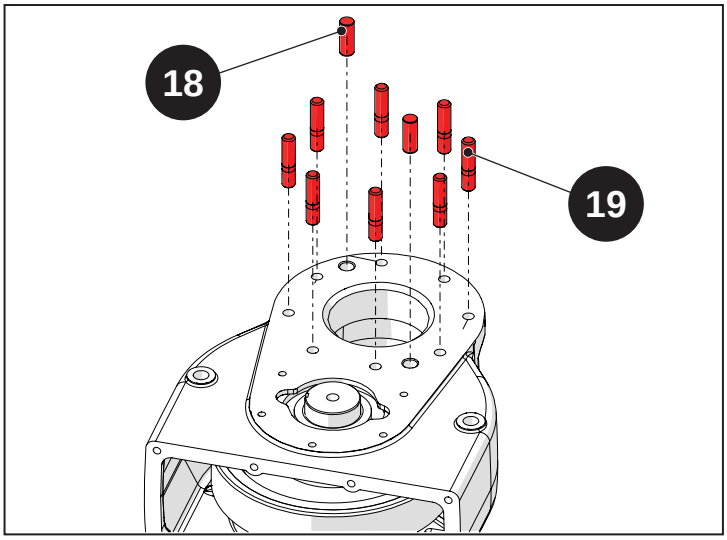

Fig. 6.26

Fit the retainer washer (17) and the ring nut (16).

Use the tool (A- p/n 07000227) to tighten the ring nut (16) to a torque of 250 N·m (25 kg·m).

Secure the ring nut (16) in place by lifting the tabs of the retainer washer (17).

Punch a dot on the ring nut (16).

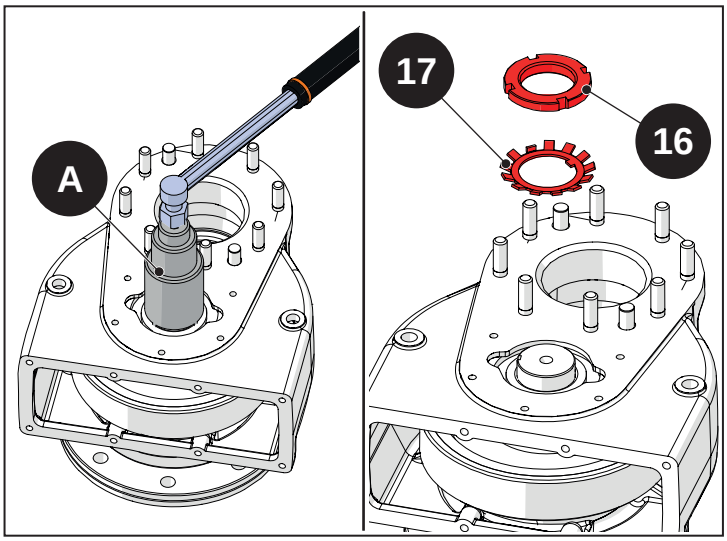

Fig. 6.27

Apply a layer of SILICONE sealant to the mating surface of the cover (15).

Fit the cover (15) and tighten the screws, complete with washers (14), to a torque of 24 N·m (2.4 kg·m).

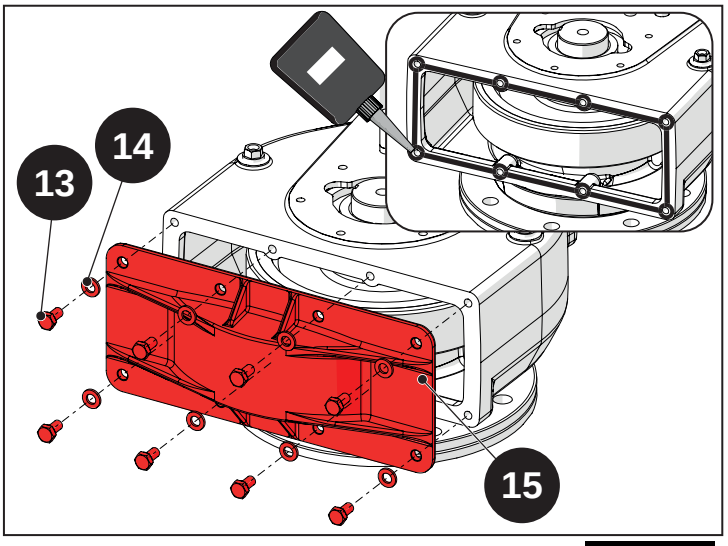

Fig. 6.28

Fit the bearing (12) on the pinion (1).

Fit the pinion (11) in the final drive unit.

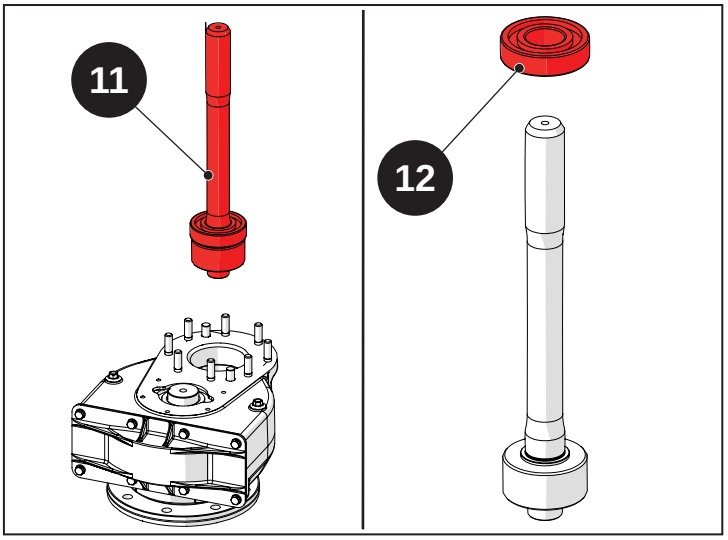

Fig. 6.29

Apply a layer of SILICONE sealant on the mating surface of the cover.

Fit the cover (10) to the final drive unit, fit the washers (9) and tighten the screws (8) to a torque of 24 N·m (2.4 kg·m).

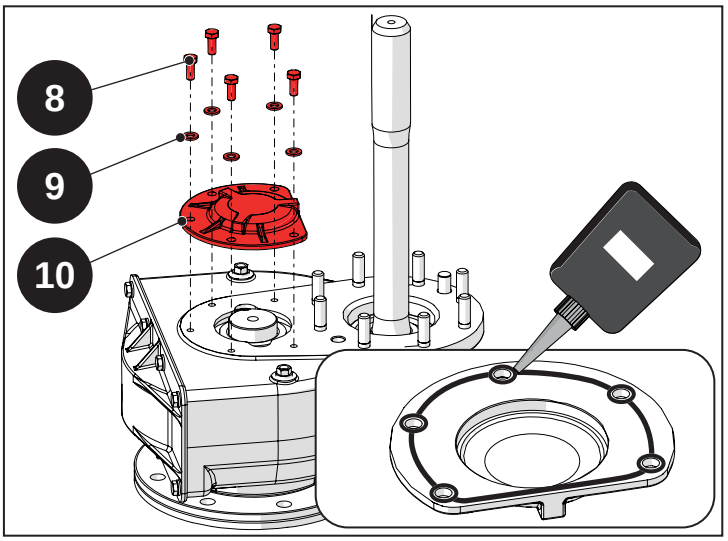

Fig. 6.30

Fit the plates (7).

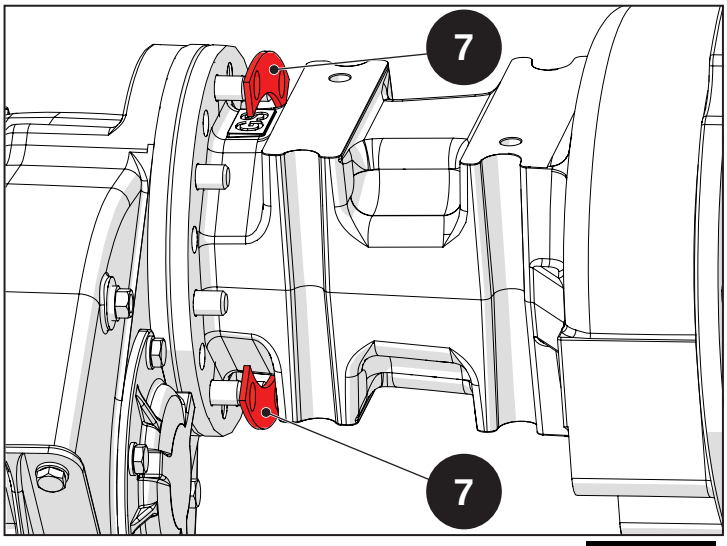

Fig. 6.31

Fit the washers (6) and tighten the nuts (5) to a torque of 80 N·m (8 kg·m).

Use a mallet and a chisel to bend up the edges of the plates (7) to prevent the nuts (5) from rotating.

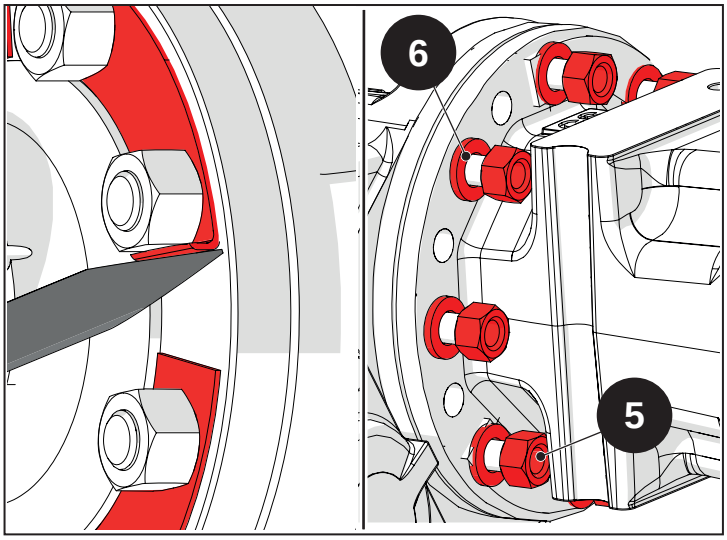

Fig. 6.32

6.5 Tightening torques

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6.5.1 Tightening torques 6-22

6.5.1 Tightening torques

The main tightening torques are listed as follows. For all other tightening torques, see chapter "1- Introduction".

Tightening torque	N·m	kg·m
Half axle fastener ring nut M50x1.5	250	25
Screw fastening wheel to half axle M18x1.5	310	31
Nut fastening final drive unit to half axle carrier M12	80	8
Screw fastening half axle ring nut cover M8x20	24	2,4
Screw fastening final drive unit gear cover M8x20	24	2,4

6.6 Tools necessary

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6.6.1 Tools necessary.....6-24

6.6.1 Tools necessary

p/n	Description	Quantity
07000227	Wrench for ring nut	1

7 : Front axle

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7.8 Tools necessary 7-73

7.8.1 Tools necessary 7-74

7.1 Safety rules

These safety precautions and warnings given in this paragraph must be observed at all times to prevent the risk of operator injury. However, the safety measures indicated in the use and maintenance manual and in chapter 1 of this manual must also be applied at all times.

Danger
All other persons must keep at a safe distance from the danger area. Avoid vibration when loosening screws.

Danger
Lift and handle all heavy parts with lifting equipment of adequate load capacity. Hoisting straps and hooks must be positioned safely on the load. When lifting loads, all personnel must keep at a safe distance from the load itself and remain within safe areas.

Danger
Do not allow the chains or metal cables used for hoisting to twist. Always wear safety gloves when handling cables or chains.

Danger
Use appropriate tools to align the holes correctly. NEVER USE YOUR HANDS OR FINGERS.

Danger
Handle all parts with extreme caution. Never place your hands or fingers between two parts.

Danger
When removing assemblies which could fall, always leave two screws in opposite positions in place for safety until the assembly is secured. Only remove these screws after securing the assembly to a hoist or after fitting support blocks in place.

Danger
If any of the screws fastening the frame or cab are loosened, or if the frame or cab is removed, ensure that all parts are refitted correctly at the end of the procedure to ensure that the driver is protected.

7.2 General introduction

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7.2.1 Assembly drawing

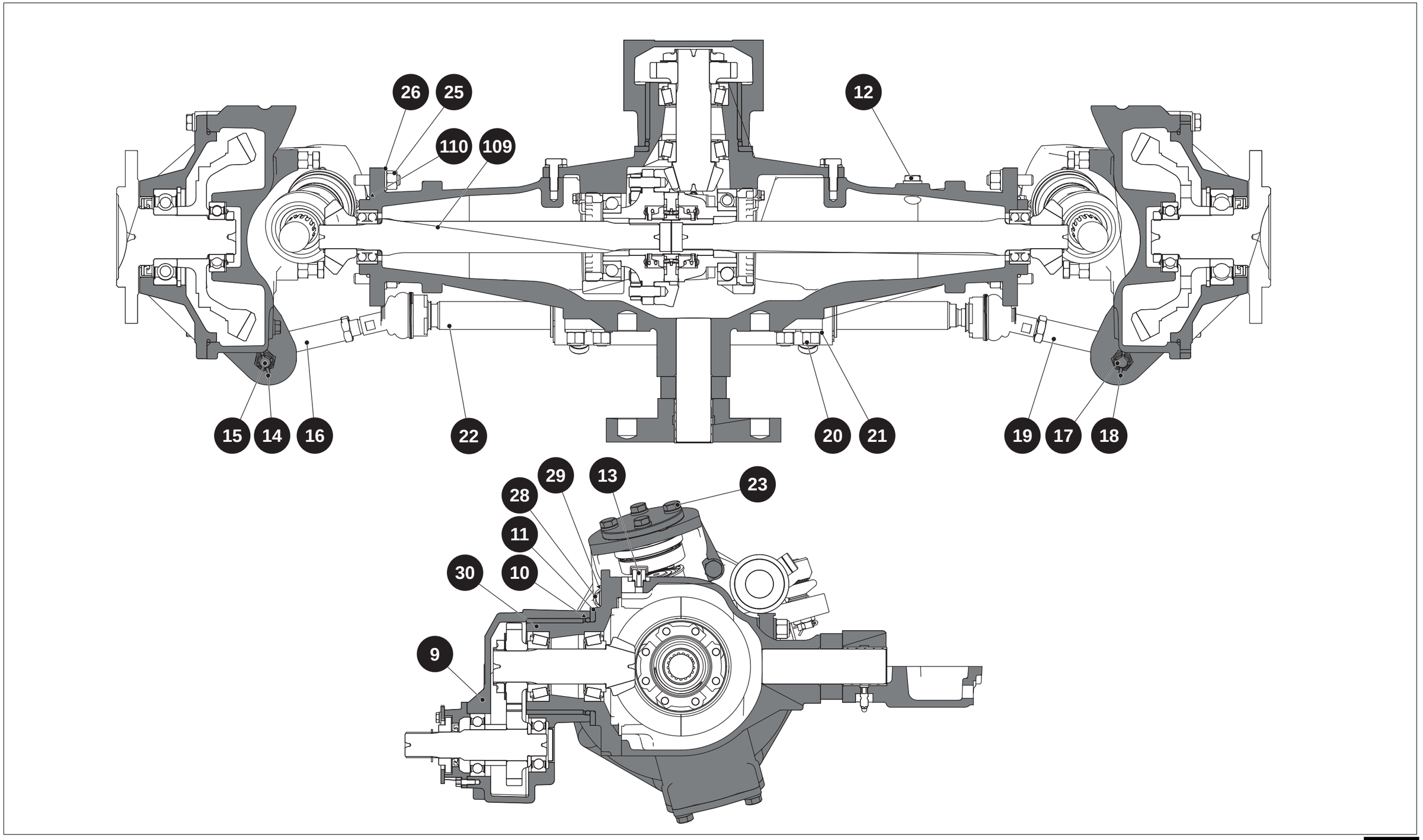

Fig. 7.1

9 - Transfer case
10 - O-ring
11 - Spacer
12 - Plug
13 - Plug
14 - Split pin
15 - Nut
16 - Steering cylinder pin
17 - Split pin
18 - Nut
19 - Steering cylinder pin
20 - Nut
21 - Washer
22 - Steering cylinder
23 - Screw
25 - Nut
26 - Washer
28 - Screw
29 - Washer
30 - Transfer case
109 - Half-axle
110 - O-ring

7.3 Technical characteristics

Index

7.3.1 Technical characteristics.....7-8

7.3.1 Technical characteristics

Steering type		Hydrostatic with load sensing valve
Steering angle	Degrees	57°

7.4 Removal

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7.4.1 Removal 7-10

7.4.1 Removal

Undo the hex socket screws (1) and remove the front shaft guard casing.

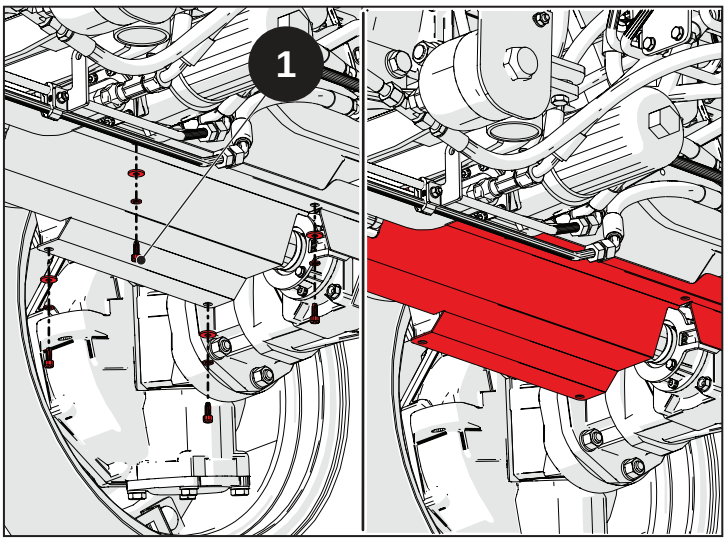

Fig. 7.2

Undo the fastener screws (2) and remove the rear shaft guard casing.

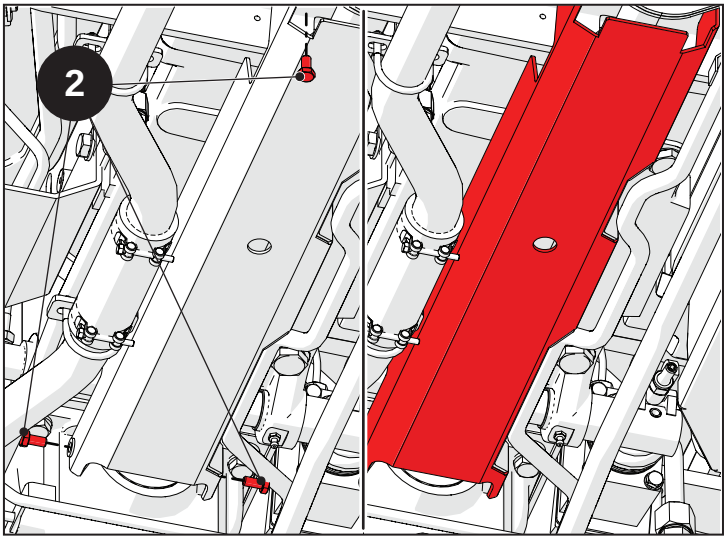

Fig. 7.3

Undo the nuts and screws (3) fastening the intermediate bearing onto the shaft.

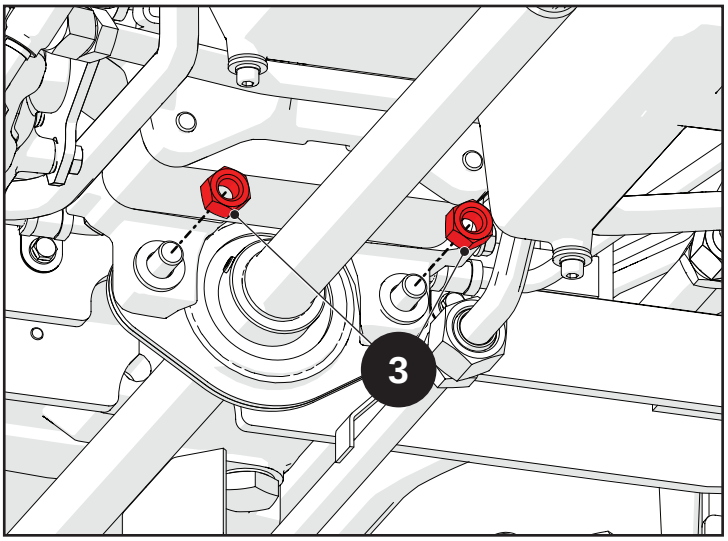

Fig. 7.4

Remove the shaft retainer circlips (4) from their seats.

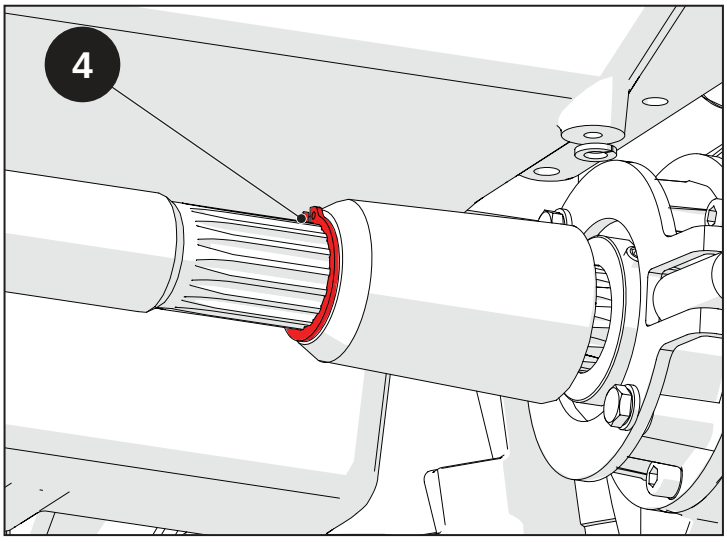

Fig. 7.5

Move the sleeves and remove the shaft.

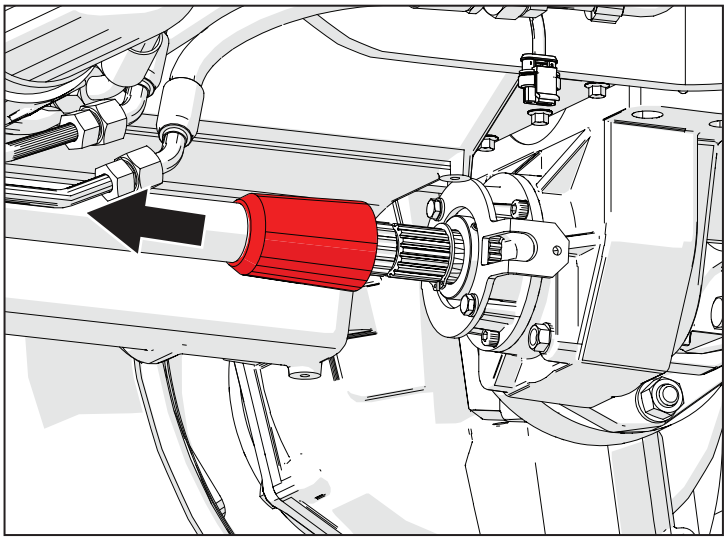

Fig. 7.6

Secure the tractor to a hoist.

Note

Ensure that the maximum lift capacity of the hoist used is adequate for the load.

Fig. 7.7

Secure the axle with stands.

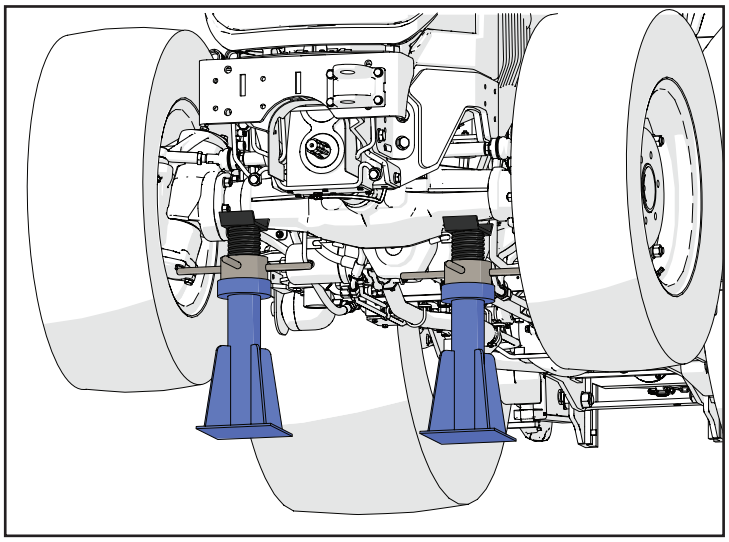

Fig. 7.8

Undo the connectors (5) and (6) and disconnect the hydraulic steering unit pipes.

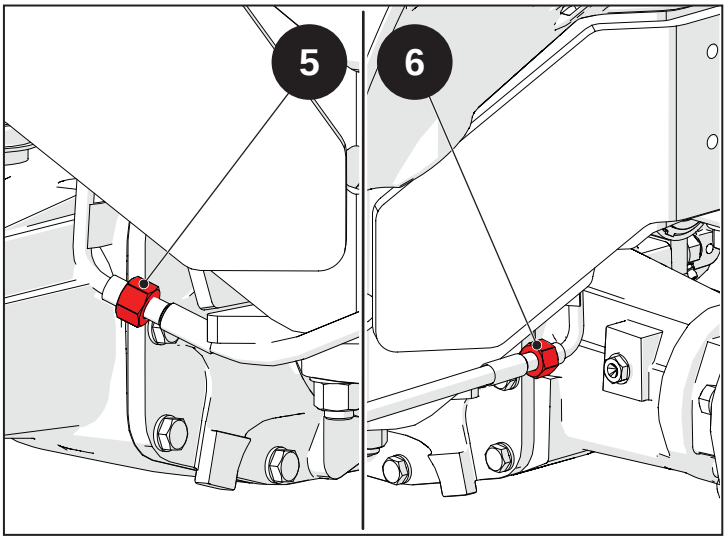

Fig. 7.9

Undo the front nuts (7) fastening the axle.

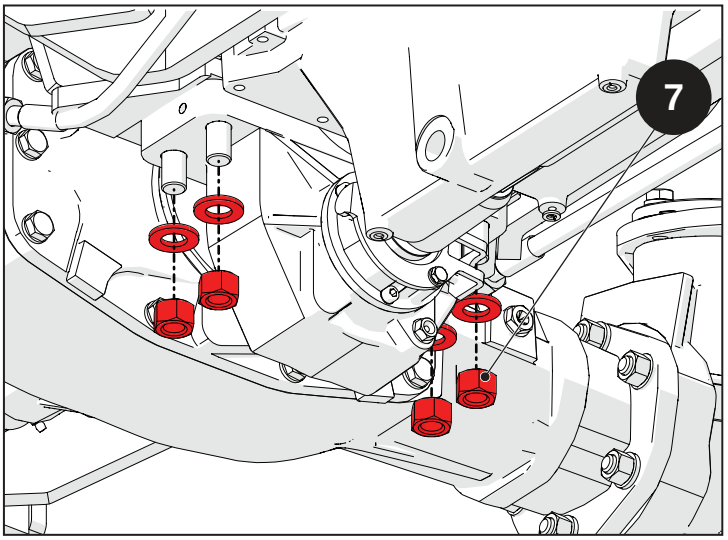

Fig. 7.10

Undo the rear nuts (8) fastening the axle.

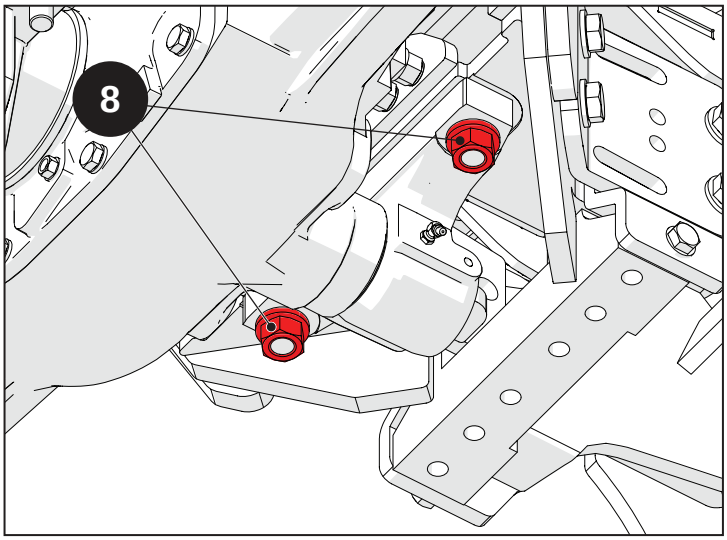

Fig. 7.11

Lift the tractor and remove the complete front axle.

Fig. 7.12

Remove the transfer case (9) and remove the O-ring (10) and the spacer (11).

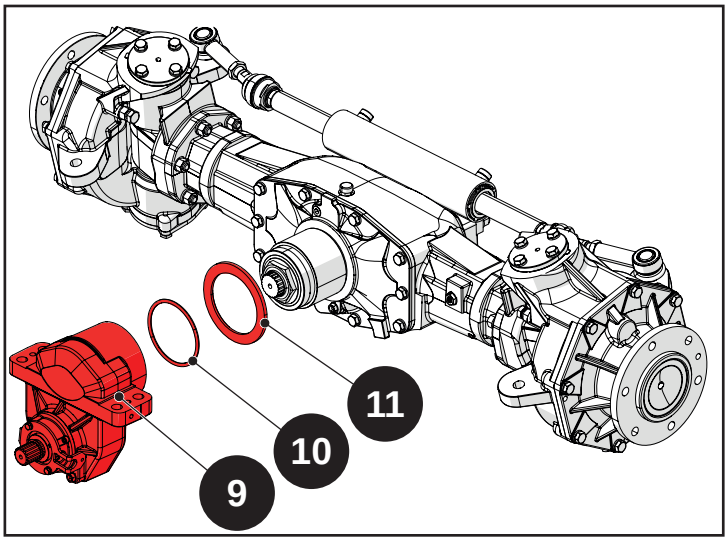

Fig. 7.13

Remove the plugs (12) and the plug (13), complete with washer, to drain the oil from the axle.

Note

Place empty drums under the plugs to collect oil.

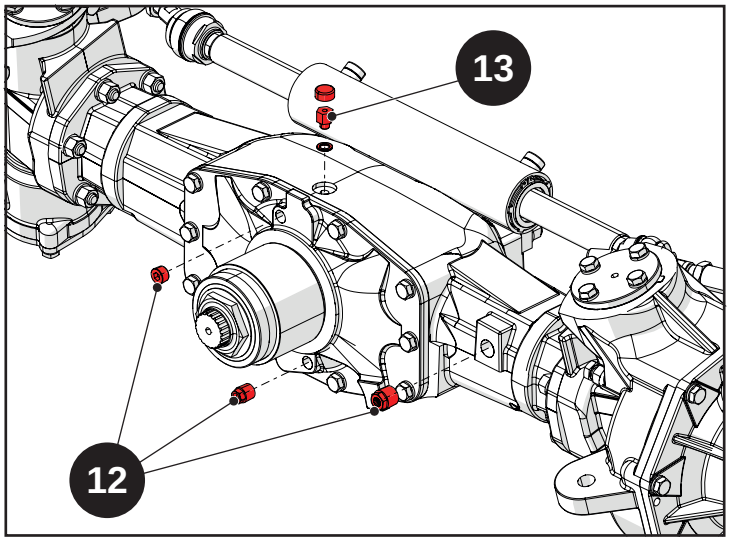

Fig. 7.14

Remove the split pin (14) and undo the retainer nut (15).

Remove the steering cylinder pins (16) from their seats on both sides.

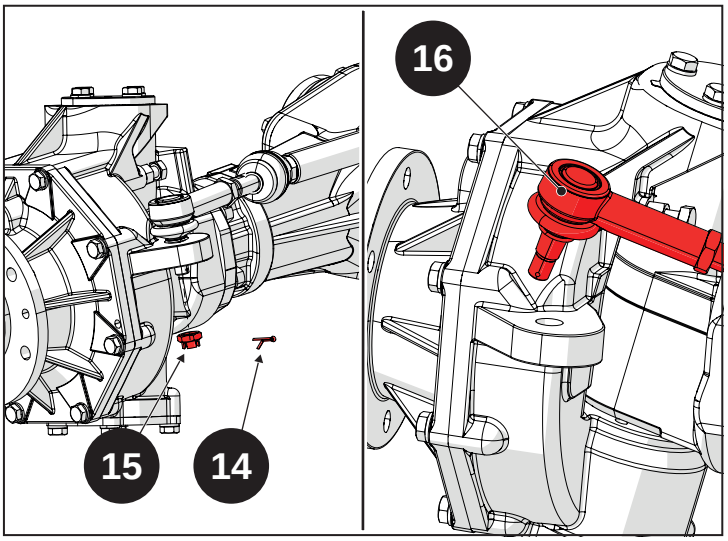

Fig. 7.15

Undo the nuts (20) fastening the steering cylinder to the front axle and remove them together with the washers (21).

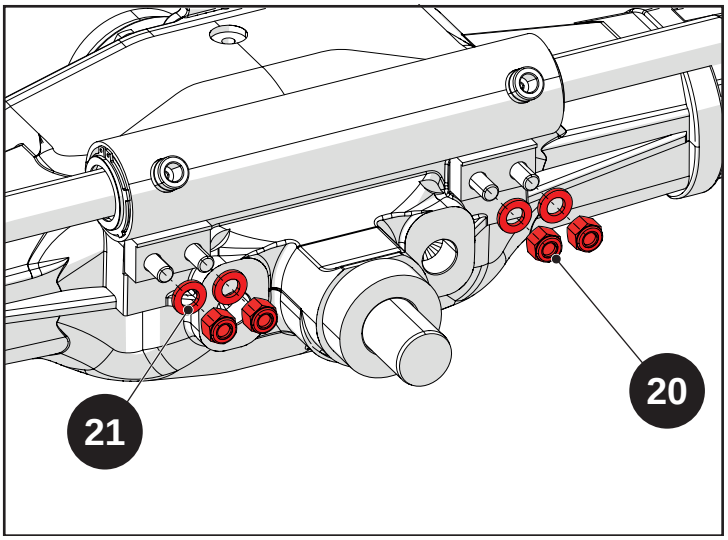

Fig. 7.16

Remove the complete steering cylinder (22).

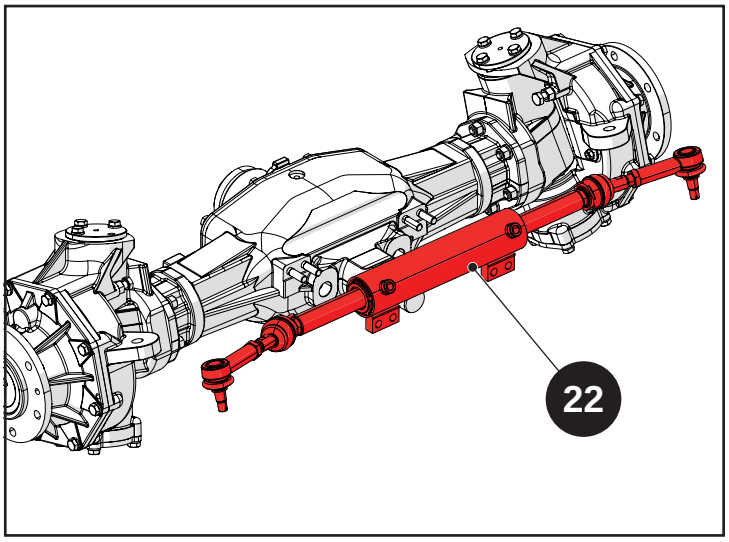

Fig. 7.17

Undo one of the fastener screws (23) of the upper final drive unit cover, complete with washer, and fit and tighten a hoisting eye-bolt (24) in its place.

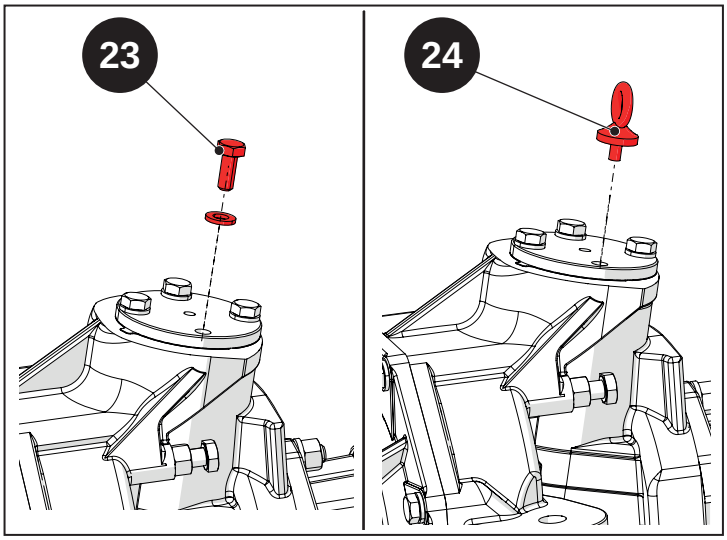

Fig. 7.18

Secure the lateral reduction gear unit to a suitable hoist using the eye-bolt.

Remove the fastener nuts (25) and washers (26), and then remove the final drive unit from the axle.

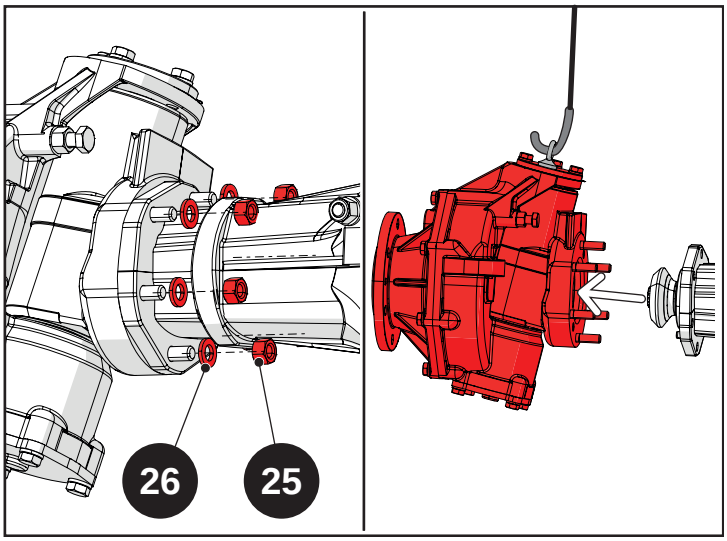

Fig. 7.19

Remove the complete half-axle (109) and remove the O-ring (110).

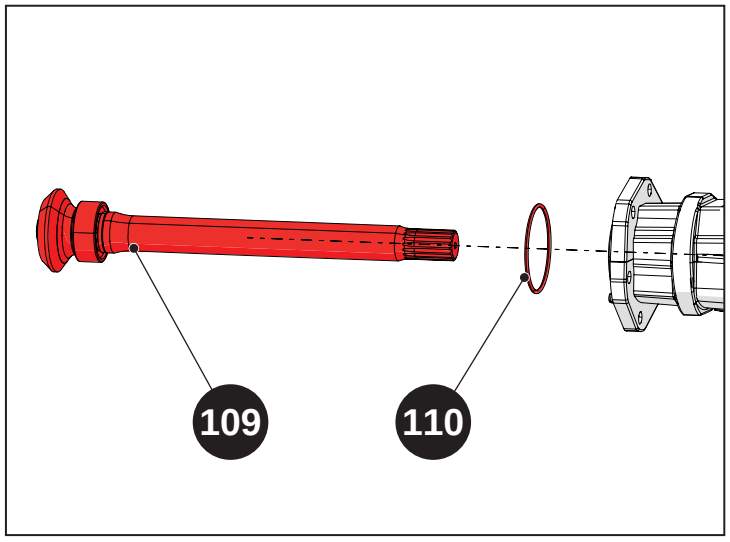

Fig. 7.20

Repeat the same procedure to remove the other final drive unit.

Fit the 2 hoisting eye-bolts (27) into the holes for the plugs on the front differential and secure them to a hoist.

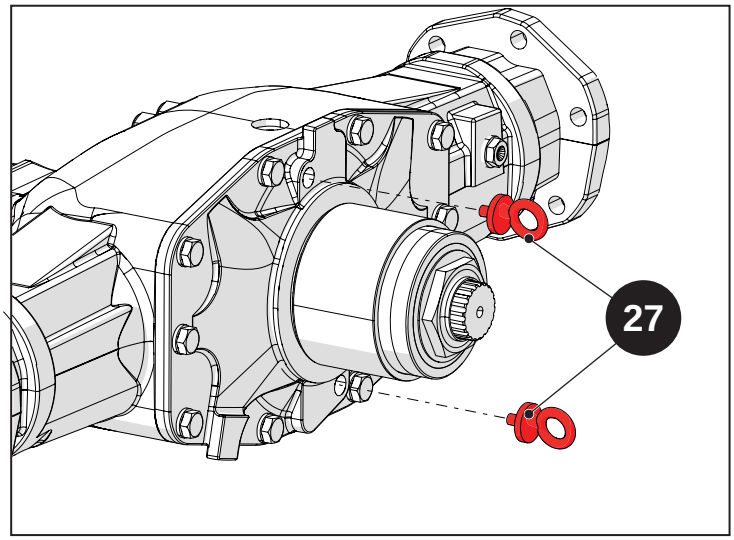

Fig. 7.21

Unscrew and remove the screws (28) and the washers (29).

Warning

The direction in which the front differential is installed is different on the High and Low versions.

Mark the differential before removal to ensure that it is refitted the right way around.

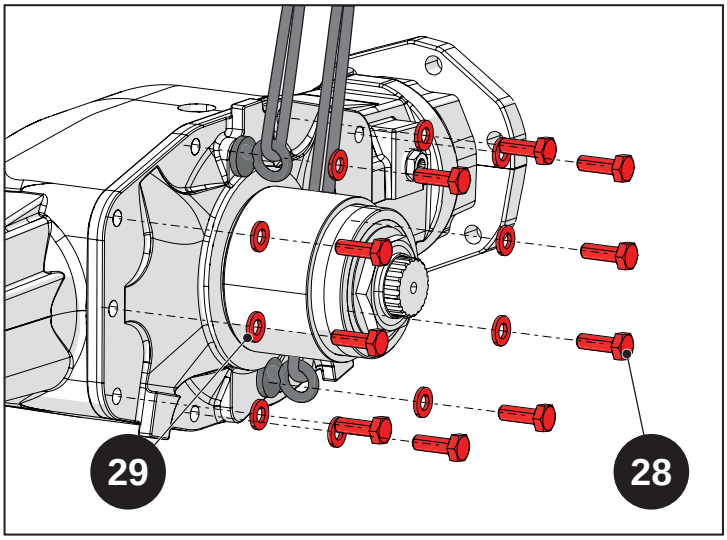

Fig. 7.22

Remove the complete front differential assembly (30).

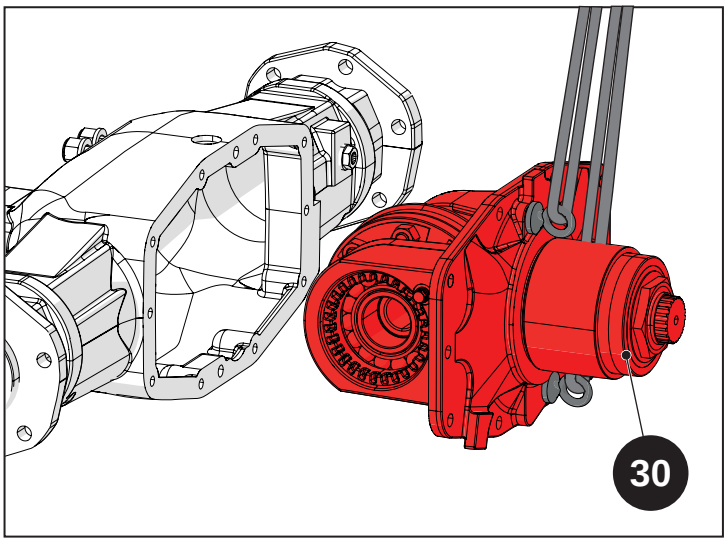

Fig. 7.23

7.5 Main components

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7.5.1 Front differential

7.5.1.1 Assembly drawing and main components

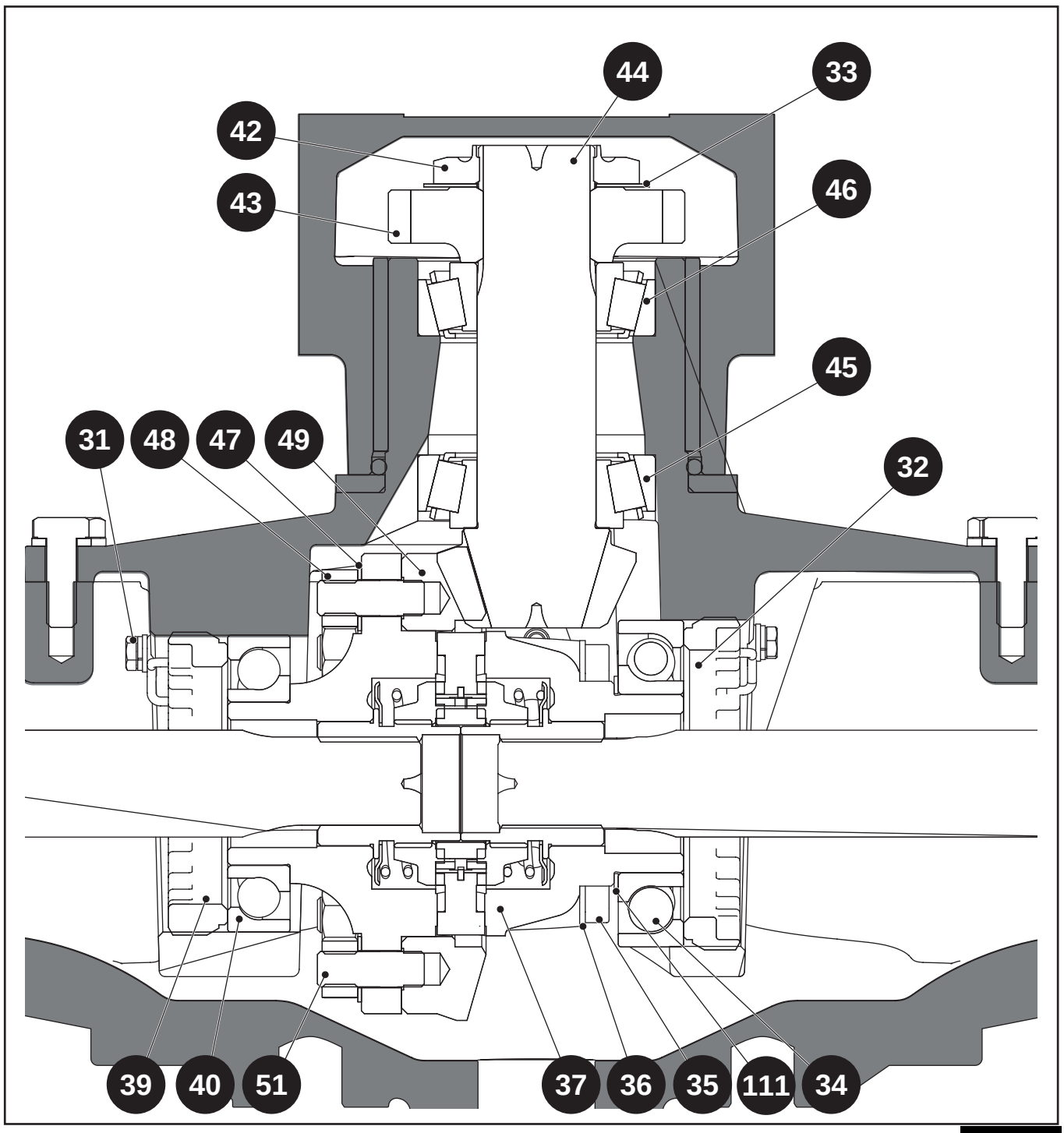

Fig. 7.24

31 - Ring nut retainer screw
32 - Ring nut
33 - Nut retainer spacer
34 - Bearing
35 - Screw
36 - Conical washer
37 - NoSPIN
38 - NoSPIN
39 - Ring nut
40 - Bearing
42 - Nut
43 - Gear
44 - Pinion
45 - Bearing
46 - Bearing
47 - Plate
48 - Nut
49 - Crown wheel
51 - Stud bolt
111 - Spacer

7.5.1.2 Disassembly

Remove the ring nut retainer screws (31) complete with washers.

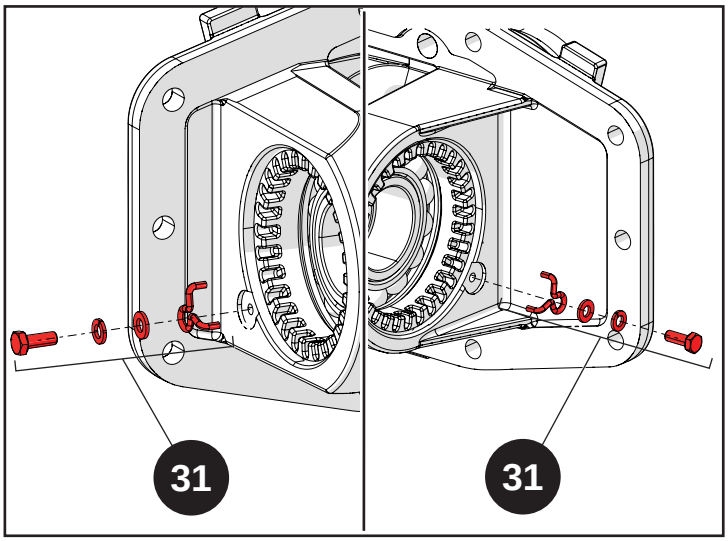

Fig. 7.25

Use the tool (A-07000243) to undo the ring nut (32) on the side opposite the crown wheel.

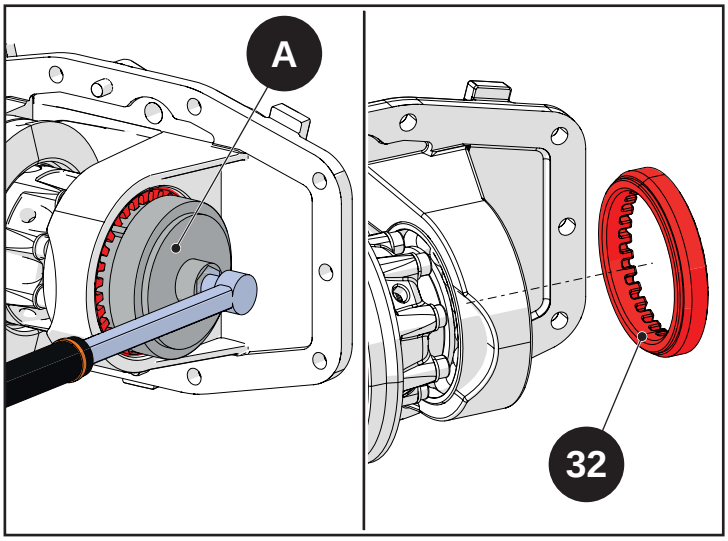

Fig. 7.26

Tighten a screw (B), complete with 2 flat washers (B1), and a wing nut (B2), to restrain the springs of the NoSPIN device.

Danger
Check that the screw and the wing nut have been tightened correctly, to prevent the springs from detaching while removing the NoSPIN device.

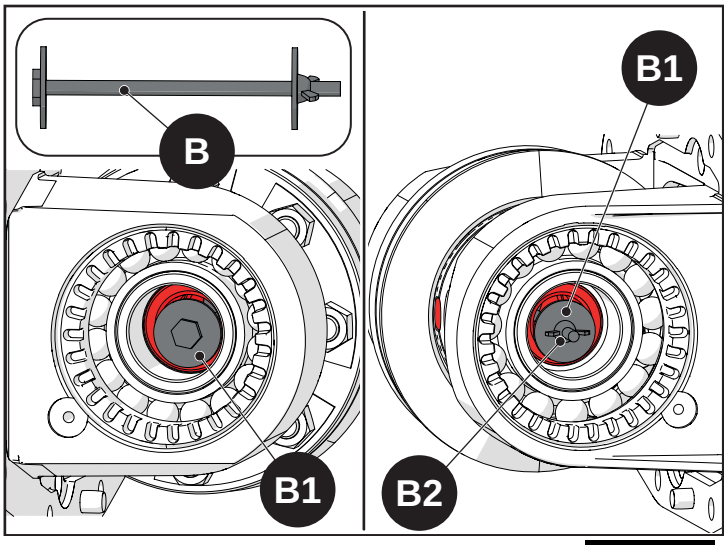

Fig. 7.27

Remove the bearing (34), tapping on the inner race.

Remove the spacer (111).

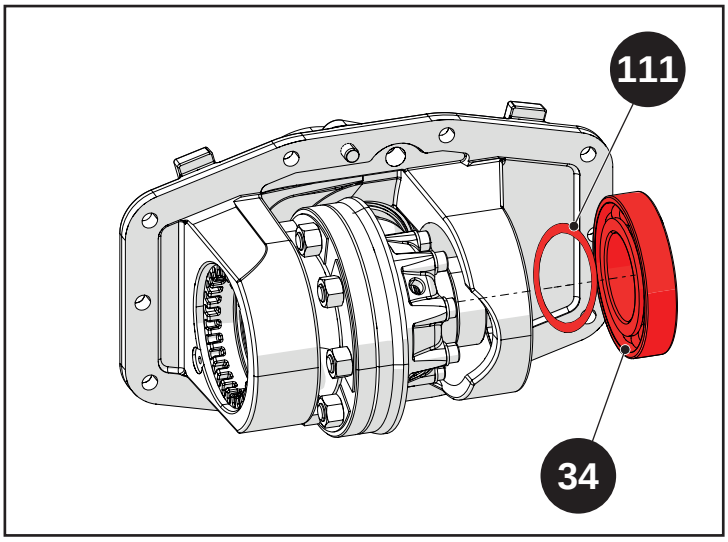

Fig. 7.28

Note

Mark the 2 parts of the NoSPIN case with a marker pen to facilitate reassembly.

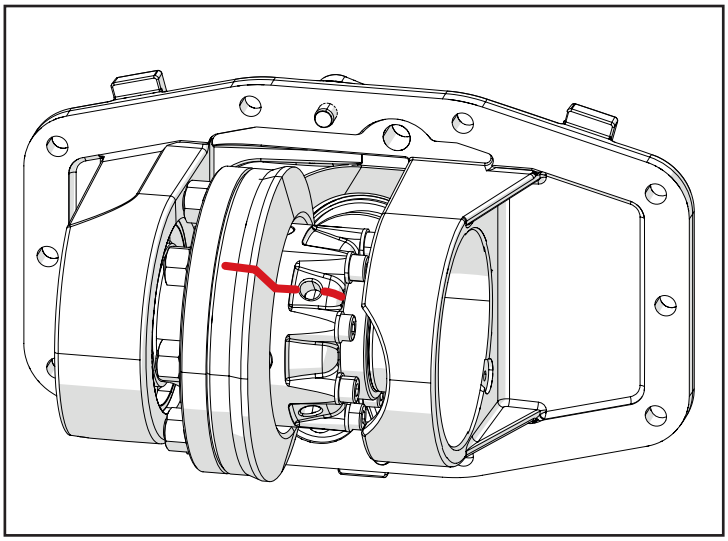

Fig. 7.29

Undo and remove the screws (35) and the conical washers (36) securing the front differential casing.

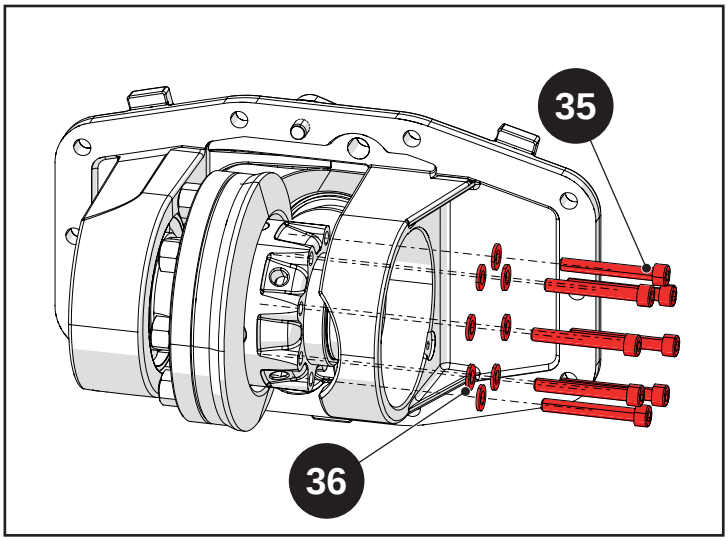

Fig. 7.30

Remove the loosened NoSPIN case (37).

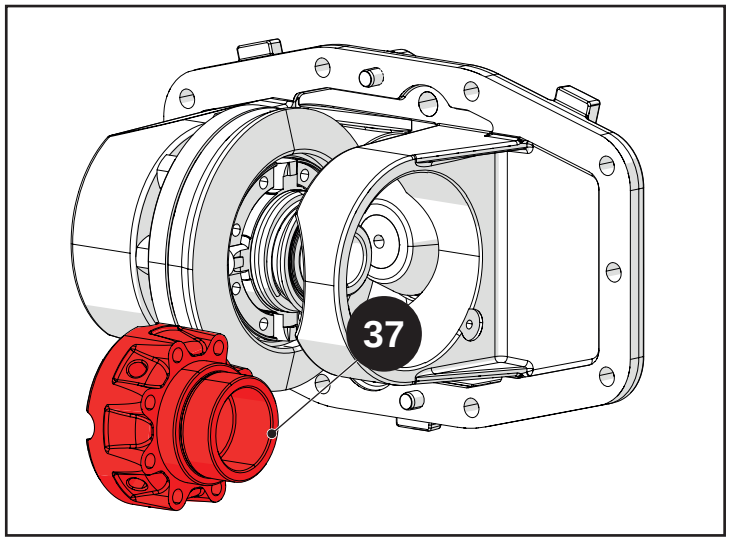

Fig. 7.31

Remove the complete NoSPIN device (38).

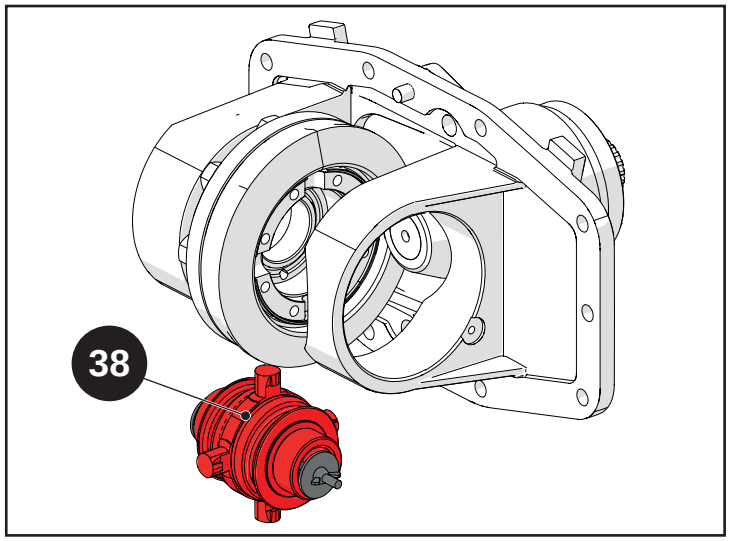

Fig. 7.32

Use the tool (C-07000237) to undo and remove the ring nut (39).

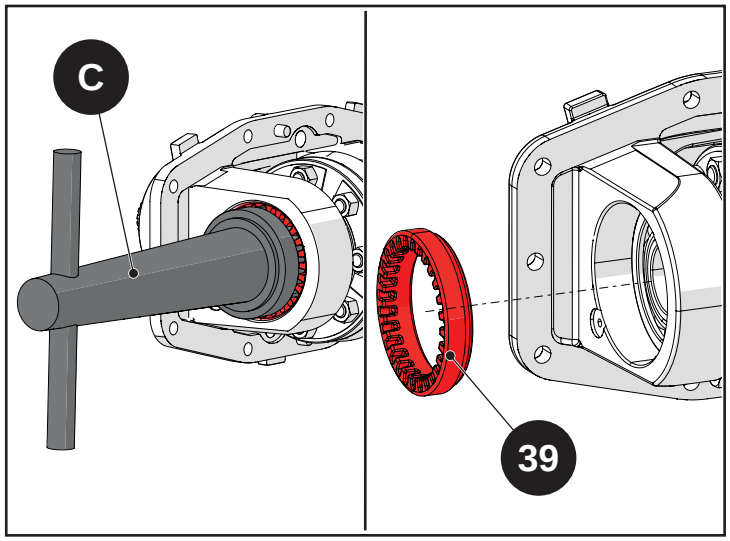

Fig. 7.33

Working via the extraction holes, tap the race of the bearing (40) with a pin punch to free the crown wheel (41).

Remove the bearing (40).

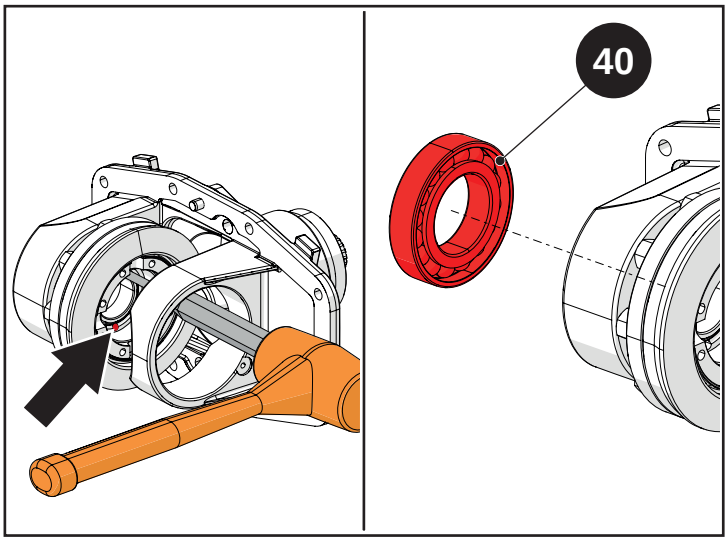

Fig. 7.34

Remove the crown wheel (41).

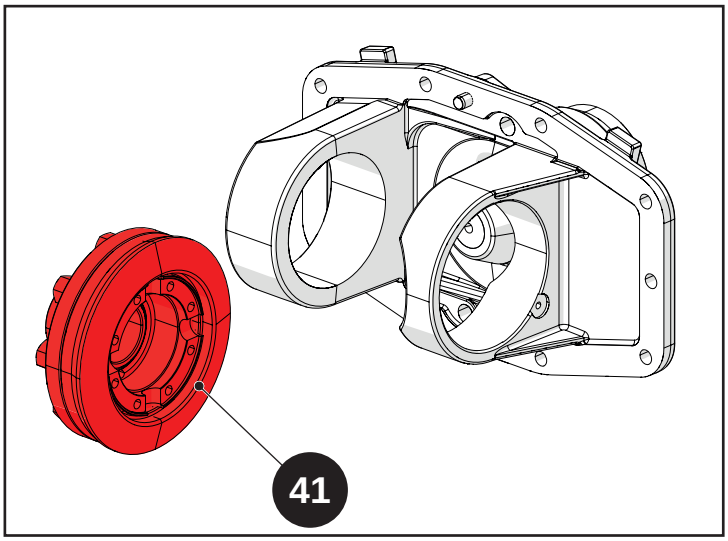

Fig. 7.35

Flatten the bent edges of the nut retainer spacer (33) with a chisel.

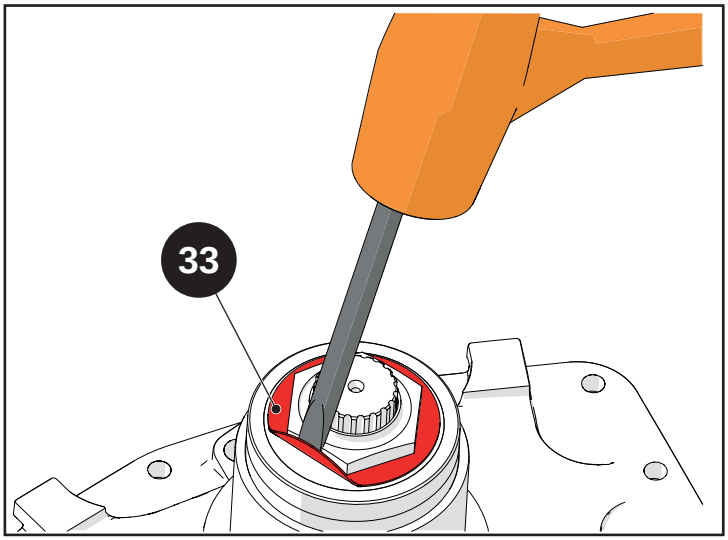

Fig. 7.36

Use an M40 socket bit to undo the nut (42) fastening the pinion.

Remove the nut (42), the spacer (33) and the gear (43).

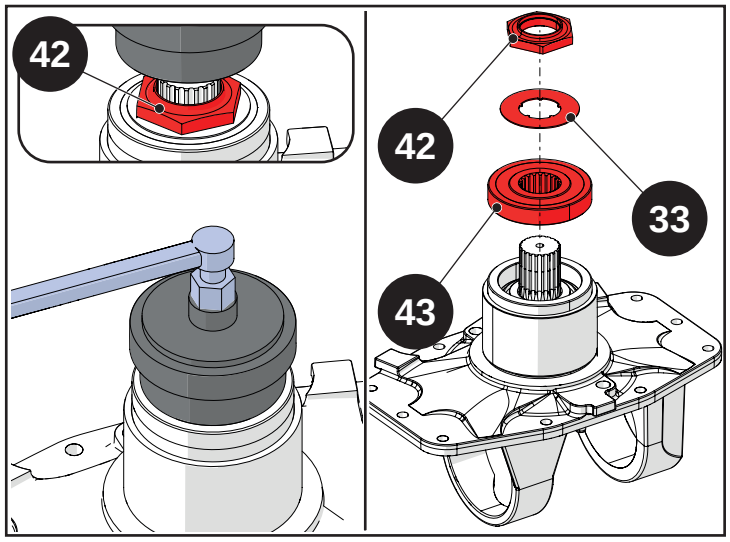

Fig. 7.37

Tap the pinion (44) with a mallet to detach it from its seat together with the inner race of the lower bearing (45).

Remove the inner race of the upper bearing (46).

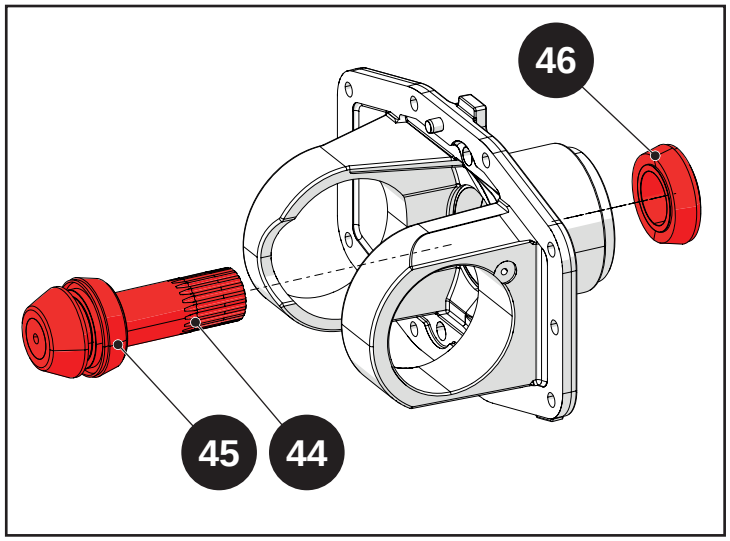

Fig. 7.38

Use a pin punch to remove the outer races of the bearings (45) and (46).

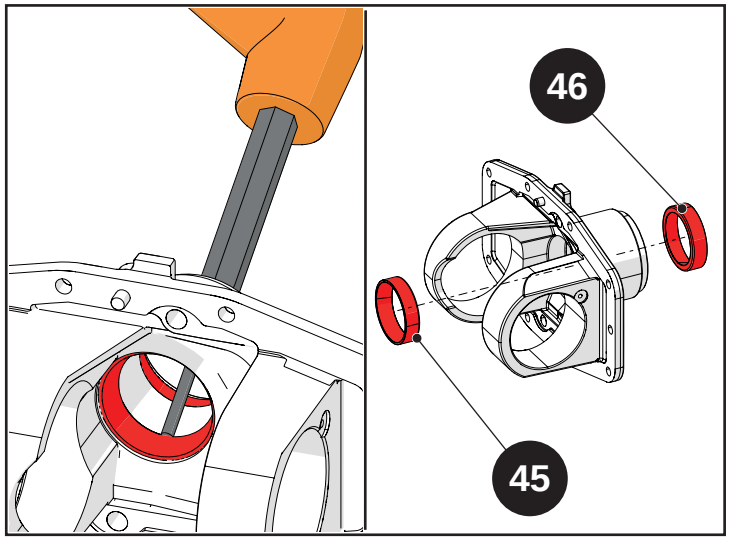

Fig. 7.39

Use a chisel to bend back the edges of the nut retainer plates (47).

Undo the nuts (48) and remove the plates (47).

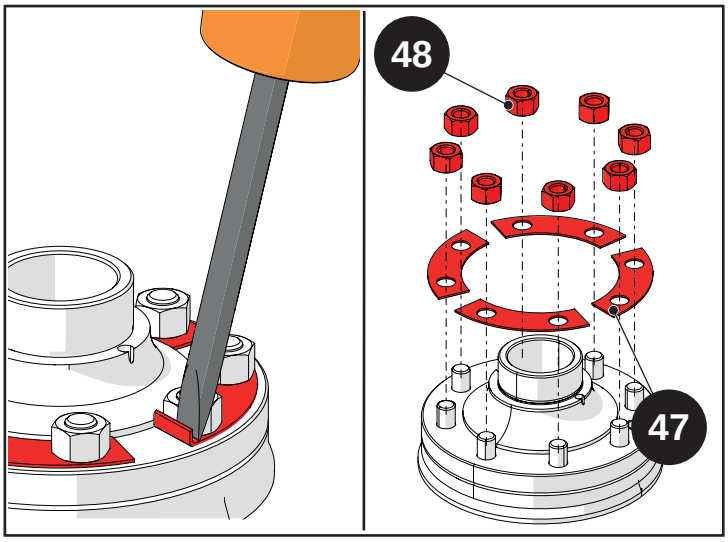

Fig. 7.40

Separate the crown wheel (49) from the NoSPIN case (37).

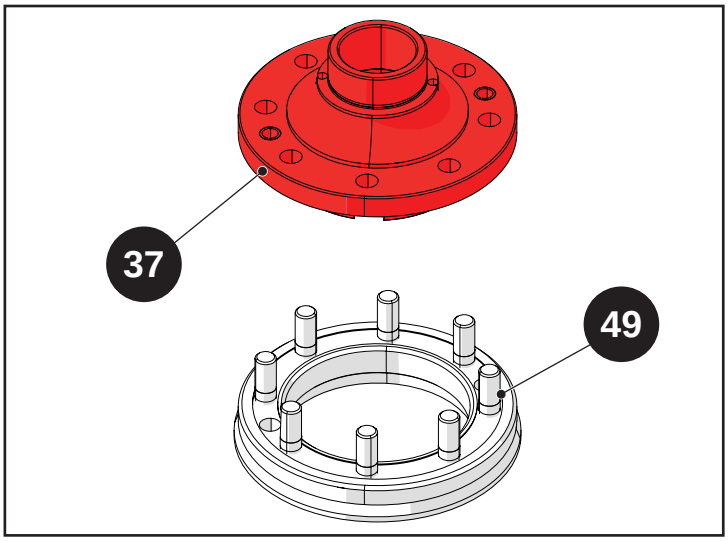

Fig. 7.41

Remove the pins (50) and the stud bolts (51).

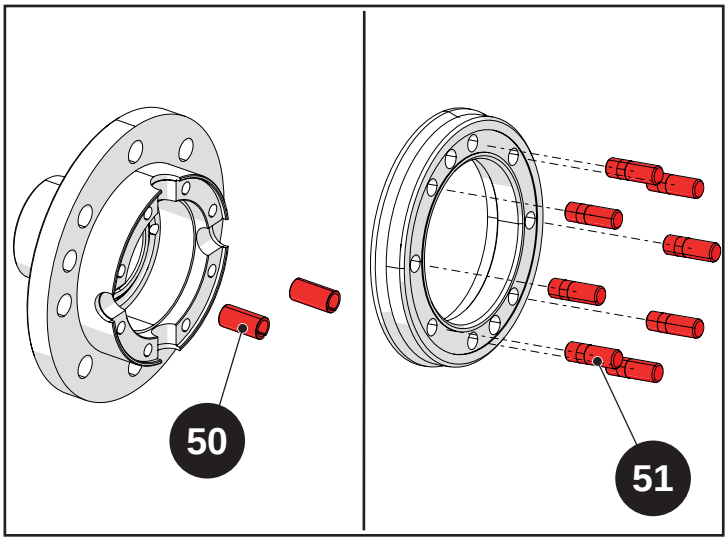

Fig. 7.42

7.5.1.3 Main inspection, reassembly and adjustment procedures

Warning

Read the instructions in chapter "1-Introduction" and, in particular, the sections concerning the installation of O-rings, oil seals and bearings, with particular care before reassembling, and follow these instructions precisely when working.

Apply the correct tightening torques when tighten the fasteners of components. Where tightening torques are not specified, refer to the table in chapter "1-Introduction".

Use the specified sealant products during reassembly. Where the sealant required is not specified, refer to the table in chapter "1-Introduction".

Fit the centring pins (50) and the stud bolts and align the crown wheel (49) with the crown wheel carrier.

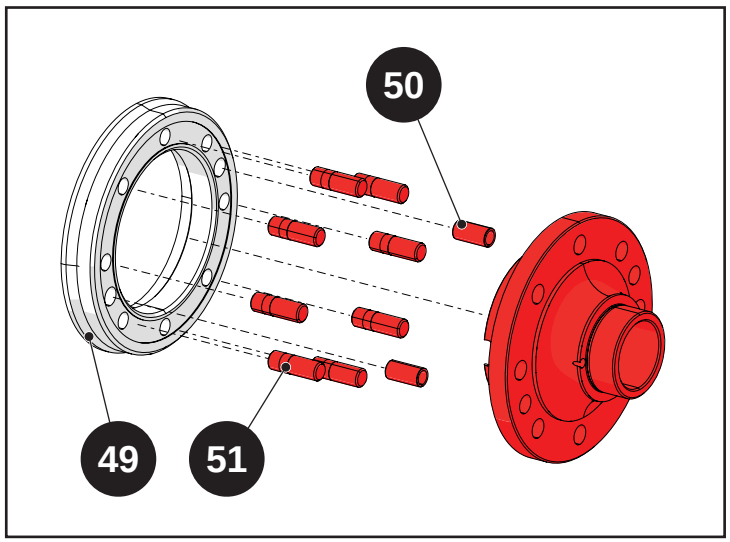

Fig. 7.43

Fit the plates (47), with the flat sides facing upwards.

Tighten the nuts (48) to a torque of 80 N·m (8 kg·m).

Use a chisel to bend the edges of the plates (47) to secure the nuts (48) and prevent them from loosening.

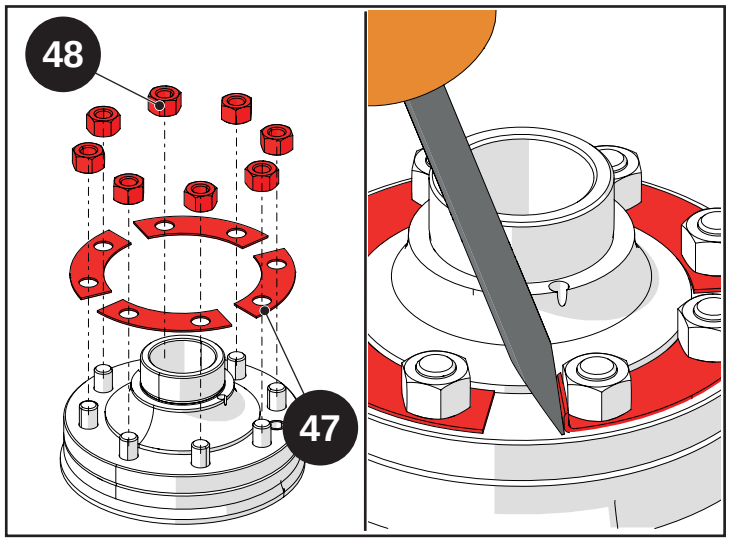

Fig. 7.44

Fit the outer races of the bearings (45) and (46).

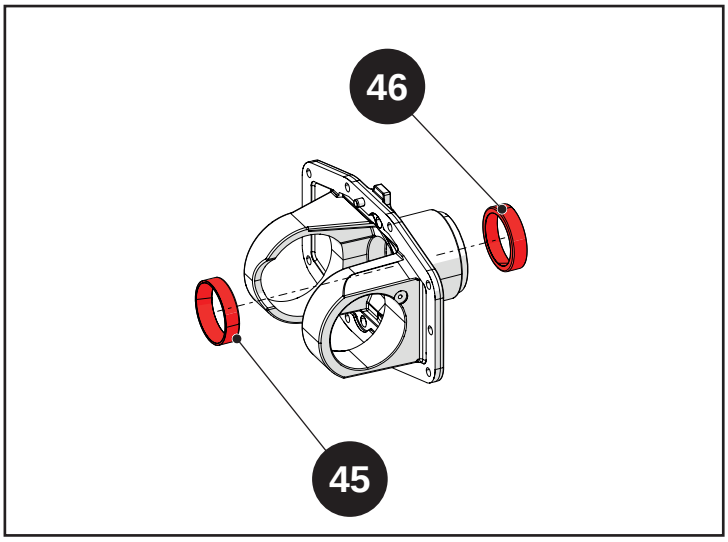

Fig. 7.45

Use a press to install the lower bearing (45) in the pinion (44).

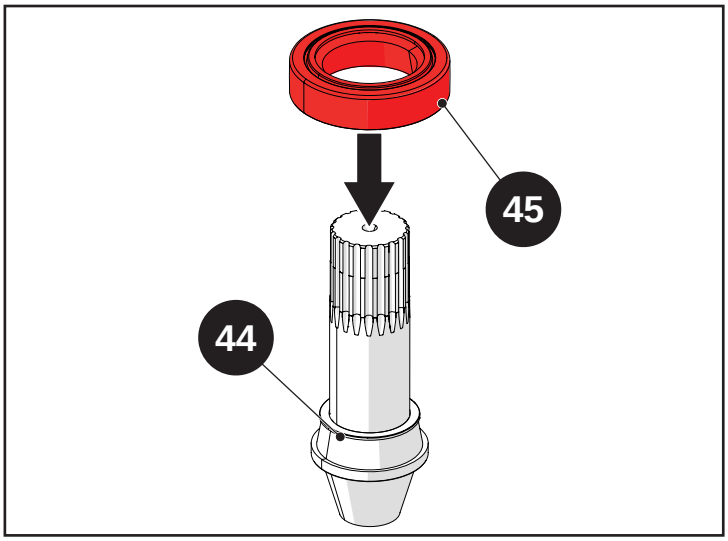

Fig. 7.46

Fit the pinion (44), complete with bearing, in the differential.

Use a bearing punch tool to install the upper bearing (46) in the pinion.

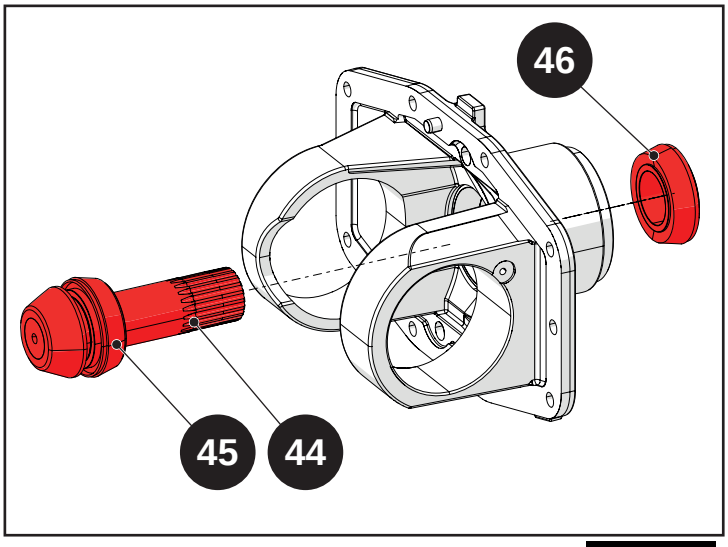

Fig. 7.47

Fit the gear (43), with the bevelled side facing towards the pinion.

Fit the nut retainer spacer (33) and the fastener nut (42).

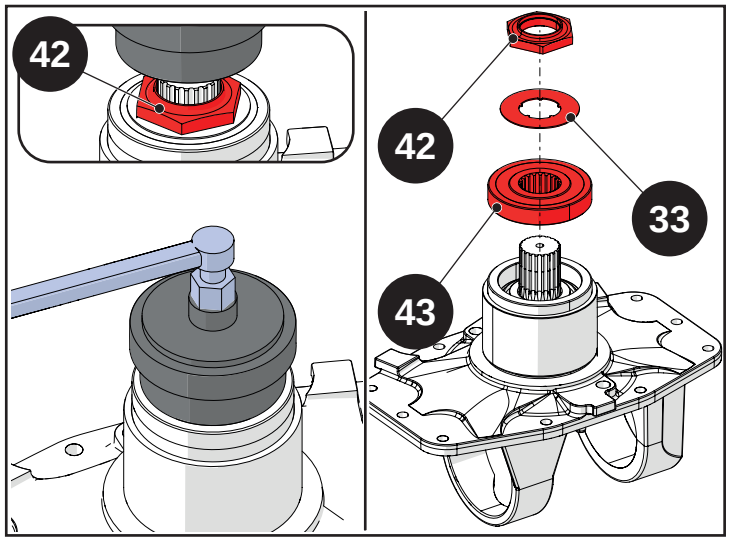

Fig. 7.48

Tighten the nut (42) to a torque of 40 N·m (4 kg·m).

Tap the pinion to seat it completely, and check that it rotates correctly. Tighten the nut (42) if the pinion turns too freely, loosen the nut if the pinion does not turn freely enough.

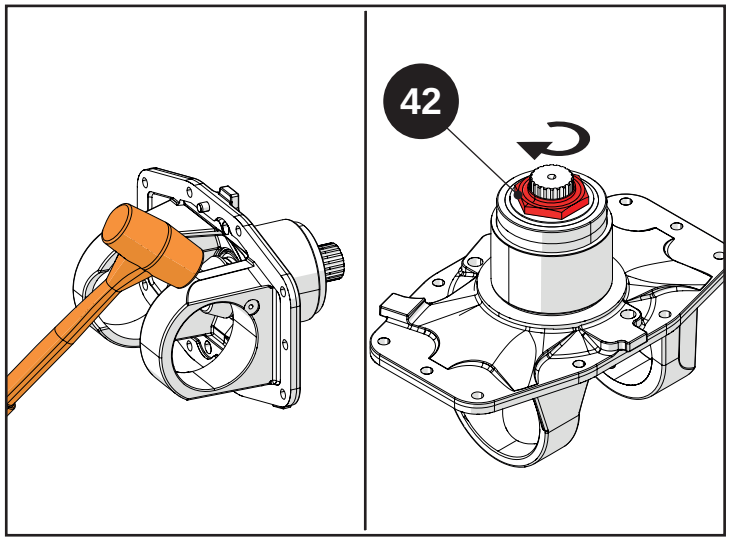

Fig. 7.49

Use a chisel to bend up the edges of the nut retainer spacer (33) to secure the nut (42) and prevent it from loosening.

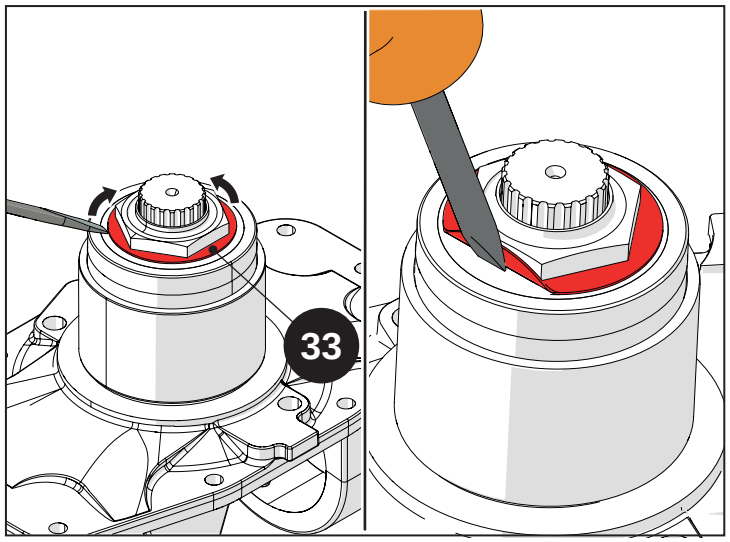

Fig. 7.50

Fit the crown wheel assembly (41).

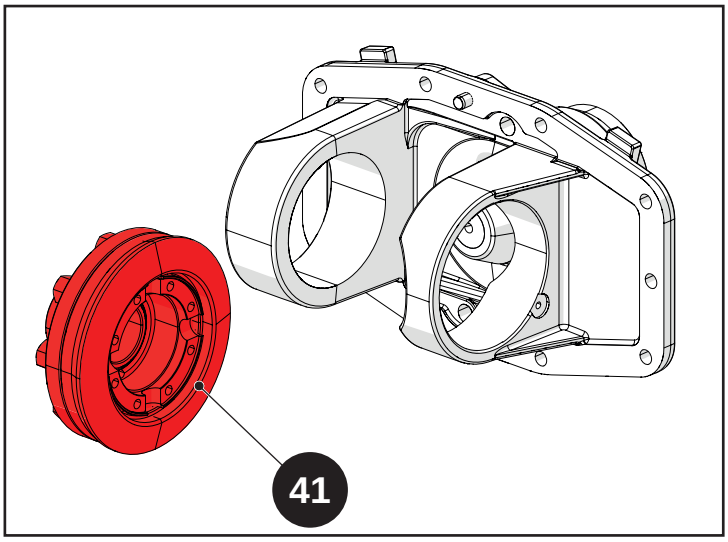

Fig. 7.51

Fit the NoSPIN device (38).

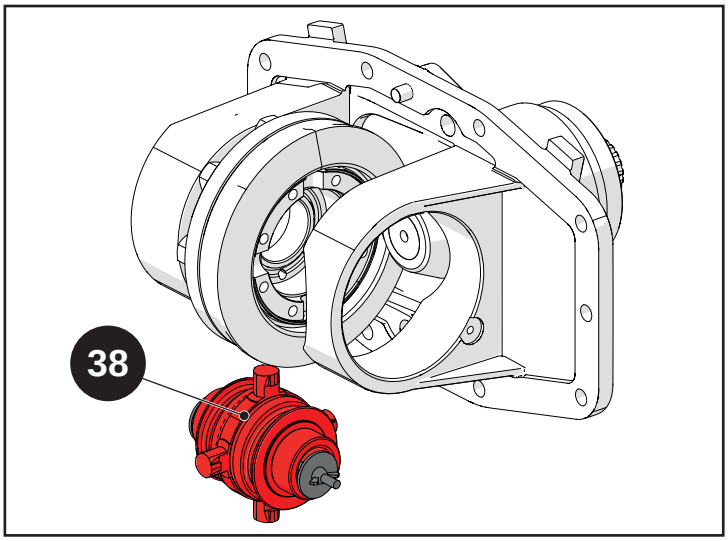

Fig. 7.52

Fit the NoSPIN case (37), aligning the markings made during disassembly.

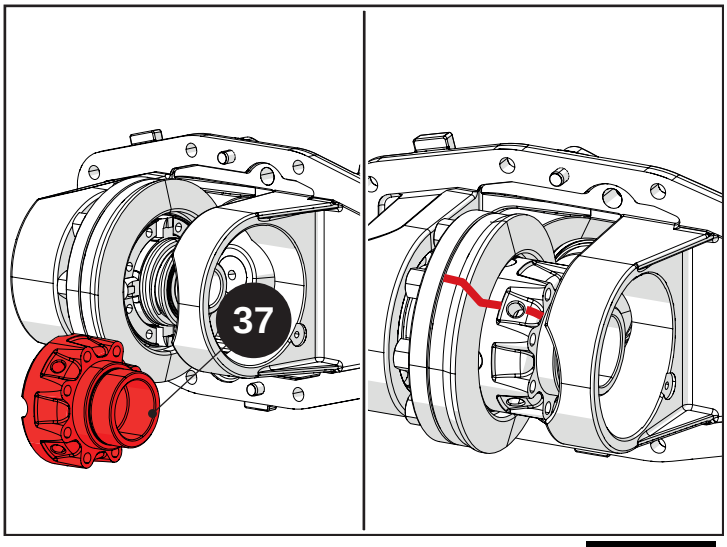

Fig. 7.53

Fit the conical washers (36) and the hex socket head cap screws (35).

Apply a coating of LOCTITE 243 to the screw threads and tighten the screws to a torque of 50 N·m (5 kg·m).

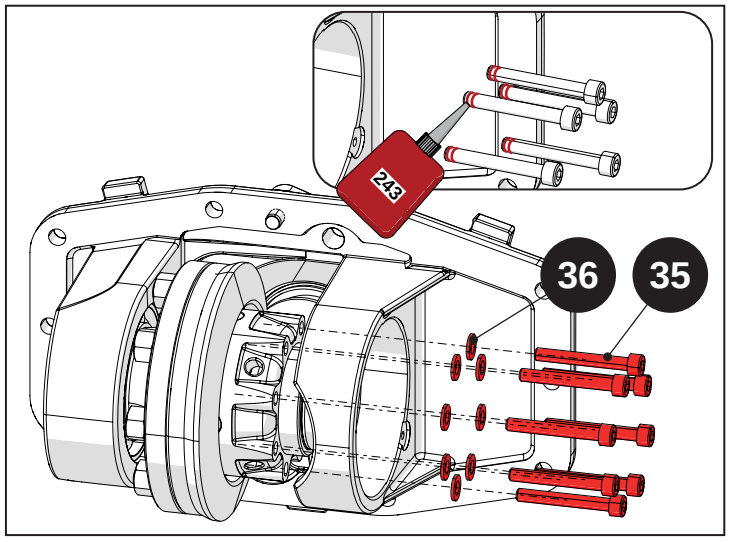

Fig. 7.54

Fit the spacer (111) on the side of the bearing (34).

Use a suitably sized bearing punch tool to drive the bearings (34) and (40) into their seats.

> **Note**
>
> Make sure that the bearings are installed on the right sides and the right way around:
>
> DO NOT install the bearings (34) and (40) fully into their seats.

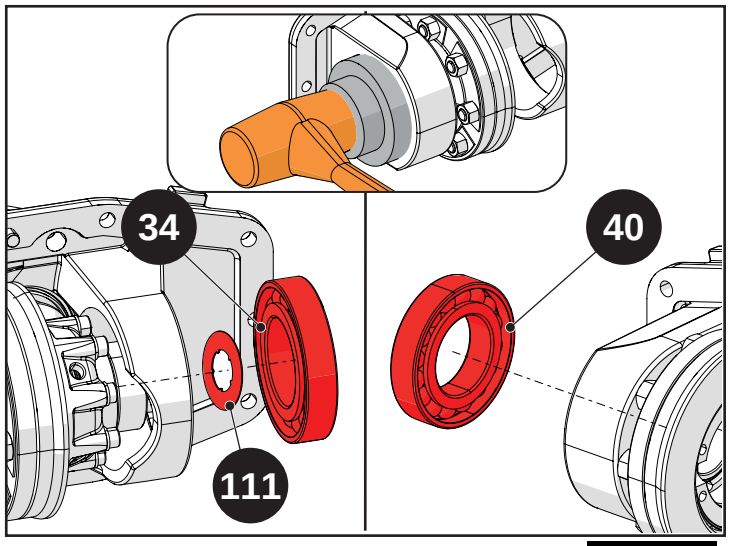

Fig. 7.55

Only drive the bearings (34) and (40) fully into their seats after checking that the crown wheel (41) is perpendicular relative to the differential casing.

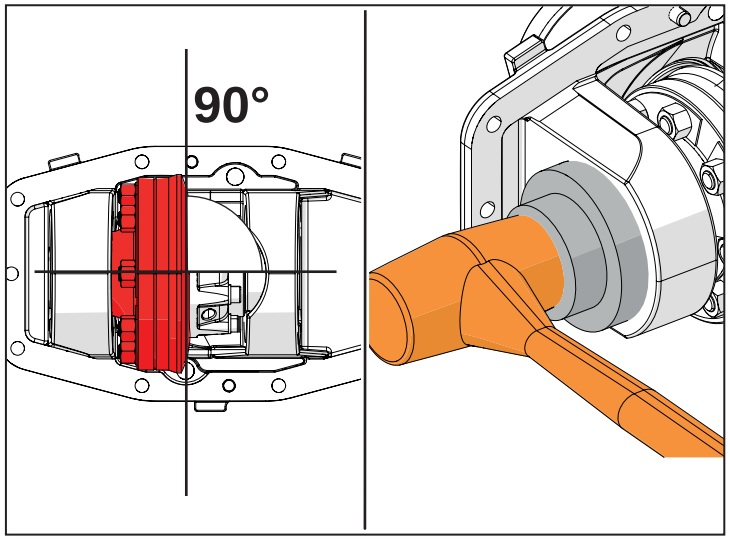

Fig. 7.56

Tighten the ring nut (39) completely using the special tool (C-07000237).

Tighten the screws to a torque of 15 N·m (1.5 kg·m).

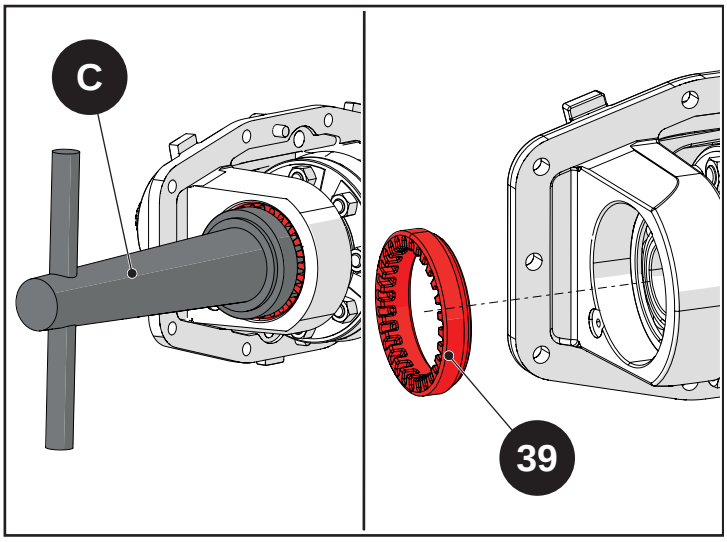

Fig. 7.57

Loosen the ring nut (turning anticlockwise) by 3 splines, using the ring nut retainer hole as reference.

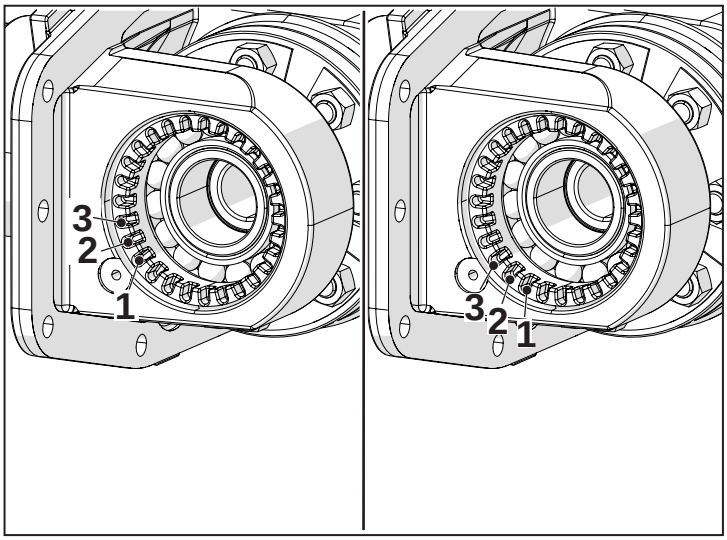

Fig. 7.58

Tighten the ring nut (32) to a torque of 40 N·m (4 kg·m).

Note

Align the hole on the ring nut retainer with one of the holes on the ring nut (32).

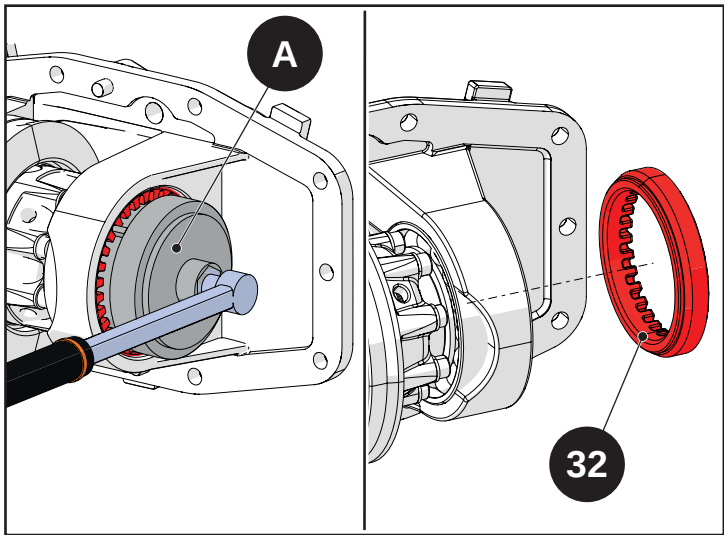

Fig. 7.59

Tap the crown wheel with a soft mallet to drive it fully against the bearing (40).

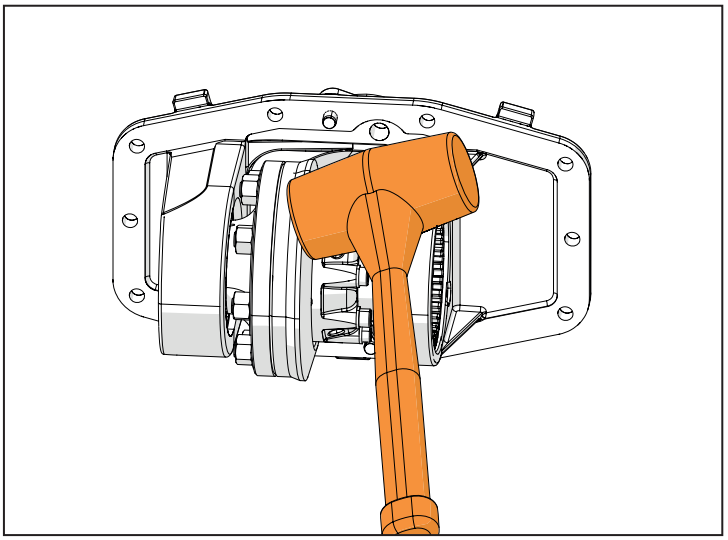

Fig. 7.60

Check that the crown wheel rotates correctly.

Restrain the pinion and turn the crown wheel to check that the backlash between the teeth of the crown wheel and the teeth of the pinion is between 0.10 and 0.18 mm.

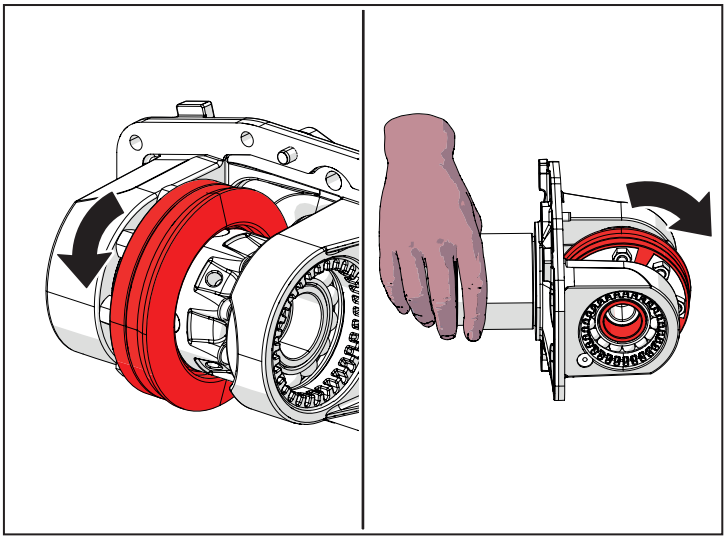

Fig. 7.61

Tighten the ring nut retainer screws (31) complete with washers

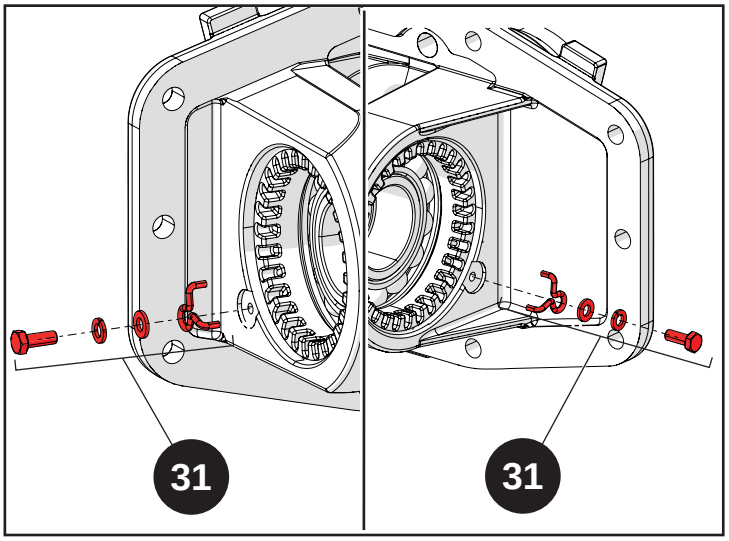

Fig. 7.62

Remove the screw and the wing nut (B) locking the NoSPIN mechanism.

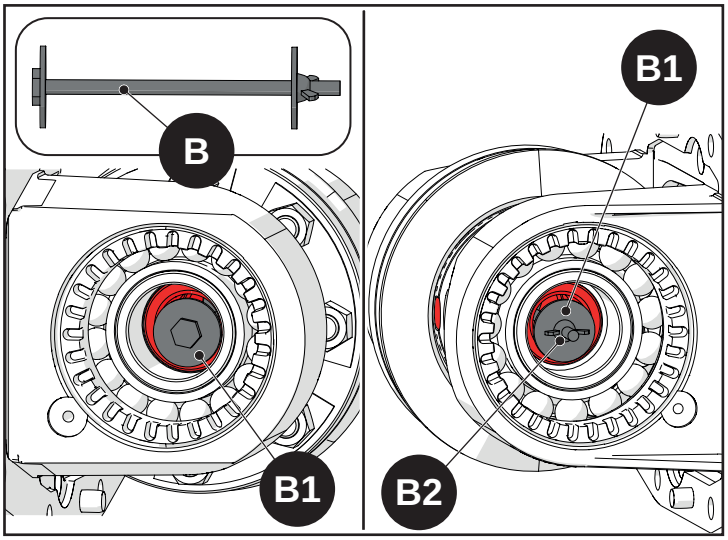

Fig. 7.63

7.5.1.3.1 Checking that the NoSPIN device functions correctly

Immobilise the pinion with the tool (E-07007078).

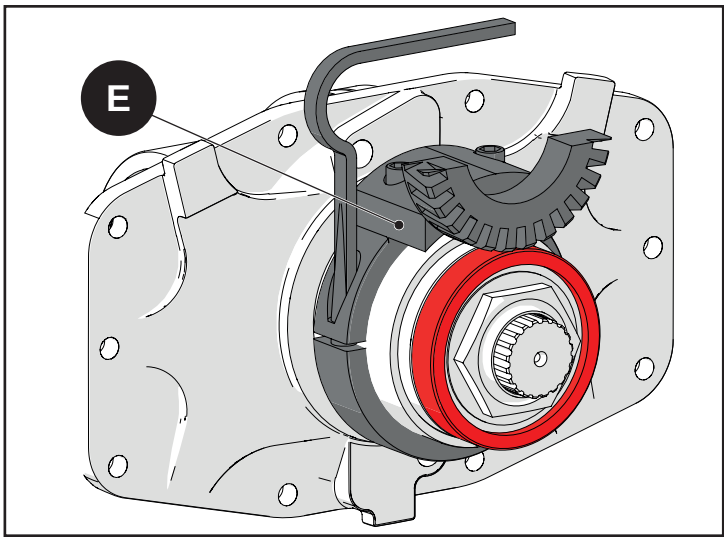

Fig. 7.64

Use the levers (D-07007179) to simulate engagement and disengagement of the differential lock. While holding one lever still, check that the other lever can be turned freely. Test in both directions of rotation on both sides.

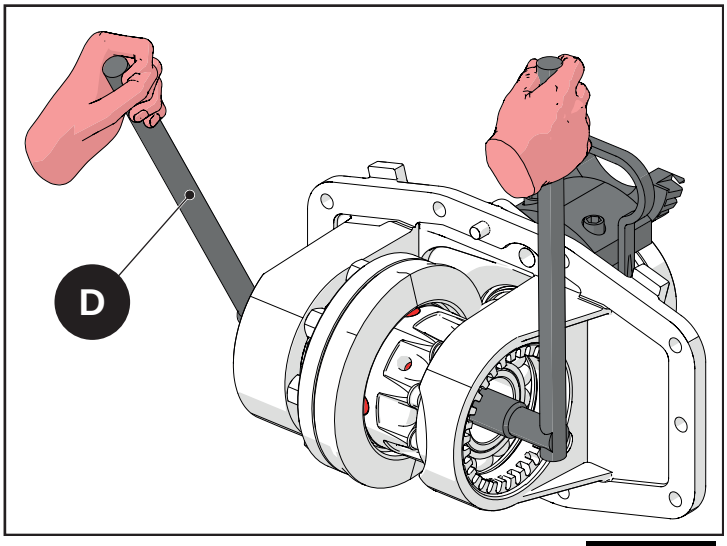

Fig. 7.65

7.5.2 Final drive unit

7.5.2.1 Assembly drawing and main components

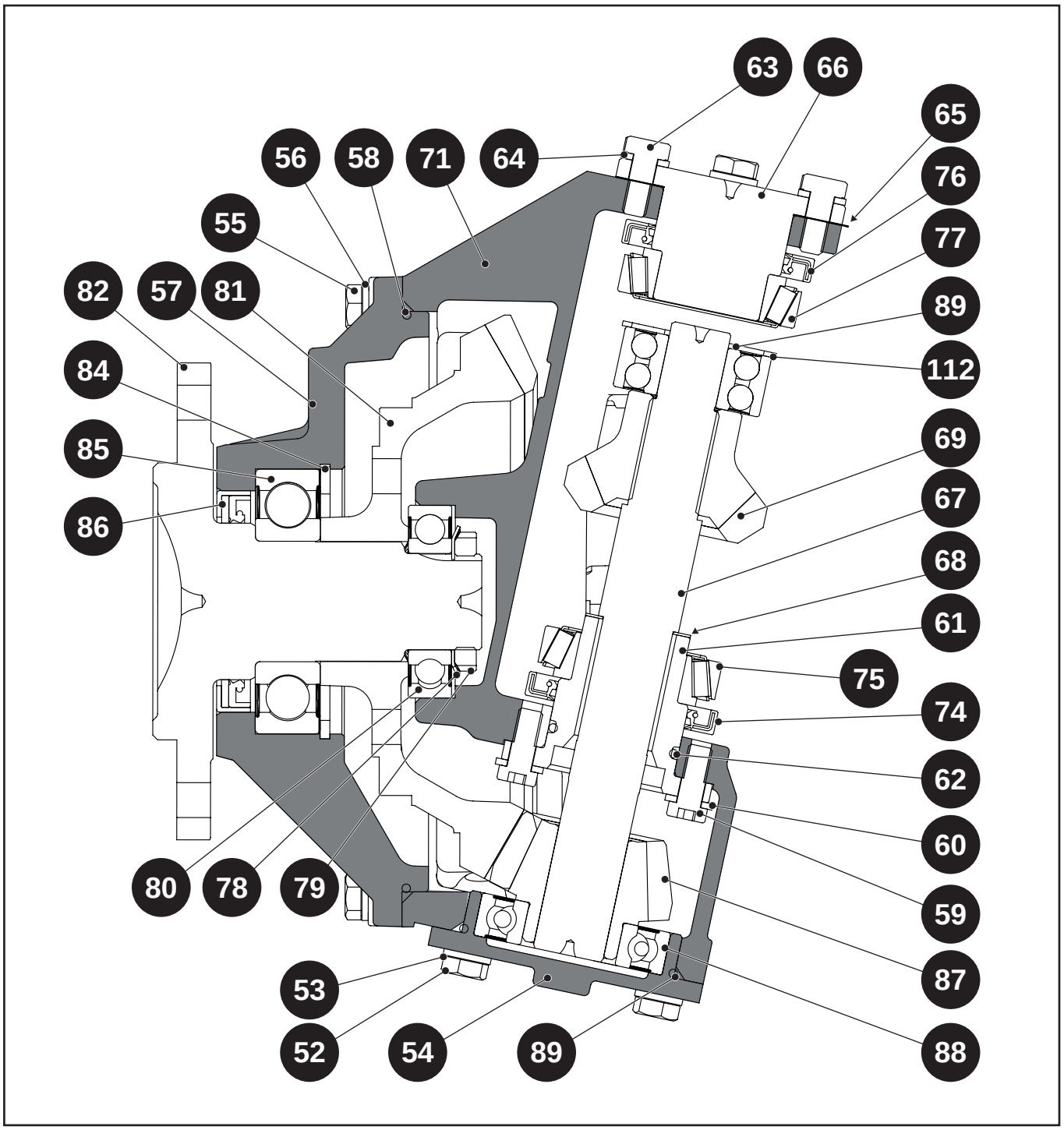

Fig. 7.66

52 - Screw
53 - Conical washer
54 - Lower cover
55 - Screw
56 - Washers
57 - Cover
58 - O-ring
59 - Hex socket head cap screw
60 - Conical washer
61 - Flange
62 - O-ring
63 - Screw
64 - Conical washer
65 - Spacer
66 - Pin
67 - Shaft
68 - Spacer
69 - Reduction gear
71 - Knuckle flange
74 - Oil seal
75 - Bearing
76 - Oil seal
77 - Bearing
78 - Ring nut retainer
79 - Ring nut
80 - Bearing
81 - Crown wheel
82 - Half-axle
83 - Cover
84 - Circlip
85 - Bearing
86 - Oil seal
87 - Gear
88 - Bearing
89 - Circlip
112 - Circlip

7.5.2.2 Disassembly

Note

Place empty drums under the plugs to collect oil.

Undo the screws (52), complete with conical washers (53), and then remove the lower cover complete with gear (54).

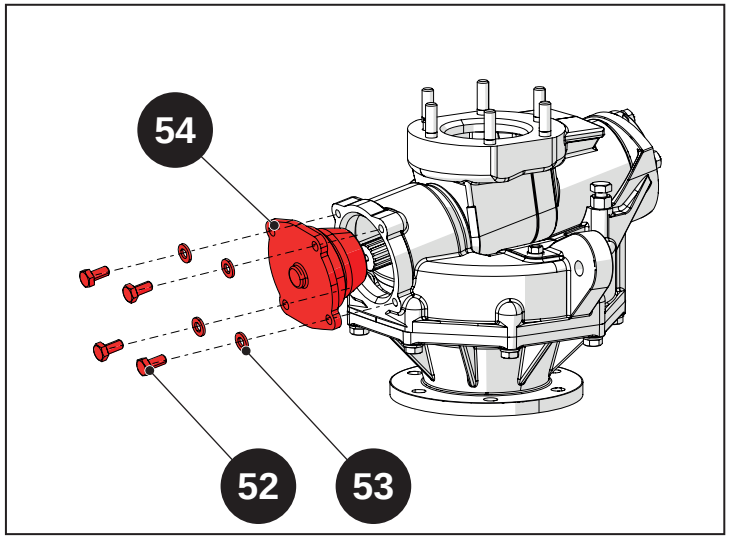

Fig. 7.67

Undo the screws (55) and remove the conical washers (56).

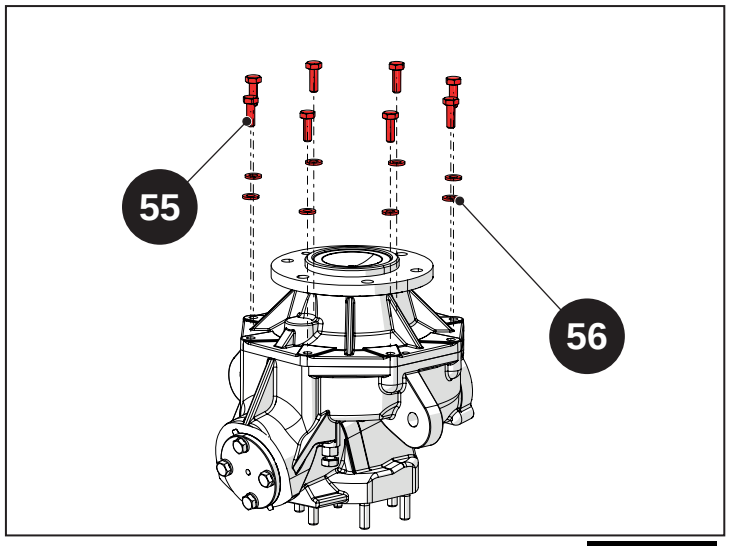

Fig. 7.68

Fit 2 screws into the extraction holes, and then tighten them to remove the final drive gear cover (57).

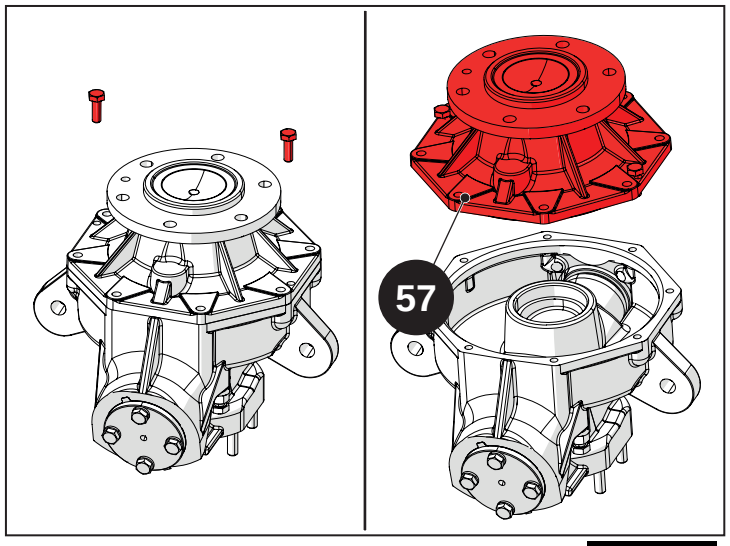

Fig. 7.69

Remove the O-ring (58).

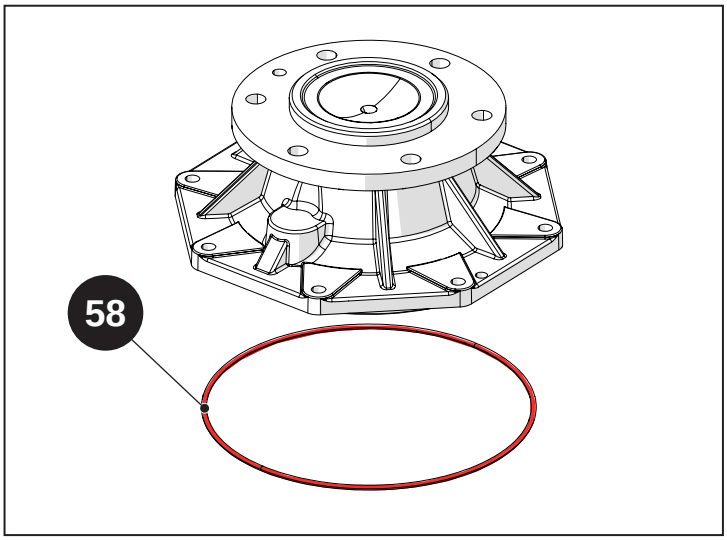

Fig. 7.70

Undo the hex socket screws (59) complete with conical washers (60), and then remove the flange (61) complete with O-ring (62).

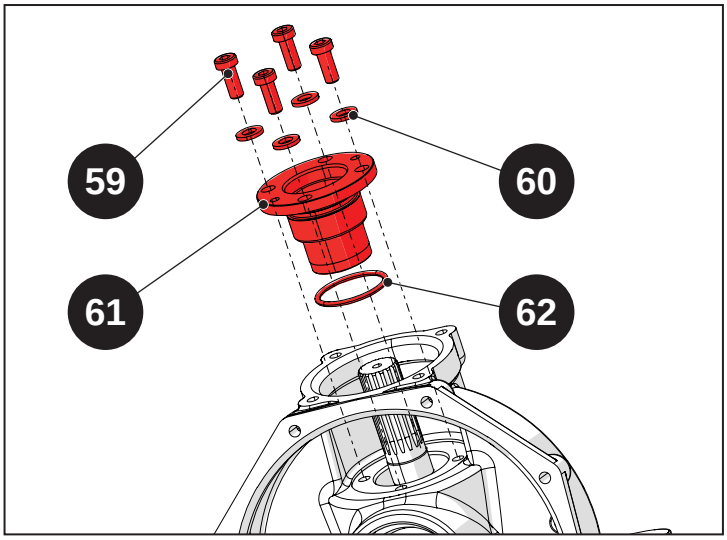

Fig. 7.71

Undo the screws (63) and remove the conical washers (64).

Remove the pin (66) and remove the 2 spacers (65) measuring 0.2 mm in thickness.

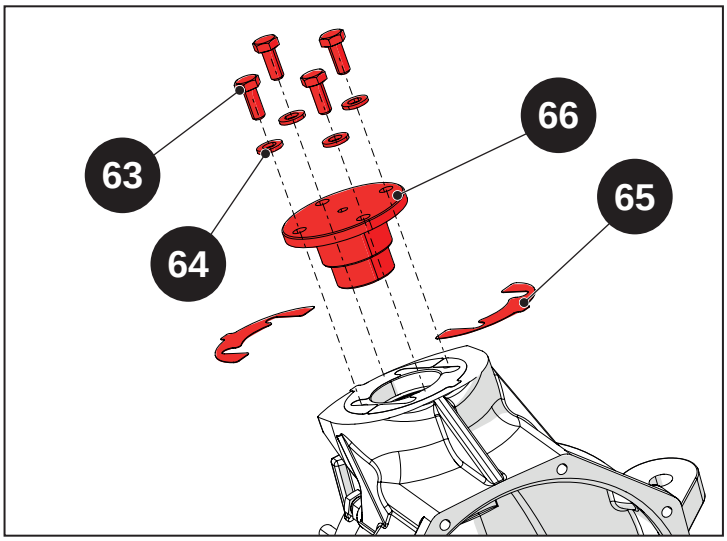

Fig. 7.72

Remove the circlip (89) to release the shaft (67)

Tap the shaft (67) with a pin punch to drive it out of the final drive unit, complete with the spacer (68).

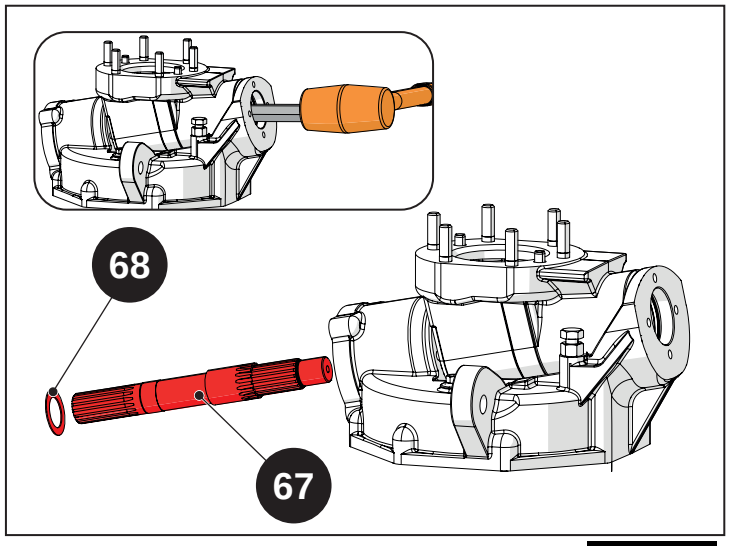

Fig. 7.73

Remove the gear of the final drive unit (69).

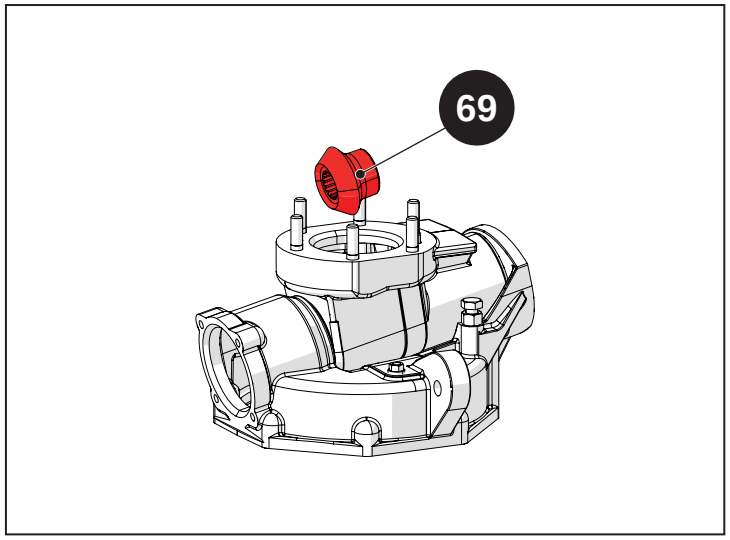

Fig. 7.74

Remove the flange (71) from the complete final drive unit.

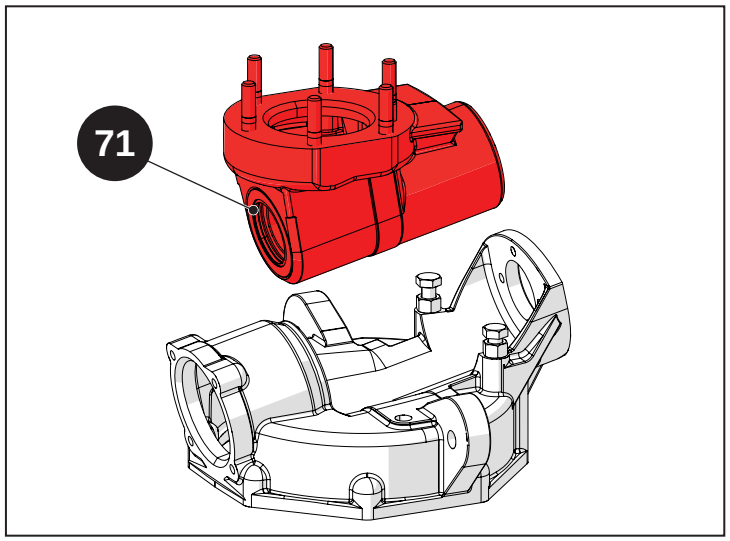

Fig. 7.75

Remove the oil seal (74) and the roller bearing (75).

Remove the oil seal (76) and the roller bearing (77).

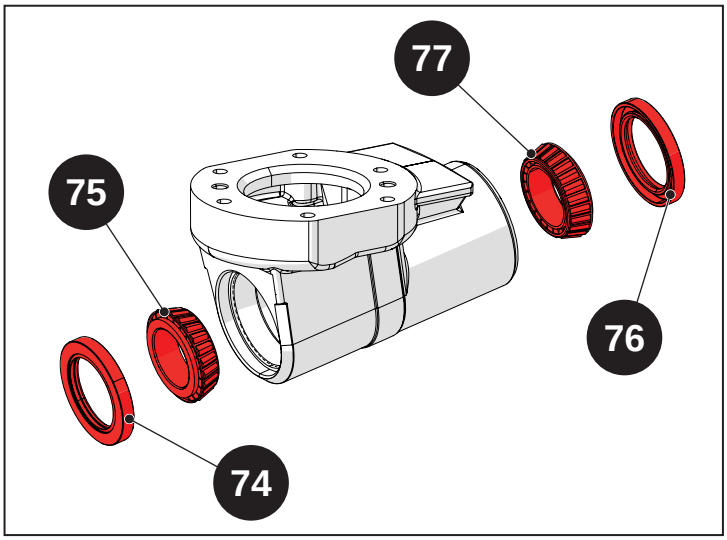

Fig. 7.76

Use a pin punch to drive out the outer races of the bearings (75) and (77).

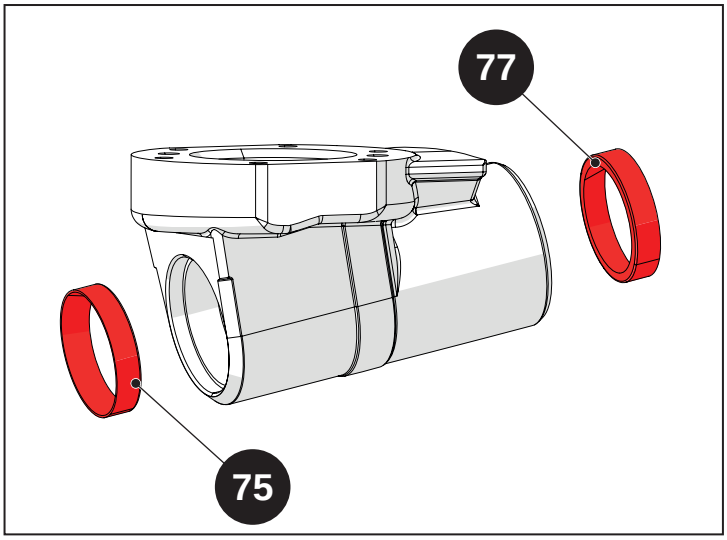

Fig. 7.77

Bend back the tooth of the ring nut retainer (78).

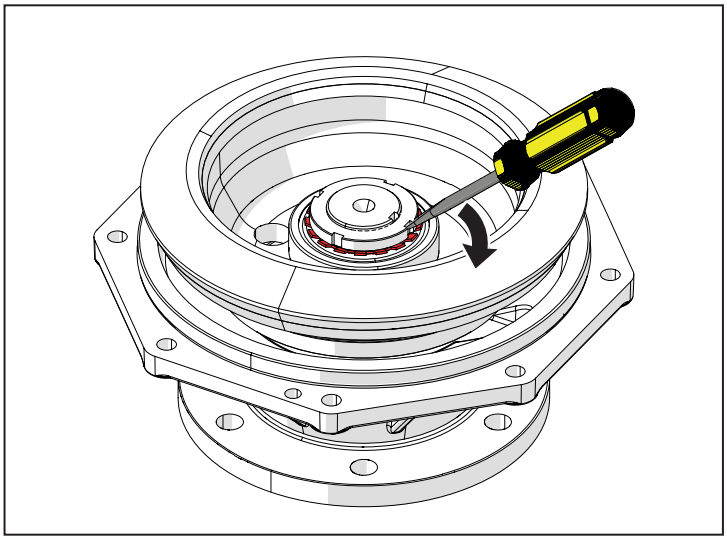

Fig. 7.78

Use the special tool (F-07000234) to undo and remove the ring nut (79).

Remove the ring nut retainer (78).

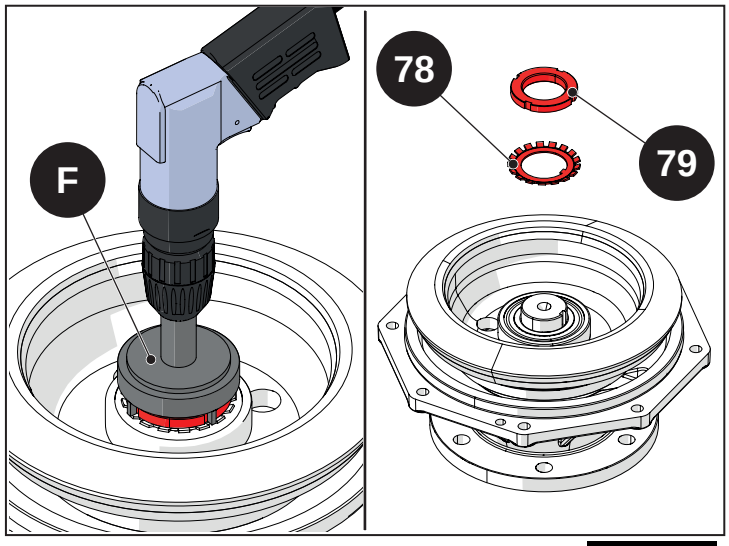

Fig. 7.79

Tap the half axle with a soft mallet to detach the bearing (80) and the crown wheel (81).

Remove the half axle (82) from the cover (83).

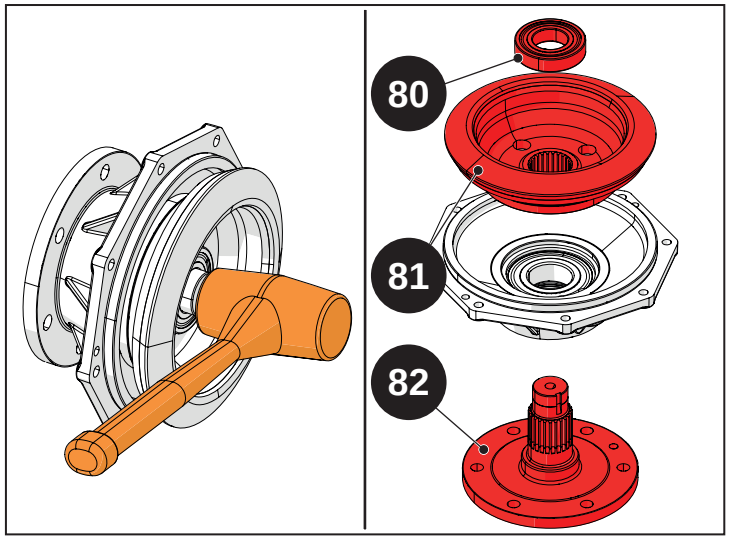

Fig. 7.80

Remove the circlip (84).

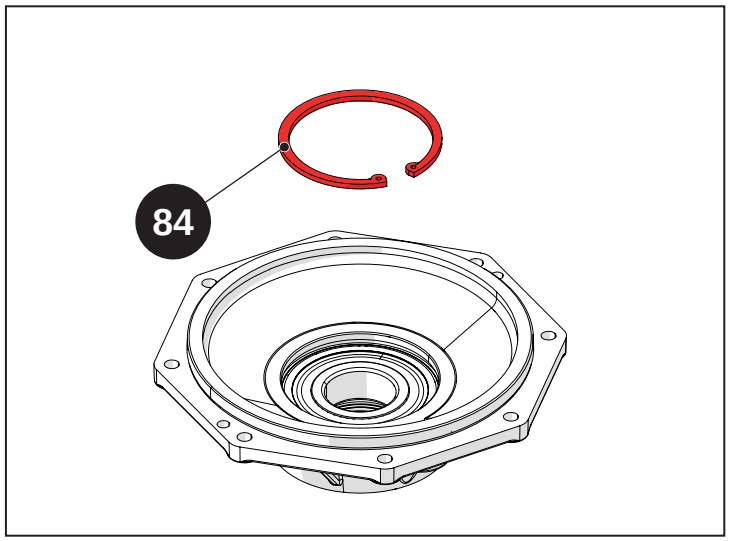

Fig. 7.81

Remove the oil seal (86).

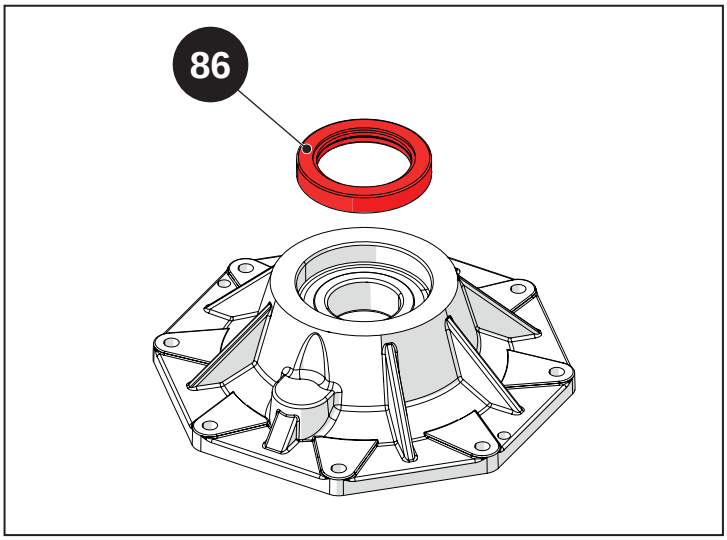

Fig. 7.82

Use a bearing punch tool to remove the bearing (85).

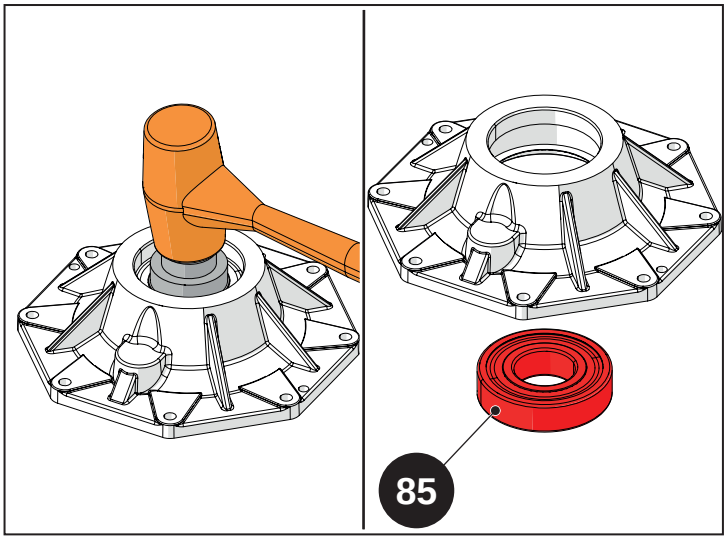

Fig. 7.83

7.5.2.3 Main inspection, reassembly and adjustment procedures

Warning

Read the instructions in chapter "1-Introduction" and, in particular, the sections concerning the installation of O-rings, oil seals and bearings, with particular care before reassembling, and follow these instructions precisely when working.

Apply the correct tightening torques when tighten the fasteners of components. Where tightening torques are not specified, refer to the table in chapter "1-Introduction".

Use the specified sealant products during reassembly. Where the sealant required is not specified, refer to the table in chapter "1-Introduction".

Use a bearing punch tool to install the bearing (85).

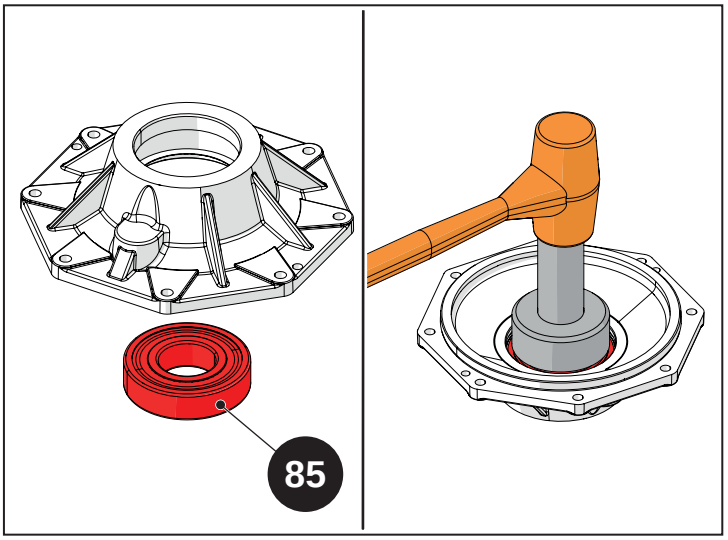

Fig. 7.84

Fit the circlip (84) in its seat.

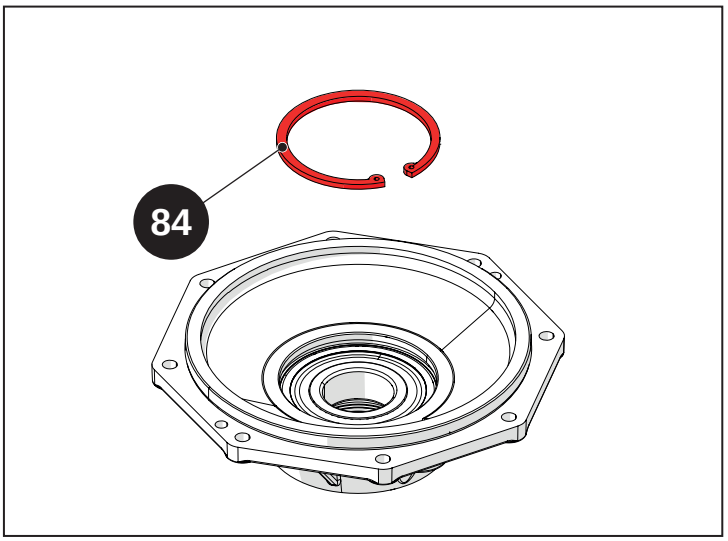

Fig. 7.85

Fit the oil seal (86), applying a layer of mastic sealant around its perimeter.

Note

Replace the oil seal (86) with a new component when reassembling.

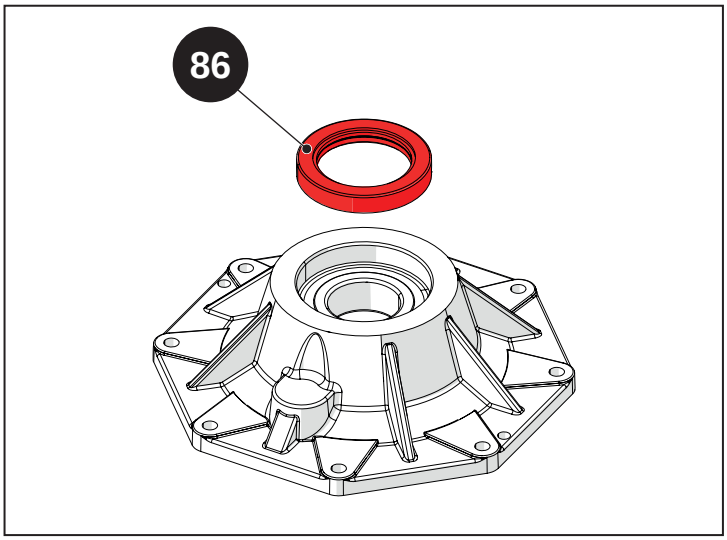

Fig. 7.86

Fit the axle shaft (82), the crown wheel (81) and the bearing (80).

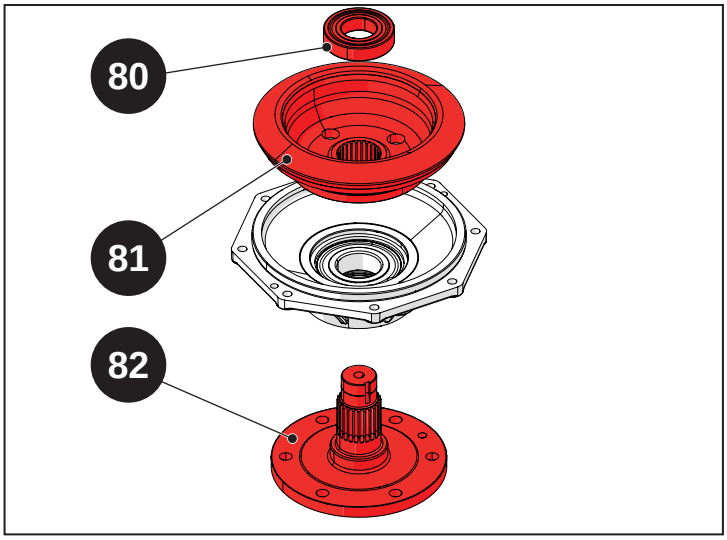

Fig. 7.87

Fit the ring nut retainer (78) and the ring nut (79).

Use the special tool (F-07000234) to tighten the ring nut (79) to a torque of 150 N·m (15 kg·m).

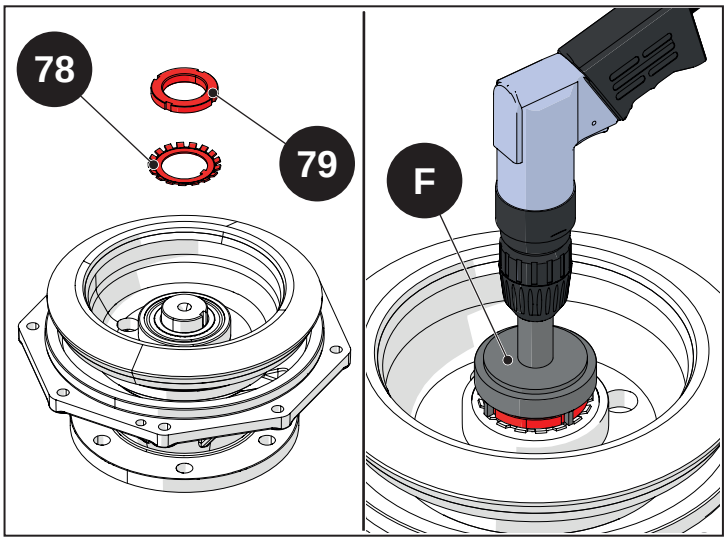

Fig. 7.88

Bend up the tooth of the ring nut retainer (78) to lock the ring nut (79).

Punch a dot on the ring nut (79) as an additional safety measure.

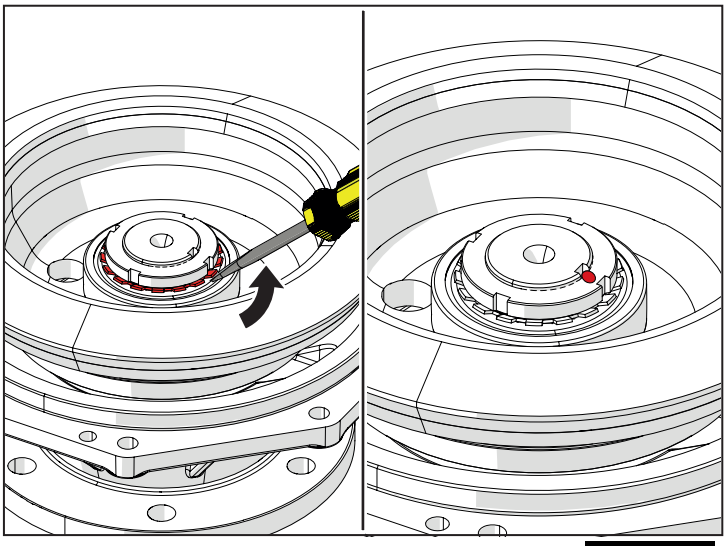

Fig. 7.89

Fit the complete roller bearing (75) and the oil seal (74).

Fit the complete roller bearing (77) and the oil seal (76).

Apply a coating of mastic sealant on the outer surface of the oil seal.

Note
Replace the oil seals (74) and (76) with new components when reassembling.

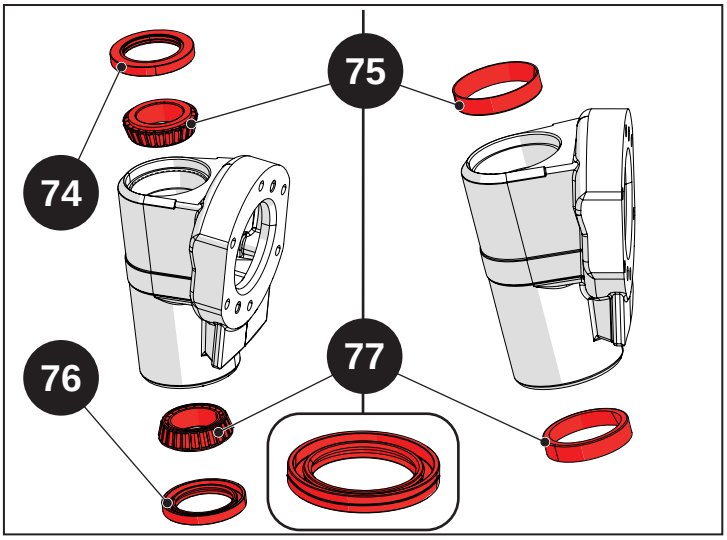

Fig. 7.90

Tighten the stud bolts of the flange (72).

Fit the centring pins (73).

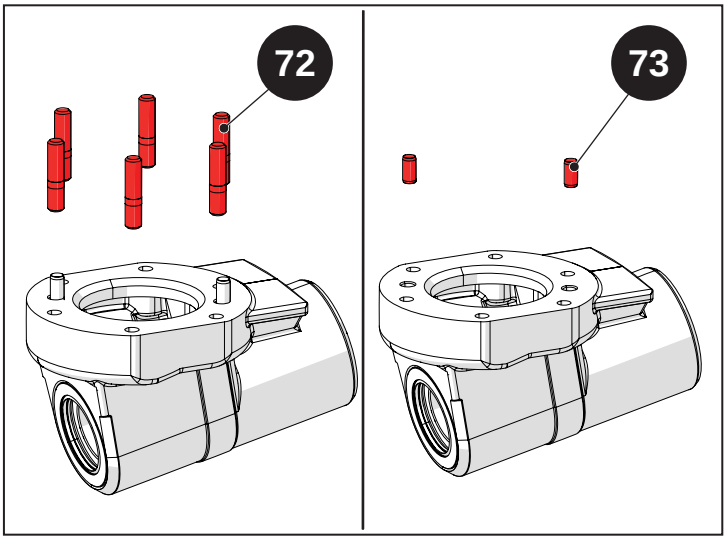

Fig. 7.91

Fit the flange (71) on the complete final drive unit.

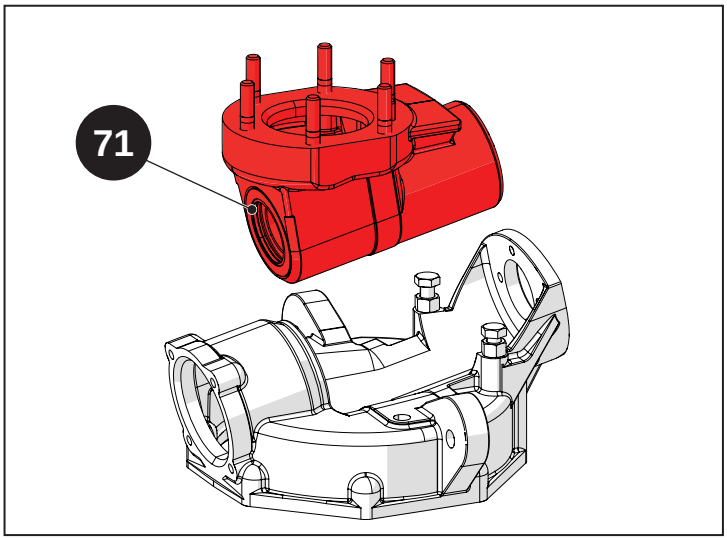

Fig. 7.92

Fit the gear of the final drive unit (69).

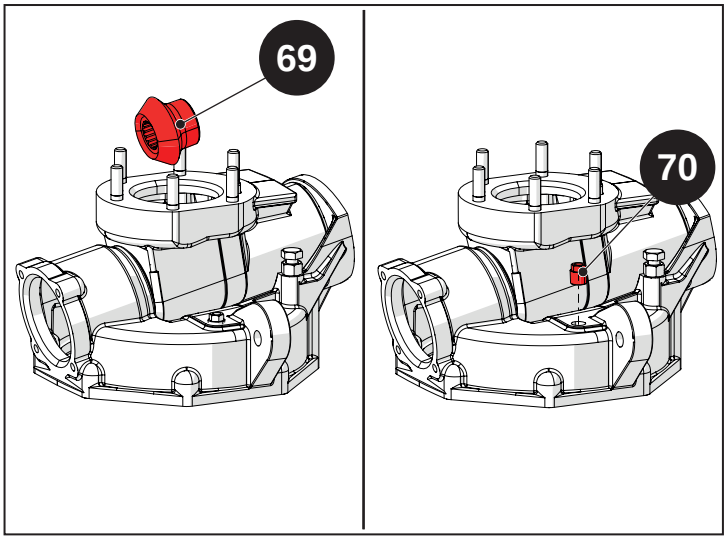

Fig. 7.93

Fit the shaft (67), complete with spacer (68), in the final drive unit and secure in place with the circlip (89).

Note

After fitting the shaft (68), check that it turns correctly.

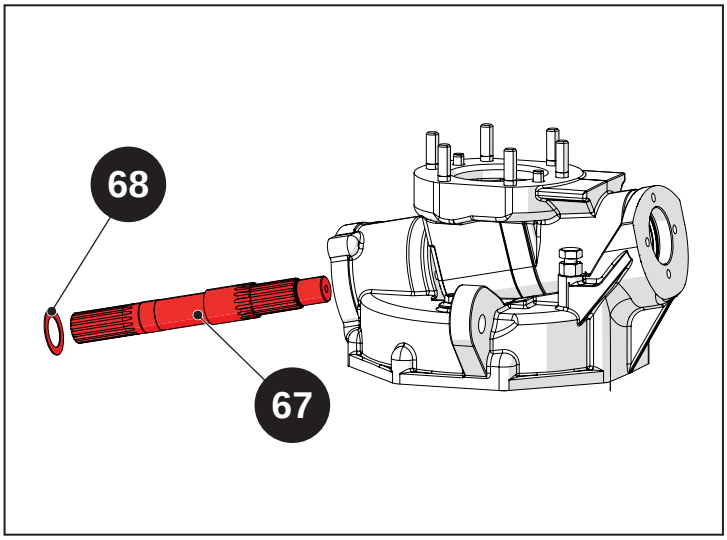

Fig. 7.94

Fit the pin (66) and the 2 spacers (65) measuring 0.2 mm in thickness.

Fit the conical washers (64) and tighten the screws (63) to a torque of 50 N·m (5 kg·m).

Note

The spacers (65) ensure that the flange bearings are preloaded correctly.

Increasing the thickness of the spacers produces a lighter steering action.

Reducing the thickness of the shim produces a stiffer steering action.

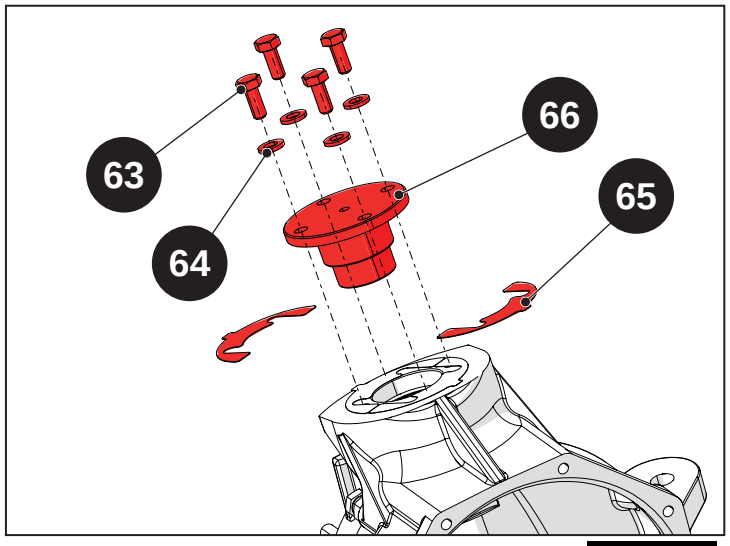

Fig. 7.95

Replace the O-ring (62) and then fit the flange (61), the conical washers (60) and the hex socket head cap screws (59).

Apply a coating of Loctite 577 to the thread of the hex socket screws (59), and then fit and tighten the screws to a torque of 50 N·m (5 kg·m)

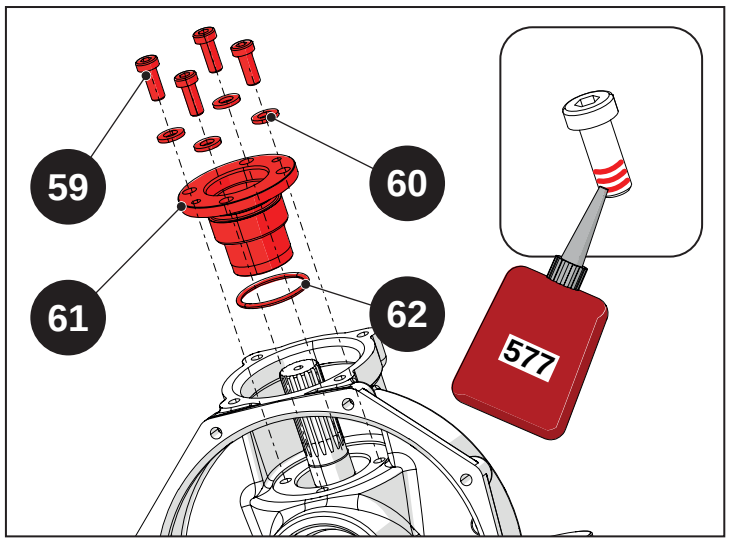

Fig. 7.96

Apply a layer of grease and then fit the O-ring (58) in its seat.

Apply a coating of silicon sealant to the O-ring (58) after fitting.

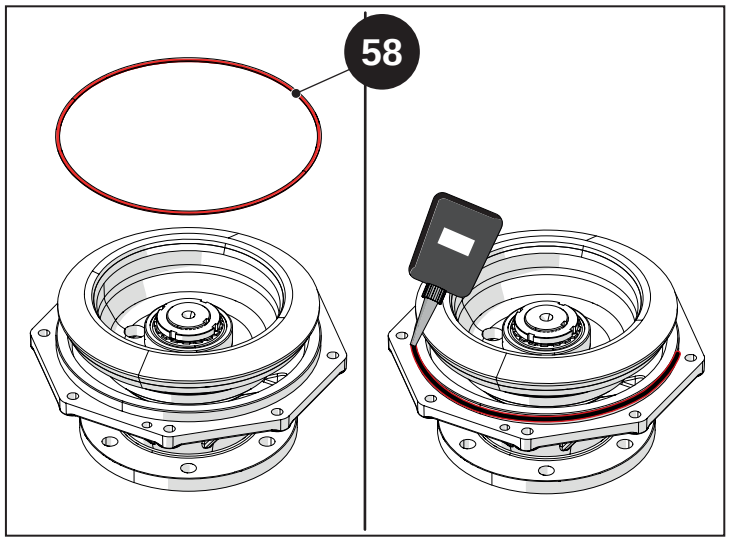

Fig. 7.97

Fit the conical washers (56) and tighten the screws (55) to a torque of 60 N·m (6 kg·m).

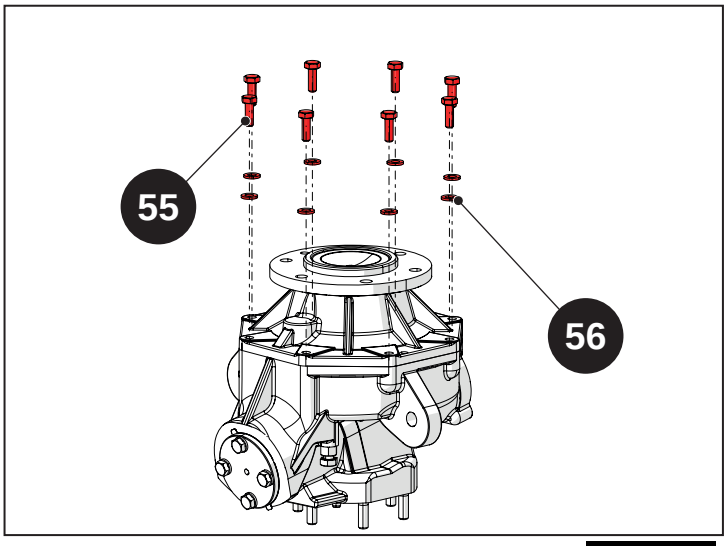

Fig. 7.98

Fit the lower cover (54), complete with gear (87) and bearing (88).

Fit the conical washers and tighten the screws (52) to a torque of 50 N·m (5 kg·m)

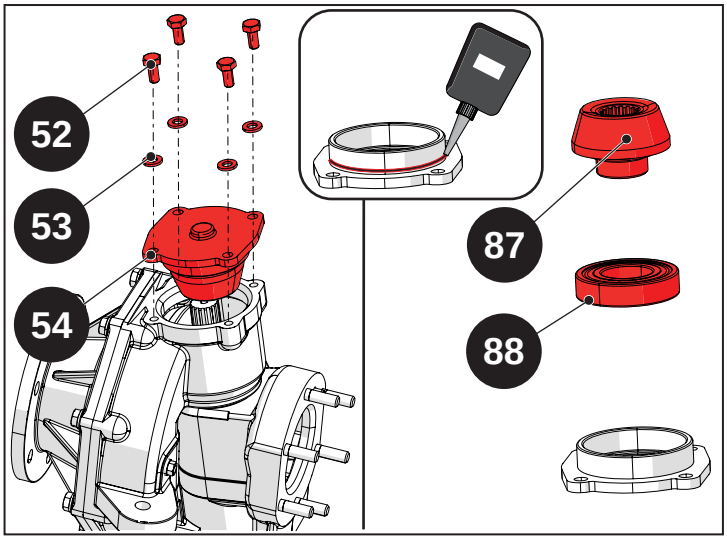

Fig. 7.99

7.5.3 Transfer case

7.5.3.1 Assembly drawing and main components

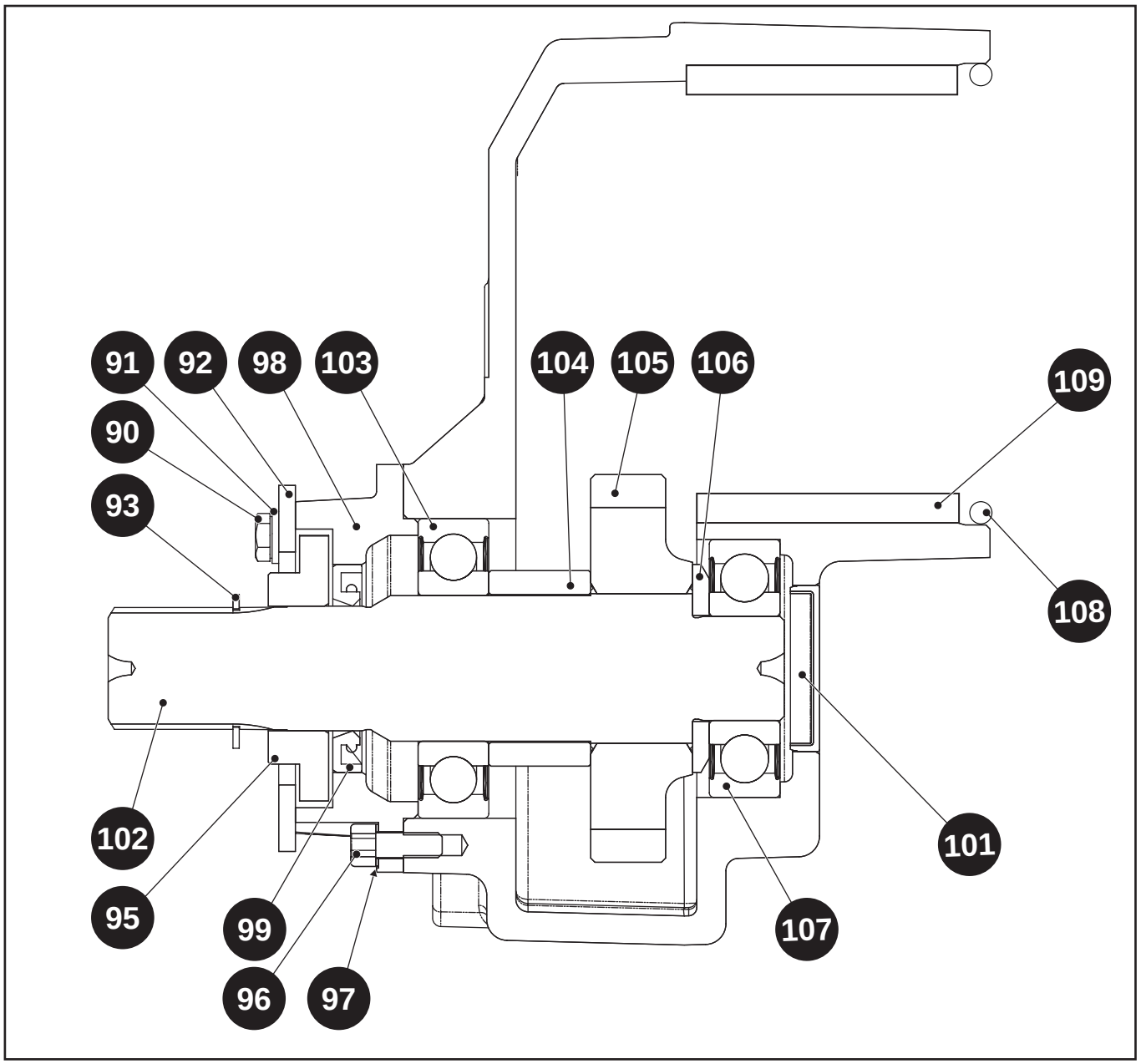

Fig. 7.100

90 - Screw
91 - Washer
92 - Plate
93 - Circlip
95 - Tone wheel
96 - Screw
97 - Knurled washer
98 - Cover
99 - Oil seal
101 - Plug
102 - Transfer shaft
103 - Bearing
104 - Bush
105 - Gear
106 - Spacer
107 - Bearing
108 - O-ring
109 - Bush

7.5.3.2 Disassembly

Undo and remove the screws (90) fastening the plate (92), complete with washers (92).

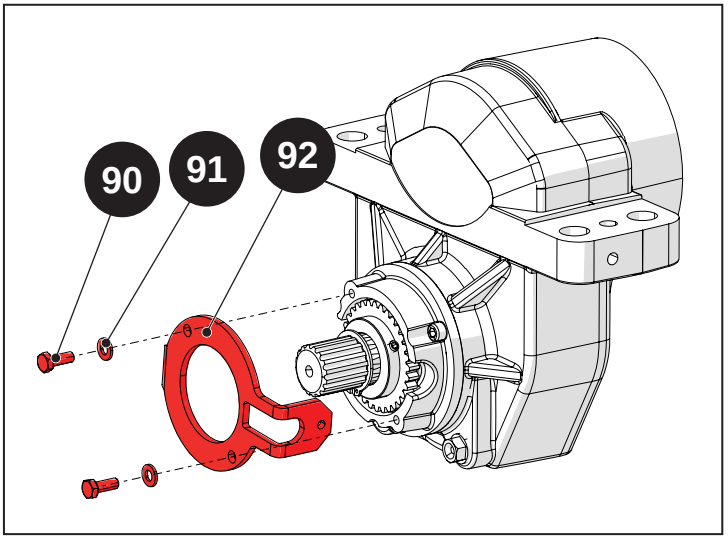

Fig. 7.101

Remove the circlip (93).

Remove the fastener grub screw (94).

Remove the tone wheel (95).

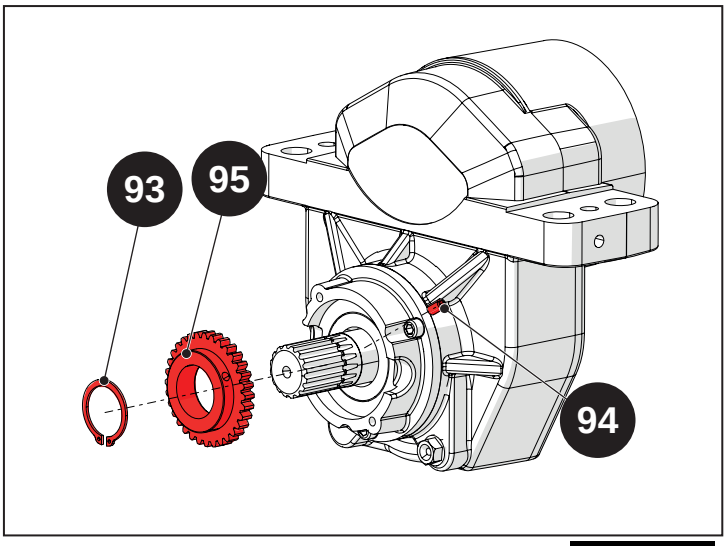

Fig. 7.102

Undo the hex socket head cap screws (96) and remove the knurled washers (97).

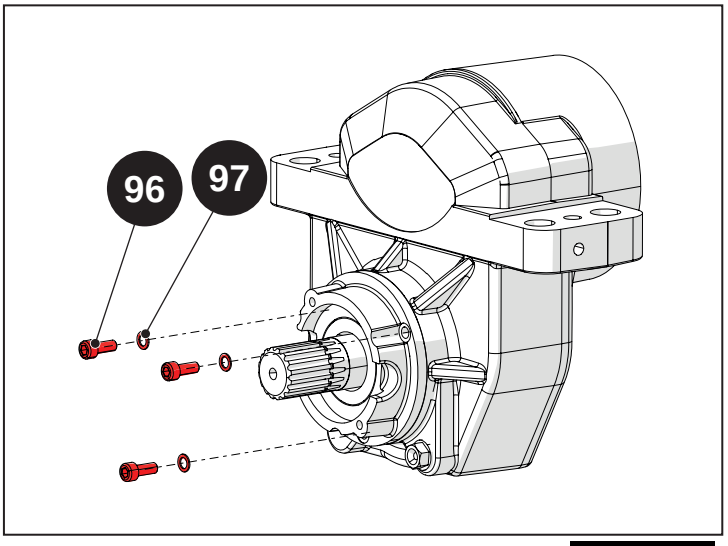

Fig. 7.103

Use a small lever to prise off and remove the cover (98), complete with oil seal (99).

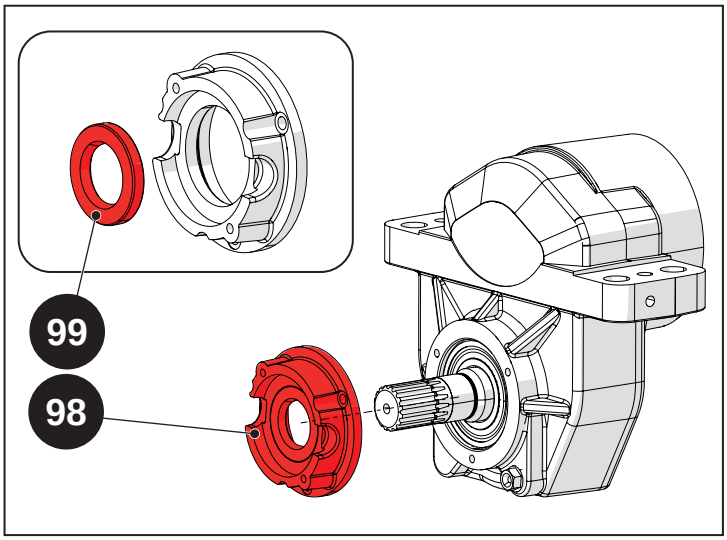

Fig. 7.104

Unscrew the plug (100).

Remove the plug (101).

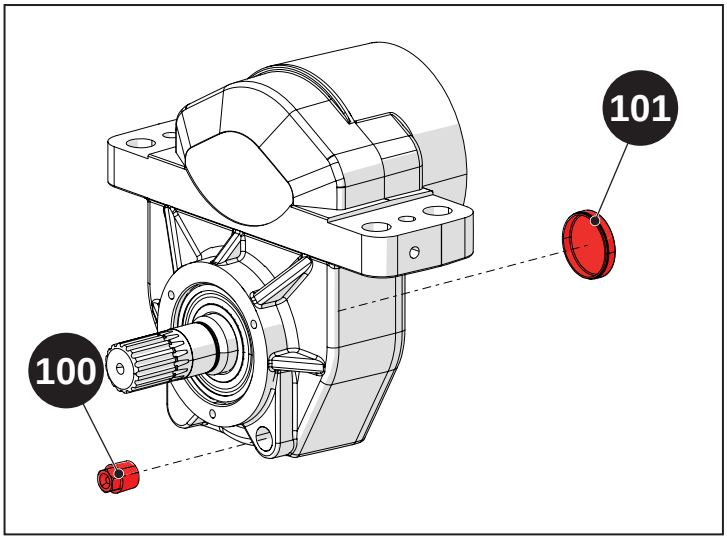

Fig. 7.105

Remove the transfer shaft (102).

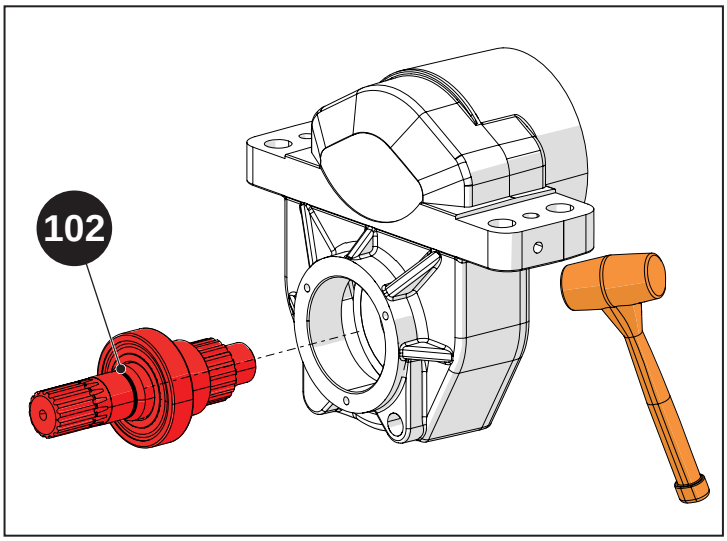

Fig. 7.106

Use a bearing extractor tool to remove the bearing (103) and the bush (104).

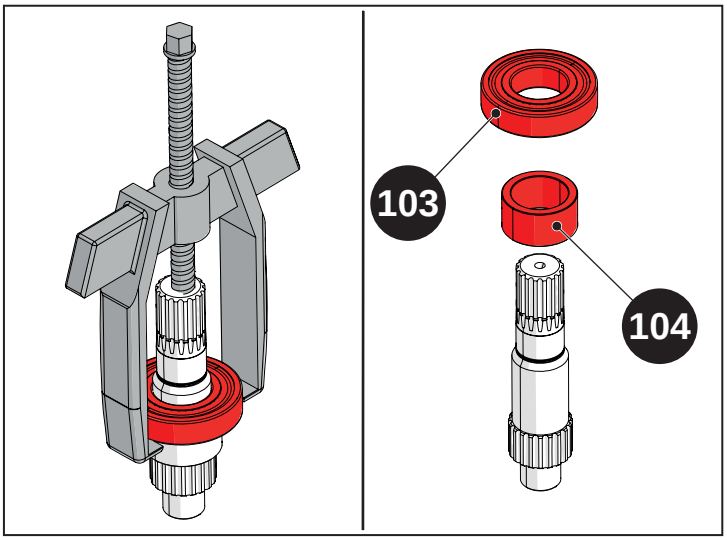

Fig. 7.107

Remove the gear (105) and the spacer (106).

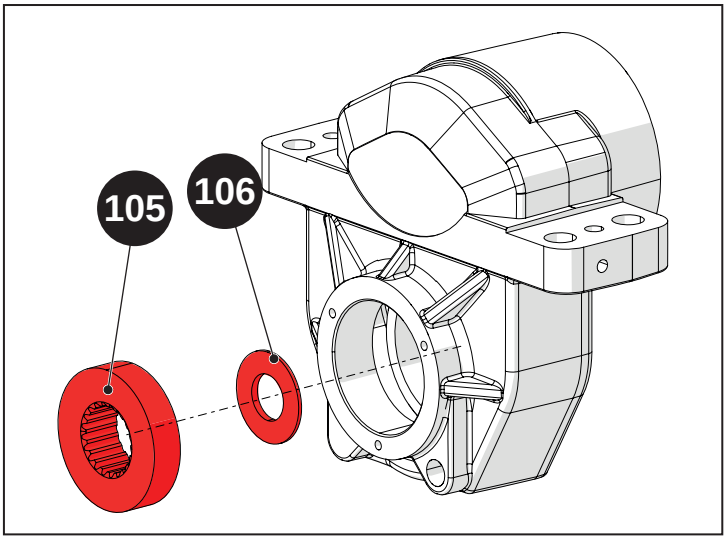

Fig. 7.108

Use a bearing punch to drive out the bearing (107)

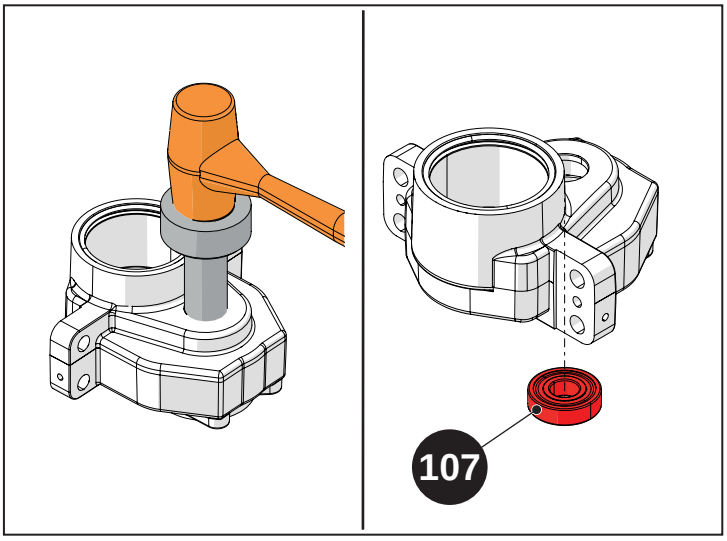

Fig. 7.109

Remove the O-ring (108)

Remove the bush (109)

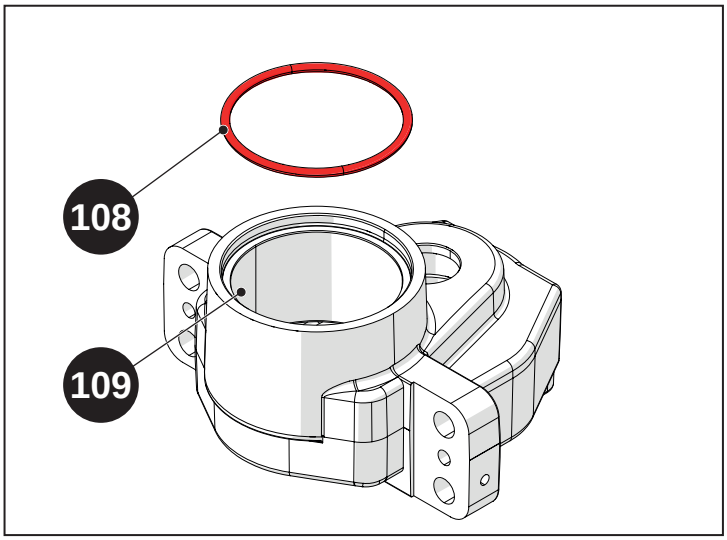

Fig. 7.110

7.5.3.3 Main inspection, reassembly and adjustment procedures

Warning

Read the instructions in chapter "1-Introduction" and, in particular, the sections concerning the installation of O-rings, oil seals and bearings, with particular care before reassembling, and follow these instructions precisely when working.

Apply the correct tightening torques when tighten the fasteners of components. Where tightening torques are not specified, refer to the table in chapter "1-Introduction".

Use the specified sealant products during reassembly. Where the sealant required is not specified, refer to the table in chapter "1-Introduction".

Check that the gap between the bush (109) and the transfer case is 8 mm.

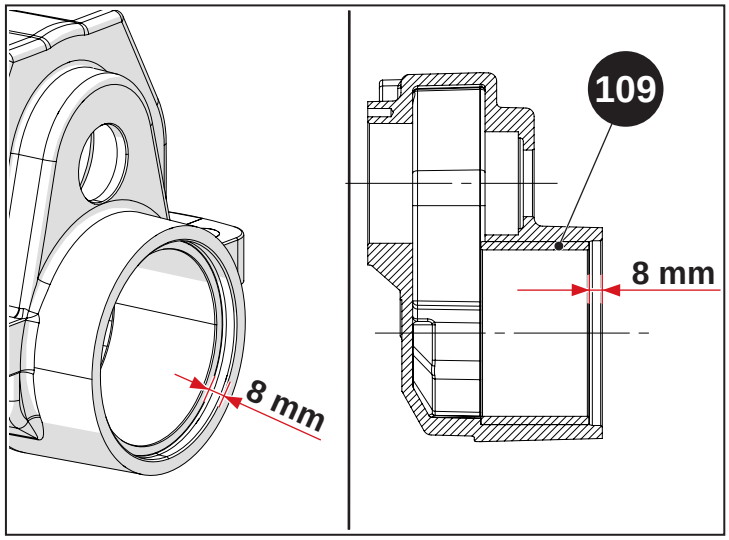

Fig. 7.111

Remove the O-ring (108) and fit a new O-ring in its seat.

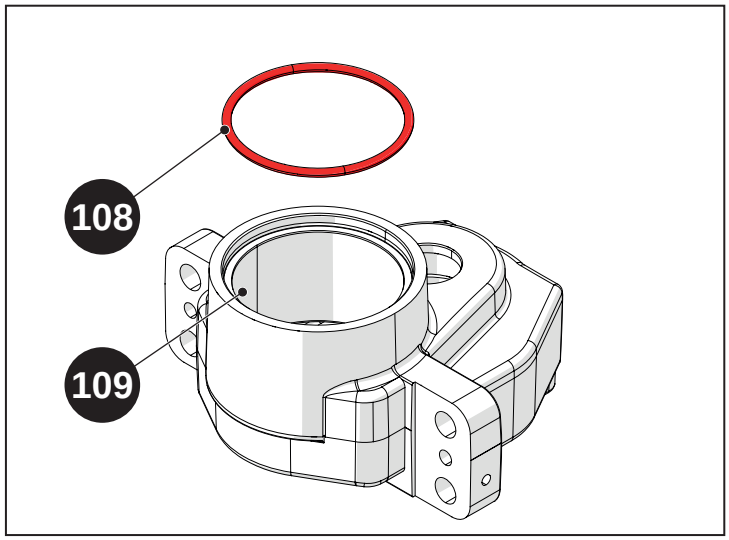

Fig. 7.112

Fit the bearing with a bearing punch tool of suitable diameter.

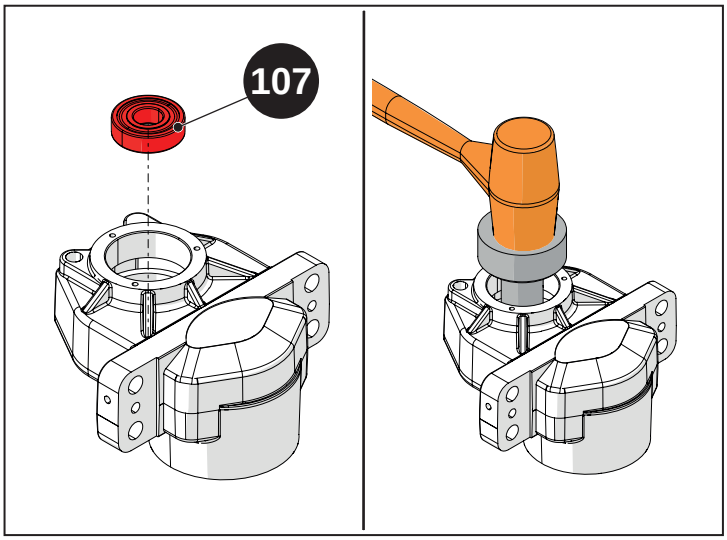

Fig. 7.113

Fit the spacer (106) and the gear (105).

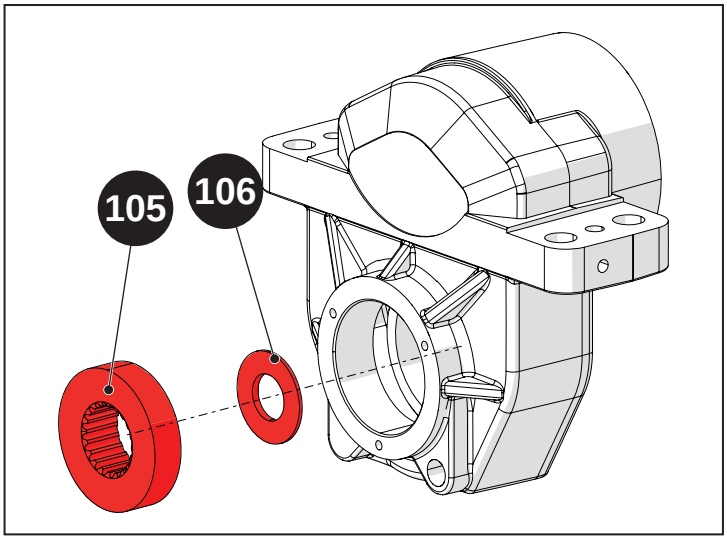

Fig. 7.114

Fit the bush (104) and the bearing (103) on the shaft (102).

Fit the complete transfer shaft in the case.

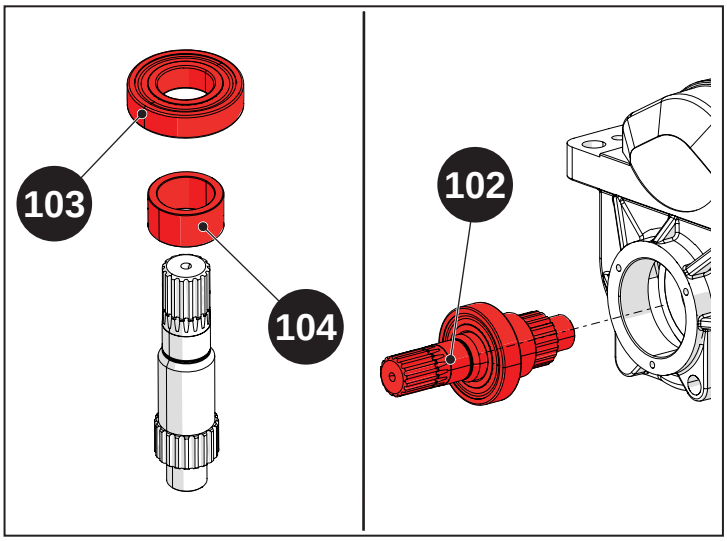

Fig. 7.115

Apply a coating of mastic sealant on the circumference of the plug (101) and then install the plug in its seat.

Apply a coating of Teflon to the thread of the plug (100) and then fit and tighten the plug.

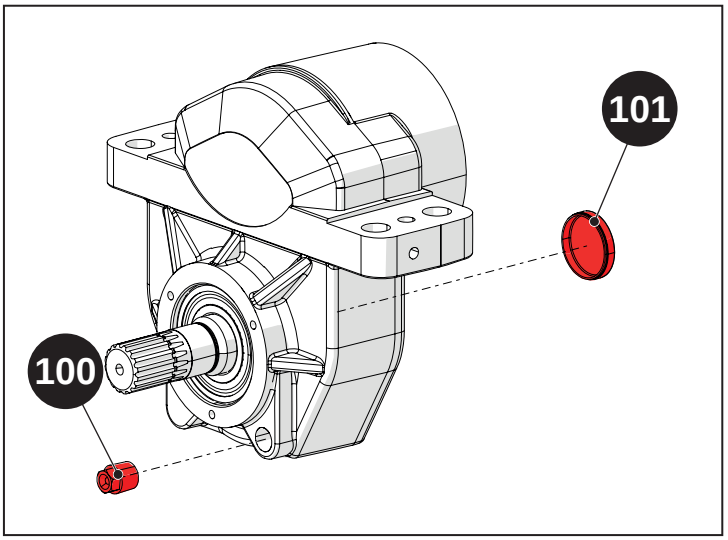

Fig. 7.116

Apply a coating of SILICONE sealant to the cover (98).

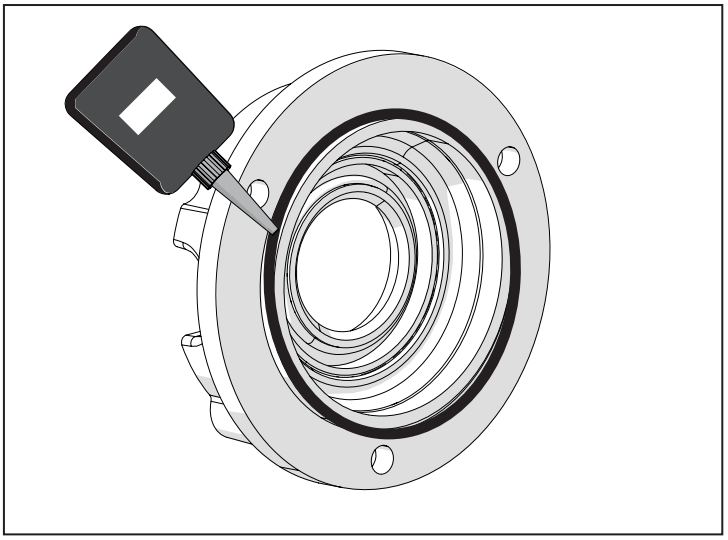

Fig. 7.117

Fit the cover (98), complete with oil seal (99).

Note

Replace the oil seal with a new component when reassembling.

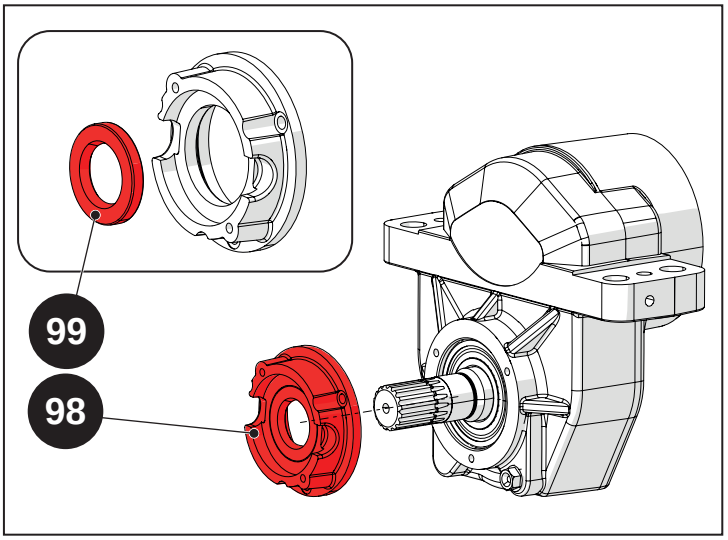

Fig. 7.118

Fit the knurled washers (97) and tighten the hex socket head cap screws to a torque of 15 N·m (1.5 kg·m).

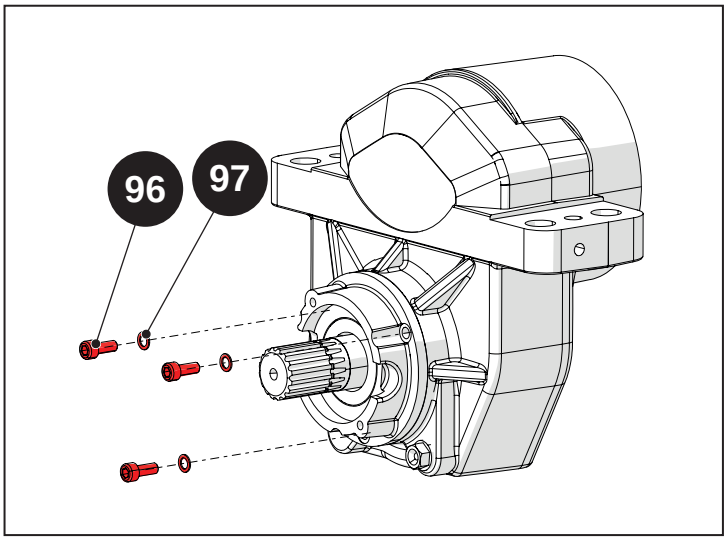

Fig. 7.119

Apply a coating of LOCTITE 270 to the thread of the grub screw.

Fit the tone wheel (95) and fasten with the grub screw (94).

Fit the circlip (93).

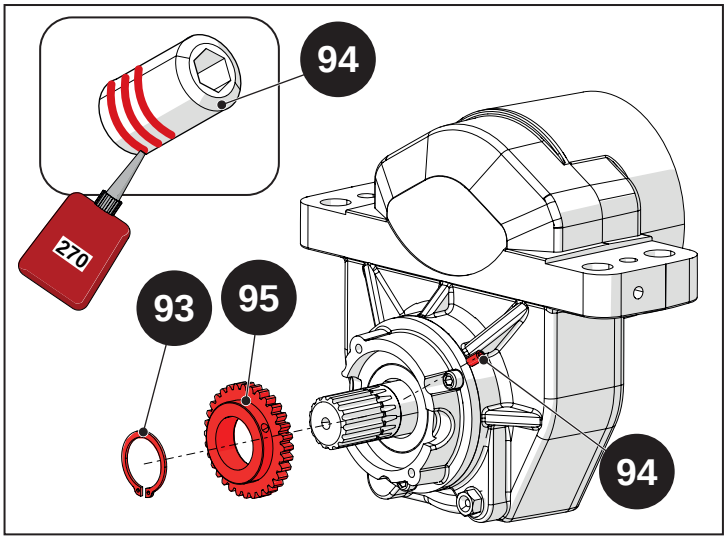

Fig. 7.120

Fit the plate (92) and the washers (91) and fit and tighten the screws (90).

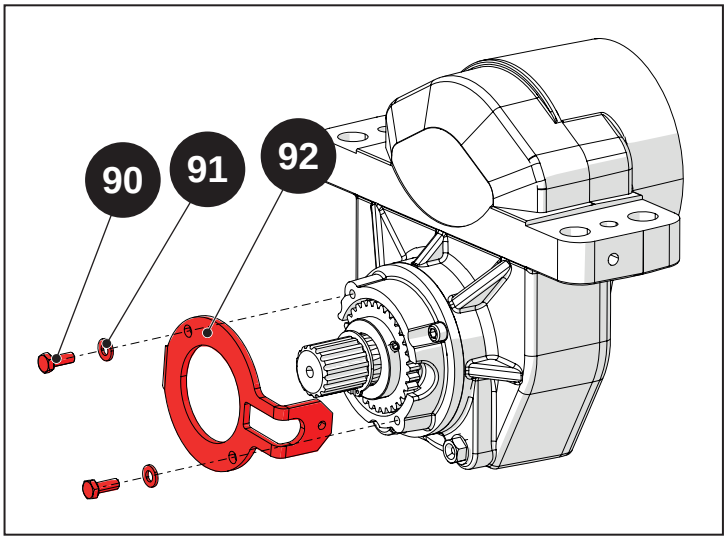

Fig. 7.121

7.6 Refitting

Index

7.6.1 Refitting 7-62
7.6.1.1 Adjusting the steering cylinder 7-67

7.6.1 Refitting

Warning

Read the instructions in chapter "1-Introduction" and, in particular, the sections concerning the installation of O-rings, oil seals and bearings, with particular care before reassembling, and follow these instructions precisely when working.

Apply the correct tightening torques when tighten the fasteners of components. Where tightening torques are not specified, refer to the table in chapter "1-Introduction".

Use the specified sealant products during reassembly. Where the sealant required is not specified, refer to the table in chapter "1-Introduction".

Apply a layer of SILICONE sealant on the mating surface of the transfer case.

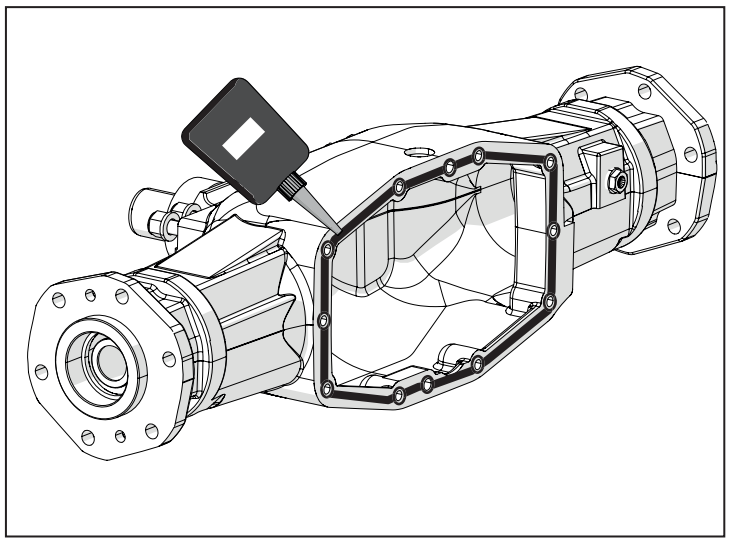

Fig. 7.122

Fit the complete front differential assembly (30).

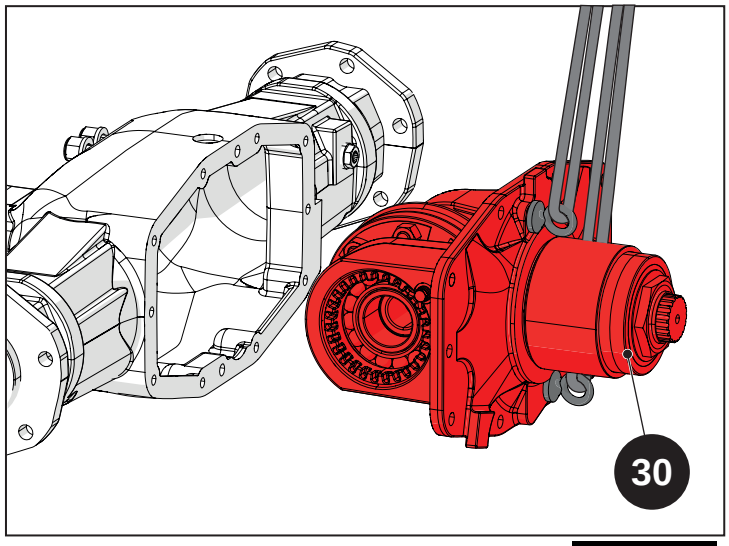

Fig. 7.123

Fit and tighten the plugs (12) and the plug (13).

Note

Apply a coating of Teflon to the threads of the plugs (12).

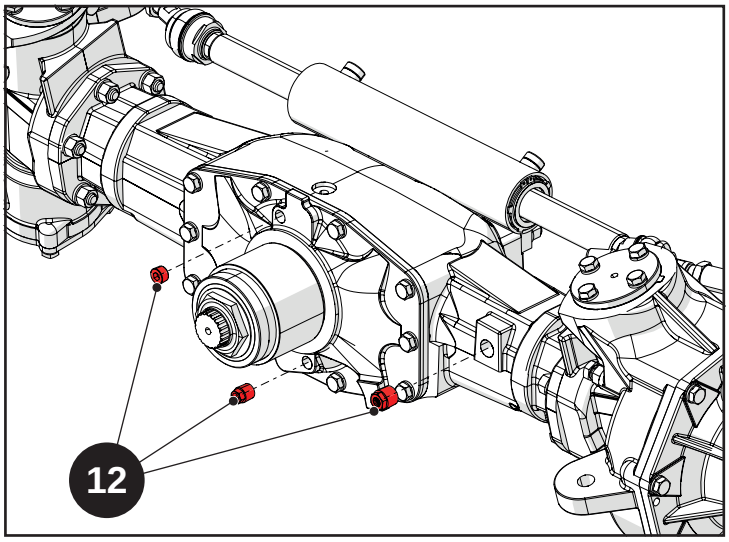

Fig. 7.124

Fit the washers (29) and tighten the screws (28) to a torque of 55 N·m (5,5 kg·m).

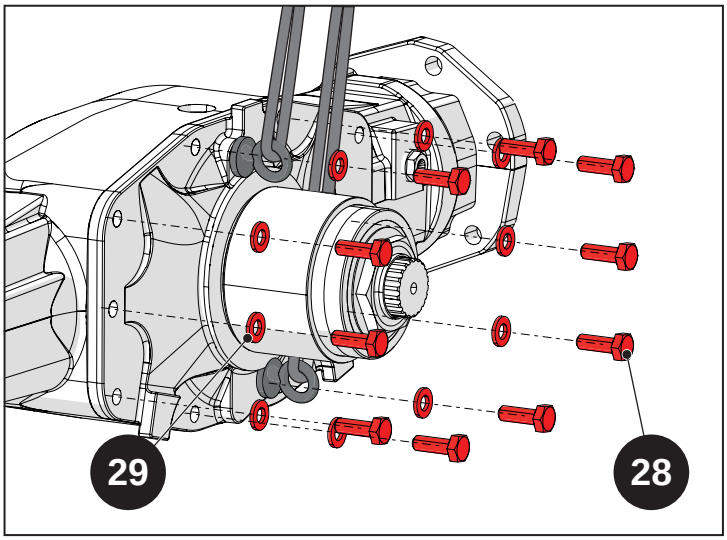

Fig. 7.125

Fit the complete half-axle (109) and the O-ring (110).

Note

Replace the O-ring (110) with a new component when reassembling.

Warning

Make sure that the two half axles are installed on the correct sides: install the shorter half axle on the left hand side of the half axle case, and install the longer half axle on the right hand side.

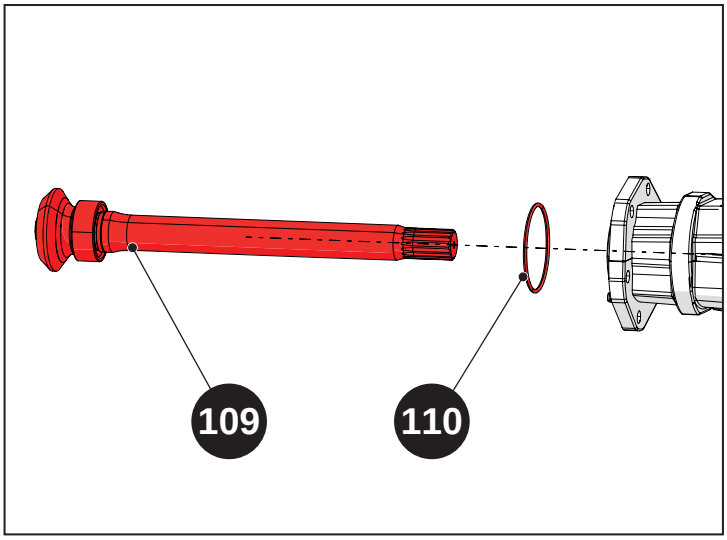

Fig. 7.126

Fit the complete lateral final drive unit.

Warning
The longer adjustment screw is situated on the front of the axle.

Fit the washers (26) and tighten the nuts to a torque of 85 N·m (8.5 kg·m).

Apply a coating of silicone sealant to the mating surfaces of the final drive unit.

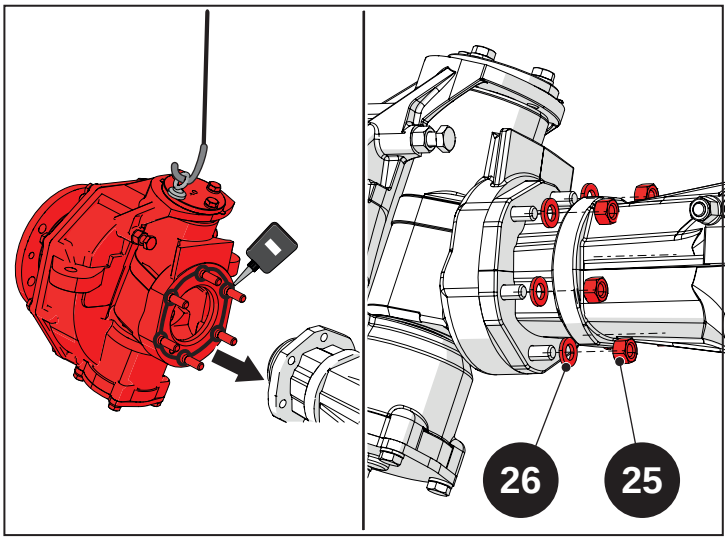

Fig. 7.127

Remove the hoisting eye bolt (24) and tighten a fastener screw (23) in its place.

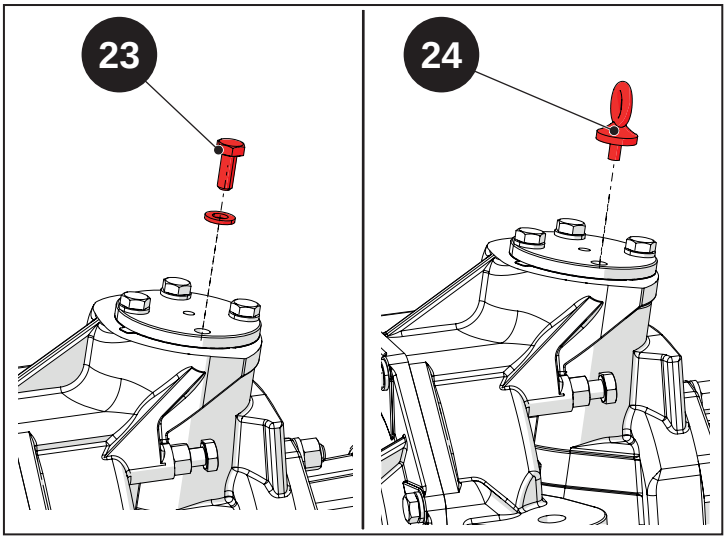

Fig. 7.128

Note
Repeat the same procedure for the other final drive unit.

Fit the spacer (11), the O-ring (10) and the transfer case (9).

Note

Apply a coating of grease to the differential gear to facilitate installation on the relative shaft.

Replace the O-ring (10) with a new component when reassembling.

Apply a coating of grease to the O-ring (10).

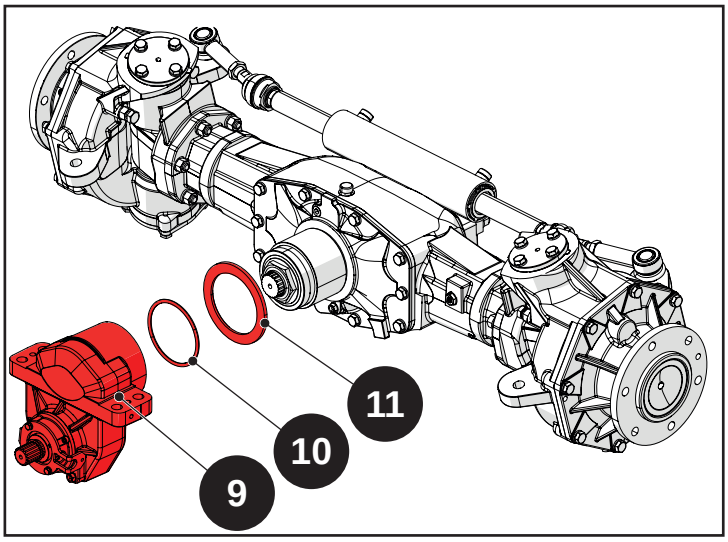

Fig. 7.129

Fill the axle with oil via the hole.

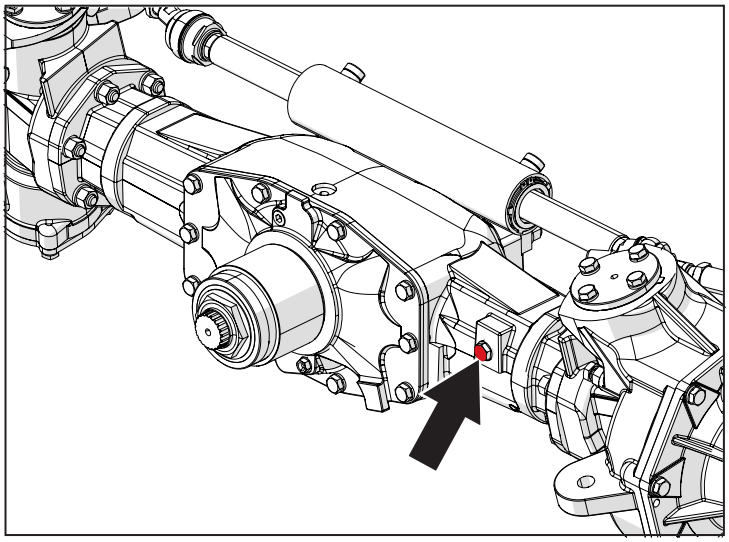

Fig. 7.130

Fill the final drive units with oil via the respective holes.

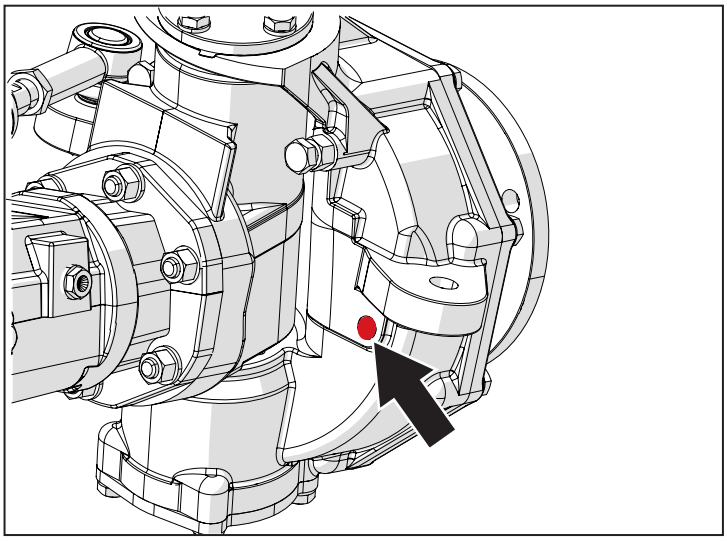

Fig. 7.131

Fit the complete steering cylinder (22).

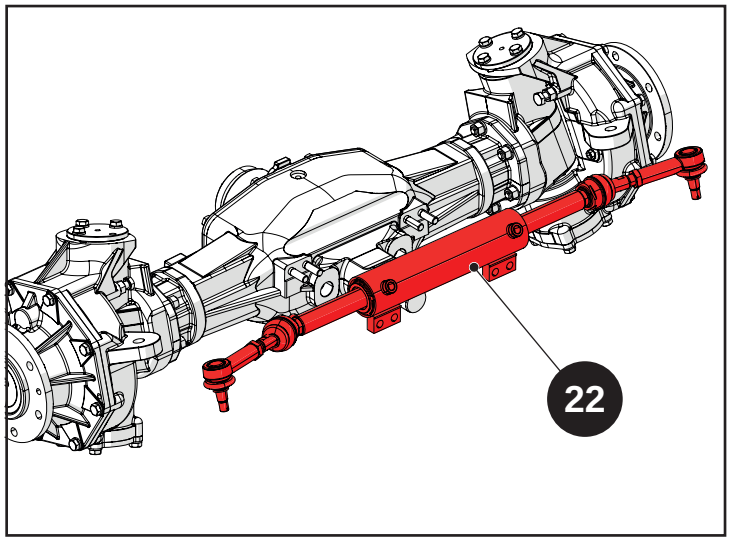

Fig. 7.132

Fit the conical washers (21) and fit and tighten the self-locking nuts (20) fastening the steering cylinder to the front axle.

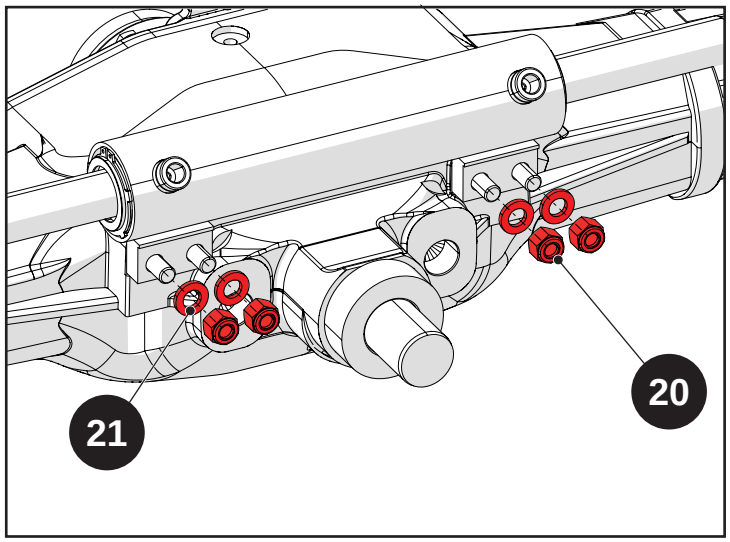

Fig. 7.133

7.6.1.1 Adjusting the steering cylinder

Adjust the toe angle to ensure even tyre wear and correct steering geometry.

Fit the steering cylinder pin (16) in its seat.

Fit and tighten the retainer nut (15) and secure with the split pin (14).

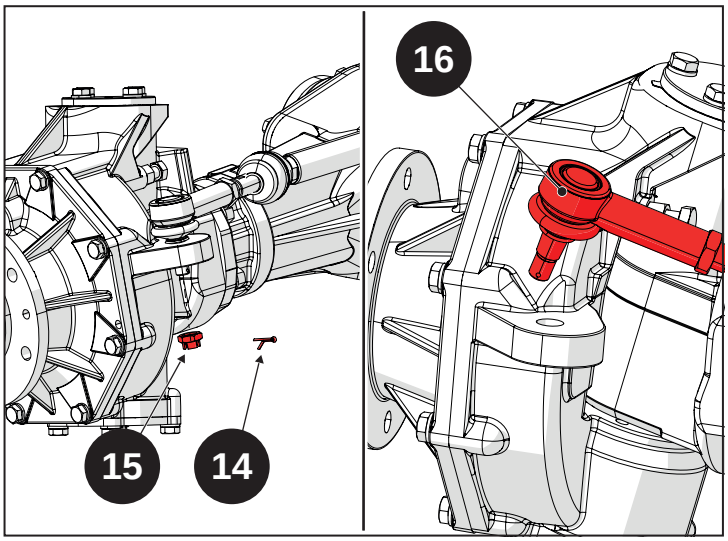

Fig. 7.134

Fit the steering cylinder pin (19) in its seat.

Fit and tighten the retainer nut (18) and secure with the split pin (17).

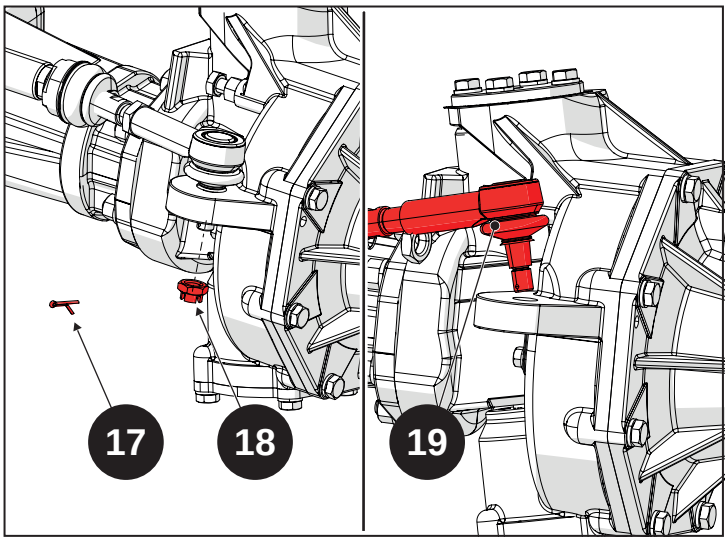

Fig. 7.135

Tighten the fastener nuts of the steering pins.

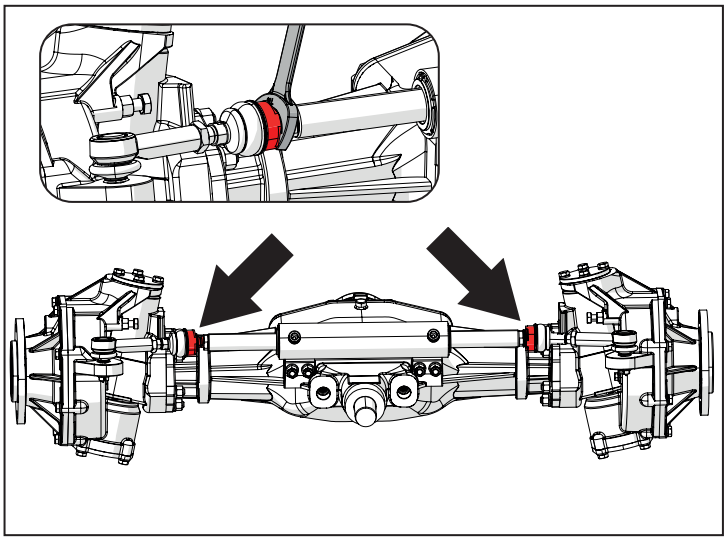

Fig. 7.136

Fit and tighten the special tools (G-07007180) for adjusting the cylinder on the final drive unit half axles.

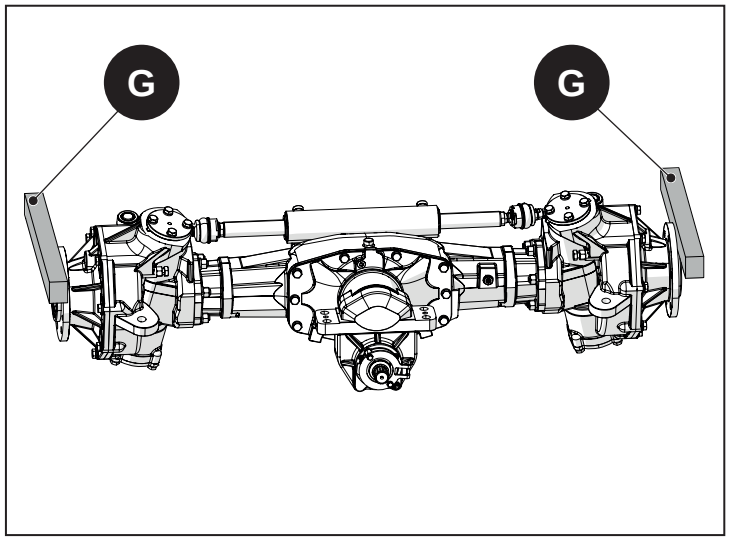

Fig. 7.137

Fit the special tools (G-07007180) at right angles relative to the half axles.

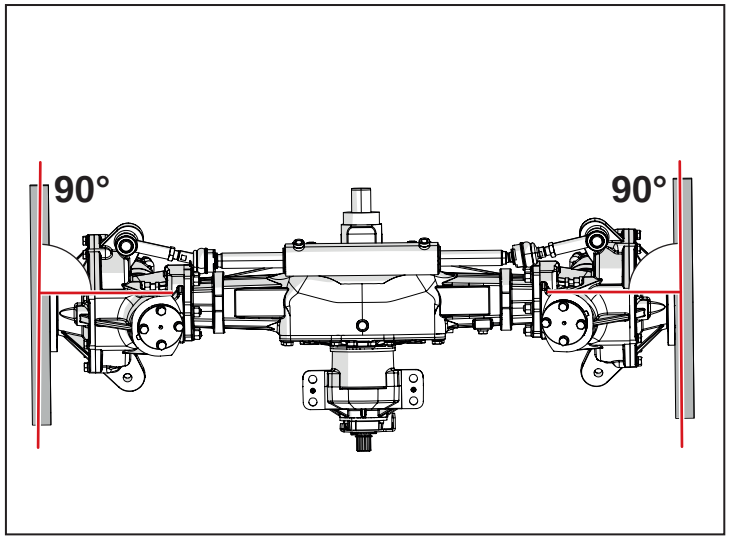

Fig. 7.138

Measure the distance between the ends of the tools (G) at the front (X) and rear (Y).

The values measured must satisfy the following formula:

Y = X - 2 to 5 mm

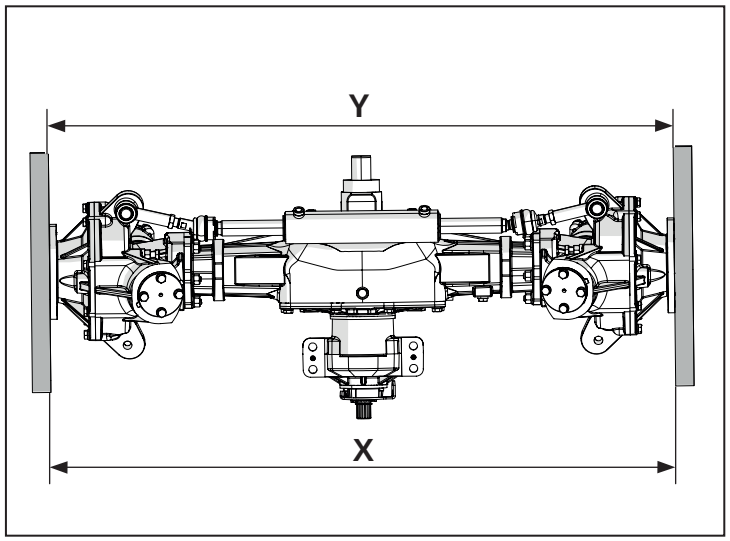

Fig. 7.139

Tighten or loosen the nuts of the steering cylinder pins to increase or decrease the distance between the half axles.

Warning

When increasing or decreasing the distance, the lengths of the cylinder rods must be the same on both sides.

If one bar is longer than the other, the turning circle will be shorter on that side.

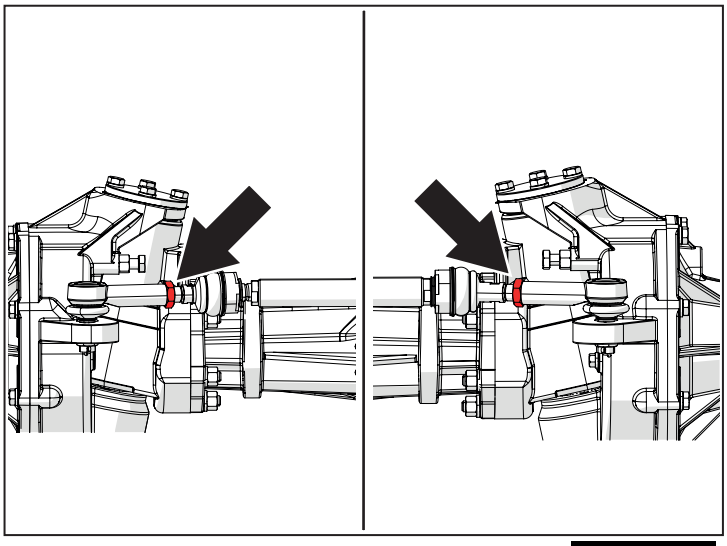

Fig. 7.140

Reassemble by following the procedure for disassembly in reverse order.

7.7 Tightening torques

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7.7.1 Tightening torques 7-72

7.7.1 Tightening torques

The main tightening torques are listed as follows. For all other tightening torques, see chapter "1- Introduction".

Tightening torque	N·m	kg·m
Screw fastening final drive unit cover M10x30	60	6
Ring nut fastening bevel pinion M35x1.5	40	4
Screw fastening differential carrier to axle M10x30	60	6
Screw and nut fastening bevel crown wheel M12	80	8
Nut fastening final drive unit to axle M10x30	85	8.5
Screw fastening bevel pinion cover M6x16	15	1.5
Screw fastening NoSpin device	50	5
Crown wheel fastener ring nut	15	1.5
Ring nut M112x2	40	4
Screw fastening wheel to half axle M16x1.5	220	22

7.8 Tools necessary

Index

7.8.1 Tools necessary.....7-74

7.8.1 Tools necessary

p/n	Description	Quantity
07000237	Wrench for ring nut	1
07000243	Wrench for no-spin ring nut	1
07007078	Lock tool for front bevel pinion	1
07007179	Lever for checking NO-SPIN nut	1
07000234	Wrench for ring nut 06340273	1
07007180	Toe angle measurement tool	1

8 : Transfer case

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8.7 Tools necessary.....8-33

8.7.1 Tools necessary.....8-34

8.1 Safety rules

These safety precautions and warnings given in this paragraph must be observed at all times to prevent the risk of operator injury. However, the safety measures indicated in the use and maintenance manual and in chapter 1 of this manual must also be applied at all times.

Danger
All other persons must keep at a safe distance from the danger area.

Danger
Lift and handle all heavy parts with lifting equipment of adequate load capacity. Hoisting straps and hooks must be positioned safely on the load. When lifting loads, all personnel must keep at a safe distance from the load itself and remain within safe areas.

Danger
Do not allow the chains or metal cables used for hoisting to twist. Always wear safety gloves when handling cables or chains.

Danger
Use appropriate tools to align the holes correctly. NEVER USE YOUR HANDS OR FINGERS.

Danger
Handle all parts with extreme caution. Never place your hands or fingers between two parts.

Danger
When removing assemblies which could fall, always leave two screws in opposite positions in place for safety until the assembly is secured. Only remove these screws after securing the assembly to a hoist or after fitting support blocks in place.

Danger
If any of the screws fastening the frame or cab are loosened, or if the frame or cab is removed, ensure that all parts are refitted correctly at the end of the procedure to ensure that the driver is protected.

Attention
Beware of sharp edges and corners at the top of the gearbox housing.

Attention
Used oils must be collected and disposed of in compliance with applicable legislation.

8.2 General introduction

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8.2.1 Assembly drawing 8-4

8.2.1 Assembly drawing

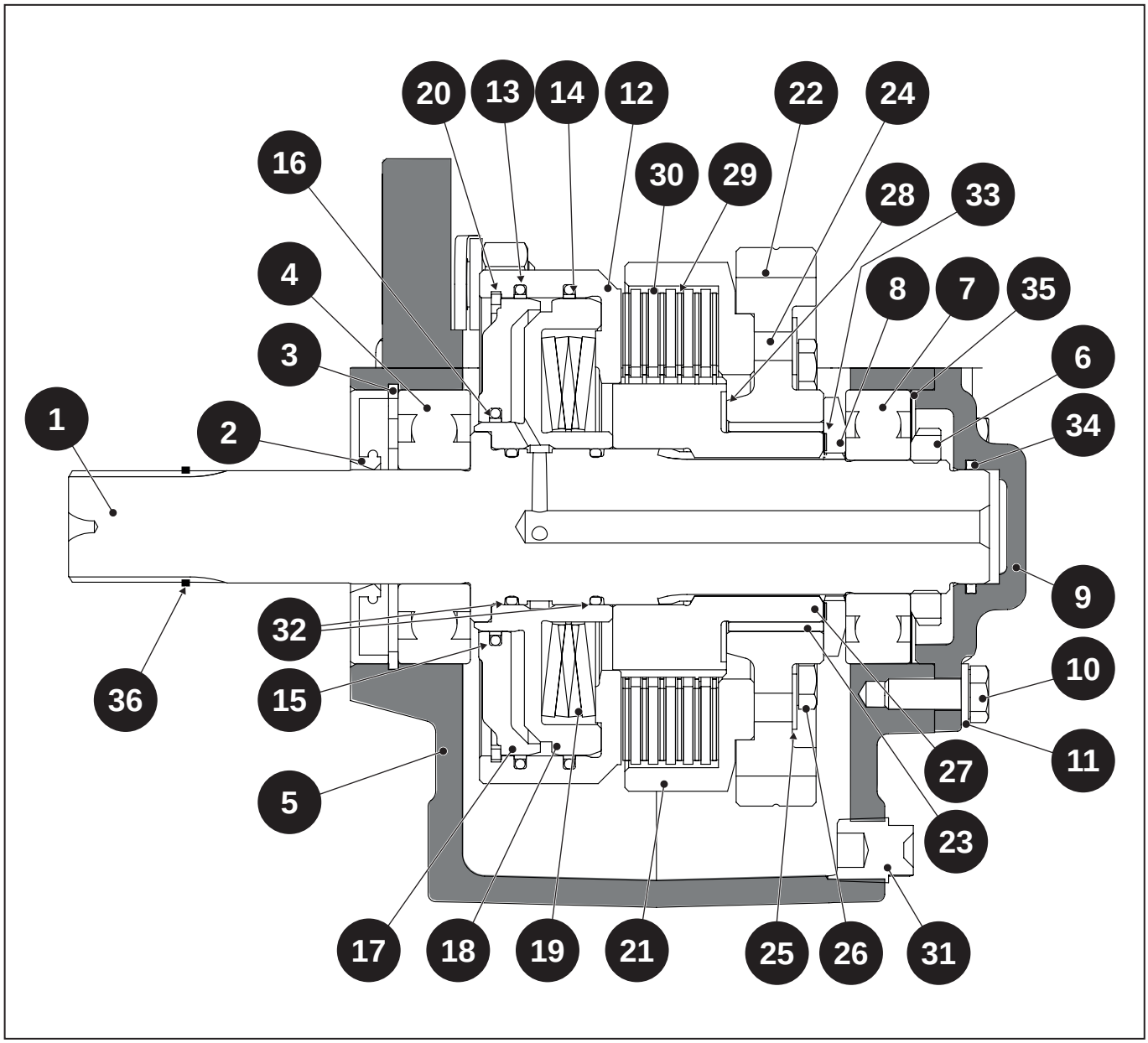

Fig. 8.1

1 - Front wheel drive shaft
2 - Oil seal
3 - Circlip
4 - Bearing
5 - Gear case
6 - Ring nut
7 - Bearing
8 - Spacer
9 - Cover
10 - Screw
11 - Washer
12 - Front wheel drive drum
13 - O-ring
14 - Seal surface ring
15 - O-ring
16 - Seal surface ring
17 - Front wheel drive disengage flange
18 - Fixed disengage flange
19 - Cup spring
20 - Circlip
21 - Clutch housing
22 - Front wheel drive gear
23 - Bush
24 - Centring pins
25 - Screw retainer plate
26 - Screw
27 - Drive bush
28 - Spacer
29 - Clutch plate
30 - Steel disc
31 - Plug
32 - O-ring
33 - Spacer
34 - Quad ring
35 - Spacer
36 - Circlip

8.3 Technical characteristics

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8.3.1 Technical characteristics.....8-8

8.3.1 Technical characteristics

Operation	Electrohydraulic
Clutch	Multiplate wet clutch

8.4 Disassembly

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8.4.1 Disassembly.....8-10

8.4.1 Disassembly

Unscrew and remove the screws (35) and the washers (36).

Attention
Support the weight of the assembly during the procedure.

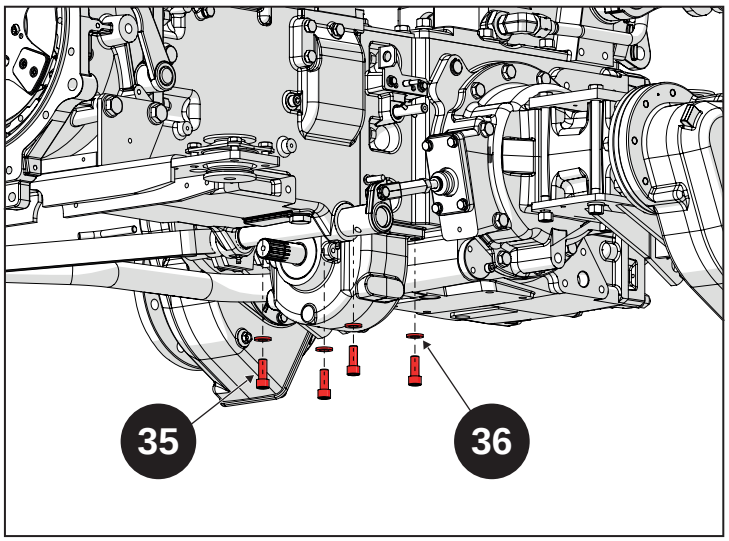

Fig. 8.2

Remove the complete assembly.

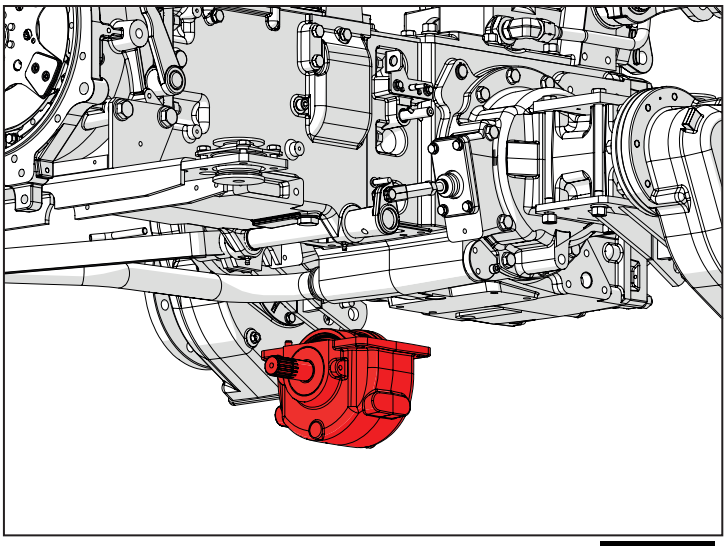

Fig. 8.3

Remove oil seal (2).

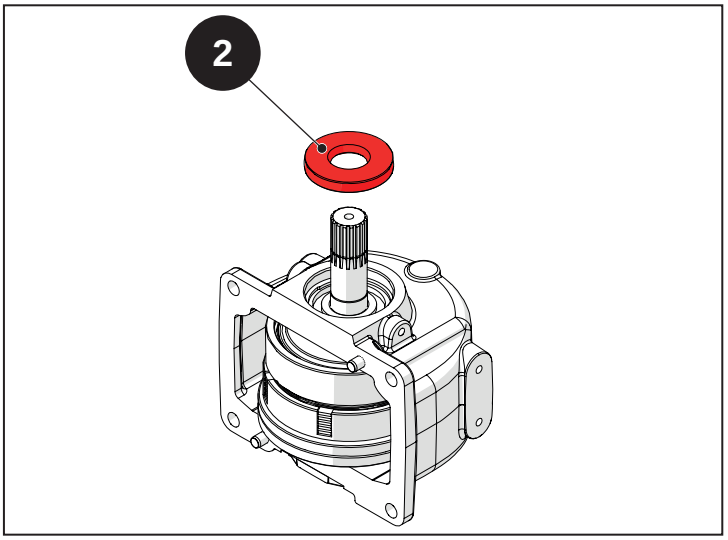

Fig. 8.4

Undo the screws (10) and remove the washers (11), the screws (10) and the cover (9).

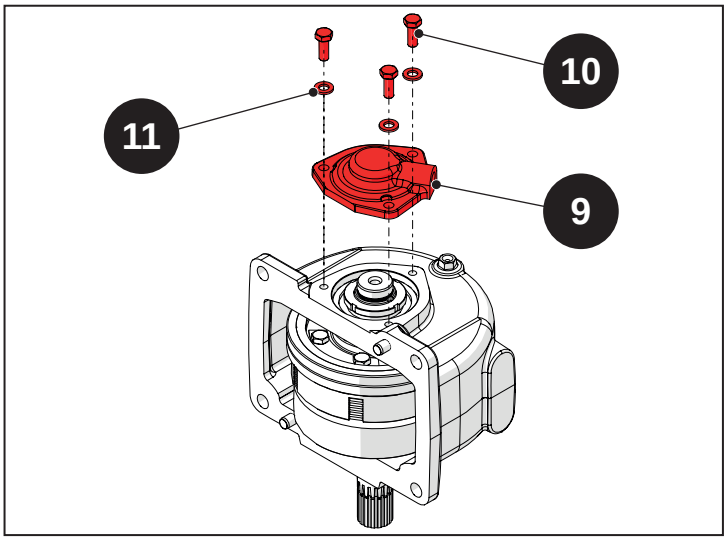

Fig. 8.5

Remove the Quad Ring (34) from the cover (9).

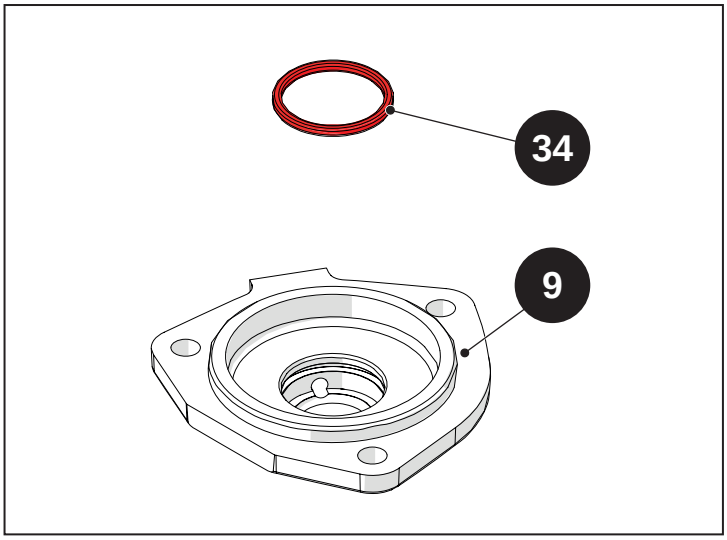

Fig. 8.6

Remove the shim (35).

Remove the ring nut (6).

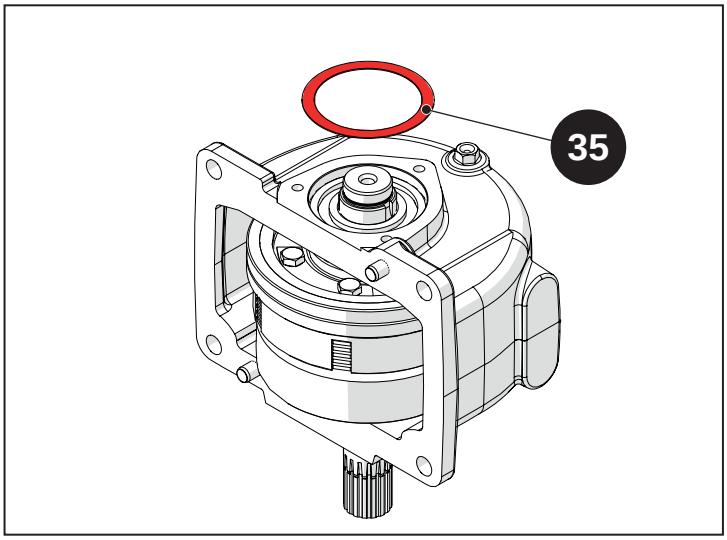

Fig. 8.7

Remove the circlip (3) and then remove the shaft (1), complete with bearing (32).

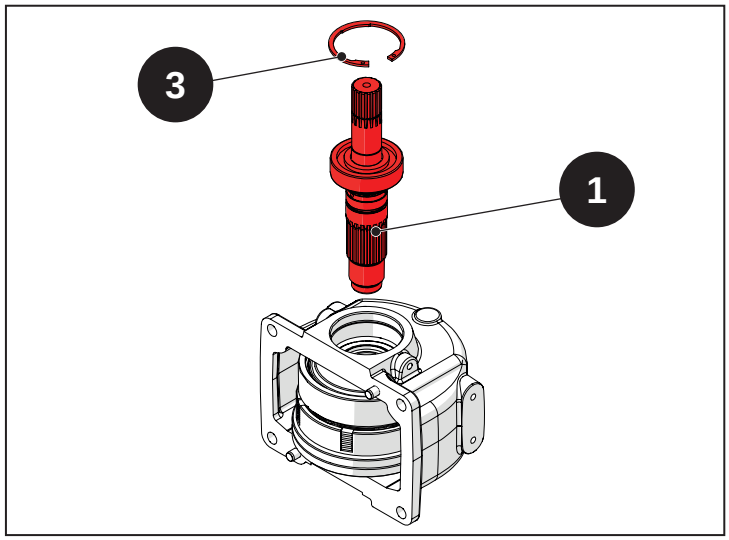

Fig. 8.8

Remove the bearing (7), the spacers (33) and the spacer (8).

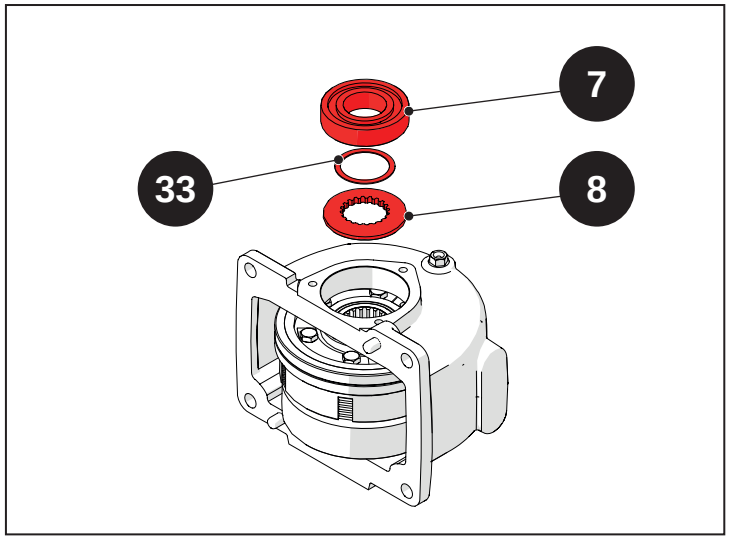

Fig. 8.9

Remove the O-rings (32) from the shaft.

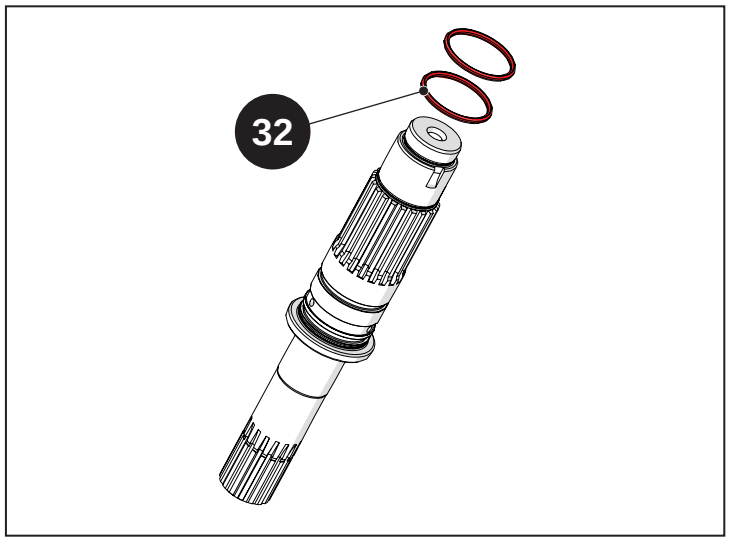

Fig. 8.10

Remove the clutch pack from the case (5).

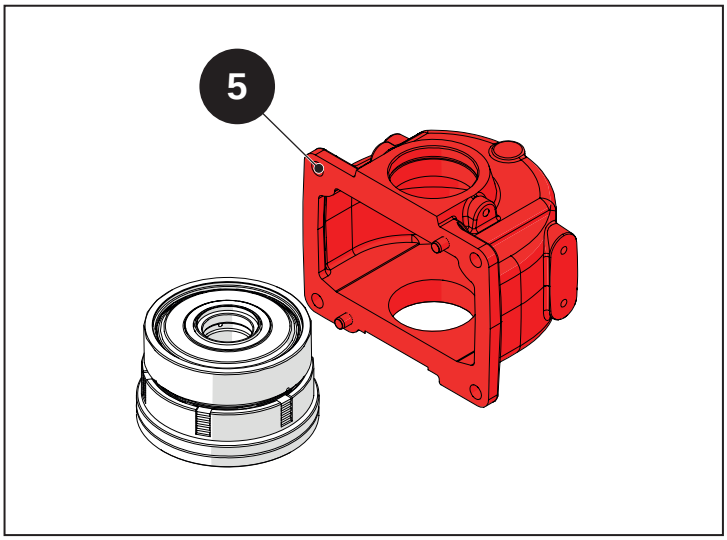

Fig. 8.11

Separate the two assemblies and then remove the clutch discs (29) and the steel discs (30) from the housing (21).

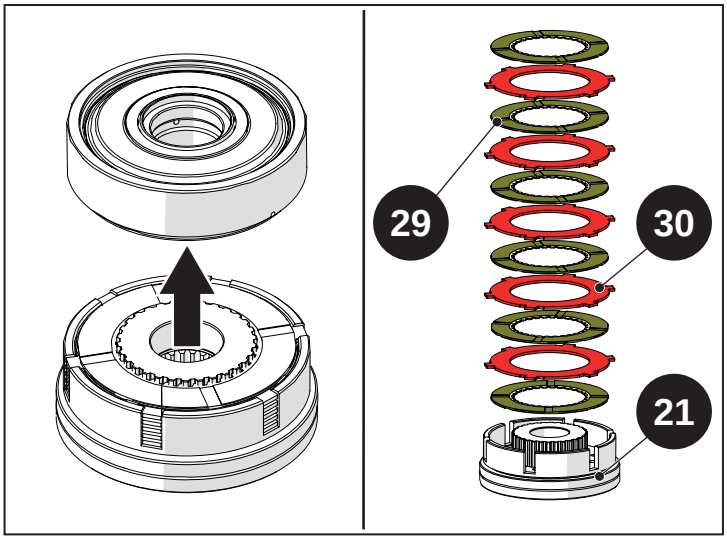

Fig. 8.12

Remove the spacers (28) and the drive bush (27).

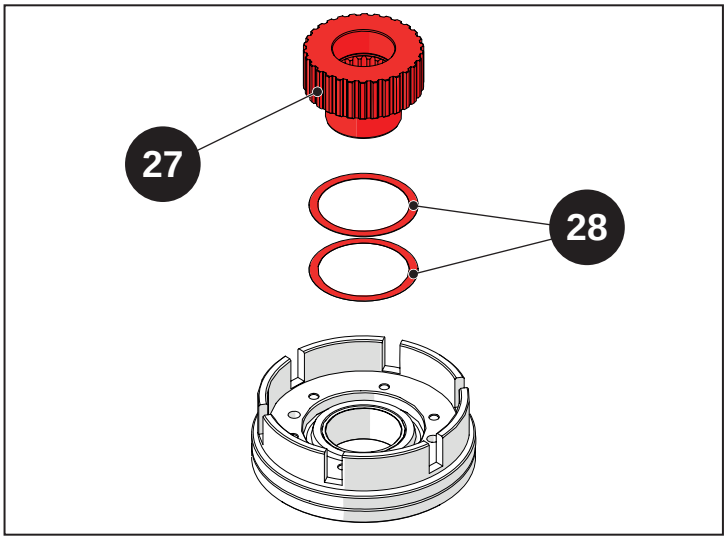

Fig. 8.13

Bend down the ends of the plates (25) to permit removal of the screws (26), and then remove the screws.

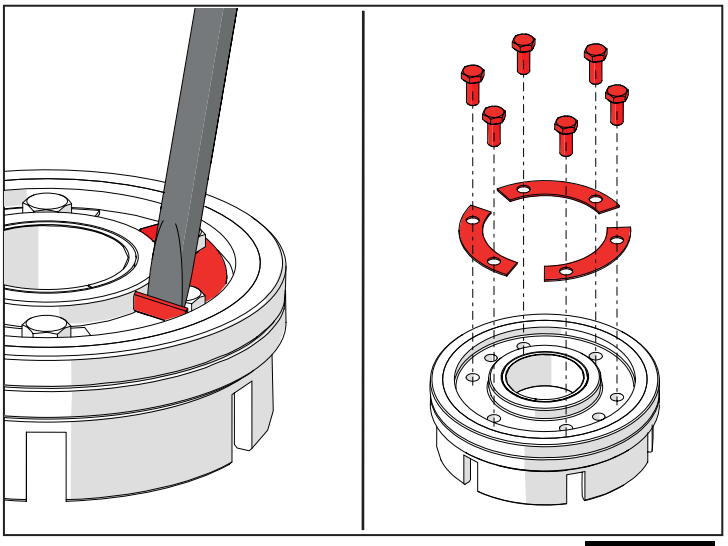

Fig. 8.14

Remove the centring pins (24), and then remove the front wheel drive gear (22), complete with bush (23), from the clutch housing (21).

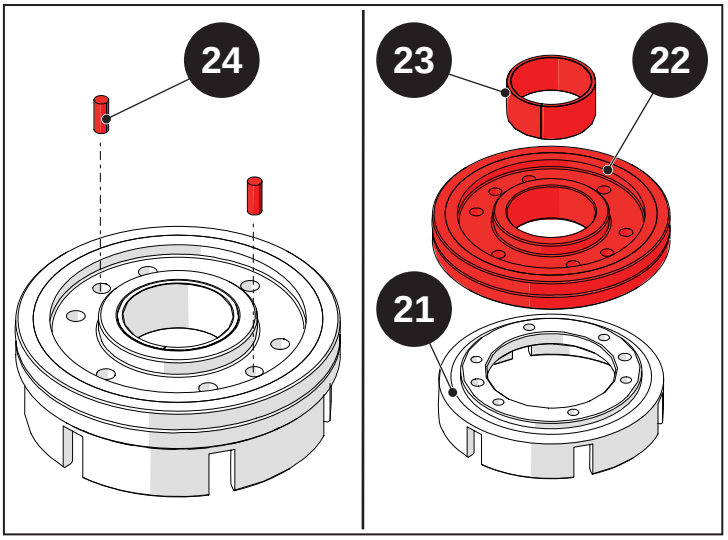

Fig. 8.15

Use a press and a punch (G- p/n 07006210) to press the flange (17) and compress the cup springs (19), allowing access to the seat of the snap ring (20).

Attention
Use a press with a capacity of at least 500 kg.

Remove the ring (20).

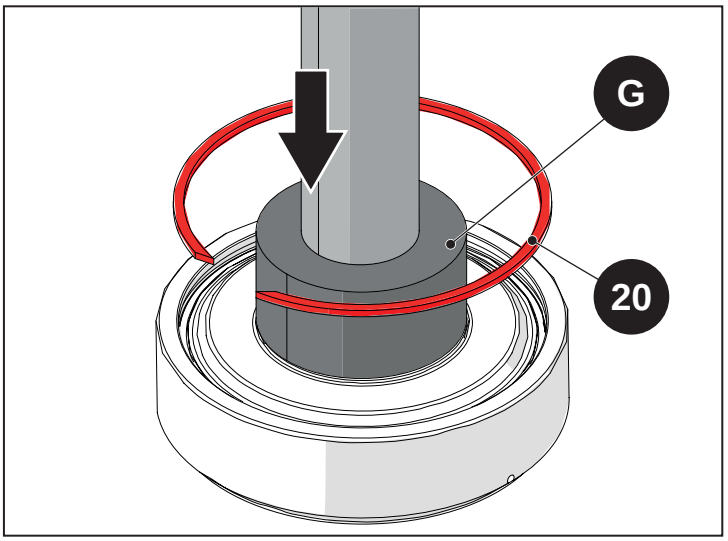

Fig. 8.16

Remove the complete assembly from the front wheel drive drum (12).

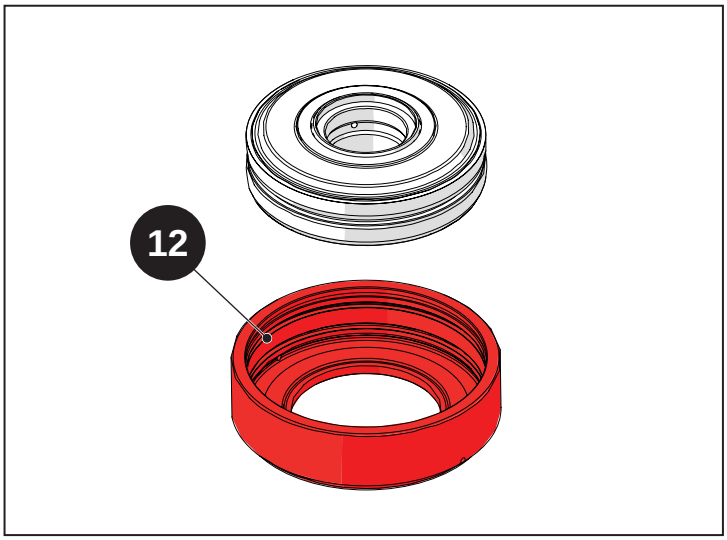

Fig. 8.17

Remove the flange (17) from the fixed disengage flange (18).

Remove the cup springs (19).

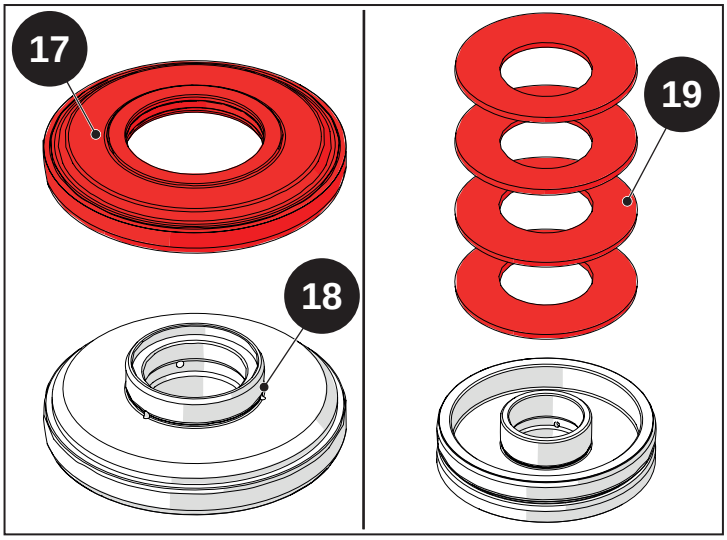

Fig. 8.18

Remove the O-rings (13) and the flat seal rings (14) from the front wheel drive drum (12).

Remove the O-ring (15) and the flat seal ring (16) from the front wheel drive disengage flange (17).

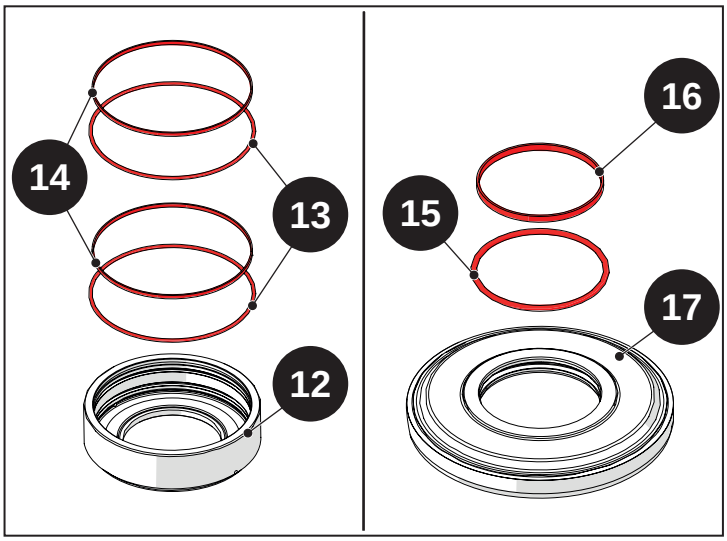

Fig. 8.19

8.5 Main inspection, reassembly and adjustment procedures

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8.5.1 Main inspection, reassembly and adjustment procedures.....8-18

8.5.1 Main inspection, reassembly and adjustment procedures

Danger

All other persons must keep at a safe distance from the danger area.

Warning

Read the instructions in chapter "1-Introduction" and, in particular, the sections concerning the installation of O-rings, oil seals and bearings, with particular care before reassembling, and follow these instructions precisely when working.

Apply the correct tightening torques when tighten the fasteners of components. Where tightening torques are not specified, refer to the table in chapter "1-Introduction".

Use the specified sealant products during reassembly. Where the sealant required is not specified, refer to the table in chapter "1-Introduction".

Prepare the front wheel drive drum (12), fitting the O-rings (13) and the flat seal rings (14) in their seats.

Prepare the front wheel drive disengage flange (17, fitting the O-ring (15) and the flat seal ring (16) in their seats.

Attention

To prevent damage to the flat rings during reassembly, check that they are not bent after fitting them in their seats.

After fitting the seal rings, lubricate with OIL to facilitate assembly with the other components.

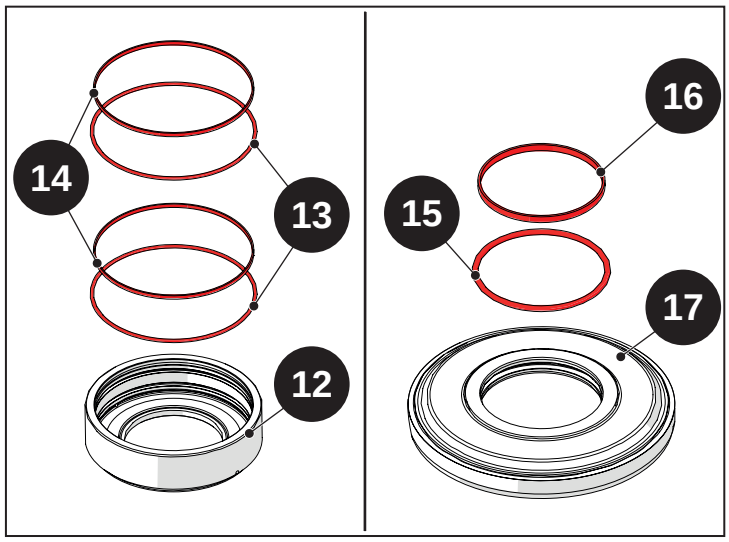

Fig. 8.20

Attention

Make sure that the flat seal rings (14) and (16) are fitted the right way around.

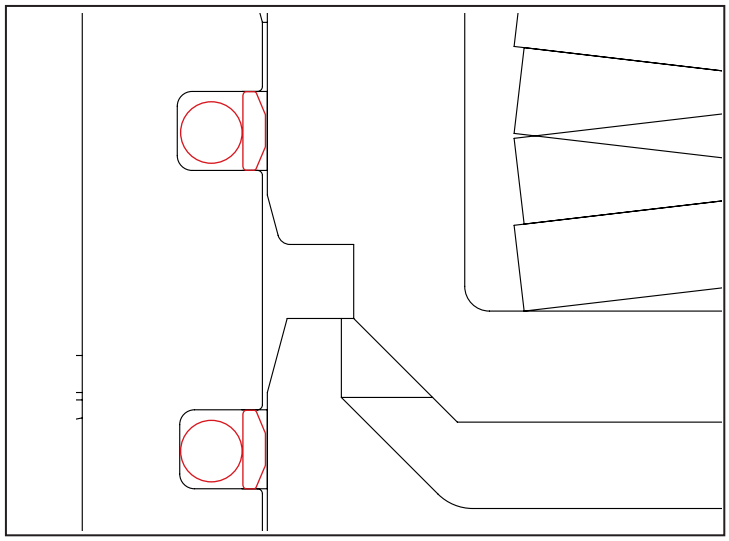

Fig. 8.21

Fit the flange (17) on the fixed disengage flange (18).

Fit the cup springs (19).

Attention

Make sure that the cup springs are installed the right way around.

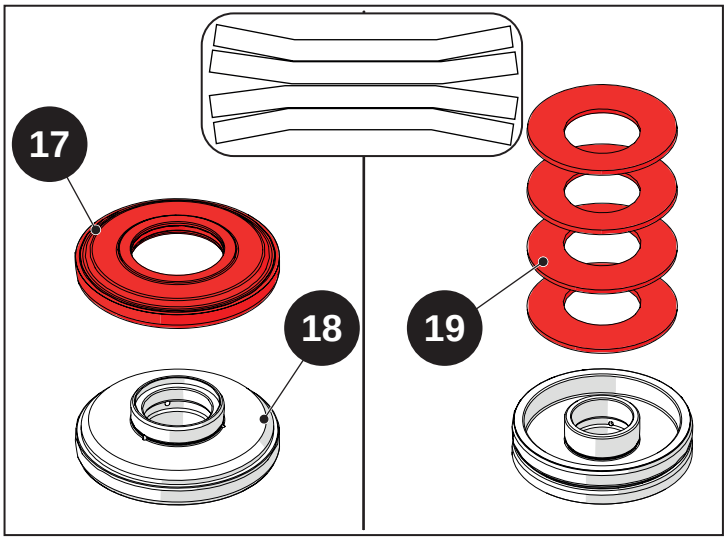

Fig. 8.22

Fit the drum (12) on the complete assembly.

Attention

Lubricate the seal rings.

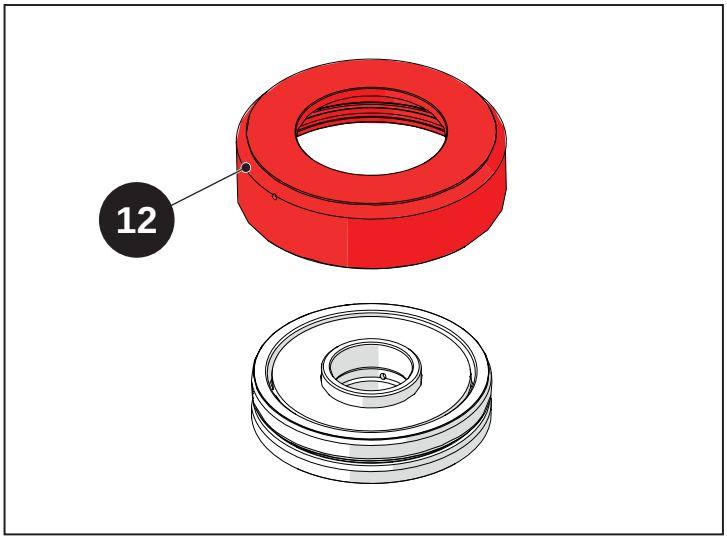

Fig. 8.23

Use a press and a punch (G- p/n 07006210) to press the flange (17) and compress the cup springs (19), allowing access to the seat of the snap ring (20).

Attention

Use a press with a capacity of at least 500 kg.

Fit the snap ring (20) and rotate it in its seat.

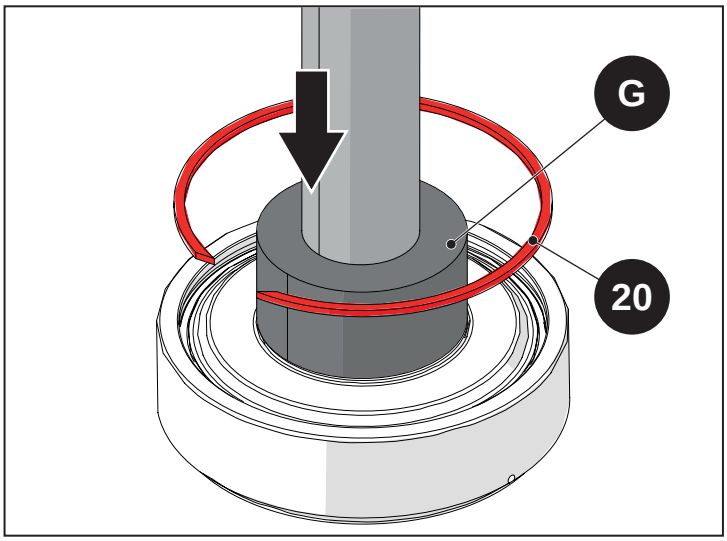

Fig. 8.24

Fit the front wheel drive gear (22), complete with bush (23), on the clutch housing (21).

Attention
Align the holes.

Fit the centring pins (24).

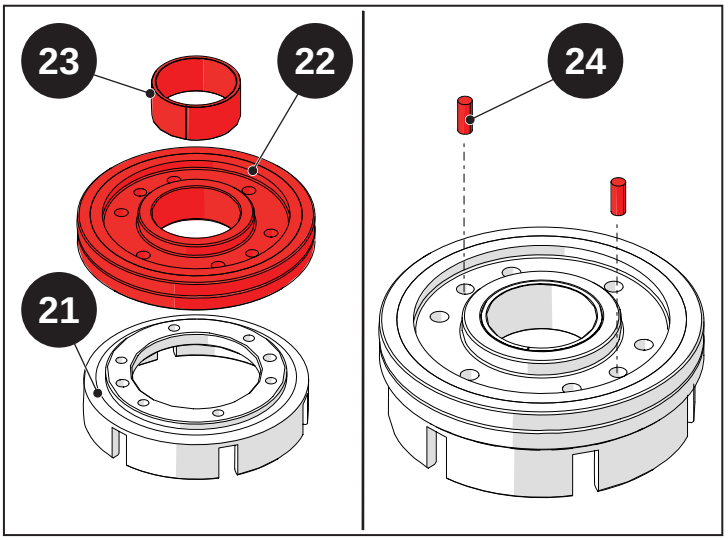

Fig. 8.25

Fit the screw retainer plates (25) and then fit and tighten the screws (26) to a torque of 30 N·m (3 kg·m).

Bend up the ends of the plates (25) with a chisel to prevent the screws (26) from loosening.

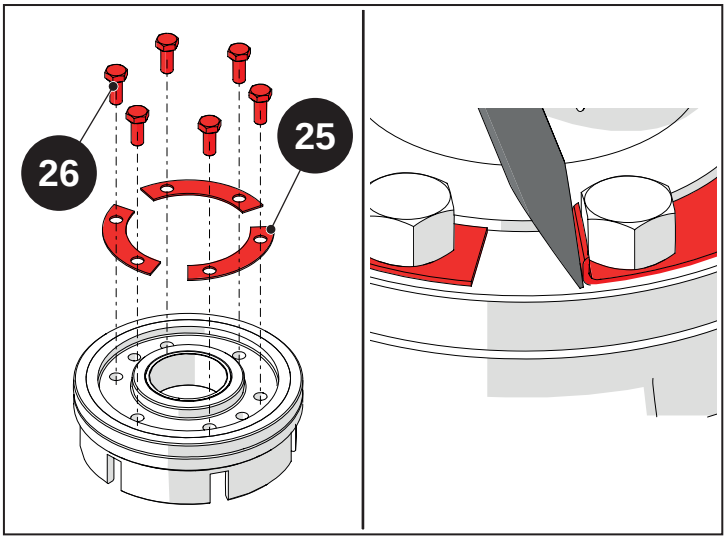

Fig. 8.26

Fit the drive bush (27) and the spacers (28) measuring 1 mm and 1.2 mm in thickness.

Attention
Check that the bush (27) turns freely.

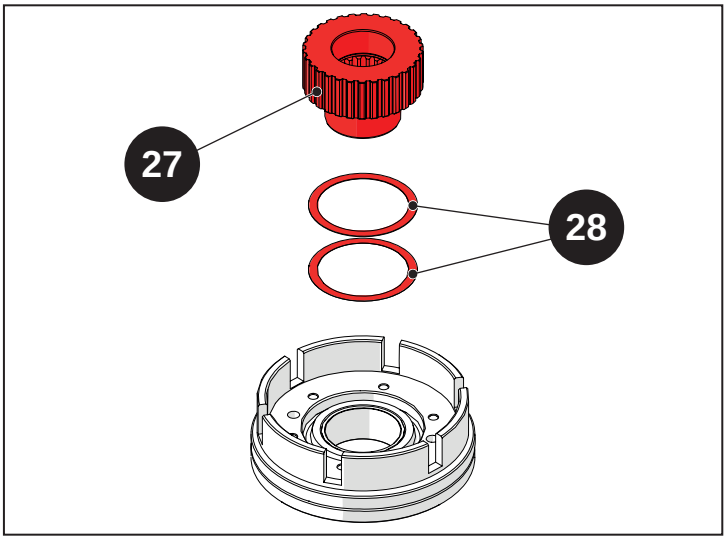

Fig. 8.27

Assemble the disc pack, alternating friction discs (29) with steel discs (30), and starting with a friction disc.

Once assembled, the pack will consist of 6 friction plates (29) and 5 steel discs (30).

Mate the two assembled packs.

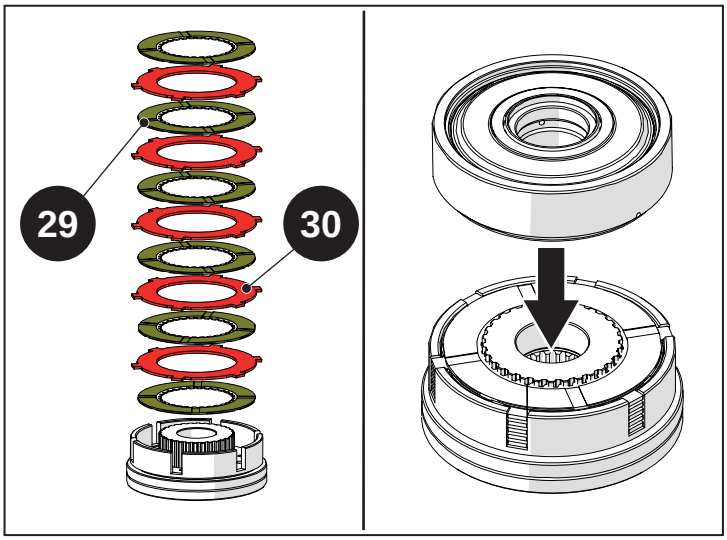

Fig. 8.28

Fit the two O-rings (32) on the shaft (1).

Attention

Use a guide (A-07003831) to prevent damage to the O-rings caused by contact with the splines of the shaft.

Lubricate the O-rings with OIL after installing.

Fit the circlip (36).

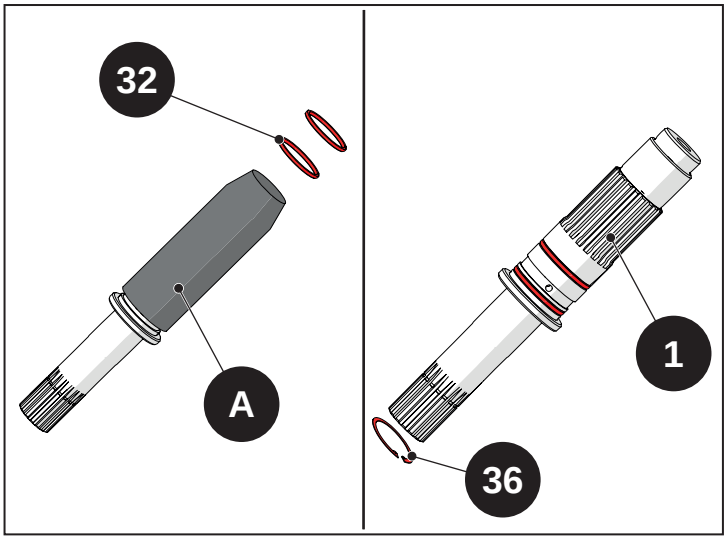

Fig. 8.29

Determining shim size necessary and installation in clutch assembly

To ensure that the transfer case clutch engages correctly, it is necessary to check that the kiss point pressure is correct and that the clutch discs are spaced at the correct distance within the assembly.

Place the assembly on the support (F- p/n 07006211).

Apply a pressure of 60 bar to the clutch assembly with an external hydraulic pump to compress the cup springs and separate the discs.

Attention
Check that there are no oil leaks.

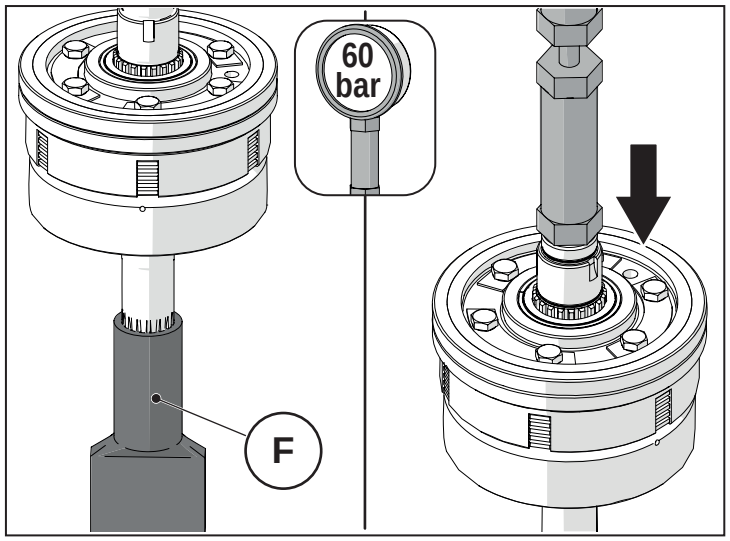

Fig. 8.30

Fit the spacers (33) and the spacer (8).

Fit a dummy bearing (C- p/n 07002766).

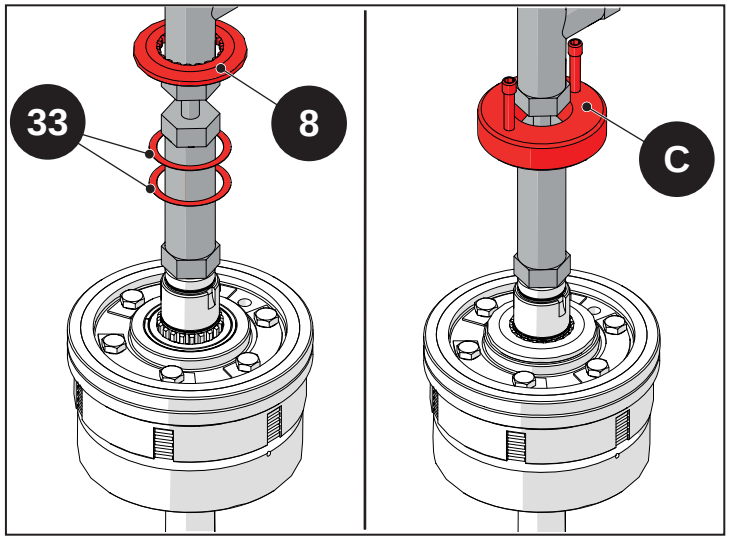

Fig. 8.31

Fit the ring nut (6) and use the tool (D- p/n 07006128) to tighten the it to a torque of 220 N·m (22 kg·m).

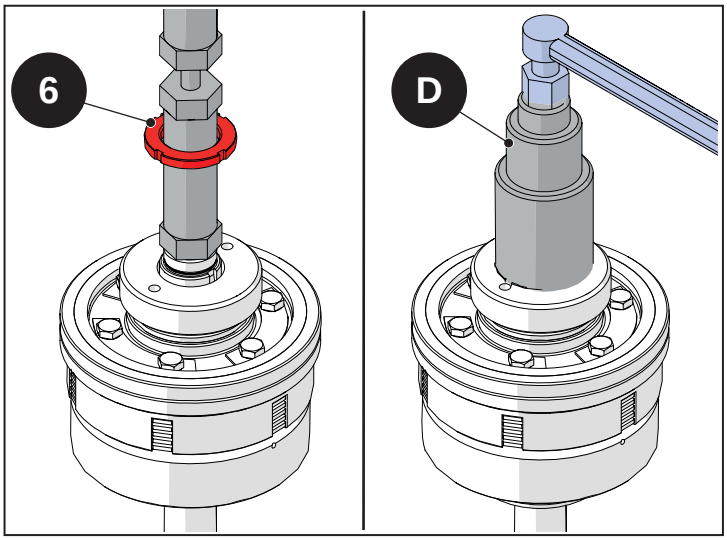

Fig. 8.32

Apply a pressure of 40 bar.

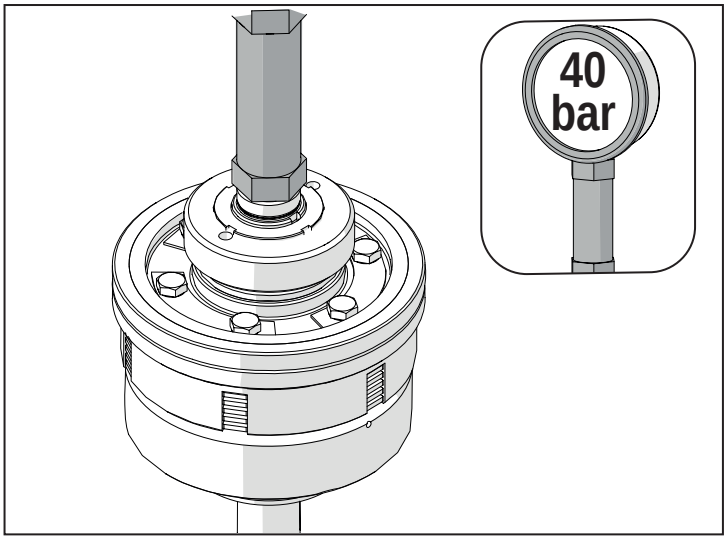

Fig. 8.33

While pressing on the clutch housing, use a feeler gauge to check that the distance between the clutch discs and the cup spring pack is between 0.8 and 1.2 mm.

If the clearance measured is not within the specified range, adjust the thickness of the shims (28) fitted previously.

