WORKSHOP MANUAL

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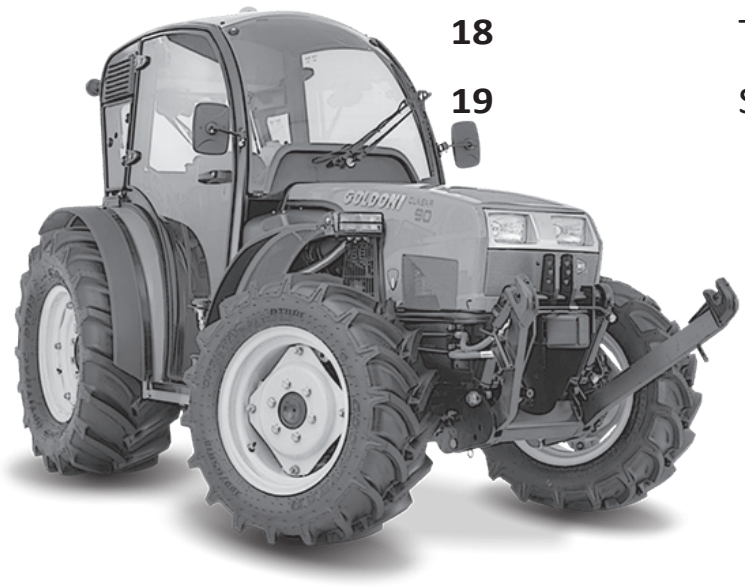
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GOLDONI

Tractors for **Life**

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Section 1 : How to consult the manual

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1.1 Introduction

The purpose of this workshop manual is to provide the user with the information, operating principles and instructions about the adjustments to which the various parts of our tractors must be subjected.

The manual does not give full details about how to disassemble the parts as it has been compiled for assistance technicians who have already taken part in the training courses. It must therefore be used along with the theoretic and practical information that the instructor gives during these courses.

Before you begin to read the manual, it is essential to consult section "2- Safety notes" in order to prevent errors or mistakes that could jeopardize the safety of the technicians in the workshop.

The information in this manual was up to date on the date printed on the page. Goldoni S.p.A. reserves the right to make changes without being obliged to give notice. Please contact your dealer or the importer if discrepancies are discovered or for any other requirement.

1.2 Structure of the manual

The manual is divided into chapters, and each chapter into sections.

Page numbering begins with 1 in each chapter, with the chapter number alongside.

Example: 3-9 indicates page 9 of chapter 3.

Numbering of the figures also begins with 1 in each chapter, with the chapter number alongside.

Example: Fig. 8.16 indicates figure 16 of chapter 8.

The tools considered essential for correctly disassembling, re-assembling and adjusting the part in question are listed at the end of each chapter.

The main tightening torque values for correct assembly of the tractor are given at the end of each chapter. Consult the "Tightening Torque Values" section of chapter "1-Introduction" for all tightening torque values that have not been specified.

1.3 Tractor identification

Whenever you contact the Assistance Service or order a part from the Spare Parts Store, you also must also give the identification data of your tractor. We require the following information:

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

All these data are stamped on the metal data plate, which is in an easily accessible part of the machine.

1 - Commercial name
2 - Production series
3 - Machine type
4 - Variant/Version
5 - Identification number (serial number)

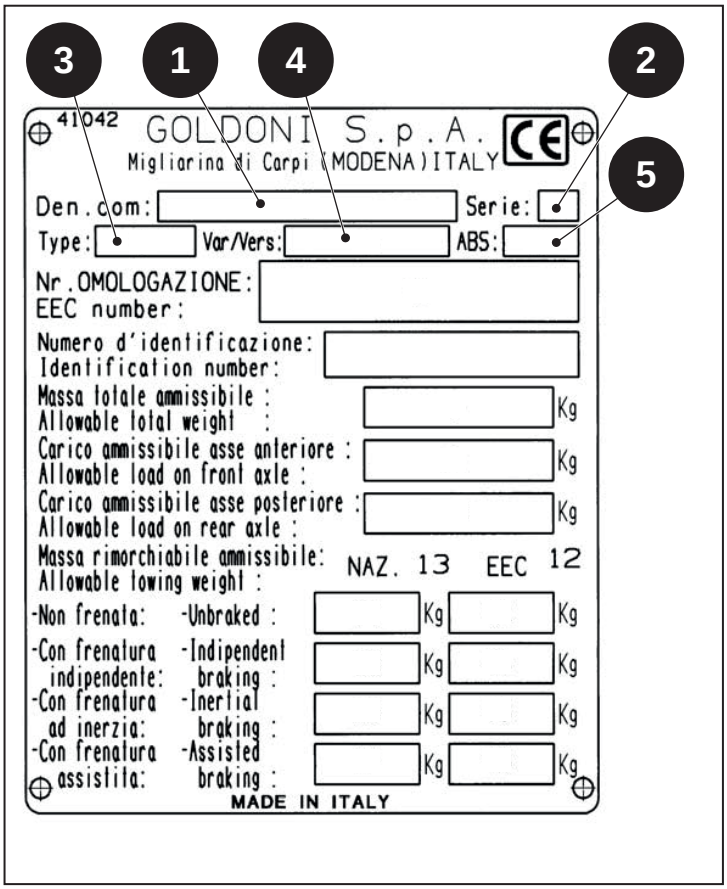


Fig. 1.1

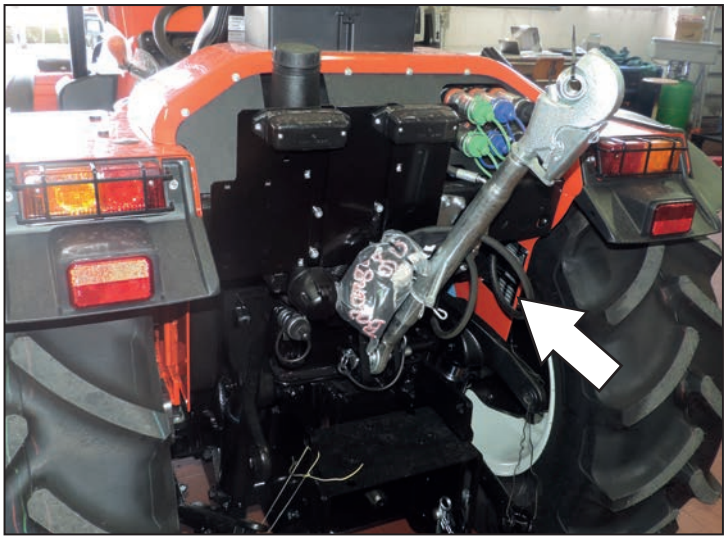


Fig. 1.2

The chassis number is stamped on the chassis itself.

1 - Manufacturer's initials and trade-mark
2 - Production series
3 - Machine type
4 - Chassis number (serial number)

Note

Refer to the workshop manuals provided by the relative manufacturers for the engine identification data.



Fig. 1.3

Section 2 : Safety notes

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2.1 Essential rules for accident prevention

The structures, systems and equipment in repair shops must conform to the current laws governing labour safety in order to safeguard the health and safety of each worker.

Although they are obviously only partial, the regulations given in this section inform the workers about the dangers they may encounter on the job.

Always bear your safety and that of others in mind whenever you work on a machine, whichever type it may be.

To work in complete safety, it is essential to know the nature of the job, to correctly use the tools and materials required and to reply on your common sense. Read the safety messages in the introductory part of this manual and pay attention to the "**Caution**", "**Warning**" and "**Danger**" notes when they appear in the text.

	This symbol means: **NOTE!** This symbol highlights particular methods or procedures required in order to correctly service the tractor.
	This symbol means: **CAUTION** This symbol highlights operations that must be performed with particular care since they could cause the tractor or its components to be damaged.
	This symbol means: **WARNING!** This symbol highlights a safety instruction. Read it carefully. Also make sure that you have perfectly understood the causes of potentially dangerous or lethal accidents.
	This symbol means: **DANGER!** This symbol highlights a situation that is dangerous for yourself and for others. Read it carefully. Also make sure that you have perfectly understood the causes of potentially dangerous or lethal accidents.

2.1.1 Rules of a general character

2.1.1.1 Preliminary instructions

- always comply with the instructions received from superiors;
- always comply with the indications on the stickers and signs;
- never use machines or systems without authorization and never carry out operations and maneuvers that are the competence of others;
- use the safety devices and other means of protection with care;
- inform your superiors if the safety and protective means and devices are defective or about any danger conditions of which you may have become aware;
- never remove or modify the safety devices and other means of protection without having been authorized to do so;
- let your superiors know immediately about any accidents you have had or about which you may have become aware;
- keep your place of work clean and orderly. Keep the floor clear of any materials that are not strictly required for the job in hand and prevent greasy or oily substances from being spilt (clean them up with absorbent material if this should occur).

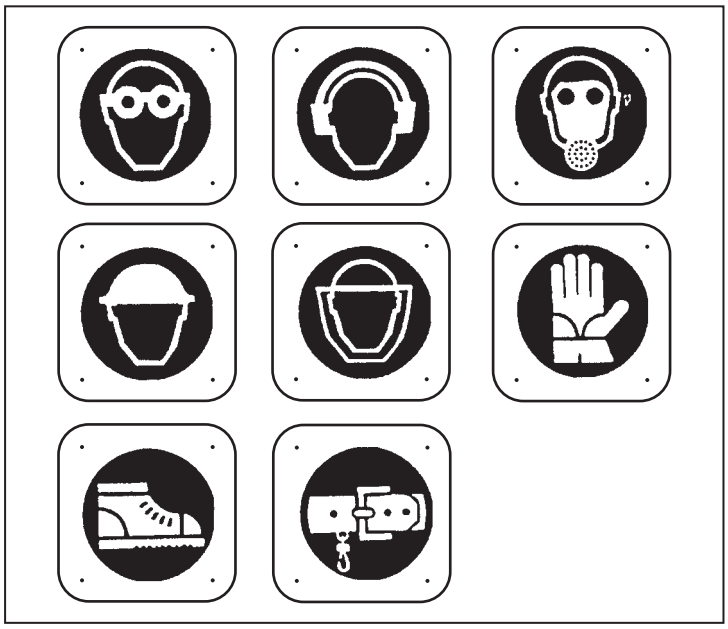


Fig. 1.4

2.1.1.2 Work clothes

- Do not wear loose clothing that could become caught up in moving parts or garments that are not tight at the cuffs;
- do not wear necklaces, rings, bracelets and similar;
- do not clean the garments with inflammable or harmful substances, or using compressed air;
- do not wear sandals, slippers, clogs or shoes with high heels.
- always wear protective clothing (goggles - visors - gloves - footwear, etc.).

2.1.1.3 Machines and systems

- Before beginning work, make sure that the guards and screens are in place, in a good condition and that the safety devices are functional;
- check the operation of any exhaust or ventilating systems installed;
- never remove the guards or safety devices from the machine unless this is strictly necessary and only after having been authorized to do so by your superiors, who will also indicate the precautions that must be taken;
- the protections and safety devices must be fitted back in place and re-activated as soon as the reasons for their having been temporarily removed have ceased;
- it is forbidden to clean, oil or grease moving parts of machines and systems by hand;
- it is forbidden to carry out any work or adjustment on moving parts.

2.1.1.4 Lifting and carrying

By hand

- do not bend your back to lift loads;
- hold the load safely where it is easy to get a good grip;
- do not carry loads with greasy or oily hands;
- hand trucks without drawbars should be pushed, not pulled;
- never deposit loads near stairs, fire-fighting systems, first-aid means or places of transit.

On vehicles

- comply with the capacity limits and regulate your speed according to the road conditions, the load and the braking distance;
- make sure that the loads are well harnessed and fastened;
- avoid passing with hanging loads in places where dropping could cause a danger hazard. If this is inevitable, indicate when the maneuver is made or have all bystanders move out of the area.

2.1.1.5 Internal circulation

People

- use the correct and authorized routes (pedestrian crossings, gangways and similar);
- do not run;
- do not walk or stand under hanging loads or in places where loads could drop;
- do not ride on means of transport or lifting equipment designed for handling materials alone.

Vehicles

proceed at a moderate speed and with due care, depending on the road conditions. Comply with the farm/company rules and with the road signs.

2.1.1.6 Electricity

- Do not make electrical connections with makeshift means and never ever insert the ends of wet conductors into sockets;
- disconnect plugs from sockets by holding the outer casing, never by pulling the electric cable;
- avoid twisting the cables;
- frequently check the insulating material of conductors and electrical equipment and make sure that it is in a good condition;
- point out any damage to electrical equipment and systems, with particular reference to the condition of the ground conductors;
- do not open cabinets or containers housing equipment or carry out work inside unless you are trained and authorized to do so;
- watch out for overhead electricity lines when approaching or working in their vicinity.

2.1.1.7 Fire outbreaks

In departments or processes where there may be a danger of fire outbreaks owing to the presence or use of inflammable substances:

- it is forbidden to smoke;
- it is forbidden to use equipment with open flames and to handle glowing materials;
- do not place inflammable materials near heat sources;
- do not store materials in front of extinguishers or fire hydrants.

2.1.1.8 Dangerous substances and preparations

Take the following precautions when using dangerous chemical products (fire, explosion, irritation, caustic burning, scalding, intoxication):

- only keep receptacles containing dangerous products open for the time strictly required for their use;
- do not use or transfer dangerous products into containers that are not designed for this use, or into those without indications as to their contents or without the relative marking;
- comply with the indications on the relative labels when using chemical products.

2.1.1.9 Defence against gas, fumes, dust, harmful vapours

- make sure that the exhaust systems are operating correctly;
- use protective clothing and equipment;
- install temporary exhausts as near as possible to the sources;
- do not work in the direction of the flow of polluting substances blown out by exhaust systems.

2.1.1.10 Agents of a biological nature

- in the event of fermentation (development of algae), avoid direct contact and act with appropriate protective means;
- only enter places where anaerobic fermentation may have taken place and produced fumes (e.g. ammoniacal) after having work a protective mask.

2.1.1.11 Guide to choosing the right extinguisher

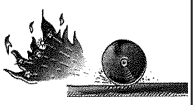
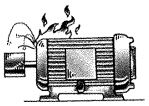
Agente estinguente					
Classe di fuoco	Acqua	Polvere	CO^2	Schiuma	Polveri speciali
 combustibili solidi ordinari	✓	✓	✓ Solo per incendi di piccole dimensioni	✓	✗
 liquidi infiammabili	✗ Tranne che utilizzando attrezzature adatte	✓	✓	✓	✗
 gas infiammabili	✗	✓	✓	✗	✗
 metalli combustibili	✗ Possono reagire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

Fig. 1.5

2.1.2 Tools

Makeshift, inadequate or defective tools may cause faults or accidents. Never use the wrong tools since such action could cause injuries and spoil the finished job.

Always use the special tools recommended by the manufacturer when disassembling, overhauling and re-assembling the various parts of a tractor.

Use of specific tools will reduce the effort and time required for the job and, consequently, the cost. You will also be certain that the work has been correctly done.

Never use:

- A hammer with a loose head or cracked handle.
- Pincers or pieces of iron instead of a hammer;
- Drill bits or bolts instead of pin drivers;
- Worn or welded wrenches;
- A steel hammer to tap bearings or stress-relieved components (use one made of bronze or brass).

The engine and gearbox and the front and rear transmissions must be split for certain jobs on the tractor components. This operation is facilitated and made safer by use of the special divider kit.

When lifting weights, make sure that the chains, lifting brackets, hooks, cables or ropes comply with EC standards. Unless different indications are given, an adjustable bracket must be used when particularly heavy parts are removed.

All chains and cables must be parallel to each other and as near to the vertical as possible, depending on the component being lifted.

2.1.3 First Aid

Mechanics are exposed to various risks at work.

If anyone should be injured, use sterile materials and disinfectants for first aid purposes. These materials should be kept in the first-aid box, equipped in compliance with the laws in force.

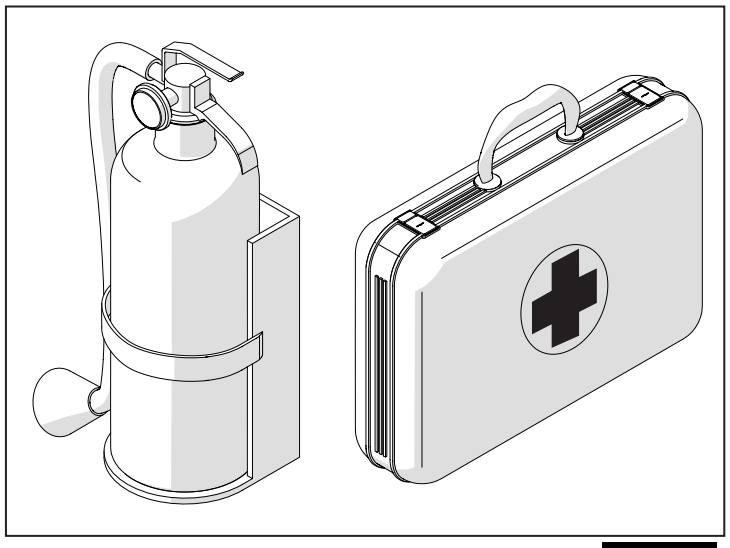


Fig. 1.6

2.1.4 Tractor safety regulations

Caution

Before you get on to the tractor, it is essential for you to have read and strictly complied with the instructions in the operation and maintenance manual.

2.1.4.1 Ignition

- Do not allow the engine to run in a closed room without adequate ventilation systems able to dispose of the exhaust gas.
- Never put your head, body, limbs, feet, hands or fingers near spinning fans or belts.

2.1.4.2 Engine

- Before removing the radiator plug completely, turn it very slowly to relieve the pressure in the circuit.

  Coolant fluid must only be topped up with the engine at a standstill or idling, if hot.
- Do not refuel whilst the engine is running, particularly if it is hot. This could lead to the risk of a fire outbreak if fuel were to be spilt.
- Do not attempt to check or adjust the tension of the fan belts with the engine running. Do not regulate the fuel injection pump whilst the machine is on the move.
- Never lubricate the machine when the engine is running.

2.1.4.3 Electrical system

- If auxiliary batteries must be used, remember that the cables must be connected in the prescribed way at both ends: (+) with (+) and (-) with (-). Do not short-circuit the terminals.

Danger

The gas issued by batteries is highly inflammable.

Always leave the battery compartment uncovered when recharging, to ensure a more efficient ventilation. Never ever check the battery charge using the "jumpers" obtained by placing metal objects on the terminals. Prevent sparks or flames in the battery area. Do not smoke as this could cause explosions.

- Before proceeding with any work, make sure that there are no fuel leaks: repair these leaks before proceeding.
- Do not recharge batteries in closed places: make sure that there is adequate ventilation to prevent accidental explosions from occurring due to an accumulation of the gas issued when recharging.
- Always disconnect the batteries before working on the electrical system.
- If the battery acid freezes, the battery may explode if you attempt to charge it or to start the engine by pushing and allowing it to run. Always keep the battery well charged to prevent the battery acid from freezing.
- Batteries contain acid and explosive gases. Sparks, flames or incorrect cable connections can cause the gases to explode.

2.1.4.4 Hydraulic circuit

- Fluid leaking from a very small hole can be almost invisible yet have sufficient force to penetrate under the skin. Use a piece of cardboard or wood if you must check for such leaks. **Never check for leaks with the hands**: immediately seek medical help if fluid penetrates under the skin. Serious infections or dermatitis may occur if you fail to receive prompt medical treatment.
- Use the right tools to check the pressure in the circuits.

2.1.4.5 Hitching and unhitching

- Lift and handle all heavy parts with lifting equipment of an adequate capacity. Make sure that the parts are supported by appropriate harness and hooks. Use the lifting eyelets provided. Take care of bystanders near the load being lifted.
- Handle all parts with the utmost care. Do not put your hands or fingers between one part and the next. Wear approved safety garments such as goggles, gloves and safety footwear.
- Do not twist metal ropes or chains. Always wear safety gloves when handling cables or chains.

2.2 Safe use of the tractor

Only qualified and authorized operators are able to use farming tractors in safety. To be qualified you also need to be familiar with the instructions in the operation and maintenance manual and to strictly comply with these indications.

Moreover, operators need to know the labour safety regulations. For example, some regulations specify that no one under the age of 18 years may use a tractor.

You are responsible for knowing these regulations and for complying with them at work. They also include the following instructions for safe use of the tractor.

WARNING

The operator must never use alcohol or drugs that can affect his attention or the co-ordination of his movements.

Observe the following precautions

- Do not allow children or unauthorized persons to drive your tractor.
- Fasten your seat belt if the tractor is fitted with a safety frame.
- Whenever possible, do not use the tractor near ditches or embankments.
- Reduce speed when turning the tractor, crossing slopes and on rough, slippery or muddy surfaces.
- Keep clear of slopes too steep for safe operation.
- Watch where you are going - especially at row ends and around trees.
- Never let anyone else get on to the tractor or the implement.
- Operate the tractor smoothly, with no sudden movements: do not turn, start or stop abruptly.
- Hitch only to the drawbar and recommended hitch points. Never hitch above the central line of the rear axle.
- Apply the parking brake whenever the tractor is stopped.
- Never alter or remove any part of the equipment.
- Keep others well clear of your work area.
- Never use attachments that are not designed for your tractor.

2.2.1 Safety frame

The tractor is equipped with a safety frame and seat belts. If the safety frame has been removed, you must equip the tractor with a new safety frame and seat belts. The safety frame reduces the risk of injury should the tractor tip over. Tipping over without a safety structure can cause damage and serious injury.

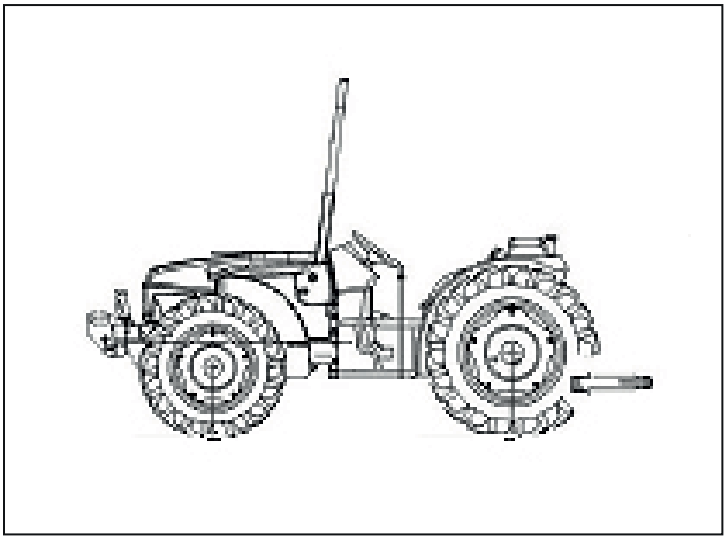


Fig. 1.7

User

- Before using the tractor, ensure that the safety frame has not been damaged and that it is securely fastened to the tractor.

- Do not attach chains, cables, etc., to the safety frame of cab for towing purposes as this could cause the tractor to tip up: always use the drawbar for this purpose.

- Always fasten your seat belt. Do not fasten your seat belt if the tractor is not fitted with a safety frame or cab.

- Check the safety belts for damage. Damaged belts must be replaced.

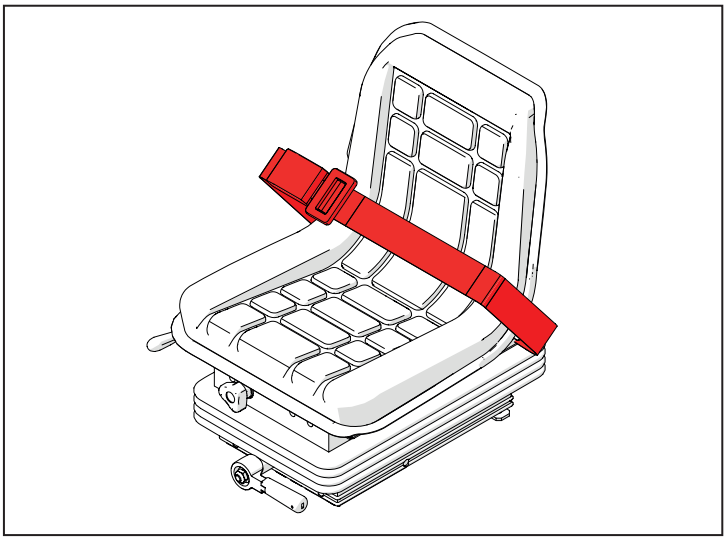


Fig. 1.8

Damaged safety frames

If the tractor has tipped over and the safety frame has been damaged (e.g. in the case of a crash against a bridge), it must be replaced in order to ensure the original degree of protection.

After an accident, check the safety frame, the driving seat, the seat belts and the anchor points of the seat belts. Replace all damaged parts before using the tractor again.

Do not weld, drill, bend or straighten the safety frame or cab: to do so reduces the degree of protection that is ensured by the original equipment.

Safety precautions

- Protect yourself

- Wear all protective clothing and any personal protection devices called for by the work conditions.

- Never take any risks.

Use the following protective garments (Fig. 1.9):

- A hard hat;

- Safety goggles or mask;

- Hearing protection;

- Respirator or filter mask;

- Clothing for bad weather;

- Reflective clothing;

- Heavy-duty gloves (neoprene for chemicals, leather for rough work).

- Safety footwear.

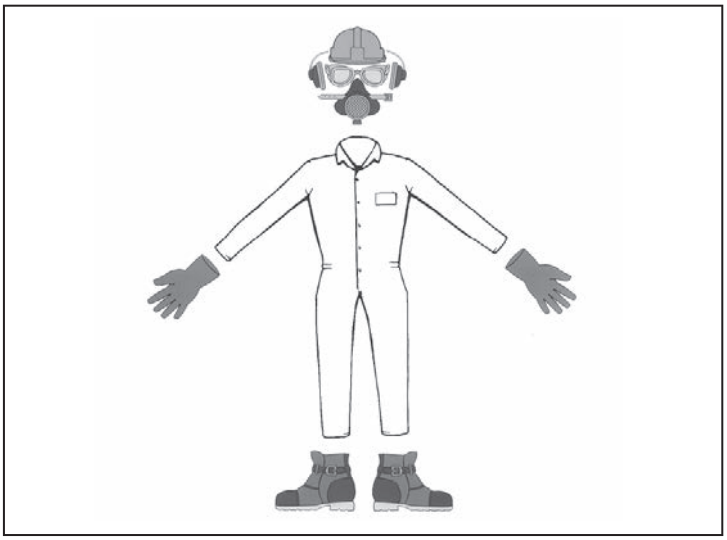


Fig. 1.9

2.2.2 Safety - cab

- The safety cab has been specially designed for assembly on these tractors and complies with all the safety requirements and noise limits established by the current laws.
- The safety cab conforms to international safety standards. The cab must never be drilled or modified in order to install accessories or implements.
- It is forbidden to weld damaged cab components.
- Never attach chains or cables to the main framework of the cab for towing purposes.

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3.1 Spare parts

When replacing parts, ask for and use strictly original spare parts.

The use of non-original spare parts voids your Warranty rights.

Give the following information when ordering spare parts:

- Tractor model and commercial name;

- Chassis number;

- Order code of required spare part (see the Spare Parts Catalogue).

3.2 Specific implements

The implements listed and illustrated in this book are specifically studied by the manufacturer to ensure prompt, rational and accurate work.

Moreover, they allow you to obtain the best results with the minimum effort, thus avoiding operations that could impair the result of your work.

Note
The wear limits indicated are purely guidelines but no way binding. The indications "front","rear", "right-hand" and "left-had" refer to the operator facing the normal tractor driving direction, with respect to the seat.

3.3 Oil seal for rotating shaft

Comply with the following instructions to fit the oil seal correctly:

- Thoroughly clean the shaft and make sure that its work surface is not damaged;
- Point the sealing lip toward the fluid. If it is of the hydro-dynamic type, the grooves, with respect to the shaft rotation direction, must be positioned so that they tend to return the fluid toward the inside of the sealing device;
- Spread a film of lubricant on the sealing lip (prefer oil to grease) and fill the compartment between the sealing lip and the dust-guard lip of the double-lip gaskets with grease;
- Fit the oil seal into its seat, using a punch with flat contact surface; never use a hammer directly;
- When seating the oil seal, make sure that it is inserted perpendicular to the housing and, after it has been seated, make sure that it touches the support (when required);
- To prevent the oil seal lip of the gasket from being damaged by the shaft, insert an adequate protection while installing the two parts.

3.4 Adjuster shims

Whenever adjusting, select the adjustment shims by measuring them one at a time with a micrometer and then add the measured values together.

Note
Do not rely on the measurement of the pack as a whole or on the nominal value indicated for each ring, as this could be incorrect.

3.5 “O-RING” seals

Lubricate the O-RING seals before fitting them into their seats to prevent them, during installation, from rolling on themselves and being incorrectly positioned, since this would compromise their sealing ability.

3.6 Sealants required

Different types of adhesives must be used for the various assembling operations, depending on their specific characteristics.

Sealer

Use LOCTITE 518 when a hermetic seal is required between two or more parts.

Use:

- Use a metal brish to remove any incrustations from both the surfaces to be coupled;
- Thoroughly degrease the surfaces using one of the following detergents: trichloroethylene, wash oil, acetone or warm water and soda.
- Spread the product uniformly on just one of the contact surfaces and then assemble.

Threadlockers

Use LOCTITE 243 or LOCTITE 270 to prevent a screw or nut from working loose.

Use:

- Clean as described above;
- Apply one or two drops of the product to the screw thread or in the hole;
- Insert the screw or nut and tighten.

3.7 Spring pins

When mounting split tube spring pins, make sure that their notches point in the direction of the force exercised on the pin itself.

Spiral flexible pins do not need to be positioned in any particular direction when being fitted.

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4.1 Engine

Engine type	VM D754 TE3
Rated power	59.8 kW / 81.3 HP - 2600 rpm
Cylinders	4
Cooling system	Liquid coolant
Swept volume	2970 cc
Torque reserve	19.8%
Fuel tank	60 litres

4.2 Transmission

Number of speeds	40
	8+8 with synchronized reverse shuttle
	16+8 with synchronized Dual Power (-20%)
Clutch	11" diameter dry single-plate
Reverse shuttle	Synchronized
Rear differential lock	Electrohydraulic
Front differential lock	No-spin
Speed	40 km/h

4.3 Brakes and steering system

Type of brakes	With IST and oil-cooled multiple-plates
Parking and emergency brake lever	Acts on the rear brake assembly. Mechanical control completely independent from main brakes
Type of steering system	Hydrostatic with load sensing valve
Steering angle	55°

4.4 Rear Power Take-Off

Rotation	Clockwise
Profile	1-3/8" with 6 splines
Speed	540/540E (750 rpm)
	540 / 1000 rpm.
Type	Independent - Synchronized
Operating mechanism	Mechanical

4.5 Front power take-off

Rotation	Anti-clockwise
Profile	1-3/8" with 6 splines
Speed	1000 rpm
Type	Independent
Clutch	Electromagnetic
Operating mechanism	Electrical

4.6 Rear hitch

Type	With position and draft control
Lifting capacity	2400 kg
3-point hitch	Class 1 and 2

4.7 Front hitch

Type	Up-down with floating mode
Lifting capacity	1200 kg
3-point hitch	Class 1 and 1N

4.8 Hydraulic circuit

Pump capacity	45 l/min
Number of rear hydraulic control valves	Up to 3
Type of rear hydraulic control valves	Double-acting with fourth floating position and lever connection
Number of front hydraulic control valves	Up to 3

4.9 Driver's position

Platform	Integral platform on silent-blocks
Safety frame	Folding roll bar or cab
Instruments	Multifunction digital instrument
Seat	Adjustable in the horizontal and vertical directions and installed on type-approved elastic suspensions.
Tow hook	CUNA type - Class C
	CUNA type - Class D2
	Class EEC
	Type BT02 EEC Class drawbar

4.10 Weights and dimensions

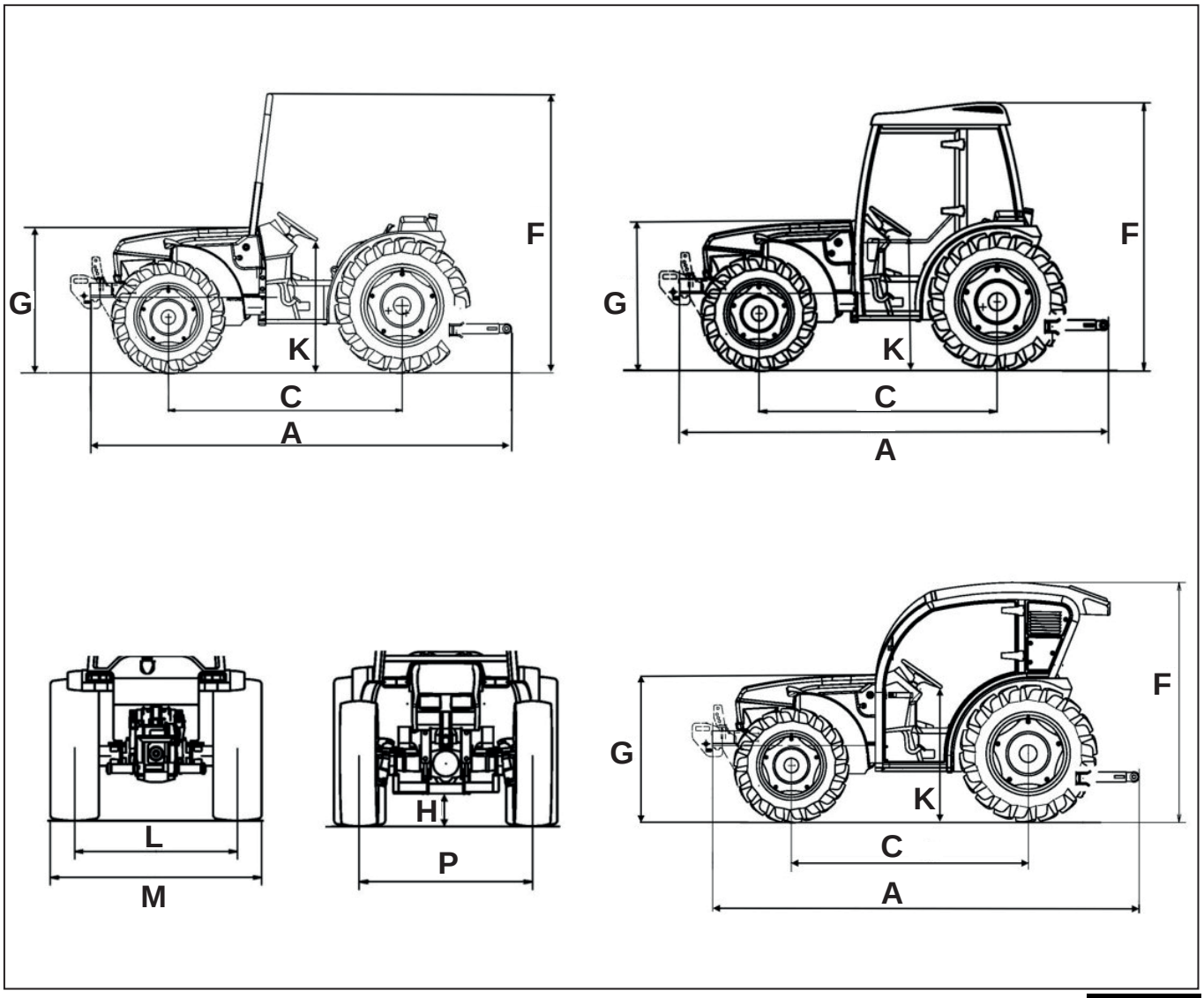


Fig. 1.10

The data are calculated with 320/70-R24" rear and 280/70-R20" front wheels

Reference	Description	Low version	High version
A	Maximum length	3026 mm	3056 mm
M	Minimum width	1398 mm	1408 mm
	Maximum width	1774 mm	1784 mm
F	Chassis height	2217 mm	2278
	Height of GL cab version	2140 mm	2200 mm
	Height of SG1 320/70-R20" cab version	1800 mm	1860 mm
K	Seat height	855-1,150 mm	915-1220 mm
G	Bonnet height	1165 mm	1215 mm
H	Ground clearance	275 mm	349 mm
C	Wheelbase	1871	1921
P	Minimum front wheel track	1122	1132
	Maximum front wheel track	1498	1508
L	Minimum rear wheel track	1048	1424
	Maximum rear wheel track	1048	1424
	Minimum turning radius with brakes	2.9 m	2.95 m
	Weight with safety frame	2230 kg	2230 kg

4.10.1 Maximum load per axle

Low version

	Tyres	Load capacity	Maximum load on front axle	Total weight
Rear	320/70-R20"	1170 kg	2340 kg	3600 kg
Front	250/80-16"	910 kg	1800 kg	
Rear	340/65-R20"	1180 kg	2430 kg	3600 kg
Front	260/70-R16”	1030 kg	1800 kg	
Rear	340/65-R20"	1180 kg	2430 kg	3600 kg
Front	280/70-R16"	1120 kg	1800 kg	
Rear	340/65-R20"	1180 kg	2430 kg	3600 kg
Front	300/65-R16"	1180 kg	1800 kg	
Rear	360/70-R20"	1400 kg	2500 kg	3600 kg
Front	280/70-R18"	1180 kg	1800 kg	
Rear	420/65-R20"	1360 kg	2500 kg	3600 kg
Front	300/65-R18"	1250 kg	1800 kg	
Rear	420/65-R20"	1360 kg	2500 kg	3600 kg
Front	320/65-R18"	1030 kg	1800 kg	
Rear	320/70-R24"	1250 kg	2500 kg	3600 kg
Front	280/70-R20"	1250 kg	1800 kg	

High version

	Tyres	Load capacity	Maximum load on front axle	Total weight
Rear	340/65-R20"	1215 kg	2430 kg	3600 kg
Front	260/70-R16”	1180 kg	1800 kg	
Rear	340/65-R20"	1215 kg	2430 kg	3600 kg
Front	280/70-R16"	1030 kg	1800 kg	
Rear	340/65-R20"	1215 kg	2430 kg	3600 kg
Front	300/65-R16"	1120 kg	1800 kg	
Rear	360/70-R20"	1400 kg	2500 kg	3600 kg
Front	280/70-R18"	1180 kg	1800 kg	
Rear	420/65-R20"	1360 kg	2500 kg	3600 kg
Front	300/65-R18"	1250 kg	1800 kg	
Rear	420/65-R20"	1360 kg	2500 kg	3600 kg
Front	320/65-R18"	1030 kg	1800 kg	
Rear	320/70-R24"	1250 kg	2500 kg	3600 kg
Front	280/70-R20"	1250 kg	1800 kg	

4.11 Lubricants

Original lubricants

Arbor Alfatech Synt 10W-40 oil	
Viscosity at 100°C	14 mm2/s
Viscosity index	158
Flash point V.A.	200° C
Pour point	-33° C
Density 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 index	135
Flash point V.A.	220° C
Pour point	-36° C
Density 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 index	104
Flash point V.A.	220° C
Pour point	-27° C
Density 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 index	160
Flash point V.A.	200° C
Pour point	-40° C
Density at 15°C	0.870 kg/l
Colour	Red

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

Original protective fluids

PARAFLU 11 antifreeze fluid	
Density at 15° C	1.135 g/cm3
pH	7.7 dil. 50%
Alkaline reserve	16 ml HCl 0.1 N
Boiling point	-38° C dil. 50%
Foam at 88°C	50 cc

4.12 Speed

The speed data were obtained with engine at 2600 rpm and 320/70-R24" wheels (values are indicative).

Forward - Slow

Gear	Dual Power mode (16-8 speeds)		Reverse shuttle mode (8+8 speeds)
	Regular speeds	20% Dual Power reduction	
1st	1.70 km/h	1.28 km/h	1.70 km/h
2nd	2.80 km/h	2.10 km/h	2.80 km/h
3rd	4.83 km/h	3.62 km/h	4.83 km/h
4th	6.99 km/h	5.24 km/h	6.99 km/h

Forward-Fast

Gear	Dual Power mode (16-8 speeds)		Reverse shuttle mode (8+8 speeds)
	Regular speeds	20% Dual Power reduction	
1st	9.70 km/h	7.28 km/h	9.70 km/h
2nd	15.98 km/h	11.98 km/h	15.98 km/h
3rd	27.58 km/h	20.68 km/h	27.58 km/h
4th	39.90 km/h	29.92 km/h	39.90 km/h

Reverse-Slow

Gear	Dual Power mode (16-8 speeds)		Reverse shuttle mode (8+8 speeds)
	Regular speeds	20% Dual Power reduction	
1st	4.06 km/h	3.05 km/h	1.45 km/h
2nd	6.69 km/h	5.02 km/h	2.38 km/h
3rd	11.54 km/h	8.66 km/h	4.11 km/h
4th	16.70 km/h	12.53 km/h	5.94 km/h

Reverse-Fast

Gear	Dual Power mode (16-8 speeds)		Reverse shuttle mode (8+8 speeds)
	Regular speeds	20% Dual Power reduction	
1st	-	-	8.25 km/h
2nd	-	-	13.58 km/h
3rd	-	-	23.44 km/h
4th	-	-	33.91 km/h

4.13 Conversion tables

1 mm	= 99.97 cm
1 cm	= 9.91 mm
1 mm	= 0.991 mm
1 km	= 0.62 ml
1 km/h	= 0.2 mph
1 l	= 0.21 UK gal
1 l	= 0.26 US lqd gal
1 kg	= 2.20 lb
1 cv	= 735.49 W
1 cv	= 0.98 hp
1 kw	= 1.35 hp
1 bar	= 14.50 psi
1 bar	= 100 kPa
1 psi	= 6.89 kPa

Section 5 : Tightening torques and sealants

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5.1 Nut tightening torques

Type	Nm	kgm
M 8x8	30	3
M 10x10	50	5
M 10x10 self-locking	50	5
M 12x1.25x12 (for fixing gearshift 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 (for fixing hydraulic pump gear)	50	5
M 12x1.25x8	90	9
M 14x14	120	12
M 16x1.5x8 (for fixing gearshift 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

5.2 Ring nut tightening torques

Type	Nm	kgm
M 20x1.5	35	3.5
M 20x1x9	80	8
M 25x1.5 (P.T.O.)	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

5.3 Hex screw tightening torques

Type	Nm	kgm
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 support for track leaf spring)	180	18
M 18 x 1.5	250	25
M 16	130	13
M 16 x 1.5	130	13

5.4 Stud bolt tightening torques

Type	Nm	kgm
M 10	30	3
M 12	40	4
M 14	50	5
M 16	60	6
M 18	70	7
M 20	80	8

5.5 Conical plug tightening torques

Type	Nm	kgm
1/2"	30	3

5.6 Type of Loctite sealant

	Denomination	Type	Use
Threadlocker	Low-strength threadlocker	Loctite 222	Low-strength locking and sealing of screws, adjuster screws
	Medium-strength threadlocker	Loctite 243 (formerly 242)	Medium-strength locking and sealing of threaded parts in general.
	Strong threadlocker	Loctite 271 (formerly 270)	Highly resistant fixing, locking and sealing of stud bolts, nuts, screws.
	Penetrating threadlocker	Loctite 290	Locks and seals already mounted parts by capillary action. Microporosity sealing.
Assembly of parts	Retaining compound	Loctite 603 (formerly 601)	Highly resistant fixing of coupling surfaces.
	Controlled strength retaining compound	Loctite 641	Medium-strength fixing of bushes, bearings, etc. . Disassembly possible using normal tools.
	Maximum strength retaining compound	Loctite 638	Rapid fixing of highly heat-resistant cylindrical parts. Dynamic loads.
	High-temperature retaining adhesive	Loctite 648	Rapid fixing of highly heat-resistant cylindrical parts.
Thread sealant	Hydraulic and pneumatic connectors	Loctite 542	Sealing of threaded unions on hydraulic or pneumatic pipes up to ¾" in diameter
	Slow cure thread sealant	Loctite 572	Sealing of threaded unions in general.
Liquid seals	Flange sealant	Loctite 510	Sealing of flat surfaces. Manual application.
	Flange sealant	Loctite 573	Sealing of close-fitting joints. Applied by hand or by screen-print systems.
Parts cleaner	Cleaner and degreaser	Loctite 7063	Prepares components for application of an adhesive or sealant.
	Gasket remover	Loctite 7200	Removes all traces of sealant and gasket material.

Section 6 : General assembly instructions

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6.1 Gasket seals (oil retainers)

6.1.1 General rules

One single gasket is generally sufficient to ensure tightness. The seal lip must point towards the fluid it must retain or from the side on which a pressure is exercised.

Prevent mechanical parts from coming into contact with the seal lip since, besides impairing the actual sealing action, it would also considerably shorten the life of the seal.

Thoroughly lubricate the retention ring with grease before assembly to prevent it from operating dry as the shaft turns the first few times.

Retention rings with scoring must not be lubricated with grease but with oil, as grease would fill the grooves and annul the lubricating effect.

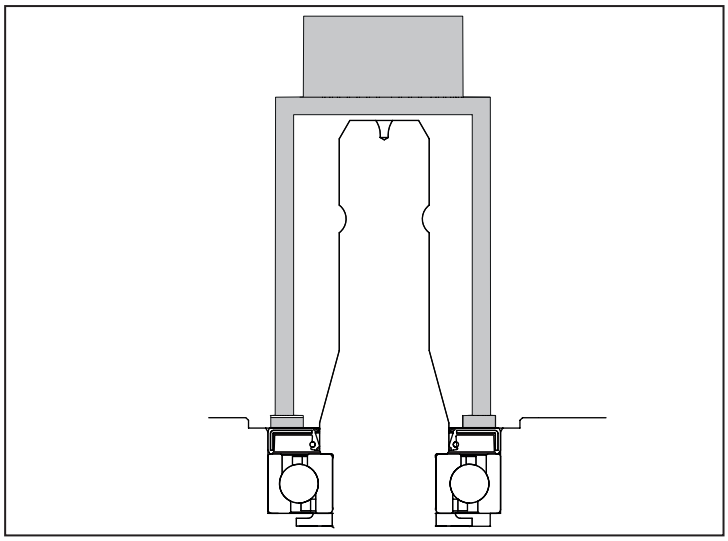


Fig. 1.11

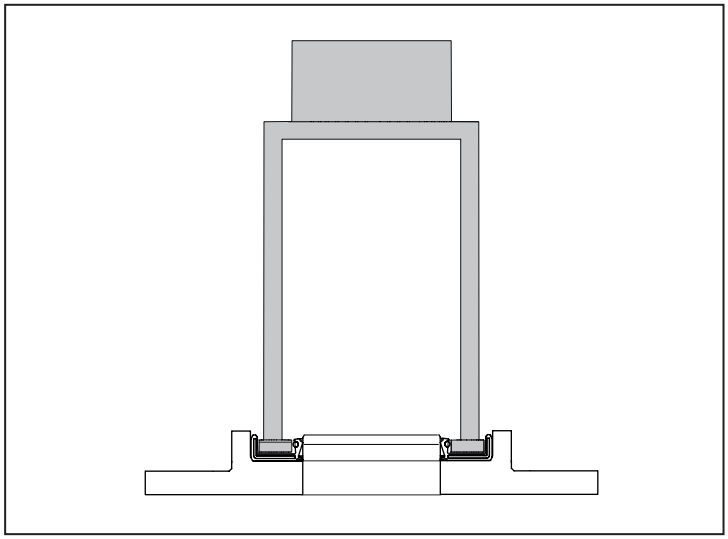


Fig. 1.12

6.1.2 Assembly

1 - The shaft must have a chamfer to facilitate seal assembly.

2 - Protect the seal edge from damage due to threads, rakes, sharp edges, slots for splines, etc. These parts of the shaft should be adequately covered at the time the seal is assembled.

3 - It is advisable to fit the seal in its housing with the aid of a mechanical hydraulic press.

4 - The force required to insert the seal must be exercised as near as possible to the outer diameter of the seal itself. Particularly make sure that the seal is perpendicular to the hole axis.

5 - It is inadvisable to glue the seal to the housing as, even though precautions are taken, the seal lip could be covered with glue and this would lead to deterioration and leaking fluid right from the very first shaft turns.

6.1.3 Replacement

If an assembly is overhauled, it is always advisable to replace the retention rings on rotating shafts and the other seals in general.

Make sure that the sealing edge of the new ring does not act on the same sliding track as the previous ring.

6.2 O-ring seals

6.2.1 Assembly

1 - O-Ring seals must not be forced over sharp edges, threaded parts or grooves. When this cannot be avoided, it is advisable to use a conical assembly sleeve or some other similar device.

2 - Before it is assembled, make sure that the O-Ring seal corresponds to the required type. Clean the O-Ring seal housing with the utmost care. Impurities can damage both the seals and the sliding surfaces.

3 - To facilitate assembly and provide the necessary lubrication right from the start, it is advisable to immerse the seal in the oil it must keep out or to apply a light film of lubricating grease compatible with the material with which the seal is made.

4 - Fit the O-Ring into its housing, taking care not to twist it.

5 - Take great care when assembling the components to prevent the seal from being damaged.

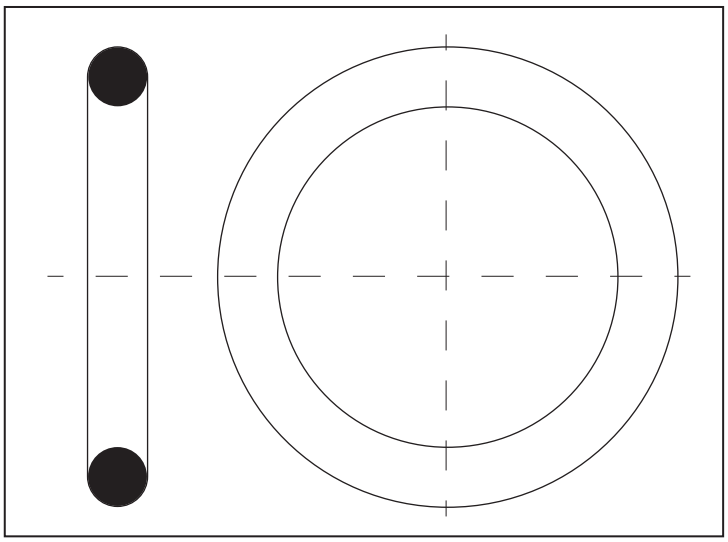


Fig. 1.13

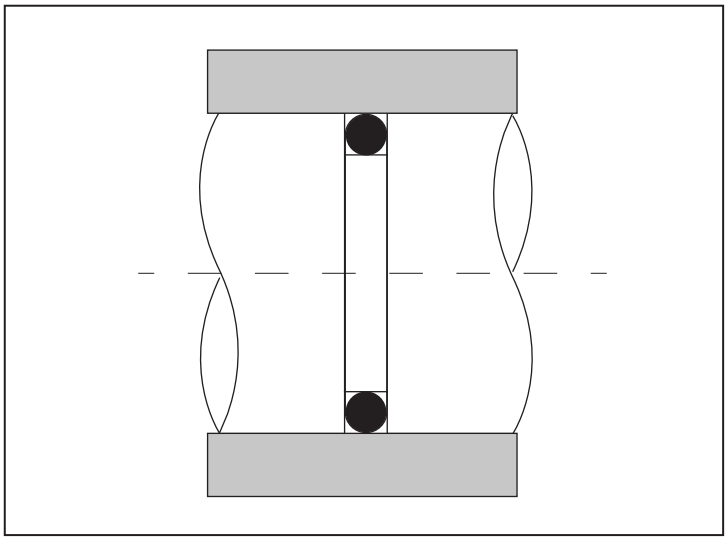


Fig. 1.14

6.3 Bearings

6.3.1 Introduction

Experience and cleanliness when assembling bearings are essential if good performance is to be ensured and to premature yielding prevented. Bearings should be assembled in a dust-free, dry place far from machine tools that produce swarf or machines that create dust.

6.3.2 How to prepare for assembly

1 - Before bearings are assembled, all the necessary parts, tools and equipment must be ready to hand in the order in which the various components must be assembled, as established by the instructions or drawings in question.

2 - All components affected in bearing application (housings, shafts, etc.) must be thoroughly cleaned and freed from residues due to machining. The rough inner surfaces of cast iron housings must be free from foundry sand. All the bearing components must be checked for size and defects. Bearings will only operate perfectly when the prescribed tolerances are complied with.

3 - The bearings must only be removed from their original packaging when they are about to be assembled, this to prevent foreign bodies from entering.

4 - It is usually necessary to remove the rust-inhibitor applied to the external cylindrical surface and hole of new bearings before they leave the factory.

If the bearings must be lubricated with grease and used at a very high or low temperature, they must be washed and dried to prevent harmful effects on the lubricating properties of the grease used for these extreme temperature conditions.

5 - Bearings that have been contaminated through negligent handling (damaged packaging, etc.) must be washed and dried before assembly. Bearings which, when removed from their original packaging, are covered by a relatively thick and greasy layer of rust-inhibitor must also be washed and dried, since they will have been hot-dipped (hot-dipping is still done, particularly when the bearings are very large).

Bearings that are supplied already lubricated and equipped with watertight or protective shields on both sides must NEVER be washed before they are assembled.

6.3.3 Assembly

1 - It is very important to avoid impact on the rings, cages and rolling elements during assembly as they could be damaged. In no case must pressure be applied to a ring in order to indirectly assemble another. Before the bearings are assembled, the surfaces of their housings must be slightly oiled.

Never strike the rings, cages or rolling elements directly as they could be damaged. Never ever apply pressure to one ring in order to indirectly assemble another. Before the bearings are assembled, the surfaces of their housings must be slightly oiled.

2 - By and large, the first ring to be assembled is the one that creates the greater interference. Small bearings, which must be coupled with a slight interference, can be fitted into their housings by slightly tapping with a mallet and soft metal punch or, preferably, a piece of pipe positioned adjacent to the ring face. These blows must act successively on the entire face to prevent the ring from settling off centre in relation to the housing. The cup tool illustrated in Fig. 1.15 allows a well-centred centrifugal force to be applied, thus one that acts evenly on the entire face of the ring. Mechanical or hydraulic presses are generally used for mass production assembly.

3 - When a non-modular bearing must be assembled on the shaft and housing at the same time, it is advisable to insert a disc between the actual bearing and the tubular fixture (Fig.) so as to divide the assembly force evenly over the faces of the two rings. This method is particularly recommended in the case of positionable bearings to prevent the relative outer ring from settling off-centre in relation to the housing. Alternatively, a special cap can be used with two bearing surfaces, one for the inner ring and the other one for the outer ring (Fig.): these surfaces must be coplanar.

4 - The inner and outer rings of modular bearings can be assembled separately. This facilitates assembly to a considerable extent especially if forced couplings are required for both rings. The moment the two parts of the bearing, already assembled in their respective housings, must be re-coupled, take care to prevent the axes of two rings and the row of balls from slanting, otherwise the tracks could be damaged.

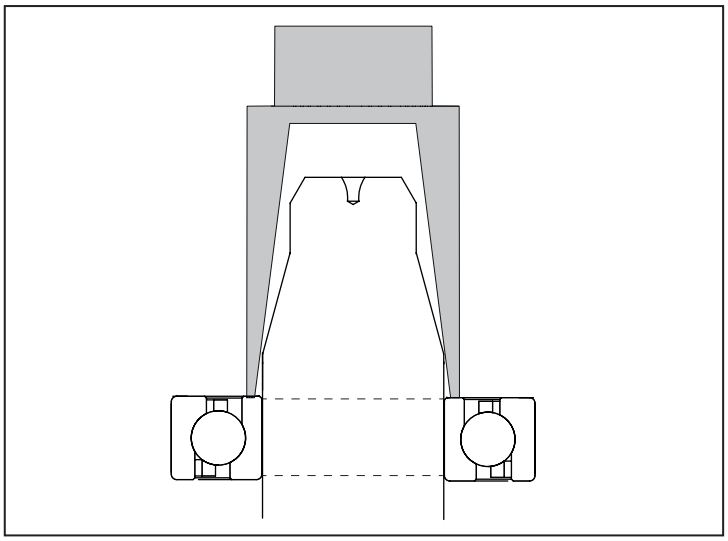


Fig. 1.15

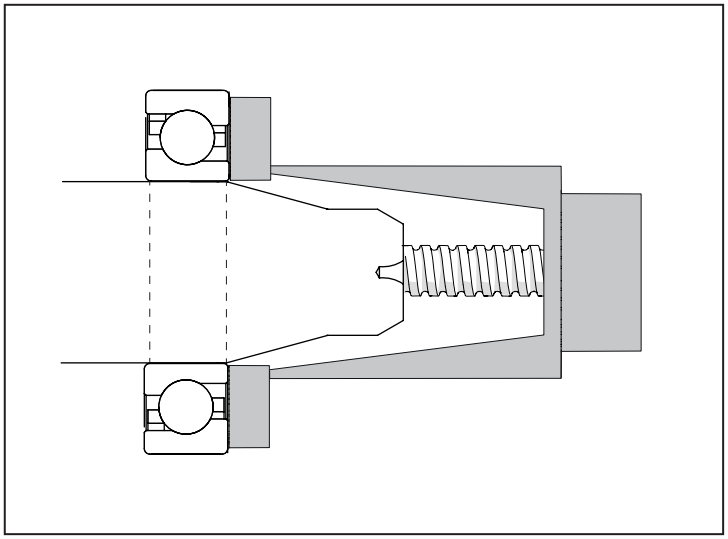


Fig. 1.16

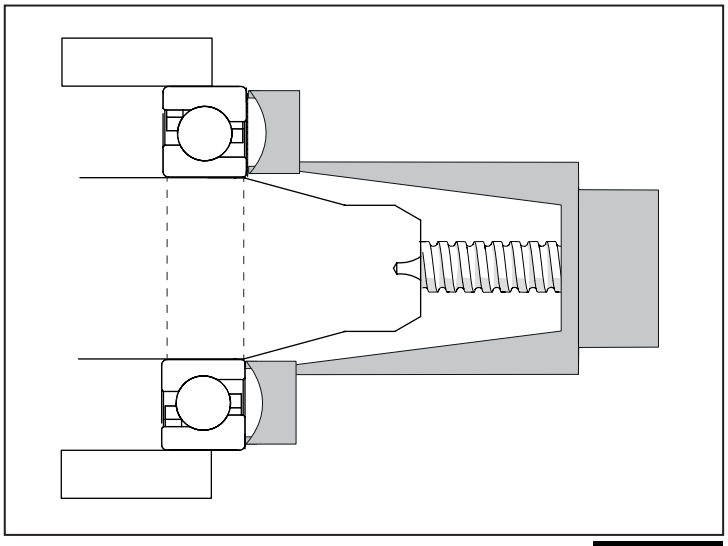


Fig. 1.17

- Rather large bearings cannot always be assembled cold on the shaft or in their housing owing to the entity of the force required (the force required for assembly increases with the size of the bearing). The bearings, their rings or supports (hubs, etc.) should therefore be heated prior to assembly.
- The temperature difference between the ring and the part to be coupled depends on the interference required and the diameter of the housing.
- The bearings should be heated in an oil bath or muffle furnace. If electric plates are used, the bearings should be turned several times to make sure that they are heated evenly.

Warning

Never heat the bearing more than 125°C otherwise as this could lead to structural transformations in the material with consequent dimensional variations and a reduction in hardness.

Avoid localized heating.

Warning

Bearings with protective shields and watertight bearings should not be heated before assembly as this could impair the characteristics of the lubricant.

6.3.4 Disassembly

- When bearings are to be reused after removal from their housings, the forces to apply must never be transmitted through the rolling elements. The ring with the looser coupling must be removed first in non-modular bearings. To remove rings assembled with a strong interference, use the tools and fixtures described below depending on the type of bearing and its size.
- Small bearings can be removed from their housings using:
  - A hammer and punch made of soft metal;
    Use them to tap lightly over the entire face of the ring in question.
  - A mechanical puller;
    Apply the pullerto the face of the ring being removed, or to a part adjacent to this.

  Disassembly is facilitated in cases where the application design includes stop points on the shaft and housing, notches for the puller jaws, or threaded holes for the puller screws.
- To disassemble the inner rings of parallel roller bearings without borders or with one single border, there are special tools with which the rings can be quickly heated before the shaft can sensibly heat and thus expand.

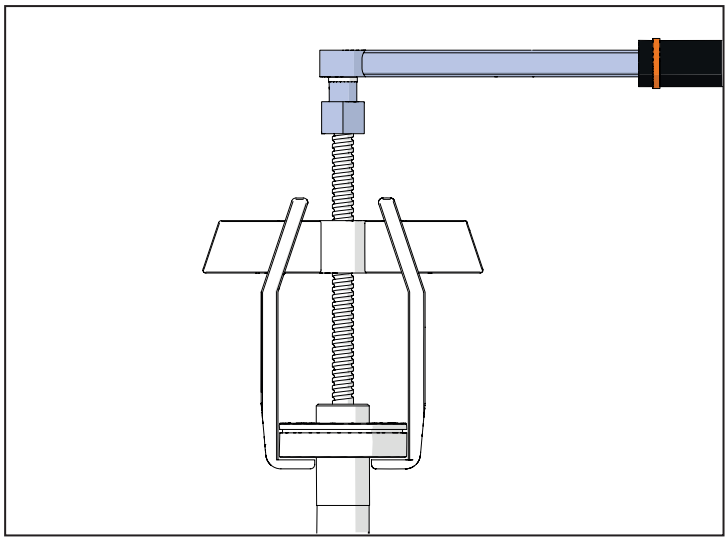


Fig. 1.18

Chapter 2 : Engine

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Section 1 : Safety notes

Certain precautions and safety recommendations are described in this section. It is important for operators to comply with these instructions in order to prevent accidents. Moreover, always bear in mind the safety measures described in the Operation and Maintenance Manual and in chapter 1 of this manual.

Caution
Do not fill the engine with lubricating oil beyond the mark on the dipstick, since it could damage the engine itself.
Lubricate the rocker arm and camshaft before starting the engine to prevent the this latter from being damaged if the lubrication system has been discharged.
These engines must only be used for the type of application for which they have been designed. Do not modify the technical specifications of the engine.
Clean up any spilt fuel. Materials soiled with fuel must be taken to a safe place.
Do not refuel when the engine is running (unless this is absolutely necessary).
Do not clean, add lubricant or tune the engine while it is running (unless you have received the appropriate training and even then, you must pay the utmost attention to avoid accidents).
Do not attempt to make adjustments that you do not understand.
Make sure that you do not run the engine in places where toxic emissions could build up.
Unauthorized persons must be kept at a safety distance when the engine or auxiliary equipment are operating.
Do not run the engine if a protection has been removed.
Always disconnect the battery terminals before working on the electrical system.
Make sure that you only operate the engine from the control panel or from the driving seat.
Make sure that the gearshift lever is in the neutral position before turning on the engine.
Dispose of used lubricating oil in a safe way to prevent it from dispersing in the environment.
Take the utmost care if emergency repairs must be made in difficult conditions.
Do not clean the engine while it is operating. Certain of the components could be damaged if cold cleaning fluids were to be applied to a hot engine.
Only use original spare parts.

Danger
Do not smoke while refueling.
The combustible material with which certain engine components are made (e.g. certain of the seals) can become extremely dangerous if burnt. Never allow burnt material to come into contact with the skin or eyes.
Do not remove the fill plug from the cooling system when the engine is hot and the coolant is under pressure as a jet of boiling fluid could squirt out.
Immediately seek medical help if pressurized fuel squirts on to the skin. Diesel fuel and lubricating oil (especially used oil) can be harmful for the skin of certain persons. Protect your hands by wearing gloves or applying a special protective cream. Do not wear garments soiled by lubricating oil. Do not put items soiled by lubricating oil into your pockets.
Do not allow compressed air to come into contact with the skin. Immediately seek medical help if compressed air penetrates into the skin.
Keep well away of moving parts when the engine is running. Danger! Some of the moving parts are not clearly visible when the engine is on.
Keep loose garments and long hair well away from moving parts.
Turbocompressors operate at high speeds and temperatures. Keep your fingers, tools and other objects well away from the suction and exhaust ports of the turbocompressor and do not touch hot surfaces.
Keep the batteries well away from naked flames or sparks (especially when they are being charged) as the gas produced by the electrolyte is highly inflammable. Battery fluid is dangerous for the skin and particularly for the eyes.
The exhaust fumes of the air conditioning circuit are harmful to the health. Open the doors and ventilate the place after the operations have terminated.

Lifting the engine in safe conditions

Danger
Make sure that there are no bystanders near the load being handled.

Danger
The engine is very heavy. Proceed with care and comply with all the safety instructions.

Caution
Always use engine lifting equipment of the approved type and correct lifting capacity in order to lift the engine.
Always use the lifting equipment recommended by the manufacturer.
Always use the lifting equipment recommended by the manufacturer.
Make sure that the lifting brackets are not damaged and that they are firmly fastened before you lift the engine.
To prevent the rocker arm cover from being damaged, make sure that there is a clear gap between the hooks and the cover itself.
Use lifting equipment or ask for help from another technician when lifting the heavy parts of the engine, such as the cylinder block, cylinder head, flywheel housing, drive shaft and flywheel.

Section 2 : Technical specifications

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2.1 Technical specifications

Brand	VM
Model	D754 TE3
Fuel system	Diesel with direct injection
Power rating (ECE R120)	59.8 kW / 81.3 HP
Emissions standard	STEP 3A
Number of cylinders	4
Aspiration	Turbocharged
Engine rate	2600 rpm
Cooling system	Liquid coolant
Swept volume	2970 cc
Specific fuel consumption (max torque rate)	252 g/kWh
Maximum torque	274Nm@1800 rpm
Torque reserve	19.8%
Tank capacity	60 litres
Bonnet	Sheet metal

Section 3 : Engine splitting and re-assembly

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3.1 Disassembly 2-8

3.2 Re-assembly 2-15

3.1 Splitting

Release the connector (1) and belt (2).

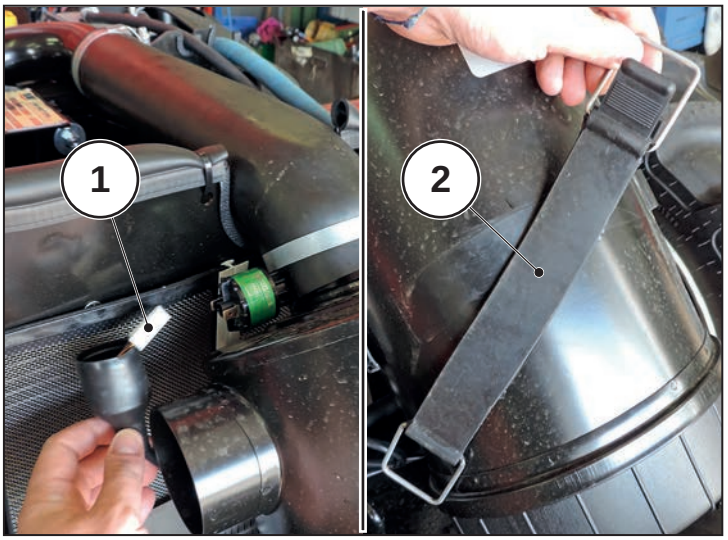


Fig. 2.1

Loosen the clamps (3) and remove the sleeve (4) and filter (5).

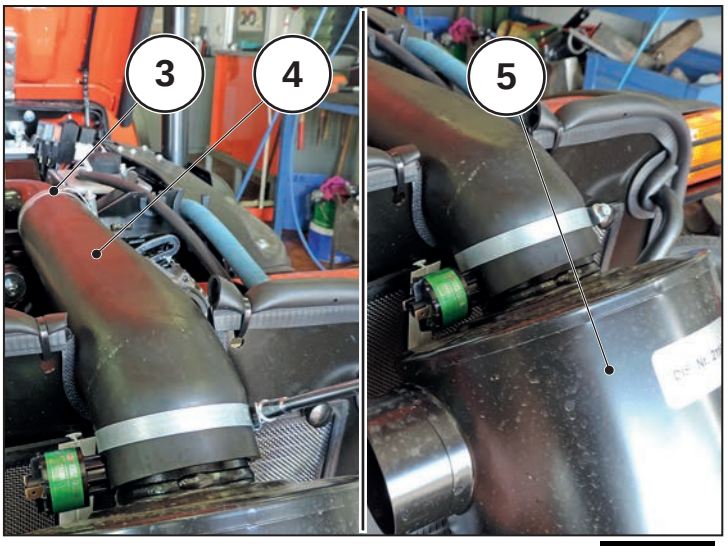


Fig. 2.2

Empty the radiator after removing the plug (6).

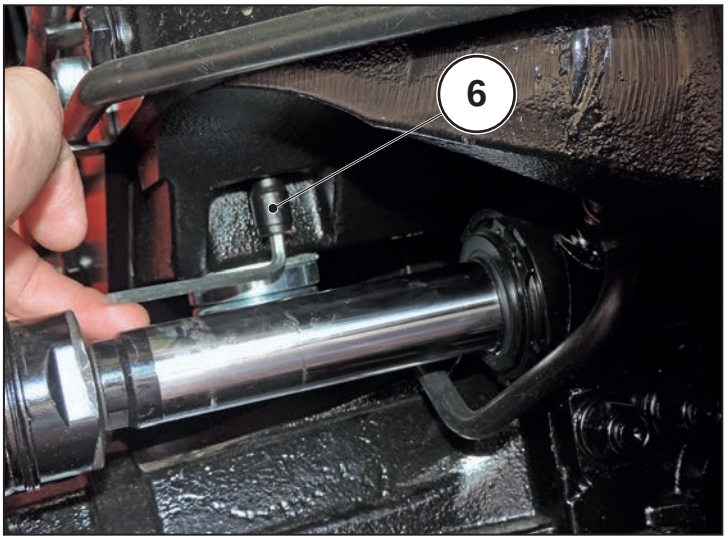


Fig. 2.3

Remove the right cover (7).

Remove the sheath (8).

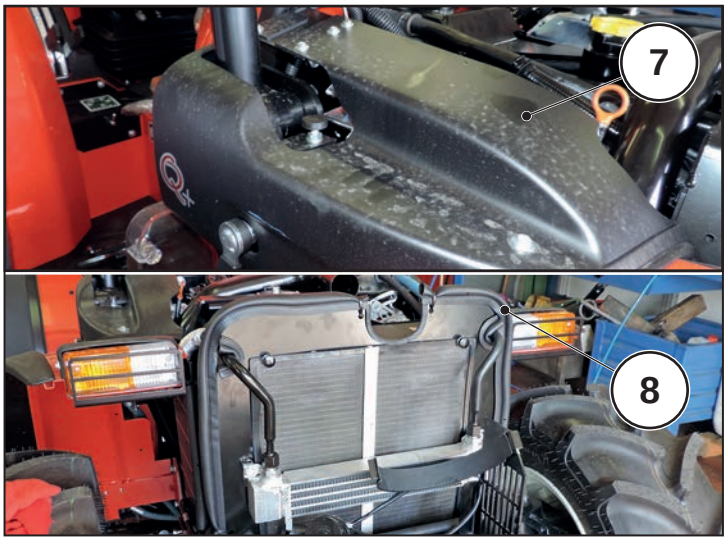


Fig. 2.4

Unscrew the clamps (9) and remove the intake tube of the turbine (10).

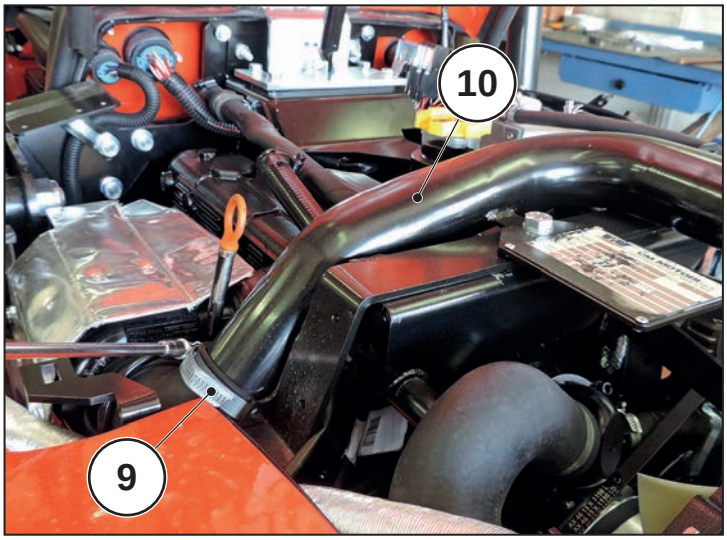


Fig. 2.5

Unscrew the tube unions (11).



Fig. 2.6

Unscrew the screws that fasten the radiator (12).

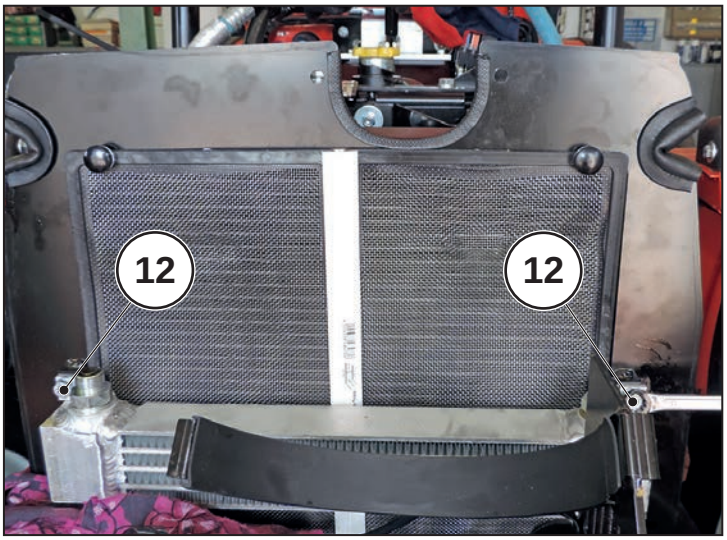


Fig. 2.7

Remove the radiator (13).

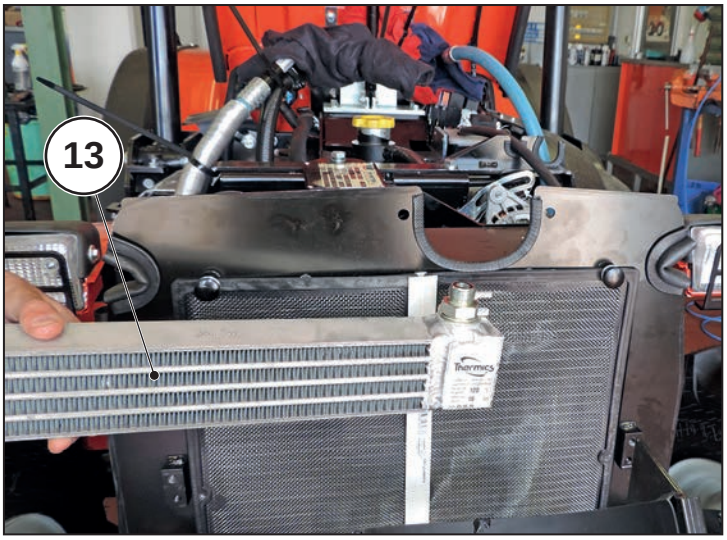


Fig. 2.8

Unscrew the retainers (14) and remove the protective nets (15).

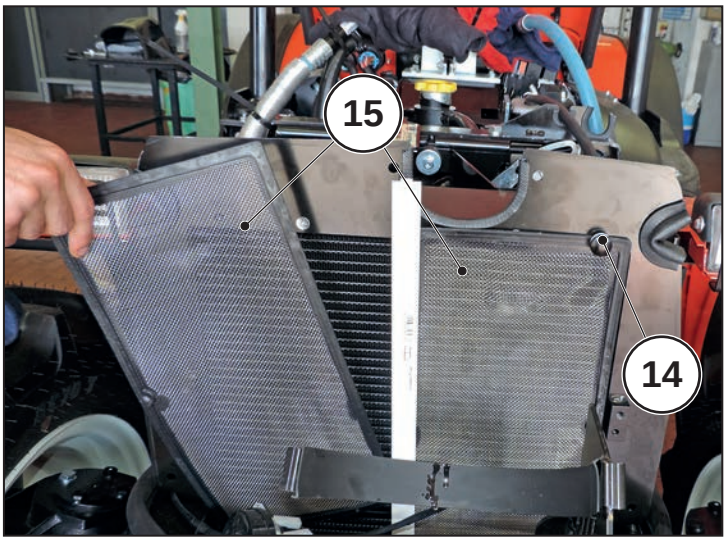


Fig. 2.9

Unscrew the four screws that fix the filter bearing plate (16).

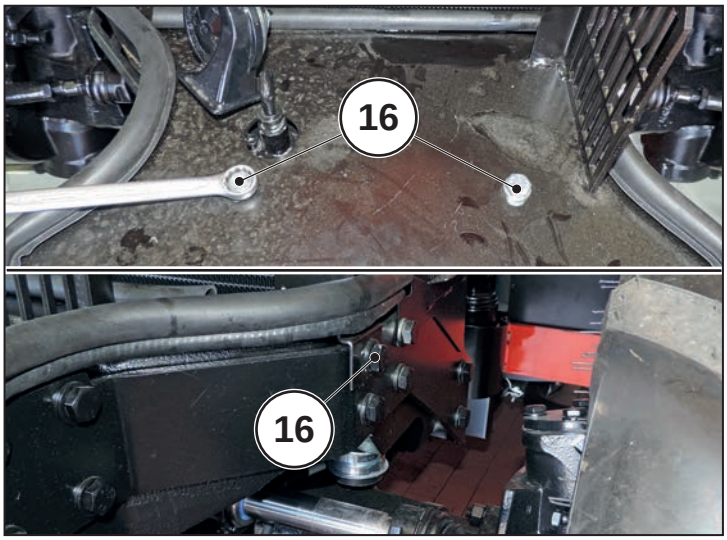


Fig. 2.10

Remove the two allen screws (18) and the radiator plate (19).

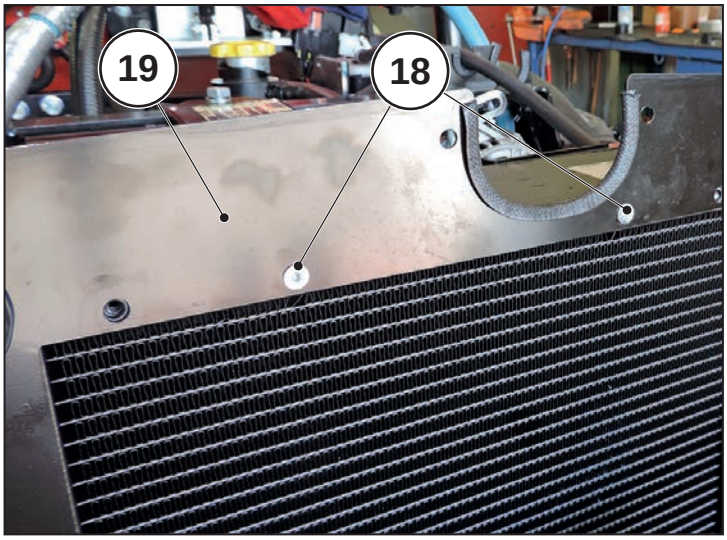


Fig. 2.11

Remove the filter bearing plate (20) and spacers (17).

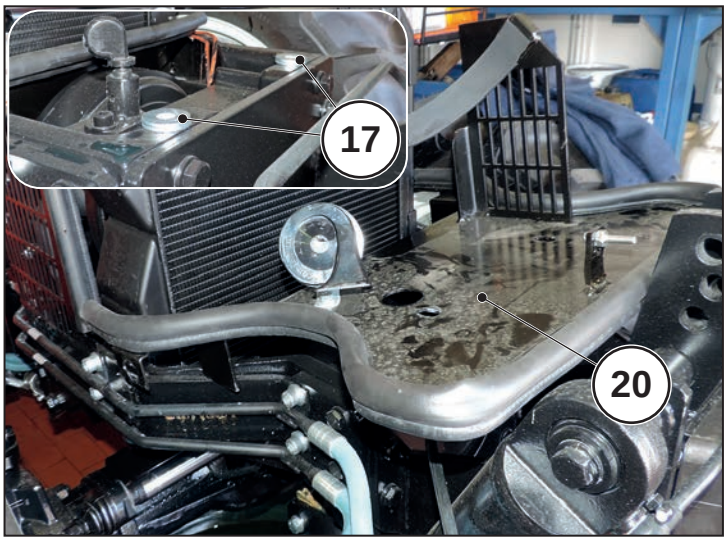


Fig. 2.12

Remove the pipe clamps (21) and take out the pipe (22).

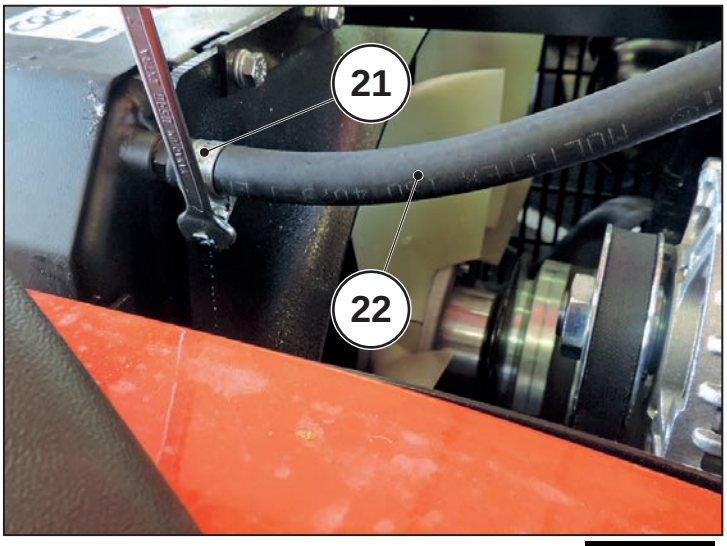


Fig. 2.13

Loosen the clamps (23) and remove the sleeve (24).

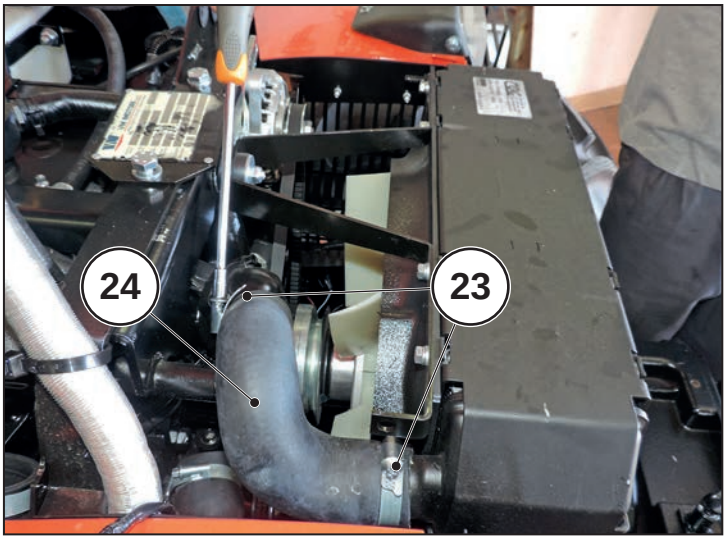


Fig. 2.14

Unscrew the screws (25) and remove the protections (26).

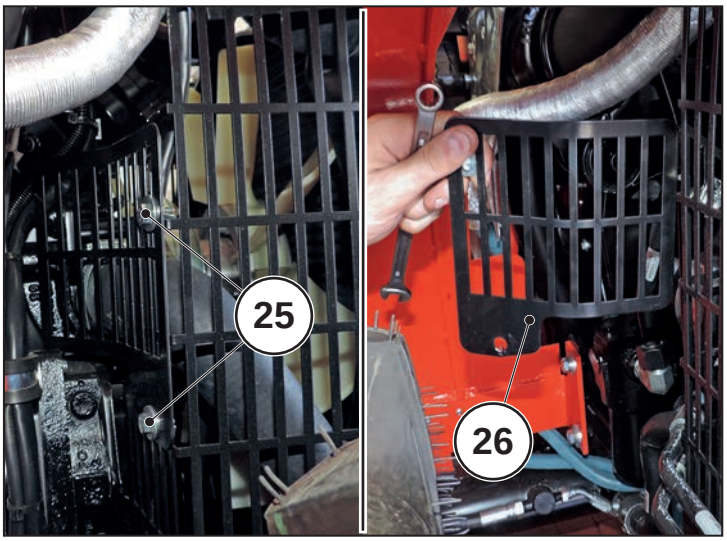


Fig. 2.15

Unscrew the screws (27) and remove the protections (28) from both sides.

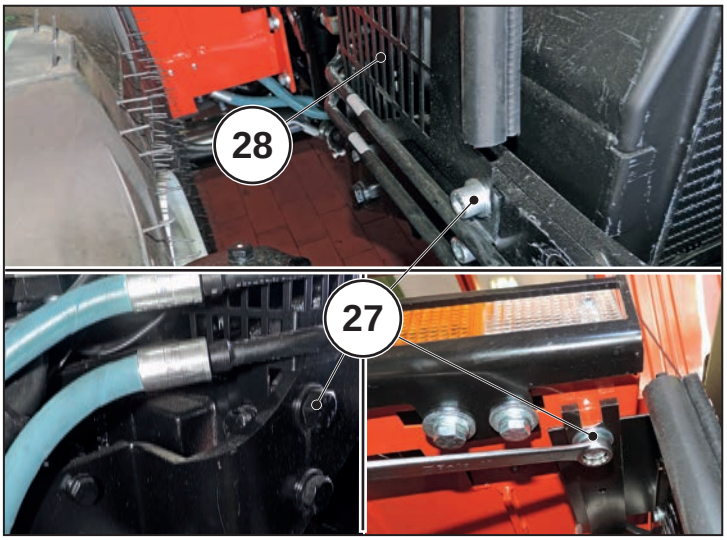


Fig. 2.16

Unscrew the clamps (29) and remove the sleeve (30).

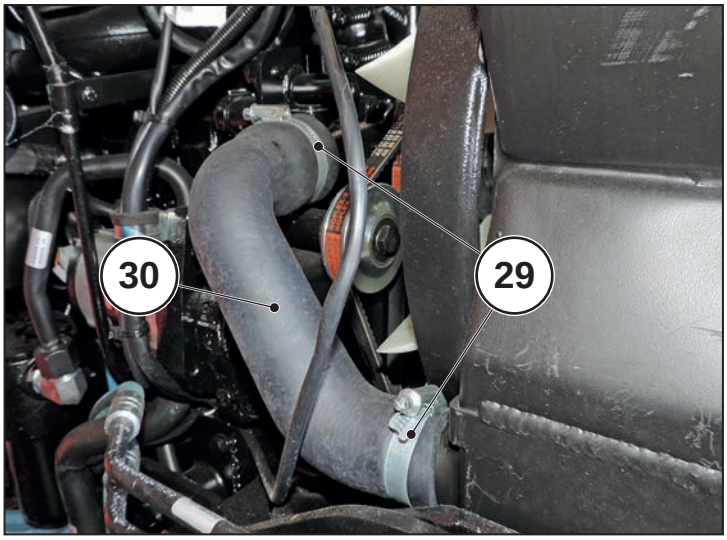


Fig. 2.17

Unscrew the screw (33) and the four screws (32).

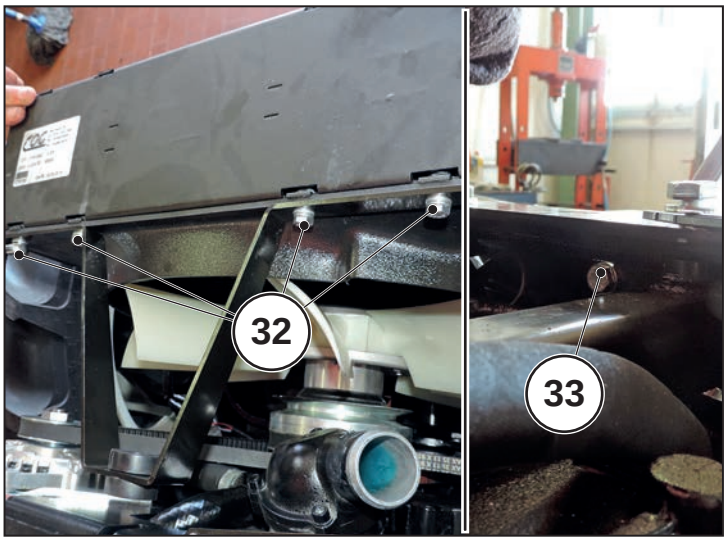


Fig. 2.18

Unscrew the four screws that fix the conveyor (34) and remove it (35).

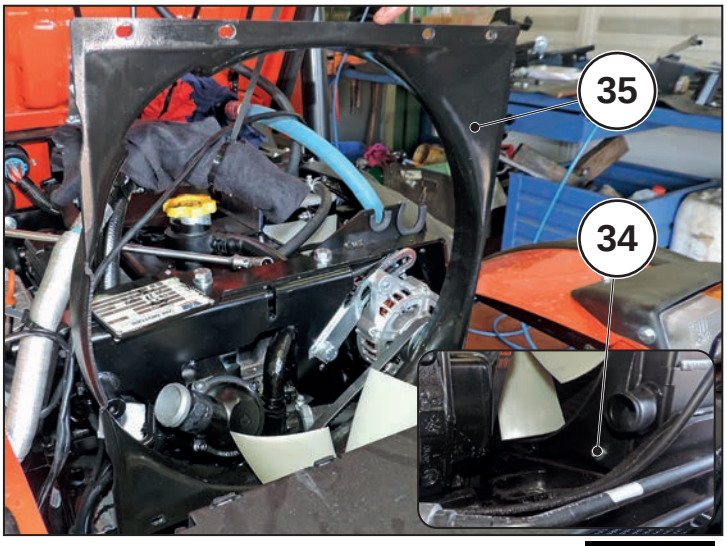


Fig. 2.19

Remove the radiator (36).

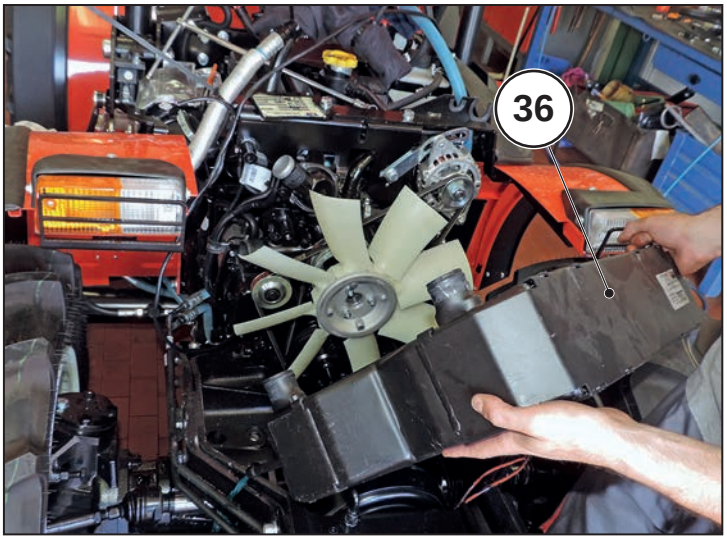


Fig. 2.20

Unscrew the allen screws (37) and remove the fan (38).

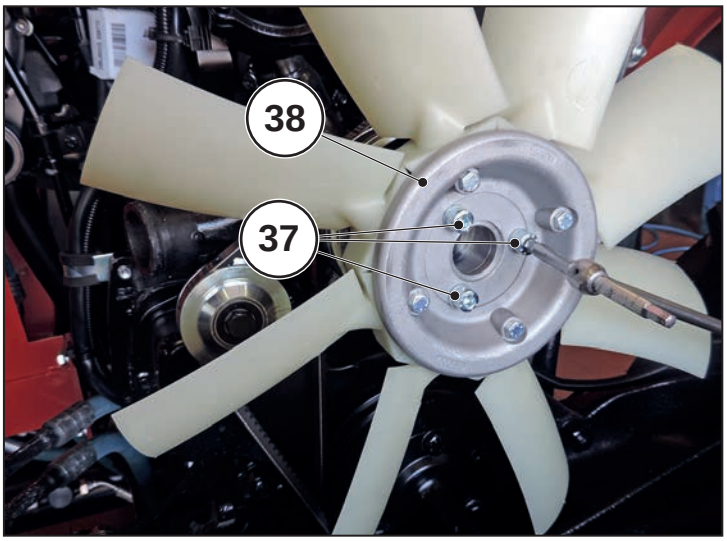


Fig. 2.21

3.2 Re-assembly

Danger

Make sure that all persons keep well away from the danger zone. Avoid vibrations when the bolts are loosened.

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.

Comply with the disassembly instructions in reverse order when re-assembling the platform.

Warning

Make sure that the fan turns smoothly without obstructions.

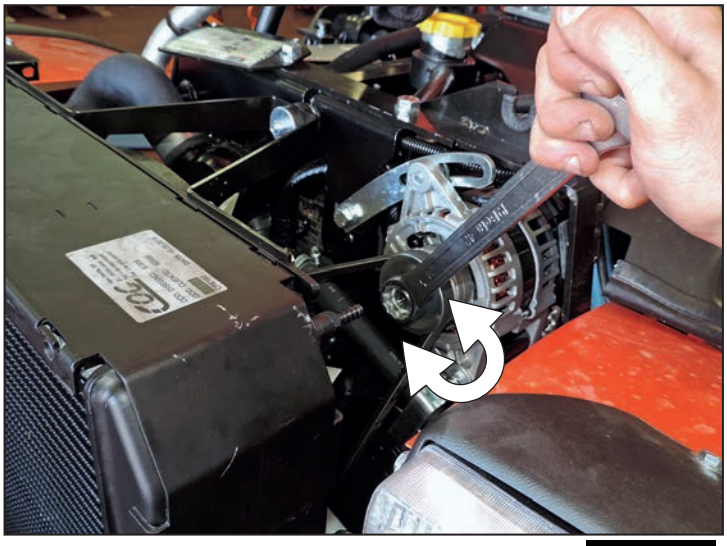


Fig. 2.22

Chapter 3 : Clutch bowl

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6.1 Tightening torques 3-28

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7.1 Tools required 3-30

Section 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.

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 the sharp edges around the top of the transmission housing.

Caution

Used oil must be collected and disposed of in compliance with the anti-pollution laws in force.

Section 2 : General introduction

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2.1 Drawing of the assembly 3-4

2.1 Drawing of the assembly

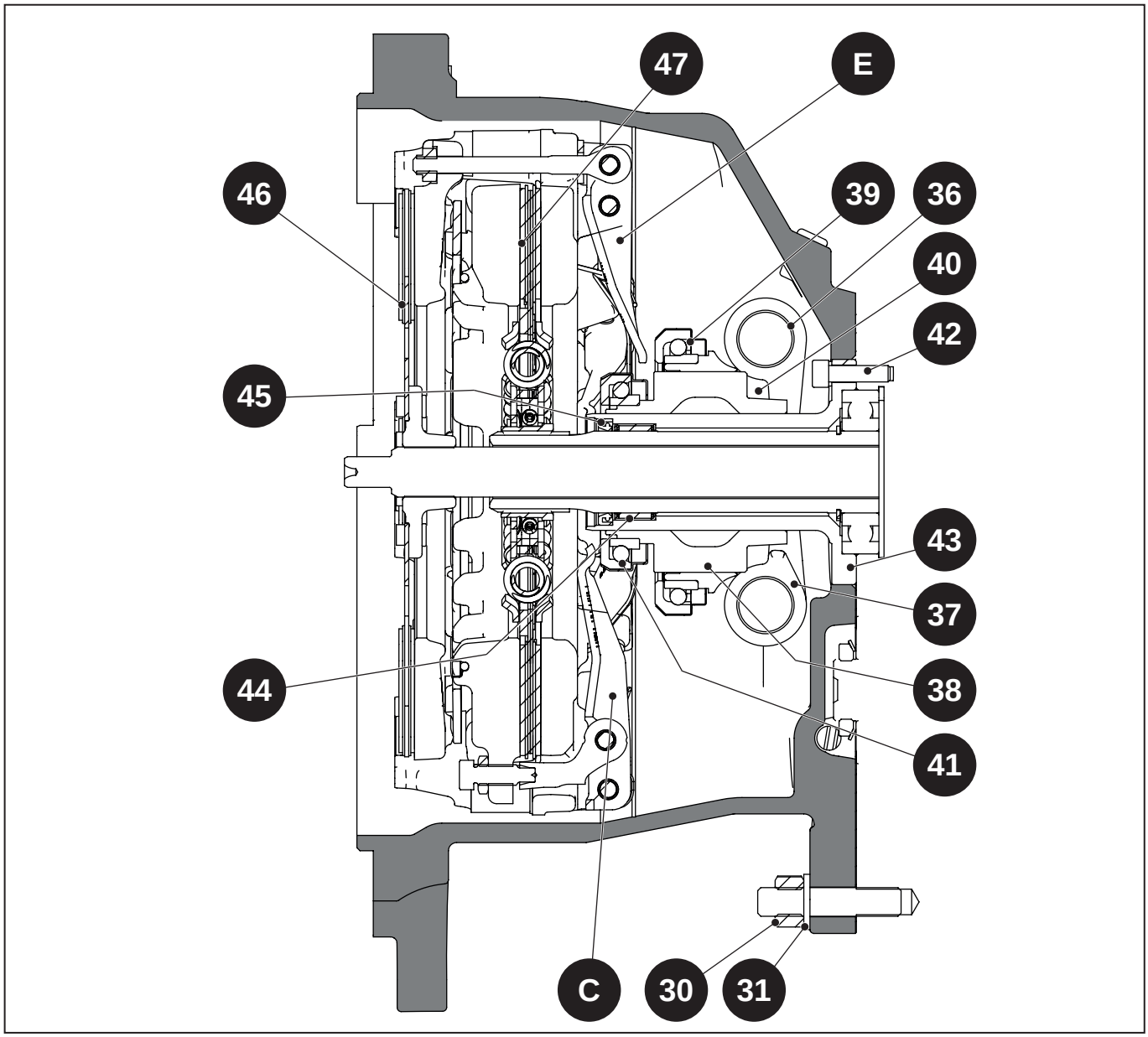


Fig. 3.1

30 - Nut
31 - Washer
36 - Transmission clutch lever
37 - Power take-off clutch lever
38 - Sleeve
39 - Bearing
40 - Sleeve
41 - Bearing
42 - Screw
43 - Sleeve guide cover
44 - Roller cage
45 - Oil retainer
46 - P.T.O. clutch plate
47 - Transmission clutch plate
C - P.T.O clutch lever
E - Transmission clutch lever

Section 3 : Technical specifications

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3.1 Technical specifications

Clutch type

Transmission	11" diameter dry single-plate
Power take-off	Independent, mechanical with dry disc

Clutch control

Transmission	Mechanical, pedal operated
Power take-off	Mechanical, lever operated

Section 4 : Disassembly

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4.1 Preliminary operations 3-8

4.2 Clutch disassembly 3-16

4.1 Preliminary operations

The main operations required to access the unit are described below:

Caution

Always make sure that the assemblies have been completely freed before splitting them, otherwise their components could be damaged.

- Remove the platform (see chapter "13- Platform")

  Remove the cab (see chapter "14- Cab")

Danger

Before the units are disassembled, make sure that they have been secured to lifting equipment of an adequate capacity.

If lifting equipment is not available, place the units on a stand.

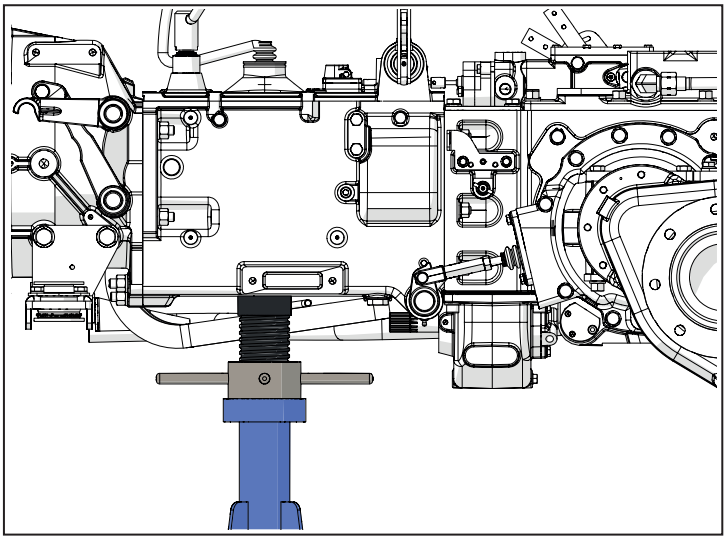


Fig. 3.2

Remove the screws (1) that fasten the silencer.

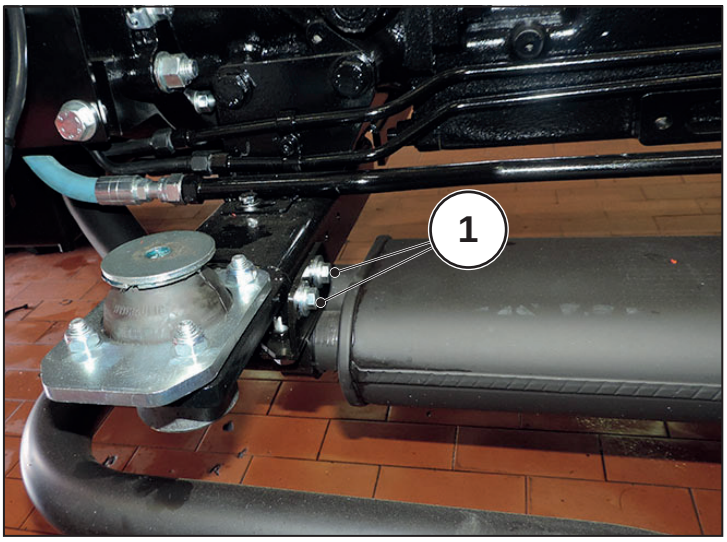


Fig. 3.3

Unscrew the nut (2) and remove the clamp (3).

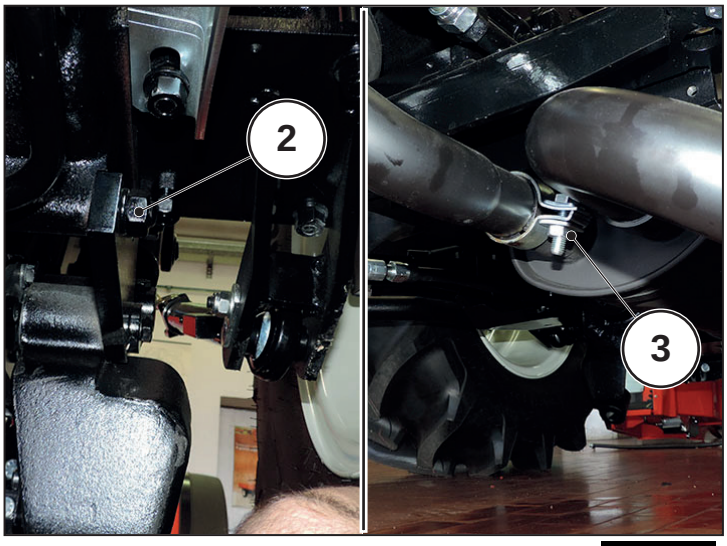


Fig. 3.4

Remove the silencer (4).

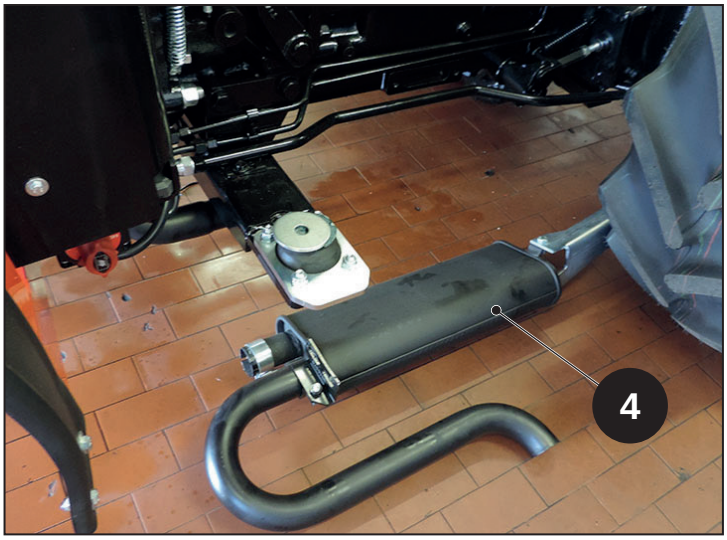


Fig. 3.5

Unscrew the screws (5) and remove washers (6) and spacer (7).

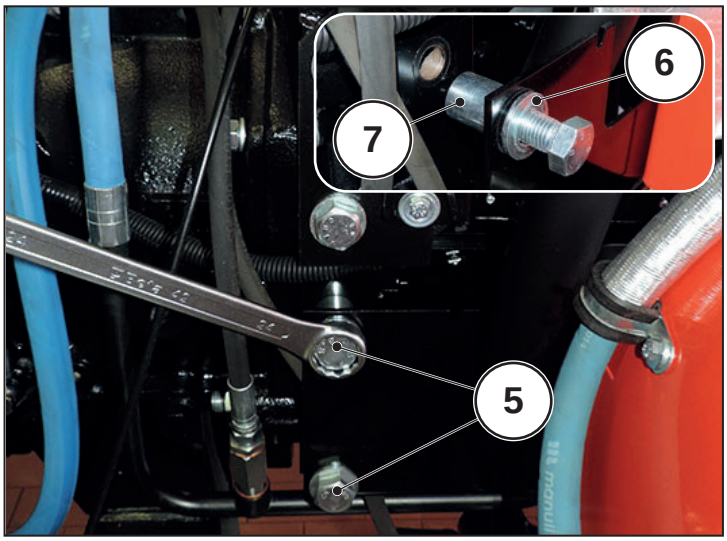


Fig. 3.6

Remove the clamp (8) and disconnect the pipe (9).

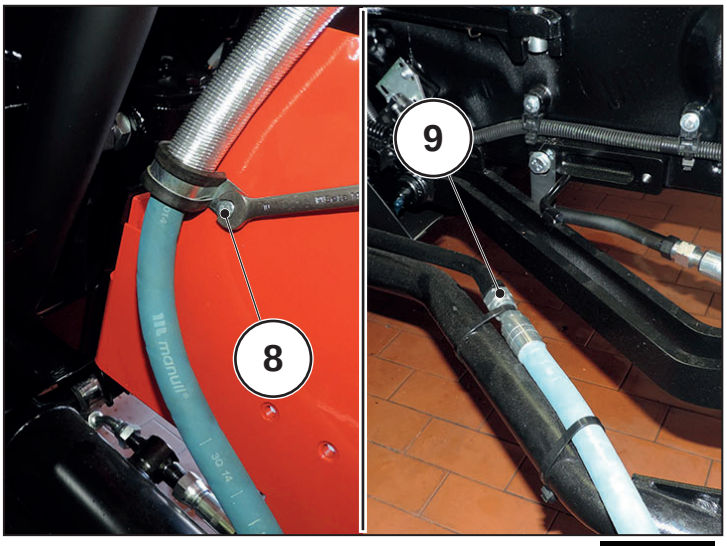


Fig. 3.7

Unscrew the screws (10) and remove the cover from the right front headlight.

Disconnect the connector (11) and remove the wires from the cable towards the engine.

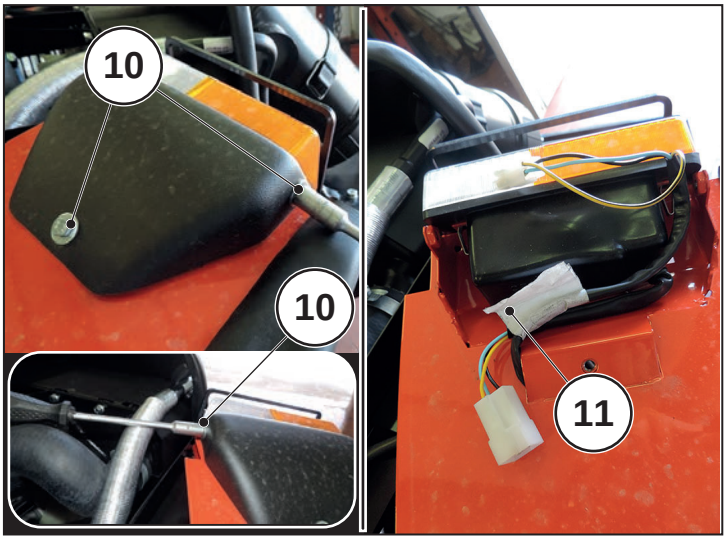


Fig. 3.8

Route the cables through the slit in the right mudguard.

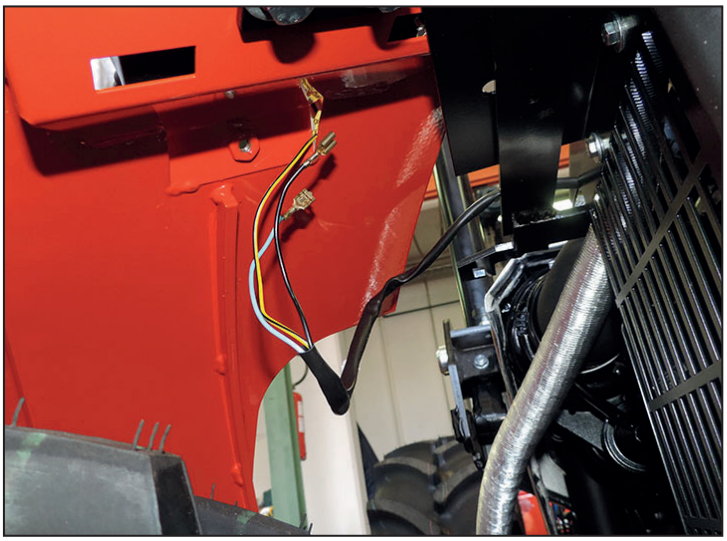


Fig. 3.9

Unscrew the screw (12) and remove the mudguard.

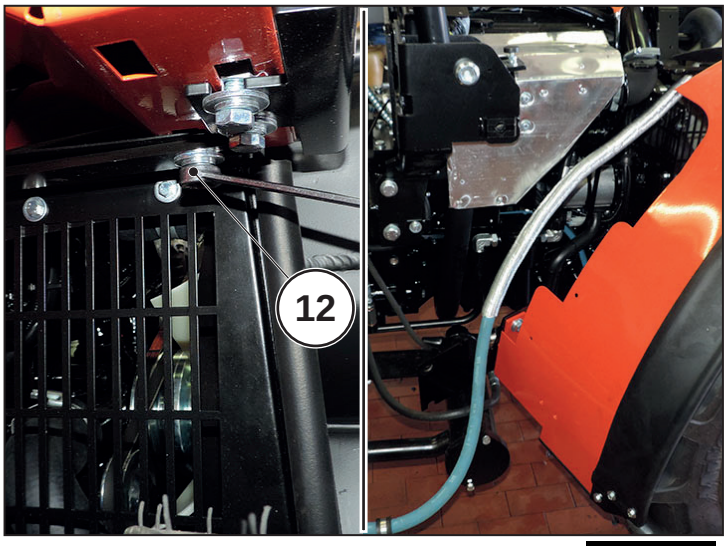


Fig. 3.10

Unscrew the nut (13), free the clutch spring (14), then loosen it.

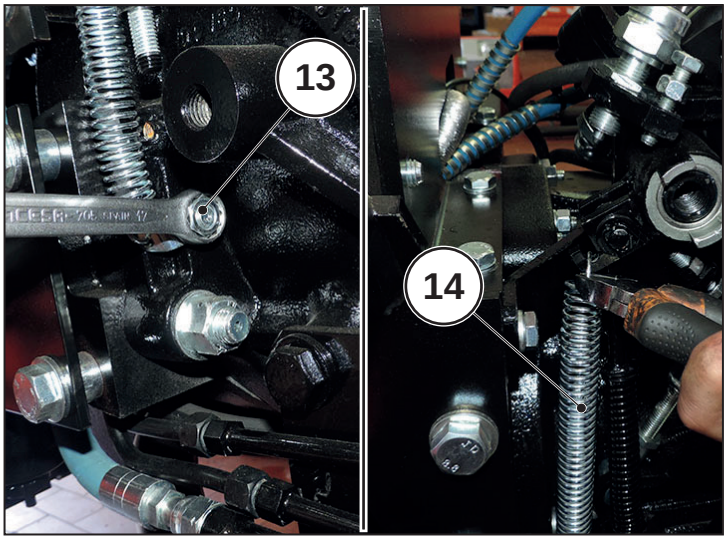


Fig. 3.11

Remove the split pin.

Remove the pins and link (15).

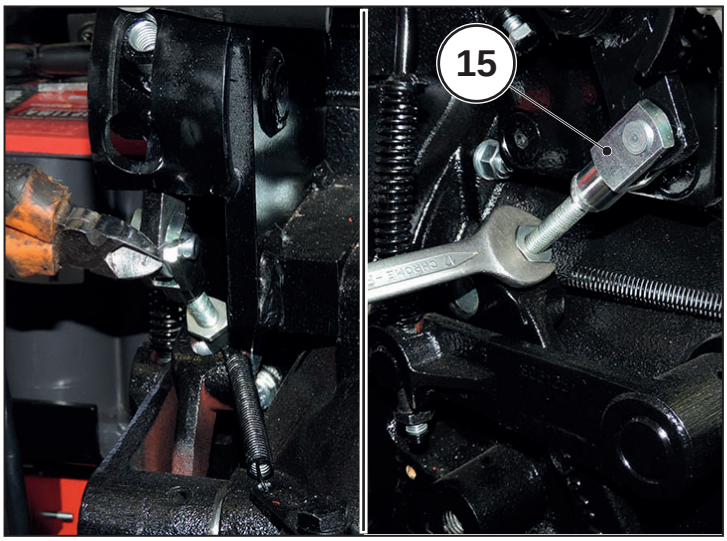


Fig. 3.12

Warning

Drain oil from the gearbox.

Unscrew the clamps and remove the sleeve (16).

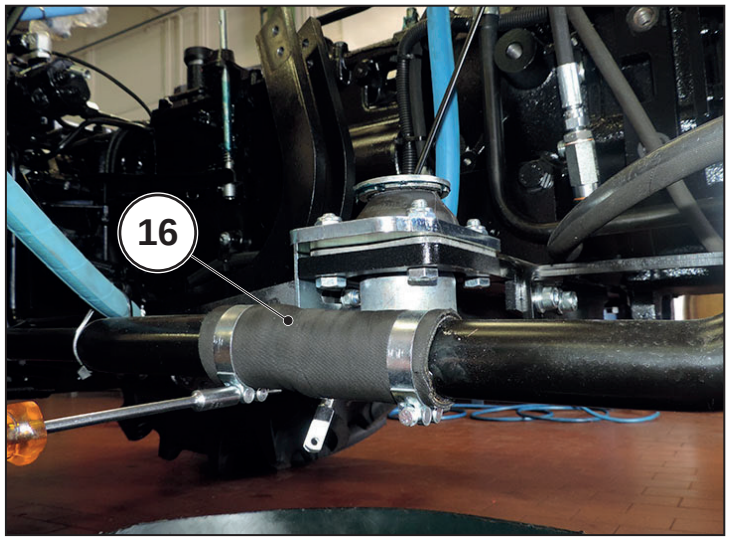


Fig. 3.13

Unscrew the screws (17) that fasten the filter tube on the intake.

Disconnect the tube (18).

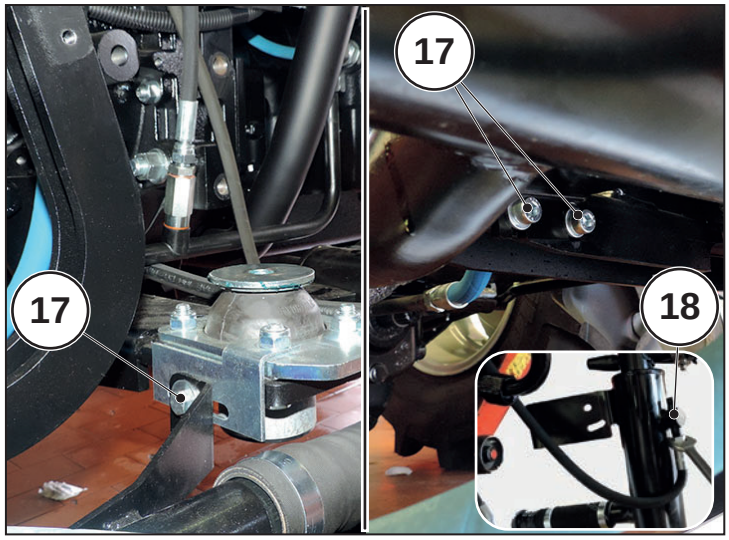


Fig. 3.14

Unscrew the union (19) of the power steering delivery tube on the right-hand side.

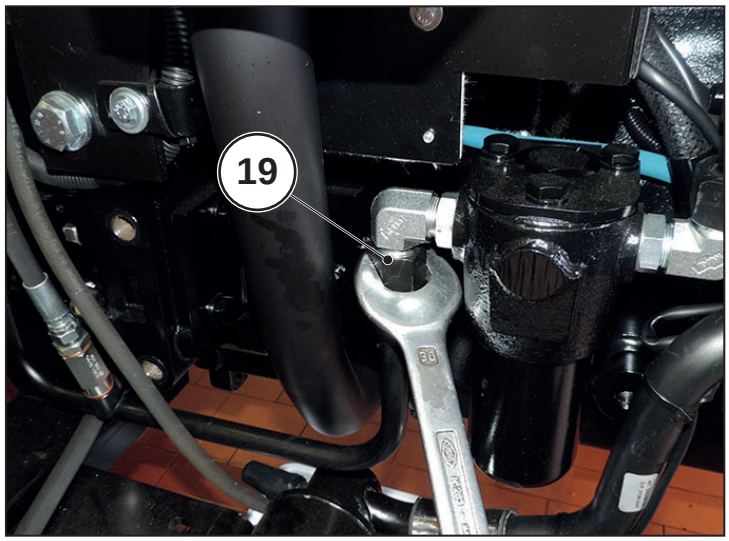


Fig. 3.15

Unscrew the union (20) of the power steering discharge tube from the filter on the intake.

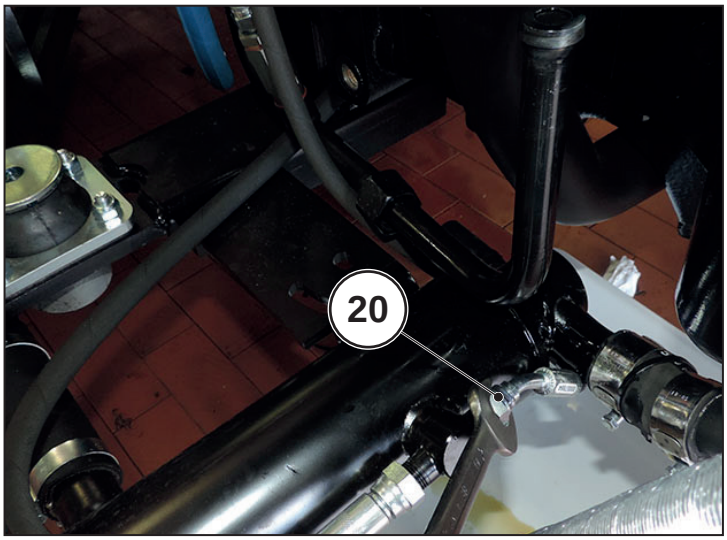


Fig. 3.16

Unscrew the screw (21) that fastens the tube on the left-hand side.

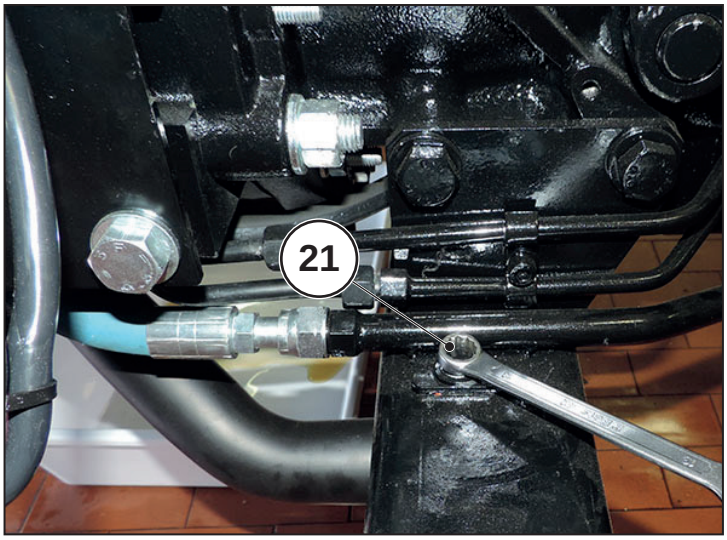


Fig. 3.17

Unscrew and disconnect the hydraulic pipe unions (22), (23) and (24), on the right-hand side.

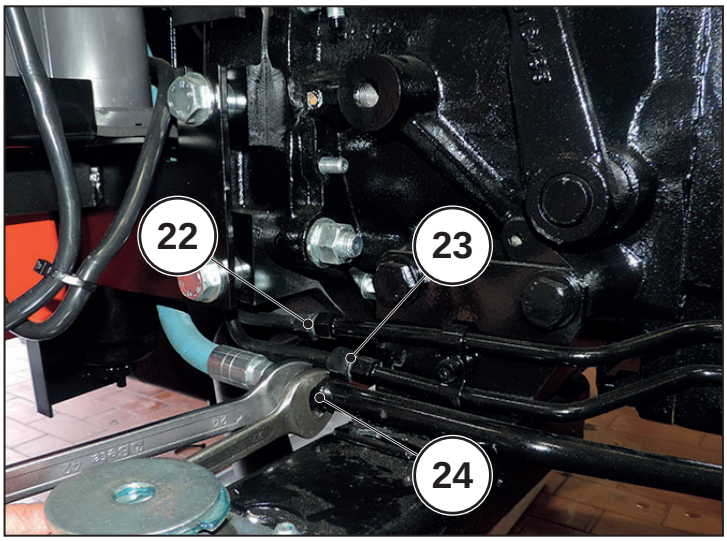


Fig. 3.18

Remove the clamp (25) that fastens the wiring.

Unscrew the screw (26) and remove the wiring.

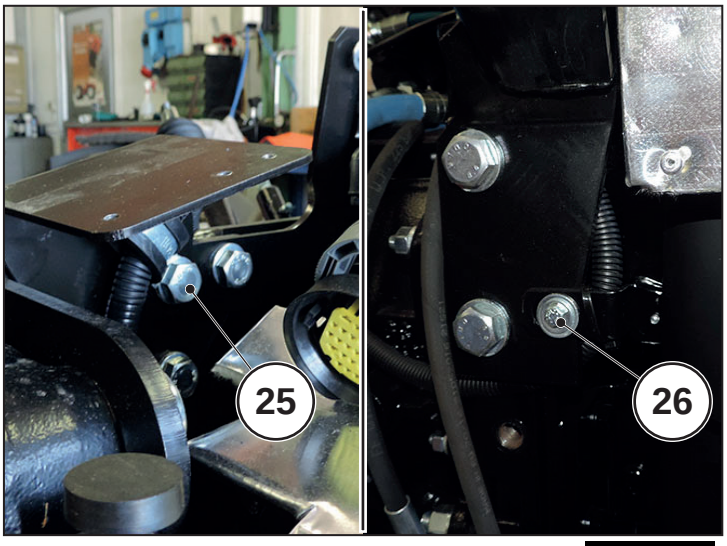


Fig. 3.19

Remove the allen screws (27), the nuts and washers, then remove the roll-bar.

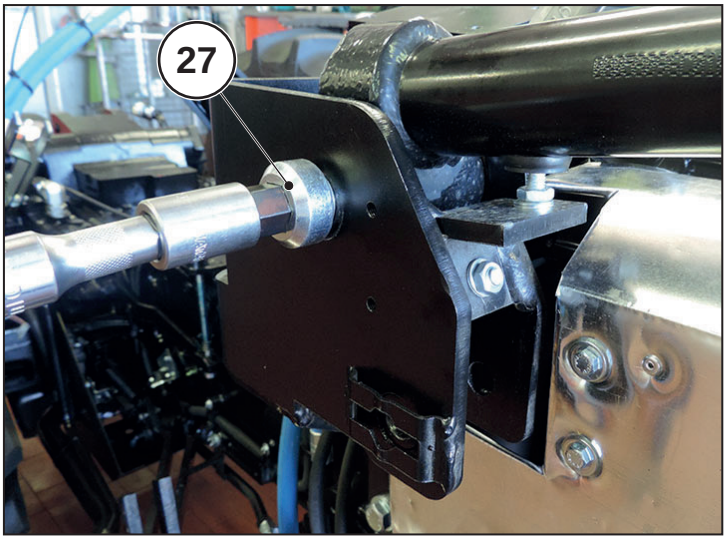


Fig. 3.20

Screw in 2 lifting eyebolts and use fixture (A-code_____) to hold the engine in position.

Danger
Apply the hand brake as a further safety measure.



Fig. 3.21

Unscrew unions (28) and (29), then remove the hydraulic pipes of the power steering system.

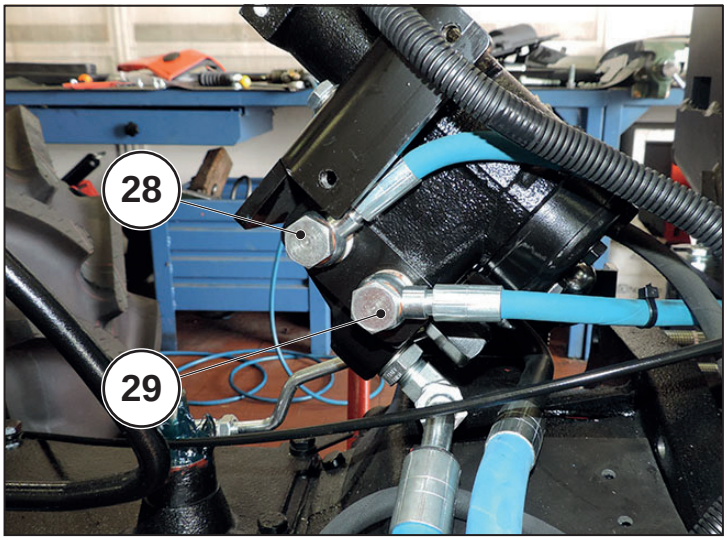


Fig. 3.22

Remove the screws and nuts that fasten the clutch bowl to the engine.

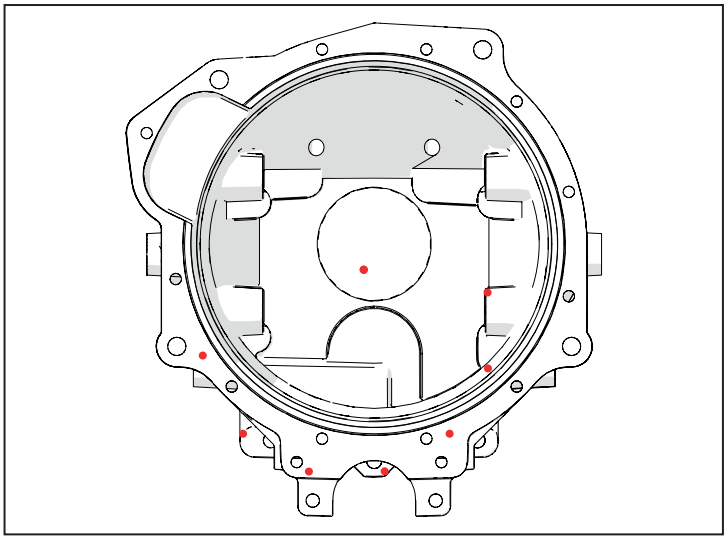


Fig. 3.23

Split the units.

Danger

Lift and handle all heavy parts with lifting equipment of an adequate capacity. Make sure that the hooks and harness are fixed in safe positions. Operators must remain at a distance and in a safe position, well away from the lifted load. Before the units are disassembled, make sure that they have been secured to lifting equipment of an adequate capacity.

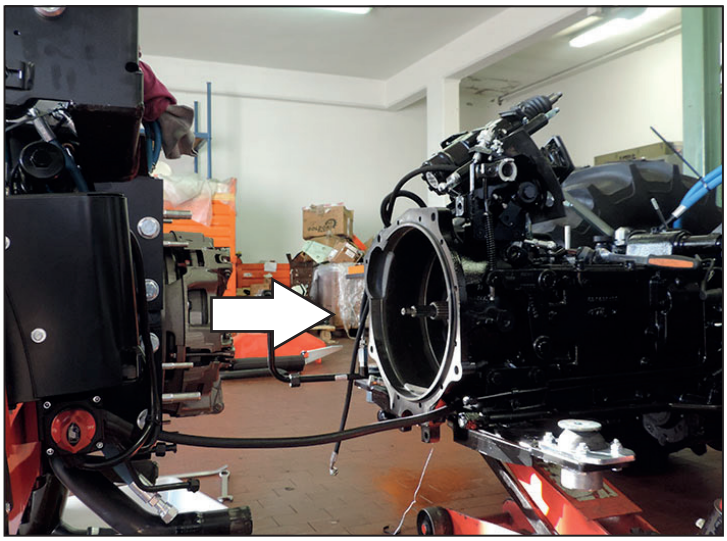


Fig. 3.24

4.2 Clutch disassembly

Insert tool (B-07007171) and use lifting equipment to ensure that the clutch assembly remains in a safe position.

Unscrew the screws that fasten the clutch.

Remove the entire clutch unit.

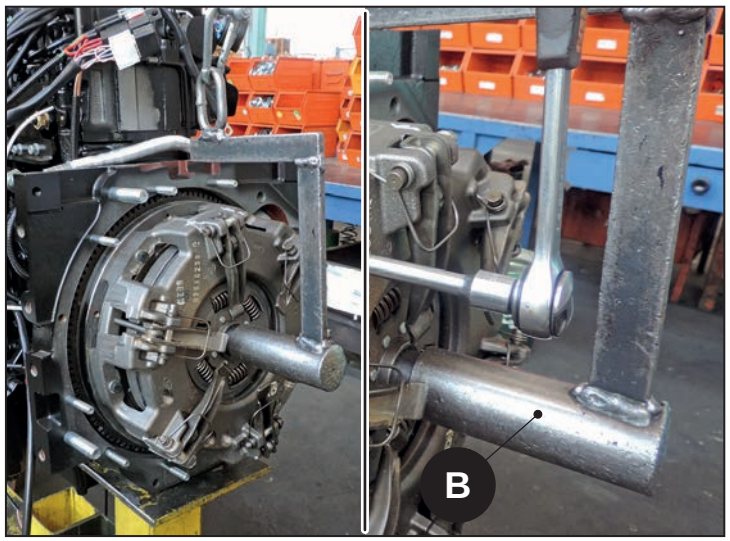


Fig. 3.25

Remove the levers of the transmission clutch (36) and PTO clutch (37) from the bowl complete with rods, levers and springs.

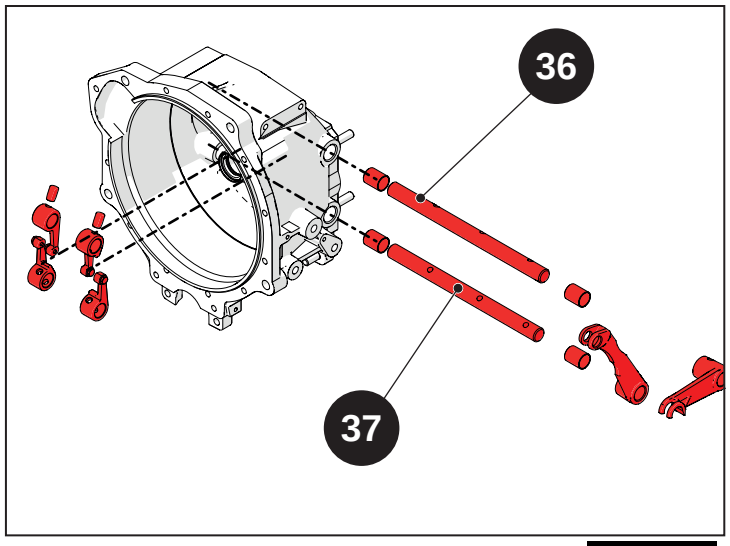


Fig. 3.26

Remove the sleeve (38) and the bearing (39) that engages the transmission clutch.

Remove the sleeve (40) and the bearing (41) that engages the PTO clutch.

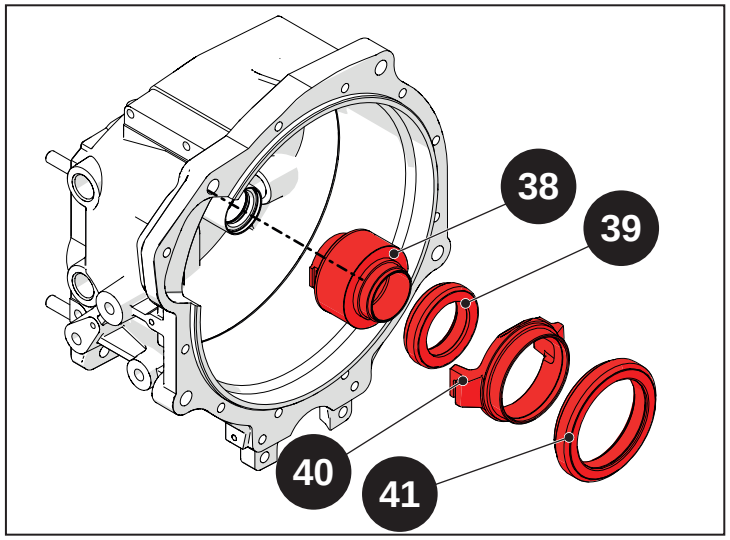


Fig. 3.27

Unscrew the screws (42) and sleeve guide cover (43).

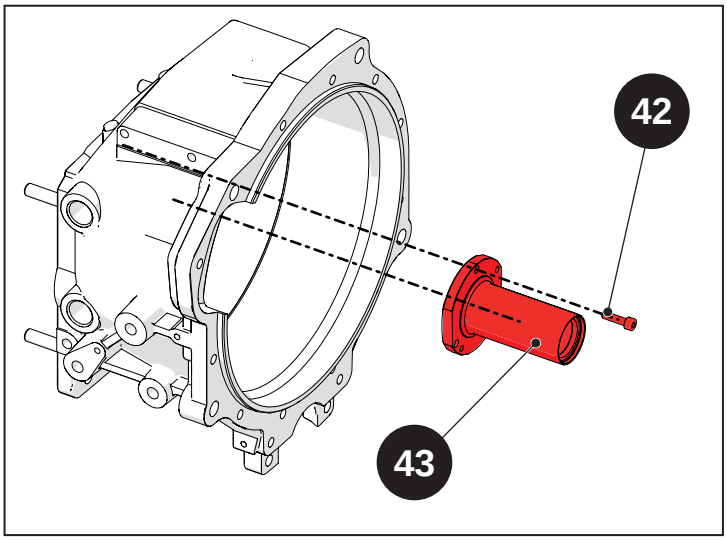


Fig. 3.28

Remove the roller cage (44) and oil retainer (45) from the sleeve guide cover.

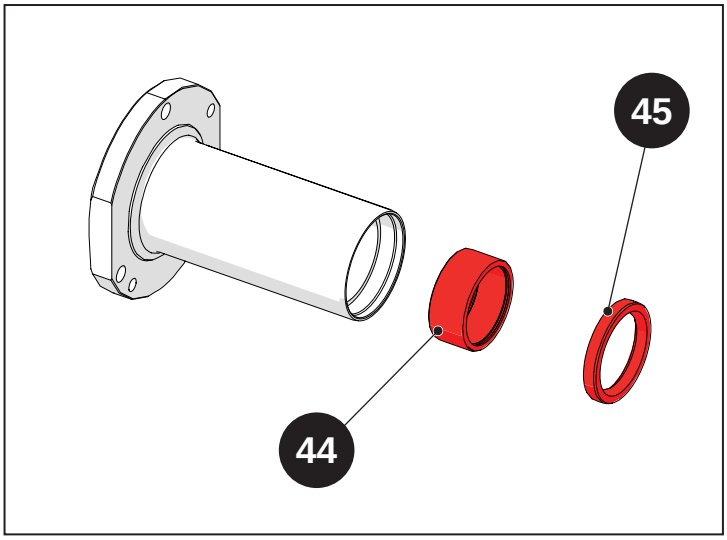


Fig. 3.29

Section 5 : Main inspection, re-assembly and adjustment operations

Index

5.1 Main inspection, re-assembly and adjustment operations.....3-20

5.1 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.

Inspection and control of clutch components

To ensure that the clutch assemblies function properly, the pressure plates must be in a good condition. Make sure that there is no scoring or signs of overheating. The surfaces must be ground if scoring or signs of overheating are discovered.

Remove material from the contact surfaces down to a depth of 0.5 mm.

If this is not sufficient, remove material to an equal extent from the coupling seat of the clutch on the flywheel.

Warning

Material can be removed down to a maximum 1 mm in depth. The component must be replaced if it is worn to a greater extent.

Warning

Before proceeding with the disassembly operations, mark the components so that they can be re-assembled in the same positions.

The plate wearing depths are listed below:

Transmission: X= 10.3÷6.3 mm

Power take-off: Y= 8.7÷5.7 mm

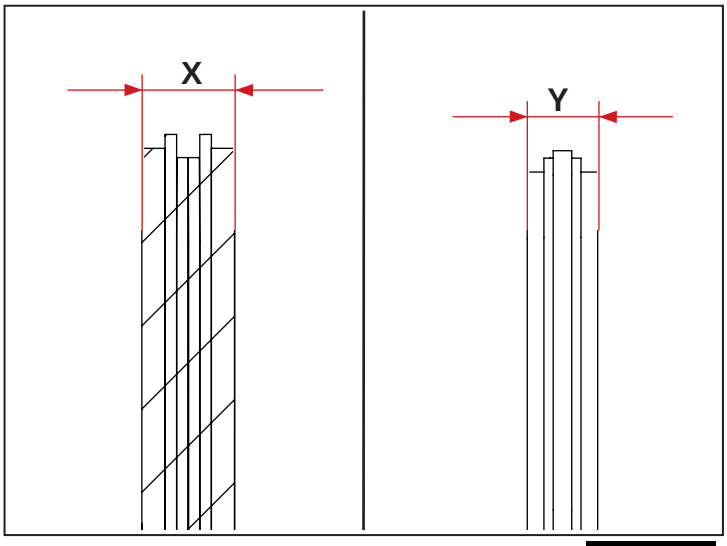


Fig. 3.30

Make sure that when the spring is discharged, it measures 11.7±0,1 mm:

If this is not the case, the spring must be replaced since it will no longer be able to exercise the correct pressure on the clutch plate.

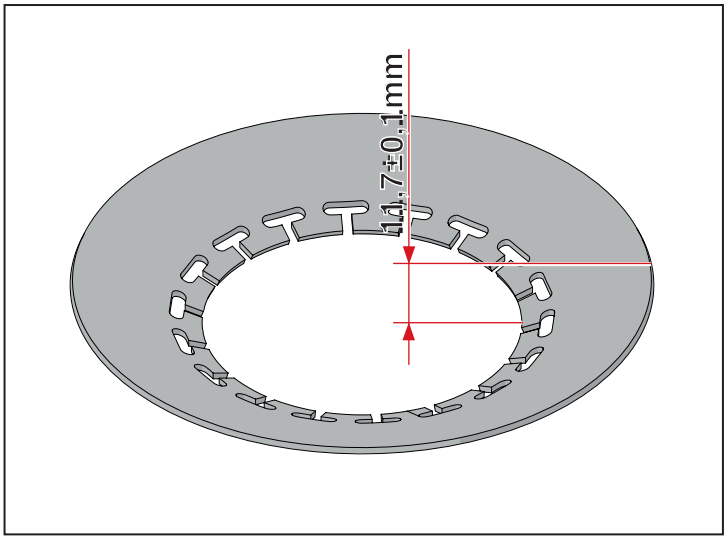


Fig. 3.31

Clutch lever adjustment

The levers of the transmission clutch (36) and PTO clutch (37) must be adjusted to ensure controlled clutch engagement.

To adjust the transmission clutch correctly, the levers (C) must be adjusted so that dimension X= 25 mm.

Loosen the check nuts and tighten or unscrew the nuts (D) until dimension X= 25 mm.

Tighten the check nuts after having made the adjustment.

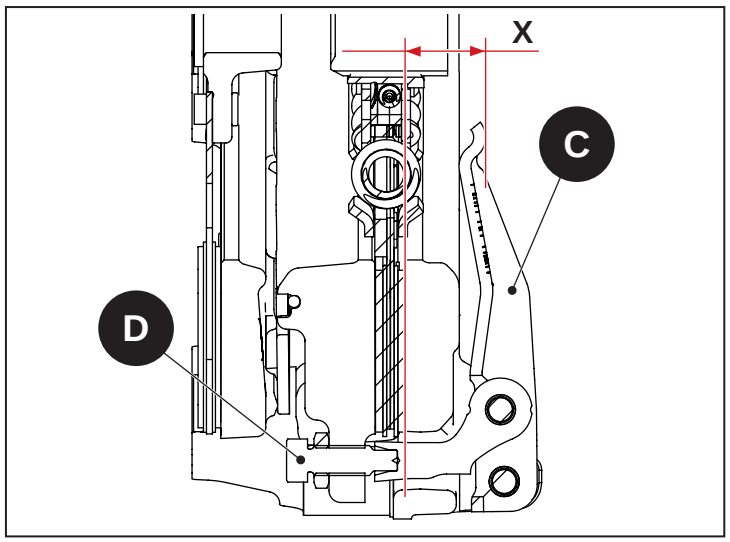


Fig. 3.32

To adjust the PTO clutch correctly, the levers (E) must be adjusted so that dimension Y= 50 mm.

Loosen or tighten the nuts (F) until dimension Y= 50 mm.

Once the adjustments have been made, pinch the edge of the nut with a pair of locking pliers and mark it with colour.

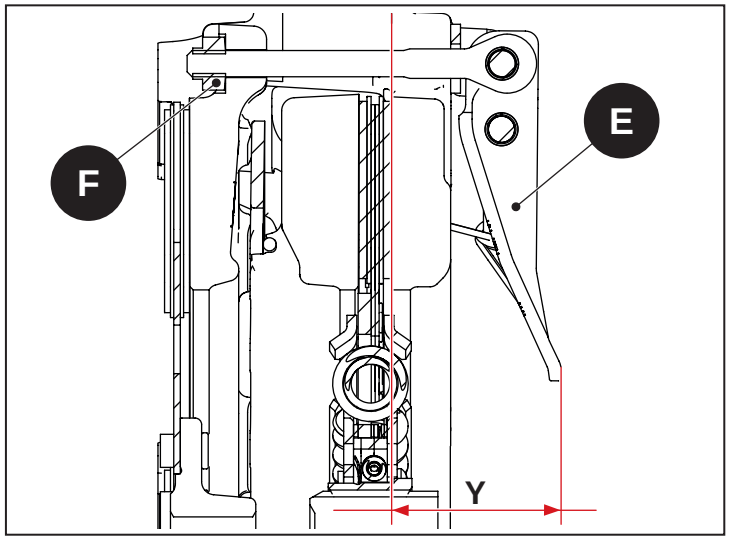


Fig. 3.33

Check that the maximum play between the clutch pressure plate and clutch body is within the optimal values.

Measure dimension A and dimension B.

Calculate the play X using the formula X=A-B.

The value of X must be 0.3 to 0.8 mm.

Take these measurements on both clutch assemblies.

Warning

Replace the assembly if X dimension is not within the limits.

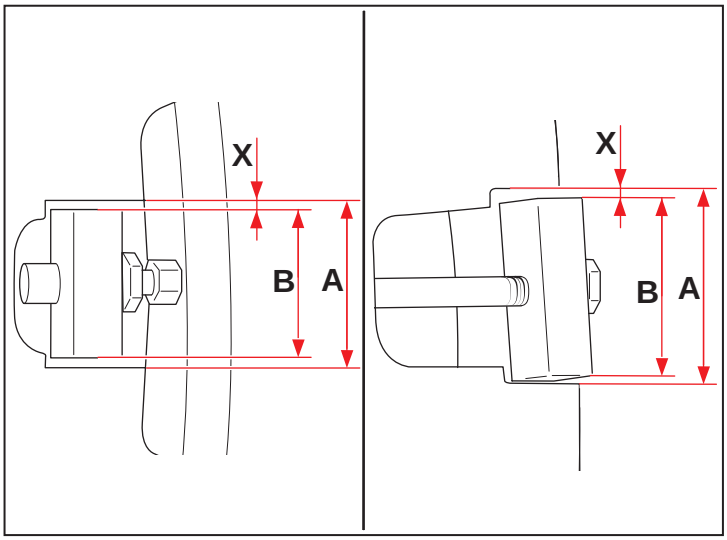


Fig. 3.34

Re-assembly of the clutch unit

Use a plug of a suitable diameter and insert the roller cage (44) into the sleeve guide cover.

Apply a layer of sealant to the outer perimeter of the oil retainer (45) and, using a plug of a suitable diameter, fit it into the sleeve guide cover.

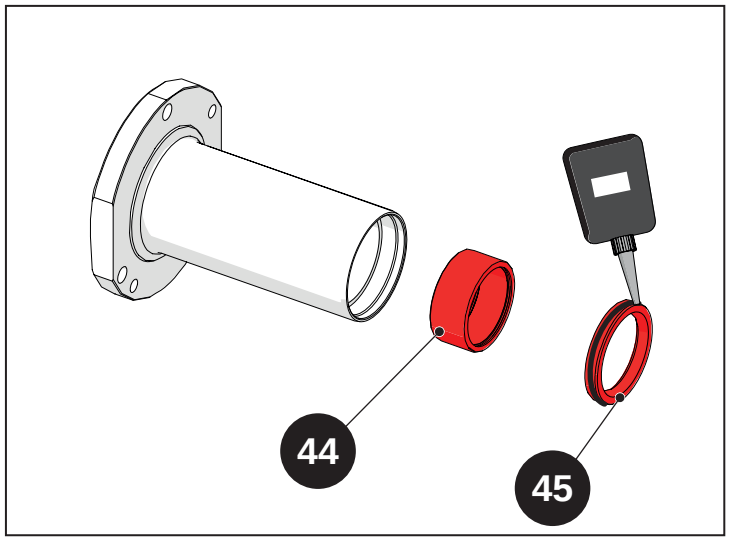


Fig. 3.35

Use a plug of a suitable diameter and insert the bearing (41) onto the sleeve (40).

Use a plug of a suitable diameter and insert the bearing (39) onto the sleeve (38).

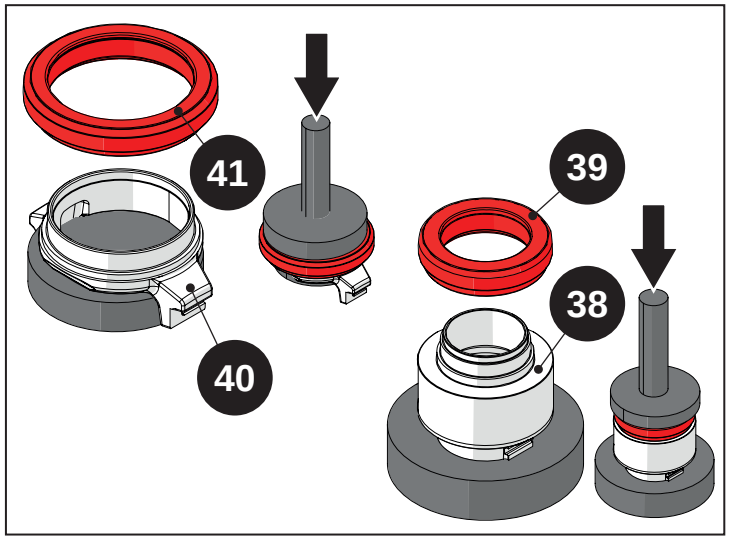


Fig. 3.36

Insert the levers of the transmission clutch (36) and PTO clutch (37), complete with rods, levers and springs.

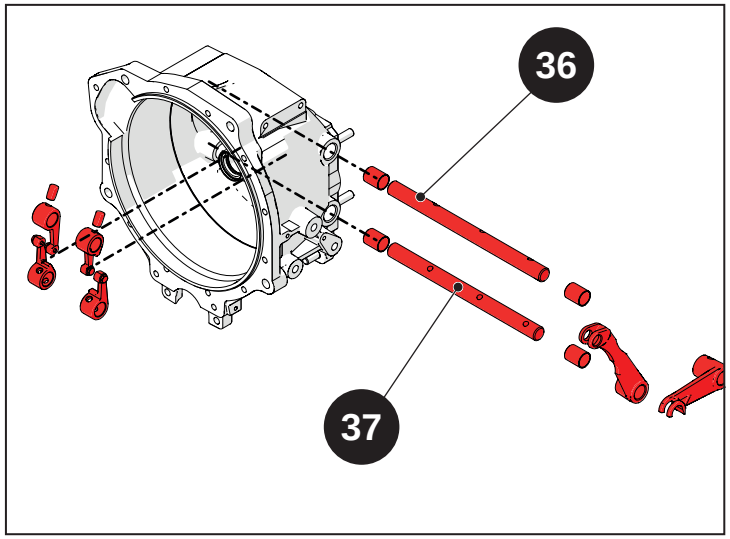


Fig. 3.37

Insert tool (B-07007171) and lift the clutch assembly using lifting equipment.

Fasten the clutch assembly onto the engine by tightening the screws 40 Nm (4 kgm).

Warning
Replace the M8 screws whenever the unit is reassembled.

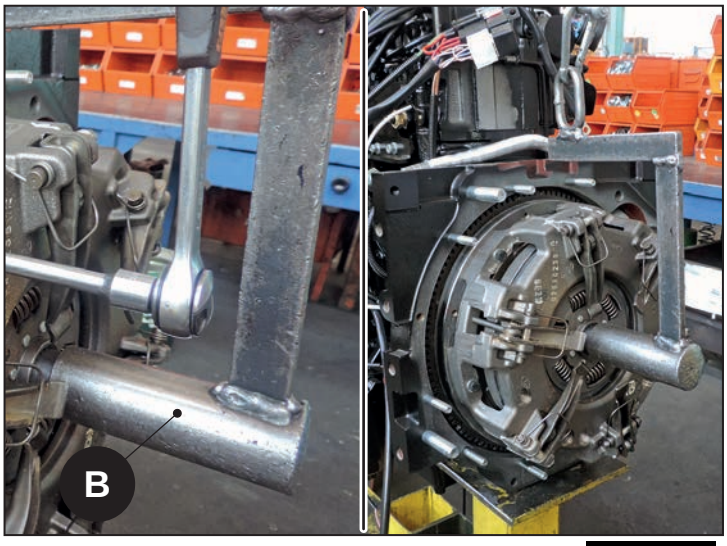


Fig. 3.38

Line up the units.

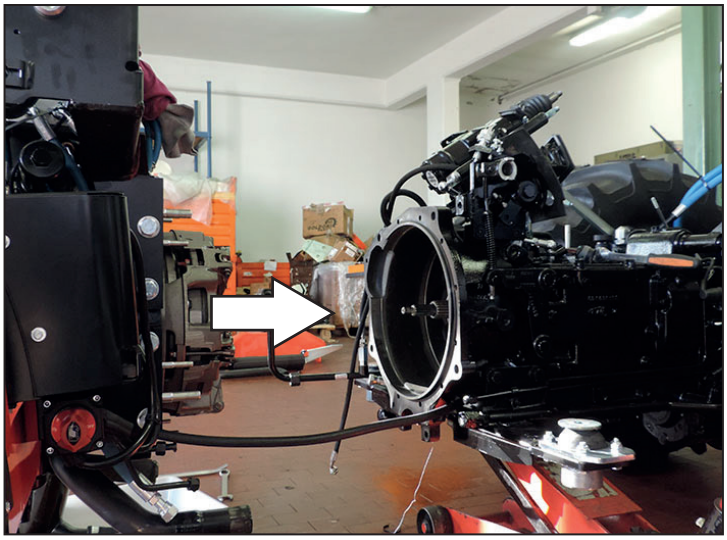


Fig. 3.39

Tighten the screws and nuts that fasten the clutch bowl to the engine. Apply the following tightening torque values:

M10 = 50 Nm (5 kgm)

M16 = 212 Nm (21.2 kgm)

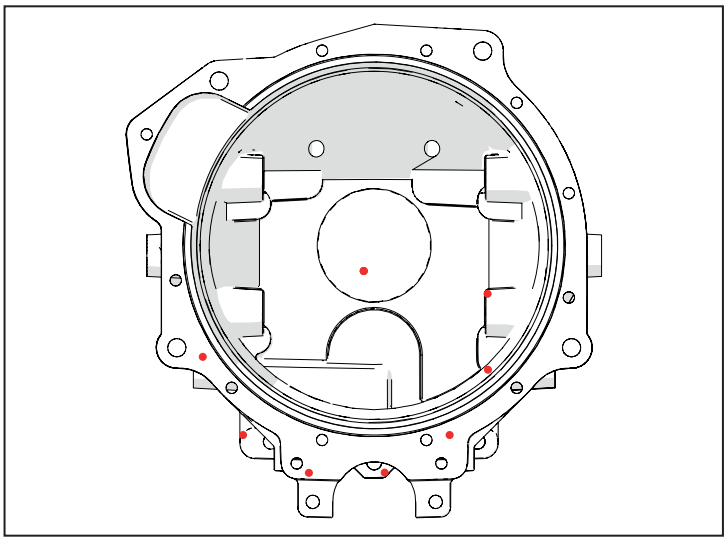


Fig. 3.40

Proceed with the re-assembly operations by working through the disassembly instructions in reverse order.

Clutch pedal adjustment

Clutch pedal travel must be adjusted in order to engage the transmission clutch properly.

> **Warning**
>
> Completely reassemble the clutch unit on the gearbox and engine before adjusting the clutch pedal.

Use the travel start screw (48) and travel end screw (49) to adjust pedal travel.

> **Note**
>
> Remove the left-hand case to access the clutch pedal end of travel screws (see chapter "13-Platform").

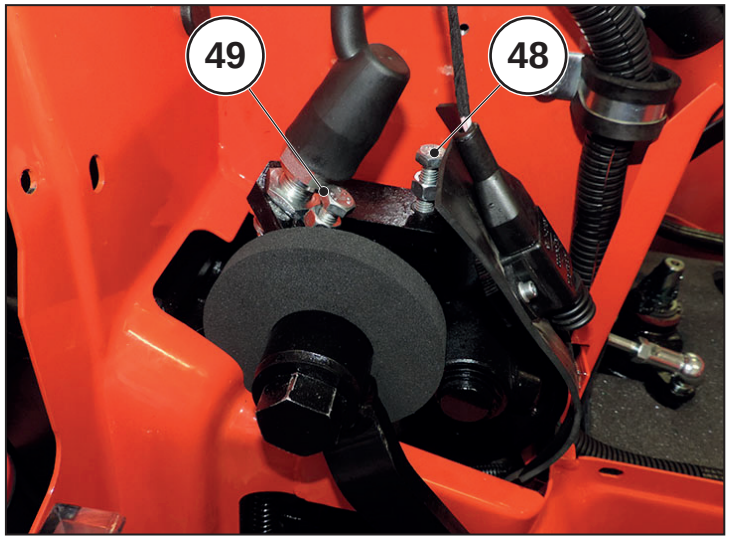


Fig. 3.41

> **Caution**
>
> After having joined the basic assembly and before re-assembling the platform, make sure that the clutch functions correctly by depressing the pedal and driving the machine with the fourth gear engaged. Also check the operation of the PTO clutch by engaging the PTO and moving the rear shaft by hand.

Pedal free (A)	195 mm
Start of pedal travel (B)	220 mm
End of pedal travel (C)	360 mm

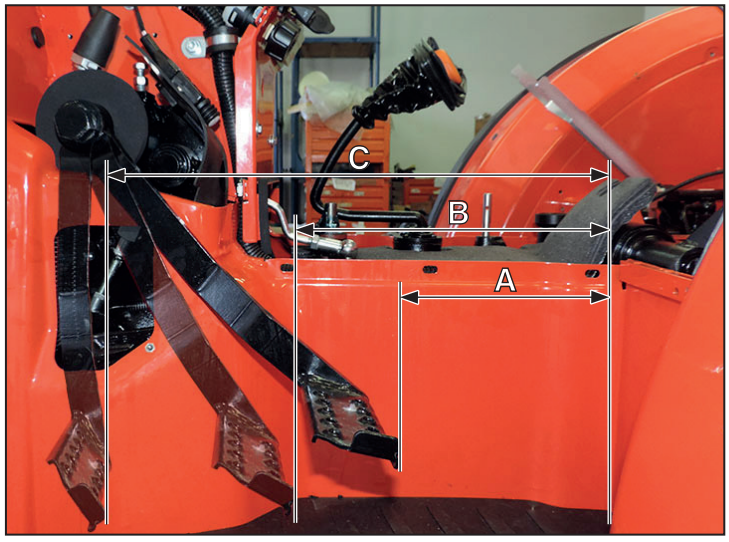


Fig. 3.42

Section 6 : Tightening torques

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6.1 Tightening torques.....3-28

6.1 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	Nm	kgm
M8x90 screw that fastens clutch to flywheel	40	4
M10x12.5 nut that fastens engine flange to clutch bowl	60	6
M8x20 screw that fastens main shaft sleeve	35	3.5
M12x35 screw that fastens dashboard support	80	8
M10x140 screw that fastens engine flange - clutch bowl	80	8

Section 7 : Tools required

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7.1 Tools required 3-30

7.1 Tools required

Code	Description	Quantity
07000226	Clutch dowel pin 1616	1
07000245	Tractor splitting support	1
07007171	STAR clutch plate dowel pin	1

Chapter 4 : Gearbox

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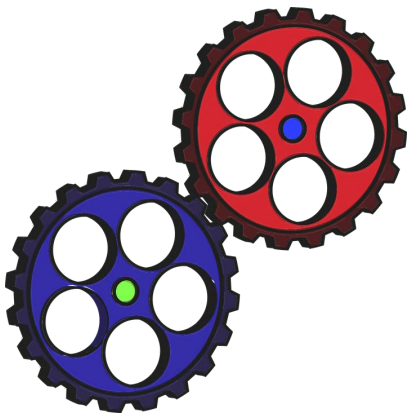
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Section 1 : Safety notes

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 the sharp edges around the top of the transmission housing.

Caution

Used oil must be collected and disposed of in compliance with the anti-pollution laws in force.

Section 2 : General introduction

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2.1 Drawing of the assembly

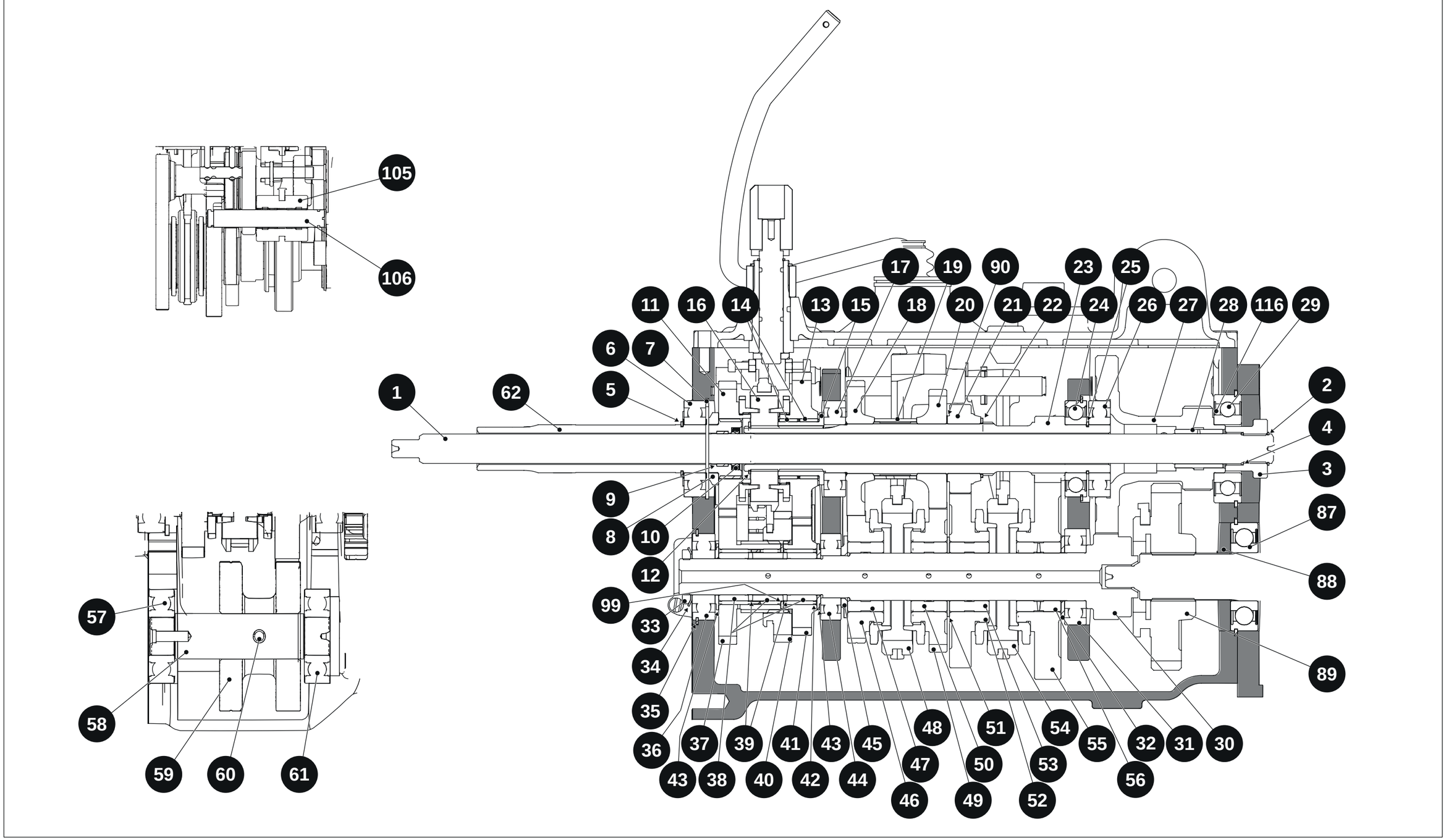


Fig. 4.1

1 - P.T.O. drive shaft
2 - Circlip
3 - P.T.O gear
4 - Spring ring
5 - Circlip
6 - Bearing
7 - Circlip
8 - Drive shaft spacer
9 - Rod guiding ring
10 - Oil retainer
11 - 8+8 gear
12 - Circlip
13 - 16+8 gear
14 - Roller cage
15 - Keyed bushing
16 - Synchromesh
17 - Bearing
18 - 4th speed gear
19 - Spacer
20 - 3rd speed gear
21 - 2nd speed gear
22 - Circlip
23 - Shaft
24 - Bearing
25 - Circlip
26 - Bearing
27 - Gear
28 - Bushing
29 - Bearing
30 - Layshaft
31 - Bearing
32 - Spacer
33 - Ring nut
34 - Safety washer
35 - Circlip
36 - Bearing
37 - Driven gear
38 - Roller cage
39 - Spacer
40 - Reverse shuttle gear
41 - Driving gear
42 - Bush
43 - Spacer
44 - Bearing
45 - Spacer
46 - 4-8 gear
47 - Bush
48 - Synchromesh
49 - 3-7 gear
50 - Bush
51 - Spacer
52 - 2-6 gear
53 - Bush
54 - Synchromesh
55 - 1-5 driven gear
56 - Bush
57 - Bearing
58 - Reverse shuttle shaft
59 - Reverse shuttle double gear
60 - Spring pin
61 - Bearing
62 - Gearbox front drive shaft
87 - Bearing
88 - Spacer
89 - Driving gear
90 - Spacer
99 - Spacer
105 - Reverse gear
106 - Reverse shaft
116 - Spacer

Section 3 : Technical specifications

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3.1 Technical specifications 4-8

3.1 Technical specifications

Type	Dual Power 16+8/8+8 synchronized
Operating mechanism	Mechanical with side levers

Section 4 : Disassembly

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4.1 Preliminary operations 4-10

4.2 Gearbox disassembly 4-11

4.1 Preliminary operations

Comply with the following instructions to access the gearbox unit:

1 - Remove the platform (see chapter "13- Platform")

Remove the cab (see chapter "14- Cab")

2 - Split the Clutch/Gearbox (see chapter "3- Clutch bowl")

3 - Split the Rear differential/Gearbox (see chapter "4- Gearbox")

Fasten the clutch bowl to lifting equipment.

Unscrew the nuts (117) and remove the washers (118) that fasten the bowl to the gearbox.

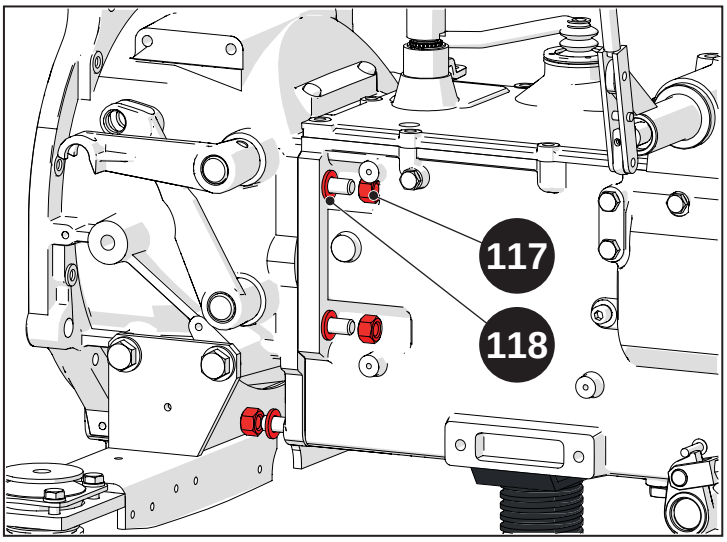


Fig. 4.2

Remove the clutch bowl assembly and recover the paper gasket (119).

Note
The paper gasket (119) keeps the heat produced by the clutch away from the gearbox assembly.

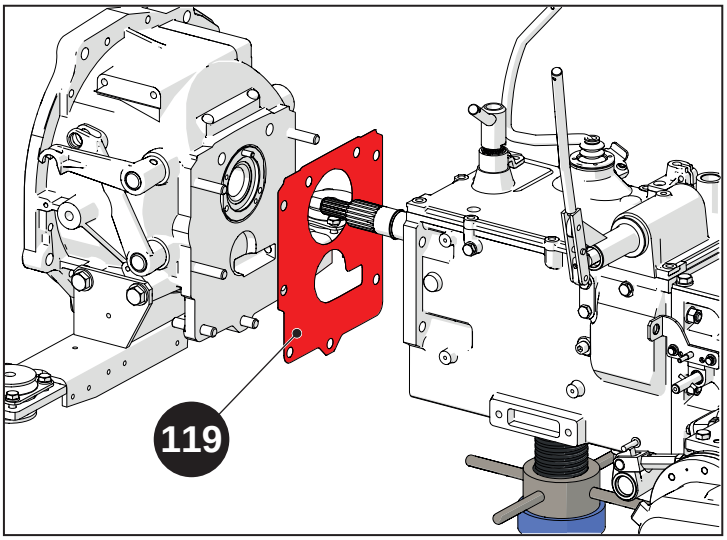


Fig. 4.3

4.2 Gearbox disassembly

Unscrew the screws (107) and washers (108) that fasten the cover.

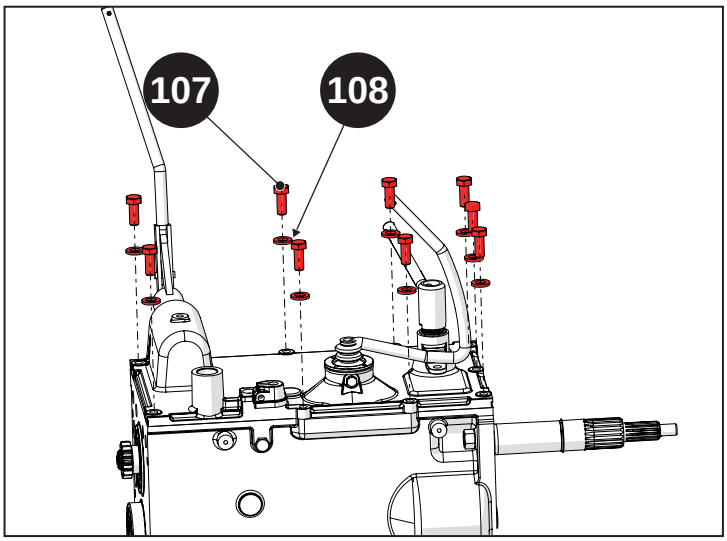


Fig. 4.4

Remove the complete cover (109).

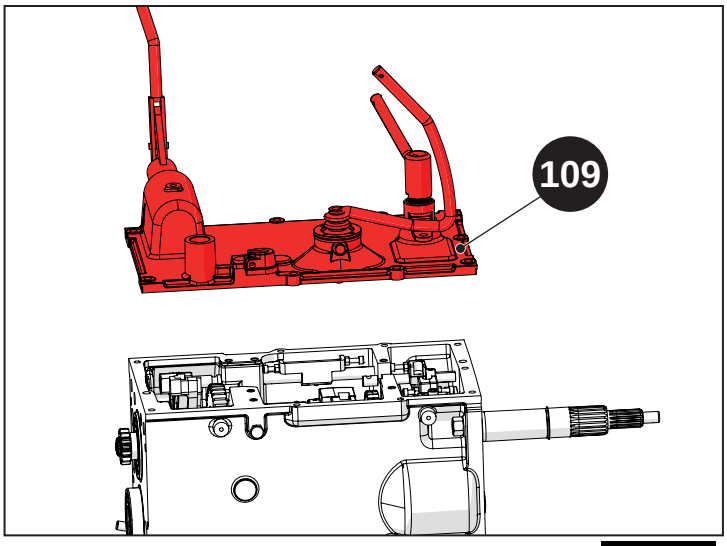


Fig. 4.5

Remove the springs (110) and balls (111).

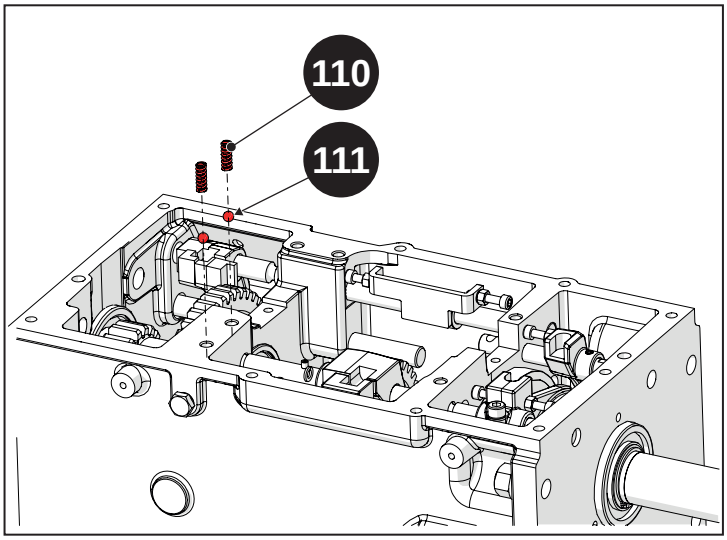


Fig. 4.6

Unscrew the screws (114) and remove washers (115) and sleeve (113).

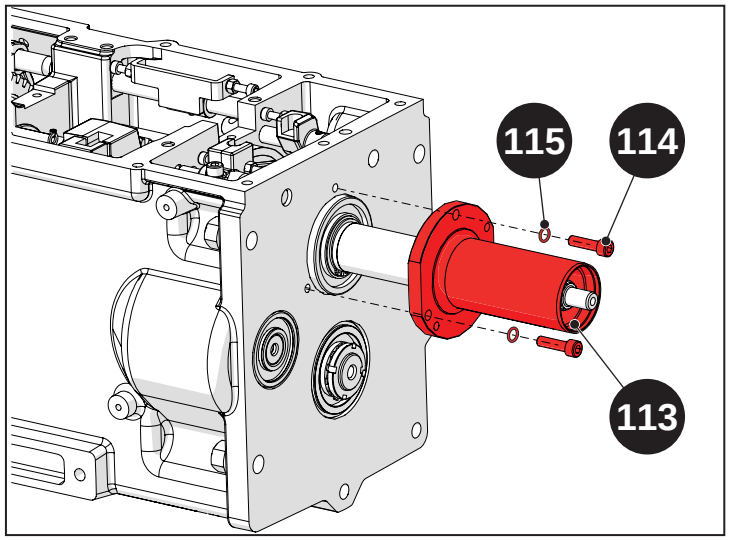


Fig. 4.7

Remove the front drive shaft (62) complete with bearing (6), circlip (5) and spacer (8).

Remove the circlip (7).

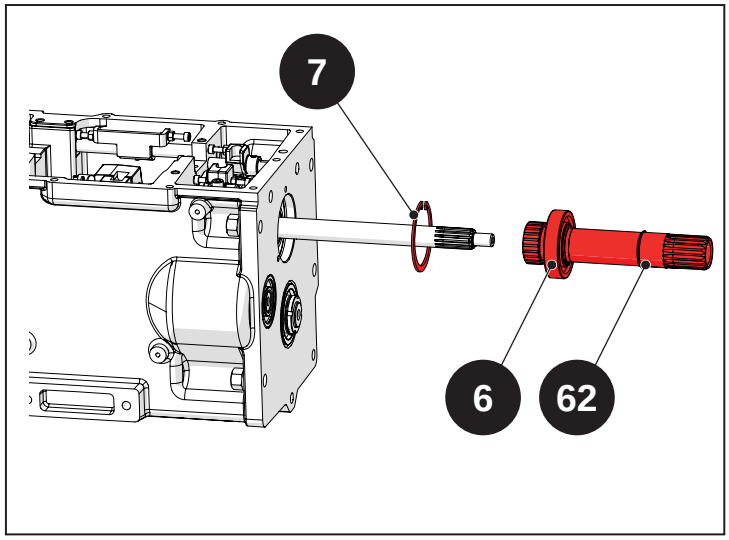


Fig. 4.8

Remove the P.T.O. drive shaft (1) along with the gear (3), spring ring (4) and circlip (2).

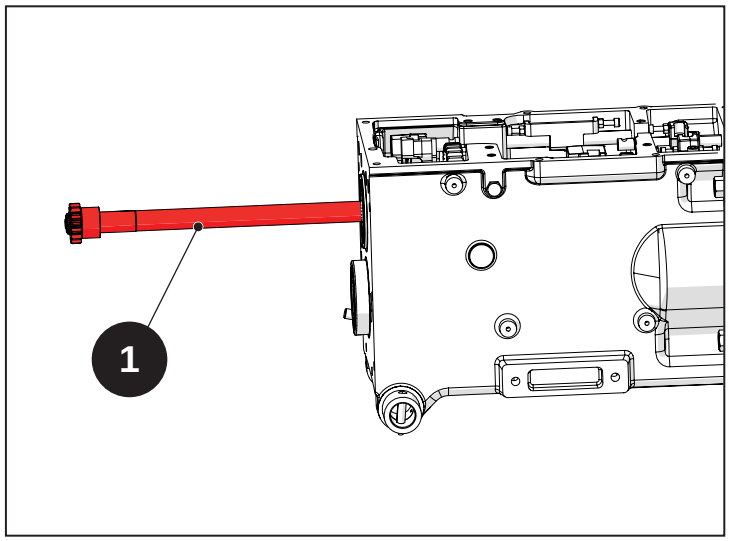


Fig. 4.9

Remove the centring pin (63) and rod (64).

Danger

When removing the rod (64), plug the hole where the spring and selection ball are positioned since they could suddenly spring out in a dangerous way.

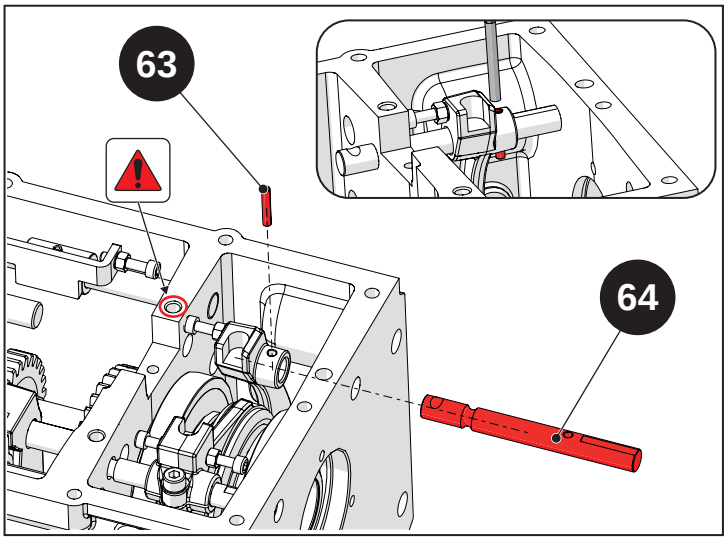


Fig. 4.10

Remove the spring (65) and ball (66).

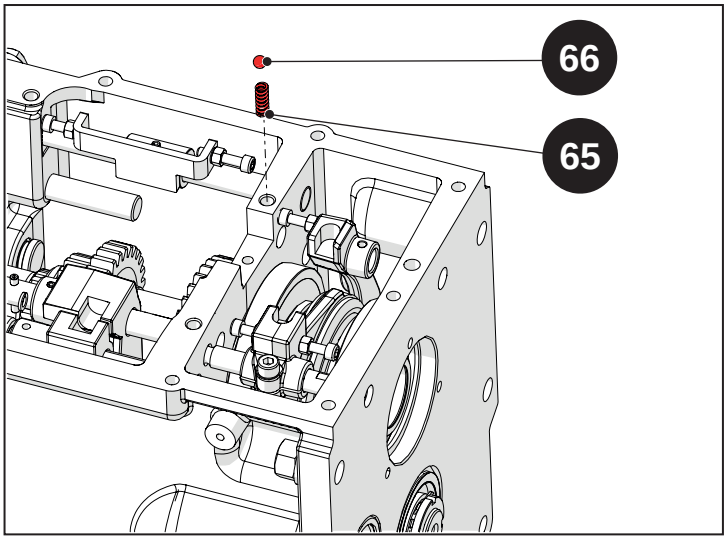


Fig. 4.11

Unscrew the plug (67), washer (68) and then the retainer (69).

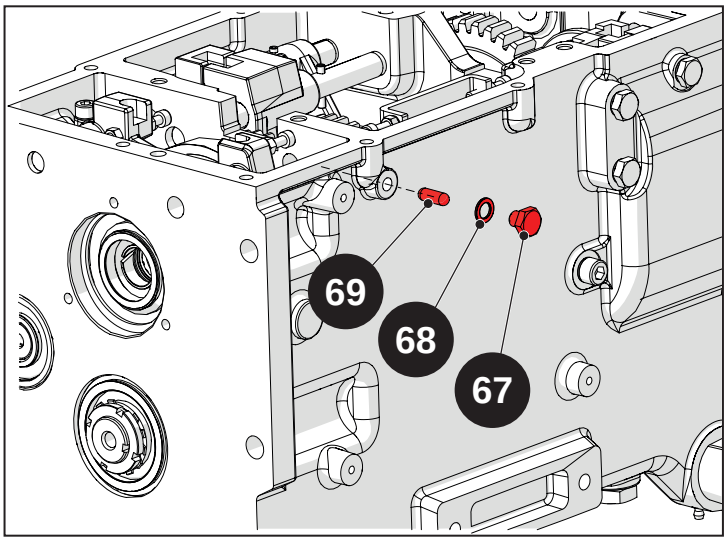


Fig. 4.12

Remove the fork (70).

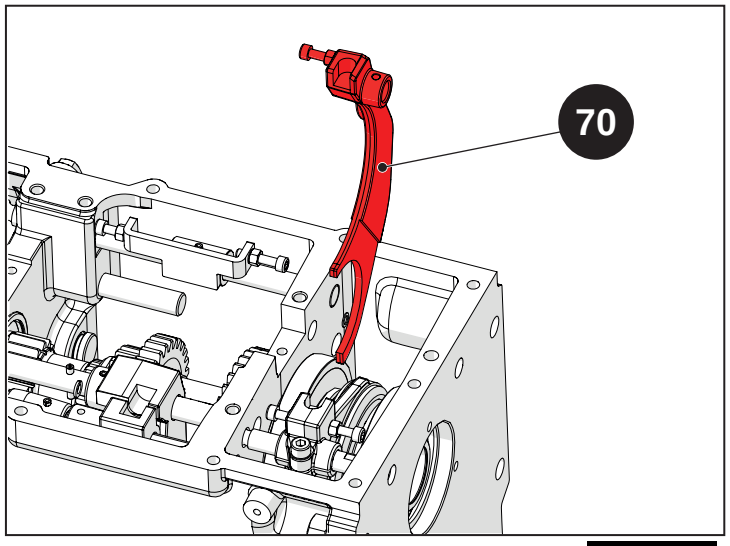


Fig. 4.13

Remove the rod (71).

Danger

When removing the rod (71), plug the hole where the spring and selection ball are positioned since they could suddenly spring out in a dangerous way.

Remove the spring (100) and ball (101).

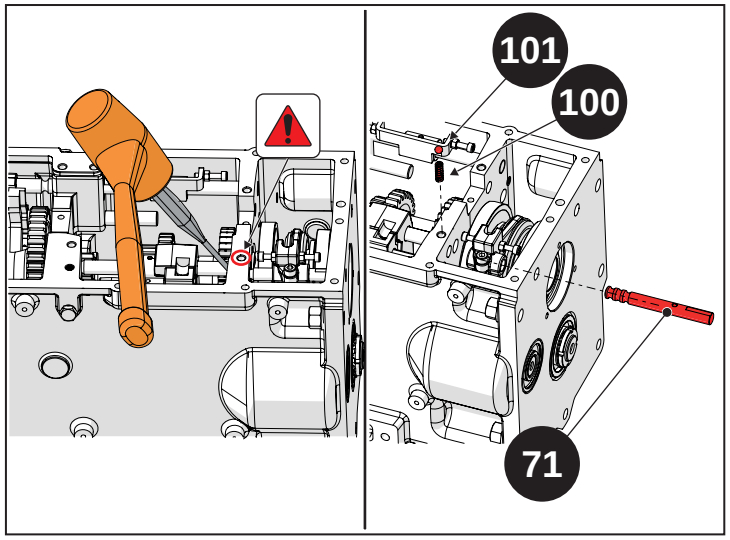


Fig. 4.14

Remove the fork (72).

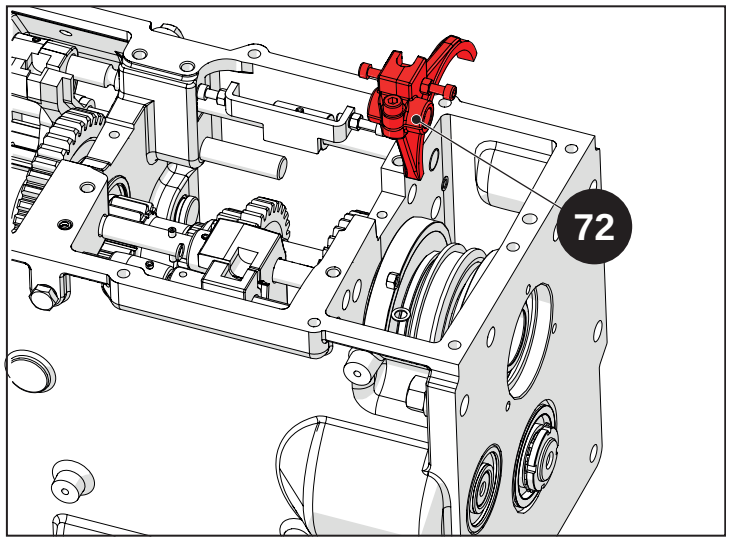


Fig. 4.15

Remove the 2 fixing pins (73) and (74).

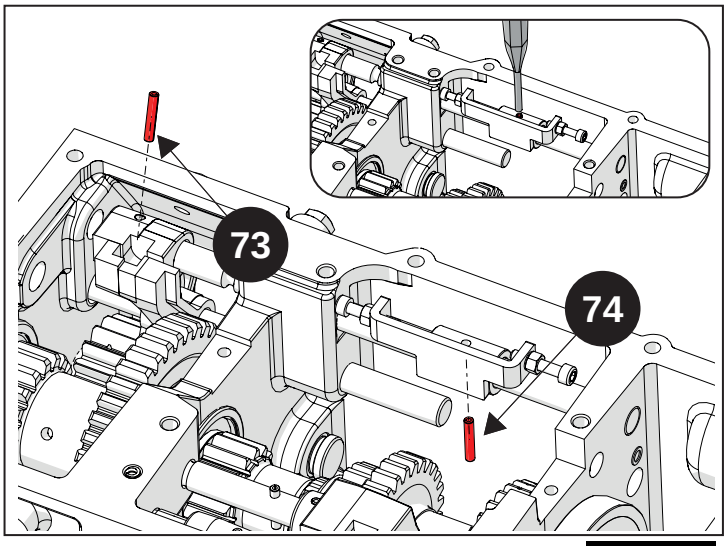


Fig. 4.16

Lock the selection rod (75) in place then move it towards the front so as to release and remove it.

Warning

Make sure that the gear (89) is in neutral.

Danger

When removing the rod (64), plug the hole where the spring and selection ball are positioned since they could suddenly spring out in a dangerous way.

Remove the selection rod (75) and the adjuster block (76).

Remove the ball (77), spring (78) and the second ball (79).

Remove the retainer (80).

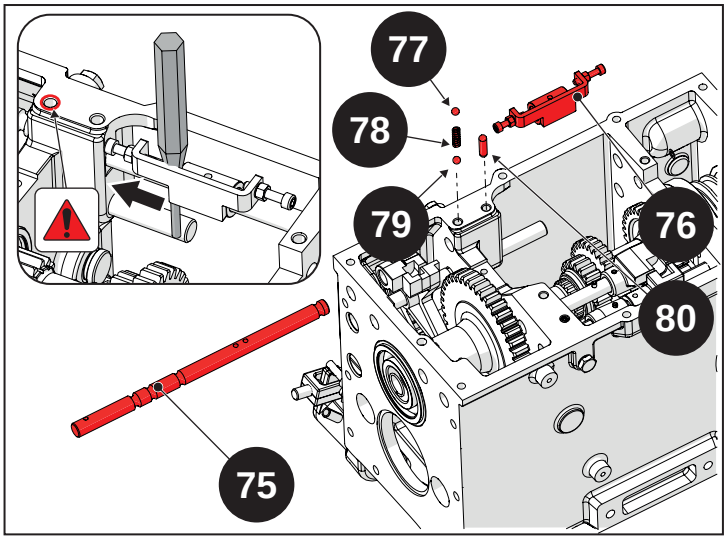


Fig. 4.17

Remove the locking pin (81).

Tap the rod (82) to release it from the pin (81).

Note

The pin (81) will remain inside the gearbox. Remember to recover it.

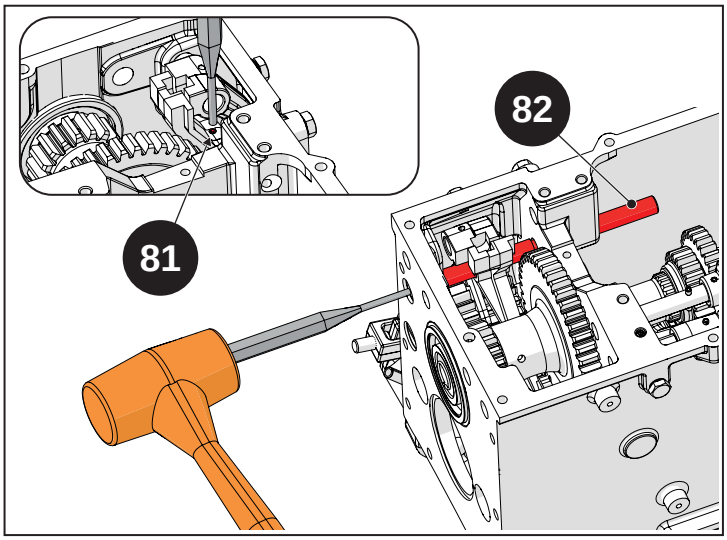


Fig. 4.18

Take out the rod (82) and the reversing fork (83).

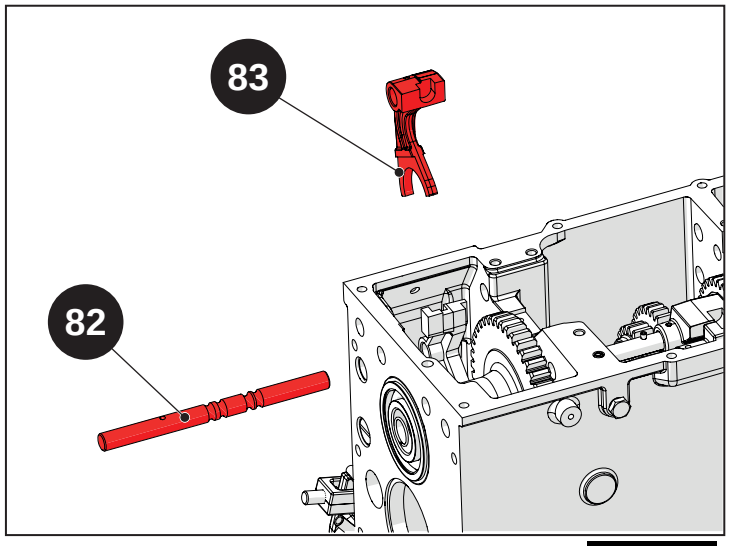


Fig. 4.19

Using a soft mallet, release the gear (27) from its housing and, using a puller, remove the bearing (29) and fork (84).

> **Note**
>
> The gear (27) will remain inside the gearbox during this phase.

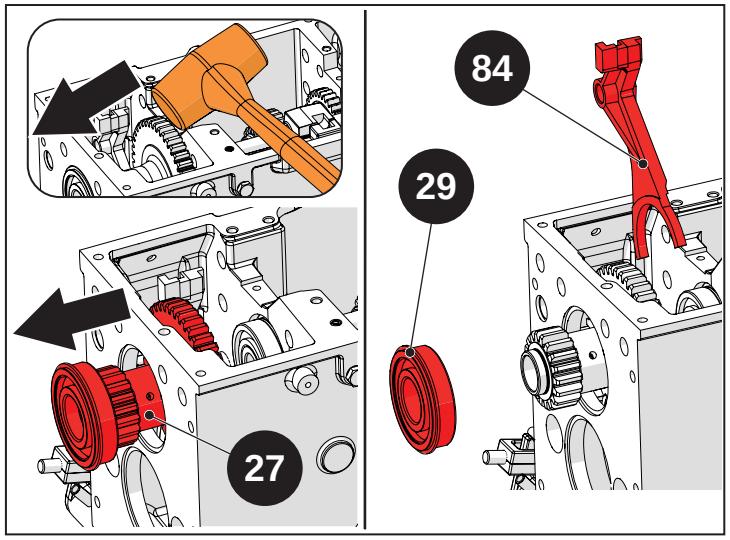


Fig. 4.20

Unscrew the screw (85) and remove washer (86), then take out the reverse shaft (106).

Remove the gear (105) at the same time.

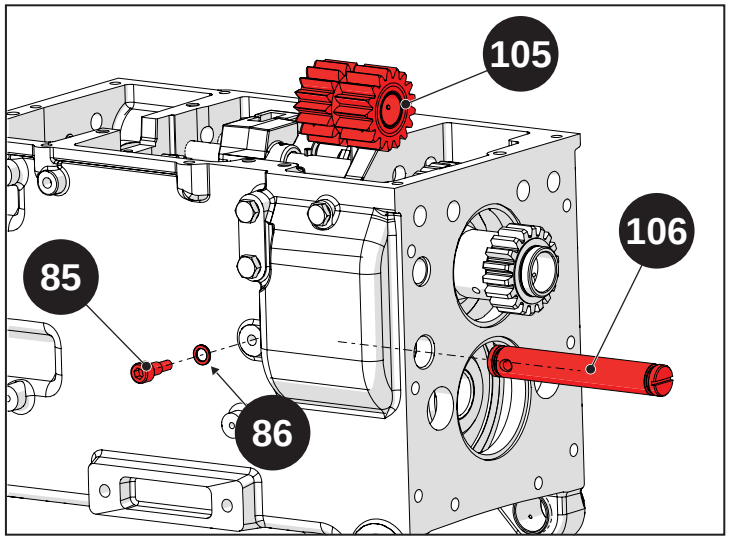


Fig. 4.21

Release and remove the bearing (26).

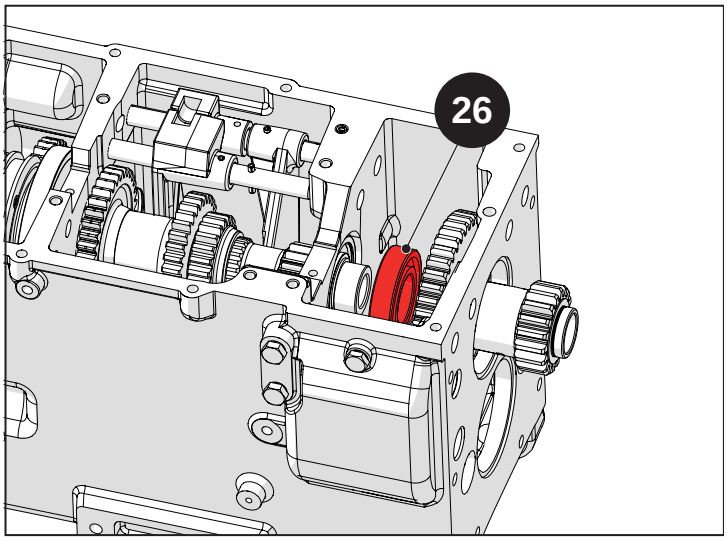


Fig. 4.22

Remove the circlip (25) and then remove the bearing (24).

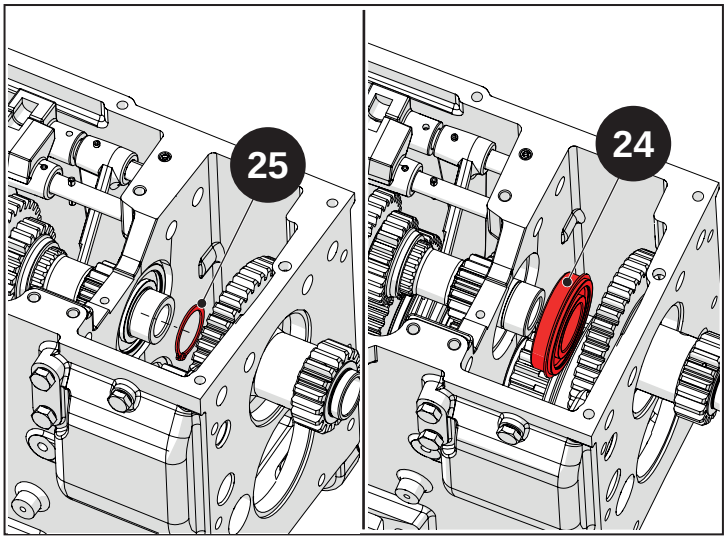


Fig. 4.23

Remove the circlip (12).

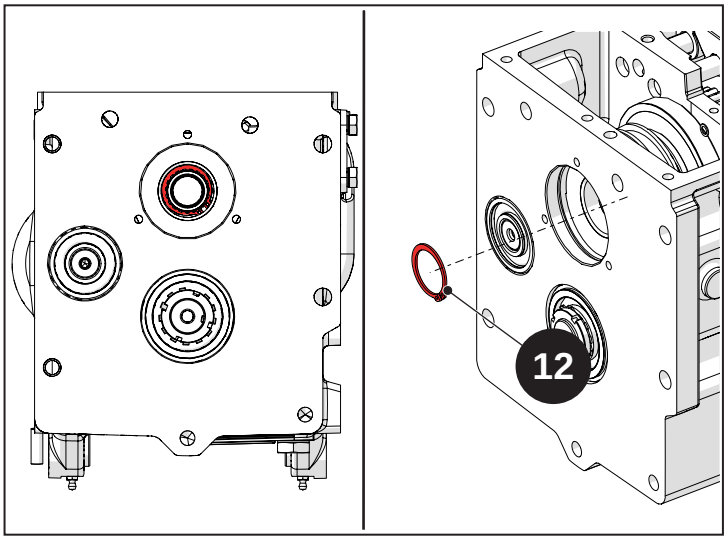


Fig. 4.24

Move the shaft so as to release and turn it.

Turn the shaft so as to remove the circlip (22) from its housing.

Note
It will not be possible to remove the circlip (22) from the shaft during this phase.

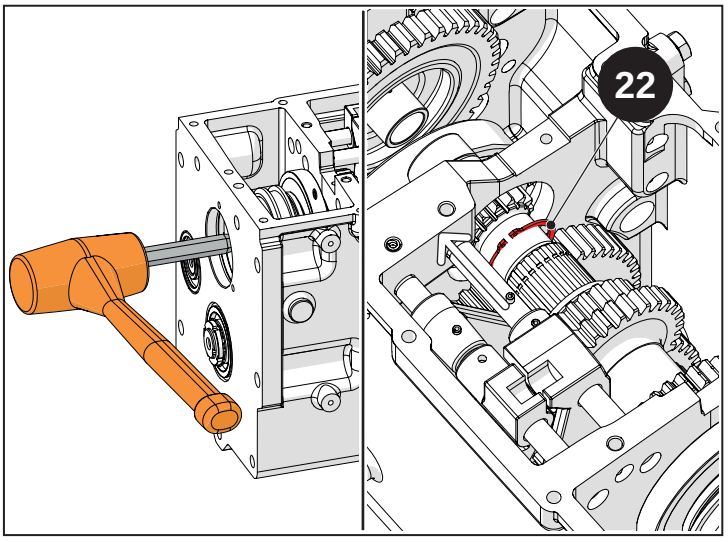


Fig. 4.25

Having done this, it will now be possible to remove the assembly from the gearbox complete with

- 8+8 gear (11);
- Synchromesh (16);
- 16+8 gear (13);
- Keyed bushing (15);
- Roller cage (14);

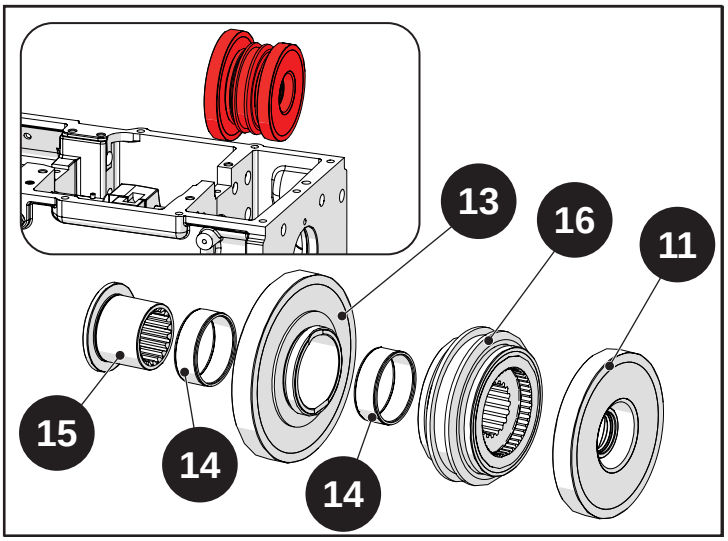


Fig. 4.26

Move the shaft so as to remove the gear (27) complete with bushing (28).

Remove the gear (89).

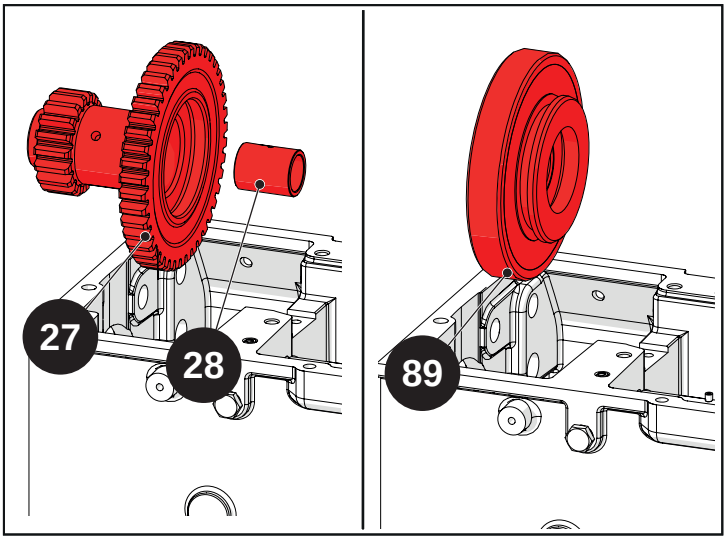


Fig. 4.27

Remove the bearing (17).

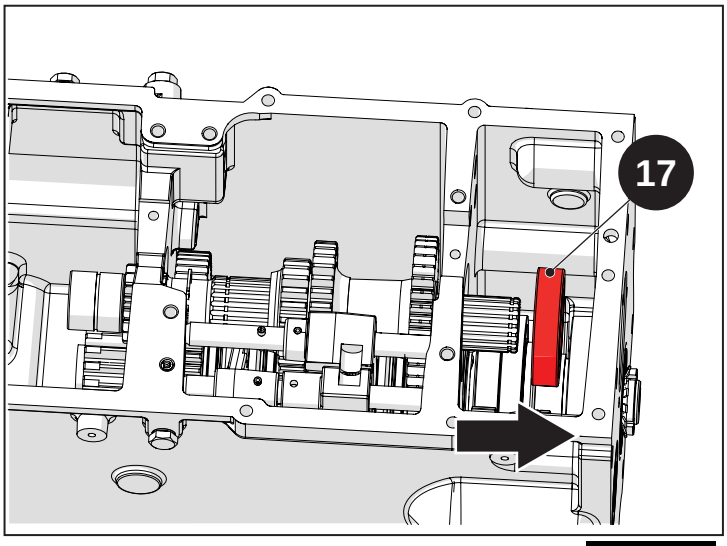


Fig. 4.28

By removing the shaft (23) it will also be possible to move:

- the 4th speed gear (18);
- the spacer (19);
- the 3rd speed gear (20);
- the spacers (90);
- the 2nd speed gear (21);

Note

The circlip (22) can now be removed from the shaft.

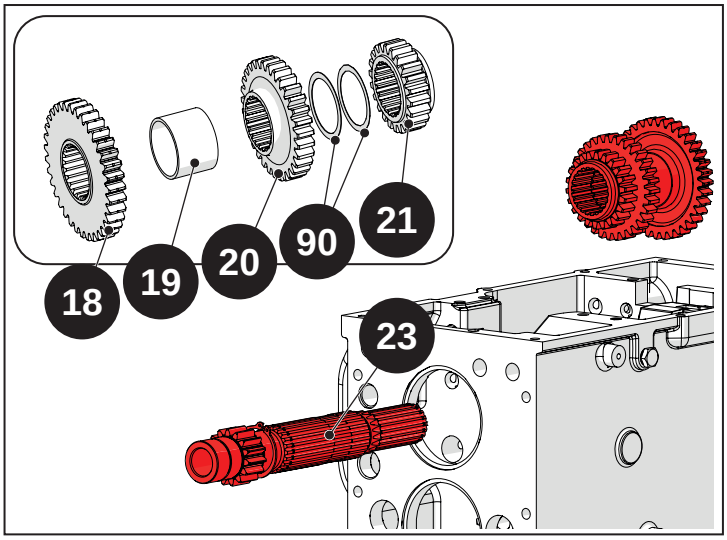


Fig. 4.29

Remove the plug (91), then remove the rod (92) and fork (93).

Unscrew the screw (102), then remove the washer (103) and retainer (104).

Note

The retainer (104) differs from the others since it has a groove at the end.

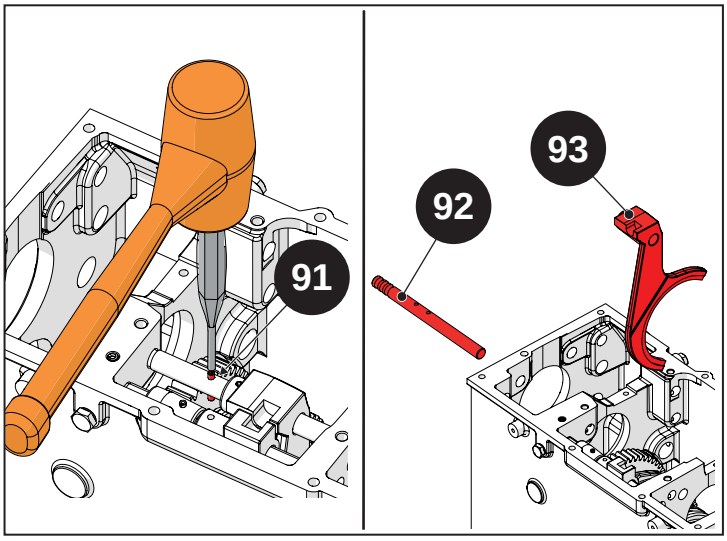


Fig. 4.30

Remove the pins (94) and (95, then remove the rod (96) and sleeve.

Take out the rod (96), sleeve (97) and fork (98).

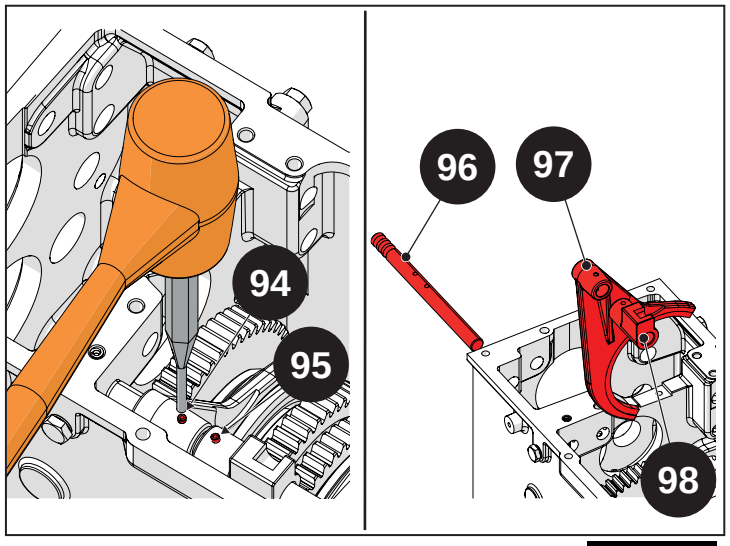


Fig. 4.31

Use tool (A-07007955) to lock the layshaft (30).

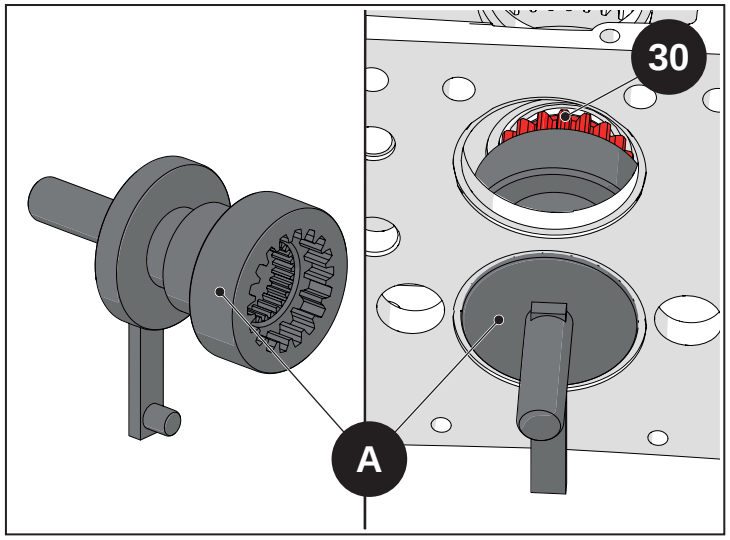


Fig. 4.32

Use tool (B-07000240) to unscrew and remove the ring nut (33).

Remove the safety washer (34).

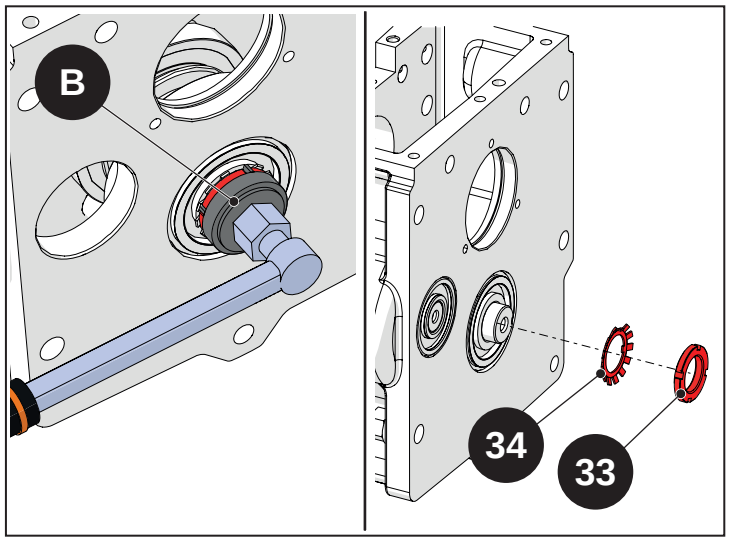


Fig. 4.33

Tap the layshaft (30) so as to remove it from the opposite side along with the bearing (31).

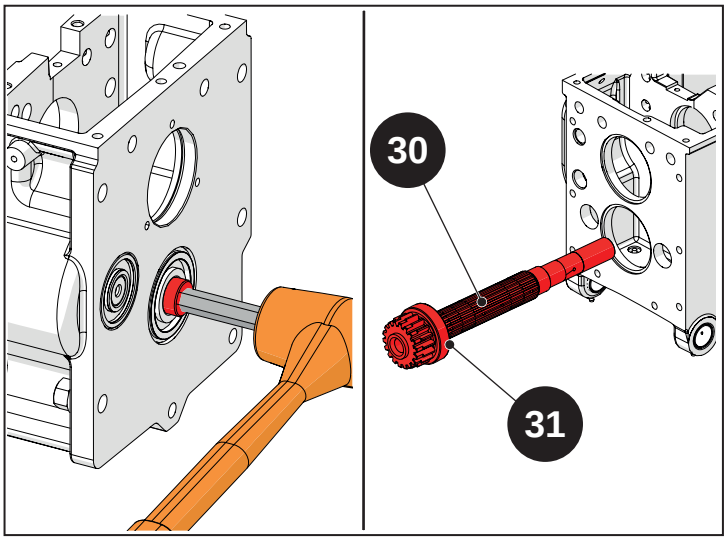


Fig. 4.34

The gear pack can now be removed from the gearbox together with:

- driven gear (37);
- roller cage (38);
- spacers (39);
- reverse shuttle gear (40);
- driving gear (41);
- bush (42);
- spacer (43);
- spacer (99);

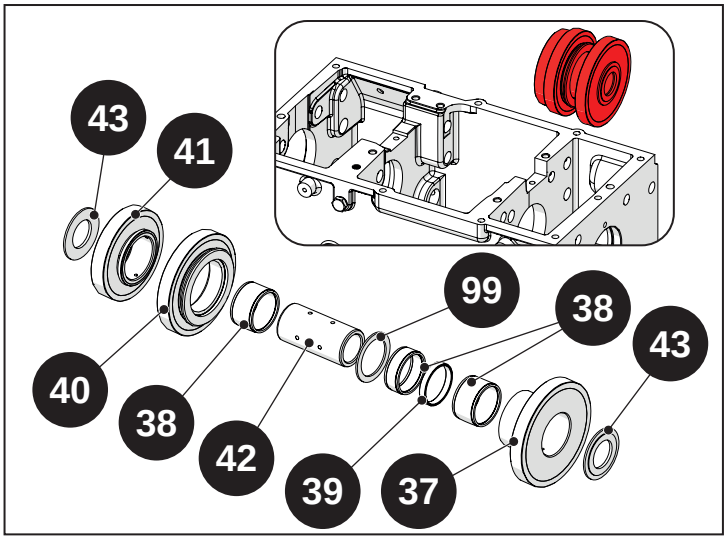


Fig. 4.35

Remove the gear pack from the gearbox together. The pack consists of:

- spacer (45);
- 4-8 gear (46);
- bush (47);
- synchromesh (48);
- 3-7 gear (49);
- bush (50);
- spacer (51);
- 2-6 gear (52);
- bush (53);
- synchromesh (54);
- 1-5 driven gear (55);
- bush (56);
- spacer (32);

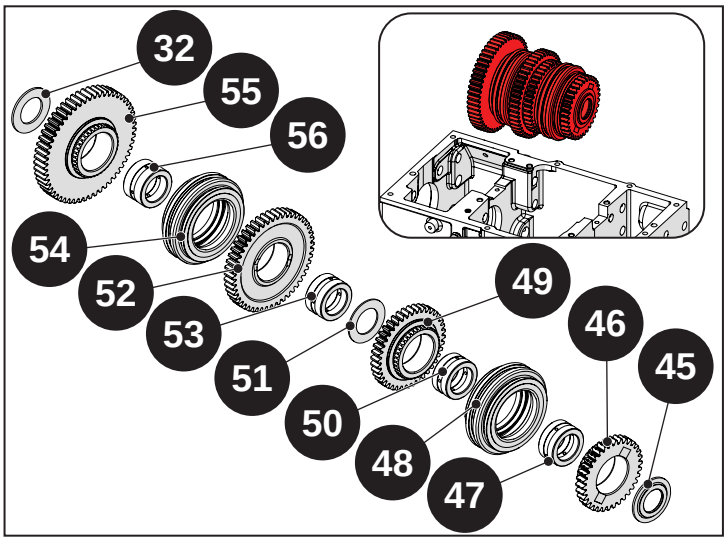


Fig. 4.36

Remove the bearings (36) and (44).

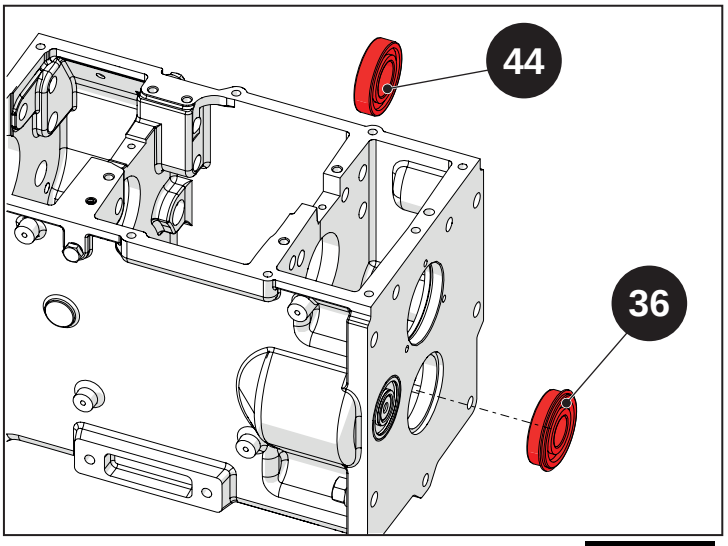


Fig. 4.37

Remove the pin (60).

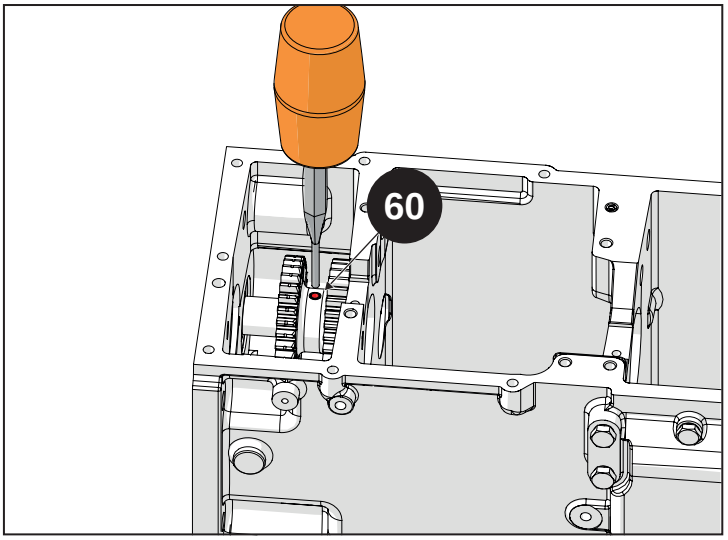


Fig. 4.38

Screw the tool (C-07000306) into the threaded hole of the reverse shuttle shaft (58).

Continue to screw in the tool (B) until the reverse shuttle shaft (58) can be removed along with the bearing (58).

Remove the double gear (59) of the reverse shuttle.

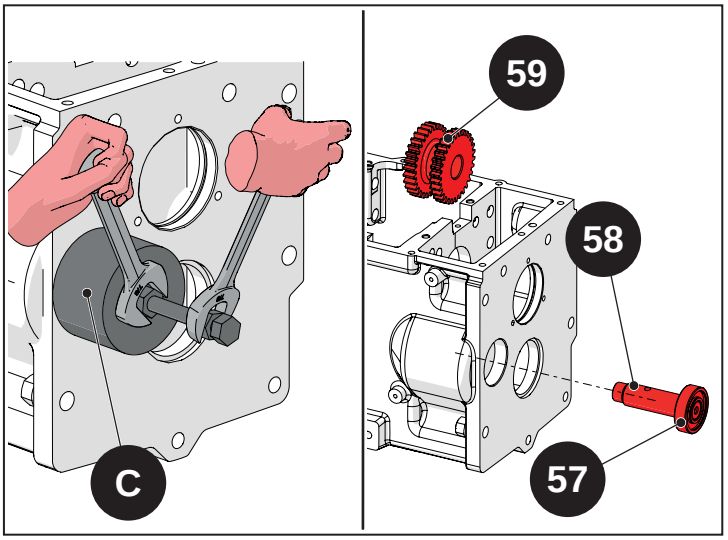


Fig. 4.39

Remove the bearing (61).

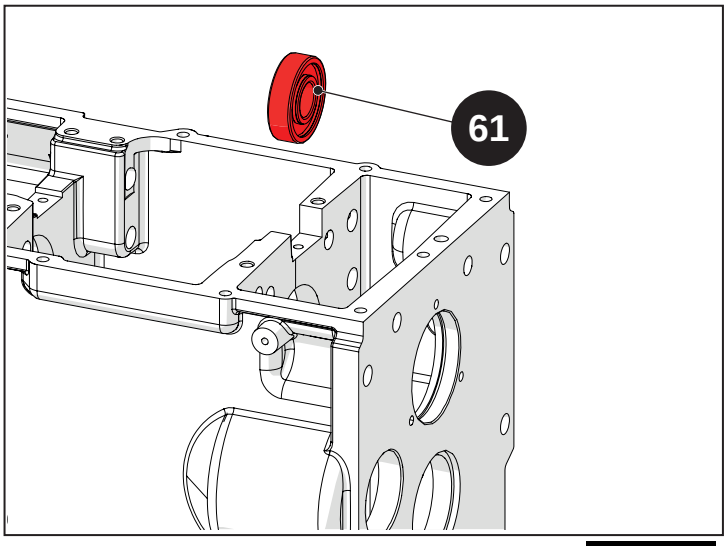


Fig. 4.40

Section 5 : Main inspection, re-assembly and adjustment operations

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5.1 Main inspection, re-assembly and adjustment operations.....4-26

5.1 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.

Use tool (D-07007954) to lock the synchromeshes and to insert the 2 complete gear packs. make sure that you do not disassemble them unintentionally.

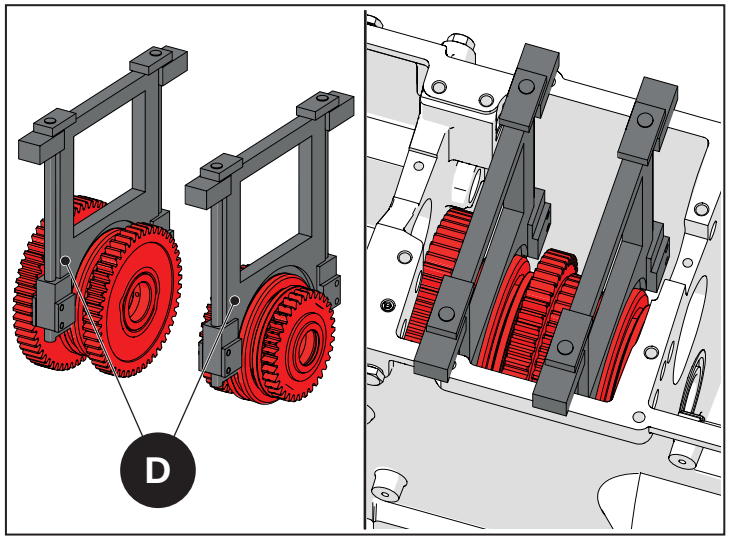


Fig. 4.41

Use tool (E-07007957) to insert the spacer (51) between the two gear packs and make sure that you do not drop it.

Warning

Make sure that the spacer is installed in the right direction (51).

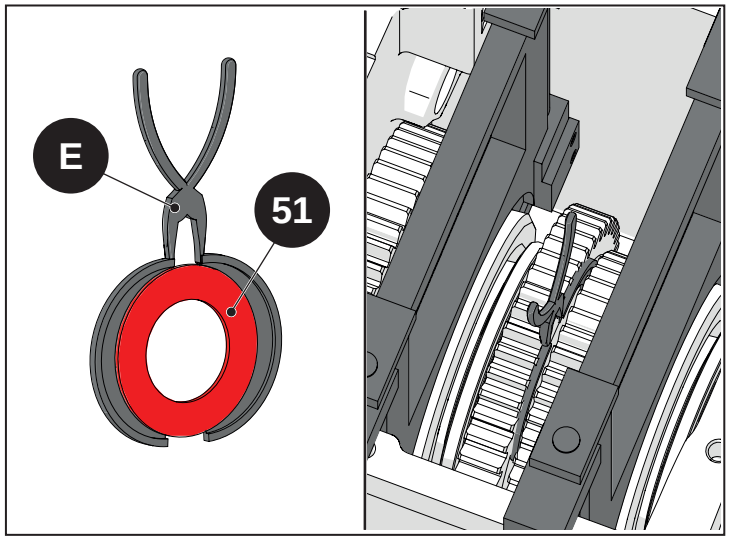


Fig. 4.42

Insert the shaft (30) complete with bearing (31) and spacer (32).

Use tool (F-07007956) to make it easier to insert the shaft (30) into the gearbox.

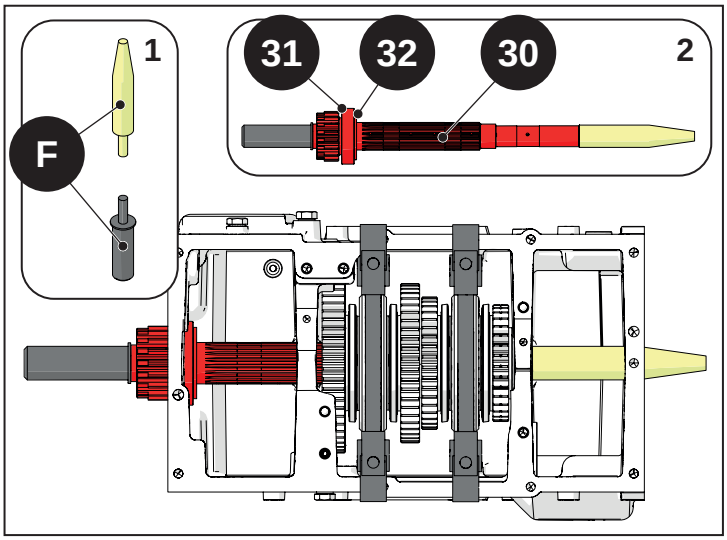


Fig. 4.43

Insert the spacer (45) and bearing (44).

> **Warning**
>
> Make sure that the spacer is installed in the right direction (45).
>
> The relieved part must point towards the bearing to facilitate lubrication.
>
> Use a plug of an adequate diameter to completely seat the bearing (44).

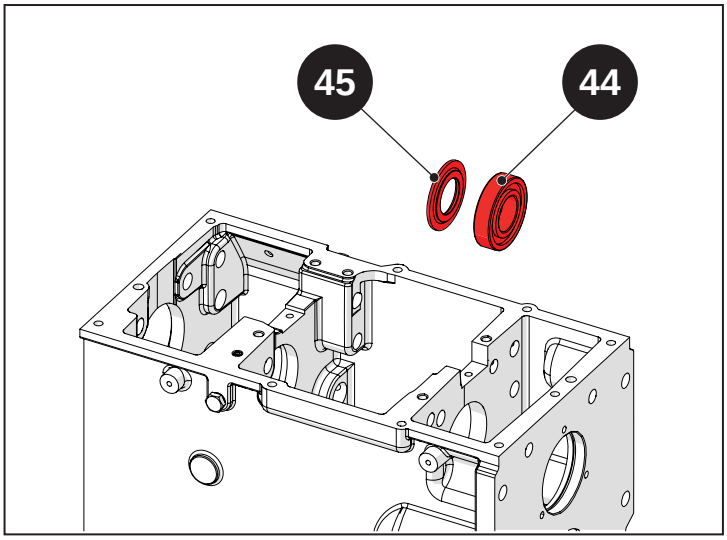


Fig. 4.44

Tools (D) and (E) can be removed after the gears have been mounted on the shaft (30).

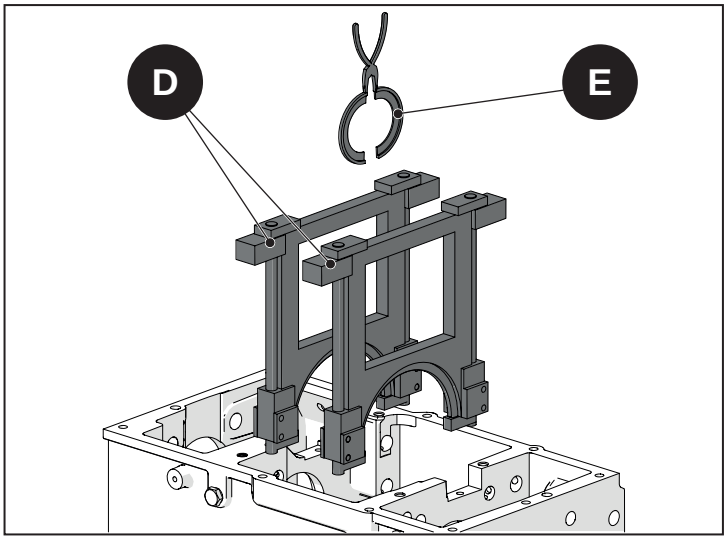


Fig. 4.45

Insert the complete gear pack into the gearbox and align the joint with the shaft (30).

The gear pack includes:

- driven gear (37);
- roller cage (38);
- spacers (39);
- reverse shuttle gear (40);
- driving gear (41);
- bush (42);
- spacer (43);
- spacer (99);

Warning

Make sure that the spacers are installed in the right direction (43).

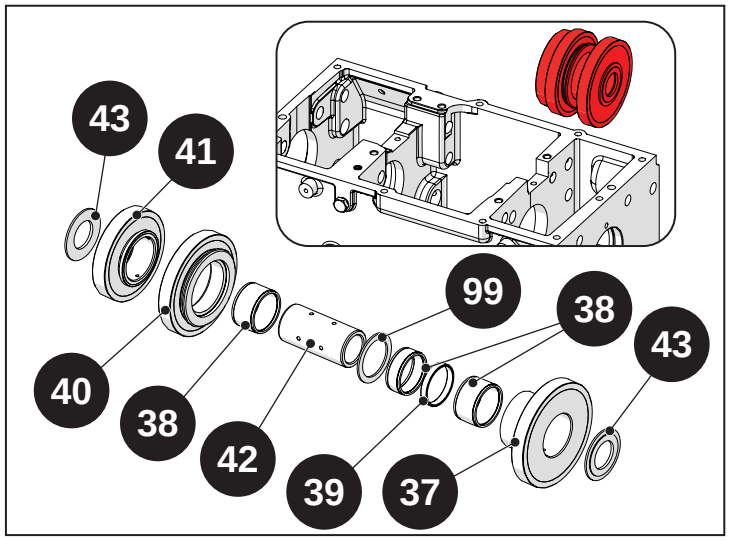


Fig. 4.46

Use a mallet and a plug of a suitable diameter to tap the shaft (30) and fully seat it together with the bearing (31).

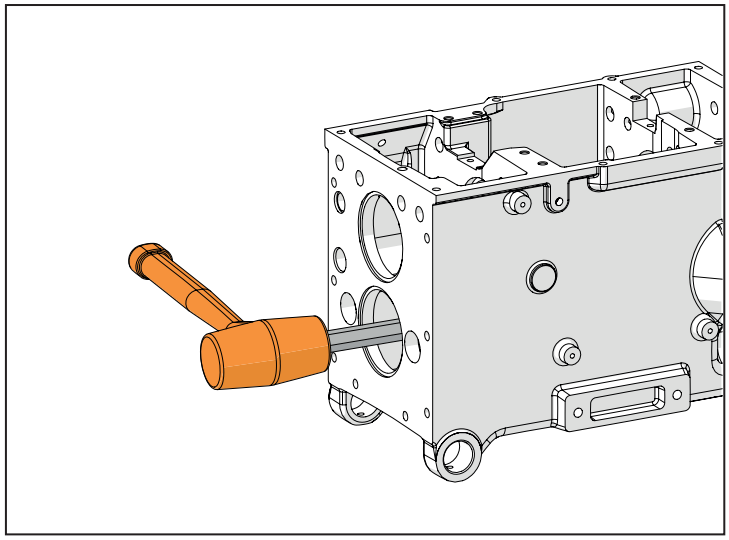


Fig. 4.47

Screw tool (G-07007953) onto the shaft (30) so as to hold it in place and prevent it from slipping out of its seat when the bearing (36) is reassembled.

Use a plug of a suitable diameter to fully insert the bearing (36).

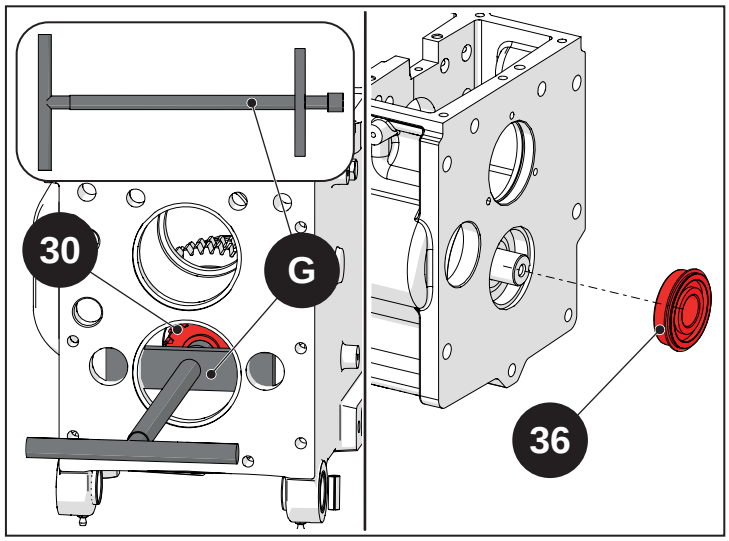


Fig. 4.48

Remove the tool (G).

Use tool (A-07007955) to lock the layshaft (30).

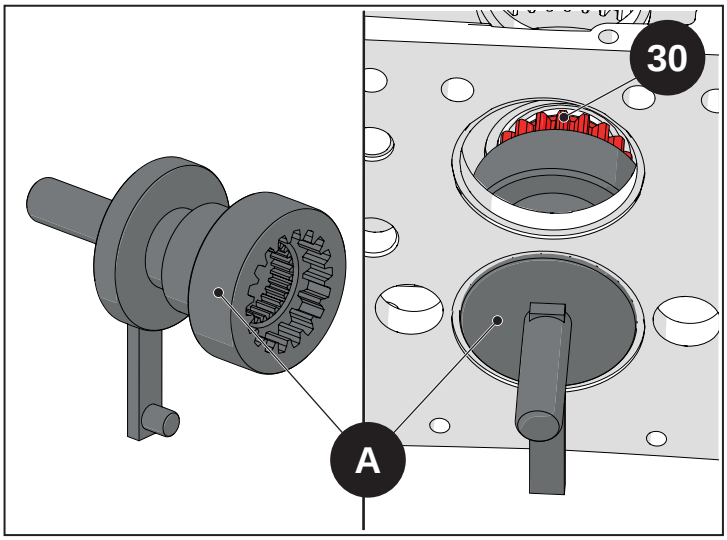


Fig. 4.49

Insert the safety washer (34) and ring nut (33).

Use tool (B-07000240) to tighten the ring nut (33). Apply 100 Nm tightening torque

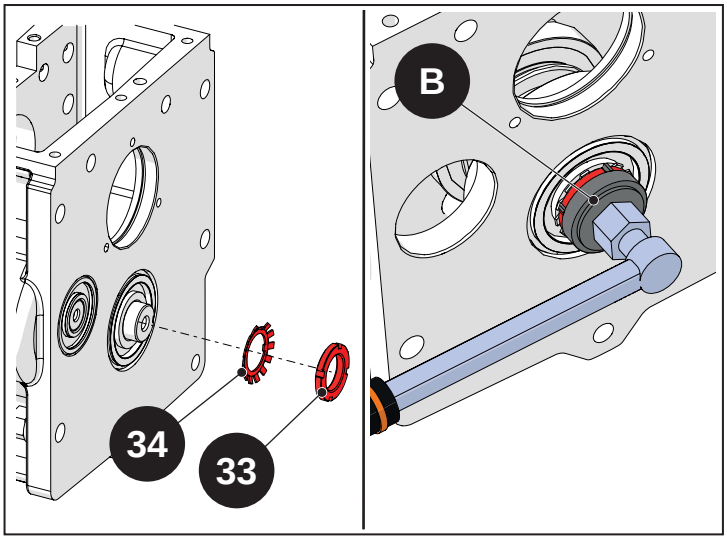


Fig. 4.50

Clinch the tooth of the safety washer (34) into the groove of the ring nut (33) as a further safety measure.

Punch the ring nut on a level with the groove in the layshaft (30).

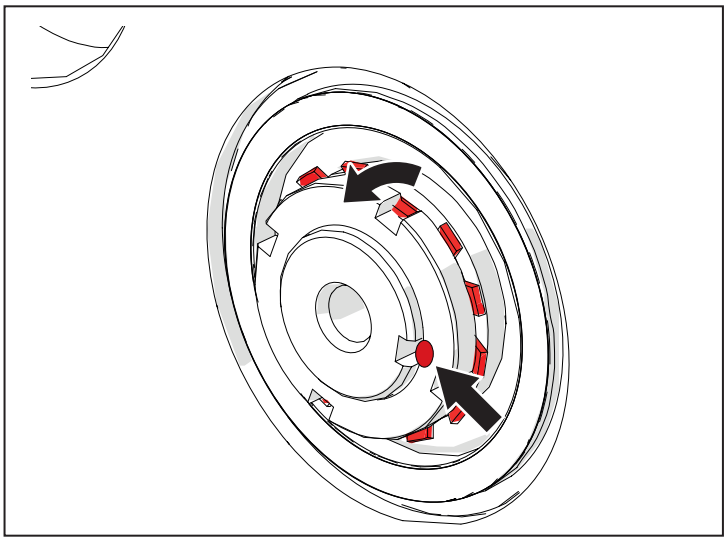


Fig. 4.51

Use a plug of an adequate diameter to seat the bearing (61).

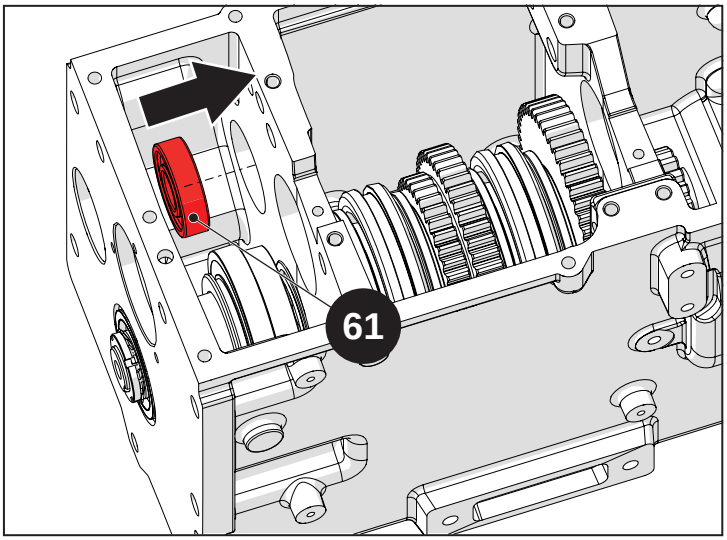


Fig. 4.52

Insert the double gear of the reverse shuttle (59), then the transmission shaft (58) complete with bearing (57).

Insert the locking pin (60) of the reverse shuttle shaft.

Caution

Fit the gear (59) into the gearbox with the starting edge of the teeth pointing towards the rear part.

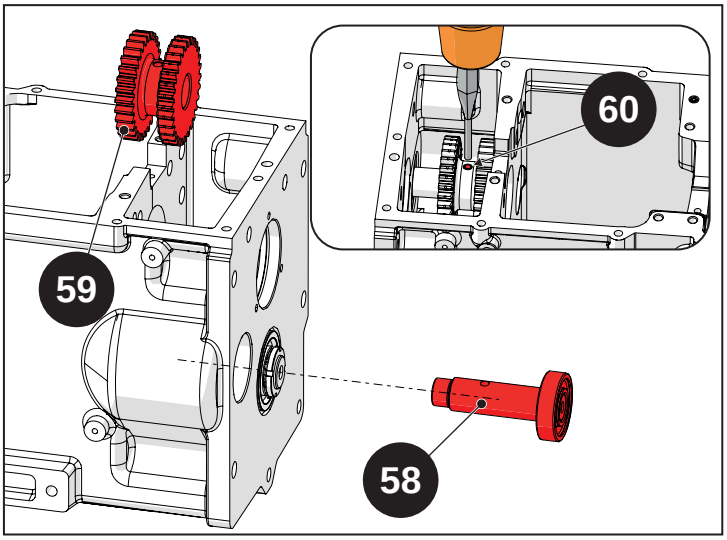


Fig. 4.53

Insert the gear (105) and reverse shaft (106).

Warning

Ensure that the notch at the end of the reverse shaft (106) is vertical so as to make the setscrew easier to insert (85).

Insert the washer (86) then tighten the setscrew (85).

Caution

Fit the gear (105) into the gearbox with the starting edge of the teeth pointing towards the rear part.

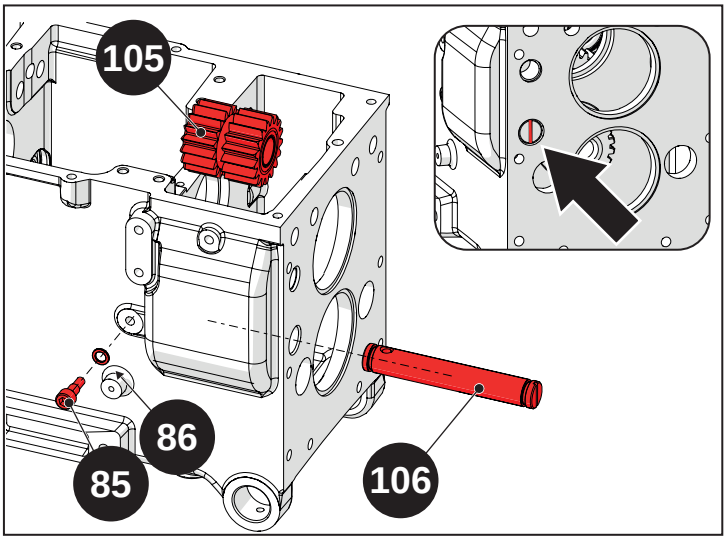


Fig. 4.54

Assemble the forks (93) and (98).

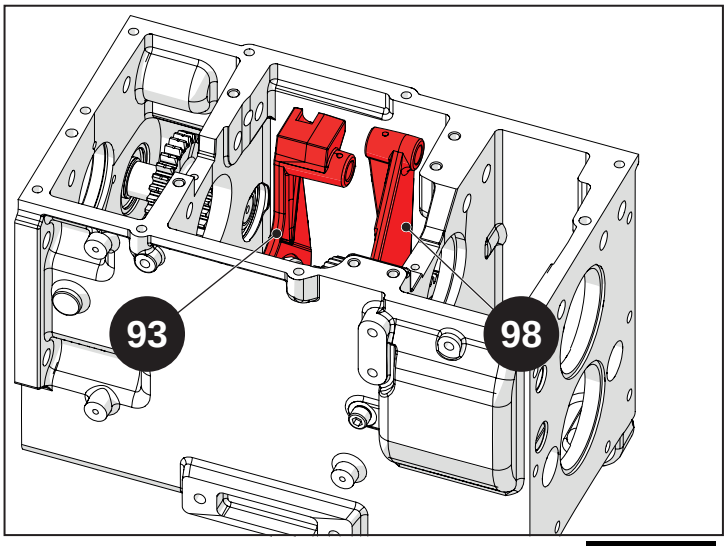


Fig. 4.55

insert the rod (92) and lock in place with the fastening pin (91).

Insert the retainer (104).

> **Warning**
>
> The retainer (104) differs from the others since it has a groove at the end.

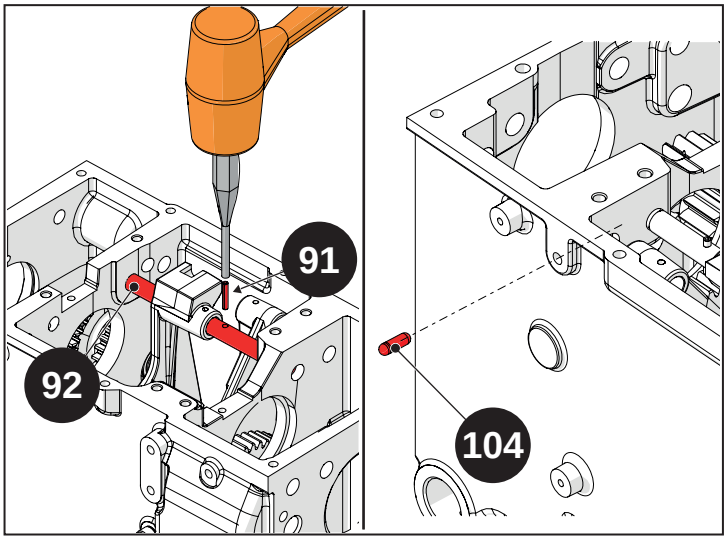


Fig. 4.56

insert the rod (96), the sleeve (98) and lock them in place with the fastening pins (94) and (95).

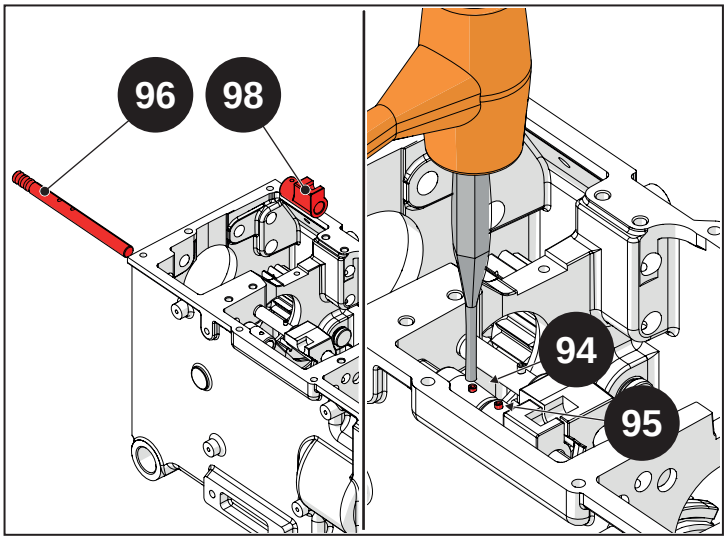


Fig. 4.57

Fit the circlip (22) into the drive shaft (23).

> **Warning**
>
> The circlip (22) must be inserted with the smaller diameter holes pointing towards the rear part of the tractor.

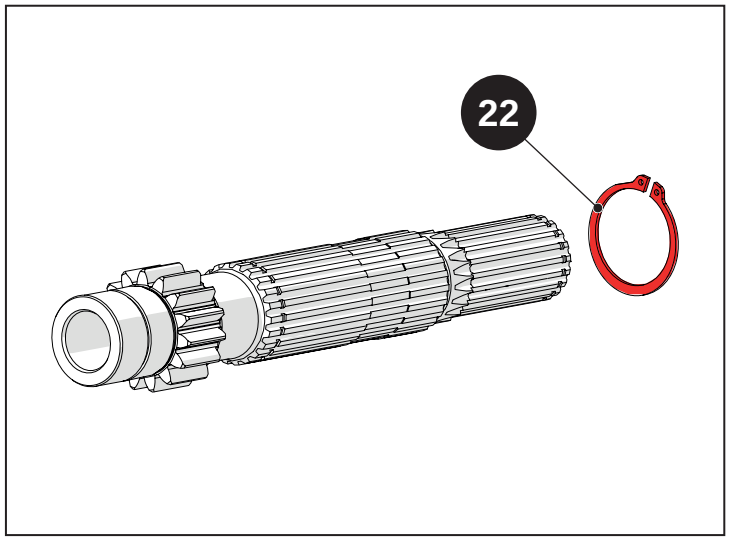


Fig. 4.58

Fit the drive shaft (23) into the gearbox, then align the following components in the given order:

- 2nd speed gear (21);
- spacers (90);
- 3rd speed gear (20);
- spacer (19);
- 4th speed gear (18);

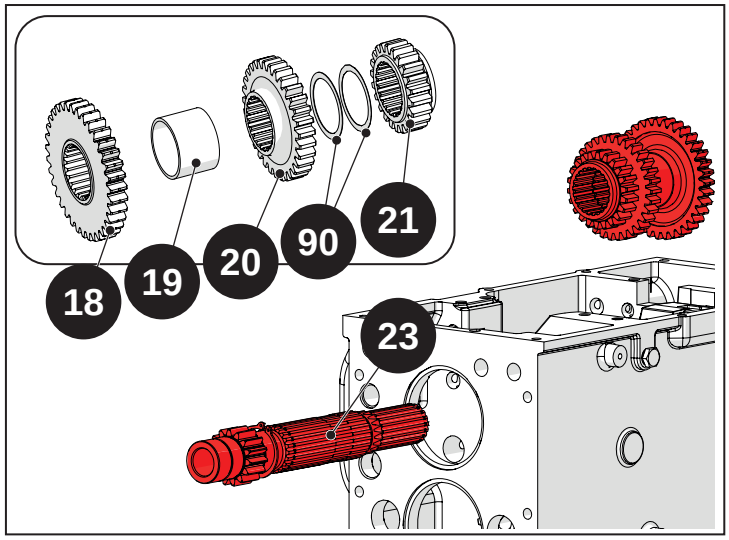


Fig. 4.59

Fit gear (89) and gear (27) into the gearbox complete with the bush (28) and bearing (26).

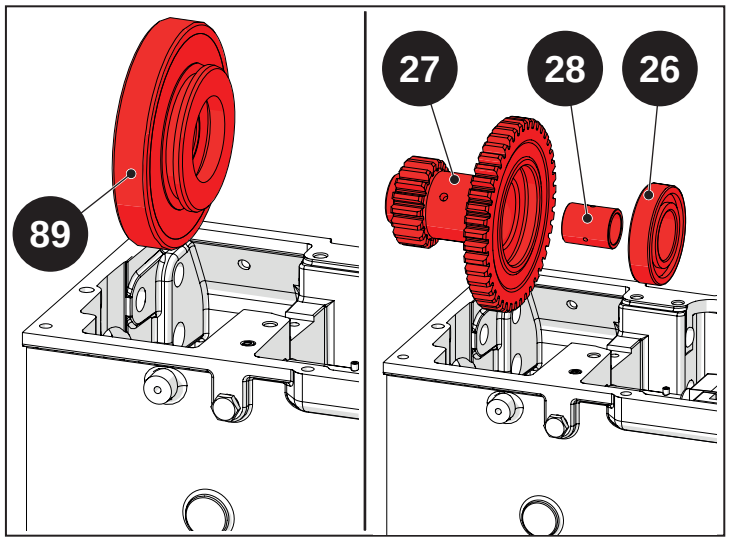


Fig. 4.60

Seat the bearings (17) and (24), then use a plug of a suitable diameter to fully insert them.

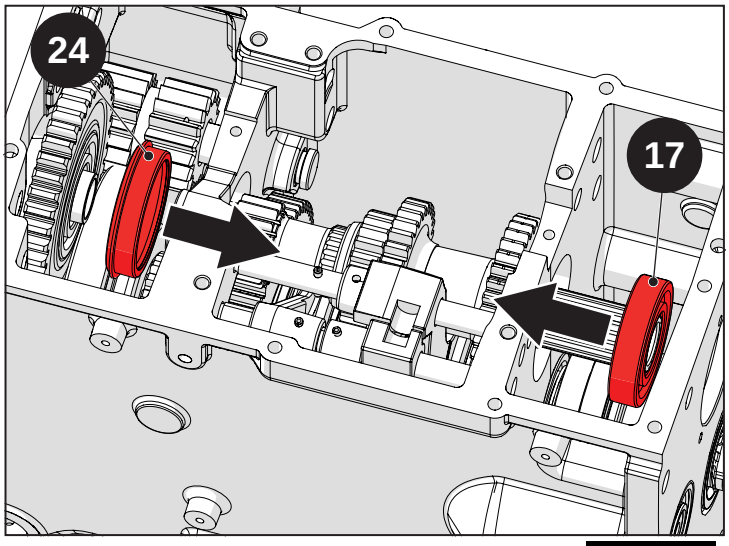


Fig. 4.61

Fit the complete gear pack into the gearbox. The pack consists of:

- 8+8 gear (11);
- Synchromesh (16);
- 16+8 gear (13);
- Keyed bushing (15);
- Roller cage (14);

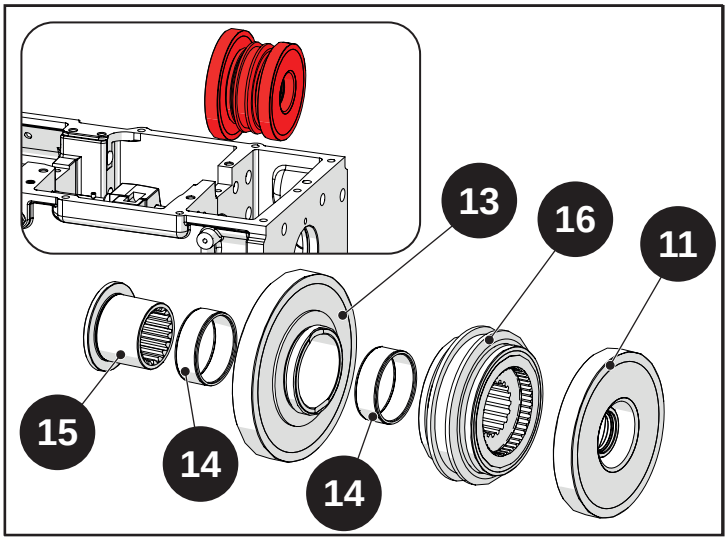


Fig. 4.62

Fit the circlip (22) into its housing.

Insert a shim between the 8+8 gear and the end of the box to prevent it from moving when the drive shaft (23) is installed.

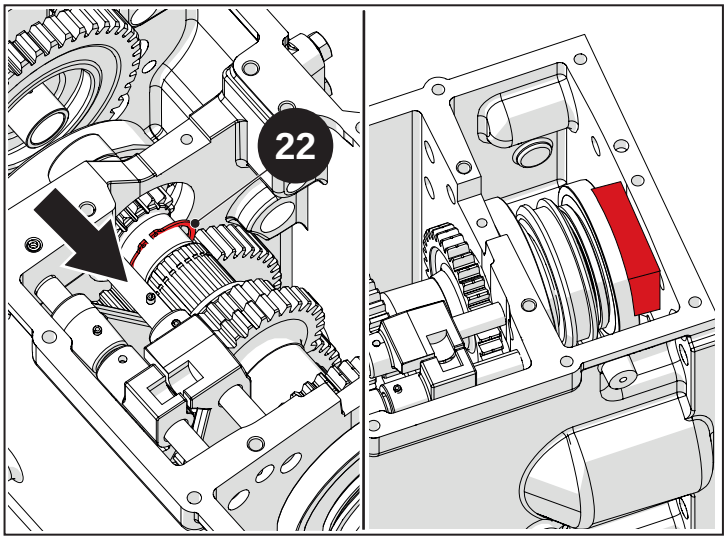


Fig. 4.63

Tap the shaft (23) with a mallet made of soft material so as to fully seat it.

Lock the shaft in place with the circlips (12) and (25).

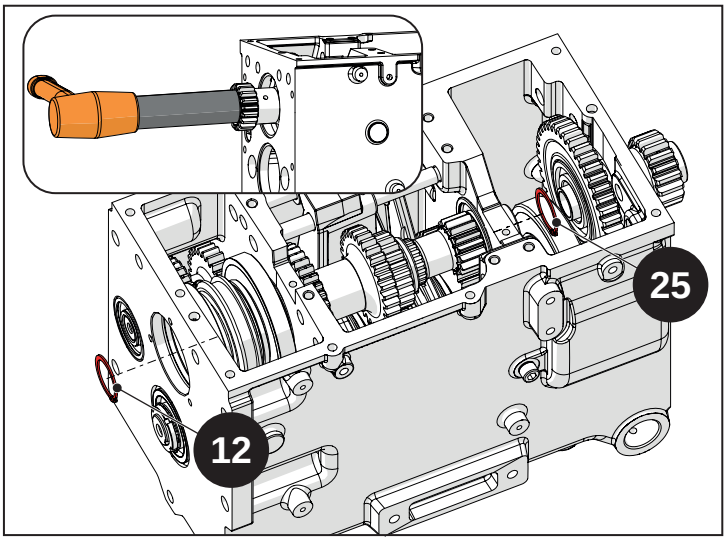


Fig. 4.64

Insert the forks (83) and (84).

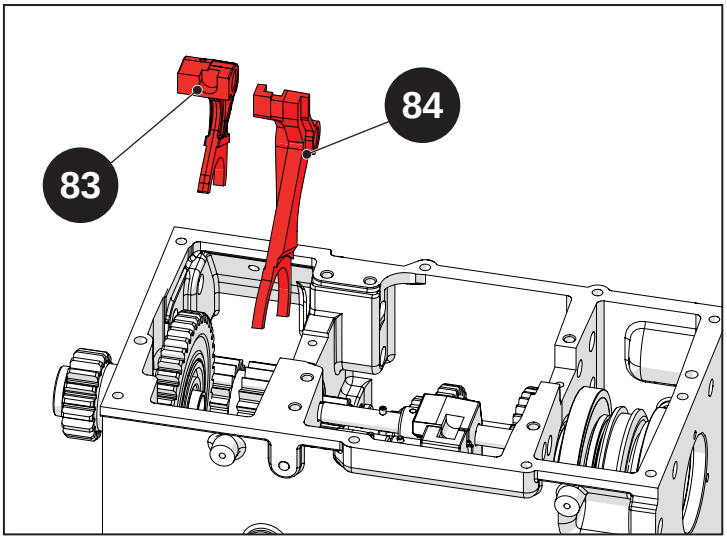


Fig. 4.65

Insert the spacer (116) and bearing (29).

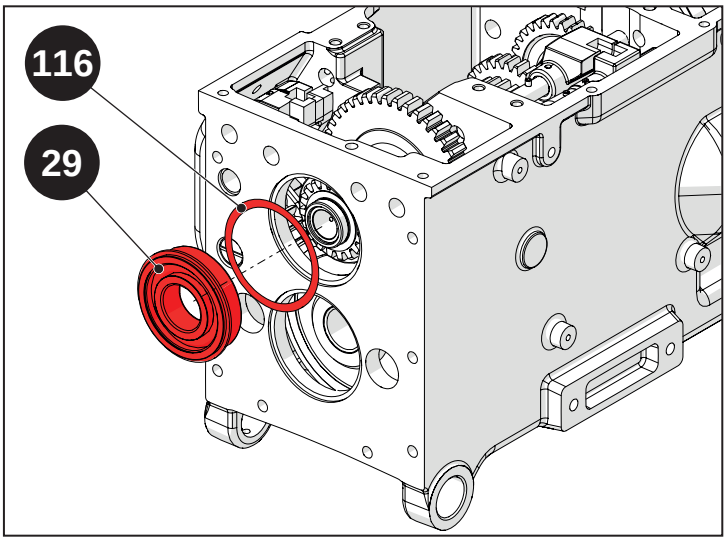


Fig. 4.66

Insert the forks (70) and (72).

Insert the rods (64) and (71).

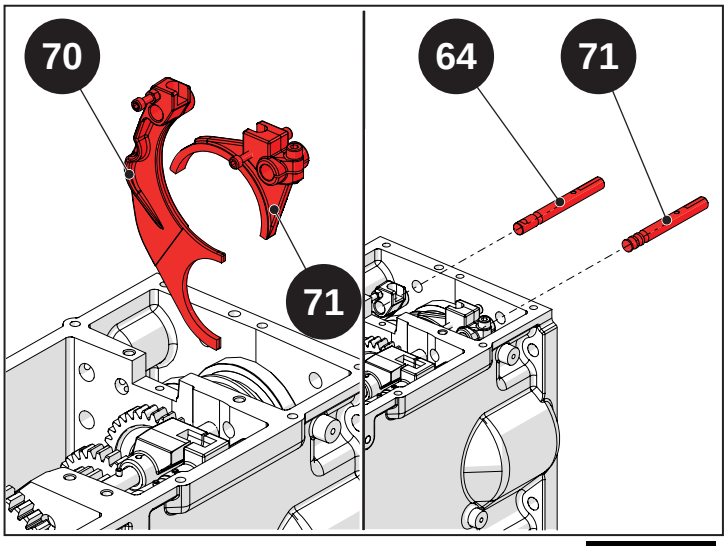


Fig. 4.67

Fit the spring (100) and ball (101) into the hole.

Fit the spring (65) and ball (66) into the hole.

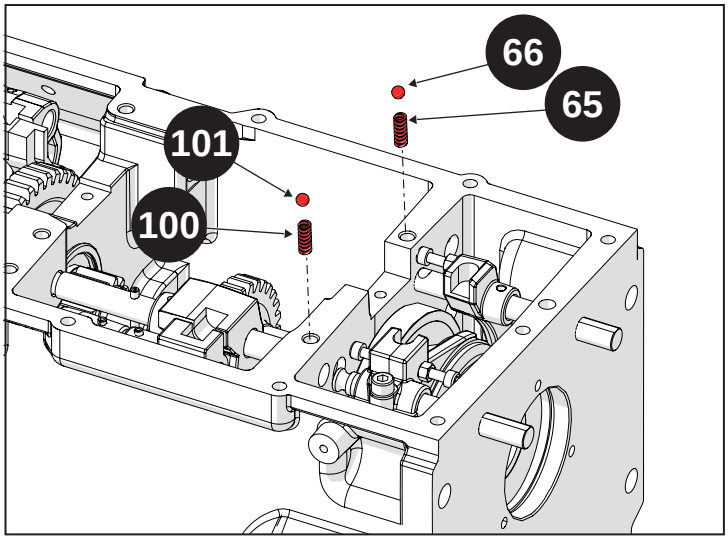


Fig. 4.68

Using a pin driver or punch, push the springs (100) and (65) downwards while pushing the rods (64) and (71), so as to fit the balls (101) and (66) into their seats.

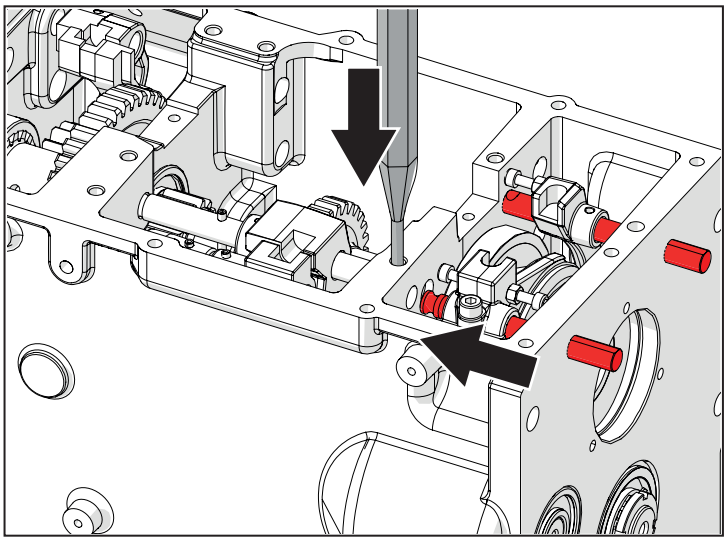


Fig. 4.69

Insert the retainer (69) and washer (68), then tighten the plug (67).

Warning
Apply a layer of SILICONE to the seating perimeter of the plug (67).

Fix the rod (64) in place with the plug (63).

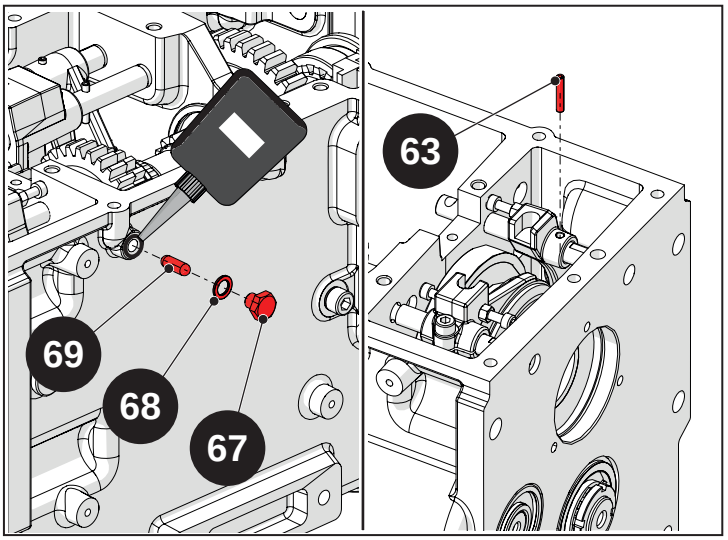


Fig. 4.70

Insert the rod (82) and lock in place with the centring pin (81).

Insert the retainer (80).

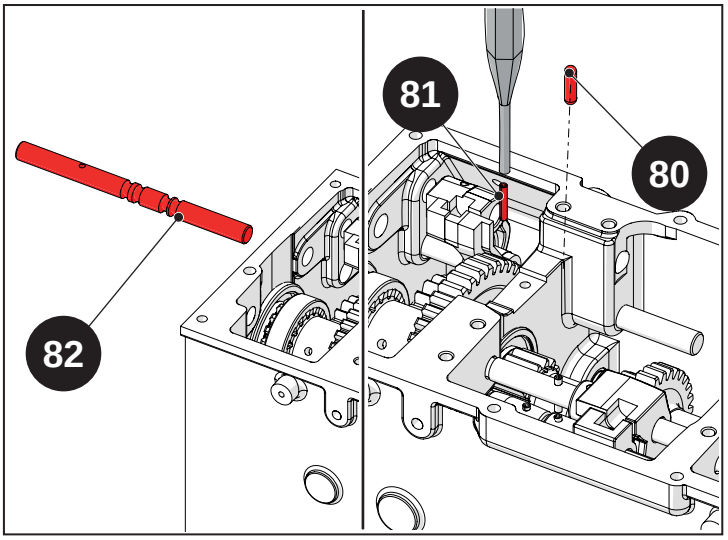


Fig. 4.71

Insert the ball (79), spring (78) and ball hole (77).

Insert the rod (75).

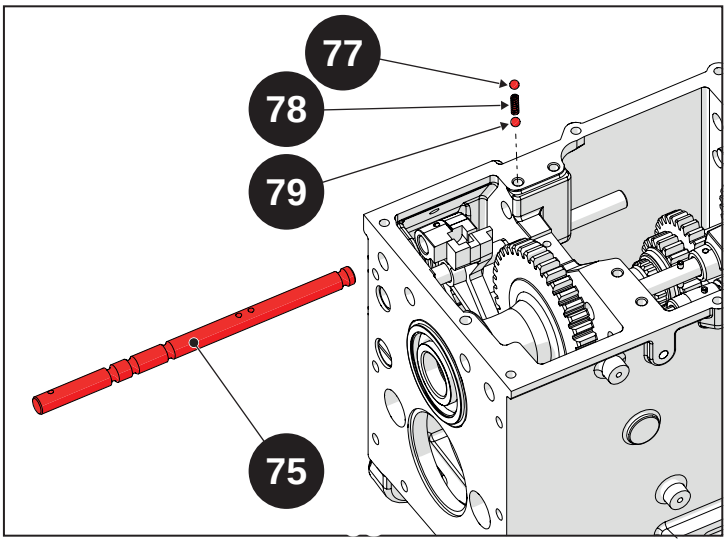


Fig. 4.72

Using a pin driver or punch, push the spring (78) downwards while pushing the rod (75), so as to fit the ball (79) into its seat.

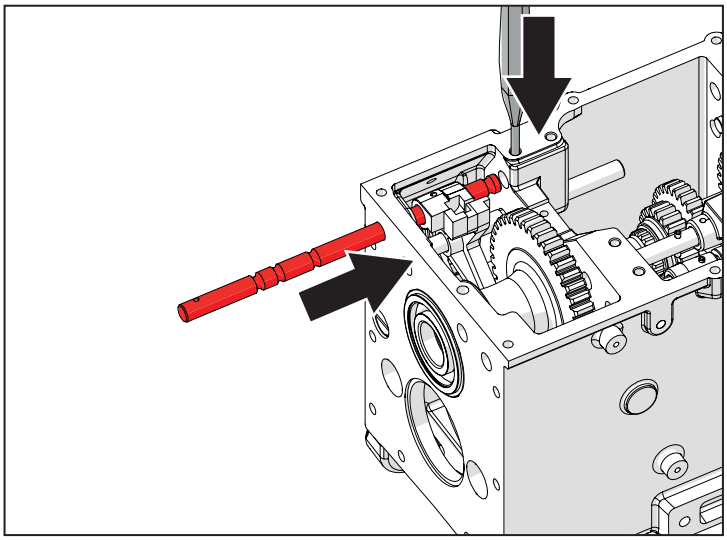


Fig. 4.73

Insert the adjuster block (76).

Lock the rod (75) and block (76) in place with the fastening pins (73) and (74).

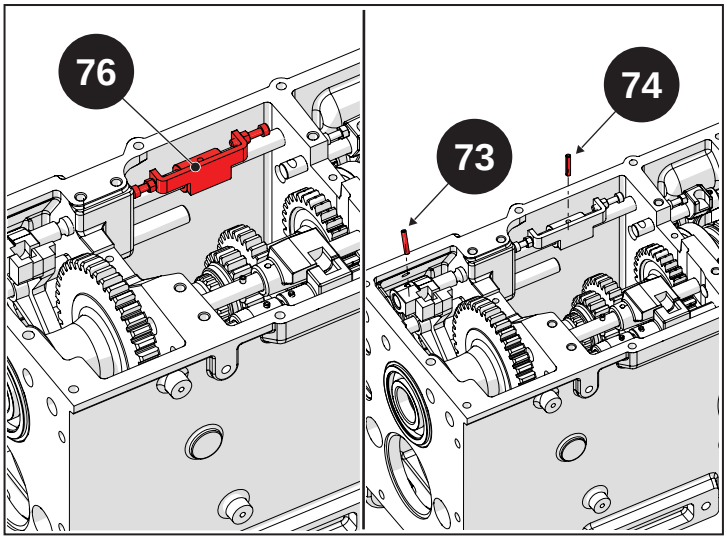


Fig. 4.74

Insert the P.T.O. drive shaft (1) along with the gear (3), spring ring (4) and circlip (2).

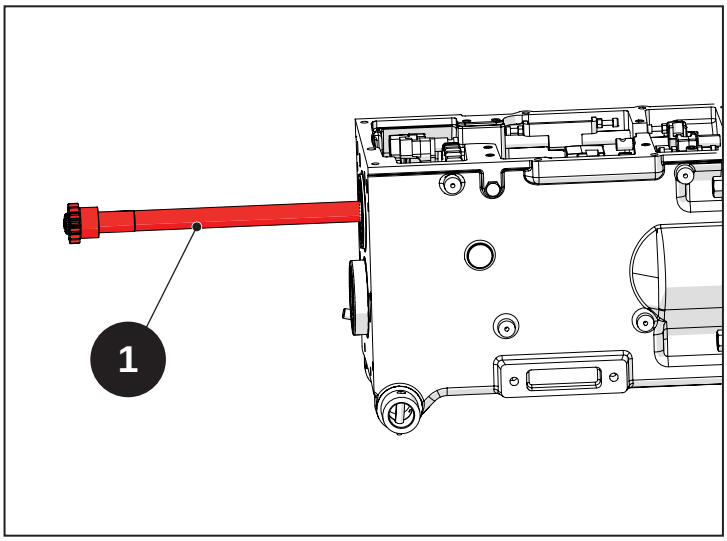


Fig. 4.75

How to shim the upper drive shaft

To ensure the synchromesh (16) has the right amount of play, the distance (X) between the spacer (8) and 8+8 gear (11) must be 0.6 mm.

Spacers (112), the sum of which must always be 1.8 mm, must be inserted in order to obtain the correct distance. The position of the shims will change the distance (value X).

Depending on the positioning required, insert shims (112) between the bearing (6) and circlip (5)(furthest away) or between the bearing (6) and spacer (8) (nearest). Make sure that the sum of these shims is always 1.8 mm.

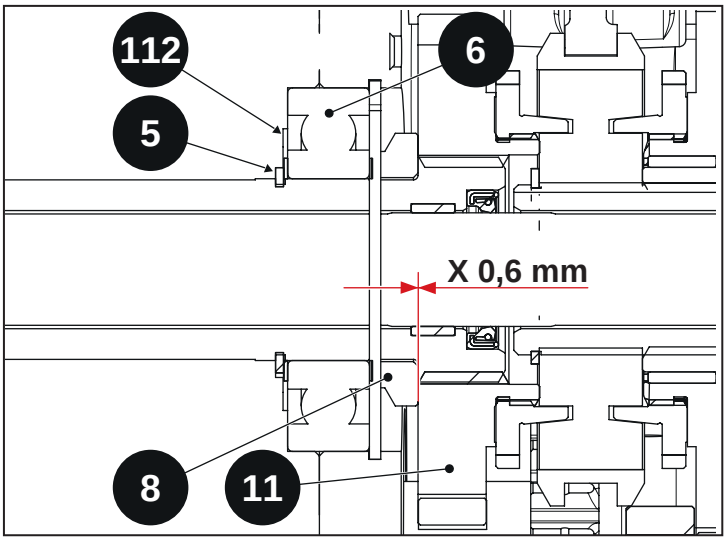


Fig. 4.76

Install the circlip (7) and insert the shaft (62), complete with:

- spacer (8);
- rod guiding ring (9);
- oil retainer (10);
- bearing 6
- pack of shims (112);
- circlip (5);

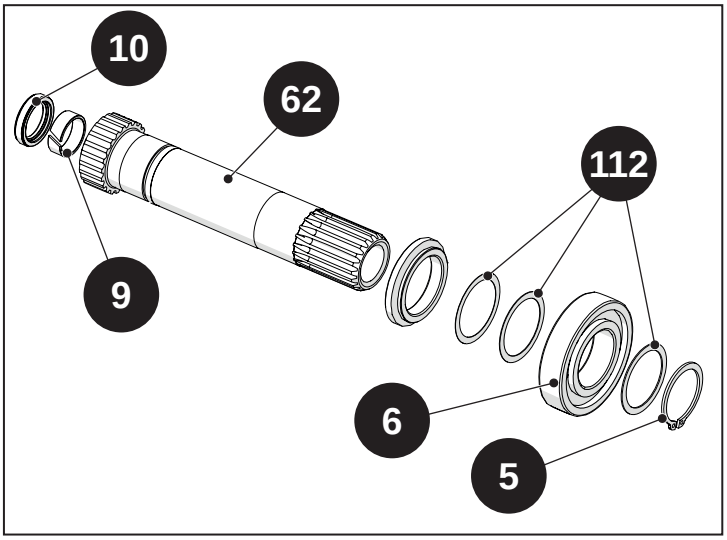


Fig. 4.77

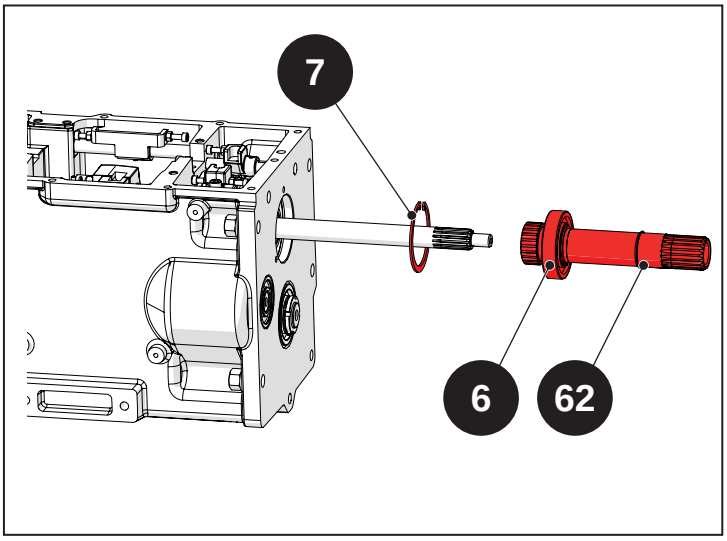


Fig. 4.78

Check that the distance (X) between the spacer (8) and the 8+8 gear (11) is 0.6 mm.

If this is not the case, move the shims to obtain the correct value.

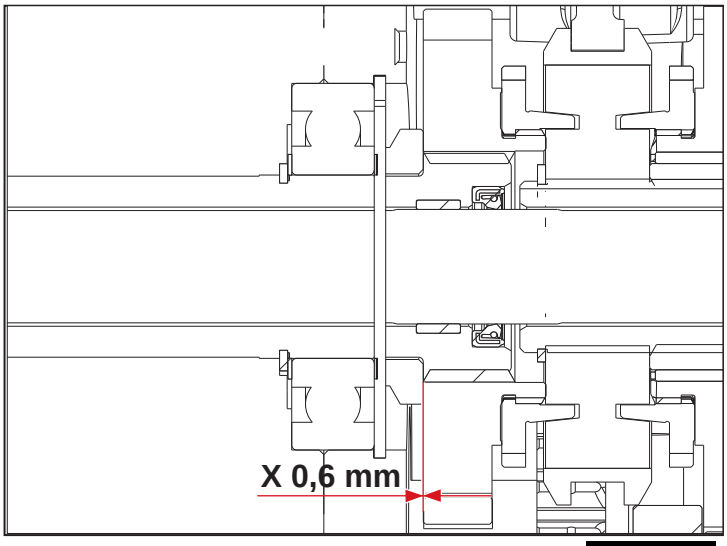


Fig. 4.79

Apply a layer of SILICONE to the coupling surface of the sleeve (113).

Insert the sleeve (113), washers (115) and tighten the screws by applying 30 Nm (3 kgm) tightening torque.

Apply a layer of TEFLON or SILICONE to the screw threads (114).

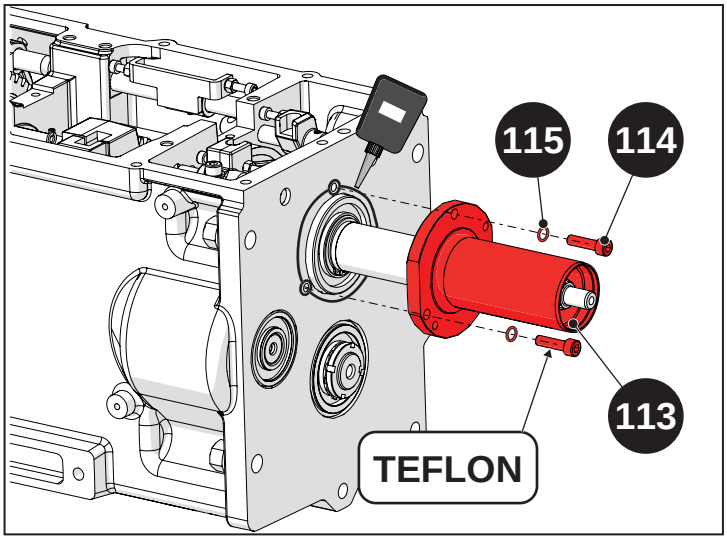


Fig. 4.80

Gearshift lever end of travel adjustment

To engaged the speed gears correctly, the gearshift levers must be adjusted so that the fork is exactly in the centre, between two gears.

When a speed gear is engaged, a space between 0.5 and 1 mm must be left between the adjuster screws and gearbox casing to ensure the rod engages on the ball.

Set the fork in the idle position and check that it is in the centre of the gap between the two gears.

Tighten the screw to lock the position of the fork.

Warning

Engage the speed gear and, using a small screwdriver, check that the ring of the synchromesh under the fork moves slightly. If the ring is blocked, it means that the fork has been fixed too near the speed gear that has just been engaged.

Check synchromesh engagement in both positions.

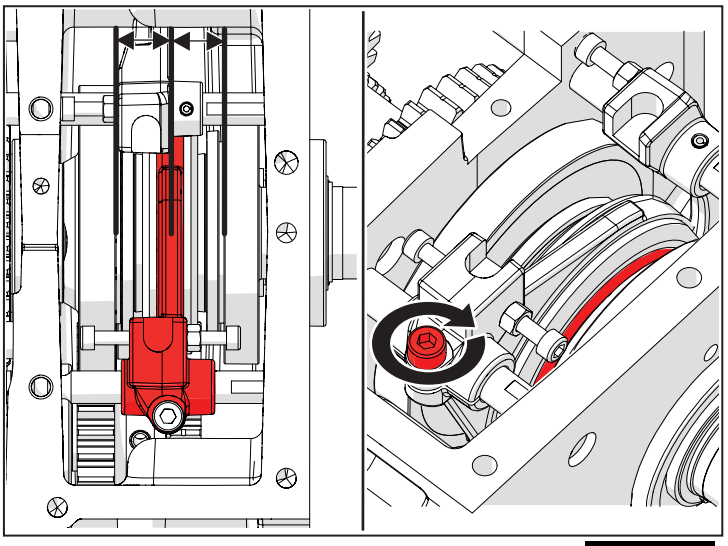


Fig. 4.81

Engage a speed gear.

Position the adjuster screw between 0.5 and 1 mm away from the casing.

Lock the screw in position with a nut.

Adjust the second speed gear in the same way.

Warning

All the levers on the gearshift must be adjusted.

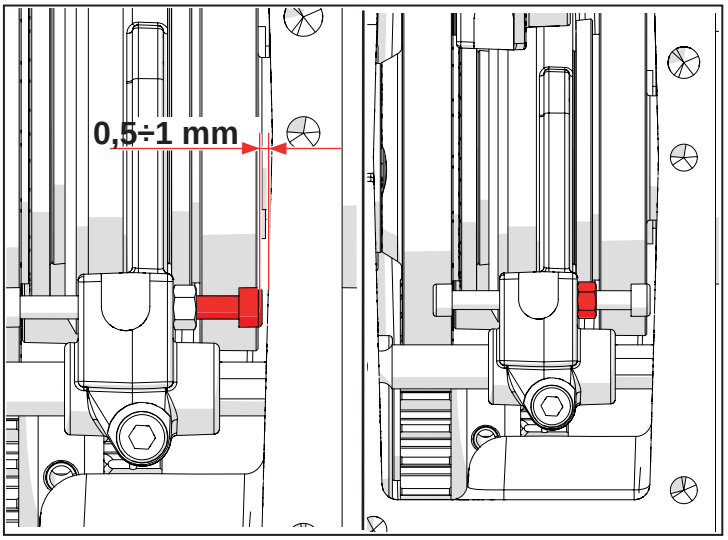


Fig. 4.82

Insert the balls (111) and springs (110).

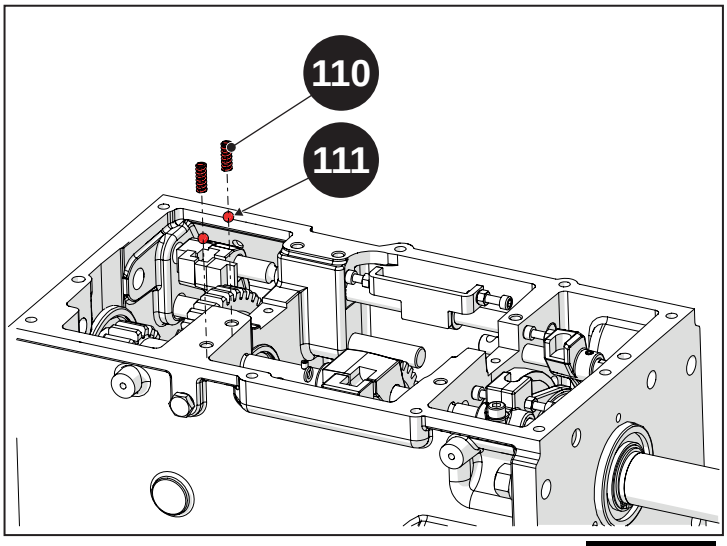


Fig. 4.83

Fit on the complete cover (109) and match the forks with the levers.

> **Warning**
>
> Apply a layer of SILICONE along the entire bearing perimeter of the cover.

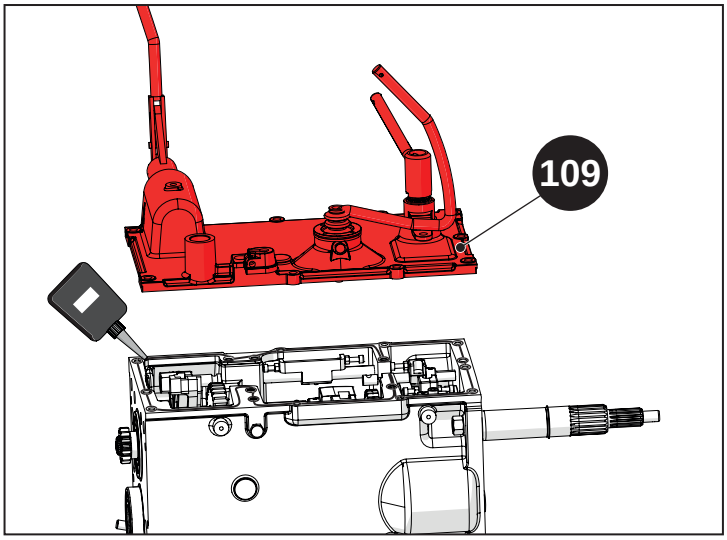


Fig. 4.84

Insert the washers (108) and tighten the screws (107) by applying 54 Nm (5.4 kgm) tightening torque.

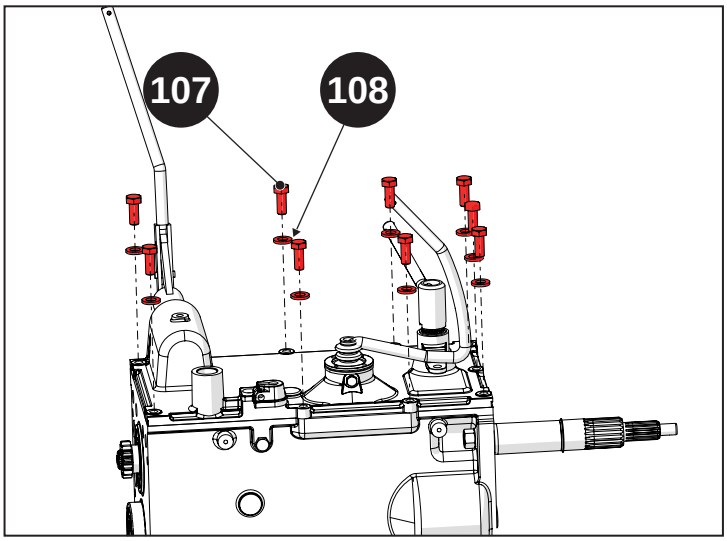


Fig. 4.85

Fit the stud bolts into the gearbox and tighten them through to the end of their threads.

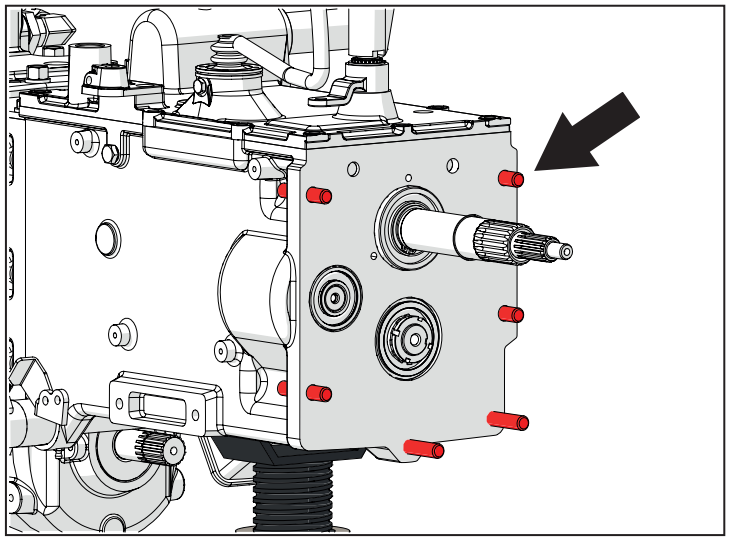


Fig. 4.86

Apply a layer of SILICONE to the surface on which the gearbox couples with the clutch bowl.

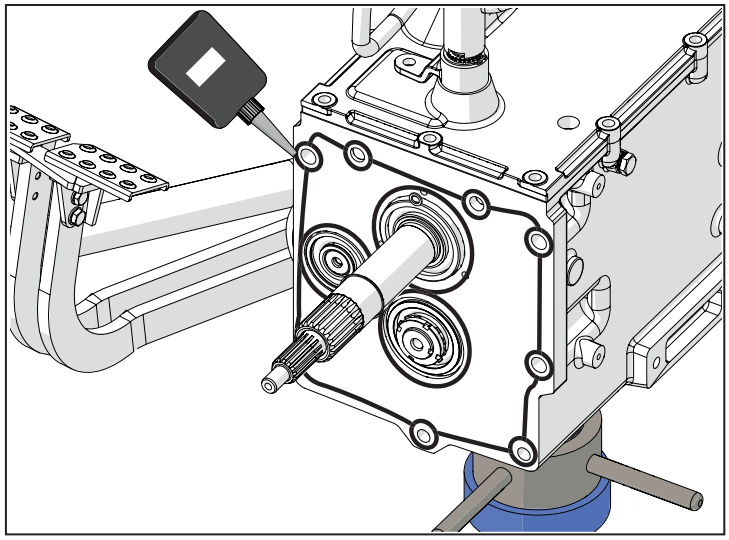


Fig. 4.87

Insert the paper gasket (119), then apply a further layer of SILICONE to the gasket.

⚠ Warning
Replace the paper gasket (119) whenever the components are reassembled.

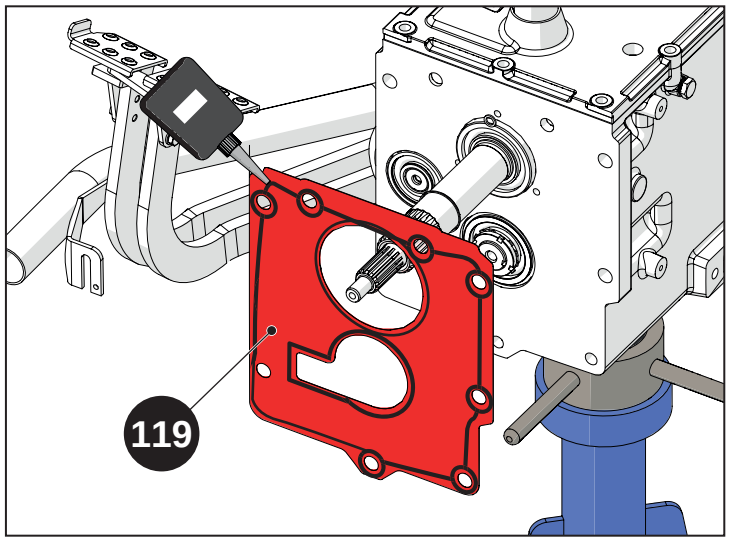


Fig. 4.88

Insert the spacer.

Caution
Use silicone to keep the spacer in the centre.

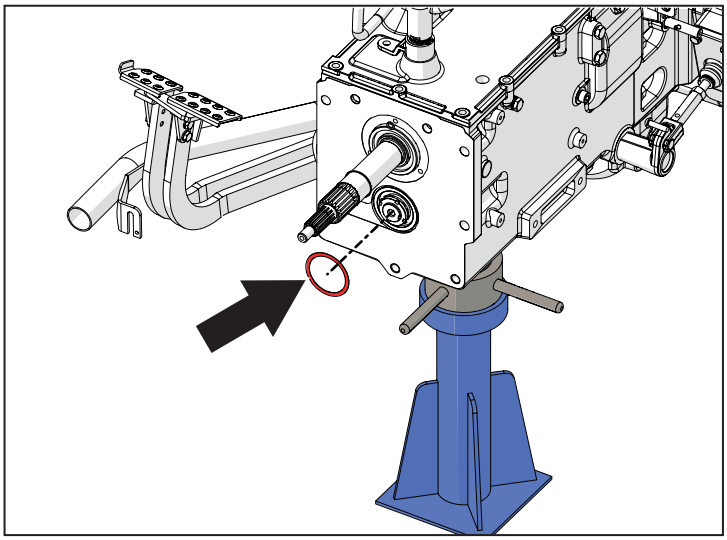


Fig. 4.89

Align the clutch bowl with the gearbox.

Insert the washers (118) and nuts (117), then tighten them by applying 80 Nm (8 kgm) tightening torque.

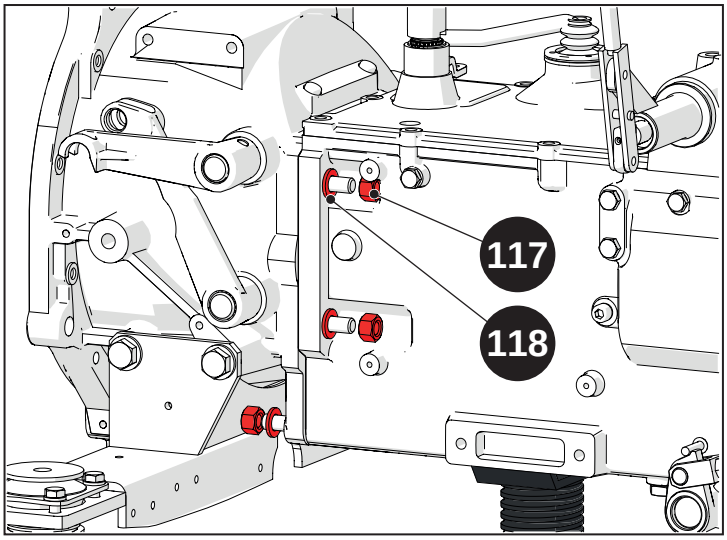


Fig. 4.90

Section 6 : Tightening torques

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6.1 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	Nm	kgm
M10x30 gearbox cover screw	54	5.4
M30x1.5 transmission shaft ring nut	100	10
M35x1.5 transmission shaft ring nut	100	10
M8x30 drive shaft cover screw	24	2.4
M8x16 retainer plate fastening screw	24	2.4
M10x140 screw that fastens engine flange - clutch bowl	100	10
Screw that locks fork on rod	35	3.5

Section 7 : Tools required

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7.1 Tools required

Code	Description	Quantity
07007955	Layshaft locking tool	1
07000240	Tool for removing/inserting ring nuts	1
07000306	Tool for removing reverse shuttle shaft	1
07007954	Synchromesh locking tool	1
07007957	Spacer inserting tool	1
07007956	Tool for fitting shaft into gearbox	1
07007953	Layshaft spacer tool	1

Chapter 5 : Rear differential

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Section 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 the sharp edges around the top of the transmission housing.

Caution

Used oil must be collected and disposed of in compliance with the anti-pollution laws in force.

Section 2 : General introduction

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2.1 Drawing of the assembly

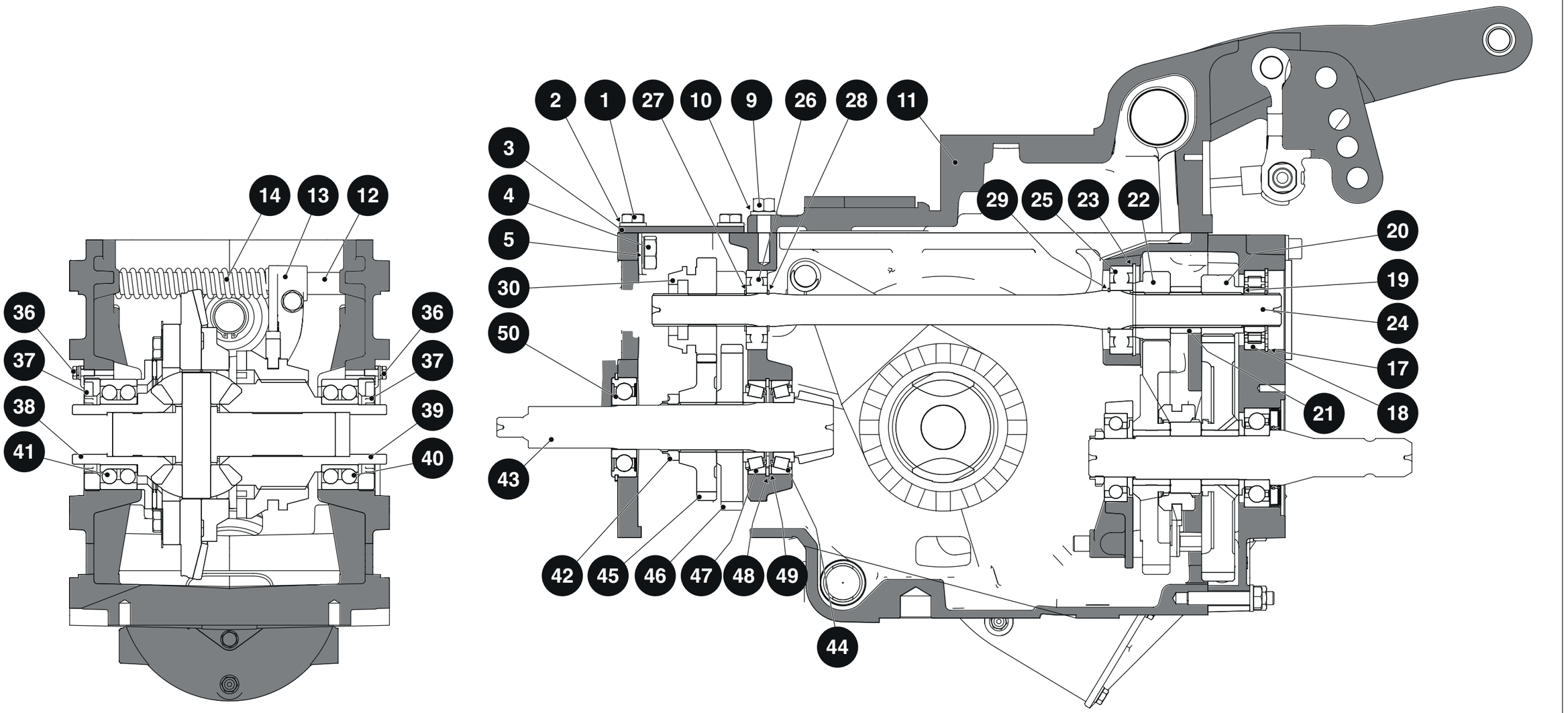


Fig. 5.1

1 - Screw
2 - Washer
3 - Housing cover
4 - Screw
5 - Washer
9 - Nut
10 - Washer
11 - Hitch unit
12 - Rod
13 - Spring
14 - Fork
17 - Circlip
18 - Bearing
19 - Spacer
20 - Gear
21 - Spacer
22 - Gear
23 - Circlip
24 - P.T.O. internal shaft
25 - Bearing
26 - Bearing
27 - Circlip
28 - Circlip
29 - Circlip
30 - P.T.O engaging gear
36 - Ring nut retainer
37 - Ring nut
38 - Crown wheel
39 - Crown wheel
40 - Bearing
41 - Bearing
42 - Nut
43 - Pinion
44 - Bearing
45 - P.T.O gear
46 - Driving gear
47 - Bearing
48 - Circlip
49 - Spacer
50 - Bearing

Section 3 : Technical specifications

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3.1 Technical specifications

Operating mechanism	Electrohydraulic
Pinion / ring gear play	0.07 to 0.15 mm

Section 4 : Disassembly

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4.2 Disassembly 5-14

4.2.1 Disassembly/Assembly of the differential ring gear 5-20

4.1 Preliminary operations

The main operations required to access the rear differential assembly are described below:

Caution

Always make sure that the assemblies have been completely freed before splitting them, otherwise their components could be damaged.

- Remove the platform (see chapter "13- Platform")

  Remove the cab (see chapter "14- Cab")

Danger

Before proceeding with the disassembly operations, make sure that the rear differential and gearbox have been secured to lifting equipment of an adequate capacity.

If lifting equipment is not available, place the units on a stand.

Tools

07000245: Tractor splitting support.

07000215: Gearbox - base unit support.

07000247: Differential support.

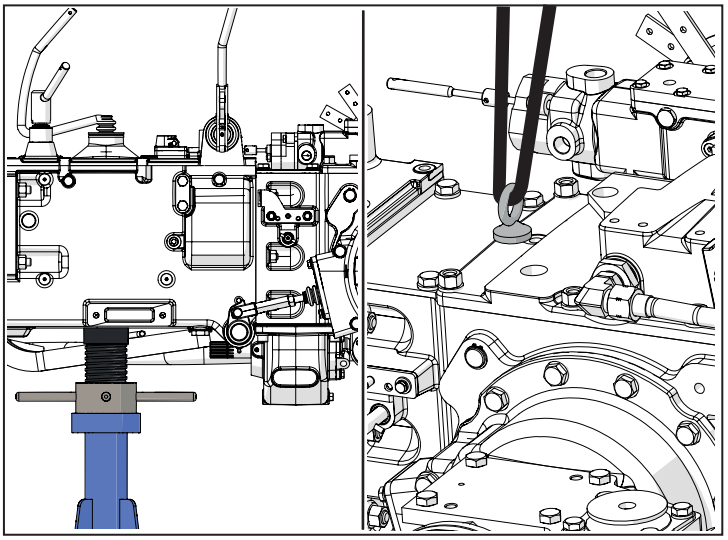


Fig. 5.2

Unscrew the screws (1) and remove the washers (2).

Remove the cover (3).

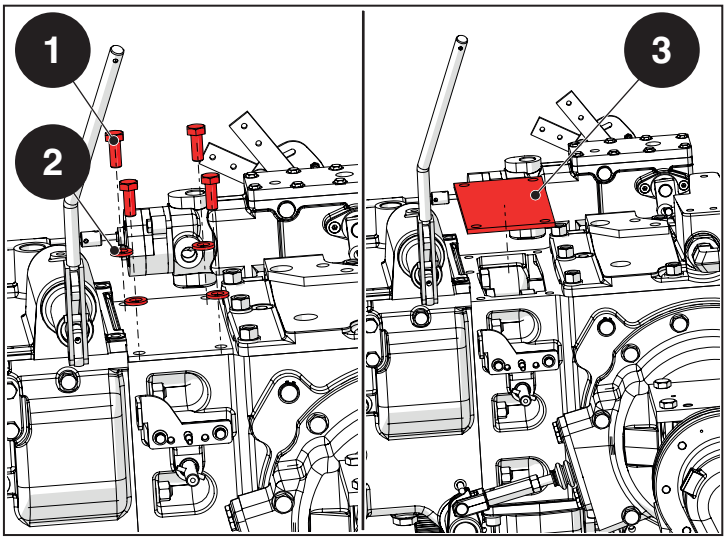


Fig. 5.3

Unscrew and remove the screws and washers.

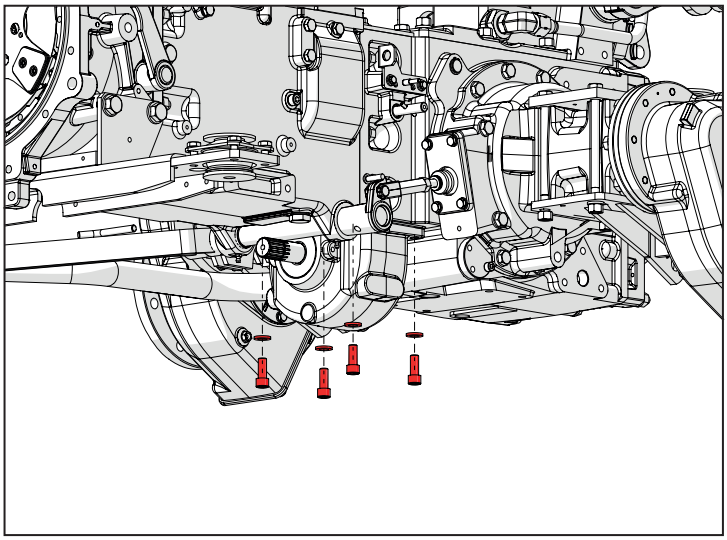


Fig. 5.4

Remove the complete drive transmission unit.

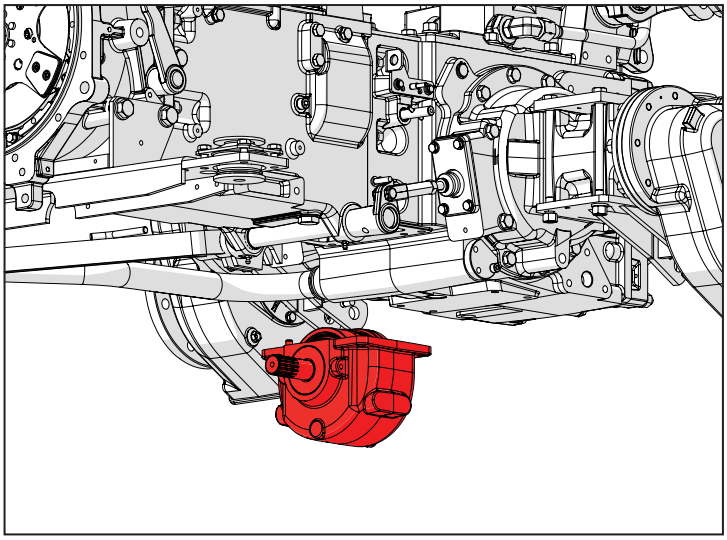


Fig. 5.5

Unscrew the self-locking nuts.

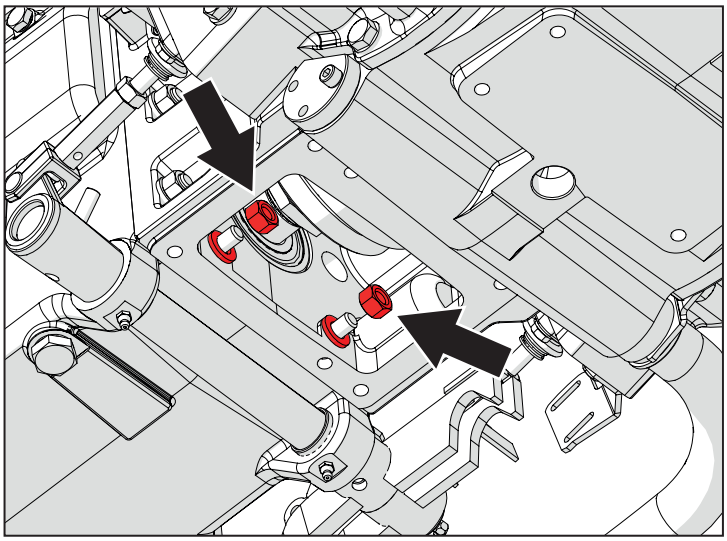


Fig. 5.6

Unscrew the screws (4) and remove the washers (5) that fasten the gearbox to the rear differential assembly.

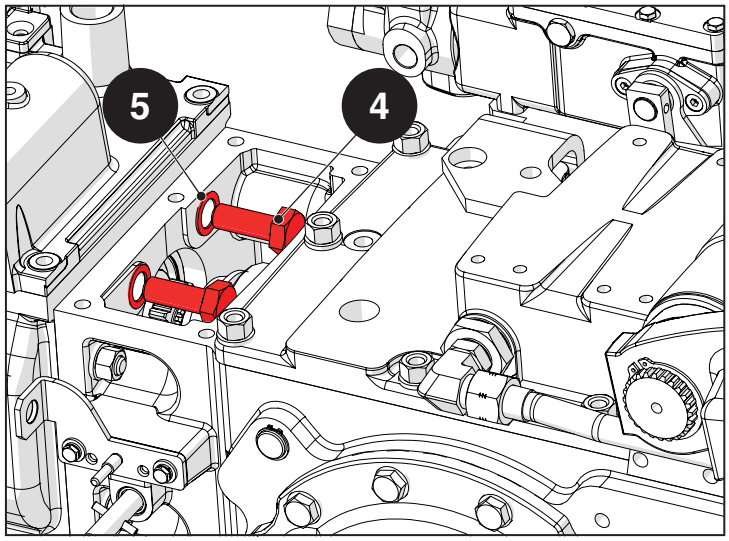


Fig. 5.7

Unscrew the nuts (6) and remove the washers (7) that fasten the gearbox to the rear differential assembly.

Remove the pins (8) from the brake rods.

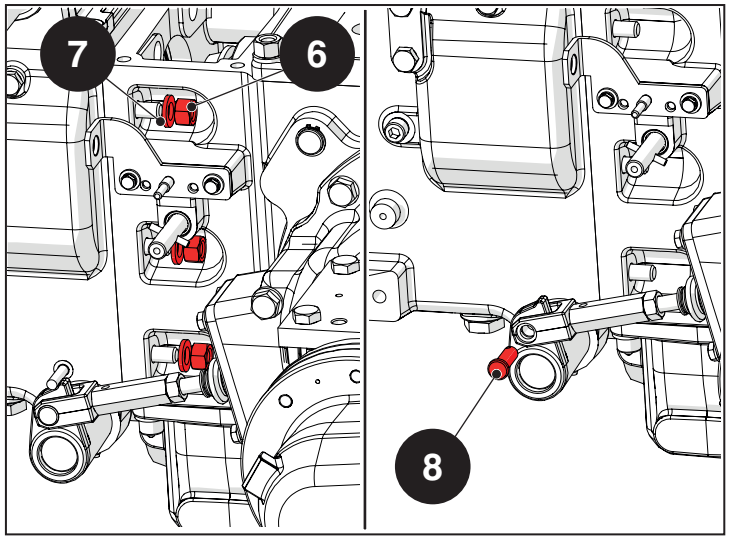


Fig. 5.8

Split the units.

Danger

Lift and handle all heavy parts with lifting equipment of an adequate capacity. Make sure that the hooks and harness are fixed in safe positions. Operators must remain at a distance and in a safe position, well away from the lifted load. Before proceeding with the disassembly operations, make sure that the rear differential and gearbox have been secured to lifting equipment of an adequate capacity.

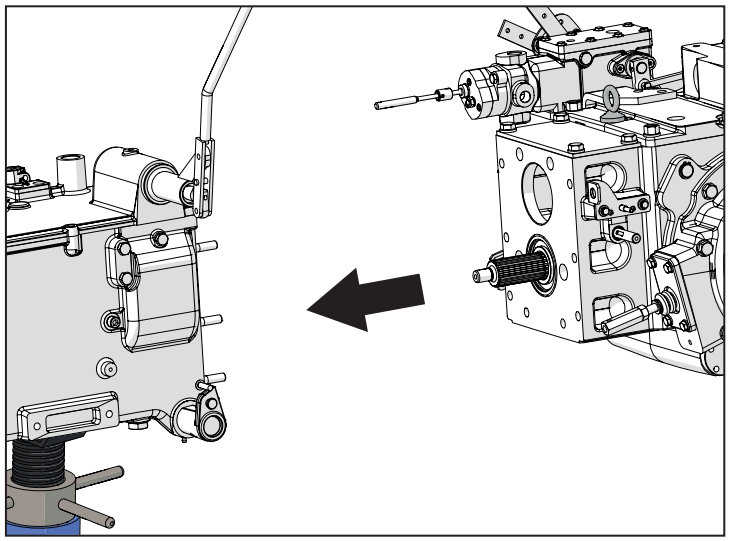


Fig. 5.9

Danger

Secure the hitch unit to lifting equipment of adequate capacity.

Unscrew the nuts (9) and remove the washers (10) that fasten the hitch to the rear differential assembly.

Lift and remove the rear hitch assembly (11).

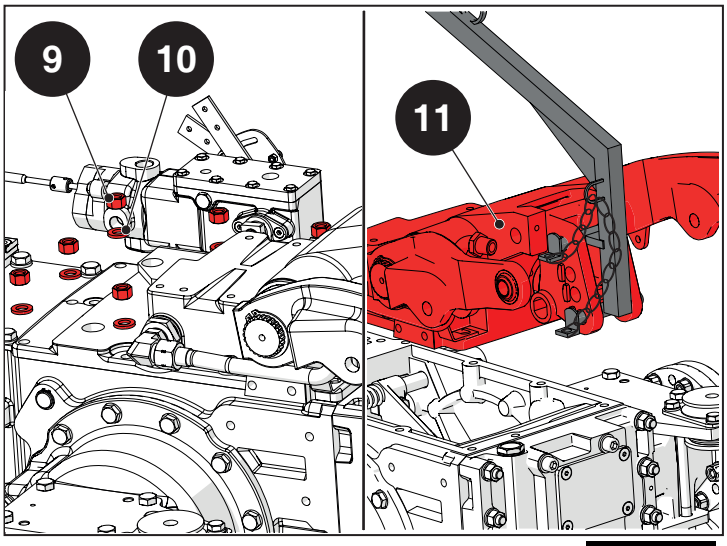


Fig. 5.10

Continue disassembling the components from the rear differential as described below:

1 - Remove the final drives (see chapter "6- Rear final drives")

2 - Remove the rear P.T.O. (see chapter "9- Rear P.T.O.")

4.2 Disassembly

Remove the rod (12), spring (13) and fork (14) of the differential lock unit.

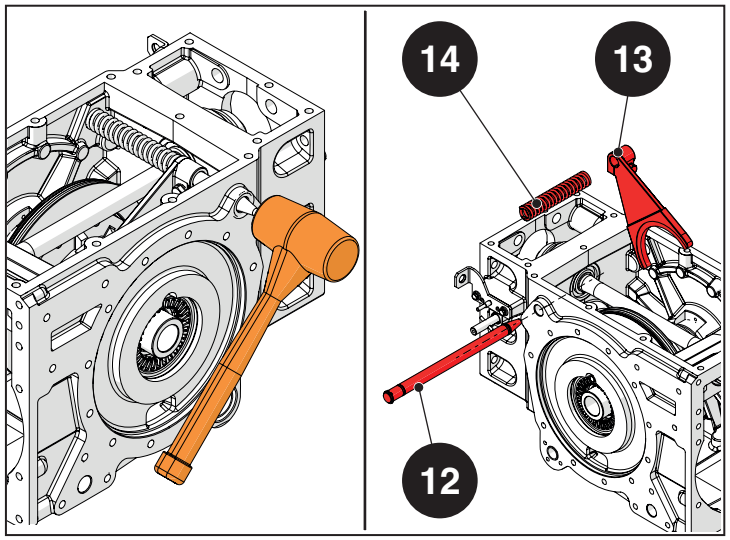


Fig. 5.11

Remove the circlip (15) and the O-Rings (16) from the rod (12) of the differential lock.

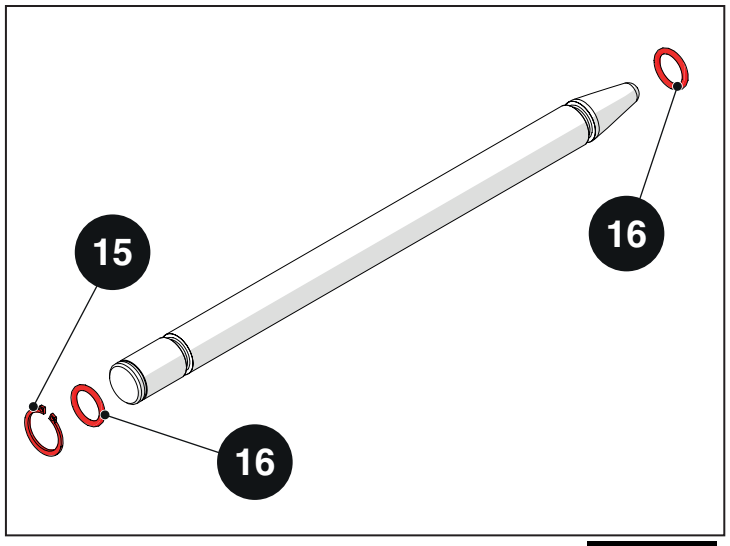


Fig. 5.12

Remove the circlip (17).