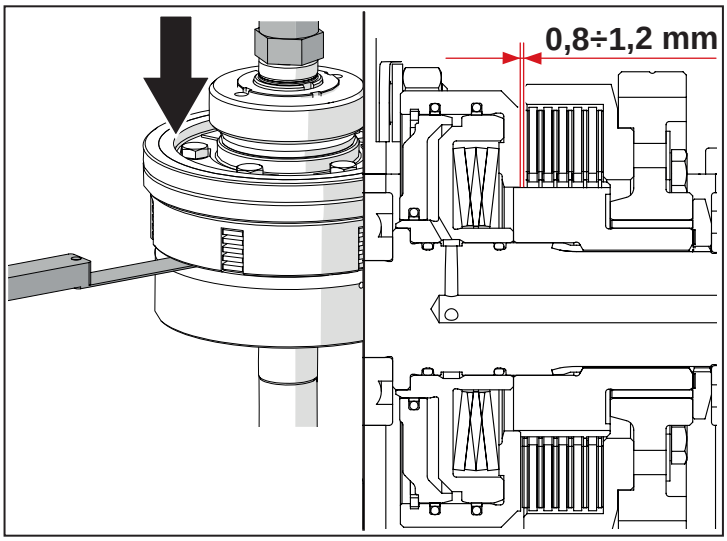

Fig. 8.34

Now check that the clutch disengages at the correct pressure.

Apply gradually increasing pressure to the clutch assembly while simultaneously attempting to turn the gear.

Check that the gear is released and can be rotated at a pressure of 30 to 32 bar.

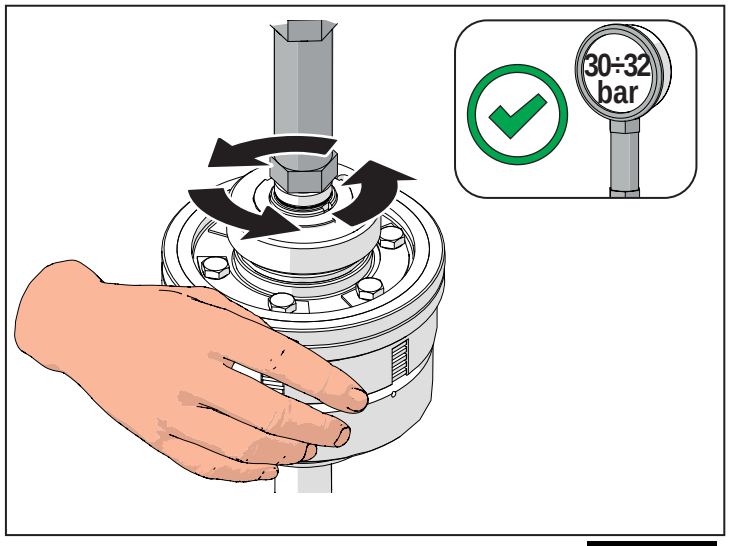

Fig. 8.35

If the gear is not released at the specified pressure, replace the shim pack (33) with a pack of the thickness necessary to attain the correct kiss point pressure. Note that:

- Increasing the total thickness of the shim pack causes the gear to lock at a lower pressure;
- Reducing the total thickness of the shim pack causes the gear to release at a higher pressure.

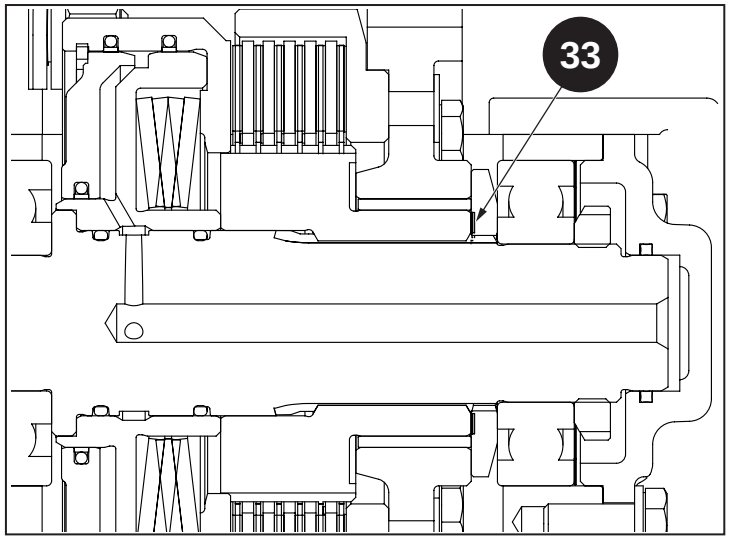

Fig. 8.36

While continuing to apply a pressure of 40 bar to the assembly, check that the clearance between the gear (22) and the spacer (8) is between 0.3 and 0.5 mm.

If the clearance measured is not within the specified range, check if the adjustments made previously are correct.

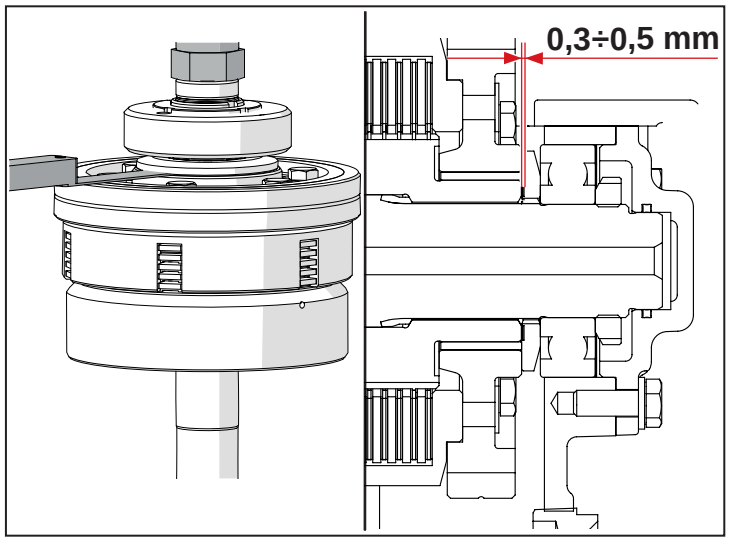

Fig. 8.37

If all the values are correct, the unit may be reassembled.

Apply a pressure of 60 bar and remove the ring nut (6) and the dummy bearing (C- p/n 07002766)

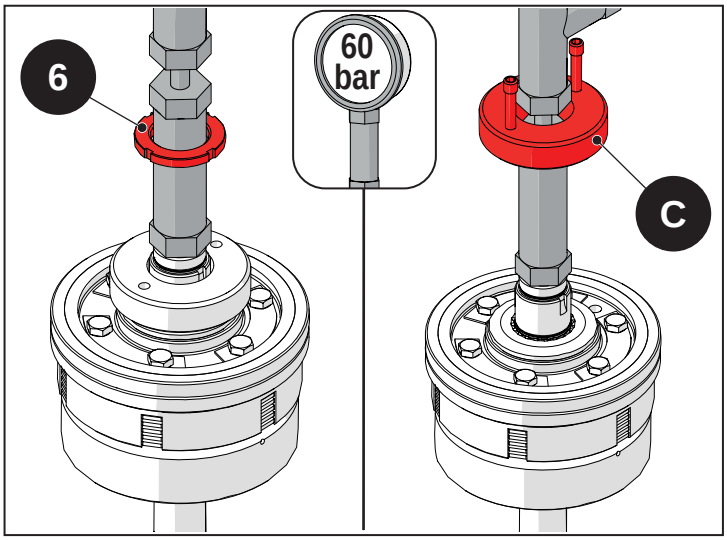

Fig. 8.38

Release the pressure and then disconnect from the hydraulic pump.

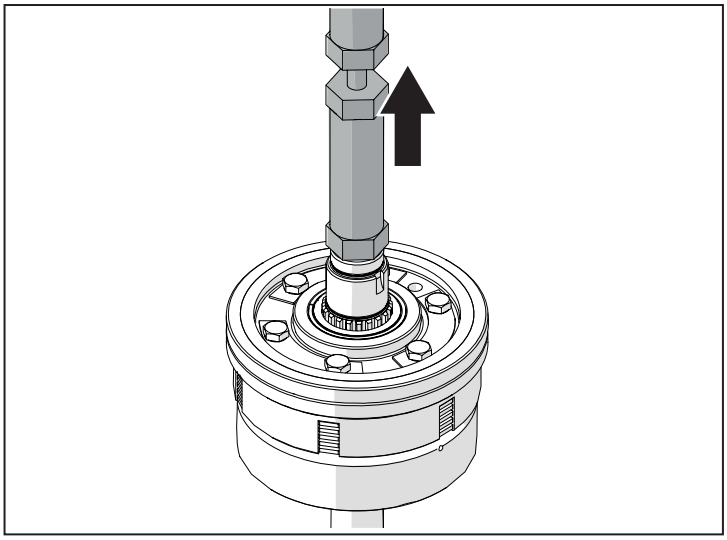

Fig. 8.39

Apply a coating of TEFLON to the thread of the plug (31), and fit and tighten the plug into the transfer case (5).

Install the complete clutch pack in the case (5).

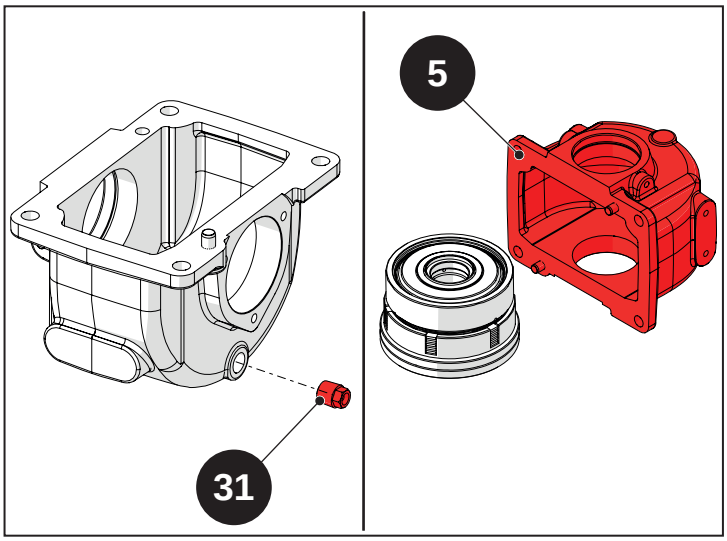

Fig. 8.40

Fit the bearing (4), and drive it fully into its seat with the punch (B- p/n 07006208).

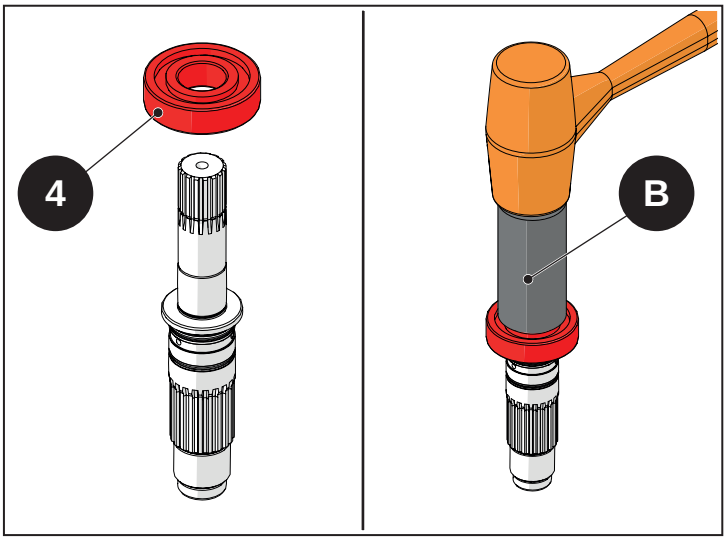

Fig. 8.41

Fit the complete shaft (1), and drive it fully into its seat with the punch (B- p/n 07006208).

Secure in place with the circlip (3).

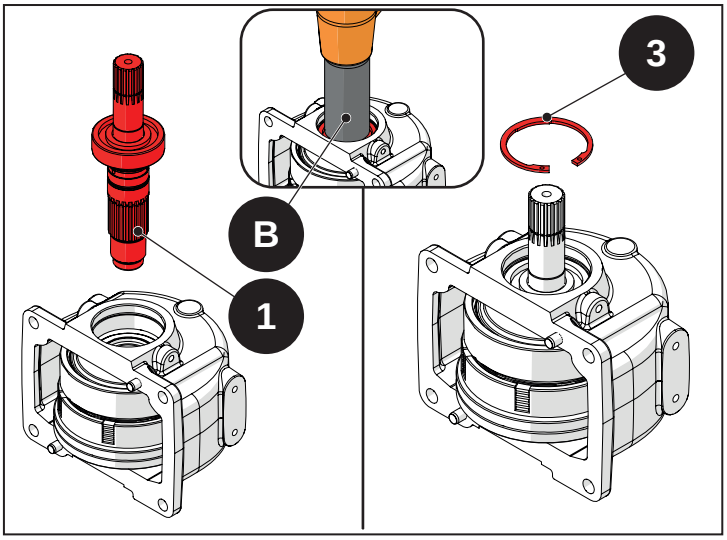

Fig. 8.42

Fit the spacers (33) and the spacer (8).

Fit the bearing (7), and drive it fully into its seat with the punch (E- p/n 07006209).

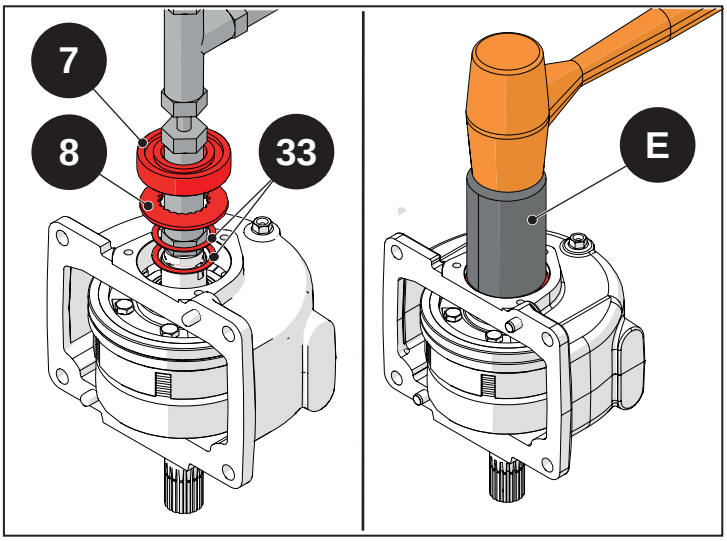

Fig. 8.43

Fit the ring nut (6) and tighten to a torque of 220 N·m (22 kg·m).

Punch a dot on the ring nut (6).

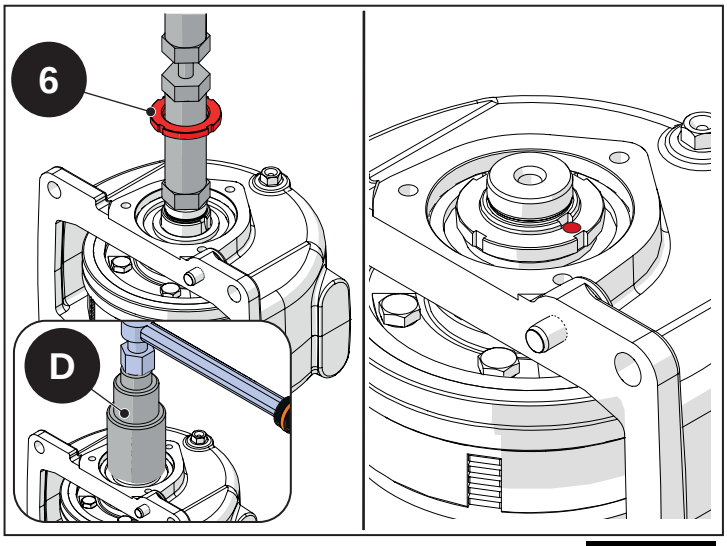

Fig. 8.44

Attention

After replacing the dummy bearing (A) with the real bearing (7), perform the checks described previously again.

Before refitting the cover, the shim thickness necessary for the bearing (7) to eliminate free play within the assembly must be determined.

Measure the width (X) of the edge of the cover.

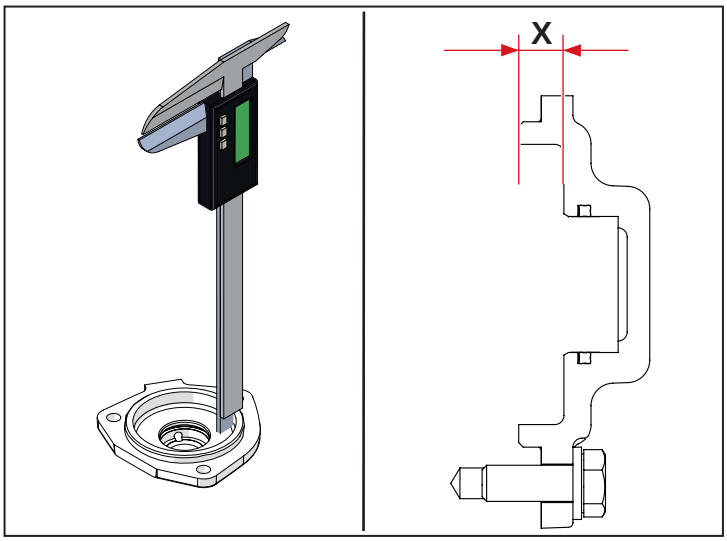

Fig. 8.45

Measure the distance (Y) between the contact surface of the transfer case and the bearing.

The result of the calculation X-Y is the value of the shim to be installed between the bearing (7) and the cover (9).

e.g.:

X= 5.20 mm

Y= 5.00 mm

X-Y= 0.20 mm

In this case, a shim measuring 0.2 mm in thickness must be used.

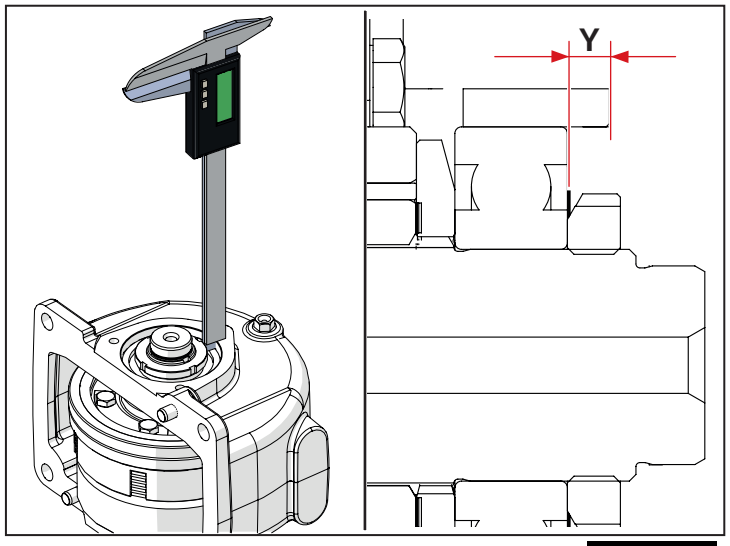

Fig. 8.46

Fit the shim (35) of the thickness calculated.

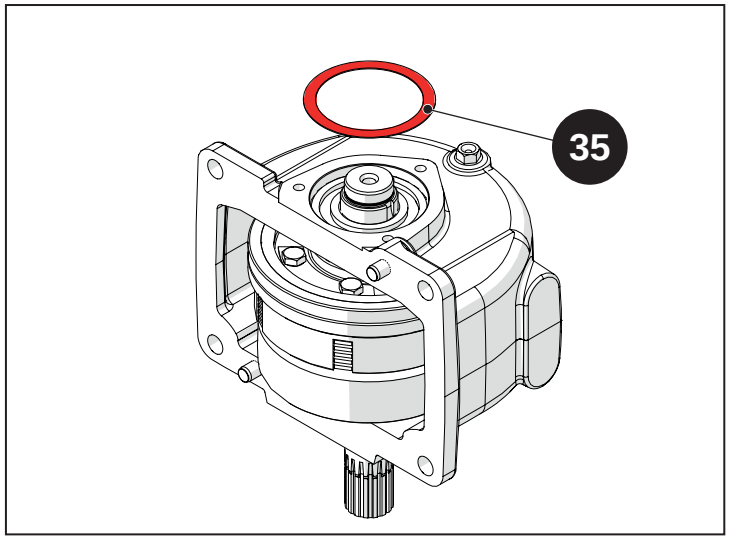

Fig. 8.47

Fit the Quad Ring (34) inside the cover (9).

Attention

To prevent damage to the Quad Ring during reassembly, check that it is not bent after fitting it in its seat.

After fitting the Quad Ring, lubricate it with OIL to facilitate assembly with the other components.

Apply a coating of SILICONE sealant to the cover (9).

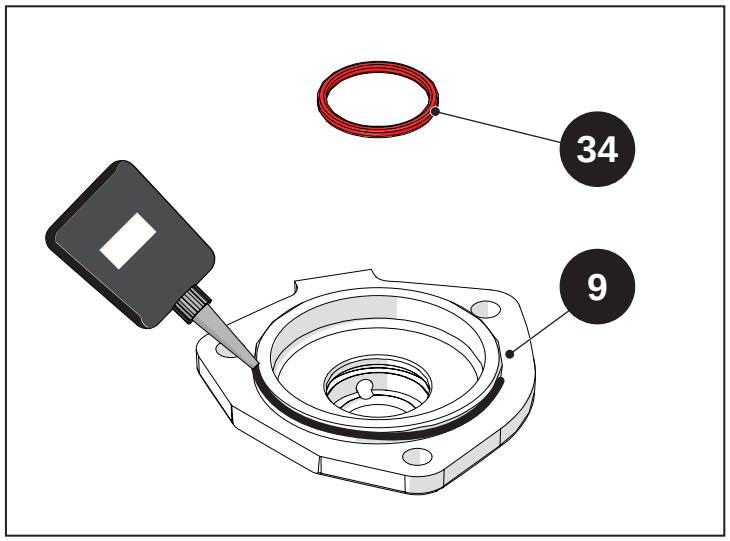

Fig. 8.48

Fit the cover (9).

Fit the washers (11) and the screws (10) and tighten the screws to a torque of 35 N·m (3.5 kg·m).

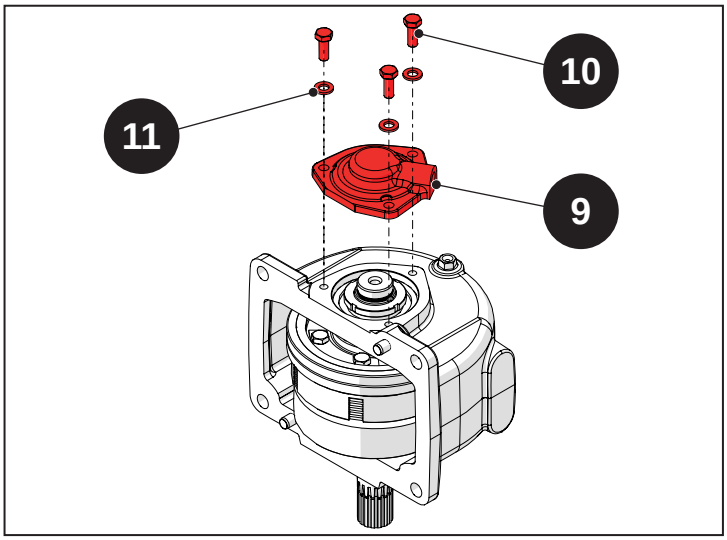

Fig. 8.49

Check that there are no leaks from the cover by applying a pressure of 60 bar to the port indicated with a hydraulic pump.

Attention
Replace the Quad Ring (34) if any oil leaks are noted.

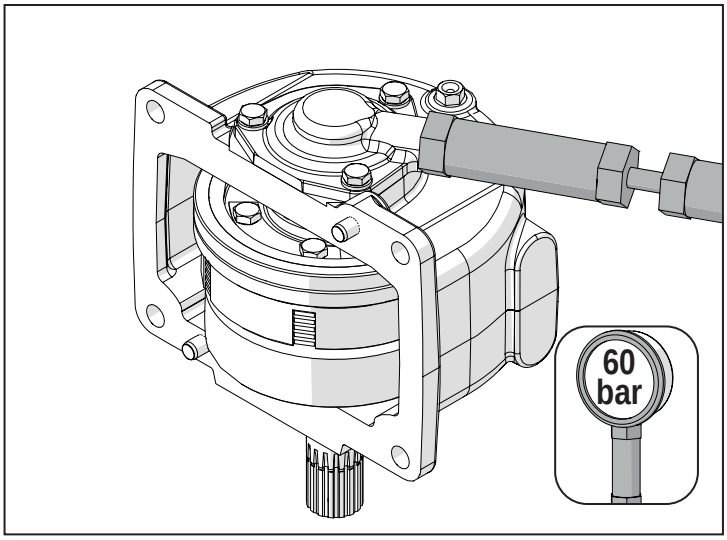

Fig. 8.50

Apply a layer of mastic sealant to the outer surface of the oil seal (2), then install the seal in its seat with a punch tool of suitable diameter.

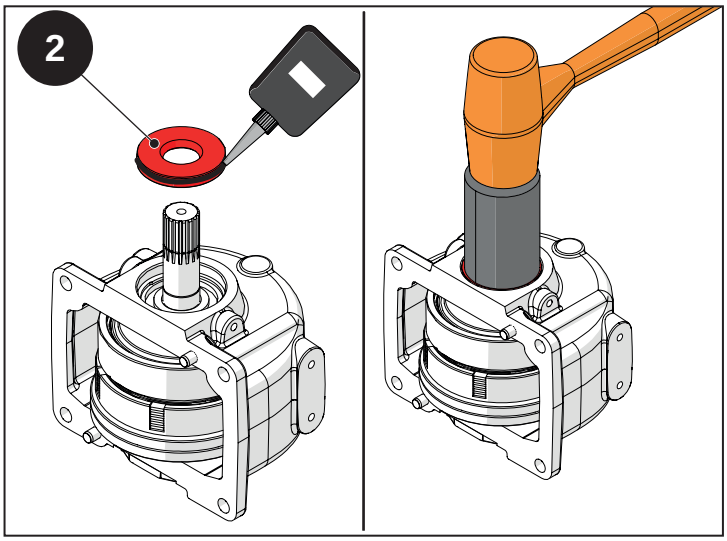

Fig. 8.51

Apply a coating of silicone sealant to the mating surfaces.

Install the complete assembly underneath the gearbox housing.

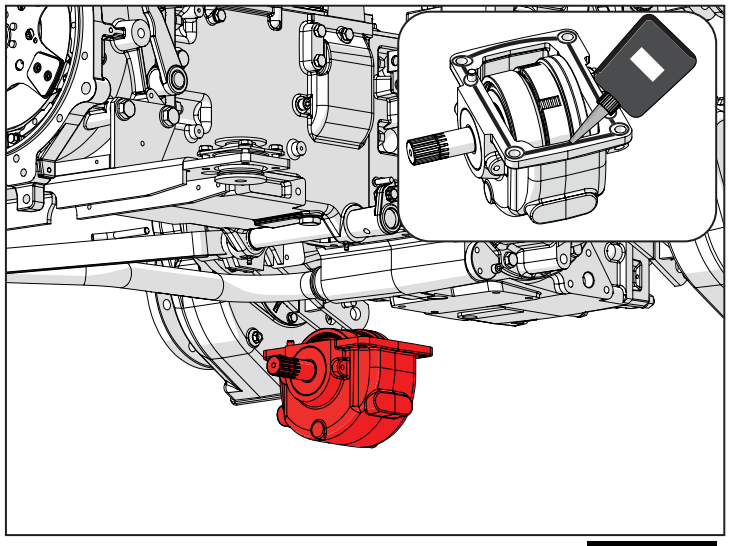

Fig. 8.52

Fit the washers (36) and tighten the screws (35) to a torque of 85 N·m (8.5 kg·m).

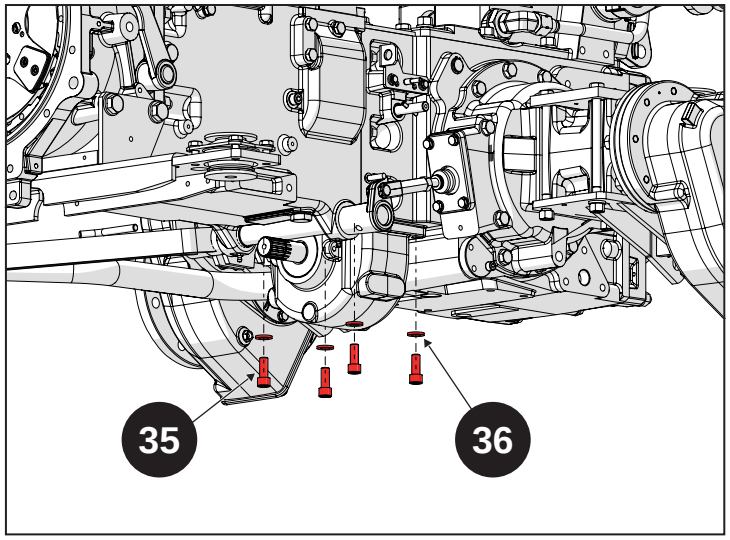

Fig. 8.53

8.6 Tightening torques

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8.6.1 Tightening torques 8-32

8.6.1 Tightening torques

The main tightening torques are listed as follows. For all other tightening torques, see chapter "1- Introduction".

Tightening torque	N·m	kg·m
Screws fastening 4WD transfer case cover M8	35	3.5
Screws fastening 4WD transfer case M12	8	8
4WD clutch pack fastener ring	220	22
1/4” clutch pack delivery nipple	30	3
4WD transfer unit fastener screw	85	8.5

8.7 Tools necessary

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8.7.1 Tools necessary.....8-34

8.7.1 Tools necessary

p/n	Description	Quantity
07002766	Bearing installation spacer	1
07006128	Wrench for ring nut	1
07006208	Punch for installing differential	1
07006209	Punch for installing differential	1
07006210	Punch for installing flange in spring pack	1
07006211	4WD casing support	1
07003831	Protective cover for 4WD shaft	1

9 : Rear power take off

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9.1 Safety rules

These safety precautions and warnings given in this paragraph must be observed at all times to prevent the risk of operator injury. However, the safety measures indicated in the use and maintenance manual and in chapter 1 of this manual must also be applied at all times.

Danger
All other persons must keep at a safe distance from the danger area.

Danger
Lift and handle all heavy parts with lifting equipment of adequate load capacity. Hoisting straps and hooks must be positioned safely on the load. When lifting loads, all personnel must keep at a safe distance from the load itself and remain within safe areas.

Danger
Do not allow the chains or metal cables used for hoisting to twist. Always wear safety gloves when handling cables or chains.

Danger
Use appropriate tools to align the holes correctly. NEVER USE YOUR HANDS OR FINGERS.

Danger
Handle all parts with extreme caution. Never place your hands or fingers between two parts.

Danger
When removing assemblies which could fall, always leave two screws in opposite positions in place for safety until the assembly is secured. Only remove these screws after securing the assembly to a hoist or after fitting support blocks in place.

Danger
If any of the screws fastening the frame or cab are loosened, or if the frame or cab is removed, ensure that all parts are refitted correctly at the end of the procedure to ensure that the driver is protected.

Attention
Beware of sharp edges and corners at the top of the gearbox housing.

Attention
Used oils must be collected and disposed of in compliance with applicable legislation.

9.2 General introduction

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9.2.1 Assembly drawing 9-4

9.2.1 Assembly drawing

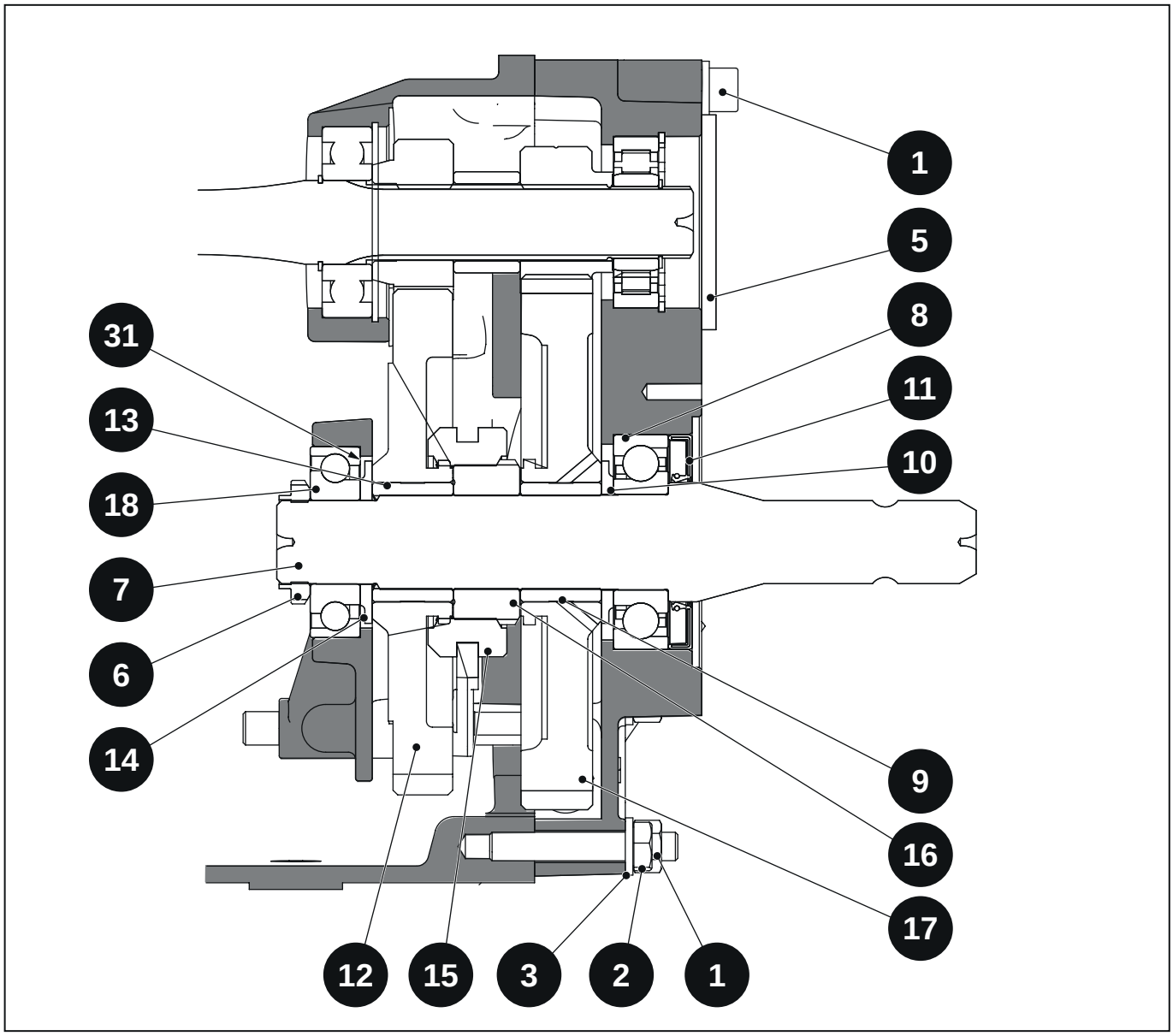

Fig. 9.1

1 - Screw
2 - Nut
3 - Washer
5 - Cover
6 - Ring nut
7 - Shaft
8 - Bearing
9 - Bush
10 - Spacer
11 - Oil seal
12 - Gear
13 - Bush
14 - Spacer
15 - Sleeve
16 - Splined bush
17 - Gear
18 - Bearing
31 - Spacers
32 - 750 gear
33 - 540 gear

9.3 Technical characteristics

Index

9.3.1 Technical characteristics.....9-6

9.3.1 Technical characteristics

Type	Single shaft, independent and synchronised
PTO speed independent of ground speed	540/750 rpm
Ground speed synchronised	Yes
Direction of rotation (looking at PTO)	Clockwise
Profile	1-3/8" with 6 splines
Clutch	Independent, mechanical dry clutch
Clutch control	Mechanical with lever
Safety	PUSH & START device on clutch pedal and on PTO

PTO speed table

PTO speed selector lever	Direction of rotation	Ratio	PTO speed (rpm)	Engine rpm
540	Clockwise	4,000	540	2160
540E	1-3/8" profile with 6 splines	2,947	750	2210
			540	1591

Ground speed PTO speed table

540	540E
4,7908	6,5018

9.4 Disassembly

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9.4.1 Disassembly.....9-8

9.4.1 Disassembly

Undo the fastener screws (1) and nuts (2) and remove the washers (3).

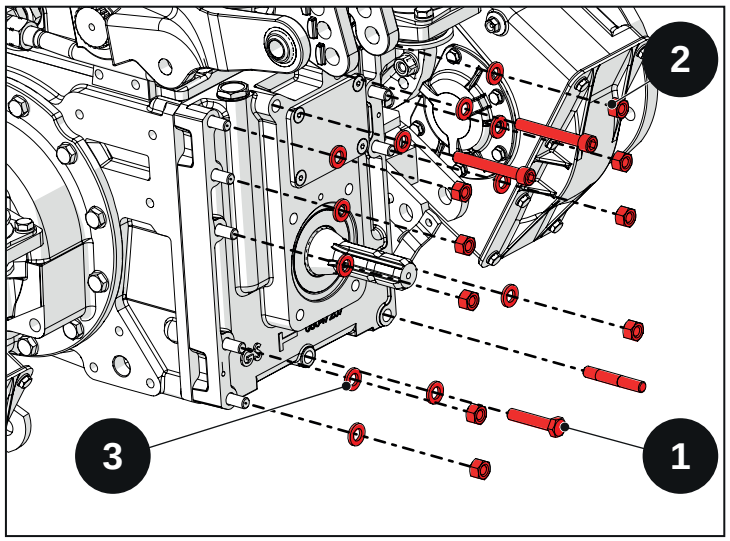

Fig. 9.2

Connect the PTO unit to a hoist and then separate it from the differential unit.

Warning
Tighten two screws into the threaded extraction holes to facilitate separation of the unit.

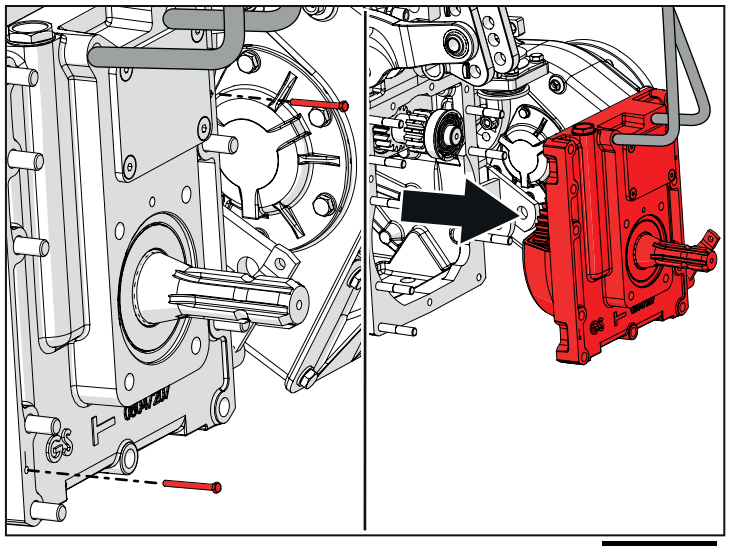

Fig. 9.3

Remove the fastener screws of the cover (4) and remove the cover (5).

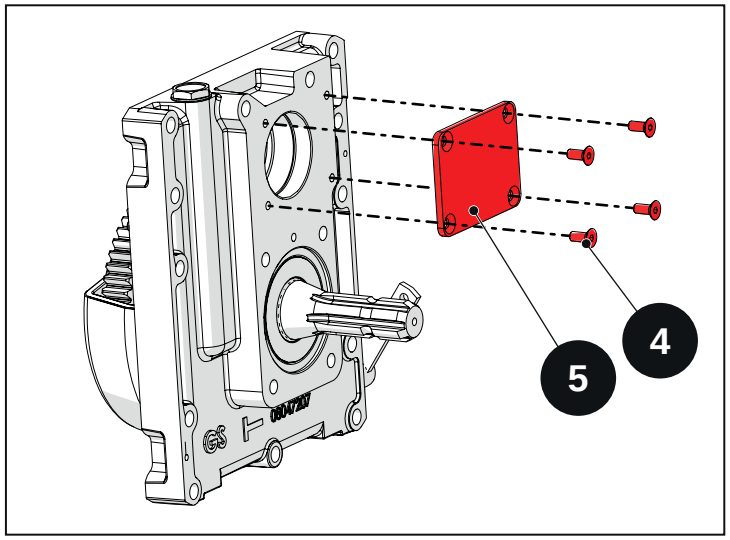

Fig. 9.4

Remove the circlip and the bearing.

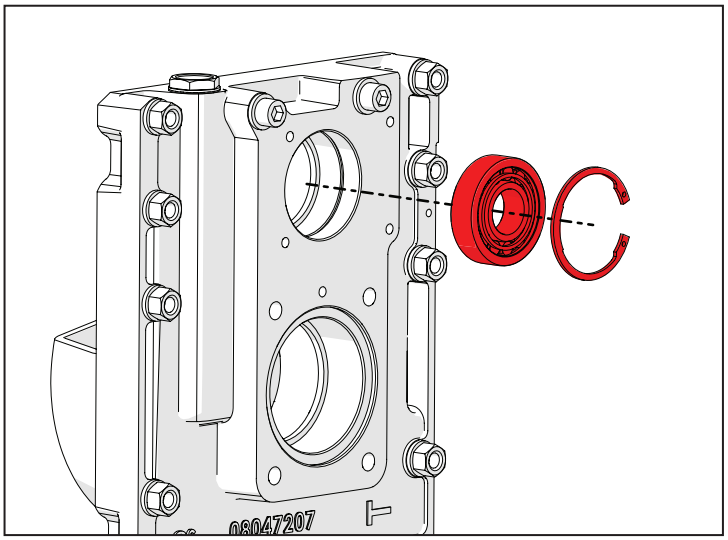

Fig. 9.5

Use the tool (A-p/n 07006128) to remove the ring nut (6).

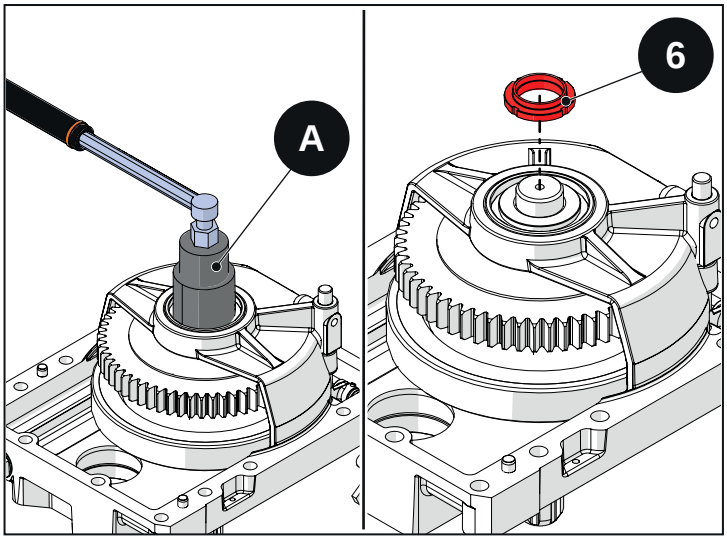

Fig. 9.6

Remove the shaft (7) complete with bearing (8), bush (9), spacer (10) and oil seal (11).

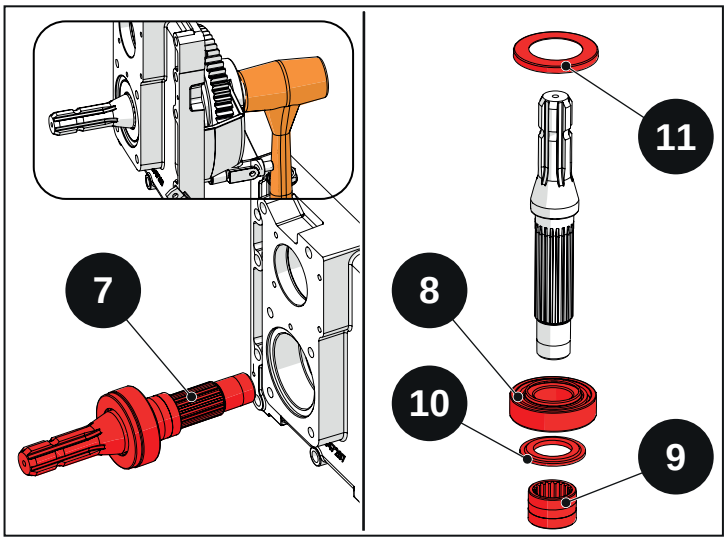

Fig. 9.7

Remove the gear (12).

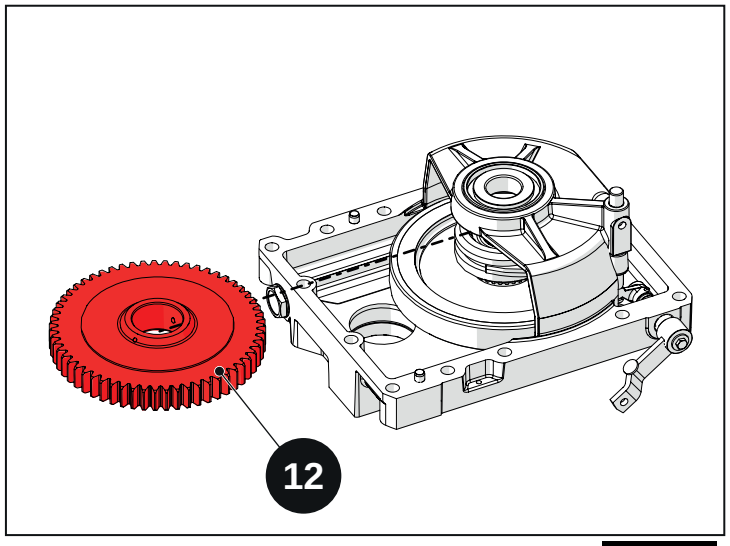

Fig. 9.8

Remove the sleeve (15) and the splined bush (16).

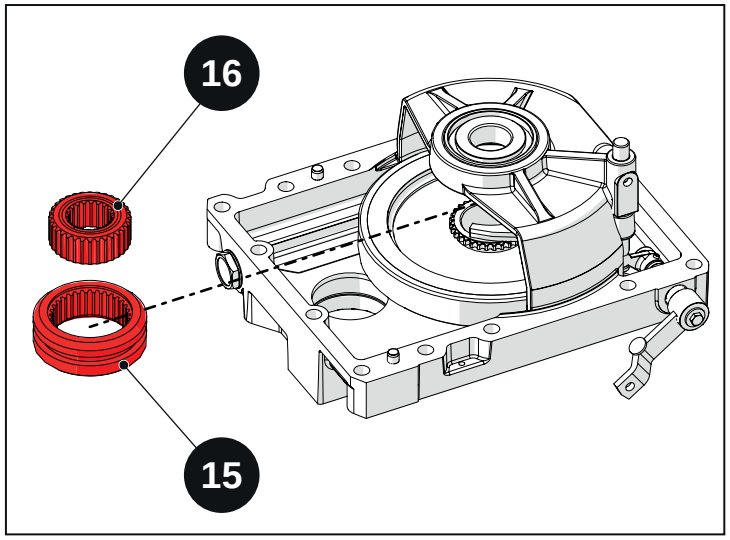

Fig. 9.9

Remove the gear (17).

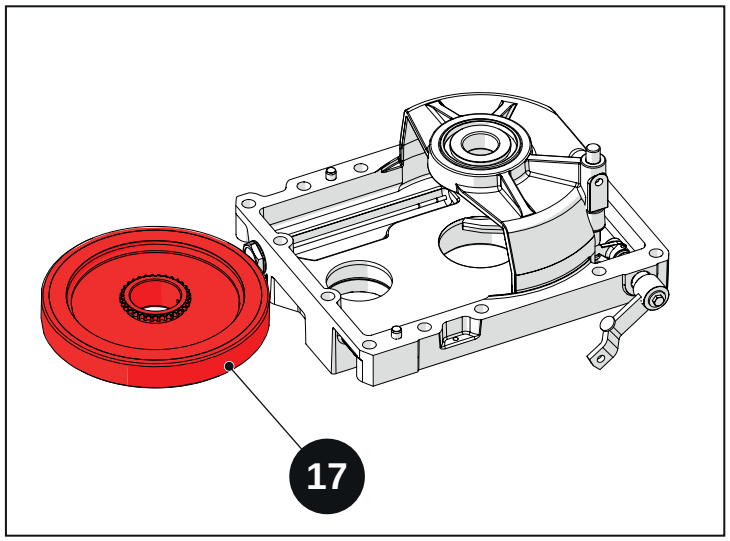

Fig. 9.10

Remove the bearing (18), using a mallet.

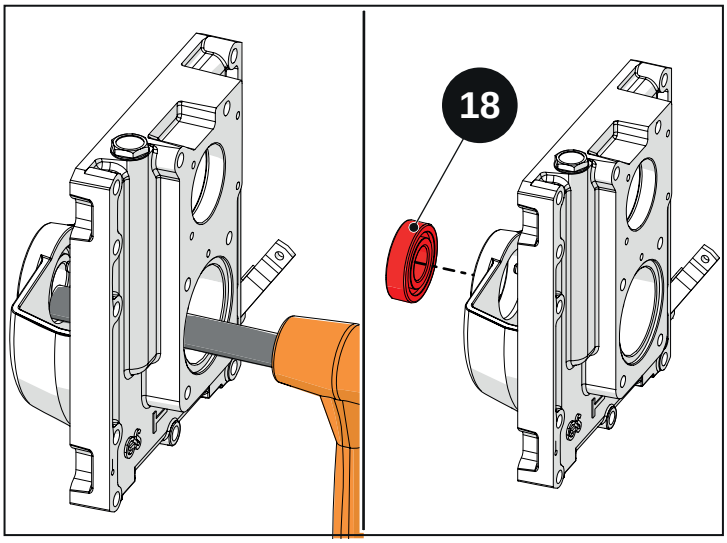

Fig. 9.11

Remove the pin (19).

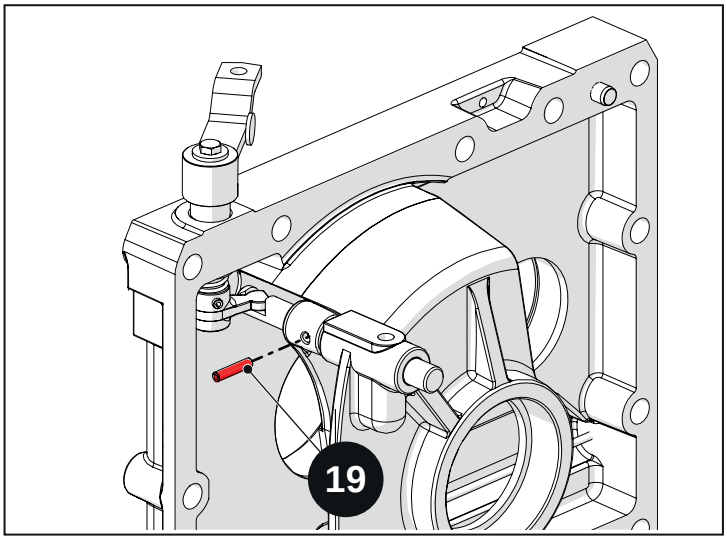

Fig. 9.12

Turn the lever to free the rod.

Undo the screw (20) and remove the washer (21) and the lever (22).

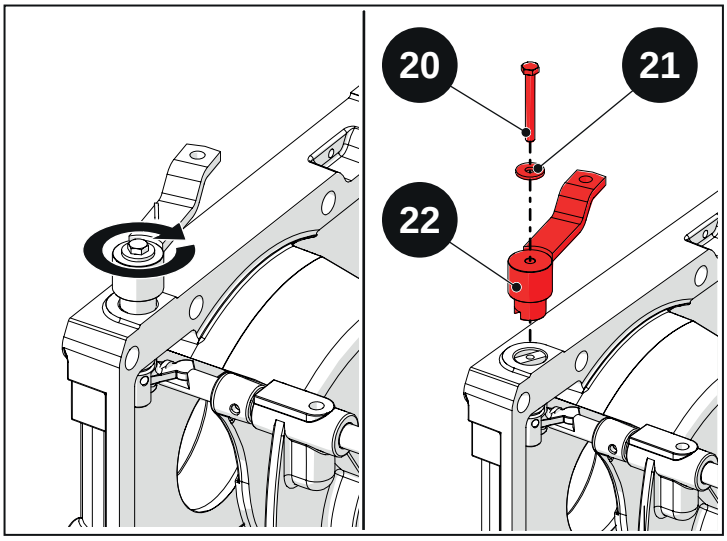

Fig. 9.13

Remove the rod (23) and the fork (24).

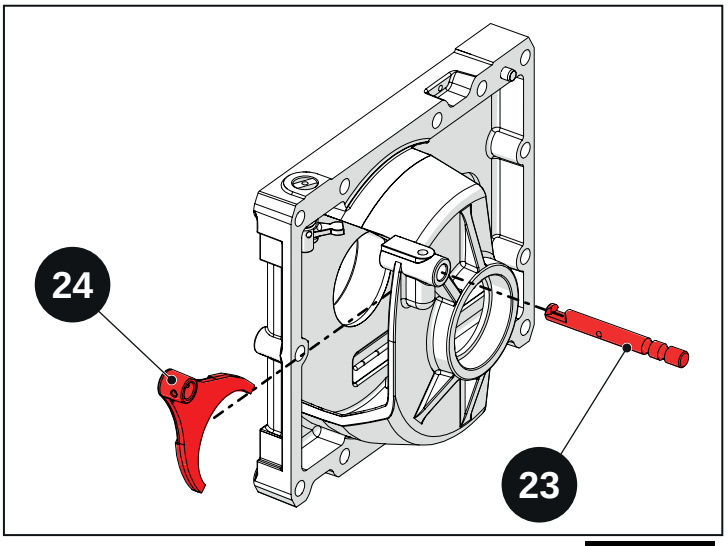

Fig. 9.14

Remove the pin (25) and remove the lever (26), the spring (27) and the spacer (28).

Danger
The spring is compressed. Take care when removing the pin. Wear adequate protective equipment.

Remove the pin (29) and the O-ring (30).

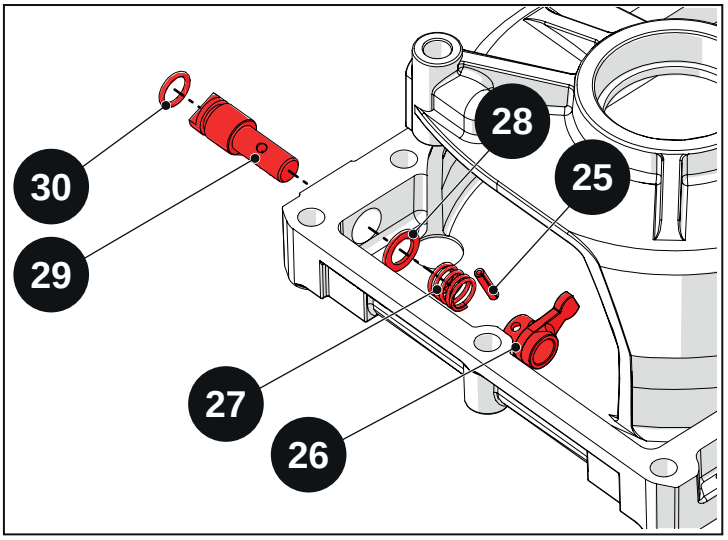

Fig. 9.15

9.5 Main inspection, reassembly and adjustment procedures

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9.5.1 Main inspection, reassembly and adjustment procedures.....9-14

9.5.1 Main inspection, reassembly and adjustment procedures

Warning

Read the instructions in chapter "1-Introduction" and, in particular, the sections concerning the installation of O-rings, oil seals and bearings, with particular care before reassembling, and follow these instructions precisely when working.

Apply the correct tightening torques when tighten the fasteners of components. Where tightening torques are not specified, refer to the table in chapter "1-Introduction".

Use the specified sealant products during reassembly. Where the sealant required is not specified, refer to the table in chapter "1-Introduction".

Fit the O-ring (30) on the pin (29).

Warning

Apply a coating of grease to the O-ring before installing it in its seat.

Fit the spacer (28), the spring (27) and the lever (26).

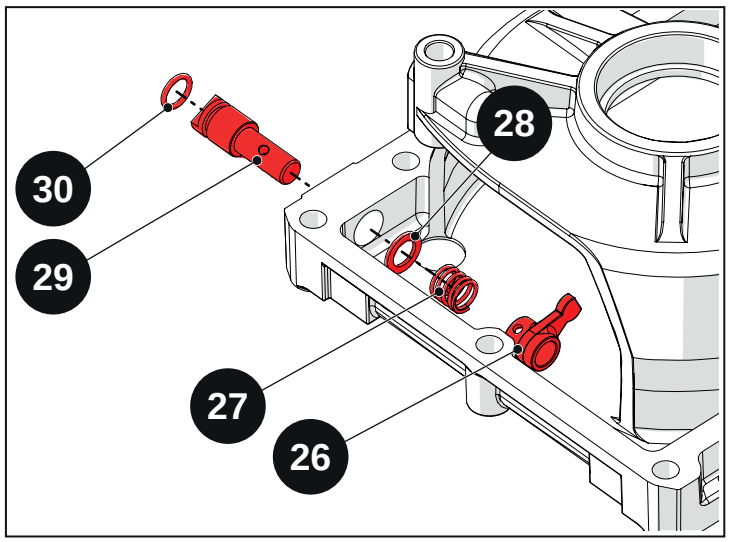

Fig. 9.16

Use the tool (B-07007182) to compress the spring and then fit the pin (29).

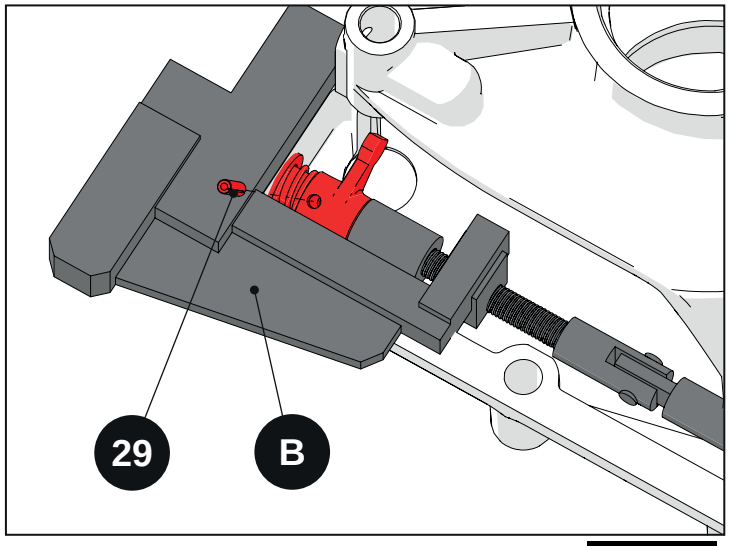

Fig. 9.17

Fit the rod (23) and the fork (24).

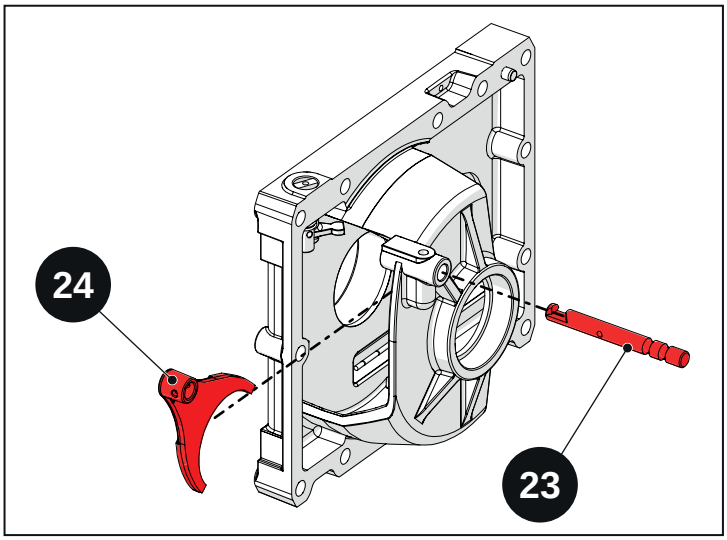

Fig. 9.18

Fit the lever (22) and the washer (21) and then fit and tighten the screw (20).

Fit the pin (19).

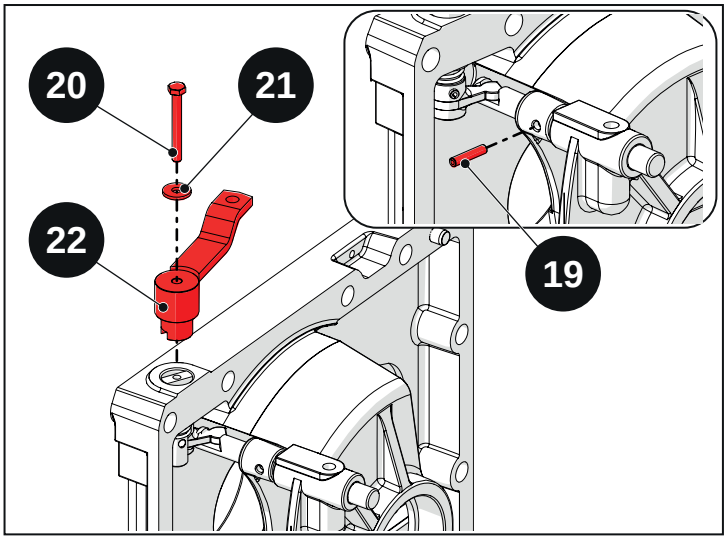

Fig. 9.19

Fit the gear (17).

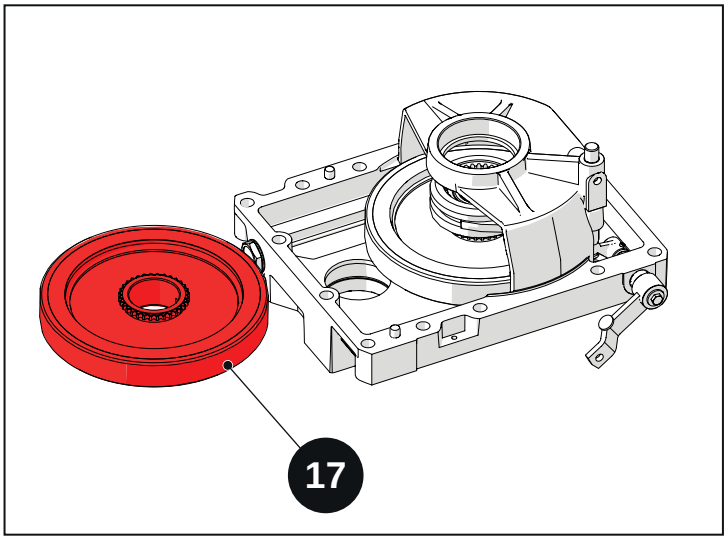

Fig. 9.20

Fit the sleeve (15) and the splined bush (16).

Warning
Align the fork with the sleeve.

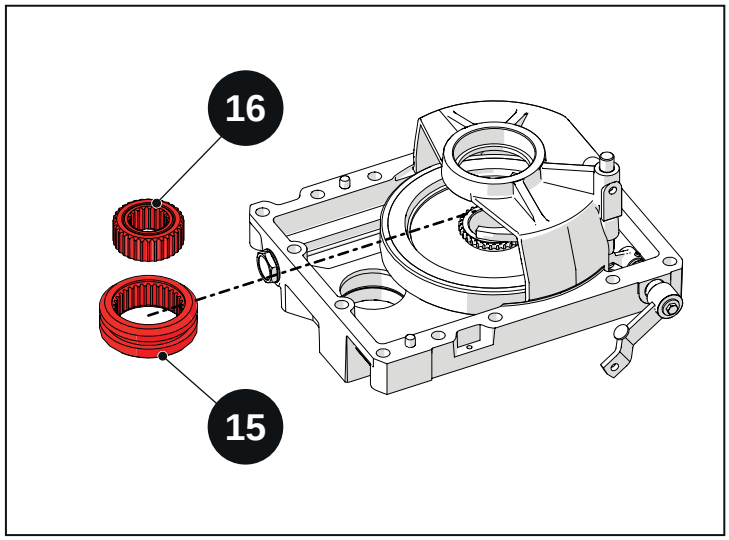

Fig. 9.21

Fit the gear (12).

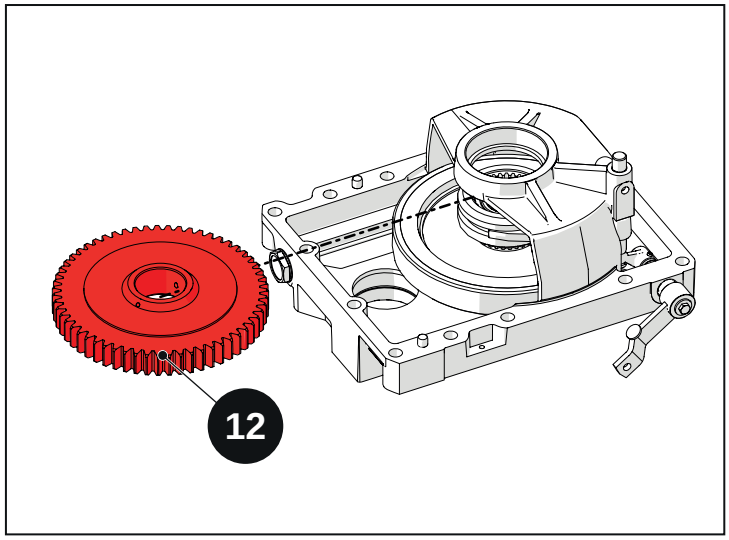

Fig. 9.22

Fit the bearing (8) on the shaft (7) and drive it fully into its seat with a punch tool of suitable diameter.

Fit the bush (9) and the spacer (10) on the shaft.

Warning
Make sure that the spacer is fitted the right way around. The bevelled side must face towards the bearing.

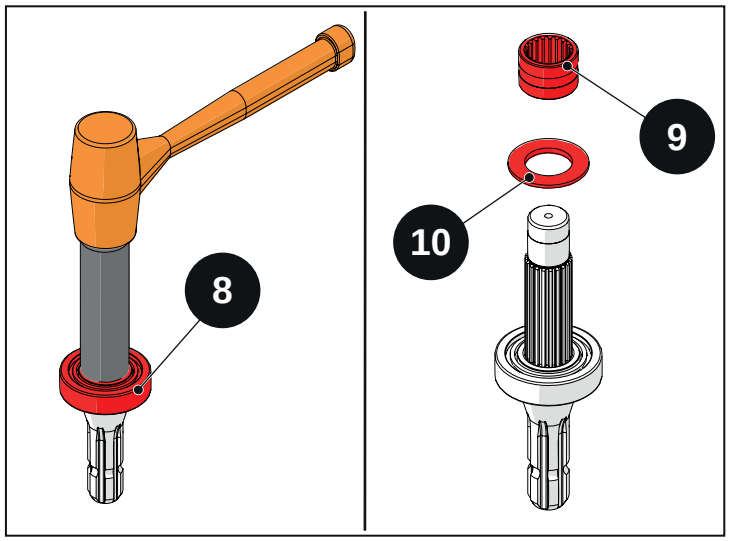

Fig. 9.23

Fit the shaft assembled in the previous step in the unit, and then fit the spacers (10).

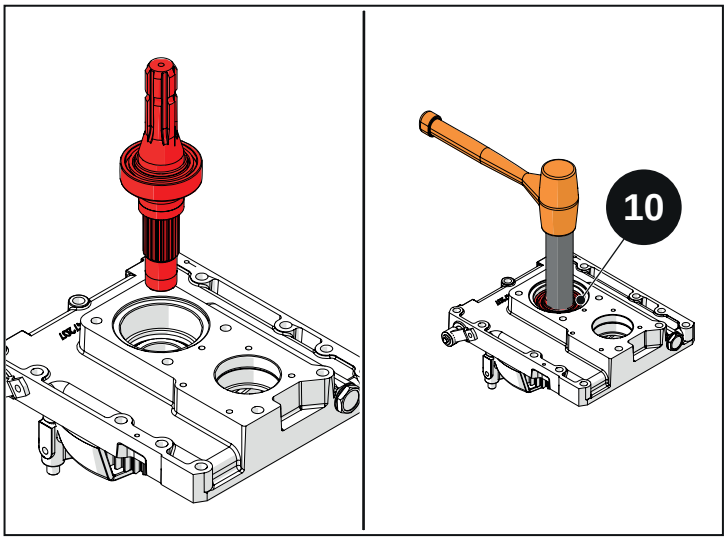

Fig. 9.24

Fit the bush (13), the spacer (14) and the 0.2 mm spacer (31).

Fit the bearing (18) and drive it fully into its seat with a bearing punch tool of suitable diameter.

Warning

Make sure that the spacer is fitted the right way around.

The bevelled side must face towards the bearing.

Warning

Make sure that the tapered roller bearings (8) and (18) are installed on the right sides and the right way around:

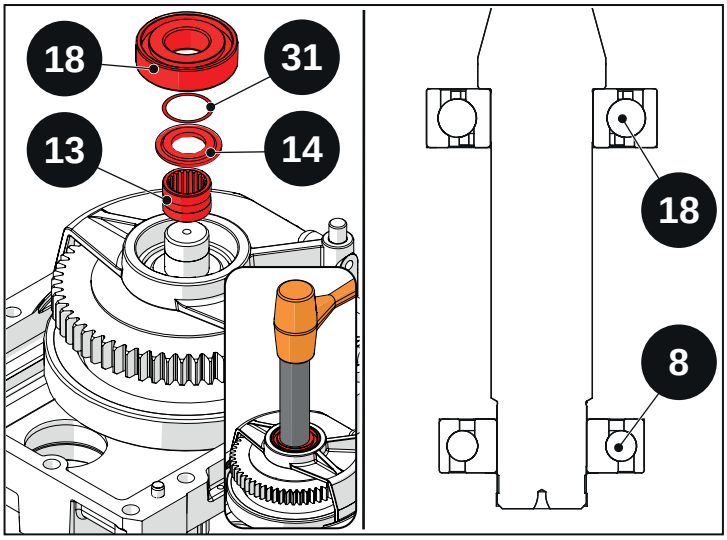

Fig. 9.25

Apply a coating of LOCTITE 270 to the thread of the ring nut (6), and then use the tool (A- p/n 07006128) to tighten the ring nut to a torque of 25 N·m (2.5 kg·m).

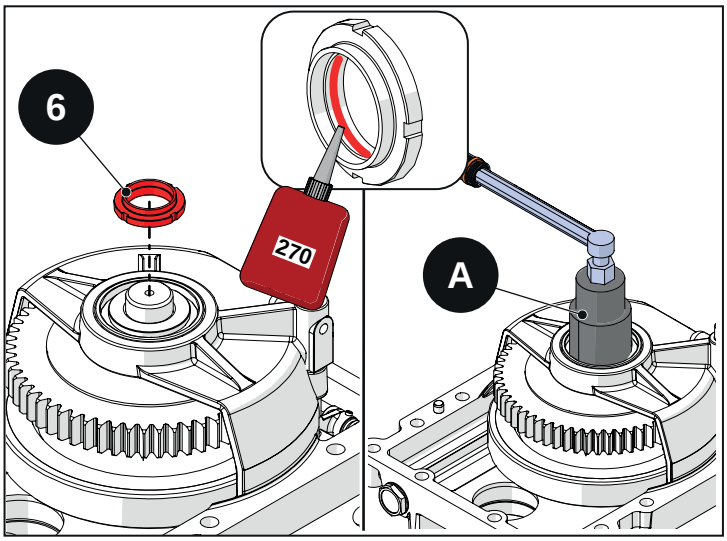

Fig. 9.26

Loosen the ring nut and then retighten to a torque of 25 N·m (2.5 kg·m).

Make a reference marking on the ring nut and shaft, and make another marking on the shaft at 45° from the first marking in a clockwise direction.

Loosen the ring nut again and retighten to 200 N·m (20 kg·m).

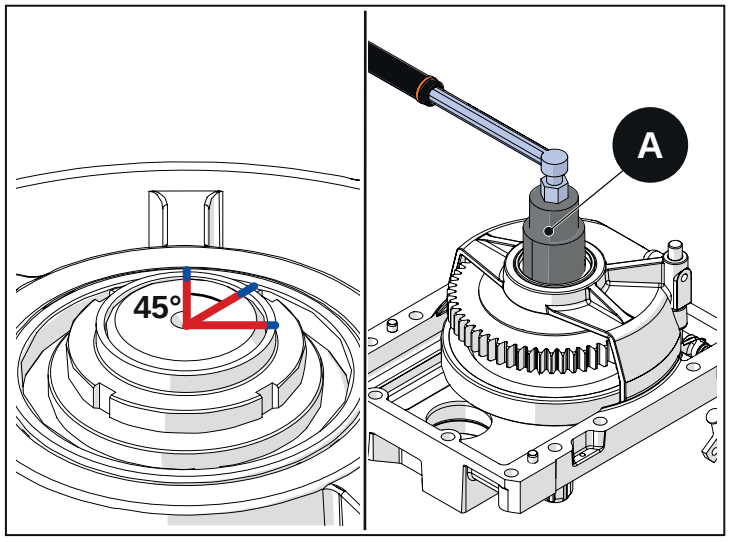

Fig. 9.27

Check that the mark on the ring nut does not rotate beyond the marking made at 45° from the initial marks

Warning

If the mark on the ring nut rotates by more than 45° relative to the initial marks, increase the thickness of the shim (31) fitted previously.

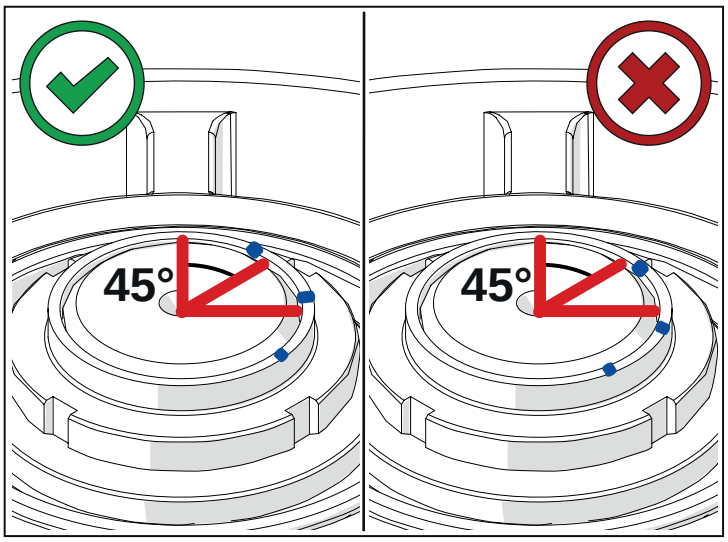

Fig. 9.28

Punch the ring nut (6) to prevent it from rotating.

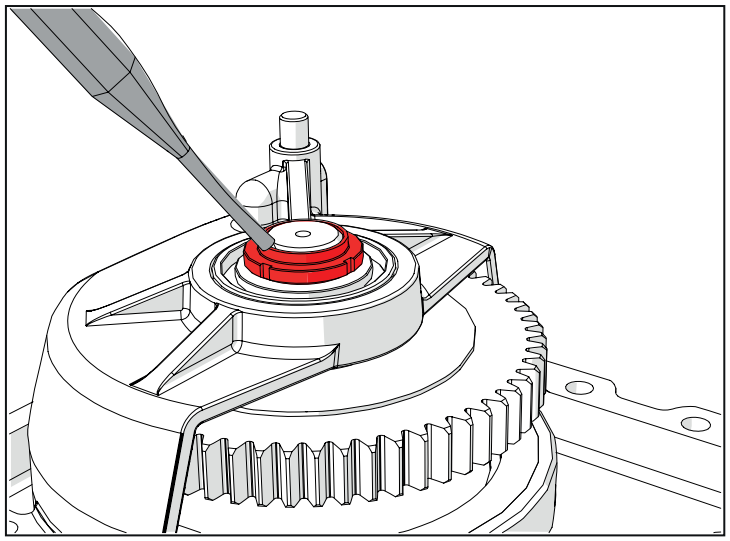

Fig. 9.29

Fit the oil seal (11) and drive it into its seat with a punch tool of suitable diameter.

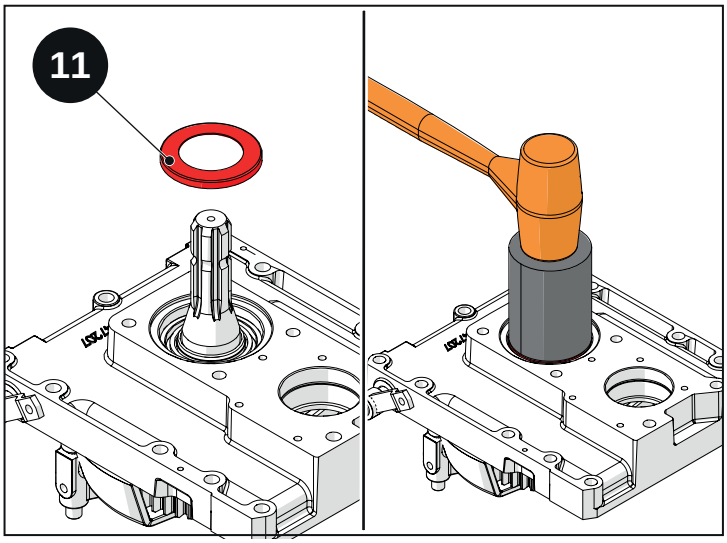

Fig. 9.30

Apply a coating of SILICONE sealant to the mating surface of the PTO.

Using a hoist, mate the PTO unit correctly with the rear differential.

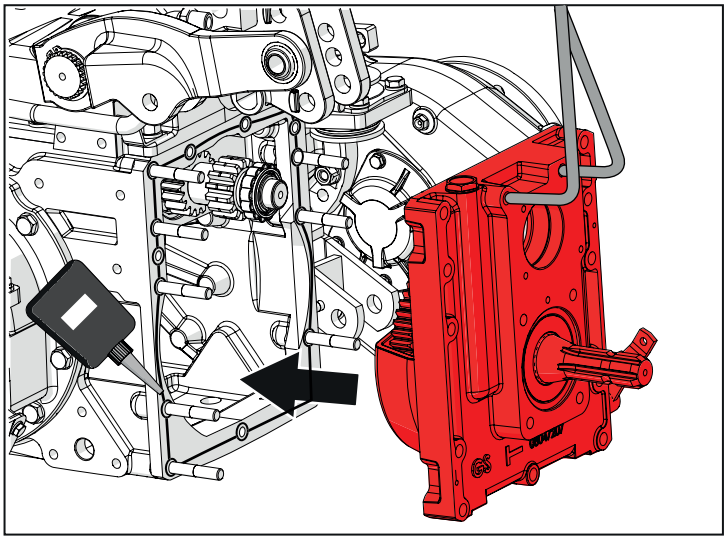

Fig. 9.31

Install the outer race of the bearing with a punch tool of suitable diameter and then secure in place with the circlip.

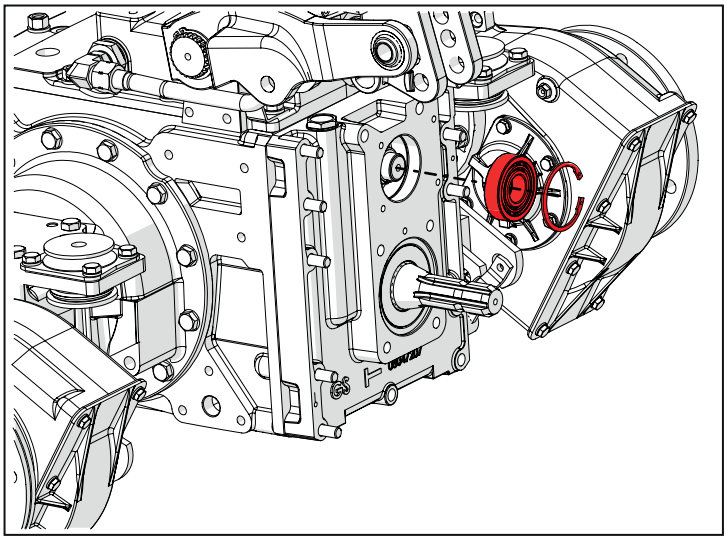

Fig. 9.32

Apply a coating of SILICONE sealant and fit the cover (5).

Fasten the cover with the screws (6).

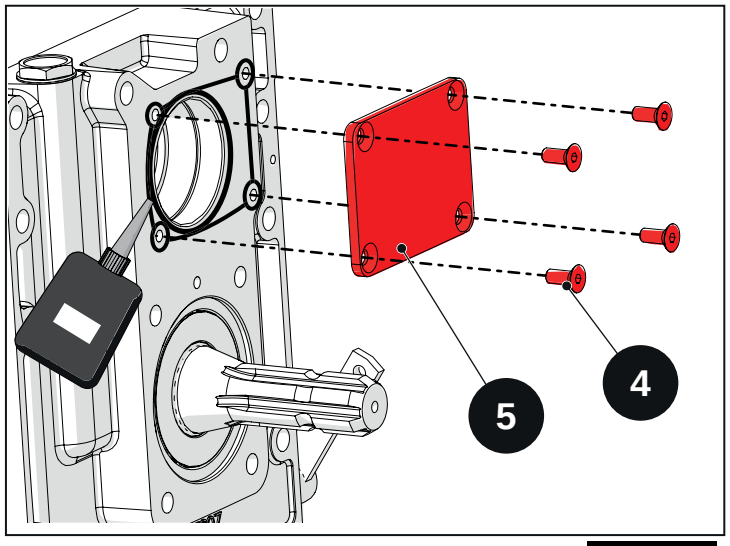

Fig. 9.33

Fit the washers (3) and tighten the screws (1) and nuts (2) to a torque of 90 N·m (9 kg·m).

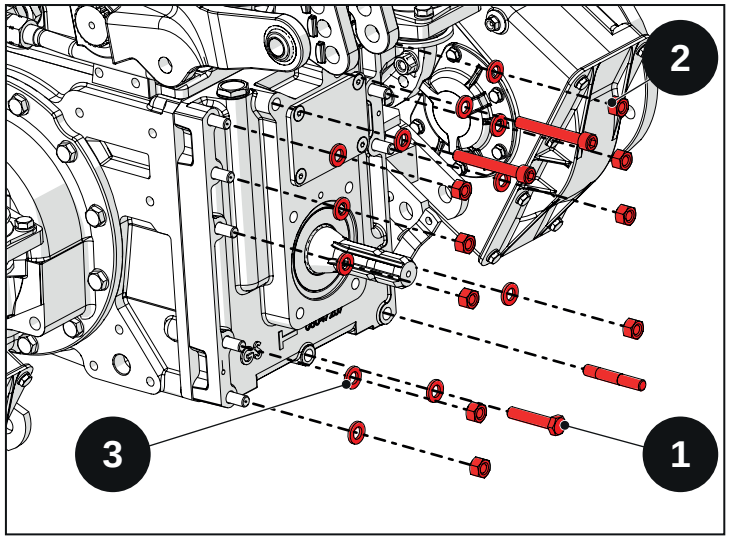

Fig. 9.34

9.6 Tightening torques

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9.6.1 Tightening torques

The main tightening torques are listed as follows. For all other tightening torques, see chapter "1- Introduction".

Tightening torque	N·m	kg·m
Rear PTO shaft fastener ring nut M35x1.5	200	20
Rear PTO unit fastener nut M12	80	8
Screw fastening upper PTO aperture cover M12x30	49	4,9
Transfer unit fastener screw M12x35	49	4,9
Screw fastening rear PTO cover M8x20	24	2,4
Screw fastening PTO unit to differential	90	9

9.7 Tools necessary

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9.7.1 Tools necessary

p/n	Description	Quantity
07006128	Wrench for ring nut	1
07007182	Spring pre-compression tool	1

10 : Brakes

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10.1 Safety rules

These safety precautions and warnings given in this paragraph must be observed at all times to prevent the risk of operator injury. However, the safety measures indicated in the use and maintenance manual and in chapter 1 of this manual must also be applied at all times.

Danger
All other persons must keep at a safe distance from the danger area.

Danger
Lift and handle all heavy parts with lifting equipment of adequate load capacity. Hoisting straps and hooks must be positioned safely on the load. When lifting loads, all personnel must keep at a safe distance from the load itself and remain within safe areas.

Danger
Do not allow the chains or metal cables used for hoisting to twist. Always wear safety gloves when handling cables or chains.

Danger
Use appropriate tools to align the holes correctly. NEVER USE YOUR HANDS OR FINGERS.

Danger
Handle all parts with extreme caution. Never place your hands or fingers between two parts.

Danger
When removing assemblies which could fall, always leave two screws in opposite positions in place for safety until the assembly is secured. Only remove these screws after securing the assembly to a hoist or after fitting support blocks in place.

Danger
If any of the screws fastening the frame or cab are loosened, or if the frame or cab is removed, ensure that all parts are refitted correctly at the end of the procedure to ensure that the driver is protected.

Attention
Beware of sharp edges and corners at the top of the gearbox housing.

Attention
Used oils must be collected and disposed of in compliance with applicable legislation.

10.2 General introduction

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10.2.1 Assembly drawing

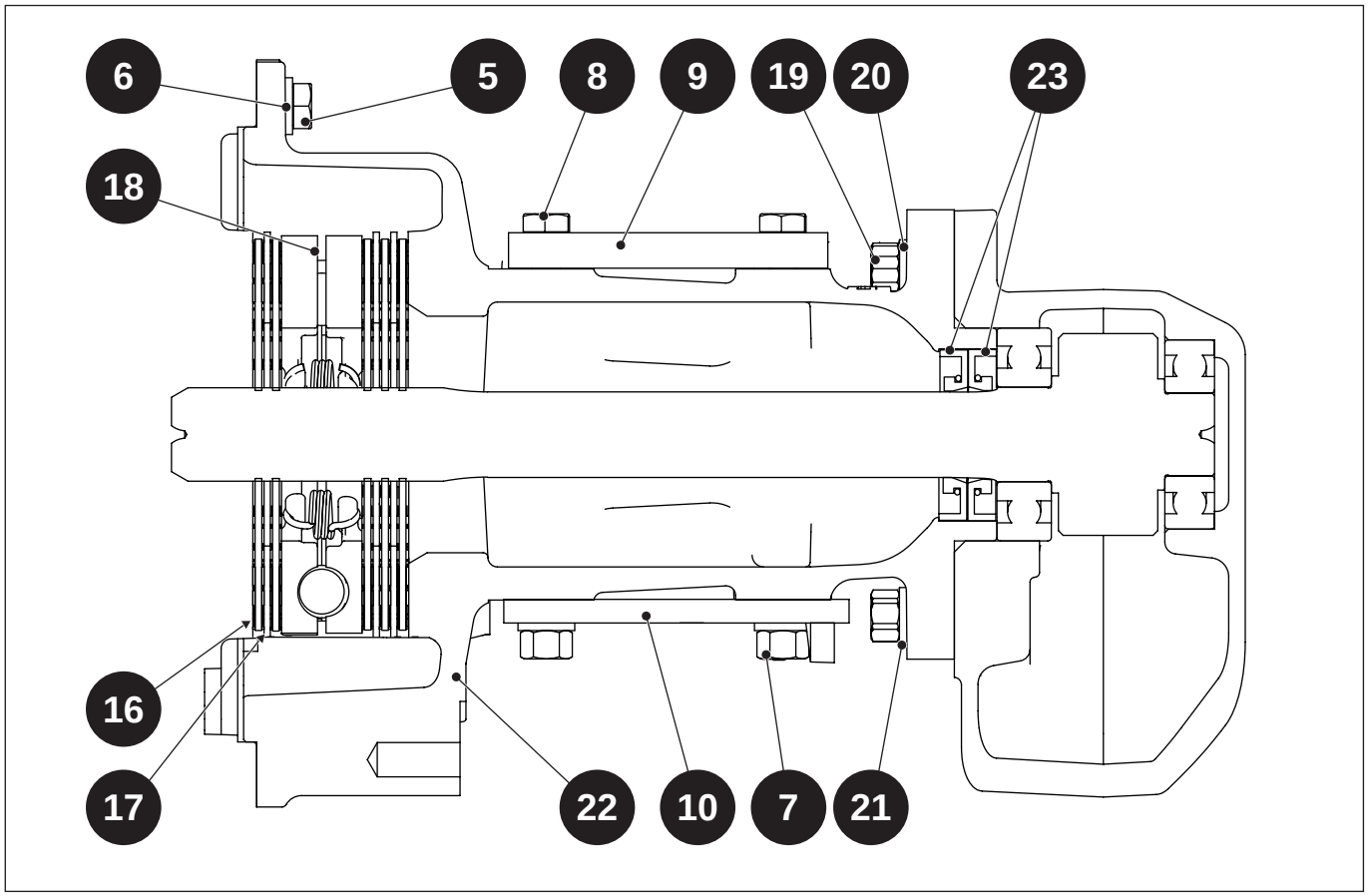

Fig. 10.1

5 - Screw
6 - Washer
7 - Nut
8 - Screw
9 - Upper platform carrier flange
10 - Lower platform carrier flange
16 - Friction disc
17 - Steel disc
18 - Braking plate
19 - Nut
20 - Washer
21 - Plate
22 - Hub
23 - Oil seal

10.3 Technical characteristics

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10.3.1 Technical characteristics

Braking system	multi-disc wet brakes
Operation	hydraulic
Emergency and parking brake	mechanically and independently operated brakes

10.4 Disassembly

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10.4.1 Preliminary operations 10-8

10.4.2 Disassembly 10-9

10.4.1 Preliminary operations

The main operations necessary to access the lateral final drive units are indicated as follows.

Attention
Always make sure that the assemblies are completely disconnected before separation to prevent damage to components.

- Removing the platform (see chapter "13-Platform")

  Removing the cab (see chapter "14-Cab")

Danger
Secure the assemblies to lifting equipment of adequate load capacity before disassembly. If suitable lifting equipment is not available, assemblies may be secured with a support stand.

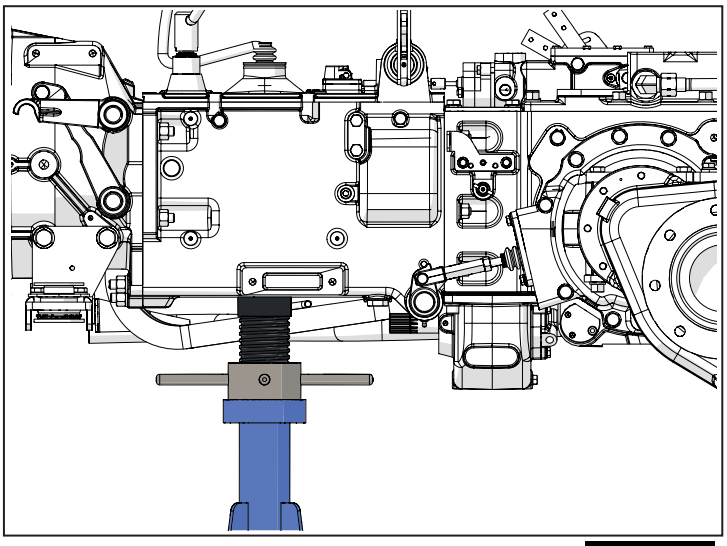

Fig. 10.2

10.4.2 Disassembly

Secure the unit to suitable hoist.

Warning
Use a hoist of suitable lift capacity.

Undo the screws (5) and remove the washers (6).

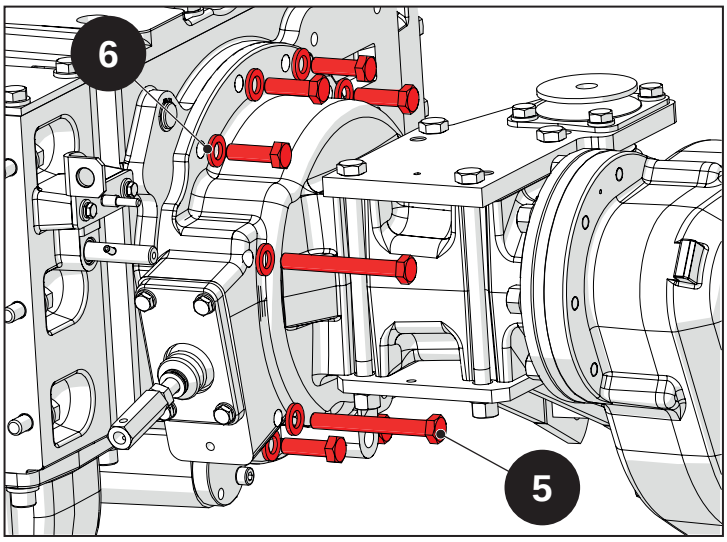

Fig. 10.3

Using a hoist, separate the unit from the rear differential.

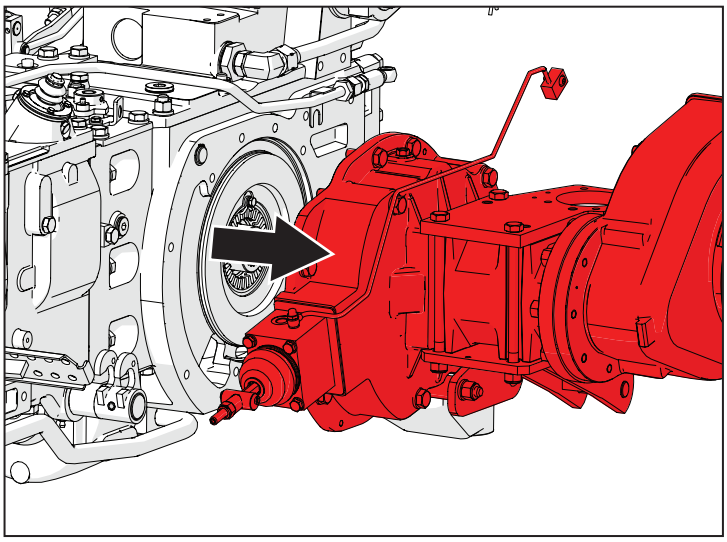

Fig. 10.4

Undo the nut (11) and remove the ferrule (12) with the spacer (24), the screw (25) and the split washer (26).

Remove the gaiter (14).

Undo the screw (13) and remove the hydraulic connector.

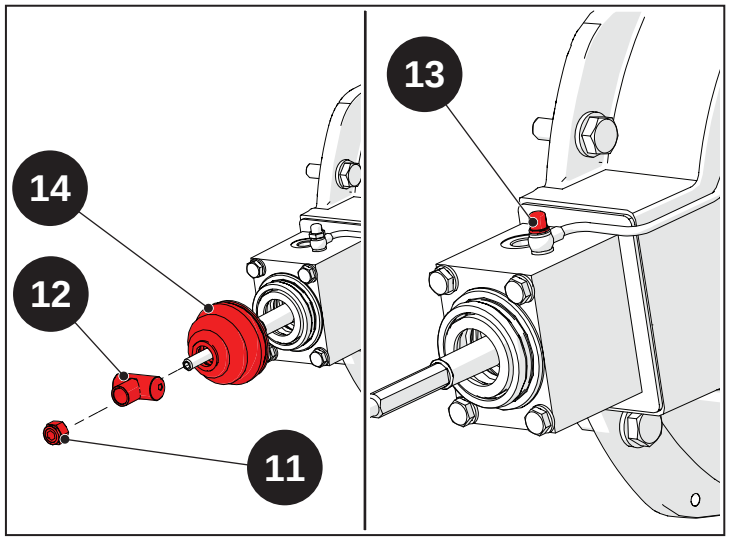

Fig. 10.5

Remove the screws (15) and the washers (24).

Loosen the link rod of the parking brake (25) to separate the brake cylinder housing from the link rod of the annular piston.

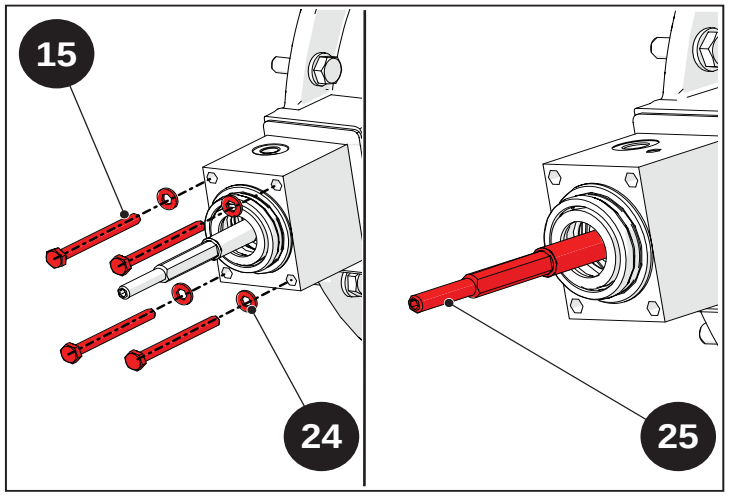

Fig. 10.6

Remove the entire assembly, consisting of the following components:

- Link rod (25);
- Cursor (27);
- Seal ring (28);
- Flanged ring (29);
- Fastener ring (30);
- Central pin (31);
- Cursor (32);
- Circlip (33);
- Seal ring (34);
- Stop ring (35);
- Spring (37);
- Plate (38).

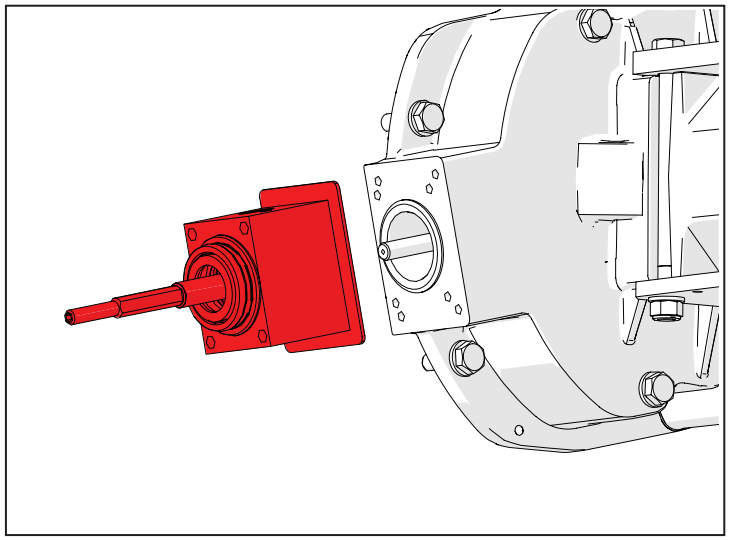

Fig. 10.7

Remove the five friction discs (16), the three steel discs (17) and the annular piston (18).

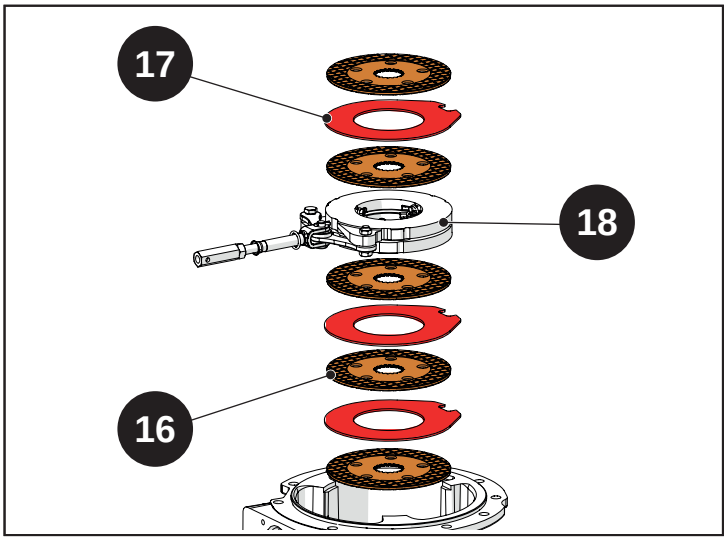

Fig. 10.8

10.5 Main inspection, reassembly and adjustment procedures

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10.5.3 Adjusting the emergency and parking brake 10-19

10.5.1 Main inspection, reassembly and adjustment procedures

Warning

Read the instructions in chapter "1-Introduction" and, in particular, the sections concerning the installation of O-rings, oil seals and bearings, with particular care before reassembling, and follow these instructions precisely when working.

Apply the correct tightening torques when tighten the fasteners of components. Where tightening torques are not specified, refer to the table in chapter "1-Introduction".

Use the specified sealant products during reassembly. Where the sealant required is not specified, refer to the table in chapter "1-Introduction".

Fit the steel discs (16), the friction discs (17) and the annular piston (18) in the hub.

Note

Fit two friction discs and one steel disc on the differential side; and three friction discs and two steel discs on the final drive unit side.

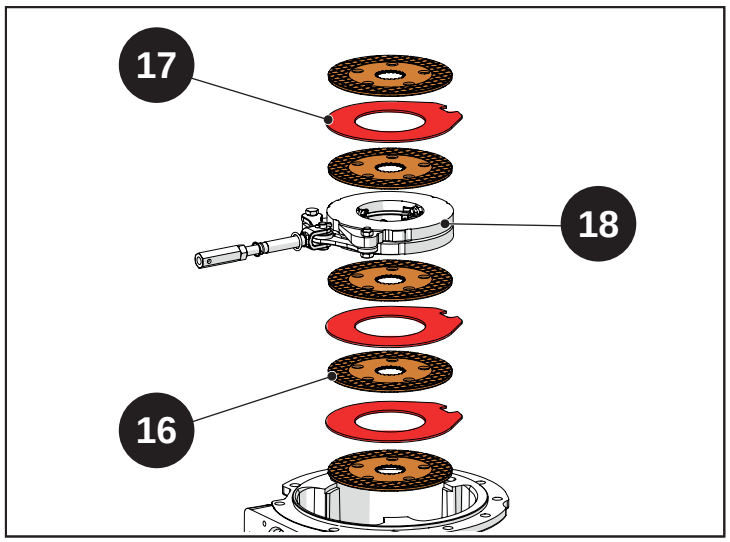

Fig. 10.9

Install the entire assembly, consisting of the following components:

- Link rod (25);
- Cursor (27);
- Seal ring (28);
- Flanged ring (29);
- Fastener ring (30);
- Central pin (31);
- Cursor (32);
- Circlip (33);
- Seal ring (34);
- Stop ring (35);
- Spring (37);
- Plate (38).

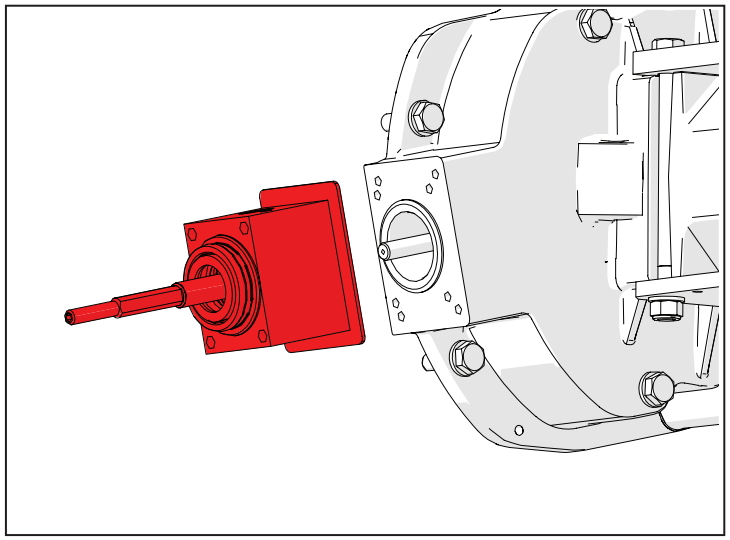

Fig. 10.10

Tighten the link rod of the parking brake (25) to connect the brake cylinder housing to the link rod of the annular piston.

Tighten the screws (15), complete with washers (24).

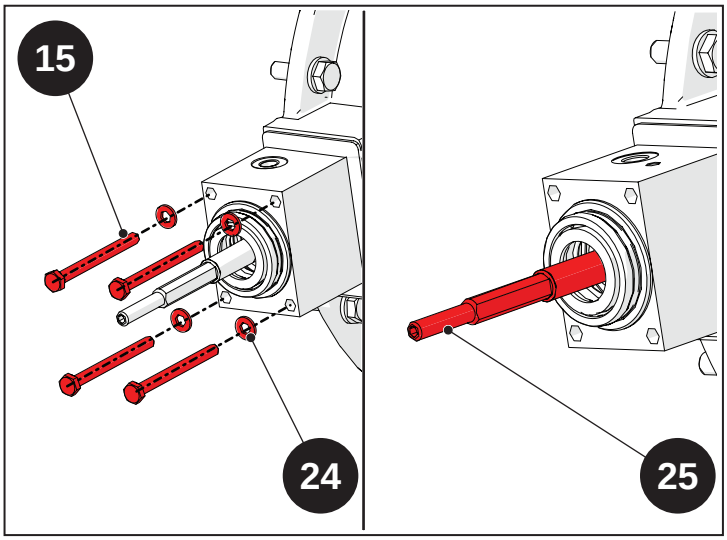

Fig. 10.11

Fit the gaiter (14).

Connect the hydraulic connector and tighten the screw (13).

Fit the ferrule (12) with the spacer (24), and then fit and tighten the screw (25), complete with split washer (26).

Tighten the nut (11).

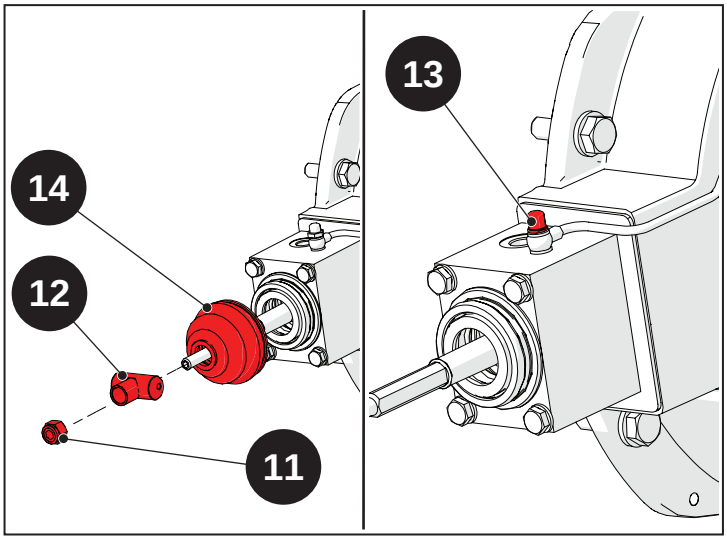

Fig. 10.12

Apply a coating of SILICONE sealant to the mating surface between the hub and the rear differential.

Secure the assembly to a hoist and mate the hub with the rear differential.

Warning
Use a hoist of suitable lift capacity.

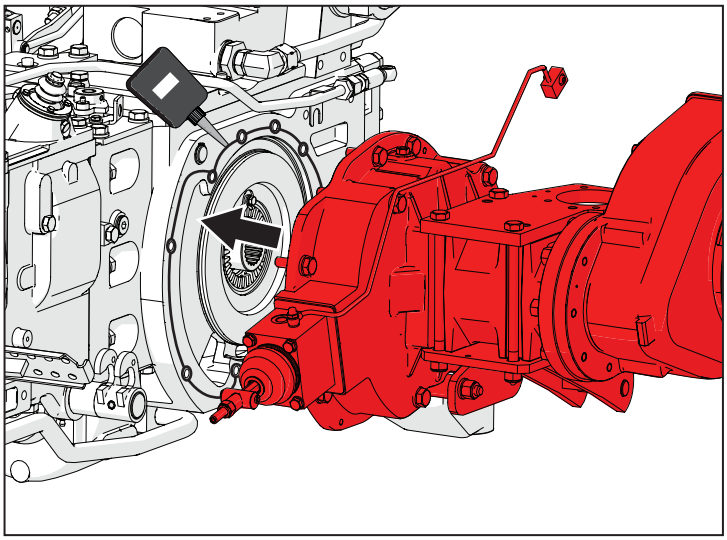

Fig. 10.13

Fit the washers (6) and tighten the screws (5) to a torque of 85 N·m (8.5 kg·m).

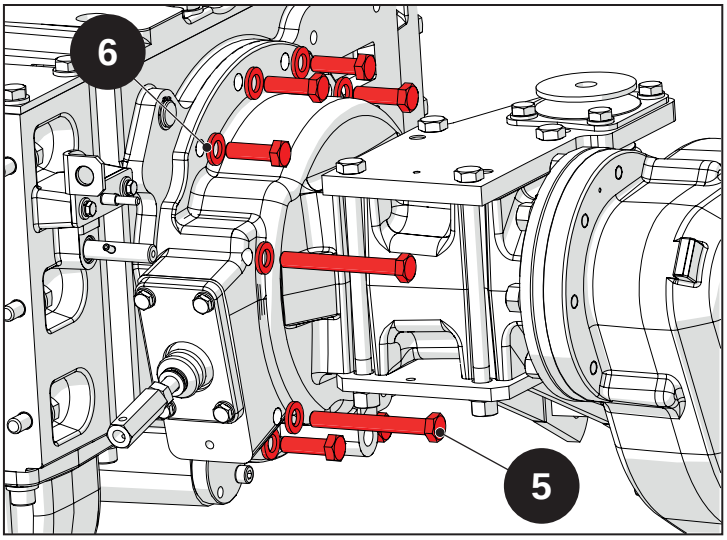

Fig. 10.14

10.5.2 Adjusting the service brakes

For the service brakes to function correctly, the braking action must only begin after a pedal dead zone of 35 to 40 mm.

Loosen the screw (13) to free the anti-rotation ferrule.

Tighten the link-rod (25) to expand the annular piston until it starts to compress the discs.

Turn the link rod back by 3/4 of a turn to create the dead zone necessary, ensuring that one of the two flat surfaces on the link rod (25) is aligned with the screw (13).

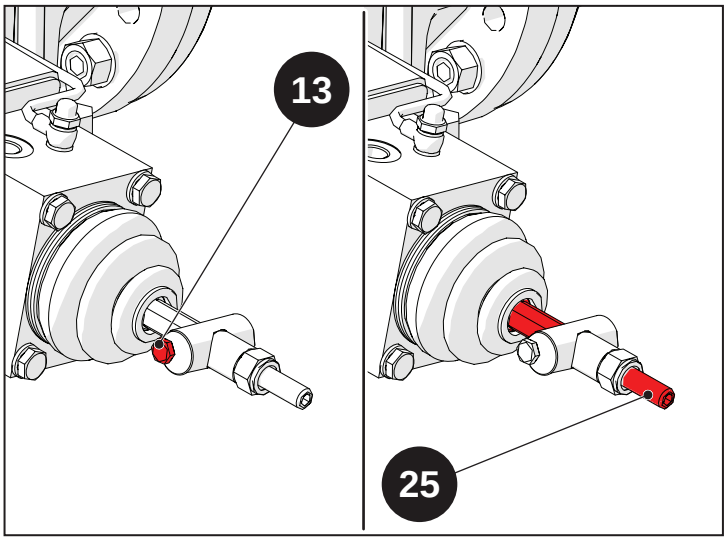

Fig. 10.15

Tighten the screw (13) onto one of the two flat surfaces.

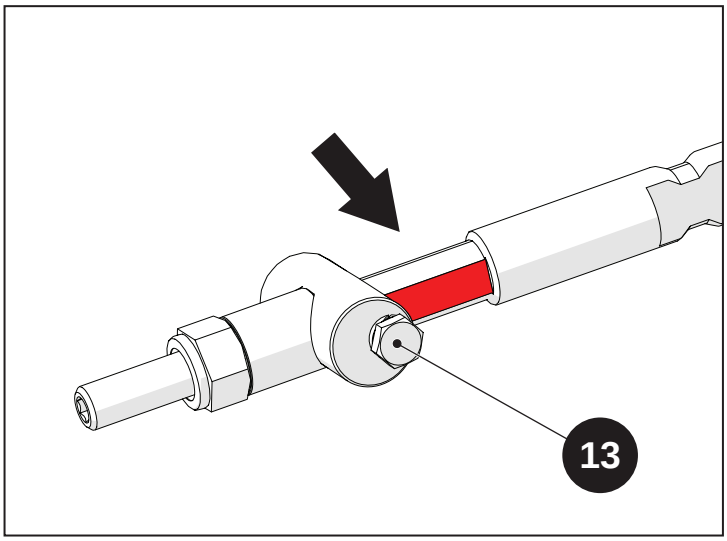

Fig. 10.16

After adjusting, perform the procedure to bleed the braking system.

The screws (A) must not be fitted during the bleeding procedure.

After bleeding, refit and tighten the screws (A).

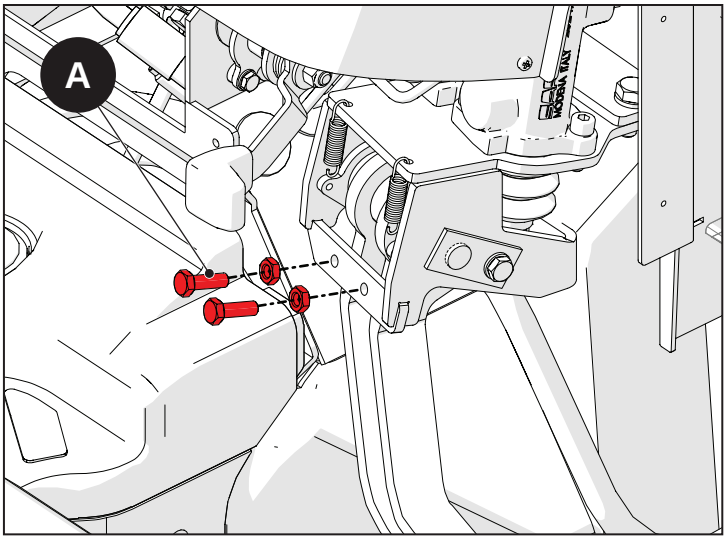

Fig. 10.17

After tightening the screws, adjust the gap (Q) to between 2 and 8 mm.

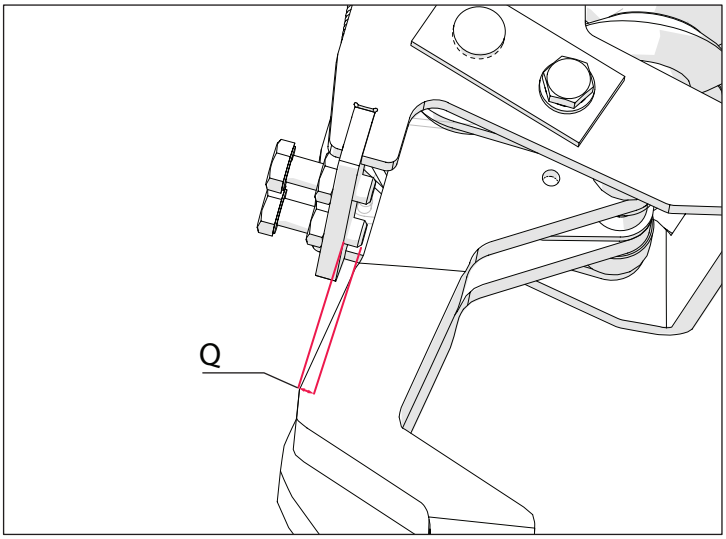

Fig. 10.18

Note
Leave a little free space at the end of the brake master cylinder rod before adjusting.

Note
Check that the machine is not braked.

10.5.3 Adjusting the emergency and parking brake

The relative control lever must be adjusted correctly to ensure that the emergency brake works correctly.

Remove the fork (D) fitted on the link rod next to the right hand cylinder. Loosen the check nut (B) on the adjuster screw (C). Tighten/loosen the adjuster screw (C) to set the correct parking brake lever travel.

Set the control lever (A) into a position allowing for a maximum travel of 6-7 ratchet clicks.

Tighten the fastener nut (B).

After adjusting, check that the parking brake works correctly.

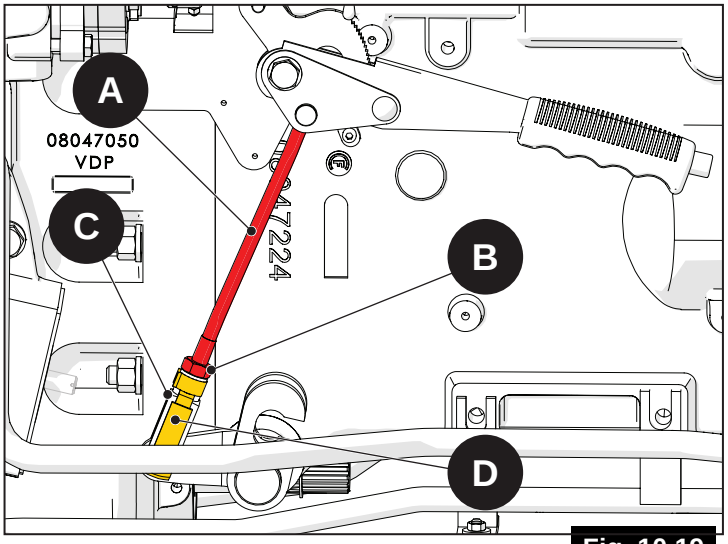

Fig. 10.19

12 : Hydraulic System

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12.1 Safety rules

These safety precautions and warnings given in this paragraph must be observed at all times to prevent the risk of operator injury. However, the safety measures indicated in the use and maintenance manual and in chapter 1 of this manual must also be applied at all times.

Danger
Do not start work until the pressure in the hydraulic system has dropped to zero.

Danger
Jets of escaping pressurised fluid may penetrate the skin and cause severe injury. In the event of an accident involving pressurised fluid, seek immediate medical attention to avoid the risk of severe infection.

Danger
When using adhesives or detergents, follow the safety and usage instructions provided by the manufacturer.

Danger
Take all precautions necessary to avoid burns when working with hot oil. Never heat oil to above 190°C, as the oil vapour may suddenly and spontaneously ignite.

Attention
Used oils must be collected and disposed of in compliance with applicable legislation.

12.2 Main hydraulic circuit

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12.2.1 Base version

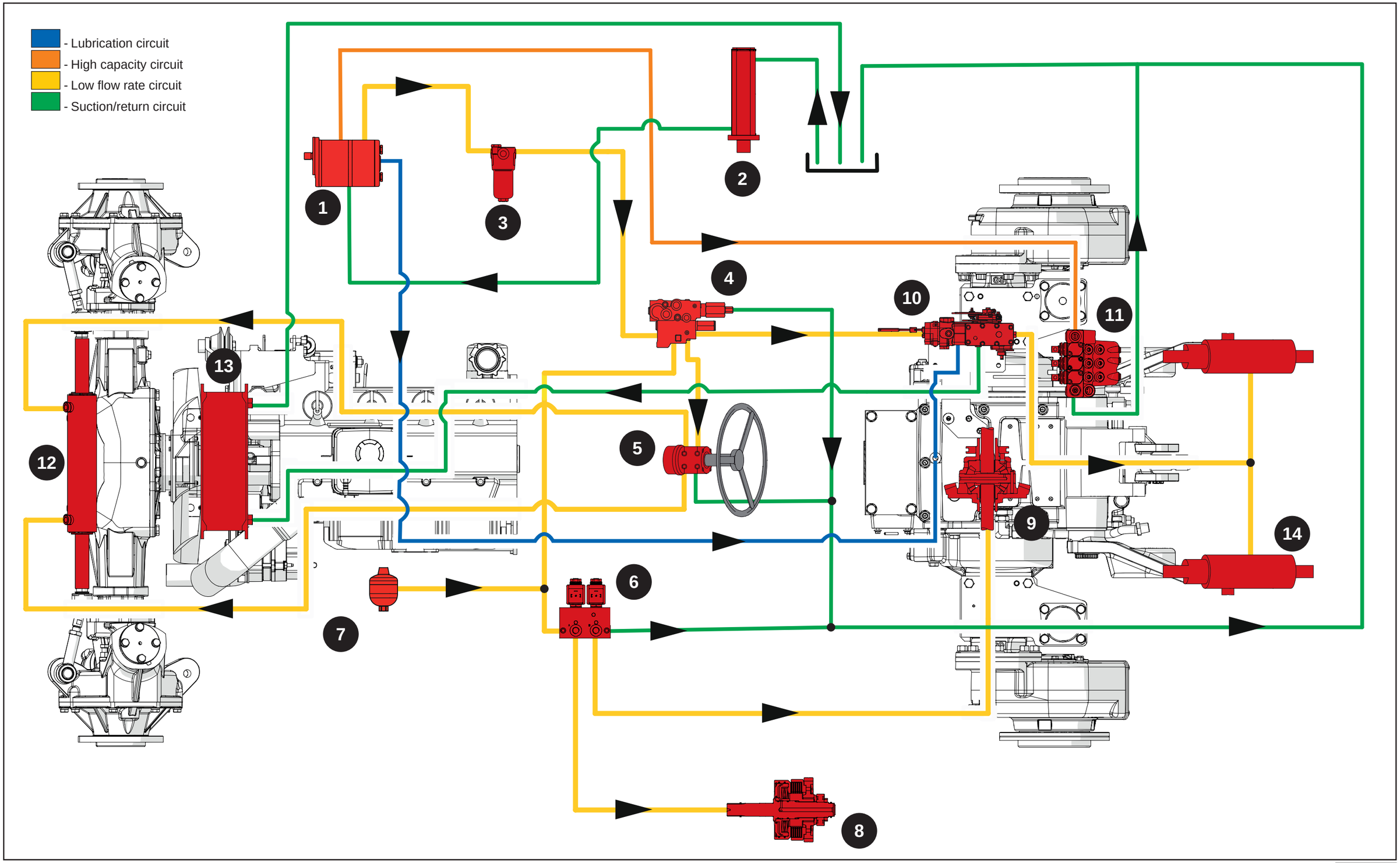

Fig. 12.1

1 - Hydraulic pump
2 - Suction line filter
3 - Low flow rate circuit delivery line filter
4 - Priority valve
5 - Hydraulic steering valve
6 - Hydraulic unit
7 - Accumulator
8 - Four-wheel drive
9 - Rear differential lock
10 - Rear lift distributor
11 - Rear auxiliary distributors
12 - Steering cylinders
13 - Oil heat exchanger
14 - Lift cylinders

12.2.2 General description

The hydraulic system consists of two separate circuits fed by dual tandem pumps driven by the timing system gears. A suction line filter cleans the oil aspirated by the pumps. Another filter is installed in the low flow rate circuit, in the delivery line after the pump.

The priority valve ensures that the hydraulic steering unit receives sufficient oil.

The priority valve then delivers oil to the differential lock unit, the 4WD unit and the rear lift. The pressure relief valve on the exterior of the lift distributor block is calibrated to 180 bar.

The oil that is not used by the lift is cooled by a heat exchanger and then delivered to the gearbox circuit. In addition to lubricating the gearbox, the oil is also used for bearing lubrication, with a portion of the flow redirected by a throttle immediately after the lift distributor

The circuit feeding the hydraulic system includes a diaphragm accumulator, which maintains a constant pressure in the circuit in all conditions. The control unit energises and de-energises the differential lock and 4WD unit actuator solenoid valves. The 4WD actuator solenoid valve is energised when the tractor is started, while the differential lock solenoid valve actuates a hydraulic piston which moves the mechanical clutch engage lever.

The high flow rate circuit feeds the rear auxiliary distributor block only. The distributor block pressure relief valve is calibrated to 180 bar.

A throttle on the delivery filter of the high flow rate circuit redirects part of the oil flow to lubricate the gearbox.

On the hydraulic system version with a diverter valve connected to the auxiliary distributors, oil is fed to a flow diverter which delivers oil either to operate a hydraulically controlled stabiliser arm or to permit use of another distributor.

12.3 Lift hydraulic system

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12.3.1 Technical characteristics

Pump

	Main pump	Secondary pump
Direction of rotation (looking at drive shaft)	Left	
Displacement	23.319 cm3/rev	14.533 cm3/rev
Pump delivery pressure range	0.7 - 3 bar abs.	
Max. continuous pressure	170 bar	250 bar
Max. intermittent pressure	190 bar	280 bar
Max. peak pressure	210 bar	300 bar
Maximum speed	2500 rpm	
Minimum speed	500 rpm	
Minimum operating temperature	-25 °C	
Maximum continuous temperature	+110 °C	
Maximum peak pressure	+125 °C	

Hydraulic steering valve

Make	Sauer Danfoss
Maximum steering pressure	120-125 bar

Suction line filter

Filtration rating	90 microns

Low flow rate circuit delivery line filter

Filtration rating	16 microns
Maximum operating pressure	420 bar
Operating temperature	-25 to +110 °C

Distributors

Coupler type	Front and rear quick couplings
Calibration valve	180 bar

12.3.2 Hydraulic circuit diagram

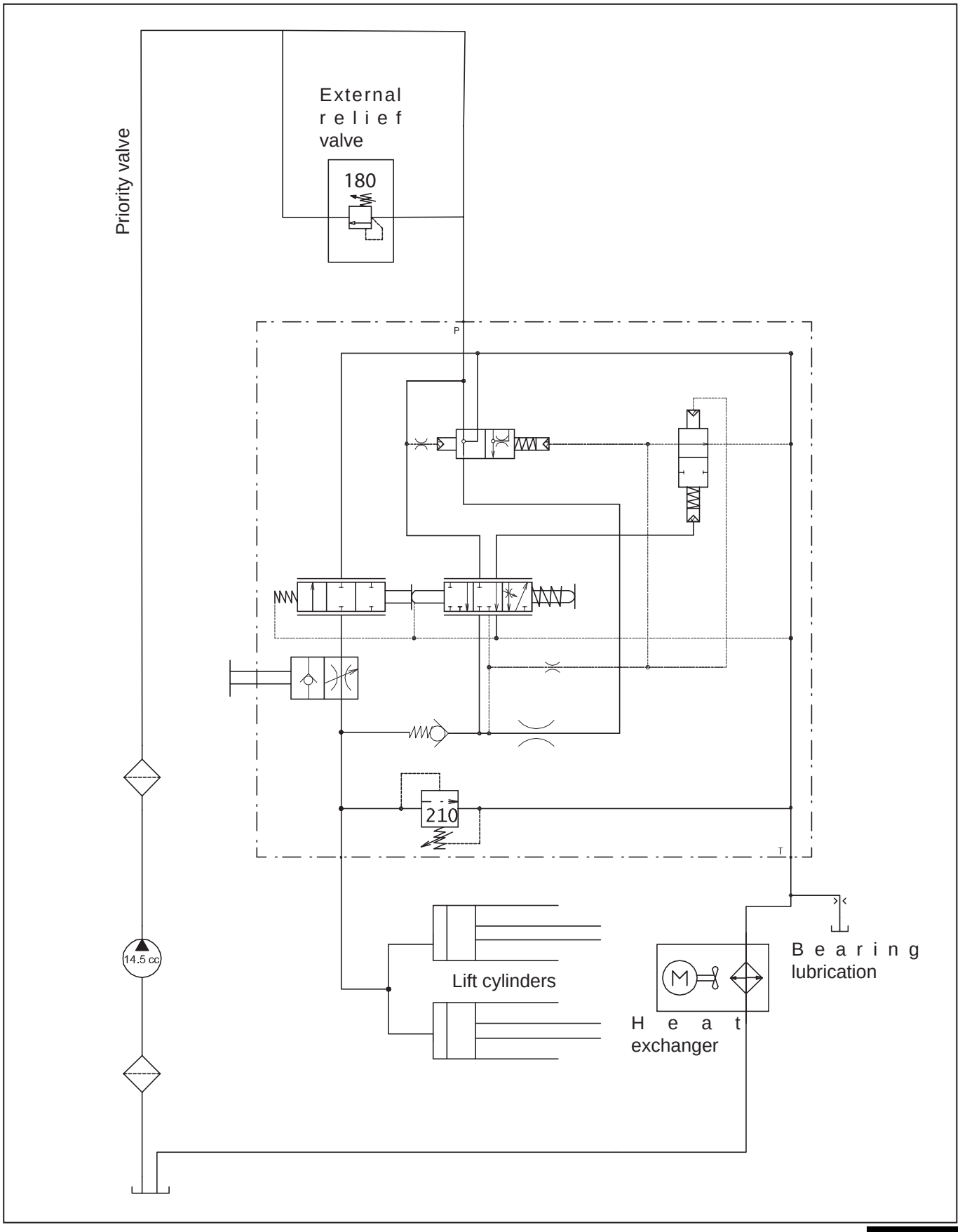

Fig. 12.2

12.3.3 Using the control levers

The two control levers may be used to obtain the following operating modes.

- position control;
- draft control;
- mixed position/draft control.

The mode used must be selected in accordance with the task, the type of implement and the hardness of the surface of the soil.

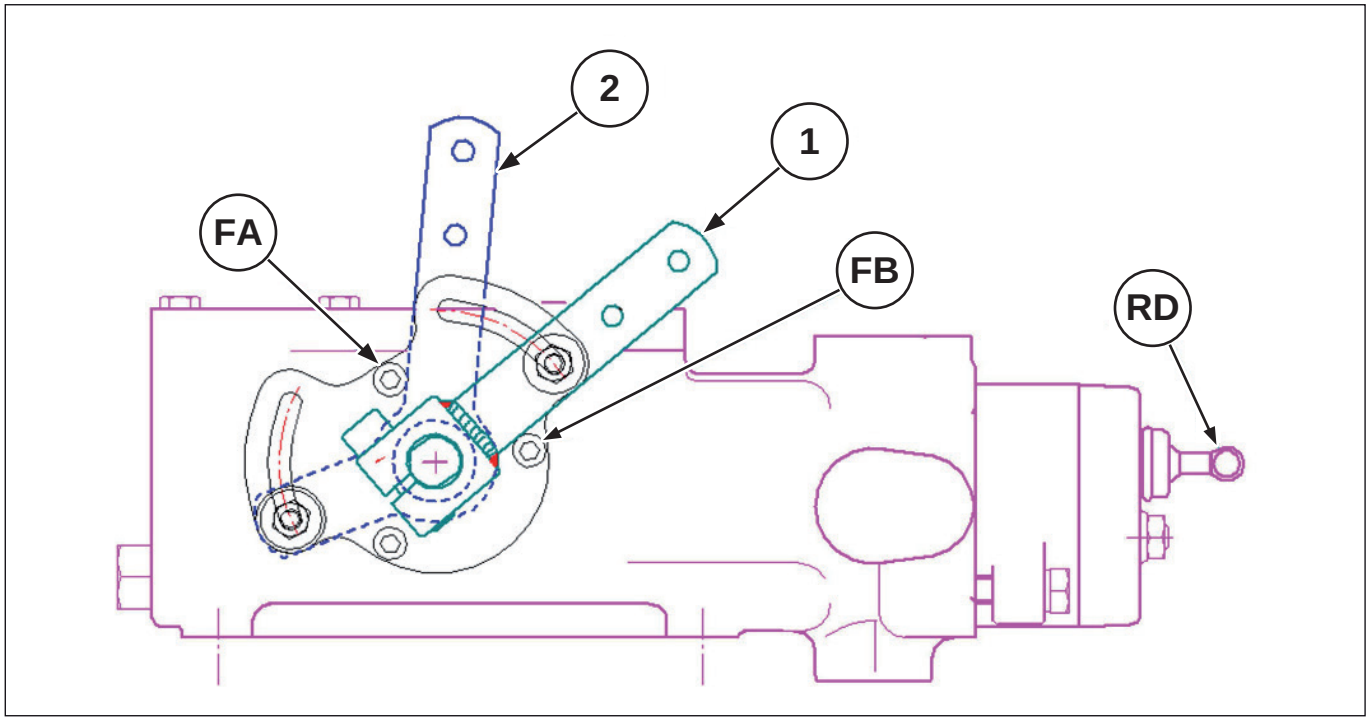

Fig. 12.3

A - Position control (lever 1)

In POSITION CONTROL mode, the position of the lift arms reflects the position of control lever 1.

To use this mode, move the draft control lever 2 against the stop FB. To set the implement position (engaged or disengaged with soil), move lever 1 towards the stop FA to raise the implement, or towards the stop FB to lower the implement.

B - Draft control (lever 2)

To use this mode, move control the position control lever 1 against the stop FB, and then engage the implement to the required working depth by gradually moving lever 2 towards the stop FB. In this mode, each position of lever 2 corresponds to a specific draft or compression force exerted on the top link.

C - Mixed position/draft control

MIXED POSITION/DRAFT CONTROL mode is particularly useful when working in uneven terrain conditions. In this mode, the lift functions as if it were in draft control mode but also prevents the implement from engaging excessively when softer soil is encountered, ensuring more uniform results.

Engage the implement in the soil and set the average working depth required as described for draft control mode. Once at the required depth, move lever 1 gradually towards the stop FA until the lift arms lift slightly.

12.3.4 Functions of control distributor

The control distributor has three operating states:

- A) NEUTRAL
- B) DELIVERY
- C) RETURN

A) NEUTRAL

In this state, the control distributor keeps the oil in the cylinder under pressure, supporting the load, while oil from the pump drains freely to the tank.

In this state, the control spool (1) connects the chamber (26) of the pilot valve (27) directly with the drain line via the port (16). The pilot valve (27) opens port (28), which connects the chamber (15) of the regulator piston (2) to the drain line via the channel (29). In this condition, oil from the pump is delivered to the chamber (22), allowing the regulator piston (2) to open the ports (17), through which the oil drains to the tank.

The oil in the cylinder chamber (23) remains under pressure and sustains the load applied to the lift arms. The oil is retained by check valve (3), the drain valve (4) and the safety relief valve (5), which are all connected to the cylinder by the annular channel (18).

The safety relief valve (5) protects the cylinder against overpressure produced by the load oscillating while driving on the road.

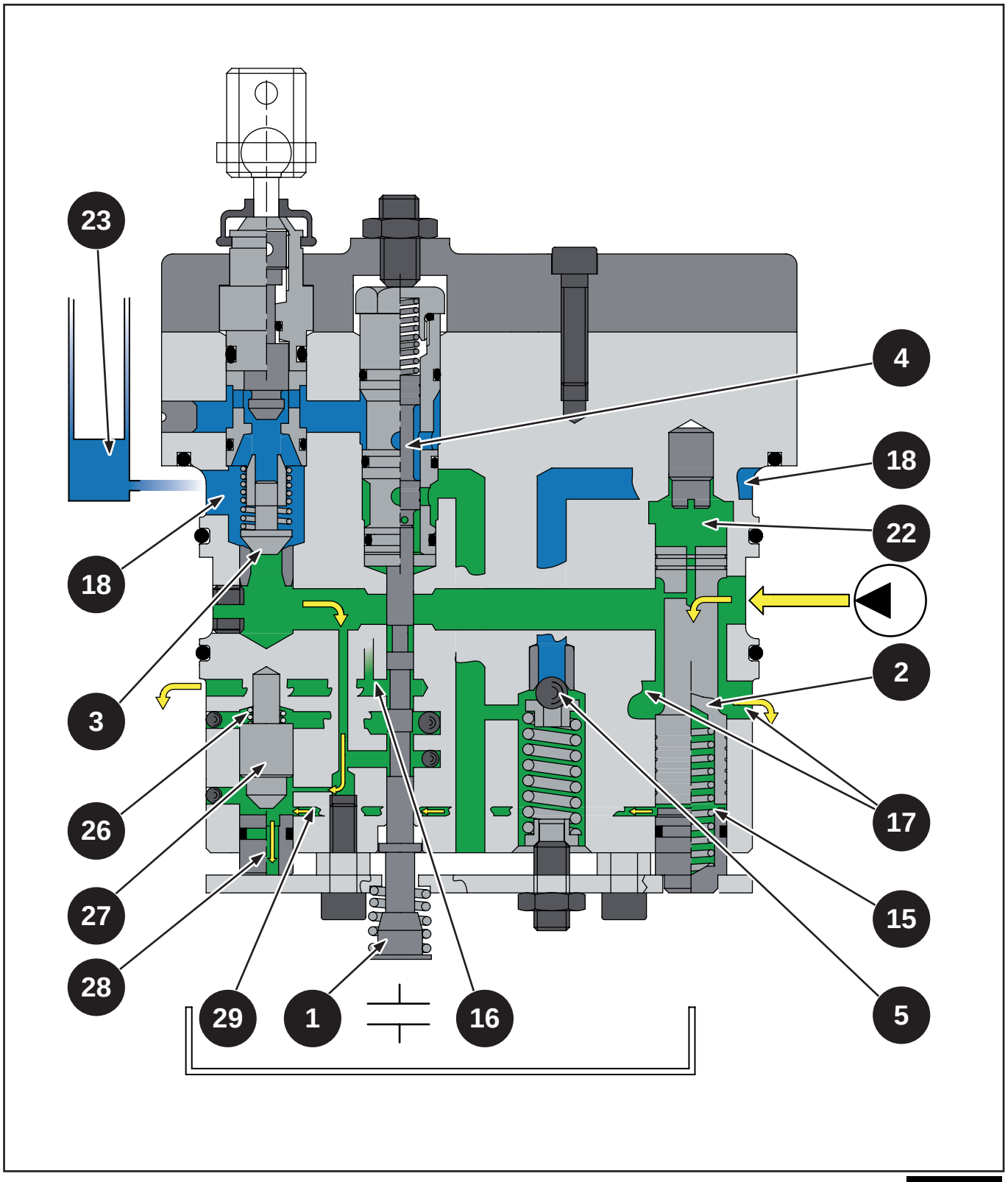

Fig. 12.4

B) DELIVERY

In delivery state, the control distributor sends pressurised oil to the cylinder chamber (23), causing the arms to lift.

The position occupied by the control spool (1) in this state allows oil to reach the chamber (26) via the annular channel (19) and ports (21), (20) and (30), and close the pilot valve (27).

Oil from the pump is now delivered at the same pressure to chamber (22) and chamber (15) (via channel the 29) of the regulator piston (2), which closes the drain holes (17) due to the action of the return spring.

Pressurised oil reaches the cylinder via the annular channel (19), enters the port (20) via the fixed throttle (6) and the variable throttle passage created by the control spool (1) and port (21), opens the check valve (3), enters the annular channel (18) and feeds chamber (23) of the cylinder.

To regulate the flow of oil delivered to the cylinder, the regulator piston (2) uses the difference in pressure exerted on chambers (15) and (22) generated by the flow of oil through the variable throttle passage (31), which is opened or closed by the control spool (1) as it is moved by the internal linkages of the lift.

Oil flow in excess of the pressure required to lift the arms is exhausted via the ports (17), limiting the maximum lift rate and ensuring a damped action when the arms start and stop.

The maximum operating pressure is controlled by a safety relief valve in the hydraulic circuit outside the CR90 unit (this valve may be installed on the auxiliary distributor block, for example).

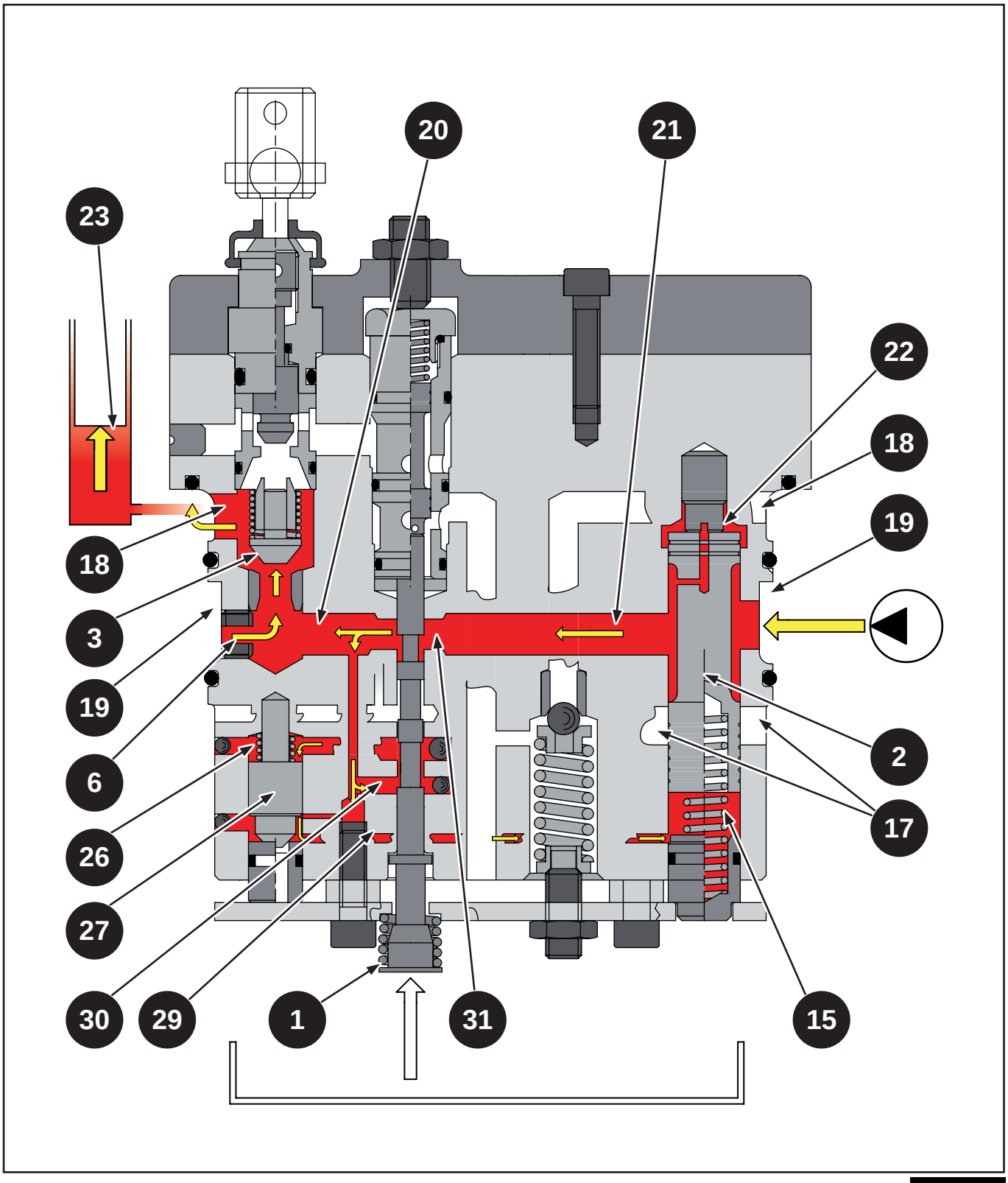

Fig. 12.5

C) RETURN

In return state, the control distributor directs oil flow received from the pump and from the cylinder chamber (23) to the drain line, causing the lift arms to lower.

The position occupied by the control spool (1) in this state connects chamber (26) of the pilot valve (27) directly to the drain line via port (16). This causes the pilot valve to open port (28), connecting chamber (15) of the regulator piston (2) to the drain line via channel (29).

As in the neutral state, the oil pressure from the pump now pushes the regulator piston towards chamber (15), causing the piston to open the drain ports (17) and drain the oil back to the tank.

Simultaneously, pressurised oil from the cylinder (chamber (23) enters the annular channel (18), flows out from the ports (32) of the drop rate regulator (8) and from port (24), and enters the drain valve (4), from which it drains to the tank via port (25), causing the arms to drop.

In return state, the drop rate of the arms may be adjusted with the manual lever (RD: tighten to reduce drop rate).

As a safety measure to prevent the lift control levers from being operated unintentionally when driving on the road, tighten the lever (RD) completely; this brings the valve (8) against its seat, sealing off the passage between the chamber (23) of the cylinder and the drain valve (4).

When the safety lock is in use, the cylinder is still protected against accidental overpressure by the safety relief valve (5).

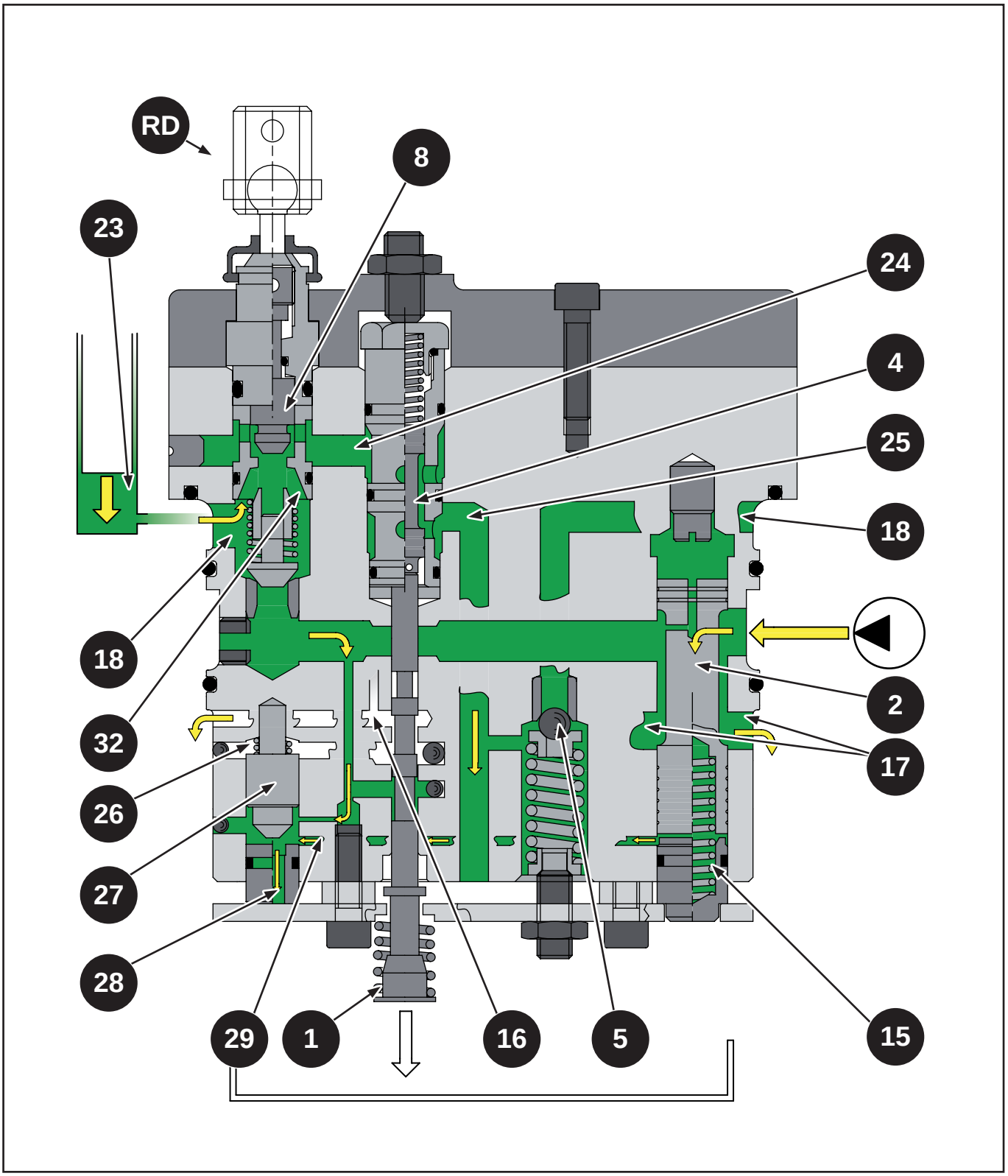

Fig. 12.6

12.4 Lift with position and draft control

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12.4.1 General introduction

12.4.1.1 General system diagram

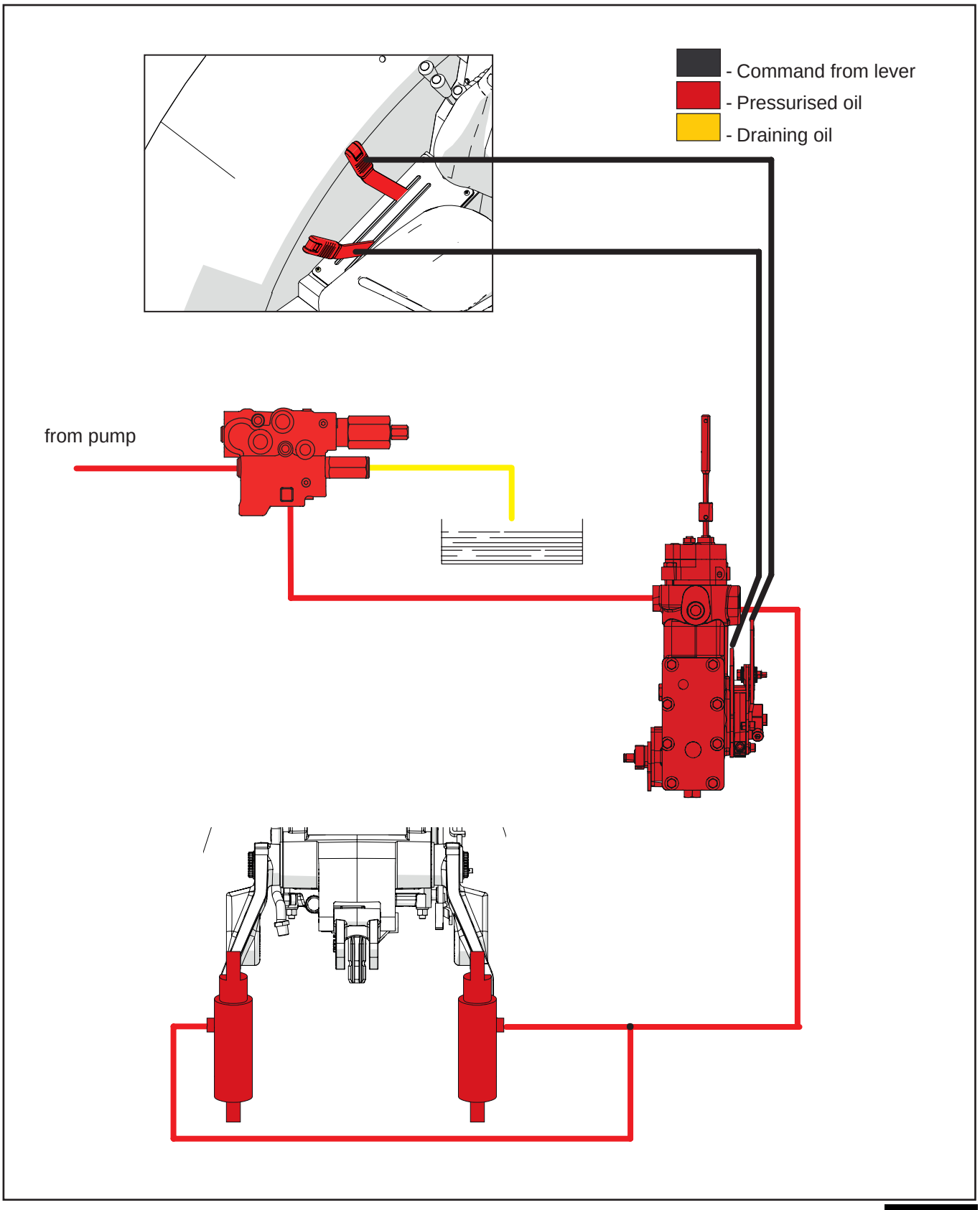

Fig. 12.7

12.4.1.2 Control levers

The lift with draft and position control may be used in the following modes:

- position control;
- draft control;
- mixed position/draft control.
- float mode.

The required mode is set by using the position control lever (1) and the draft control lever (2) in combination.

The control levers for the position and draft control lift are situated to the right of the driver, next to the seat

(1) - Position control lever.
(2) - Draft control lever.
(3) - Lift arm drop rate setting lever.
Turn clockwise to reduce drop rate; turn anticlockwise to increase drop rate.

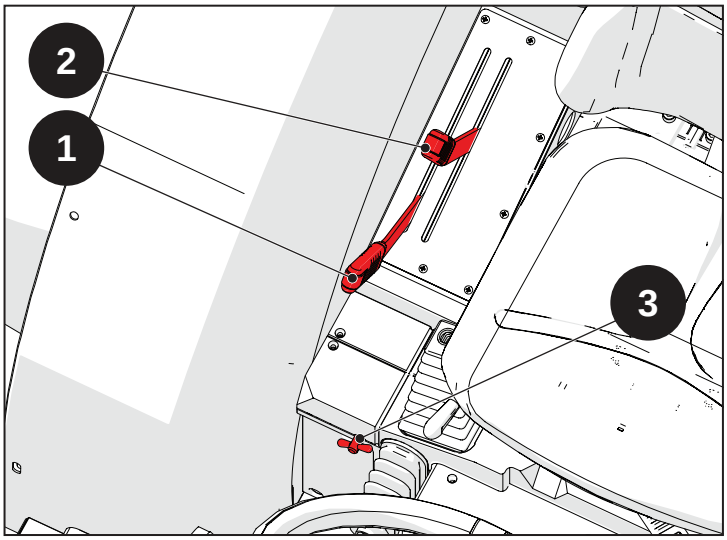

Fig. 12.8

12.4.1.3 Operating mode

POSITION CONTROL

Position control mode may be used to set and maintain the implement in any position between fully raised and fully lowered, either engaged in the soil or above the ground, by moving the control lever (1) into the required position.

Proceed as follows:

- The lever (1) controls the position of the arms; each position of the lever corresponds to a position of the lift arms from fully raised (lever pulled back fully) to fully lowered (lever pushed fully forwards).
- Push the draft control lever (2) fully forwards.
- Move the position control lever (1) forwards to lower the arms or back to raise the arms.

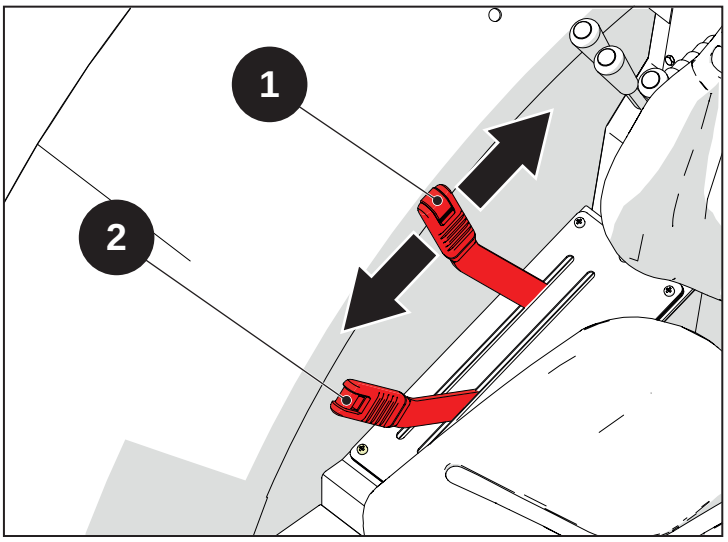

Fig. 12.9

The implement remains at the same working depth even if the consistency of the terrain changes (e.g.: zone c = clay soil; zone d = sandy soil; zone e = compacted soil)

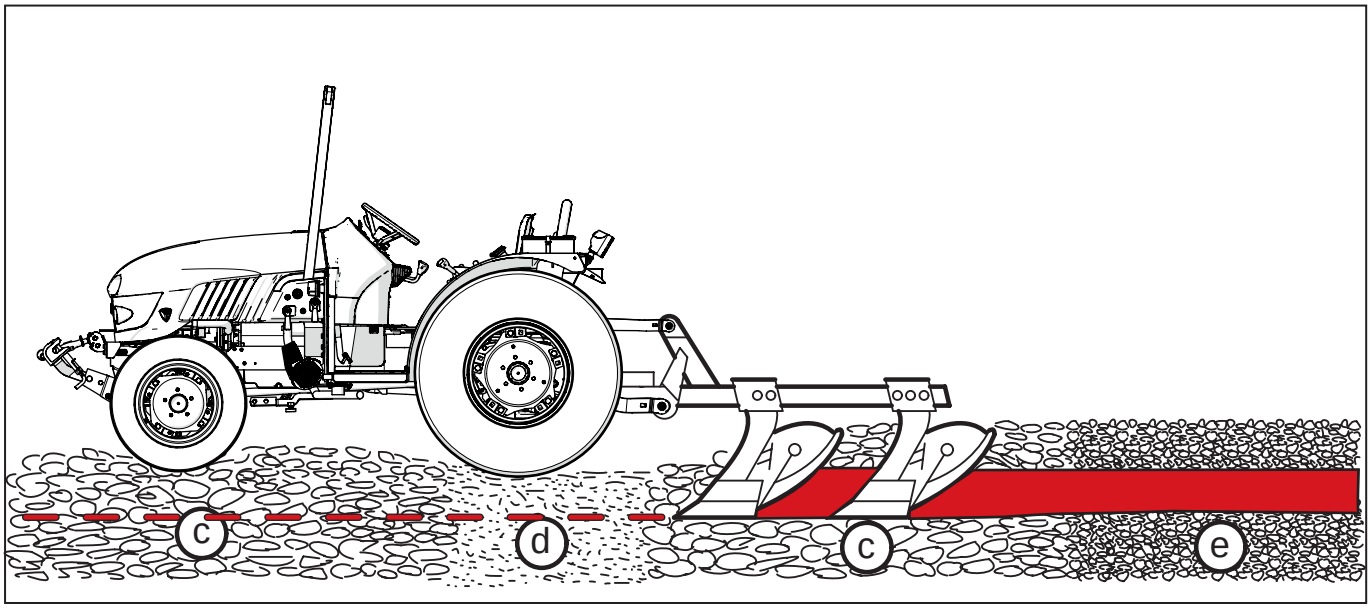

Fig. 12.10

DRAFT CONTROL

The draft control function is particularly useful for tasks with high draft demands performed with mounted implements, as the weight of the implement shifts much of the draft force to the rear wheels and increases the traction of the tractor relative to the terrain.

With this mode, the working depth of the implement may vary significantly when the implement itself encounters differences in terrain consistency (e.g.: zone c = clay soil; zone d = sandy soil; zone e = compacted soil), whether flat or with dips and humps.

Proceed as follows:

- Move the position control lever (1) fully forwards.
- Move the draft control lever (2) forwards gradually to engage the implement at the required working depth. The working depth attained by the implement is proportional to the draft force and dependent on the consistency of the soil. In this mode, the draft force requested by the lift from the tractor remains constant.
- At the end of each pass, use the position control lever (1) to raise the implement.

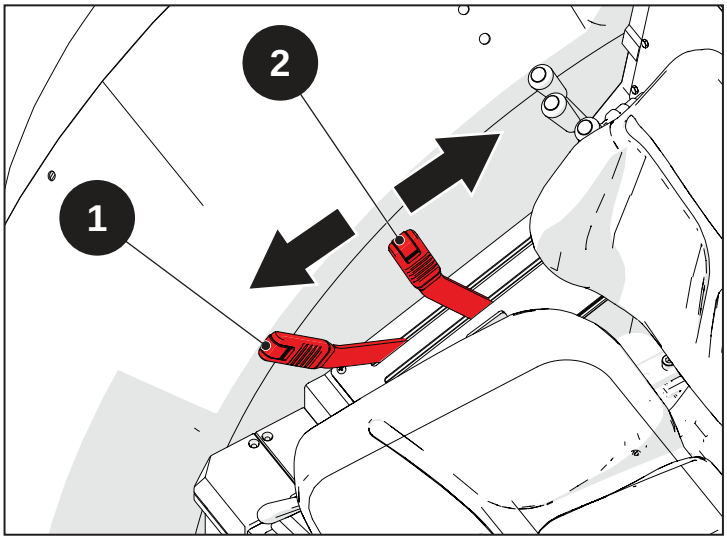

Fig. 12.11

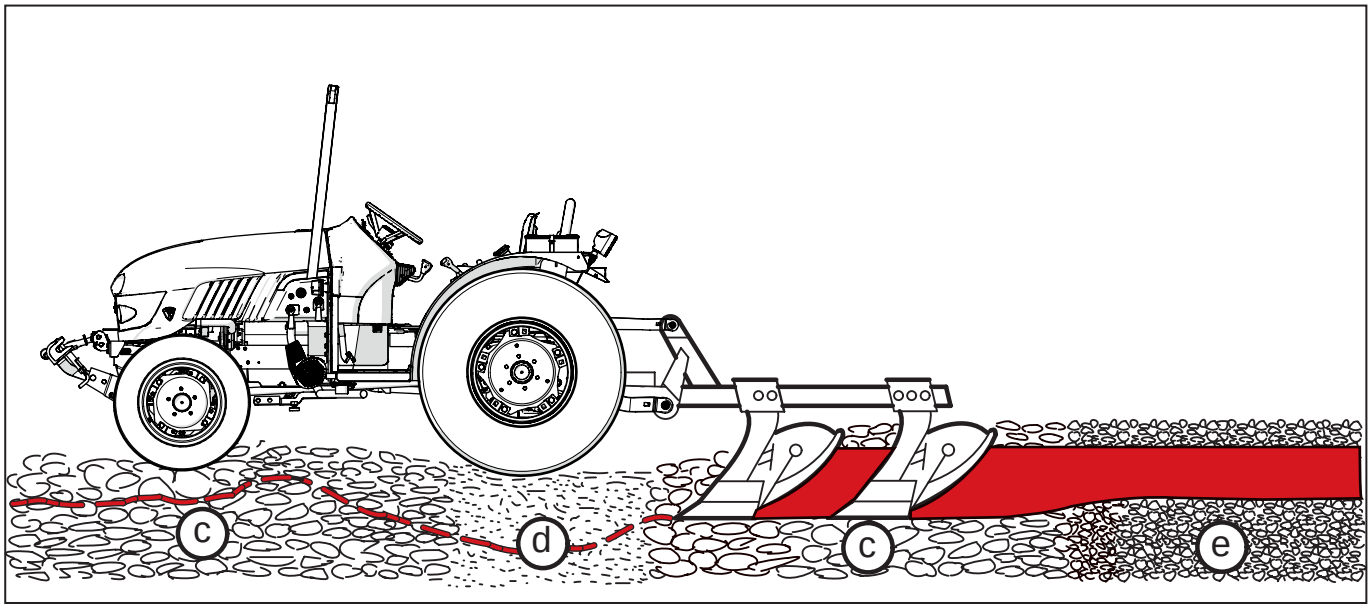

Fig. 12.12

MIXED POSITION/DRAFT CONTROL

Using the draft control function may produce excessive variations in working depth for certain crop applications

In these cases, mixed position/draft control mode may be used instead. Engage the implement in the soil and set the required working depth as described for draft control mode.

- Engage the implement in the soil and set the required working depth as described for draft control mode.
- Once the implement has stabilised at the required working depth, pull the position control lever (1) back until the lift arms tend to lift.
- With these settings, the lift controls draft but prevents the implement from engaging too deeply if it encounters softer terrain.
- Use the position control lever (1) to lower and raise the implement at the start and end of each pass.

Adjust the lever while working to determine the ideal position which offers the best compromise between variations in draft and variations in depth.

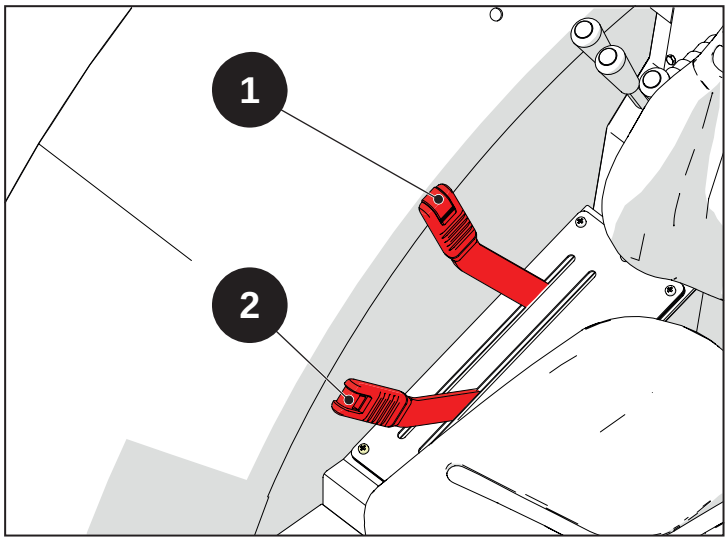

Fig. 12.13

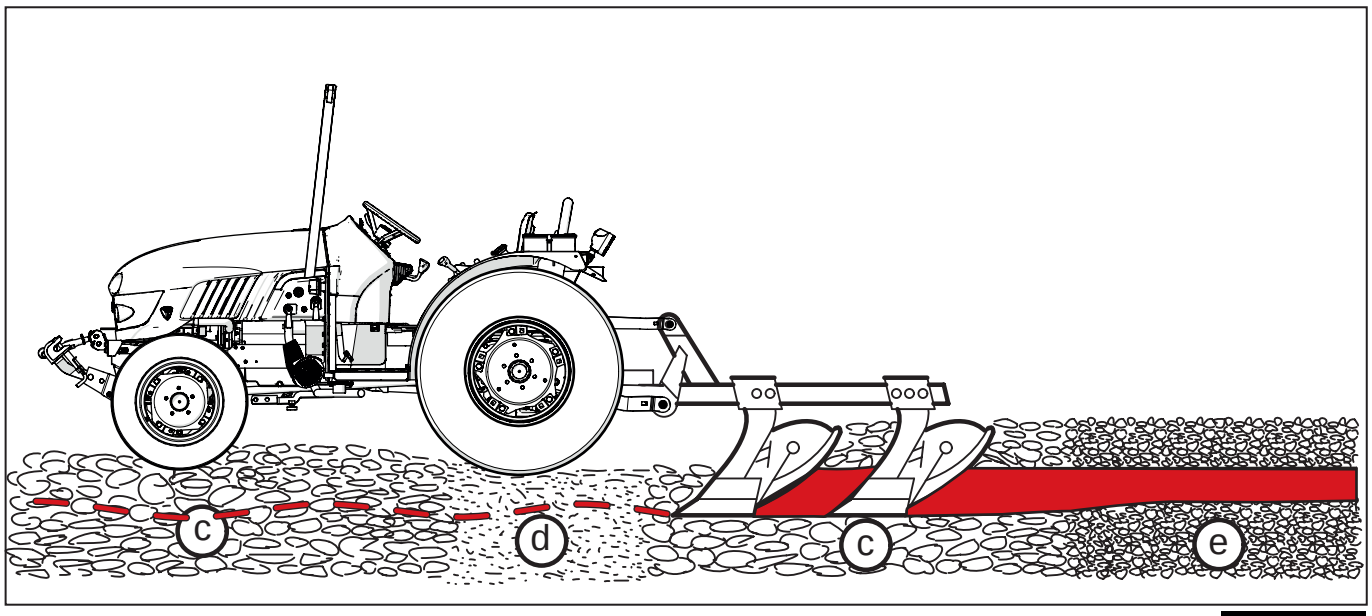

Fig. 12.14

FLOAT MODE

- Push the position control lever (1) and the draft control lever (2) fully forwards.
- Use the position control lever (1) to lower and raise the implement at the start and end of each pass.

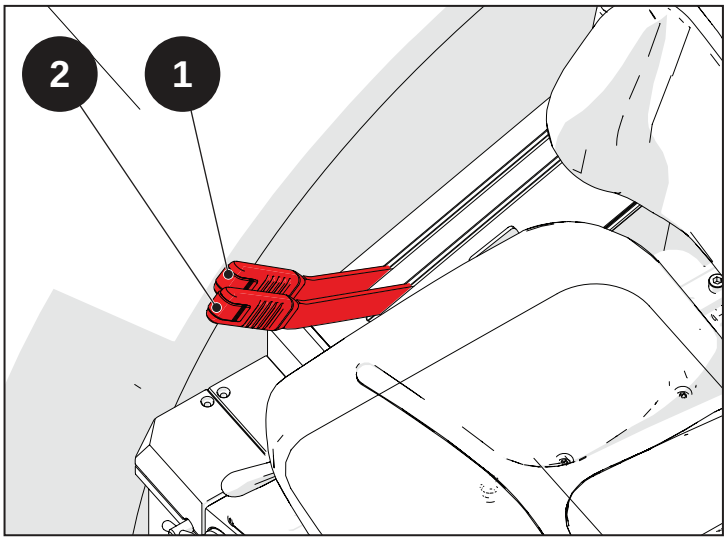

Fig. 12.15

12.4.2 Technical characteristics

Rear lift	Hydraulic with position and draft control
Lift capacity at lower link ends	2400 kg
3-point linkage category	Category 1 and 2
Mechanical top link arm	Category 1 and 2
Hydraulic top link arm	Category 1 and 2 / 1 and 2 with quick hitch
Lower arm type	Telescopic with quick hitch
Right hand stabiliser bar type	Hydraulic

12.4.3 Main adjustments

12.4.3.1 Adjusting the position and draft control tie-rods

Warning
The adjustments described below must be made with no implements hitched to the tractor.

Adjusting the position lever tie-rod

The maximum lift height of the lift is adjustable with the cam tie-rod. Move the position lever (1) all the way up and the draft lever (2) all the way down.

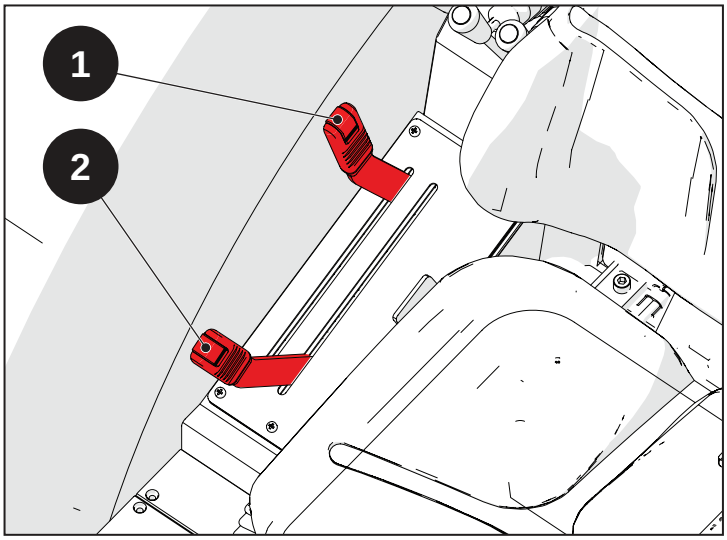

Fig. 12.16

Adjust the tie-rod with the nut until the pump is under no load.

Warning
The lift arms must have a dead zone of 3 cm in the maximum lift height position to prevent the pump from remaining under pressure.

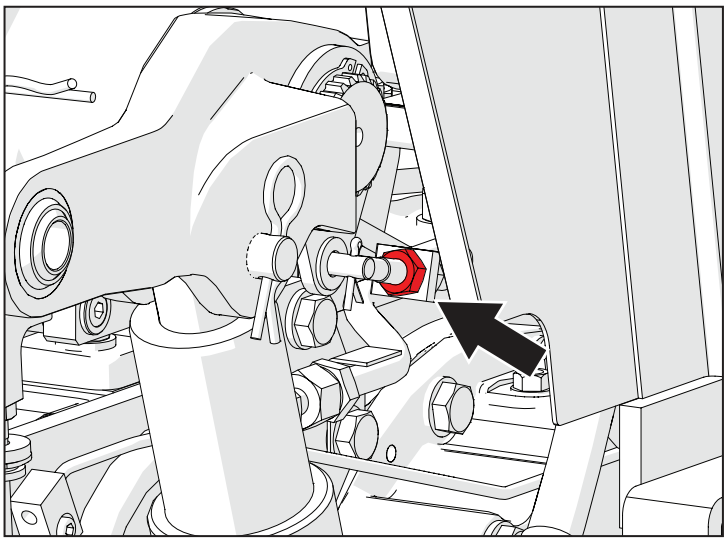

Fig. 12.17

Adjusting the draft lever tie-rod

Fit tool (F-p/n 07000249) to pull the top link mount back.

Warning
The top link must have no free play.

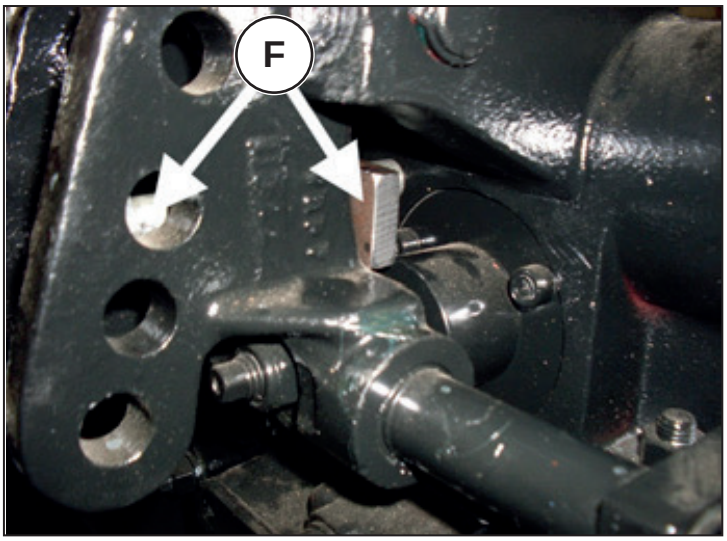

Fig. 12.18

Move the position lever (1) all the way down and the draft lever (2) all the way up. The lift rises.

Move the lever down by 5-6 notches.

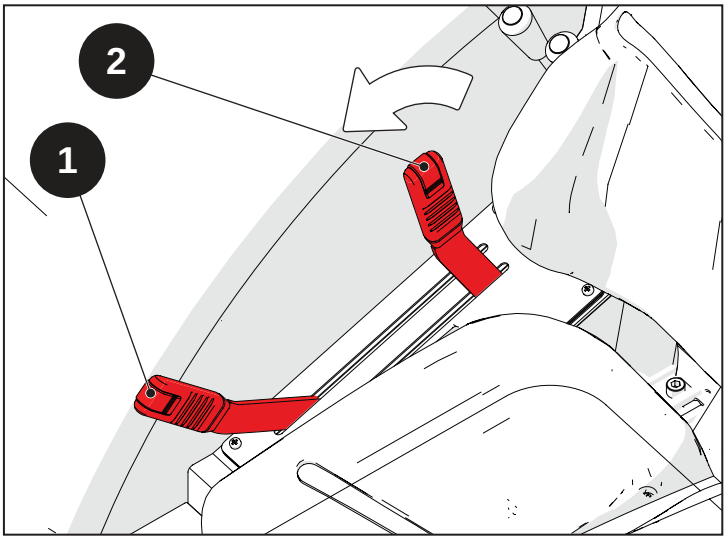

Fig. 12.19

Adjust the tie-rod on the top link mount until the lift just starts to lower, and then tighten the check nut.

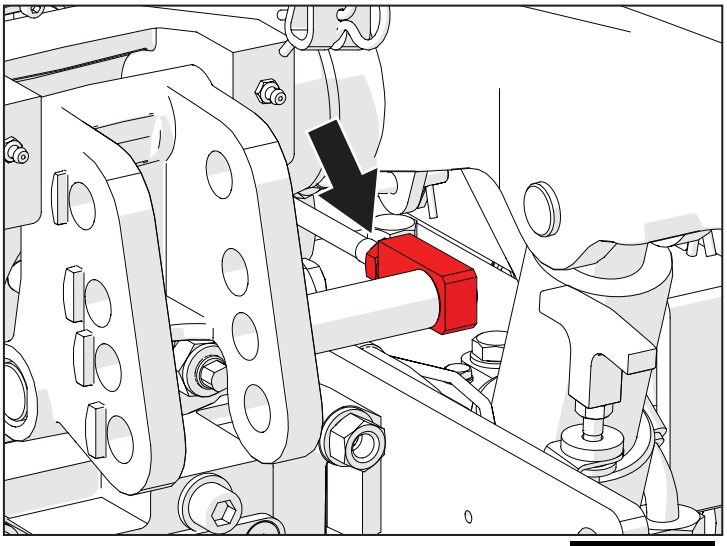

Fig. 12.20

12.4.4 Disassembling front side of distributor

Undo the 3 fastener screws of the cover and remove the cover. The internal components of the two valves may now be removed.

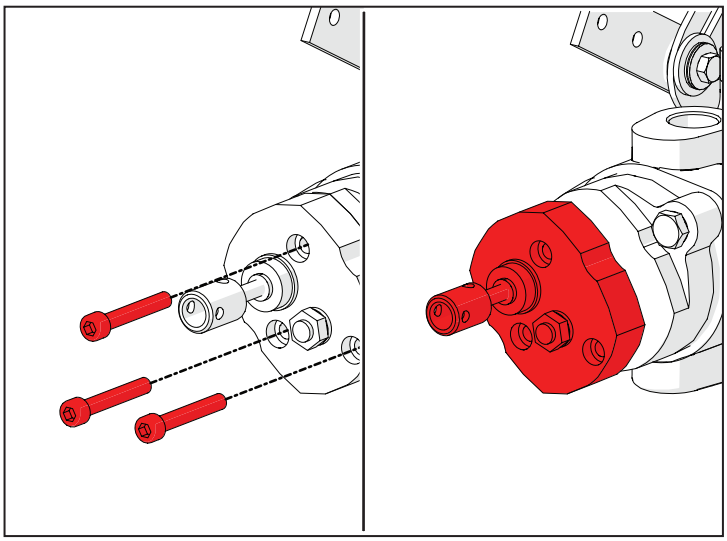

Fig. 12.21

The internal components of the distributor, grouped by utility channel, are shown in the figure.

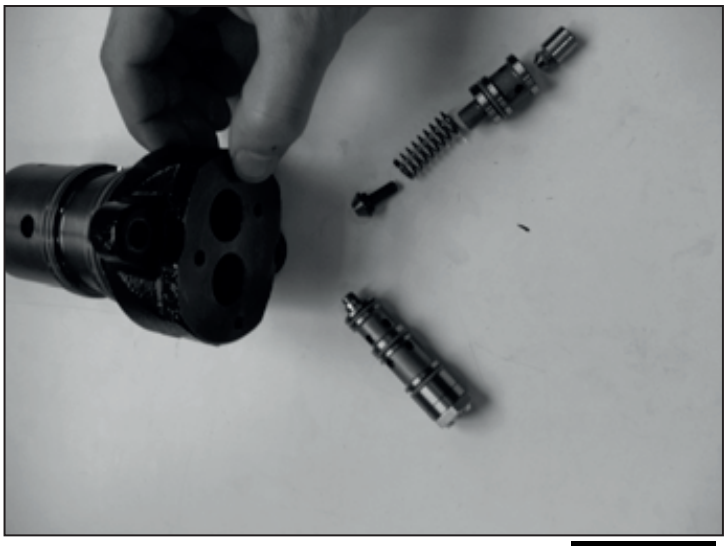

Fig. 12.22

12.4.5 Disassembling rear side of distributor

Undo the 3 screws and remove the spool retainer plate.

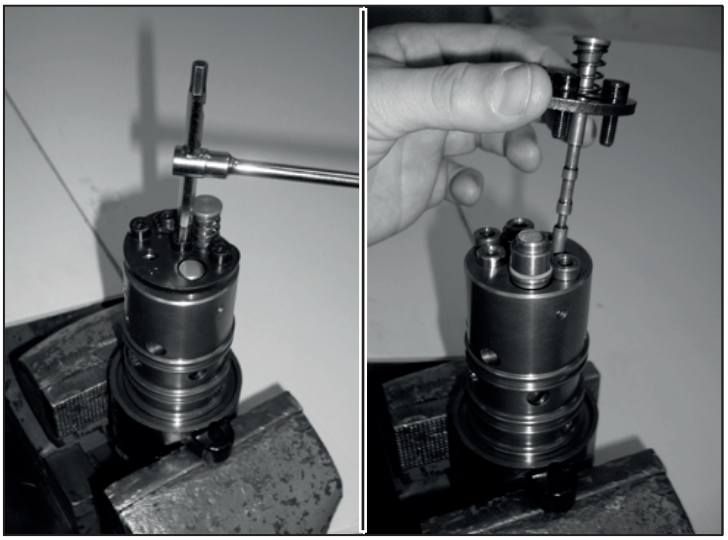

Fig. 12.23

Remove the spring, the ball and the two spacers.

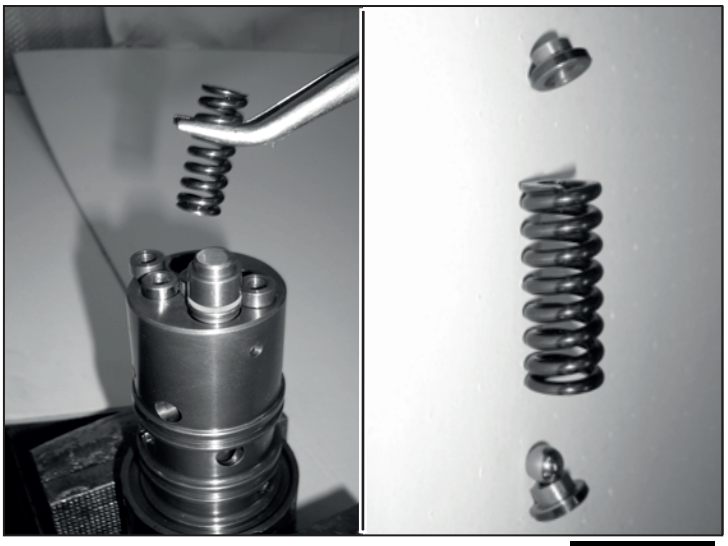

Fig. 12.24

Remove the valve seat, the valve and the relative spring.

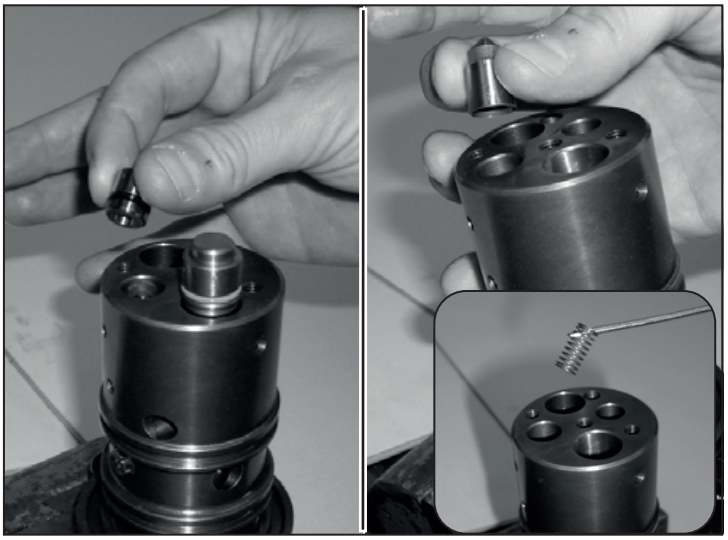

Fig. 12.25

Remove the spring holder cap and the valve seat.

Fig. 12.26

The internal components of the distributor, grouped by utility channel, are shown in the figure.

Fig. 12.27

The retainer plate, the three fastener screws with the relative spacers and the internal spool with the relative spring are shown in the figure.

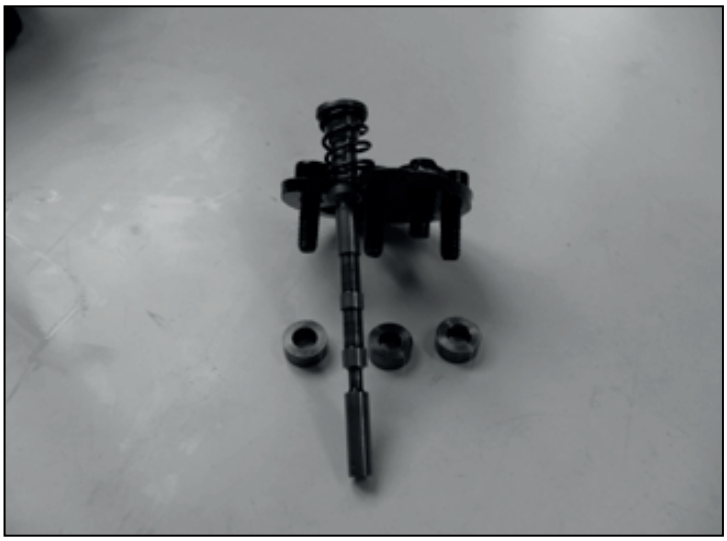

Fig. 12.28

When reassembling the distributor, check that the O-rings are in good condition and are not pinched.

Lubricate the O-rings with grease to prevent malfunctions requiring the unit to be disassembled and serviced again.

Fig. 12.29

If the lift bounces when weight is applied, adjust the sensitivity with the screw B.

Move the lift arms to approximately the mid travel point. In this position, the control distributor is in the neutral state. Loosen the check nut and undo the grub screw until the lift stops bouncing. Undo the grub screw by another half a turn and tighten the check nut.

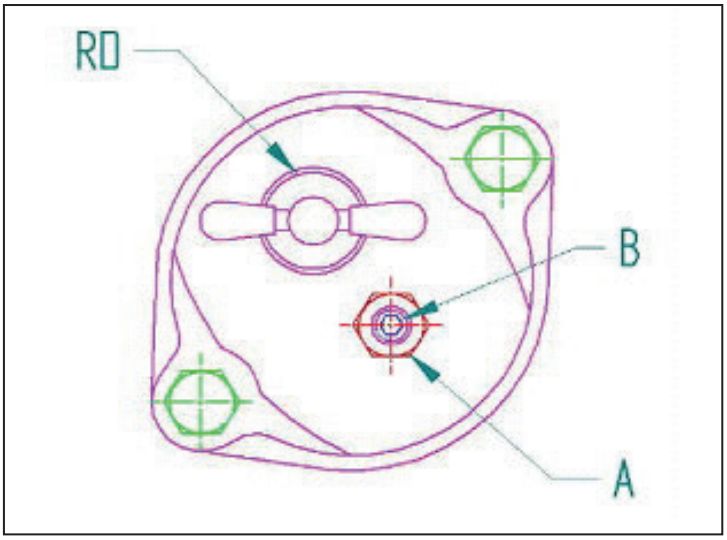

Fig. 12.30

12.4.6 Dismantling internal lift distributor linkages

Note

The correct sequence of operations for fitting the internal and external lift linkages is illustrated here. This procedure is illustrated for informative purposes only, to present the main linkage components of the rear lift.

Problems with these components are extremely, and the procedure to assemble the components themselves is extremely simple. An overview of the assembly is simply shown in this sequence of photographs, as it is not necessary to describe the operations in detail.

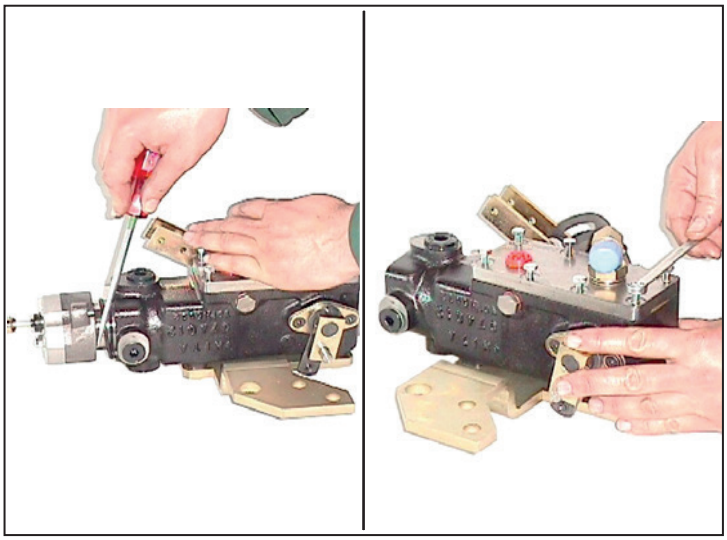

Fig. 12.31

The preliminary operations necessary in order to remove the internal position and draft control linkages are illustrated on this page.

The main purpose of these images is to present and allow the operator to recognise all the linkages and pivots constituting the components of the inner linkage mechanism.

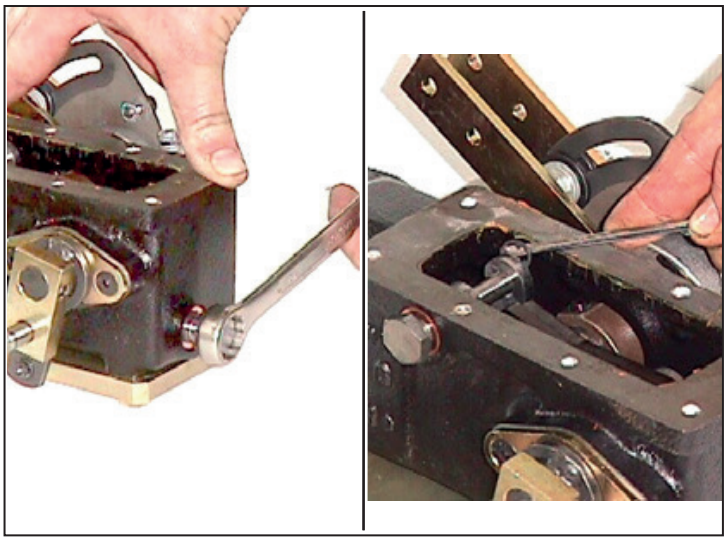

Fig. 12.32

The images illustrate the steps in the disassembly of the two position and draft control cams.

Unlike other lift control distributors, this distributor features a number of fixed settings and preset control positions.

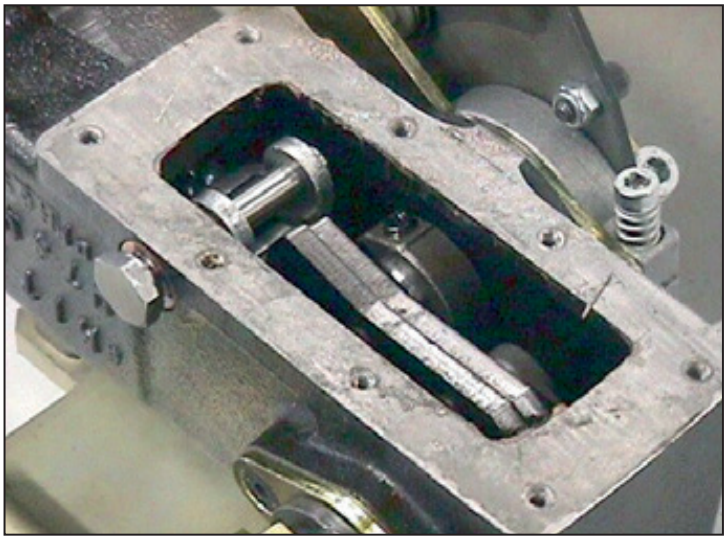

Fig. 12.33

The images on this page illustrate the steps in the subsequent procedure to disassemble the external position and draft control levers.

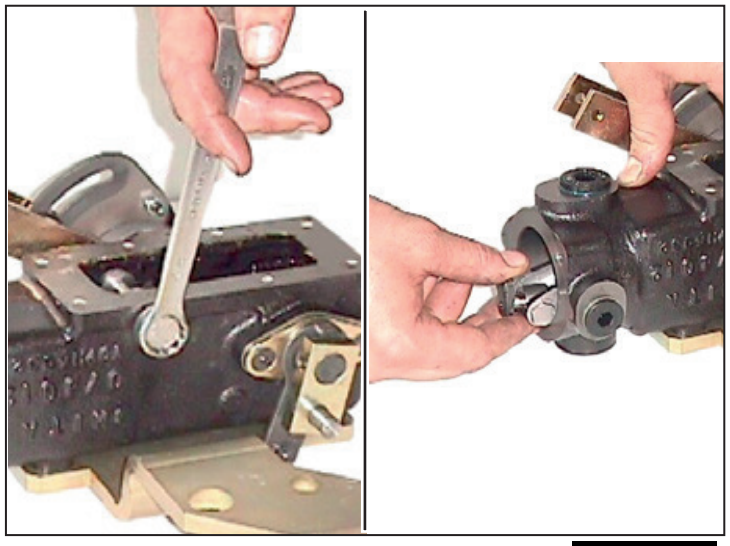

Fig. 12.34

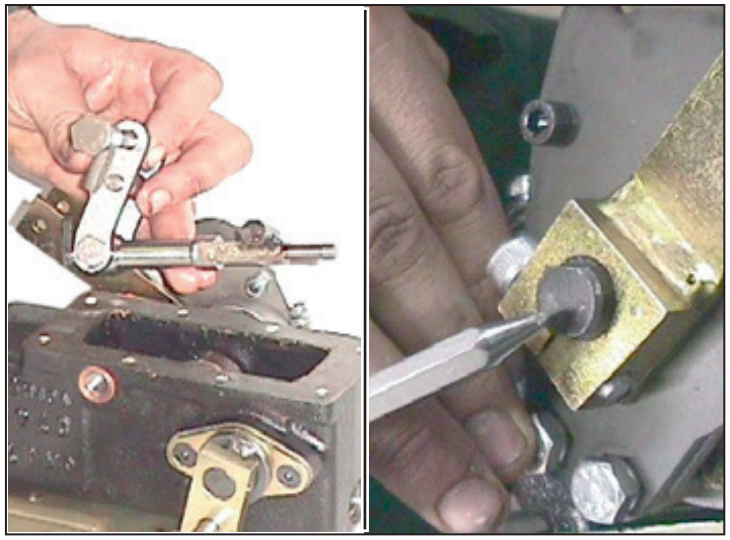

Fig. 12.35

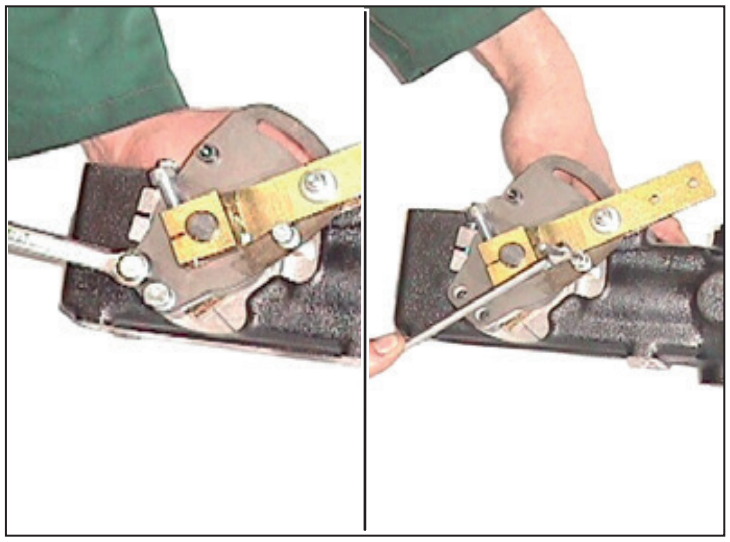

Fig. 12.36

The next sequence of images illustrates the steps in the procedure to fit the pivot of the position and draft control levers. These images illustrate the steps in the disassembly procedure necessary to check for damaged internal components.

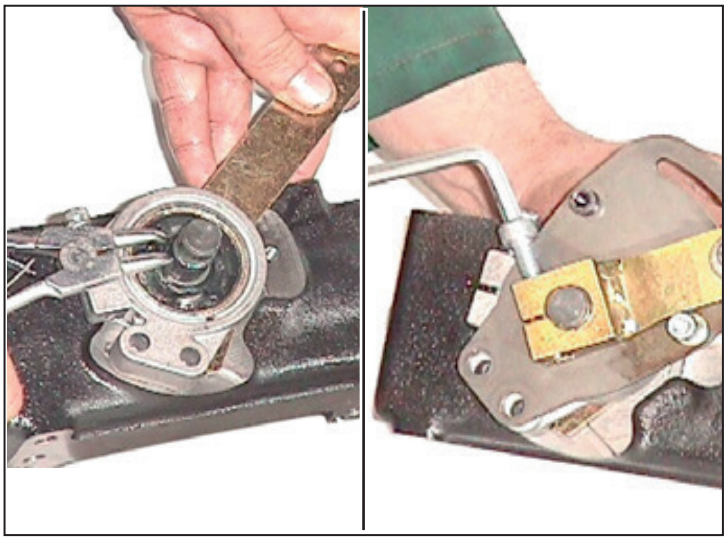

Fig. 12.37

The order of the steps in the procedure only is shown, as components can only be installed in the correct positions and no particular adjustment is necessary.

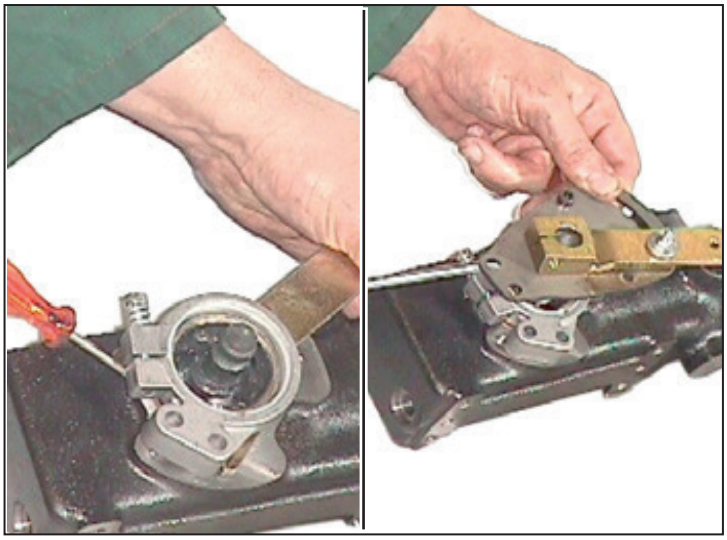

Fig. 12.38

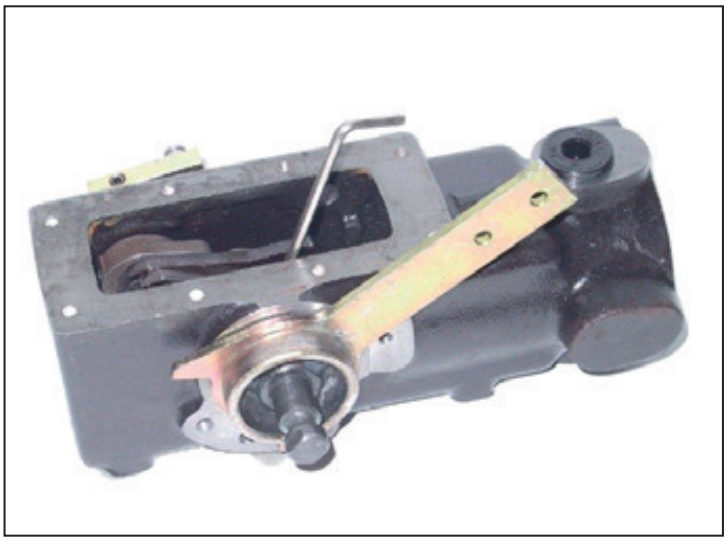

Fig. 12.39

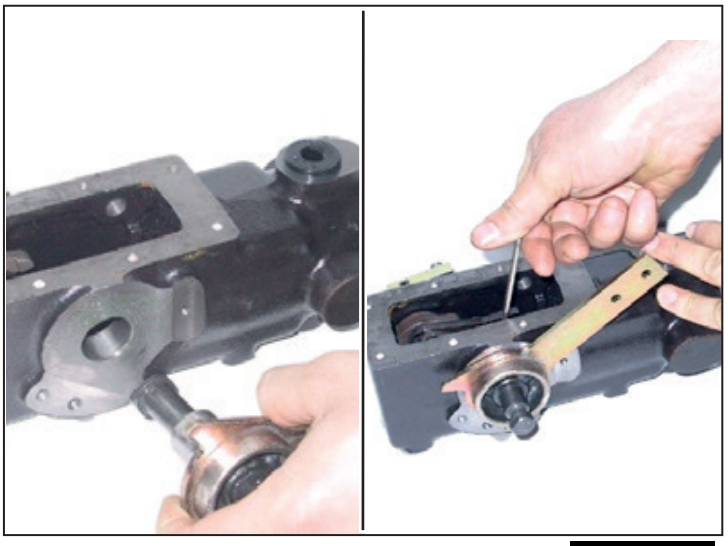

Fig. 12.40

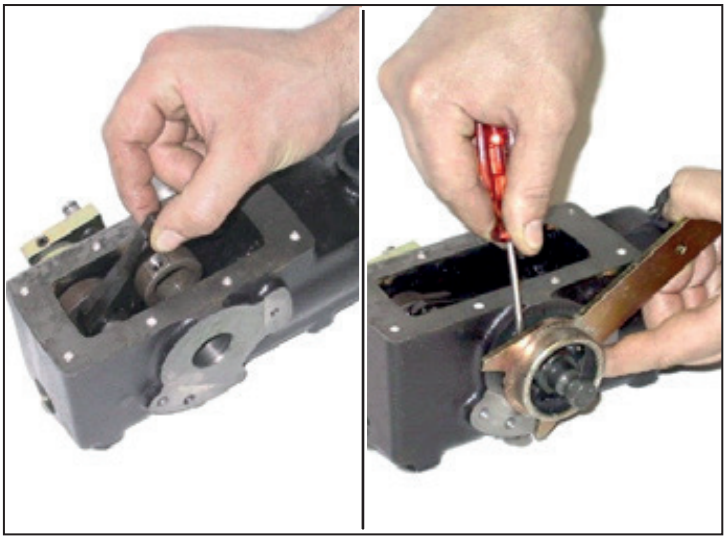

Fig. 12.41

The final step in the disassembly procedure is to remove the double fork implementing position and draft control of the lift.

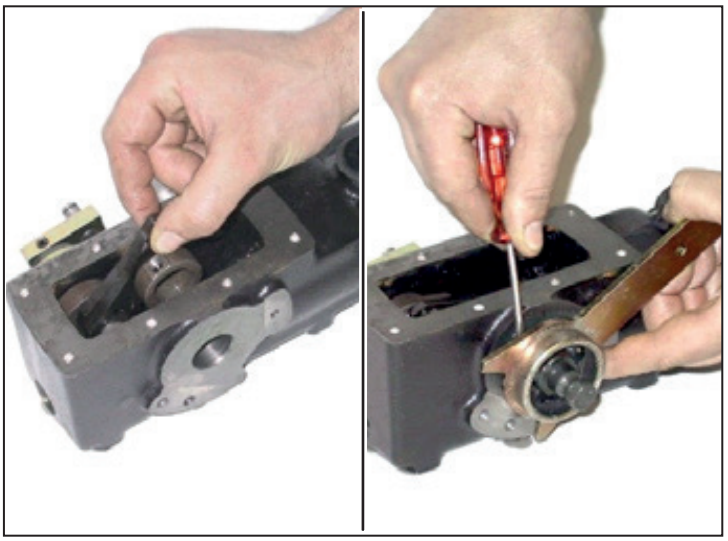

Fig. 12.42

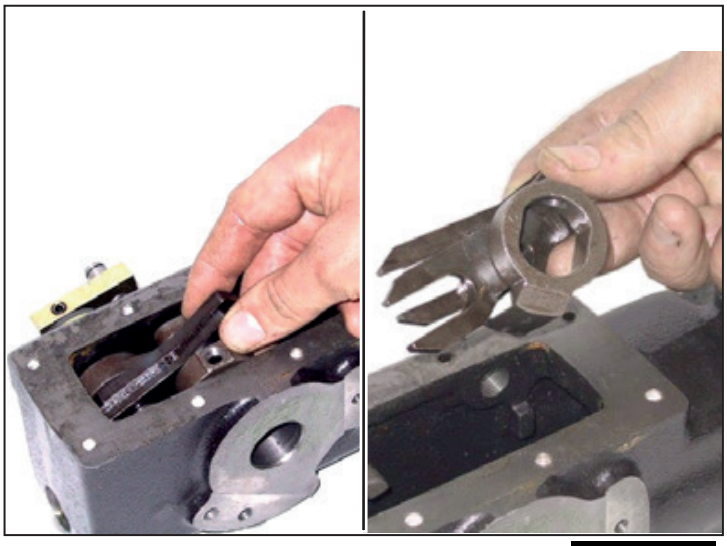

Fig. 12.43

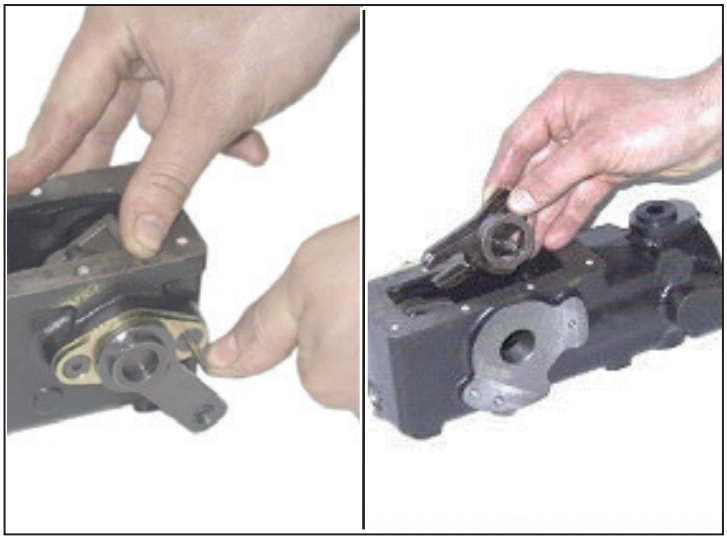

Fig. 12.44

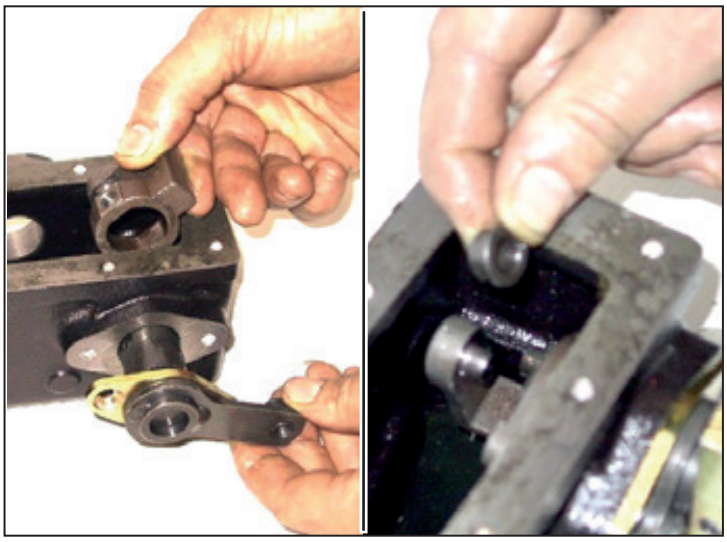

Fig. 12.45

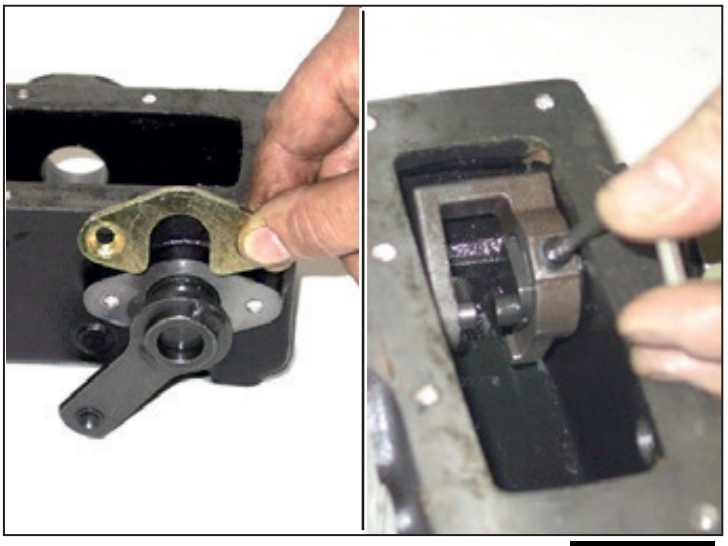

Fig. 12.46

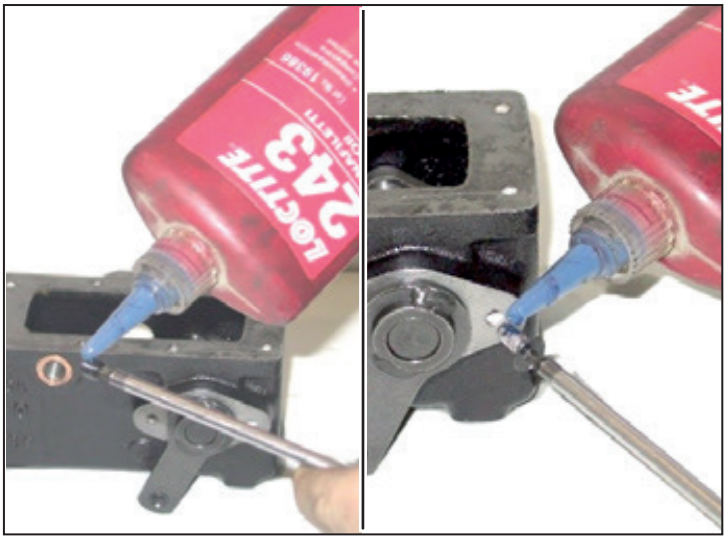

Fig. 12.47

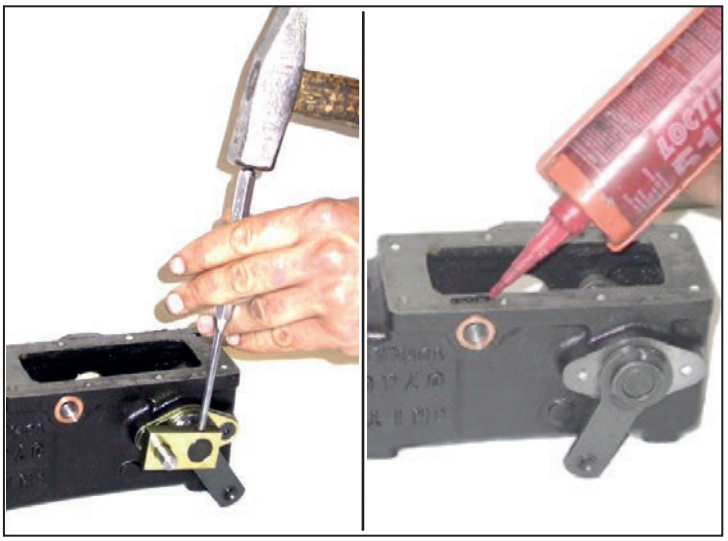

Fig. 12.48

Carry out the following checks to ensure that the position and draft control link rods are adjusted correctly on the tractor:

- With no implement connected to the lift and with the position control lever fully raised, push the draft control lever towards its upper stop and check that the arms start to rise at approximately 3/4 of its travel.

- If this does not occur, adjust the draft control link rod as necessary until the lift arms start to rise at the correct lever position.

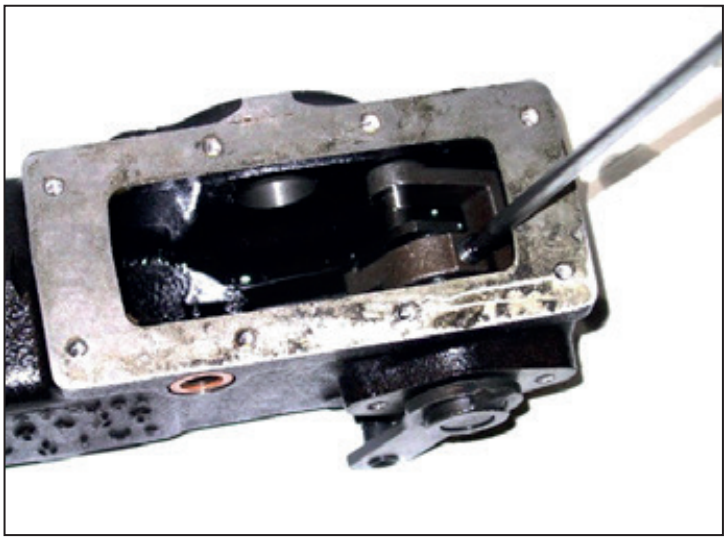

Fig. 12.49

12.5 Main components

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12.5.1 Hydraulic pump 12-42

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12.5.6 Front hydraulic distributors 12-47

12.5.1 Hydraulic pump

The tandem hydraulic pumps are situated on the right hand side of the tractor. The pumps are driven by the timing system gears and deliver oil to the high and low flow rate circuits. Oil from the gearbox and filtered by the suction line filter flows into the suction pipe (A). The pump sends oil via (B) to the high flow rate circuit of the auxiliary distributors. Two throttles are situated just after the pump to redirect oil to lubricate the gearbox. The pump sends oil via (C) to the low flow rate circuit, which feeds the priority valve delivering oil to the remaining utilities.

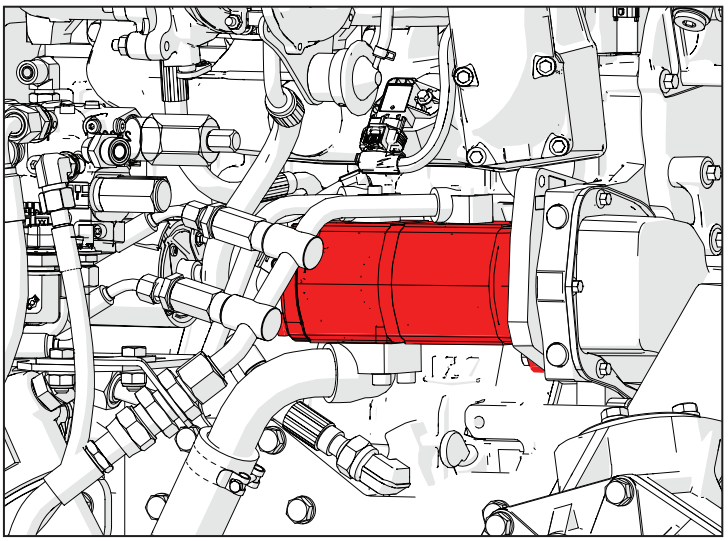

Fig. 12.50

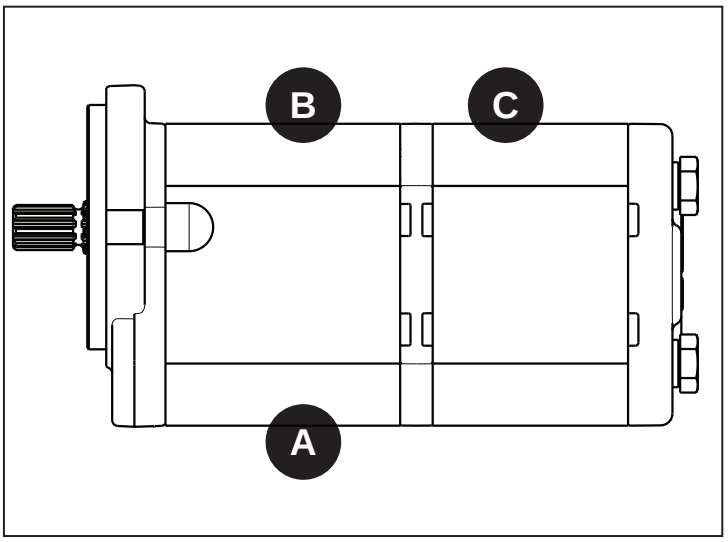

Fig. 12.51

12.5.2 Priority valve

The priority valve delivers oil with priority to the steering unit over other functions. The priority valve then delivers oil to the remaining utilities in relation to demand.

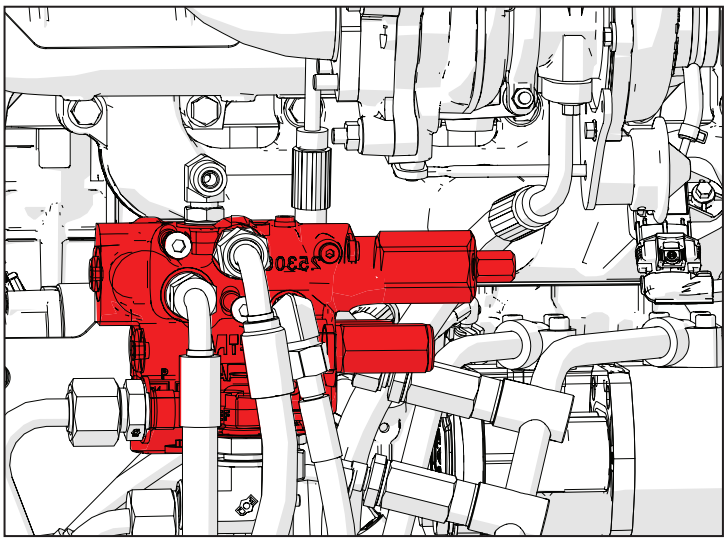

Fig. 12.52

Oil flow is received from the pump via the pipe (P), and, if not used, is sent to the drain line via (T).

The valve monitors the oil demand of the accumulator via the channel (F) and, if necessary, sends oil to meet this demand via (R).

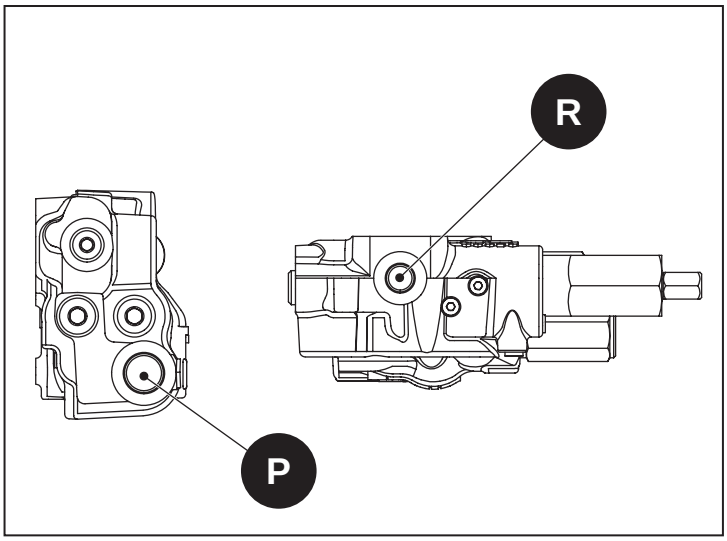

Fig. 12.53

The valve monitors the oil demand of the hydraulic steering unit via the load sensing channel (L1), and sends oil to meet this demand via (ST).

The demand of the trailer braking system, if applicable, is monitored via the load sensing channel (L2), and oil is sent to meet this demand via the pipe (TB).

The lift receives oil via the pipe (EF).

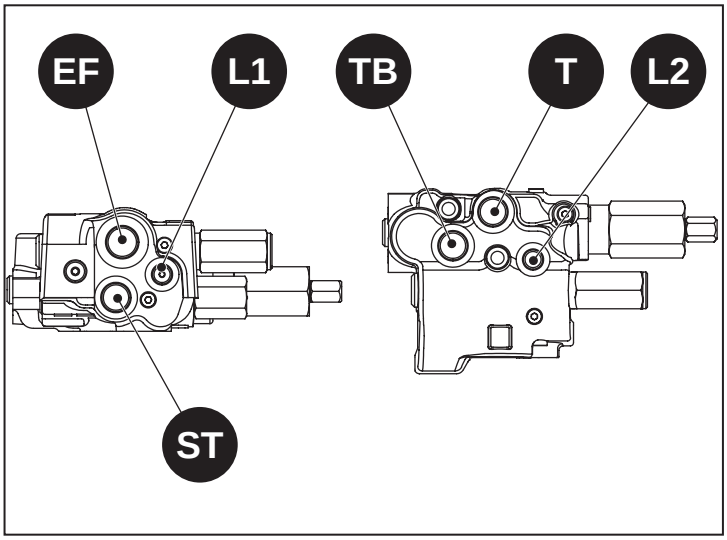

Fig. 12.54

12.5.3 Hydraulic steering valve

The hydraulic steering circuit has priority over other functions and, whenever the steering wheel is turned, draws the necessary quantity of oil from the low flow rate circuit to move the double acting cylinder in response to the steering input of the driver. The circuit also includes a pressure relief valve calibrated to 125 bar and two overpressure safety valves protecting the cylinder and the hydraulic steering unit against accidental damage.

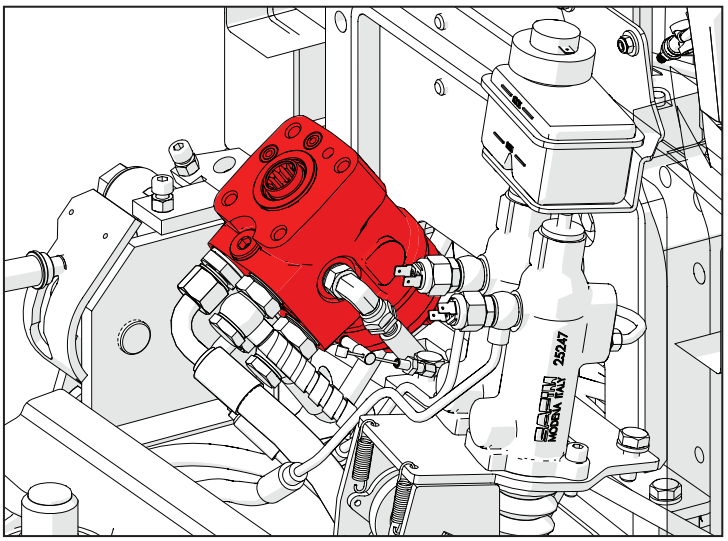

Fig. 12.55

12.5.4 Rear hydraulic distributors

The tractor is equipped with auxiliary hydraulic distributors situated on the rear right hand side of the tractor for operating external hydraulic cylinders. The distributors are fed directly by the pump via the high flow rate circuit.

A number of different configurations with the following types of distributor are available:

- Single acting;
- Double acting;
- Double acting with drain detent;
- Double acting distributor with float mode.

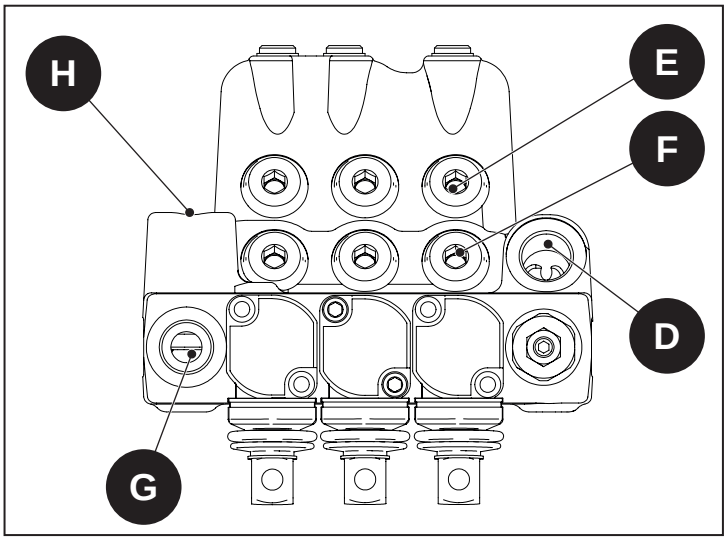

Fig. 12.56

Oil received from the high flow rate pump flows directly into the inlet head (D), which is equipped with a pressure relief valve (K) calibrated to 180 bar. In response to movements of the distributor levers, oil is sent to the delivery (E) or return (F) hydraulic couplers, and then to the drain line (G). If there is no oil demand from the distributors, the oil is sent to the drain line (H).

Note

While the distributors are fed simultaneously, operating one disables oil feed to the other distributors in the system, impeding simultaneous usage.

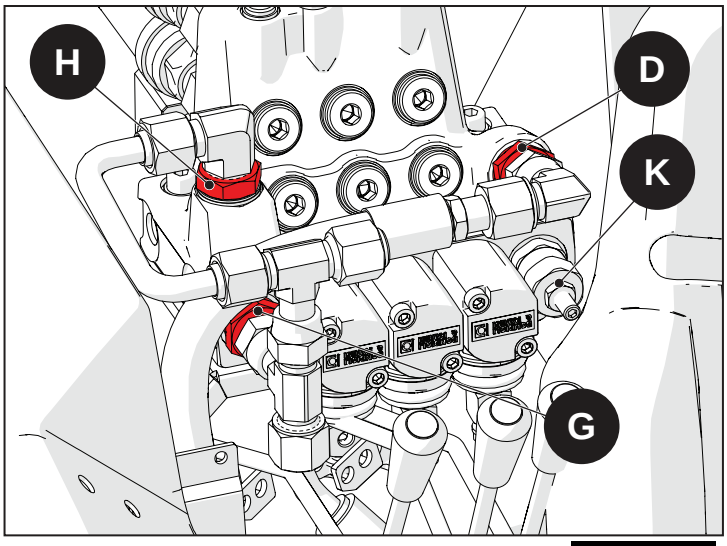

Fig. 12.57

12.5.5 Hydraulic unit

The hydraulic unit is situated under the platform. The hydraulic unit receives oil from the priority valve (I) and controls engagement of the differential lock and 4WD.

While the solenoid valves are energised, the priority valve also feeds oil to the accumulator (which is used to ensure the additional flow necessary if multiple utilities are activated by the priority valve).

4WD is engaged by default and is actively disengaged. Each time the tractor is switched on, the 4WD engagement solenoid valve (O) is energised and delivers oil (P) at a pressure of 40 bar to disengage the hydraulic clutch. When the driver presses the 4WD selector button, the solenoid valve is de-energised, compressing the clutch pack and transmitting drive to the front wheels.

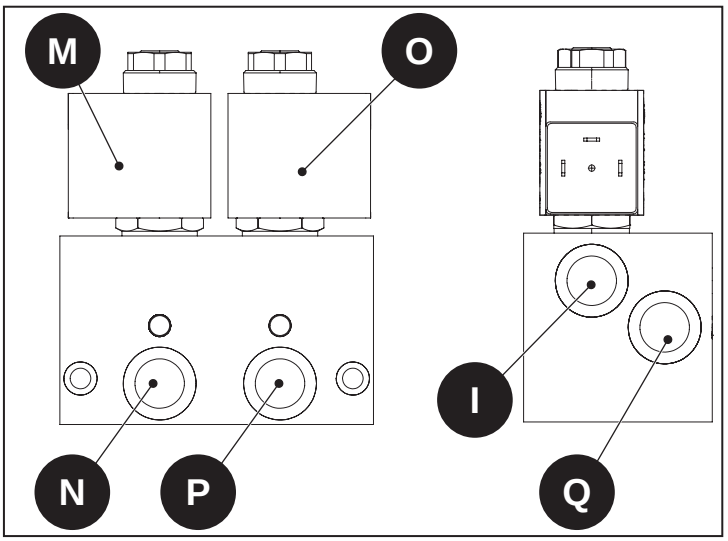

Fig. 12.58

The differential lock is operated by pressing the BD on/off button. This energises the solenoid valve (M), which delivers oil (N) to the actuator cylinder, which overcomes the force of the spring and engages the clutch.

The oil used by the hydraulic unit is returned to the transmission (Q).

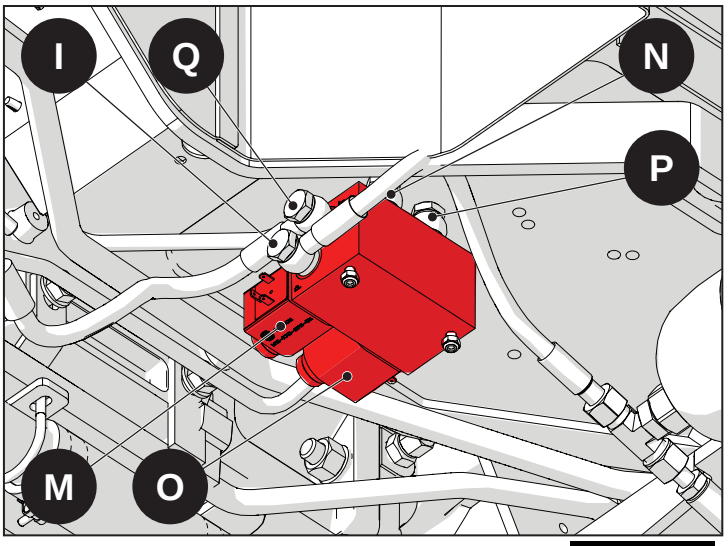

Fig. 12.59

12.5.6 Front hydraulic distributors

Depending on configuration, the tractor may be equipped with supplementary distributors situated at the front right of the machine. On tractors equipped with supplementary distributors, these are fed with the same oil flow used for the rear distributors by the high flow rate circuit. The oil flow rate is controlled by a second priority valve situated ahead of the distributors.

A number of different configurations with the following types of distributor are available:

- Single acting with float mode detent;
- Double acting;
- Double acting with lever detent;
- Double acting with fourth float mode position and lever detent.

The number of front distributors installable depends on the configuration of the tractor

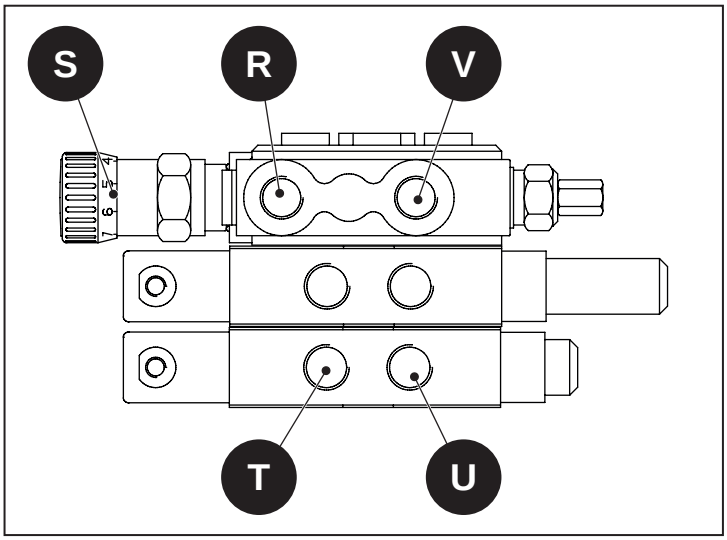

Fig. 12.60

Configuration	No. of distributors
Roll bar without front lift	3
GL cab without front lift	3
SG1 cab without front lift	2
Roll bar with front lift	2
GL cab with front lift	2
SG1 cab with front lift	1

Oil from the priority valve is received by the flow regulator (R). The flow rate delivered to the front distributors may be increased or decreased by adjusting the cock of the regulator valve (S). This may be useful when it necessary to maintain a higher oil flow for other utilities (rear lift and rear distributors) or to prevent accidental damage implements which do not require the full flow rate.

In response to movements of the distributor levers, oil is sent to the delivery (T) or return (U) hydraulic couplers, and then to the drain line (V).

Note

While the distributors are fed simultaneously, operating one disables oil feed to the other distributors in the system, impeding simultaneous usage.

12.6 Checking operating pressure values

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12.6.2 Checking the hydraulic steering unit pressure relief valve calibration pressure 12-51

12.6.3 Checking the pressure of the 4WD circuit 12-52

12.6.4 Checking the pressure of the auxiliary distributors 12-52

12.6.5 Checking the pressure of the rear lift distributor 12-53

12.6.1 Introduction

The operating pressure values must be checked if any problems are experienced with any utilities and during a general check of the tractor itself.

Excessively low calibration settings for the pressure relief valves in the circuit may cause the hydraulic clutches to slip and unsatisfactory performance of the steering system, auxiliary distributors and lift.

Excessively high calibration settings for the pressure relief valves will stress all the components in the system.

After checking the values, correct the calibration settings if necessary with the relative adjuster screws.

Danger
Jets of escaping pressurised fluid may penetrate the skin and cause severe injury. In the event of an accident involving pressurised fluid, seek immediate medical attention to avoid the risk of severe infection

Danger
Take all precautions necessary to avoid burns when working with hot oil. Never heat oil to above 190°C, as the oil vapour may suddenly and spontaneously ignite.

Attention
Used oils must be collected and disposed of in compliance with applicable legislation.

Attention
Do not start work until the pressure in the hydraulic system has dropped to zero.

12.6.2 Checking the hydraulic steering unit pressure relief valve calibration pressure

The hydraulic steering unit pressure relief valve is calibrated to 125 bar. To check the calibration pressure of pressure relief valve, connect the pressure gauge (A-p/n 07000303) to the hydraulic steering unit pilot signal return pipe and move the steering cylinder to the end stops on the right and left hand sides.

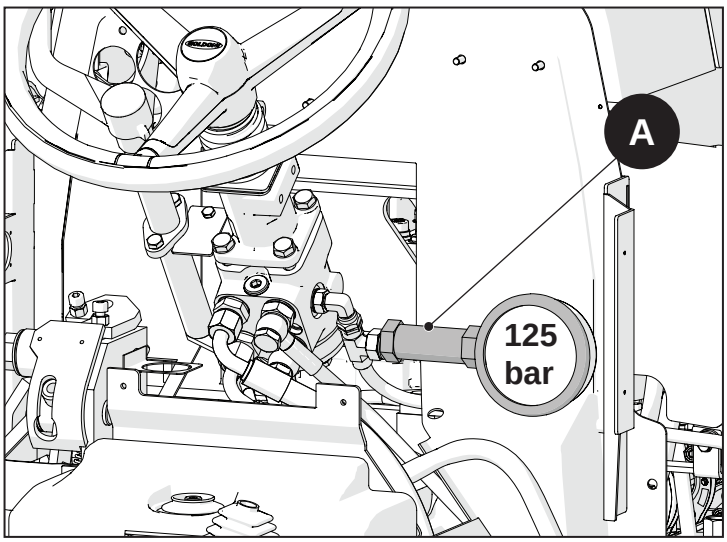

Fig. 12.61

Open the plug R to adjust the calibration pressure of the hydraulic steering unit pressure relief valve.

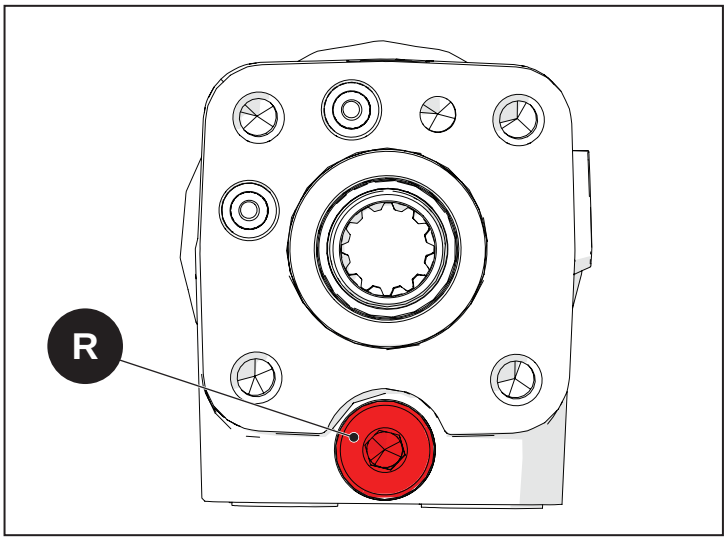

Fig. 12.62

12.6.3 Checking the pressure of the 4WD circuit

To check the pressure in the 4WD circuit, a pressure gauge with a cock may be fitted onto the 4WD unit delivery connector. Close the cock and check that the output pressure from the solenoid valve is between 40 and 42 bar.

If the pressure measured is within specifications, check that there are no leaks within the 4WD unit. Open the cock and check that the pressure does not drop.

Tools
07000303: pressure gauge.

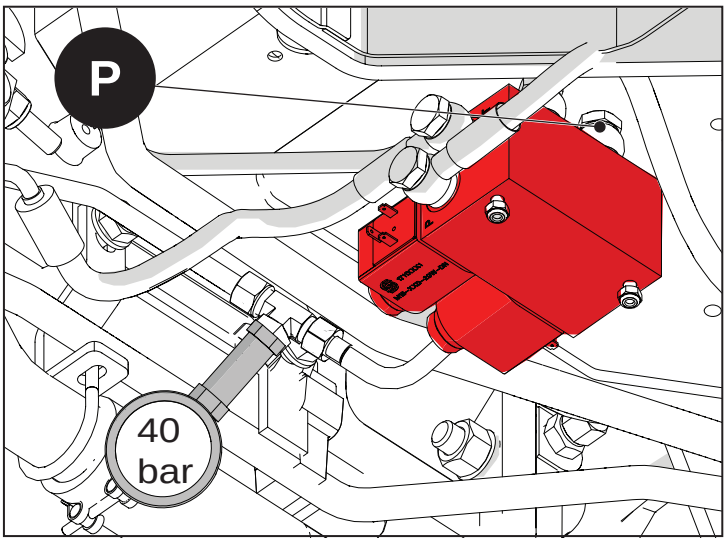

Fig. 12.63

12.6.4 Checking the pressure of the auxiliary distributors

Connect a pressure gauge to the outlet of the quick connector of one of the hydraulic couplers. With the engine running, use the relative control lever.

A value of 180 bar should be read on the pressure gauge.

If the values read are not as indicated, adjust the setting of the pressure relief valve on the rear distributor mounting plate.

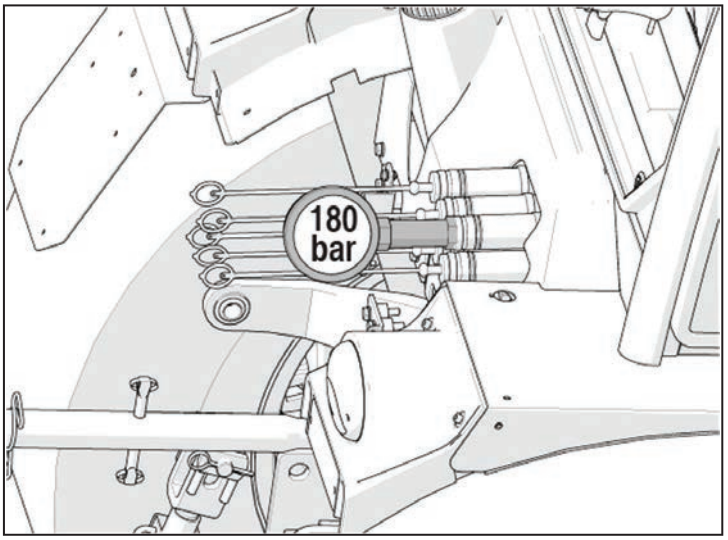

Fig. 12.64

12.6.5 Checking the pressure of the rear lift distributor

Fit a pressure gauge on the delivery connector to check the pressure of the lift distributor.

Lock the lift arms with the tool (B-p/n 07006220). This tool simulates lifting a load exceeding the maximum capacity of the lift.

Use the lift position lever and check that a pressure of 180 bar is indicated on the pressure gauge.

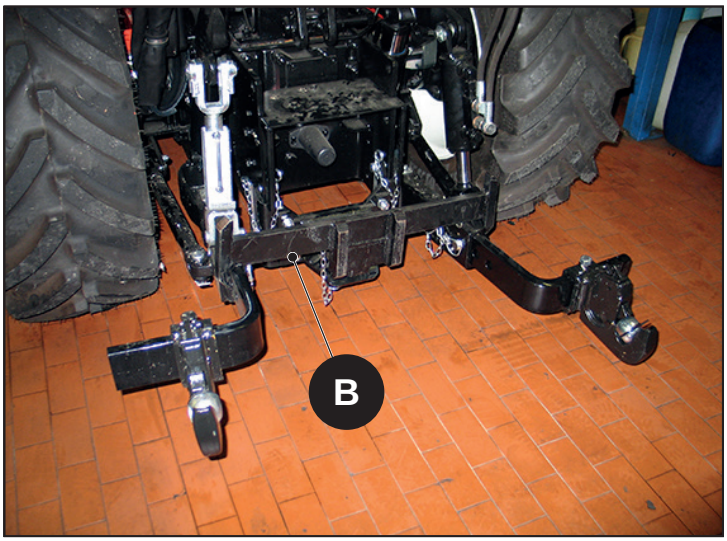

Fig. 12.65

Adjust the pressure relief valve calibration using the check nut.

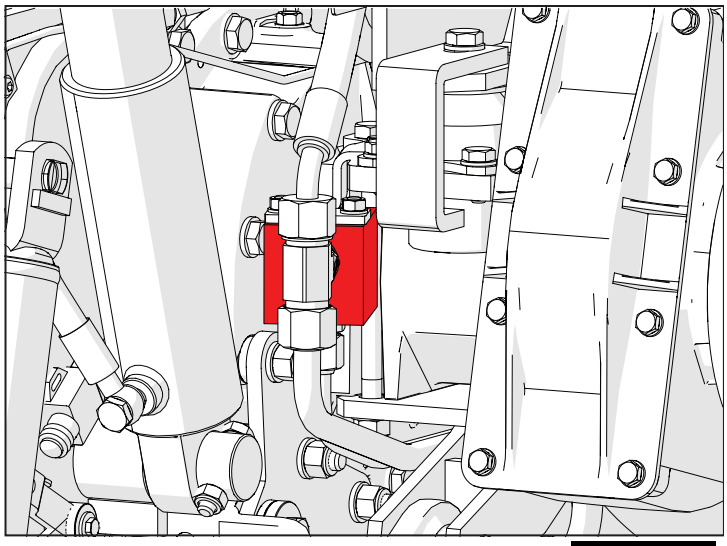

Fig. 12.66

12.7 Tools necessary

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12.7.1 Tools necessary 12-56

12.7.1 Tools necessary

p/n	Description	Quantity
07000249	Lift draft adjustment tool	1
07000303	Pressure gauge	1
07006220	Arm locking tool	1

13 : Platform

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13.2.3 Refitting.....13-23

13.3 Tools necessary 13-25

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13.1 Safety rules

These safety precautions and warnings given in this paragraph must be observed at all times to prevent the risk of operator injury. However, the safety measures indicated in the use and maintenance manual and in chapter 1 of this manual must also be applied at all times.

Danger
All other persons must keep at a safe distance from the danger area.

Danger
Lift and handle all heavy parts with lifting equipment of adequate load capacity. Hoisting straps and hooks must be positioned safely on the load. When lifting loads, all personnel must keep at a safe distance from the load itself and remain within safe areas.

Danger
Do not allow the chains or metal cables used for hoisting to twist. Always wear safety gloves when handling cables or chains.

Danger
Use appropriate tools to align the holes correctly. NEVER USE YOUR HANDS OR FINGERS.

Danger
Handle all parts with extreme caution. Never place your hands or fingers between two parts.

Danger
When removing assemblies which could fall, always leave two screws in opposite positions in place for safety until the assembly is secured. Only remove these screws after securing the assembly to a hoist or after fitting support blocks in place.

Danger
If any of the screws fastening the frame or cab are loosened, or if the frame or cab is removed, ensure that all parts are refitted correctly at the end of the procedure to ensure that the driver is protected.

Attention
Beware of sharp edges and corners.

Attention
Used oils must be collected and disposed of in compliance with applicable legislation.

13.2 Removing and refitting the platform

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13.2.2 Removal 13-4

13.2.3 Refitting 13-23

13.2.1 Preliminary operations

The main operations necessary to remove the platform are indicated as follows.

- Removing the cab (see chapter "14-Cab").
- Remove the front wheel drive shaft (see chapter "7- Front axle").

13.2.2 Removal

Undo the screws (1) and remove the left hand cover (2).

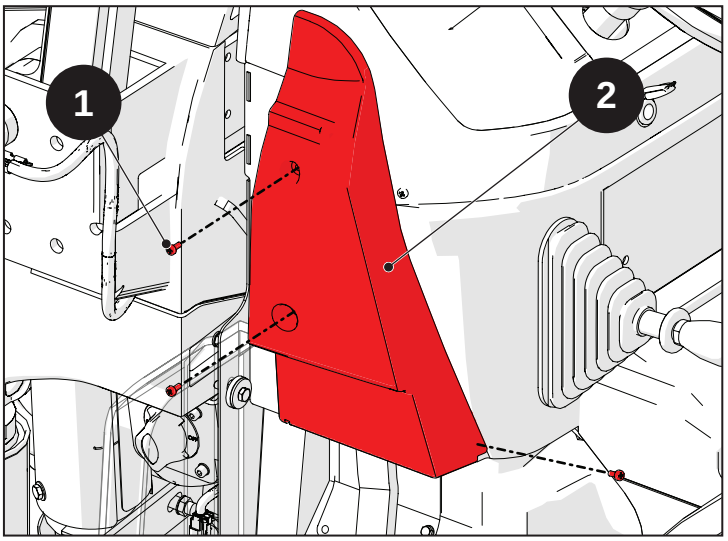

Fig. 13.1

Undo the screws (1) and remove the right hand cover (3).

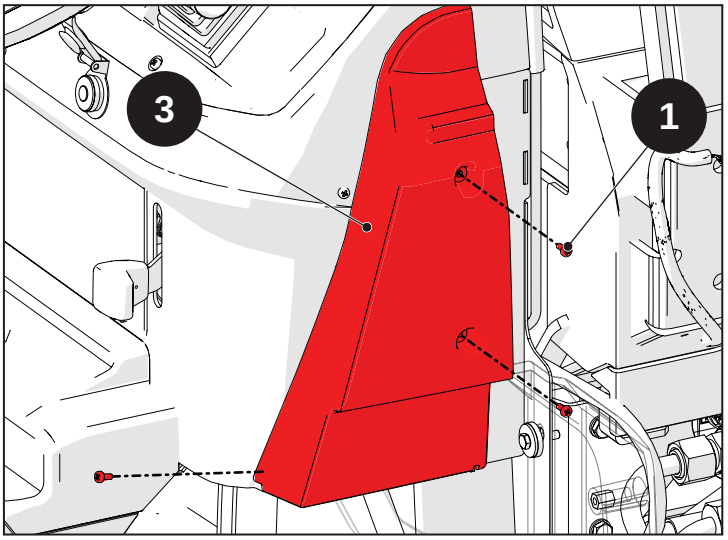

Fig. 13.2

Undo the screw (4) and remove the hand throttle lever handle.

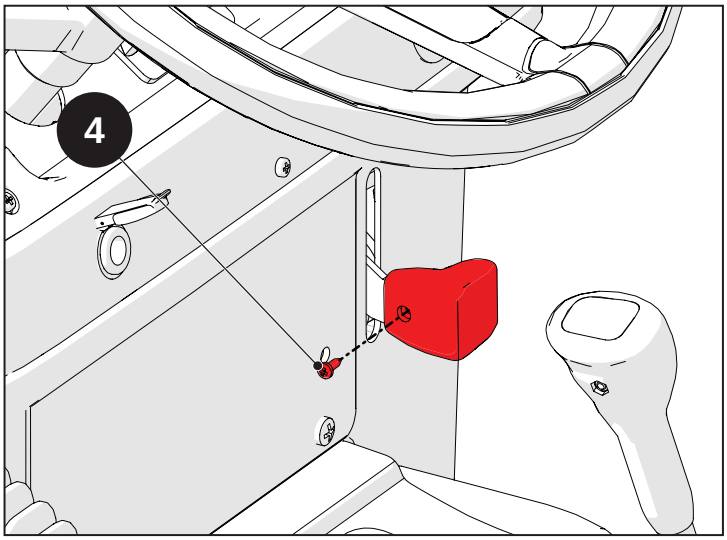

Fig. 13.3

Undo the stop hex socket head cap screw and remove the seat.

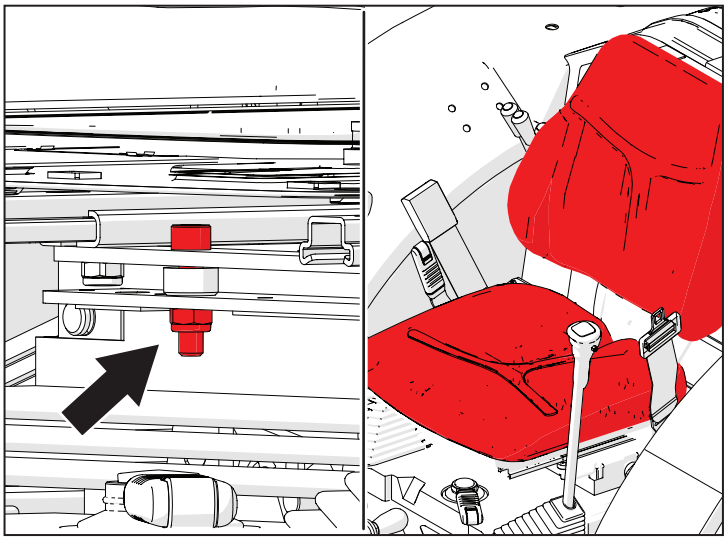

Fig. 13.4

Undo the 4 fastener screws (5) of the seat suspension and remove the suspension.

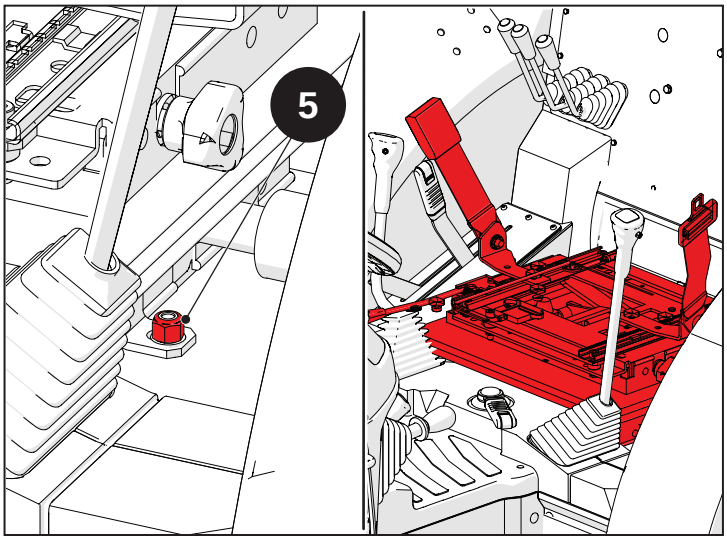

Fig. 13.5

Remove the handles of the lift control levers.

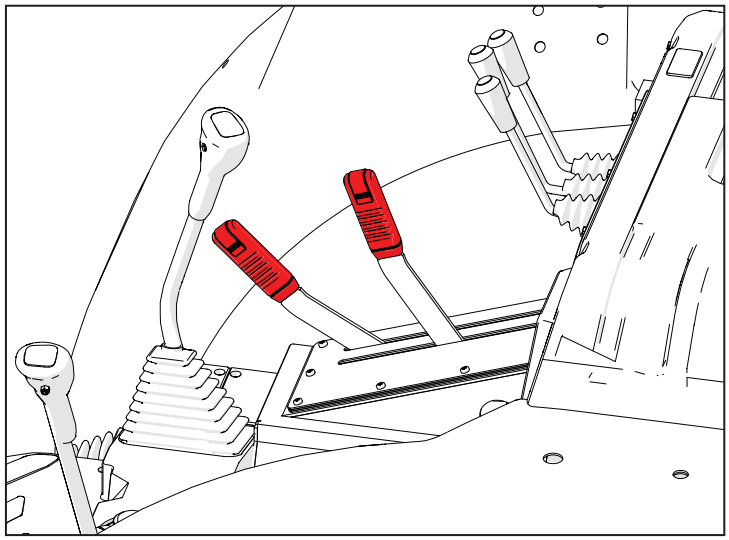

Fig. 13.6

Undo the screws (6) and remove the lift control lever plate (7).

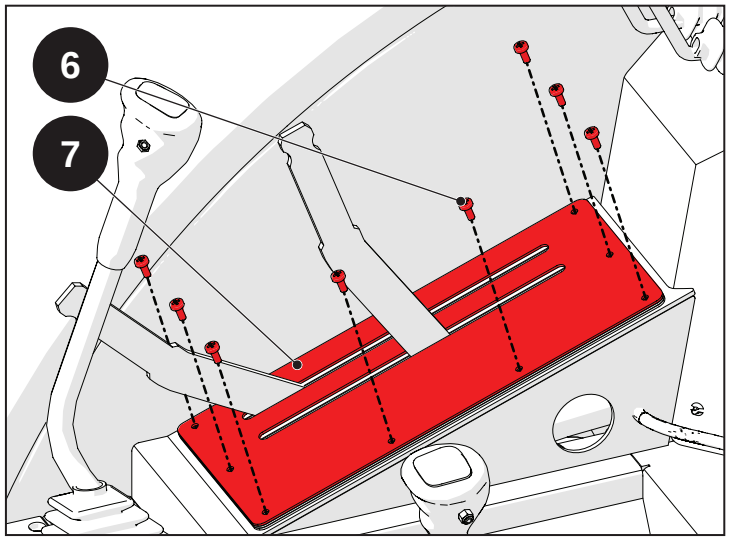

Fig. 13.7

Undo the screws (8) fastening the rear guard plate to the rear cover.

Remove the screws (9) and washers (10) fastening the rear cover to the cross bar.

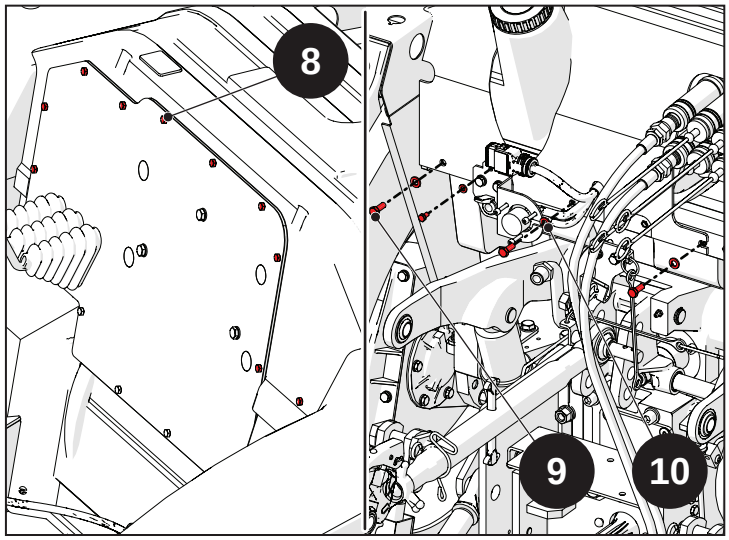

Fig. 13.8

Remove the rear cover (11).

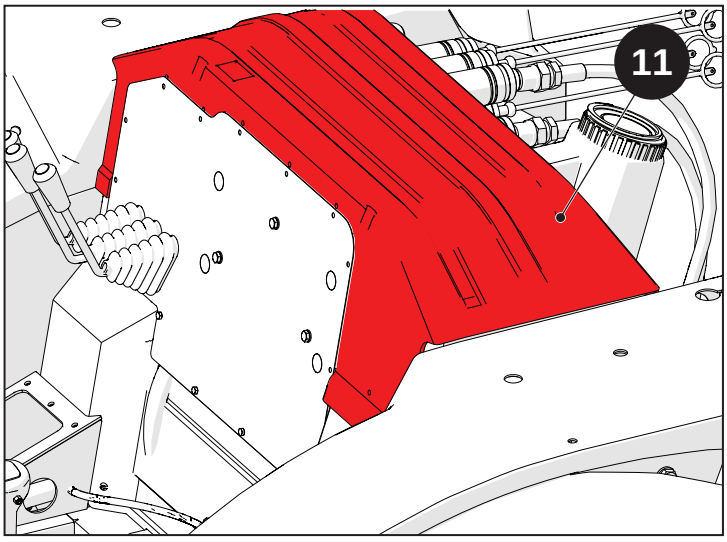

Fig. 13.9

Remove the handles of the distributor control levers.

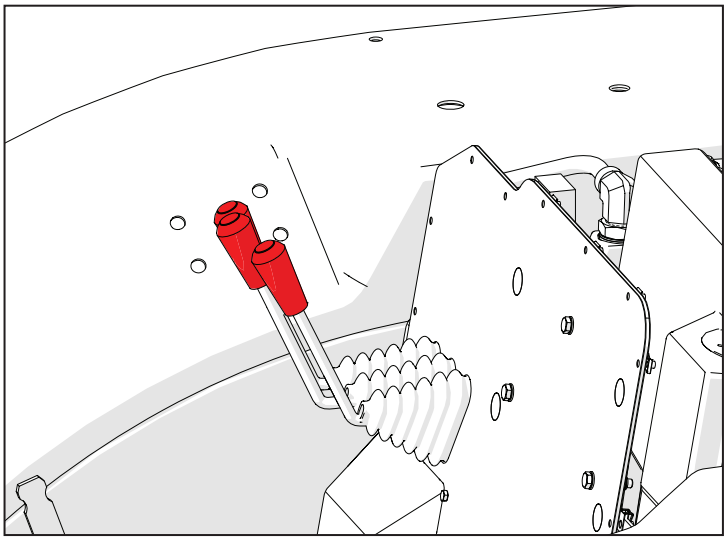

Fig. 13.10

Remove the screws (8) of the rear guard plate.

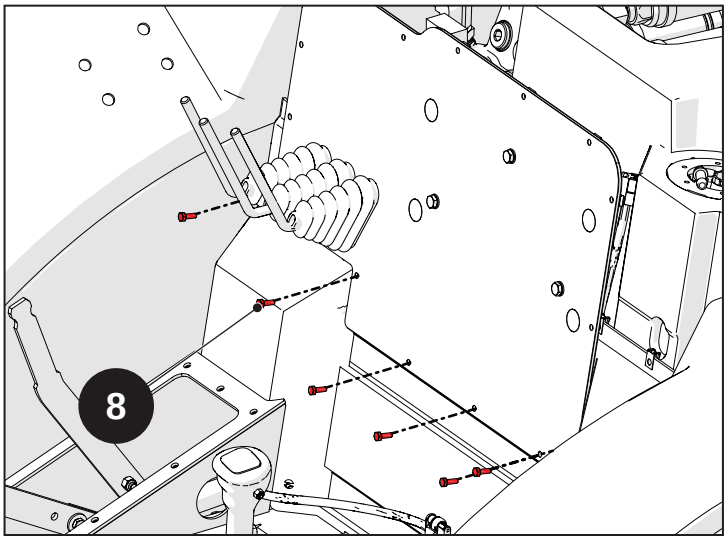

Fig. 13.11

Remove the rear guard plate (12), disconnecting the vehicle ECU connector.

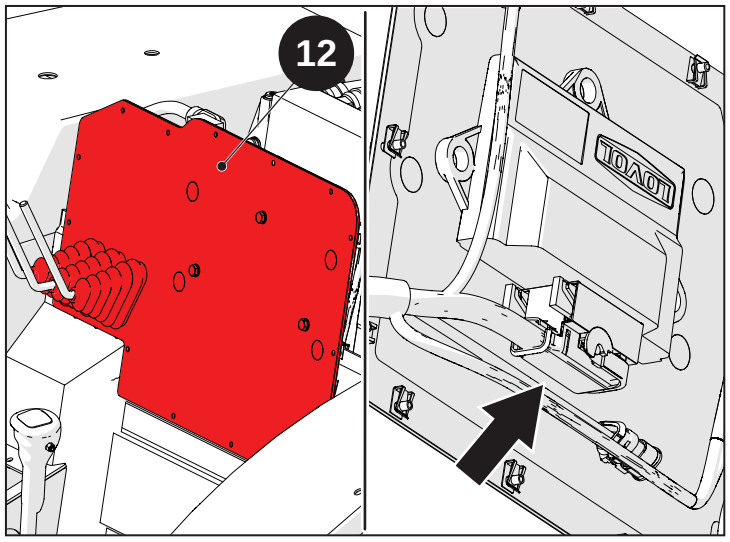

Fig. 13.12

Remove the cap on the PTO speed selector lever (13).

Undo the screw (14) and remove the washer (15) and the lever (16).

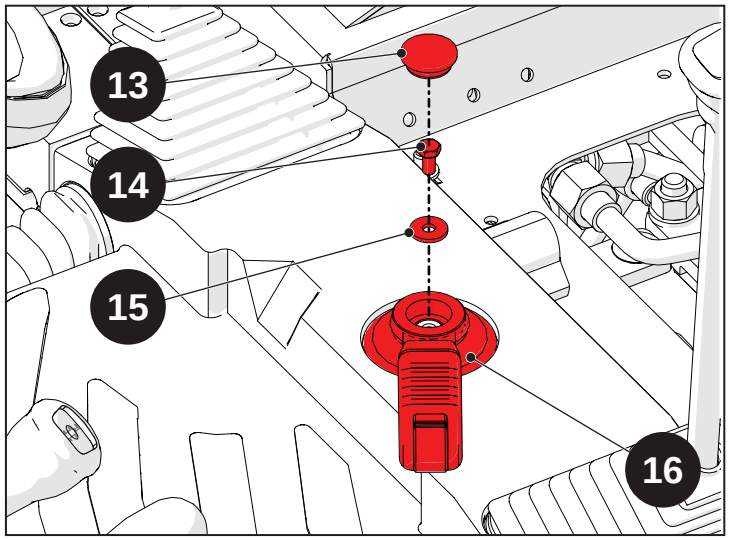

Fig. 13.13

Remove the cap on the underdrive selector lever (17).

Undo the screw (18) and remove the washer (19) and the lever (20).

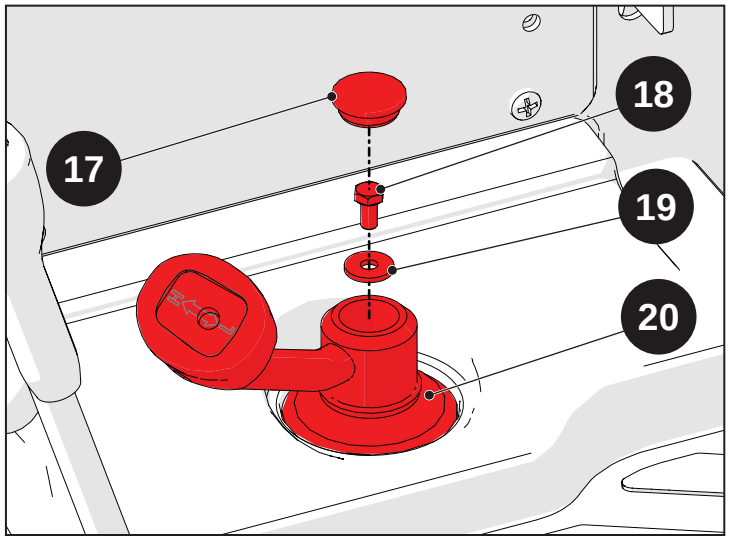

Fig. 13.14

Undo the screws (21) fastening the tunnel footboard.

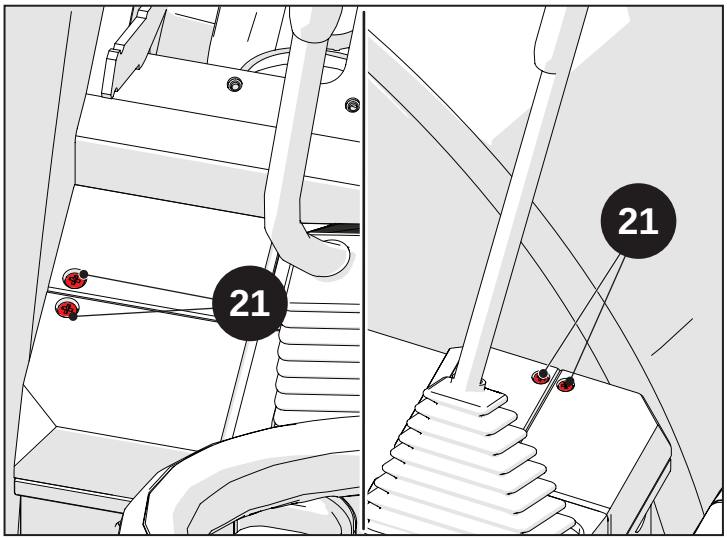

Fig. 13.15

Lift the tunnel footboard (22) to permit removal of the gear and range shift levers.

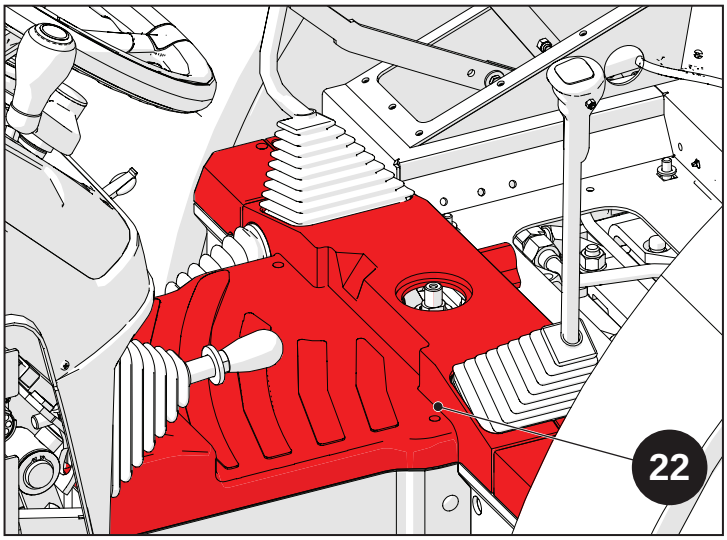

Fig. 13.16

Undo and remove the nut (23) with the washer (24), and remove the pin (25).

Repeat the same procedure for the other lever.

Note
The tunnel footboard may now be removed.

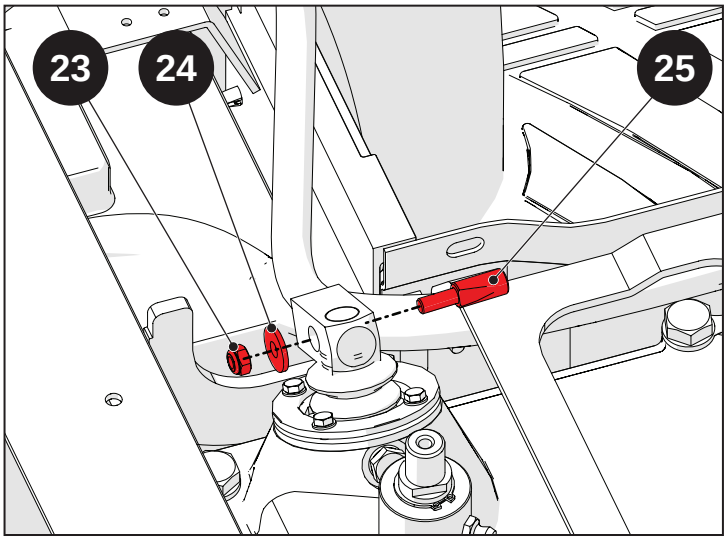

Fig. 13.17

Remove the PTO clutch lever (26).

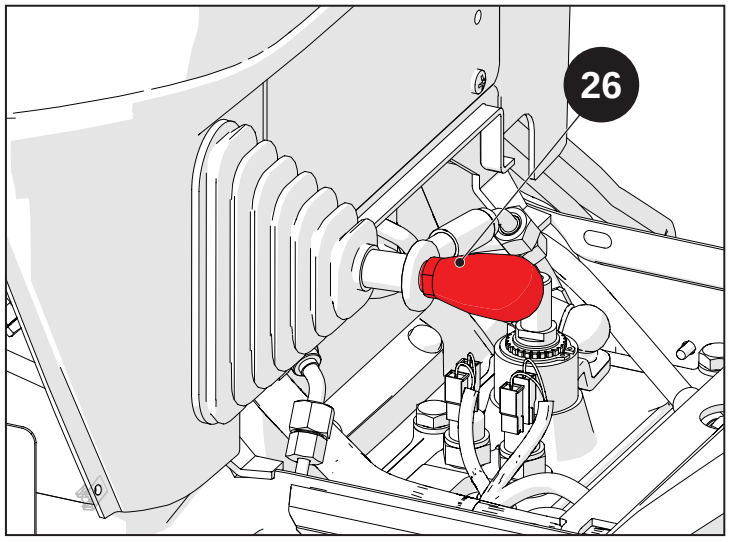

Fig. 13.18

Remove the screws (1) connecting the dashboard mount to the dashboard.

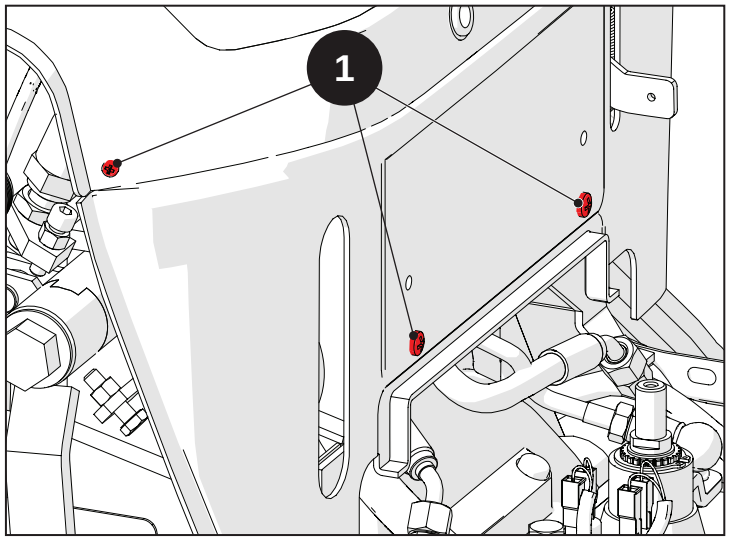

Fig. 13.19

Remove the mount (27).

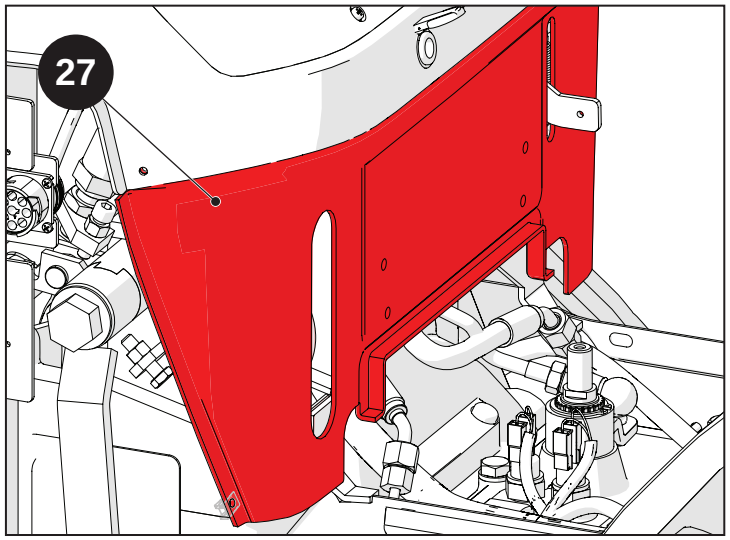

Fig. 13.20

Remove the screws (29) and the washers (28) fastening the lateral dashboard guards.

Remove the guards.

Note

The version with SG1/1 cab is not equipped with lateral dashboard guards.

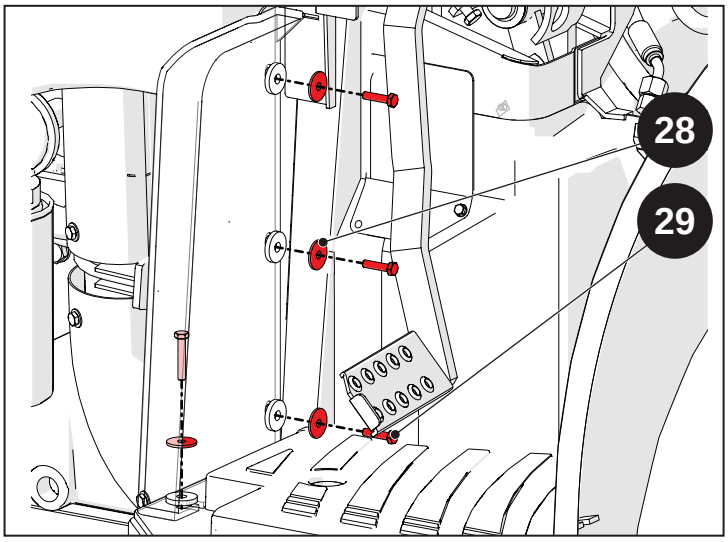

Fig. 13.21

Remove the rod of the lift quick drop cock (30).

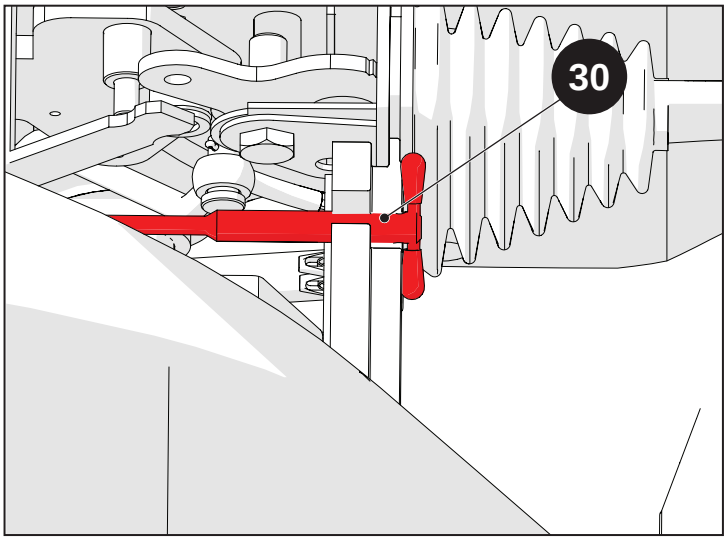

Fig. 13.22

Loosen the steering wheel position adjustment lever and raise and extend the steering column completely.

Remove the cover (31).

Use the puller tool (A- p/n 07006212) and a mallet to detach the steering wheel so that it can be removed.

Warning

Tap gently.

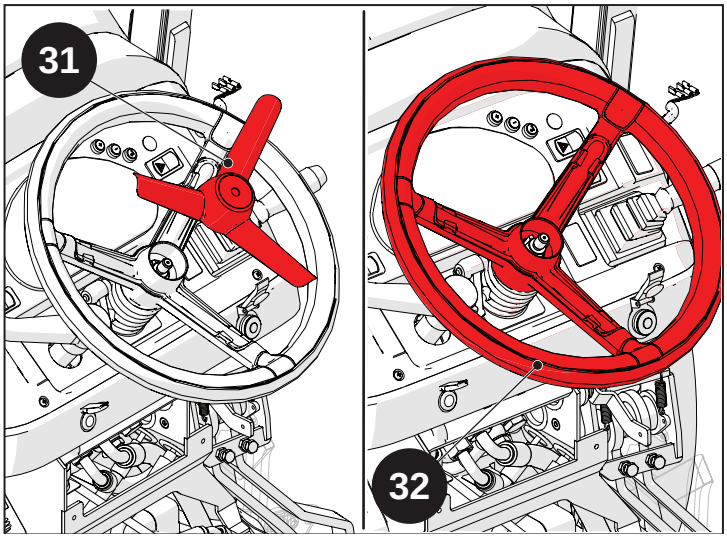

Fig. 13.23

Remove the cap (33) on the reverse shuttle lever (14).

Remove the nut (34), the washer (35) and the reverse shuttle lever (36).

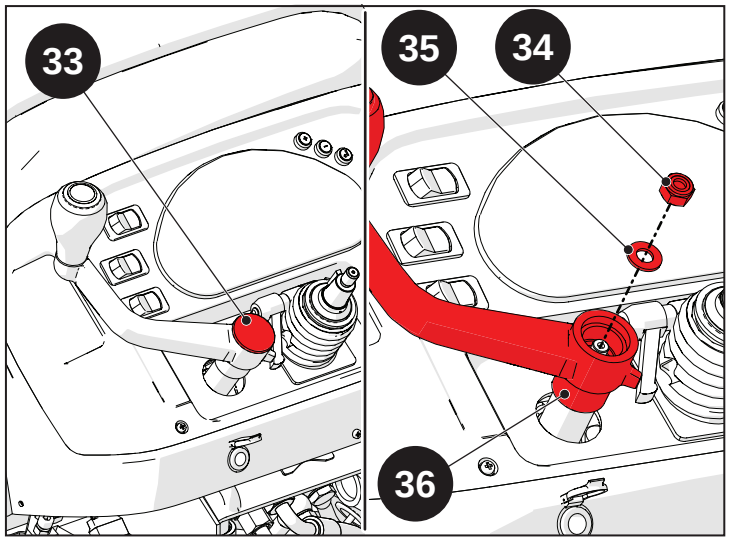

Fig. 13.24

Remove the steering wheel position adjustment lever (37).

Warning
Pull the lever first and then loosen the retainer screw.

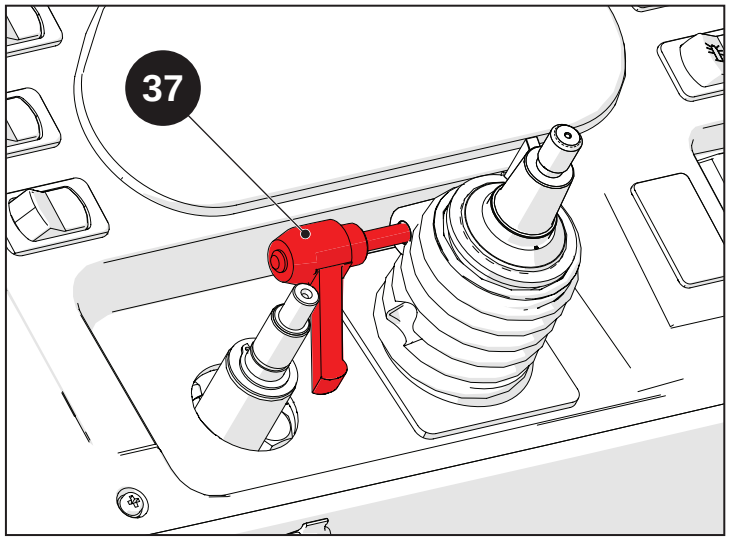

Fig. 13.25

Remove the fastener screws (1) of the dashboard.

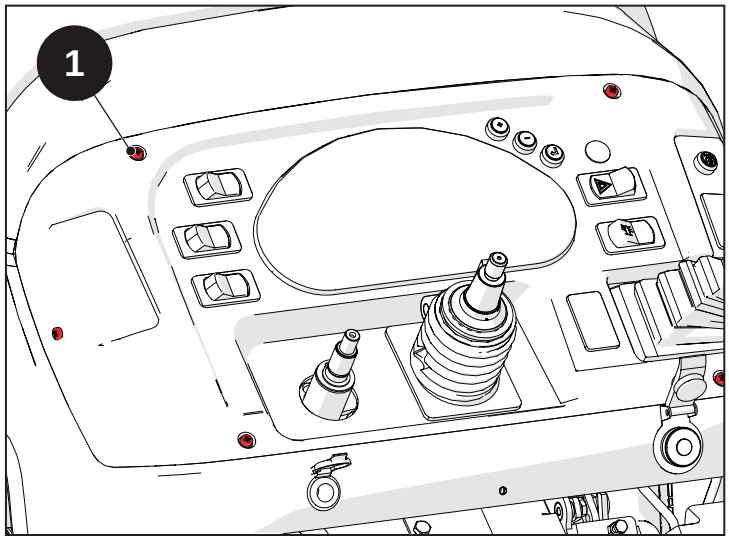

Fig. 13.26

Remove the dashboard (38).

> **Attention**
>
> Take care not to damage the cables, and label them to ensure that they are reconnected in the correct positions.

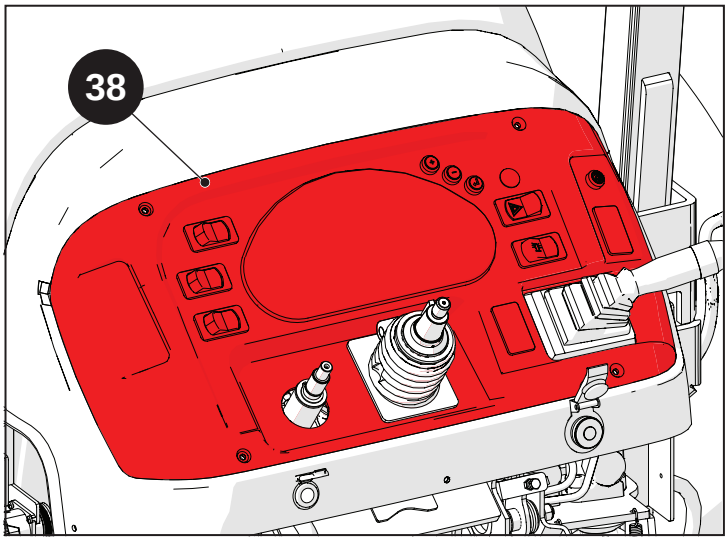

Fig. 13.27

Lift the cowl.

Undo the screws (39) and remove the front dashboard guard (40).

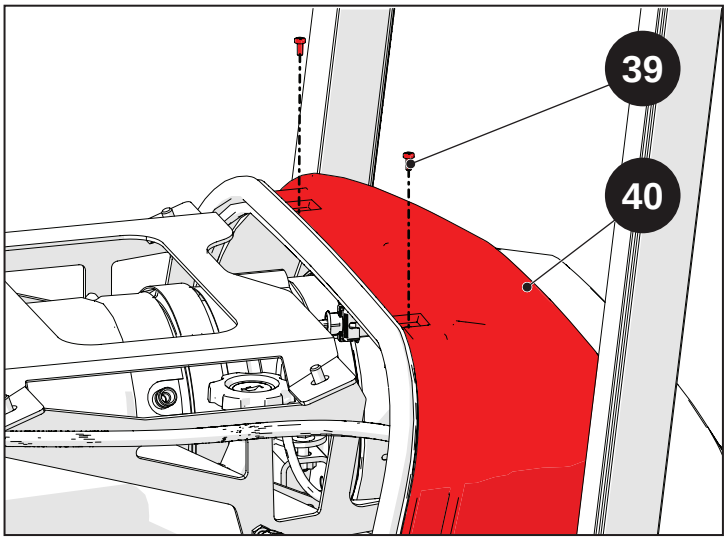

Fig. 13.28

Undo the screws (41) and remove the dashboard surround (42).

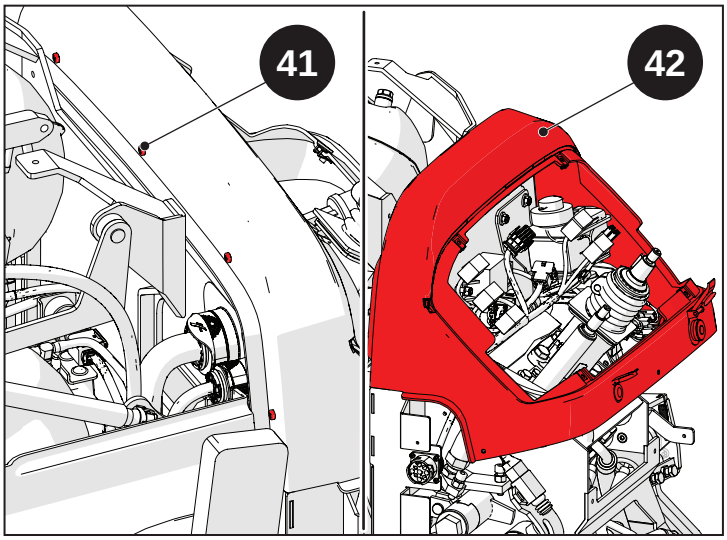

Fig. 13.29

Disconnect the cables between the dashboard and the engine.

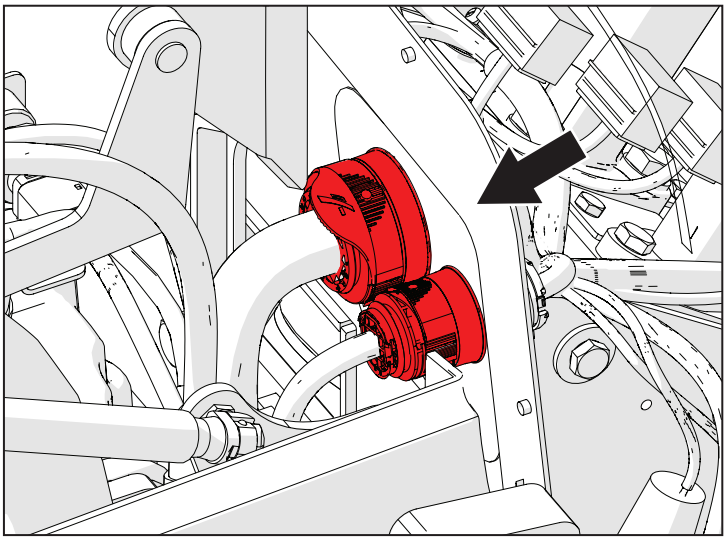

Fig. 13.30

Remove the pin (43) and the washer (44) of the clutch pedal.

Remove the clutch pedal (45).

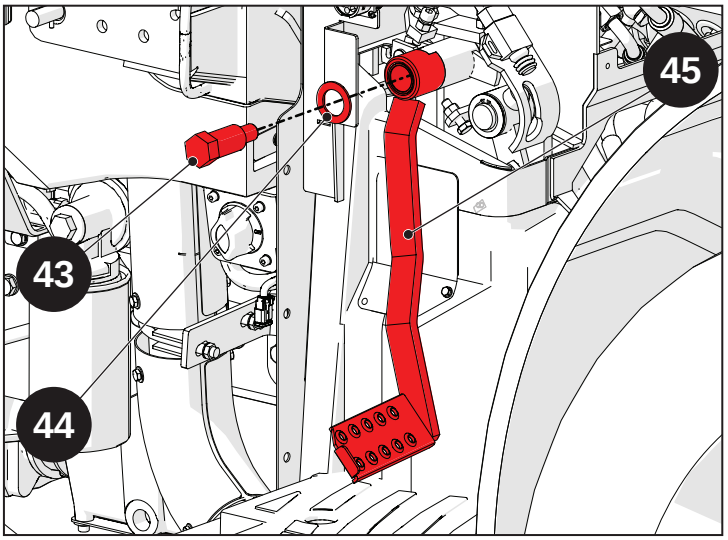

Fig. 13.31

Remove the screws (47) and the washers (48) of the dashboard-engine cable connector carrier plate (46).

Remove the plate (46).

Remove the screws (49) and remove the diagnostic port.

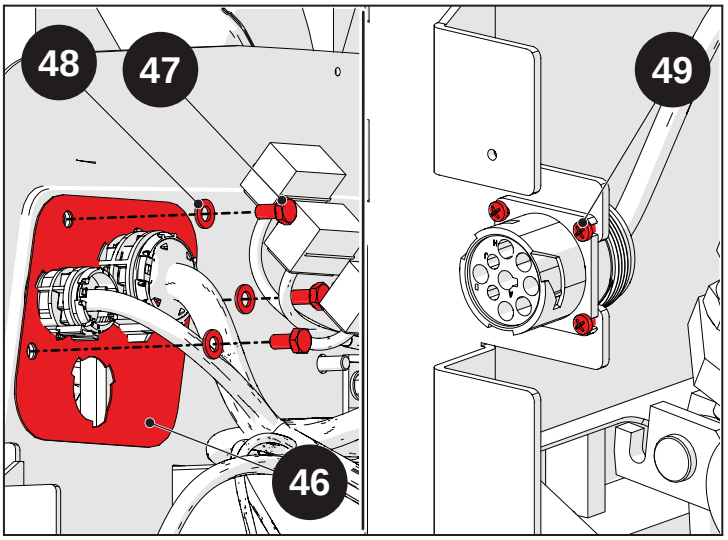

Fig. 13.32

Disconnect and remove the dashboard wiring harness.

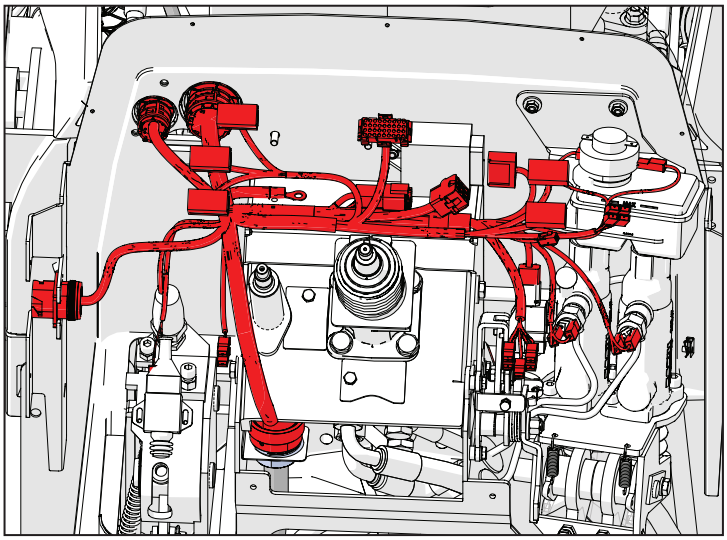

Fig. 13.33

Disconnect the reverse shuttle control linkage.

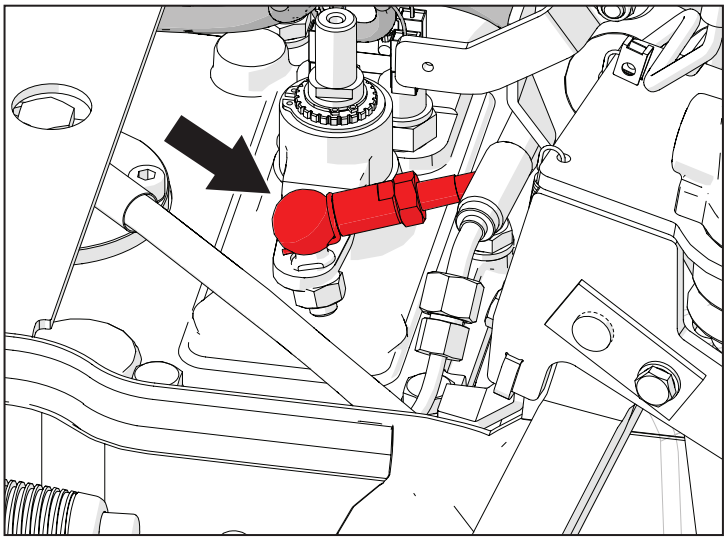

Fig. 13.34

Release the springs (50).

Remove the screw (51) and the washer (52) and remove the plate (53).

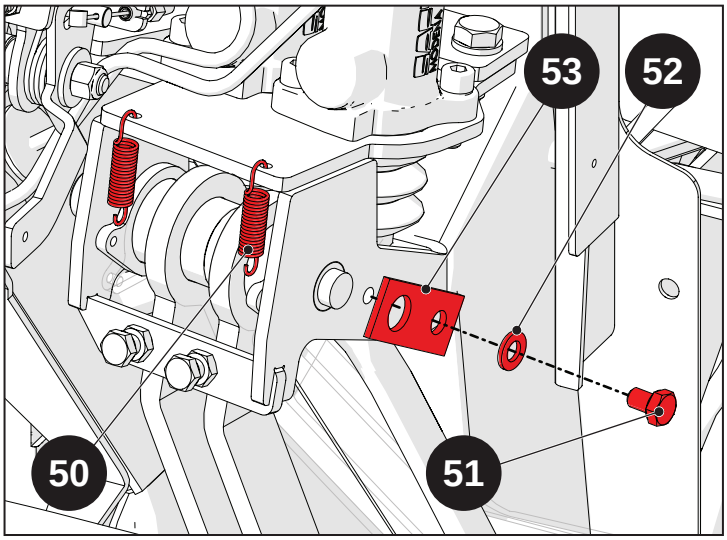

Fig. 13.35

Remove the pin of the brake pedals (54) and then remove the complete brake pedal assembly (55).

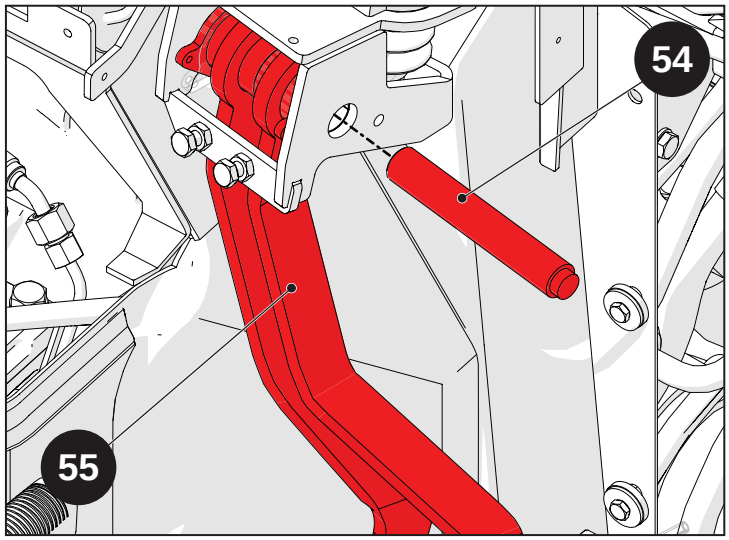

Fig. 13.36

Remove the top link.

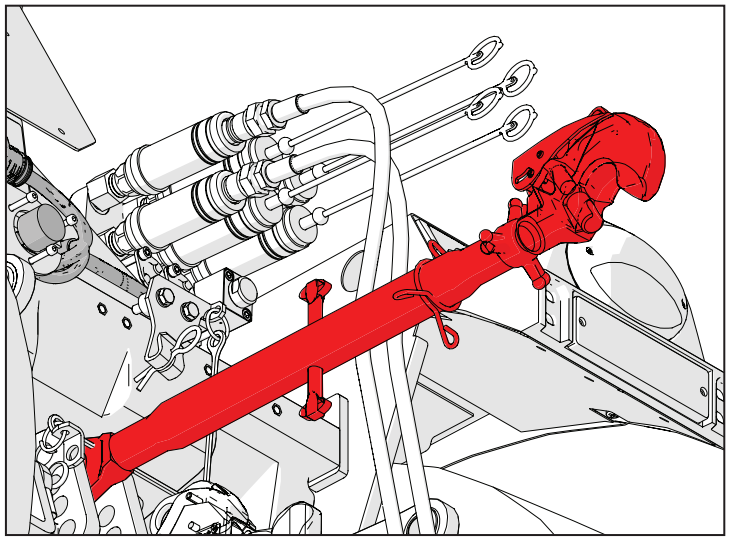

Fig. 13.37

Remove the screw (57) to permit removal of the parking brake lever (56).

To remove the parking brake lever, first remove the split pin to release the retainer pin (58) and remove the pin.

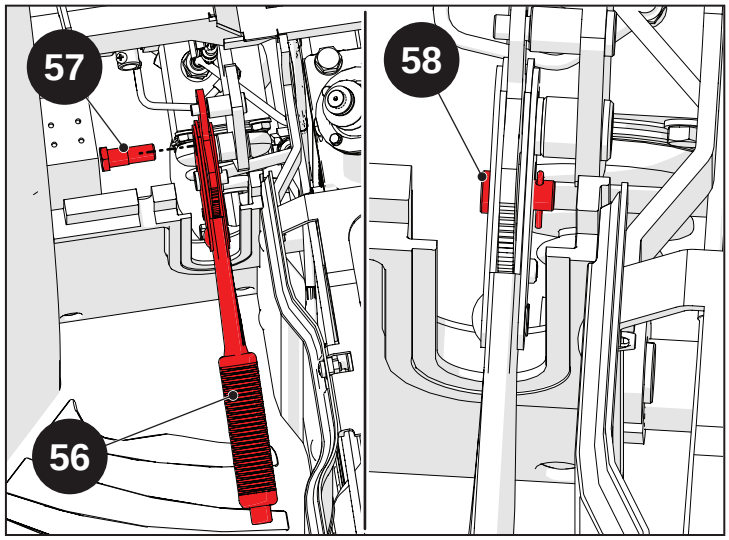

Fig. 13.38

Undo the fastener nut (59) and remove the foot throttle pedal (60) and the rubber gaiter (61).

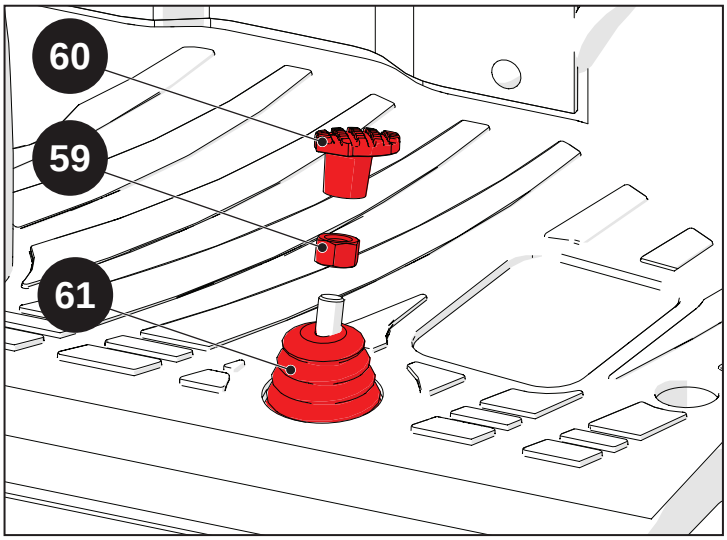

Fig. 13.39

Undo the screws (62) of the footboards.

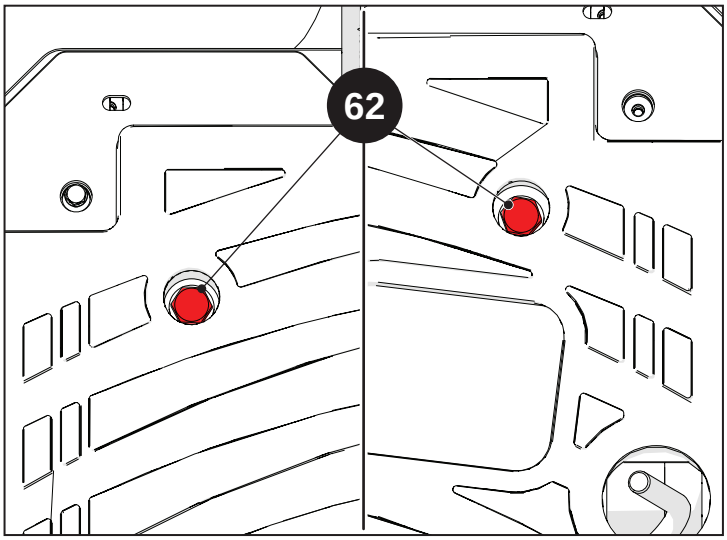

Fig. 13.40

Undo and disconnect the hydraulic connectors of the distributors.

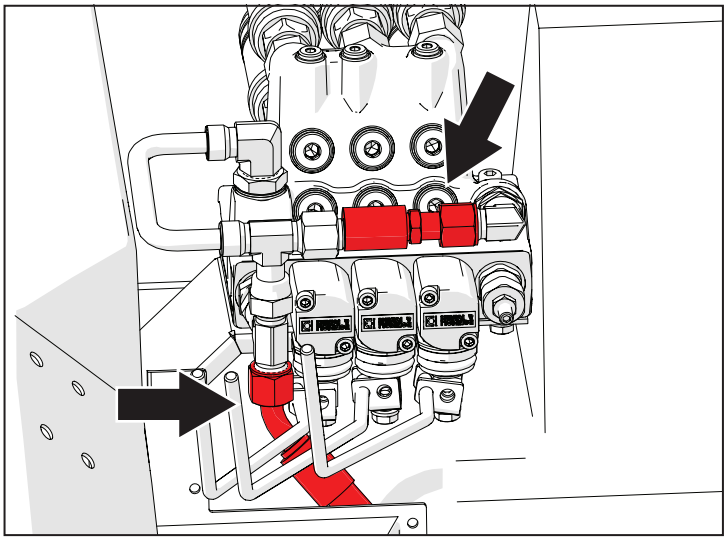

Fig. 13.41

Undo the fastener screws (63) and the screws (64) of the distributors.

Remove the distributor levers.

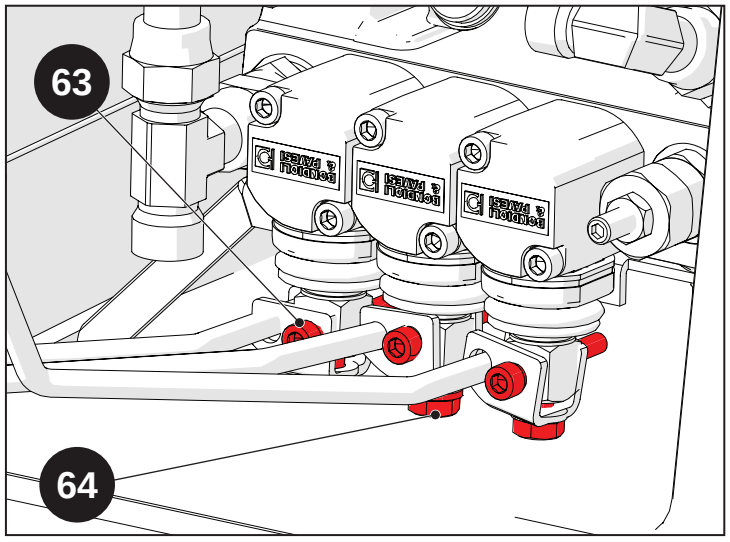

Fig. 13.42

Remove the screws fastening the distributor block (65) to the platform.

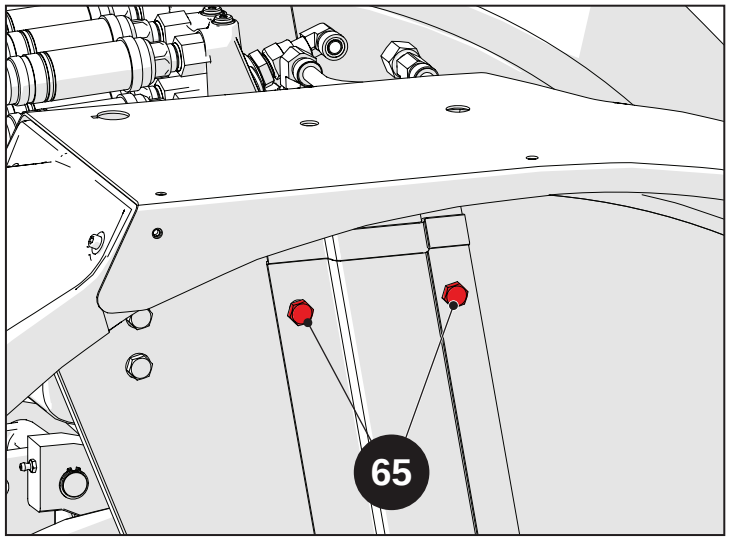

Fig. 13.43

Remove the rear distributors.

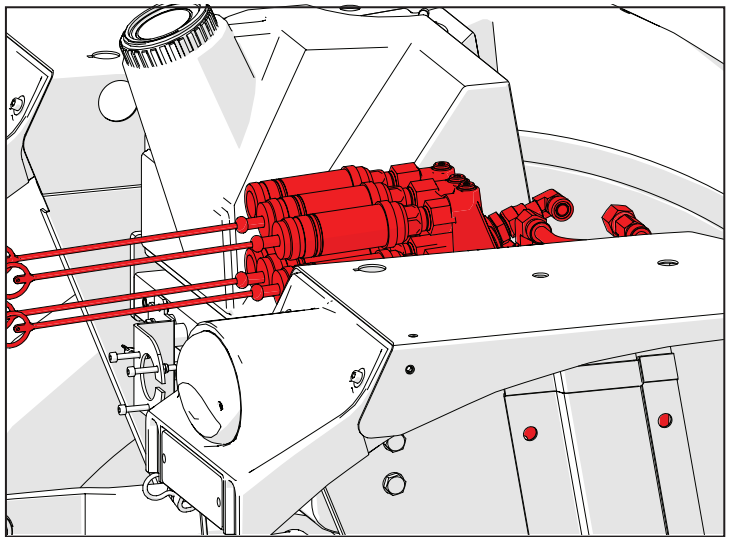

Fig. 13.44

Remove the screws (66) and the washers (67) fastening the rear cross bar.

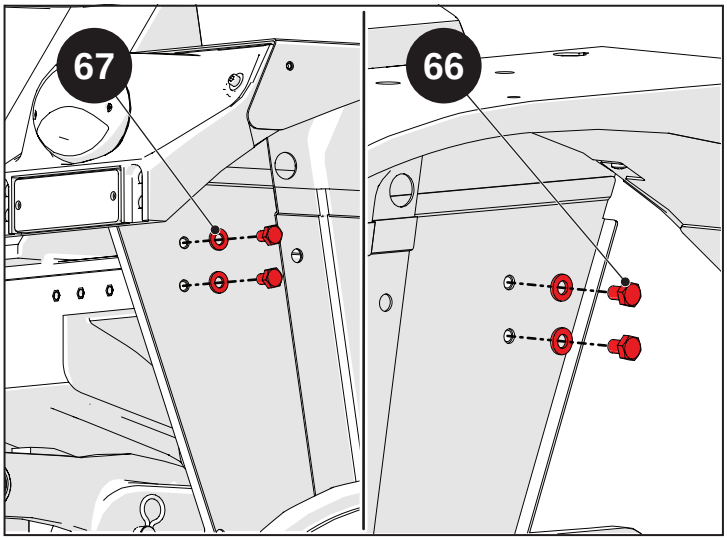

Fig. 13.45

Remove the screws (68) and the washers (69) fastening the flange with the electrical sockets.

Remove the rear cross bar (70).

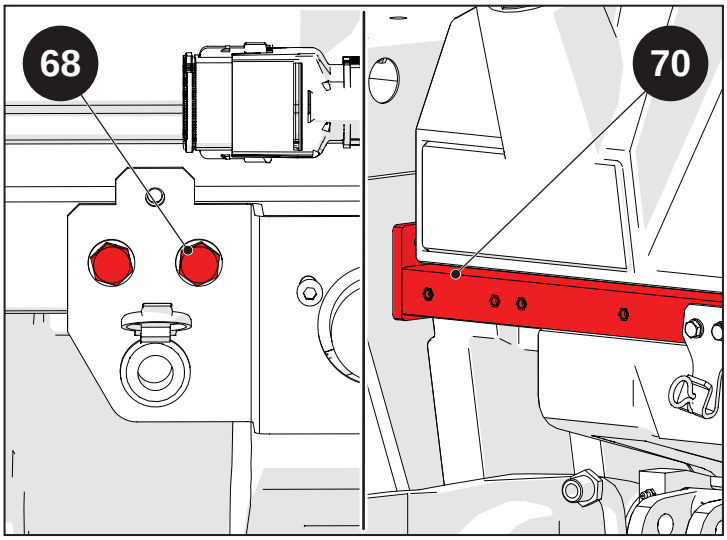

Fig. 13.46

Remove the right and left hand rear anti tip-over devices (71).

Remove the right and left hand lateral anti tip-over devices (72), ans also remove the mounting bracket (73) for the nitrogen accumulator on the right hand side.

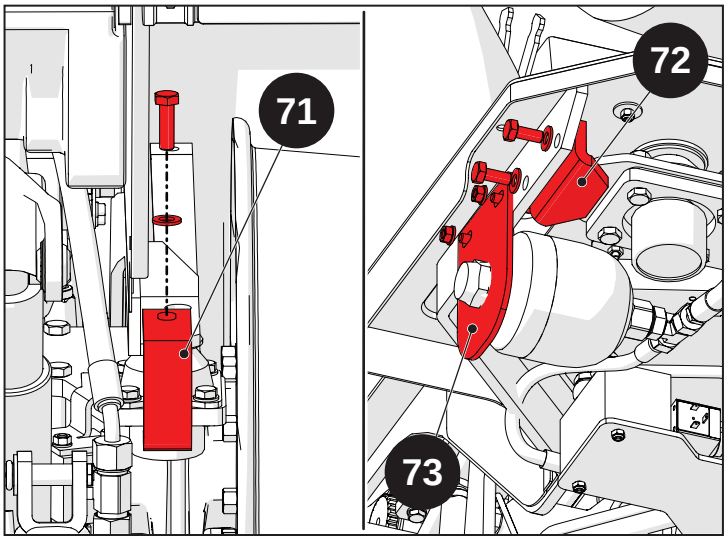

Fig. 13.47

Undo the hydraulic brake connectors.

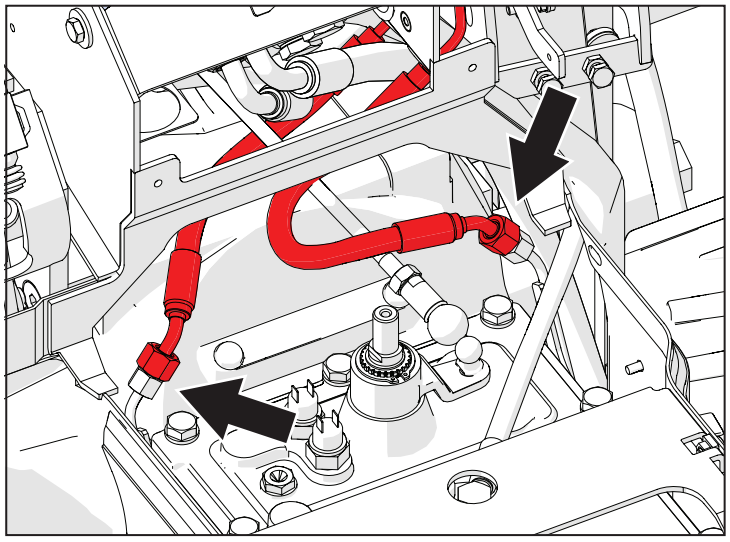

Fig. 13.48

Disconnect and remove the main vehicle wiring harness.

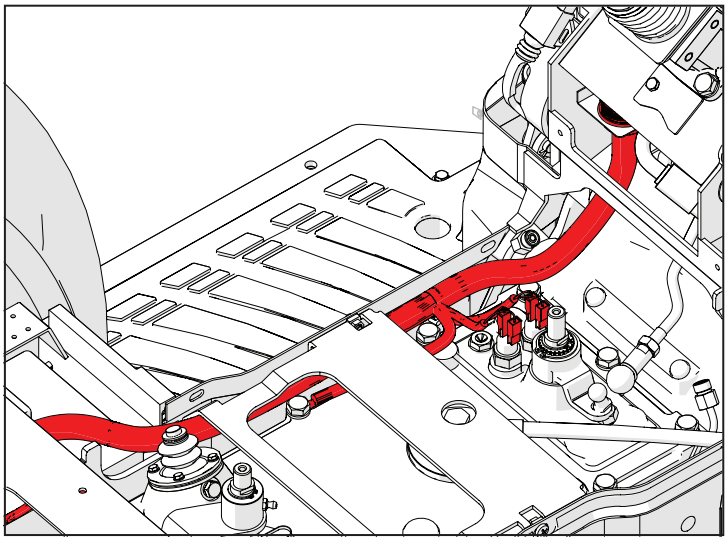

Fig. 13.49

Undo and remove the screws (74), complete with washers (75), fastening the hydraulic steering unit to the platform.

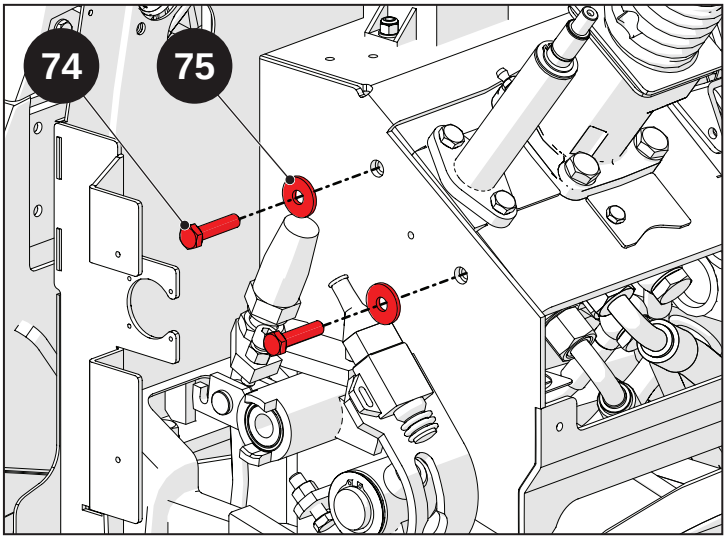

Fig. 13.50

Disconnect the fuel return line from the tank.

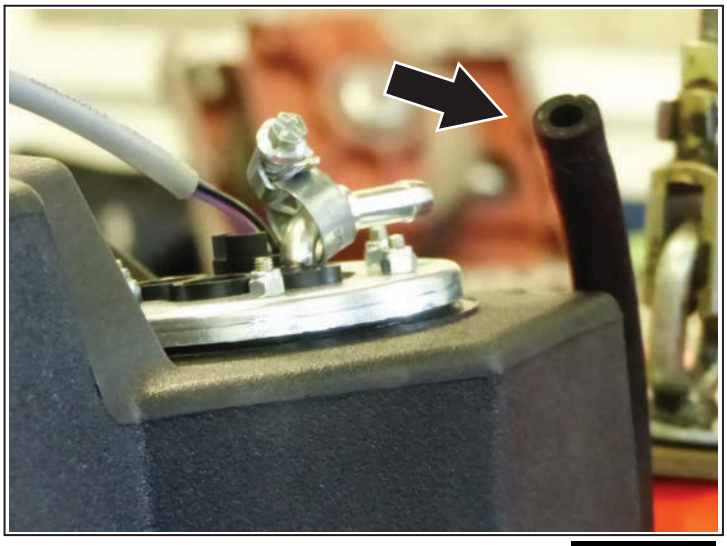

Fig. 13.51

Remove the nut fastening the ground point and remove the lug terminal.

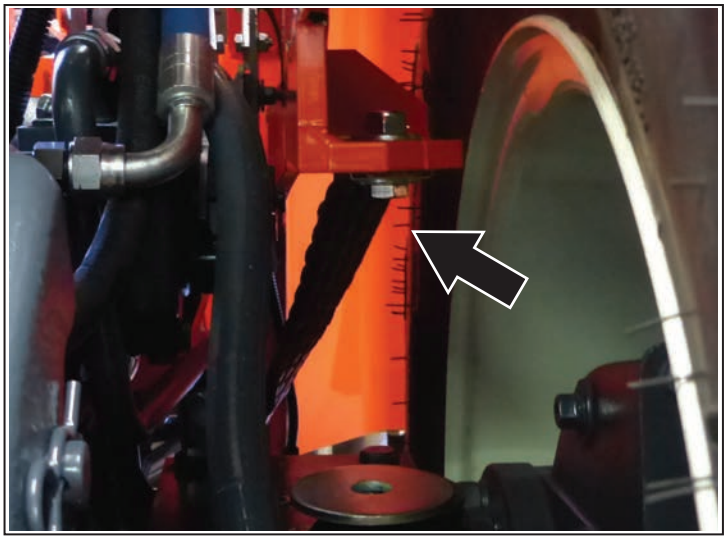

Fig. 13.52

Use the tool (B-07007181) to lift the platform.

Warning
Use a hoist of suitable lift capacity.

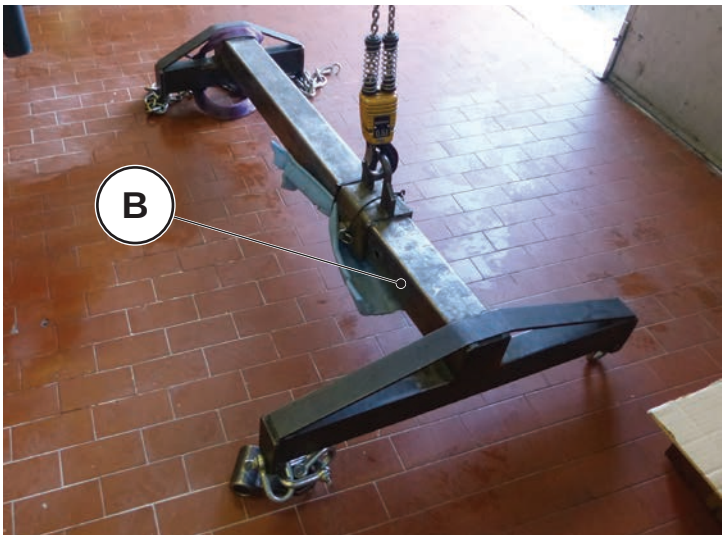

Fig. 13.53

Lift the platform (76) slightly to permit removal of the tank.

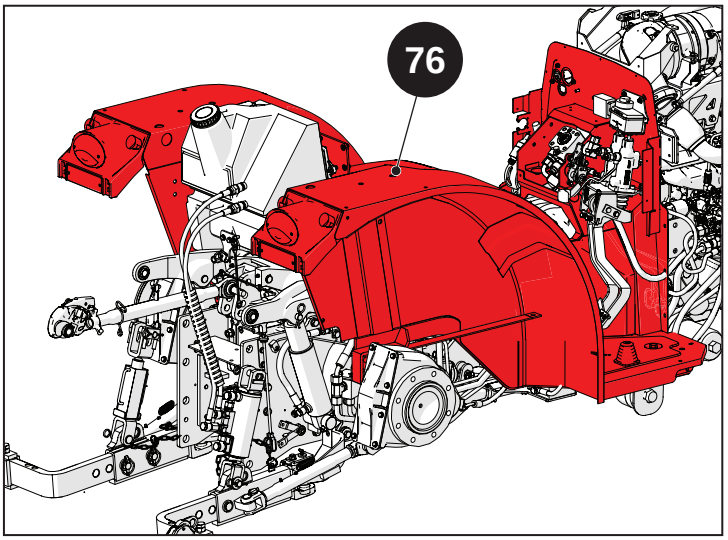

Fig. 13.54

Separate the main tank (77) from the reserve tank and remove the main tank.

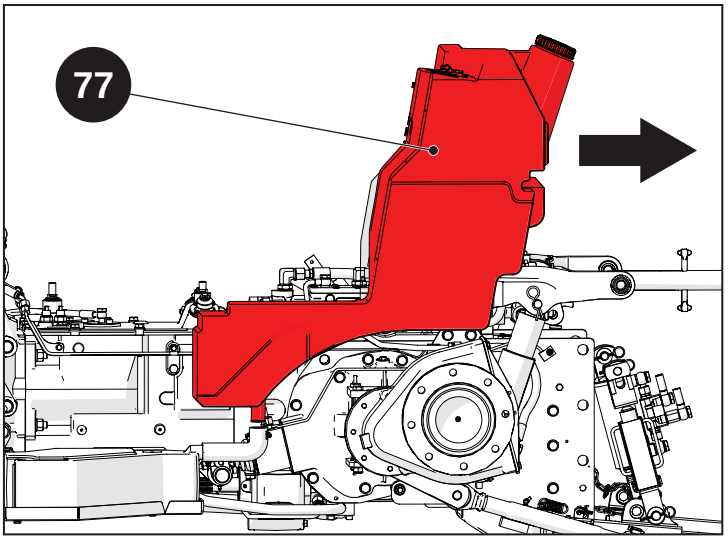

Fig. 13.55

Remove the platform (76).

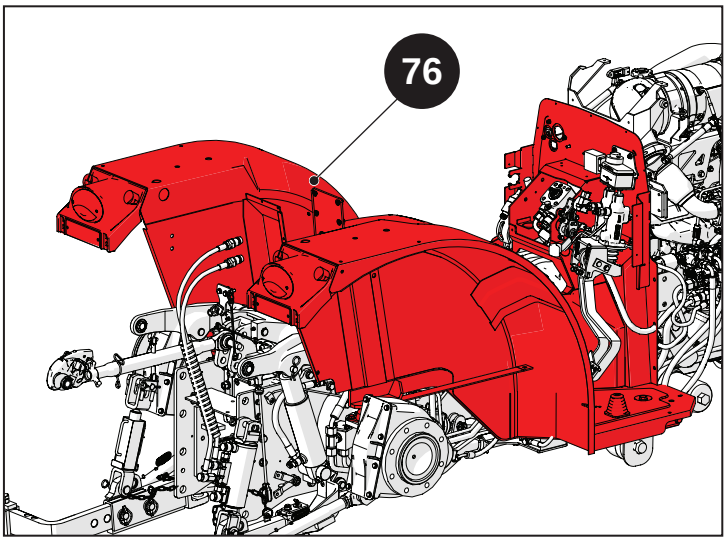

Fig. 13.56

13.2.3 Refitting

Danger
All other persons must keep at a safe distance from the danger area.

Warning
Read the instructions in chapter "1-Introduction" and, in particular, the sections concerning the installation of O-rings, oil seals and bearings, with particular care before reassembling, and follow these instructions precisely when working. Apply the correct tightening torques when tighten the fasteners of components. Where tightening torques are not specified, refer to the table in chapter "1-Introduction". Use the specified sealant products during reassembly. Where the sealant required is not specified, refer to the table in chapter "1-Introduction".

Refit the platform by following the procedure for removal in reverse order.

13.3 Tools necessary

Index

13.3.1 Tools necessary 13-26

13.3.1 Tools necessary

p/n	Description	Quantity
07006212	Flywheel puller tool	1
07007181	Platform/cab hoisting tool	1

14 : Cab

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14.1 Safety rules

These safety precautions and warnings given in this paragraph must be observed at all times to prevent the risk of operator injury. However, the safety measures indicated in the use and maintenance manual and in chapter 1 of this manual must also be applied at all times.

Danger
All other persons must keep at a safe distance from the danger area.

Danger
When using adhesives or detergents, follow the safety and usage instructions provided by the manufacturer.

Danger
Used oils must be collected and disposed of in compliance with applicable legislation.

Danger
Take all precautions necessary to avoid burns when working with hot oil. Never heat oil to above 190°C, as the oil vapour may suddenly and spontaneously ignite.

Danger
Jets of escaping pressurised fluid may penetrate the skin and cause severe injury. In the event of an accident involving pressurised fluid, seek immediate medical attention to avoid the risk of severe infection.

Danger
Lift and handle all heavy parts with lifting equipment of adequate load capacity. Hoisting straps and hooks must be positioned safely on the load. When lifting loads, all personnel must keep at a safe distance from the load itself and remain within safe areas.

Danger
Do not allow the chains or metal cables used for hoisting to twist. Always wear safety gloves when handling cables or chains.

Danger
Use appropriate tools to align the holes correctly. NEVER USE YOUR HANDS OR FINGERS.

Danger
Handle all parts with extreme caution. Never place your hands or fingers between two parts.

Danger
When removing assemblies which could fall, always leave two screws in opposite positions in place for safety until the assembly is secured. Only remove these screws after securing the assembly to a hoist or after fitting support blocks in place.

Danger
If any of the screws fastening the frame or cab are loosened, or if the frame or cab is removed, ensure that all parts are refitted correctly at the end of the procedure to ensure that the driver is protected.

Danger
Always wear protective eyewear and gloves when handling refrigerant. Avoid skin contact with refrigerant.

Danger
Implements used to handle refrigerant must be used in an adequately ventilated enviroN·ment, in which the entire volume of air is exchanged at least four times every hour.

Danger
Do not use implements for handling refrigerant in the vicinity of unsealed or leaking recipients containing flammable substances.

Danger
Do not tamper with or modify the vent and safety valves of the containers and implements used for collecting and treating refrigerant.

Danger
Do not fill any recipient (cylinders, A/C system charging equipment or other storage containers) with refrigerant unless it is approved for this purpose and equipped with a suitable safety relief valve.

Danger
Never fill any storage container beyond 80% of its total capacity.

Danger
Use extreme caution when connecting utility lines as they may still contain pressurised refrigerant.

14.2 Technical characteristics

Index

14.2.1 Technical characteristics.....14-6

14.2.1 Technical characteristics

Refrigerant

Type	R134
Quantity	0.8 kg

14.3 Removing and refitting

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14.3.2 Removing the SG1 cab 14-8

14.3.3 Refitting the SG1 cab.....14-11

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14.3.5 Reassembly procedure for GL11 cab.....14-16

14.3.1 Preliminary operations

Warning
Before removing the cab, discharge all the gas contained in the air conditioning system.

14.3.2 Removing the SG1 cab

Remove the cable ties (3).

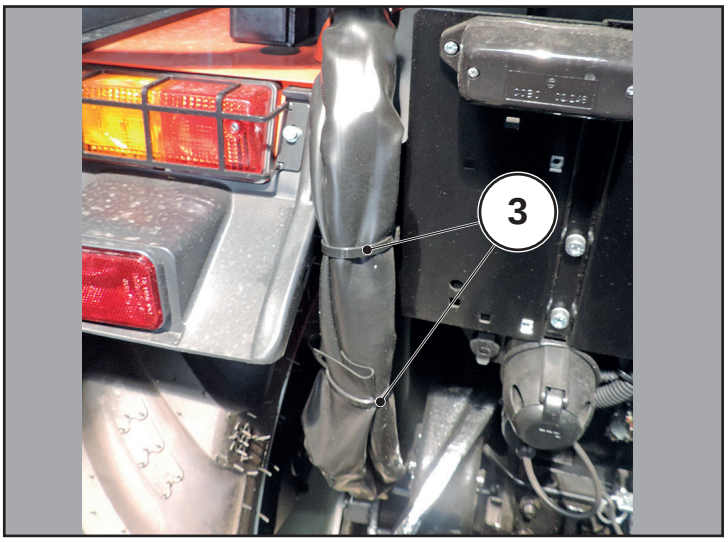

Fig. 14.1

Disconnect the wiring harnesses (4).

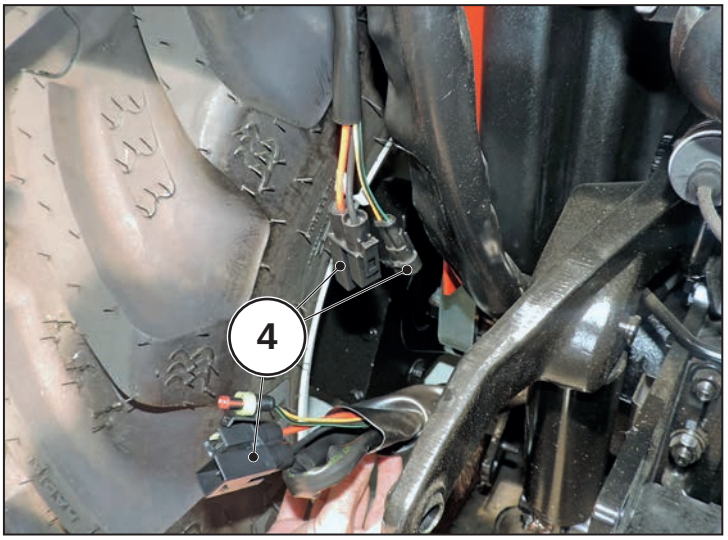

Fig. 14.2

Disconnect the water and air conditioning system pipes (5) on the right and left hand sides.

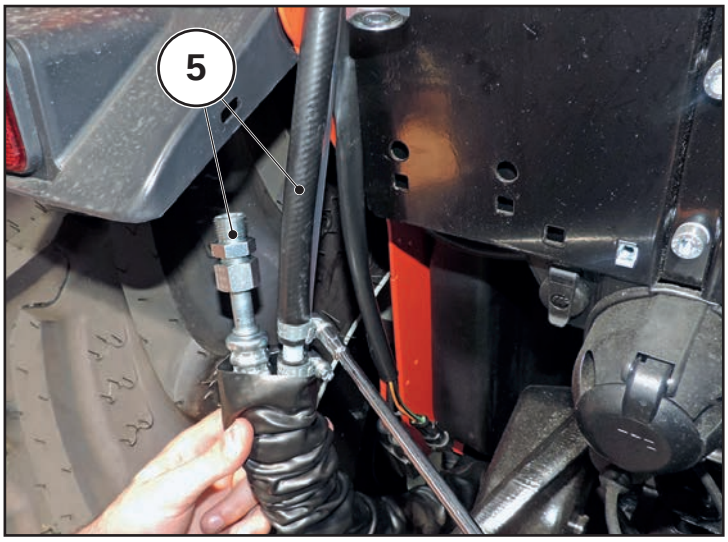

Fig. 14.3

Remove the fastener screws of the cab (6), with the relative nuts and washers, situated on the right and left hand rear sides.

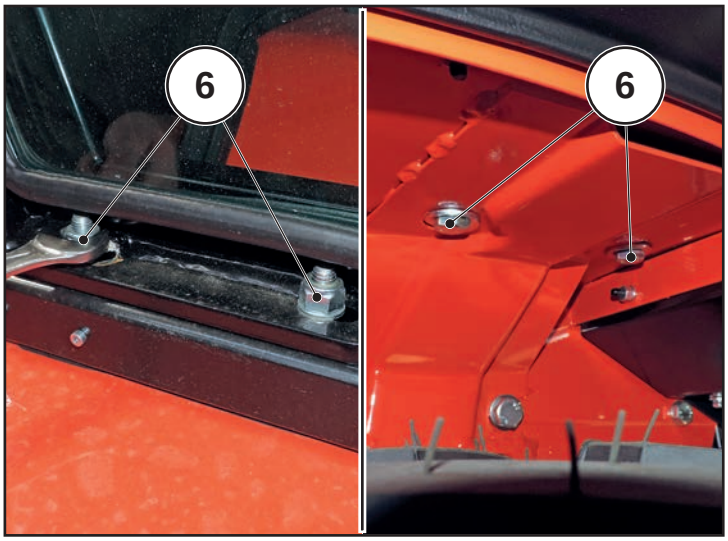

Fig. 14.4

Undo the nuts and remove the lower fastener screws (7) at the front of the footboards.

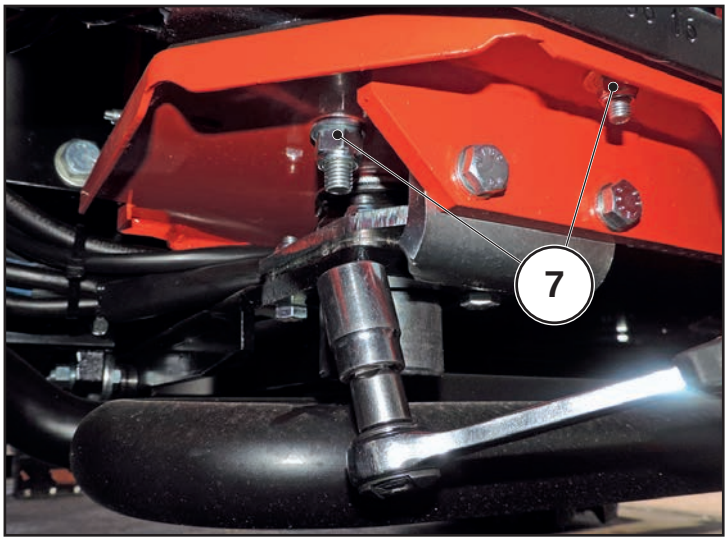

Fig. 14.5

Undo and remove the clamps (10) and disconnect the water pipes.

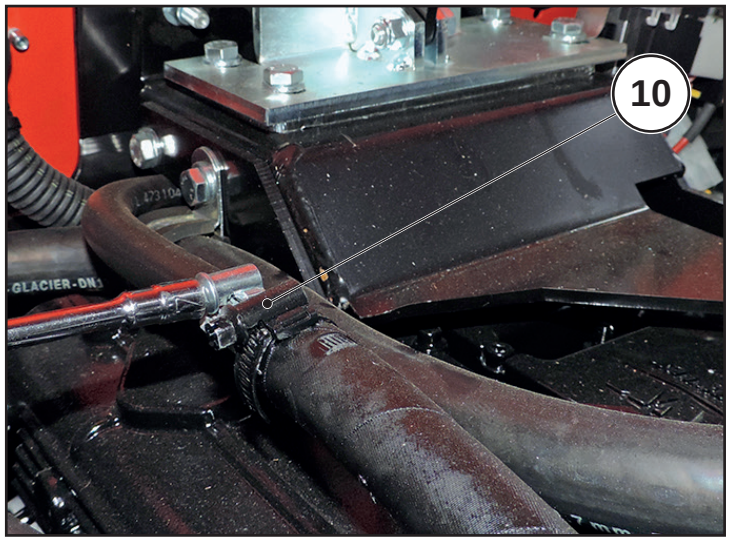

Fig. 14.6

Warning

If removing the cab completely, also undo the connectors of the pipes (8) from the compressor (9).

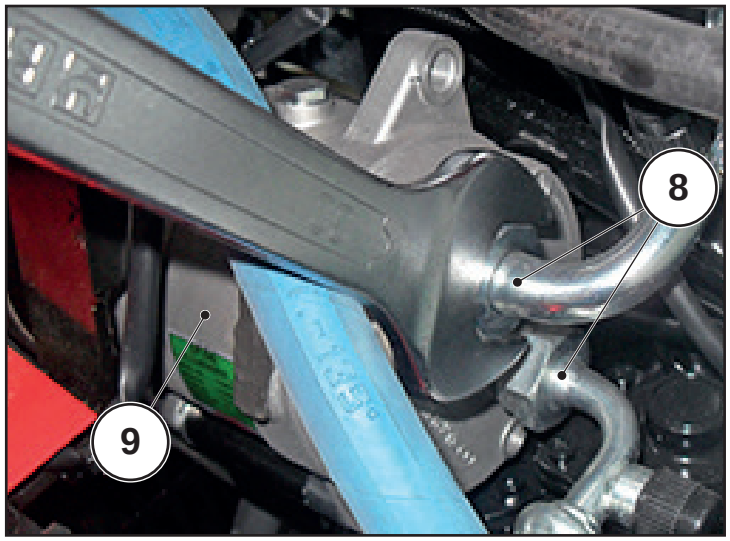

Fig. 14.7

Lift the cab (1) with a hoist (2).

Attention

Place the lifting straps as far to the rear of the cab as possible to prevent damage to the cab itself when lifting.

Fig. 14.8

14.3.3 Refitting the SG1 cab

Danger
All other persons must keep at a safe distance from the danger area.

Warning
Read the instructions in chapter "1-Introduction" and, in particular, the sections concerning the installation of O-rings, oil seals and bearings, with particular care before reassembling, and follow these instructions precisely when working. Apply the correct tightening torques when tighten the fasteners of components. Where tightening torques are not specified, refer to the table in chapter "1-Introduction". Use the specified sealant products during reassembly. Where the sealant required is not specified, refer to the table in chapter "1-Introduction".

Refit the cab by following the procedure for removal in reverse order.

14.3.4 Removing procedure for GL11 cab

Undo the four fastener screws of the cab (12). Two of these screws are situated at the front of the cab, the other two are at the rear.

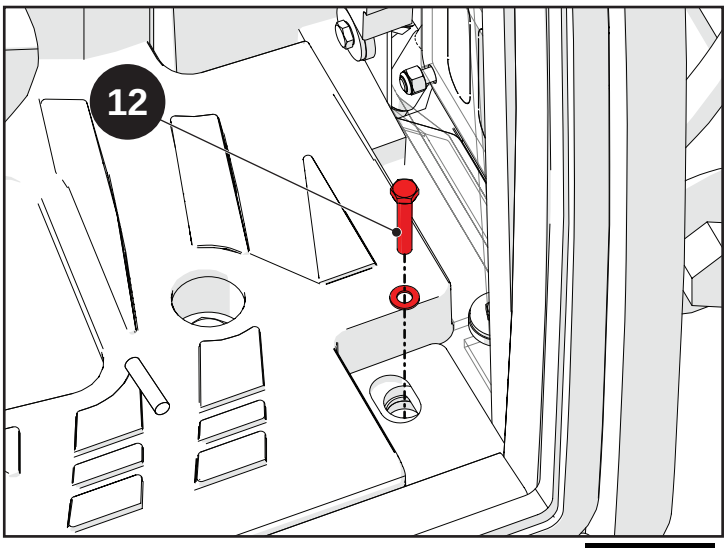

Fig. 14.9

Undo the connectors of the pipes (8) from the compressor (9).

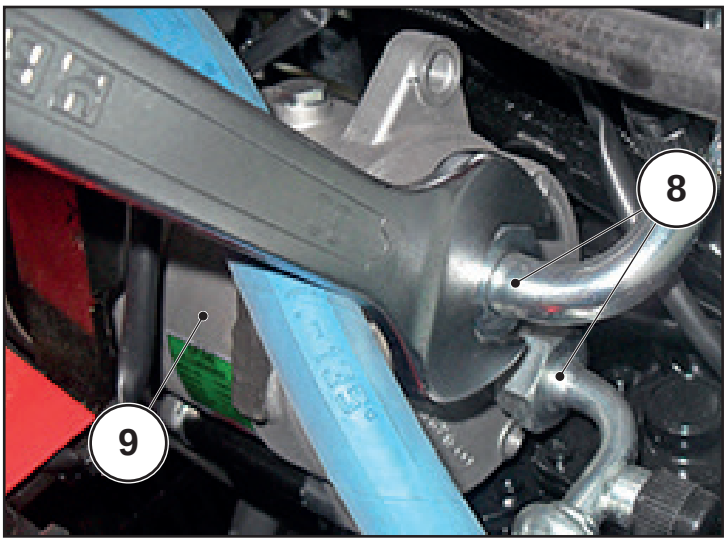

Fig. 14.10

Undo the clamp (13).

Disconnect the water pipes (14).

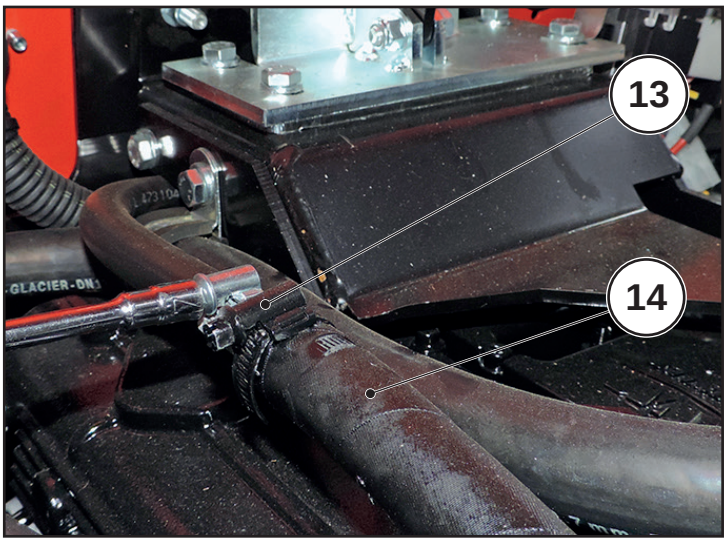

Fig. 14.11

Undo the nut (15) and remove the ground lug terminal (16).

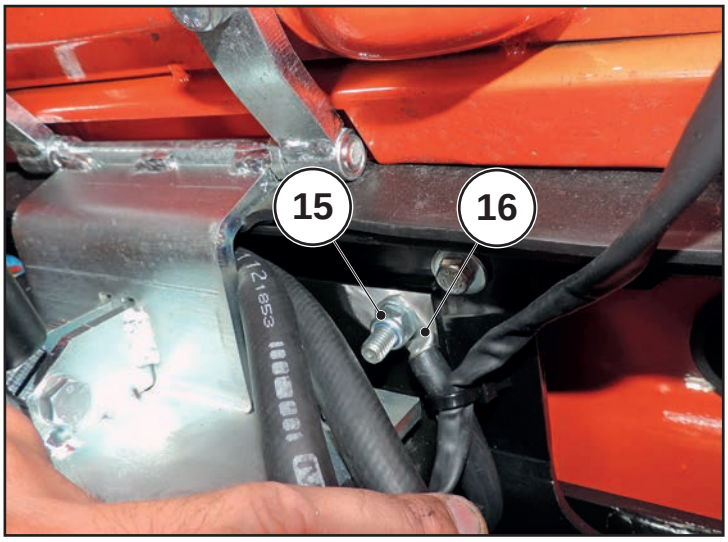

Fig. 14.12

Undo the screws (17) and remove the guard (18).

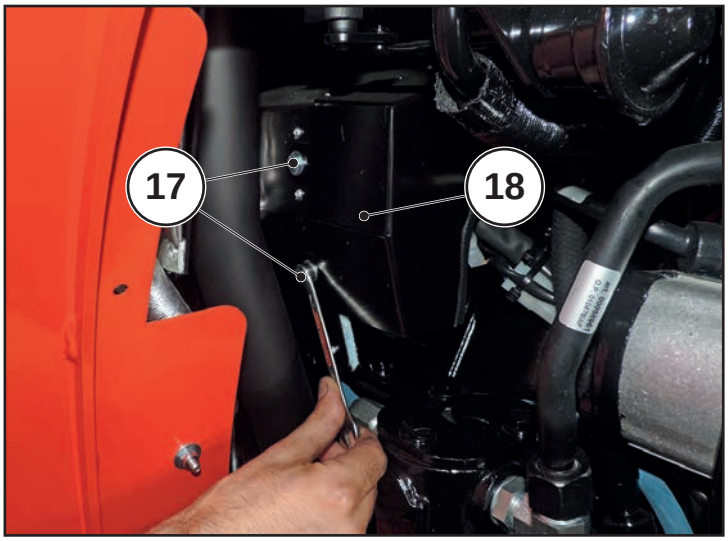

Fig. 14.13

Disconnect wiring connector (19).

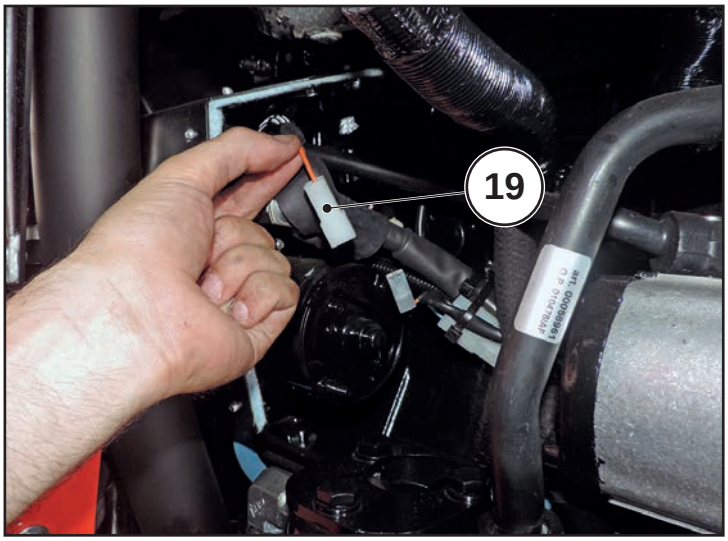

Fig. 14.14

Disconnect the positive cable (20).

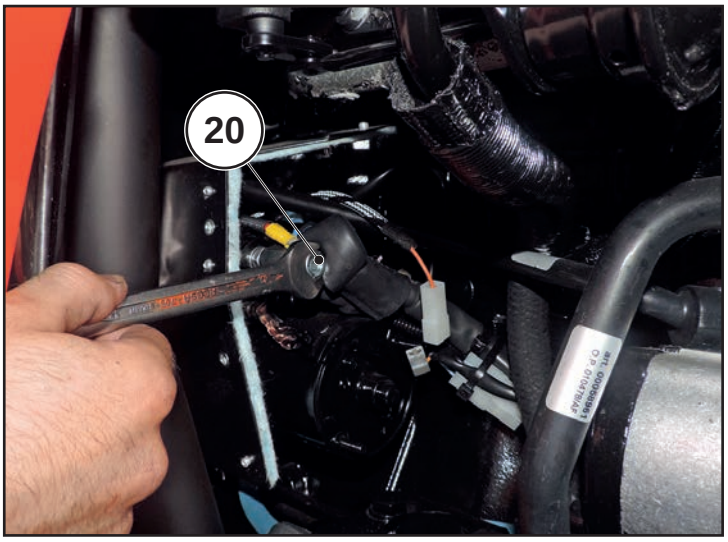

Fig. 14.15

Undo the four screws (21)

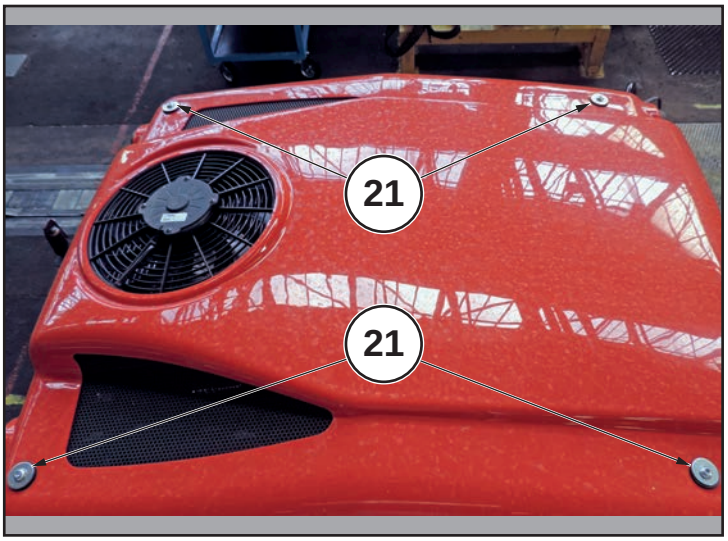

Fig. 14.16

Remove the cover (22).

Fit and tighten the four hoisting eye-bolts (23).

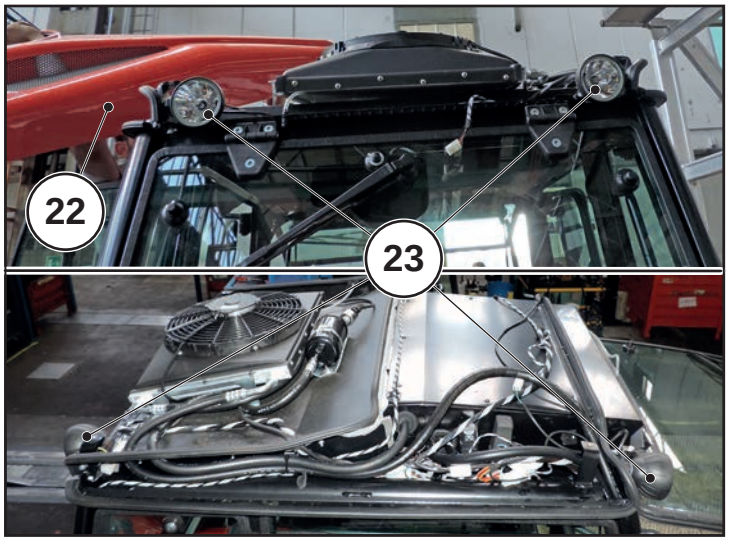

Fig. 14.17

Use the tool (A-07007181) to lift the cab (11).

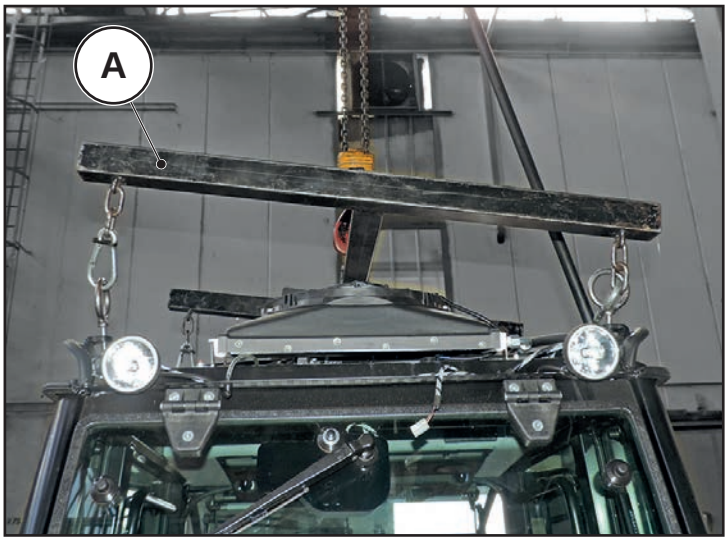

Fig. 14.18

14.3.5 Reassembly procedure for GL11 cab

Danger
All other persons must keep at a safe distance from the danger area.

Warning
Read the instructions in chapter "1-Introduction" and, in particular, the sections concerning the installation of O-rings, oil seals and bearings, with particular care before reassembling, and follow these instructions precisely when working. Apply the correct tightening torques when tighten the fasteners of components. Where tightening torques are not specified, refer to the table in chapter "1-Introduction". Use the specified sealant products during reassembly. Where the sealant required is not specified, refer to the table in chapter "1-Introduction".

Refit the cab by following the procedure for removal in reverse order.

14.4 Air conditioning system

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14.4.1 General description

14.4.1.1 Basic concepts

14.4.1.1.1 Introduction

Before describing the practical and theoretical aspects of air conditioning and air conditioning systems, it has been decided to give a brief presentation of some of the most important basic principles of elementary physics.

Increasing numbers of tractors are now equipped with an air conditioning system. It is therefore crucial that today's repair technicians acquire an adequate theoretical understanding of the fundamental principles concerning refrigeration systems in order to repair and service these systems with the competence necessary.

14.4.1.1.2 Pressure

In general, **pressure** is a physical quantity defined by the ratio between a given force with a vector perpendicular to a surface and the area of the surface itself (e.g.: 1 Kg over 1 cm2 of horizontal surface).

The **atmospheric pressure** in any given point of the atmosphere is the weight of the air column of unitary cross section (e.g.: 1 cm2) extending upward from this point to the upper limit of the atmosphere itself. The atmospheric pressure therefore decreases as the altitude of the measurement point increases (e.g.: the atmospheric pressure in the mountains is lower than the atmospheric pressure at sea level).

The most commonly used unit of measurement for pressure in the past was the **atmosphere**, whereby one atmosphere is equal to the atmospheric pressure at sea level in 'Normal Atmospheric Pressure' conditions, and is equivalent to the pressure exerted by a column of mercury (Hg) of unitary cross section measuring 760 mm in height measured at 0°C, at sea level and at latitude of 45°. This unit of measurement is denominated "**physical atmosphere**" and is represented by the symbol **atm**.

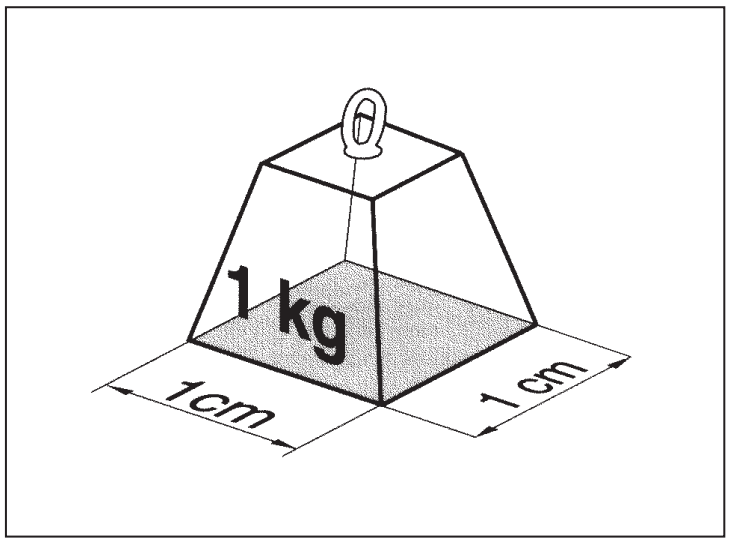

Fig. 14.19

The instrument used to measure the pressure of fluids is the pressure gauge (Fig.14.20).

Differential pressure gauges are normally used in technical applications, as they indicate the difference in pressure between the pressure of the enviroN·ment measured and atmospheric pressure.

On a differential pressure gauge (regardless of the unit of measurement used), the “0” reading on the scale corresponds to atmospheric pressure. As a result, the pressure value read by the pressure gauge is denominated "relative pressure".

Conversely, on pressure gauges with a scale on which "0" corresponds to an absolute vacuum and "1" corresponds to normal atmospheric pressure, the pressure value read is denominated "absolute pressure".

Absolute pressure is therefore the sum of the indicated relative pressure and normal atmospheric pressure (by definition = 1).

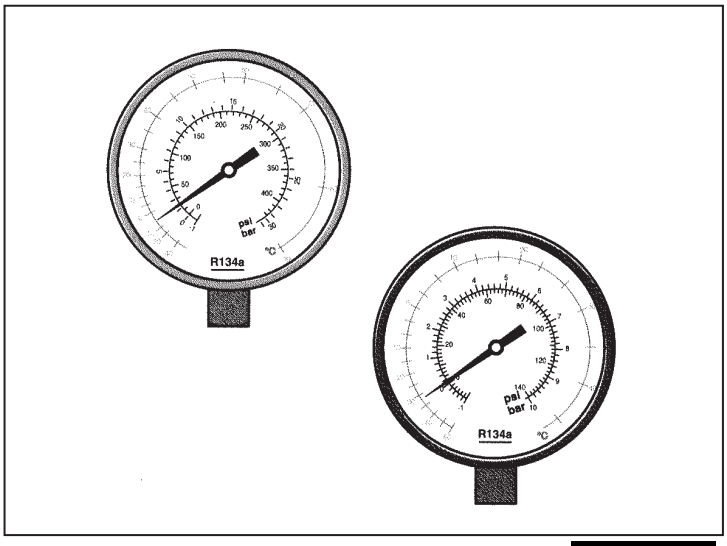

Fig. 14.20

A relative pressure lower than normal atmospheric pressure is called a negative pressure or vacuum. Negative pressures are measured with a vacuum meter (Fig.14.21).

Conversion factors between most commonly used units of measurement for pressure:

- 1 N/m2 = 1 Pa
- 1 N/cm2 = 104 Pa
- 1 bar = 105 Pa = 105 N/m2 = 10 N/cm2
- 1 atm= 101325 Pa= 1.01325 x 105 Pa
- 1 at = 98066.5 Pa = 0.980665 x 105 Pa
- 1 atm = 1.01325 bat = 10.1325 N/cm2
- 1 at = 0.980665 bar = N/cm2
- 1 bar = 0.98692 atm = 1.01972 at
- 1 psi = 0.068 atm = 0.069 bar = 6894.6 Pa
- 1 atm = 14.697 psi
- 1 bar = 14.505 psi

1 - reference pointer
2 - pressure reading pointer

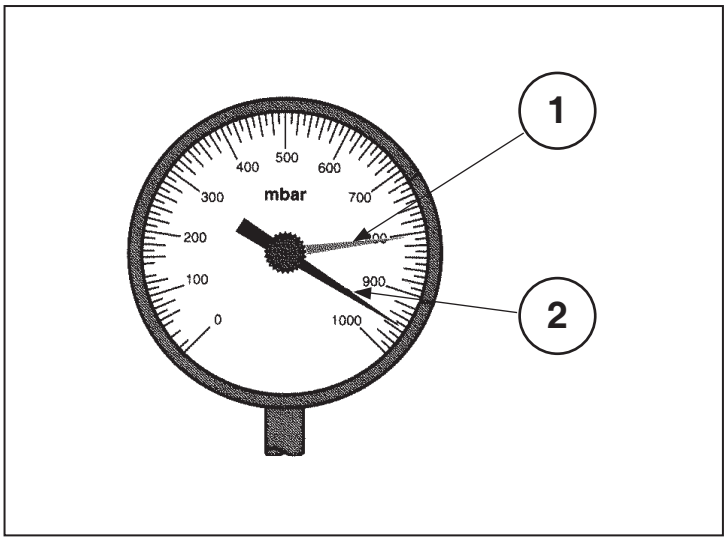

Fig. 14.21

14.4.1.1.3 Heat and temperature

The terms heat and temperature are regularly used in daily life.

One may say, for example, that a flame or the sun gives heat, and that therefore, these are heat sources.

Or, one could say the temperature of a an object that feels hotter than another to the touch is higher than that of the other object.

To clarify the meanings of the terms heat and temperature, so that they may be used correctly, more precise definitions of these terms are given as follows, with explanations of their main properties. The units of measurement for heat and temperature (which are largely interdependent) are also indicated.

Heat

Heat is a form of energy (thermal energy) occurring, albeit in different quantities, in all objects in the natural world.

The quantity of heat exchanged between different bodies cannot be measured directly, and may only be determined on the basis of the effects caused (e.g. variation in temperature, change in physical state, chemical reactions, production of mechanical work etc.).

The traditional unit of measurement for heat is the small calorie (cal), which is defined as follows: the quantity of heat necessary to increase the temperature of 1 gram of distilled water by 1°C (from 14.5 to 15.5 °C) at normal atmospheric pressure and at sea level.

In practice, however, the large calorie (Cal) or kilocalorie (kcal = 1000 cal) is generally used. This is defined as: the quantity of heat necessary to increase the temperature of 1 kilogram of distilled water by °C (from 14.5 to 15.5 °C) at normal atmospheric pressure and at sea level.

The unit of measurement for heat in use in the UK and US is the British Thermal Unit (BTU):

1 BTU = 0.252 kcal

However, neither the calorie nor the BTU are accepted units of measurement in the International System of units (SI), according to which the unit of measurement for heat is the Joule (J):

1 J = 0.000239 kcal = 0.000948 BTU

Other conversion factors between the units of measurement indicated above are given as follows:

- 1 cal = 4.186 J
- 1 kcal = 4186 J = 4.186 kJ
- 1 kcal = 3.968 BTU
- 1 BTU = 1054.87 J

In refrigeration and air conditioning systems and in the refrigeration industry in general, the commonly used unit of measurement for heat is the frigorie, which is defined as a quantity of extracted heat equivalent to 1 kcal.

In the UK and the US, the unit of measurement for refrigeration is the ton of refrigeration (which equates to 288000 BTU of extracted heat per day). The relation between these units is as follows:

1 ton = 12000 BTU/h = 3027 kcal/h = 12672 kj/h = 3.52 kW.

Temperature

The temperature of a body indicates the concentration of heat contained within the body itself, provided that both the mass (quantity of matter) and volume of the body remain the same.

Temperature is generally expressed in degrees.

As temperature may be measured according to different scales, the interval of temperature corresponding to 1 degree is different for different scales.

The most commonly used scales are Celsius and Kelvin.

The Celsius scale was obtained by dividing the temperature interval between the melting point of ice (0°C) and the boiling point of water (100°C) (for distilled water at normal atmospheric pressure and at sea level) into 100 equal parts. The degree Celsius is represented by the symbol °C. On the Celsius scale, the temperature at which there is

a complete absence of heat is –273.16 °C.

The Kelvin scale uses the same temperature intervals as the Celsius scale (i.e. the interval between the melting and boiling points of water divided by 100), but starts (0 K) at absolute zero (total absence of heat). As a result, the Kelvin scale is an absolute temperature scale. According to the Kelvin scale, the temperature of

melting ice is 273.16 K, while the temperature of boiling water is 373.16 K. The unit of measurement in the Kelvin scale is expressed with the symbol K.

In the UK and US, the Fahrenheit scale is used, according to which the temperature of melting ice is 32°F, the temperature of boiling water is 212°F and the temperature of absolute zero is – 459.67°F. The degree Fahrenheit is represented by the symbol °F.

Fig.14.22 compares a number of different temperature scales: Fahrenheit (°F), Celsius (°C), Réaumur (°r), Kelvin (K) and Rankine (°R).

The formulae for converting temperature values between different scales are given in this table.

scales	conversion formulae
°F > °C	°C = (°F-32) / 1.8
°F > °C	°F = (°C x 1.8) + 32
°F > K	K = (°F+459.67) / 1.8
°C > K	K = °C+273.16
°r > K	K = (°r+1.25)+273.16
°R > K	K = °R:1.8
K > °F	°F = (Kx1.8)-459.67
K > °C	°C = K-273.16

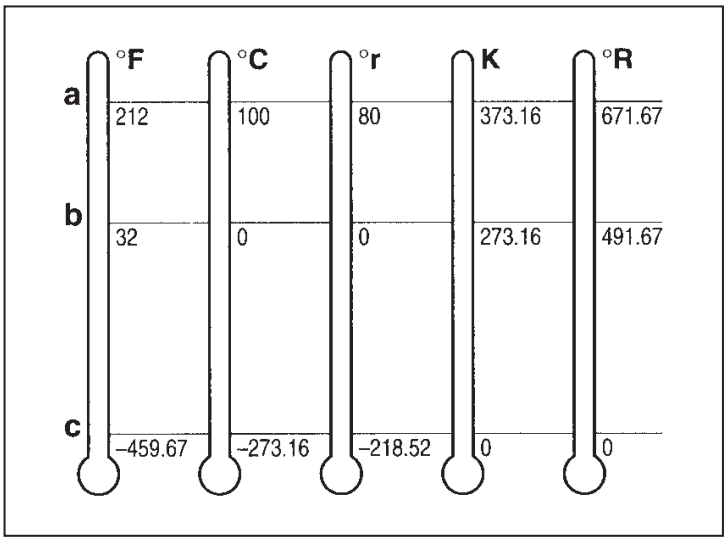

Fig. 14.22

a - boiling point of water
b - freezing point of water
c - absolute zero

Principles and modes of heat transfer

The main principle of heat transfer states that, between two bodies of different temperature, heat will move spontaneously from the body at a higher temperature to the body at the lower temperature or, within a single body of non-uniform temperature, heat will move spontaneously from warmer points to cooler points.

The transfer of heat from a cooler body to a warmer body can only occur if forced, and requires the expenditure of energy.

The quantity of heat which may be ran transferred over a unit of time from a warmer body to a cooler body is directly proportional to the difference in temperature.

There are three fundamental modes in which heat may be transferred between bodies at different temperatures:

- Conduction

  Takes place though contact between two bodies, without the movement of matter (typically between solid bodies).
- Convection

  Takes place through the movement of matter (typically in fluids).
- Radiation

  Takes place between different bodies that are not in contact through electromagnetic radiation (and infrared light in particular), even if there is a complete vacuum (no matter) between the bodies themselves.
  The most significant example of this in nature is how the sun's radiation heats the earth.

14.4.1.1.4 Influence of heat on transformations in the physical state of matter (at constant pressure)

To make the general considerations on the principles concerned in this topic discussed later in this chapter easier to understand, and illustrate how they are applicable in the operation of an air conditioning system, before moving onto the principles themselves, the following simple experiment is described as an example, in which it is possible to observe a number of physical phenomena occurring in a given substance (in this case water) when heat is applied.

This experiment takes place at sea level and at normal atmospheric pressure (760 mmHg = 1 Atm absolute), and requires a container, a source of heat (e.g. a flame), a thermometer and 1 kg of distilled water.

Experiment

Before the experiment starts, the water is placed in a freezer and allowed to transform into ice (solidify). The block of ice is then transferred to a container, the bulb of the thermometer is placed in contact with the ice and the container is placed on the flame (Fig.14.23 a-b).

At the start of the experiment, the thermometer indicates the temperature of the ice as it was removed from the freezer, e.g.: – 10°C.

As time passes, it is noted how applying heat causes the temperature of the ice itself to progressively rise, and the reading can be seen to increase, to –9°C, –8°C and so on up to 0°C.

Drops of liquid water now start to appear on the surface of the ice (Fig.14.23 c), indicating that the ice has started to melt. This process continues (Fig.14.23 d) until there is no remaining water in the solid phase and all the water in the container is in liquid state (Fig.14.23 e).

Observing the thermometer, it can be seen that the reading indicated remains at a steady 0°C throughout the entire duration of the melting process.

If heat is continued to be applied, while holding the bulb of the thermometer immersed in the water, the temperature reading will now rise continuously (Fig.14.23 f) until, as shown in (Fig.14.23 g):

- the thermometer indicates 100°C,
- while simultaneously, turbulent motion is generated in the water as a large quantity of steam is released.

The water has now started to boil (vaporise). This phenomenon continues until there is no trace of liquid water remaining.

If the bulb of the thermometer is held in contact with the boiling water during the interval of time from when the water starts to boil to when all the water has turned to vapour, it can be seen that the temperature indicated remains at 100°C.

If all the steam produced is collected in a suitable recipient (Fig.14.23 h) and we continue to apply heat, all the liquid will disappear (Fig.14.23 i), after which the temperature of the steam will progressively rise beyond 100 °C (Fig.14.23 l).

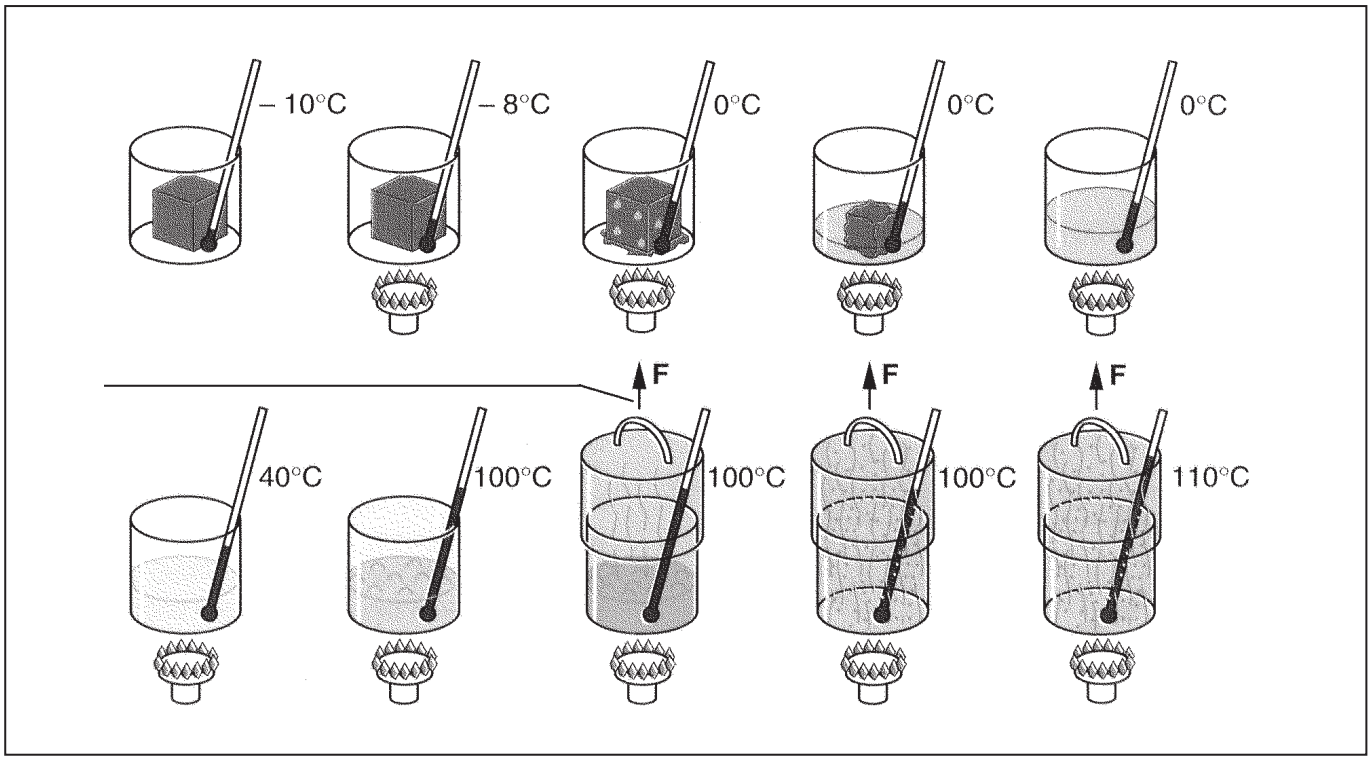

Fig. 14.23

The different stages in the experiment are represented in this graph.

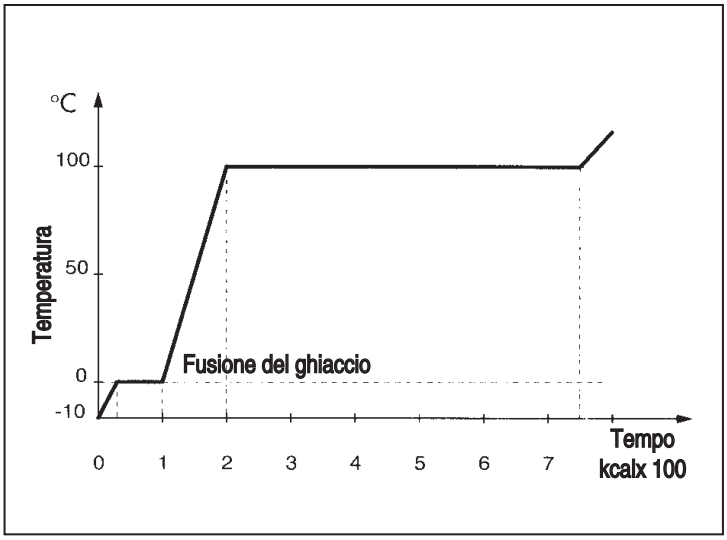

Fig. 14.24

During this experiment, two transformations in physical state were caused by applying heat only and without altering pressure:

- from solid (ice) to liquid -> fusion
- from liquid to vapour -> vaporisation

It was also observed that applying heat to the substance when in one phase only (solid, liquid or vapour) produced the following increases in temperature in the substance itself (water):

- from – 10°C to 0°C, for the solid phase (ice)
- from 0°C to 100°C, for the liquid phase
- beyond 100°C, for the steam (water in gaseous state).

The heat applied in these intervals, which produces a variation in temperature, is called sensible heat.

It was also noted that during the two transformations in physical state (fusion and vaporisation), the heat applied did not produce a variation in temperature, which remained at a steady:

- 0°C during fusion,
- and 100°C during vaporisation.

The heat exchanged in these intervals is called latent heat of fusion and of vaporisation. It is called latent, or hidden, because it causes no variation in temperature.

The vapour existing together with the liquid phase at the temperature of vaporisation is called saturated vapour.

Vapour existing without the liquid phase at temperatures above the temperature of vaporisation is called superheated vapour.

If this experiment is now repeated in reverse, starting with superheated vapour and subtracting heat, the water assumes the following states in the sequence indicated: saturated vapour at 100°C, liquid at 100°C, liquid at 0°C, solid (ice) at 0°C, solid at temperatures below 0°C (e.g. – 10°C).

The transformation from saturated vapour to liquid water is called condensation, and the heat subtracted is the latent heat of condensation.

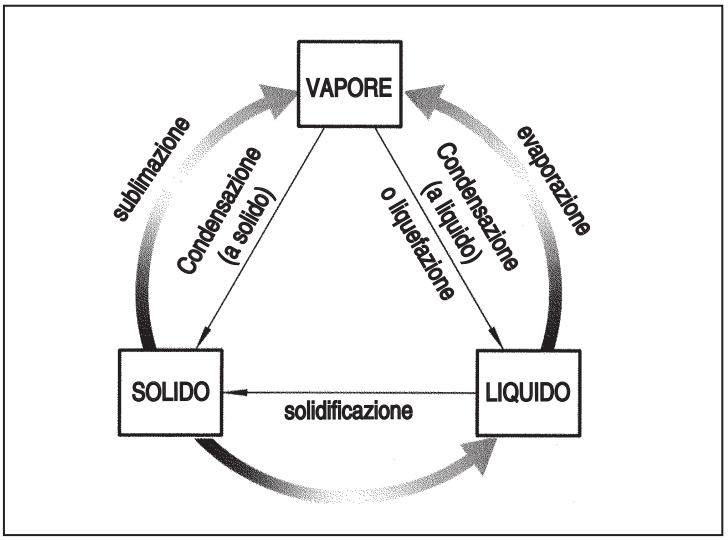

Fig. 14.25

The different transformations in physical state are summarised in Fig.14.25 and the relative forms of heat exchanged are shown in Fig.14.26.

If the experiment is performed using a constant heat source, and assuming that all the heat produced by this source is transferred to the substance, then the quantity of heat exchanged is proportional to time and, as a result, it can be seen (Fig.14.23) that the quantity of heat absorbed by the substance during the transformation of physical state from liquid to saturated vapour (latent heat) is significantly greater than the quantity of heat absorbed in heating the liquid substance from 0°C to 100°C (sensitive heat).

In the case of this example, 1 Kg of water: requires approximately 100 kcal (418.6 kj) of energy to increase in temperature from 0°C to 100°C; and approximately 540 kcal (2260 kj) to evaporate.

Analogous conclusions may be made if the experiment is performed in reverse, subtracting heat instead of applying heat.

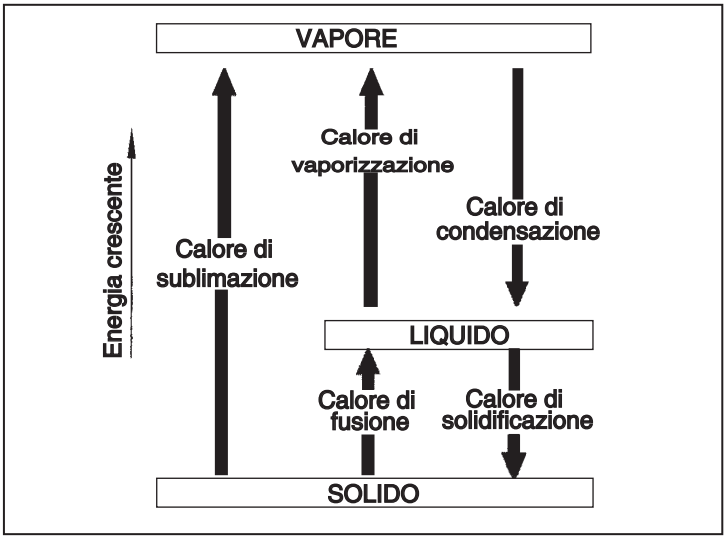

Fig. 14.26

Observations

From the above, it is evident that for a given mass of a given substance, the quantity of heat necessary to transform physical state, at constant pressure, much greater than the quantity necessary to change the temperature from the end of one state to the beginning of the next (e.g.: from the end of fusion to the start of vaporisation or vice versa).

This fundamental property of matter is used to make an air conditioning system work (refrigeration cycle).

Note

Solids which melt at a precise temperature (fusion point) are said to have a crystalline structure.

A non-crystalline or amorphous solid, on the other hand, (e.g. glass or plastic), softens gradually and changes to fluid state over a variable temperature interval when heated.

14.4.1.1.5 Influence of pressure on transformations in the physical state of matter

The experiment described in the previous paragraph demonstrated that if a given quantity of water is maintained at a constant pressure (p) of 1 bar absolute, it will boil when it reaches a temperature of 100°C (Fig.14.27 a).

If pressure is generated above the liquid the recipient – e.g. by applying a force F to a plunger sealed tightly against the walls of the recipient (Fig.14.27 b) - exceeding 1 atm abs, it will be seen that the water boils at a temperature higher than 100°C.

Conversely, if a pressure below 1 atm absolute (depression) is created in the recipient – e.g. by raising the piston (Fig.14.27 c) - the water will boil at a temperature lower than 100°C.

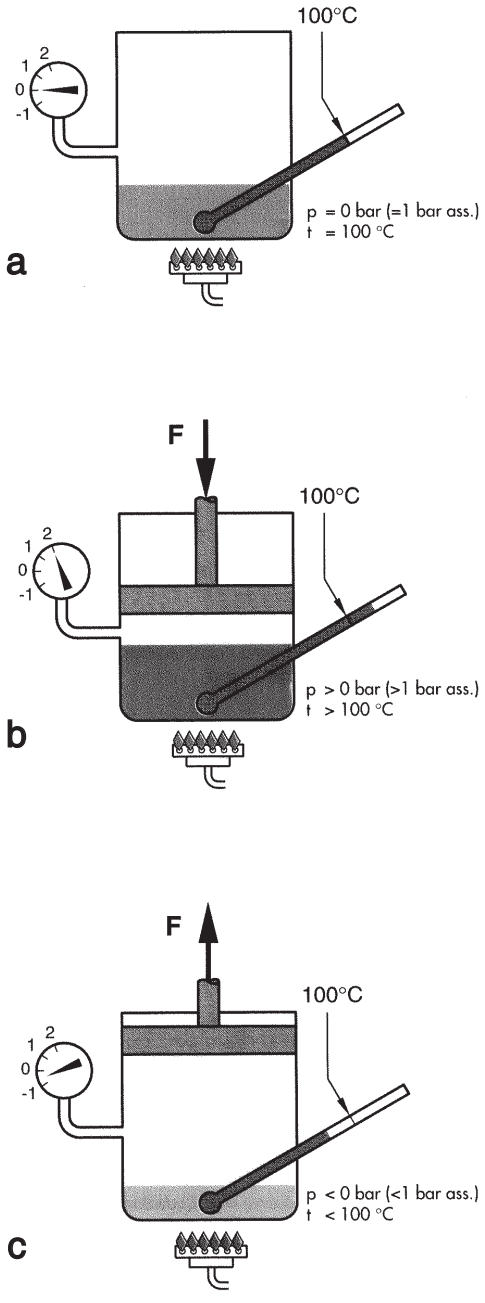

Fig. 14.27

This test may be repeated a significant number of times in different conditions to produce a graph (Fig.14.28), in which the curve (Z) represents all the temperature/pressure conditions in which the liquid state and the saturated vapour state of water are in equilibrium. In these combinations of pressure and temperature conditions, adding heat will transform the liquid into vapour, while subtracting heat will transform the vapour into liquid.

p - absolute pressure (bar)
t - temperature (°C)

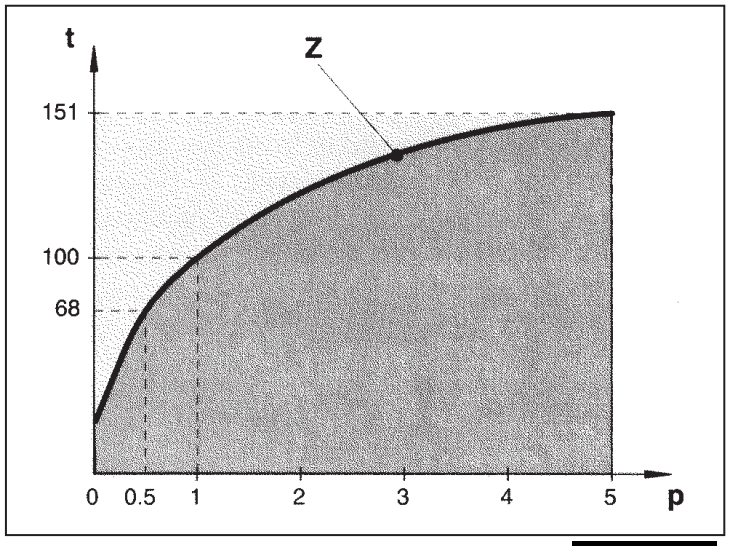

Fig. 14.28

14.4.1.1.6 Relation between temperature, pressure and volume in aeriform fluids

With regards to the aeriform fluids (gases and vapours) used in technical applications, a number of physical laws defined for ideal gases may be considered to apply, albeit with some degree of approximation.

These laws are summarised by the equation of state for an ideal gas:

$PV = RT$

where P = pressure, T = absolute temperature, V = volume, R = universal constant.

In practice, this means that altering any one of the quantities will change at least one of the other two.

The following principles are used in the refrigeration cycle:

- a reduction in volume (compression) causes an increase in pressure and temperature;
- an increase volume (expansion) causes a reduction in pressure and temperature.

Specifically, for a given mass of a given substance, this means that:

- at constant temperature,
  - an increase in volume reduces pressure;
  - a decrease in volume increases.
- at constant pressure,
  - an increase in temperature increases volume;
  - a decrease in temperature increases volume.
- at constant volume,
  - an increase in temperature increases pressure;
  - a decrease in temperature increases pressure.

14.4.1.1.7 Humidity

Generally, the term humidity is intended as the percentage ratio between the weight (or volume) of the water existing in a body and the weight (or volume) of the body itself.

Atmospheric air is a mixture of dry air and water vapour, and the quantity of this water vapour contained in the mixture is denominated atmospheric humidity.

Atmospheric humidity is measured with the following two different temperature values:

- dry bulb temperature (in °C), measured with a normal thermometer,
- and wet bulb temperature (in °C), measured with a thermometer, the bulb of which is covered in gauze soaked with water and ventilated.

The wet bulb temperature is always lower than the dry bulb temperature, as the water soaking the gauze evaporates, cooling the bulb itself.

These two temperature values may be used to determine:

- absolute humidity, defined as the mass of water vapour contained in a unit of volume of air, and expressed in grams of vapour per cubic meter of air;
- and relative humidity, defined as the percentage ratio between the mass of water vapour effectively existing in a given volume of air and the mass of vapour which would exist in the same volume of air in a saturated state, at the same temperature and pressure.

A relative humidity of 100% indicates a saturated state.

When saturated air cools, a proportion of the water vapour condenses, forming fog, rain or snow.

14.4.1.2 Operating principle of a refrigeration cycle

14.4.1.2.1 Description of the refrigeration and air treatment cycle

In this chapter, we will discuss the basic operating principle of an air conditioning system.

The extremely simplified schematic diagram in Fig.14.29 illustrates a closed circuit system consisting of the four indispensable components for the refrigeration cycle - evaporator (1), compressor (2), condenser (3) and expansion valve (4) - organised in their functional order, and of the tubing (5) connecting the components themselves.

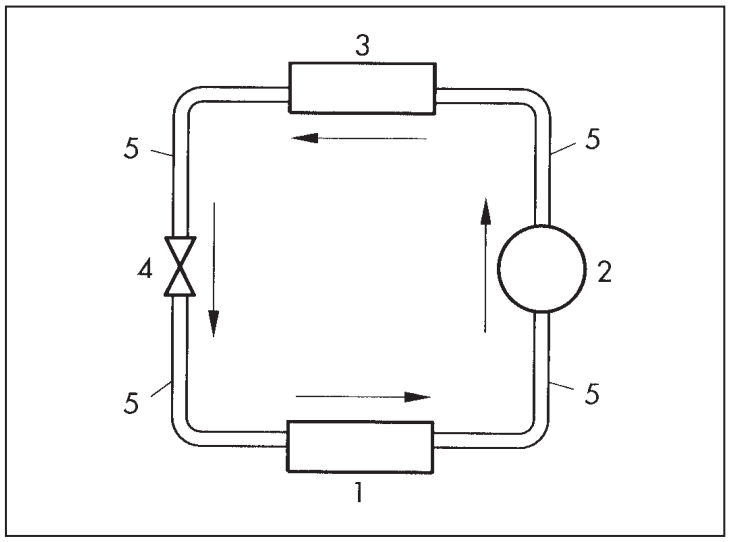

Fig. 14.29

The basic function of the system is to transfer heat from one enviroN·ment (cabin) to another (the enviroN·ment surrounding the vehicle). This is achieved by subjecting a refrigerant fluid, with which the system is filled, to a thermodynamic cycle consisting of pressure changes (in the compressor and expansion valve) and transformations in physical state (in two heat exchangers, namely the evaporator and condenser).

The basic principles of physics illustrated in the previous chapter may be used to explain each stage in this cycle. As an aid for understanding the concepts explained, another simplified circuit diagram (Fig.14.31), which is similar to the circuit shown in Fig.14.29, will be used as an example. Before continuing with the description of the cycle, however, to offer a clearer understanding of the pressure and temperature values mentioned, the pressure/temperature curve of R134a refrigerant - which is currently used in air conditioning systems for passenger vehicles and agricultural tractors - is given as a broadly generalised example (see Fig.14.30).

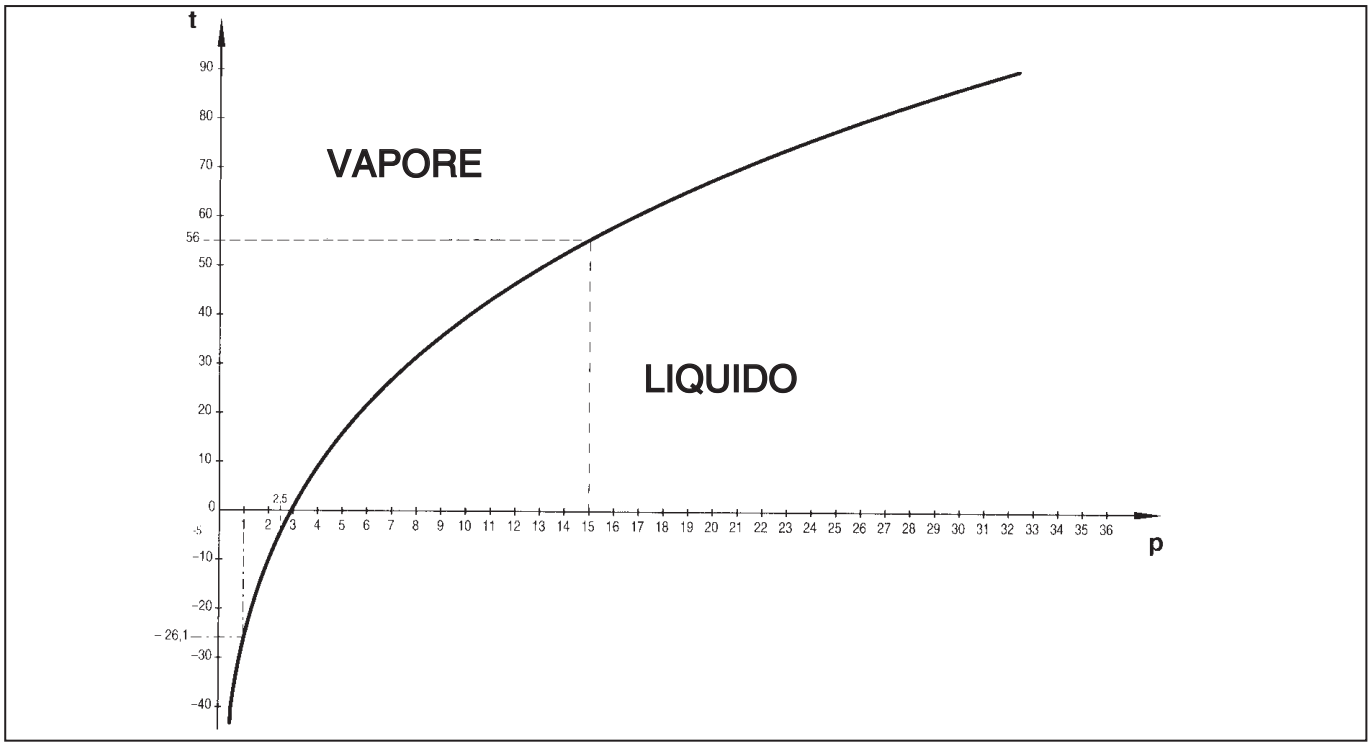

Fig. 14.30

p - absolute pressure (bar)
t - temperature (°C)

While the subject of refrigerants will be dealt with in more detail in the next paragraph, from this diagram, it can already be seen that at a pressure of 1 bar abs. (atmospheric pressure at sea level), R134a has a boiling point of -26.1 °C and that therefore, very low temperatures may be obtained by expanding the refrigerant at low pressure. Conversely, even if compressed at relatively low pressures, the refrigerant can remain in a gaseous state at reasonably high temperatures (e.g.: p = 15 bar and t = 56 °C).

Another important characteristic of the refrigerant for this application is its high latent heat values of vaporisation and condensation (e.g. 51 kcal/kg at 1 bar abs.).

In essence, therefore, this substance has a number of characteristics that make it ideally suited to this application, as it allows an operating range from very low temperatures to relatively high temperatures and may be used at low pressure values, permitting the use of components that are not excessively heavy or bulky.

We shall now analyse the stages in the cycle, beginning from point A in the circuit (Fig.14.31), at the inlet side of the evaporator. As the function of the evaporator is to extract heat from the cabin, it may be situated within or be directly connected to the cabin. In order to extract heat, the temperature of the evaporator must be lower than that of the enviroN·ment to be cooled, to allow heat to flow spontaneously from the (warmer) enviroN·ment to the (cooler) evaporator. Suppose that at point A, the refrigerant is in liquid state at a pressure of 2.5 bar and, therefore, at a temperature of approximately -5 °C (Fig.14.30).

To cool the cabin:

- it must either be flushed with cold air
- or the air in the cabin must be extracted, cooled and returned to the cabin.

In the first case, external air is passed through the evaporator to cool it and then forced into the cabin to expel the hotter air.

In the second case, the air from the cabin is recirculated through the evaporator.

Consider a situation in which the external air surrounding the cabin is at a temperature of 25 °C.
Point A - p = 2.5 bar t = -5°C
Point B - p = 2.5 bar t = -5°C
Point C - p = 15 bar t = 56°C
Point D - p = 15 bar t = 56°C

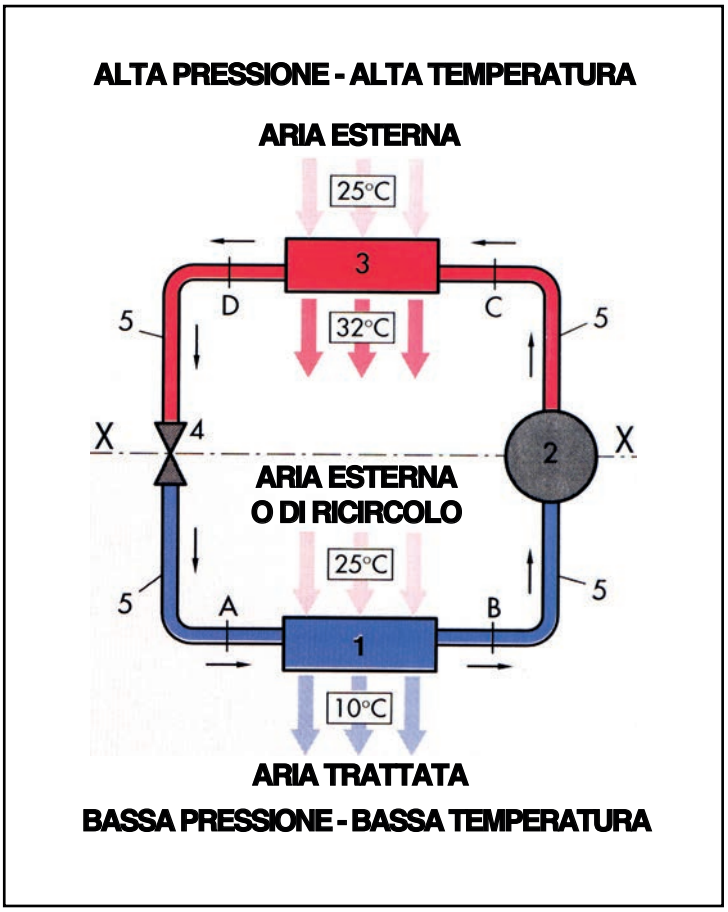

Fig. 14.31

The exterior air passes through the evaporator, the walls of which are at a temperature between 1 and 3 °C. As it is 22 to 24 °C warmer than the evaporator, the exterior yields part of the heat it contains to the evaporator itself, and cools from its initial temperature of 25 °C to 10 °C.

As it enters the cab, this treated air mixes with the existing air in the cabin, which is initially at 25 °C, and progressively lowers the air temperature.

Simultaneously, the refrigerant, which entered the evaporator with a pressure p of 2.5 bar and a temperature t of -5 °C, absorbs the heat extracted from the air at it passes through the evaporator, and transforms from liquid to gaseous state while remaining at the same pressure and temperature (latent heat).

At the outlet of the evaporator (Point B), the refrigerant is still at a pressure p of 2.5 bar and a temperature t of -5 °C, but is now in gaseous state and carries the quantity of heat yielded to it by the exterior air.

In order for the cycle to function continuously, as the circuit is sealed, the refrigerant leaving Point B must return to Point A in the same initial conditions (p = 2.5 bar, t = -5 °C).

For this to be possible, the refrigerant must first give up the heat it absorbed as it passed through the evaporator, and then returned to low pressure and low temperature.

The only way to give up this heat is to yield it the surrounding enviroN·ment which, however, is at a higher temperature (25 °C). The temperature of the refrigerant must therefore be raised from –5 °C to a value greater than 25 °C, so that the heat itself may transfer spontaneously from the refrigerant to the exterior enviroN·ment. This takes place in the compressor.

The compressor: aspirates the low pressure gaseous refrigerant received from the evaporator, compresses it and then delivers it to Point C at high pressure and high temperature (e.g. 15 bar, 56 °C).

The refrigerant, in gaseous state and still in approximately the same high pressure and temperature conditions in which it left the compressor, enters the second heat exchanger - the condenser - which yields the heat absorbed by the refrigerant in the evaporator to the exterior enviroN·ment.

To ensure that this process occurs as efficiently as possible, the refrigerant transforms from gaseous state to liquid state at constant pressure and temperature, so that it is the latent heat of condensation that is released.

Note

While by extracting heat, the exterior air passing through the condenser increases in temperature (e.g. from 25 to 32 °C), it then mixes with the surrounding enviroN·ment without perceptibly altering the conditions of the enviroN·ment itself.

When it leaves the condenser at Point D, the refrigerant is in liquid state and no longer carries the heat absorbed previously. However, it is still at a higher pressure and temperature than the initial conditions at Point A. The expansion valve is used to reduce the pressure and temperature of the refrigerant.

This component essentially forms a constriction in the circuit, ahead of which the pressure and temperature of the refrigerant are high, whereas after the valve, as their is space for the refrigerant to expand, the refrigerant itself undergoes a drastic reduction in pressure (e.g. from 15 to 2.5 bar) and, as a result, in temperature (from 56 °C to -5°C), while remaining in liquid state (albeit nebulised).

The initial conditions have therefore been restored and the cycle may be repeated continuously as long as the compressor is running.

Note

From the above description, it can be seen that the system consists of a hot section and a cold section.

These two sections are separated by the theoretical line X-X shown in Fig.14.31, cutting through the compressor and the expansion valve.

This separation is one of the fundamental elements to be taken into consideration when testing or troubleshooting the circuit.

14.4.1.2.2 Notes and comments

The process described above is extremely simplified. As a result, a number of additional notes are given as follows to explain how the principles of physics described in the previous chapter apply, along with comments explaining, at least in elementary form, the main differences between this simplified process and a real system which may be encountered in practice.

Heat exchange

Heat is exchanged between the different bodies involved in the cycle (air, components of the A/C or climate control system) and within the bodies themselves in the following modes:

- from the air to the outer walls of the evaporator (by conduction)
- from the outer walls of the evaporator to the inner walls, and from the inner walls of the evaporator to the refrigerant (by conduction)
- within the refrigerant and during the transit of the refrigerant from the evaporator to the condenser
- via the compressor (by convection)
- from the refrigerant to the inner walls of the condenser (by conduction)
- from the inner walls of the condenser to the outer walls of the condenser (by conduction)
- from the outer walls of the condenser to the air flowing through the condenser, and from this air to the external enviroN·ment (by convection and radiation).

Note: Heat is also exchanged between the interior of the system and the surrounding enviroN·ment through the walls of the pipes and filter. This heat exchange decreases the overall efficiency of the system, albeit by only a small degree.

Practical notes

For simplicity, the pairs of temperature and pressure values used as examples are considered to remain constant in both sides of the system (cold and hot) in relation to the conditions of the refrigerant.

In reality, however, the following considerations must be taken into account:

a - in heat exchangers, there is some difference in temperature between the inner and outer surfaces (e.g. an inner temperature of – 5 °C and an outer temperature of + 2 °C in the evaporator; an inner temperature of + 56 °C and an outer temperature of + 50 °C in the condenser)

b - there are differences between the temperature of the refrigerant entering and leaving the heat exchangers attributable to the fact that the components of the system are sized and calibrated to ensure that:
  - the refrigerant leaves the evaporator and reaches the compressor in completely gaseous state (as the compressor is specifically constructed to work with gaseous substances only and not with liquids). To ensure this, the gaseous state refrigerant must be slightly superheated to a temperature slightly above the saturated vapour phase (e.g. – 2 °C instead of – 5 °C);
  - the refrigerant leaving the condenser is completely in the liquid state, to optimise efficiency. As a result, the temperature of the refrigerant must be slightly lower than the condensation point temperature at the pressure considered (e.g. 52 °C instead of 56 °C: supercooled liquid);

c - other differences of a few degrees more on the cold side and a few degrees less on the cold side must be taken into account as a result of heat exchange occurring along the lines from the heat exchanger to the other (see previous note);

d - the refrigerant may sustain a loss in pressure along the circuit as a result of friction, turbulence etc. (loss of charge); additional positive or negative variations in pressure other than those produced by the expansion valve and the compressor are attributable to the aforementioned exchange heat taking place along the circuit and outside the heat exchangers;

e - The energy expended to operate the compressor (usually drawn from the engine of the vehicle) is transformed into heat. This is then yielded to the refrigerant and must be extracted together with the heat absorbed in the evaporator.

While the sequence of the components in the system will always be the same, in practice, their physical locations in the vehicle will be determined by the space available and by all other safety and functional constraints.

To prevent lost efficiency, however, it is vital that the expansion valve is placed within extreme proximity of the evaporator (to practically form a single unit).

The simplified diagram in Fig.15-12 shows the four main components of the system (evaporator, compressor, condenser and expansion valve), as, together with the refrigerant in the circuit, they are fundamental for the realisation of the thermodynamic cycle (refrigeration cycle).

In practice, however, the system contains another component - the receiver-drier - situated in series in the circuit between the condenser and the expansion valve. While this component performs a number of important functions, it is not involved in the thermodynamic cycle itself.

14.4.1.3 Main components of and air conditioning system

14.4.1.3.1 Refrigerant

This is the fluid used to fill the A/C or climate control system. It is the thermal vector which transports heat from the point in which it is extracted from the cabin (or, more correctly, from the air delivered to the cabin or recirculated within the cabin) by the evaporator, to the point in which it is yielded to the exterior enviroN·ment by the condenser.

Up until a few years ago, the A/C systems of passenger vehicles generally used R12 refrigerant (which is still in use today, where available, for the maintenance of old systems), a product with the chemical formula CCI2+F2 (dichlorodifluoromethane) and by numerous manufacturers under a wide variety of brand names and product denominations.

Consisting of a molecule which includes chlorine (Cl), R12 belongs to the family of compounds (CFC) acknowledged as among the primary causes of the depletion of the stratospheric ozone layer and of the consequent damage to the global ecology, and which are therefore considered with particular concern by the international community object. Starting with the Vienna Convention 1985, and with the subsequent Montreal Protocol of 1987, the international community has set itself the goal of outlawing the aforementioned substances, with a progressive reduction in their use leading to a total ban in their production alongside the introduction of legislation defining their limited permitted applications.

The ban on the production of these substances is already in effect throughout Europe (implemented in Italy with Law 549 of 28/12/93) and in the majority of other nations, whereas their use, as mentioned above, is now limited by their extreme rarity on the market.

In response to this, the industry has identified alternative substances with analogous physical properties but which do not contain chlorine and, as a result, are not harmful for the stratospheric ozone layer.

In particular, R12 (CFC-12) has been replaced by the refrigerant R134a (HFC –134a), with the chemical formula CH2+FCF3+ (1, 1, 2 – tetrafluoroethane).

The basic properties of this substance making it particularly suitable for use as a refrigerant are as follows:

- low boiling point, even at atmospheric pressure at sea level (29.8 °C for R12 and –26.1 °C for R134a).

  This simplifies the construction of the cold body (evaporator) absorbing heat from the air in contact with it.
- high boiling points, relative to the high ambient temperatures possible in summer (30 to 35 °C), at low pressure (e.g. 70°C at 18 and 21 bar respectively for R12 and R134a).

  These properties make it possible to dissipate heat effectively to the exterior enviroN·ment via the condenser, and construct a system without necessitating highly pressure-resistant and therefore heavy, costly components.
- high latent heat values of vaporisation and condensation in different temperature and pressure conditions.

- High pressure liquid
- High pressure gas
- Low pressure liquid
- Low pressure gas

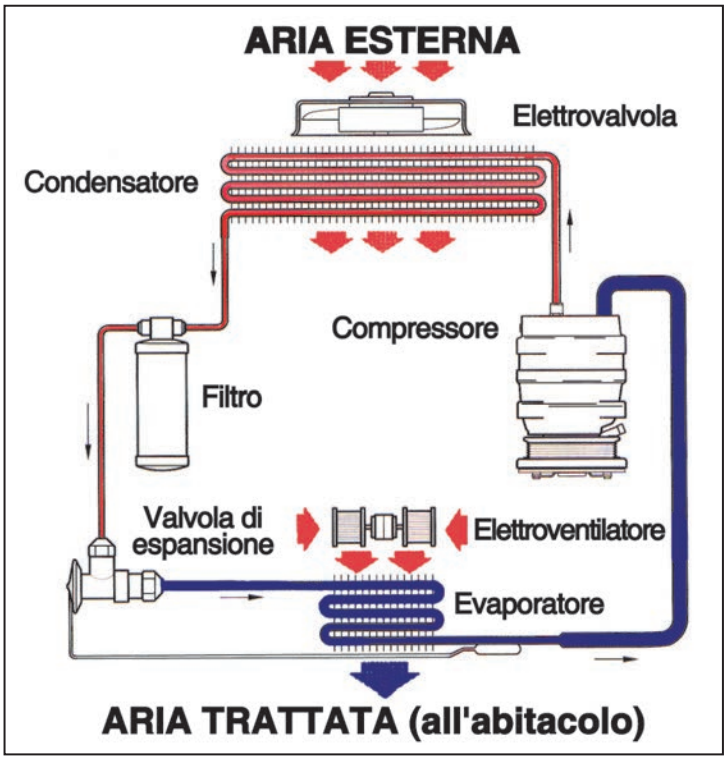

Fig. 14.32

14.4.1.3.2 Evaporator

As mentioned in the previous chapter, the evaporator is the component of the A/C system which extracts heat from the air delivered to the cabin (the relative modes of heat exchange have already been described).

Another very important function of the evaporator, which was not mentioned previously, is to dehumidify the air.

This takes place with the following process:

- in normal conditions, air contains a certain quantity of water vapour;
- this vapour condenses when it comes into contact with the cold surfaces of the evaporator;
- this water in liquid state (condensate) is collected in a tray and drained via specific pipes or ducts;
- the heat of condensation of this water vapour is yielded to the refrigerant via the walls of the evaporator, together with the heat extracted from the air to reduce its temperature.

As a result, the treated air leaving the evaporator and delivered to the cabin is not only at a lower temperature but also contains less humidity.

14.4.1.3.3 Compressor (F)

The compressor is the component which pumps and circulates the refrigerant around the A/C circuit.

The functions of the compressor are:

- circulate refrigerant around the circuit
- raise the pressure and, as a result, the temperature of the gaseous state refrigerant received at low pressure and low temperature from the evaporator.

To perform these functions, the compressor consists of the following basic parts:

- a housing, made up of a different components and equipped with brackets for fastening to the vehicle;
- an internal mechanism to actually pump the fluid;
- a system of valves to regulate the intake and output of refrigerant;
- connectors for connecting pipes;
- a pulley/clutch (electro-clutch) assembly to receive power;
- a quantity of oil.

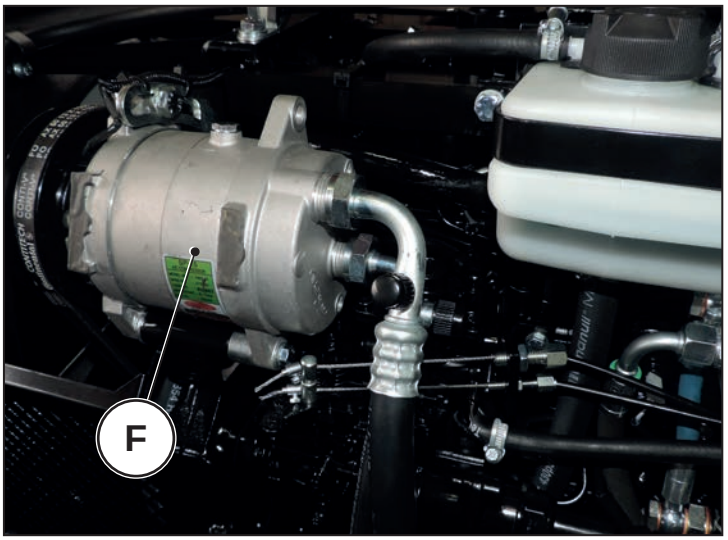

Fig. 14.33

14.4.1.3.4 Condenser (G)

The condenser is the heat exchanger which extracts the heat absorbed in the evaporator and the heat produced as a result of the energy expended to operate the compressor from the refrigerant circulating in the A/C system.

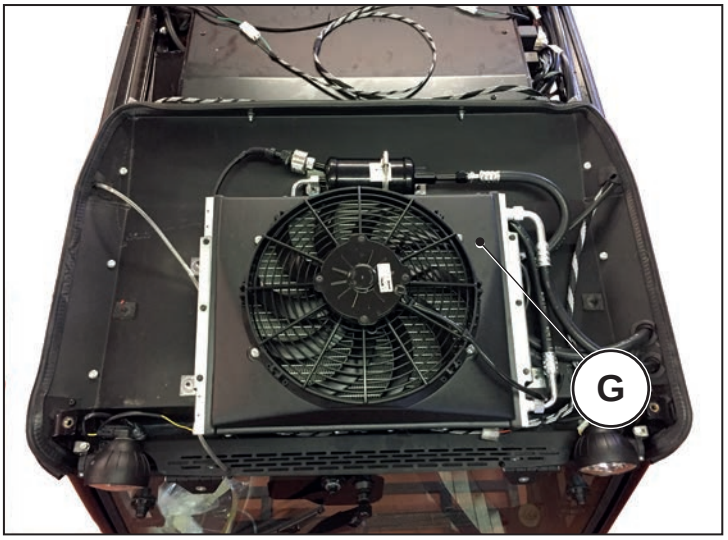

Fig. 14.34

14.4.1.3.5 Receiver drier (H)

While installed in series with the other components along the flow of refrigerant within the A/C system, the receiver drier performs no thermodynamic functions and therefore does not influence the transformation in state of the refrigerant or heat exchange.

However, as will be seen later, the receiver drier has numerous very important functions.

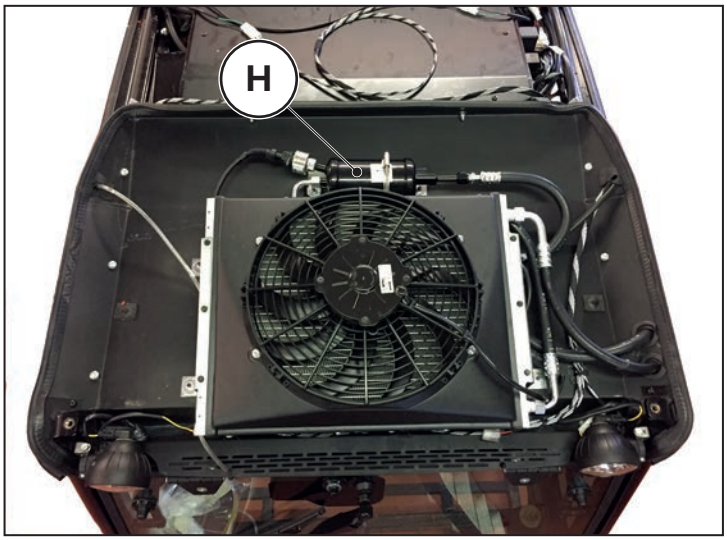

Fig. 14.35

14.4.1.3.6 Expansion or regulator valve

The expansion valve performs the following two essential functions in the A/C system:

1 - it drastically reduces the pressure and, therefore, the temperature of the liquid refrigerant received, via the receiver drier, from the condenser;

2 - it continuously regulates the flow of refrigerant to the evaporator so ensure that, in all possible thermal load conditions, the refrigerant evaporates completely as it passes through the evaporator and is superheated during the final part of the evaporator itself by just enough to ensure that it reaches the compressor in a completely gaseous state.

14.4.2 Discharging and charging the system

14.4.2.1 Safety rules

Always observe the following health and safety rules precisely when handling refrigerant.

a - Always wear protective eyewear and gloves when handling refrigerant.
In the event of contact with the eyes, refrigerant may cause damage to the sight or blindness.

b - Avoid skin contact with refrigerant.
Refrigerant has a very low boiling point (approximately –26 °C for R134a and approximately –30 °C for R12 at ambient pressure and sea level) and may cause freezing.

c - Implements used to handle refrigerant must be used in an adequately ventilated enviroN·ment, in which the entire volume of air is exchanged at least four times every hour. Prolonged inhalation of refrigerant vapour may be harmful to the health or even lethal.

d - Do not use implements for handling refrigerant in the vicinity of unsealed or leaking recipients containing flammable substances.

e - Do not tamper with or modify the vent and safety valves of the containers and implements used for collecting and treating refrigerant.

f - Do not fill any recipient (cylinders, A/C system charging equipment or other storage containers) with refrigerant unless it is approved for this purpose and equipped with a suitable safety relief valve.

g - Never fill any storage container beyond 80% of its total capacity.

h - Use extreme caution when disconnecting the service lines as they may still contain pressurised refrigerant.

14.4.2.2 Charging procedure

14.4.2.2.1 Introduction

An A/C or climate control system may be installed as original equipment during the assembly of the tractor itself on the production line, after production, on the assembled tractor before delivery to the customer, or as an aftermarket installation on a tractor already in use.

In all three cases, once it has been correctly and completely installed on the vehicle, an A/C or climate control system must be charged with refrigerant fluid before it can be operated. The following are described in the subsequent paragraphs:

- the essential implements necessary to charge the system (fill with refrigerant);
- the relative procedures;
- the functional and performance tests for the installation.

14.4.2.2.2 Basic implements

The basic implements for charging an A/C or climate control system consist of the following:

- a vacuum pump;
- a metering cylinder or scales for measuring the quantity of refrigerant (in weight) necessary;
- a pair of pressure gauges;
- a vacuum meter;
- a set of taps for making and handling the connections between the aforementioned components, the A/C system and the auxiliary refrigerant bottle;
- a set of service lines with relative connectors for connecting to the service valves of the system and of the auxiliary bottle.

The aforementioned components are usually grouped together in a housing to form a single station which may be used to perform all the operations involved in charging the system.

According to current legislation in Italy, Europe and the majority of other countries, it is no longer permitted to release refrigerant into the enviroN·ment, and it is it is mandatory to recover all the refrigerant contained when discharging a system.

As a result, appropriate implements must be used to discharge A/C systems.

In addition to the specific components required for charging A/C systems indicated above, the R12 and R134a versions of the DVX recovery, recycling and recharging station and the Refmaticplus station (Fig.26-12) also include the following:

- a hermetically sealed compressor which aspirates the refrigerant discharged from the A/C or climate control system, recirculates it through an internal recycling system and then transfers it to a tank for subsequent reuse;
- a filter separating solid particulate, humidity and corrosive contained in the recovered refrigerant;
- a distiller for separating oil;
- a condenser unit for separating non-condensing gases, with relative automatic or manual venting device;
- an electronic scale for weighing the refrigerant;
- a microprocessor with keyboard and display for selecting and monitoring the different automatic cycles.

14.4.2.2.3 Procedure

This procedure consists of the following stages:

- evacuation of all the air in the system;
- dehydration;
- vacuum seal tightness test;
- charging with refrigerant;
- activating system and testing performance.

Evacuation of all the air in the system

All the air contained in the system must be evacuated:

- to ensure that the entire internal volume of the system is available for the refrigerant;
- to prevent air and the moisture its contains (even if only in very small quantities) from contaminating the refrigerant and altering its thermodynamic properties.

Air is aspirated from the system with the vacuum pump, connected to the LP and HP service connectors of the A/C or climate control system using the service connectors of the charging station, with the engine of the vehicle switched off.

This stage in the procedure is very short. During this stage, the readings on the HP and LP manometers on the charging station drop from 0 to almost -1.

1 - Recovery manometer
2 - Charging manometer
3 - Display
4 - Start Recovery Cycle
5 - Start Vacuum Cycle
6 - Start Charge Cycle
7 - Start/Stop
8 - Alarm indicator
9 - Report
10 - menu +/-

Fig. 14.36

Dehydration

This is a continuation of the previous stage, during which the vacuum pump continues to run and the pressure reading indicated by the manometers remains close to -1.

The recommended duration of this stage is 40 to 45 minutes, or even longer in the case of particularly large circuits. During this stage, any moisture that had not been evacuated together with the air and remained trapped in liquid state inside the system (in pits and recesses in the inner walls of parts such as hoses in particular, dissolved in the compressor oil, absorbed by the filter etc.), vaporises and is extracted in gaseous state by the vacuum pump.

Note: As explained earlier, the boiling point of water is dependent on pressure.

The temperature within a system as it is being prepared for charging is practically the same as the ambient temperature in the workshop. As this temperature may be very low, especially in winter (e.g. 10 to 15 °C), the only way to evaporate all the moisture in the system is to reduce the pressure, which is done using the vacuum pump.

The considerable length of this stage in the procedure is necessary to allow all the water vapour released from even the remotest parts of the circuit to reach the service valves and be extracted.

All the moisture contained in the system must be removed to prevent:

- the formation of corrosive acids as a result of chemical reaction with the refrigerant and oil, and the consequent damage to components;
- the formation of ice within the expansion valve, obstructing the calibrated hole and rendering the system inoperative.

Vacuum seal tightness test

The system must be tested to check that it is perfectly gas-tight before it is charged with refrigerant. To check the seal tightness of the system, once the dehydration cycle is complete, the tap connecting the A/C or climate control system to the vacuum pump is closed, the vacuum pump is stopped and the connection between the system and vacuum gauge is opened.

The pointer of the vacuum gauge now shows a reading close to -1. The reading is either noted or set with the reference pointer (vacuum meters often include a secondary, manually settable reference pointer). If the reading indicated has not changed noticeably after approximately 10 minutes, the system may be considered to be perfectly gas tight. The vacuum gauge connection tap is now closed and the system is charged.

If the vacuum gauge reading moves noticeably towards 0 during the test interval, this means that the system is not gas tight. A system that is not gas-tight will quickly lose refrigerant charge and, as a result, performance. In this case, the leak or leaks must be located and rectified and the procedure restarted from the beginning.

Charging with refrigerant

The quantity (weight) of refrigerant necessary for optimum operation of the A/C or climate control system is determined by the manufacturer and indicated in the respective use and maintenance manual.

If, for any reason, this value is not available, it may be determined empirically by charging the system gradually with refrigerant until optimum pressure values are obtained.

Where the correct weight of refrigerant necessary to charge the system is known, it must be measured out precisely.

There are essentially two different ways of doing this, depending on the implements available:

- from the difference in weight of the refrigerant container at the start and the end of the charging procedure, using an high electronic precision scale, as in the case of DVX Refmatic stations.
- indirectly, using the pressure (temperature) and volume of the refrigerant, measured with a conventional metering cylinder (as in the case of the DVX Fill Station), to determine the difference between the start and end weights.

The system may be charged with refrigerant:

in liquid phase

if the pressure in the metering container or cylinder is sufficiently high (8 to 10 bar) to permit the entire quantity of refrigerant necessary to be transferred to the system solely by the difference in pressure between the container and the A/C or climate control system.

In the case of a refrigerant container at a lower pressure (e.g. 5.7 bar), if the container is not in contact with any source of heat, the temperature inside the container is the same as the ambient temperature (e.g. 20 °C), and as a

result, simply connecting one with the other will only produce the same pressure in the A/C or climate control system.

In this situation, due to the pressure equilibrium created between the container and the system, it will not be possible to charge the system completely with refrigerant in the liquid phase.

To increase the pressure within the container, the refrigerant is heated before it is transferred to the A/C or climate control system.

- This is done with a heater element applied to the metering cylinder (as in the case of the Fill Station);
- or with a compressor within the station itself (as in the case of the Refmatic).

Note
Charging with refrigerant in liquid phase is only possible by introducing refrigerant into the part of the circuit downstream of the compressor via the high pressure service valve. Introducing refrigerant in liquid phase upstream of the compressor would damage the compressor itself as soon as it is started.

In gaseous phase

The container is connected to the low pressure service valve, the engine of the vehicle is started and the refrigerant is aspirated into the system in pure gaseous state by the compressor of the system itself. Taps along the route of the refrigerant within the station from the container to the system are used to create throttles to ensure that all the refrigerant is in gaseous state.

In mixed phase

In this case, refrigerant is first transferred to the system in liquid phase until pressure equilibrium is attained, and then aspirated into the system in gaseous phase by the compressor.

In this case, the taps of the station must be opened and closed as necessary to ensure that liquid phase refrigerant is delivered downstream of the compressor and gaseous phase refrigerant is delivered upstream of the compressor.

Activating system and testing performance

Once the charging procedure is complete, with charging station still connected, the A/C system is activated and its performance is tested as follows:

- start the engine and set and maintain an engine speed of 1500 to 1800 rpm;
- set the controls of the A/C or climate control system for maximum cooling, with the lowest thermostat setting (if applicable) and the maximum fan speed setting;
- open the doors of the vehicle;
- leave the system running in these conditions for approximately 10 minutes;
- close the doors and windows;
- read the pressure values indicated on the HP (high pressure) and LP (low pressure) manometers;
- measure the temperature of the surrounding enviroN·ment with a thermometer.

If the system is functioning correctly, the pressure values read, in relation to the ambient temperature measured, should be within the ranges indicated in Table 1.

R134a

Ambient temperature (°C)	High Pressure manometer (kg/cm²)		Low Pressure manometer (kg/cm²)	
	min	max	min	max
15.5°	9.5	13	0.5	3
21.0°	12.5	17.5	0.5	3
26.5°	14	20.5	0.5	3
32.0°	16	24	0.5	3.5
38.5°	18.5	25.5	0.5	3.5
43.0°	22	28	0.5	3.5
Table 1				

To interpret the manometer readings correctly, it is necessary to take into account the fact that the pressure readings themselves are influenced by atmospheric pressure which, minor differences due to weather aside, decreases progressively with increasing altitude above sea level.

To allow for these differences in pressure, the correction values given in Table 2 must be subtracted from the manometer readings.

Variation in pressure with altitude

Altitude (m) asl	Absolute atmospheric pressure (kg/cm²)	Correction(kg/cm²)
0	1.029	0
300	0.994	-0.035
600	0.959	-0.070
900	0.924	-0.105
1200	0.889	-0.140
1500	0.854	-0.175
1800	0.815	-0.210
2100	0.791	-0.238
2400	0.763	-0.266
Table 2		

14.4.3 Functional tests

14.4.3.1 Implements necessary

The following implements are needed to check that the system is working correctly and diagnose any problems:

- Refrigerant recovery, recycling and charging station (Fig.14.37).
- Thermometer / hygrometer (Fig.14.38).
- Refrigerant leak detectors (Fig.14.39).
- Protective gloves and eyewear (Fig.14.40).

Fig. 14.37

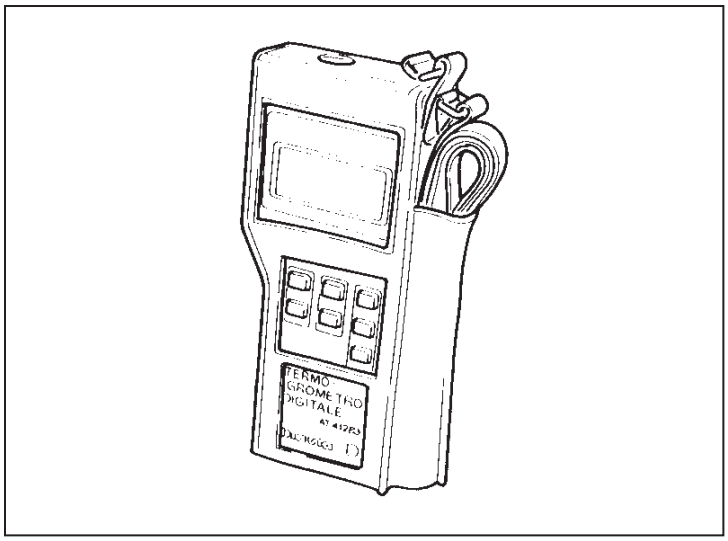

Fig. 14.38

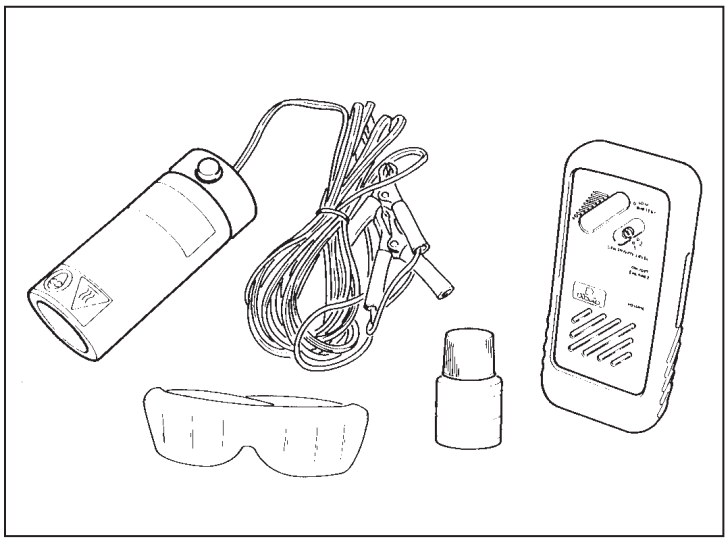

Fig. 14.39

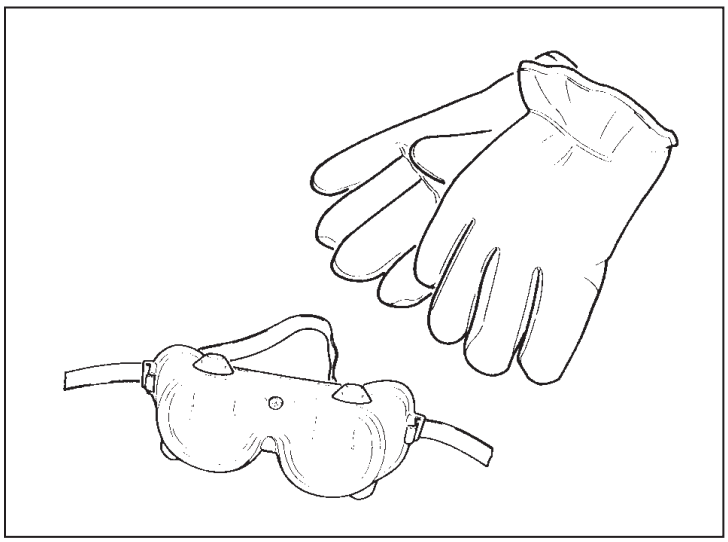

Fig. 14.40

14.4.3.2 Measuring temperature

After checking that the pressure values are correct and that all the filters are clean, a functional test of the system is carried out by measuring the temperature of the air delivered from the vents in the cab. Follow the procedure described below, referring to the following table.

Temperature table

Temp. outside vehicle (°C)	Temp. of air exiting centre vents (°C) (average)
20°	6°-8°
25°	8°-10°
30°	8°-12°
35°	9°-14°
Table 3	

1 - Select the minimum temperature setting from the control panel and select an intermediate fan speed.

2 - If applicable, check that the thermostat setting is correct with the dial set one quarter of a turn from the coldest setting.

3 - Switch on the system and maintain an engine speed of 1500-1800 rpm.

4 - Measure the temperature with the thermometer probe held in front of the vents, and compare against the value indicated in the table.

If the air temperature in the cabin is higher than the exterior temperature, open the doors, allow the temperature to stabilise with the system running for 5 - 10 minutes and then measure the temperature values.

For any problems such as unpleasant odours, insufficient cooling power or abnormal noise, contact a service centre specialised in Delphi A/C systems.

14.5 Tools necessary

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14.5.1 Tools necessary

p/n	Description	Quantity
07007181	Cab hoisting tool	1

15 : Rear hitch

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15.1 Safety notes

To prevent accidents and injuries, always comply with the precautions and safety recommendations described in this section. In addition, operators must always comply with the safety instructions given in the operation and maintenance manual and in chapter 1 of this manual.

Danger
Make sure that all persons keep well away from the danger zone. Avoid vibrations when the bolts are loosened.

Danger
Lift and handle all heavy parts with lifting equipment of an adequate capacity. Arrange all harness and hooks in safe positions. Operators must remain at a distance and in a safe position, well away from the lifted load.

Danger
Do not twist the chains or metal ropes used for lifting purposes. Always wear safety gloves when handling cables or chains.

Danger
Use the right tools to align holes. NEVER USE YOUR FINGERS OR HANDS.

Danger
Handle all parts with the utmost care. Do not put your hands or fingers between one part and the next.

Danger
For safety reasons, always leave two screws on opposite sides when removing components that could fall. Only remove these screws after having secured the component to lifting equipment or placed bearing blocks underneath.

Danger
If the bolts that fix the safety frame or cab have loosened or if the safety frame or cab are removed, make sure that the parts are re-installed correctly so that adequate protection is provided for the operator.

Caution
Keep clear of sharp edges.

Caution
Used oil must be collected and disposed of in compliance with the anti-pollution laws in force.

15.2 Technical specifications

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15.2.1 Technical specifications 15-4

15.2.1 Technical specifications

Type	Hydraulic with position and draft control
Lifting capacity at ball ends	2400 kg
Three-point linkage class	Class 1 and 2
Mechanical top link linkage	Class 1 and 2
Hydraulic top link linkage	Class 1 and 2 / 1 and 2 with quick coupling
Type of lower links	Telescopic with quick couplings
Type of right-hand link	Hydraulic

15.3 Disassembly

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15.3.1 Disassembly

Danger

Secure the hitch unit to lifting equipment of adequate capacity.

Unscrew the nuts (1) and remove the washers (2) that fasten the hitch to the rear differential assembly.

Lift and remove the rear hitch assembly (3).

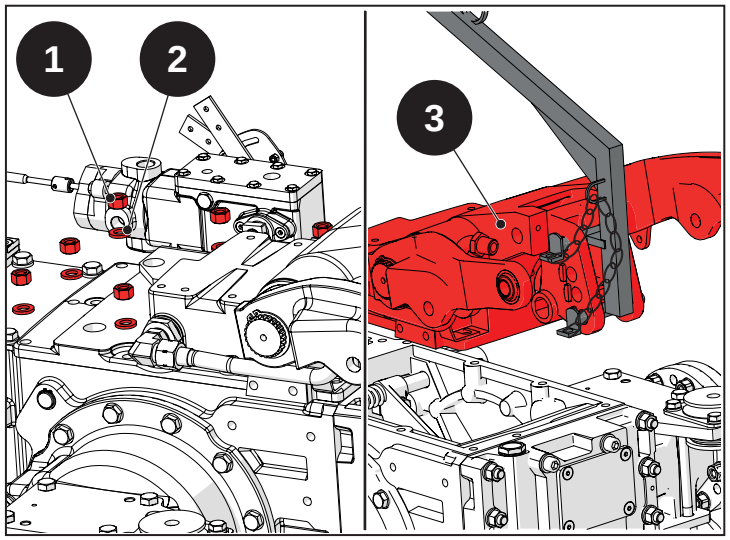

Fig. 15.1

Remove the union (4) and washer (5).

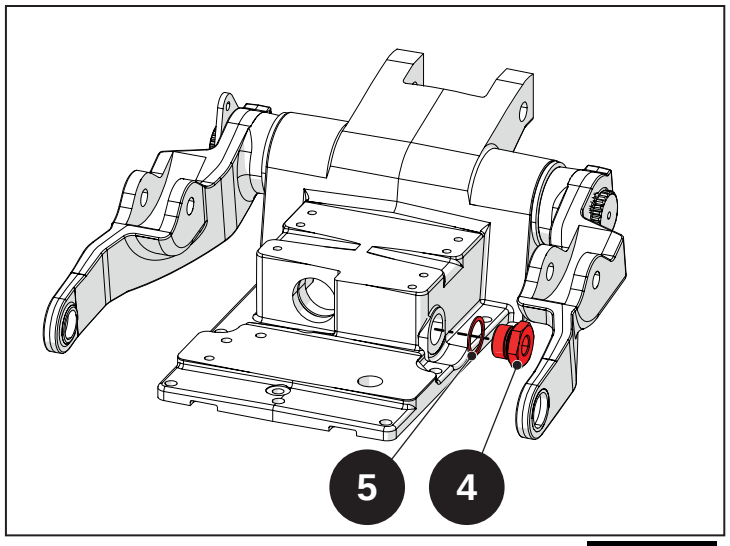

Fig. 15.2

Remove the circlips (6) and part (7).

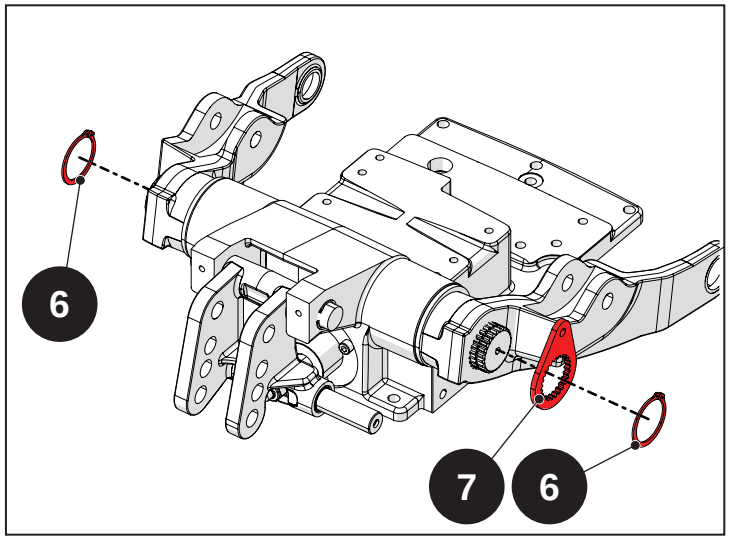

Fig. 15.3

Remove the linkages (8).

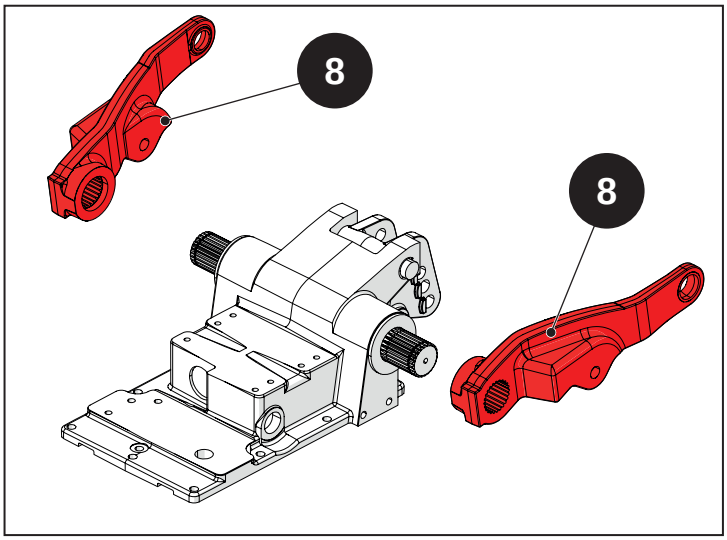

Fig. 15.4

Remove the spacers (9).

Remove the oil retainers (10).

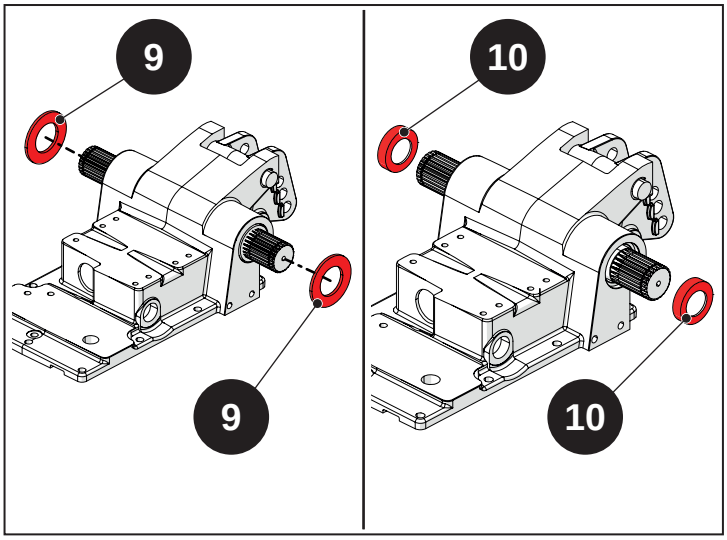

Fig. 15.5

Remove the shaft (11).

Unscrew the self-locking nut (12).

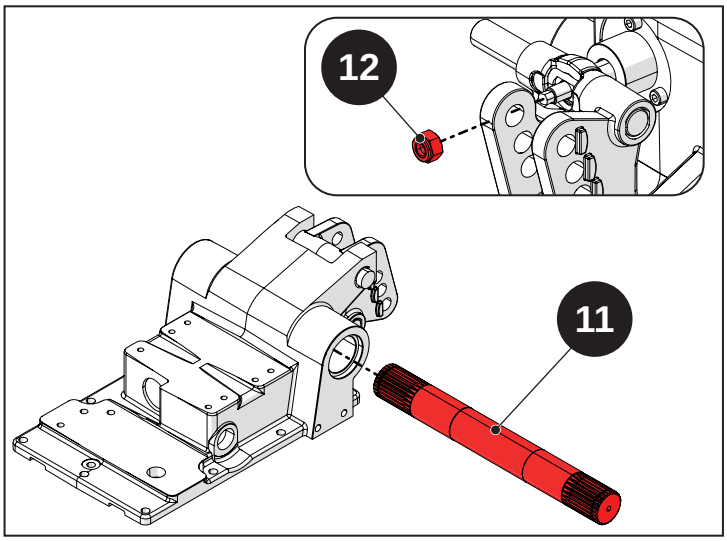

Fig. 15.6

Remove the circlips (13) and upper pin (14).

Remove the top link support (15).

Remove the lower pin (16) and O-ring (17).

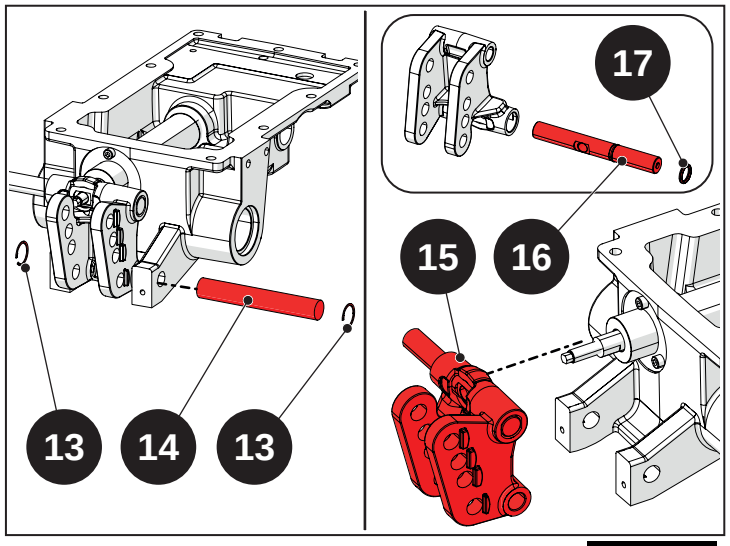

Fig. 15.7

Unscrew the screws (18) and remove the washers (19).

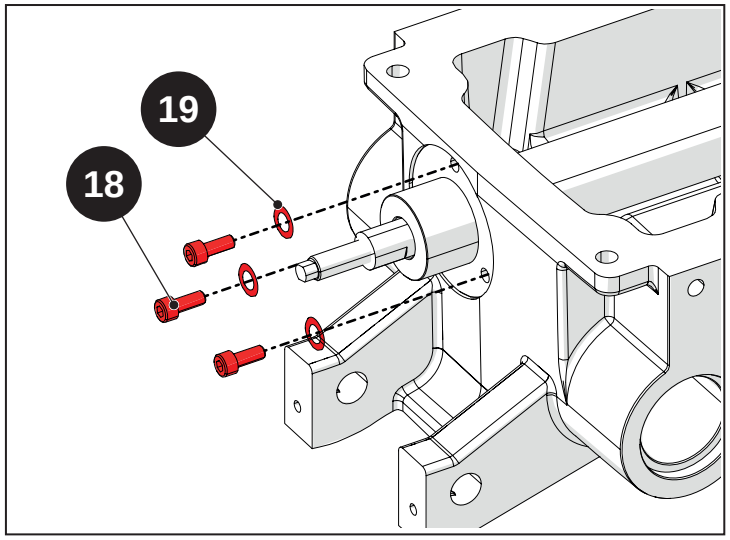

Fig. 15.8

Remove the cover (20) and draft control adjuster, which consists of:

- Screw (21);
- Spacer (22);
- Spring (23);
- Spacer (24);
- Spring adjuster spacer (25);

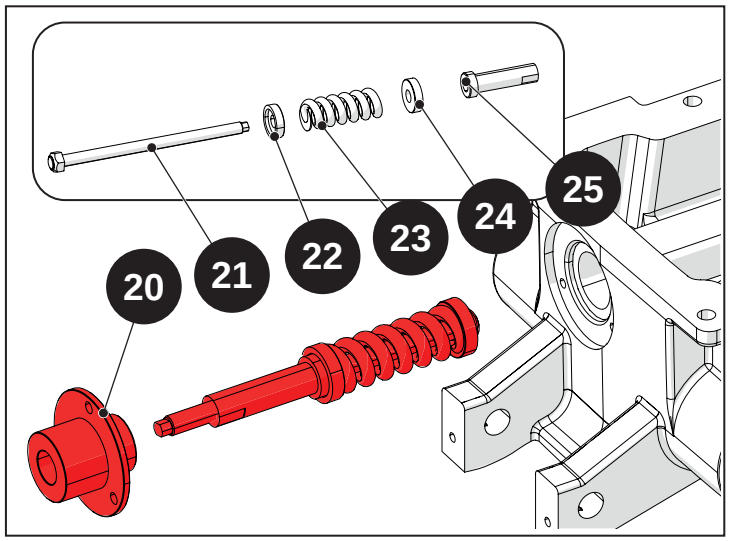

Fig. 15.9

Remove the sleeve (26) along with O-rings (27) and (28).

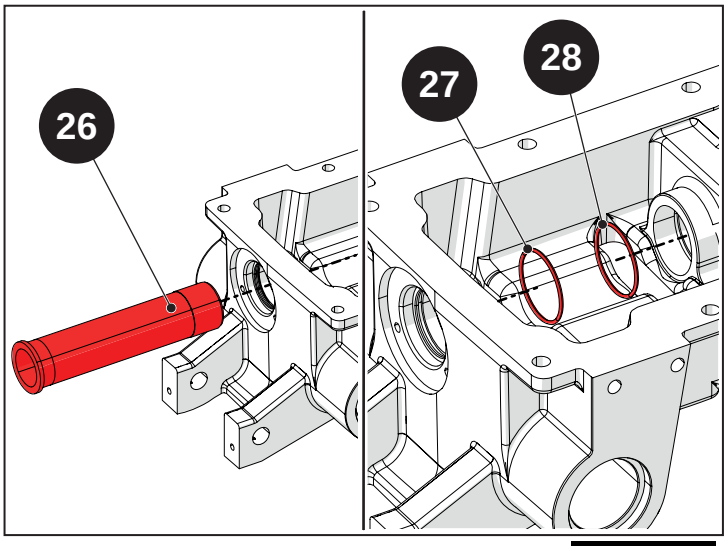

Fig. 15.10

15.4 Main inspection, re-assembly and adjustment operations

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15.4.1 Main inspection, re-assembly and adjustment operations 15-12

15.4.1 Main inspection, re-assembly and adjustment operations

Warning

Before proceeding with the re-assembly operations, carefully read and comply with the instructions given in chapter "1-Introduction", especially those describing how to assemble O-Rings, oil retainers and bearings.

Use the correct tightening torques when screwing in the components. Consult the table in chapter "1-Introduction" if the tightening torque value is not given.

Use the indicated sealants when re-assembling the parts. Consult the table in chapter "1-Introduction" if the sealant is not indicated.

Insert the O-rings (27) and (28).

Warning

Apply a layer of grease over the O-Rings after they have been installed.

Insert the sleeve (26).

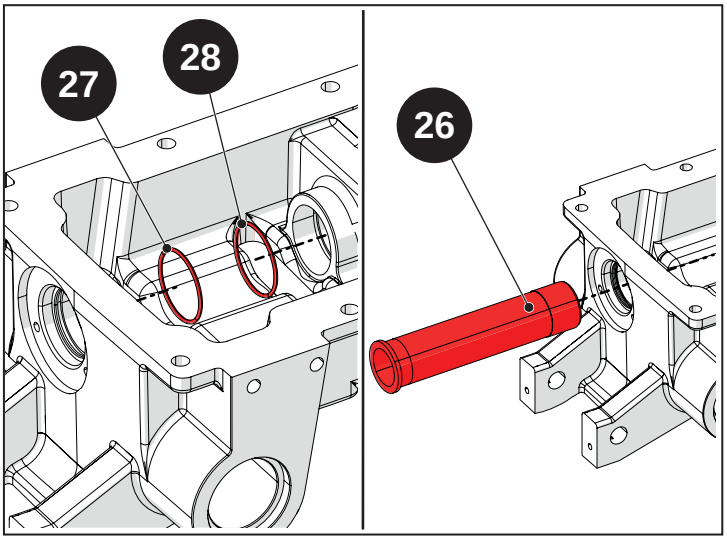

Fig. 15.11

Pre-assemble the draft control adjuster by assembling the following parts in the given order:

- Screw (21);
- Spacer (22);
- Spring (23);
- Spacer (24);
- Spring adjuster spacer (25);

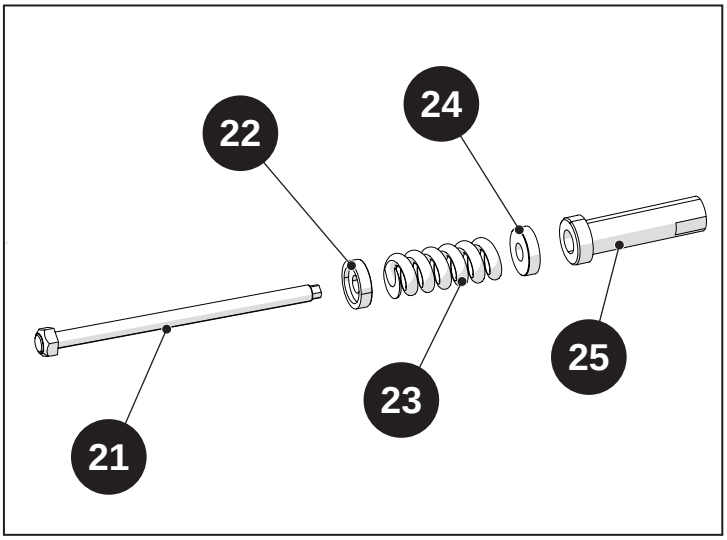

Fig. 15.12

Screw in the spring adjuster spacer (25) so as to eliminate the spring float.

Warning
Apply a preload of less than 1 mm to the spring. Do not compress the spring unnecessarily.

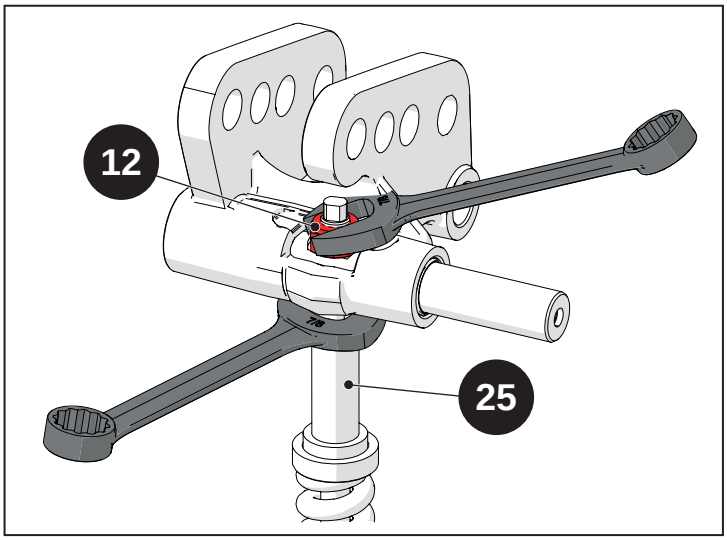

Fig. 15.13

Fit the sleeve (20) on to the draft control adjuster block.

Fit the O-ring (17) onto the lower pin (16) of the draft control unit, then assemble it onto the top link support.

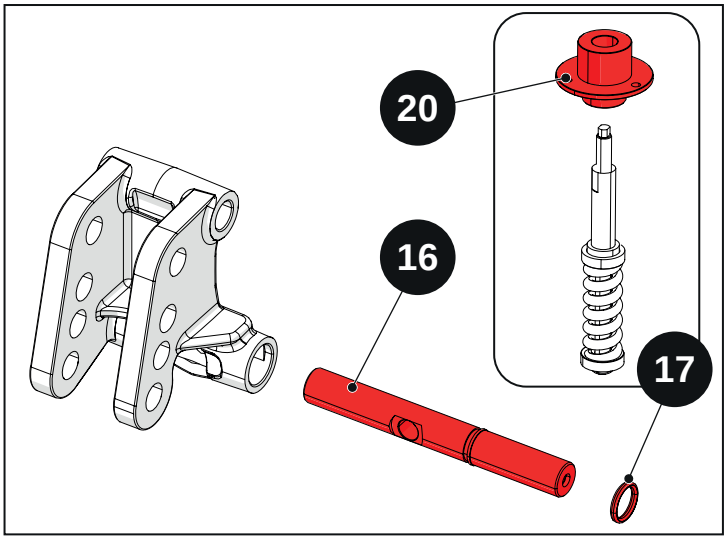

Fig. 15.14

Install the two newly assembled units then apply a layer of LOCTITE 242 to the screw and tighten the nut (12).

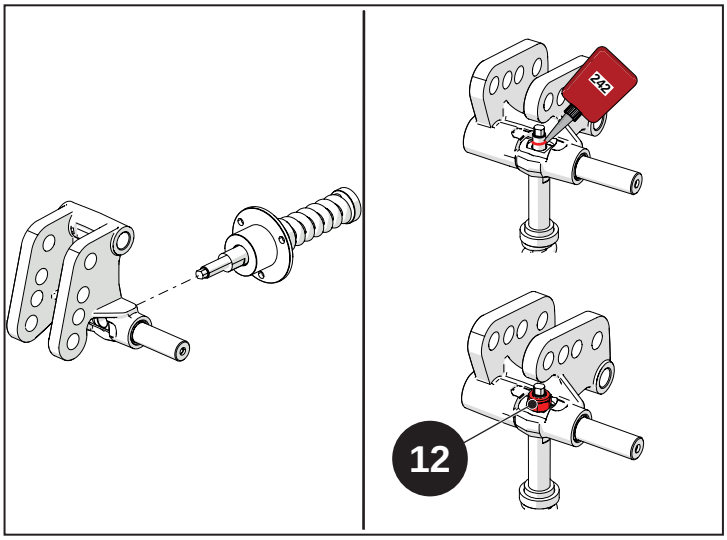

Fig. 15.15

Tighten the nut (12) while holding the spacer (25) in position and by applying 150 N·m (15 kg·m) tightening torque.

Warning

Make sure that the spacer (25) is unable to move when the nut (12) is being tightened, otherwise the spring adjustment could be changed.

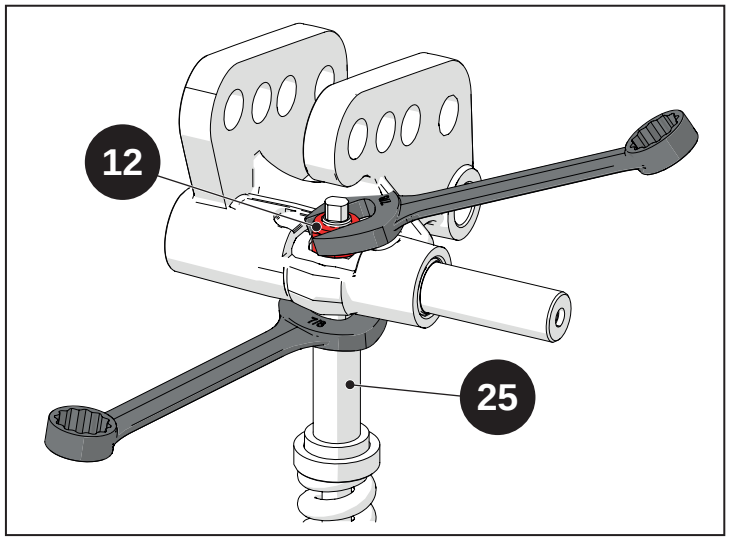

Fig. 15.16

Fit the top link support complete with adjuster block onto the hitch cover.

Fit the upper pin (14) onto the top link support and lock it in place with the 2 circlips (13).

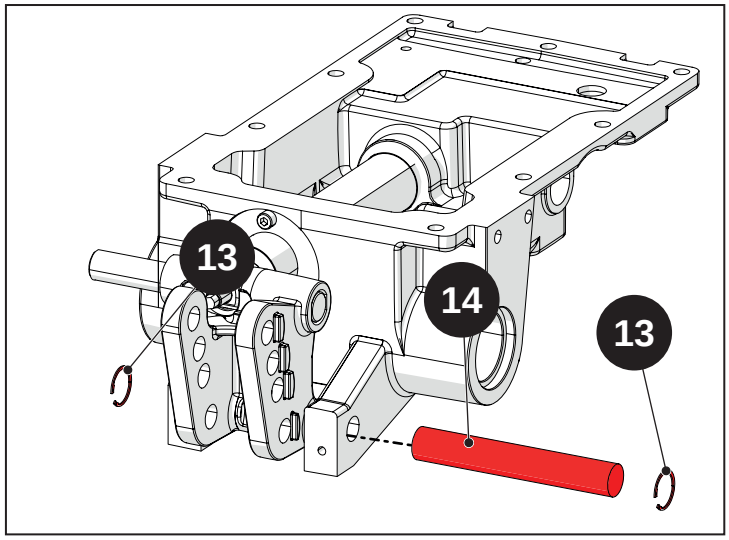

Fig. 15.17

Insert the washers (19) and tighten the screws (18).

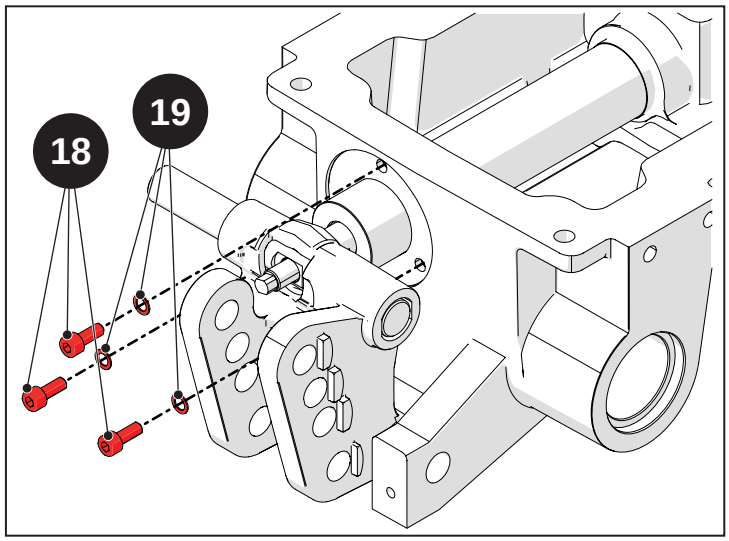

Fig. 15.18

Insert the hitch shaft (11).

Warning

Make sure that the shaft is assembled in the right direction. The side with the longer teeth must be on the right.

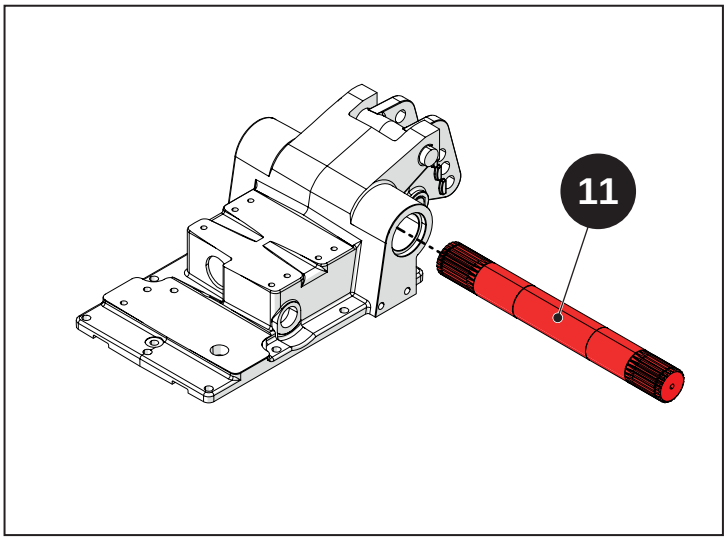

Fig. 15.19

Apply a layer of grease to the oil retainer housing (10).

Use tool (A-07007176) to insert the oil retainers (10) and plug (B-07007184) to fully seat them.

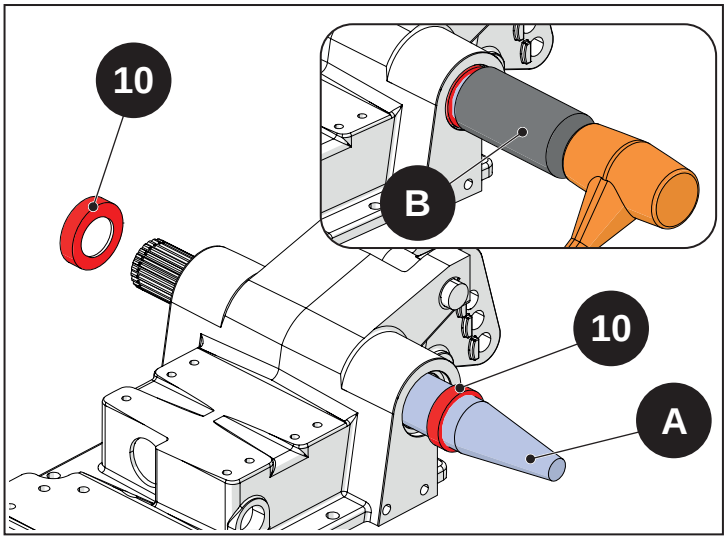

Fig. 15.20

Insert the spacers (9), then fit the right and left links (8) onto the shaft.

Warning

Make sure that the hitch links are at the same height when they have been inserted.

Lock the left link with the circlip (6).

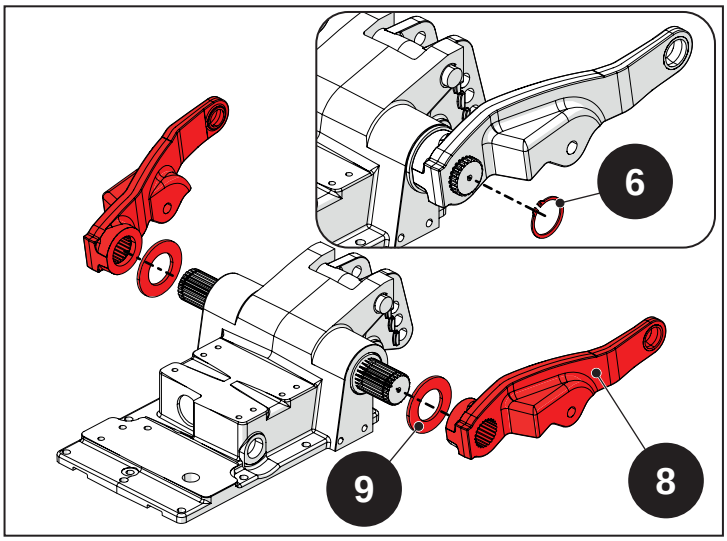

Fig. 15.21

Overturn the hitch links.

Insert the 2 spacers (29) and the positioner (7).

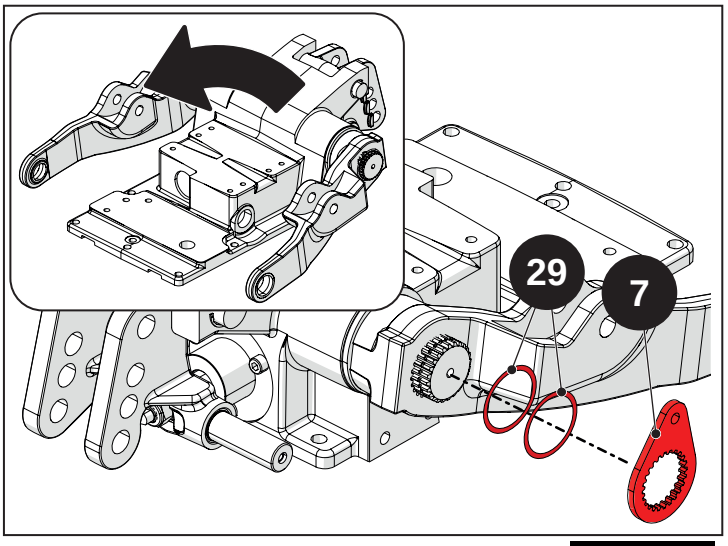

Fig. 15.22

Set the positioner so that there is a 135 mm centre/centre distance between its hole and the hole used for assembling the ram on the right link.

Lock the right link by inserting the circlip (6).

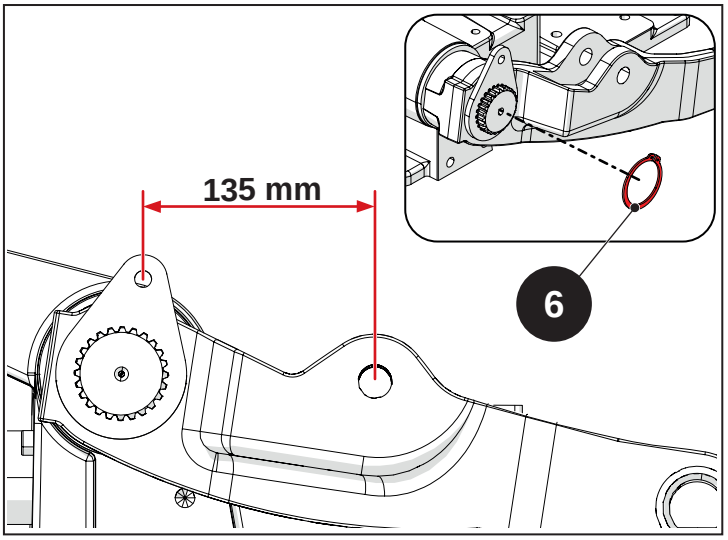

Fig. 15.23

Apply TEFLON to the thread, then tighten the union (4).

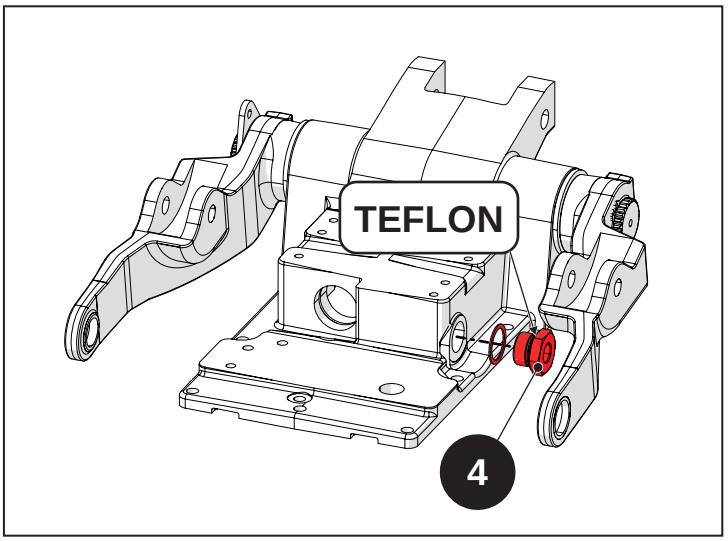

Fig. 15.24

Apply a layer of SILICONE to the coupling surface of the hitch cover.

Warning

The hole indicated in the figure must be completely filled.

Apply SILICONE behind the stud bolt on the front part, as shown in the figure.

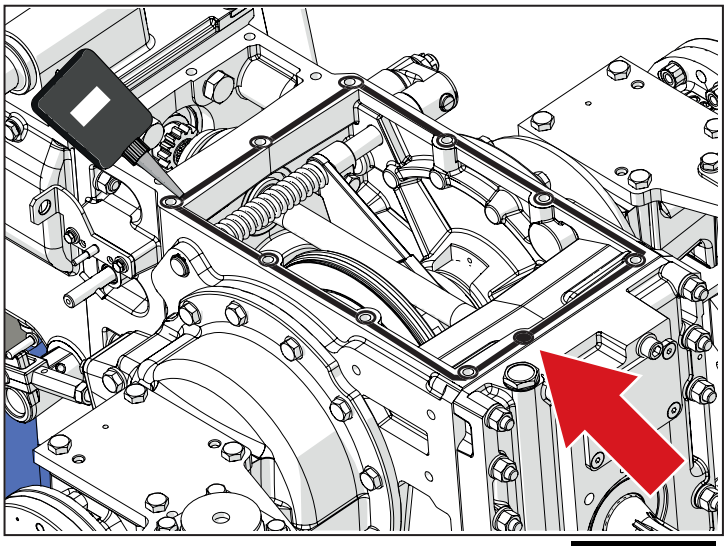

Fig. 15.25

Danger

Secure the hitch unit to lifting equipment of adequate capacity.

Align the cover with the differential.

Insert the washers (2) and tighten the nuts (1) that fasten the hitch to the rear differential assembly.

Tighten the nuts by applying 85 N·m (8.5 kg·m) tightening torque.

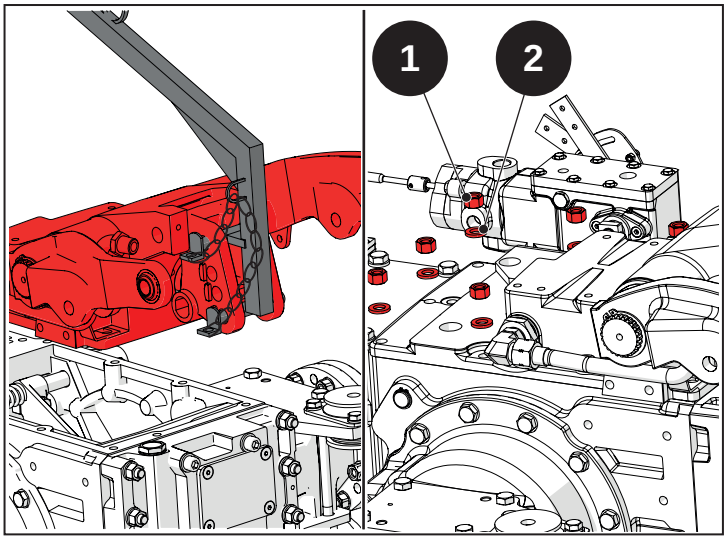

Fig. 15.26

15.5 Tightening torques

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15.5.1 Tightening torques.....15-20

15.5.1 Tightening torques

The main tightening torque values are listed below. Consult chapter "1- Introduction" for the remaining tightening torques.

Screws and nuts to be tightened	N·m	kg·m

15.6 Tools required

Index

15.6.1 Tools required 15-22

15.6.1 Tools required

Code	Description	Quantity
07007176	Rear hitch shaft protection	1
07007184	Rear hitch oil retainer plug	1

17 : Electrical system

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17.1 Safety rules

A number of safety precautions and warnings are indicated in this paragraph; these must be observed to prevent the risk of operator injury. However, the safety measures indicated in the use and maintenance manual and in chapter 1 of this manual must be applied at all times.

Observe all safety rules with the following symbol with particular care:

Attention
Always read the instructions in the relative use and maintenance manual when working on the battery.

Attention
Take all the necessary precautions when installing batteries containing sulphuric acid. In the event of acid coming into contact with the skin or eyes, rinse the affected parts of the body immediately with clean water.

Attention
When mixing acid with water, POUR THE ACID SLOWLY INTO THE WATER. NEVER POUR WATER INTO ACID.

Attention
The battery releases explosive gas when charging. Ensure that the area is well ventilated and keep away from naked flame and sources of sparking.

Attention
Always switch the battery charger off before disconnecting the cables.

Attention
Keep the battery out of the reach of children.

Attention
Do not smoke when checking or handling batteries.

Attention
Disconnect the negative terminal first. When refitting the battery, connect the positive terminal first. Take particular care not to connect the terminals to the wrong battery poles.

Attention
Before working on the electrical system, always disconnect the earth cable (-) from the battery.

17.2 Introduction

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17.2.1 Cable colour table

The abbreviations used to identify cable colours are explained in the following table.

Rd	Red
Bn	Brown
Gn	Green
Wh	White
Bk	Black
Lgn	Light green
Ye	Yellow
Pu	Pink
Or	Orange
Bu	Blue

17.2.2 Component key

Refer to the following table to identify component types by the code letter used.

A	Starting and charging
B	Valves and fuses
C	Plates
D	Intermediate junctions
E	On board instrument and visual and audible indicator/ warning devices
F	External lights
G	Internal lights
H	Manual electric controls
I	Switches
J	Relays / relay switches
K	Sensors and transmitters
L	Electromagnets
M	Electric/electronic devices, flasher units and timer units
N	Electric motors and actuators
O	Resistors and rheostats
P	Other utilities
Q	Safety devices
R	Diagnostics

17.3 Wiring looms

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17.3.1 02004176 - Battery ground

17.3.1.1 Installation of battery ground cable

Fig. 17.1

17.3.1.2 Location of battery ground cable

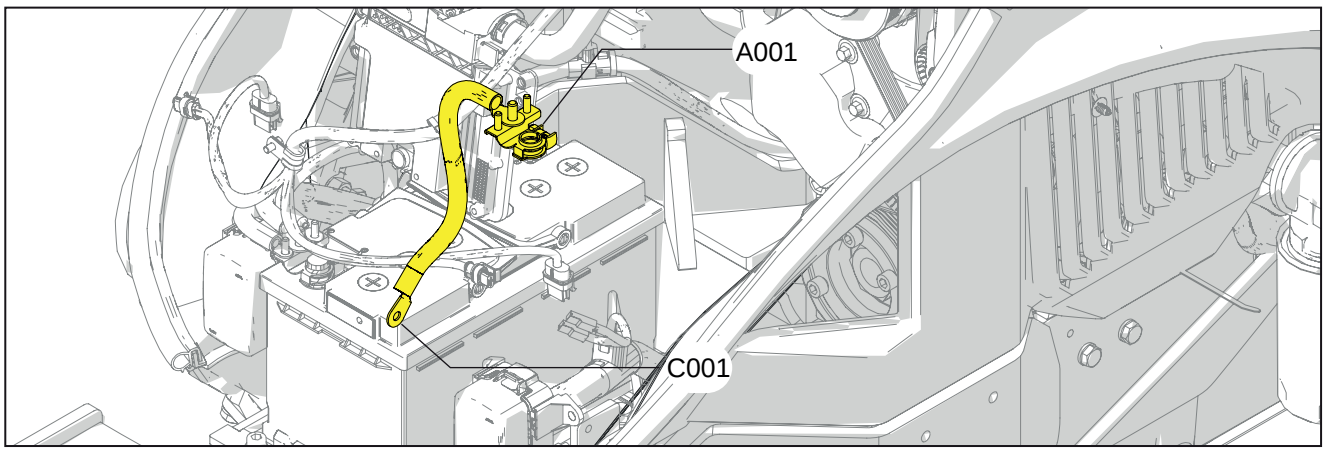

Fig. 17.2

17.3.1.3 Component identification codes

System code	Source code	Description
A001	P11	Negative battery terminal
C001	P66	Battery ground

17.3.2 02004177 - Battery positive terminal

17.3.2.1 Installation of battery positive cable

Fig. 17.3

17.3.2.2 Location of battery positive cable

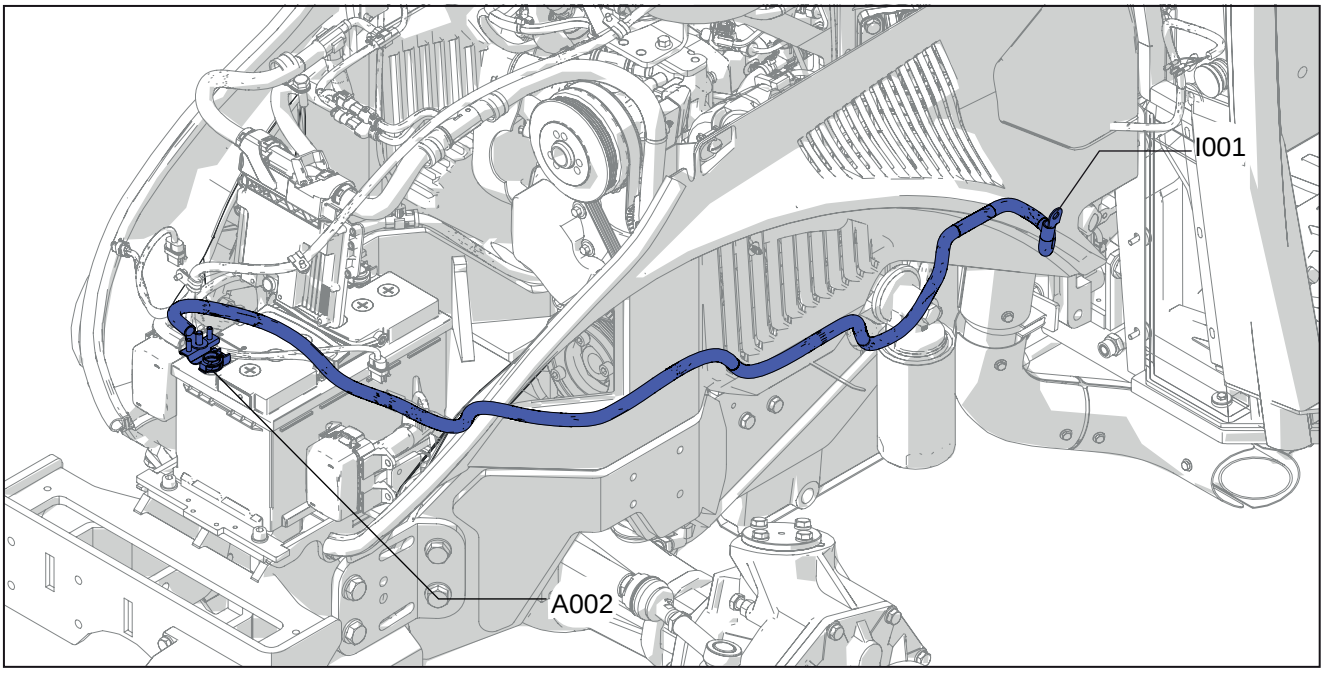

Fig. 17.4

17.3.2.3 Component identification codes

System code	Source code	Description
A002	P55	Positive battery terminal
I001	P39	Battery master relay switch (input terminal)

17.3.3 02004178 - Battery master switch - engine start

17.3.3.1 Installation of battery master switch - engine start cable

Fig. 17.5

17.3.3.2 Location of battery master switch - engine start cable

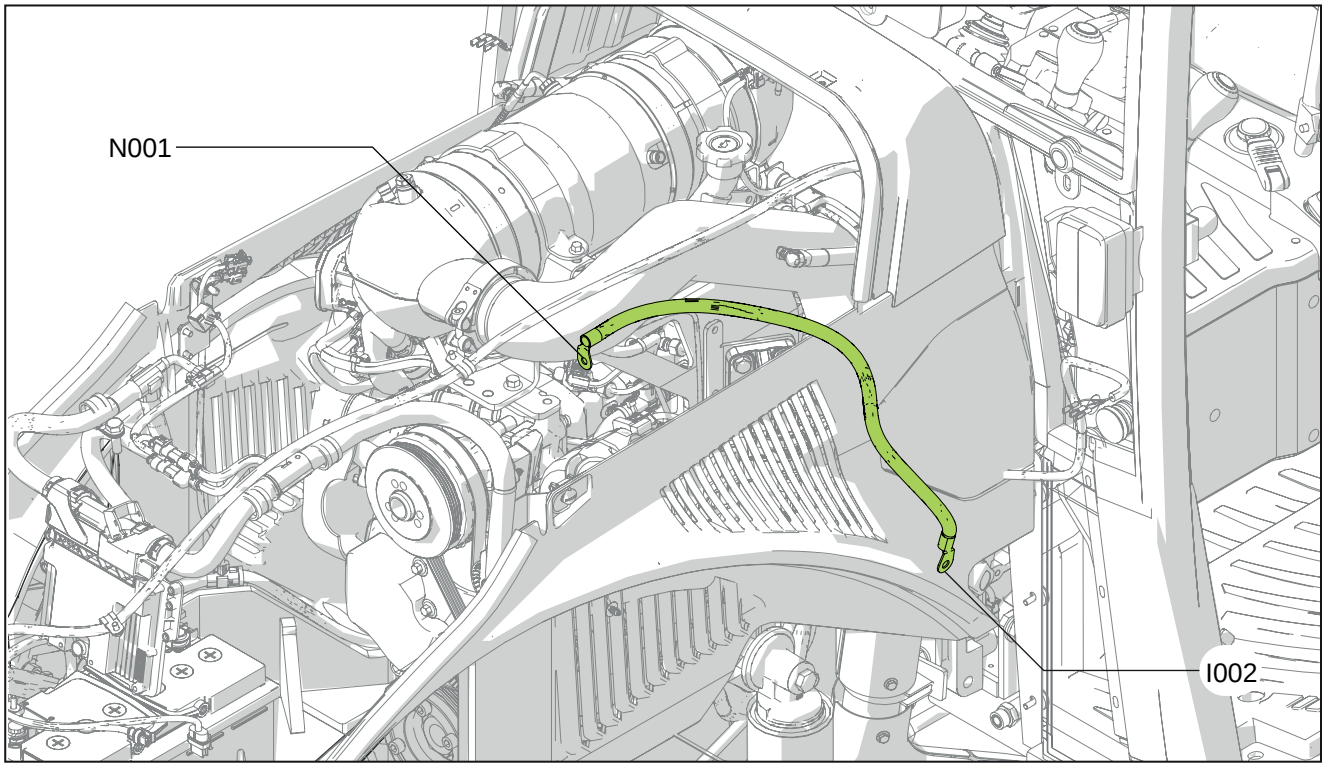

Fig. 17.6

17.3.3.3 Component identification codes

System code	Source code	Description
I002	P23	Battery master relay switch (output terminal)
N001	P10	Starter motor "30"

17.3.4 02004179 - Battery - Alternator

17.3.4.1 Installation of battery - alternator cable

Fig. 17.7

17.3.4.2 Location of battery - alternator cable

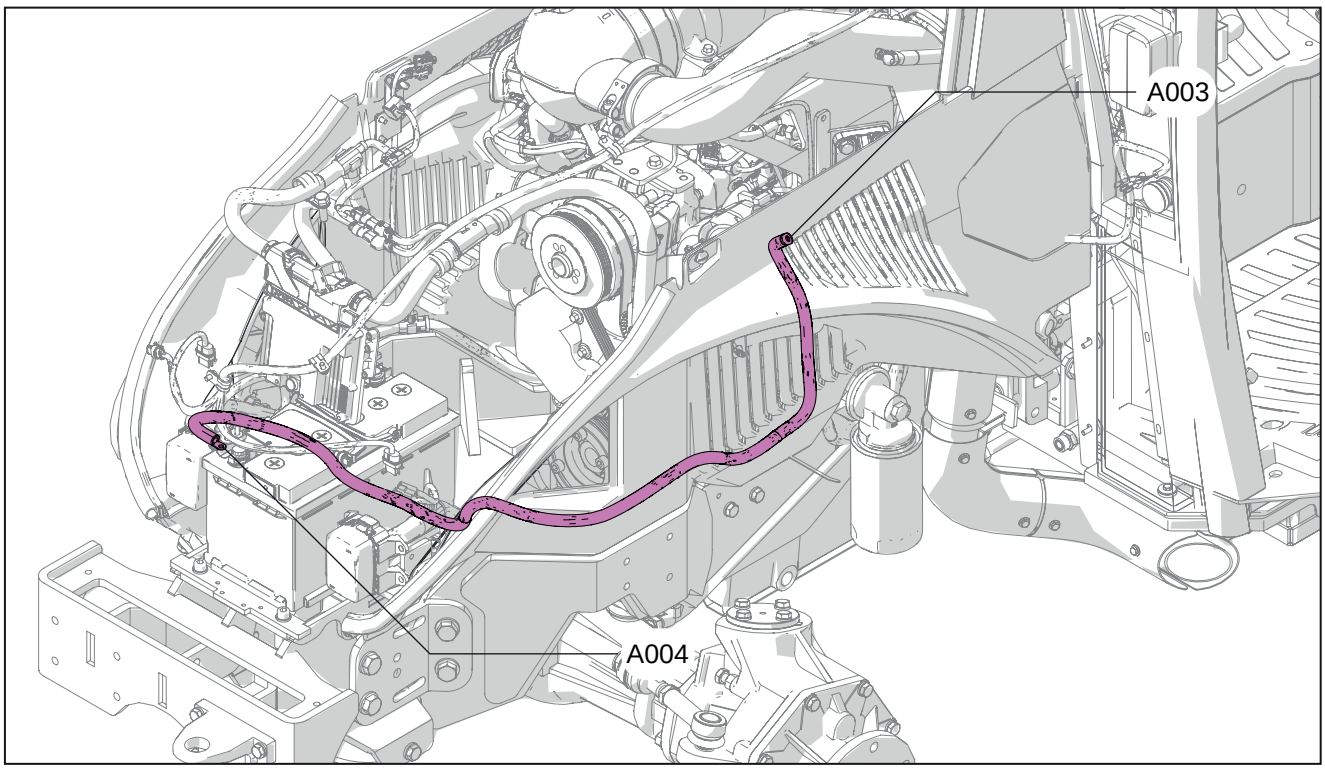

Fig. 17.8

17.3.4.3 Component identification codes

System code	Source code	Description
A003	P64	Alternator "B+"
A004	P65	Negative battery terminal

17.3.5 02004180 - Front lights

17.3.5.1 Installation of front lights wiring loom

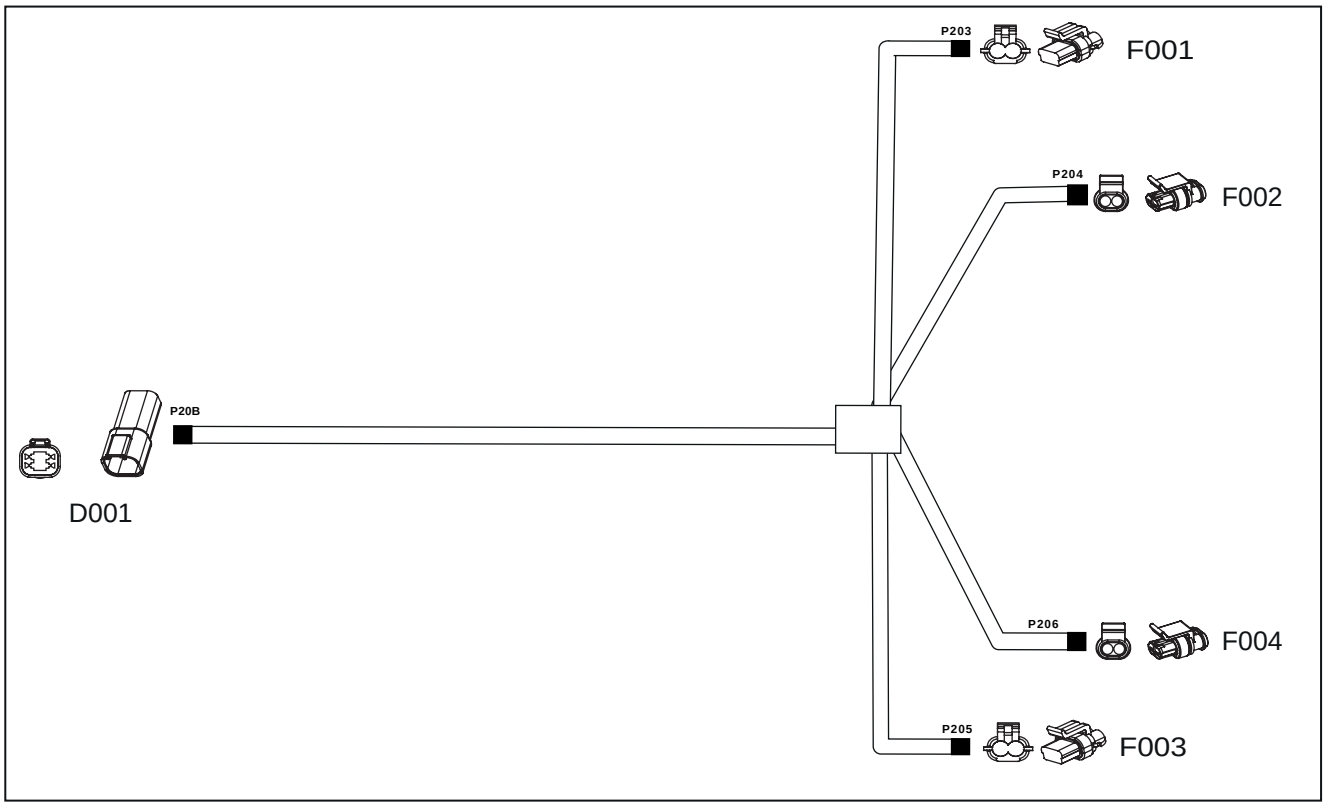

Fig. 17.9

17.3.5.2 Front lights wiring loom wiring diagram

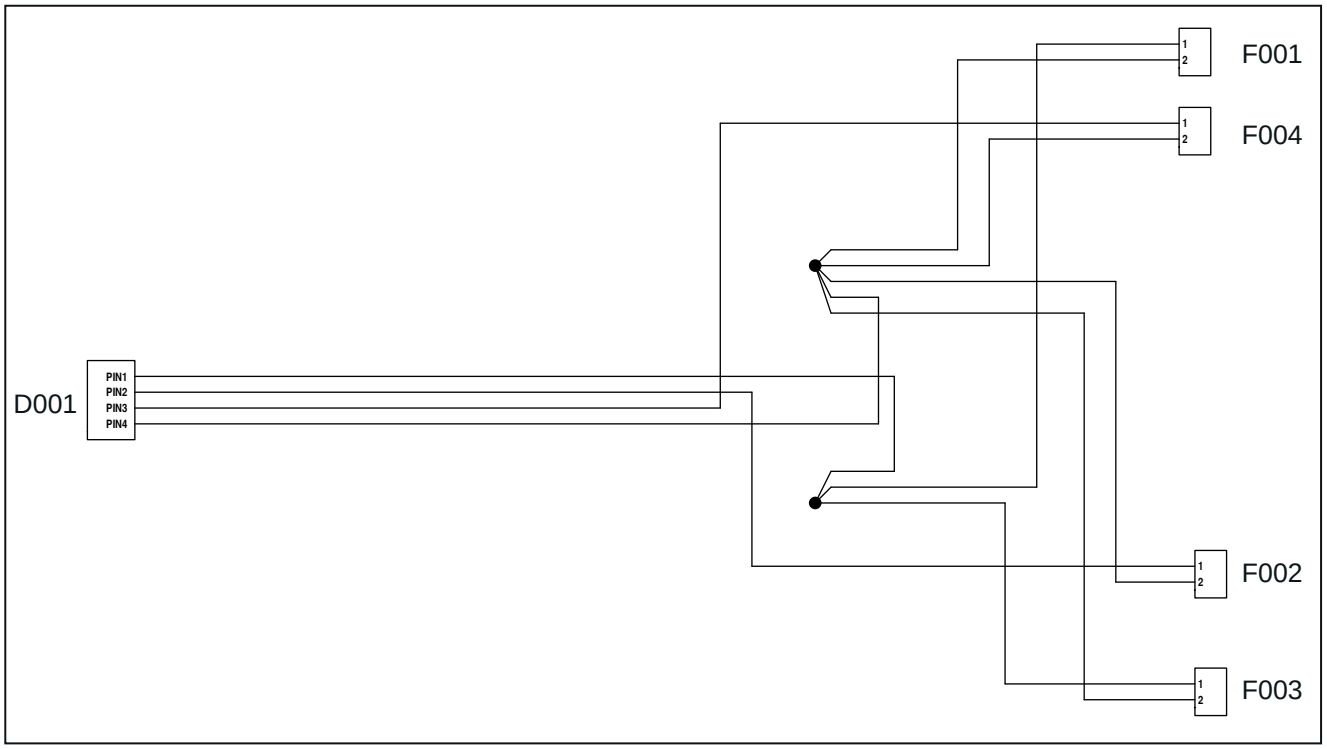

Fig. 17.10

17.3.5.3 Location of front lights wiring loom

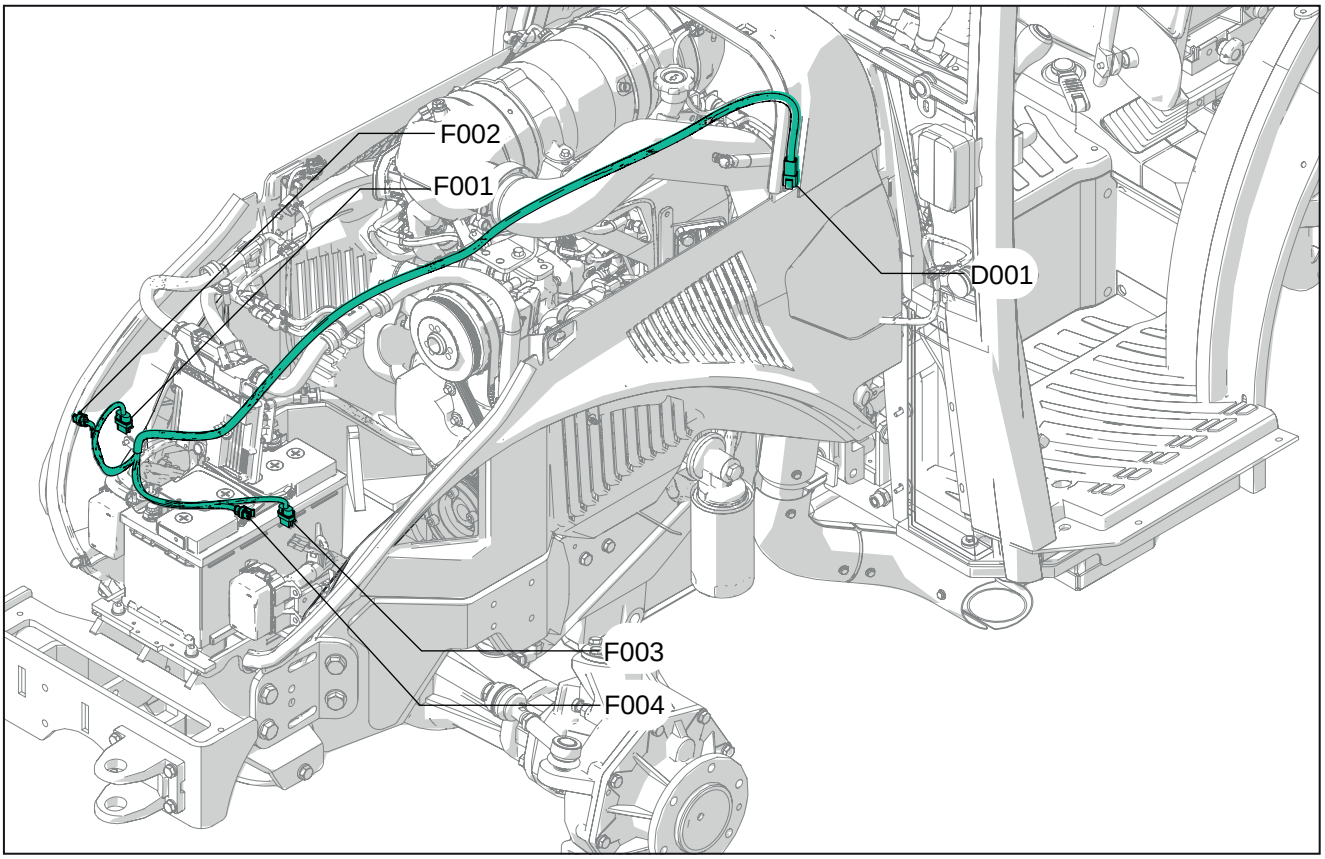

Fig. 17.11

17.3.5.4 Component identification codes

System code	Source code	Description
D001	P20B	Wiring connector for engine wiring loom
F001	P203	RH high beam headlight
F002	P204	RH low beam headlight
F003	P205	LH high beam headlight
F004	P206	LH low beam headlight

17.3.6 02004181 - LH parking lights

17.3.6.1 Installation of LH parking lights wiring loom

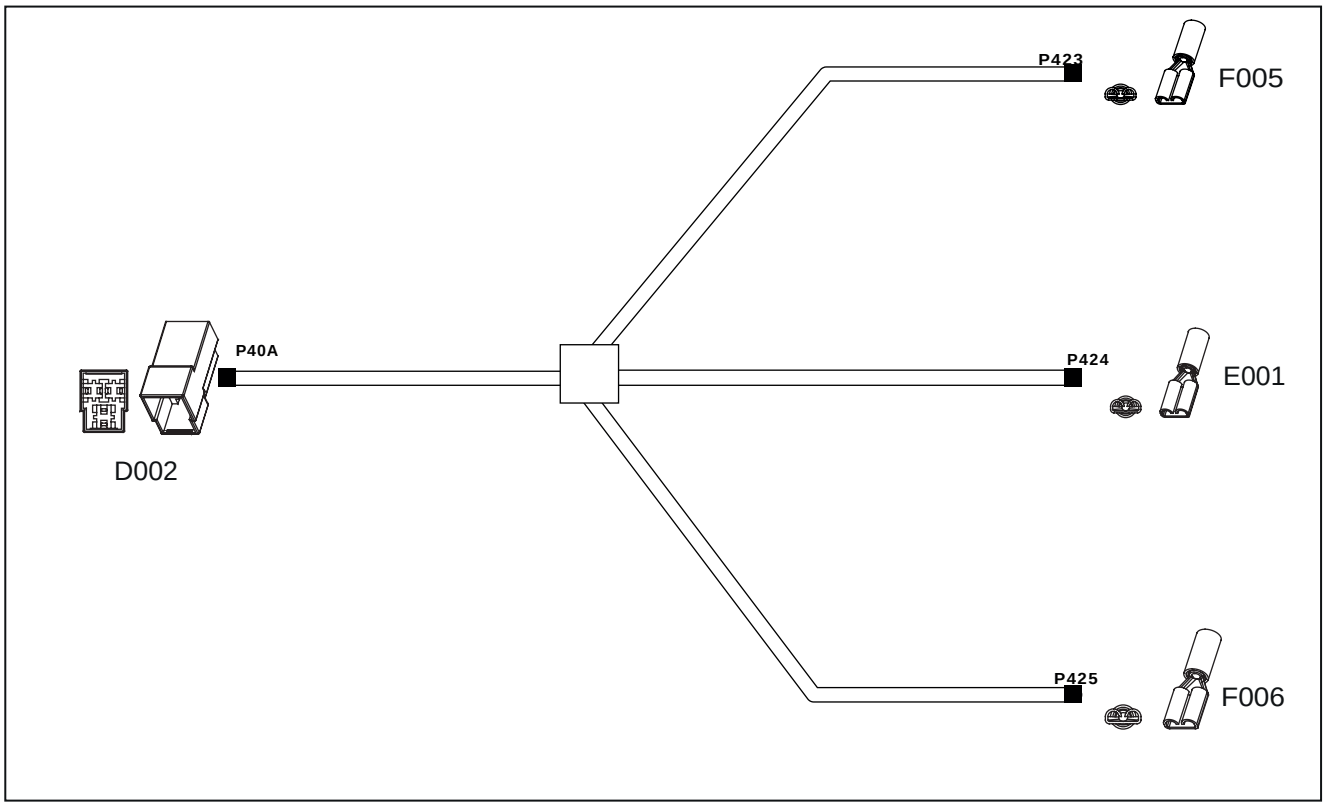

Fig. 17.12

17.3.6.2 LH parking lights wiring loom wiring diagram

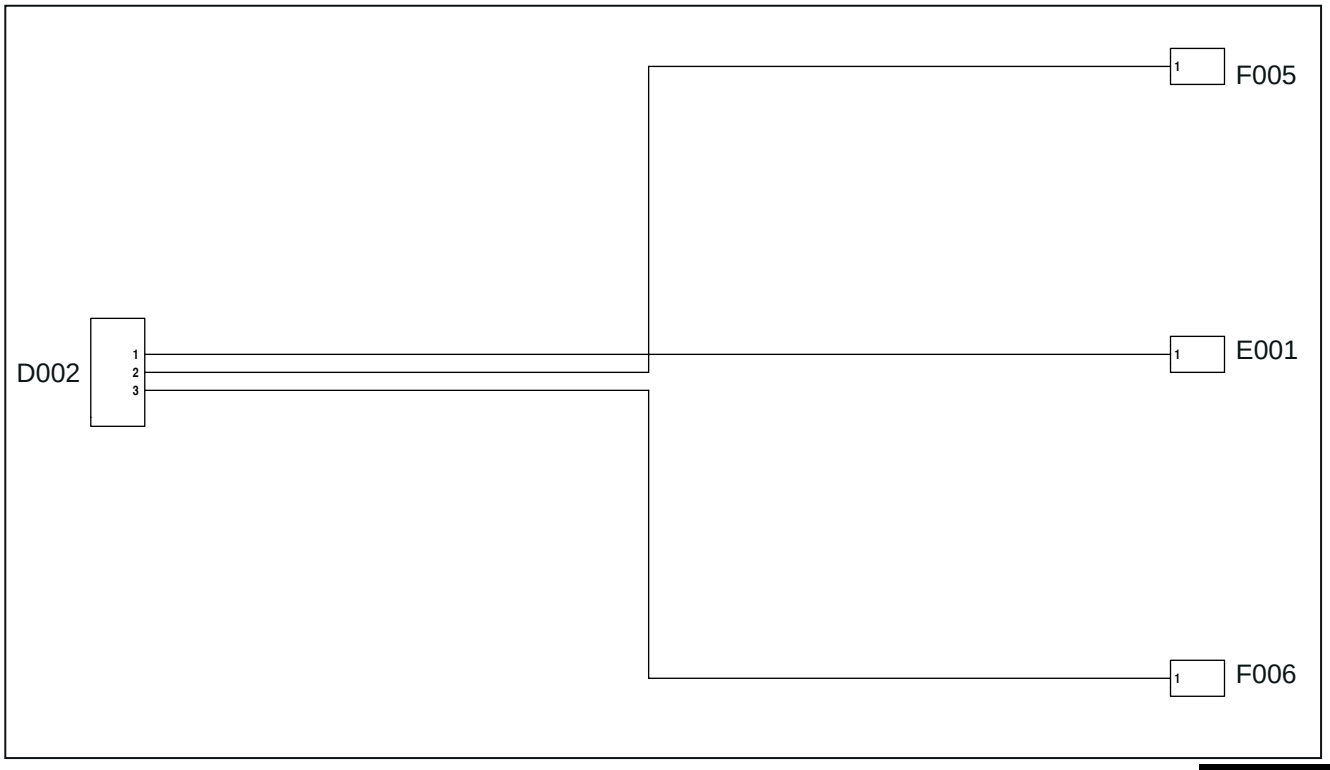

Fig. 17.13

17.3.6.3 Location of LH parking lights wiring loom

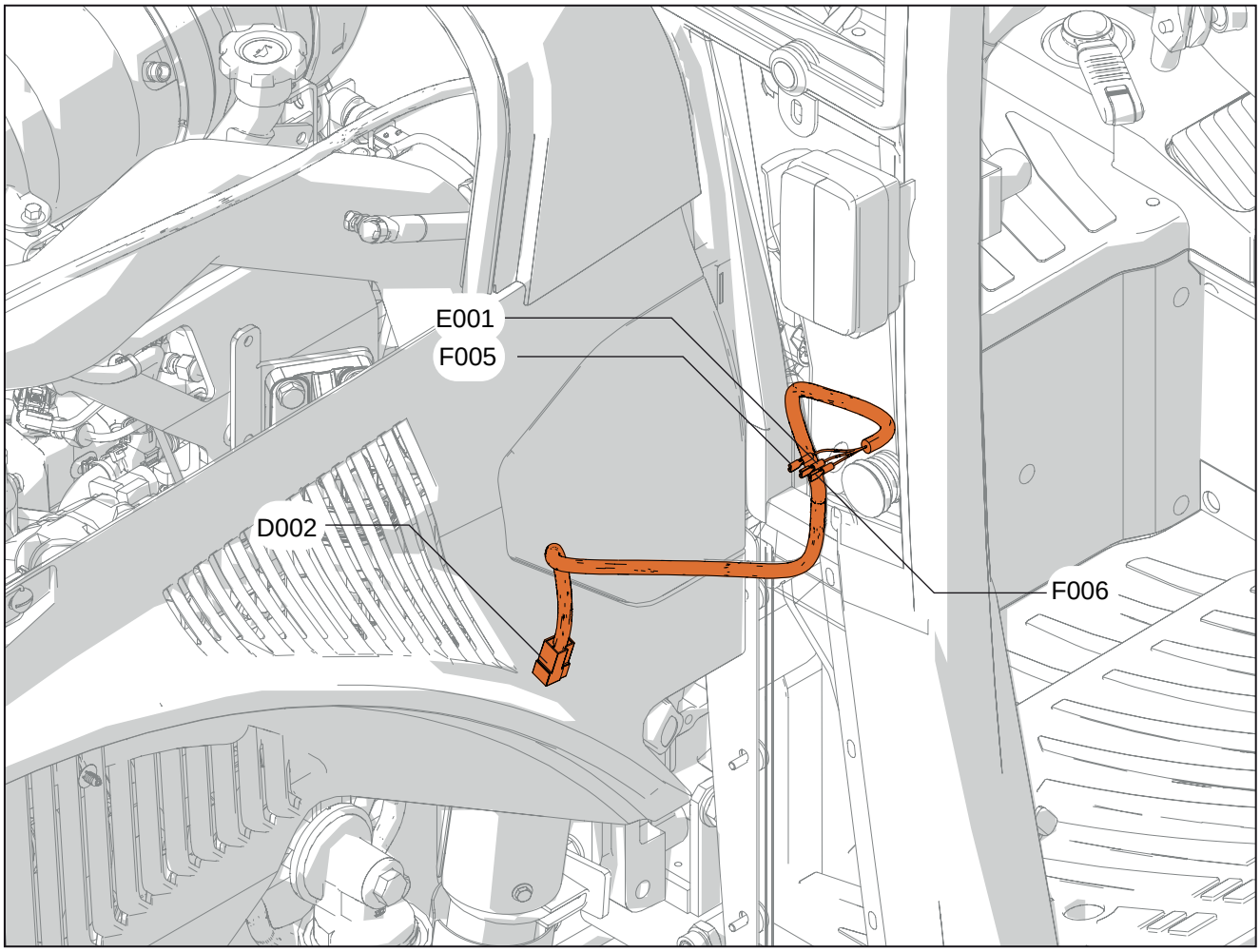

Fig. 17.14

17.3.6.4 Component identification codes

System code	Source code	Description
D002	P40A	Wiring connector for engine wiring loom
E001	P424	LH turn indicator
F005	P423	Parking light
F006	P425	Mudguard light

17.3.7 02004182 - RH parking lights

17.3.7.1 Installation of RH parking lights wiring loom

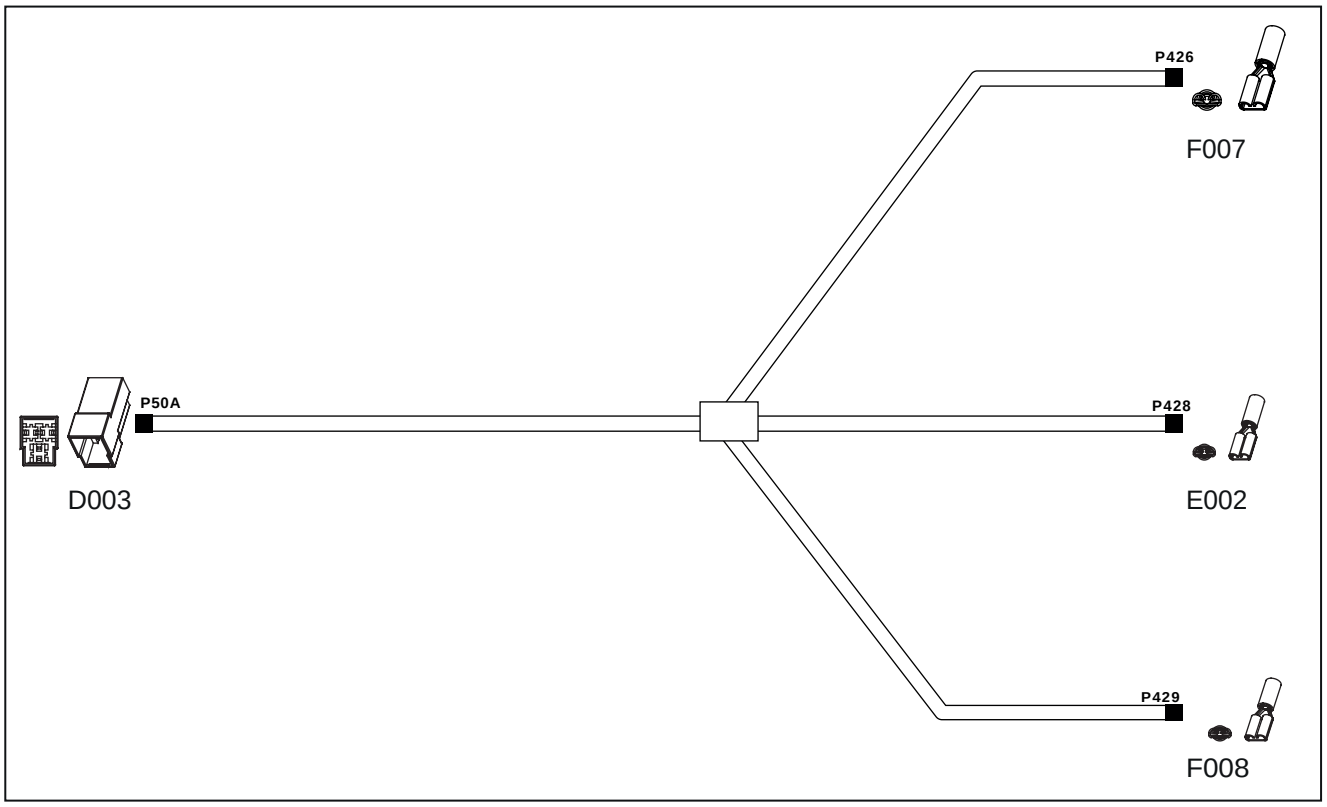

Fig. 17.15

17.3.7.2 RH parking lights wiring loom wiring diagram

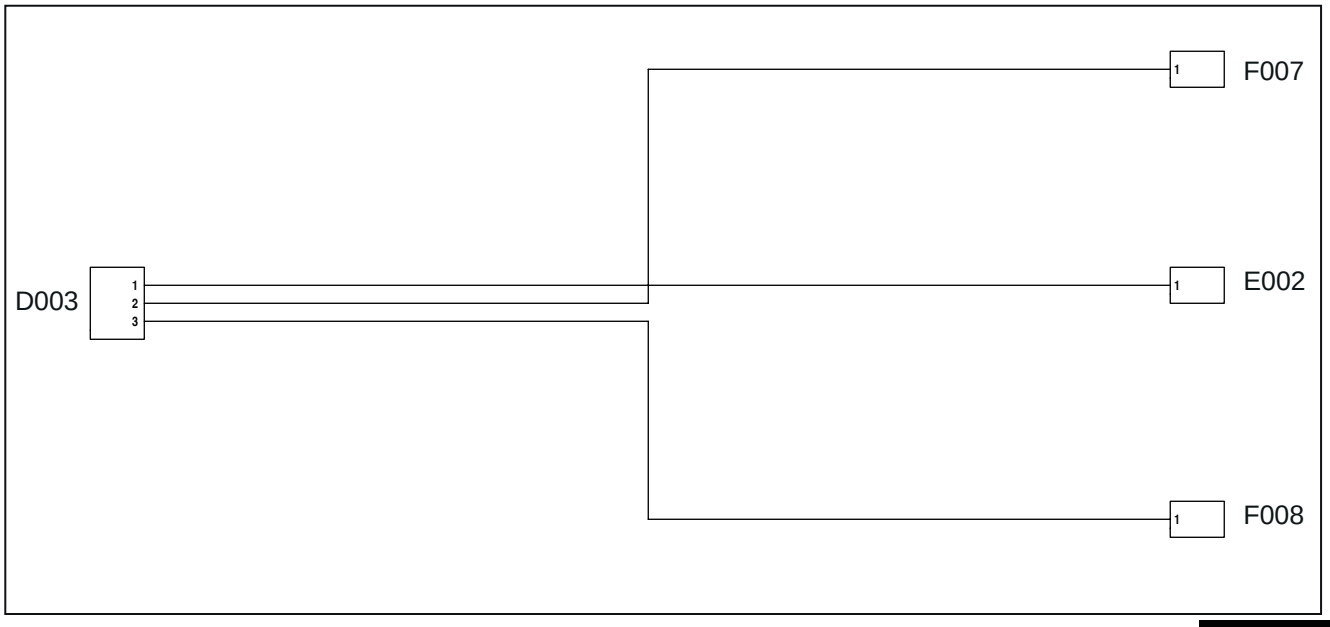

Fig. 17.16

17.3.7.3 Location of RH parking lights wiring loom

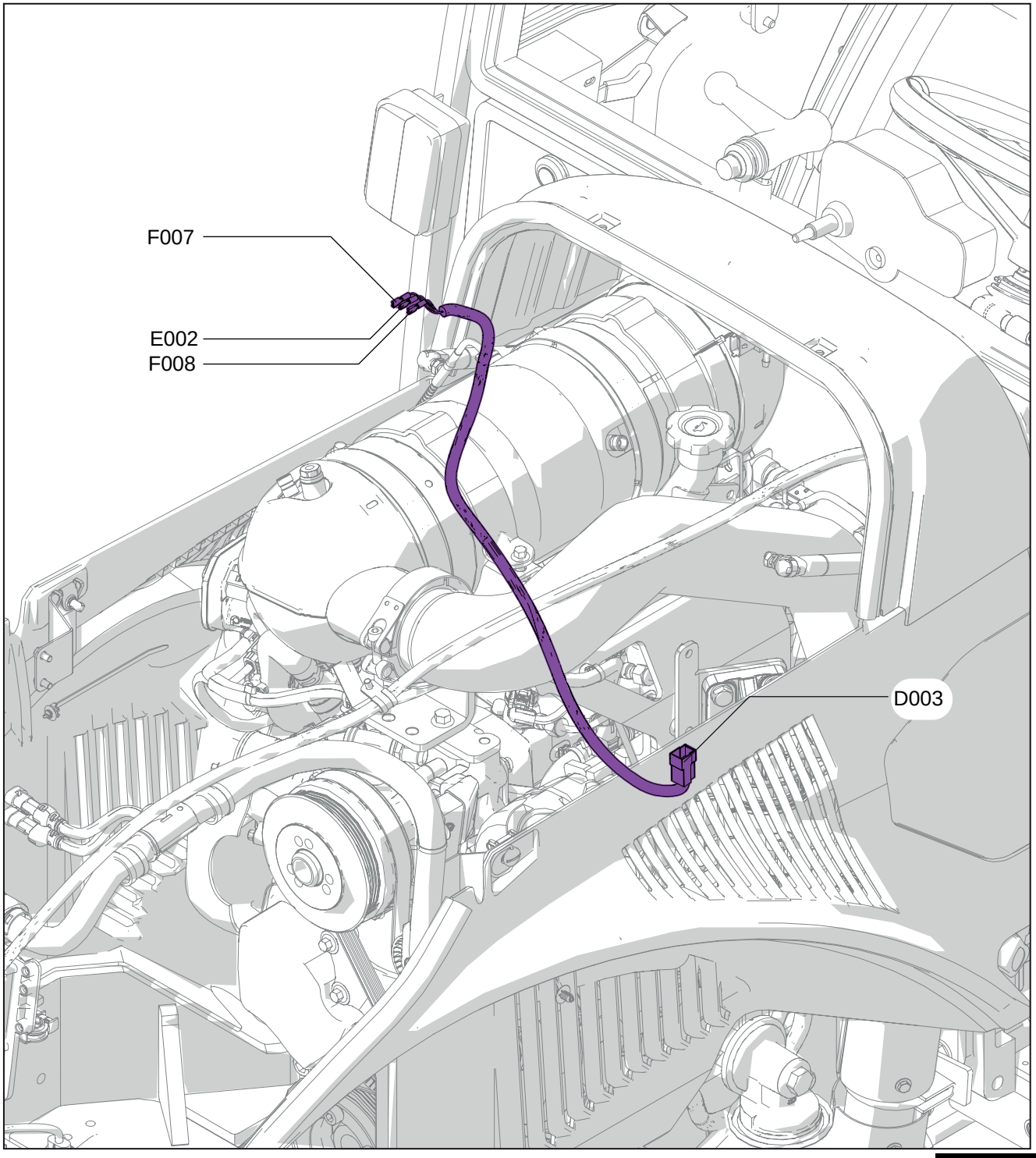

Fig. 17.17

17.3.7.4 Component identification codes

System code	Source code	Description
D003	P50A	Wiring connector for engine wiring loom
E002	P428	RH turn indicator
F007	P426	Parking light
F008	P429	Mudguard light

17.3.8 02004183 - Rear lights

17.3.8.1 Installation of rear lights wiring loom

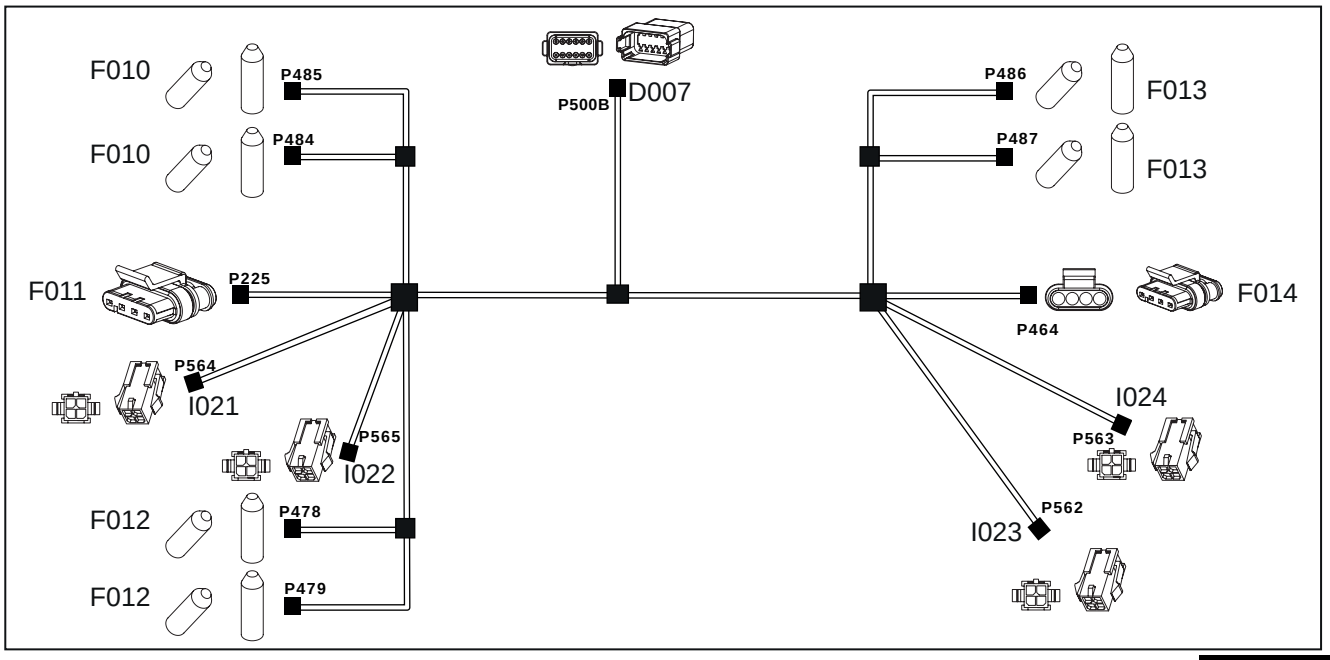

Fig. 17.18

17.3.8.2 Rear lights wiring loom wiring diagram

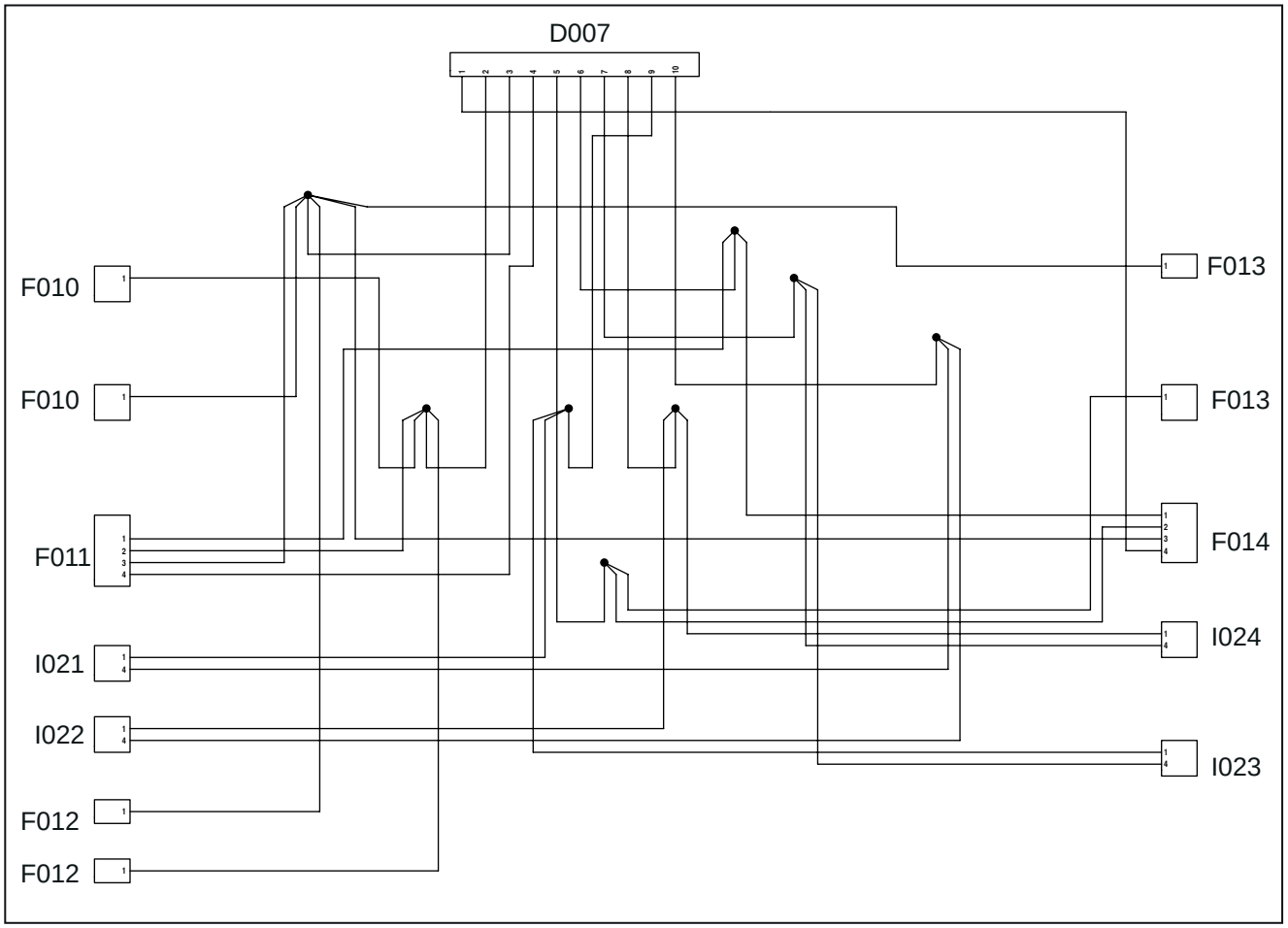

Fig. 17.19

17.3.8.3 Location of rear lights wiring loom

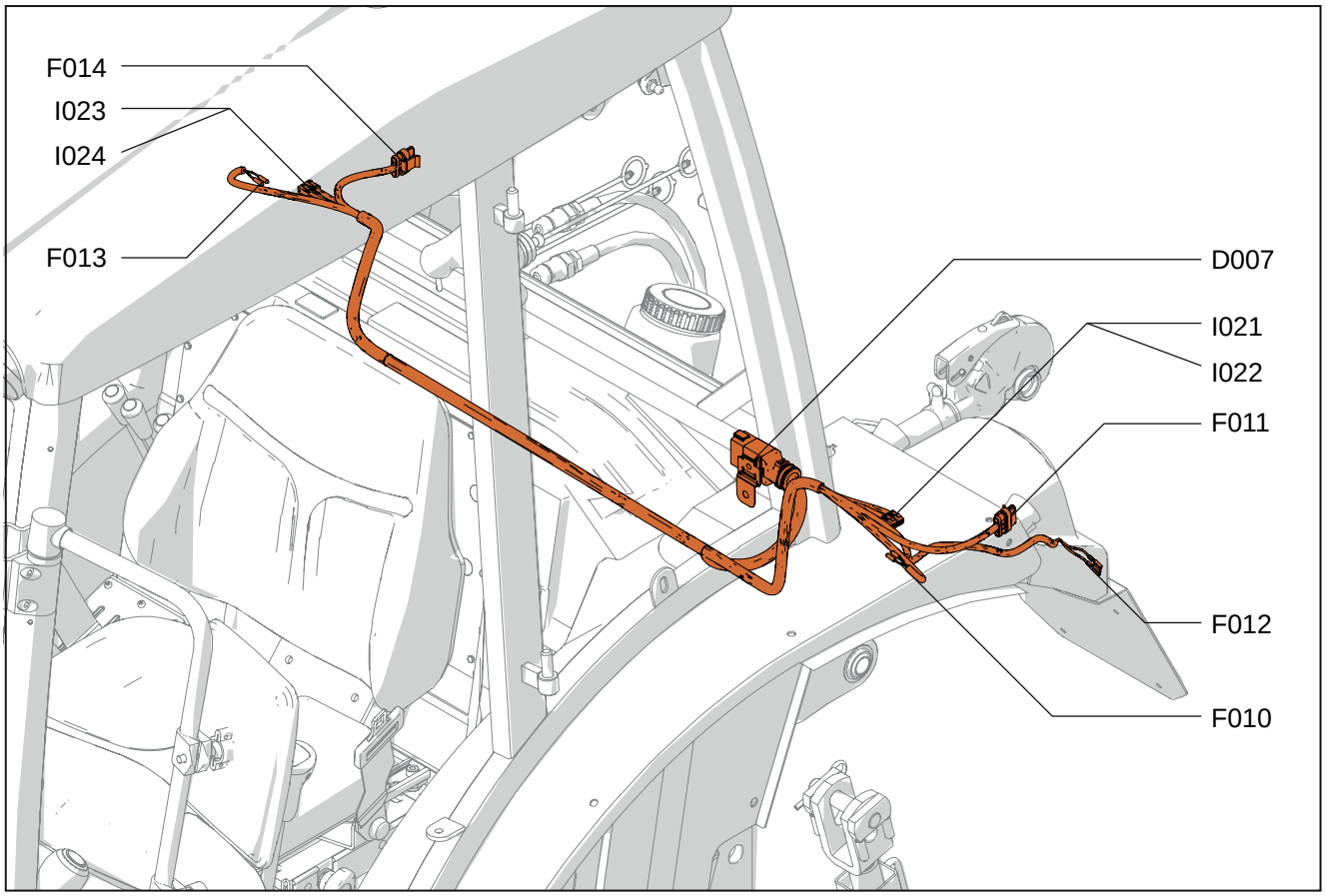

Fig. 17.20

17.3.8.4 Component identification codes

System code	Source code	Description
D007	P500B	Wiring connector for main wiring loom
F010	P484,P485	LH work lights
F011	P225	LH rear mudguard lights
F012	P478,P479	Number plate light
F013	P486,P487	RH work lights
F014	P464	RH rear mudguard lights
I021	P564	LH electronic lift down button
I022	P565	LH electronic lift up button
I023	P562	RH electronic lift down button
I024	P563	RH electronic lift up button

17.3.9 02004184 - Dashboard

17.3.9.1 Installation of dashboard wiring loom

Table 1

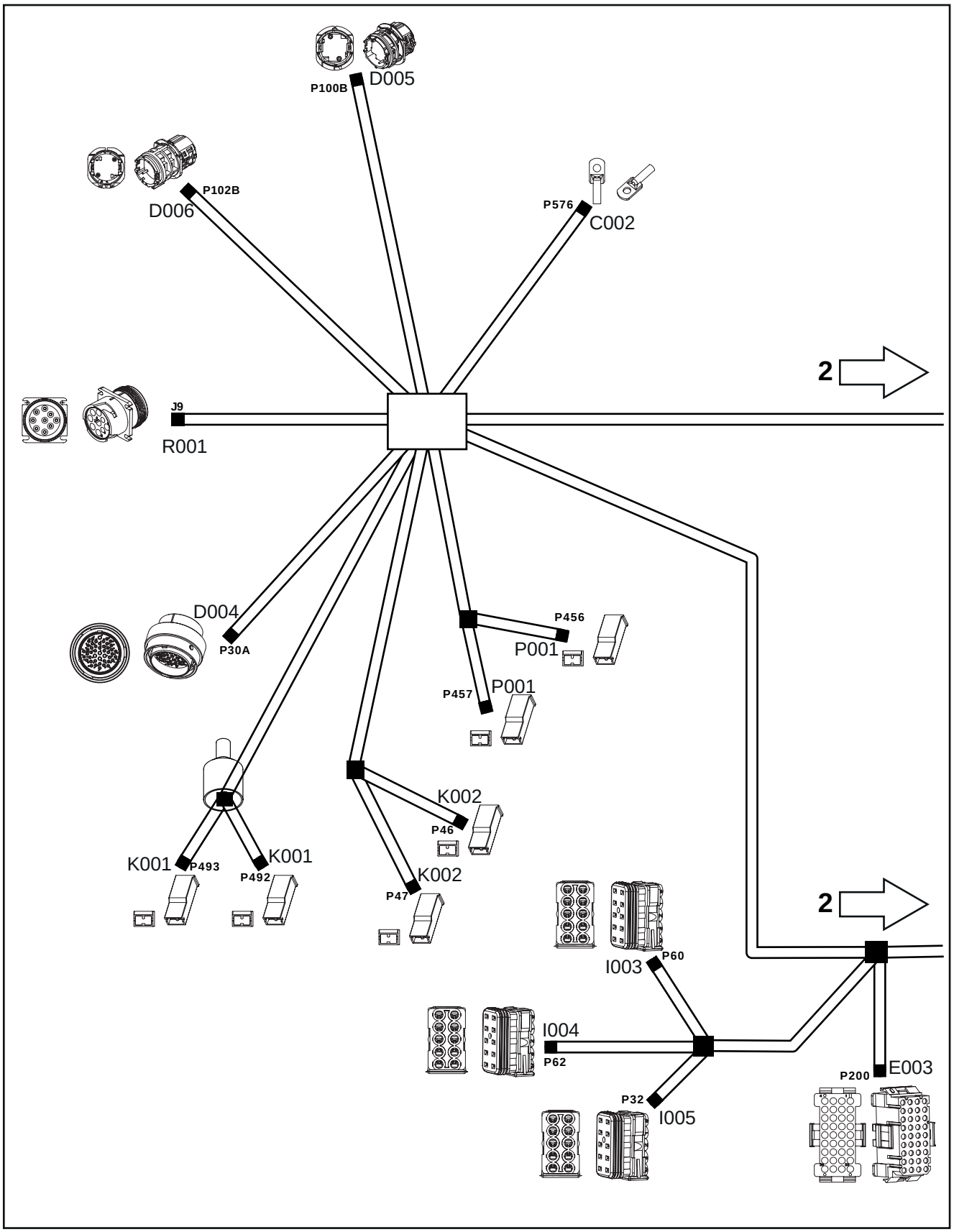

Fig. 17.21

Table 2

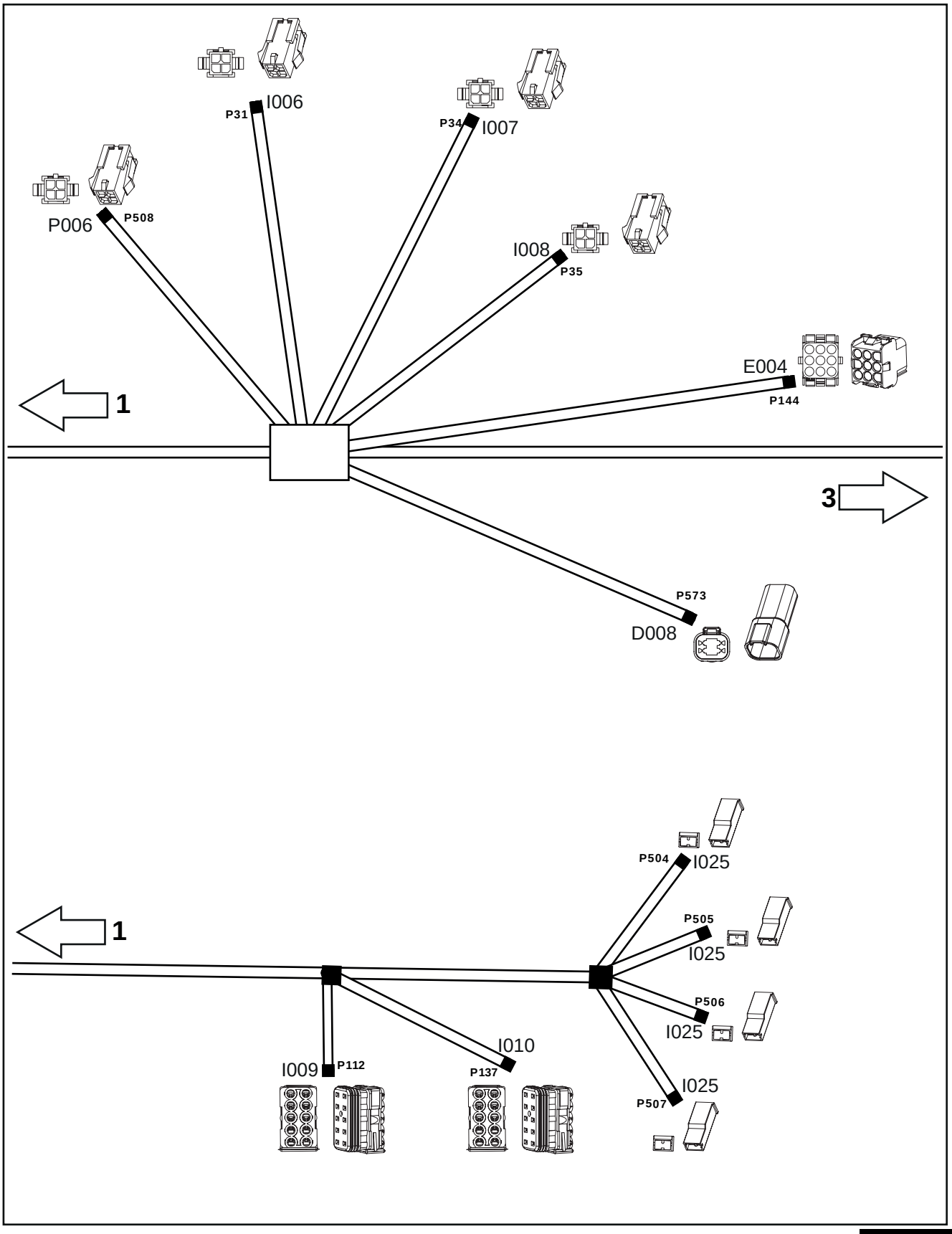

Fig. 17.22

Table 3

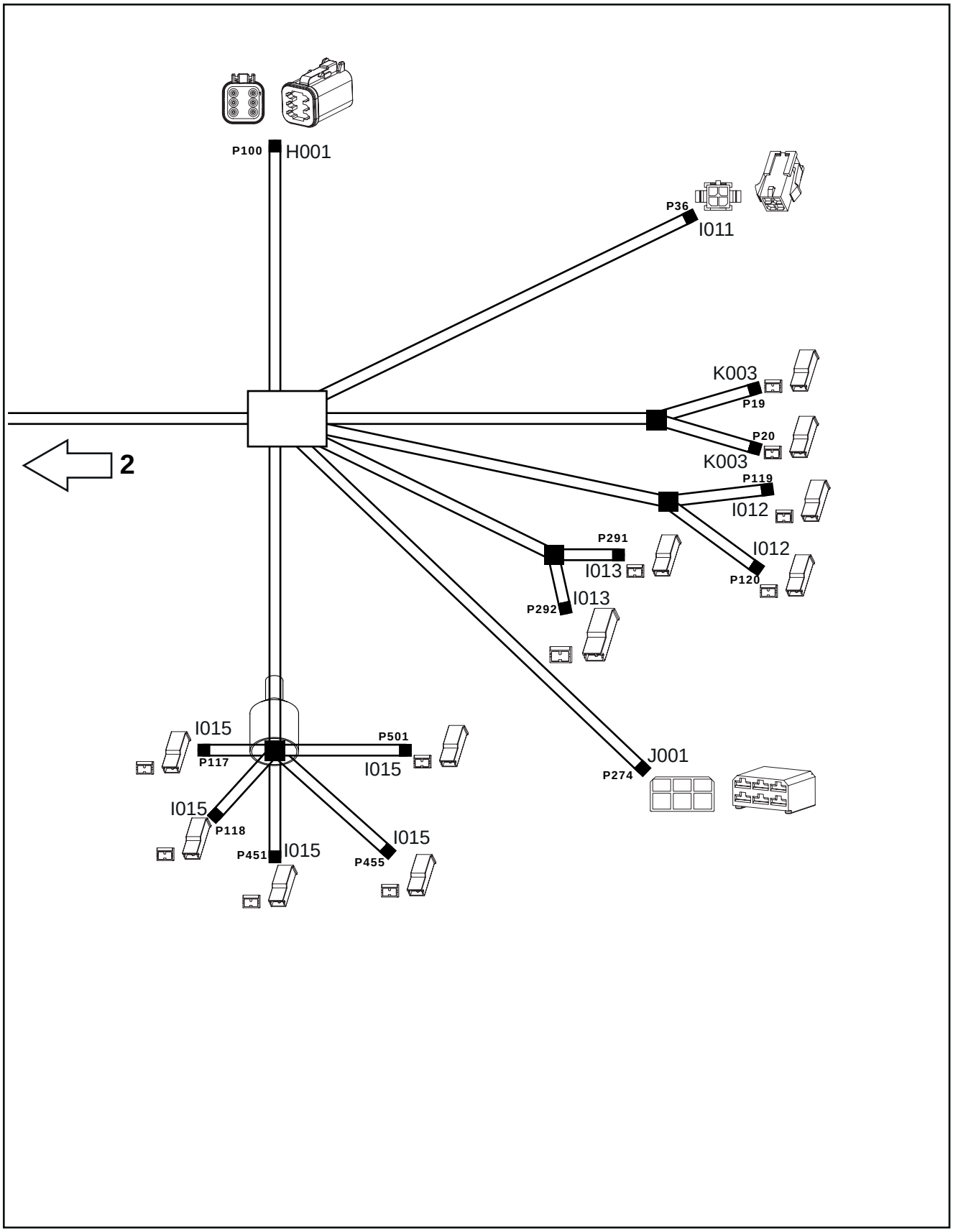

Fig. 17.23

17.3.9.2 Dashboard wiring loom wiring diagram

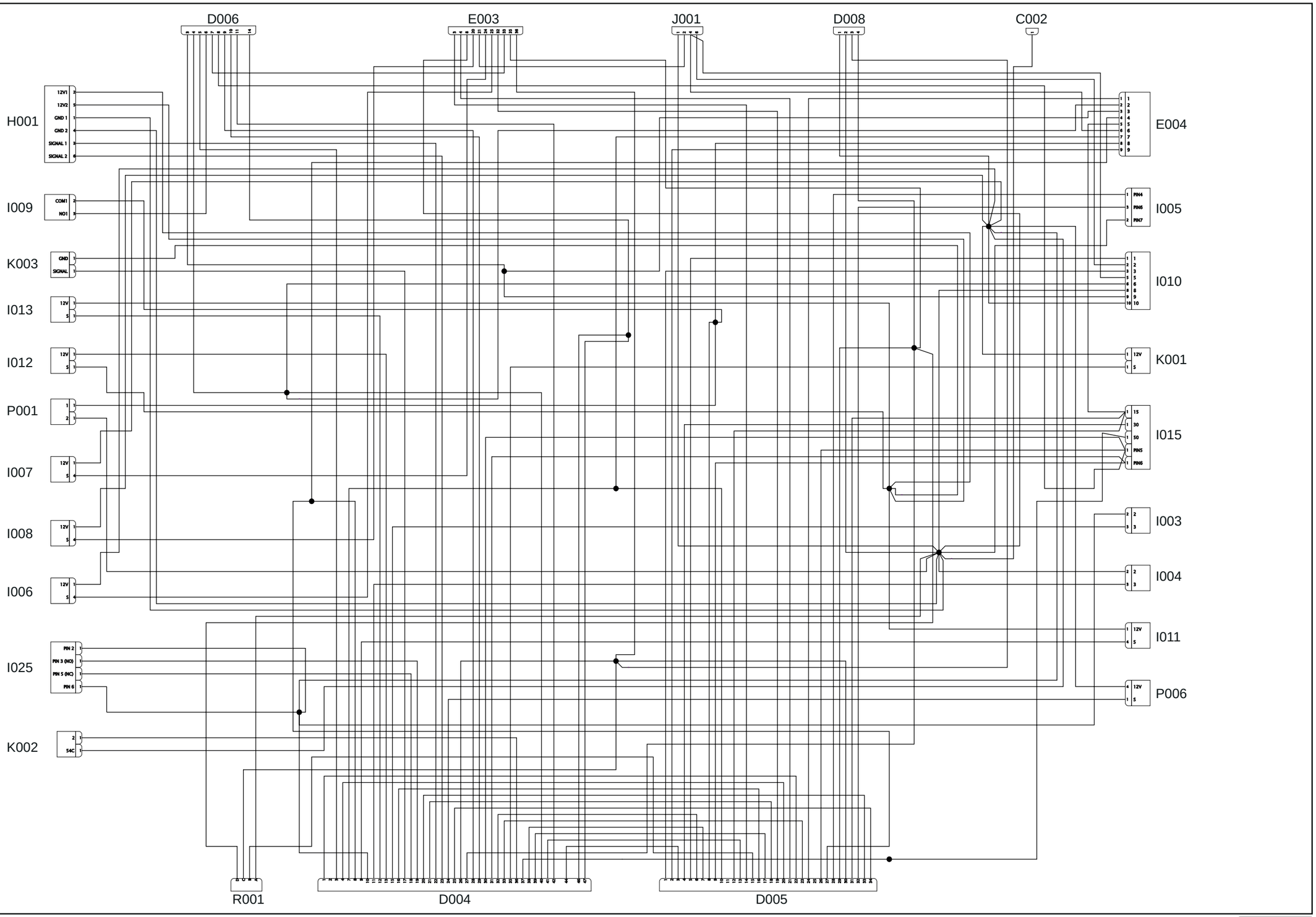

Fig. 17.24

17.3.9.3 Location of dashboard wiring loom

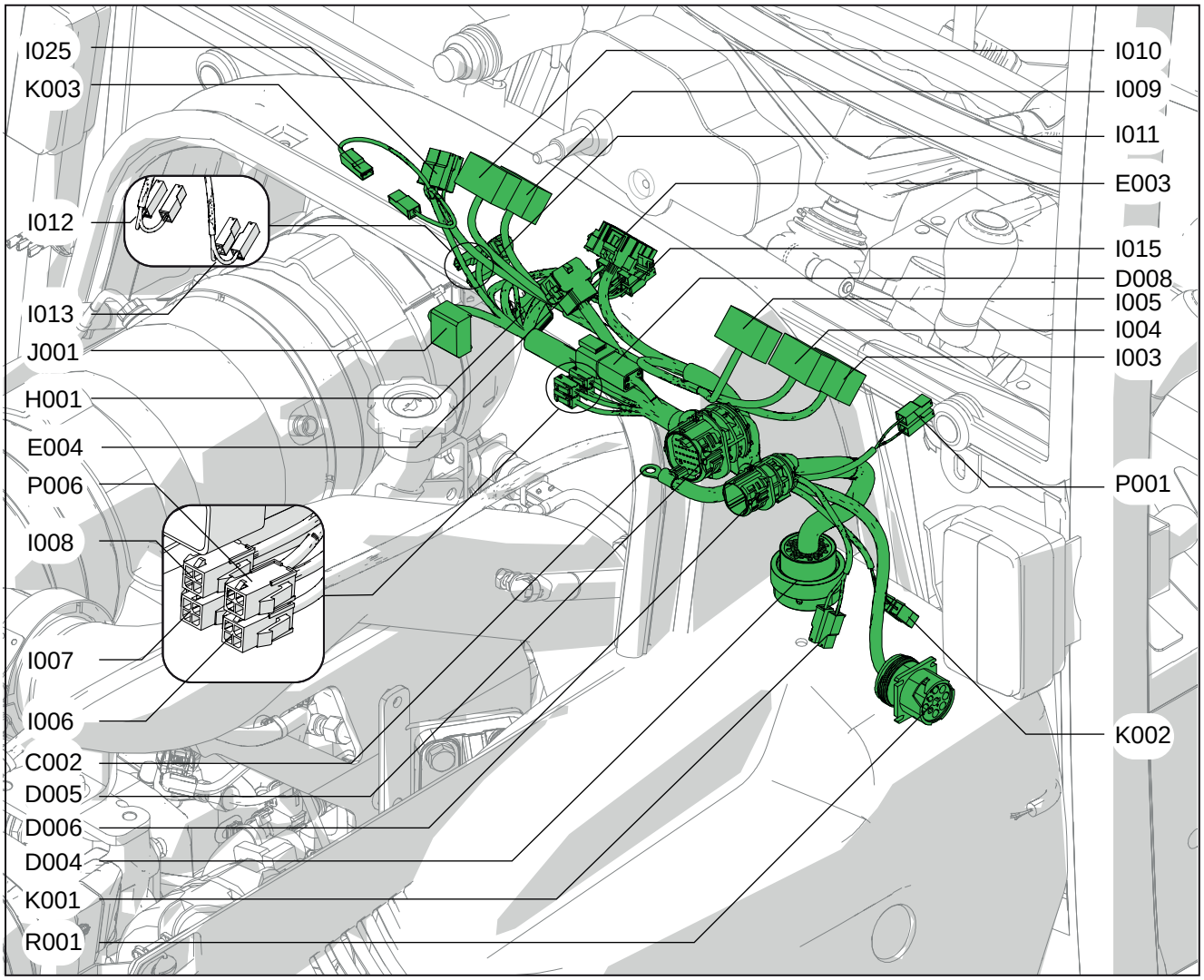

Fig. 17.25

17.3.9.4 Component identification codes

System code	Source code	Description
C002	P576	Cab ground
D004	P30A	Wiring connector for main wiring loom
D005	P100B	Wiring connector for engine wiring loom
D006	P102B	Wiring connector for engine wiring loom
D008	P573	Wiring connector for joystick wiring loom
E003	P200	Dashboard
E004	P144	RH turn signal indicator
H001	P100	Hand throttle
I003	P60	Hydraulic 4WD selector switch
I004	P62	Hydraulic differential lock switch
I005	P32	Regeneration cycle disable switch
I006	P31	ENTER dashboard button
I007	P34	+ dashboard button
I008	P35	- dashboard button
I009	P112	Rotating beacon button
I010	P137	Hazard warning lights button
I011	P36	Auto PTO switch
I012	P119,P120	Right brake pedal switch
I013	P291,P292	Left brake pedal switch
I015	P117,P118,P451,P455,P501	Ignition switch
I025	P504,P505,P506,P507	PTO mode selector
J001	P274	Hazard warning lights relay
K001	P492,P493	Clutch engine start enable sensor
K002	P46,P47	PTO start enable signal / dashboard indicator signal
K003	P19,P20	Brake oil level sensor
P001	P456,P457	1-pole socket
P006	P508	Trailer test (not used)
R001	J9	Diagnostic port

17.3.10 02004494 - Dashboard (from serial number 0000622678)