Using a puller, now remove the bearing (18), spacers (19) and gear (20) from the shaft.

Remove the spacer (21) and gear (22).

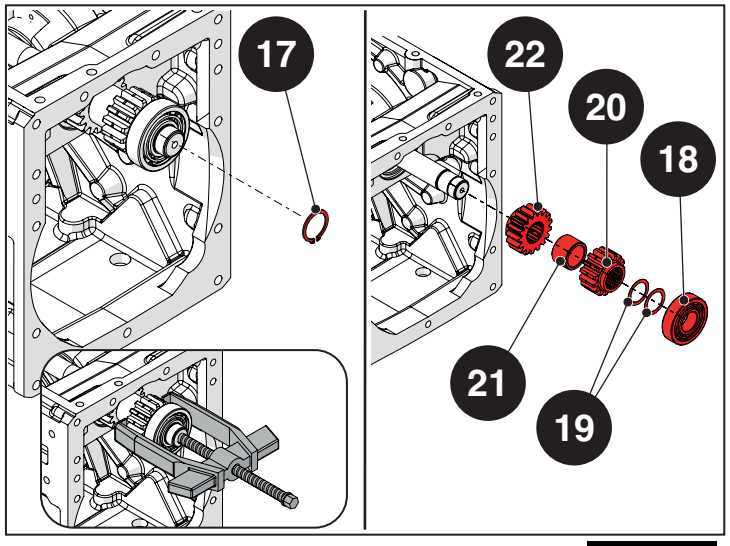


Fig. 5.13

Remove the circlip (23).

Tap the shaft (24) from the opposite side to release it together with the bearings.

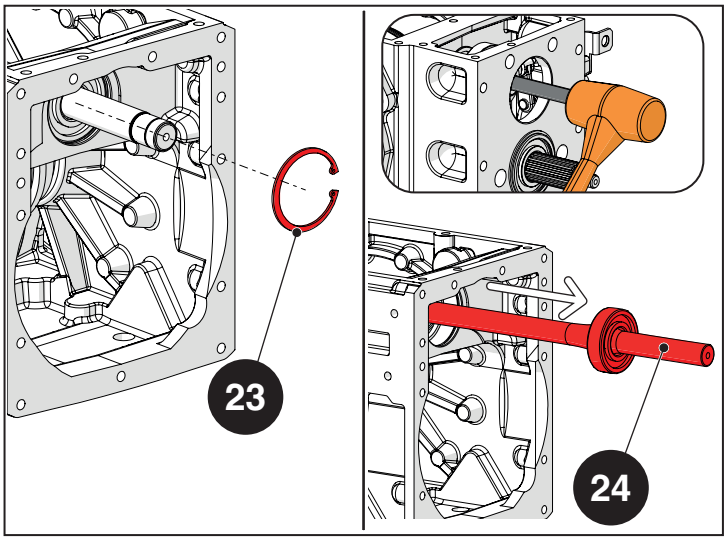


Fig. 5.14

Use a puller to remove the bearing (25).

You will now be able to remove the shaft (24) complete with bearing (26) and circlips (27), (28) and (29) from the differential housing.

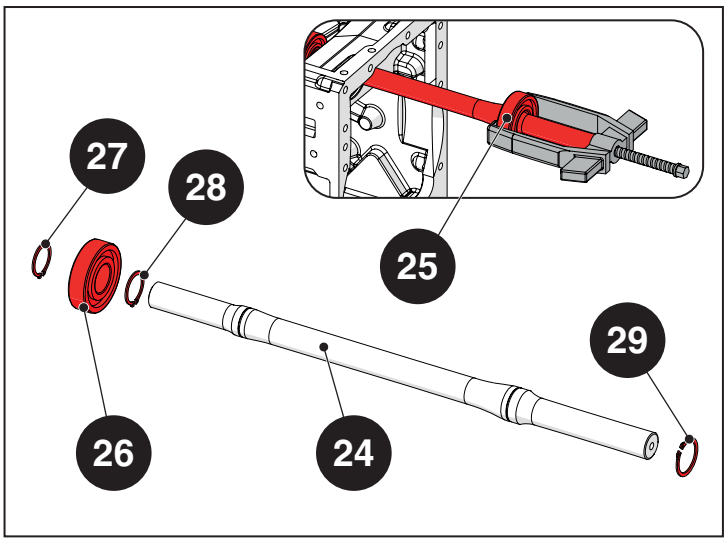


Fig. 5.15

Remove the gear (30).

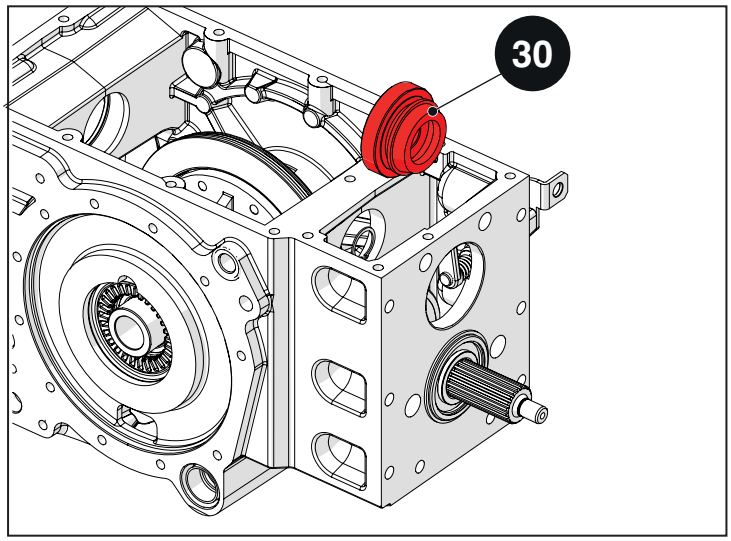


Fig. 5.16

Remove the selector pin (31).

Remove the pin then remove the selection lever (32) complete with spring (33) and spacer (34).

Remove the oil retainer (35).

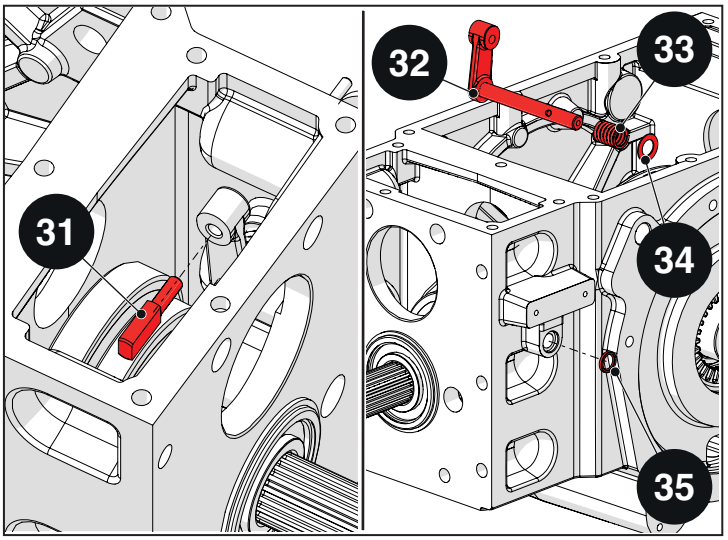


Fig. 5.17

Remove the ring nut retainer (36) from both sides.

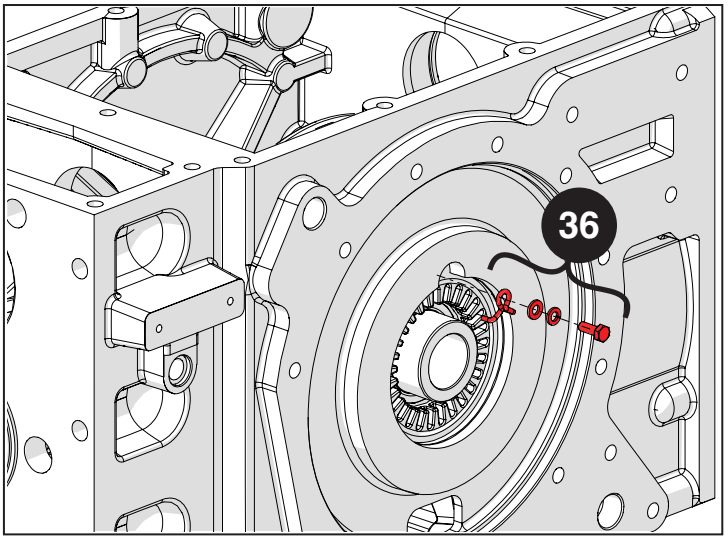


Fig. 5.18

Unscrew and remove the ring nut (37) from both sides.

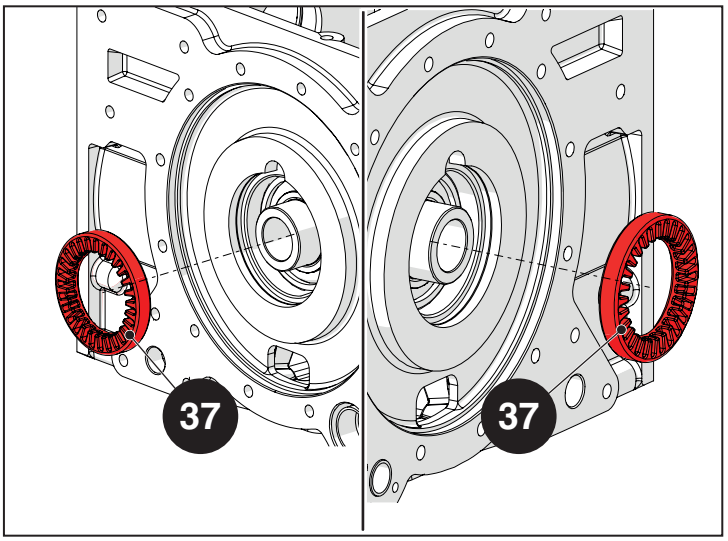


Fig. 5.19

Remove both crown wheels (38) and (39) with the bearings (40) and (41).

Use a puller to remove the bearings from the crown wheels.

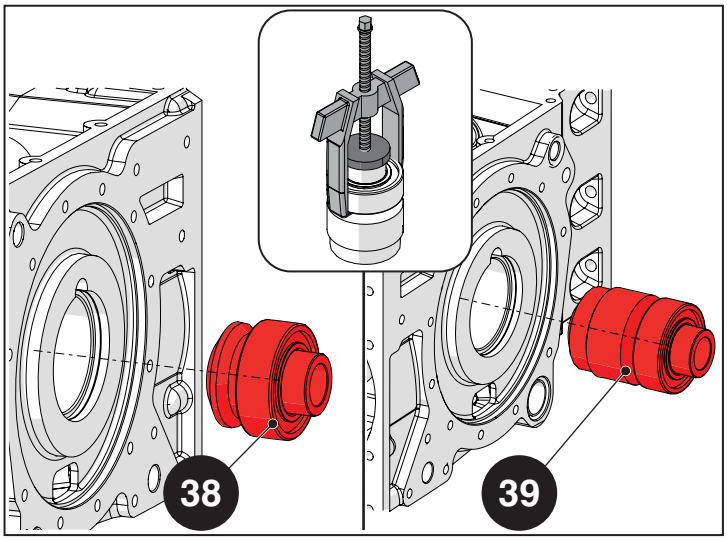


Fig. 5.20

Working from above, remove the complete ring gear from the rear differential housing.

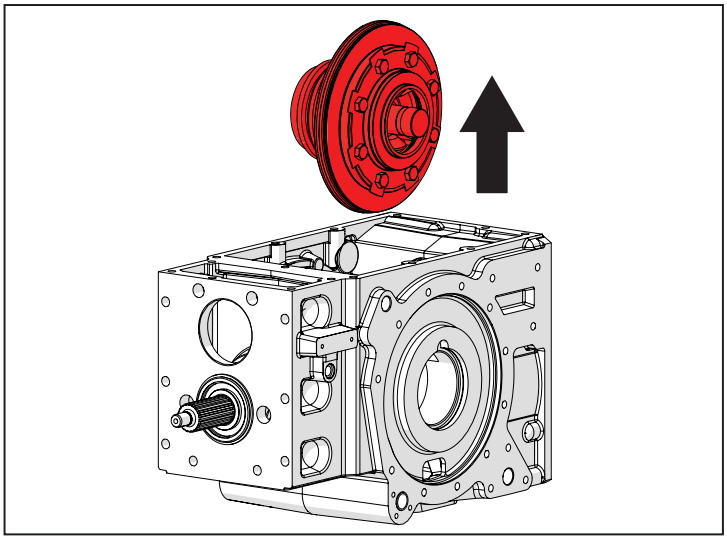


Fig. 5.21

Lock the nut (42), using tool (A- Code 07000239).

Use tool (A) to tighten the pinion (43) and consequently unscrew the nut (42).

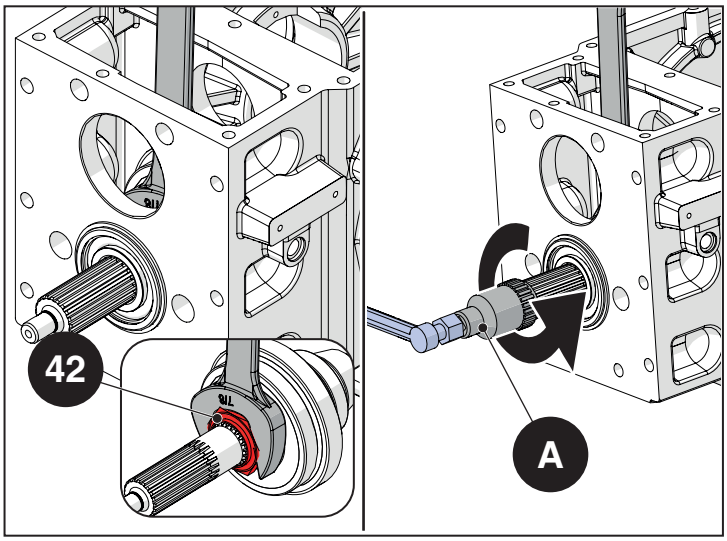


Fig. 5.22

After having unscrewed the nut (42), tap on the pinion (43) so as to remove it from the opposite side along with the external ring of the bearing (44).

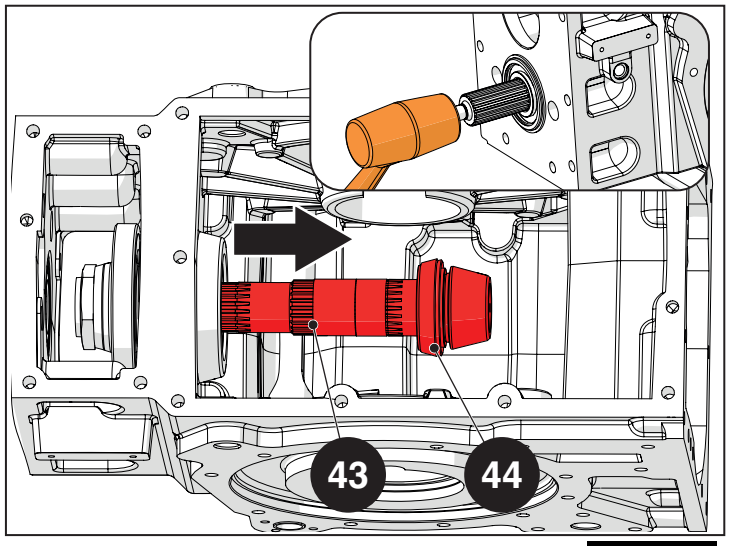


Fig. 5.23

Remove the following components from the differential housing:

- Nut (42);
- P.T.O. gear (45);
- Driving gear (46);
- Inner bearing ring (44);

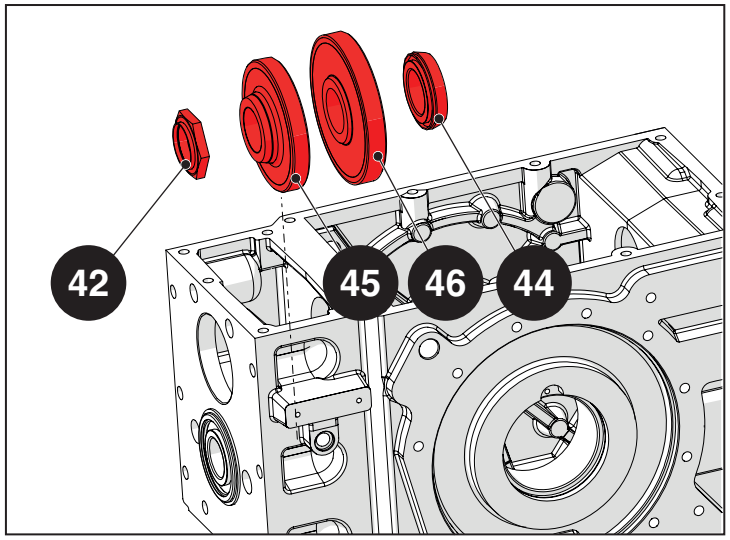


Fig. 5.24

Remove the bearing (47), external bearing ring (44), the circlip (48) and the spacer (49).

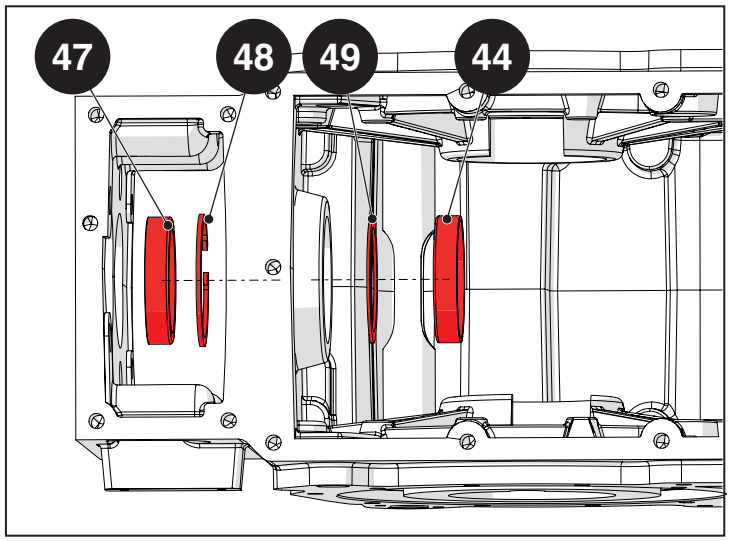


Fig. 5.25

Remove the bearing (50).

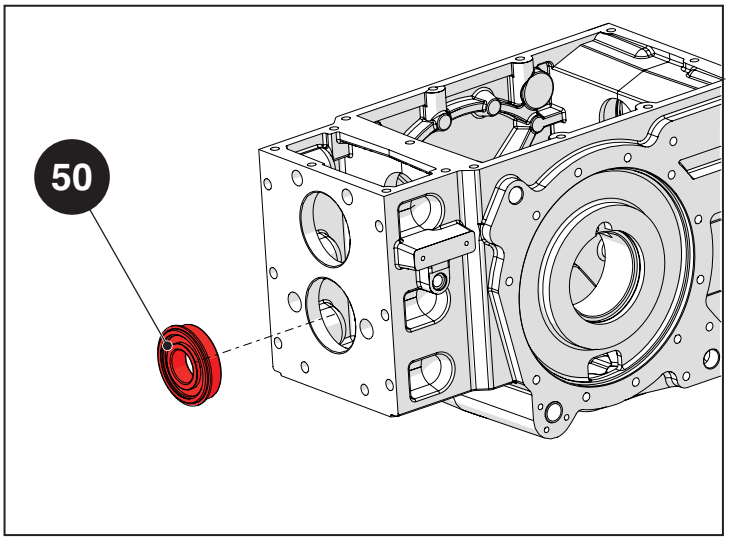


Fig. 5.26

4.2.1 Disassembly/Assembly of the differential ring gear

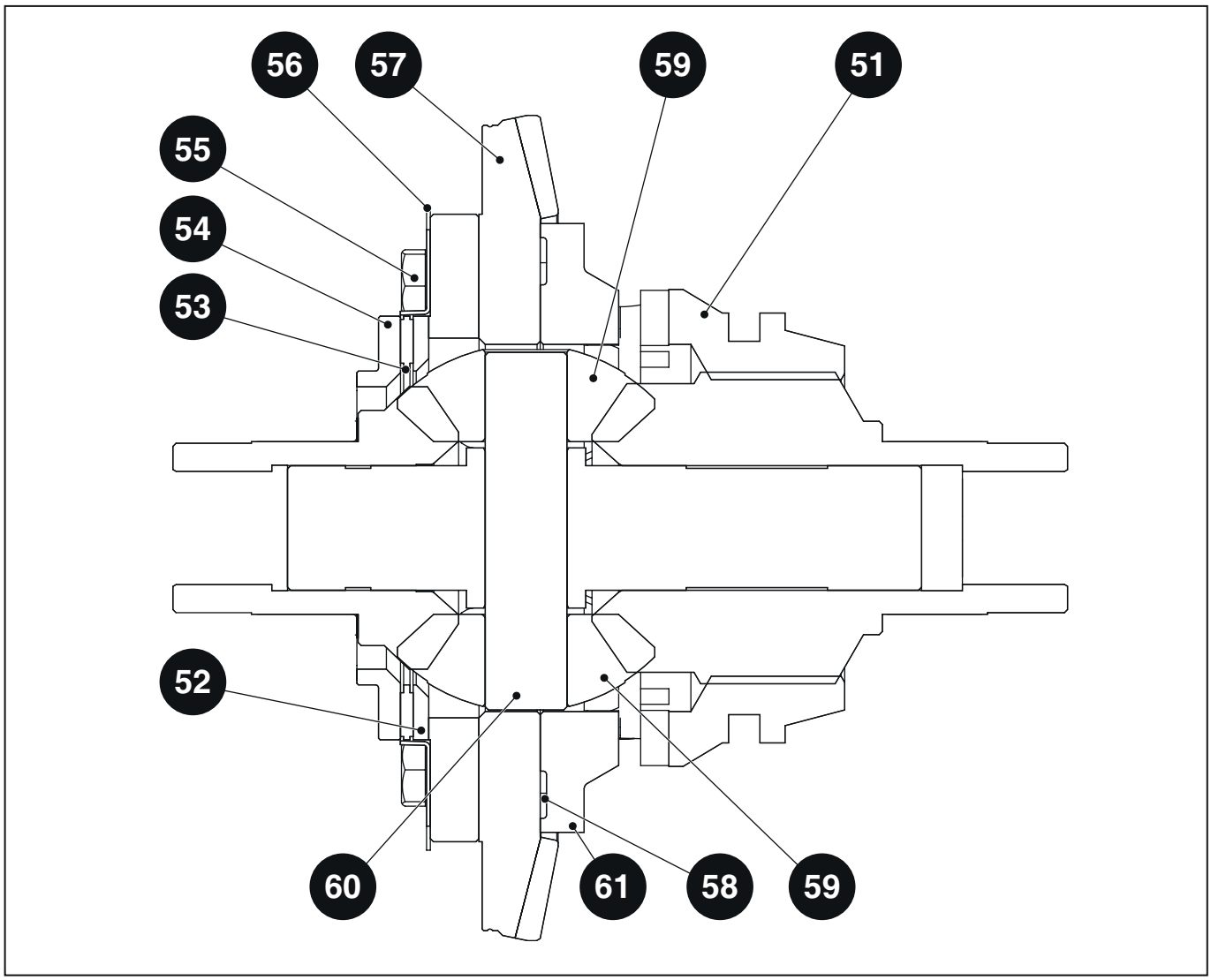


Fig. 5.27

51 - Differential lock pinion
52 - Spacer
53 - Roller cage
54 - Spacer
55 - Screw
56 - Plate
57 - Ring gear
58 - Pin
59 - Planetary gear
60 - Central differential shaft
61 - Diff lock fixed ring

Disassembly

Remove the pinion (51) and fixed ring (61) of the differential lock.

Remove the spacer (52), roller cage (53) and the spacer (54).

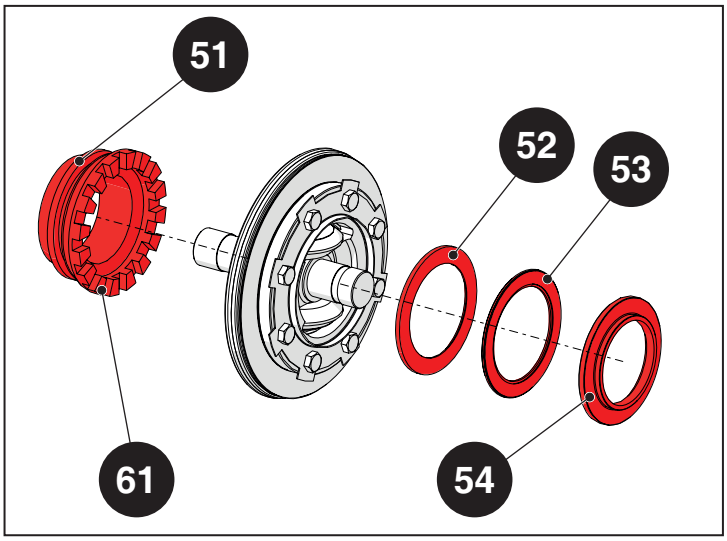


Fig. 5.28

Free the screws (55) from the folds in the plate (56) using a chisel (56).

Unscrew the screws (55) and remove the plate (56).

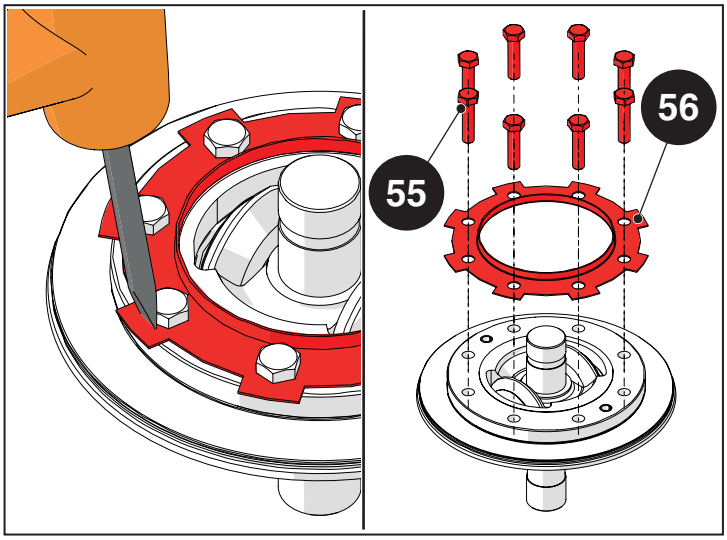


Fig. 5.29

Remove the ring gear (57).

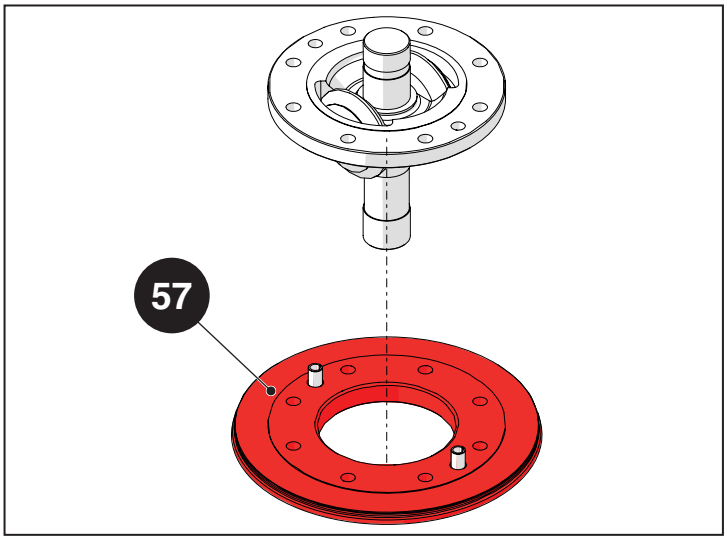


Fig. 5.30

Remove the pins (58) from the ring gear (57).

Remove the planetary gears (59) and central shaft (60) of the differential.

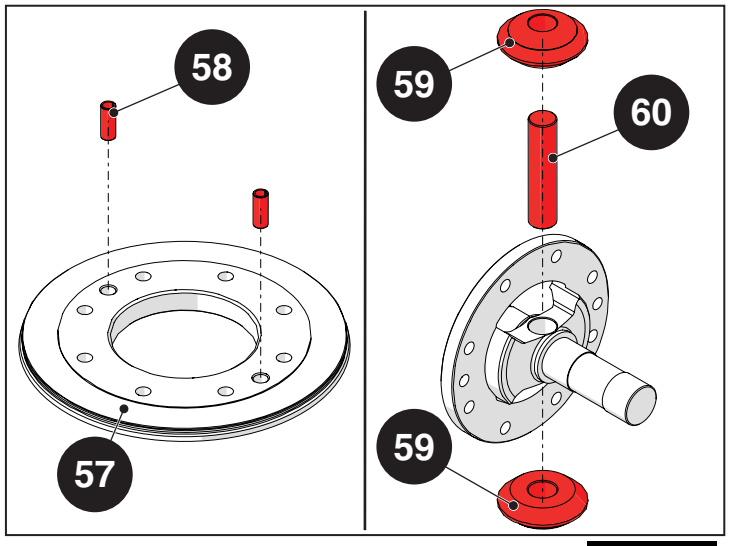


Fig. 5.31

Assembly

Insert the planetary gears (59) and central shaft (60) of the differential.

Insert the pins (58) into the ring gear (57).

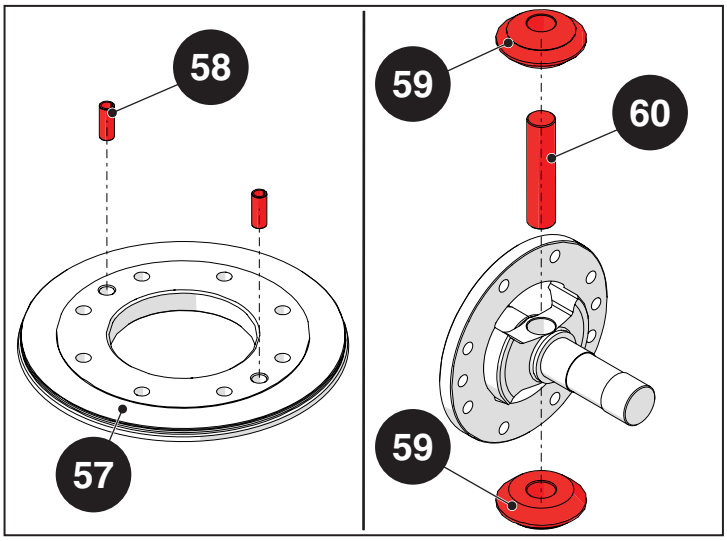


Fig. 5.32

Install the two assembled units. Make sure that the pins (59) match.

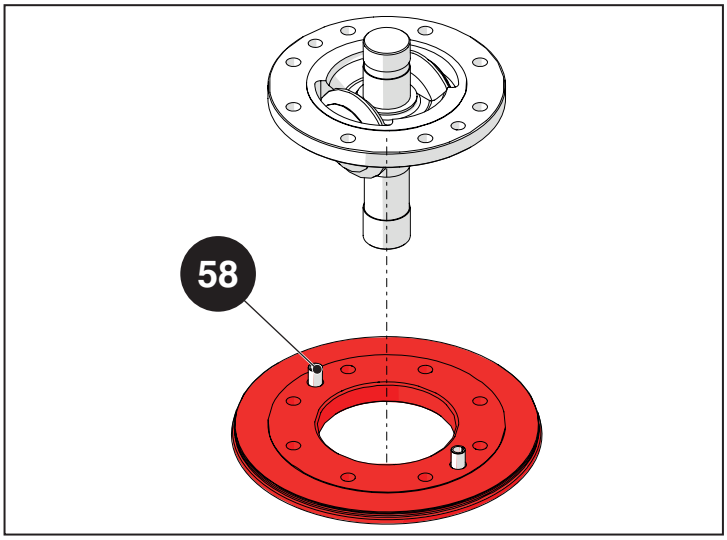


Fig. 5.33

Insert the plate (56).

Tighten the screws (55) by applying a 90 Nm (9 kgm) tightening torque.

Clinch the plate over the screw heads (55) with a hammer and chisel.

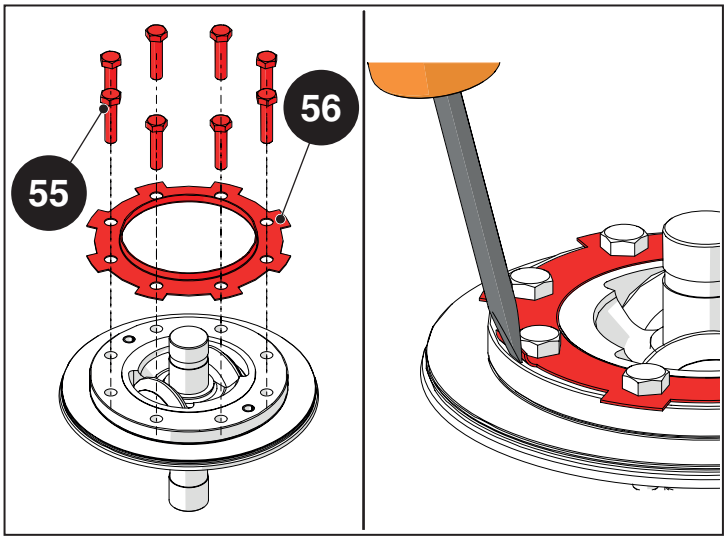


Fig. 5.34

Section 5 : Main inspection, re-assembly and adjustment operations

Index

5.1 Main inspection, re-assembly and adjustment operations.....5-26

5.1 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.

Pinion shimming

Caution

The bearings behind the pinion must be shimmed whenever the rear taper bearing, the bevel gear pair or gearbox are replaced.

The thickness of the spacer (49) between the bearing (44) and circlip (48) must be calculated in order to adjust the position of the pinion (43) in relation to the ring gear.

Total dimension Y of the bearing (44), circlip (48) and the spacer (49) to be inserted must be **27.75 mm**.

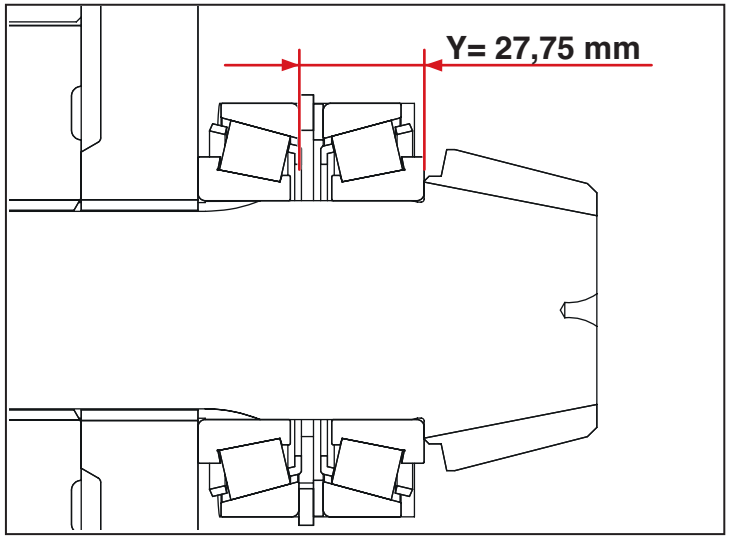


Fig. 5.35

Measure the thickness X of the taper bearing (44) along with the circlip (48).

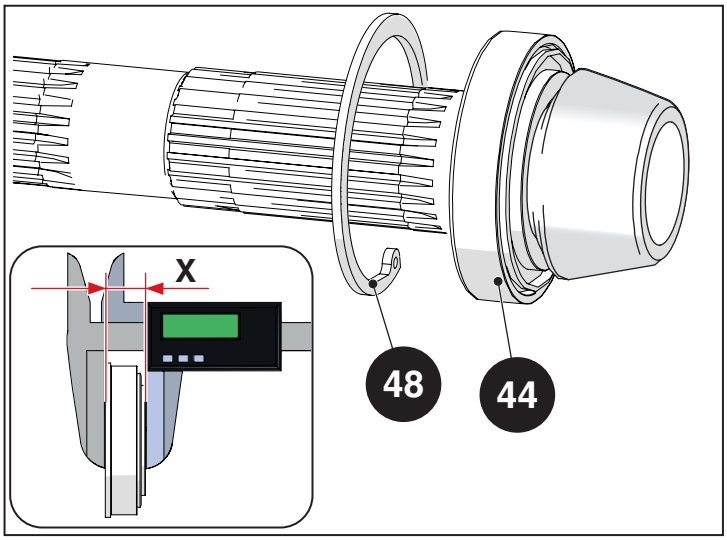


Fig. 5.36

The thickness (Z) of the spacer (49) to be inserted is obtained by means of the following formula:

Y (dimension required 27.75) **- X** (thickness of bearing+circlip) **= Z** (spacer thickness)

Caution
Choose the shim nearest to the calculated value from among those available.

Fit the calculated spacer (49) into the differential housing followed by the circlip (48).

Use the plug (B-code 07006223) to seat the external bearing rings (44) and (47)

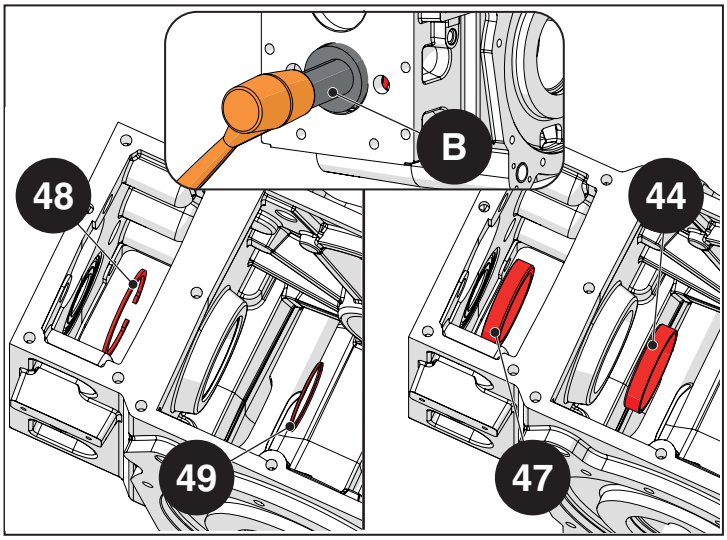


Fig. 5.37

Insert the inner bearing ring (47) into the differential housing.

Use the plug (C-code 07006224) to insert the inner bearing ring (44) into the pinion (43).

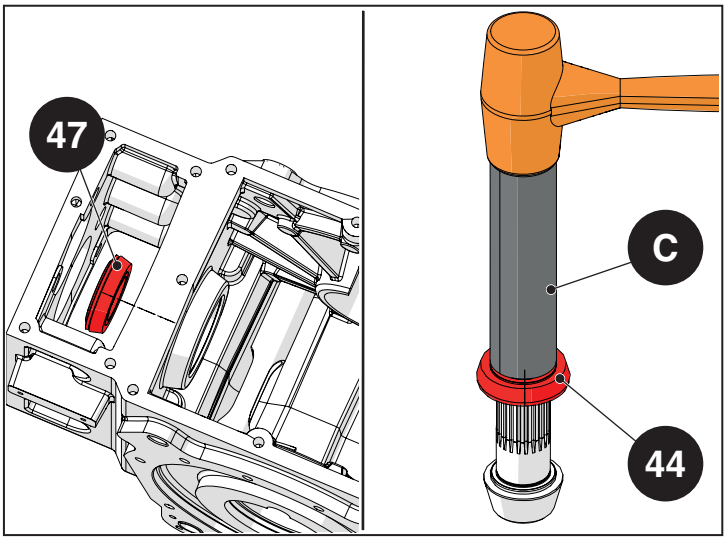


Fig. 5.38

Fit the pinion into the differential housing and mesh it with the driving gear (46), P.T.O. gear (45) and nut (42).

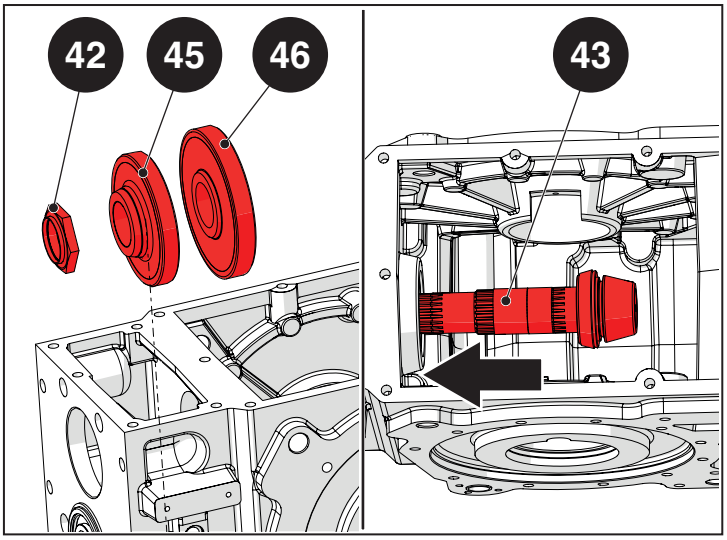


Fig. 5.39

Use the plug (C-code 07006224) to fully seat the bearings.

Use the tool (I-code 07006225) to restrain the pinion.

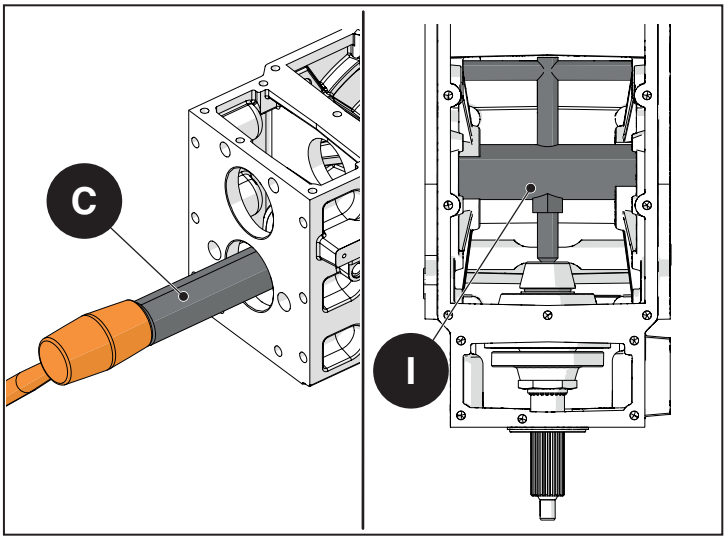


Fig. 5.40

Lock the nut (42), using tool (A- Code 07000239).

Use tool (A) to unscrew the pinion (43) and consequently tighten the nut (42), applying a 60 Nm (6 kgm) tightening torque.

Fully tighten the nut (42), then loosen it about 1/4 of a turn and tighten it again by applying a 40 Nm (4 kgm) tightening torque.

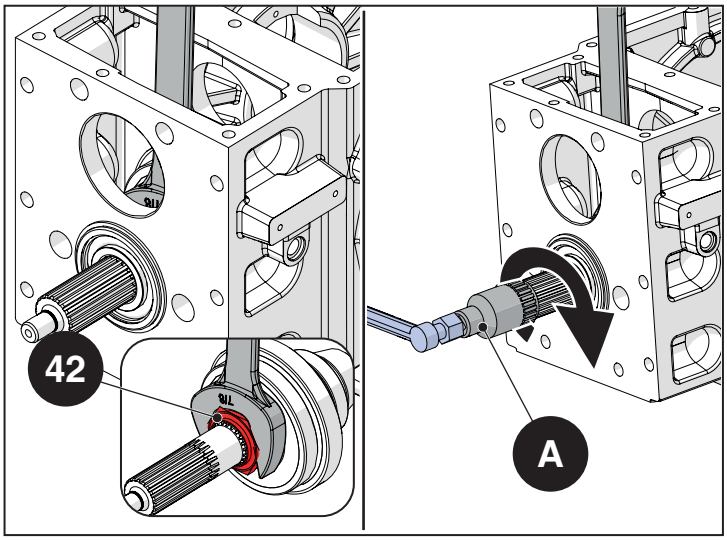


Fig. 5.41

Caution

Tap the pinion with a mallet made of soft material.

Tighten the nut again to the indicated tightening torque so as to ensure that all play has been eliminated.

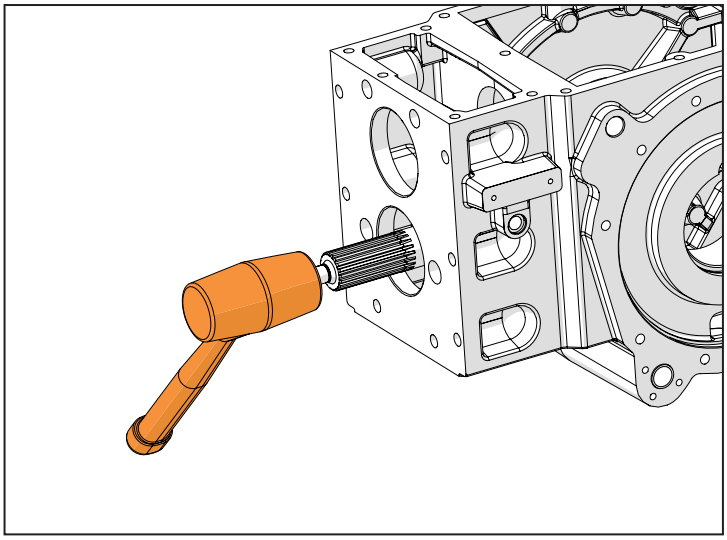


Fig. 5.42

Use tool (D-code 07006221) to chamfer the nut (42).

Position it on the nut (42), then tap it with a mallet to create the chamfers.

Caution

Make sure that the pinion is able to turn smoothly, which must occur by applying a minimum force.

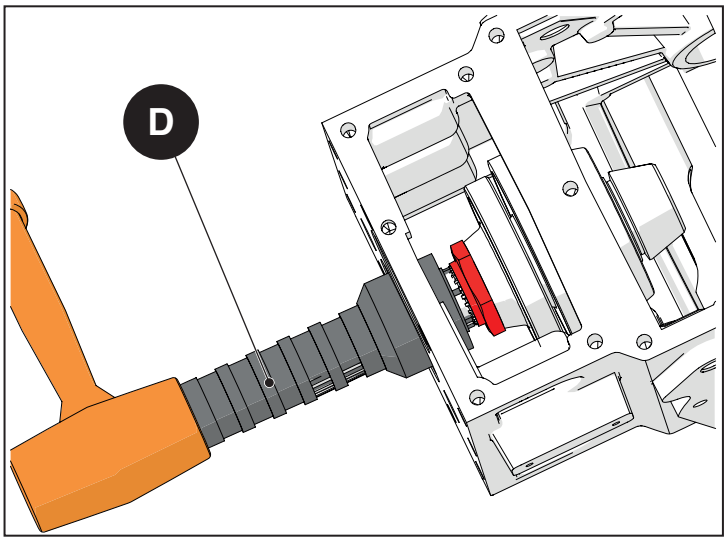


Fig. 5.43

Insert and fully seat the bearing (50).

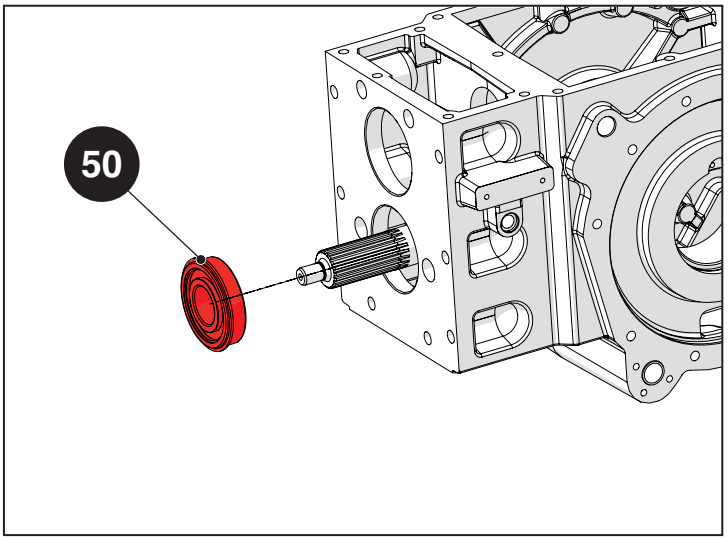


Fig. 5.44

Pinion / ring gear play adjustment

Position the complete ring gear of the differential in the differential housing.

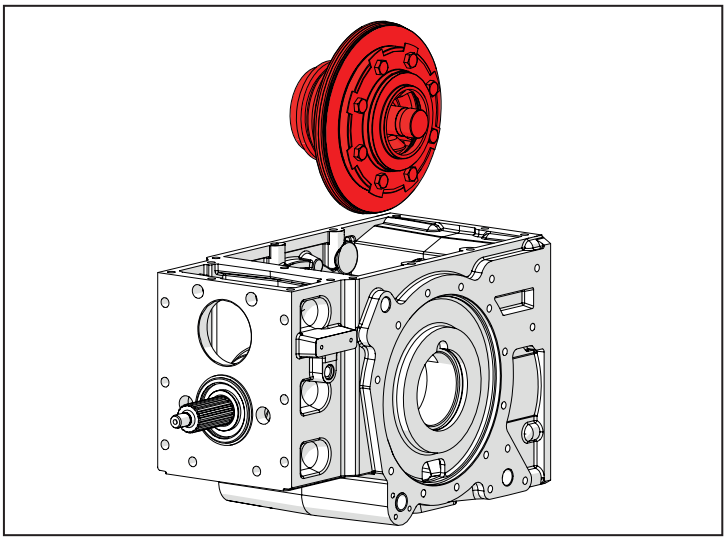


Fig. 5.45

Remove the crown wheels (38) and (39).

Insert the bearings (40) and (41), then seat them by using the plug (E-cod.07006226).

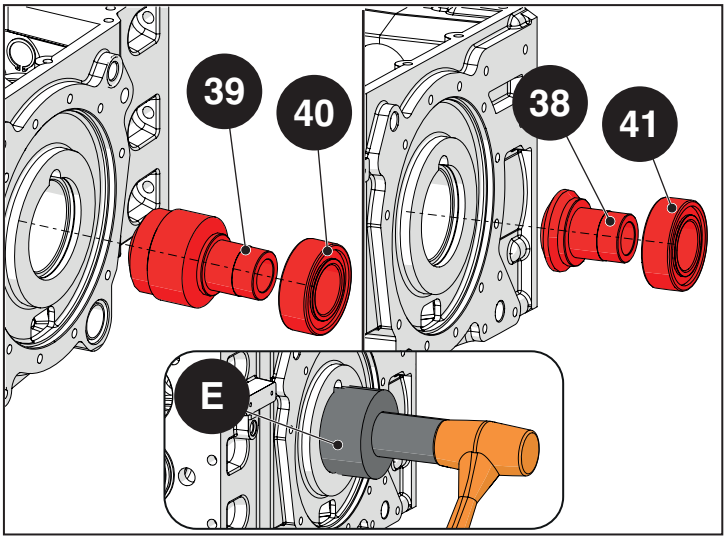


Fig. 5.46

Use tool (F-code 07000237) and fully tighten the left-hand ring nut (37) so as to eliminate the play between the pinion and ring gear.

Caution

Match any slits in the ring nut with the hole where the ring nut retainer is inserted.

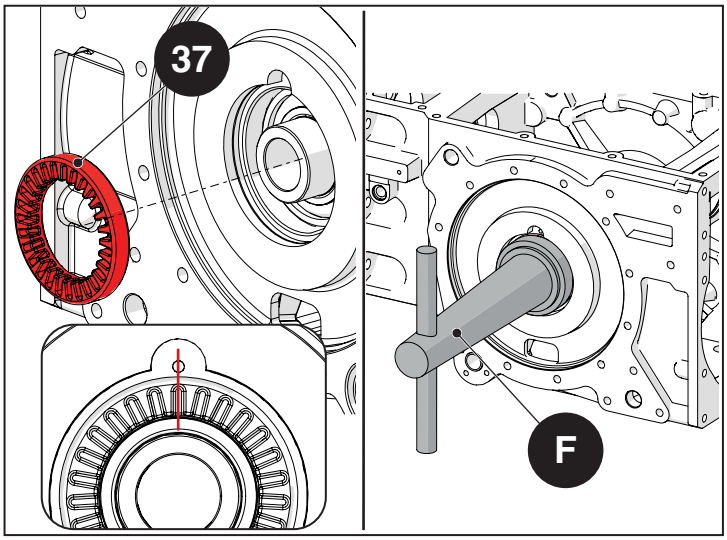


Fig. 5.47

Unscrew the ring nut by 3 grooves, using the ring nut retainer hole as a reference.

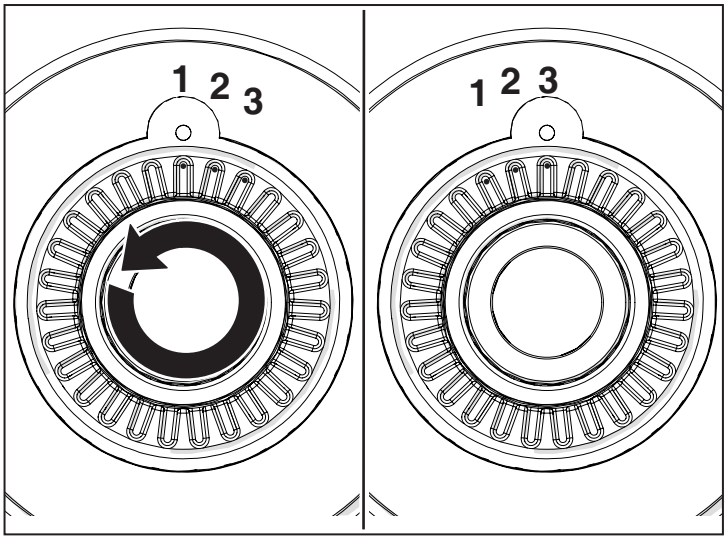


Fig. 5.48

Use tool (F-code 07000237) and fully tighten the right-hand ring nut (37) by applying a 20 Nm (2 kgm) tightening torque.

Caution

Match any slits in the ring nut with the hole where the ring nut retainer is inserted.

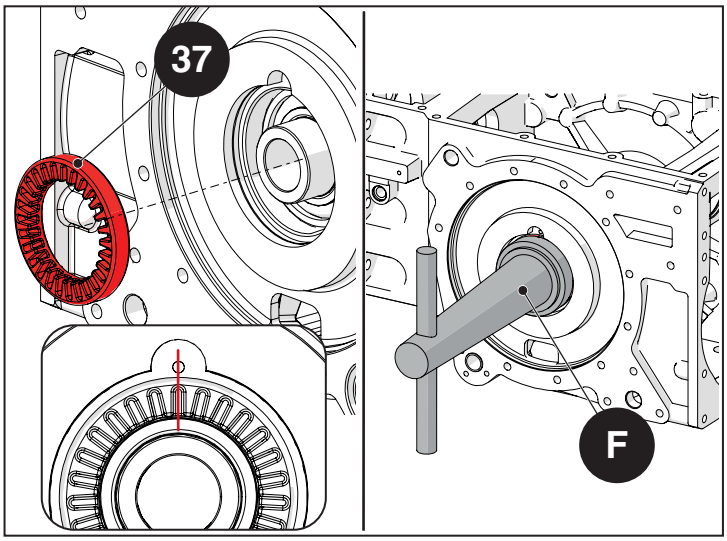


Fig. 5.49

Now measure the play that formed when the left-hand ring nut was unscrewed.

Position a comparator with magnetic base (G) on one of the ring gear teeth and reset it to zero.

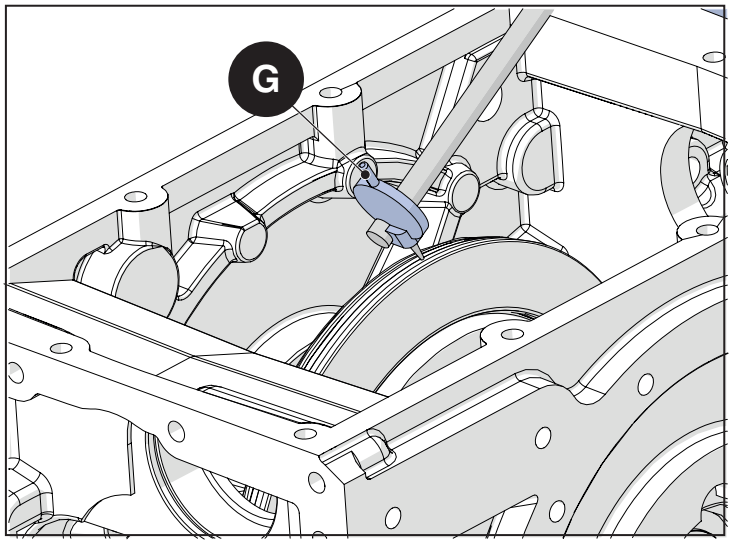


Fig. 5.50

Slightly move the ring nut so as to measure the play on the pinion teeth.

The play between the pinion and ring gear teeth must be 0.07 to 0.15 mm.

Caution

Take the measurements in at least 4 different points of the ring gear.

Note

If the play does not fall within the given values, tighten or loosen the ring nut (37) on the ring gear side.

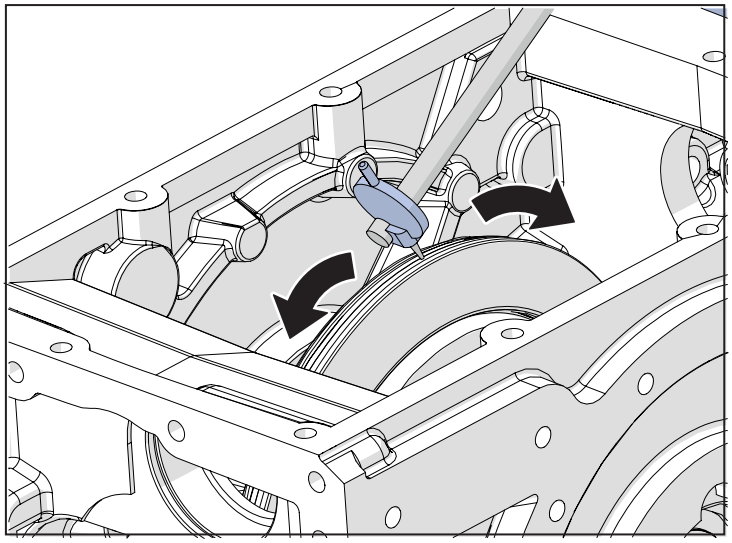


Fig. 5.51

Use tool (F-code 07000237) and fully tighten the right-hand ring nut (37).

Now unscrew it in the anti-clockwise direction by 5 grooves, using the ring nut retainer hole as a reference.

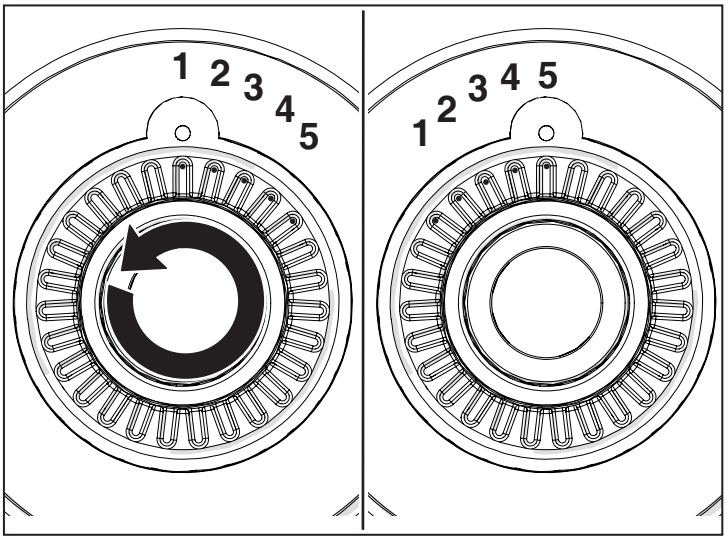


Fig. 5.52

To make sure that the preload is correct on both sides, tap with a mallet on the planetary gear (59) on the ring gear.

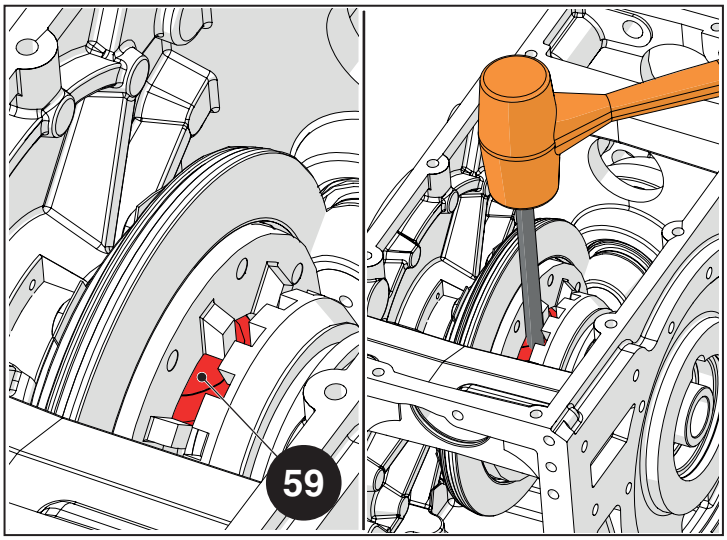


Fig. 5.53

Continue to press down on the planetary gear (59), then attempt to turn one of the crown wheels (38) or (39) and check that, in this phase, the play between the teeth of the pinion and ring gear has been completely eliminated.

Adjust the right-hand ring nut if there is a still play between the teeth.

Caution
Check both the crown wheels.

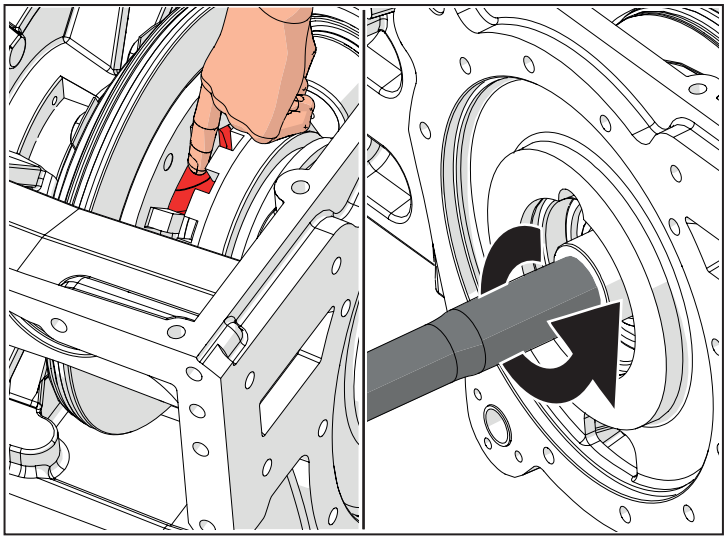


Fig. 5.54

Tighten the ring nut retainer (36).

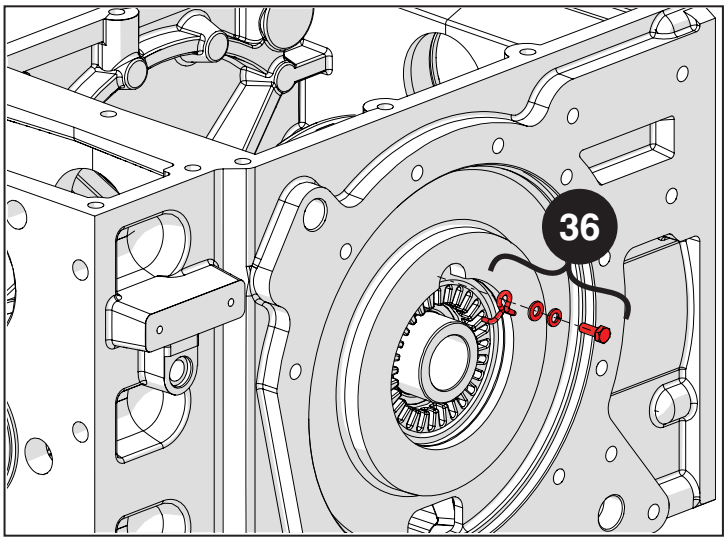


Fig. 5.55

Assemble the oil retainer (35).

Insert the selection lever (32) complete with spring (33) and spacer (34), then lock the lever with the centring pin.

Insert the selector pin (31).

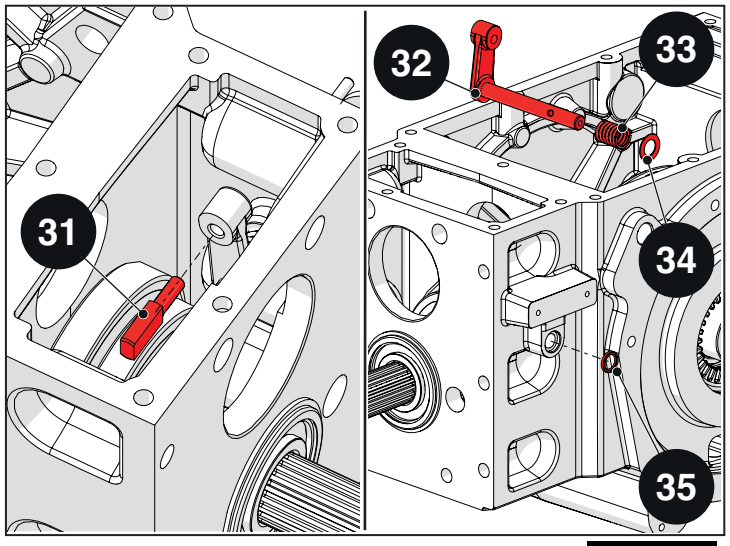


Fig. 5.56

Assemble the circlip (28) on the P.T.O. shaft (24), then use a plug of a suitable diameter to fully seat the bearing (26).

Caution

Insert the circlip (28) upside down so as to facilitate the disassembly operations.

Take care not to bend the circlip when the bearing is installed.

Insert the circlips (27) and (29).

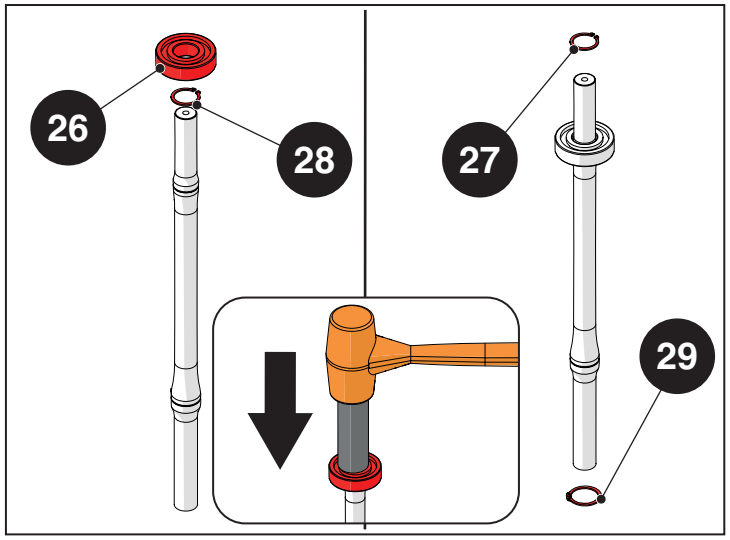


Fig. 5.57

Fit the complete shaft (24) into the differential housing. Make sure that it aligns with the gear (30).

Align the gear (30) with the selector pin (31) at the same time.

Caution

Tap the shaft (24) with a mallet made of soft material so as to fully seat the bearing (26).

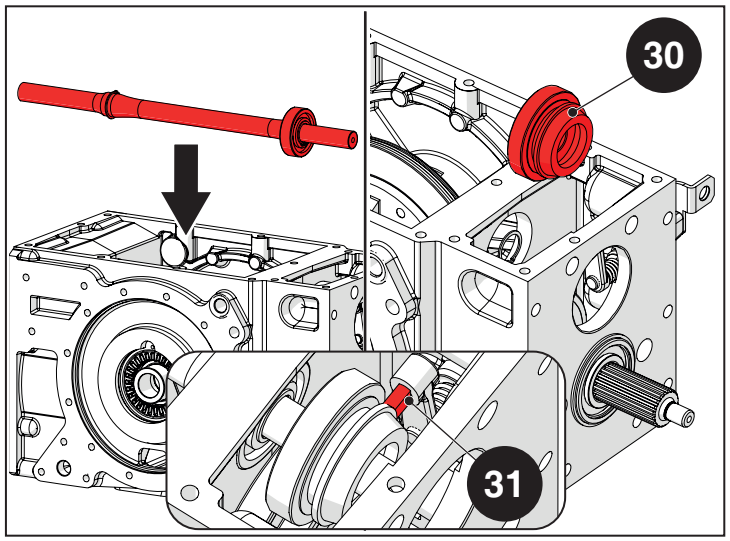


Fig. 5.58

Use a plug of a suitable diameter to insert the bearing (25) and seat it onto the circlip (29).

Caution

Take care not to bend the circlip when the bearing is installed.

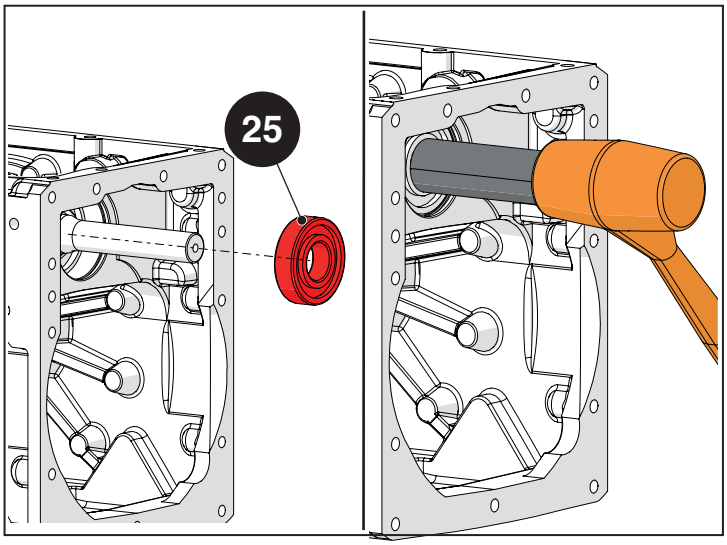


Fig. 5.59

Insert the circlip (23);

Insert the following components in the given order:

- gear (22);
- spacer (21);
- gear (20);
- spacers (19) - one size 0.2 mm and the other 0.4 mm;

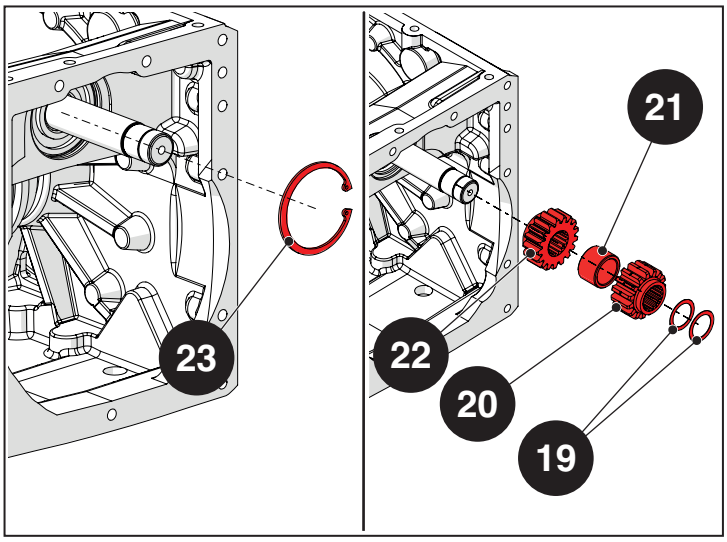


Fig. 5.60

Caution

Fit a spacer between the casing of the housing and the shaft to prevent it from moving and damaging the circlips.

Use a plug of an adequate diameter to completely seat the inner race of the bearing (18).

Assemble the outer race of the bearing (18) and the circlip (17).

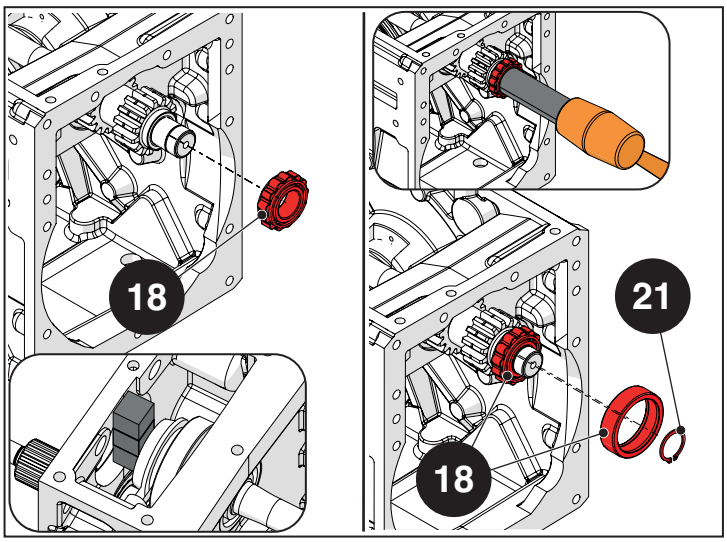


Fig. 5.61

Pre-assemble the rod (12) with the O-Rings (16) and circlip (15).

Fit the the rod (12), spring (14) and fork (13) into the differential housing.

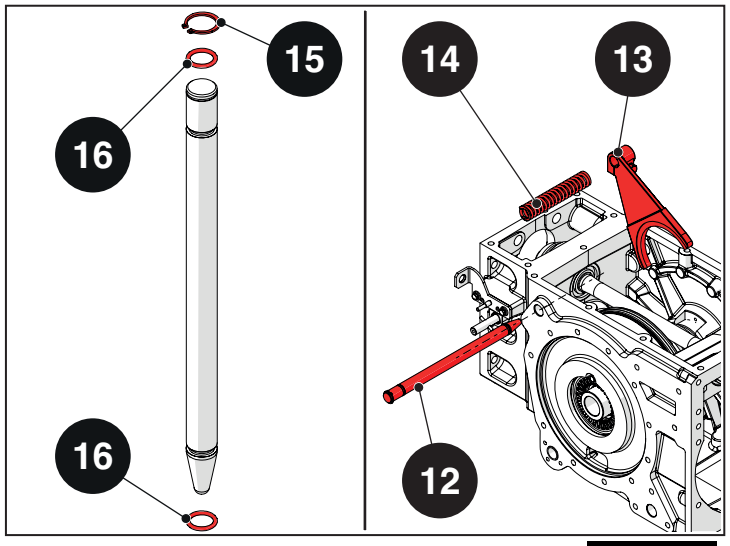


Fig. 5.62

Insert the spring rings (62) into the piston (63).

Apply a layer of grease to the cylinder of the lever (64), then insert the piston.

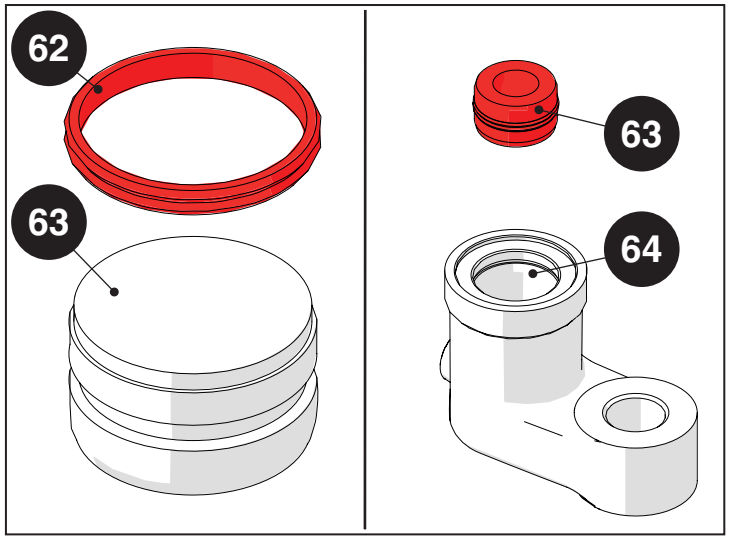


Fig. 5.63

Push the piston fully into the cylinder and then fit the circlip (65) into its housing.

Make sure that the piston slides smoothly by blowing compressed air into the hole until it reaches the circlip (65).

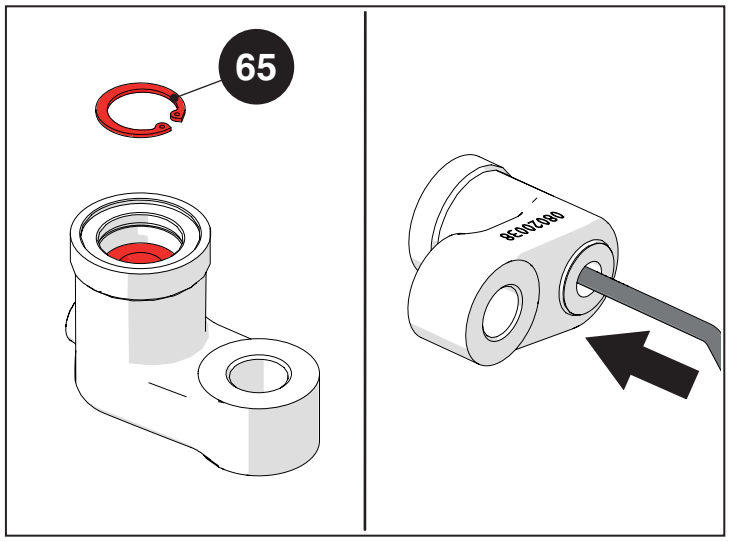


Fig. 5.64

Screw tool (H-07007183) onto the cylinder to keep it against the circlip (65).

Assemble the stud bolt (66), lever (67), cylinder (64) and washers (68) on the differential unit.

Tighten the nut (69).

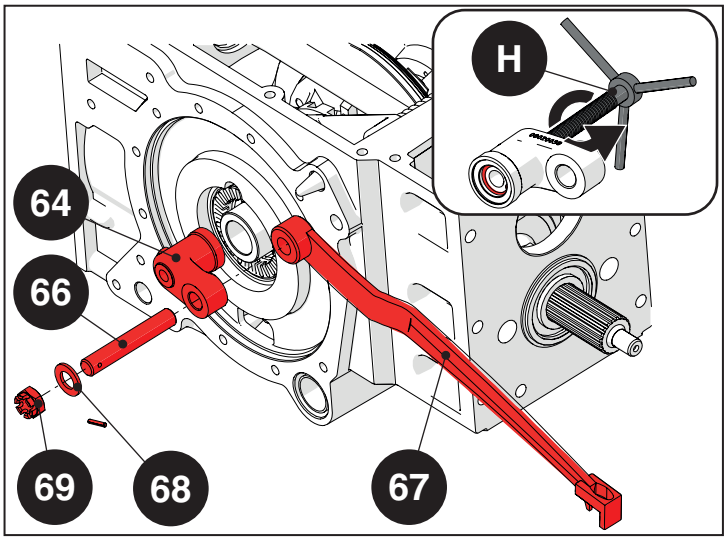


Fig. 5.65

After having assembled the lever of the differential lock, adjust the travel of the fork by checking that a 1.5 to 2 mm gap remains between the differential lock ring and ring gear teeth.

Screw tool (H-07007183) into the hole again so as to push the piston (63) and, consequently, the rod (12).

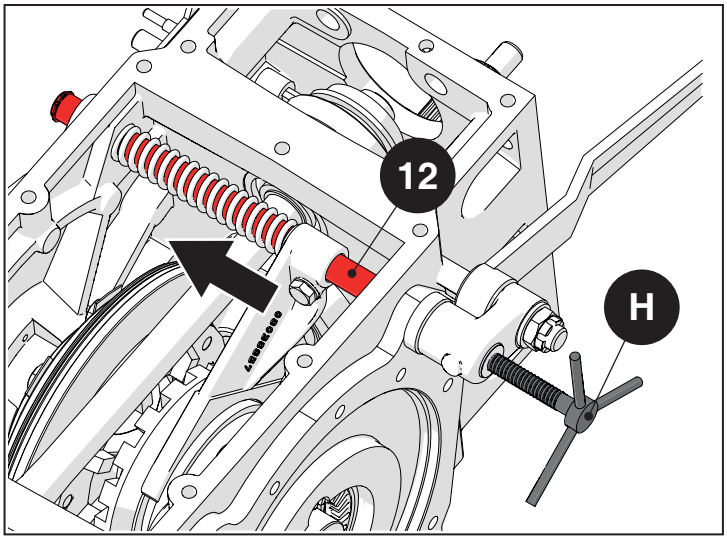


Fig. 5.66

Move the fork (13) with a lever so as to load the spring (14).

Push the rod (12) fully against the piston (63).

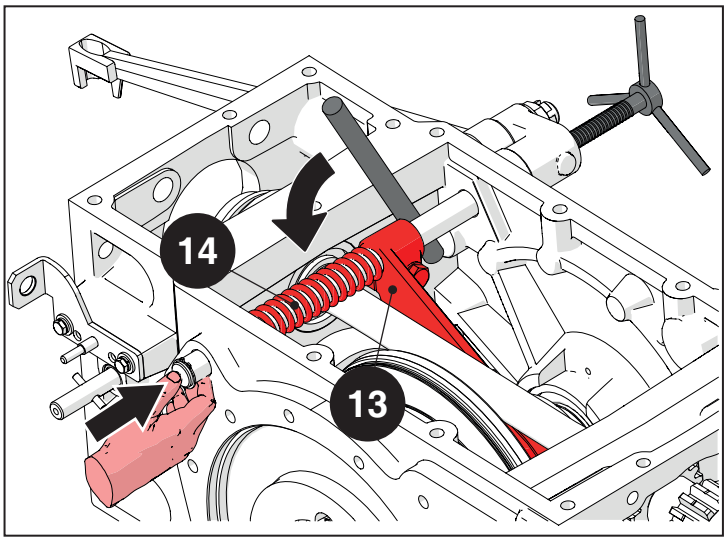


Fig. 5.67

Relieve the spring (14) by making the fork (13) travel 1.5-2 mm.

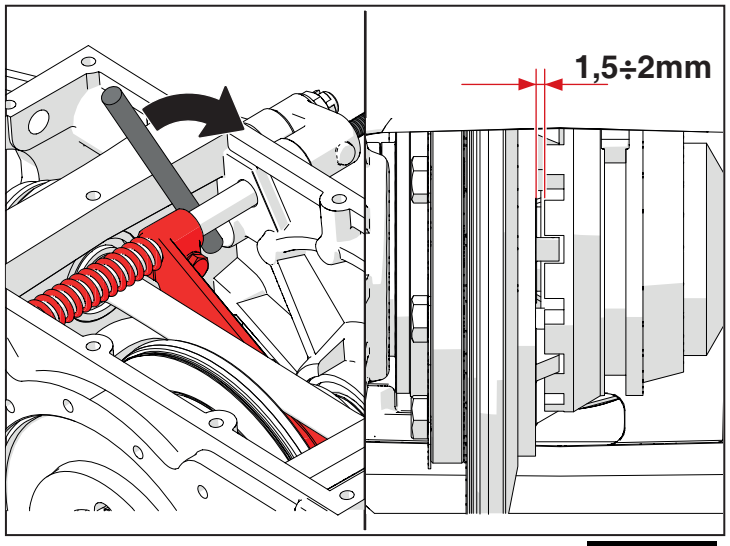


Fig. 5.68

Tighten the fixing screw of the fork (13) onto the rod (12).

Unscrew tool (H) and fully relieve the spring (14).

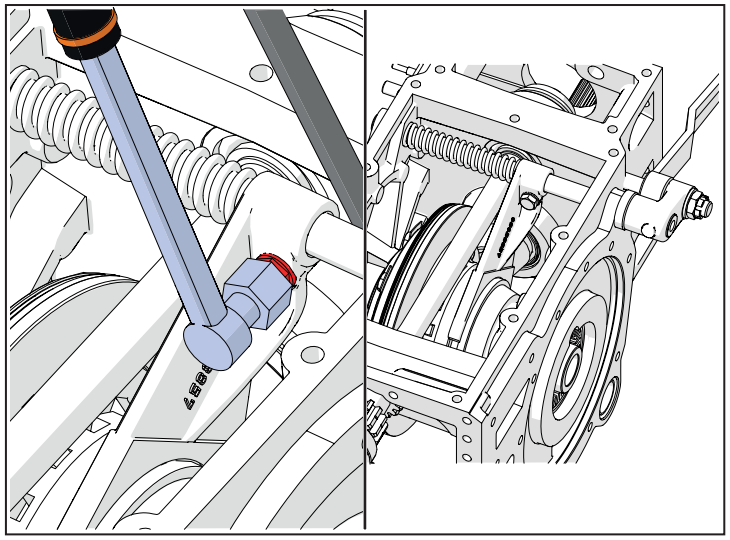


Fig. 5.69

P.T.O. selection lever adjustment

Put the selection lever in neutral.

Assemble tool (G-code 07001643) on the differential housing, aligning the plug of the tool with the gear race (30).

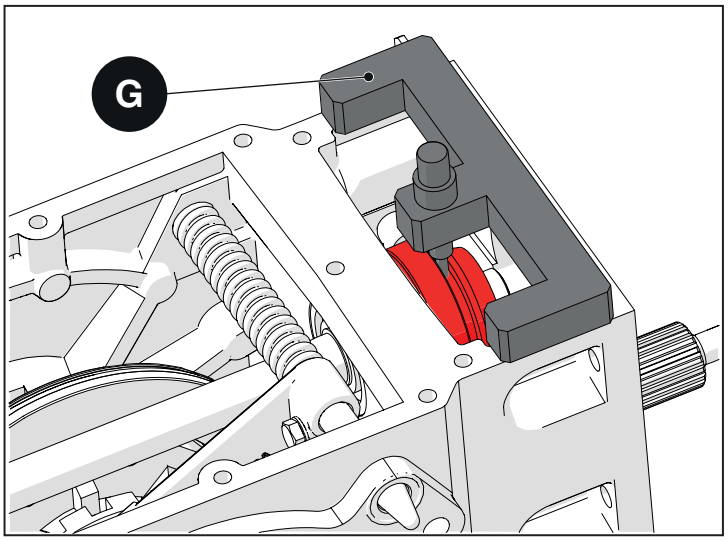


Fig. 5.70

Tighten the screws and washers to fix the selector plate in position.

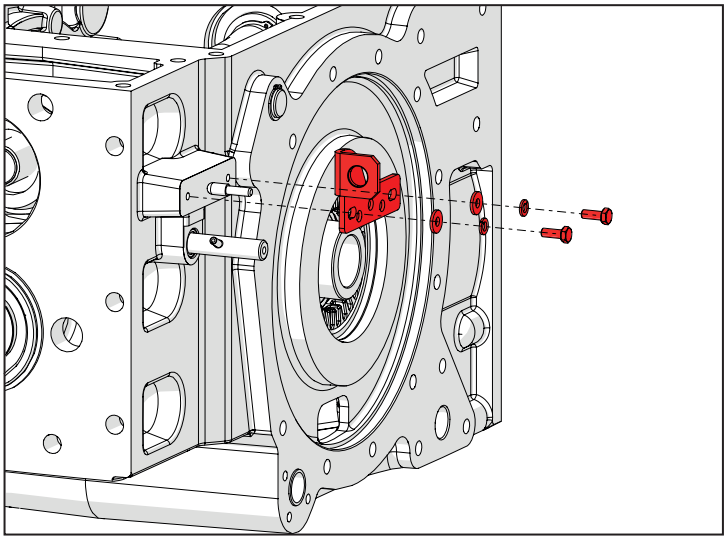


Fig. 5.71

Apply TEFLON to the stud bolt on a level with the through hole so as to prevent leaks.

Apply a layer of SILICONE to the surface on which the gearbox couples with the differential.

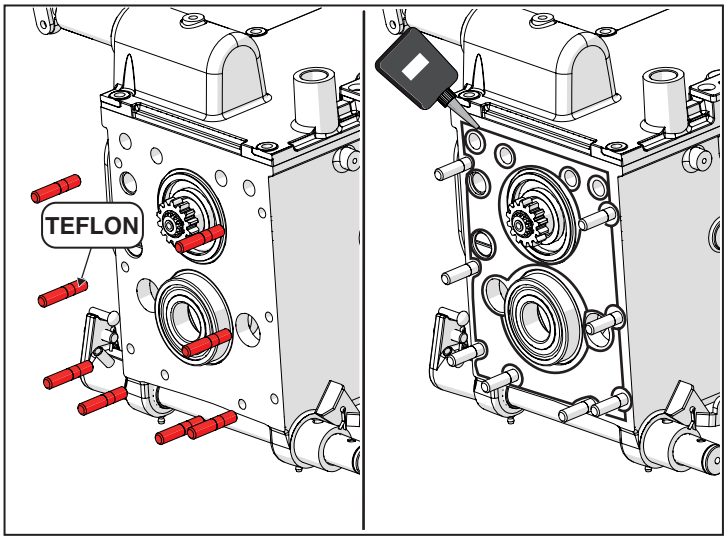


Fig. 5.72

Align the gearbox with the differential.

> **Caution**
>
> Engage the speed gears to make it easier to couple the units.

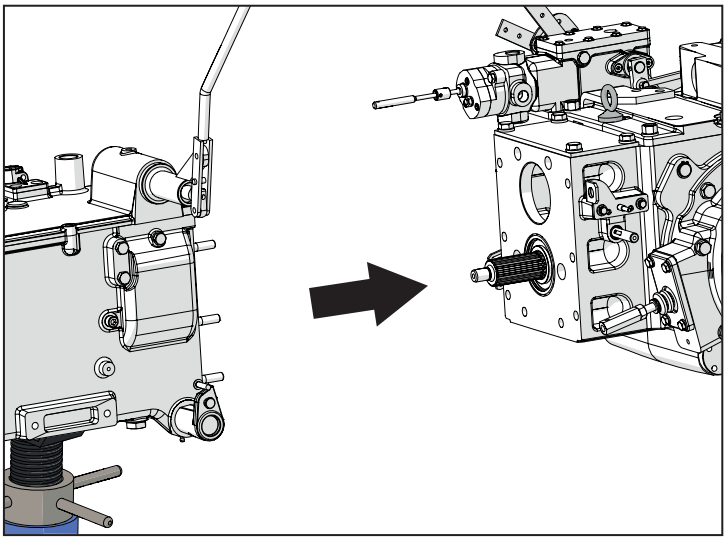


Fig. 5.73

Insert the washers (5) and tighten the screws (4) by applying 160 Nm (16 kgm) tightening torque.

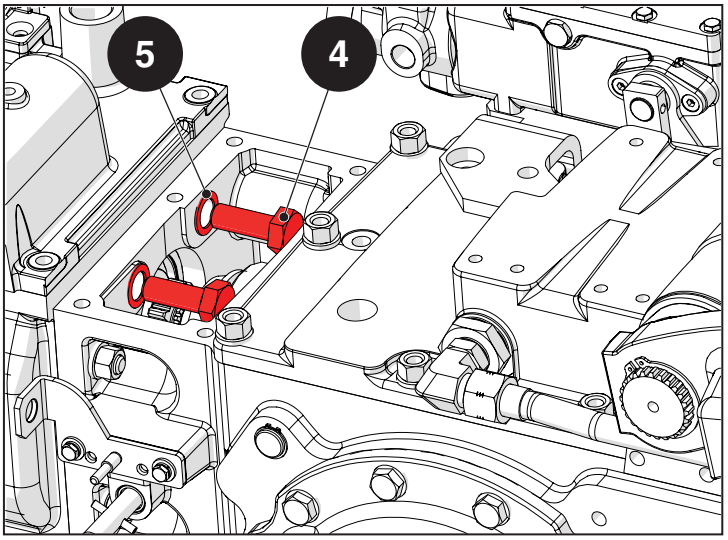


Fig. 5.74

Tighten the two self-locking nuts.

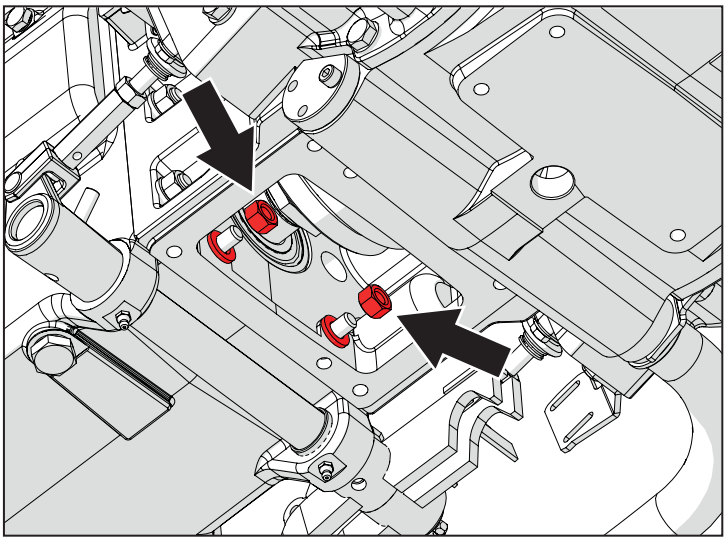


Fig. 5.75

Insert the washers (7) and tighten the nuts (6) by applying 85 Nm (8.5 kgm) tightening torque.

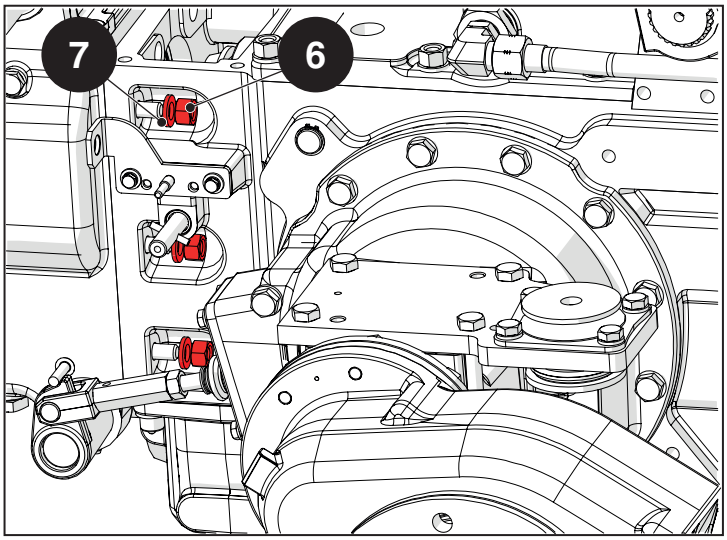


Fig. 5.76

Apply a layer of SILICONE to the coupling surface.

Insert the complete drive transmission unit.

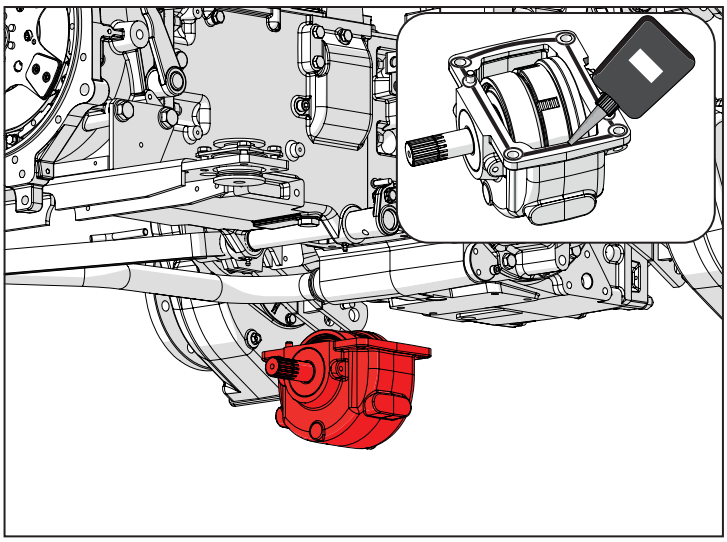


Fig. 5.77

Insert the washers and tighten the screws by applying 85 Nm (8.5 kgm) tightening torque.

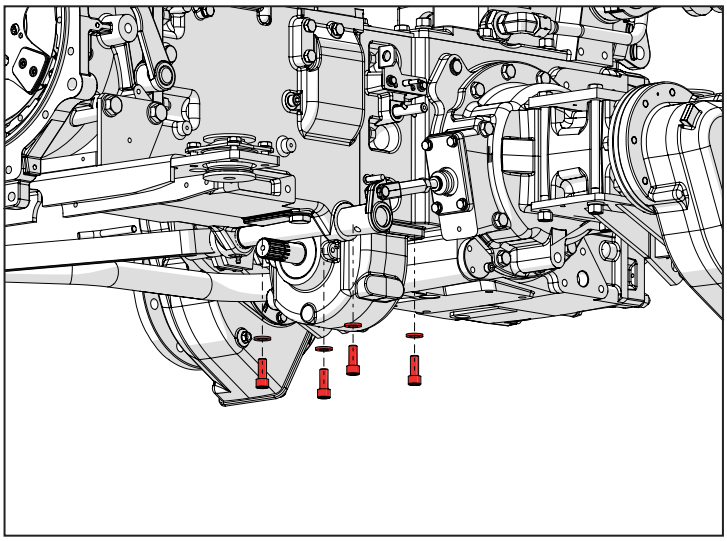


Fig. 5.78

Section 6 : Tightening torques

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6.1 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	Nm	kgm
M12x12 nut for fastening differential housing-gearbox	85	8.5
M18x1.5 screw for fastening differential housing-gearbox	160	16
M12x12 nut for fastening differential housing-hitch	85	8.5
M12x30 screw for fixing rear hitch cover	85	8.5
M12x12 nut for fastening differential housing-rear P.T.O. cover	85	8.5
M12x40 screw for fastening differential housing-hubs	85	8.5
M12x35 screw for fastening differential housing-drive transmission support	85	8.5
M10x50 screw for fastening bevel gear pair	90	9
M10x35 screw for fastening diff lock control fork	55	5.5
Ring nut for fastening bevel pinion	40	4
Ring nut for fastening differential	20	2
Ring nut for fastening P.T.O. shaft	25	2.5

Section 7 : Tools required

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7.1 Tools required

Code	Description	Quantity
07000237	Ring nut wrench - 1363	1
07000239	Tool 1363/20 - 1363	1
07000247	Differential support	1
07006221	Plug for multiple chiseling of pinion ring nut	1
07006223	Plug for assembling differential taper bearings	1
07006224	Plug for assembling bevel pinion taper bearings	1
07006225	Bevel pinion retainer tool	1
07006226	Plug for assembling differential crown wheel bearing	1
07001643	P.T.O. selection lever adjuster tool	1
07007183	Tool for assembling rear diff lock locking cylinder	1
07000215	Gearbox - base unit support	1
07000245	Tractor splitting support	1

Chapter 6 : Rear final drives

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Section 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.

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 the sharp edges around the top of the transmission housing.

Caution

Used oil must be collected and disposed of in compliance with the anti-pollution laws in force.

Section 2 : General introduction

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2.1 Drawing of the assembly

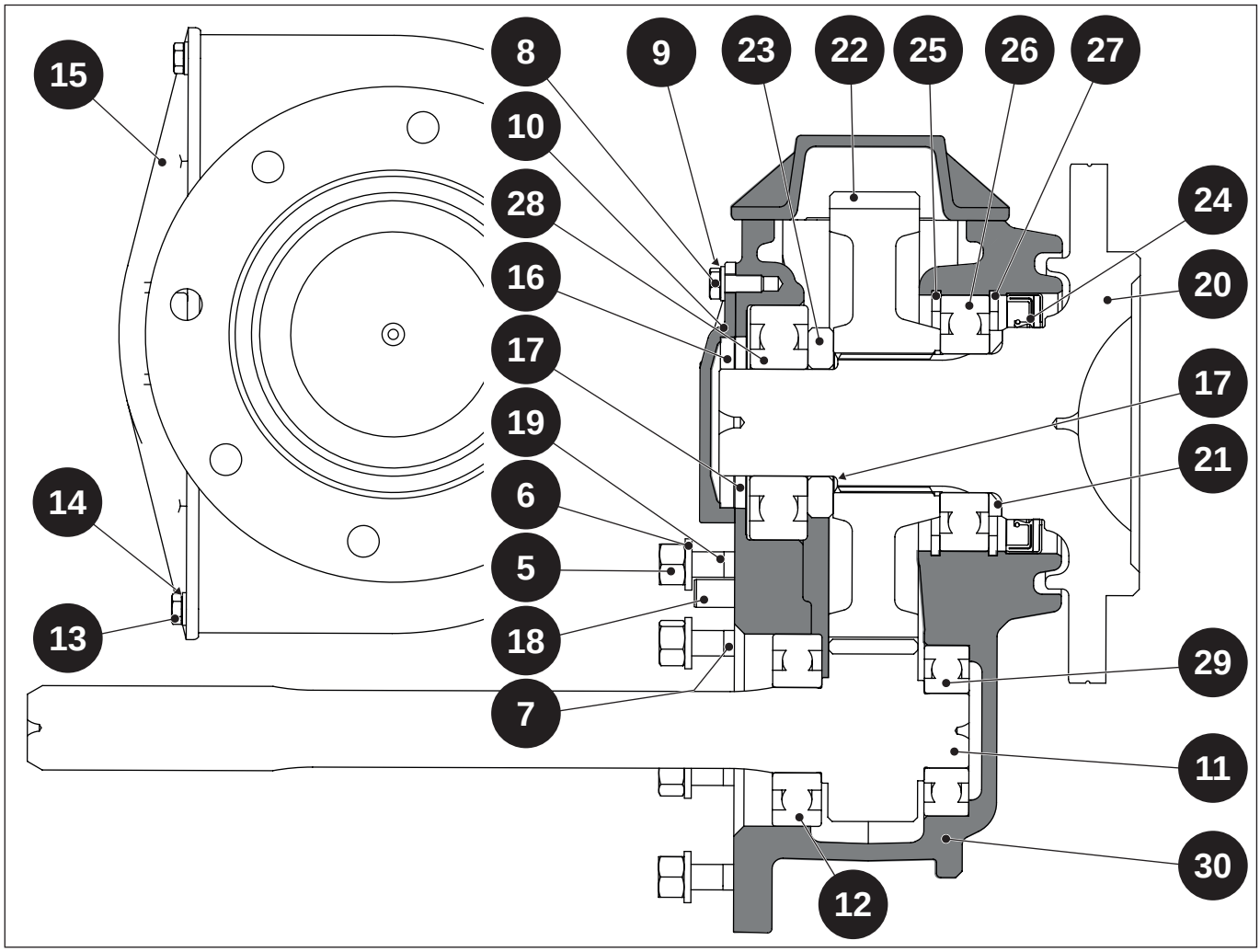


Fig. 6.1

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 - Retainer washer
18 - Centring pin
19 - Stud bolt
20 - Axle shaft
21 - Spacer
22 - Final drive gear
23 - Spacer
24 - Oil retainer
25 - Circlip
26 - Bearing
27 - Circlip
28 - Bearing
29 - Bearing
30 - Rear final drive casing

Section 3 : Disassembly

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3.1 Disassembly 6-6

3.1 Disassembly

Caution

The following instructions apply to both final drives. Bear in mind that the ring nut (16) on the left final drive has a left-hand thread, while the ring nut on the right final drive has a right-hand thread. Moreover, the left axle shaft (20) is shorter than the one on the right.

Use a hammer and chisel to release the nuts.

Unscrew the nuts (5) and remove the washers (6).

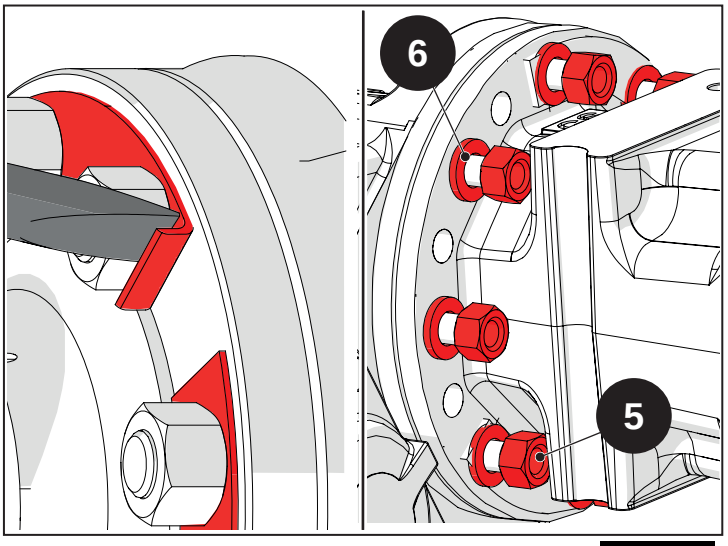


Fig. 6.2

Remove the plates (7).

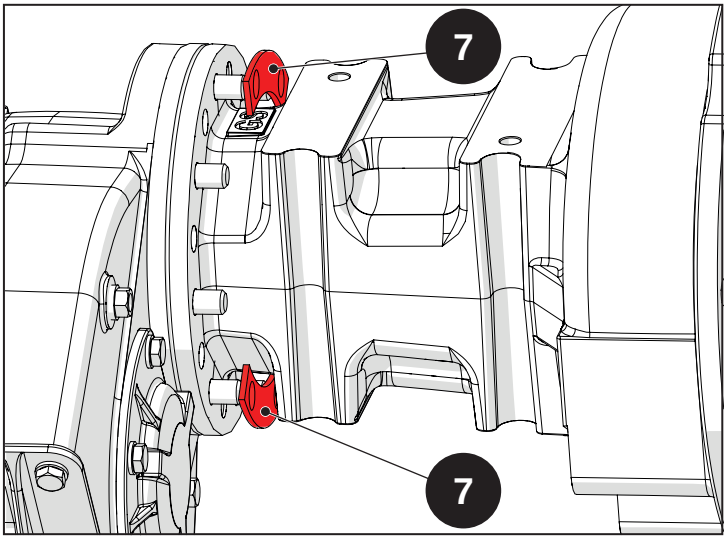


Fig. 6.3

Remove the complete final drive from the rear axle shaft, along with the O-Ring.

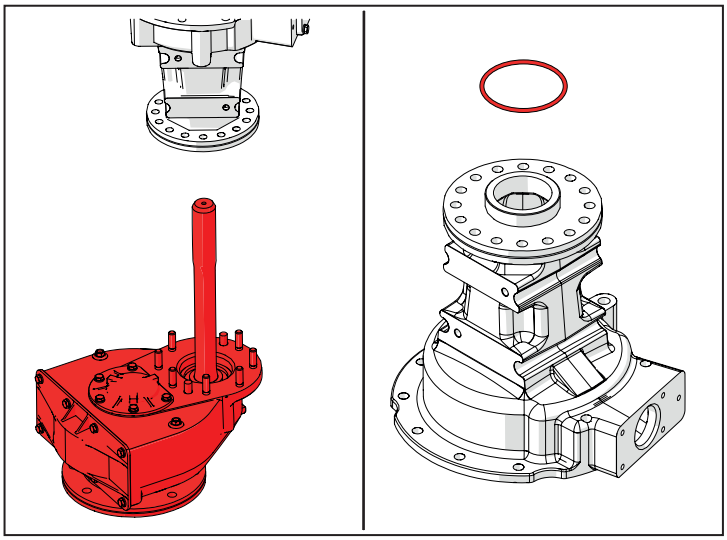


Fig. 6.4

Unscrew the screws (8) and remove washers (9) and cover (10).

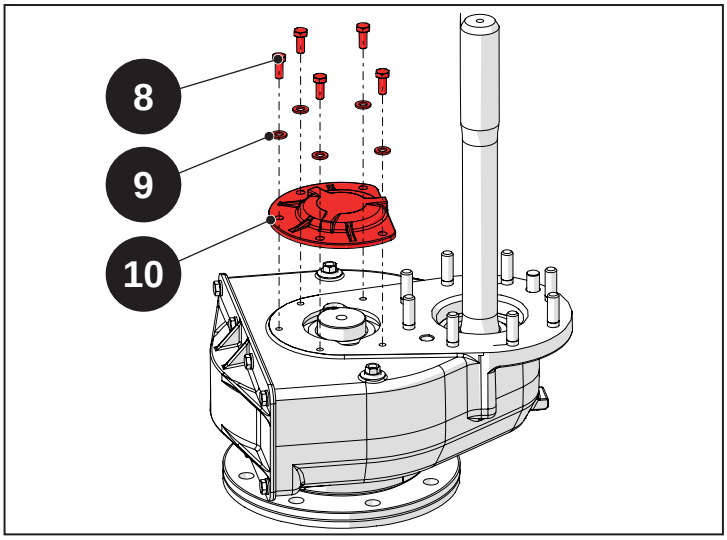


Fig. 6.5

Remove the pinion (11) from the final drive.

Remove the bearing (12) from the pinion (11).

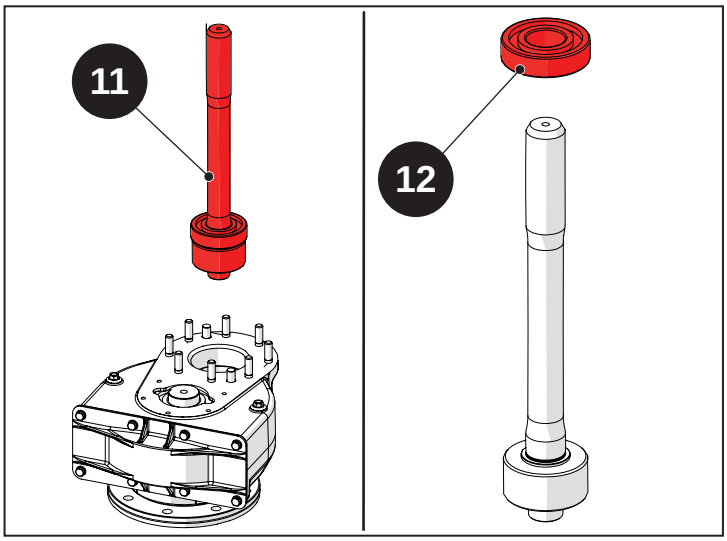


Fig. 6.6

Unscrew the screws (13) and remove washers (14) and cover (15).

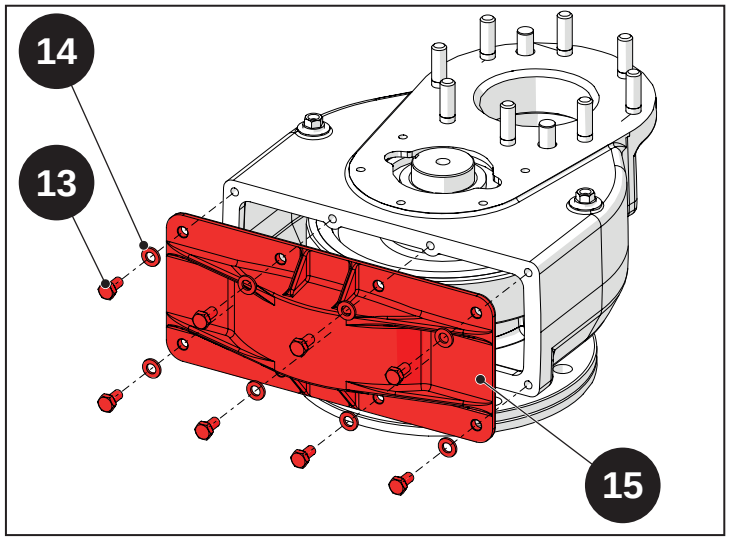


Fig. 6.7

Use tool (A-code 07000227) to remove the ring nut (16).

Remove the safety washer (17).

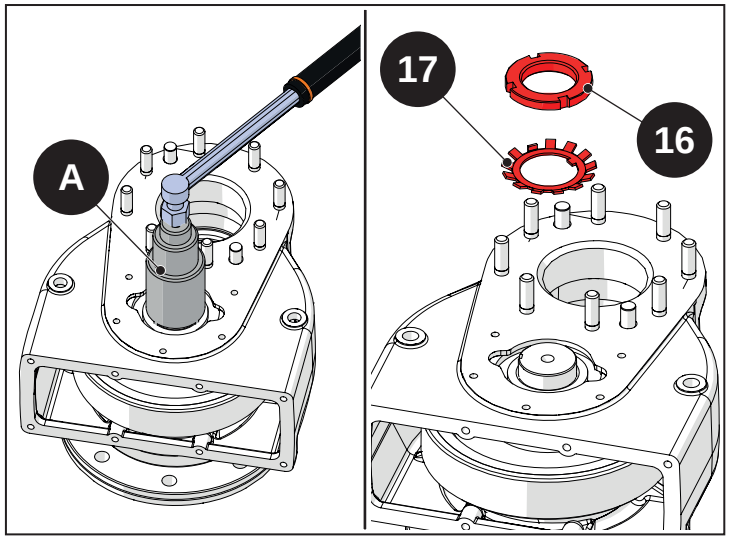


Fig. 6.8

Remove the rear axle shaft (20) from the casing, then remove the spacer (21).

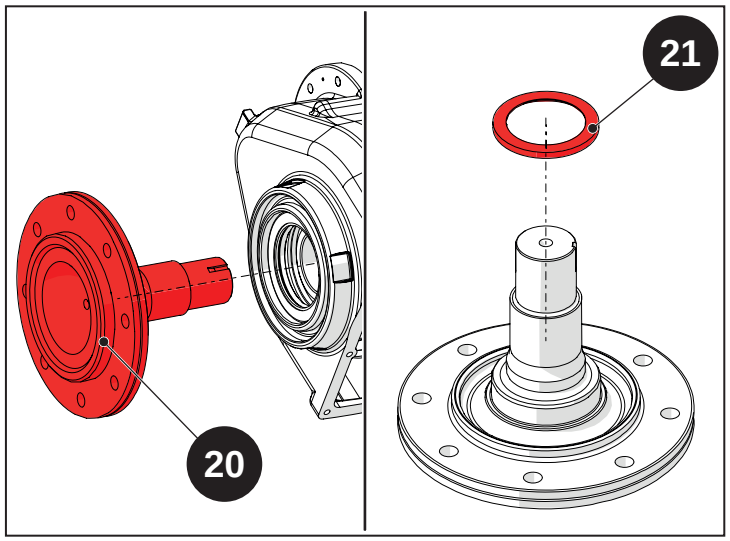


Fig. 6.9

Remove the reduction gear (22) and spacer (23) from the rear final drive housing.

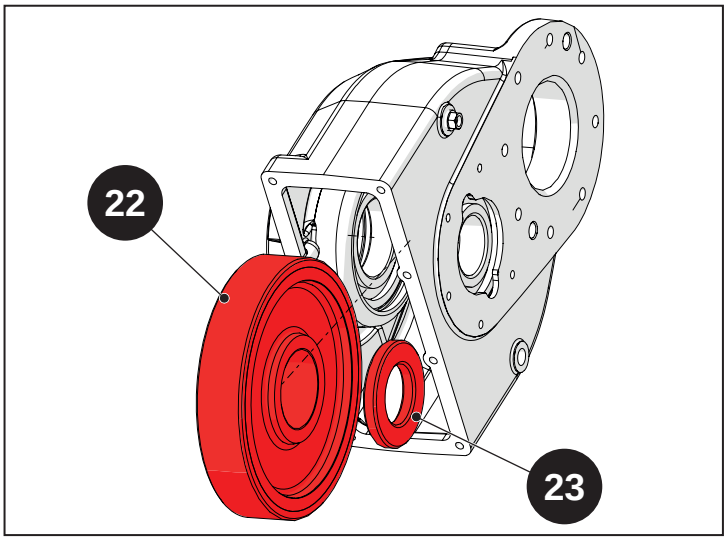


Fig. 6.10

Remove the oil retainer (24).

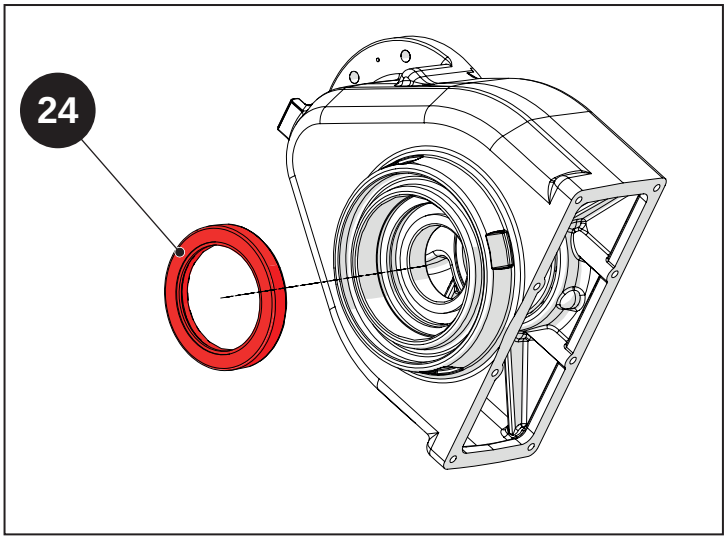


Fig. 6.11

Remove the circlip (25) and bearing (26).

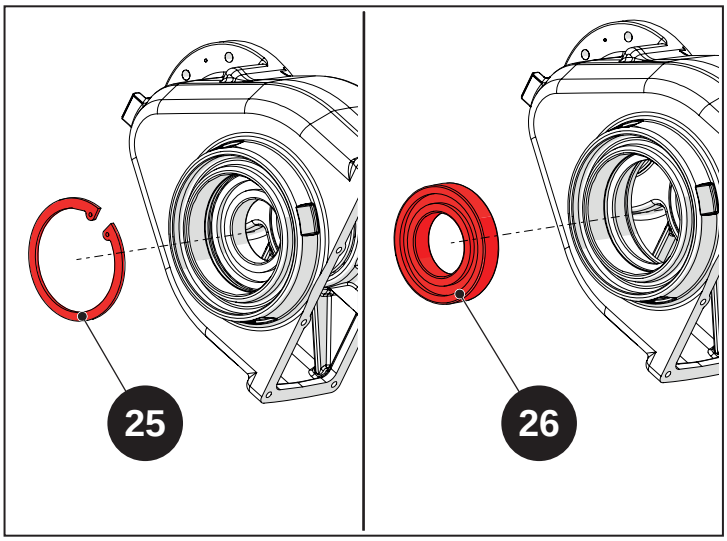


Fig. 6.12

Remove the circlip (27).

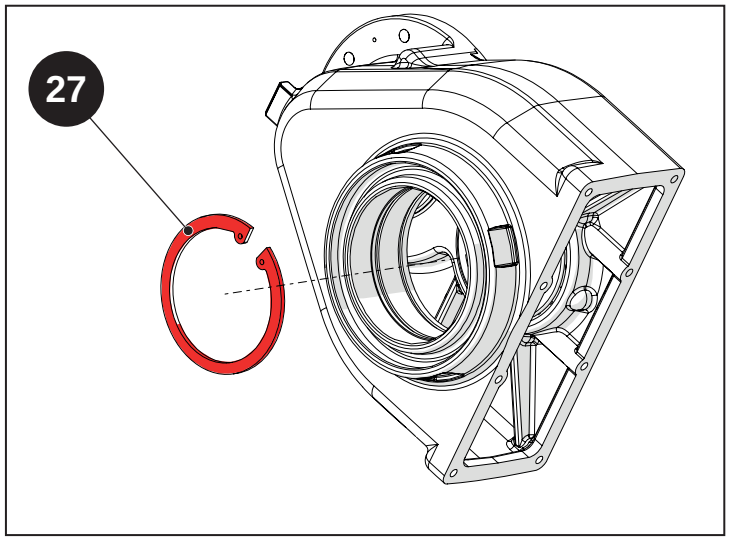


Fig. 6.13

Remove the bearing (28).

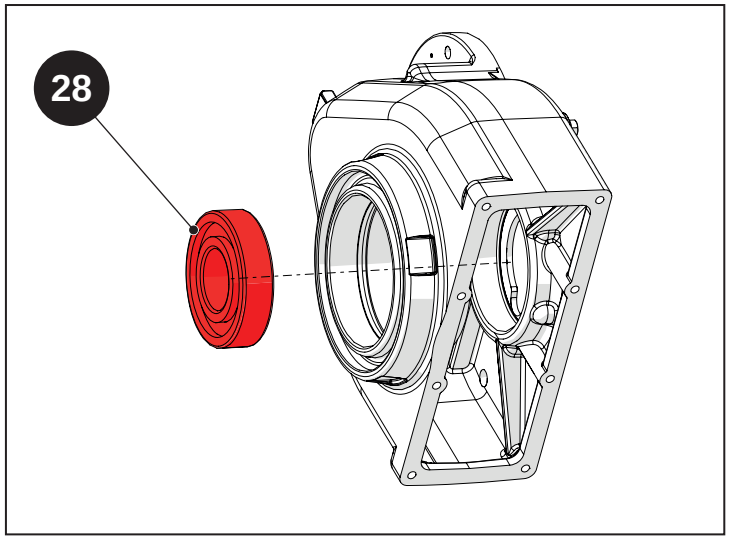


Fig. 6.14

Remove the bearing (29)

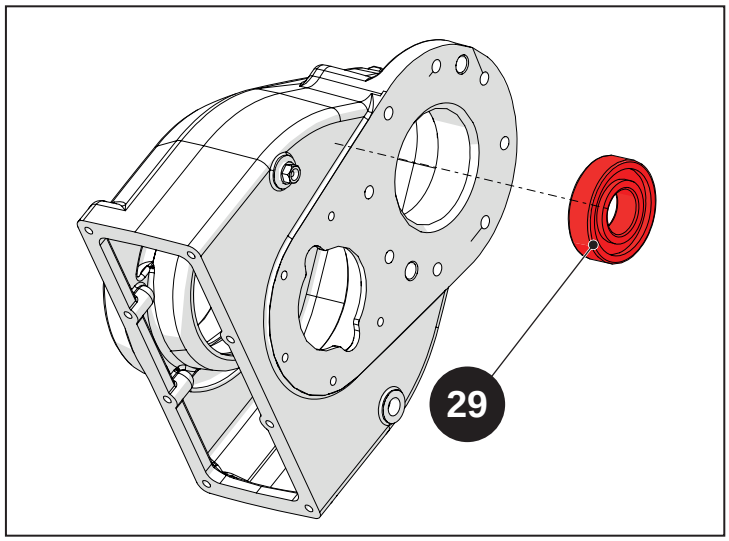


Fig. 6.15

Section 4 : Main inspection, re-assembly and adjustment operations

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4.1 Main inspection, re-assembly and adjustment operations.....6-12

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.

Apply a layer of SILICONE to the threads, then tighten the plugs (31).

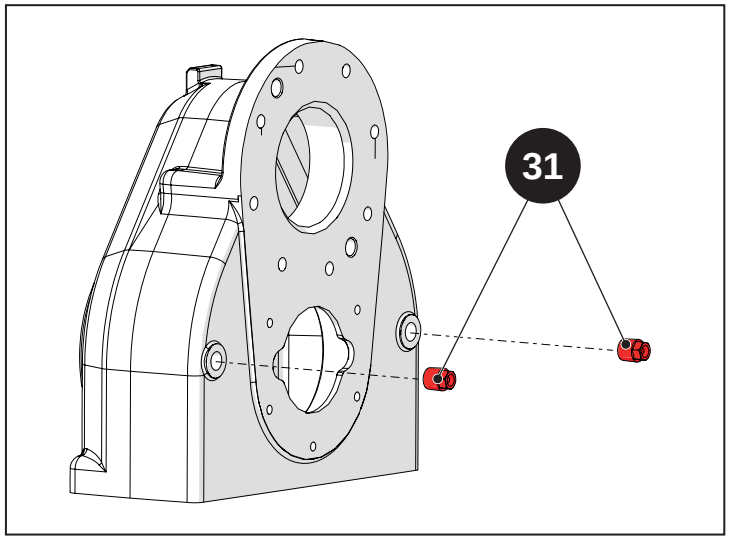


Fig. 6.16

Use a plug of a suitable diameter to insert the bearing (29) onto the rear final drive casing.

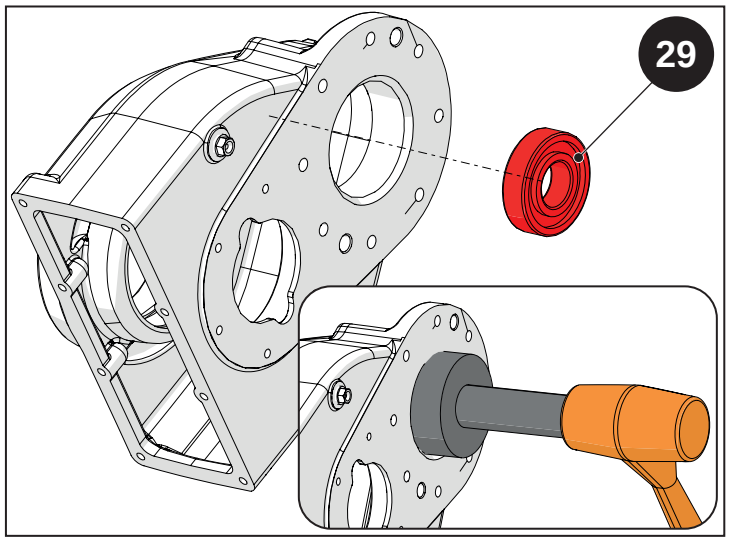


Fig. 6.17

Use a plug of a suitable diameter to insert the bearing (28) onto the rear final drive casing.

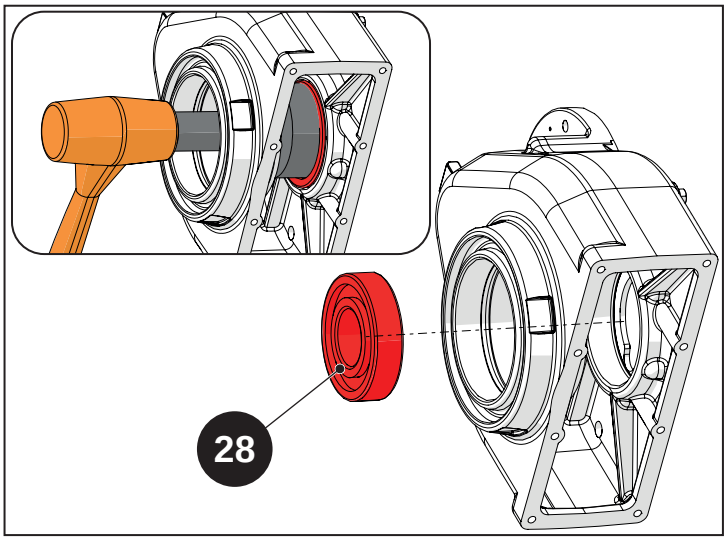


Fig. 6.18

Insert the circlip (27);

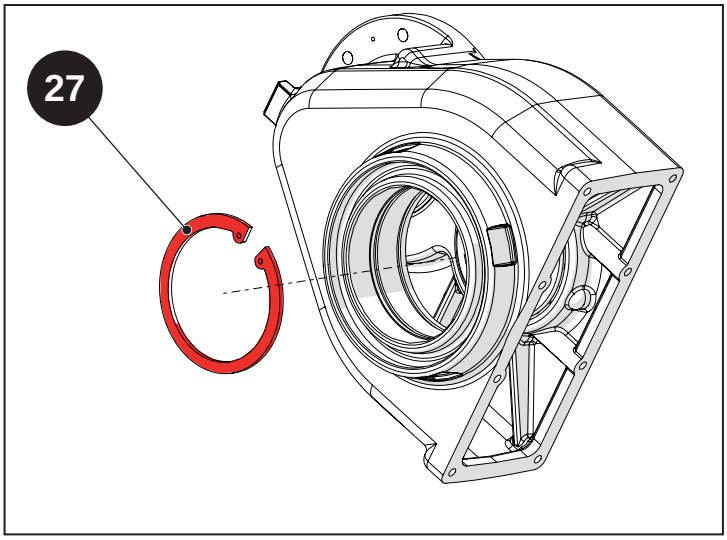


Fig. 6.19

Insert the bearing (26) and then the circlip (25).

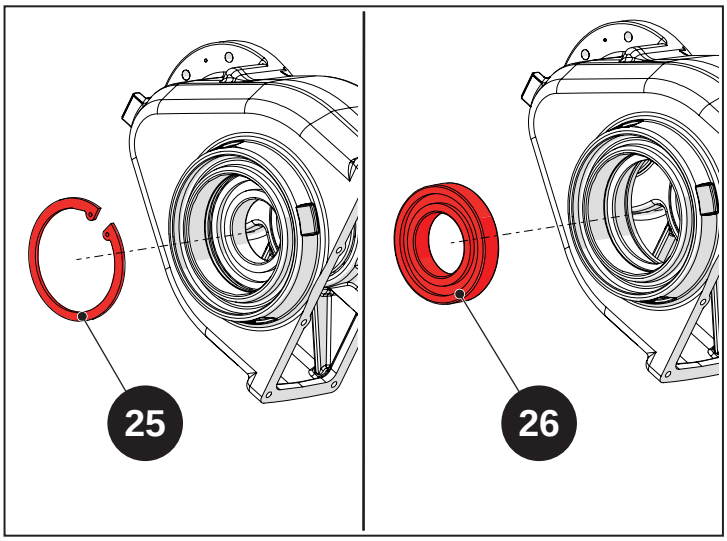


Fig. 6.20

Fit the oil retainer (24) into its housing using a plug of adequate diameter.

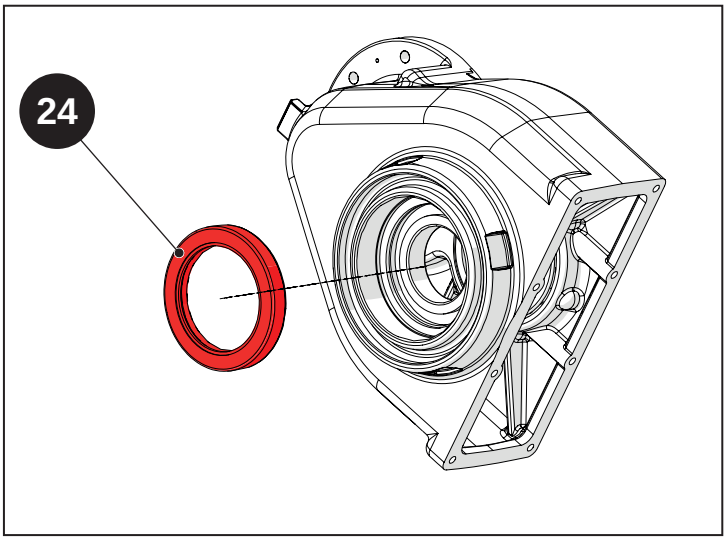


Fig. 6.21

Fit the reduction gear (22) and spacer (23) into the rear final drive housing.

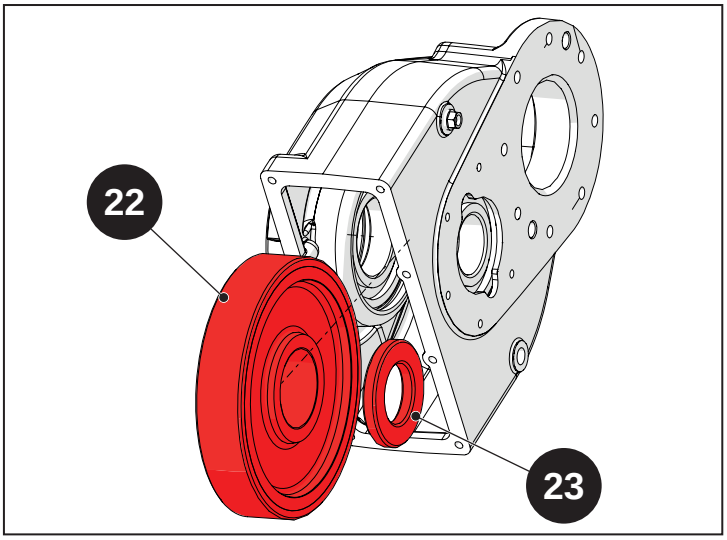


Fig. 6.22

Assemble the spacer (21) on the rear half axle (20), then fit the entire unit into the casing.

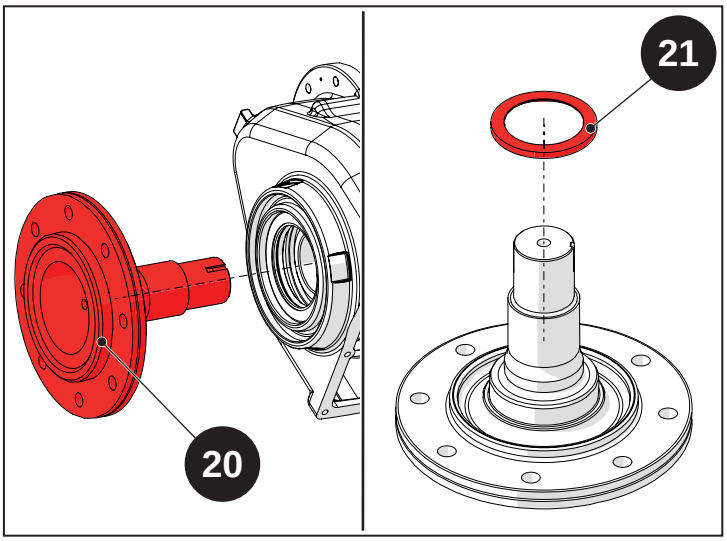


Fig. 6.23

Use a plug of an adequate diameter to completely seat the bearing (28).

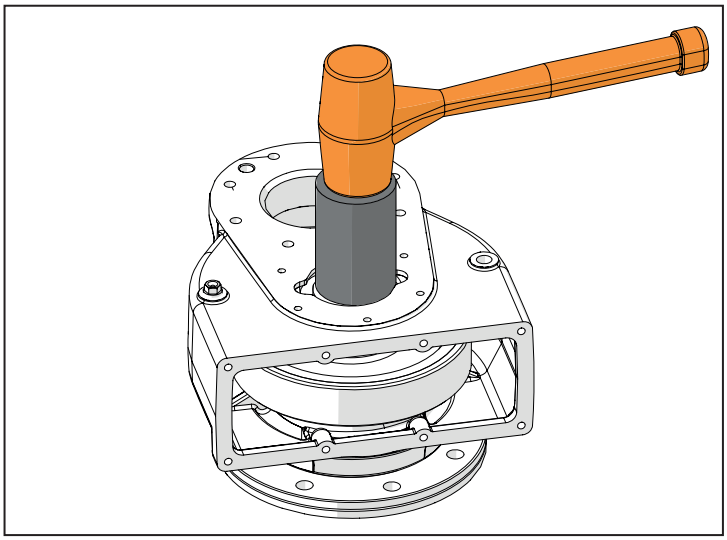


Fig. 6.24

Insert the pins (18) and tighten the stud bolts (19).

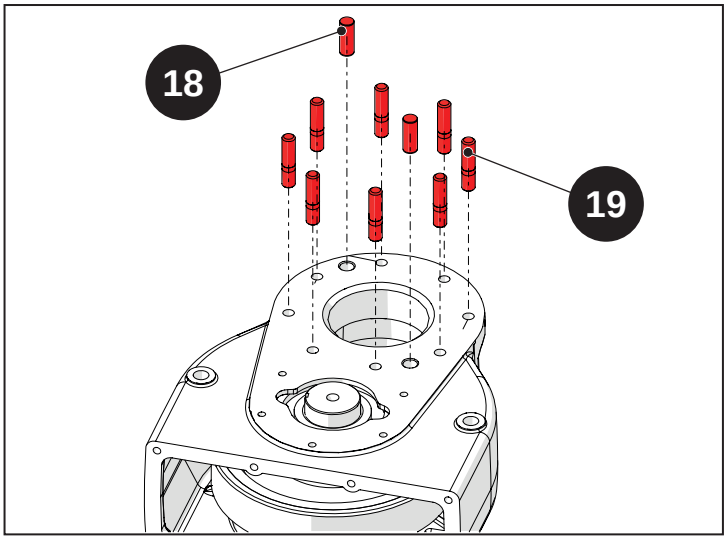


Fig. 6.25

Insert the safety washer (17) and ring nut (16).

Use tool (A-code 07000227) and tighten the ring nut (16) by applying a 250 Nm (25 kgm) tightening torque.

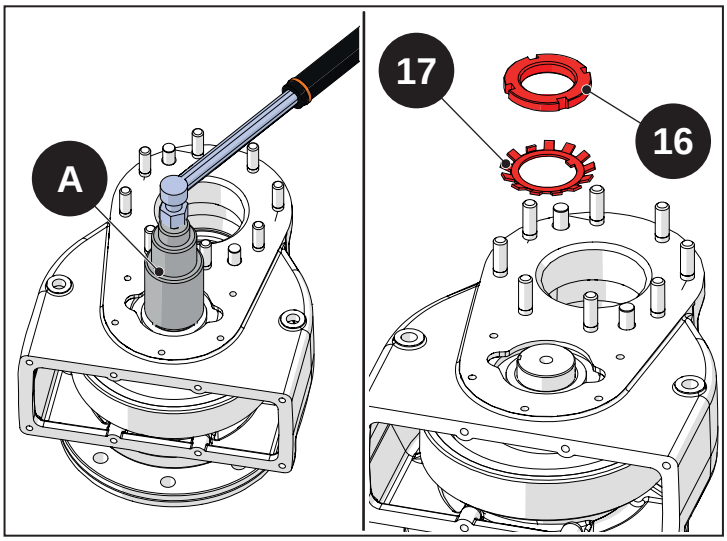


Fig. 6.26

Lock the ring nut (16) by raising the safety washer (17).

Chisel the ring nut (16).

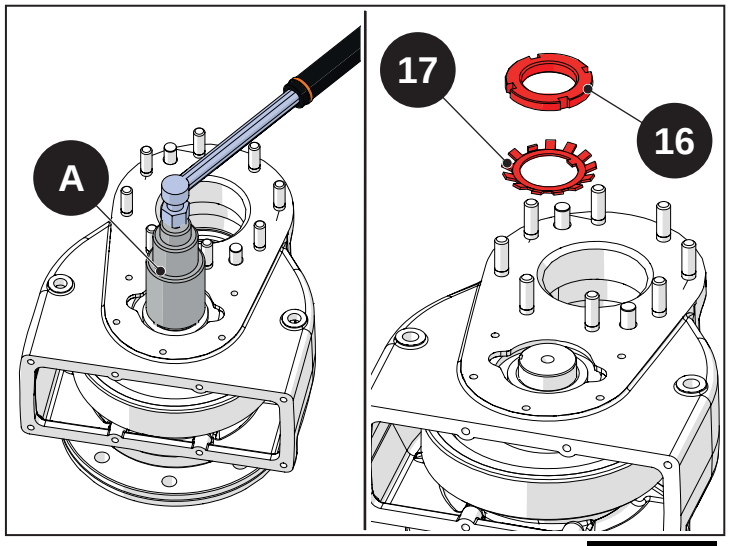


Fig. 6.27

Apply a layer of SILICONE to the coupling surface of the cover (15).

Assemble the cover (15) then fix it in place by inserting the washers (14) and tightening the screws (13) by applying 24 Nm (2.4 kgm) tightening torque.

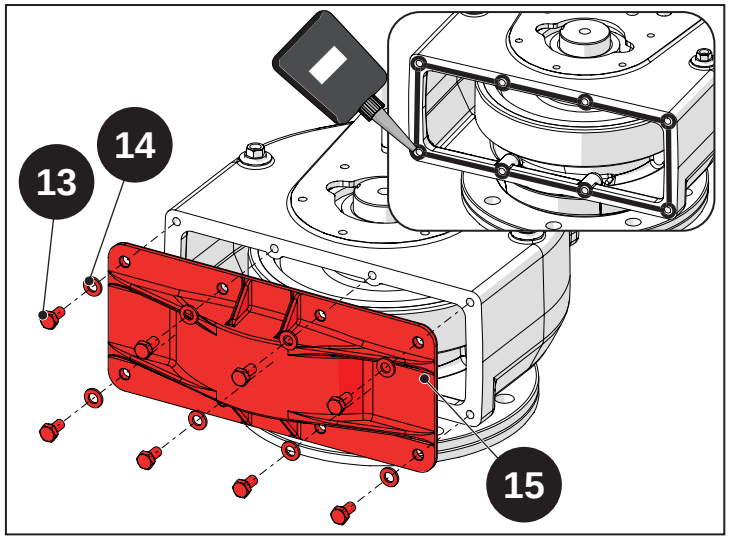


Fig. 6.28

Insert the bearing (12) onto the pinion (1).

Fit the pinion (11) into the final drive (43).

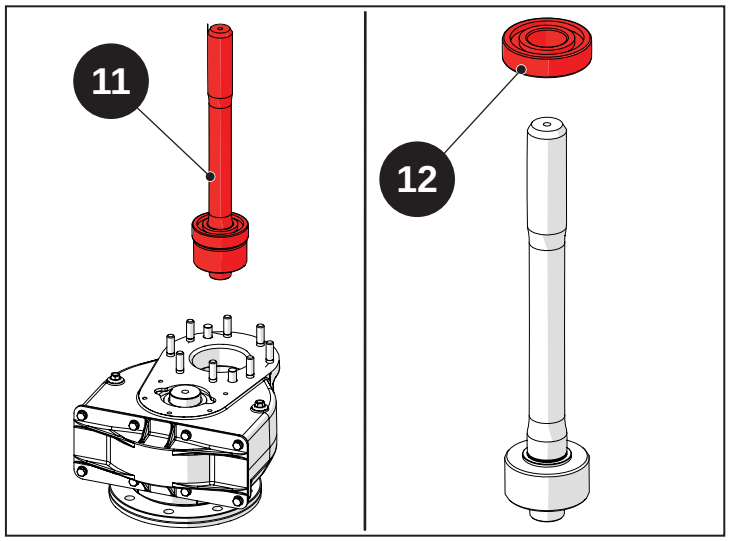


Fig. 6.29

Apply a layer of SILICONE to the coupling surface of the cover.

Fasten the cover (10) to the final drive with the washers (9) and screws (8) by applying 24 Nm (2.4 kgm) tightening torque.

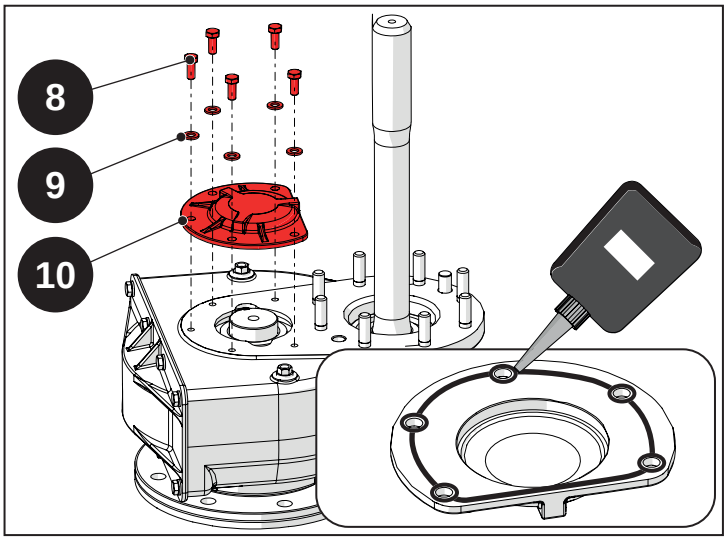


Fig. 6.30

Assemble the O-ring.

Apply a layer of SILICONE to the O-Ring.

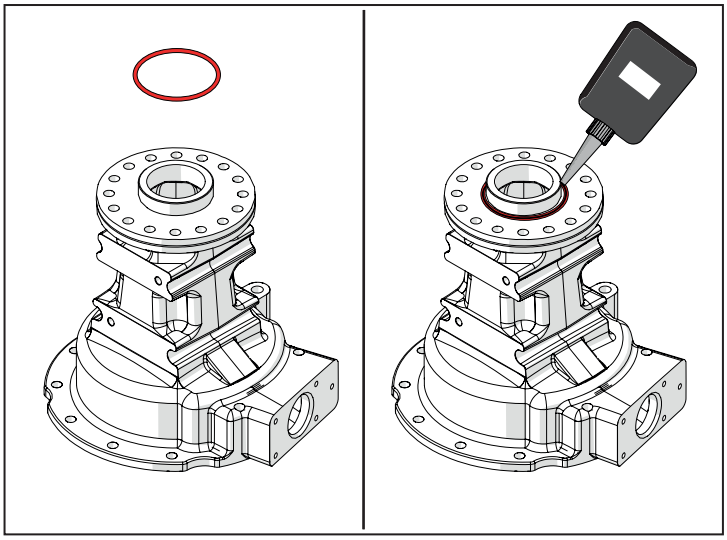


Fig. 6.31

Insert the plates (7).

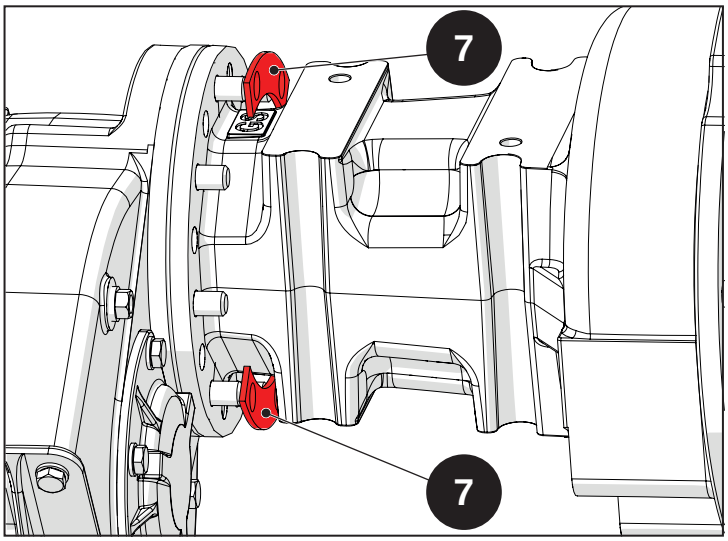


Fig. 6.32

Insert the washers (6) and tighten the nuts (5) by applying 80 Nm (8 kgm) tightening torque.

Use a hammer and chisel to clinch the plates (7) over the nuts (5).

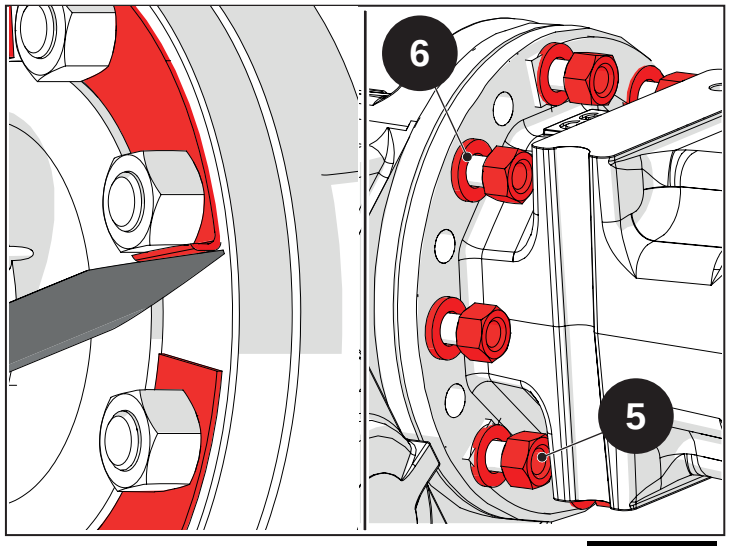


Fig. 6.33

Section 5 : Tightening torques

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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	Nm	kgm
M50x1.5 axle shaft fastening nut	250	25
M18x1.5 screw for fastening wheel to axle shaft	310	31
M12 nut for fastening final drive to axle shaft support	80	8
M8x20 screw for fastening axle shaft ring nut cover	24	2.4
M8x20 screw for fastening final drive gear cover	24	2.4

Section 6 : Tools required

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6.1 Tools required

Code	Description	Quantity
07000227	Ring nut wrench	1

Chapter 7 : Front axle

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Section 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.

Section 2 : General introduction

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2.1 Drawing of the assembly

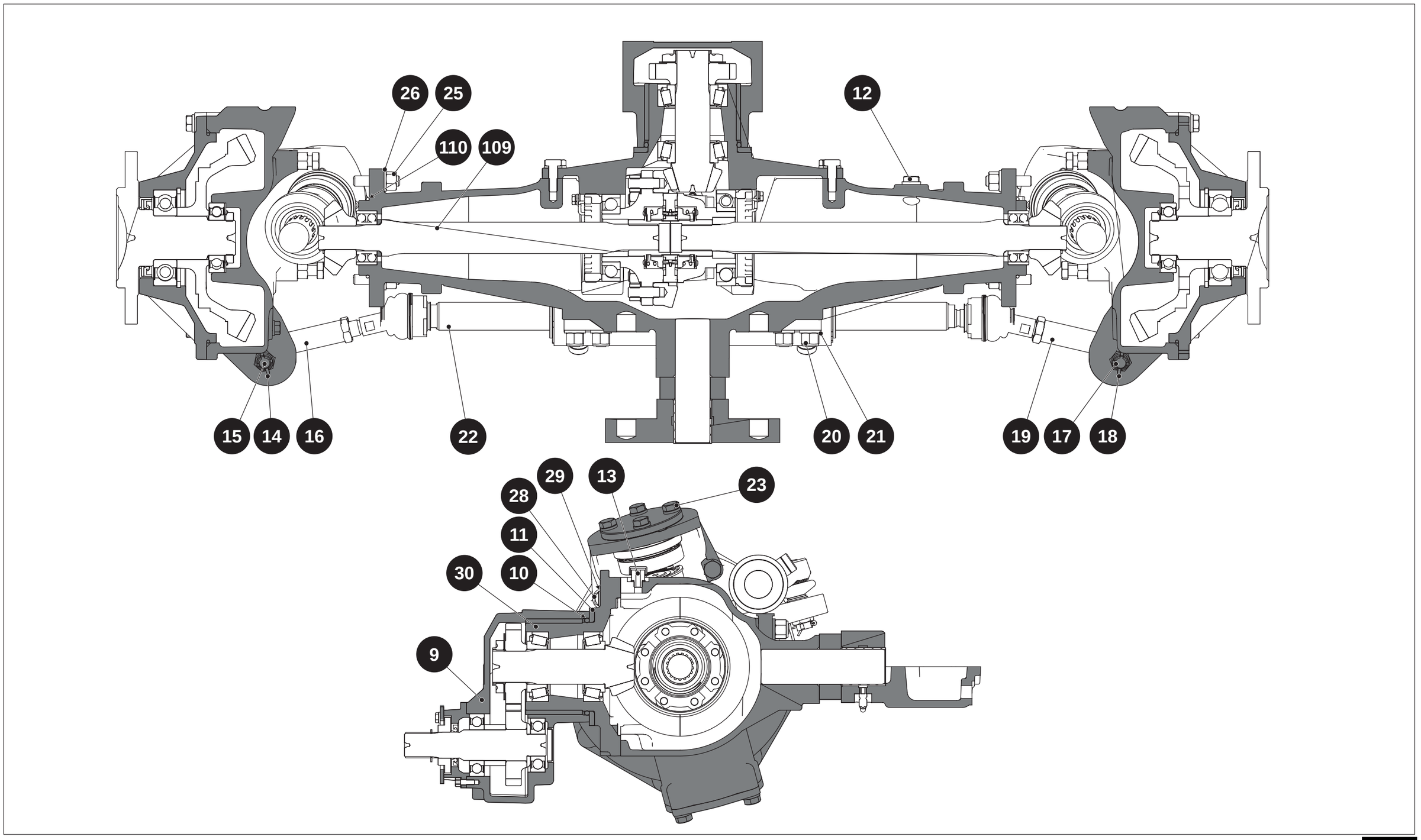


Fig. 7.1

9 - Transmission housing
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 - Transmission housing
109 - Axle shaft
110 - O-ring

Section 3 : Technical specifications

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3.1 Technical specifications

Section 4 : Splitting

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4.1 Splitting

Unscrew the allen screws (1) and remove the front casing that protects the shaft.

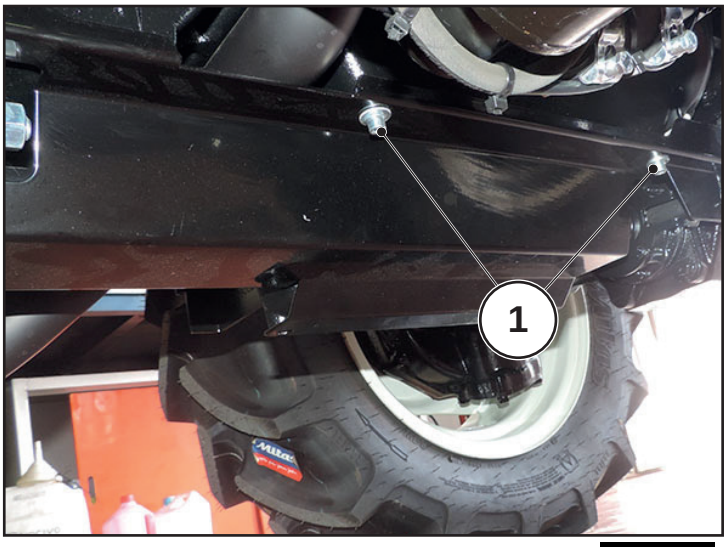


Fig. 7.2

Unscrew the screws (2) and remove the rear casing that protects the shaft.

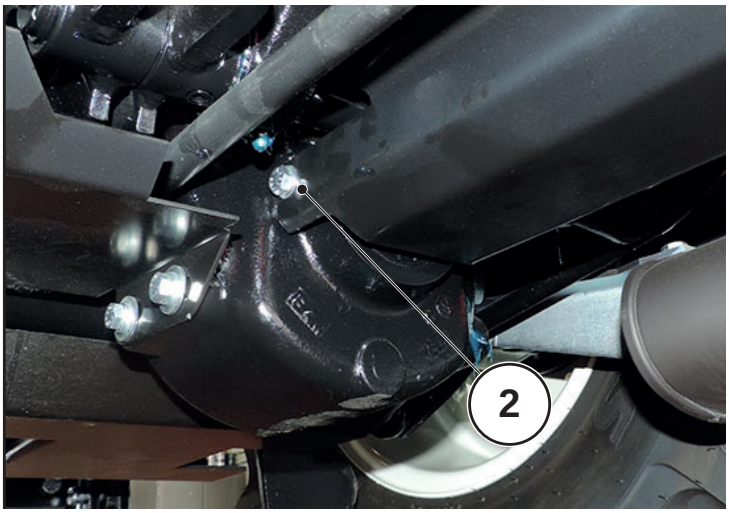


Fig. 7.3

Unscrew the nuts and screws (3) that fasten the intermediate bearing to the shaft.

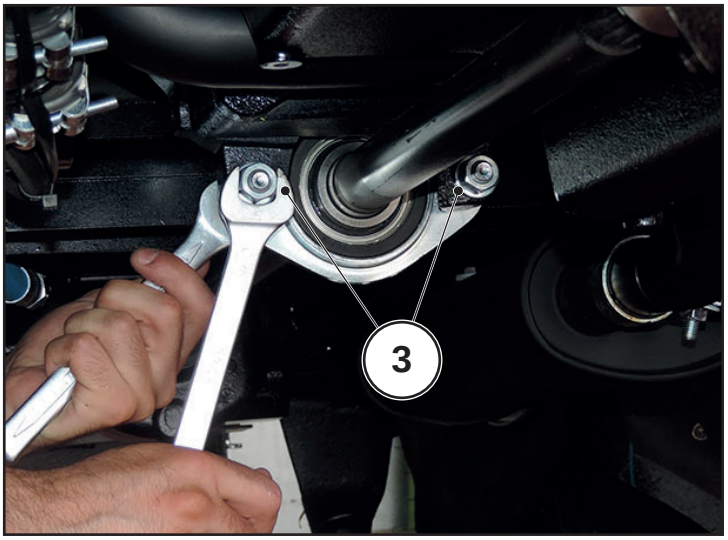


Fig. 7.4

Remove the shaft fixing circlips (4) from their seat.

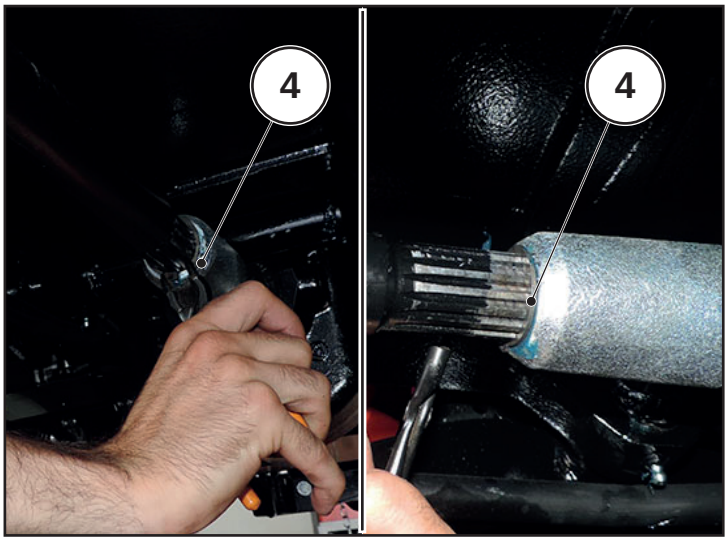


Fig. 7.5

Shift the sleeves and remove the shaft.

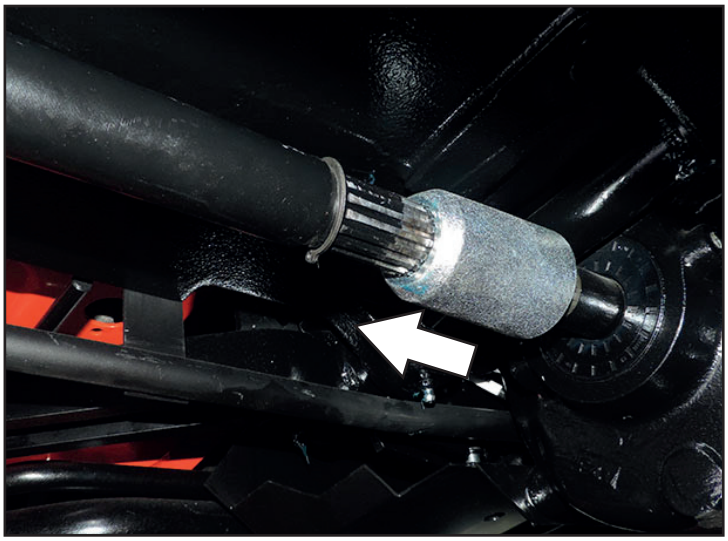


Fig. 7.6

Harness the engine to suitable lifting equipment.

Note

Make sure that the maximum lifting capacity of the equipment is adequate.



Fig. 7.7

Prop the axle onto suitable supports.

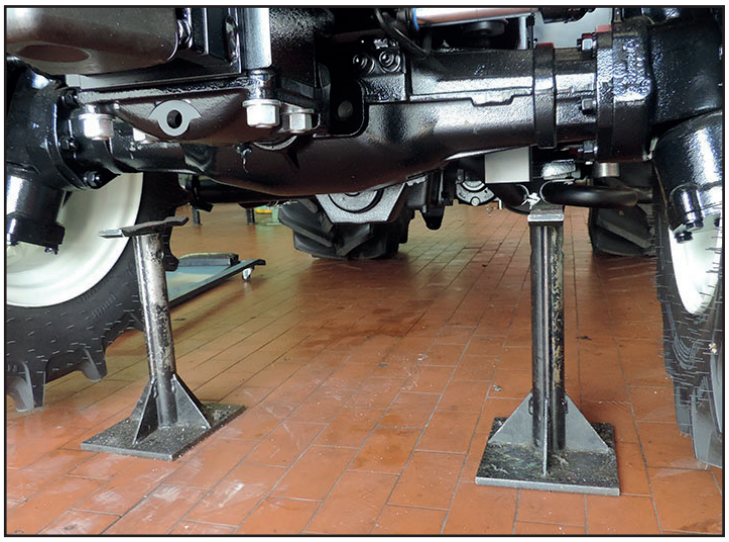


Fig. 7.8

Unscrew unions (5) and (6), then disconnect the pipes of the power steering system.

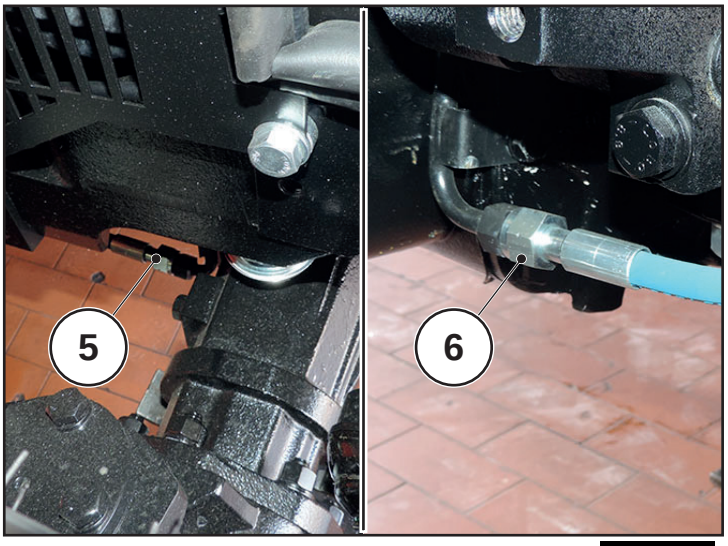


Fig. 7.9

Unscrew the front nuts (7) that fasten the axle.

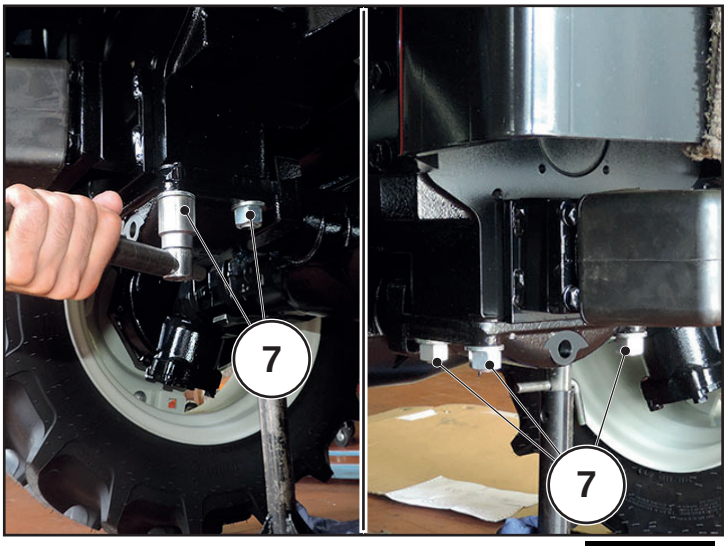


Fig. 7.10

Unscrew the rear nuts (8) that fasten the axle.

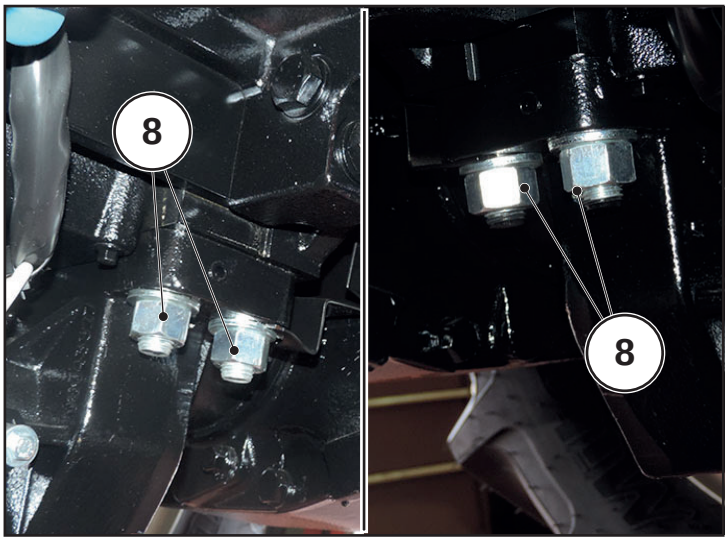


Fig. 7.11

Raise the tractor so as to remove the complete front axle.



Fig. 7.12

Remove the transmission housing (9), then remove the O-Ring (10) and spacer (11).

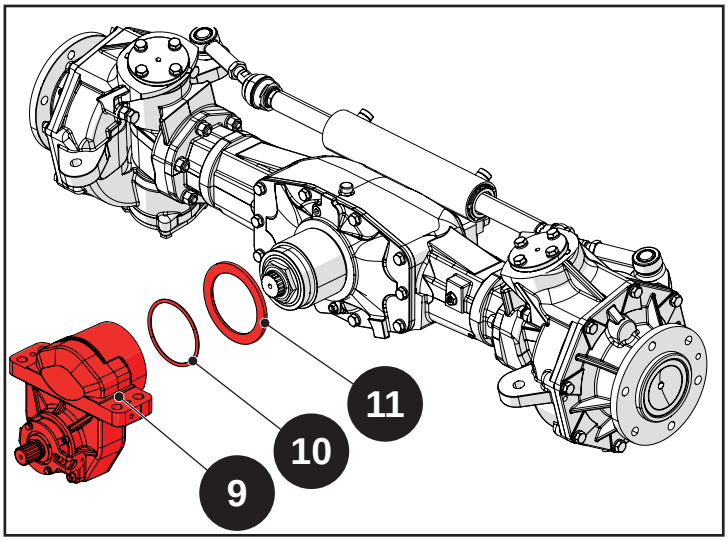


Fig. 7.13

Remove the plugs (12) and plug (13) complete with washer so as to drain the oil from the axle.

> **Note**
>
> Place empty cans under the plugs so as to collect the oil.

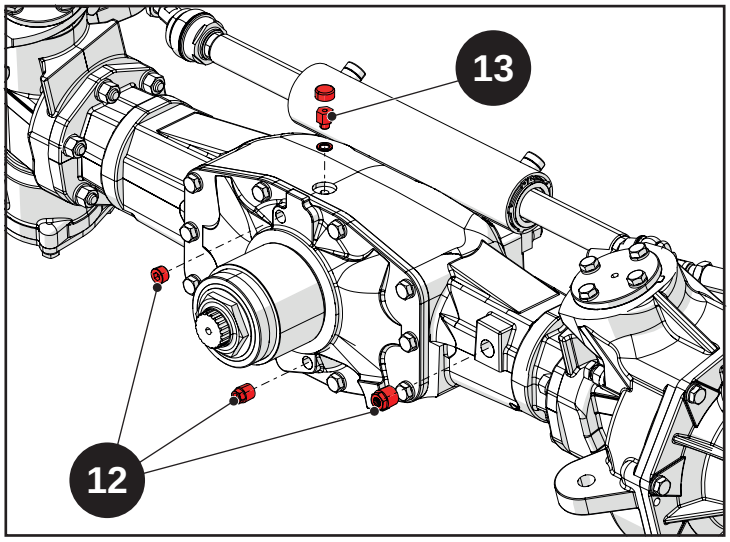


Fig. 7.14

Remove the split pin (14) and unscrew the lock nut (15).

Remove the steering cylinder pin (16) from its housing, on both sides.

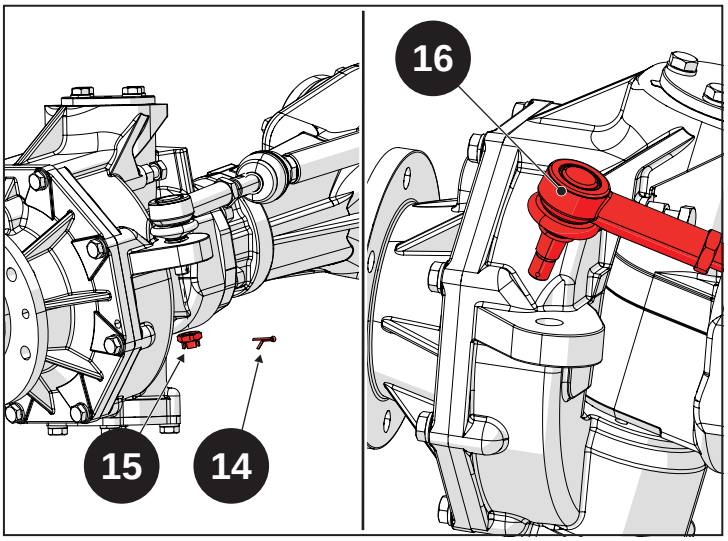


Fig. 7.15

Unscrew the nuts (20) that fasten the steering cylinder to the front axle and remove them along with the washers (21).

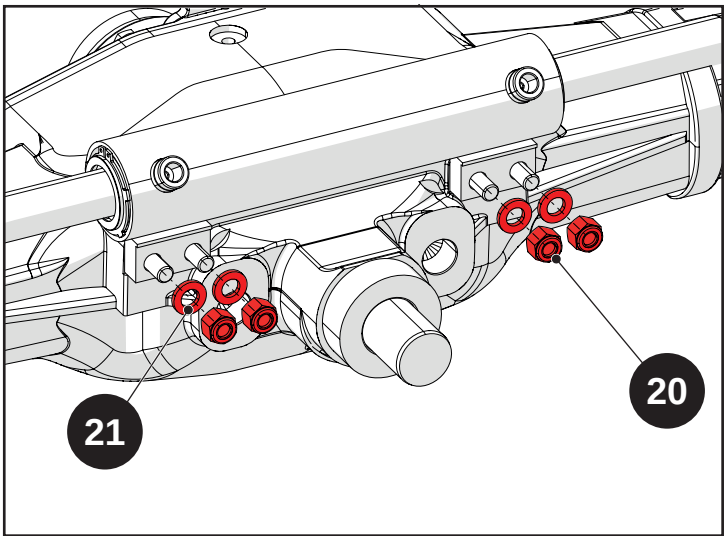


Fig. 7.16

Remove the complete steering cylinder (22).

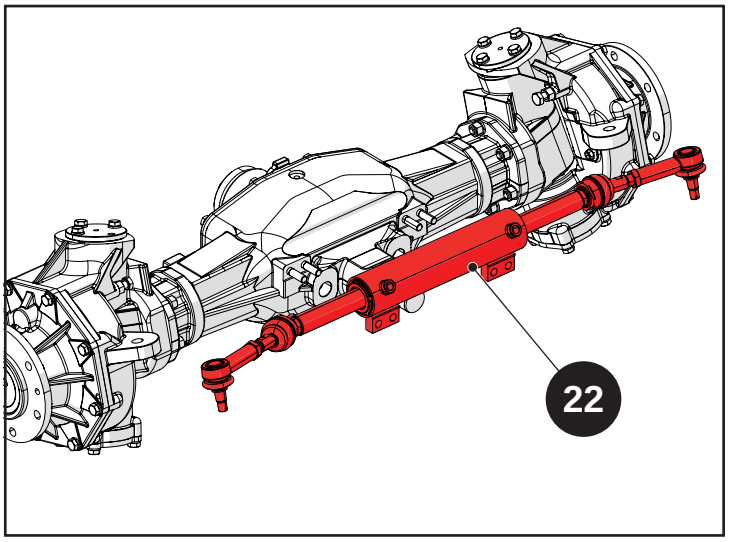


Fig. 7.17

Unscrew a fastening screw (23) complete with washer from the upper cover of the side final drive and screw-in a lifting eyebolt (24) in its stead.

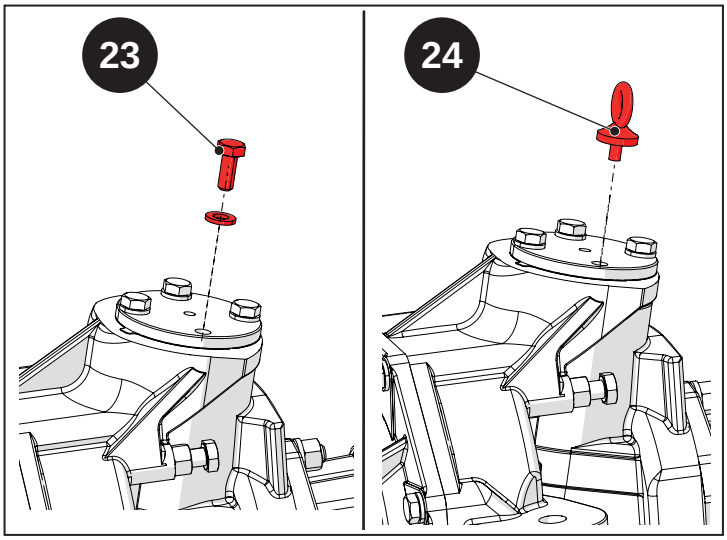


Fig. 7.18

Harness the side final drive to suitable lift equipment by means of the eyebolt.

Remove the nuts (25) and washers (26), then remove the final drive from the axle.

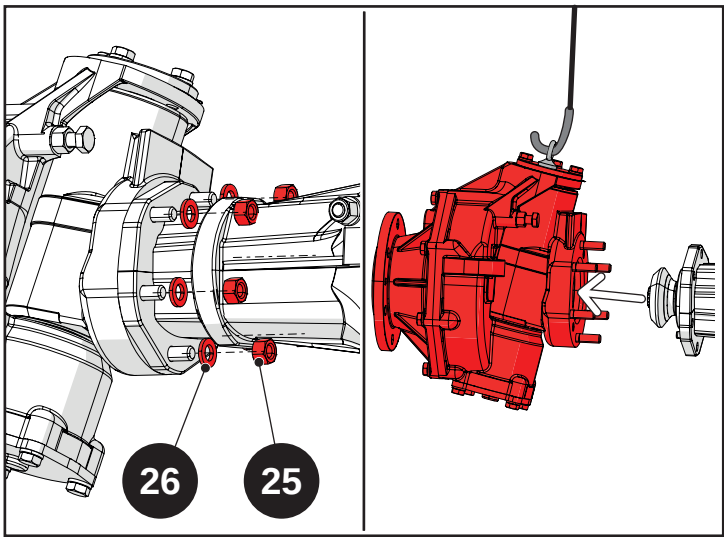


Fig. 7.19

Remove the complete axle shaft (109) and O-ring (110).

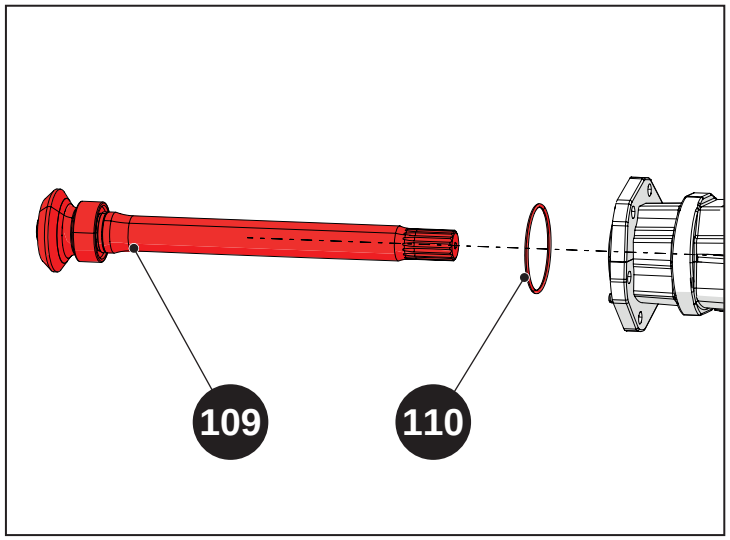


Fig. 7.20

Repeat the same procedure for the second final drive.

Insert 2 lifting eyebolts (27) into the holes in the plugs on the front differential and harness them to a lifting tool.

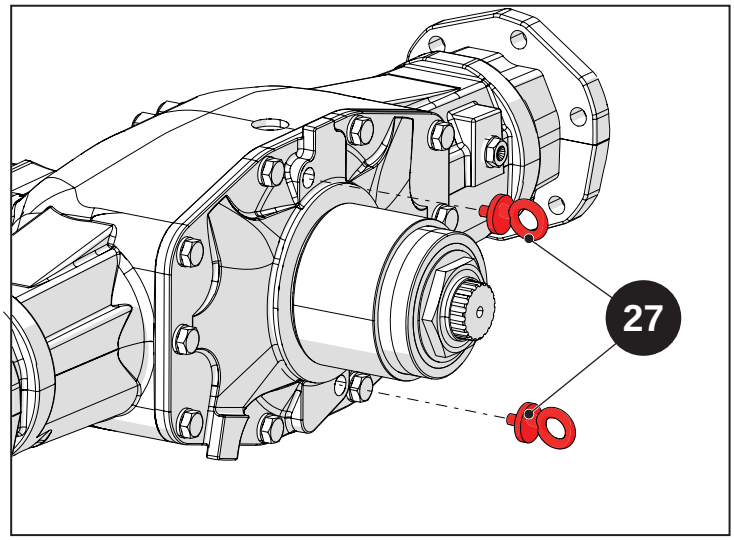


Fig. 7.21

Unscrew and remove the screws (28) and washers (29).

Warning

The direction in which the front differential is assembled changes, depending on whether it is the High or Low version.

Mark the differential before it is removed so that it can be reassembled in the same direction.

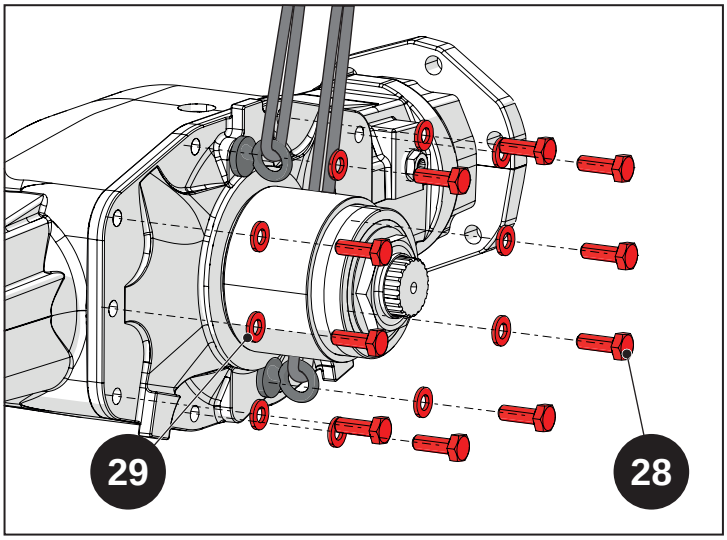


Fig. 7.22

Remove the whole front differential unit (30).

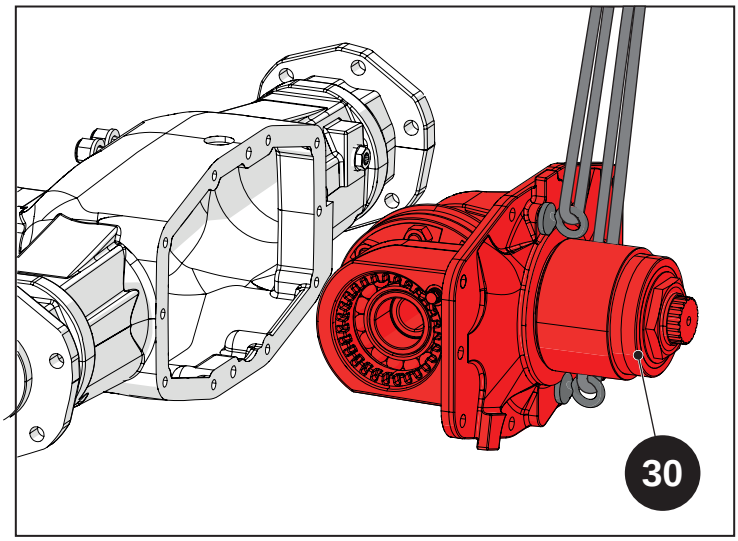


Fig. 7.23

Section 5 : Main components

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5.1 Front differential

5.1.1 Assembly drawing and main components

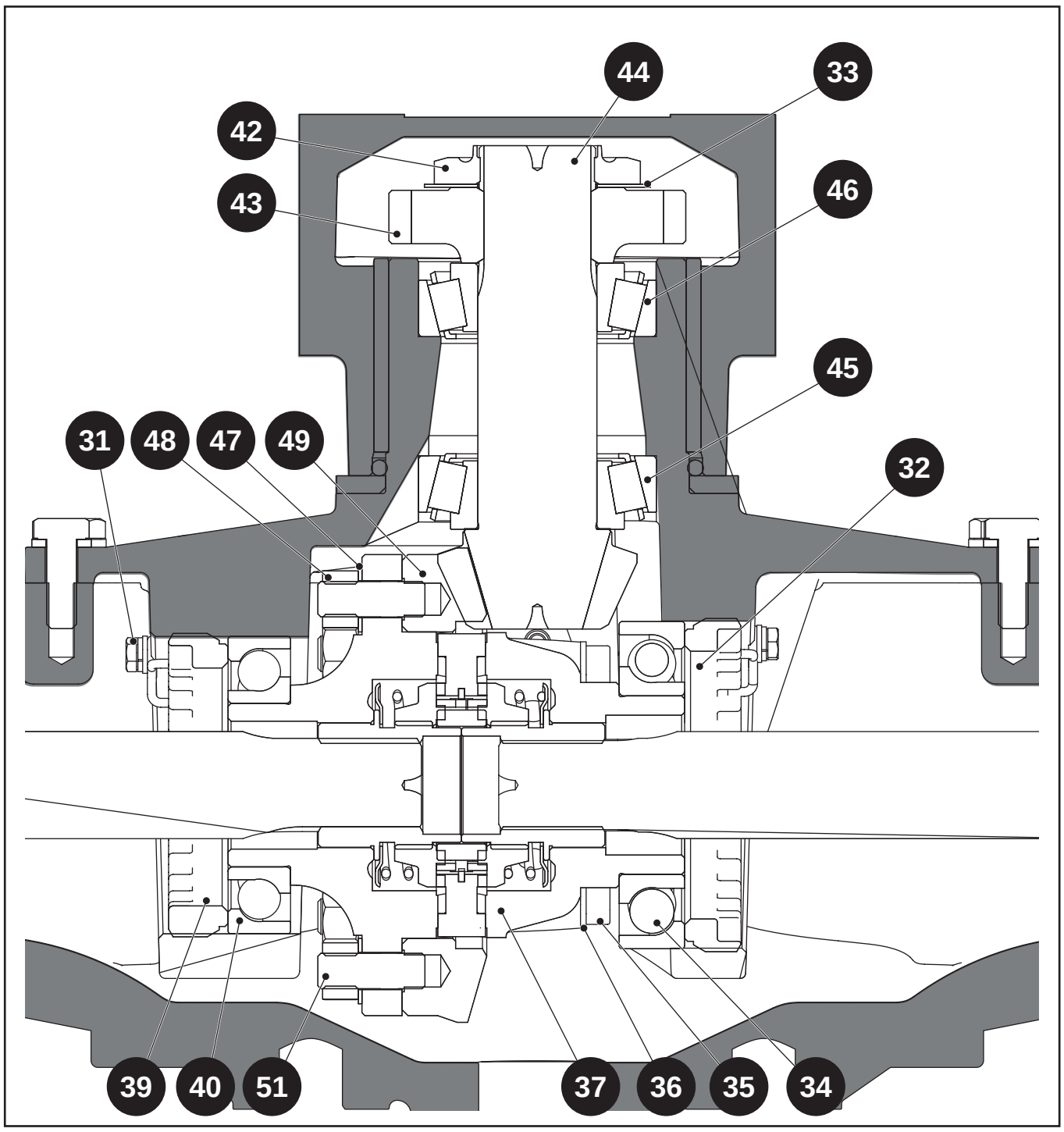


Fig. 7.24

31 - Ring nut screw
32 - Ring nut
33 - Nut retaining spacer
34 - Bearing
35 - Screw
36 - Taper washer
37 - NoSPIN housing
38 - NoSPIN
39 - Ring nut
40 - Bearing
42 - Nut
43 - Gear
44 - Pinion
45 - Bearing
46 - Bearing
47 - Plate
48 - Nut
49 - Ring gear
51 - Stud bolt

5.1.2 Disassembly

Remove the ring nut locking screw (31) complete with washers.

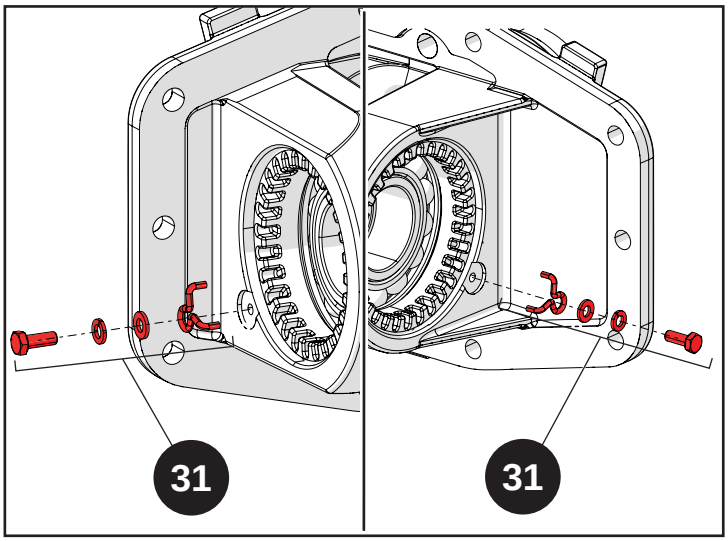


Fig. 7.25

Using tool (A-07000243), unscrew the ring nut (32) from the side opposite the ring gear.

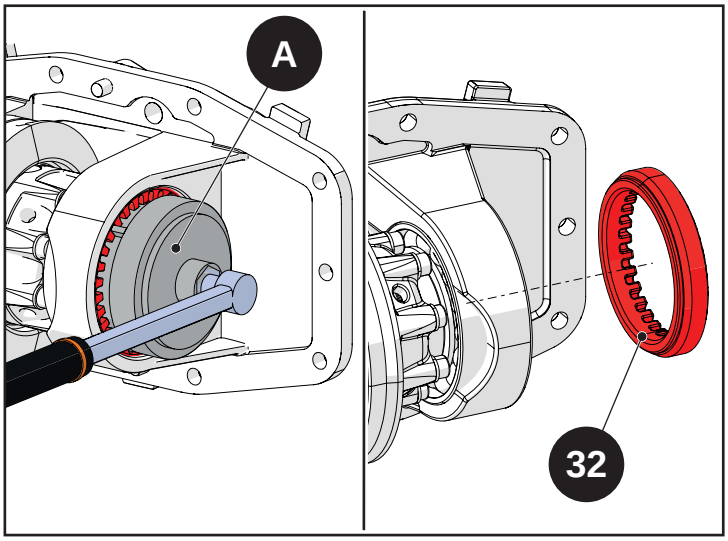


Fig. 7.26

Unscrew a screw (B) complete with 2 flat washers (B1) and a wing nut (B2) to lock the springs of the NoSPIN device.

Danger

Make sure that the screw and wing nut are tightened properly so as to prevent the springs from detaching when the NoSPIN device is removed.

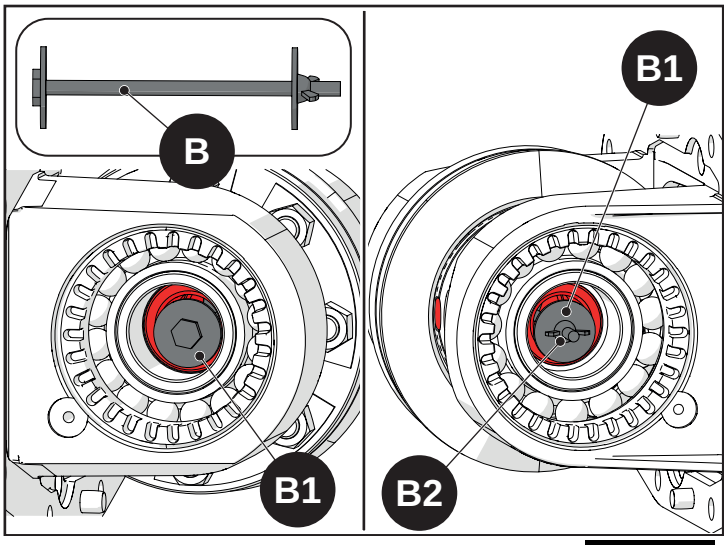


Fig. 7.27

Remove the bearing (34) by tapping on its inner race.

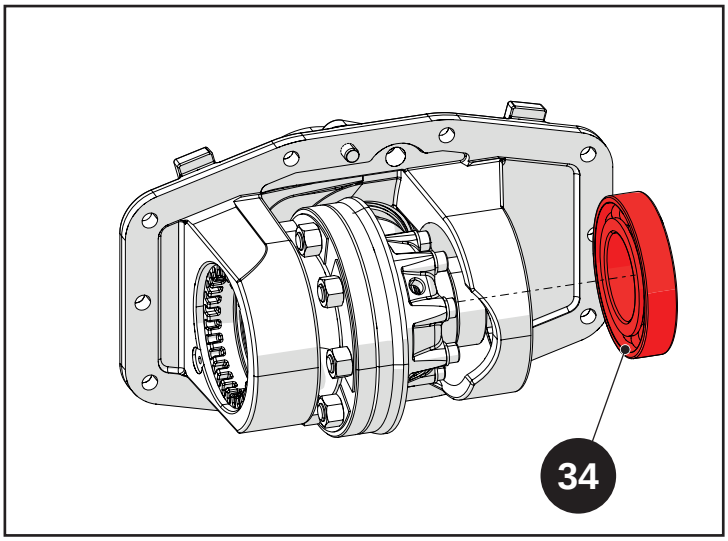


Fig. 7.28

Note

Make a mark with a felt tip pen between the 2 parts of the NoSPIN housing to facilitate the reassembly operations.

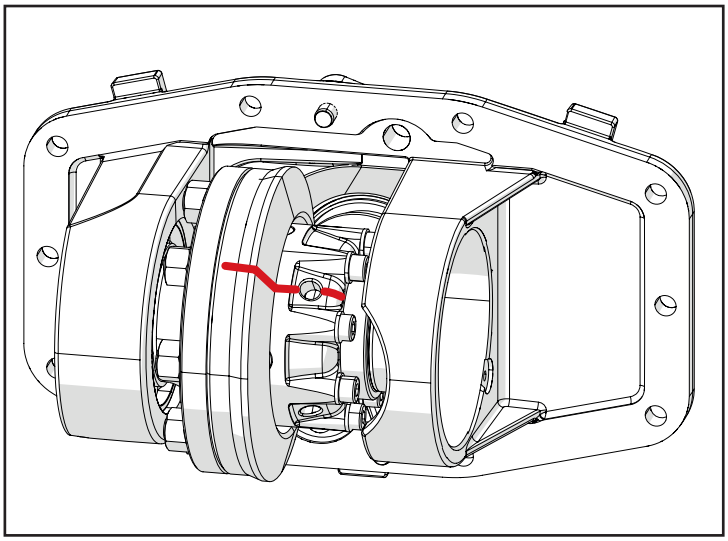


Fig. 7.29

Unscrew and remove the screws (35) and taper washers (36) that fasten the front differential housing.

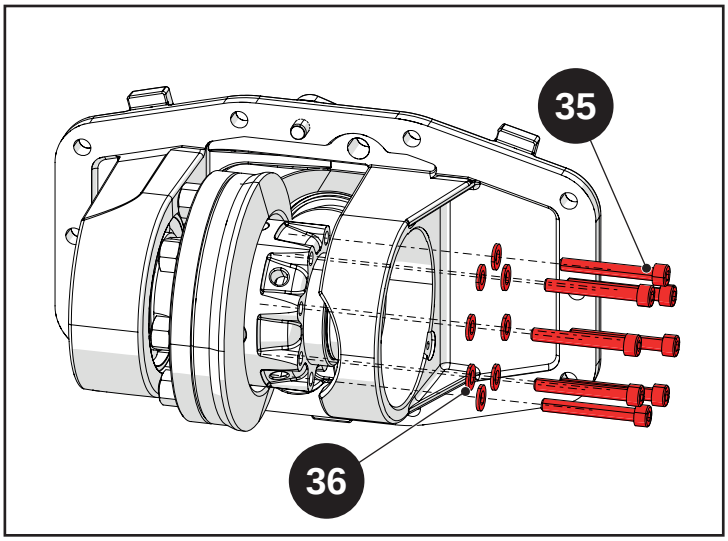


Fig. 7.30

Remove the housing of the NoSPIN device (37), which will now have been disengaged.

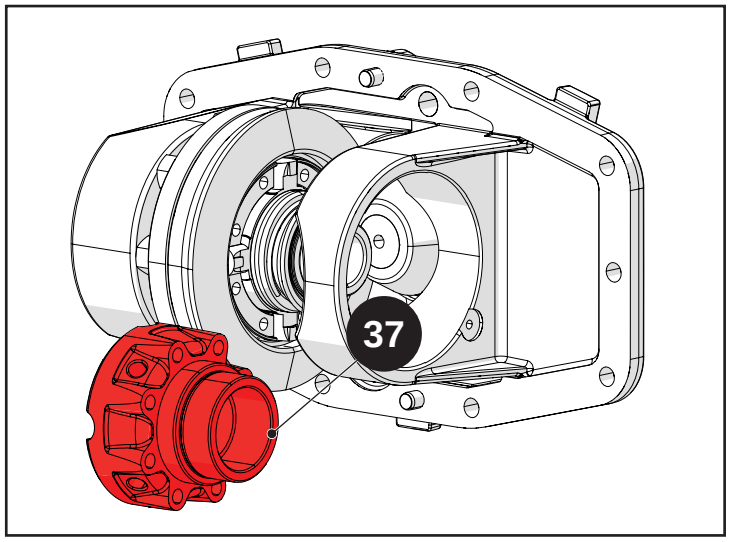


Fig. 7.31

Remove the complete NoSPIN device (38).

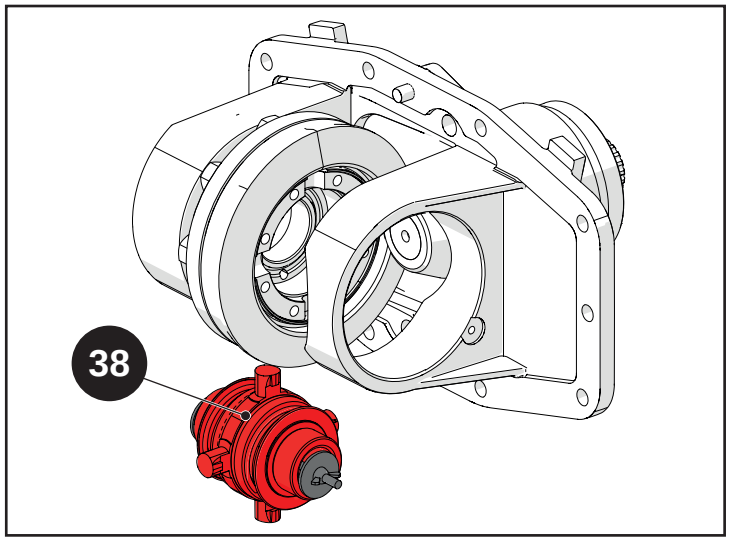


Fig. 7.32

Use tool (C-07000237) to unscrew and remove the ring nut (39).

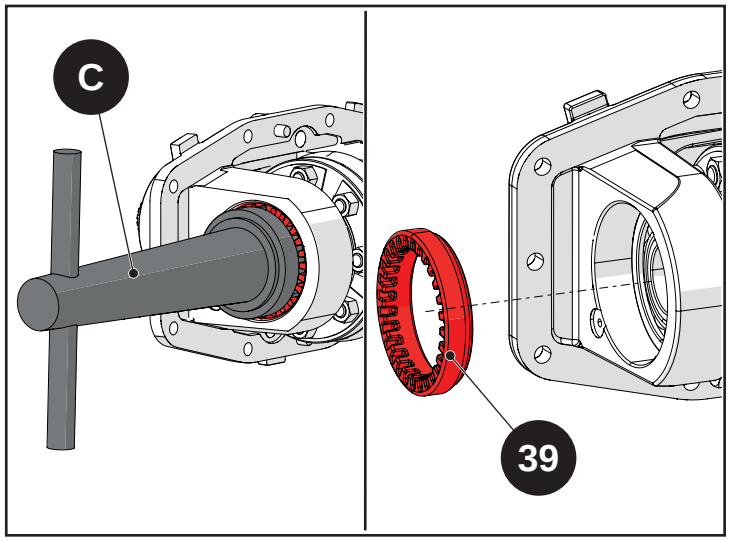


Fig. 7.33

Tap on the bearing race (40) with a pin driver and pass through the extraction holes so as to free the ring gear (41).

Remove the bearing (40).

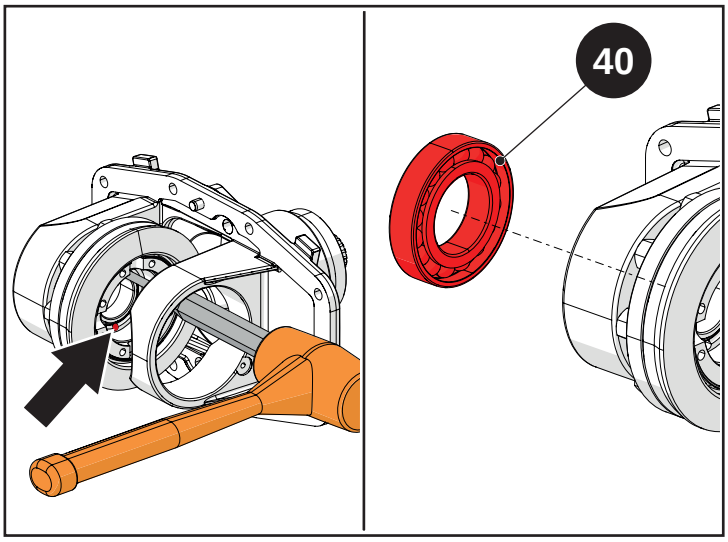


Fig. 7.34

Remove the ring gear (41).

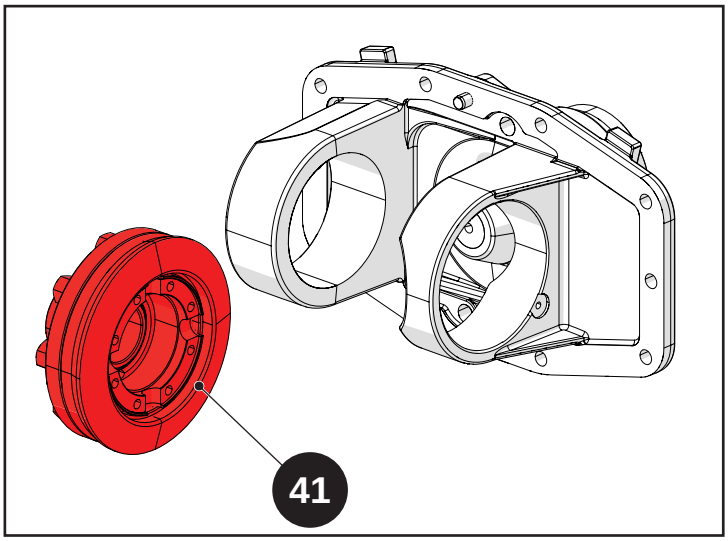


Fig. 7.35

Push down the lobes of the nut retainer spacer (33) with a chisel.

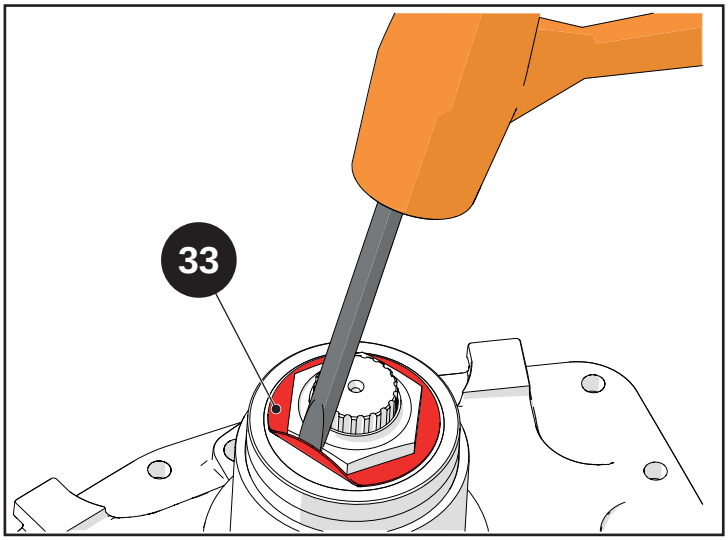


Fig. 7.36

Use the M40 sleeve to unscrew the nut (42) that fastens the pinion.

Remove the nut (42), the spacer (33) and gear (43).

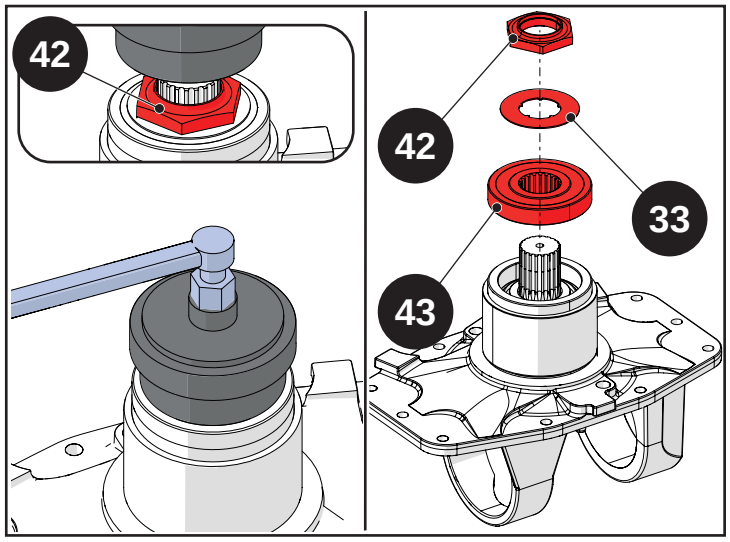


Fig. 7.37

Tap the pinion (44) with a mallet made of soft material and release it from its seat together with the inner race of the lower bearing (45).

Remove the inner race of the upper bearing (46).

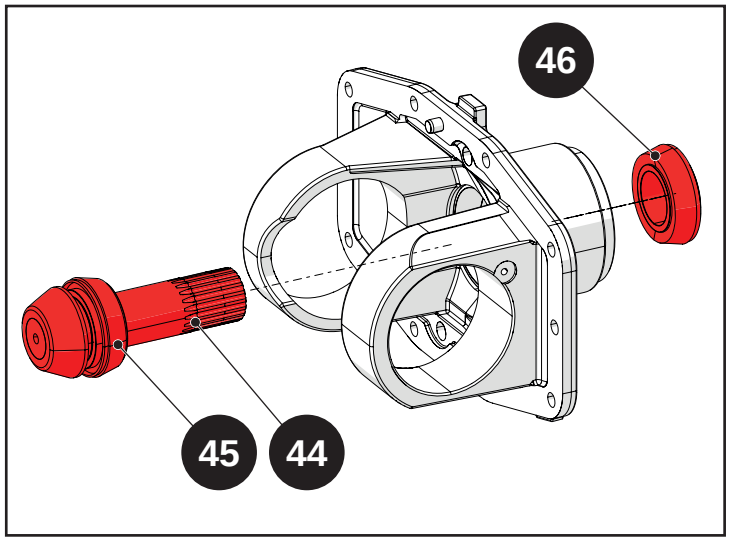


Fig. 7.38

Using a pin driver, remove the outer races of the bearings (45) and (46).

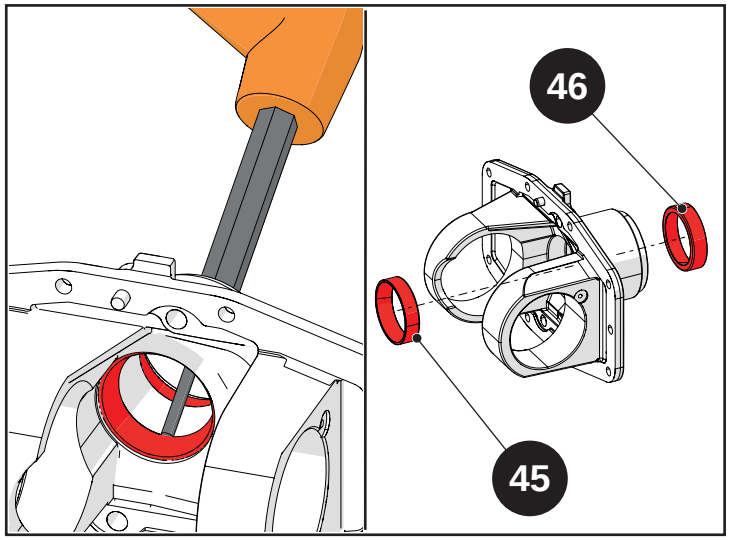


Fig. 7.39

Push down the lobes of the nut fastening plates (47) with a chisel.

Unscrew the nuts (48) and remove the plates (47).

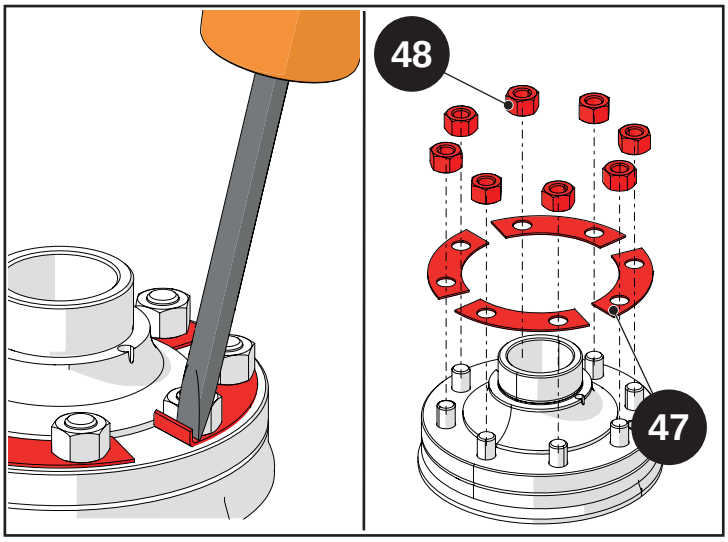


Fig. 7.40

Split the ring gear (49) from the NoSPIN housing (37).

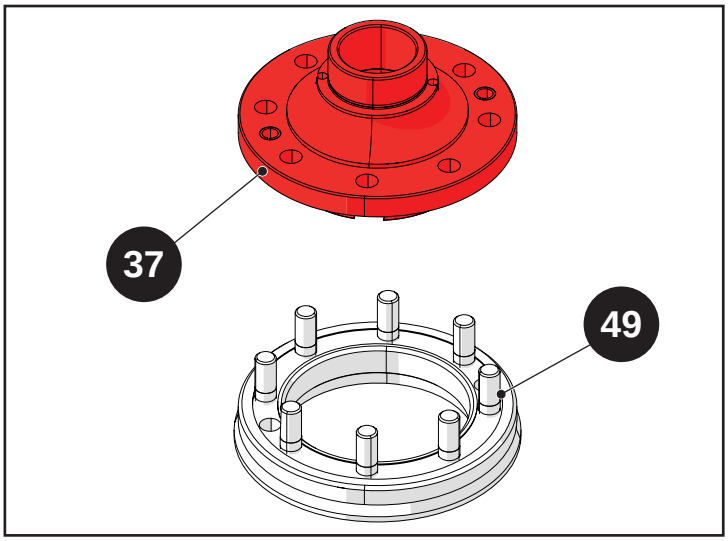


Fig. 7.41

Remove the pins (50) and stud bolts (51).

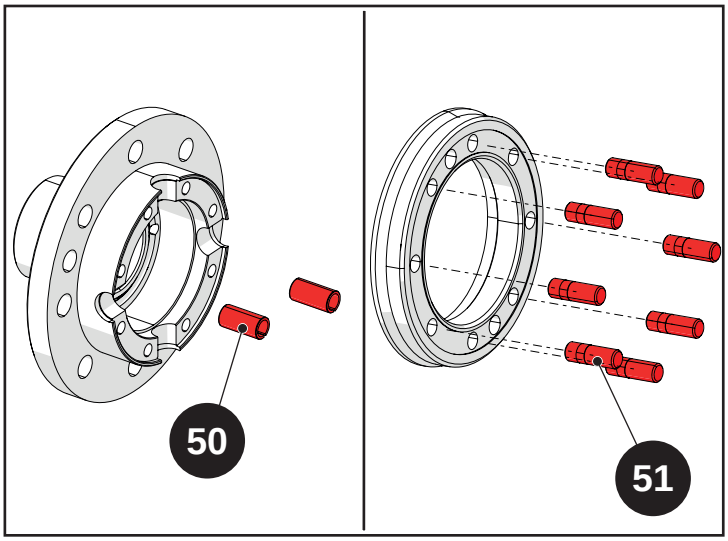


Fig. 7.42

5.1.3 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 centring pins (50) and stud bolts (51) and match the ring gear (49) with the ring gear support.

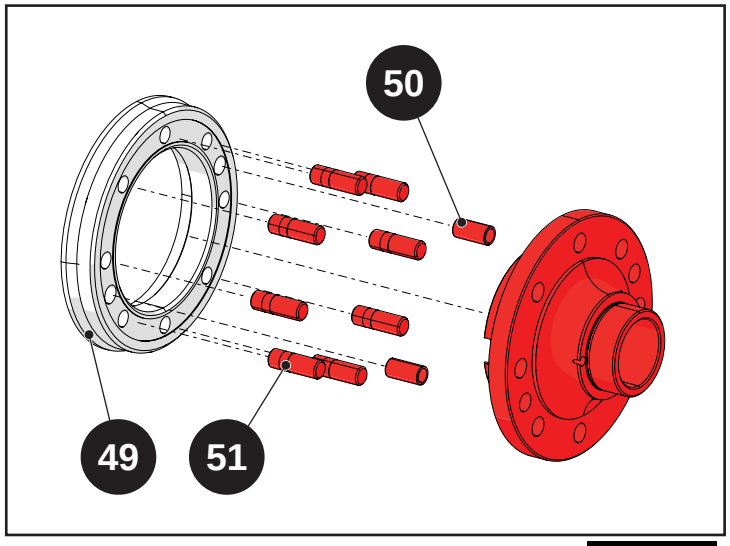


Fig. 7.43

Insert the plates (47) with the flat part pointing upwards.

Tighten the nuts (48) by applying 80 Nm (8 kgm) tightening torque.

Using a chisel, clinch the plates (47) to fix the nuts (48) and prevent them from loosening.

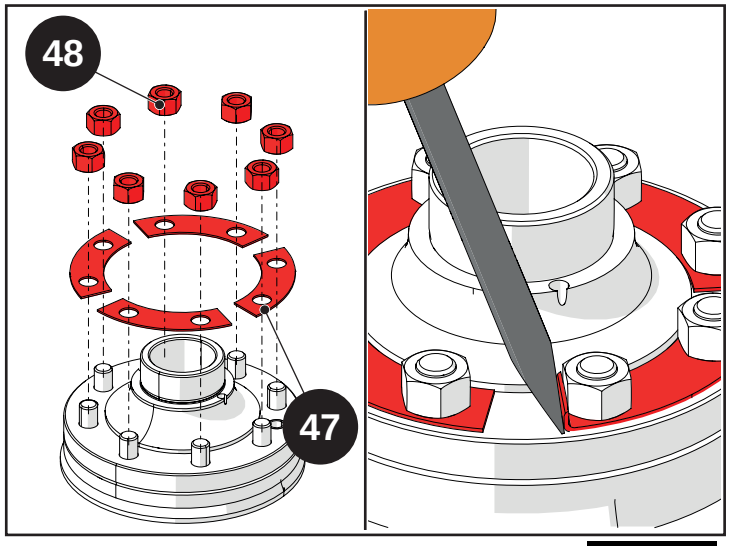


Fig. 7.44

Insert the inner and outer races of the bearings (45) and (46).

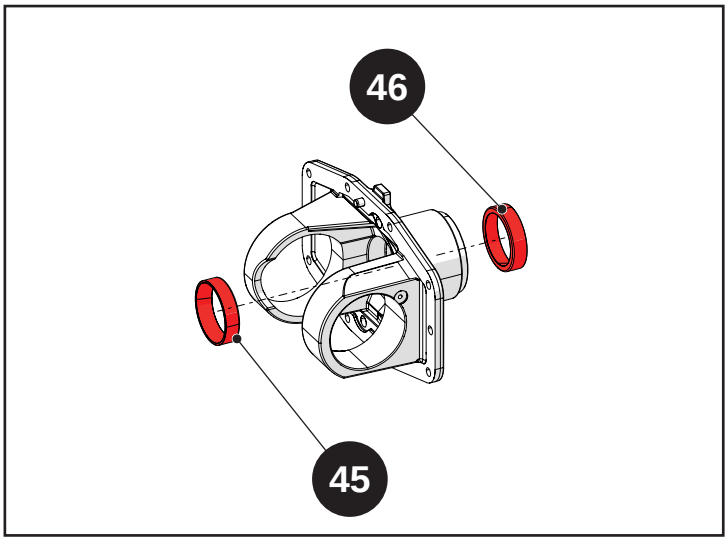


Fig. 7.45

Use a press to insert the lower bearing (45) of the pinion (44).

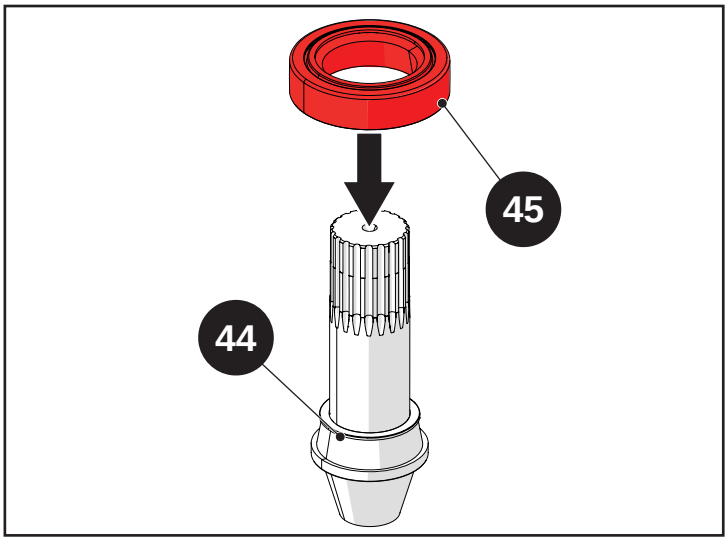


Fig. 7.46

Insert the pinion (44) complete with bearing into the differential.

Using a plug, insert the upper bearing (46) into the pinion.

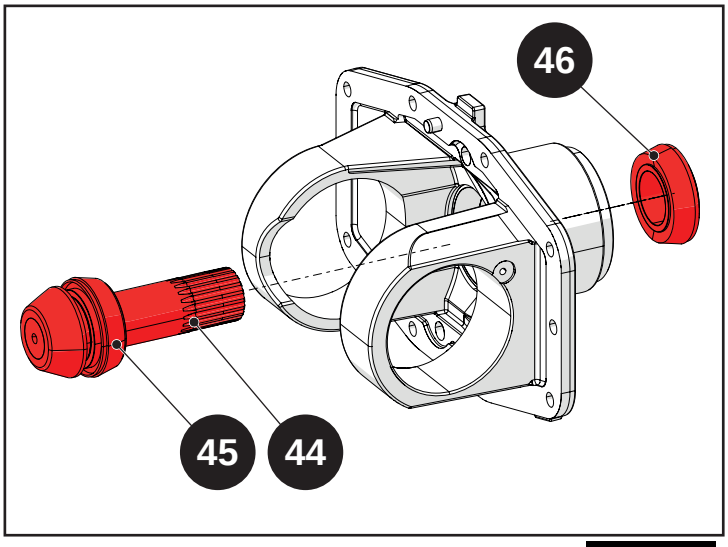


Fig. 7.47

Insert the gear (43) with the conical part pointing towards the pinion.

Insert the nut retaining spacer (33) and nut (42).

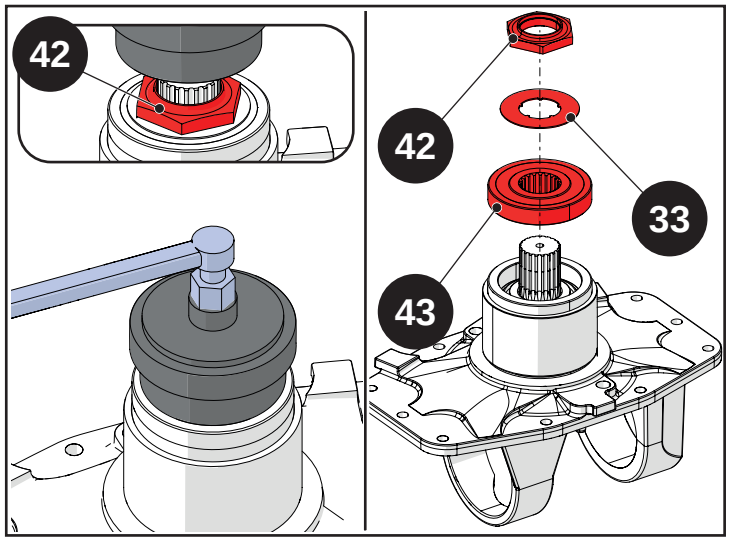


Fig. 7.48

Tighten the nut (42) by applying 40 Nm (4 kgm) tightening torque.

Tap the pinion so as to completely seat it, then make sure that it is free to turn. Tighten the nut (42) if it turns too loosely, or loosen the nut if the rotation movement is too stiff.

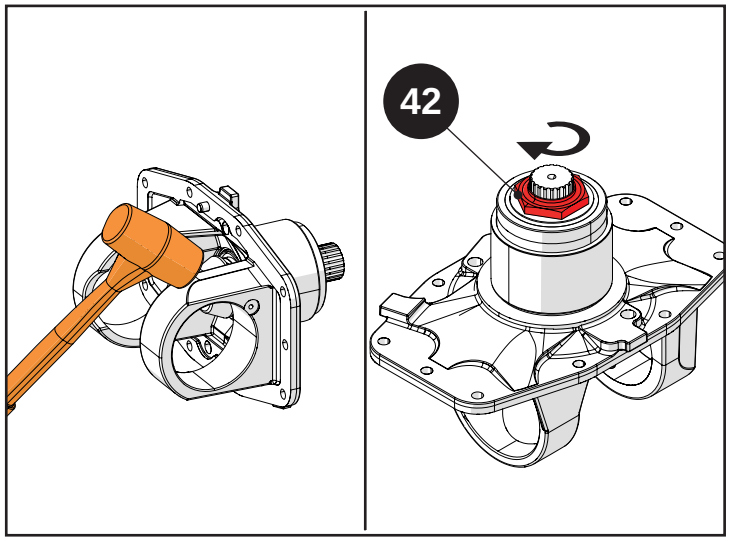


Fig. 7.49

Using a chisel, clinch the nut retaining spacer (33) to fix the nut (42) and prevent it from loosening.

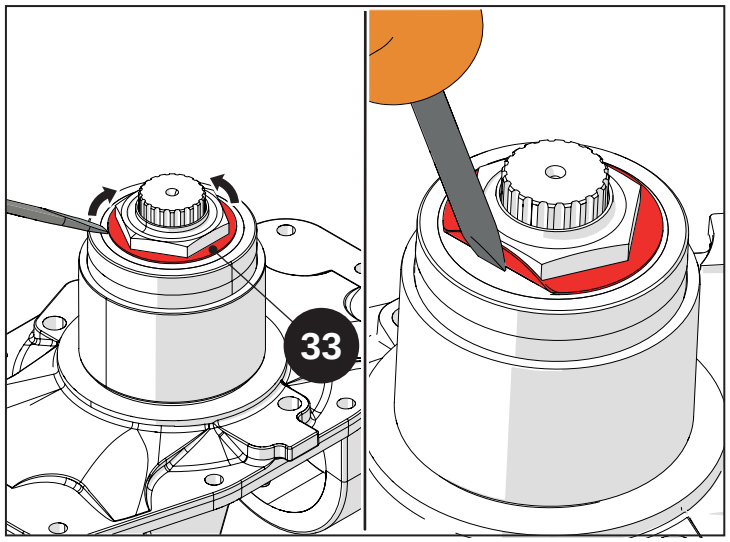


Fig. 7.50

Fit the unit into the ring gear (41).

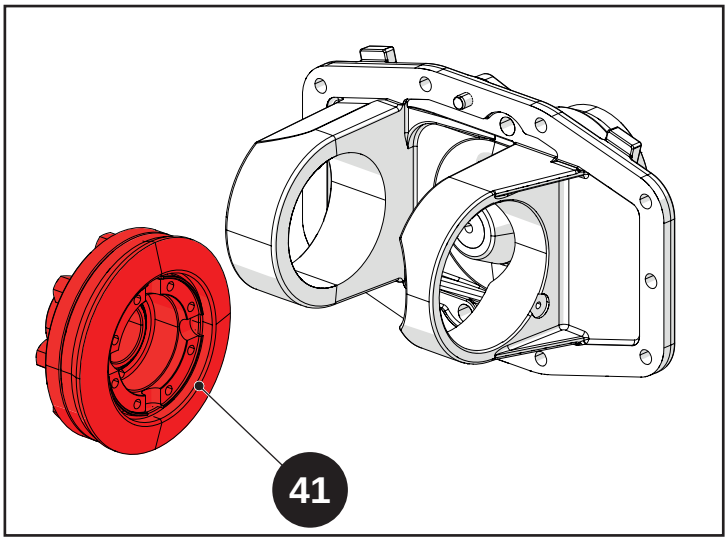


Fig. 7.51

Insert the NoSPIN unit (38).

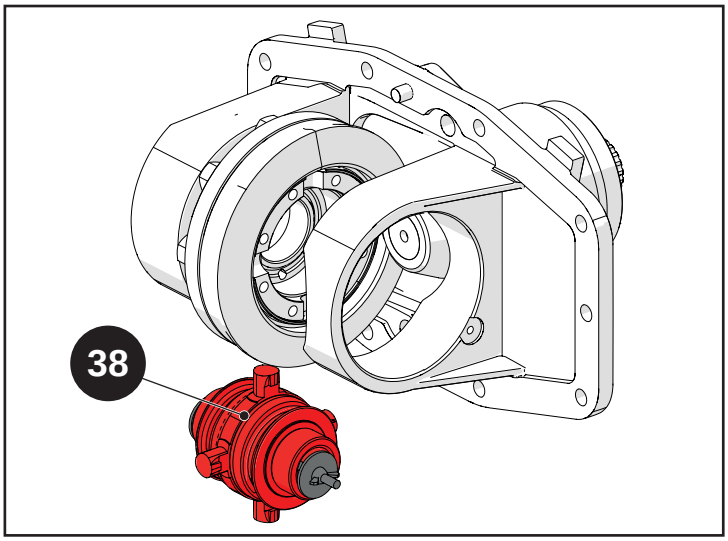


Fig. 7.52

Insert the housing of the NoSPIN unit (37), matching the mark made during the disassembly operations.

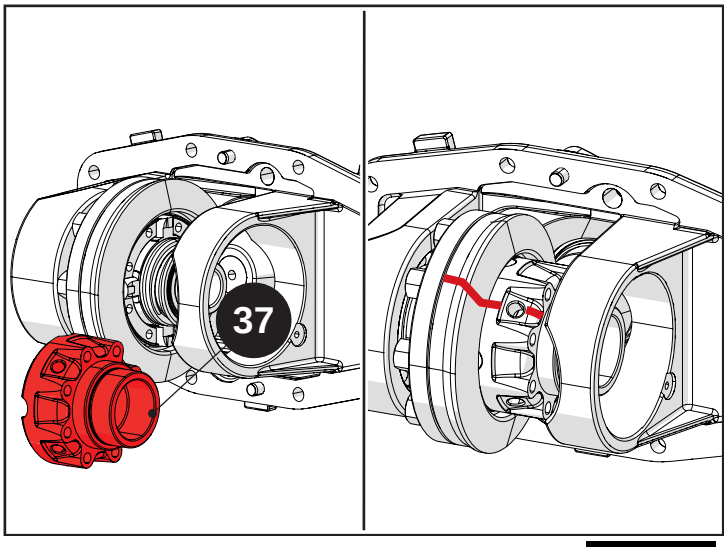


Fig. 7.53

Insert the lock washers (36) and allen screws (35).

Apply a layer of LOCTITE 243 to the threads and tighten the screws with a 50 Nm (5 kgm) driving torque.

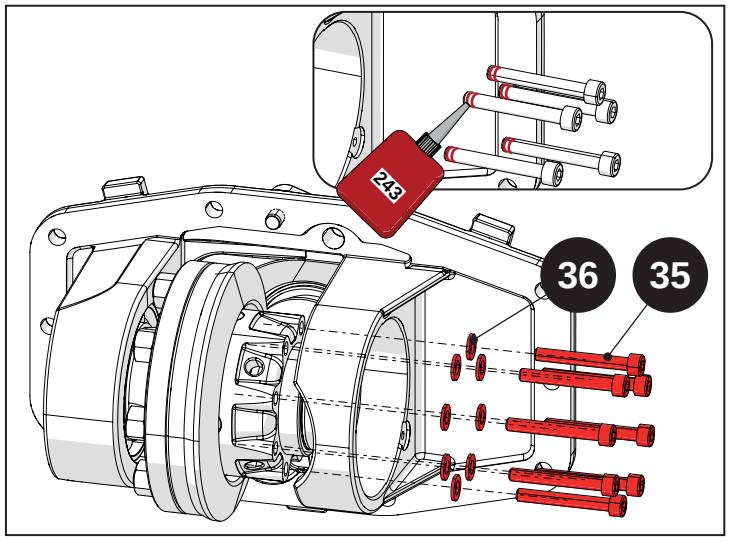


Fig. 7.54

Use a plug of a suitable size to seat the bearings (34) and (40).

Note

Make sure that the bearings are installed in the right direction.

DO NOT fully insert the bearings (34) and (40).

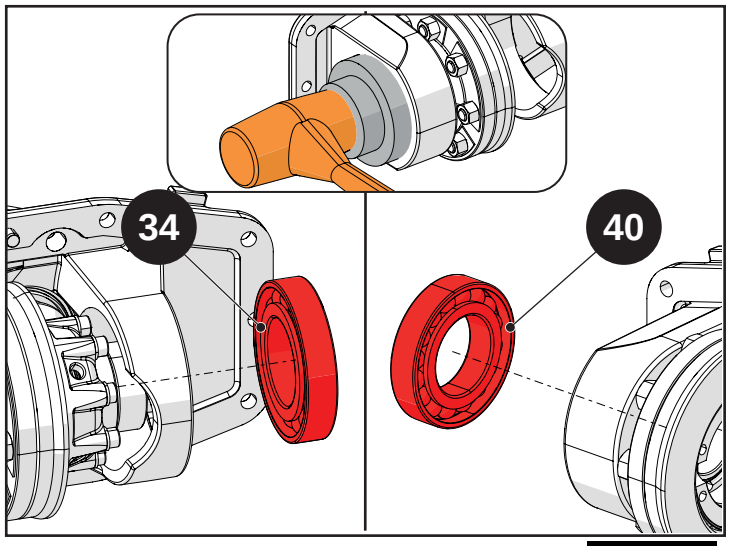


Fig. 7.55

Fully seat the bearings (34) and (40) after having checked that the ring gear (41) is perpendicular to the differential housing.

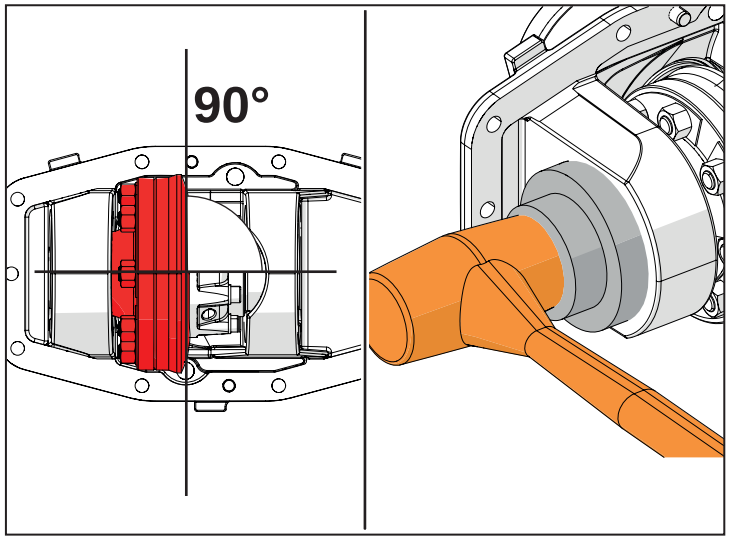


Fig. 7.56

Fully screw in the ring nut (39) using tool (C-07000237).

Apply 15 Nm (1.5 kgm) tightening torque.

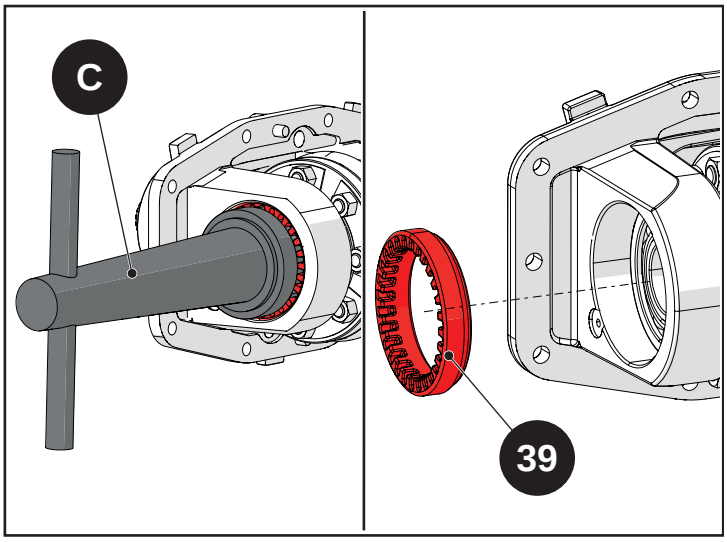


Fig. 7.57

Unscrew the ring nut in the anticlockwise direction by 3 grooves, using the ring nut retainer hole as a reference.

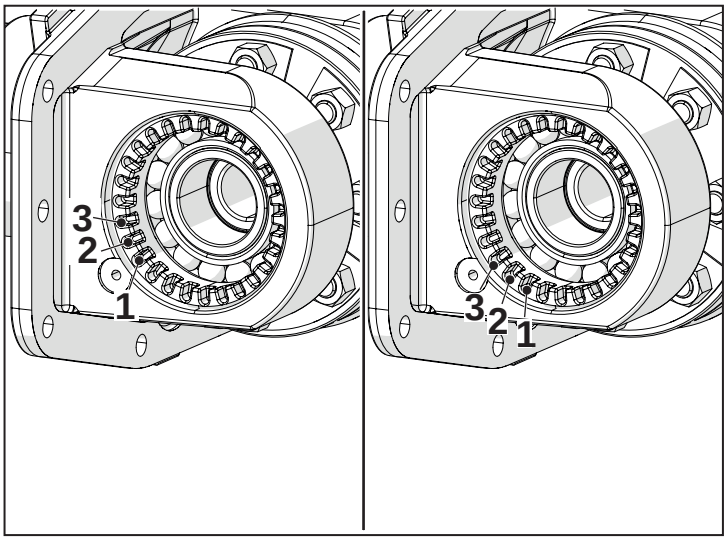


Fig. 7.58

Tighten the ring nut (32) by applying 40 Nm (4 kgm) tightening torque.

Note

Match the hole of the ring nut retainer with one of the ring nut (32) holes.

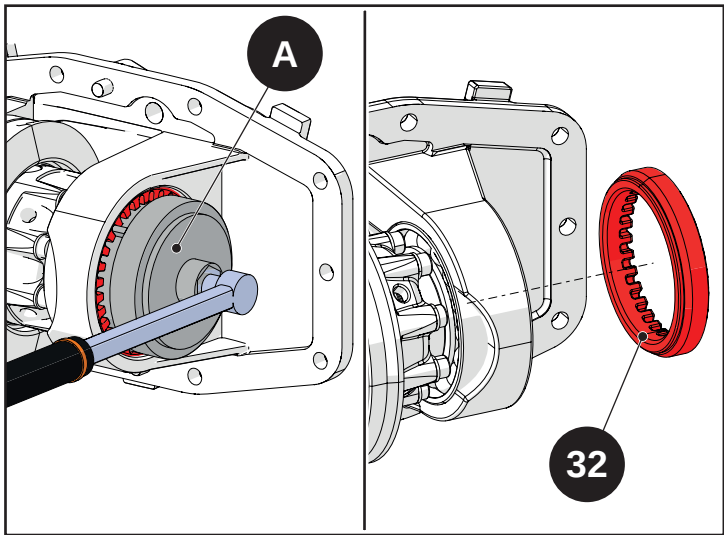


Fig. 7.59

Tap the ring gear with a mallet made of soft material so as to fully seat it on the bearing (40).

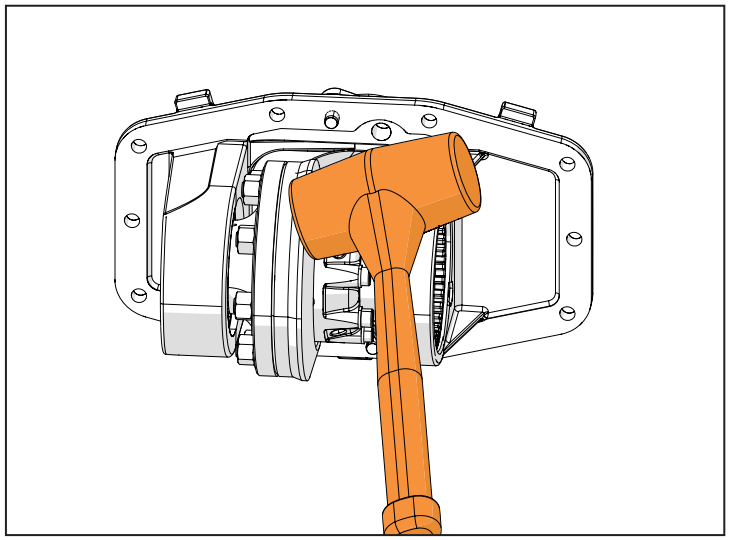


Fig. 7.60

Make sure that the ring gear is free to turn.

Hold the pinion steady and turn the ring gear so as to make sure that the play between the ring gear and pinion teeth is 0.10-0.18 mm.

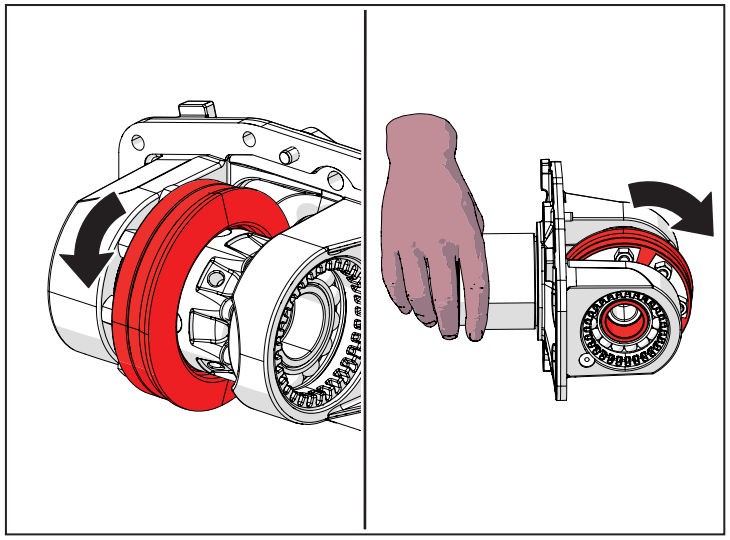


Fig. 7.61

Tighten the ring nut (31) complete with washers.

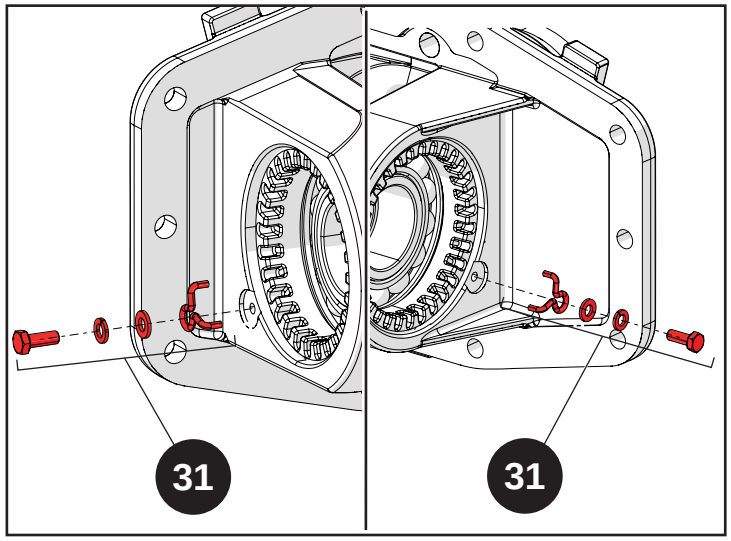


Fig. 7.62

Remove the screw and locking wing nut (B) from the NoSPIN mechanism.

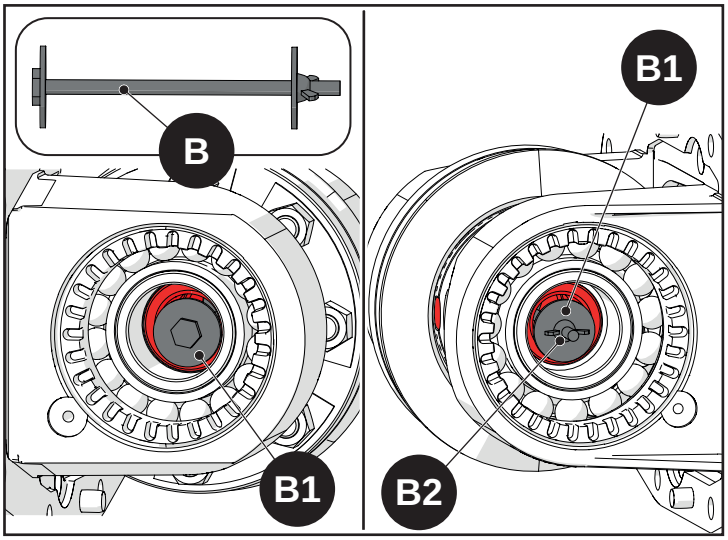


Fig. 7.63

5.1.3.1 Make sure that the NoSPIN device functions correctly

Lock the pinion using tool (E-07007078).

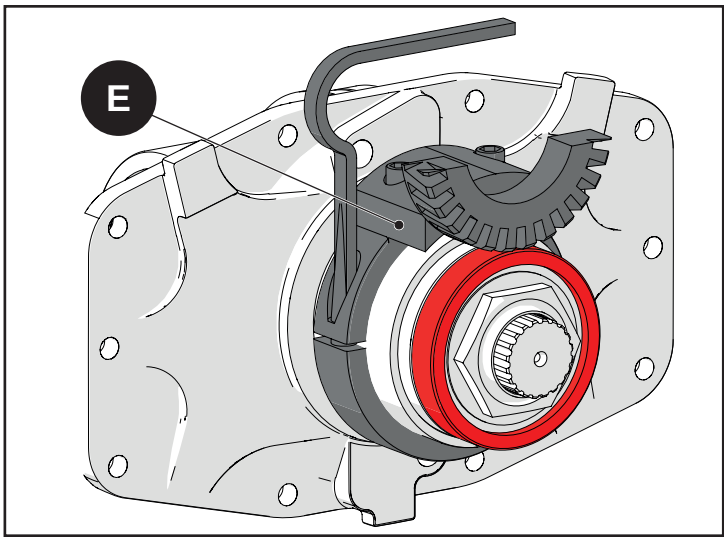


Fig. 7.64

Use the levers (D-07007179) to simulate differential lock engagement and disengagement. Hold a lever steady and move the other to make sure it is free to turn. Perform the test in both rotation directions on both sides.

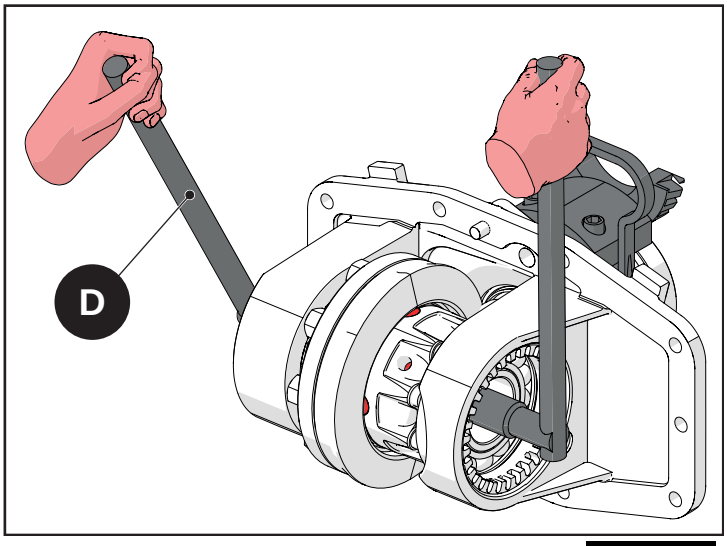


Fig. 7.65

5.2 Side final drive

5.2.1 Assembly drawing and main components

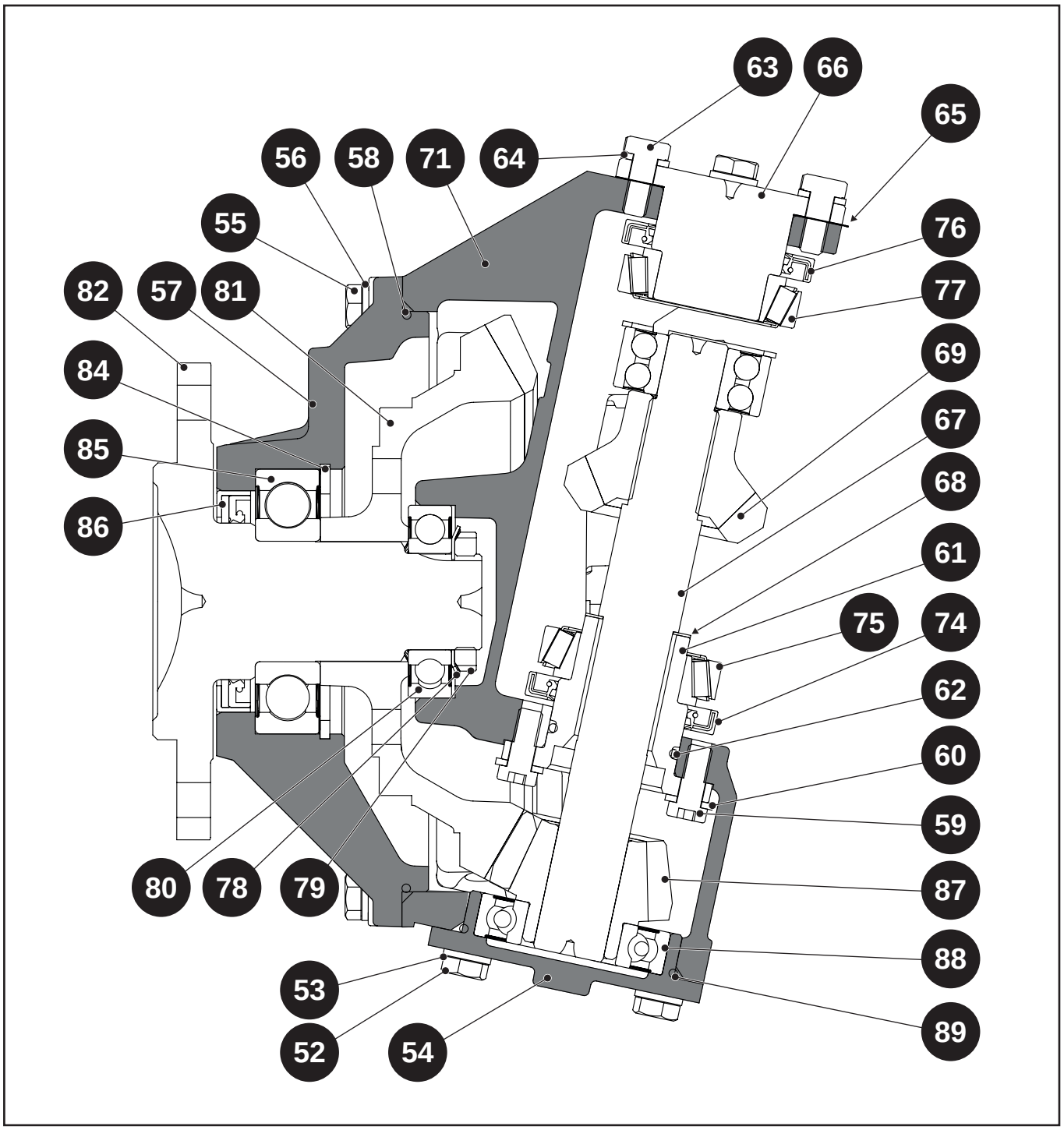


Fig. 7.66

52 - Screw
53 - Taper washer
54 - Lower cover
55 - Screw
56 - Washers
57 - Cover
58 - O-ring
59 - Allen screw
60 - Taper washer
61 - Flange
62 - O-ring
63 - Screw
64 - Taper washer
65 - Spacer
66 - Pin
67 - Shaft
68 - Spacer
69 - Final drive gear
71 - Pivot flange
74 - Oil retainer
75 - Bearing
76 - Oil retainer
77 - Bearing
78 - Ring nut retainer
79 - Ring nut
80 - Bearing
81 - Ring gear
82 - Axle shaft
83 - Cover
84 - Circlip
85 - Bearing
86 - Oil retainer
87 - Gear
88 - Bearing
89 - O-ring

5.2.2 Disassembly

Note

Place empty cans under the plugs so as to collect the oil.

Unscrew the screws (52) and taper washers (53), then remove the lower cover complete with gear (54).

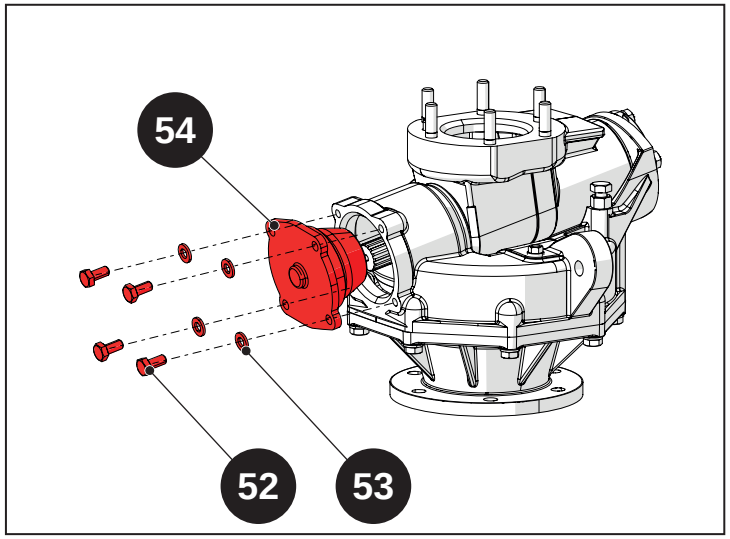


Fig. 7.67

Unscrew the screws (55) and remove the taper washers (56).

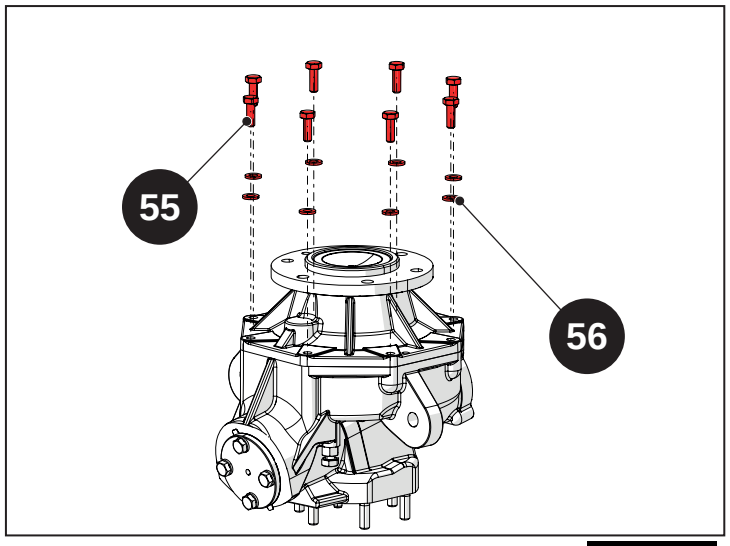


Fig. 7.68

Insert 2 screws into the extraction holes, then tighten them to remove the cover of the final drive (57).

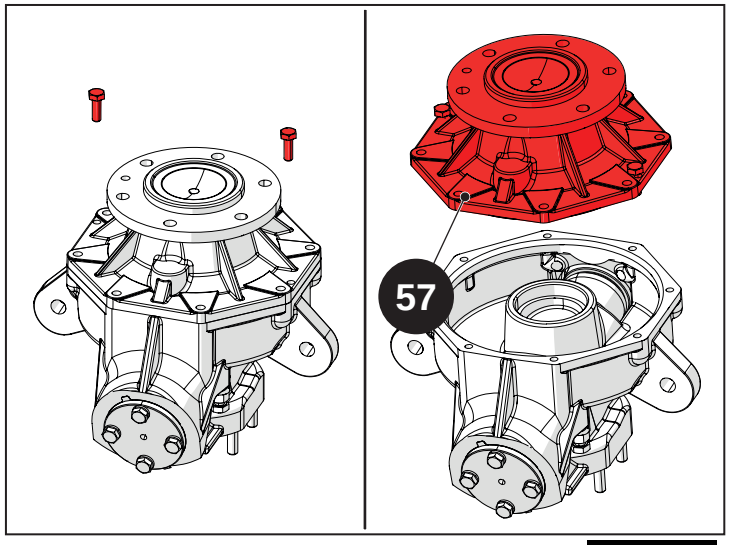


Fig. 7.69

Remove the O-ring (58).

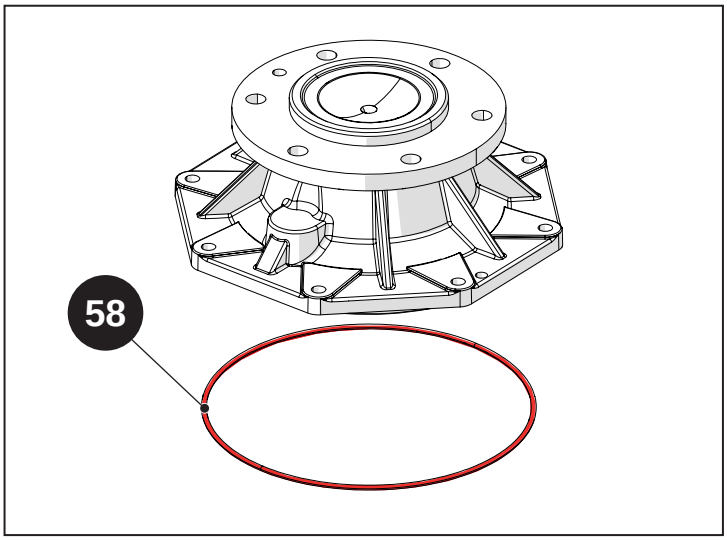


Fig. 7.70

Unscrew the allen screws (59) and taper washers (60), then remove the flange (61) complete with O-ring (62).

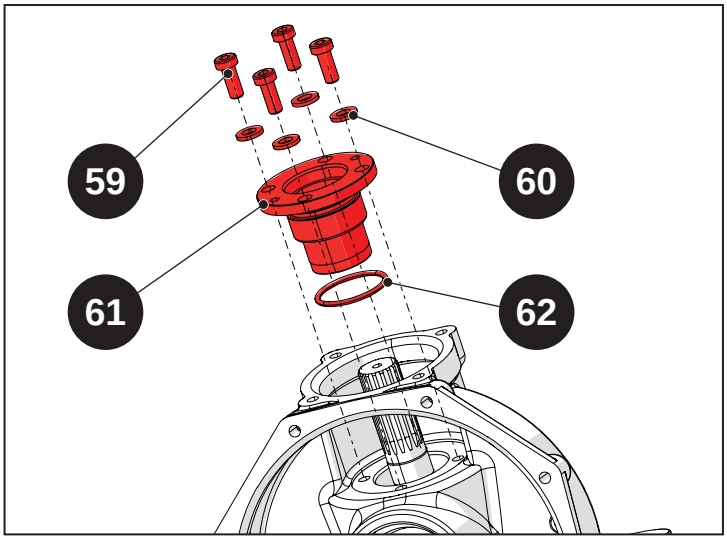


Fig. 7.71

Unscrew the screws (63) and remove the taper washers (64).

Remove the pin (66), then extract the two 0.2 mm thick spacers (65).

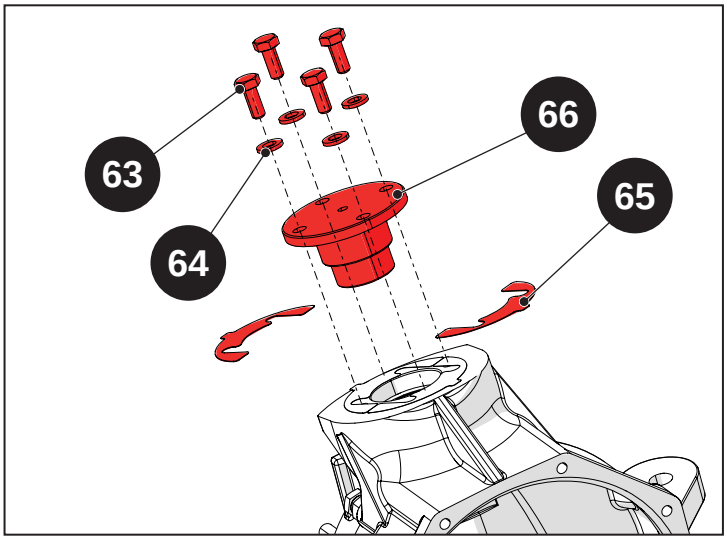


Fig. 7.72

Tap the shaft (67) with a pin driver to remove it from the final drive complete with spacer (68).

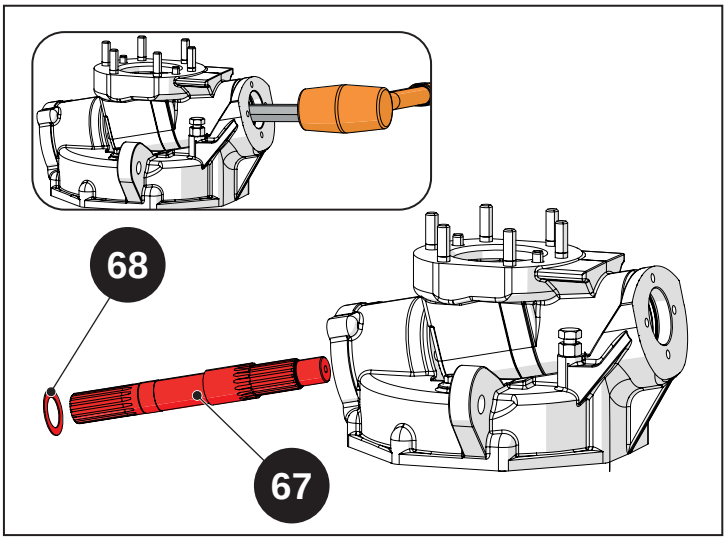


Fig. 7.73

Remove the final drive gear with 13 teeth (69).

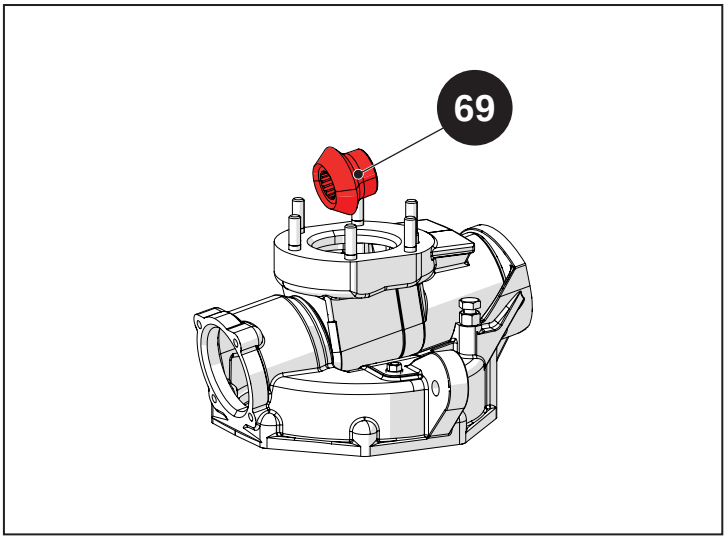


Fig. 7.74

Remove the flange (71) from the complete final drive.

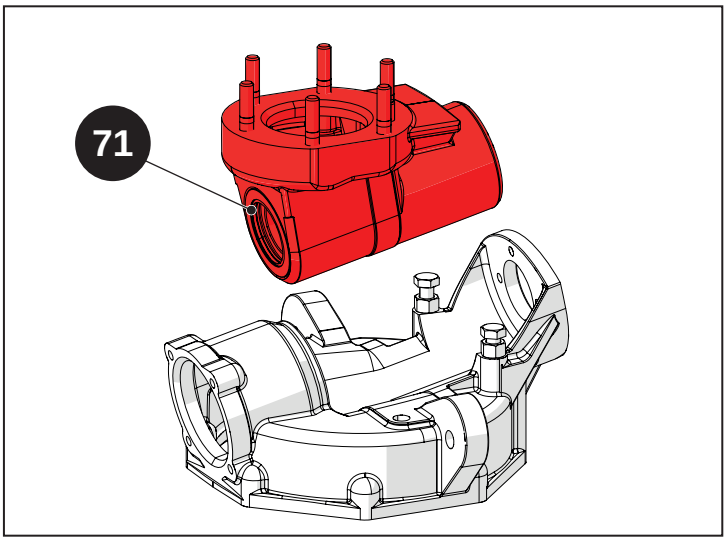


Fig. 7.75

Remove the oil retainer (74) and roller bearing (75).

Remove the oil retainer (76) and roller bearing (77).

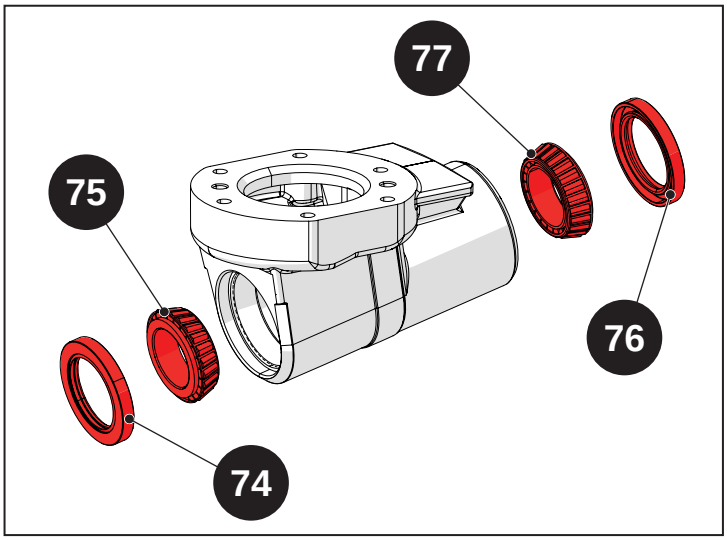


Fig. 7.76

Using a pin driver, remove the outer races of the bearings (75) and (77).

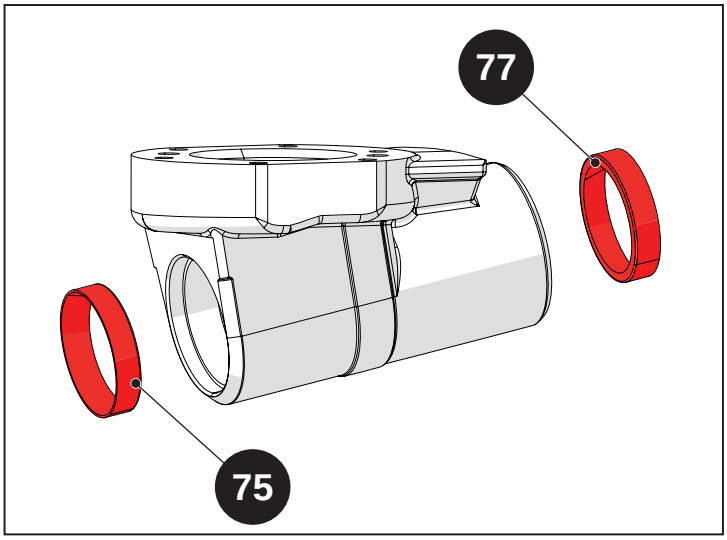


Fig. 7.77

Lower the tooth of the ring nut retainer (78).

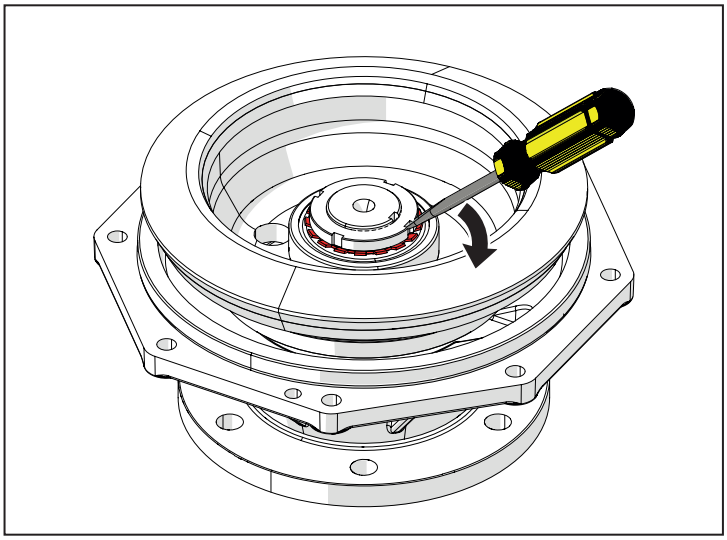


Fig. 7.78

Use special tool (F-07000234) to unscrew and remove the ring nut (79).

Remove the ring nut retainer (78).

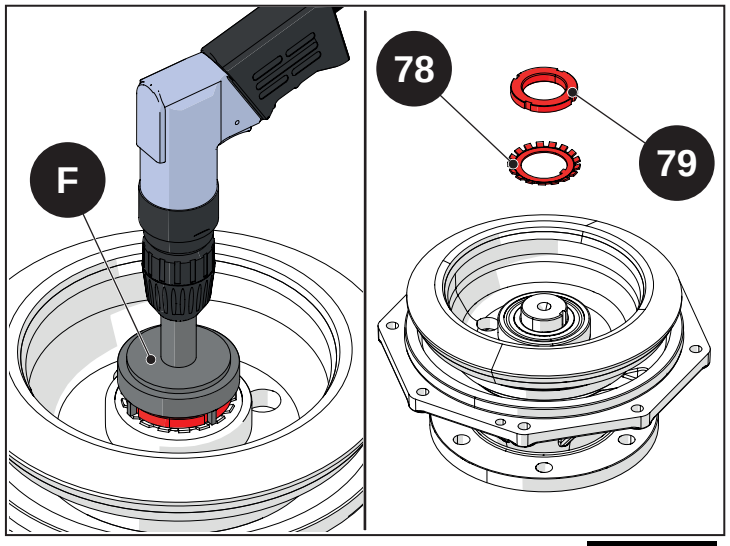


Fig. 7.79

Using a mallet made of soft material, tap the axle shaft to disengage the bearing (80) and ring gear (81).

Remove the axle shaft (82) from the cover (83).

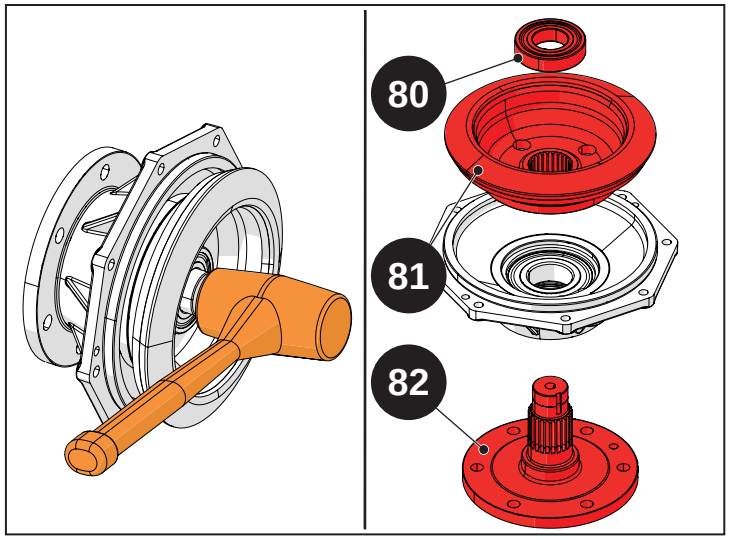


Fig. 7.80

Remove the circlip (84).

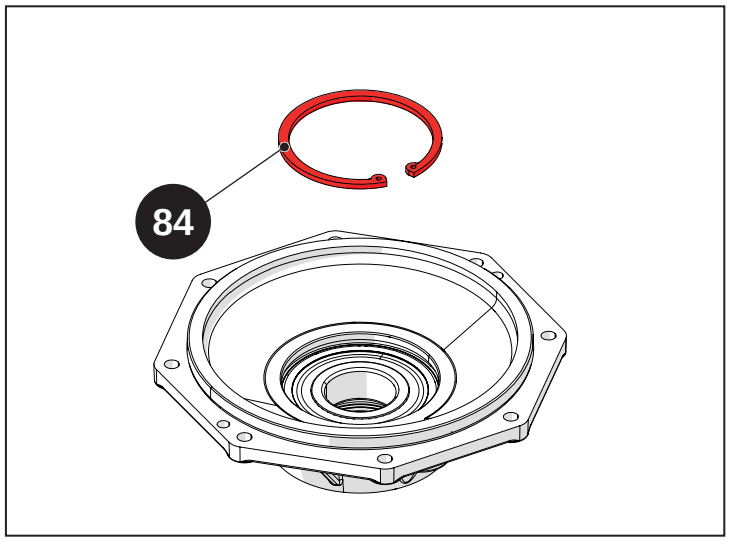


Fig. 7.81

Remove the oil retainer (86).

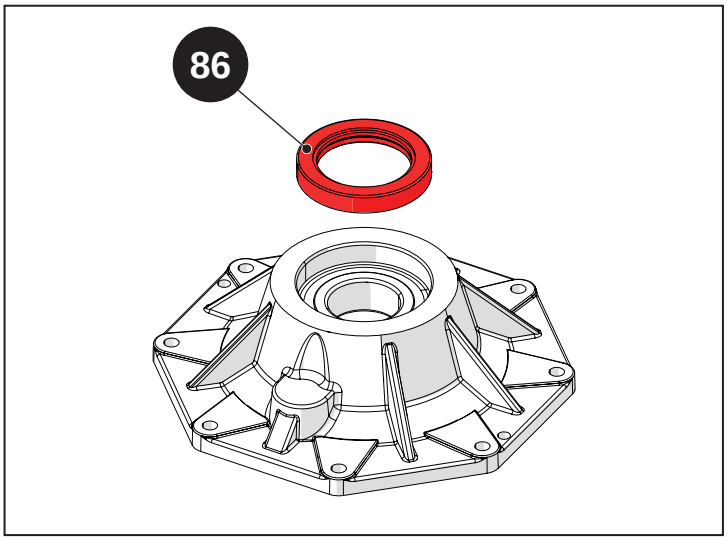


Fig. 7.82

Use a plug to remove the bearing (85).

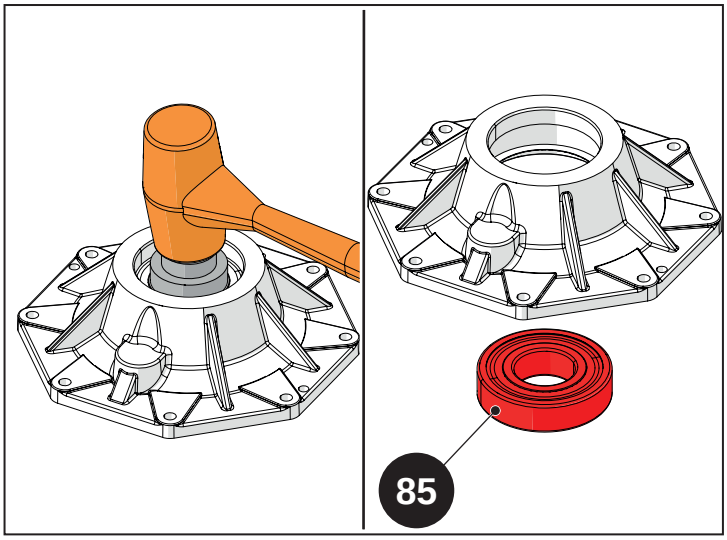


Fig. 7.83

5.2.3 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.

Use a plug to insert the bearing (85).

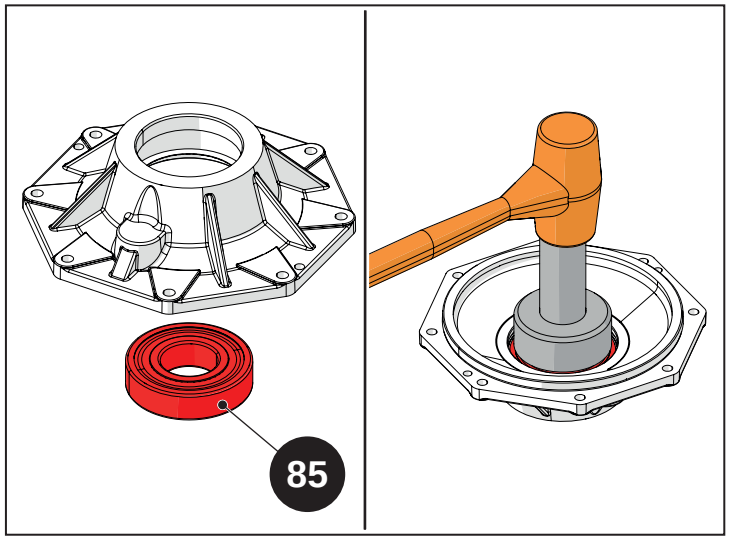


Fig. 7.84

Fit the circlip (84) into its housing.

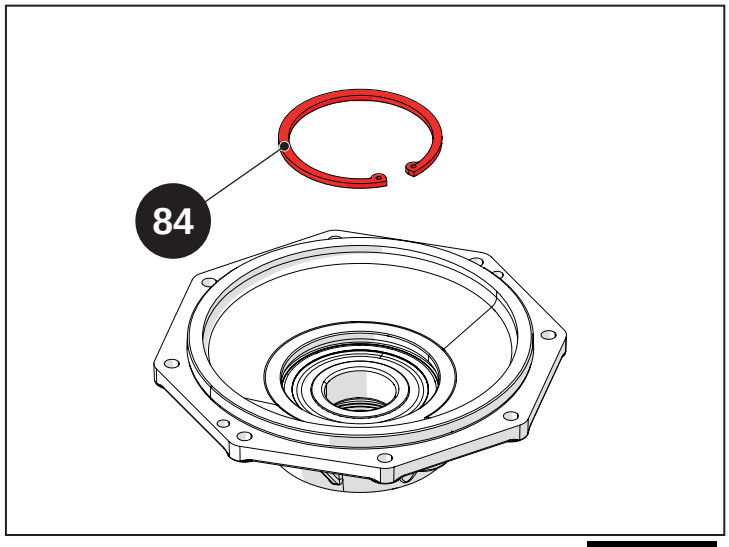


Fig. 7.85

Insert the oil retainer (86) after applying a layer of sealane around the perimeter.

Note

Replace the oil retainer (86) when the components are reassembled.

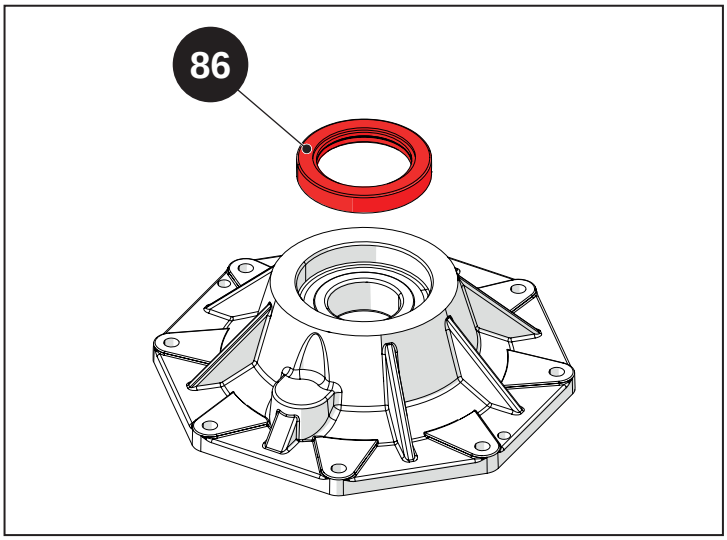


Fig. 7.86

Insert the axle shaft (82), ring gear (81) and bearing (80).

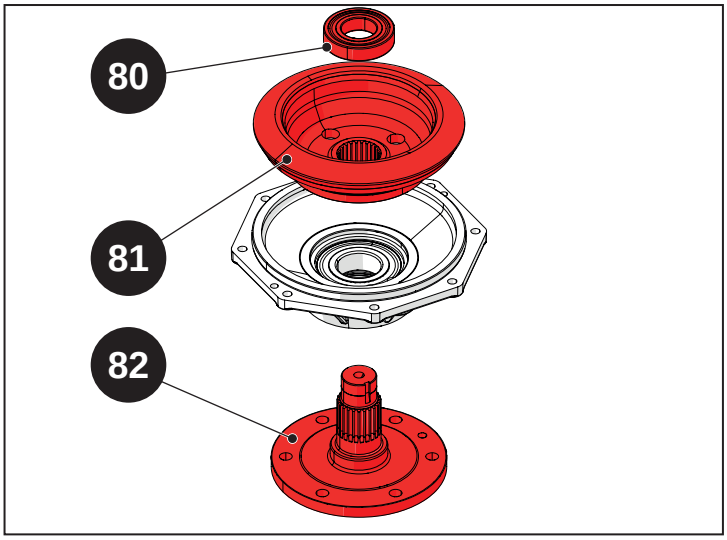


Fig. 7.87

Insert the ring nut retainer (78) and ring nut (79).

Using special tool (F-07000234), tighten the ring nut (79) by applying 150 Nm (15 kgm) tightening torque.

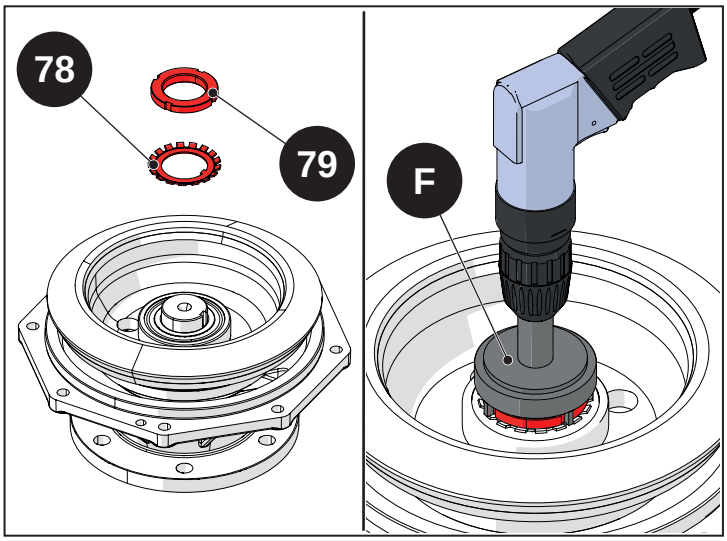


Fig. 7.88

Raise the tooth of the ring nut retainer (78) to fix the ring nut (79).

Chisel the ring nut (79) to ensure it is safely fixed in place.

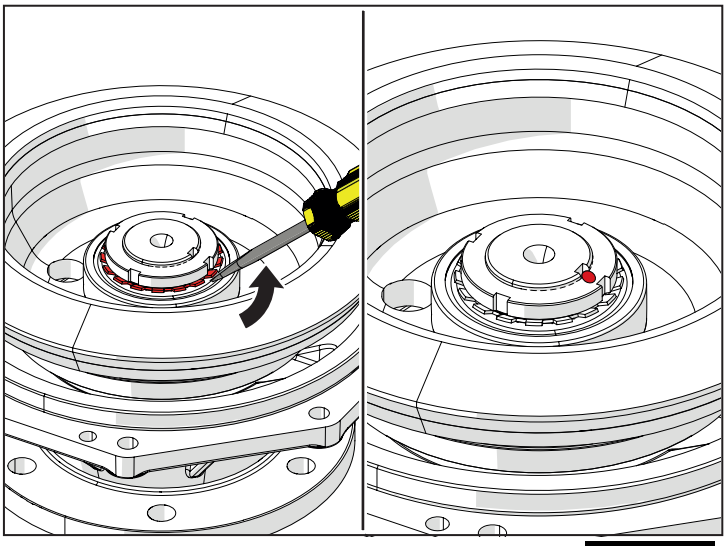


Fig. 7.89

Insert the complete roller bearing (75) and oil retainer (74).

Insert the complete roller bearing (77) and oil retainer (76).

Apply a layer of SEALANT to the outer side of the oil retainer.

> **Note**
>
> Replace the oil retainers (74) and (76) when the components are reassembled.

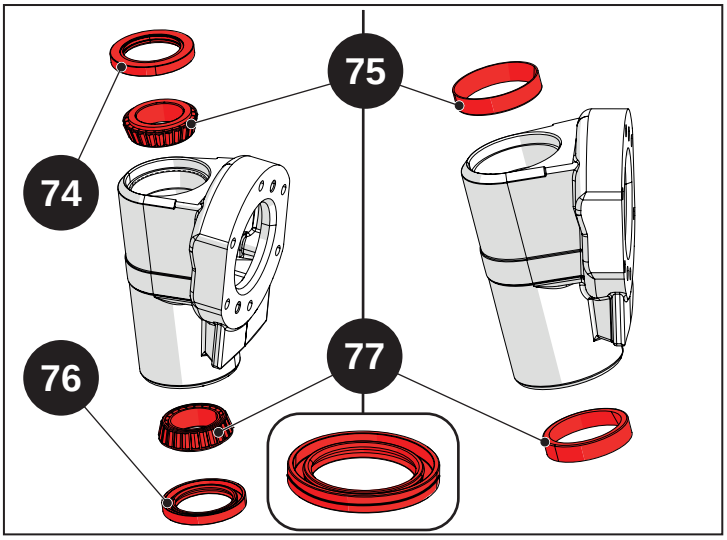


Fig. 7.90

Screw the stud bolts to the flange (72).

Insert the centring springs (73).

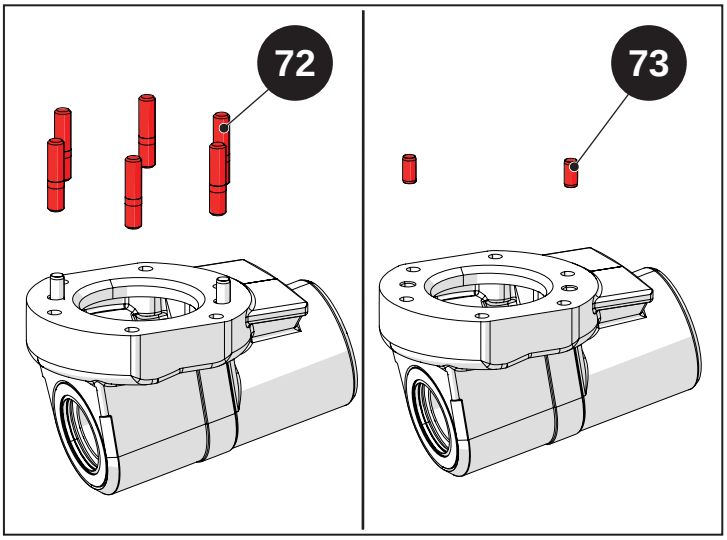


Fig. 7.91

Insert the flange (71) into the complete final drive.

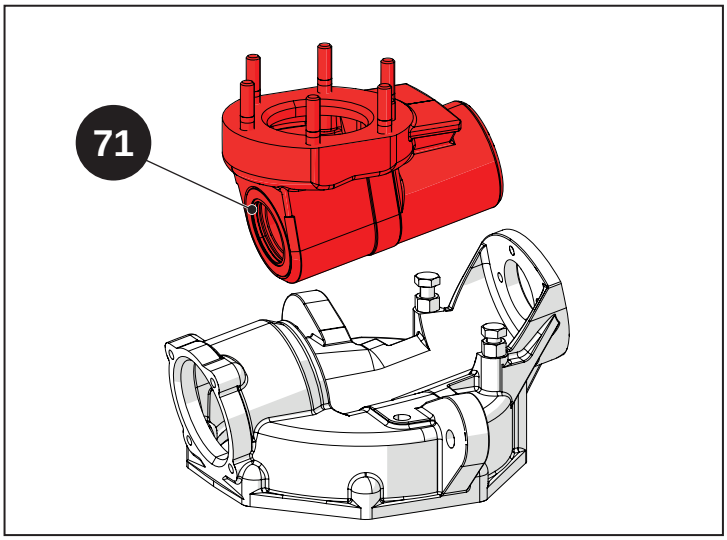


Fig. 7.92

Remove the final drive gear with 13 teeth (69).

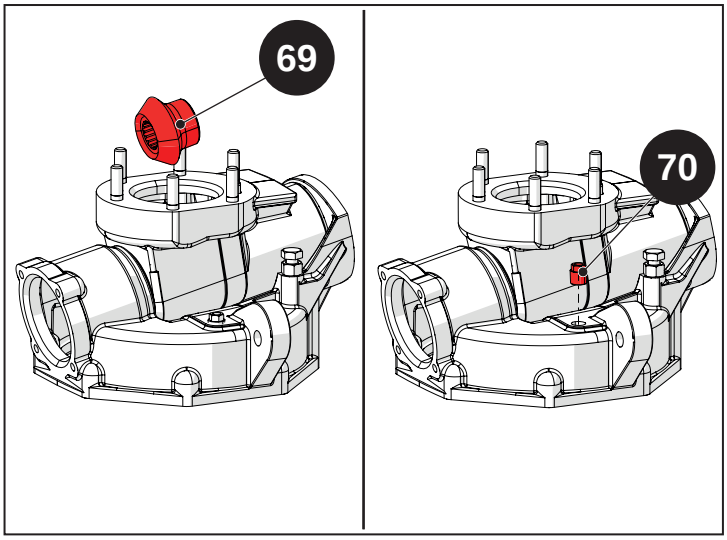


Fig. 7.93

Insert the pin (66) and the two 0.2 mm thick spacers (65).

Insert the taper washers (64) and tighten the screws (63) by applying 50 Nm (5 kgm) tightening torque.

Note

The spacer (65) provides the correct load on the flange bearings.

Steering will be smoother as the thickness of the spacers increases.

Vice versa, steering will be stiffer as the thickness of the spacers decreases.

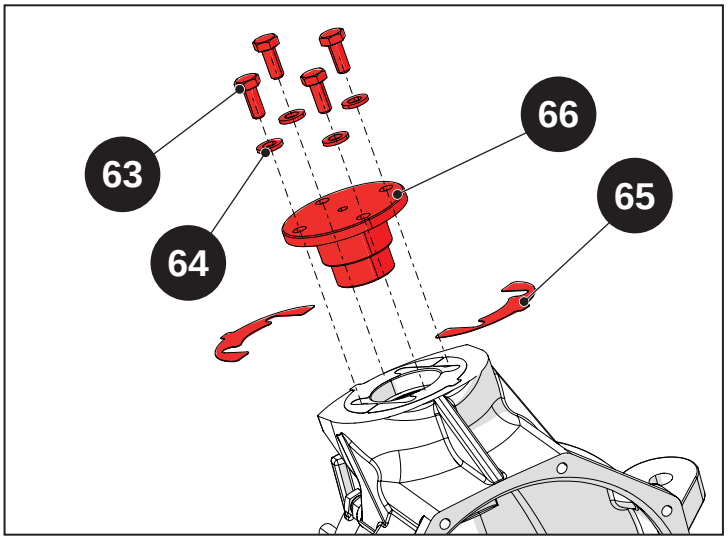


Fig. 7.94

Insert the shaft (67) complete with spacer (68) into the final drive.

> **Note**
>
> Make sure that the shaft (68) turns correctly once it has been assembled.

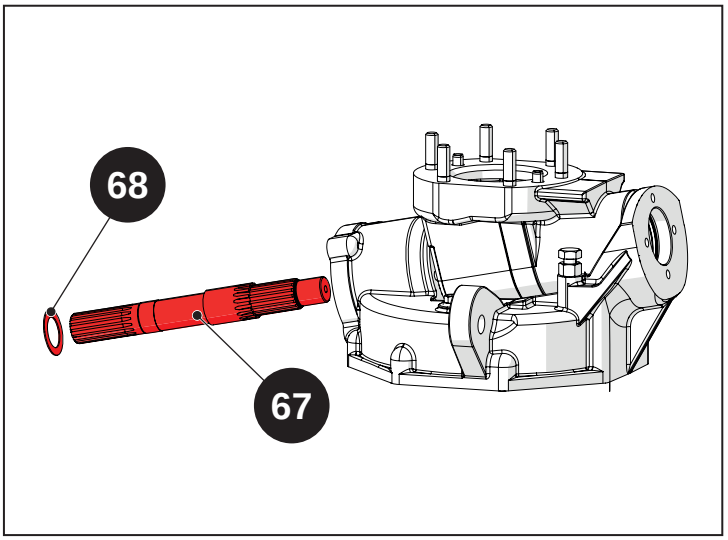


Fig. 7.95

Replace the O-ring (62), then insert the flange (61), lock washers (60) and allen screws (59).

Apply a layer of Loctite 577 to the threads of the allen screws (59) and tighten them by applying 50Nm (5 kgm) driving torque.

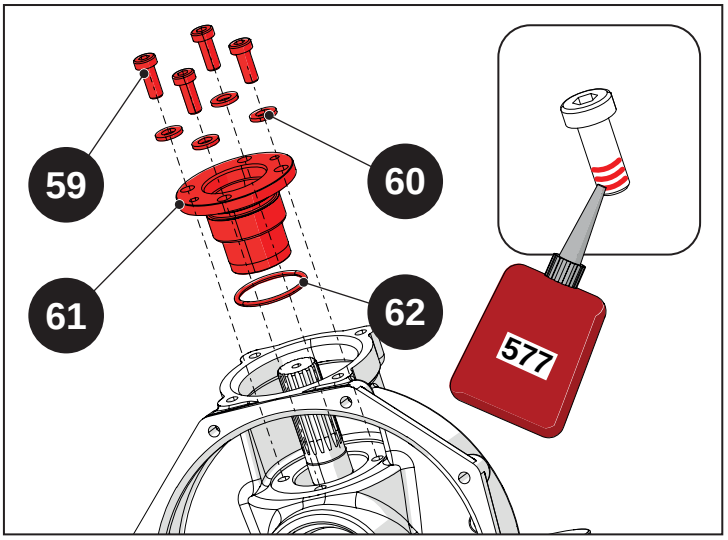


Fig. 7.96

Apply a layer of grease, then insert the O-Ring (58) into its housing.

Apply a layer of SILICONE to the O-Ring (58) after it has been inserted.

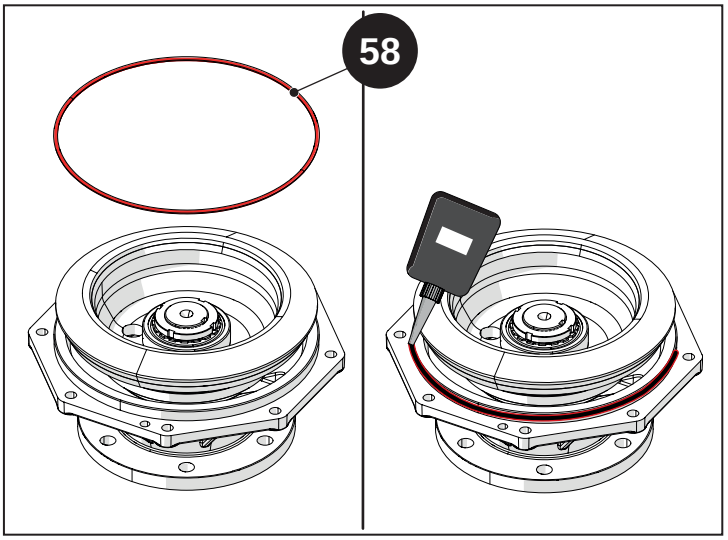


Fig. 7.97

Insert the taper washers (56) and tighten the screws (55) by applying 60 Nm (6 kgm) tightening torque.

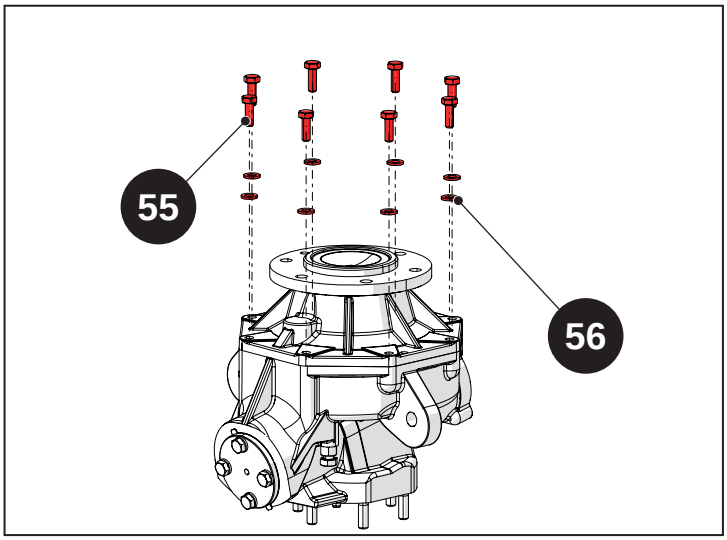


Fig. 7.98

Insert the lower cover (54) complete with gear (87), bearing (88) and O-ring (89).

Insert the taper washers and tighten the screws (52) by applying 50 Nm (5 kgm) tightening torque.

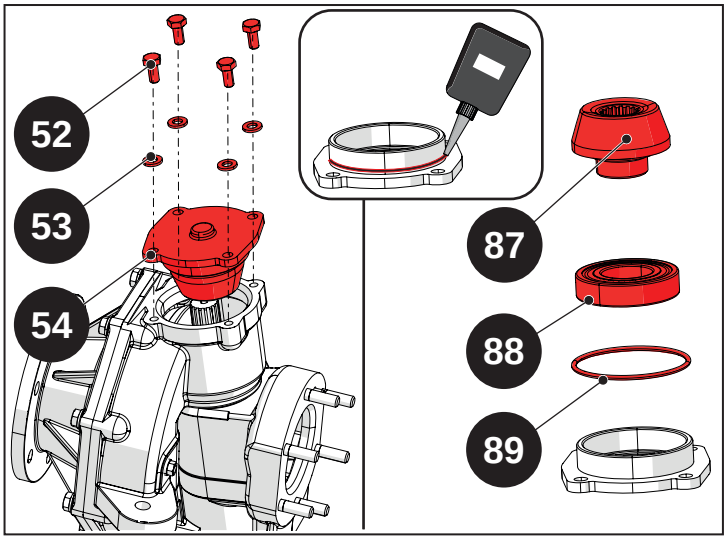


Fig. 7.99

5.3 Drive transmission casing

5.3.1 Assembly drawing and main components

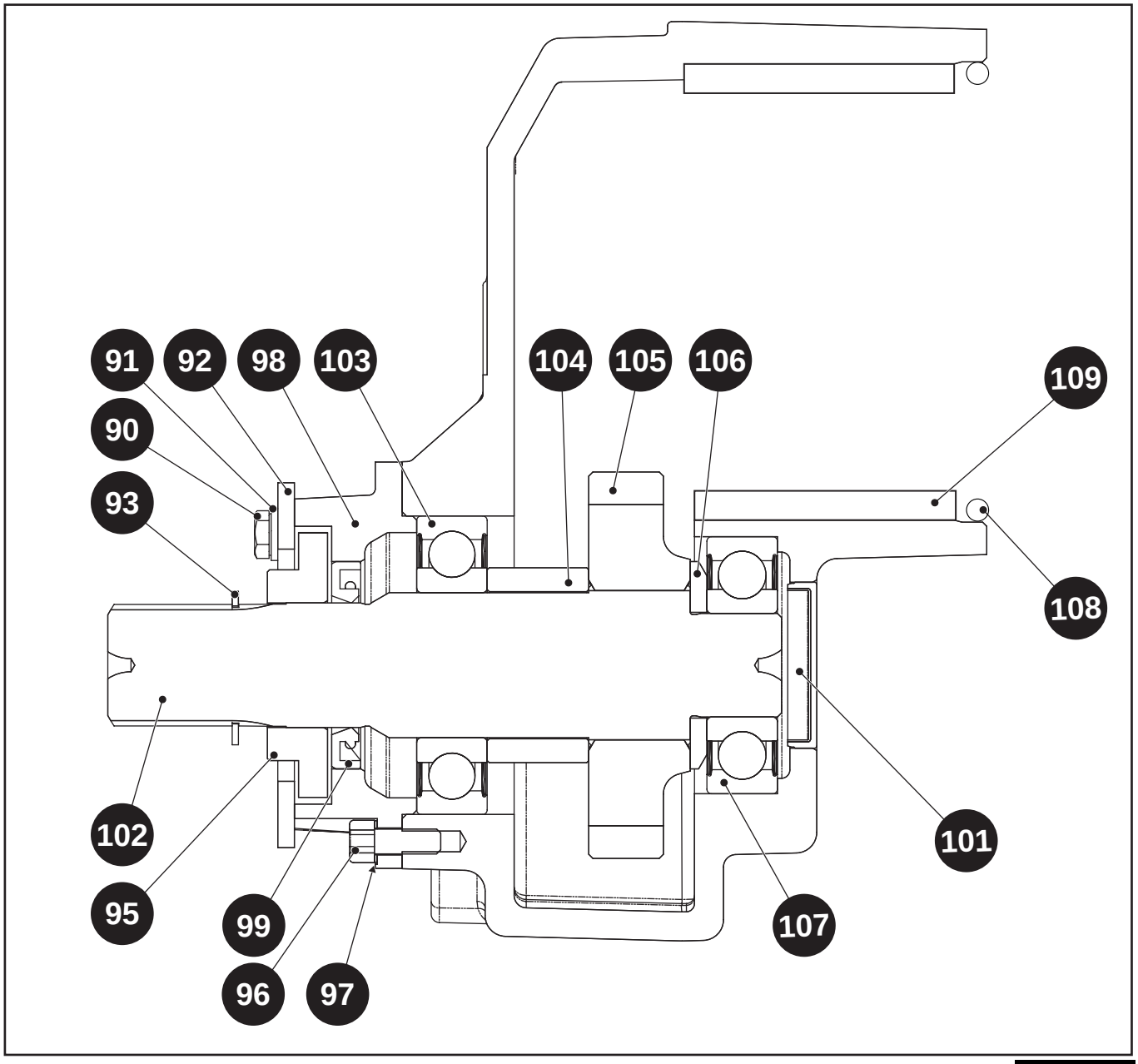


Fig. 7.100

90 - Screw
91 - Washer
92 - Plate
93 - Circlip
95 - Phonic wheel
96 - Screw
97 - Knurled washer
98 - Cover
99 - Oil retainer
101 - Plug
102 - Transmission shaft
103 - Bearing
104 - Bush
105 - gear
106 - Spacer
107 - Bearing
108 - O-ring
109 - Bushing

5.3.2 Disassembly

Unscrew the screws (90) and remove the washers (91) that fasten the plate (92).

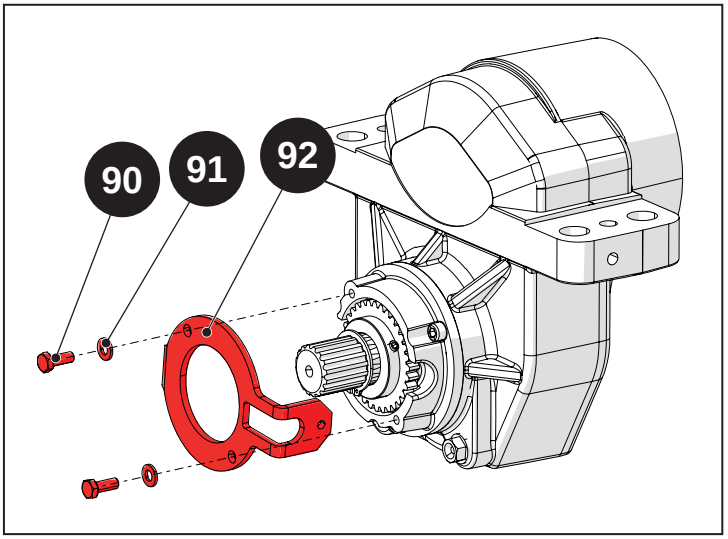


Fig. 7.101

Remove the circlip (93).

Remove the stop dowel (94).

emove the phonic wheel (95).

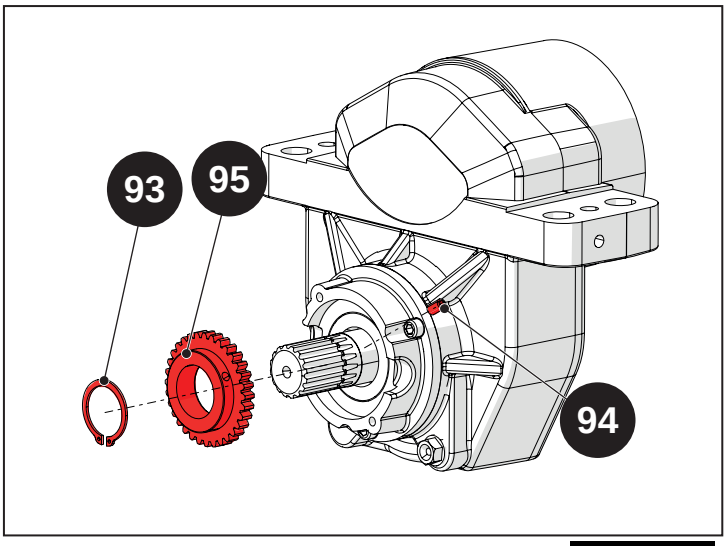


Fig. 7.102

Unscrew the allen screws (96) and remove the knurled washers (97).

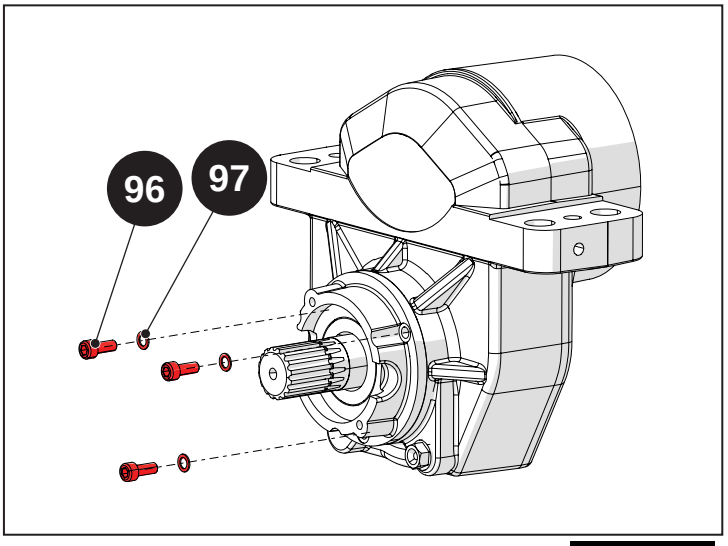


Fig. 7.103

Using a lever, remove the cover (98) complete with oil retainer (99).

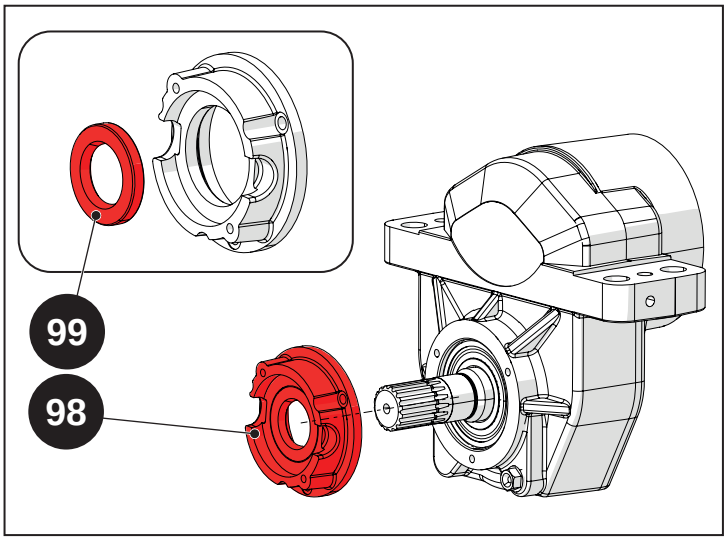


Fig. 7.104

Unscrew the plug (100).

Remove the plug (101).

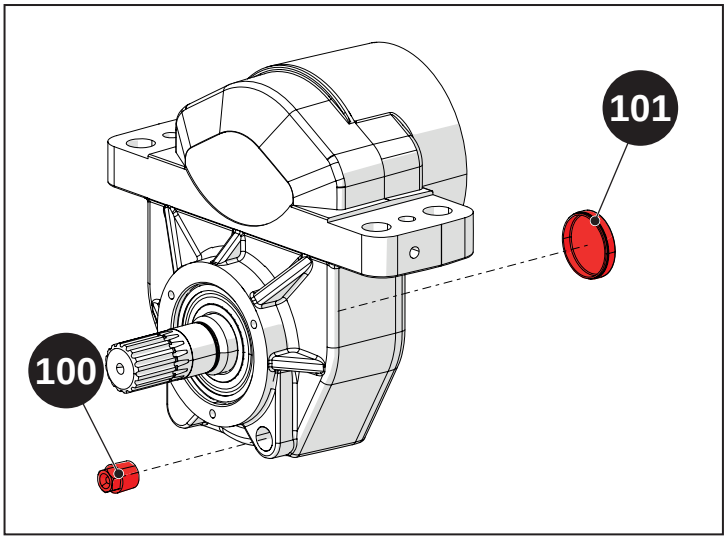


Fig. 7.105

Remove the transmission shaft (102).

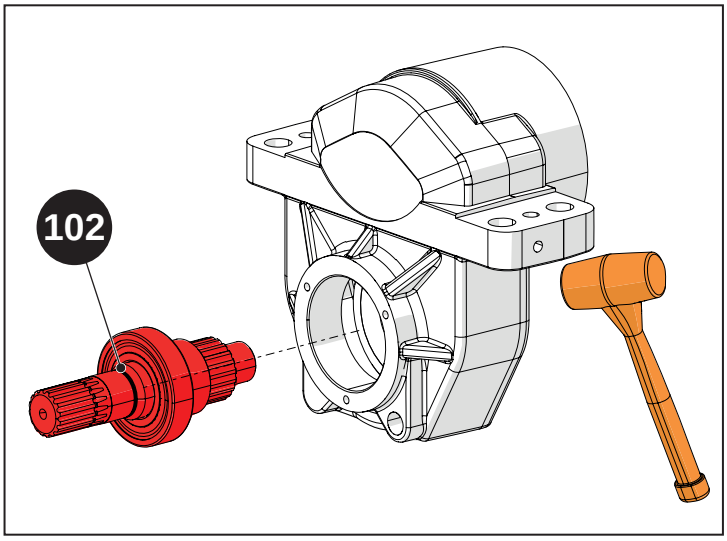


Fig. 7.106

Use a puller to remove the bearing (103) and bush (104).

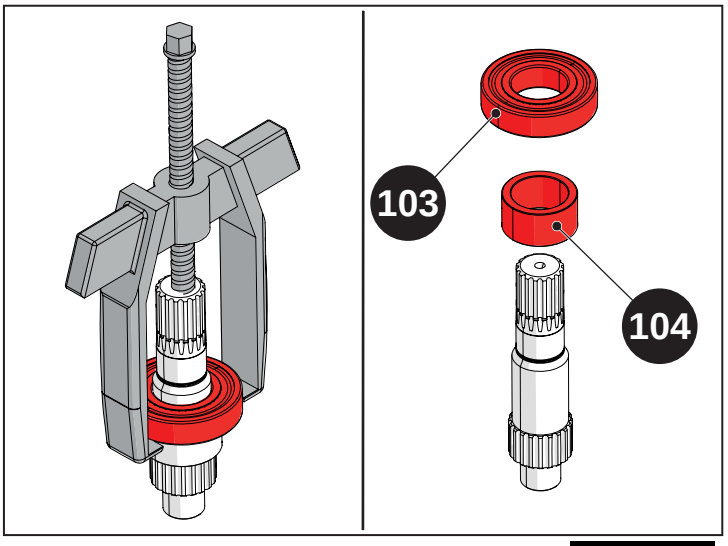


Fig. 7.107

Remove the gear (105) and spacer (106).

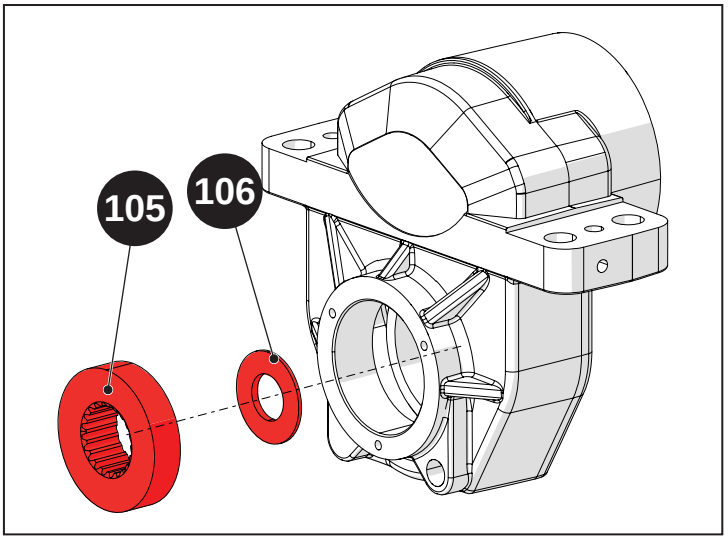


Fig. 7.108

Remove the bearing (107) using a plug.

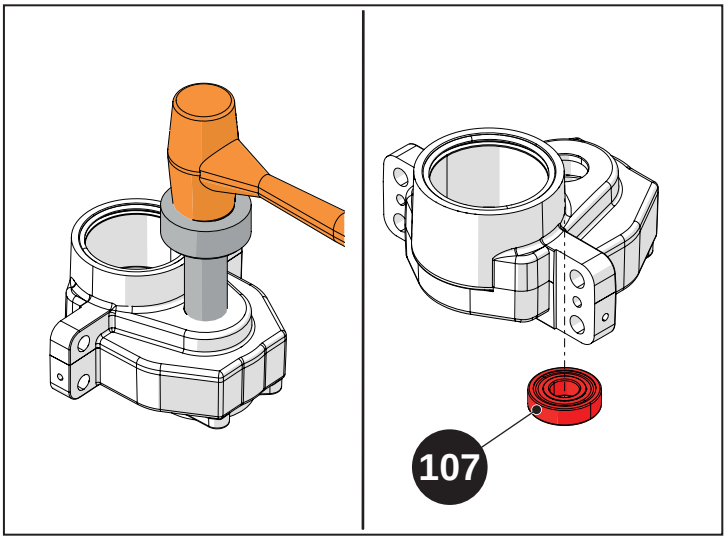


Fig. 7.109

Remove the O-ring (108).

Remove the bush (109).

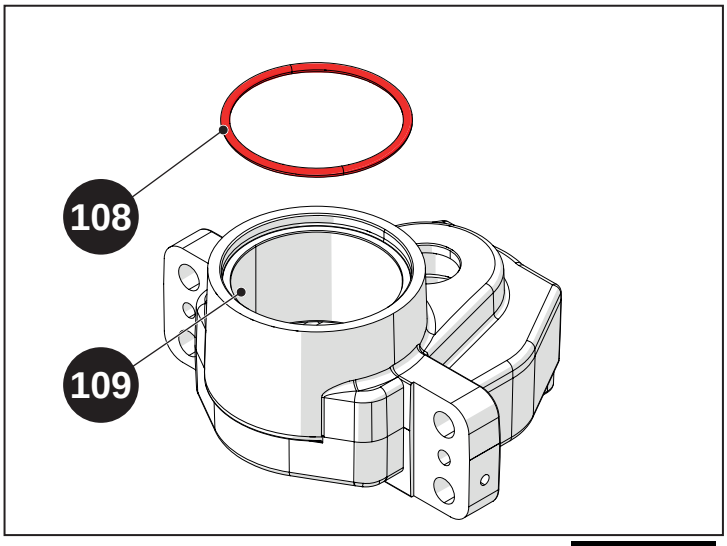


Fig. 7.110

5.3.3 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.

Make sure that the distance between the bush (109) and transmission casing is 8 mm.

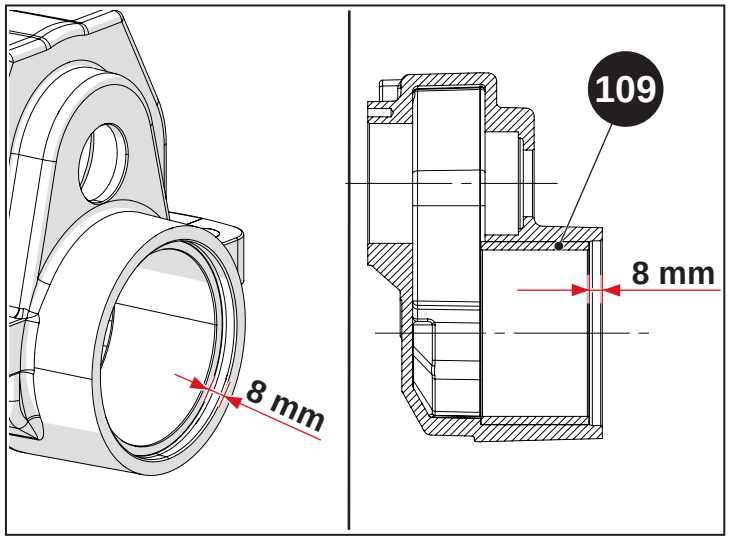


Fig. 7.111

Replace the O-ring (108) and seat the new one.

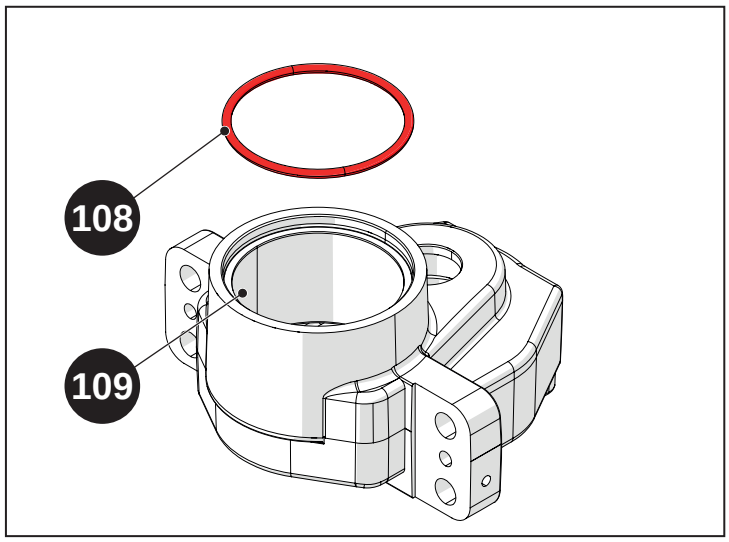


Fig. 7.112

Insert the bearing (107) using a plug.