17.3.10.1 Installation of dashboard wiring loom

Table 1

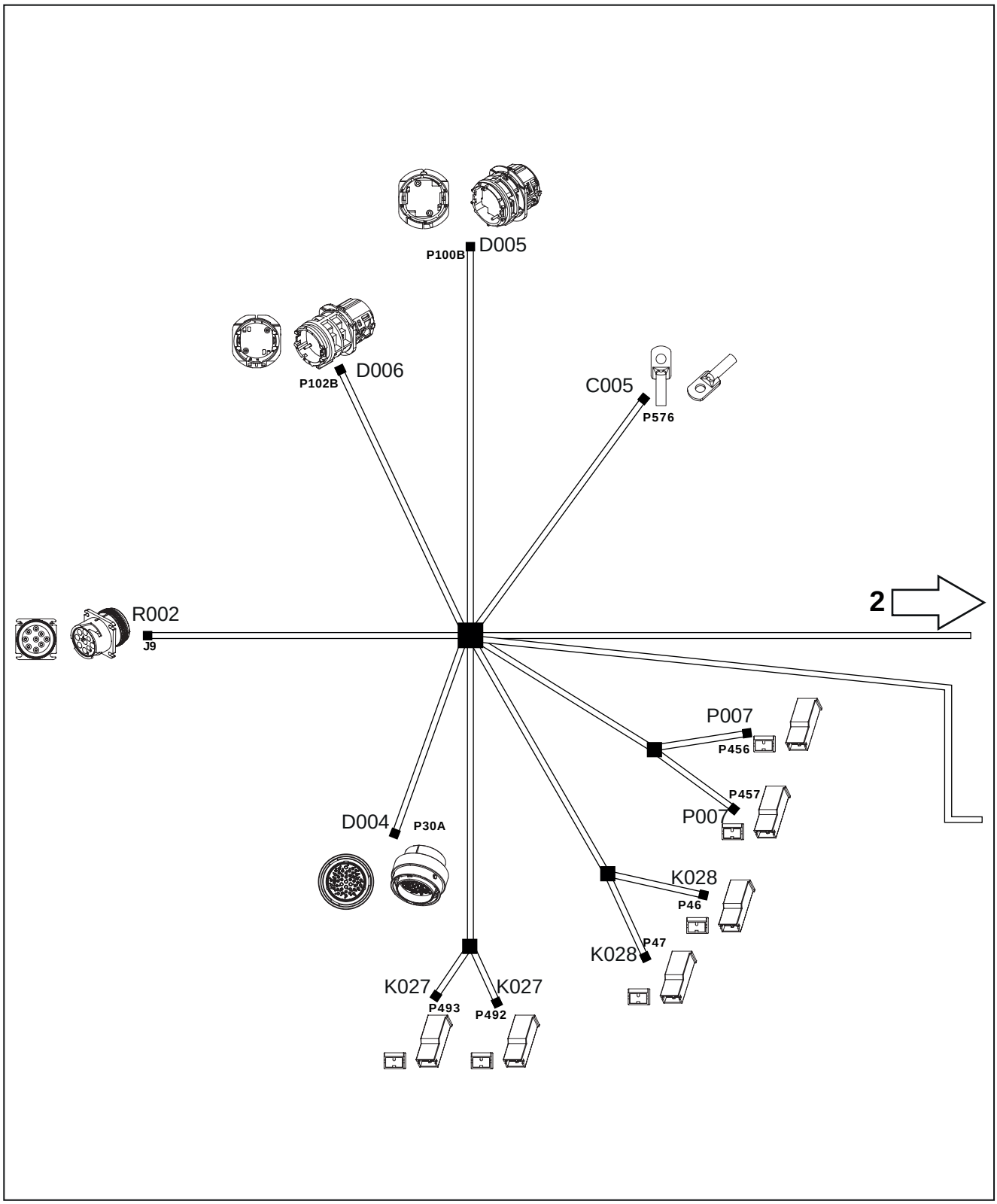

Fig. 17.26

Table 2

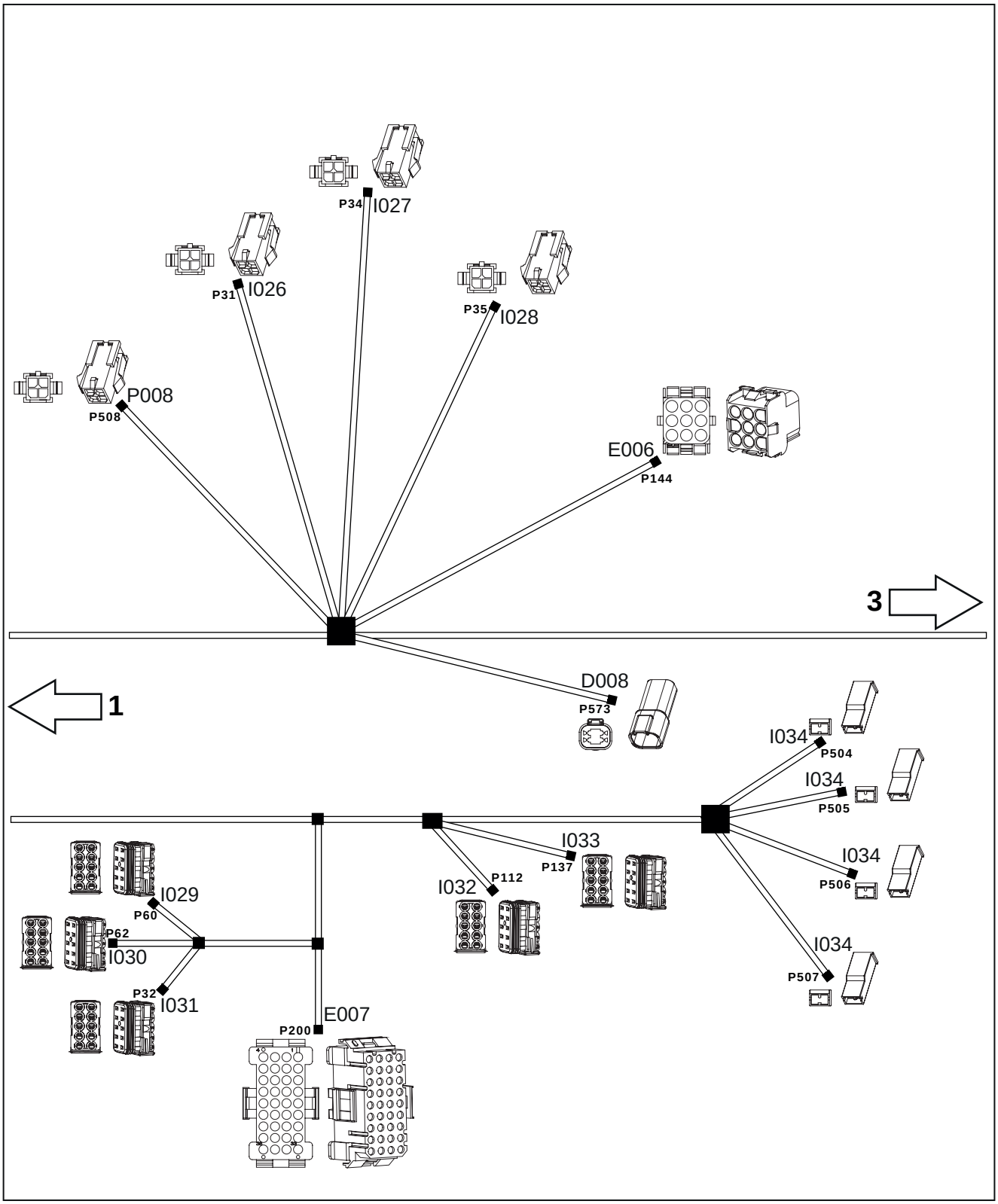

Fig. 17.27

Table 3

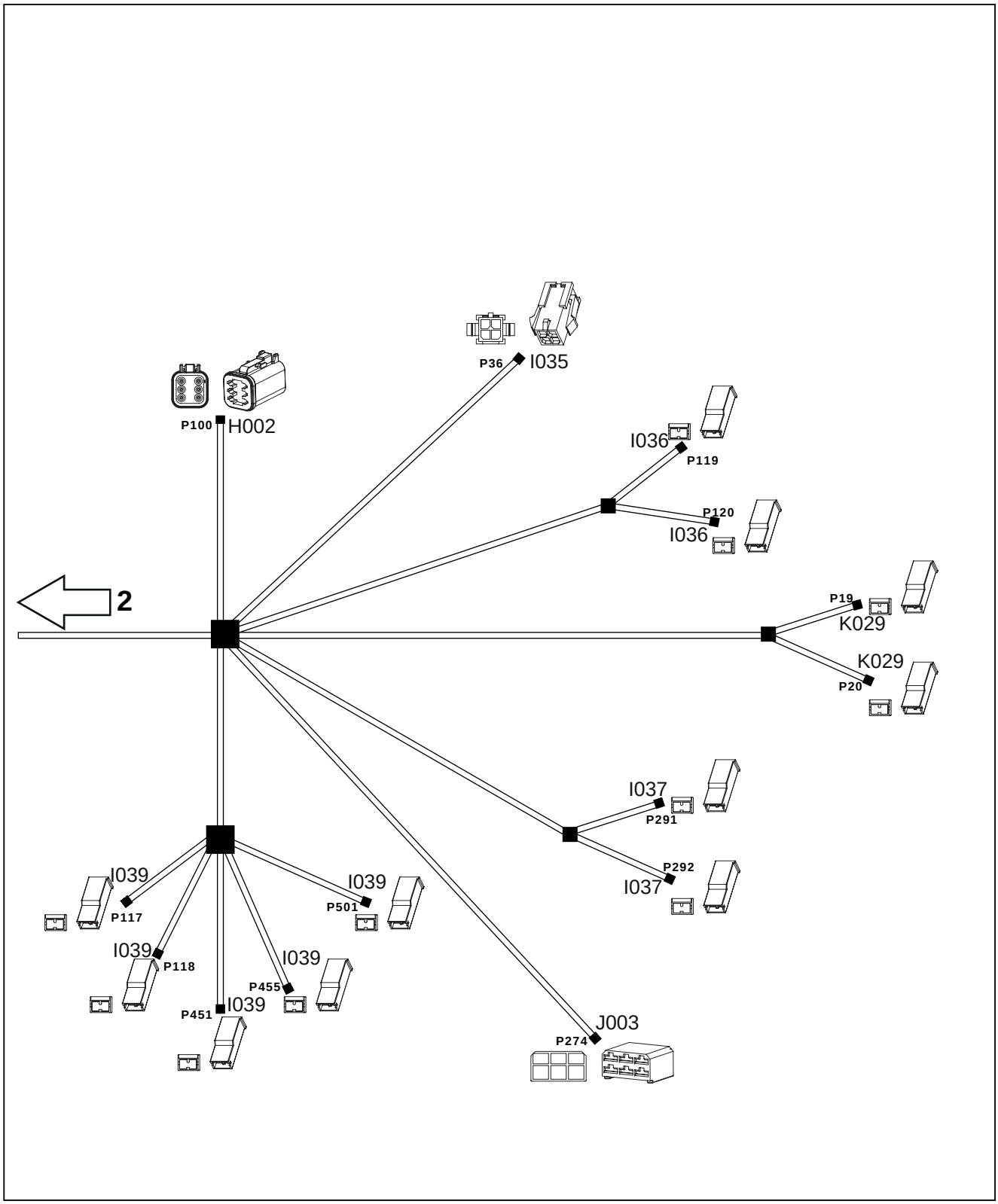

Fig. 17.28

17.3.10.2 Dashboard wiring loom wiring diagram

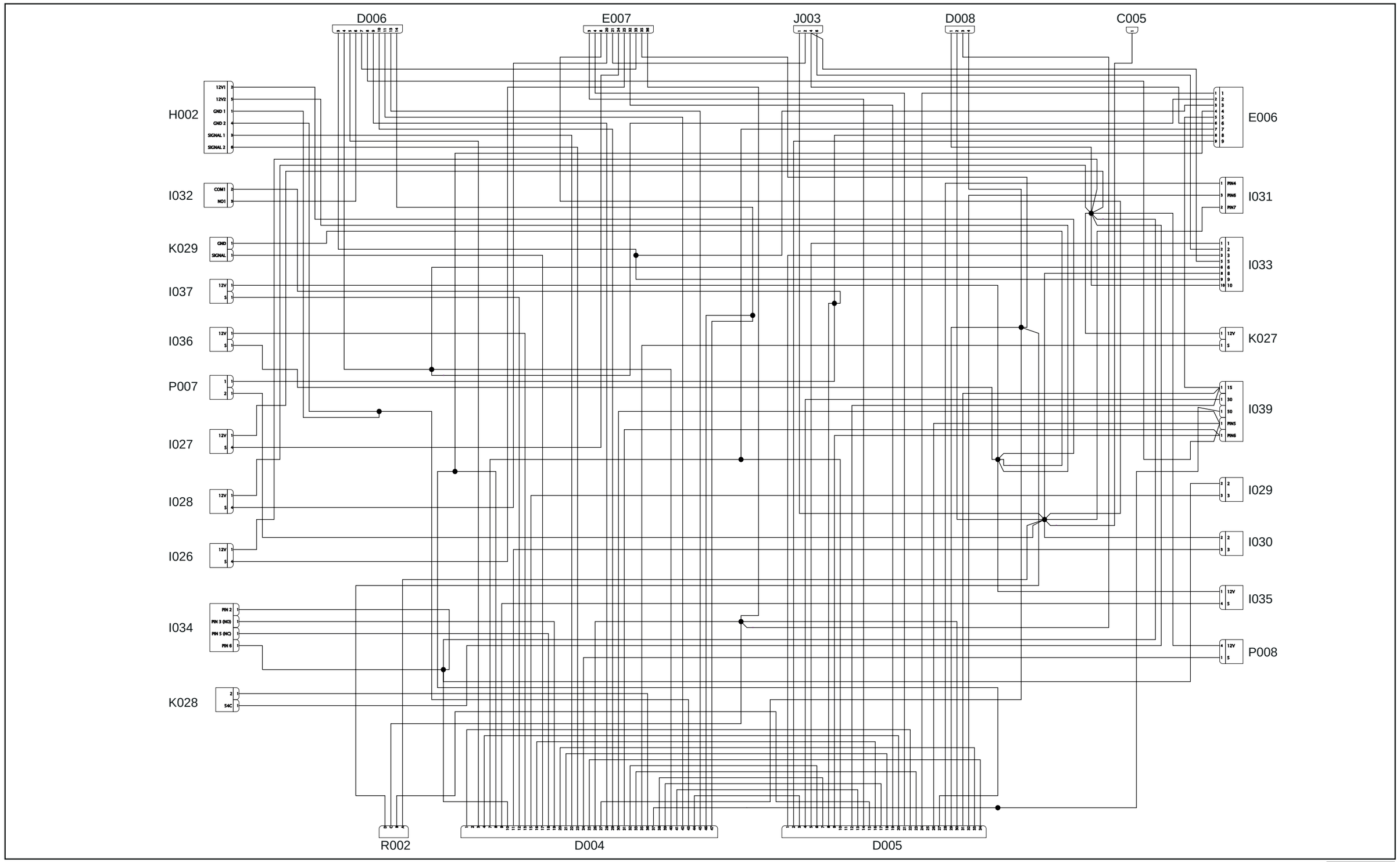

Fig. 17.29

17.3.10.3 Location of dashboard wiring loom

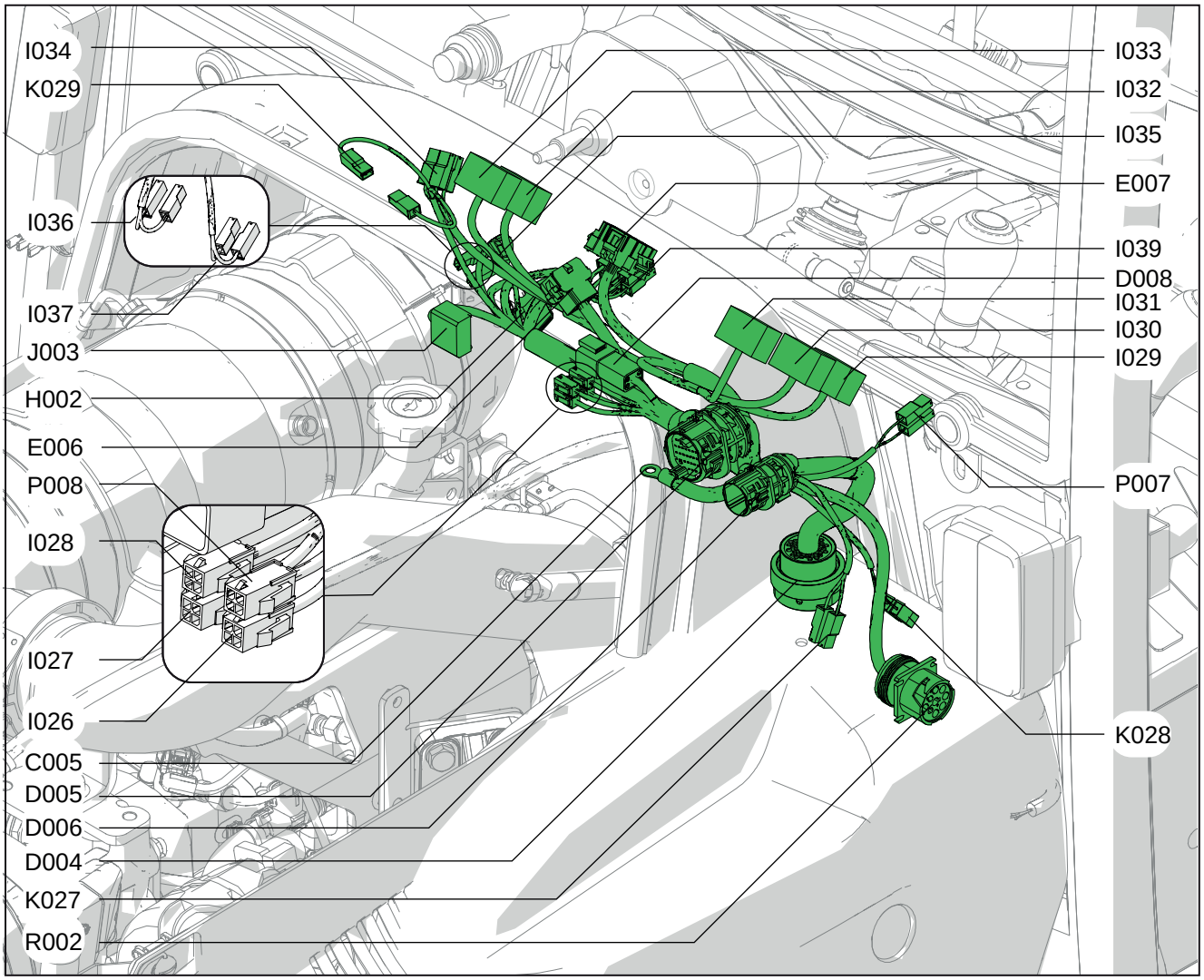

Fig. 17.30

17.3.10.4 Component identification codes

System code	Source code	Description
C005	P576	Cab ground
D004	P30A	Wiring connector for main wiring loom
D005	P100B	Wiring connector for engine wiring loom
D006	P102B	Wiring connector for engine wiring loom
D008	P573	Wiring connector for joystick wiring loom
E006	P144	Right hand turn indicator signal
E007	P200	Dashboard
H002	P100	Hand throttle
I026	P31	ENTER dashboard button
I027	P34	+ dashboard button
I028	P35	- dashboard button
I029	P60	Hydraulic 4WD selector switch
I030	P62	Hydraulic differential lock switch
I031	P32	Regeneration cycle disable switch
I032	P112	Rotating beacon button
I033	P137	Hazard warning lights button
I034	P504,P505,P506,P507	PTO mode selector
I035	P36	Auto PTO switch
I036	P119,P120	Right brake pedal switch
I037	P291,P292	Left brake pedal switch
I039	P117,P118,P451,P455,P501	Ignition switch
J003	P274	Hazard warning lights relay
K027	P492,P493	Clutch engine start enable sensor
K028	P46,P47	PTO start enable signal / dashboard indicator signal
K029	P19,P20	Brake oil level sensor
P007	P456,P457	1-pole socket
P008	P508	Trailer test (not used)
R002	J9	Diagnostic port

17.3.11 02004185 - Engine

17.3.11.1 Installation of engine wiring loom

Table 1

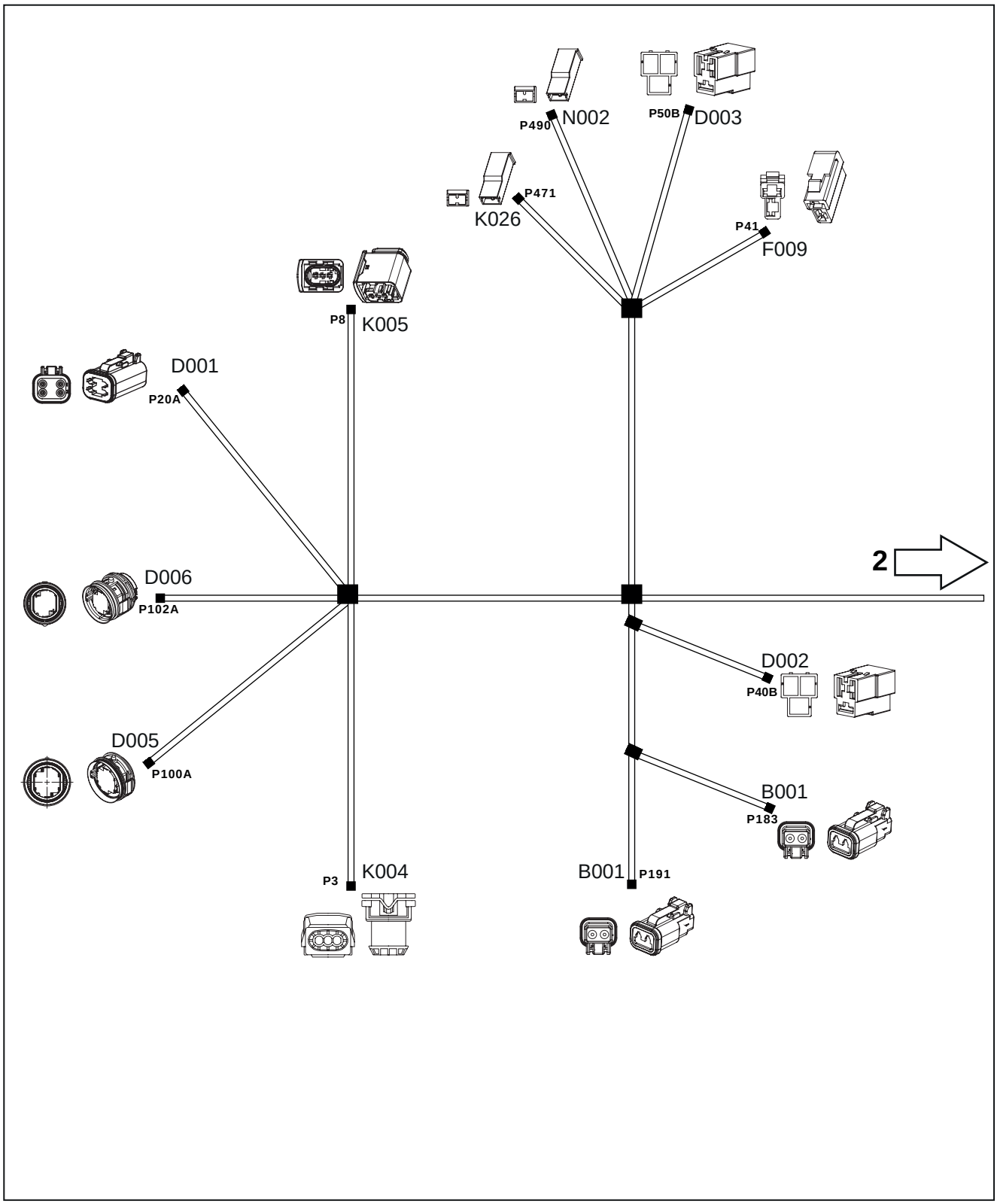

Fig. 17.31

Table 2

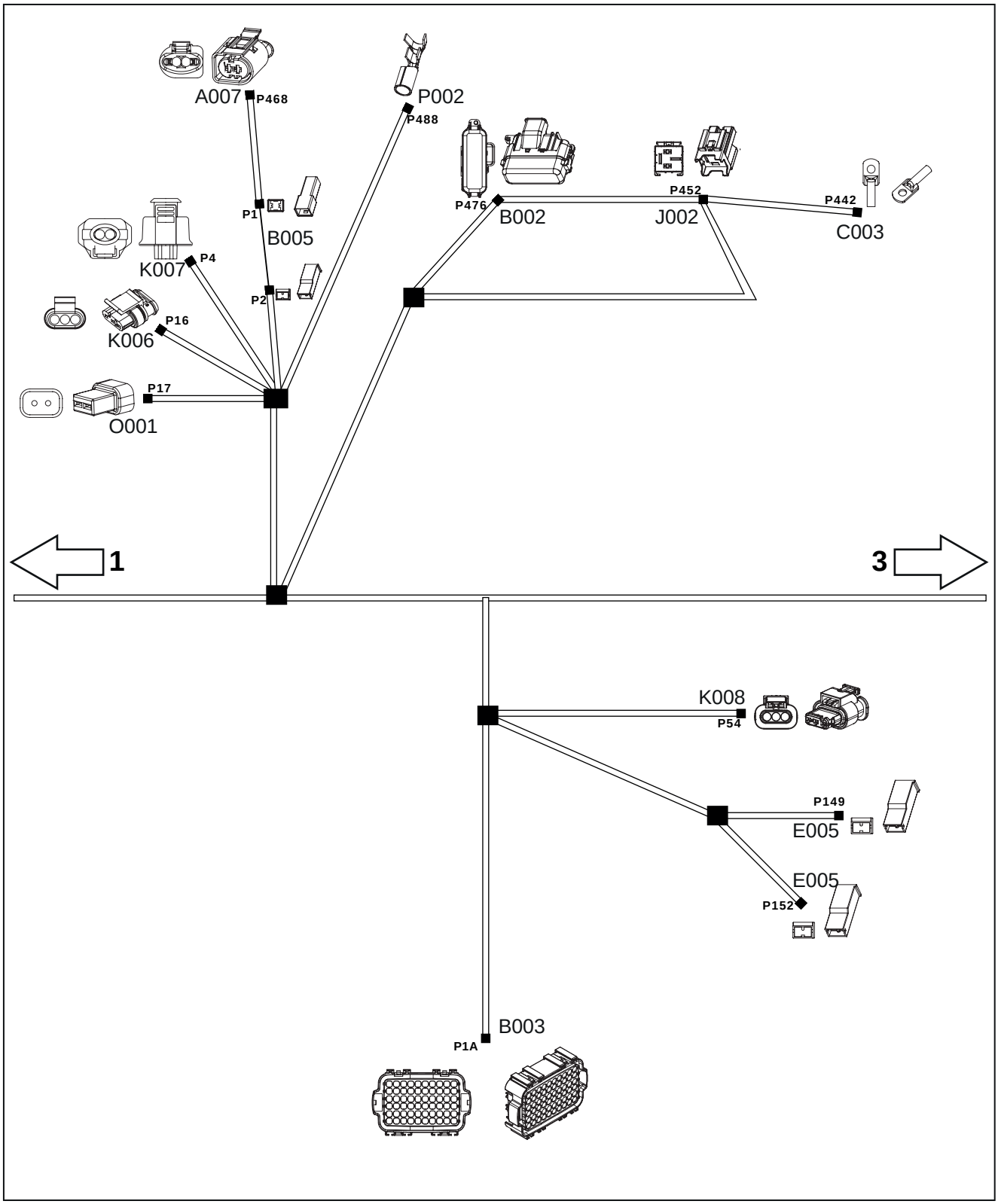

Fig. 17.32

Table 3

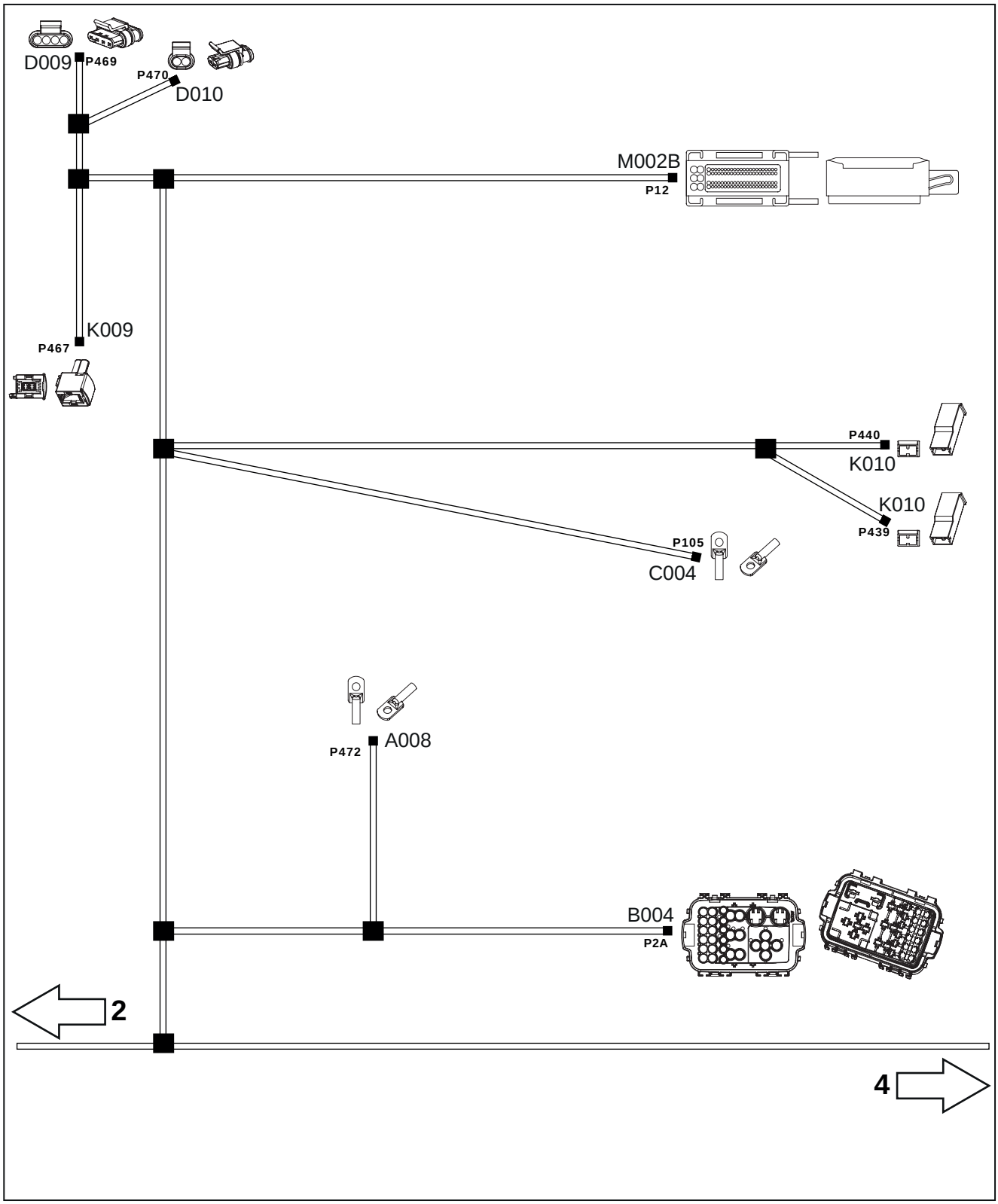

Fig. 17.33

Table 4

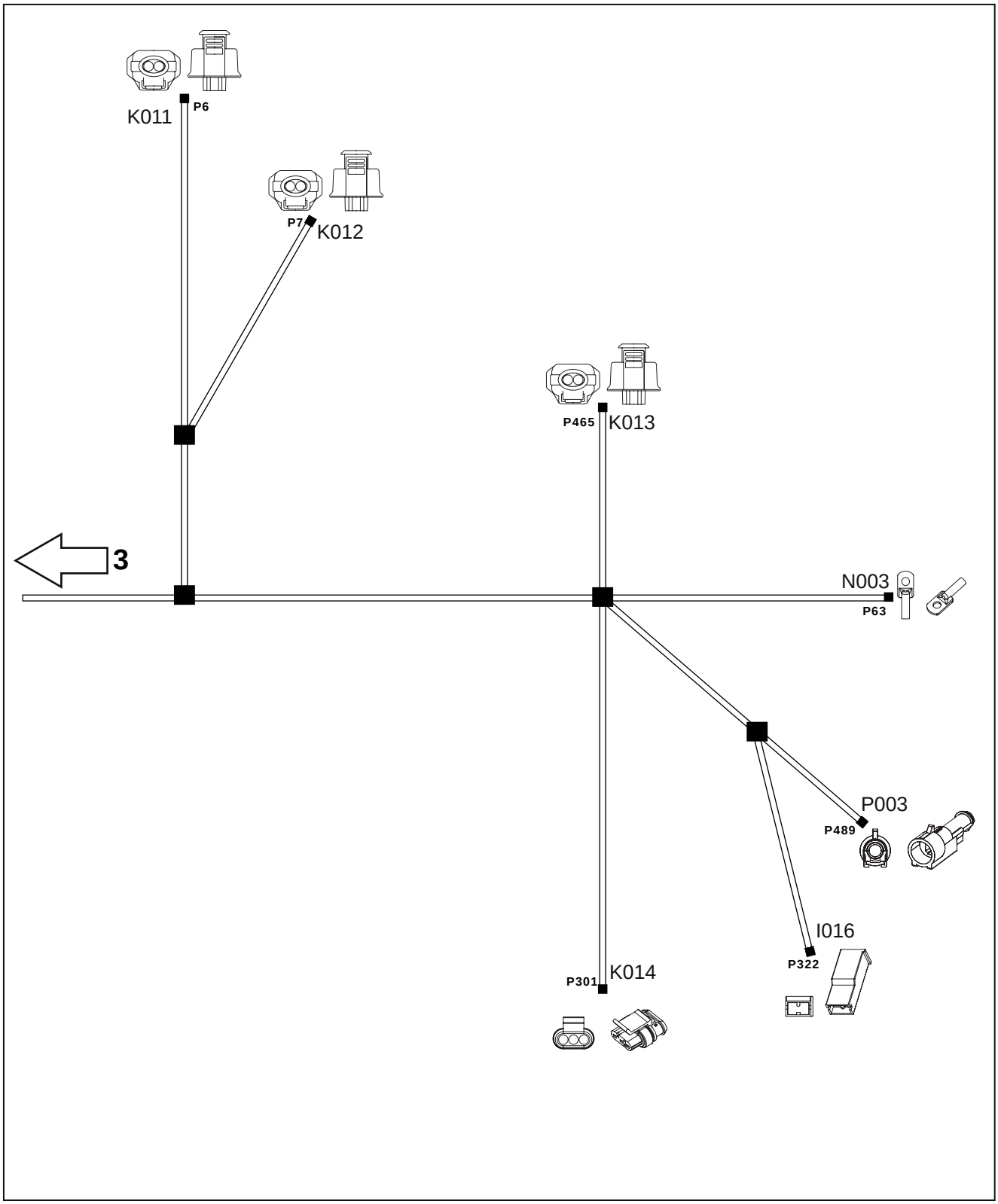

Fig. 17.34

17.3.11.2 Engine wiring loom wiring diagram

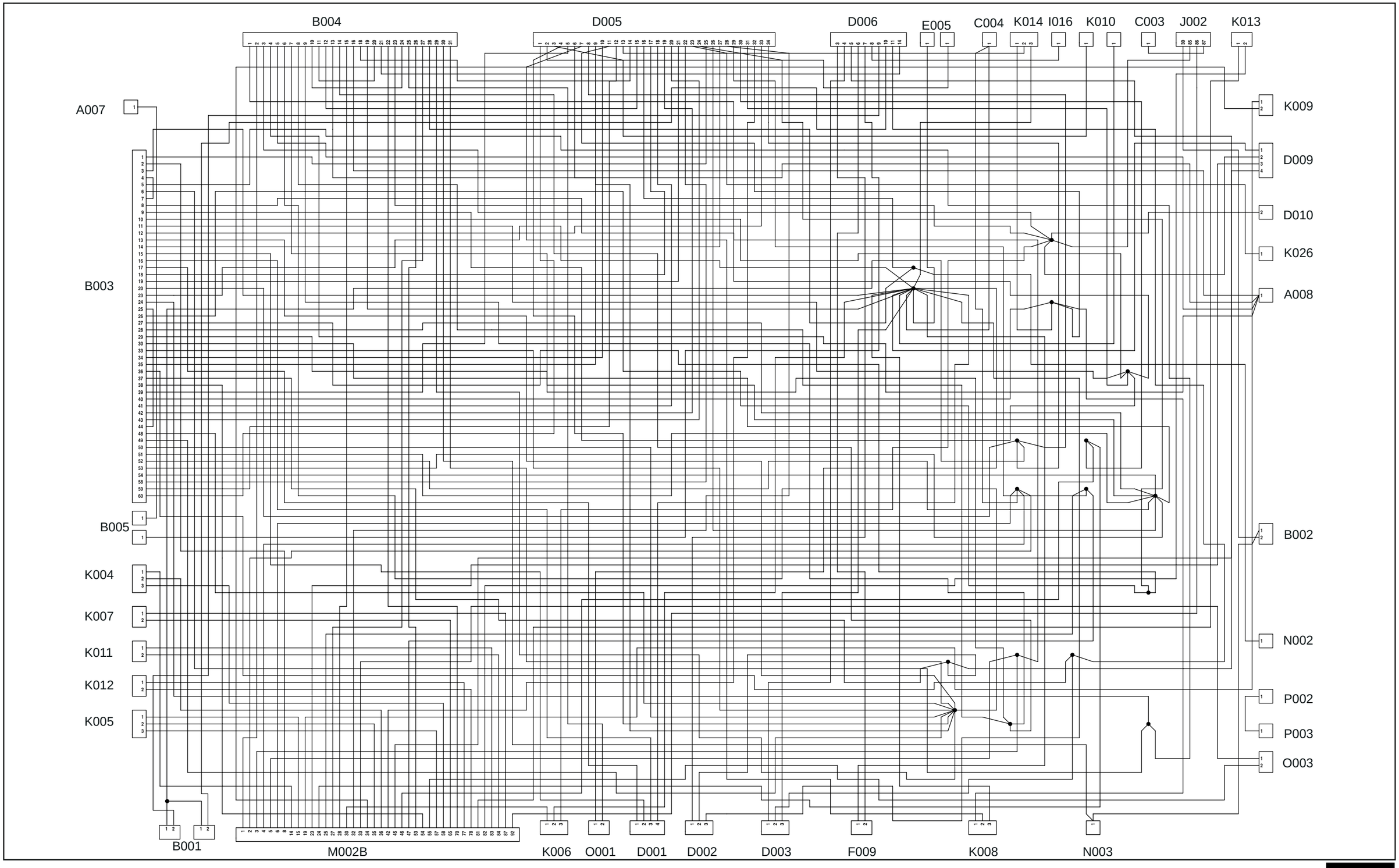

Fig. 17.35

17.3.11.3 Location of engine wiring loom

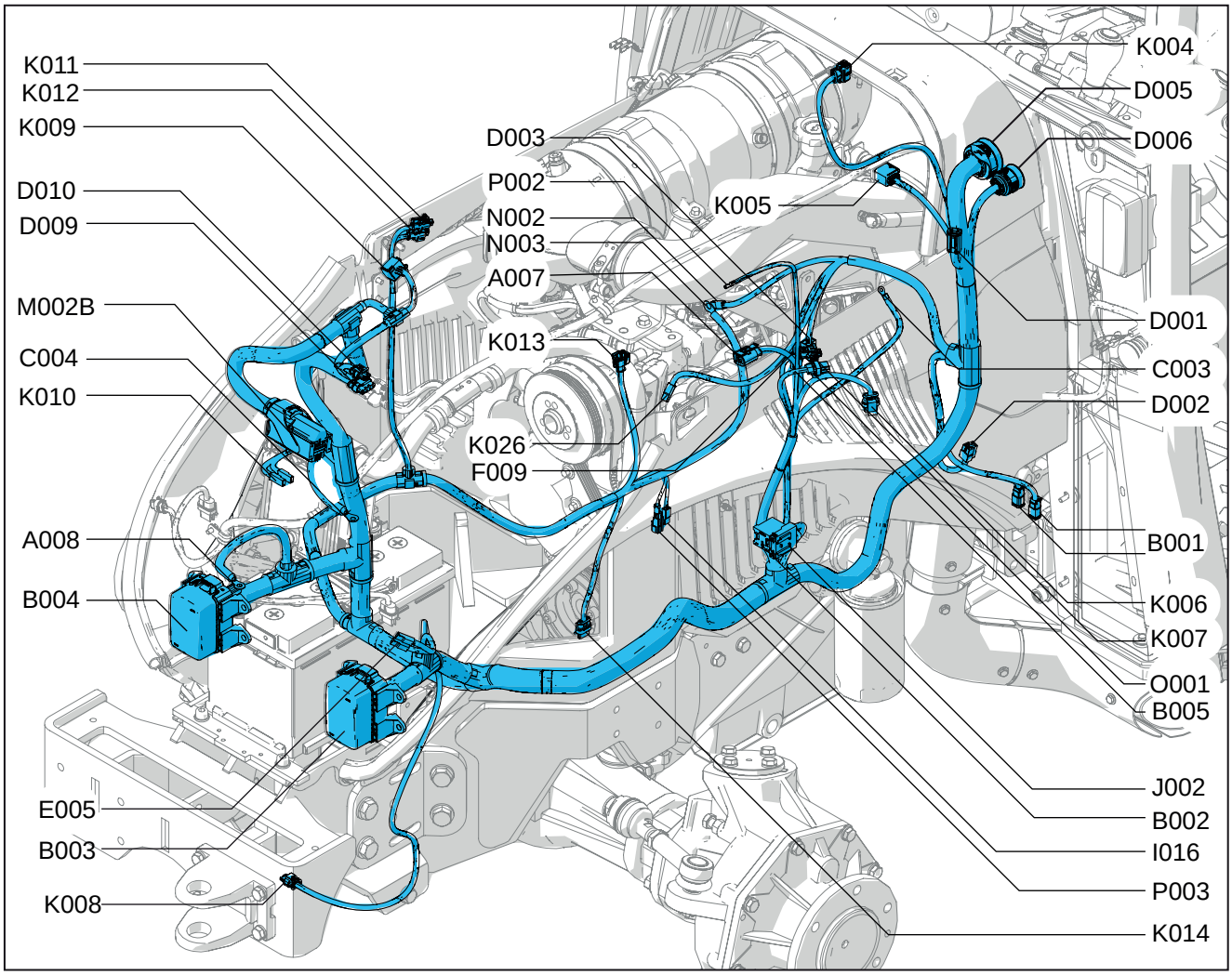

Fig. 17.36

17.3.11.4 Component identification codes

System code	Source code	Description
A007	P468	Alternator
A008	P472	Positive battery terminal
B001	P183,P191	Front PTO valves
B002	P476	Fuse holder for incandescent lamps
B003	P1A	Fuse box "2"
B004	P2A	Fuse box "1"
B005	P1,P2	Diode
C003	P442	Glow plug ground
C004	P105	Engine ground point
D001	P20A	Wiring connector for cowl wiring loom
D002	P40B	Wiring connector for LH parking lights wiring loom
D003	P50B	Wiring connector for RH parking lights wiring loom
D005	P100A	Wiring connector for dashboard wiring loom
D006	P102A	Wiring connector for dashboard wiring loom
D009	P469	Wiring connector for prewired engine wiring loom
D010	P470	Wiring connector for prewired engine wiring loom
D011	P10A	PTO valve connector
E005	P152,P149	Horn
F009	P41	Provision for rotating beacon, roll-bar version
I016	P322	Cab key
J002	P452	Glow plug relay
K004	P3	Differential pressure sensor
K005	P8	P3 sensor (exhaust pressure)
K006	P16	Water in fuel sensor
K007	P4	Fuel temperature sensor
K008	P54	PTO shaft speed sensor
K009	P467	Ambient air temperature sensor
K010	P439,P440	Air filter sensor
K011	P6	DPF temperature sensor
K012	P7	DOC temperature sensor
K013	P465	Exhaust gas temperature sensor
K014	P301	Wheel speed sensor
K026	P471	Suction line hydraulic oil pressure sensor
M002B	P12	Engine control unit
N002	P490	Starter motor50
N003	P63	Starter motor
O001	P17	Fuel filter heater
O003	330 Ohms	Resistance 330 Ohms
P002	P488	Compressor
P003	P489	From cab to compressor

17.3.12 02004186 - Main

17.3.12.1 Installation of main wiring loom

Table 1

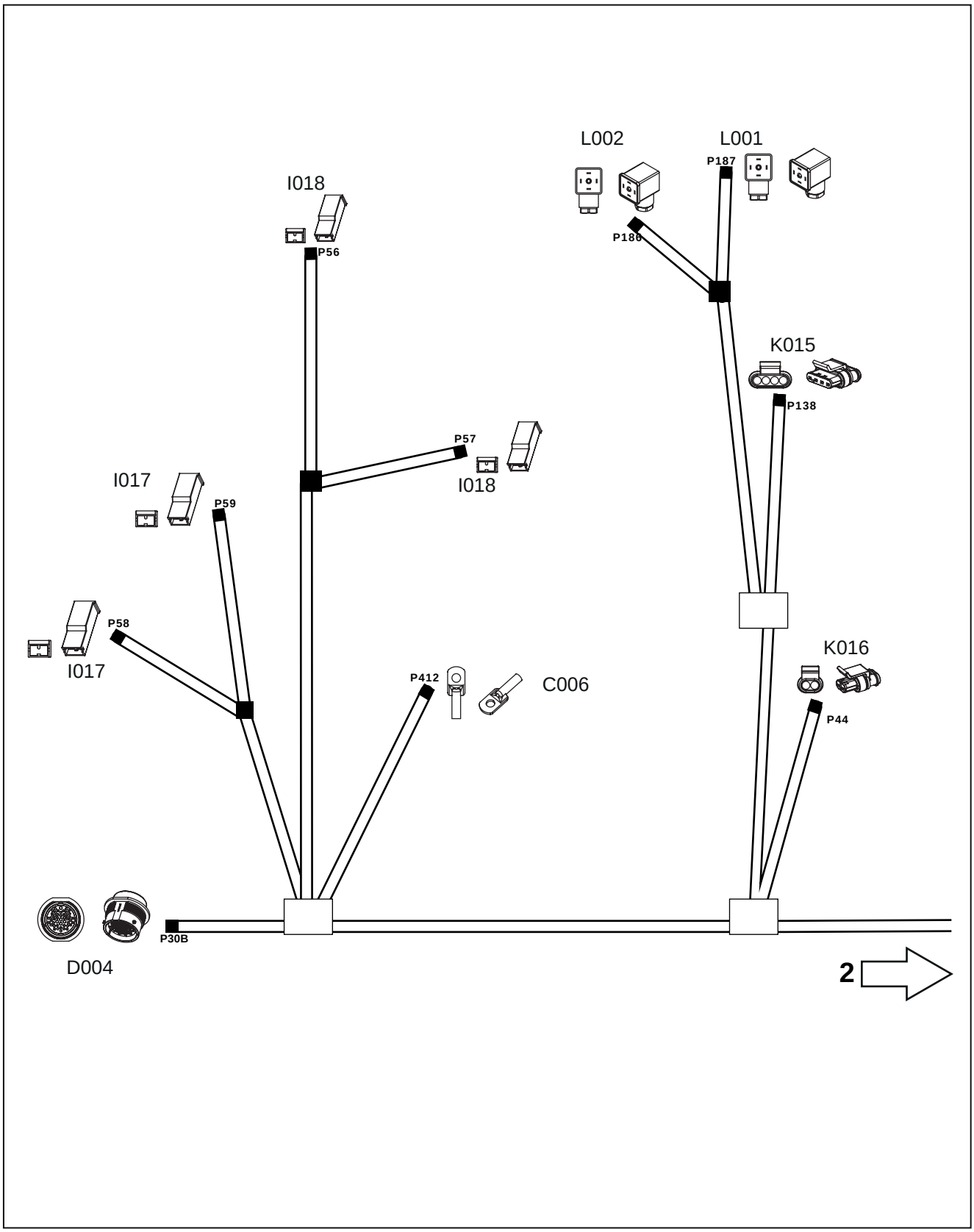

Fig. 17.37

Table 2

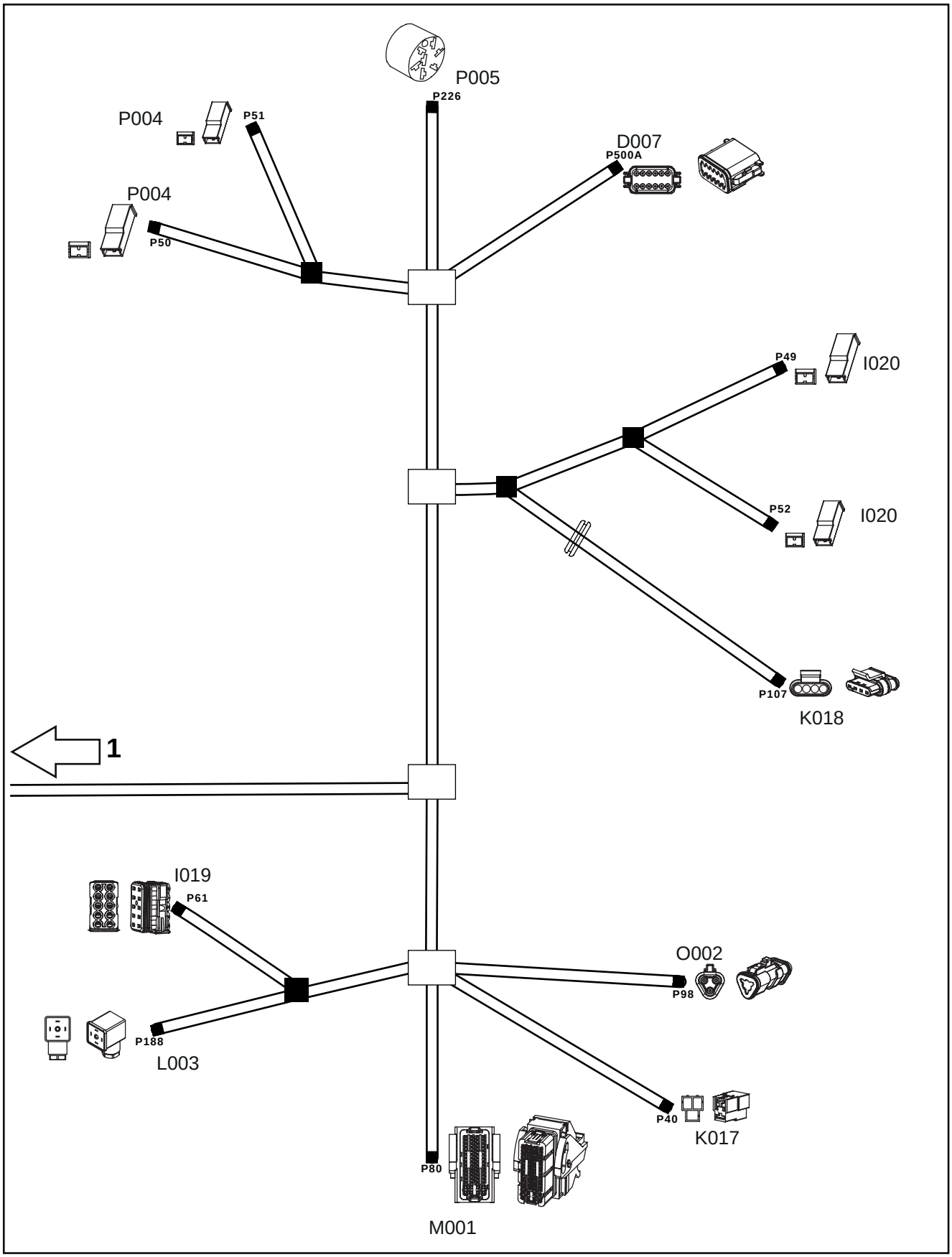

Fig. 17.38

17.3.12.2 Main wiring loom wiring diagram

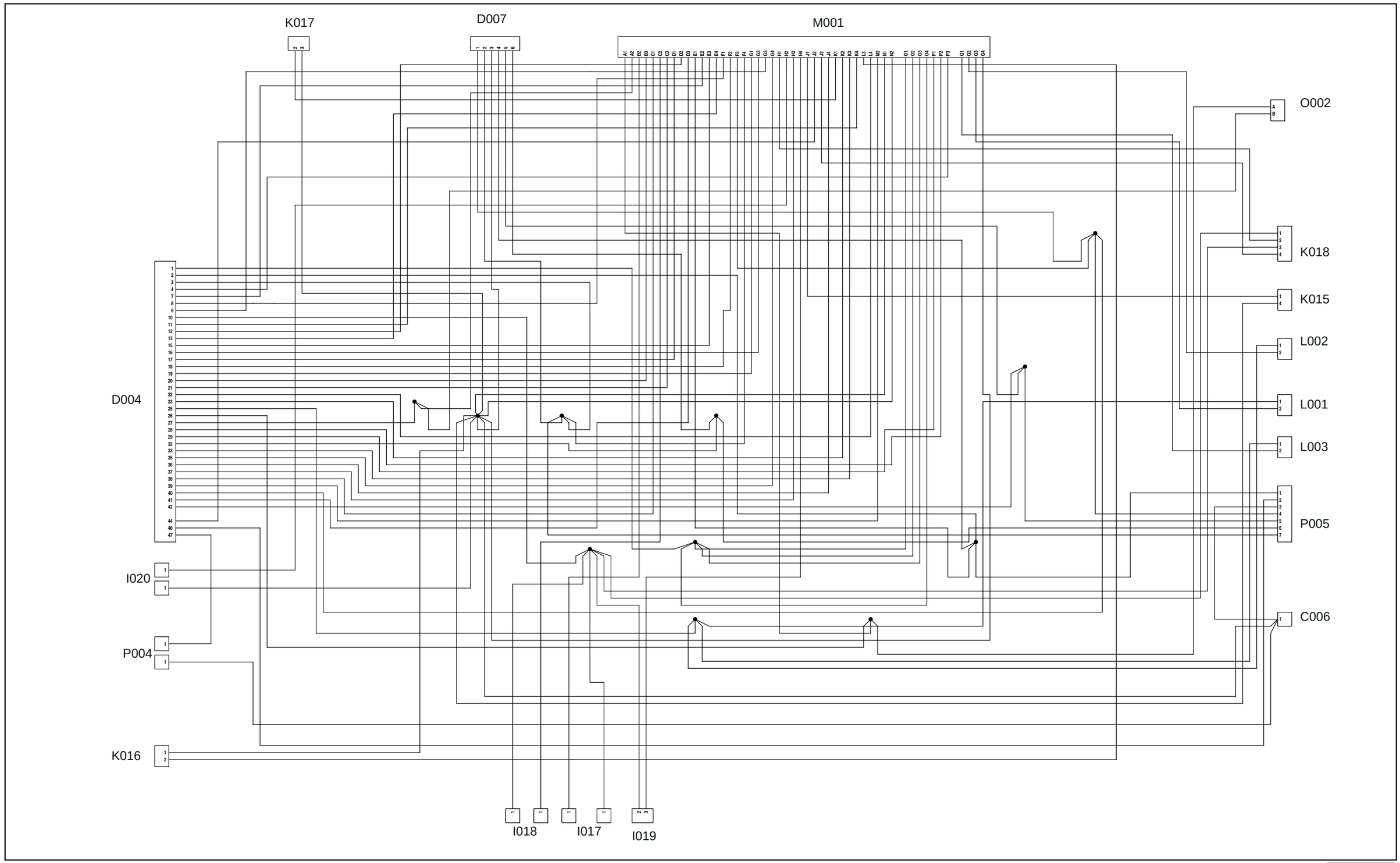

Fig. 17.39

17.3.12.3 Location of main wiring loom

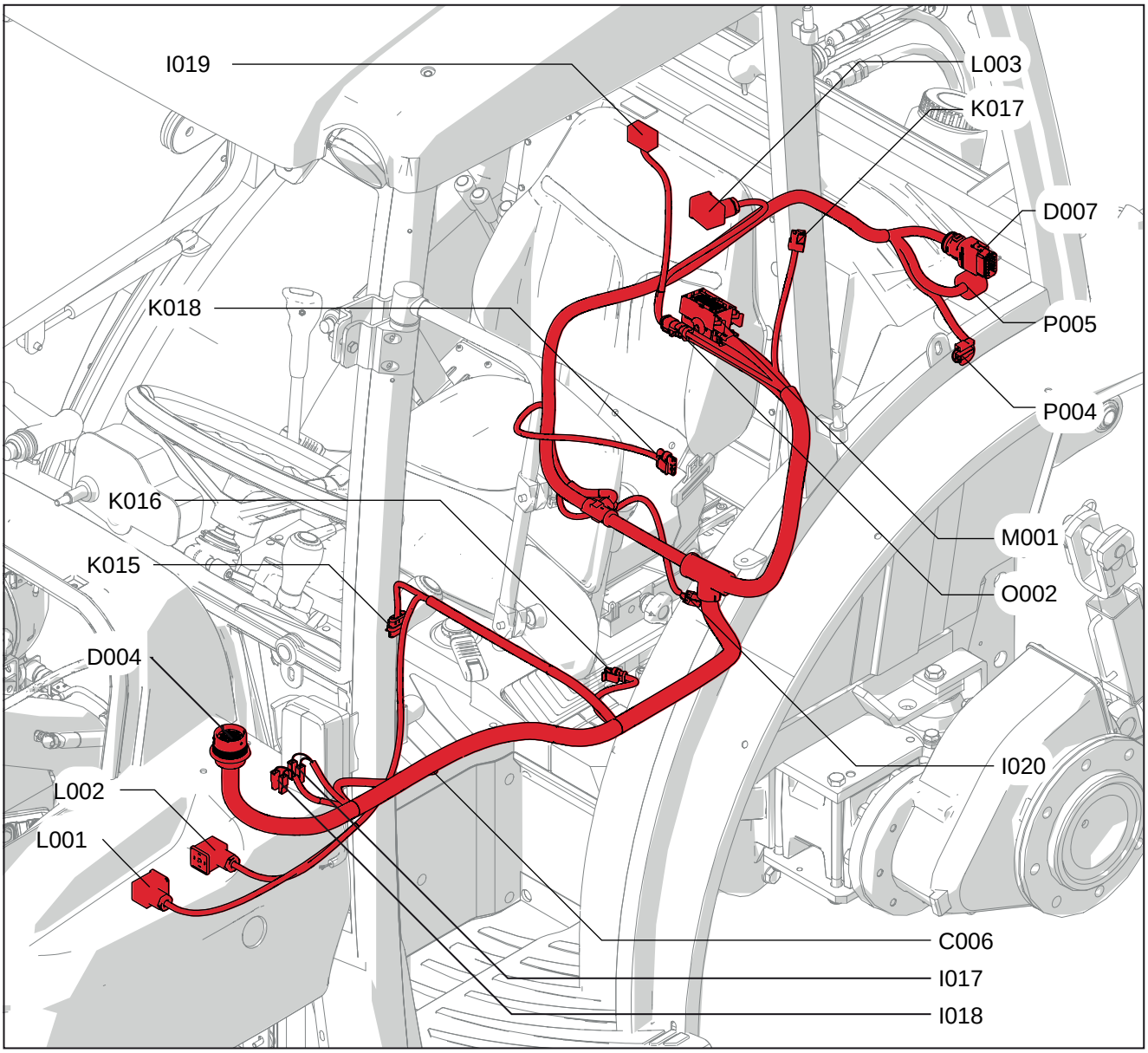

Fig. 17.40

17.3.12.4 Component identification codes

System code	Source code	Description
D004	P30B	Wiring connector for dashboard wiring loom
D007	P500A	Wiring connector for rear lights wiring loom
I017	P58,P59	H/L Forward lever button
I018	P56,P57	H/L Reverse lever button
C006	P412	Main wiring loom ground
L001	P187	Differential lock "ON/OFF" solenoid valve
L002	P186	4WD "ON/OFF" solenoid valve
K015	P138	Park brake start enable signal
K016	P44	PTO mode sensor
I019	P61	"Diverter" button
L003	P188	"Diverter" solenoid valve
M001	P80	Vehicle ECU
K017	P40	Fuel level sensor
O002	P98	CAN line termination
I020	P49,P52	Rear PTO speed mode selector
K018	P107	Seat start enable signal
P004	P50,P51	1-pole socket
P005	P226	Rear 7 pole socket

17.3.13 02004495 - Main (from serial No. 0000622678 for Roll Bar versions with SG1/1 3B cabs and front lift)

17.3.13.1 Installation of main wiring loom

Table 1

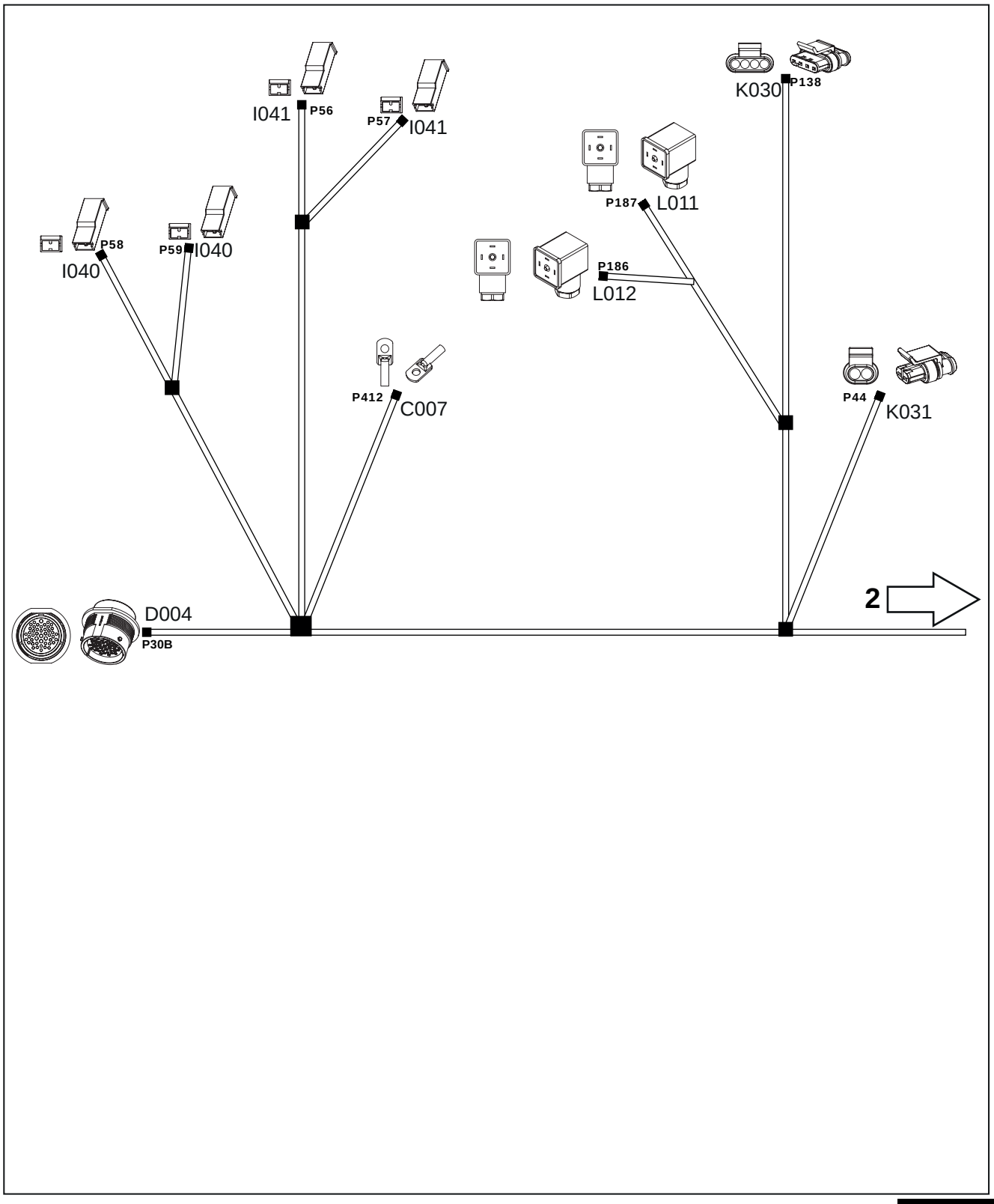

Fig. 17.41

Table 2

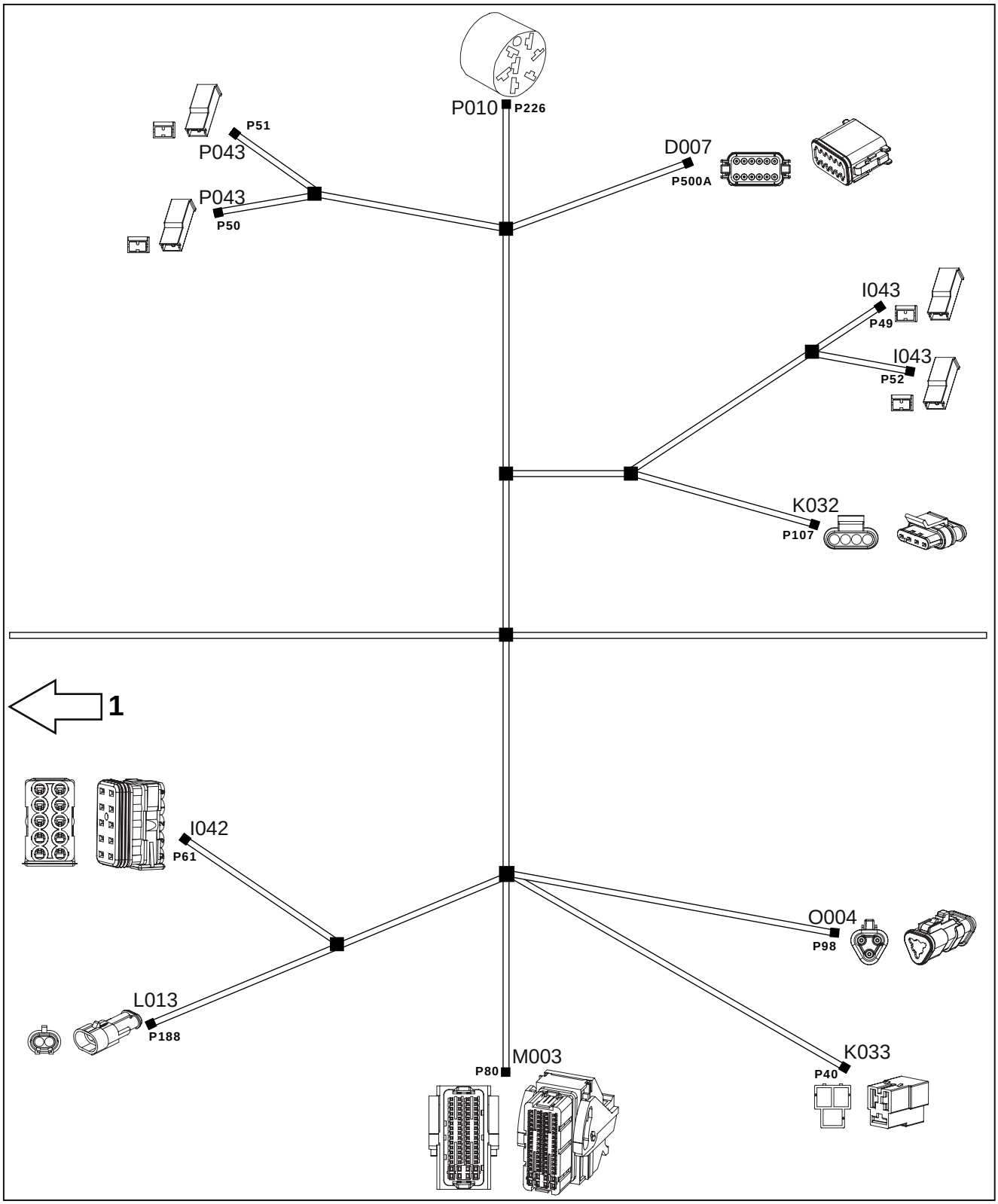

Fig. 17.42

17.3.13.2 Main wiring loom wiring diagram

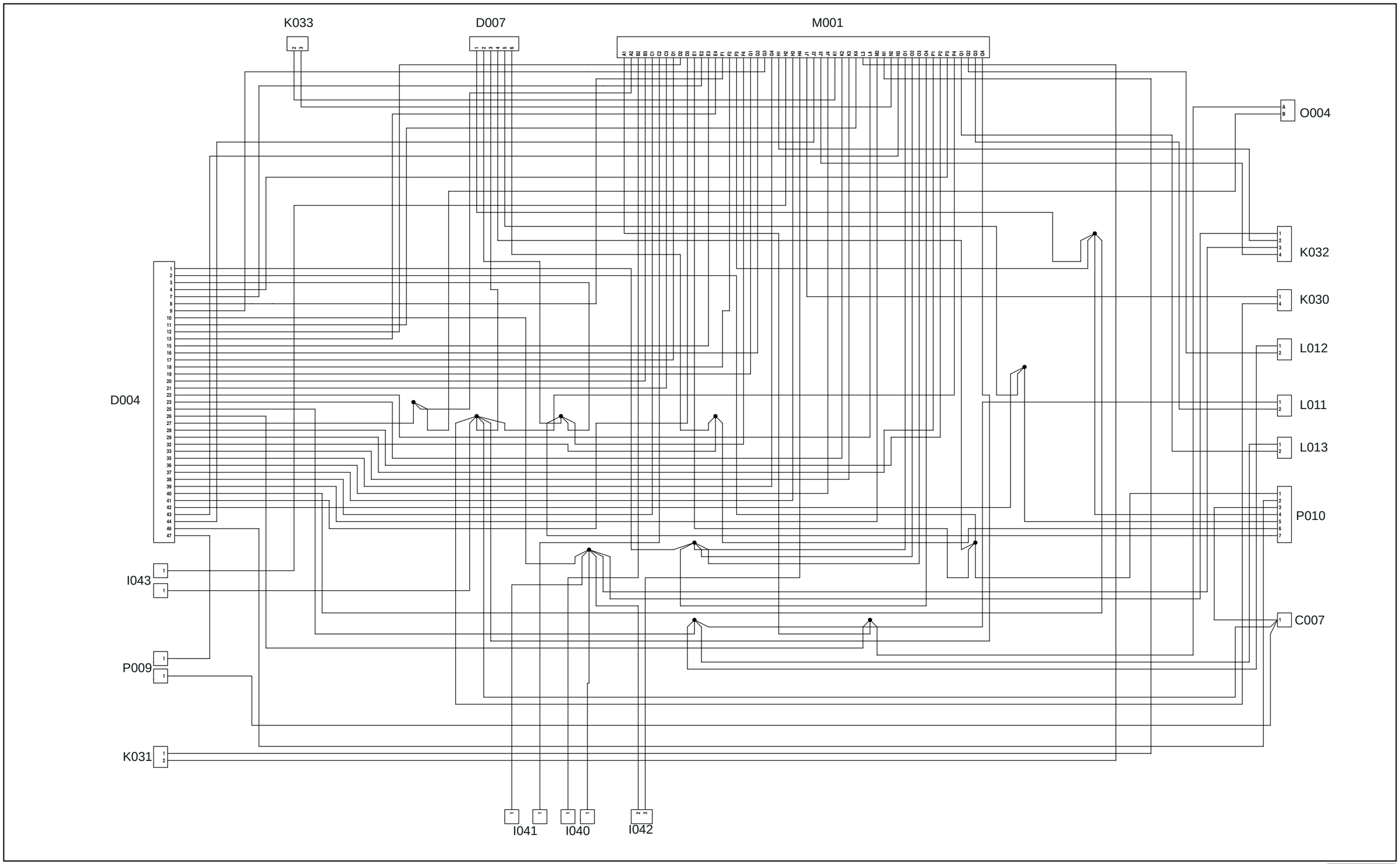

Fig. 17.43

17.3.13.3 Location of main wiring loom

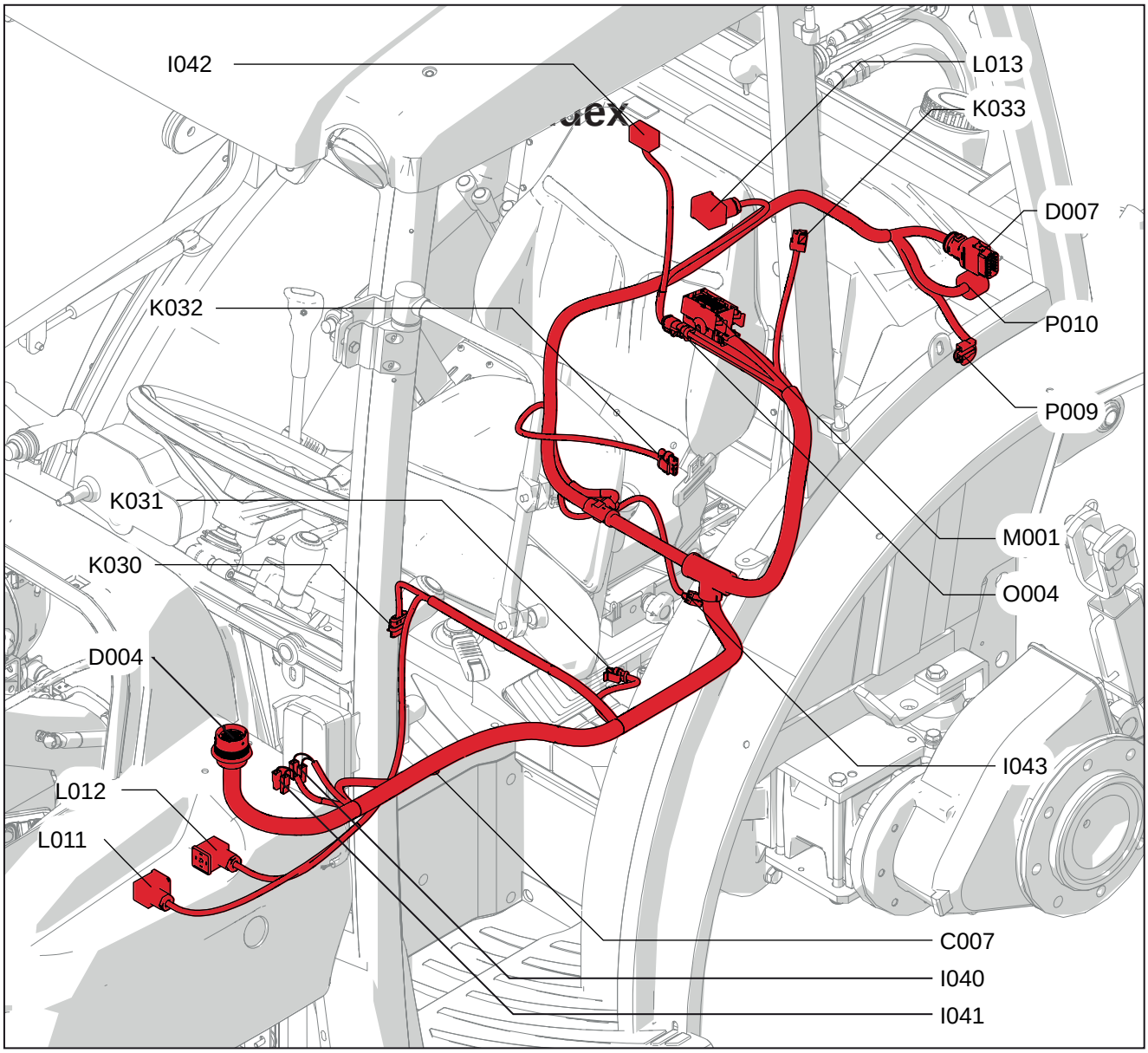

Fig. 17.44

17.3.13.4 Component identification codes

System code	Source code	Description
D004	P30B	Wiring connector for dashboard wiring loom
C007	P412	Main wiring loom ground
D007	P500A	Wiring connector for rear lights wiring loom
I040	P58,P59	H/L Forward lever button
I041	P56,P57	H/L Reverse lever button
I042	P61	"Diverter" button
I043	P49,P52	Rear PTO speed mode selector
K030	P138	Park brake start enable signal
K031	P44	PTO mode sensor
K032	P107	Seat start enable signal
K033	P40	Fuel level sensor
L011	P187	Differential lock "ON/OFF" solenoid valve
L012	P186	4WD "ON/OFF" solenoid valve
L013	P188	"Diverter" solenoid valve
M001	P80	Vehicle ECU
O004	P98	CAN line termination
P009	P50,P51	1-pole socket
P010	P226	Rear 7 pole socket

17.3.14 46335436 - Prewired engine wiring loom

17.3.14.1 Installation of prewired engine wiring loom

Table 1

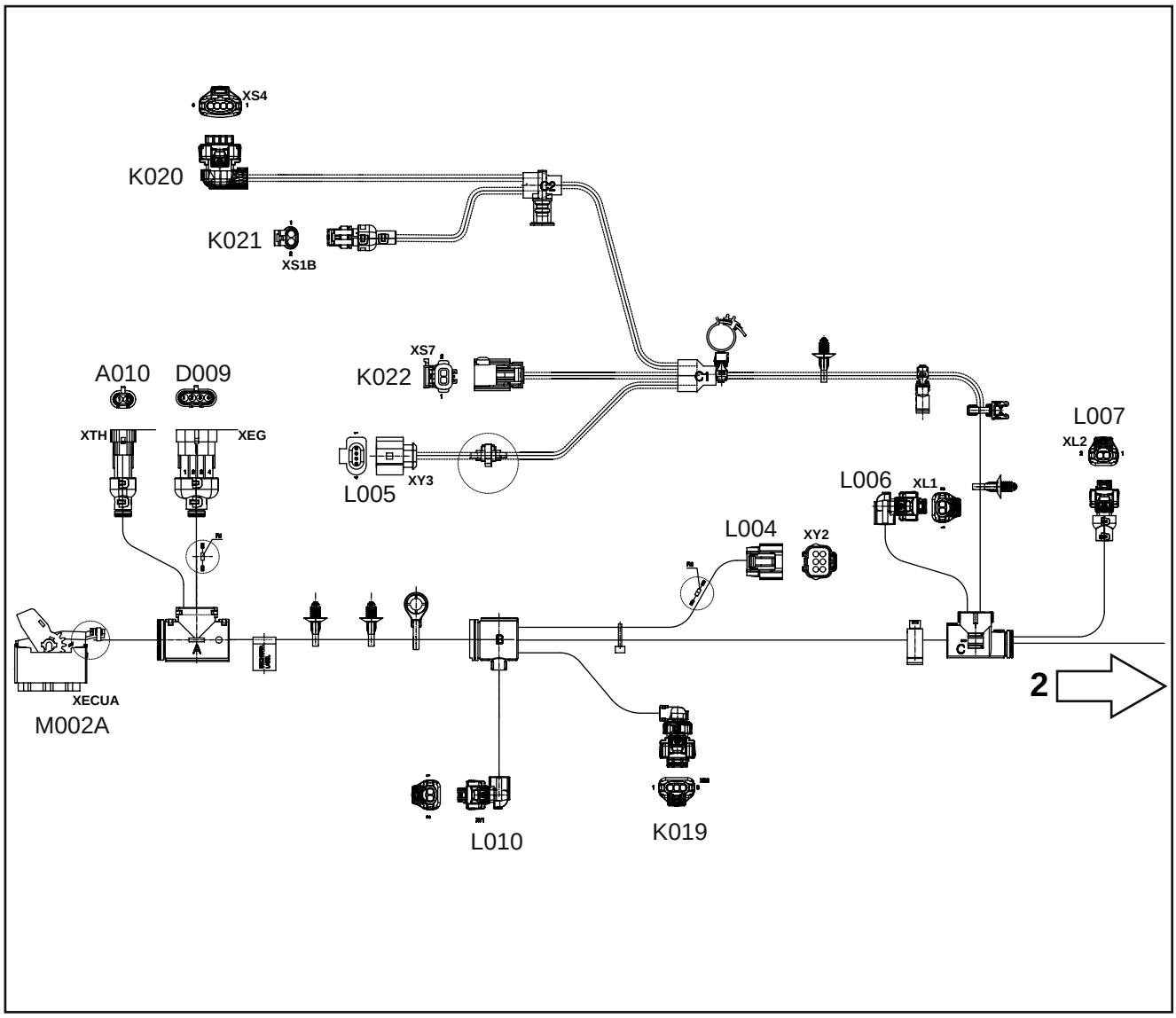

Fig. 17.45

Table 2

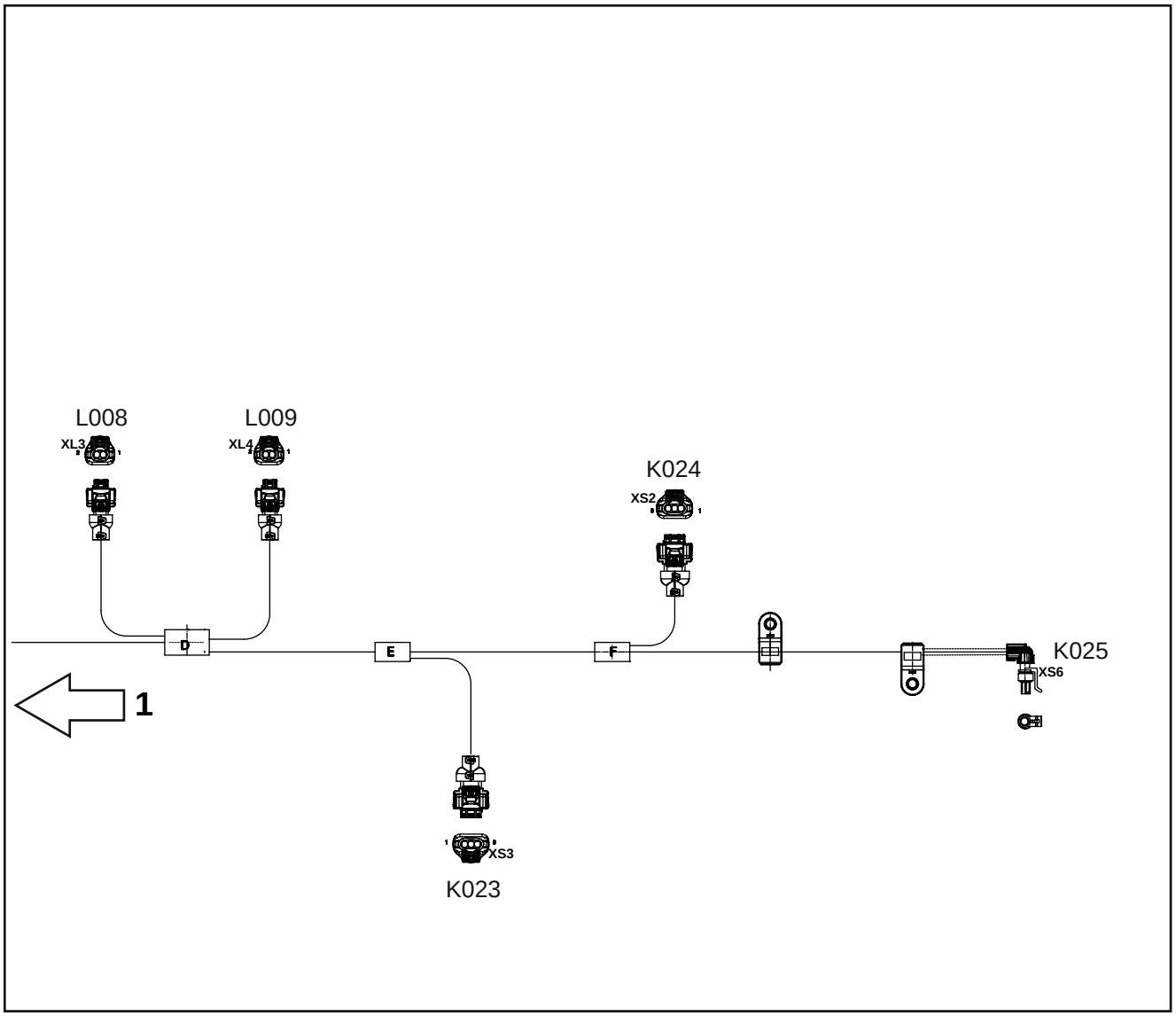

Fig. 17.46

17.3.14.2 Prewired engine wiring loom wiring diagram

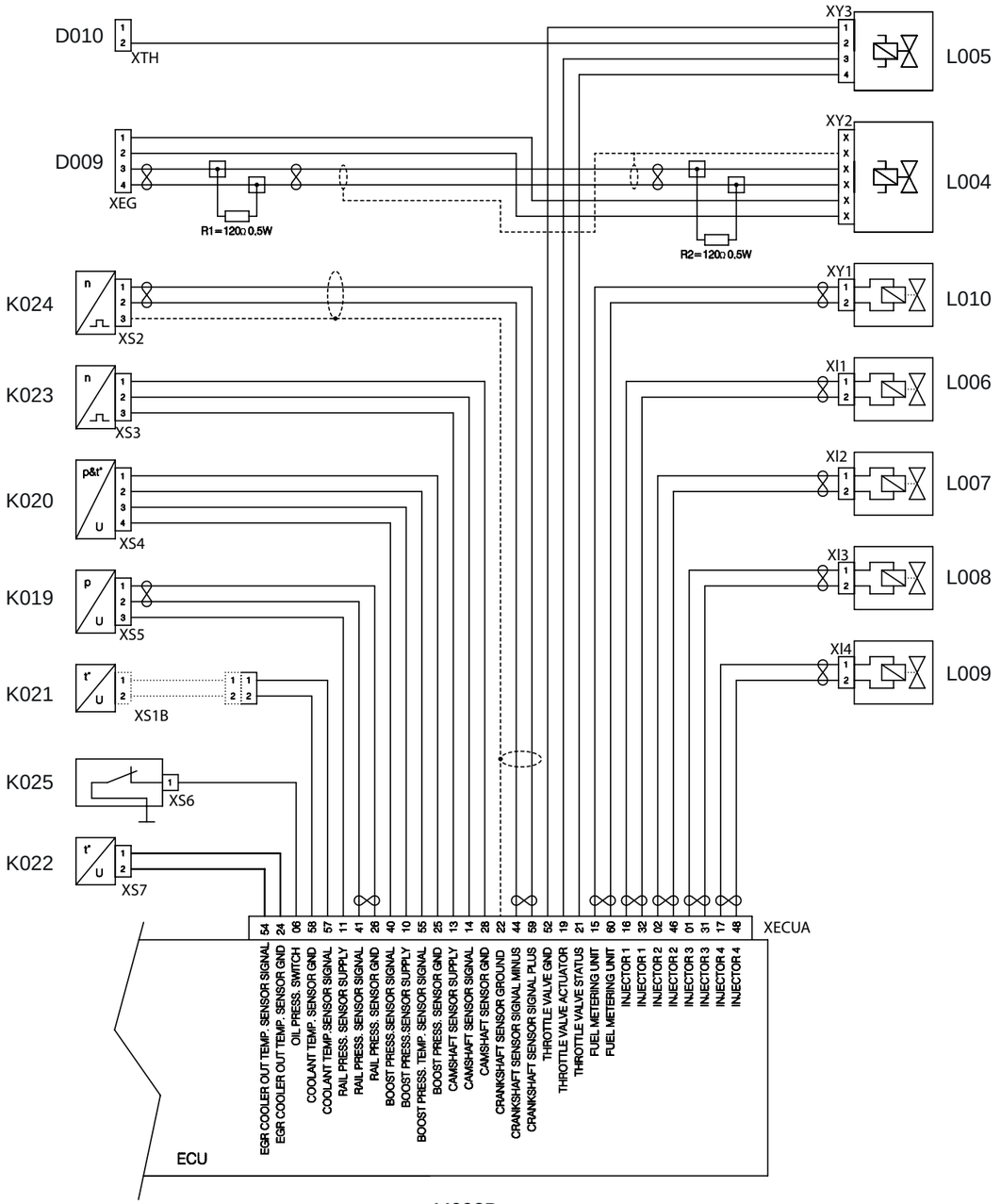

Fig. 17.47

17.3.14.3 Location of prewired engine wiring loom

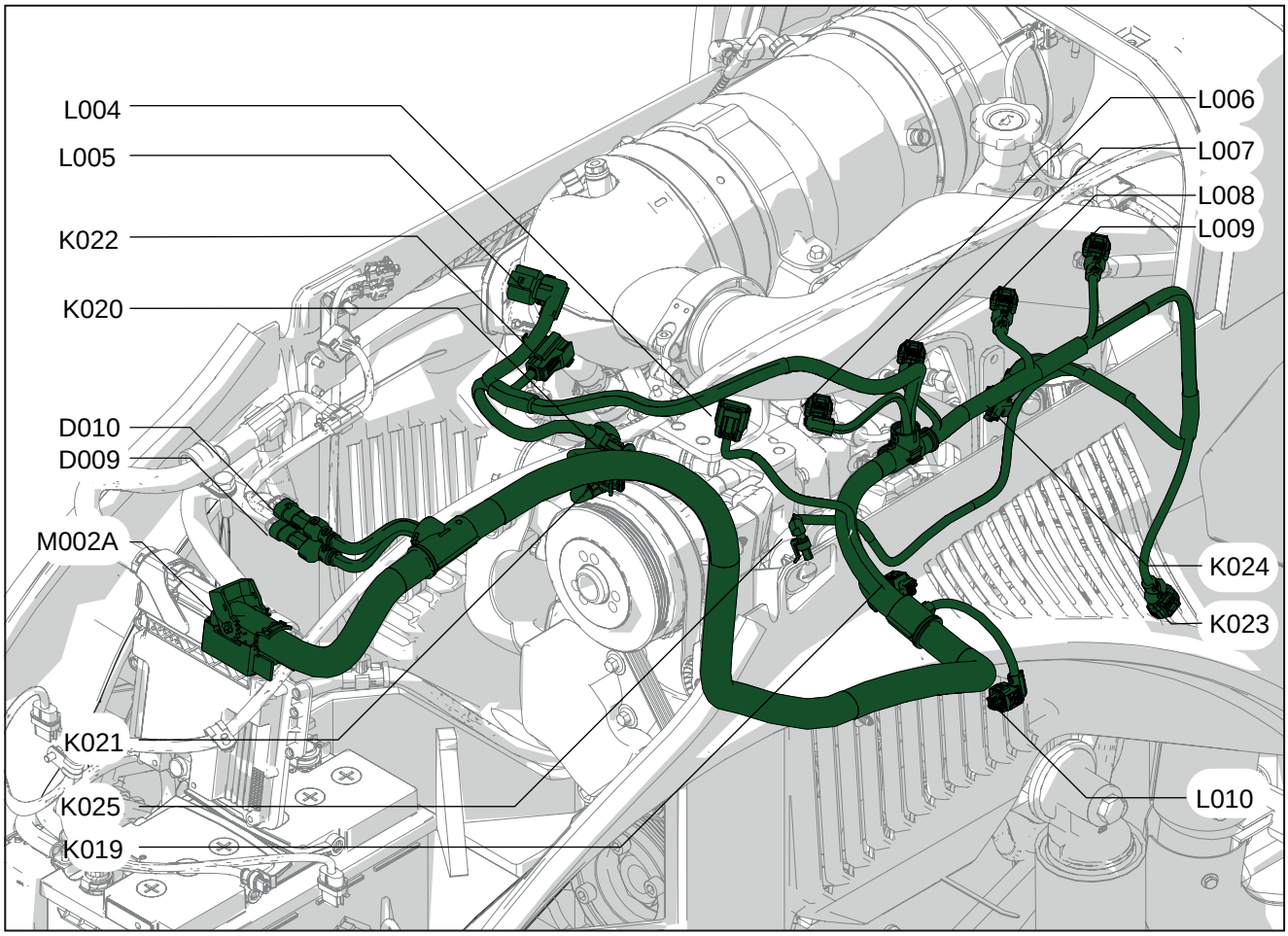

Fig. 17.48

17.3.14.4 Component identification codes

System code	Source code	Description
D009	XEG	Exhaust gas recirculation solenoid valve power feed
D010	XTH	Throttle valve power feed
K019	XS5	Common Rail fuel pressure sensor
K020	XS4	Temperature and pressure sensor (BOOST)
K021	XS1B	Coolant temperature sensor
K022	XS7	EGR temperature sensor
K023	XS3	Camshaft timing sensor
K024	XS2	Crankshaft speed sensor
K025	XS6	Oil pressure switch
L004	XY2	Exhaust gas recirculation solenoid valve (EGR)
L005	XY3	Throttle valve
L006	XI1	Fuel electro-injector 1
L007	XI2	Fuel electro-injector 2
L008	XI3	Fuel electro-injector 3
L009	XI4	Fuel electro-injector 4
L010	XY1	High pressure pump
M002A	XECUA	Engine control unit

17.4 Systems

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17.4.1 S001 - Power feed and starting

Electrical wiring diagram: Power feed and starting

Table 1

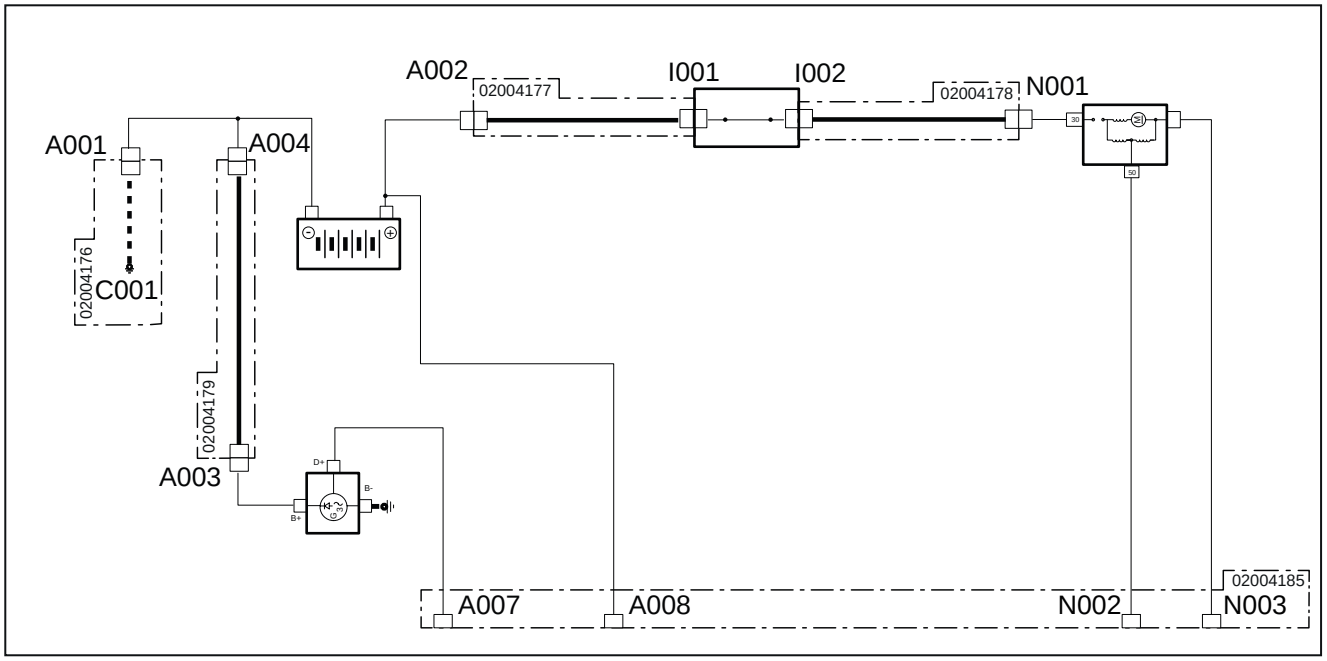

Fig. 17.49

Table 2

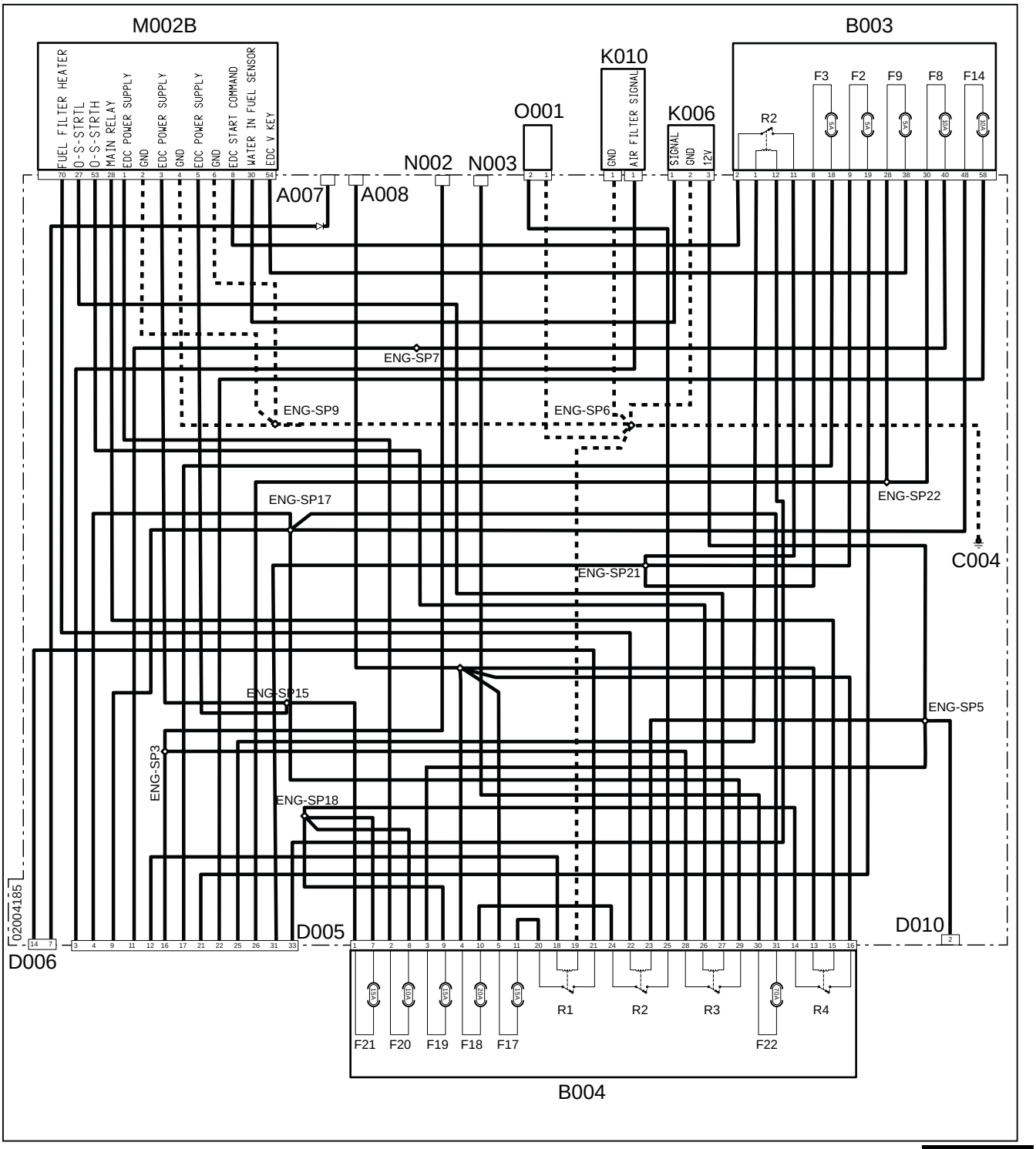

Fig. 17.50

Table 3

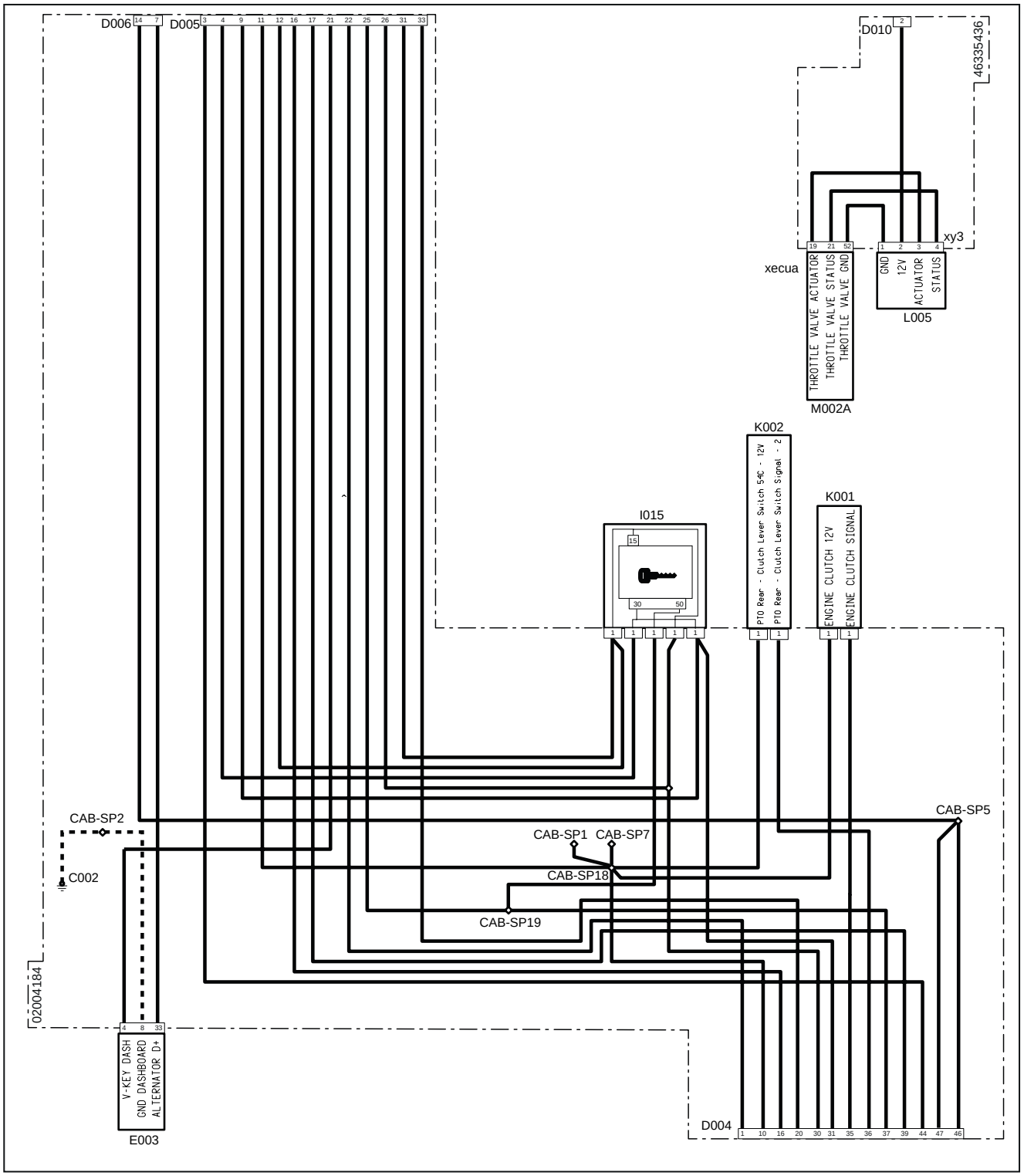

Fig. 17.51

Table 4

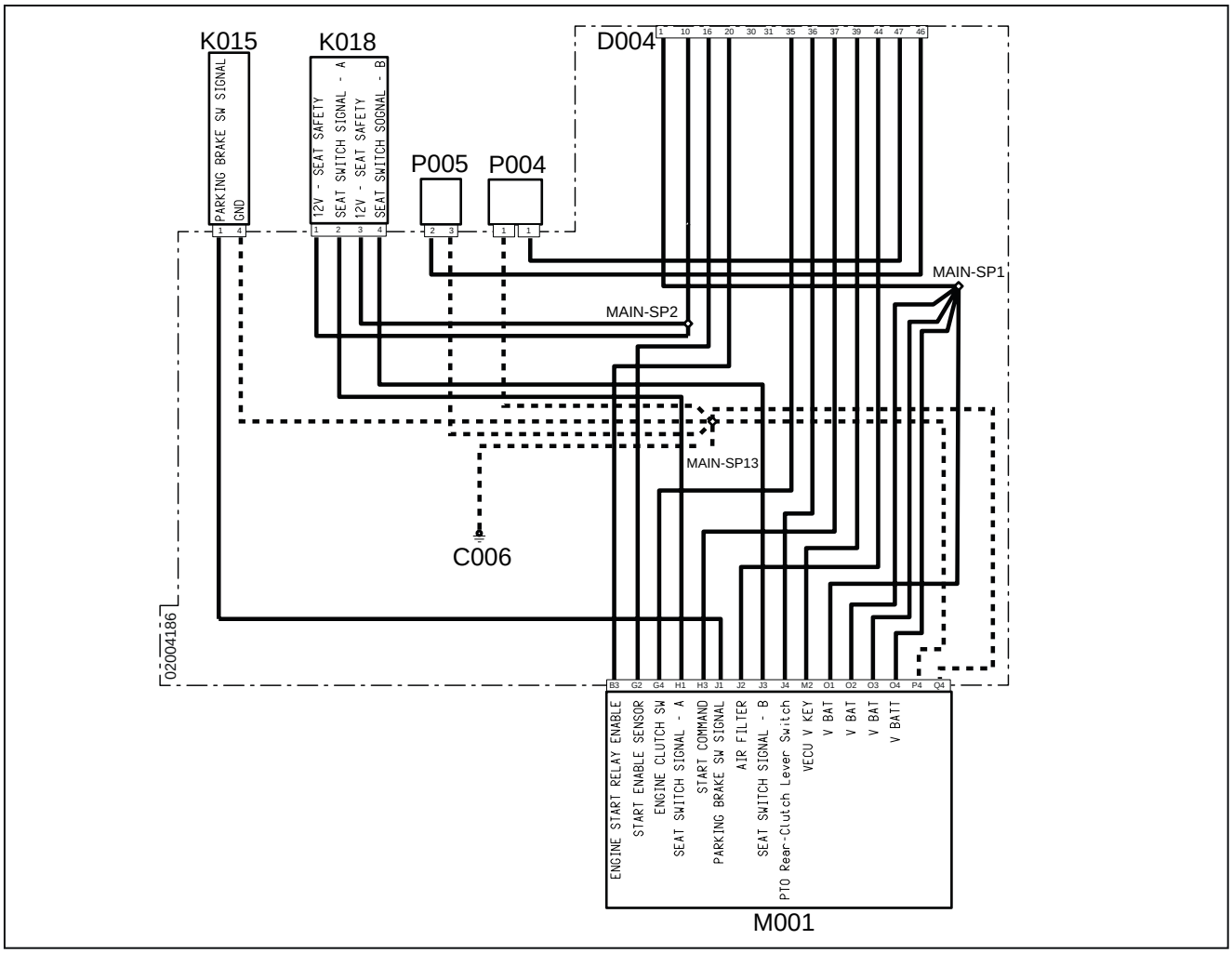

Fig. 17.52

A001 - Negative battery terminal
A002 - Positive battery terminal
A003 - Alternator "B+"
A004 - Negative battery terminal
A007 - Alternator
A008 - Positive battery terminal
B003 - Fuse box "2"
B003(R2) - Start enable relay
B003(F3) - Key-on power feed for VCU (5A)
B003(F2) - Key-on power feed for dashboard (5A)
B003(F9) - Key-on power feed for ECU (5A)
B003(F8) - Turn indicators (10A)
B003(F14) - 12V VCU power feed (10A)
B004 - Fuse box "1"
B004(F21) - 12V ECU power feed (15A)
B004(F20) - 12V ECU power feed (10A)
B004(F19) - Accessories (15A)
B004(F18) - Fuel pre-heat (20A)
B004(F17) - Trailer socket (15A)
B004(R1) - Trailer socket relay (30A)
B004(R2) - Fuel pre-heat relay (20A)
B004(R3) - Start relay (20A)
B004(F22) - Main maxi fuse (70A)
B004(R4) - Main relay (30A)
C001 - Battery ground
C002 - Cab ground
C004 - Engine ground point
C006 - Main wiring loom ground
D004 - Wiring connector
D005 - Wiring connector
D006 - Wiring connector
D010 - Wiring connector
E003 - Dashboard
I001 - Battery master relay switch (input terminal)
I002 - Battery master relay switch (output terminal)
I015 - Ignition switch
K001 - Clutch engine start enable sensor
K002 - PTO start enable signal / dashboard indicator signal
K006 - Water in fuel sensor
K010 - Air filter sensor
K015 - Park brake start enable signal
K018 - Seat start enable signal
L005 - Throttle valve
M001 - Vehicle ECU
M002A - Engine control unit
M002B - Engine control unit
N001 - Starter motor "30"
N002 - Starter motor 50
N003 - Starter motor
O001 - Fuel filter heater
P004 - 1-pole socket
P005 - Rear 7 pole socket

Location in vehicle: Power feed and starting

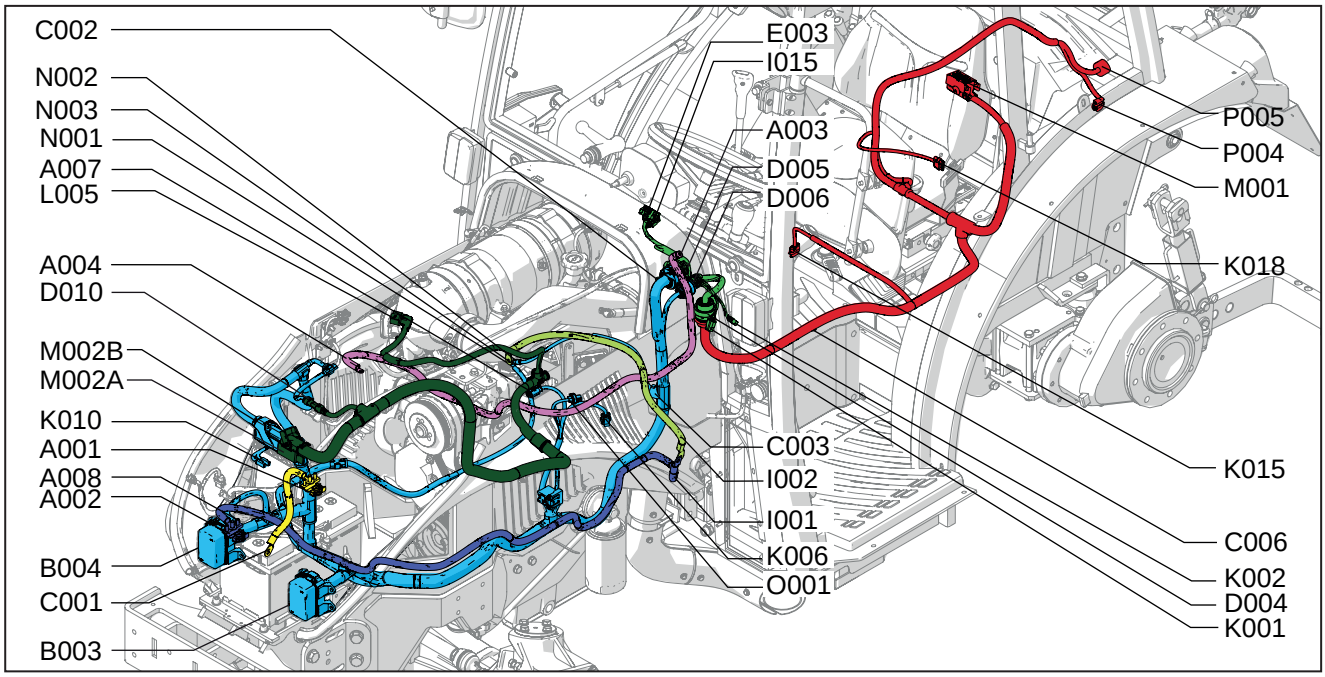

Fig. 17.53

A001 - Negative battery terminal
A002 - Positive battery terminal
A003 - Alternator "B+"
A004 - Negative battery terminal
A007 - Alternator
A008 - Positive battery terminal
B003 - Fuse box "2"
B004 - Fuse box "1"
C001 - Battery ground
C002 - Cab ground
C004 - Engine ground point
C006 - Main wiring loom ground
D004 - Wiring connector
D005 - Wiring connector
D006 - Wiring connector
D010 - Wiring connector
E003 - Dashboard
I001 - Battery master relay switch (input terminal)
I002 - Battery master relay switch (output terminal)
I015 - Ignition switch
K001 - Clutch engine start enable sensor
K002 - PTO start enable signal / dashboard indicator signal
K006 - Water in fuel sensor
K010 - Air filter sensor
K015 - Park brake start enable signal
K018 - Seat start enable signal
L005 - Throttle valve
M001 - Vehicle ECU
M002A - Engine control unit
M002B - Engine control unit
N001 - Starter motor "30"
N002 - Starter motor 50
N003 - Starter motor
O001 - Fuel filter heater
P004 - 1-pole socket
P005 - Rear 7 pole socket

17.4.2 S002 - DPF

Electrical wiring diagram: DPF

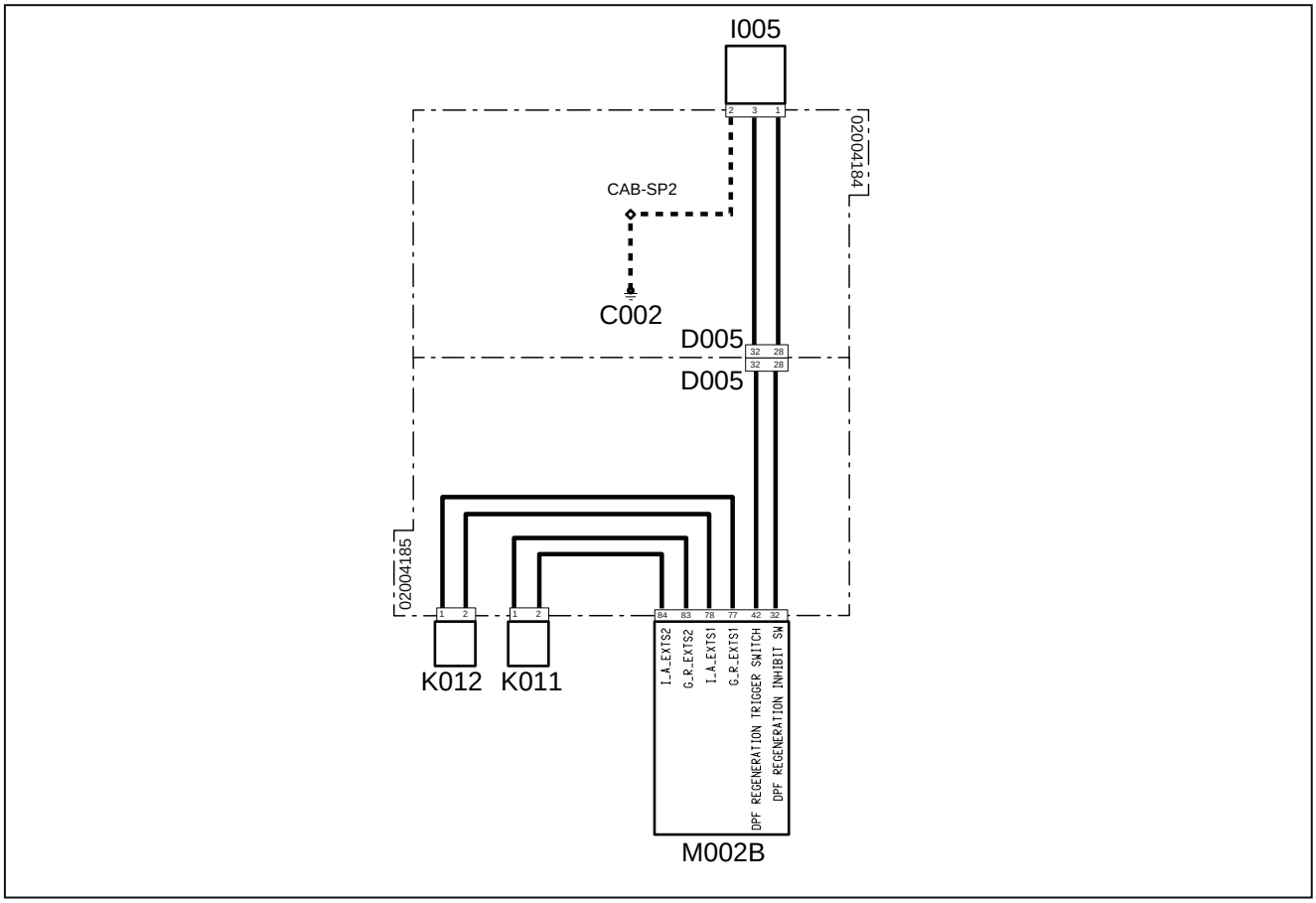

Fig. 17.54

C002 - Cab ground
D005 - Wiring connector
I005 - Regeneration cycle disable switch
K011 - DPF temperature sensor
K012 - DOC temperature sensor
M002B - Engine control unit

Location in vehicle: DPF

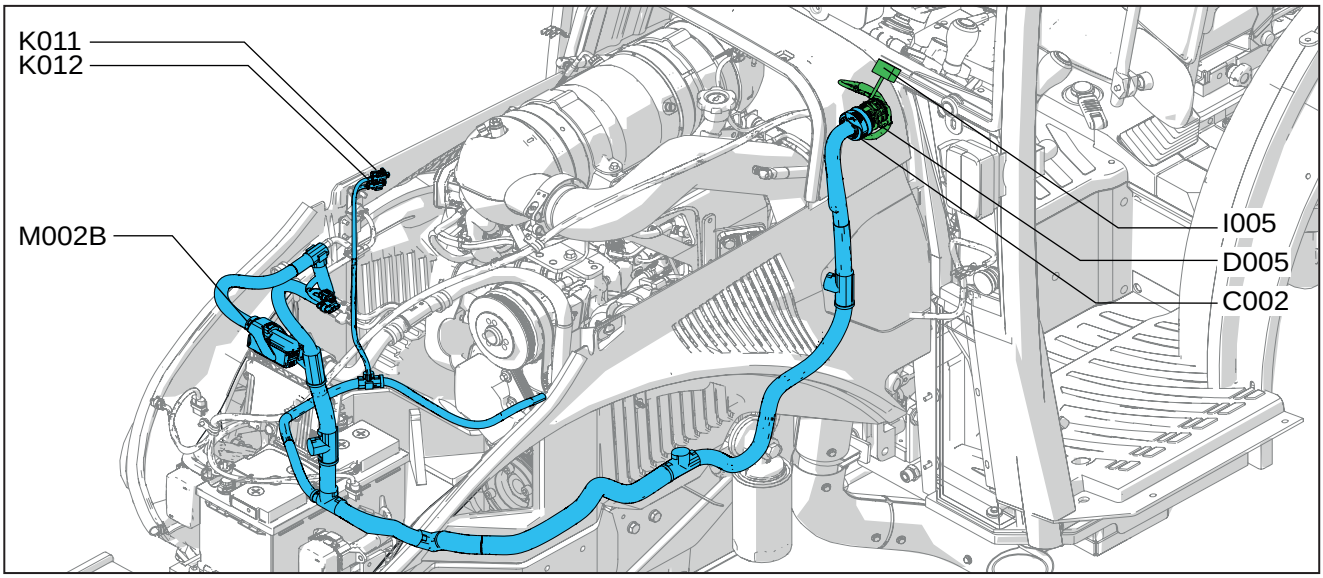

Fig. 17.55

C002 - Cab ground
D005 - Wiring connector
I005 - Regeneration cycle disable switch
K011 - DPF temperature sensor
K012 - DOC temperature sensor
M002B - Engine control unit

17.4.3 S003 - Electronic engine management

Electrical wiring diagram: Electronic engine management

Table 1

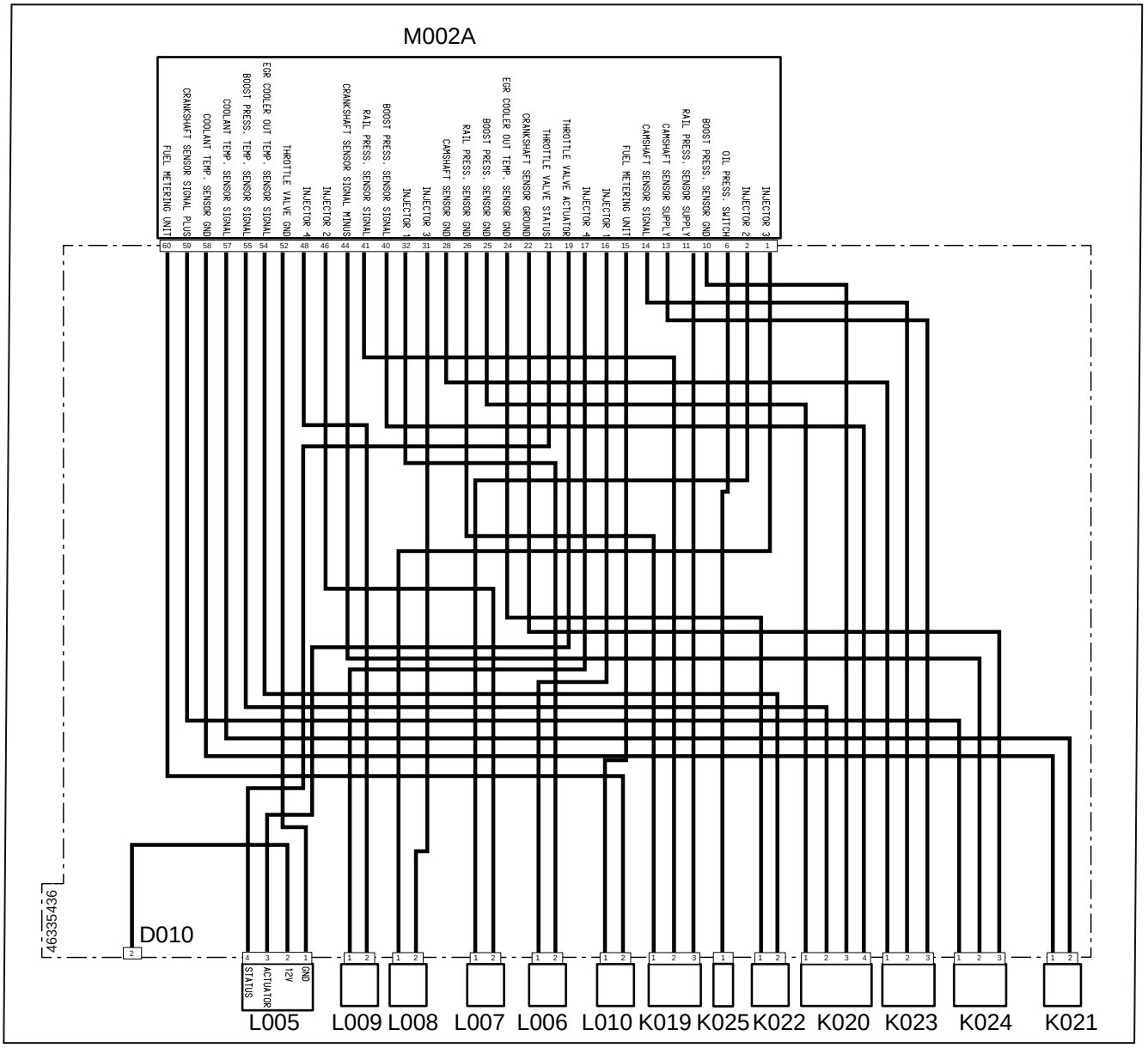

Fig. 17.56

Table 2

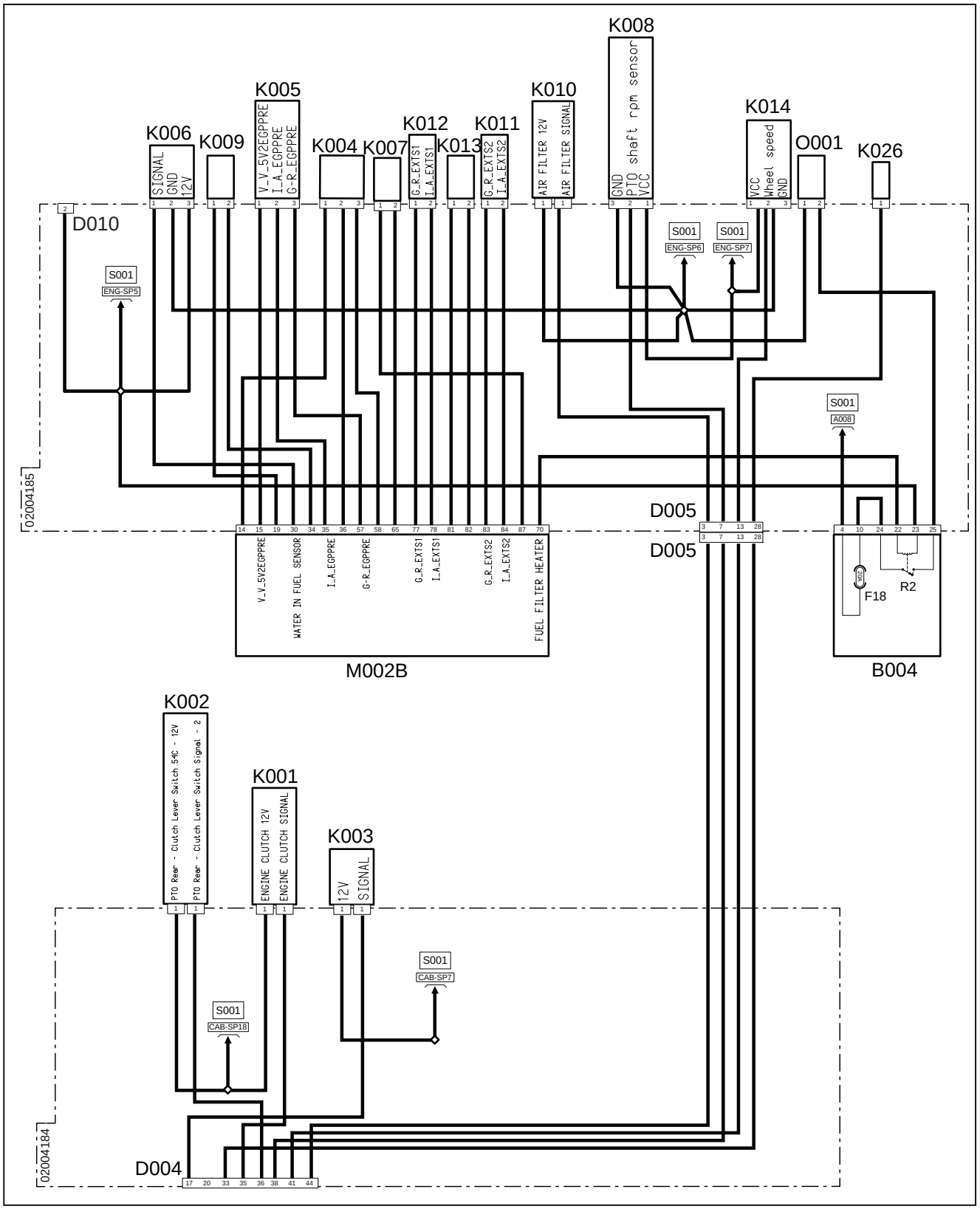

Fig. 17.57

Table 3

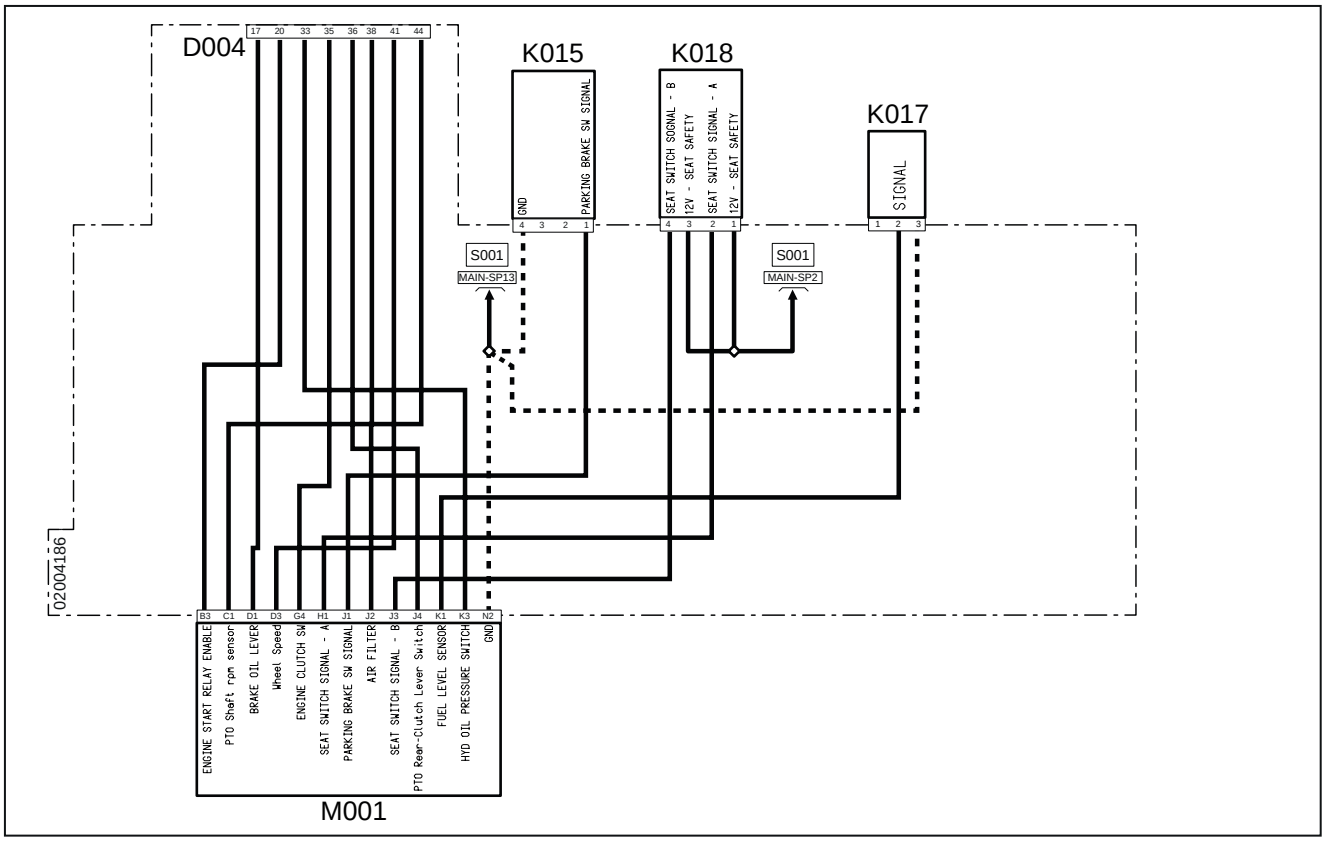

Fig. 17.58

B004 - Fuse box "1"
B004(F18) - Fuel pre-heat (20A)
B004(R2) - Fuel pre-heat relay (20A)
D004 - Wiring connector
D005 - Wiring connector
D010 - Wiring connector
K001 - Clutch engine start enable sensor
K002 - PTO start enable signal / dashboard indicator signal
K003 - Brake oil level sensor
K004 - Differential pressure sensor
K005 - P3 sensor (exhaust pressure)
K006 - Water in fuel sensor
K007 - Fuel temperature sensor
K008 - PTO shaft speed sensor
K009 - Ambient air temperature sensor
K010 - Air filter sensor
K011 - DPF temperature sensor
K012 - DOC temperature sensor
K013 - Exhaust gas temperature sensor
K014 - Wheel speed sensor
K015 - Park brake start enable signal
K017 - Fuel level sensor
K018 - Seat start enable signal
K019 - Common Rail fuel pressure sensor
K020 - Temperature and pressure sensor (BOOST)
K021 - Coolant temperature sensor
K022 - EGR temperature sensor
K023 - Camshaft timing sensor
K025 - Oil pressure switch
K026 - Suction line hydraulic oil pressure sensor
L005 - Throttle valve
L006 - Fuel electro-injector 1
L007 - Fuel electro-injector 2
L008 - Fuel electro-injector 3
L009 - Fuel electro-injector 4
L010 - High pressure pump
M001 - Vehicle ECU
M002A - Engine control unit
M002B - Engine control unit
O001 - Fuel filter heater

Location in vehicle: Electronic engine management

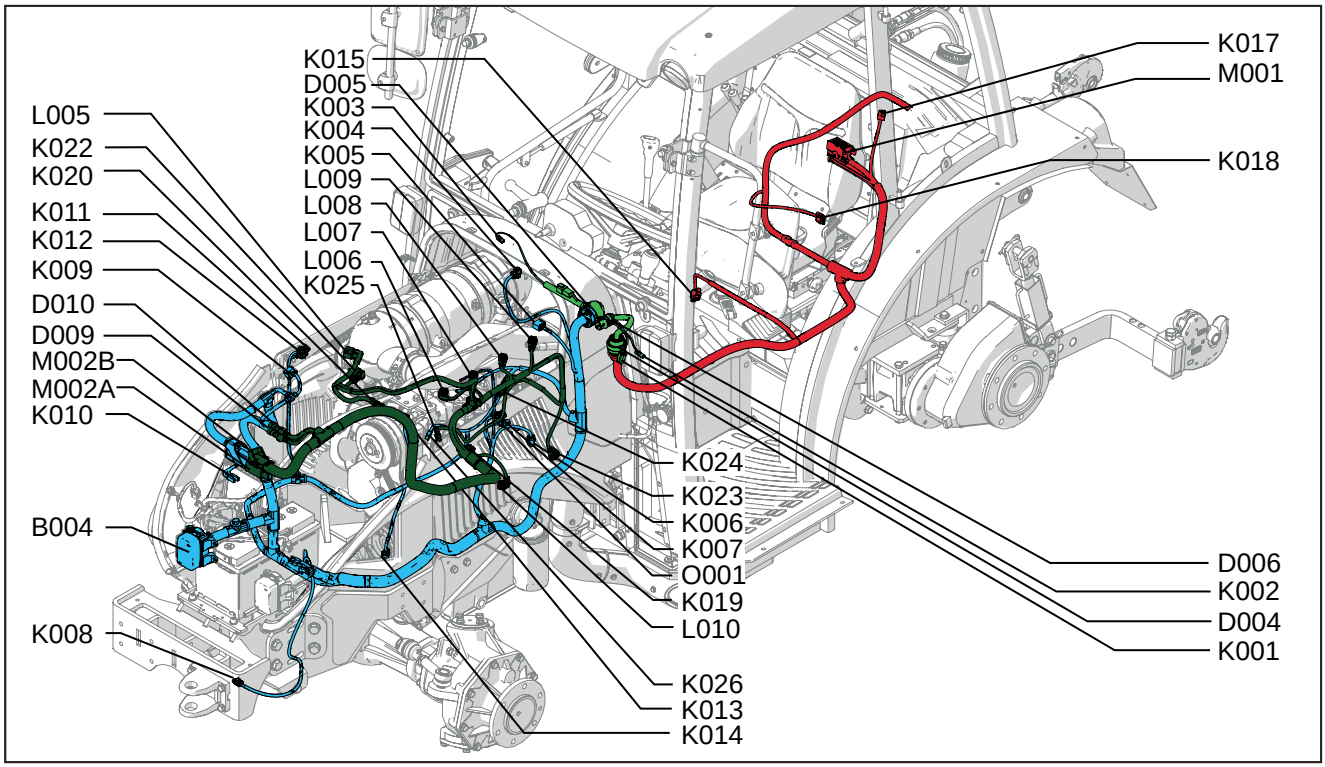

Fig. 17.59

B004 - Fuse box "1"
D004 - Wiring connector
D005 - Wiring connector
D010 - Wiring connector
K001 - Clutch engine start enable sensor
K002 - PTO start enable signal / dashboard indicator signal
K003 - Brake oil level sensor
K004 - Differential pressure sensor
K005 - P3 sensor (exhaust pressure)
K006 - Water in fuel sensor
K007 - Fuel temperature sensor
K008 - PTO shaft speed sensor
K009 - Ambient air temperature sensor
K010 - Air filter sensor
K011 - DPF temperature sensor
K012 - DOC temperature sensor
K013 - Exhaust gas temperature sensor
K014 - Wheel speed sensor
K015 - Park brake start enable signal
K017 - Fuel level sensor
K018 - Seat start enable signal
K019 - Common Rail fuel pressure sensor
K020 - Temperature and pressure sensor (BOOST)
K021 - Coolant temperature sensor
K022 - EGR temperature sensor
K023 - Camshaft timing sensor
K025 - Oil pressure switch
K026 - Suction line hydraulic oil pressure sensor
L005 - Throttle valve
L006 - Fuel electro-injector 1
L007 - Fuel electro-injector 2
L008 - Fuel electro-injector 3
L009 - Fuel electro-injector 4
L010 - High pressure pump
M001 - Vehicle ECU
M002A - Engine control unit
M002B - Engine control unit
O001 - Fuel filter heater

17.4.4 S004 - Lights and horn

Electrical wiring diagram: Lights and horn

Table 1

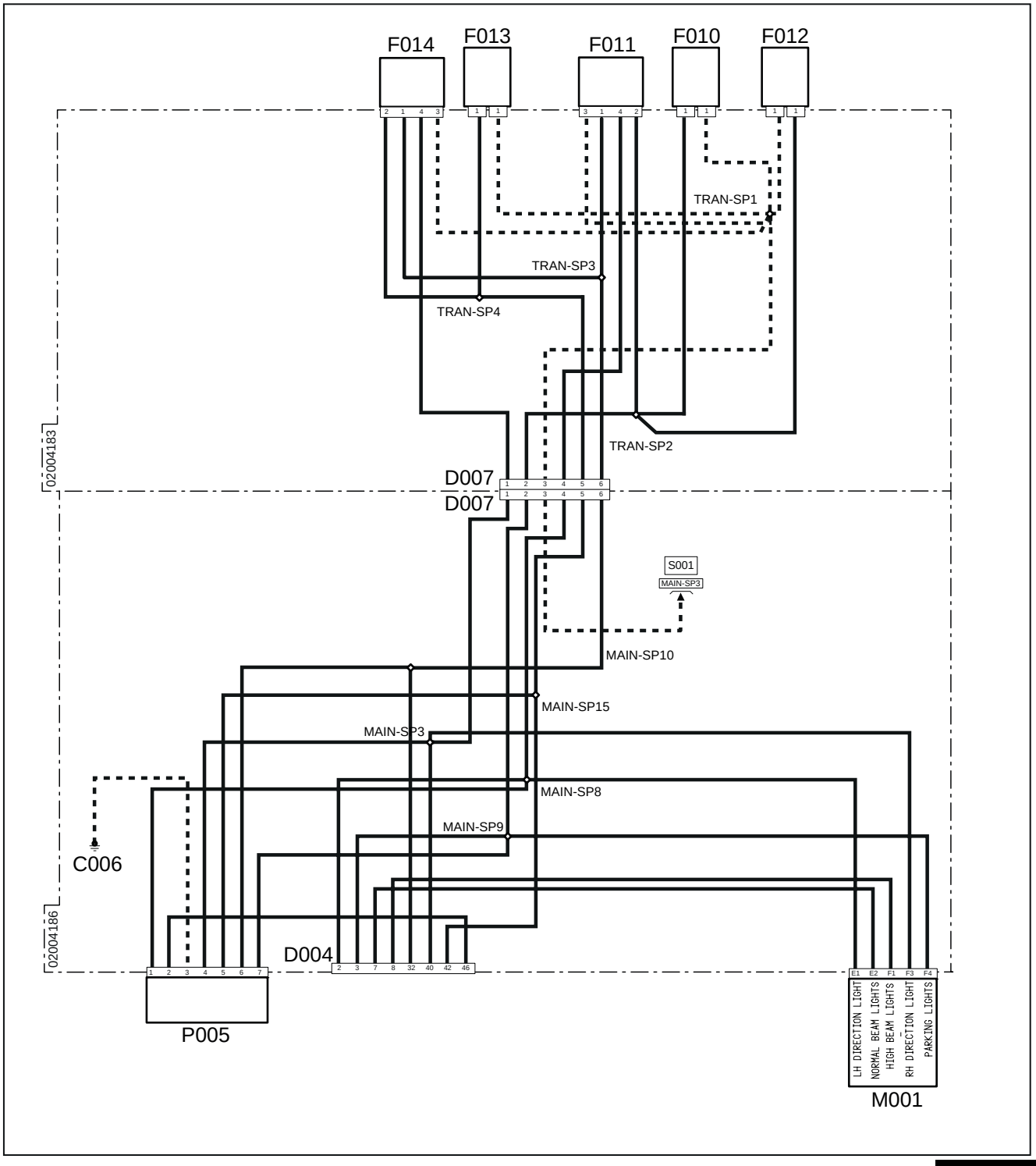

Fig. 17.60

Table 2

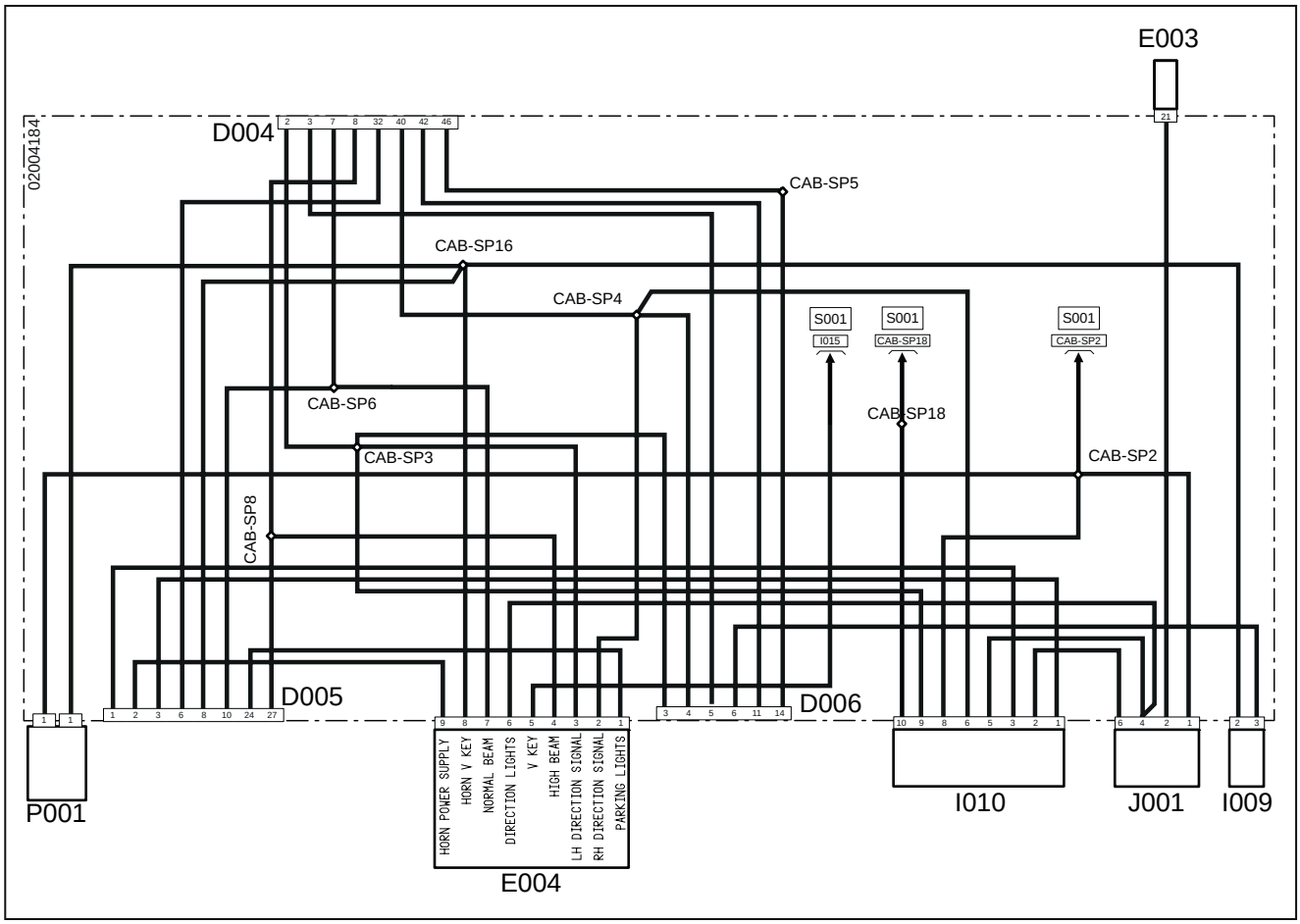

Fig. 17.61

Table 3

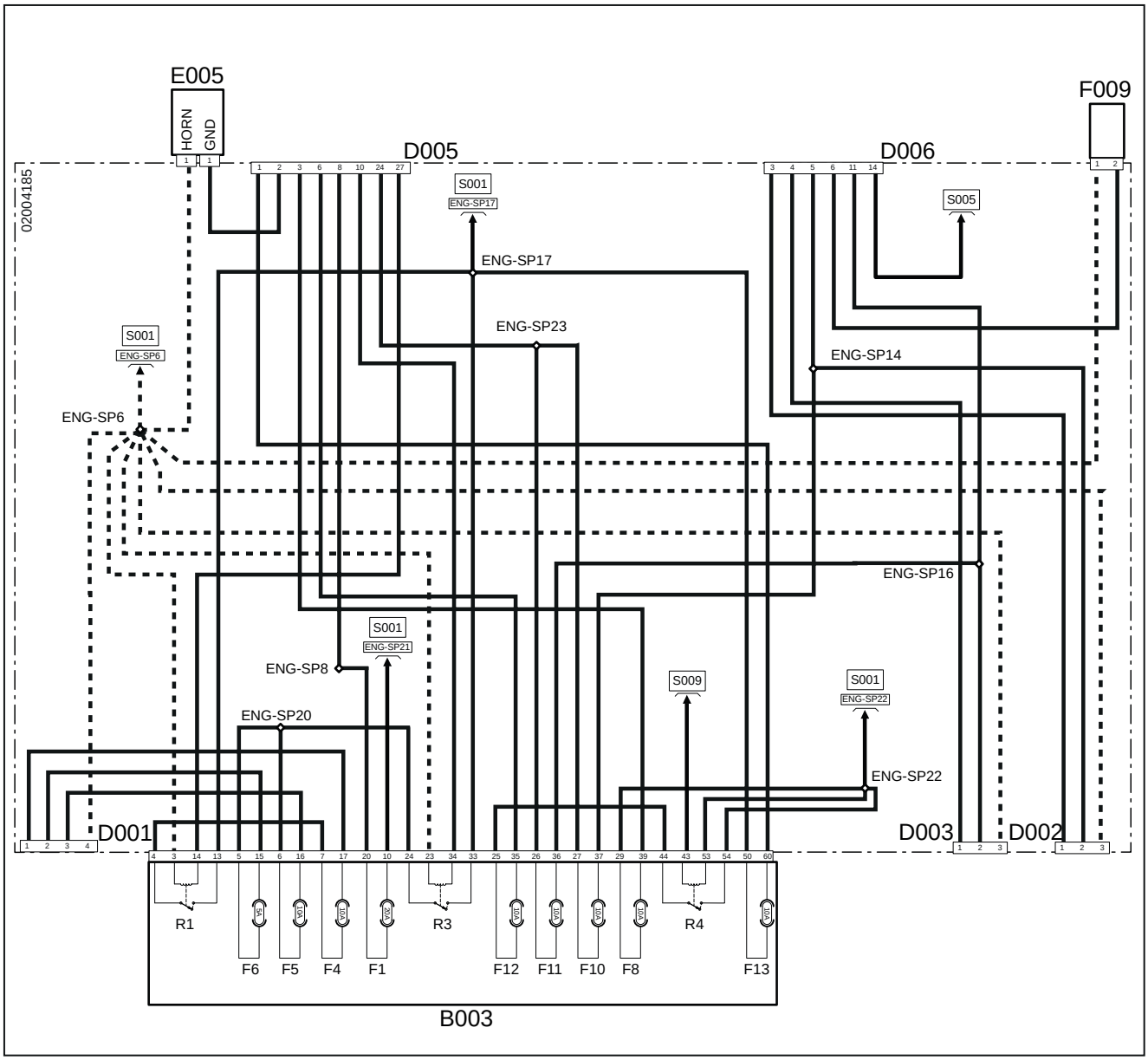

Fig. 17.62

Table 4

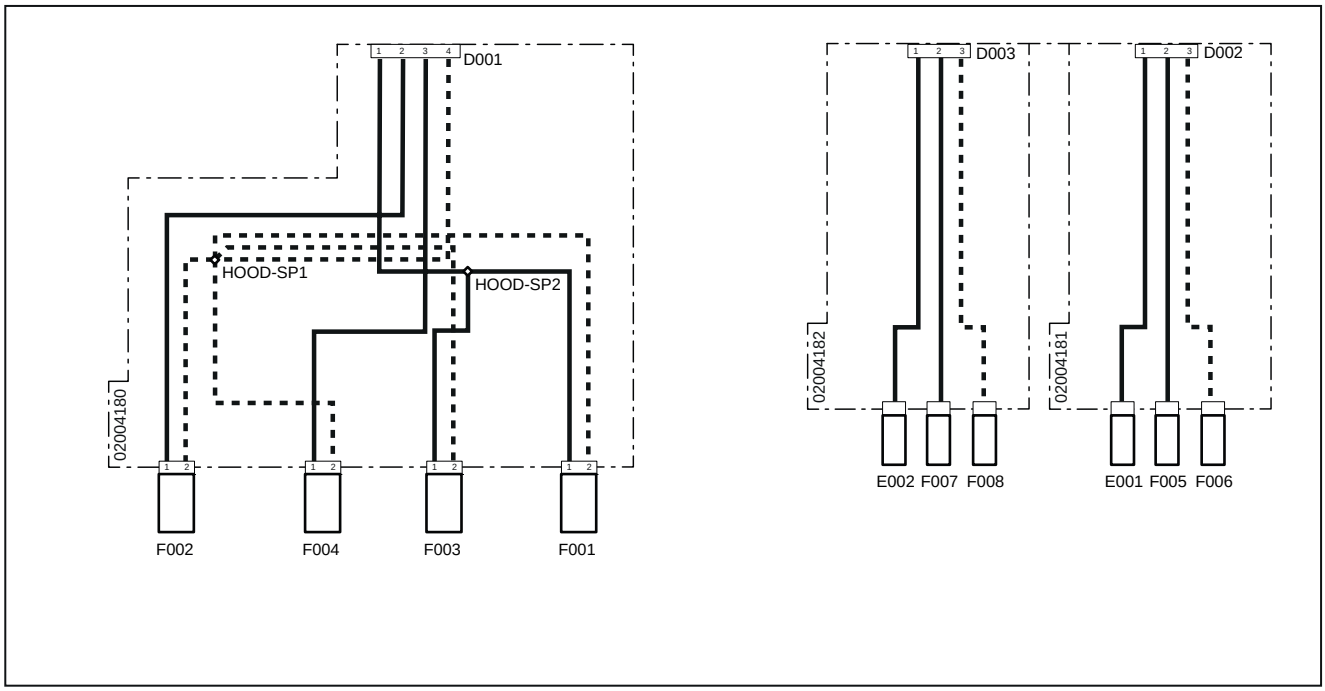

Fig. 17.63

B003 - Fuse box "2"
B003(R1) - High beam relay
B003(F6) - RH low beams (10A)
B003(F5) - LH low beams (10A)
B003(F4) - High beam (10A)
B003(F1) - Socket - Rotating beacon (20A)
B003(R3) - Low beam relay
B003(F12) - Brake lights (10A)
B003(F11) - RH sidelights (10A)
B003(F10) - LH sidelights (10A)
B003(F8) - Turn indicators (10A)
B003(R4) - Brake light relay
B003(F13) - Hazard warning lights (10A)
C006 - Main wiring loom ground
D001 - Wiring connector
D002 - Wiring connector
D003 - Wiring connector
D004 - Wiring connector
D005 - Wiring connector
D006 - Wiring connector
D007 - Wiring connector
E001 - LH turn indicator
E002 - RH turn indicator
E003 - Dashboard
E004 - RH turn signal indicator
E005 - Horn
F005 - Parking light
F006 - Mudguard light
F007 - Parking light
F008 - Mudguard light
F009 - Provision for rotating beacon, roll-bar version
F010 - LH work lights
F011 - LH rear mudguard lights
F012 - Number plate light
F013 - RH work lights
F001 - RH high beam headlight
F002 - RH low beam headlight
F003 - LH high beam headlight
F004 - LH low beam headlight
I009 - Rotating beacon button
I010 - Hazard warning lights button
I015 - Ignition switch
J001 - Hazard warning lights relay
M001 - Vehicle ECU
P001 - 1-pole socket
P005 - Rear 7 pole socket

Location in vehicle: Lights and horn

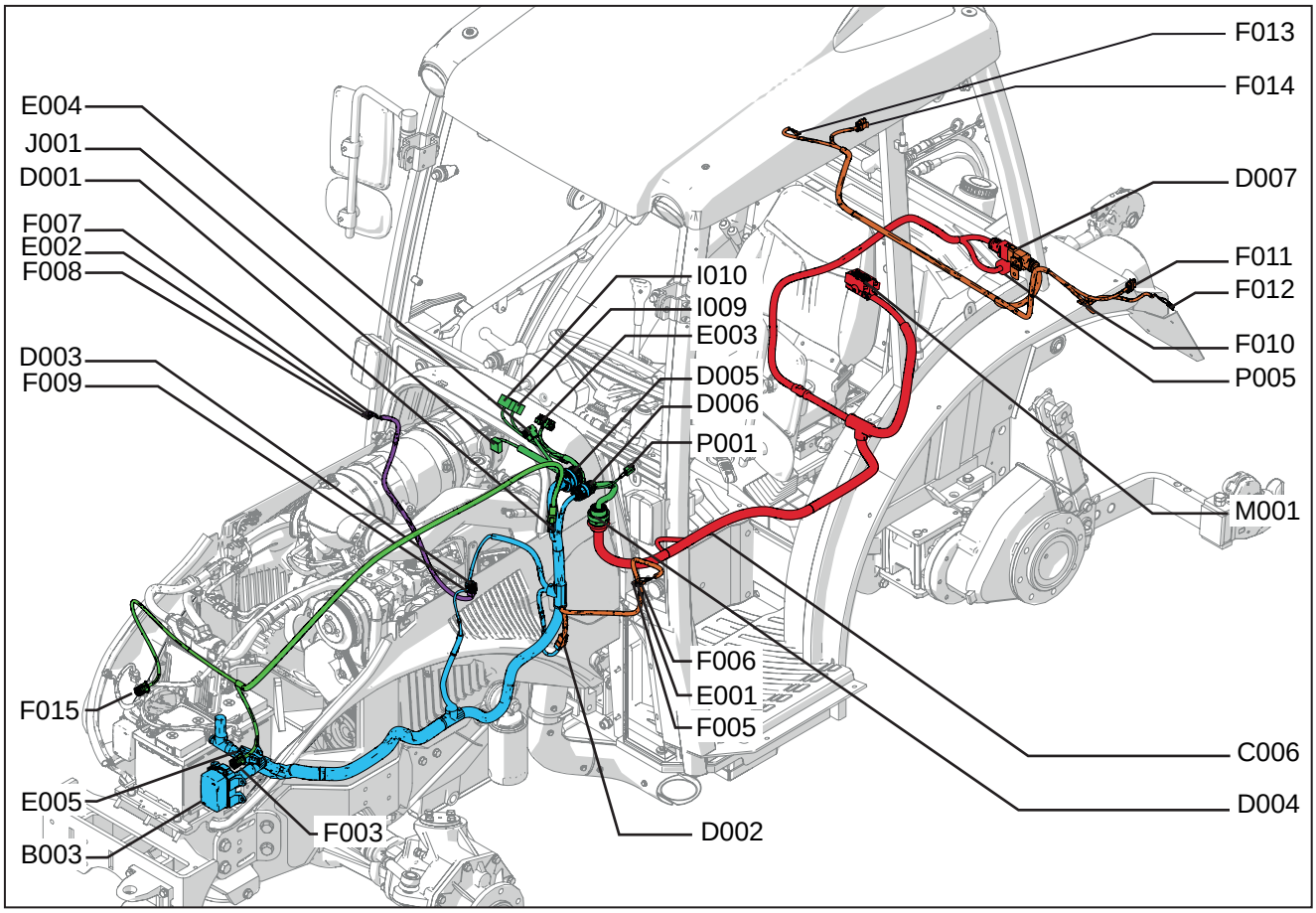

Fig. 17.64

B003 - Fuse box "2"
C006 - Main wiring loom ground
D001 - Wiring connector
D002 - Wiring connector
D003 - Wiring connector
D004 - Wiring connector
D005 - Wiring connector
D006 - Wiring connector
D007 - Wiring connector
E001 - LH turn indicator
E002 - RH turn indicator
E003 - Dashboard
E004 - RH turn signal indicator
E005 - Horn
F005 - Parking light
F006 - Mudguard light
F007 - Parking light
F008 - Mudguard light
F009 - Provision for rotating beacon, roll-bar version
F010 - LH work lights
F011 - LH rear mudguard lights
F012 - Number plate light
F013 - RH work lights
F001 - RH high beam headlight
F002 - RH low beam headlight
F003 - LH high beam headlight
F004 - LH low beam headlight
I009 - Rotating beacon button
I010 - Hazard warning lights button
I015 - Ignition switch
J001 - Hazard warning lights relay
M001 - Vehicle ECU
P001 - 1-pole socket
P005 - Rear 7 pole socket

17.4.5 S005 - Power sockets and accessories

Electrical wiring diagram: Power sockets and accessories

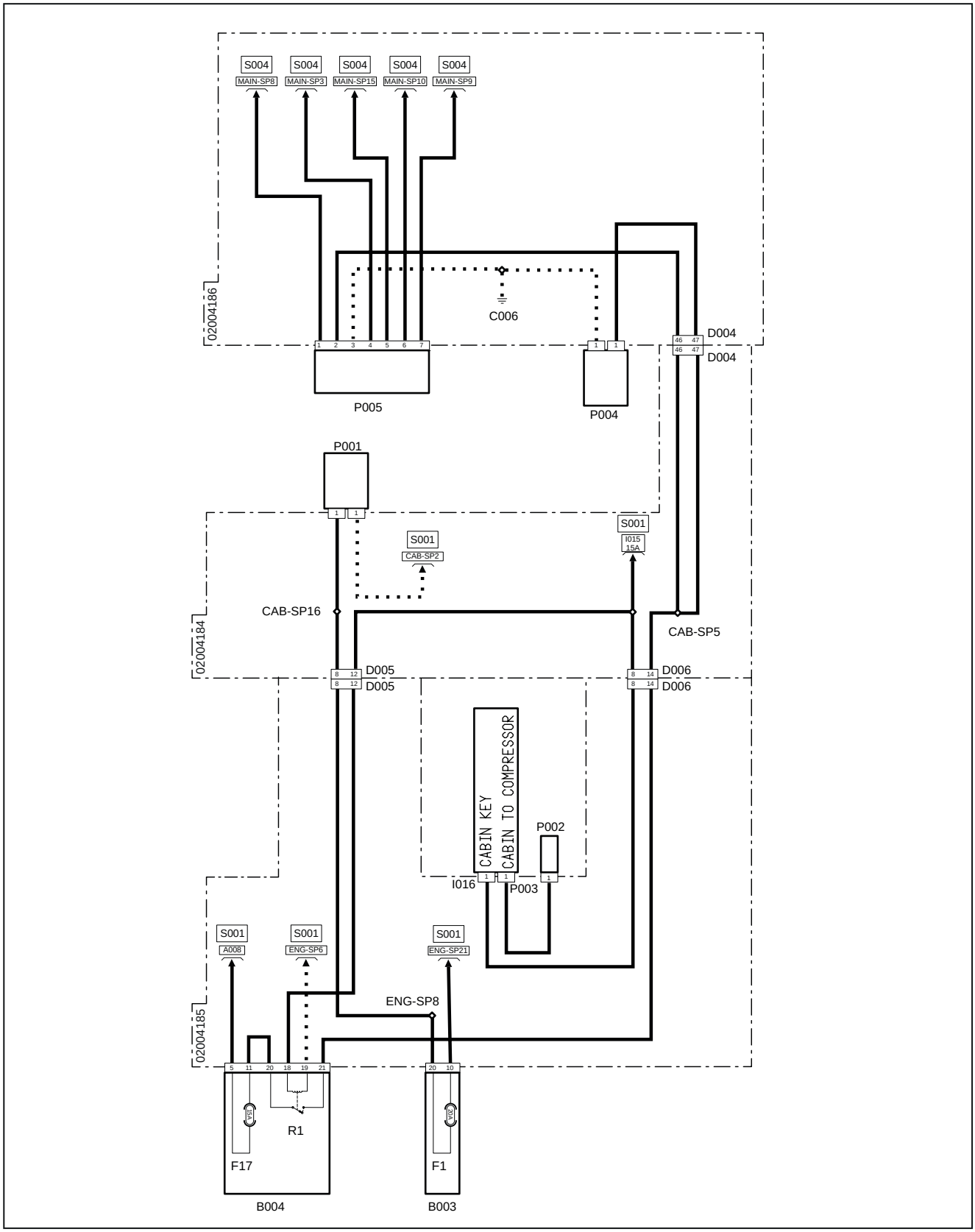

Fig. 17.65

A008 - Positive battery terminal
B003 - Fuse box "2"
B003(F1) - Socket - Rotating beacon (20A)
B004 - Fuse box "1"
B004(F17) - Trailer socket (15A)
B004(R1) - Trailer socket relay (30A)
C006 - Main wiring loom ground
D004 - Wiring connector
D005 - Wiring connector
D006 - Wiring connector
I016 - Cab key
P001 - 1-pole socket
P002 - Compressor
P003 - From cab to compressor
P004 - 1-pole socket
P005 - Rear 7 pole socket

Location in vehicle: Power sockets and accessories

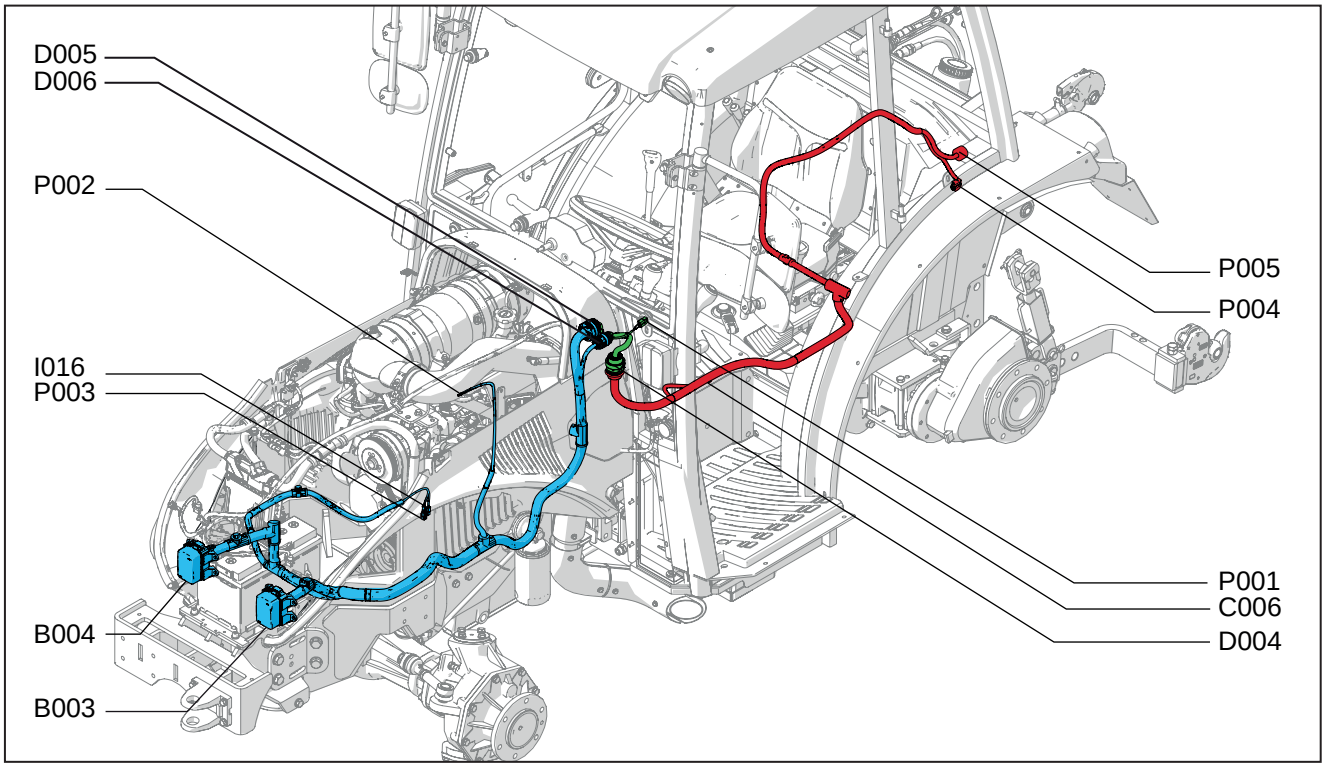

Fig. 17.66

A008 - Positive battery terminal
B003 - Fuse box "2"
B004 - Fuse box "1"
C006 - Main wiring loom ground
D004 - Wiring connector
D005 - Wiring connector
D006 - Wiring connector
I016 - Cab key
P001 - 1-pole socket
P002 - Compressor
P003 - From cab to compressor
P004 - 1-pole socket
P005 - Rear 7 pole socket

17.4.6 S006 - Diagnostics and CAN lines

Electrical wiring diagram: Diagnostics and CAN lines

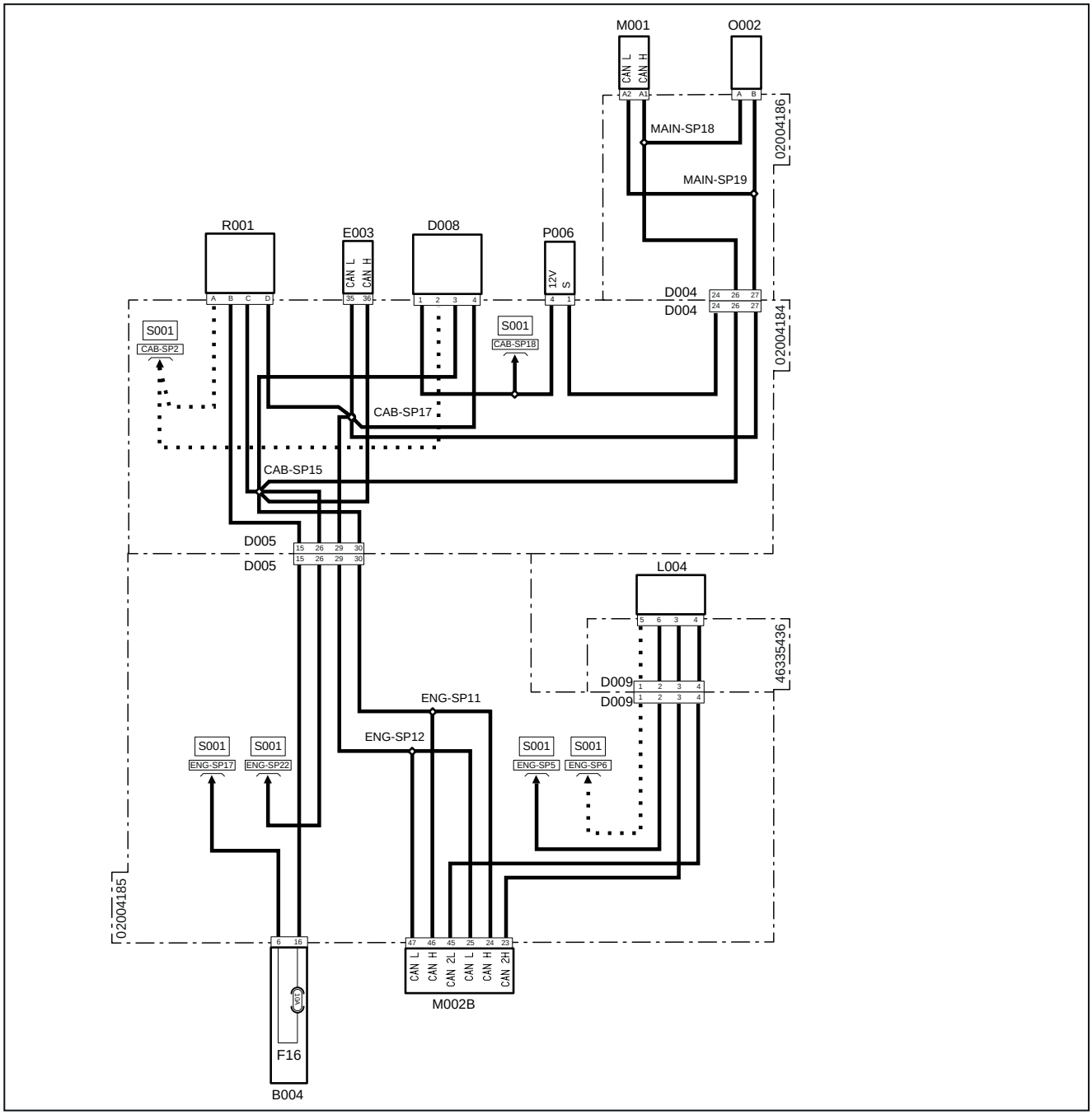

Fig. 17.67

B004 - Fuse box "1"
B004(F16) - Diagnostic socket (10A)
D004 - Wiring connector
D005 - Wiring connector
D008 - Wiring connector for joystick wiring loom
D009 - Exhaust gas recirculation solenoid valve power feed
E003 - Dashboard
L004 - Exhaust gas recirculation solenoid valve (EGR)
M001 - Vehicle ECU
M002B - Engine control unit
O002 - CAN line termination
P006 - Trailer test (not used)
R001 - Diagnostic port

Location in vehicle: Diagnostics and CAN lines

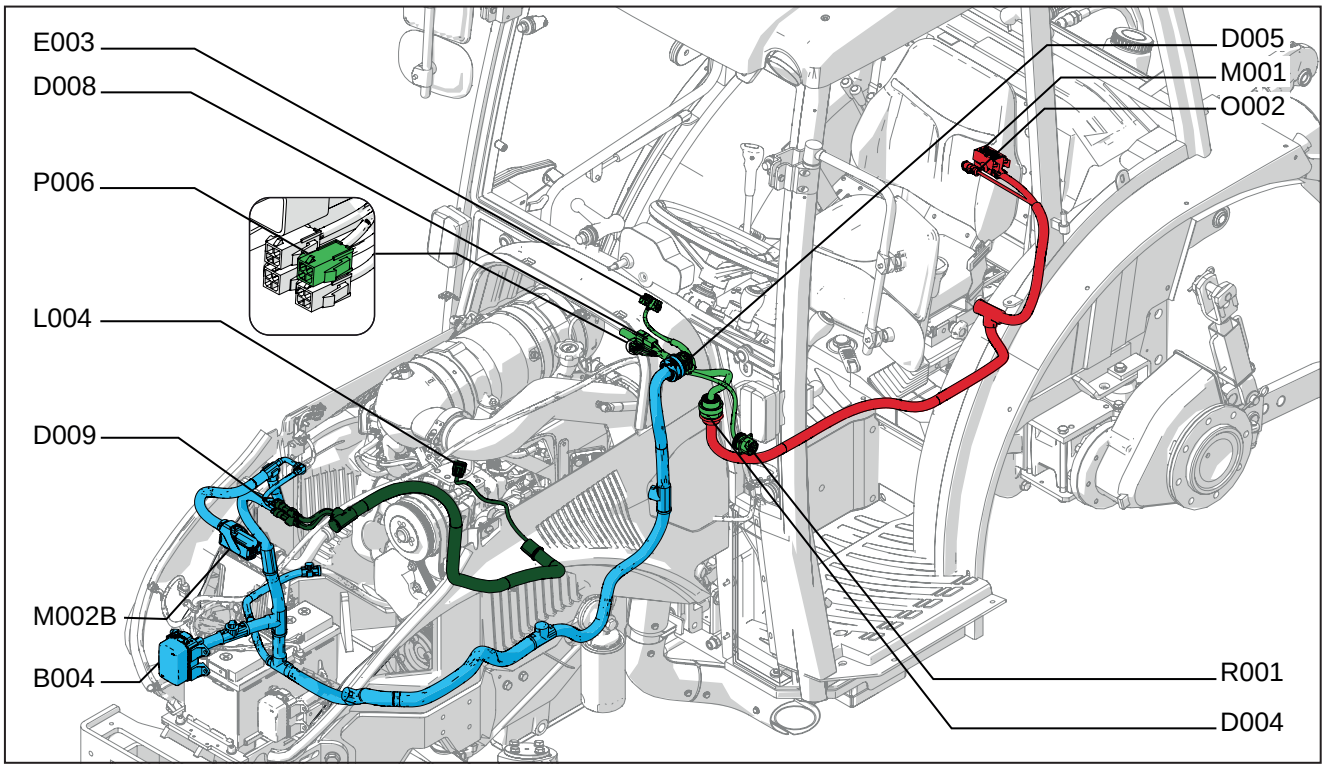

Fig. 17.68

B004 - Fuse box "1"
D004 - Wiring connector
D005 - Wiring connector
D008 - Wiring connector for joystick wiring loom
D009 - Exhaust gas recirculation solenoid valve power feed
E003 - Dashboard
L004 - Exhaust gas recirculation solenoid valve (EGR)
M001 - Vehicle ECU
M002B - Engine control unit
O002 - CAN line termination
P006 - Trailer test (not used)
R001 - Diagnostic port

17.4.7 S007 - Dashboard

Electrical wiring diagram: Dashboard

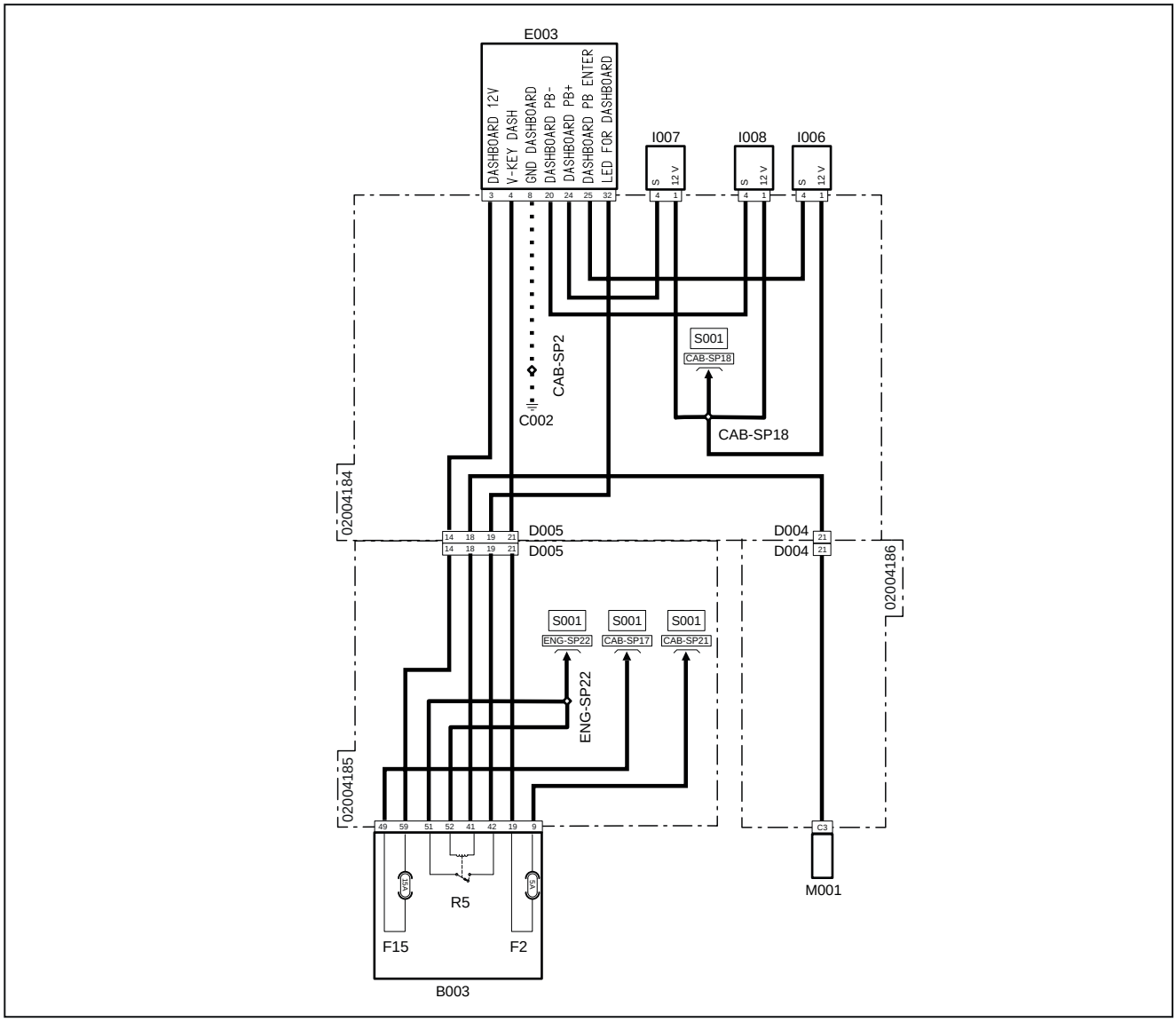

Fig. 17.69

B003 - Fuse box "2"
B003(R5) - Dashboard LED relay
B003(F15) - 12V dashboard power feed (10A)
B003(F2) - Key-on power feed for dashboard (5A)
C002 - Cab ground
D004 - Wiring connector
D005 - Wiring connector
E003 - Dashboard
I006 - ENTER dashboard button
I007 - + dashboard button
I008 - - dashboard button
M001 - Vehicle ECU

Location in vehicle: Dashboard

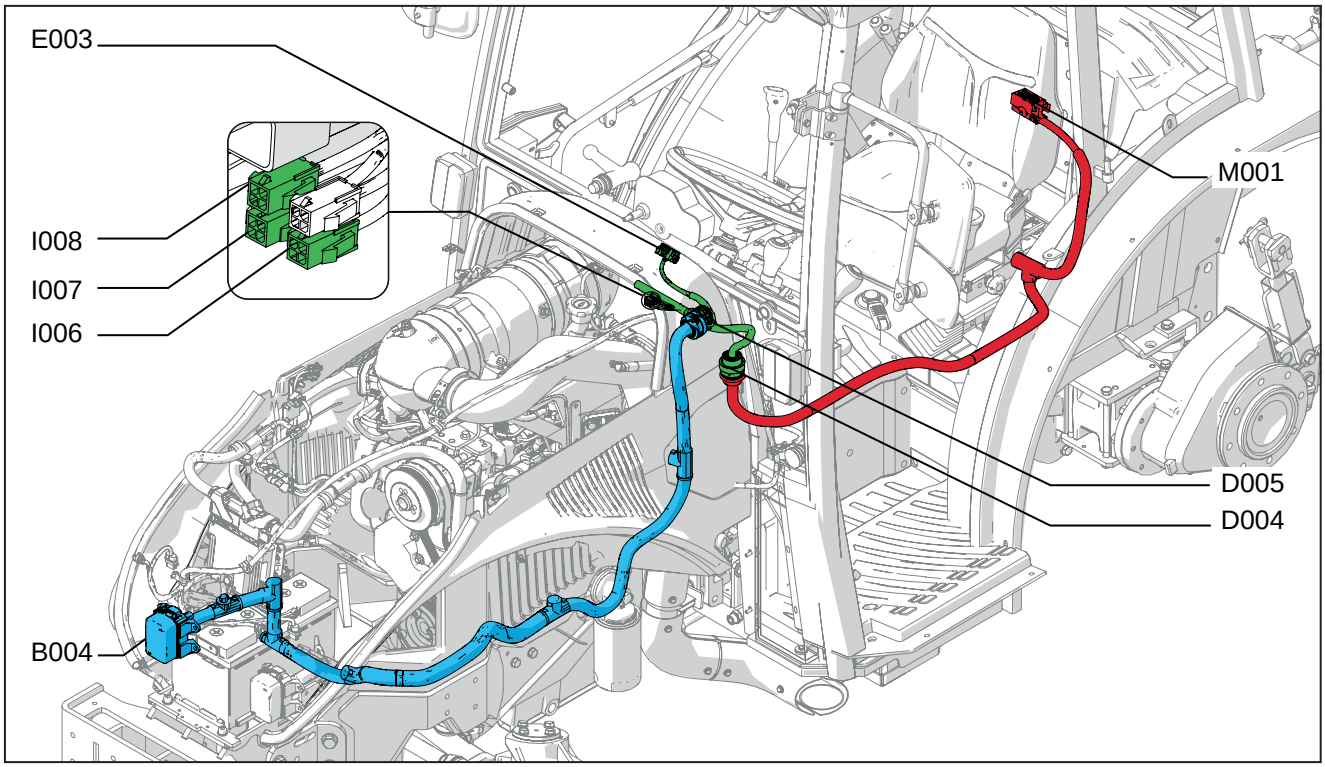

Fig. 17.70

B004 - Fuse box "1"
C002 - Cab ground
D004 - Wiring connector
D005 - Wiring connector
E003 - Dashboard
I006 - ENTER dashboard button
I007 - + dashboard button
I008 - - dashboard button
M001 - Vehicle ECU

17.4.8 S008 - Transmission

Electrical wiring diagram: Transmission

Table 1

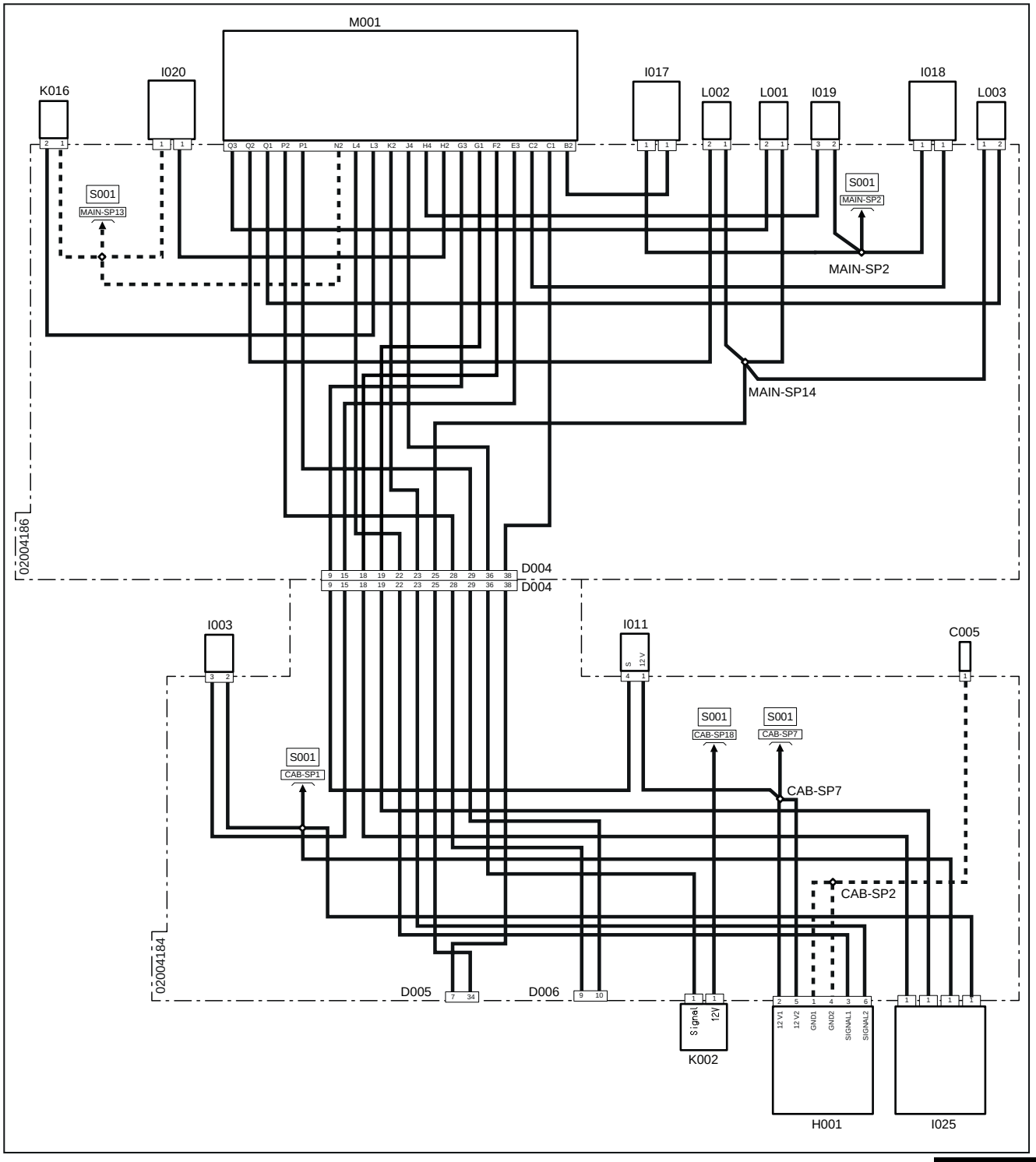

Fig. 17.71

Table 2

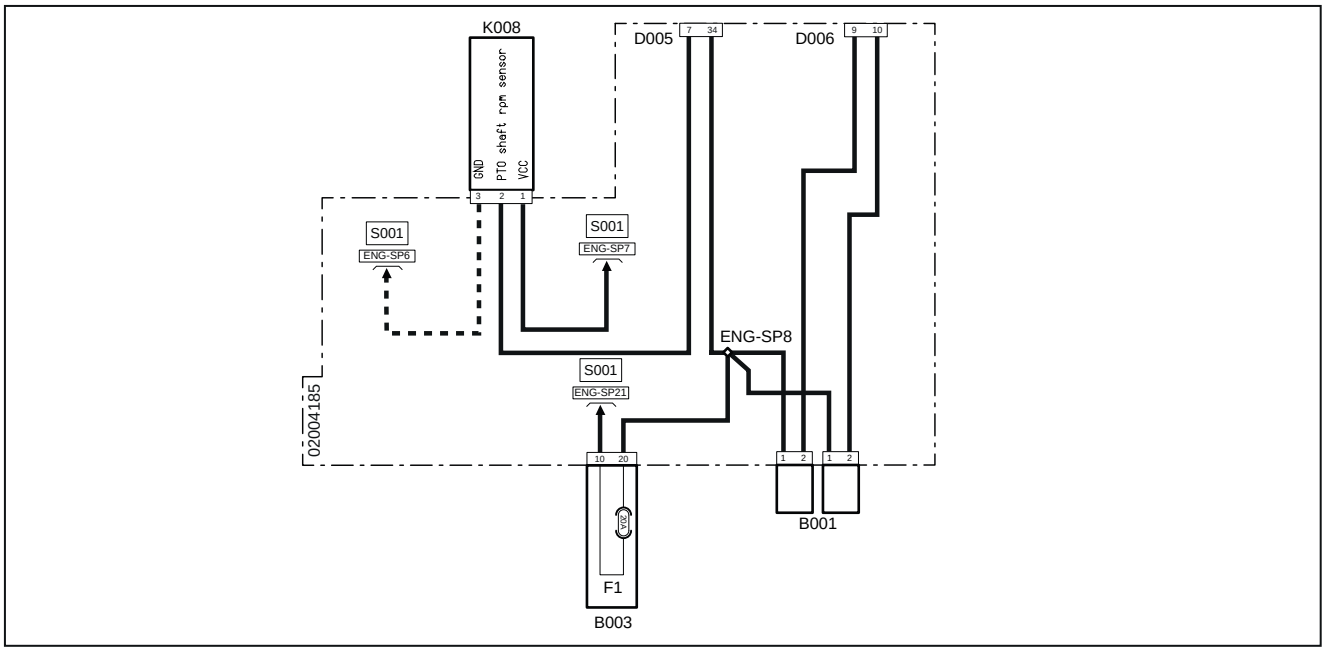

Fig. 17.72

B003 - Fuse box "2"
B003(F1) - Socket - Rotating beacon (20A)
D004 - Wiring connector
D005 - Wiring connector
D006 - Wiring connector
B001 - Front PTO valves
H001 - Hand throttle
I003 - Hydraulic 4WD selector switch
I011 - Auto PTO switch
I017 - H/L Forward lever button
I018 - H/L Reverse lever button
I019 - "Diverter" button
I020 - Rear PTO speed mode selector
I025 - PTO mode selector
K002 - PTO start enable signal / dashboard indicator signal
K008 - PTO shaft speed sensor
K016 - PTO mode sensor
L001 - Differential lock "ON/OFF" solenoid valve
L002 - 4WD "ON/OFF" solenoid valve
L003 - "Diverter" solenoid valve
M001 - Vehicle ECU

Location in vehicle: Transmission

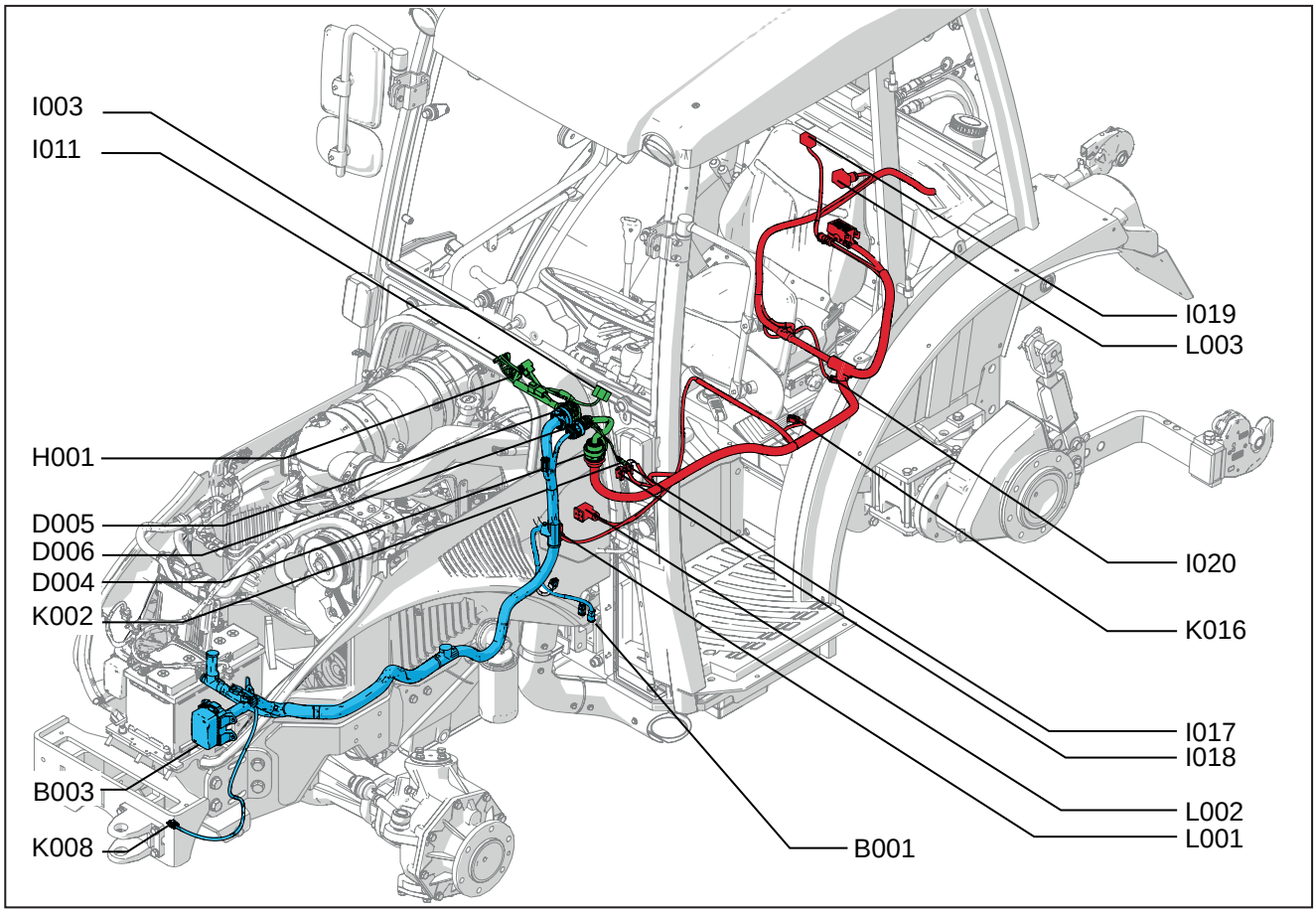

Fig. 17.73

B003 - Fuse box "2"
D004 - Wiring connector
D005 - Wiring connector
D006 - Wiring connector
B001 - Front PTO valves
H001 - Hand throttle
I003 - Hydraulic 4WD selector switch
I011 - Auto PTO switch
I017 - H/L Forward lever button
I018 - H/L Reverse lever button
I019 - "Diverter" button
I020 - Rear PTO speed mode selector
I025 - PTO mode selector
K002 - PTO start enable signal / dashboard indicator signal
K008 - PTO shaft speed sensor
K016 - PTO mode sensor
L001 - Differential lock "ON/OFF" solenoid valve
L002 - 4WD "ON/OFF" solenoid valve
L003 - "Diverter" solenoid valve
M001 - Vehicle ECU

17.4.9 S009 - Brakes

Electrical wiring diagram: Brakes

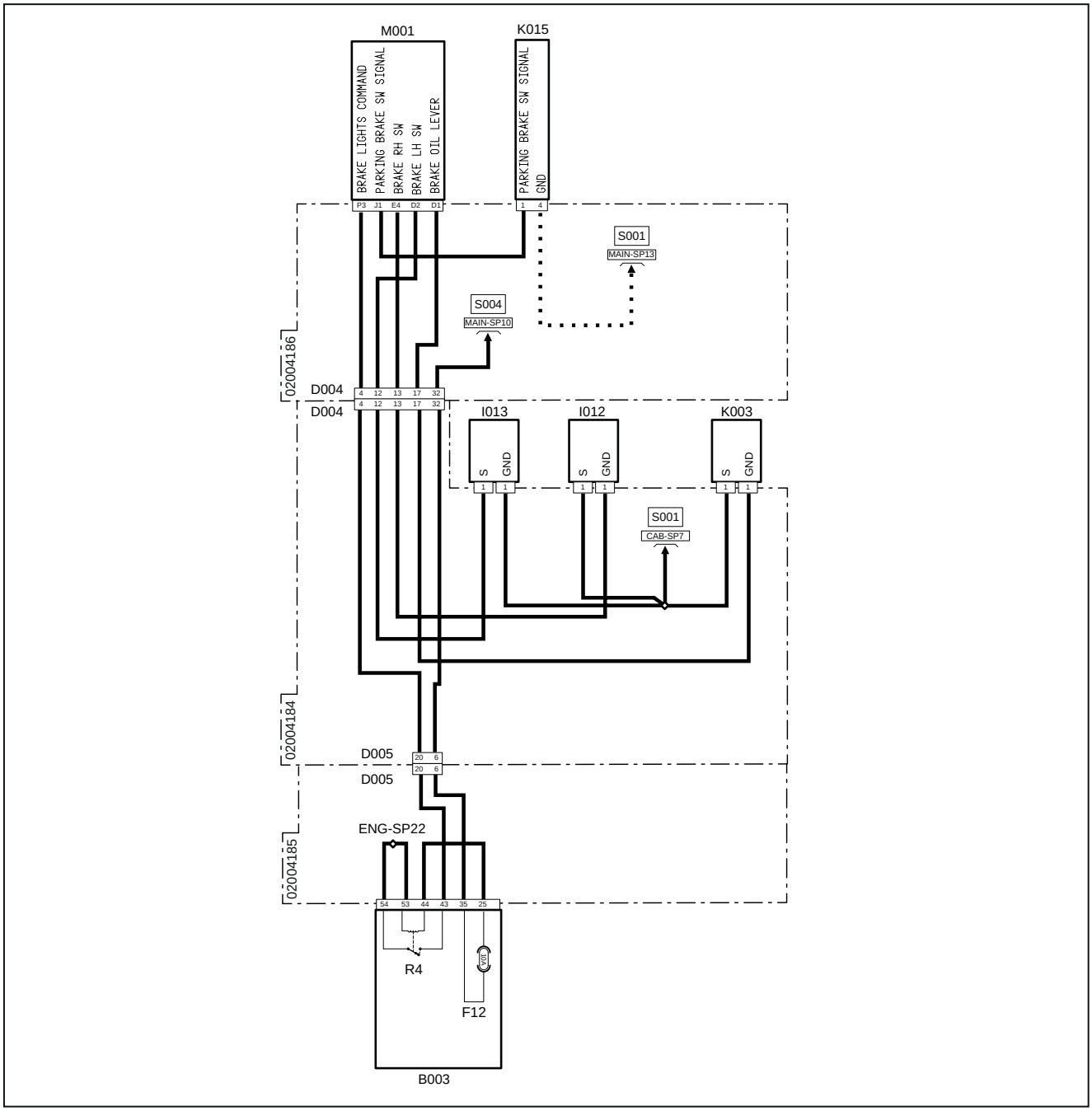

Fig. 17.74

B003 - Fuse box "2"
B003(R4) - Brake light relay
B003(F12) - Brake lights (10A)
D004 - Wiring connector
D005 - Wiring connector
I012 - Right brake pedal switch
I013 - Left brake pedal switch
I014 - LH brake signal switch
I021 - RH brake signal switch
K003 - Brake oil level sensor
K015 - Park brake start enable signal
M001 - Vehicle ECU

Location in vehicle: Brakes

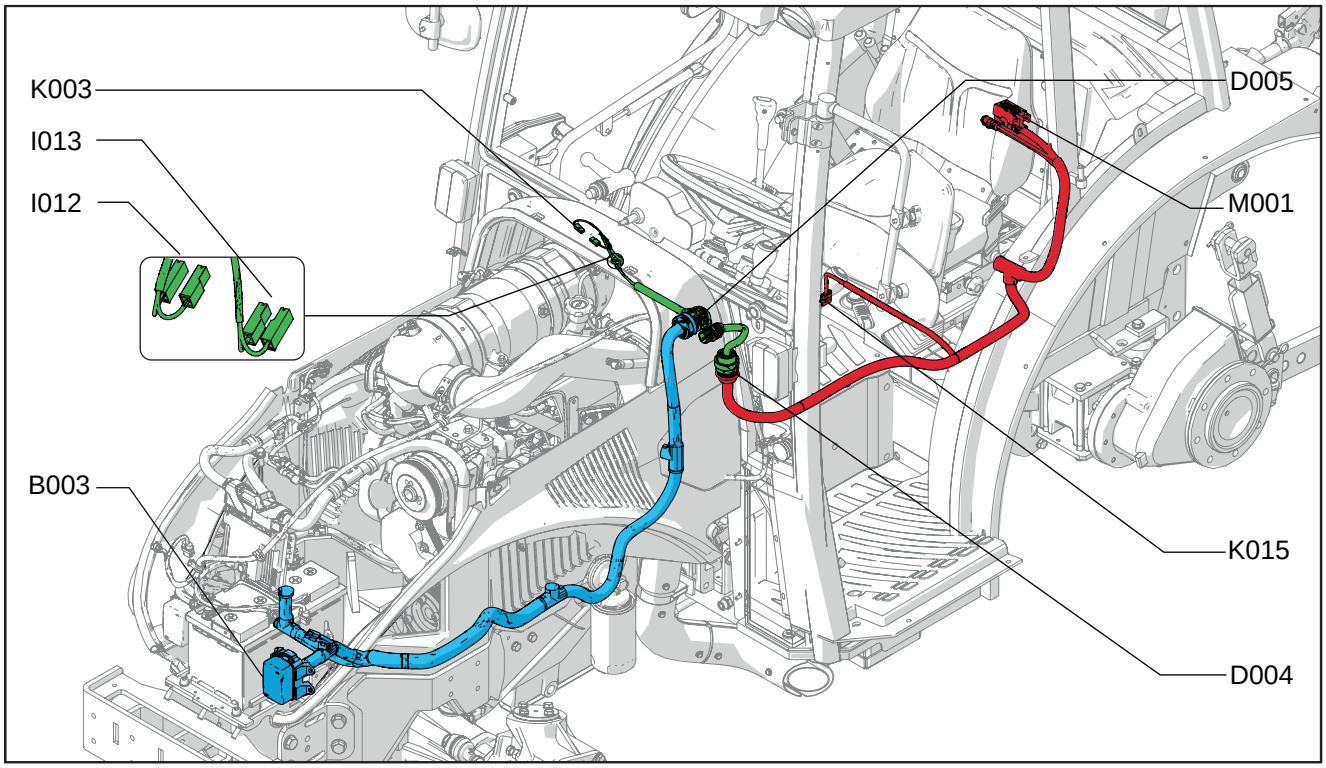

Fig. 17.75

B003 - Fuse box "2"
D004 - Wiring connector
D005 - Wiring connector
I012 - Right brake pedal switch
I013 - Left brake pedal switch
I014 - LH brake signal switch
I021 - RH brake signal switch
K003 - Brake oil level sensor
K015 - Park brake start enable signal
M001 - Vehicle ECU

17.5 Systems for wiring harnesses (from serial No. 0000622678 for Roll Bar versions with SG1/1 3B cabs and front lift)

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17.5.1 S001 - Power feed and starting

Electrical wiring diagram: Power feed and starting

Table 1

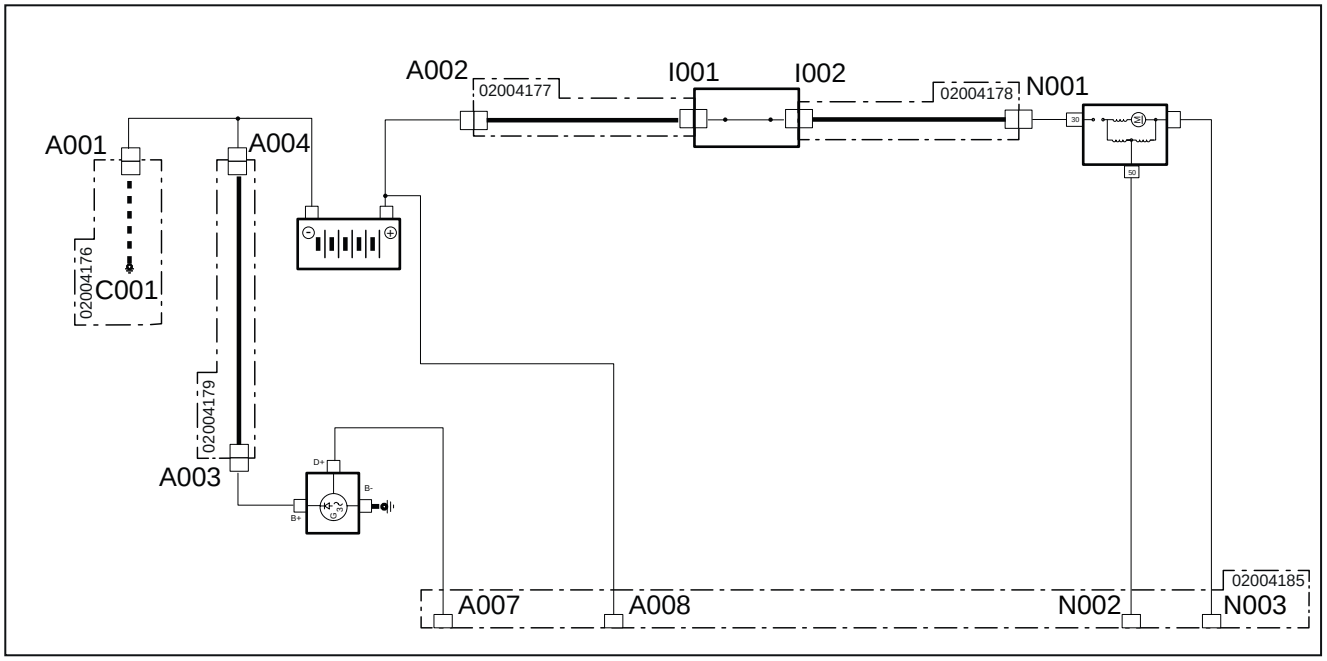

Fig. 17.76

Table 2

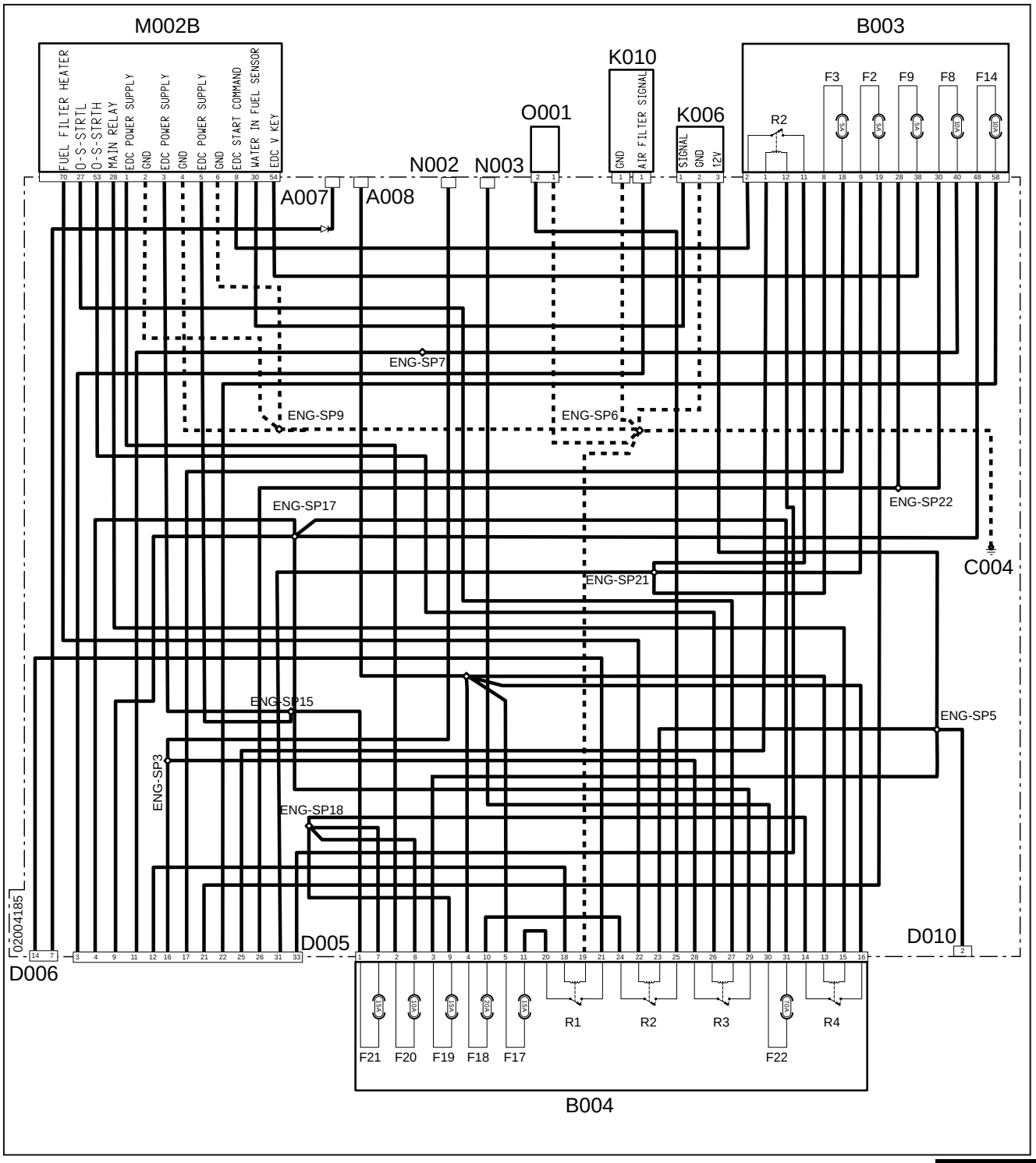

Fig. 17.77

Table 3

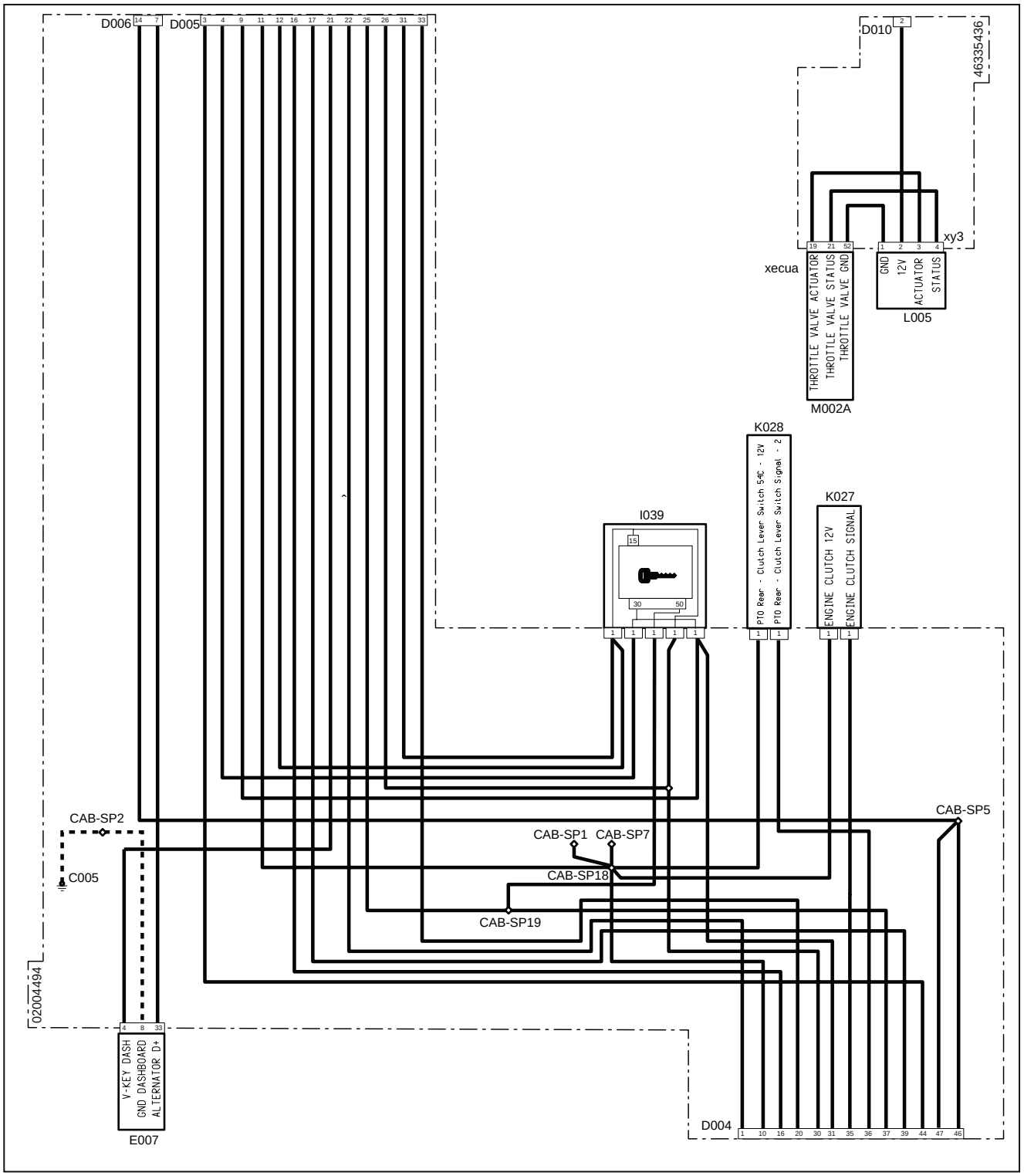

Fig. 17.78

Table 4

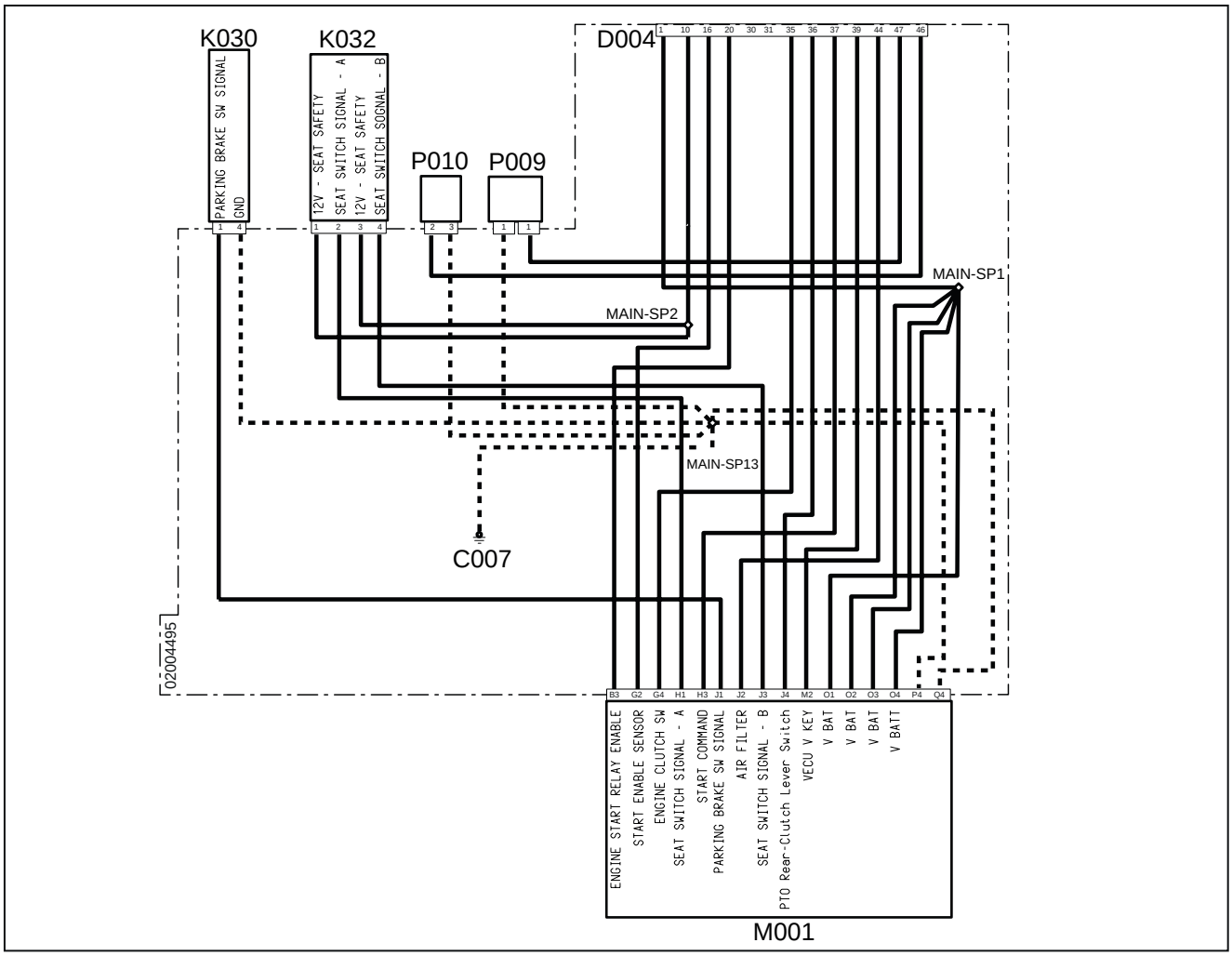

Fig. 17.79

A001 - Negative battery terminal
A002 - Positive battery terminal
A003 - Alternator "B+"
A004 - Negative battery terminal
A007 - Alternator
A008 - Positive battery terminal
B003 - Fuse box "2"
B003(R2) - Start enable relay
B003(F3) - Key-on power feed for VCU (5A)
B003(F2) - Key-on power feed for dashboard (5A)
B003(F9) - Key-on power feed for ECU (5A)
B003(F8) - Turn indicators (10A)
B003(F14) - 12V VCU power feed (10A)
B004 - Fuse box "1"
B004(F21) - 12V ECU power feed (15A)
B004(F20) - 12V ECU power feed (10A)
B004(F19) - Accessories (15A)
B004(F18) - Fuel pre-heat (20A)
B004(F17) - Trailer socket (15A)
B004(R1) - Trailer socket relay (30A)
B004(R2) - Fuel pre-heat relay (20A)
B004(R3) - Start relay (20A)
B004(F22) - Main maxi fuse (70A)
B004(R4) - Main relay (30A)
C001 - Battery ground
C004 - Engine ground point
C005 - Cab ground
C007 - Main wiring loom ground
D004 - Wiring connector
D005 - Wiring connector
D006 - Wiring connector
D010 - Wiring connector
E007 - Dashboard
I001 - Battery master relay switch (input terminal)
I002 - Battery master relay switch (output terminal)
I039 - Ignition switch
K006 - Water in fuel sensor
K010 - Air filter sensor
K027 - Clutch engine start enable sensor
K028 - PTO start enable signal / dashboard indicator signal
K030 - Park brake start enable signal
K032 - Seat start enable signal
L005 - Throttle valve
M001 - Vehicle ECU
M002A - Engine control unit
M002B - Engine control unit
N001 - Starter motor "30"
N002 - Starter motor 50
N003 - Starter motor
O001 - Fuel filter heater
P009 - 1-pole socket
P010 - Rear 7 pole socket

Location in vehicle: Power feed and starting

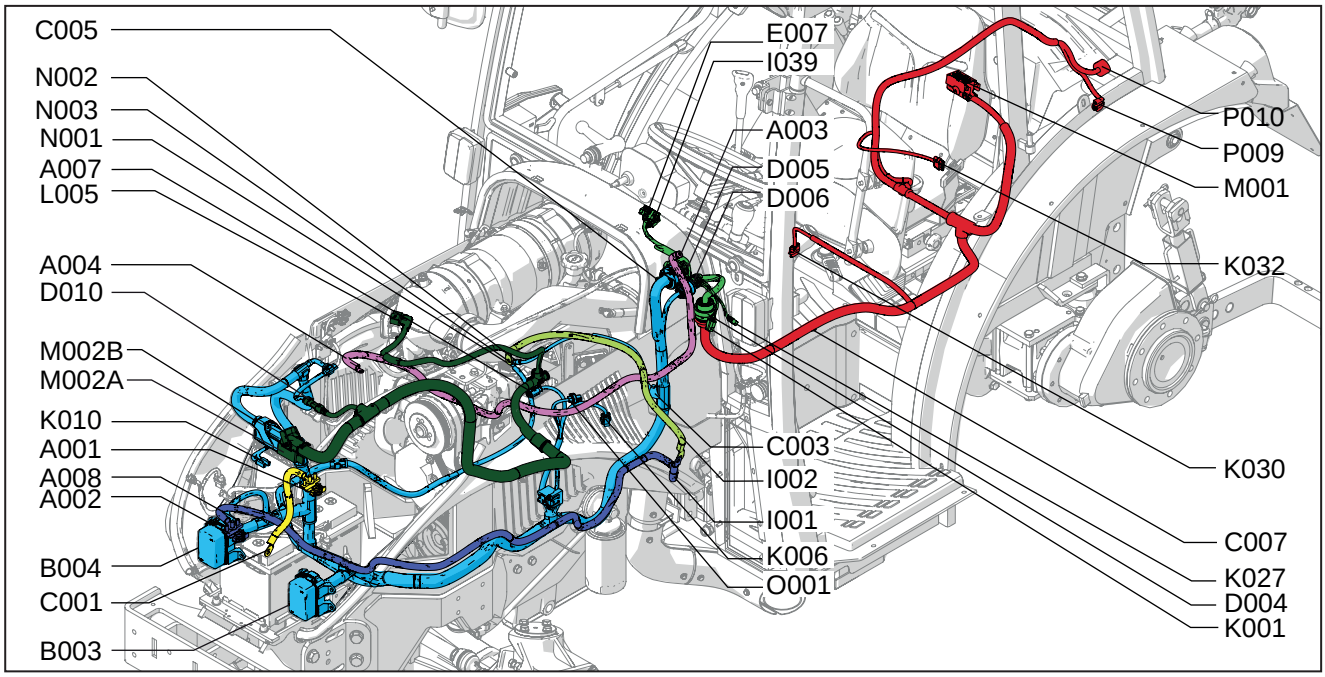

Fig. 17.80

A001 - Negative battery terminal
A002 - Positive battery terminal
A003 - Alternator "B+"
A004 - Negative battery terminal
A007 - Alternator
A008 - Positive battery terminal
B003 - Fuse box "2"
B004 - Fuse box "1"
C001 - Battery ground
C004 - Engine ground point
C005 - Cab ground
C007 - Main wiring loom ground
D004 - Wiring connector
D005 - Wiring connector
D006 - Wiring connector
D010 - Wiring connector
E007 - Dashboard
I001 - Battery master relay switch (input terminal)
I002 - Battery master relay switch (output terminal)
I039 - Ignition switch
K006 - Water in fuel sensor
K010 - Air filter sensor
K027 - Clutch engine start enable sensor
K028 - PTO start enable signal / dashboard indicator signal
K030 - Park brake start enable signal
K032 - Seat start enable signal
L005 - Throttle valve
M001 - Vehicle ECU
M002A - Engine control unit
M002B - Engine control unit
N001 - Starter motor "30"
N002 - Starter motor 50
N003 - Starter motor
O001 - Fuel filter heater
P009 - 1-pole socket
P010 - Rear 7 pole socket

17.5.2 S002 - DPF

Electrical wiring diagram: DPF

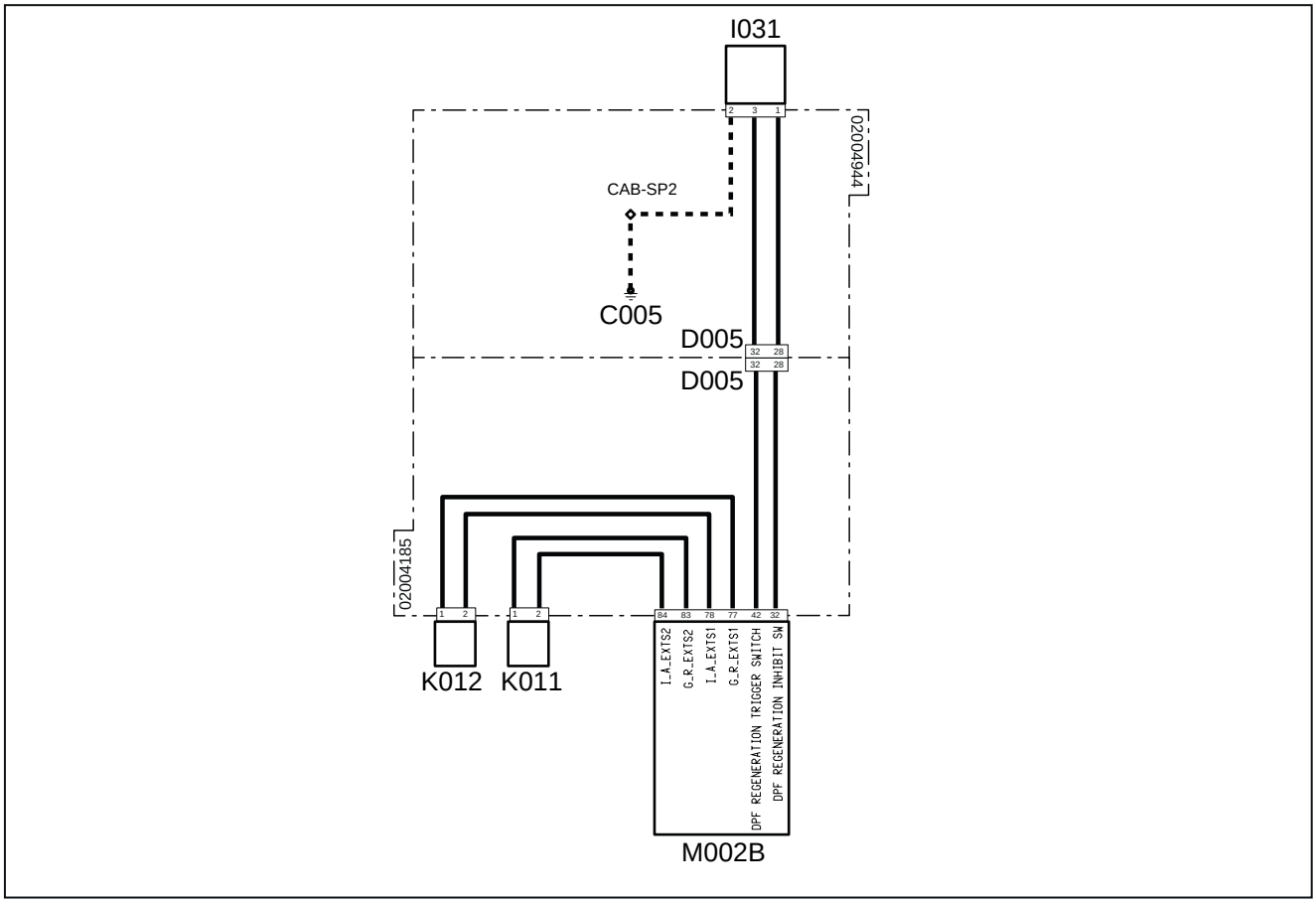

Fig. 17.81

C005 - Cab ground
D005 - Wiring connector
I031 - Regeneration cycle disable switch
K011 - DPF temperature sensor
K012 - DOC temperature sensor
M002B - Engine control unit

Location in vehicle: DPF

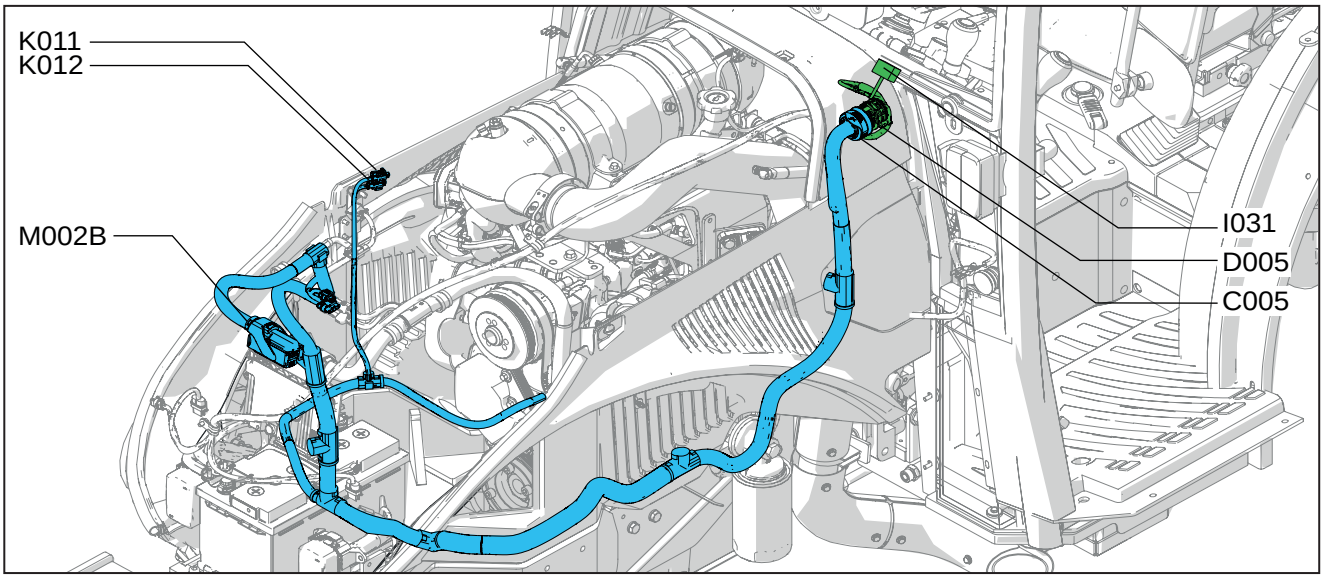

Fig. 17.82

C005 - Cab ground
D005 - Wiring connector
I031 - Regeneration cycle disable switch
K011 - DPF temperature sensor
K012 - DOC temperature sensor
M002B - Engine control unit

17.5.3 S003 - Electronic engine management

Electrical wiring diagram: Electronic engine management

Table 1

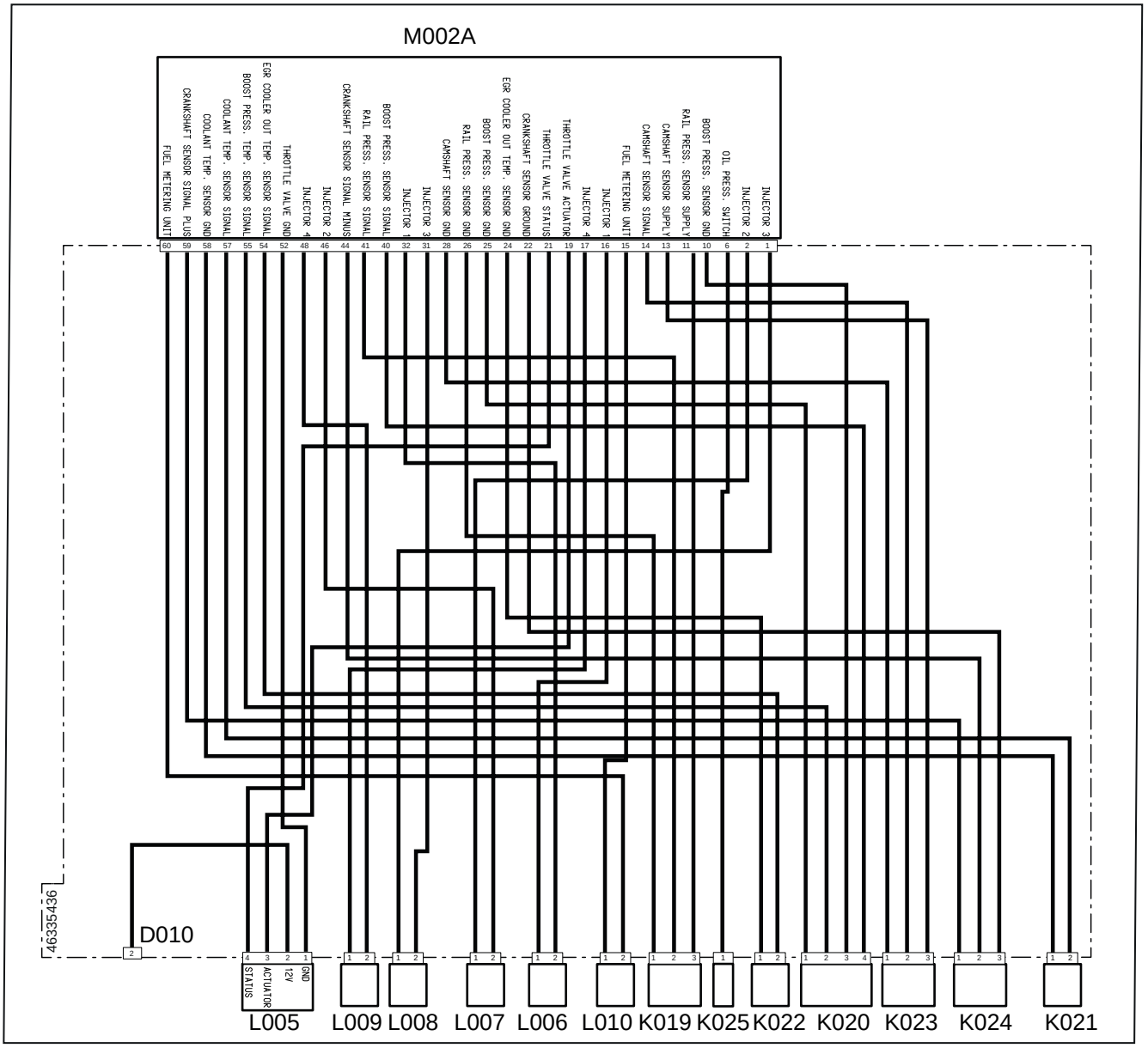

Fig. 17.83

Table 2

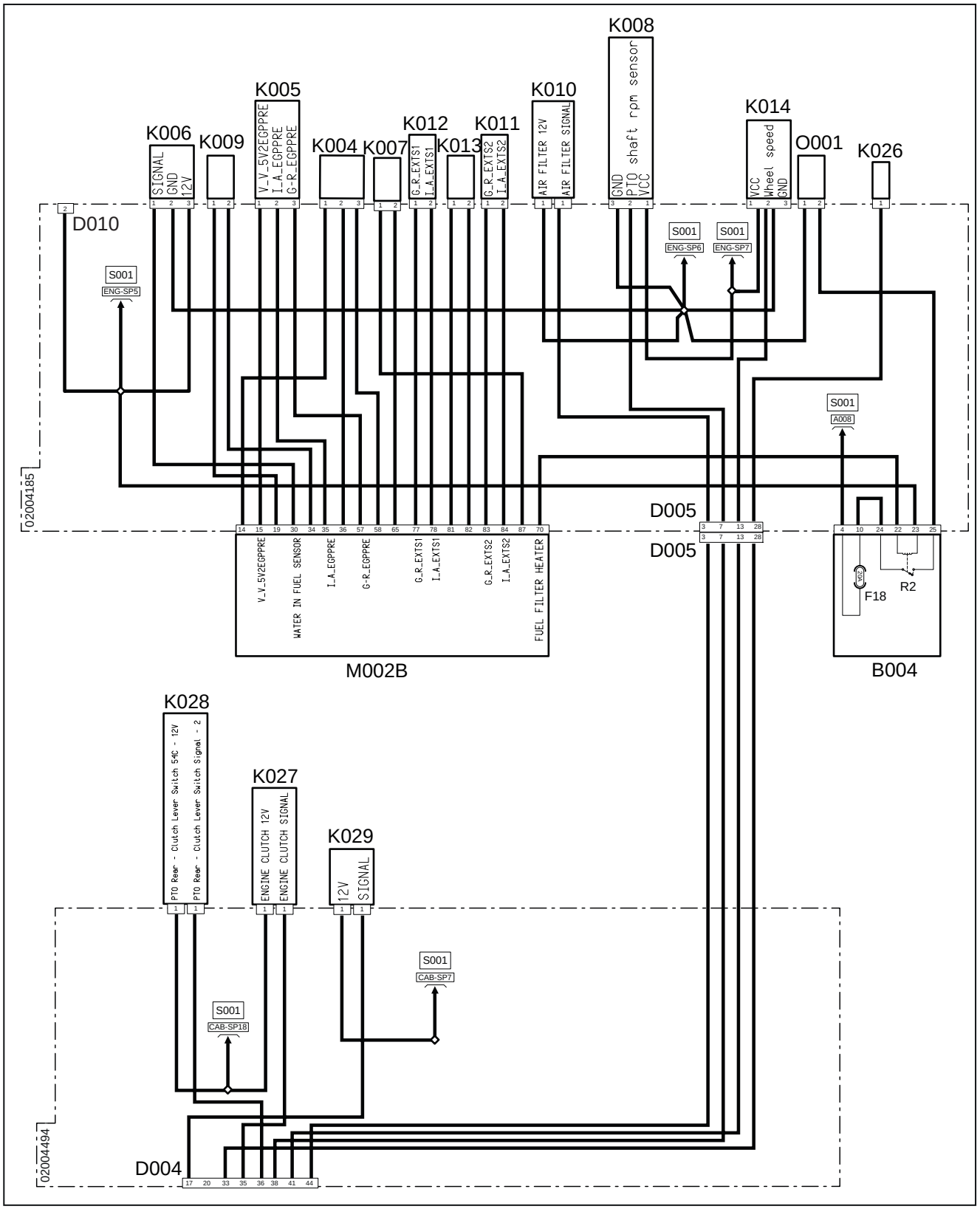

Fig. 17.84

Table 3

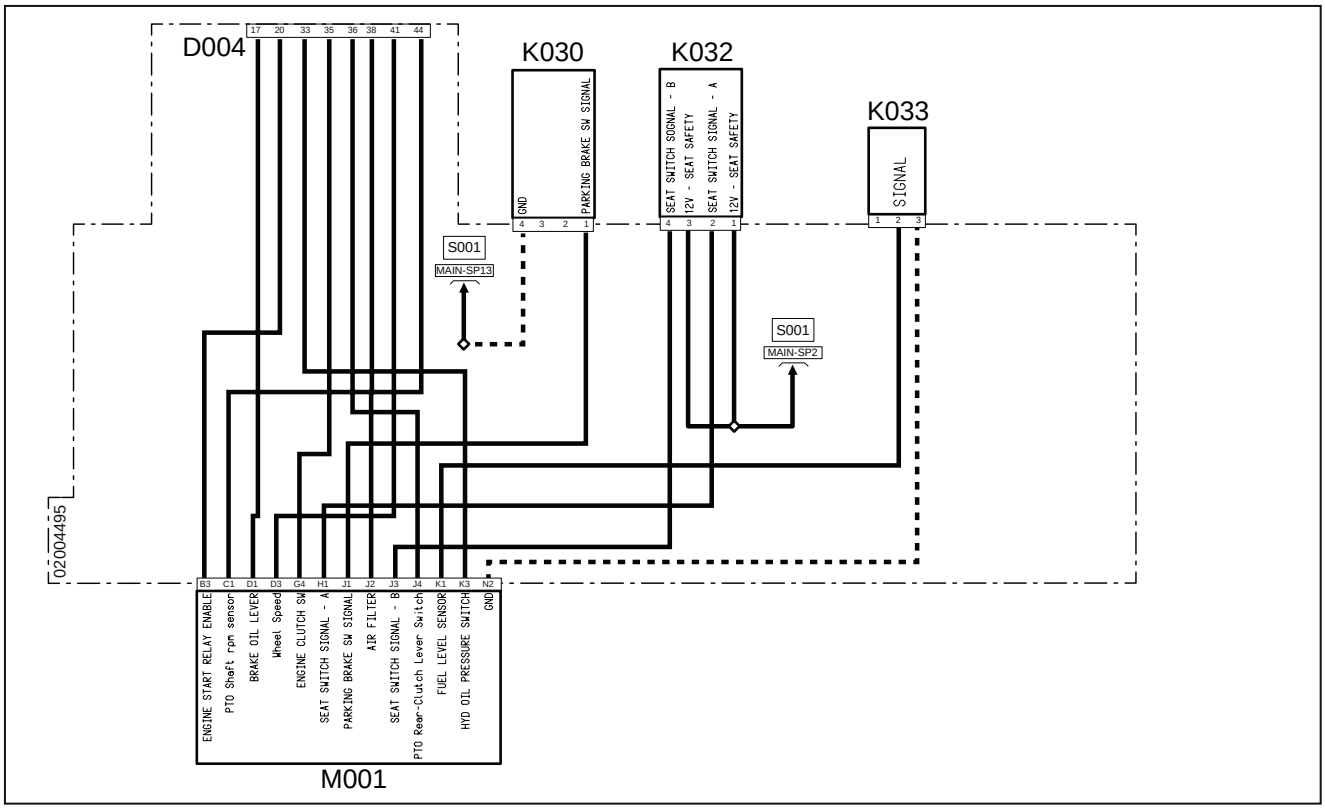

Fig. 17.85

B004 - Fuse box "1"
B004(F18) - Fuel pre-heat (20A)
B004(R2) - Fuel pre-heat relay (20A)
D004 - Wiring connector
D005 - Wiring connector
D010 - Wiring connector
K004 - Differential pressure sensor
K005 - P3 sensor (exhaust pressure)
K006 - Water in fuel sensor
K007 - Fuel temperature sensor
K008 - PTO shaft speed sensor
K009 - Ambient air temperature sensor
K010 - Air filter sensor
K011 - DPF temperature sensor
K012 - DOC temperature sensor
K013 - Exhaust gas temperature sensor
K014 - Wheel speed sensor
K019 - Common Rail fuel pressure sensor
K020 - Temperature and pressure sensor (BOOST)
K021 - Coolant temperature sensor
K022 - EGR temperature sensor
K023 - Camshaft timing sensor
K024 - Crankshaft speed sensor
K025 - Oil pressure switch
K026 - Suction line hydraulic oil pressure sensor
K027 - Clutch engine start enable sensor
K028 - PTO start enable signal / dashboard indicator signal
K029 - Brake oil level sensor
K030 - Park brake start enable signal
K032 - Seat start enable signal
K033 - Fuel level sensor
L005 - Throttle valve
L006 - Fuel electro-injector 1
L007 - Fuel electro-injector 2
L008 - Fuel electro-injector 3
L009 - Fuel electro-injector 4
L010 - High pressure pump
M001 - Vehicle ECU
M002A - Engine control unit
M002B - Engine control unit
O001 - Fuel filter heater

Location in vehicle: Electronic engine management

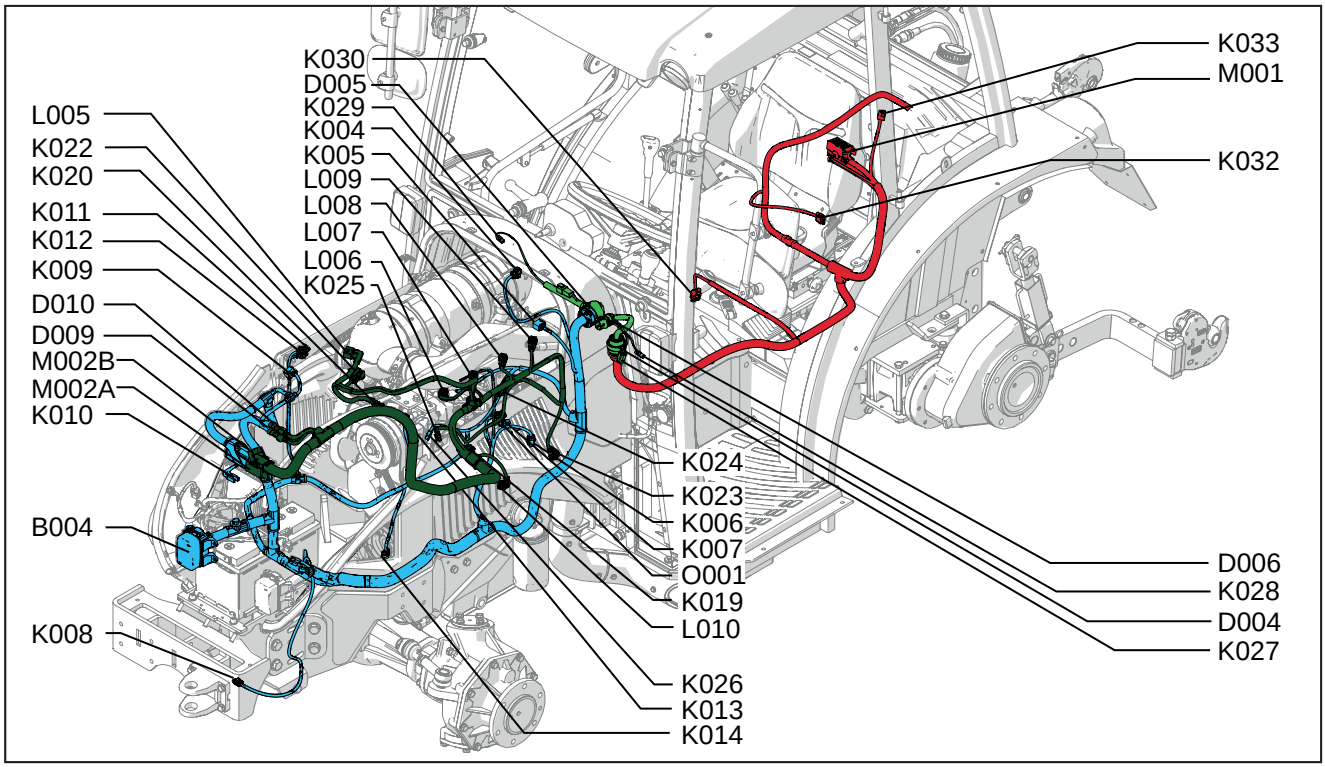

Fig. 17.86

B004 - Fuse box "1"
D004 - Wiring connector
D005 - Wiring connector
D010 - Wiring connector
K004 - Differential pressure sensor
K005 - P3 sensor (exhaust pressure)
K006 - Water in fuel sensor
K007 - Fuel temperature sensor
K008 - PTO shaft speed sensor
K009 - Ambient air temperature sensor
K010 - Air filter sensor
K011 - DPF temperature sensor
K012 - DOC temperature sensor
K013 - Exhaust gas temperature sensor
K014 - Wheel speed sensor
K019 - Common Rail fuel pressure sensor
K020 - Temperature and pressure sensor (BOOST)
K021 - Coolant temperature sensor
K022 - EGR temperature sensor
K023 - Camshaft timing sensor
K024 - Crankshaft speed sensor
K025 - Oil pressure switch
K026 - Suction line hydraulic oil pressure sensor
K027 - Clutch engine start enable sensor
K028 - PTO start enable signal / dashboard indicator signal
K029 - Brake oil level sensor
K030 - Park brake start enable signal
K032 - Seat start enable signal
K033 - Fuel level sensor
L005 - Throttle valve
L006 - Fuel electro-injector 1
L007 - Fuel electro-injector 2
L008 - Fuel electro-injector 3
L009 - Fuel electro-injector 4
L010 - High pressure pump
M001 - Vehicle ECU
M002A - Engine control unit
M002B - Engine control unit
O001 - Fuel filter heater

17.5.4 S004 - Lights and horn

Electrical wiring diagram: Lights and horn

Table 1

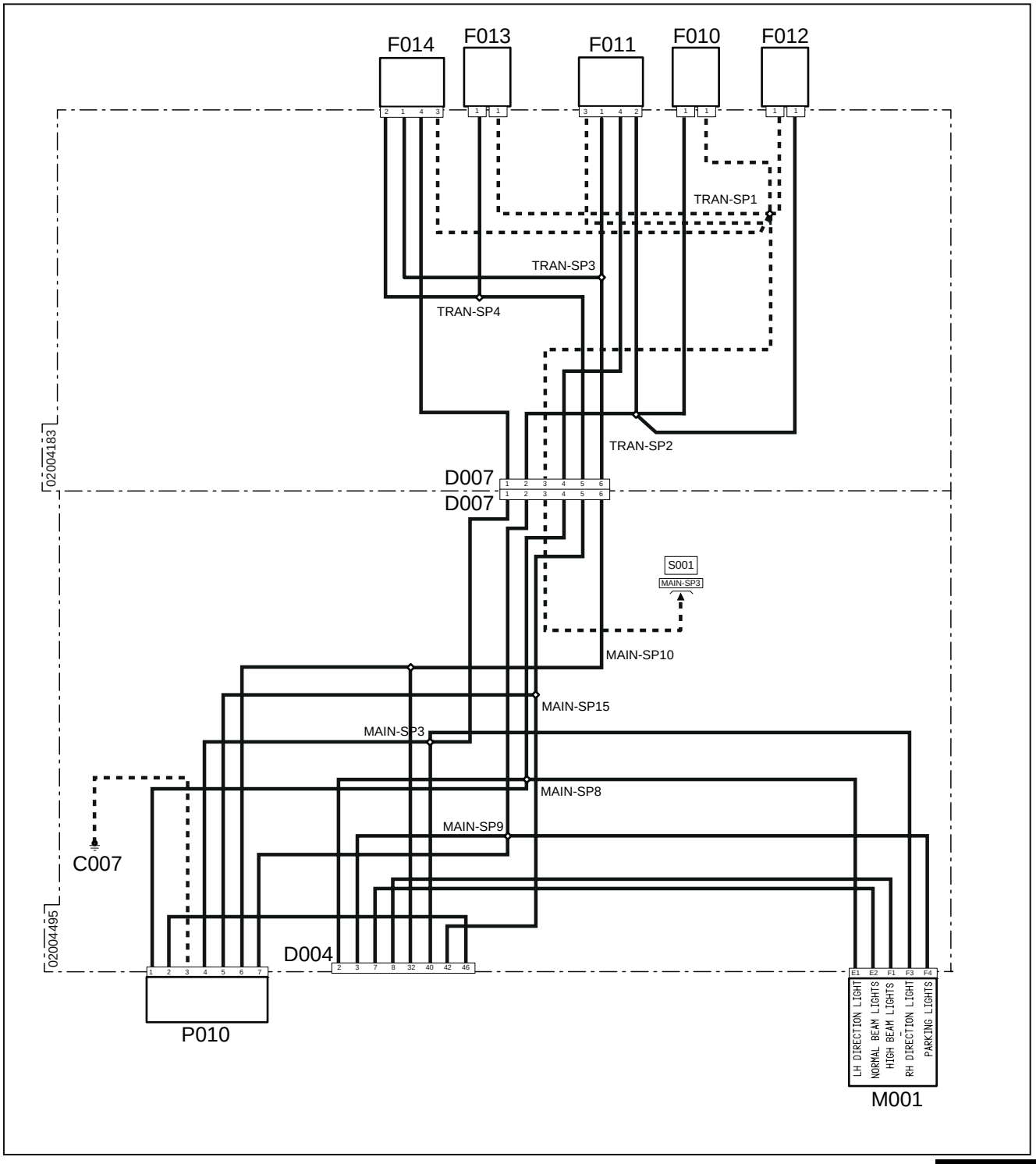

Fig. 17.87

Table 2

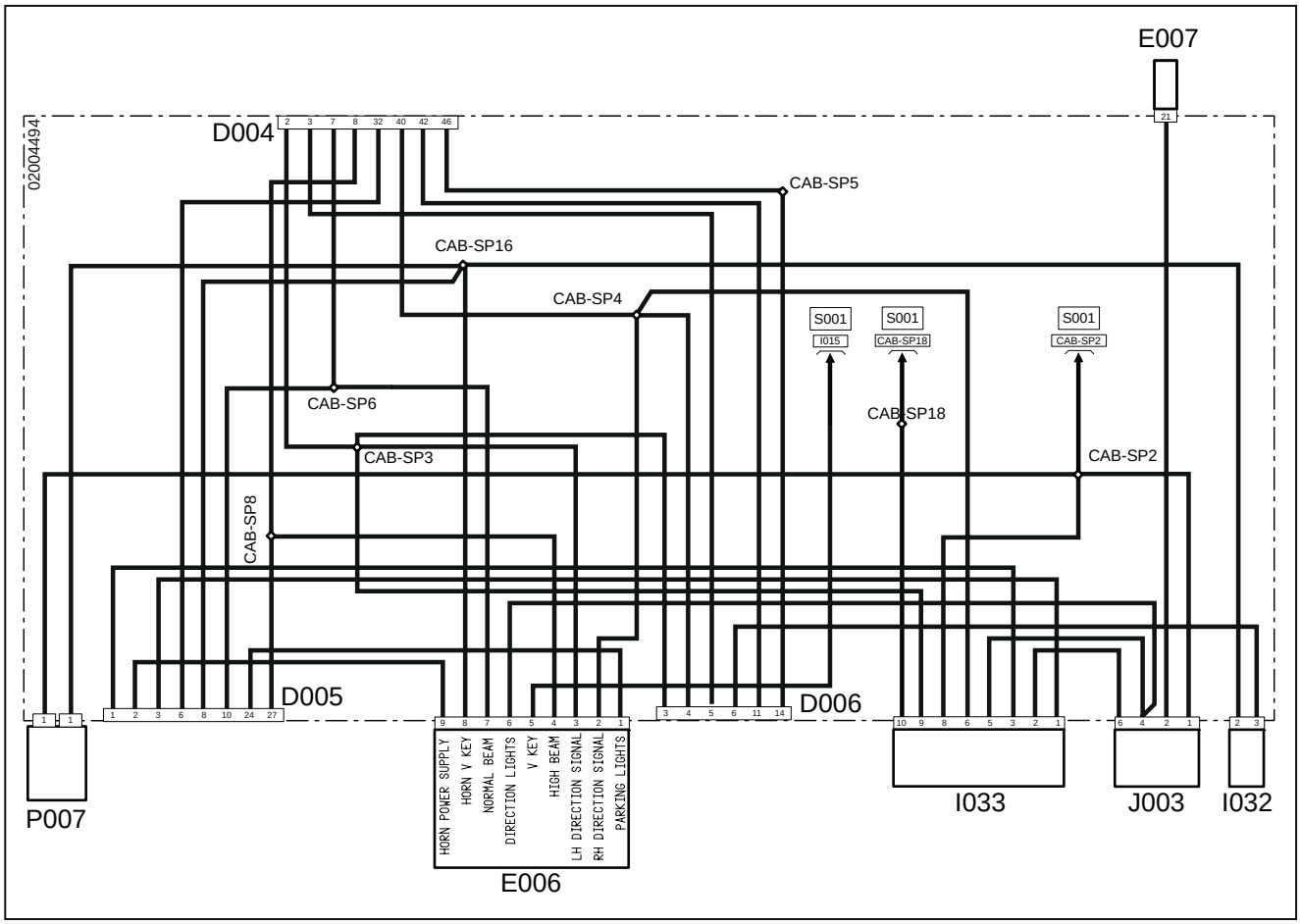

Fig. 17.88

Table 3

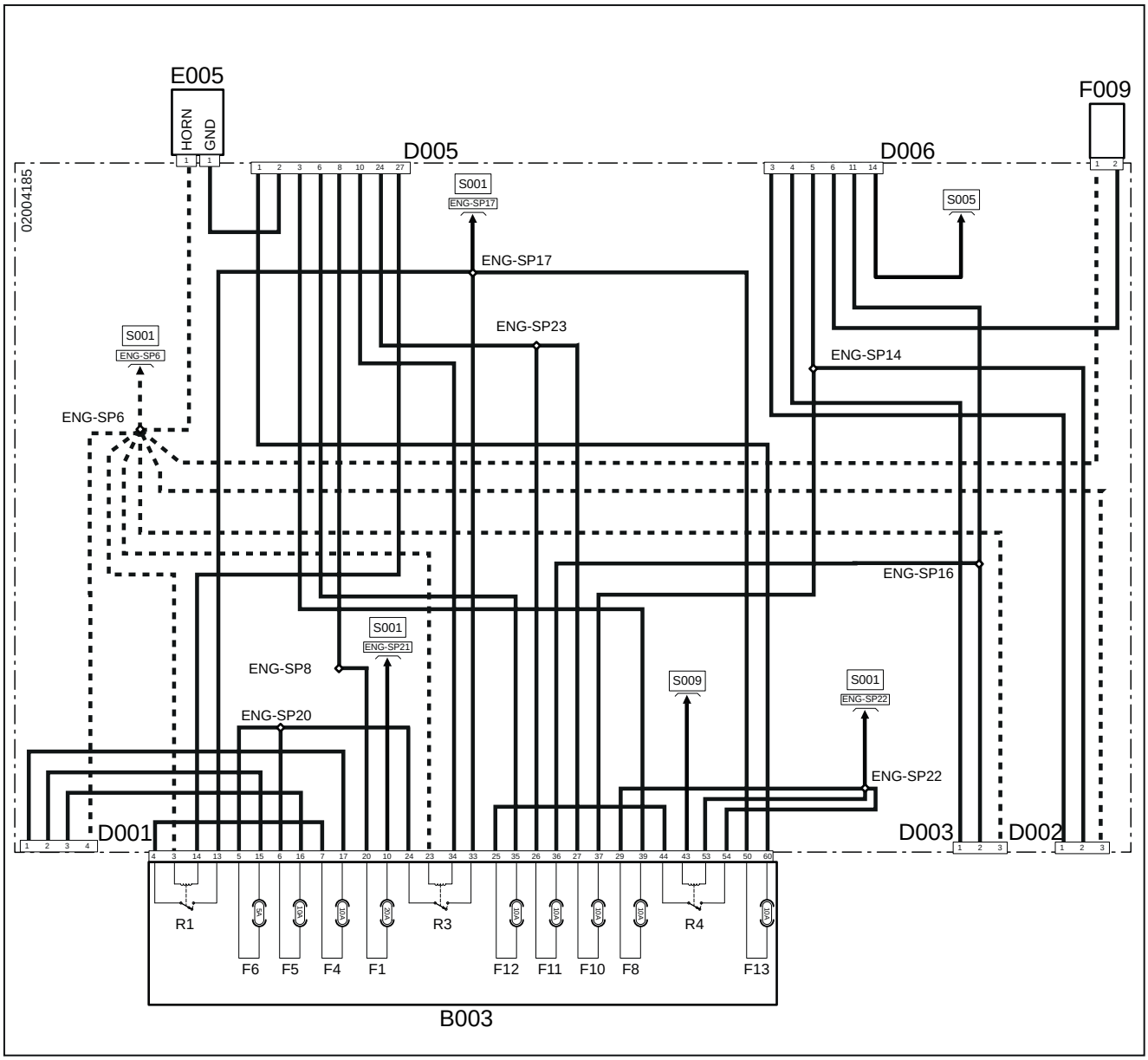

Fig. 17.89

Table 4

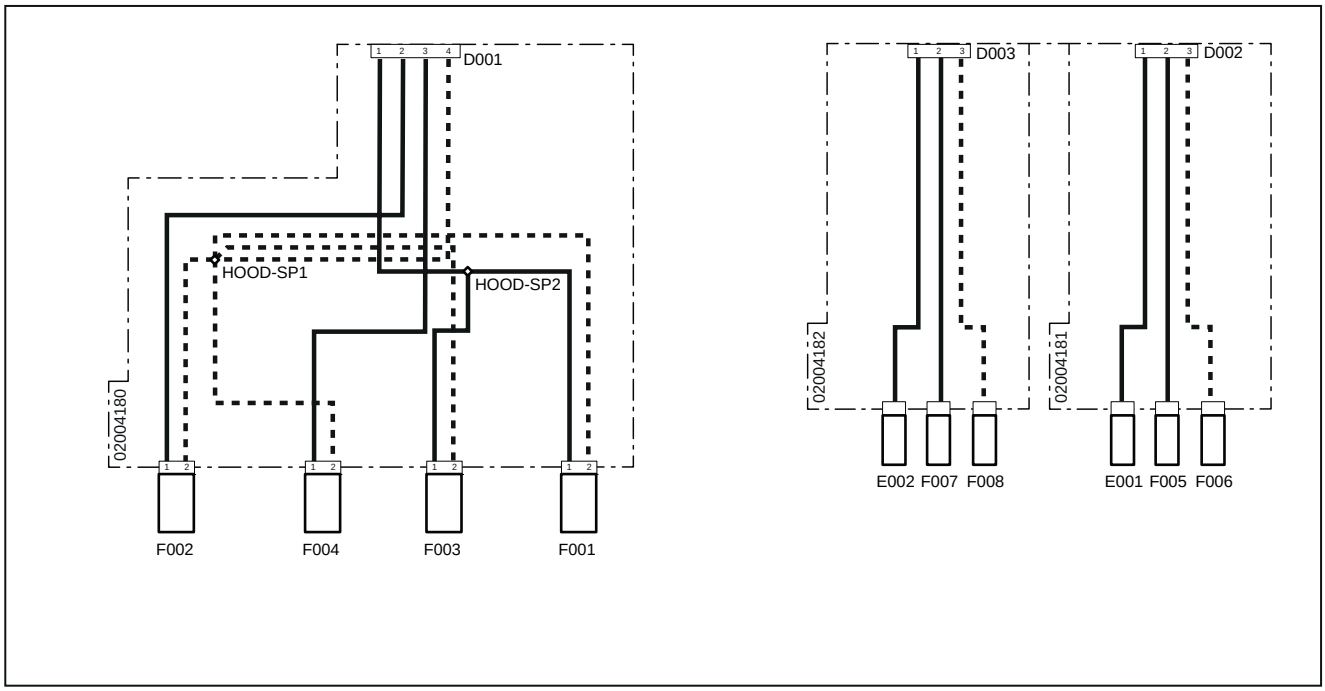

Fig. 17.90

B003 - Fuse box "2"
B003(R1) - High beam relay
B003(F6) - RH low beams (10A)
B003(F5) - LH low beams (10A)
B003(F4) - High beam (10A)
B003(F1) - Socket - Rotating beacon (20A)
B003(R3) - Low beam relay
B003(F12) - Brake lights (10A)
B003(F11) - RH sidelights (10A)
B003(F10) - LH sidelights (10A)
B003(F8) - Turn indicators (10A)
B003(R4) - Brake light relay
B003(F13) - Hazard warning lights (10A)
C007 - Main wiring loom ground
D001 - Wiring connector
D002 - Wiring connector
D003 - Wiring connector
D004 - Wiring connector
D005 - Wiring connector
D006 - Wiring connector
D007 - Wiring connector
E001 - Left turn indicator
E002 - Right turn indicator
E005 - Horn
E006 - Right hand turn indicator signal
E007 - Dashboard
F005 - Parking light
F006 - Mudguard light
F007 - Parking light
F008 - Mudguard light
F009 - Provision for rotating beacon, roll-bar version
F010 - LH work lights
F011 - LH rear mudguard lights
F012 - Number plate light
F013 - RH work lights
F014 - RH rear mudguard lights
F001 - RH high beam headlight
F002 - RH low beam headlight
F003 - LH high beam headlight
F004 - LH low beam headlight
I032 - Rotating beacon button
I033 - Hazard warning lights button
J003 - Hazard warning lights relay
M001 - Vehicle ECU
P007 - 1-pole socket
P010 - Rear 7 pole socket

Location in vehicle: Lights and horn

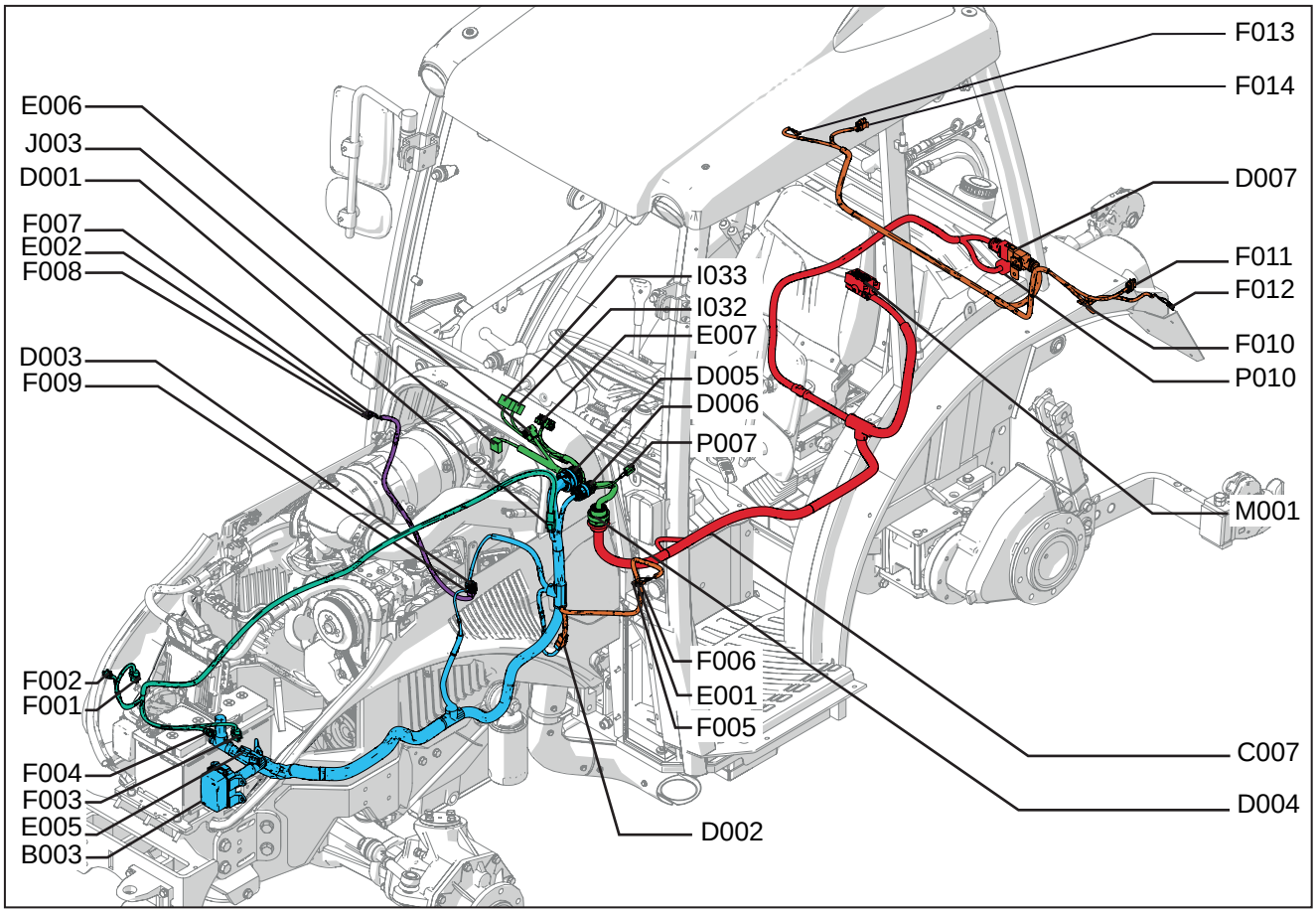

Fig. 17.91

B003 - Fuse box "2"
C007 - Main wiring loom ground
D001 - Wiring connector
D002 - Wiring connector
D003 - Wiring connector
D004 - Wiring connector
D005 - Wiring connector
D006 - Wiring connector
D007 - Wiring connector
E001 - Left turn indicator
E002 - Right turn indicator
E005 - Horn
E006 - Right hand turn indicator signal
E007 - Dashboard
F005 - Parking light
F006 - Mudguard light
F007 - Parking light
F008 - Mudguard light
F009 - Provision for rotating beacon, roll-bar version
F010 - LH work lights
F011 - LH rear mudguard lights
F012 - Number plate light
F013 - RH work lights
F014 - RH rear mudguard lights
F001 - RH high beam headlight
F002 - RH low beam headlight
F003 - LH high beam headlight
F004 - LH low beam headlight
I032 - Rotating beacon button
I033 - Hazard warning lights button
J003 - Hazard warning lights relay
M001 - Vehicle ECU
P007 - 1-pole socket
P010 - Rear 7 pole socket

17.5.5 S005 - Power sockets and accessories

Electrical wiring diagram: Power sockets and accessories

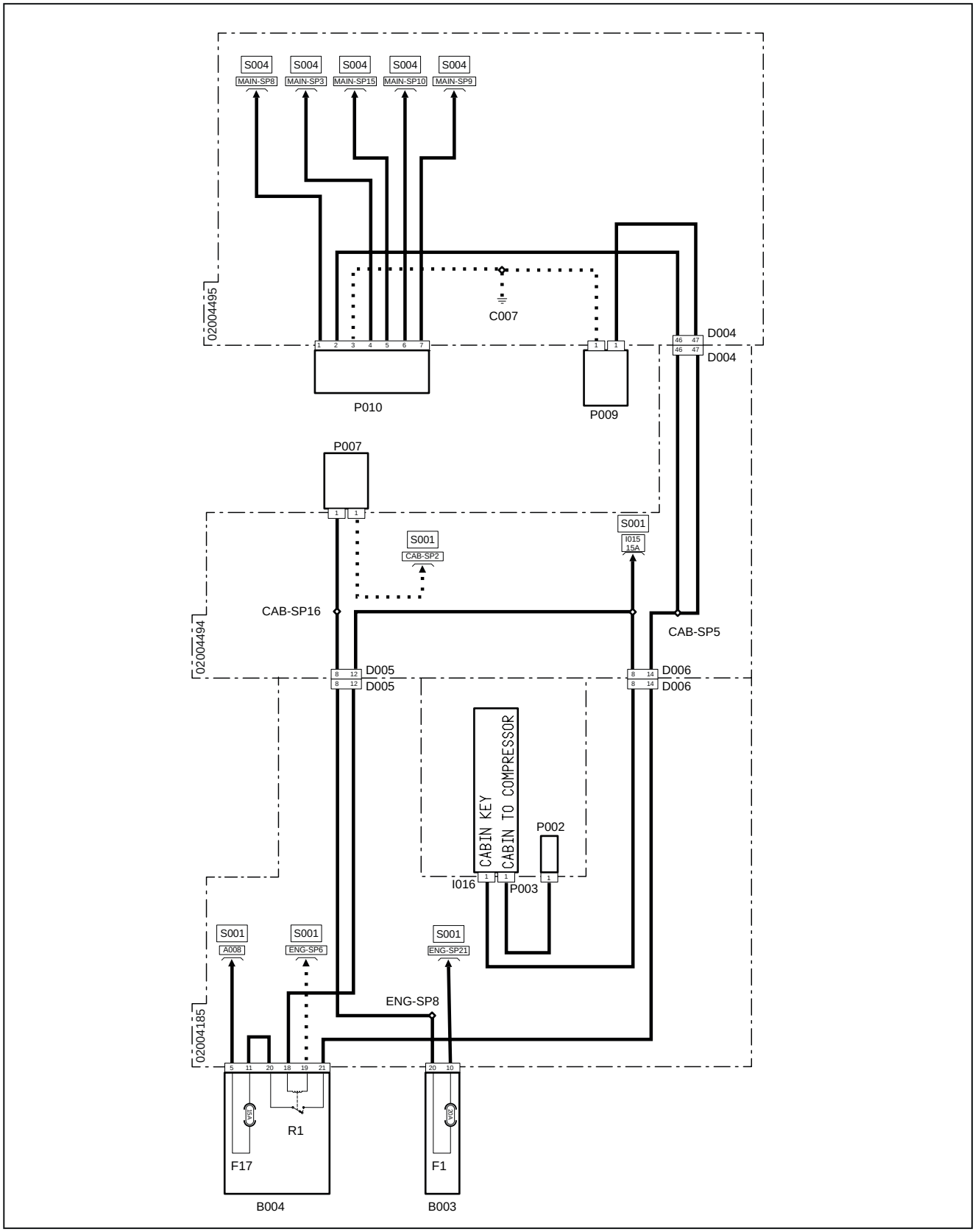

Fig. 17.92

B003 - Fuse box "2"
B003(F1) - Socket - Rotating beacon (20A)
B004 - Fuse box "1"
B004(F17) - Trailer socket (15A)
B004(R1) - Trailer socket relay (30A)
C007 - Main wiring loom ground
D004 - Wiring connector
D005 - Wiring connector
D006 - Wiring connector
I016 - Cab key
P002 - Compressor
P003 - From cab to compressor
P007 - 1-pole socket
P009 - 1-pole socket
P010 - Rear 7 pole socket

Location in vehicle: Power sockets and accessories

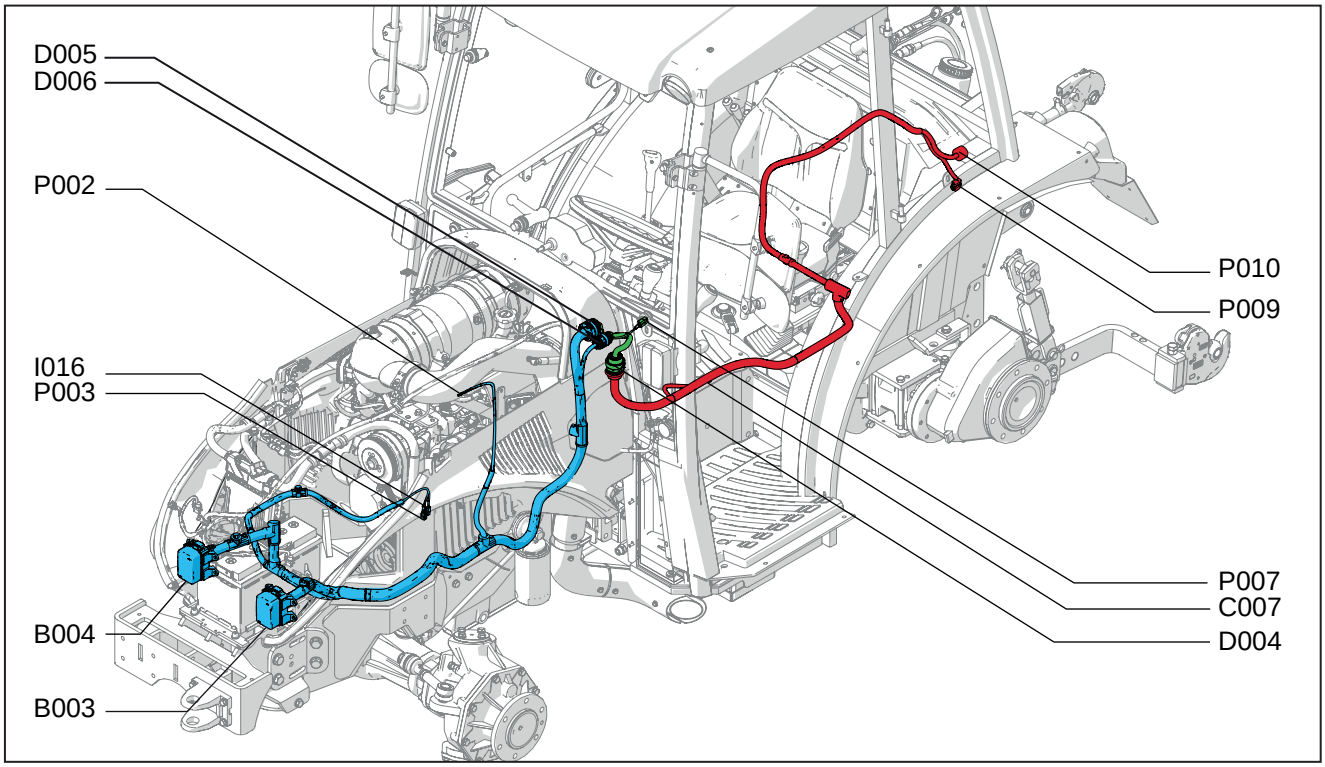

Fig. 17.93

B003 - Fuse box "2"
B004 - Fuse box "1"
C007 - Main wiring loom ground
D004 - Wiring connector
D005 - Wiring connector
D006 - Wiring connector
I016 - Cab key
P002 - Compressor
P003 - From cab to compressor
P007 - 1-pole socket
P009 - 1-pole socket
P010 - Rear 7 pole socket

17.5.6 S006 - Diagnostics and CAN lines

Electrical wiring diagram: Diagnostics and CAN lines

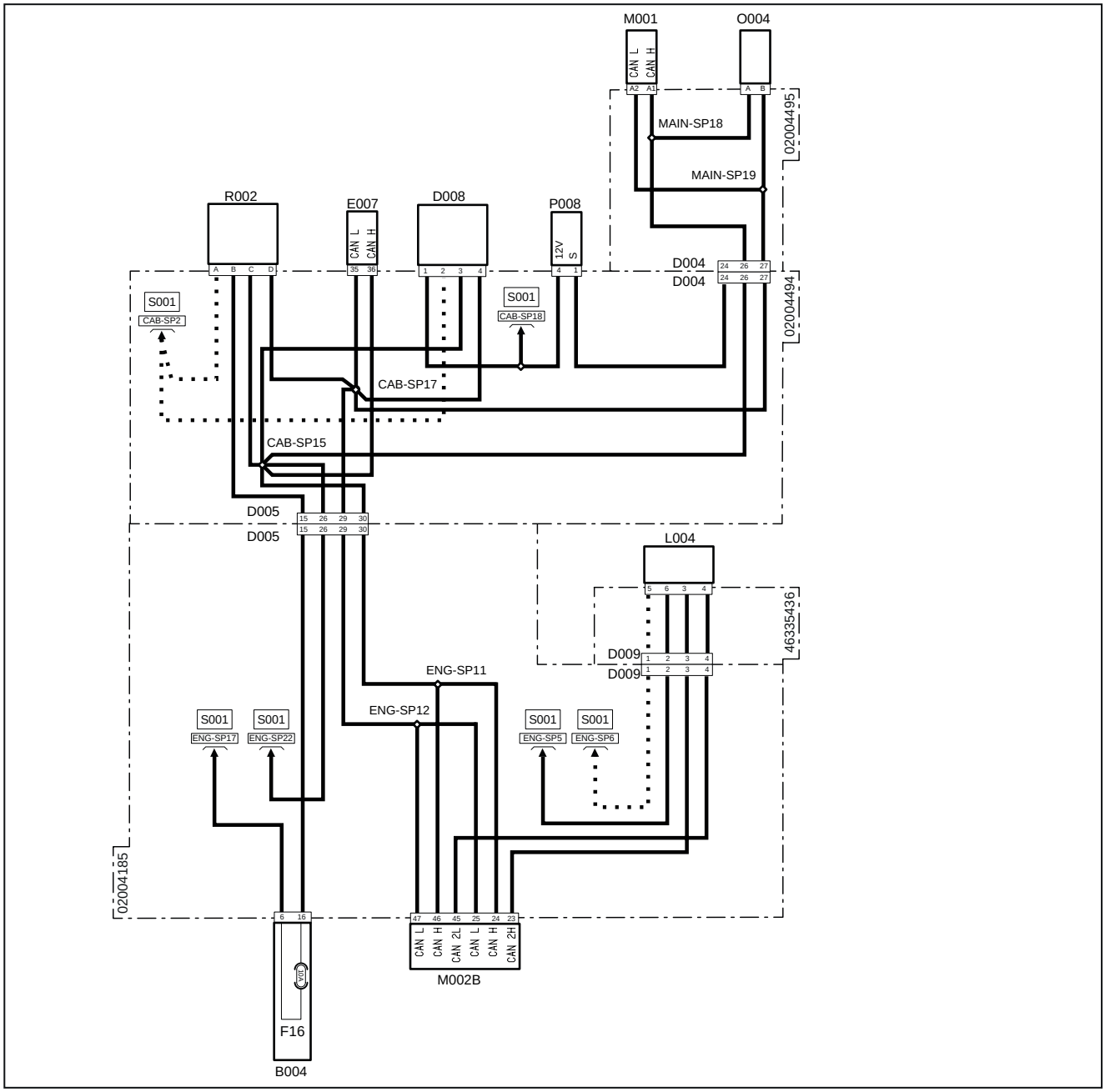

Fig. 17.94

B004 - Fuse box "1"
B004(F16) - Diagnostic socket (10A)
D004 - Wiring connector
D005 - Wiring connector
D008 - Wiring connector for joystick wiring loom
D009 - Wiring connector
E007 - Dashboard
L004 - Exhaust gas recirculation solenoid valve (EGR)
M001 - Vehicle ECU
M002B - Engine control unit
O004 - CAN line termination
P008 - Trailer test (not used)
R002 - Diagnostic port

Location in vehicle: Diagnostics and CAN lines

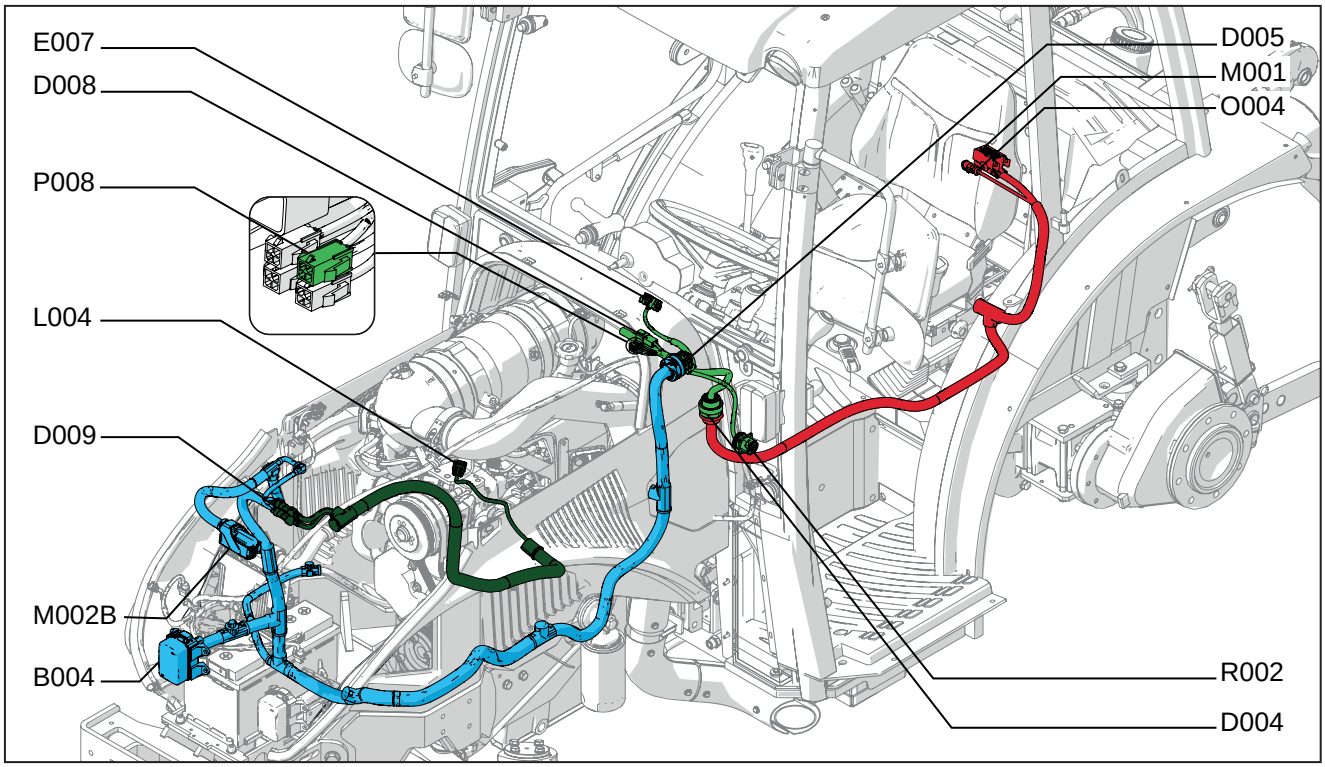

Fig. 17.95

B004 - Fuse box "1"
D004 - Wiring connector
D005 - Wiring connector
D008 - Wiring connector for joystick wiring loom
D009 - Wiring connector
E007 - Dashboard
L004 - Exhaust gas recirculation solenoid valve (EGR)
M001 - Vehicle ECU
M002B - Engine control unit
O004 - CAN line termination
P008 - Trailer test (not used)
R002 - Diagnostic port

17.5.7 S007 - Dashboard

Electrical wiring diagram: Dashboard

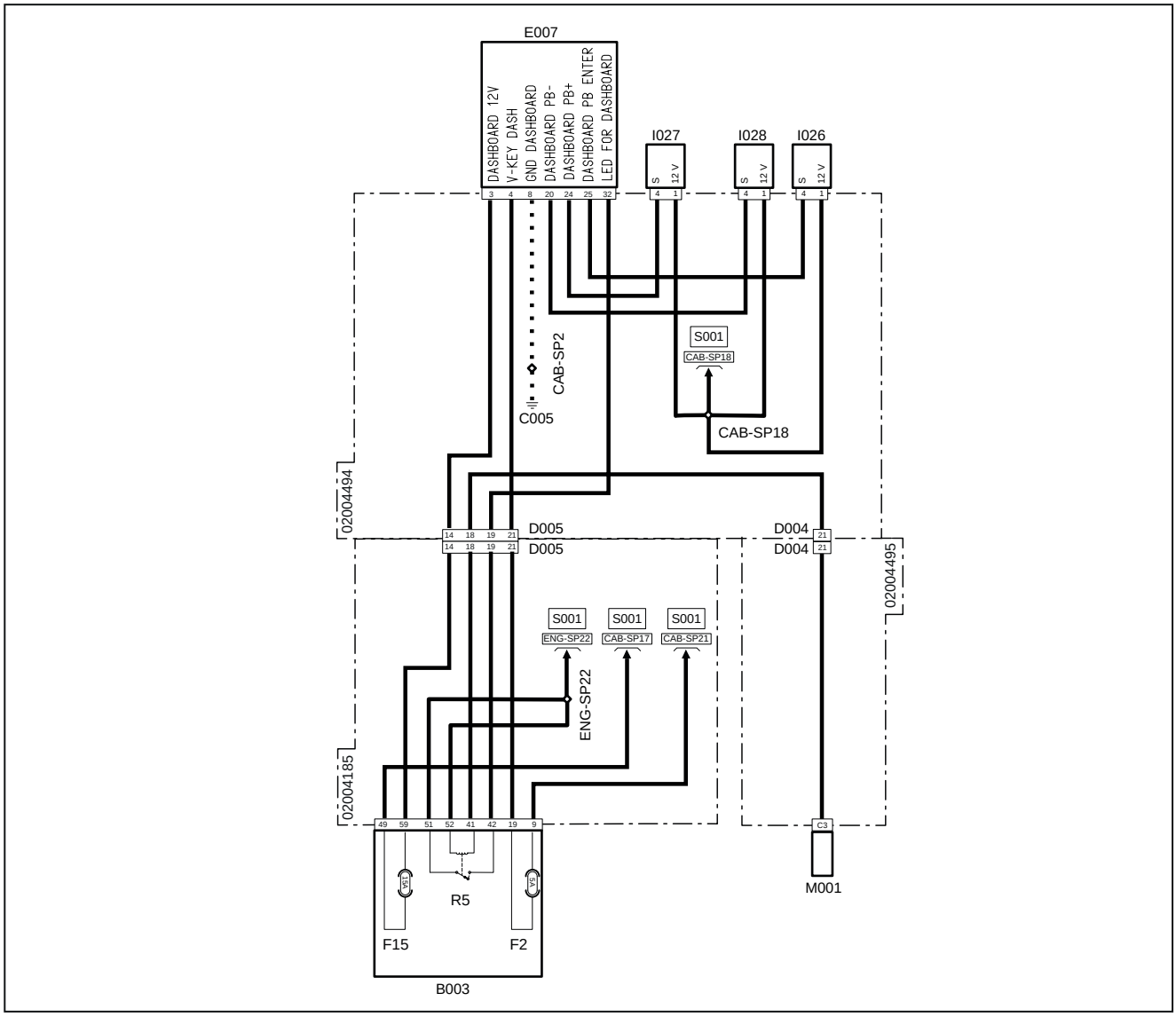

Fig. 17.96

B003 - Fuse box "2"
B003(R5) - Dashboard LED relay
B003(F15) - 12V dashboard power feed (10A)
B003(F2) - Key-on power feed for dashboard (5A)
C005 - Cab ground
D004 - Wiring connector
D005 - Wiring connector
E007 - Dashboard
I026 - ENTER dashboard button
I027 - + dashboard button
I028 - - dashboard button
M001 - Vehicle ECU

Location in vehicle: Dashboard

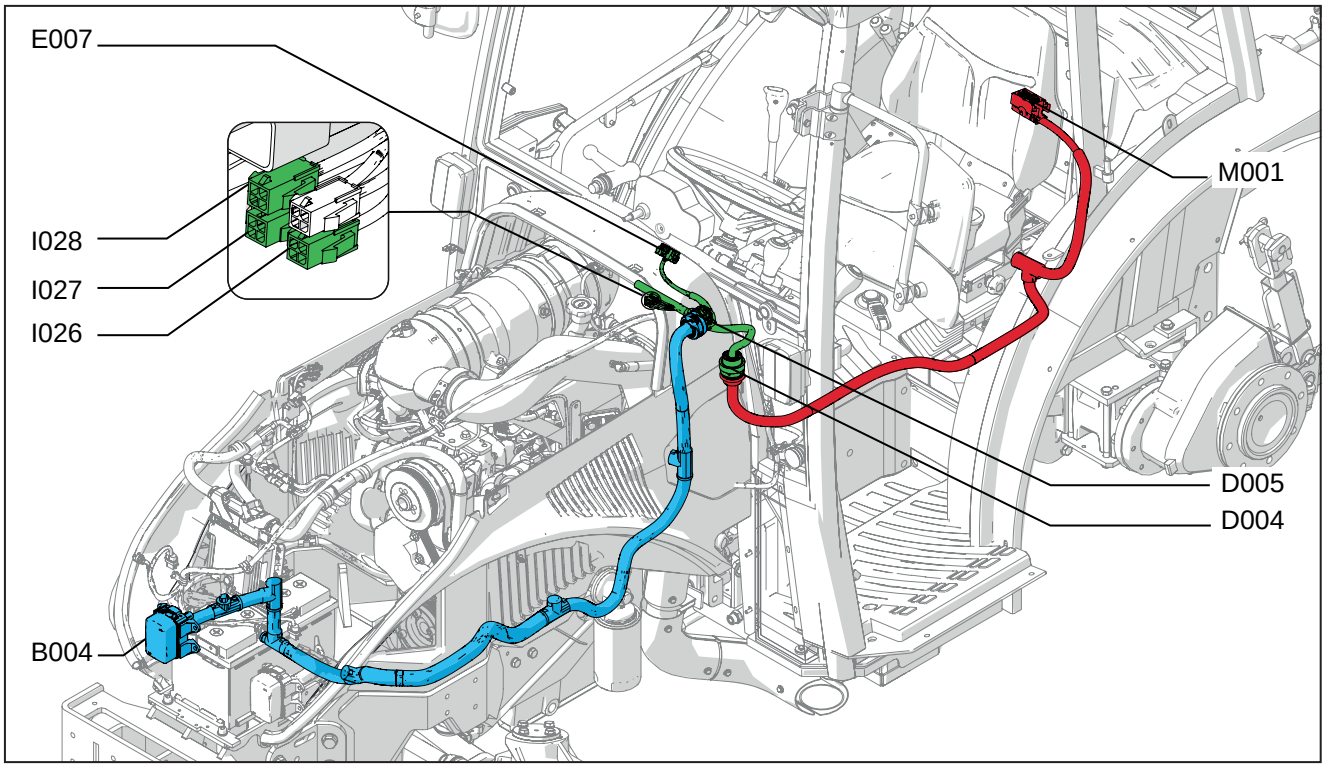

Fig. 17.97

B003 - Fuse box "2"
C005 - Cab ground
D004 - Wiring connector
D005 - Wiring connector
E007 - Dashboard
I026 - ENTER dashboard button
I027 - + dashboard button
I028 - - dashboard button
M001 - Vehicle ECU

17.5.8 S008 - Transmission

Electrical wiring diagram: Transmission

Table 1

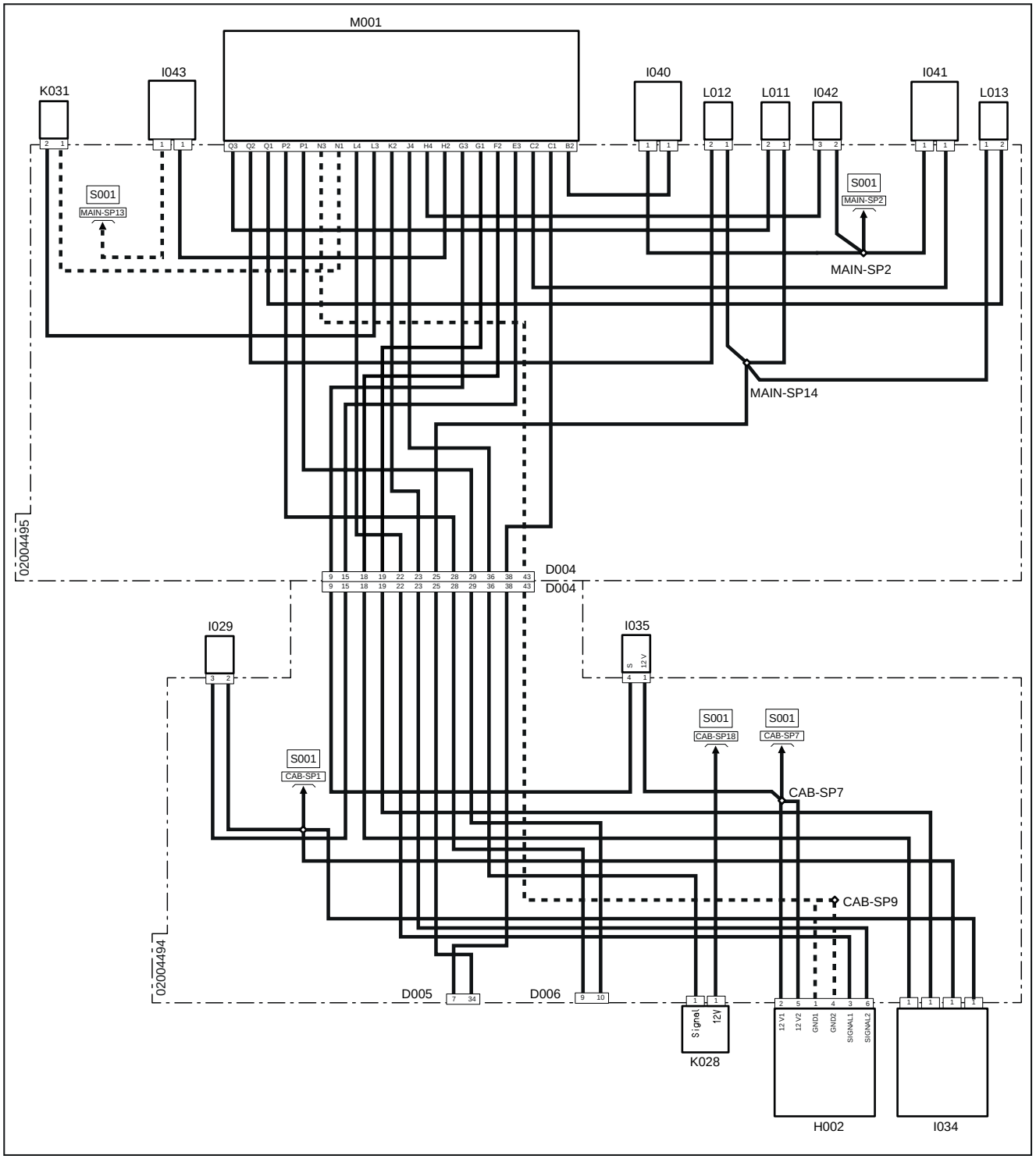

Fig. 17.98

Table 2

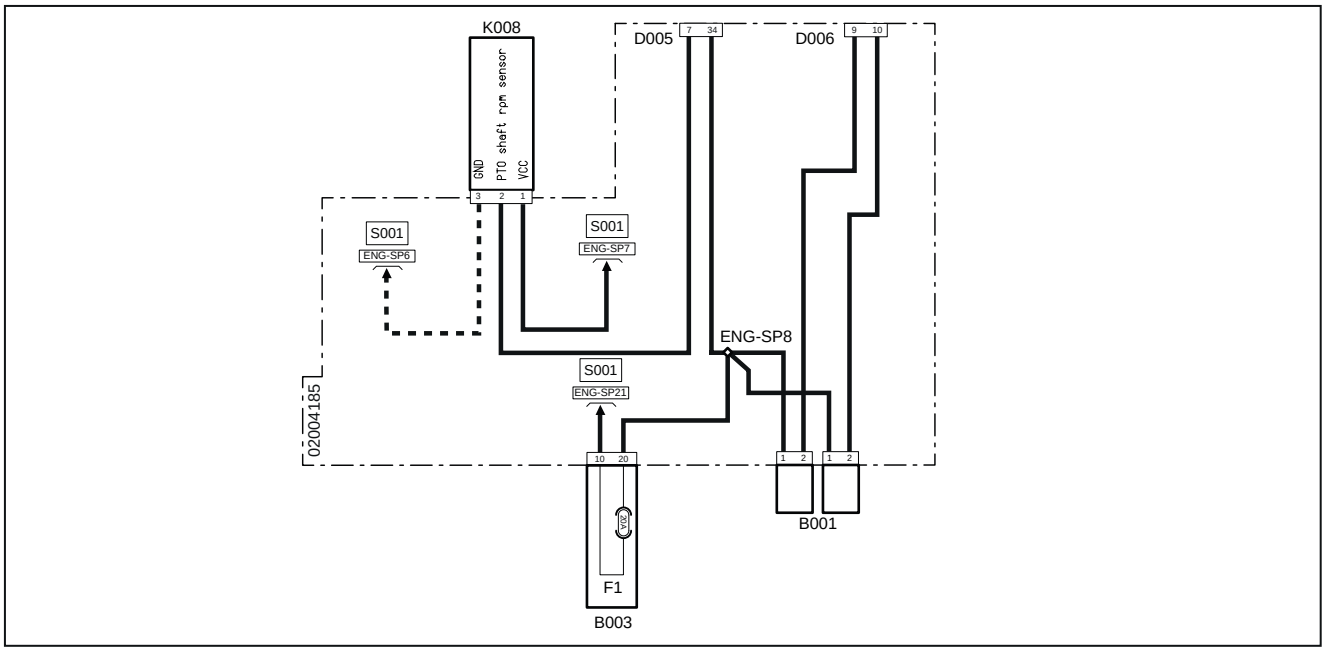

Fig. 17.99

B001 - Front PTO valves
B003 - Fuse box "2"
B003(F1) - Socket - Rotating beacon (20A)
D004 - Wiring connector
D005 - Wiring connector
D006 - Wiring connector
H002 - Hand throttle
I029 - Hydraulic 4WD selector switch
I034 - PTO mode selector
I035 - Auto PTO switch
I040 - H/L Forward lever button
I041 - H/L Reverse lever button
I042 - "Diverter" button
I043 - Rear PTO speed mode selector
K008 - PTO shaft speed sensor
K028 - PTO start enable signal / dashboard indicator signal
K031 - PTO mode sensor
L011 - Differential lock "ON/OFF" solenoid valve
L012 - 4WD "ON/OFF" solenoid valve
L013 - "Diverter" solenoid valve
M001 - Vehicle ECU

Location in vehicle: Transmission

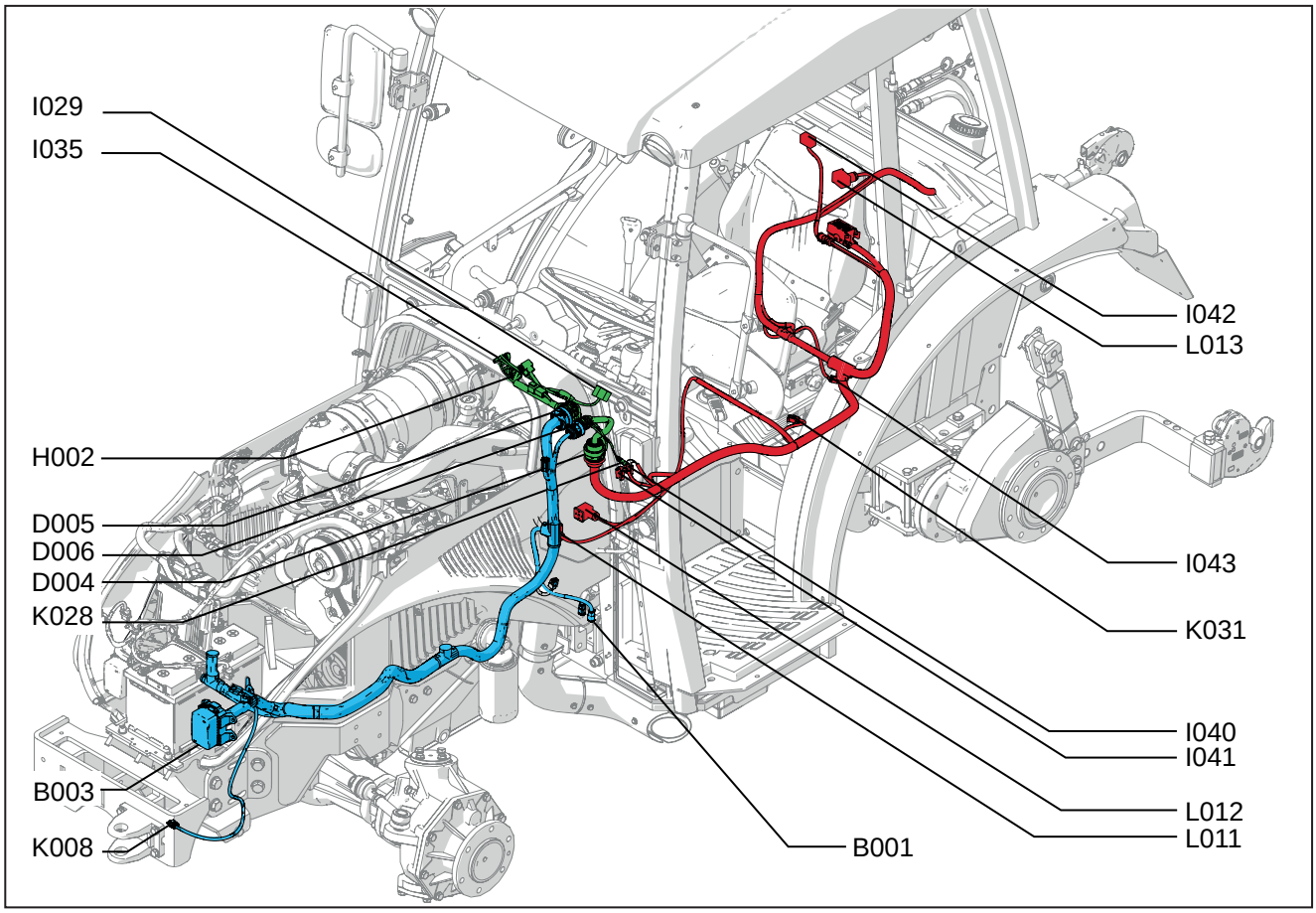

Fig. 17.100

B001 - Front PTO valves
B003 - Fuse box "2"
D004 - Wiring connector
D005 - Wiring connector
D006 - Wiring connector
H002 - Hand throttle
I029 - Hydraulic 4WD selector switch
I034 - PTO mode selector
I035 - Auto PTO switch
I040 - H/L Forward lever button
I041 - H/L Reverse lever button
I042 - "Diverter" button
I043 - Rear PTO speed mode selector
K008 - PTO shaft speed sensor
K028 - PTO start enable signal / dashboard indicator signal
K031 - PTO mode sensor
L011 - Differential lock "ON/OFF" solenoid valve
L012 - 4WD "ON/OFF" solenoid valve
L013 - "Diverter" solenoid valve
M001 - Vehicle ECU

17.5.9 S009 - Brakes

Electrical wiring diagram: Brakes

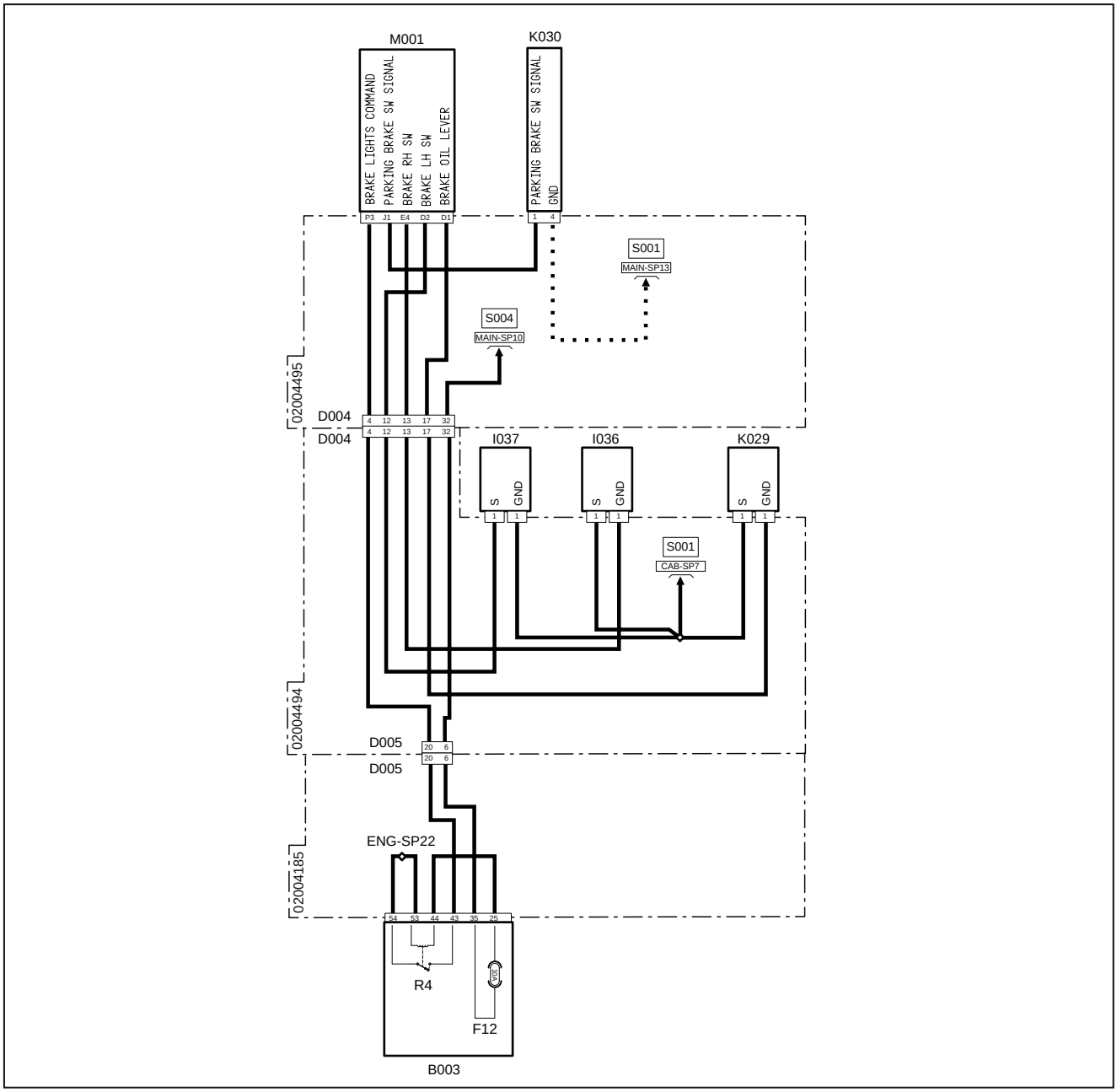

Fig. 17.101

B003 - Fuse box "2"
B003(R4) - Brake light relay
B003(F12) - Brake lights (10A)
D004 - Wiring connector
D005 - Wiring connector
I036 - Right brake pedal switch
I037 - Left brake pedal switch
K029 - Brake oil level sensor
K030 - Park brake start enable signal
M001 - Vehicle ECU

Location in vehicle: Brakes

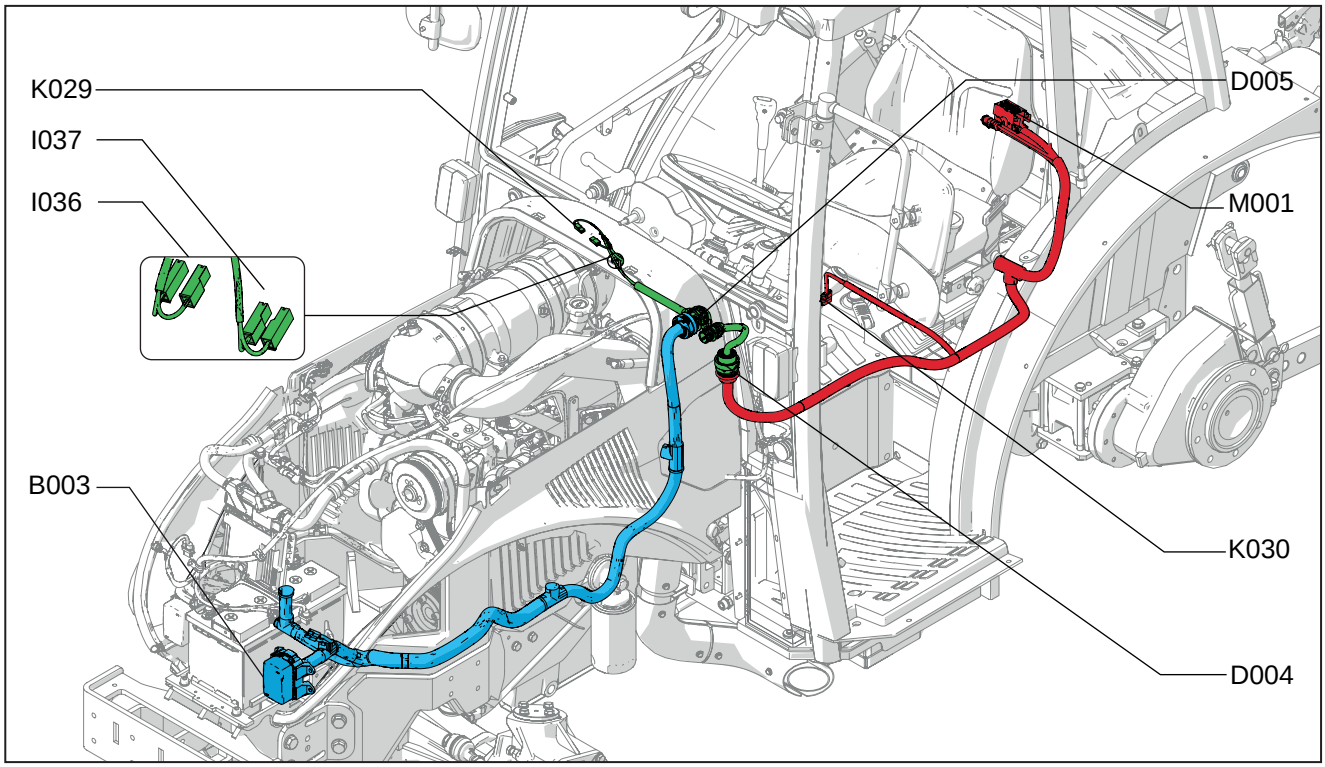

Fig. 17.102

B003 - Fuse box "2"
D004 - Wiring connector
D005 - Wiring connector
I036 - Right brake pedal switch
I037 - Left brake pedal switch
K029 - Brake oil level sensor
K030 - Park brake start enable signal
M001 - Vehicle ECU

17.6 Fuse box

Index

17.6.1 Fuses 17-110

17.6.2 Glow plug fuse and relay 17-110

17.6.3 Fuse box 17-110

17.6.4 GL cab fuse box 17-112

17.6.5 SG1 cab fuse box 17-113

17.6.1 Fuses

All the electrical circuits are protected by fuses. Each fuse bears a label showing its amperage. Use the colour code to distinguish the various types of fuse and easily select the right spare part.