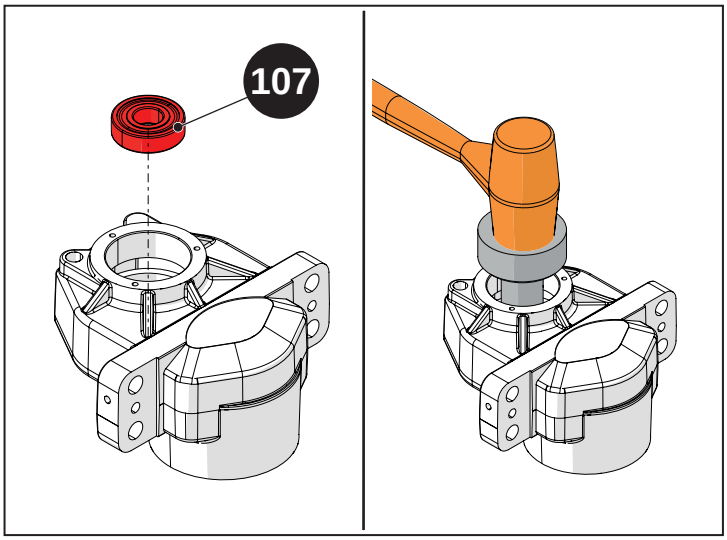


Fig. 7.113

Insert the spacer (106) and gear (105).

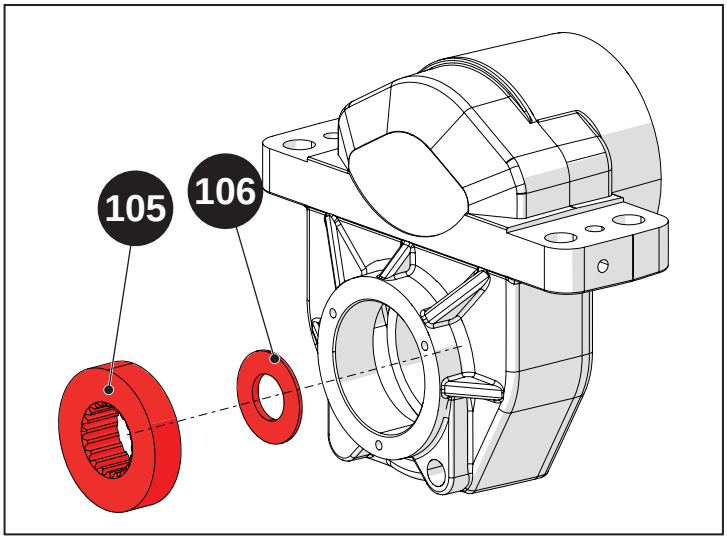


Fig. 7.114

Assemble the shaft (102), the bush (104) and bearing (103).

Fit the complete transmission shaft into the casing.

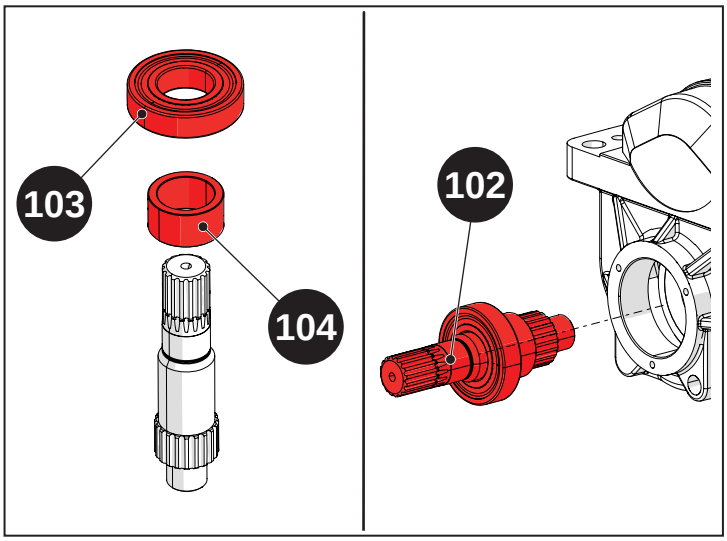


Fig. 7.115

Apply a layer of SEALANT to the perimeter of the plug (101), then fit it into its housing.

Apply TEFLON to the thread, then tighten the plug (100).

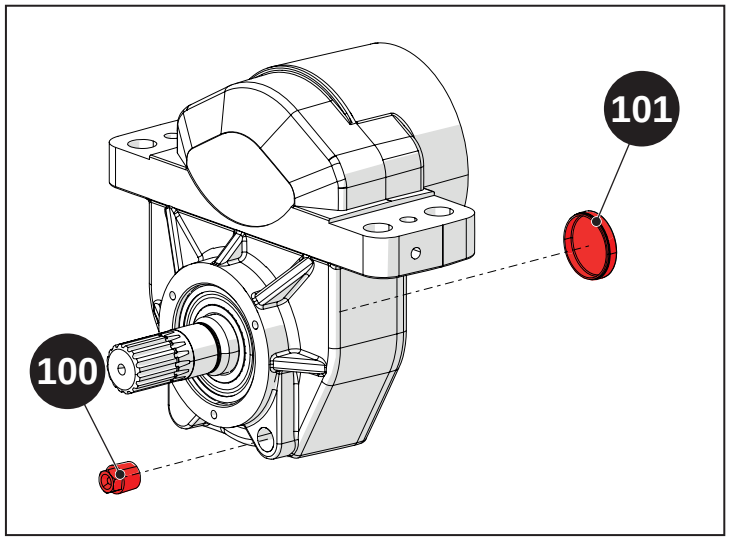


Fig. 7.116

Apply a layer of SILICONE to the cover (98).

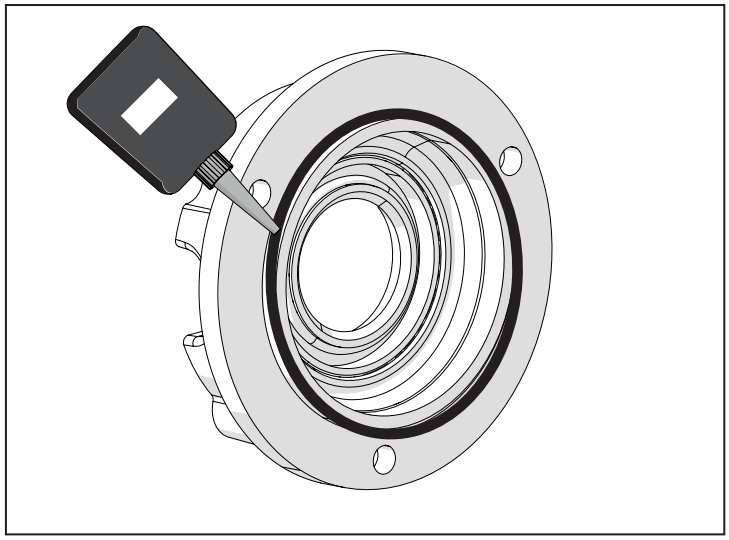


Fig. 7.117

Assemble the cover (98) complete with oil retainer (99).

Note

Replace the oil retainer when the components are reassembled.

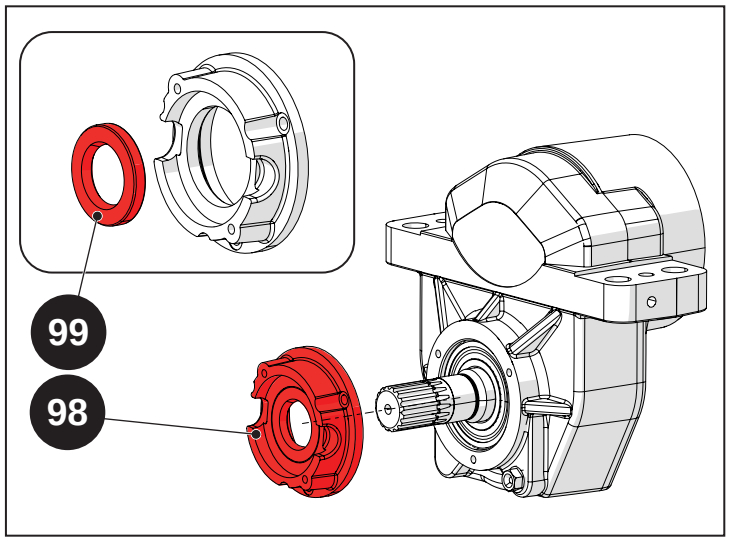


Fig. 7.118

Insert the knurled washers (97) and tighten the allen screws by applying 15 Nm (5 kgm) tightening torque.

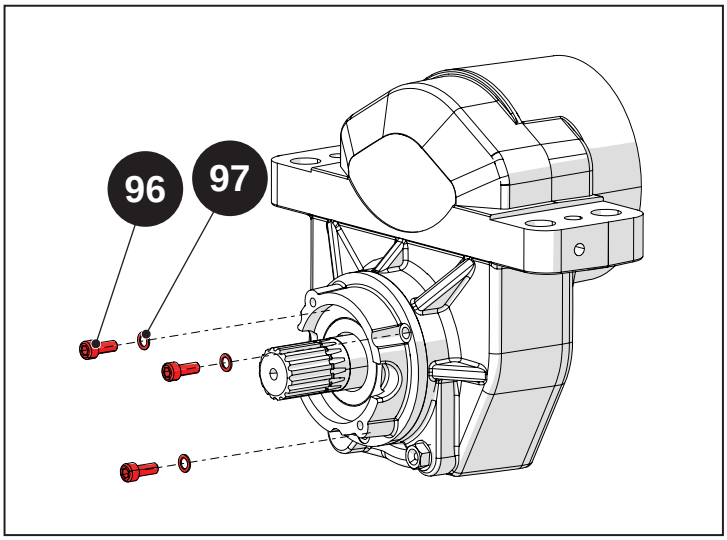


Fig. 7.119

Apply a layer of LOCTITE 270 to the dowel thread (94).

Insert the phonic wheel (95) and lock in place with the dowel (94).

Insert the circlip (93);

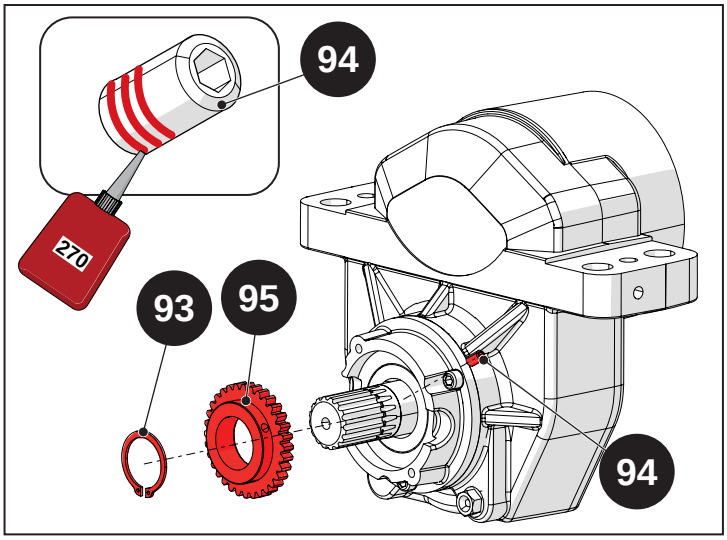


Fig. 7.120

Insert the plate (92), washers (91) and tighten the screws (90).

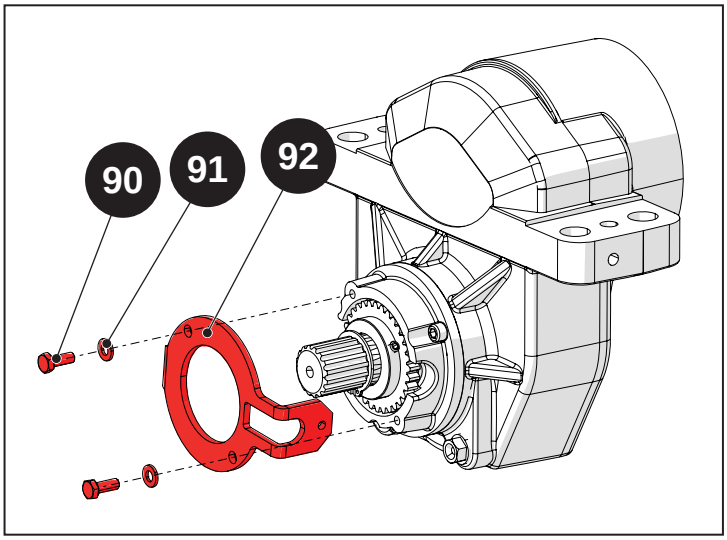


Fig. 7.121

Section 6 : Re-assembly

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6.1 Re-assembly

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.

Apply a layer of SILICONE to the bearing surface of the transmission housing.

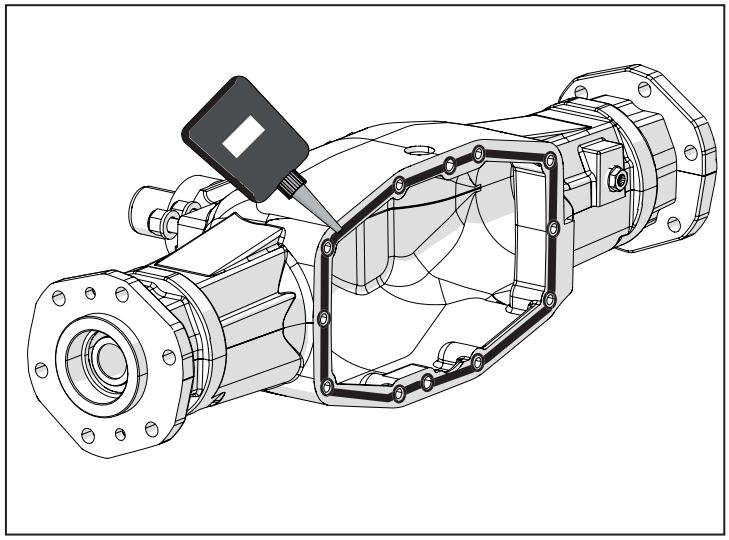


Fig. 7.122

Insert the complete front differential unit (30).

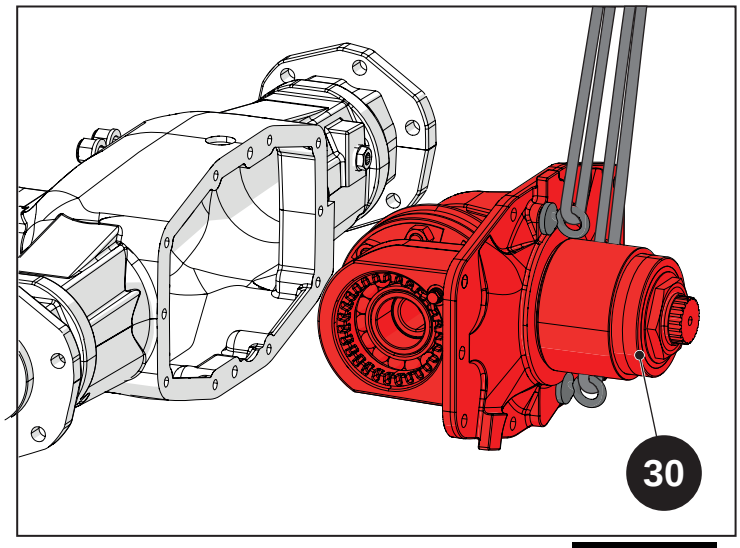


Fig. 7.123

Tighten the plugs (12) and plug (13).

Note

Apply TEFLON to the thread of the plugs (12).

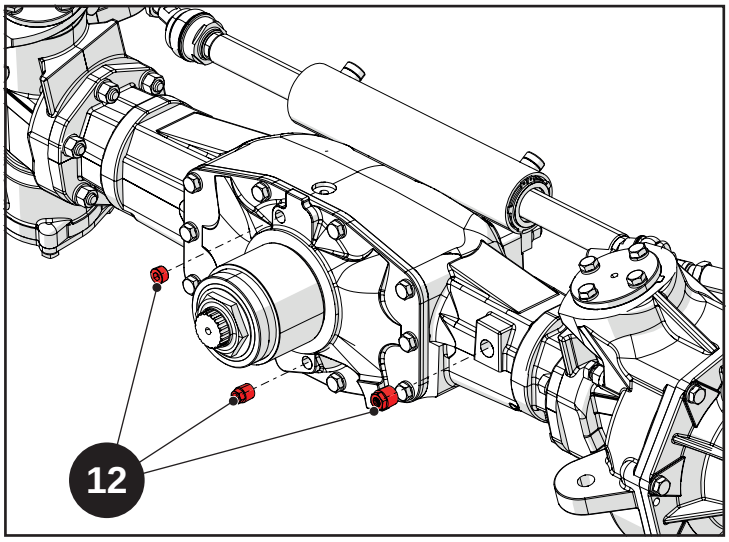


Fig. 7.124

Insert the washers (29) and tighten the screws (28) by applying 55 Nm (5.5 kgm) tightening torque.

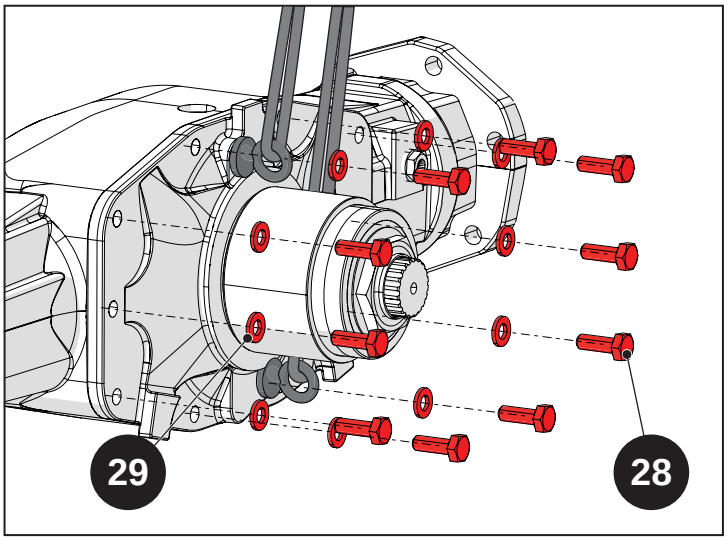


Fig. 7.125

Assemble the complete axle shaft (109) and O-ring (110).

Note

Replace the O-ring (110) when the components are reassembled.

Warning

Make sure that the two axle shafts are installed correctly. The shorter axle shaft must be fitted into the left side and the longer one on the right side.

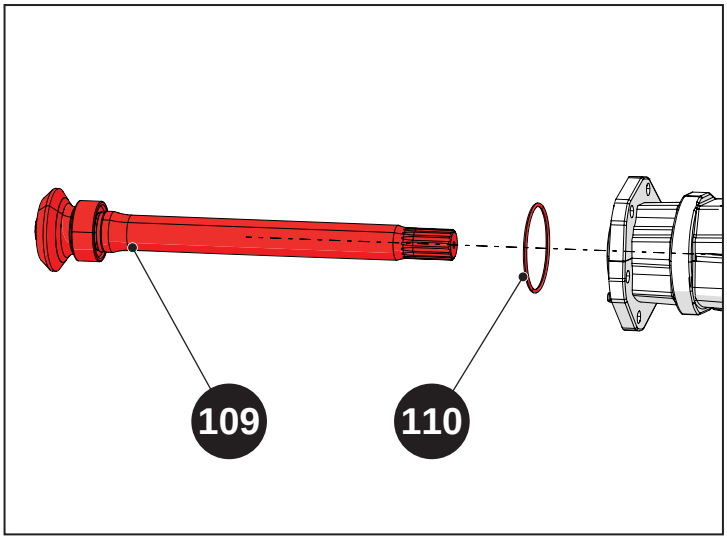


Fig. 7.126

Insert the complete side final drive.

> **Warning**
>
> The longer adjuster screw is on the front side of the axle.

Insert the washers (26) and tighten the nuts by applying 85 Nm (8.5 kgm) tightening torque.

Apply a layer of SILICONE to the coupling surface of the final drive.

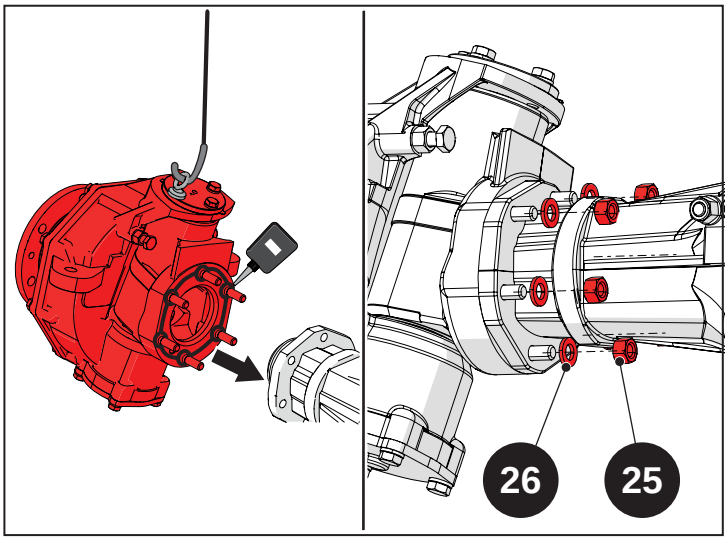


Fig. 7.127

Remove the lifting eyebolt (24) and screw a fastening bolt (23) in its place.

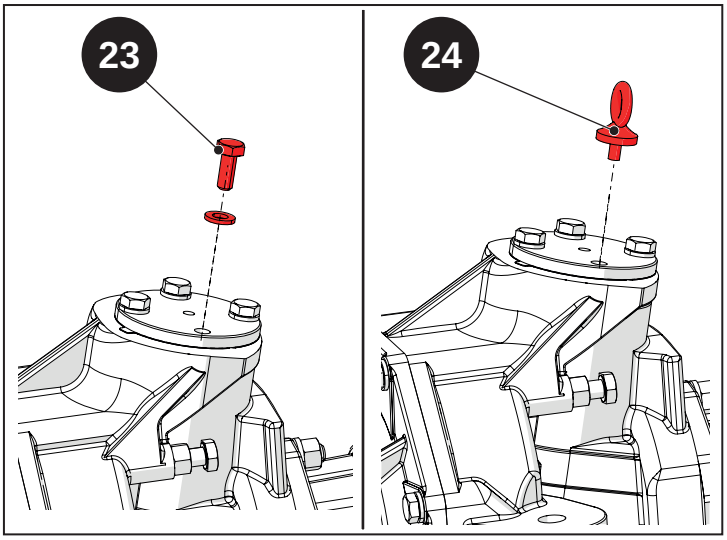


Fig. 7.128

> **Note**
>
> Repeat the same procedure for the second final drive.

Insert the spacer (11), the O-ring (10) and transmission housing (9).

Note

Apply a layer of grease to the differential gear so as to facilitate the operations.

Replace the O-ring (10) when the components are reassembled.

Apply a layer of grease to the O-Ring (10).

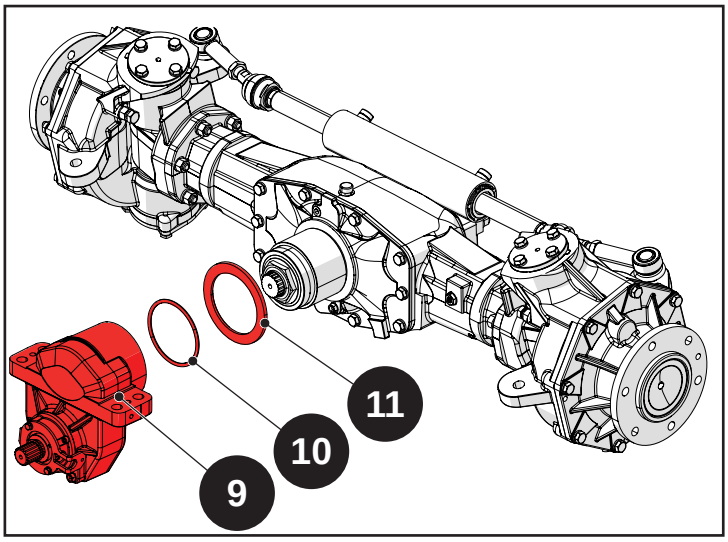


Fig. 7.129

Pour oil into the axle through the hole.

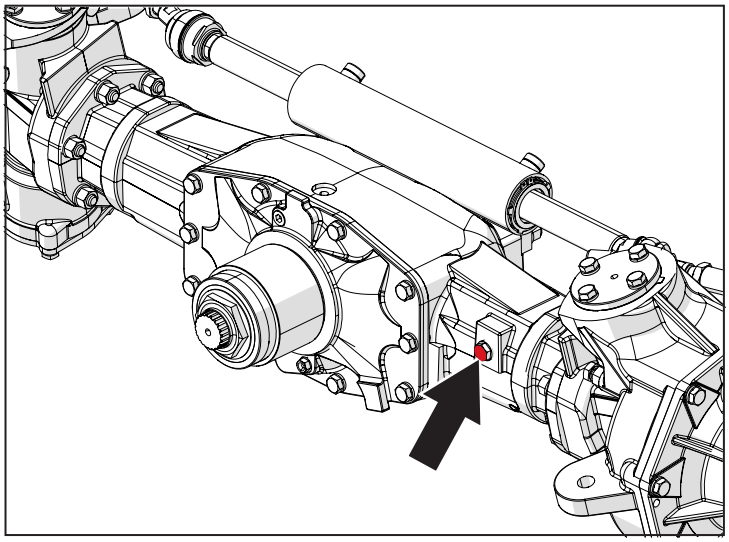


Fig. 7.130

Pour oil into the final drives through the hole.

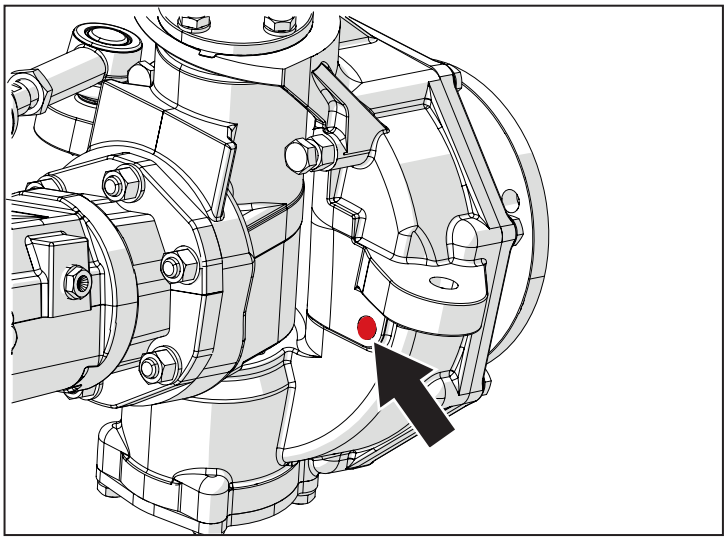


Fig. 7.131

Insert the complete steering cylinder (22).

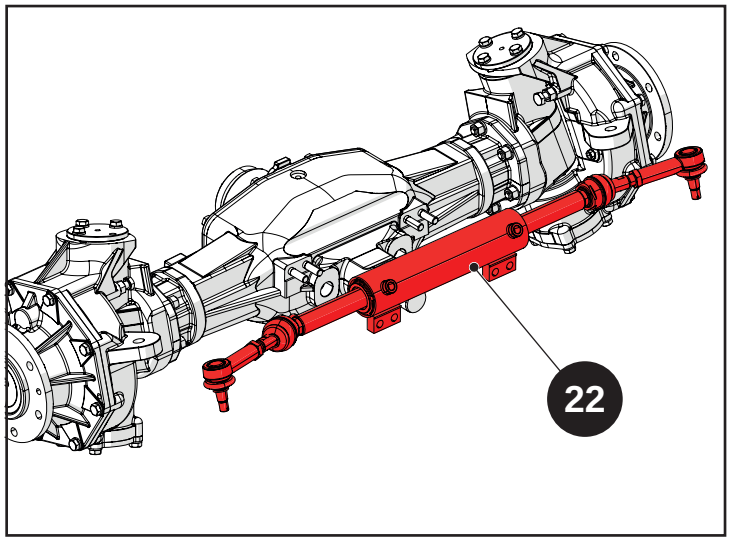


Fig. 7.132

Insert the lock washers (21) and tighten the self-locking nuts (20) that fasten the steering cylinder to the front axle.

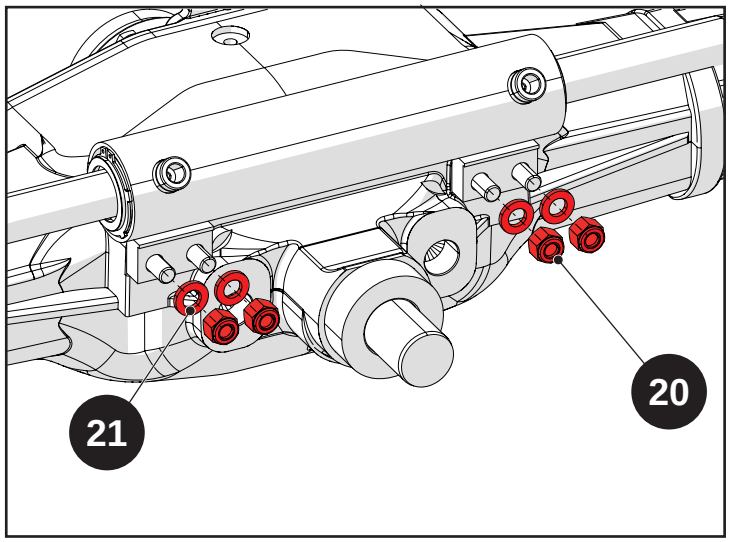


Fig. 7.133

6.1.1 Steering cylinder adjustment

Adjust toe-in to ensure correct tyre wear and wheel alignment.

Fit the steering cylinder pin (16) into its housing.

Tighten the lock nut (15) and lock it with the split pin (14).

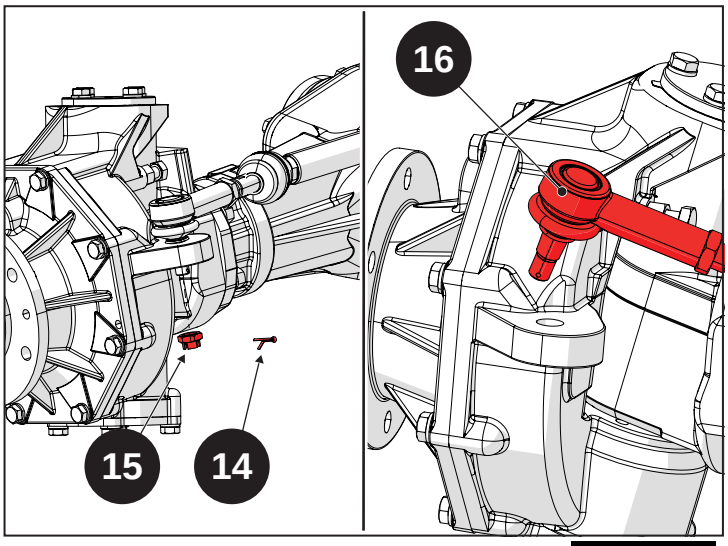


Fig. 7.134

Fit the steering cylinder pin (19) into its housing.

Tighten the lock nut (18) and lock it with the split pin (17).

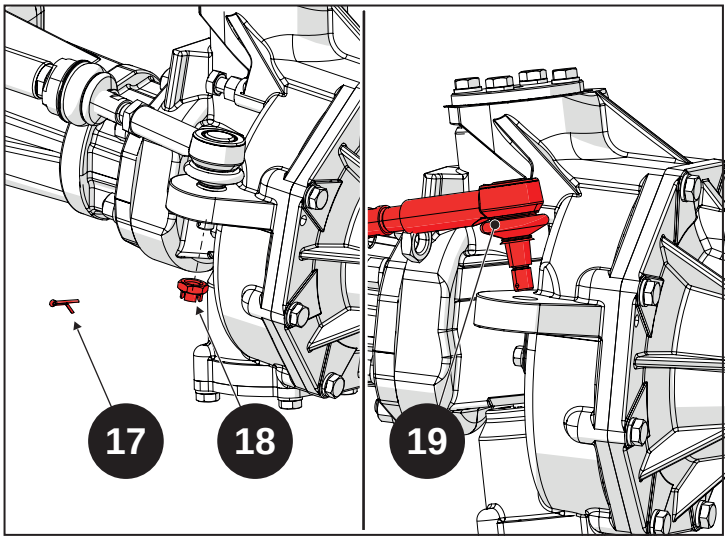


Fig. 7.135

Tighten the nuts of the steering pins.

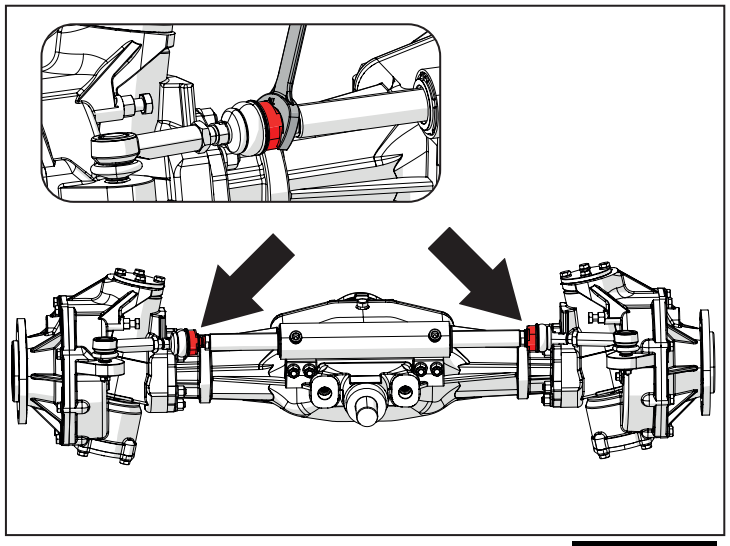


Fig. 7.136

Screw in special tools (G-07007180) in order to adjust the cylinder on the final drive axle shafts.

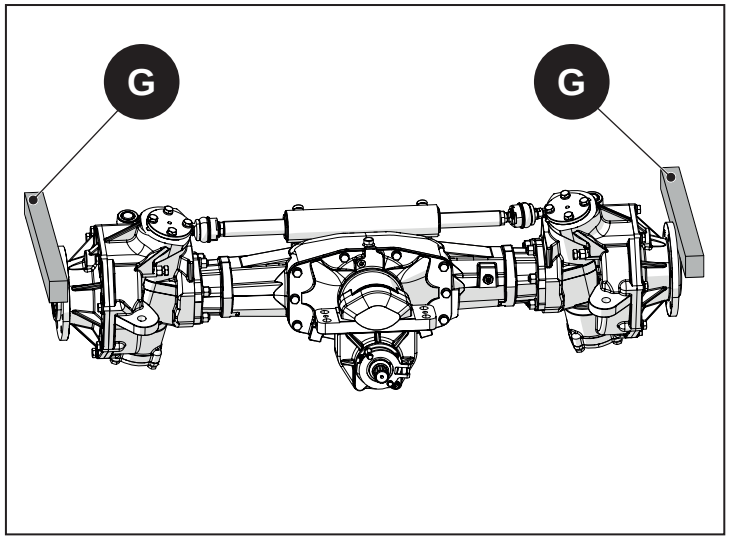


Fig. 7.137

Position special tools (G-07007180) perpendicular to the axle shaft.

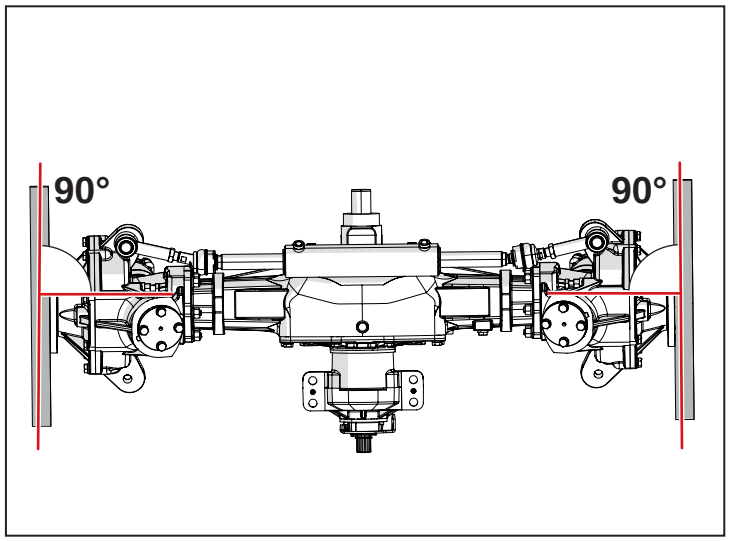


Fig. 7.138

Measure the distance between the ends of the tools (G) at both (X) the front and rear (Y).

The values measured must comply with the following formula:

Y = X + 2 ÷ 5 mm

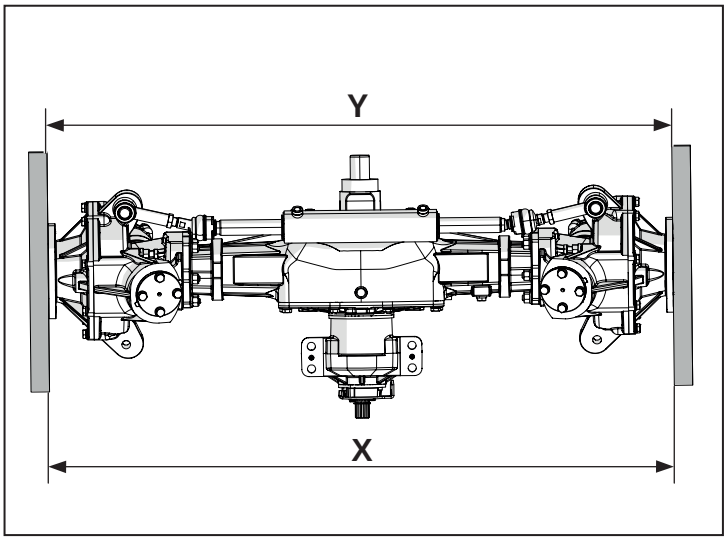


Fig. 7.139

Tighten or loosen the nuts of the steering cylinder pins to increase or decrease the distance between the exle shafts.

Warning

Increase or decrease the distance by keeping the cylinder rods an equal length on each side.

If one of the rods is longer than the other, the turning radius will be less on that side.

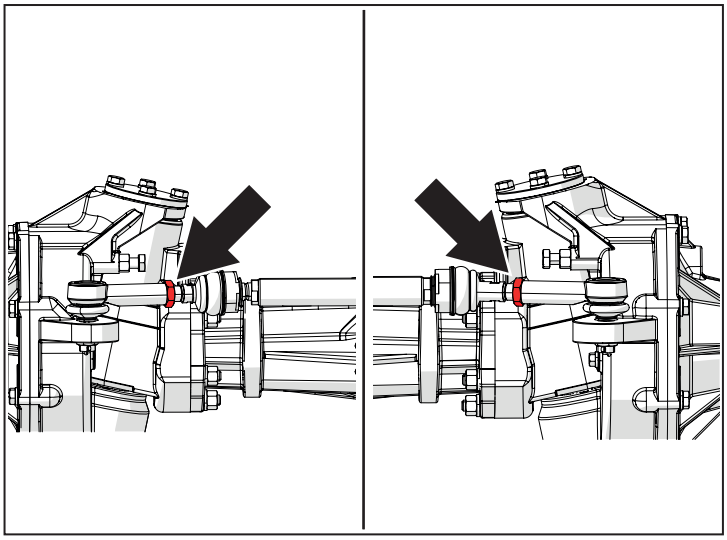


Fig. 7.140

Re-assemble the components by working through the splitting instructions in reverse order.

Section 7 : Tightening torques

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7.1 Tightening torques.....7-72

7.1 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	Nm	kgm
M10x30 screw for fixing the final drive cover	60	6
M35x1.5 ring nut for fastening bevel pinion	40	4
M10x30 screw for fastening differential support to axle	60	6
M12 screw and nut for fastening ring bevel gear	80	8
M10x30 nut for fixing final drive axle	85	8.5
M6x16 screw for fastening bevel pinion cover	15	1.5
NoSPIN fixing screw	50	5
Ring gear fixing nut	15	1.5
M112x2 Ring nut	40	4
M16x1.5 screw for fastening wheel to axle shaft	220	22

Section 8 : Tools required

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8.1 Tools required 7-74

8.1 Tools required

Code	Description	Quantity
07000215	Gearbox - base unit support	1
07000237	Ring nut wrench	1
07000243	Wrench for NoSPIN ring nut	1
07007078	Front bevel pinion retainer tool	1
07007179	NoSPIN control lever	1
07000234	Ring nut wrench 06340273	1
07007180	Toe-in testing tool	1

Chapter 8 : Drive transmission

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Section 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.

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 the sharp edges around the top of the transmission housing.

Caution

Used oil must be collected and disposed of in compliance with the anti-pollution laws in force.

Section 2 : General introduction

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2.1 Drawing of the assembly 8-4

2.1 Drawing of the assembly

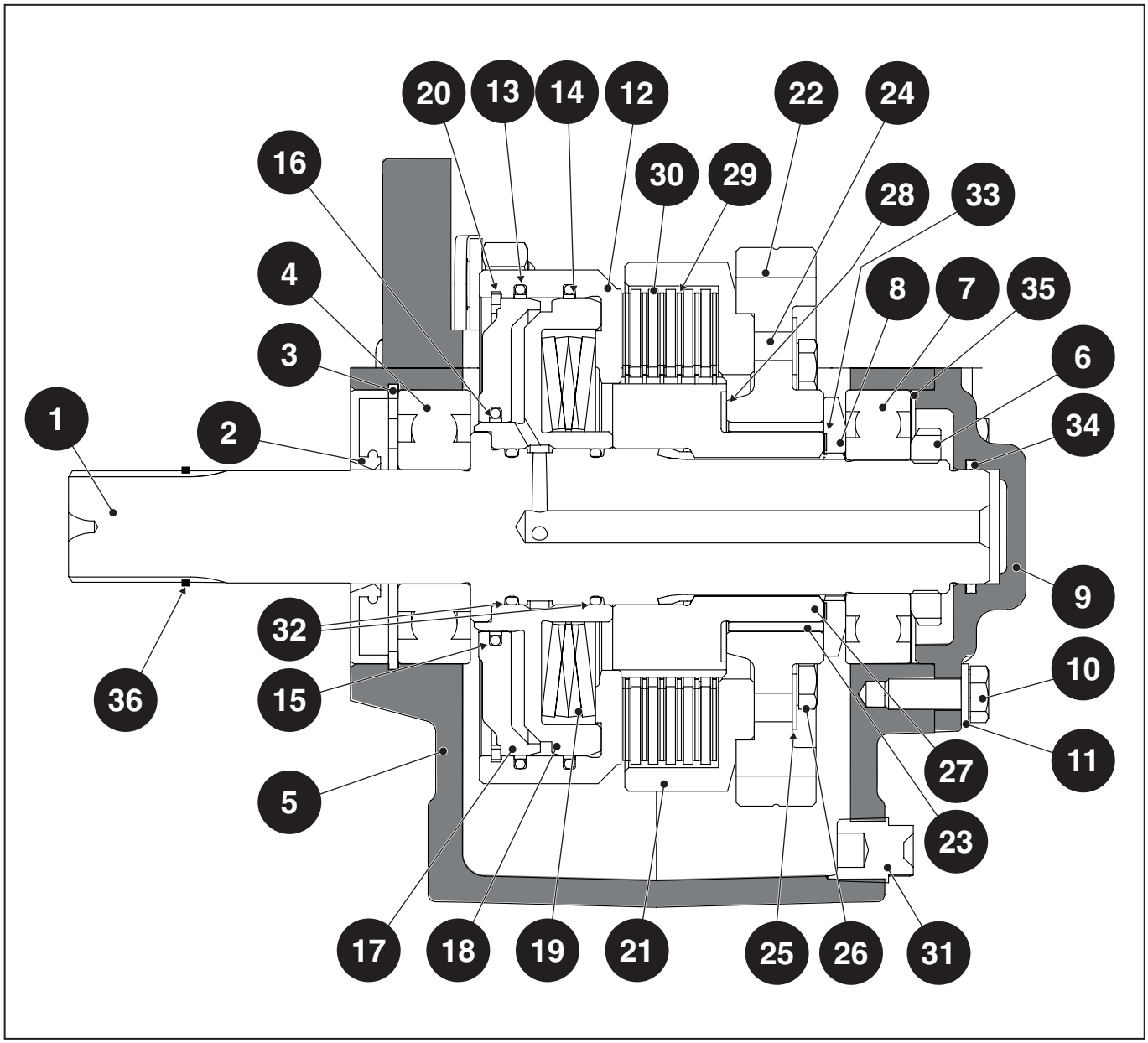


Fig. 8.1

1 - Front drive shaft
2 - Oil retainer
3 - Circlip
4 - Bearing
5 - Gearbox
6 - Ring nut
7 - Bearing
8 - Spacer
9 - Cover
10 - Screw
11 - Washer
12 - Front drive drum
13 - O-ring
14 - Seal ring
15 - O-ring
16 - Seal ring
17 - Front drive disengagement flange
18 - Fixed disengagement flange
19 - Belleville washer
20 - Spring ring
21 - Clutch bowl
22 - Front drive gear
23 - Bush
24 - Centring pins
25 - Screw retainer plate
26 - Screw
27 - Bush
28 - Spacer
29 - Clutch plate
30 - Steel plate
31 - Plug
32 - O-ring
33 - Spacer
34 - Quad-ring
35 - Spacer
36 - Circlip

Section 3 : Technical specifications

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3.1 Technical specifications

Operating mechanism	Electrohydraulic
Clutch	Oil-cooled multiple-plate

Section 4 : Disassembly

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4.1 Disassembly 8-10

4.1 Disassembly

Unscrew and remove the screws (35) and washers (36).

> **Caution**
>
> Make sure the unit is supported during the operations.

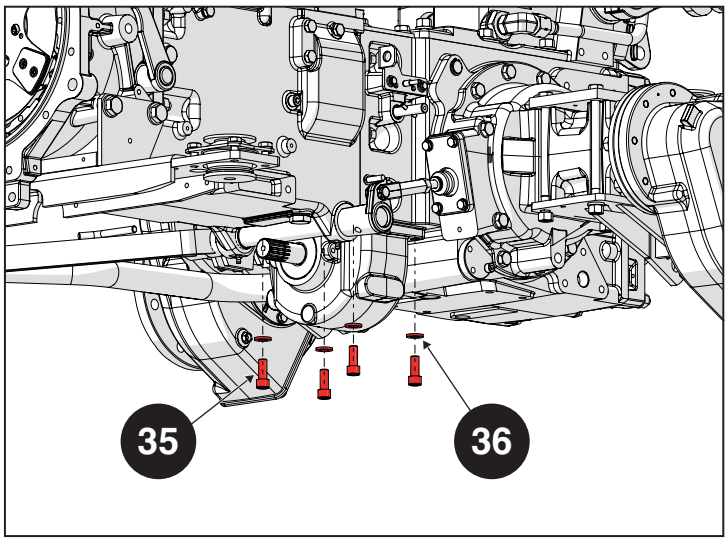


Fig. 8.2

Remove the complete unit.

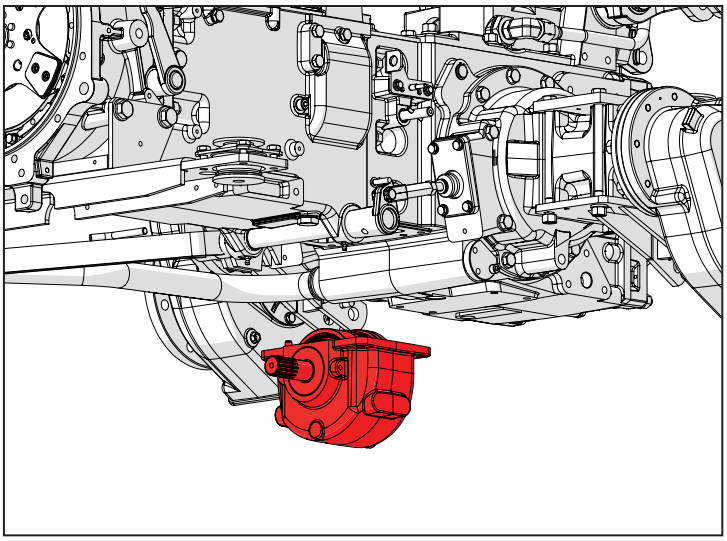


Fig. 8.3

Remove the oil retainer (2).

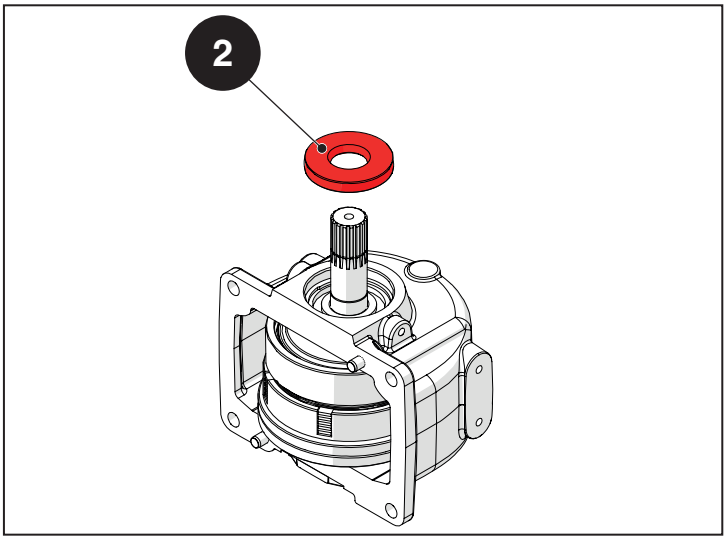


Fig. 8.4

Remove the screws (10), washers (11), screws (10) and cover (9).

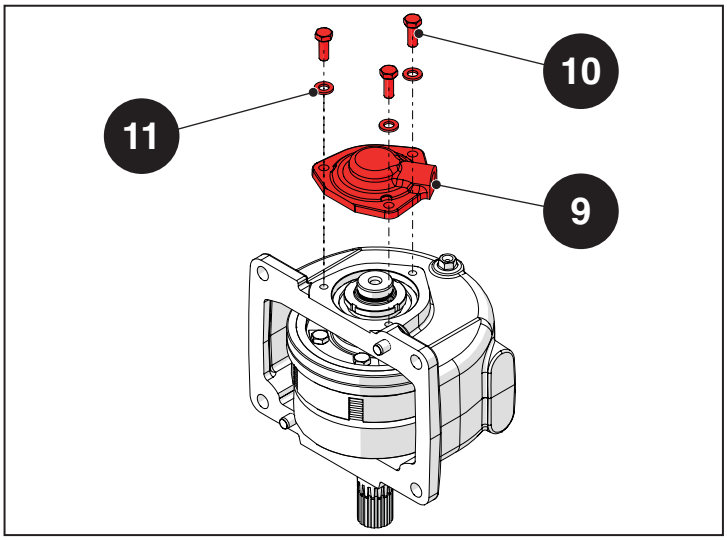


Fig. 8.5

Remove the Quad ring (34) from the cover.

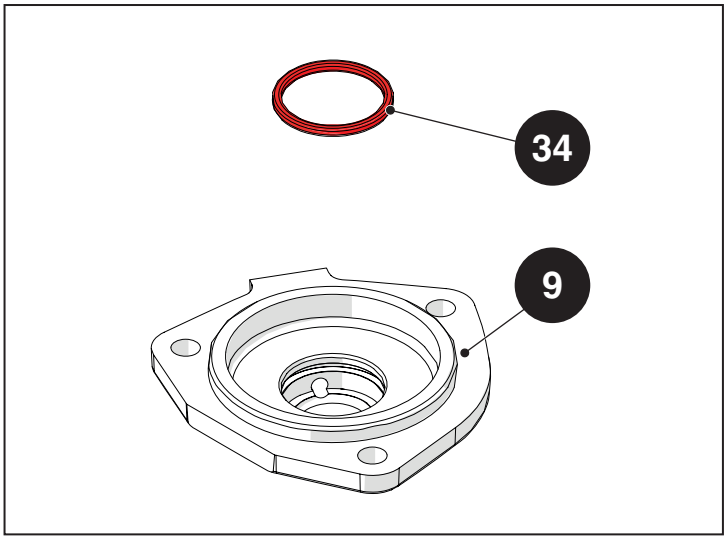


Fig. 8.6

Remove the shim (35).

Remove the ring nut (6).

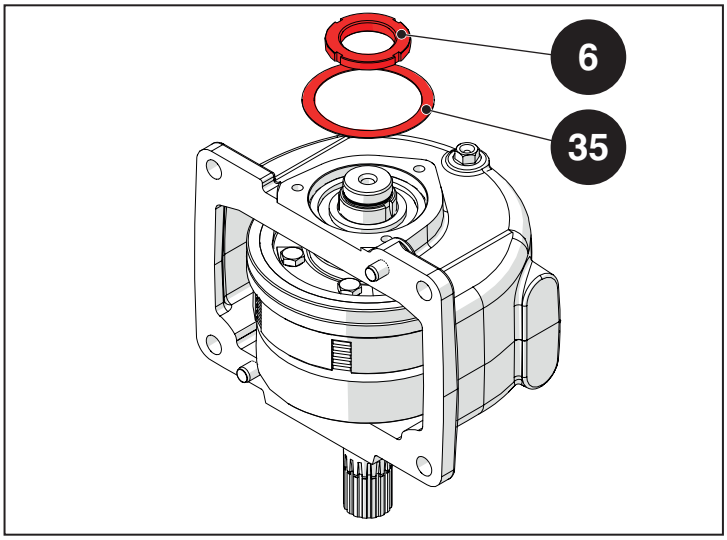


Fig. 8.7

Remove the circlip (3), then remove the shaft (1) complete with bearing (32).

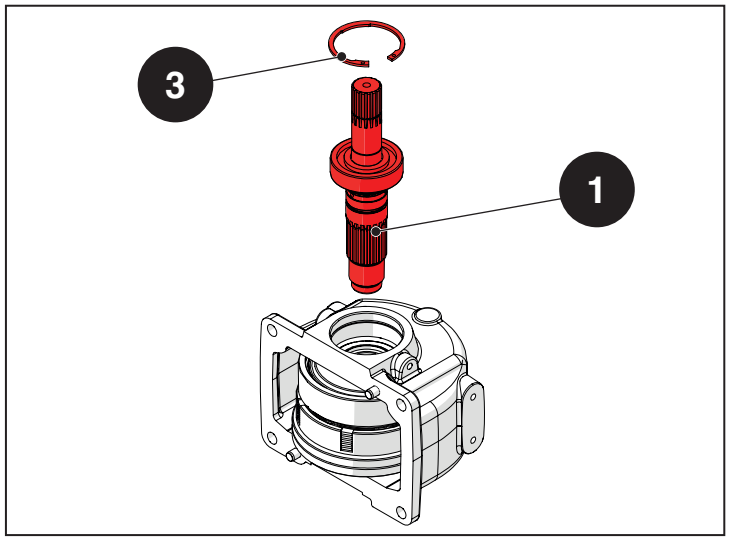


Fig. 8.8

Remove the bearing (7), spacers (33) and spacer (8).

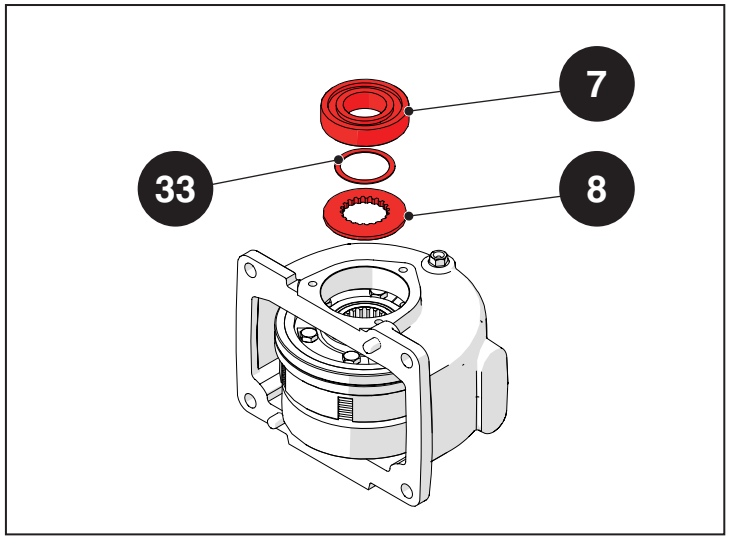


Fig. 8.9

Remove the O-rings (32) from the shaft.

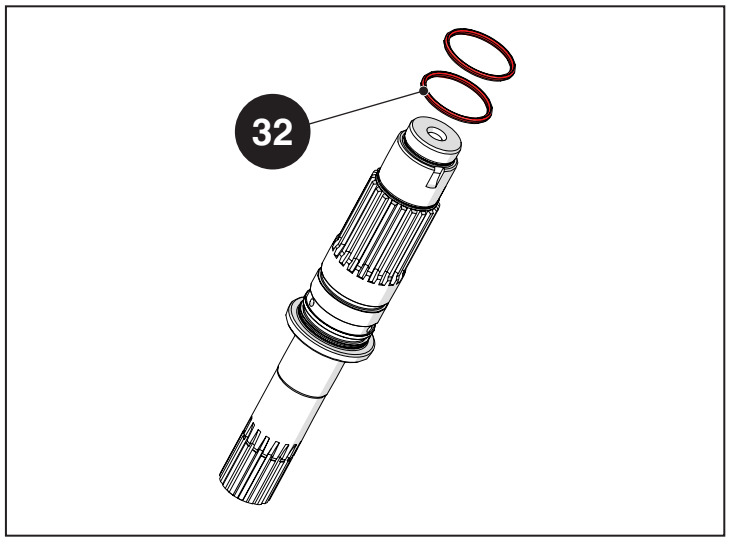


Fig. 8.10

Remove the clutch pack from the housing (5).

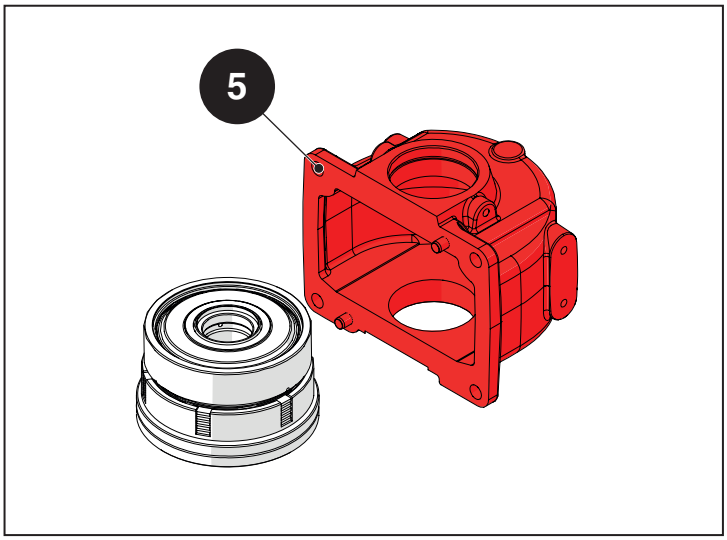


Fig. 8.11

Split the two units then remove the clutch plates (29) and steel plates (30) from the bowl (21).

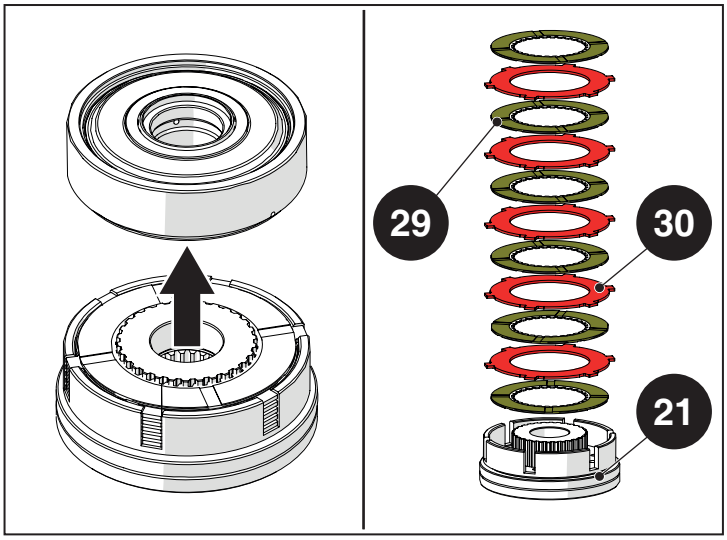


Fig. 8.12

Remove the spacers (28) and bush (27).

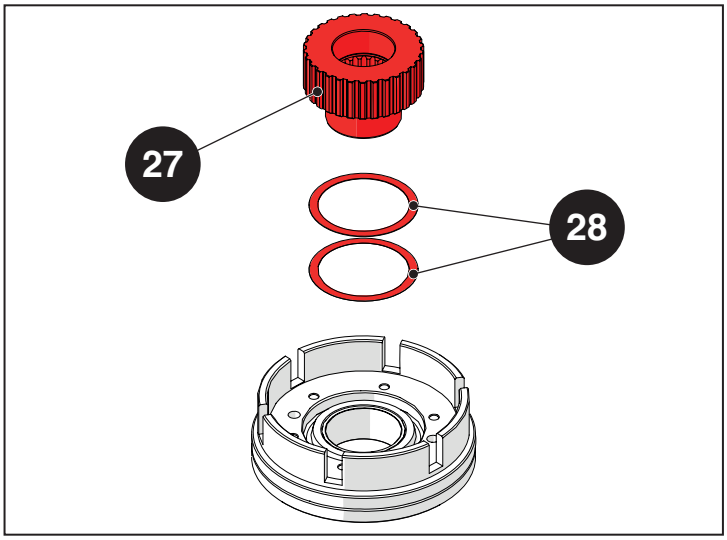


Fig. 8.13

Lower the sides of the plates (25) so as to remove the screws (26).

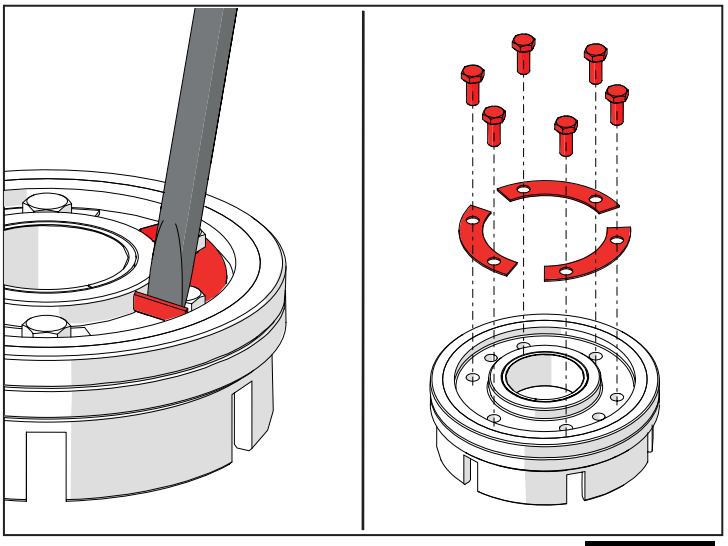


Fig. 8.14

Remove the centring pins (24), then remove the front drive gear (22) complete with bush (23) from the clutch bowl (21).

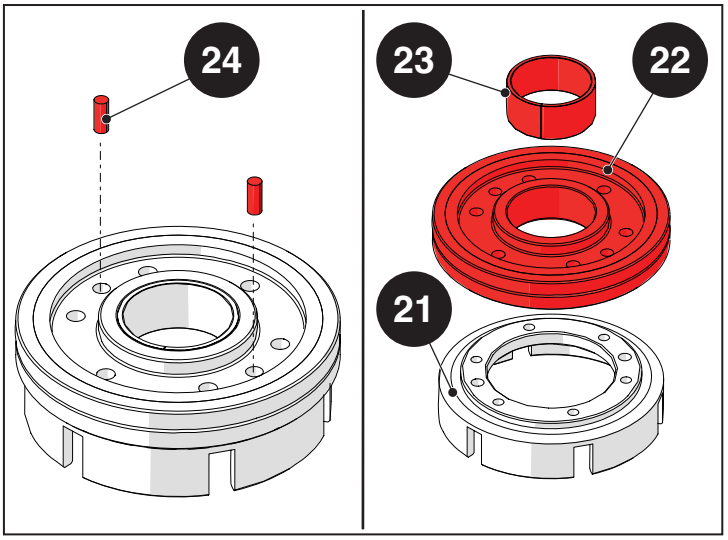


Fig. 8.15

Use a press and the driver tool (G- p/n 07006210) to press the flange (17) and compress the Belleville washers (19) and clear the seat of the circlip (20).

Caution
Use a press with a loading capacity of at least 500 kg.

Remove the spring ring (20).

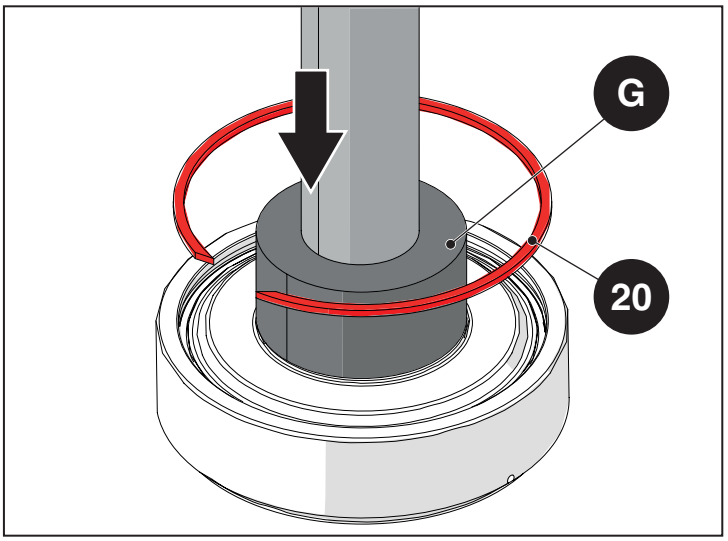


Fig. 8.16

Remove the complete unit from the front drive drum (12).

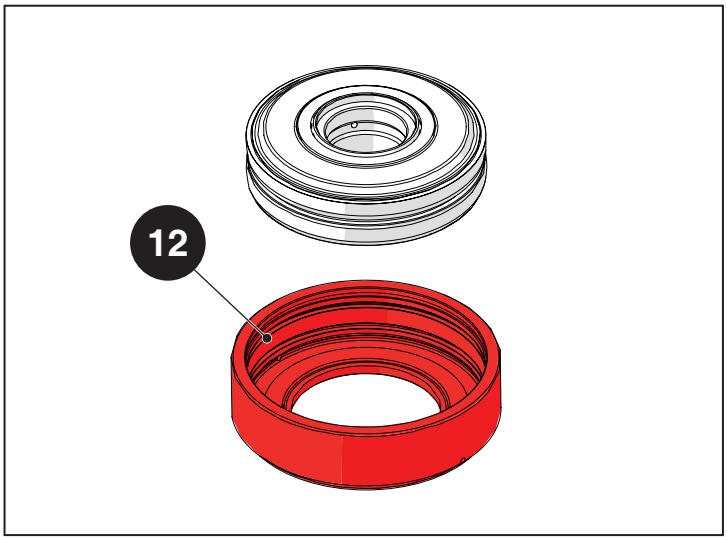


Fig. 8.17

Remove the flange (17) from the fixed disengagement flange (18).

Now remove the belleville washers (19).

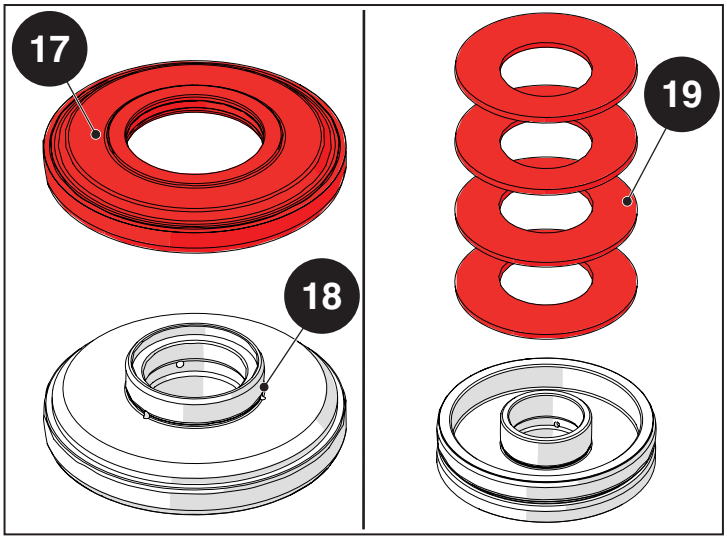


Fig. 8.18

Remove the O-rings (13) and flat seal rings (14) from the drive drum (12).

Remove the O-ring (15) and flat seal ring (16) from the front drive disengaging flange (17).

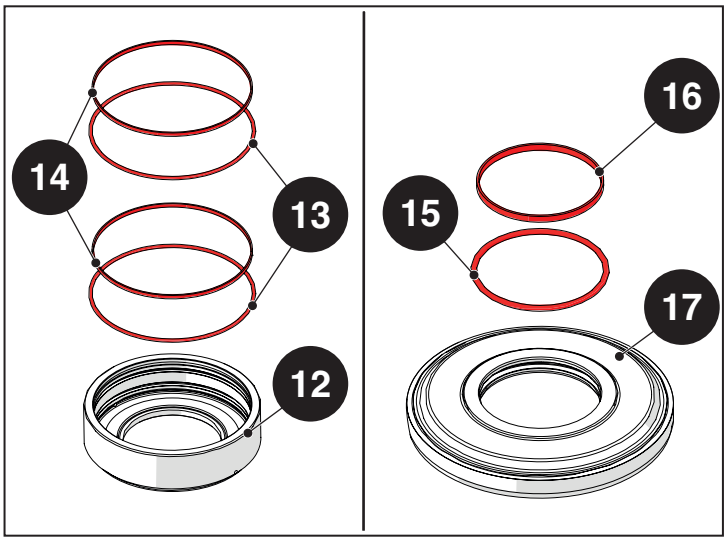


Fig. 8.19

Section 5 : Main inspection, re-assembly and adjustment operations

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5.1 Main inspection, re-assembly and adjustment operations.....8-18

5.1 Main inspection, re-assembly and adjustment operations

Danger

Make sure that all persons keep well away from the danger zone.

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.

Prepare the drive drum (12) by fitting the O-rings (13) and flat seal rings (14) into their seats.

Prepare the front drive disengaging flange (17) by fitting the O-ring (15) and flat seal ring (16) into their seats.

Caution

Make sure that the flat seal rings are not bent after having been fitted into their housings, this to prevent them from being damaged when the components are reassembled.

After the seal rings have been fitted, lubricate them with OIL to facilitate their engagement with the other components.

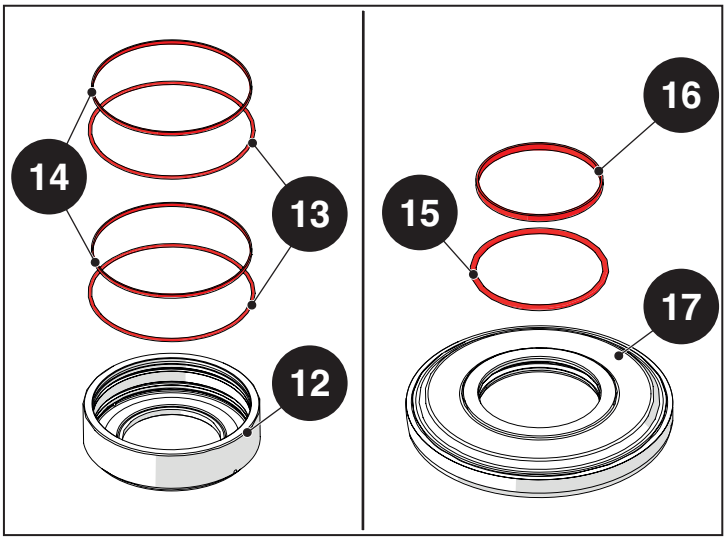


Fig. 8.20

Caution

Make sure that the flat seal rings (14) and (16) are installed in the right direction.

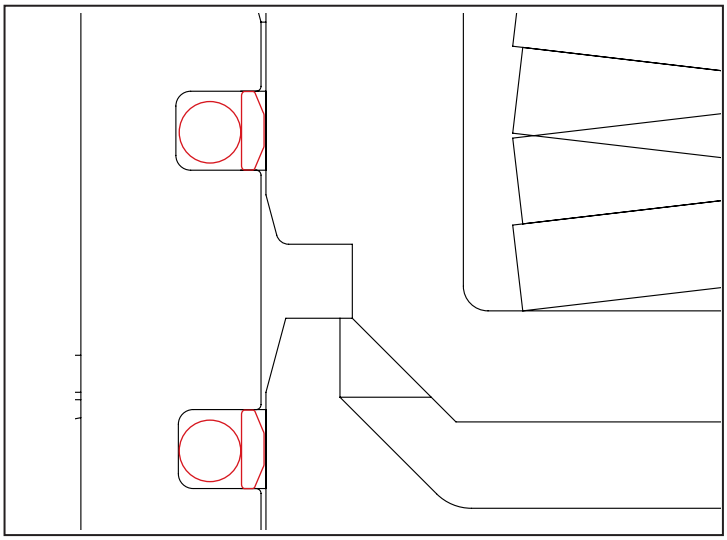


Fig. 8.21

Insert the flange (17) into the fixed disengagement flange (18).

Now insert the belleville washers (19).

Caution

Make sure that the belleville washers are installed in the right direction.

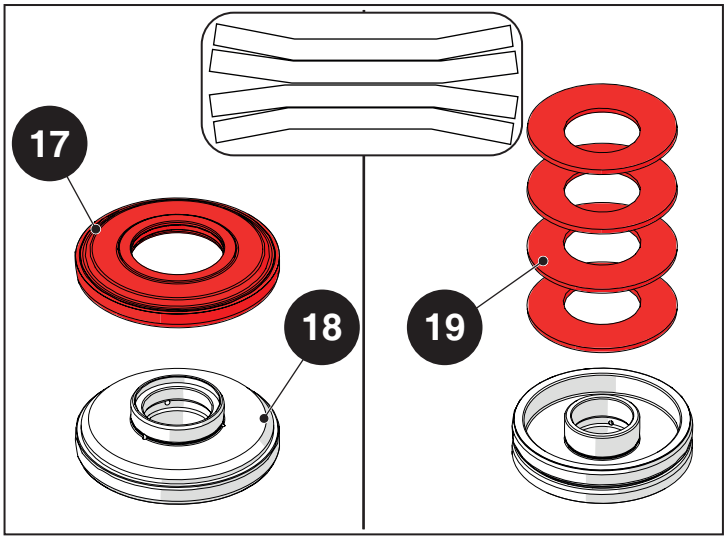


Fig. 8.22

Insert the drum (12) onto the complete unit.

Caution

Lubricate the seal rings.

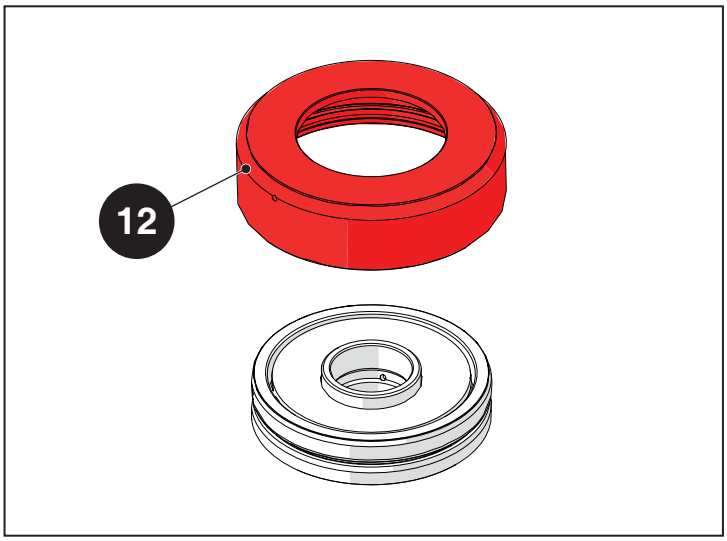


Fig. 8.23

Use a press and the driver tool (G- p/n 07006210) to press the flange (17) and compress the Belleville washers (19) and clear the seat of the circlip (20).

Caution
Use a press with a loading capacity of at least 500 kg.

Insert the spring ring (20) and turn it in its housing.

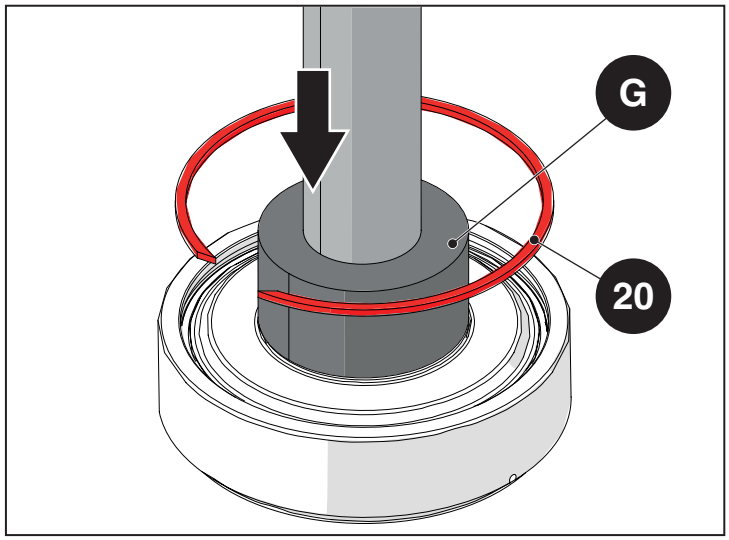


Fig. 8.24

Insert the front drive gear (22) complete with bush (23) onto the clutch bowl (21).

Caution
Align the holes.

Insert the centring springs (24).

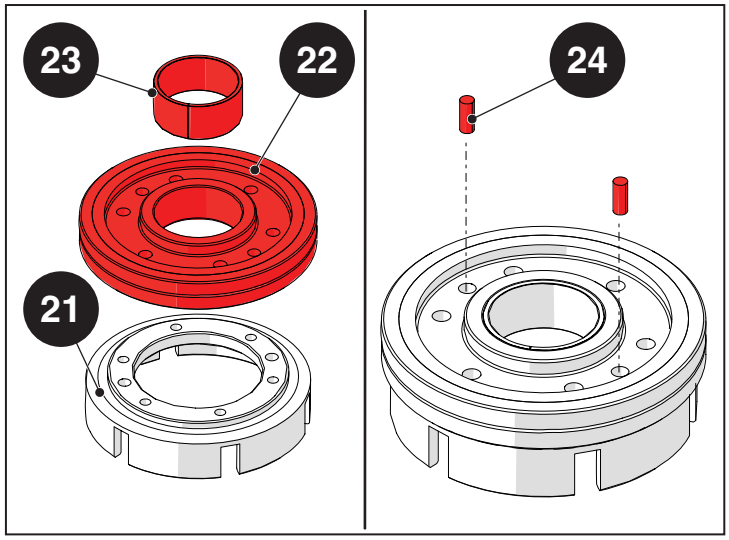


Fig. 8.25

Position the screw retainer plates (25), then tighten the screws (26) by applying 30 Nm (3 kgm) tightening torque.

Clinch the corners of the plates (25) with a chisel so as to lock the screws 826).

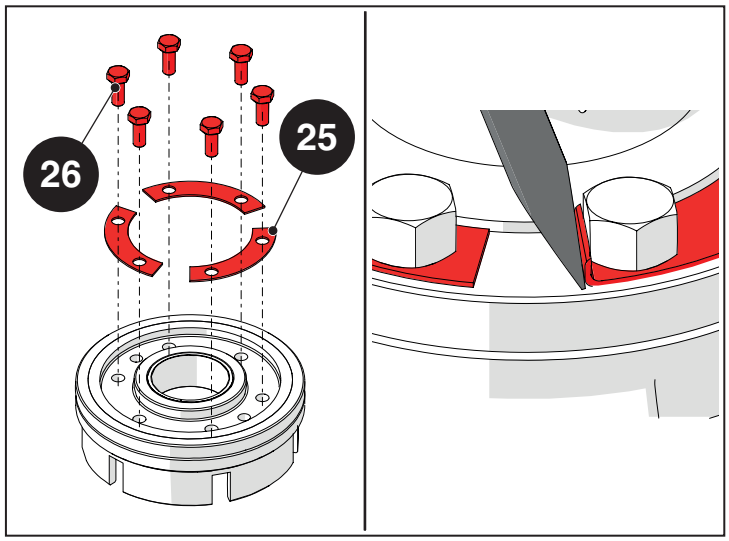


Fig. 8.26

Insert the bush (27) and the 1 mm and 1.2 mm thick spacers 828)..

> **Caution**
>
> Make sure that the bush turns (27).

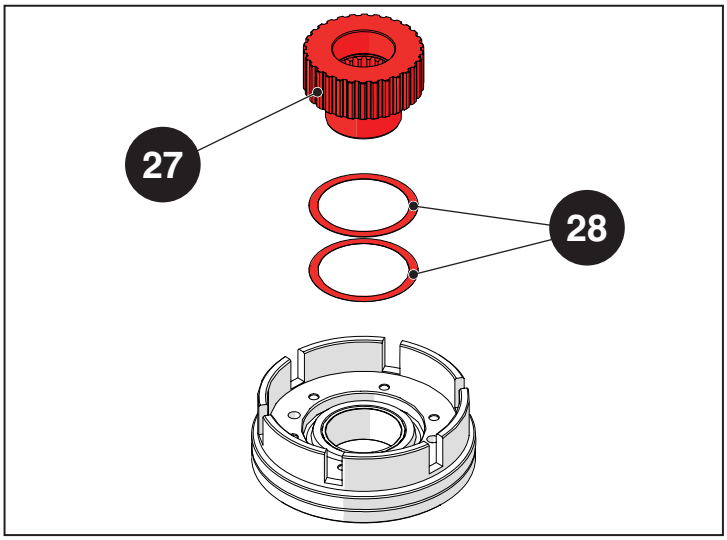


Fig. 8.27

Insert the clutch plates (29) and steel plates (30) alternately. Always begin with a clutch plate.

A total 6 clutch plates (29) and 5 steel plates (30) must be installed.

Couple the two newly assembled units.

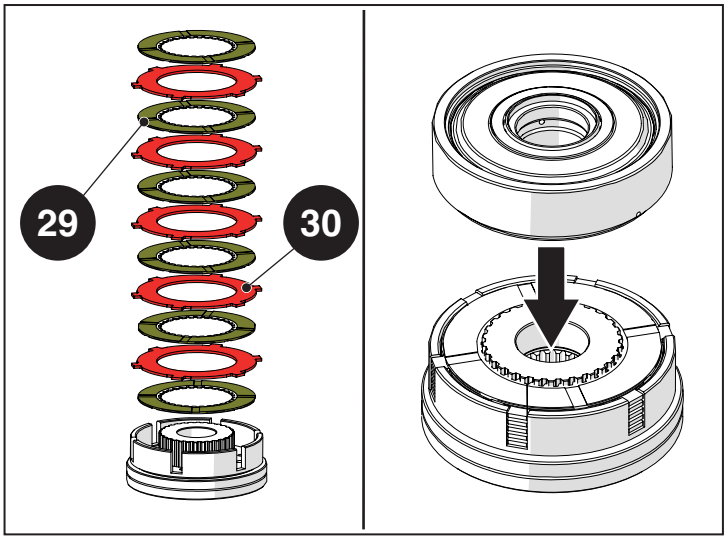


Fig. 8.28

Fit the two O-rings (32) on the shaft (1).

> **Caution**
>
> Use a guide (A-07003831) to prevent the O-rings from being damaged by contact with the shaft teeth.
>
> After having installed the O-rings, lubricate them with OIL.

Install the circlip (36).

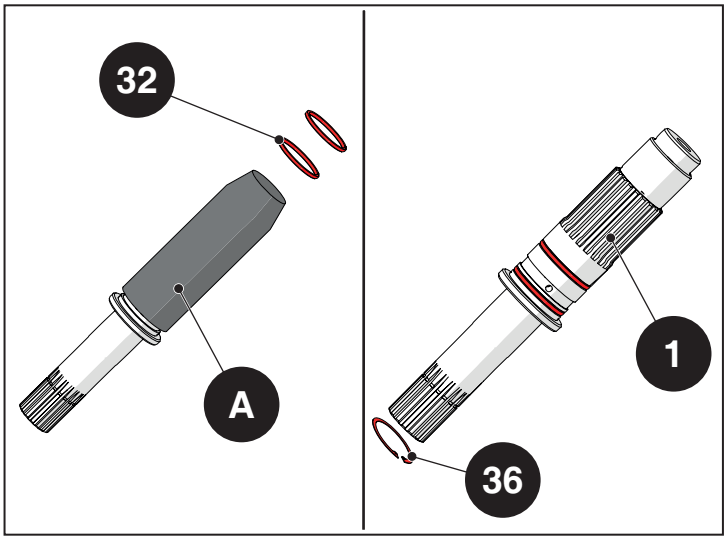


Fig. 8.29

Shimming

To ensure that the transmission clutch engages properly, make sure that the engaging pressure is optimal and that the clutch plates are positioned at the correct distance in the unit.

Place the assembly on a support (F- code 07006211).

Using an external hydraulic pump, apply a pressure of 60 bar so as to compress the belleville washers and free the plates.

Caution
Make sure that there are no oil leaks.

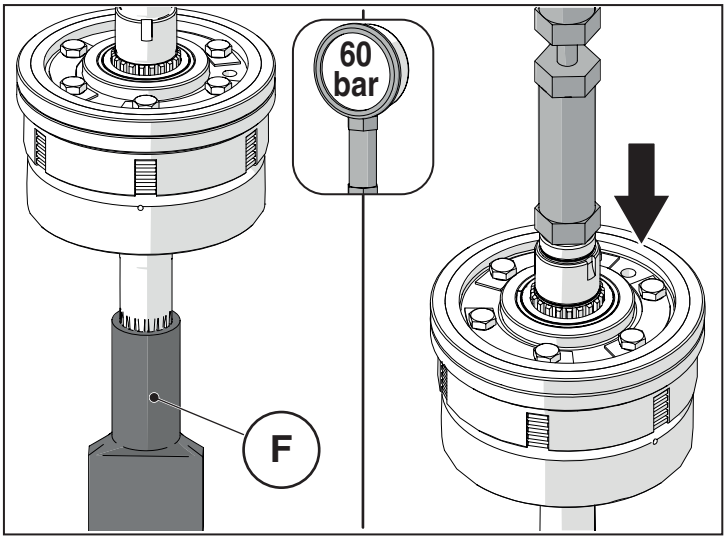


Fig. 8.30

Insert the spacers (33) and spacer (8).

Insert a dummy bearing (C-code 07002766).

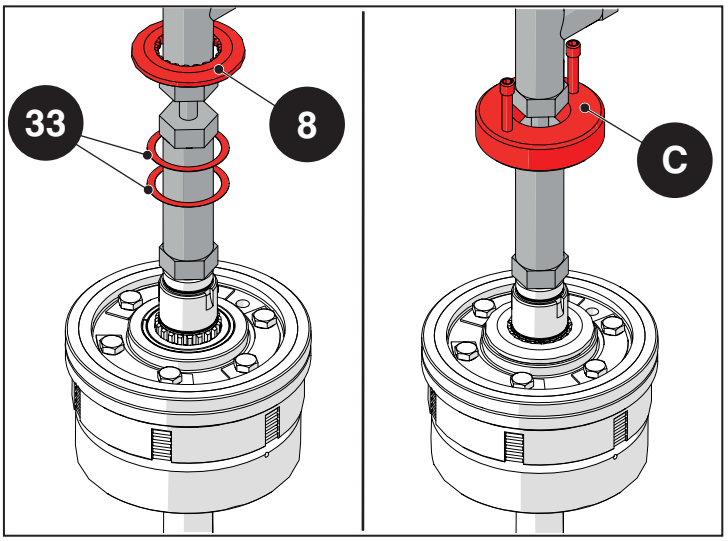


Fig. 8.31

Insert the ring nut (6) and use tool (D-code 07006128) to tighten it by applying 220 Nm (22 kgm) tightening torque.

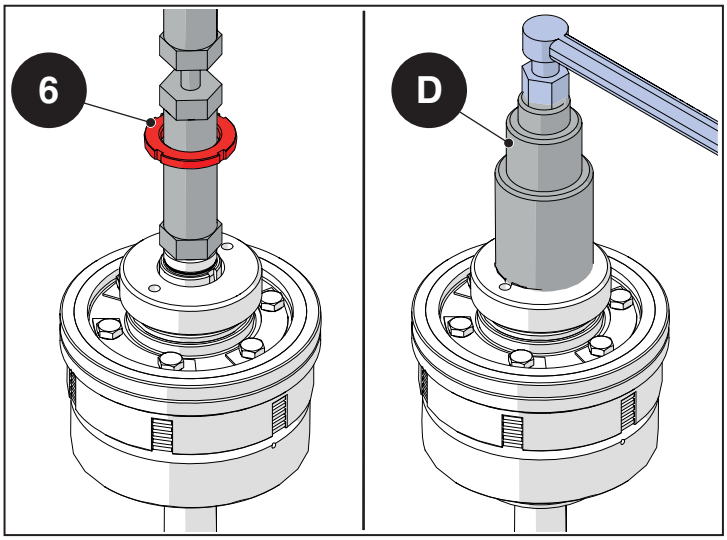


Fig. 8.32

Pressure 42 bar pressure.

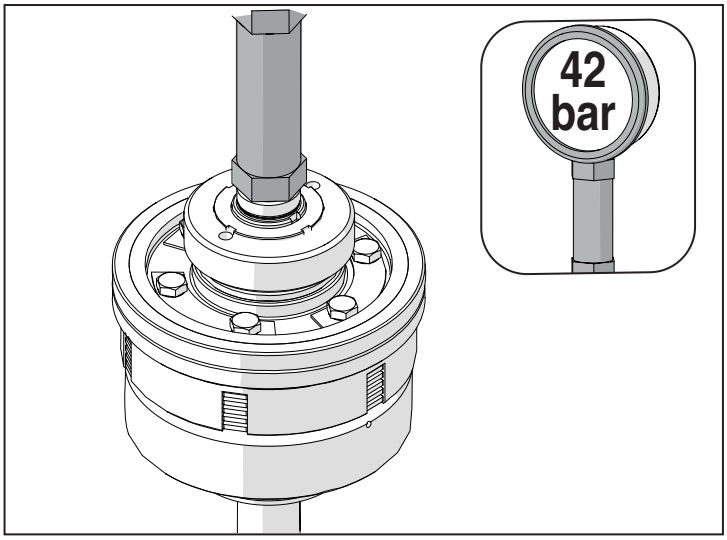


Fig. 8.33

Exercise pressure on the clutch bowl and check with a thickness gauge that the distance netween the clutch plates and pack of belleville washers is 0.8-1.2 mm.

The previously assembled spacers (28) must be changed if the play is not within this measurement.

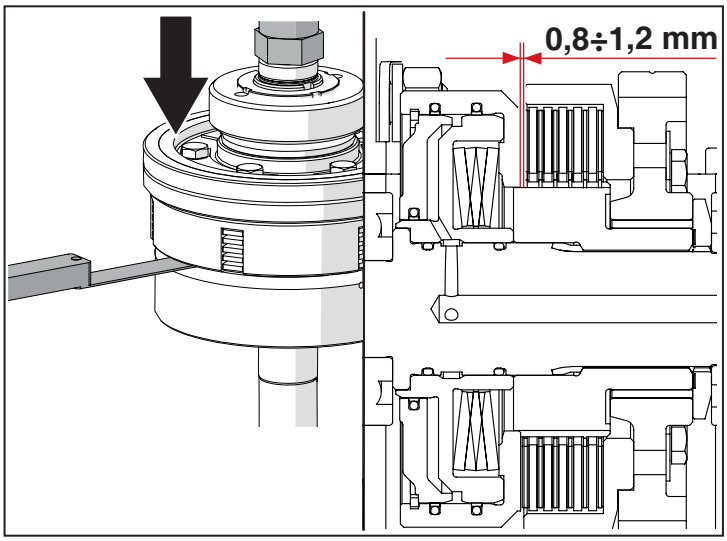


Fig. 8.34

Now check that the clutch disengages when the right pressure is applied.

Slowly apply pressure to the unit while moving the gear.

Check that the gear releases at a pressure of 30-32 bar.

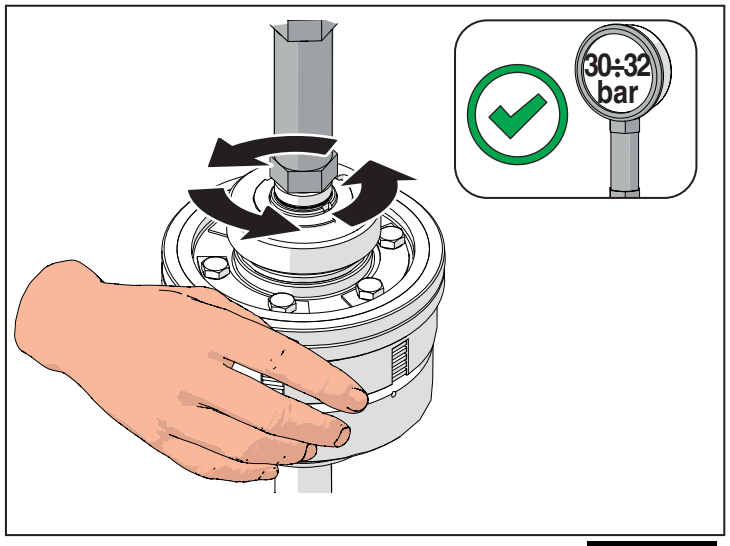


Fig. 8.35

The group of spacers (33) must be replaced if the gear fails to release at the established pressure. Bear in mind that:

- By increasing the total thickness, the gear will lock at a lower pressure than the value required previously.
- By decreasing the total thickness, the gear will lock at a higher pressure than the value required previously.

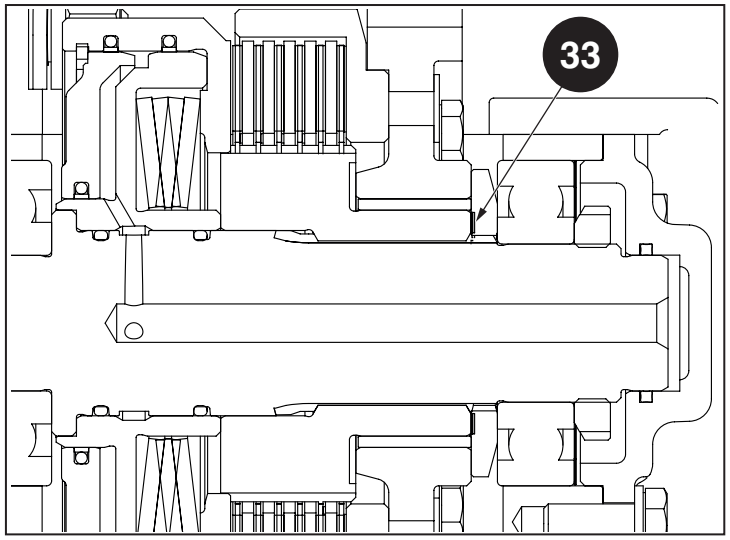


Fig. 8.36

Maintain a pressure of 42 bar and check that the play between the gear (22) and spacer (8) is 0.3-0.5 mm.

Check to make sure that the previous adjustments have been made correctly if the play is not within the given values.

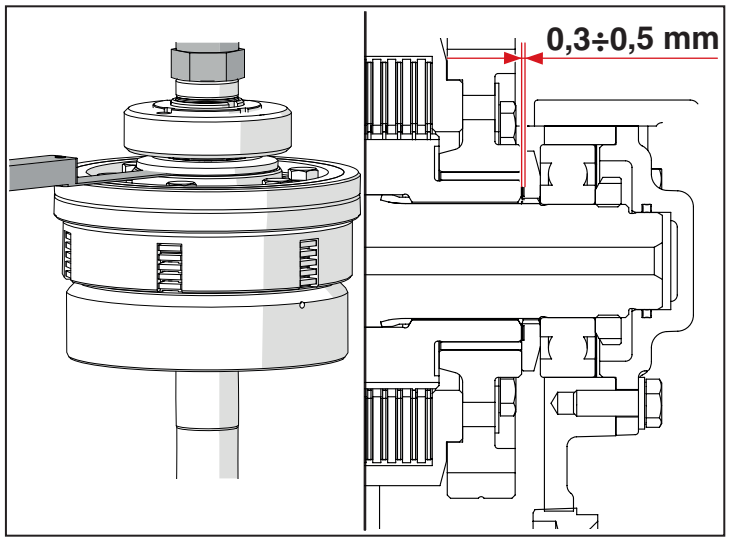


Fig. 8.37

If all the values are correct, the components can be reassembled.

Apply 60 bar pressure, then remove the ring nut (6) and dummy bearing (C- code 07002766)

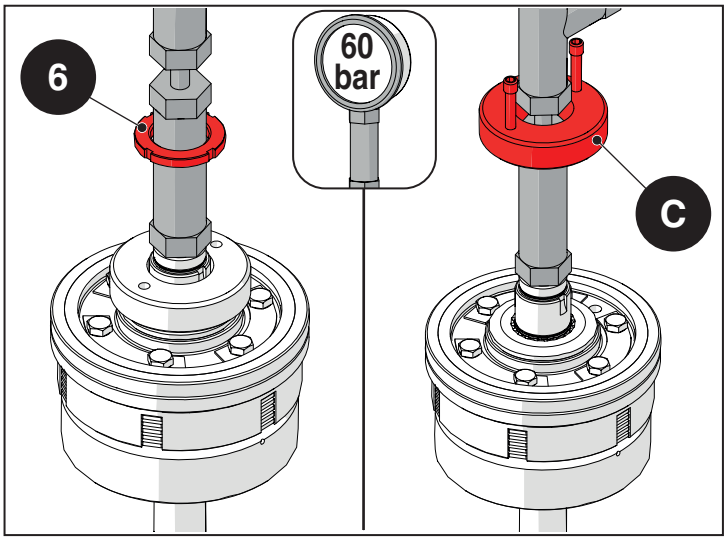


Fig. 8.38

Relieve the pressure, then remove the sleeve of the hydraulic pump.

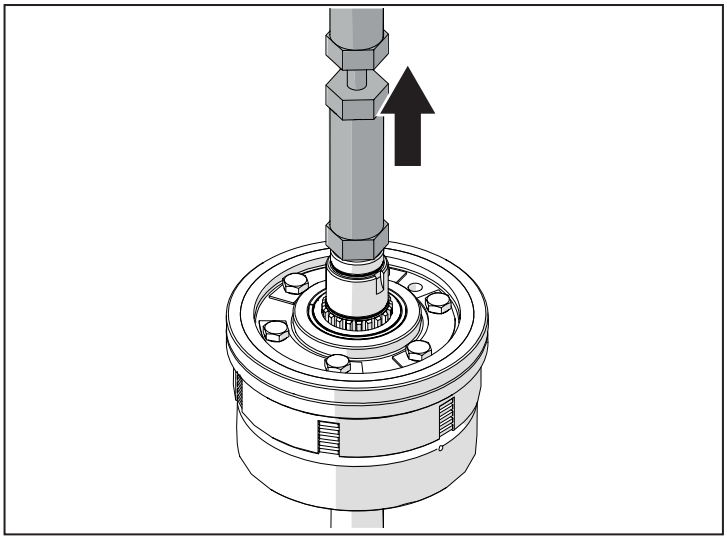


Fig. 8.39

Apply TEFLON to the thread of the plug (31) and screw it into the transmission housing (5).

Fit the complete clutch pack into the housing (5).

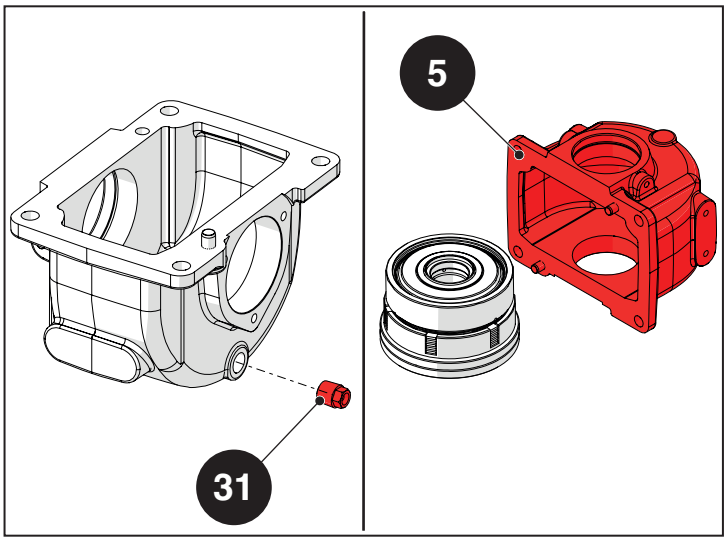


Fig. 8.40

Insert the bearing (4), then seat it by using the plug (B-code 07006208).

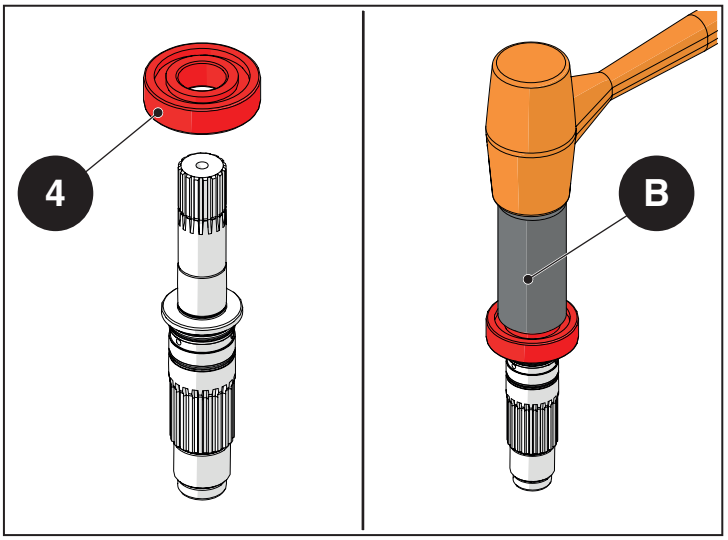


Fig. 8.41

Insert the complete shaft (1), then seat it by using the plug (B-code 07006208).

Lock with the circlip (3).

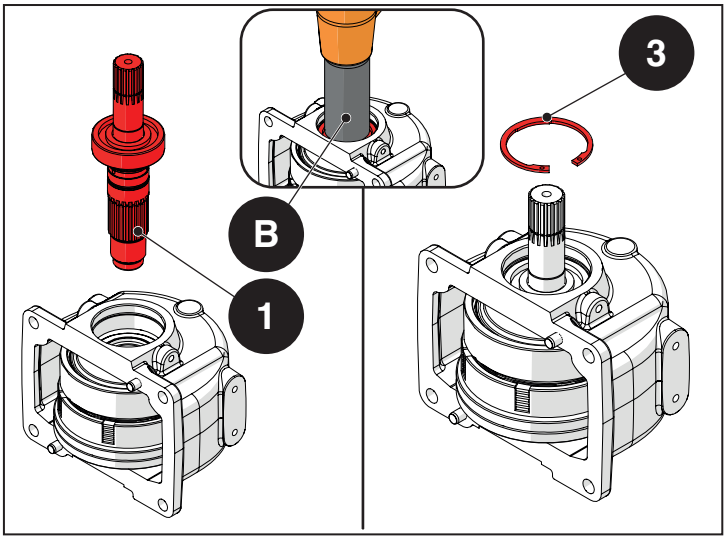


Fig. 8.42

Insert the spacers (33) and spacer (8).

Insert the bearing (7) and seat it by using plug (E-code 07006209).

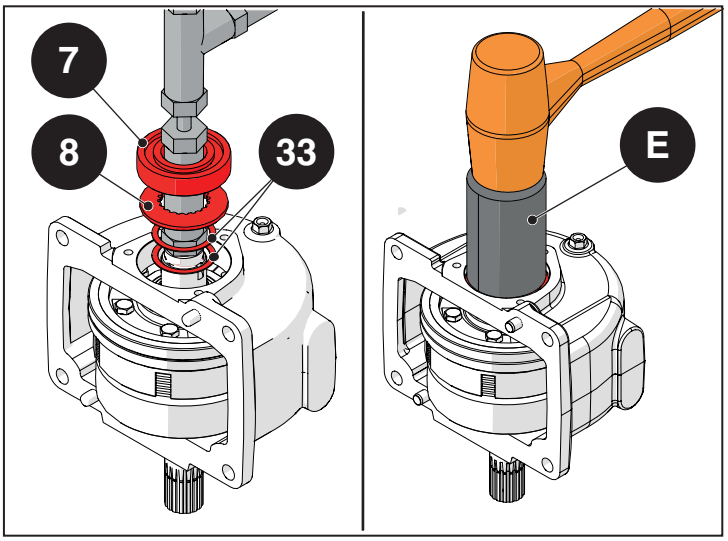


Fig. 8.43

Insert the ring nut (6) and tighten it by applying 220 Nm (22 kgm) tightening torque.

Chisel the ring nut (6).

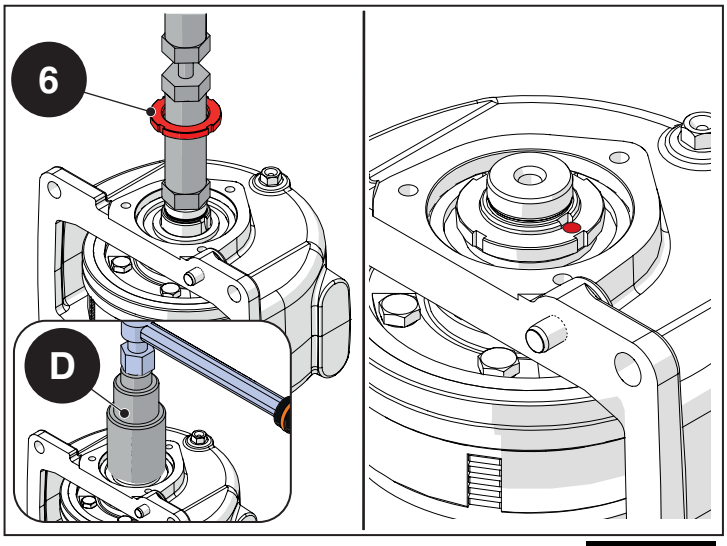


Fig. 8.44

Caution

Repeat the previously described tests for the sake of safety since the dummy bearing (A) has been replaced with the real bearing (7).

Before the cover is reassembled, establish the shims required by the bearing (7) so as to eliminate any play inside the unit.

Measure cover edge distance (X).

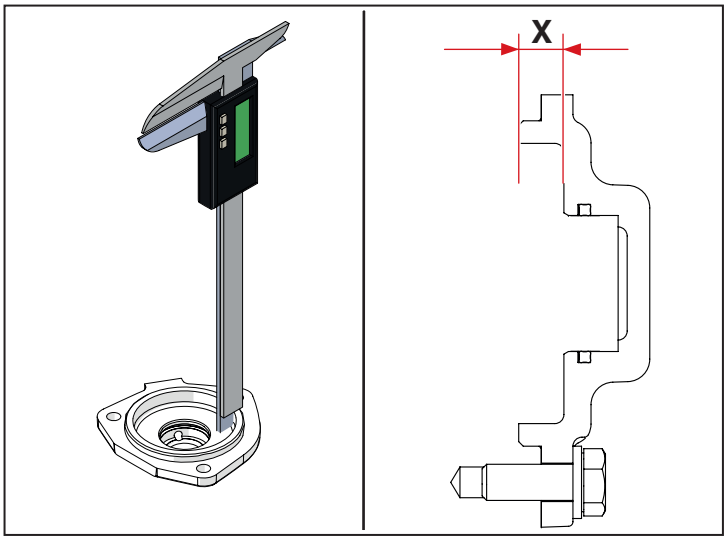


Fig. 8.45

Measure the distance (Y) between the operating surface of the transmission housing and the bearing.

The result of the X-Y formula will be the value of the shim to insert between the bearing (7) and cover (9).

E.g.:

X= 5.20 mm

Y= 5.00 mm

X-Y= 0.20 mm

In this case, the shim must be 0.2 mm thick.

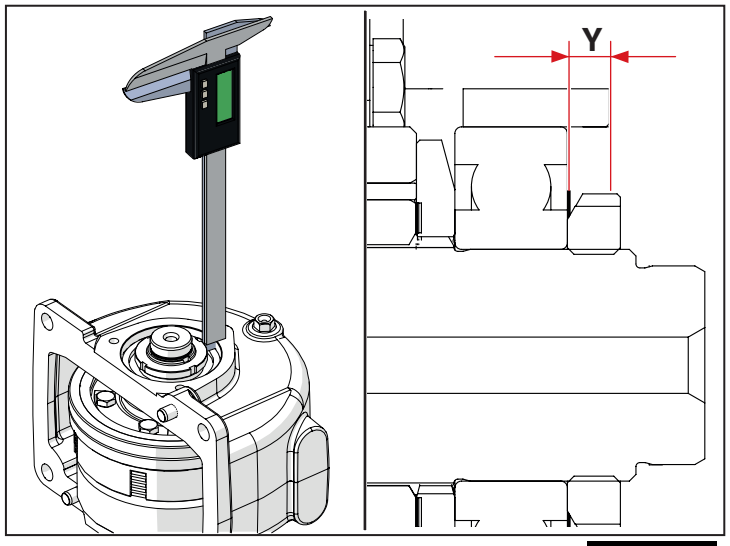


Fig. 8.46

Insert the newly calculated shim (35).

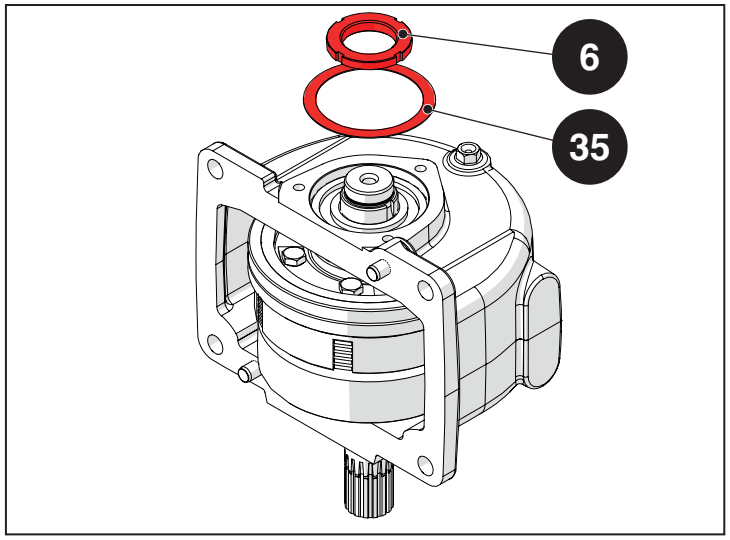


Fig. 8.47

Fit the Quad ring (34) inside the cover.

Caution

Make sure that the Quad Ring is not bent after having been fitted into its housing, this to prevent it from being damaged when the components are reassembled.

After the Quad Ring has been fitted, lubricate it with OIL to facilitate its engagement with the other components.

Apply a layer of SILICONE to the cover (9).

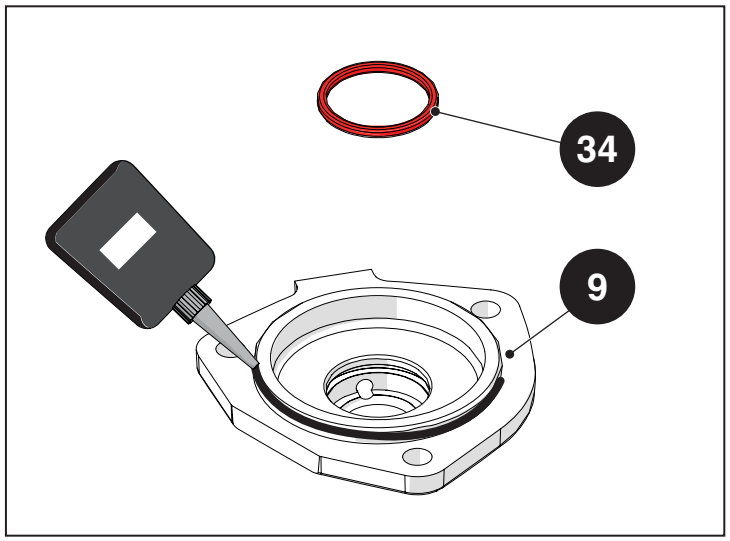


Fig. 8.48

Insert the cover (9).

Insert the washers (11) and screws (10), then tighten them by applying 35 Nm (3.5 kgm) tightening torque.

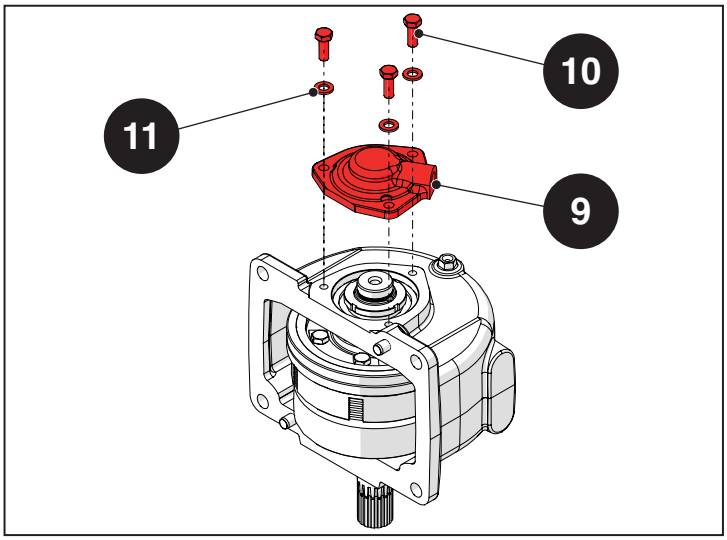


Fig. 8.49

Make sure that there are no leaks from the cover by using a hydraulic pump and applying 60 bar pressure on the indicated hole.

Caution
Replace the Quad ring (34) is leaks are discovered.

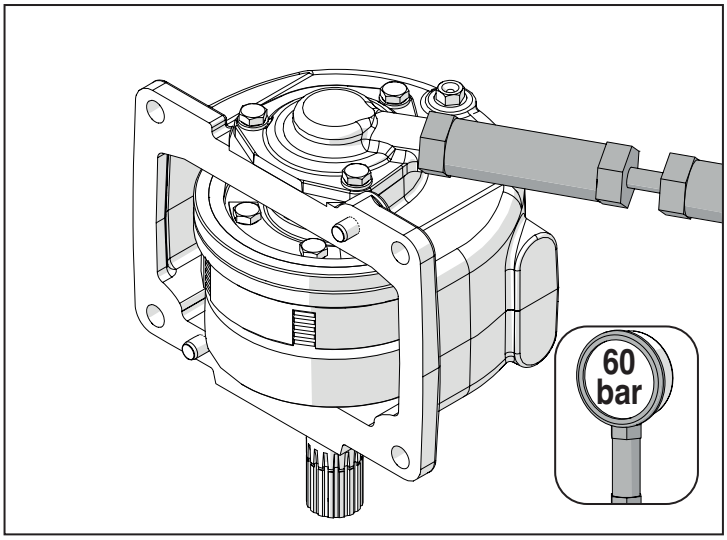


Fig. 8.50

Apply a layer of SEALANT to the outer edge of the oil retaioner (2), then fit it into its housing using a plug of an adequate diameter.

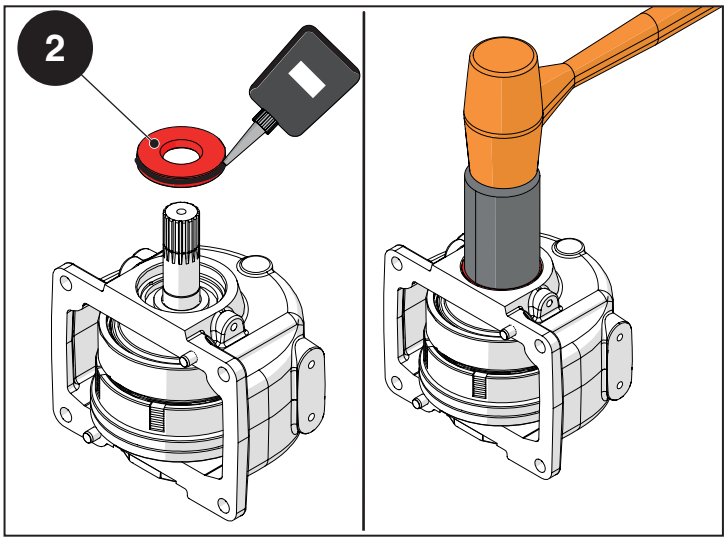


Fig. 8.51

Apply a layer of SILICONE to the coupling surface.

Fit the complete unit into the gearbox.

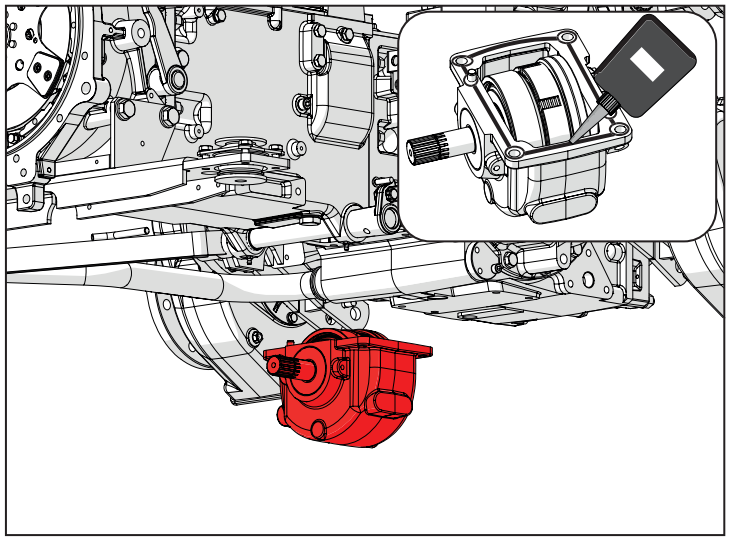


Fig. 8.52

Insert the washers (36) and tighten the screws (35) by applying 85 Nm (8.5 kgm) tightening torque.

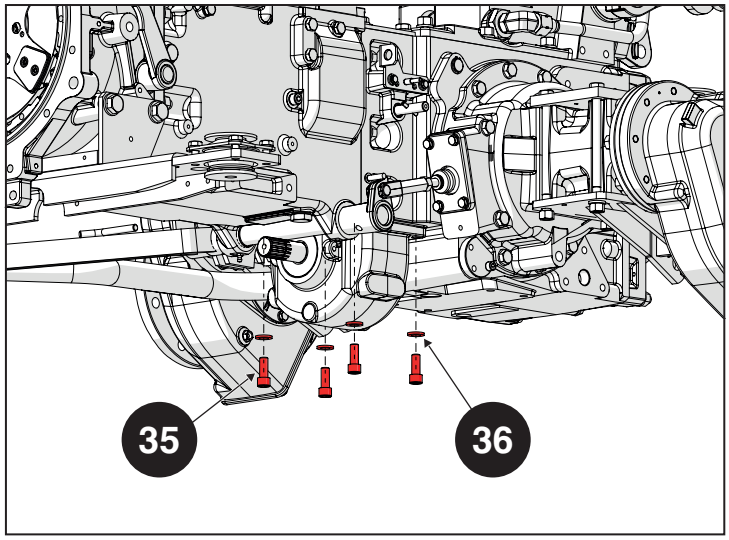


Fig. 8.53

Section 6 : Tightening torques

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6.1 Tightening torques.....8-32

6.1 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	Nm	kgm
M8 screw that fastens the transmission housing cover	35	3.5
M12 screw that fastens the transmission housing	8	8
Ring nut for fastening the 4WD clutch pack	220	22
1/4” nipple for clutch pack supply	30	3
Screw for fixing the transmission unit	85	8.5

Section 7 : Tools required

Index

7.1 Tools required 8-34

7.1 Tools required

Code	Description	Quantity
07002766	Spacer for bearing assembly	1
07006128	Ring nut wrench	1
07006208	Plug for assembling bearing	1
07006209	Plug for assembling bearing	1
07006210	Driver tool for installing flange in spring pack	1
07006211	4WD housing support	1
07003831	4WD shaft guard	1

Chapter 9 : Rear Power Take-Off

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7.1 Tools required 9-24

Section 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.

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 the sharp edges around the top of the transmission housing.

Caution

Used oil must be collected and disposed of in compliance with the anti-pollution laws in force.

Section 2 : General introduction

Index

2.1 Drawing of the assembly 9-4

2.1 Drawing of the assembly

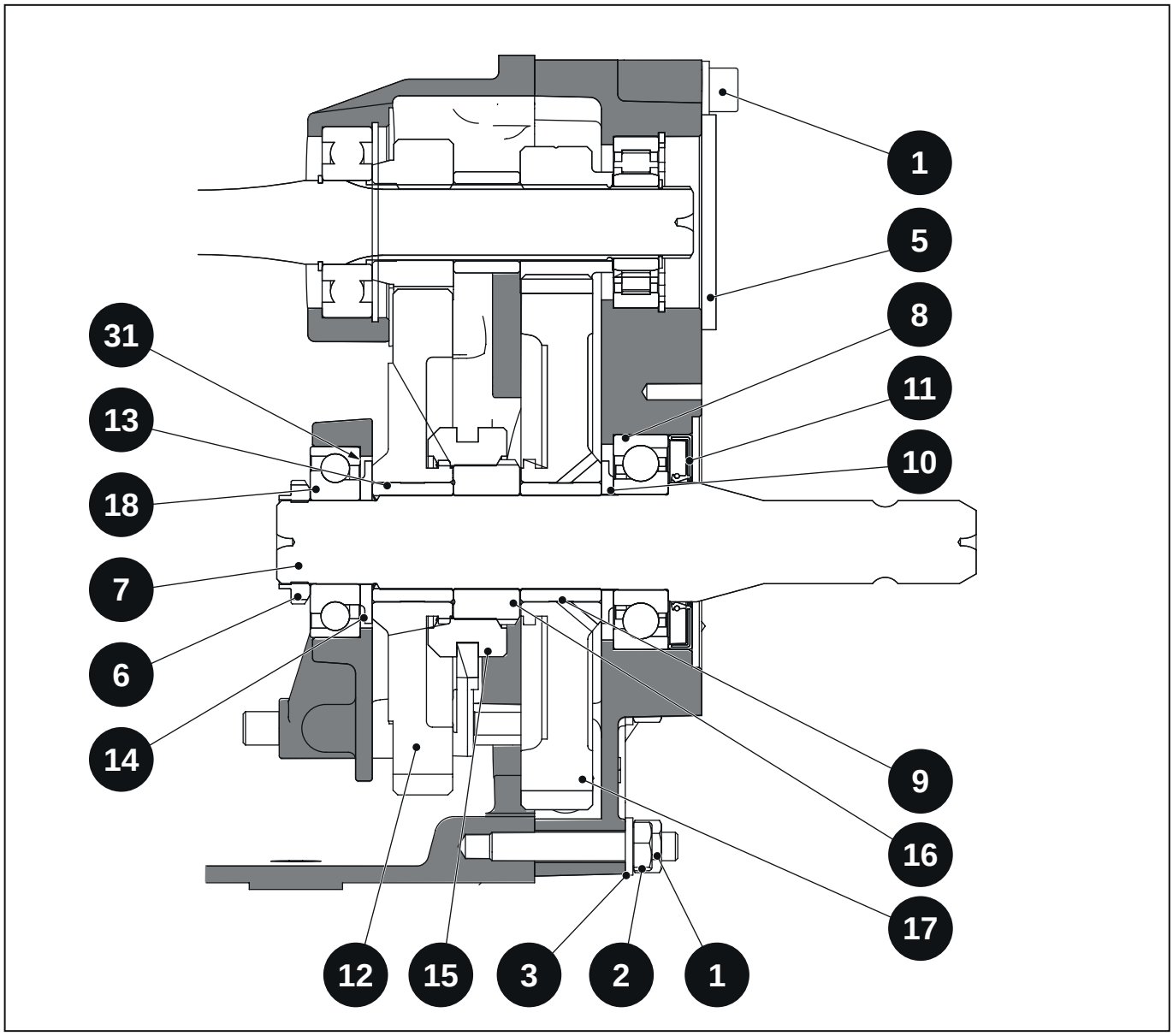


Fig. 9.1

1 - Screw
2 - Nut
3 - Washer
5 - Cover
6 - Ring nut
7 - Shaft
8 - Bearing
9 - Bush
10 - Spacer
11 - Oil retainer
12 - Gear
13 - Bush
14 - Spacer
15 - Sleeve
16 - Grooved bushing
17 - Gear
18 - Bearing
31 - Spacers
32 - 750/1000 gear
33 - 540 gear

Section 3 : Technical specifications

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3.1 Technical specifications 9-6

3.1 Technical specifications

Type	Single-shaft, independent and synchronized
Speeds independent from ground speed	540/750 rpm
Other speeds independent from ground speed	540/1000 rpm
Speed synchronized with ground speed	Yes
Direction of rotation (viewing the PTO)	Clockwise
Profile	1-3/8" with 6 splines
Clutch	Independent, mechanical with dry disc
Clutch control	Mechanical, lever operated
Safety	PUSH & START device on clutch pedal and on PTO

PTO speed table

PTO speed selector lever	Direction of rotation	Ratio	PTO rpm rate	Engine rpm rate
540	Clockwise rotation	4.500	540	2430
540E	1"-3/8 profile with 6 splines	3.471	750	2603
			540	1874
1000		2.214	1000	2214

Synchronized PTO speed table

Low version

540	540E	1000
4.684	6.074	9.520

High version

540	540E	1000
4.258	5.522	8.654

Section 4 : Disassembly

Index

4.1 Disassembly 9-8

4.1 Disassembly

Unscrew the screws (1) and nuts (2), and remove the washers (3).

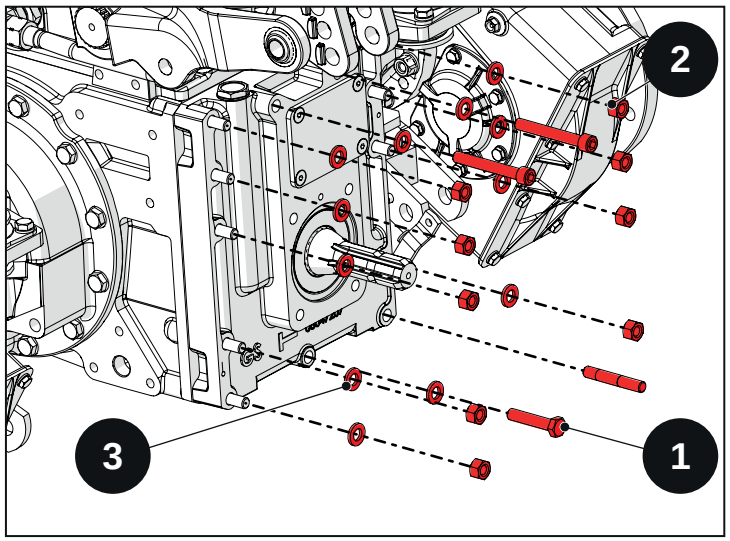


Fig. 9.2

Connect lifting equipment to the PTO unit, then remove it from the differential assembly.

Warning
Screw two threaded screws into the extraction holes to facilitate the operation.

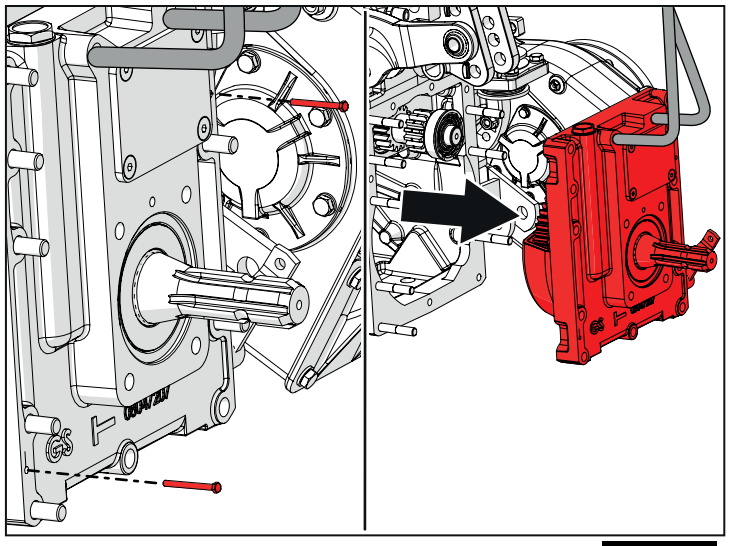


Fig. 9.3

Remove the fixing screws from the cover (4) and remove the cover (5).

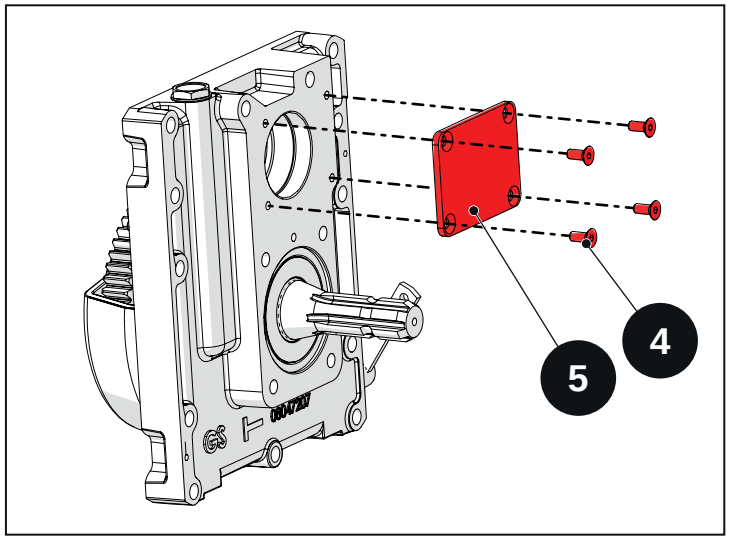


Fig. 9.4

Use tool (A-code 07006128) to remove the ring nut (6).

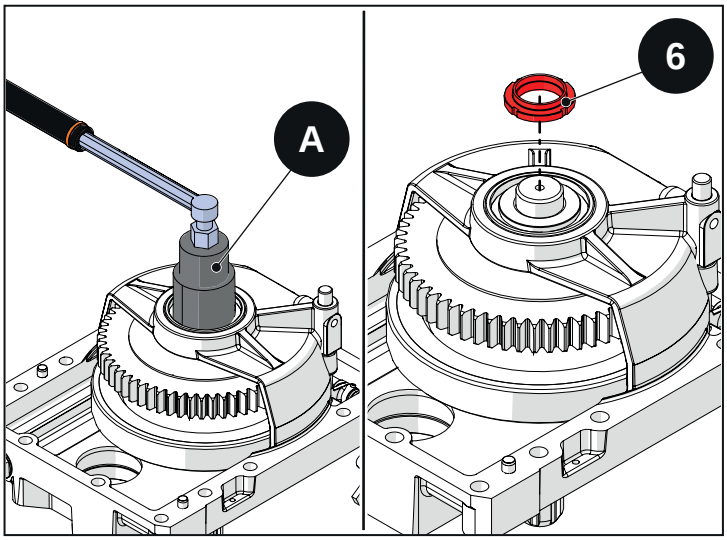


Fig. 9.5

Remove the shaft (7) complete with bearing (8), bush (9), spacer (10) and oil retainer (11).

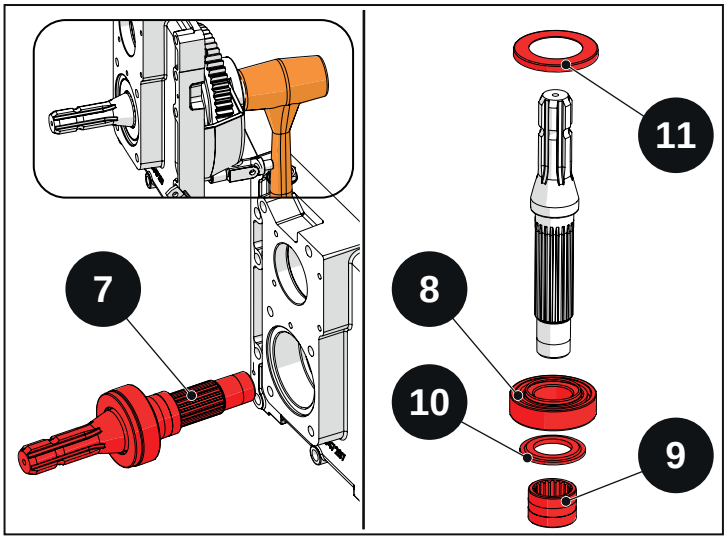


Fig. 9.6

Remove the gear (12).

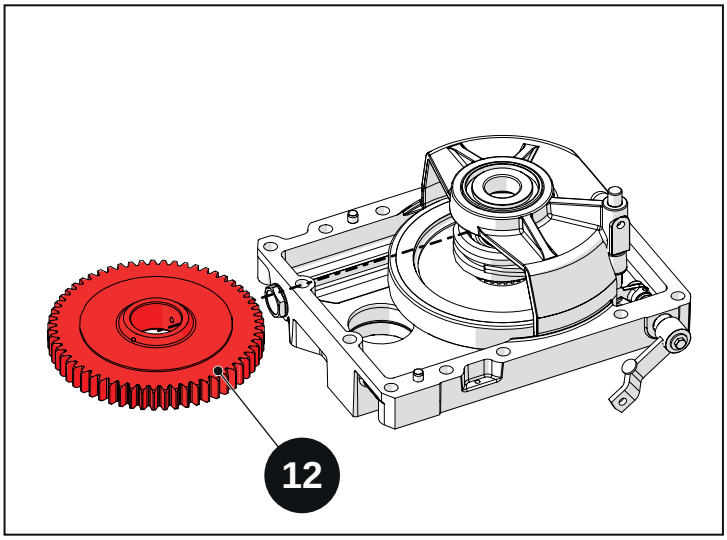


Fig. 9.7

Remove the sleeve (15) and grooved bush (16).

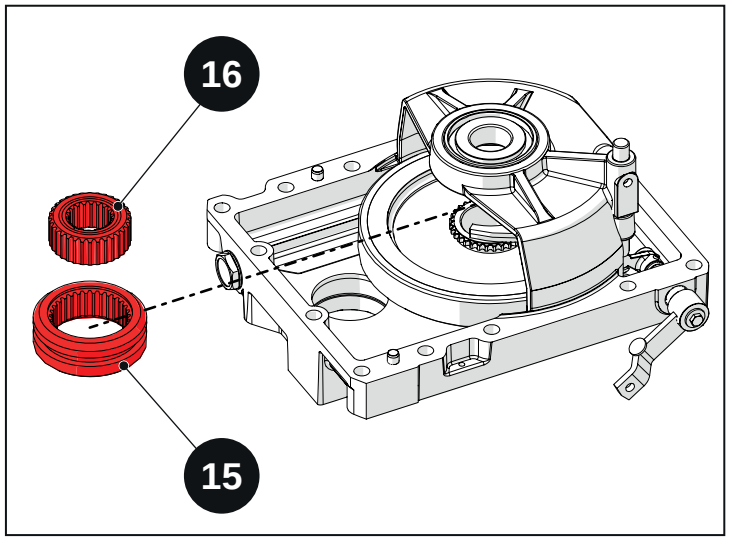


Fig. 9.8

Remove the gear (17).

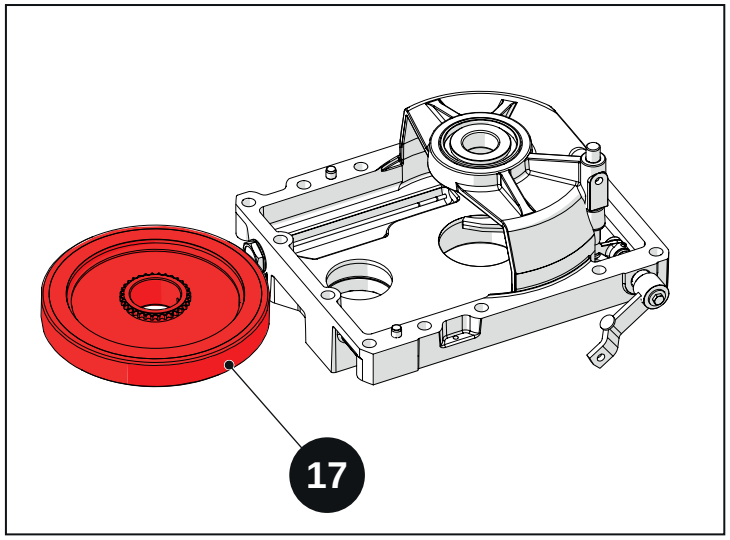


Fig. 9.9

Remove the bearing (18) with the aid of a hammer.

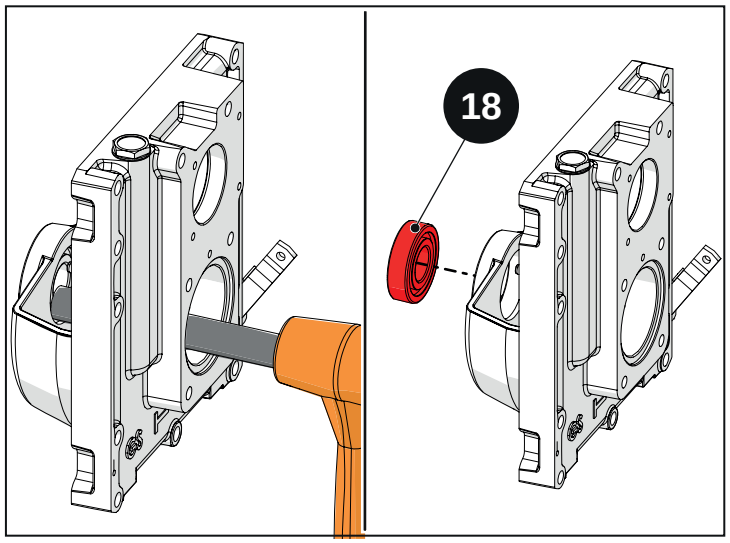


Fig. 9.10

Remove the pin (19).

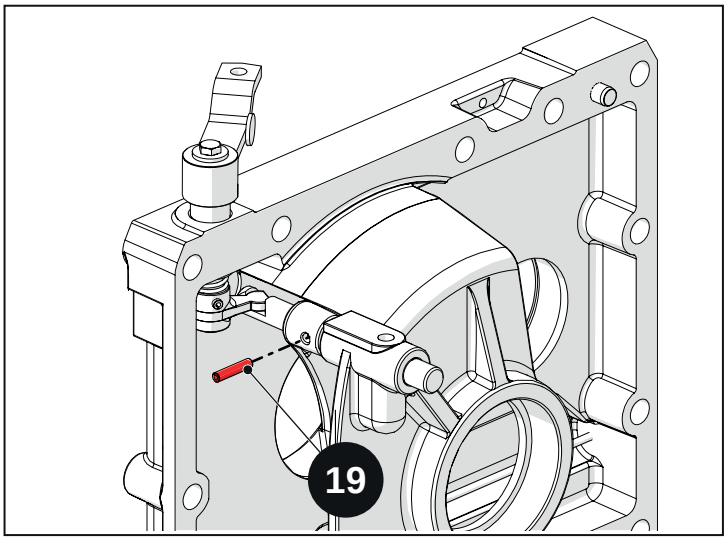


Fig. 9.11

Turn the lever to release the rod.

Unscrew the screw (20), then remove the washer (21) and lever (22).

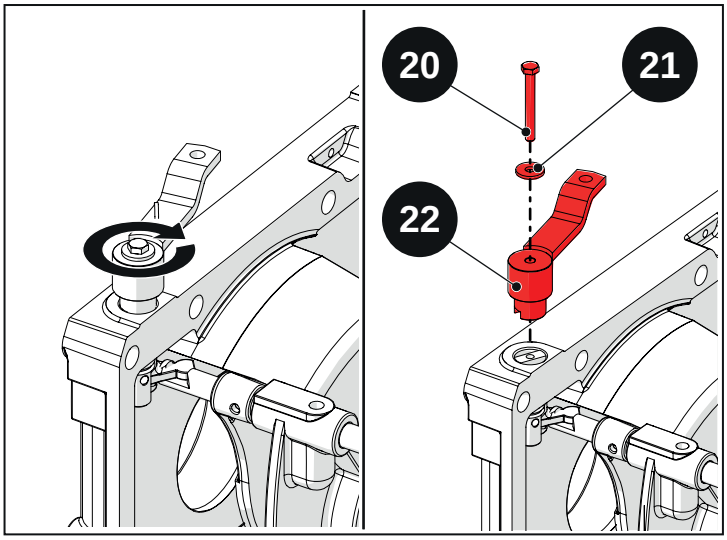


Fig. 9.12

Take out the rod (23) and fork (24).

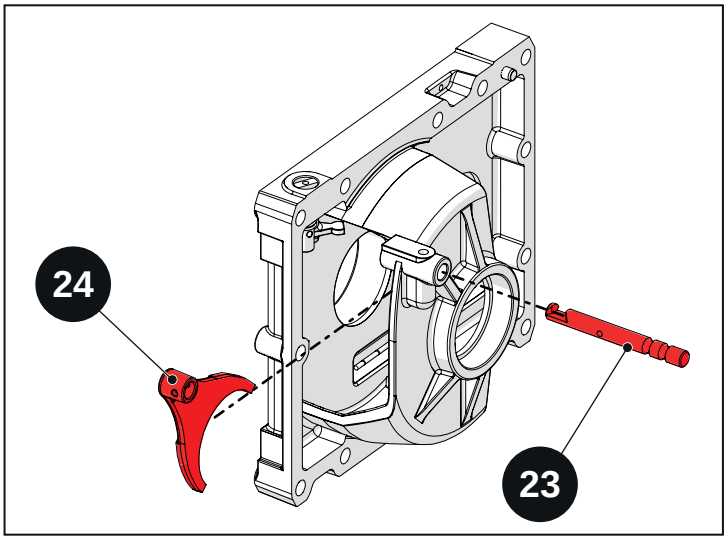


Fig. 9.13

Remove the pin (25) then remove the lever (26), the spring (27) and spacer (28).

Danger
The spring is loaded. Take care and protect yourself when the pin is removed.

Remove the plug (29) and O-ring (30).

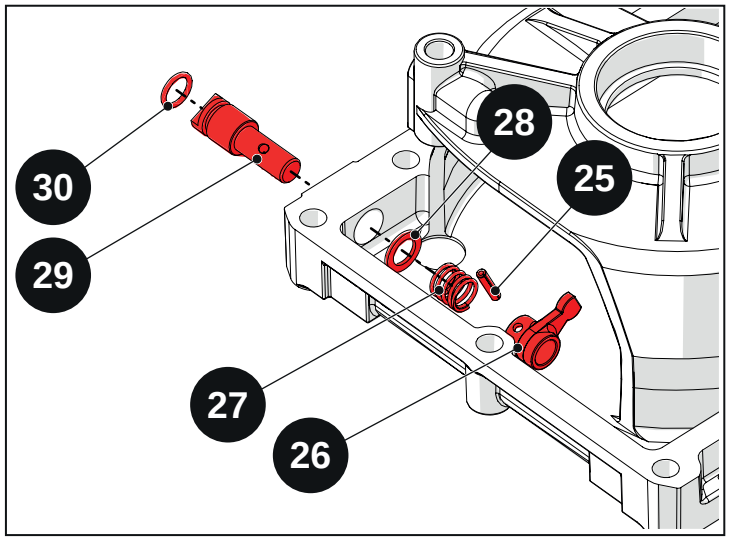


Fig. 9.14

Section 5 : Main inspection, re-assembly and adjustment operations

Index

5.1 Main inspection, re-assembly and adjustment operations.....9-14

5.1 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.

Fit the O-ring (30) onto the pin (29).

Warning

Apply a layer of grease to the O-Ring (10) before fitting it into its housing.

Insert the spacer (28), spring (27) and lever (26).

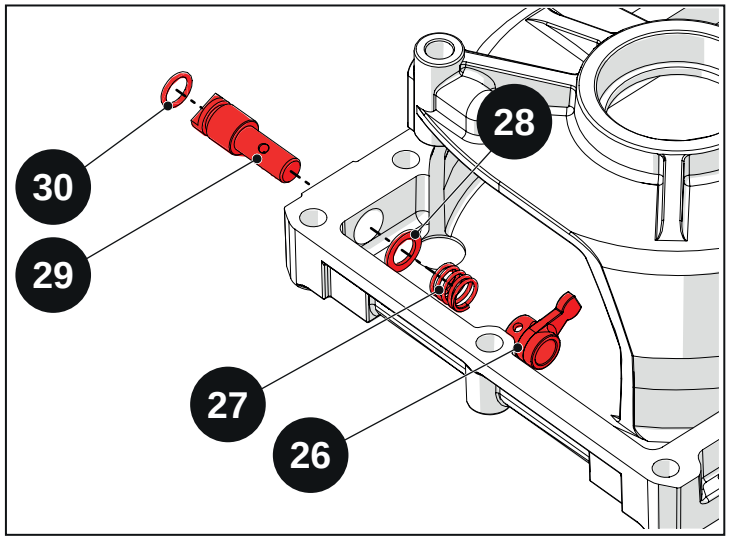


Fig. 9.15

Use tool (B-07007182) to load the spring, then insert the pin (29).

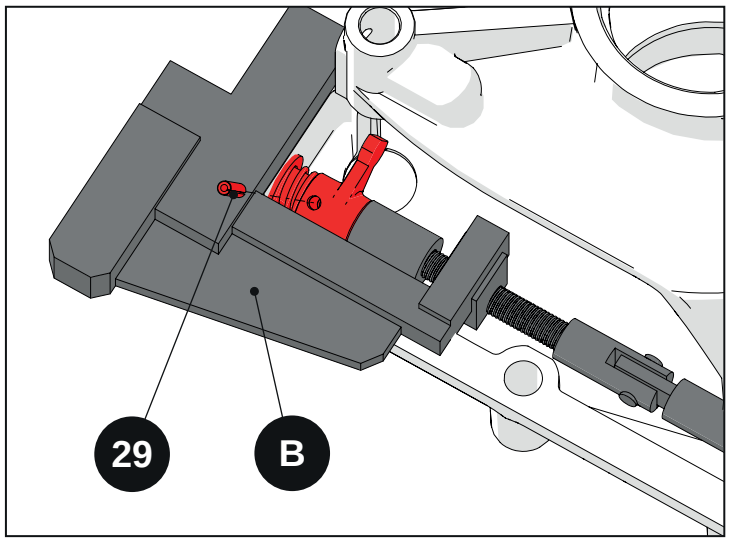


Fig. 9.16

Insert the rod (23) and fork (24).

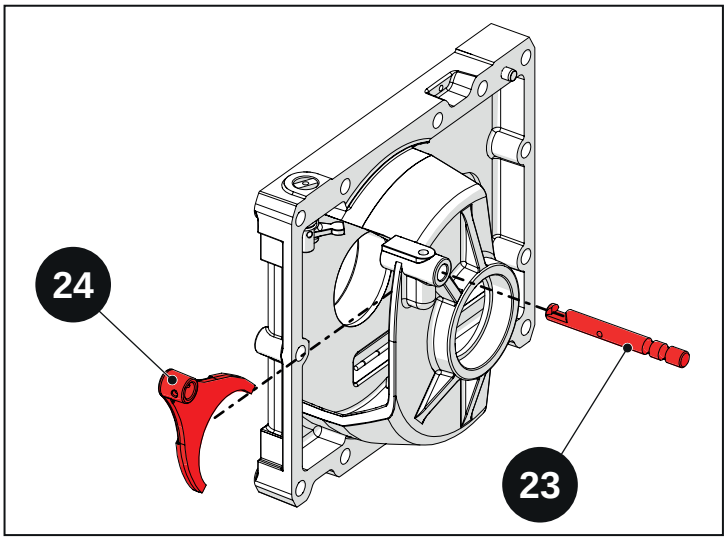


Fig. 9.17

Insert the lever (22), the washer (21), and tighten the screw (20).

Insert the pin (19).

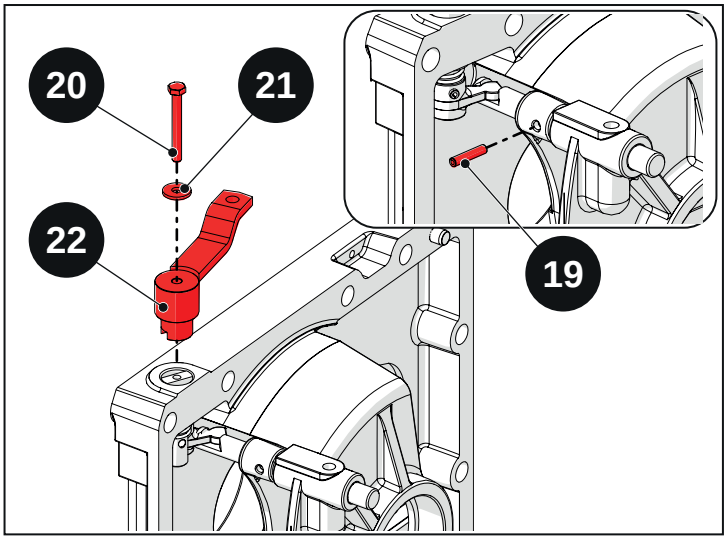


Fig. 9.18

Insert the gear (17).

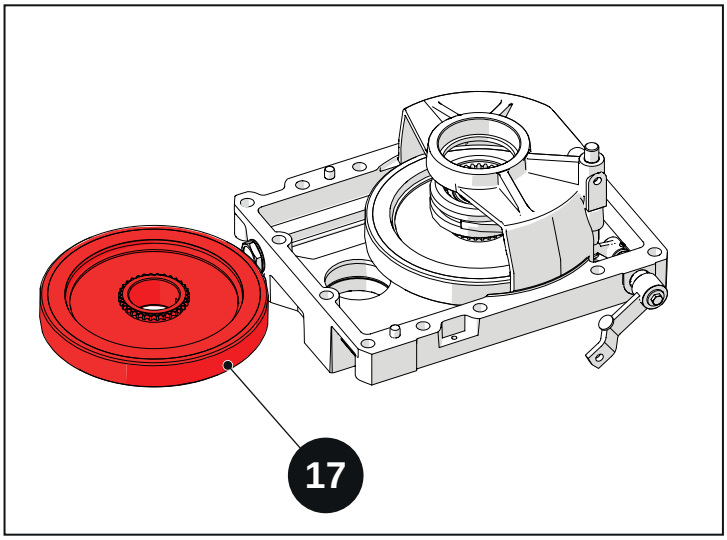


Fig. 9.19

Insert the sleeve (15) and grooved bush (16).

Warning
Align the fork with the sleeve.

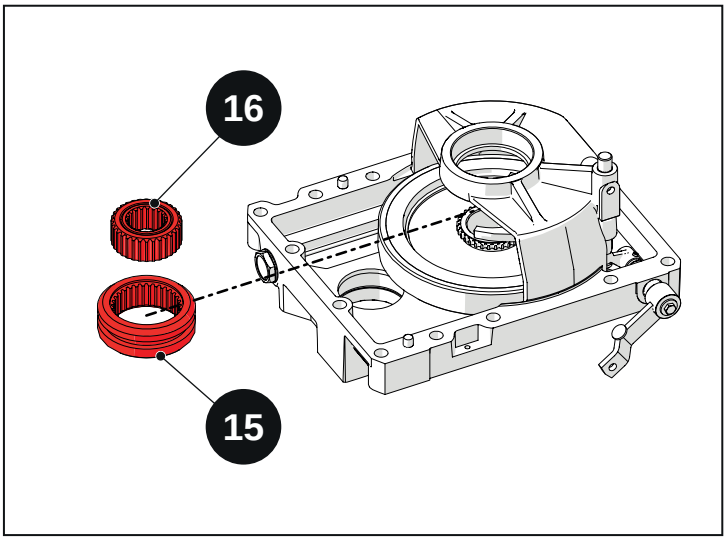


Fig. 9.20

Insert the gear (12).

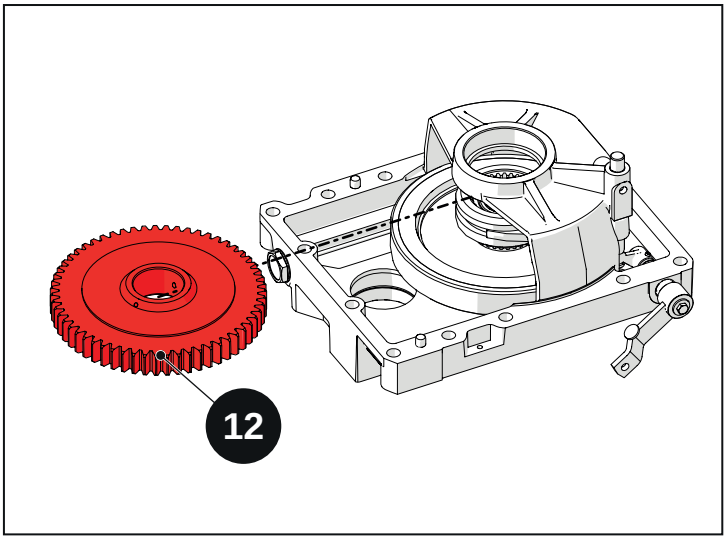


Fig. 9.21

Assemble the bearing (8) on the shaft (7) and fully seat it using a plug of a suitable diameter.

Fit the bush (9) and spacer (10) onto the shaft.

Warning
Make sure that the spacer is installed correctly. The chamfered part must point towards the bearing.

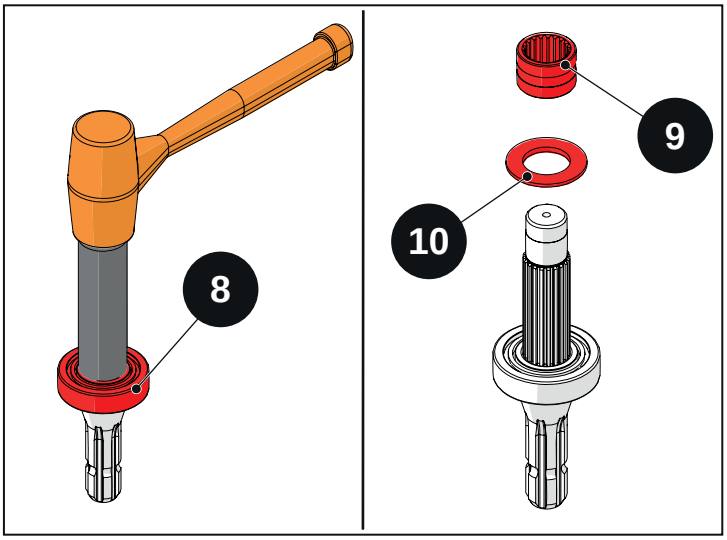


Fig. 9.22

Fit the newly assembled shaft into the unit, then insert the spacers (10).

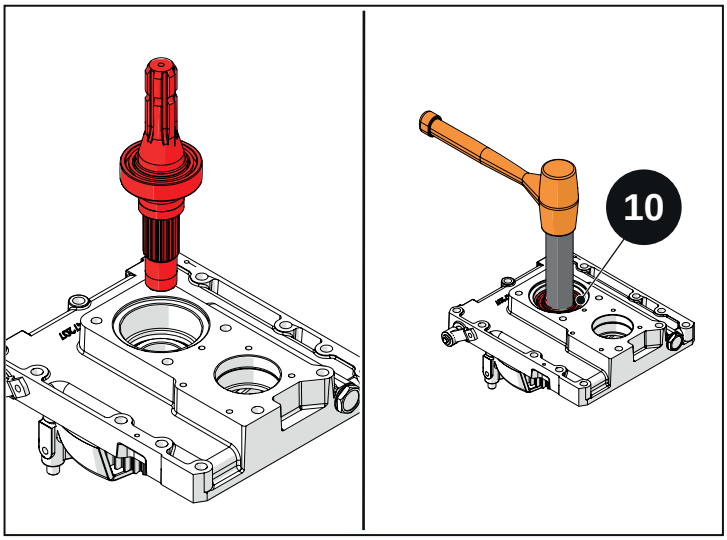


Fig. 9.23

Insert the bush (13), spacer (14) and 0.2 mm spacer (31).

Assemble the bearing (18) and fully seat it using a plug of a suitable diameter.

Warning

Make sure that the spacer is installed correctly.

The chamfered part must point towards the bearing.

Warning

Make sure that the taper bearings (8) and (18) are installed in the right direction.

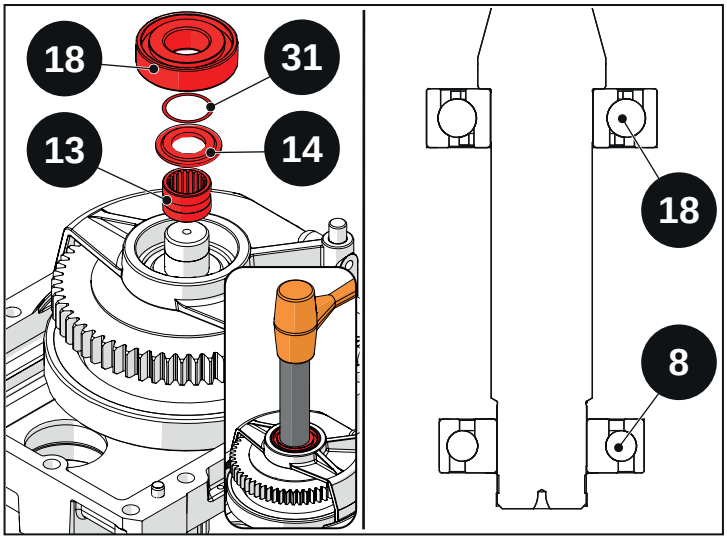


Fig. 9.24

Apply a layer of LOCTITE 270 to the ring nut thread (6), then tighten it using tool (A- code. 07006128). Apply 25 Nm (2.5 kgm) tightening torque.

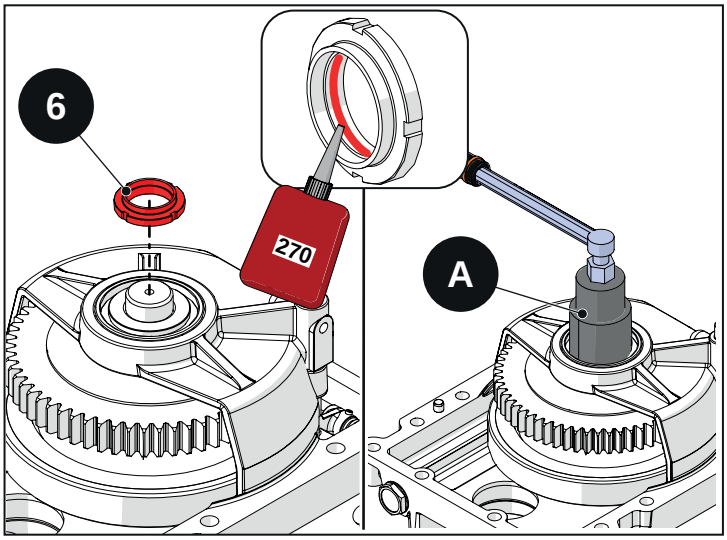


Fig. 9.25

Loosen the ring nut and tighten it again by applying 25 Nm (2.5 kgm) tightening torque.

Make a mark on the ring nut and on the shaft. Make another mark on the shaft turned 45° in the clockwise direction.

Loosen the ring nut and tighten it again to 200 Nm (20 kgm).

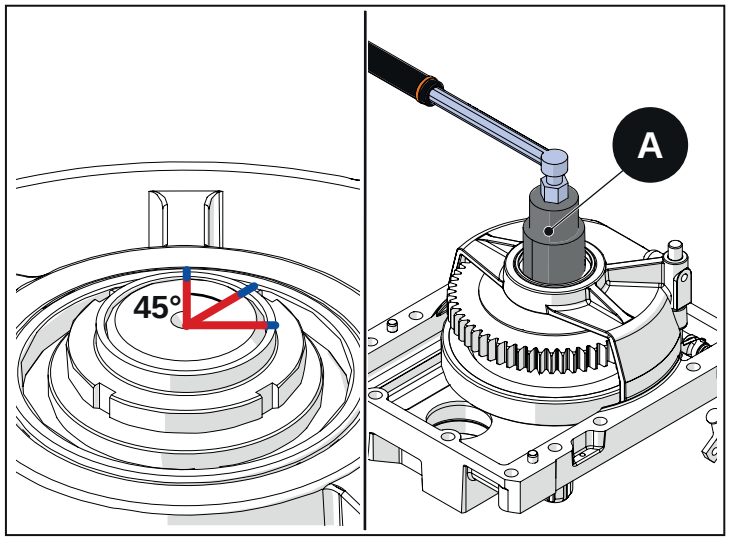


Fig. 9.26

Make sure that the ring nut has moved no more than 45° by checking the previously made marks.

Warning

If it has moved more than 45°, increase the thickness of the previously installed spacer (31).

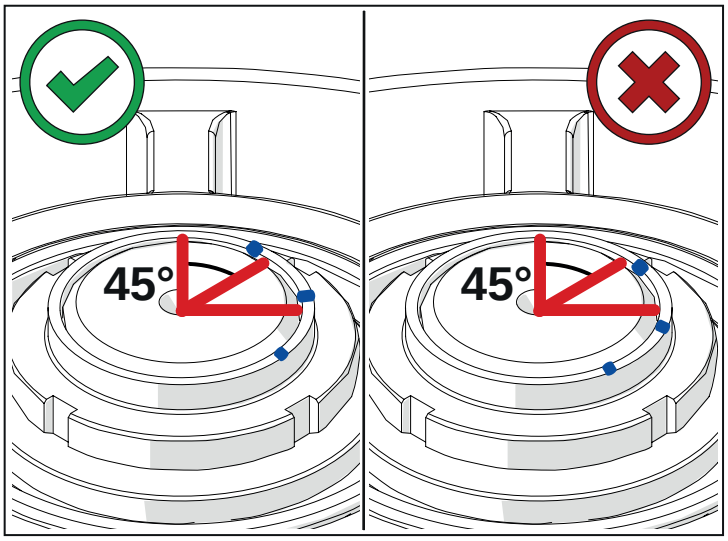


Fig. 9.27

Punch the ring nut (6) to lock it definitively in place.

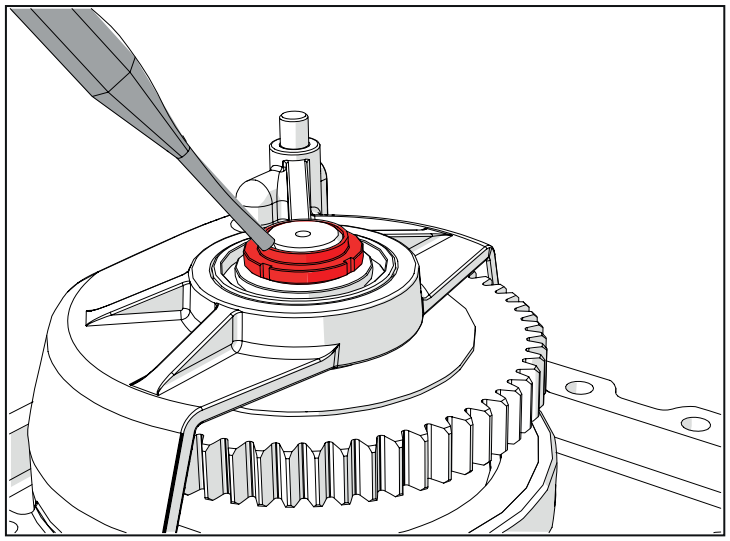


Fig. 9.28

Insert the oil retainer (11) and fully seat it by using a plug of a suitable diameter.

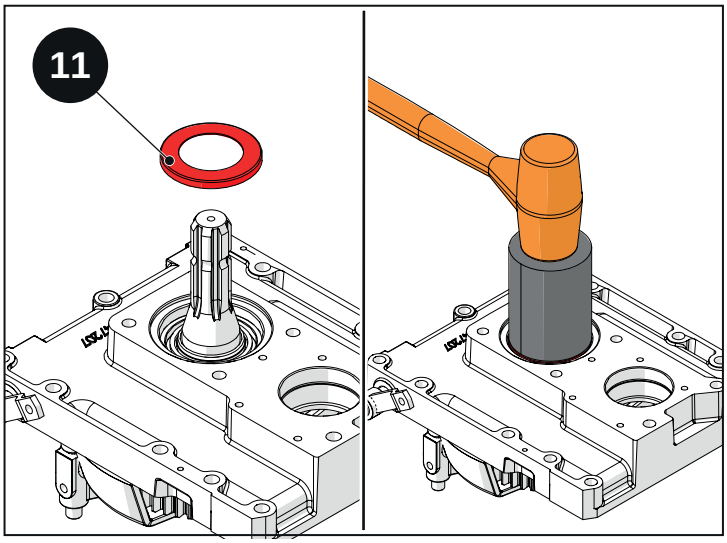


Fig. 9.29

Apply a layer of SILICONE to the coupling surface of the PTO.

Use lifting equipment to slign the PTO unit with the rear differential.

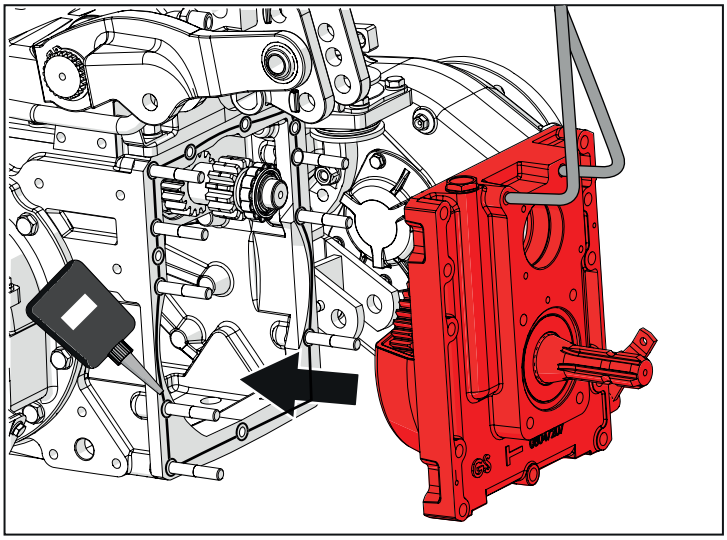


Fig. 9.30

Insert the outer race of the bearing using a plug of an adequate diameter, then lock it with the circlip.

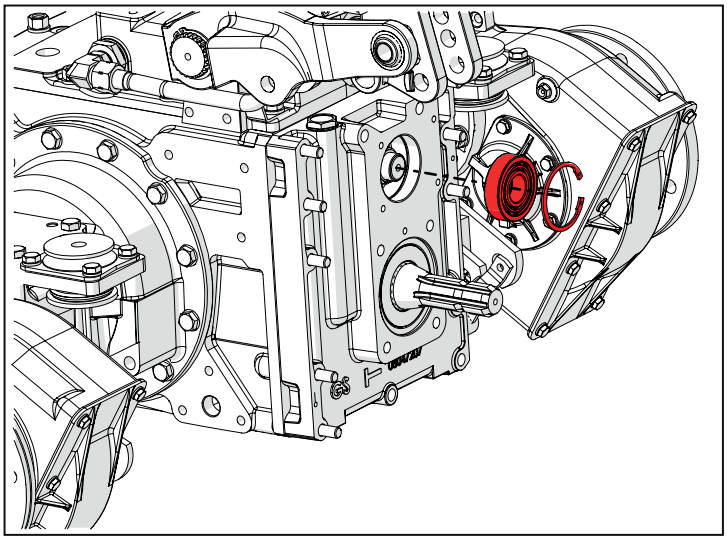


Fig. 9.31

Apply a layer of SILICONE and fit on the cover (5).

Fasten the cover with the screws (6).

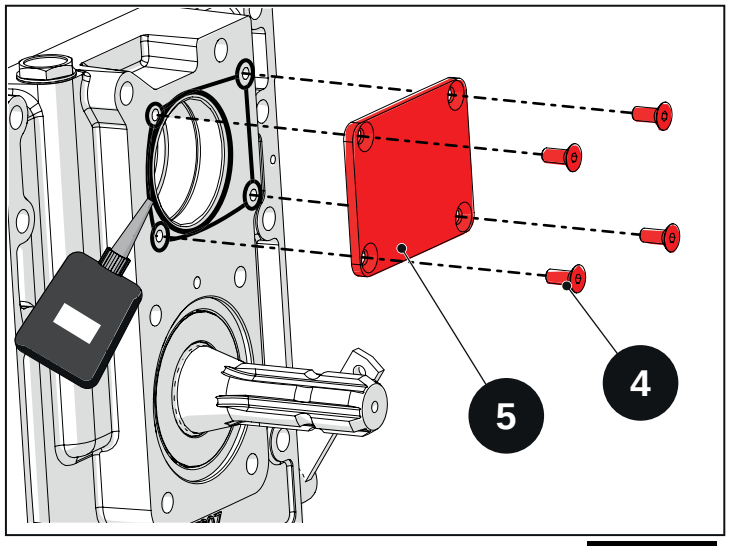


Fig. 9.32

Insert the washers (3) and tighten the screws (1) and nuts (2) by applying 90 Nm (9 kgm) tightening torque.

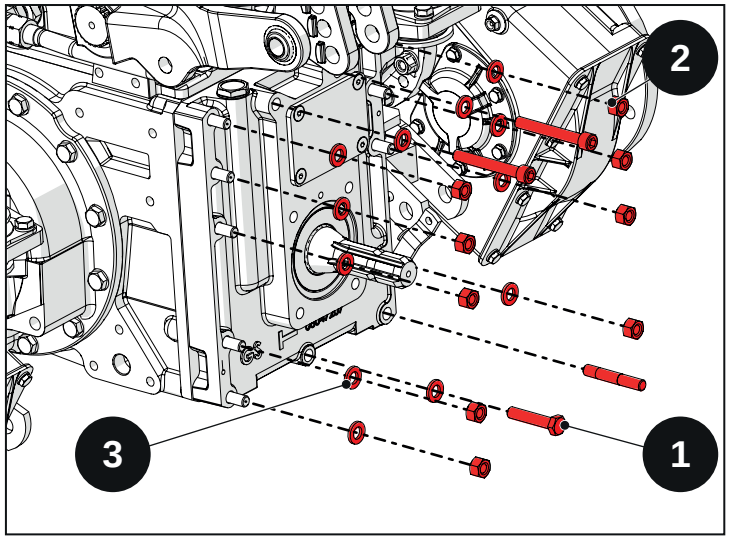


Fig. 9.33

Section 6 : Tightening torques

Index

6.1 Tightening torques.....9-22

6.1 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	Nm	kgm
M35x1.5 ring nut for fastening rear P.T.O. shaft	200	20
M12 nut for fastening rear P.T.O. assembly	80	8
M12x30 screw for fastening upper P.T.O. compartment cover	49	4.9
M12x35 screw for fastening transmission unit	49	4.9
M8x20 screw for fastening rear P.T.O. cover	24	2.4
Screw for fastening P.T.O. unit to differential	90	9

Section 7 : Tools required

Index

7.1 Tools required 9-24

7.1 Tools required

Code	Description	Quantity
07006128	Ring nut wrench	1
07007182	Spring pre-loading tool	1

Chapter 10 : Brakes

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Section 5 : Main inspection, re-assembly and adjustment operations 10-13

5.1 Main inspection, re-assembly and adjustment operations 10-14

5.2 Adjustment of the main brakes 10-16

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Section 6 : Tightening torques 10-19

6.1 Tightening torques 10-20

Section 7 : Tools required 10-21

7.1 Tools required 10-22

Section 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.

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 the sharp edges around the top of the transmission housing.

Caution

Used oil must be collected and disposed of in compliance with the anti-pollution laws in force.

Section 2 : General introduction

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2.1 Drawing of the assembly 10-4

2.1 Drawing of the assembly

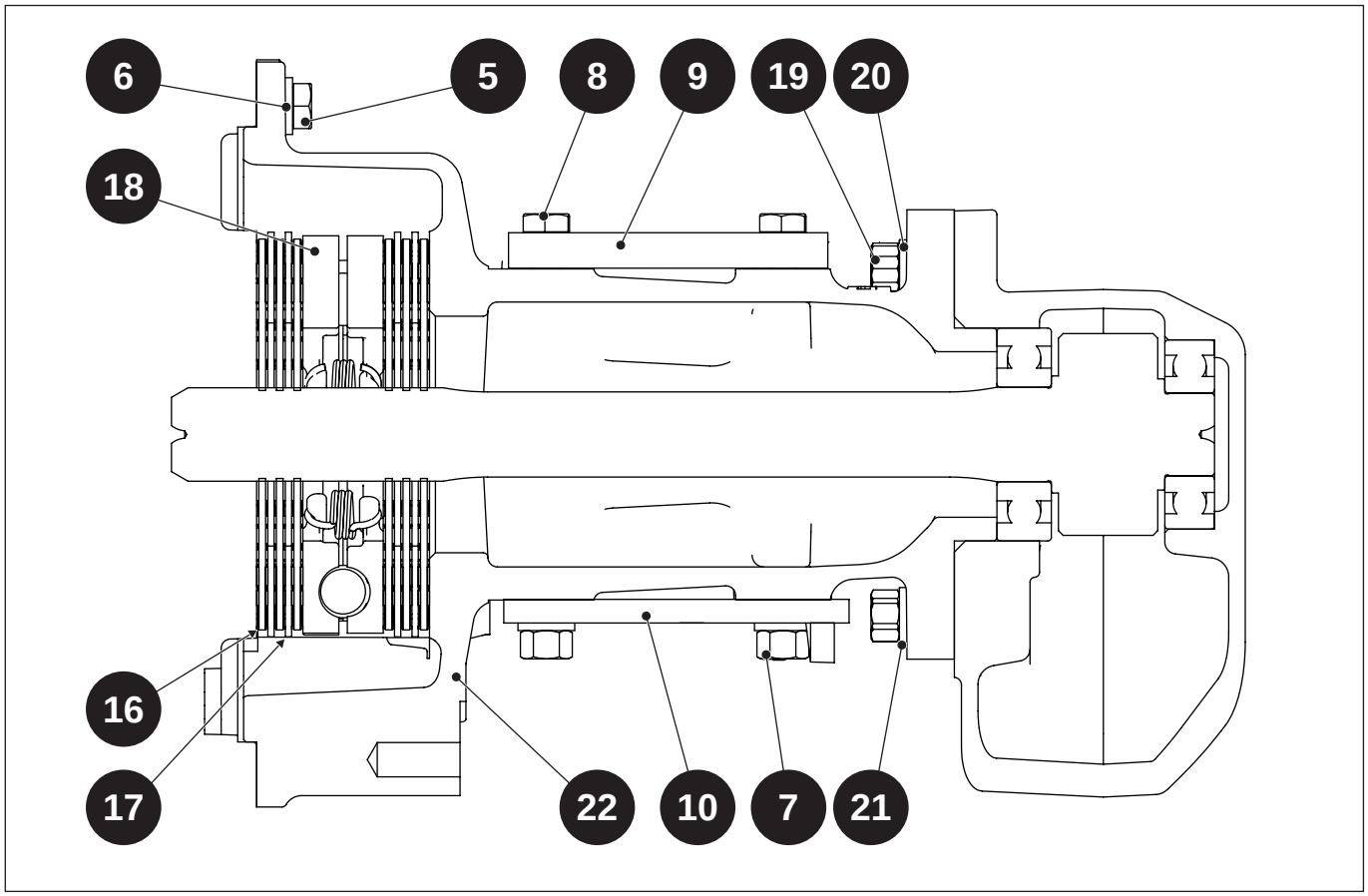


Fig. 10.1

5 - Screw
6 - Washer
7 - Nut
8 - Screw
9 - Upper flange for supporting platform
10 - Lower flange for supporting platform
16 - Friction plate
17 - Steel plate
18 - Braking mass
19 - Nut
20 - Washer
21 - Plate
22 - Hub

Section 3 : Technical specifications

Index

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3.1 Technical specifications

Type of braking	with oil-cooled multiple-plates
Operating mechanism	mechanical
Safety and parking brake	independent with mechanical control

Section 4 : Disassembly

Index

4.1 Preliminary operations 10-8

4.2 Disassembly 10-10

4.1 Preliminary operations

The main operations required to access the side final drives are described below:

Remove the front screws (1) that fix the platform.

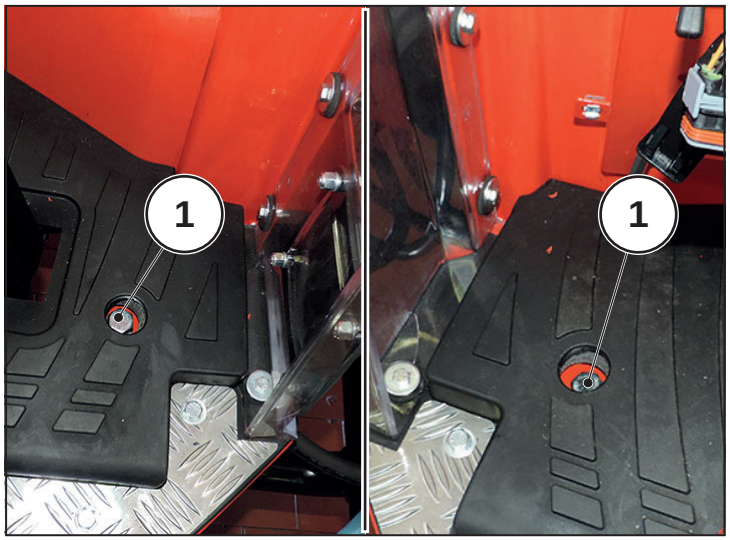


Fig. 10.2

Remove the roll-over protection devices (2) from the rear hubs.

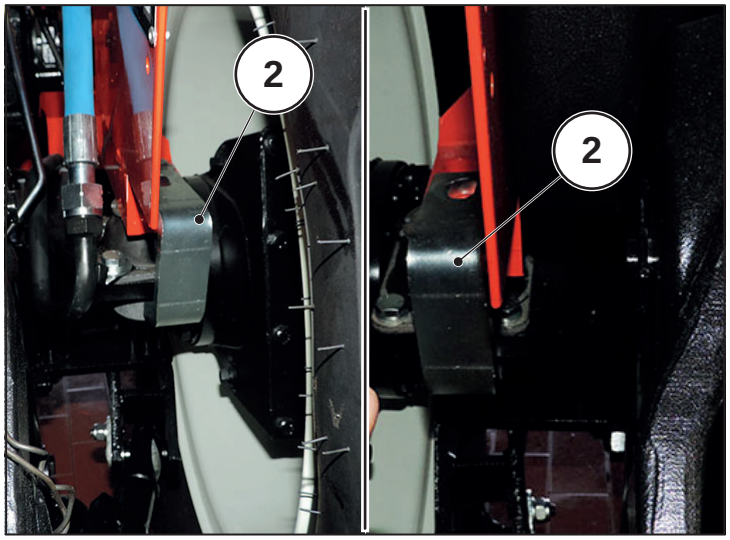


Fig. 10.3

Unscrew and disconnect the discharge pipe of the rear control valves (3).

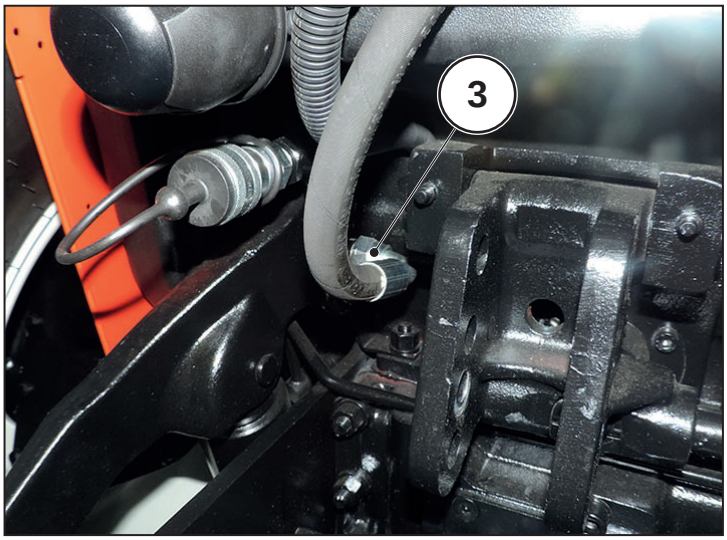


Fig. 10.4

Connect a lifting device to the rear cross-member of the mudguards so as to lift the machine.

Warning

Use lifting equipment with an adequate capacity.

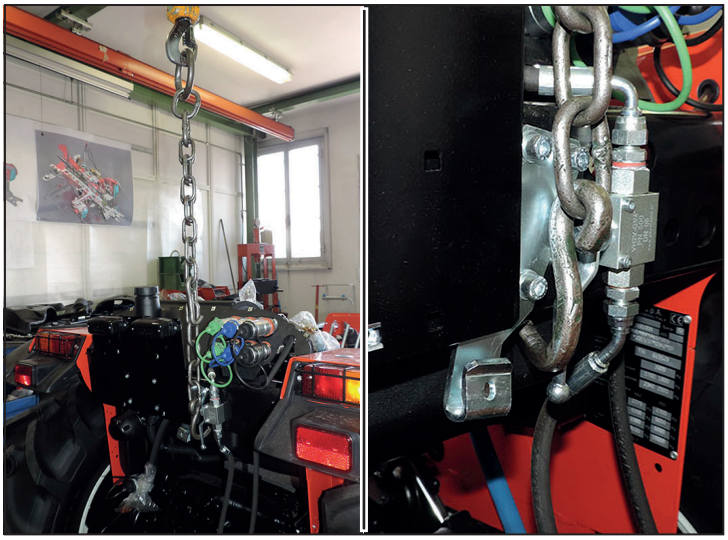


Fig. 10.5

Raise the platform about 20 cm and fit two safety spacers (4) between the platform and tank.

Caution

Take care not to damage any of the pipes or components when the platform is lifted.

Danger

Make sure that the safety spacers remain firmly in position.

Make sure that the lifting equipment is secure and that it functions correctly.

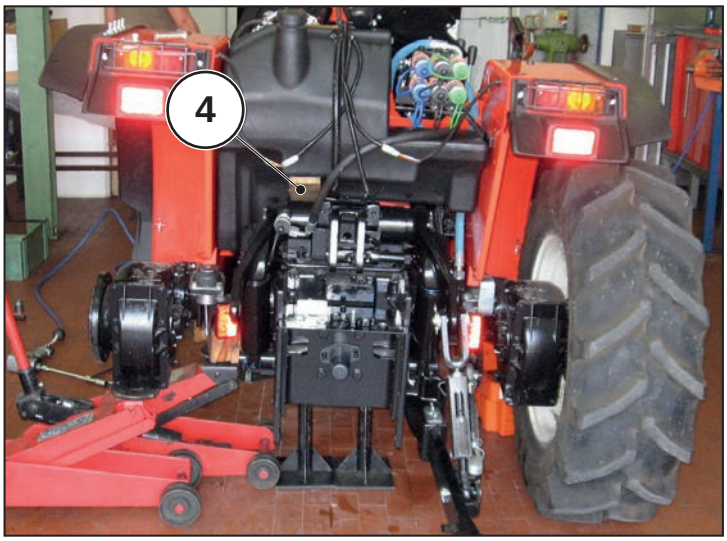


Fig. 10.6

4.2 Disassembly

Harness the unit to suitable lifting equipment.

Warning
Use lifting equipment with an adequate capacity.

Unscrew the screws (5) and remove the washers (6).

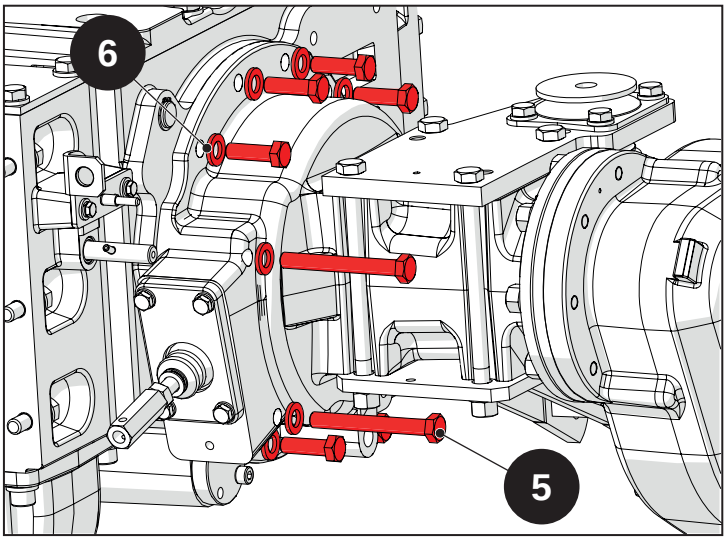


Fig. 10.7

Using lifting equipment, remove the unit from the rear differential.

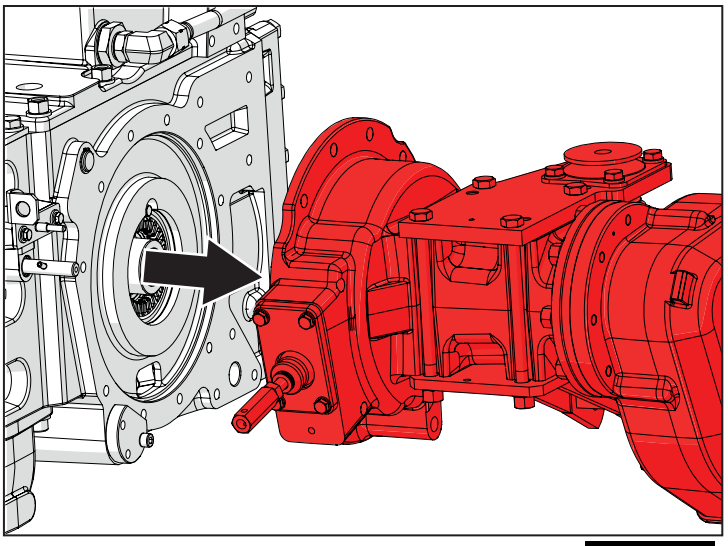


Fig. 10.8

Unscrew the screws (11) and remove washers (12) and flange (14).

Remove the link (19) and nut (20), then remove the retention spring (21), the bellow (13), cover (15) and O-ring (22).

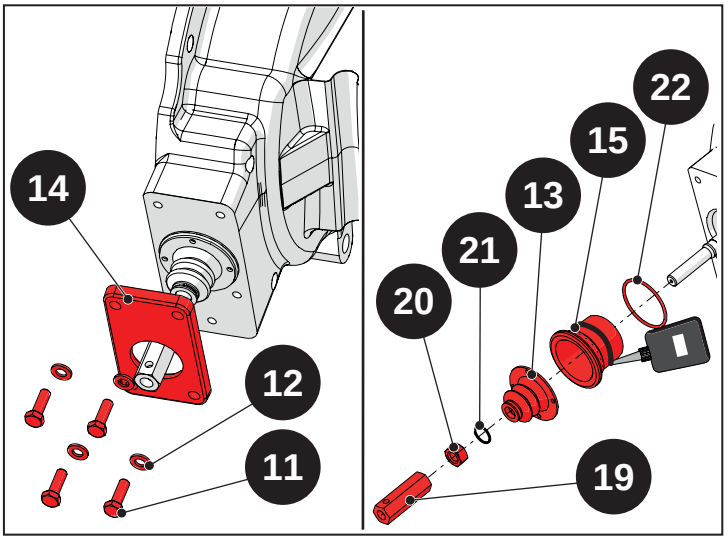


Fig. 10.9

Remove the six friction plates (16), the four steel plates (17) and the brake assembly (18) from the hub.

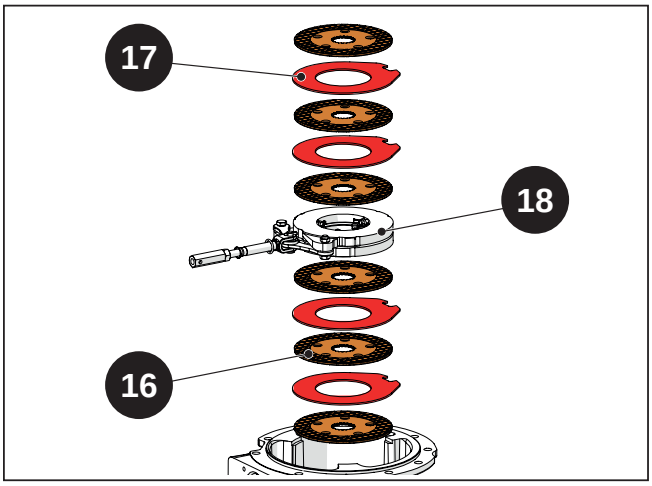


Fig. 10.10

Section 5 : Main inspection, re-assembly and adjustment operations

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5.1 Main inspection, re-assembly and adjustment operations 10-14

5.2 Adjustment of the main brakes 10-16

5.3 Adjustment of the parking and emergency brake 10-18

5.1 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 thefriction plates (16), the steel plates (17) and the brake assembly (18) into the hub.

Note

A total of three friction plates and two steel plates must be installed on each side of the braking mass.

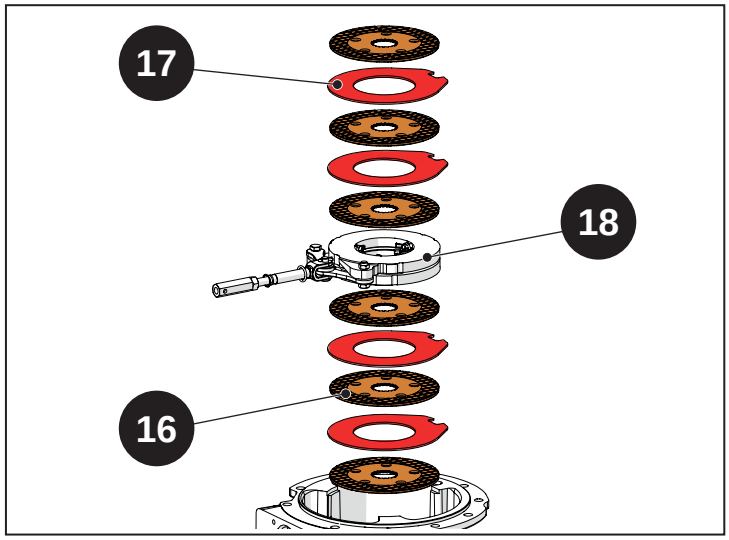


Fig. 10.11

Insert the O-ring (22), then apply a layer of SILICONE to the perimeter of the cover (15), then fit it into its housing.

Insert the bellow (13) and lock it with the retaining spring (21).

Tighten the nut (20) and link (19).

Warning

Make sure that the brake link is positioned in the centre of the hole.

Insert the flange (14), the washers (12) and tighten the screws (11).

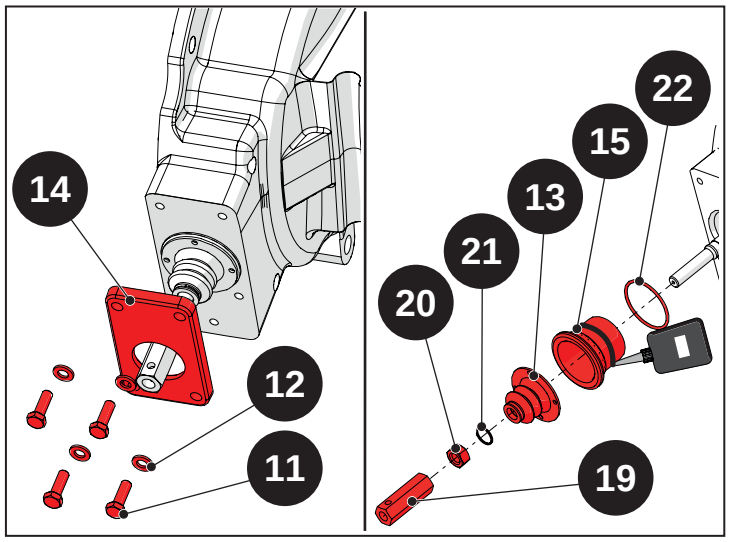


Fig. 10.12

Apply a layer of SILICONE to the surface on which the hub couples with the rear differential.

Harness the unit to lifting equipment and align the hub with the rear differential unit.

Warning
Use lifting equipment with an adequate capacity.

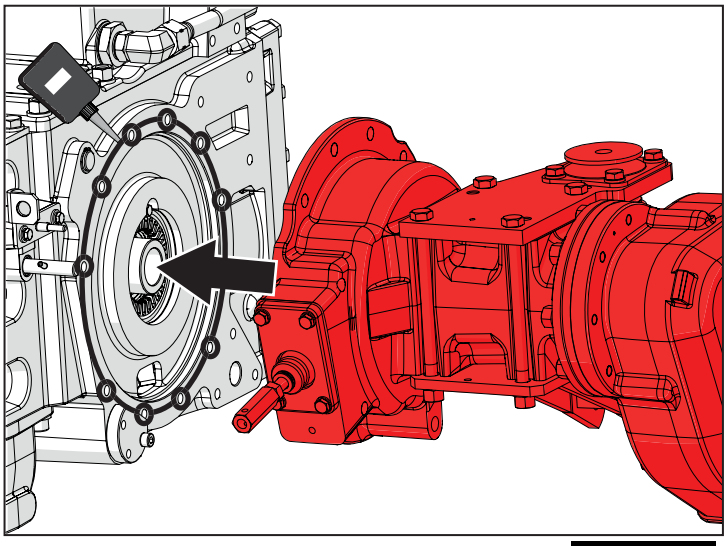


Fig. 10.13

Insert the washers (6) and tighten the screws (5) by applying 85 Nm (8.5 kgm) tightening torque.

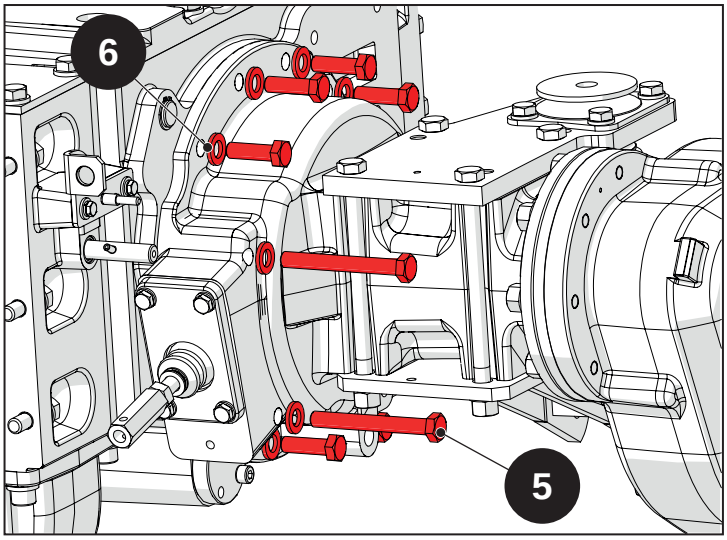


Fig. 10.14

5.2 Adjustment of the main brakes

To ensure that the main brakes function correctly, the braking action must occur after 35-40 mm free pedal travel.

Loosen the nut (D) and adjust the link (E) until the distance indicated above has been reached.

Tighten the nut (D).

> **Warning**
>
> Make sure that the braking action occurs simultaneously on both wheels. If this fails to occur, loosen the link of the wheel that brakes in advance.

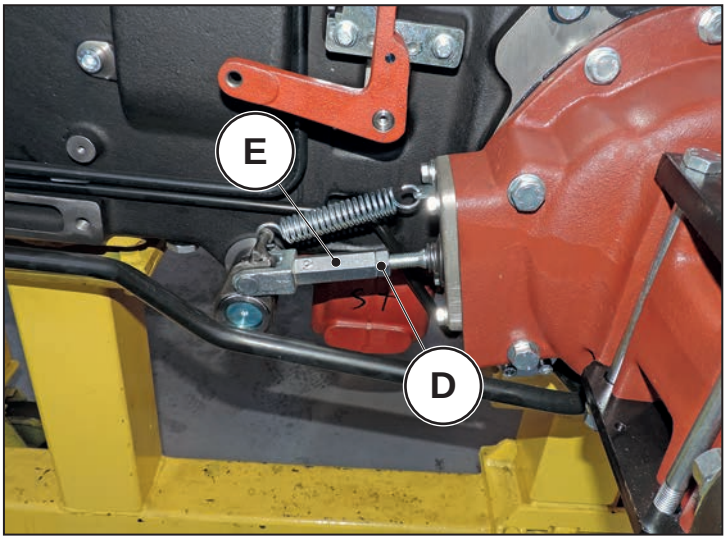


Fig. 10.15

Once the adjustments have been made, grease the internal bushes by means of the grease nipples (F).

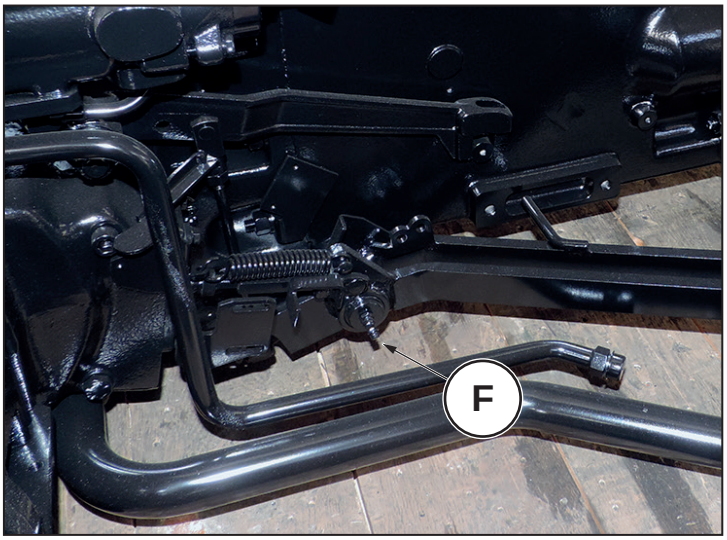


Fig. 10.16

The brake pedals must be about 15 cm away from the footboard.

Once the adjustments have been made, check that the idle travel of the pedals prior to the braking action is 30-35 mm.

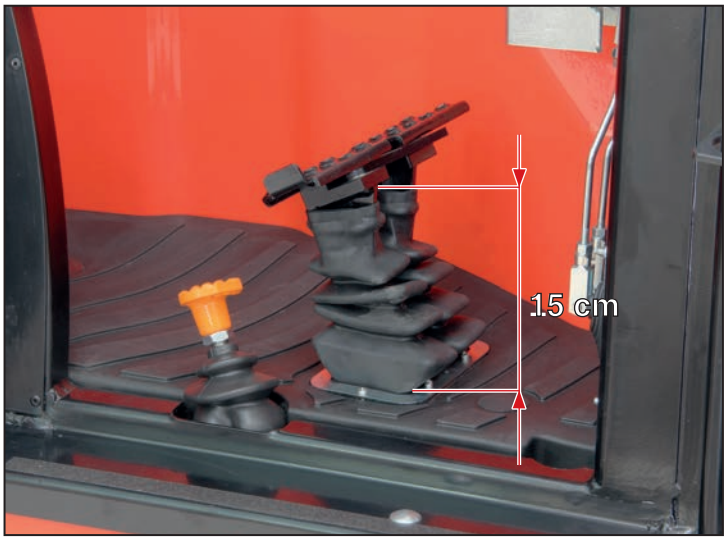


Fig. 10.17

5.3 Adjustment of the parking and emergency brake

Check the relative control lever must be adjusted so as to ensure that the parking brake functions correctly.

Adjust the control lever (A) by calculating a maximum travel of 6-7 positions (clicks).

Tighten the nut (B) that fixes the block.

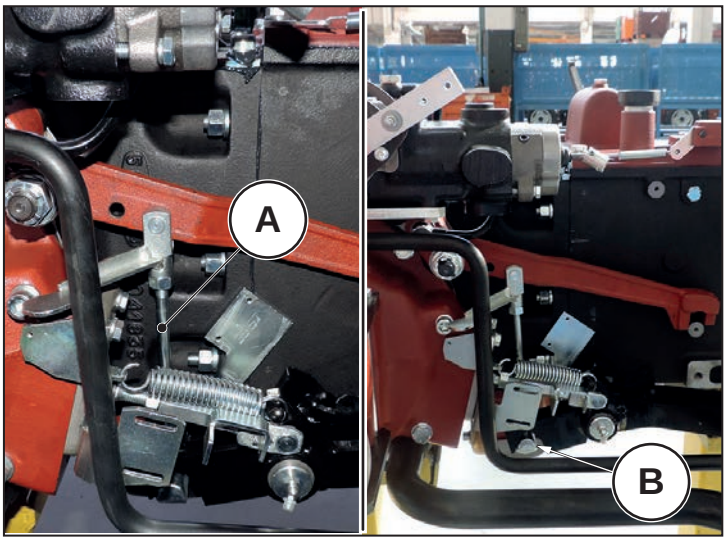


Fig. 10.18

Section 6 : Tightening torques

Index

6.1 Tightening torques.....10-20

6.1 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	Nm	kgm

Section 7 : Tools required

Index

7.1 Tools required 10-22

7.1 Tools required

Code	Description	Quantity

Chapter 11 : Front power take-off

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3.1 Technical specifications 11-8

Section 4 : Disassembly 11-9

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Section 5 : Work on the assembly 11-11

5.1 Clutch adjustment 11-12

5.2 Clutch plate shimming 11-15

Section 6 : Tightening torques 11-19

6.1 Tightening torques 11-20

Section 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.

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.

Section 2 : General introduction

Index

2.1 Drawing of the assembly 11-4

2.1 Drawing of the assembly

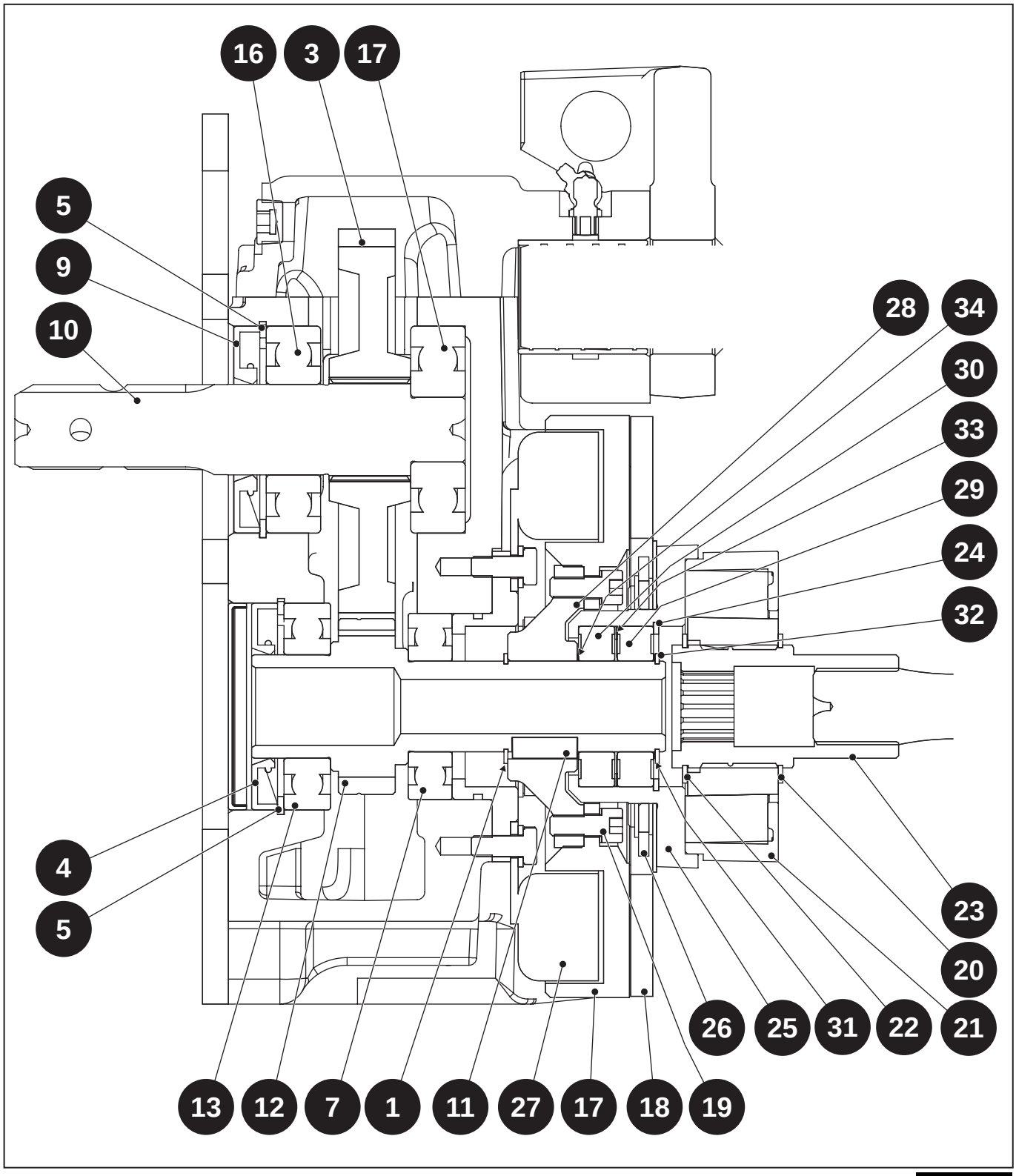


Fig. 11.1

1 - Circlip
2 - Bearing
3 - P.T.O gear
4 - Oil retainer
5 - Circlip
6 - Spacer
7 - Bearing
8 - Spacer
9 - Oil retainer
10 - Front P.T.O. shaft
11 - Feather key
12 - Shaft
13 - Bearing
14 - Spacer
15 - Spacer
16 - Bearing
17 - Front P.T.O. disc
18 - Disc
19 - Screw
20 - Circlip
21 - Flexible coupling
22 - Circlip
23 - Sleeve
24 - Circlip
25 - Bearing hub
26 - Threaded spacer
27 - Clutch magnet
28 - Flange
29 - Screened bearing
30 - Screened bearing
31 - Shims
32 - Circlip
33 - Shim
34 - Shim

Section 3 : Technical specifications

Index

3.1 Technical specifications 11-8

3.1 Technical specifications

Type	Independent single-shaft
Speeds independent from ground speed	1000 rpm
Direction of rotation (viewing the PTO)	Anticlockwise
Profile	1-3/8" with 6 splines
Clutch	Electromagnetic
Clutch control	Electrical

Section 4 : Disassembly

Index

4.1 Preliminary operations 11-10

4.1 Preliminary operations

The air filter and support must be removed in order to access the P.T.O. unit.

See chapter "2- Engine".

Remove the plates.

Warning
If the plates are difficult to remove, the operation can be facilitated by raising the machine with the front axle slanting. The swinging movement will allow the components to be accessed.

Section 5 : Work on the assembly

Index

5.1 Clutch adjustment 11-12

5.2 Clutch plate shimming 11-15

5.1 Clutch adjustment

Adjustments must be made to ensure that the front P.T.O. functions correctly.

Use a thickness gauge to measure the distance between the discs (17) and (18), which must be between 0.6 and 1.2 mm.

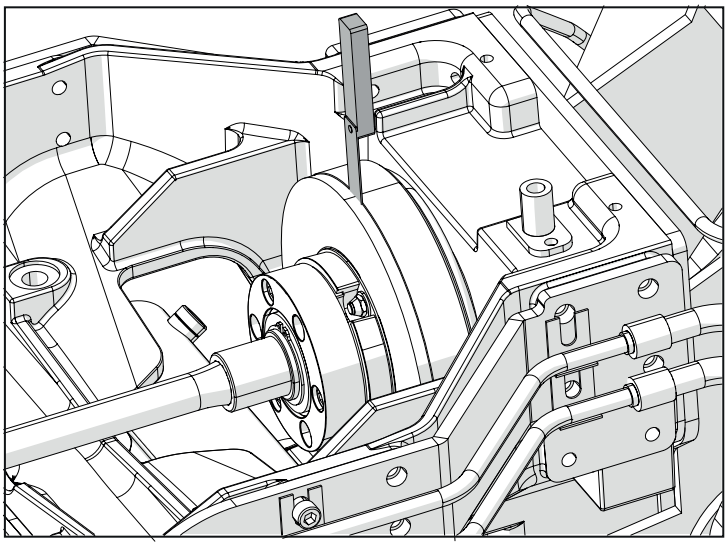


Fig. 11.2

Unscrew the screws (19) and remove the circlip (20).

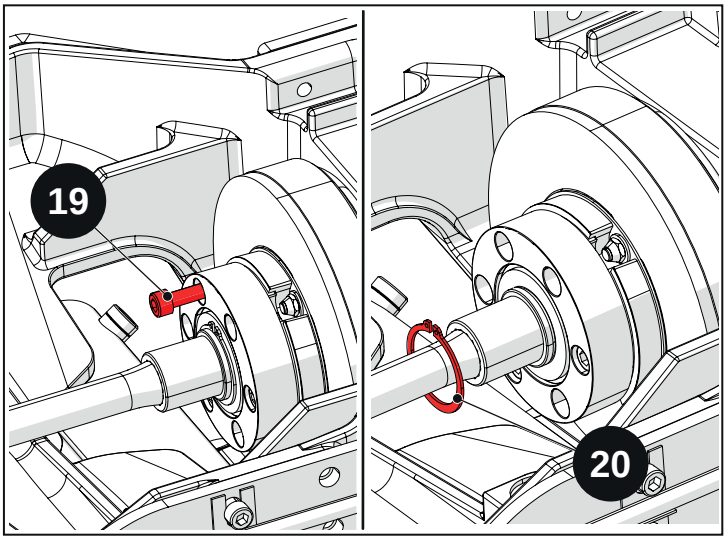


Fig. 11.3

Slide the flexible coupling (21) towards the engine and remove the circlip (22) from its housing.

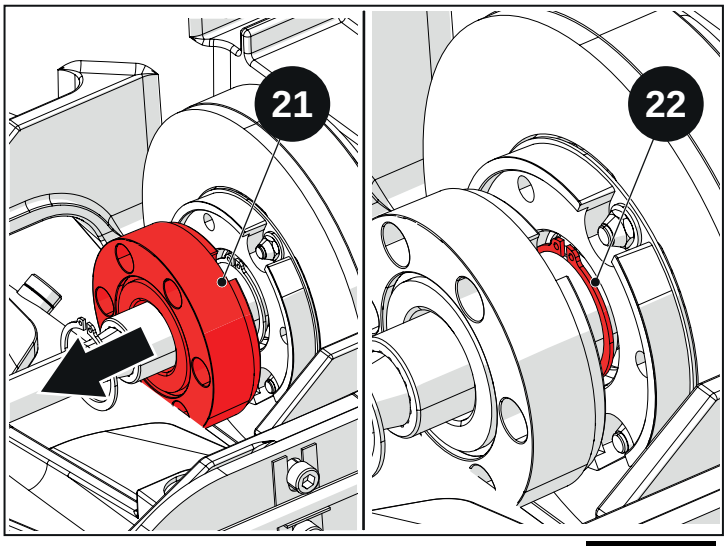


Fig. 11.4

Slide the keyed sleeve (23) towards the engine while holding back the coupling (21).

Remove the coupling (21).

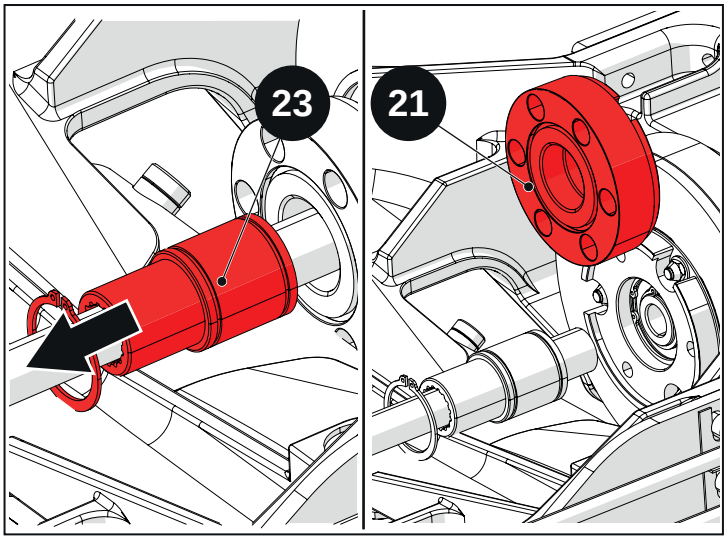


Fig. 11.5

Remove the circlip (32) and spacers (31). Remove the bearing hub (25) complete with threaded spacer (26) and disc (18).

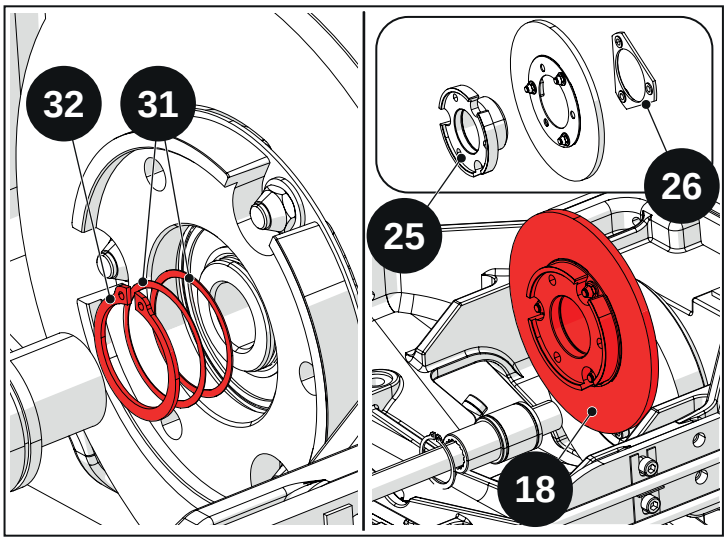


Fig. 11.6

Remove the circlip (24), bearing (29) and the spacers (33) of bearing (30) from the hub.

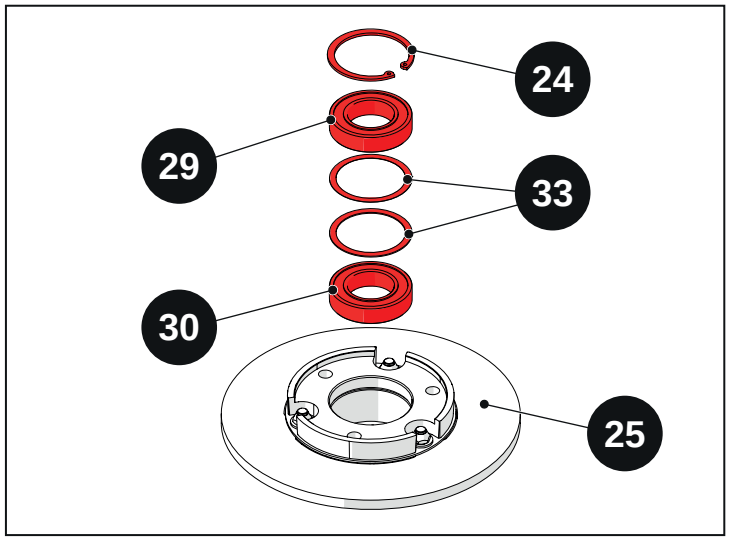


Fig. 11.7

Remove the spacers (34)

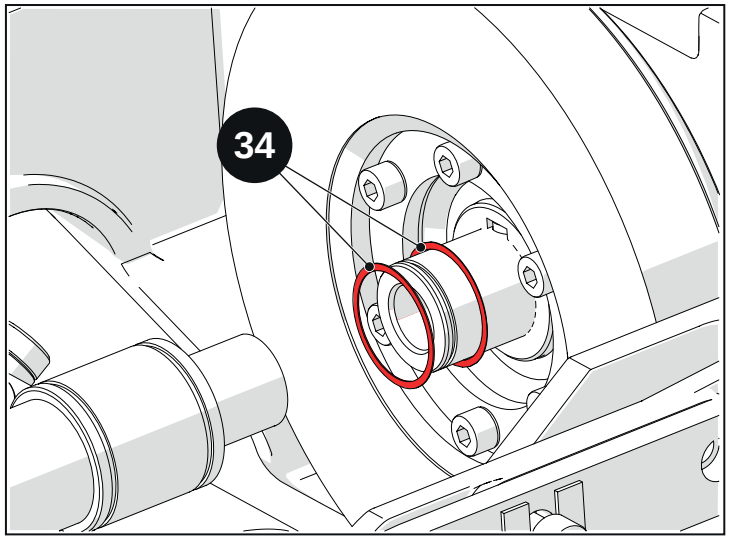


Fig. 11.8

Measure and make a note of the thickness of the disc (18).

Warning

Replace the clutch if the thickness of the disc (18) is less than 6.4 mm.

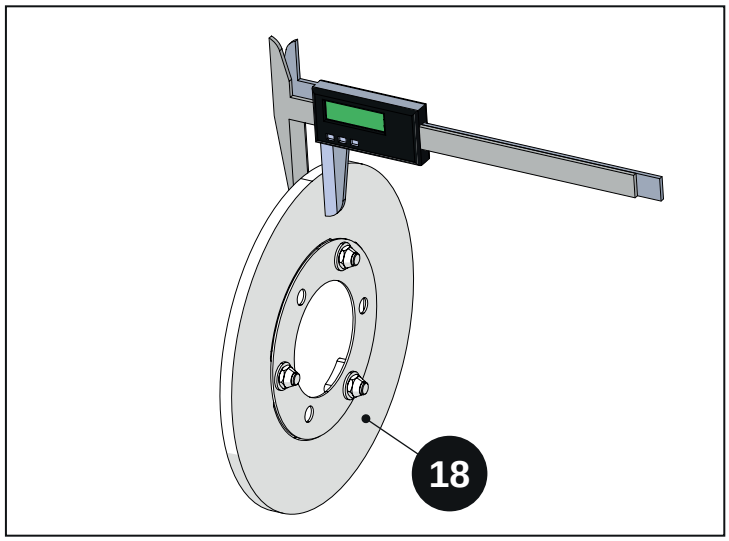


Fig. 11.9

5.2 Clutch plate shimming

Warning

It may be necessary to replace the discs (18) and (17) or flange (28) if the feather key has broken (11) or for other reasons.

Shimming must be performed whenever the discs (17), (18) and flange (28) are replaced.

Assemble the bearing hub (25) with the disc (28) and threaded spacer (26).

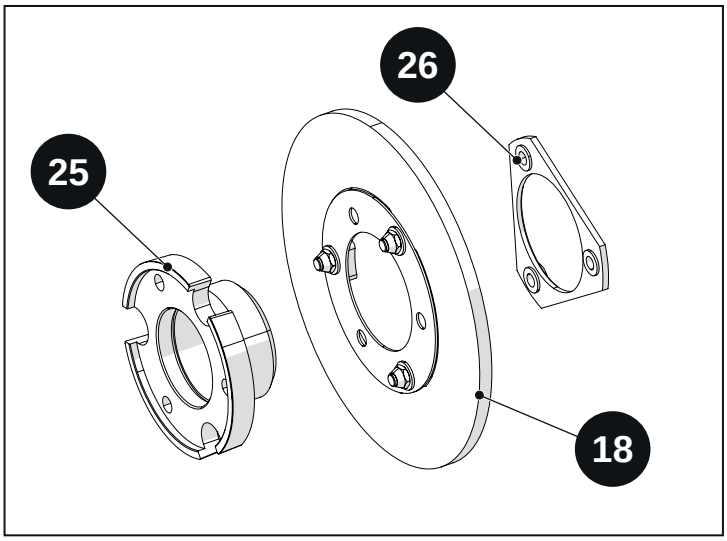


Fig. 11.10

Insert the screened bearings (29) and (30) onto the hub together with the shims (31).

Warning

The number of shims inserted must completely eliminate the play of bearings (29) and (30).

Lock the bearings with the circlip (24).

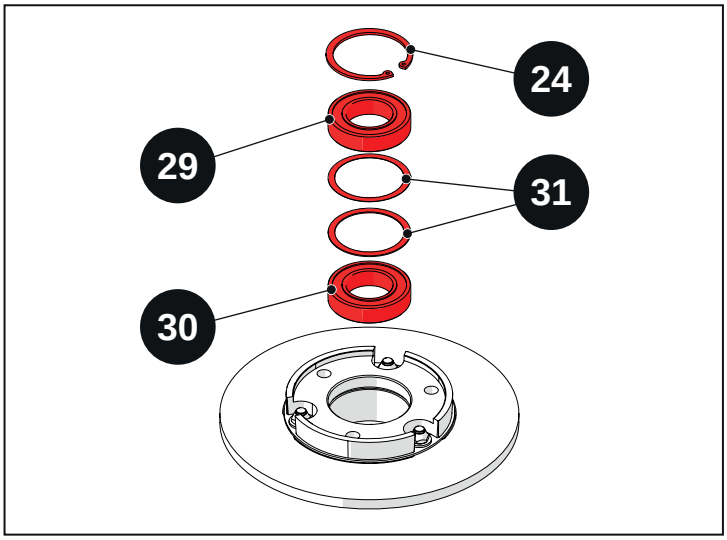


Fig. 11.11

Using a tube of a width suited to the bearings, assemble the complete hub (28), the clutch magnet (27), disc (17), and insert the previously removed spacers (34).

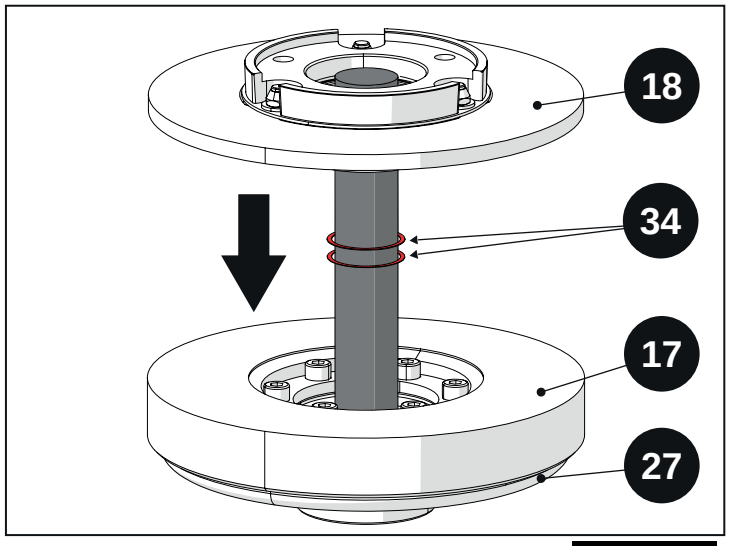


Fig. 11.12

Use a thickness gauge to measure distance Y between the discs (17) and (18), which must be between 0.6 and 0.8 mm.

Warning

Increase or reduce the thickness of the spacers (34) if the value of distance Y fails to comply with the parameters.

Warning

After having assembled the moving part, check again to make sure that the value of Y is within the parameters.

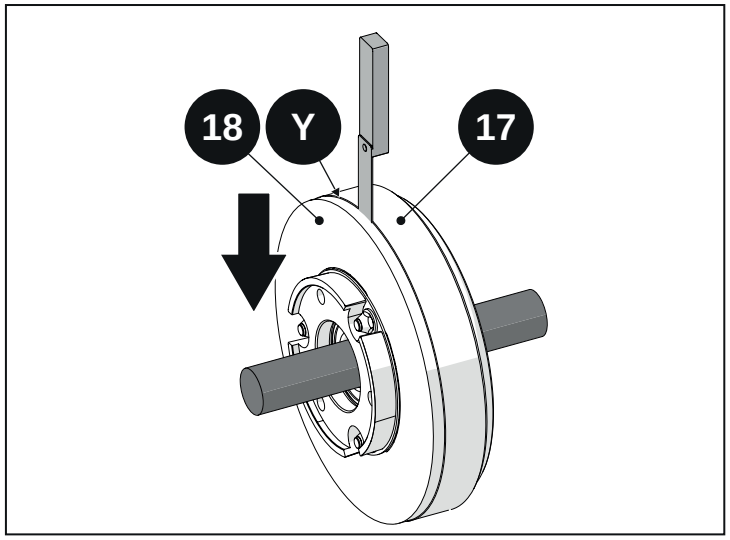


Fig. 11.13

Proceed with the reassembly operations by inserting the discs (17) and (18), the spacers (31) and circlip (32).

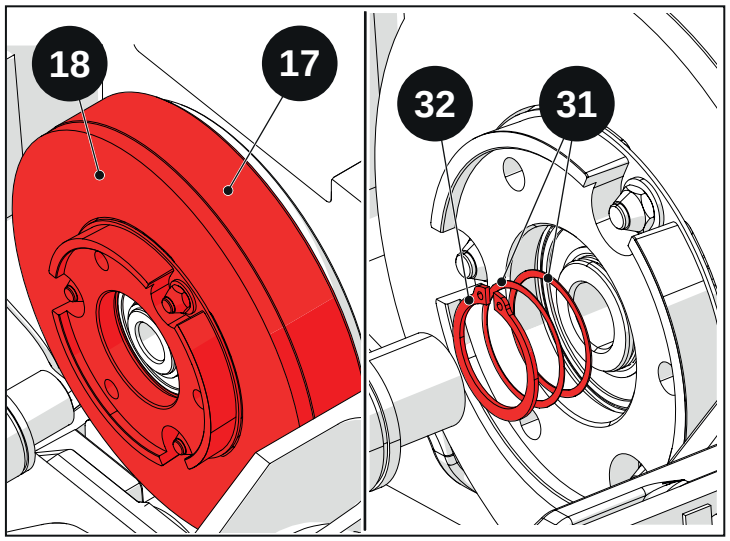


Fig. 11.14

Assemble the flexible coupling (21) with the sleeve (23) and lock it in place with circlips (20) and (22).

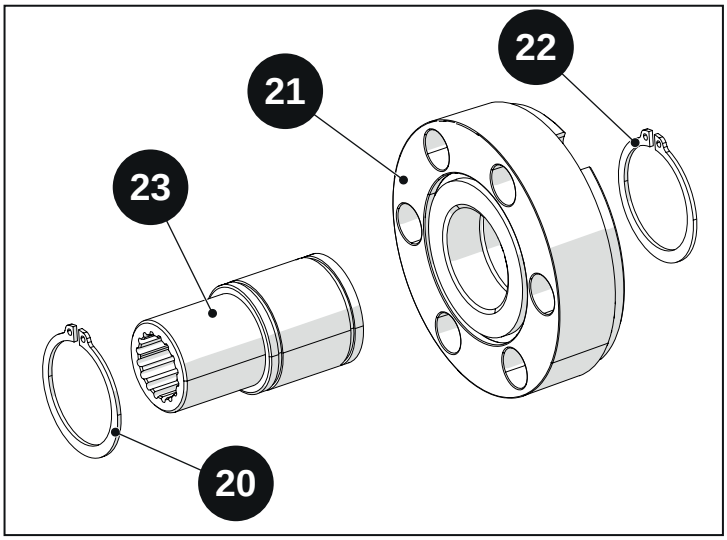


Fig. 11.15

Apply a layer of LOCTITE 5922 inside the sleeve (23) to eliminate the play between the teeth and prevent vibrations.

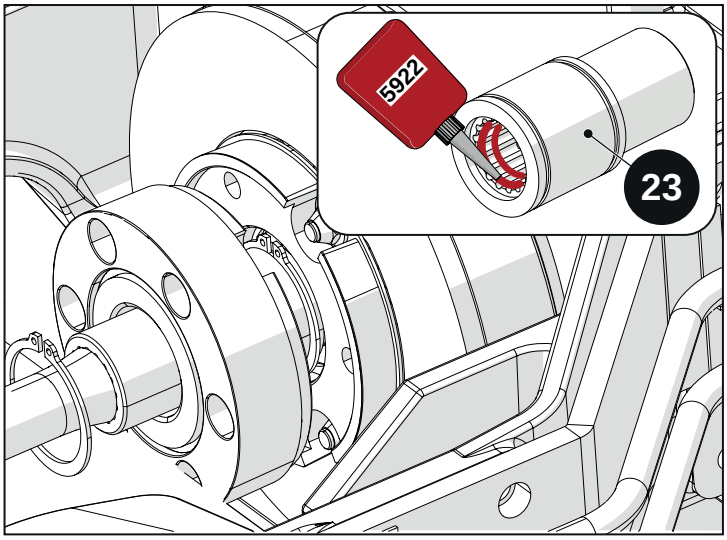


Fig. 11.16

Apply a layer of LOCTITE threadlocker to the screws (19) then tighten them by applying 30 Nm (3 kgm) tightening torque.

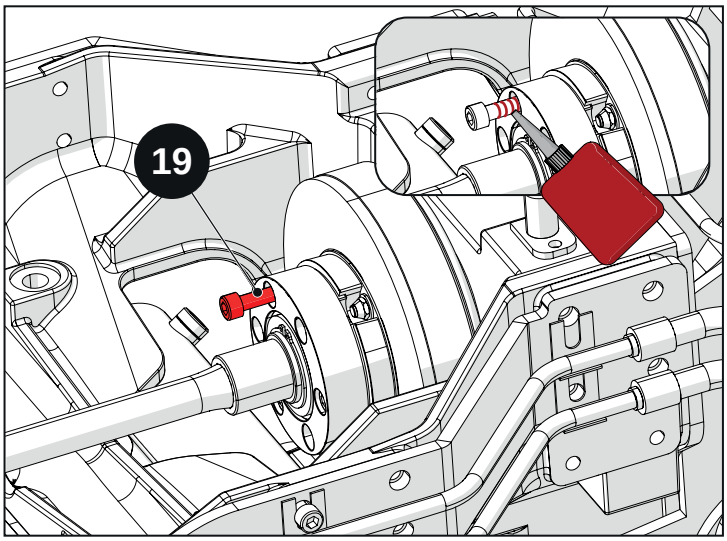


Fig. 11.17

After having reassembled the unit, check again to make sure that the distance between discs (17) and (18) is between 0.6 and 1.2 mm.

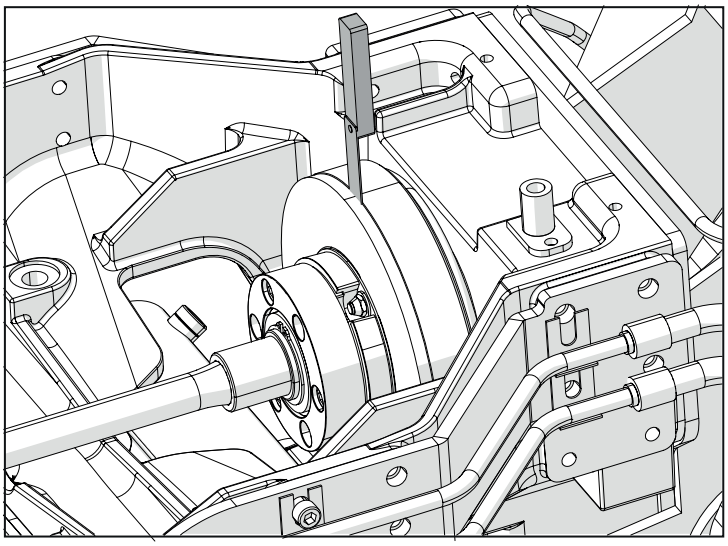


Fig. 11.18

Section 6 : Tightening torques

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6.1 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	Nm	kgm
Electromagnetic flange screw	25	2.5
Damper fixing screw	30	3
Coil fastening screw	20	2
Clutch fixing screw	40	4

Chapter 12 : Hydraulic circuit

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Section 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

Do not begin work until the pressure in the hydraulic circuit has dropped to zero.

Danger

Splashes of fluid under pressure can penetrate under the skin and cause serious injuries. If accidents occur, immediately seek medical help in order to avoid serious infections.

Danger

Always comply with the operating instructions supplied by the manufacturer when using adhesive materials or detergents.

Danger

Take care to avoid burns when working with boiling oil. Never heat oil to temperatures exceeding 190°C as the oil or its vapours could suddenly catch fire.

Caution

Used oil must be collected and disposed of in compliance with the anti-pollution laws in force.

Section 2 : General hydraulic circuit

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2.1 Basic version

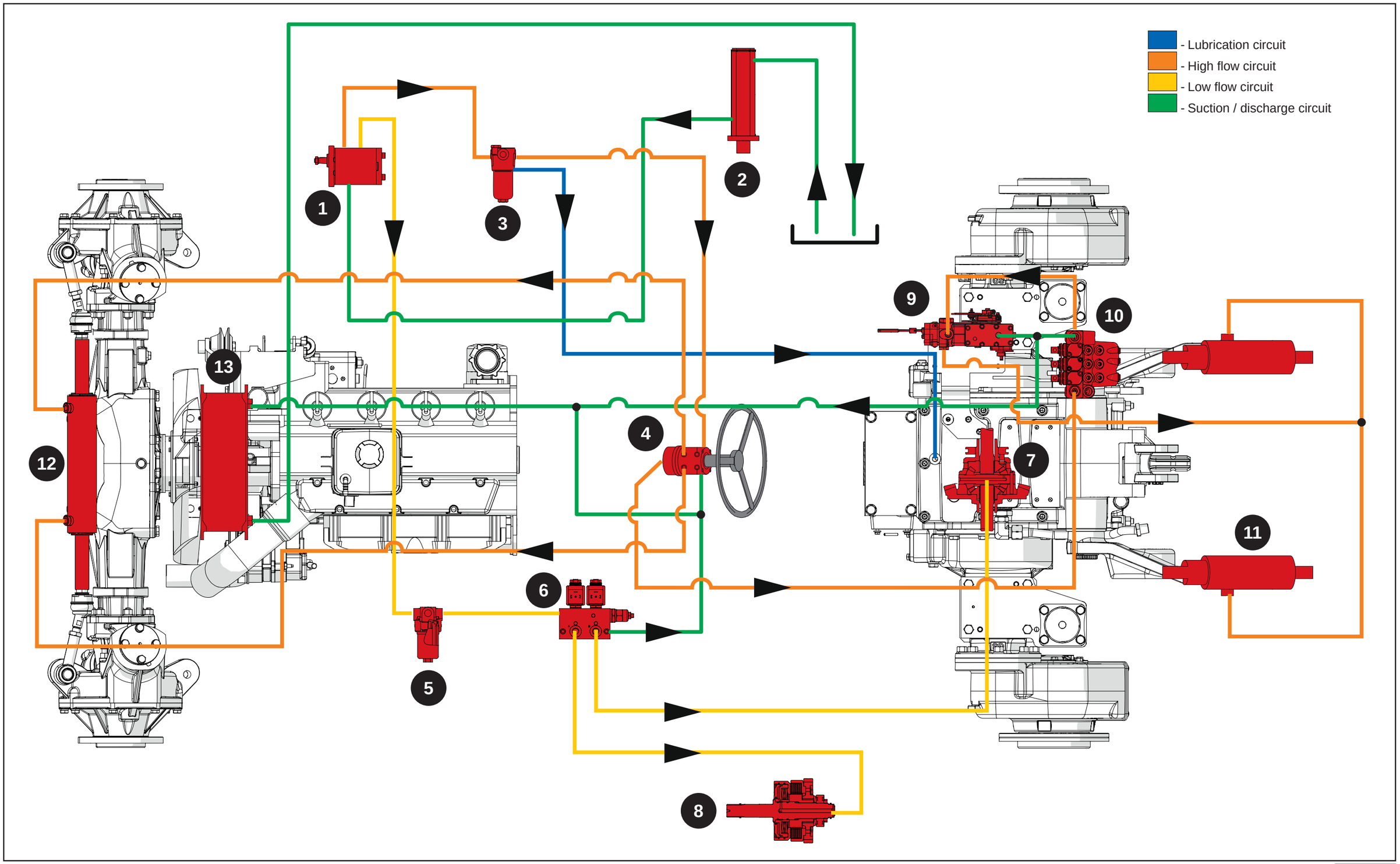


Fig. 12.1

1 - Hydraulic pump
2 - Intake filter
3 - High flow circuit delivery filter
4 - Power steering system
5 - Low flow circuit delivery filter
6 - Hydraulic power pack
7 - Rear differential lock
8 - Four-wheel drive
9 - Rear hitch valve system
10 - Rear auxiliary control valves
11 - Hitch cylinders
12 - Steering cylinders
13 - Oil heat exchanger

2.2 Full Optional version

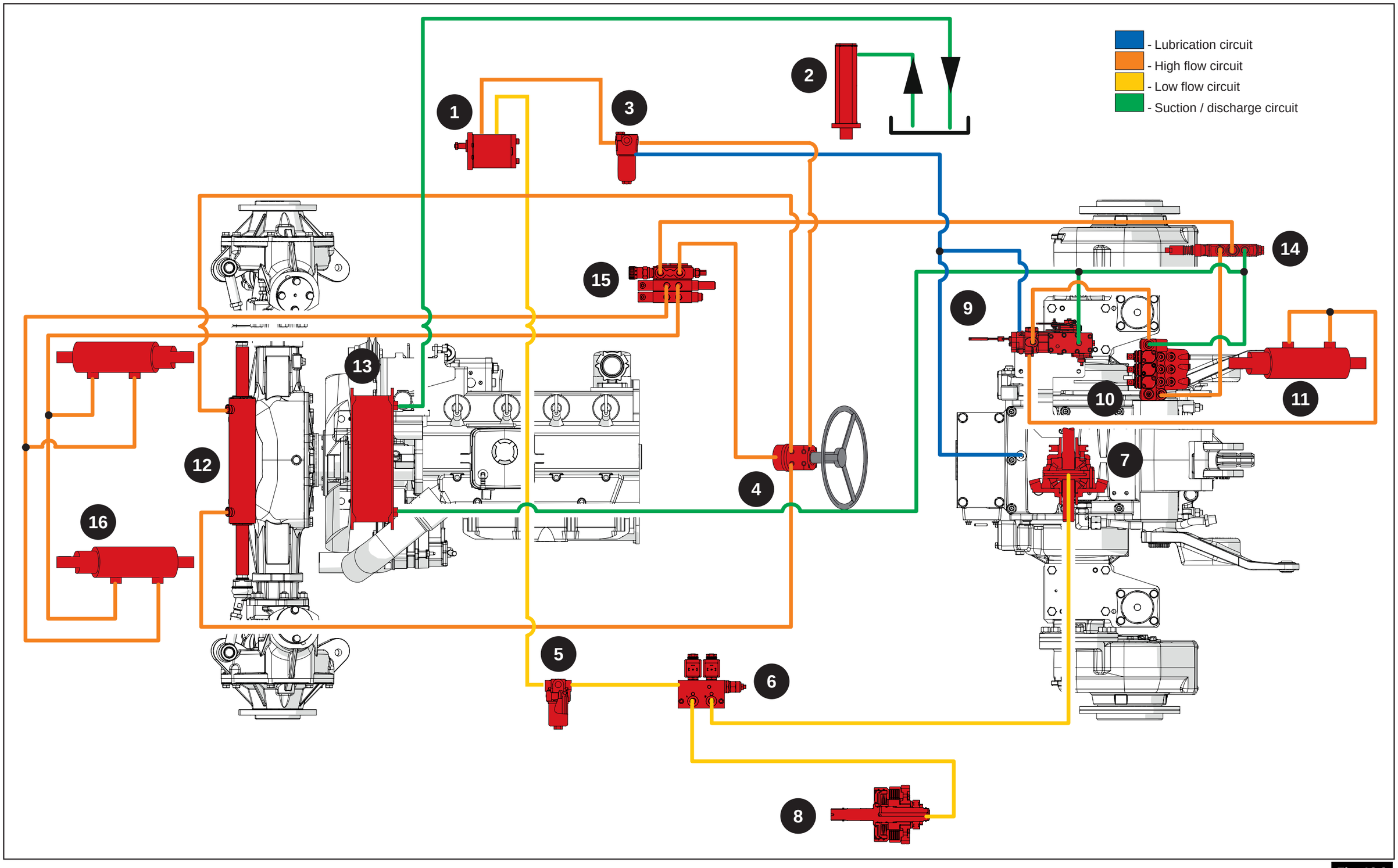


Fig. 12.2

1 - Hydraulic pump
2 - Intake filter
3 - High flow circuit delivery filter
4 - Power steering system
5 - Low flow circuit delivery filter
6 - Hydraulic power pack
7 - Rear differential lock
8 - Four-wheel drive
9 - Rear hitch valve system
10 - Rear auxiliary control valves
11 - Rear hitch cylinders
12 - Steering cylinders
13 - Oil heat exchanger
14 - Trailer brake valve
15 - Front supplementary control valves with flow rate governor
16 - Front hitch cylinders

2.3 General description

The hydraulic circuit consists of two separate circuits supplied by a double tandem pump controlled by the gears of the timing system. A filter on the intake filters the oil drawn in by the pumps. Another 2 filters on the delivery side are installed upstream of the pumps.

The priority valve installed on the power steering system draws oil from the main pump for priority supply of the steering system.

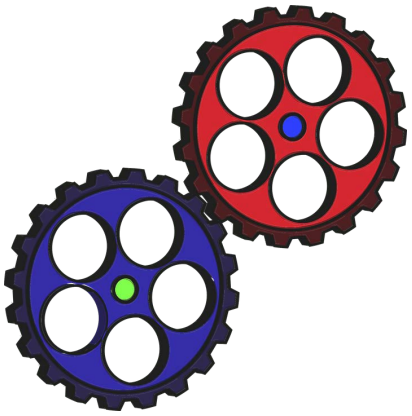
After this, oil is supplied to the supplementary control valves and rear hitch. The setting of the relief valve in the inlet flange of the control valve unit is 180 bar while that of the hitch valve system is 210 bar.

Oil that is not used by the hitch and supplementary control valves is cooled by a heat exchanger before being re-circulated in the gearbox.

The secondary circuit supplies the hydraulic power pack, which energizes and de-energizes the solenoid valves that engage the diff lock and four-wheel drive. The solenoid valve that engages the four-wheel drive is energized when the tractor engine is turned on, while that of the diff lock activates a hydraulic piston so as to move the mechanical engaging lever.

Part of the oil is drawn by means of a throttle on the delivery circuit of the high flow circuit and used for lubricating the gearbox.

In the Full Optional version, the front supplementary control valves and trailer brake valve are supplied immediately after the power steering system. Besides the standard lubrication, there is a throttle for lubricating the bearings immediately after the hitch valve system.



Section 3 : Hydraulic circuit of the hitch

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3.4 Control valve system operation 12-14

3.1 Technical specifications

Pump

	Main pump	Secondary pump
Direction of rotation (viewing the driving shaft)	Left	
Swept volume	14.53 cc/rev	1.60 cc/rev
Pump supply pressure range	0.7 - 3 bar abs.	
Max. continuous pressure	250 bar	260 bar
Intermittent max. pressure	280 bar	280 bar
Peak max. pressure	300 bar	290 bar
Maximum speed	650 rpm	
Minimum speed	3500 rpm	
Minimum temperature	-15 °C	
Continuous maximum pressure	+110 °C	
Peak maximum temperature	+125 °C	

Power steering system

Manufacturer	Sauer Danfoss
Maximum steering pressure	110-115 bar
Priority control valve	4 bar

Intake filter

Filtering degree	90 micron

Low flow circuit delivery filter

Filtering degree	25 micron
Maximum operating pressure	110 bar
Operating temperature	-25 to +110 °C

High flow circuit delivery filter

Filtering degree	16 micron
Maximum operating pressure	420 bar
Operating temperature	-25 to +110 °C
Collapse pressure	20 bar
Bypass valve	6 bar ± 10 %

Supplementary control valves

Type of connection	Front and rear quick couplings
Calibration valve	180 bar

3.2 Hydraulic diagram

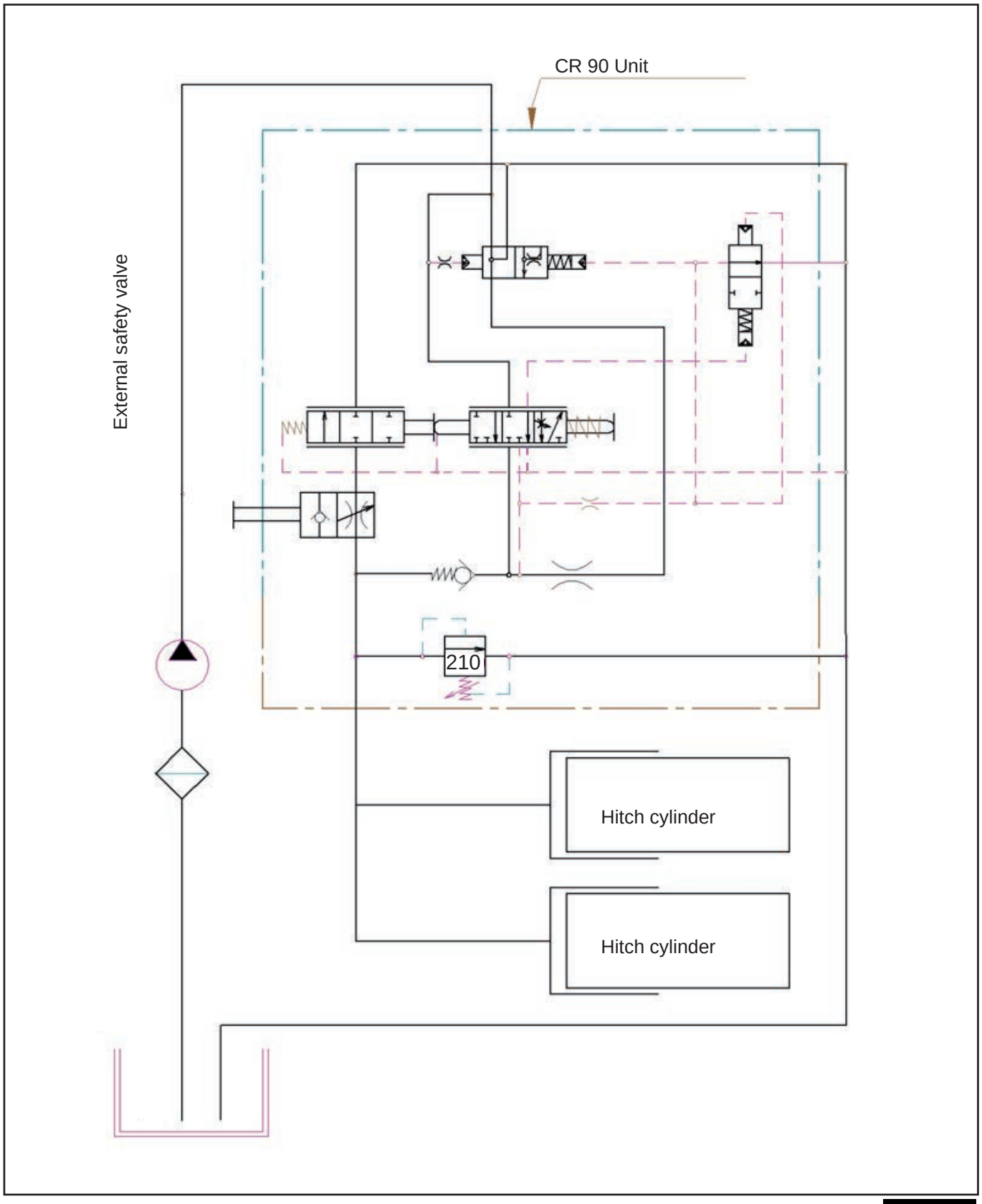


Fig. 12.3

3.3 Use of control levers

The two control levers enable the following operating conditions.

- position control;
- draft control;
- mixed position and draft control;

Each of these modes must be chosen according to the type of work required, the type of implement used and the surface consistency of the soil.

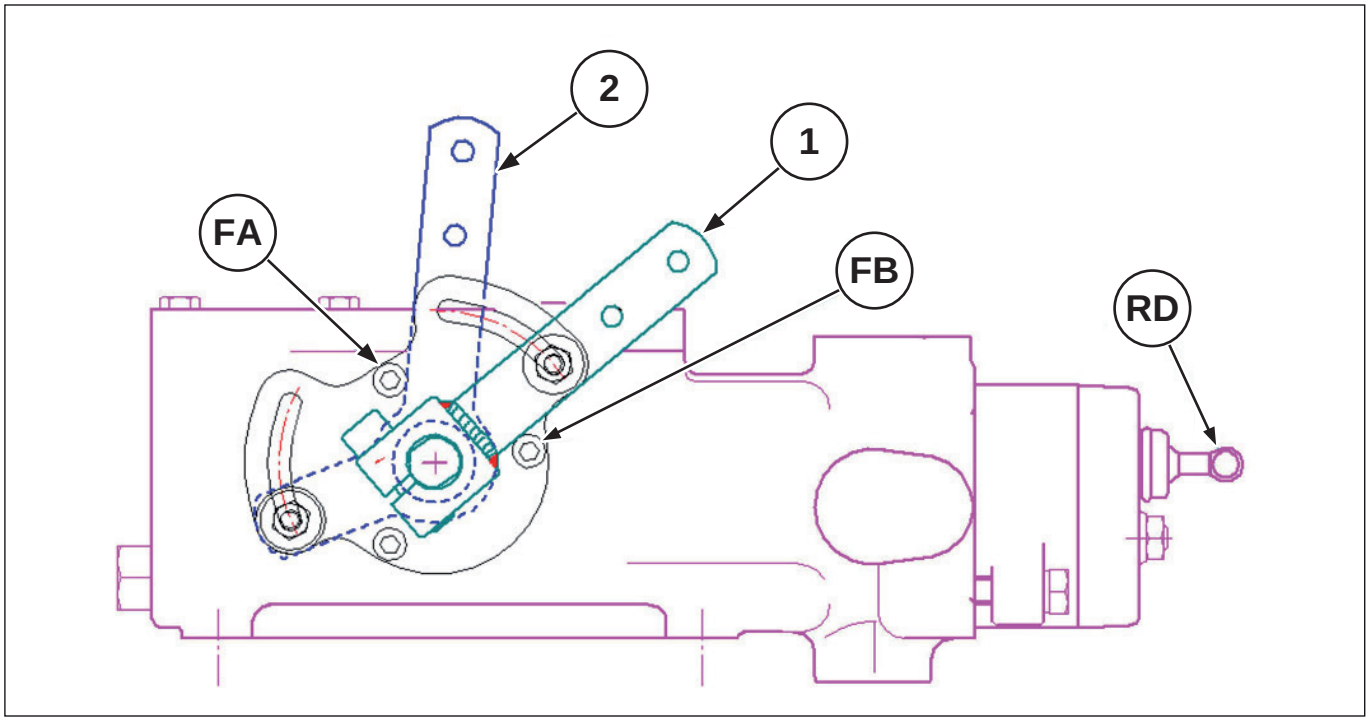


Fig. 12.4

A - Position control (lever 1)

In the POSITION CONTROL mode, the position of control lever 1 corresponds to the position of the lift links.

It is obtained by moving draft control lever 2 against stop FB. Establish the position of the implement, either in or out of the soil, by moving lever 1 towards stop FA to raise it, or towards stop FB to lower it.

B - Draft control (lever 2)

This operating mode is obtained by moving position control lever 1 against stop FB and setting the implement to the required depth by slowly moving lever 2 towards stop FB. In this adjustment each position of lever 2 corresponds to a certain draft or compression on the 3-point hitch.

C - Mixed position and draft control

The MIXED DRAFT AND POSITION CONTROL mode is useful in soils of varying consistency. The hitch operates in the draft control mode but meanwhile prevents the implement from digging excessively into softer soil and producing an uneven job.

Lower the implement into the soil and find the average tilling depth required as described for draft control. When the required depth has been reached, gradually move lever 1 towards stop FA until the hitch links tend to rise slightly.

3.4 Control valve system operation

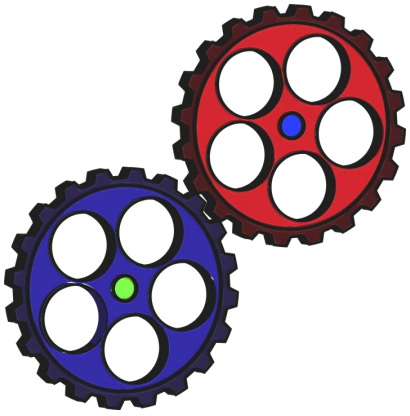
The valve system functions in three phases:

- A) NEUTRAL PHASE
- B) LOAD PHASE.
- C) DISCHARGE PHASE

A) NEUTRAL PHASE

During this phase, the control valve system maintains the oil in the cylinder pressurized so as to support the load, allowing oil from the pump to freely flow to the tank.

The position occupied by the control rod (1) during this phase allows chamber (26) of the pilot valve (27) to link directly to the outlet through hole (16). The pilot valve (27) then opens hole (28), which enables chamber (15) of the adjuster plunger (2) to communicate with the outlet through duct (29). This allows oil from the pump to supply chamber (22) so that regulator plunger (2) can open holes (17), through which the oil flows to the tank.



The oil in the cylinder (chamber (23) remains pressurized and supports the load applied to the lift links. The oil is actually held back by the check valve (3), by the discharge valve (4) and by the safety valve (5), which are all connected to the cylinder by means of the ring duct (18).

The safety valve (5) protects the cylinder from any over-pressure that may occur when the load swings during road transport.

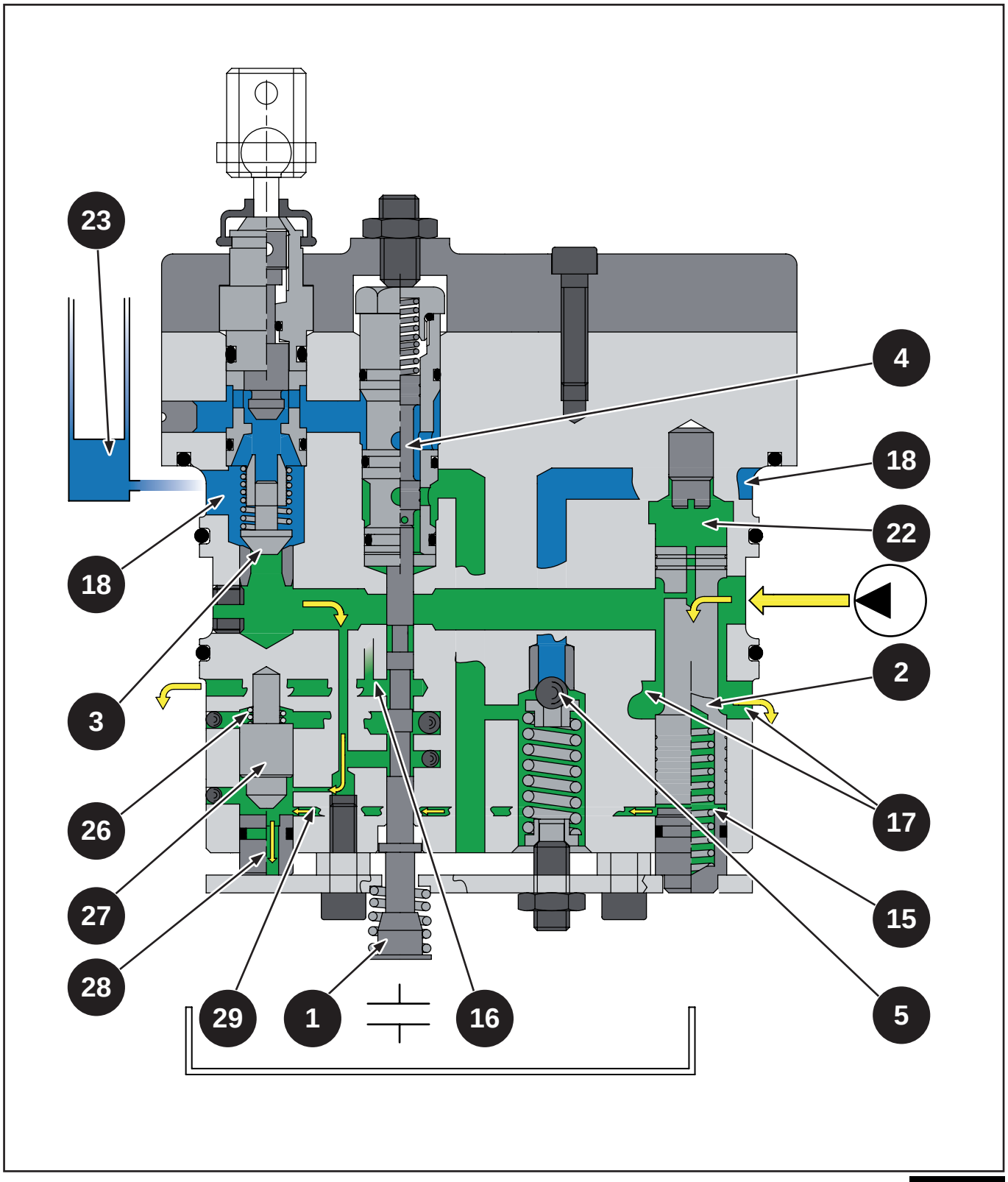


Fig. 12.5

B) LOAD PHASE

During the load phase, the valve system sends pressurized oil to the cylinder (chamber (23)), thus allowing the links to lift.

The position, which occupies the control rod (1) in this phase, allows oil from the pump to reach chamber (26) by means of the ring duct (19) and the holes (21), (20) and (30), and to lastly close the pilot valve (27).

Oil from the pump can supply, at the same pressure, chamber (22) and chamber (15) (through duct (29)) of the regulator plunger (2), which closes the discharge holes (17) thanks to the thrusting action of the return spring.

Pressurized oil flows to the ram from the ring duct (19), enters hole (20) through fixed throttle (6) and the variable throttle created by the control rod (1) with hole (21), opens the check valve (3) enters the ring duct (18) and supplies the ram chamber (23).

The plunger (2) regulates the oil that flows to the ram, since chambers (15) and (22) are affected by the difference in pressure created by the oil flowing through the variable throttle (31), which the control shaft (1) opens or closes, depending on its movement caused by the effect of the linkages in the hitch.

The excess oil flow is rejected by the lifting pressure of the lift links through holes (17), thus regulating the maximum lifting speed and allowing the lift links to slowly start and reach their position.

The maximum operating pressure is controlled by a safety valve on the hydraulic circuit, outside unit CR90 (on the supplementary control valves, for example).

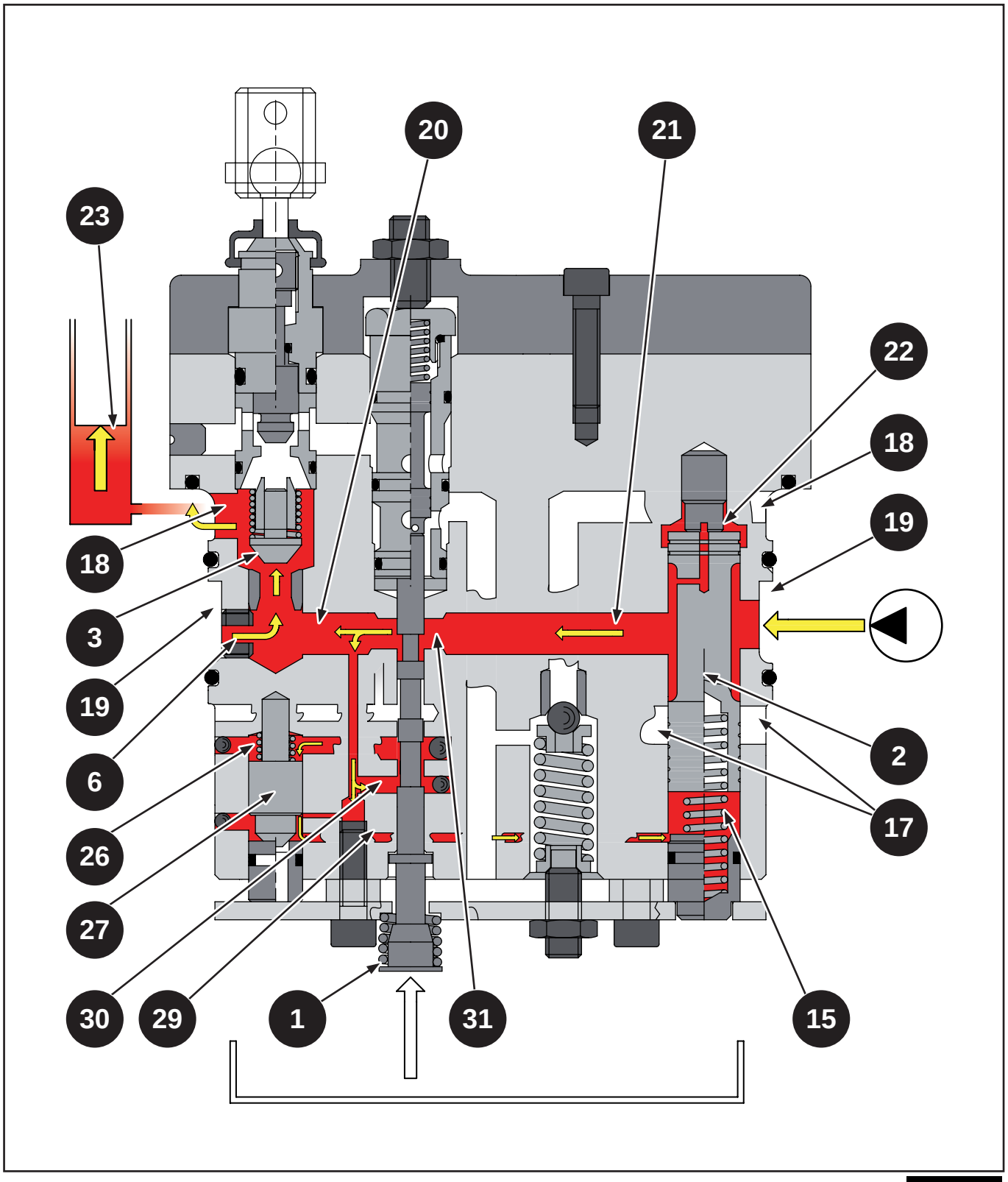


Fig. 12.6

C) DISCHARGE PHASE

During this phase, the valve system allows the oil from the pump and the oil from the ram chamber (23) to flow towards the outlet at the same time, thus lowering the hitch links.

The position of the control rod (1) allows the chamber (26) of the pilot valve (27) to connect straight to the outlet by means of hole (16). This enables the pilot valve to open the hole (28) and thus discharge the chamber (15) of the regulator plunger (2) through duct (29).

As in the neutral phase, the pump oil moves the regulator plunger towards the chamber (15). This opens the discharge holes (17) and allows the oil to flow towards the tank.

Meanwhile, the ram's pressurized oil (chamber (23)) flows into the ring duct (18), passes through holes (32) of the lowering regulator (8) and through hole (24), enters the discharge valve (4) and flows into the tank through hole (25), thus lowering the links.

In this phase, the lowering speed of the links can be regulated with the hand lever (RD): screw in to reduce the lowering speed).

For road transport, there is a safety function against accidental manoeuvres with the hitch's control levers. It is obtained by fully screwing in the lever (RD) so as to move the valve (8) tight against its housing and shut off the passage between chamber (23) of the ram and the discharge valve (4).

When this safety function is operating, the ram is always protected against accidental overpressure by the safety valve (5).

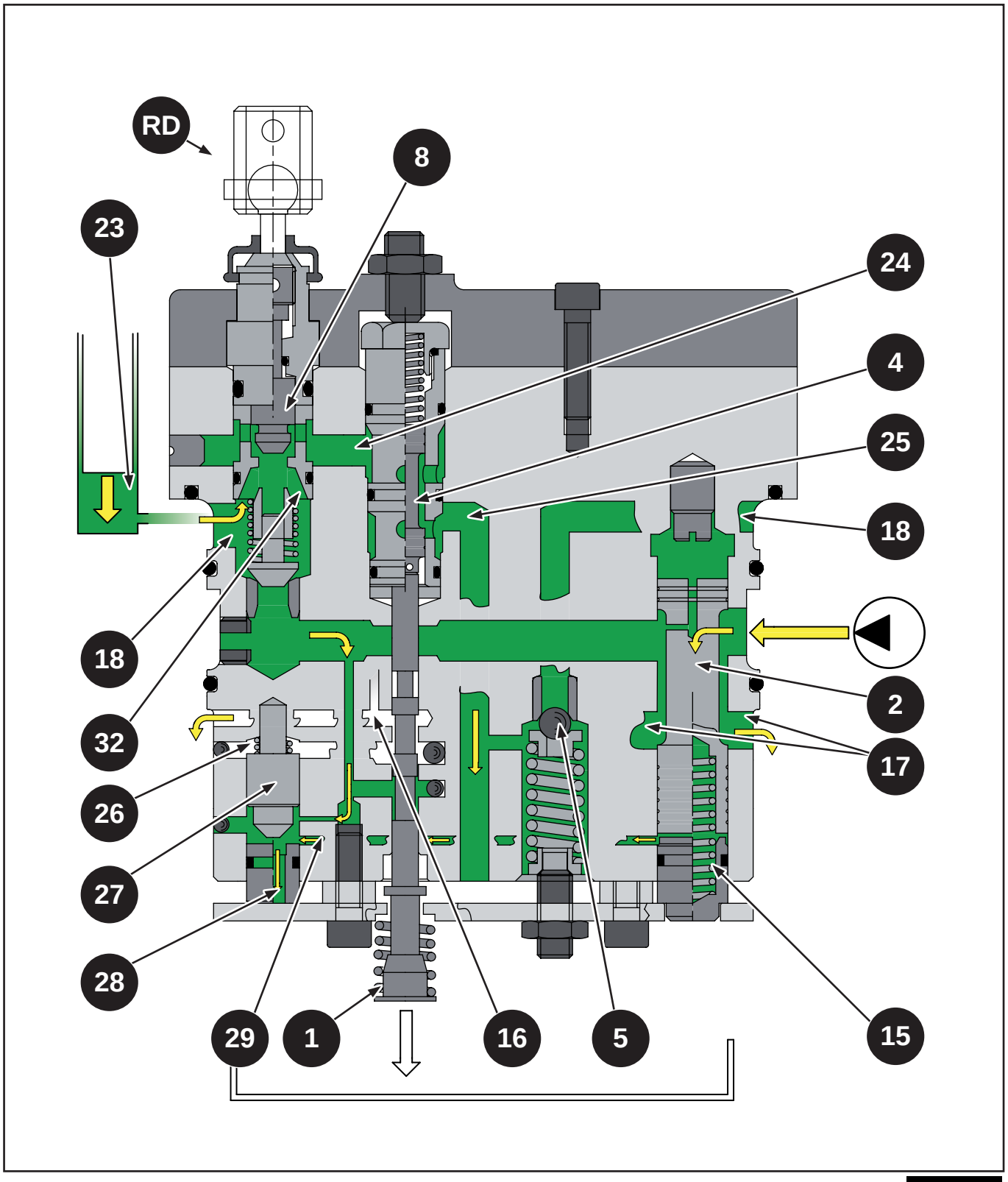


Fig. 12.7

Section 4 : Hitch with position and draft control

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4.1 General introduction

4.1.1 Main diagram

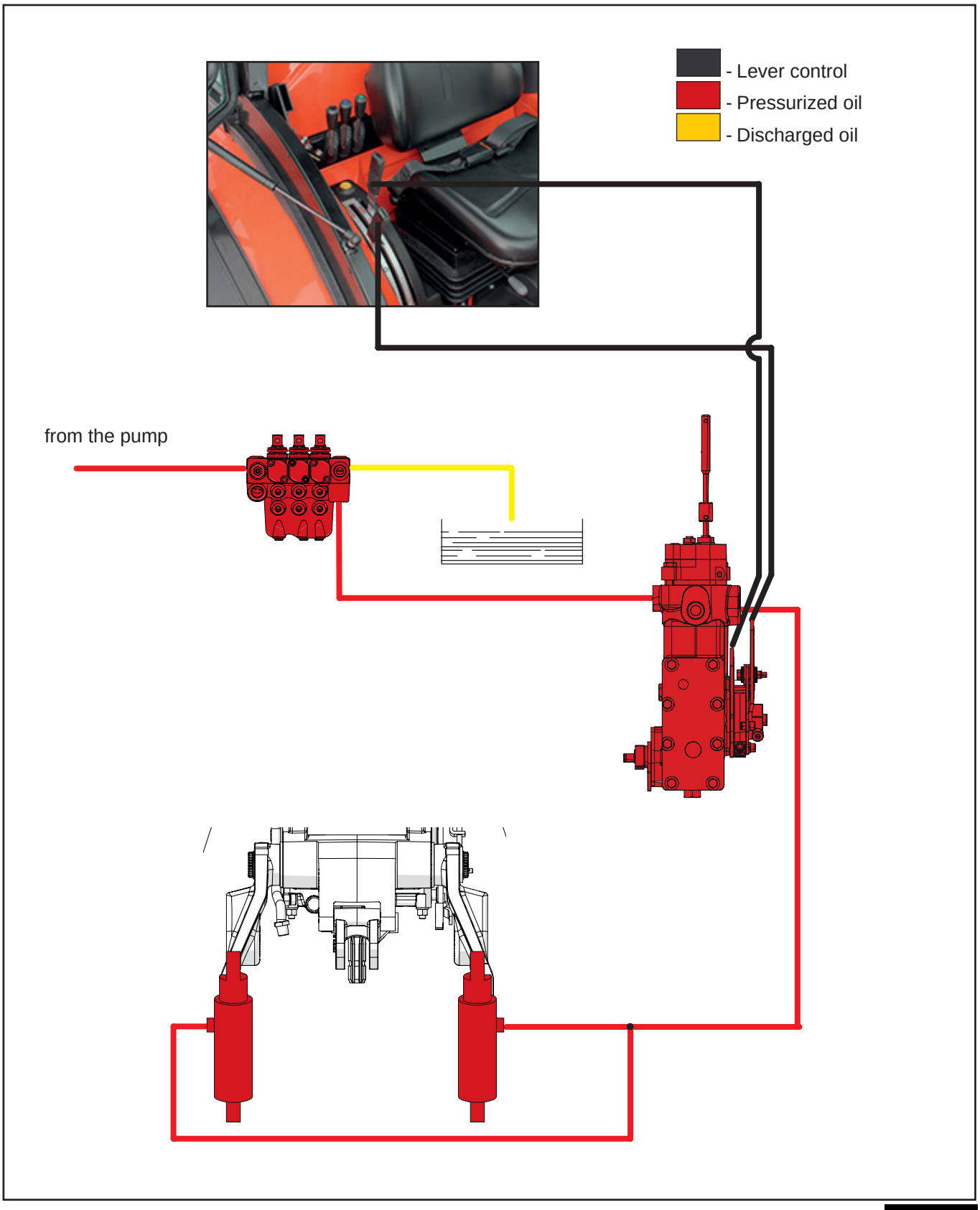


Fig. 12.8

4.1.2 Control levers

The draft and position control hitch can be used in the following conditions:

- position control;
- draft control;
- mixed position and draft control;
- floating mode.

These conditions can be obtained with the combined use of the position control lever (1) and draft control lever (2).

The position and draft control hitch control levers are installed on the right-hand side of the driver, alongside the seat.

(1) - Position control lever
(2) - Draft control lever
(3) - Lever to adjust the lowering speed of the hitch links. Turn the knob clockwise to reduce the lowering speed. Turn it anti-clockwise to increase the speed.

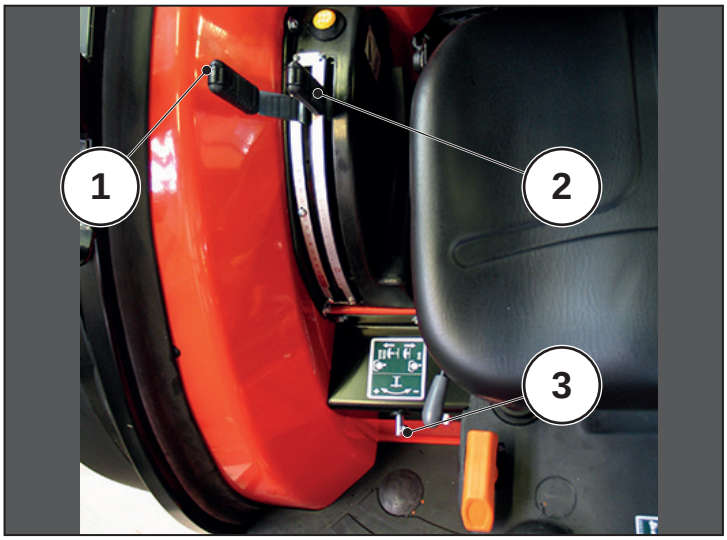


Fig. 12.9

4.1.3 Operating modes

POSITION CONTROL

The position control mode allows the implement to be set at a determined position at any point between the highest and lowest one, both in and out of the soil, depending on the position to which the control lever is set (1).

Proceed as described below:

- Lever (1) is used to control the position of the links. Each position of the lever corresponds to a position of the hitch links, from fully raised (lever fully back) to fully lowered (lever fully forwards).
- Move the draft control lever (2) fully forwards.
- Move the position control lever (1) forwards to lower or back to lift.

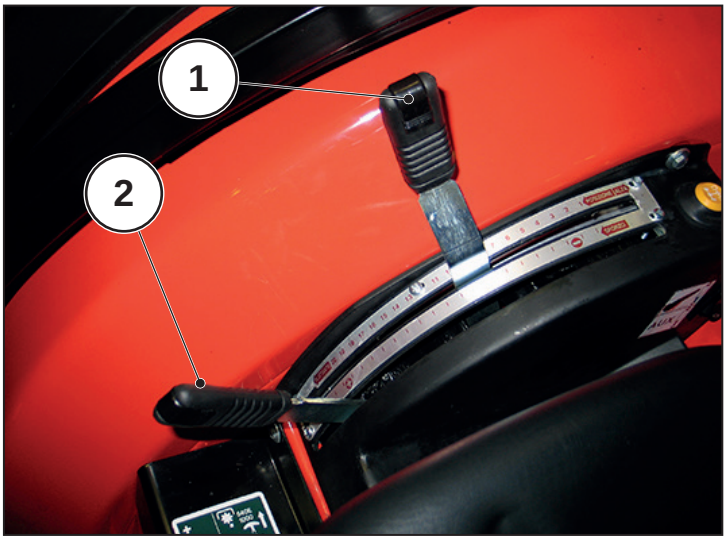


Fig. 12.10

The depth at which the implement works will not change even if it encounters soil of a different consistency (example: zone c = clayey soil; zone d = sandy soil; zone e = compact soil).

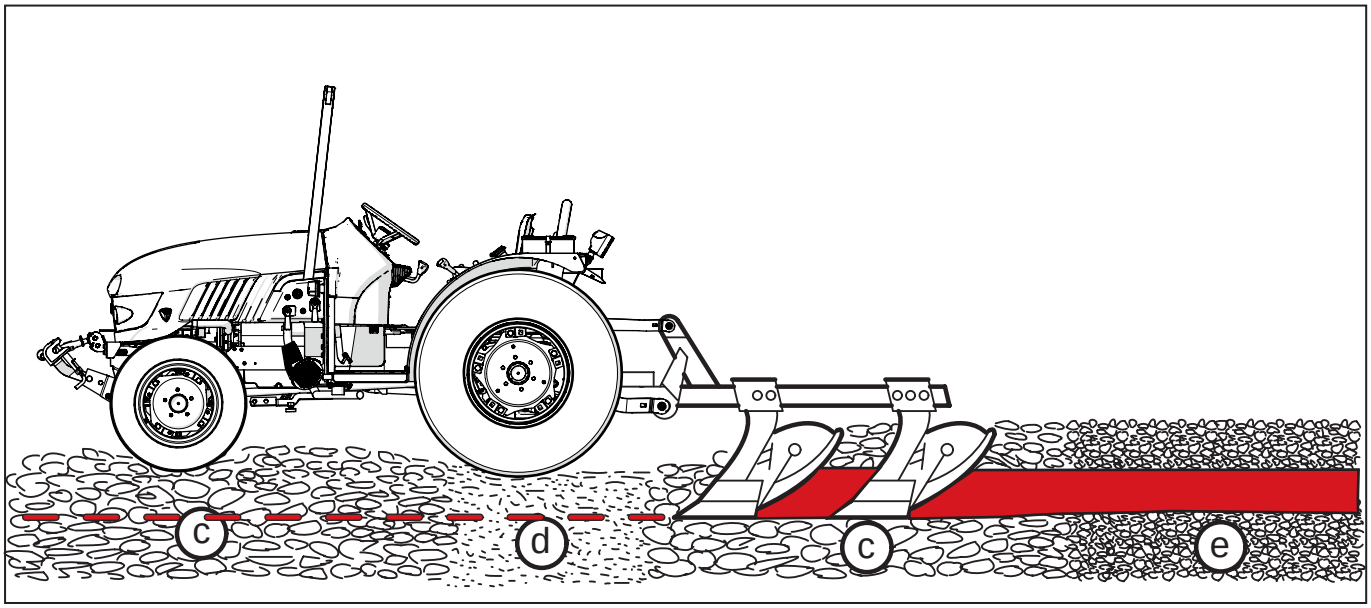


Fig. 12.11

DRAFT CONTROL

Use of the draft control mode is particularly helpful during work that requires considerable lugging power performed with mounted implements, since these transfer most of this lugging power to the rear wheels, thus increasing the tractor's wheel grip.

In this operating mode, the depth at which the implement works may change to a considerable degree if it encounters soil of a different consistency (e.g.: zone c = clayey soil; zone d = sandy soil; zone e = compact soil), whether the ground surface is flat or with humps and hollows.

Proceed as described below:

- Move the draft control lever (1) fully forwards.
- Gradually move the draft control lever forwards (2) until the implement digs into the soil down to the required depth. The depth reached by the implement is proportional to the tractive effort determined by the consistency of the soil. The tractive force required from the tractor is automatically kept constant in these conditions by the hitch.
- Lift the implement at the end of each run by means of the position control lever (1).

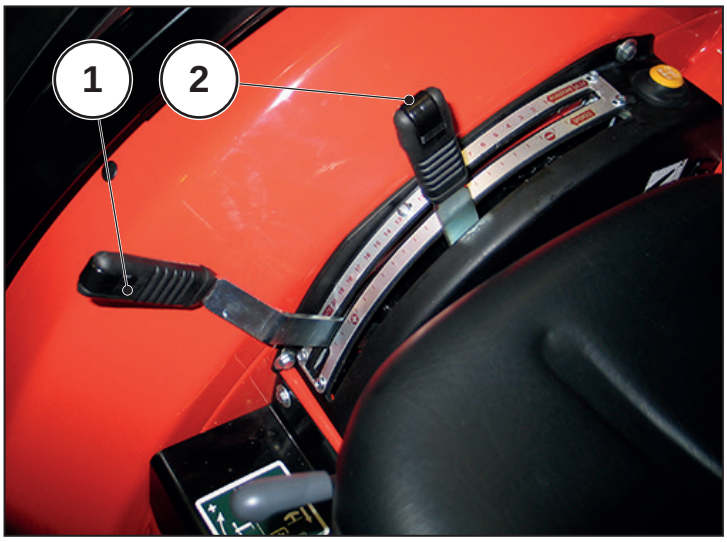


Fig. 12.12

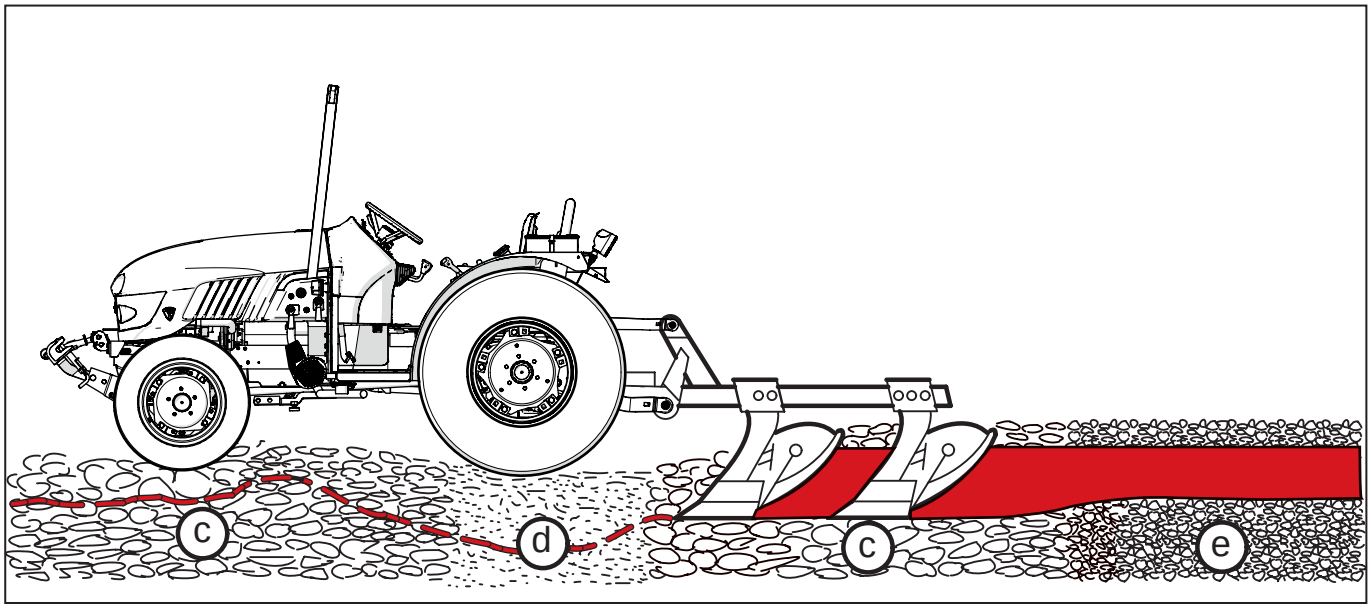


Fig. 12.13

MIXED POSITION AND DRAFT CONTROL MODE

Use of the draft control function could lead to an excessively irregular tilling depth, which does not suit the crops to be grown in that area.

In these conditions, the mixed position-draft control mode should be used. Lower the implement into the soil and find the correct work depth as indicated in the section on draft control.

- Dig the implement into the soil and find the correct work depth as indicated for the "Draft control" mode.
- When the required depth has been reached, move the position control lever (1) back until the links of the hitch begin to rise slightly.
- The hitch operates in the draft control mode but meanwhile prevents the implement from digging excessively into softer soil and producing an uneven job.
- Lower and lift the implement at the beginning and end of each run by means of the position control lever (1).

During work, the operator must find the best position for the selector lever in order to obtain the best compromise between draft variation and depth.

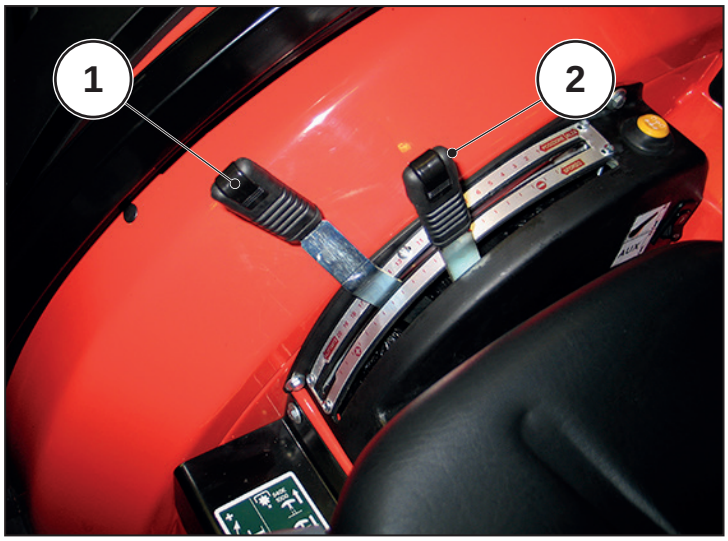


Fig. 12.14

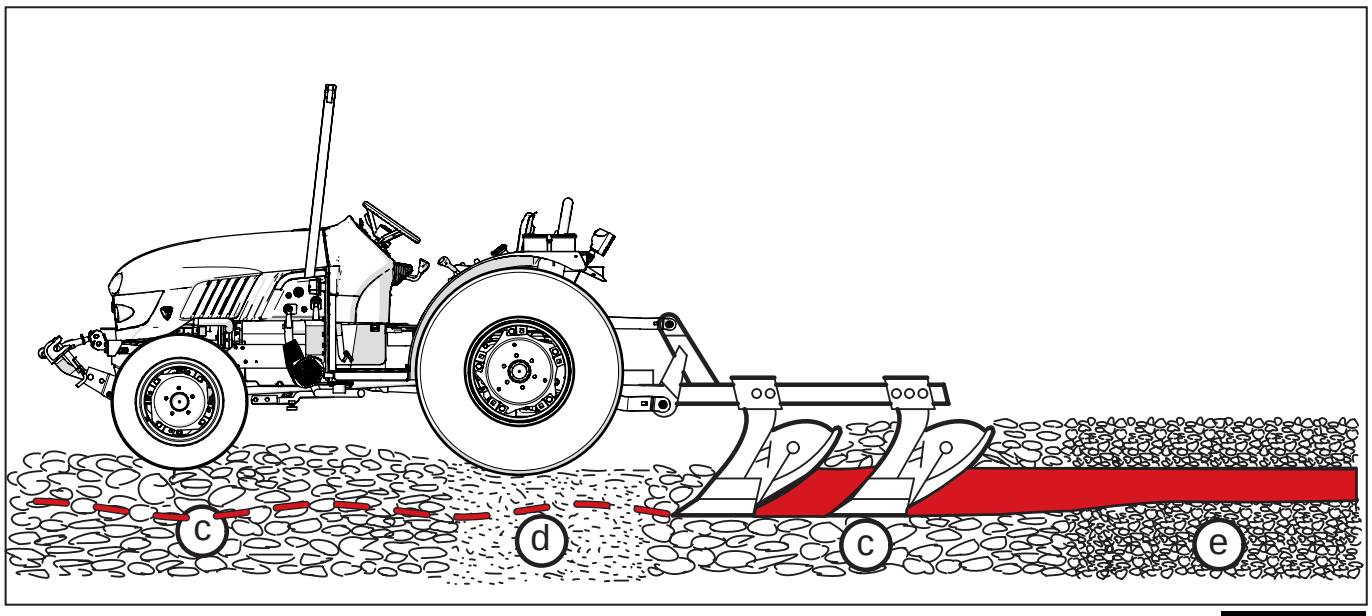


Fig. 12.15

FLOATING MODE

- Move the position control lever (1) and the draft control lever (2) fully forwards.
- Lower and lift the implement at the beginning and end of each run by means of the position control lever (1).

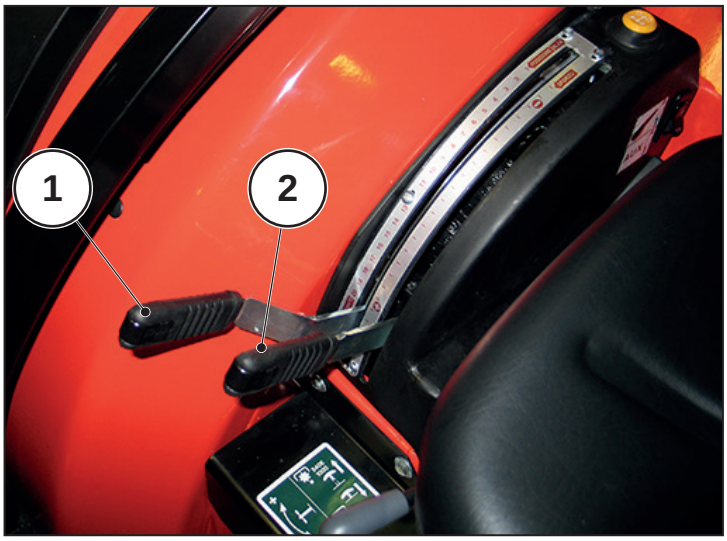


Fig. 12.16

4.2 Technical specifications

Rear hitch	Hydraulic with position and draft control
Lifting capacity at the 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

4.3 Main adjustments

4.3.1 Adjustment of the position and draft control links

> **Warning**
>
> The adjustments described below must be made without any implement hitched to the tractor.

Position lever link adjustment

The maximum height of the hitch can be adjusted by leans of the link. Move the position lever (1) fully forwards and the draft lever (2) fully back.

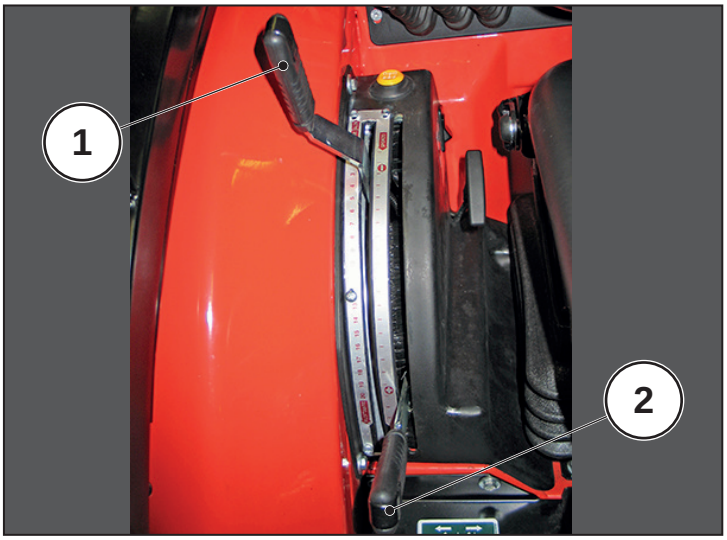


Fig. 12.17

Use the nut to adjust the link until the pump is not under load.

> **Warning**
>
> In the fully raised position, there must be 3 cm idle play on the links to prevent the pump from continuing to be pressurized.

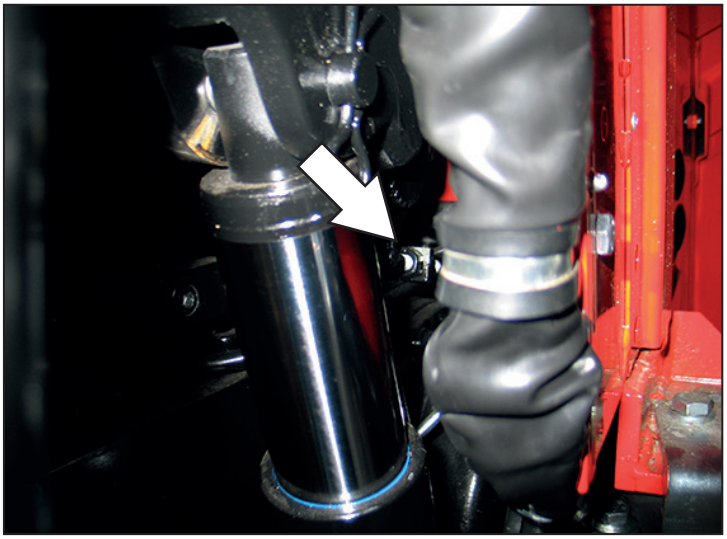


Fig. 12.18

Draft lever link adjustment

Insert tool (F-code 07000249) so as to pull back the thre-point hitch.

Warning
There must be no play on the third link.

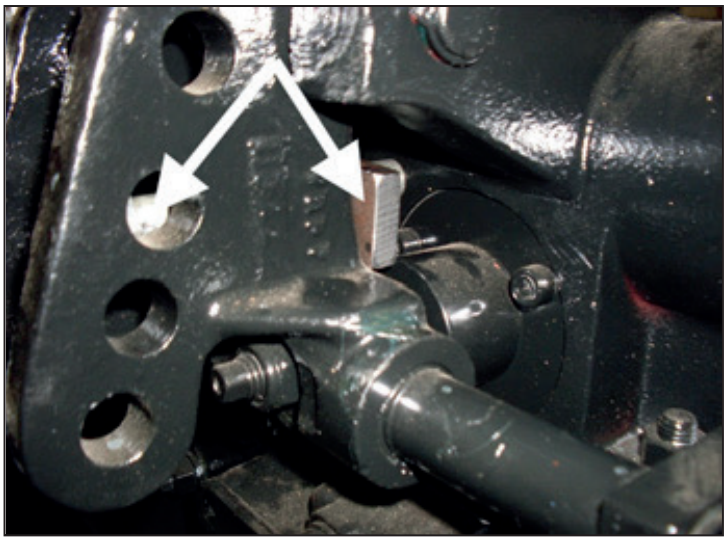


Fig. 12.19

Move the position lever (1) fully back and the draft control lever (2) fully up. The hitch will lift.

Lower the lever by 5-6 positions.

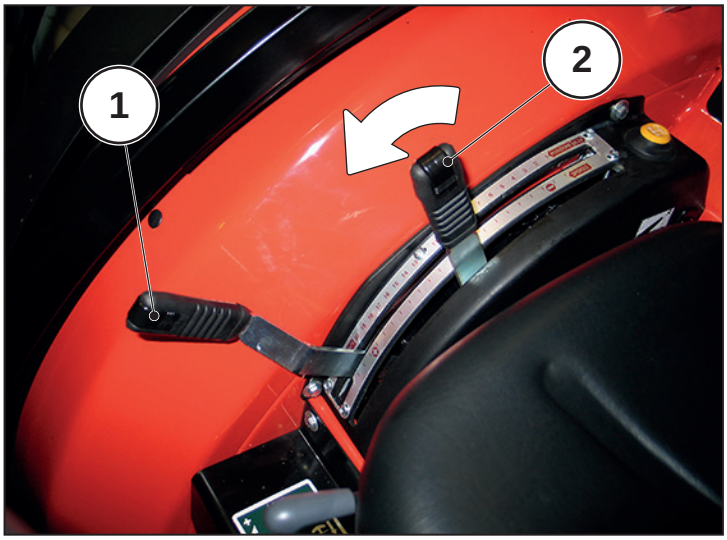


Fig. 12.20

Adjust the link on the three-point hitch so that tghe hitch begins to lower, then lock the check nut.

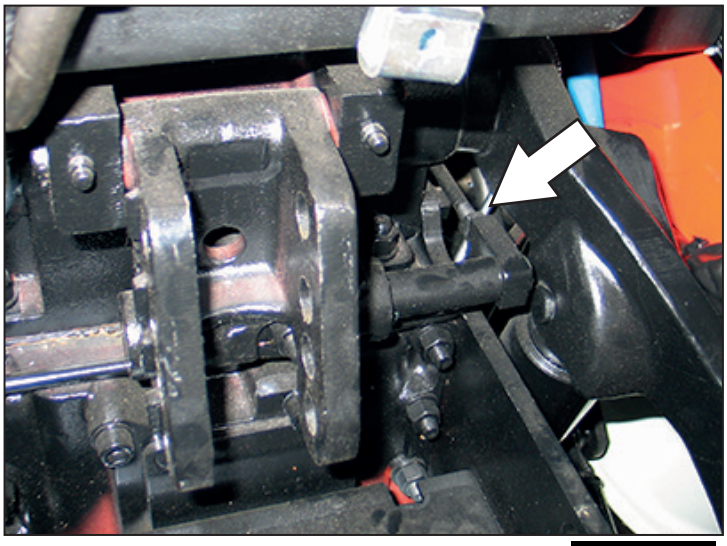


Fig. 12.21

4.4 Disassembly of front side of valve unit

Unscrew the 3 screws that fix the front cover and remove it. The internal components of the two valves can now be removed.

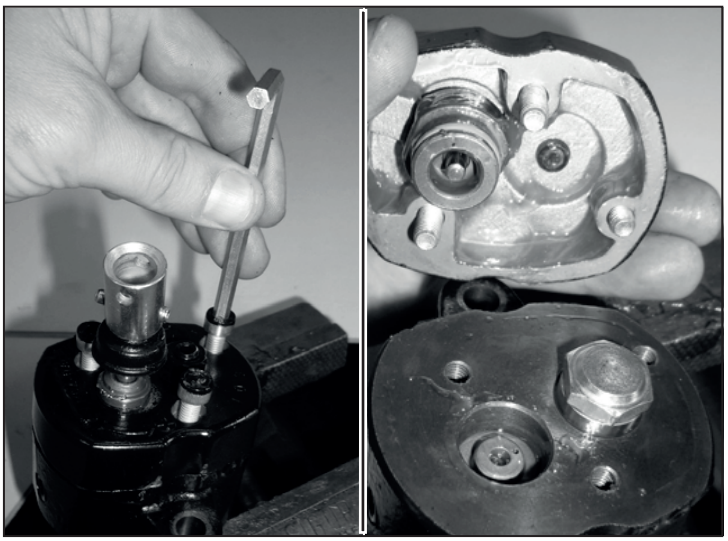


Fig. 12.22

The photograph shows the internal components of the valve system, divided as to branch of use.

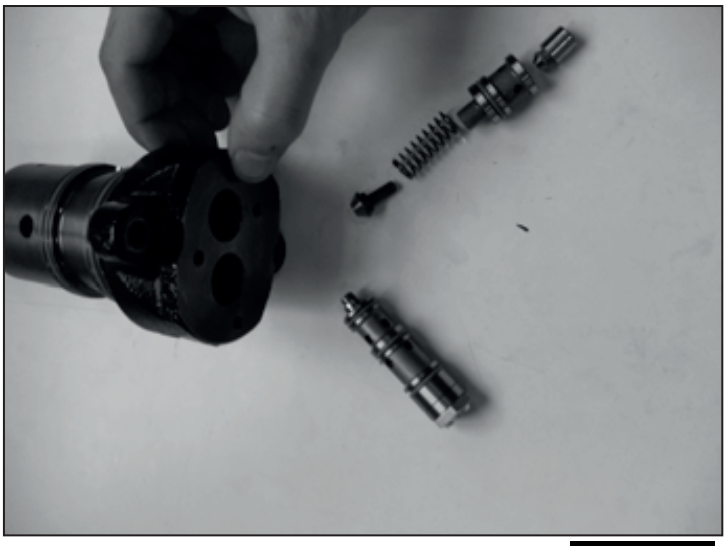


Fig. 12.23

4.5 Disassembly of rear side of valve unit

Unscrew the 3 screws and remove the check plate and cursor.

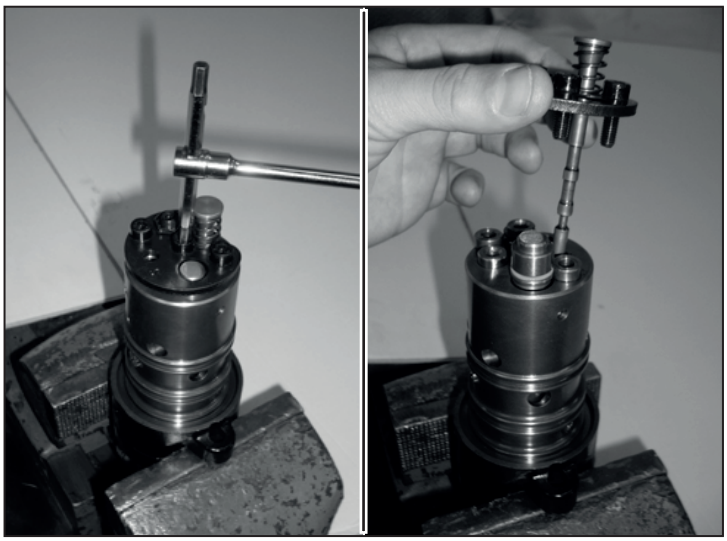


Fig. 12.24

Remove the spring, ball and the two spacers.

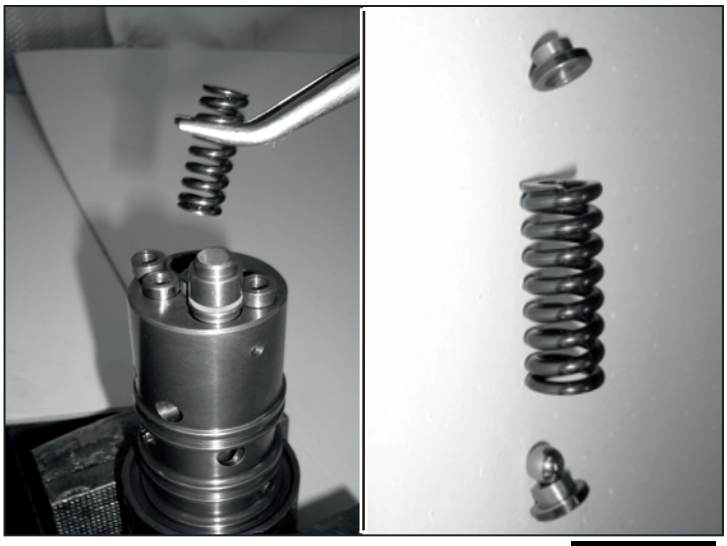


Fig. 12.25

Remove the valve, the valve and relative spring from the housing.

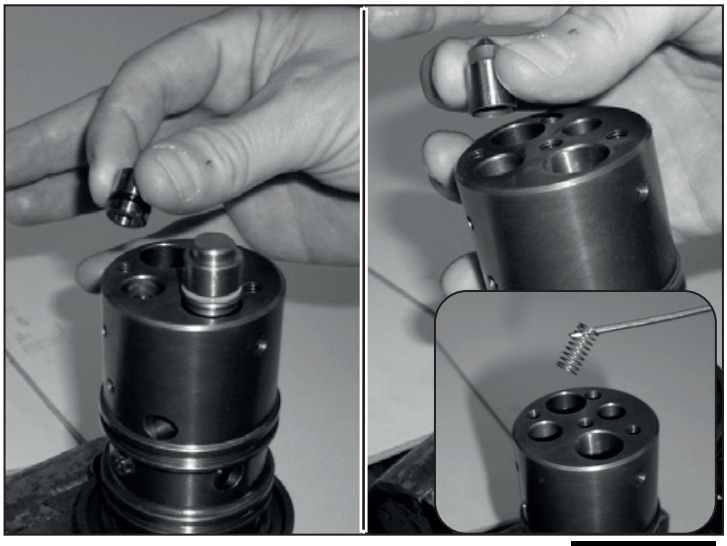


Fig. 12.26

Remove the spring plug, the spring and valve housing.



Fig. 12.27

The photograph shows the internal components of the valve system, divided as to branch of use.

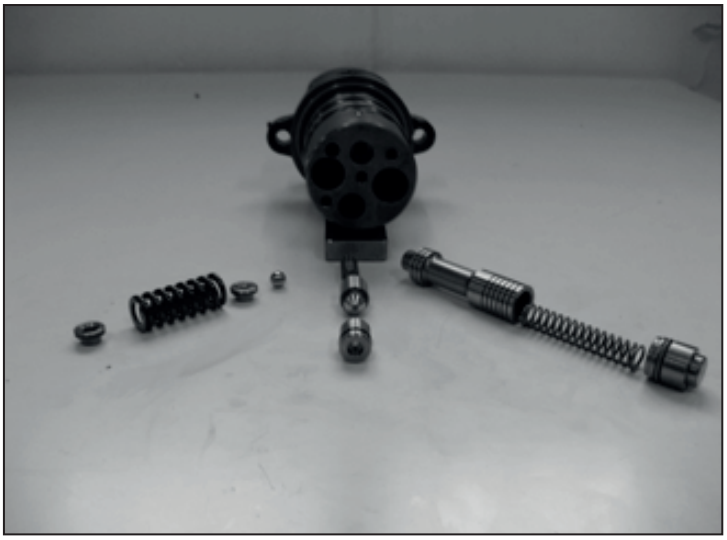


Fig. 12.28

The photograph shows the check plate, the three fastening screws with their spacers, the internal cursor and relative spring.

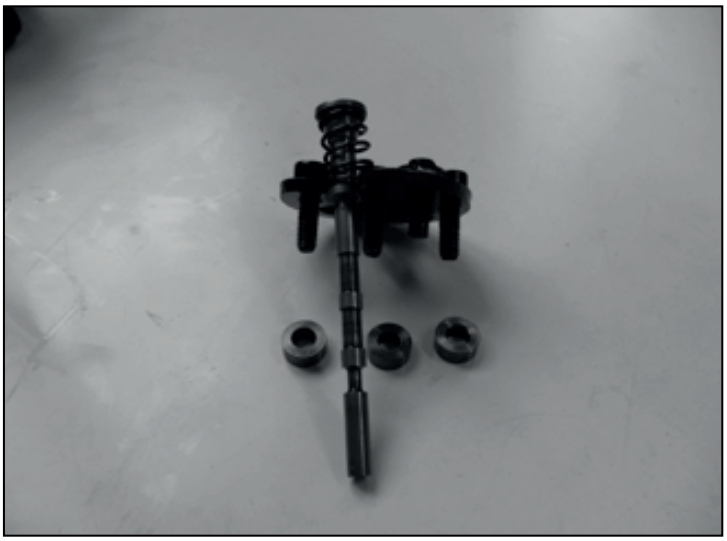


Fig. 12.29

When the valve unit is reassembled, make sure that none of the O-rings have been pinched and that everything is in a good condition.

Lubricate the O-rings with grease to prevent faulty operation from leading to the need for further work on the assembly.



Fig. 12.30

If the hitch jolts when a weight is applied to it, the sensitivity can be adjusted by means of screw B.

Set the links to about halfway along their travel. In this condition, the valve system is in the neutral phase. After having loosened the check nut, unscrew the dowel until the hitch stops jolting. Unscrew the dowel a further half turn and lock the check nut.

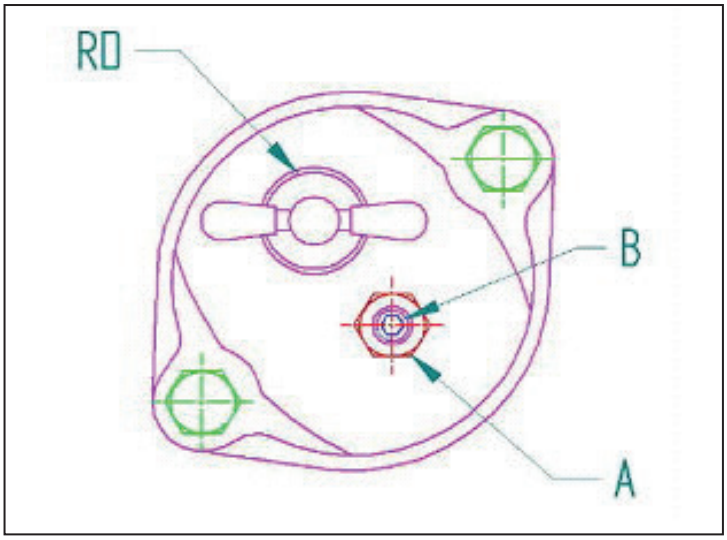


Fig. 12.31

4.6 Disassembly of linkages in the hitch valve unit

Note

The sequence illustrates assembly of the internal and external linkages of the hitch. This is simply a note describing the main components of the linkages of the rear hitch unit.

Faults involving these components are extremely unlikely and they are extremely simple to assemble. This is why a sequence of photographs is given without going into detail.

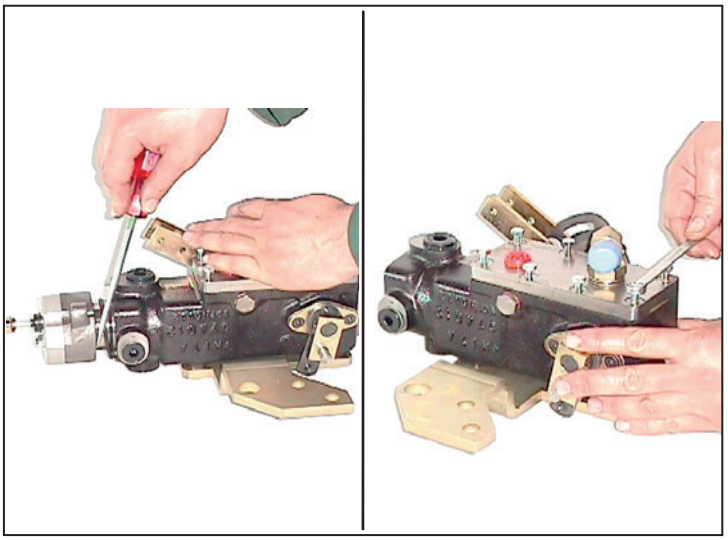


Fig. 12.32

The preliminary operations for disassembling the internal position and draft linkages are shown on this page.

The most important step is to analyse the components forming the internal mechanism and fulcrum of the linkages with all the transmissions it comprises.

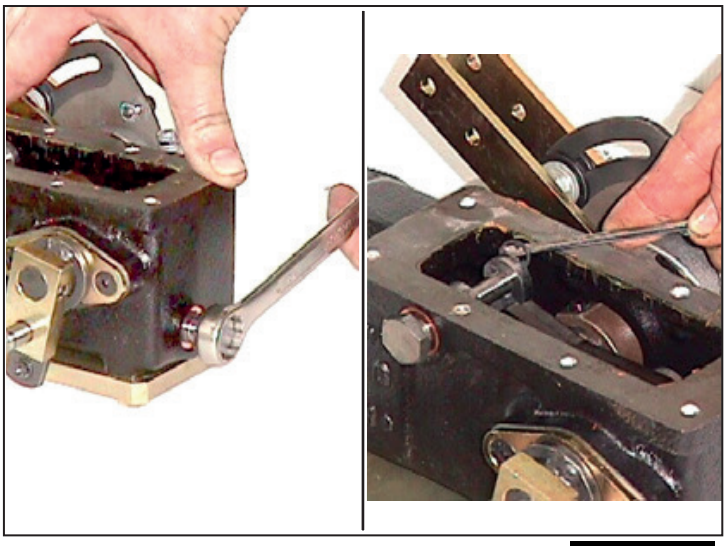


Fig. 12.33

The photos depict the assembly sequence of the two position and draft control cams.

Unlike other valve units that control hitches, many settings are fixed and the positions already determined.

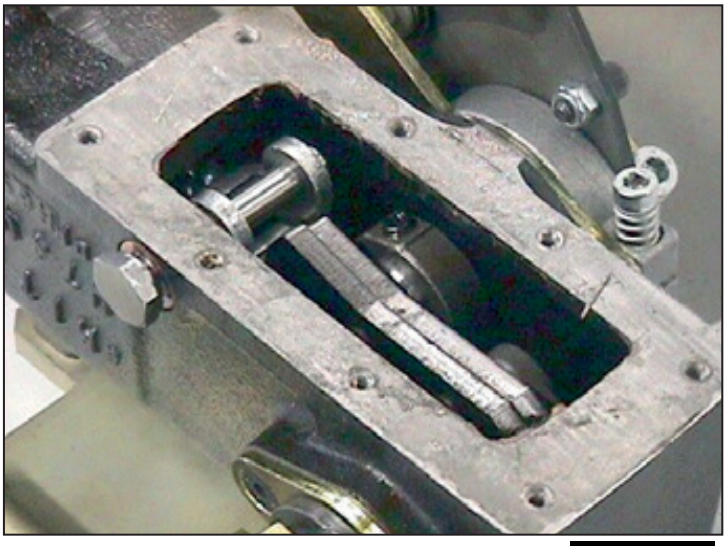


Fig. 12.34

These photographs illustrate the next steps for disassembling the external linkages of the position and draft control mechanisms.