Warning
Identify and resolve the cause of the short circuit before replacing a fuse.

Warning
Do not replace the old fuse with a new one with a higher rated value. This may damage the machine. Contact an authorised service centre if replacement fuses with the correct rating blow continuously.

17.6.2 Glow plug fuse and relay

Located on left hand side of engine.

1	Glow plug relay	-
2	Glow plug fuse	60A

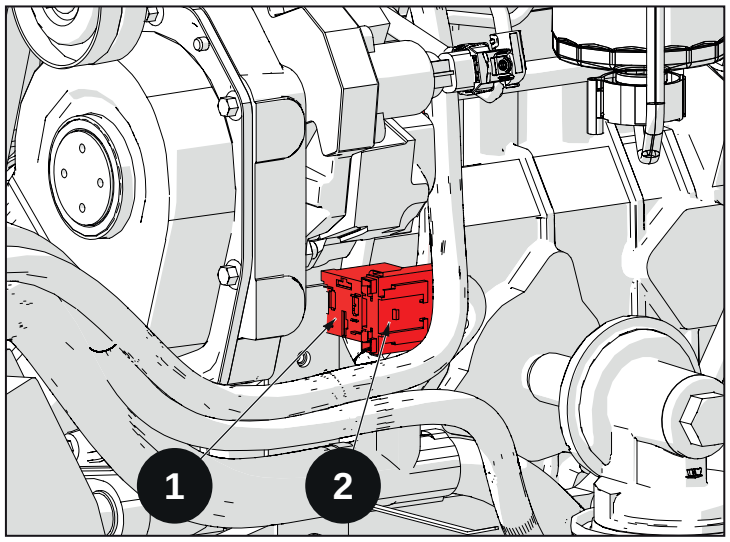

Fig. 17.103

17.6.3 Fuse box

The entire electrical system is protected by dual fuse boxes (1) and (2).

These fuse boxes are situated in front of the engine, to the sides of the battery.

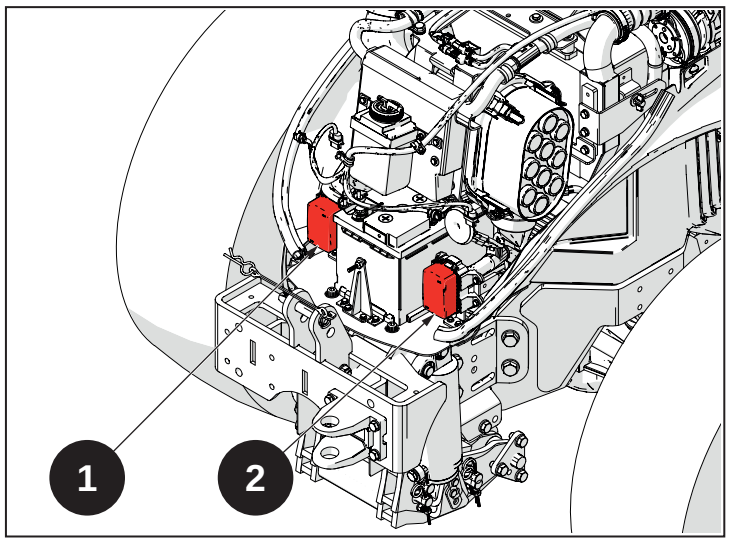

Fig. 17.104

Functions of fuse box (1), figure 17.104:

A	Main relay	30A
B	Main fuse	70A
C	Starter relay	20A
D	Fuel heater	20A
E	Trailer socket	30A
F	Engine control unit (battery)	15A
G	Engine control unit (battery)	10A
H	Accessories	15A
I	Fuel heater	20A
L	Trailer socket	15A
M	Diagnostic port	10A

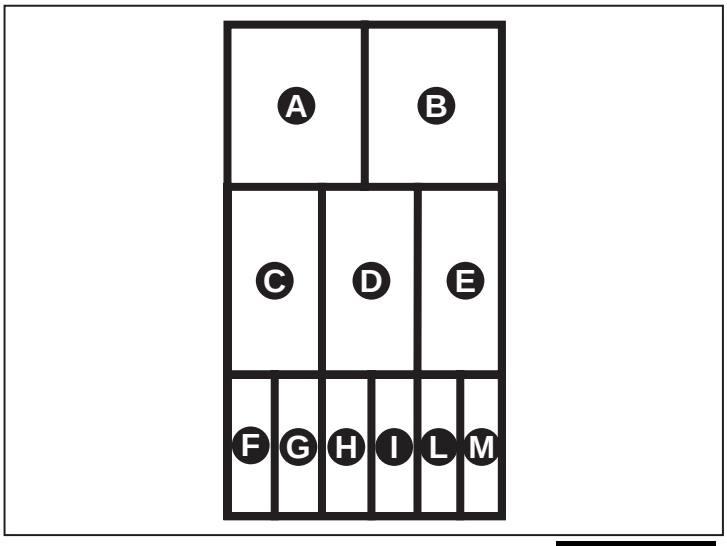

Fig. 17.105

Functions of fuse box (2), figure 17.104:

A	Hazard warning lights	10A
B	Sensor switch	10A
C	Horn, power socket, rotating beacon	20A
D	Dashboard (battery)	10A
E	Turn indicator lights	10A
F	Dashboard (ignition switch)	5A
G	Vehicle ECU (battery)	10A
H	Engine ECU (ignition switch)	5A
I	Vehicle ECU (ignition switch)	5A
L	LH parking light	10A
M	High beam headlights	10A
N	RH parking light	10A
O	LH low beam headlight	10A
P	Brake light	10A
Q	RH low beam headlight.	10A
R	Brake light relay	-
S	Low beam relay	-
T	High beam relay	-
U	Dashboard LED relay	-
V	Start enable relay	-

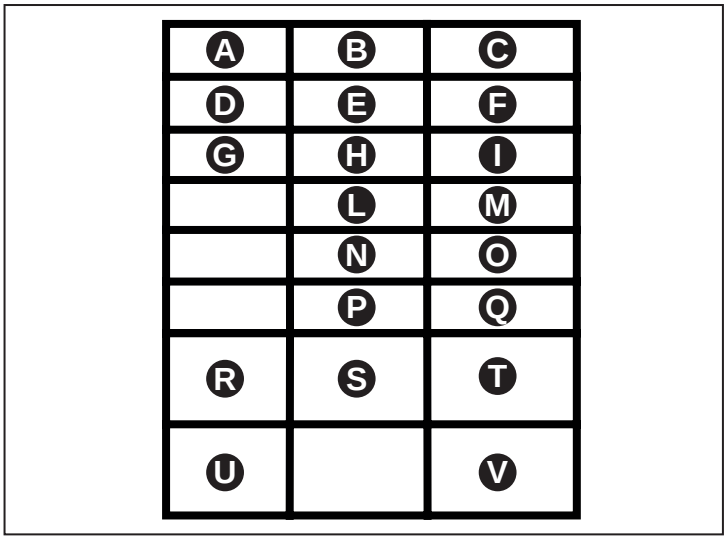

Fig. 17.106

17.6.4 GL cab fuse box

The entire electrical system is protected by a single power circuit fuse box (1).

The fuse box is situated on the right hand side of the roof headliner.

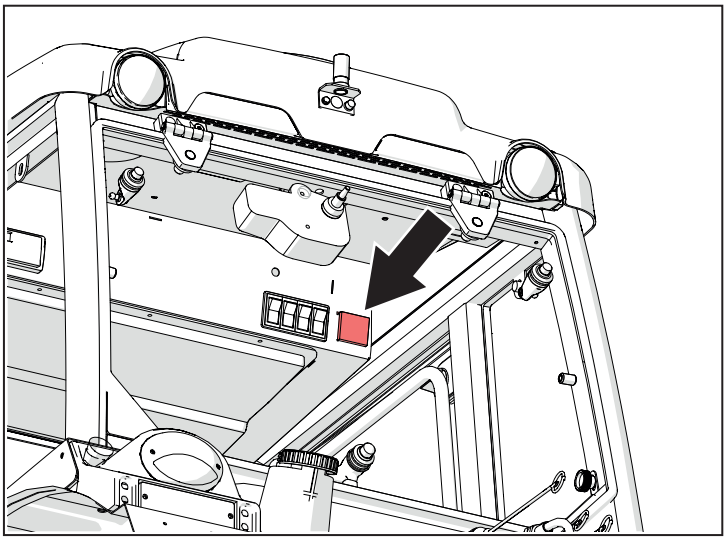

Fig. 17.107

A	Windscreen wiper/washer	7.5A
B	Fan switch Cabin light unit	20A
C	Work light	15A
D	The fan housing/heat exchanger	25A
E	Rear lights	10A
F	Rotating beacon	20A

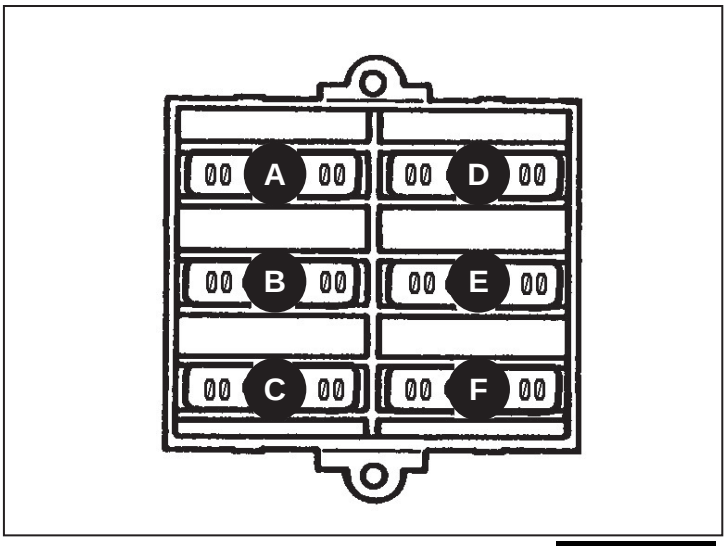

Fig. 17.108

17.6.5 SG1 cab fuse box

The entire electrical system is protected by a single power circuit fuse box (1).

The fuse box is situated in the right hand rear corner of the roof headliner.

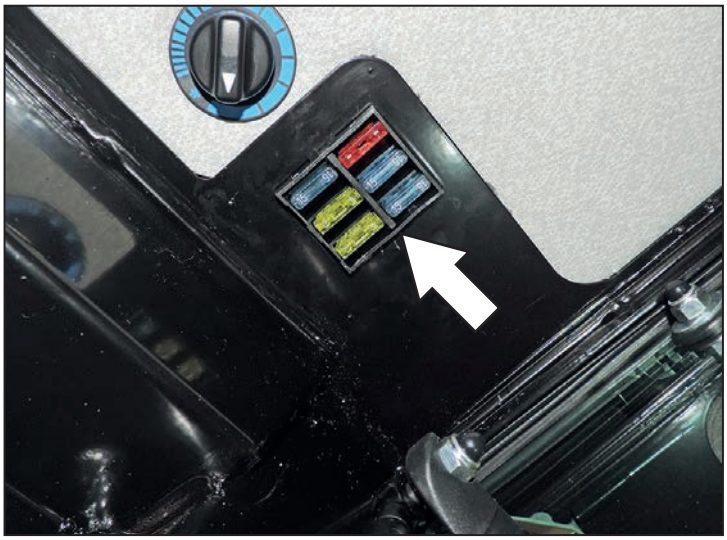

Fig. 17.109

A	Windscreen wiper/washer	10A
B	The fan housing/heat exchanger	15A
C	Work light	15A
D	Fan switch Air conditioner power feed	15A
E	Cabin light unit	30A
F	Compressor	5A

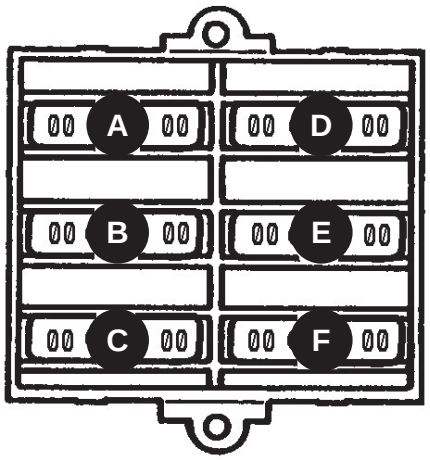

Fig. 17.110

17.7 Error code list

Index

17.7.1 Engine 17-116

17.7.2 Vehicle 17-124

17.7.1 Engine

Error IDN	SPN	FMI	PCODE DESCRIPTION according to SAE-J2012	DESCRIPTION (VM Internal)
3001	27	0	Exhaust Gas Recirculation Temperature Sensor "A" Circuit Range/Performance	Invalid Data Received From Exhaust Gas Recirculation Control
3002	27	1	Invalid Data Received From Exhaust Gas Recirculation Control Module "B"	Exhaust Gas Recirculation Control Circuit Range/Performance
3003	27	2	Exhaust Gas Recirculation "A" Control Circuit Range/Performance	TimeOut from EGR message
3004	27	3	Lost Communication With Exhaust Gas Recirculation Control Module "A"	EGR High battery supply voltage error
3005	27	4	Diesel Particulate Filter Pressure Sensor "A" Circuit Range/Performance	EGR Low battery supply voltage error
3006	27	6	Diesel Particulate Filter Regeneration Frequency	Diagnostic fault check for EGR Over current.
3007	27	7	Diesel Particulate Filter Restriction - Ash Accumulation	EGR low flow
3008	27	11	Diesel particulate filter differential pressure too low Bank 1	Lost communication with EGR module (internal temperature)
3009	27	12	Water in fuel	Exhaust Gas Recirculation Control valve Stuck Closed
3010	27	13	Engine Oil Pressure Too Low	EGR Drive Motor Position Sensor Circuit High
3011	27	17	Turbocharger/Supercharger Wastegate Solenoid "A"	EGR valve stuck closed position
3012	27	18	Manifold Absolute Pressure - Barometric Pressure Correlation	EGR valve stuck open position
3013	27	19	Turbocharger/Supercharger Boost Sensor "A" Circuit High	Lost communication from ECM to EGR
3014	81	0	Exhaust Gas Recirculation "A" Control Circuit Range/Performance	Diesel Particulate Filter overloaded - Soot Accumulation
3015	81	1	Exhaust Gas Recirculation "A" Control Stuck Closed	PFltDiff pressure --> Hoseline error
3016	81	3	Exhaust Gas Recirculation System Performance	Diesel Particulate Filter Regeneration Frequency too high
3017	81	11	Diesel Particulate Filter Pressure Sensor "A" Circuit Range/Performance	Differential pressure sensor --> Fault check for pressure sensor plausibility
3018	81	12	Engine Oil Level Too High	PFltDiff pressure --> Hoseline frozen
3019	97	3	Exhaust Gas Recirculation "A" Control Stuck Open	Water in fuel detection or sensor open load
3020	98	0	Exhaust Gas Recirculation "A" Control Circuit Range/Performance	Lubricant --> Fluidity critical below minimal default oil level
3021	100	0	Exhaust Gas Recirculation "A" Control Circuit Range/Performance	Engine Oil low level
3022	100	1	Exhaust Gas Recirculation "A" Control Circuit High	Engine oil switch not plausible. Oil pressure above 1.8 bar (abs) with engine not running
3023	102	0	High Speed CAN Communication Bus	Intake pressure (P5) above threshold (overpressure)

3024	102	3	Exhaust Gas Recirculation "A" Flow Insufficient Detected	Intake pressure sensor short circuit to battery or open load
3025	102	4	Turbocharger/Supercharger Boost Sensor "A" Circuit Low	Intake pressure sensor short circuit to ground
3026	102	16	Engine Oil Pressure Sensor/Switch Circuit	Manifold Absolute Pressure - Barometric Pressure Correlation
3027	102	18	Manifold Absolute Pressure - Barometric Pressure Correlation	Manifold Absolute Pressure - Barometric Pressure Correlation
3028	105	3	Intake Air Temperature Sensor 2 Circuit High Bank 1	SRC High for Charge air cooler downstream Temperature
3029	105	4	Intake Air Temperature Sensor 2 Circuit Low Bank 1	SRC low for Charge air cooler downstream Temperature
3030	108	3	Barometric Pressure Sensor "A" Circuit High	Ambient pressure sensor SRC high
3031	108	4	Barometric Pressure Sensor "A" Circuit Low	Ambient pressure sensor SRC low
3032	110	0	Engine Coolant Temperature Sensor 1 Circuit Range/Performance	Engine coolant over temperature
3033	110	3	Engine Coolant Temperature Sensor 1 Circuit High	Coolant Trremperature sensor --> raw signal above maximum threshold
3034	110	4	Engine Coolant Temperature Sensor 1 Circuit Low	Coolant Trremperature sensor --> raw signal below minimum threshold
3035	131	0	Diesel particulate filter differential pressure too high Bank 1	Diesel particulate filter differential pressure too high DPF overloaded.
3036	131	1	Diesel particulate filter differential pressure too low Bank 1	Diesel particulate filter differential pressure too low Internal substrate failure
3037	131	3	Diesel Particulate Filter Pressure Sensor "A" Circuit High	DPF Differential pressure sensor --> SRC max
3038	131	4	Diesel Particulate Filter Pressure Sensor "A" Circuit Low	DPF Differential pressure sensor --> SRC min
3039	157	0	Fuel Rail/System Pressure - Too Low	Rail pressure --> maximum positive deviation exceeded
3040	157	2	Fuel Rail/System Pressure - Too High	Rail pressure --> maximum negative rail pressure deviation with metering unit on lower limit is exceeded
3041	157	4	Fuel Rail/System Pressure - Too High	Rail pressure --> maximum positive deviation exceeded
3042	157	12	Fuel Rail/System Pressure - Too Low	Rail pressure --> minimum positive deviation exceeded
3043	164	3	Fuel Rail Pressure Sensor "A" Circuit High	Rail pressure sensor --> max. voltageSRC
3044	164	4	Fuel Rail Pressure Sensor "A" Circuit Low	Rail pressure sensor --> min. SRC voltage
3045	164	12	Fuel Rail Pressure Sensor "A" Circuit Intermittent/Erratic	rail pressure --> pressure gradient too excessive
3046	164	16	Fuel Rail Pressure Sensor "A" Circuit Range/Performance	Rail pressure --> raw value is above maximum offset
3047	164	18	Fuel Rail Pressure Sensor "A" Circuit Range/Performance	Rail pressure --> raw value is below minimum offset
3048	168	3	System Voltage High	System Voltage High
3049	168	4	System Voltage Low	System Voltage Low

3050	171	3	Ambient Air Temperature Sensor Circuit High	Ambient temp --> SRC Max
3051	171	4	Ambient Air Temperature Sensor Circuit Low	Ambient temp --> SRC Min
3052	174	3	Fuel Temperature Sensor "A" Circuit High	Fuel temperature sensor --> short to battery or open load
3053	174	4	Fuel Temperature Sensor "A" Circuit Low	Fuel temperature sensor --> short to ground
3054	190	1	Crankshaft Position Sensor "A" Circuit Range/Performance	Crankshaft signal diagnose --> disturbed signal
3055	190	5	Crankshaft Position Sensor "A" Circuit	Crankshaft signal diagnose --> no signal
3056	228	0	Crankshaft Position - Camshaft Position Correlation Bank 1 Sensor A	Camshaft signal diagnose --> offset angle exceeded
3057	275	13	Internal Control Module Fuel Injector Control Performance	Internal Control Module Fuel Injector Control Performance
3058	412	3	Exhaust Gas Recirculation Temperature Sensor "A" Circuit High	SRC high for EGR cooler downstream temperature sensor
3059	412	4	Exhaust Gas Recirculation Temperature Sensor "A" Circuit Low	SRC low for EGR cooler downstream temperature sensor
3060	627	2	Internal Control Module Main Processor Performance	Operation Condition of WDA/ABE shut-off --> Diagnostic fault check to report "WDA active" due to errors in query-/response communication
3061	627	3	Internal Control Module Main Processor Performance	Operation Condition of WDA/ABE shut-off --> Diagnostic fault check to report "ABE active" due to overvoltage detection
3062	627	4	Internal Control Module Main Processor Performance	Operation Condition of WDA/ABE shut-off --> Diagnostic fault check to report "ABE active" due to undervoltage detection
3063	627	12	Internal Control Module Main Processor Performance	Operation Condition of WDA/ABE shut-off --> Diagnostic fault check to report "WDA or ABE active" due to unknown reason
3064	628	2	Internal Control Module EEPROM Error	EEP Write Error based on the error for more blocks
3065	628	3	Internal Control Module EEPROM Error	EEP Erase Error based on the error for more blocks
3066	628	4	Internal Control Module EEPROM Error	EEP Read Error based on the error for more blocks
3067	629	0	Internal Control Module Torque Performance	Monitoring level 2 --> Diagnosis of set path limitation forced by ECU
3068	629	3	Actuator Supply Voltage "A" Circuit High	Monitoring function --> Reported OverVoltage of Supply
3069	629	4	Actuator Supply Voltage "A" Circuit Low	Monitoring function --> Reported UnderVoltage of Supply
3070	629	11	Control Module Performance	Visibility of SoftwareResets in DSM
3071	629	12	Control Module Performance	Visibility of SoftwareResets in DSM
3072	629	13	Control Module Performance	Visibility of SoftwareResets in DSM

3073	629	14	Internal Control Module A/D Processing Performance	Internal Control Module A/D Processing Performance
3074	630	2	Internal Control Module Fuel Injector Control Performance	Monitoring Function --> Plausib error between level 1 energizing time and level 2 information
3075	630	4	Internal Control Module Fuel Injector Control Performance	Monitoring Function --> non plausib in ZFC
3076	630	5	Internal Control Module Engine RPM Performance	Monitoring Function --> Engine speed error
3077	630	6	Internal Control Module Fuel Injector Control Performance	Monitoring Function --> plausib error between the injection begin and injection type
3078	630	7	Injector/Injection Timing Control Circuit	Monitoring Function --> error due to overrun
3079	630	8	Internal Control Module Torque Performance	Monitoring level 2 --> Diagnosis of curr path limitation forced by ECU
3080	630	10	Internal Control Module Torque Calculation Performance	Monitoring Function --> plaus error in rail pressure monitoring
3081	630	11	Internal Control Module Fuel Injector Control Performance	Monitoring Function --> Diagnosis fault check to report the error to demand for an ICO due to an error in the PoI3 efficiency factor
3082	630	12	Internal Control Module Torque Calculation Performance	Monitoring Function --> error due to torque comparison
3083	630	13	Internal Control Module Vehicle Speed Performance	Internal Control Module Vehicle Speed Performance
3084	630	15	Internal Control Module Fuel Injector Control Performance	Monitoring Function --> Diagnosis fault check to report the error to demand for an ICO due to an error in the PoI2 shut-off
3085	630	16	Internal Control Module Fuel Injector Control Performance	Monitoring Function --> error due to quantity correction
3086	630	17	Internal Control Module Torque Calculation Performance	Internal Control Module Torque Calculation Performance
3087	630	19	Internal Control Module Torque Performance	Monitoring level 2 --> Diagnosis of lead path limitation forced by ECU
3088	630	21	Internal Control Module Fuel Injector Control Performance	Monitoring Function --> Diagnosis fault check to report the demand for normal mode due to an error in the PoI2 quantity
3089	631	0	Internal Control Module Fuel Injector Control Performance	Internal Control Module Fuel Injector Control Performance
3090	631	1	Internal Control Module A/D Processing Performance	ADC Monitoring --> Implausible ADC test errors
3091	631	2	Internal Control Module A/D Processing Performance	ADC Monitoring --> Implausible voltage ratio
3092	631	3	Internal Control Module A/D Processing Performance	Query-response communic Monitoring --> Error in the plausibility of the function controller and the monitoring module
3093	631	4	Internal Control Module Read Only Memory (ROM) Error	Monitoring ROM check --> multiple error in complete ROM-test during postdrive detected

3094	631	5	Internal Control Module A/D Processing Performance	Monitoring of redundant shut-off paths --> Error during the execution of the shut-off path test; uncertain cause (defective injector or shut-off path)
3095	631	6	Internal Control Module A/D Processing Performance	Monitoring of redundant shut-off paths --> Error trying to set MM Response time
3096	631	7	Internal Control Module A/D Processing Performance	Monitoring of redundant shut-off paths --> Error detected in the SPI communication
3097	631	8	Internal Control Module A/D Processing Performance	Monitoring of redundant shut-off paths --> Error in the check of the shut-off path test of the under voltage detection
3098	631	9	Internal Control Module A/D Processing Performance	Monitoring of redundant shut-off paths --> Error in the check of the shut-off path of the monitoring module
3099	631	10	Internal Control Module A/D Processing Performance	Monitoring of redundant shut-off paths --> Time out error trying to set or cancelling the alarm task
3100	631	11	Internal Control Module A/D Processing Performance	Monitoring of redundant shut-off paths --> Error during positive test
3101	631	12	Serial Communication Link	Query-response communic Monitoring --> interrupted SPI communication
3102	631	13	Internal Control Module A/D Processing Performance	Monitoring of redundant shut-off paths --> Error in the check of the shut-off path test of the over voltage detection
3103	631	14	Internal Control Module A/D Processing Performance	Internal Control Module A/D Processing Performance
3104	631	15	Internal Control Module A/D Processing Performance	Monitoring of redundant shut-off paths --> Too less bytes received by MM from CPU as response
3105	631	18	Internal Control Module A/D Processing Performance	Monitoring of redundant shut-off paths --> Time out error trying to set or cancelling the alarm task
3106	632	0	Internal Control Module Fuel Injector Control Performance	Injection cut off demand (ICO) for shut off coordinator
3107	634	0	Internal Control Module Throttle Actuator Controller Performance	Intake Throttle valve stuck
3108	634	1	Internal Control Module Throttle Actuator Controller Performance	Intake Throttle valve feedback line open load or short circuit
3109	634	2	Internal Control Module Throttle Actuator Controller Performance	Intake Throttle valve feedback line not plausible during initialization
3110	634	3	Throttle Actuator "A" Control Motor Circuit High	Intake Throttle valve short circuit to battery
3111	634	4	Throttle Actuator "A" Control Motor Circuit Low	Intake Throttle valve SCG
3112	634	5	Throttle Actuator "A" Control Motor Circuit/Open	Intake Throttle valve open load circuit
3113	634	6	Throttle Actuator "A" Control Motor Circuit Range/Performance	Intake Throttle valve Over Temperature
3114	639	3	Vehicle Communication Bus A	CAN Bus Off node A - active error
3115	639	4	Vehicle Communication Bus A	CAN Bus Off node A - passive error

3116	641	0	Turbocharger/Supercharger "A" Underboost Condition	PCR underboost
3117	641	1	Turbocharger/Supercharger "A" Overboost Condition	PCR overboost
3118	651	3	Cylinder 1 Injector Circuit High	A general cylinder short circuit is detected by the pattern detection
3119	651	4	Cylinder 1 Injector Circuit Low	A HS/LS short circuit is detected by the pattern detection
3120	651	5	Injector Circuit/Open - Cylinder 1	An open load error is detected by the pattern detection
3121	651	13	Cylinder 1 Injector Data Incompatible	Monitoring for missing or faulty programming of the injector adjustment values (%= cylinder index)
3122	652	3	Cylinder 2 Injector Circuit High	A general cylinder short circuit is detected by the pattern detection
3123	652	4	Cylinder 2 Injector Circuit Low	A HS/LS short circuit is detected by the pattern detection
3124	652	5	Injector Circuit/Open - Cylinder 2	An open load error is detected by the pattern detection
3125	652	13	Cylinder 2 Injector Data Incompatible	Monitoring for missing or faulty programming of the injector adjustment values (%= cylinder index)
3126	653	3	Cylinder 3 Injector Circuit High	A general cylinder short circuit is detected by the pattern detection
3127	653	4	Cylinder 3 Injector Circuit Low	A HS/LS short circuit is detected by the pattern detection
3128	653	5	Injector Circuit/Open - Cylinder 3	An open load error is detected by the pattern detection
3129	653	13	Cylinder 3 Injector Data Incompatible	Monitoring for missing or faulty programming of the injector adjustment values (%= cylinder index)
3130	654	3	Cylinder 4 Injector Circuit High	A general cylinder short circuit is detected by the pattern detection
3131	654	4	Cylinder 4 Injector Circuit Low	A HS/LS short circuit is detected by the pattern detection
3132	654	5	Injector Circuit/Open - Cylinder 4	An open load error is detected by the pattern detection
3133	654	13	Cylinder 4 Injector Data Incompatible	Monitoring for missing or faulty programming of the injector adjustment values (%= cylinder index)
3134	657	0	Fuel Injector Group "A" Supply Voltage Circuit High	Piezo injector Bank 0 --> short circuit
3135	657	1	Fuel Injector Group "B" Supply Voltage Circuit High	Piezo injector Bank 1 --> short circuit
3136	677	0	Starter Relay Circuit	Defective T50 switch
3137	677	1	Starter Relay Circuit Low	Starter relay over current
3138	677	3	Starter Relay Circuit High	Starter relay high side short circuit to battery
3139	677	4	Starter Relay Circuit High	Starter relay high side short circuit to ground
3140	677	5	Starter Relay Circuit Low	Starter relay low side open load circuit
3141	677	15	Starter Relay Circuit Low	Starter relay low side short to battery

3142	677	16	Starter Relay Circuit Low	Starter relay low side short to ground
3143	723	0	Camshaft Position Sensor "A" Circuit Bank 1 or Single Sensor	Camshaft signal diagnose --> disturbed signal
3144	723	1	Camshaft Position Sensor "A" Circuit Range/Performance Bank 1 or Single Sensor	Camshaft signal diagnose --> no signal
3145	898	0	Lost Communication With Vehicle Dynamics Control Module	TSC1 Rx message time out error
3146	898	2	Lost Communication With Vehicle Dynamics Control Module	TSC1VE Rx message passive error
3147	898	3	Lost Communication With Vehicle Dynamics Control Module	TSC1VE Rx message active error
3148	898	12	Lost Communication With Vehicle Dynamics Control Module	TSC1 Rx message DLC error
3149	1079	0	Sensor Reference Voltage "A" Circuit/ Open	Error Sensor supplies 1
3150	1079	1	Sensor Reference Voltage "B" Circuit/ Open	Error Sensor supplies 2
3151	1079	2	Sensor Reference Voltage "C" Circuit/ Open	Error Sensor supplies 3
3152	1180	3	Exhaust Gas Temperature Sensor Circuit High Bank 1 Sensor 1	Temperature sensor upstream turbine voltage above threshold high
3153	1180	4	Exhaust Gas Temperature Sensor Circuit Low Bank 1 Sensor 1	Temperature sensor upstream turbine voltage below threshold low
3154	1209	0	Exhaust Pressure Sensor "A" Circuit Range/Performance	Exhaust pressure sensor Ds turbine drifted compare to ambient pressure.
3155	1209	1	Exhaust Pressure Sensor "A" Circuit Range/Performance	Exhaust pressure sensor Ds turbine drifted compare to ambient pressure.
3156	1209	3	Exhaust Pressure Sensor "A" Circuit High	Exhaust pressure sensor Ds turbine short circuit to battery or open load.
3157	1209	4	Exhaust Pressure Sensor "A" Circuit Low	Exhaust pressure sensor Ds turbine short circuit to ground.
3158	1231	3	Vehicle Communication Bus B	CAN Bus Off node B - active error
3159	1231	4	Vehicle Communication Bus B	CAN Bus Off node B - passive error
3160	1347	0	Injection Pump Fuel Metering Control "A" (Cam/Rotor/Injector)	Metering Unit --> Error check for loose contact between metering unit (MeUn) and ECU
3161	1347	3	Injection Pump Fuel Metering Control "A" High (Cam/Rotor/Injector)	Metering Unit --> SCB
3162	1347	4	Injection Pump Fuel Metering Control "A" Low (Cam/Rotor/Injector)	Metering Unit --> SCG
3163	1347	5	Injection Pump Fuel Metering Control "A" (Cam/Rotor/Injector)	Metering Unit --> OL
3164	1347	12	Injection Pump Fuel Metering Control "A" Range/Performance (Cam/Rotor/ Injector)	Metering Unit --> Over Temperature
3165	1485	4	ECM/PCM Power Relay Control Circuit/Open	Main relay --> Stuck
3166	1485	5	ECM/PCM Power Relay De-Energized Performance - Too Early	Main relay --> Early opening defect
3167	3058	5	Exhaust Gas Recirculation "A" Control Circuit	EGR Drive Motor terminal open error (internal error)

3168	3241	3	Catalyst Temperature Sensor Circuit High Bank 1 Sensor 1	Oxidation Catalyst upstream temperature sensor --> SRC max
3169	3241	4	Catalyst Temperature Sensor Circuit Low Bank 1 Sensor 1	Oxidation Catalyst upstream temperature sensor --> SRC min
3170	3242	3	Catalyst Temperature Sensor Circuit High Bank 1 Sensor 2	Temperature sensor upstream DPF --> SRC max
3171	3242	4	Catalyst Temperature Sensor Circuit Low Bank 1 Sensor 2	Temperature sensor upstream DPF voltage below threshold low
3172	4752	0	Exhaust Gas Recirculation Cooling System Performance	Low EGR cooler efficiency
3173	4754	0	Catalyst System Efficiency Below Threshold Bank 1	The calculated conversion rate of the DOC is lower than the limiting value or the inlet/outlet DOC temperature sensor are Swappped
3174	5571	0	Fuel Pressure Regulator 2 Performance	Fuel Pressure Regulator 2 Performance
3175	5571	1	Fuel Pressure Regulator 2 Performance	Fuel Pressure Regulator 2 Performance
3176	5571	2	Fuel Pressure Regulator 2 Performance	Fuel Pressure Regulator 2 Performance
3177	5571	3	Fuel Pressure Regulator 2 Performance	Opened pressure relief valve.
3178	5571	4	Fuel Rail/System Pressure - Too High	Monitoring for maximum rail pressure in limp home mode with PRV.
3179	5571	6	Fuel Pressure Regulator 2 Performance	Open time of PRV for over pressure monitoring had exceeded
3180	5571	12	Fuel Pressure Regulator 2 Performance	Fuel Pressure Regulator 2 Performance
3181	5571	13	Fuel Pressure Regulator 2 Performance	Force Opening of PRV with a Pressure shock is not possible because in RED corridor.
3182	5765	15	Exhaust Gas Recirculation Sensor "B" Circuit Low	Diagnostic fault check for EGR high internal temperature thermistor failure
3183	5765	16	Exhaust Gas Recirculation "A" Control Circuit Range/Performance	Diagnostic fault check for EGR low internal temperature thermistor failure
3184	5829	15	Exhaust Gas Recirculation System Performance	Maximum deviation of EGR valve duty cycle
3185	5829	16	Exhaust Gas Recirculation System Performance	Minimum deviation of EGR valve duty cycle

17.7.2 Vehicle

Error IDN	SPN	FMI	PCODE DESCRIPTION according to SAE-J2012	INTERNAL DESCRIPTION
1001	170	0	Temperature of air inside the part of the vehicle that encloses the driver and vehicle operating controls.	High Temperature of ECU
1002	170	1	Temperature of air inside the part of the vehicle that encloses the driver and vehicle operating controls.	Low Temperature of ECU
1003	168	0	Measured electrical potential of the battery.	High Voltage of BATTERY
1004	168	1	Measured electrical potential of the battery.	Low Voltage of BATTERY
1005	3509	0	Sensor ECU supply voltage 1	High Voltage of SENSORS
1006	3509	1	Sensor ECU supply voltage 1	Low Voltage of SENSORS
1007	520192	31		Boot request of HW_BOOT
1008	520193	31		Boot request of SW_BOOT
1009	520194	31		Bus off of CAN0_BUS
1010	520195	31		Wd ECU of ECU
1011	520196	31		Lvd of ECU
1012	520197	31		Csv of ECU
1013	96	3	Ratio of volume of fuel to the total volume of fuel storage container.	High Level of FUEL
1014	96	4	Ratio of volume of fuel to the total volume of fuel storage container.	Low Level of FUEL
1015	3645	6		Overload of AWD
1016	3645	5		Open circuit of AWD
1017	569	6	State used which indicates the condition of the rear axle 1 differential lock.	Overload of DiffLock
1018	569	5	State used which indicates the condition of the rear axle 1 differential lock.	Opencircuit of D
1019	904	8	The average speed of the two front wheels.	Abnormal frequency of RPM
1020	91	3	The ratio of actual position of the analog engine speed/torque request input device to the maximum position of the input device.	Stb _pedal1 of ACC
1021	91	4	The ratio of actual position of the analog engine speed/torque request input device to the maximum position of the input device.	Stg _pedal1 of ACC
1022	29	3	The ratio of actual position of the second analog engine speed/torque request input device to the maximum position of the input device.	Stb _pedal2 of ACC
1023	29	4	The ratio of actual position of the second analog engine speed/torque request input device to the maximum position of the input device.	Stg _pedal2 of ACC

1024	91	2	The ratio of actual position of the analog engine speed/torque request input device to the maximum position of the input device.	Incorrect DATA of ACC
1025	29	2	The ratio of actual position of the second analog engine speed/torque request input device to the maximum position of the input device.	Incorrect DATA of ACC
1026	1504	2		Invalid Seat_Switch_Status of SEAT
1027	626	2	Devices that assist an Engine in starting, e.g. intake heaters and ether. Primary starting aid. Parameter indicating whether the start enable device 1 is ON or OFF	Invalid Start_Enab_Sens of START
1028	708	6	Identifies the current status of auxiliary input/output functions that are configured uniquely per application.	Overload of DIVERTER
1029	708	5	Identifies the current status of auxiliary input/output functions that are configured uniquely per application.	Opencircuit of DIVERTER
1030	707	6	Identifies the current status of auxiliary input/output functions that are configured uniquely per application.	Overload of TRAILER Brake
1031	707	5	Identifies the current status of auxiliary input/output functions that are configured uniquely per application.	Opencircuit of Trailer Brake
1032	167	4	Electrical potential measured at the charging system output. The charging system may be any device charging the batteries. This includes alternators, generators, solid state charger and other charging devices.	Alternator not Charging
1033	524287	13		Anti-tamper
1033	524286	19		No VCU configuration

1 : Troubleshooting

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Engine control unit (ECU)

3001 - Incorrect message via CAN BUS between EGR and ECU

Description of fault

The control unit detects communication error on CAN Bus line between EGR and ECU engine control unit

Severity of error

Medium

Additional information

Amber lamp illuminated

Generic CAN Bus line fault icon displayed on multifunction instrument screen, accompanied by buzzer.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check that the connectors of the EGR valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect the connectors and reconnect correctly
- If all the connectors are fitted and connected correctly, proceed to the next step

2 - Check the condition of the CAN Bus communication pins of the engine control unit
- Disconnect the respective connectors
- Check that the contact surfaces of the pins are in good condition
- In no damage or corrosion are found, proceed to the next step

3 - Check that the resistance measured on the CAN Bus line is 60 Ohm
- Disconnect the connectors and measure the resistance of the wiring loom with a tester applied to the pins of the CAN Bus line. If the value measured is not 60 Ohm, the line is not working correctly.
- If the value measured is 60 Ohm, the line is working correctly: proceed to the next step

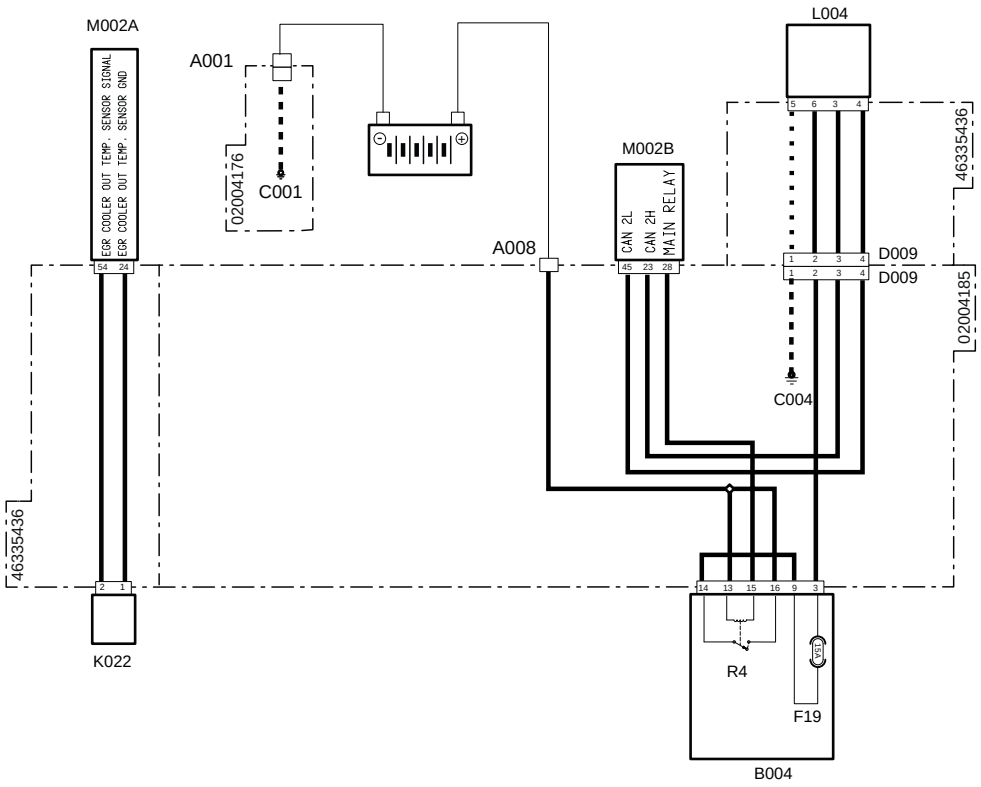
4 - Check the general condition of the CAN Bus line - check that there are no disconnected cables and that all the resistors are fitted correctly.
- Inspect the entire length of all the cables of the wiring loom to check the condition of the cables and connectors
- If all the cables are connected correctly, proceed to the next step

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Check that the wiring loom connectors are connected correctly and not damaged

7 - Replace the engine control unit

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A008(pag.439)	P472	Positive battery terminal
C001(pag.367)	P66	Battery ground
C004(pag.430)	P105	Engine ground point
D009(pag.437)	P469	Wiring connector for prewired engine wiring loom
D009(pag.460)	XEG	Exhaust gas recirculation solenoid valve power feed
F19(B004) (pag.418)	F19	Accessories (15A)
K022(pag.467)	XS7	EGR temperature sensor
L004(pag.469)	XY2	Exhaust gas recirculation solenoid valve (EGR)
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R2(B004) (pag.418)	R2	Fuel pre-heat relay (20A)

3002 - EGR position sensor malfunction

Description of fault

Engine control unit cannot identify correct aperture position of EGR valve

Severity of error

Medium

Additional information

Amber lamp illuminated

The percentage aperture of the valve and the relative electrical value may be determined with the diagnostic tool.

The solenoid valve is completely open when it is not powered. The solenoid valve is completely closed when it is powered.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the accessories fuse (15A) and replace if necessary
- Disconnect the accessories fuse (15A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

3 - Check that the connectors of the EGR valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the EGR is not mechanically stuck
- Remove the EGR valve and check that it is not stuck. Dirt residue may compromise the operation of the valve. Always clean the valve before refitting.
- After refitting the valve, check if it works correctly.
  Replace the EGR valve if it does not work correctly
- If the problem persists even though the valve is working correctly, proceed to the next step

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Check the condition of the CAN Bus communication pins of the engine control unit
- Disconnect the respective connectors
- Check that the contact surfaces of the pins are in good condition
- In no damage or corrosion are found, proceed to the next step

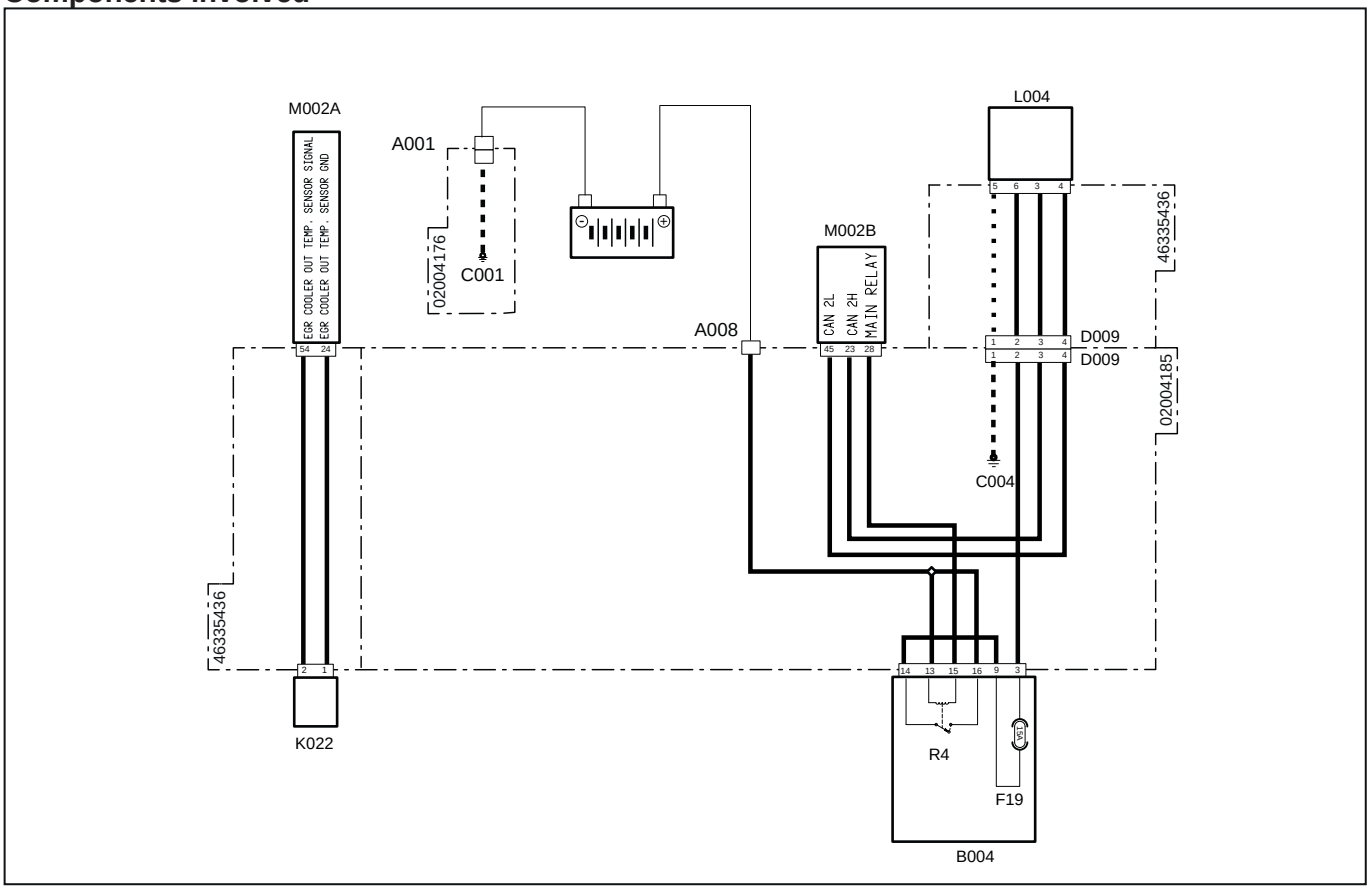
7 - Check that the resistance measured on the CAN Bus line is 60 Ohm
- Disconnect the connectors and measure the resistance of the wiring loom with a tester applied to the pins of the CAN Bus line. If the value measured is not 60 Ohm, the line is not working correctly.
- If the value measured is 60 Ohm, the line is working correctly: proceed to the next step

8 - Check the general condition of the CAN Bus line - check that there are no disconnected cables and that all the resistors are fitted correctly.
- Inspect the entire length of all the cables of the wiring loom to check the condition of the cables and connectors

- If all the cables are connected correctly, proceed to the next step

9 - Contact the technical support service

Components involved



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C001(pag.367)	P66	Battery ground
C004(pag.430)	P105	Engine ground point
D009(pag.437)	P469	Wiring connector for prewired engine wiring loom
D009(pag.460)	XEG	Exhaust gas recirculation solenoid valve power feed
F19(B004) (pag.418)	F19	Accessories (15A)
K022(pag.467)	XS7	EGR temperature sensor
L004(pag.469)	XY2	Exhaust gas recirculation solenoid valve (EGR)
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R2(B004) (pag.418)	R2	Fuel pre-heat relay (20A)

3003 - No CAN Bus message between EGR valve and engine control unit

Description of fault

Control unit not receiving signal from EGR valve

Severity of error

Medium

Additional information

Amber lamp illuminated

The percentage aperture of the valve and the relative electrical value may be determined with the diagnostic tool.

The solenoid valve is completely open when it is not powered. The solenoid valve is completely closed when it is powered.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check that the connectors of the EGR valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect the connectors and reconnect correctly
- If all the connectors are fitted and connected correctly, proceed to the next step

2 - Check the condition of the CAN Bus communication pins of the engine control unit
- Disconnect the respective connectors
- Check that the contact surfaces of the pins are in good condition
- In no damage or corrosion are found, proceed to the next step

3 - Check that the resistance measured on the CAN Bus line is 60 Ohm
- Disconnect the connectors and measure the resistance of the wiring loom with a tester applied to the pins of the CAN Bus line. If the value measured is not 60 Ohm, the line is not working correctly.
- If the value measured is 60 Ohm, the line is working correctly: proceed to the next step

4 - Check the general condition of the CAN Bus line - check that there are no disconnected cables and that all the resistors are fitted correctly.
- Inspect the entire length of all the cables of the wiring loom to check the condition of the cables and connectors
- If all the cables are connected correctly, proceed to the next step

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Check that the wiring loom connectors are connected correctly and not damaged

7 - Contact the technical support service

3004 - EGR power feed voltage not within permitted range

Description of fault

The control unit detects a power feed voltage exceeding permitted range

Severity of error

Medium

Additional information

Amber lamp illuminated

The power feed voltage of the EGR valve may be measured with the diagnostic tool

The solenoid valve is completely open when it is not powered. The solenoid valve is completely closed when it is powered.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the connectors of the EGR valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

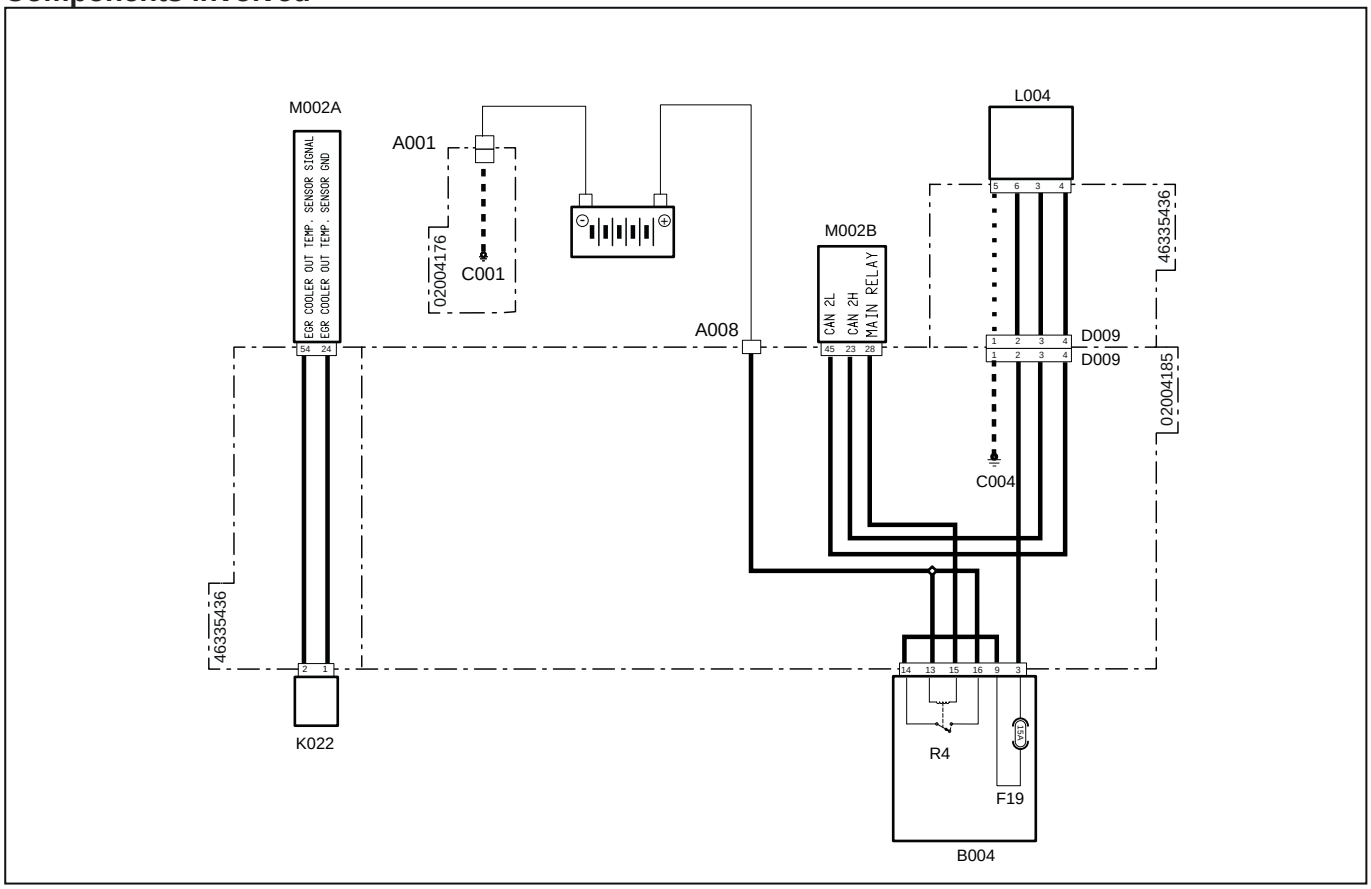
3 - Use the diagnostic tool to check that the EGR valve is working correctly (see documentation of diagnostic tool)
- Check that the power feed voltage of the EGR valve is within the correct range specified. Replace the EGR valve if the voltage is not within the correct range
- If the power feed voltage is correct, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Check that the wiring loom connectors are connected correctly and not damaged

6 - Contact the technical support service

Components involved



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C001(pag.367)	P66	Battery ground
C004(pag.430)	P105	Engine ground point
D009(pag.437)	P469	Wiring connector for prewired engine wiring loom
D009(pag.460)	XEG	Exhaust gas recirculation solenoid valve power feed
F19(B004) (pag.418)	F19	Accessories (15A)
K022(pag.467)	XS7	EGR temperature sensor
L004(pag.469)	XY2	Exhaust gas recirculation solenoid valve (EGR)
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R2(B004) (pag.418)	R2	Fuel pre-heat relay (20A)

3005 - Low EGR power feed voltage

Description of fault

The electronic control unit detects low power feed voltage

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The power feed voltage of the EGR valve may be measured with the diagnostic tool

The solenoid valve is completely open when it is not powered. The solenoid valve is completely closed when it is powered.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the connectors of the EGR valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

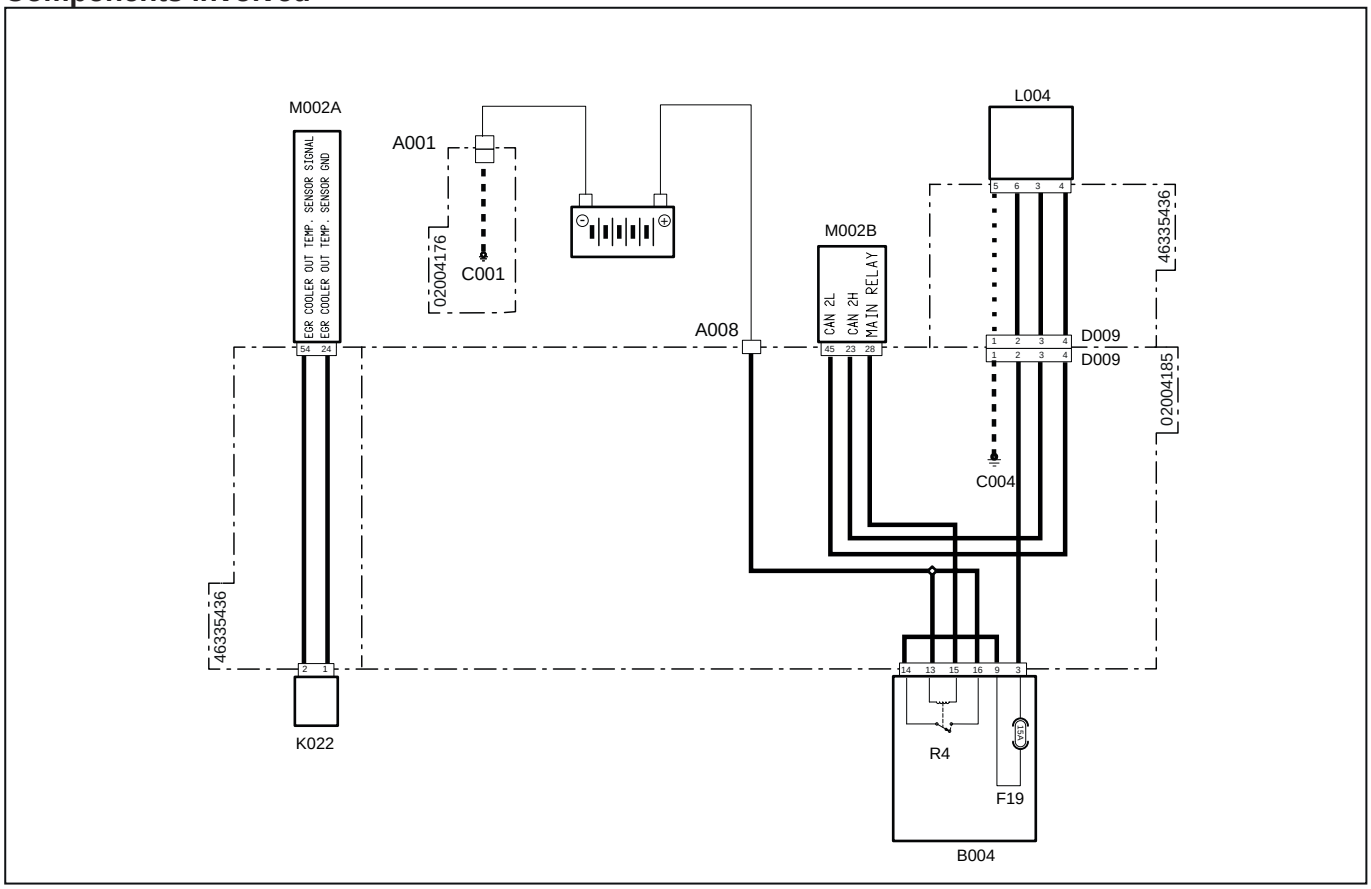
3 - Use the diagnostic tool to check that the EGR valve is working correctly (see documentation of diagnostic tool)
- Check that the power feed voltage of the EGR valve is within the correct range specified. Replace the EGR valve if the voltage is not within the correct range
- If the power feed voltage is correct, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Check that the wiring loom connectors are connected correctly and not damaged

6 - Contact the technical support service

Components involved



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D009(pag.460)	XEG	Exhaust gas recirculation solenoid valve power feed
F19(B004) (pag.418)	F19	Accessories (15A)
K022(pag.467)	XS7	EGR temperature sensor
L004(pag.469)	XY2	Exhaust gas recirculation solenoid valve (EGR)
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R2(B004) (pag.418)	R2	Fuel pre-heat relay (20A)

3006 - EGR valve power circuit current not within permitted range

Description of fault

The control unit detects a short circuit to ground or an open circuit state on the EGR valve.

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The solenoid valve is completely open when it is not powered. The solenoid valve is completely closed when it is powered.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the connectors of the EGR valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

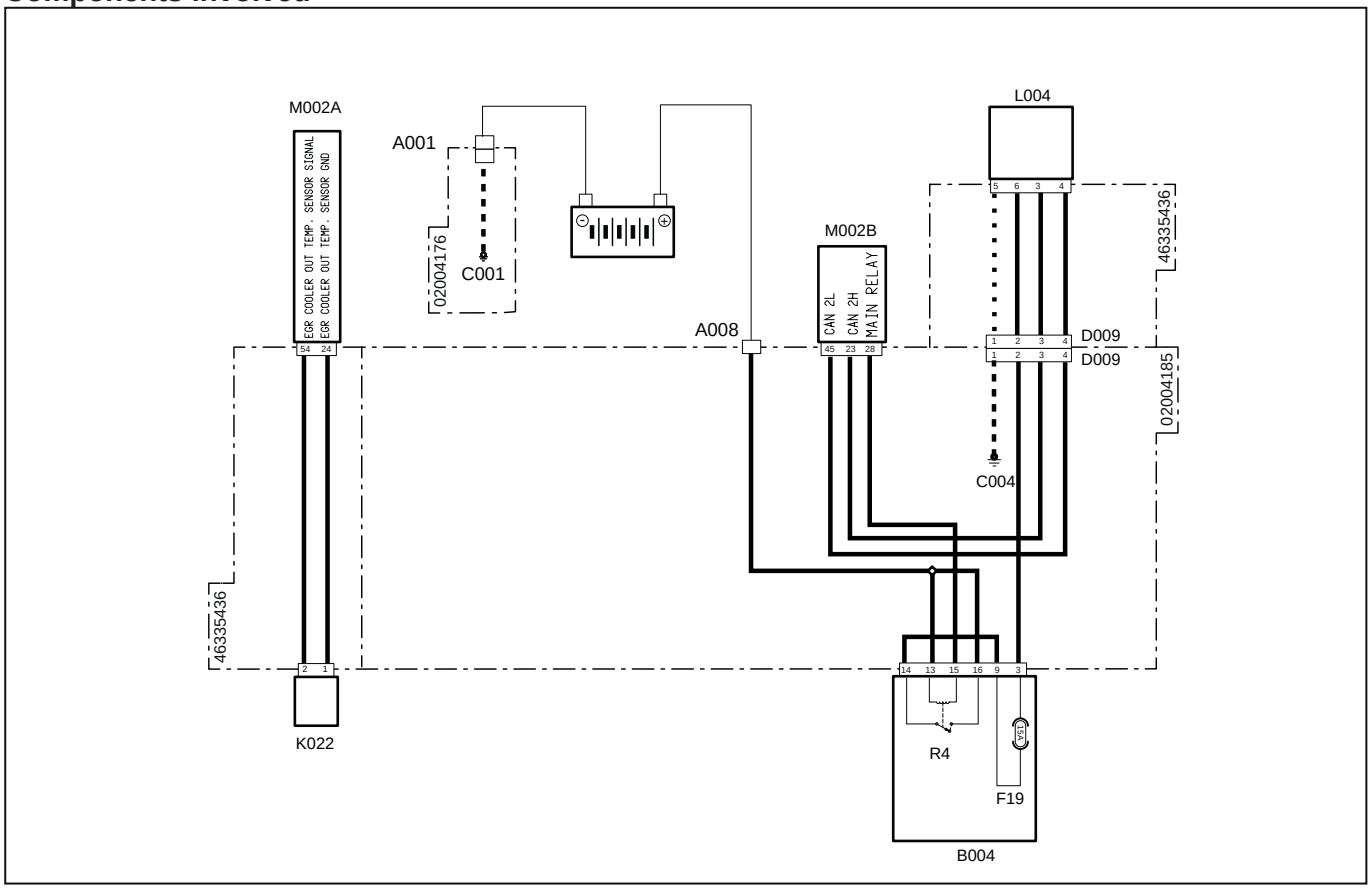
3 - Use the diagnostic tool to check that the EGR valve is working correctly (see documentation of diagnostic tool)
- Check that the power feed voltage of the EGR valve is within the correct range specified. Replace the EGR valve if the voltage is not within the correct range
- If the power feed voltage is correct, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Check that the wiring loom connectors are connected correctly and not damaged

6 - Contact the technical support service

Components involved



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F19(B004) (pag.418)	F19	Accessories (15A)
K022(pag.467)	XS7	EGR temperature sensor
L004(pag.469)	XY2	Exhaust gas recirculation solenoid valve (EGR)
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R2(B004) (pag.418)	R2	Fuel pre-heat relay (20A)

3007 - Low EGR circuit flow

Description of fault

The control unit detects excessively low EGR recirculated exhaust gas flow

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Insufficient gas flow in the EGR circuit may not necessarily be due to a malfunction of the EGR valve. The control unit calculates values in relation to the information received, and checks that the pressure and temperature values measured in the intake manifold by the BOOST sensor match these values. This error is displayed if the values measured do not match the calculated values.

This error may be caused by a measurement error or by a malfunction of any of the following components:

- EGR Valve
- EGR temperature sensor
- Boost pressure sensor
- Exhaust pressure sensor (P3)
- Exhaust temperature sensor (T3)
- Throttle valve

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - After checking that all the components associated with this error are working correctly, proceed to the next step
- Check for fouling and/or obstruction in the EGR exhaust gas circuit
- Check for fouling and/or obstruction in the intake air system

3008 - No EGR temperature message on CAN Bus line

Description of fault

Control unit receives no temperature signal from EGR gas temperature sensor

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the connectors of the EGR temperature sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Check the condition of the CAN Bus communication pins of the engine control unit
- Disconnect the respective connectors
- Check that the contact surfaces of the pins are in good condition
- In no damage or corrosion are found, proceed to the next step

4 - Check that the resistance measured on the CAN Bus line is 60 Ohm
- Disconnect the connectors and measure the resistance of the wiring loom with a tester applied to the pins of the CAN Bus line. If the value measured is not 60 Ohm, the line is not working correctly.
- If the value measured is 60 Ohm, the line is working correctly: proceed to the next step

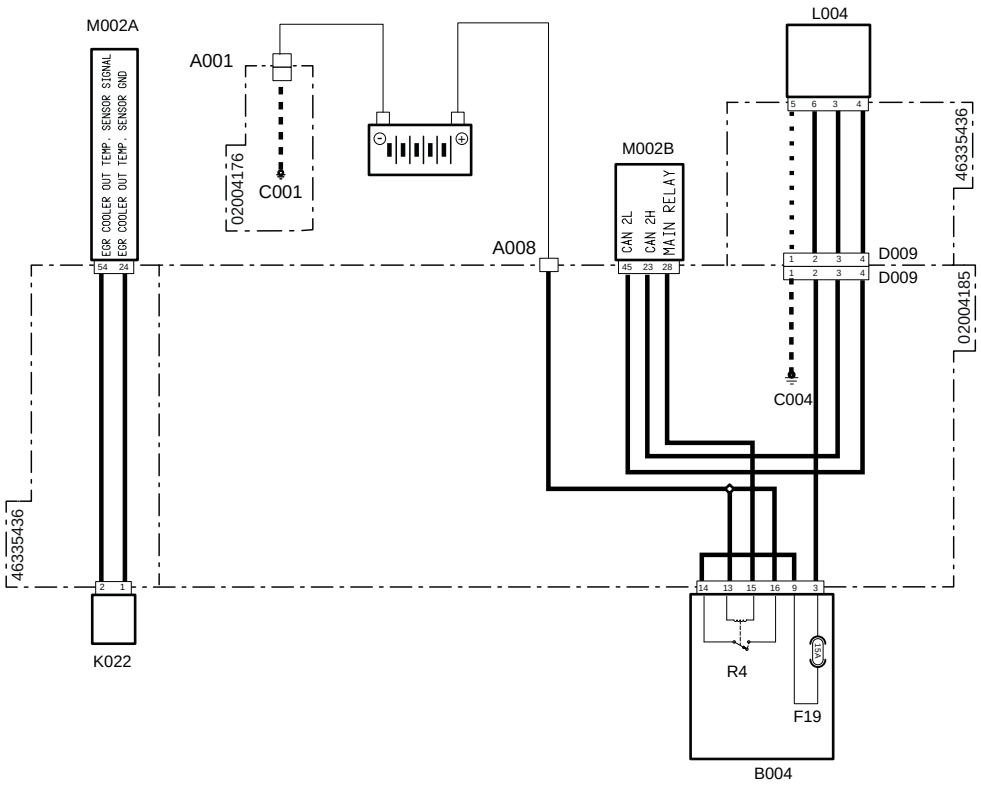
5 - Check the general condition of the CAN Bus line - check that there are no disconnected cables and that all the resistors are fitted correctly.
- Inspect the entire length of all the cables of the wiring loom to check the condition of the cables and connectors
- If all the cables are connected correctly, proceed to the next step

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service

Components involved



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F19(B004) (pag.418)	F19	Accessories (15A)
K022(pag.467)	XS7	EGR temperature sensor
L004(pag.469)	XY2	Exhaust gas recirculation solenoid valve (EGR)
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R2(B004) (pag.418)	R2	Fuel pre-heat relay (20A)

3009 - EGR valve stuck closed

Description of fault

The control unit detects that the EGR valve is permanently closed

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The percentage aperture of the valve and the relative electrical value may be determined with the diagnostic tool. The EGR valve may also be tested with the engine off.

The solenoid valve is completely open when it is not powered. The solenoid valve is completely closed when it is powered.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the accessories fuse (15A) and replace if necessary
- Disconnect the accessories fuse (15A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

3 - Use the diagnostic tool to check that the EGR valve is working correctly (see documentation of diagnostic tool)
- Carry out the EGR valve aperture test while simultaneously checking the effective percentage aperture of the valve itself

  The EGR valve test may also be performed with the engine off
- If the test is passed successfully and no abnormal values are measured, the problem may be due to a different component.
  If the test is failed, proceed to the next step

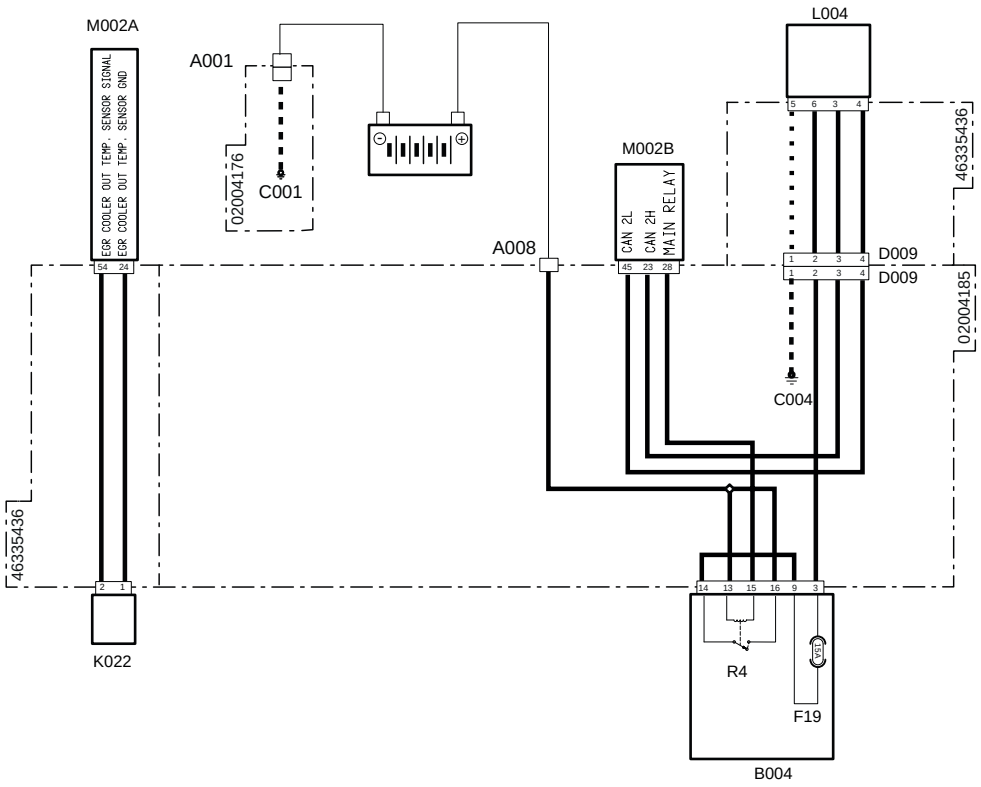
4 - Check that the connectors of the EGR valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

5 - Check that the EGR is not mechanically stuck
- Remove the EGR valve and check that it is not stuck. Dirt residue may compromise the operation of the valve. Always clean the valve before refitting.
- After refitting the valve, check if it works correctly.
  Replace the EGR valve if it does not work correctly
- If the problem persists even though the valve is working correctly, proceed to the next step

6 - After checking that all the components associated with this error are working correctly, proceed to the next step
- Check for fouling and/or obstruction in the EGR exhaust gas circuit
- Check for fouling and/or obstruction in the intake air system

7 - Contact the technical support service if the problem persists

Components involved



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A008(pag.439)	P472	Positive battery terminal
C001(pag.367)	P66	Battery ground
C004(pag.430)	P105	Engine ground point
D009(pag.437)	P469	Wiring connector for prewired engine wiring loom
D009(pag.460)	XEG	Exhaust gas recirculation solenoid valve power feed
F19(B004) (pag.418)	F19	Accessories (15A)
K022(pag.467)	XS7	EGR temperature sensor
L004(pag.469)	XY2	Exhaust gas recirculation solenoid valve (EGR)
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R2(B004) (pag.418)	R2	Fuel pre-heat relay (20A)

3010 - EGR valve position sensor power feed voltage not within permitted range

Description of fault

The control unit detects an EGR valve position sensor power feed voltage exceeding _____ V

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The percentage aperture of the valve and the relative electrical value may be determined with the diagnostic tool. The EGR valve may also be tested with the engine off.

The solenoid valve is completely open when it is not powered. The solenoid valve is completely closed when it is powered.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the connectors of the EGR valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

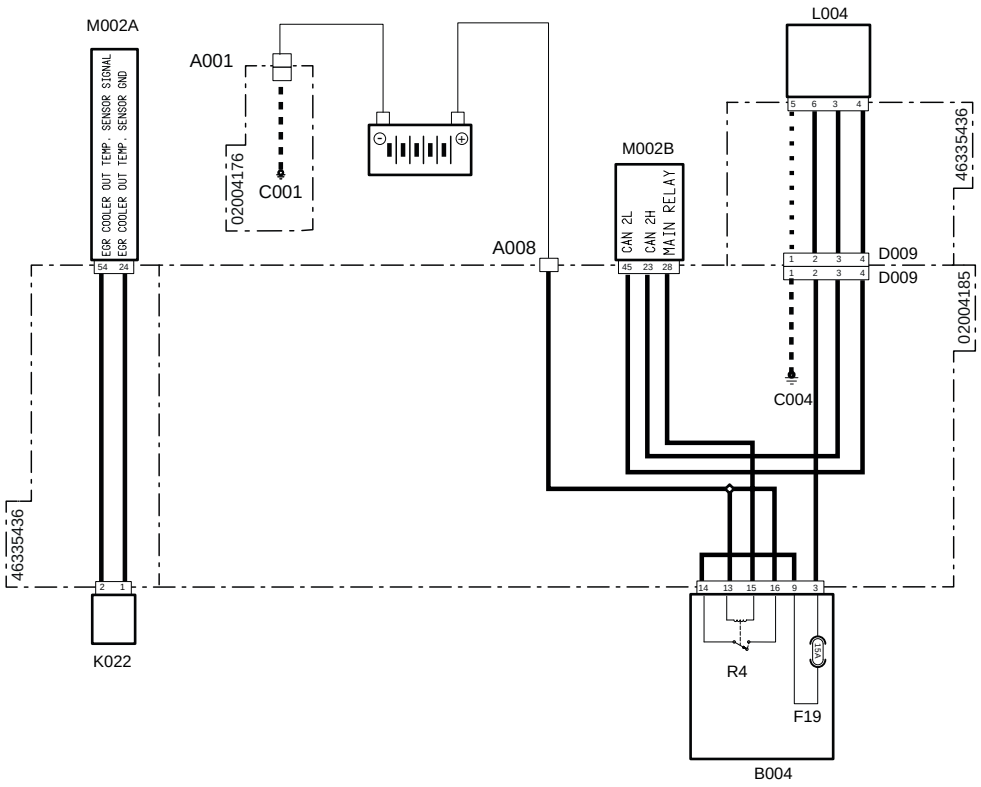
3 - Use the diagnostic tool to check that the EGR valve position sensor is working correctly (see documentation of diagnostic tool)
- Check that the power feed voltage of the EGR valve position sensor is within the correct range specified. Replace the EGR valve if the voltage is not within the correct range
- If the power feed voltage is correct, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Check that the wiring loom connectors are connected correctly and not damaged

6 - Contact the technical support service

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A008(pag.439)	P472	Positive battery terminal
C001(pag.367)	P66	Battery ground
C004(pag.430)	P105	Engine ground point
D009(pag.437)	P469	Wiring connector for prewired engine wiring loom
D009(pag.460)	XEG	Exhaust gas recirculation solenoid valve power feed
F19(B004) (pag.418)	F19	Accessories (15A)
K022(pag.467)	XS7	EGR temperature sensor
L004(pag.469)	XY2	Exhaust gas recirculation solenoid valve (EGR)
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R2(B004) (pag.418)	R2	Fuel pre-heat relay (20A)

3011 - EGR valve position error during self-test at key-on

Description of fault

Each time the tractor is switched on, the control unit runs an EGR valve test cycle. This error is generated if the values read by the control unit during this test are non-conformant.

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The percentage aperture of the valve and the relative electrical value may be determined with the diagnostic tool. The EGR valve may also be tested with the engine off.

The solenoid valve is completely open when it is not powered. The solenoid valve is completely closed when it is powered.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the accessories fuse (15A) and replace if necessary
- Disconnect the accessories fuse (15A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

3 - Check that the connectors of the EGR valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the EGR is not mechanically stuck
- Remove the EGR valve and check that it is not stuck. Dirt residue may compromise the operation of the valve. Always clean the valve before refitting.
- After refitting the valve, check if it works correctly.
  Replace the EGR valve if it does not work correctly
- If the problem persists even though the valve is working correctly, proceed to the next step

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Check the condition of the CAN Bus communication pins of the engine control unit
- Disconnect the respective connectors
- Check that the contact surfaces of the pins are in good condition
- In no damage or corrosion are found, proceed to the next step

7 - Check that the resistance measured on the CAN Bus line is 60 Ohm
- Disconnect the connectors and measure the resistance of the wiring loom with a tester applied to the pins of the CAN Bus line. If the value measured is not 60 Ohm, the line is not working correctly.
- If the value measured is 60 Ohm, the line is working correctly: proceed to the next step

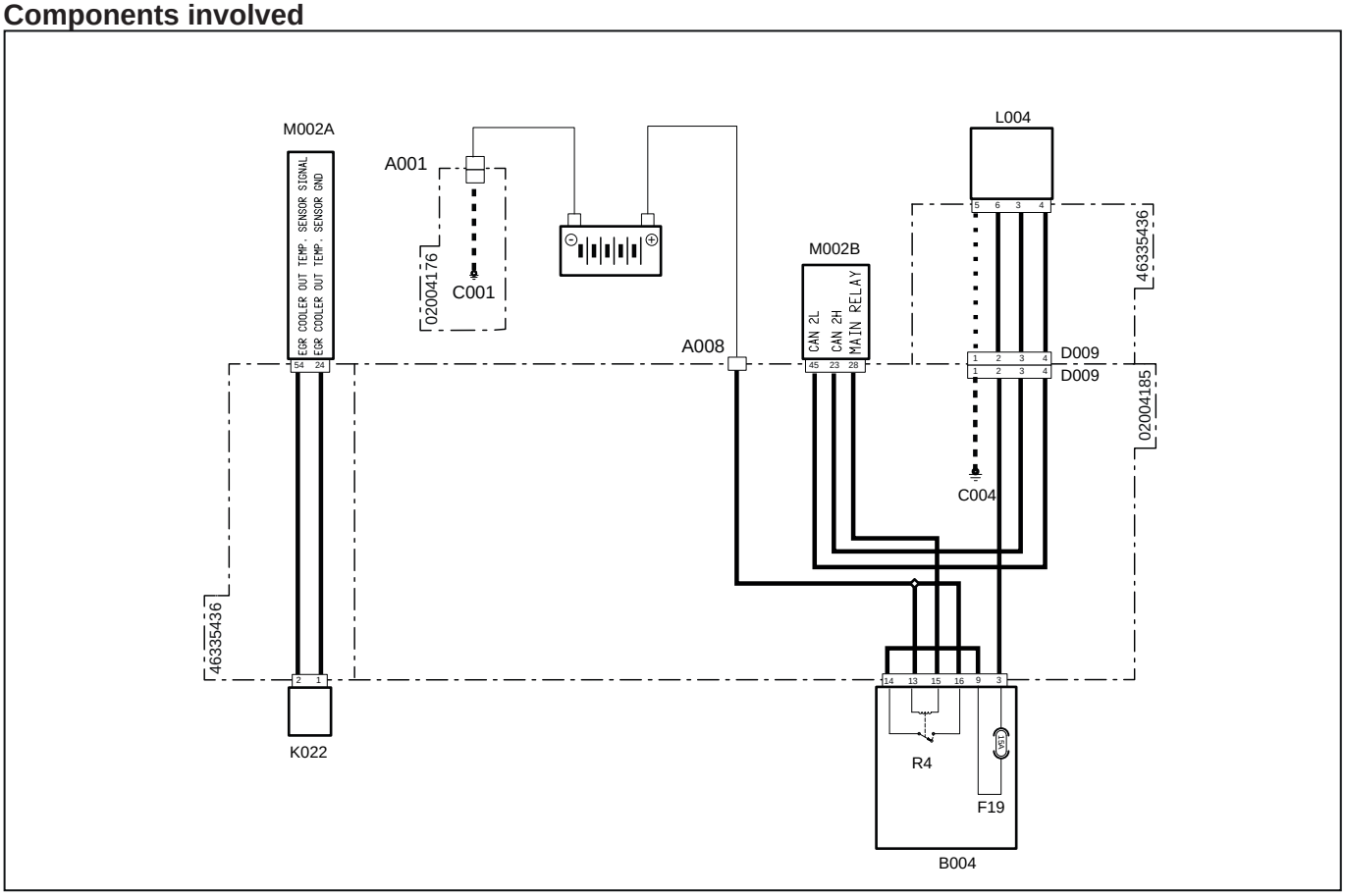
8 - Check the general condition of the CAN Bus line - check that there are no disconnected cables and that all the

resistors are fitted correctly.

- Inspect the entire length of all the cables of the wiring loom to check the condition of the cables and connectors
- If all the cables are connected correctly, proceed to the next step

9 - Contact the technical support service

Components involved



System code	Source code	Description
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A008(pag.439)	P472	Positive battery terminal
C001(pag.367)	P66	Battery ground
C004(pag.430)	P105	Engine ground point
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D009(pag.460)	XEG	Exhaust gas recirculation solenoid valve power feed
F19(B004) (pag.418)	F19	Accessories (15A)
K022(pag.467)	XS7	EGR temperature sensor
L004(pag.469)	XY2	Exhaust gas recirculation solenoid valve (EGR)
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R2(B004) (pag.418)	R2	Fuel pre-heat relay (20A)

3012 - EGR valve stuck open

Description of fault

The control unit detects that the EGR valve is permanently open

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Insufficient gas flow in the EGR circuit may not necessarily be due to a malfunction of the EGR valve. The control unit calculates values in relation to the information received, and checks that the pressure and temperature values measured in the intake manifold by the BOOST sensor match these values. This error is displayed if the values measured do not match the calculated values.

This error may be caused by a measurement error or by a malfunction of any of the following components:

- EGR Valve
- EGR temperature sensor
- Boost pressure sensor
- Exhaust pressure sensor (P3)
- Exhaust temperature sensor (T3)
- Throttle valve

Behaviour of system

The engine may be started but the EGR valve remains closed.The engine operates with limited torque and regeneration is disabled

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - After checking that all the components associated with this error are working correctly, proceed to the next step
- Check for fouling and/or obstruction in the EGR exhaust gas circuit
- Check for fouling and/or obstruction in the intake air system

3013 - CAN Bus line communication error between EGR and ECU control unit

Description of fault

The control unit detects communication error on CAN Bus line between EGR and ECU engine control unit

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Generic CAN Bus line fault icon displayed on multifunction instrument screen, accompanied by buzzer.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check that the connectors of the EGR valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect the connectors and reconnect correctly
- If all the connectors are fitted and connected correctly, proceed to the next step

2 - Check the condition of the CAN Bus communication pins of the engine control unit
- Disconnect the respective connectors
- Check that the contact surfaces of the pins are in good condition
- In no damage or corrosion are found, proceed to the next step

3 - Check that the resistance measured on the CAN Bus line is 60 Ohm
- Disconnect the connectors and measure the resistance of the wiring loom with a tester applied to the pins of the CAN Bus line. If the value measured is not 60 Ohm, the line is not working correctly.
- If the value measured is 60 Ohm, the line is working correctly: proceed to the next step

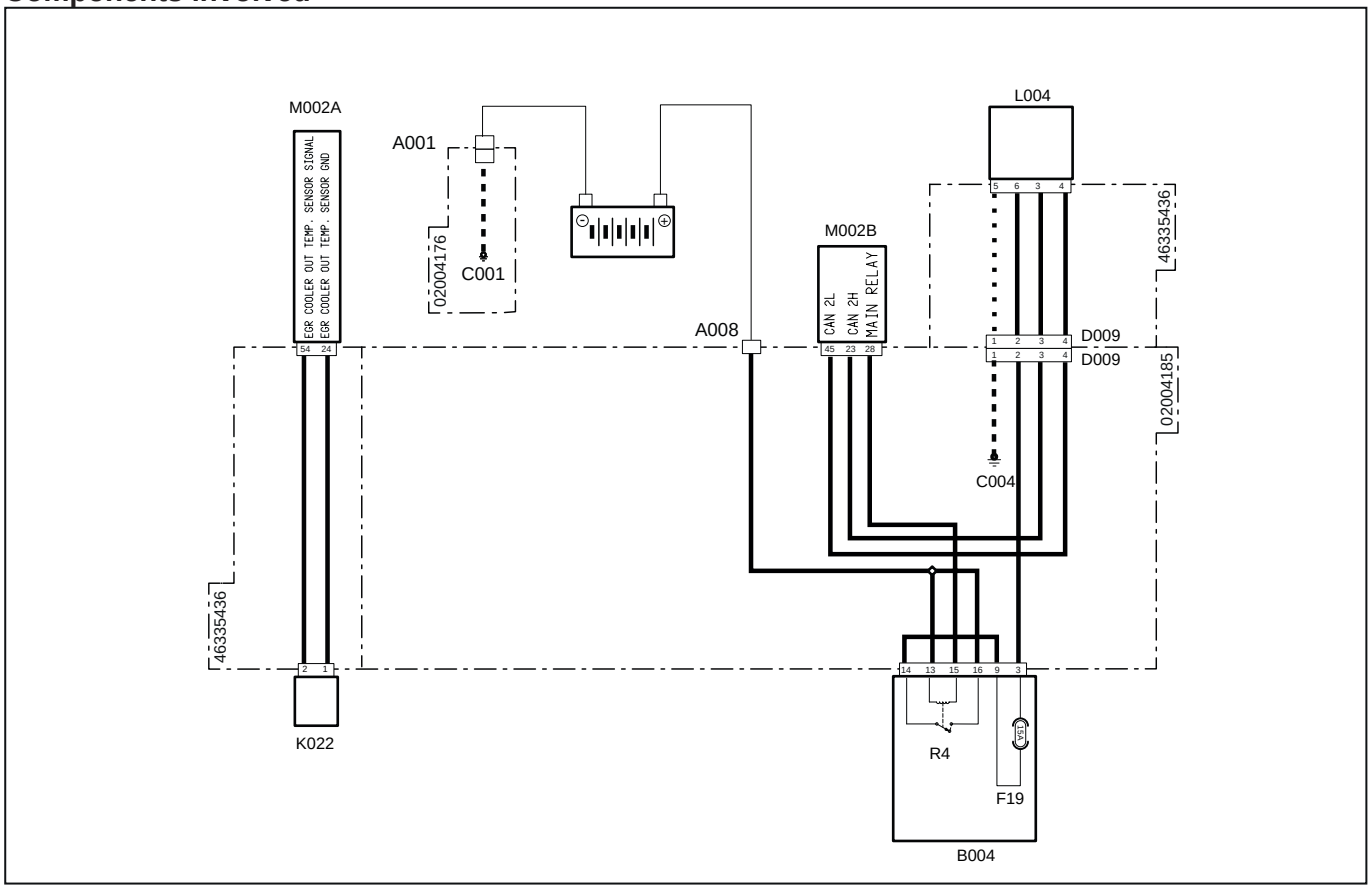
4 - Check the general condition of the CAN Bus line - check that there are no disconnected cables and that all the resistors are fitted correctly.
- Inspect the entire length of all the cables of the wiring loom to check the condition of the cables and connectors
- If all the cables are connected correctly, proceed to the next step

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Check that the wiring loom connectors are connected correctly and not damaged

7 - Replace the engine control unit

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
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C001(pag.367)	P66	Battery ground
C004(pag.430)	P105	Engine ground point
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D009(pag.460)	XEG	Exhaust gas recirculation solenoid valve power feed
F19(B004) (pag.418)	F19	Accessories (15A)
K022(pag.467)	XS7	EGR temperature sensor
L004(pag.469)	XY2	Exhaust gas recirculation solenoid valve (EGR)
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R2(B004) (pag.418)	R2	Fuel pre-heat relay (20A)

3014 - Excessive soot levels in DPF filter

Description of fault

The control unit detects excessive levels of soot trapped in the diesel particulate filter.

Severity of error

High

Additional information

Red indicator lamp flashing

The degree of clogging of the DPF filter is monitored by the ECU unit via the signals received from the differential pressure sensor, which measures the pressure ahead of and after the filter. If the pressure read by the sensor on the inlet side is higher than the pressure read on the outlet side, this means that the filter is clogged.

The differential pressure sensor reading may be viewed with the diagnostic tool

Behaviour of system

The engine may be started but the EGR valve remains closed. The engine operates with limited torque and regeneration is disabled

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the differential pressure sensor is installed correctly
- If the differential pressure sensor is installed the wrong way around or if the tubes are swapped, the reading produced by the sensor will be incorrect
- Proceed to the next step if the sensor is installed correctly

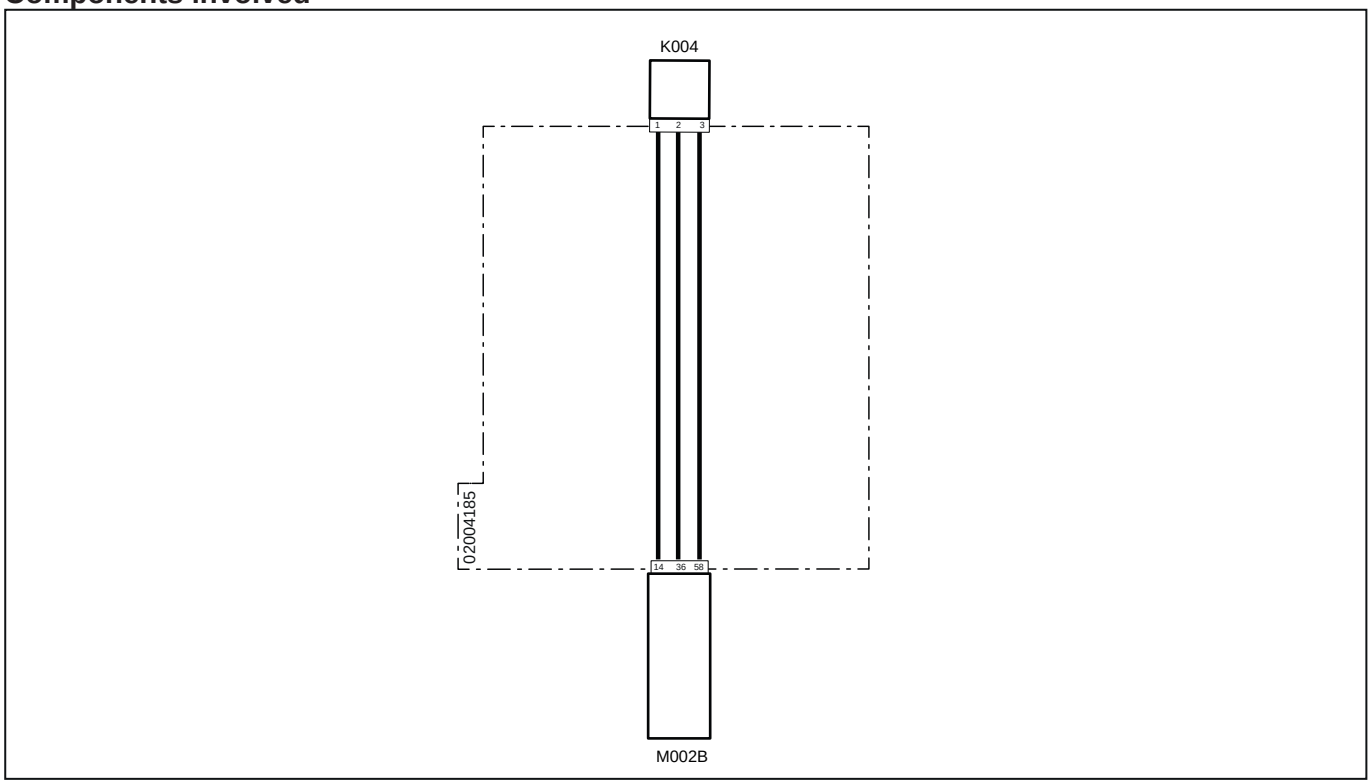
3 - Perform the service regeneration procedure for the DPF filter (see the documentation of the diagnostic tool)
- Read the safety information given in the use and maintenance manual of the vehicle with particular care.
- If the problem persists, proceed to the next step

4 - Use the diagnostic tool to view the differential pressure sensor reading (see the documentation of the diagnostic tool)
- Check if the differential pressure sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

5 - Check that the rubber tubes connected to the differential pressure sensor are not obstructed. An obstruction in these tubes may cause the sensor to read incorrect measurements

6 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K004(pag.420)	P3	Differential pressure sensor
M002B(pag.423)	P12	Engine control unit

3015 - DPF differential pressure too low (lines obstructed or swapped)

Description of fault

Pressure difference detected by control unit between inlet and outlet sides of diesel particulate filter is too low or negative

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The degree of clogging of the DPF filter is monitored by the ECU unit via the signals received from the differential pressure sensor, which measures the pressure ahead of and after the filter. If the pressure read by the sensor on the inlet side is higher than the pressure read on the outlet side, this means that the filter is clogged.

The differential pressure sensor reading may be viewed with the diagnostic tool

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the differential pressure sensor is installed correctly
- If the differential pressure sensor is installed the wrong way around or if the tubes are swapped, the reading produced by the sensor will be incorrect
- Proceed to the next step if the sensor is installed correctly

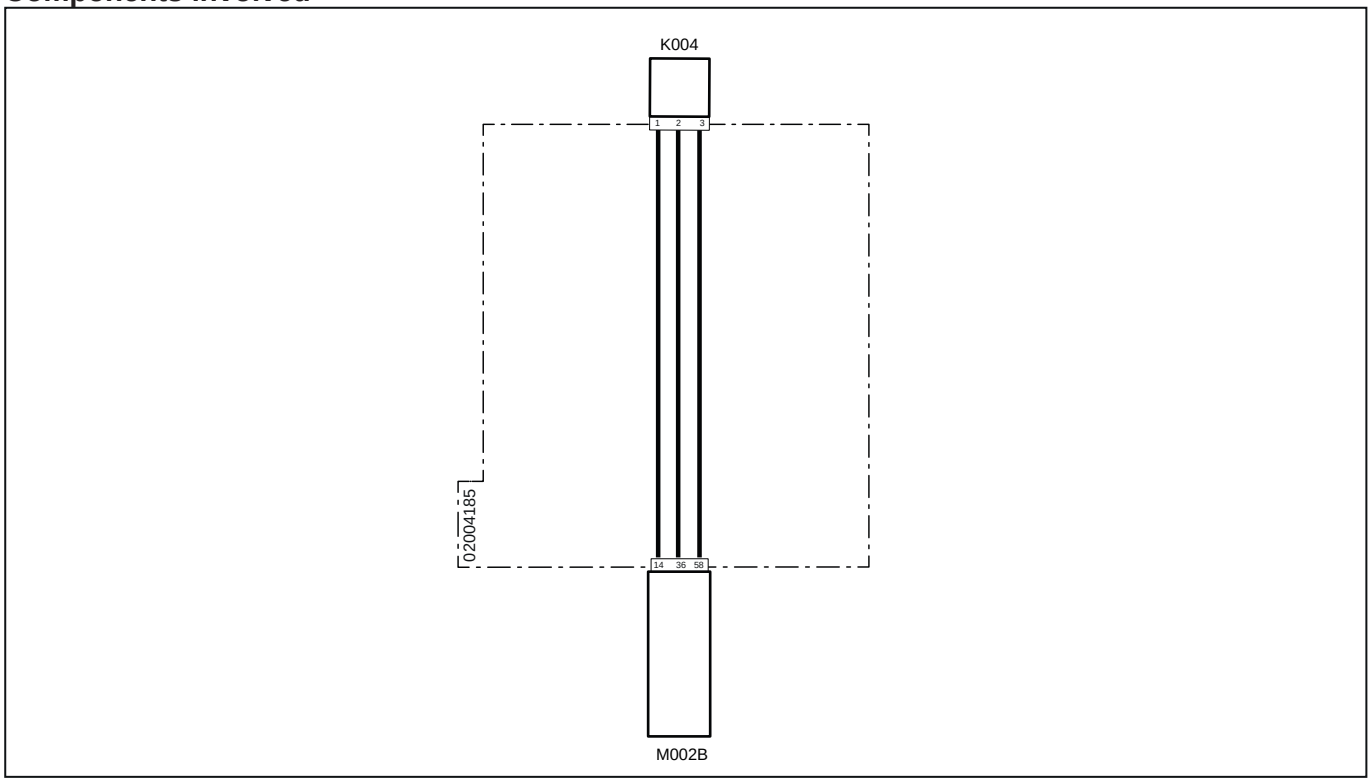
3 - Perform the service regeneration procedure for the DPF filter (see the documentation of the diagnostic tool)
- Read the safety information given in the use and maintenance manual of the vehicle with particular care.
- If the problem persists, proceed to the next step

4 - Use the diagnostic tool to view the differential pressure sensor reading (see the documentation of the diagnostic tool)
- Check if the differential pressure sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

5 - Check that the rubber tubes connected to the differential pressure sensor are not obstructed. An obstruction in these tubes may cause the sensor to read incorrect measurements

6 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K004(pag.420)	P3	Differential pressure sensor
M002B(pag.423)	P12	Engine control unit

3016 - Frequent regeneration cycle error

Description of fault

The ECU engine control unit detects that an excessively high number of a large number of regeneration cycles has been performed

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The degree of clogging of the DPF filter is monitored by the ECU unit via the signals received from the differential pressure sensor, which measures the pressure ahead of and after the filter. If the pressure read by the sensor on the inlet side is higher than the pressure read on the outlet side, this means that the filter is clogged.

The differential pressure sensor reading may be viewed with the diagnostic tool

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the differential pressure sensor is installed correctly
- If the differential pressure sensor is installed the wrong way around or if the tubes are swapped, the reading produced by the sensor will be incorrect
- Proceed to the next step if the sensor is installed correctly

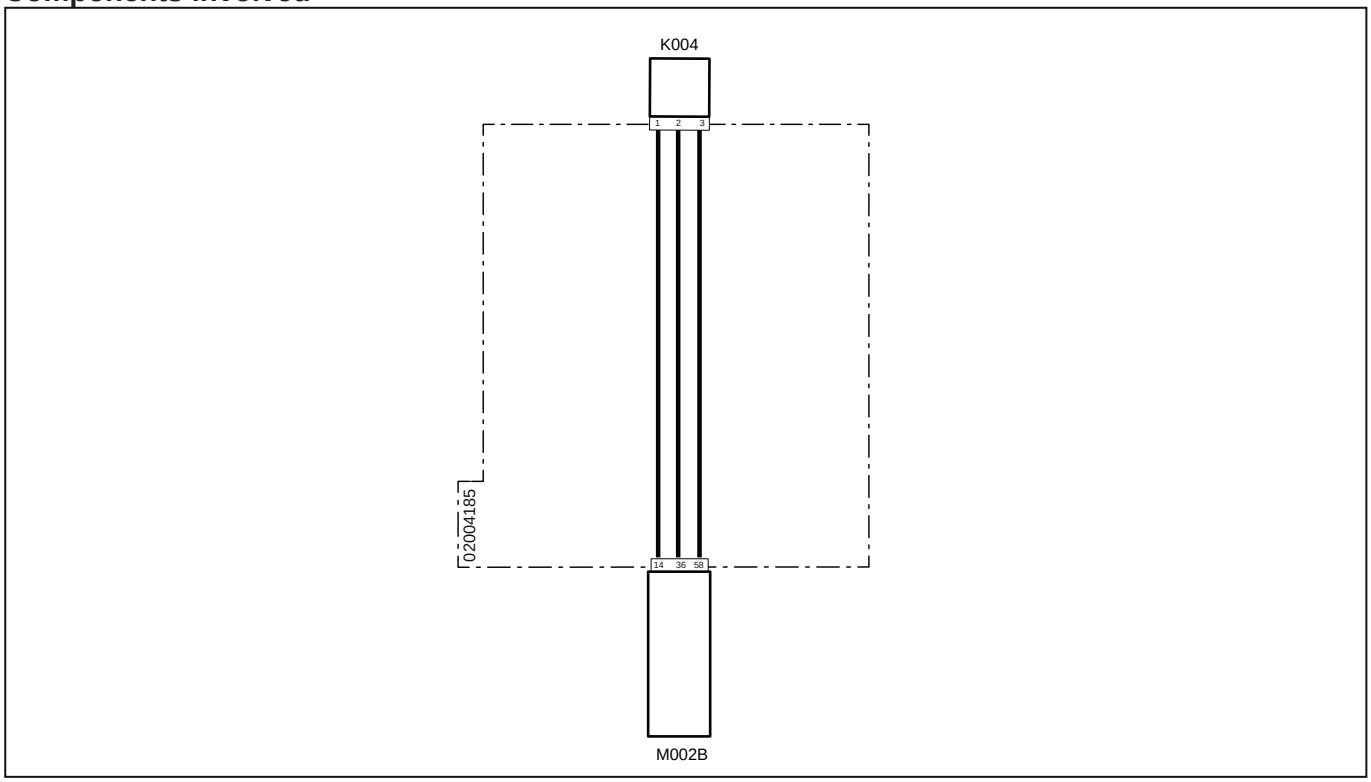
3 - Perform the service regeneration procedure for the DPF filter (see the documentation of the diagnostic tool)
- Read the safety information given in the use and maintenance manual of the vehicle with particular care.
- If the problem persists, proceed to the next step

4 - Use the diagnostic tool to view the differential pressure sensor reading (see the documentation of the diagnostic tool)
- Check if the differential pressure sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

5 - Check that the rubber tubes connected to the differential pressure sensor are not obstructed. An obstruction in these tubes may cause the sensor to read incorrect measurements

6 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K004(pag.420)	P3	Differential pressure sensor
M002B(pag.423)	P12	Engine control unit

3017 - DPF differential pressure: value not plausible

Description of fault

The ECU engine control unit detects a differential pressure sensor reading error. The difference between the pressure values read at the inlet and outlet of the filter is not plausible

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The degree of clogging of the DPF filter is monitored by the ECU unit via the signals received from the differential pressure sensor, which measures the pressure ahead of and after the filter. If the pressure read by the sensor on the inlet side is higher than the pressure read on the outlet side, this means that the filter is clogged.

The differential pressure sensor reading may be viewed with the diagnostic tool

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the differential pressure sensor is installed correctly
- If the differential pressure sensor is installed the wrong way around or if the tubes are swapped, the reading produced by the sensor will be incorrect
- Proceed to the next step if the sensor is installed correctly

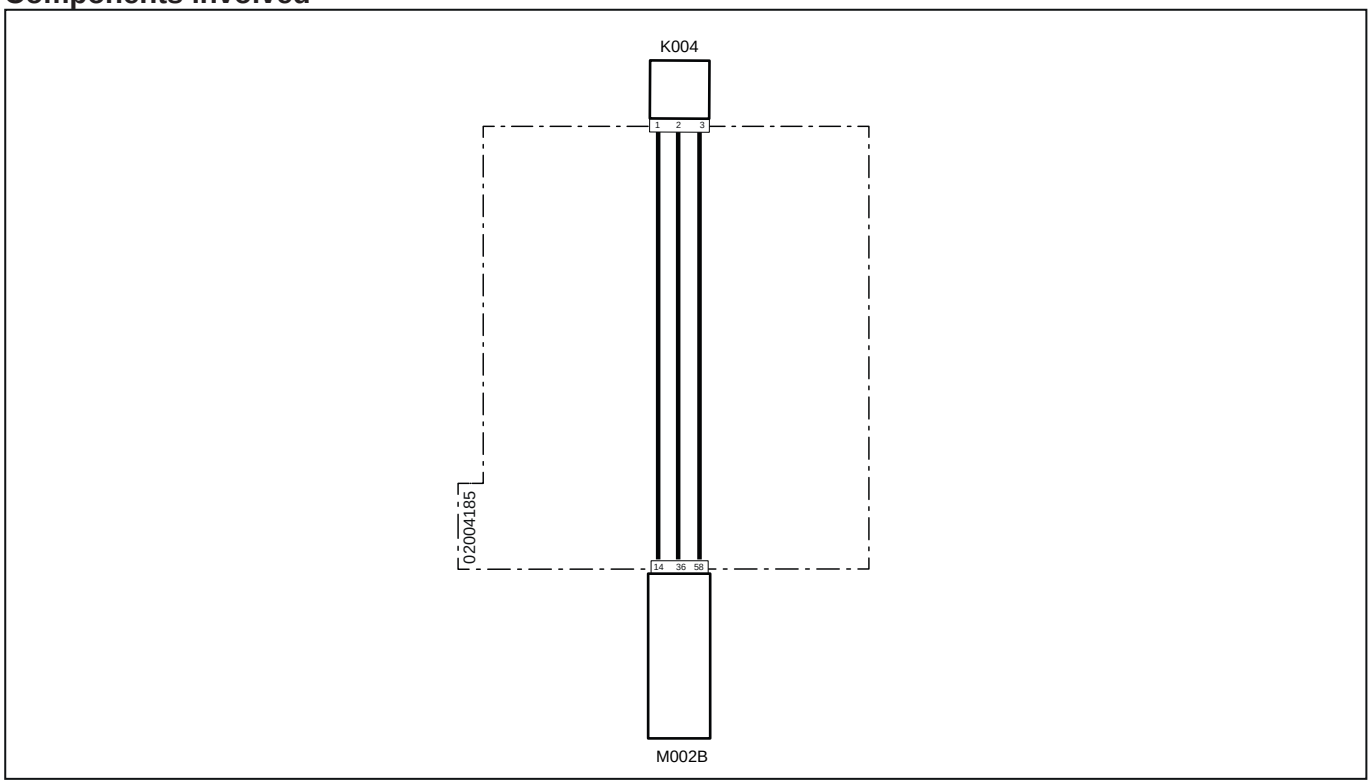
3 - Perform the service regeneration procedure for the DPF filter (see the documentation of the diagnostic tool)
- Read the safety information given in the use and maintenance manual of the vehicle with particular care.
- If the problem persists, proceed to the next step

4 - Use the diagnostic tool to view the differential pressure sensor reading (see the documentation of the diagnostic tool)
- Check if the differential pressure sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

5 - Check that the rubber tubes connected to the differential pressure sensor are not obstructed. An obstruction in these tubes may cause the sensor to read incorrect measurements

6 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K004(pag.420)	P3	Differential pressure sensor
M002B(pag.423)	P12	Engine control unit

3018- Differential pressure sensor lines frozen

Description of fault

The ECU engine control unit detects that the connector pipes of the differential pressure sensor are frozen

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The degree of clogging of the DPF filter is monitored by the ECU unit via the signals received from the differential pressure sensor, which measures the pressure ahead of and after the filter. If the pressure read by the sensor on the inlet side is higher than the pressure read on the outlet side, this means that the filter is clogged.

The differential pressure sensor reading may be viewed with the diagnostic tool

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the differential pressure sensor is installed correctly
- If the differential pressure sensor is installed the wrong way around or if the tubes are swapped, the reading produced by the sensor will be incorrect
- Proceed to the next step if the sensor is installed correctly

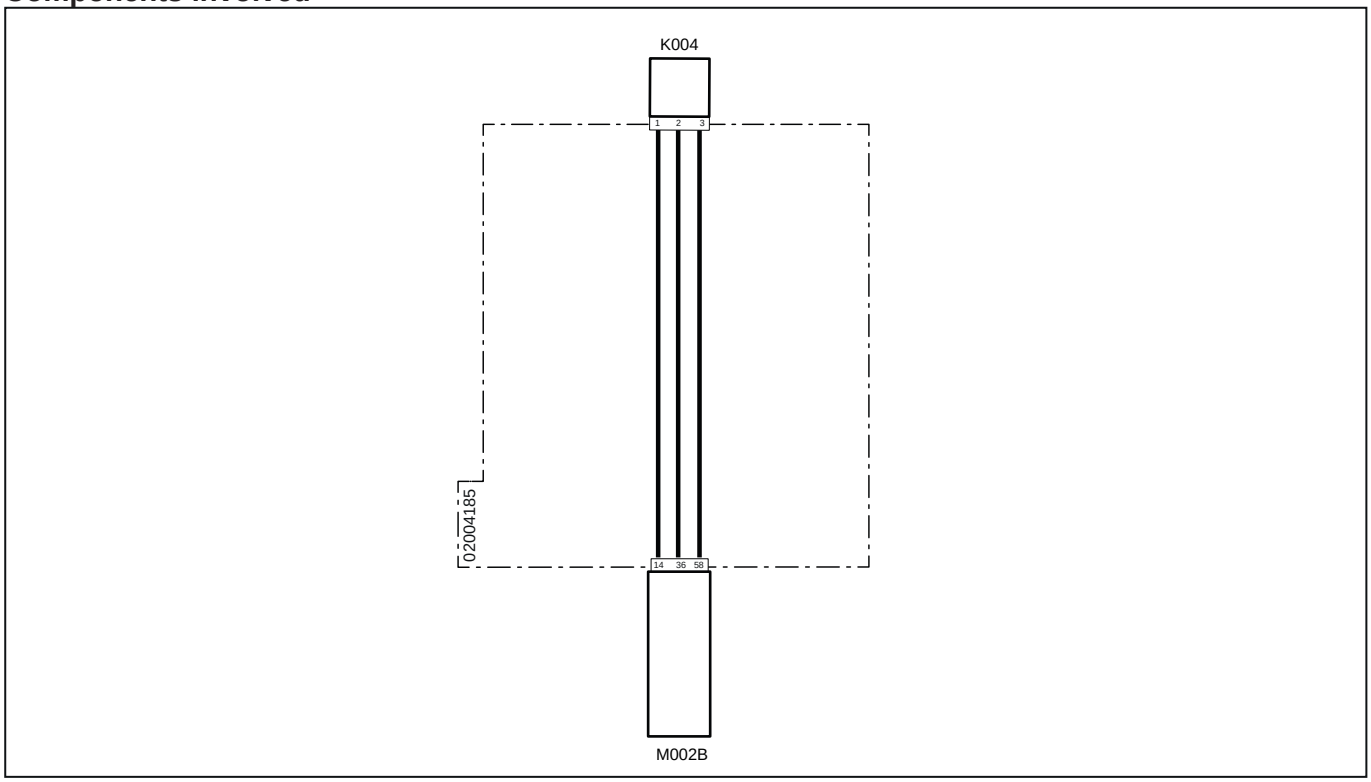
3 - Check that the rubber tubes connected to the differential pressure sensor are not obstructed. An obstruction in these tubes may cause the sensor to read incorrect measurements

4 - Perform the service regeneration procedure for the DPF filter (see the documentation of the diagnostic tool)
- Read the safety information given in the use and maintenance manual of the vehicle with particular care.
- If the problem persists, proceed to the next step

5 - Use the diagnostic tool to view the differential pressure sensor reading (see the documentation of the diagnostic tool)
- Check if the differential pressure sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

6 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K004(pag.420)	P3	Differential pressure sensor
M002B(pag.423)	P12	Engine control unit

3019 - Water in fuel or water in fuel sensor open circuit

Description of fault

The ECU engine control unit detects water in the fuel. This error may also be generated by an open circuit on the water in fuel sensor line

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

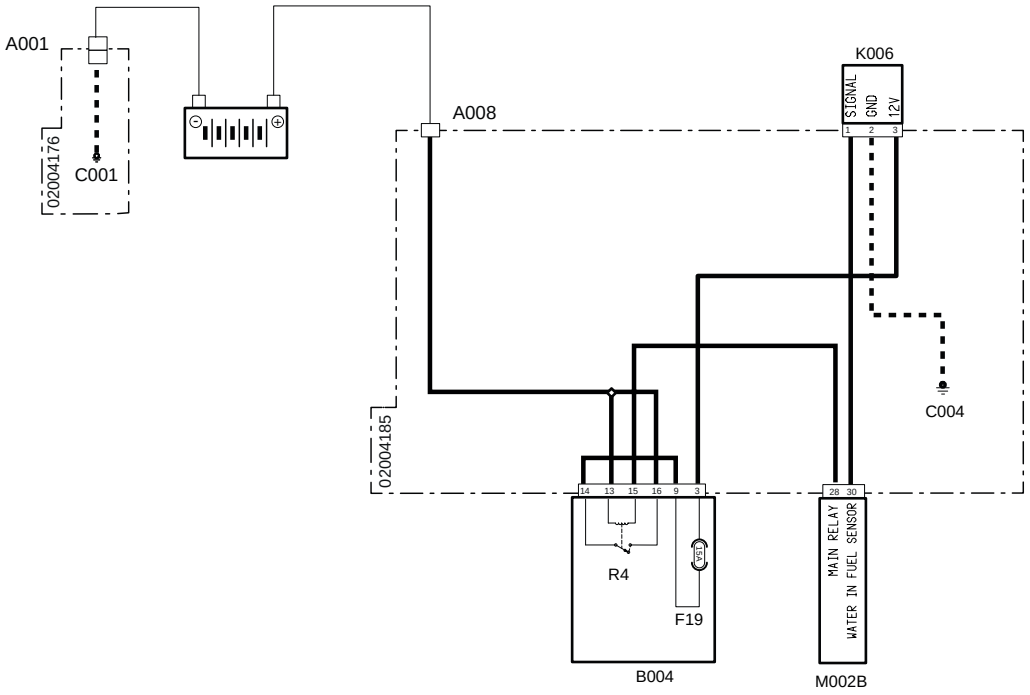
2 - Drain the water from the fuel filter
- See the use and maintenance of the vehicle for the procedure to drain water from the filter.
- If the problem persists after draining the water from the filter, proceed to the next step

3 - Check that the connectors of the water in fuel sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A008(pag.439)	P472	Positive battery terminal
C001(pag.367)	P66	Battery ground
C004(pag.430)	P105	Engine ground point
F19(B004) (pag.418)	F19	Accessories (15A)
K006(pag.425)	P16	Water in fuel sensor
M002B(pag.423)	P12	Engine control unit
R3(B004) (pag.418)	R3	Start relay (20A)

3020 - Oil dilution value too high

Description of fault

The ECU engine control unit determines that the oil dilution value is too high

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The oil dilution value is calculated by the control unit in accordance with a number of parameters such as usage of the tractor, number of regeneration cycles performed and engine oil pressure, together with other factors. There is no specific sensor for monitoring oil dilution. The control unit uses information received during usage of the tractor to determine when it is necessary to change the oil.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Change the engine oil
- See the use and maintenance of the vehicle for the procedure to change the engine oil.
- Reset the oil dilution parameter (see the documentation of the diagnostic tool)

3 - Contact the technical support service if the problem persists

3021 - Low oil pressure

Description of fault

The ECU engine control unit detects insufficient engine oil pressure

Severity of error

High

Additional information

Red indicator lamp flashing

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the engine oil level is correct and top up if necessary.
- See the use and maintenance manual of the vehicle for the correct procedure for topping up the engine oil
- Reset the oil dilution parameter (see the documentation of the diagnostic tool)

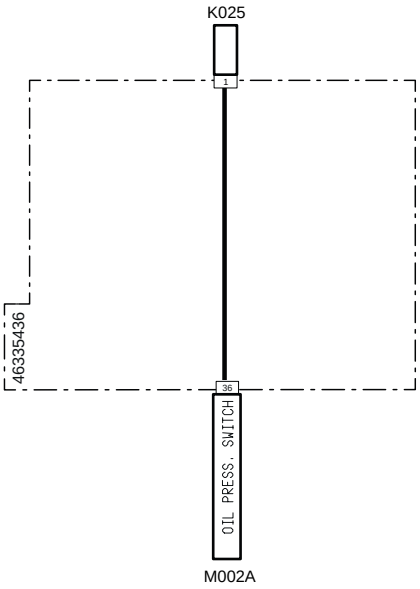
3 - Check that the connectors of the engine oil pressure sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check the condition of the single contact oil pressure sensor switch

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
M002A(pag.458)	XECUA	Engine control unit
K025(pag.466)	XS6	Oil pressure switch

3022 - Engine oil pressure switch malfunction or short circuit

Description of fault

The ECU engine control unit detects a malfunction or an open circuit state of the engine oil pressure switch

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

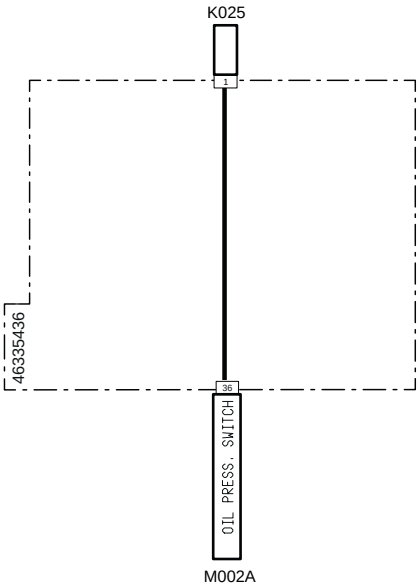
2 - Check that the connectors of the engine oil pressure sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Check the condition of the single contact oil pressure sensor switch

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
M002A(pag.458)	XECUA	Engine control unit
K025(pag.466)	XS6	Oil pressure switch

3023 - Maximum permitted boost pressure exceeded error

Description of fault

The control unit detects an excessively high pressure in the intake manifold

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Use the diagnostic tool to monitor the throttle valve (see documentation of diagnostic tool)
- Check that the throttle valve is working correctly and replace if necessary
- If the problem persists, proceed to the next step

3 - Manually check that the wastegate situated on the turbocharger is working correctly
- The wastegate valve opens to release boost pressure produced by the turbocharger and reduce the pressure in the intake manifold. The pressure increases significantly if the valve remains closed
- There are two methods for checking that the valve is working correctly:
  1- applying leverage on the valve actuator link rod with a suitable tool, taking care not to damage the rod;
  2- increasing engine speed, with the engine running and with the tractor stationary, until the valve opens;
  Follow the safety instructions and rules given in the use and maintenance manual and in the workshop manual precisely
- If the problem persists, proceed to the next step

4 - Use the diagnostic tool to monitor the boost pressure sensor (see the documentation of the diagnostic tool)
- Monitor the pressure in the intake manifold to check that the boost pressure sensor is working correctly
- If the problem persists, proceed to the next step

5 - Check that the connectors of the boost pressure sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

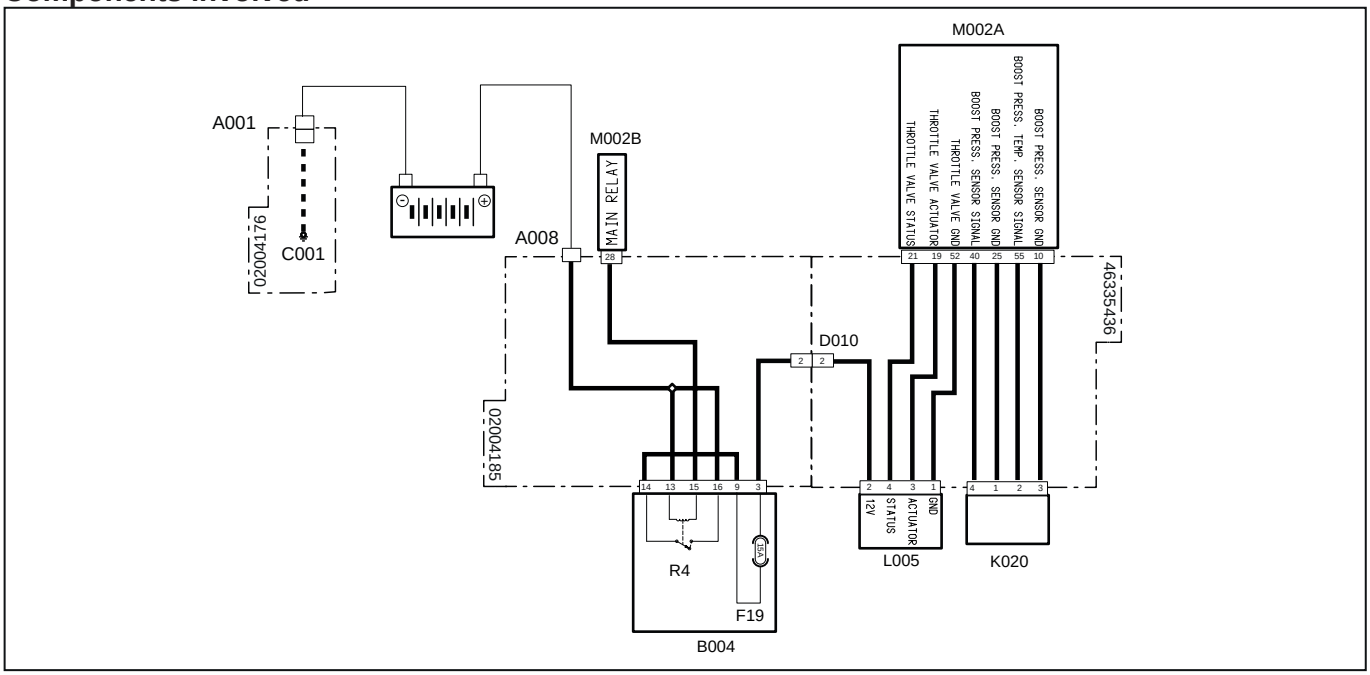
6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Check that the intake ducts are not fouled or obstructed
- Remove the intake ducts from the engine and check that they are not obstructed. Obstructions in the ducts will cause a significant increase in intake pressure.
- If the problem persists, proceed to the next step

9 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A008(pag.439)	P472	Positive battery terminal
C001(pag.367)	P66	Battery ground
D010(pag.438)	P470	Wiring connector for prewired engine wiring loom
D010(pag.468)	XTH	Throttle valve power feed
F19(B004) (pag.418)	F19	Accessories (15A)
K020(pag.465)	XS4	Temperature and pressure sensor (BOOST)
L005(pag.470)	XY3	Throttle valve
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R4(B004) (pag.418)	R4	Main relay (30A)

3024 - Temperature and pressure sensor (BOOST): short circuit to battery

Description of fault

The ECU engine control unit detects a short circuit to battery on the temperature and pressure sensor (BOOST)

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started but the EGR valve remains closed. The engine operates with limited torque

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

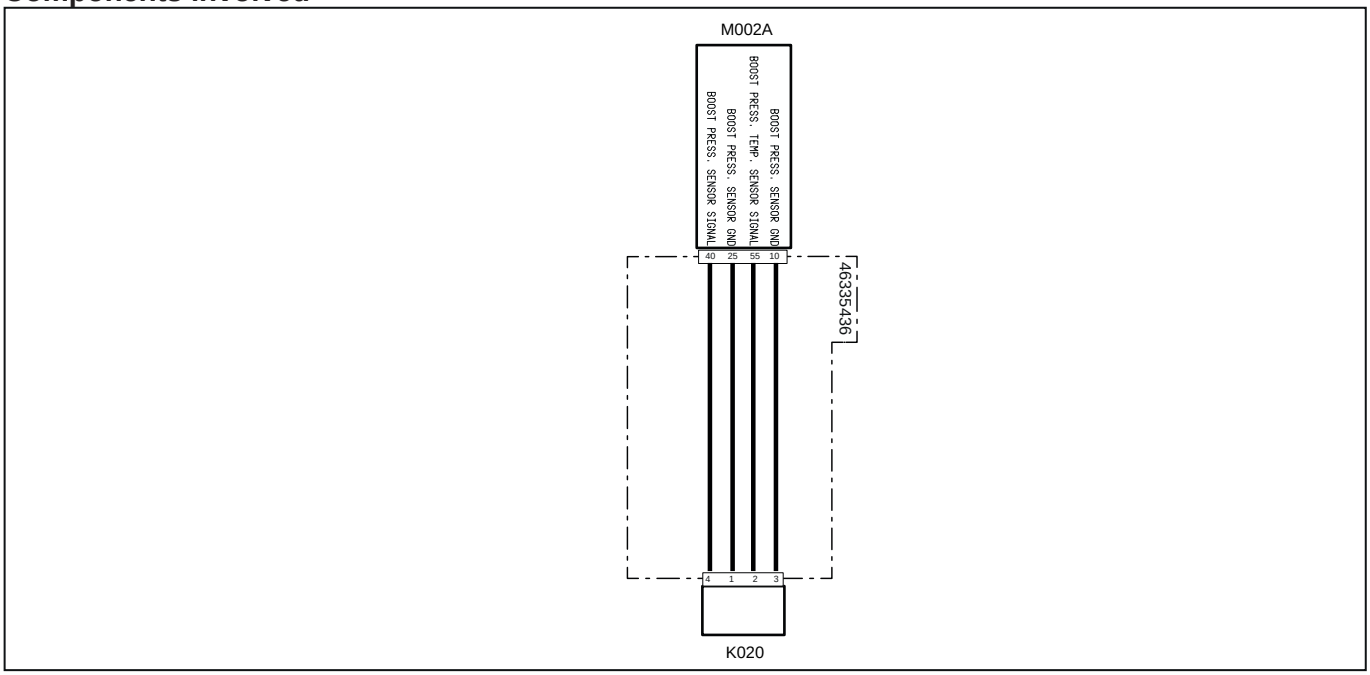
2 - Use the diagnostic tool to monitor the boost pressure sensor (see the documentation of the diagnostic tool)
- Monitor the pressure in the intake manifold to check that the boost pressure sensor is working correctly
- If the problem persists, proceed to the next step

3 - Check that the connectors of the boost pressure sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K020(pag.465)	XS4	Temperature and pressure sensor (BOOST)
M002A(pag.458)	XECUA	Engine control unit

3025 - Temperature and pressure sensor (BOOST): short circuit to ground

Description of fault

The ECU engine control unit detects a short circuit to ground on the temperature and pressure sensor (BOOST)

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started but the EGR valve remains closed. The engine operates with limited torque

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

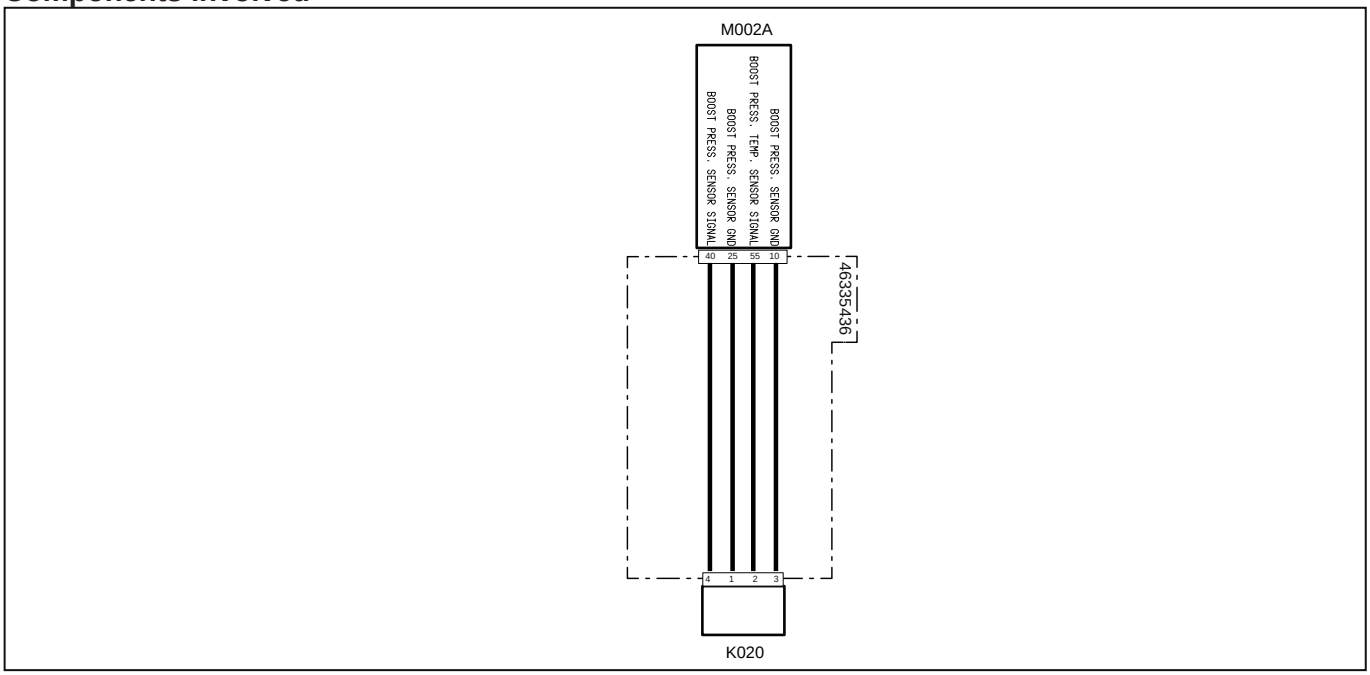
2 - Use the diagnostic tool to monitor the boost pressure sensor (see the documentation of the diagnostic tool)
- Monitor the pressure in the intake manifold to check that the boost pressure sensor is working correctly
- If the problem persists, proceed to the next step

3 - Check that the connectors of the boost pressure sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K020(pag.465)	XS4	Temperature and pressure sensor (BOOST)
M002A(pag.458)	XECUA	Engine control unit

3026 - Boost pressure too high relative to barometric pressure

Description of fault

The ECU engine control unit detects that the pressure measured by the temperature and pressure sensor (BOOST) is much higher than the barometric pressure read by the control unit itself

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The ECU engine control unit has an internal barometric sensor which measures atmospheric pressure. The atmospheric pressure value is crucial for determining the strategies implemented by the engine control unit

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Use the diagnostic tool to monitor the throttle valve (see documentation of diagnostic tool)
- Check that the throttle valve is working correctly and replace if necessary
- If the problem persists, proceed to the next step

3 - Use the diagnostic tool to monitor the boost pressure sensor (see the documentation of the diagnostic tool)
- Monitor the pressure in the intake manifold to check that the boost pressure sensor is working correctly
- If the problem persists, proceed to the next step

4 - Use the diagnostic tool to check that the EGR valve is working correctly (see documentation of diagnostic tool)
- Carry out the EGR valve aperture test while simultaneously checking the effective percentage aperture of the valve itself

  The EGR valve test may also be performed with the engine off
- If the test is passed successfully and no abnormal values are measured, the problem may be due to a different component.
  If the test is failed, proceed to the next step

5 - Check that the connectors of the boost pressure sensor, of the throttle valve, of the EGR valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

6 - Manually check that the wastegate situated on the turbocharger is working correctly
- The wastegate valve opens to release boost pressure produced by the turbocharger and reduce the pressure in the intake manifold. The pressure increases significantly if the valve remains closed
- There are two methods for checking that the valve is working correctly:
  1- applying leverage on the valve actuator link rod with a suitable tool, taking care not to damage the rod;
  2- increasing engine speed, with the engine running and with the tractor stationary, until the valve opens;

  Follow the safety instructions and rules given in the use and maintenance manual and in the workshop manual precisely
- If the problem persists, proceed to the next step

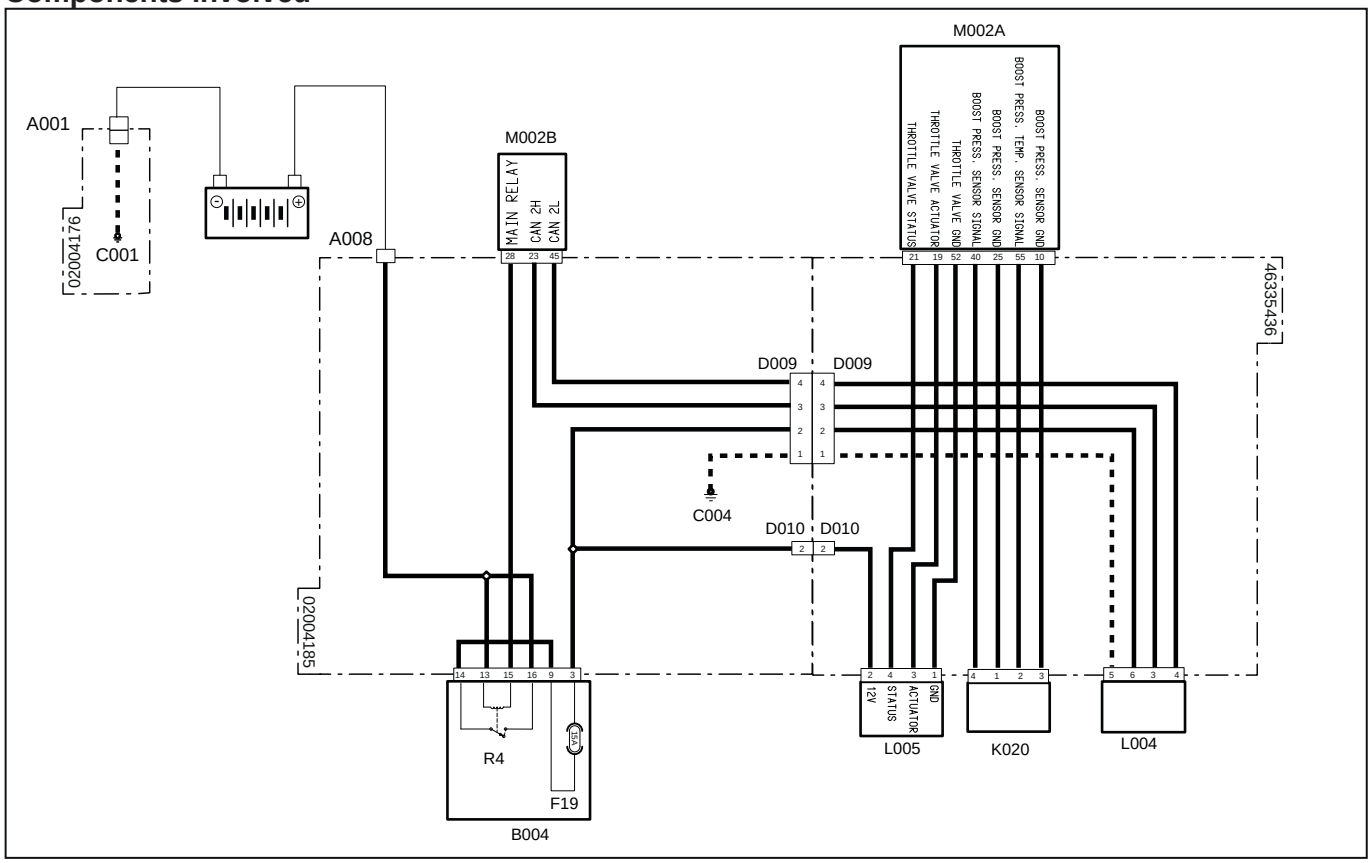
7 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

8 - Check that the wiring loom connectors are connected correctly and not damaged

9 - Check that the intake ducts are not fouled or obstructed
- Remove the intake ducts from the engine and check that they are not obstructed. Obstructions in the ducts will cause a significant increase in intake pressure.
- If the problem persists, proceed to the next step

10 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A008(pag.439)	P472	Positive battery terminal
C001(pag.367)	P66	Battery ground
C004(pag.430)	P105	Engine ground point
D009(pag.437)	P469	Wiring connector for prewired engine wiring loom
D009(pag.460)	XEG	Exhaust gas recirculation solenoid valve power feed
D010(pag.438)	P470	Wiring connector for prewired engine wiring loom
D010(pag.468)	XTH	Throttle valve power feed
F19(B004)(pag.418)	F19	Accessories (15A)
K020(pag.465)	XS4	Temperature and pressure sensor (BOOST)
L004(pag.469)	XY2	Exhaust gas recirculation solenoid valve (EGR)
L005(pag.470)	XY3	Throttle valve
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R4(B004)(pag.418)	R4	Main relay (30A)

3027 - Boost pressure too low relative to barometric pressure

Description of fault

The ECU engine control unit detects that the pressure measured by the temperature and pressure sensor (BOOST) is much lower than the barometric pressure read by the control unit itself

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The ECU engine control unit has an internal barometric sensor which measures atmospheric pressure. The atmospheric pressure value is crucial for determining the strategies implemented by the engine control unit

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Use the diagnostic tool to monitor the throttle valve (see documentation of diagnostic tool)
- Check that the throttle valve is working correctly and replace if necessary
- If the problem persists, proceed to the next step

3 - Use the diagnostic tool to monitor the boost pressure sensor (see the documentation of the diagnostic tool)
- Monitor the pressure in the intake manifold to check that the boost pressure sensor is working correctly
- If the problem persists, proceed to the next step

4 - Use the diagnostic tool to check that the EGR valve is working correctly (see documentation of diagnostic tool)
- Carry out the EGR valve aperture test while simultaneously checking the effective percentage aperture of the valve itself

  The EGR valve test may also be performed with the engine off
- If the test is passed successfully and no abnormal values are measured, the problem may be due to a different component.
  If the test is failed, proceed to the next step

5 - Check that the connectors of the boost pressure sensor, of the throttle valve, of the EGR valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

6 - Manually check that the wastegate situated on the turbocharger is working correctly
- The wastegate valve opens to release boost pressure produced by the turbocharger and reduce the pressure in the intake manifold. The pressure increases significantly if the valve remains closed
- There are two methods for checking that the valve is working correctly:
  1- applying leverage on the valve actuator link rod with a suitable tool, taking care not to damage the rod;
  2- increasing engine speed, with the engine running and with the tractor stationary, until the valve opens;

  Follow the safety instructions and rules given in the use and maintenance manual and in the workshop manual precisely
- If the problem persists, proceed to the next step

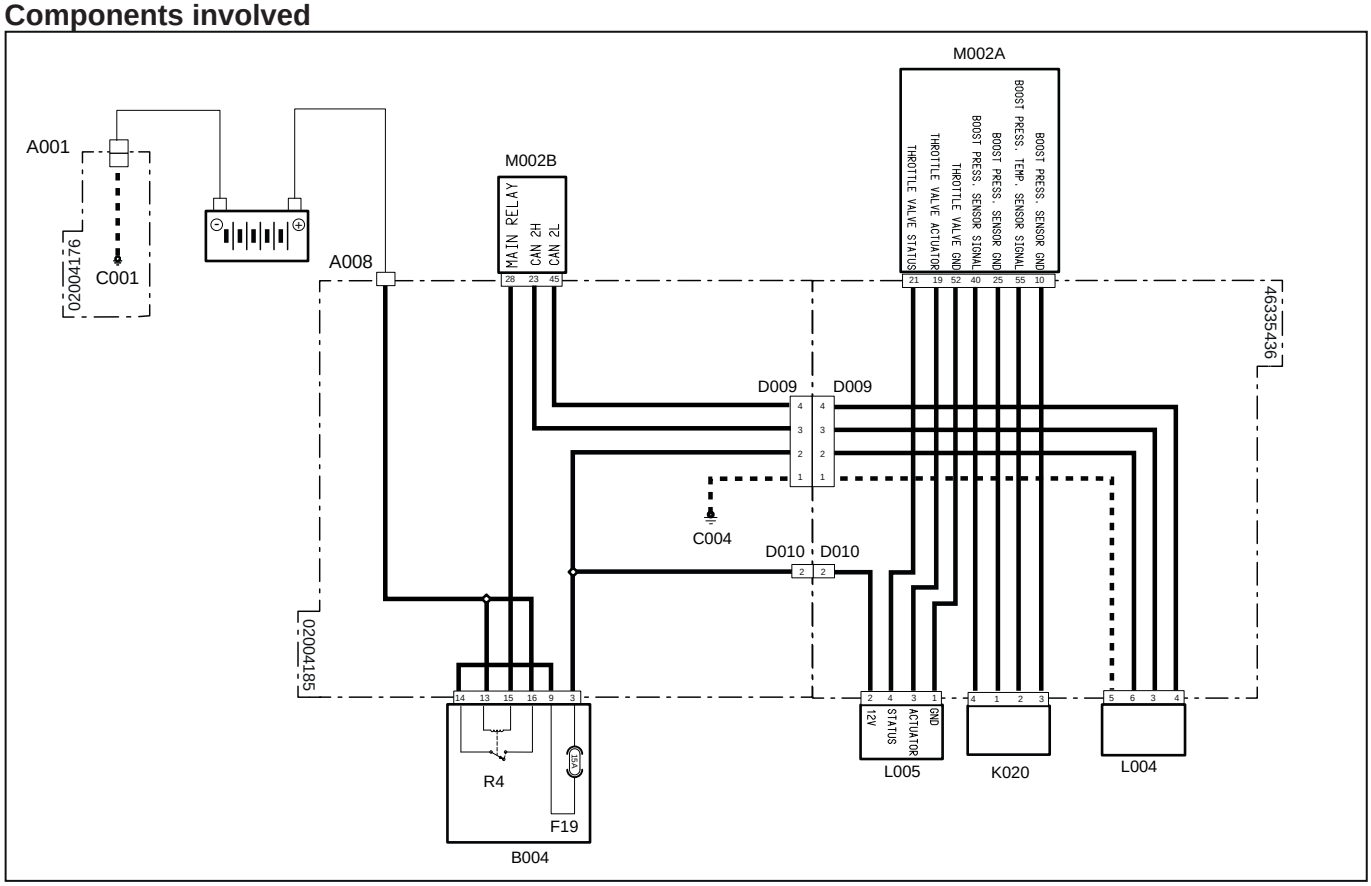
7 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

8 - Check that the wiring loom connectors are connected correctly and not damaged

9 - Check that the intake ducts are not fouled or obstructed
- Remove the intake ducts from the engine and check that they are not obstructed. Obstructions in the ducts will cause a significant increase in intake pressure.
- If the problem persists, proceed to the next step

10 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A008(pag.439)	P472	Positive battery terminal
C001(pag.367)	P66	Battery ground
C004(pag.430)	P105	Engine ground point
D009(pag.437)	P469	Wiring connector for prewired engine wiring loom
D009(pag.460)	XEG	Exhaust gas recirculation solenoid valve power feed
D010(pag.438)	P470	Wiring connector for prewired engine wiring loom
D010(pag.468)	XTH	Throttle valve power feed
F19(B004)(pag.418)	F19	Accessories (15A)
K020(pag.465)	XS4	Temperature and pressure sensor (BOOST)
L004(pag.469)	XY2	Exhaust gas recirculation solenoid valve (EGR)
L005(pag.470)	XY3	Throttle valve
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R4(B004)(pag.418)	R4	Main relay (30A)

3028 - Temperature and pressure sensor (BOOST): short circuit to battery or open circuit

Description of fault

The ECU engine control unit detects a short circuit to battery or open circuit state on the temperature and pressure sensor (BOOST)

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

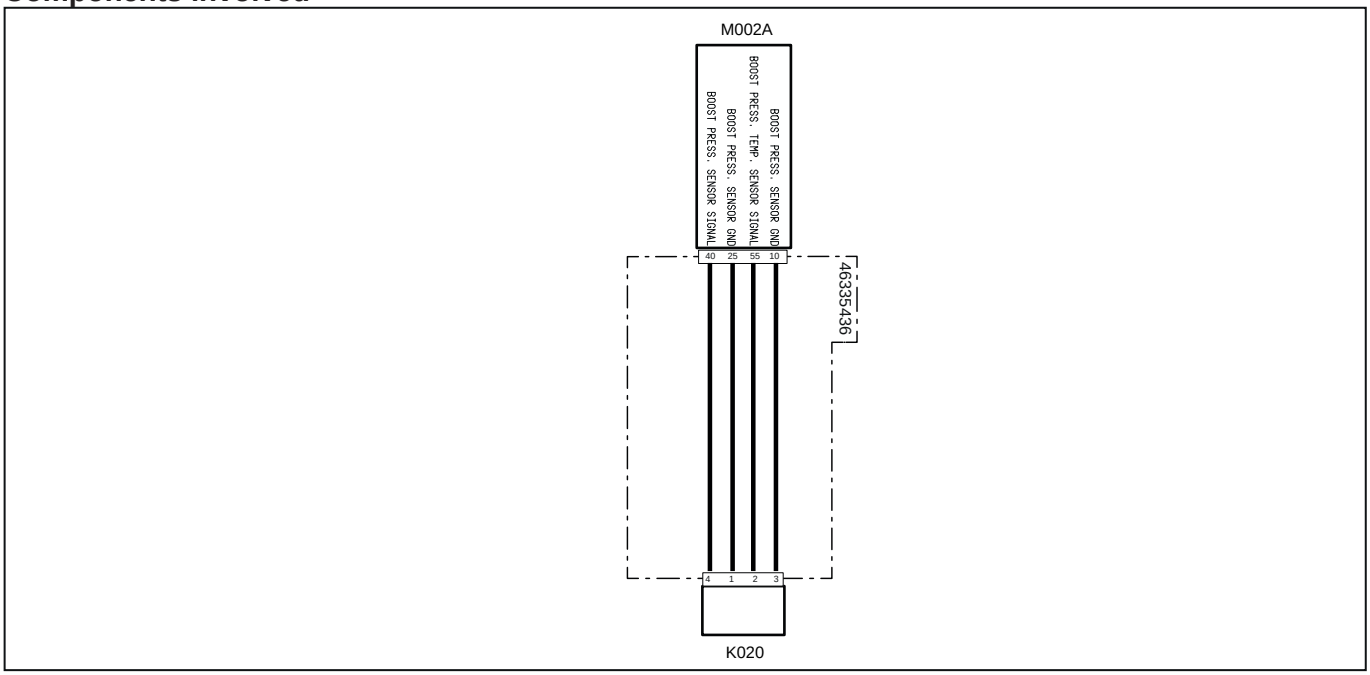
2 - Use the diagnostic tool to monitor the boost pressure sensor (see the documentation of the diagnostic tool)
- Monitor the pressure in the intake manifold to check that the boost pressure sensor is working correctly
- If the problem persists, proceed to the next step

3 - Check that the connectors of the boost pressure sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K020(pag.465)	XS4	Temperature and pressure sensor (BOOST)
M002A(pag.458)	XECUA	Engine control unit

3029 - Temperature and pressure sensor (BOOST): short circuit to ground

Description of fault

The ECU engine control unit detects a short circuit to ground on the temperature and pressure sensor (BOOST)

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

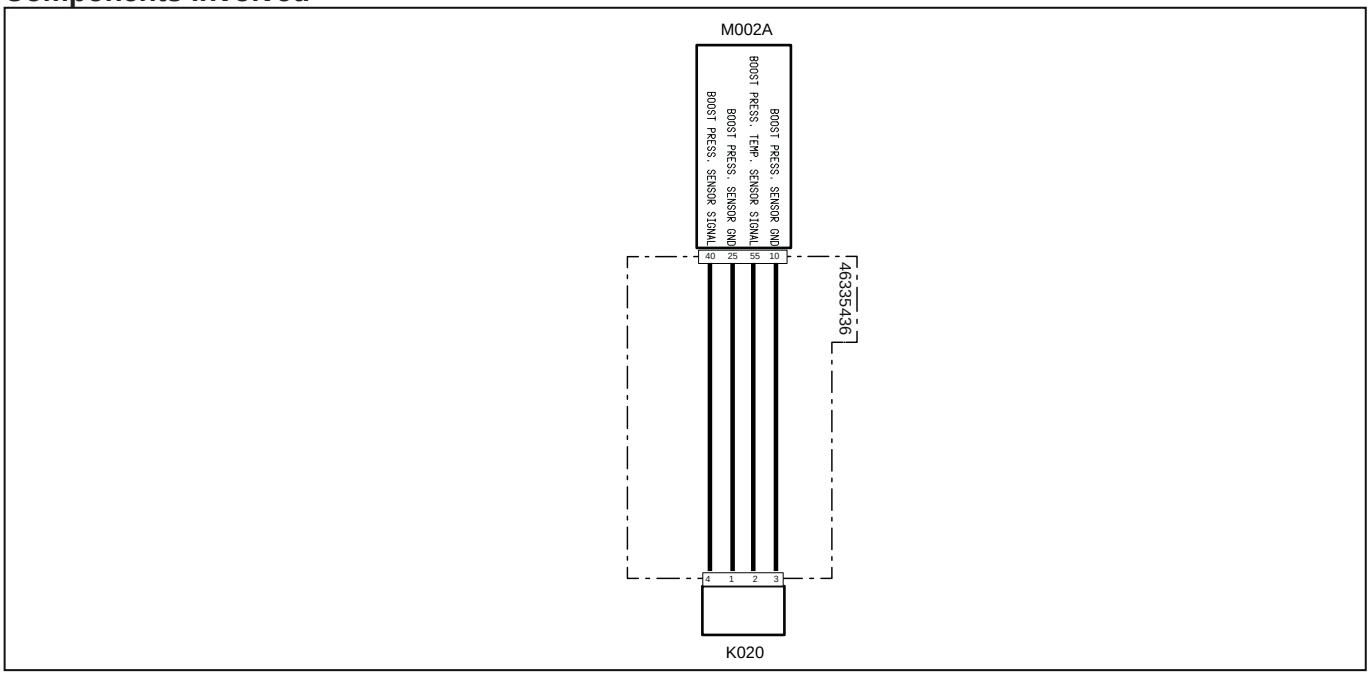
2 - Use the diagnostic tool to monitor the boost pressure sensor (see the documentation of the diagnostic tool)
- Monitor the pressure in the intake manifold to check that the boost pressure sensor is working correctly
- If the problem persists, proceed to the next step

3 - Check that the connectors of the boost pressure sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K020(pag.465)	XS4	Temperature and pressure sensor (BOOST)
M002A(pag.458)	XECUA	Engine control unit

3030 - Barometric pressure sensor: short circuit to battery or open circuit

Description of fault

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check that the connectors of the pressure sensor on the control unit and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly

2 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

3 - Check that the wiring loom connectors are connected correctly and not damaged

3031 - Barometric pressure sensor: short circuit to ground

Description of fault

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check that the connectors of the pressure sensor on the control unit and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly

2 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

3 - Check that the wiring loom connectors are connected correctly and not damaged

Components involved

P186	None
P80	None
P118	None

3032 - Coolant temperature too high

Description of fault

The ECU engine control unit detects an excessively high coolant temperature

Severity of error

High

Additional information

Red indicator lamp flashing

Behaviour of system

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the coolant level in the radiator and top up if necessary
- See the use and maintenance manual of the vehicle for the correct procedure for topping up coolant
- If the problem persists, proceed to the next step

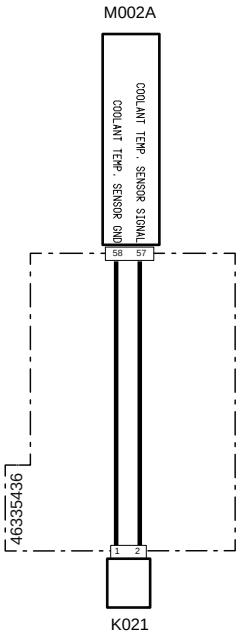
3 - Check for leaks from the coolant circuit
- Place a sheet of cardboard under the engine and start the engine. Any leaks in the circuit will wet the cardboard
  Even if no leaks are found, check the coolant level again after a couple of hours at work. If the level has dropped, this means that there is a leak somewhere in the circuit
- Check the condition of the radiator and hoses and check that the hose clamps are fastened correctly
- If the problem persists, proceed to the next step

4 - Check that the connectors of the coolant temperature sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
M002A(pag.458)	XECUA	Engine control unit
K021(pag.463)	XS1B	Coolant temperature sensor

3033 - Coolant temperature sensor: short circuit to positive or open circuit

Description of fault

The ECU engine control unit detects a short circuit to positive or open circuit fault on the coolant temperature sensor

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

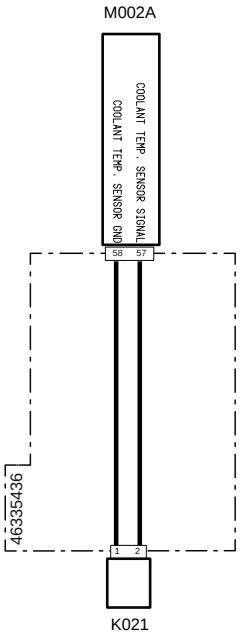
1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the connectors of the coolant temperature sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

4 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
M002A(pag.458)	XECUA	Engine control unit
K021(pag.463)	XS1B	Coolant temperature sensor

3034 - Coolant temperature sensor: short circuit to ground

Description of fault

The ECU engine control unit detects a short circuit to ground on the coolant temperature sensor

Severity of error

Medium

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

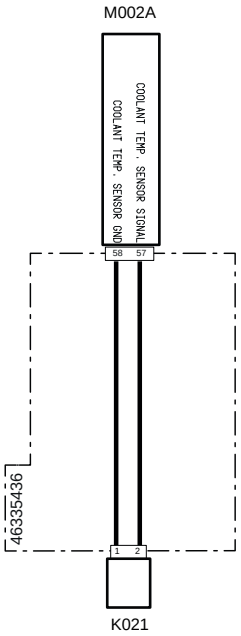
1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the connectors of the coolant temperature sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

4 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
M002A(pag.458)	XECUA	Engine control unit
K021(pag.463)	XS1B	Coolant temperature sensor

3035 - DPF differential pressure too high

Description of fault

Pressure difference detected by control unit between inlet and outlet sides of diesel particulate filter is too high

Severity of error

Medium

Additional information

Red indicator lamp flashing

The degree of clogging of the DPF filter is monitored by the ECU unit via the signals received from the differential pressure sensor, which measures the pressure ahead of and after the filter. If the pressure read by the sensor on the inlet side is higher than the pressure read on the outlet side, this means that the filter is clogged.

The differential pressure sensor reading may be viewed with the diagnostic tool

Behaviour of system

The engine may be started but the EGR valve remains closed. The engine operates with limited torque

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the differential pressure sensor is installed correctly
- If the differential pressure sensor is installed the wrong way around or if the tubes are swapped, the reading produced by the sensor will be incorrect
- Proceed to the next step if the sensor is installed correctly

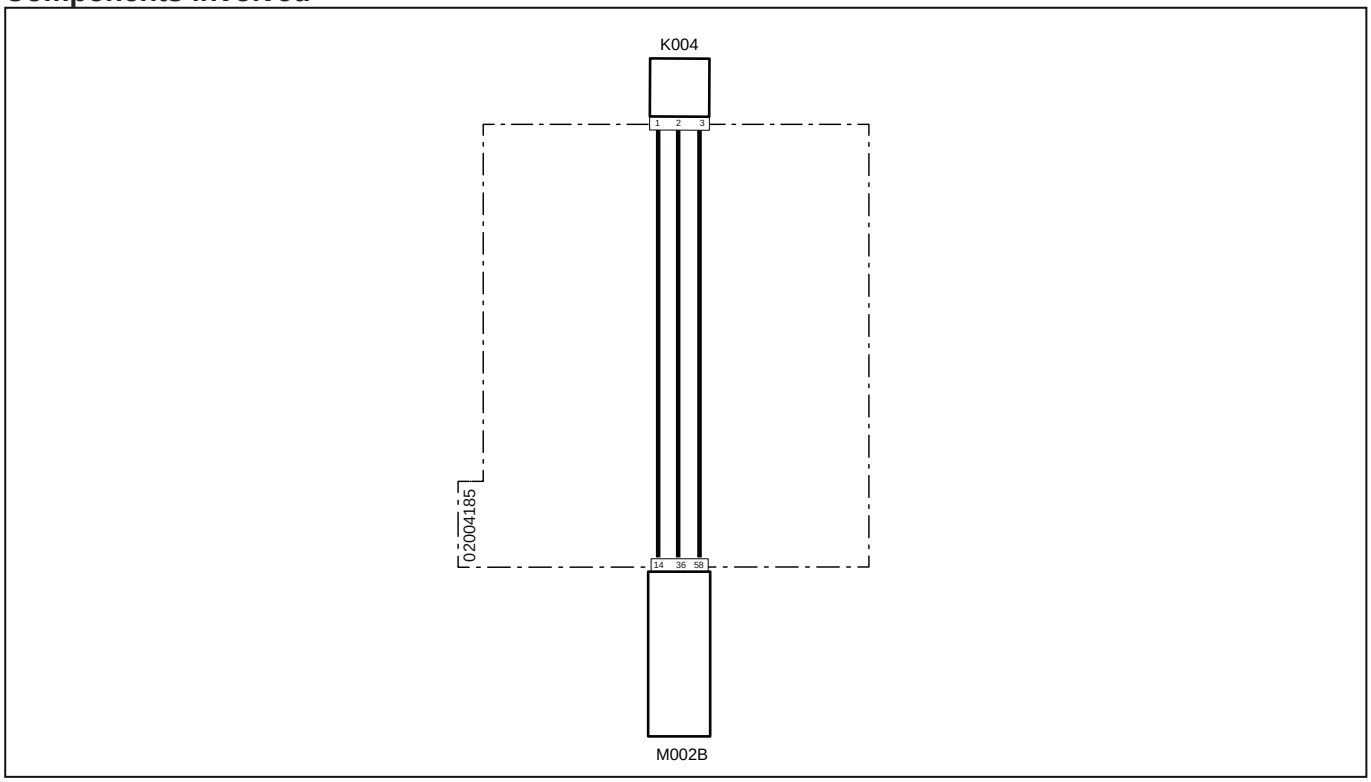
3 - Perform the service regeneration procedure for the DPF filter (see the documentation of the diagnostic tool)
- Read the safety information given in the use and maintenance manual of the vehicle with particular care.
- If the problem persists, proceed to the next step

4 - Use the diagnostic tool to view the differential pressure sensor reading (see the documentation of the diagnostic tool)
- Check if the differential pressure sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

5 - Check that the rubber tubes connected to the differential pressure sensor are not obstructed. An obstruction in these tubes may cause the sensor to read incorrect measurements

6 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K004(pag.420)	P3	Differential pressure sensor
M002B(pag.423)	P12	Engine control unit

3036 - DPF differential pressure too low

Description of fault

Pressure difference detected by control unit between inlet and outlet sides of diesel particulate filter is too low

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The degree of clogging of the DPF filter is monitored by the ECU unit via the signals received from the differential pressure sensor, which measures the pressure ahead of and after the filter. If the pressure read by the sensor on the inlet side is higher than the pressure read on the outlet side, this means that the filter is clogged.

The differential pressure sensor reading may be viewed with the diagnostic tool

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the differential pressure sensor is installed correctly
- If the differential pressure sensor is installed the wrong way around or if the tubes are swapped, the reading produced by the sensor will be incorrect
- Proceed to the next step if the sensor is installed correctly

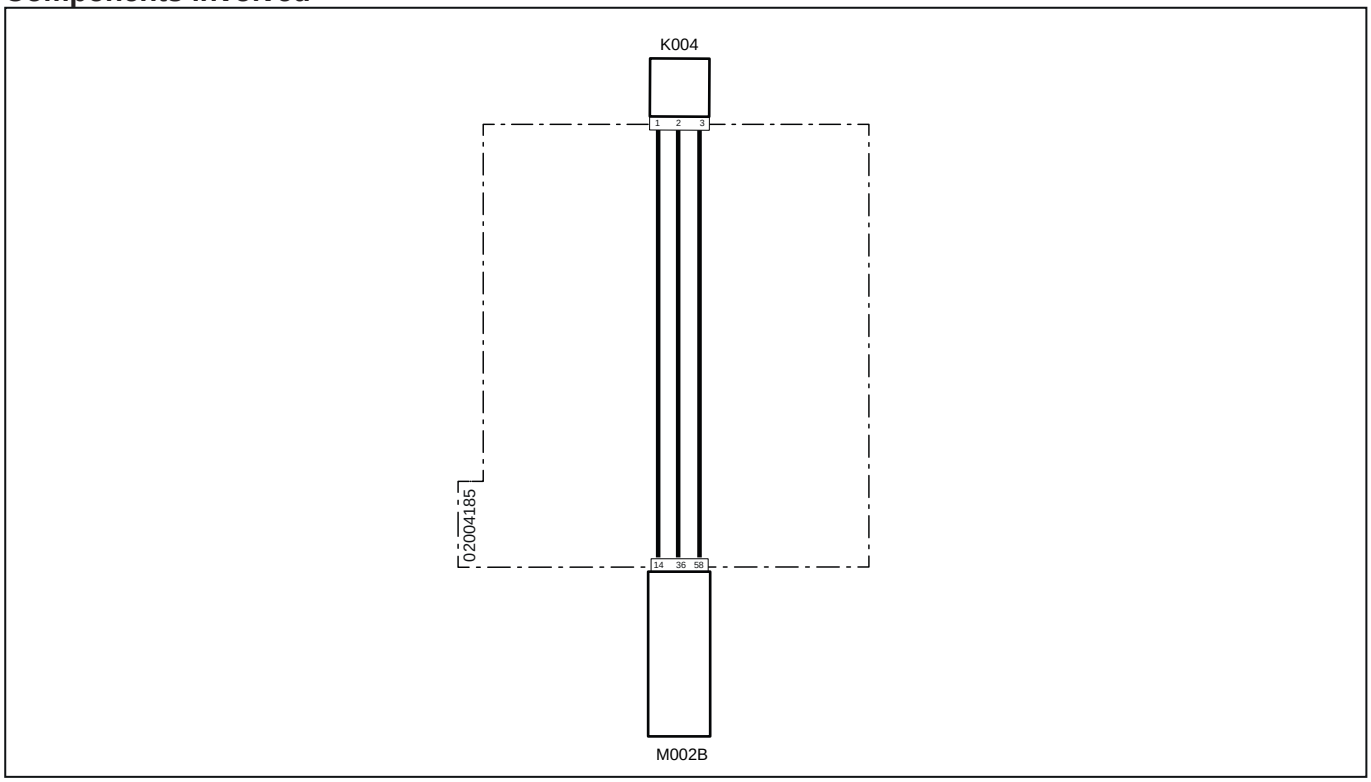
3 - Perform the service regeneration procedure for the DPF filter (see the documentation of the diagnostic tool)
- Read the safety information given in the use and maintenance manual of the vehicle with particular care.
- If the problem persists, proceed to the next step

4 - Use the diagnostic tool to view the differential pressure sensor reading (see the documentation of the diagnostic tool)
- Check if the differential pressure sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

5 - Check that the rubber tubes connected to the differential pressure sensor are not obstructed. An obstruction in these tubes may cause the sensor to read incorrect measurements

6 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K004(pag.420)	P3	Differential pressure sensor
M002B(pag.423)	P12	Engine control unit

3037 - Differential pressure sensor: short circuit to battery or open circuit

Description of fault

The ECU engine control unit detects a short circuit to battery or open circuit fault on the differential pressure sensor

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The degree of clogging of the DPF filter is monitored by the ECU unit via the signals received from the differential pressure sensor, which measures the pressure ahead of and after the filter. If the pressure read by the sensor on the inlet side is higher than the pressure read on the outlet side, this means that the filter is clogged.

The differential pressure sensor reading may be viewed with the diagnostic tool

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

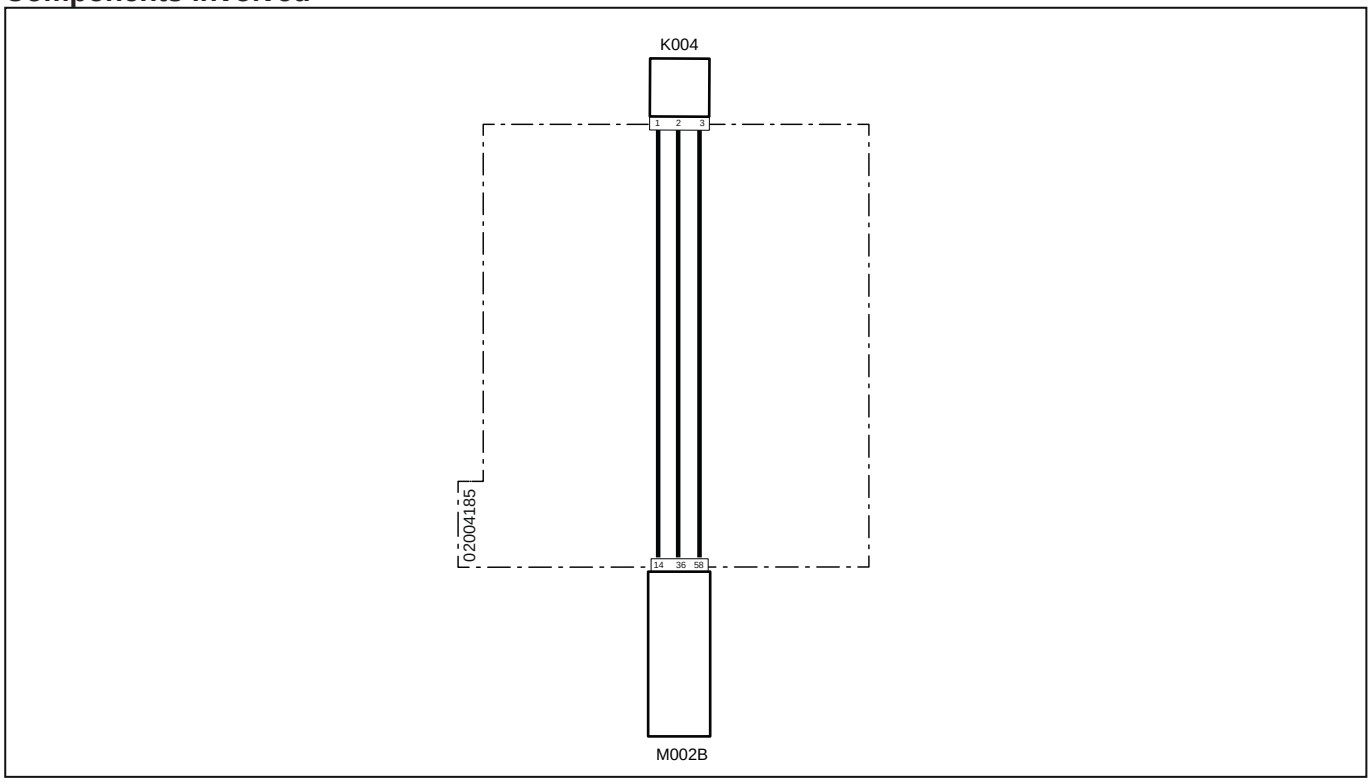
2 - Check that the differential pressure sensor is installed correctly
- If the differential pressure sensor is installed the wrong way around or if the tubes are swapped, the reading produced by the sensor will be incorrect
- Proceed to the next step if the sensor is installed correctly

3 - Use the diagnostic tool to view the differential pressure sensor reading (see the documentation of the diagnostic tool)
- Check if the differential pressure sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K004(pag.420)	P3	Differential pressure sensor
M002B(pag.423)	P12	Engine control unit

3038 - Differential pressure sensor: short circuit to ground

Description of fault

The ECU engine control unit detects a short circuit to ground on the differential pressure sensor

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The degree of clogging of the DPF filter is monitored by the ECU unit via the signals received from the differential pressure sensor, which measures the pressure ahead of and after the filter. If the pressure read by the sensor on the inlet side is higher than the pressure read on the outlet side, this means that the filter is clogged.

The differential pressure sensor reading may be viewed with the diagnostic tool

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

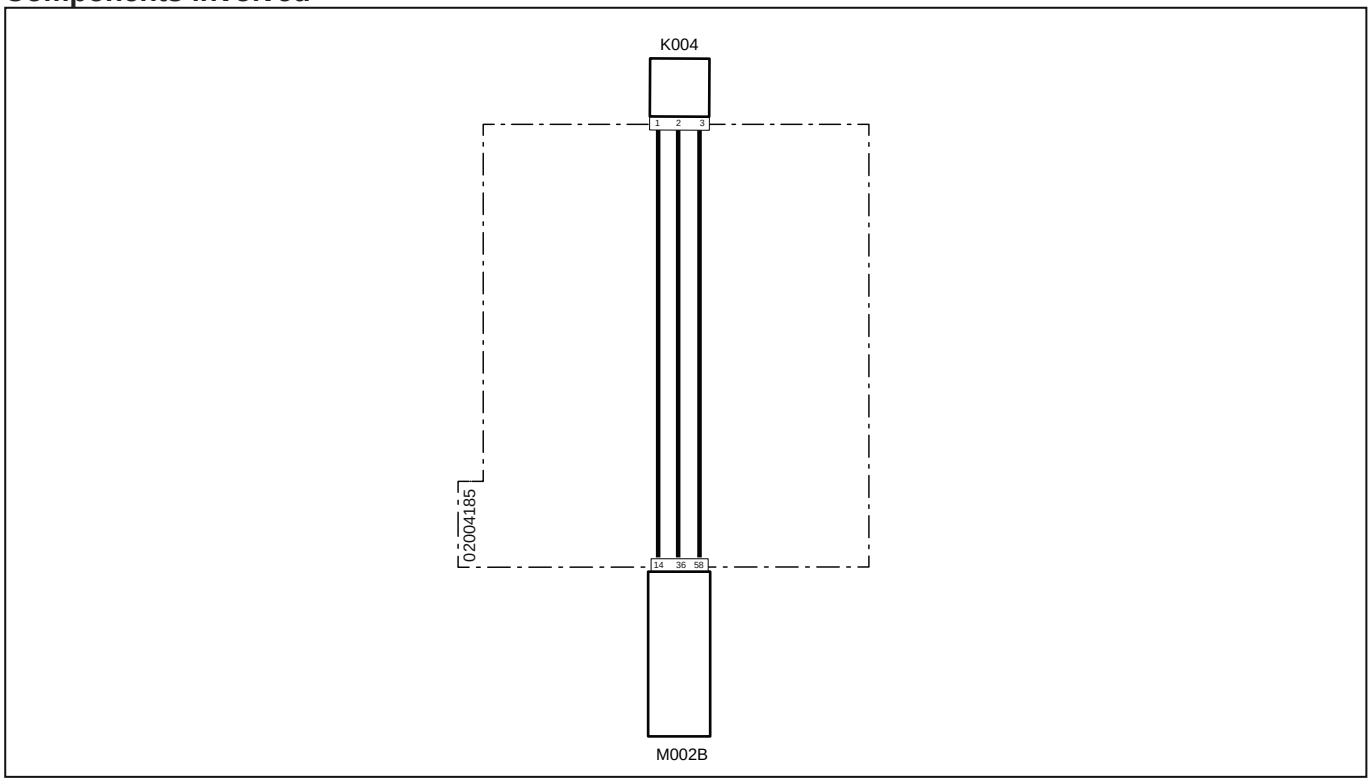
2 - Check that the differential pressure sensor is installed correctly
- If the differential pressure sensor is installed the wrong way around or if the tubes are swapped, the reading produced by the sensor will be incorrect
- Proceed to the next step if the sensor is installed correctly

3 - Use the diagnostic tool to view the differential pressure sensor reading (see the documentation of the diagnostic tool)
- Check if the differential pressure sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K004(pag.420)	P3	Differential pressure sensor
M002B(pag.423)	P12	Engine control unit

3039 - Low rail pressure

Description of fault

The ECU engine control unit detects insufficient pressure in the rail circuit

Severity of error

High

Additional information

Red indicator lamp flashing

The rail pressure is monitored by the rail pressure sensor. Rail pressure is managed by the ECU engine control unit, which determines the percentage aperture of the MProp metering valve situated on the high pressure fuel pump in relation to a number of different parameters

Behaviour of system

The engine may be started, but the engine operates with limited torque

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Use the diagnostic tool to check that the MProp metering valve is working correctly (see documentation of diagnostic tool)
- Check that the MProp valve is working correctly and replace if necessary
- Check that the percent aperture of the valve is congruent with the pressure measured by the rail pressure sensor
- If the problem persists, proceed to the next step

3 - Use the diagnostic tool to check that the rail pressure sensor is working correctly (see documentation of diagnostic tool)
- Check if the rail pressure sensor is working correctly and replace if necessary
- Check that the pressure measured by the rail pressure sensor is congruent with the percent aperture of the valve
- If the problem persists, proceed to the next step

4 - Check that the connectors of the rail pressure sensor, of the MProp metering valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

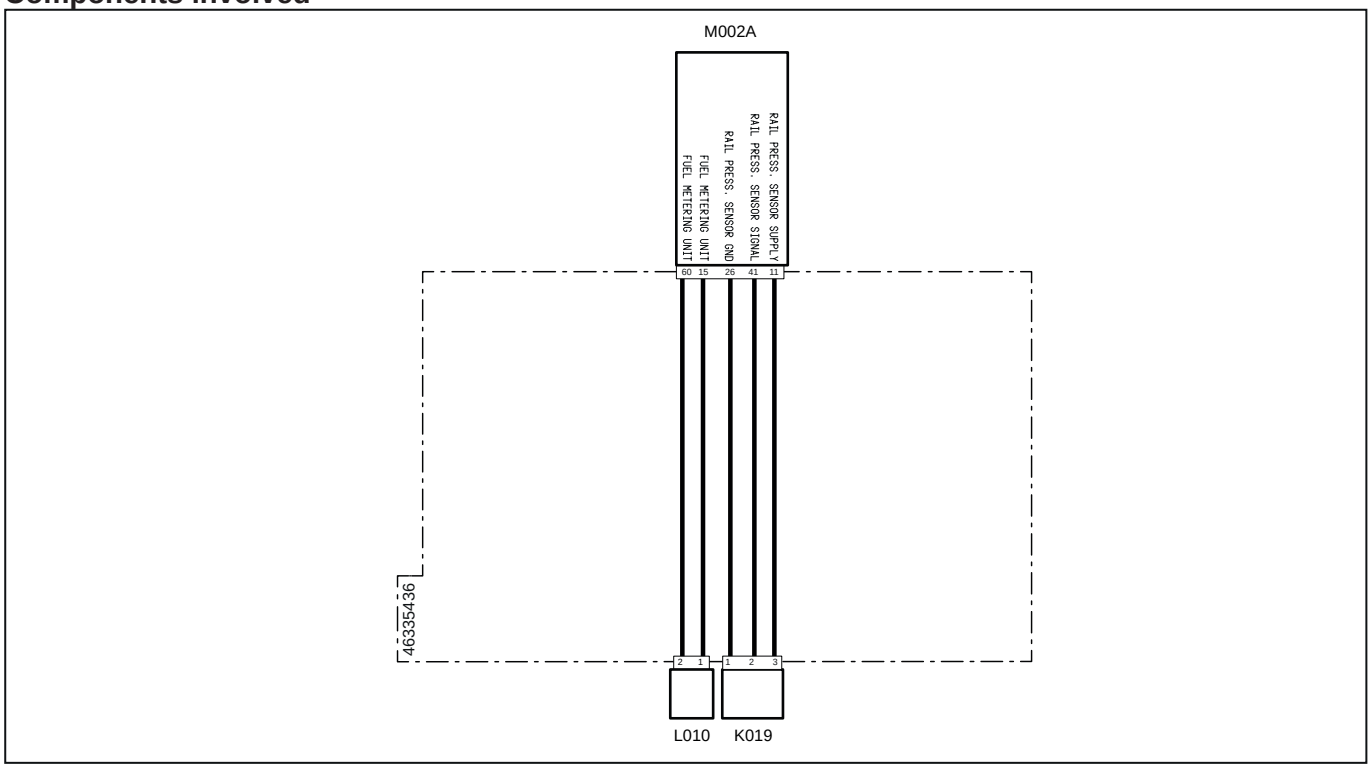
5 - Check the fuel delivery circuit for leaks and/or obstructions
- Check that there are no obstructions in the fuel suction pipe (low pressure side) leading from the fuel tank
- Check that the fuel filter is not clogged and replace if necessary
- Check that there are no leaks from the high pressure side pipes connected to the rail and injectors

The high pressure circuit can cause severe injury. Work with extreme caution and observe all the safety rules and instructions given in the workshop manual of the vehicle

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K019(pag.466)	XS5	Common Rail fuel pressure sensor
L010(pag.468)	XY1	High pressure pump
M002A(pag.458)	XECUA	Engine control unit

3040 - High rail pressure

Description of fault

The ECU engine control unit detects excessively high pressure in the rail circuit

Severity of error

High

Additional information

Red indicator lamp flashing

The rail pressure is monitored by the rail pressure sensor. Rail pressure is managed by the ECU engine control unit, which determines the percentage aperture of the MProp metering valve situated on the high pressure fuel pump in relation to a number of different parameters

Behaviour of system

The engine may be started, but the engine operates with limited torque

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Use the diagnostic tool to check that the MProp metering valve is working correctly (see documentation of diagnostic tool)
- Check that the MProp valve is working correctly and replace if necessary
- Check that the percent aperture of the valve is congruent with the pressure measured by the rail pressure sensor
- If the problem persists, proceed to the next step

3 - Use the diagnostic tool to check that the rail pressure sensor is working correctly (see documentation of diagnostic tool)
- Check if the rail pressure sensor is working correctly and replace if necessary
- Check that the pressure measured by the rail pressure sensor is congruent with the percent aperture of the valve
- If the problem persists, proceed to the next step

4 - Check that the connectors of the rail pressure sensor, of the MProp metering valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

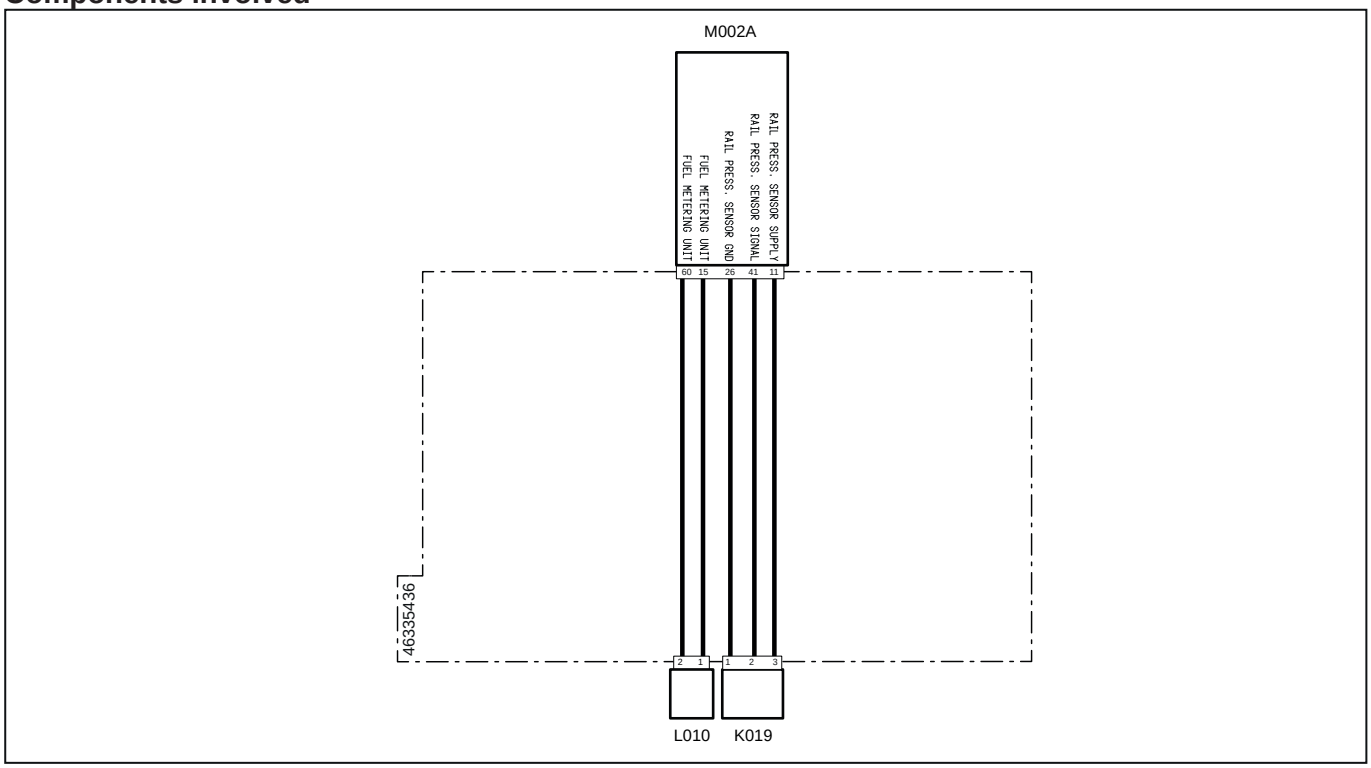
5 - Check the fuel delivery circuit for leaks and/or obstructions
- Check that the fuel filter is not clogged and replace if necessary
- Check that there are no leaks from the high pressure side pipes connected to the rail and injectors

The high pressure circuit can cause severe injury. Work with extreme caution and observe all the safety rules and instructions given in the workshop manual of the vehicle

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K019(pag.466)	XS5	Common Rail fuel pressure sensor
L010(pag.468)	XY1	High pressure pump
M002A(pag.458)	XECUA	Engine control unit

3041 - High rail pressure

Description of fault

The ECU engine control unit detects excessively high pressure in the rail circuit

Severity of error

High

Additional information

Red indicator lamp flashing

The rail pressure is monitored by the rail pressure sensor. Rail pressure is managed by the ECU engine control unit, which determines the percentage aperture of the MProp metering valve situated on the high pressure fuel pump in relation to a number of different parameters

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Use the diagnostic tool to check that the MProp metering valve is working correctly (see documentation of diagnostic tool)
- Check that the MProp valve is working correctly and replace if necessary
- Check that the percent aperture of the valve is congruent with the pressure measured by the rail pressure sensor
- If the problem persists, proceed to the next step

3 - Use the diagnostic tool to check that the rail pressure sensor is working correctly (see documentation of diagnostic tool)
- Check if the rail pressure sensor is working correctly and replace if necessary
- Check that the pressure measured by the rail pressure sensor is congruent with the percent aperture of the valve
- If the problem persists, proceed to the next step

4 - Check that the connectors of the rail pressure sensor, of the MProp metering valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

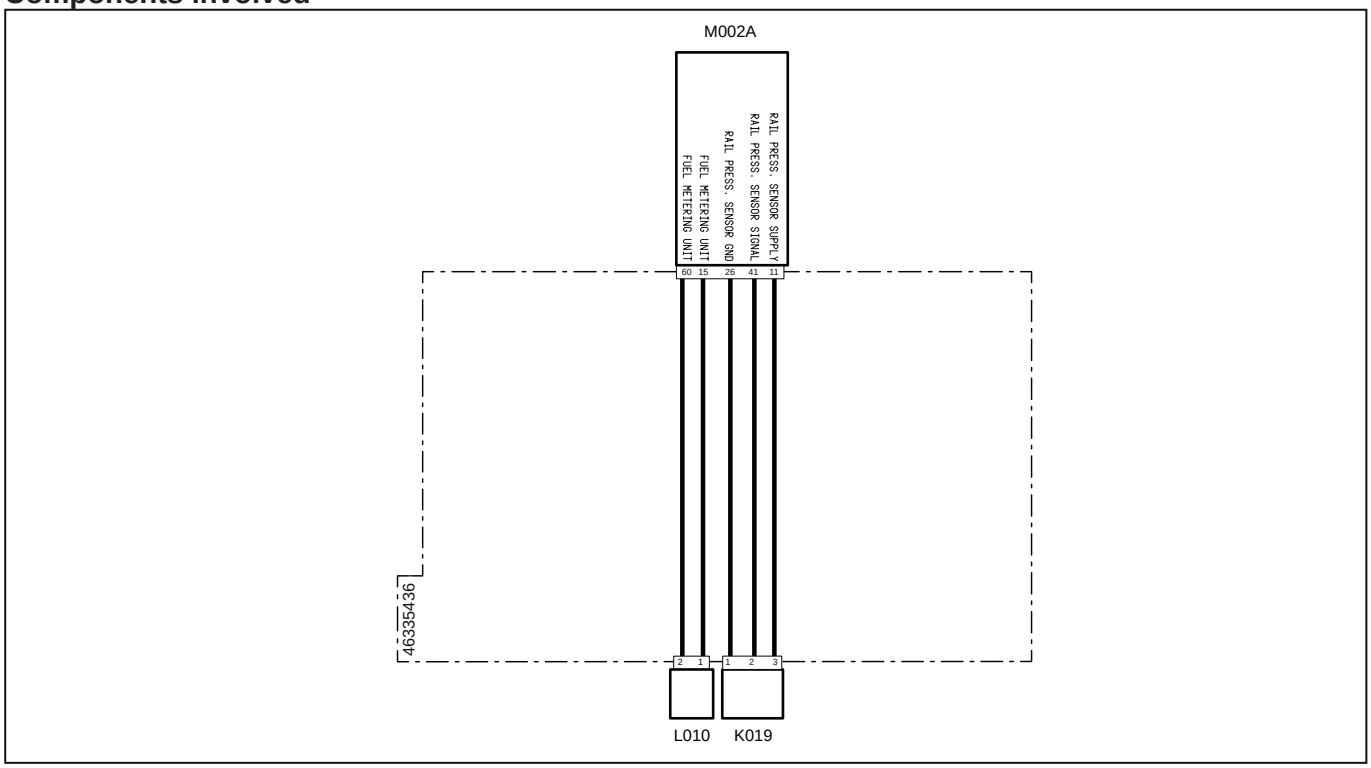
5 - Check the fuel delivery circuit for leaks and/or obstructions
- Check that the fuel filter is not clogged and replace if necessary
- Check that there are no leaks from the high pressure side pipes connected to the rail and injectors

The high pressure circuit can cause severe injury. Work with extreme caution and observe all the safety rules and instructions given in the workshop manual of the vehicle

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K019(pag.466)	XS5	Common Rail fuel pressure sensor
L010(pag.468)	XY1	High pressure pump
M002A(pag.458)	XECUA	Engine control unit

3042 - Low rail pressure

Description of fault

The ECU engine control unit detects insufficient pressure in the rail circuit

Severity of error

High

Additional information

Red indicator lamp flashing

The rail pressure is monitored by the rail pressure sensor. Rail pressure is managed by the ECU engine control unit, which determines the percentage aperture of the MProp metering valve situated on the high pressure fuel pump in relation to a number of different parameters

Behaviour of system

The engine may be started, but the engine operates with limited torque

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Use the diagnostic tool to check that the MProp metering valve is working correctly (see documentation of diagnostic tool)
- Check that the MProp valve is working correctly and replace if necessary
- Check that the percent aperture of the valve is congruent with the pressure measured by the rail pressure sensor
- If the problem persists, proceed to the next step

3 - Use the diagnostic tool to check that the rail pressure sensor is working correctly (see documentation of diagnostic tool)
- Check if the rail pressure sensor is working correctly and replace if necessary
- Check that the pressure measured by the rail pressure sensor is congruent with the percent aperture of the valve
- If the problem persists, proceed to the next step

4 - Check that the connectors of the rail pressure sensor, of the MProp metering valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

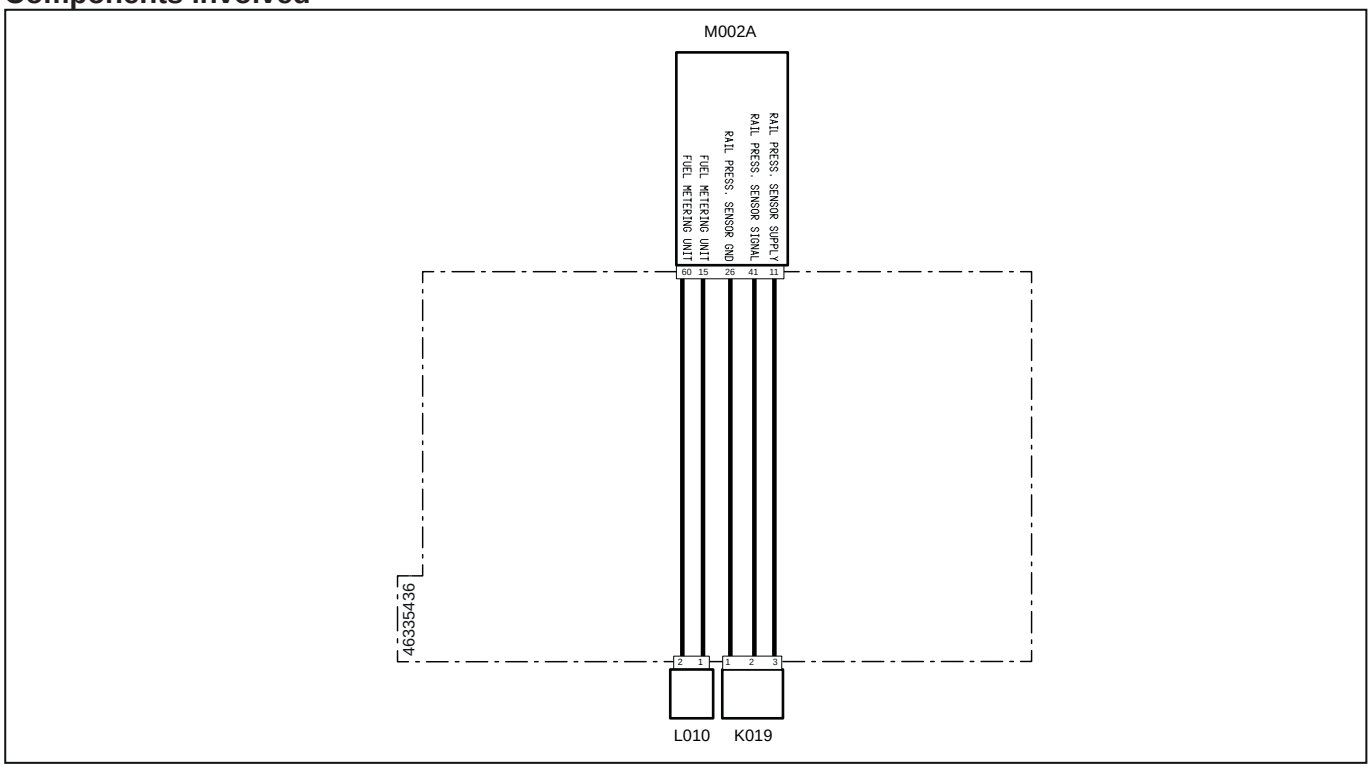
5 - Check the fuel delivery circuit for leaks and/or obstructions
- Check that there are no obstructions in the fuel suction pipe (low pressure side) leading from the fuel tank
- Check that the fuel filter is not clogged and replace if necessary
- Check that there are no leaks from the high pressure side pipes connected to the rail and injectors

The high pressure circuit can cause severe injury. Work with extreme caution and observe all the safety rules and instructions given in the workshop manual of the vehicle

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K019(pag.466)	XS5	Common Rail fuel pressure sensor
L010(pag.468)	XY1	High pressure pump
M002A(pag.458)	XECUA	Engine control unit

3043 - Rail pressure sensor: short circuit to battery or open circuit

Description of fault

The ECU engine control unit detects a short circuit to battery or open circuit fault on the rail pressure sensor

Severity of error

High

Additional information

Red indicator lamp flashing

The rail pressure is monitored by the rail pressure sensor. Rail pressure is managed by the ECU engine control unit, which determines the percentage aperture of the MProp metering valve situated on the high pressure fuel pump in relation to a number of different parameters

Behaviour of system

The engine may be started, but the engine operates with limited torque

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

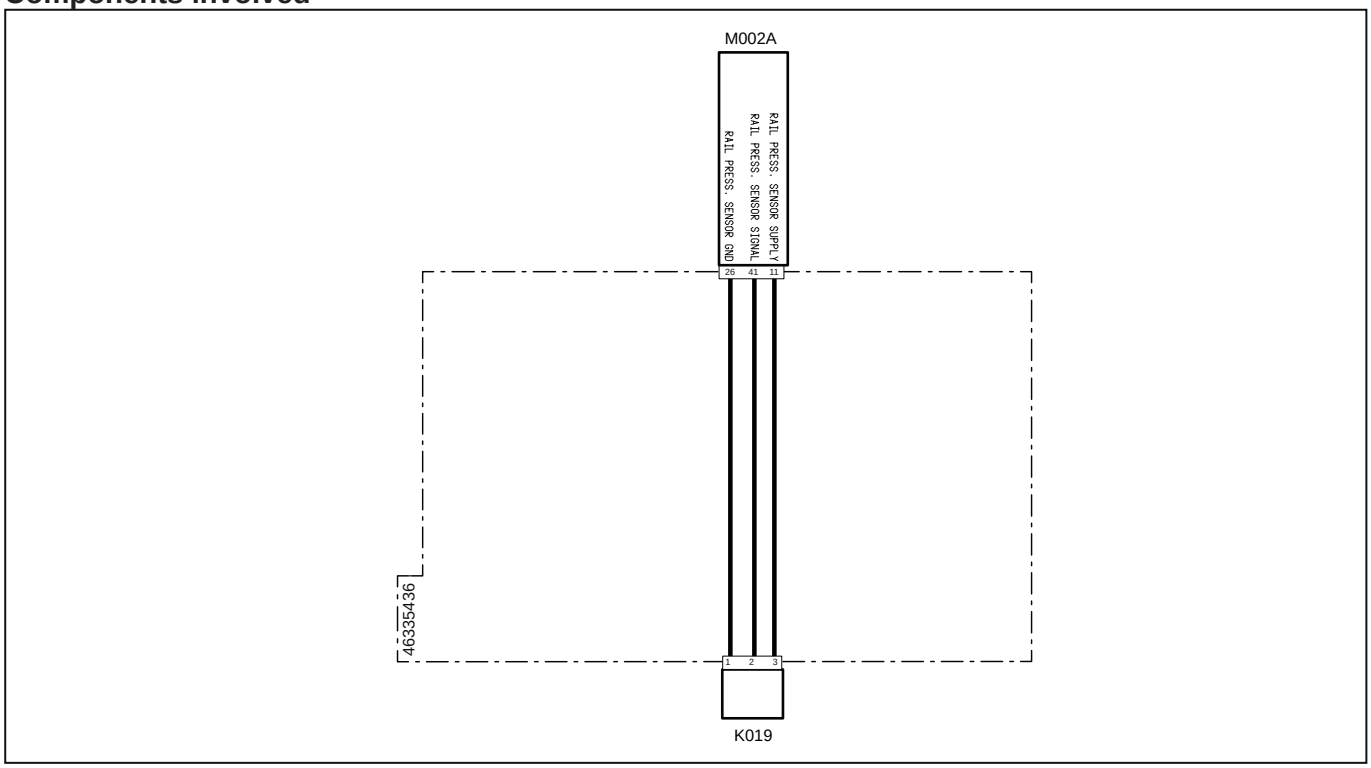
2 - Use the diagnostic tool to check that the rail pressure sensor is working correctly (see documentation of diagnostic tool)
- Check if the rail pressure sensor is working correctly and replace if necessary
- Check that the pressure measured by the rail pressure sensor is congruent with the percent aperture of the valve
- If the problem persists, proceed to the next step

3 - Check that the connectors of the rail pressure sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K019(pag.466)	XS5	Common Rail fuel pressure sensor
M002A(pag.458)	XECUA	Engine control unit

3044 - Rail pressure sensor: short circuit to ground

Description of fault

The ECU engine control unit detects a short circuit to ground on the rail pressure sensor

Severity of error

High

Additional information

Red indicator lamp flashing

The rail pressure is monitored by the rail pressure sensor. Rail pressure is managed by the ECU engine control unit, which determines the percentage aperture of the MProp metering valve situated on the high pressure fuel pump in relation to a number of different parameters

Behaviour of system

The engine may be started, but the engine operates with limited torque

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

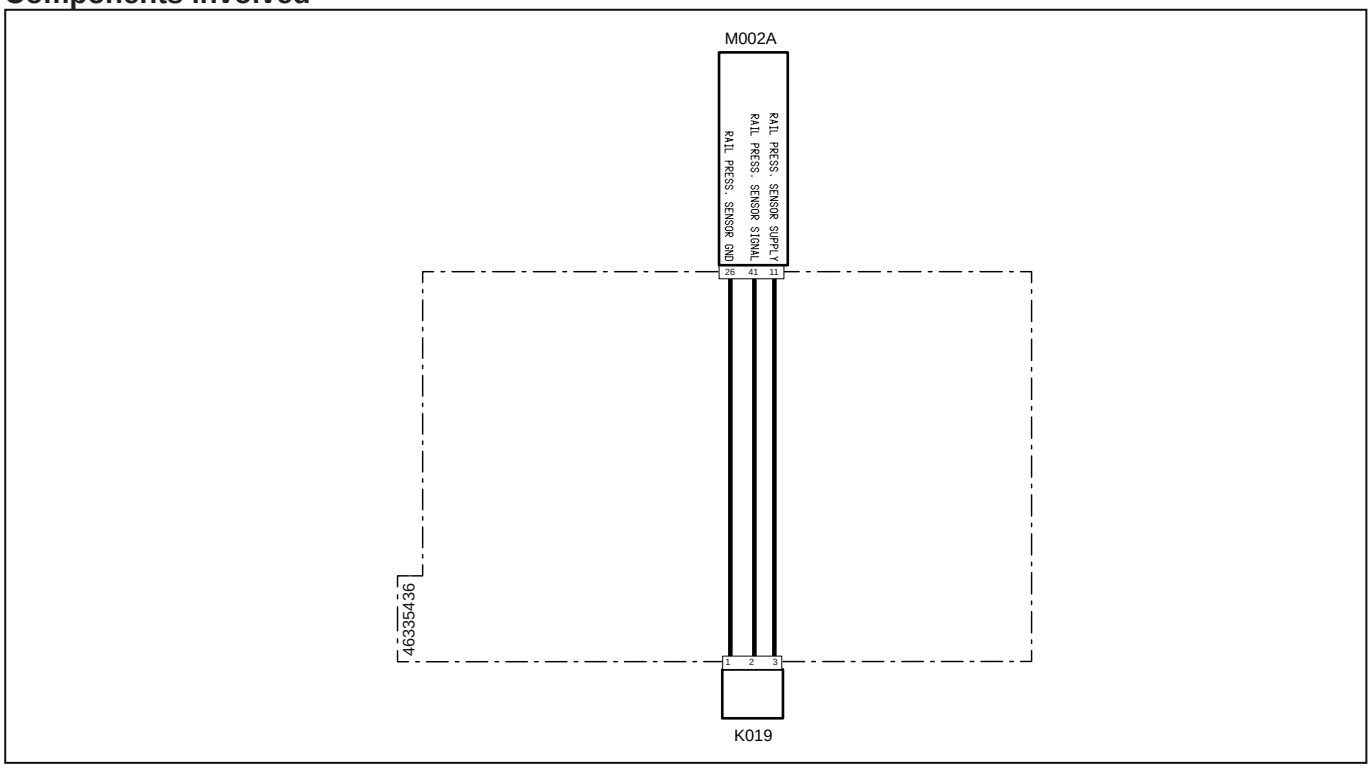
2 - Use the diagnostic tool to check that the rail pressure sensor is working correctly (see documentation of diagnostic tool)
- Check if the rail pressure sensor is working correctly and replace if necessary
- Check that the pressure measured by the rail pressure sensor is congruent with the percent aperture of the valve
- If the problem persists, proceed to the next step

3 - Check that the connectors of the rail pressure sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K019(pag.466)	XS5	Common Rail fuel pressure sensor
M002A(pag.458)	XECUA	Engine control unit

3045 - Rail pressure sensor: spurious contact

Description of fault

The ECU engine control unit determines that the rail pressure sensor is producing an incorrect signal due to a spurious contact on the sensor itself

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The rail pressure is monitored by the rail pressure sensor. Rail pressure is managed by the ECU engine control unit, which determines the percentage aperture of the MProp metering valve situated on the high pressure fuel pump in relation to a number of different parameters

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

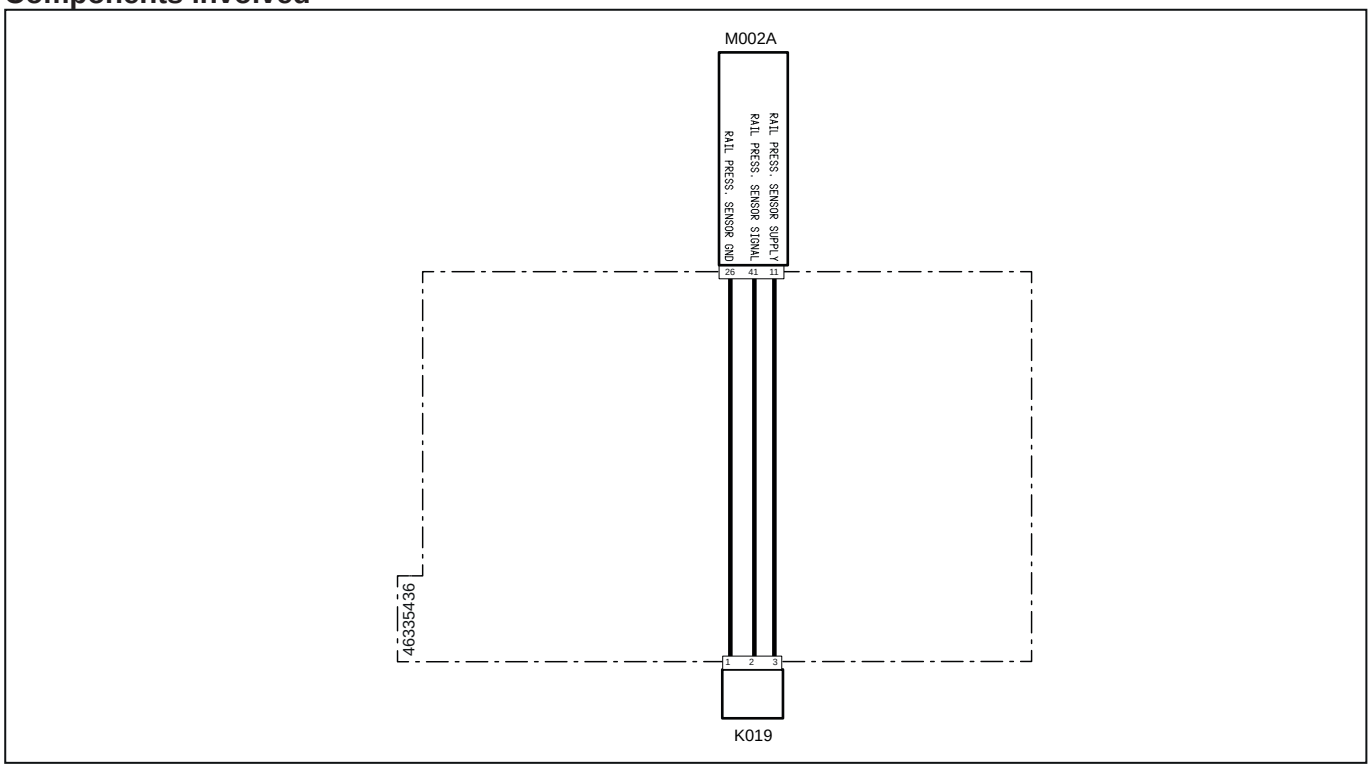
2 - Use the diagnostic tool to check that the rail pressure sensor is working correctly (see documentation of diagnostic tool)
- Check if the rail pressure sensor is working correctly and replace if necessary
- Check that the pressure measured by the rail pressure sensor is congruent with the percent aperture of the valve
- If the problem persists, proceed to the next step

3 - Check that the connectors of the rail pressure sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K019(pag.466)	XS5	Common Rail fuel pressure sensor
M002A(pag.458)	XECUA	Engine control unit

3046 - Rail pressure sensor deviation

Description of fault

Signal received by the ECU engine control unit from the rail pressure sensor is not congruent with the signal received from the barometric pressure sensor at key-on

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The rail pressure sensor monitors the pressure in the rail continuously. The sensor may start to produce inaccurate readings after extended operation. The control unit detects this malfunction by comparing the pressure value received from the rail sensor with the atmospheric pressure value received from the barometric pressure sensor within the unit itself

Behaviour of system

The engine may be started, but the engine operates with limited torque

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

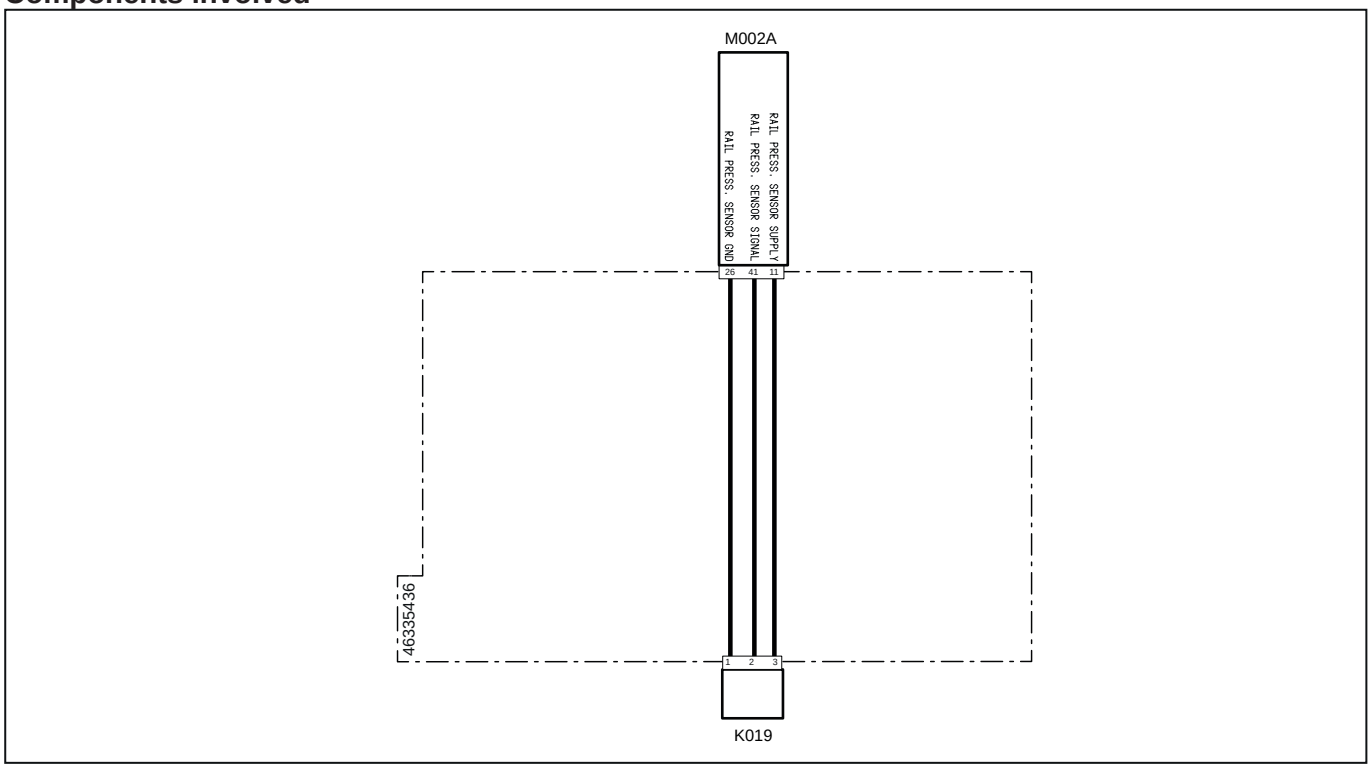
2 - Use the diagnostic tool to check that the rail pressure sensor is working correctly (see documentation of diagnostic tool)
- Check if the rail pressure sensor is working correctly and replace if necessary
- Check that the pressure measured by the rail pressure sensor is congruent with the percent aperture of the valve
- If the problem persists, proceed to the next step

3 - Check that the connectors of the rail pressure sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K019(pag.466)	XS5	Common Rail fuel pressure sensor
M002A(pag.458)	XECUA	Engine control unit

3047 - Rail pressure sensor deviation

Description of fault

Signal received by the ECU engine control unit from the rail pressure sensor is not congruent with the signal received from the barometric pressure sensor at key-on

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The rail pressure sensor monitors the pressure in the rail continuously. The sensor may start to produce inaccurate readings after extended operation. The control unit detects this malfunction by comparing the pressure value received from the rail sensor with the atmospheric pressure value received from the barometric pressure sensor within the unit itself

Behaviour of system

The engine may be started, but the engine operates with limited torque

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

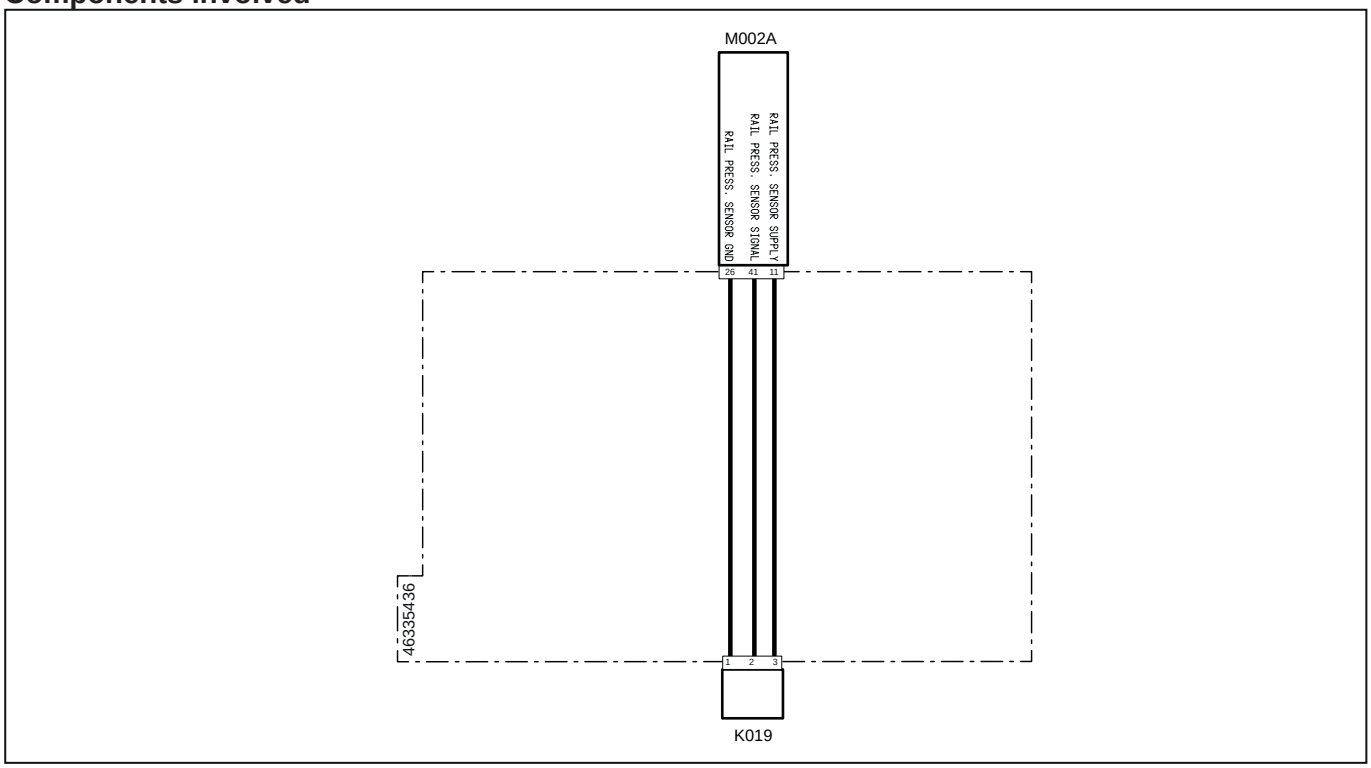
2 - Use the diagnostic tool to check that the rail pressure sensor is working correctly (see documentation of diagnostic tool)
- Check if the rail pressure sensor is working correctly and replace if necessary
- Check that the pressure measured by the rail pressure sensor is congruent with the percent aperture of the valve
- If the problem persists, proceed to the next step

3 - Check that the connectors of the rail pressure sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K019(pag.466)	XS5	Common Rail fuel pressure sensor
M002A(pag.458)	XECUA	Engine control unit

3048 - Battery voltage high

Description of fault

The electronic control unit detects a power feed voltage received from the battery exceeding 16 V

Severity of error

High

Additional information

The battery voltage may be checked from the display of the multifunction instrument

Red indicator lamp flashing

Behaviour of system

The tractor cannot be switched on

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the main fuse (70A) and replace if necessary
- Disconnect the main fuse (70A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

3 - Check the condition of the VCU fuse (10A) and replace if necessary
- Disconnect the VCU fuse (10A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

4 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

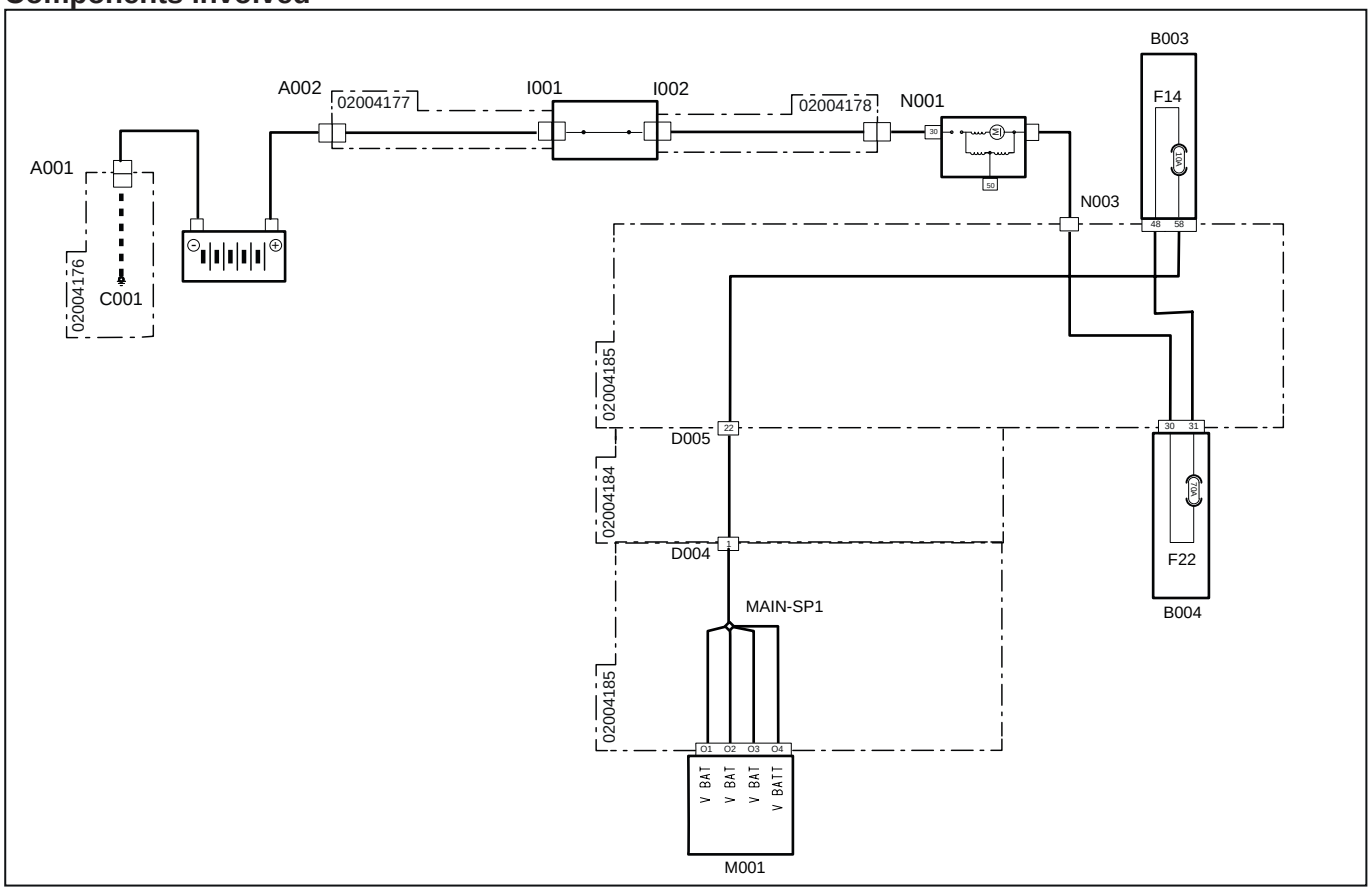
5 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

6 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

7 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

8 - Check that the wiring loom connectors are connected correctly and not damaged

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A002(pag.369)	P55	Positive battery terminal
B003 (pag.415)	P1A	Fuse box "2"
B004(pag.418)	P2A	Fuse box "1"
D004(pag.390)	P30A	Wiring connector for main wiring loom
D004(pag.443)	P30B	Wiring connector for dashboard wiring loom
D005(pag.398)	P100B	Wiring connector for engine wiring loom
D005(pag.400)	P100A	Wiring connector for dashboard wiring loom
F14(B003) (pag.415)	F14	12V VCU power feed (10A)
F22(B004) (pag.418)	F22	Main maxi fuse (70A)
I001(pag.368)	P39	Battery master relay switch (input terminal)
I002(pag.370)	P23	Battery master relay switch (output terminal)
M001(pag.449)	P80	Vehicle ECU
N001(pag.369)	P10	Starter motor "30"
N003(pag.430)	P63	Starter motor

3049 - Battery voltage too low

Description of fault

The electronic control unit detects a power feed voltage received from the battery below 7 V

Severity of error

High

Additional information

The battery voltage may be checked from the display of the multifunction instrument

Red indicator lamp flashing

Behaviour of system

The tractor cannot be switched on

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the main fuse (70A) and replace if necessary
- Disconnect the main fuse (70A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

3 - Check the condition of the VCU fuse (10A) and replace if necessary
- Disconnect the VCU fuse (10A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

4 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

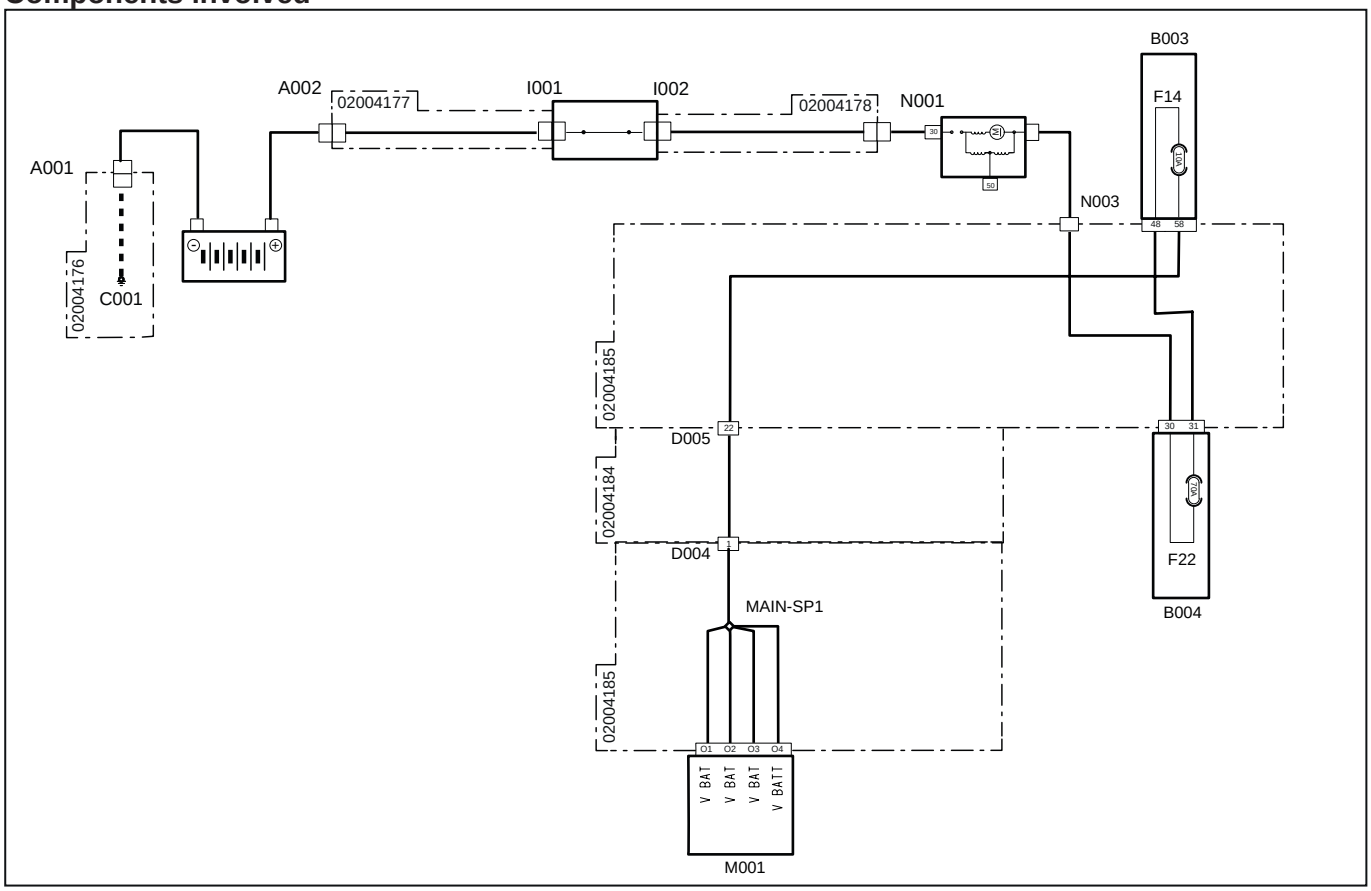
5 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

6 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

7 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

8 - Check that the wiring loom connectors are connected correctly and not damaged

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A002(pag.369)	P55	Positive battery terminal
B003(pag.415)	P1A	Fuse box "2"
B004(pag.418)	P2A	Fuse box "1"
D004(pag.390)	P30A	Wiring connector for main wiring loom
D004(pag.443)	P30B	Wiring connector for dashboard wiring loom
D005(pag.398)	P100B	Wiring connector for engine wiring loom
D005(pag.400)	P100A	Wiring connector for dashboard wiring loom
F14(B003) (pag.415)	F14	12V VCU power feed (10A)
F22(B004) (pag.418)	F22	Main maxi fuse (70A)
I001(pag.368)	P39	Battery master relay switch (input terminal)
I002(pag.370)	P23	Battery master relay switch (output terminal)
M001(pag.449)	P80	Vehicle ECU
N001(pag.369)	P10	Starter motor "30"
N003(pag.430)	P63	Starter motor

3050 - Ambient air temperature sensor: short circuit to battery or open circuit

Description of fault

The ECU engine control unit detects a short circuit to battery or open circuit fault on the ambient air temperature sensor

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

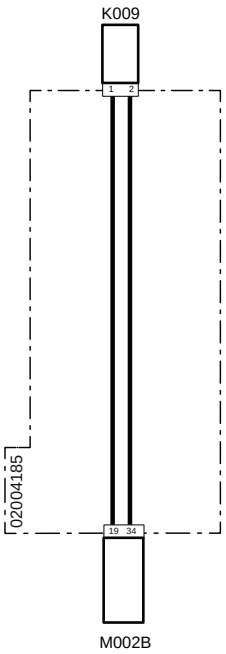
2 - Check that the connectors of the ambient air temperature sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Use the diagnostic tool to check that the ambient air temperature sensor is working correctly (see documentation of diagnostic tool)
- Check if the ambient air temperature sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K009	P467	Ambient air temperature sensor
M002B(pag.423)	P12	Engine control unit

3051 - Ambient air temperature sensor: short circuit to ground

Description of fault

The ECU engine control unit detects a short circuit to ground on the ambient air temperature sensor

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

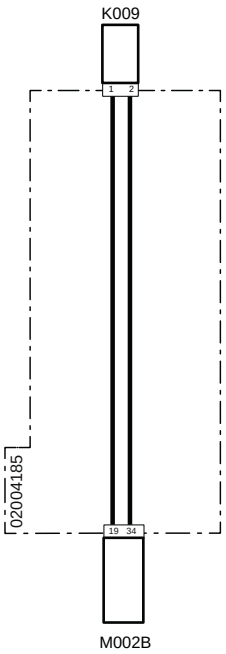
2 - Check that the connectors of the ambient air temperature sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Use the diagnostic tool to check that the ambient air temperature sensor is working correctly (see documentation of diagnostic tool)
- Check if the ambient air temperature sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K009	P467	Ambient air temperature sensor
M002B(pag.423)	P12	Engine control unit

3052 - Fuel temperature sensor: short circuit or open circuit

Description of fault

The ECU engine control unit detects a short circuit to battery or open circuit fault on the fuel temperature sensor

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

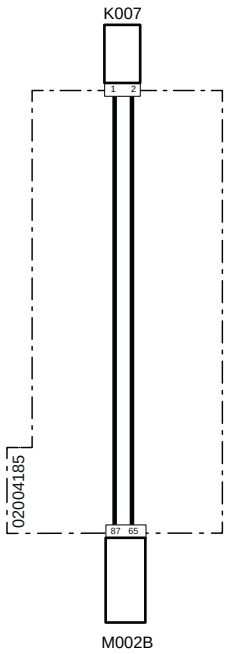
2 - Check that the connectors of the fuel temperature sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Use the diagnostic tool to check that the fuel temperature sensor is working correctly (see documentation of diagnostic tool)
- Check if the ambient air temperature sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K007(pag.420)	P4	Fuel temperature sensor
M002B(pag.423)	P12	Engine control unit

3053 - Short circuit: fuel temperature sensor

Description of fault

The ECU engine control unit detects a short circuit on the fuel temperature sensor

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

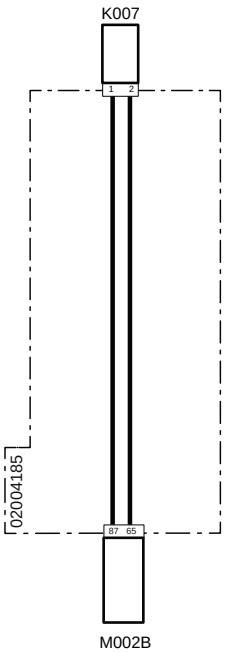
2 - Check that the connectors of the fuel temperature sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Use the diagnostic tool to check that the fuel temperature sensor is working correctly (see documentation of diagnostic tool)
- Check if the fuel temperature sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K007(pag.420)	P4	Fuel temperature sensor
M002B(pag.423)	P12	Engine control unit

3054 - Crankshaft speed sensor: disturbed signal or spurious contact

Description of fault

The ECU engine control unit detects a disturbed signal from, or a spurious contact fault on, the crankshaft speed sensor

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The crankshaft speed sensor reads the speed of the crankshaft from a tone wheel mounted on the crankshaft itself. If the tone wheel is damaged, the sensor will read the speed incorrectly and transmit an erroneous signal to the ECU engine control unit

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the connectors of the crankshaft speed sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

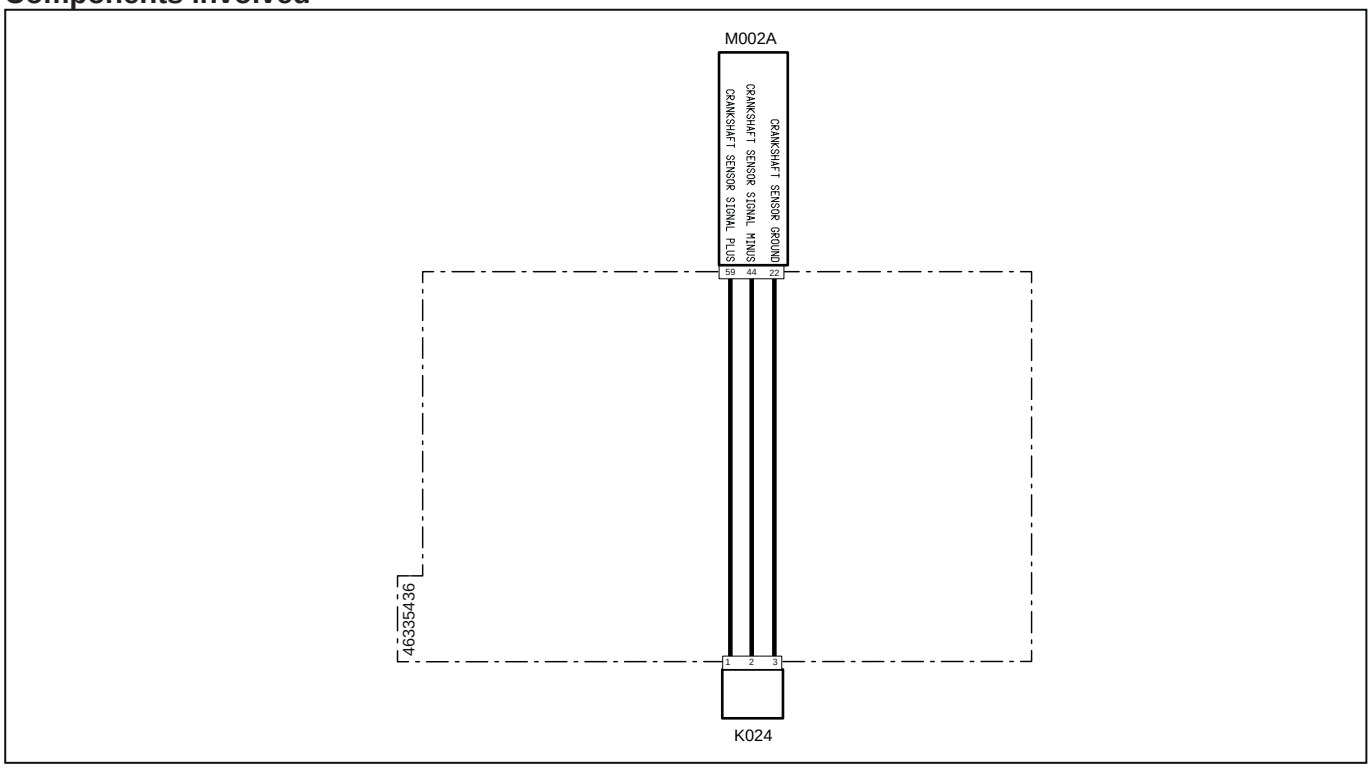
3 - Use the diagnostic tool to check that the crankshaft speed sensor is working correctly (see documentation of diagnostic tool)
- Check if the crankshaft speed sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

4 - Check the condition of the tone wheel on the crankshaft
- Remove the crankshaft speed sensor
- Turn the crankshaft and, using a light, visually inspect the tone wheel to check if it is damaged
- An oscilloscope may also be used to check the tone wheel for damage which may not be noted with a visual inspection
- If the tone wheel is damaged, remove the engine and replace the tone wheel
- Proceed to the next step if the tone wheel is not damaged

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K024(pag.464)	XS2	Crankshaft speed sensor
M002B(pag.423)	P12	Engine control unit

3055 - Open circuit: crankshaft speed sensor

Description of fault

The ECU engine control unit detects an open circuit fault on the crankshaft speed sensor

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

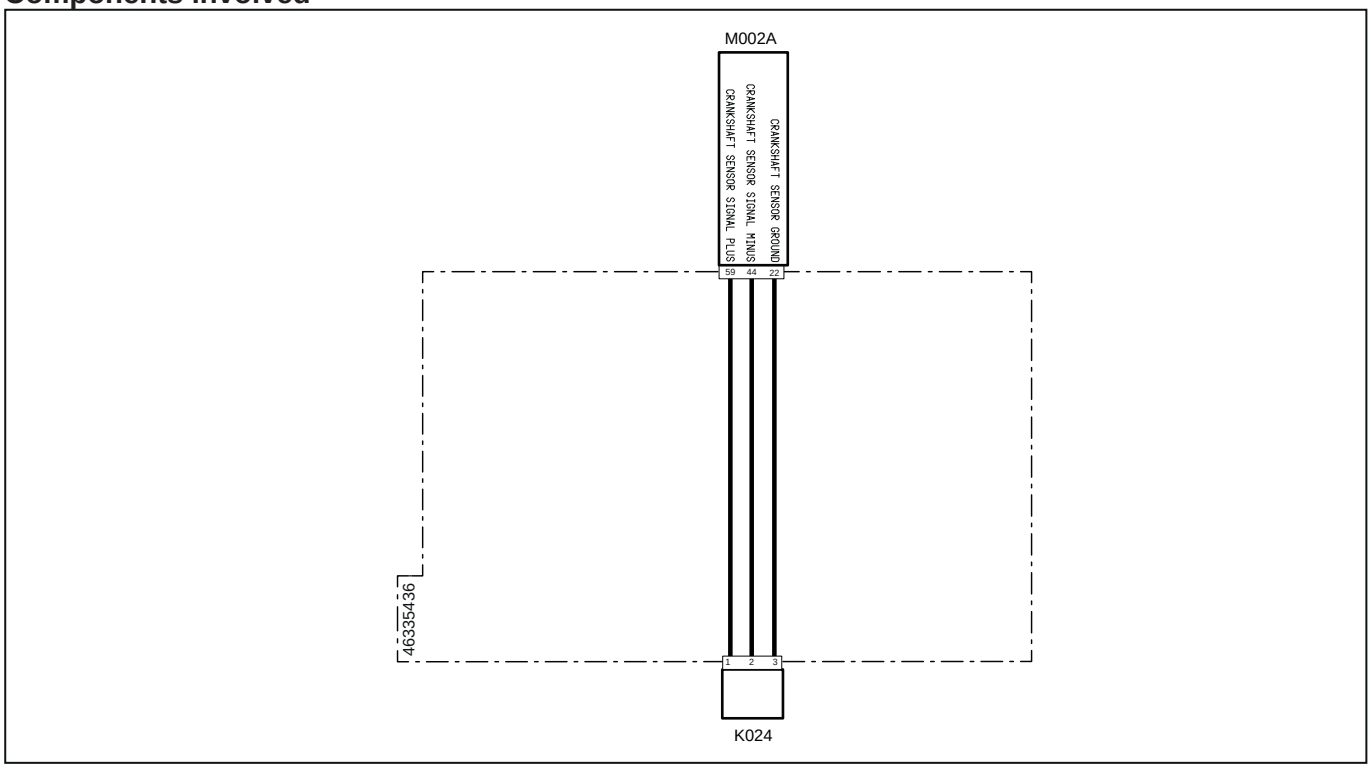
2 - Check that the connectors of the crankshaft speed sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Use the diagnostic tool to check that the crankshaft speed sensor is working correctly (see documentation of diagnostic tool)
- Check if the crankshaft speed sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K024(pag.464)	XS2	Crankshaft speed sensor
M002B(pag.423)	P12	Engine control unit

3056 - Camshaft speed sensor synchronisation error

Description of fault

The ECU engine control unit detects that the camshaft speed signal is not synchronised with the crankshaft speed signal

Severity of error

Additional information

To ensure accurate injection management, the ECU engine control unit monitors the crankshaft and camshaft speed sensor signals together with a number of other parameters. These parameters allow the control unit to identify the positions of the pistons and the aperture of the valves precisely. If these two parameters are not congruent, a synchronisation error is generated

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the connectors of the camshaft speed sensor, the crankshaft speed sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Use the diagnostic tool to check that the camshaft speed sensor is working correctly (see documentation of diagnostic tool)
- Check if the ambient air temperature sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

4 - Use the diagnostic tool to check that the crankshaft speed sensor is working correctly (see documentation of diagnostic tool)
- Check if the ambient air temperature sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

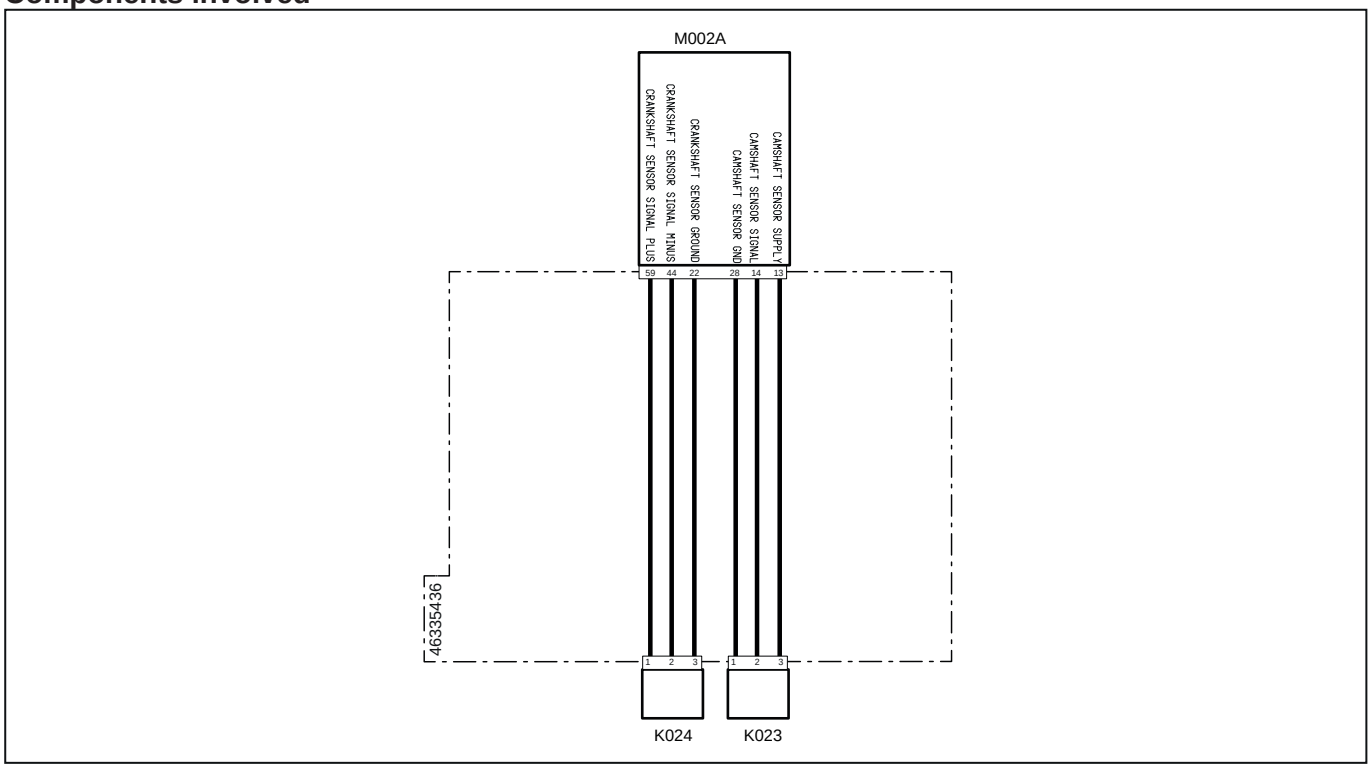
5 - Check the condition of the camshaft
- Remove the camshaft speed sensor
- Turn the camshaft and, using a light, visually check if the tooth on the camshaft is damaged
- An oscilloscope may also be used to check the camshaft for damage which may not be noted with a visual inspection
- If the camshaft is damaged, remove the engine and replace the camshaft
- Proceed to the next step if the camshaft is not damaged

6 - Check the condition of the tone wheel on the crankshaft
- Remove the crankshaft speed sensor
- Turn the crankshaft and, using a light, visually inspect the tone wheel to check if it is damaged
- An oscilloscope may also be used to check the tone wheel for damage which may not be noted with a visual inspection
- If the tone wheel is damaged, remove the engine and replace the tone wheel
- Proceed to the next step if the tone wheel is not damaged

7 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

8 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K023(pag.464)	XS3	Camshaft timing sensor
K024(pag.464)	XS2	Crankshaft speed sensor
M002B(pag.423)	P12	Engine control unit

3057 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3058 - EGR temperature sensor: short circuit to battery or open circuit

Description of fault

The ECU engine control unit detects a short circuit to battery or open circuit fault on the EGR temperature sensor

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

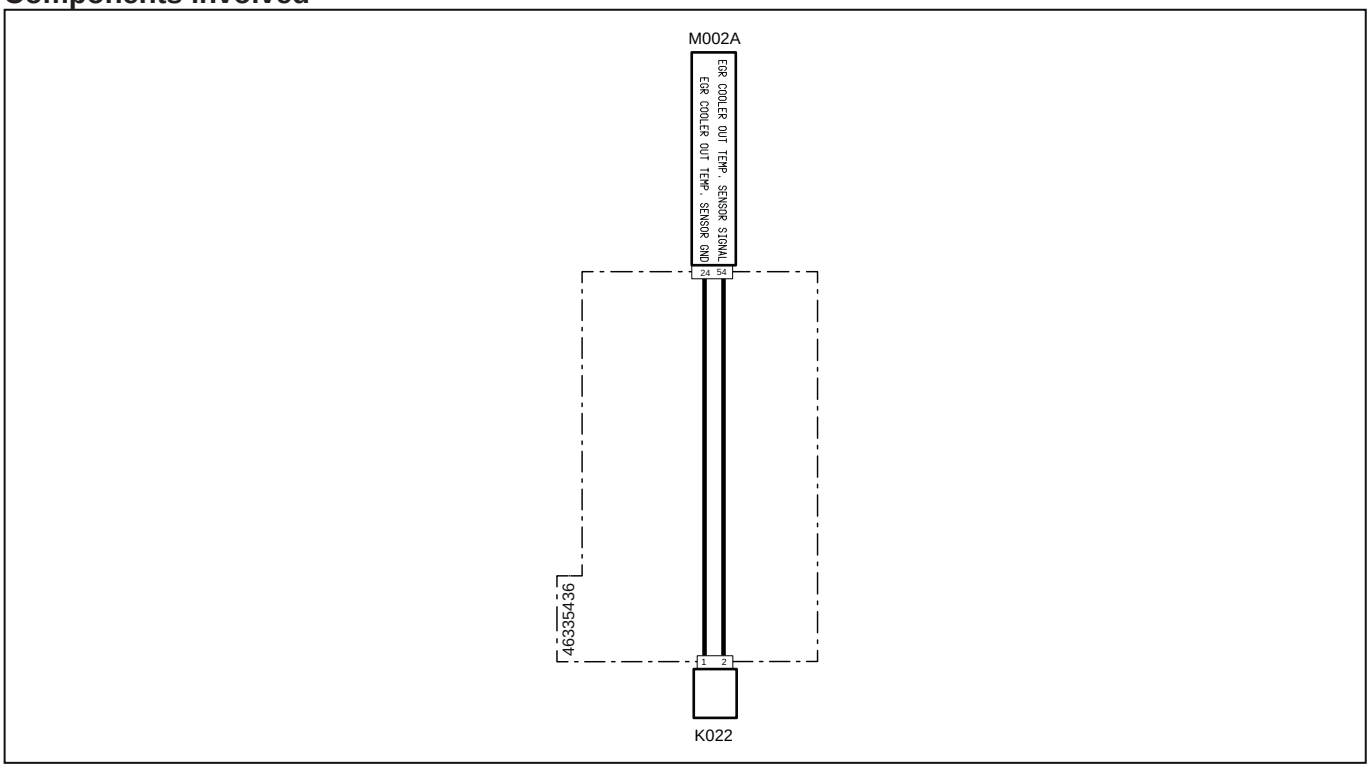
2 - Check that the connectors of the EGR temperature sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Use the diagnostic tool to check that the EGR temperature sensor is working correctly (see documentation of diagnostic tool)
- Check if the EGR temperature sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K022(pag.467)	XS7	EGR temperature sensor
M002B(pag.423)	P12	Engine control unit

3059 - EGR temperature sensor: short circuit to ground

Description of fault

The ECU engine control unit detects a short circuit to ground

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

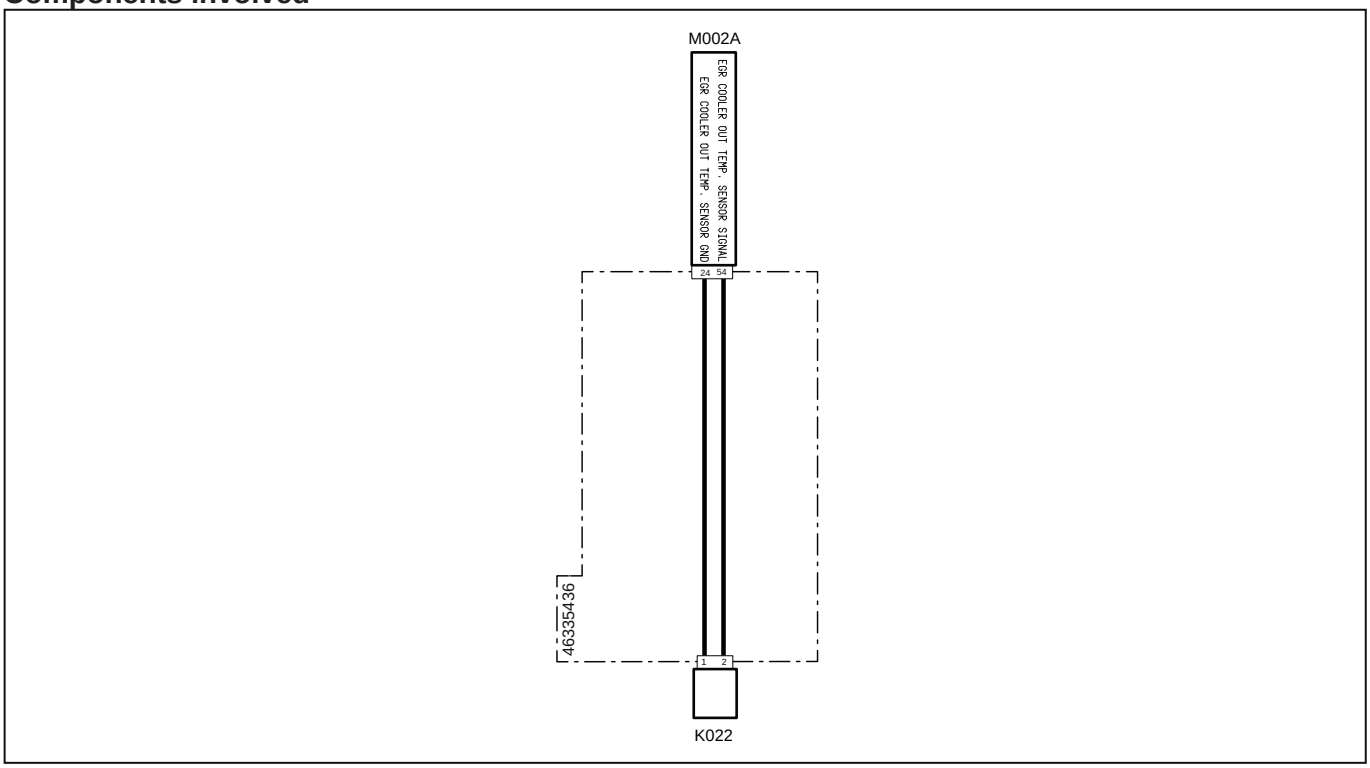
2 - Check that the connectors of the EGR temperature sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Use the diagnostic tool to check that the EGR temperature sensor is working correctly (see documentation of diagnostic tool)
- Check if the EGR temperature sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K022(pag.467)	XS7	EGR temperature sensor
M002B(pag.423)	P12	Engine control unit

3060 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3061 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3062 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3063 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3064 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3065 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3066 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3067 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3068 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3069 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3070 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3071 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3072 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3073 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3074 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3075 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3076 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3077 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3078 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3079 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3080 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3081 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3082 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3083 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3084 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3085 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3086 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3087 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3088 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3089 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3090 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3091 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3092 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

Engine start not possible

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3093 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3094 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started, but the engine operates with limited torque

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3095 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3096 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3097 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3098 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3099 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3100 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3101 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3102 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3103 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3104 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3105 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3106 - Internal control unit error

Description of fault

Internal control unit error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The error may be due to an incorrect power feed voltage or to short circuits in the wiring loom or between connector pins.