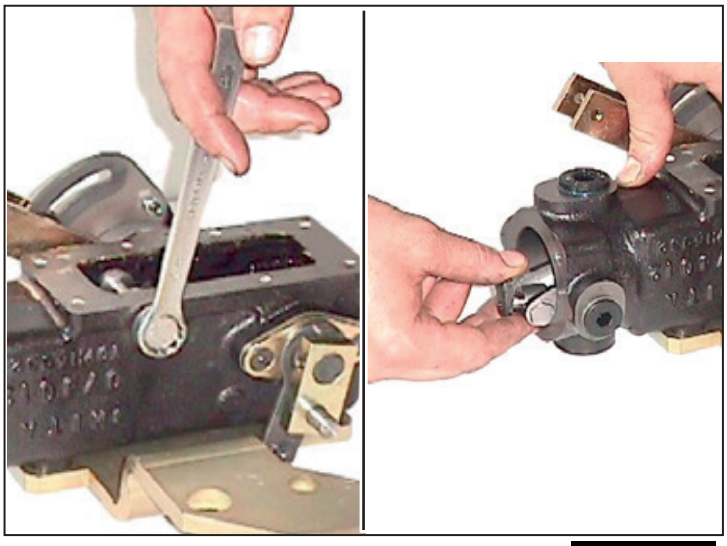


Fig. 12.35

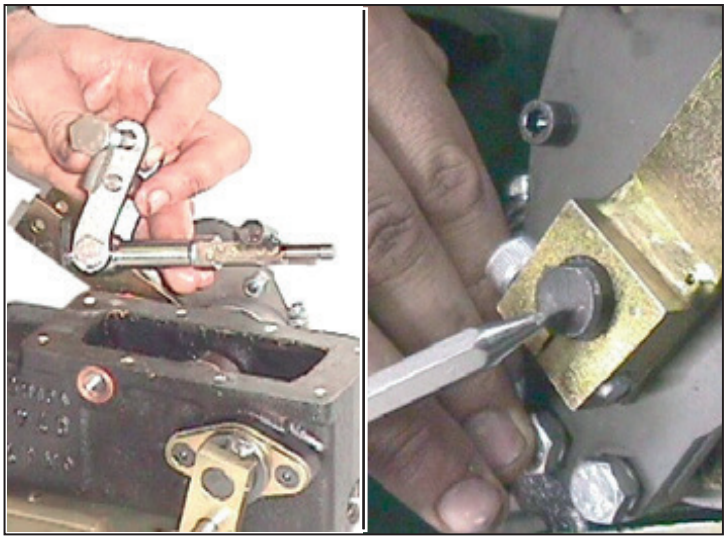


Fig. 12.36

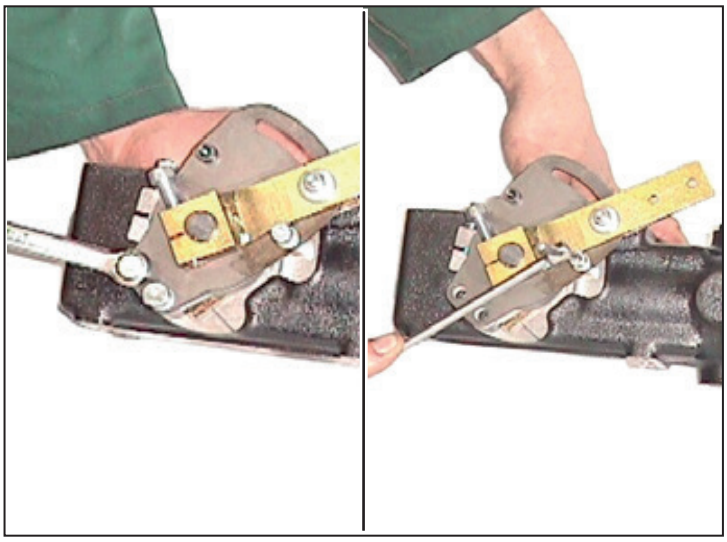


Fig. 12.37

The following sequences illustrate how the fuldrum of the position and draft levers is assembled. The disassembly sequence is shown for the purpose of allowing the operator to check whether any of the internal components are broken.

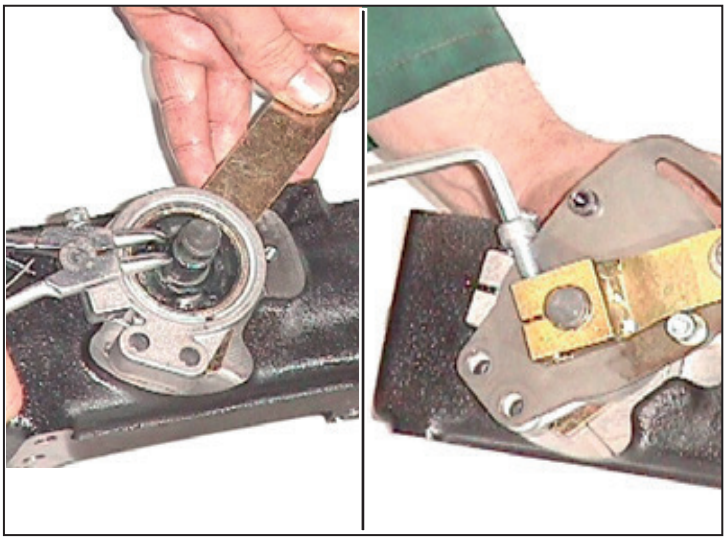


Fig. 12.38

Only the order in which the operations are performed is indicated since there are no particular adjustments required. Assembly is intuitive.

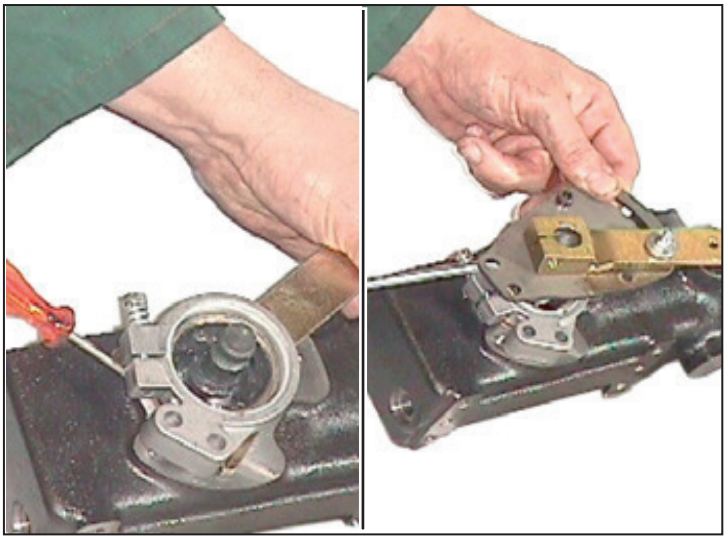


Fig. 12.39

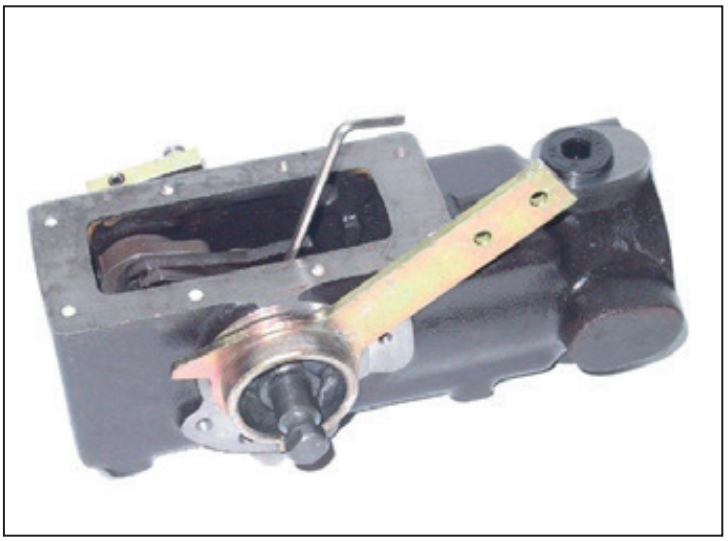


Fig. 12.40

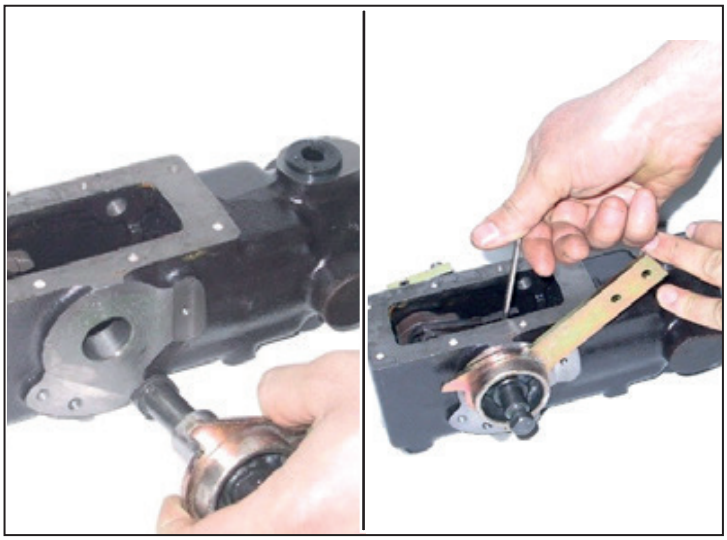


Fig. 12.41

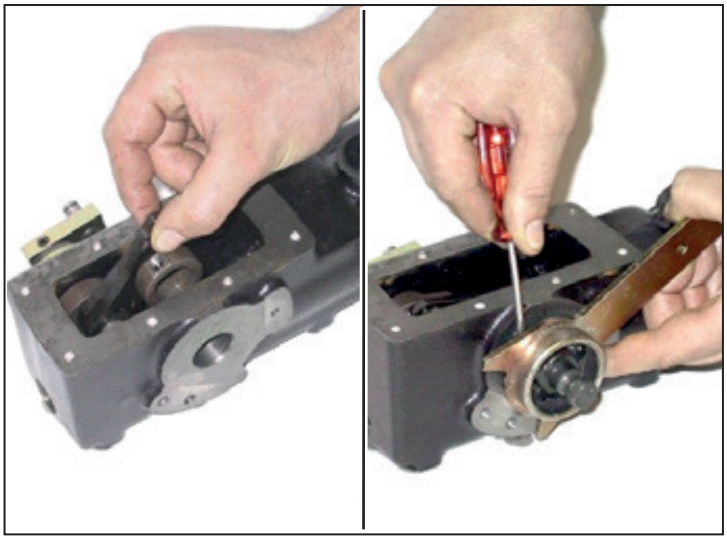


Fig. 12.42

The last thing to do is to disassemble the double fork that activates the position and draft mode of the hitch.

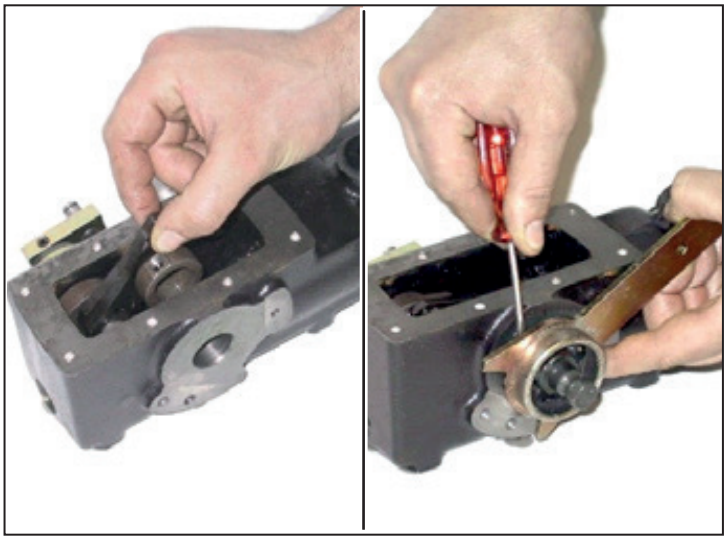


Fig. 12.43

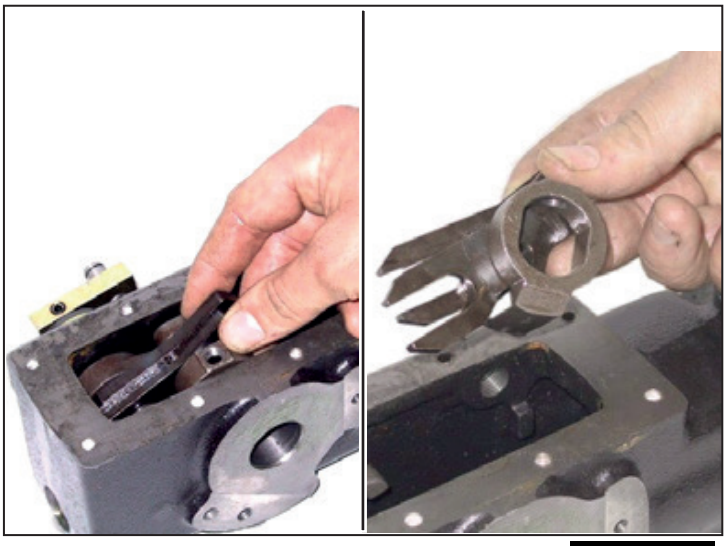


Fig. 12.44

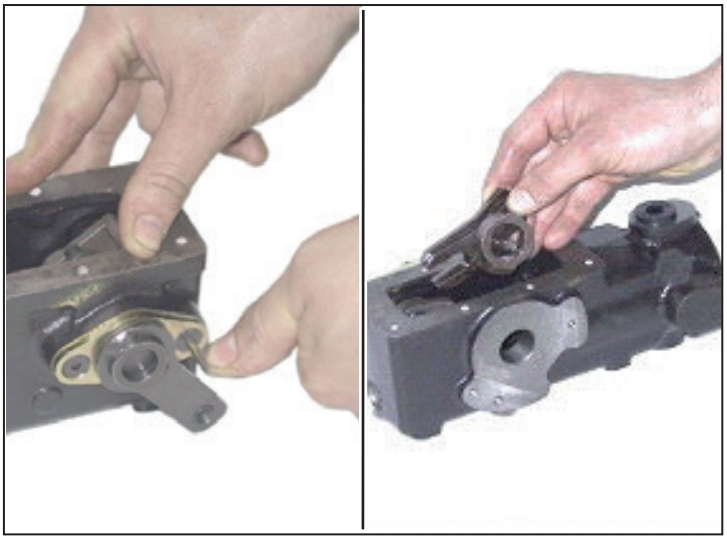


Fig. 12.45

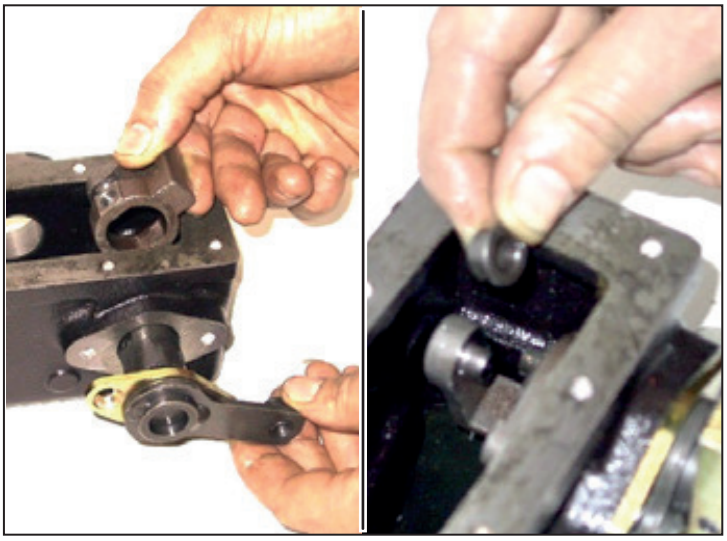


Fig. 12.46

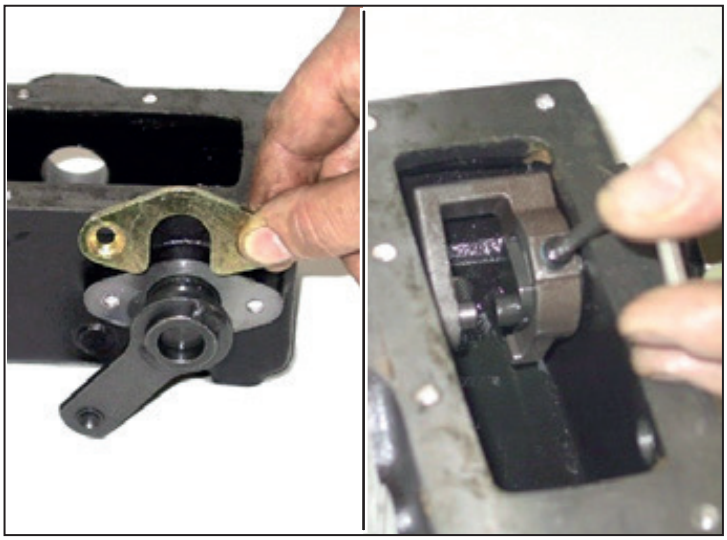


Fig. 12.47

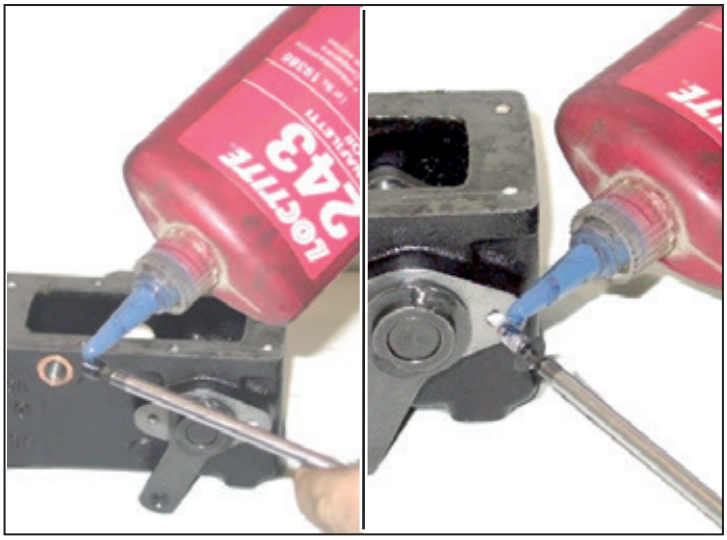


Fig. 12.48

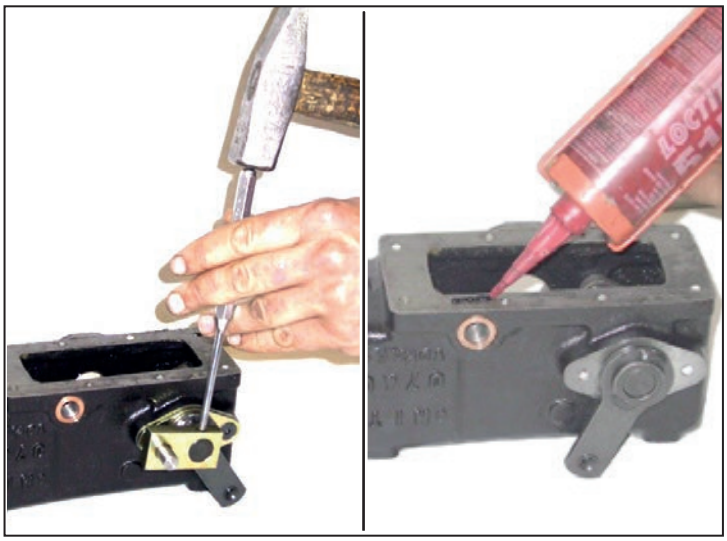


Fig. 12.49

Perform the following tests to make sure that the position and draft control linkages on the tractor have been adjusted properly:

- Without any implement applied to the hitch and with the position lever fully up, check that the links begin to lift when the draft lever is moved towards top dead centre, to approximately 3/4 of its travel.

- If this fails to occur, adjust the draft linkage until the above condition is obtained.

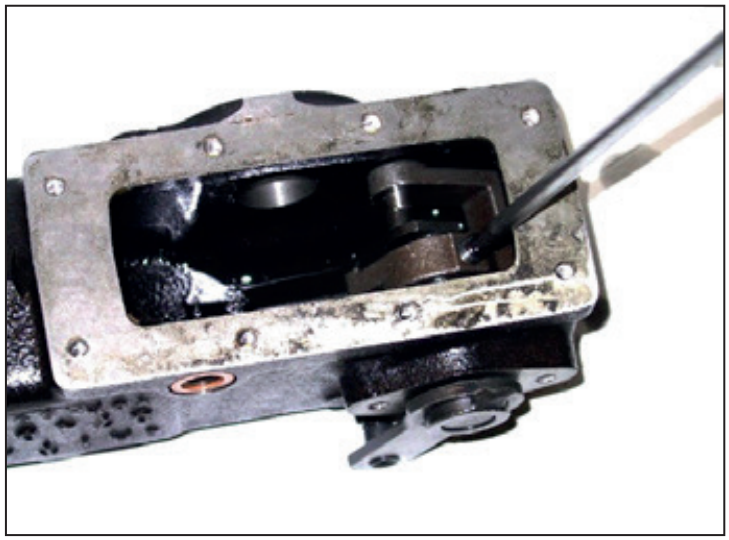


Fig. 12.50

Section 5 : Main components

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5.4 Hydraulic power pack 12-45

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5.6 Trailer brake valve - type for ITALY 12-47

5.1 Hydraulic pump

The hydraulic tandem pump is installed on the right-hand side of the tractor. It is controlled by the gears of the timing system and controls the high and low flow circuits. Oil from the gearbox and filtered by the suction filter flows into the suction pipe (A). The pump supplies oil through (B) to the high flow circuit of the power steering system, and to the supplementary control valves and rear hitch. The pump supplies oil through (C) to the low flow circuit, which supplies the hydraulic power pack that controls four-wheel drive and diff lock engagements. After this, the oil flows to the gearbox lubrication circuit.

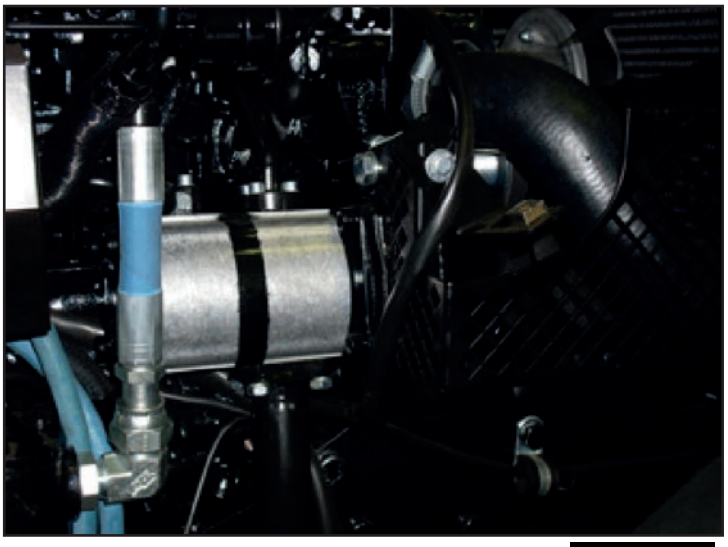


Fig. 12.51

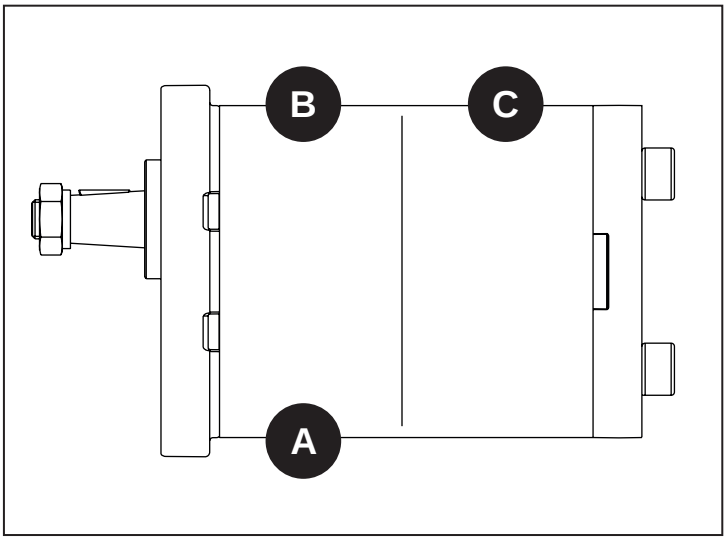


Fig. 12.52

5.2 Power steering system

The power steering circuit consists of a priority valve which, whenever the steering wheel is turned, draws the oil required for operating the steering system and for moving the double-acting cylinder from the high flow circuit by priority. There is also a relief valve with 110-120 bar setting and two overpressure valves that protect the cylinder and power steering system from accidental damage.

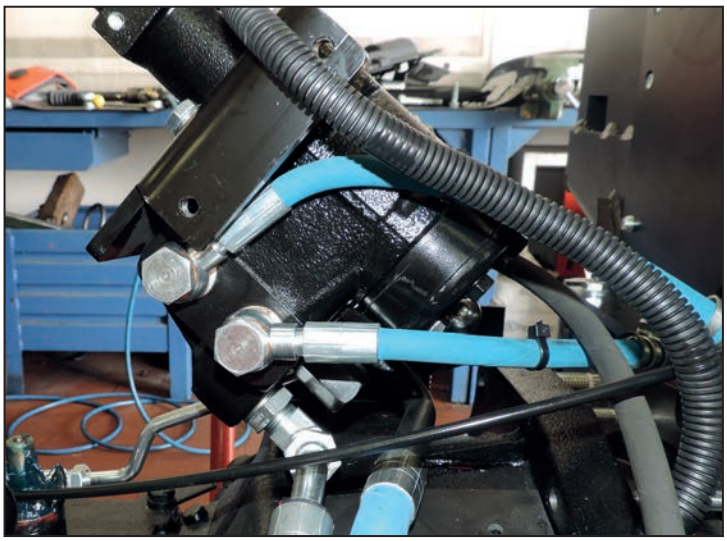


Fig. 12.53

5.3 Rear hydraulic control valves

The tractor is equipped with supplementary hydraulic control valves that control the external hydraulic cylinders installed on the right-hand side. The control valves are supplied by the high flow circuit with oil from the power steering system.

Different configurations are available with control valves of various types:

- Single-acting;
- Double acting;
- Double-acting with engagement in relieved condition;
- Floating double-acting.

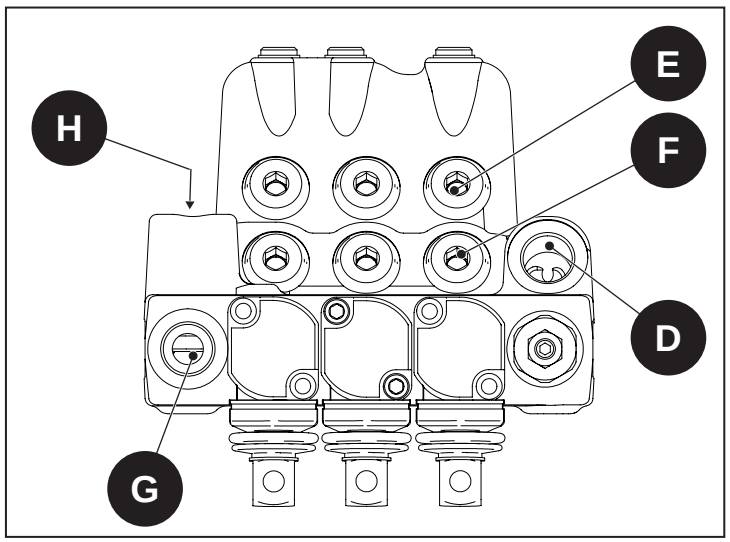


Fig. 12.54

Oil from the power steering system flows into the inlet head (D) where a relief valve with 180 bar setting is installed. Depending on how the control levers are moved, oil is delivered to the hydraulic taps on the delivery (E) and return (F) sides and then towards the outlet (G). If the control valves do not require oil, this flows towards the valve system of the rear hitch (H).

Note

The control valves are supplied at the same time, but activation of one of them shuts off the flow of oil to the following control valves and to the hitch, thus preventing then from operating contemporaneously.

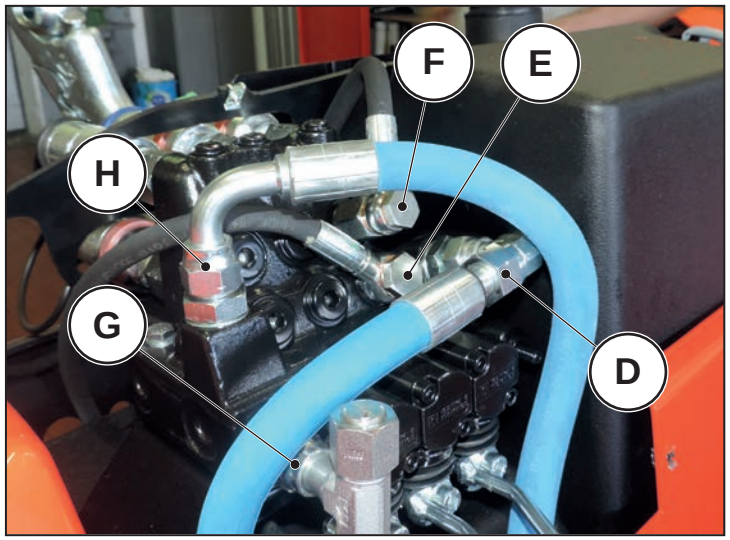


Fig. 12.55

5.4 Hydraulic power pack

The hydraulic power pack is installed under the bonnet, on the left-hand side. It receives oil filtered by the pump filter from the low flow circuit (I) and its purpose is to engage the diff lock and four-wheel drive. It has a relief valve (L) with 45 bar setting.

The four-wheel drive has a negative engaging control. Each time the tractor is turned on, solenoid valve (M) of the 4WD energizes automatically sends oil (N) at a pressure of 42 bar and the hydraulic clutch is disengaged. By pressing the 4WD engaging button, the solenoid valve de-energizes and packs the hydraulic clutch, allowing driving power to be transmitted to the front axle.

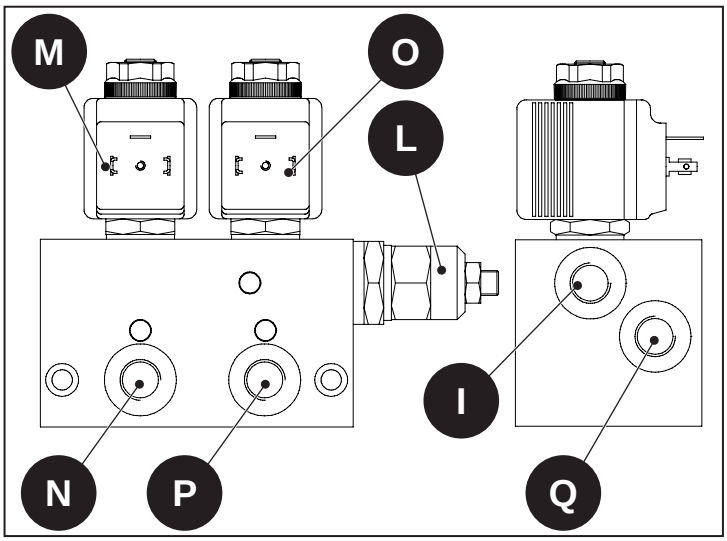


Fig. 12.56

The diff lock is locked by pressing engaging button BD. This, by energizing solenoid valve (O), sends oil (P) to the actuator cylinder, which overcomes the force of the spring and allows engagement to take place.

The oil discharged (Q) by the hydraulic power pack allows the gearbox to be lubricated.

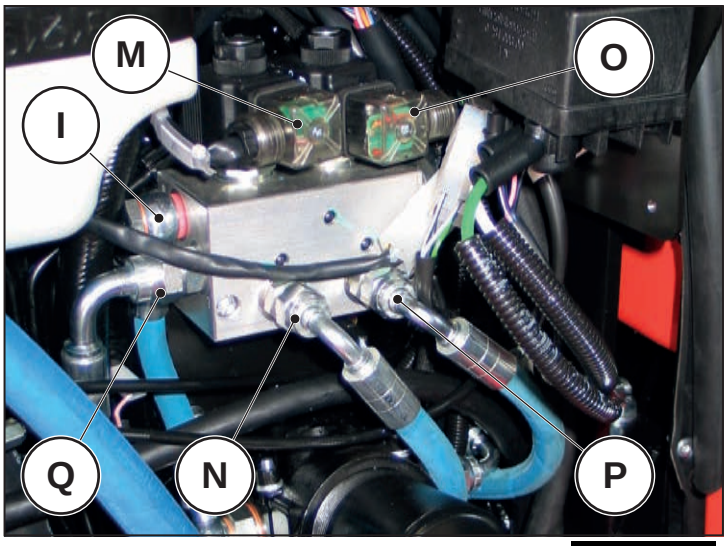


Fig. 12.57

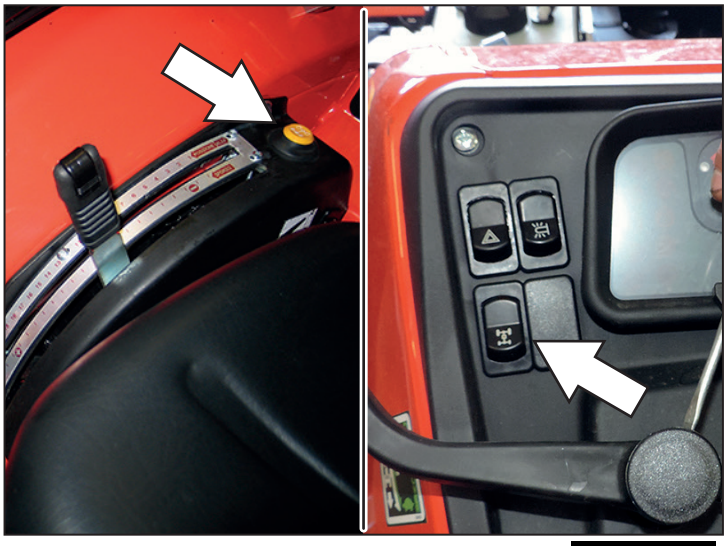


Fig. 12.58

5.5 Front hydraulic control valves

Depending on the version, the tractor can be equipped with supplementary control valves to be installed on the front right side. When present, these control valves are supplied by the high flow circuit with oil from the power steering system. The oil flow is controlled by a flow governor upstream of the control valves themselves.

Different configurations are available with control valves of various types:

- Single-acting with engagement in floating position;
- Double acting;
- double-acting with lever engagement;
- Double-acting with fourth floating position and lever engagement.

A different number of front control valves can be installed, depending on the tractor version.

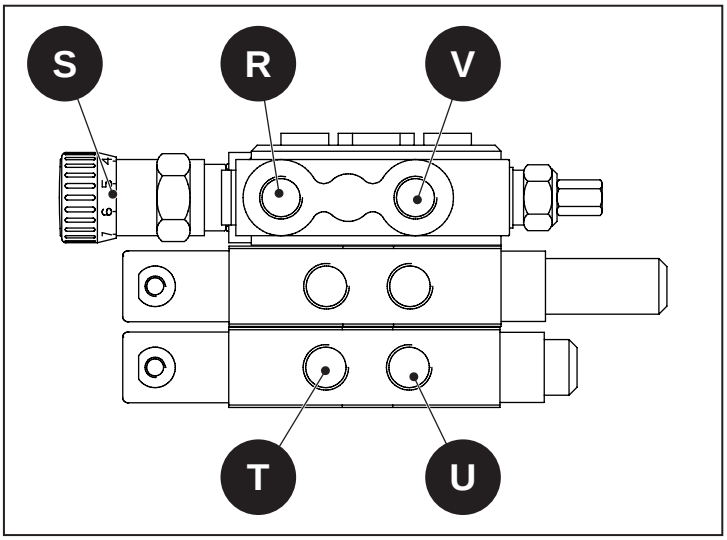


Fig. 12.59

Version	No.control valves
Roll Bar without front hitch	3
GL cab without front hitch	3
SG1 cab without front hitch	2
Roll Bar with front hitch	2
GL cab with front hitch	2
SG1 cab with front hitch	1

Oil from the power steering system flows into the flow governor (R). The oil flow to the front control valves can be increased or reduced by using the tap (S) of the governor. This is useful for maintaining a flow of oil to the other users (rear hitch and rear control valves) and to prevent accidental damage to implements that do not need the total flow rate.

Depending on how the control valve levers are moved, oil is delivered to the hydraulic taps on the delivery (T) and return (U) sides and then towards the outlet (V). If the control valves do not require oil, this flows towards the trailer braking valve.

Note

The control valves are supplied at the same time, but activation of one of them shuts off the flow of oil to the following control valves, thus preventing then from operating contemporaneously.

5.6 Trailer brake valve - type for ITALY

Italian laws require the trailer to self-brake when unhitched from the tractor. Moreover, the trailer brake must engage when the tractor stops and the parking brake is engaged. Thus, when the tractor has hitched the trailer, oil must still be delivered to the trailer brake at a constant pressure even though the brakes are not applied. This to keep the mechanical brake disengaged.

Oil from the pump flows to the trailer through (Z) and to the rear control valves through (X). Connection to the outlet occurs through (W).

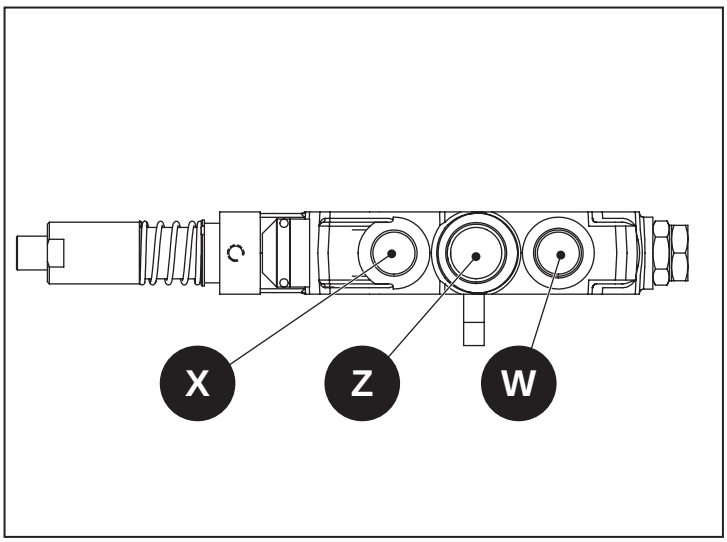


Fig. 12.60

Flow rate	20-80 l/min
Maximum pressure	200 bar
Maximum pressure at quick coupling	120-140 bar
Constant pressure at quick coupling	10.5-14.5 bar

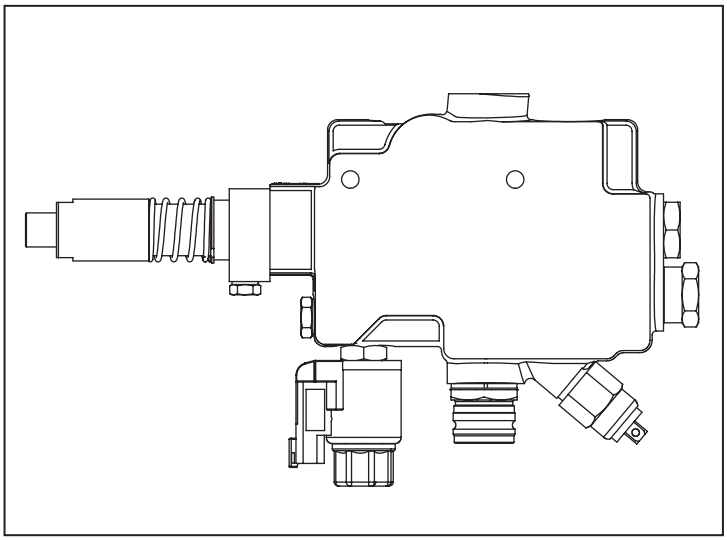


Fig. 12.61

Section 6 : Operating pressure tests

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6.2 Power steering system relief valve pressure test 12-51

6.3 Four-wheel drive circuit pressure test 12-52

6.4 Supplementary control valve pressure test 12-53

6.5 Rear hitch control valve pressure test 12-54

6.1 Introduction

The operating pressure test must be conducted whenever faults are encountered or when the tractor is generally overhauled.

A low setting for the maximum valves in the circuit could make the hydraulic clutch assemblies slip or prevent the steering system, supplementary control valves or hitch from operating in a fully efficient way.

On the other hand, an excessively high valve pressure setting could stress all the components in question and, in the case of the valve that controls the lubricating pressure, cause all the transmission retention rings to break.

At the end of the tests, use the relative adjusters to ensure that the valve settings are correct.

Danger

Splashes of fluid under pressure can penetrate under the skin and cause serious injuries. If accidents occur, immediately seek medical help in order to avoid serious infections.

Danger

Take care to avoid burns when working with boiling oil. Never heat oil to temperatures exceeding 190°C as the oil or its vapours could suddenly catch fire.

Caution

Used oil must be collected and disposed of in compliance with the anti-pollution laws in force.

Caution

Do not begin work until the pressure in the hydraulic circuit has dropped to zero.

6.2 Power steering system relief valve pressure test

The setting of the relief valve of the power steering system 110-120 bar. The relief valve setting can be checked by inserting pressure gauge (A-Code 07000122) on the power steering/cylinder delivery pipe and moving the steering cylinder to end of stroke on the right or left side.

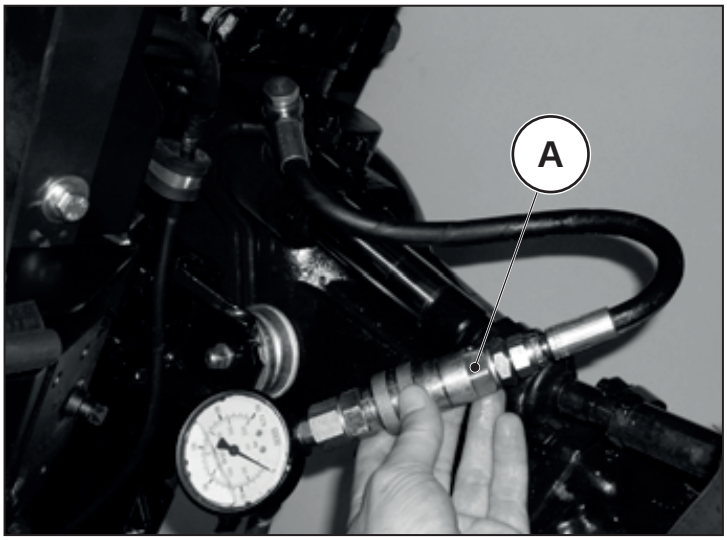


Fig. 12.62

Plug R provides access when the relief valve of the steering unit must be adjusted.

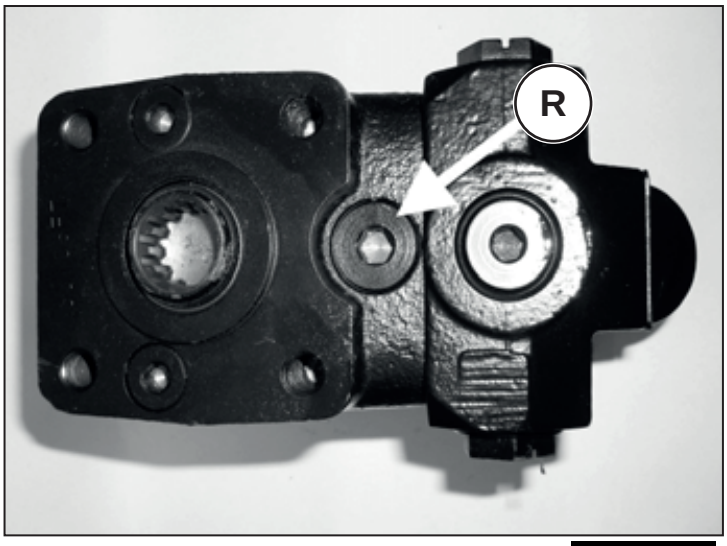


Fig. 12.63

Faulty operation of the power steering system could be caused by impurities clogging orifice (S) or the spool of the priority valve.

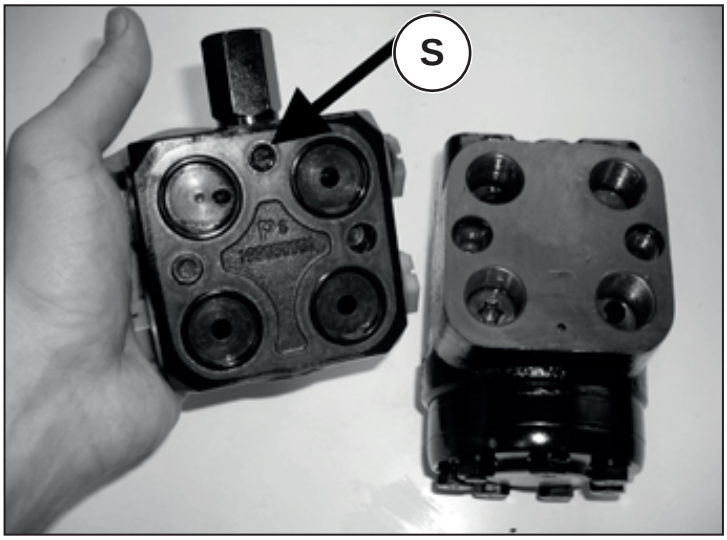


Fig. 12.64

Clean inside the priority valve.

Warning

Take care to reassemble all the components in the right order.

Note

Consult the manufacturer's operation and maintenance manual if further details are required.

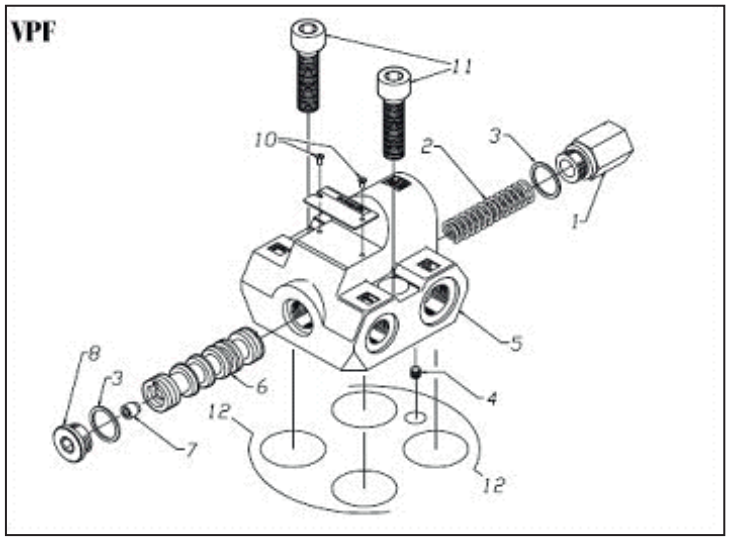


Fig. 12.65

6.3 Four-wheel drive circuit pressure test

A pressure gauge equipped with a tap can be fitted on the union of the delivery line to the 4WD for the purpose of checking the pressure in the 4WD circuit. Close the tap and check that the pressure on the solenoid outlet is 42 to 45 bar.

If the pressure value is different, check to make sure that there are no leaks inside the 4WD assembly. Open the tap and make sure there is no drop in pressure.

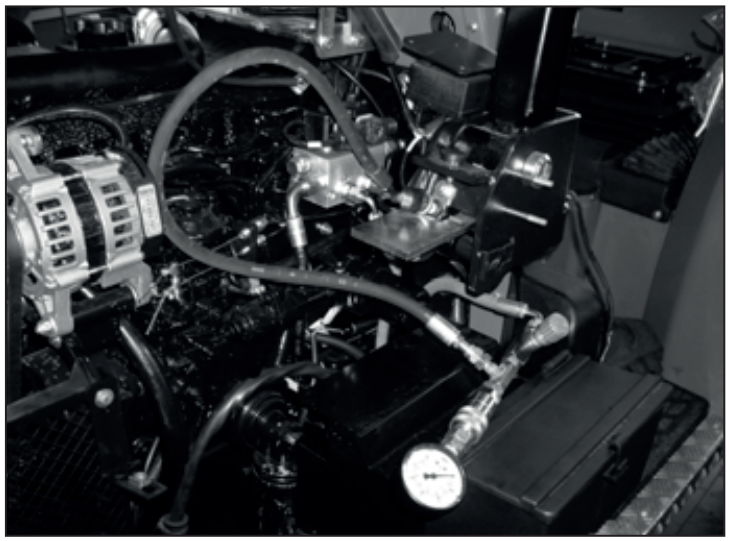


Fig. 12.66

6.4 Supplementary control valve pressure test

Install a pressure gauge on the outlet of the quick coupling of one of the hydraulic taps. With the engine running, activate the corresponding lever control.

The pressure gauge must indicate 180 bar.

If the value is different, adjust by means of the relief valve on the plate that supports the rear control valves.

Warning

Disassemble the upper mudguard cross-member and the protection plate of the control valve levers to access the relief valve.

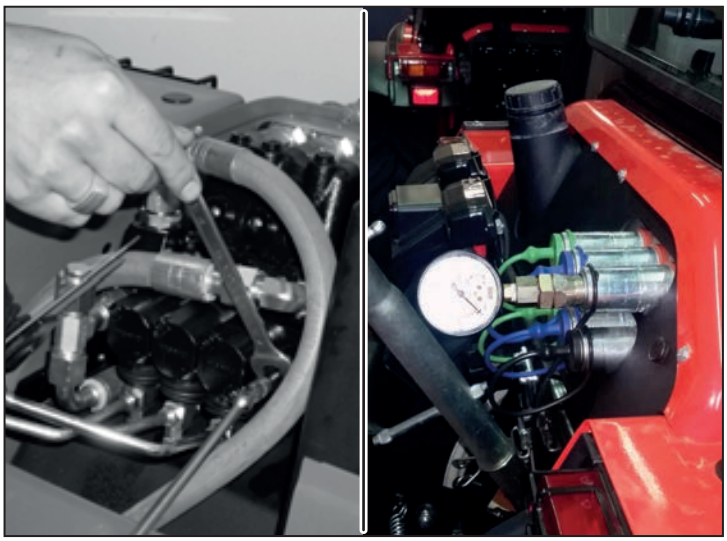


Fig. 12.67

6.5 Rear hitch control valve pressure test

Fit a pressure gauge on the delivery union to check the pressure in the hitch control valve.

Lock the hitch links with took (B-code 07006220). This tool simulates lifting of a load exceeding the maximum capacity of the hitch.

Operate the hitch position lever and check that the pressure reading on the gauge is 180 bar.

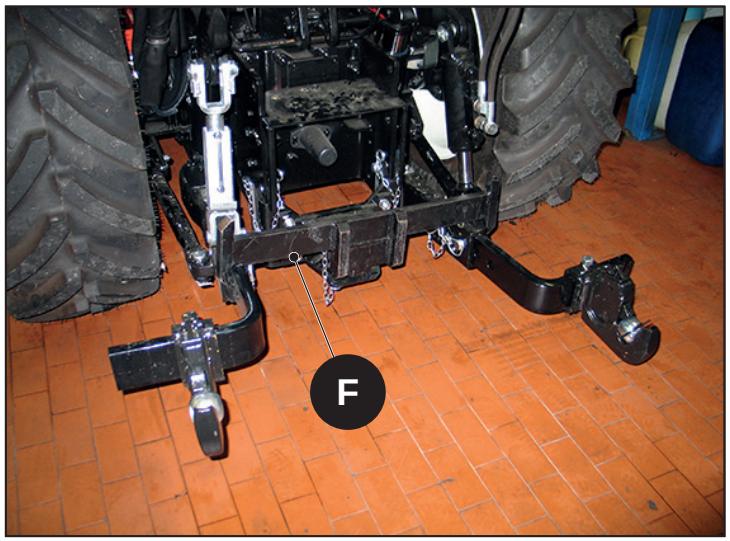


Fig. 12.68

To change the setting of the relief valve of the control valve, use screw (C) and lock the position by tightening the check nut.

Use tool (E-code 07000241) to make sure that the setting is 210 bar. The pressure of the relief valve (C) can be adjusted if necessary.

To perform the test, pressurize the control valve, keeping cursor D depressed, once the inlet pressure has stabilized, this corresponds to the valve setting. Release cursor D to relieve the control valve.

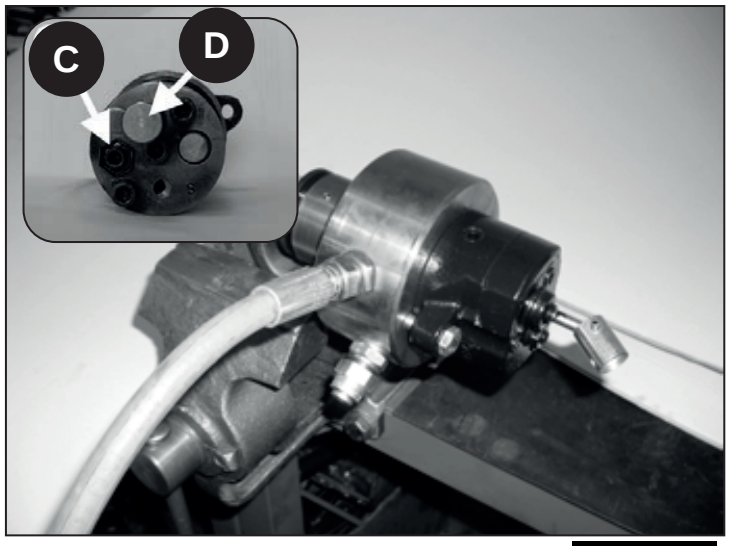


Fig. 12.69

Section 7 : Tools required

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7.1 Tools required 12-56

7.1 Tools required

Code	Description	Quantity
07000249	Hitch draft adjuster tool	1
07000122	Pressure gauge	1
07006220	Link retaining tool	1
07000241	1363 dist. test tool	1

Chapter 13 : Platform

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2.2 Splitting 13-4
2.3 Re-assembly 13-20

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Section 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.

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.

Section 2 : Splitting and re-assembly of the platform

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2.1 Preliminary operations 13-4

2.2 Splitting 13-4

2.3 Re-assembly 13-20

2.1 Preliminary operations

The main operations required to disassemble the platform are described below:

- Removal of the front drive shaft (see chapter "7- Front axle")

2.2 Splitting

Unscrew the screws (1) and remove the right and left covers (2).

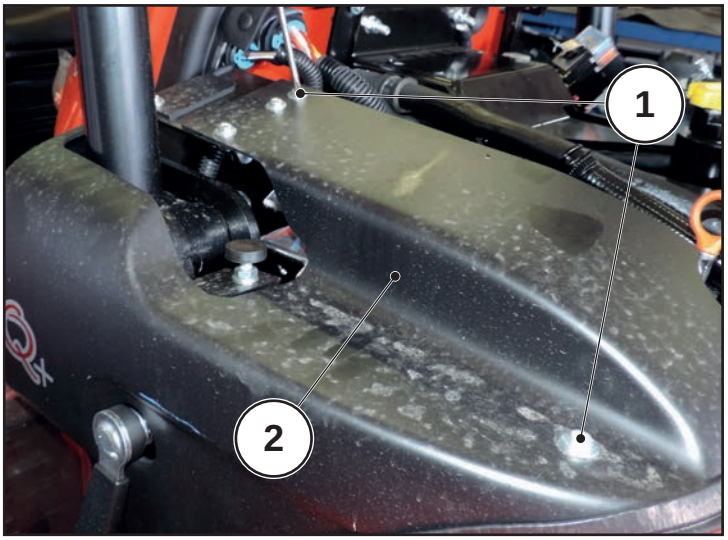


Fig. 13.1

Unscrew the screws (3) and remove the rubber seal (4) of the bonnet.

Warning
The screws can be loosened without removing them.

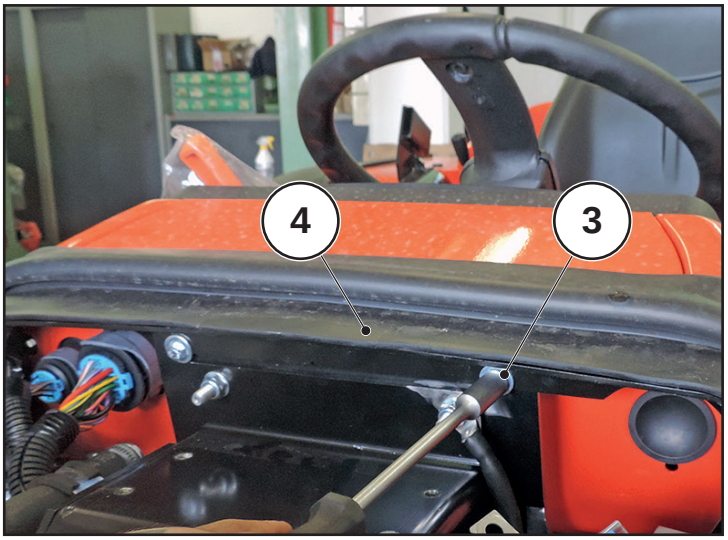


Fig. 13.2

Unscrew the allen screw (5), loosen the lever (6) and remove the seat.

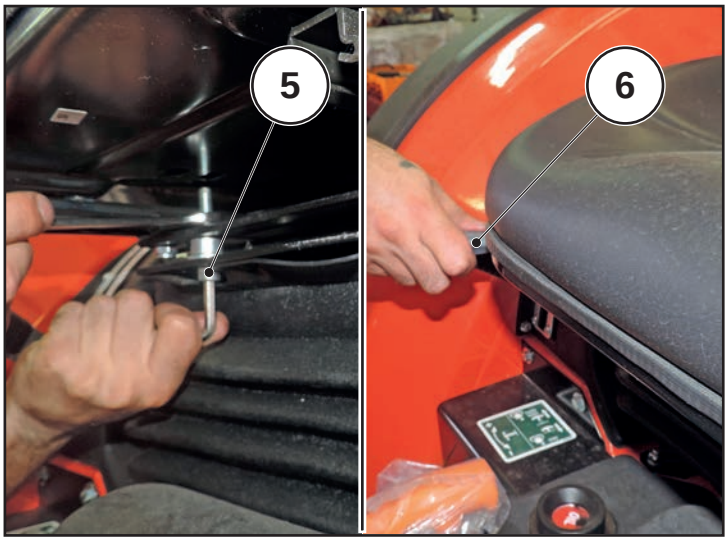


Fig. 13.3

Unscrew the 4 screws (7) that fasten the seat suspension.

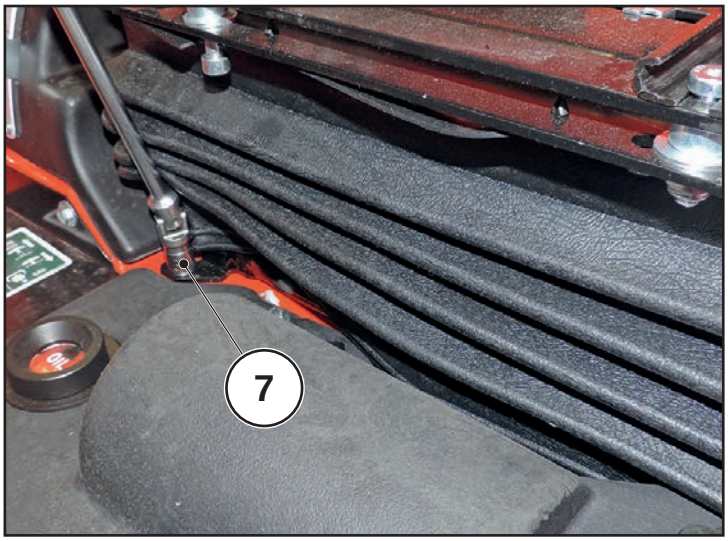


Fig. 13.4

Remove the knob of the rear P.T.O. lever (8) and the hitch lever knobs (9).

Unscrew the fixing screws (10).

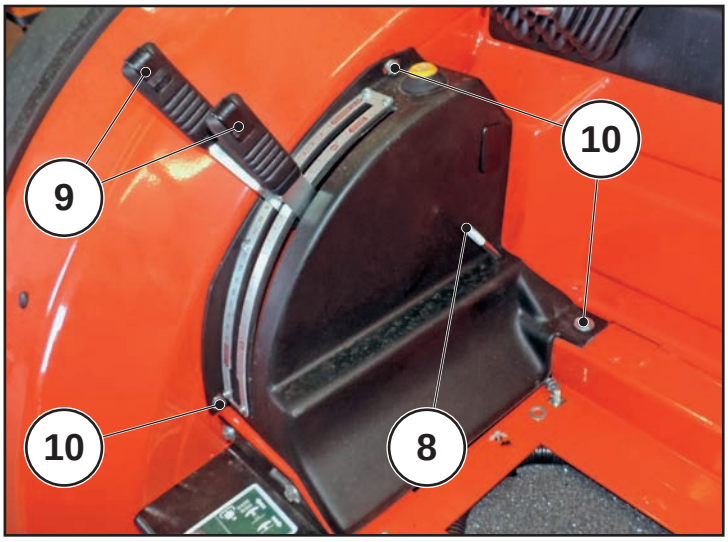


Fig. 13.5

Remove the wiring of the push-button that activates the diff lock (11) and the lever protection (12).

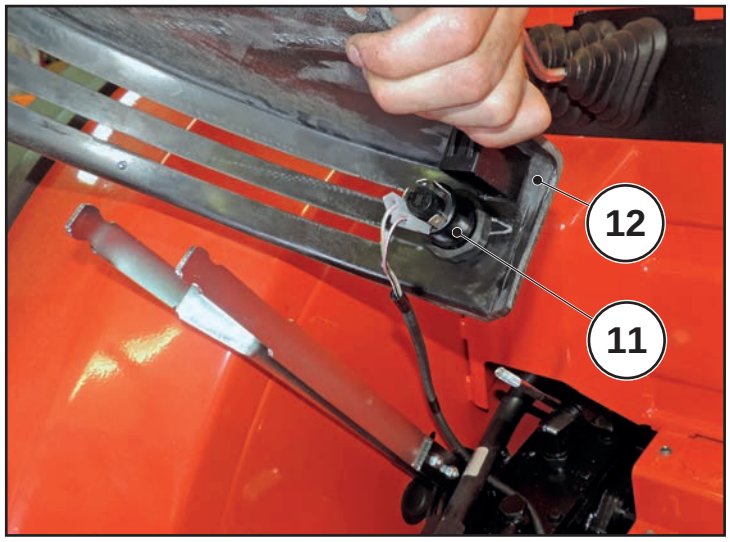


Fig. 13.6

Remove the cover and remove the nut (13) and washer.



Fig. 13.7

Loosen the lever that adjusts the position of the steering wheel and lift this latter so as to completely extent the column.

Use a puller (A- code 07006212) and hammer, move the steering wheel so that it can be removed.

⚠ Warning
Tap very delicately.

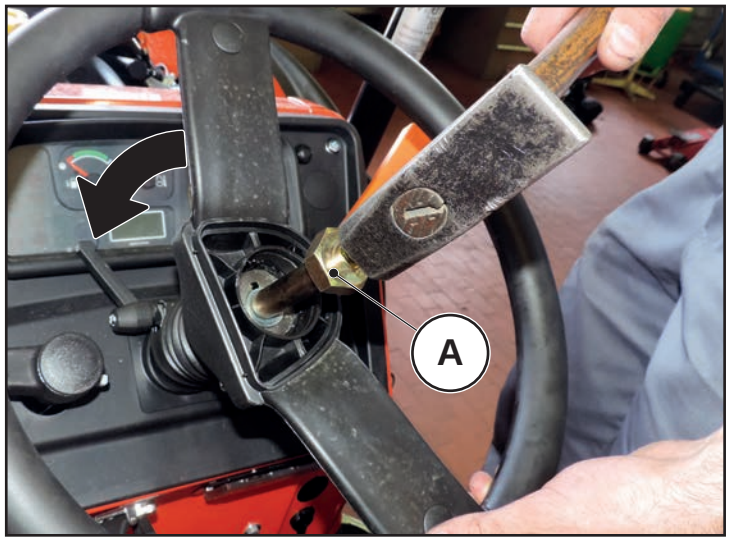


Fig. 13.8

Remove the reverse shuttle lever (14) and the hand throttle lever (15).



Fig. 13.9

Remove the lever that adjusts the position of the steering wheel (16).

Warning
Pull the lever, then unscrew the screw.

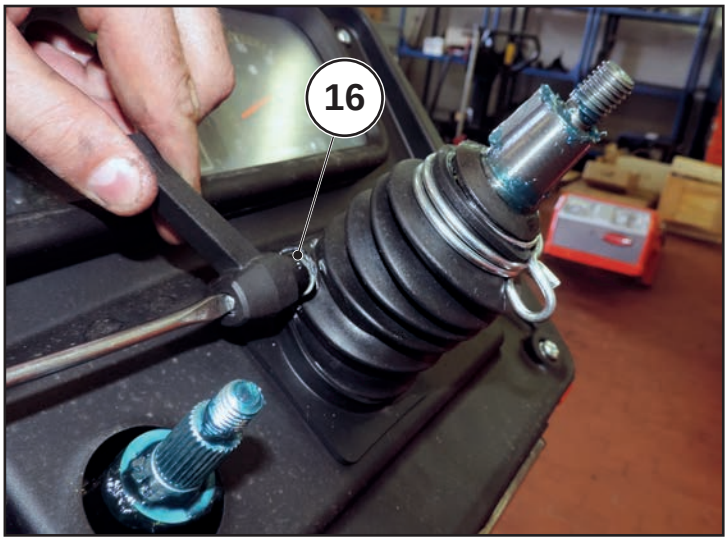


Fig. 13.10

Remove the dashboard by unscrewing the screws that fasten it (17).



Fig. 13.11

Disconnect the connectors.

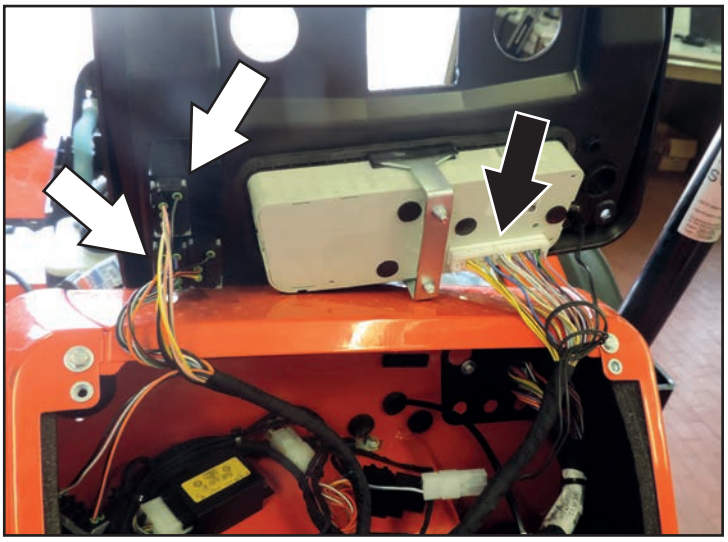


Fig. 13.12

Unscrew the lever that engages the P.T.O. (18) and remove it.

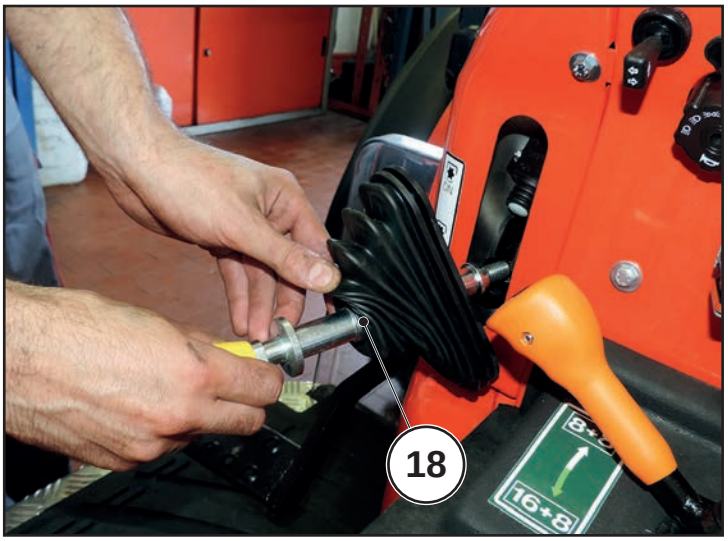


Fig. 13.13

Unscrew the screws that hold the front compartments in place.

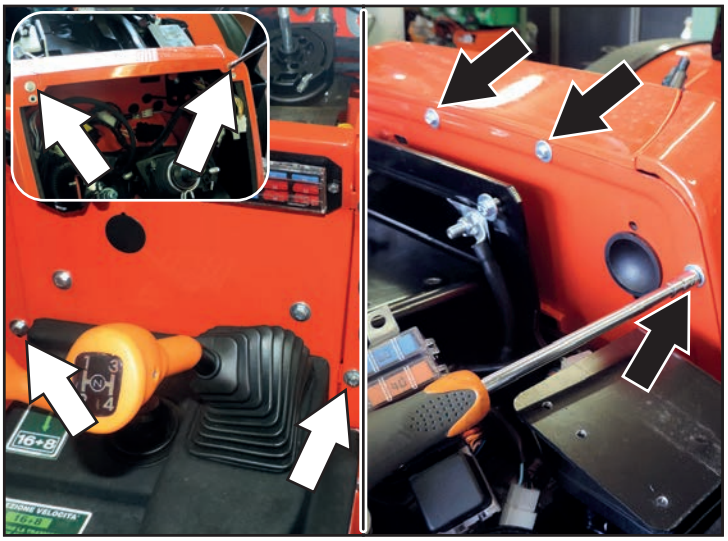


Fig. 13.14

Disconnect the wiring, then remove the compartments.

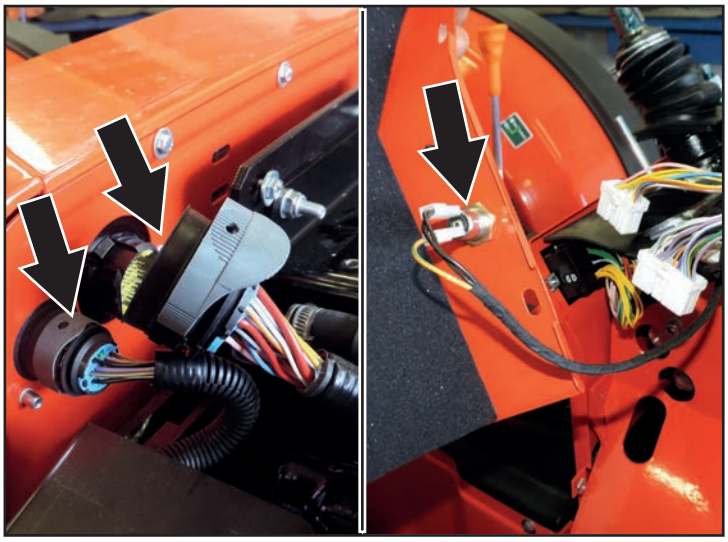


Fig. 13.15

Remove the handgrip (19).

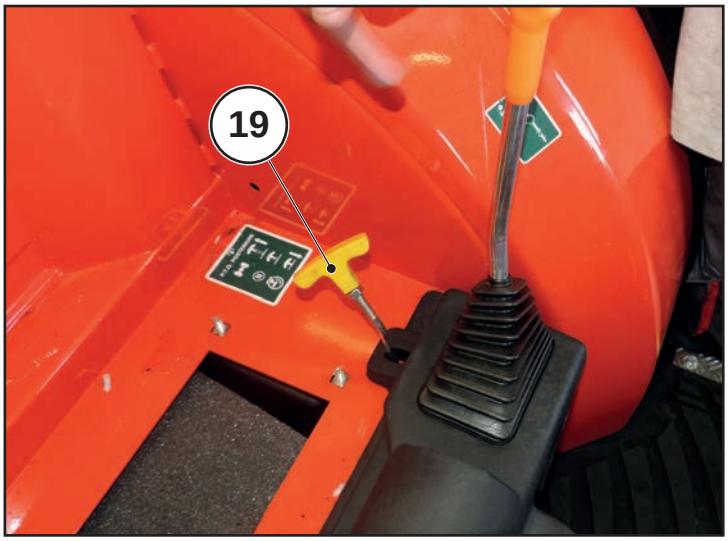


Fig. 13.16

Remove the gearshift lever (20) by unscrewing the screw.



Fig. 13.17

Remove the pin (21) then remove the hand brake lever (22) and spacer (23).

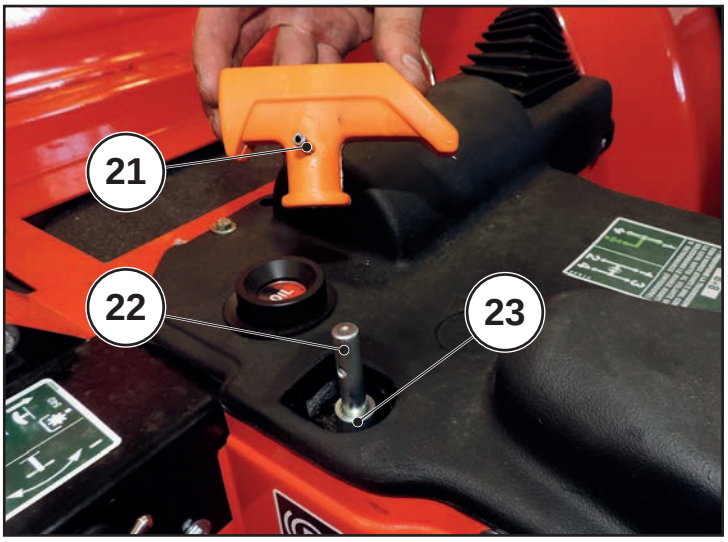


Fig. 13.18

Unscrew the fixing screws (24) and remove the washers (25) of the central covering.

Remove the central covering (26).

> **Warning**
>
> To remove the central covering more easily, the P.T.O. lever must be moved to the "Synchronized" position.

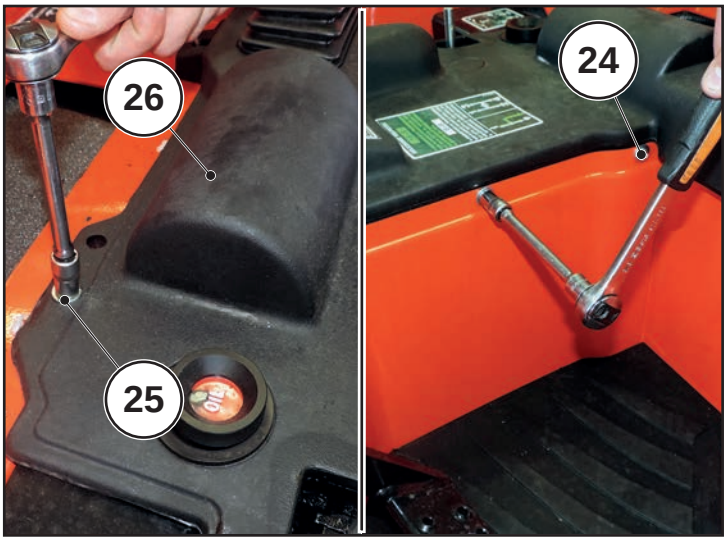


Fig. 13.19

Unscrew the fixing screws (27) and remove the washers (28) of the upper mudguard protection.

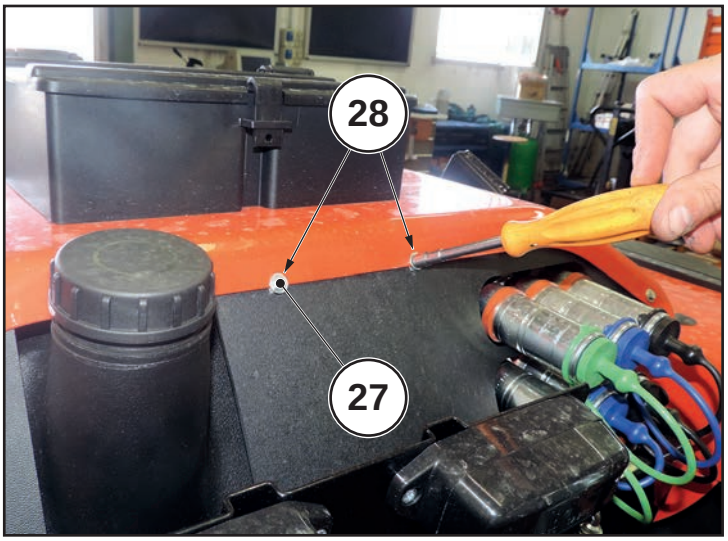


Fig. 13.20

Unscrew the fixing screws (29) and remove the side washers (25) from under the mudguards.



Fig. 13.21

Remove the rear protection.

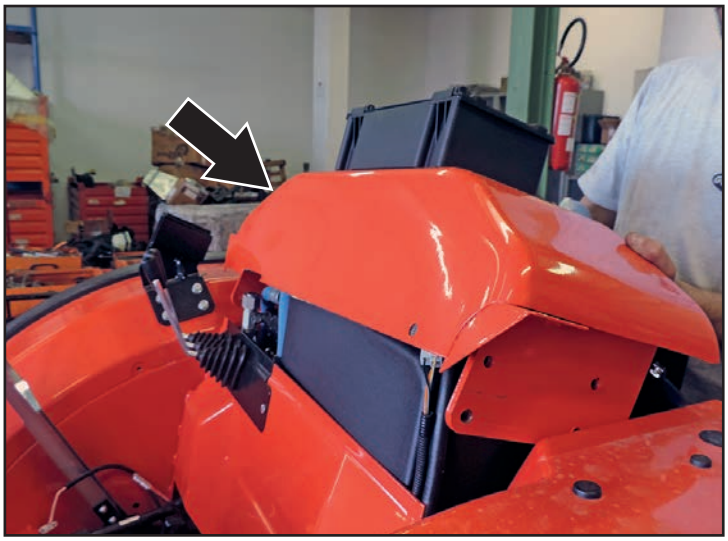


Fig. 13.22

Unscrew the fixing screws (30) and remove the washers (28) from the protective casing of the hitch cock.

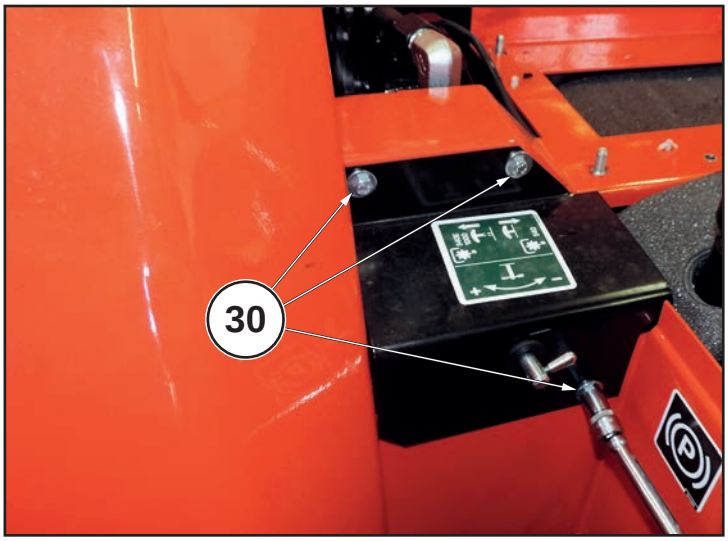


Fig. 13.23

Unscrew the nut (31) and screw (32) so as to remove the cock lever (33).

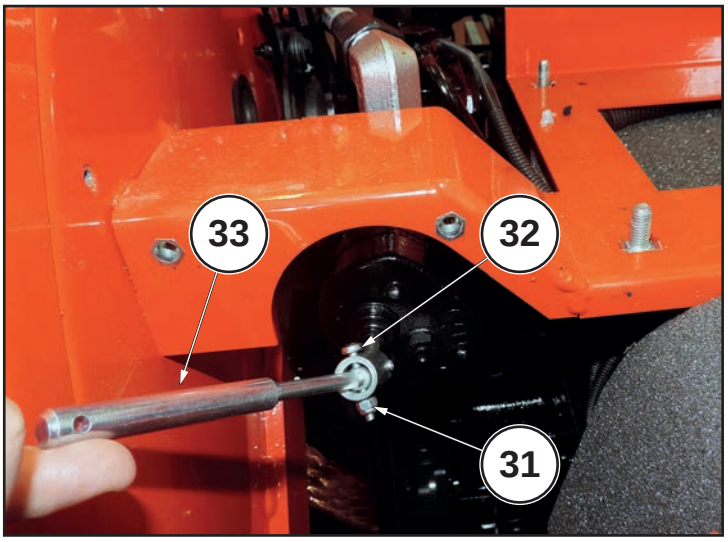


Fig. 13.24

Unscrew and remove the accelerator pedal (34).

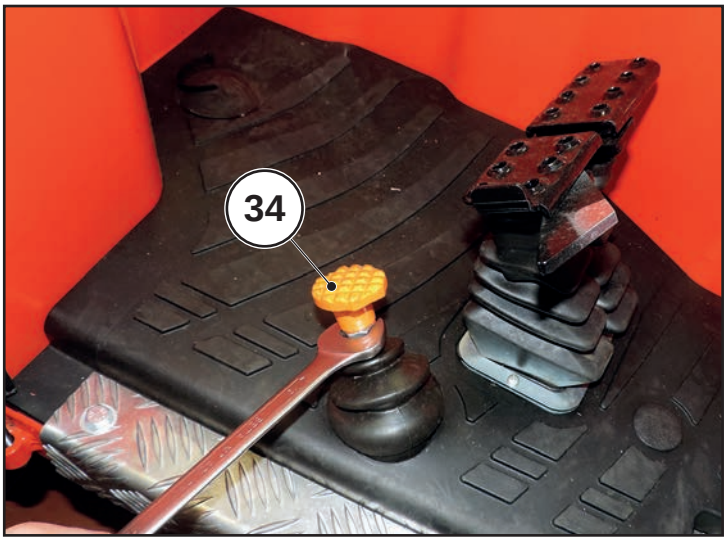


Fig. 13.25

Unscrew the screws (35) that fix the brake pedals and remove them.



Fig. 13.26

Remove the knobs of the rear control valve levers (36), unscrew the screws and remove the support.

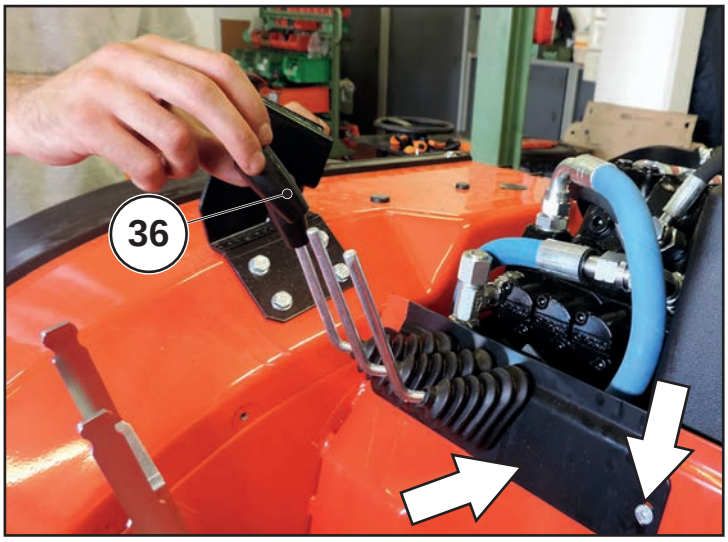


Fig. 13.27

Unscrew the clamp (37) and screws (38) of the protective structure (39), then remove it.

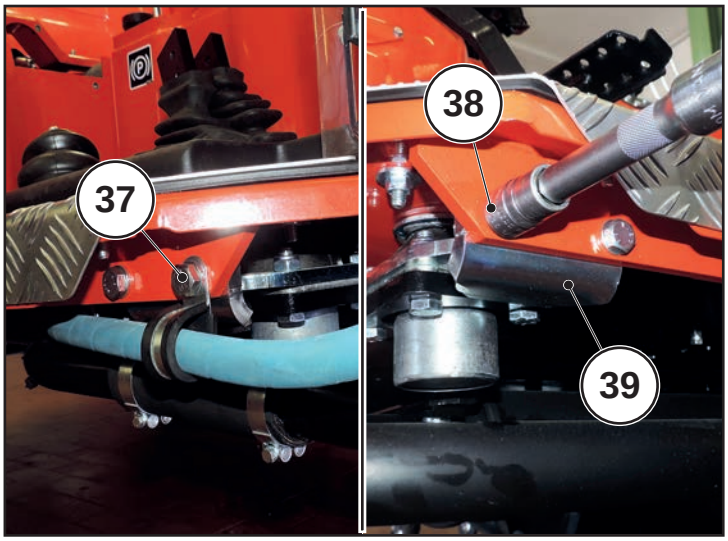


Fig. 13.28

Unscrew the screw and remove the spacers from the clutch pedal (40).

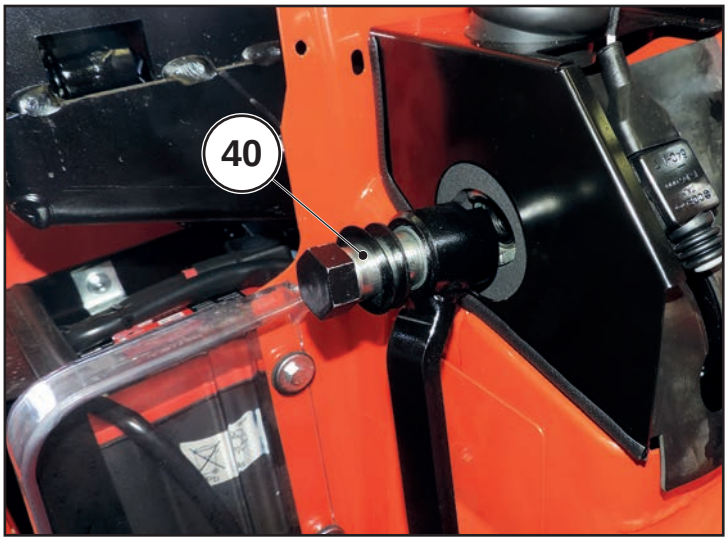


Fig. 13.29

Disconnect the ignition enabling (41) and P.T.O. switch (42) connectors.

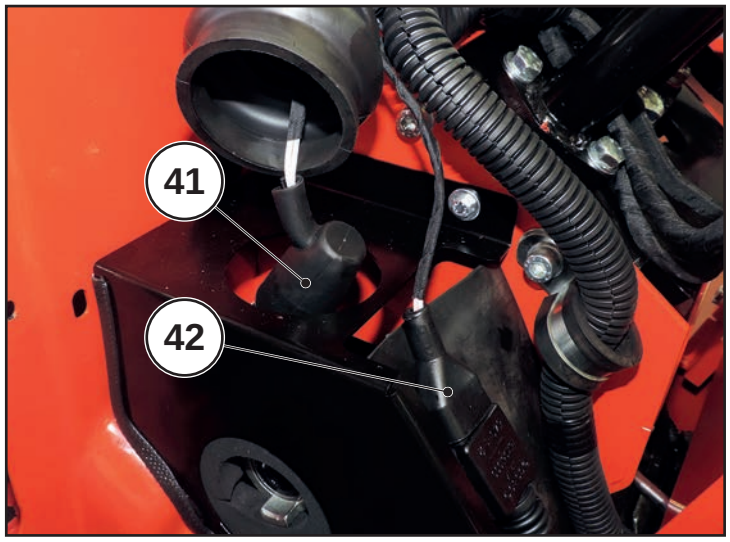


Fig. 13.30

Unscrew the screws and washers (43) from the protective casing of the clutch pedal, then remove it.

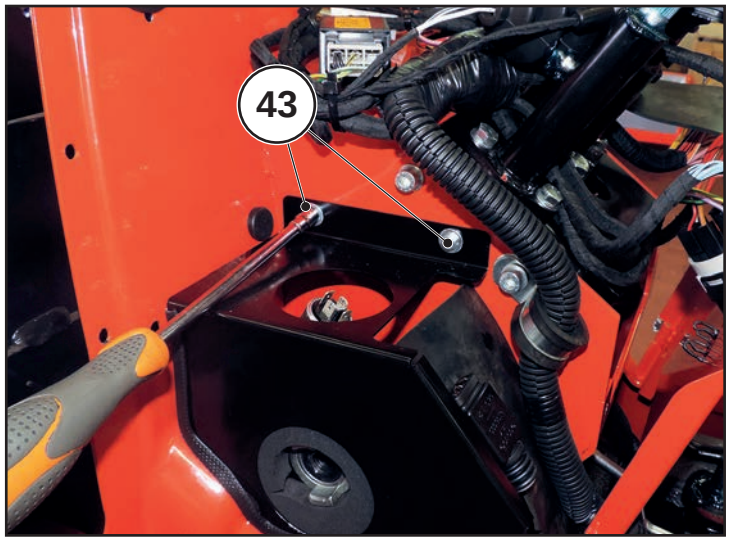


Fig. 13.31

Loosen the clutch pedal end of travel screws (44).

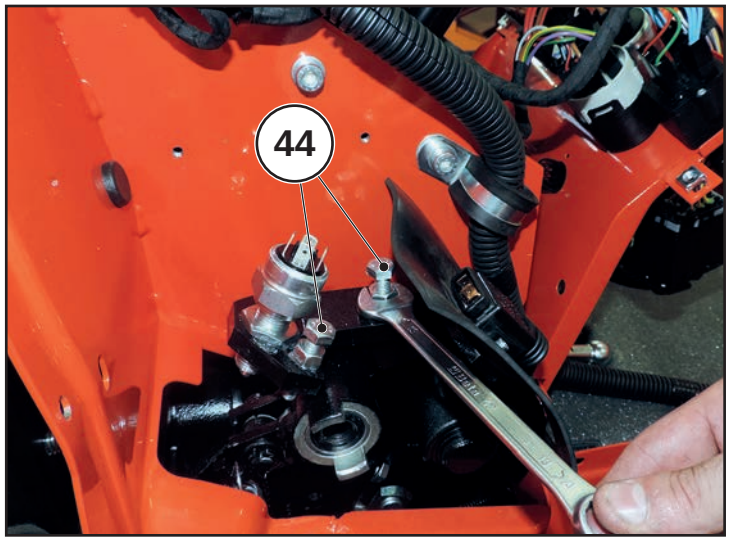


Fig. 13.32

Unscrew the screw (45) and washer from the door (46) that accesses the clutch pedal, then remove it.

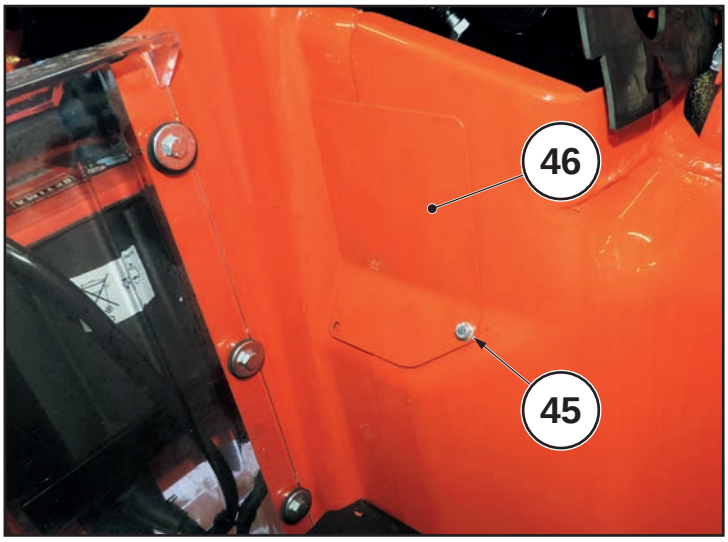


Fig. 13.33

Unscrew the nut (47) to release the clutch return spring.

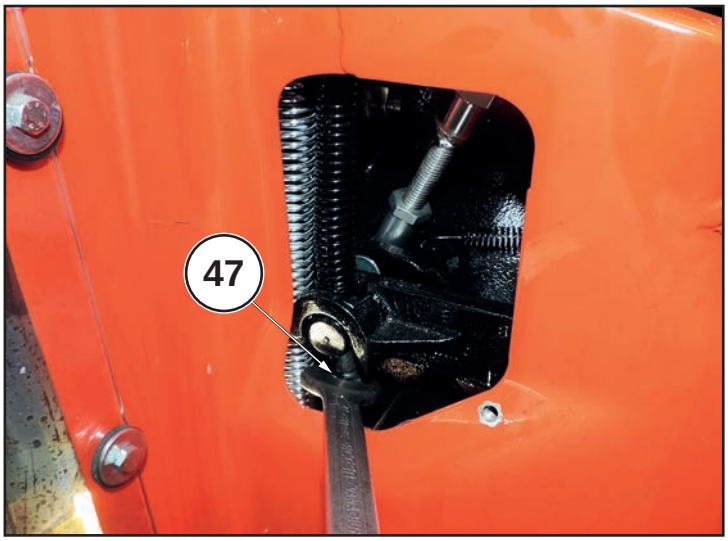


Fig. 13.34

Disconnect the discharge pipe of the control valves (48).

Disconnect the delivery pipe of the control valves (49).

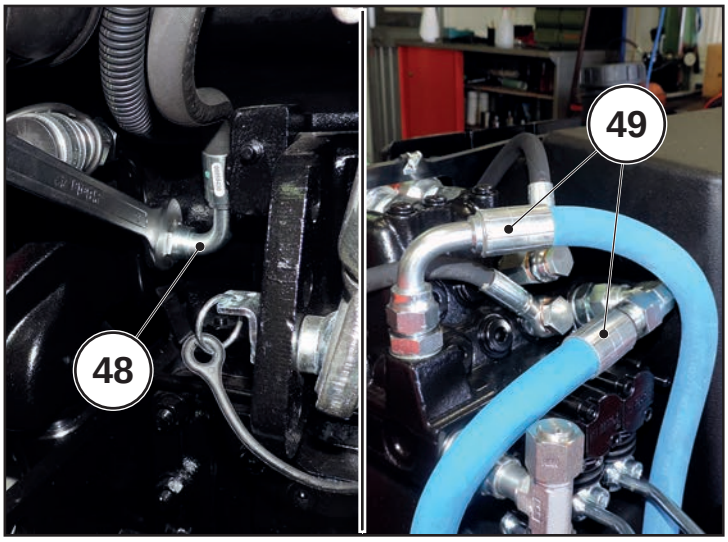


Fig. 13.35

Hold the cable in place with a pair of needle-nose pliers and unscrew the plate (50).

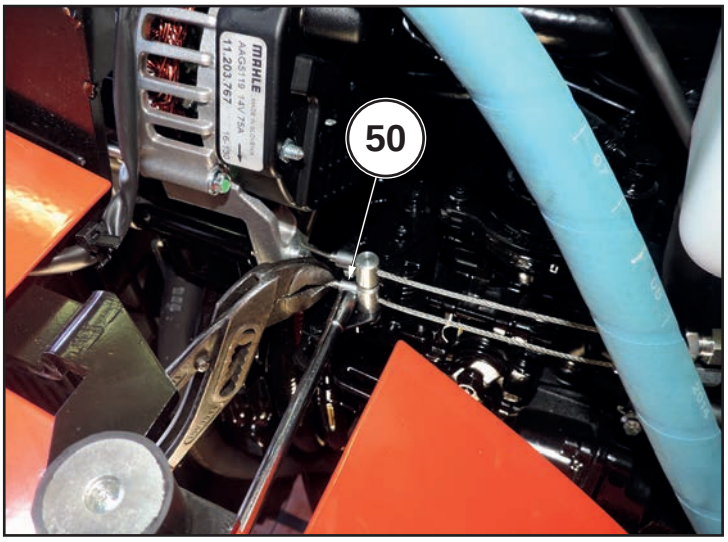


Fig. 13.36

Remove the cable (51) from the driver's position along with the sheath.

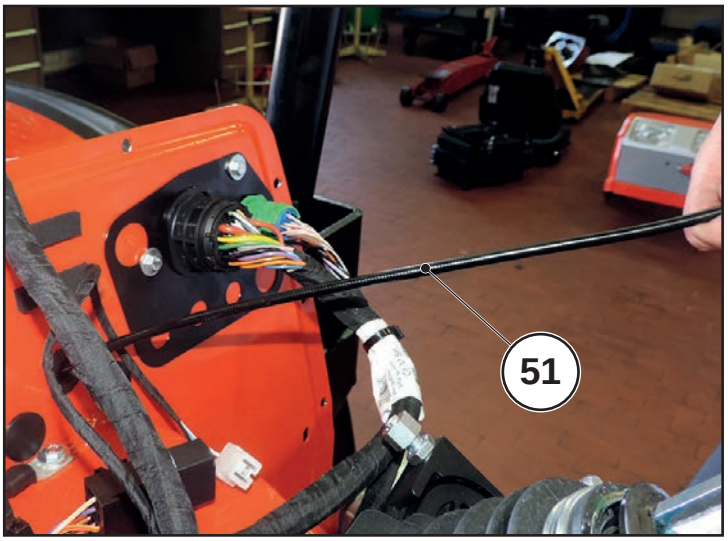


Fig. 13.37

Unscrew the fixing screw (52) and remove the throttle support plate (53).

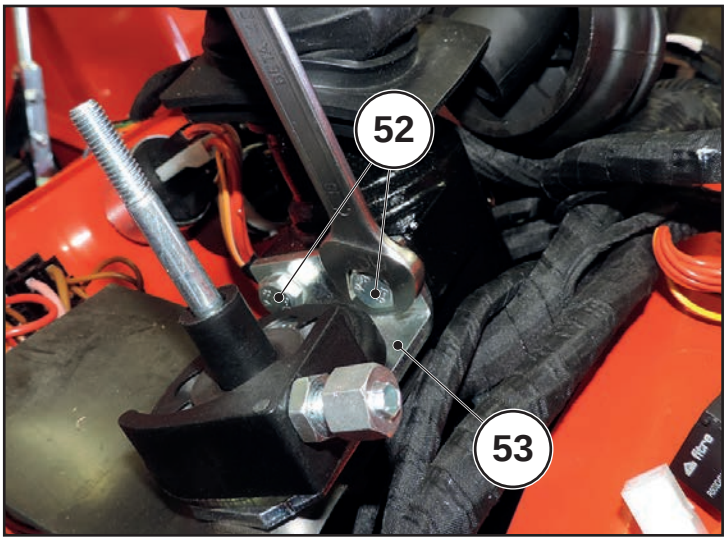


Fig. 13.38

Unscrew the fixing screws (54) and remove the wiring support plate (55) so as to free the point in which the platform is lifted.

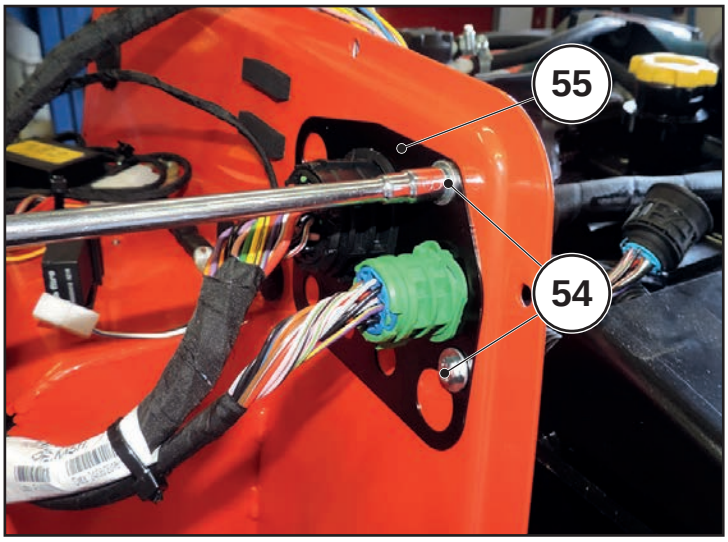


Fig. 13.39

Unscrew the nut and screw (56) that fix the lever (57), then remove it.

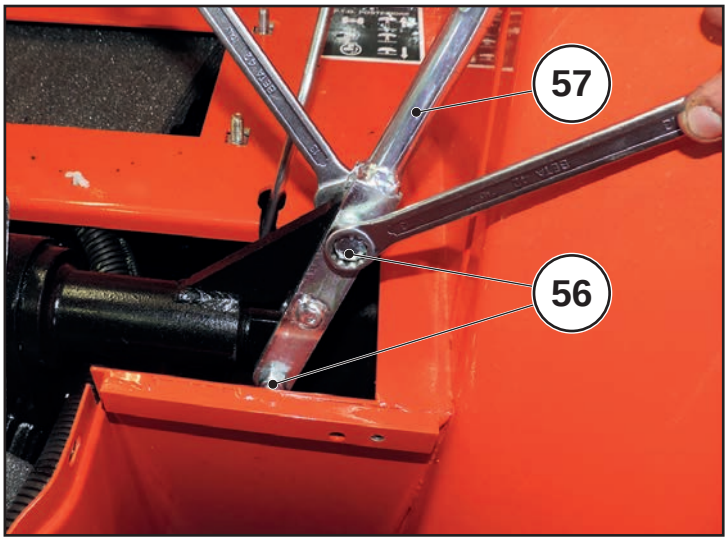


Fig. 13.40

Unscrew the allen screws (58) that fasten the power steering unit.

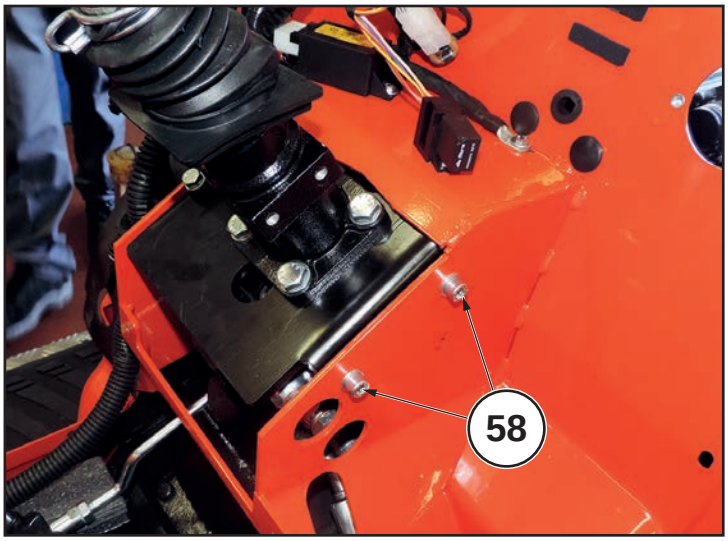


Fig. 13.41

Unscrew the clamp (59) and remove the fuel outlet pipe (60).

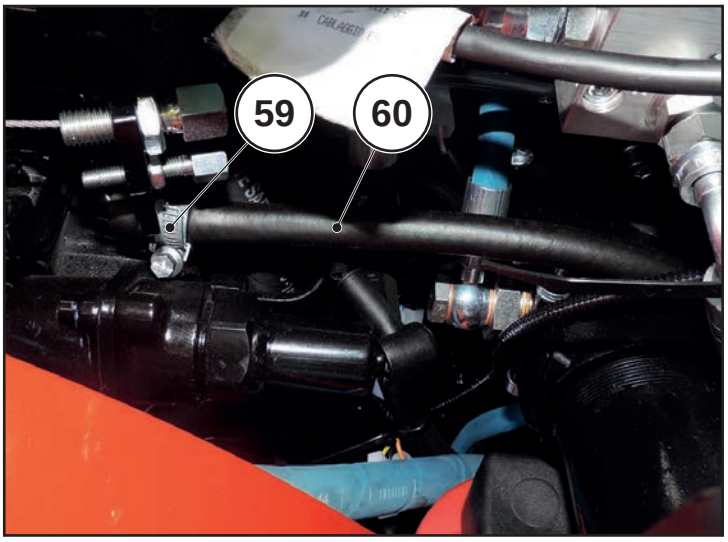


Fig. 13.42

Unscrew the screws and remove the washers (61) from the protective casing of the engine oil filter, then remove the casing (62).

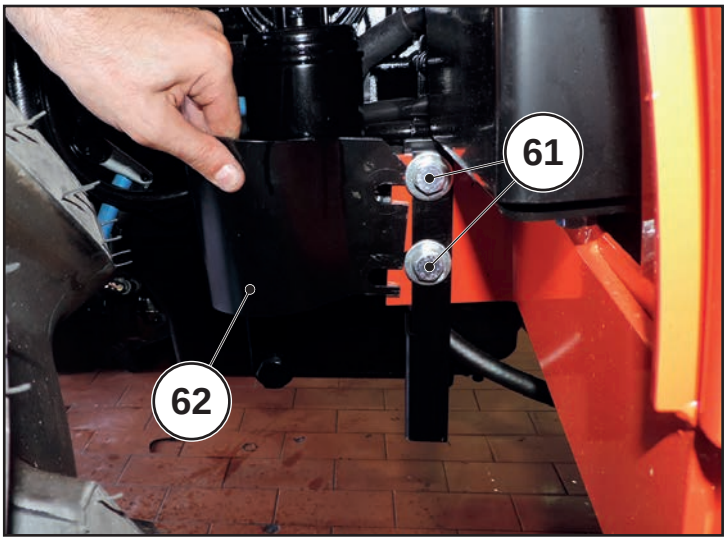


Fig. 13.43

Unscrew the clamp (63) and disconnect the delivery tube of the filter.

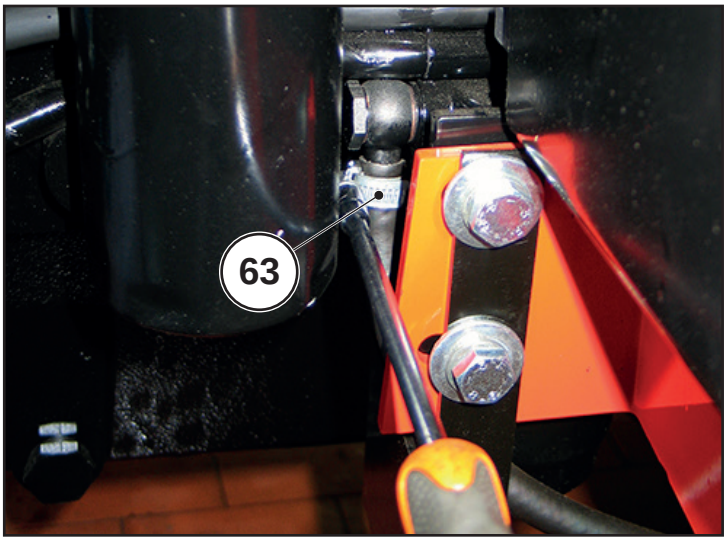


Fig. 13.44

Remove the Kalvas plate (64) of the accelerator pedal cable (65) and remove it from its housing.

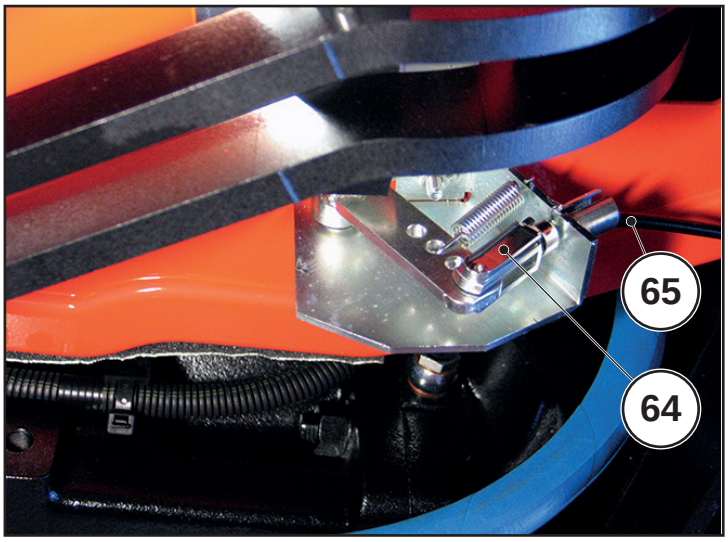


Fig. 13.45

Remove the plugs (66) from the footboards and unscrew the front and rear screws (67).

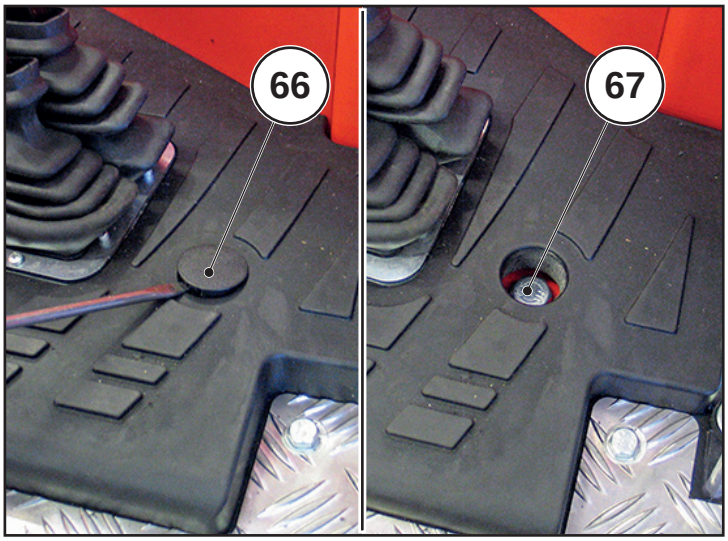


Fig. 13.46

Remove the ground point nut (68) and take out the eyelet.

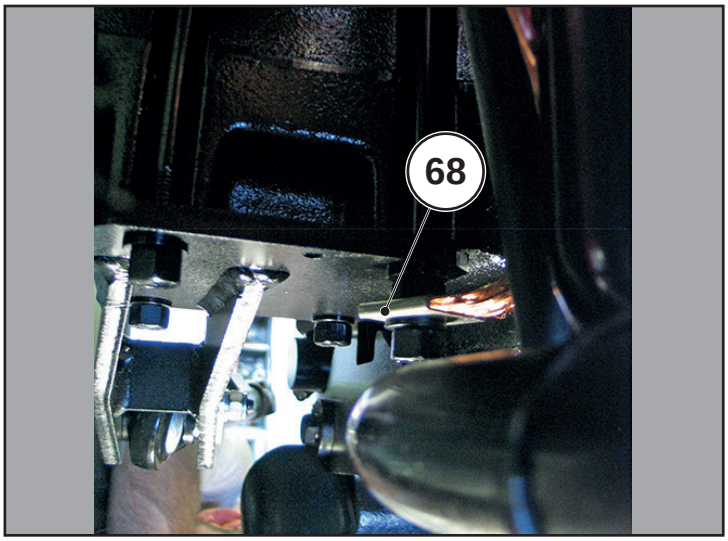


Fig. 13.47

Use tool (B-07007181) to lift the platform.

Warning
Use lifting equipment with an adequate capacity.

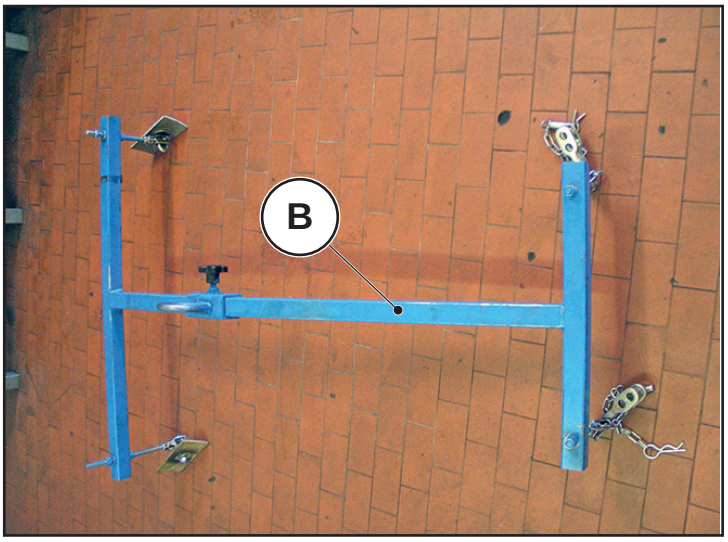


Fig. 13.48

2.3 Re-assembly

Danger
Make sure that all persons keep well away from the danger zone.

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.

Comply with the disassembly instructions in reverse order when re-assembling the platform.

Section 3 : Tools required

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3.1 Tools required

Code	Description	Quantity
07006212	Steering wheel puller	1
07007181	Platform/cab lifting tool	1

Chapter 14 : Cab

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Section 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.

Danger

Always comply with the operating instructions supplied by the manufacturer when using adhesive materials or detergents.

Danger

Used oil must be collected and disposed of in compliance with the anti-pollution laws in force.

Danger

Take care to avoid burns when working with boiling oil. Never heat oil to temperatures exceeding 190°C as the oil or its vapours could suddenly catch fire.

Danger

Splashes of fluid under pressure can penetrate under the skin and cause serious injuries. If accidents occur, immediately seek medical help in order to avoid serious infections.

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.

Danger

Always wear protective goggles and gloves when handling coolant.

Do not allow the coolant to splash on to the skin.

Danger

The equipment for treating the coolant must be used in adequately ventilated places, with at least four air changes per hour.

Danger

Do not use equipment for treating coolant near open containers holding inflammable substances or with leaks.

Danger

Do not tamper with or modify the settings of the breather and safety valves in the containers and equipment for treating coolant.

Danger

Do not fill any vessel (cylinder, A/C charging equipment) with coolant unless it has not been approved for the purpose and equipped with a relative safety valve.

Danger

Do not fill any storage vessel beyond 80% of its capacity.

Danger

Take the utmost care when the service pipes are disconnected since they may contain pressurized coolant.

Section 2 : Technical specifications

Index

2.1 Technical specifications 14-6

2.1 Technical specifications

Coolant fluid

Type	R134
Quantity	0.8 kg

Section 3 : Splitting and re-assembly

Index

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3.3 Reassembly of SG1 cab 14-11

3.4 Removal of GL9 cab 14-12

3.5 Reassembly of GL9 cab 14-16

3.1 Preliminary operations

Warning
Discharge all the gas from the air conditioning system before proceeding with the operations required to split the cab from the tractor.

3.2 Removal of SG1 cab

Unscrew the screws (1) and washers and remove the side covers (2).

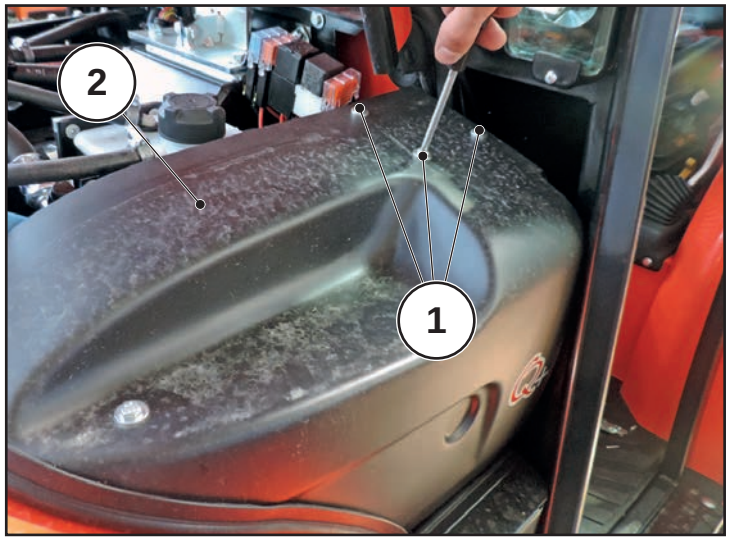


Fig. 14.1

Remove the clamps (3).

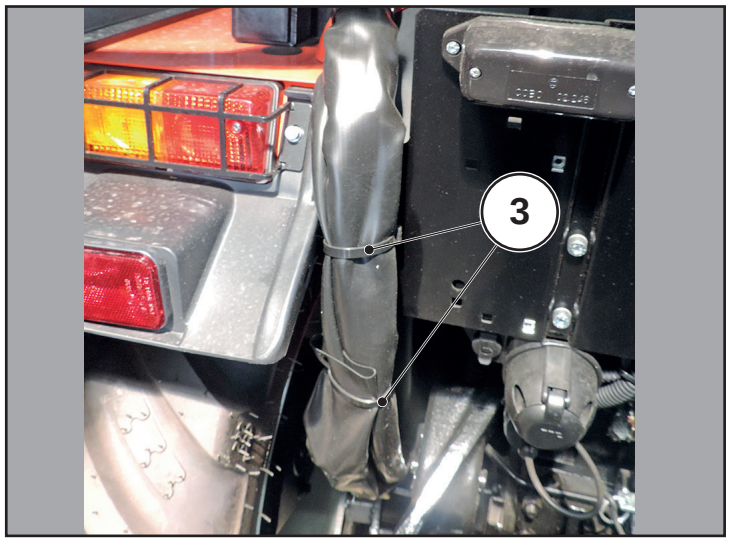


Fig. 14.2

Disconnect the wiring (4).

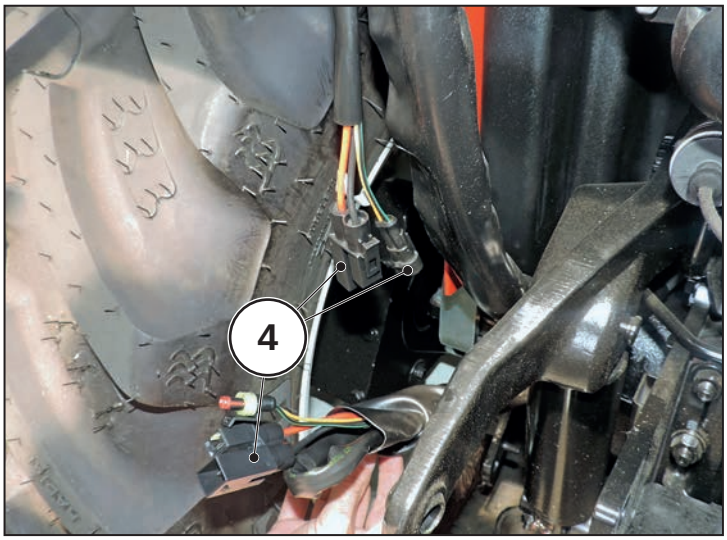


Fig. 14.3

Disconnect the water and air conditioning tubes (5) on the right and left sides.

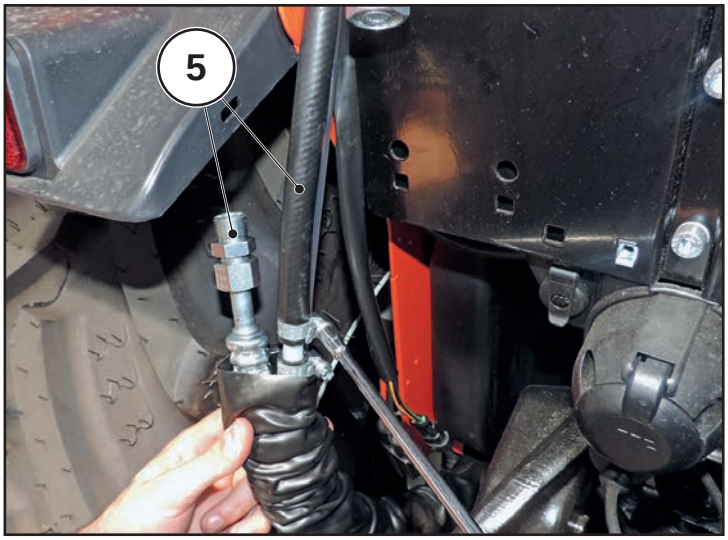


Fig. 14.4

Remove the screws that fasten the cab (6) along with their nuts and washers on the rear right and rear left sides.

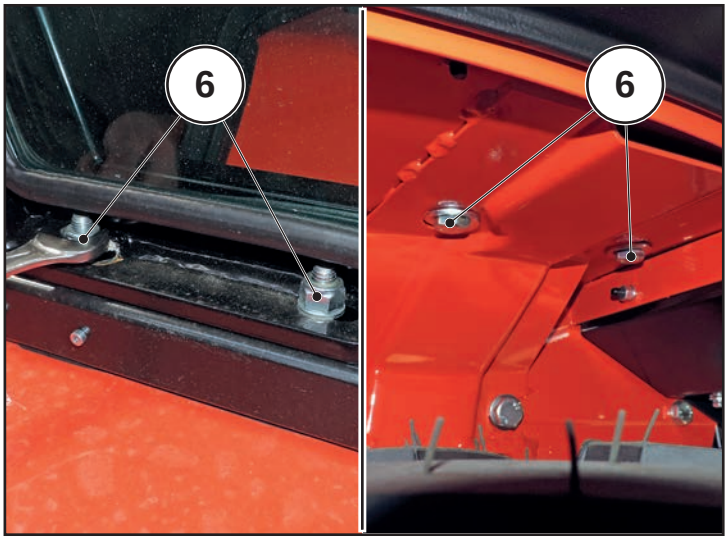


Fig. 14.5

Unscrew the nuts and remove the lower screws (7) from the front part of the footboards.

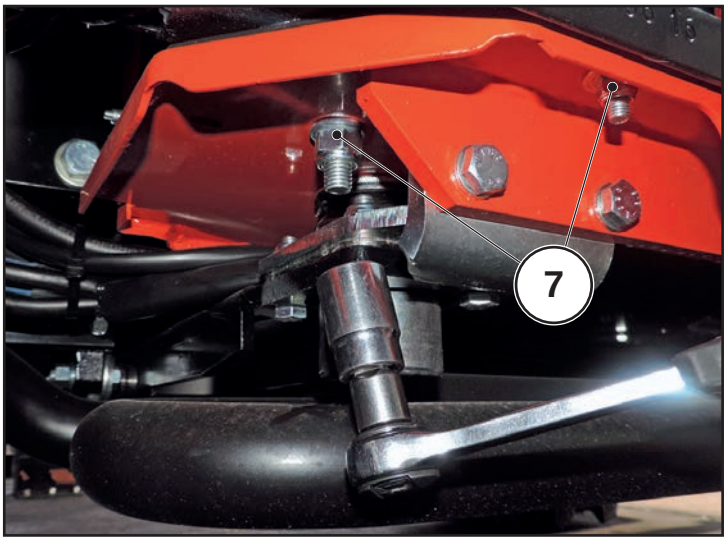


Fig. 14.6

Unscrew and remove the clamps (10) and disconnect the water pipes.

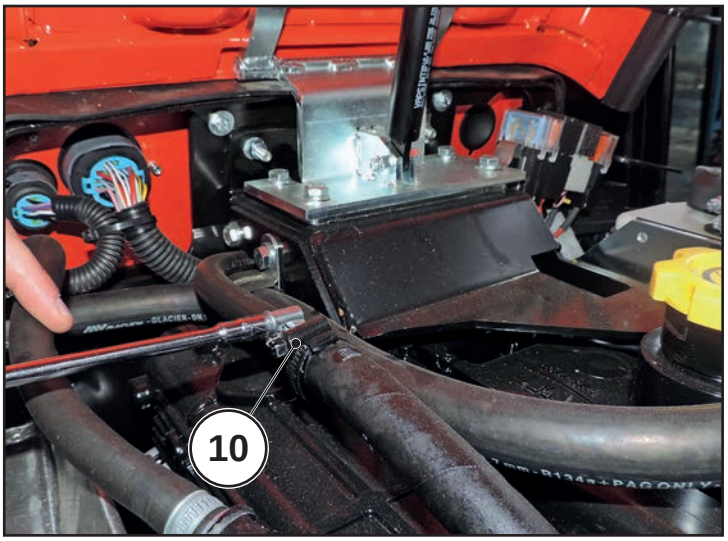


Fig. 14.7

Warning

If the cab is to be completely removed from the tractor, unscrew the pipe unions (8) from the compressor (9).

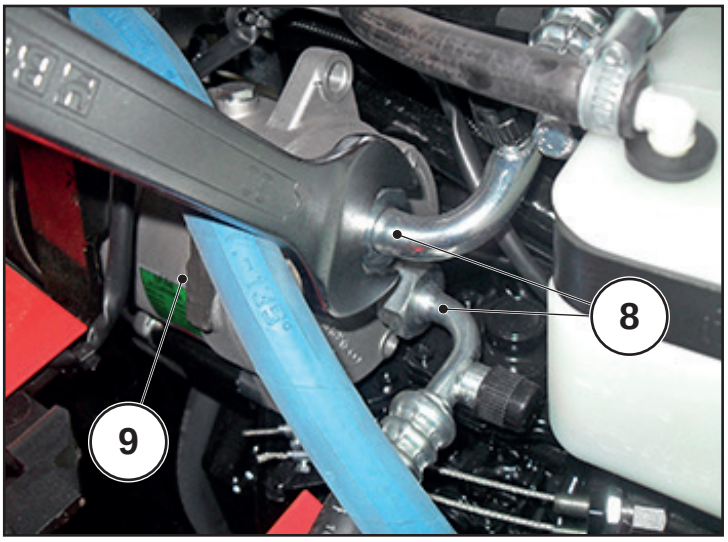


Fig. 14.8

Raise the cab (25) using suitable lifting equipment (24).

Caution

Make sure that the lifting harness is positioned as near as possible to the rear part of the cab so as to prevent this from becoming misshapen when the cab is lifted.



Fig. 14.9

3.3 Reassembly of SG1 cab

Danger

Make sure that all persons keep well away from the danger zone.

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.

Comply with the splitting instructions in reverse order when reassembling the cab.

3.4 Removal of GL9 cab

Remove the side covers (11).



Fig. 14.10

Unscrew the four screws that fasten the cab (12), two in the front part and two in the rear part of the cab.

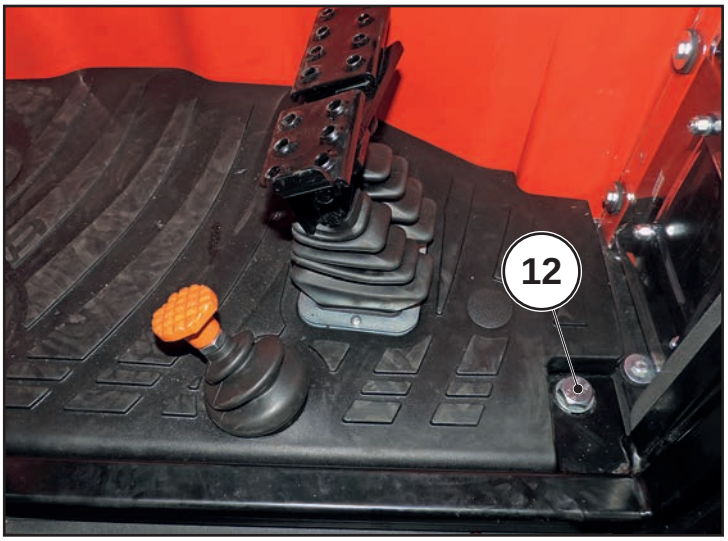


Fig. 14.11

Unscrew the tube unions (8) from the compressor (9).

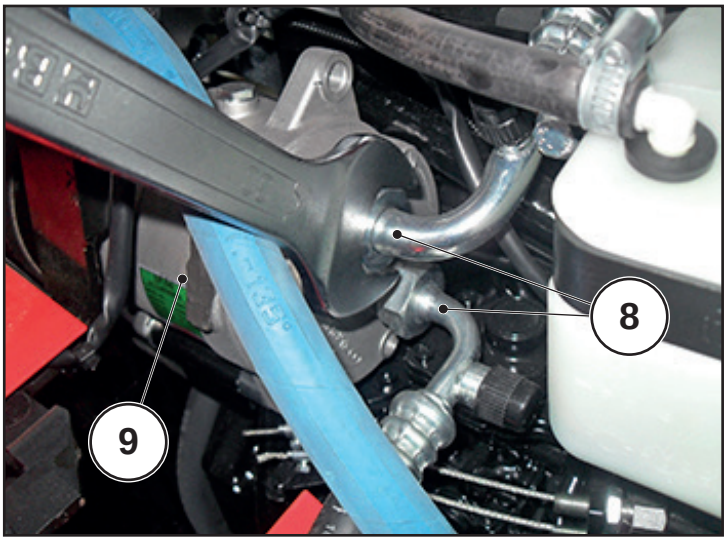


Fig. 14.12

Unscrew the clamp (13).

Disconnect the water pipes (14).

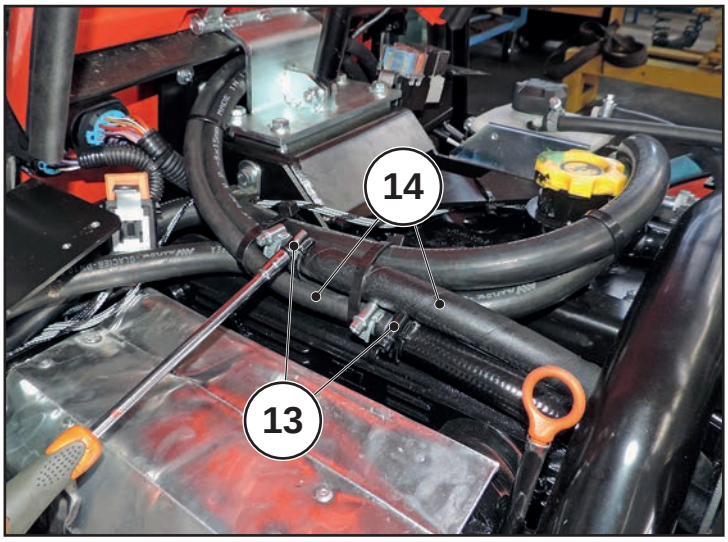


Fig. 14.13

Unscrew the nut (15) and remove the grounding eyelet (16).

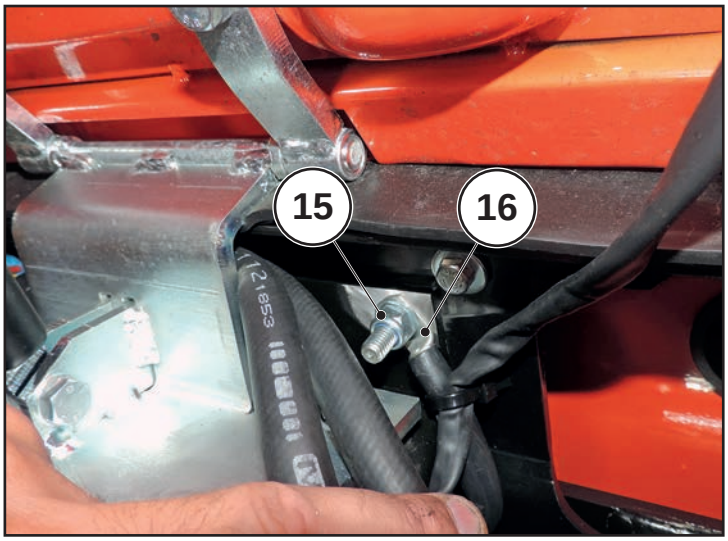


Fig. 14.14

Unscrew the screws (17) and remove the protection (18).

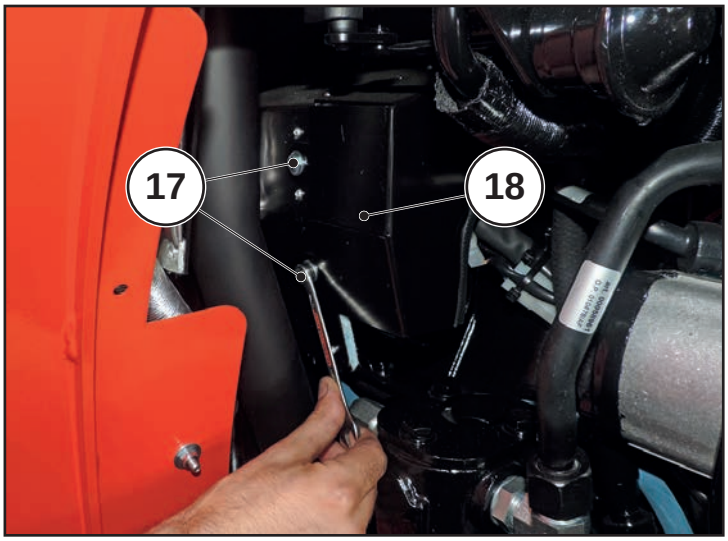


Fig. 14.15

Disconnect the connector (19).

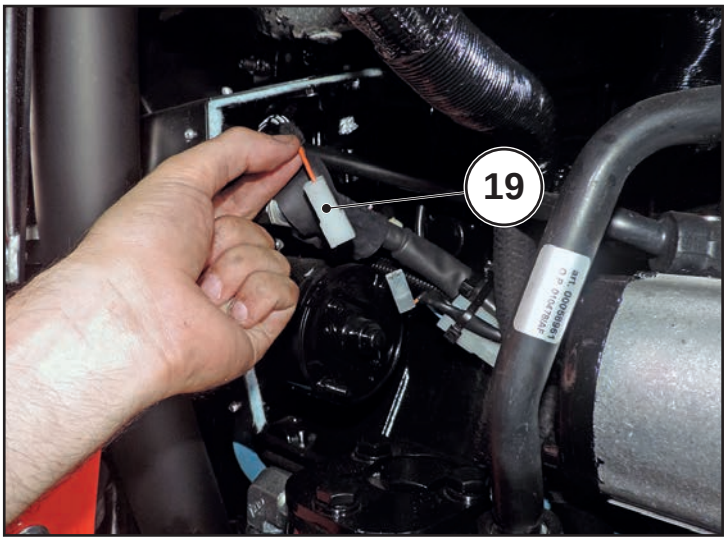


Fig. 14.16

Disconnect the positive cable (20).

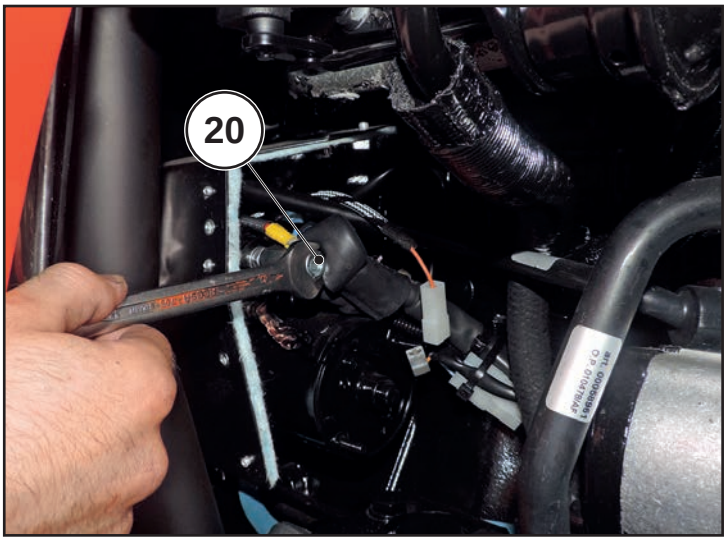


Fig. 14.17

Unscrew the four screws (21).

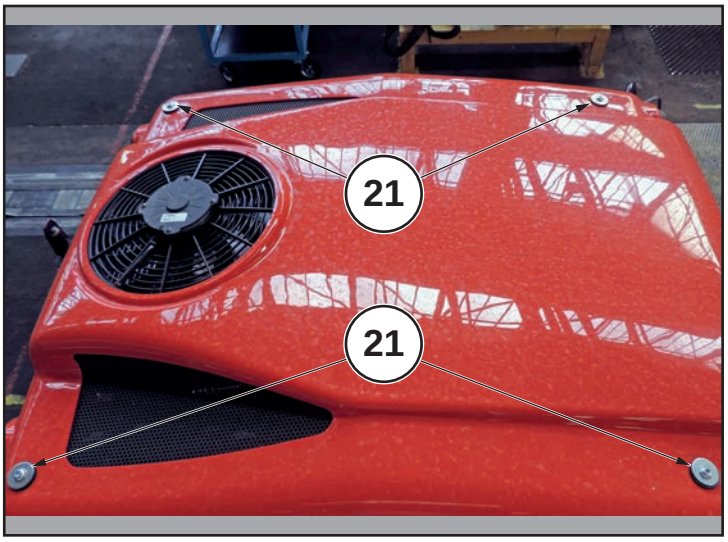


Fig. 14.18

Remove the cover (22).

Screw in the four eyebolts (23).

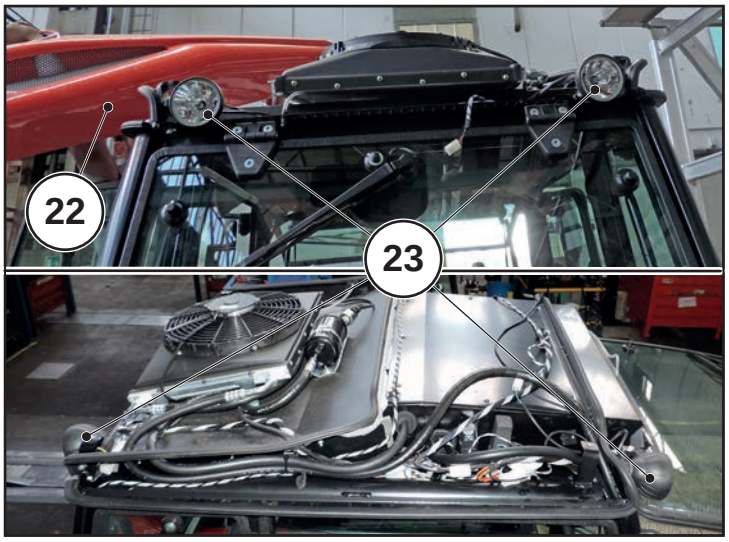


Fig. 14.19

Use tool (A-07007181) to lift the platform.

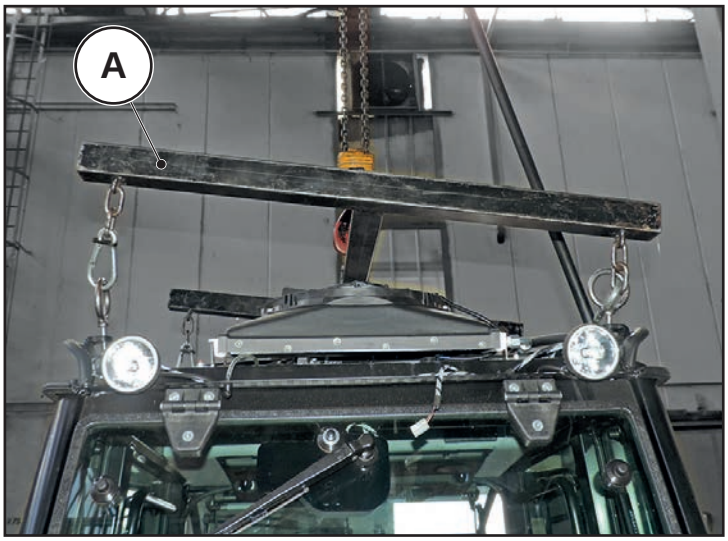


Fig. 14.20

3.5 Reassembly of GL9 cab

Danger

Make sure that all persons keep well away from the danger zone.

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.

Comply with the splitting instructions in reverse order when reassembling the cab.

Section 4 : Air conditioning system

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4.1 General description

4.1.1 Basic concepts

4.1.1.1 Introduction

We considered it advisable to give a brief explanation of the more important basic principles dictated by elementary notions of physics before proceeding with the theoretical-practical analysis of the air conditioning system.

Nowadays, an increasingly higher number of tractors is being equipped with an air conditioning system. It is therefore essential for repair engineers to acquire a theoretic knowledge of those fundamental principles on which a cooling system is based in order to be able to work with adequate competence when servicing and repairing such systems.

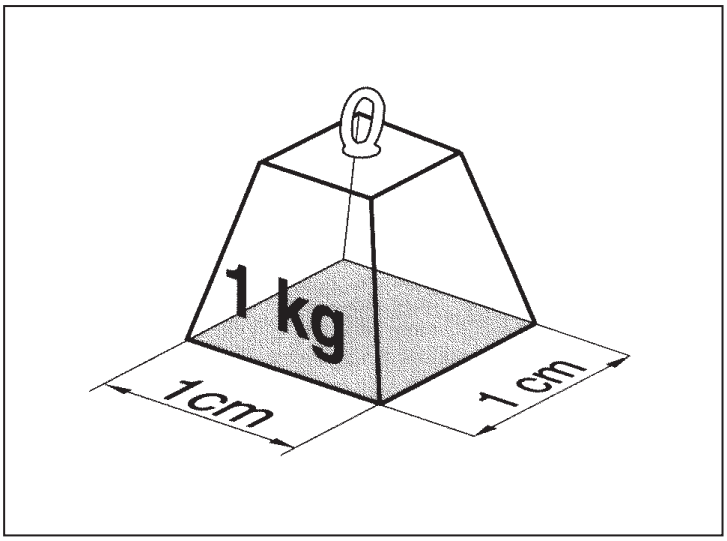


Fig. 14.21

4.1.1.2 Pressure

The **pressure** is a physical entity defined by the ratio between a certain force, perpendicular to a surface, and the area of the surface itself (e.g.: 1 kg on 1 cm2 of a horizontal surface).

The **atmospheric pressure**in a determined point of the atmosphere, is the weight of the air column of unitary section (e.g.: 1 cm2), that goes from the above mentioned point to the upper limit of the atmosphere itself. The higher the point in which atmospheric pressure is measured, the less it will therefore be (e.g.: atmospheric pressure in mountain districts is less than at sea level).

The unit of measurement most commonly used in the past was the**Atmosphere**, since it corresponded to the atmospheric pressure at sea level in determined conditions - Normal Atmospheric Pressure - and equivalent to the pressure exercised by a mercury column (Hg) of unitary section, 760 mm high at 0°C, at sea level and at a latitude of 45°. This unit of measurement is the**physical atmosphere** and its symbol is the **atm**.

The instrument used to measure the pressure of fluids is the pressure gauge (Fig.14.22).

The pressure gauges normally used in practice are the differential type since they indicate the difference between the pressure of the environment in question and the atmospheric pressure.

The dials of differential pressure gauges have scales (in the required units of measurement) where zero“0” corresponds to the atmospheric pressure and where the indicated pressure or manometric pressure is called relative pressure.

On the other hand, absolute pressure is the pressure measured on a scale where zero “0” is the absolute vacuum and “1” corresponds to the normal atmospheric pressure.

The absolute pressure is therefore given by the sum of the manometric (or relative) pressure and the normal pressure (_1 by definition).

A relative pressure that is lower than the normal pressure is indicated as negative pressure or vacuum, or degree of vacuum. The instrument used to measure the negative pressure is the vacuometer (Fig.14.23).

Main conversions between the more common 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

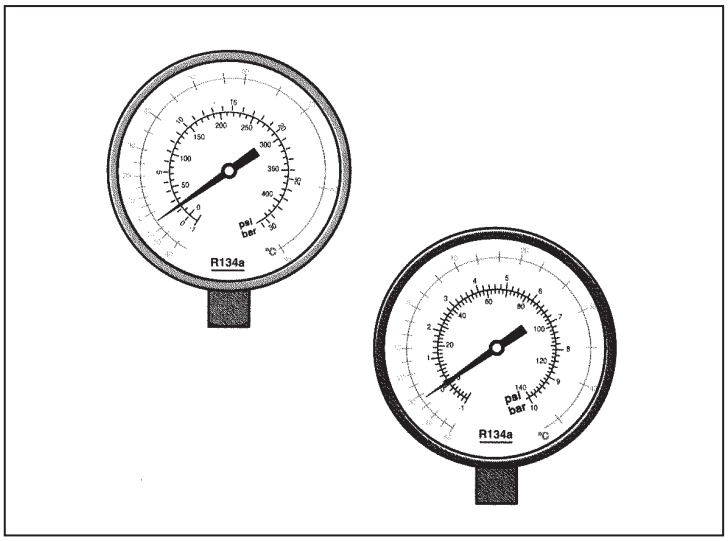


Fig. 14.22

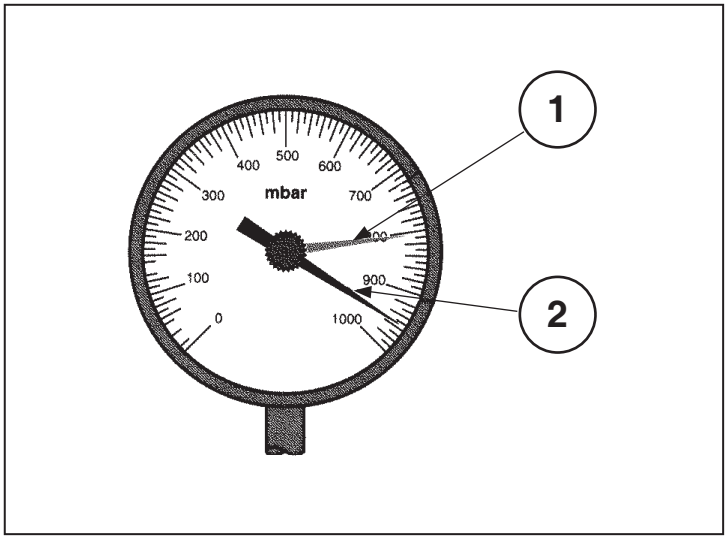


Fig. 14.23

1 - reference pointer
2 - measuring pointer

4.1.1.3 Heat and temperature

The terms heat and temperature are often used in daily practice.

For example, heat is received from a flame or from the Sum. For this reason, they are called heat sources.

An object which, when touched, gives us the sensation of being hotter than another, is said to have a higher temperature.

To explain the meanings of the terms heat and temperature and to allow them to be correctly used, we will now give stricter definitions indicating the main properties and the relative units of measurement (which are widely interdependent).

Heat

Heat is a form of energy (thermal energy) generally present in nature since it is contained in all bodies, although in different concentrations.

The quantity of heat exchanged between bodies cannot be measured directly but only according to the effects produced (temperature variation, modification of the physical status, chemical reactions, production of mechanical work, etc.).

The conventional unit of measurement for the quantity of heat is the calorie (cal) or small calorie, defined in the following way: the quantity of heat required to increase the temperature of the mass of 1 gram of distilled water at the normal atmospheric pressure at sea level by 1°C - from 14.5 to 15.5°C.

In practice, the large calorie (Cal) or kilocalorie (kcal) = 1000 cal is used and is defined as: quantity of heat required to increase the temperature of the mass of one kg of distilled water at the normal atmospheric pressure at sea level by 1 degree - from 14.5 to 15.5°C.

In English speaking countries, the unit of measurement for heat in use is the British Thermal Unit (BTU):

1 BTU = 0.252 kcal

Both the calorie and the BTU are units of measurement that are not permitted by the International System (SI), according to which the unit of measurement for the heat quantity is the Joule (J):

1 J = 0.000239 kcal = 0.000948 BTU

Other conversion formulas amongst the above mentioned units of measurement are:

- 1 cal = 4.186 J
- 1 kcal = 4186 J = 4.186 kJ
- 1 kcal = 3.968 BTU
- 1 BTU = 1054.87 J

In refrigerating, air conditioning systems and in the cold industry in general, the commonly used unit of measurement is the refrigeration unit, defined as the quantity of heat removed equivalent to 1 kcal.

In English speaking countries, the unit of measurement for cooling is the ton of refrigeration (meaning the extraction of 288000 BTU/day). Hence the following equivalences:

1 ton = 12000 BTU/h = 3027 kcal/h = 12672 kj/h = 3.52 kw.

Temperature

The temperature of a body indicates the level of heat concentration it contains, given the weight (qualtity of matter) and the volume of the body itself.

The unit of measurement of temperature is the degree.

Since the temperature can be measured with reference to the different scales in use, the temperature interval corresponding to 1 degree differs in the various scales themselves.

The most commonly used scales are Celsius and Kelvin.

The Celsius scale is obtained by dividing the interval between the temperature of melting ice (considered = 0) and that of boiling water (considered = 100) into one hundred equal parts (distilled water, atmospheric pressure at sea level). Thus defined, the symbol of the Celsius degree is °C. By convention, the absolute absence of heat is -273.16°C on the Celsius scale.

The Kelvin scale considers the same reference points (melting ice and boiling water) and the same division (into 100 equal parts) of the relative temperature interval, but the zero mark corresponds to absolute zero (absence of heat): this is why the Kelvin scale is also called absolute scale of temperature. This scale includes the temperature of ice.

Freezing point of water at 273.16 and the temperature of boiling water at 373.16. Symbol K represents the degree in the Kelvin scale.

The Fahrenheit scale is used in English speaking countries, where the temperature of ice is 32 and that of boiling water 212 and the absolute absence of heat is -459.67. Symbol °F represents the Fahrenheit temperature degree.

Fig.14.24 compares the different temperature scales: Fahrenheit (°F), Celsius (°C), Réaumur (°r), Kelvin (K) and Rankine (°R).

The table on the right gives the conversion formulas allowing users to switch from one unit of measurement to the other.

scale	conversion tables
°F > °C	°C = (°F-32):1.8
°F > °C	°F = (°Cx1.8):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

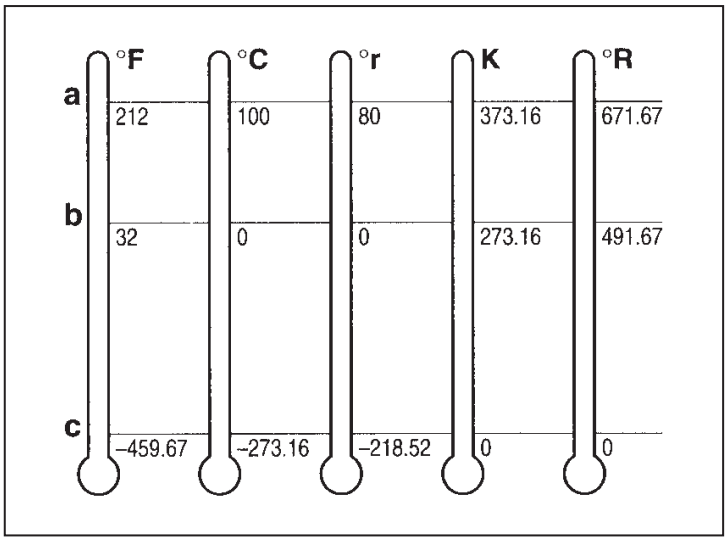


Fig. 14.24

a - boiling point of water
b - freezing point of water
c - absolute zero

Heat transmission properties and modes

The basic property is that, according to which, when there are two bodies at different temperatures, heat moves spontaneously from the higher temperature body (the warmer one) to that with a lower temperature (the cooler one); or, within a single body where the temperature is not uniform, heat moves spontaneously from the higher temperature parts to those at a lower temperature.

Heat transfer from a cooler body to a warmer one can only be carried out in a forced way, thus with a use of energy.

The quantity of heat that can be transmitted within a given time unit from a body at a higher temperature to one at a lower temperature is directly proportional to the temperature difference.

There are three basic methods according to which heat can be transmitted from one body to another of a different temperature:

- Transmission by conduction

  This occurs by contact between the two bodies without movement of matter (characteristic between solid bodies).
- Transmission by convection

  Occurs by movement of matter (typical in fluids).
- Transmission by radiation

  Occurs between different bodies, not in contact, by means of electromagnetic waves (particularly infrared rays) even if the space between the bodies themselves is completely empty (without matter).

  Typical and most important example in nature is the Earth, heated by the sun's rays.

4.1.1.4 Influence of heat on transformations of physical states in bodies (at constant pressure)

To make the general considerations given on this subject easier to understand and to justify their use in an air conditioning system, we are proposing a simple experiment for purely indicative purposes, which will allow certain physical phenomena to take place in a determined substance (e.g.: water) depending on the heat administered.

The experiment must be carried out at sea level and at normal atmospheric pressure (760 mmHg = 1 absolute Atm) using a vessel, a heat source (e.g.: a flame), a thermometer and 1 kg of distilled water.

Experiment

The experiment begins by placing water in a freezer to form ice, i.e. so that it solidifies. Now transfer the block of ice to the vessel, place the thermometer bulb in contact with the ice and place everything over the flame (Fig.14.26 a-b).

At the beginning of the experiment, the thermometer will indicate the temperature of ice as taken from the freezer, e.g.: – 10°C.

As time goes by, you will note that the heat will cause the temperature of the ice to progressively rise to -9°C, -8°C, etc., until it reaches 0°C.

Drops of liquid will now begin to form on the surface of the ice (Fig.14.26 c): the ice has begun to melt and this process will continue (Fig.14.26 d) until the solid phase disappears and the water is all in the liquid state (Fig.14.26 e).

If you watch the thermometer, you will note that the temperature indicated will remain at 0°C all through the ice melting phase.

If you continue to administer heat, maintaining the thermometer bulb immersed in the water, you will note that the temperature progressively increases (Fig.14.26 f) until the following phenomena occur at the same time (Fig.14.26 g):

- the thermometer indicates 100°C
- turbulent movement occurs in the water, with separation of a great quantity of steam.

Boiling or water evaporation has begun. This phenomenon will continue for as long as a trace of water remains.

During this period of time (from the beginning of evaporation to the end) and if the thermometer bulb is kept in continuous contact with the boiling liquid, the temperature indicated will have remained at 100°C.

If the steam that has developed is collected in a suitable vessel (Fig.14.26 h) and heat continues to be administered, the liquid will completely disappear (Fig.14.26 i), after which the temperature of the steam will progressively increase above 100°C (Fig.14.26 l).

Graph Fig.14.25 represents the successive phases of the experiment.

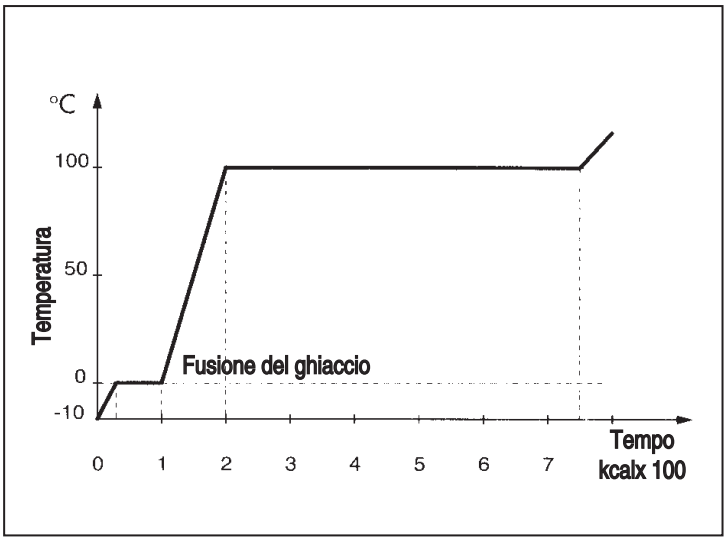


Fig. 14.25

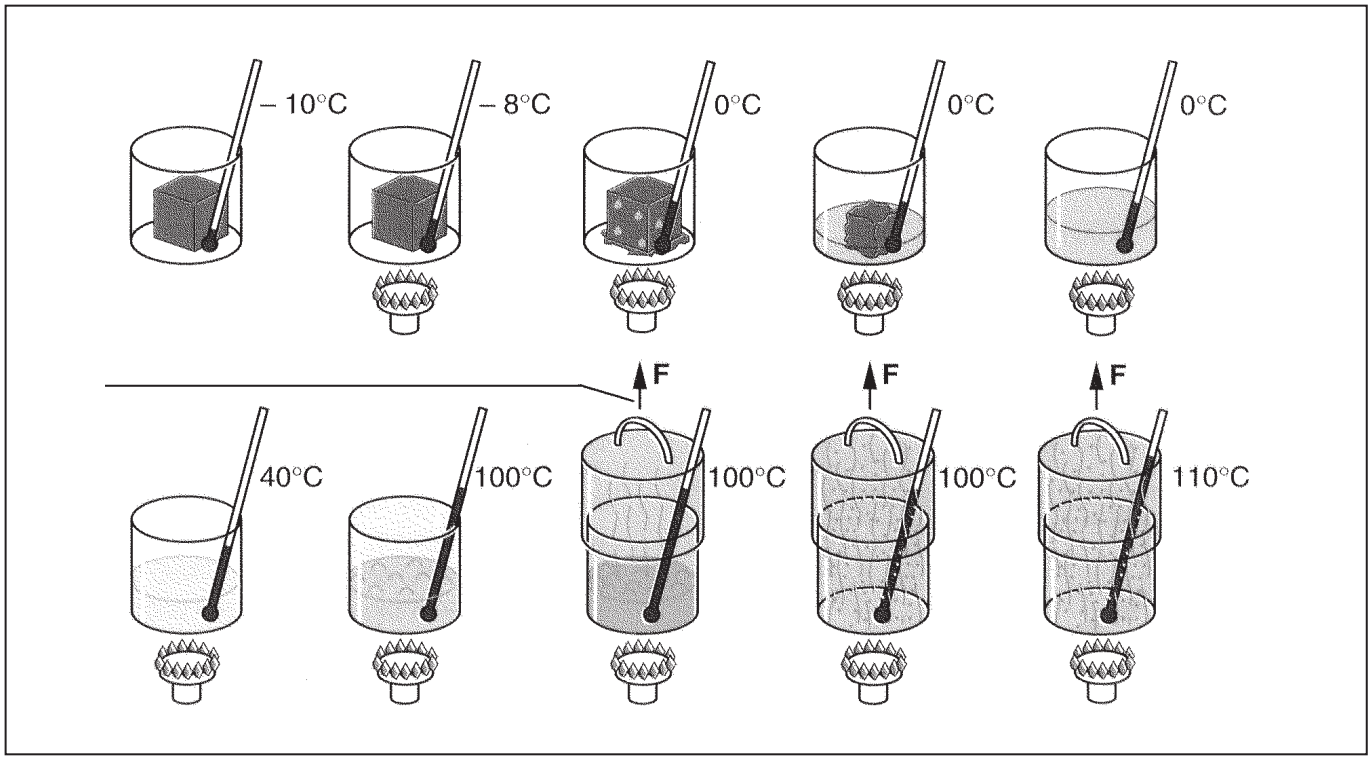


Fig. 14.26

During the experiment, two changes in the physical state will have been observed, by solely administering heat and keeping the pressure at a constant value:

- from solid (iced) to liquid melting
- from liquid to steam evaporation

You will have also noted that heat applied when there is one single phase (solid, liquid, steam) is shown by a temperature increase in the examined substance (water):

- from - 10°C to 0°C, for the solid state (ice)
- from 0°C to 100°C, for the liquid state
- over 100°C for steam (water in a gaseous state).

The heat applied within these intervals and that determines the temperature variation, is called sensitive heat.

On the other hand, you will have noted that during changes in the physical state - melting and evaporation - the heat applied caused no variations to the temperature, which remained the same:

- at 0°C during the melting phase
- at 100°C during the evaporation phase.