This type of error may also be generated when attempting to start the tractor with very low battery charge or if the battery is disconnected (either by physically disconnecting the terminal clamps or with the battery master switch) without allowing the control unit to complete the After Run procedure

Do not replace the control unit without first identifying and resolving the problem which caused the error. If the control unit is replaced without resolving the problem, the new control unit may be damaged again within a few working hours

Behaviour of system

Engine start not possible

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the fuses and relays in the fuse box and replace any damaged fuses or relays

3 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

4 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

5 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Contact the technical support service if the problem persists

3107- Throttle valve stuck

Description of fault

The ECU engine control unit detects that the throttle valve is stuck permanently in the same position

Severity of error

High

Additional information

Red indicator lamp flashing

The aperture of the throttle valve affects the pressure in the intake manifold. As a result, it is also necessary to check that the temperature and pressure sensor (BOOST) and EGR valve are working correctly

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the throttle valve is working correctly
- Use the diagnostic tool to monitor the throttle valve (see documentation of diagnostic tool)
- If any abnormal values are noted, visually check if the throttle valve is effectively stuck. Now clean the valve to remove all dirt and encrusted residue
  Replace the throttle valve if necessary
- If the problem persists, proceed to the next step

3 - Use the diagnostic tool to monitor the boost pressure sensor (see the documentation of the diagnostic tool)
- Monitor the pressure in the intake manifold to check that the boost pressure sensor is working correctly
- If the problem persists, proceed to the next step

4 - Use the diagnostic tool to check that the EGR valve is working correctly (see documentation of diagnostic tool)
- Carry out the EGR valve aperture test while simultaneously checking the effective percentage aperture of the valve itself

  The EGR valve test may also be performed with the engine off
- If the test is passed successfully and no abnormal values are measured, the problem may be due to a different component.
  If the test is failed, proceed to the next step

5 - Check that the connectors of the boost pressure sensor, of the throttle valve, of the EGR valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

6 - Manually check that the wastegate situated on the turbocharger is working correctly
- The wastegate valve opens to release boost pressure produced by the turbocharger and reduce the pressure in the intake manifold. The pressure increases significantly if the valve remains closed

- There are two methods for checking that the valve is working correctly:
  1- applying leverage on the valve actuator link rod with a suitable tool, taking care not to damage the rod;
  2- increasing engine speed, with the engine running and with the tractor stationary, until the valve opens;
  Follow the safety instructions and rules given in the use and maintenance manual and in the workshop manual precisely
- If the problem persists, proceed to the next step

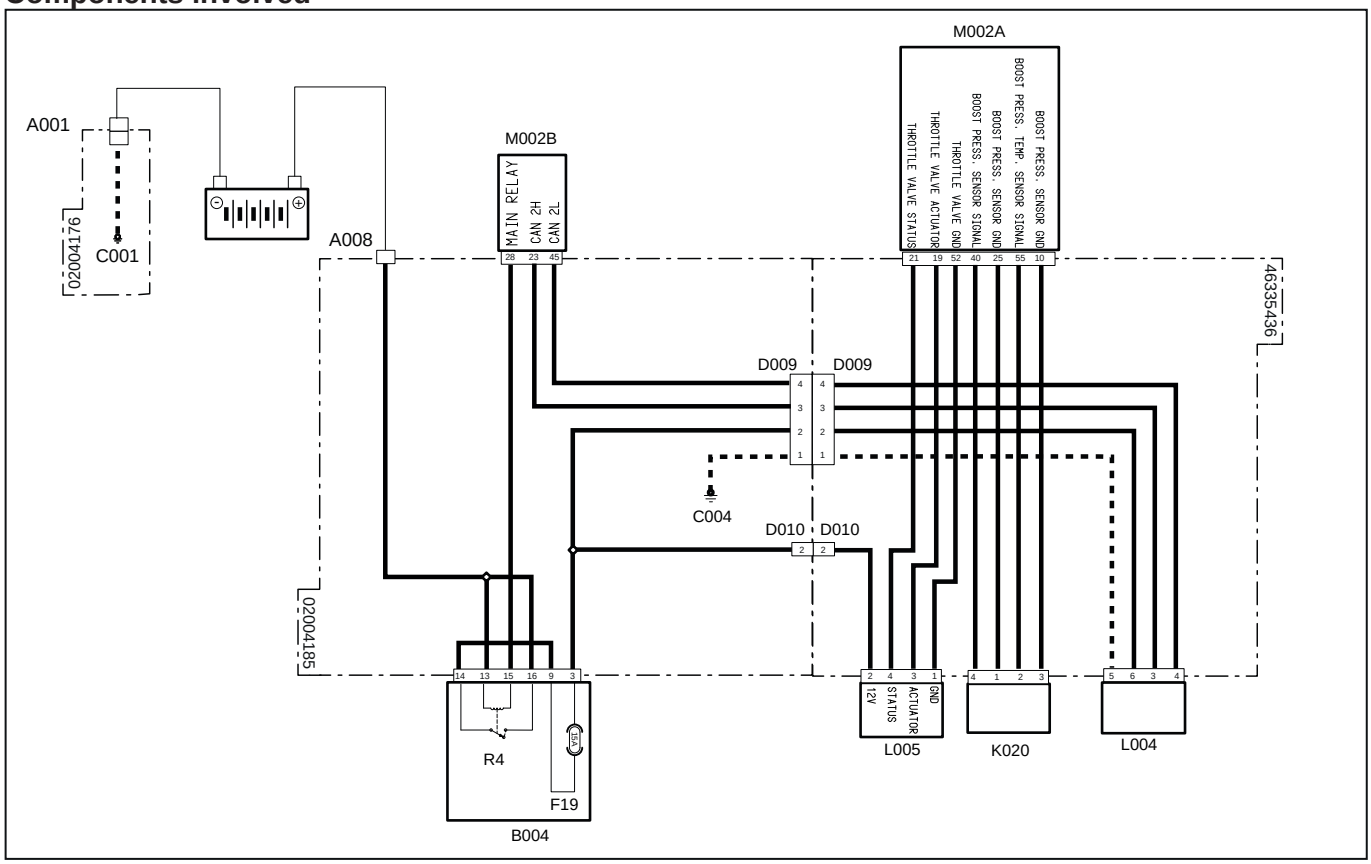
7 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

8 - Check that the wiring loom connectors are connected correctly and not damaged

9 - Check that the intake ducts are not fouled or obstructed
- Remove the intake ducts from the engine and check that they are not obstructed. Obstructions in the ducts will cause a significant increase in intake pressure.
- If the problem persists, proceed to the next step

10 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A008(pag.439)	P472	Positive battery terminal
C001(pag.367)	P66	Battery ground
C004(pag.430)	P105	Engine ground point
D009(pag.437)	P469	Wiring connector for prewired engine wiring loom
D009(pag.460)	XEG	Exhaust gas recirculation solenoid valve power feed
D010(pag.438)	P470	Wiring connector for prewired engine wiring loom
D010(pag.468)	XTH	Throttle valve power feed
F19(B004) (pag.418)	F19	Accessories (15A)
K020(pag.465)	XS4	Temperature and pressure sensor (BOOST)
L004(pag.469)	XY2	Exhaust gas recirculation solenoid valve (EGR)
L005(pag.470)	XY3	Throttle valve
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R4(B004) (pag.418)	R4	Main relay (30A)

3108 - Throttle valve circuit: open circuit

Description of fault

The ECU engine control unit detects an open circuit fault in the circuit of the throttle valve

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Use the diagnostic tool to monitor the throttle valve (see documentation of diagnostic tool)
- Check that the throttle valve is working correctly and replace if necessary
- If the problem persists, proceed to the next step

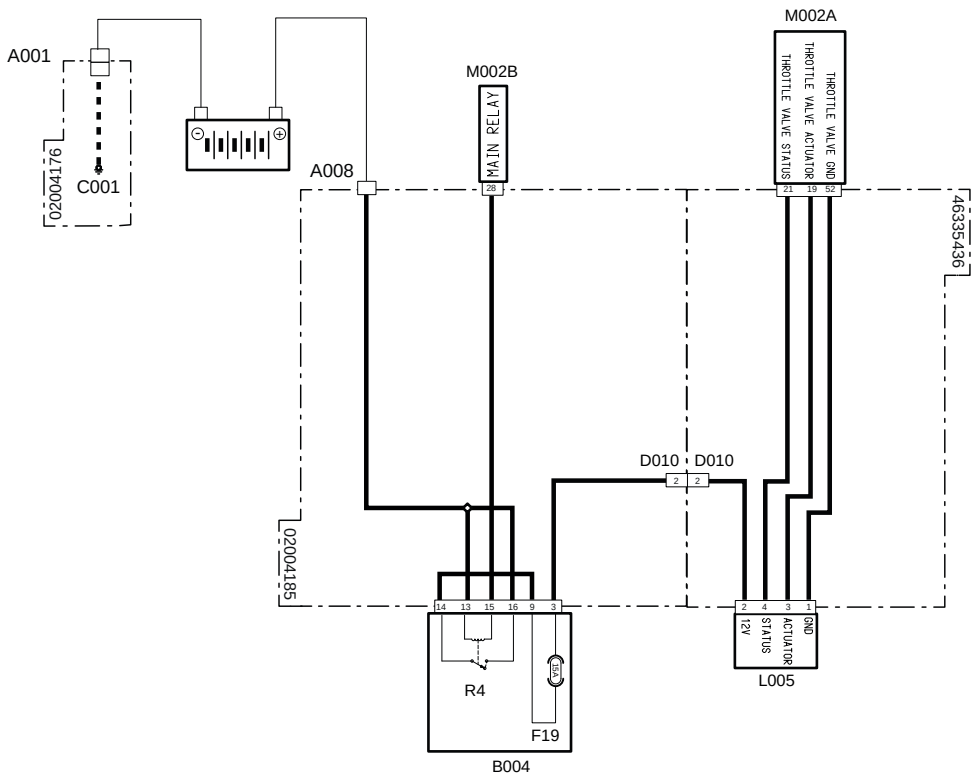
3 - Check that the connectors of the throttle valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Check that the wiring loom connectors are connected correctly and not damaged

6 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A008(pag.439)	P472	Positive battery terminal
D010(pag.438)	P470	Wiring connector for prewired engine wiring loom
D010(pag.468)	XTH	Throttle valve power feed
F19(B004) (pag.418)	F19	Accessories (15A)
L005(pag.470)	XY3	Throttle valve
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R4(B004) (pag.418)	R4	Main relay (30A)

3109 - Throttle valve relay: short circuit to ground

Description of fault

The ECU engine control unit detects a short circuit to ground in the circuit of the throttle valve

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Use the diagnostic tool to monitor the throttle valve (see documentation of diagnostic tool)
- Check that the throttle valve is working correctly and replace if necessary
- If the problem persists, proceed to the next step

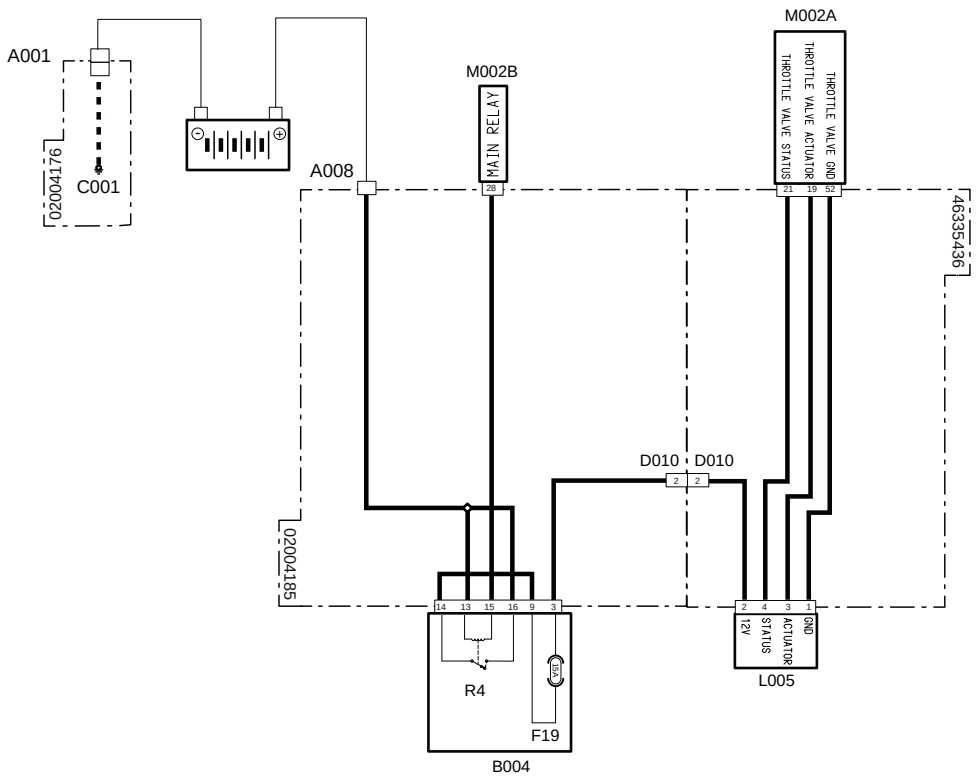
3 - Check that the connectors of the throttle valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Check that the wiring loom connectors are connected correctly and not damaged

6 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A008(pag.439)	P472	Positive battery terminal
D010(pag.438)	P470	Wiring connector for prewired engine wiring loom
D010(pag.468)	XTH	Throttle valve power feed
F19(B004) (pag.418)	F19	Accessories (15A)
L005(pag.470)	XY3	Throttle valve
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R4(B004) (pag.418)	R4	Main relay (30A)

3110 - Throttle valve relay: short circuit to battery

Description of fault

The ECU engine control unit detects a short circuit to battery in the circuit of the throttle valve

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started but the EGR valve remains closed and the throttle valve does not work

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Use the diagnostic tool to monitor the throttle valve (see documentation of diagnostic tool)
- Check that the throttle valve is working correctly and replace if necessary
- If the problem persists, proceed to the next step

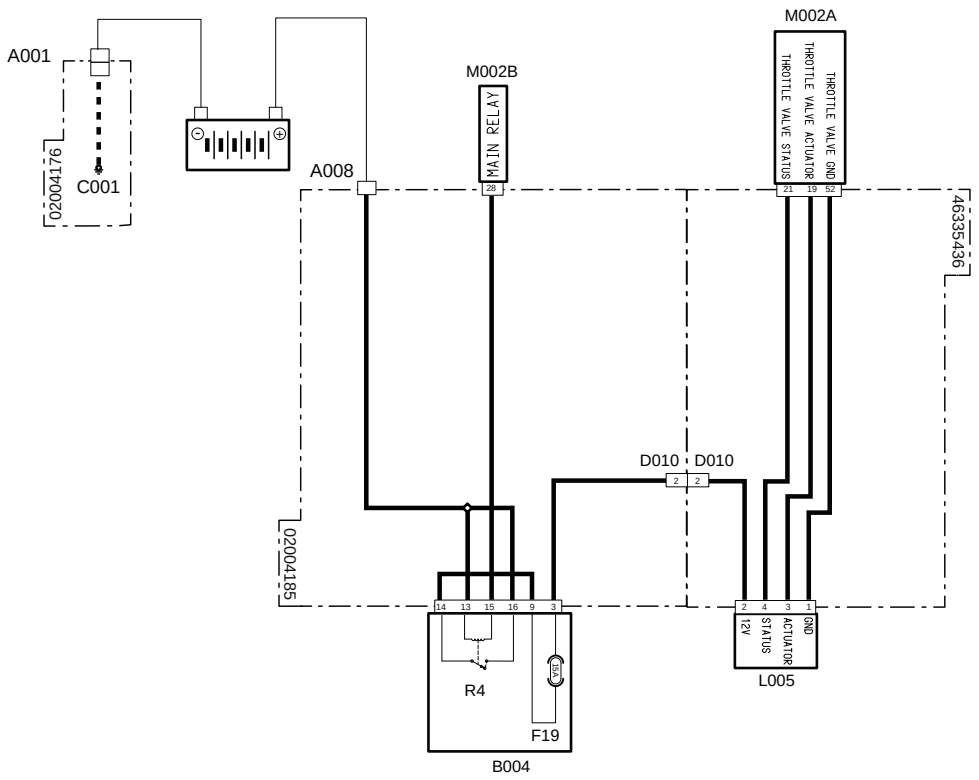
3 - Check that the connectors of the throttle valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Check that the wiring loom connectors are connected correctly and not damaged

6 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A008(pag.439)	P472	Positive battery terminal
D010(pag.438)	P470	Wiring connector for prewired engine wiring loom
D010(pag.468)	XTH	Throttle valve power feed
F19(B004) (pag.418)	F19	Accessories (15A)
L005(pag.470)	XY3	Throttle valve
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R4(B004) (pag.418)	R4	Main relay (30A)

3111 - Throttle valve relay: short circuit to ground

Description of fault

The ECU engine control unit detects a short circuit to ground in the circuit of the throttle valve

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started but the EGR valve remains closed and the throttle valve does not work

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Use the diagnostic tool to monitor the throttle valve (see documentation of diagnostic tool)
- Check that the throttle valve is working correctly and replace if necessary
- If the problem persists, proceed to the next step

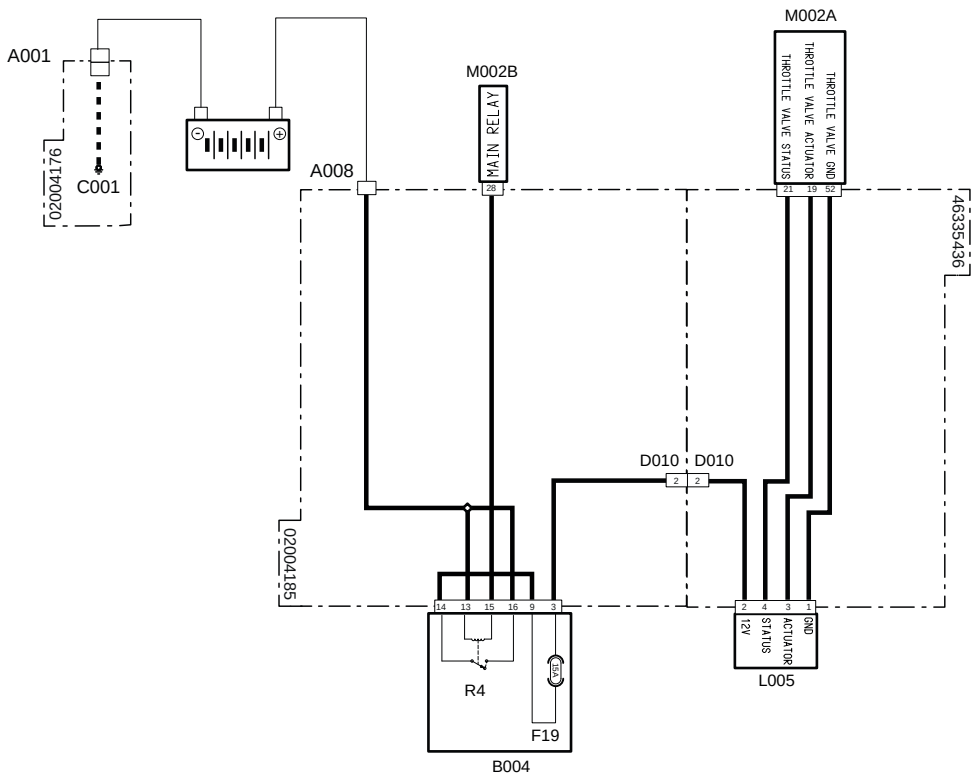
3 - Check that the connectors of the throttle valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Check that the wiring loom connectors are connected correctly and not damaged

6 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A008(pag.439)	P472	Positive battery terminal
D010(pag.438)	P470	Wiring connector for prewired engine wiring loom
D010(pag.468)	XTH	Throttle valve power feed
F19(B004) (pag.418)	F19	Accessories (15A)
L005(pag.470)	XY3	Throttle valve
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R4(B004) (pag.418)	R4	Main relay (30A)

3112 - Throttle valve: open circuit

Description of fault

The ECU engine control unit detects a short circuit in the circuit of the throttle valve

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started but the EGR valve remains closed and the throttle valve does not work

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Use the diagnostic tool to monitor the throttle valve (see documentation of diagnostic tool)
- Check that the throttle valve is working correctly and replace if necessary
- If the problem persists, proceed to the next step

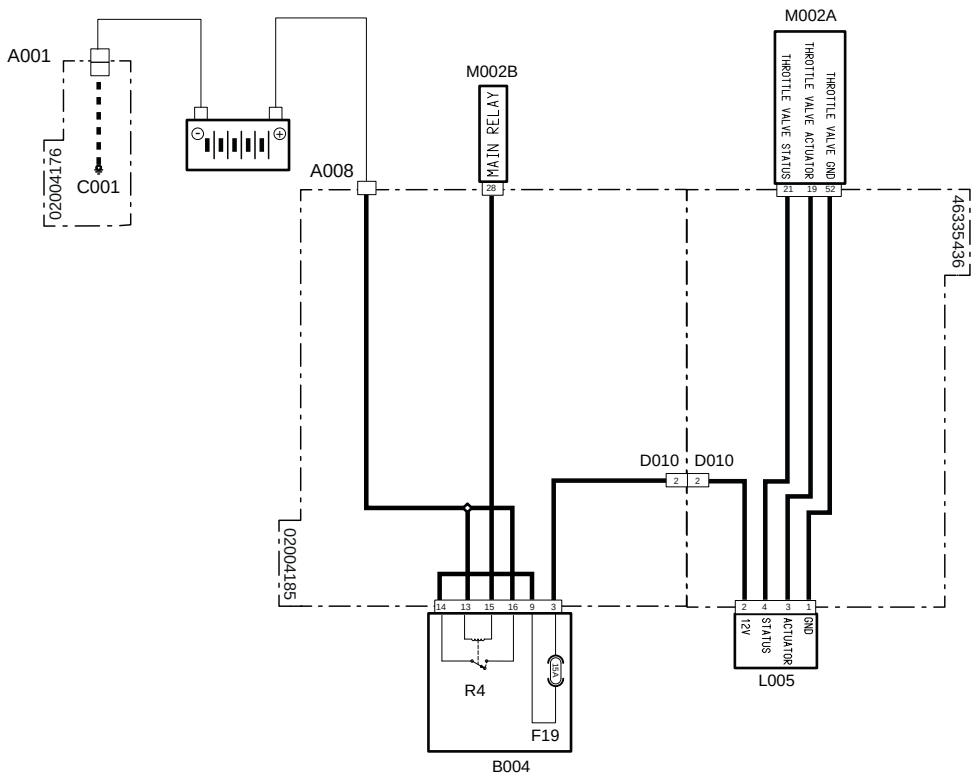
3 - Check that the connectors of the throttle valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Check that the wiring loom connectors are connected correctly and not damaged

6 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A008(pag.439)	P472	Positive battery terminal
D010(pag.438)	P470	Wiring connector for prewired engine wiring loom
D010(pag.468)	XTH	Throttle valve power feed
F19(B004) (pag.418)	F19	Accessories (15A)
L005(pag.470)	XY3	Throttle valve
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R4(B004) (pag.418)	R4	Main relay (30A)

3113 - Throttle valve current too high

Description of fault

The ECU engine control unit detects and excessively high current across the throttle valve

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Use the diagnostic tool to monitor the throttle valve (see documentation of diagnostic tool)
- Check that the throttle valve is working correctly and replace if necessary
- If the problem persists, proceed to the next step

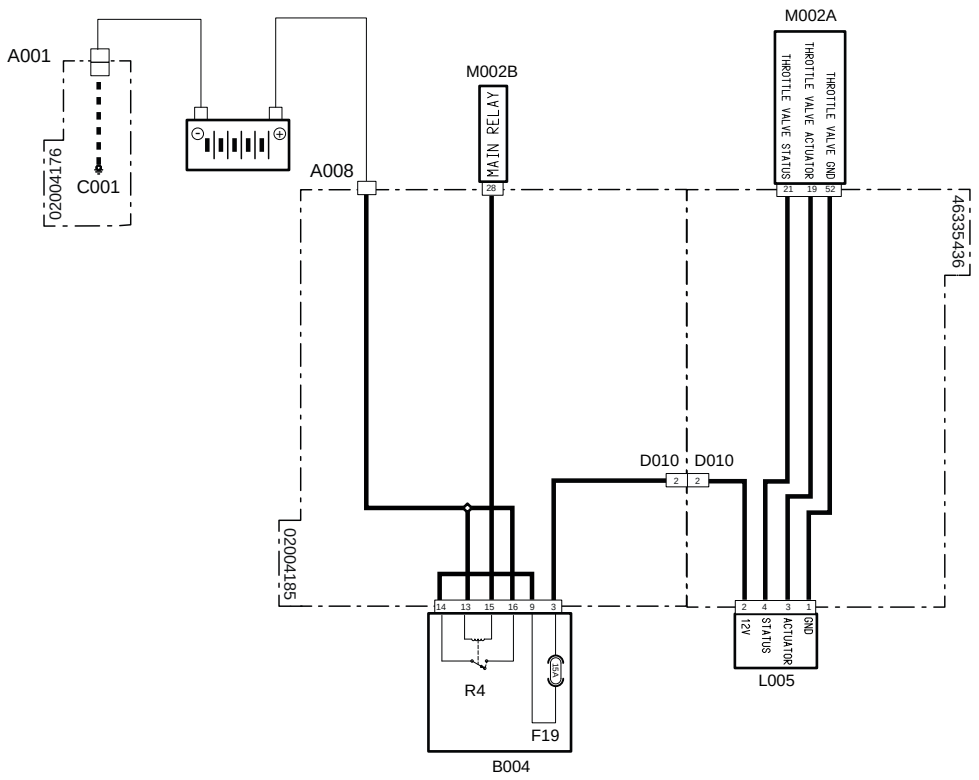
3 - Check that the connectors of the throttle valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Check that the wiring loom connectors are connected correctly and not damaged

6 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A008(pag.439)	P472	Positive battery terminal
D010(pag.438)	P470	Wiring connector for prewired engine wiring loom
D010(pag.468)	XTH	Throttle valve power feed
F19(B004) (pag.418)	F19	Accessories (15A)
L005(pag.470)	XY3	Throttle valve
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R4(B004) (pag.418)	R4	Main relay (30A)

3114 - CAN Bus line communication error

Description of fault

The control unit detects a communication error on the CAN Bus line

Severity of error

High

Additional information

Generic CAN Bus line fault icon displayed on multifunction instrument screen, accompanied by buzzer.

Red indicator lamp flashing

Behaviour of system

Engine start not possibleThe instrument panel may be switched on (ignition on).

Checks necessary

1 - Check that the connectors of the engine control unit are fitted and connected correctly
- Disconnect the connectors and reconnect correctly
- If all the connectors are fitted and connected correctly, proceed to the next step

2 - Check the condition of the CAN Bus communication pins of the engine control unit
- Disconnect the respective connectors
- Check that the contact surfaces of the pins are in good condition
- In no damage or corrosion are found, proceed to the next step

3 - Check that the resistance measured on the CAN Bus line is 60 Ohm
- Disconnect the connectors and measure the resistance of the wiring loom with a tester applied to the pins of the CAN Bus line. If the value measured is not 60 Ohm, the line is not working correctly.
- If the value measured is 60 Ohm, the line is working correctly: proceed to the next step

4 - Check the general condition of the CAN Bus line - check that there are no disconnected cables and that all the resistors are fitted correctly.
- Check the relative connectors on each cable
- If all the cables are connected correctly, proceed to the next step

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Check that the wiring loom connectors are connected correctly and not damaged

7 - Replace the engine control unit

Components involved

System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A002(pag.369)	P55	Positive battery terminal
M002A(pag.458)	XECUA	Engine control unit

3115 - CAN Bus line communication error

Description of fault

The control unit detects a communication error on the CAN Bus line

Severity of error

High

Additional information

Generic CAN Bus line fault icon displayed on multifunction instrument screen, accompanied by buzzer.

Red indicator lamp flashing

Behaviour of system

Engine start not possible The instrument panel may be switched on (ignition on).

Checks necessary

1 - Check that the connectors of the engine control unit are fitted and connected correctly
- Disconnect the connectors and reconnect correctly
- If all the connectors are fitted and connected correctly, proceed to the next step

2 - Check the condition of the CAN Bus communication pins of the engine control unit
- Disconnect the respective connectors
- Check that the contact surfaces of the pins are in good condition
- In no damage or corrosion are found, proceed to the next step

3 - Check that the resistance measured on the CAN Bus line is 60 Ohm
- Disconnect the connectors and measure the resistance of the wiring loom with a tester applied to the pins of the CAN Bus line. If the value measured is not 60 Ohm, the line is not working correctly.
- If the value measured is 60 Ohm, the line is working correctly: proceed to the next step

4 - Check the general condition of the CAN Bus line - check that there are no disconnected cables and that all the resistors are fitted correctly.
- Check the relative connectors on each cable
- If all the cables are connected correctly, proceed to the next step

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Check that the wiring loom connectors are connected correctly and not damaged

7 - Replace the engine control unit

Components involved

System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A002(pag.369)	P55	Positive battery terminal
M002A(pag.458)	XECUA	Engine control unit

3116 - Low boost pressure

Description of fault

The pressure value received by the ECU engine control unit from the temperature and pressure sensor (BOOST) is too low

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started but the EGR valve remains closed. The engine operates with limited torque, regeneration is disabled and the throttle valve does not work

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Use the diagnostic tool to monitor the throttle valve (see documentation of diagnostic tool)
- Check that the throttle valve is working correctly and replace if necessary
- If the problem persists, proceed to the next step

3 - Use the diagnostic tool to monitor the boost pressure sensor (see the documentation of the diagnostic tool)
- Monitor the pressure in the intake manifold to check that the boost pressure sensor is working correctly
- If the problem persists, proceed to the next step

4 - Use the diagnostic tool to check that the EGR valve is working correctly (see documentation of diagnostic tool)
- Carry out the EGR valve aperture test while simultaneously checking the effective percentage aperture of the valve itself

  The EGR valve test may also be performed with the engine off
- If the test is passed successfully and no abnormal values are measured, the problem may be due to a different component.
  If the test is failed, proceed to the next step

5 - Check that the connectors of the boost pressure sensor, of the throttle valve, of the EGR valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

6 - Manually check that the wastegate situated on the turbocharger is working correctly
- The wastegate valve opens to release boost pressure produced by the turbocharger and reduce the pressure in the intake manifold. The pressure increases significantly if the valve remains closed
- There are two methods for checking that the valve is working correctly:
  1- applying leverage on the valve actuator link rod with a suitable tool, taking care not to damage the rod;
  2- increasing engine speed, with the engine running and with the tractor stationary, until the valve opens;

  Follow the safety instructions and rules given in the use and maintenance manual and in the workshop manual precisely
- If the problem persists, proceed to the next step

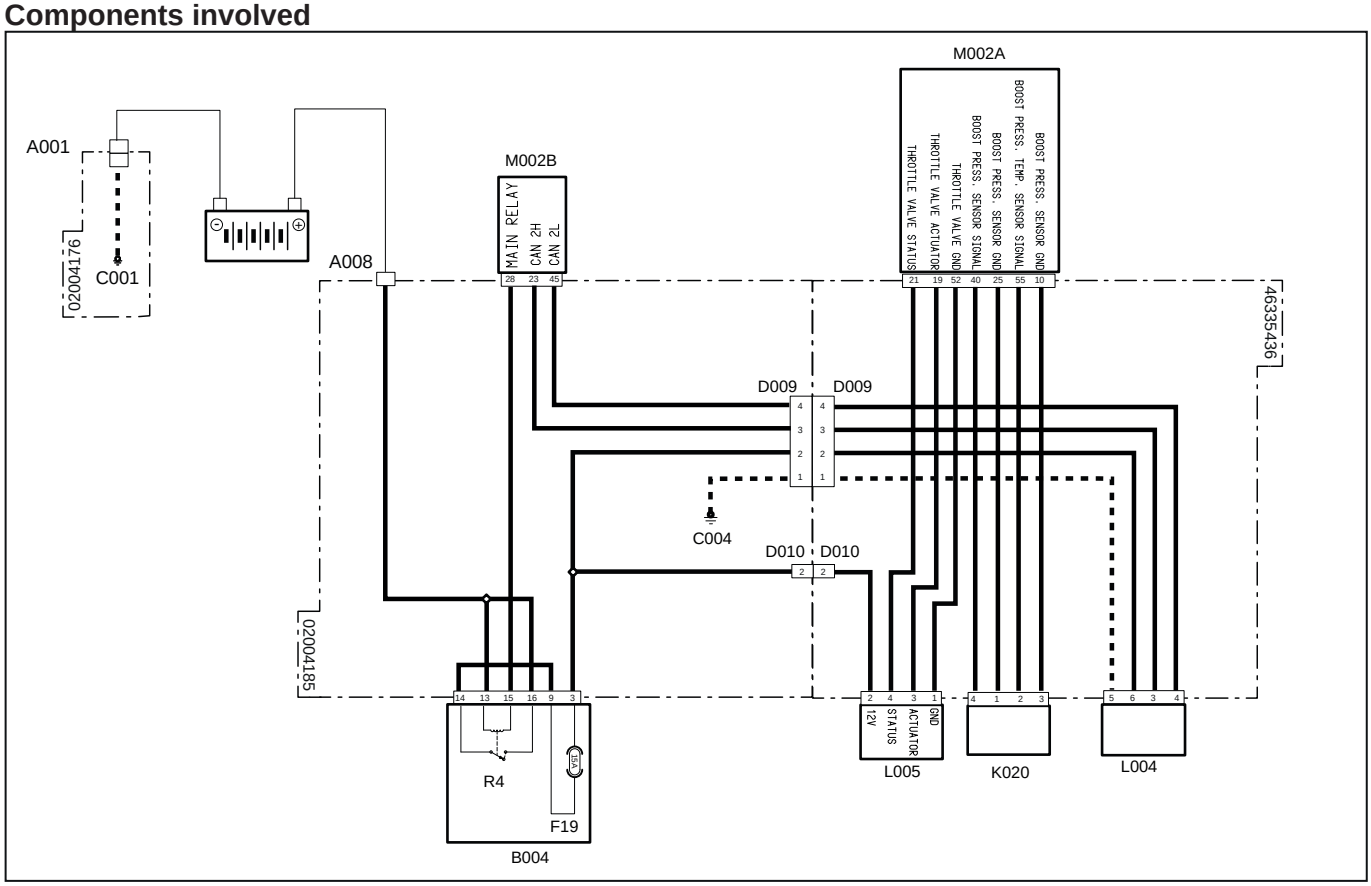
7 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

8 - Check that the wiring loom connectors are connected correctly and not damaged

9 - Check that the intake ducts are not fouled or obstructed
- Remove the intake ducts from the engine and check that they are not obstructed. Obstructions in the ducts will cause a significant increase in intake pressure.
- If the problem persists, proceed to the next step

10 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A008(pag.439)	P472	Positive battery terminal
C001(pag.367)	P66	Battery ground
C004(pag.430)	P105	Engine ground point
D009(pag.437)	P469	Wiring connector for prewired engine wiring loom
D009(pag.460)	XEG	Exhaust gas recirculation solenoid valve power feed
D010(pag.438)	P470	Wiring connector for prewired engine wiring loom
D010(pag.468)	XTH	Throttle valve power feed
F19(B004) (pag.418)	F19	Accessories (15A)
K020(pag.465)	XS4	Temperature and pressure sensor (BOOST)
L004(pag.469)	XY2	Exhaust gas recirculation solenoid valve (EGR)
L005(pag.470)	XY3	Throttle valve
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R4(B004) (pag.418)	R4	Main relay (30A)

3117 - High boost pressure

Description of fault

The pressure value received by the ECU engine control unit from the temperature and pressure sensor (BOOST) is very high

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started but the EGR valve remains closed. The engine operates with limited torque, regeneration is disabled and the throttle valve does not work

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Use the diagnostic tool to monitor the throttle valve (see documentation of diagnostic tool)
- Check that the throttle valve is working correctly and replace if necessary
- If the problem persists, proceed to the next step

3 - Use the diagnostic tool to monitor the boost pressure sensor (see the documentation of the diagnostic tool)
- Monitor the pressure in the intake manifold to check that the boost pressure sensor is working correctly
- If the problem persists, proceed to the next step

4 - Check that the connectors of the boost pressure sensor, of the throttle valve, of the EGR valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

5 - Manually check that the wastegate situated on the turbocharger is working correctly
- The wastegate valve opens to release boost pressure produced by the turbocharger and reduce the pressure in the intake manifold. The pressure increases significantly if the valve remains closed
- There are two methods for checking that the valve is working correctly:
  1- applying leverage on the valve actuator link rod with a suitable tool, taking care not to damage the rod;
  2- increasing engine speed, with the engine running and with the tractor stationary, until the valve opens;
  Follow the safety instructions and rules given in the use and maintenance manual and in the workshop manual precisely
- If the problem persists, proceed to the next step

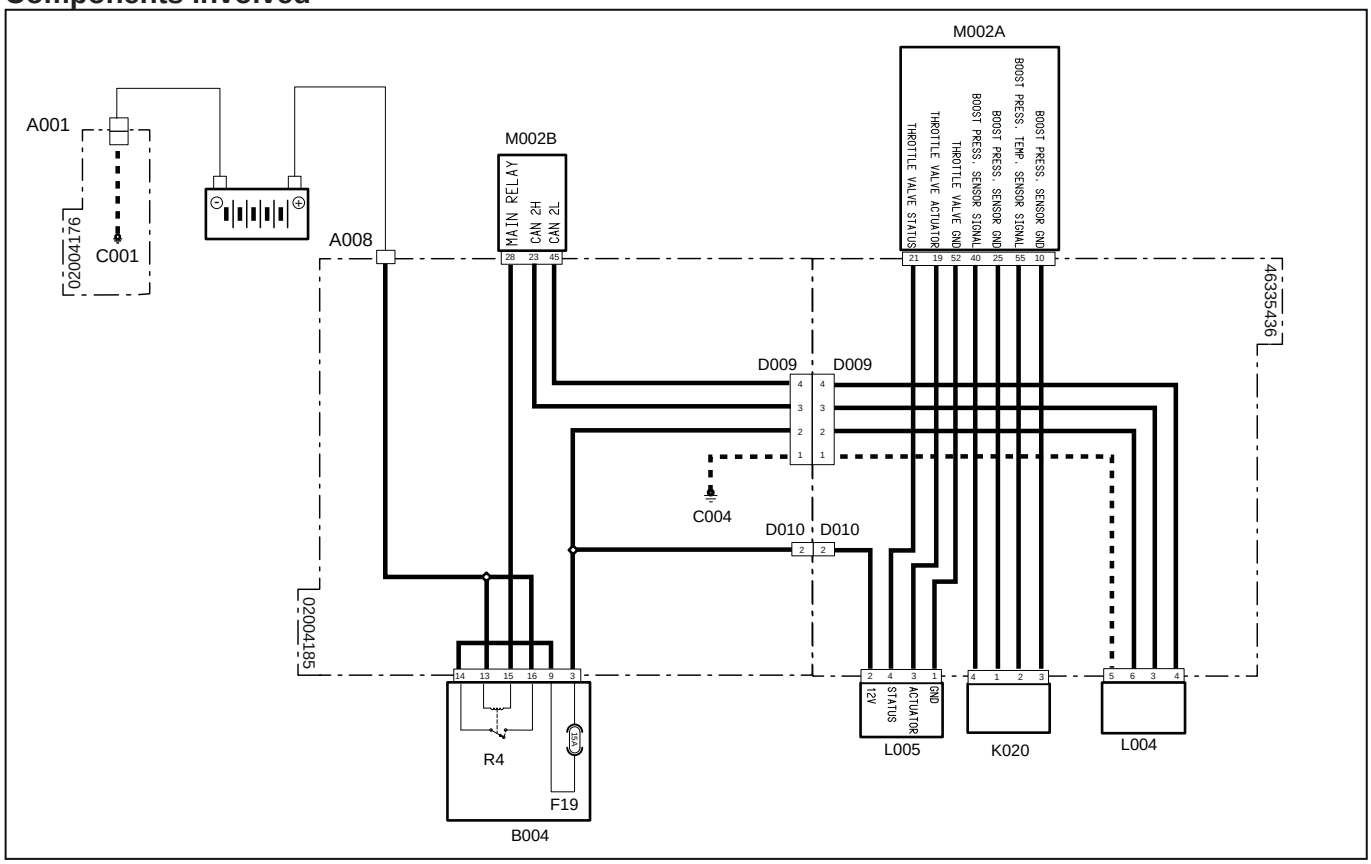
6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Check that the wiring loom connectors are connected correctly and not damaged

8 - Check that the intake ducts are not fouled or obstructed
- Remove the intake ducts from the engine and check that they are not obstructed. Obstructions in the ducts will cause a significant increase in intake pressure.
- If the problem persists, proceed to the next step

9 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A008(pag.439)	P472	Positive battery terminal
C001(pag.367)	P66	Battery ground
C004(pag.430)	P105	Engine ground point
D009(pag.437)	P469	Wiring connector for prewired engine wiring loom
D009(pag.460)	XEG	Exhaust gas recirculation solenoid valve power feed
D010(pag.438)	P470	Wiring connector for prewired engine wiring loom
D010(pag.468)	XTH	Throttle valve power feed
F19(B004) (pag.418)	F19	Accessories (15A)
K020(pag.465)	XS4	Temperature and pressure sensor (BOOST)
L004(pag.469)	XY2	Exhaust gas recirculation solenoid valve (EGR)
L005(pag.470)	XY3	Throttle valve
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R4(B004) (pag.418)	R4	Main relay (30A)

3118 - Injector 1 (from timing side): short circuit

Description of fault

The ECU engine control unit detects a short circuit on the first injector (from timing side)

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Do not swap injectors to test them. Mark the position of the injector with a marker pen before removing

Individual injectors may be disabled from the diagnostic tool to test them (see the documentation of the diagnostic tool)

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

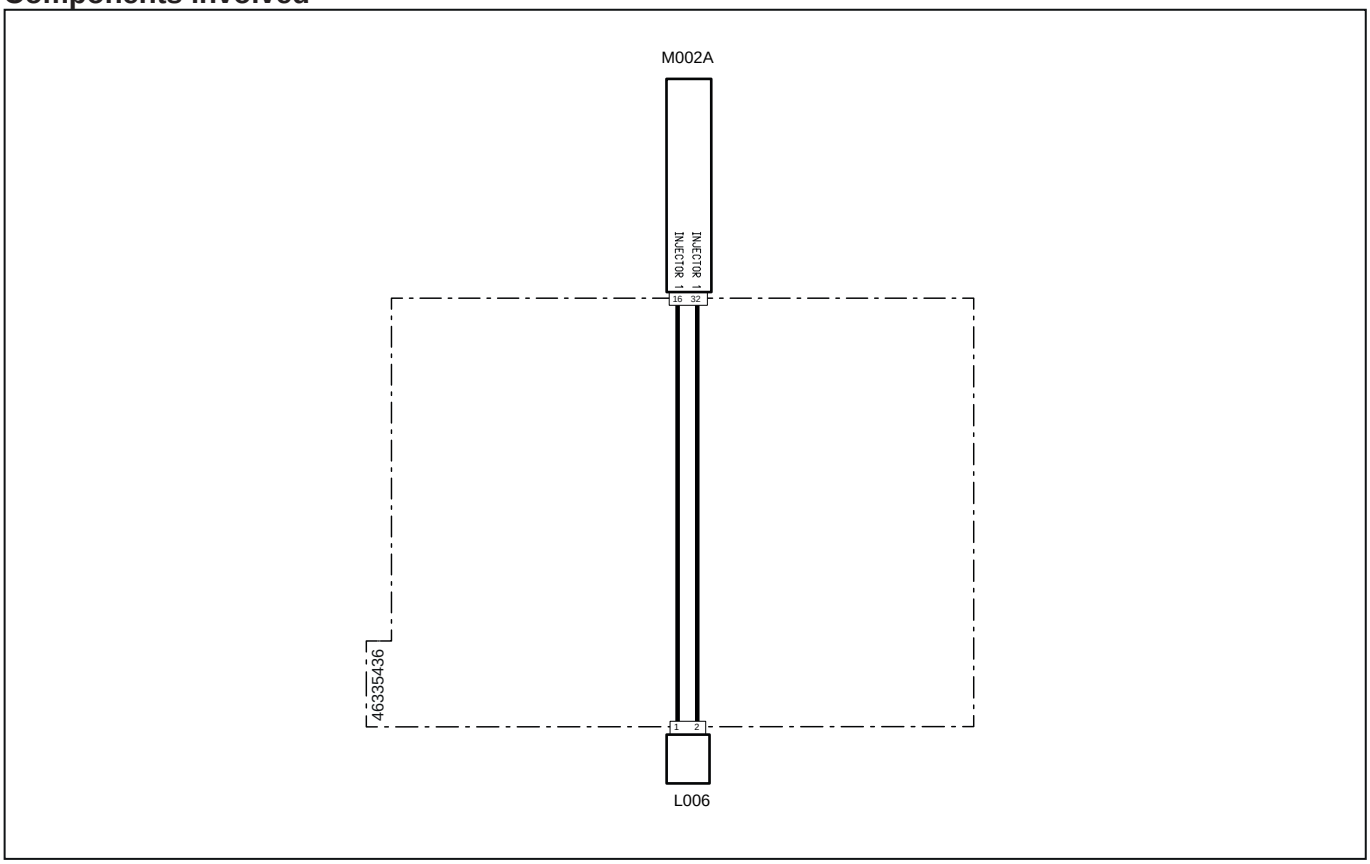
2 - Check that the connectors of the injector and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

4 - Check that the wiring loom connectors are connected correctly and not damaged

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
L006(pag.460)	XI1	Fuel electro-injector 1
M002A(pag.458)	XECUA	Engine control unit

3119 - Injector 1 (from timing side): short circuit

Description of fault

The ECU engine control unit detects a short circuit on the first injector (from timing side)

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Do not swap injectors to test them. Mark the position of the injector with a marker pen before removing

Individual injectors may be disabled from the diagnostic tool to test them (see the documentation of the diagnostic tool)

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

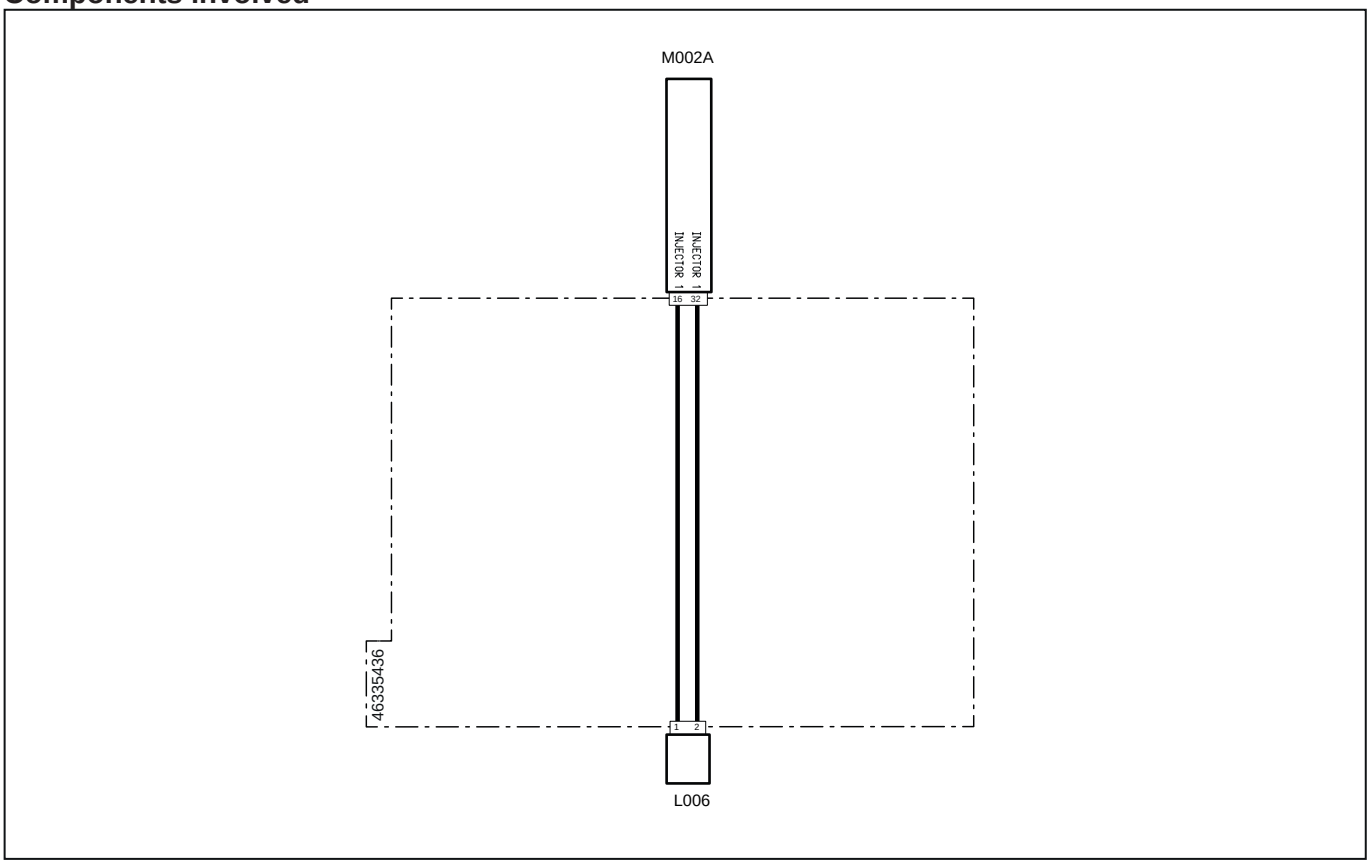
2 - Check that the connectors of the injector and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

4 - Check that the wiring loom connectors are connected correctly and not damaged

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
L006(pag.460)	XI1	Fuel electro-injector 1
M002A(pag.458)	XECUA	Engine control unit

3120 - Injector 1 (from timing side): open circuit

Description of fault

The ECU engine control unit detects an open circuit fault on the first injector (from timing side)

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Do not swap injectors to test them. Mark the position of the injector with a marker pen before removing

Individual injectors may be disabled from the diagnostic tool to test them (see the documentation of the diagnostic tool)

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

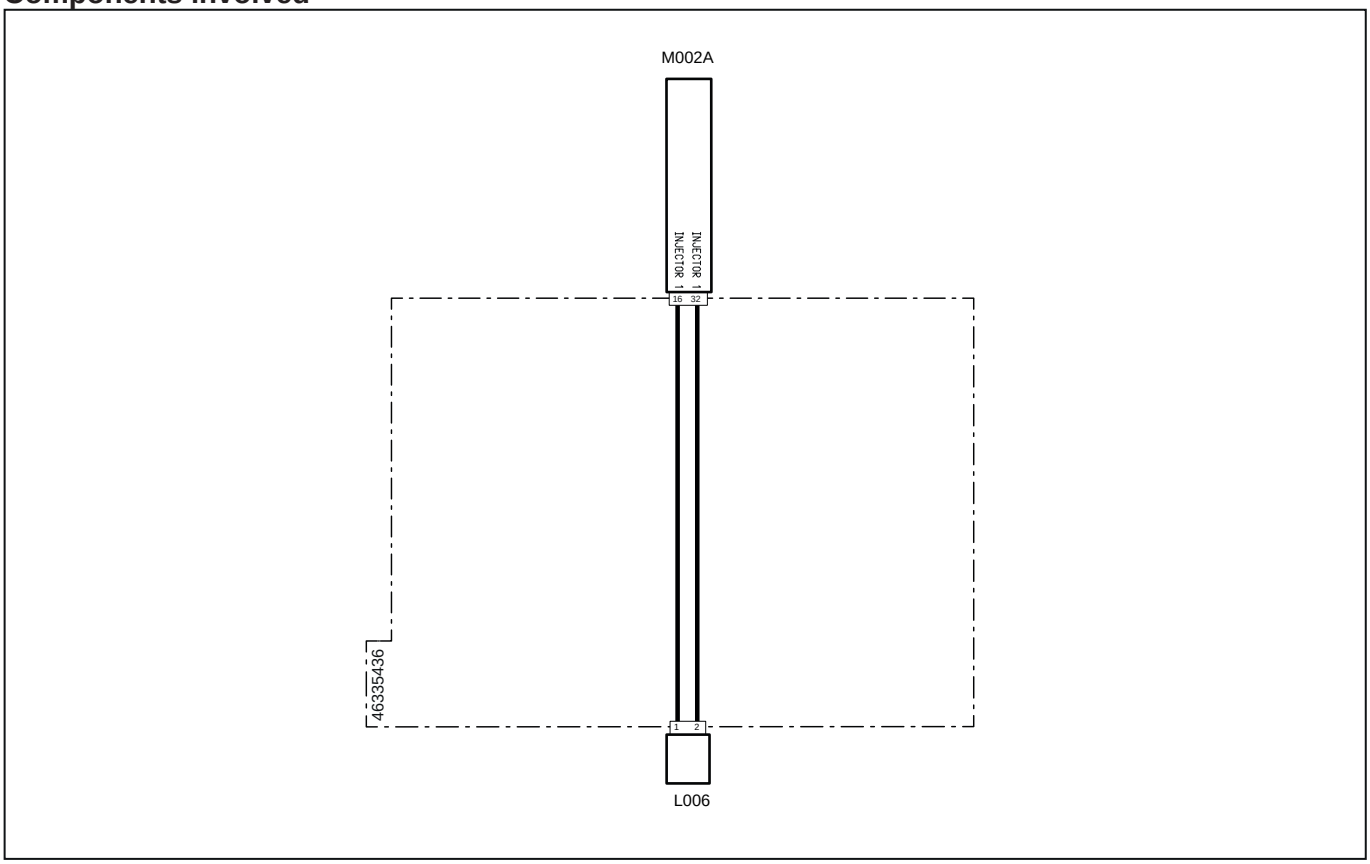
2 - Check that the connectors of the injector and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

4 - Check that the wiring loom connectors are connected correctly and not damaged

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
L006(pag.460)	XI1	Fuel electro-injector 1
M002A(pag.458)	XECUA	Engine control unit

3121 - Injector 1 (from timing side): IMA code not written

Description of fault

The ECU engine control unit detects that the IMA for injector 1 (from timing side) has not been written in the memory

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The unique IMA code of each injector identifies the manufacturing tolerance values of the injector itself. The control unit uses this code together with other parameters to ensure accurate injection management. The IMA code is indicated on the head of the injector

This information must be saved manually in the control unit memory, entering the new IMA code with the diagnostic tool (see the documentation of the diagnostic tool) each time an injector is replaced

Do not swap injectors to test them. Mark the position of the injector with a marker pen before removing

Individual injectors may be disabled from the diagnostic tool to test them (see the documentation of the diagnostic tool)

Behaviour of system

The engine may be started as normal

Checks necessary

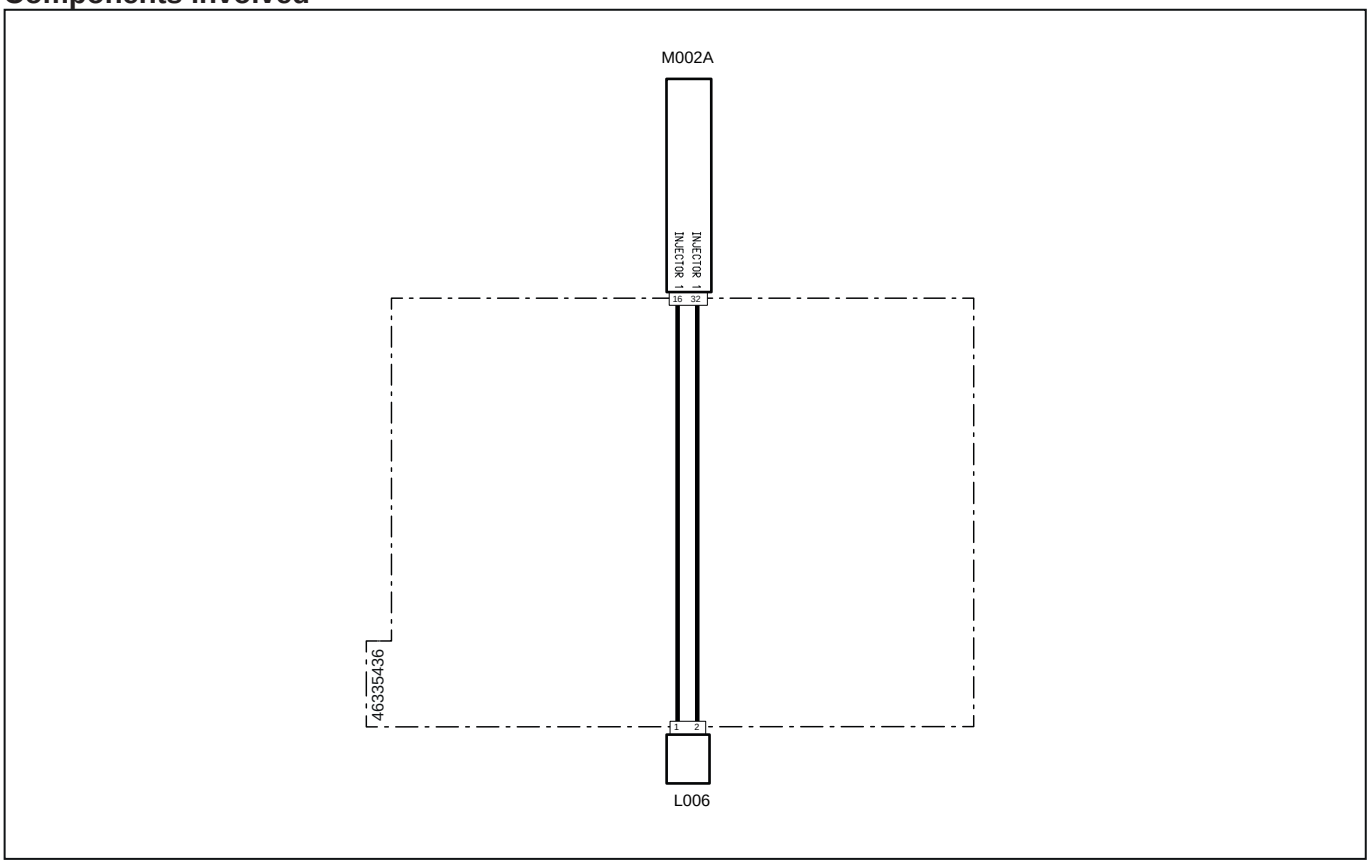
1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Use the diagnostic tool to check if the IMA code has not been saved in the control unit memory

3 - Write the IMA code of the injector in the control unit memory
- Note the IMA code indicated on the head of the injector on a sheet of paper
- Use the diagnostic tool to write the IMA code in the control unit memory (see the documentation of the diagnostic tool)

4 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
L006(pag.460)	XI1	Fuel electro-injector 1
M002A(pag.458)	XECUA	Engine control unit

3122 - Injector 2 (from timing side): short circuit

Description of fault

The ECU engine control unit detects a short circuit on the second injector (from timing side)

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Do not swap injectors to test them. Mark the position of the injector with a marker pen before removing

Individual injectors may be disabled from the diagnostic tool to test them (see the documentation of the diagnostic tool)

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

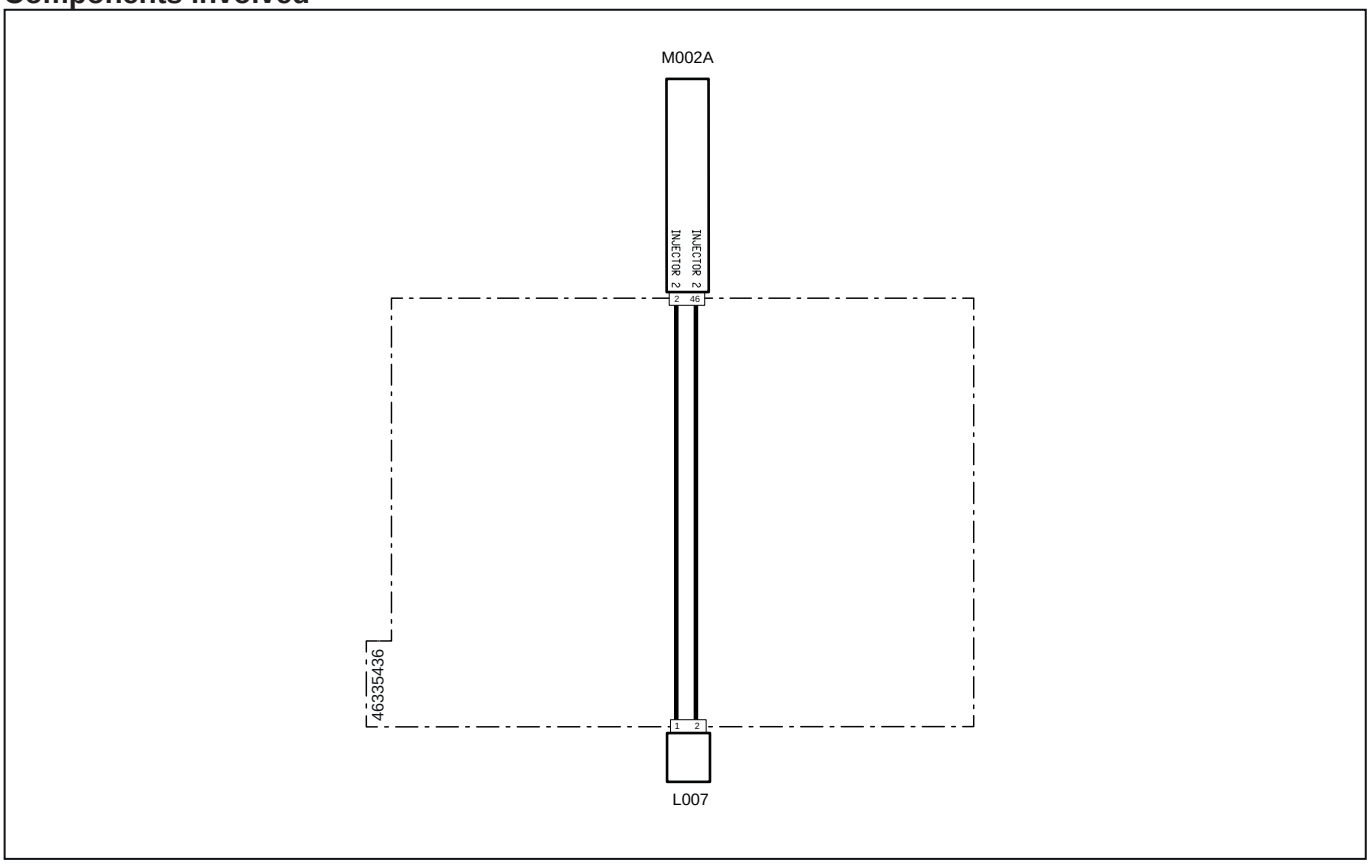
2 - Check that the connectors of the injector and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

4 - Check that the wiring loom connectors are connected correctly and not damaged

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
L007(pag.461)	XI2	Fuel electro-injector 2
M002A(pag.458)	XECUA	Engine control unit

3123 - Injector 2 (from timing side): short circuit

Description of fault

The ECU engine control unit detects a short circuit on the second injector (from timing side)

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Do not swap injectors to test them. Mark the position of the injector with a marker pen before removing

Individual injectors may be disabled from the diagnostic tool to test them (see the documentation of the diagnostic tool)

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

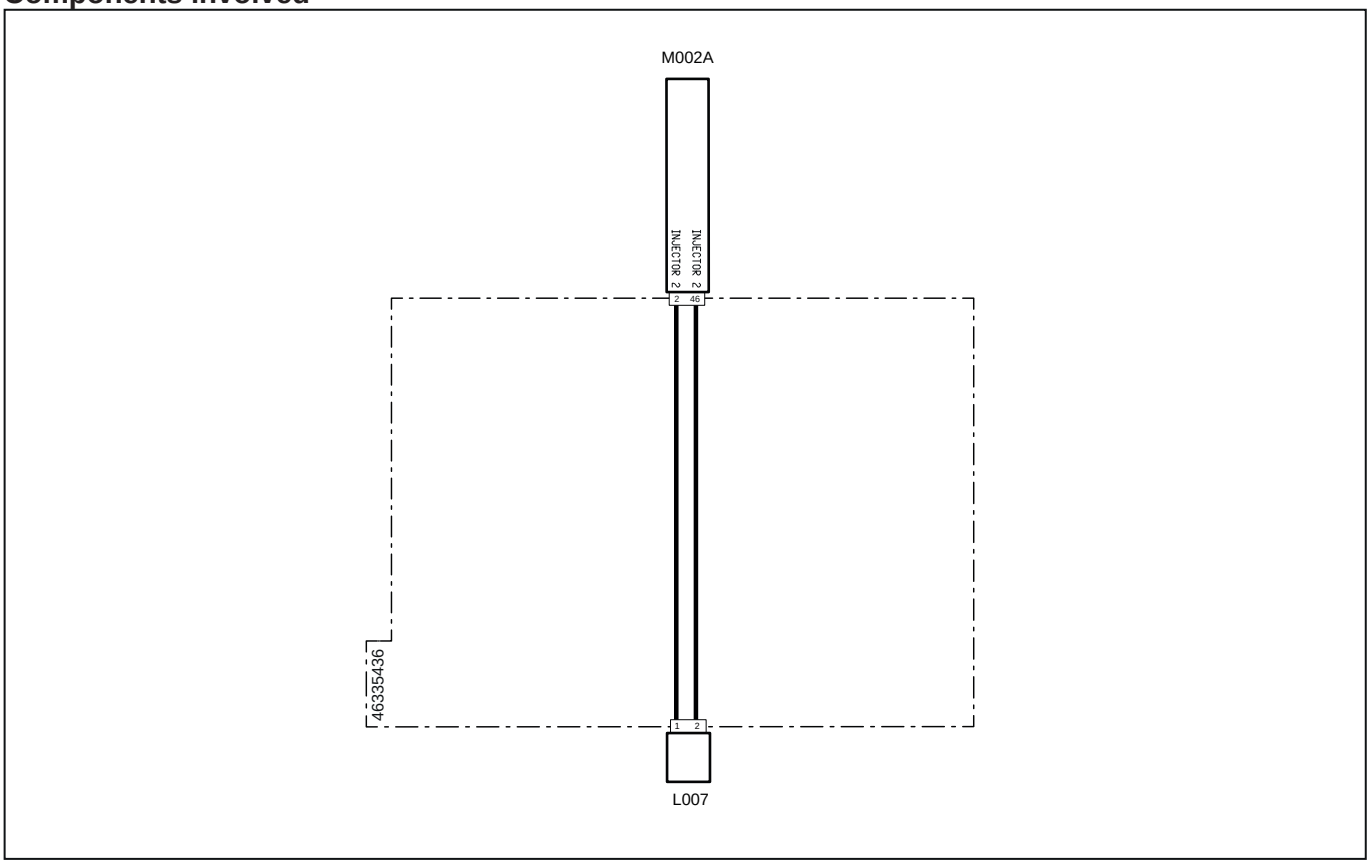
2 - Check that the connectors of the injector and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

4 - Check that the wiring loom connectors are connected correctly and not damaged

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
L007(pag.461)	XI2	Fuel electro-injector 2
M002A(pag.458)	XECUA	Engine control unit

3124 - Injector 2 (from timing side): open circuit

Description of fault

The ECU engine control unit detects an open circuit fault on the second injector (from timing side)

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Do not swap injectors to test them. Mark the position of the injector with a marker pen before removing

Individual injectors may be disabled from the diagnostic tool to test them (see the documentation of the diagnostic tool)

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

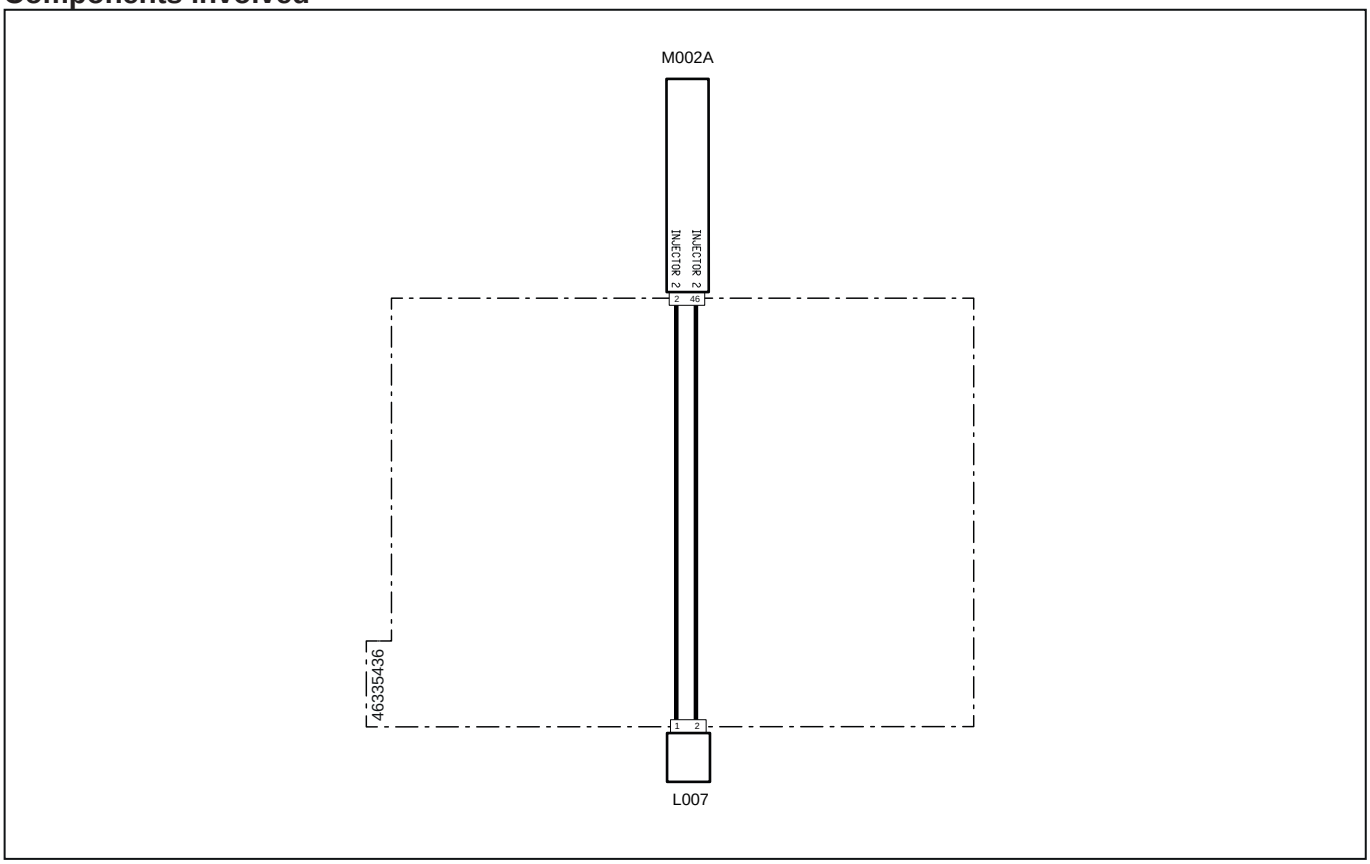
2 - Check that the connectors of the injector and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

4 - Check that the wiring loom connectors are connected correctly and not damaged

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
L007(pag.461)	XI2	Fuel electro-injector 2
M002A(pag.458)	XECUA	Engine control unit

3125 - Injector 2 (from timing side): IMA code not written

Description of fault

The ECU engine control unit detects that the IMA for injector 2 (from timing side) has not been written in the memory

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The unique IMA code of each injector identifies the manufacturing tolerance values of the injector itself. The control unit uses this code together with other parameters to ensure accurate injection management. The IMA code is indicated on the head of the injector

This information must be saved manually in the control unit memory, entering the new IMA code with the diagnostic tool (see the documentation of the diagnostic tool) each time an injector is replaced

Do not swap injectors to test them. Mark the position of the injector with a marker pen before removing

Individual injectors may be disabled from the diagnostic tool to test them (see the documentation of the diagnostic tool)

Behaviour of system

The engine may be started as normal

Checks necessary

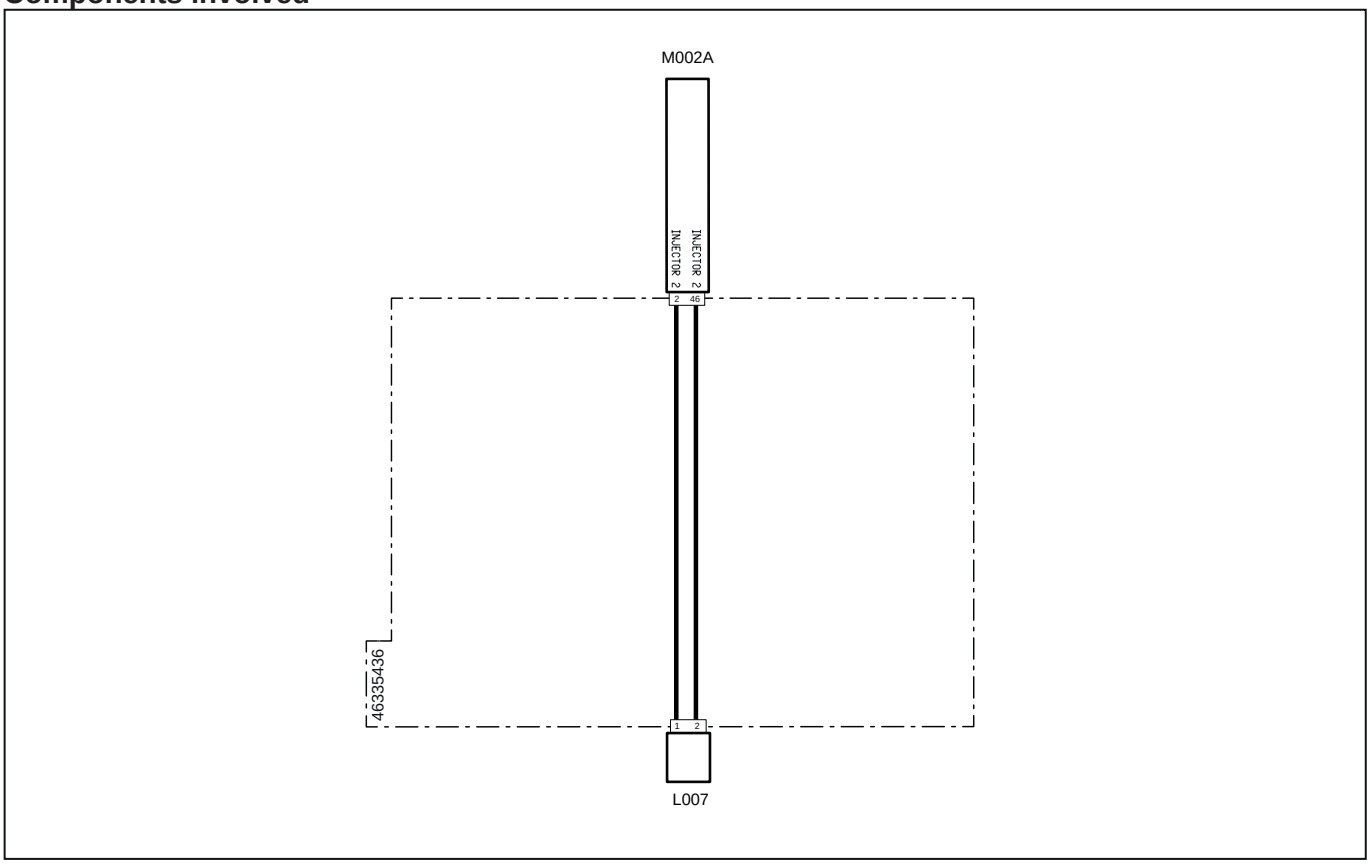
1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Use the diagnostic tool to check if the IMA code has not been saved in the control unit memory

3 - Write the IMA code of the injector in the control unit memory
- Note the IMA code indicated on the head of the injector on a sheet of paper
- Use the diagnostic tool to write the IMA code in the control unit memory (see the documentation of the diagnostic tool)

4 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
L007(pag.461)	XI2	Fuel electro-injector 2
M002A(pag.458)	XECUA	Engine control unit

3126 - Injector 3 (from timing side): short circuit

Description of fault

The ECU engine control unit detects a short circuit on the third injector (from timing side)

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Do not swap injectors to test them. Mark the position of the injector with a marker pen before removing

Individual injectors may be disabled from the diagnostic tool to test them (see the documentation of the diagnostic tool)

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

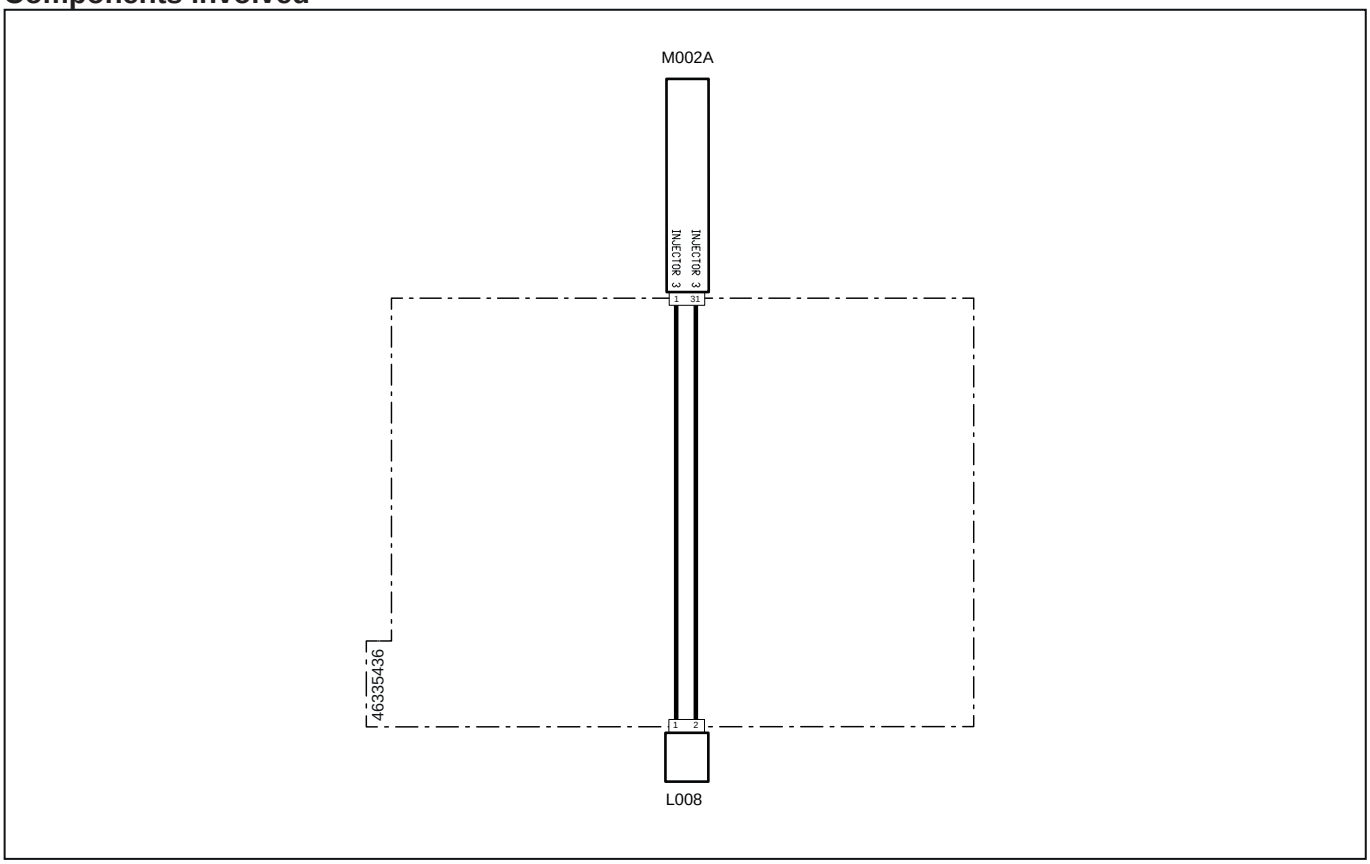
2 - Check that the connectors of the injector and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

4 - Check that the wiring loom connectors are connected correctly and not damaged

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
L008(pag.462)	XI3	Fuel electro-injector 3
M002A(pag.458)	XECUA	Engine control unit

3127 - Injector 3 (from timing side): short circuit

Description of fault

The ECU engine control unit detects a short circuit on the third injector (from timing side)

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Do not swap injectors to test them. Mark the position of the injector with a marker pen before removing

Individual injectors may be disabled from the diagnostic tool to test them (see the documentation of the diagnostic tool)

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

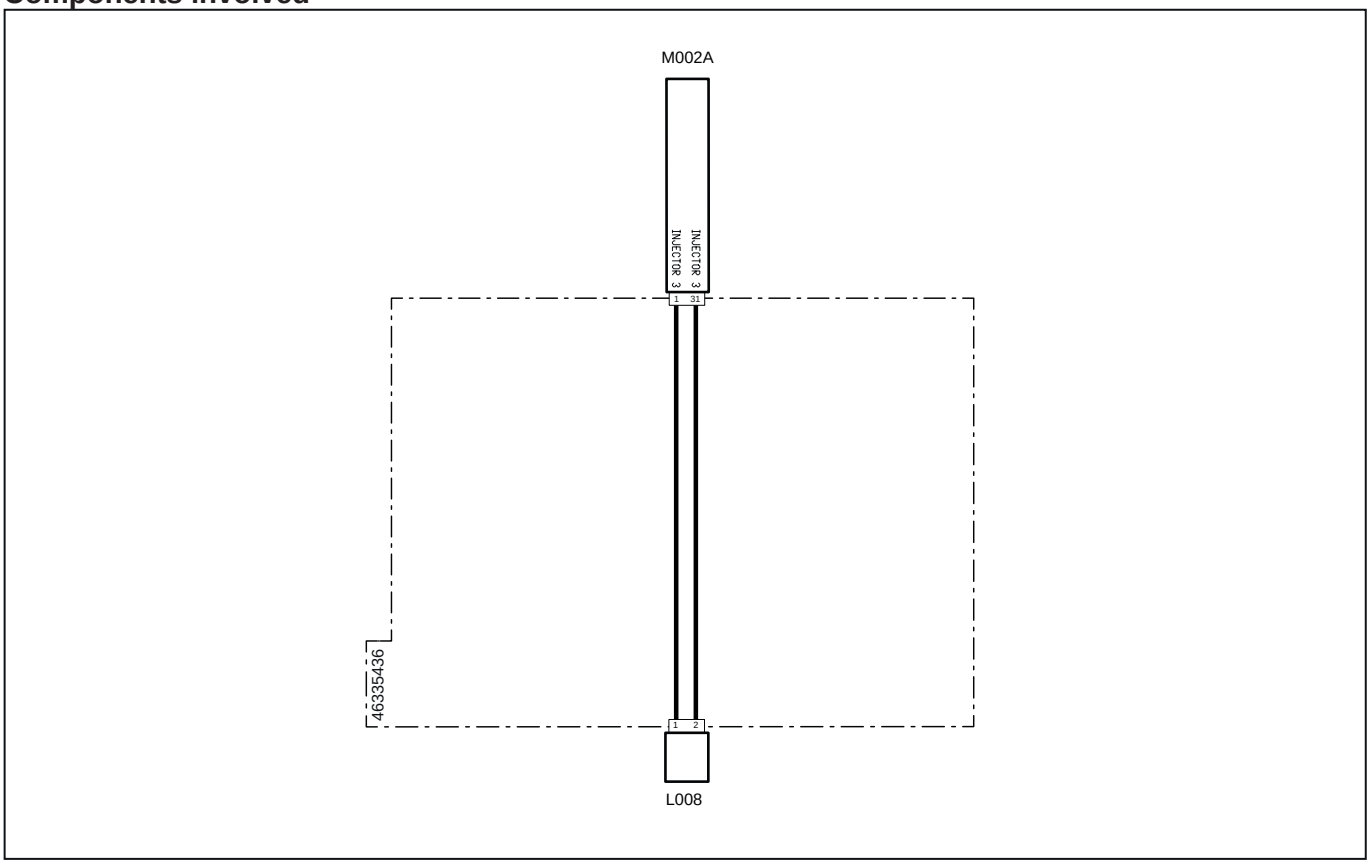
2 - Check that the connectors of the injector and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

4 - Check that the wiring loom connectors are connected correctly and not damaged

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
L008(pag.462)	XI3	Fuel electro-injector 3
M002A(pag.458)	XECUA	Engine control unit

3128 - Injector 3 (from timing side): open circuit

Description of fault

The ECU engine control unit detects an open circuit fault on the third injector (from timing side)

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Do not swap injectors to test them. Mark the position of the injector with a marker pen before removing

Individual injectors may be disabled from the diagnostic tool to test them (see the documentation of the diagnostic tool)

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

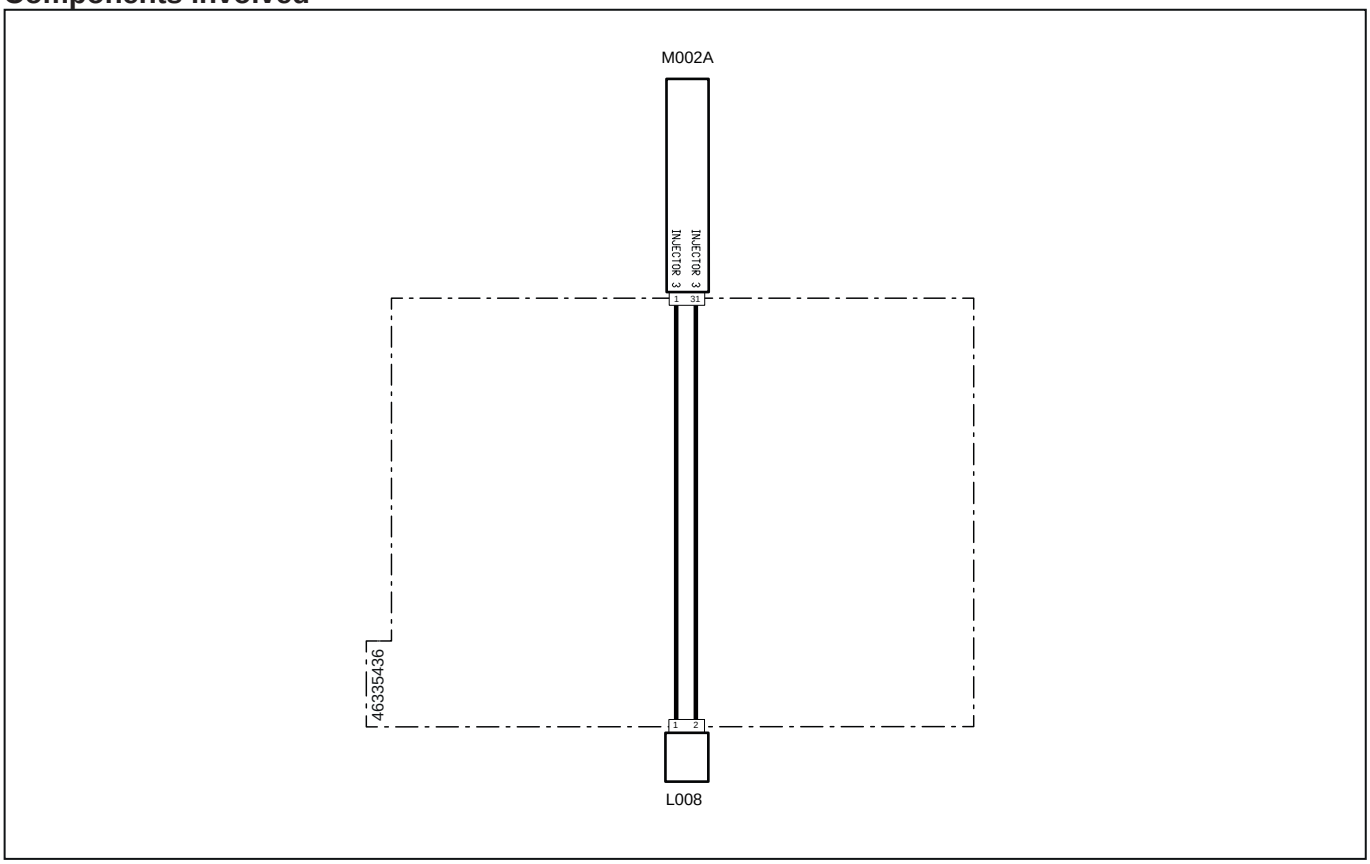
2 - Check that the connectors of the injector and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

4 - Check that the wiring loom connectors are connected correctly and not damaged

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
L008(pag.462)	XI3	Fuel electro-injector 3
M002A(pag.458)	XECUA	Engine control unit

3129 - Injector 3 (from timing side): IMA code not written

Description of fault

The ECU engine control unit detects that the IMA for injector 3 (from timing side) has not been written in the memory

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The unique IMA code of each injector identifies the manufacturing tolerance values of the injector itself. The control unit uses this code together with other parameters to ensure accurate injection management. The IMA code is indicated on the head of the injector

This information must be saved manually in the control unit memory, entering the new IMA code with the diagnostic tool (see the documentation of the diagnostic tool) each time an injector is replaced

Do not swap injectors to test them. Mark the position of the injector with a marker pen before removing

Individual injectors may be disabled from the diagnostic tool to test them (see the documentation of the diagnostic tool)

Behaviour of system

The engine may be started as normal

Checks necessary

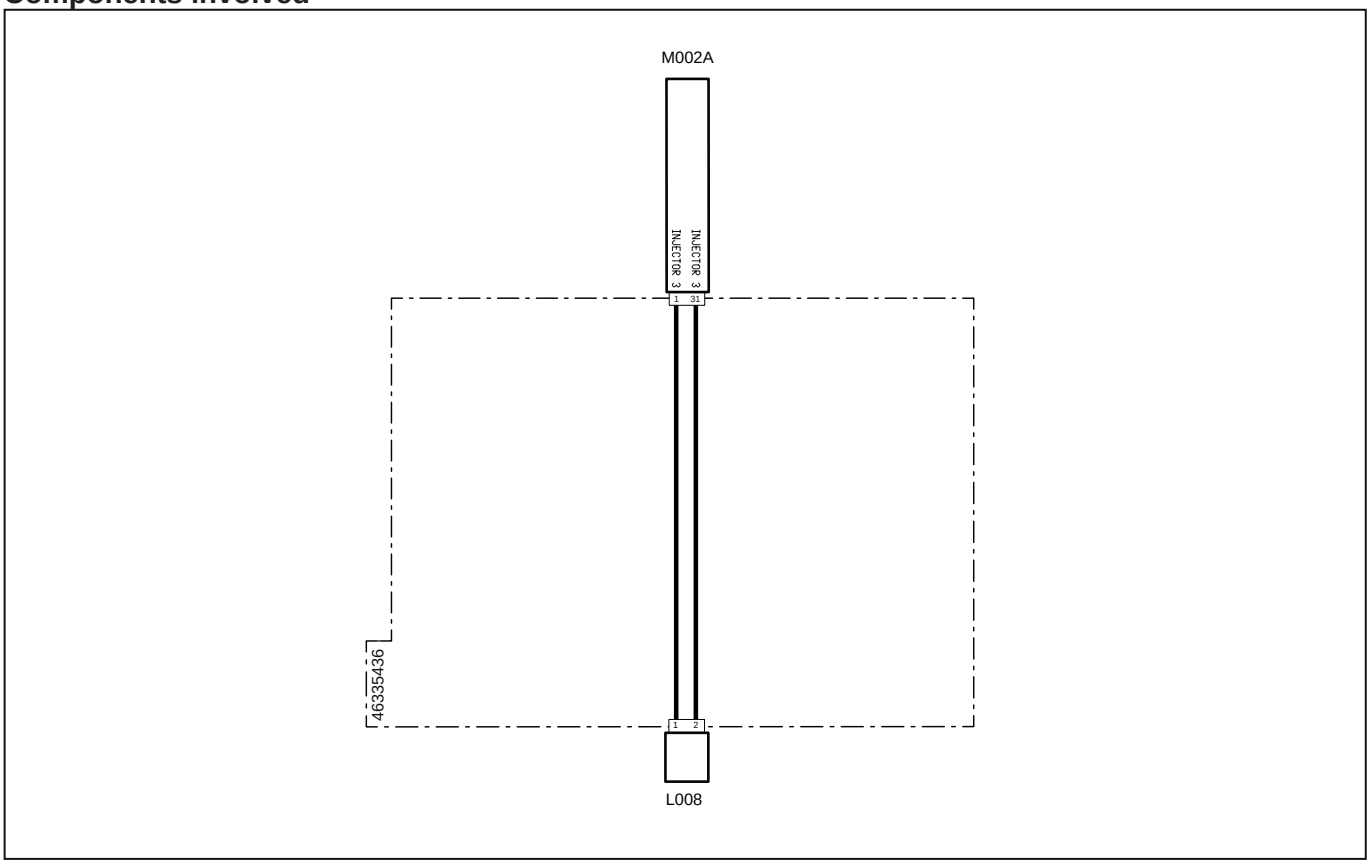
1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Use the diagnostic tool to check if the IMA code has not been saved in the control unit memory

3 - Write the IMA code of the injector in the control unit memory
- Note the IMA code indicated on the head of the injector on a sheet of paper
- Use the diagnostic tool to write the IMA code in the control unit memory (see the documentation of the diagnostic tool)

4 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
L008(pag.462)	XI3	Fuel electro-injector 3
M002A(pag.458)	XECUA	Engine control unit

3130 - Injector 4 (from timing side): short circuit

Description of fault

The ECU engine control unit detects a short circuit on the fourth injector (from timing side)

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Do not swap injectors to test them. Mark the position of the injector with a marker pen before removing

Individual injectors may be disabled from the diagnostic tool to test them (see the documentation of the diagnostic tool)

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

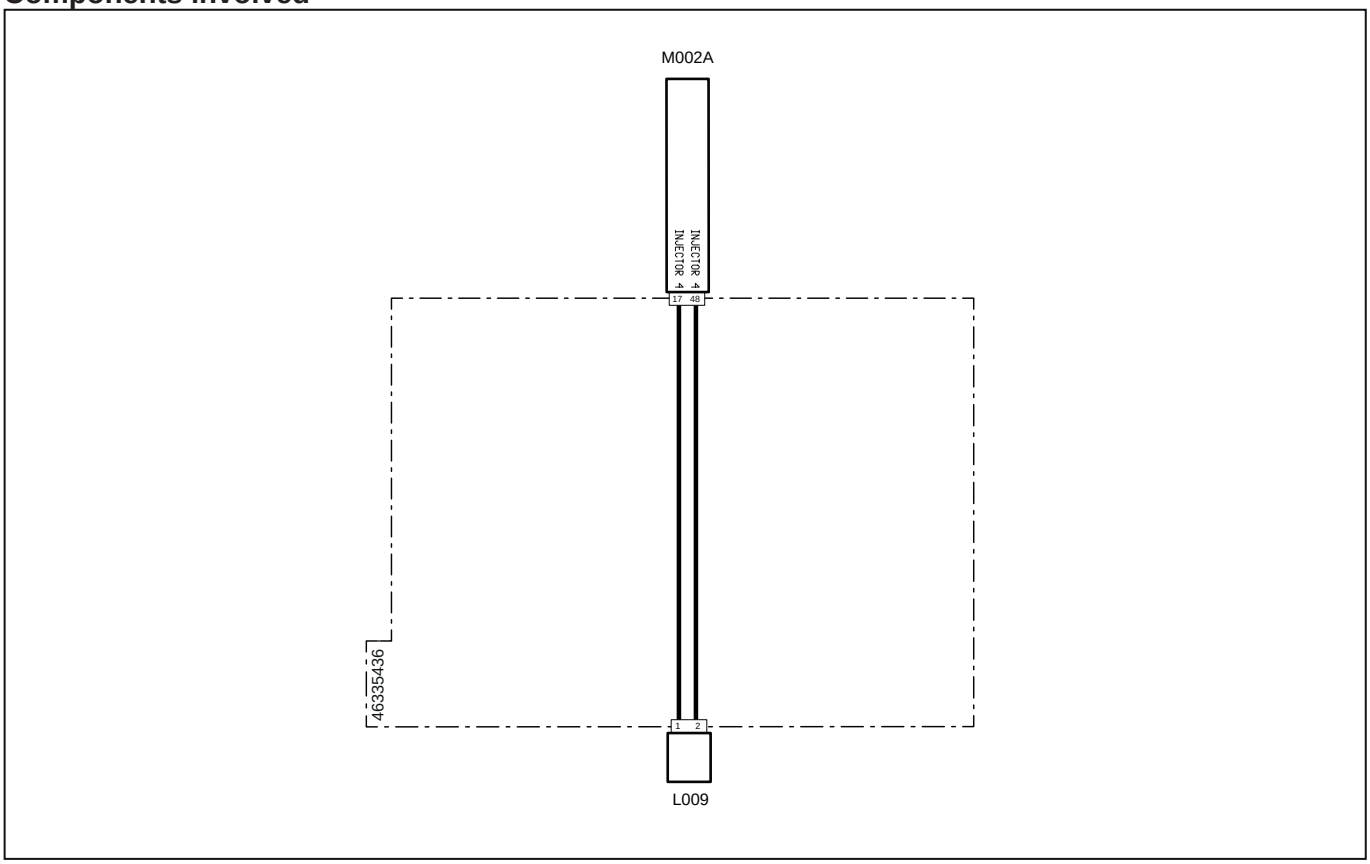
2 - Check that the connectors of the injector and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

4 - Check that the wiring loom connectors are connected correctly and not damaged

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
L009(pag.462)	XI4	Fuel electro-injector 4
M002A(pag.458)	XECUA	Engine control unit

3131 - Injector 4 (from timing side): short circuit

Description of fault

The ECU engine control unit detects a short circuit on the fourth injector (from timing side)

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Do not swap injectors to test them. Mark the position of the injector with a marker pen before removing

Individual injectors may be disabled from the diagnostic tool to test them (see the documentation of the diagnostic tool)

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

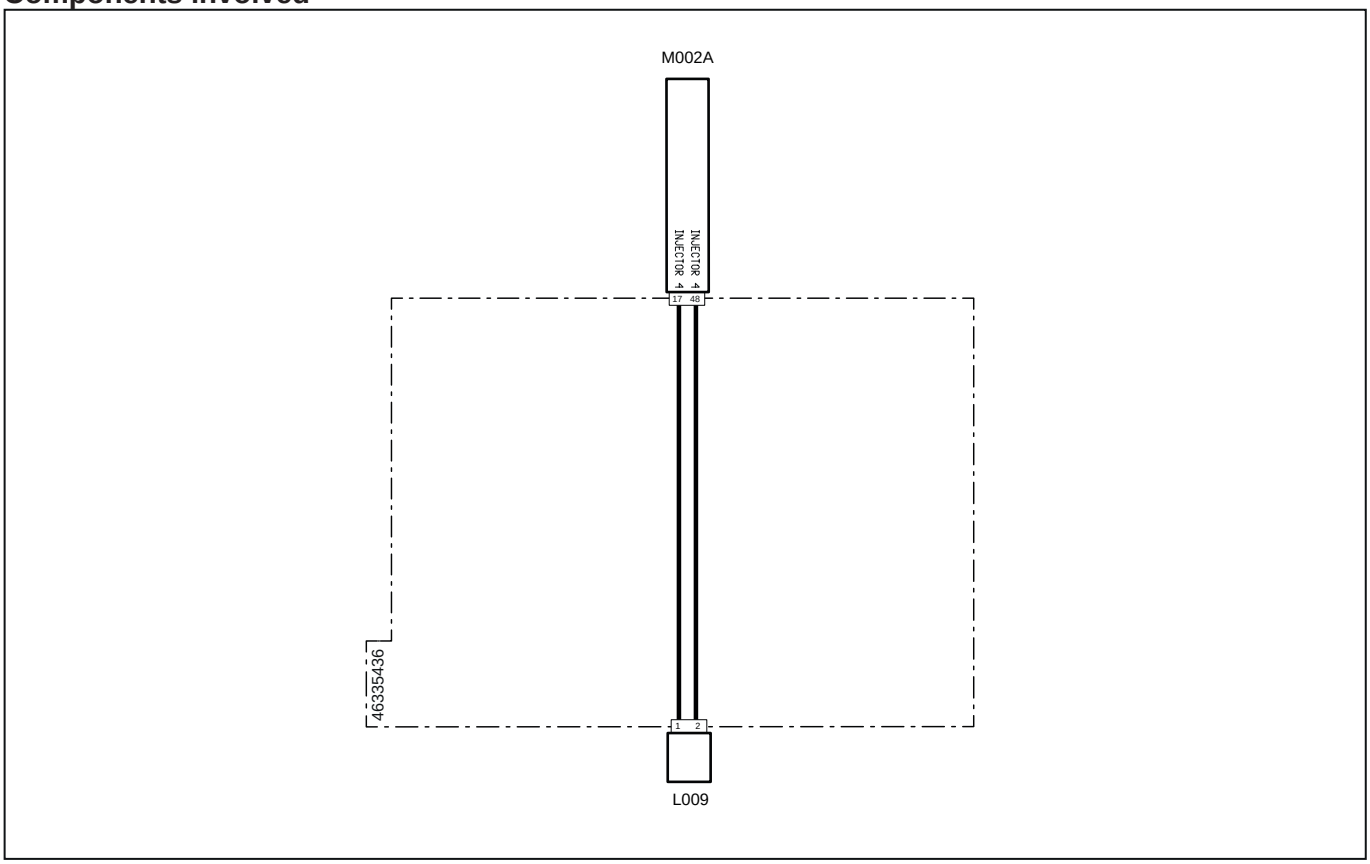
2 - Check that the connectors of the injector and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

4 - Check that the wiring loom connectors are connected correctly and not damaged

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
L009(pag.462)	XI4	Fuel electro-injector 4
M002A(pag.458)	XECUA	Engine control unit

3132 - Injector 4 (from timing side): open circuit

Description of fault

The ECU engine control unit detects an open circuit fault on the fourth injector (from timing side)

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Do not swap injectors to test them. Mark the position of the injector with a marker pen before removing

Individual injectors may be disabled from the diagnostic tool to test them (see the documentation of the diagnostic tool)

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

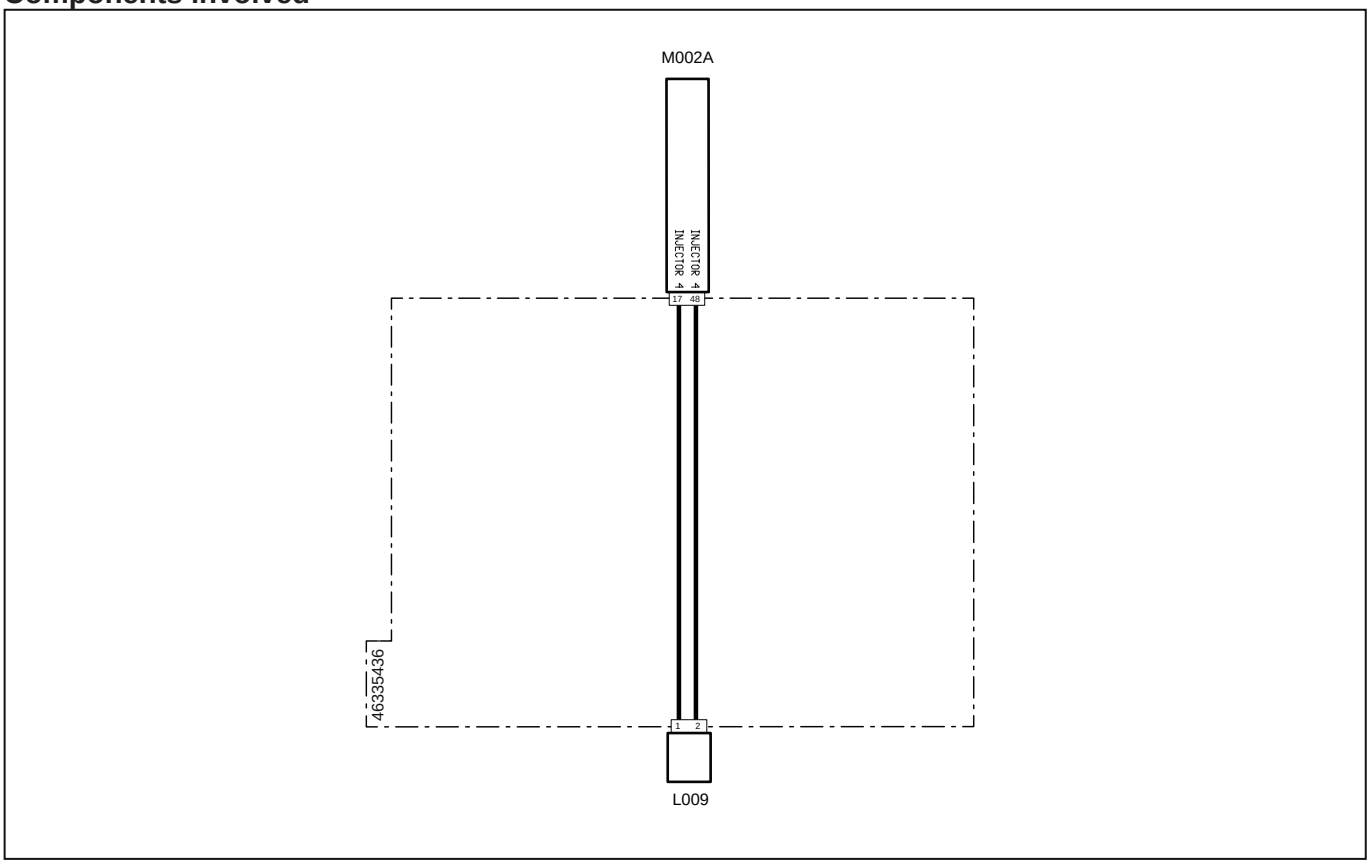
2 - Check that the connectors of the injector and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

4 - Check that the wiring loom connectors are connected correctly and not damaged

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
L009(pag.462)	XI4	Fuel electro-injector 4
M002A(pag.458)	XECUA	Engine control unit

3129 - Injector 4 (from timing side): IMA code not written

Description of fault

The ECU engine control unit detects that the IMA for injector 4 (from timing side) has not been written in the memory

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The unique IMA code of each injector identifies the manufacturing tolerance values of the injector itself. The control unit uses this code together with other parameters to ensure accurate injection management. The IMA code is indicated on the head of the injector

This information must be saved manually in the control unit memory, entering the new IMA code with the diagnostic tool (see the documentation of the diagnostic tool) each time an injector is replaced

Do not swap injectors to test them. Mark the position of the injector with a marker pen before removing

Individual injectors may be disabled from the diagnostic tool to test them (see the documentation of the diagnostic tool)

Behaviour of system

The engine may be started as normal

Checks necessary

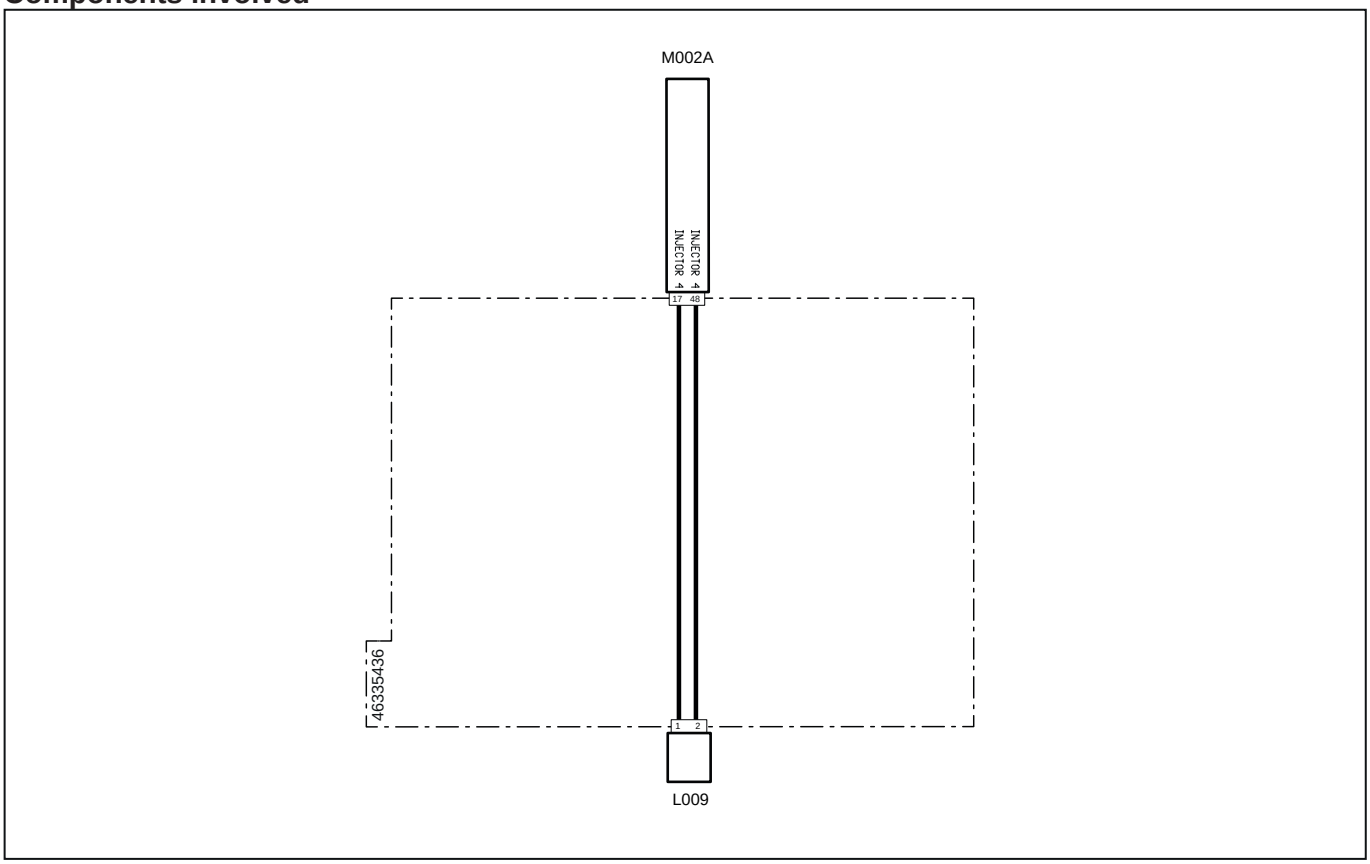
1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Use the diagnostic tool to check if the IMA code has not been saved in the control unit memory

3 - Write the IMA code of the injector in the control unit memory
- Note the IMA code indicated on the head of the injector on a sheet of paper
- Use the diagnostic tool to write the IMA code in the control unit memory (see the documentation of the diagnostic tool)

4 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
L009(pag.462)	XI4	Fuel electro-injector 4
M002A(pag.458)	XECUA	Engine control unit

3134 - Injector 1 and 4 solenoids: short circuit

Description of fault

The control unit detects a short circuit fault simultaneously on the solenoids of injector 1 and injector 4

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Do not swap injectors to test them. Mark the position of the injector with a marker pen before removing

Individual injectors may be disabled from the diagnostic tool to test them (see the documentation of the diagnostic tool)The new IMA must always be written in the engine control unit memory whenever an injector is replaced

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

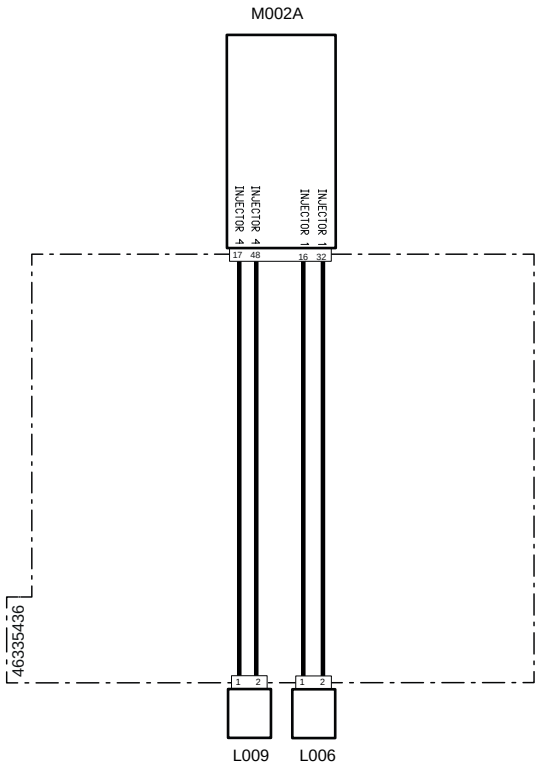
2 - Check that the connectors of injector 1, injector 4 and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

4 - Check that the wiring loom connectors are connected correctly and not damaged

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
L006(pag.460)	XI1	Fuel electro-injector 1
L009(pag.462)	XI4	Fuel electro-injector 4
M002A(pag.458)	XECUA	Engine control unit

3135 - Injector 2 and 3 solenoids: short circuit

Description of fault

The control unit detects a short circuit fault simultaneously on the solenoids of injector 2 and injector 3

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Do not swap injectors to test them. Mark the position of the injector with a marker pen before removing

Individual injectors may be disabled from the diagnostic tool to test them (see the documentation of the diagnostic tool) The new IMA must always be written in the engine control unit memory whenever an injector is replaced

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

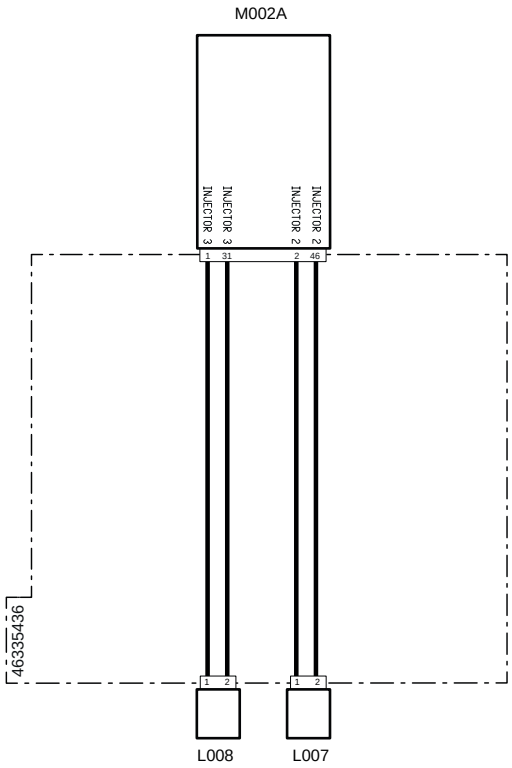
2 - Check that the connectors of injector 2, injector 3 and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

4 - Check that the wiring loom connectors are connected correctly and not damaged

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
L007(pag.461)	XI2	Fuel electro-injector 2
L008(pag.462)	XI3	Fuel electro-injector 3
M002A(pag.458)	XECUA	Engine control unit

3136 - Starter motor powered for more than 25 seconds

Description of fault

The ECU engine control unit detects that the start relay has been powering the starter motor for more than 25 seconds

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Use the diagnostic tool to check that the MProp metering valve is working correctly (see documentation of diagnostic tool)
- Check that the MProp valve is working correctly and replace if necessary
- Check that the percent aperture of the valve is congruent with the pressure measured by the rail pressure sensor
- If the problem persists, proceed to the next step

3 - Use the diagnostic tool to check that the rail pressure sensor is working correctly (see documentation of diagnostic tool)
- Check if the rail pressure sensor is working correctly and replace if necessary
- Check that the pressure measured by the rail pressure sensor is congruent with the percent aperture of the valve
- If the problem persists, proceed to the next step

4 - Check that the connectors of the rail pressure sensor, of the MProp metering valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

5 - Check the fuel delivery circuit for leaks and/or obstructions
- Check that there are no obstructions in the fuel suction pipe (low pressure side) leading from the fuel tank
- Check that the fuel filter is not clogged and replace if necessary
- Check that there are no leaks from the high pressure side pipes connected to the rail and injectors

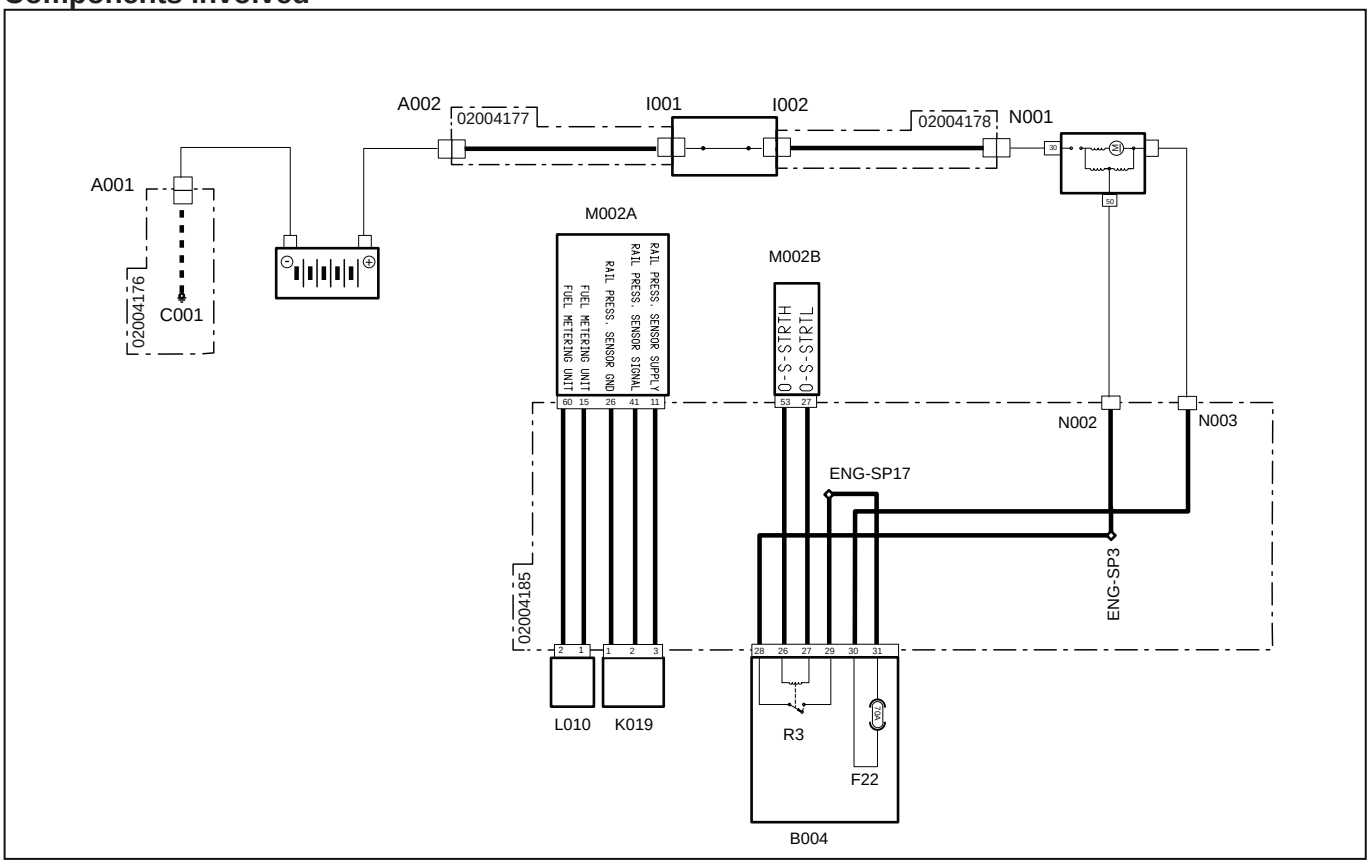
The high pressure circuit can cause severe injury. Work with extreme caution and observe all the safety rules and instructions given in the workshop manual of the vehicle

6 - Check the state of starter motor circuit "50"
- Check the condition of lug terminal N002 connected to the starter motor
- Check that the starter motor works correctly

7 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

8 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A002(pag.369)	P55	Positive battery terminal
F22(B004) (pag.418)	F22	Main maxi fuse (70A)
I001(pag.368)	P39	Battery master relay switch (input terminal)
I002(pag.370)	P23	Battery master relay switch (output terminal)
K019(pag.466)	XS5	Common Rail fuel pressure sensor
L010(pag.468)	XY1	High pressure pump
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
N001(pag.369)	P10	Starter motor "30"
N002(pag.442)	P490	Starter motor50
N003(pag.430)	P63	Starter motor
R3(B004) (pag.418)	R3	Start relay (20A)

3137 - Start relay overcurrent

Description of fault

The ECU engine control unit detects a overcurrent fault in the start relay circuit

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

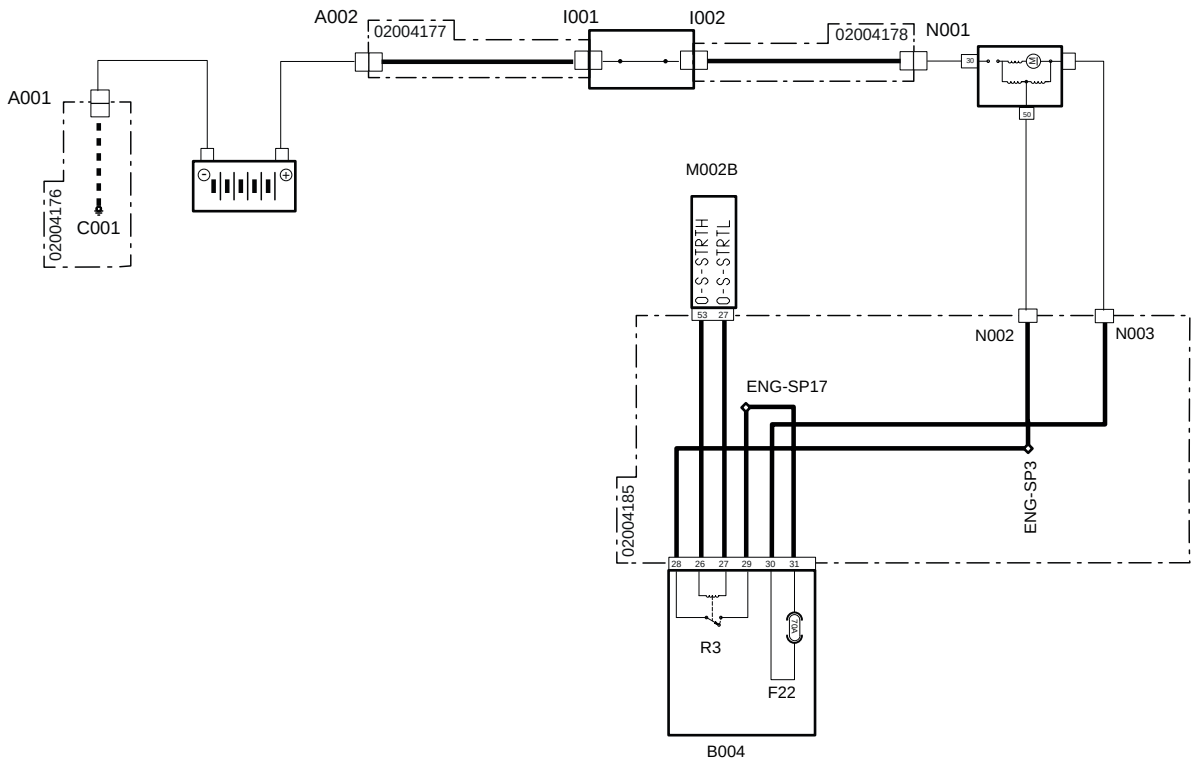
2 - Check that the connectors of the start relay and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Visually inspect the start relay and replace if necessary
- Open the fuse box cover and disconnect the start relay
- Visually inspect the relay and replace if necessary
- If the relay does not need to be replaced, reconnect it to the fuse box and proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A002(pag.369)	P55	Positive battery terminal
F22(B004) (pag.418)	F22	Main maxi fuse (70A)
I001(pag.368)	P39	Battery master relay switch (input terminal)
I002(pag.370)	P23	Battery master relay switch (output terminal)
M002B(pag.423)	P12	Engine control unit
N001(pag.369)	P10	Starter motor "30"
N002(pag.442)	P490	Starter motor50
N003(pag.430)	P63	Starter motor
R3(B004) (pag.418)	R3	Start relay (20A)

3138 - Start relay: short circuit to battery

Description of fault

The ECU engine control unit detects a short circuit to battery on the start relay

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the connectors of the start relay and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

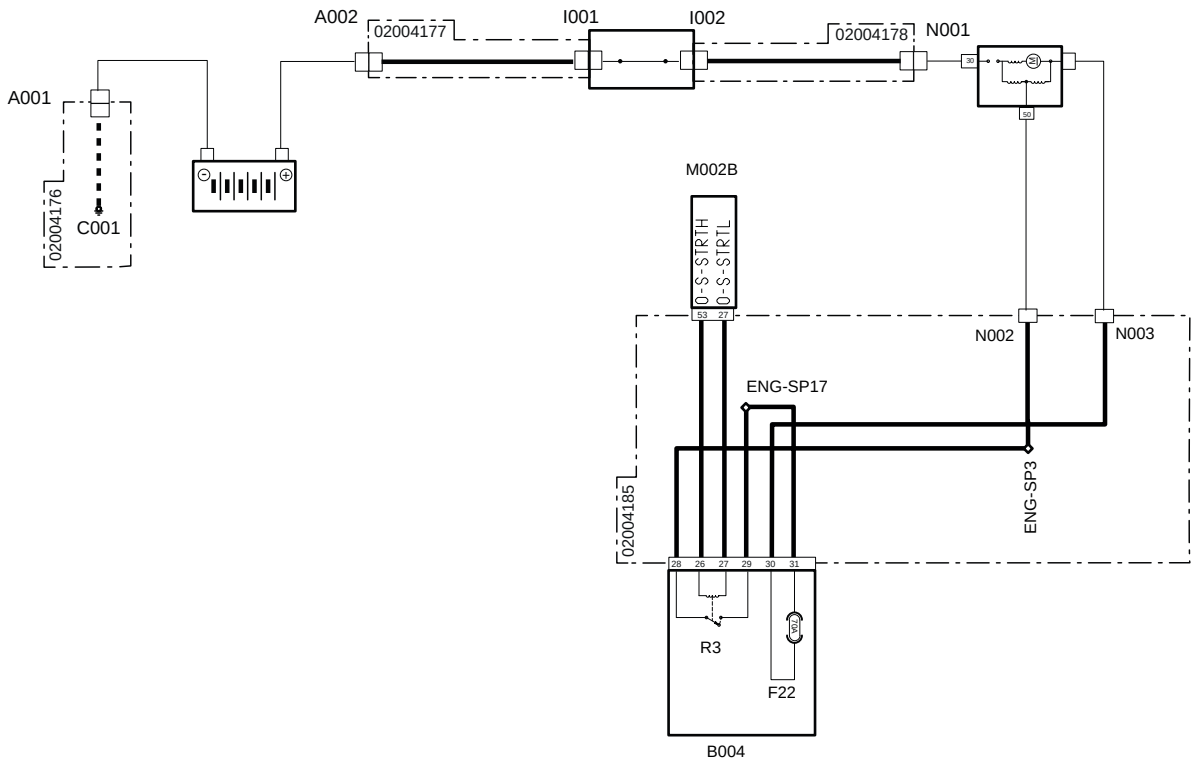
3 - Visually inspect the start relay and replace if necessary
- Open the fuse box cover and disconnect the start relay
- Visually inspect the relay and replace if necessary
- If the relay does not need to be replaced, reconnect it to the fuse box and proceed to the next step

4 - Check the connection between the fuse box pins and the control unit pins
- Check the connection between pin 27 of the engine control unit and pin 27 of the fuse box
- Check the connection between pin 53 of the engine control unit and pin 26 of the fuse box

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A002(pag.369)	P55	Positive battery terminal
F22(B004) (pag.418)	F22	Main maxi fuse (70A)
I001(pag.368)	P39	Battery master relay switch (input terminal)
I002(pag.370)	P23	Battery master relay switch (output terminal)
M002B(pag.423)	P12	Engine control unit
N001(pag.369)	P10	Starter motor "30"
N002(pag.442)	P490	Starter motor50
N003(pag.430)	P63	Starter motor
R3(B004) (pag.418)	R3	Start relay (20A)

3139 - Start relay: short circuit to battery

Description of fault

The ECU engine control unit detects a short circuit to battery on the start relay

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the connectors of the start relay and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

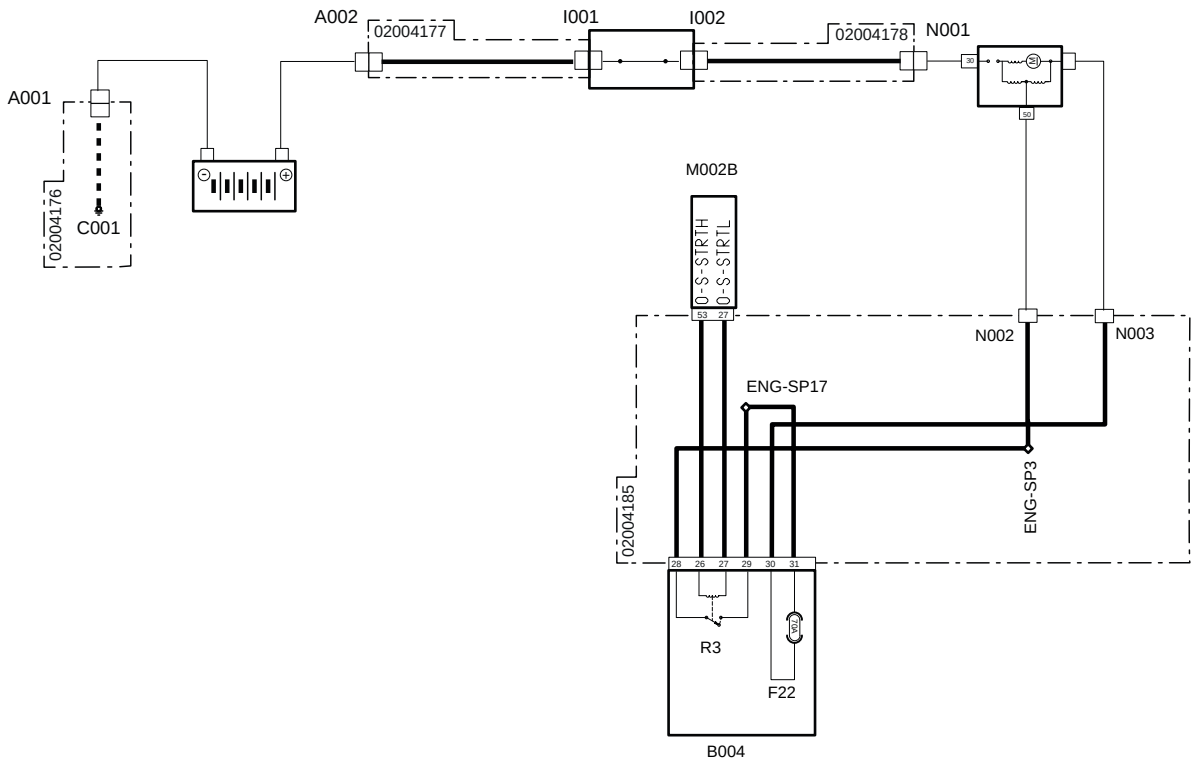
3 - Visually inspect the start relay and replace if necessary
- Open the fuse box cover and disconnect the start relay
- Visually inspect the relay and replace if necessary
- If the relay does not need to be replaced, reconnect it to the fuse box and proceed to the next step

4 - Check the connection between the fuse box pins and the control unit pins
- Check the connection between pin 27 of the engine control unit and pin 27 of the fuse box
- Check the connection between pin 53 of the engine control unit and pin 26 of the fuse box

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A002(pag.369)	P55	Positive battery terminal
F22(B004) (pag.418)	F22	Main maxi fuse (70A)
I001(pag.368)	P39	Battery master relay switch (input terminal)
I002(pag.370)	P23	Battery master relay switch (output terminal)
M002B(pag.423)	P12	Engine control unit
N001(pag.369)	P10	Starter motor "30"
N002(pag.442)	P490	Starter motor50
N003(pag.430)	P63	Starter motor
R3(B004) (pag.418)	R3	Start relay (20A)

3140 - Start relay: open circuit

Description of fault

The ECU engine control unit detects a open circuit fault in the start relay circuit

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

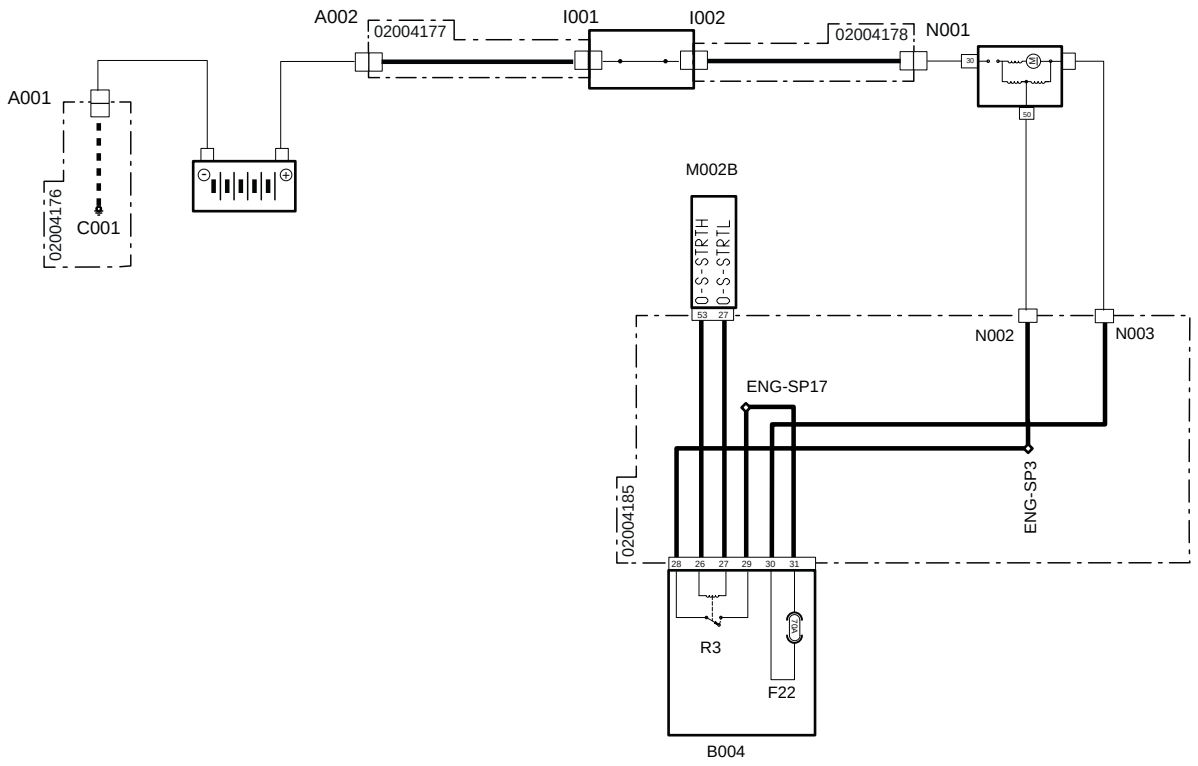
2 - Check that the connectors of the start relay and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Visually inspect the start relay and replace if necessary
- Open the fuse box cover and disconnect the start relay
- Visually inspect the relay and replace if necessary
- If the relay does not need to be replaced, reconnect it to the fuse box and proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A002(pag.369)	P55	Positive battery terminal
F22(B004) (pag.418)	F22	Main maxi fuse (70A)
I001(pag.368)	P39	Battery master relay switch (input terminal)
I002(pag.370)	P23	Battery master relay switch (output terminal)
M002B(pag.423)	P12	Engine control unit
N001(pag.369)	P10	Starter motor "30"
N002(pag.442)	P490	Starter motor50
N003(pag.430)	P63	Starter motor
R3(B004) (pag.418)	R3	Start relay (20A)

3141 - Start relay: short circuit to ground

Description of fault

The ECU engine control unit detects a short circuit to ground on the start relay

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started as normal

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the connectors of the start relay and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

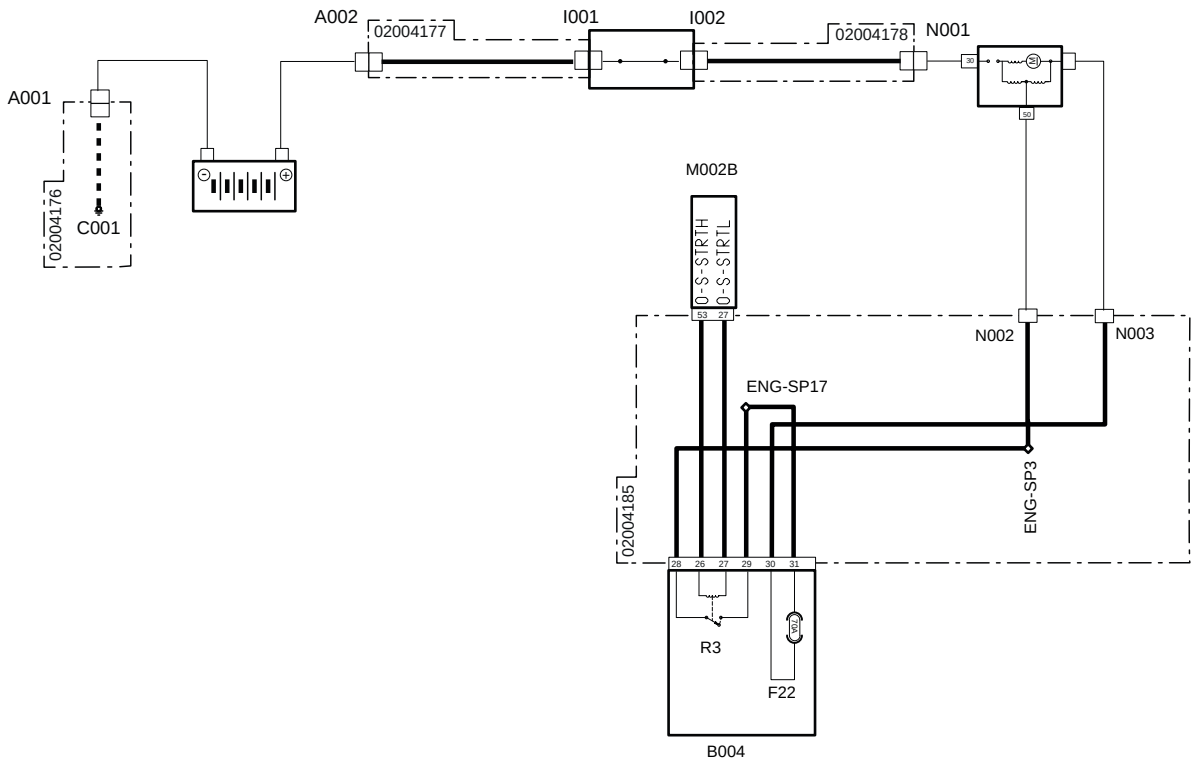
3 - Visually inspect the start relay and replace if necessary
- Open the fuse box cover and disconnect the start relay
- Visually inspect the relay and replace if necessary
- If the relay does not need to be replaced, reconnect it to the fuse box and proceed to the next step

4 - Check the connection between the fuse box pins and the control unit pins
- Check the connection between pin 27 of the engine control unit and pin 27 of the fuse box
- Check the connection between pin 53 of the engine control unit and pin 26 of the fuse box

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A002(pag.369)	P55	Positive battery terminal
F22(B004) (pag.418)	F22	Main maxi fuse (70A)
I001(pag.368)	P39	Battery master relay switch (input terminal)
I002(pag.370)	P23	Battery master relay switch (output terminal)
M002B(pag.423)	P12	Engine control unit
N001(pag.369)	P10	Starter motor "30"
N002(pag.442)	P490	Starter motor50
N003(pag.430)	P63	Starter motor
R3(B004) (pag.418)	R3	Start relay (20A)

3142 - Start relay: short circuit to ground

Description of fault

The ECU engine control unit detects a short circuit to ground on the start relay

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

No engine limiting strategy implemented by the control unit

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the connectors of the start relay and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

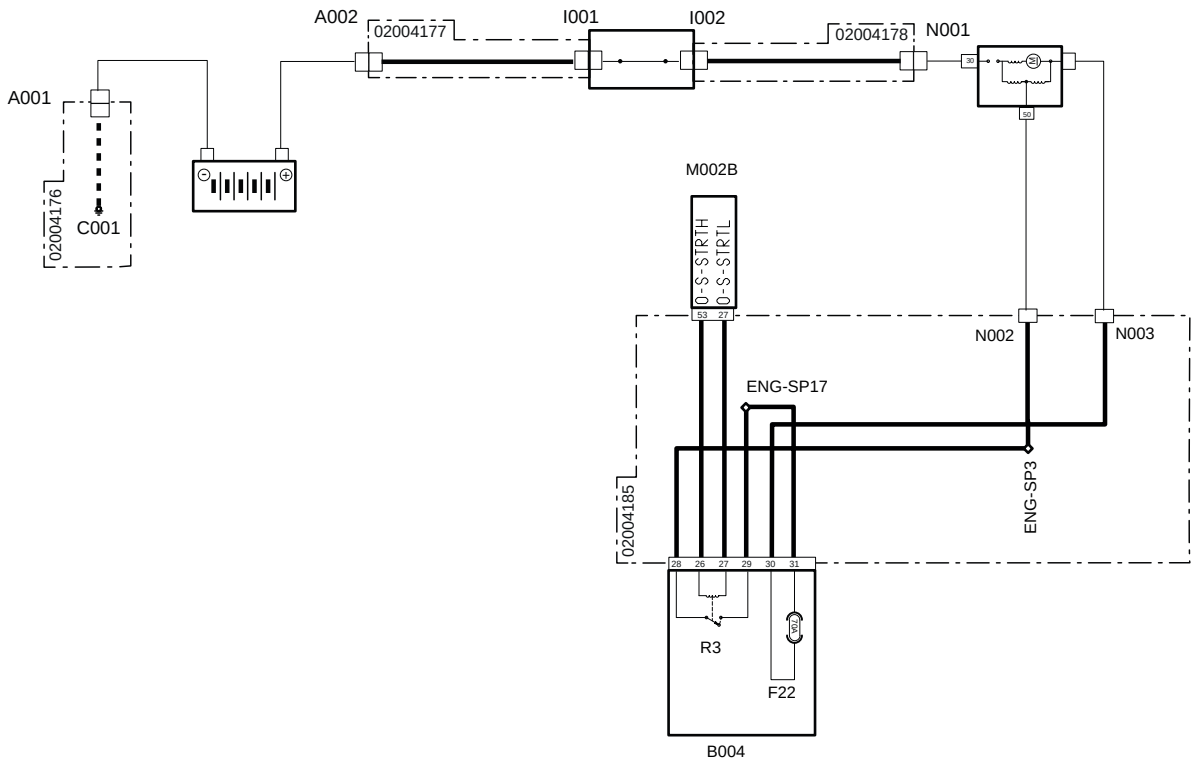
3 - Visually inspect the start relay and replace if necessary
- Open the fuse box cover and disconnect the start relay
- Visually inspect the relay and replace if necessary
- If the relay does not need to be replaced, reconnect it to the fuse box and proceed to the next step

4 - Check the connection between the fuse box pins and the control unit pins
- Check the connection between pin 27 of the engine control unit and pin 27 of the fuse box
- Check the connection between pin 53 of the engine control unit and pin 26 of the fuse box

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A002(pag.369)	P55	Positive battery terminal
F22(B004) (pag.418)	F22	Main maxi fuse (70A)
I001(pag.368)	P39	Battery master relay switch (input terminal)
I002(pag.370)	P23	Battery master relay switch (output terminal)
M002B(pag.423)	P12	Engine control unit
N001(pag.369)	P10	Starter motor "30"
N002(pag.442)	P490	Starter motor50
N003(pag.430)	P63	Starter motor
R3(B004) (pag.418)	R3	Start relay (20A)

3143 - Camshaft sensor:disturbed signal/spurious contact

Description of fault

The ECU engine control unit detects a disturbed signal from, or a spurious contact fault on, the camshaft speed sensor

Severity of error

Additional information

Behaviour of system

The engine may be started, but the engine operates with limited torque

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the connectors of the camshaft speed sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

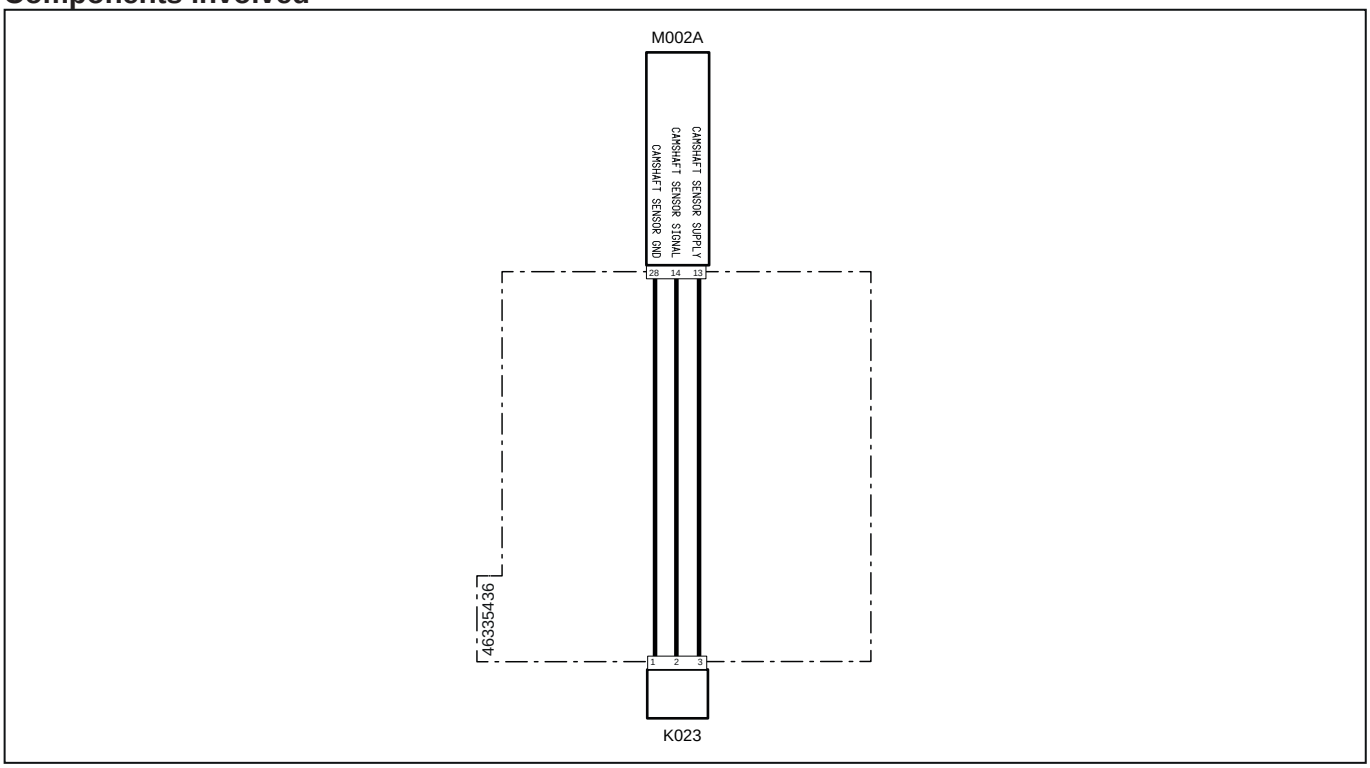
3 - Use the diagnostic tool to check that the camshaft speed sensor is working correctly (see documentation of diagnostic tool)
- Check if the ambient air temperature sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

4 - Check the condition of the camshaft
- Remove the camshaft speed sensor
- Turn the camshaft and, using a light, visually check if the tooth on the camshaft is damaged
- An oscilloscope may also be used to check the camshaft for damage which may not be noted with a visual inspection
- If the camshaft is damaged, remove the engine and replace the camshaft
- Proceed to the next step if the camshaft is not damaged

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K023(pag.464)	XS3	Camshaft timing sensor
M002B(pag.423)	P12	Engine control unit

3144 - Camshaft sensor: open circuit

Description of fault

The ECU engine control unit detects an open circuit fault in the circuit of the camshaft speed sensor

Severity of error

Additional information

Behaviour of system

The engine may be started, but the engine operates with limited torque

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

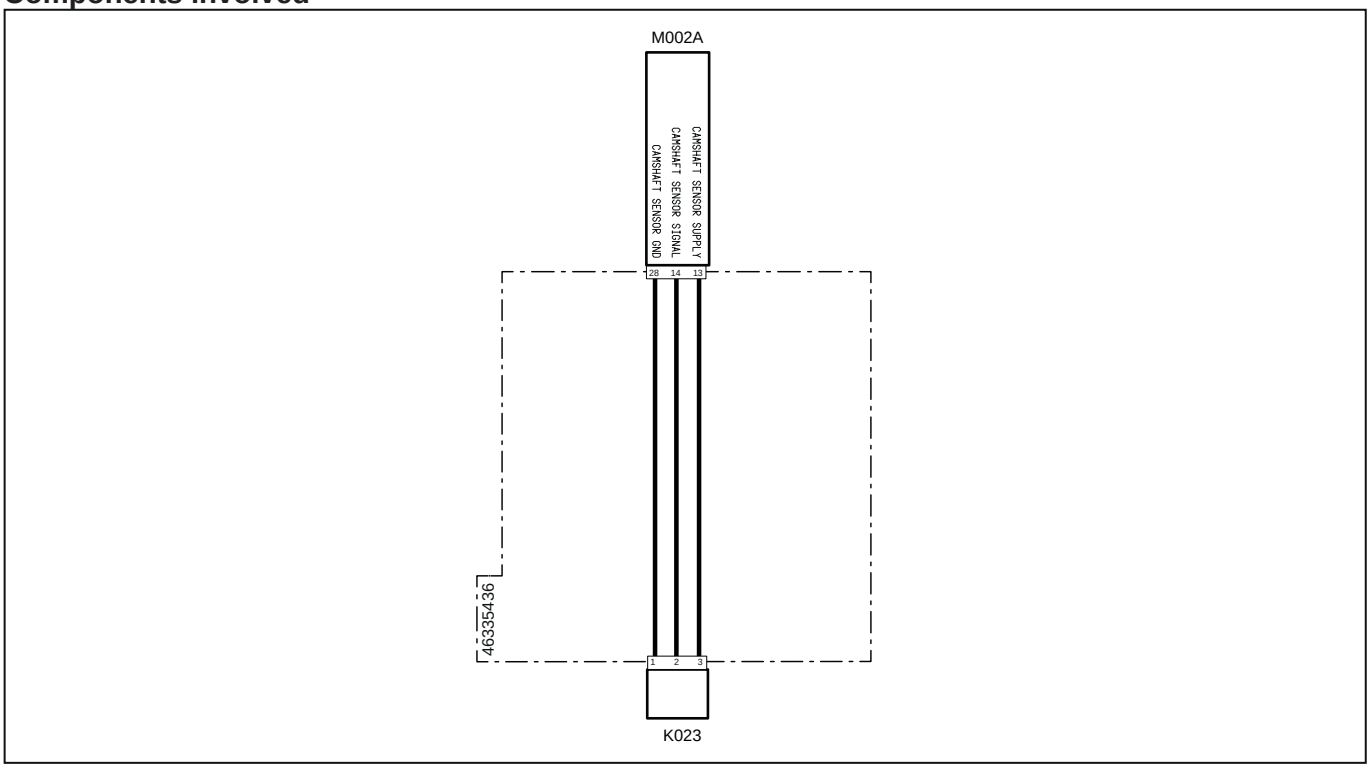
2 - Check that the connectors of the camshaft speed sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Use the diagnostic tool to check that the camshaft speed sensor is working correctly (see documentation of diagnostic tool)
- Check if the ambient air temperature sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K023(pag.464)	XS3	Camshaft timing sensor
M002B(pag.423)	P12	Engine control unit

3145 - No communication between ECU engine control unit and VCU vehicle control unit

Description of fault

ECU engine control not receiving signal from VCU control unit via the CAN Bus line

Severity of error

High

Additional information

Generic CAN Bus line fault icon displayed on multifunction instrument screen, accompanied by buzzer.

Red indicator lamp flashing

Behaviour of system

Engine start not possible The instrument panel may be switched on (ignition on).

Checks necessary

1 - Check that the connectors of the control units are fitted and connected correctly
- Disconnect the connectors and reconnect correctly
- If all the connectors are fitted and connected correctly, proceed to the next step

2 - Check the condition of the CAN Bus communication pins of the engine control unit
- Disconnect the respective connectors
- Check that the contact surfaces of the pins are in good condition
- In no damage or corrosion are found, proceed to the next step

3 - Check that the resistance measured on the CAN Bus line is 60 Ohm
- Disconnect the connectors and measure the resistance of the wiring loom with a tester applied to the pins of the CAN Bus line. If the value measured is not 60 Ohm, the line is not working correctly.
- If the value measured is 60 Ohm, the line is working correctly: proceed to the next step

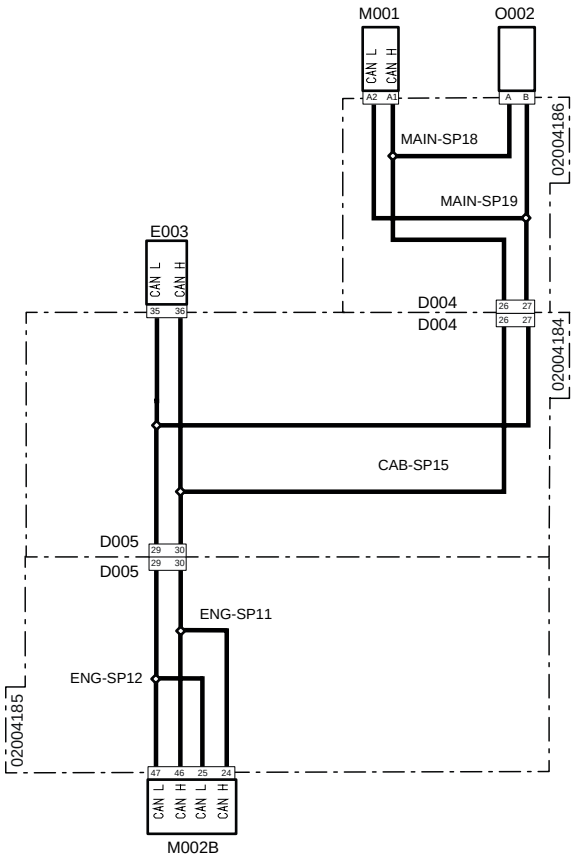
4 - Check the general condition of the CAN Bus line - check that there are no disconnected cables and that all the resistors are fitted correctly.
- Check the relative connectors on each cable
- If all the cables are connected correctly, proceed to the next step

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Check that the wiring loom connectors are connected correctly and not damaged

7 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
D004(pag.390)	P30A	Wiring connector for main wiring loom
D004(pag.443)	P30B	Wiring connector for dashboard wiring loom
D005(pag.398)	P100B	Wiring connector for engine wiring loom
D005(pag.400)	P100A	Wiring connector for dashboard wiring loom
E003(pag.408)	P200	Dashboard
M001(pag.449)	P80	Vehicle ECU
M002B(pag.423)	P12	Engine control unit
O002(pag.452)	P98	CAN line termination

3146 - No communication between ECU engine control unit and VCU vehicle control unit

Description of fault

ECU engine control not receiving signal from VCU control unit via the CAN Bus line

Severity of error

High

Additional information

Generic CAN Bus line fault icon displayed on multifunction instrument screen, accompanied by buzzer.

Red indicator lamp flashing

Behaviour of system

Engine start not possible The instrument panel may be switched on (ignition on).

Checks necessary

1 - Check that the connectors of the control units are fitted and connected correctly
- Disconnect the connectors and reconnect correctly
- If all the connectors are fitted and connected correctly, proceed to the next step

2 - Check the condition of the CAN Bus communication pins of the engine control unit
- Disconnect the respective connectors
- Check that the contact surfaces of the pins are in good condition
- In no damage or corrosion are found, proceed to the next step

3 - Check that the resistance measured on the CAN Bus line is 60 Ohm
- Disconnect the connectors and measure the resistance of the wiring loom with a tester applied to the pins of the CAN Bus line. If the value measured is not 60 Ohm, the line is not working correctly.
- If the value measured is 60 Ohm, the line is working correctly: proceed to the next step

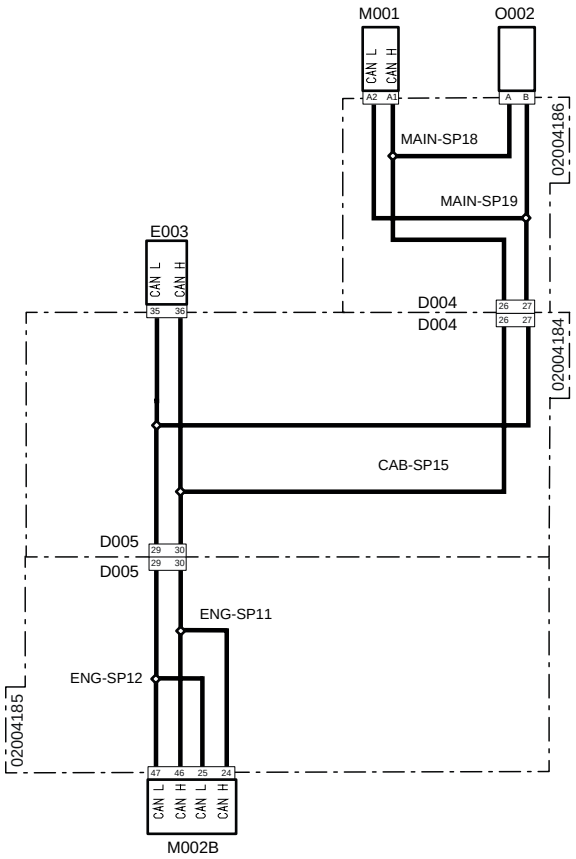
4 - Check the general condition of the CAN Bus line - check that there are no disconnected cables and that all the resistors are fitted correctly.
- Check the relative connectors on each cable
- If all the cables are connected correctly, proceed to the next step

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Check that the wiring loom connectors are connected correctly and not damaged

7 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
D004(pag.390)	P30A	Wiring connector for main wiring loom
D004(pag.443)	P30B	Wiring connector for dashboard wiring loom
D005(pag.398)	P100B	Wiring connector for engine wiring loom
D005(pag.400)	P100A	Wiring connector for dashboard wiring loom
E003(pag.408)	P200	Dashboard
M001(pag.449)	P80	Vehicle ECU
M002B(pag.423)	P12	Engine control unit
O002(pag.452)	P98	CAN line termination

3147 - No communication between ECU engine control unit and VCU vehicle control unit

Description of fault

ECU engine control not receiving signal from VCU control unit via the CAN Bus line

Severity of error

High

Additional information

Generic CAN Bus line fault icon displayed on multifunction instrument screen, accompanied by buzzer.

Red indicator lamp flashing

Behaviour of system

Engine start not possible The instrument panel may be switched on (ignition on).

Checks necessary

1 - Check that the connectors of the control units are fitted and connected correctly
- Disconnect the connectors and reconnect correctly
- If all the connectors are fitted and connected correctly, proceed to the next step

2 - Check the condition of the CAN Bus communication pins of the engine control unit
- Disconnect the respective connectors
- Check that the contact surfaces of the pins are in good condition
- In no damage or corrosion are found, proceed to the next step

3 - Check that the resistance measured on the CAN Bus line is 60 Ohm
- Disconnect the connectors and measure the resistance of the wiring loom with a tester applied to the pins of the CAN Bus line. If the value measured is not 60 Ohm, the line is not working correctly.
- If the value measured is 60 Ohm, the line is working correctly: proceed to the next step

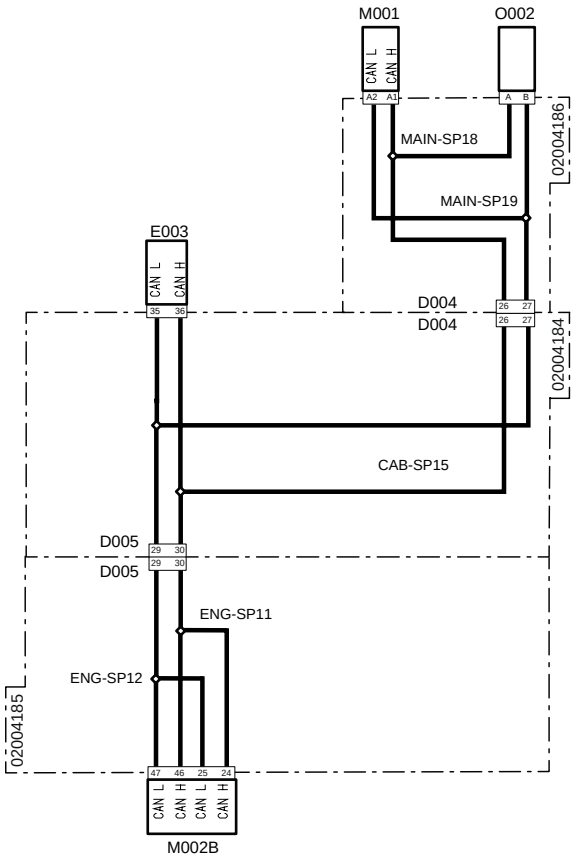
4 - Check the general condition of the CAN Bus line - check that there are no disconnected cables and that all the resistors are fitted correctly.
- Check the relative connectors on each cable
- If all the cables are connected correctly, proceed to the next step

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Check that the wiring loom connectors are connected correctly and not damaged

7 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
D004(pag.390)	P30A	Wiring connector for main wiring loom
D004(pag.443)	P30B	Wiring connector for dashboard wiring loom
D005(pag.398)	P100B	Wiring connector for engine wiring loom
D005(pag.400)	P100A	Wiring connector for dashboard wiring loom
E003(pag.408)	P200	Dashboard
M001(pag.449)	P80	Vehicle ECU
M002B(pag.423)	P12	Engine control unit
O002(pag.452)	P98	CAN line termination

3148 - Invalid message transmitted between ECU engine control unit and VCU vehicle control unit

Description of fault

ECU engine control receives an invalid message from the VCU control unit via the CAN Bus line

Severity of error

High

Additional information

Generic CAN Bus line fault icon displayed on multifunction instrument screen, accompanied by buzzer.

Red indicator lamp flashing

Behaviour of system

Engine start not possible The instrument panel may be switched on (ignition on).

Checks necessary

1 - Check that the connectors of the control units are fitted and connected correctly
- Disconnect the connectors and reconnect correctly
- If all the connectors are fitted and connected correctly, proceed to the next step

2 - Check the condition of the CAN Bus communication pins of the engine control unit
- Disconnect the respective connectors
- Check that the contact surfaces of the pins are in good condition
- In no damage or corrosion are found, proceed to the next step

3 - Check that the resistance measured on the CAN Bus line is 60 Ohm
- Disconnect the connectors and measure the resistance of the wiring loom with a tester applied to the pins of the CAN Bus line. If the value measured is not 60 Ohm, the line is not working correctly.
- If the value measured is 60 Ohm, the line is working correctly: proceed to the next step

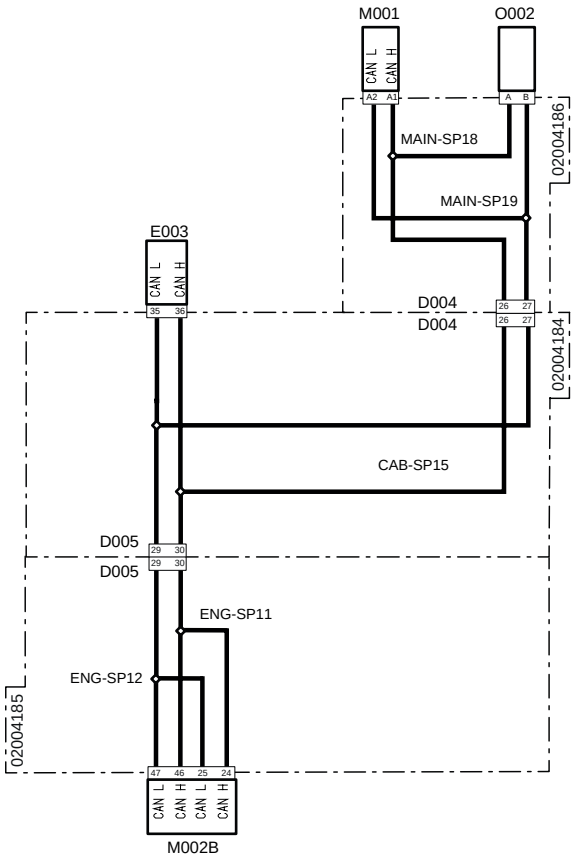
4 - Check the general condition of the CAN Bus line - check that there are no disconnected cables and that all the resistors are fitted correctly.
- Check the relative connectors on each cable
- If all the cables are connected correctly, proceed to the next step

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Check that the wiring loom connectors are connected correctly and not damaged

7 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
D004(pag.390)	P30A	Wiring connector for main wiring loom
D004(pag.443)	P30B	Wiring connector for dashboard wiring loom
D005(pag.398)	P100B	Wiring connector for engine wiring loom
D005(pag.400)	P100A	Wiring connector for dashboard wiring loom
E003(pag.408)	P200	Dashboard
M001(pag.449)	P80	Vehicle ECU
M002B(pag.423)	P12	Engine control unit
O002(pag.452)	P98	CAN line termination

3149 - Group 1 active sensor or actuator power feed error

Description of fault

The ECU engine control unit detects that all the sensors or actuators of group 1 are not receiving power

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the accessories fuse (15A)
- Open the fuse box cover and disconnect the accessories fuse
- Visually inspect the fuse and replace if necessary
- If the fuse does not need to be replaced, reconnect it to the fuse box and proceed to the next step

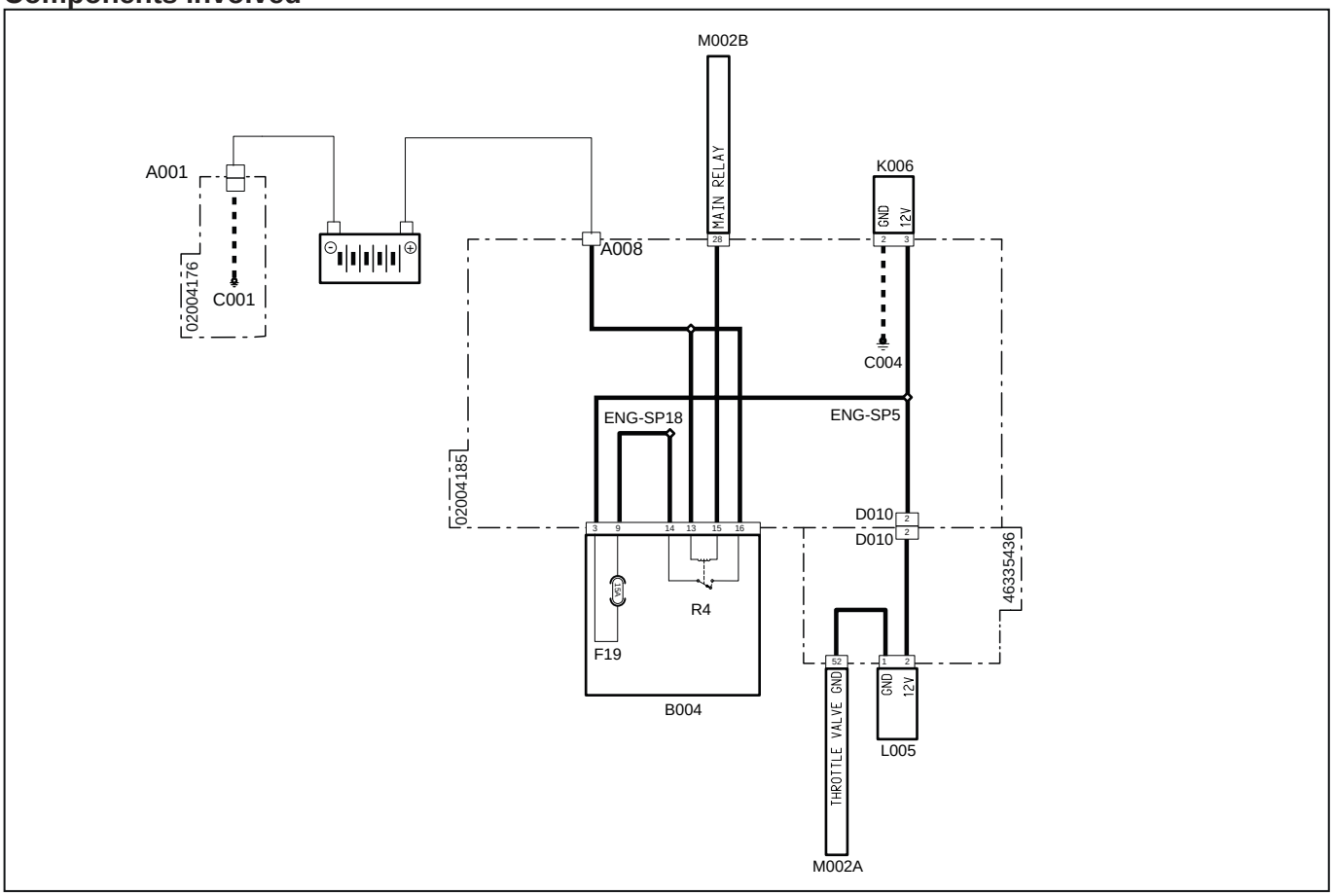
3 - Check that the connectors of the camshaft speed sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Check that the wiring loom connectors are connected correctly and not damaged

6 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A008(pag.439)	P472	Positive battery terminal
C001(pag.367)	P66	Battery ground
C004(pag.430)	P105	Engine ground point
D010(pag.438)	P470	Wiring connector for prewired engine wiring loom
D010(pag.468)	XTH	Throttle valve power feed
F19(B004) (pag.418)	F19	Accessories (15A)
K006(pag.425)	P16	Water in fuel sensor
L005(pag.470)	XY3	Throttle valve
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R4(B004) (pag.418)	R4	Main relay (30A)

3150 - Group 2 active sensor or actuator power feed error

Description of fault

The ECU engine control unit detects that all the sensors or actuators of group 2 are not receiving power

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check that the connectors of the potentiometer and of the engine control unit are fitted and connected correctly

2 - Check the general condition of the wiring loom between the engine control unit and the potentiometer.

3 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

4 - Check that the wiring loom connectors are connected correctly and not damaged

5 - Check that the timing sensor is working correctly using the diagnostic tool

3151 - Group 3 active sensor or actuator power feed error

Description of fault

The ECU engine control unit detects that all the sensors or actuators of group 3 are not receiving power

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check that the rail pressure sensor is working correctly using the diagnostic tool

2 - Check that the P3 exhaust pressure sensor is working correctly using the diagnostic tool

3152 - Exhaust temperature sensor: short circuit to battery or open circuit

Description of fault

The ECU engine control unit detects a short circuit to battery or open circuit fault in the exhaust gas temperature sensor circuit

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

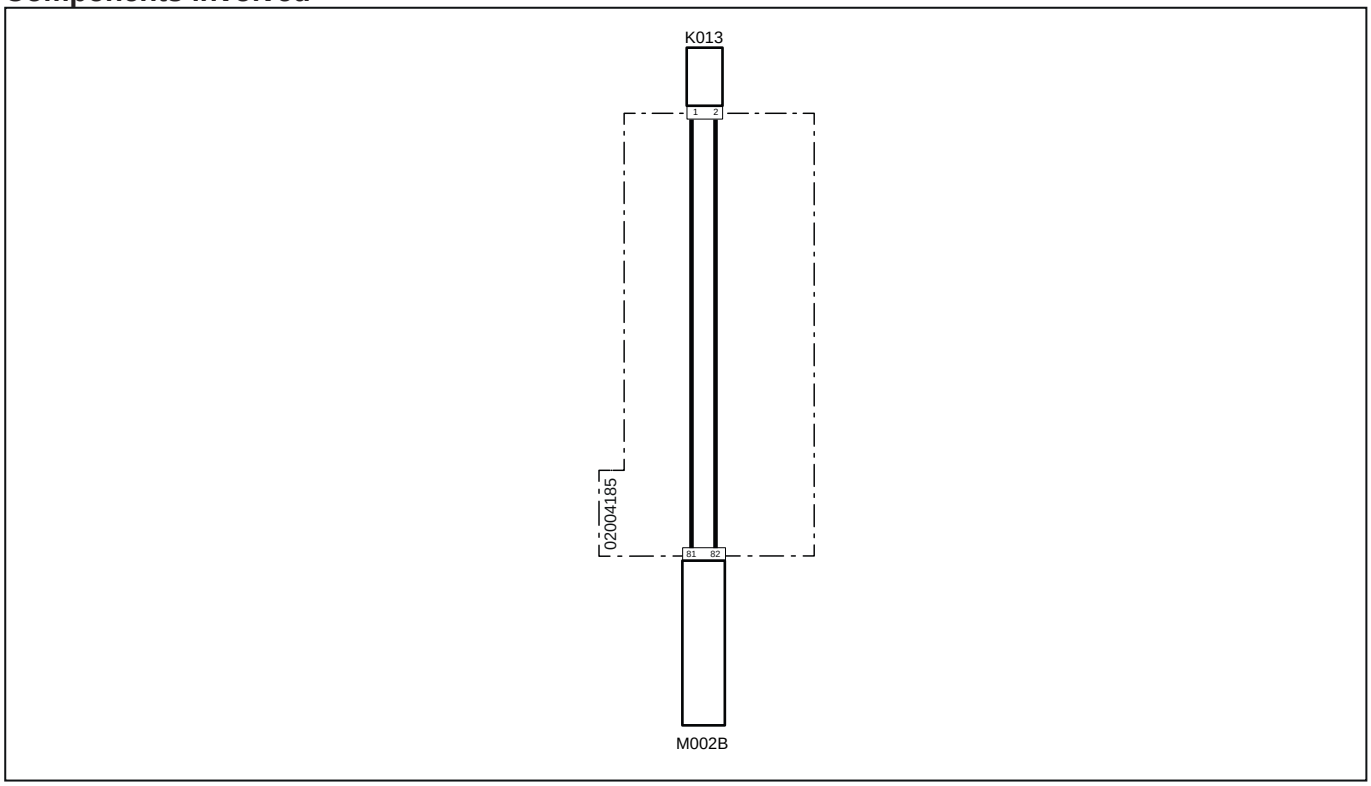
2 - Use the diagnostic tool to monitor the exhaust temperature sensor (see the documentation of the diagnostic tool)
- Check if the exhaust temperature sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

3 - Check that the connectors of the exhaust temperature sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K013(pag.436)	P465	Exhaust gas temperature sensor
M002B(pag.423)	P12	Engine control unit

3153 - Exhaust gas temperature sensor: short circuit to ground

Description of fault

The ECU engine control unit detects a short circuit to ground in the exhaust gas temperature sensor circuit

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

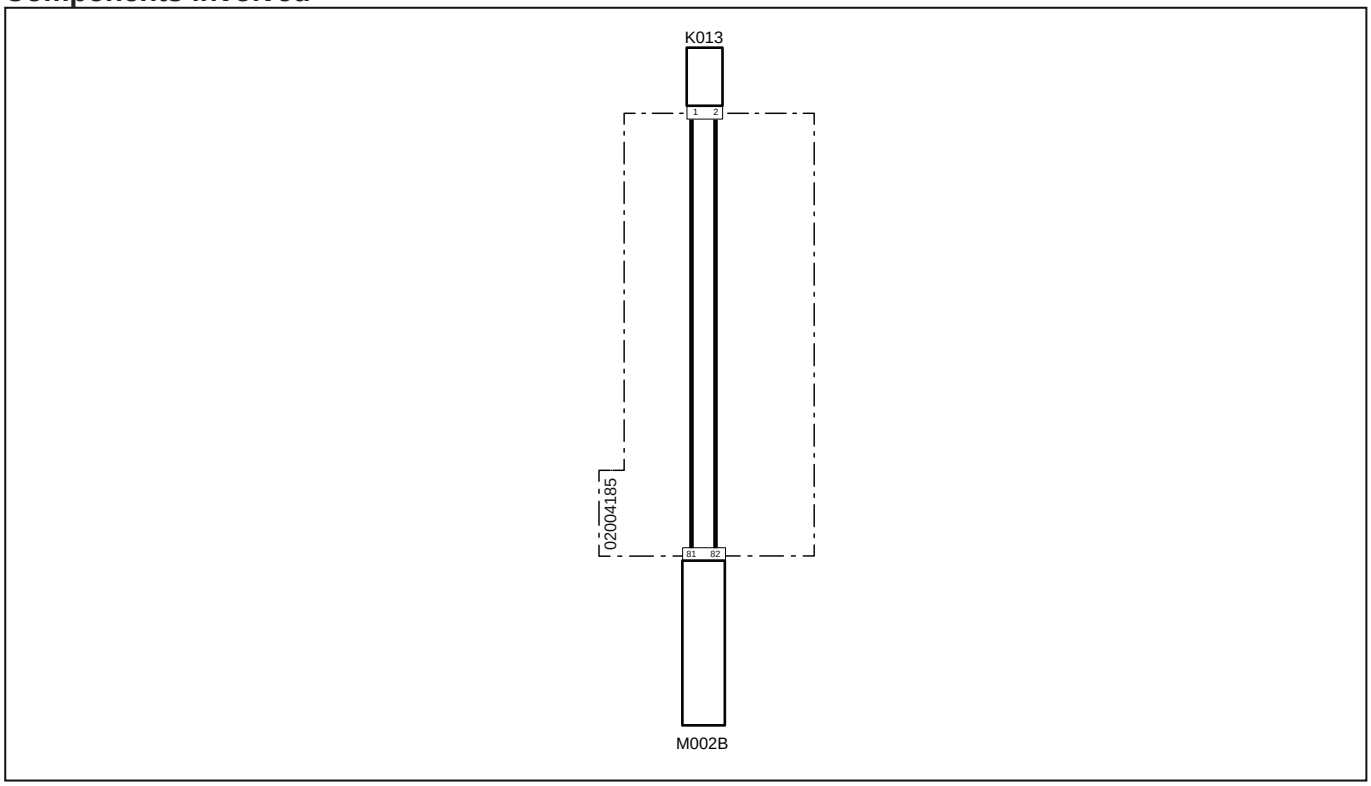
2 - Use the diagnostic tool to monitor the exhaust temperature sensor (see the documentation of the diagnostic tool)
- Check if the exhaust temperature sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

3 - Check that the connectors of the exhaust temperature sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K013(pag.436)	P465	Exhaust gas temperature sensor
M002B(pag.423)	P12	Engine control unit

3154 - Exhaust pressure too high relative to barometric pressure

Description of fault

At key-on, the ECU engine control unit detects that the pressure measured by the exhaust pressure sensor is much higher than the barometric pressure read by the control unit itself

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The ECU engine control unit has an internal barometric sensor which measures atmospheric pressure. The atmospheric pressure value is crucial for determining the strategies implemented by the engine control unit

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Use the diagnostic tool to monitor sensor P3 (exhaust pressure) (see the documentation of the diagnostic tool)
- Check if sensor P3 (exhaust pressure) is working correctly and replace if necessary
- If the problem persists, proceed to the next step

3 - Check that the connectors of sensor P3 (exhaust pressure) and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

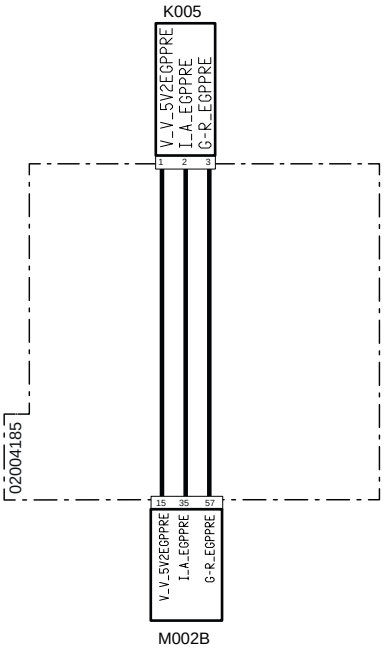
4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Check that the wiring loom connectors are connected correctly and not damaged

6 - Check that there are no obstructions in the exhaust line
- The exhaust manifold must be removed from the engine to carry out this check. Refer to the workshop manual of the tractor

7 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K005(pag.422)	P8	P3 sensor (exhaust pressure)
M002B(pag.423)	P12	Engine control unit

3155 - Exhaust pressure too low relative to barometric pressure

Description of fault

At key-on, the ECU engine control unit detects that the pressure measured by the exhaust pressure sensor is lower than the barometric pressure read by the control unit itself

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The ECU engine control unit has an internal barometric sensor which measures atmospheric pressure. The atmospheric pressure value is crucial for determining the strategies implemented by the engine control unit

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Use the diagnostic tool to monitor sensor P3 (exhaust pressure) (see the documentation of the diagnostic tool)
- Check if sensor P3 (exhaust pressure) is working correctly and replace if necessary
- If the problem persists, proceed to the next step

3 - Check that the connectors of sensor P3 (exhaust pressure) and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

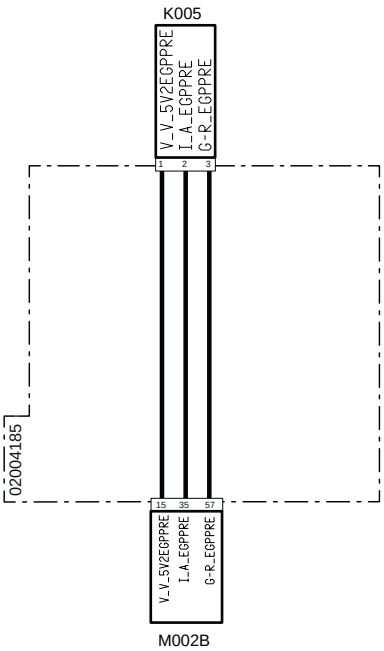
4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Check that the wiring loom connectors are connected correctly and not damaged

6 - Check that there are no obstructions in the exhaust line
- The exhaust manifold must be removed from the engine to carry out this check. Refer to the workshop manual of the tractor

7 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K005(pag.422)	P8	P3 sensor (exhaust pressure)
M002B(pag.423)	P12	Engine control unit

3156 - Exhaust pressure sensor: short circuit to battery or open circuit

Description of fault

The ECU engine control unit detects a short circuit to ground in the exhaust gas pressure sensor circuit

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

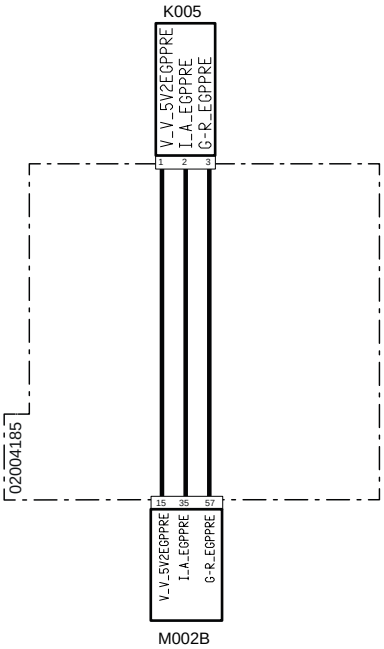
2 - Use the diagnostic tool to monitor the exhaust pressure sensor (see the documentation of the diagnostic tool)
- Check if the exhaust pressure sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

3 - Check that the connectors of the exhaust pressure sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K005(pag.422)	P8	P3 sensor (exhaust pressure)
M002B(pag.423)	P12	Engine control unit

3157 - Exhaust gas pressure sensor: short circuit to ground

Description of fault

The ECU engine control unit detects a short circuit to ground in the exhaust gas pressure sensor circuit

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

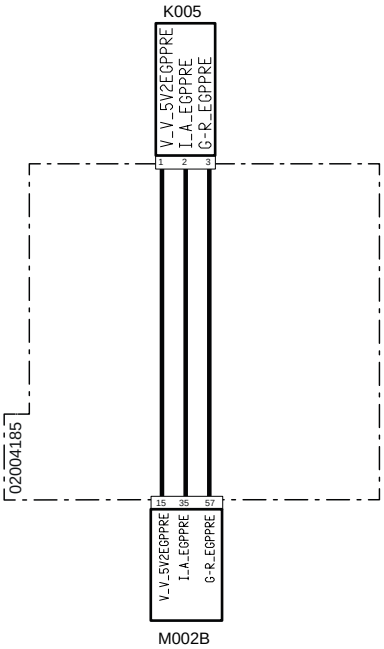
2 - Use the diagnostic tool to monitor the exhaust pressure sensor (see the documentation of the diagnostic tool)
- Check if the exhaust pressure sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

3 - Check that the connectors of the exhaust pressure sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K005(pag.422)	P8	P3 sensor (exhaust pressure)
M002B(pag.423)	P12	Engine control unit

3158 - Transmission error between EGR valve and ECU engine control unit

Description of fault

The ECU engine control unit detects an EGR valve transmission error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The percentage aperture of the valve and the relative electrical value may be determined with the diagnostic tool.

The solenoid valve is completely open when it is not powered. The solenoid valve is completely closed when it is powered.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check that the connectors of the EGR valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect the connectors and reconnect correctly
- If all the connectors are fitted and connected correctly, proceed to the next step

2 - Check the condition of the CAN Bus communication pins of the engine control unit
- Disconnect the respective connectors
- Check that the contact surfaces of the pins are in good condition
- In no damage or corrosion are found, proceed to the next step

3 - Check that the resistance measured on the CAN Bus line is 60 Ohm
- Disconnect the connectors and measure the resistance of the wiring loom with a tester applied to the pins of the CAN Bus line. If the value measured is not 60 Ohm, the line is not working correctly.
- If the value measured is 60 Ohm, the line is working correctly: proceed to the next step

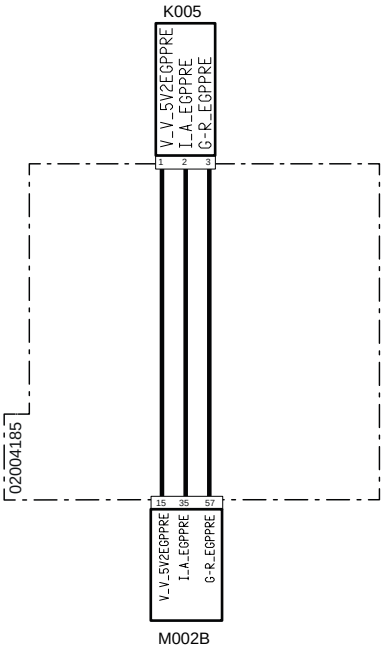
4 - Check the general condition of the CAN Bus line - check that there are no disconnected cables and that all the resistors are fitted correctly.
- Inspect the entire length of all the cables of the wiring loom to check the condition of the cables and connectors
- If all the cables are connected correctly, proceed to the next step

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Check that the wiring loom connectors are connected correctly and not damaged

7 - Contact the technical support service

Components involved



System code	Source code	Description
D009(pag.437)	P469	Wiring connector for prewired engine wiring loom
D009(pag.460)	XEG	Exhaust gas recirculation solenoid valve power feed
L004(pag.469)	XY2	Exhaust gas recirculation solenoid valve (EGR)
M002B(pag.423)	P12	Engine control unit

3159 - Reception error between EGR valve and ECU engine control unit

Description of fault

The ECU engine control unit detects an EGR valve transmission error

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The percentage aperture of the valve and the relative electrical value may be determined with the diagnostic tool.

The solenoid valve is completely open when it is not powered. The solenoid valve is completely closed when it is powered.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check that the connectors of the EGR valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect the connectors and reconnect correctly
- If all the connectors are fitted and connected correctly, proceed to the next step

2 - Check the condition of the CAN Bus communication pins of the engine control unit
- Disconnect the respective connectors
- Check that the contact surfaces of the pins are in good condition
- In no damage or corrosion are found, proceed to the next step

3 - Check that the resistance measured on the CAN Bus line is 60 Ohm
- Disconnect the connectors and measure the resistance of the wiring loom with a tester applied to the pins of the CAN Bus line. If the value measured is not 60 Ohm, the line is not working correctly.
- If the value measured is 60 Ohm, the line is working correctly: proceed to the next step

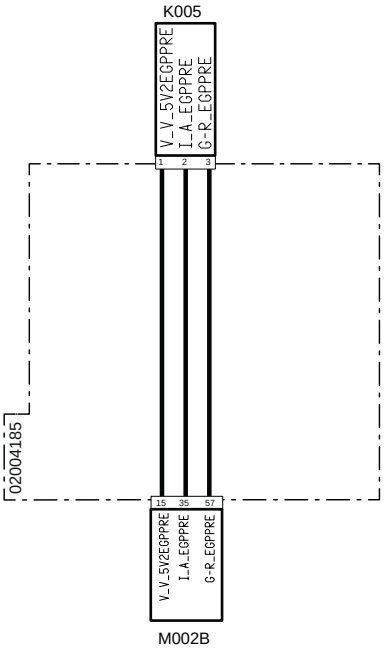
4 - Check the general condition of the CAN Bus line - check that there are no disconnected cables and that all the resistors are fitted correctly.
- Inspect the entire length of all the cables of the wiring loom to check the condition of the cables and connectors
- If all the cables are connected correctly, proceed to the next step

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Check that the wiring loom connectors are connected correctly and not damaged

7 - Contact the technical support service

Components involved



System code	Source code	Description
D009(pag.437)	P469	Wiring connector for prewired engine wiring loom
D009(pag.460)	XEG	Exhaust gas recirculation solenoid valve power feed
L004(pag.469)	XY2	Exhaust gas recirculation solenoid valve (EGR)
M002B(pag.423)	P12	Engine control unit

3160 - High pressure pump valve: disturbed signal or spurious contact

Description of fault

The ECU engine control unit detects a disturbed signal from, or a spurious contact fault on, the high pressure pump valve

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The rail pressure is monitored by the rail pressure sensor. Rail pressure is managed by the ECU engine control unit, which determines the percentage aperture of the MProp metering valve situated on the high pressure fuel pump in relation to a number of different parameters

Behaviour of system

No engine limiting strategy implemented by the control unit

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Use the diagnostic tool to check that the MProp metering valve is working correctly (see documentation of diagnostic tool)
- Check that the MProp valve is working correctly and replace if necessary
- Check that the percent aperture of the valve is congruent with the pressure measured by the rail pressure sensor
- If the problem persists, proceed to the next step

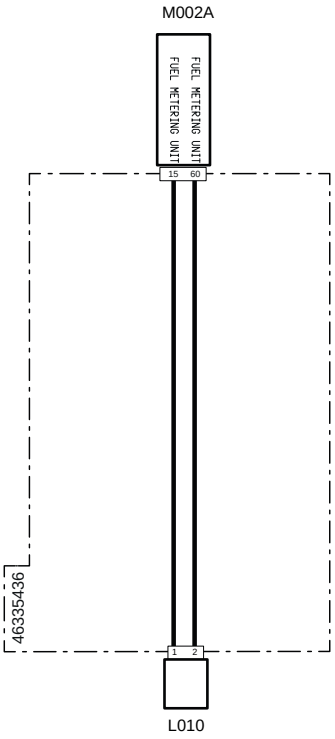
3 - Check that the resistance measured on the CAN Bus line is 60 Ohm
- Disconnect the connectors and measure the resistance of the wiring loom with a tester applied to the pins of the CAN Bus line. If the value measured is not 60 Ohm, the line is not working correctly.
- If the value measured is 60 Ohm, the line is working correctly: proceed to the next step

4 - Check the general condition of the CAN Bus line - check that there are no disconnected cables and that all the resistors are fitted correctly.
- Inspect the entire length of all the cables of the wiring loom to check the condition of the cables and connectors
- If all the cables are connected correctly, proceed to the next step

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
L010(pag.468)	XY1	High pressure pump
M002A(pag.458)	XECUA	Engine control unit

3161 - High pressure pump metering valve: short circuit to battery

Description of fault

The ECU engine control unit detects a short circuit to battery in the circuit of the Mprop valve of the high pressure fuel pump

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

No engine limiting strategy implemented by the control unit

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

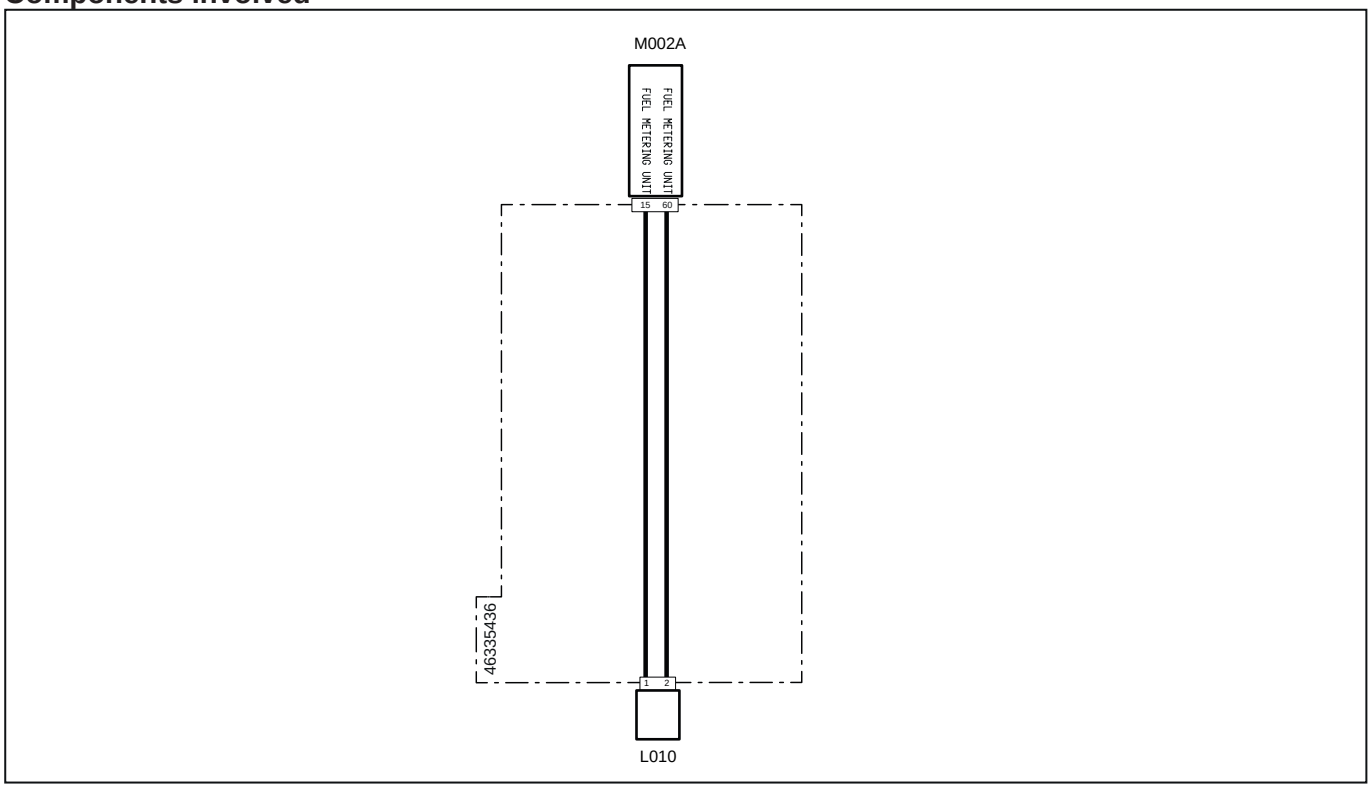
2 - Check that the connectors of the MProp metering valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

4 - Check that the wiring loom connectors are connected correctly and not damaged

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
L010(pag.468)	XY1	High pressure pump
M002A(pag.458)	XECUA	Engine control unit

3162 - High pressure pump metering valve: short circuit to ground

Description of fault

The ECU engine control unit detects a short circuit to ground in the circuit of the Mprop valve of the high pressure fuel pump

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

Engine start not possible

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

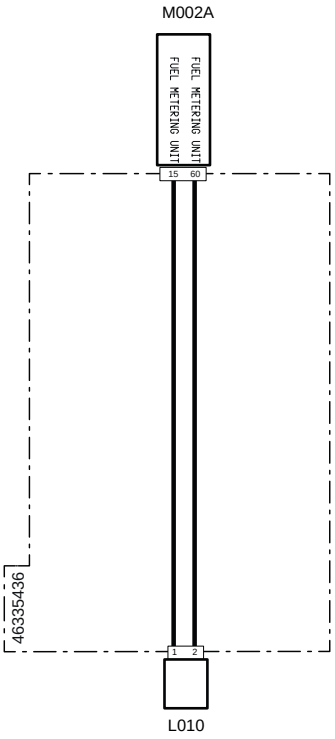
2 - Check that the connectors of the MProp metering valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

4 - Check that the wiring loom connectors are connected correctly and not damaged

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
L010(pag.468)	XY1	High pressure pump
M002A(pag.458)	XECUA	Engine control unit

3163 - High pressure pump metering valve: open circuit

Description of fault

The ECU engine control unit detects an open circuit fault in the circuit of the Mprop valve of the high pressure fuel pump

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

No engine limiting strategy implemented by the control unit

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

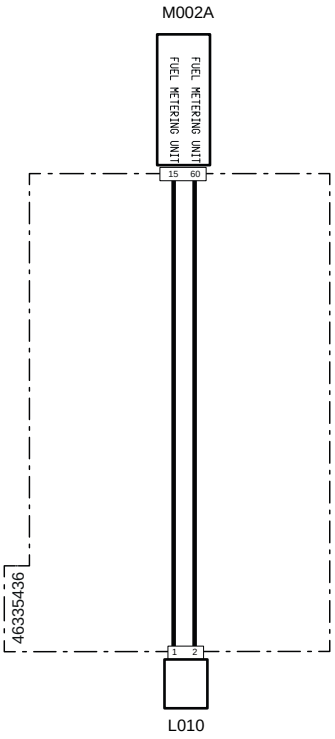
2 - Check that the connectors of the MProp metering valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

4 - Check that the wiring loom connectors are connected correctly and not damaged

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
L010(pag.468)	XY1	High pressure pump
M002A(pag.458)	XECUA	Engine control unit

3164 - High pressure pump metering valve: overcurrent

Description of fault

The ECU engine control unit detects an excessively high current in the circuit of the Mprop valve of the high pressure fuel pump

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

No engine limiting strategy implemented by the control unit

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

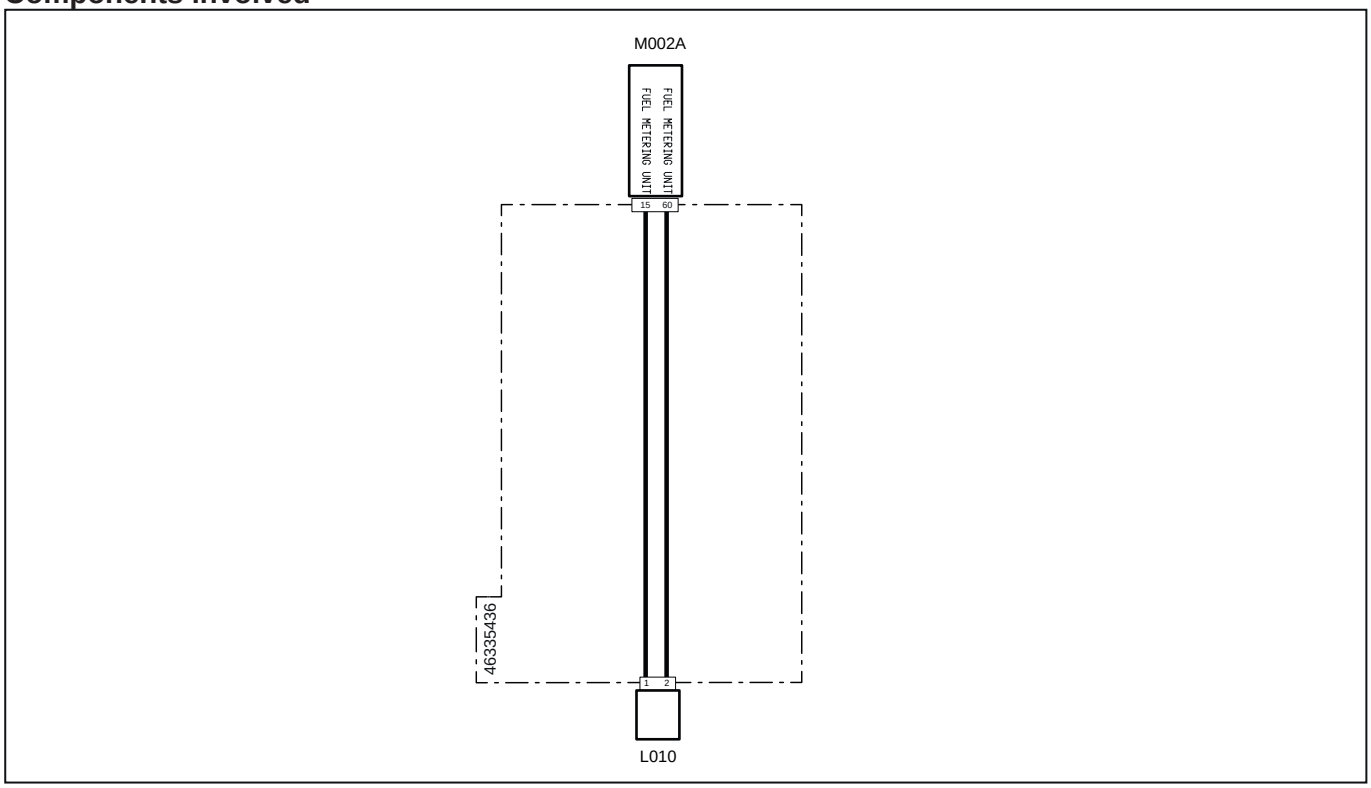
2 - Check that the connectors of the MProp metering valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

4 - Check that the wiring loom connectors are connected correctly and not damaged

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
L010(pag.468)	XY1	High pressure pump
M002A(pag.458)	XECUA	Engine control unit

3165 - Main relay contact permanently closed and ECU control unit permanently powered

Description of fault

The contact of the main relay remains permanently closed and, as a result, the ECU engine control unit remains powered at all times

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

No engine limiting strategy implemented by the control unit

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the connectors of the main relay and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

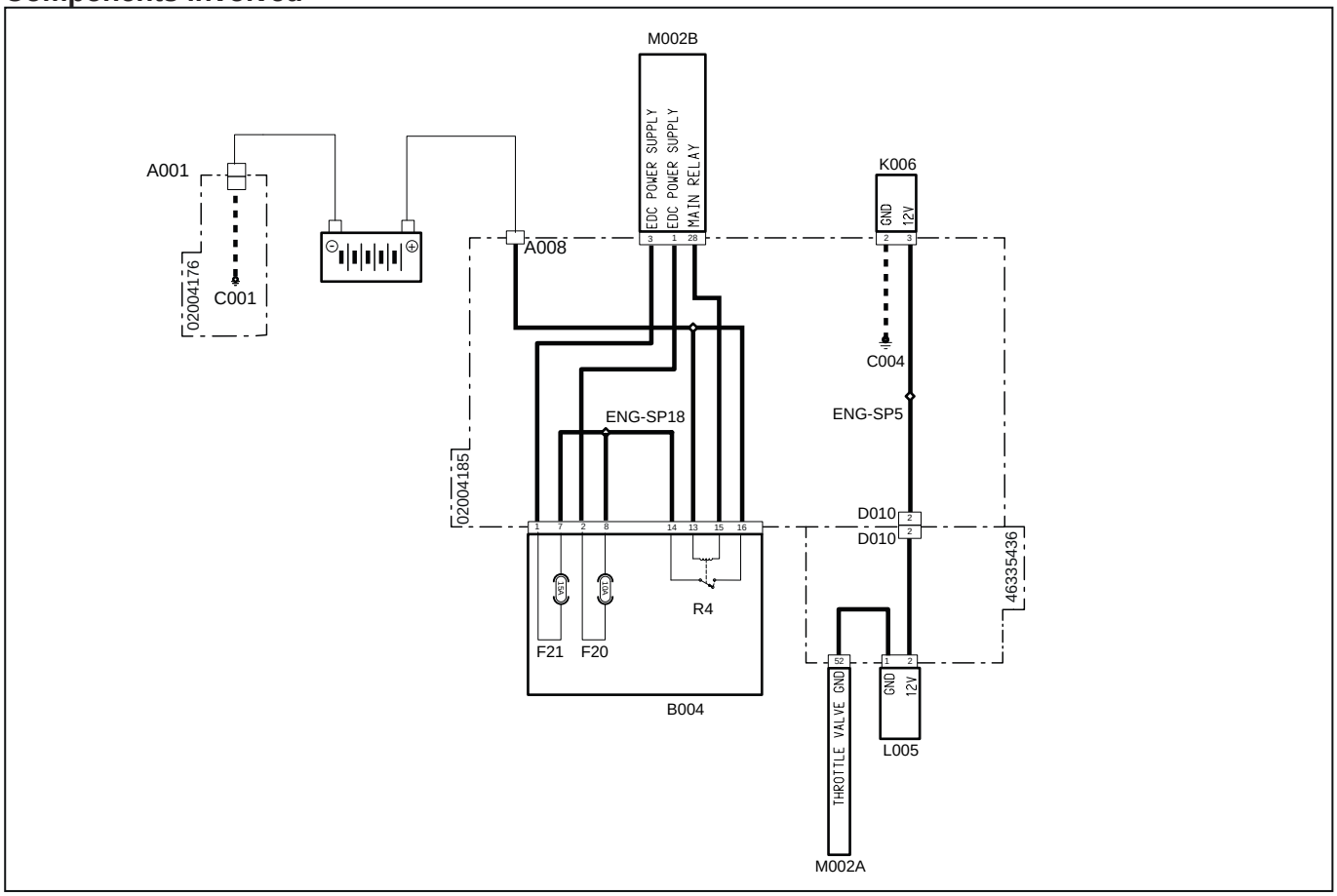
3 - Visually inspect the main relay and replace if necessary
- Open the fuse box cover and disconnect the start relay
- Visually inspect the relay and replace if necessary
- If the relay does not need to be replaced, reconnect it to the fuse box and proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Check that the wiring loom connectors are connected correctly and not damaged

6 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A008(pag.439)	P472	Positive battery terminal
C001(pag.367)	P66	Battery ground
C004(pag.430)	P105	Engine ground point
D010(pag.438)	P470	Wiring connector for prewired engine wiring loom
D010(pag.468)	XTH	Throttle valve power feed
F20(B004) (pag.418)	F20	12V ECU power feed (10A)
F21(B004) (pag.418)	F21	12V ECU power feed (15A)
K006(pag.425)	P16	Water in fuel sensor
L005(pag.470)	XY3	Throttle valve
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R4(B004) (pag.418)	R4	Main relay (30A)

3166 - Premature main relay aperture fault at end of After Run

Description of fault

The contact of the main relay opens earlier than it should relative to the After Run time of the ECU engine control unit

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Each time the instrument panel is switched off by turning the ignition switch to off, the control unit continues to receive power for the period of time necessary to save all the parameters acquired during operation of the tractor

Always wait a few minutes after turning the tractor off before physically disconnecting the battery or using the battery master switch

Behaviour of system

No engine limiting strategy implemented by the control unit

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the connectors of the main relay and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

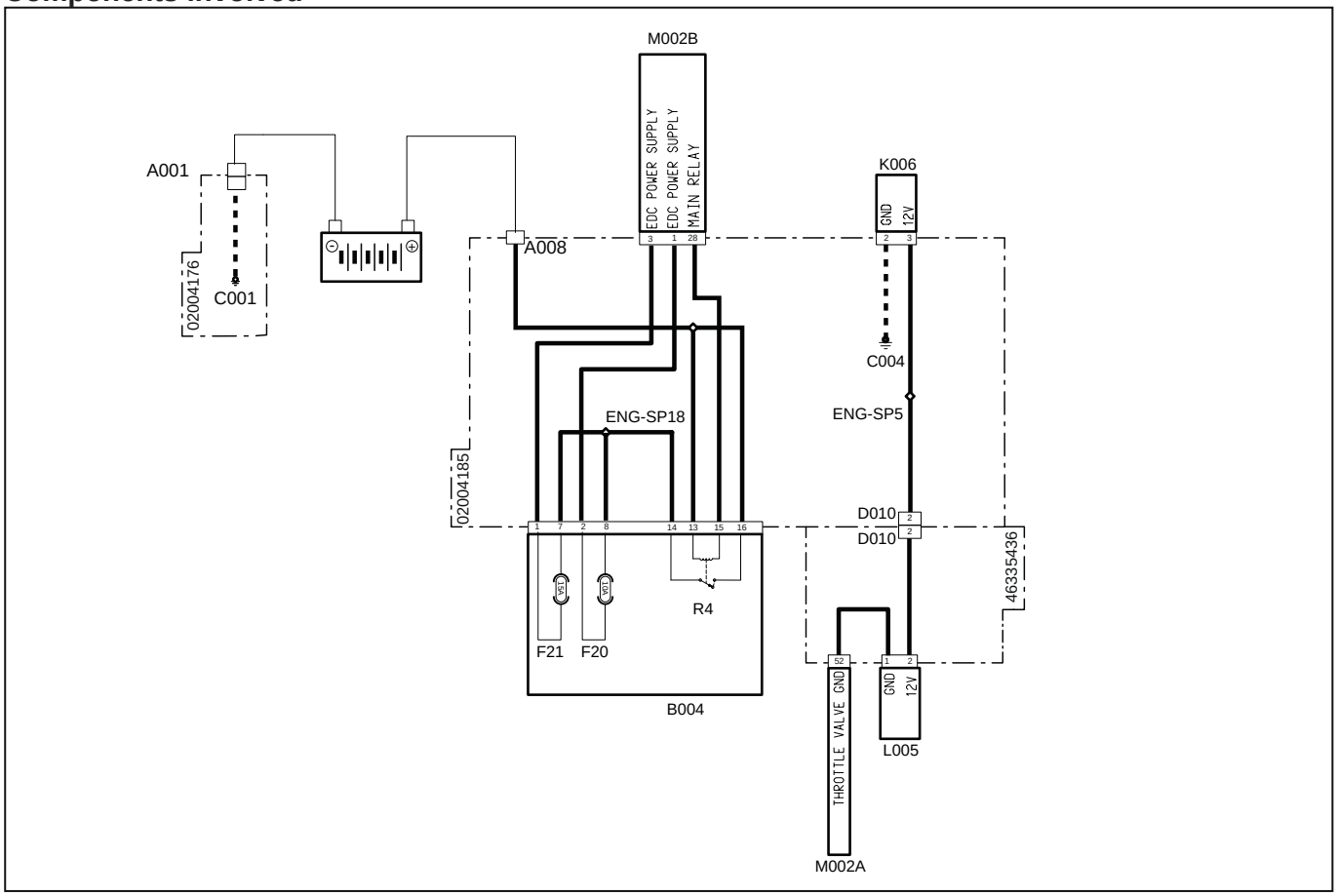
3 - Visually inspect the main relay and replace if necessary
- Open the fuse box cover and disconnect the start relay
- Visually inspect the relay and replace if necessary
- If the relay does not need to be replaced, reconnect it to the fuse box and proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Check that the wiring loom connectors are connected correctly and not damaged

6 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A008(pag.439)	P472	Positive battery terminal
C001(pag.367)	P66	Battery ground
C004(pag.430)	P105	Engine ground point
D010(pag.438)	P470	Wiring connector for prewired engine wiring loom
D010(pag.468)	XTH	Throttle valve power feed
F20(B004) (pag.418)	F20	12V ECU power feed (10A)
F21(B004) (pag.418)	F21	12V ECU power feed (15A)
K006(pag.425)	P16	Water in fuel sensor
L005(pag.470)	XY3	Throttle valve
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R4(B004) (pag.418)	R4	Main relay (30A)

3167 - EGR valve: open circuit

Description of fault

The ECU engine control unit detects an open circuit fault in the circuit of the EGR valve

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the connectors of the EGR valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

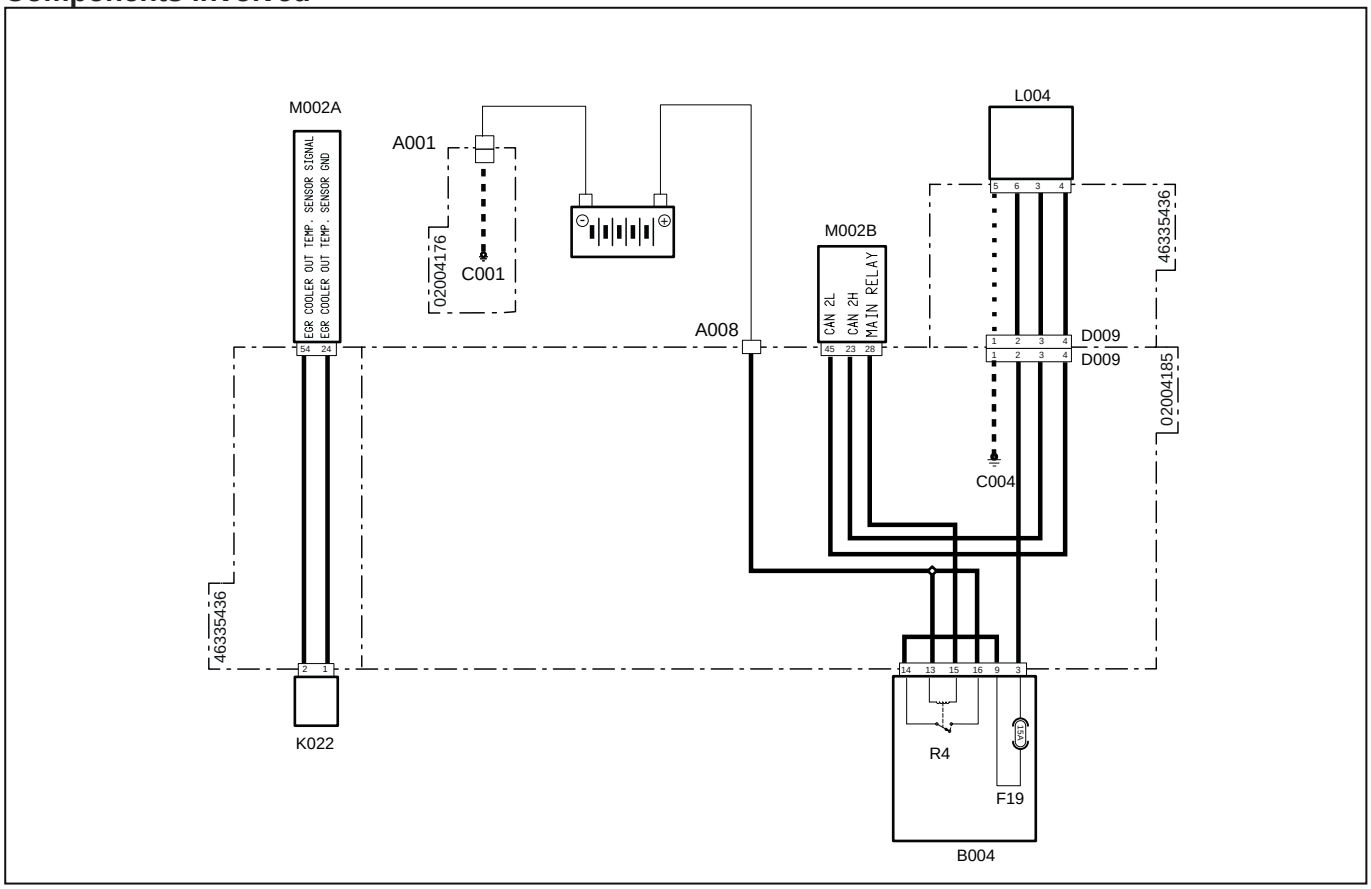
3 - Use the diagnostic tool to check that the EGR valve position sensor is working correctly (see documentation of diagnostic tool)
- Check that the power feed voltage of the EGR valve position sensor is within the correct range specified. Replace the EGR valve if the voltage is not within the correct range
- If the power feed voltage is correct, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Check that the wiring loom connectors are connected correctly and not damaged

6 - Contact the technical support service

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A008(pag.439)	P472	Positive battery terminal
C001(pag.367)	P66	Battery ground
C004(pag.430)	P105	Engine ground point
D009(pag.437)	P469	Wiring connector for prewired engine wiring loom
D009(pag.460)	XEG	Exhaust gas recirculation solenoid valve power feed
F19(B004) (pag.418)	F19	Accessories (15A)
K022(pag.467)	XS7	EGR temperature sensor
L004(pag.469)	XY2	Exhaust gas recirculation solenoid valve (EGR)
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R2(B004) (pag.418)	R2	Fuel pre-heat relay (20A)

3168 - DOC temperature sensor: short circuit to battery or open circuit

Description of fault

The ECU engine control unit detects a short circuit to battery or open circuit fault in the circuit of the DOC temperature sensor

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The ECU engine control unit monitors the readings of the DOC (upstream) and DPF (downstream) temperature sensors to determine if the DOC is working correctly. The DOC sensor should produce a temperature reading lower than or the same as the reading produced by the DPF sensor. If it does not, this means that the DOC is not working correctly

Behaviour of system

No engine limiting strategy implemented by the control unit

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

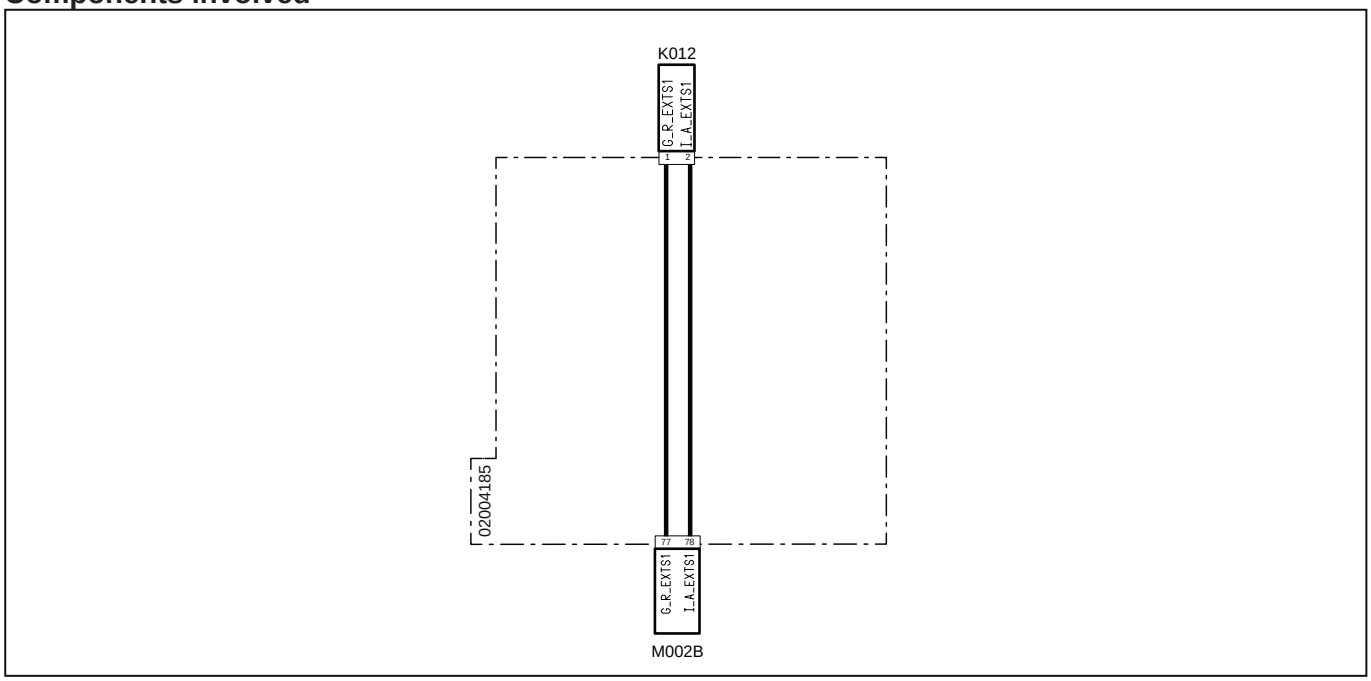
2 - Use the diagnostic tool to monitor the DOC temperature sensor (see the documentation of the diagnostic tool)
- Monitor the temperature in the intake manifold to check that the DOC temperature sensor is working correctly
- If the problem persists, proceed to the next step

3 - Check that the connectors of the DOC temperature sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K012(pag.422)	P7	DOC temperature sensor
M002B(pag.423)	P12	Engine control unit

3169 - DOC temperature sensor: short circuit to ground

Description of fault

The ECU engine control unit detects a short circuit to ground in the circuit of the DOC temperature sensor

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The ECU engine control unit monitors the readings of the DOC (upstream) and DPF (downstream) temperature sensors to determine if the DOC is working correctly. The DOC sensor should produce a temperature reading lower than or the same as the reading produced by the DPF sensor. If it does not, this means that the DOC is not working correctly

Behaviour of system

No engine limiting strategy implemented by the control unit

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

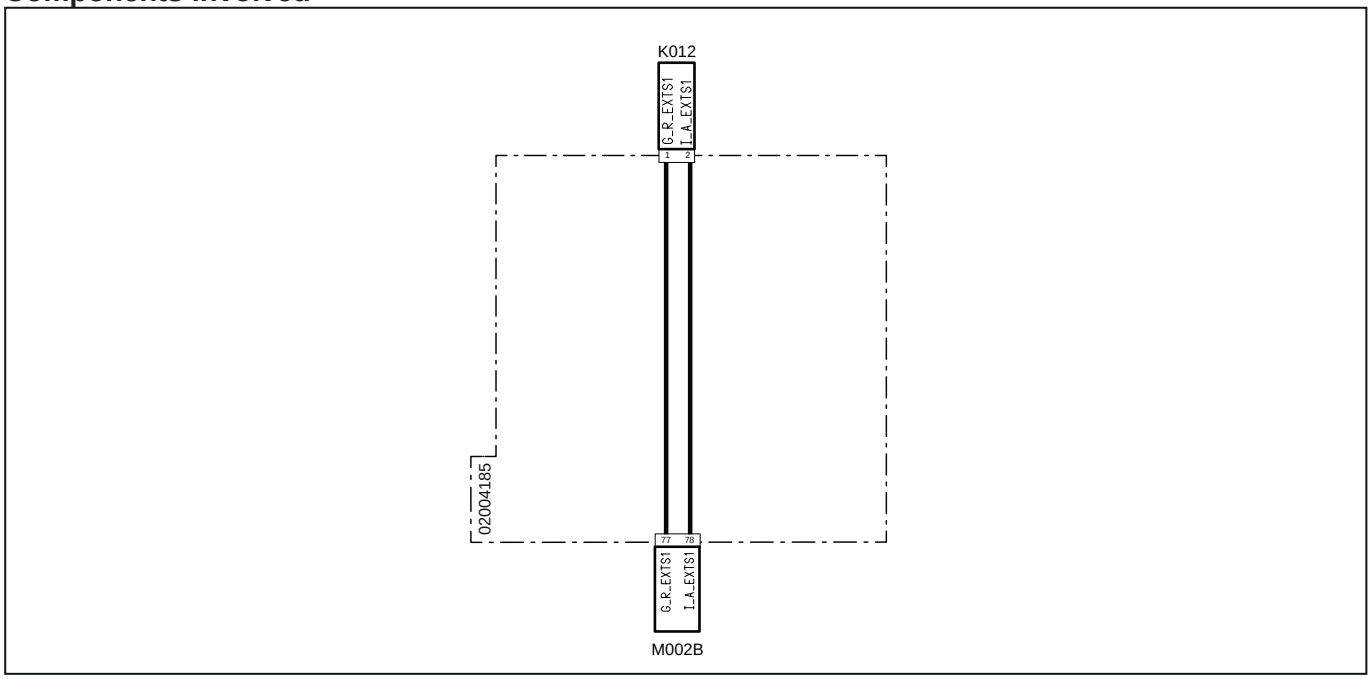
2 - Use the diagnostic tool to monitor the DOC temperature sensor (see the documentation of the diagnostic tool)
- Monitor the temperature in the intake manifold to check that the DOC temperature sensor is working correctly
- If the problem persists, proceed to the next step

3 - Check that the connectors of the DOC temperature sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K012(pag.422)	P7	DOC temperature sensor
M002B(pag.423)	P12	Engine control unit

3170 - DPF temperature sensor: short circuit to battery or open circuit

Description of fault

The ECU engine control unit detects a short circuit to battery or open circuit fault in the circuit of the DPF temperature sensor

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The ECU engine control unit monitors the readings of the DOC (upstream) and DPF (downstream) temperature sensors to determine if the DOC is working correctly. The DOC sensor should produce a temperature reading lower than or the same as the reading produced by the DPF sensor. If it does not, this means that the DOC is not working correctly

Behaviour of system

No engine limiting strategy implemented by the control unit

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

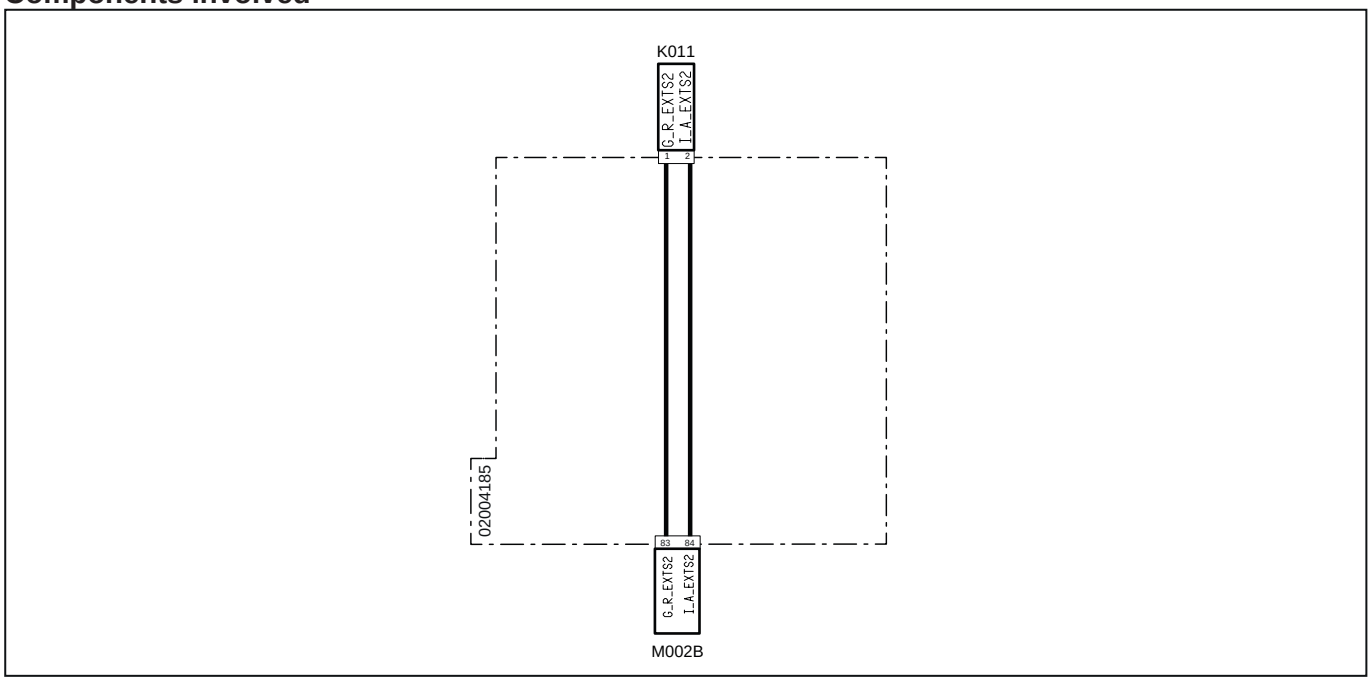
2 - Use the diagnostic tool to monitor the DPF temperature sensor (see the documentation of the diagnostic tool)
- Monitor the temperature in the intake manifold to check that the DOC temperature sensor is working correctly
- If the problem persists, proceed to the next step

3 - Check that the connectors of the DPF temperature sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K011(pag.421)	P6	DPF temperature sensor
M002B(pag.423)	P12	Engine control unit

3171 - DPF temperature sensor: short circuit to ground

Description of fault

The ECU engine control unit detects a short circuit to ground in the circuit of the DPF temperature sensor

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The ECU engine control unit monitors the readings of the DOC (upstream) and DPF (downstream) temperature sensors to determine if the DOC is working correctly. The DOC sensor should produce a temperature reading lower than or the same as the reading produced by the DPF sensor. If it does not, this means that the DOC is not working correctly

Behaviour of system

No engine limiting strategy implemented by the control unit

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

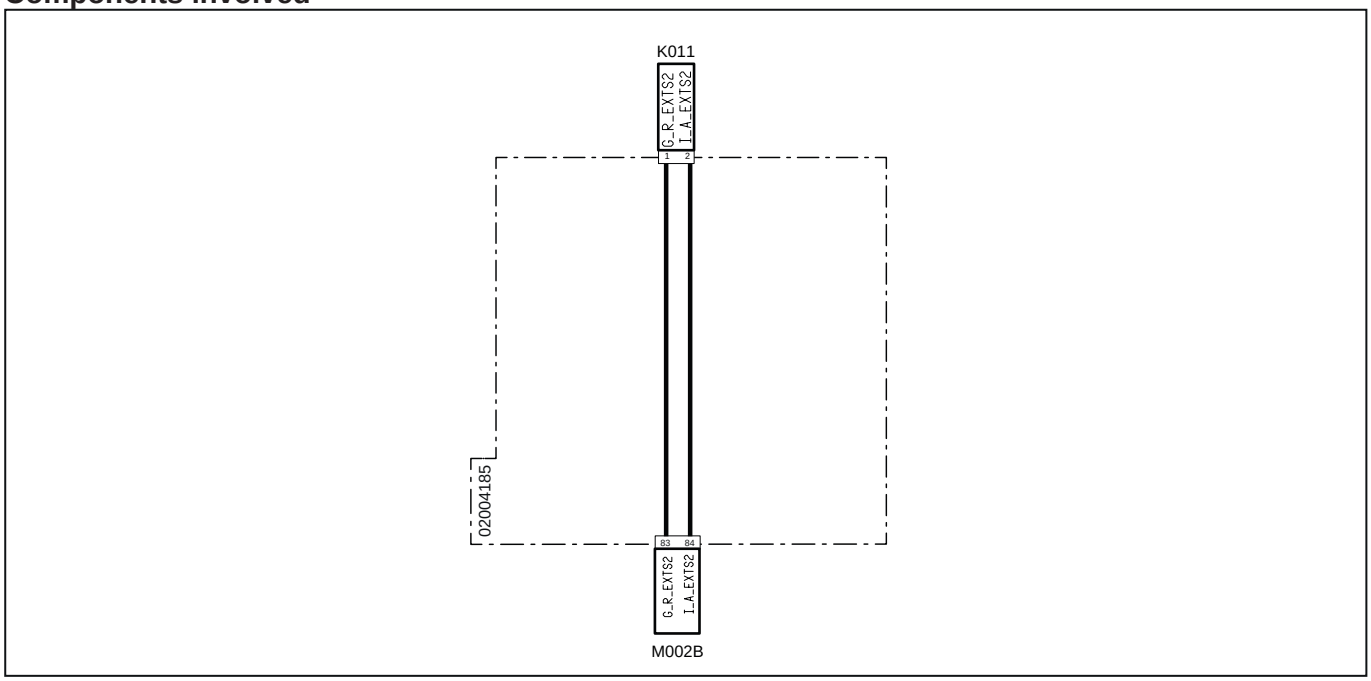
2 - Use the diagnostic tool to monitor the DPF temperature sensor (see the documentation of the diagnostic tool)
- Monitor the temperature in the intake manifold to check that the DOC temperature sensor is working correctly
- If the problem persists, proceed to the next step

3 - Check that the connectors of the DPF temperature sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K011(pag.421)	P6	DPF temperature sensor
M002B(pag.423)	P12	Engine control unit

3172 - Reduced cooling capacity of EGR cooler

Description of fault

None

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The EGR cooler system cools the exhaust gas recovered from the exhaust manifold before it is recirculated into the intake manifold. The quantity of gas recovered is determined by the aperture of the EGR valve, while the temperature of the gas is monitored by the EGR temperature sensor. If the temperature read by the EGR temperature sensor is the same as or higher than the value read by the exhaust gas temperature sensor, this means that the EGR cooler is not working correctly

Behaviour of system

No engine limiting strategy implemented by the control unit

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the coolant level in the radiator and top up if necessary
- See the use and maintenance manual of the vehicle for the correct procedure for topping up coolant
- If the problem persists, proceed to the next step

3 - Check for leaks from the coolant and EGR cooler circuits
- Place a sheet of cardboard under the engine and start the engine. Any leaks in the circuit will wet the cardboard
  Even if no leaks are found, check the coolant level again after a couple of hours at work. If the level has dropped, this means that there is a leak somewhere in the circuit
- Check the condition of the radiator and hoses and check that the hose clamps are fastened correctly- Check the condition of the EGR cooler
- If the problem persists, proceed to the next step

4 - Check the engine coolant level
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

5 - Check that the connectors of the EGR temperature sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

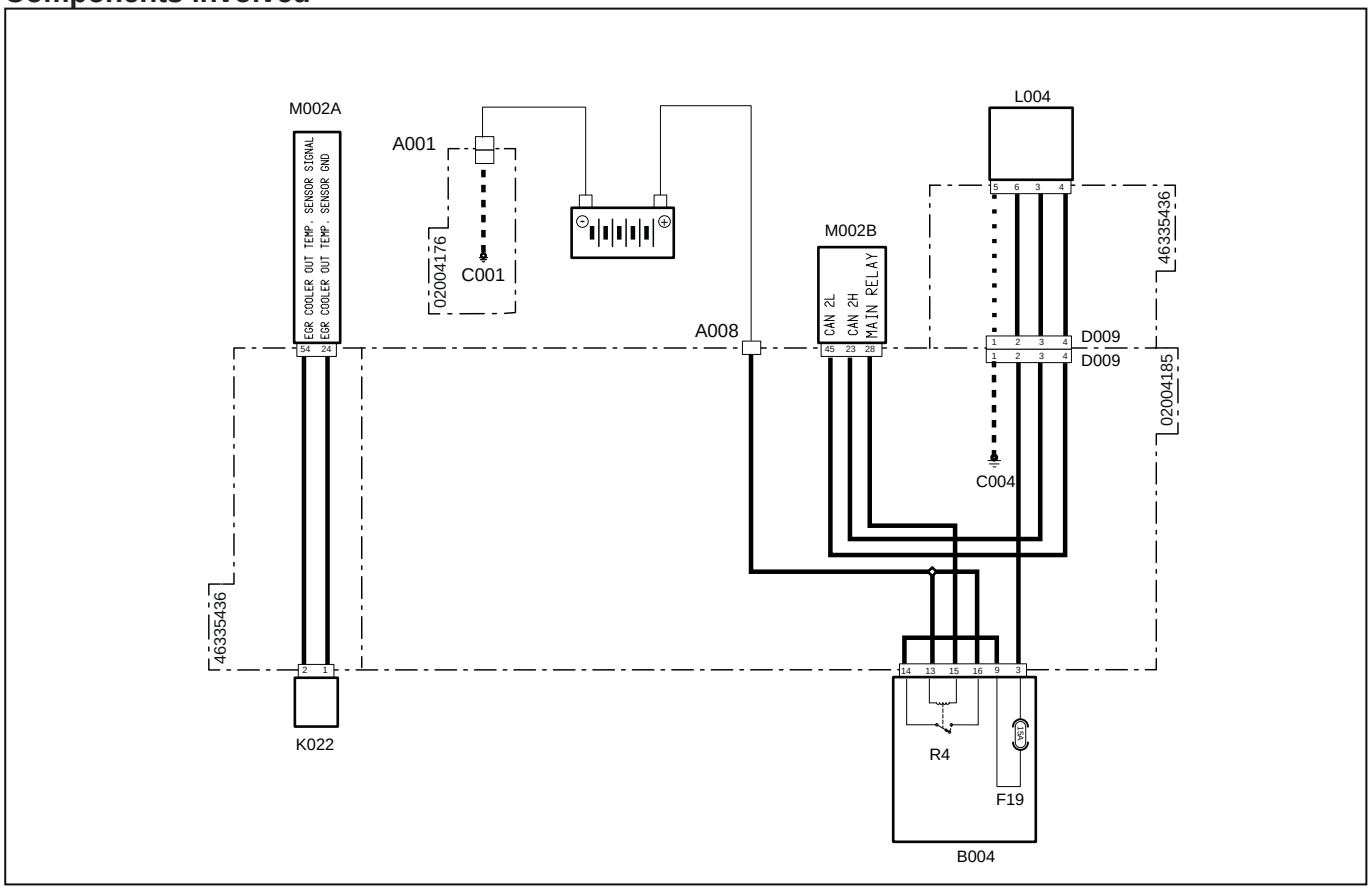
6 - Use the diagnostic tool to check that the EGR temperature sensor is working correctly (see documentation of diagnostic tool)
- Check if the EGR temperature sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

7 - Check that the connectors of the coolant temperature sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

8 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

9 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A008(pag.439)	P472	Positive battery terminal
C001(pag.367)	P66	Battery ground
C004(pag.430)	P105	Engine ground point
D009(pag.437)	P469	Wiring connector for prewired engine wiring loom
D009(pag.460)	XEG	Exhaust gas recirculation solenoid valve power feed
F19(B004) (pag.418)	F19	Accessories (15A)
K022(pag.467)	XS7	EGR temperature sensor
L004(pag.469)	XY2	Exhaust gas recirculation solenoid valve (EGR)
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R2(B004) (pag.418)	R2	Fuel pre-heat relay (20A)

3173 - DOC catalytic converter not working correctly

Description of fault

The control unit detects that the DOC catalytic converter is not working correctly

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The ECU engine control unit monitors the readings of the DOC (upstream) and DPF (downstream) temperature sensors to determine if the DOC is working correctly. The DOC sensor should produce a temperature reading lower than or the same as the reading produced by the DPF sensor. If it does not, this means that the DOC is not working correctly

Behaviour of system

The engine may be started but regeneration is disabled

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the connectors of the DOC and DPF temperature sensors have not been accidentally swapped
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Use the diagnostic tool to monitor the DOC temperature sensor (see the documentation of the diagnostic tool)
- Monitor the temperature in the intake manifold to check that the DOC temperature sensor is working correctly
- If the problem persists, proceed to the next step

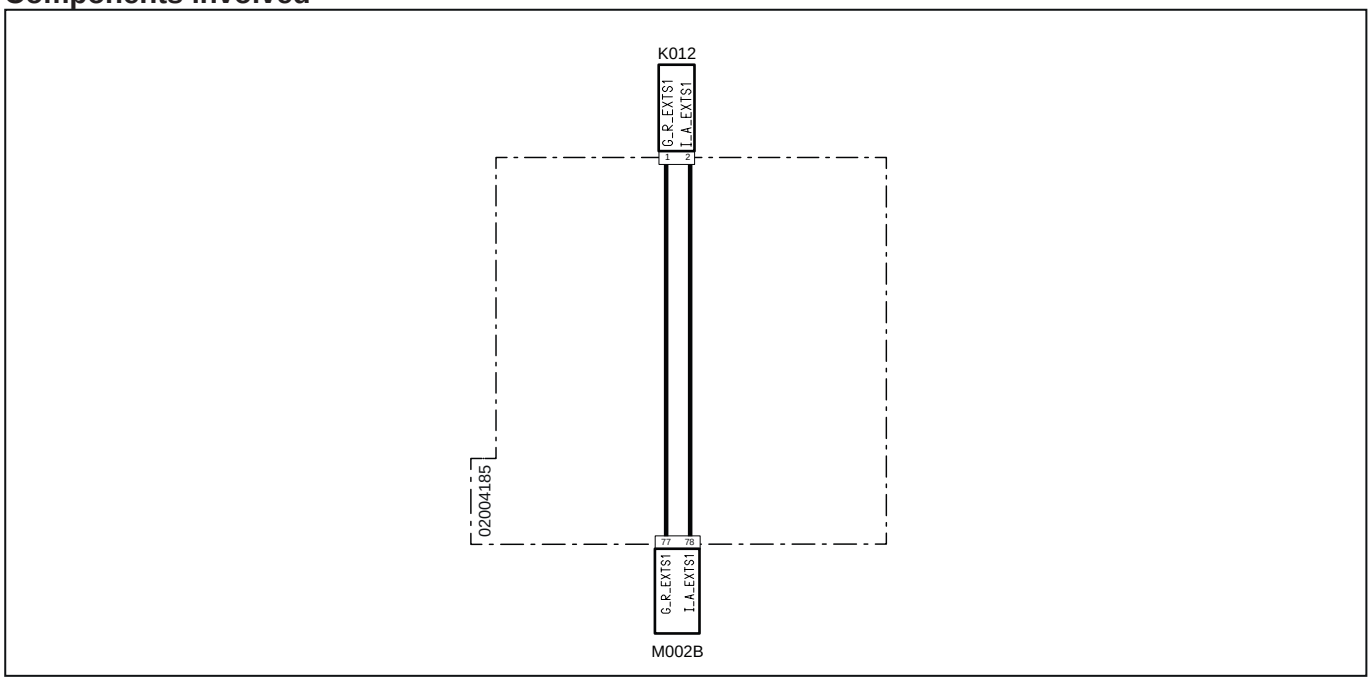
4 - Use the diagnostic tool to monitor the DPF temperature sensor (see the documentation of the diagnostic tool)
- Monitor the temperature in the intake manifold to check that the DOC temperature sensor is working correctly
- If the problem persists, proceed to the next step

5 - Check that the connectors of the DPF temperature sensor, the DOC temperature sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

6 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

7 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K011(pag.421)	6	DPF temperature sensor
K012(pag.422)	P7	DOC temperature sensor
M002B(pag.423)	P12	Engine control unit

3174 - Maximum permitted number of rail pressure relief valve apertures reached

Description of fault

The ECU engine control unit detects that the maximum permitted number of rail pressure relief valve apertures has been reached

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The pressure relief valve on the rail is a safety valve which redirects fuel to the return line if the pressure in the rail is too high. This valve is calibrated to 1900 bar, and may no longer function correctly if it opens too many times (more than 5). As a result, an error is generated once the valve has opened more than 5 times, requiring the valve to be replaced together with the rail and the fuel delivery pipes leading to the injectors

The pressure relief valve is completely mechanical. The ECU engine control unit detects a rapid drop in pressure in the rail via the rail pressure sensor, and interprets this an a pressure relief value aperture event

Behaviour of system

The engine may be started, but the engine operates with limited torque

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

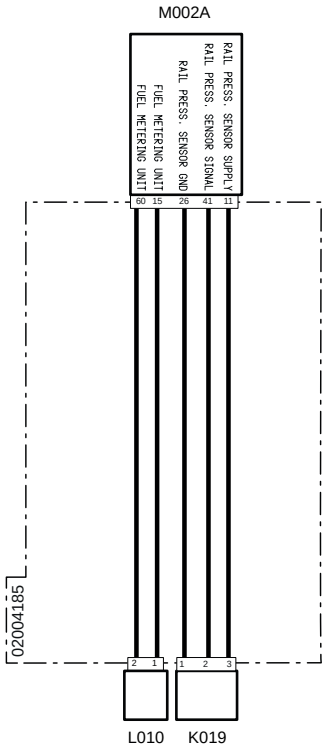
2 - Use the diagnostic tool to check that the MProp metering valve is working correctly (see documentation of diagnostic tool)
- Check that the MProp valve is working correctly and replace if necessary
- Check that the percent aperture of the valve is congruent with the pressure measured by the rail pressure sensor
- If the problem persists, proceed to the next step

3 - Use the diagnostic tool to check that the rail pressure sensor is working correctly (see documentation of diagnostic tool)
- Check if the rail pressure sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

4 - Use the diagnostic tool to check that the pressure relief valve is working correctly (see documentation of diagnostic tool)
- Throttle up to maximum engine speed, and simultaneously monitor the pressure reading of the rail pressure sensor
- If the pressure drops drastically during this check, this may be indicative of a calibration problem of the mechanical pressure relief valve

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K019(pag.466)	XS5	Common Rail fuel pressure sensor
L010(pag.468)	XY1	High pressure pump
M002A(pag.458)	XECUA	Engine control unit

3175 - Maximum permitted rail pressure exceeded

Description of fault

The ECU engine control unit detects that the calibrated aperture pressure of the mechanical pressure relief valve (1900 bar) has been exceeded

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The pressure relief valve on the rail is a safety valve which redirects fuel to the return line if the pressure in the rail is too high. This valve is calibrated to 1900 bar, and may no longer function correctly if it opens too many times (more than 5). As a result, an error is generated once the valve has opened more than 5 times, requiring the valve to be replaced together with the rail and the fuel delivery pipes leading to the injectors

The pressure relief valve is completely mechanical. The ECU engine control unit detects a rapid drop in pressure in the rail via the rail pressure sensor, and interprets this an a pressure relief value aperture event

Behaviour of system

No engine limiting strategy implemented by the control unit

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

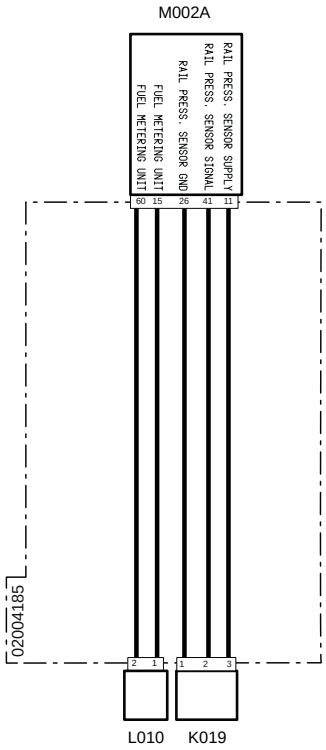
2 - Use the diagnostic tool to check that the MProp metering valve is working correctly (see documentation of diagnostic tool)
- Check that the MProp valve is working correctly and replace if necessary
- Check that the percent aperture of the valve is congruent with the pressure measured by the rail pressure sensor
- If the problem persists, proceed to the next step

3 - Use the diagnostic tool to check that the rail pressure sensor is working correctly (see documentation of diagnostic tool)
- Check if the rail pressure sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

4 - Use the diagnostic tool to check that the pressure relief valve is working correctly (see documentation of diagnostic tool)
- Throttle up to maximum engine speed, and simultaneously monitor the pressure reading of the rail pressure sensor
- If the pressure drops drastically during this check, this may be indicative of a calibration problem of the mechanical pressure relief valve

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K019(pag.466)	XS5	Common Rail fuel pressure sensor
L010(pag.468)	XY1	High pressure pump
M002A(pag.458)	XECUA	Engine control unit

3176 - Maximum permitted rail pressure exceeded

Description of fault

The ECU engine control unit detects that the calibrated aperture pressure of the mechanical pressure relief valve (1900 bar) has been exceeded

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The pressure relief valve on the rail is a safety valve which redirects fuel to the return line if the pressure in the rail is too high. This valve is calibrated to 1900 bar, and may no longer function correctly if it opens too many times (more than 5). As a result, an error is generated once the valve has opened more than 5 times, requiring the valve to be replaced together with the rail and the fuel delivery pipes leading to the injectors

The pressure relief valve is completely mechanical. The ECU engine control unit detects a rapid drop in pressure in the rail via the rail pressure sensor, and interprets this an a pressure relief value aperture event

Behaviour of system

Engine start not possible

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

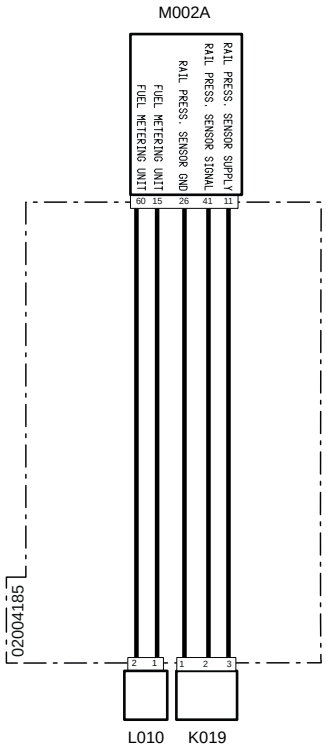
2 - Use the diagnostic tool to check that the MProp metering valve is working correctly (see documentation of diagnostic tool)
- Check that the MProp valve is working correctly and replace if necessary
- Check that the percent aperture of the valve is congruent with the pressure measured by the rail pressure sensor
- If the problem persists, proceed to the next step

3 - Use the diagnostic tool to check that the rail pressure sensor is working correctly (see documentation of diagnostic tool)
- Check if the rail pressure sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

4 - Use the diagnostic tool to check that the pressure relief valve is working correctly (see documentation of diagnostic tool)
- Throttle up to maximum engine speed, and simultaneously monitor the pressure reading of the rail pressure sensor
- If the pressure drops drastically during this check, this may be indicative of a calibration problem of the mechanical pressure relief valve

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K019(pag.466)	XS5	Common Rail fuel pressure sensor
L010(pag.468)	XY1	High pressure pump
M002A(pag.458)	XECUA	Engine control unit

3177 - Maximum permitted rail pressure exceeded

Description of fault

The ECU engine control unit detects that the calibrated aperture pressure of the mechanical pressure relief valve (1900 bar) has been exceeded

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The pressure relief valve on the rail is a safety valve which redirects fuel to the return line if the pressure in the rail is too high. This valve is calibrated to 1900 bar, and may no longer function correctly if it opens too many times (more than 5). As a result, an error is generated once the valve has opened more than 5 times, requiring the valve to be replaced together with the rail and the fuel delivery pipes leading to the injectors

The pressure relief valve is completely mechanical. The ECU engine control unit detects a rapid drop in pressure in the rail via the rail pressure sensor, and interprets this an a pressure relief value aperture event

Behaviour of system

The engine may be started, but the engine operates with limited torque

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

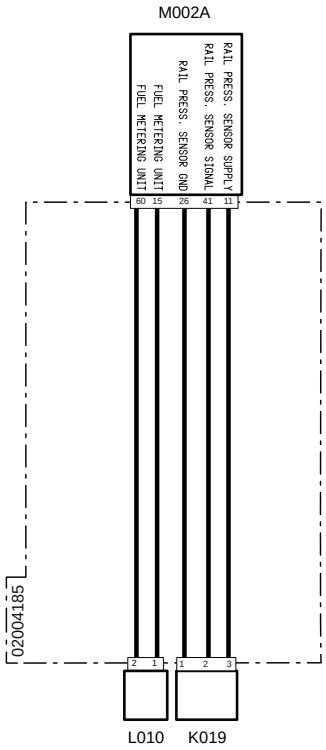
2 - Use the diagnostic tool to check that the MProp metering valve is working correctly (see documentation of diagnostic tool)
- Check that the MProp valve is working correctly and replace if necessary
- Check that the percent aperture of the valve is congruent with the pressure measured by the rail pressure sensor
- If the problem persists, proceed to the next step

3 - Use the diagnostic tool to check that the rail pressure sensor is working correctly (see documentation of diagnostic tool)
- Check if the rail pressure sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

4 - Use the diagnostic tool to check that the pressure relief valve is working correctly (see documentation of diagnostic tool)
- Throttle up to maximum engine speed, and simultaneously monitor the pressure reading of the rail pressure sensor
- If the pressure drops drastically during this check, this may be indicative of a calibration problem of the mechanical pressure relief valve

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K019(pag.466)	XS5	Common Rail fuel pressure sensor
L010(pag.468)	XY1	High pressure pump
M002A(pag.458)	XECUA	Engine control unit

3178 - Rail overpressure during torque limiting

Description of fault

The ECU engine control unit detects that the mechanical pressure relief valve opens while torque limiting is in effect

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The pressure relief valve on the rail is a safety valve which redirects fuel to the return line if the pressure in the rail is too high. This valve is calibrated to 1900 bar, and may no longer function correctly if it opens too many times (more than 5). As a result, an error is generated once the valve has opened more than 5 times, requiring the valve to be replaced together with the rail and the fuel delivery pipes leading to the injectors

The pressure relief valve is completely mechanical. The ECU engine control unit detects a rapid drop in pressure in the rail via the rail pressure sensor, and interprets this an a pressure relief value aperture event

In certain conditions, the ECU engine control unit limits the torque produced by the engine for safety

Behaviour of system

Engine start not possible The EGR valve remains closedThe engine operates with limited torque and the throttle valve does not work

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

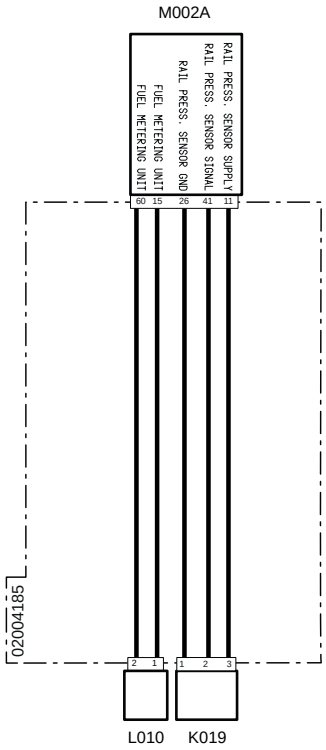
2 - Use the diagnostic tool to check that the MProp metering valve is working correctly (see documentation of diagnostic tool)
- Check that the MProp valve is working correctly and replace if necessary
- Check that the percent aperture of the valve is congruent with the pressure measured by the rail pressure sensor
- If the problem persists, proceed to the next step

3 - Use the diagnostic tool to check that the rail pressure sensor is working correctly (see documentation of diagnostic tool)
- Check if the rail pressure sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

4 - Use the diagnostic tool to check that the pressure relief valve is working correctly (see documentation of diagnostic tool)
- Throttle up to maximum engine speed, and simultaneously monitor the pressure reading of the rail pressure sensor
- If the pressure drops drastically during this check, this may be indicative of a calibration problem of the mechanical pressure relief valve

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K019(pag.466)	XS5	Common Rail fuel pressure sensor
L010(pag.468)	XY1	High pressure pump
M002A(pag.458)	XECUA	Engine control unit

3179 - Maximum permitted rail pressure exceeded

Description of fault

The ECU engine control unit detects that the calibrated aperture pressure of the mechanical pressure relief valve (1900 bar) has been exceeded

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The pressure relief valve on the rail is a safety valve which redirects fuel to the return line if the pressure in the rail is too high. This valve is calibrated to 1900 bar, and may no longer function correctly if it opens too many times (more than 5). As a result, an error is generated once the valve has opened more than 5 times, requiring the valve to be replaced together with the rail and the fuel delivery pipes leading to the injectors

The pressure relief valve is completely mechanical. The ECU engine control unit detects a rapid drop in pressure in the rail via the rail pressure sensor, and interprets this an a pressure relief value aperture event

Behaviour of system

The engine may be started, but the engine operates with limited torque

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

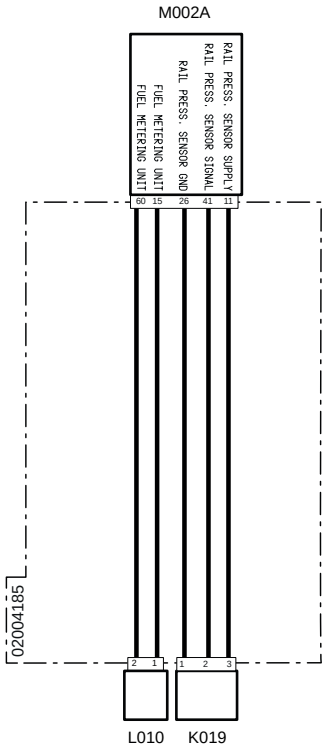
2 - Use the diagnostic tool to check that the MProp metering valve is working correctly (see documentation of diagnostic tool)
- Check that the MProp valve is working correctly and replace if necessary
- Check that the percent aperture of the valve is congruent with the pressure measured by the rail pressure sensor
- If the problem persists, proceed to the next step

3 - Use the diagnostic tool to check that the rail pressure sensor is working correctly (see documentation of diagnostic tool)
- Check if the rail pressure sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

4 - Use the diagnostic tool to check that the pressure relief valve is working correctly (see documentation of diagnostic tool)
- Throttle up to maximum engine speed, and simultaneously monitor the pressure reading of the rail pressure sensor
- If the pressure drops drastically during this check, this may be indicative of a calibration problem of the mechanical pressure relief valve

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K019(pag.466)	XS5	Common Rail fuel pressure sensor
L010(pag.468)	XY1	High pressure pump
M002A(pag.458)	XECUA	Engine control unit

3180 - Pressure relief valve opened before 1200 bar

Description of fault

The ECU engine control unit detects a drastic reduction in rail pressure before the 1200 bar limit is reached, due to the aperture of the pressure relief valve

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The pressure relief valve on the rail is a safety valve which redirects fuel to the return line if the pressure in the rail is too high. This valve is calibrated to 1900 bar, and may no longer function correctly if it opens too many times (more than 5). As a result, an error is generated once the valve has opened more than 5 times, requiring the valve to be replaced together with the rail and the fuel delivery pipes leading to the injectors

The pressure relief valve is completely mechanical. The ECU engine control unit detects a rapid drop in pressure in the rail via the rail pressure sensor, and interprets this an a pressure relief value aperture event

Behaviour of system

No engine limiting strategy implemented by the control unit

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

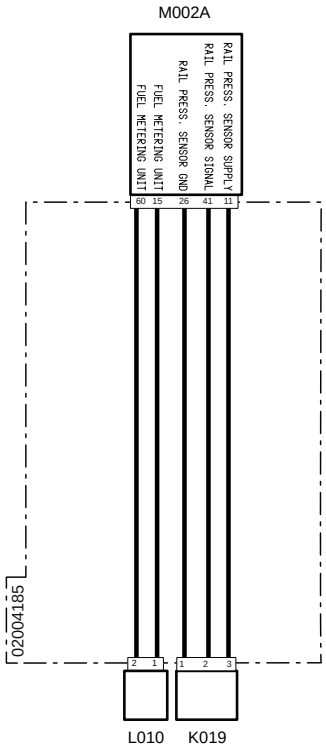
2 - Use the diagnostic tool to check that the MProp metering valve is working correctly (see documentation of diagnostic tool)
- Check that the MProp valve is working correctly and replace if necessary
- Check that the percent aperture of the valve is congruent with the pressure measured by the rail pressure sensor
- If the problem persists, proceed to the next step

3 - Use the diagnostic tool to check that the rail pressure sensor is working correctly (see documentation of diagnostic tool)
- Check if the rail pressure sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

4 - Use the diagnostic tool to check that the pressure relief valve is working correctly (see documentation of diagnostic tool)
- Throttle up to maximum engine speed, and simultaneously monitor the pressure reading of the rail pressure sensor
- If the pressure drops drastically during this check, this may be indicative of a calibration problem of the mechanical pressure relief valve

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K019(pag.466)	XS5	Common Rail fuel pressure sensor
L010(pag.468)	XY1	High pressure pump
M002A(pag.458)	XECUA	Engine control unit

3181 - Maximum permitted rail pressure exceeded

Description of fault

The ECU engine control unit detects that the calibrated aperture pressure of the mechanical pressure relief valve (1900 bar) has been exceeded

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The pressure relief valve on the rail is a safety valve which redirects fuel to the return line if the pressure in the rail is too high. This valve is calibrated to 1900 bar, and may no longer function correctly if it opens too many times (more than 5). As a result, an error is generated once the valve has opened more than 5 times, requiring the valve to be replaced together with the rail and the fuel delivery pipes leading to the injectors

The pressure relief valve is completely mechanical. The ECU engine control unit detects a rapid drop in pressure in the rail via the rail pressure sensor, and interprets this an a pressure relief value aperture event

Behaviour of system

Engine start not possible

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

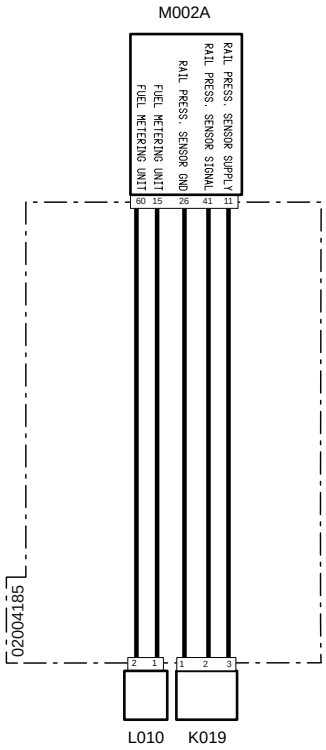
2 - Use the diagnostic tool to check that the MProp metering valve is working correctly (see documentation of diagnostic tool)
- Check that the MProp valve is working correctly and replace if necessary
- Check that the percent aperture of the valve is congruent with the pressure measured by the rail pressure sensor
- If the problem persists, proceed to the next step

3 - Use the diagnostic tool to check that the rail pressure sensor is working correctly (see documentation of diagnostic tool)
- Check if the rail pressure sensor is working correctly and replace if necessary
- If the problem persists, proceed to the next step

4 - Use the diagnostic tool to check that the pressure relief valve is working correctly (see documentation of diagnostic tool)
- Throttle up to maximum engine speed, and simultaneously monitor the pressure reading of the rail pressure sensor
- If the pressure drops drastically during this check, this may be indicative of a calibration problem of the mechanical pressure relief valve

5 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
K019(pag.466)	XS5	Common Rail fuel pressure sensor
L010(pag.468)	XY1	High pressure pump
M002A(pag.458)	XECUA	Engine control unit

3182 - EGR valve temperature too high

Description of fault

The EGR valve notifies the ECU engine control unit that the internal temperature in the EGR valve itself is too high

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the connectors of the EGR temperature sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Check the condition of the CAN Bus communication pins of the engine control unit
- Disconnect the respective connectors
- Check that the contact surfaces of the pins are in good condition
- In no damage or corrosion are found, proceed to the next step

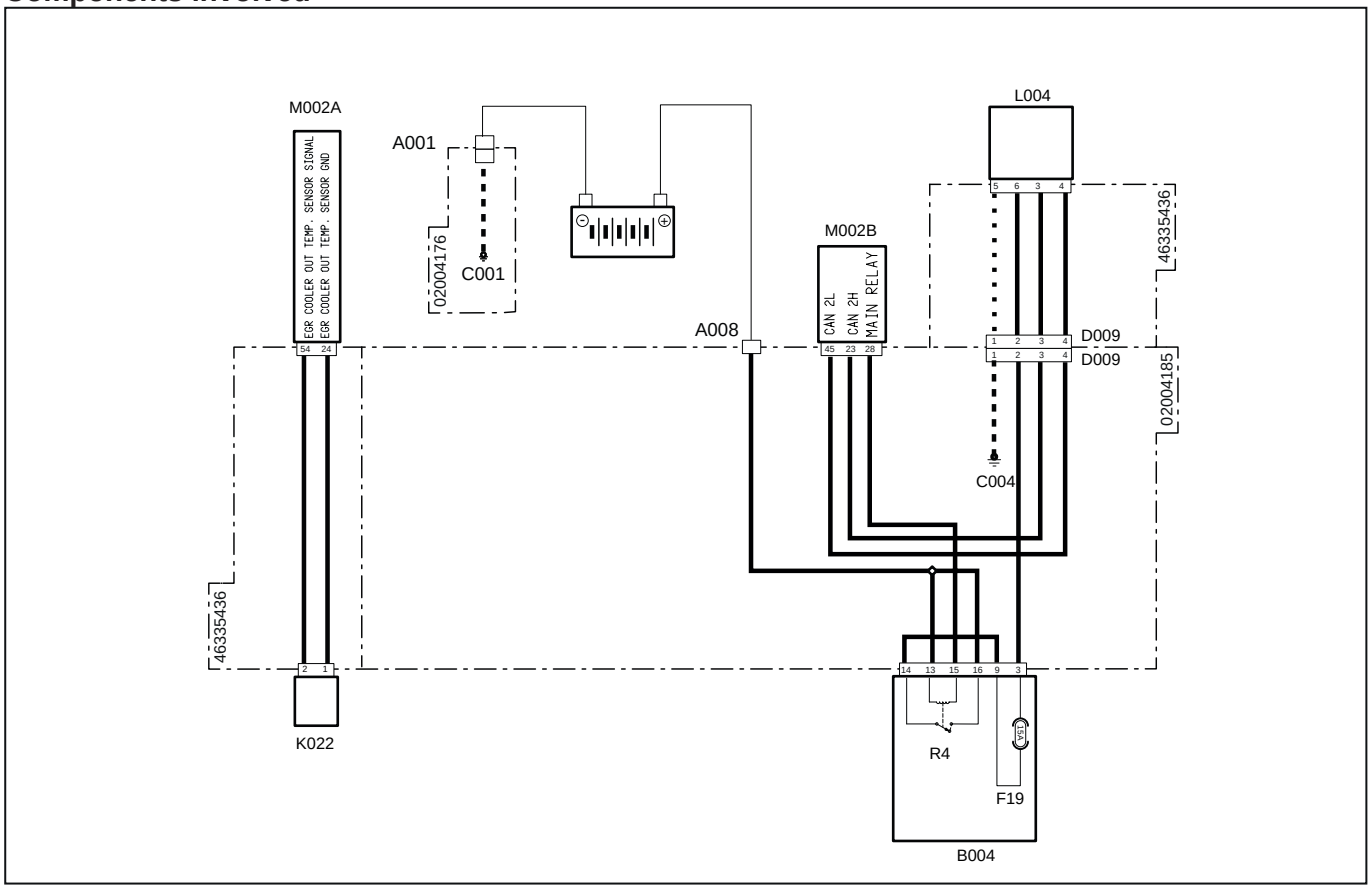
4 - Check the general condition of the CAN Bus line - check that there are no disconnected cables and that all the resistors are fitted correctly.
- Inspect the entire length of all the cables of the wiring loom to check the condition of the cables and connectors
- If all the cables are connected correctly, proceed to the next step

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Check that the wiring loom connectors are connected correctly and not damaged

7 - Contact the technical support service

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A008(pag.439)	P472	Positive battery terminal
C001(pag.367)	P66	Battery ground
C004(pag.430)	P105	Engine ground point
D009(pag.437)	P469	Wiring connector for prewired engine wiring loom
D009(pag.460)	XEG	Exhaust gas recirculation solenoid valve power feed
F19(B004) (pag.418)	F19	Accessories (15A)
K022(pag.467)	XS7	EGR temperature sensor
L004(pag.469)	XY2	Exhaust gas recirculation solenoid valve (EGR)
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R2(B004) (pag.418)	R2	Fuel pre-heat relay (20A)

3183 - EGR valve temperature too low

Description of fault

The EGR valve notifies the ECU engine control unit that the internal temperature in the EGR valve itself is too high

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check that the connectors of the EGR temperature sensor and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

3 - Check the condition of the CAN Bus communication pins of the engine control unit
- Disconnect the respective connectors
- Check that the contact surfaces of the pins are in good condition
- In no damage or corrosion are found, proceed to the next step

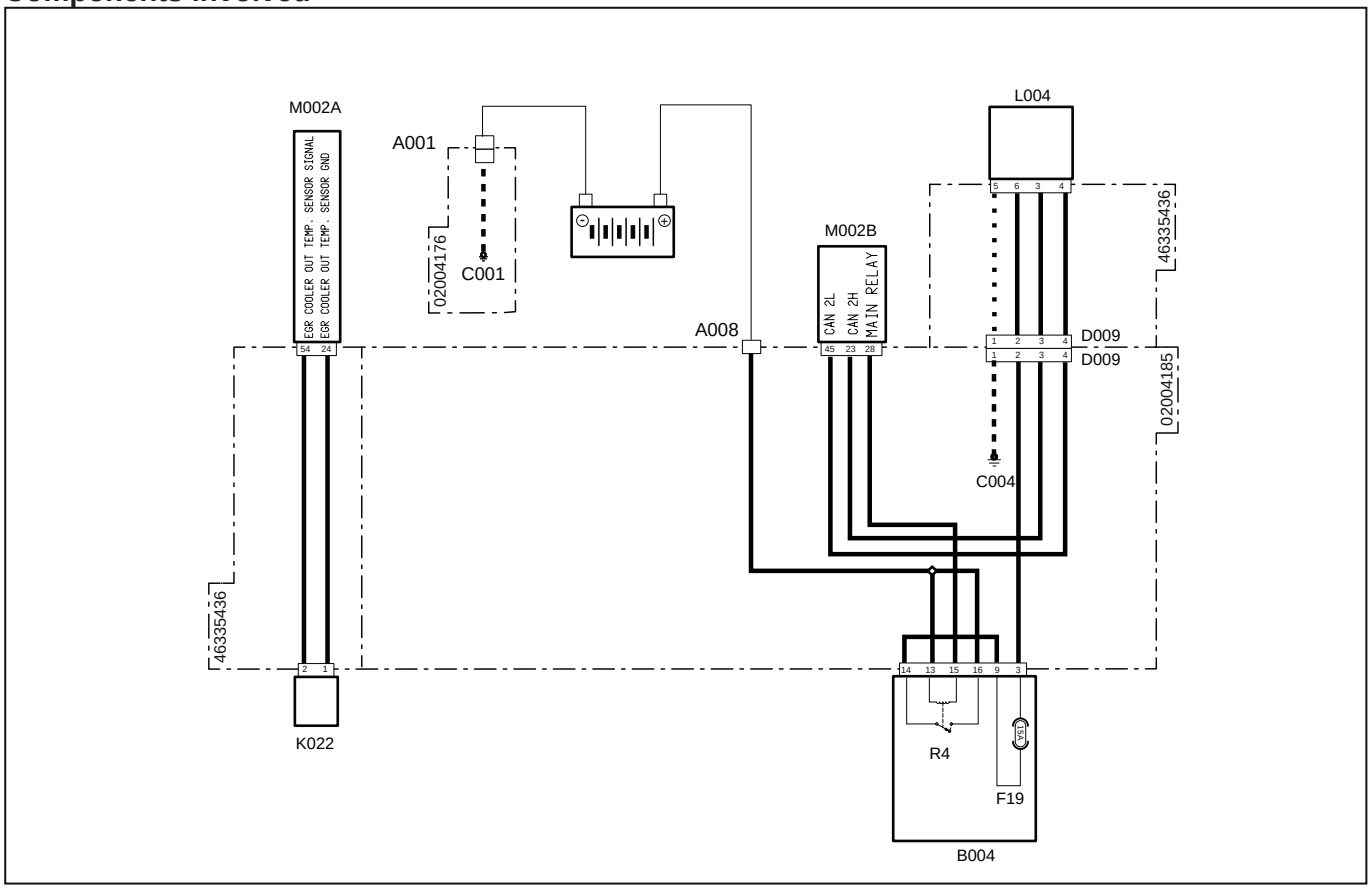
4 - Check the general condition of the CAN Bus line - check that there are no disconnected cables and that all the resistors are fitted correctly.
- Inspect the entire length of all the cables of the wiring loom to check the condition of the cables and connectors
- If all the cables are connected correctly, proceed to the next step

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Check that the wiring loom connectors are connected correctly and not damaged

7 - Contact the technical support service

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A008(pag.439)	P472	Positive battery terminal
C001(pag.367)	P66	Battery ground
C004(pag.430)	P105	Engine ground point
D009(pag.437)	P469	Wiring connector for prewired engine wiring loom
D009(pag.460)	XEG	Exhaust gas recirculation solenoid valve power feed
F19(B004) (pag.418)	F19	Accessories (15A)
K022(pag.467)	XS7	EGR temperature sensor
L004(pag.469)	XY2	Exhaust gas recirculation solenoid valve (EGR)
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R2(B004) (pag.418)	R2	Fuel pre-heat relay (20A)

3184 - EGR valve position error

Description of fault

The ECU engine control unit detects that the percentage error between the effective position of the EGR valve and the requested position is not within the permissible range

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The percentage aperture of the valve and the relative electrical value may be determined with the diagnostic tool. The EGR valve may also be tested with the engine off.

The solenoid valve is completely open when it is not powered. The solenoid valve is completely closed when it is powered.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the accessories fuse (15A) and replace if necessary
- Disconnect the accessories fuse (15A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

3 - Use the diagnostic tool to check that the EGR valve is working correctly (see documentation of diagnostic tool)
- Carry out the EGR valve aperture test while simultaneously checking the effective percentage aperture of the valve itself

  The EGR valve test may also be performed with the engine off
- If the test is passed successfully and no abnormal values are measured, the problem may be due to a different component.
  If the test is failed, proceed to the next step

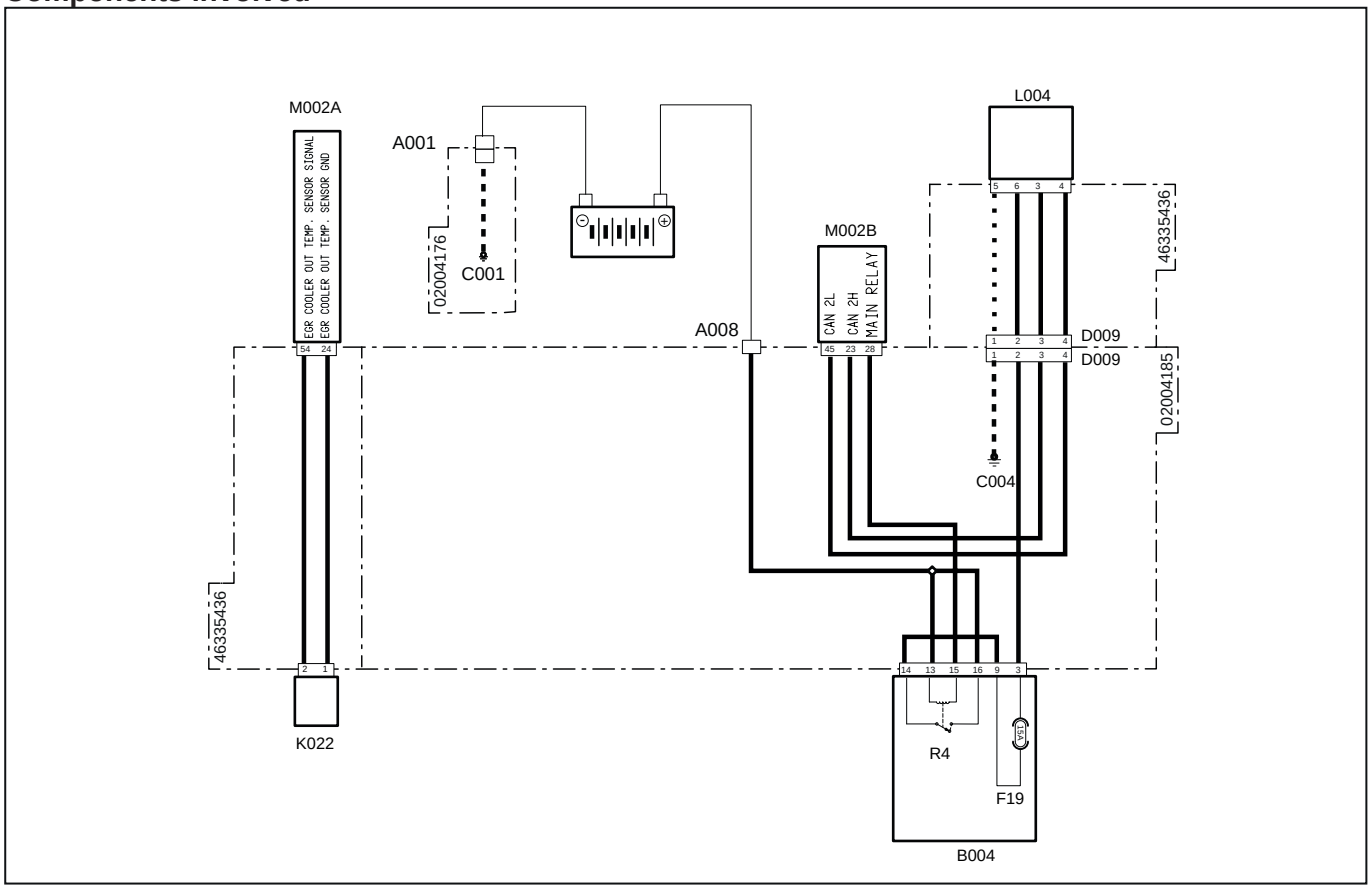
4 - Check that the connectors of the EGR valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

5 - Check that the EGR is not mechanically stuck
- Remove the EGR valve and check that it is not stuck. Dirt residue may compromise the operation of the valve. Always clean the valve before refitting.
- After refitting the valve, check if it works correctly.
  Replace the EGR valve if it does not work correctly
- If the problem persists even though the valve is working correctly, proceed to the next step

6 - After checking that all the components associated with this error are working correctly, proceed to the next step
- Check for fouling and/or obstruction in the EGR exhaust gas circuit
- Check for fouling and/or obstruction in the intake air system

7 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A008(pag.439)	P472	Positive battery terminal
C001(pag.367)	P66	Battery ground
C004(pag.430)	P105	Engine ground point
D009(pag.437)	P469	Wiring connector for prewired engine wiring loom
D009(pag.460)	XEG	Exhaust gas recirculation solenoid valve power feed
F19(B004) (pag.418)	F19	Accessories (15A)
K022(pag.467)	XS7	EGR temperature sensor
L004(pag.469)	XY2	Exhaust gas recirculation solenoid valve (EGR)
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R2(B004) (pag.418)	R2	Fuel pre-heat relay (20A)

3185 - EGR valve position error

Description of fault

The ECU engine control unit detects that the percentage error between the effective position of the EGR valve and the requested position is not within the permissible range

Severity of error

Medium

Additional information

ALERT icon illuminated. While it is not necessary to switch the engine off immediately, the problem causing the error should be diagnosed as soon as possible.

The percentage aperture of the valve and the relative electrical value may be determined with the diagnostic tool. The EGR valve may also be tested with the engine off.

The solenoid valve is completely open when it is not powered. The solenoid valve is completely closed when it is powered.

Behaviour of system

The engine may be started but the EGR valve remains closed

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the accessories fuse (15A) and replace if necessary
- Disconnect the accessories fuse (15A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

3 - Use the diagnostic tool to check that the EGR valve is working correctly (see documentation of diagnostic tool)
- Carry out the EGR valve aperture test while simultaneously checking the effective percentage aperture of the valve itself

  The EGR valve test may also be performed with the engine off
- If the test is passed successfully and no abnormal values are measured, the problem may be due to a different component.
  If the test is failed, proceed to the next step

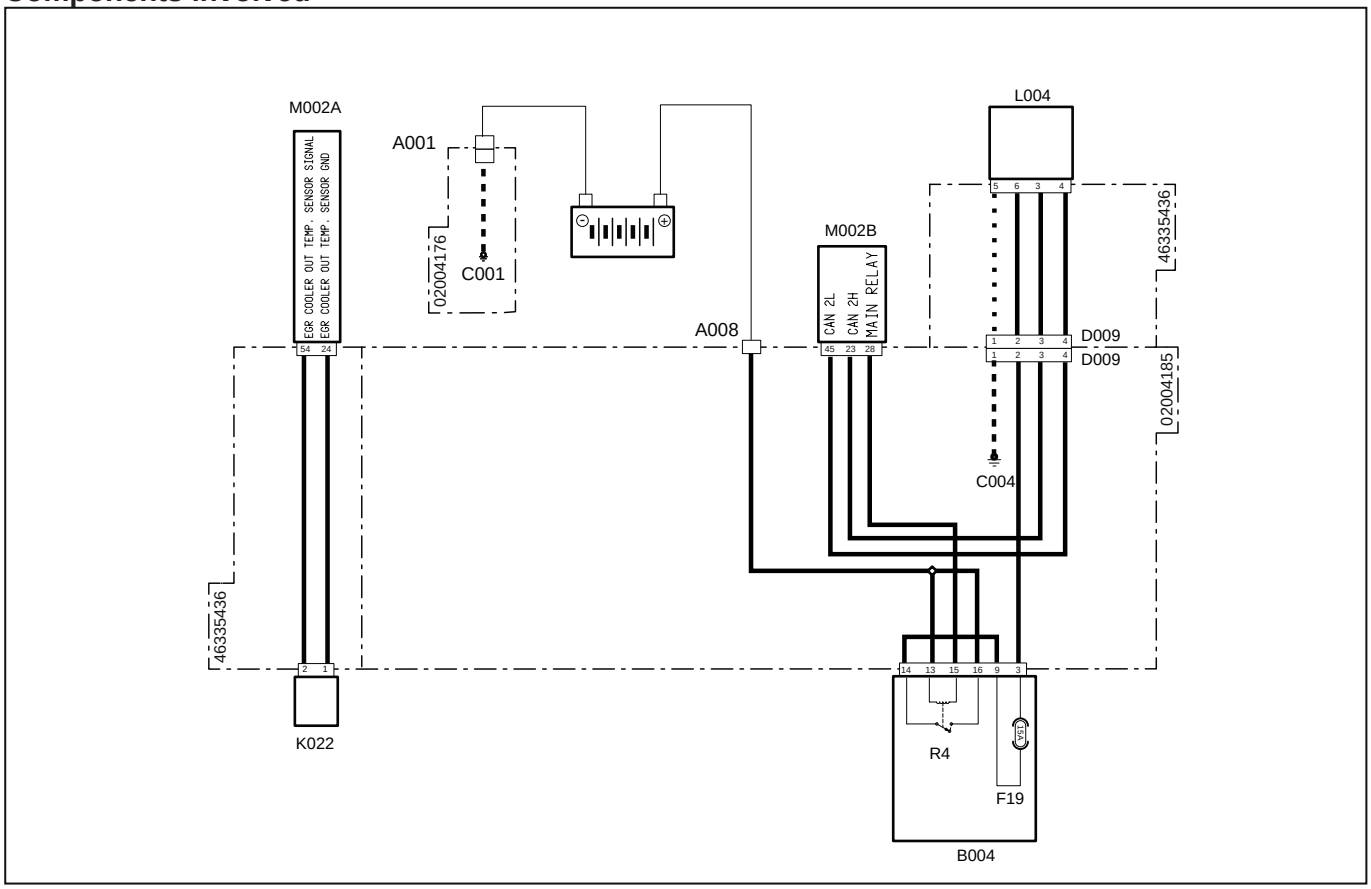
4 - Check that the connectors of the EGR valve and of the engine control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

5 - Check that the EGR is not mechanically stuck
- Remove the EGR valve and check that it is not stuck. Dirt residue may compromise the operation of the valve. Always clean the valve before refitting.
- After refitting the valve, check if it works correctly.
  Replace the EGR valve if it does not work correctly
- If the problem persists even though the valve is working correctly, proceed to the next step

6 - After checking that all the components associated with this error are working correctly, proceed to the next step
- Check for fouling and/or obstruction in the EGR exhaust gas circuit
- Check for fouling and/or obstruction in the intake air system

7 - Contact the technical support service if the problem persists

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A008(pag.439)	P472	Positive battery terminal
C001(pag.367)	P66	Battery ground
C004(pag.430)	P105	Engine ground point
D009(pag.437)	P469	Wiring connector for prewired engine wiring loom
D009(pag.460)	XEG	Exhaust gas recirculation solenoid valve power feed
F19(B004) (pag.418)	F19	Accessories (15A)
K022(pag.467)	XS7	EGR temperature sensor
L004(pag.469)	XY2	Exhaust gas recirculation solenoid valve (EGR)
M002A(pag.458)	XECUA	Engine control unit
M002B(pag.423)	P12	Engine control unit
R2(B004) (pag.418)	R2	Fuel pre-heat relay (20A)

Vehicle control unit (VCU)

1003 - Battery voltage high

Description of fault

The electronic control unit detects a power feed voltage received from the battery exceeding 16 V

Severity of error

High

Additional information

The battery voltage may be checked from the display of the multifunction instrument

STOP icon flashing. Switch the engine off immediately

Behaviour of system

The tractor cannot be switched on

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the main fuse (70A) and replace if necessary
- Disconnect the main fuse (70A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

3 - Check the condition of the VCU fuse (10A) and replace if necessary
- Disconnect the VCU fuse (10A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

4 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

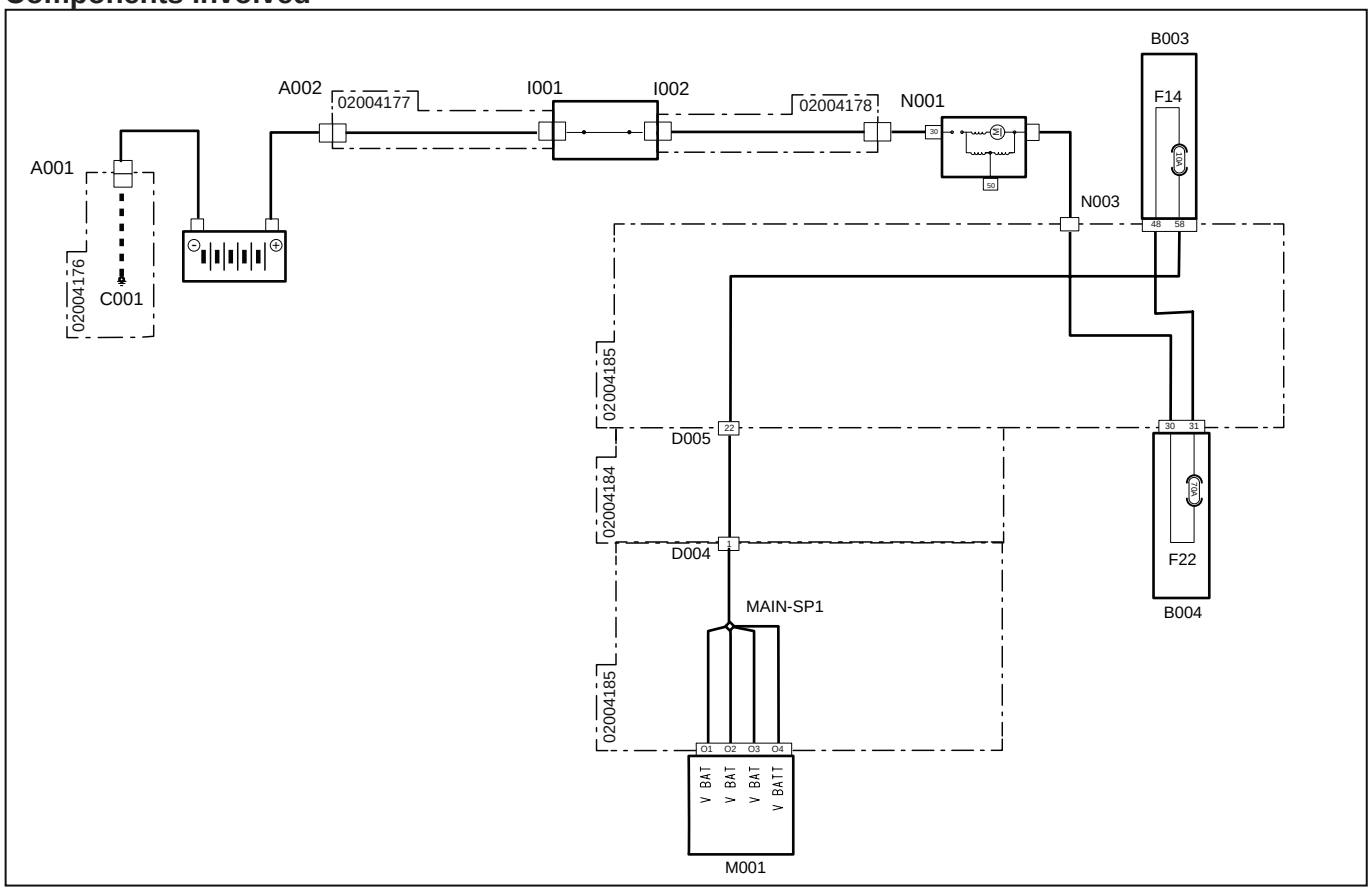
5 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

6 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

7 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

8 - Check that the wiring loom connectors are connected correctly and not damaged

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A002(pag.369)	P55	Positive battery terminal
B003(pag.415)	P1A	Fuse box "2"
B004(pag.418)	P2A	Fuse box "1"
D004(pag.390)	P30A	Wiring connector for main wiring loom
D004(pag.443)	P30B	Wiring connector for dashboard wiring loom
D005(pag.398)	P100B	Wiring connector for engine wiring loom
D005(pag.400)	P100A	Wiring connector for dashboard wiring loom
F14(B003) (pag.415)	F14	12V VCU power feed (10A)
F22(B004) (pag.418)	F22	Main maxi fuse (70A)
I001(pag.368)	P39	Battery master relay switch (input terminal)
I002(pag.370)	P23	Battery master relay switch (output terminal)
M001(pag.449)	P80	Vehicle ECU
N001(pag.369)	P10	Starter motor "30"
N003(pag.430)	P63	Starter motor

1004 - Battery voltage too low

Description of fault

The electronic control unit detects a power feed voltage received from the battery below 7 V

Severity of error

High

Additional information

The battery voltage may be checked from the display of the multifunction instrument

STOP icon flashing. Switch the engine off immediately

Behaviour of system

The tractor cannot be switched on

Checks necessary

1 - Check if there are any other error codes
- If there are any other error codes, also refer to these codes to facilitate correct diagnosis of the problem
- If there are no other error codes, proceed to the next step

2 - Check the condition of the main fuse (70A) and replace if necessary
- Disconnect the main fuse (70A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

3 - Check the condition of the VCU fuse (10A) and replace if necessary
- Disconnect the VCU fuse (10A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

4 - Check the battery state of charge:
- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

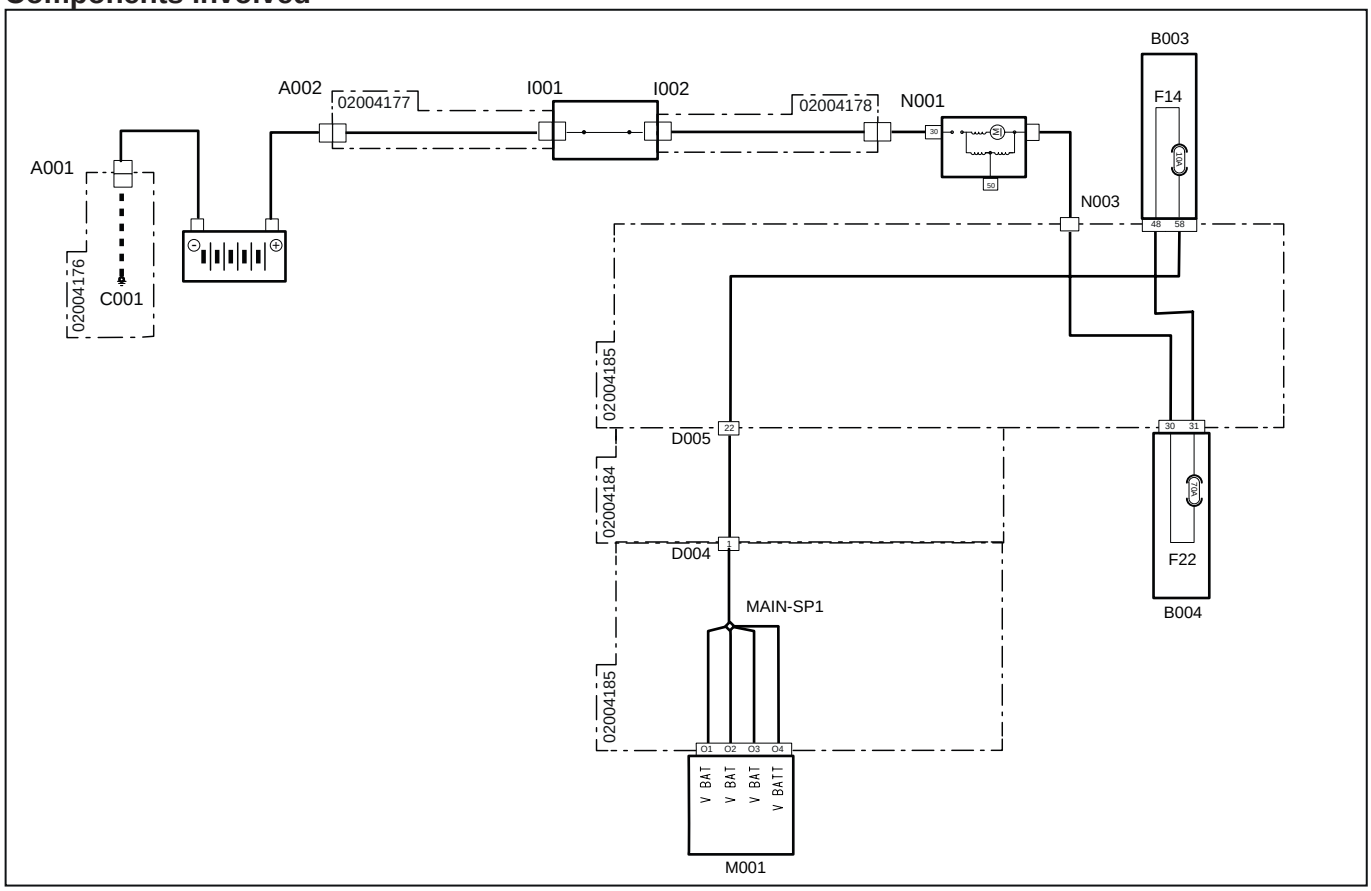
5 - Check that the battery state of charge measured is the same as the value shown on the multifunction instrument display
- Open the "Information" screen on the digital display to view the state of charge of the battery read by the control unit
- If the battery state of charge shown on the display is not the same as the value measured with the tester, replace the VCU vehicle control unit.
- If the values match, proceed to the next step

6 - Check that the alternator is working correctly
- the alternator may be tested with a tester or checked with the diagnostic tool.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

7 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

8 - Check that the wiring loom connectors are connected correctly and not damaged

Components involved



System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A002(pag.369)	P55	Positive battery terminal
B003(pag.415)	P1A	Fuse box "2"
B004(pag.418)	P2A	Fuse box "1"
D004(pag.390)	P30A	Wiring connector for main wiring loom
D004(pag.443)	P30B	Wiring connector for dashboard wiring loom
D005(pag.398)	P100B	Wiring connector for engine wiring loom
D005(pag.400)	P100A	Wiring connector for dashboard wiring loom
F14(B003) (pag.415)	F14	12V VCU power feed (10A)
F22(B004) (pag.418)	F22	Main maxi fuse (70A)
I001(pag.368)	P39	Battery master relay switch (input terminal)
I002(pag.370)	P23	Battery master relay switch (output terminal)
M001(pag.449)	P80	Vehicle ECU
N001(pag.369)	P10	Starter motor "30"
N003(pag.430)	P63	Starter motor

1009 - CAN Bus line communication error

Description of fault

The control unit detects a communication error on the CAN Bus line

Severity of error

High

Additional information

Generic CAN Bus line fault icon displayed on multifunction instrument screen, accompanied by buzzer.

STOP icon flashing. Switch the engine off immediately

Behaviour of system

Engine start not possible The instrument panel may be switched on (ignition on).

Checks necessary

1 - Check that the connectors of the vehicle control unit are fitted and connected correctly
- Disconnect the connectors and reconnect correctly
- If all the connectors are fitted and connected correctly, proceed to the next step

2 - Check the condition of the CAN Bus communication pins of the vehicle control unit
- Disconnect the respective connectors
- Check that the contact surfaces of the pins are in good condition
- In no damage or corrosion are found, proceed to the next step

3 - Check that the resistance measured on the CAN Bus line is 60 Ohm
- Disconnect the connectors and measure the resistance of the wiring loom with a tester applied to the pins of the CAN Bus line. If the value measured is not 60 Ohm, the line is not working correctly.
- If the value measured is 60 Ohm, the line is working correctly: proceed to the next step

4 - Check the general condition of the CAN Bus line - check that there are no disconnected cables and that all the resistors are fitted correctly.
- Check the relative connectors on each cable
- If all the cables are connected correctly, proceed to the next step

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Check that the wiring loom connectors are connected correctly and not damaged

7 - Replace the vehicle control unit

Components involved

System code	Source code	Description
A001	P11	Negative battery terminal
A002	P55	Positive battery terminal
M001	P80	Vehicle ECU

1010 - Vehicle control unit hardware fault

Description of fault

The control unit detects a hardware fault

Severity of error

High

Additional information

This error is not shown in the error list. Generic CAN Bus line fault icon displayed on multifunction instrument screen, accompanied by buzzer.

STOP icon flashing. Switch the engine off immediately

Behaviour of system

Engine start not possible The instrument panel may be switched on (ignition on).

Checks necessary

1 - Check that the connectors of the vehicle control unit are fitted and connected correctly
- Disconnect the connectors and reconnect correctly
- If all the connectors are fitted and connected correctly, proceed to the next step

2 - Disconnect and reconnect the battery to reset the system
- Make sure that the battery is reconnected correctly

3 - Check that all the fuses and relays are in working order and are connected correctly
- Disconnect the fuses
- Replace any blown fuses with new fuses of the same current rating
- Check that the relays are connected correctly
- the relay connections may be tested with a tester.
- If all the fuses and relays are in working order, proceed to the next step

4 - Check the general condition of the CAN Bus line - check that there are no disconnected cables and that all the resistors are fitted correctly
- Check the relative connectors on each cable
- If everything is connected correctly, proceed to the next step

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Check that the wiring loom connectors are connected correctly and not damaged

7 - Use the diagnostic tool to initialise the vehicle control unit (see the documentation of the diagnostic tool)

8 - Replace the vehicle control unit if the problem persists

Components involved

System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A002(pag.369)	P55	Positive battery terminal
M001(pag.449)	P80	Vehicle ECU

1011 - Vehicle control unit hardware fault

Description of fault

The control unit detects a hardware fault

Severity of error

High

Additional information

This error is not shown in the error list. Generic CAN Bus line fault icon displayed on multifunction instrument screen, accompanied by buzzer.

STOP icon flashing. Switch the engine off immediately

Behaviour of system

Engine start not possible The instrument panel may be switched on (ignition on).

Checks necessary

1 - Check that the connectors of the vehicle control unit are fitted and connected correctly
- Disconnect the badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

2 - Disconnect and reconnect the battery to reset the system
- Make sure that the battery is reconnected correctly

3 - Check that all the fuses and relays are in working order and are connected correctly
- Disconnect the fuses
- Replace any blown fuses with new fuses of the same current rating
- Check that the relays are connected correctly
- the relay connections may be tested with a tester.
- If all the fuses and relays are in working order, proceed to the next step

4 - Check the general condition of the CAN Bus line - check that there are no disconnected cables and that all the resistors are fitted correctly
- Check the relative connectors on each cable
- If everything is connected correctly, proceed to the next step

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Check that the wiring loom connectors are connected correctly and not damaged

7 - Use the diagnostic tool to initialise the vehicle control unit (see the documentation of the diagnostic tool)

8 - Replace the vehicle control unit if the problem persists

Components involved

System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A002(pag.369)	P55	Positive battery terminal
M001(pag.449)	P80	Vehicle ECU

1012 - Vehicle control unit hardware fault

Description of fault

The control unit detects a hardware fault

Severity of error

High

Additional information

This error is not shown in the error list. Generic CAN Bus line fault icon displayed on multifunction instrument screen, accompanied by buzzer.

STOP icon flashing. Switch the engine off immediately

Behaviour of system

Engine start not possible The instrument panel may be switched on (ignition on).

Checks necessary

1 - Check that the connectors of the vehicle control unit are fitted and connected correctly
- Disconnect the connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

2 - Disconnect and reconnect the battery to reset the system
- Make sure that the battery is reconnected correctly

3 - Check that all the fuses and relays are in working order and are connected correctly
- Disconnect the fuses
- Replace any blown fuses with new fuses of the same current rating
- Check that the relays are connected correctly
- the relay connections may be tested with a tester.
- If all the fuses and relays are in working order, proceed to the next step

4 - Check the general condition of the CAN Bus line - check that there are no disconnected cables and that all the resistors are fitted correctly
- Check the relative connectors on each cable
- If everything is connected correctly, proceed to the next step

5 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

6 - Check that the wiring loom connectors are connected correctly and not damaged

7 - Use the diagnostic tool to initialise the vehicle control unit (see the documentation of the diagnostic tool)

8 - Replace the vehicle control unit if the problem persists

Components involved

System code	Source code	Description
A001(pag.367)	P11	Negative battery terminal
A002(pag.369)	P55	Positive battery terminal
M001(pag.449)	P80	Vehicle ECU

1013 - Fuel level sensor voltage not within permitted range

Description of fault

The control unit detects an excessively high voltage or a short circuit to positive on the fuel level sensor

Severity of error

Medium

Additional information

The fuel level sensor produces a voltage signal exceeding 4600 mV. This voltage signal may be checked with the diagnostic tool

Amber indicator lamp flashing

Behaviour of system

The engine may be started but the fuel gauge needle remains at 0.

Checks necessary

1 - Check that the connectors of the fuel level sensor and of the vehicle control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

2 - Use the diagnostic tool to check that the fuel level sensor is working correctly (see documentation of diagnostic tool)
- Replace the sensor if it is faulty
- Proceed to the next step if the sensor is working correctly

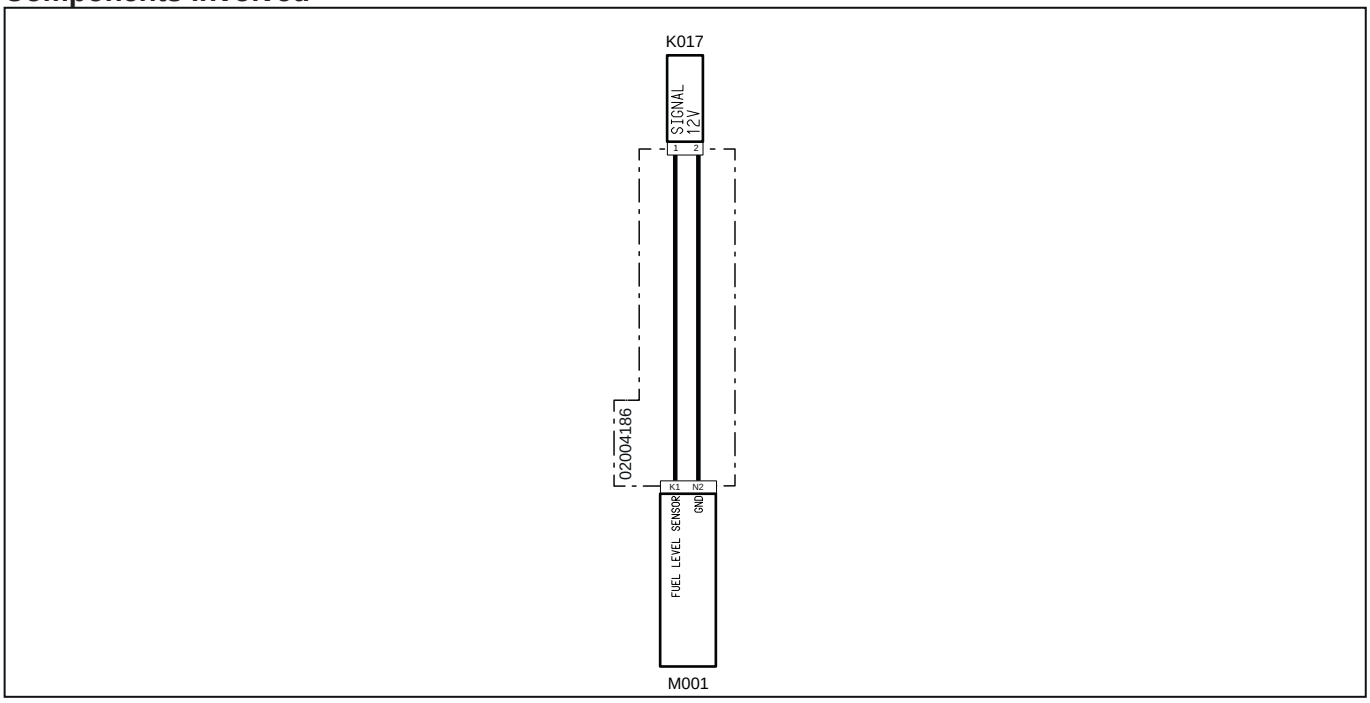
3 - Check the general condition of the wiring loom
- Inspect the entire length of all the cables of the wiring loom to check the condition of the cables and connectors
- If no problems are found, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Check that the wiring loom connectors are connected correctly and not damaged

6 - Replace the fuel level sensor if the problem persists

Components involved



System code	Source code	Description
K017(pag.445)	P40	Fuel level sensor
M001(pag.449)	P80	Vehicle ECU

1014 - Fuel level sensor voltage not within permitted range

Description of fault

The control unit detects an excessively low voltage or a short circuit to ground on the fuel level sensor

Severity of error

Medium

Additional information

The fuel level sensor produces a voltage signal below 1 mV. This voltage signal may be checked with the diagnostic tool

Amber indicator lamp flashing

Behaviour of system

The engine may be started but the fuel gauge needle remains at 0.

Checks necessary

1 - Check that the connectors of the fuel level sensor and of the vehicle control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

2 - Use the diagnostic tool to check that the fuel level sensor is working correctly (see documentation of diagnostic tool)
- Replace the sensor if it is faulty
- Proceed to the next step if the sensor is working correctly

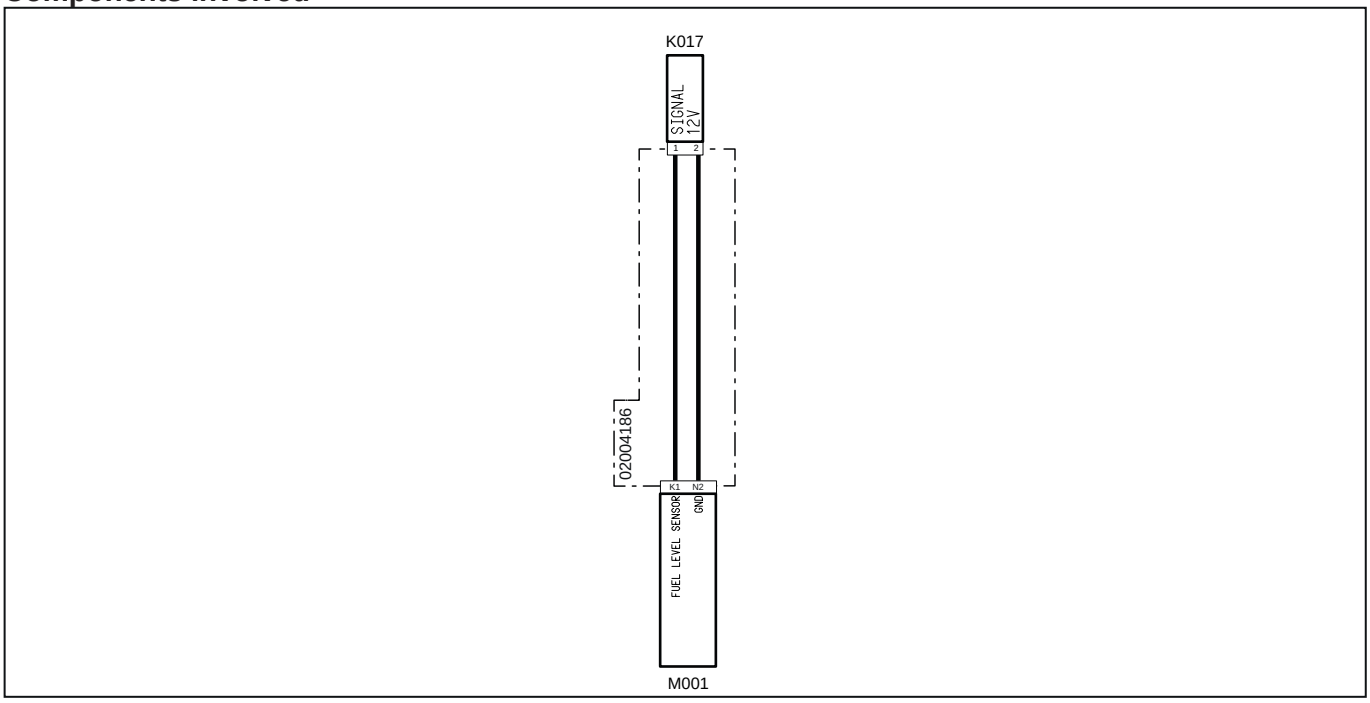
3 - Check the general condition of the wiring loom
- Inspect the entire length of all the cables of the wiring loom to check the condition of the cables and connectors
- If no problems are found, proceed to the next step

4 - Check that the terminals are not contaminated with dirt or water. Dirt or water in the terminals may be the result of cleaning the engine with a pressure washer, loose connections or poor connector seal integrity.

5 - Check that the wiring loom connectors are connected correctly and not damaged

6 - Replace the fuel level sensor if the problem persists

Components involved



System code	Source code	Description
K017(pag.445)	P40	Fuel level sensor
M001(pag.449)	P80	Vehicle ECU

1015 - Four wheel drive solenoid valve current not within permitted range

Description of fault

The control unit detects a short circuit to ground or an open circuit state on the 4WD solenoid valve. The signal current is above 2400 mA

Severity of error

High

Additional information

STOP icon flashing. Switch the engine off immediately

Behaviour of system

The engine may be started but 4WD cannot be selected

Checks necessary

1 - Check the condition of the horn - socket - rotating beacon fuse (20A) and replace if necessary
- Disconnect the horn - socket - rotating beacon fuse (20A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

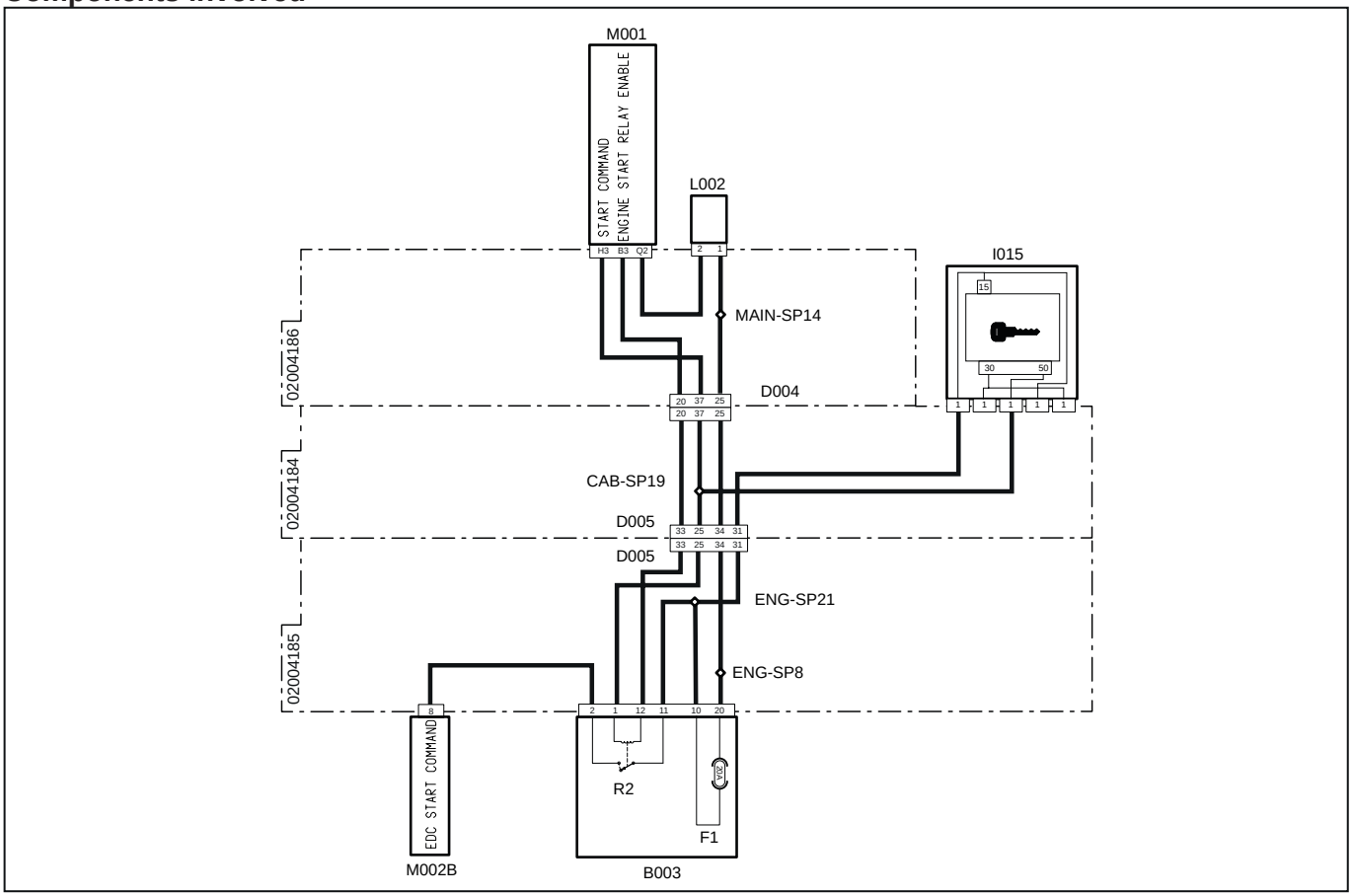
2 - Check if the 4WD solenoid valve is working correctly and replace if necessary
- See the section "Components" for information on the functional states of the solenoid valve
- Proceed to the next step if the component is working correctly

3 - Check that the connectors of the 4WD solenoid valve and of the vehicle control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Use the diagnostic tool to check that the 4WD solenoid valve is working correctly and that the signal is read correctly by the control unit (see documentation of diagnostic tool)

5 - Replace the vehicle control unit if the problem persists

Components involved



System code	Source code	Description
D004(pag.390)	P30A	Wiring connector for main wiring loom
D004(pag.443)	P30B	Wiring connector for dashboard wiring loom
D005(pag.398)	P100B	Wiring connector for engine wiring loom
D005(pag.400)	P100A	Wiring connector for dashboard wiring loom
F1(B003) (pag.415)	F1	Socket - Rotating beacon (20A)
I015(pag.410)	P117,P118, P451,P455,P501	Ignition switch
L002(pag.454)	P186	4WD "ON/OFF" solenoid valve
M001(pag.449)	P80	Vehicle ECU
M002B(pag.423)	P12	Engine control unit
R2(B003) (pag.415)	R1	Start enable relay

1016 - Four wheel drive solenoid valve current not within permitted range

Description of fault

The control unit detects a short circuit to ground or an open circuit state on the 4WD solenoid valve. The signal current is below 75 mA

Severity of error

High

Additional information

STOP icon flashing. Switch the engine off immediately

Behaviour of system

The engine may be started but 4WD cannot be selected

Checks necessary

1 - Check the condition of the horn - socket - rotating beacon fuse (20A) and replace if necessary
- Disconnect the horn - socket - rotating beacon fuse (20A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

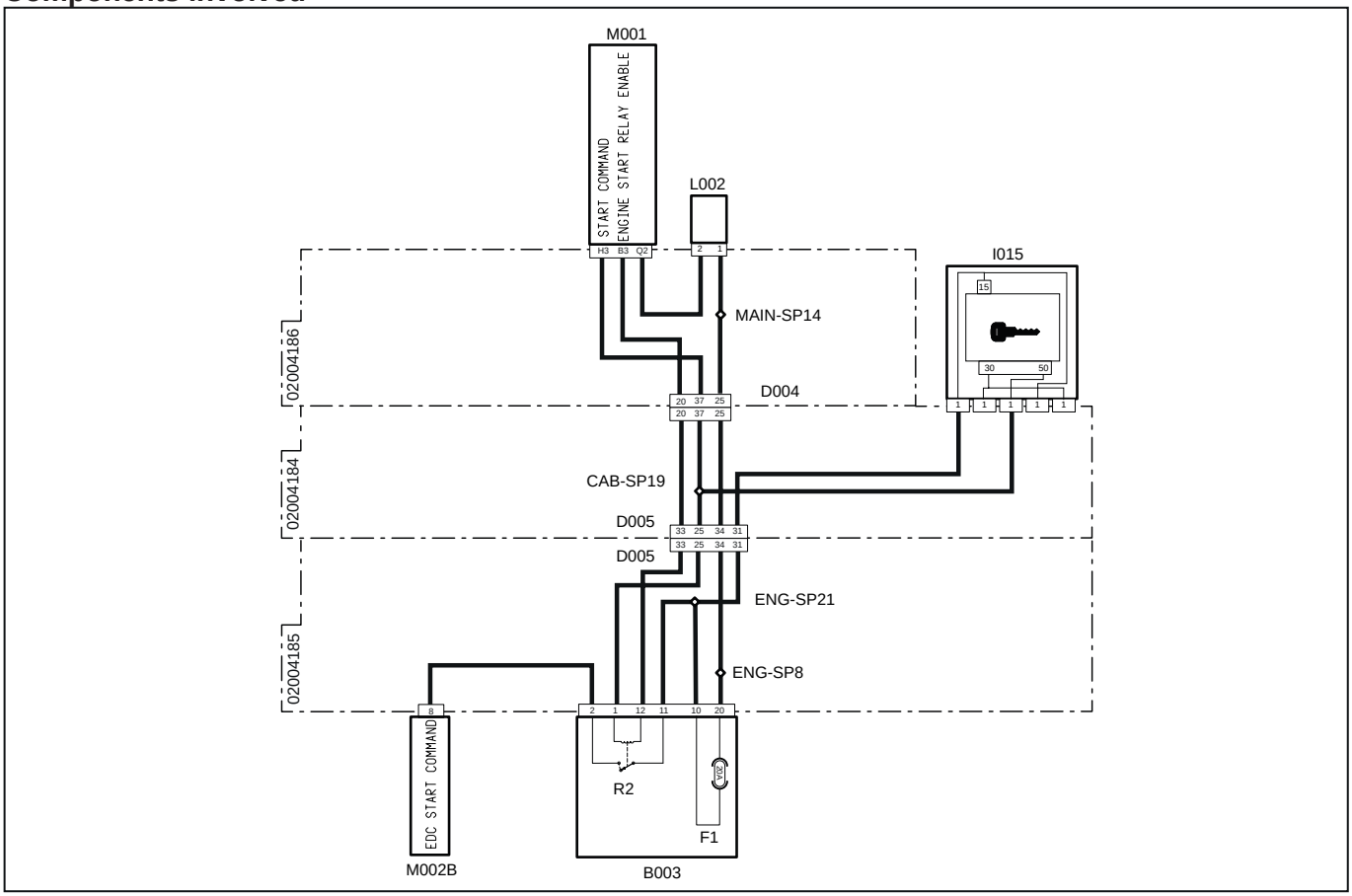
2 - Check if the 4WD solenoid valve is working correctly and replace if necessary
- See the section "Components" for information on the functional states of the solenoid valve
- Proceed to the next step if the component is working correctly

3 - Check that the connectors of the 4WD solenoid valve and of the vehicle control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Use the diagnostic tool to check that the 4WD solenoid valve is working correctly and that the signal is read correctly by the control unit (see documentation of diagnostic tool)

5 - Replace the vehicle control unit if the problem persists

Components involved



System code	Source code	Description
D004(pag.390)	P30A	Wiring connector for main wiring loom
D004(pag.443)	P30B	Wiring connector for dashboard wiring loom
D005(pag.398)	P100B	Wiring connector for engine wiring loom
D005(pag.400)	P100A	Wiring connector for dashboard wiring loom
F1(B003) (pag.415)	F1	Socket - Rotating beacon (20A)
I015(pag.410)	P117,P118, P451,P455,P501	Ignition switch
L002(pag.454)	P186	4WD "ON/OFF" solenoid valve
M001(pag.449)	P80	Vehicle ECU
M002B(pag.423)	P12	Engine control unit
R2(B003) (pag.415)	R1	Start enable relay

1017 - Differential lock solenoid valve current not within permitted range

Description of fault

The control unit detects a short circuit to ground or an open circuit state in the circuit of the differential lock solenoid valve. The signal current is above 2400 mA

Severity of error

High

Additional information

STOP icon flashing. Switch the engine off immediately

Behaviour of system

The engine may be started but the differential lock cannot be engaged

Checks necessary

1 - Check the condition of the horn - socket - rotating beacon fuse (20A) and replace if necessary
- Disconnect the horn - socket - rotating beacon fuse (20A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

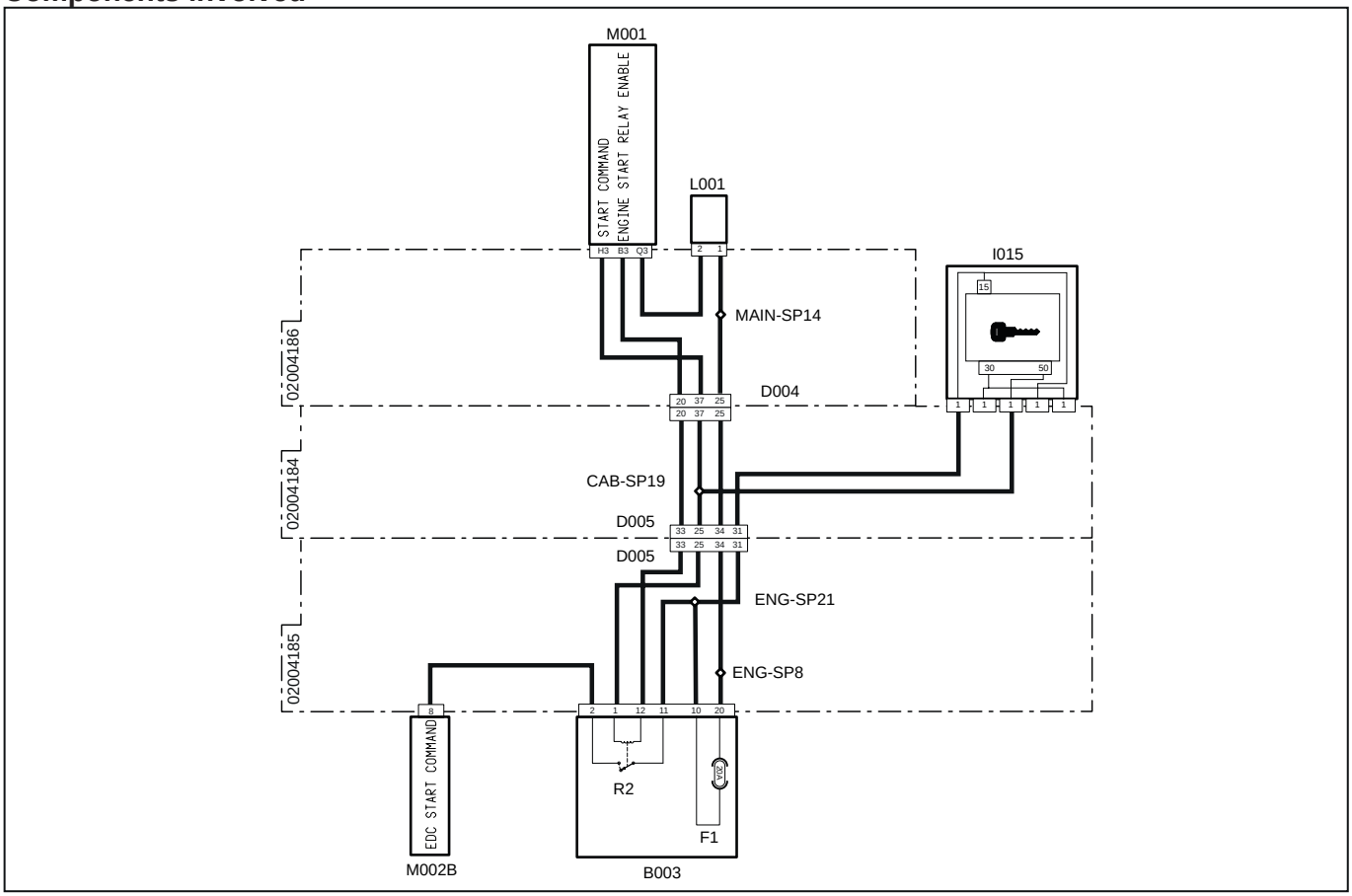
2 - Check if the DL solenoid valve is working correctly and replace if necessary
- See the section "Components" for information on the functional states of the solenoid valve
- Proceed to the next step if the component is working correctly

3 - Check that the connectors of the DL solenoid valve and of the vehicle control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Use the diagnostic tool to check that the DL solenoid valve is working correctly and that the signal is read correctly by the control unit (see documentation of diagnostic tool)

5 - Replace the vehicle control unit if the problem persists

Components involved



System code	Source code	Description
D004(pag.390)	P30A	Wiring connector for main wiring loom
D004(pag.443)	P30B	Wiring connector for dashboard wiring loom
D005(pag.398)	P100B	Wiring connector for engine wiring loom
D005(pag.400)	P100A	Wiring connector for dashboard wiring loom
F1(B003) (pag.415)	F1	Socket - Rotating beacon (20A)
I015(pag.410)	P117,P118, P451,P455,P501	Ignition switch
L001(pag.454) (pag.454)	P187	Differential lock "ON/OFF" solenoid valve
M001(pag.449)	P80	Vehicle ECU
M002B(pag.423)	P12	Engine control unit
R2(B003) (pag.415)	R1	Start enable relay

1018 - Differential lock solenoid valve current not within permitted range

Description of fault

The control unit detects a short circuit to ground or an open circuit state in the circuit of the differential lock solenoid valve. The signal current is below 75 mA

Severity of error

High

Additional information

STOP icon flashing. Switch the engine off immediately

Behaviour of system

The engine may be started but the differential lock cannot be engaged

Checks necessary

1 - Check the condition of the horn - socket - rotating beacon fuse (20A) and replace if necessary
- Disconnect the horn - socket - rotating beacon fuse (20A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

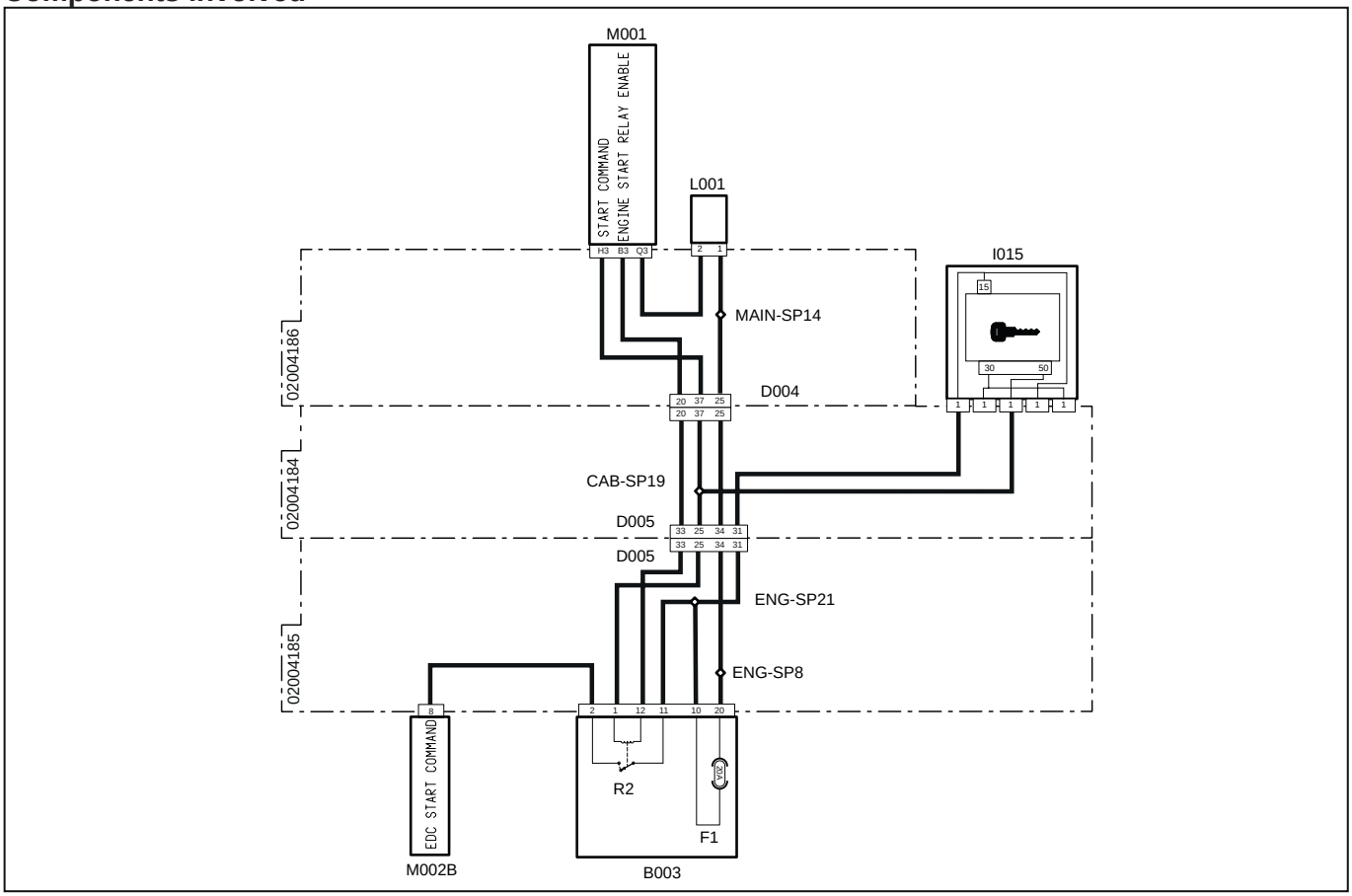
2 - Check if the DL solenoid valve is working correctly and replace if necessary
- See the section "Components" for information on the functional states of the solenoid valve
- Proceed to the next step if the component is working correctly

3 - Check that the connectors of the DL solenoid valve and of the vehicle control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

4 - Use the diagnostic tool to check that the DL solenoid valve is working correctly and that the signal is read correctly by the control unit (see documentation of diagnostic tool)

5 - Replace the vehicle control unit if the problem persists

Components involved



System code	Source code	Description
D004(pag.390)	P30A	Wiring connector for main wiring loom
D004(pag.443)	P30B	Wiring connector for dashboard wiring loom
D005(pag.398)	P100B	Wiring connector for engine wiring loom
D005(pag.400)	P100A	Wiring connector for dashboard wiring loom
F1(B003) (pag.415)	F1	Socket - Rotating beacon (20A)
I015(pag.410)	P117,P118, P451,P455,P501	Ignition switch
L001(pag.454) (pag.454)	P187	Differential lock "ON/OFF" solenoid valve
M001(pag.449)	P80	Vehicle ECU
M002B(pag.423)	P12	Engine control unit
R2(B003) (pag.415)	R1	Start enable relay

1019 - Tractor speed sensor reading error

Description of fault

The ECU engine control unit detects a tractor speed sensor reading error.

Severity of error

High

Additional information

The tractor speed sensor reads the speed from a tone wheel on the front axle and produces a signal with a frequency value in Hertz

STOP icon flashing. Switch the engine off immediately

Behaviour of system

The tractor may be started but the tractor speed will not be displayed on the digital display

Checks necessary

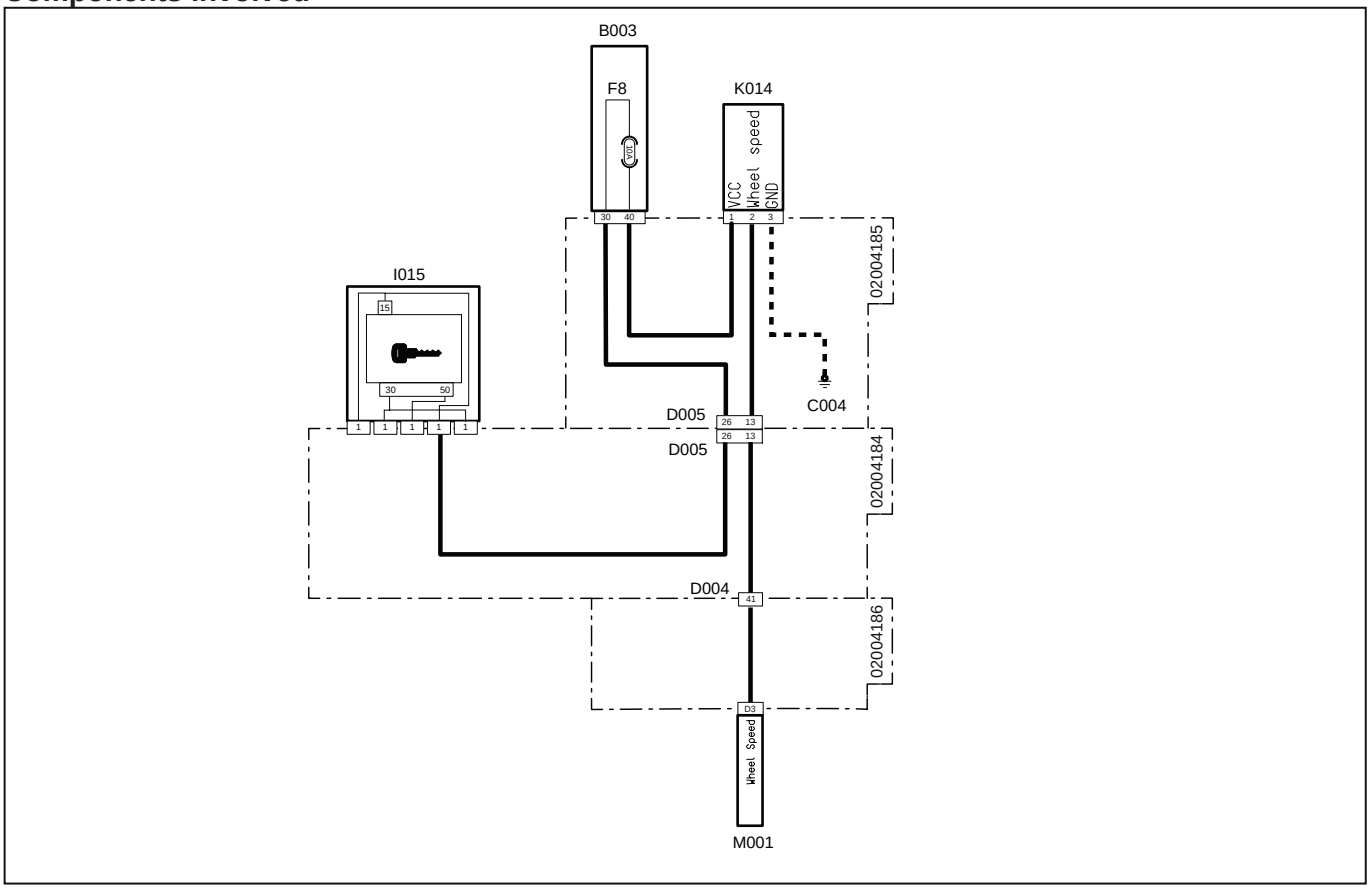
1 - Check the condition of the sensors/switched fuse (10A) and replace if necessary
- Disconnect the sensors/switches fuse (10A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

2 - Check if the sensor is working correctly and replace if necessary
- See the section "Components" for information on the functional states of the sensor
- Proceed to the next step if the component is working correctly

3 - Check that the sensor is installed in the correct position relative to the tone wheel

4 - Check that the connectors of the tractor speed sensor and of the vehicle control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

Components involved



System code	Source code	Description
C004(pag.430)	P105	Engine ground point
D004(pag.390)	P30A	Wiring connector for main wiring loom
D004(pag.443)	P30B	Wiring connector for dashboard wiring loom
D005(pag.398)	P100B	Wiring connector for engine wiring loom
D005(pag.400)	P100A	Wiring connector for dashboard wiring loom
F8(B003) (pag.415)	F8	Turn indicators (10A)
I015(pag.410)	P117,P118, P451,P455,P501	Ignition switch
K014(pag.432)	P301	Wheel speed sensor
M001(pag.449)	P80	Vehicle ECU

1020 - Throttle potentiometer: short circuit in power feed line

Description of fault

The control units detects a short circuit in the throttle potentiometer power feed line. The power feed voltage exceeds 4.5 V

Severity of error

High

Additional information

Error codes 1024 or 1025 may also be displayed

STOP icon flashing. Switch the engine off immediately

Behaviour of system

The engine may be started but no throttle control is possible

Checks necessary

1 - Check the condition of the sensors/switched fuse (10A) and replace if necessary
- Disconnect the sensors/switches fuse (10A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

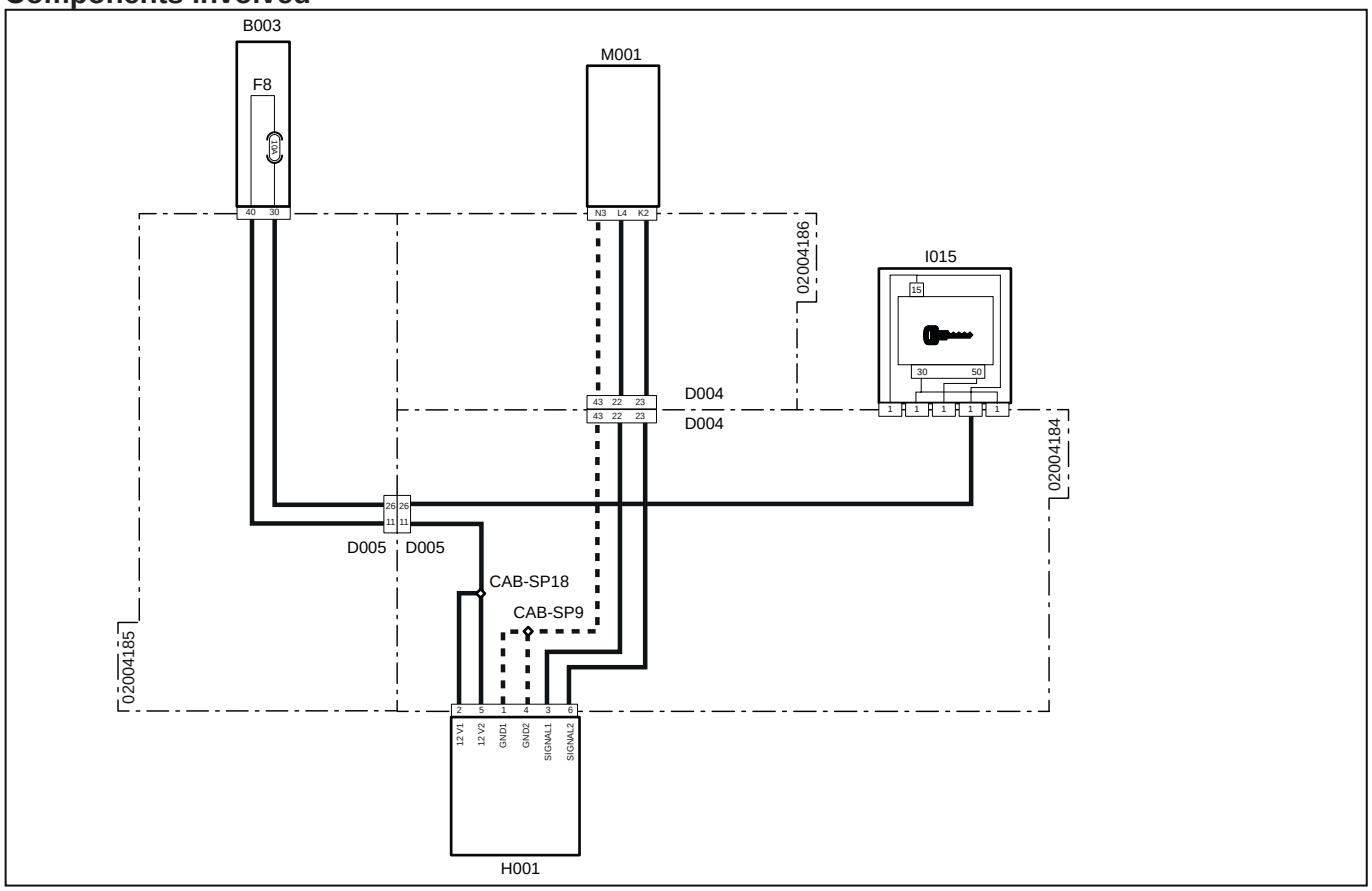
2 - Check if the potentiometer is working correctly and replace if necessary
- See the section "Components" for information on the functional states of the potentiometer
- Proceed to the next step if the component is working correctly

3 - Calibrate the foot throttle potentiometer (see the documentation of the diagnostic tool)
- Proceed to the next step if the component is calibrated correctly

4 - Check that the connectors of the potentiometer and of the vehicle control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

5 - Use the diagnostic tool to check that the potentiometer is working correctly and that the signal is read correctly by the control unit (see documentation of diagnostic tool)

Components involved



System code	Source code	Description
D004(pag.390)	P30A	Wiring connector for main wiring loom
D004(pag.443)	P30B	Wiring connector for dashboard wiring loom
F8(B003) (pag.415)	F8	Turn indicators (10A)
H001(pag.397)	P100	Hand throttle
I015(pag.410)	P117,P118, P451,P455,P501	Ignition switch
M001(pag.449)	P80	Vehicle ECU

1021 - Throttle potentiometer: short circuit to ground

Description of fault

The control unit detects a short circuit to ground on the throttle potentiometer. Power feed voltage is less than 0.5 V

Severity of error

High

Additional information

Error codes 1024 or 1025 may also be displayed

STOP icon flashing. Switch the engine off immediately

Behaviour of system

The engine may be started but no throttle control is possible

Checks necessary

1 - Check the condition of the sensors/switched fuse (10A) and replace if necessary
- Disconnect the sensors/switches fuse (10A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

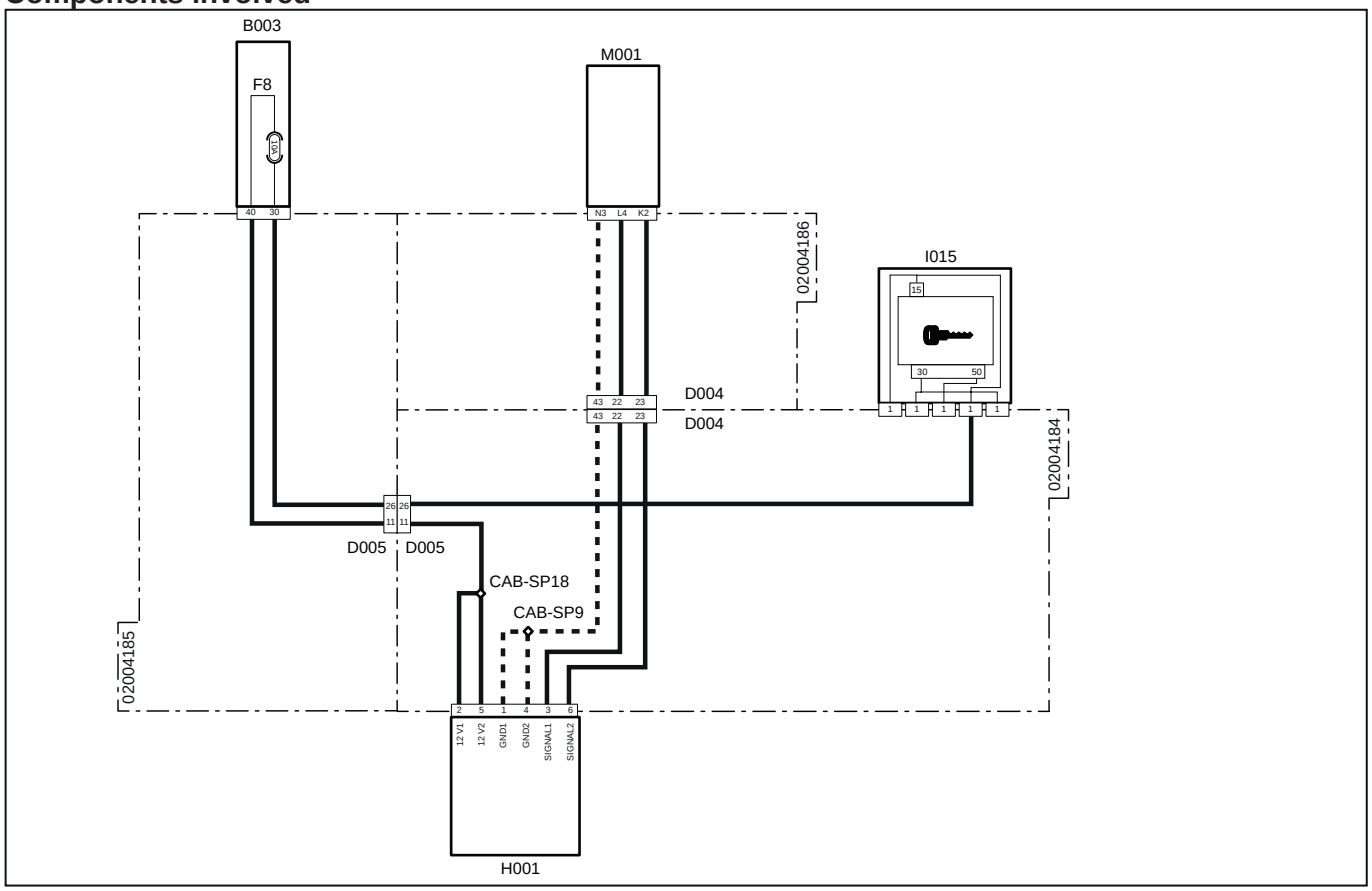
2 - Check if the potentiometer is working correctly and replace if necessary
- See the section "Components" for information on the functional states of the potentiometer
- Proceed to the next step if the component is working correctly

3 - Calibrate the foot throttle potentiometer (see the documentation of the diagnostic tool)
- Proceed to the next step if the component is calibrated correctly

4 - Check that the connectors of the potentiometer and of the vehicle control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

5 - Use the diagnostic tool to check that the potentiometer is working correctly and that the signal is read correctly by the control unit (see documentation of diagnostic tool)

Components involved



System code	Source code	Description
D004(pag.390)	P30A	Wiring connector for main wiring loom
D004(pag.443)	P30B	Wiring connector for dashboard wiring loom
F8(B003) (pag.415)	F8	Turn indicators (10A)
H001(pag.397)	P100	Hand throttle
I015(pag.410)	P117,P118, P451,P455,P501	Ignition switch
M001(pag.449)	P80	Vehicle ECU

1022 - Throttle potentiometer: short circuit in power feed line

Description of fault

The control units detects a short circuit in the throttle potentiometer power feed line. The power feed voltage exceeds 4.5 V

Severity of error

High

Additional information

Error codes 1024 or 1025 may also be displayed

STOP icon flashing. Switch the engine off immediately

Behaviour of system

The engine may be started but no throttle control is possible

Checks necessary

1 - Check the condition of the sensors/switched fuse (10A) and replace if necessary
- Disconnect the sensors/switches fuse (10A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

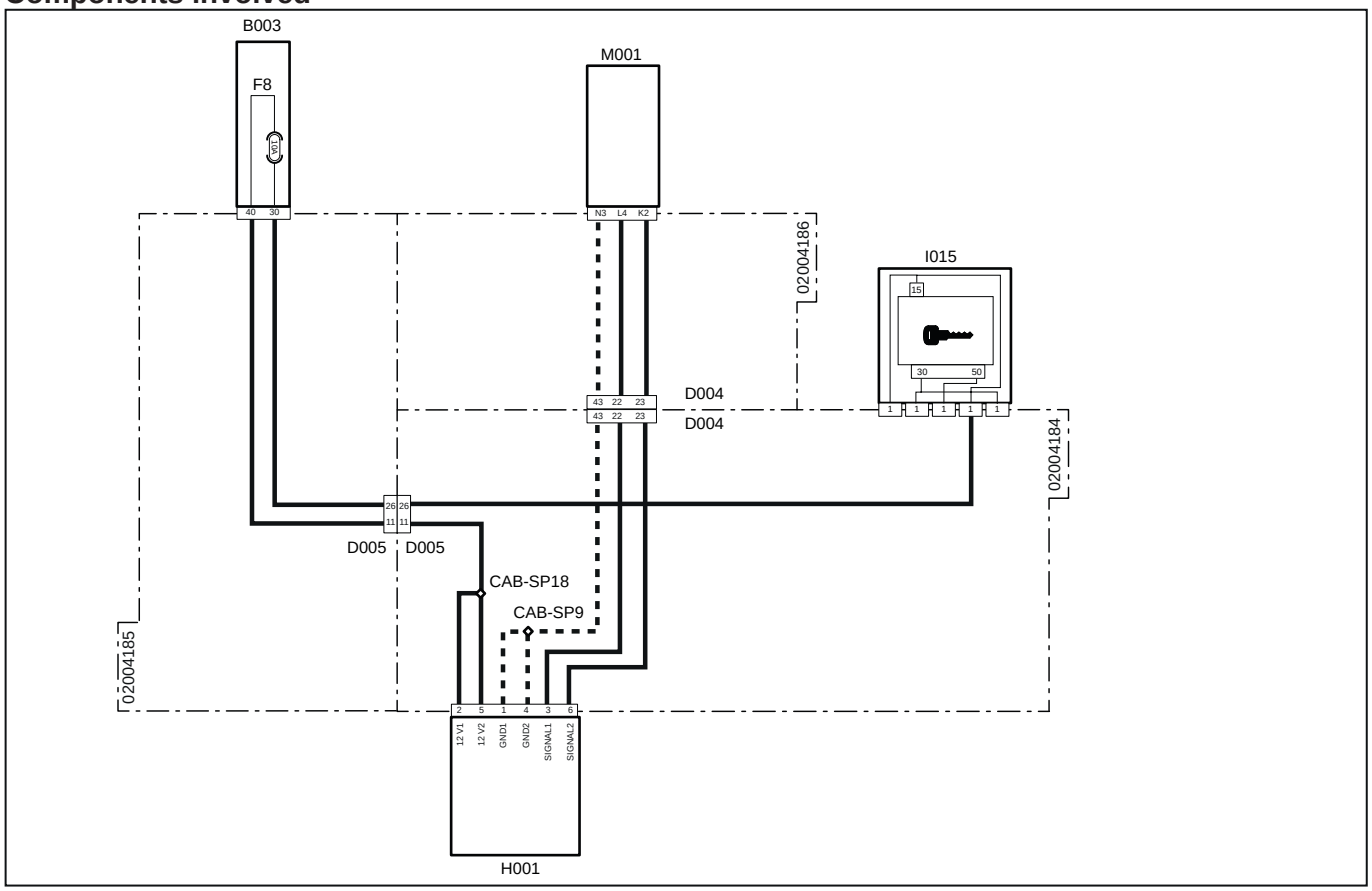
2 - Check if the potentiometer is working correctly and replace if necessary
- See the section "Components" for information on the functional states of the potentiometer
- Proceed to the next step if the component is working correctly

3 - Calibrate the foot throttle potentiometer (see the documentation of the diagnostic tool)
- Proceed to the next step if the component is calibrated correctly

4 - Check that the connectors of the potentiometer and of the vehicle control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect any badly connected connectors and reconnect correctly
- If all the connectors are connected correctly, proceed to the next step

5 - Use the diagnostic tool to check that the potentiometer is working correctly and that the signal is read correctly by the control unit (see documentation of diagnostic tool)

Components involved



System code	Source code	Description
D004(pag.390)	P30A	Wiring connector for main wiring loom
D004(pag.443)	P30B	Wiring connector for dashboard wiring loom
F8(B003) (pag.415)	F8	Turn indicators (10A)
H001(pag.397)	P100	Hand throttle
I015(pag.410)	P117,P118, P451,P455,P501	Ignition switch
M001(pag.449)	P80	Vehicle ECU

1023 - Throttle potentiometer: short circuit to ground

Description of fault

The control unit detects a short circuit to ground on the throttle potentiometer. Power feed voltage is less than 0.5 V

Severity of error

High

Additional information

Error codes 1024 or 1025 may also be displayed

STOP icon flashing. Switch the engine off immediately

Behaviour of system

The engine may be started but no throttle control is possible

Checks necessary

1 - Check the condition of the sensors/switched fuse (10A) and replace if necessary
- Disconnect the sensors/switches fuse (10A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

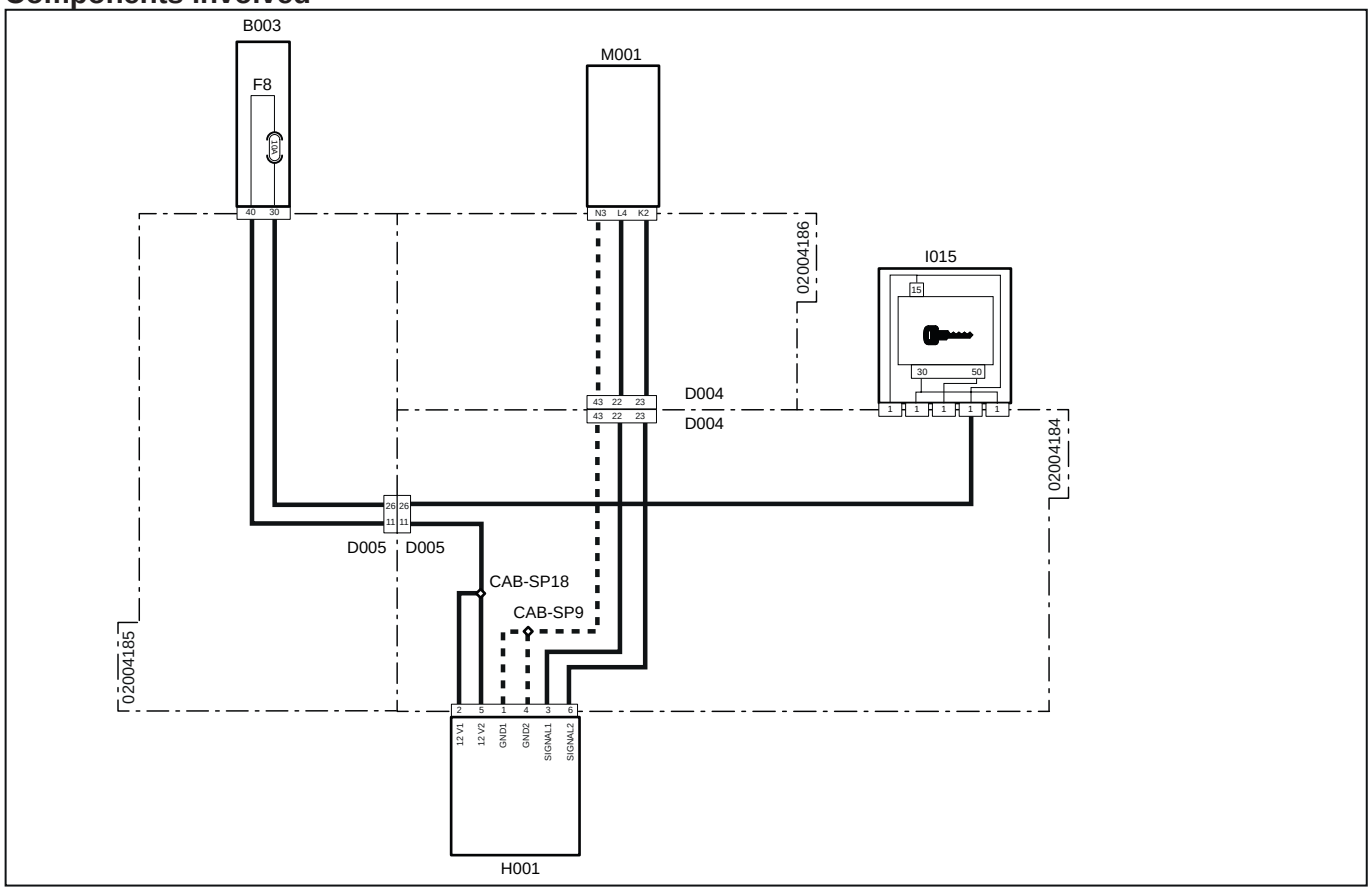
2 - Check if the potentiometer is working correctly and replace if necessary
- See the section "Components" for information on the functional states of the potentiometer
- Proceed to the next step if the component is working correctly

3 - Calibrate the foot throttle potentiometer (see the documentation of the diagnostic tool)
- Proceed to the next step if the component is calibrated correctly

4 - Check that the connectors of the potentiometer and of the vehicle control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect the connectors and reconnect correctly
- If all the connectors are fitted and connected correctly, proceed to the next step

5 - Use the diagnostic tool to check that the potentiometer is working correctly and that the signal is read correctly by the control unit (see documentation of diagnostic tool)

Components involved



System code	Source code	Description
D004(pag.390)	P30A	Wiring connector for main wiring loom
D004(pag.443)	P30B	Wiring connector for dashboard wiring loom
F8(B003) (pag.415)	F8	Turn indicators (10A)
H001(pag.397)	P100	Hand throttle
I015(pag.410)	P117,P118, P451,P455,P501	Ignition switch
M001(pag.449)	P80	Vehicle ECU

1024 - Signal 1 value not correct

Description of fault

The control unit detects that the value of signal 1 of the throttle potentiometer is not correct

Severity of error

High

Additional information

During calibration of the throttle potentiometer, a travel of at least 10% between the minimum and maximum positions must be detected. If not, the error code is generated. This may also occur if the potentiometer has not been calibrated

STOP icon flashing. Switch the engine off immediately

Behaviour of system

The engine may be started but no throttle control is possible

Checks necessary

1 - Check the condition of the sensors/switched fuse (10A) and replace if necessary
- Disconnect the sensors/switches fuse (10A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

2 - Check that the potentiometer receives a power feed voltage of 12V
- This may be done with a tester.
- Proceed to the next step if the component is powered correctly

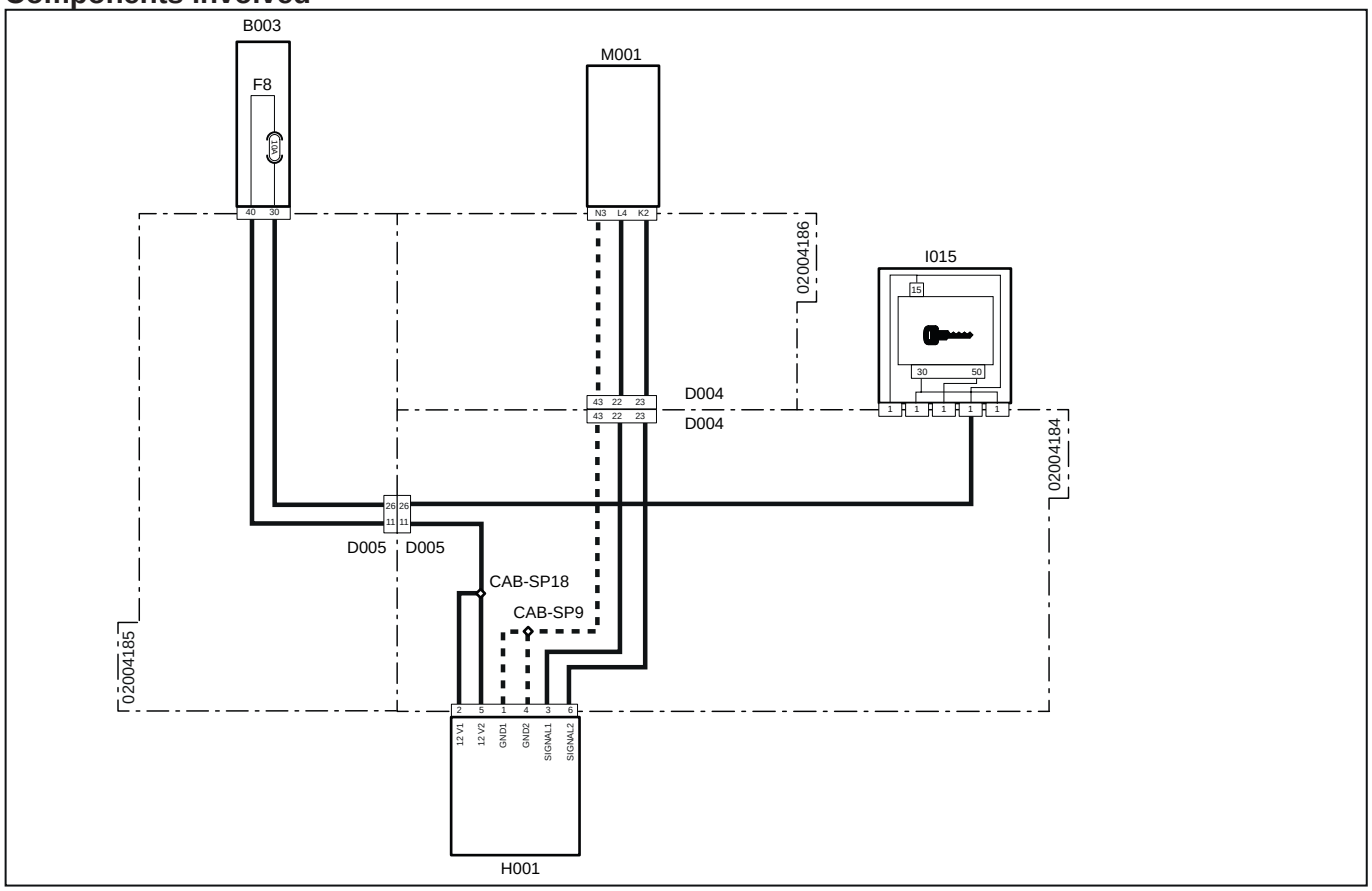
3 - Check if the potentiometer is working correctly and replace if necessary
- See the section "Components" for information on the functional states of the potentiometer
- Proceed to the next step if the component is working correctly

4 - Calibrate the foot throttle potentiometer (see the documentation of the diagnostic tool)
- Proceed to the next step if the component is calibrated correctly

5 - Check that the connectors of the potentiometer and of the vehicle control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect the connectors and reconnect correctly
- If all the connectors are fitted and connected correctly, proceed to the next step

6 - Use the diagnostic tool to check that the potentiometer is working correctly and that the signal is read correctly by the control unit (see documentation of diagnostic tool)

Components involved



System code	Source code	Description
D004(pag.390)	P30A	Wiring connector for main wiring loom
D004(pag.443)	P30B	Wiring connector for dashboard wiring loom
F8(B003) (pag.415)	F8	Turn indicators (10A)
H001(pag.397)	P100	Hand throttle
I015(pag.410)	P117,P118, P451,P455,P501	Ignition switch
M001(pag.449)	P80	Vehicle ECU

1025 - Signal 2 value not correct

Description of fault

The control unit detects that the value of signal 2 of the throttle potentiometer is not correct

Severity of error

High

Additional information

During calibration of the throttle potentiometer, a travel of at least 10% between the minimum and maximum positions must be detected. If not, the error code is generated. This may also occur if the potentiometer has not been calibrated

STOP icon flashing. Switch the engine off immediately

Behaviour of system

The engine may be started but no throttle control is possible

Checks necessary

1 - Check the condition of the sensors/switched fuse (10A) and replace if necessary
- Disconnect the sensors/switches fuse (10A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

2 - Check that the potentiometer receives a power feed voltage of 12V
- This may be done with a tester.

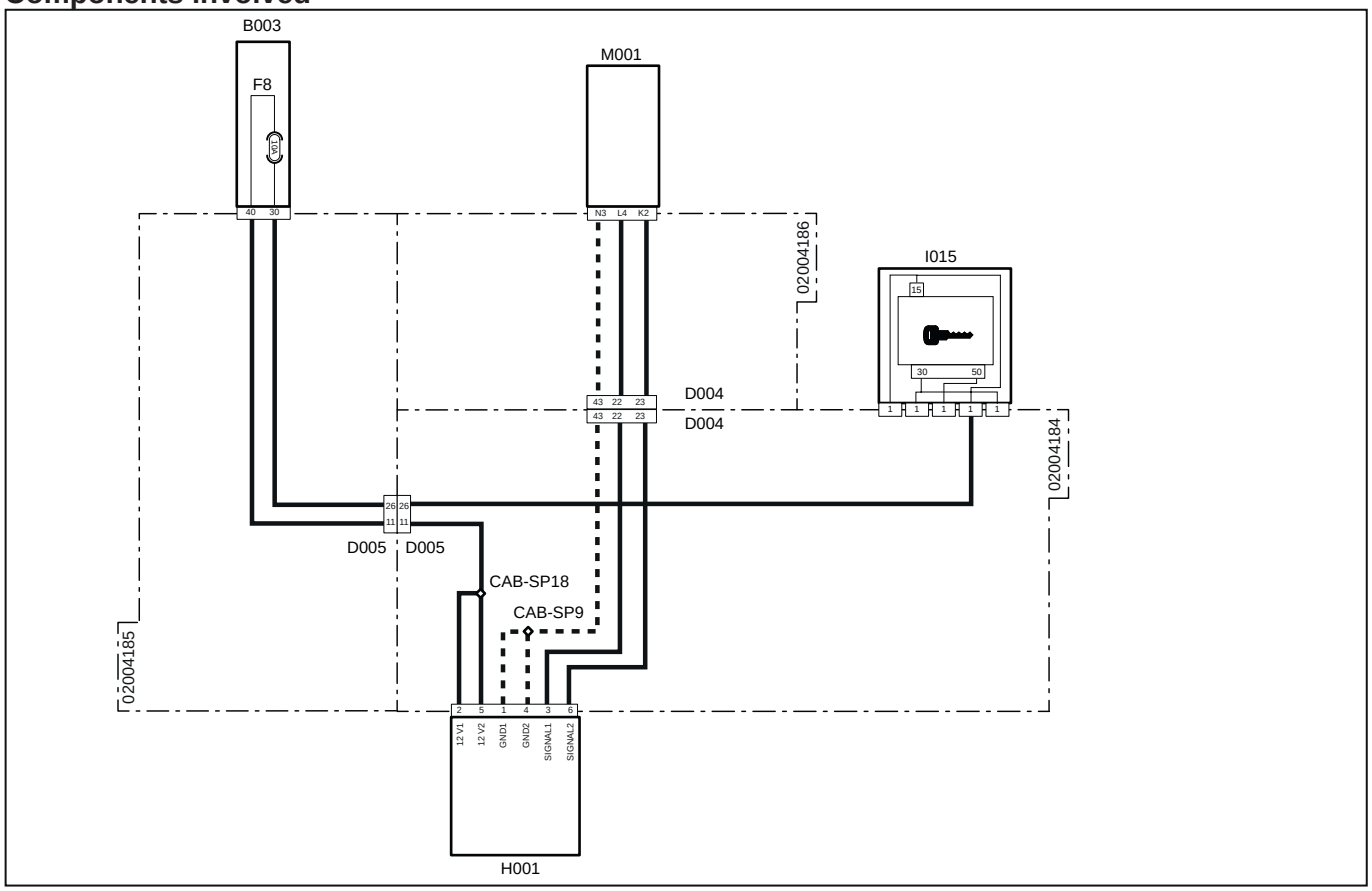
3 - Check if the potentiometer is working correctly and replace if necessary
- See the section "Components" for information on the functional states of the potentiometer
- Proceed to the next step if the component is working correctly

4 - Calibrate the foot throttle potentiometer (see the documentation of the diagnostic tool)
- Proceed to the next step if the component is calibrated correctly

5 - Check that the connectors of the potentiometer and of the vehicle control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect the connectors and reconnect correctly
- If all the connectors are fitted and connected correctly, proceed to the next step

6 - Use the diagnostic tool to check that the potentiometer is working correctly and that the signal is read correctly by the control unit (see documentation of diagnostic tool)

Components involved



System code	Source code	Description
D004(pag.390)	P30A	Wiring connector for main wiring loom
D004(pag.443)	P30B	Wiring connector for dashboard wiring loom
F8(B003) (pag.415)	F8	Turn indicators (10A)
H001(pag.397)	P100	Hand throttle
I015(pag.410)	P117,P118, P451,P455,P501	Ignition switch
M001(pag.449)	P80	Vehicle ECU

1026 - Invalid operated seated sensor state

Description of fault

The control unit detects that the operator seated sensor is disconnected or malfunctioning

Severity of error

High

Additional information

STOP icon flashing. Switch the engine off immediately

Behaviour of system

Once the tractor is switched off, it will no longer be possible to switch it on again

Checks necessary

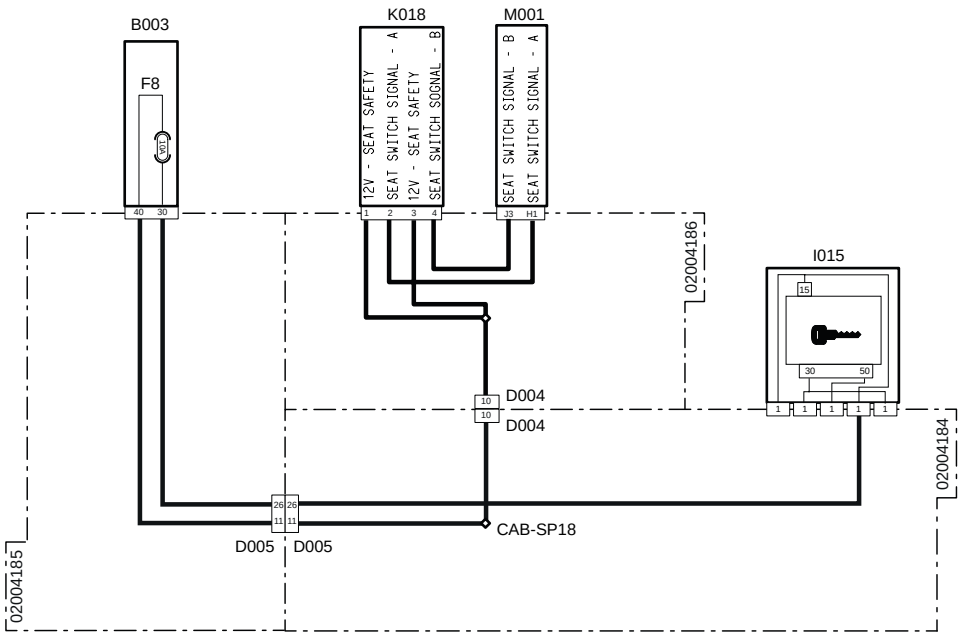
1 - Check the condition of the sensors/switched fuse (10A) and replace if necessary
- Disconnect the sensors/switches fuse (10A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

2 - Check that the sensor receives a power feed voltage of 12V
- This may be done with a tester.
- Proceed to the next step if the sensor is powered correctly

3 - Check if the sensor is working correctly and replace if necessary
- See the section "Components" for information on the functional states of the sensor
- Proceed to the next step if the sensor is working correctly

4 - Check that the connectors of the potentiometer and of the vehicle control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect the badly connected connectors and reconnect correctly

Components involved



System code	Source code	Description
D004(pag.390)	P30A	Wiring connector for main wiring loom
D004(pag.443)	P30B	Wiring connector for dashboard wiring loom
D005(pag.398)	P100B	Wiring connector for engine wiring loom
D005(pag.400)	P100A	Wiring connector for dashboard wiring loom
I015(pag.410)	P117,P118, P451,P455,P501	Ignition switch
K018(pag.452)	P107	Seat start enable signal
M001(pag.449)	P80	Vehicle ECU

1027 - Failed engine start

Description of fault

The control unit detects a condition lasting more than 2 seconds in which the start relay contact is closed but the engine does not start

Severity of error

High

Additional information

STOP icon flashing. Switch the engine off immediately

Behaviour of system

Tractor does not start

Checks necessary

1 - Check that the start relay is connected correctly

- the relay may be tested with a tester.
- Proceed to the next step if the component is connected correctly

2 - Check that the starter motor is connected correctly

- Proceed to the next step if the component is connected correctly

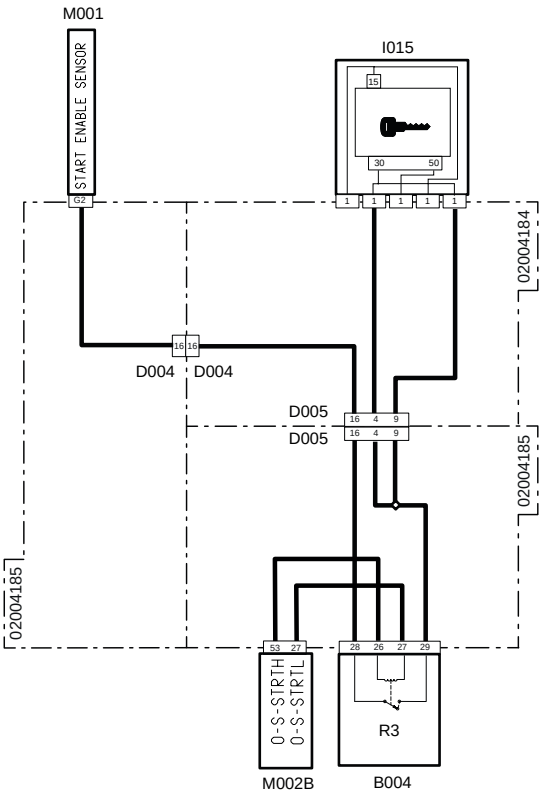
3 - Check if the components are working correctly and replace if necessary

- See the section "Components" for information on the functional states of the start system components
- Proceed to the next step if the components are working correctly

4 - Check the peak battery voltage during starting

- the voltage may be measured with a tester.

Components involved



System code	Source code	Description
D004(pag.390)	P30A	Wiring connector for main wiring loom
D004(pag.443)	P30B	Wiring connector for dashboard wiring loom
D005(pag.398)	P100B	Wiring connector for engine wiring loom
D005(pag.400)	P100A	Wiring connector for dashboard wiring loom
I015(pag.410)	P117,P118, P451,P455,P501	Ignition switch
M001(pag.449)	P80	Vehicle ECU
M002B(pag.423)	P12	Engine control unit
R3(B004) (pag.418)	R3	Start relay (20A)

1028 - Diverter solenoid valve current not within permitted range

Description of fault

The control unit detects a short circuit to ground or an open circuit state on the diverter solenoid valve. The signal current is above 2400 mA

Severity of error

High

Additional information

STOP icon flashing. Switch the engine off immediately

Behaviour of system

The engine may be started but the diverter cannot be used

Checks necessary

1 - Check the condition of the horn - socket - rotating beacon fuse (20A) and replace if necessary
- Disconnect the horn - socket - rotating beacon fuse (20A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

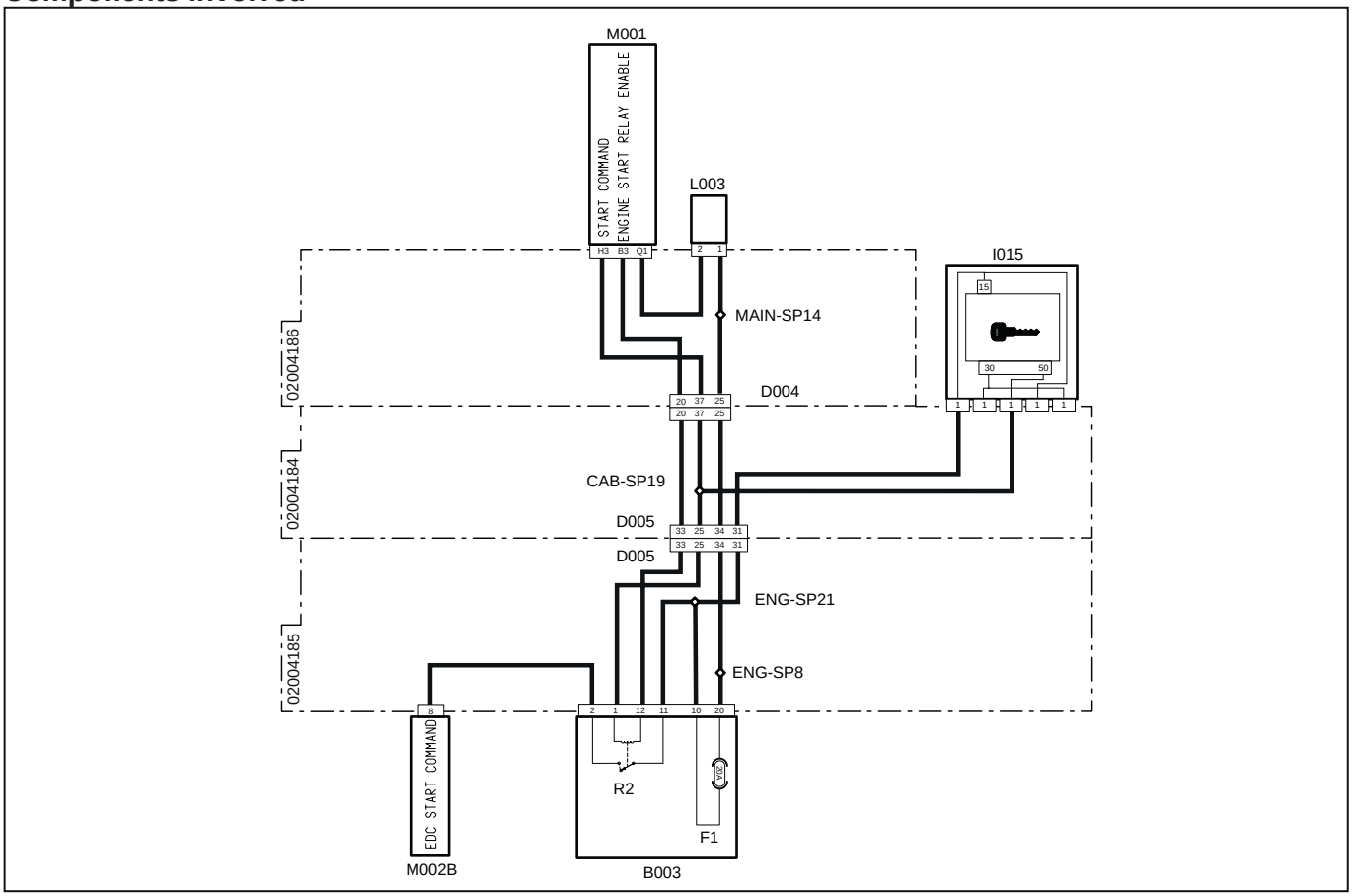
2 - Check if the diverter solenoid valve is working correctly and replace if necessary
- See the section "Components" for information on the functional states of the solenoid valve

3 - Check that the connectors of the diverter solenoid valve and of the vehicle control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect the badly connected connectors and reconnect correctly
- If all the connectors are fitted and connected correctly, proceed to the next step

4 - Use the diagnostic tool to check that the diverter solenoid valve is working correctly and that the signal is read correctly by the control unit (see documentation of diagnostic tool)

5 - Replace the vehicle control unit if the problem persists

Components involved



System code	Source code	Description
D004(pag.390)	P30A	Wiring connector for main wiring loom
D004(pag.443)	P30B	Wiring connector for dashboard wiring loom
D005(pag.398)	P100B	Wiring connector for engine wiring loom
D005(pag.400)	P100A	Wiring connector for dashboard wiring loom
F1(B003) (pag.415)	F1	Socket - Rotating beacon (20A)
I015(pag.410)	P117,P118, P451,P455,P501	Ignition switch
L003(pag.455)	P188	"Diverter" solenoid valve
M001(pag.449)	P80	Vehicle ECU
M002B(pag.423)	P12	Engine control unit
R2(B003) (pag.415)	R1	Start enable relay

1029 - Diverter solenoid valve current not within permitted range

Description of fault

The control unit detects a short circuit to ground or an open circuit state on the diverter solenoid valve. The signal current is below 75 mA

Severity of error

High

Additional information

STOP icon flashing. Switch the engine off immediately

Behaviour of system

The engine may be started but the diverter cannot be used

Checks necessary

1 - Check the condition of the horn - socket - rotating beacon fuse (20A) and replace if necessary
- Disconnect the horn - socket - rotating beacon fuse (20A)
- Replace the fuse if it is blown
- Proceed to the next step if the fuse is in working order

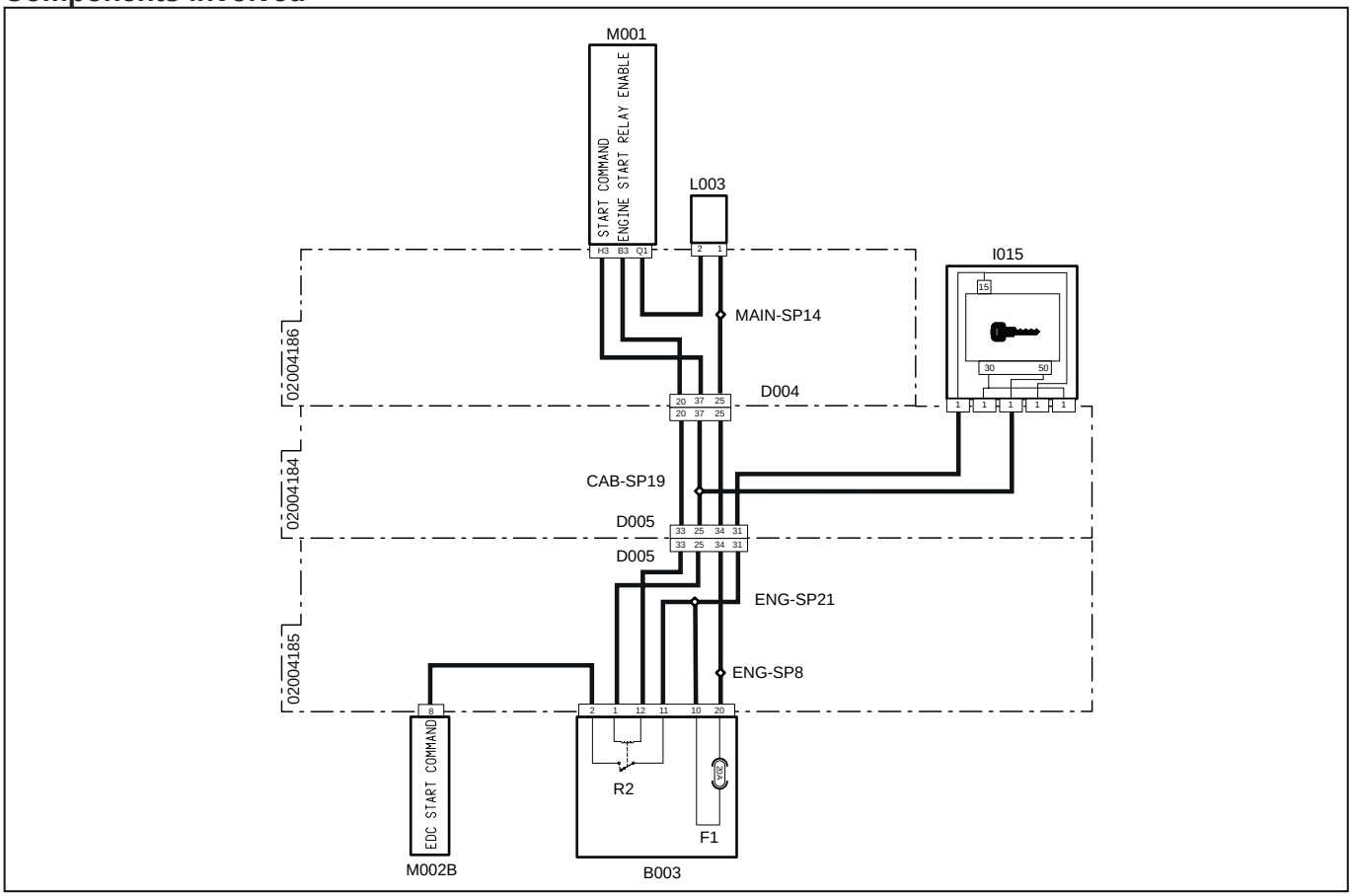
2 - Check if the diverter solenoid valve is working correctly and replace if necessary
- See the section "Components" for information on the functional states of the solenoid valve

3 - Check that the connectors of the diverter solenoid valve and of the vehicle control unit, and any intermediate interface connectors, are fitted and connected correctly
- Disconnect the badly connected connectors and reconnect correctly
- If all the connectors are fitted and connected correctly, proceed to the next step

4 - Use the diagnostic tool to check that the diverter solenoid valve is working correctly and that the signal is read correctly by the control unit (see documentation of diagnostic tool)

5 - Replace the vehicle control unit if the problem persists

Components involved



System code	Source code	Description
D004(pag.390)	P30A	Wiring connector for main wiring loom
D004(pag.443)	P30B	Wiring connector for dashboard wiring loom
D005(pag.398)	P100B	Wiring connector for engine wiring loom
D005(pag.400)	P100A	Wiring connector for dashboard wiring loom
F1(B003) (pag.415)	F1	Socket - Rotating beacon (20A)
I015(pag.410)	P117,P118, P451,P455,P501	Ignition switch
L003(pag.455)	P188	"Diverter" solenoid valve
M001(pag.449)	P80	Vehicle ECU
M002B(pag.423)	P12	Engine control unit
R2(B003) (pag.415)	R1	Start enable relay

1032 - Alternator not charging

Description of fault

The vehicle control unit (VCU) detects an excessively low alternator voltage (below 2 V) or a short circuit to ground

Severity of error

High

Additional information

STOP icon flashing. Switch the engine off immediately

Behaviour of system

An alternator malfunction may cause a loss of tractor power and subsequent engine cut-out due to a drained battery

Checks necessary

1 - Check battery charge

- the state of charge of the battery may be checked with a tester or with the diagnostic tool.
- Recharge the battery if drained, or replace if necessary
- Proceed to the next step if the battery is charged correctly

2 - Check the condition of the alternator and that it is working correctly

- the alternator may be tested with a tester.
- Replace the alternator if is not working correctly
- Proceed to the next step if the alternator is working correctly

3 - Replace the components if necessary.

Components involved

Alternator
Battery

1033 - Anti-tampering function

Description of fault

The VCU control unit detects that the parameters transmitted to the engine control unit are not the real parameters

Severity of error

High

Additional information

This error prevents installation of an control unit for a different power output than intended for the vehicle

STOP icon flashing. Switch the engine off immediately

Behaviour of system

An alternator malfunction may cause a loss of tractor power and subsequent engine cut-out due to a drained battery

Checks necessary

1 - Contact the technical support service

1034 - Vehicle control unit not calibrated

Description of fault

The vehicle control unit has not been calibrated correctly

Severity of error

High

Additional information

STOP icon flashing. Switch the engine off immediately

Behaviour of system

The instrument panel switches on but the engine cannot be started

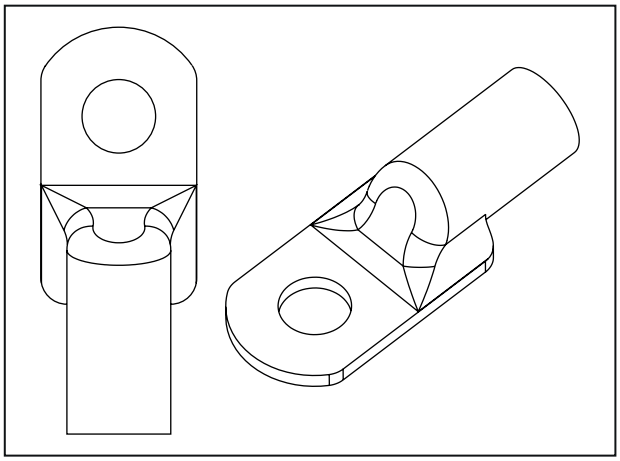
Checks necessary

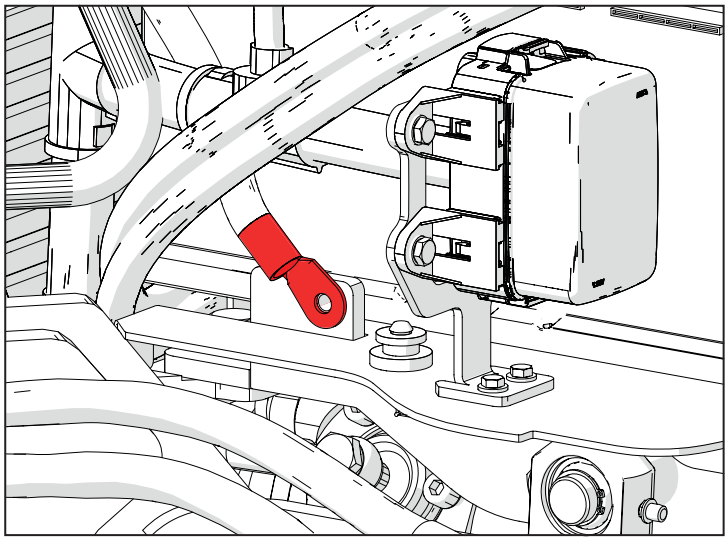
1 - Use the diagnostic tool to calibrate the vehicle control unit (see the documentation of the diagnostic tool)

Connector List

A001 (P11) Negative battery terminal

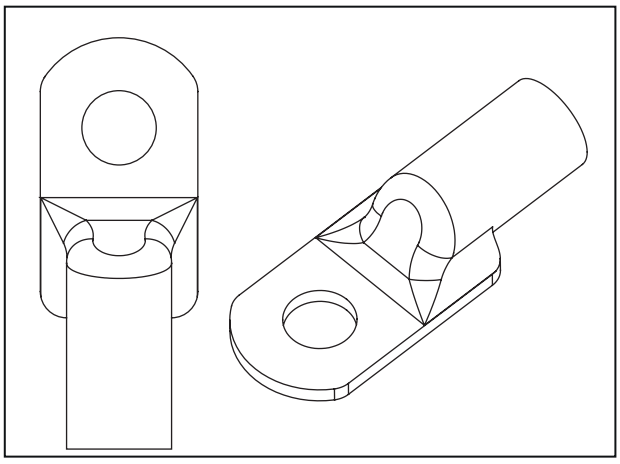
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	B-GND	BK	50	P66	1

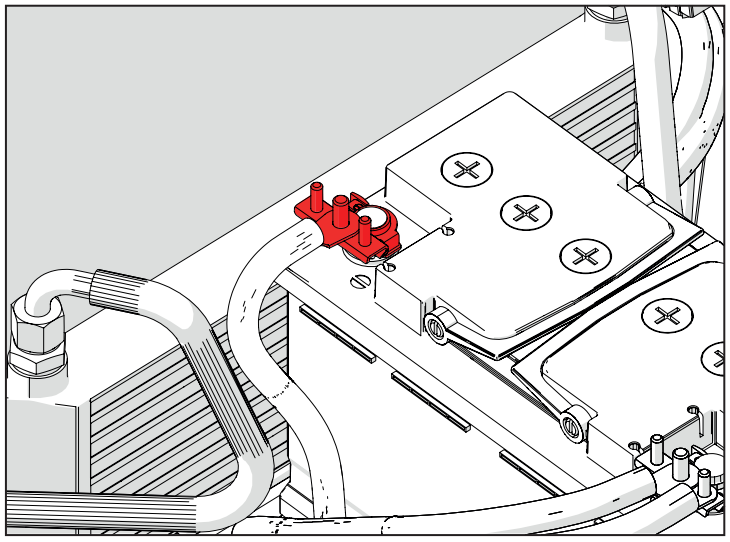




C001 (P66) Battery ground

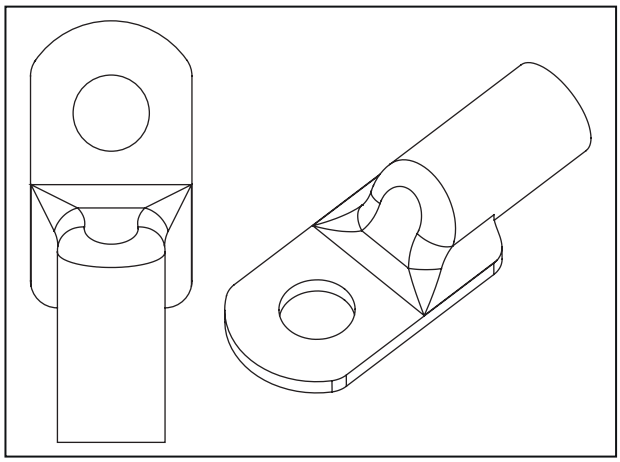
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	B-GND	BK	50	P66	1

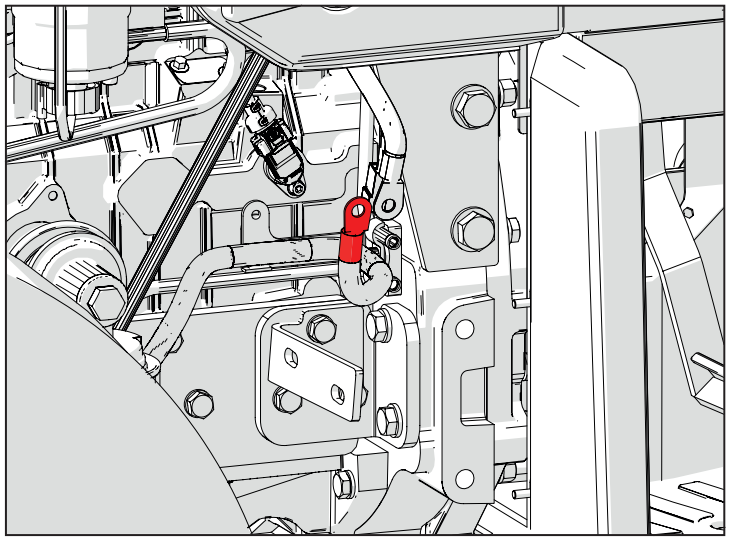




I001 (P39) Battery master switch (input terminal)

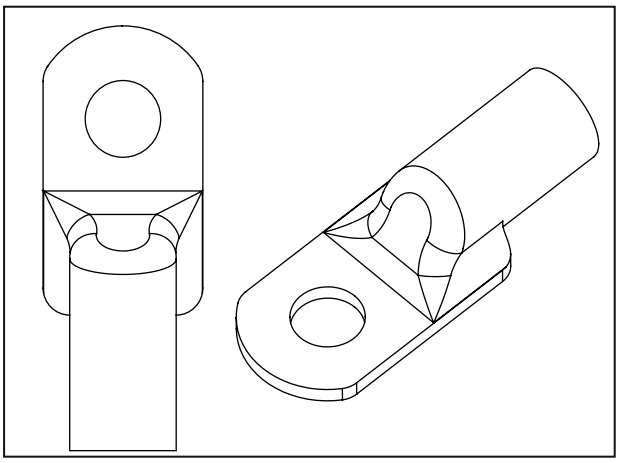
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	BATTERY POSITIVE	Rd	50	P55	1

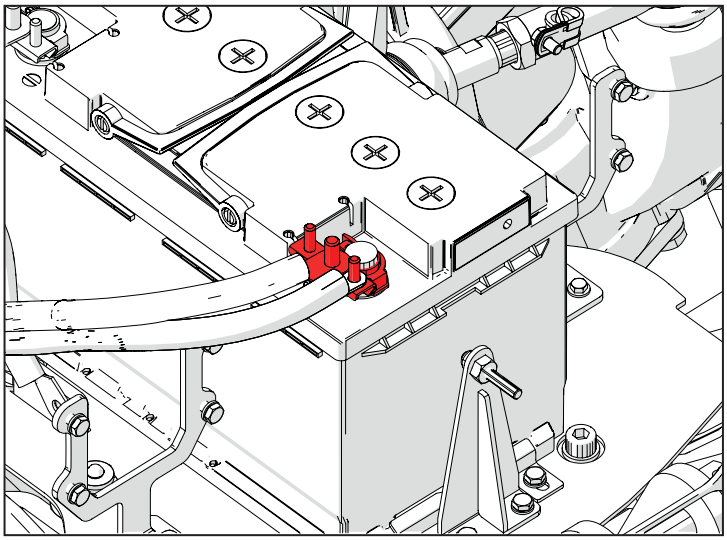




A002 (P55) Positive battery terminal

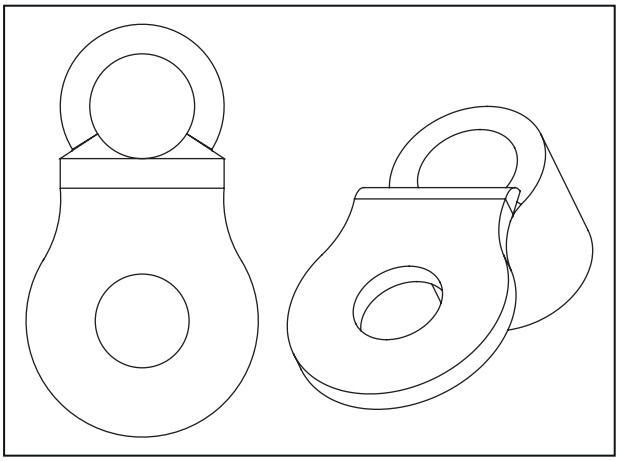
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	BATTERY POSITIVE	Rd	50	P39	1

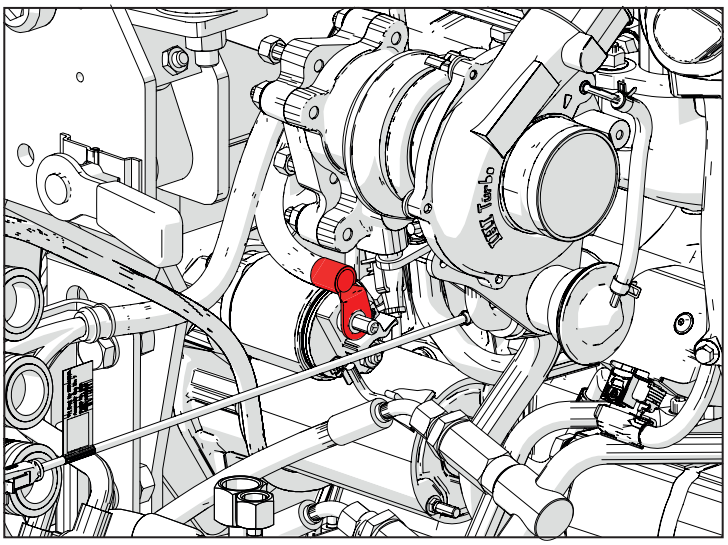




N001 (P10) Starter motor "30"

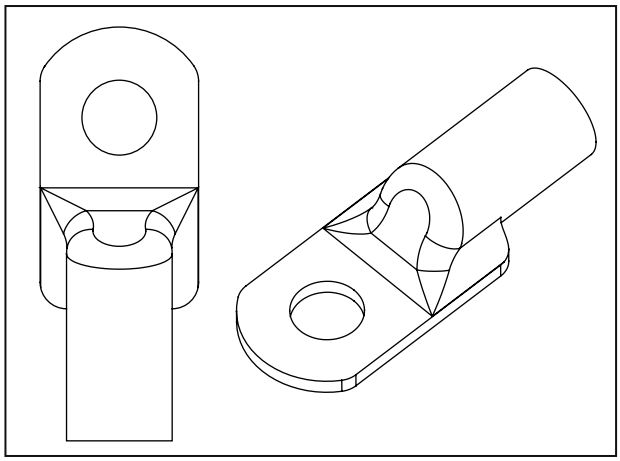
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	STARTER MOTOR INPUT	Rd	50	P23	1

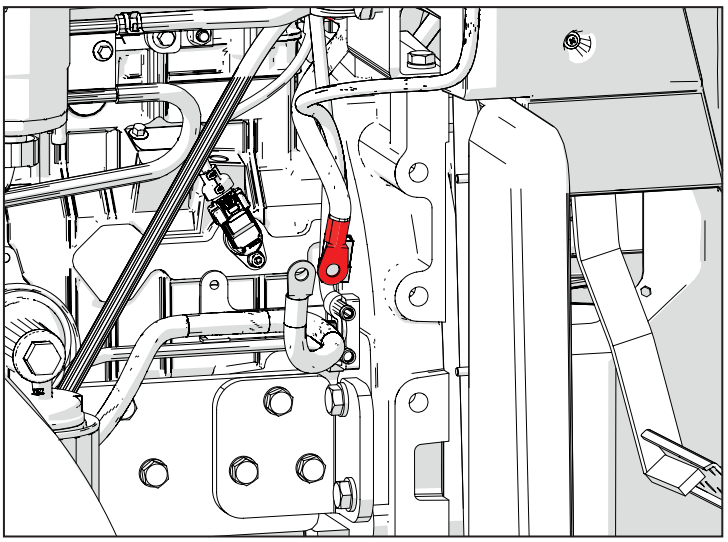




I002 (P23) Battery master switch (output terminal)

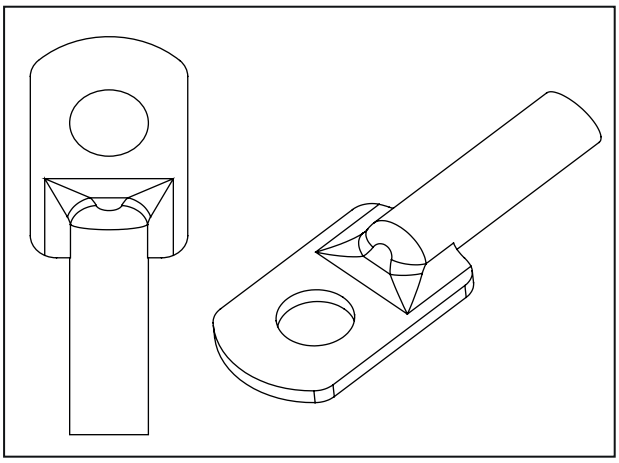
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	STARTER MOTOR INPUT	Rd	50	P10	1

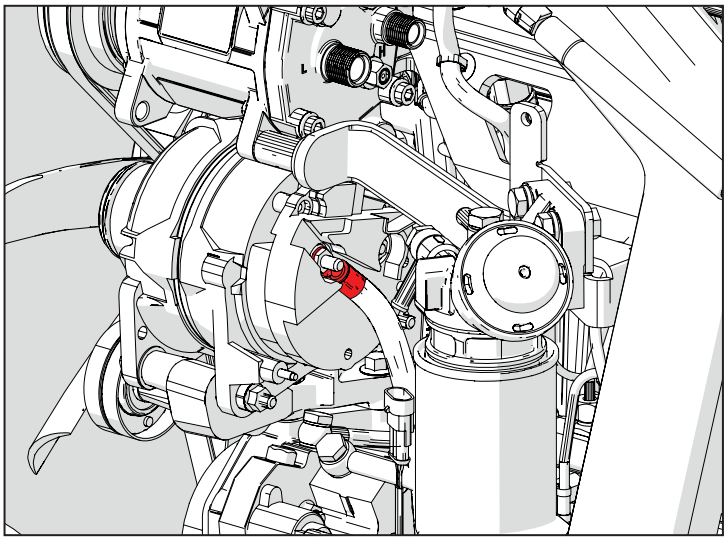




A003 (P64) Alternator "B+"

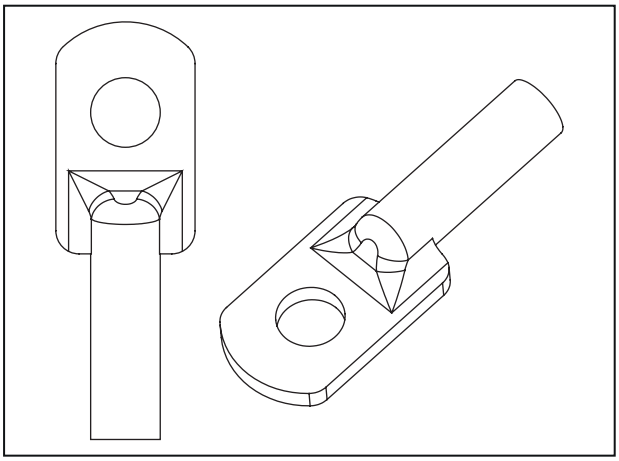
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	ALTERNATOR POWER FEED	Rd	25	P65	1

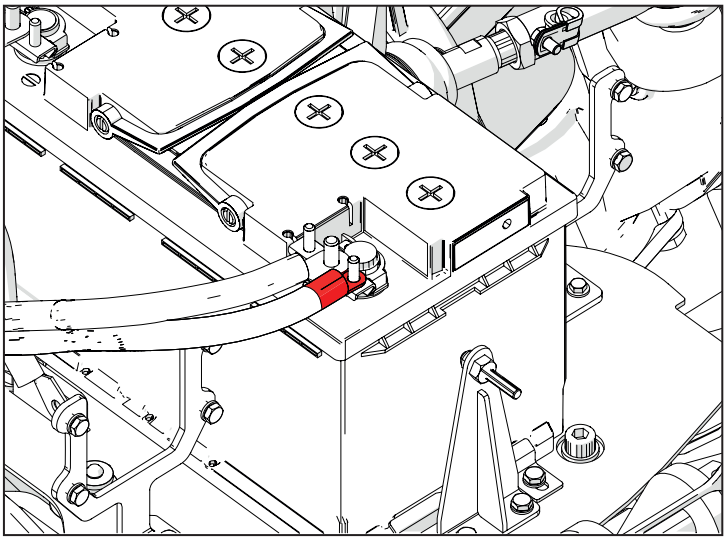




A004 (P65) Negative battery terminal

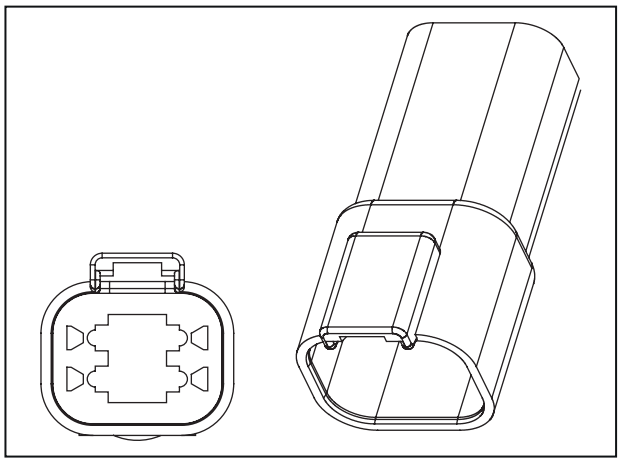
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	ALTERNATOR POWER FEED	Rd	25	P65	1

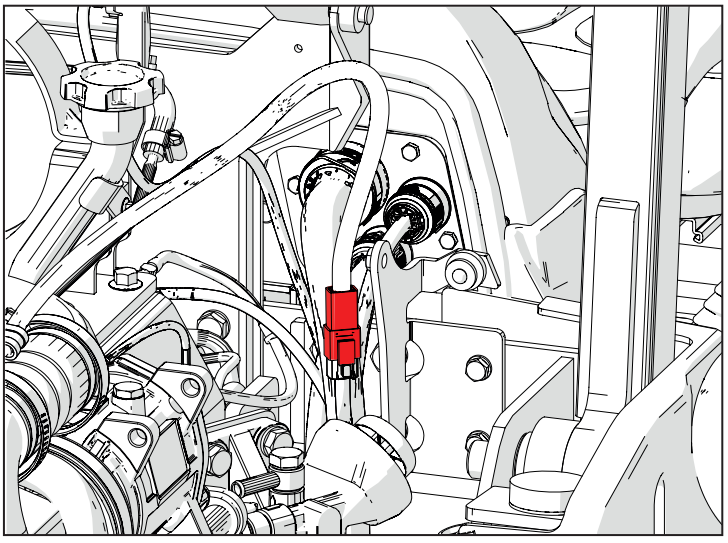




D001 (P20B) Wiring connector for engine wiring loom

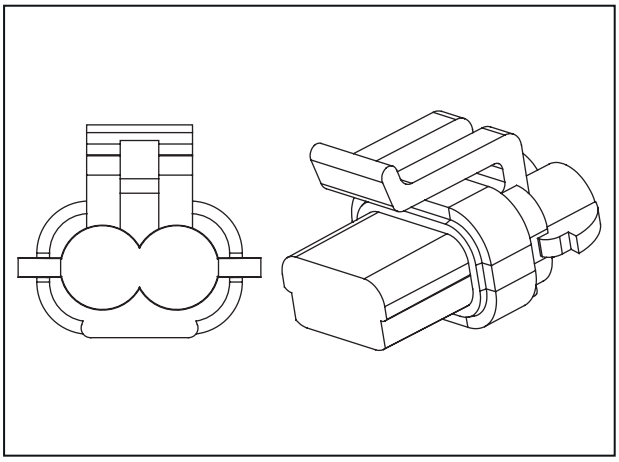
Pin	Description	Colour	Sect.	Input Conn.	Pin
4	FRONT LIGHTS GND	BK	1.5	HOOD-SP1	PIN1
2	NORMAL BEAM LIGHT RH	Pu	1	P204	1
3	NORMAL BEAM LIGHT LH	Pu	1	P206	1
1	HIGH BEAM LIGHTS	Pu	1.5	HOOD-SP2	PIN1

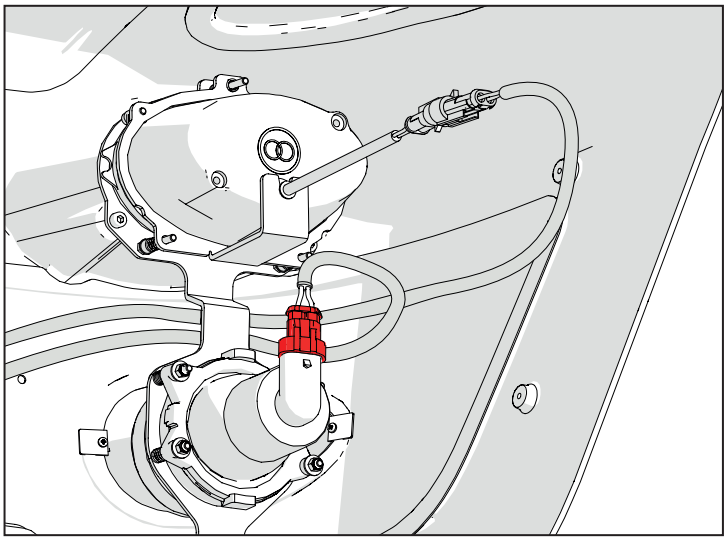




F001 (P203) RH high beam

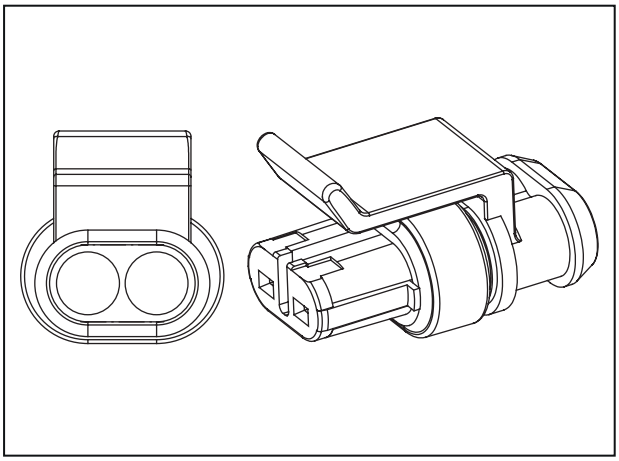
Pin	Description	Colour	Sect.	Input Conn.	Pin
2	GND	BK	1	HOOD-SP1	PIN1
2	RH HIGH BEAM LIGHT	Pu	1	HOOD-SP2	PIN1

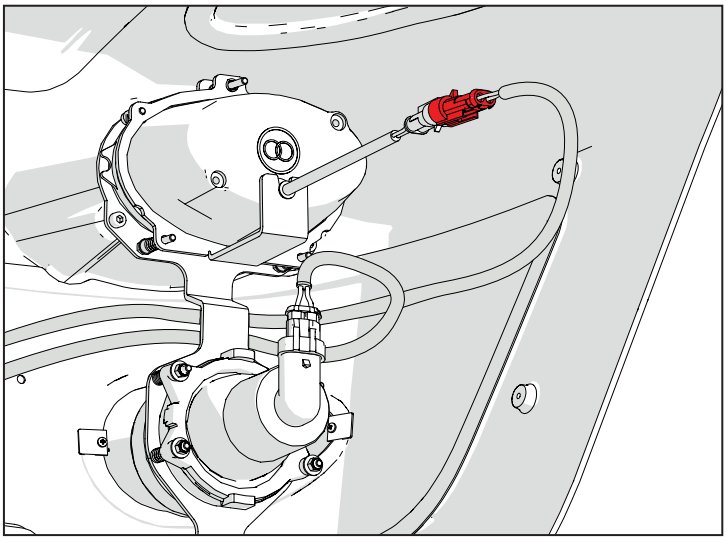




F002 (P204) RH low beam

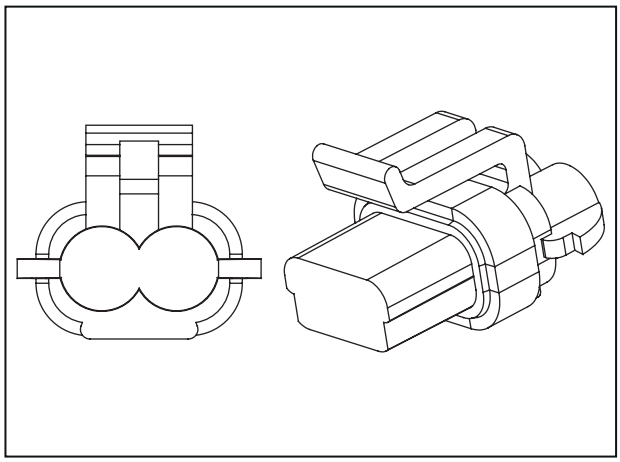
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	NORMAL BEAM LIGHT RH	Pu	1	P20B	2
2	GND	BK	1	HOOD-SP1	PIN1

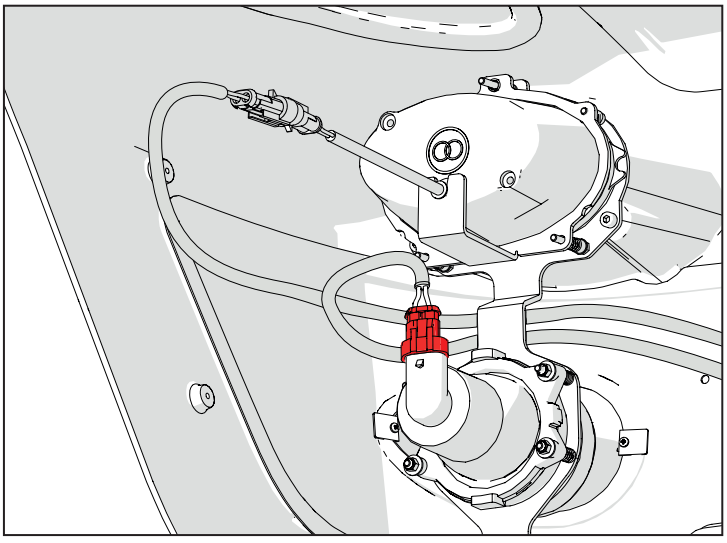




F003 (P205) LH high beam

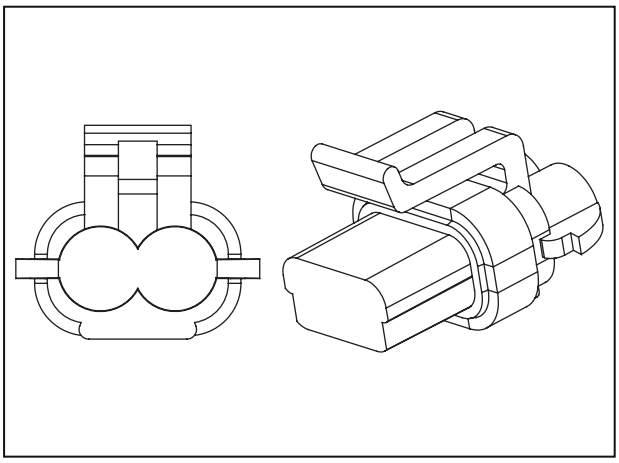
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	LH HIGH BEAM LIGHT	Pu	1	HOOD-SP2	PIN1
2	GND	BK	1	HOOD-SP1	PIN1

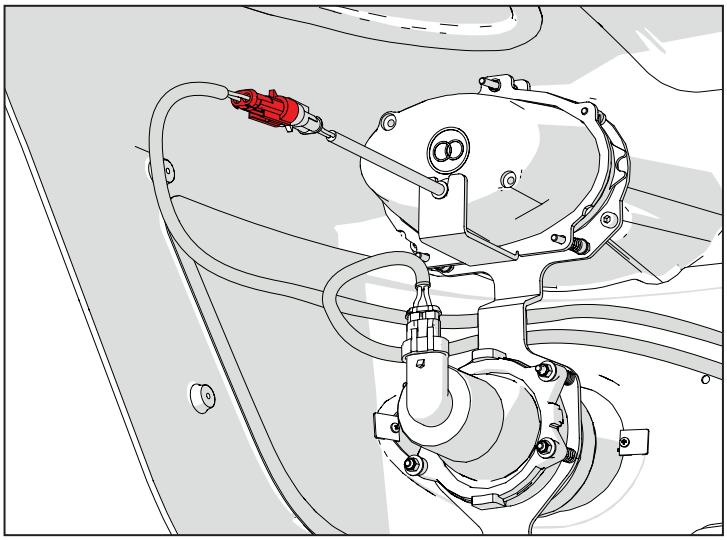




F004 (P206) LH low beam

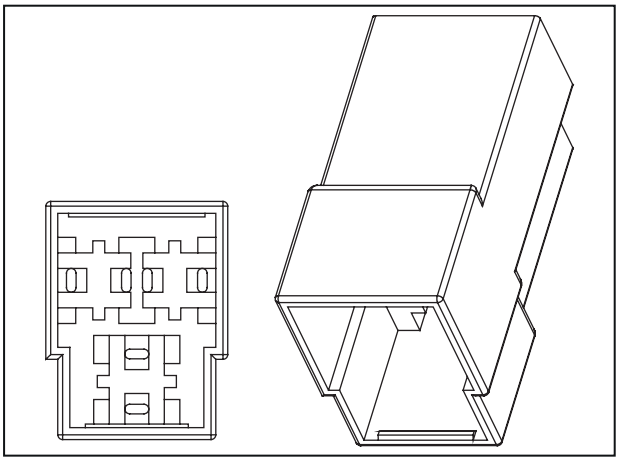
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	NORMAL BEAM LIGHT LH	Pu	1	P20B	3
2	GND	BK	1	HOOD-SP1	PIN1

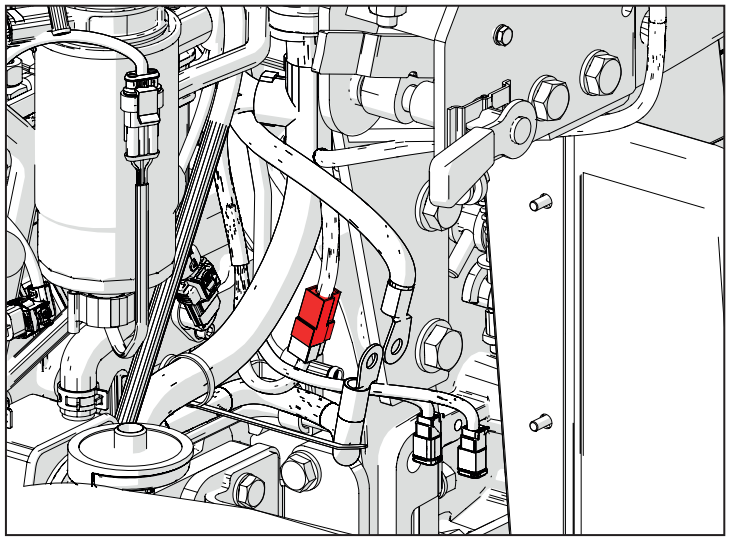




D002 (P40A) Wiring connector for engine wiring loom

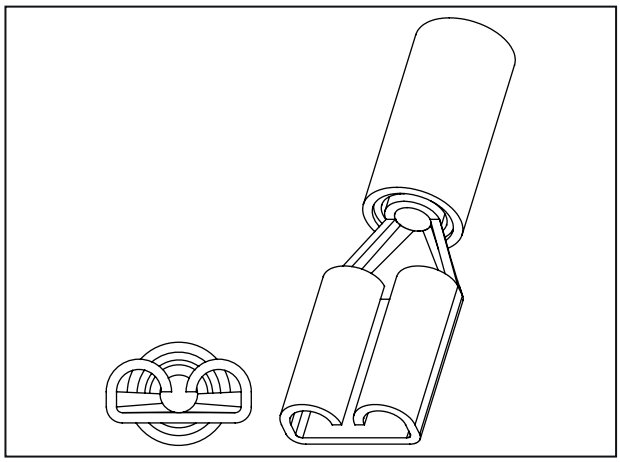
Pin	Description	Colour	Sect.	Input Conn.	Pin
2	FUEL LEVEL SENSOR	Bu	0.5	P80	K1
3	GND	BK	0.5	P80	N2
1	LEFT INDICATOR LIGHTS	Bu	0,75	P424	1

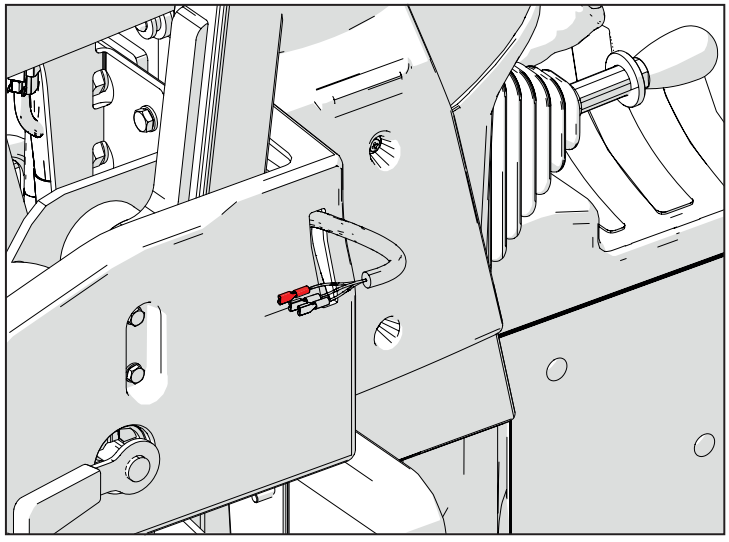




F005 (P423) Park light

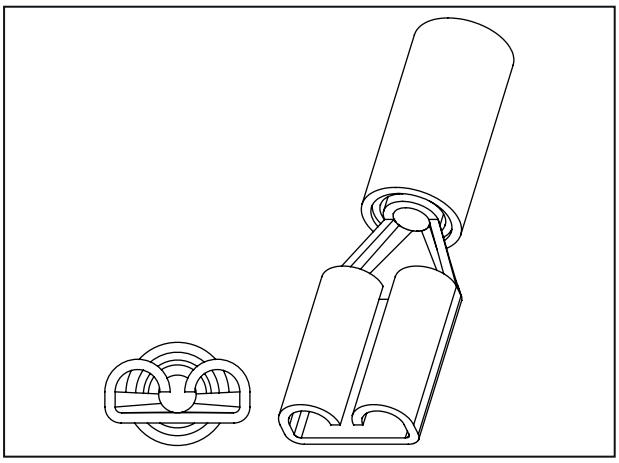
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	PARKING LIGHTS LH	Ye	0,75	P40A	2

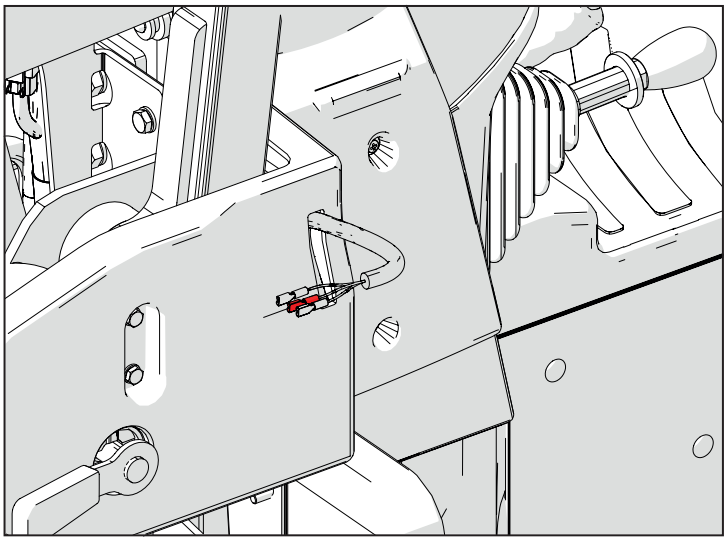




E001 (P424) LH turn indicator

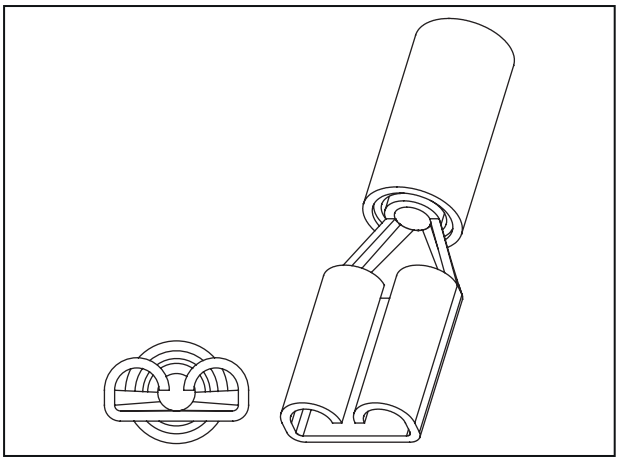
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	LEFT INDICATOR LIGHTS	Bu	0,75	P40A	1

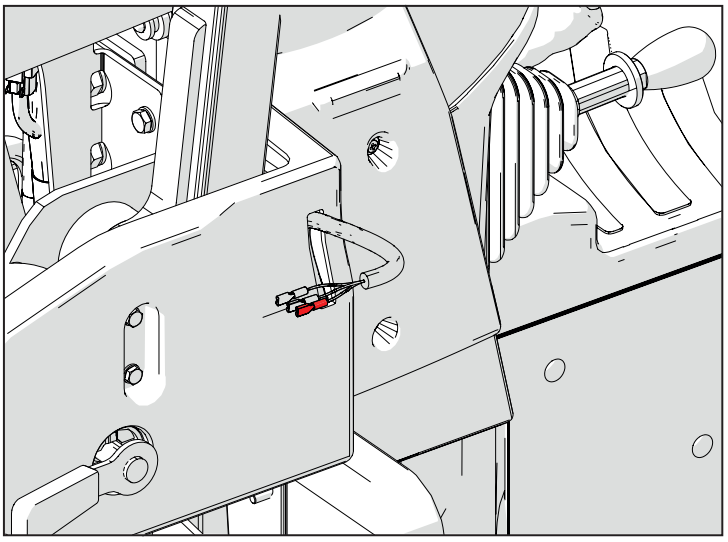




F006 (P425) Mudguard light

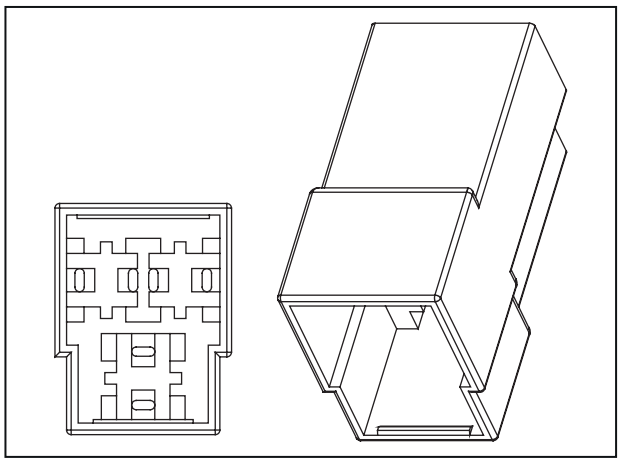
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	LH FENDER LIGHTS GND	BK	0,75	P40A	3

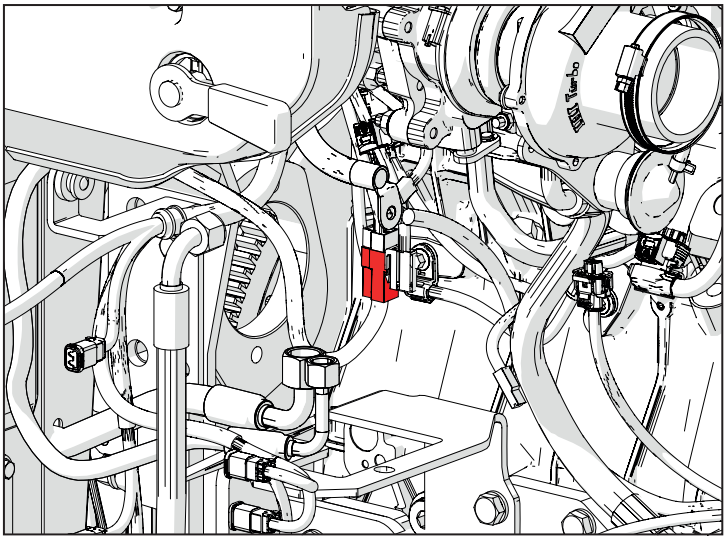




D003 (P50A) Wiring connector for engine wiring loom

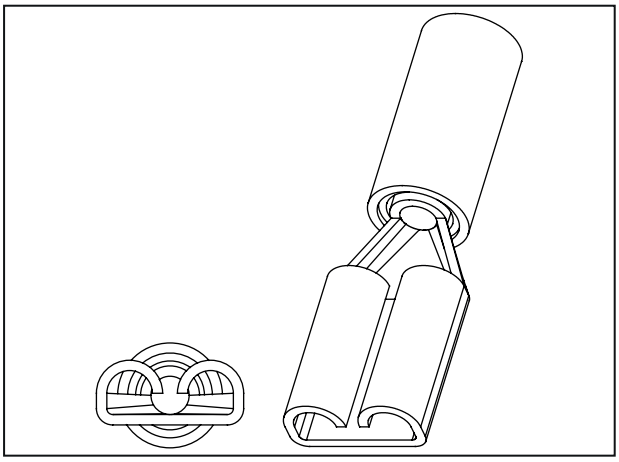
Pin	Description	Colour	Sect.	Input Conn.	Pin
3	RH FENDER LIGHTS GND	BK	0,75	P429	1
1	RIGHT INDICATOR LIGHTS	Bu	0,75	P428	1
2	PARKING LIGHTS	Ye	1	P426	1

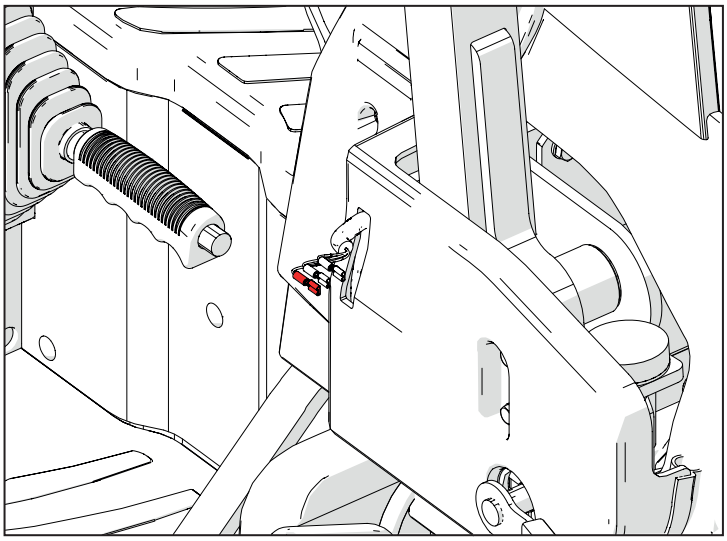




F007 (P426) Park light

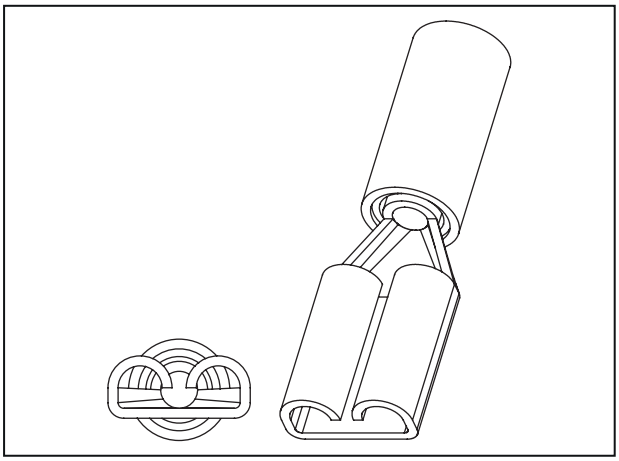
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	PARKING LIGHTS	Ye	1	P50A	2

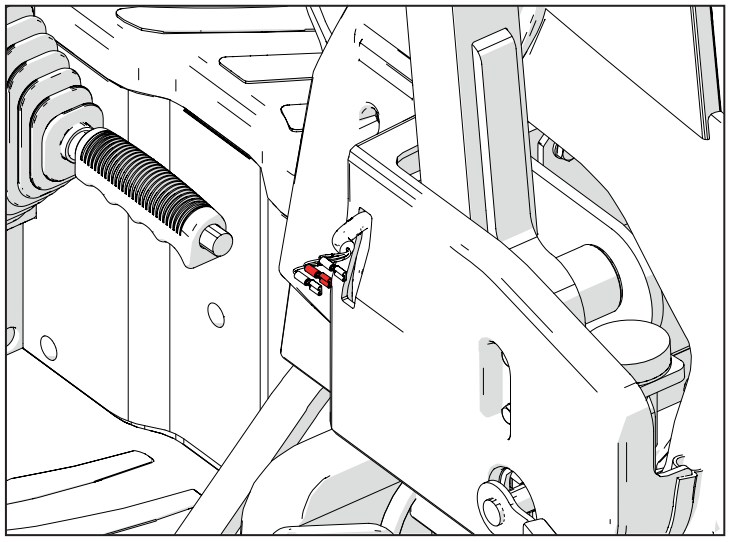




E002 (P428) RH turn indicator

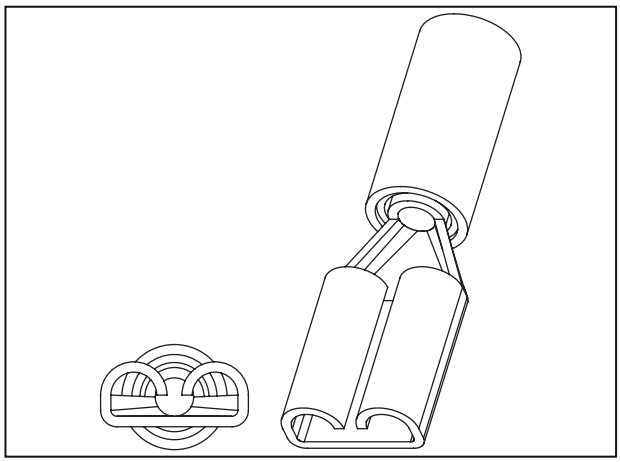
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	RIGHT INDICATOR LIGHTS	Bu	0,75	P50A	1

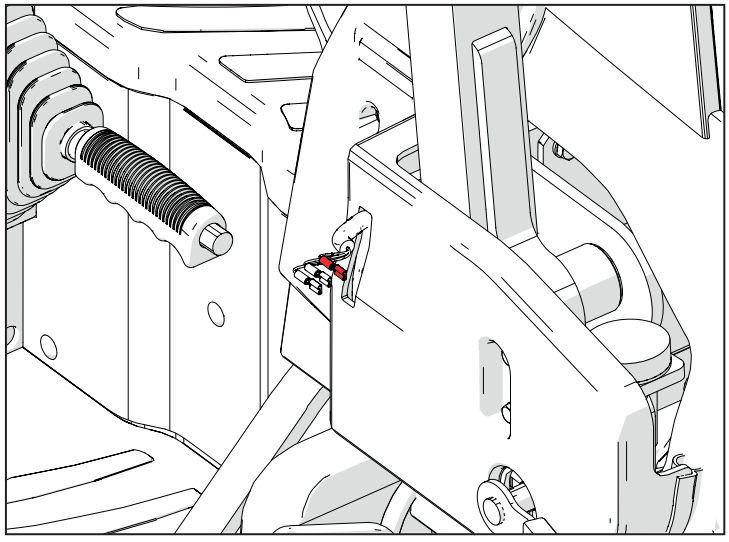




F008 (P429) Mudguard light

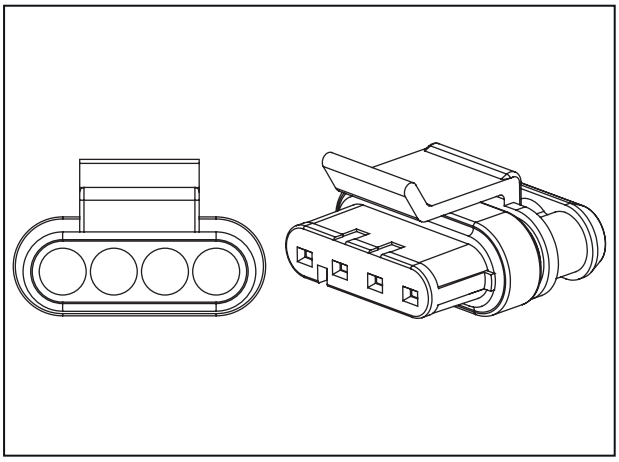
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	RH FENDER LIGHTS GND	BK	0,75	P50A	3

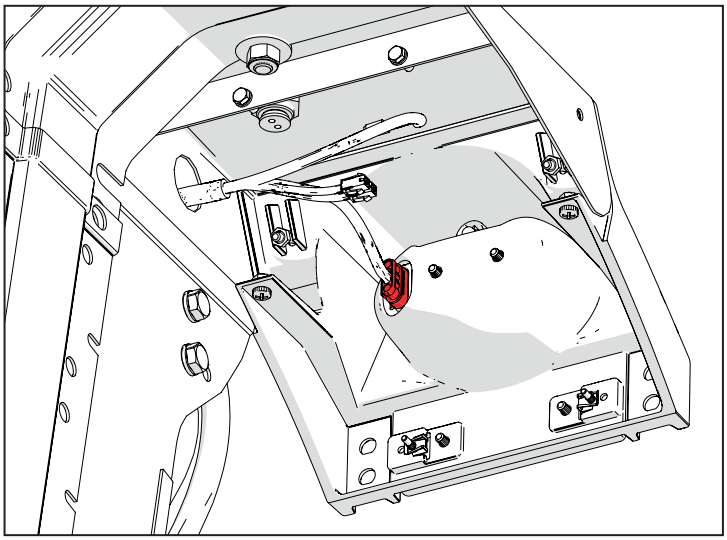




F011 (P225) LH rear mudguard lights

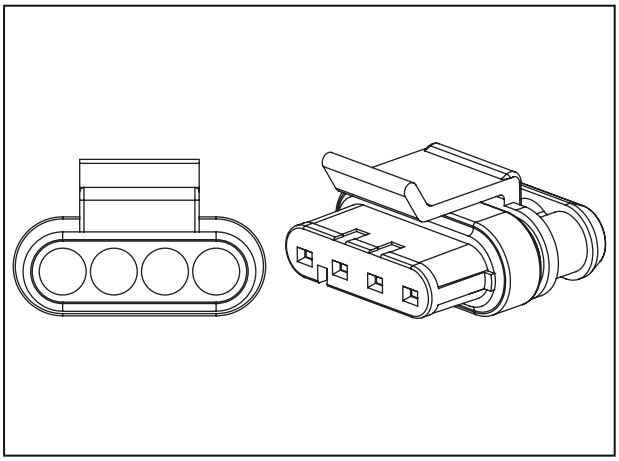
Pin	Description	Colour	Sect.	Input Conn.	Pin
2	PARKING LIGHT LH	Ye	0,75	TRAN-SP2	PIN1
3	GND REAR LIGHTS	BK	0,75	TRAN-SP1	PIN1
1	BRAKE LAMP	Rd	0,75	TRAN-SP3	PIN1
4	LH TURN SIGNAL	Gn	0,75	P500B	4

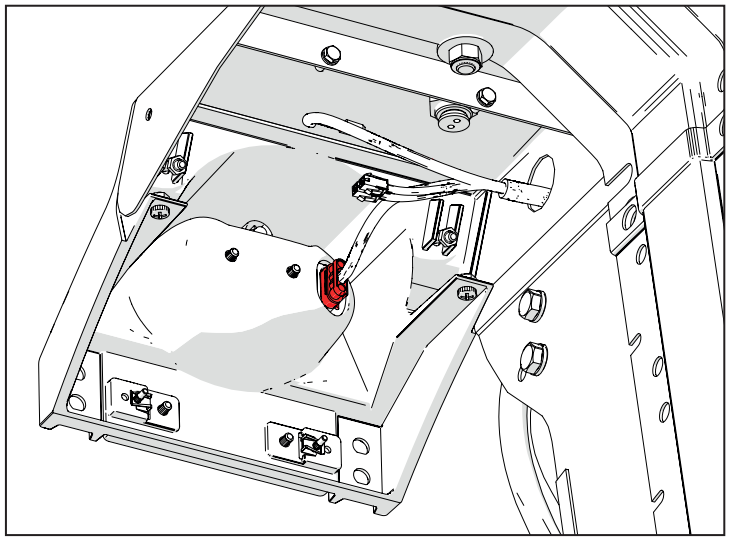




F014 (P464) RH rear mudguard lights

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	BRAKE LAMP	Rd	0,75	TRAN-SP3	PIN1
2	PARKING LIGHT LH	Ye	0,75	TRAN-SP4	PIN1
3	GND REAR LIGHTS	BK	1	TRAN-SP1	PIN1
4	RH TURN SIGNAL	Bu	0,75	P500B	1

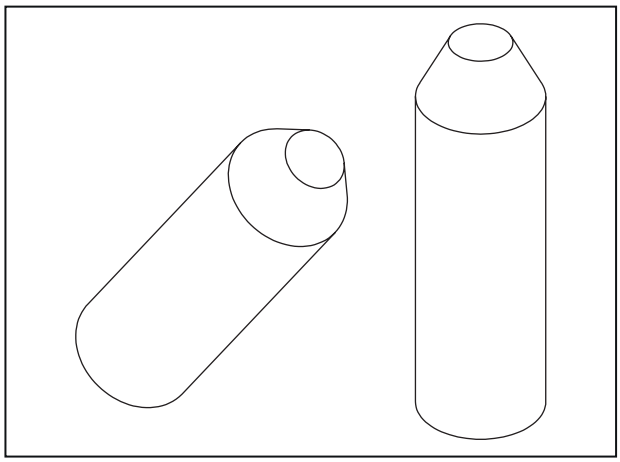


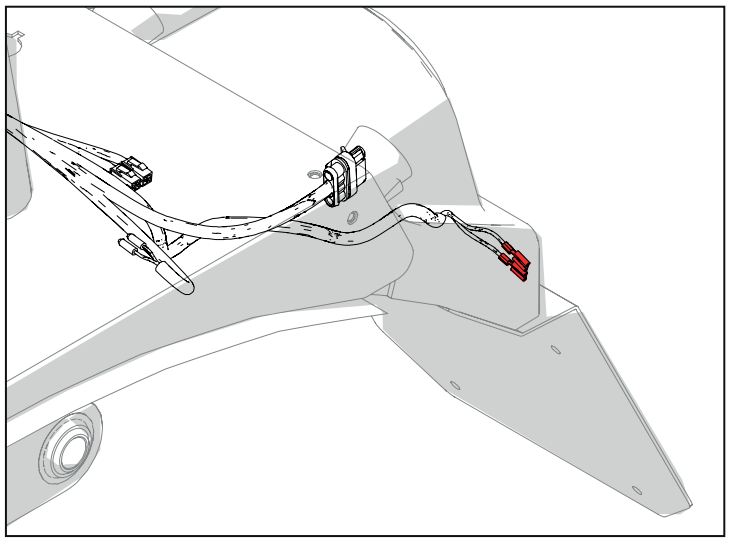


F012 (P478-P479) License plate light

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	GND	BK	0,75	TRAN-SP1	PIN1

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	PLATE LIGHT	Ye	0,75	TRAN-SP2	PIN1

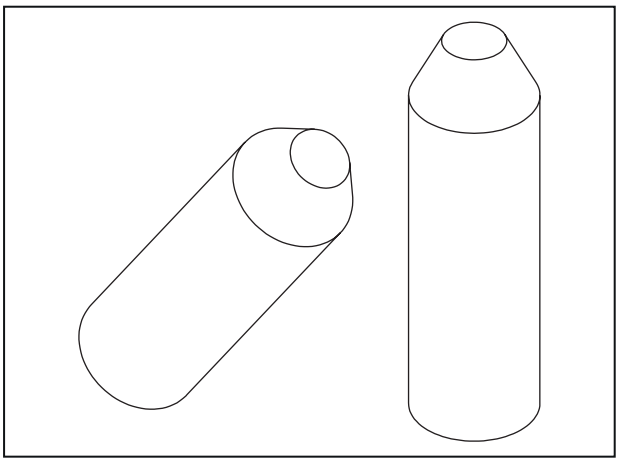


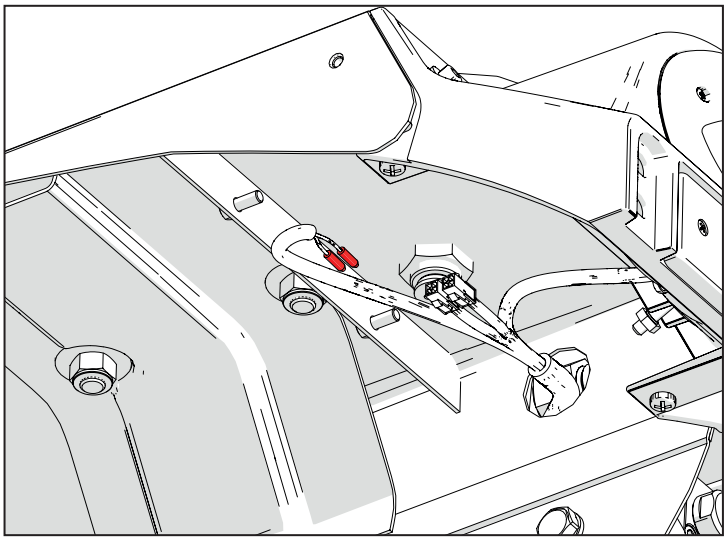


F010 (P484-P485) LH work lights

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	GND	BK	1	TRAN-SP1	PIN1

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	WORKING LIGHT	Ye	1	TRAN-SP2	PIN1

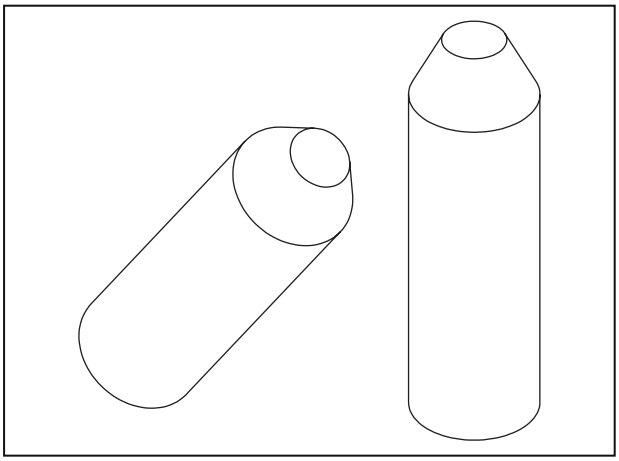


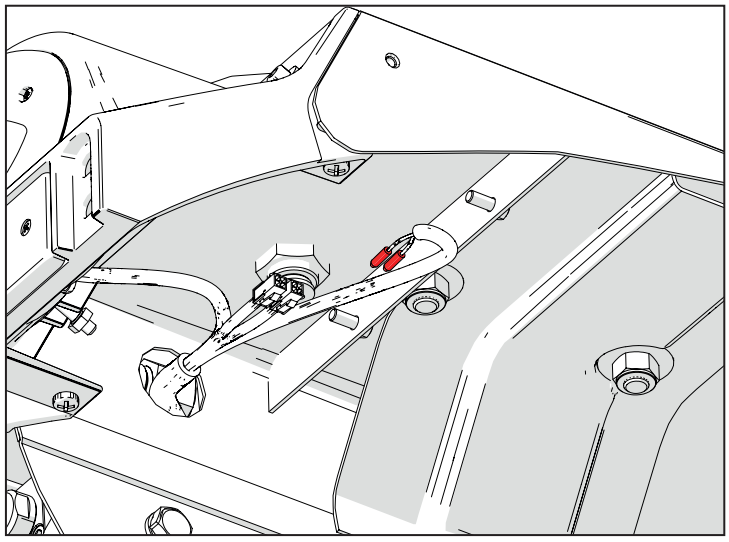


F013 (P486-P487) RH work lights

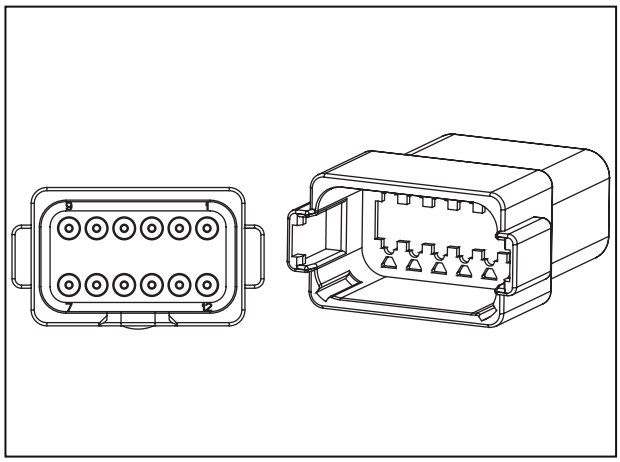
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	GND	BK	1	TRAN-SP1	PIN1

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	WORKING LIGHT	Ye	1	TRAN-SP4 .	PIN1 .

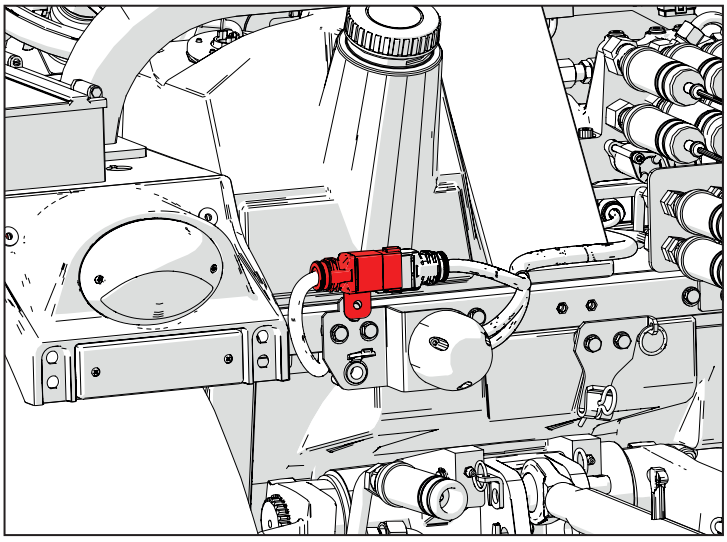




D007 (P500B) Wiring connector for main wiring loom

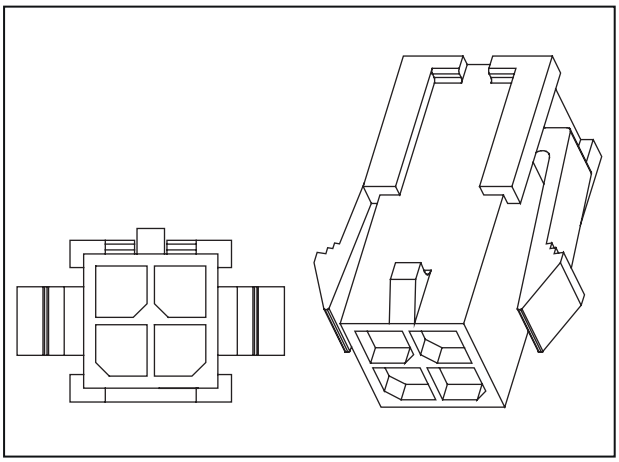


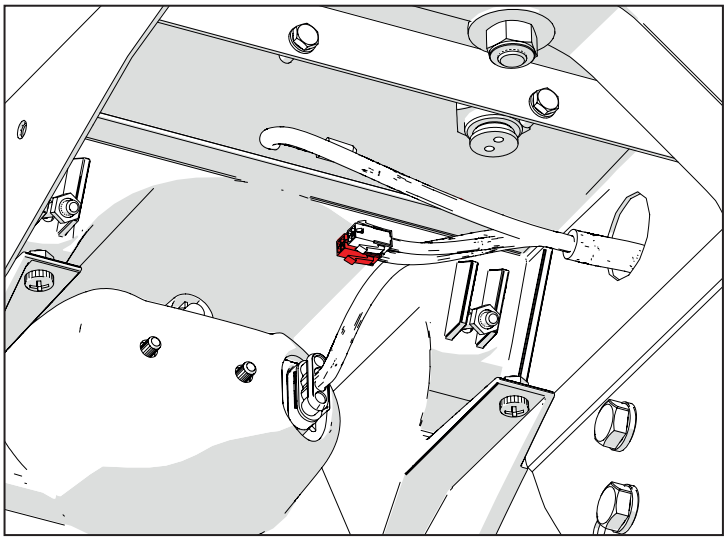
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	RH TURN SIGNAL	Bu	0,75	P464	4
2	REAR PARKING LIGHT LH	Ye	0,75	TRAN-SP2	PIN1
3	GND REAR LIGHTS	BK	1.5	TRAN-SP1	PIN1
4	LH TURN SIGNAL	Gn	0,75	P225	4
5	PARKING LIGHT RH	Ye	0,75	TRAN-SP4	PIN1
6	BRAKE LAMP LH	Rd	0,75	TRAN-SP3	PIN1
7	COMMON	Pu	0.5	TRAN-SP6	PIN1
8	Lift Command	Gy	0.5	TRAN-SP5	PIN1
9	Descend Command	WH	0.5	TRAN-SP7	PIN1
10	COMMON	Pu	0.5	TRAN-SP8	PIN1



I023 (P562) RH electronic lift down button

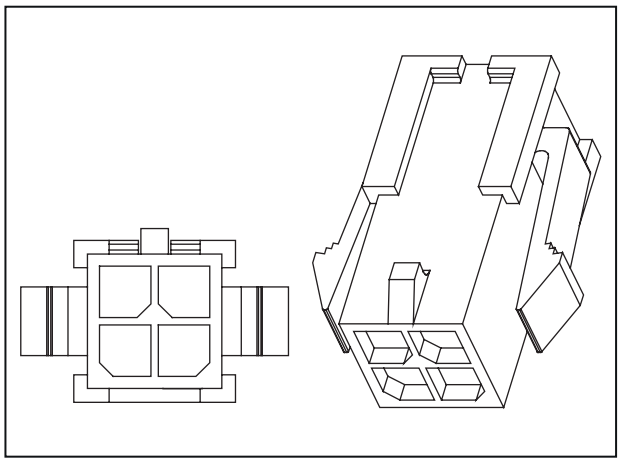
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	Descend Command	WH	0.5	TRAN-SP7	1
4	COMMON	Pu	0.5	TRAN-SP6	PIN1

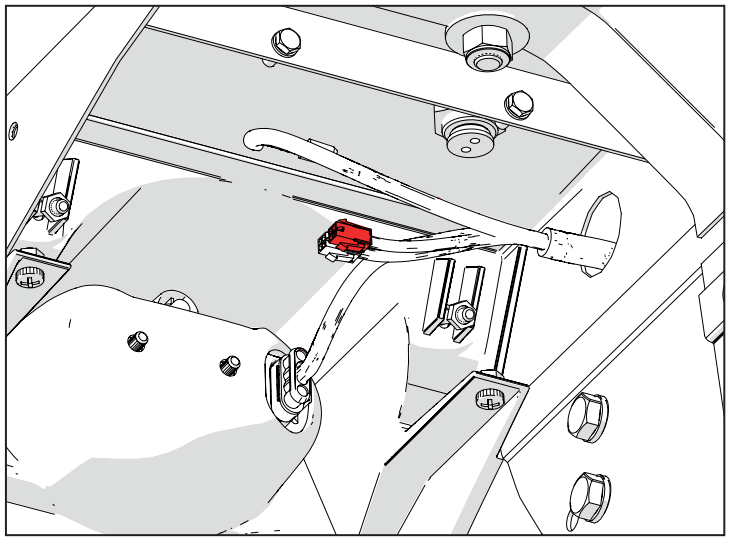




I024 (P563) RH electronic lift up button

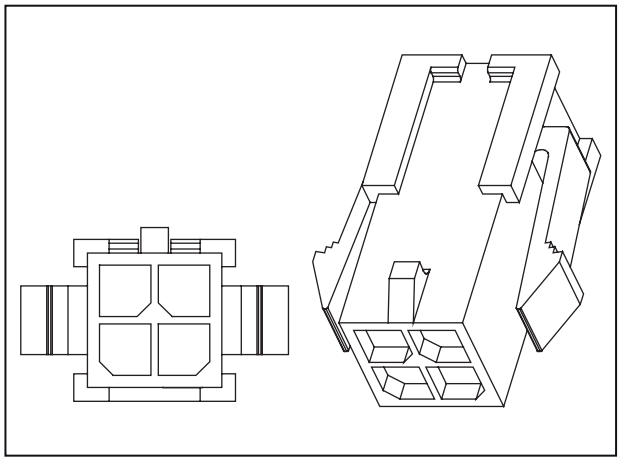
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	Lift Command	Gy	0.5	TRAN-SP5	PIN1
4	COMMON	Pu	0.5	TRAN-SP6	PIN1 20

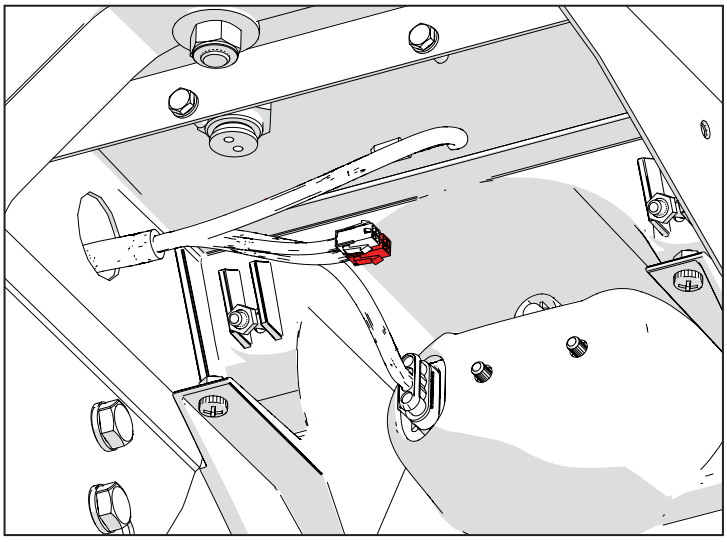




I021 (P564) LH electronic lift down button

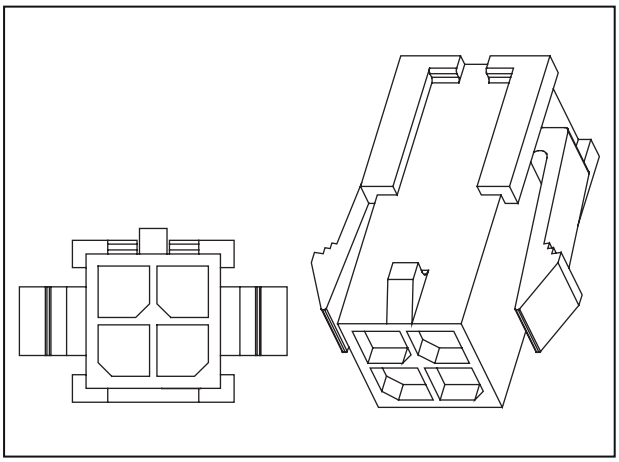
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	Descend Command	WH	0.5	TRAN-SP7	PIN1
4	COMMON	Pu	0.5	TRAN-SP8	PIN1

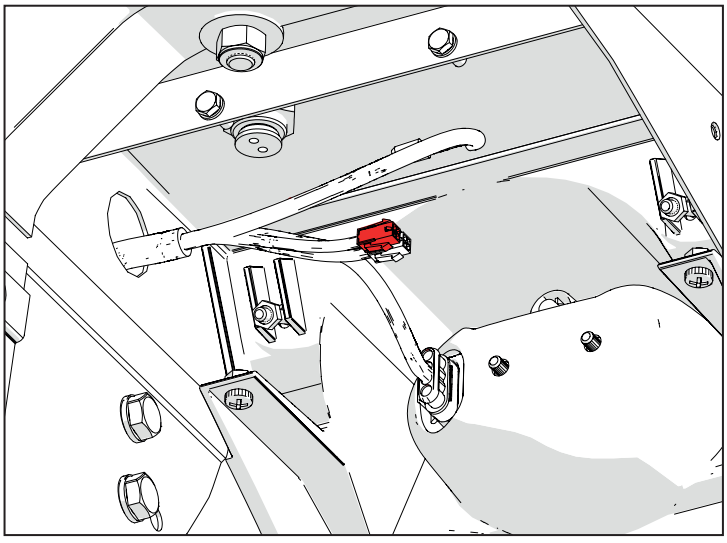




I022 (P565) LH electronic lift up button

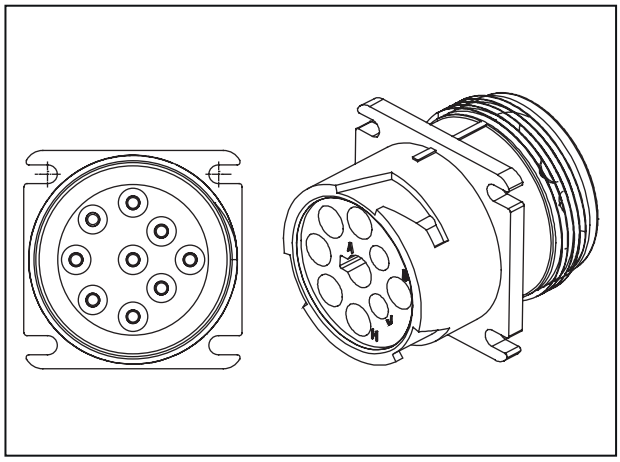
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	Lift Command	Gy	0.5	TRAN-SP5	PIN1
4	COMMON	Pu	0.5	TRAN-SP8	PIN1

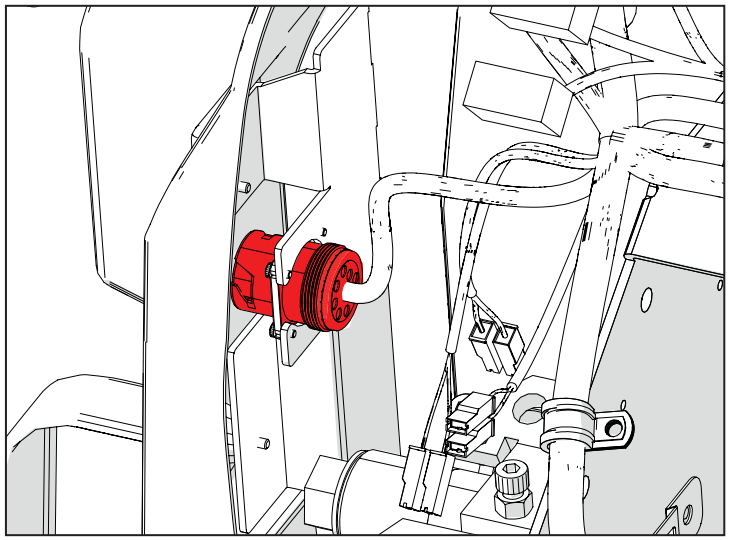




R001 (j9) Diagnostic port

Pin	Description	Colour	Sect.	Input Conn.	Pin
A	GND J1939	BK	1.5	CAB-SP2	PIN1
B	VJ1939 POWER SUPPLY	Rd	1.5	P100B	15
C	CAN H	Ye	0.5	CAB-SP15	PIN1
D	CAN L	Gn	0.5	CAB-SP17	PIN1

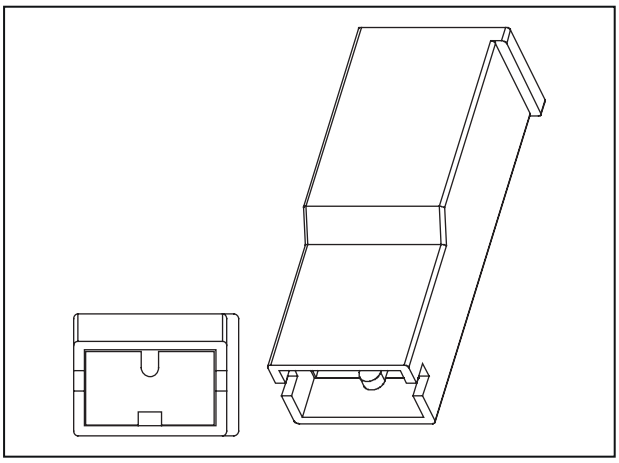


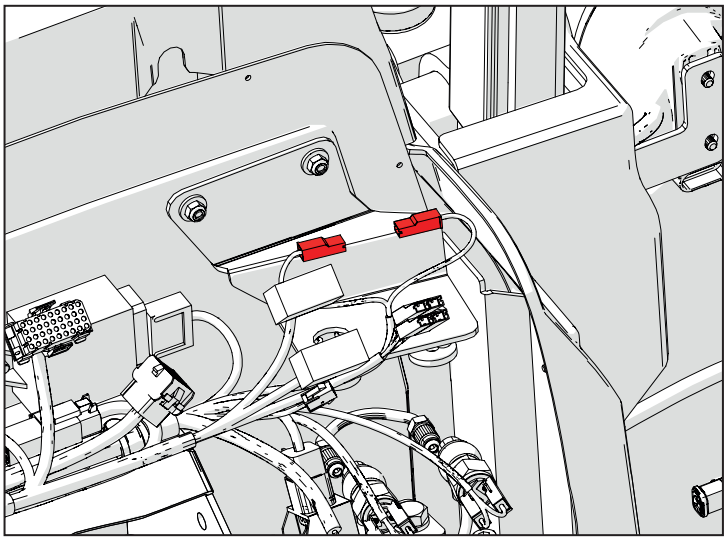


K003 (P19-P20) Brake oil level sensor

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	BRAKE OIL LEVEL	Gn	0,75	P30A	17

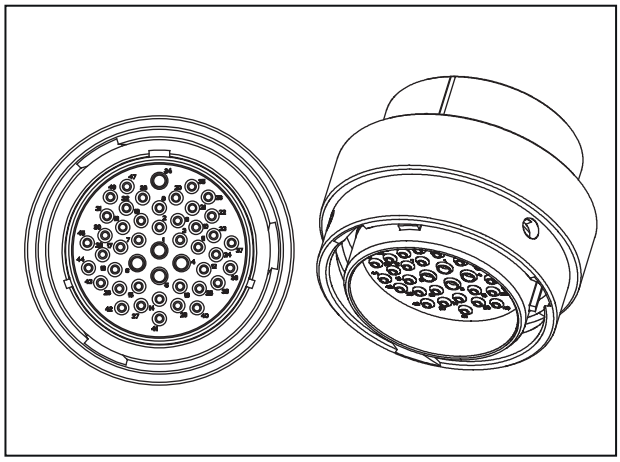
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	12V	Bn	0,75	CAB-SP7	PIN1



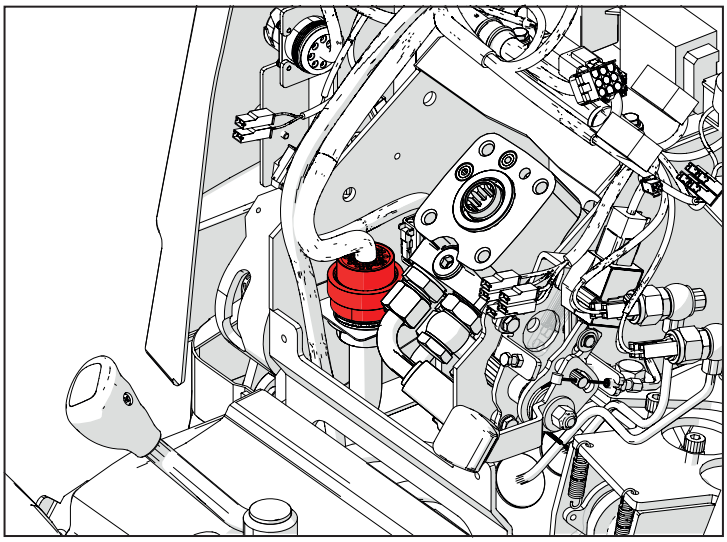


D004 (P30A) Wiring connector for main wiring loom

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	V BAT	Rd	1.5	P100B	22
2	LH DIRECTION LIGHT	Gn	1	CAB-SP3	PIN1
3	PARKING LIGHTS LH	Ye	1	P102B	5
4	BRAKE LIGHTS COMMAND	WH	0.5	P100B	20
7	NORMAL BEAM	Gy	0.5	CAB-SP6	PIN1
8	HIGH BEAM	Gn	0.5	CAB-SP8	PIN1
9	PB - PTO Rear/ Front bypass	Bu	0.5	P36	4
10	12V	Bn	1	CAB-SP18	PIN1
11	PB - Differential lock on/off	Bu	0.5	P62	3
12	BRAKE LH SW	Ye	0,75	P292	1
13	BRAKE RH SW	Bu	0,75	P119	1
15	PB - AWD Switch	WH	0.5	P60	3
16	START ENABLE SENSOR	Rd	0.5	P100B	16
17	BRAKE OIL LEVEL	Gn	0,75	P19	1
18	PTO FRONT A	Pu	0.5	P504	1
19	PTO FRONT B	Or	0.5	P505	1
20	START ENABLE RELAY	Or	0.5	P100B	33
21	RELAY FOR DASHBOARD LED	Or	0.5	P100B	18
22	THROTTLE - SIGNAL1	Gn	0.5	P100	3
23	THROTTLE - SIGNAL2	Rd	0.5	P100	6
24	PB-TESTING TRAILER	Pu	0.5	P508	1
25	VALVES V-KEY	Pu	1	P100B	34
26	CAN H	Ye	0.5	CAB-SP15	PIN1
27	CAN L	Gn	0.5	CAB-SP17	PIN1
28	FRONT PTO DIRECTION VALVE	Bu	0.5	P102B	9
29	FRONT PTO PROP. VALVE	Bu	0.5	P102B	10

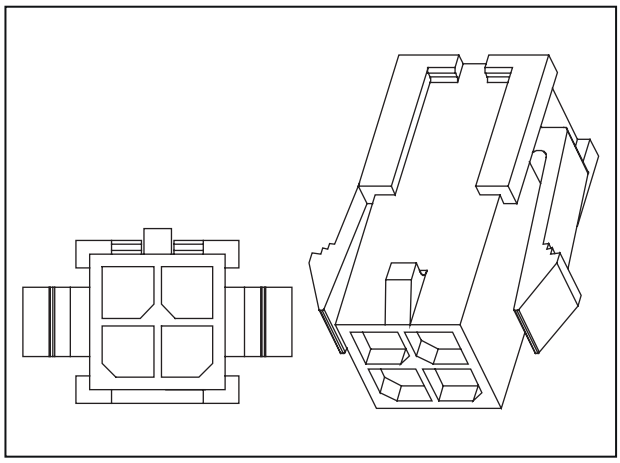


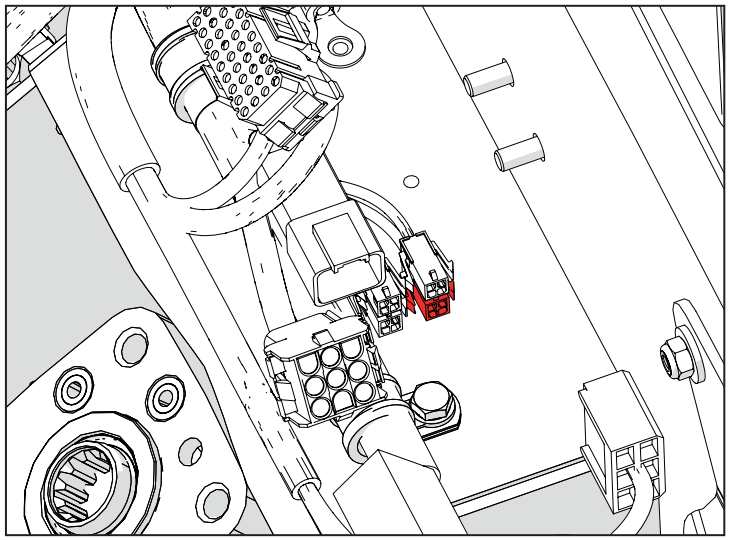
30	KEY 12 V	Bn	0.5	P451	1
31	12V BAT	Rd	1	P501	1
32	BRAKE LAMP	Rd	0,75	P100B	6
33	HYD OIL PRESSURE SWITCH	Ye	0.5	P100B	23
35	ENGINE CLUTCH SW	Or	0,75	P492	1
36	PTO Rear - Clutch Lever Switch	Bu	0,75	P46	1
37	START COMMAND	Bu	0,75	CAB-SP19	PIN1
38	PTO SHAFT RPM SENSOR	Pu	0.5	P100B	7
39	VECU V KEY	Bn	0.5	P100B	17
40	RH TURN SIGNAL LIGHT	Bu	1	CAB-SP4	PIN1
41	Wheel Speed	Bu	0.5	P100B	13
42	PARKING LIGHT RH	Ye	1	P102B	11
43	THROTTLE GND	BK	0.5	CAB-SP9	PIN1
44	AIR FILTER	Gn	0.5	P100B	3
46	12V TRAILER	Rd	1.5	CAB-SP5	PIN1
47	SOCKET 1 POLE SUPPLY	Rd	1.5	CAB-SP5	PIN1



I006 (P31) Instrument panel ENTER button

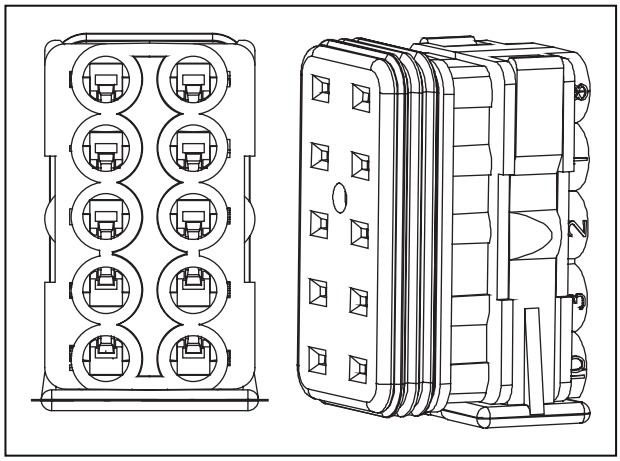
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	12V	Bn	0.5	CAB-SP18	PIN1
4	DASHBOARD PB ENTER	Bu	0.5	P200	25

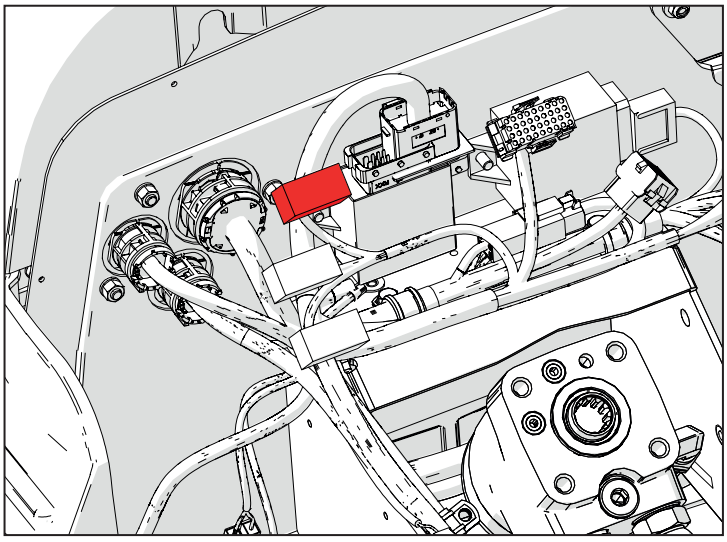




I005 (P32) Regeneration cycle disable switch

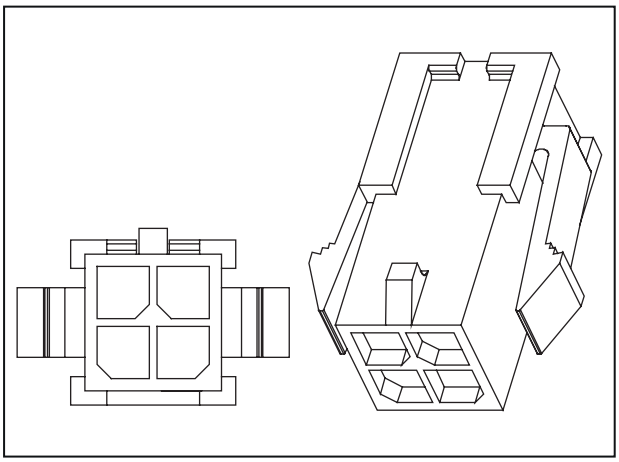
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	DPF REGENERATION INHIBIT SW	Bn	0,75	P100B	28
2	DPF REGENERATION INHIBIT SW	BK	0,75	CAB-SP2	PIN1
3	DPF REGENERATION TRIGGER SWITCH	Bu	0.5	P100B	32

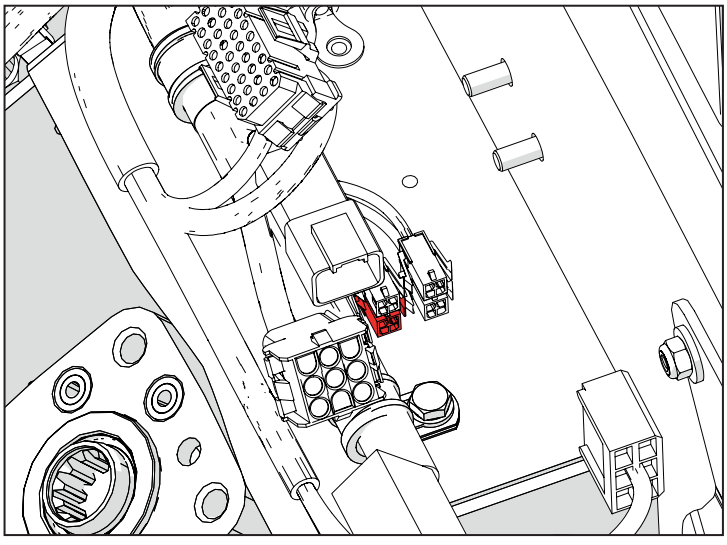




I007 (P34) Instrument panel + button

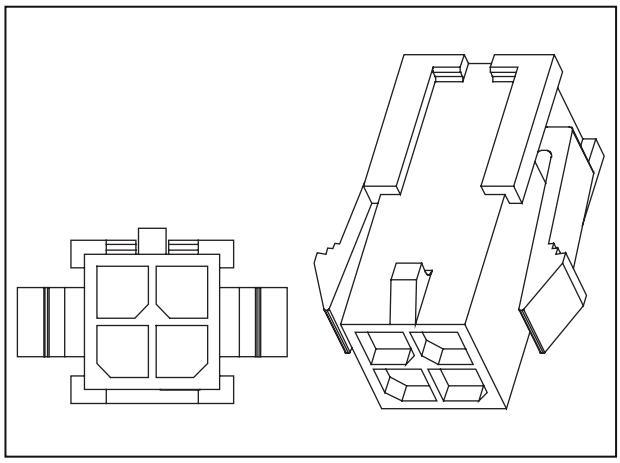
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	12V	Bn	0.5	CAB-SP18	PIN1
2	DASHBOARD PB +	Bu	0.5	P200	24

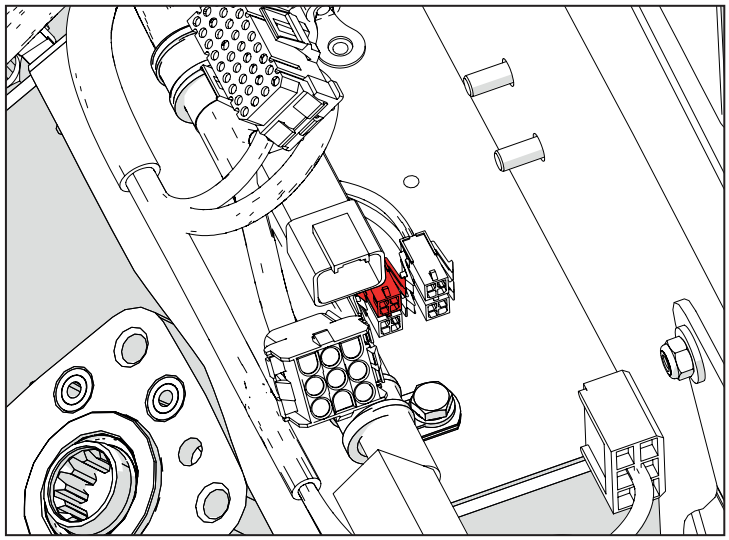




I008 (P35) Instrument panel - button

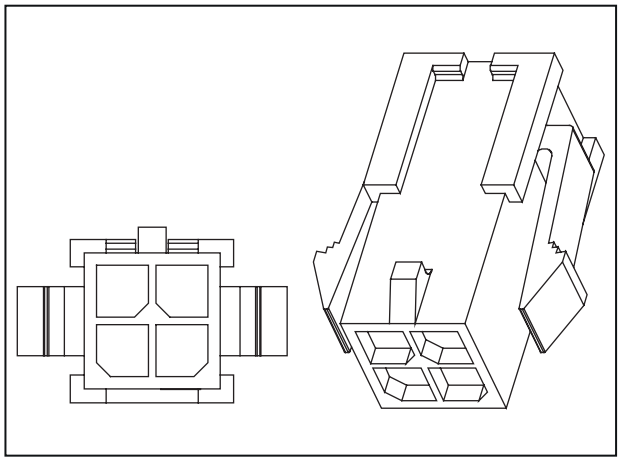
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	12V	Bn	0.5	P200	20
2	DASHBOARD PB +	Bu	0.5	CAB-SP18	PIN1

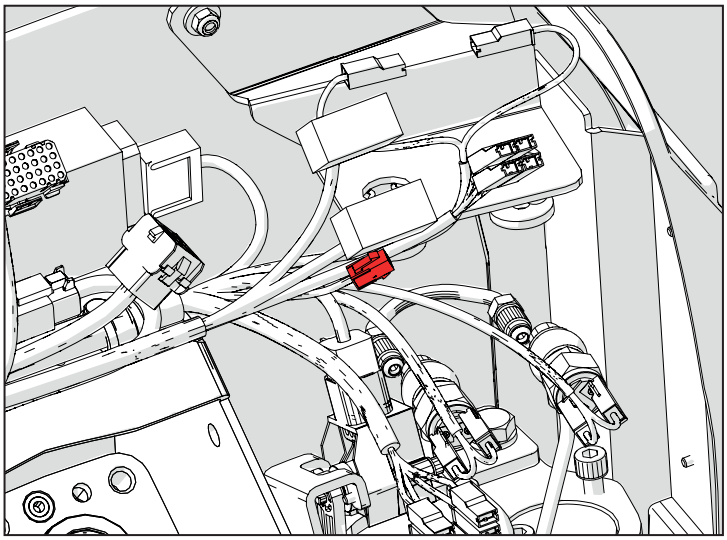




I011 (P36) Auto PTO switch

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	12V	Bn	0.5	CAB-SP7	PIN1
4	PB - PTO Rear/ Front bypass	Bu	0.5	P30A	9

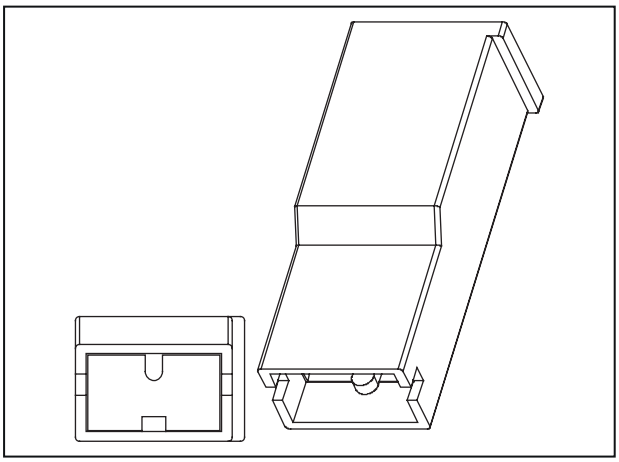


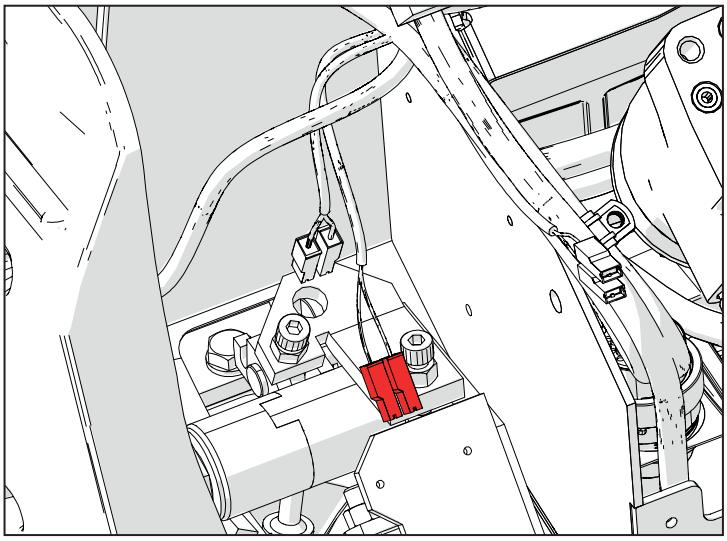


K002 (P46-P47) PTO start enable signal / dashboard indicator signal

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	PTO Rear - Clutch Lever Switch	Bu	0,75	P30A	1

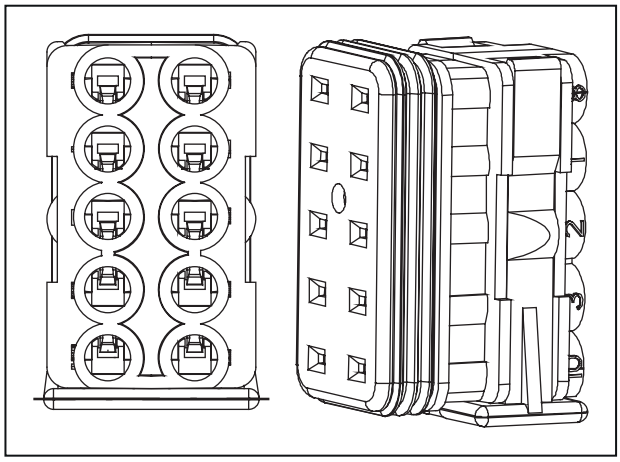
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	12V	Bn	0,75	CAB-SP18	PIN1

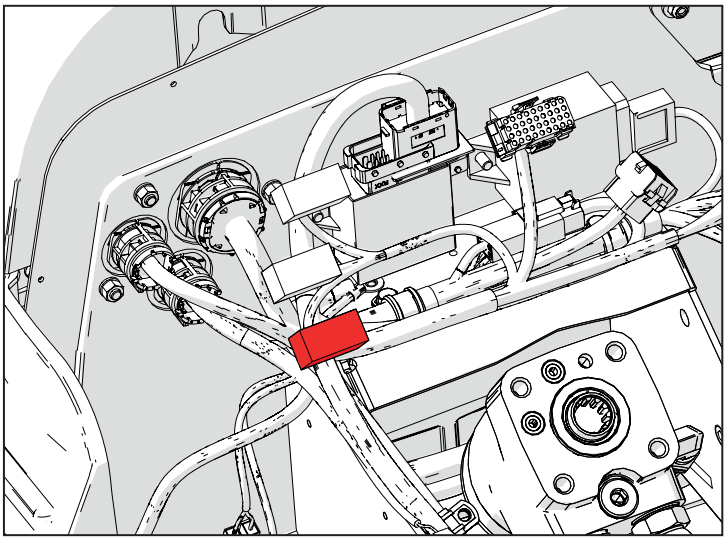




I003 (P60) Hydraulic 4WD selector switch

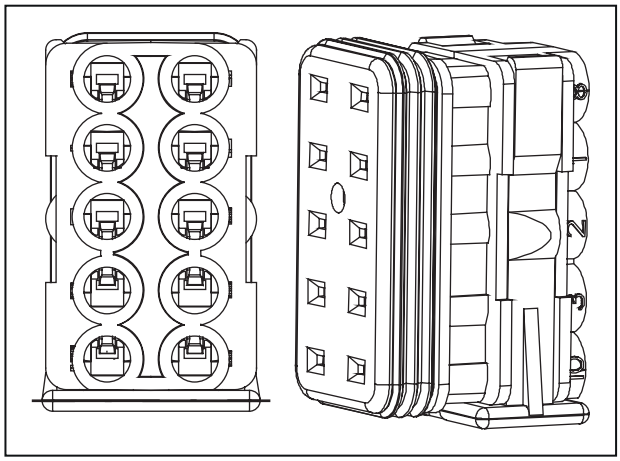
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	PB - AWD Switch	WH	0.5	P30A	15
2	PB - AWD Switch	Bn	0.5	CAB-SP1	PIN1

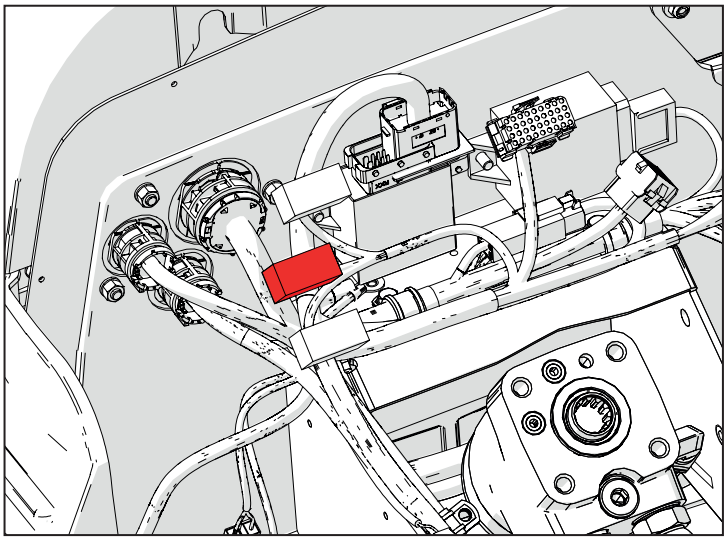




I004 (P62) Hydraulic differential lock switch

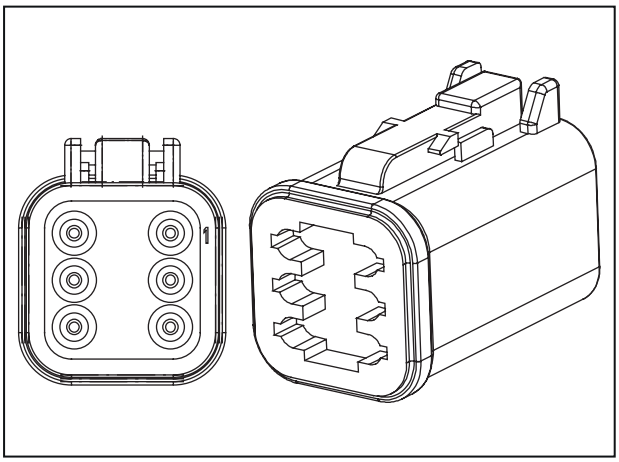
Pin	Description	Colour	Sect.	Input Conn.	Pin
2	PB - Differential lock on/off	BK	0.5	CAB-SP2	PIN1
3	PB - Differential lock on/off	Bu	0.5	P30A	11

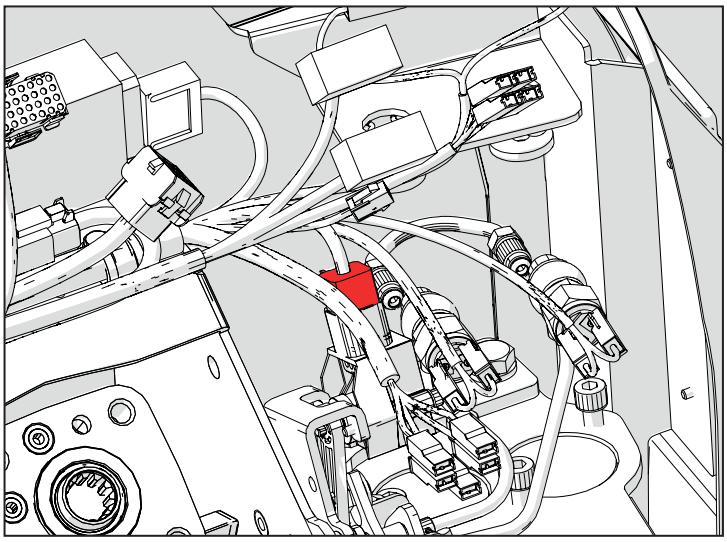




H001 (P100) Hand throttle

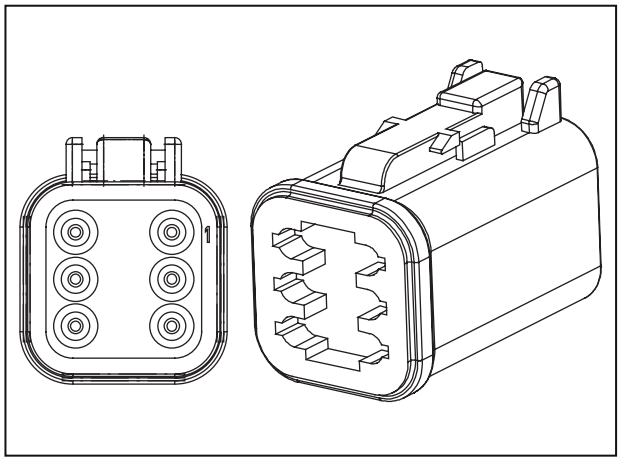
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	ACCELERATOR1 GND	BK	0.5	CAB-SP9	PIN1
2	12V	Bn	0.5	CAB-SP7	PIN1
3	THROTTLE - SIGNAL1	Gn	0.5	P30A	22
4	ACCELERATOR2 GND	BK	0.5	CAB-SP9	PIN1
5	12V	Bn	0.5	CAB-SP7	PIN1
6	THROTTLE - SIGNAL2	Rd	0.5	P30A	23



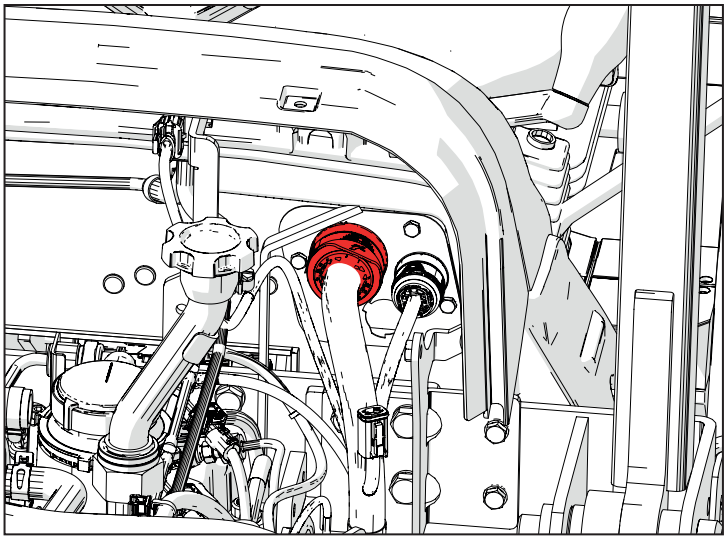


D005 (P100A) Wiring connector for dashboard wiring loom

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	HAZARD LIGHTS CONTROL	Rd	0,75	P1A	60
2	HORN POWER SUPPLY	Pu	0,75	P152	1
3	AIR FILTER	Gn	0,75	P439	1
4	12V BATT SUPPLY	Rd	2.5	ENG-SP17	PIN1
5	TURN INDICATORS	Or	0,75	P1A	39
6	BRAKE LAMP	Rd	0,75	P1A	35
7	PTO shaft rpm sensor	Pu	0,75	P54	2
8	HORN/SOCKET V KEY	Pu	1	ENG-SP8	PIN1
9	12V BATT SUPPLY	Rd	2.5	ENG-SP17	PIN1
10	NORMAL BEAM LIGHTS	Gy	0.5	P1A	34
11	VCC	Bn	1.5	ENG-SP7	PIN1
12	V KEY	Bn	0,75	P2A	18
13	Wheel Speed	Bu	0,75	P301	2
14	DASHBOARD 12V	Bn	0,75	P1A	59
15	VJ1939 POWER SUPPLY	Rd	1.5	P2A	12
16	START ENABLE SENSOR	Rd	0.5	ENG-SP3	PIN1
17	VECU V KEY	Bn	0.5	P1A	18
18	RELAY FOR DASHBOARD LED	Or	0.5	P1A	41
19	LED FOR DASH	Gn	0.5	P1A	42
20	BRAKE LIGHTS COMMAND	WH	0.5	P1A	43
21	V-KEY DASH	Bn	0.5	P1A	19
22	VCU V BATT	Rd	1.5	P1A	58
23	HYD OIL PRESSURE SWITCH	Ye	0,75	P471	1
24	PARKING LIGHTS	Ye	1.5	ENG-SP23	PIN1
25	START COMMAND	Bu	0.5	P1A	1
26	V KEY	Bn	2.5	ENG-SP22	PIN1
27	HIGH BEAM	Gn	0.5	P1A	14

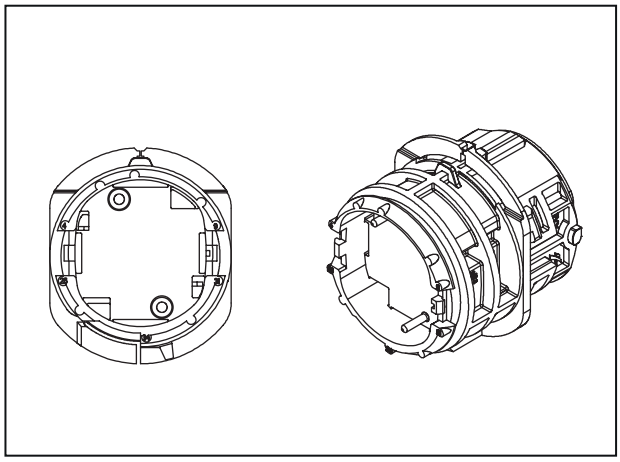


28	DPF REGENERATION INHIBIT SW	Bn	0,75	P12	32
29	CAN L	Gn	0.5	ENG-SP12	PIN1
30		Ye	0.5	ENG-SP11	PIN1
31	V KEY	Bn	2.5		PIN1
32	DPF REGENERATION TRIGGER SWITCH	Bu	0,75	P12	42
33	START ENABLE RELAY	Or	0.5	P1A	12
34	VALVES V KEY	Pu	1	ENG-SP8	PIN1

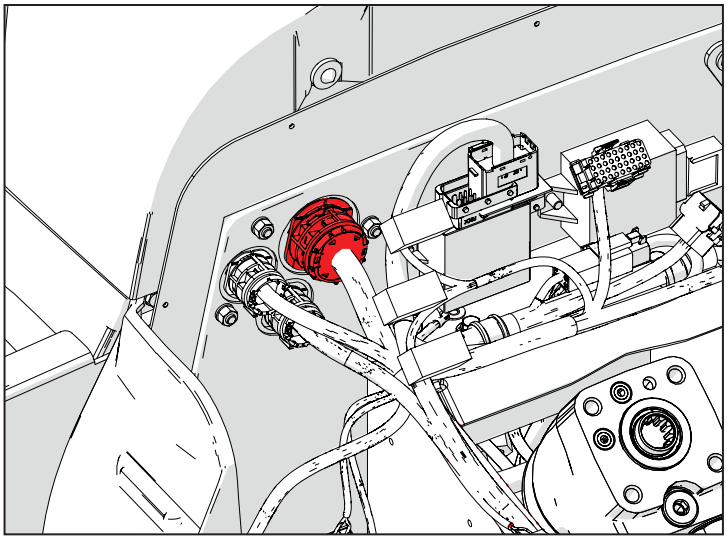


D005 (P100B) Wiring connector for engine wiring loom

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	HAZARD LIGHTS CONTROL	Rd	0,75	P137	3
2	HORN POWER SUPPLY	Pu	0,75	P144	9
3	AIR FILTER	Gn	0.5	P30A	44
4	12V BATT SUPPLY	Rd	2.5	P118	1
5	HAZARD LIGHTS CONTROL	Or	0,75	P137	1
6	BRAKE LAMP	Rd	0,75	P30A	32
7	PTO SHAFT RPM SENSOR	Pu	0.5	P30A	38
8	HORN/SOCKET V KEY	Pu	1	CAB-SP16	PIN1
9	12V BATT SUPPLY	Rd	2.5	P501	1
10	NORMAL BEAM	Gy	0.5	CAB-SP6	PIN1
11	SENSORS V-KEY	Bn	1.5	CAB-SP18	PIN1
12	V KEY	Bn	0,75	P455	1
13	Wheel Speed	Bu	0.5	P30A	41
14	DASHBOARD 12V	Bn	0,75	P200	3
15	VJ1939 POWER SUPPLY	Rd	1.5	J9	B
16	START ENABLE SENSOR	Rd	0.5	P30A	16
17	VECU V KEY	Bn	0.5	P30A	39
18	RELAY FOR DASHBOARD LED	Or	0.5	P30A	21
19	LED FOR DASHBOARD	Gn	0.5	P200	32
20	BRAKE LIGHTS COMMAND	WH	0.5	P30A	4
21	V-KEY DASH	Bn	0.5	P200	4
22	V BAT	Rd	1.5	P30A	1
23	HYD OIL PRESSURE SWITCH	Ye	0.5	P30A	33
24	PARKING LIGHTS	Ye	1.5	P144	1
25	START COMMAND	Bu	0.5	CAB-SP19	PIN1
26	V KEY	Bn	2.5	P451	1
27	HIGH BEAM	Gn	0.5	CAB-SP8	PIN1

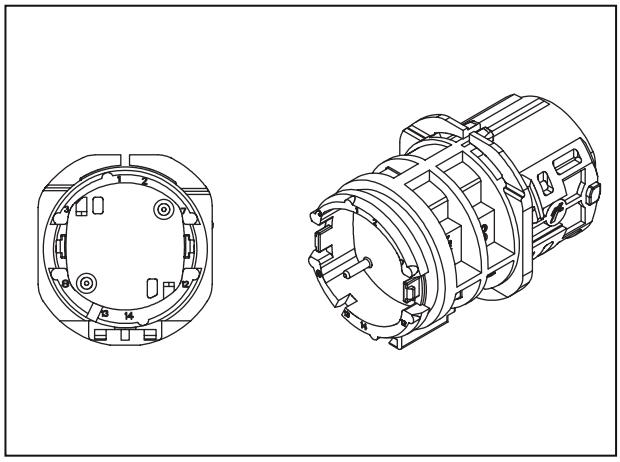


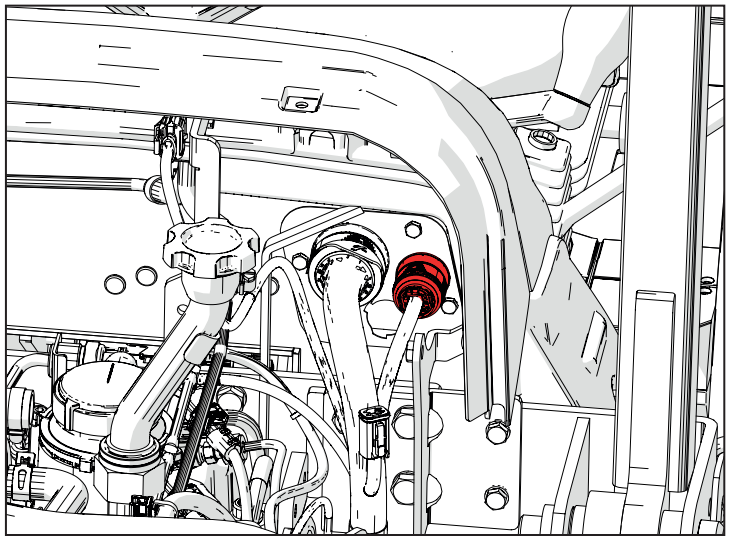
28	DPF REGENERATION INHIBIT SW	Bn	0,75	P32	1
29	CAN L	Gn	0.5	CAB-SP17	PIN1
30	CAN H	Ye	0.5	CAB-SP15	PIN1
31	V KEY	Bn	2.5	P455	1
32	DPF REGENERATION TRIGGER SWITCH	Bu	0.5	P32	3
33	START ENABLE RELAY	Or	0.5	P30A	20
34	VALVES V-KEY	Pu	1	P30A	25



D006 (P102A) Wiring connector for dashboard wiring loom

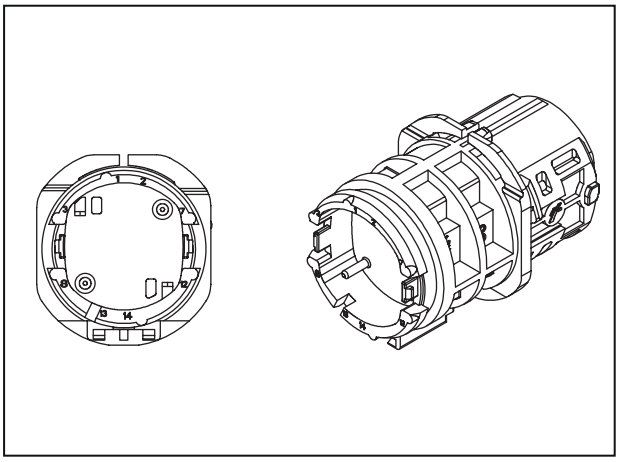
Pin	Description	Colour	Sect.	Input Conn.	Pin
3	LEFT INDICATOR LIGHT	Bu	0,75	P40B	1
4	RIGHT INDICATOR LIGHT	Bu	0,75	P50B	1
5	PARKING LIGHTS	Ye	1	ENG-SP14	PIN1
6	BEACON LIGHT SUPPLY	Pu	0,75	P41	2
7	ALTERNATOR D+	Bu	0,75	P2	1
8	V KEY	Bn	1.5	P322	1
9	FRONT PTO DIRECTION VALVE	Bu	0.5	P10A	1
10	FRONT PTO PROP. VALVE	Bu	0.5	P10A	3
11	PARKING LIGHT RH	Ye	1	ENG-SP16	PIN1
14	POWER SOCKET SUPPLY	Rd	2.5	P2A	21

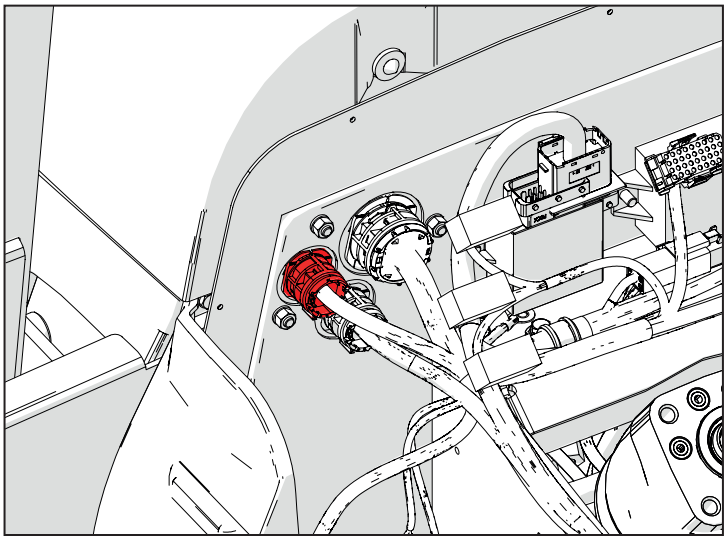




D006 (P102B) Wiring connector for engine wiring loom

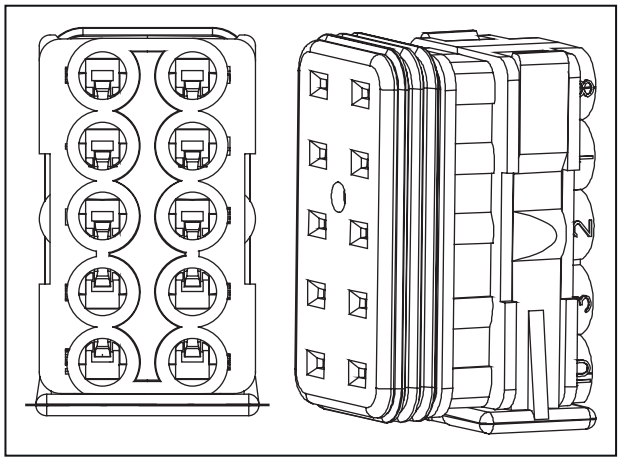
Pin	Description	Colour	Sect.	Input Conn.	Pin
3	LEFT INDICATOR LIGHT	Gn	0,75	CAB-SP3	PIN1
4	RIGHT INDICATOR LIGHT	Bu	0,75	CAB-SP4	PIN1
5	PARKING LIGHTS LH	Ye	1	P30A	3
6	BEACON LIGHT SUPPLY	Pu	0,75	P112	3
7	ALTERNATOR D+	Bu	0,75	P200	33
8	V KEY	Bn	1.5	P451	1
9	FRONT PTO DIRECTION VALVE	Bu	0.5	P30A	28
10	FRONT PTO PROP. VALVE	Bu	0.5	P30A	29
11	PARKING LIGHT RH	Ye	1	P30A	42
14	POWER SOCKET SUPPLY	Rd	2.5	CAB-SP5	PIN1

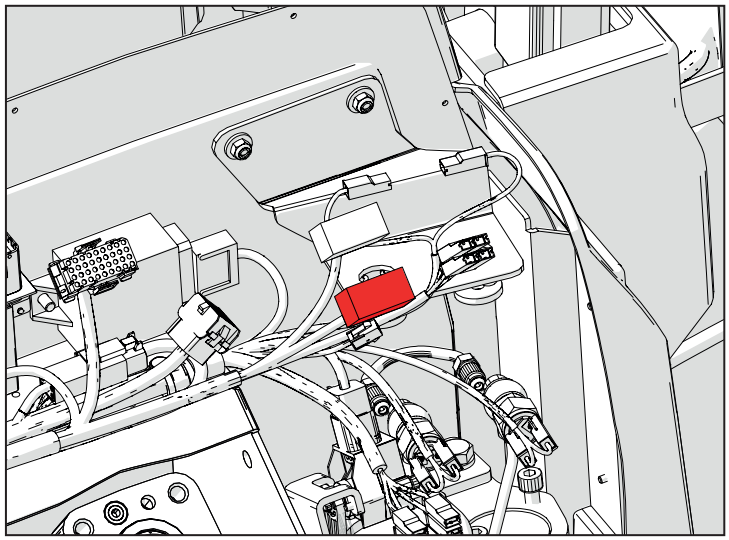




I009 (P112) Rotating beacon button

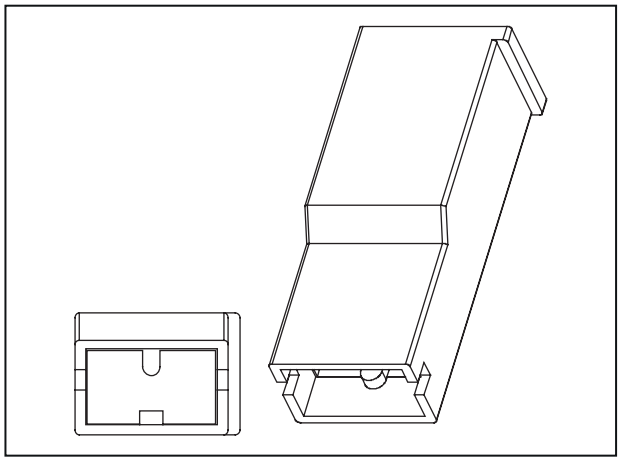
Pin	Description	Colour	Sect.	Input Conn.	Pin
2	BEACON	Pu	0,75	CAB-SP16	PIN1
3	BEACON LIGHT SUPPLY	Pu	0,75	P102B	6

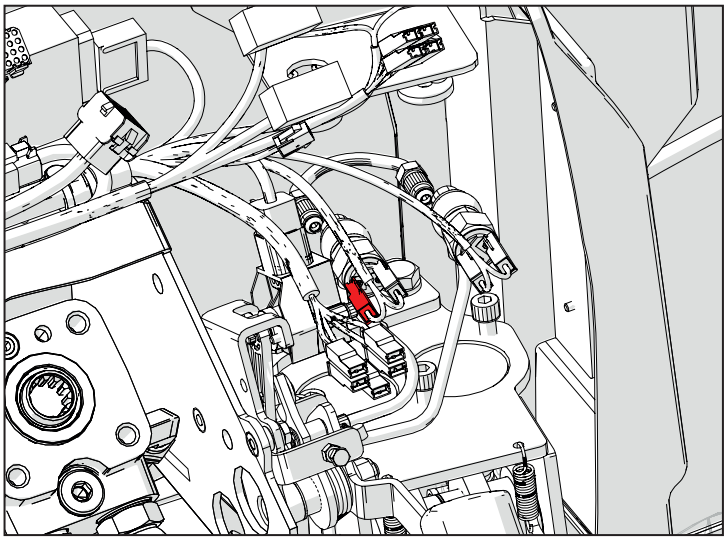




I021 (P119) RH brake signal switch

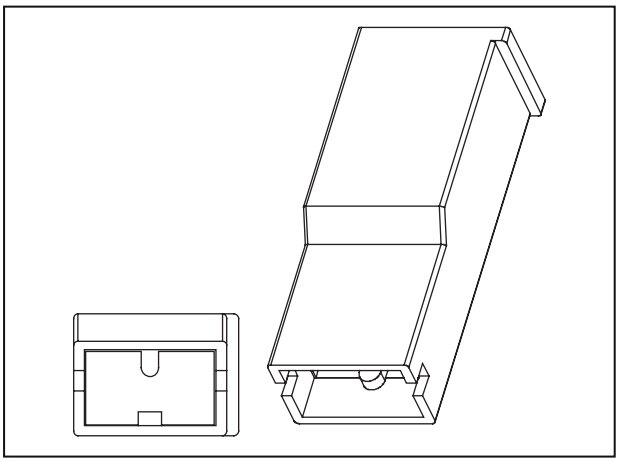
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	BRAKE RH SW	Bu	0,75	P30A	13

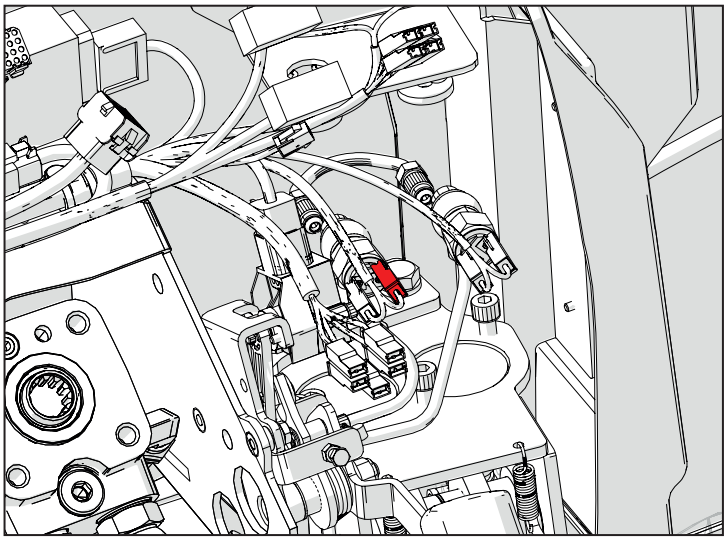




I012 (P120) Right brake pedal switch

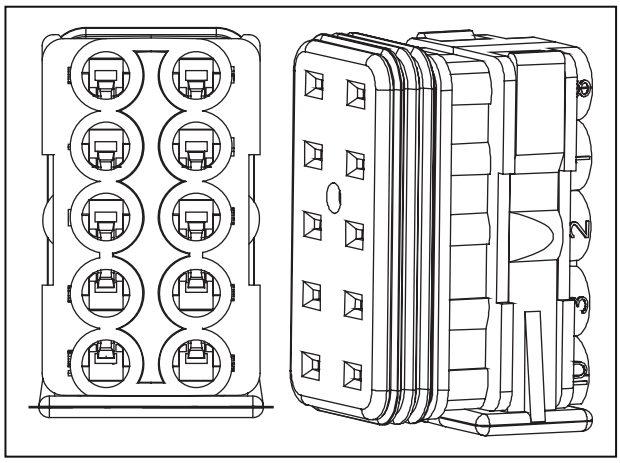
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	12V	Bn	0,75	CAB-SP7	PIN1

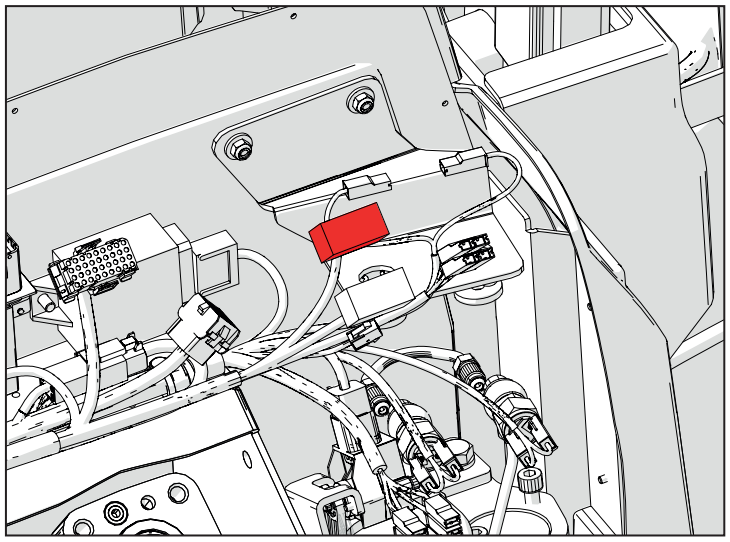




I010 (P137) Hazard warning lights button

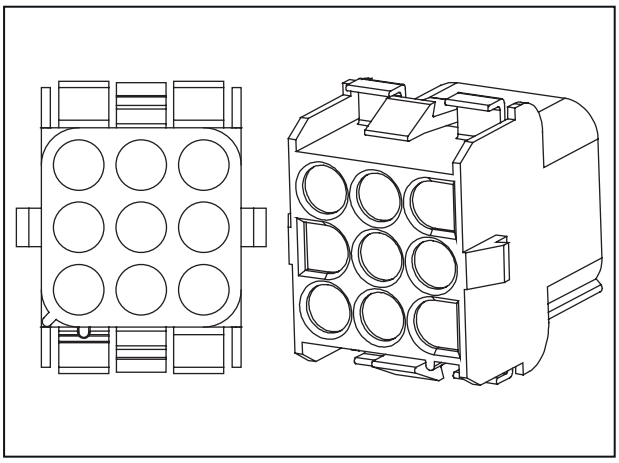
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	HAZARD LIGHTS CONTROL	Or	0,75	P100B	5
2		Pu	1	P274	6
3	HAZARD LIGHTS CONTROL	Rd	0,75	P100B	1
5	12V EMERGENCY	WH	1	P274	4
6	RH TURN SIGNAL LIGHT	Bu	1	CAB-SP4	PIN1
8	HAZARD LIGHTS CONTROL - GND	BK	0,75	CAB-SP2	PIN1
9	LH TURN SIGNAL	Gn	1	CAB-SP3	PIN1
10	LED	Bu	0,75	CAB-SP18	PIN1

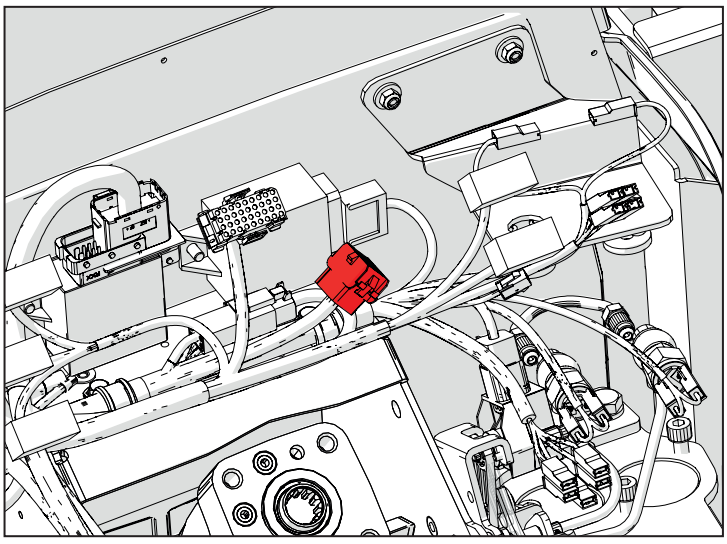




E004 (P144) RH turn indicator signal

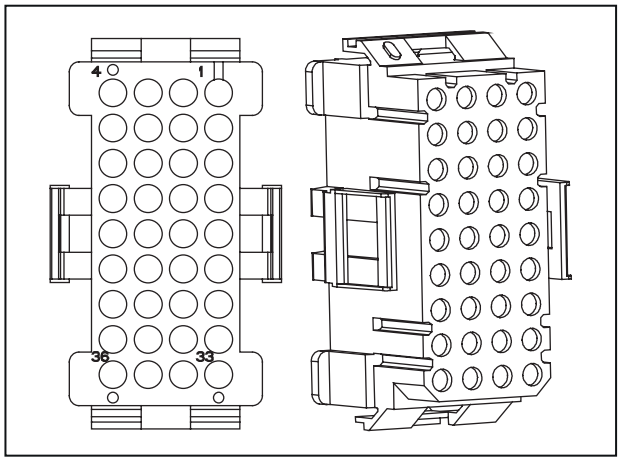
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	PARKING LIGHTS	Ye	1.5	P100B	24
2	RH TURN SIGNAL	Bu	1	CAB-SP4	PIN1
3	LH TURN SIGNAL	Gn	1	CAB-SP3	PIN1
4	HIGH BEAM	Gn	0.5	CAB-SP8	PIN1
5	V KEY	Bn	1	P455	1
6	TURN INDICATORS	WH	1	P274	4
7	NORMAL BEAM	Gy	0.5	CAB-SP6	PIN1
8	HORN V KEY	Pu	0,75	CAB-SP16	PIN1
9	HORN POWER SUPPLY	Pu	0,75	P100B	2

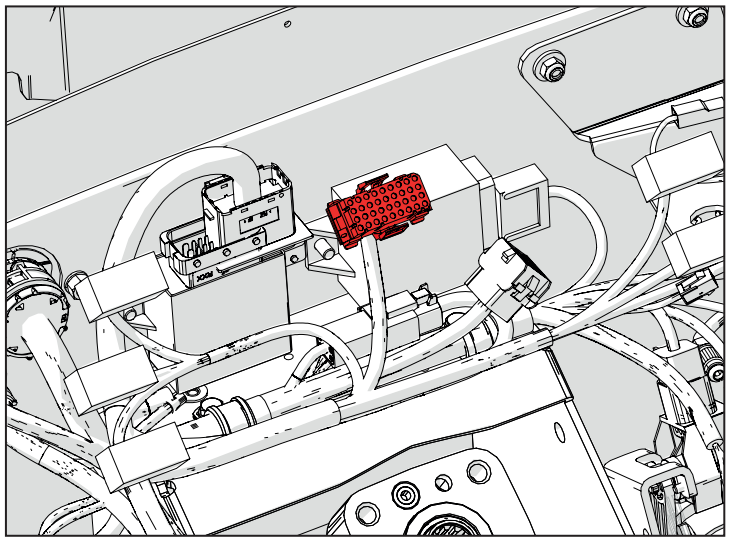




E003 (P200) Dashboard

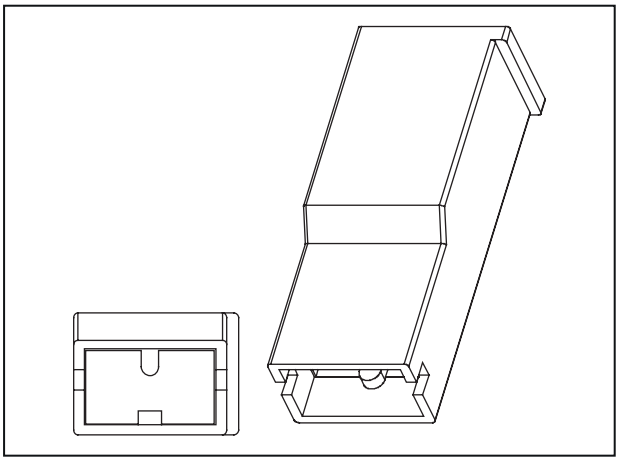
Pin	Description	Colour	Sect.	Input Conn.	Pin
3	DASHBOARD 12V	Bn	0,75	P100B	14
4	V-KEY DASH	Bn	0.5	P100B	21
8	GND DASHBOARD	BK	0,75	CAB-SP2	PIN1
20	DASHBOARD PB -	Bu	0.5	P35	4
21	TURNING LIGHTS FOR TRAILER	Or	0.5	P274	2
24	DASHBOARD PB +	Bu	0.5	P34	4
25	DASHBOARD PB ENTER	Bu	0.5	P31	4
32	LED FOR DASHBOARD	Gn	0.5	P100B	19
33	ALTERNATOR D+	Bu	0,75	P102B	7
35	CAN L	Gn	0.5	CAB-SP17	PIN1
36	CAN H	Ye	0.5	CAB-SP15	PIN1

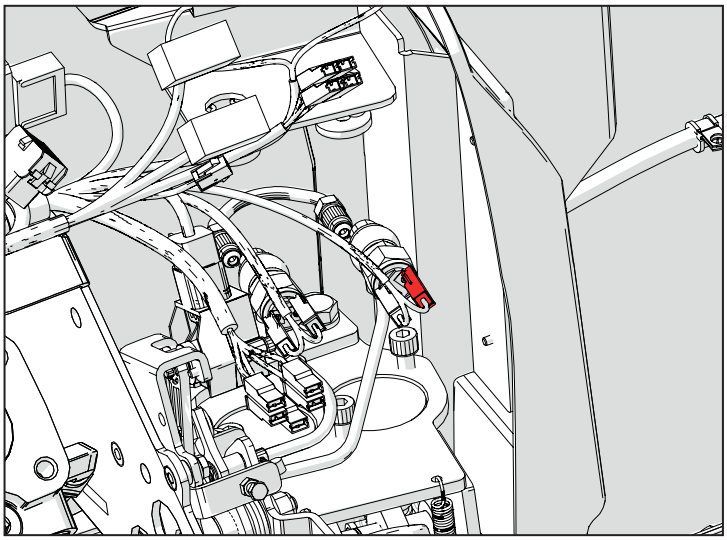




I013 (P291) Left brake pedal switch

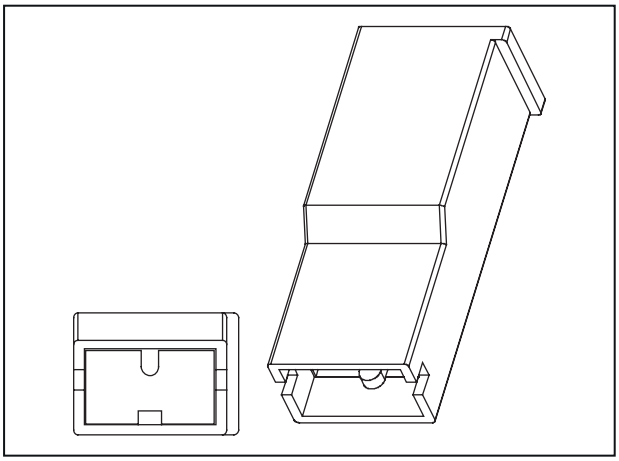
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	12V	Bn	0,75	CAB-SP7	PIN1

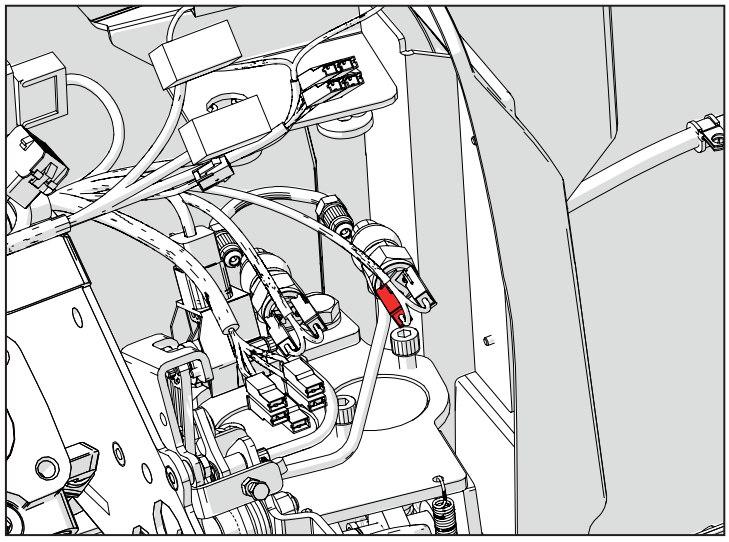




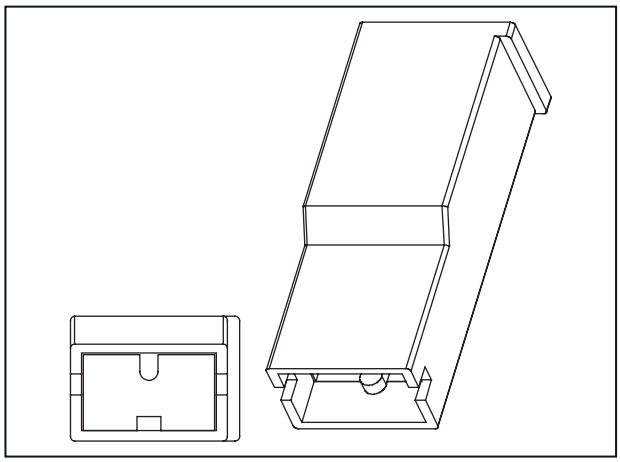
I014 (P292) LH brake signal switch

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	BRAKE LH SW	Ye	0,75	P30A	12





I015 (P117-P118-P451-P455-P501) Ignition switch



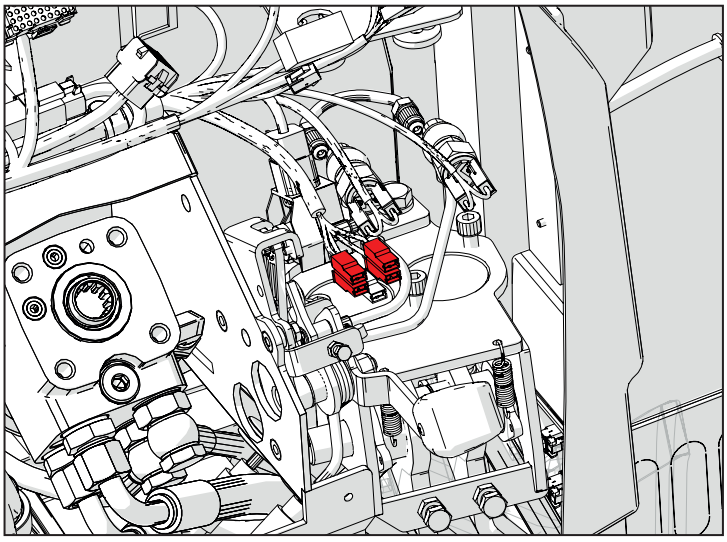
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	KEY 12 V	Bn	0.5	P30A	30
1	V KEY	Bn	1.5	P102B	8
1	V KEY	Bn	2.5	P100B	26

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	V KEY	Bn	1	P144	5
1	V KEY	Bn	2.5	P100B	31
1	V KEY	Bn	0,75	P100B	12

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	12V BAT	Rd	1	P30A	31
1	12V BATT SUPPLY	Rd	2.5	P100B	9

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	START COMMAND	Bu	0,75	CAB-SP19	PIN1

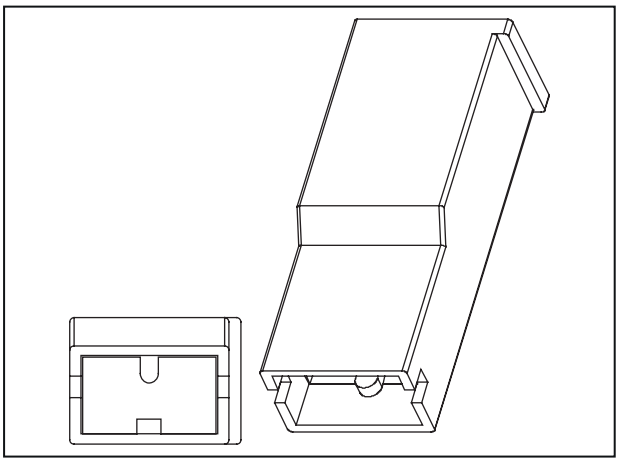
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	12V BATT SUPPLY	Rd	2.5	P100B	4

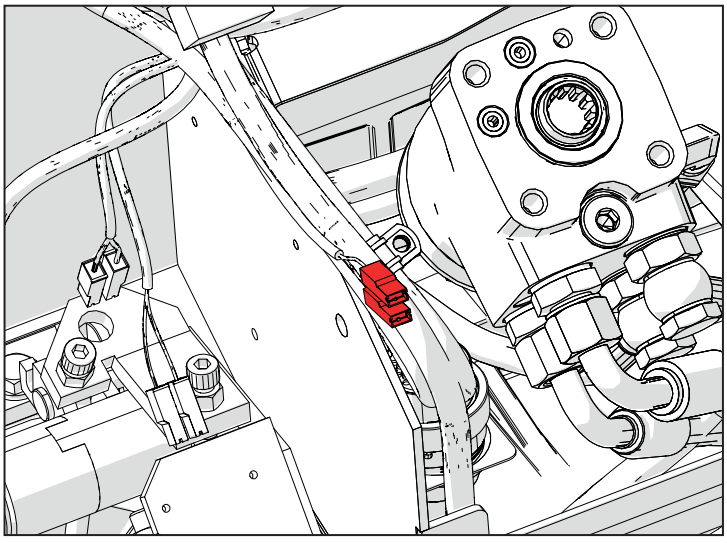


P001 (P456-P457) 1 pole socket

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	POWER SOCKET SUPPLY	Pu	1	CAB-SP16	PIN1

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	GND	BK	1	CAB-SP2	PIN1

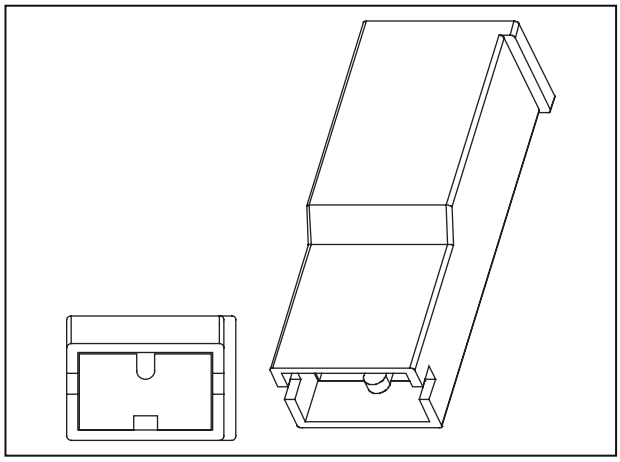


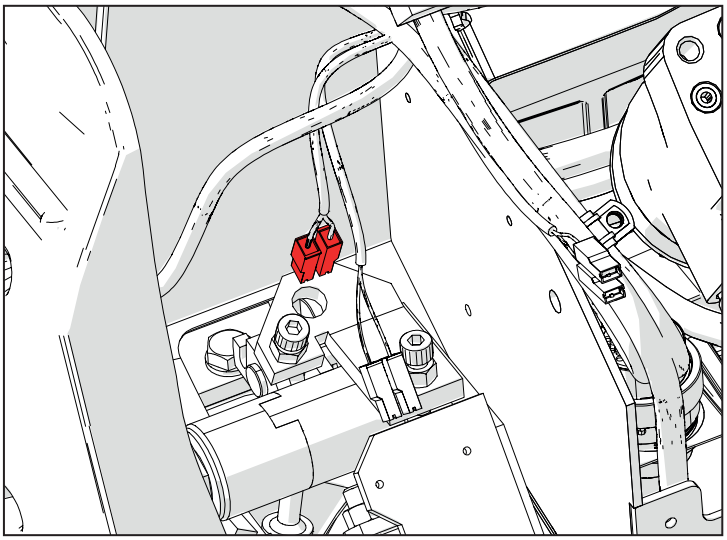


K001 (P492-P493) Clutch start enable signal

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	ENGINE CLUTCH SW	Or	0,75	P30A	35

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	12V	Bn	0,75	CAB-SP18	PIN1





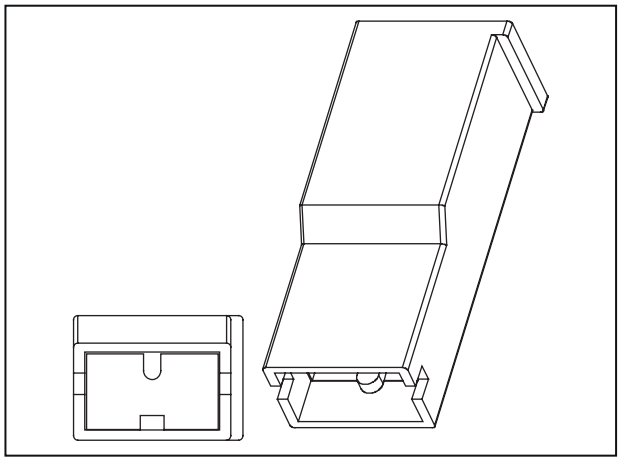
I025 (P504-P505-P506-P507) PTO mode selection

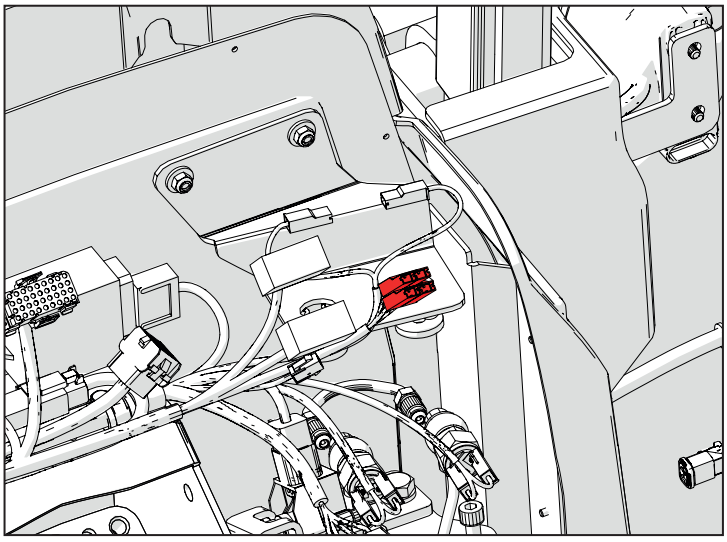
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	PTO FRONT A	Pu	0.5	P30A	18

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	PTO FRONT B	Or	0.5	P30A	19

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	FRONT PTO ENGAGED - 12V	Bn	0.5	CAB-SP1	PIN1

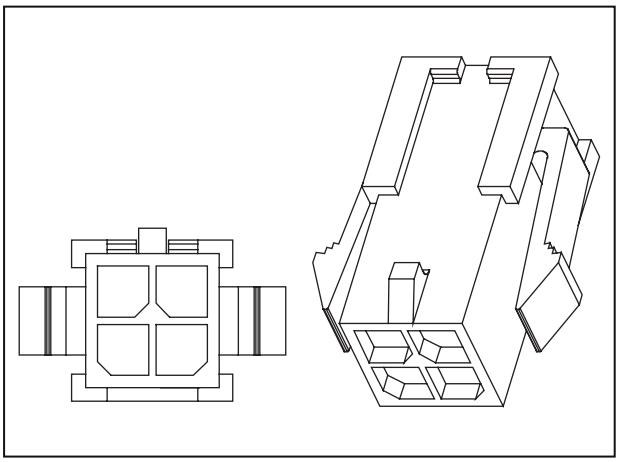
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	FRONT PTO ENGAGED - 12V	Bn	0.5	CAB-SP1	PIN1

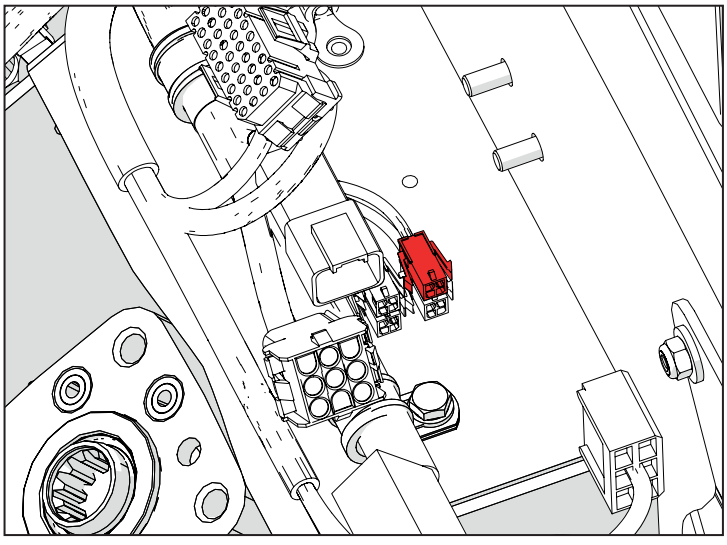




P006 (P508) Trailer test (not used)

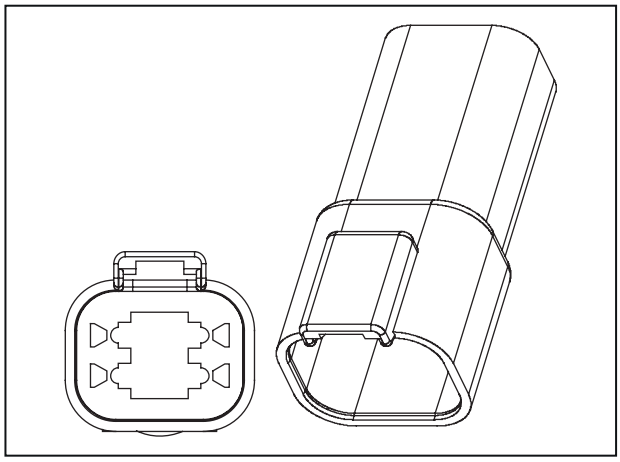
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	PB-TESTING TRAILER	Pu	0.5	P30A	24
4	12V	Bn	0.5	CAB-SP18	PIN1

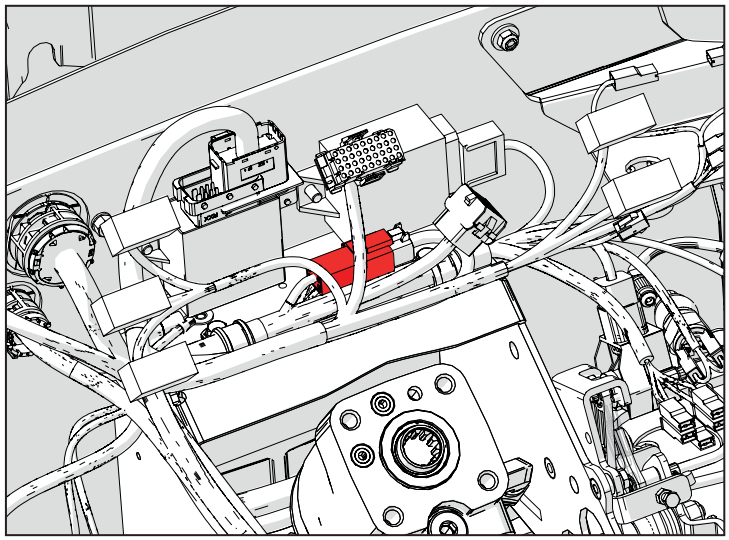




D008 (P573) Wiring connector for joystick wiring loom

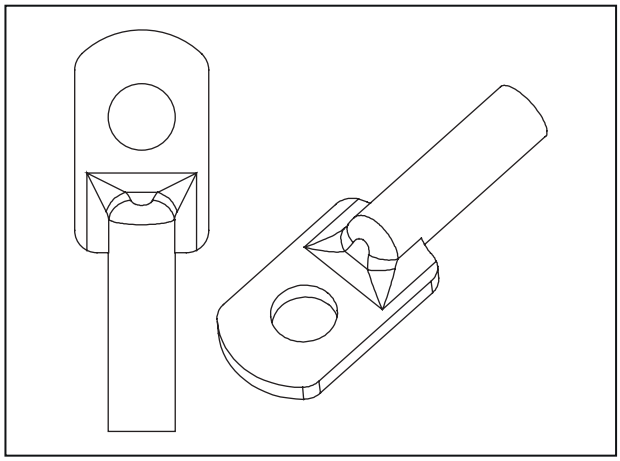
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	V KEY	Bn	V KEY	CAB-SP18	PIN1
2	GND	BK	GND	CAB-SP2	PIN1
3	CAN H	Ye	CAN H	CAB-SP15	PIN1
4	CAN L	Gn	CAN L	CAB-SP17	PIN1

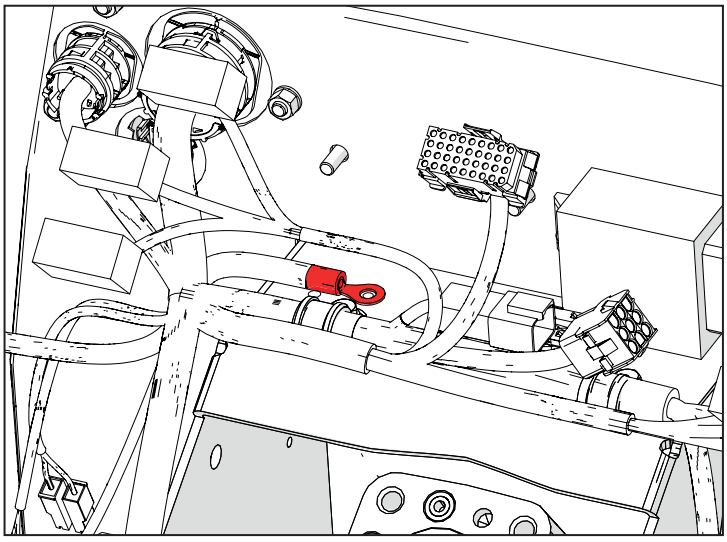




C002 (P576) Cab ground

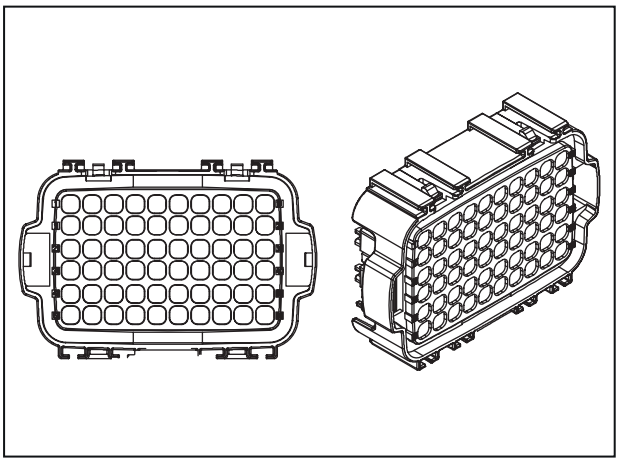
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	CAB GND	BK	4	CAB-SP2	PIN1



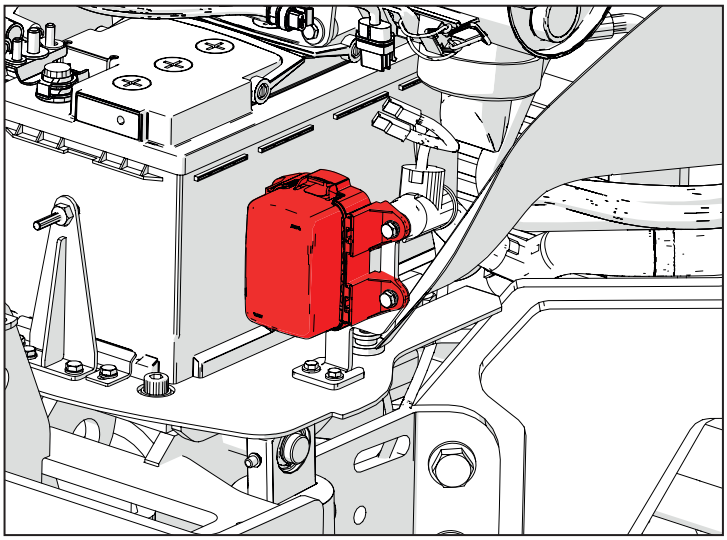


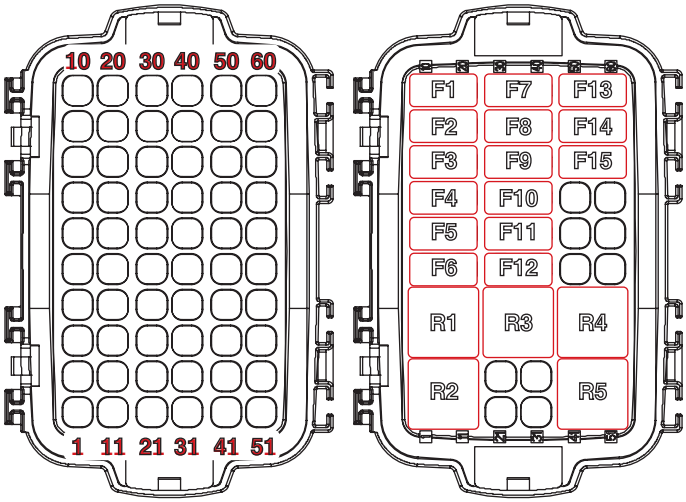
B003 (P1A) Fuse box "2"

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	START COMMAND	Bu	0.5	P100A	25
2	EDC START COMMAND	Bu	0.5	P12	8
3	GND	BK	0.5	ENG-SP6	PIN1
4	HIGH BEAM	Pu	1.5	P1A	7
5	NORMAL BEAM RH	Pu	1.5	ENG-SP20	PIN1
6	NORMAL BEAM LH	Pu	1.5	ENG-SP20	PIN1
7	HIGH BEAM	Pu	1.5	P1A	4
8	V-KEY	Bn	0.5	ENG-SP21	PIN1
9	V KEY	Bn	0.5	ENG-SP21	PIN1
10	V KEY	Bn	1.5	ENG-SP21	PIN1
11	V KEY	Bn	0.5	ENG-SP21	PIN1
12	START ENABLE RELAY	Or	0.5	P100A	33
13	BATTERY 12V	Rd	1.5	ENG-SP17	PIN1
14	HIGH BEAM	Gn	0.5	P100A	27
15	NORMAL BEAM LIGHT RH	Pu	1.5	P20A	2
16	NORMAL BEAM LIGHT LH	Pu	1.5	P20A	3
17	HIGH BEAM LIGHTS	Pu	1.5	P20A	1
18	VECU V KEY	Bn	0.5	P100A	17
19	V-KEY DASH	Bn	0.5	P100A	21
20	VALVES V KEY	Pu	1.5	ENG-SP8	PIN1
23	GND	BK	0.5	ENG-SP6	PIN1
24	NORMAL BEAM	Pu	1.5	ENG-SP20	PIN1
25	BRAKE LIGHTS	Bn	0,75	P1A	44



26	PARKING LIGHT	Ye	1	ENG-SP23	PIN1
27	PARKING LIGHT	Ye	1	ENG-SP23	PIN1
28	EDC V KEY	Bn	0,75	ENG-SP22	PIN1
29	V KEY	Bn	0,75	ENG-SP22	PIN1
30	V KEY	Bn	1.5	ENG-SP22	PIN1
33	BATTERY 12V	Rd	1.5	ENG-SP17	PIN1
34	NORMAL BEAM LIGHTS	Gy	0.5	P100A	10
35	BRAKE LAMP	Rd	0,75	P100A	6
36	PARKING LIGHTS RH	Ye	1	ENG-SP16	PIN1
37	PARKING LIGHTS LH	Ye	1	ENG-SP14	PIN1
38	EDC V KEY	Bn	0,75	P12	54
39	TURN INDICATORS	Or	0,75	P100A	5
40	SENSORS V-KEY	Bn	1.5	ENG-SP7	PIN1
41	RELAY FOR DASHBOARD LED	Or	0.5	P100A	18
42	LED FOR DASH	Gn	0.5	P100A	19
43	BRAKE LIGHTS COMMAND	WH	0.5	P100A	20
44	BRAKE LIGHTS	Bn	0,75	P1A	25
48	V BATT	Rd	1.5	ENG-SP17	PIN1
49	V BATT	Rd	0,75	ENG-SP17	PIN1
50	V BATT	Rd	0,75	ENG-SP17	PIN1
51	LED FOR DASH	Bn	0.5	ENG-SP22	PIN1
52	LED FOR DASH	Bn	0.5	ENG-SP22	PIN1
53	V-KEY	Bn	0,75	ENG-SP22	PIN1
54	V KEY	Bn	0.5	ENG-SP22	PIN1
58	VCU V BATT	Rd	1.5	P100A	22
59	DASHBOARD 12V	Bn	0,75	P100A	14
60	HAZARD LIGHTS CONTROL	Rd	0,75	P100A	1

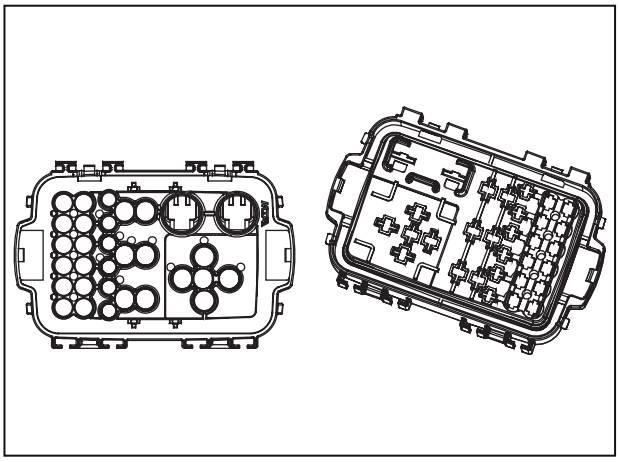




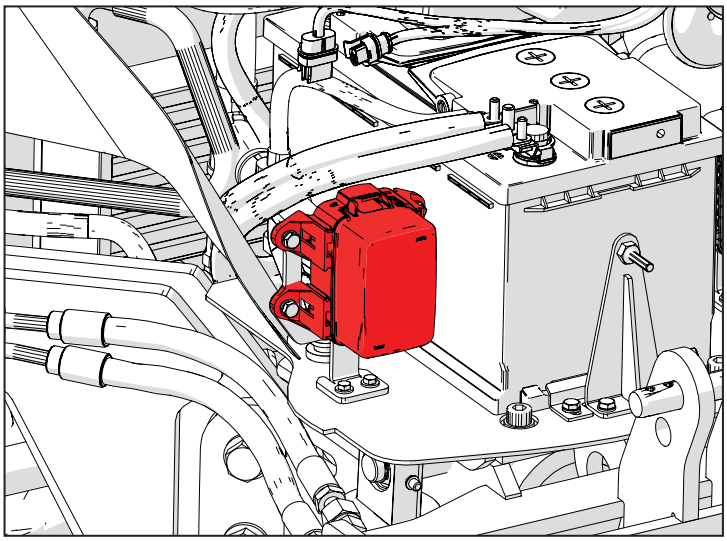
F1	Socket - Rotating beacon	20A
F2	Key-on power feed for dashboard	5A
F3	Key-on power feed for VCU	5A
F4	High beam headlights	10A
F5	LH low beams	10A
F6	RH low beams	10A
F7	Sensors/switches	10A
F8	Turn indicator lights	10A
F9	Key-on power feed for ECU	5A
F10	LH sidelights	10A
F11	RH sidelights	10A
F12	Brake lights	10A
F13	Hazard warning lights	10A
F14	12V VCU power feed	10A
F15	12V dashboard power feed	10A
R1	Start enable relay	
R3	Dashboard LED relay	
R4	High beam relay	
R5	Low beam relay	
R6	Brake light relay	

B004 (P2A) Fuse box "1"

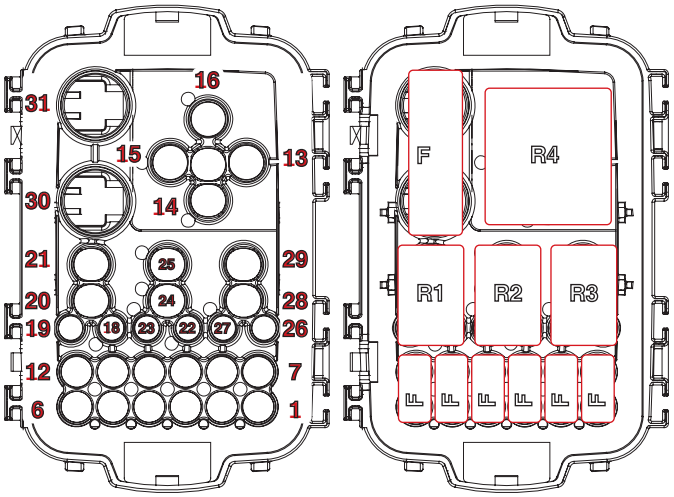
Pin	Description	Colour	Sect.	Input Conn.	Pin
31	12V BATT SUPPLY	Rd	10	ENG-SP17	PIN1
25	FUEL FILTER HEATER	Rd	2.5	P17	2
4	FUEL FILTER HEATER	Rd	2.5	P472	1
14	12V	Rd	4	ENG-SP18	PIN1
2	EDC POWER SUPPLY	Rd	1.5	P12	1
29	12V BATT SUPPLY	Rd	1.5	ENG-SP17	PIN1
13	MAIN RELAY	Rd	0.5	P472	1
11	POWER SOCKET SUPPLY	Rd	2.5	P2A	20
19	GND	BK	0.5	ENG-SP6	PIN1
5	12V TRAILER SOCKET	Rd	2.5	P472	1
18	V KEY	Bn	0,75	P100A	12
16	BATTERY 12V	Rd	4	P472	1
3	12V	Rd	2.5	ENG-SP5	PIN1
28	START ENABLE	Rd	1.5	ENG-SP3	PIN1
9	12V	Rd	1.5	ENG-SP18	PIN1
10	FUEL FILTER HEATER	Rd	2.5	P2A	24
27	O-S-STRTL	Gy	0,75	P12	27
26	O-S-STRTH	Bu	0,75	P12	53
22	FUEL FILTER HEATER	Gy	0,75	P12	70
6	12 BATT	Rd	1.5	ENG-SP17	PIN1
1	EDC POWER SUPPLY	Rd	1.5	ENG-SP15	PIN1
12	VJ1939 POWER SUPPLY	Rd	1.5	P100A	15
15	MAIN RELAY	BK	0,75	P12	28
21	POWER SOCKET SUPPLY	Rd	2.5	P102A	14
20	POWER SOCKET SUPPLY	Rd	2.5	P2A	11



30	12V BATT SUPPLY	Rd	10	P63	1
23	12V MAIN RELAY	Rd	0,75	ENG-SP5	PIN1
7	12V	Rd	1.5	ENG-SP18	PIN1
8	12V	Rd	1.5	ENG-SP18	PIN1
24	FUEL FILTER HEATER	Rd	2.5	P2A	10

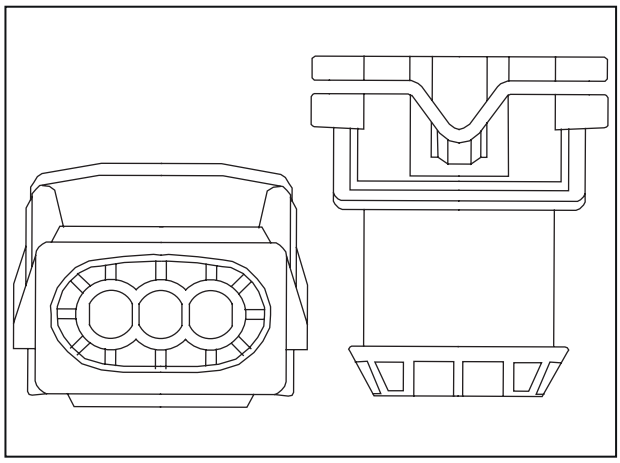


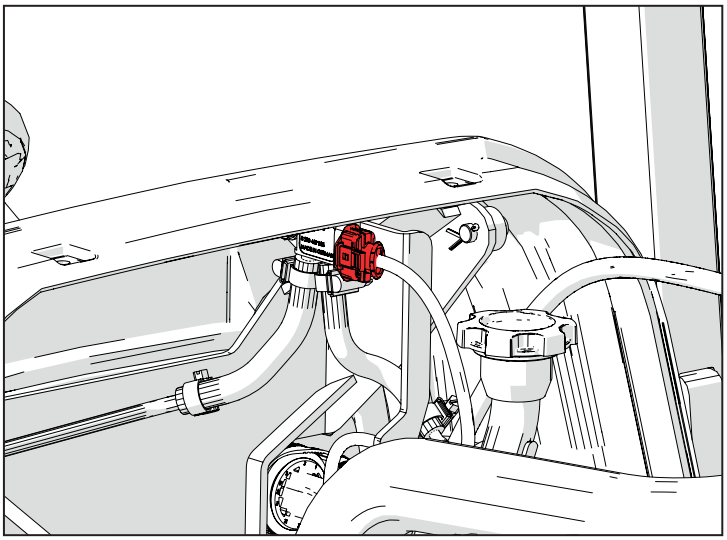
F16	Diagnostic port	10A
F17	Trailer socket	15A
F18	Fuel pre-heat	20A
F19	Accessories	15A
F20	12V ECU power feed	10A
F21	12V ECU power feed	15A
F22	Main Maxi fuse	70A
R1	Trailer socket relay	30A
R2	Fuel pre-heat relay	20A
R3	Starter relay	20A
R4	Main relay	30A



K004 (P3) Differential pressure sensor

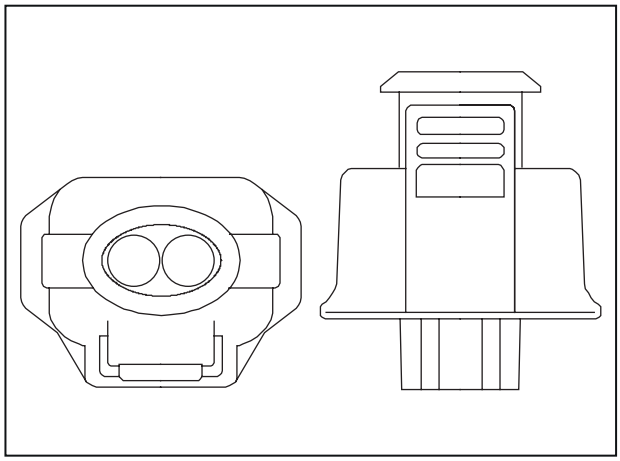
Pin	Description	Colour	Sect.	Input Conn.	Pin
1		Bu	0.5	P12	14
2		Bn	0.5	P12	36
3		Gn	0.5	P12	58

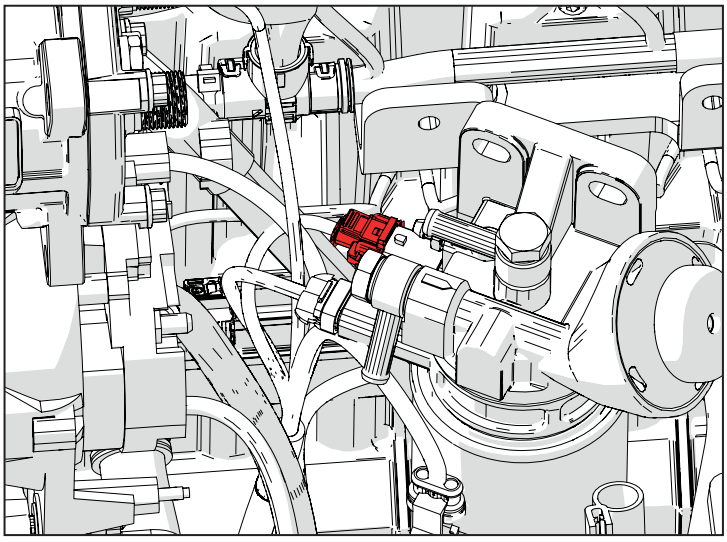




K007 (P4) Fuel temperature sensor

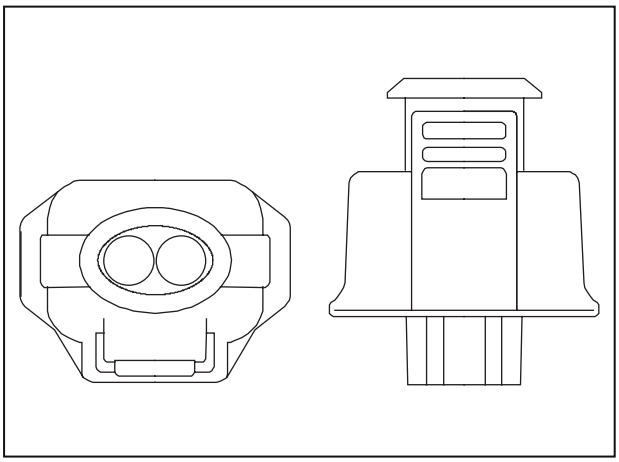
Pin	Description	Colour	Sect.	Input Conn.	Pin
1		Gn	0.5	P12	87
2		Wh	0.5	P12	65

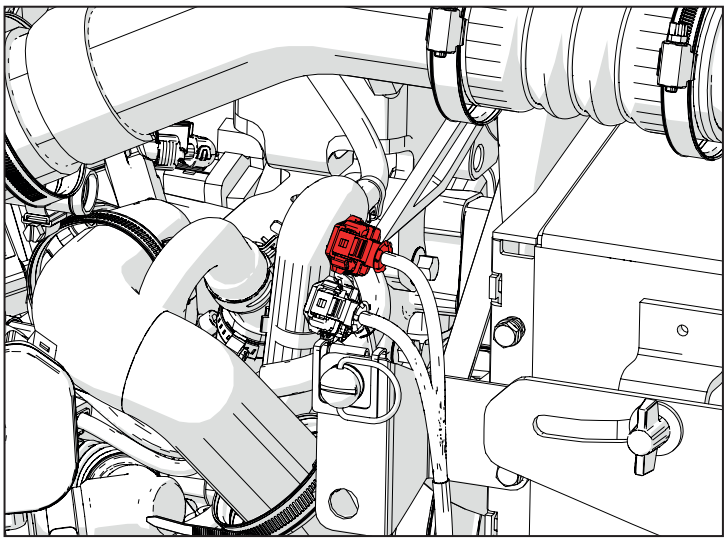




K011 (P6) DPF temperature sensor

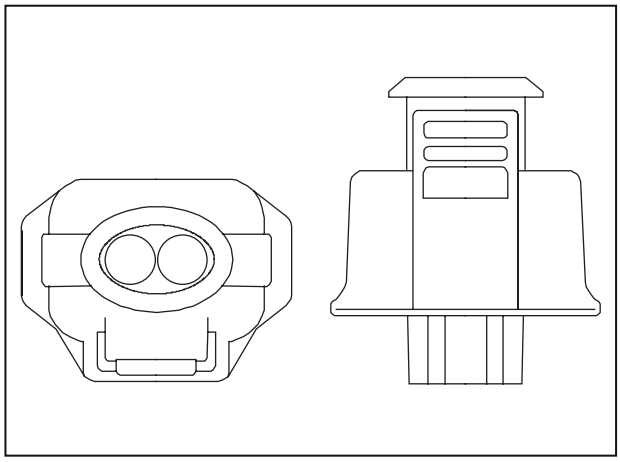
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	G_R_EXTS2	Rd	0.5	P12	83
2	I_A_EXTS2	Wh	0.5	P12	84

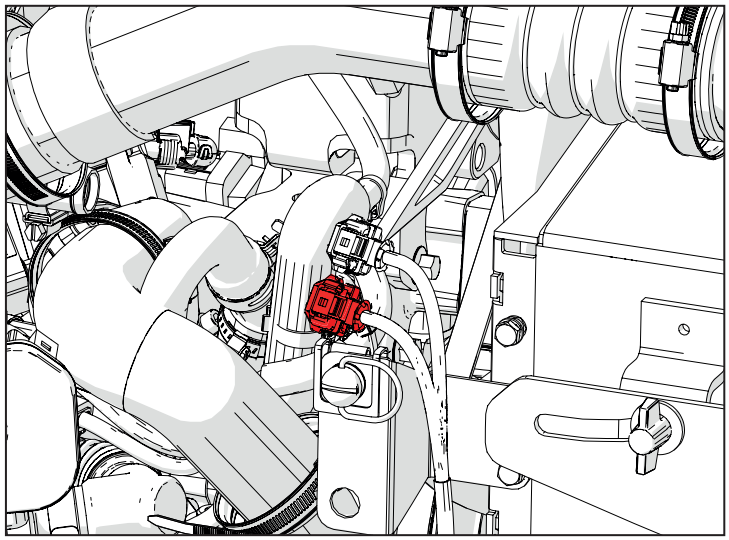




K012 (P7) DOC temperature sensor

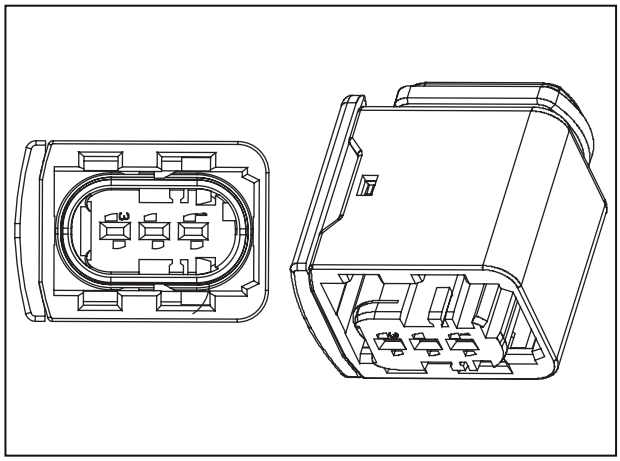
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	G_R_EXTS1	Bu	0.5	P12	77
2	I_A_EXTS1	Gy	0.5	P12	78

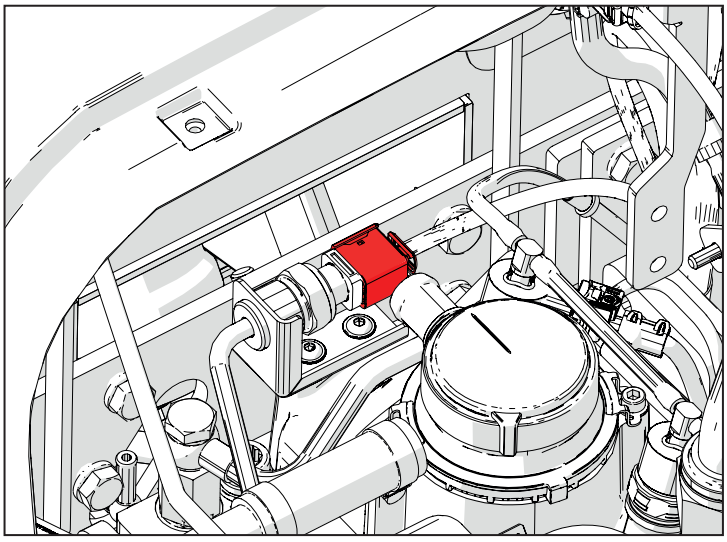




K005 (P8) P3 sensor (exhaust pressure)

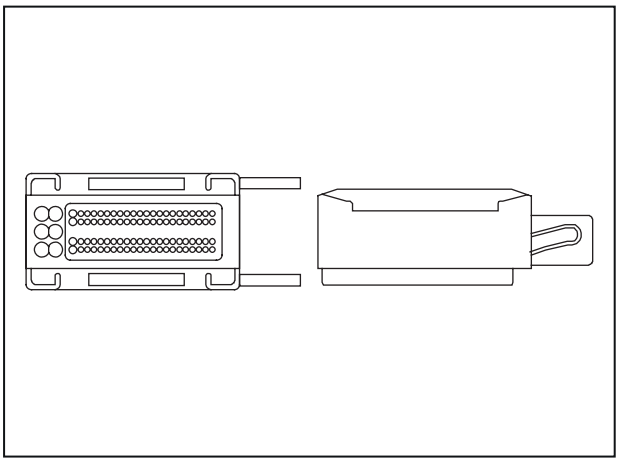
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	V_V_5V2 EGPPRE	Rd	0.5	P12	15
2	I_A_EGPPRE	Gn	0.5	P12	35
3	G_R_EGPPRE	Ye	0.5	P12	57



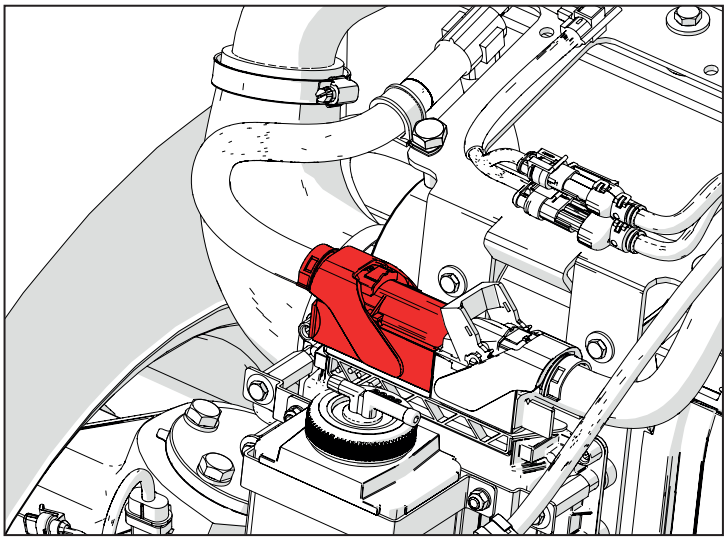


M002B (P12) Engine control unit

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	EDC POWER SUPPLY	Rd	1.5	P2A	2
2	GND	BK	1.5	ENG-SP9	PIN1
3	EDC POWER SUPPLY	Rd	1	ENG-SP15	PIN1
4	GND	BK	1.5	ENG-SP9	PIN1
5	EDC POWER SUPPLY	Rd	1	ENG-SP15	PIN1
6	GND	BK	1.5	ENG-SP9	PIN1
8	EDC START COMMAND	Bu	0.5	P1A	2
14		Bu	0.5	P3	1
15	V_V_5V2 EGPPRE	Rd	0.5	P8	1
19		Or	0.5	P467	1
23	CAN 2 H	Ye	0.5	P469	3
24	CAN H	Ye	0.5	ENG-SP11	PIN1
25	CAN L	Gn	0.5	ENG-SP12	PIN1
27	O-S-STRTL	Gy	0,75	P2A	27
28	MAIN RELAY	BK	0,75	P2A	15
30	WATER IN FUEL SENSOR	Pu	0.5	P16	1
32	DPF REGENERATION INHIBIT SW	Bn	0,75	P100A	28

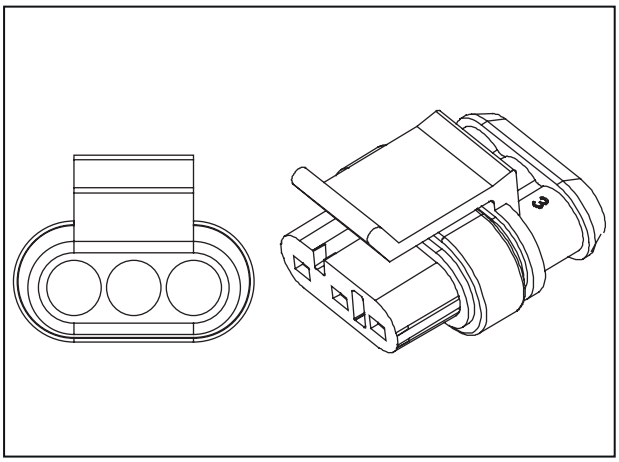


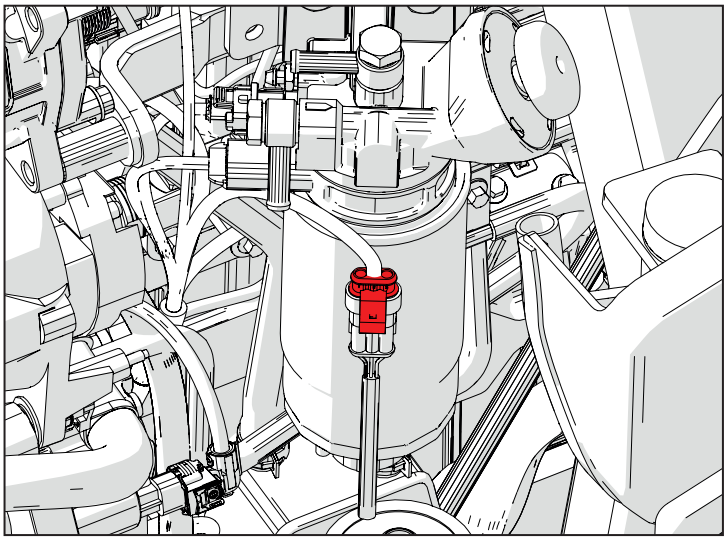
33	CLOSING CIRCUIT RESISTOR	Or	0.5	330 ohm - 1W - 1%	1
34		BK	0.5	P467	2
35	I_A_EGPPRE	Gn	0.5	P8	2
36		Bn	0.5	P3	2
42	DPF REGENERATION TRIGGER SWITCH	Bu	0,75	P100A	32
45	CAN 2 L	Gn	0.5	P469	4
46	CAN H	Ye	0.5	ENG-SP11	PIN1
47	CAN L	Gn	0.5	ENG-SP12	PIN1
53	O-S-STRTH	Bu	0,75	P2A	26
54	EDC V KEY	Bn	0,75	P1A	38
55	CLOSING CIRCUIT RESISTOR	Or	0.5	330 ohm - 1W - 1%	2
57	G_R_EGPPRE	Ye	0.5	P8	3
58		Gn	0.5	P3	3
65		Wh	0.5	P4	2
70	FUEL FILTER HEATER	Gy	0,75	P2A	22
77	G_R_EXTS1	Bu	0.5	P7	1
78	I_A_EXTS1	Gy	0.5	P7	2
81		Gn	0.5	P465	1
82		Bu	0.5	P465	2
83	G_R_EXTS2	Rd	0.5	P6	1
84	I_A_EXTS2	Wh	0.5	P6	2
87		Gn	0.5	P4	1
92	GLOW PLUGS RELAY	Bu	0,75	P452	86



K006 (P16) Water in fuel sensor

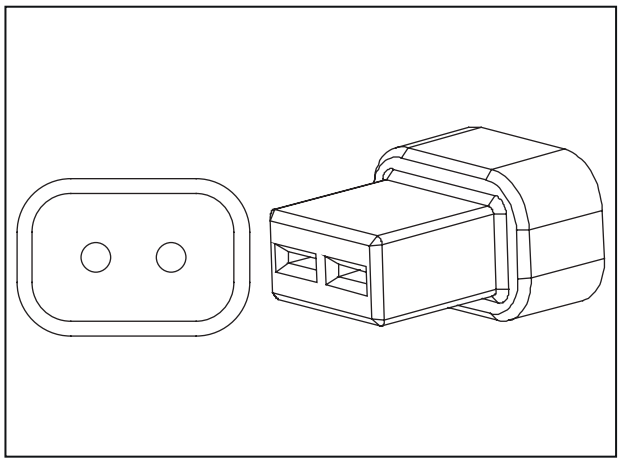
Pin	Description	Colour	Sect.	Input Conn.	Pin
2	GND	BK	0.5	ENG-SP6	PIN1
3	WATER IN FUEL 12V	Rd	0.5	ENG-SP5	PIN1

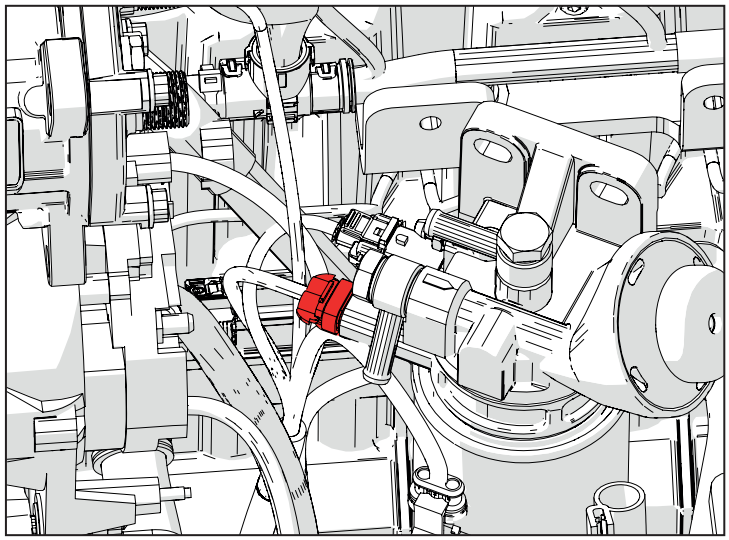




O001 (P17) Fuel filter preheat

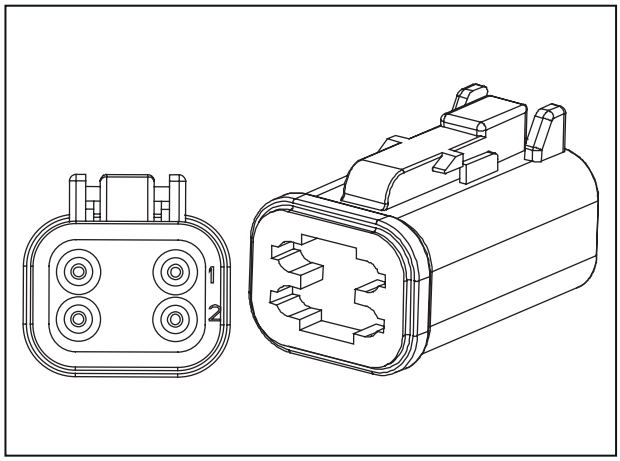
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	FUEL FILTER HEATER - GND	BK	2.5	ENG-SP6	PIN1
2	FUEL FILTER HEATER	Rd	2.5	P2A	25

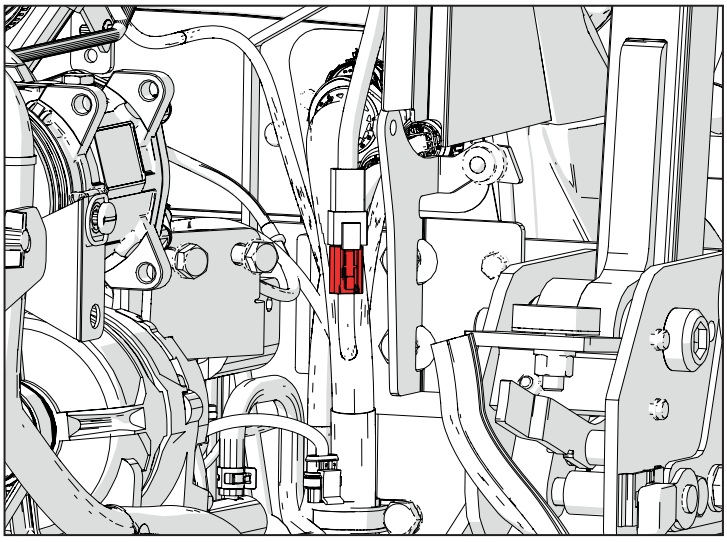




D001 (P20A) Wiring connector for cowl wiring loom

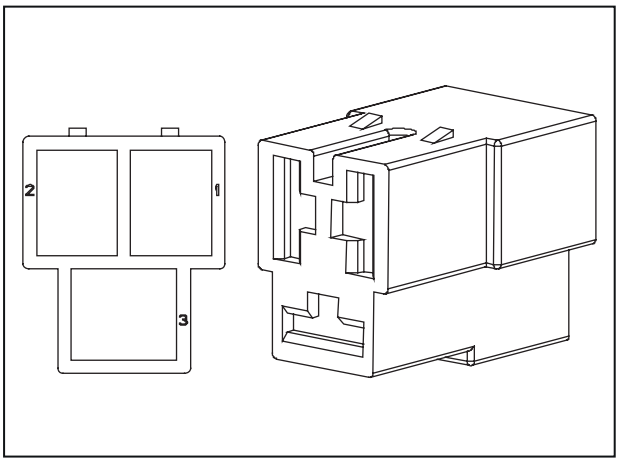
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	HIGH BEAM LIGHTS	Pu	1.5	P1A	17
2	NORMAL BEAM LIGHT RH	Pu	1.5	P1A	15
3	NORMAL BEAM LIGHT LH	Pu	1.5	P1A	16
4	FRONT LIGHTS GND	BK	1.5	ENG-SP6	PIN1

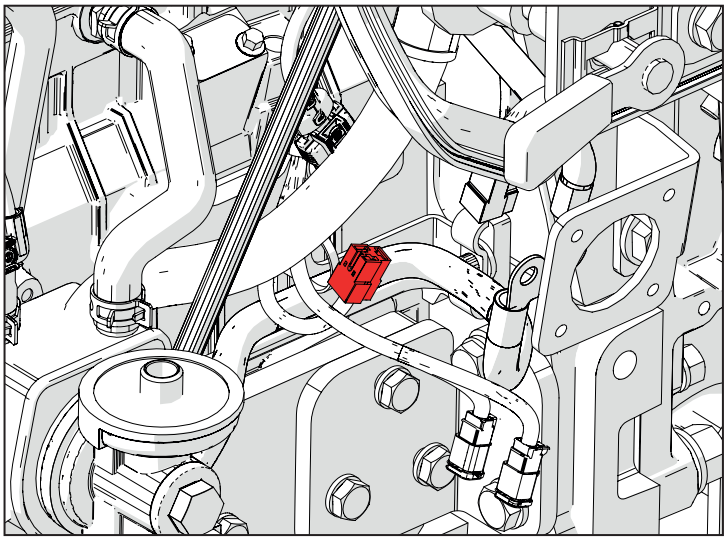




D002 (P40B) Wiring connector for LH parking lights wiring loom

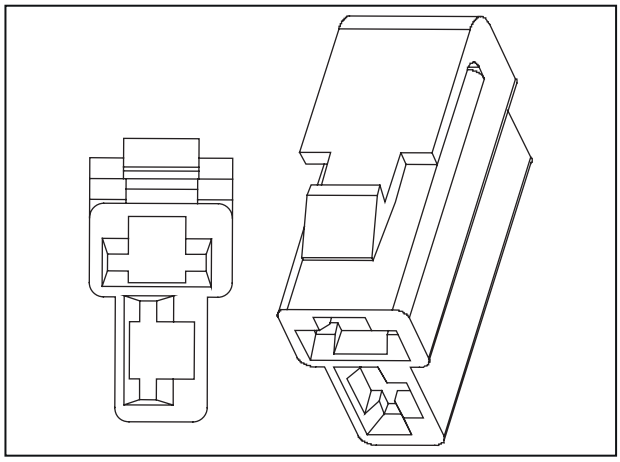
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	LEFT INDICATOR LIGHT	Bu	0,75	P102A	3
2	PARKING LIGHTS LH	Ye	0,75	ENG-SP14	PIN1
3	LH FENDER LIGHTS GND	BK	0,75	ENG-SP6	PIN1

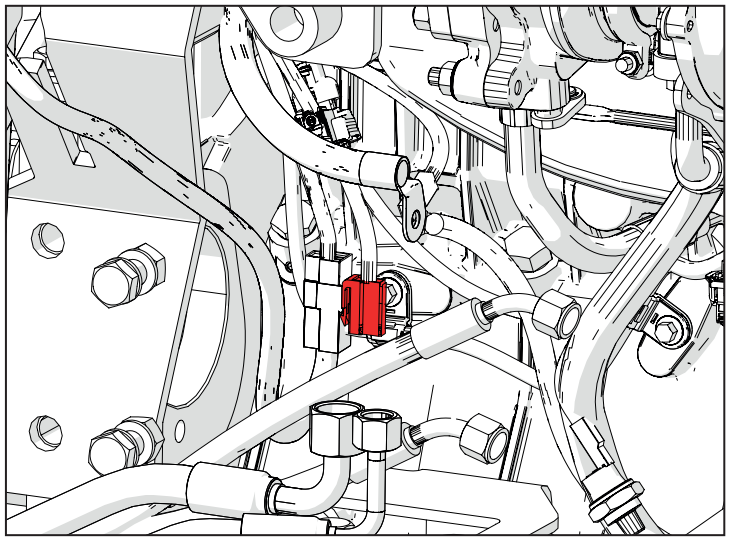




F009 (P41) Provision for rotating beacon, roll-bar version

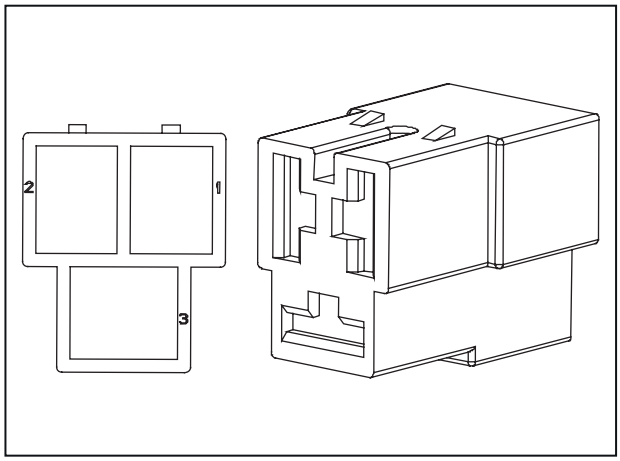
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	BEACON	BK	0,75	ENG-SP6	PIN1
2	BEACON LIGHT SUPPLY	Pu	0,75	P102A	6

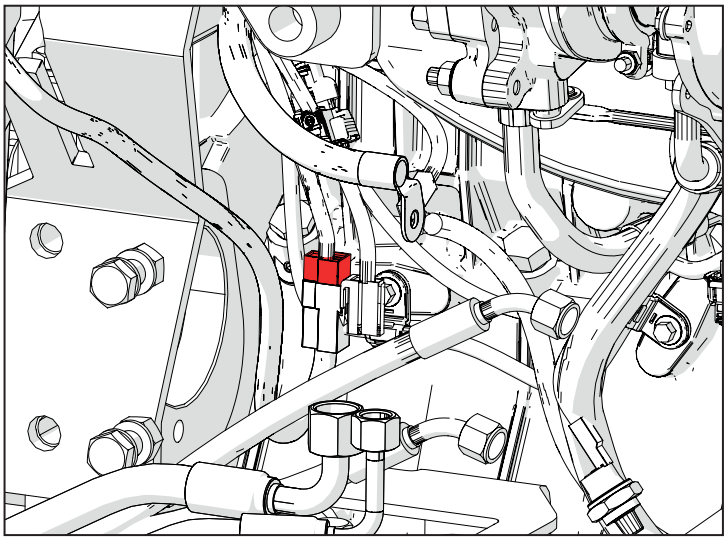




D003 (P50B) Wiring connector for RH parking lights wiring loom

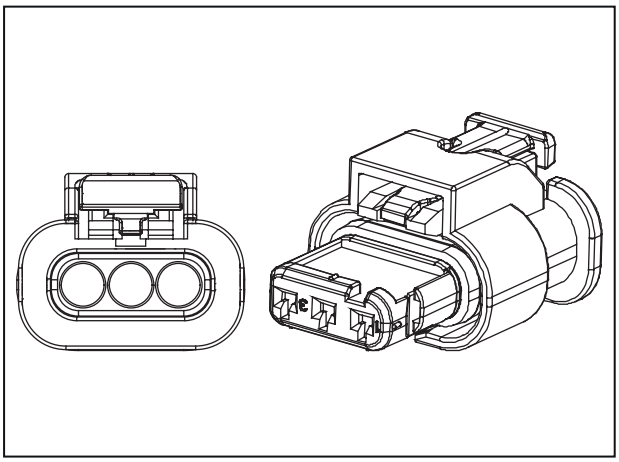
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	RIGHT INDICATOR LIGHT	Bu	0,75	P102A	4
2	PARKING LIGHTS RH	Ye	0,75	ENG-SP16	PIN1
3	RH FENDER LIGHTS GND	BK	0,75	ENG-SP6	PIN1

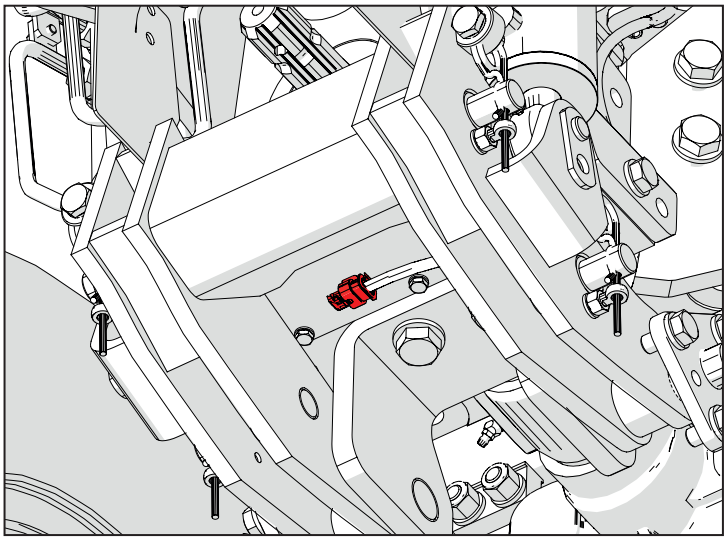




K008 (P54) PTO shaft speed sensor

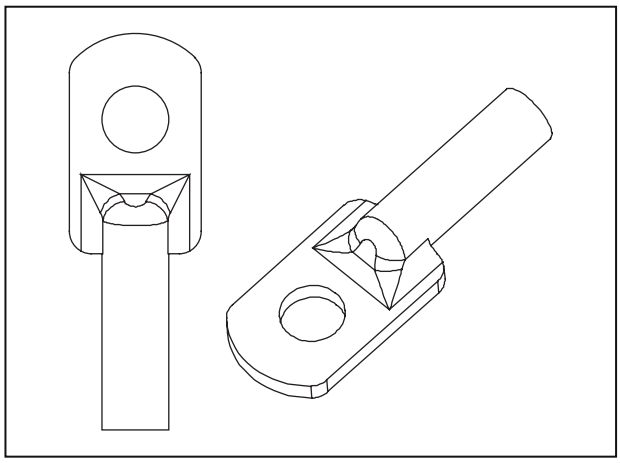
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	VCC	Bn	0,75	ENG-SP7	PIN1
2	PTO shaft rpm sensor	Pu	0,75	P100A	7
3	GND T	BK	0,75	ENG-SP6	PIN1

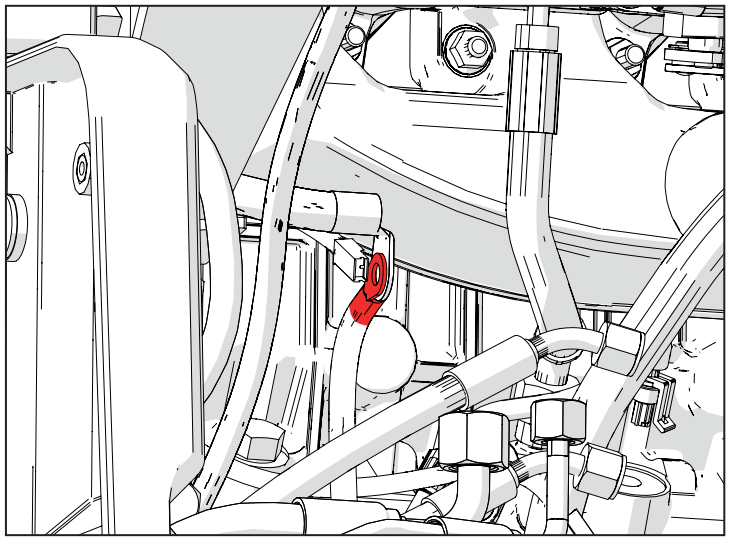




N003 (P63) Starter motor

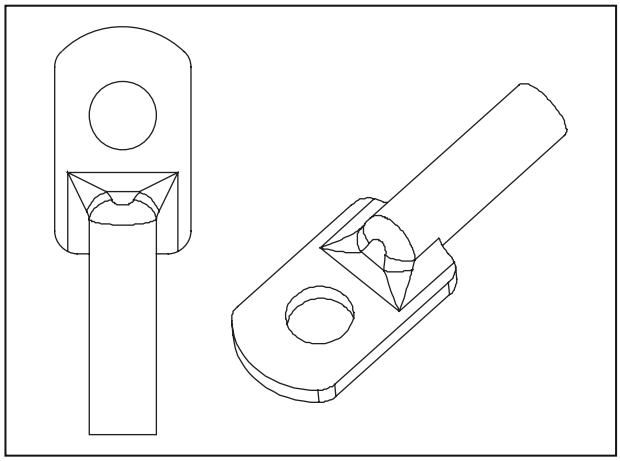
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	12V BATT SUPPLY	Rd	10	P2A	30
1	GLOW PLUG 12V	Rd	4	P476	1

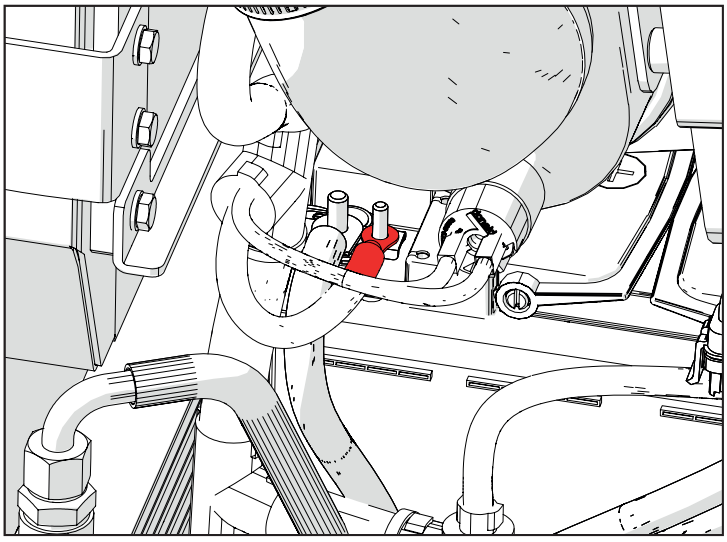




C004 (P105) Engine ground point

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	FRONT GROUND	BK	6	ENG-SP6	PIN1
1	GND	BK	4	ENG-SP9	PIN1

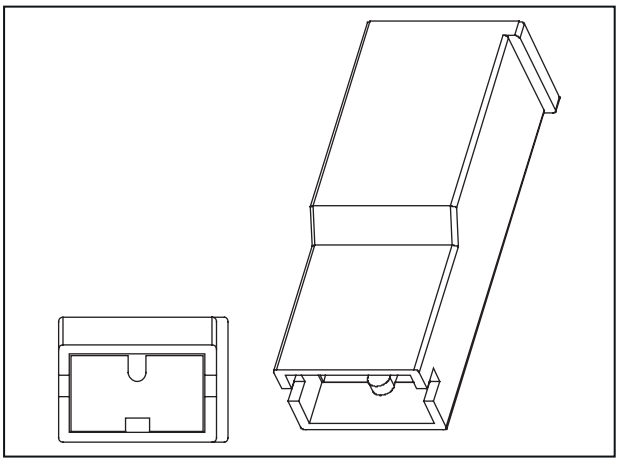


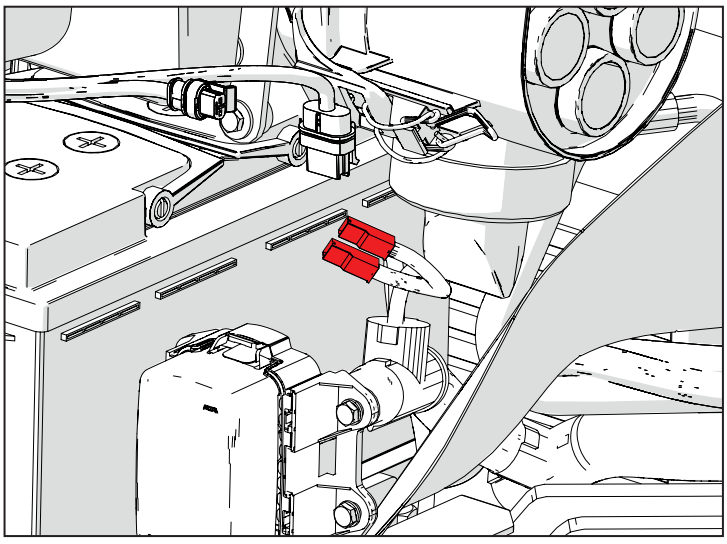


E005 (P149-P152) Horn

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	HORN - GND	BK	0,75	ENG-SP6	PIN1

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	HORN POWER SUPPLY	Pu	0,75	P100A	2

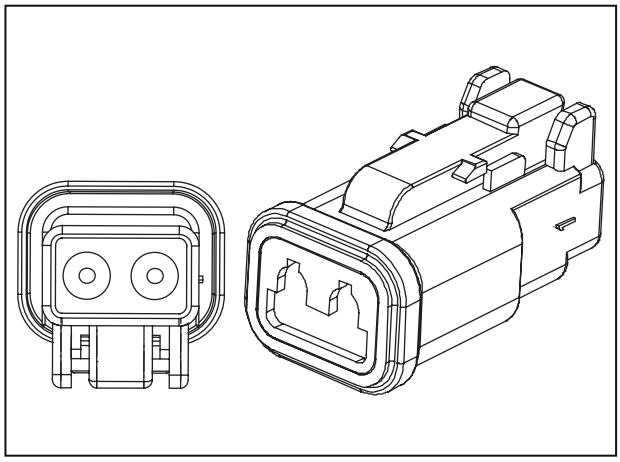


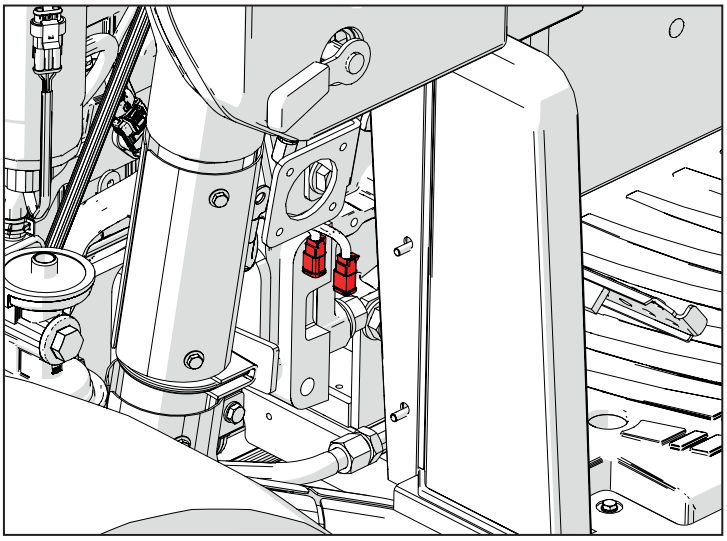


B001 (P183-P191) Front PTO valves

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	12V	Gy	0.5	VPTO-SP1	PIN1
2	FRONT PTO ON/ OFF	Gn	0.5	P10B	1

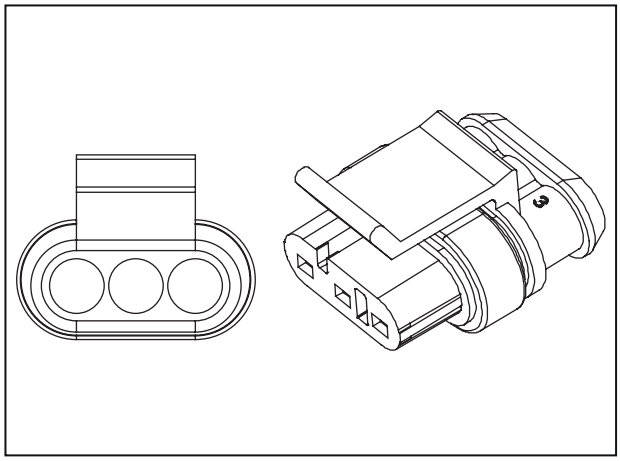
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	12V	Gy	0.5	VPTO-SP1	PIN1
3	FRONT PTO PROPORTIONAL	Bu	0.5	P10B	3

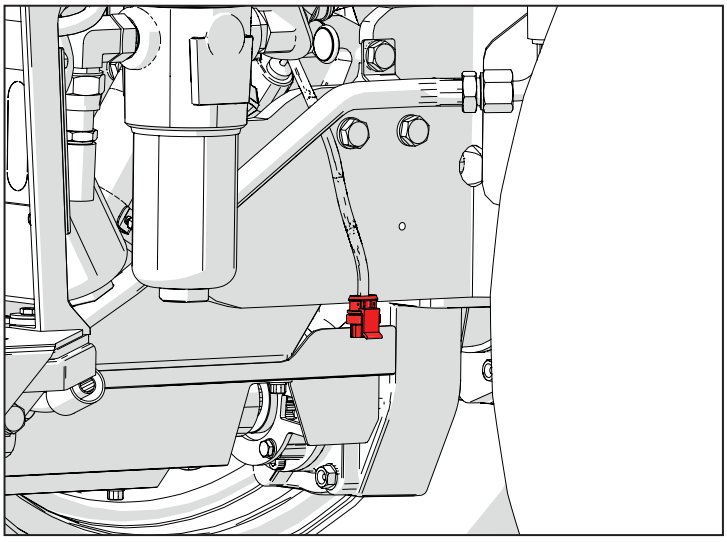




K014 (P301) Wheel speed sensor

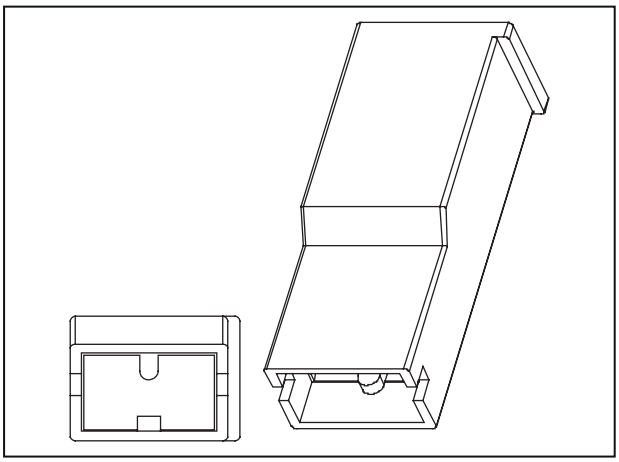
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	VCC	Bn	0,75	ENG-SP7	PIN1
2	Wheel Speed	Bu	0,75	P100A	13
3	WHEEL SPEED GND	BK	0,75	ENG-SP6	PIN1

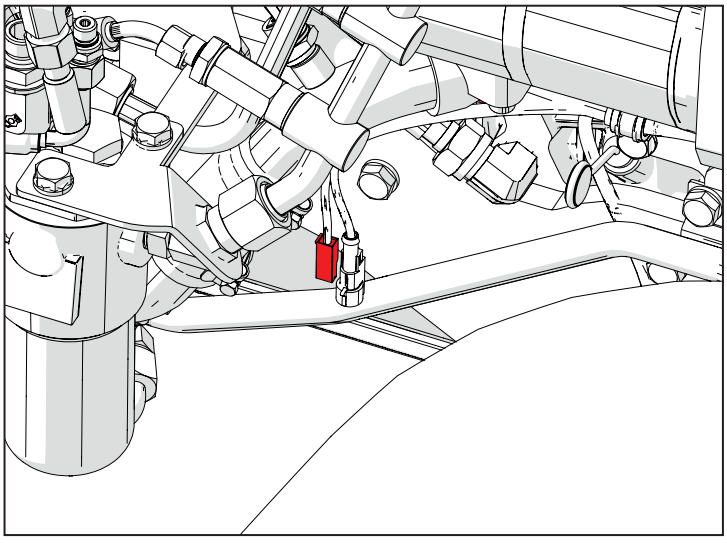




I016 (P322) Key-on power for cab

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	V KEY	Bn	1.5	P102A	8

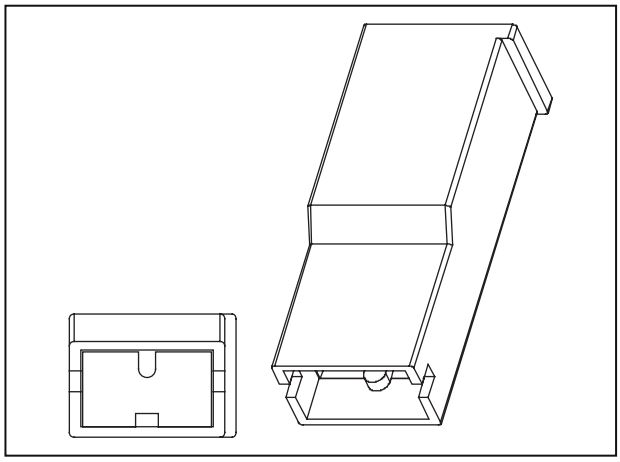


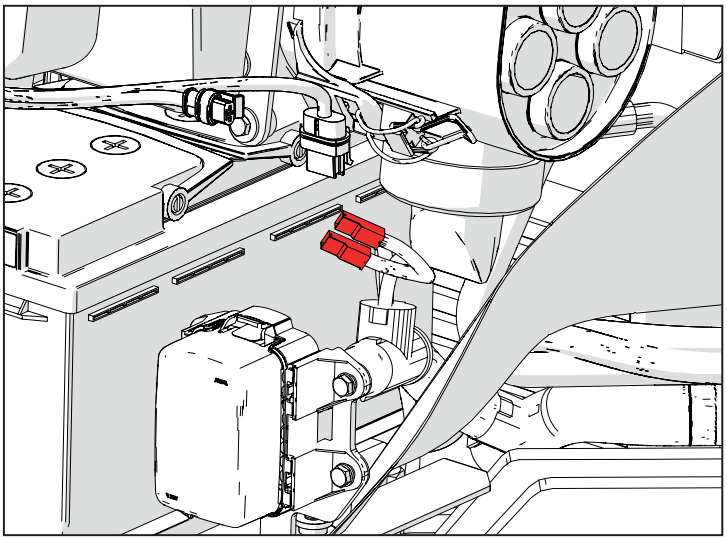


K010 (P439-P440) Air filter sensor

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	AIR FILTER	Gn	0,75	P100A	3

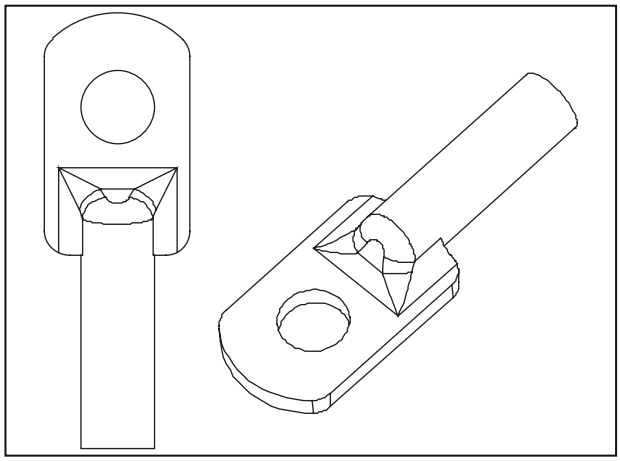
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	GND	BK	0.5	ENG-SP6	PIN1

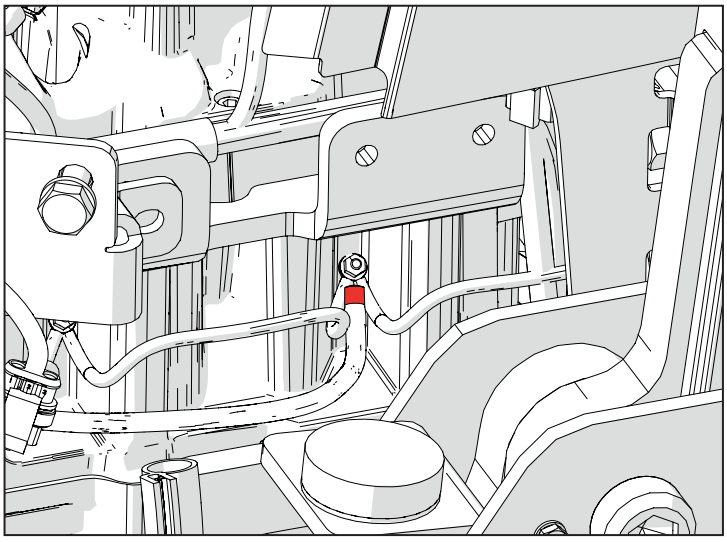




C003 (P442) Glow plug ground

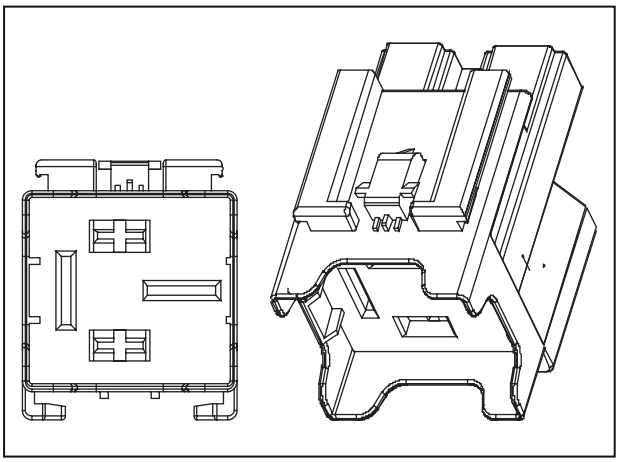
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	GLOW PLUG V BATT	Rd	4	P442	1

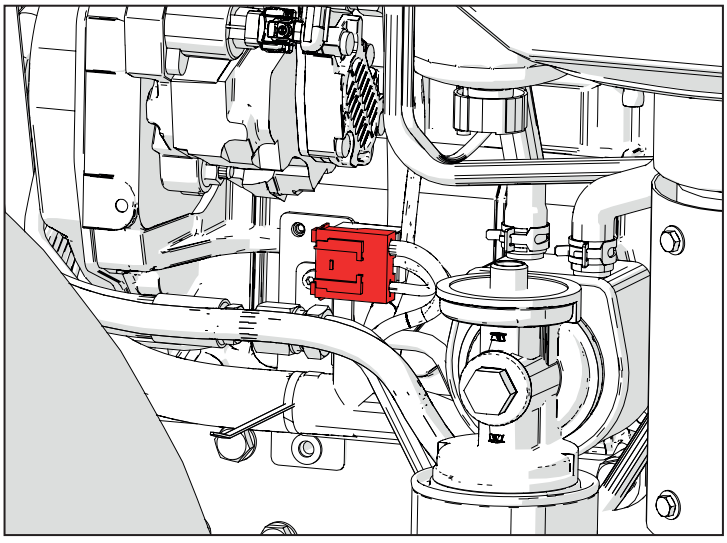




J002 (P452) Glow plug relay

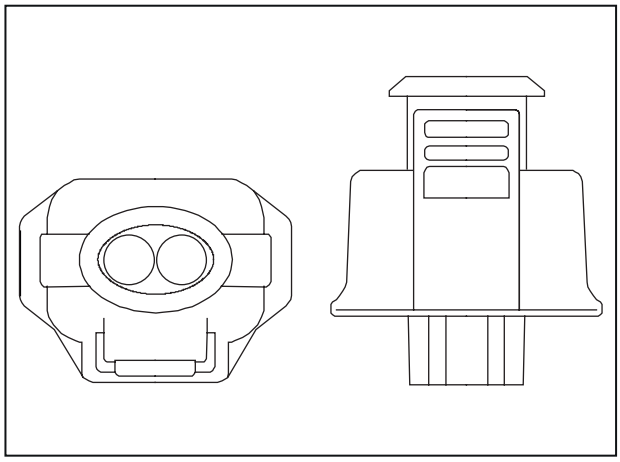
Pin	Description	Colour	Sect.	Input Conn.	Pin
30	GLOW PLUG 12V	Rd	4	P476	2
85	GLOW PLUG RELAY	Rd	1	ENG-SP5	PIN1
86	GLOW PLUGS RELAY	Bu	0,75	P12	92
87	GLOW PLUG V BATT	Rd	4	P442	1

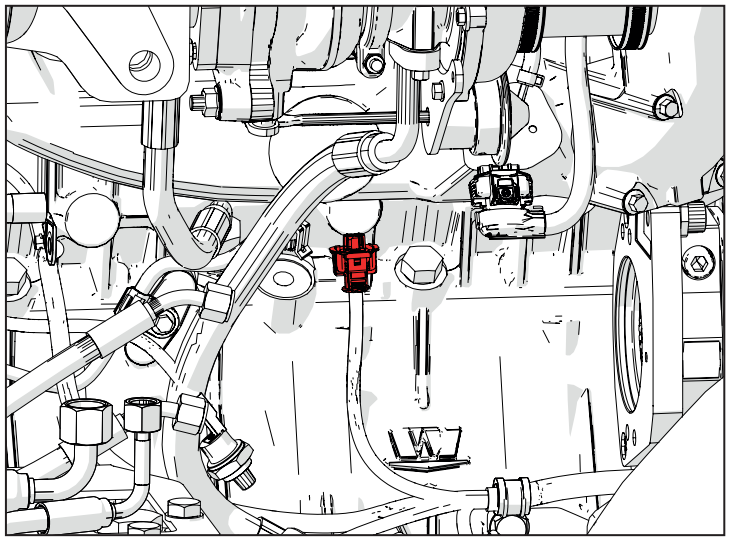




K013 (P465) Exhaust gas temperature sensor

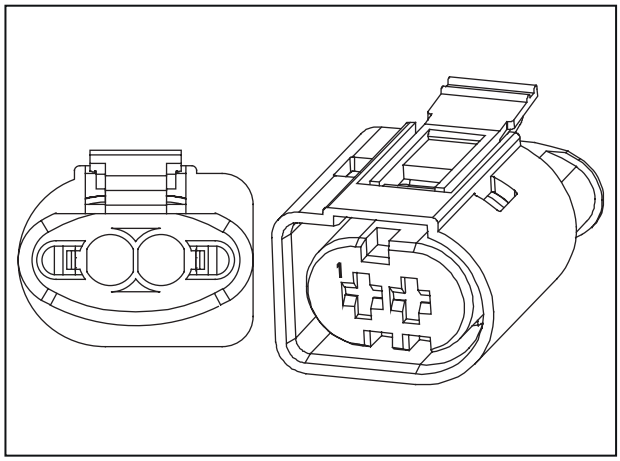
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	GLOW PLUG V BATT	Gn	0.5	P12	81
2	GLOW PLUG RELAY	Bu	0.5	P12	82

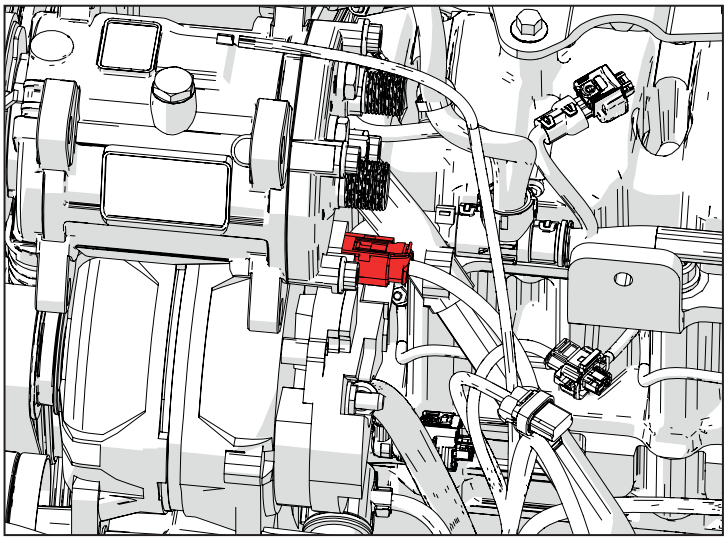




A007 (P468) Alternator

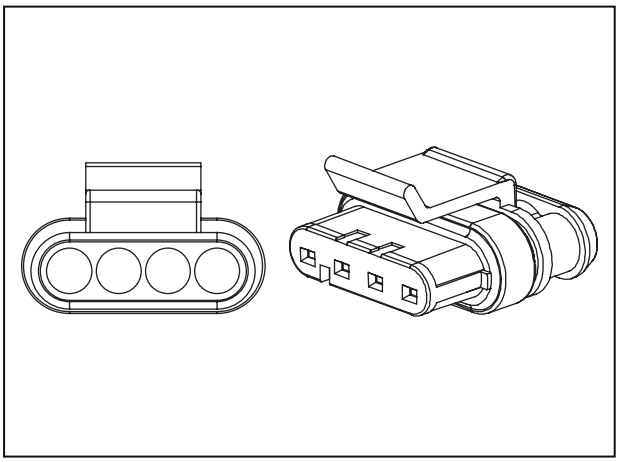
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	ALTERNATOR D+	Bu	0,75	P1	1

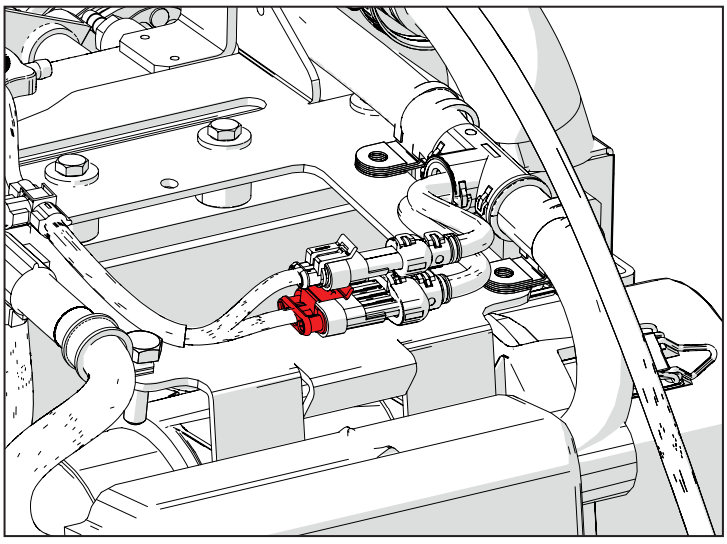




D009 (P469) Wiring connector for prewired engine wiring loom

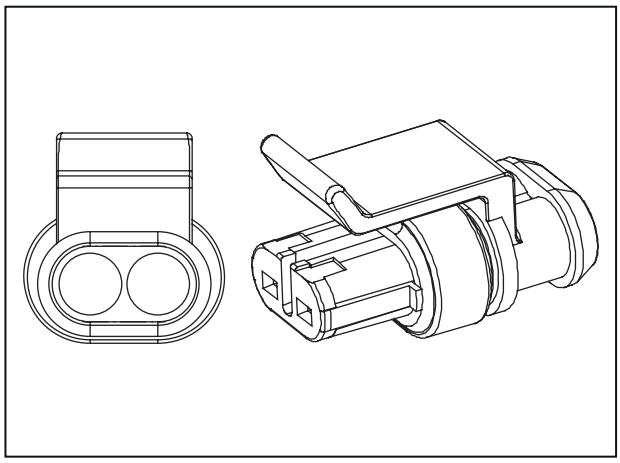
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	GND	BK	0,75	ENG-SP6	PIN1
2	EGR VALVE 12V	Rd	0,75	ENG-SP5	PIN1
3	CAN 2 H	Ye	0.5	P12	23
4	CAN 2 L	Gn	0.5	P12	45

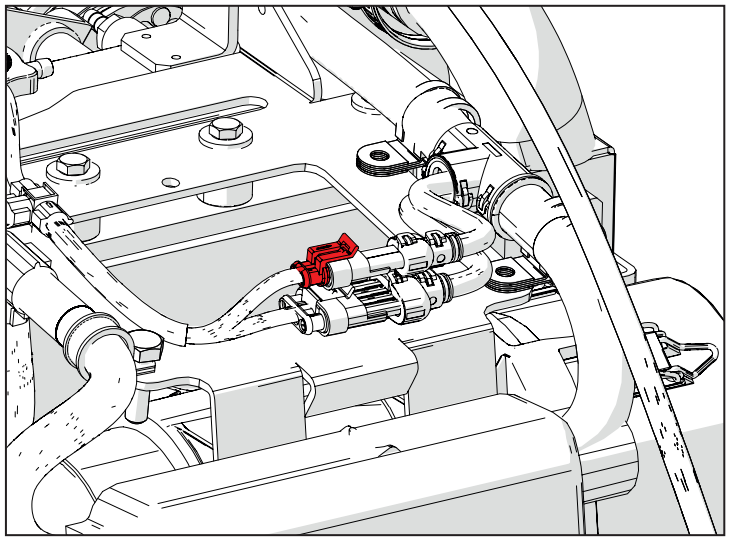




D010 (P470) Wiring connector for prewired engine wiring loom

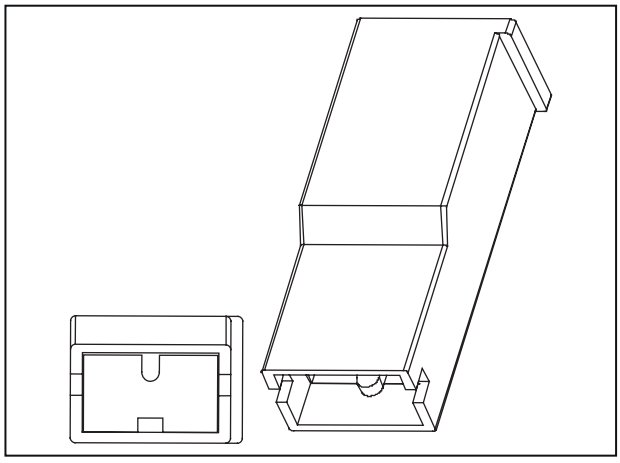
Pin	Description	Colour	Sect.	Input Conn.	Pin
2	THROTTLE VALVE 12V	Rd	0,75	ENG-SP5	PIN1

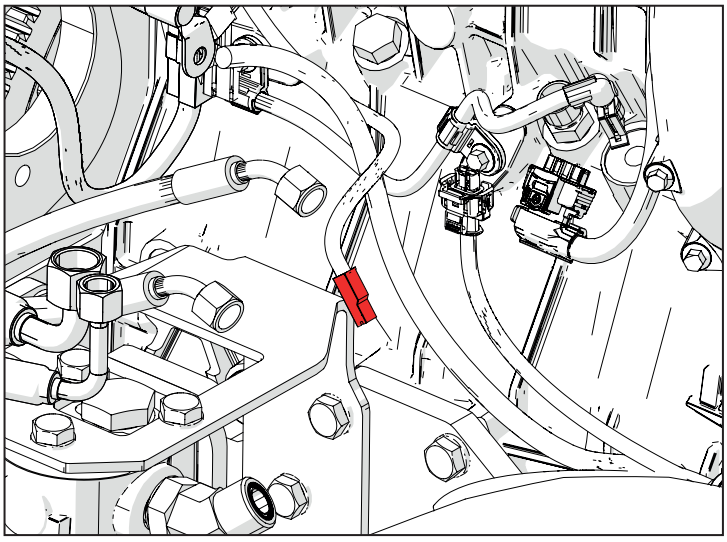




K026 (P471) Suction line hydraulic oil pressure sensor

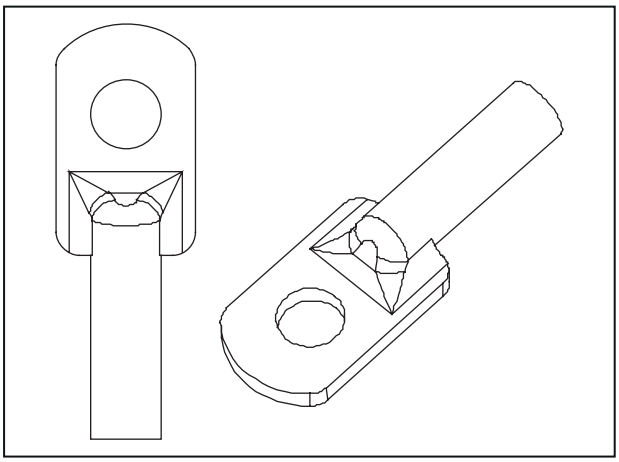
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	HYD OIL PRESSURE SWITCH	Ye	0,75	P100A	23

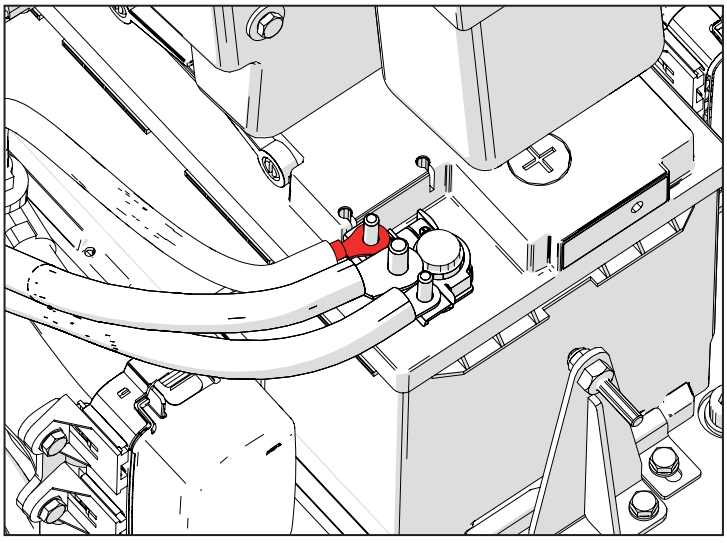




A008 (P472) Positive battery terminal

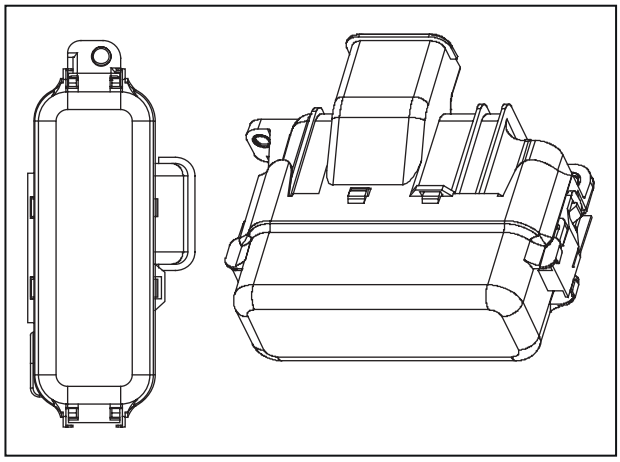
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	FUEL FILTER HEATER	Rd	2.5	P2A	4
1	MAIN RELAY	Rd	0.5	P2A	13
1	12V TRAILER SOCKET	Rd	2.5	P2A	5
1	BATTERY 12V	Rd	4	P2A	16

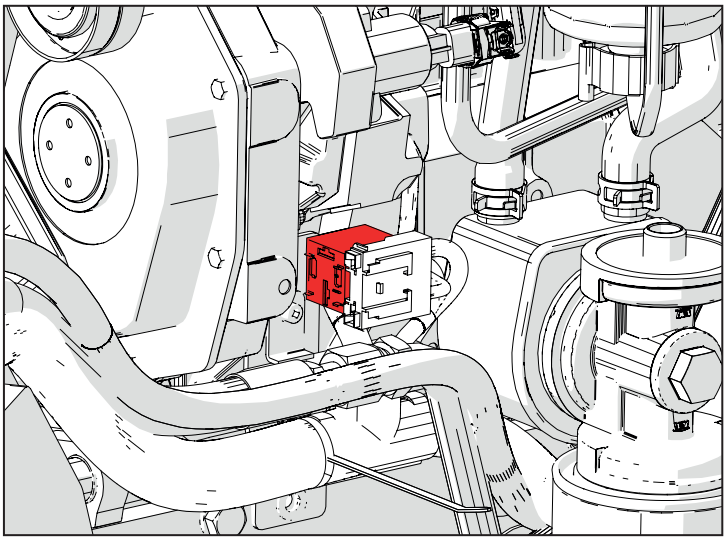




B002 (P476) Fuse holder

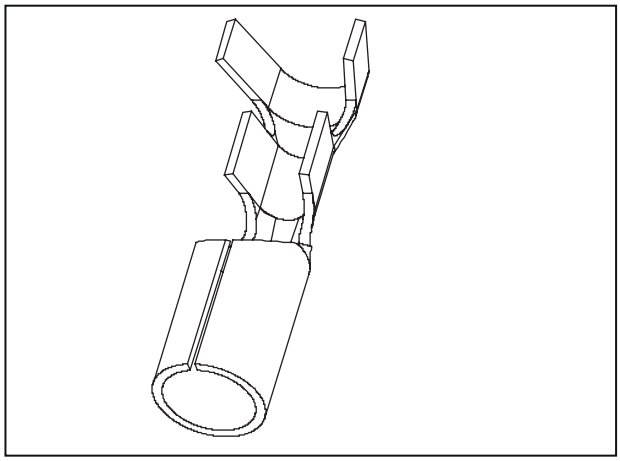
Pin	Description	Colour	Sect.	Input Conn.	Pin
2	GLOW PLUG 12V	Rd	4	P452	30
1	GLOW PLUG 12V	Rd	4	P63	1

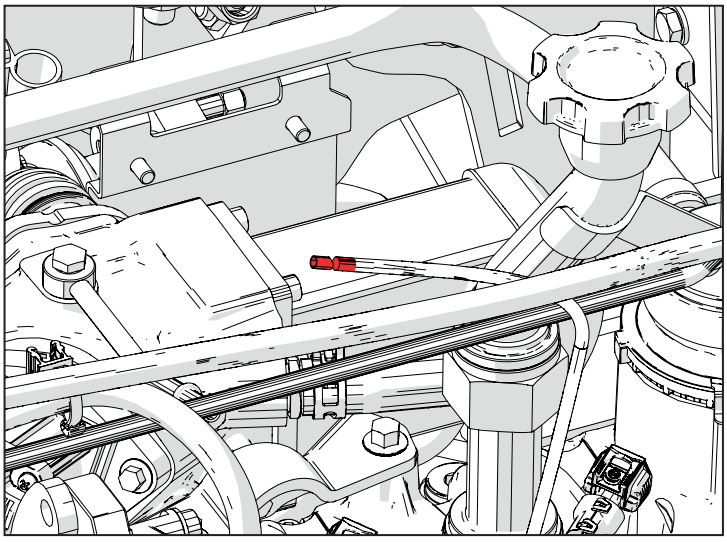




P002 (P488) Compressor

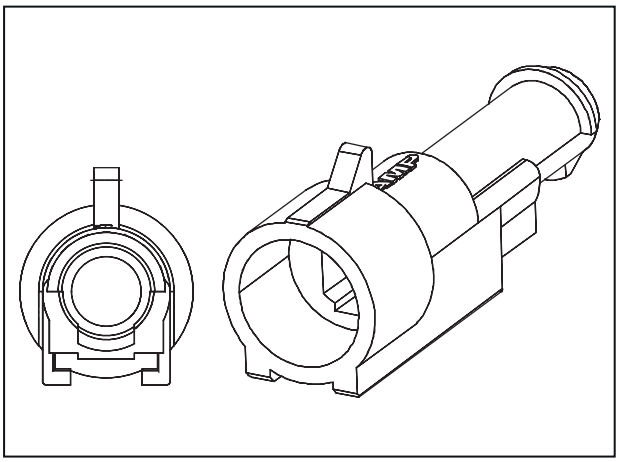
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	AC COMPRESSOR	Bu	1.5	P489	1

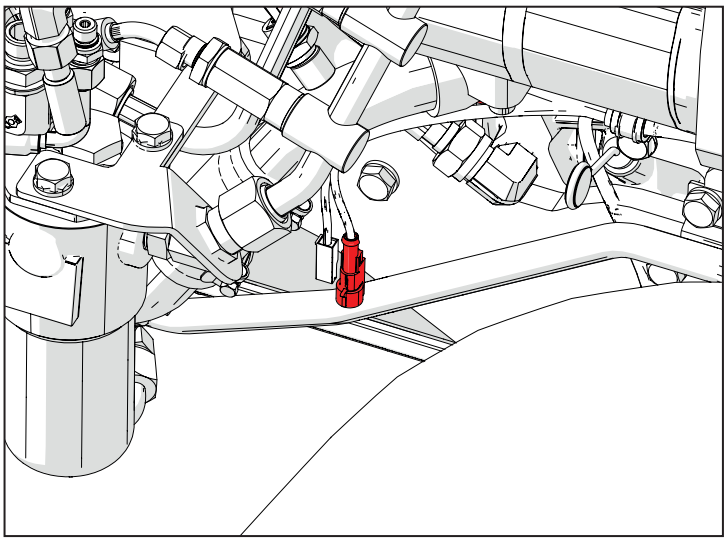




P003 (P489) From cab to compressor

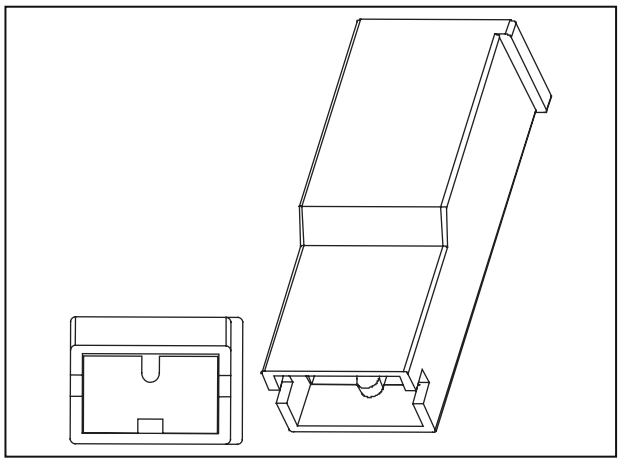
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	AC COMPRESSOR	Bu	1.5	P488	1

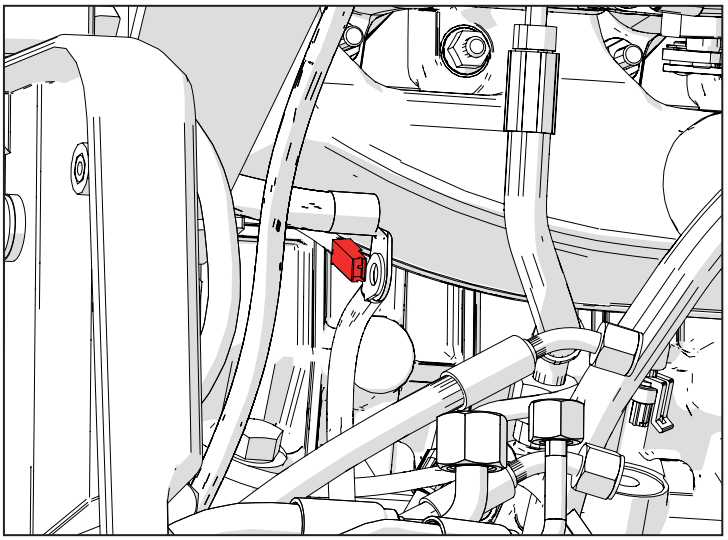




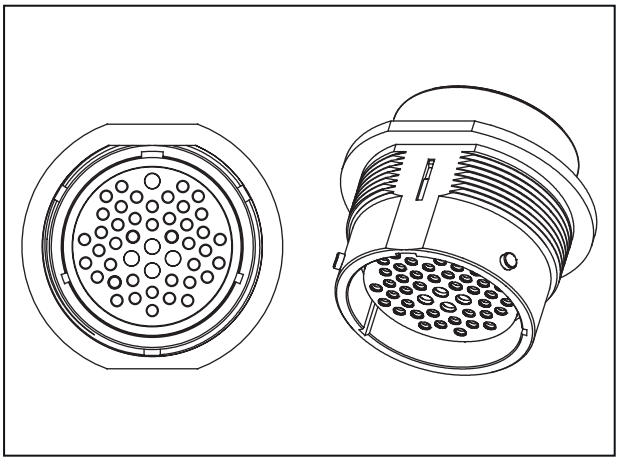
N002 (P490) Starter motor 50

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	START MOTOR	Rd	1.5	ENG-SP3	PIN1



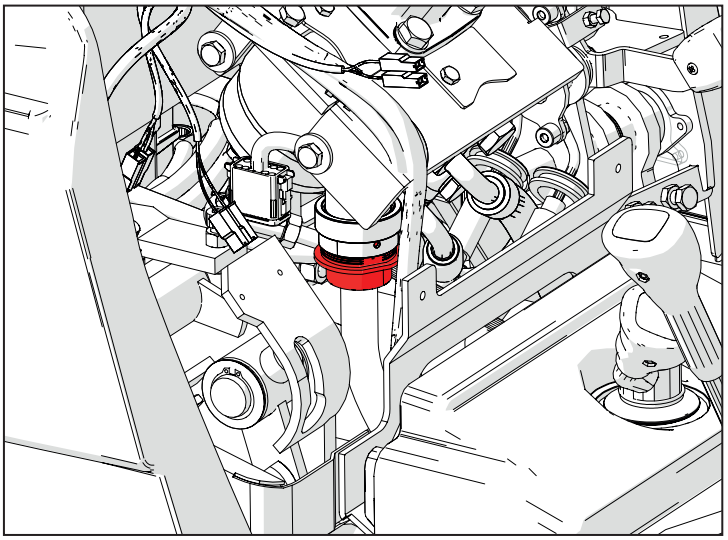


D004 (P30B) Wiring connector for dashboard wiring loom



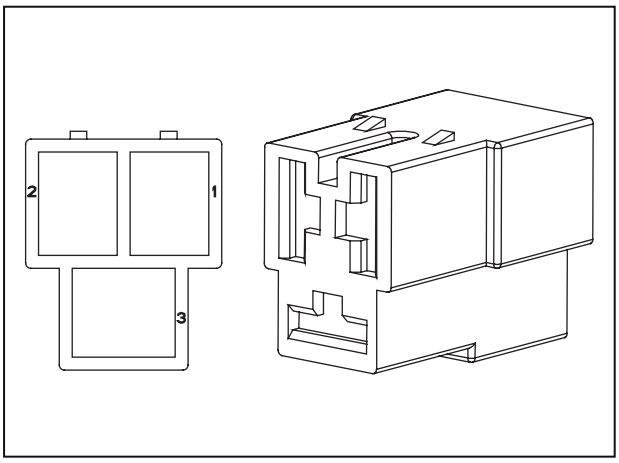
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	V BAT	Rd	1.5	MAIN-SP1	PIN1
2	LH DIRECTION LIGHT	Gn	1	MAIN-SP8	PIN1
3	REAR PARKING LIGHT LH	Ye	1	MAIN-SP9	PIN1
4	BRAKE LIGHTS COMMAND	WH	0.5	P80	P3
7	NORMAL BEAM LIGHTS	Gy	0.5	P80	E2
8	HIGH BEAM LIGHTS	Gn	0.5	P80	F1
9	PB - PTO Rear/ Front bypass	Bu	0.5	P80	G3
10	12V	Bn	1	MAIN-SP2	PIN1
11	PB - Differential lock on/off	Bu	0.5	P80	K4
12	BRAKE LH SW	Ye	0.5	P80	D2
13	BRAKE RH SW	Bu	0.5	P80	E4
15	PB - AWD Switch	WH	0.5	P80	E3
16	START ENABLE SENSOR	Rd	0.5	P80	G2
17	BRAKE OIL LEVEL	Gn	0.5	P80	D1
18	PTO FRONT A	Pu	0.5	P80	F2
19	PTO FRONT B	Or	0.5	P80	G1
20	ENGINE START RELAY ENABLE	Or	0.5	P80	B3
21	FOR DASHBOARD LED	Or	0.5	P80	C3
22	SIGNAL1	Gn	0.5	P80	L4
23	SIGNAL2	Rd	0.5	P80	K2
25	VALVES V KEY	Pu	1	MAIN-SP14	PIN1
26	CAN H	Ye	0.5	MAIN-SP18	PIN1
27	CAN L	Gn	0.5	MAIN-SP19	PIN1
28	FRONT PTO DIRECTION VALVE	Bu	0,75	P80	P2
29	FRONT PTO PROP. VALVE	Bu	0,75	P80	P1
32	BRAKE LAMP	Rd	0,75	MAIN-SP10	PIN1

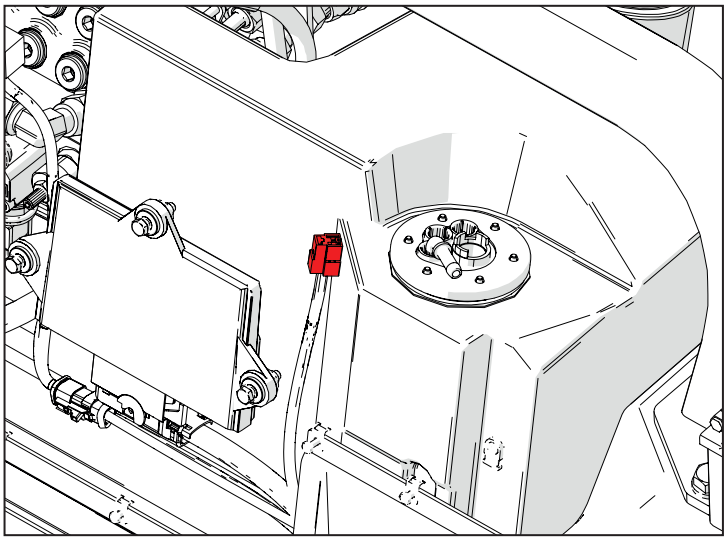
33	HYD OIL PRESSURE SWITCH	Ye	0.5	P80	K3
35	ENGINE CLUTCH SW	Or	0.5	P80	G4
36	PTO Rear - Clutch Lever Switch	Bu	0.5	P80	J4
37	START COMMAND	Bu	0.5	P80	H3
38	PTO shaft rpm sensor	Pu	0.5	P80	C1
39	VECU V KEY	Bn	0.5	P80	M2
40	RH TURN SIGNAL LIGHT	Bu	1	MAIN-SP3	PIN1
41	Wheel Speed	Bu	0.5	P80	D3
42	PARKING LIGHT RH	Ye	1	MAIN-SP15	PIN1
43	THROTTLE GND	BK	0.5	P80	N3
44	AIR FILTER	Gn	0.5	P80	J2
46	12V TRAILER	Rd	1.5	P226	2
47	SOCKET 1 POLE SUPPLY	Rd	1.5	P50	1



K017 (P40) Fuel level sensor

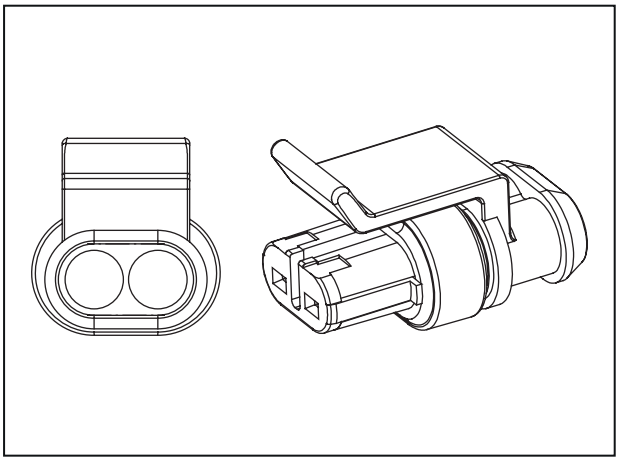
Pin	Description	Colour	Sect.	Input Conn.	Pin
2	FUEL LEVEL SENSOR	Bu	0.5	P80	K1
3	BK	Or	0.5	P80	N2

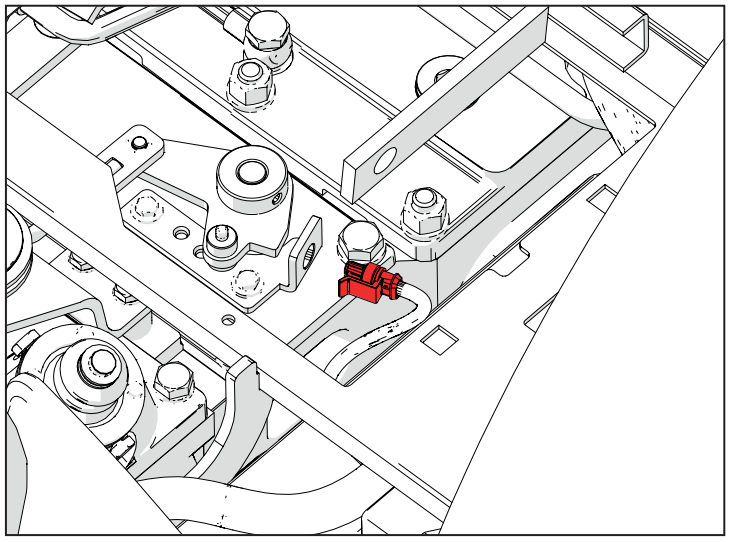




K016 (P44) PTO mode sensor

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	PTO SAFETY SW	BK	0.5	P80	N1
2	PTO SAFETY SW - REAR	Bu	0.5	P80	L3

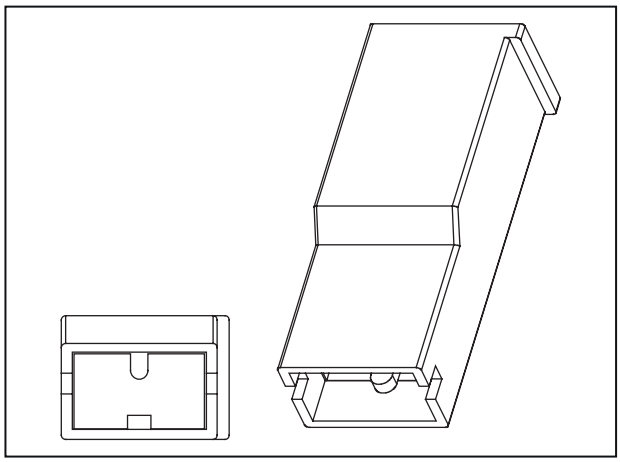


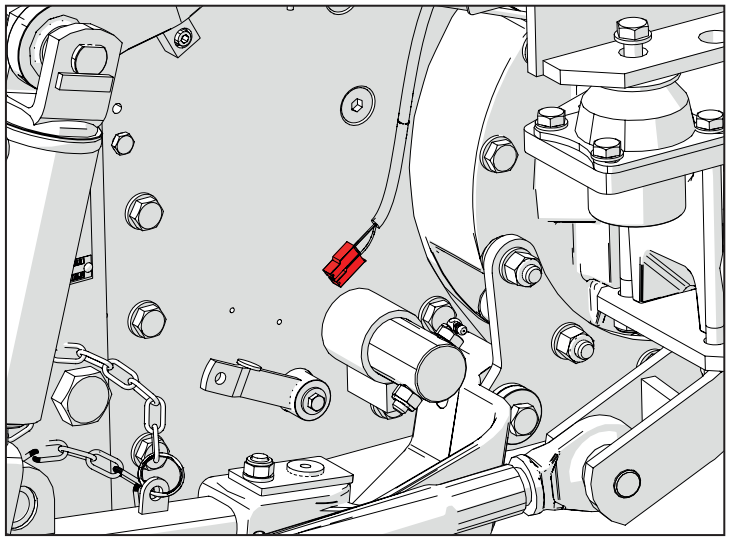


I020 (P49-P52) Rear PTO speed mode selector

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	PTO Rear - Speed Selection Lever	Gn	0.5	P80	H2

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	GND	BK	0.5	MAIN-SP13	PIN1

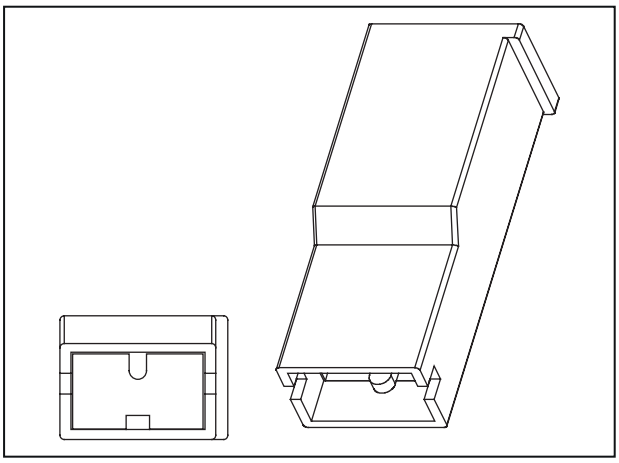


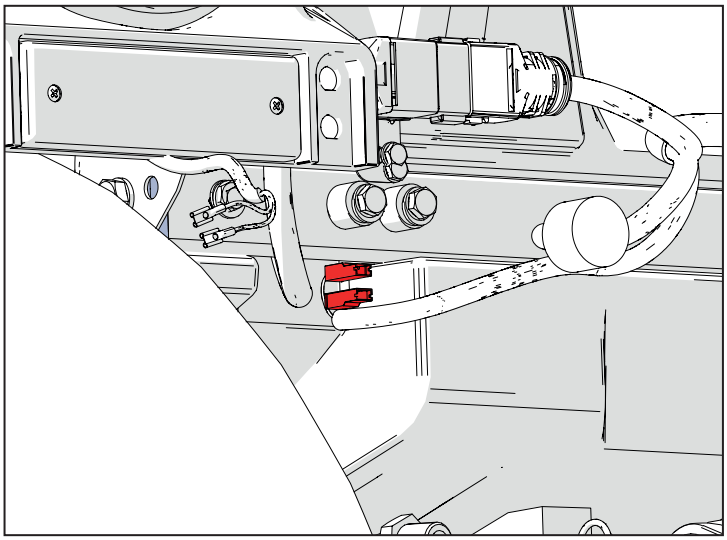


P004 (P50-P51) 1 pole socket

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	SOCKET 1 POLE SUPPLY	Rd	1.5	P30B	47

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	GND SOCKET 1 POLE	BK	2.5	P412	1

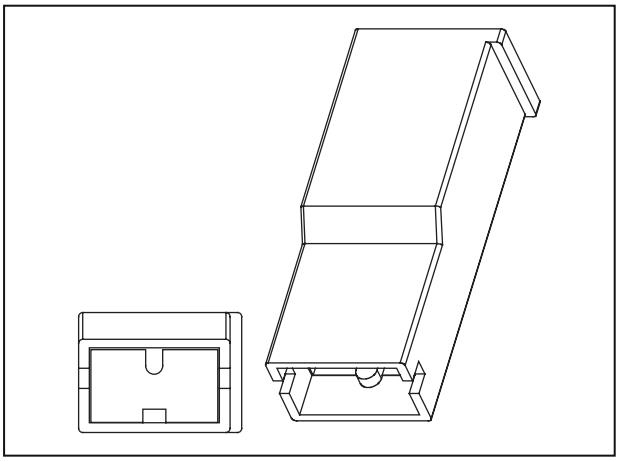


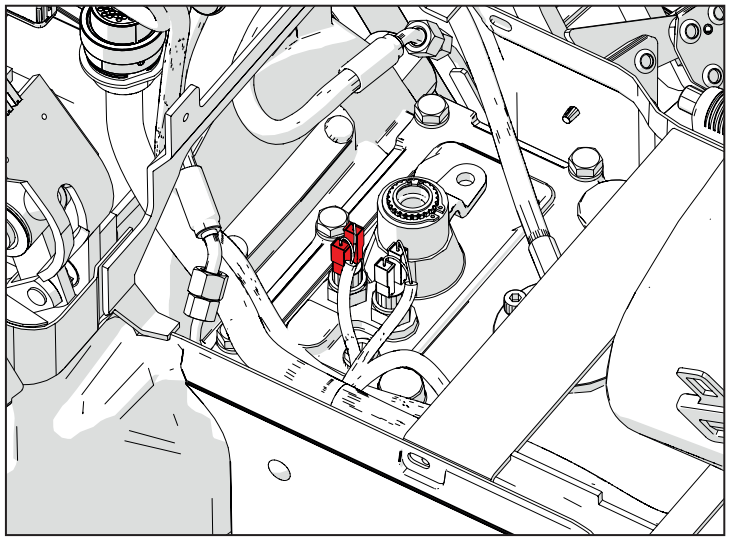


I018 (P56-P57) H/L lever reverse button

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	12V	Bn	0.5	MAIN-SP2	PIN1

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	Shuttle lever Rw switch	Ye	0.5	P80	C2

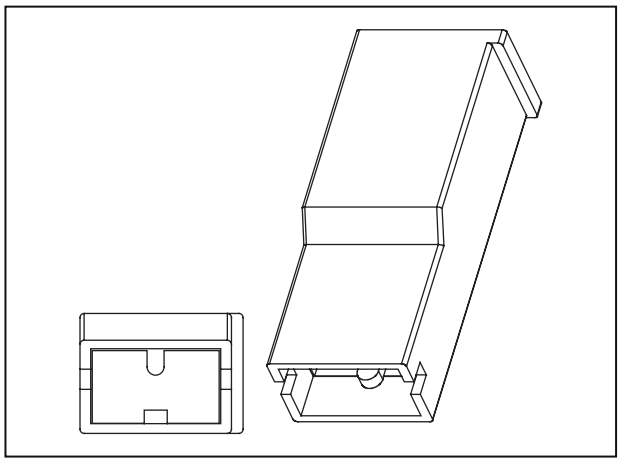


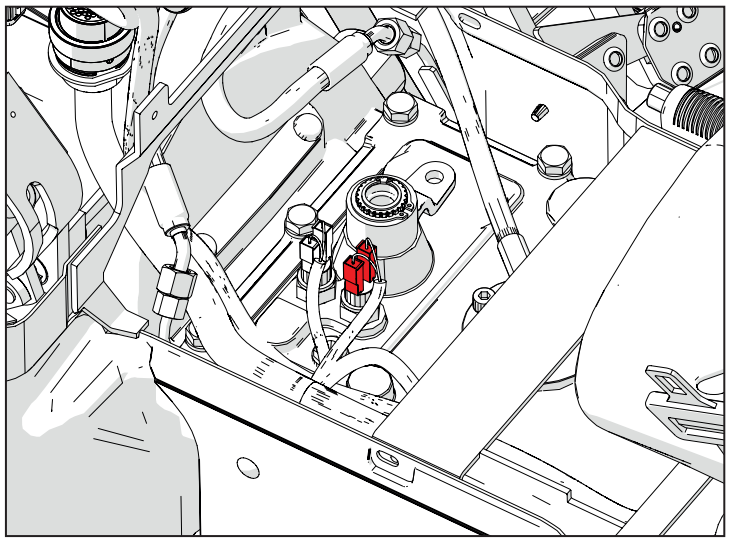


I017 (P58-P59) H/L lever forward button

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	Shuttle lever fw switch	Gn	0.5	P80	B2

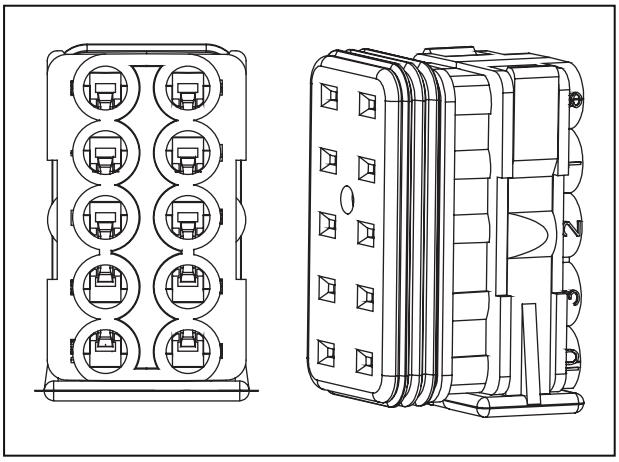
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	12V	Bn	0.5	MAIN-SP2	PIN1

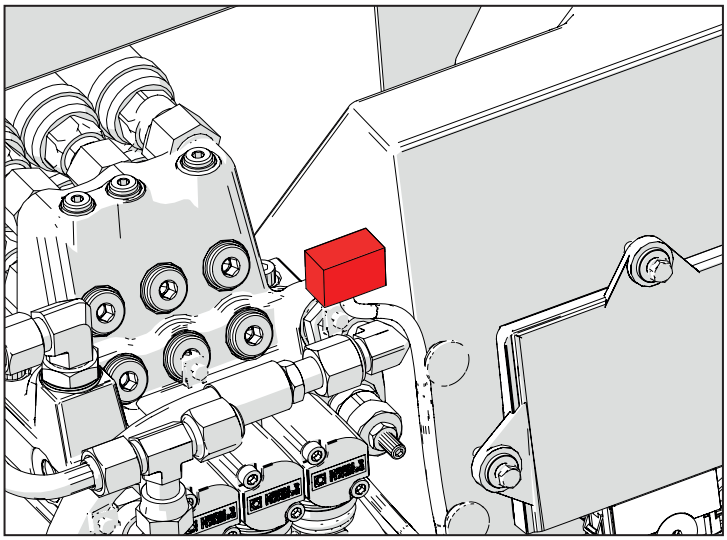




I019 (P61) "Diverter" button

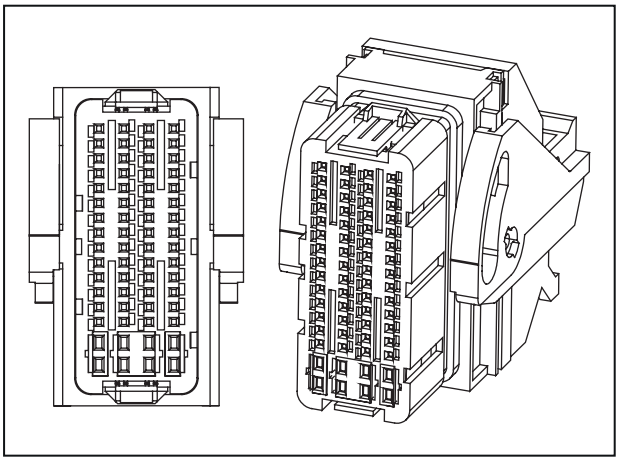
Pin	Description	Colour	Sect.	Input Conn.	Pin
2	PB - DIVERTER	Bn	0.5	MAIN-SP2	PIN1
3	PB - DIVERTER	Gy	0.5	P80	H4





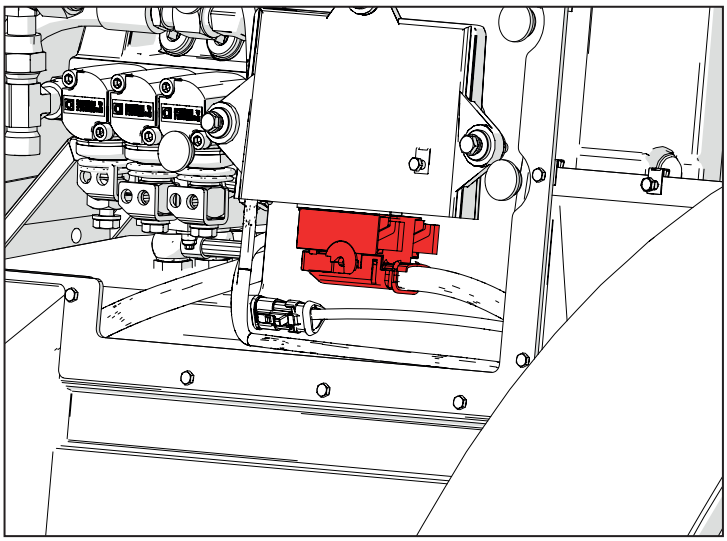
M001 (P80) Vehicle control unit

Pin	Description	Colour	Sect.	Input Conn.	Pin
A1		Ye	0.5	MAIN-SP18	PIN1
A2		Gn	0.5	MAIN-SP19	PIN1
B2	Shuttle lever fw switch	Gn	0.5	P58	1
B3	MAIN TO DASHBOARD	Or	0.5	P30B	20
C1	MAIN TO DASHBOARD	Pu	0.5	P30B	38
C2	Shuttle lever rw switch	Ye	0.5	P57	1
C3	MAIN TO DASHBOARD	Or	0.5	P30B	21
D1	MAIN TO DASHBOARD	Gn	0.5	P30B	17



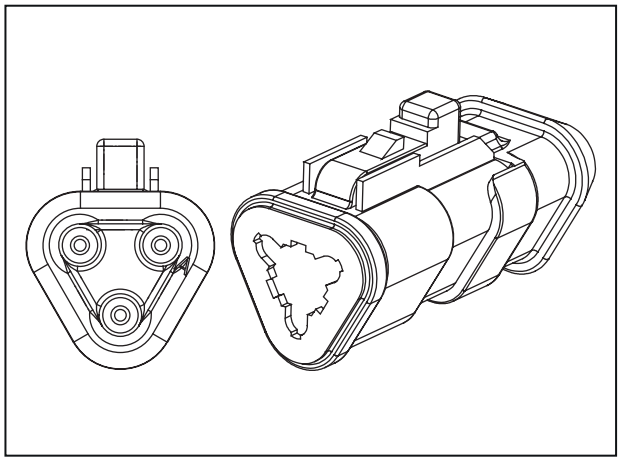
D2	MAIN TO DASHBOARD	Ye	0.5	P30B	12
D3	MAIN TO DASHBOARD	Bu	0.5	P30B	41
E1		Gn	0.5	MAIN-SP8	PIN1
E2	MAIN TO DASHBOARD	Gy	0.5	P30B	7
E3	MAIN TO DASHBOARD	WH	0.5	P30B	15
E4	MAIN TO DASHBOARD	Bu	0.5	P30B	13
F1	MAIN TO DASHBOARD	Gn	0.5	P30B	8
F2	MAIN TO DASHBOARD	Pu	0.5	P30B	18
F3		Bu	0.5	MAIN-SP3	PIN1
F4		Ye	0.5	MAIN-SP9	PIN1
G1	MAIN TO DASHBOARD	Or	0.5	P30B	19
G2	MAIN TO DASHBOARD	Rd	0.5	P30B	16
G3	MAIN TO DASHBOARD	Bu	0.5	P30B	9
G4	MAIN TO DASHBOARD	Or	0.5	P30B	35
H1	SEAT SAFETY	Bu	0.5	P107	2
H2	PTO Rear - Speed Selection Lever Signal - 2	Gn	0.5	P49	1
H3	MAIN TO DASHBOARD	Bu	0.5	P30B	37
H4	PB - DIVERTER	Gy	0.5	P61	3
J1	PARKING BRAKE SWITCH	Gn	0.5	P138	1
J2	MAIN TO DASHBOARD	Gn	0.5	P30B	44
J3	SEAT SAFETY	Gn	0.5	P107	4
J4	MAIN TO DASHBOARD	Bu	0.5	P30B	36
K1	FUEL LEVEL SENSOR	Bu	0.5	P40	2
K2	MAIN TO DASHBOARD	Rd	0.5	P30B	23
K3	MAIN TO DASHBOARD	Ye	0.5	P30B	33
K4	MAIN TO DASHBOARD	Bu	0.5	P30B	11
L3	REAR PTO SAFETY SWITCH	Bu	0.5	P44	2

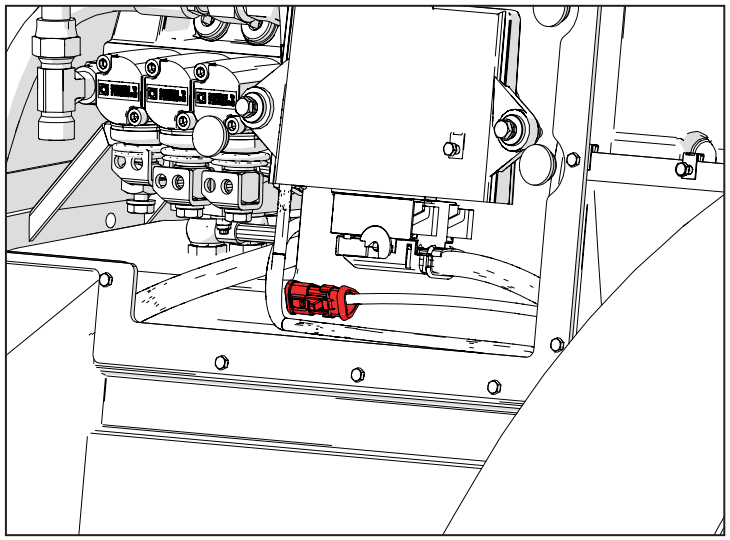
L4	MAIN TO DASHBOARD	Gn	0.5	P30B	22
M2	MAIN TO DASHBOARD	Bn	0.5	P30B	39
N1	REAR PTO SAFETY SWITCH	BK	0.5	P44	1
N2	FUEL LEVEL SENSOR	BK	0.5	P40	3
N3	MAIN TO DASHBOARD	BK	0.5	P30B	43
O1		Rd	0.5	MAIN-SP1	PIN1
O2		Rd	0.5	MAIN-SP1	PIN1
O3		Rd	0.5	MAIN-SP1	PIN1
O4		Rd	0.5	MAIN-SP1	PIN1
P1	MAIN TO DASHBOARD	Bu	0,75	P30B	29
P2	MAIN TO DASHBOARD	Bu	0,75	P30B	28
P3	MAIN TO DASHBOARD	WH	0.5	P30B	4
P4		BK	0,75	MAIN-SP13	PIN1
Q1	DIVERTER VALVE INTERCONNECTION	Bu	0,75	P188	2
Q2	4WD ON/OFF HYD VALVE	Bu	0,75	P186	2
Q3	DIFF LOCK ON/ OFF VALVE	Bu	0.5	P187	2
Q4		BK	0,75	MAIN-SP13	PIN1



O002 (P98) CAN line termination

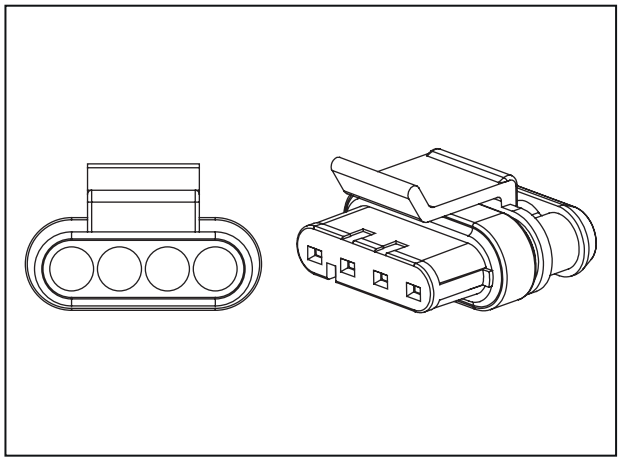
Pin	Description	Colour	Sect.	Input Conn.	Pin
A	CAN H	Ye	0.5	MAIN-SP18	PIN1
B	CAN L	Gn	0.5	MAIN-SP19	PIN1

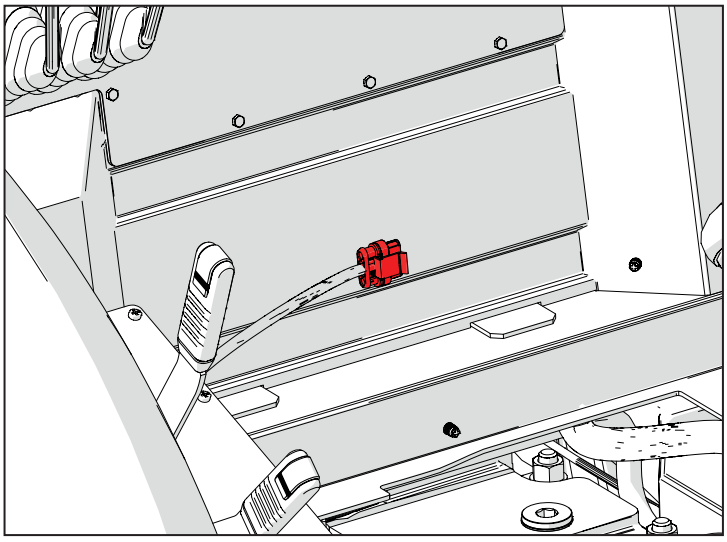




K018 (P107) Seat start enable signal

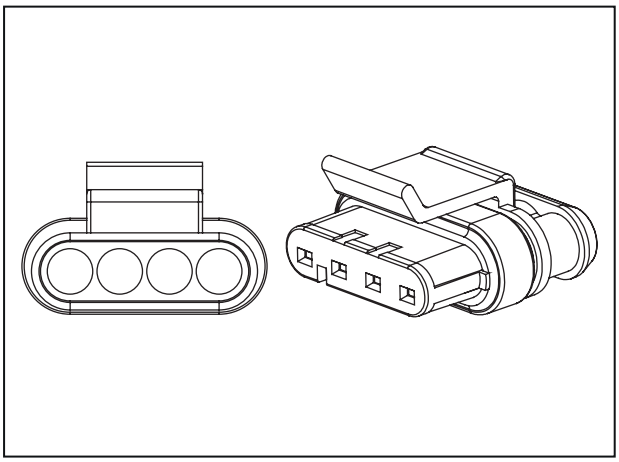
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	12V - SEAT SAFETY	Bn	0,75	MAIN-SP2	PIN1
2	SEAT SWITCH SIGNAL - A	Bu	0.5	P80	H1
3	12V - SEAT SAFETY	Bn	0,75	MAIN-SP2	PIN1
4	SEAT SWITCH SIGNAL - B	Gn	0.5	P80	J3

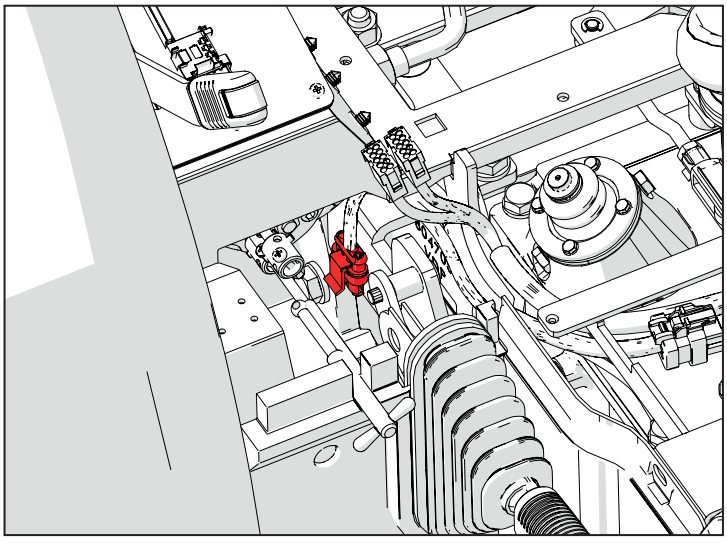




K015 (P138) Park brake start enable signal

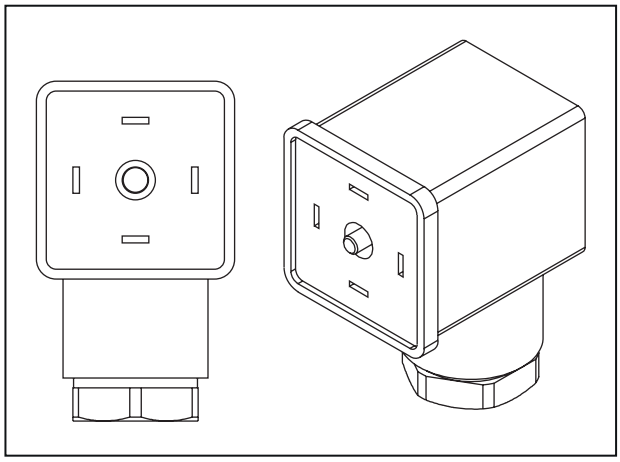
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	PARKING BRAKE SW SIGNAL	Gn	0.5	P80	J1
4	GND	BK	0.5	MAIN-SP13	PIN1

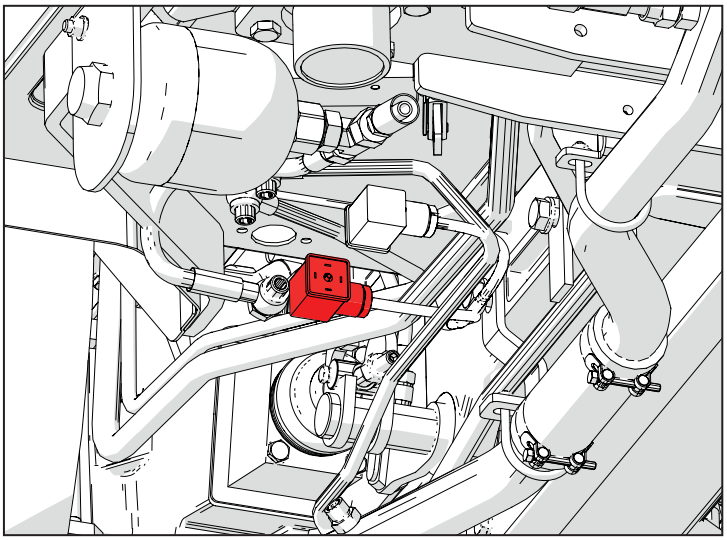




L002 (P186) 4WD ON/OFF solenoid valve

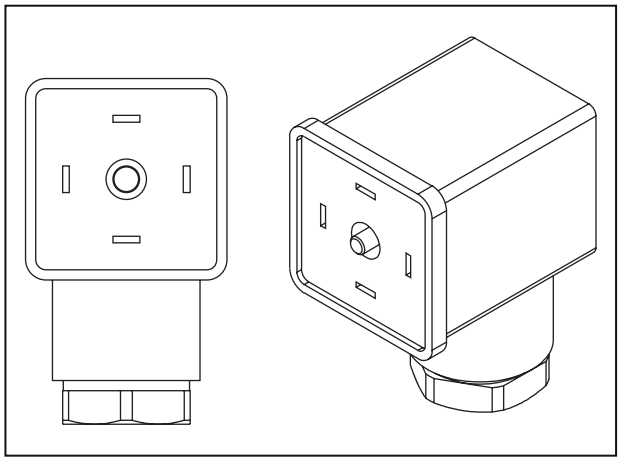
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	VALVES V KEY	Pu	0.5	MAIN-SP14	PIN1
2	4WD ON/OFF HYD VALVE	Bu	0,75	P80	Q2

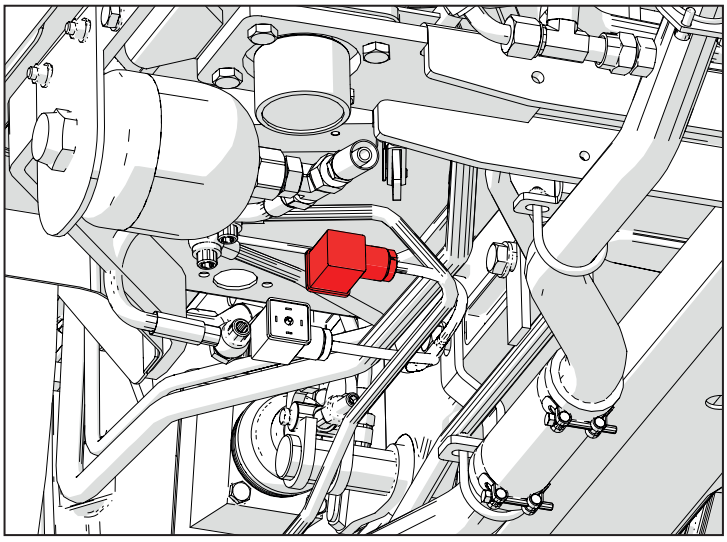




L001 (P187) Differential lock ON/OFF solenoid valve

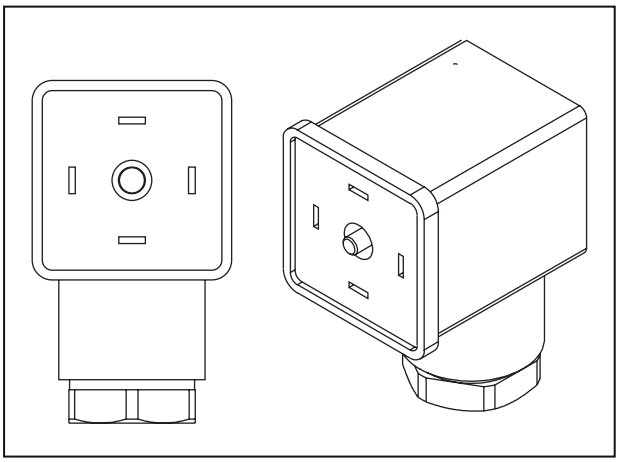
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	VALVES V KEY	Pu	0.5	MAIN-SP14	PIN1
2	DIFF LOCK ON/OFF VALVE	Bu	0.5	P80	Q3

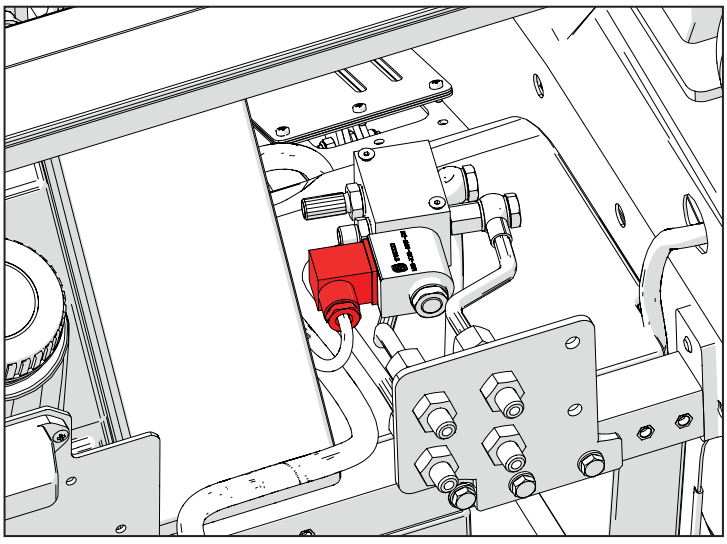




L003 (P188) "Diverter" solenoid valve

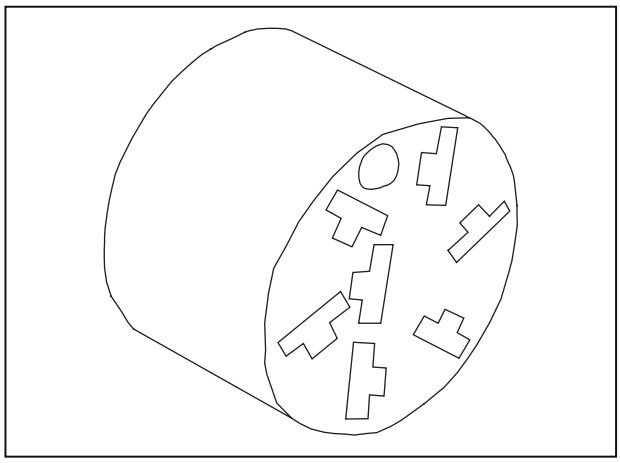
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	VALVES V KEY	Pu	0.5	MAIN-SP14	PIN1
2	DIVERTER VALVE	Bu	0,75	P80	Q1

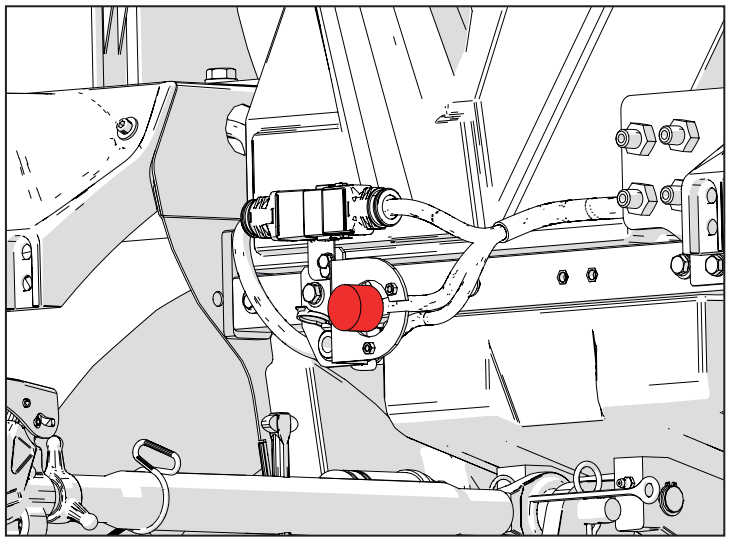




P005 (P226) Rear 7 pole socket

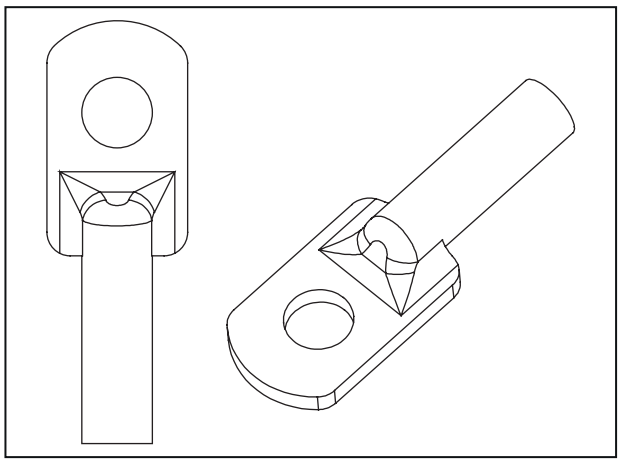
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	LH TURN SIGNAL	Gn	1	MAIN-SP8	PIN1
2	12V TRAILER	Rd	1.5	P30B	46
3	GND	BK	1.5	P412	1
4	RH TURN SIGNAL	Bu	1	MAIN-SP3	PIN1
5	PARKING LIGHT RH	Ye	0,75	MAIN-SP15	PIN1
6	BRAKE LAMP	Rd	0,75	MAIN-SP10	PIN1
7	PARKING LIGHTS LH	Ye	0,75	MAIN-SP9	PIN1

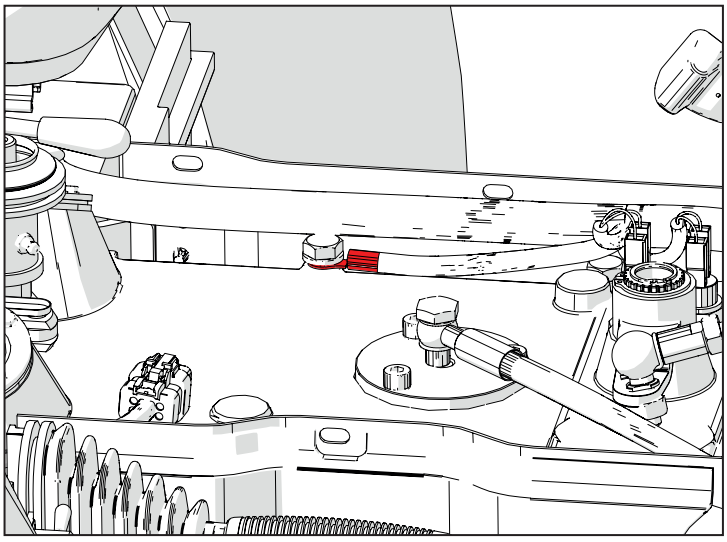




C006 (P412) Main wiring loom ground

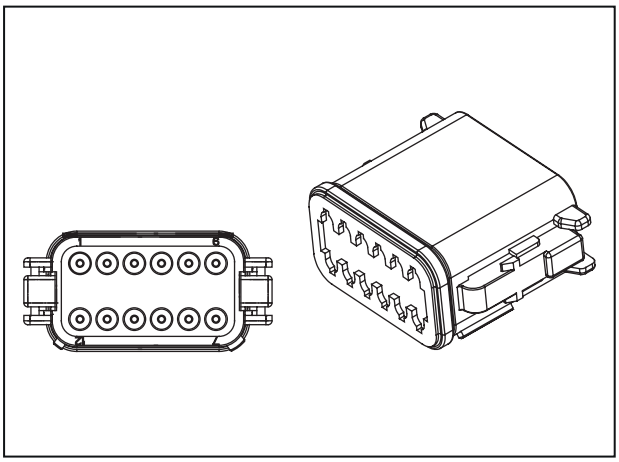
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	GND SOCKET 1 POLE	BK	2.5	P51	1
1	GND MAIN	BK	2.5	MAIN-SP13	PIN1

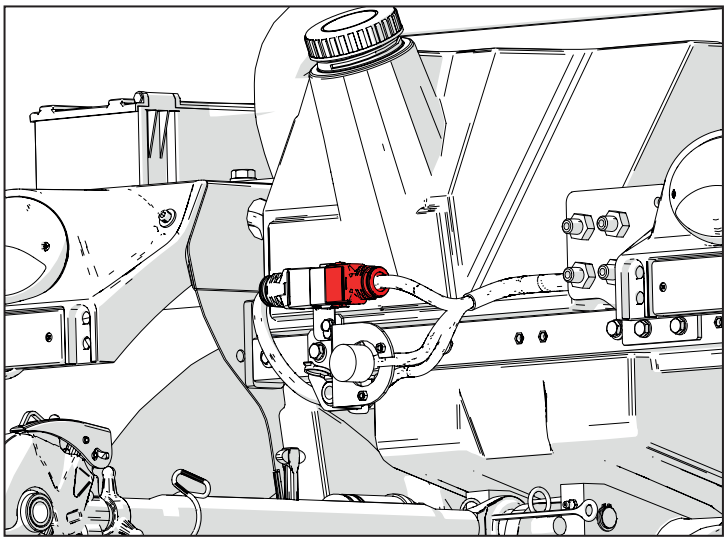




D007 (P500A) Wiring connector for rear lights wiring loom

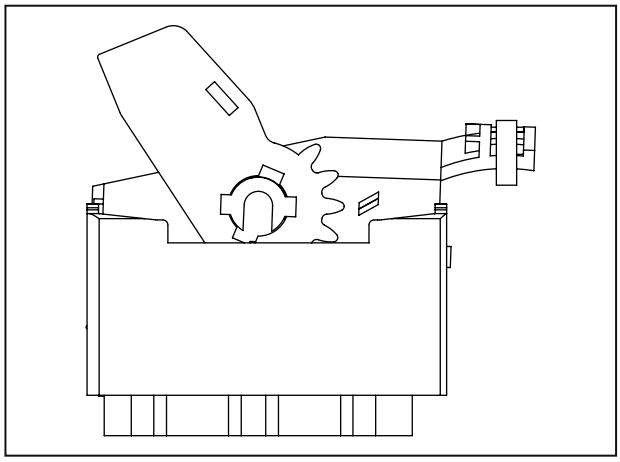
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	RH TURN SIGNAL	Bu	0,75	MAIN-SP3	PIN1
2	REAR PARKING LIGHT LH	Ye	0,75	MAIN-SP9	PIN1
3	GND REAR LIGHTS	BK	1.5	MAIN-SP13	PIN1
4	LH TURN SIGNAL	Gn	0,75	MAIN-SP8	PIN1
5	PARKING LIGHT RH	Ye	0,75	MAIN-SP15	PIN1
6	BRAKE LAMP	Rd	0,75	MAIN-SP10	PIN1



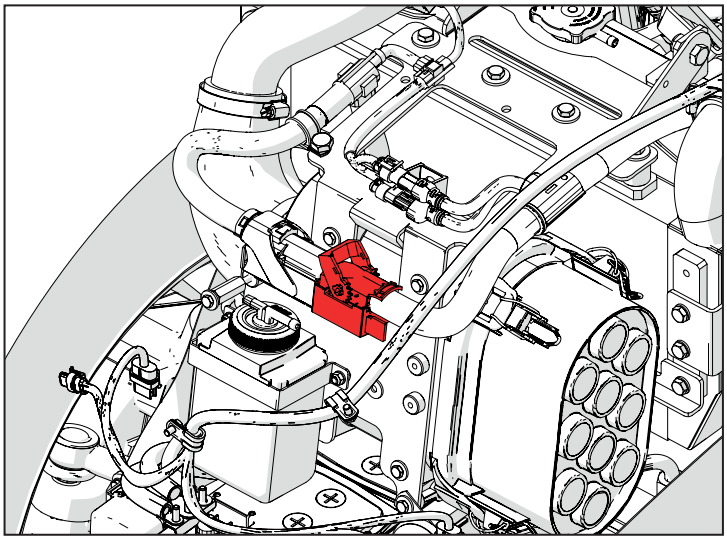


M002A (XECUA) Engine control unit

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	INJECTOR 3	MB1,5	1.5	xl3	1
2	INJECTOR 2	R1,5	1.5	xl2	1
6	OIL PRESS. SWITCH	V0.75	0,75	xs6	1
10	BOOST PRESS. SENSOR GND	CB0,75	0,75	xs4	3
11	RAIL PRESS. SENSOR SUPPLY	L0,75	0,75	xs5	3
13	CAMSHAFT SENSOR SUPPLY	GR0,75	0,75	xs3	3
14	CAMSHAFT SENSOR SIGNAL	HN0,75	0,75	xs3	2
15	FUEL METERING UNIT	ZN1,5	1.5	xy1	1
16	INJECTOR 1	RL1,5	1.5	xl1	1
17	INJECTOR 4	RB1,5	1.5	xl4	1
19	THROTTLE VALVE ACTUATOR	H0,75	0,75	xy3	3
21	THROTTLE VALVE STATUS	LG0,75	0,75	xy3	4
22	CRANKSHAFT SENSOR GROUND	SHIELD		xs2	3
24	EGR COOLER OUT TEMP. SENSOR GND	NG0,75	0,75	xs7	1
25	BOOST PRESS. SENSOR GND	MR0,75	0,75	xs4	1
26	RAIL PRESS. SENSOR GND	NZ0,75	0,75	xs5	1
28	CAMSHAFT SENSOR GND	Z0,75	0,75	xs3	1
31	INJECTOR 3	M1,5	1.5	xl3	2
32	INJECTOR 1	L1,5	1.5	xl1	2
40	BOOST PRESS. SENSOR SIGNAL	BR0,75	0,75	xs4	4
41	RAIL PRESS. SENSOR SIGNAL	G0,75	0,75	xs5	2

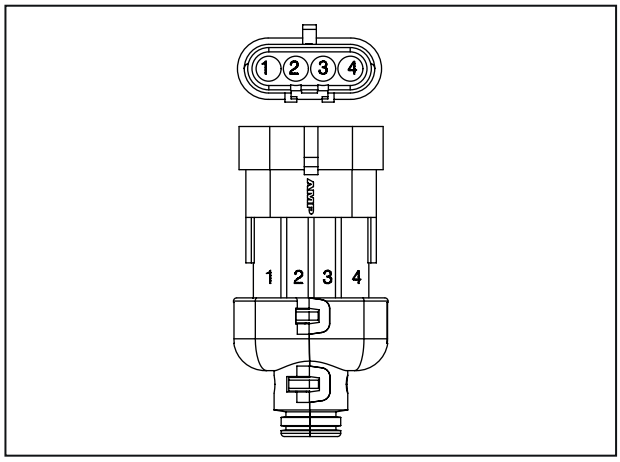


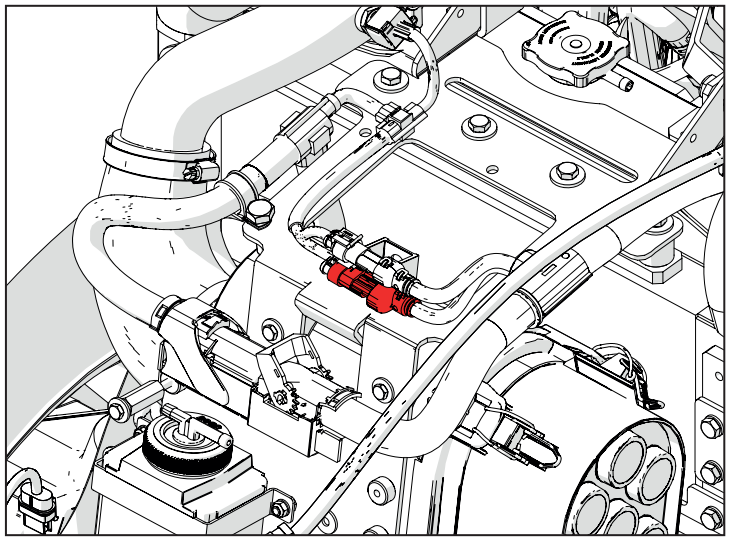
44	CRANKSHAFT SENSOR SIGNAL MINUS	V0.75	0,75	xs2	2
46	INJECTOR 2	N1,5	1.5	xl2	2
48	INJECTOR 4	RN1,5	1.5	xl4	2
52	THROTTLE VALVE GND	HL0,75	0,75	xy3	1
54	EGR COOLER OUT TEMP. SENSOR SIGNAL	RN0,75	0,75	xs7	2
55	BOOST PRESS. TEMP. SENSOR SIGNAL	BV0,75	0,75	xs4	2
57	COOLANT TEMP. SENSOR SIGNAL	S0,75	0,75	xs1	2
58	COOLANT TEMP. SENSOR GND	VG0,75	0,75	xs1	1
59	CRANKSHAFT SENSOR SIGNAL PLUS	ZN0,5	0.5	xs2	1
60	FUEL METERING UNIT	C1,5	1.5	xy1	2



D009 (XEG) Exhaust gas recirculation solenoid valve power feed

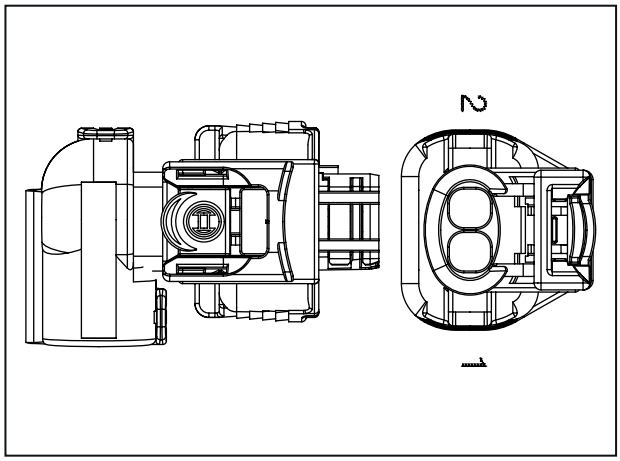
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	GND	HR	0,75	xy2	5
2	12V	CL	0,75	xy2	6
3	CAN_H	ZN	0,75	xy2	3
4	CAN_L	L	0,75	xy2	4

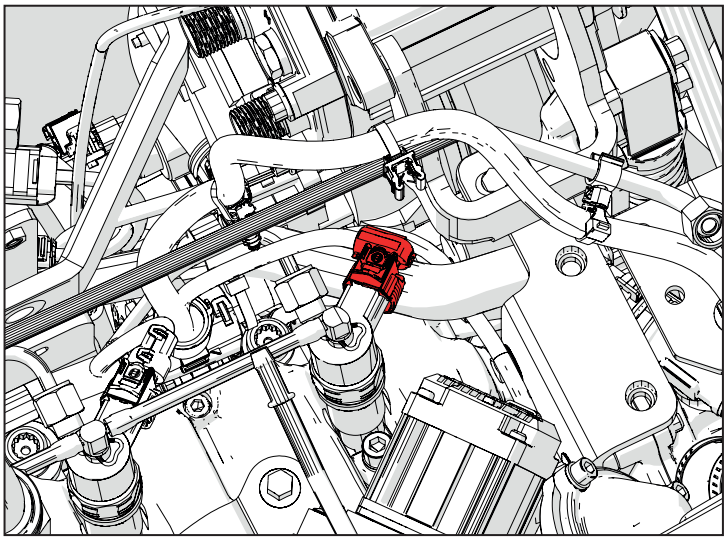




L006 (XI1) Fuel electro-injector 1

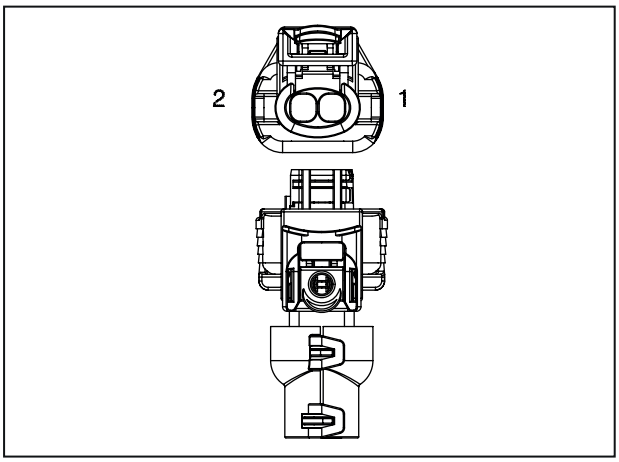
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	INJECTOR 1	RL	1.5	xecua	16
2	INJECTOR 1	L	1.5	xecua	32

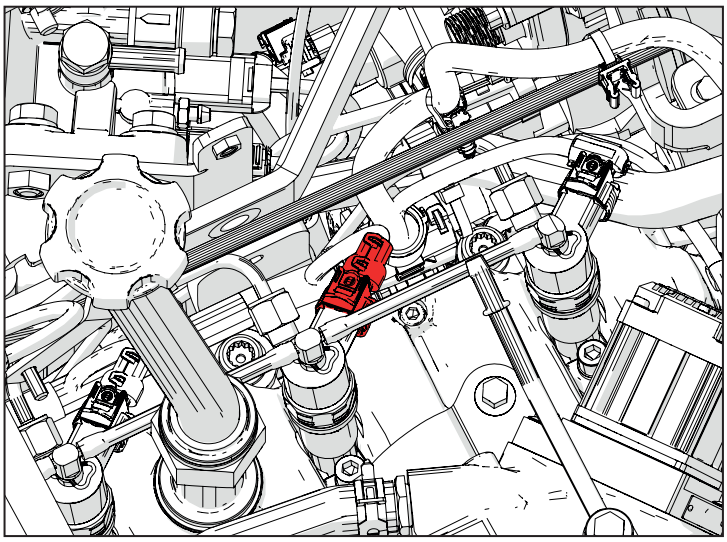




L007 (XI2) Fuel electro-injector 2

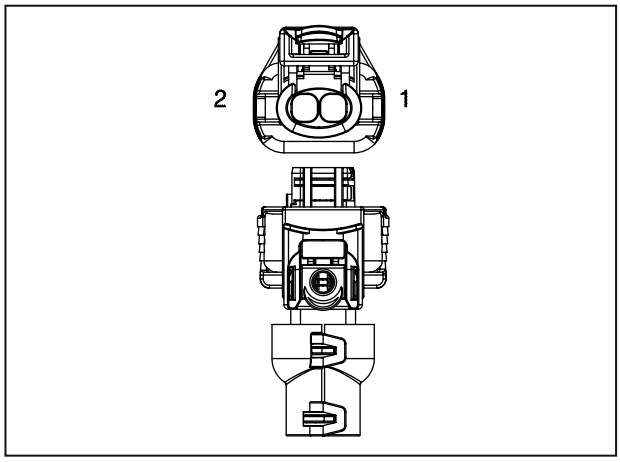
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	INJECTOR 2	R	1.5	xecua	2
2	INJECTOR 2	N	1.5	xecua	46

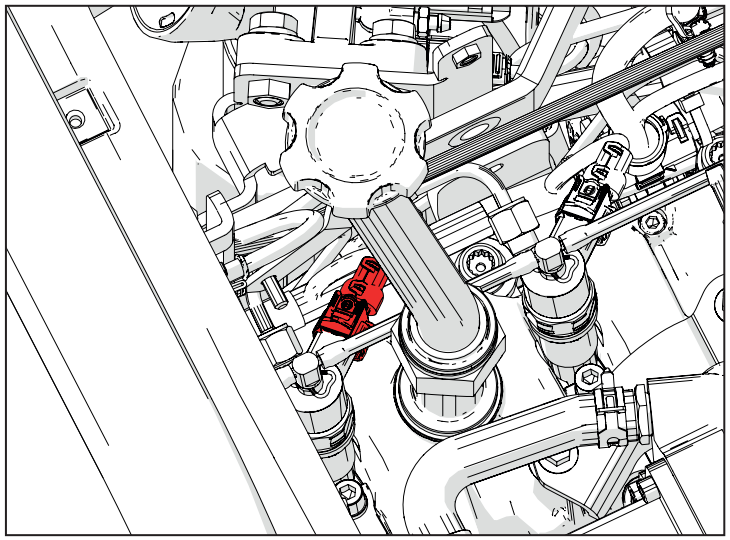




L008 (XI3) Fuel electro-injector 3

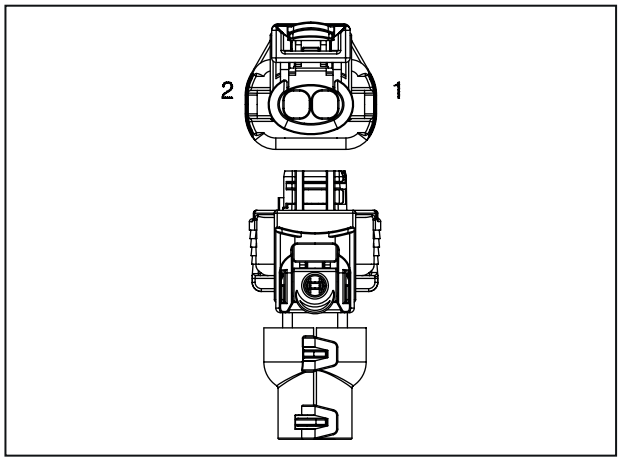
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	INJECTOR 3	MB	1.5	xecua	1
2	INJECTOR 3	MB	1.5	xecua	31

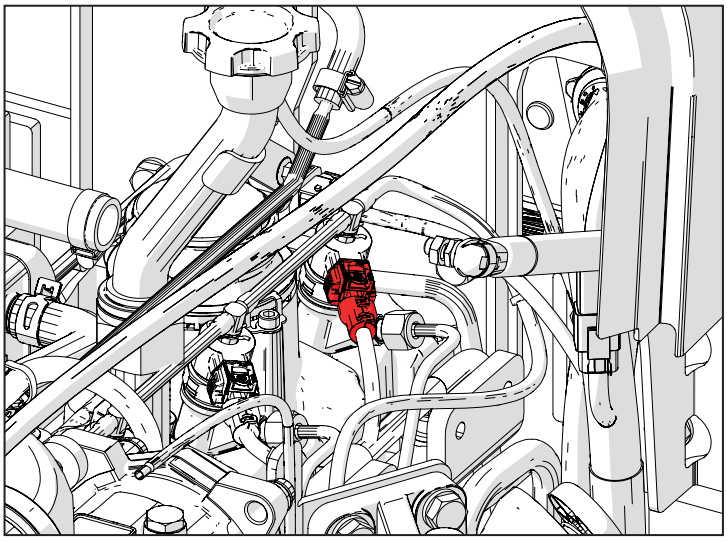




L009 (XI4) Fuel electro-injector 4

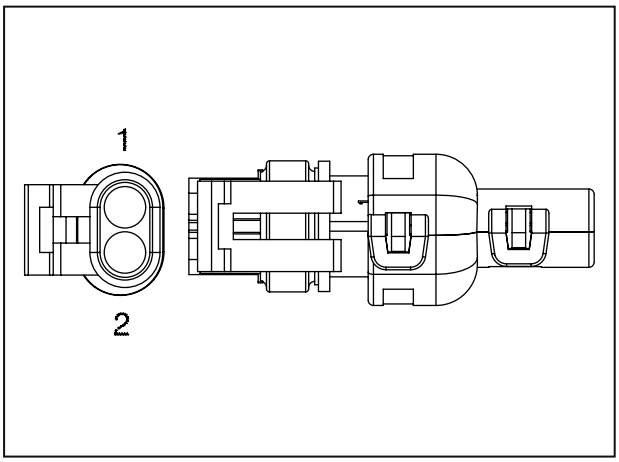
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	INJECTOR 4	RB	1.5	xecua	17
2	INJECTOR 4	RN	1.5	xecua	48

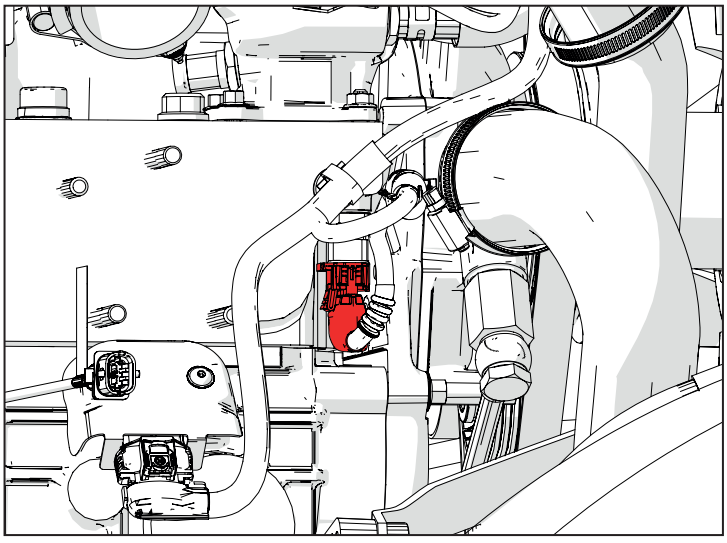




K021 (XS1B) Coolant temperature sensor

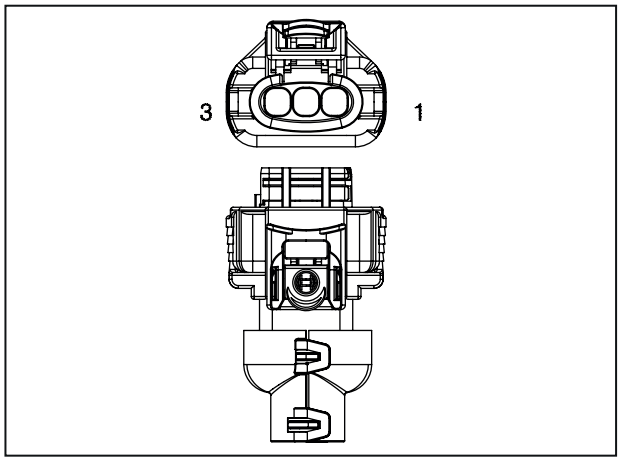
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	COOLANT TEMP. SENSOR GND	VG	0,75	xecua	58
2	COOLANT TEMP. SENSOR SIGNAL	S	0,75	xecua	57

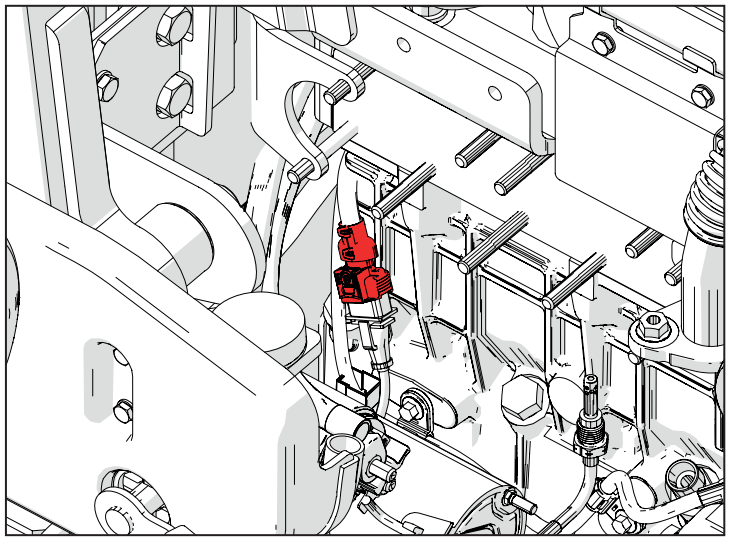




K024 (XS2) Crankshaft speed sensor

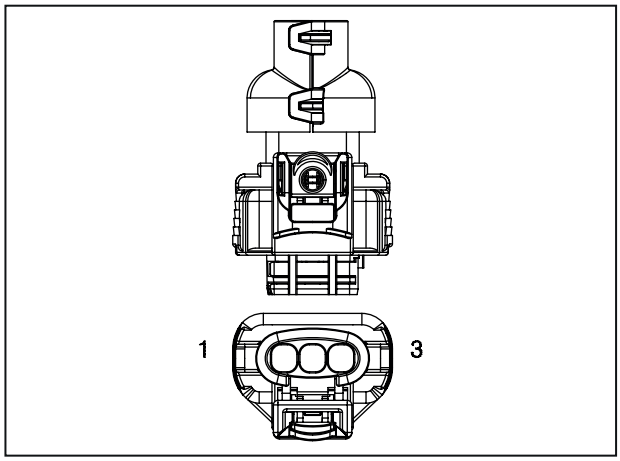
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	CRANKSHAFT SENSOR SIGNAL PLUS	ZN	0.5	xecua	44
2	CRANKSHAFT SENSOR SIGNAL MINUS	V	0.5	xecua	44
3	CRANKSHAFT SENSOR GROUND	SHIELD		xecua	22

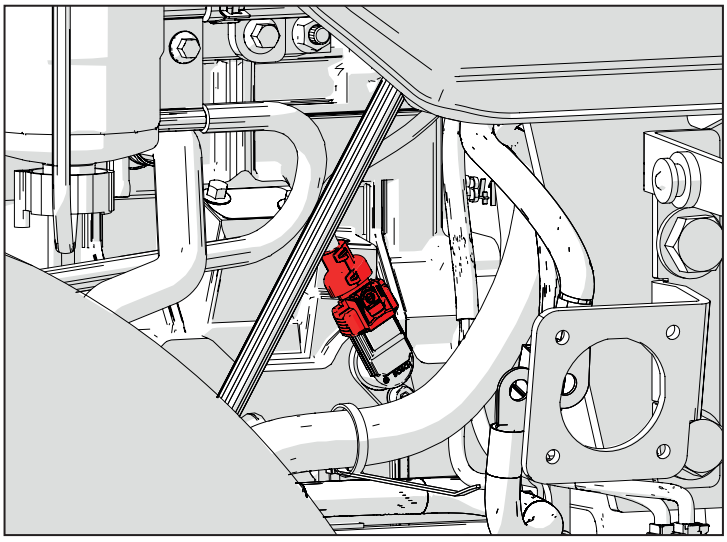




K023 (XS3) Camshaft timing sensor

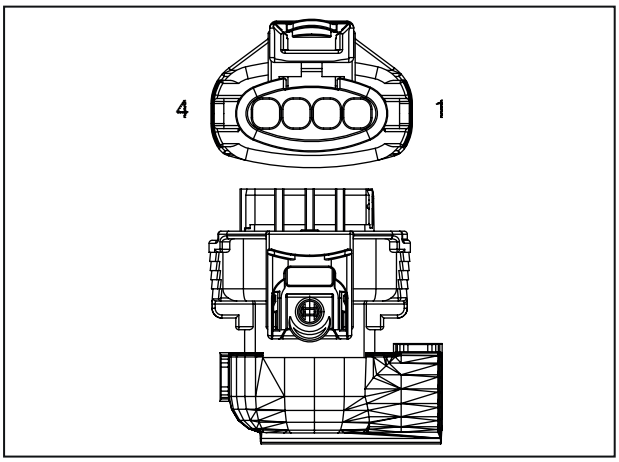
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	CAMSHAFT SENSOR GND	Z	0,75	xecua	28
2	CAMSHAFT SENSOR SIGNAL	HN	0,75	xecua	14
3	CAMSHAFT SENSOR SUPPLY	GR	0,75	xecua	13

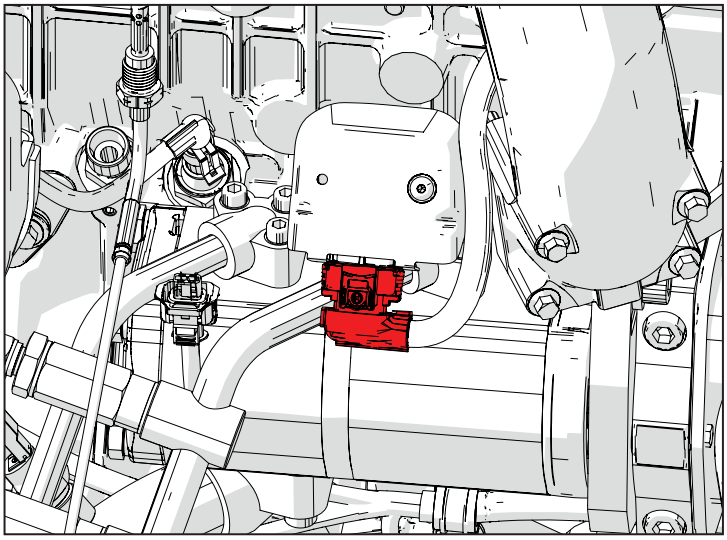




K020 (XS4) Temperature and pressure sensor (BOOST)

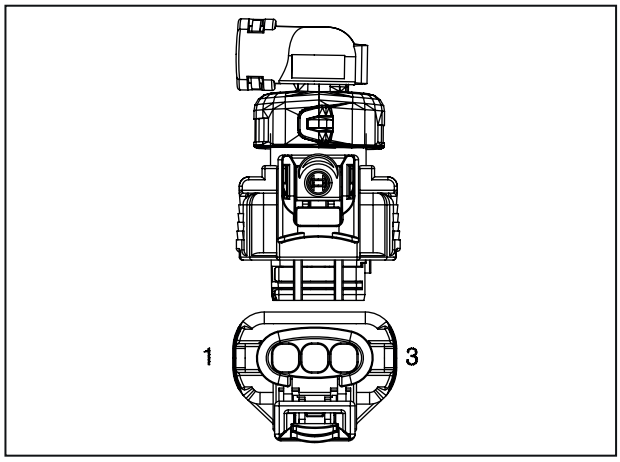
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	BOOST PRESS. SENSOR GND	MR	0,75	xecua	25
2	BOOST PRESS. TEMP. SENSOR SIGNAL	BV	0,75	xecua	55
3	BOOST PRESS. SENSOR GND	CB	0,75	xecua	10
4	BOOST PRESS. SENSOR SIGNAL	BR	0,75	xecua	40

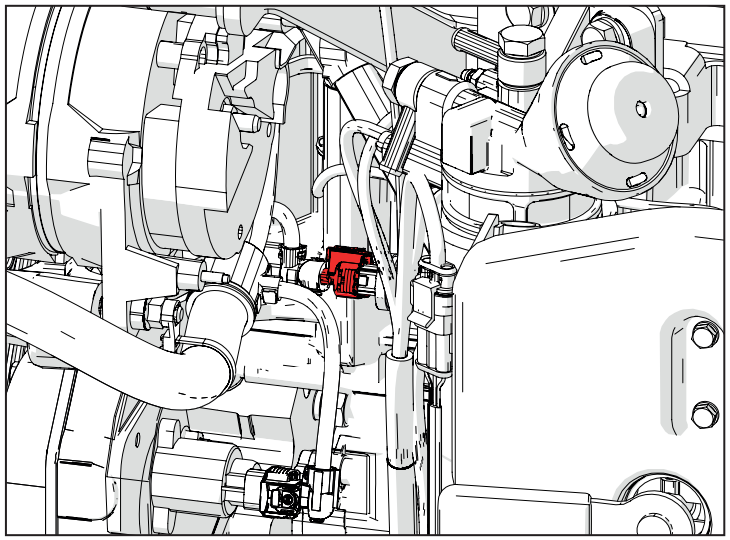




K019 (XS5) Common Rail fuel pressure sensor

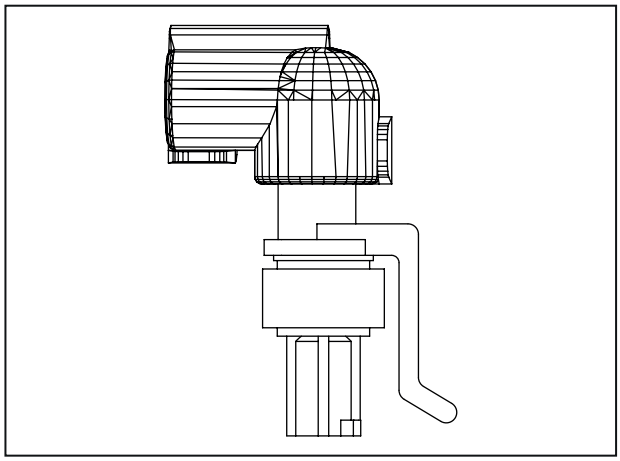
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	RAIL PRESS. SENSOR GND	NZ	0,75	xecua	26
2	RAIL PRESS. SENSOR SIGNAL	G	0,75	xecua	41
3	RAIL PRESS. SENSOR SUPPLY	L	0,75	xecua	11

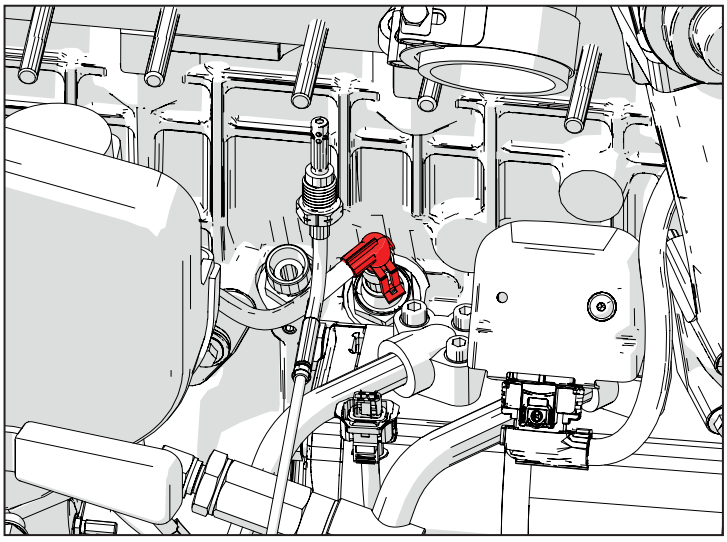




K025 (XS6) Oil pressure switch

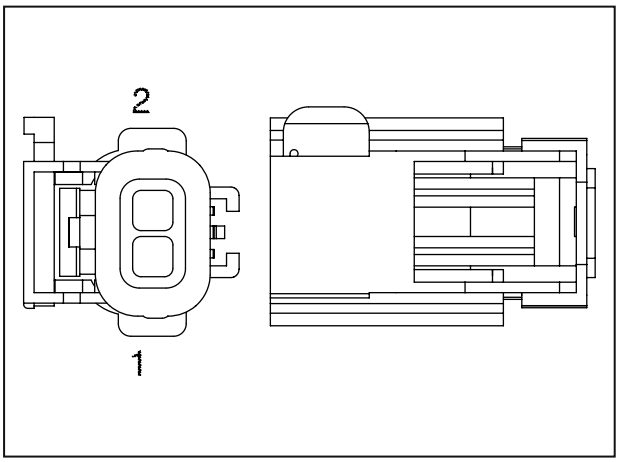
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	OIL PRESS. SWITCH	V	0,75	xecua	6

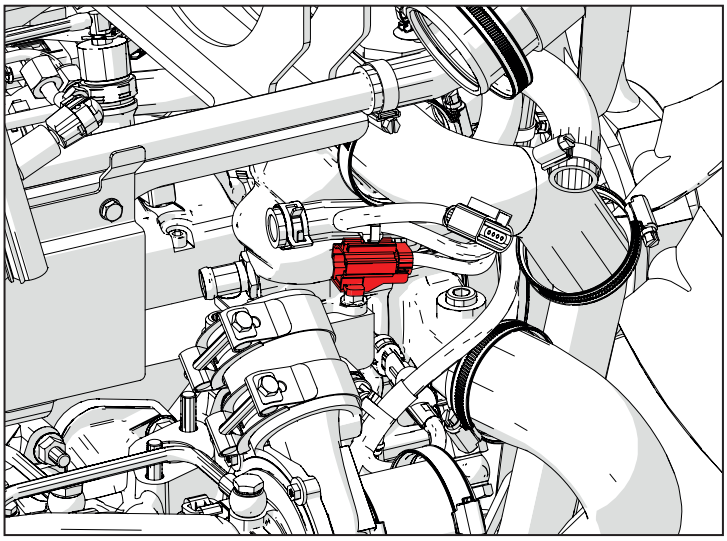




K022 (XS7) EGR temperature sensor

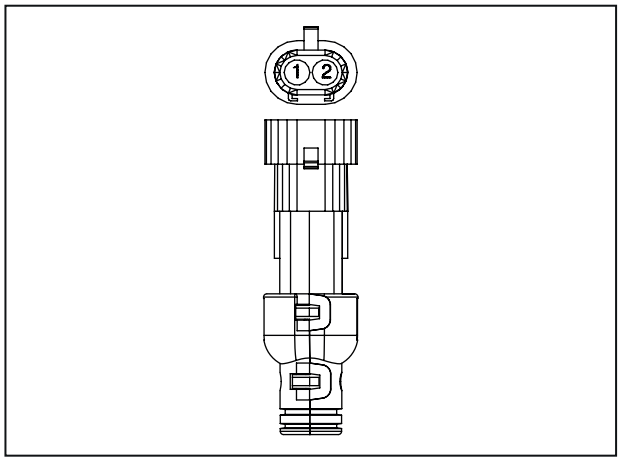
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	EGR COOLER OUT TEMP. SENSOR GND	NG	0,75	xecua	24
2	EGR COOLER OUT TEMP. SENSOR SIGNAL	RN	0,75	xecua	54

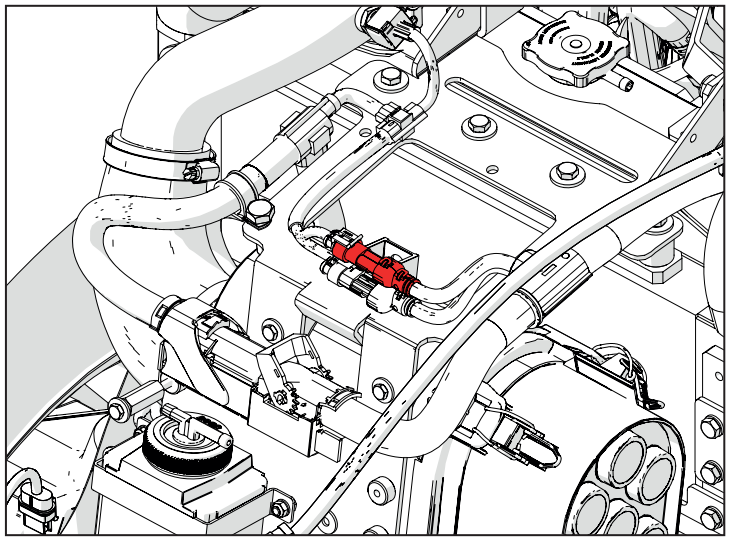




D010 (XTH) Throttle valve power feed

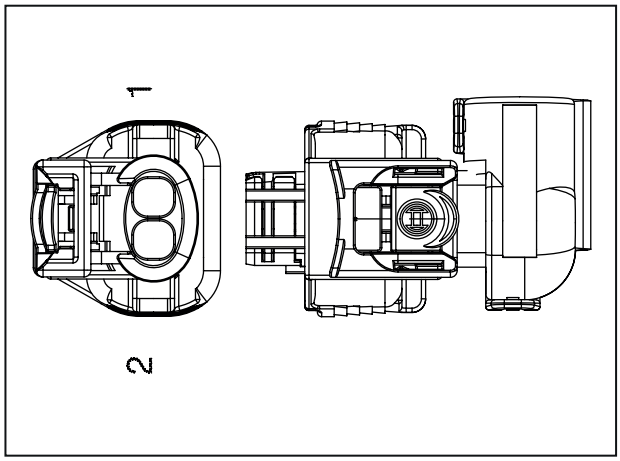
Pin	Description	Colour	Sect.	Input Conn.	Pin
2	12V	CV	0,75	xy3	2

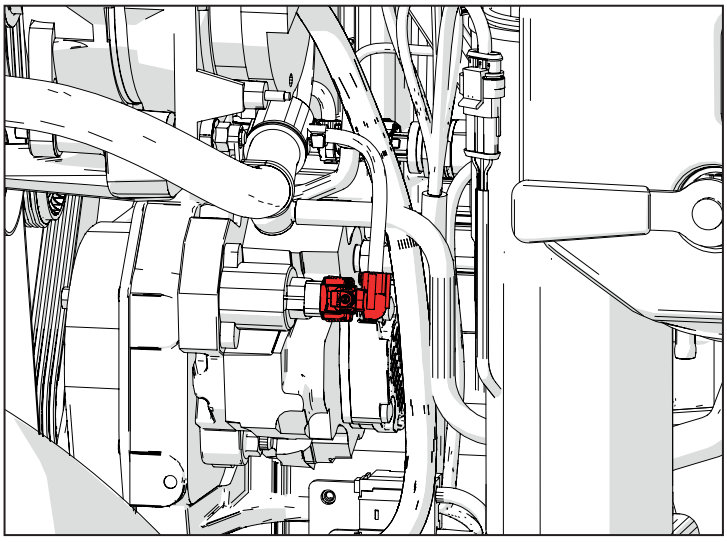




L010 (XY1) High pressure pump

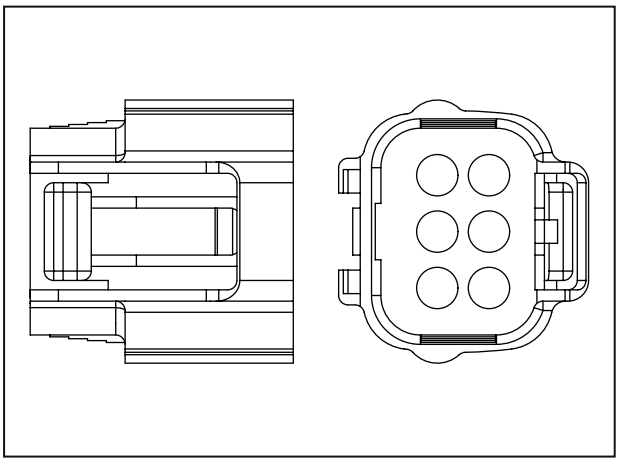
Pin	Description	Colour	Sect.	Input Conn.	Pin
1	FUEL METERING UNIT	ZN	1.5	xecua	15
2	FUEL METERING UNIT	C	1.5	xecua	60

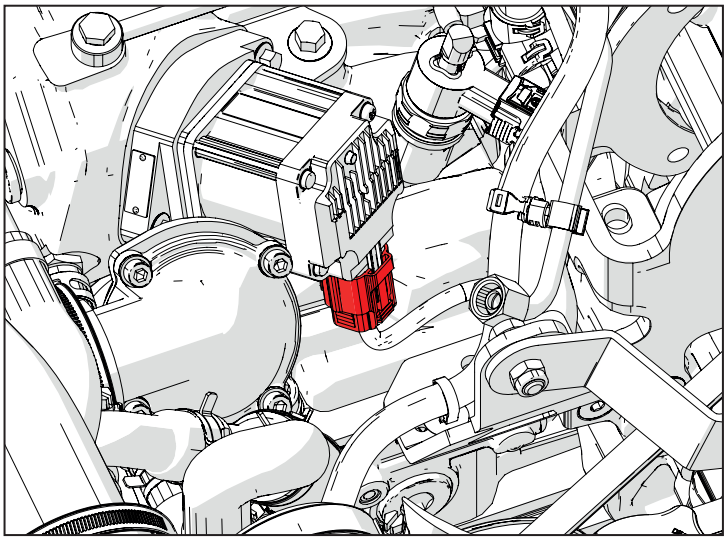




L004 (XY2) Exhaust gas recirculation solenoid valve (EGR)

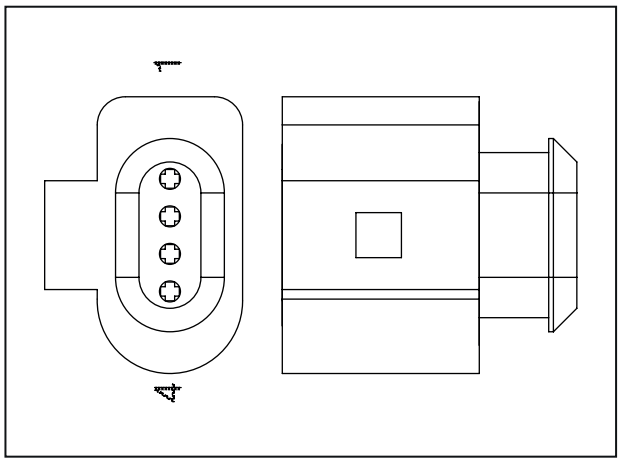
Pin	Description	Colour	Sect.	Input Conn.	Pin
3	CAN_H	ZN	0.5	xeg	3
4	CAN_L	Z	0.5	xeg	4
5	GND	HR	0,75	xeg	1
6	12V	CL	0,75	xeg	2

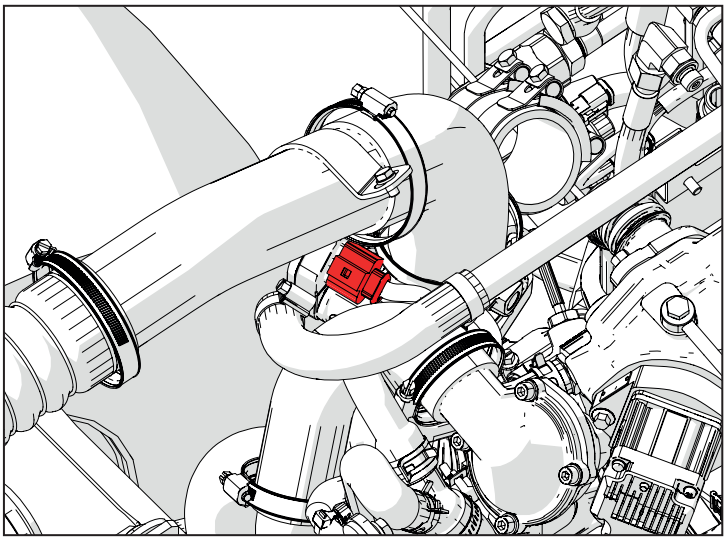




L005 (XY3) Throttle valve

Pin	Description	Colour	Sect.	Input Conn.	Pin
1	THROTTLE VALVE GND	HL	0,75	xecua	52
2	12V	CV	0,75	xth	2
3	THROTTLE VALVE ACTUATOR	H	0,75	xecua	19
4	THROTTLE VALVE STATUS	LG	0,75	xecua	21





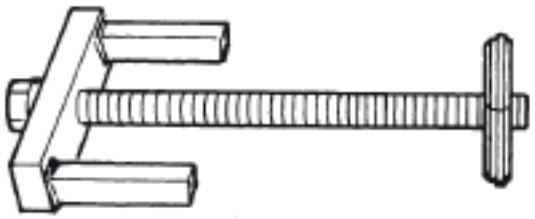
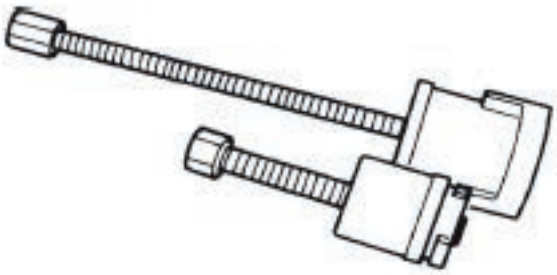
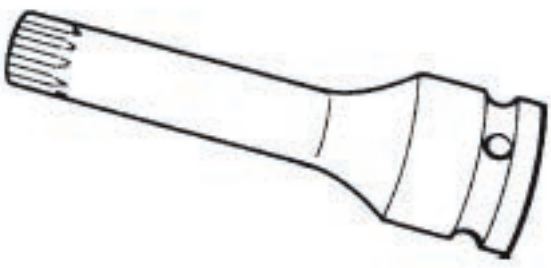
18 : Special tools

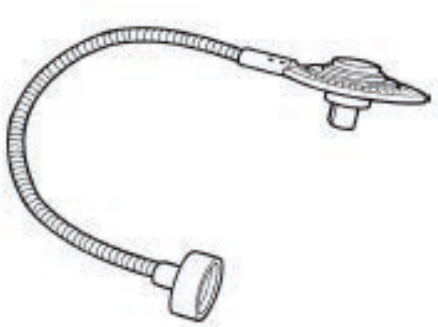
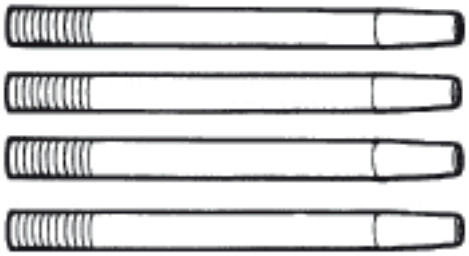
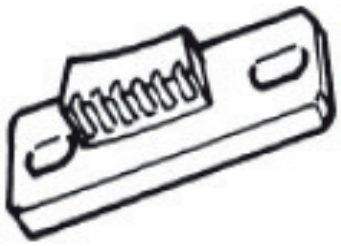
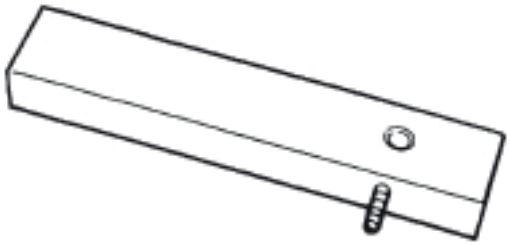
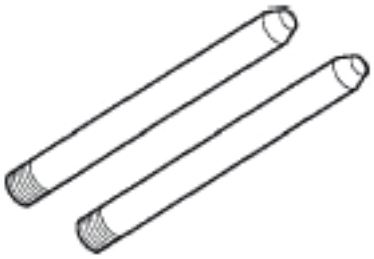
Index

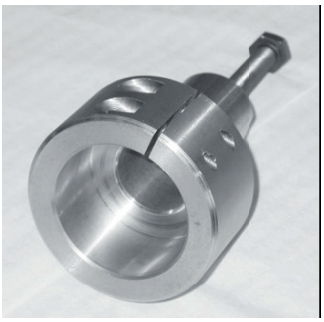
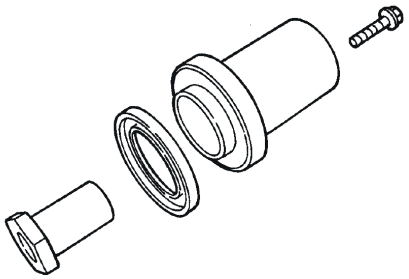
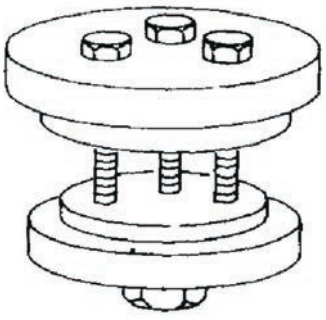
18.1 Engine tools list 18-2

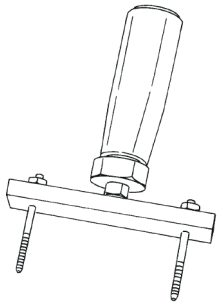
18.2 Vehicle tools list 18-7

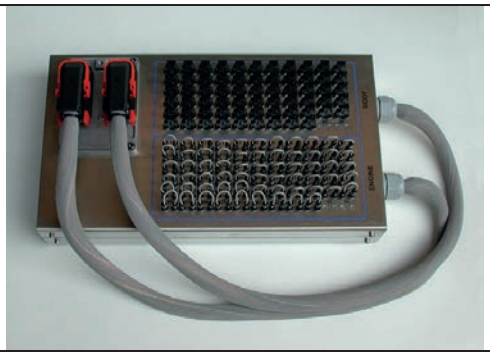
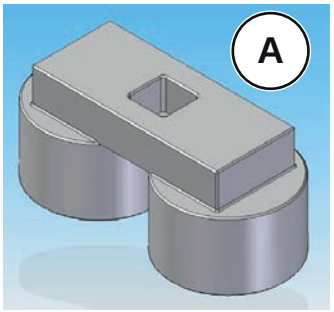
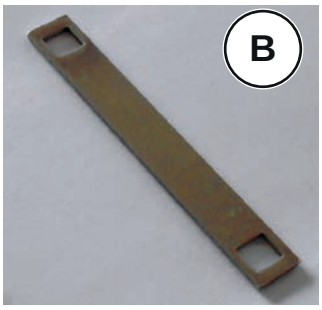
18.1 Engine tools list

code	Description	Photo
07008422	Cylinder sleeve puller tool	
07008423	Tool for installing/removing camshaft and crankshaft bushes	
07008424	Crankshaft installation tool	
07008425	Tool for removing/installing hydraulic tappets	
07008426 07008427	XZN wrench for lateral head screws (12 mm) XZN wrench for centre head screws (14 mm)	

07008428	Tool for angular wrench	
07008429	Head alignment pins	
07008430	Crankshaft immobiliser tool (installed in place of starter motor)	
07008431	Cylinder sleeve height measurement tool	
07008432	Flywheel alignment pins	

07008433	Crankshaft gear extractor tool (for crankshafts with conical front shank)	
07008434	Tool for installing front crankshaft oil seal	
07008435 07008436 07008437 07008438 07008439	Injector puller tool (complete) Housing Pin Fork R750 EURO 4 / IE3 Fork R750 EURO 5	
07008440	Tool for installing rear crankshaft oil seal	

07008441	Tool for synchronising counter-rotating counterweights (only for engine versions with counter-rotating counterweights)	
07008442 07008443	Plate for testing hydraulic seal tightness of heads Plate for testing hydraulic seal tightness of heads complete with O-rings	
07008444	Tool for removing alternator idler pulley	
07008445	**FOR EURO 4 ENGINES ONLY** Furnace for cleaning diesel particulate filter 3kW - 220V	
07008446 07008447 07008448 07008449	Engine test wiring harness R750EU4-EU5 / TE3 / IE3 / TE4/ ISE4/IE4 (without throttle potentiometer and engine control unit) (with throttle potentiometer and without engine control unit) (with throttle potentiometer and with engine control unit) Engine test wiring harness R750EU6	

07008450	Adapter for engine compression testing	
07008451 07008452	**Break out box** (without jumpers) (complete with jumpers)	
	Oscilloscope (recommended type “PicoScope”) Tool usable for viewing waveform of timing and crankshaft position sensor signals	
07008453	Belt installation tool (to be applied onto belt) (R750IE4-TE4-ISE4- R754EU6) A: setting belt tension B: restraining tensioner spring	 
07008454	Belt installation tool (to be applied onto tensioner) (R750IE4-TE4-ISE4- R754EU6)	

18.2 Vehicle tools list

p/n	06381270
Description:	Diagnostic tool kit
Chapter:	Chap.17 Electrical system

Fig. 18.1

p/n	07000215
Description:	Gearbox assembly support stand - base
Chapter:	Chap.7 Front axle

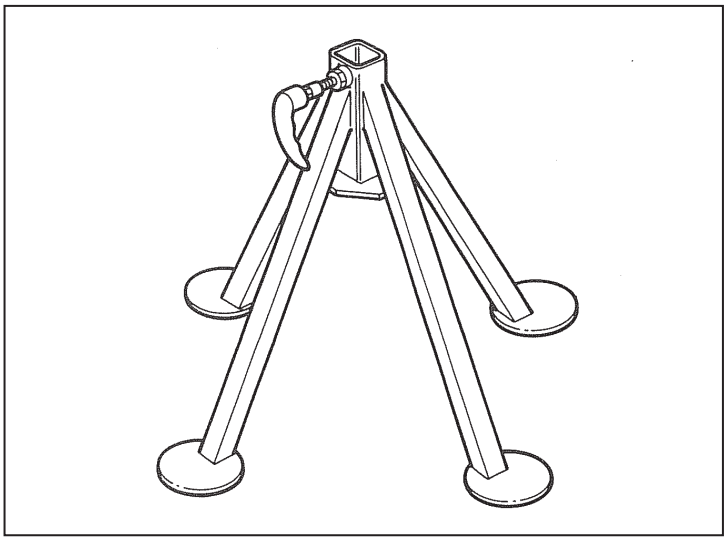


Fig. 18.2

p/n	07000227
Description:	Wrench for ring nut
Chapter:	Chap. 6 Rear final drive units

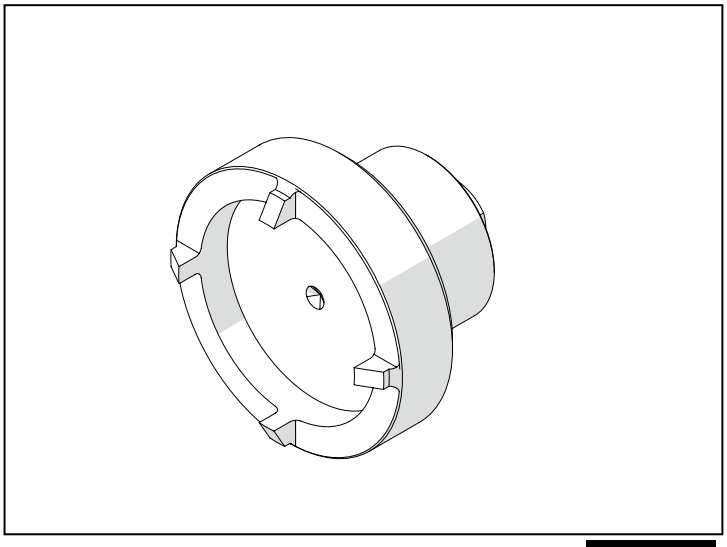


Fig. 18.3

p/n	07000234
Description:	Wrench for ring nut 06340273
Chapter:	Chap.7 Front axle

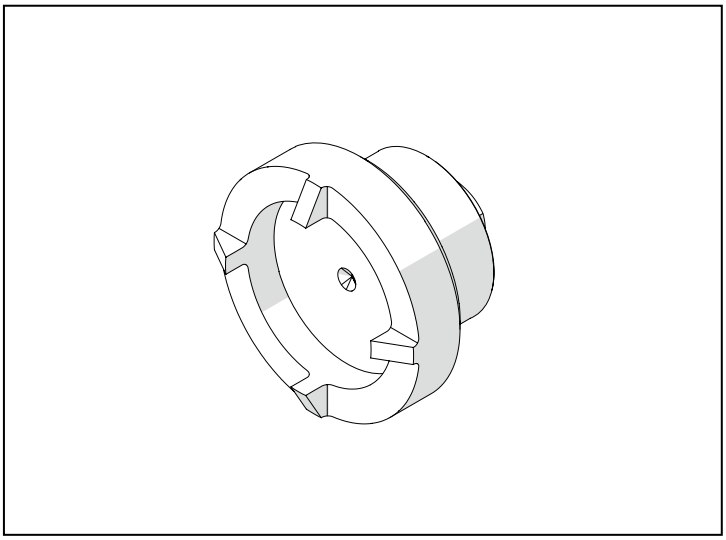


Fig. 18.4

p/n	07000237
Description:	Wrench for ring nut 1363
Chapter:	Chap.5 Rear differential
	Chap.7 Front axle

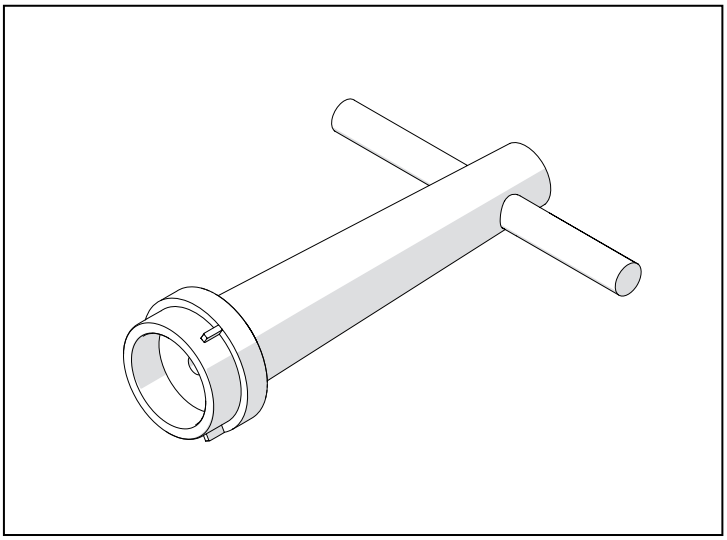


Fig. 18.5

p/n	07000239
Description:	Tool 1363/20 - 1363
Chapter:	Chap.5 Rear differential

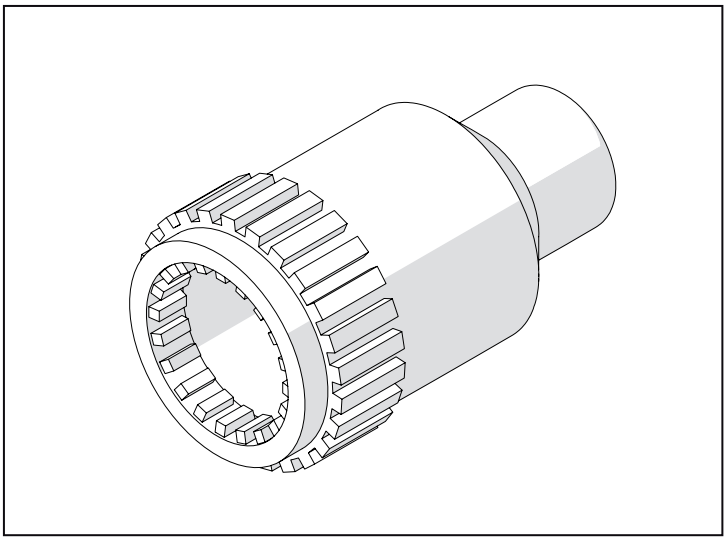


Fig. 18.6

p/n	07000240
Description:	Ring gear removal/installation tool
Chapter:	Chap. 4 Gearbox

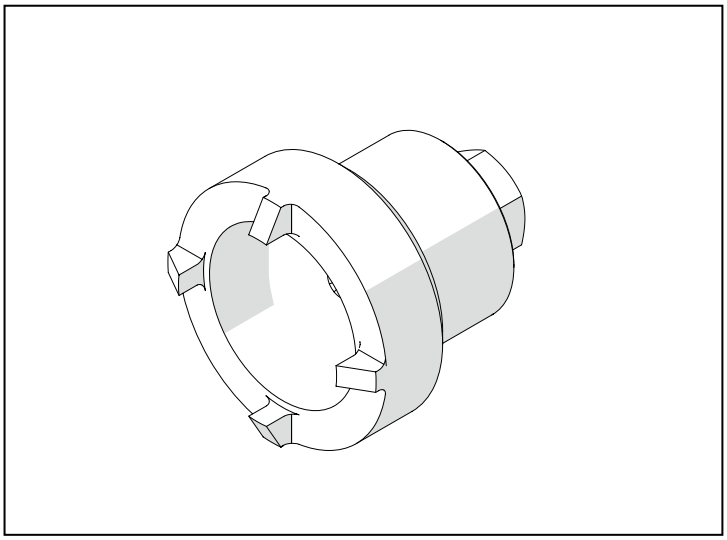


Fig. 18.7

p/n	07000241
Description:	Distributor testing tool 1363
Chapter:	Chap. 12 Hydraulic system

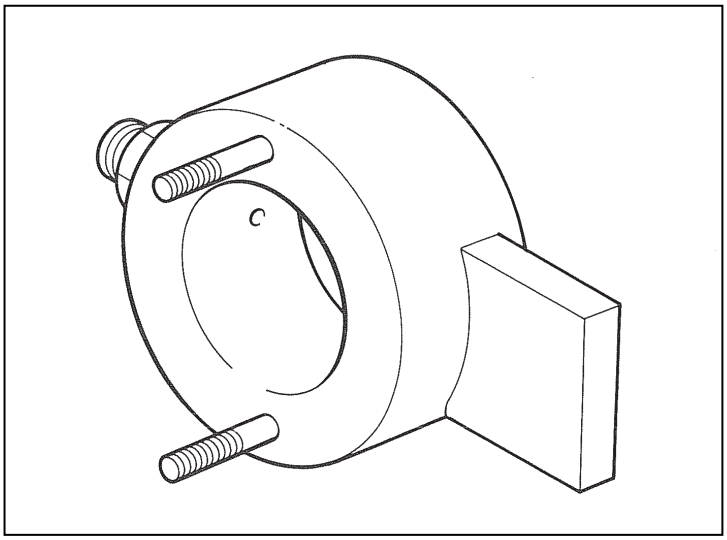


Fig. 18.8

p/n	07000243
Description:	Wrench for no-spin ring nut
Chapter:	Chap.7 Front axle

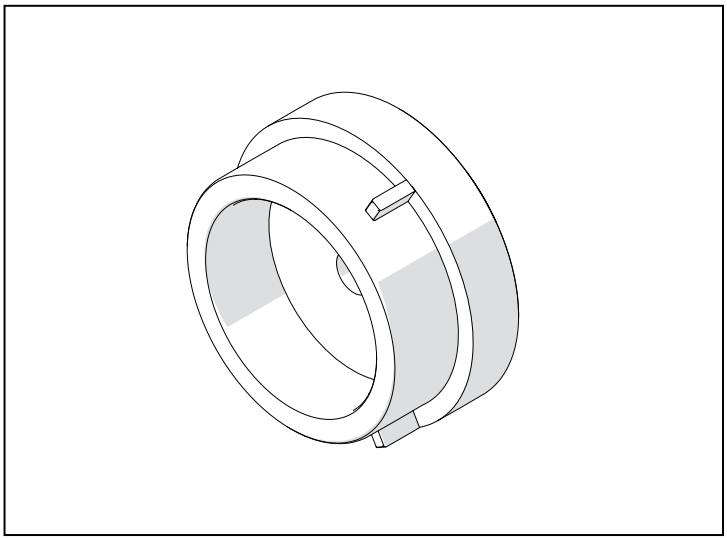


Fig. 18.9

p/n	07000245
Description:	Tractor separation support frame
Chapter:	Chap. 3 Clutch housing

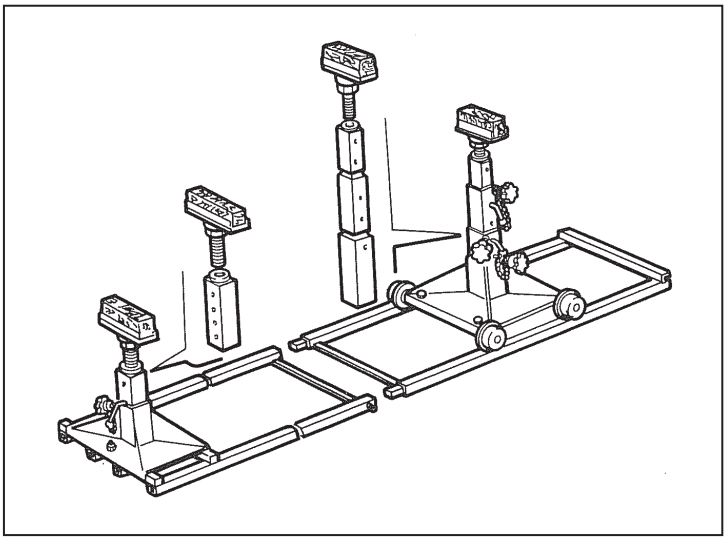


Fig. 18.10

p/n	07000246
Description:	Gearbox casing support
Chapter:	Chap. 4 Gearbox

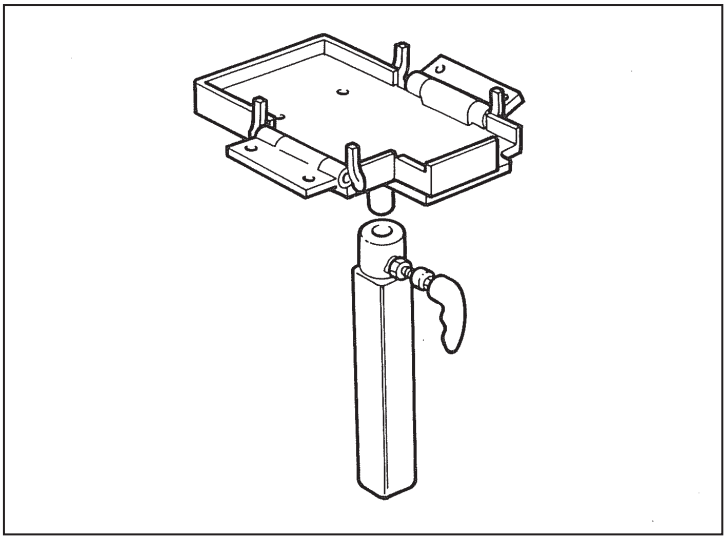


Fig. 18.11

p/n	07000247
Description:	Differential stand
Chapter:	Chap.5 Rear differential

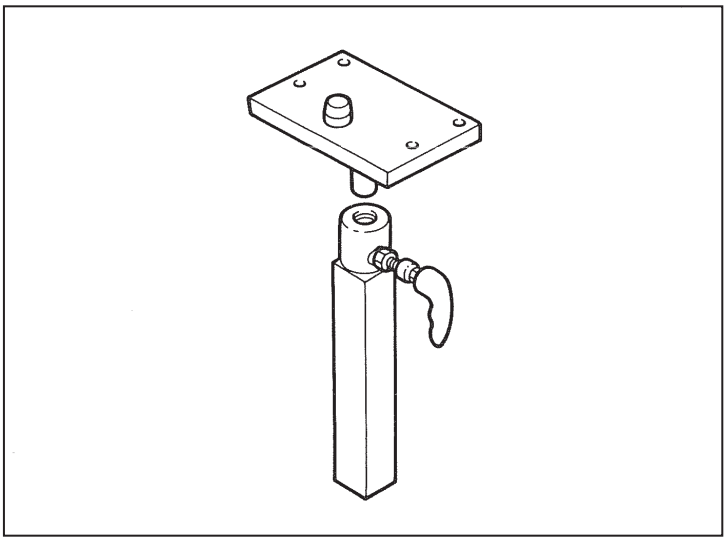


Fig. 18.12

p/n	07000249
Description:	Lift draft adjustment tool
Chapter:	Chap. 12 Hydraulic system

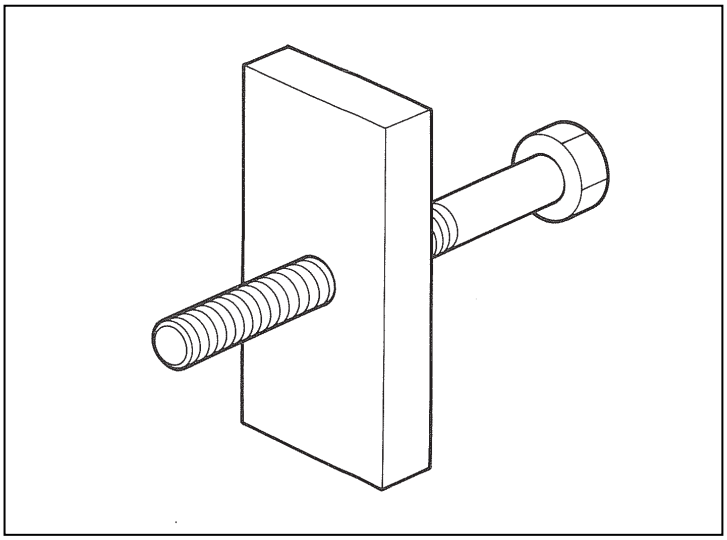


Fig. 18.13

p/n	07000303
Description:	Pressure gauge
Chapter:	Chap. 12 Hydraulic system

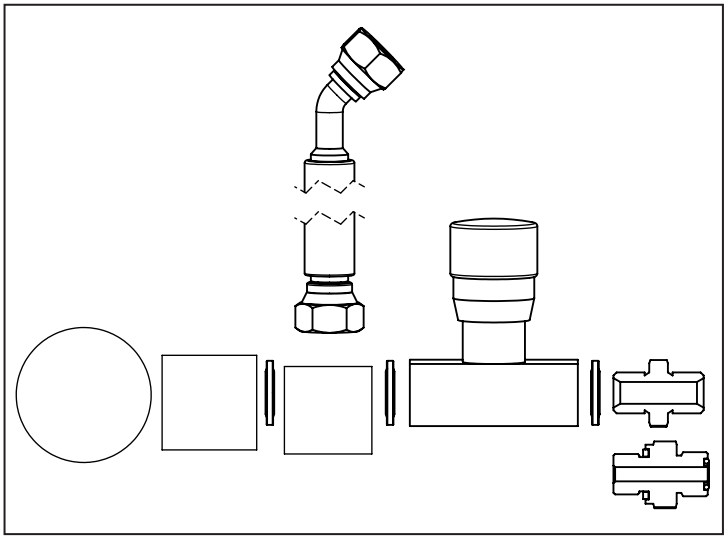


Fig. 18.14

p/n	07000306
Description:	Reverse shuttle shaft removal tool
Chapter:	Chap. 4 Gearbox

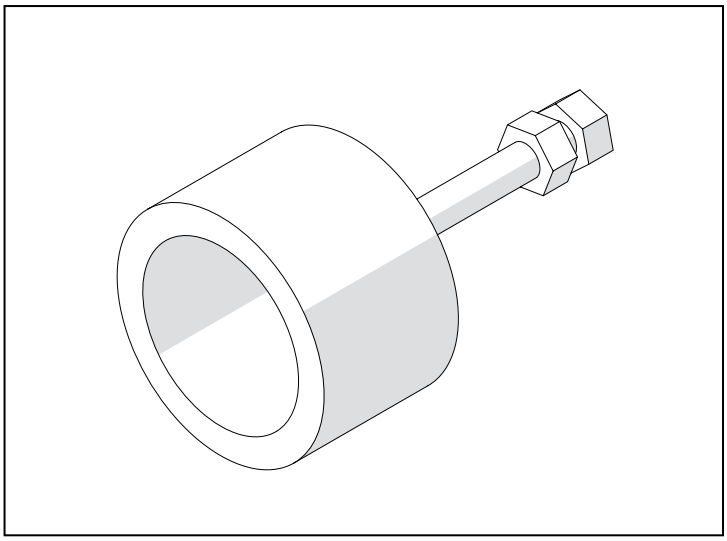


Fig. 18.15

p/n	07001643
Description:	PTO selector lever adjustment tool
Chapter:	Chap.5 Rear differential

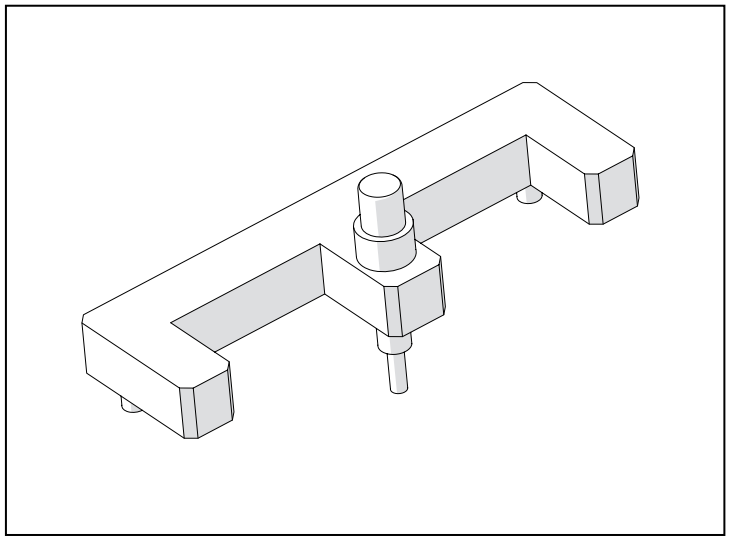


Fig. 18.16

p/n	07002766
Description:	Bearing installation spacer
Chapter:	Chap. 8 4WD transfer case

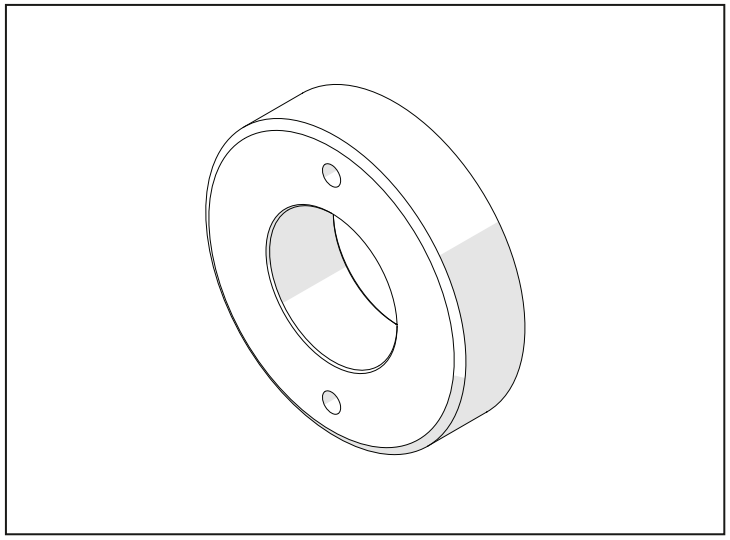


Fig. 18.17

p/n	07003831
Description:	Protective cover for 4WD shaft
Chapter:	Chap. 8 4WD transfer case

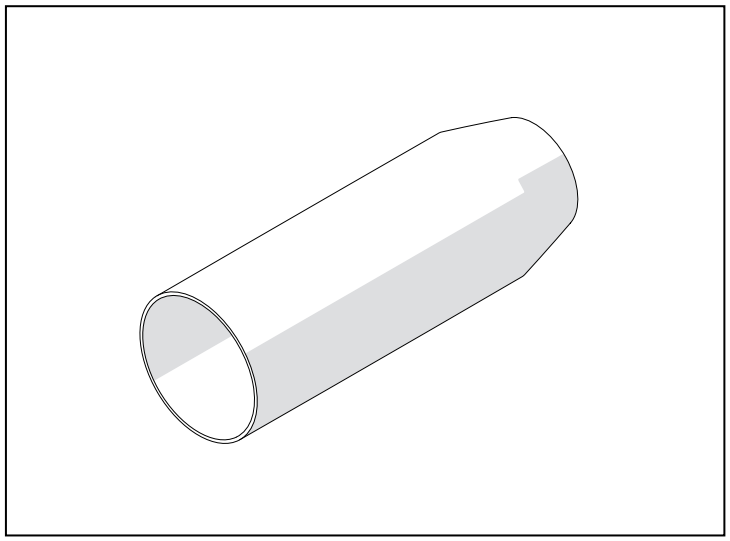


Fig. 18.18

p/n	07006128
Description:	Wrench for ring nut
Chapter:	Chap. 8 4WD transfer case
	Chap. 9 Rear PTO

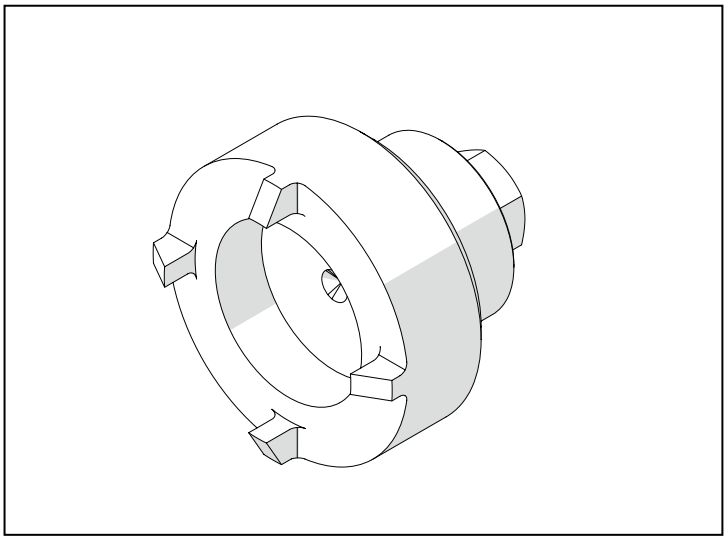


Fig. 18.19

p/n	07006220
Description:	Lift arm lock tool
Chapter:	Chap. 12 Hydraulic system

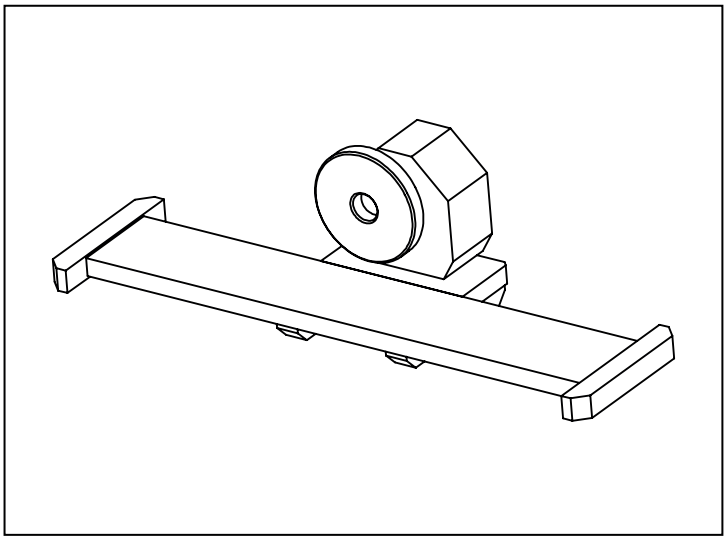


Fig. 18.20

p/n	07006221
Description:	Punch tool for punching multiple dents around pinion ring nut
Chapter:	Chap.5 Rear differential

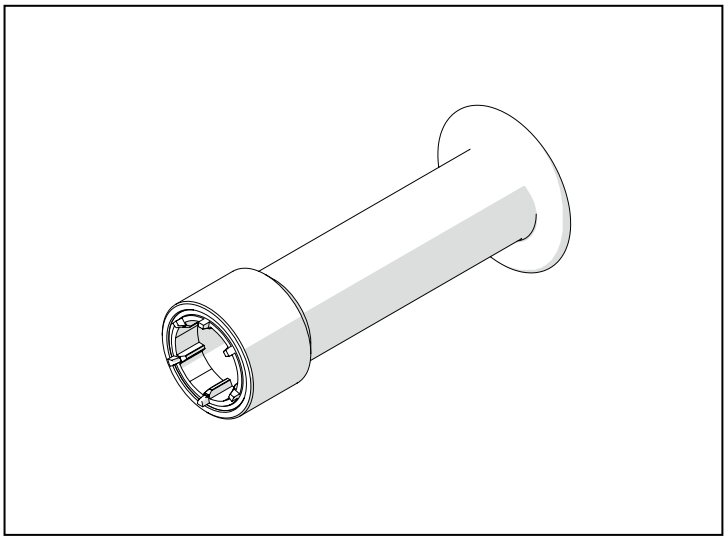


Fig. 18.21

p/n	07006223
Description:	Punch for installing differential tapered roller bearing
Chapter:	Chap.5 Rear differential

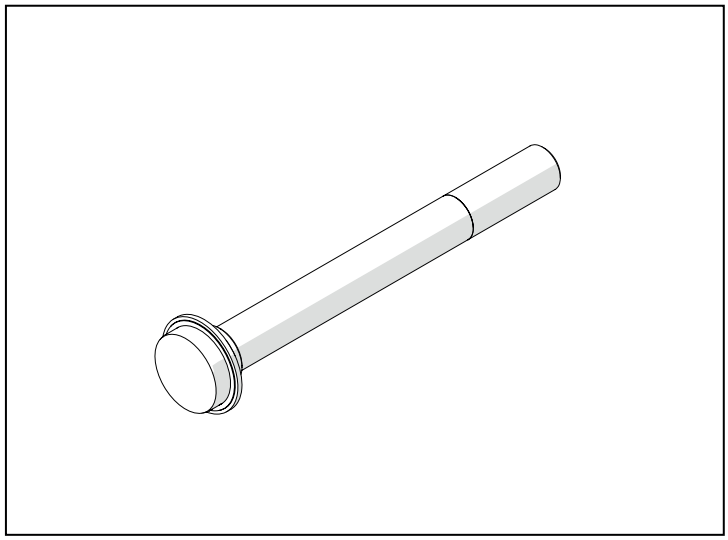


Fig. 18.22

p/n	07006224
Description:	Punch for installing bevel pinion tapered roller bearing
Chapter:	Chap.5 Rear differential

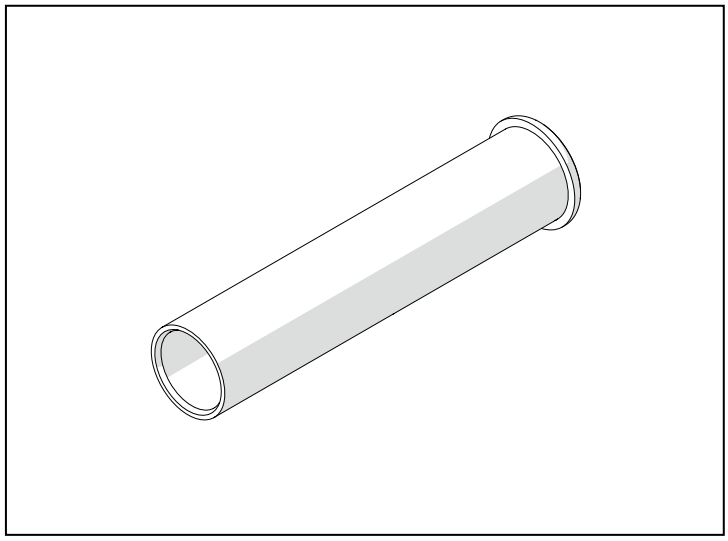


Fig. 18.23

p/n	07006225
Description:	Bevel pinion retainer tool
Chapter:	Chap.5 Rear differential

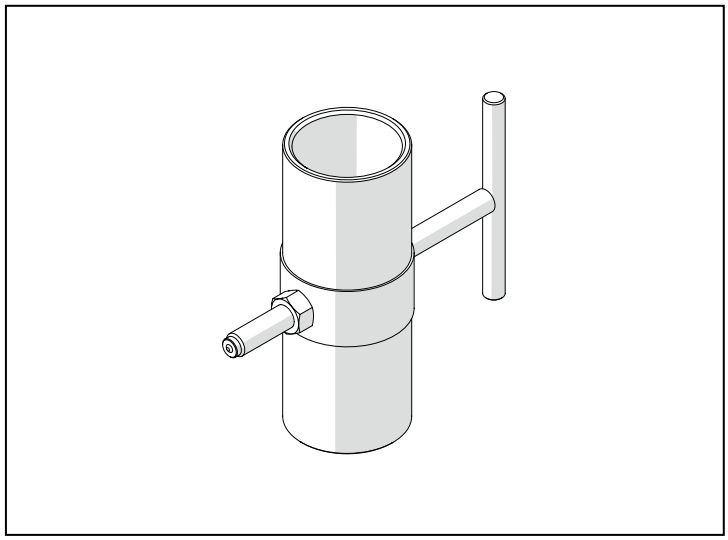


Fig. 18.24

p/n	07006226
Description:	Punch for installing differential sun gear bearing
Chapter:	Chap.5 Rear differential

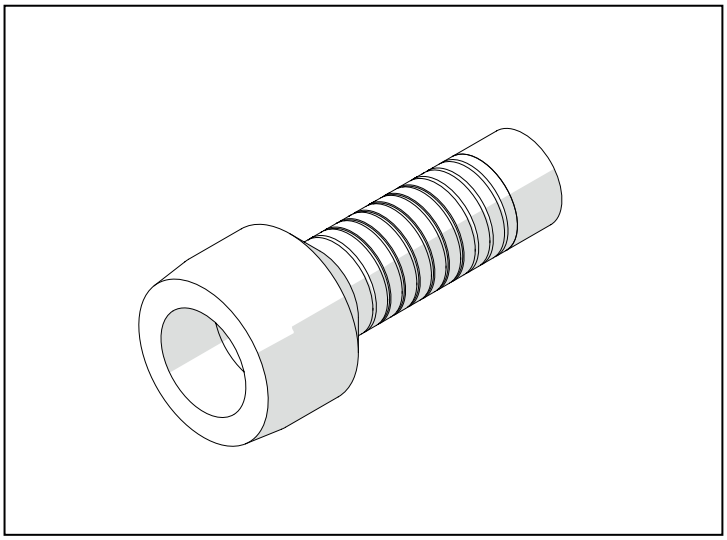


Fig. 18.25

p/n	07006208
Description:	Punch for installing differential
Chapter:	Chap. 8 4WD transfer case

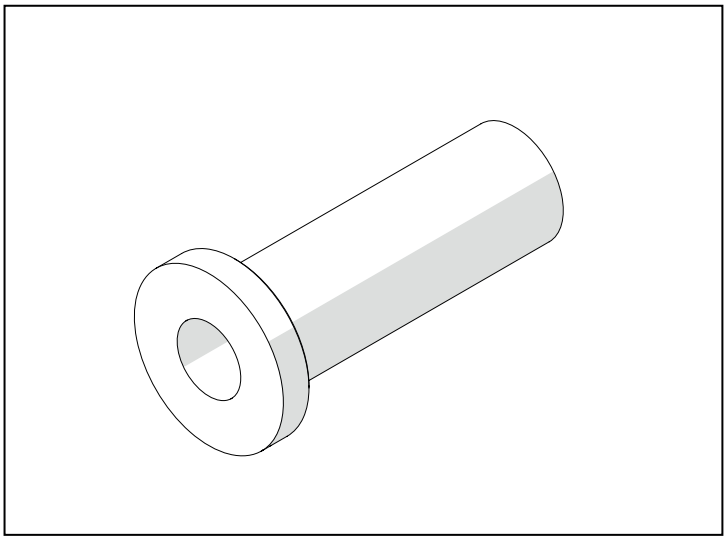


Fig. 18.26

p/n	07006209
Description:	Punch for installing differential
Chapter:	Chap. 8 4WD transfer case

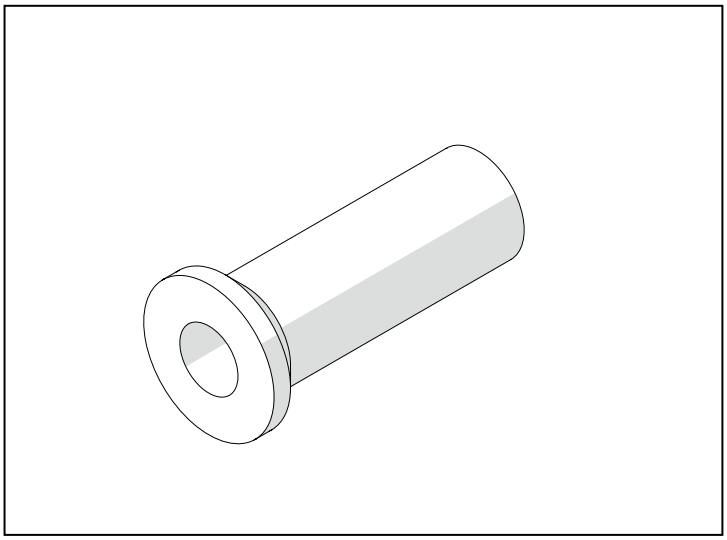


Fig. 18.27

p/n	07006210
Description:	Punch for installing flange in spring pack
Chapter:	Chap. 8 4WD transfer case

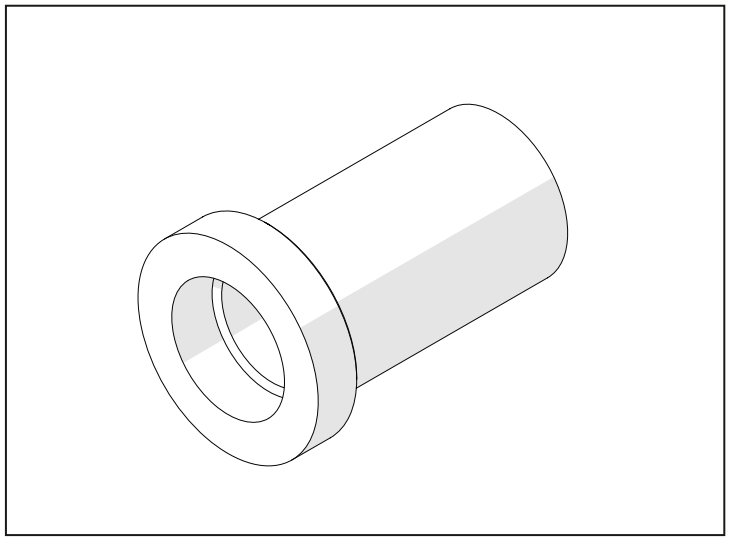


Fig. 18.28

p/n	07006211
Description:	4WD casing support
Chapter:	Chap. 8 4WD transfer case

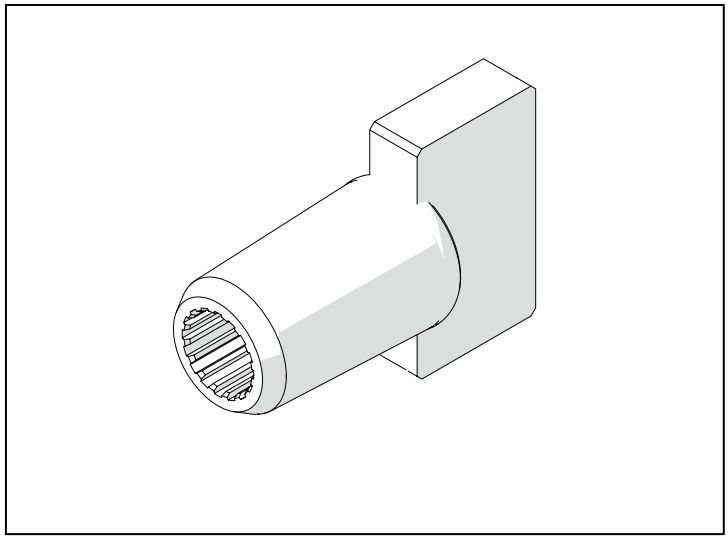


Fig. 18.29

p/n	07006212
Description:	Flywheel puller tool
Chapter:	Chap. 13 Platform

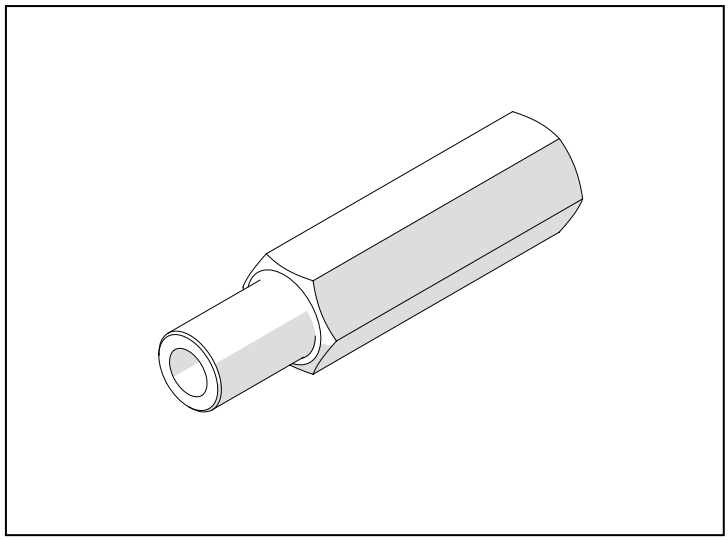


Fig. 18.30

p/n	07007078
Description:	Lock tool for front bevel pinion
Chapter:	Chap.7 Front axle

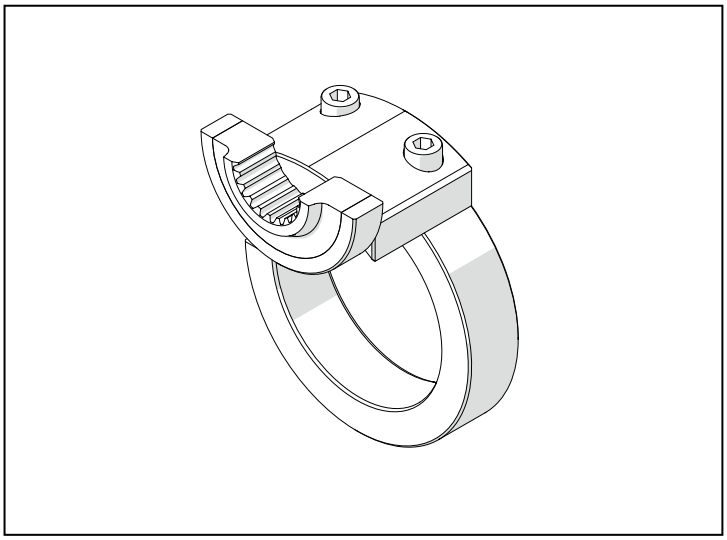


Fig. 18.31

p/n	07007171
Description:	STAR clutch plate alignment pin
Chapter:	Chap. 3 Clutch housing

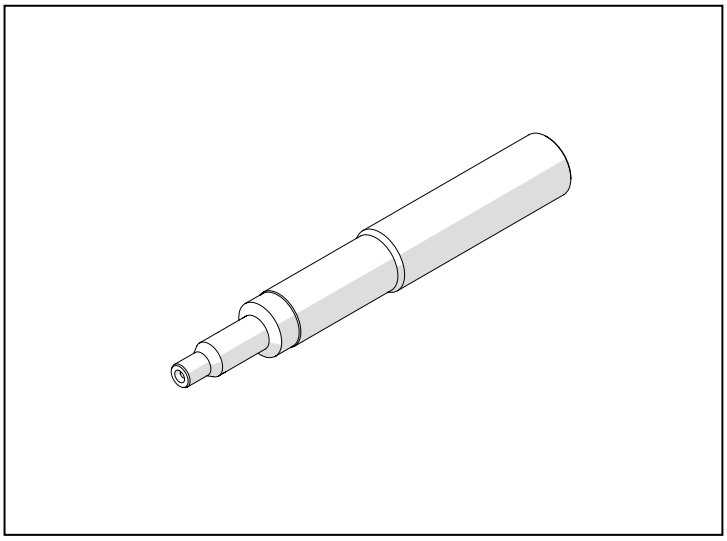


Fig. 18.32

p/n	07007176
Description:	Protective cover for rear lift shaft
Chapter:	Chap.15 Rear lift

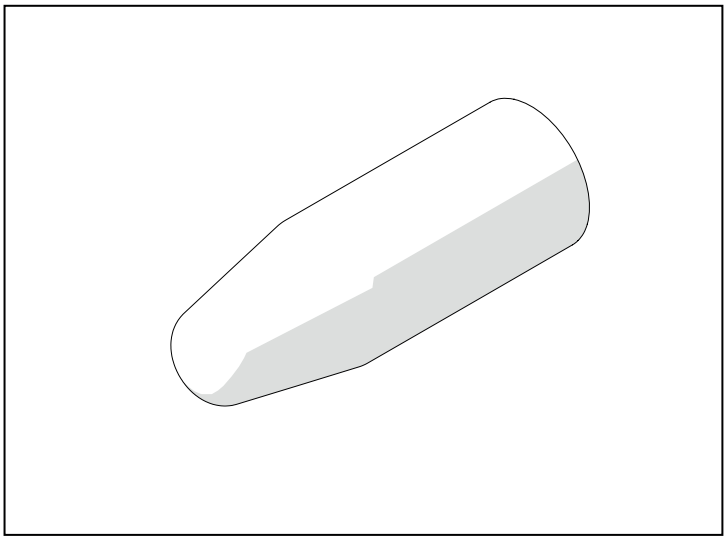


Fig. 18.33

p/n	07007179
Description:	Lever for checking NO-SPIN nut
Chapter:	Chap.7 Front axle

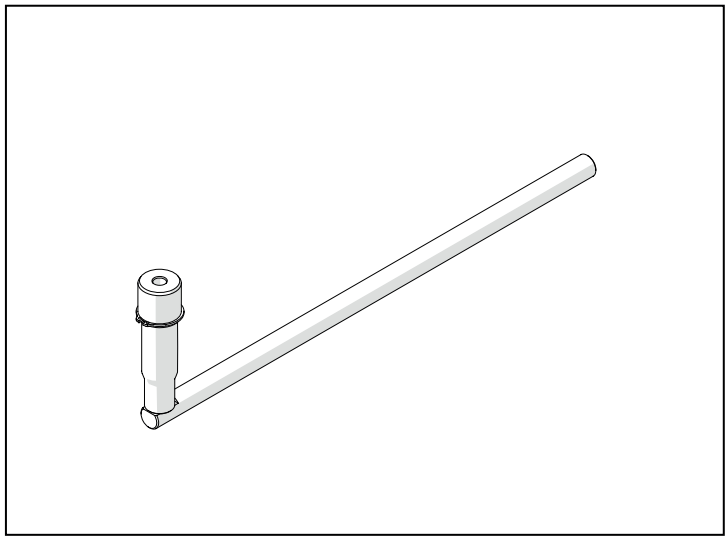


Fig. 18.34

p/n	07007180
Description:	Toe angle measurement tool
Chapter:	Chap.7 Front axle

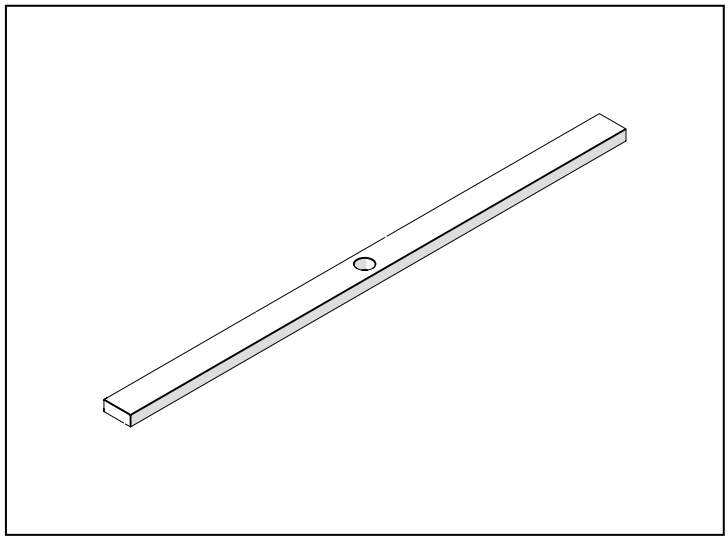


Fig. 18.35

p/n	07007181
Description:	Cab hoisting tool
Chapter:	Chap. 13 Platform
	Chap. 14 Cab

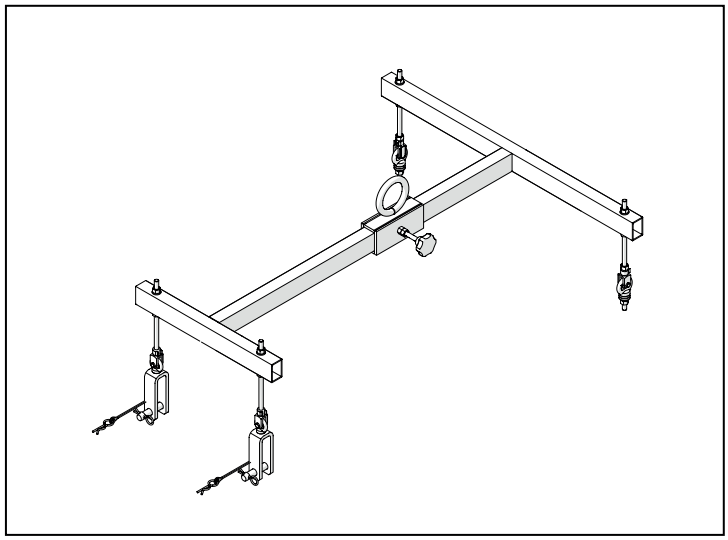


Fig. 18.36

p/n	07007182
Description:	Spring pre-compression tool
Chapter:	Chap. 9 Rear PTO

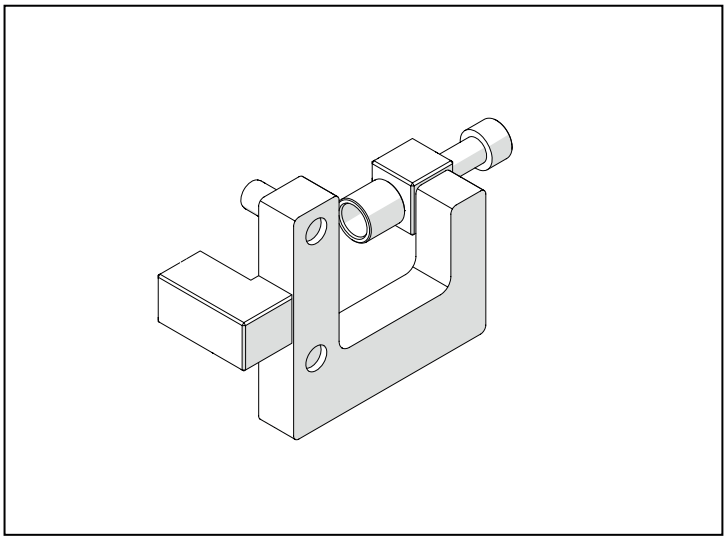


Fig. 18.37

p/n	07007183
Description:	Rear differential lock cylinder installation tool
Chapter:	Chap.5 Rear differential

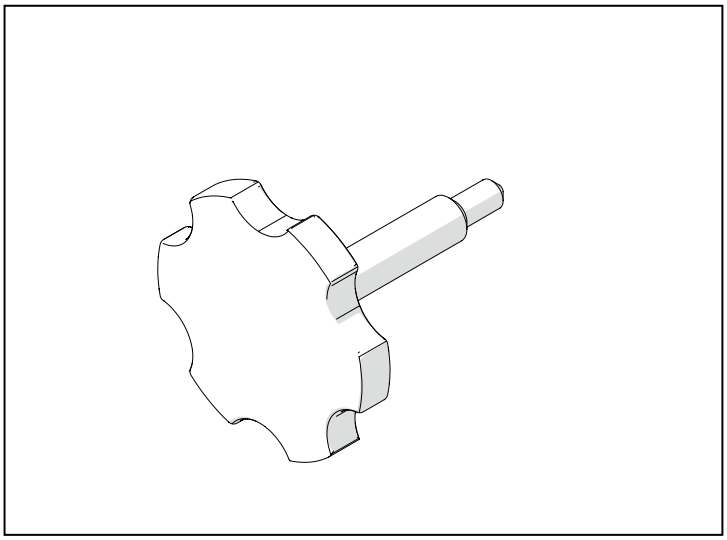


Fig. 18.38

p/n	07007184
Description:	Rear lift oil seal punch
Chapter:	Chap.15 Rear lift

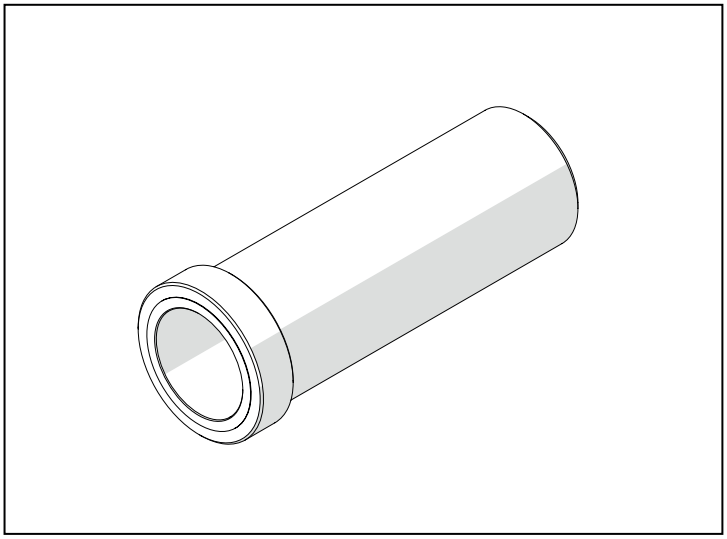


Fig. 18.39

p/n	07007953
Description:	Secondary shaft spacer tool
Chapter:	Chap. 4 Gearbox

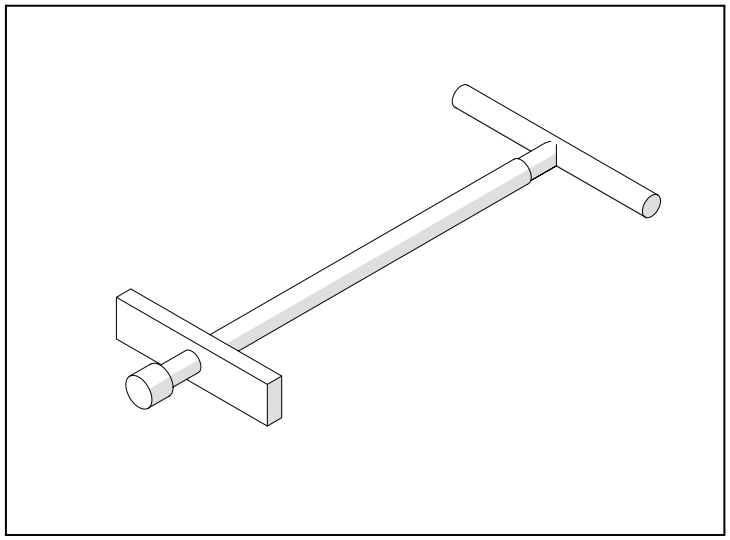


Fig. 18.40

p/n	07007954
Description:	Synchroniser immobiliser tool
Chapter:	Chap. 4 Gearbox

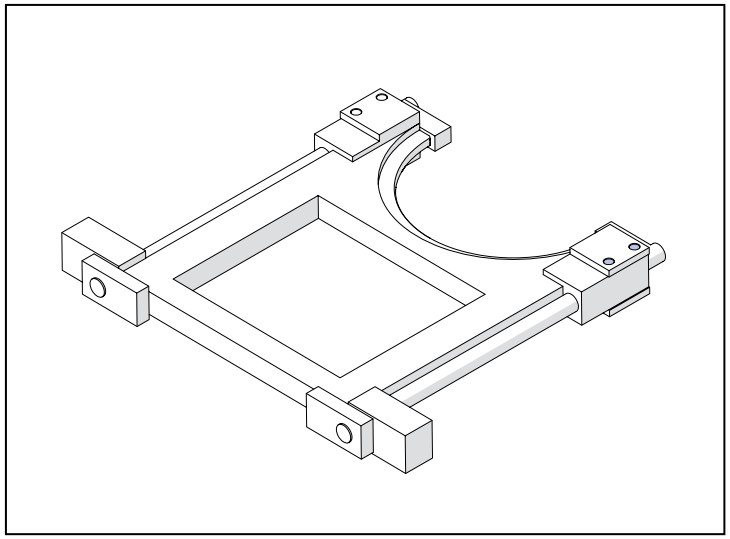


Fig. 18.41

p/n	07007955
Description:	Secondary shaft immobiliser tool
Chapter:	Chap. 4 Gearbox

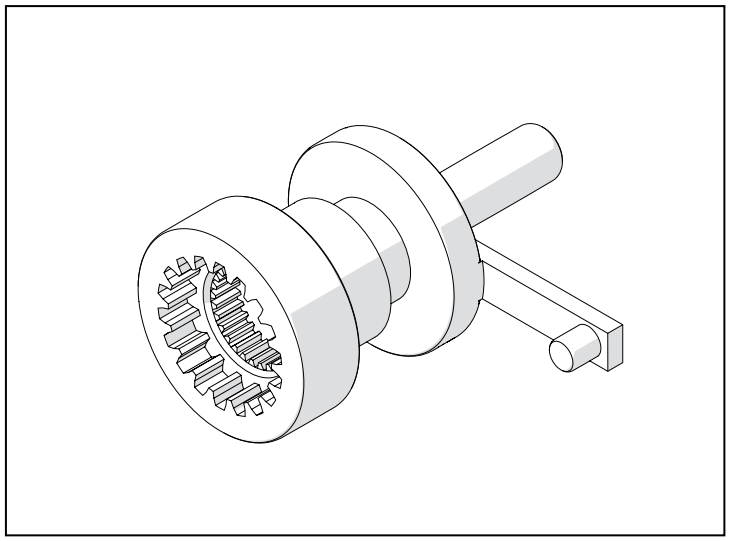


Fig. 18.42

p/n	07007956
Description:	Tool for installing shaft in gearbox
Chapter:	Chap. 4 Gearbox

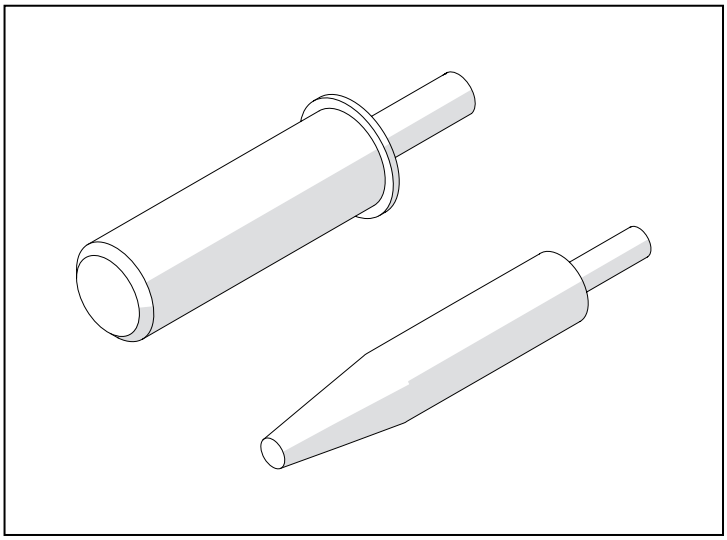


Fig. 18.43

p/n	07007957
Description:	Spacer installation tool
Chapter:	Chap. 4 Gearbox

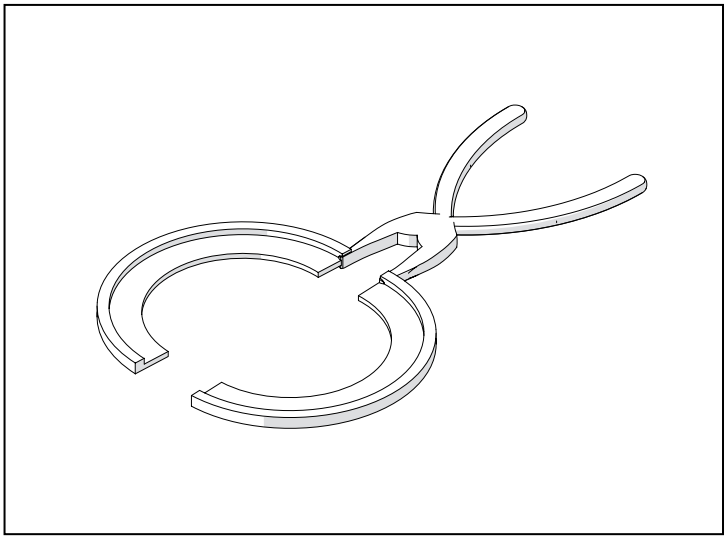


Fig. 18.44

19 : Repair times

Index

19.1 Repair times Q.....19-2

19.1 Repair times Q

GR	Manual ref.	Description	Standard time (min.)	Version
	/	Filling/Draining oil	52	ALL
	/	Removal/Installation of Tow hitch and relative carrier	57,2	ALL
	/	Removal/Installation of RH rear wheel	15,6	ALL
	/	Removal/Installation of LH rear wheel	15,6	ALL
	/	Removal/Installation of Silencer	87,1	ALL
	/	Changing tyre	31,5	ALL
	Chap.2	Removal/Installation of DPF	208	ALL
	Chap.2	Removal/Installation of Radiator	154,7	ALL
	Chap.2	Draining/Filling Coolant	31,2	ALL
	Chap.2	Removal/Installation of Oil sump	58,5	ALL
	Chap.2	14ZAAA- engine removal and re-installation	1161,29	ROLL BAR
	Chap.2	Engine removal and re-installation	1362,29	CAB
	Chap.2	3ZAAA- engine 3/4 - replacement	1552,59	ROLL BAR
	Chap.2	Engine 3/4 - replacement	1753,59	CAB
	Chap.2	7ZAAA-complete engine overhaul	2644,59	ROLL BAR
	Chap.2	Complete engine overhaul	2845,59	CAB
	Chap.2	Partial engine overhaul	1474,59	ROLL BAR
	Chap.2	Partial engine overhaul	1675,59	CAB
	Chap.2	2IAAA-engine oil consumption	1728,09	ROLL BAR
	Chap.2	2IAAA-engine oil consumption	1929,09	CAB
	Chap.2	1NAAA-engine oil leak on flywheel side	811,59	ROLL BAR
	Chap.2	1NAAA-engine oil leak on flywheel side	1012,59	CAB
	Chap.2	3Z-ABA crankcase - replacement	1552,59	ROLL BAR
	Chap.2	3Z-ABA crankcase - replacement	1753,59	CAB
	Chap.2	3Z-AIA1 cylinder sleeve - replacement (individual)	968,5	ALL
	Chap.2	3Z-AIA4 cylinder sleeve - replacement (all)	1046,5	ALL
	Chap.2	3Z- BAA crankshaft - replacement	1708,59	ROLL BAR
	Chap.2	3Z- BAA crankshaft - replacement	1909,59	CAB
	Chap.2	3Z -BIA rear main bearing - replacement	805,09	ROLL BAR
	Chap.2	3Z -BIA rear main bearing - replacement	1006,09	CAB
	Chap.2	3Z-BHA central main bearing journals	1903,59	ROLL BAR
	Chap.2	3Z-BHA central main bearing journals	2104,59	CAB
	Chap.2	3Z-BLA front crankshaft hub	213,2	ALL
	Chap.2	3Z - BFA flywheel (including ring gear)	733,59	ROLL BAR
	Chap.2	3Z - BFA flywheel (including ring gear)	934,59	CAB
	Chap.2	3Z - BAF front crankshaft gear	291,2	ALL
	Chap.2	3Z - EAC timing gears	349,7	ALL
	Chap.2	3Z - CAA1 piston and connecting rod (one)	741	ALL
	Chap.2	3Z - CAA4 piston and connecting rod (all)	819	ALL
	Chap.2	3Z - CAD piston rings (all pistons)	838,5	ALL
	Chap.2	8Z - DAA overhaul of upper part of engine (heads and/or gaskets)	884	ALL

GR	Manual ref.	Description	Standard time (min.)	Version
	Chap.2	3Z - DAA head and head gasket - replacement (all heads)	572	ALL
	Chap.2	10Z - DFA rocker assembly - check (all)	318,5	ALL
	Chap.2	3Z - DGG valve guide - replacement (all)	806	ALL
	Chap.2	3Z - DGH1 valve springs - replacement (one)	299	ALL
	Chap.2	3Z - DGH4 valve springs - replacement (all)	377	ALL
	Chap.2	3Z - EAA camshaft - replacement	661,7	ALL
	Chap.2	3Z - ECA rocker rods	357,5	ALL
	Chap.2	3Z - EBB hydraulic tappets	611	ALL
	Chap.2	3Z - EFA rocker cover	364	ALL
	Chap.2	3Z - GEA heat exchanger - engine oil (modine)	39	ALL
	Chap.2	3Z - GAA oil pump	486,2	ALL
	Chap.2	3Z - GGA engine oil pressure relief valve	312	ALL
	Chap.2	3Z - GAQ : rocker lubrication pipe	39	ALL
	Chap.2	3Z - GBA oil filter	19,5	ALL
	Chap.2	3Z - HAA water pump	193,7	ALL
	Chap.2	3Z - HAL water pump pulley	174,2	ALL
	Chap.2	3Z - HDA thermostat valve	174,2	ALL
	Chap.2	3Z - HHA radiator	154,7	ALL
	Chap.2	3Z - JBA alternator belt - automatic tensioner	174,2	ALL
	Chap.2	3Z - KAA intake manifold	71,5	ALL
	Chap.2	3Z - KDA turbocharger	52	ALL
	Chap.2	3Z - KBA exhaust manifold	71,5	ALL
	Chap.2	3Z - KCH EGR heat exchanger	279,5	ALL
	Chap.2	3Z - KCA EGR valve and throttle valve	240,5	ALL
	Chap.2	5E - KGB diesel particulate filter	71,5	ALL
	Chap.2	3Z - MAA flywheel housing	811,59	ROLL BAR
	Chap.2	3Z - MAA flywheel housing	1012,59	CAB
	Chap.2	3Z - MCA timing cover	232,7	ALL
	Chap.2	3Z - MCE timing cover	213,2	ALL
	Chap.2	3Z - MBA oil sump	244,5	ALL
	Chap.2	3Z - OAA 1 injector (one)	260	ALL
	Chap.2	3Z - OAA injector (all)	299	ALL
	Chap.2	10Z - OAA test - fuel return from injectors	32,5	ALL
	Chap.2	12Z - OEL bleeding air from fuel circuit	32,5	ALL
	Chap.2	3Z - OEC fuel filter	32,5	ALL
	Chap.2	3Z - OHB rail	52	ALL
	Chap.2	3Z - PAC injection pump gear	213,2	ALL
	Chap.2	3Z - PAA injection pump - replacement	213,2	ALL
	Chap.2	3Z - PCA fuel pressure regulator valve	32,5	ALL
	Chap.2	3Z - QAA front crankshaft bush	1747,59	ROLL BAR
	Chap.2	3Z - QAA front crankshaft bush	1948,59	CAB
	Chap.2	3Z - QBB connecting rod bushes (all connecting rods)	390	ALL
	Chap.2	3Z - QAD rear main bearing bush	831,09	ROLL BAR
	Chap.2	3Z - QAD rear main bearing bush	1032,09	CAB

GR	Manual ref.	Description	Standard time (min.)	Version
	Chap.3	Removal/Installation and Adjustment of Clutch pedal	22,1	ALL
	Chap.3	Separation/Reassembly of Engine-Transmission	694,59	ROLL BAR
	Chap.3	Separation/Reassembly of Engine-Transmission	895,59	ALL
	Chap.4	Separation/Reassembly of Clutch housing-Gearbox	724,49	ROLL BAR
	Chap.4	Separation/Reassembly of Clutch housing-Gearbox	925,49	CAB
	Chap.4	Disassembly/Assembly of Gearbox	1211,34	ROLL BAR
	Chap.4	Disassembly/Assembly of Gearbox	1412,34	CAB
	Chap.5	Removal/Installation of Gearbox-Differential	870,74	ROLL BAR
	Chap.5	Removal/Installation of Gearbox-Differential	1071,74	CAB
	Chap.5	Removal/Installation of Gearbox cover and Rear differential (PTO)	596,44	ROLL BAR
	Chap.5	Removal/Installation of Gearbox cover and Rear differential (PTO)	797,44	CAB
	Chap.5	Removal/Installation of Rear differential	1217,84	ROLL BAR
	Chap.5	Removal/Installation of Rear differential	1490,84	CAB
	Chap.7	Replacing complete axle	156	ALL
	Chap.7	Replacing Steering cylinders	90	ALL
	Chap.8	Removal/Installation of 4WD unit	161,2	ALL
	Chap.8	Disassembly/Assembly of 4WD unit	239,2	ALL
	Chap.9	Removal/Installation of rear PTO	99,45	ALL
	Chap.9	Disassembly/Assembly of Rear PTO	128,05	ALL
	Chap.10	Removal/Installation of LH rear hub	699,14	ROLL BAR
	Chap.10	Removal/Installation of RH rear hub	699,14	ROLL BAR
	Chap.10	Removal/Installation of LH rear hub	900,14	CAB
	Chap.10	Removal/Installation of RH rear hub	900,14	CAB
	Chap.10	Disassembly/Assembly of Rear hub	762,84	ROLL BAR
	Chap.10	Disassembly/Assembly of Rear hub	963,84	CAB
	Chap.10	Removal/Installation and Adjustment of Brake pedals and Parking brake lever	79,3	ALL
	Chap.12	Adjusting Draft Control	30	ALL
	Chap.12	Replacing Lift cylinder	48	ALL
	Chap.12	Servicing lift cylinder, with replacement of gaskets	90	ALL
	Chap.13	Removal/Installation of Platform	583,44	ROLL BAR
	Chap.13	Removal/Installation of Platform	784,44	CAB
	Chap.13	Removal/Installation of Dashboard	167,44	ALL
	Chap.13	Removal/Installation of Seat	13	ALL
	Chap.13	Removal/Installation of Cowl	45,5	ALL
	Chap.13	Removal/Installation of Cowl gas strut	11,7	ALL
	Chap.13	Removal/Installation of 4WD shaft and shaft guard	31,2	ALL
	Chap.13	Removal/Installation of Fixed cowl	55,9	ALL
	Chap.13	Removal/Installation of Side cowl panels	13	ALL
	Chap.14	Removal/Installation of Cab	240	CAB
	Chap.14	Replacing door opener gas strut	6	ALL
	Chap.14	Replacing screen wash fluid reservoir	18	ALL

GR	Manual ref.	Description	Standard time (min.)	Version
	Chap.15	Removal/Installation of Rear lift	645,84	ROLL BAR
	Chap.15	Removal/Installation of Rear lift	846,84	CAB
	Chap.17	Replacing Start enable switch on clutch pedal	48	ALL
	Chap.17	Replacing PTO clutch lever switch	48	ALL
	Chap.17	Replacing PTO speed selector switch	12	ALL
	Chap.17	Removal/Installation of Battery	10,4	ALL

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