The heat exchanged during these intervals is known as latent heat – of melting and evaporation –, i.e. hidden, since there is no temperature variation.

Steam in the presence of liquid and at evaporation temperature is called saturated steam.

Steam that is no longer in the presence of liquid and with a higher temperature than that of evaporation is called overheated steam.

If the above described experiment is repeated beginning with overheated steam and subtracting heat, one obtains in succession: saturated steam at 100°C, liquid at 100°C, liquid at 0°C, solid (ice) at 0°C, solid at a temperature of less than 0°C (e.g.: –10°C).

The transformation of saturated steam into liquid water is called condensation and the quantity of heat subtracted is called latent heat of condensation.

The changes in the physical state are schematized and summarized in Fig.14.27 while a diagram of the relative quantities of exchanged heat is given in Fig.14.28.

If the described experiment is conducted using a constant source of heat and all the heat issued by this source is transferred to the substance in question, the quantity of heat exchanged will be proportional to the time elapsed. You will also note (Fig.14.26) that the quantity of heat absorbed by the substance itself as the physical state changes from liquid to saturated steam (latent heat) is much more than that absorbed during the heating phase from 0°C to 100°C (sensitive heat).

In this particular case, 1 kg of water: approx. 100 kcal (418.6 kj) are required to heat it from 0°C to 100°C while 540 kcal (2260 kl) are required to evaporate it.

Similar considerations can be made proceeding in reverse, i.e. when heat is subtracted.

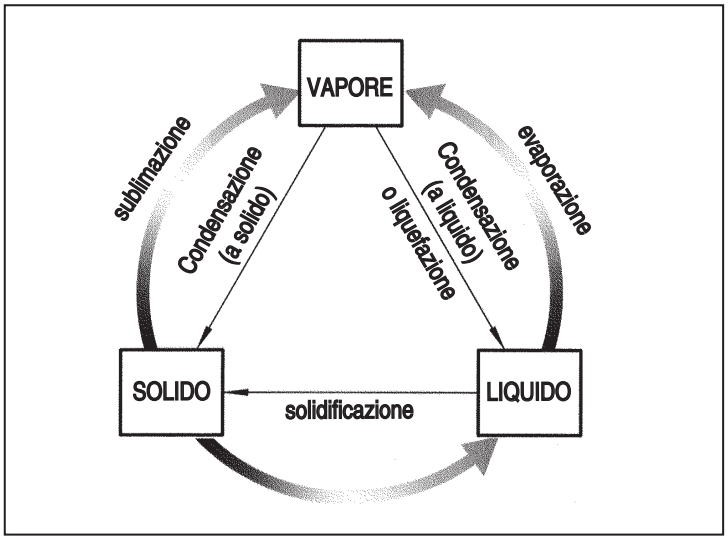


Fig. 14.27

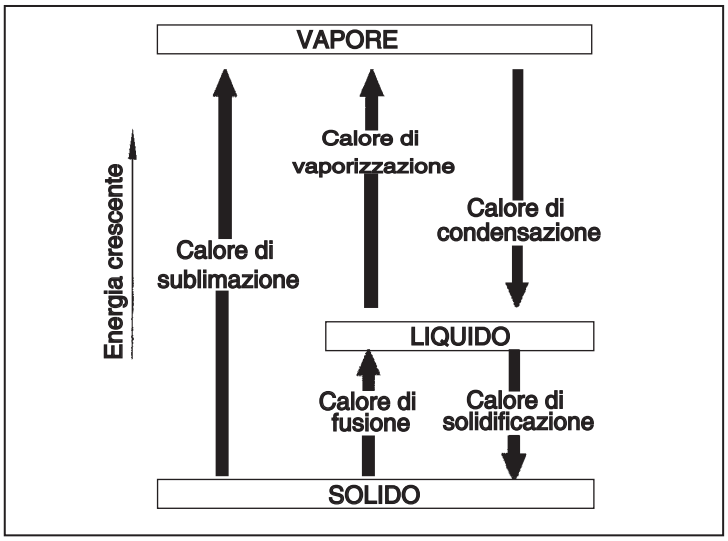


Fig. 14.28

Observations

In view of the above, one can affirm that for a certain mass of substance, the quantity of heat required to change its physical state at a constant pressure is much more than that required to change the temperature from the end of one state to the beginning of the next (e.g.: from the end of melting to the beginning of evaporation or vice versa).

This important property of bodies is used to form the operating cycle of an air conditioner (cooling cycle).

Note: Solid substances that melt at a given temperature, called melting point, are those with a crystalline structure.

There are solid substances, i.e. with an amorphous structure (e.g.: glass, plastic) which, when heated, do not melt immediately but which are subjected to a gradual softening process and that become fluid within a more or less extensive temperature range.

4.1.1.5 Influence of pressure on transformations of physical state in bodies

The previous section described how, if a certain quantity of water is maintained at the (constant) pressure (p) of 1 absolute bar, boiling will occur when the temperature (t) of the actual water reaches 100°C (Fig.14.29 a).

If a pressure is created in the vessel above the liquid, e.g. with a piston tight against the walls of the vessel, pushed with a force F (Fig.14.29 b) - at a pressure of more than 1 absolute atm, the water will boil at a temperature of more than 100°C.

Vice versa, if a pressure of less than 1 absolute atm (vacuum) is created in the vessel, e.g. by removing the piston (Fig.14.29 c) - the water will boil at a temperature of less than 100°C.

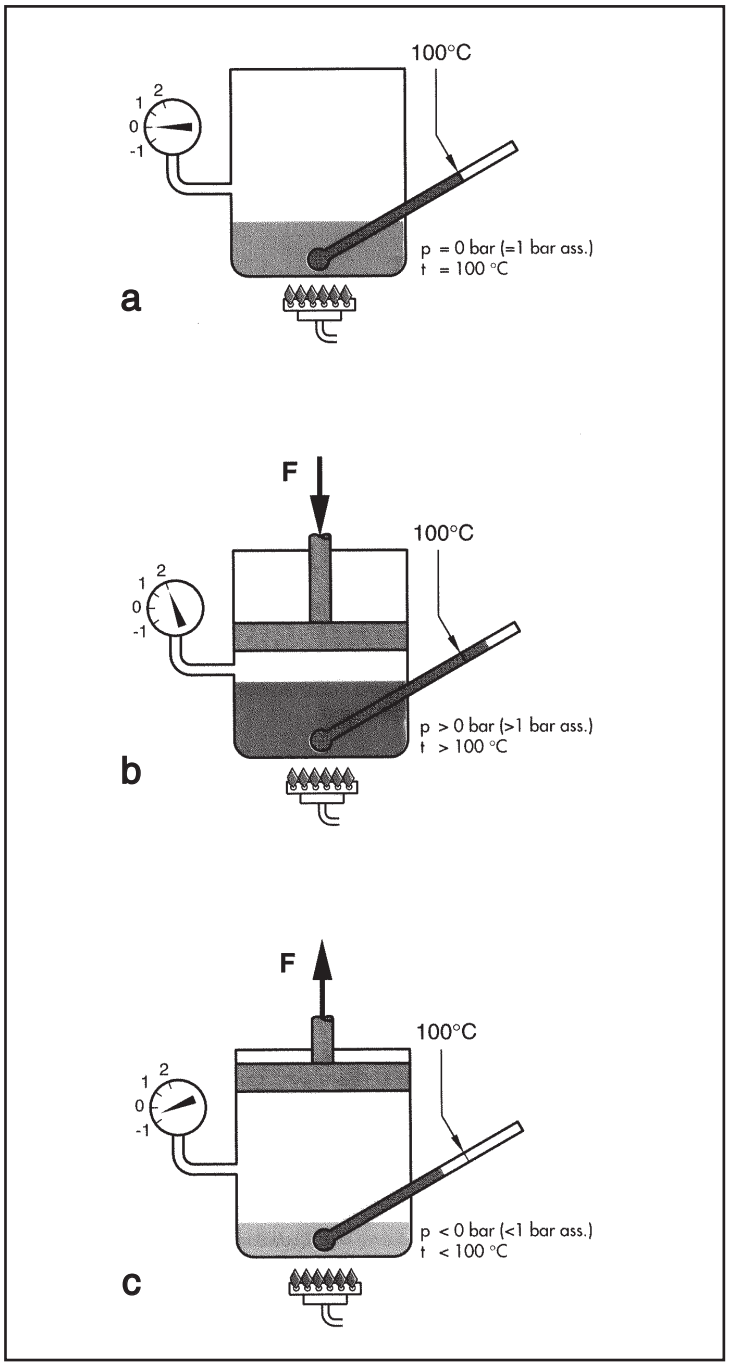


Fig. 14.29

By conducting a significant number of tests in various conditions, one can plot a graph (Fig.14.30) in which the curve (Z) is formed by all the pressure/ temperature conditions in correspondence to which the liquid state and the saturated steam state of water are balanced. Liquid changes into steam when heat is applied in correspondence to these combinations, while steam changes into liquid when heat is subtracted.

p - absolute pressure (in bar)

t - temperature (in °C)

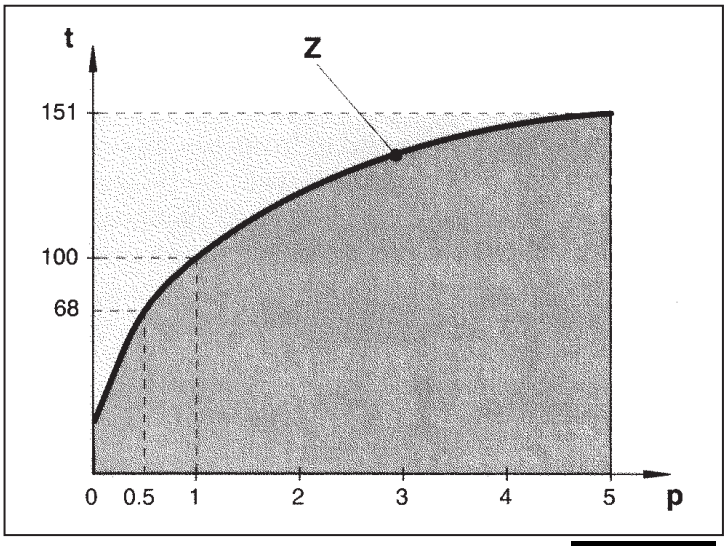


Fig. 14.30

4.1.1.6 Relations between temperature, pressure and volume in aeriform substances

Certain laws established by Physics for ideal gases can be considered valid for aeriform fluids (gases and vapours) used in technics, although with the appropriate approximations.

These laws are outlined in the Ideal gas equation of state:

PV = RT

Where P = pressure, T = absolute temperature, V = volume, R = universal constant.

This means that in practice, if one of the entities is varied at least one of the other two also varies.

The following relations should be considered when use is made in a cooling cycle:

- a reduction in volume (compression) determines an increase in pressure and temperature;
- an increase in volume (expansion) determines a reduction in pressure and temperature.

In particular, for a given mass of substance one has:

- with constant temperature
  - an increase in volume involves a decrease in pressure;
  - a decrease in volume involves an increase in pressure;
- with constant pressure
  - an increase in temperature involves an increase in volume;
  - a decrease in temperature involves a decrease in volume.
- with constant volume
  - an increase in temperature involves an increase in pressure;
  - a decrease in temperature involves a decrease in pressure.

4.1.1.7 Humidity

Humidity is generally the percentage ratio between the weight (or the volume) of the water in a body and the weight (or the volume) of the body itself.

In relation to atmospheric air, it is a mixture of dry air and water vapour, the rate of which is atmospheric humidity.

Two temperature values are used to define the atmospheric humidity rate:

- dry bulb temperature (in °C) measured with a common thermometer
- wet bulb temperature (in °C) measured with a thermometer whose bulb is covered with a gauze soaked in water and ventilated.

The wet bulb temperature is always lower than that of the dry bulb since the water used to soak the gauze tends to evaporate, cooling the bulb itself still further.

The following values can be determined using the two values indicated above:

- the absolute humidity, defined as the mass of the water vapour contained in the unit of volume of air: it is expressed in grams of vapour per cubic meter of air;
- the relative humidity, defined as the percentage relation between the mass of water vapour effectively present in a certain volume of air and the amount that could be there in saturation conditions, with the same temperature and pressure.

100% relative humidity indicates saturation point.

When saturated air is cooled, the water vapour condenses and produces fog, rain and snow.

4.1.2 Operating principle of a cooling cycle

4.1.2.1 Description of a cooling cycle and air treatment

Let us now examine the basic layout and operating principle of the air conditioning system.

In the highly simplified layout shown in Fig.14.31, the system appears to consist of a closed circuit formed by the chain of four components: evaporator (1), compressor (2), condenser (3) and expansion valve (4) (all essential in a cooling cycle and arranged in their functional sequence), plus pipes (5) which connect the components together.

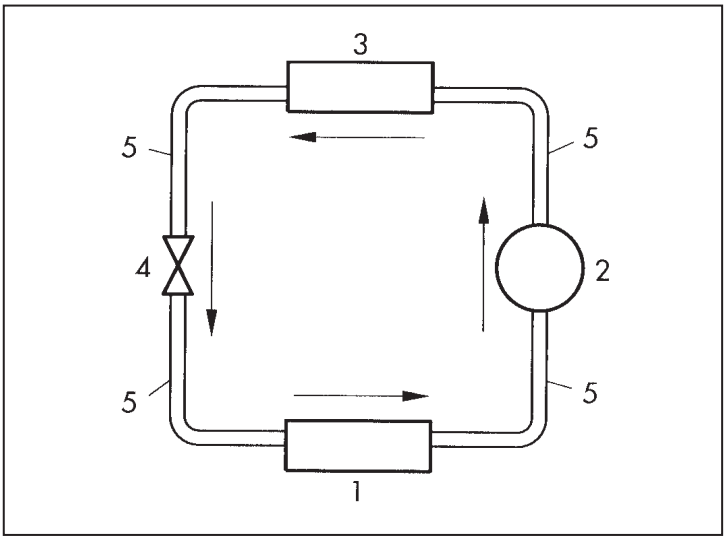


Fig. 14.31

The essential function of the system, i.e. that of transferring heat from one place (passenger compartment) to another (the environment surrounding the vehicle) is achieved by subjecting a cooling fluid with which the system itself must be filled, to a thermodynamic cycle that includes pressure variations (by means of the compressor and expansion valve) and changes in physical state (by means of two heat exchangers: the evaporator and the condenser).

The notions of Physics mentioned in the previous chapter allow each phase in the cycle to be explained and justified. For the sake of convenience, we will also refer to another simplified layout of the circuit (Fig.14.33), similar to the one in Fig.14.31. Before proceeding, and to allow readers to understand the mentioned pressure and temperature values in a better way (although solely by way of example and highly approximate), we also include the pressure/ temperature diagram of the R134a coolant currently used in air conditioning systems for vehicles and farming tractors (see Fig.14.32).

p - absolute pressure (in bar)
t - temperature (in °C)

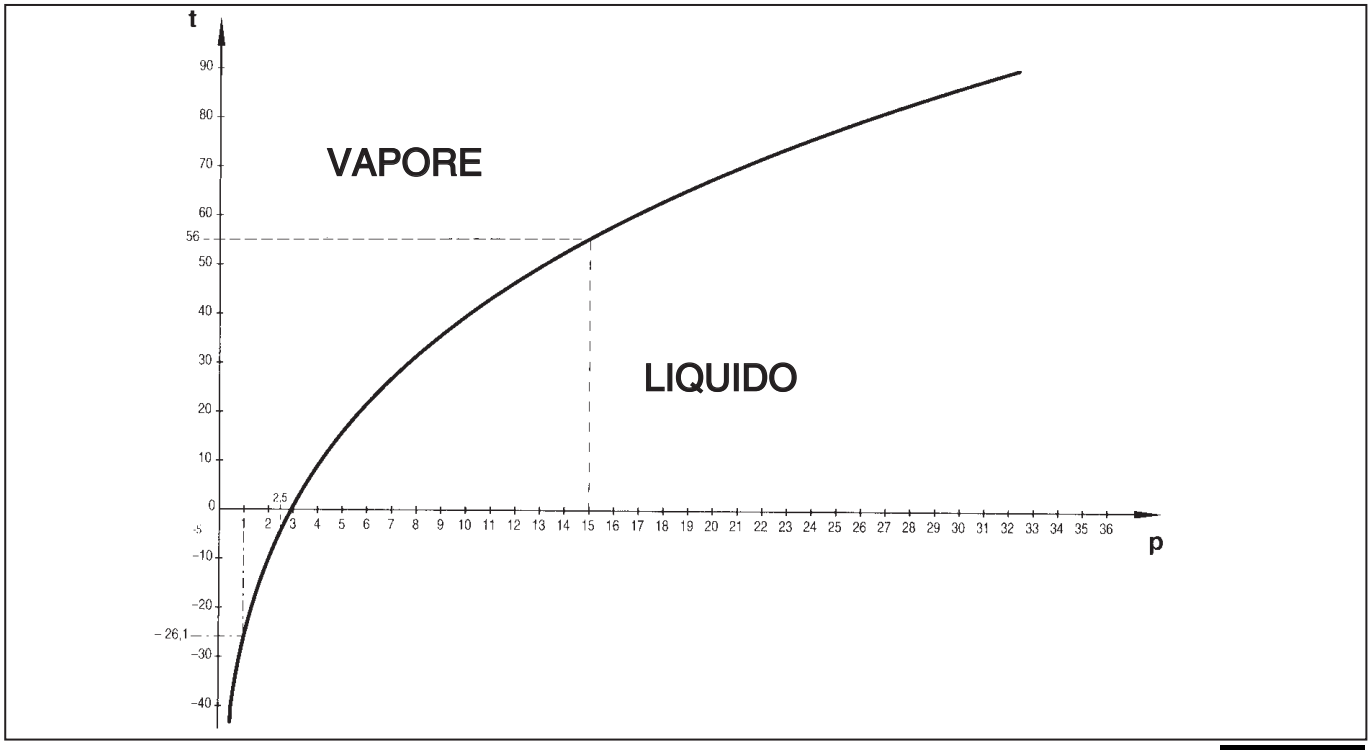


Fig. 14.32

By examining the previously mentioned diagram and while waiting to go more deeply into the subject in the next chapter, note that the boiling point of R134a is -26.1°C at a pressure of 1 abs.bar (atmospheric pressure at sea level) and that very low temperatures can be obtained by expanding it at low pressure. Vice versa, when compressed at relatively modest pressures, vapour can remain as such at fairly high temperatures (e.g.: p = 15 bar and t = 56 °C).

Another important characteristic for the particular use in question, is the high latent heat value of evaporation and condensation (e.g.: 51 kcal/kg at 1 abs.bar).

In short, this substance possesses characteristics that make it suitable for cooling circuits since both very low temperatures and relatively high temperatures can be obtained while working with modest pressure values that therefore allow fairly lightweight and not very bulky components to be used in the system.

To get back to the phases in the cycle, we will consider Sect. A (Fig.14.33) at the entrance to the evaporator as starting point. The evaporator is the component that removes heat from the cab. It is therefore positioned either in the actual cab itself or in close communication with it. To allow it to carry out its function, its temperature must be lower than that of the environment to cool so that heat can spontaneously flow from this (higher temperature) towards the evaporator itself. Let us suppose that the coolant in A is liquid at a pressure of 2.5 bar, thus at a temperature of about -5°C (Fig.14.32).

To cool the cab, it is necessary to:

- either “flush” it with cold air
- or remove the air it contains, cool it and then let it in again.

In the former case, air from the outside environment is allowed to flow towards the evaporator and is then forced into the cab, thus expelling the hotter air inside this.

In the latter case, the air in the cab must be made to recirculate through the evaporator.

Supposing that the air in the environment surrounding the vehicle or the air in the cab is at a temperature of 25°C.

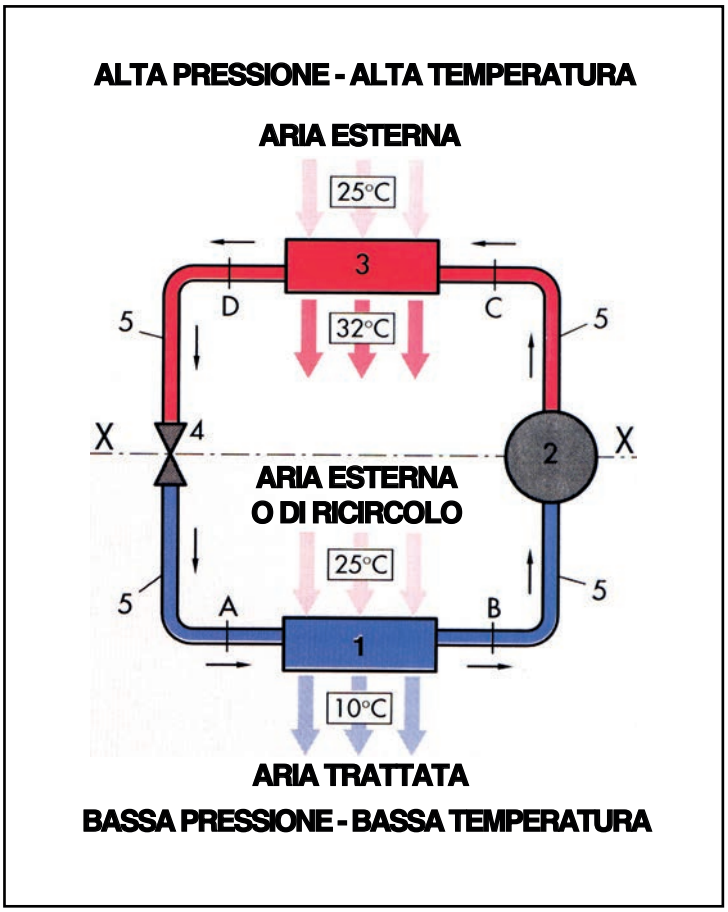


Fig. 14.33

Sect.A - p=2.5 bar t=-5°C
Sect.B - p=2.5 bar t=-5°C
Sect.C - p=15 bar t=56°C
Sect.D - p=15 bar t=56°C

This air passes through the evaporator, the external walls of which are at a temperature of 1 to 3°C for example. By virtue of its higher temperature of 22 to 24°C, the air transfers part of the heat to the evaporator, thus lowering its temperature from the initial 25°C to 10°C, for example.

Thus treated, the air enters the cab and, mixing with the already existing air initially at 25°C, progressively lowers the temperature there.

Meanwhile, the coolant that had p = 2.5 bar and t = -5 °C at the evaporator inlet, passes through this, absorbs the heat removed from the air and, at the same pressure, converts it from a liquid state to vapour, also maintaining the same temperature (latent heat).

The coolant will therefore have p = 2.5 bar and t = -5 °C at the evaporator outlet (Sect.B), but will be vapour and charged with the quantity of heat yielded by the air.

If the cycle is to have continuity and since the circuit is sealed, the coolant, which is now in B, will flow through the remaining part of the circuit and returns to A in the initial conditions (p = 2.5 bar, t = -5 °C).

To achieve this, the coolant itself must first be freed from the heat it absorbed as it passed through the evaporator and must then be brought to a low pressure and a low temperature.

The only way to dispose of the heat is to expel it into the surrounding environment where, however, the temperature is higher (25°C). The temperature of the coolant must therefore be raised from -5°C to a value higher than 25°C so that the heat can be spontaneaously transferred from the coolant itself to the outside environment. This is carried out by the compressor.

The compressor possesses these functions: it intakes vapour at a low pressure and low temperature from the evaporator, compresses it and discharges it (Sect.C) at a high pressure and high temperature (e.g.: 15 bar –56 °C).

Coolant, in the form of vapour, at a high pressure and a high temperature (approximately the same values as Sect.C), enters into the 2nd heat exchanger, the condenser, which transfers the heat the coolant had accumulated in the evaporator, into the outside environment.

To achieve this as efficiently as possible, its pressure and, thus, its temperature are kept at constant levels, but the vapour is transformed into liquid, thus the transferred heat will be latent condensation heat.

Note

By removing heat, the outside air that passes through the condenser is subjected to a temperature increase (e.g.: from 25 to 32°C), but then spreads around the surrounding environment without changing its conditions in an appreciable way.

On leaving the condenser, in Sect.D, the coolant will be in a liquid state and without the previously collected heat. However, compared to the initial condition (Sect.A), it is still at a high pressure and temperature. The expansion valve is used to lower the pressure and temperature of the coolant.

The main purpose of this component is to throttle the circuit, upstream of which the pressure and temperature are high. Downstream, since there is a space where it can expand, the coolant is subjected to a drastic pressure reduction (e.g.: from 15 to 2.5 bar) and, consequently, a temperature reduction (from 56°C to -5°C), remaining in the liquid state (even though atomized).

This forms the initial conditions again. The cycle can then be repeated in a continuous way for as long as the compressor operates.

Note

All this shows that when operating, the system is partly hot and partly cold.

The ideal separating line between the two parts is represented, in the diagram in Fig.14.33 , by straight line X-X, which cuts through the compressor and expansion valve.

Note that this is one of the basic elements to consider when evaluating whether the circuit is operating correctly or when identifying faults.

4.1.2.2 Notes and considerations

The described process has been extremely simplified. We have therefore added a certain number of notes that allow readers to understand how the notions of physics in the previous chapter have been used and have added considerations, at least in principle, about the differences between the described scheme and what actually happens in practice.

Heat exchanges

Heat exchanges amongst the various elements in question (air, components of the A/C and ECC system) and within the elements themselves, occur in the following way:

- from the air to the external walls of the evaporator (by convection)
- from the external walls to the internal walls of the evaporator and from these to the coolant (by conduction)
- from inside the coolant and when this is transferred from the evaporator to the condenser
- through the compressor (by convection)
- from the coolant to the internal walls of the condenser (by conduction)
- from internal walls to the external walls of the condenser (by conduction)
- from the external walls of the condenser to the air that passes through it and to the outside environment (by convection and by radiation).

Note: Heat exchanges between the internal parts of the system and the outside environment also occur through the walls of tubes and the filter, and this negatively influences the efficiency of the system although to a modest extent.

Practical notes

The pairs of temperature and pressure values chosen as examples for the sake of convenience, have been considered constants in each of the two parts (cold and hot) of the system and have been given with reference to the conditions of the coolant.

In practice, the following points must be taken into account:

a - there is a certain temperature difference between the internal and external surfaces of heat exchangers (e.g.: in the evaporator, internal temperature -5°C and external temperature +2°C; in the condenser, internal temperatrure +56°C and external temperature +50°C).

b - there is a difference in temperature between the coolant on the inlet and that leaving the exchangers established by the size of the system and how it is regulated in order to ensure that:
- the coolant that leaves the evaporator is completely in the state of vapour and that it reaches the compressor as such (the compressor is a pump that is only suitable for gaseous substances and not liquids).
  To ensure this, the vapour must be slightly overheated, i.e. its temperature must be higher than that of saturated vapour (e.g.: – 2°C instead of –5°C);
- when leaving the condenser, the coolant is completely in a liquid state to optimize its efficiency. Thus its temperature, at the considered pressure, must be lower than that of condensation (e.g.: 52°C instead of 56°C, liquid being cooled);

c - further differences (a few degrees more for the cold part or a few degrees less for the hot part) should then be considered owing to the effect of the heat exchanges along the route leading from one exchanger to the next (see previous note);

d - the pressure of the coolant is lowered along its route due to friction, turbulence, etc. (load loss); further variations to a greater or lesser extent than those determined by the expansion valve and compressor, are due to the previously mentioned heat exchanges along the circuit beyond the exchangers;

e - the energy used to operate the compressor (normally drawn from the vehicle's engine), is converted into heat and is then yielded to the coolant from which it must be extracted along with that collected by the evaporator.

Given that the sequence of components in the system along the circuit remains unchanged, in practice, their positions in the vehicle will be influenced by the availability of space and by all the measures taken to optimize both functionality and safety.

One essential constant to prevent the efficiency from being impaired is that the expansion valve must be positioned extremely near to the evaporator (it must practically form a single unit).

In the simplified diagram in Fig. 15-12, the four essential main components (evaporator, compressor, condenser, expansion valve) are represented together with the coolant they contain, by way of principle, in order to form the thermodynamic cycle (cooling cycle).

In actual fact, another component, the dehydrator filter, is installed in series in the circuit (between the condenser and the expansion valve) and has important functions, but does not contribute towards the operation of the thermodynamic cycle itself.

4.1.3 Main components of an air conditioning system

4.1.3.1 Coolant or cooling fluid

This is the fluid used to fill the A/C and ECC system. It acts as a carrier of heat, transferring this from the point in which it is removed from the cab (or rather, from the air let into or re-circulated around the compartment) by means of the evaporator, to the point in which it is disposed of in the outside environment by means of the condenser.

Until a few years ago, a product bearing the code name R12 was generally used in the A/C systems of vehicles (and is still used when available, to service old systems). The chemical formula of this coolant is CCI2+F2 (Dichlorodifluoromethane) and it is marketed by various producers under different trademarks / denominations.

Since this product contains Chlorine (CI) in its molecule, it is part of the group of CFC substances most greatly responsible for the destruction of the Ozone layer (O3) in the stratosphere and the consequent ecological damage, all of which is causing global concern. Right from the "Vienna Convention" of 1985 and the successive "Protocol of Montreal" in 1987, the objective has been to prohibit the above mentioned substances by gradually reducing their use until their production completely ceases while establishing regulations to govern the permitted uses.

Production has already stopped throughout Europe (in Italy, with law N° 549 of 28/12/93) and in the majority of the other countries, while use of the product, governed by the above mentioned regulations, is now limited to the very small amounts of the substance available on the market.

In view of the above, three alternative substances have been identified with suitable technical characteristics which do not, however, contain Chlorine and which therefore do not damage the Ozone in the stratosphere.

In particular, a substance known as R134a (HFC – 134a), with the chemical formula CH2+FCF3+ (1, 1,2 – Tetrafluoroethane) is used as a replacement for R12 (CFC-12).

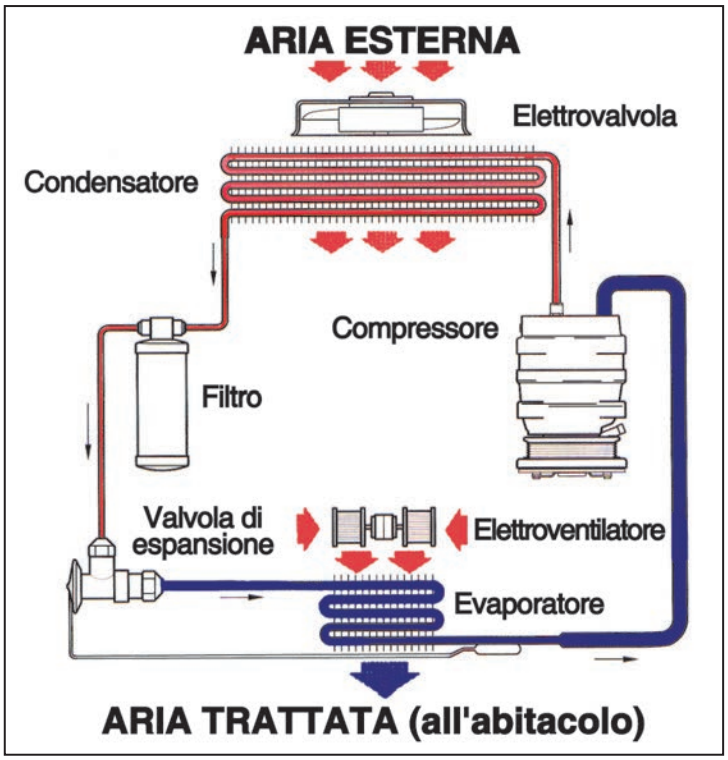


Fig. 14.34

- High pressure liquid
- High pressure vapour
- Low pressure liquid
- Low pressure vapour

The basic properties of these products that make them particularly suitable for use as coolants are:

- low boiling temperature, at atmospheric pressure at sea level (-29.8°C for R12 and –26.1°C for R134a).

  This means that it is easy to make a cold body (evaporator) able to collect the heat from the hot air that hits it.
- high vaporizing heat (latent) and condensation values in the various temperature and pressure conditions.

4.1.3.2 Evaporator

As was said in the previous chapter, the evaporator is that part of the A/C system that removes heat from the air let into the cab (the way the heat is exchanged has already been described).

Another very important function carried out by the evaporator and that has not been mentioned previously is that of dehumidifying the treated air.

This is done in the following way:

- in normal conditions, the air contains a certain quantity of watery vapour;
- the vapour condenses as it comes into contact with the cold surfaces of the evaporator;
- water in the liquid state (condensation) is collected in a receptacle and is disposed of through the relative channels;
- the condensing heat of the humidity is yielded to the coolant through the walls of the evaporator as occurs for the heat removed from the air in order to lower the temperature.

In view of the above, the treated air leaving the evaporator and let into the cab contains a lower quantity of moisture besides being cooler.

4.1.3.3 Compressor (F)

The compressor is the propelling part for the coolant in A/C systems.

Its functions are:

- to circulate the coolant around the circuit
- to raise the pressure and, thus, the temperature of the gaseous coolant from the evaporator at low pressure and low temperature.

Basically, to carry out these functions, they consist of:

- a container body (or casing) formed by a more or less large number of components and equipped with hangers to fix it to the vehicle.
- an internal mechanism to produce the pumping effect;
- a valve system to regulate coolant intake and delivery;
- fittings to connect the pipes;
- a pulley / clutch assembly (electro-clutch).
- a load of oil.

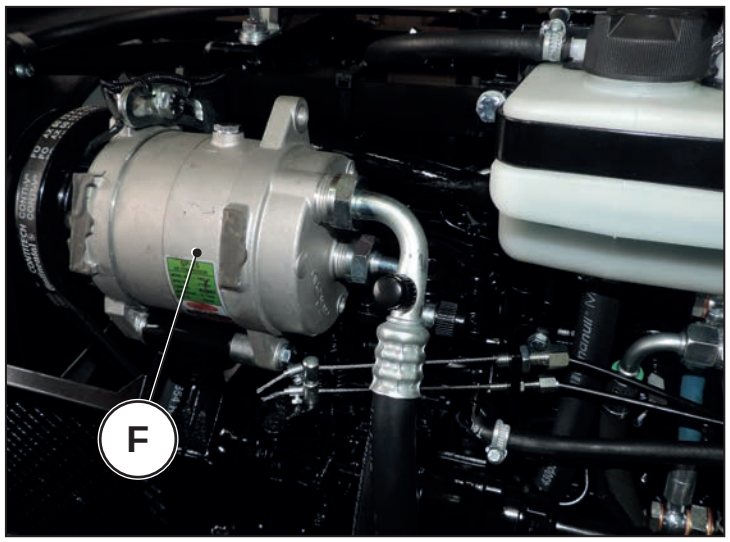


Fig. 14.35

4.1.3.4 Condenser (G)

The condenser is the exchanger that removes the heat absorbed by the evaporator and that created by converting the energy used to operate the compressor from the coolant that circulates around the A/C system.

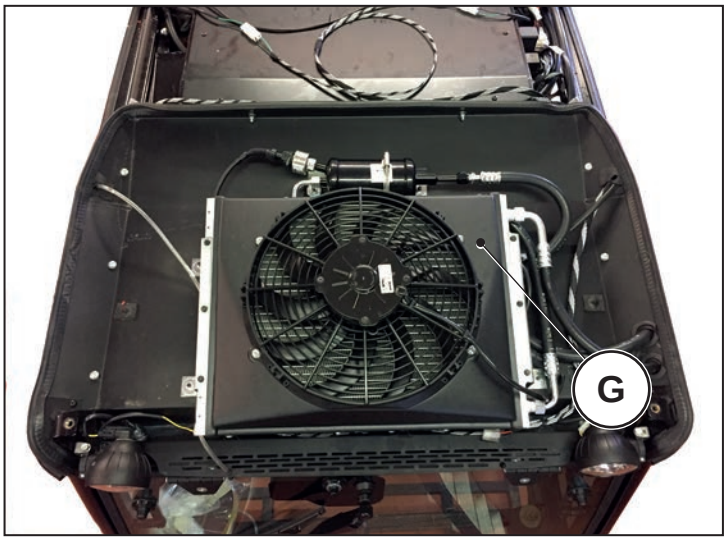


Fig. 14.36

4.1.3.5 Filter or dehydrator (H)

The filter is a component which, although being installed in series in the coolant flow within the A/C system, does not cause any type of thermodynamic effect and therefore does not influence the changes of state to which the coolant is subjected or the heat exchanges.

However, its functions are equally many and of considerable importance, as explained further on.

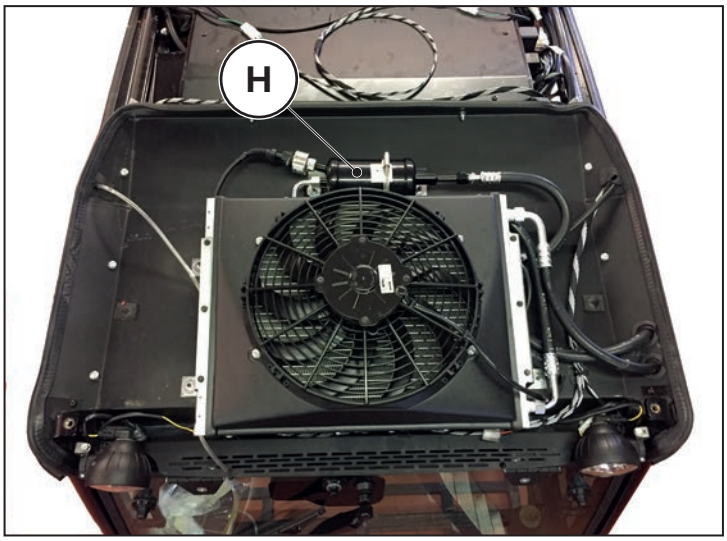


Fig. 14.37

4.1.3.6 Expansion or governor valve

The expansion valve in A/C systems carries out the following essential functions:

1 - it drastically reduces the pressure (and, thus, the temperature of the coolant fluid arriving from the condenser through the filter);

2 - it continuously regulates the coolant that flows to the evaporator so that it can completely evaporate and it passes through the evaporator in the various thermal load conditions. As it passes through the system, it also reaches a minimum degree of overheating that is sufficient to ensure it arrives in the compressor as vapour.

4.2 How to empty and recharge the system

4.2.1 Safety notes

When coolants are handled, it is always necessary to comply with the following safety rules to safeguard the health.

a - Always wear protective goggles and gloves when handling coolant.

If coolant splashes into the eyes it can damage the sight and cause blindness.

b - Do not allow the coolant to splash on to the skin.

Coolant has a very low boiling temperature which can lead to freezing (approx. -26 °C for R134a and approx. -30 °C for R12, at atmospheric pressure at sea level).

c - The equipment for treating the coolant must be used in adequately ventilated places, with at least four air changes per hour. Do not inhale coolant vapours for lengthy periods of time. It can be dangerous and even lethal.

d - Do not use equipment for treating coolant near open containers holding inflammable substances or with leaks.

e - Do not tamper with or modify the settings of the breather and safety valves in the containers and equipment for treating coolant.

f - Do not fill any vessel (cylinder, A/C charging equipment) with coolant unless it has not been approved for the purpose and equipped with a relative safety valve.

g - Do not fill any storage vessel beyond 80% of its capacity.

h - Take the utmost care when the service pipes are connected since they may contain pressurized coolant.

4.2.2 Recharging procedure

4.2.2.1 Introduction

An A/C or ECC system can be installed in a vehicle at its origin, when it is being assembled during the production phase, or it can be installed at a later date in a finished vehicle ready for delivery to the Purchaser or even in a tractor that has already been operating for some time.

In any case, once it has been completely and correctly installed, an A/C or ECC system must be adequately filled with coolant fluid. The following paragraphs therefore describe:

- the essential equipment used for charging purposes (filling with coolant);
- the relative procedures;
- the operating tests to verify the performances of the installed system.

4.2.2.2 Basic equipment

The basic equipment required to charge an A/C or ECC system consists of:

- a pump to produce vacuum;
- a metering cylinder or a scale to measure the quantity (in weight) of the required coolant;
- a pair of pressure gauges;
- a vacuometer;
- a set of taps to handle the connections of the various components listed above to the A/C system and to the coolant reserve tank (bottle);
- service pipes with relative fittings, to connect to the service valves of the system and to the bottle.

The above listed parts are normally assembled in relative casings to form a single component, allowing all the charging procedures to be carried out.

Remember that, according to the current laws in force in Italy, in Europe and in the majority of other countries, coolant can no longer be disposed of in the environment and that it is therefore obligatory to collect all the coolant emptied from a system in a suitable vessel.

It is consequently essential to be in possession of the adequate equipment when these operations are carried out.

Besides the specialistic components used for the charging operations, the Dvx coolant recovery, preparation and recharging station for R 12, R 134a and "refmaticplus" (Fig.26-12), also has:

- a hermetic compressor, which intakes the coolant when the A/C or ECC system is emptied and allows it to re-circulate through a special internal mechanism in order to prepare it, lastly depositing it in the reservoir for future use;
- a filter to retain the solid particles, the humidity and polluting acids in the recovered coolant;
- a distiller to separate the oil;
- a condensing apparatus to separate the incondensable gases, with relative automatic or manual expelling device;
- an electronic scale to weigh the coolant;
- a microprocessor, plus keypad and display, to automatically handle the various functions.

4.2.2.3 Procedure

This procedure includes the following phases:

- emptying the air from the system;
- dehydration;
- vacuum tightness test;
- filling with coolant;
- activation of the system and performance tests.

Emptying the air from the system

The air must be eliminated from the system:

- to leave all the space inside for the coolant;
- to prevent the air and the moisture it contains (even in tiny quantities) from polluting the coolant and altering its thermodynamic characteristics.

The coolant is emptied out by means of the vacuum pump which is connected, by the service pipes of the charging plant, to the HP and LP service valves of the A/C or ECC system, with the vehicle engine off.

This operation takes a very short time and during it, the pointers of the HP and LP pressure gauges move from 0 to positions near to -1.



Fig. 14.38

1 - Recovery pressure gauge
2 - Charging pressure gauge
3 - Info Display
4 - Start recovery
5 - Start vacuum
6 - Start charging
7 - Start/Stop
8 - Alarm indicator
9 - Report
10 - +/- menu

Dehydration

This follows the previous operation. The vacuum pump continues to operate and the pressure, indicated by the pressure gauges, remains near to -1.

The recommended length of this operation is 40 to 45 minutes and more, if the system is very large. In this way, humidity that is not discharged with the air but which has remained, in the liquid state, in the system (in the pores and recesses of the internal walls, especially in flexible hoses, dissolved in the compressor oil, absorbed by the filter, etc.) can be released as vapour and, as such, removed by means of the vacuum pump.

Note: Remember that the boiling point of water depends on the pressure.

Since the temperatures in a system when the charge is being prepared are practically the same as those of the environment (workshop) in which the work is carried out, they can also be very low (e.g.: 10 to 15°C) particularly in winter. The only way to evaporate the internal humidity is to lower the pressure. This is done by working with the vacuum pump.

The considerable length of this operation is also required to allow the vapour, escaping from the most distant parts of the system, to reach the service valves and to then be extracted.

Humidity must be eliminated from the system to prevent:

- the formation of corrosive acids caused by a chemical reaction with the coolant fluid and oil, which would consequently damage the components;
- the formation of ice around the expansion valve, which would clog the calibrated hole and block the system.

Vacuum tightness test

Before beginning to charge with coolant, make sure that the system is perfectly tight. To do this, at the end of the dehydration phase, shut off the tap that sets the A/C or ECC system in communication with the vacuum pump, stop this latter and open the connection between the system and the vacuometer.

The pointer of the vacuometer will set near to the -1 position. Note down this position (vacuometers often have a movable pointer. If the pointer itself has not appreciably moved after 10 minutes, the system can be considered perfectly tight). Now shut the vacuometer tap and proceed with the charging operation.

Vice versa, if the pointer of the vacuometer moves towards 0 during the above mentioned period of time, it means that the system is not tight and that, if it were to be charged in those conditions, it would very quickly lose its charge and, thus, its efficiency. In this case, identify the leak point or points, repair and repeat the procedure from the start.

Filling with coolant

The quantity (in weight) of coolant required to operate the A/C or ECC system in an optimum way is determined by the Manufacturer and indicated in the relative operation and maintenance manual.

If this value is not available for some reason, it can be determined in an empiric way by gradually charging with coolant until optimum pressure values are obtained.

Given, therefore, that the weight required for charging is known, this quantity must be measured exactly.

This can be done in two ways, depending on the available apparatus:

- by the difference between the two weight values of the coolant holder at the beginning and at the end of the charge, if a high precision scale (electronic) is available, as in Dvx "refmatic" stations for example.
- In an indirect way, depending on its pressure (temperature) and volume, using the conventional dosing cylinder (as in the Dvx "fill station"), again by the difference in the initial and final weight.

The coolant can be added:

In the liquid phase

When the pressure in the container or dosing cylinder is sufficiently high (8 to 10 bar), to allow the required quantity of coolant to be completely transferred with the sole aid of the difference in pressure between the container and the A/C or ECC system.

As the pressure inside a container of coolant (not in the presence or in contact with heat sources) is that corresponding to the temperature of the ambient in which it is to be found (e.g.: 5.7 bar at 20°C), the same pressure is also created in the A/C or ECC system by simply connecting one to the other.

Consequently, charging the liquid phase would not be completed owing to pressure balancing

To sufficiently raise the pressure in the container, the coolant is heated before it is transferred to the A/C or ECC system:

- with the resistance applied to the dosing cylinder (e.g.: in the “fill station”);
- with the compressor in the plant (e.g.: in “refmatic”).

Note

Recharging in the liquid phase can only be done by adding the coolant in the plant section after the compressor, through the high pressure valve.

If coolant were to be added prior to the compressor, it would damage this when the plant was activated.

In the vapour phase

If the container is connected to the low pressure service valve, the engine can be started and coolant drawn by the compressor in the pure vapour state. This is obtained by means of adequate throttles created with the plant taps installed along the route the coolant takes from the container to the system.

In a mixed phase

By first transferring liquid until the pressures are balanced and then vapour, with the aid of suction from the compressor.

In this case, it will be necessary to work with the plant taps so that liquid is transferred after the compressor and vapour prior to it.

Activation of the system and performance tests

Having completed the charging procedure and keeping the plant connected, activate the system and check its performances in the following way:

- start the engine and regulate the charging rate (1500 to 1800 rpm);
- select the A/C or ECC plant controls to obtain maximum cooling, i.e. the thermostat (when accessible) must be set to max position and the fan to maximum speed;
- open the doors of the vehicle;
- allow the system to operate in these conditions for about 10 minutes;
- shut the doors and windows;
- check the pressure values indicated on the (HP - High Pressure) and (LP - Low Pressure) gauges;
- check the temperature of the place in which the work is being carried out with the thermometer.

Taking the ambient temperature as a reference, the pressure values that indicate correct plant operation are within the ranges given in Table 1.

R134a				
Ambient temperature (°C)	Pressure gauge (High Pressure)(kg/cm²)		Pressure gauge (Low Pressure)(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 correctly interpret the values shown on the pressure gauges, also remember that the pressures themselves are influenced by the atmospheric pressure which, apart from the differences bound to the climatic conditions, gradually decreases as the altitude increases.

To take these pressure variations into account, subtract the correction data of Table 2 from the values read on the pressure gauges.

Pressure variations depending on altitude		
Altitude (m above sea level)	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		

4.3 Functionality tests

4.3.1 Specific equipment

Use the following equipment to test plant operation and identify any faults:

- Plant to recover, prepare and charge coolant (Fig.14.39).
- Thermometer and hygrometer (Fig.14.40).
- Coolant leak detectors (Fig.14.41).
- Protective goggles and gloves (Fig.14.42).



Fig. 14.39

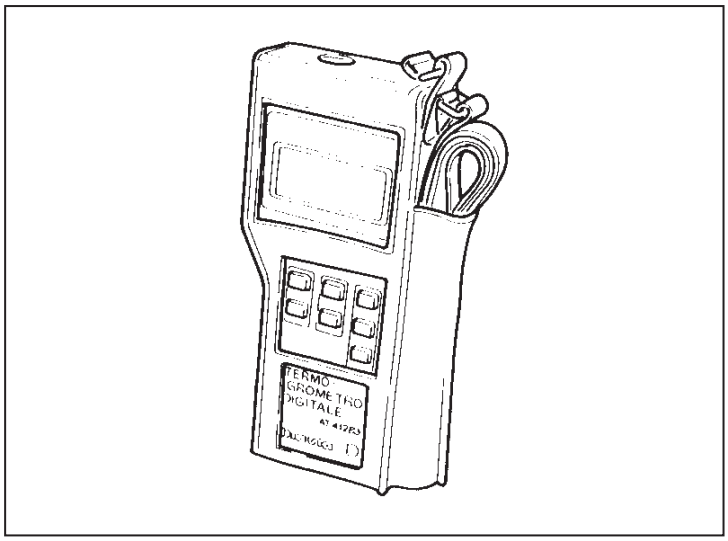


Fig. 14.40

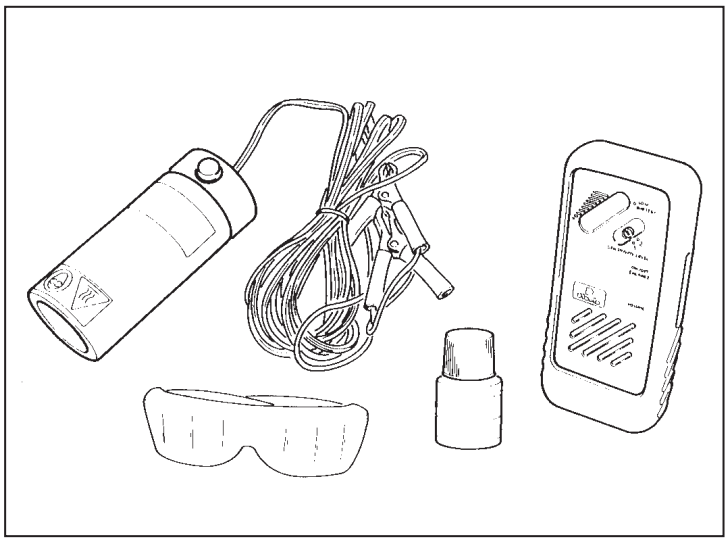


Fig. 14.41

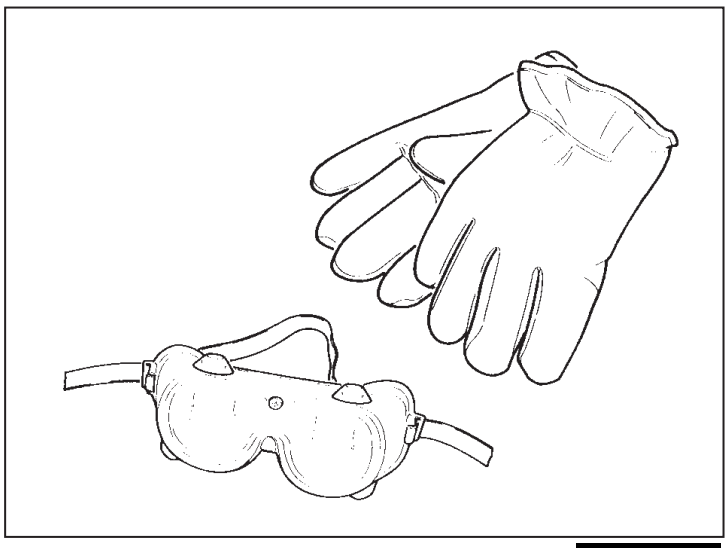


Fig. 14.42

4.3.2 Temperature check

Once you have ascertained that the pressure values are correct and that all the cab filters are clean, proceed with a functional test by measuring the temperature of the air delivered by the internal vents. Proceed as described below and refer to the following table.

Temperature table	
Temp. outside the vehicle (°C)	Temp. of air from central vents (°C) (average value)
20°	6°-8°
25°	8°-10°
30°	8°-12°
35°	9°-14°
Table 3	

1 - Select the minimum temperature available on the control panel and operate the fan at medium speed;

2 - Check that the thermostat setting (if installed) is correct (one quarter of a turn before the coldest position);

3 - Operate the system and bring the engine to a speed of 1500-1800 rpm;

4 - Measure the temperature by placing the thermometer near the vents, as shown in the table;

If the temperature inside the cab is higher than outdoors, open the doors and wait for the temperature to become stable by operating the system for 5-10 minutes. Then check the temperature again.

Consult a center specialized in Delphi A/C systems if there are further problems such as unpleasant odours, air not cool enough or abnormal noise from the system.

Section 5 : Tools required

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5.1 Tools required 14-44

5.1 Tools required

Code	Description	Quantity
07007181	Cab lifting tool	1

Chapter 15 : Rear hitch

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5.1 Tightening torques 15-20

Section 6 : Tools required 15-21

6.1 Tools required 15-22

Section 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.

Section 2 : Technical specifications

Index

2.1 Technical specifications 15-4

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

Section 3 : Disassembly

Index

3.1 Disassembly 15-6

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).

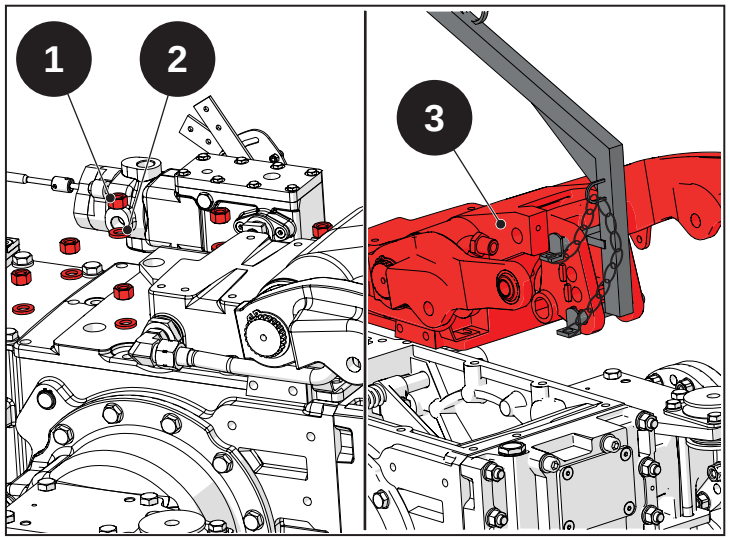


Fig. 15.1

Remove the union (4) and washer (5).

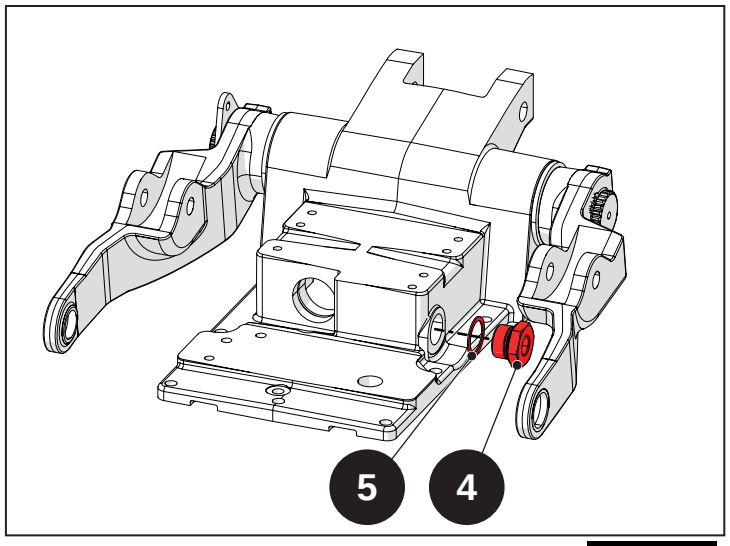


Fig. 15.2

Remove the circlips (6) and part (7).

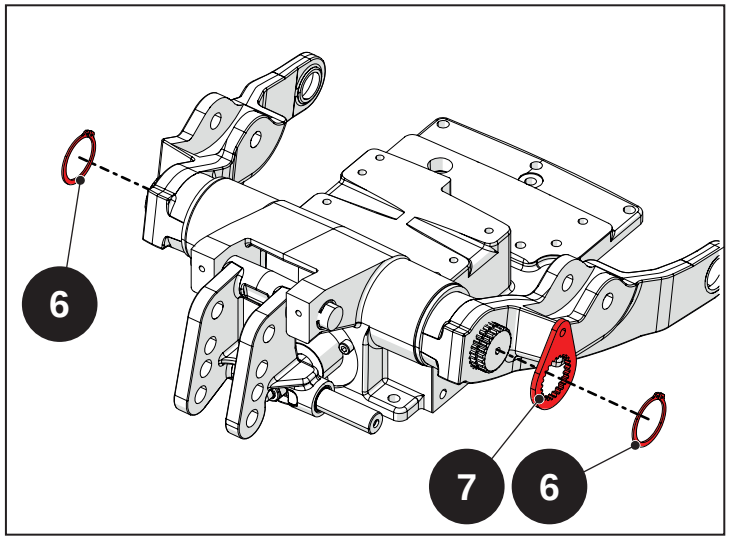


Fig. 15.3

Remove the linkages (8).

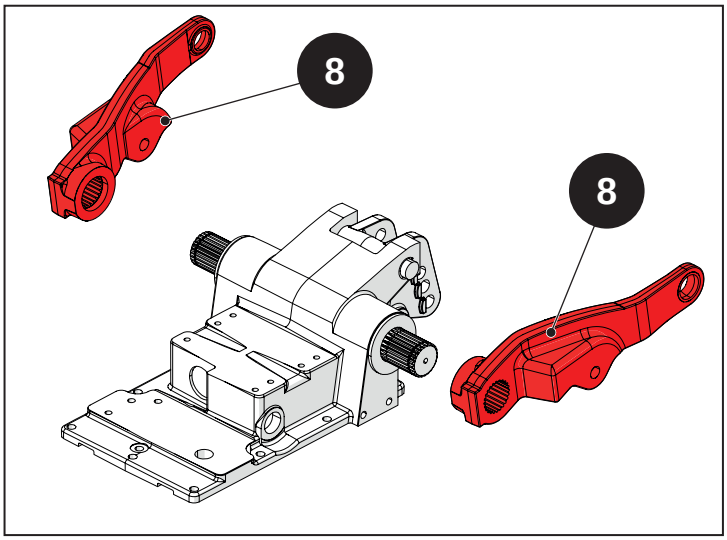


Fig. 15.4

Remove the spacers (9).

Remove the oil retainers (10).

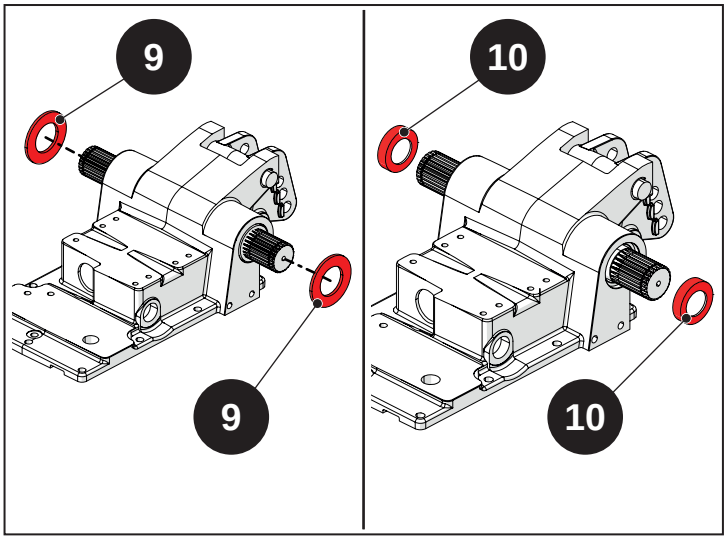


Fig. 15.5

Remove the shaft (11).

Unscrew the self-locking nut (12).

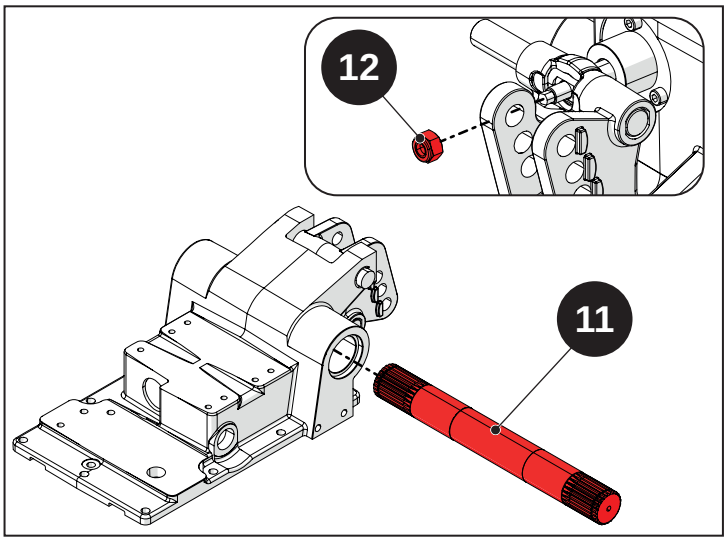


Fig. 15.6

Remove the circlips (13) and upper pin (14).

Remove the top link support (15).

Remove the lower pin (16) and O-ring (17).

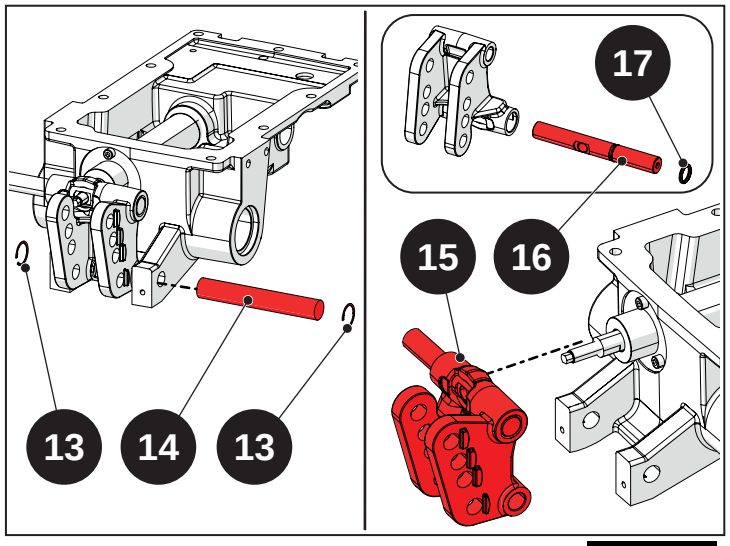


Fig. 15.7

Unscrew the screws (18) and remove the washers (19).

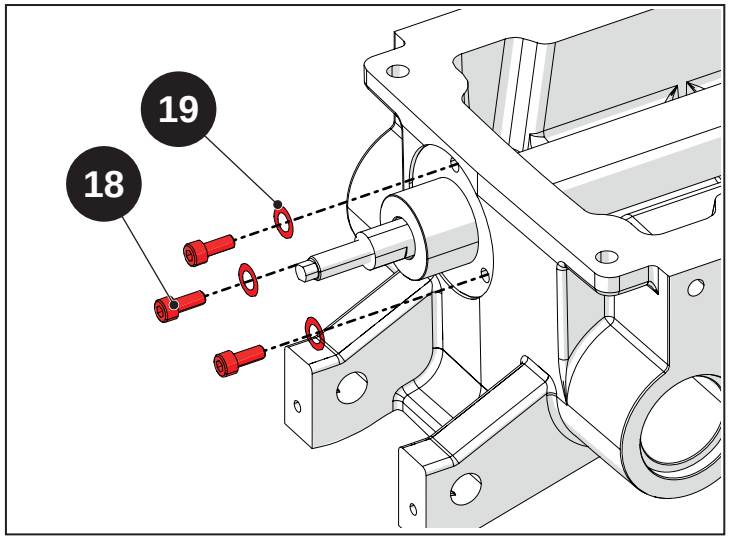


Fig. 15.8

Remove the cover (20) and draft control adjuster, which consists of:

- Screw (21);
- Spacer (22);
- Spring (23);
- Spacer (24);
- Spring adjuster spacer (25);

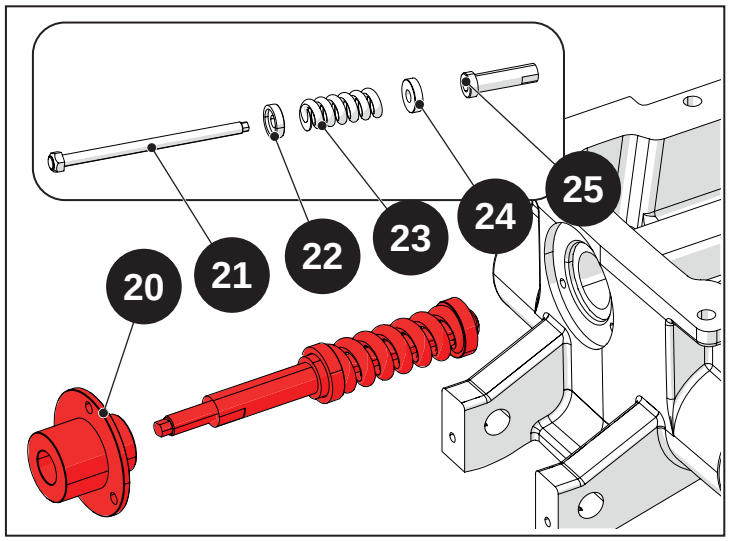


Fig. 15.9

Remove the sleeve (26) along with O-rings (27) and (28).

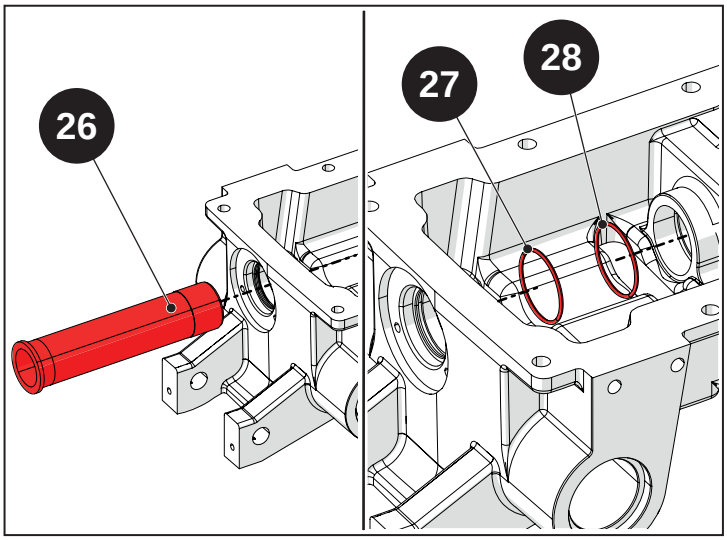


Fig. 15.10

Section 4 : Main inspection, re-assembly and adjustment operations

Index

4.1 Main inspection, re-assembly and adjustment operations.....15-12

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).

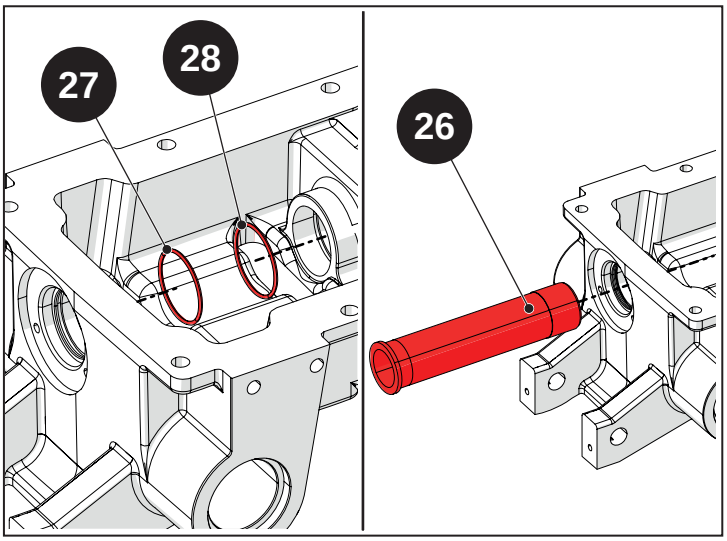


Fig. 15.11

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);

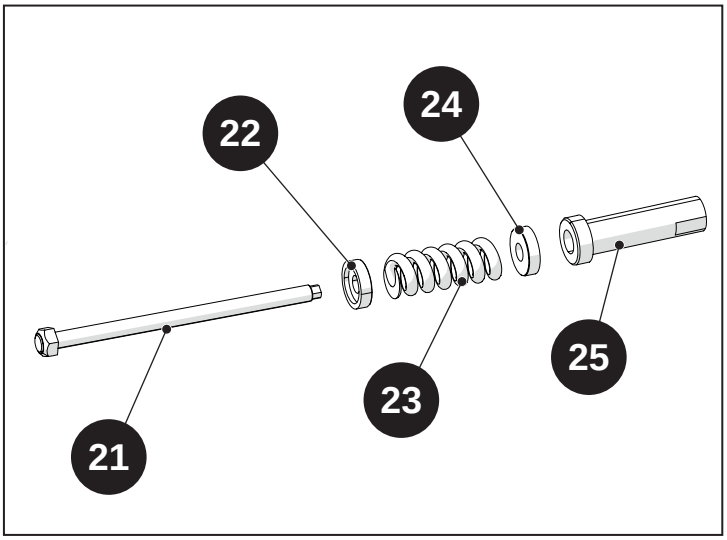


Fig. 15.12

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.

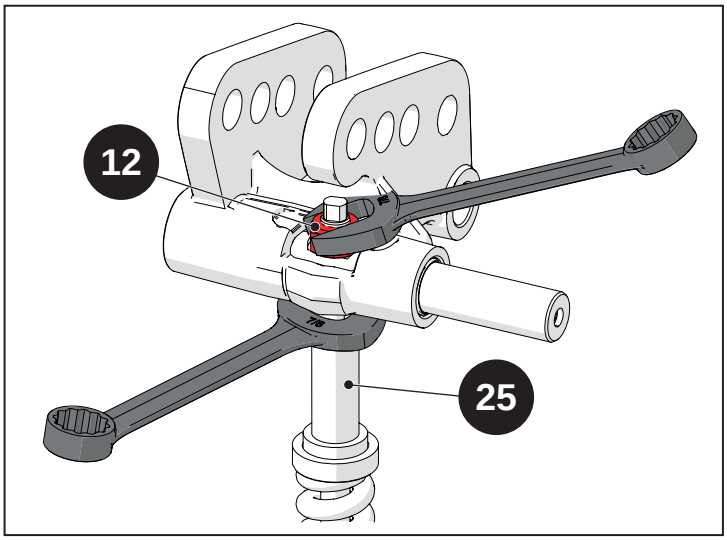


Fig. 15.13

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.

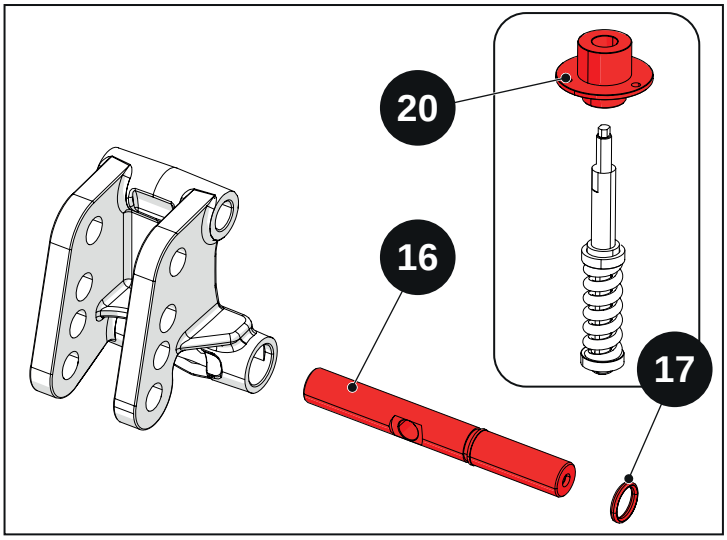


Fig. 15.14

Install the two newly assembled units then apply a layer of LOCTITE 242 to the screw and tighten the nut (12).

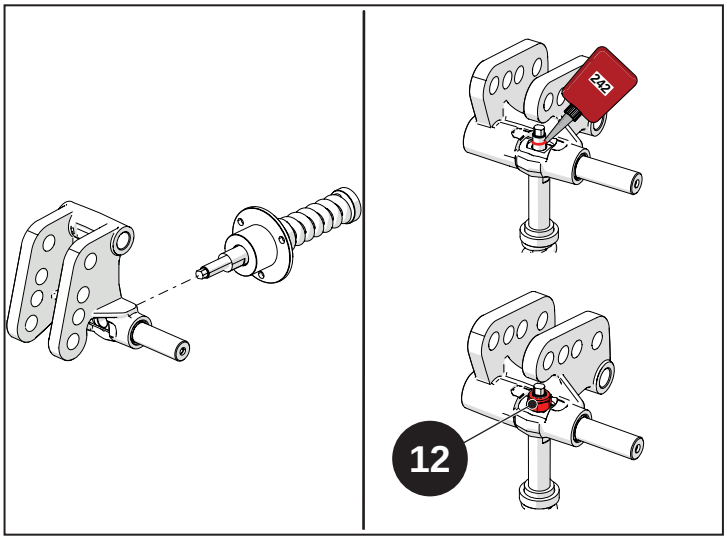


Fig. 15.15

Tighten the nut (12) while holding the spacer (25) in position and by applying 150 Nm (15 kgm) 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.

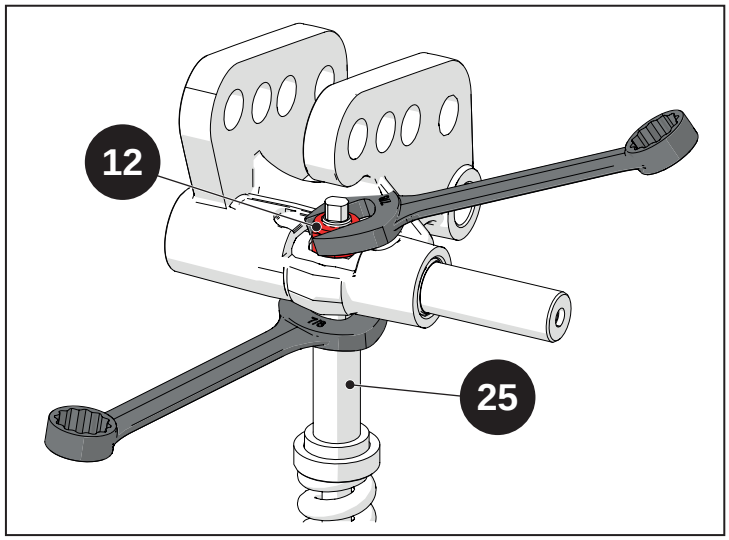


Fig. 15.16

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).

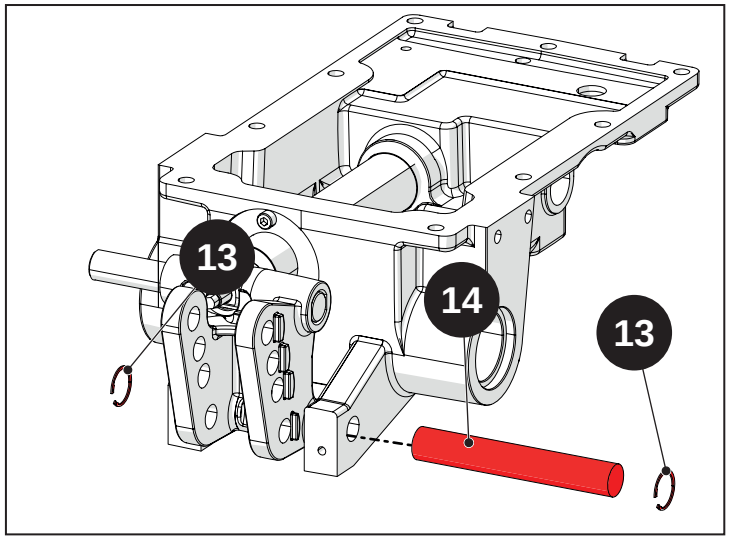


Fig. 15.17

Insert the washers (19) and tighten the screws (18).

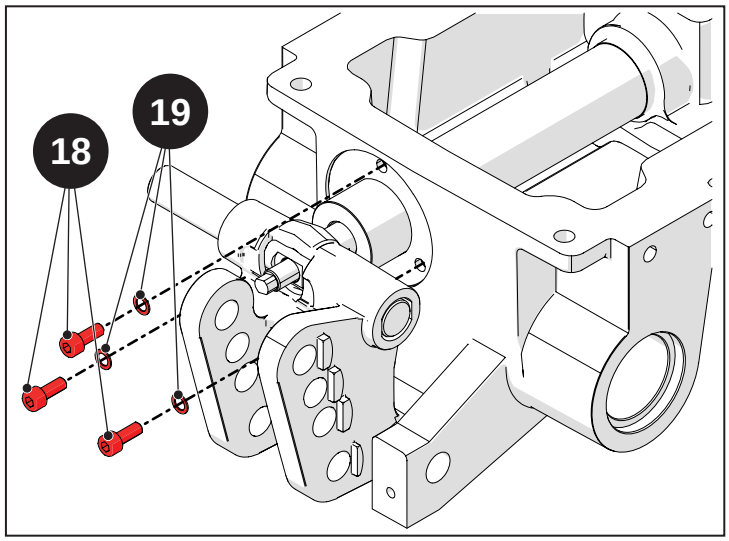


Fig. 15.18

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.

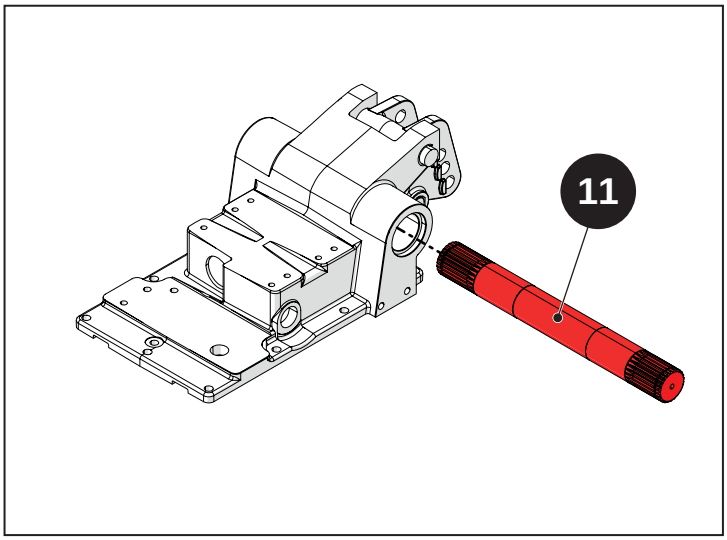


Fig. 15.19

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.

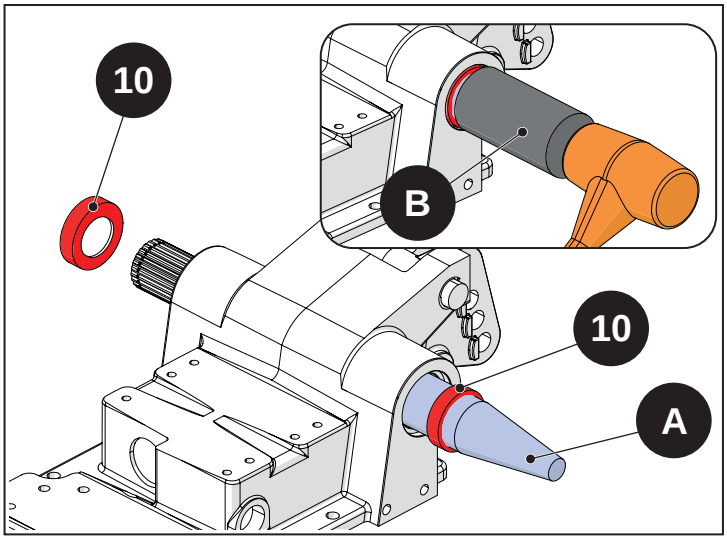


Fig. 15.20

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).

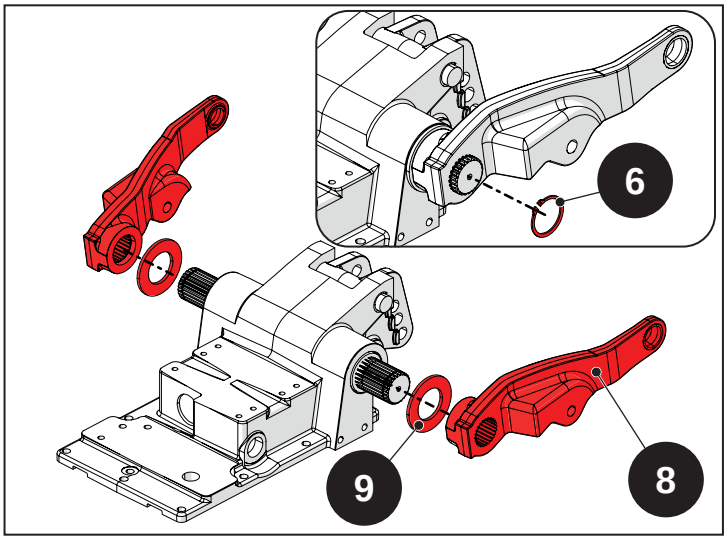


Fig. 15.21

Overturn the hitch links.

Insert the 2 spacers (29) and the positioner (7).

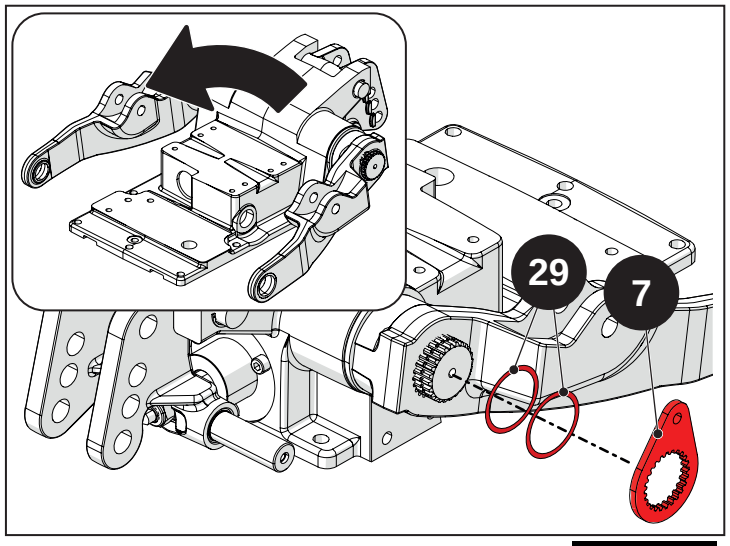


Fig. 15.22

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).

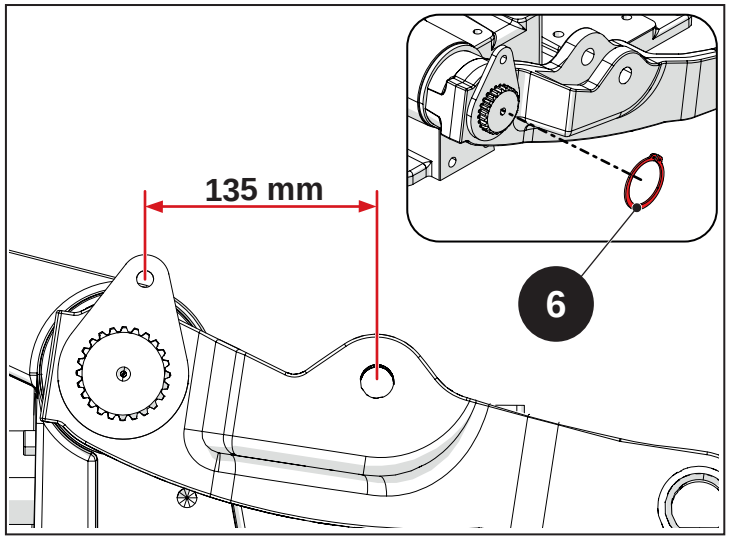


Fig. 15.23

Apply TEFLON to the thread, then tighten the union (4).

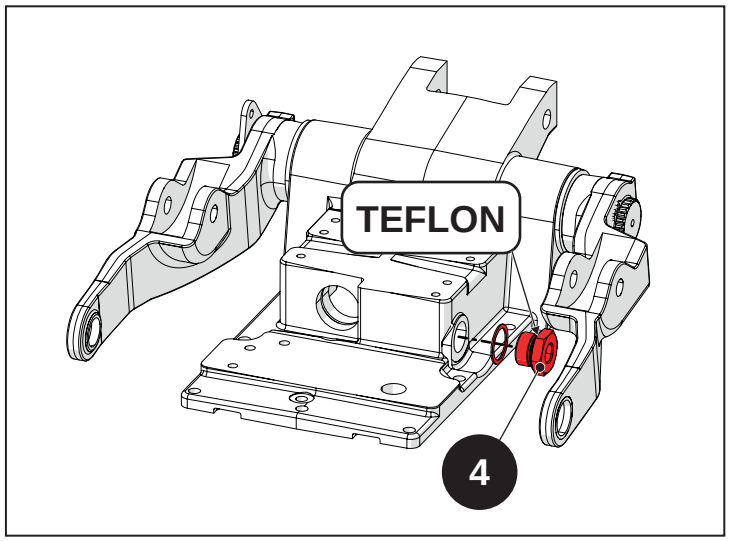


Fig. 15.24

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.

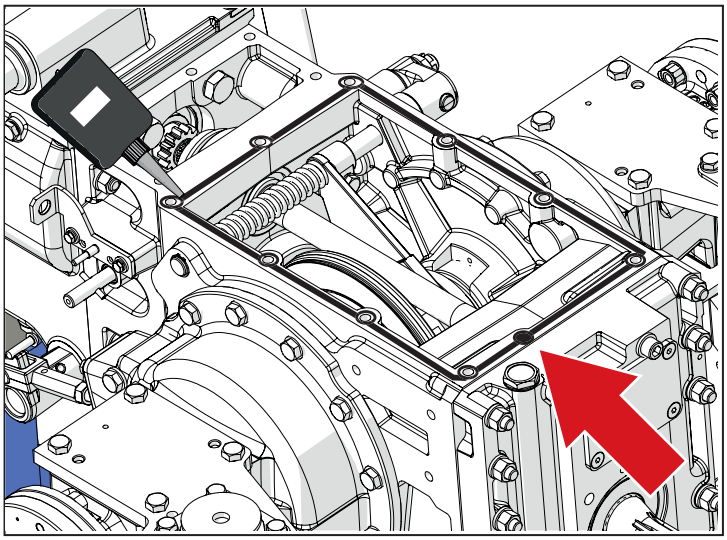


Fig. 15.25

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 Nm (8.5 kgm) tightening torque.

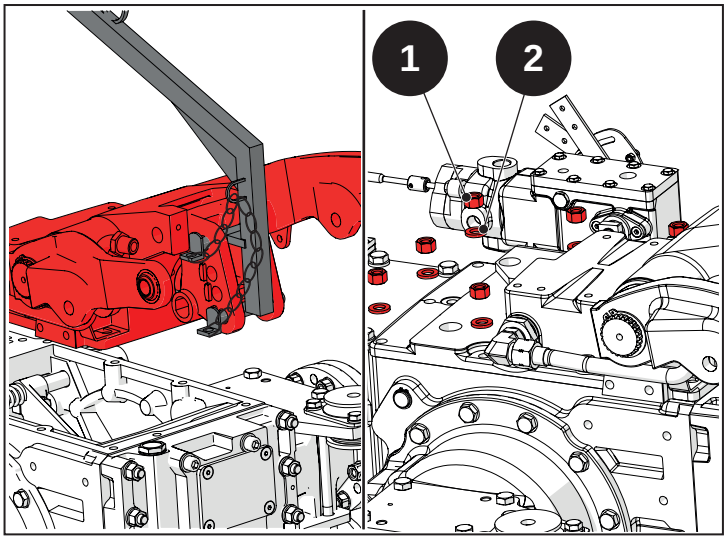


Fig. 15.26

Section 5 : Tightening torques

Index

5.1 Tightening torques.....15-20

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	Nm	kgm

Section 6 : Tools required

Index

6.1 Tools required 15-22

6.1 Tools required

Code	Description	Quantity
07007176	Rear hitch shaft protection	1
07007184	Rear hitch oil retainer plug	1

Chapter 16 : Front hitch

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Section 3 : Disassembly 16-5

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3.2 Disassembly 16-7

Section 4 : Main inspection, re-assembly and adjustment operations 16-11

4.1 Re-assembly 16-12

Section 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.

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 the sharp edges around the top of the transmission housing.

Caution

Used oil must be collected and disposed of in compliance with the anti-pollution laws in force.

Section 2 : Technical specifications

Index

2.1 Technical specifications 16-4

2.1 Technical specifications

Type	Up and down
Lifting capacity at ball ends	1200 kg
Three-point linkage class	Class 1 and 1N

Section 3 : Disassembly

Index

3.1 Preliminary operations 16-6

3.2 Disassembly 16-7

3.1 Preliminary operations

The main operations required to access the unit are described below:

Remove one of the front wheels.

Danger

Place a stand under the front axle before removing the wheel.

Make sure that the stand is able to bear its weight.

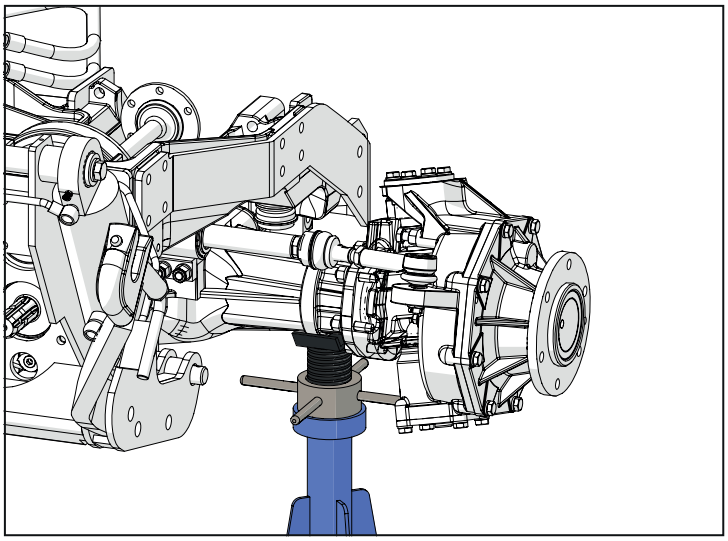


Fig. 16.1

3.2 Disassembly

Unscrew the two hydraulic pipes that come from the front control valve.

Unscrew the unions (1) and remove the washers (2) so as to free the hydraulic pipes.

> **Warning**
>
> Hydraulic pipe (3) cannot be removed at this stage. Leave it resting on the hydraulic cylinders. make sure that it is not damaged.

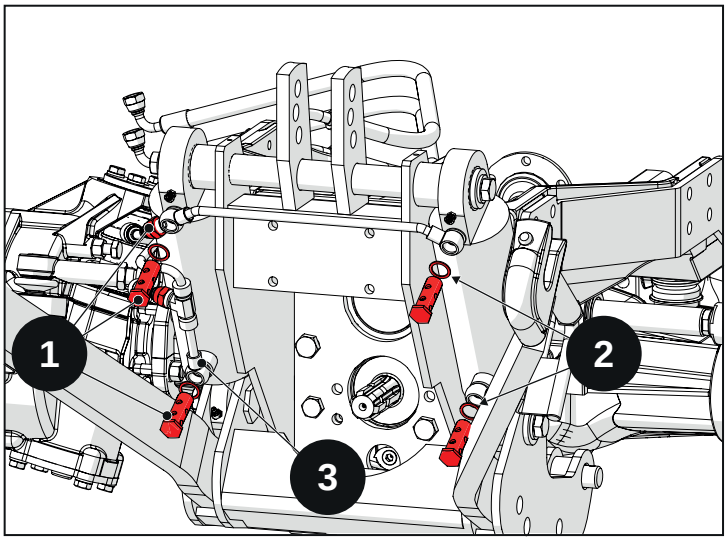


Fig. 16.2

Remove the split pins (4) and pins (5) from both sides, then remove the links (3).

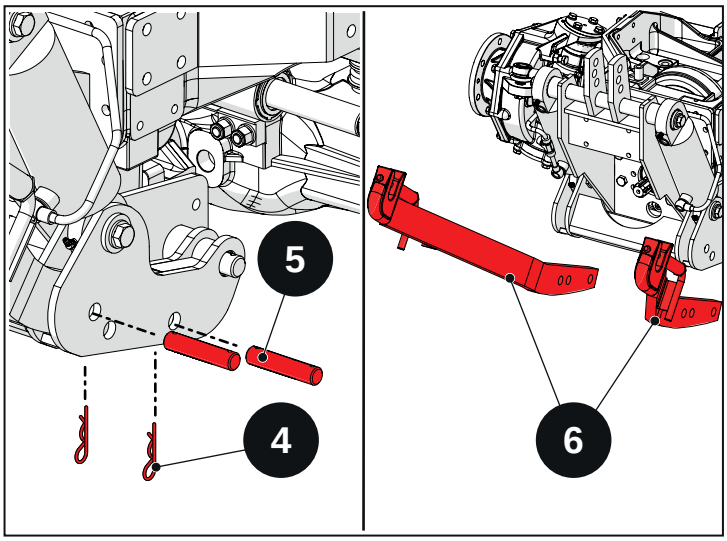


Fig. 16.3

Unscrew the screws (7) that fasten the rams (8), then remove the washers (9) and spacer (10) from both sides.

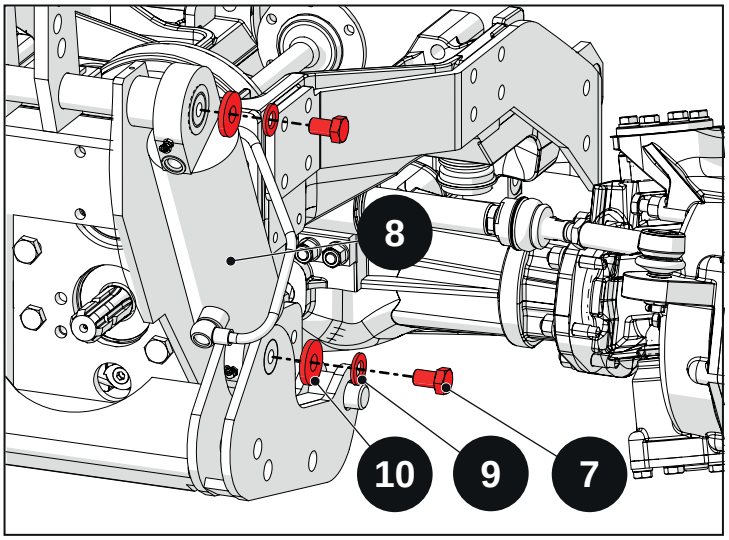


Fig. 16.4

Remove the pins (11) and take out the plug (12).

Danger

Once the plug has been removed, the link support will no longer be fastened to the machine.

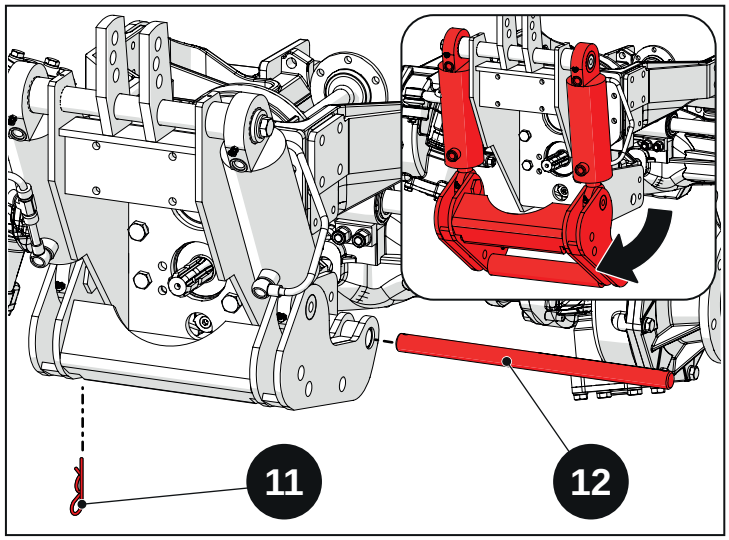


Fig. 16.5

Remove the plugs (13) and free the rams (8).

Remove the hitch link support (14).

Warning

Hydraulic pipe (3) can now be removed.

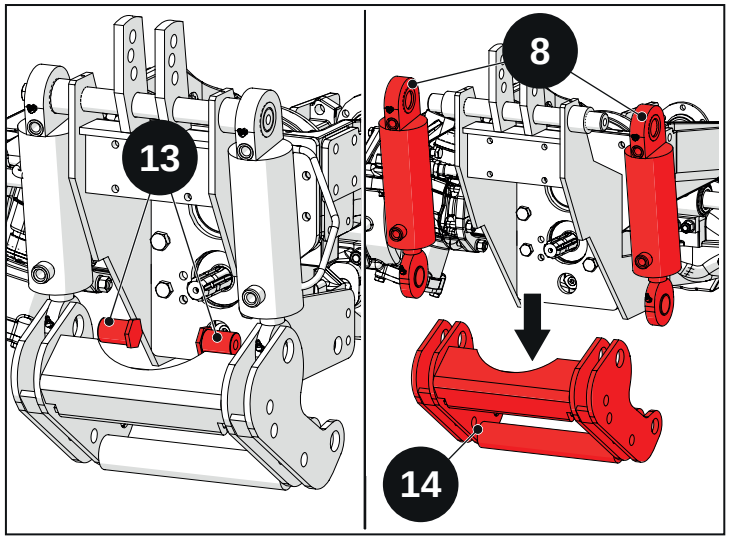


Fig. 16.6

Unscrew the screws (15) from both sides.

Unscrew the central screws (16).

Danger

Once the screws have been removed, the bearing frame of the hitch will no longer be fastened to the machine.

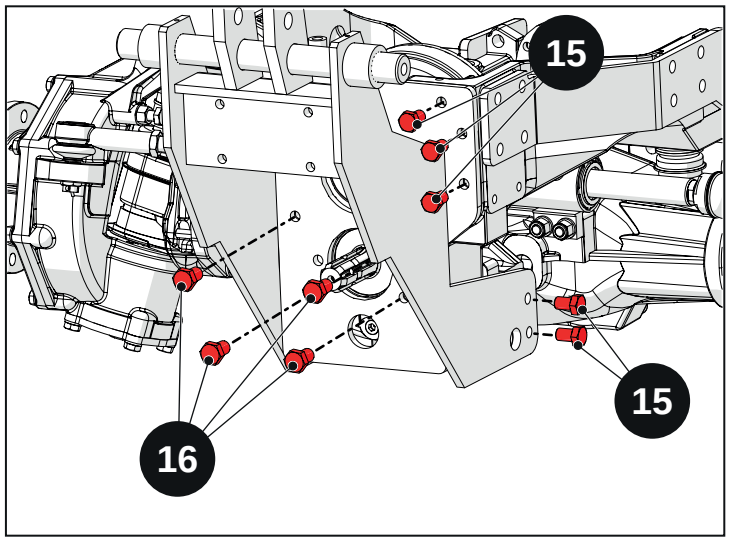


Fig. 16.7

Remove the bearing frame of the hitch (17).

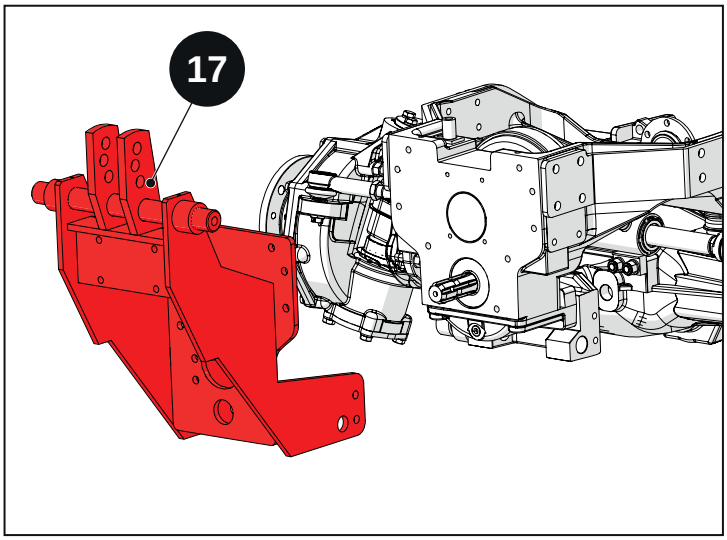


Fig. 16.8

Section 4 : Main inspection, re-assembly and adjustment operations

Index

4.1 Re-assembly.....16-12

4.1 Re-assembly

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.

Comply with the disassembly instructions in reverse order when reassembling the hitch.

Chapter 17 : Electrical system

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Section 1 : Safety notes

Certain precautions and safety recommendations are described in this section. It is important for operators to comply with these instructions in order to prevent accidents. Moreover, always bear in mind the safety measures described in the Operation and Maintenance Manual and in chapter 1 of this manual.

Carefully comply with the Warnings indicated by means of this symbol:

Caution

Always consult the instructions in the operation and maintenance manual when working on the battery.

Caution

Take all the necessary precautions when batteries containing sulfuric acid are installed. If the acid splashes on to the skin or into the eyes, immediately rinse the affected parts under clean running water.

Caution

When the acid is mixed with water, SLOWLY POUR THE ACID INTO THE WATER. NEVER EVER POUR WATER INTO THE ACID.

Caution

Explosive gases are released when batteries are charged. Work in places where there is good air circulation and keep well away from flames or sparks.

Caution

Always switch off the charging apparatus before disconnecting the cables.

Caution

Keep batteries well out of children's reach.

Caution

Do not smoke when checking or handling batteries.

Caution

Disconnect the negative terminal first. Connect the positive terminal first when installing the battery again. Always take great care to check the polarity of the terminals.

Caution

Always disconnect the ground cable (-) of the battery before working on the electrical system.

Section 2 : Instrument panel

Index

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2.2 Indicator lights 17-4

2.3 Functional diagram 17-5

2.4 Digital dashboard calibration 17-6

2.1 Digital instrument panel

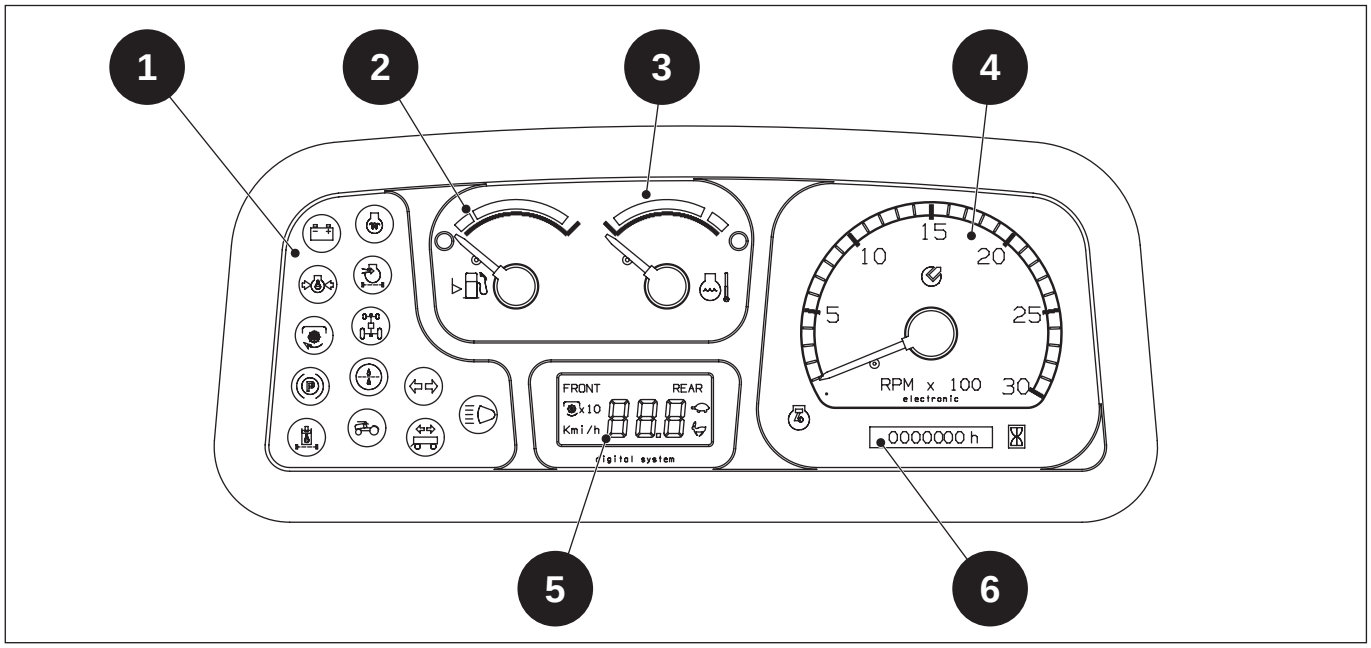


Fig. 17.1

1 - Indicator lights
2 - Fuel level indicator
3 - Coolant temperature indicator
4 - Revolution counter
5 - Digital display
6 - Hour meter

2.2 Indicator lights

1 - Battery charge indicator - red
2 - Engine preheater indicator - yellow
3 - Engine oil low pressure indicator - red
4 - Engine air filter clogged indicator - red
5 - PTO clutch disengaged indicator - red
6 - Front drive engaged indicator indicator - yellow
7 - Parking brake engaged indicator - red
8 - Clogged oil filter indicator - red
9 - Tractor turn indicator light - green
10 - Clogged oil filter indicator - red
11 - Safety frame lowered indicator - red
12 - Trailer turn indicator light - green
13 - Driving beams indicator - blue

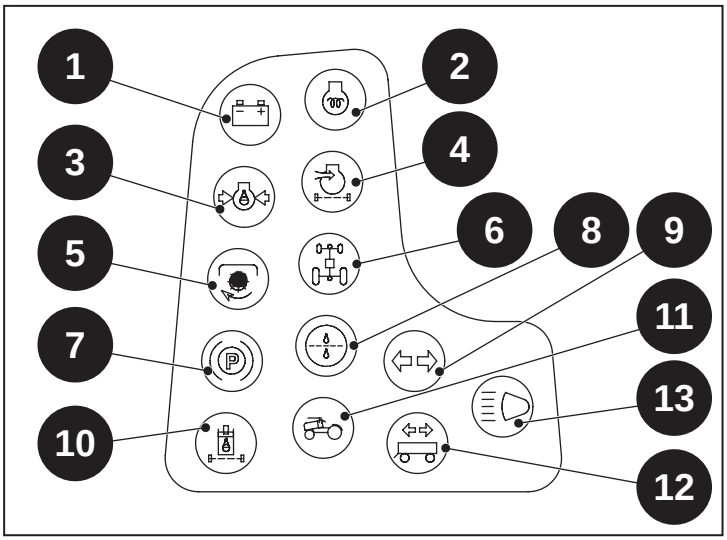


Fig. 17.2

2.3 Functional diagram

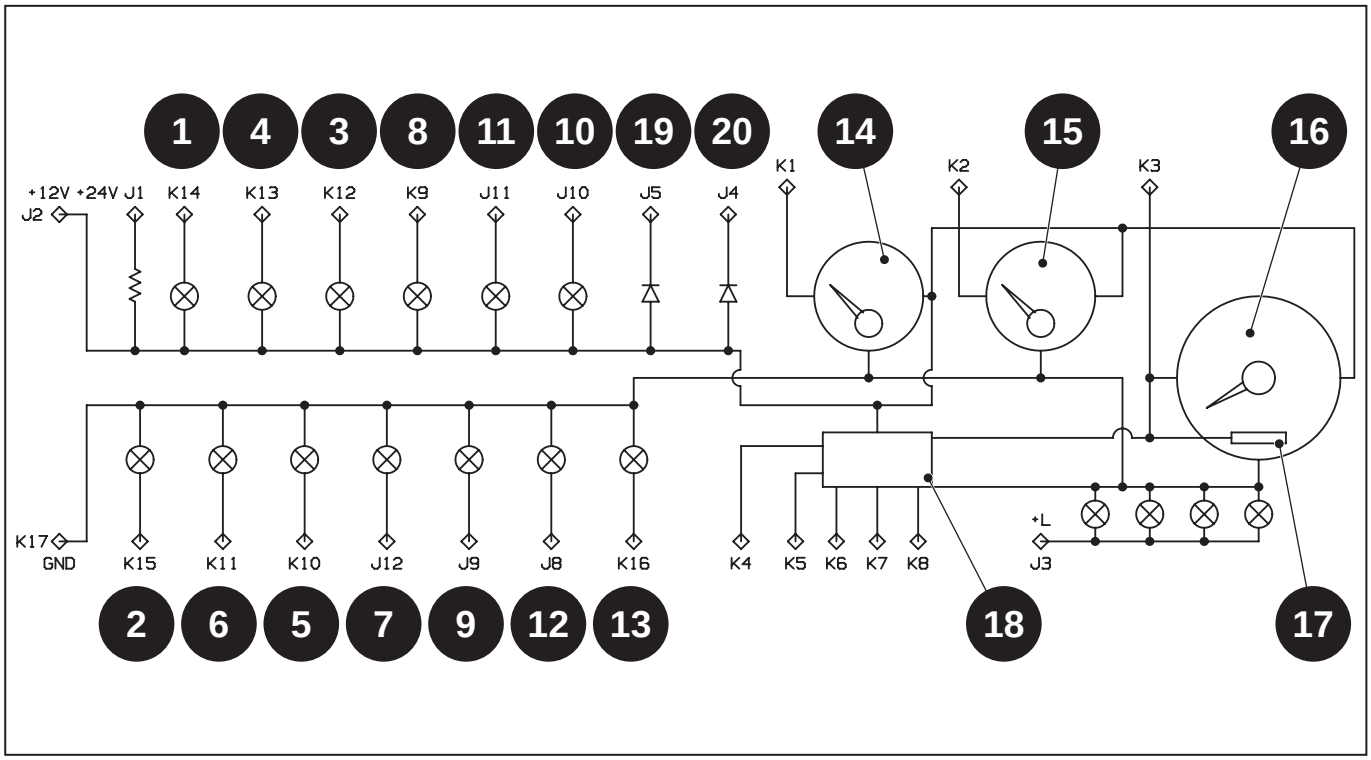


Fig. 17.3

1 - Battery charge indicator - red
2 - Engine preheater indicator - yellow
3 - Engine oil low pressure indicator - red
4 - Engine air filter clogged indicator - red
5 - PTO clutch disengaged indicator - red
6 - Front drive engaged indicator indicator - yellow
7 - Parking brake engaged indicator - red
8 - Clogged oil filter indicator - red
9 - Tractor turn indicator light - green
10 - Clogged oil filter indicator - red
11 - Safety frame lowered indicator - red
12 - Trailer turn indicator light - green
13 - Driving beams indicator - blue
14 - Fuel level
15 - Water level
16 - Engine rate
17 - Hour meter
18 - Digital display

2.4 Digital dashboard calibration

To ensure correct operation, calibrate the digital dahsboard by entering a code that varies depending on the tyres and type of P.T.O. with which the machine is fitted.

Note

The calibration code will appear for a few seconds whenever the machine is started.

Warning

The calibration code is reset to zero if the battery cables are disconnected.

	540/540E		540/1000	
	Version			
Tyres	Low	High	Low	High
320/70-R20" 250/80-R16"	185		187	
340/65-R20" 260/70-R16"	181	184	187	190
340/65-R20" 280/70-R16"	181	184	187	190
340/65-R20" 300/65-R16"	181	184	187	190
360/70-R20" 280/70-R18"	181	183	187	189
420/70-R20" 300/65-R18"	181	183	187	189
420/65-R20" 320/65-R16"	181	183	187	189
320/70-R24" 280/70-R20"	180	182	186	188

Proceed as described below to calibrate:

1 - Keep push-button (1) depressed and turn the ignition key until the dashboard lights come on. The word SET will appear when push-button 4 is released.

2 - Press the push-button (1) again until the first of the indicated three numbers begins to flash.

3 - Press push-button (1) again to scroll the first value required.

4 - Keep the button (1) depressed to memorize and move on to the next number.

5 - Repeat the two previous points to memorize the second and third numbers.

6 - After the required three values have been memorized, press push-button (1) until the indication km/h or mph appears.

7 - Release and then press push-button (1) again until the word OFF appears. Calibration will have now concluded.

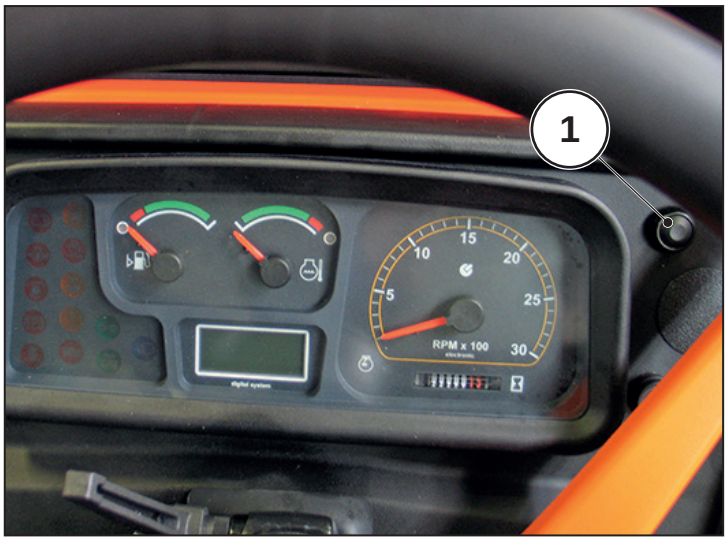


Fig. 17.4

Section 3 : Main components

Index

3.1 Battery 17-10

3.2 Battery disconnector 17-11

3.3 Fuses 17-12

3.4 Ignition 17-14

3.5 Preheater glow plugs 17-15

3.6 Four-wheel drive and brake engagement 17-16

3.7 KSB (cold start) 17-18

3.8 Installing rotating beacon on roll bar 17-19

3.1 Battery

The battery is installed on the left-hand side of the tractor, under the tool box.

Proceed as described below to ensure that the system operates correctly:

- Make sure that the terminals are fixed to the battery poles.
- Make sure that the battery is firmly fixed to the machine.
- Use a damp antistatic cloth to keep the battery clean
- Keep the battery poles and cable terminals clean
- Lightly grease the poles and terminals when necessary
- Use Vaseline-based grease, not common grease

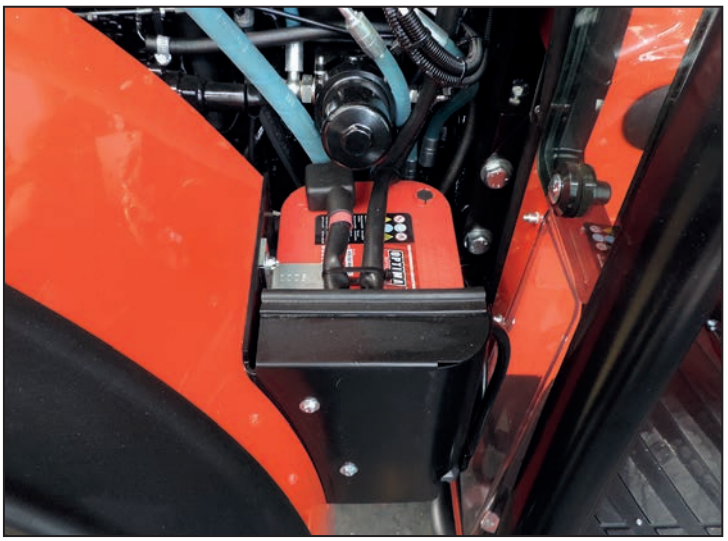


Fig. 17.5

Warning

If the machine is to remain idle for a long period of time, charge the battery as indicated by the manufacturer, disconnect the cables and store the battery in a cool, dry, well ventilated place.

Warning

If the battery must be replaced, the new one must possess the same technical characteristics (consult the values given on the battery itself).

Danger

Take the necessary precautions whenever work must be done on the battery: the electrolyte is corrosive and the gas that develops is inflammable.

3.2 Battery disconnector

This device disconnects the electrical system in a safe and correct way. It must be used when the vehicle is to remain idle for a long period of time and when work must be performed on the electrical circuit in safe conditions.

Warning
Use the battery disconnector if the tractor is to remain idle for a long period of time.

Danger
Use the battery disconnector whenever the electrical system of the tractor is serviced.



Fig. 17.6

3.3 Fuses

Fuse functions:

A	Left-hand front driving beam. Right-hand front driving beam.	15A
B	Driving beam flashes Hazard light switch. Rotating beacon switch	15A
C	Light switch powering. Horn. Seven-pin socket.	15A
D	1-pin power socket. Rear.	20A
E	Left-hand dipped beam.	10A
F	Right-hand dipped beam.	10A
G	Turn indicator switch. Cab power supply.	10A
H	Power take-off switch. Preheater plant. Alternator energizing. Motor stop solenoid valve power supply. Engine rate sensor. Speed sensor. Lead variator.	10A
I	Multifunction digital instrument. Left-hand license plate light. Seven-pin socket. Left-hand front sidelight. Right-hand rear sidelight.	10A
L	Right-hand license plate light. Seven-pin socket. Right-hand front sidelight. Left-hand rear side light.	10A
M	4WD switch. Parking brake. Brake lights. Differential lock.	15A
N	1-pin power socket. Front.	10A

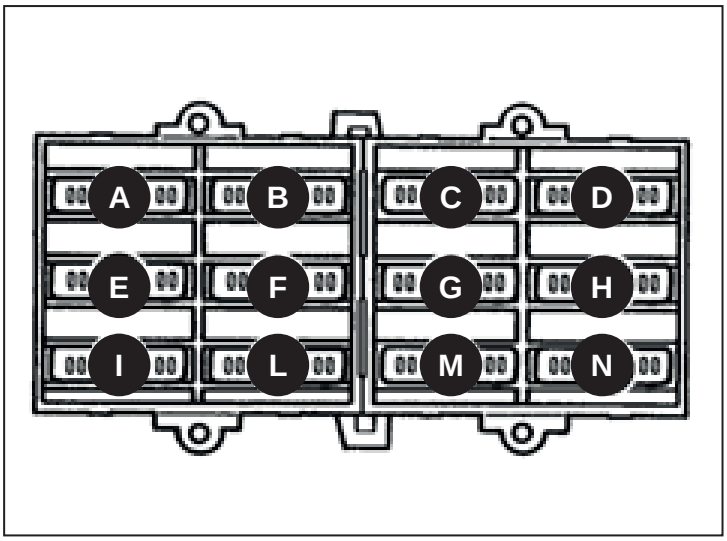


Fig. 17.7

General purpose fuses:

A	Engine preheater.	60A
B	General protection of electrical system.	40A
C	General protection of the cab electrical system (Only on machines with cab).	40A

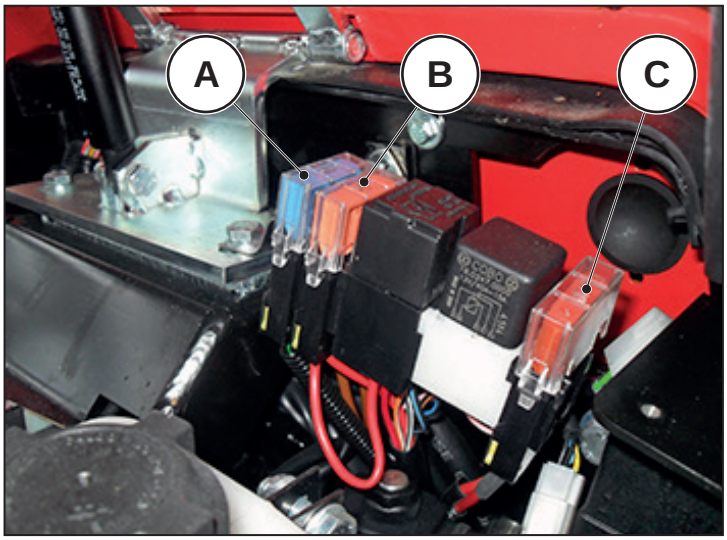


Fig. 17.8

SG1 cab fuses:

A	Windscreen wiper and window washer.	10A
B	Fan/heat exchanger compartment.	15A
C	Field light.	15A
D	Fan switch. Air conditioner power supply.	15A
E	Ceiling light.	30A
F	Compressor.	5A

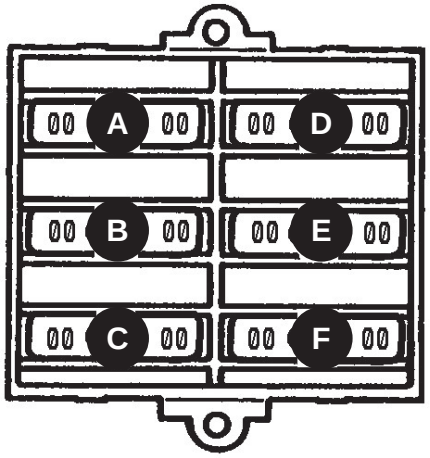


Fig. 17.9

GL Cab fuses:

A	Windscreen wiper and window washer.	7.5A
B	Fan switch. Ceiling light.	20A
C	Field light.	15A
D	Fan/heat exchanger compartment.	25A
E	Rear field lights.	10A
F	Revolving beacon.	20A

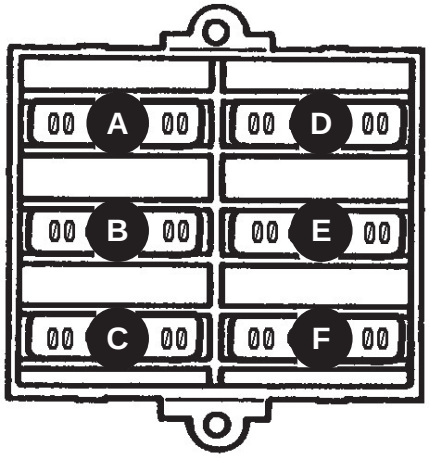


Fig. 17.10

3.4 Ignition

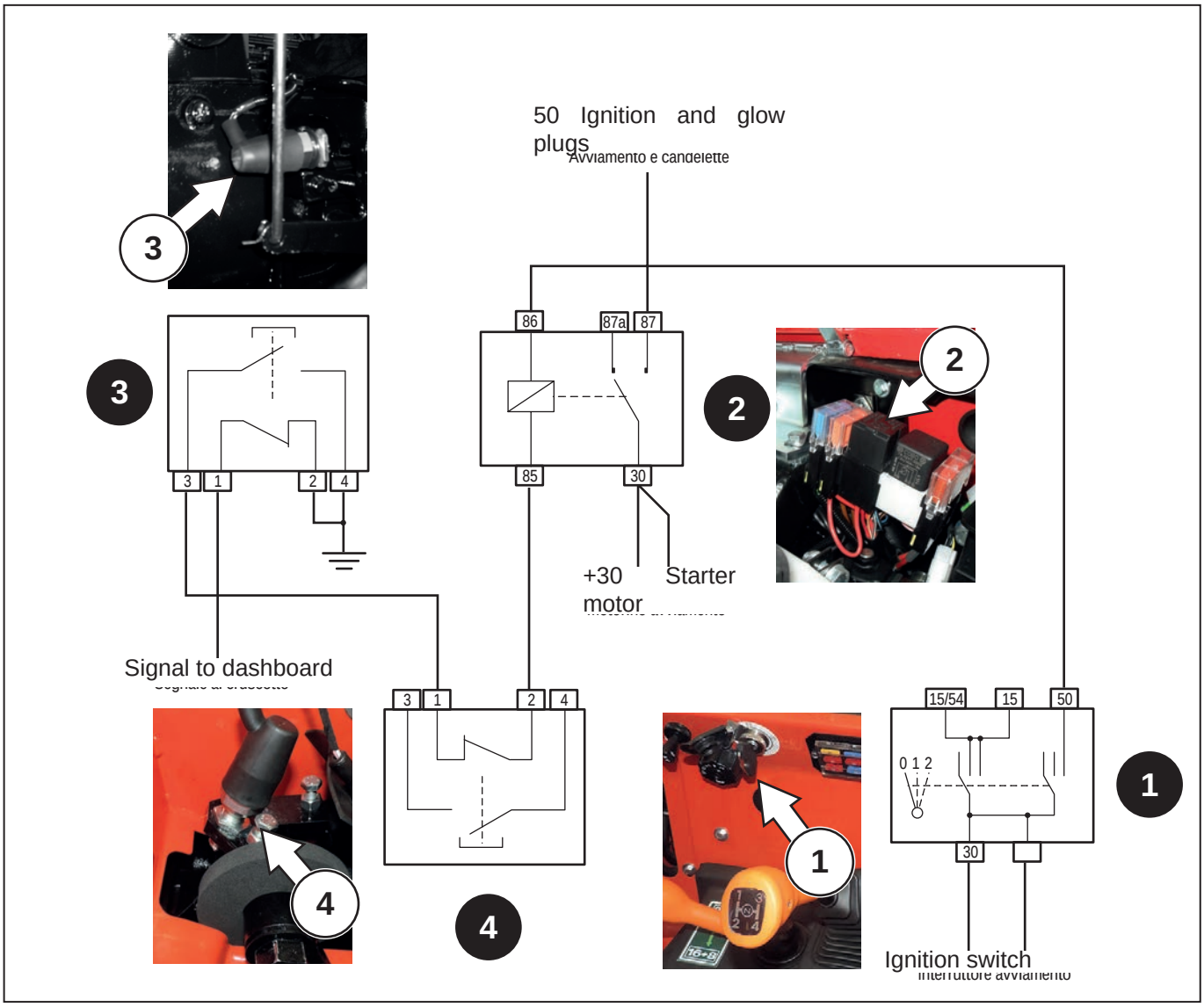


Fig. 17.11

Ignition is only possible if the rear PTO ignition enabling switch (3) is open (PTO disengaged) and the clutch pedal (4) is closed (pedal depressed). Having checked compliance with this condition, the ignition switch (1) powers the coil of the ignition relay (2) from pin 50 to pin 86. Energizing of the coil makes the contact inside the relay, which receives power from the starter motor on pin 30 and powers the glow plug preheater plant via pin 87.

3.5 Preheater glow plugs

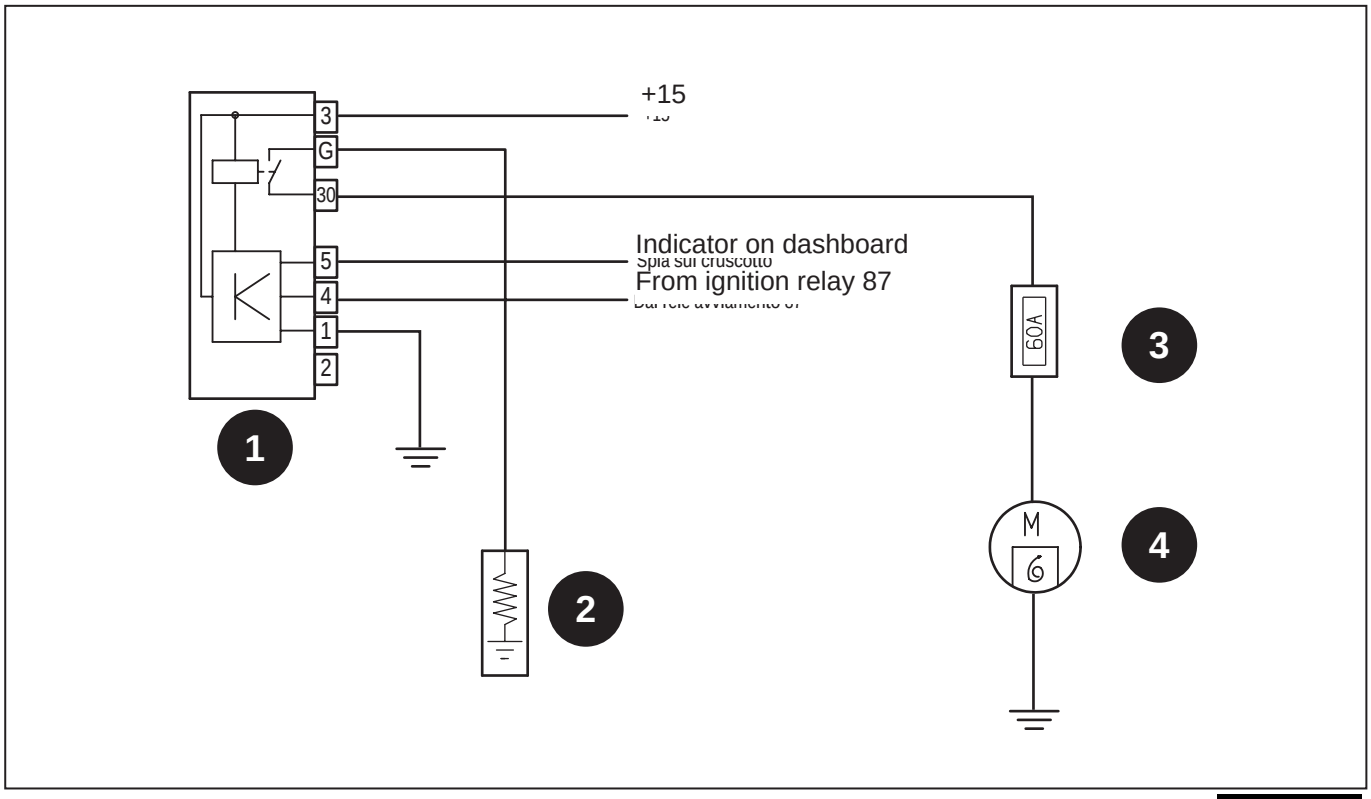


Fig. 17.12

The glow plug circuit is protected by a 60 A fuse (3). +15 key-activated power is supplied to pin 3 of the preheater plant (1) and energizes the coil. The contact that heats the glow plugs (2) makes, having been directly powered by the starter motor (4).

Thanks to the connection to the ignition relay on pin 4, the plant continues to supply current and to power the indicator light on pin 5.

3.6 Four-wheel drive and brake engagement

Note

When the coil of the solenoid valve is energized, the four-wheel drive is DISENGAGED.

When the coil of the solenoid valve is not energized, the four-wheel drive is ENGAGED.

The coil of the 4WD solenoid valve is always energized when the tractor starts.

The 4WD engages automatically when the brake pedals are depressed or when the parking brake is engaged.

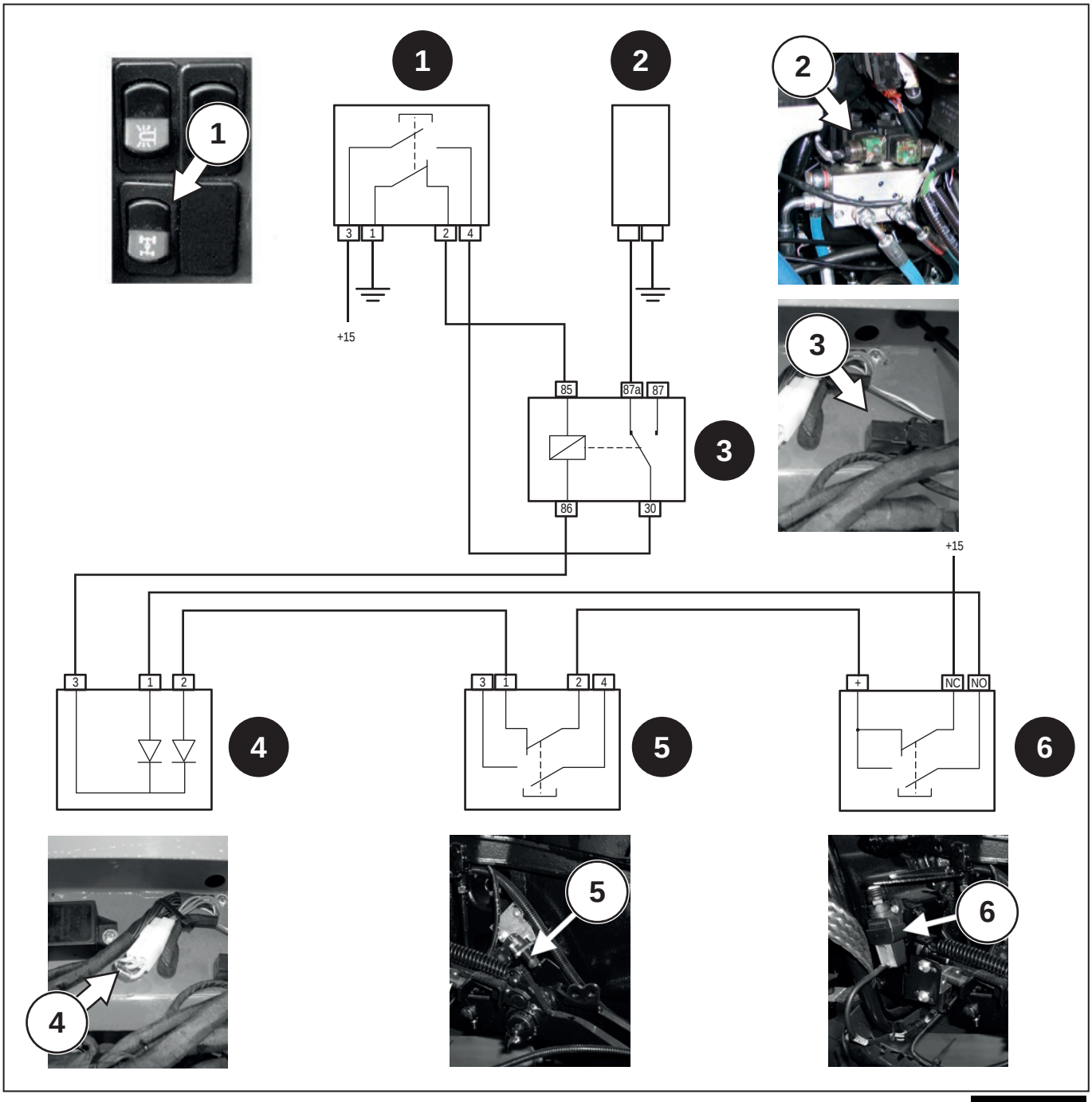


Fig. 17.13

The brake and 4WD circuit is protected by a 15A fuse.

4WD push-button not pressed

When the 4WD engaging button (1) is not pressed, the circuit is powered by the key-operated unit (+15) on pin NC (normally closed) of the parking brake switch (6) and on pin 2 of the pedal brake switch (5).

Consequently, by passing through the diode (4) and 4WD engaging relay (3), the circuit is closed to ground on pin 1 of the 4WD switch (1).

The coil of the solenoid valve (2) is energized and the 4WD clutch disengaged

4WD push-button pressed

The 4WD engaging push-button (1) receives +15 power on pin 3. When the push-button is depressed, the normally open contact makes and the normally closed contact breaks.

The contact of the 4WD engaging relay (3) breaks, thus interrupting the power supplied to the solenoid valve (2). Consequently, the 4WD clutch disengages.

Whenever the brakes (5) or parking brake (6) are depressed, the circuit opens and the power supply is interrupted. The 4WD engages automatically.

3.7 KSB (cold start)

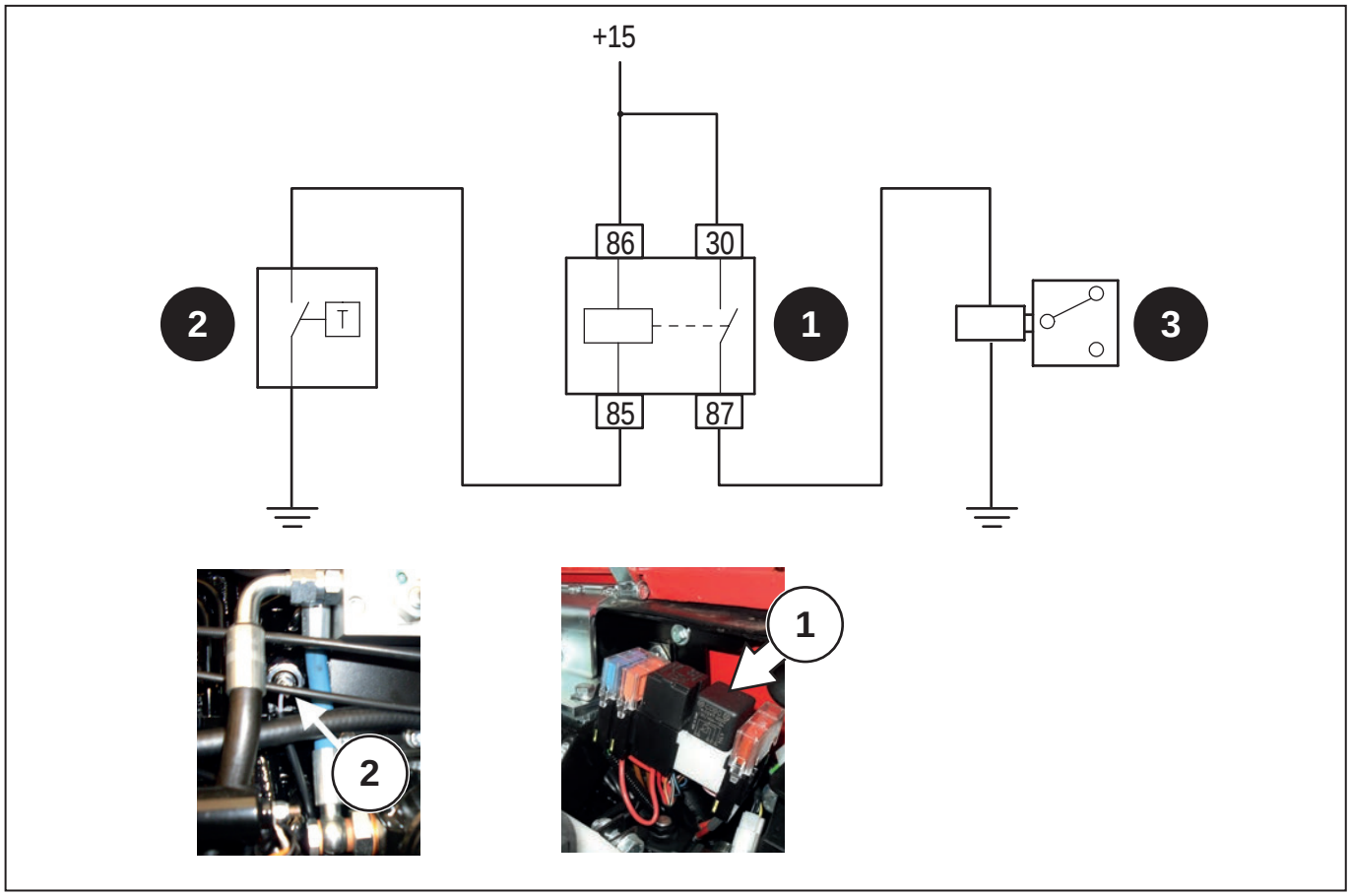


Fig. 17.14

The KSB relay receives current from the +15 key-operated circuit on both coil 86 and contact 30. None of the components are powered in this position.

When the engine temperature sensor (2) reaches the temperature of 60°C, the internal contact makes and closes the circuit that supplies the coil of relay (1). The contact inside the relay consequently closes and the circuit of coil KSB (3) is powered. Coil KSB thus changes state.

3.8 Installing rotating beacon on roll bar

Feed the cable from the base of the right hand roll bar pillar (1) up to the hole at the top of the hoop (2).

Pass the cable through the rotating beacon mount (3), fasten the mount to the roll bar, fit the cylinder (4) into the mount, leaving the two ends of the cable protruding at the top of the cylinder, fit the two Faston connectors (5) onto the cables, with the respective connector covers, and then connect them to the plug (6).

Tighten the cylinder (4) onto the plug (6) and fasten to the rotating beacon carrier (3) with the grub screw (7).

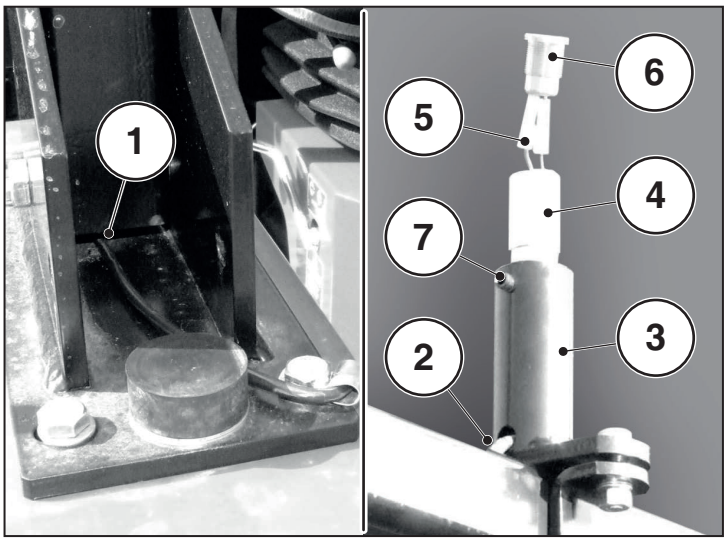


Fig. 17.15

Fasten the rotating beacon to the cylinder (4) and secure by tightening the screw (8).

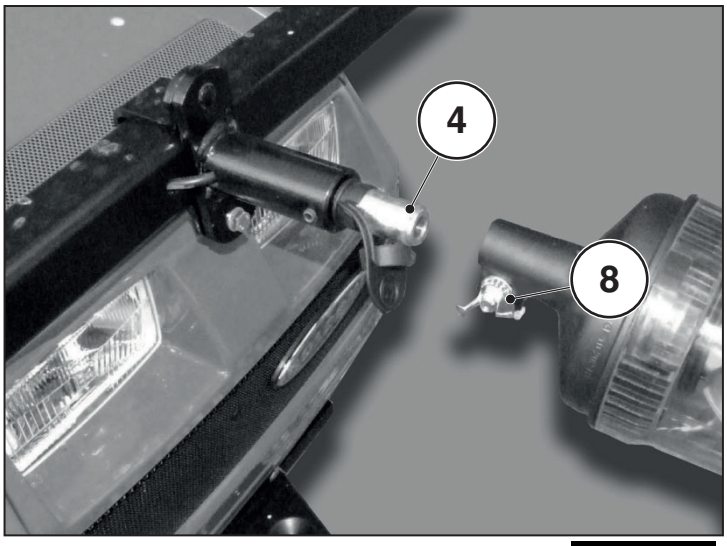


Fig. 17.16

Feed the cable through the cable guide and fasten the cable guide to one of the fastener bolts of the roll bar pillar.

Connect the cable terminal to the plug (10) of the rotating beacon switch (11), under the dashboard of the machine.

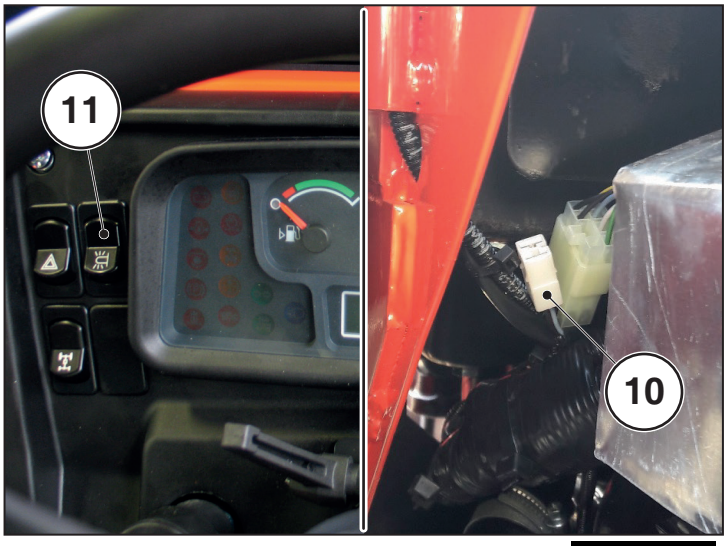


Fig. 17.17

Section 4 : Wiring

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4.1 02002737 - Front power take-off 17-22

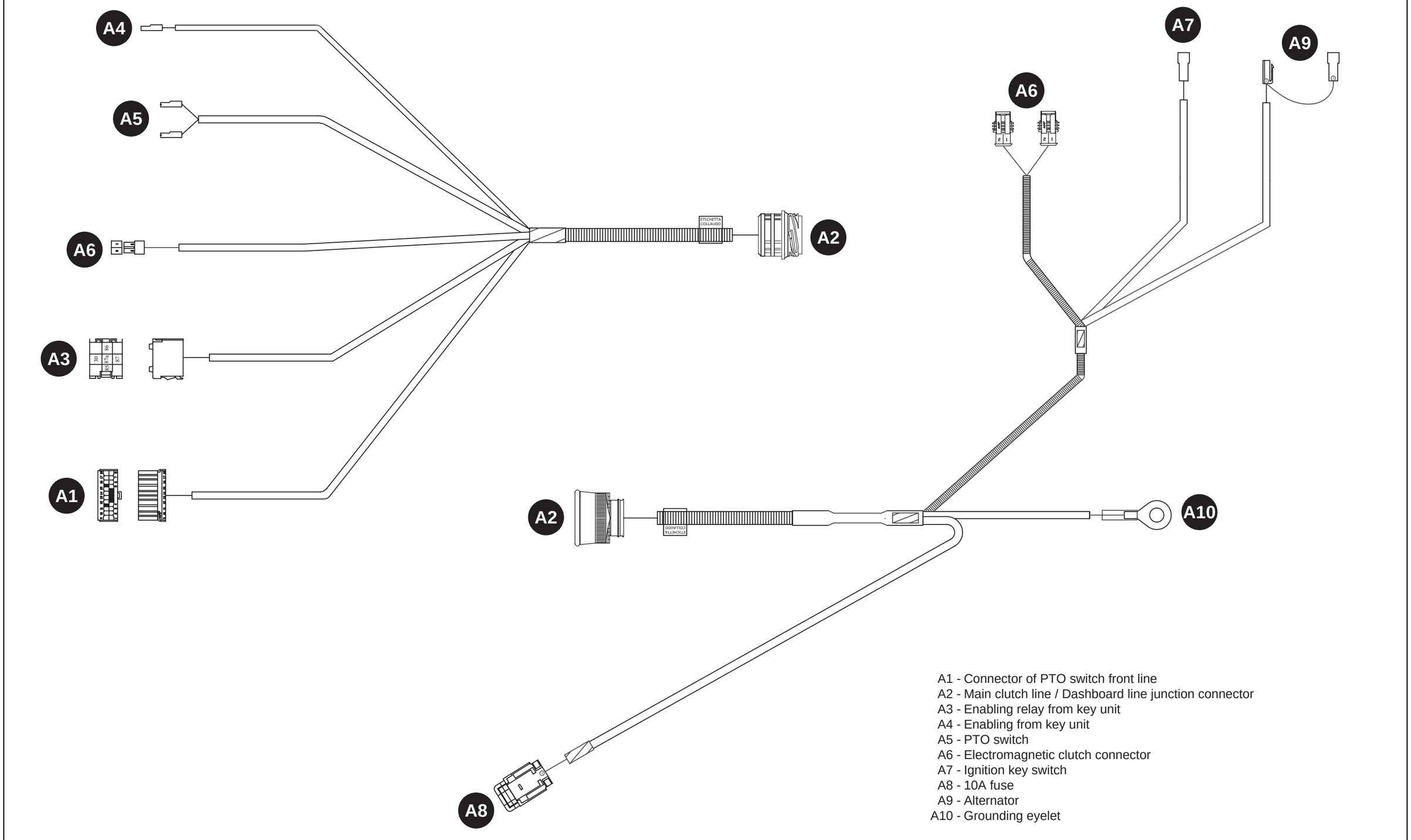
4.2 02003476 - Engine 17-24

4.3 02003654 - Platform 17-27

4.4 GL cab 17-30

4.5 02003655- Transmission 17-34

4.1 02002737 - Front power take-off



A1 - Connector of PTO switch front line
A2 - Main clutch line / Dashboard line junction connector
A3 - Enabling relay from key unit
A4 - Enabling from key unit
A5 - PTO switch
A6 - Electromagnetic clutch connector
A7 - Ignition key switch
A8 - 10A fuse
A9 - Alternator
A10 - Grounding eyelet

Fig. 17.18

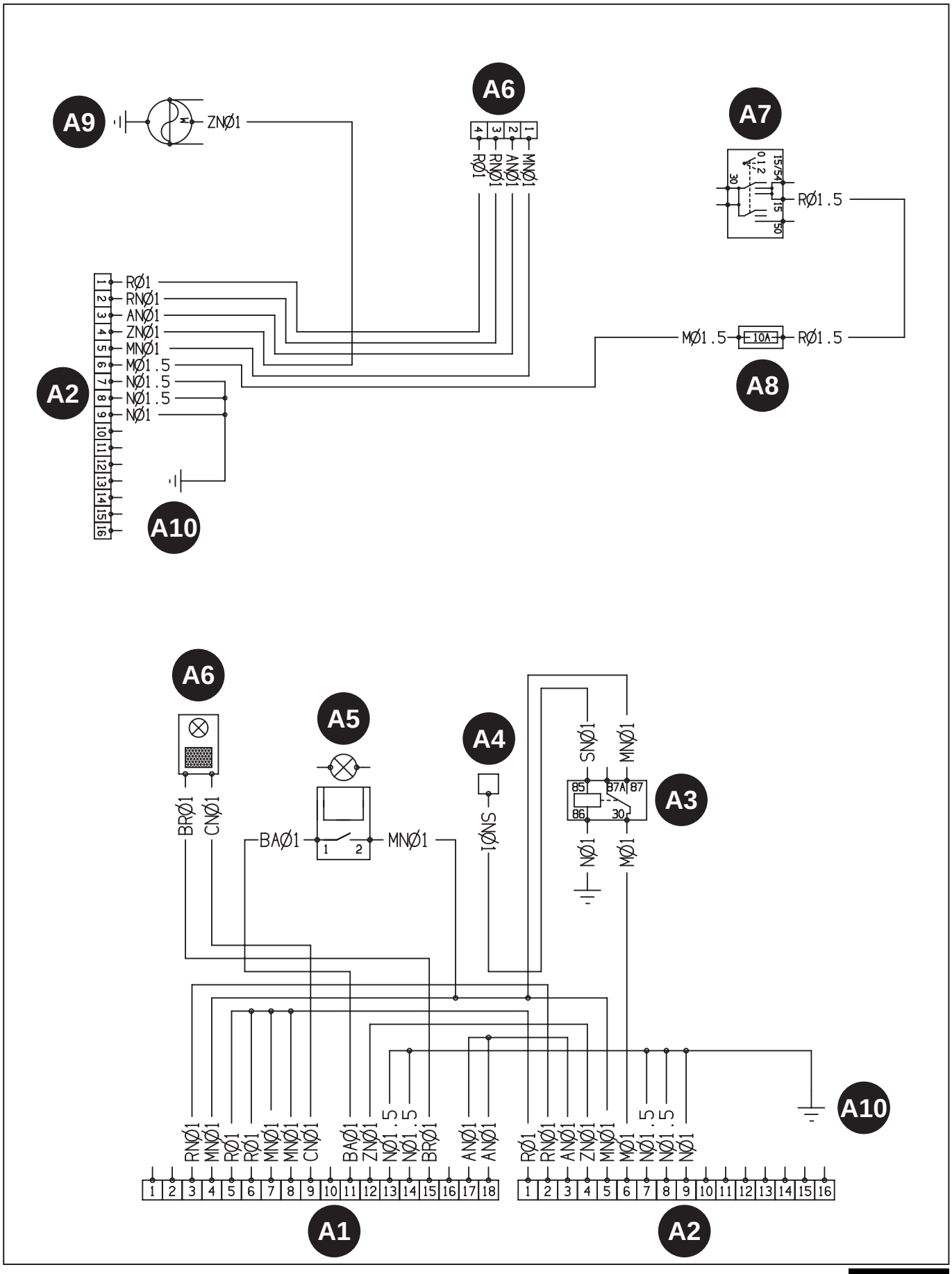

A9
ZNØ1
A6
MNØ1
ANØ1
RNØ1
RØ1
A7
15/54
30
RØ1.5
15
50
A2
RØ1
RNØ1
ANØ1
ZNØ1
MNØ1
MØ1.5
NØ1.5
NØ1.5
NØ1
MØ1.5
10A
RØ1.5
A8
A10
A6
BRØ1
CNØ1
A5
BAØ1
MNØ1
A4
SNØ1
SNØ1
MNØ1
85
87A
87
86
30
A3
NØ1
MØ1
A10
RNØ1
MNØ1
RØ1
RØ1
MNØ1
MNØ1
CNØ1
BAØ1
ZNØ1
NØ1.5
NØ1.5
BRØ1
ANØ1
ANØ1
RØ1
RNØ1
ANØ1
ZNØ1
MNØ1
MØ1
NØ1.5
NØ1.5
NØ1
A1
A2

Fig. 17.19

4.2 02003476 - Engine

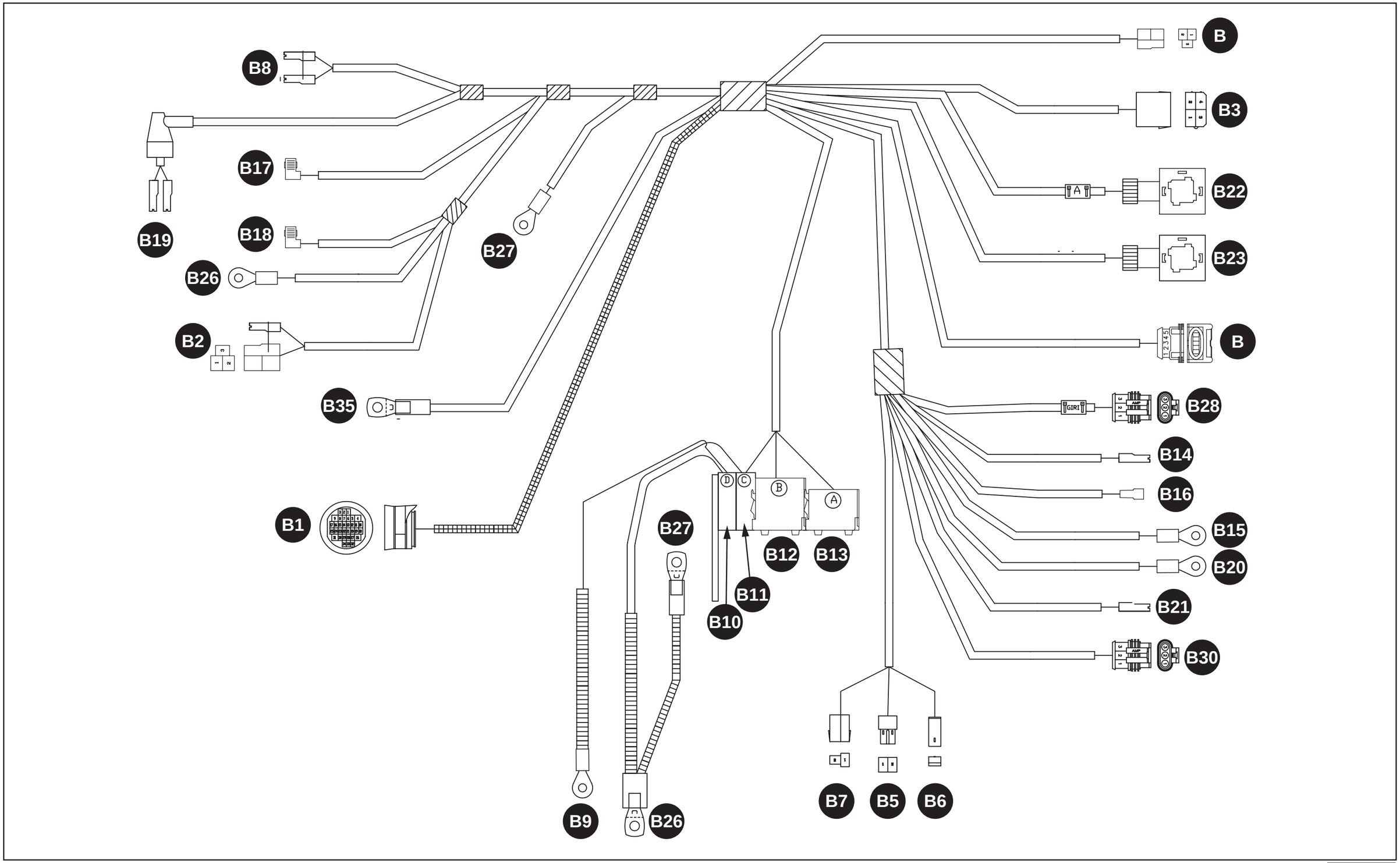


Fig. 17.20

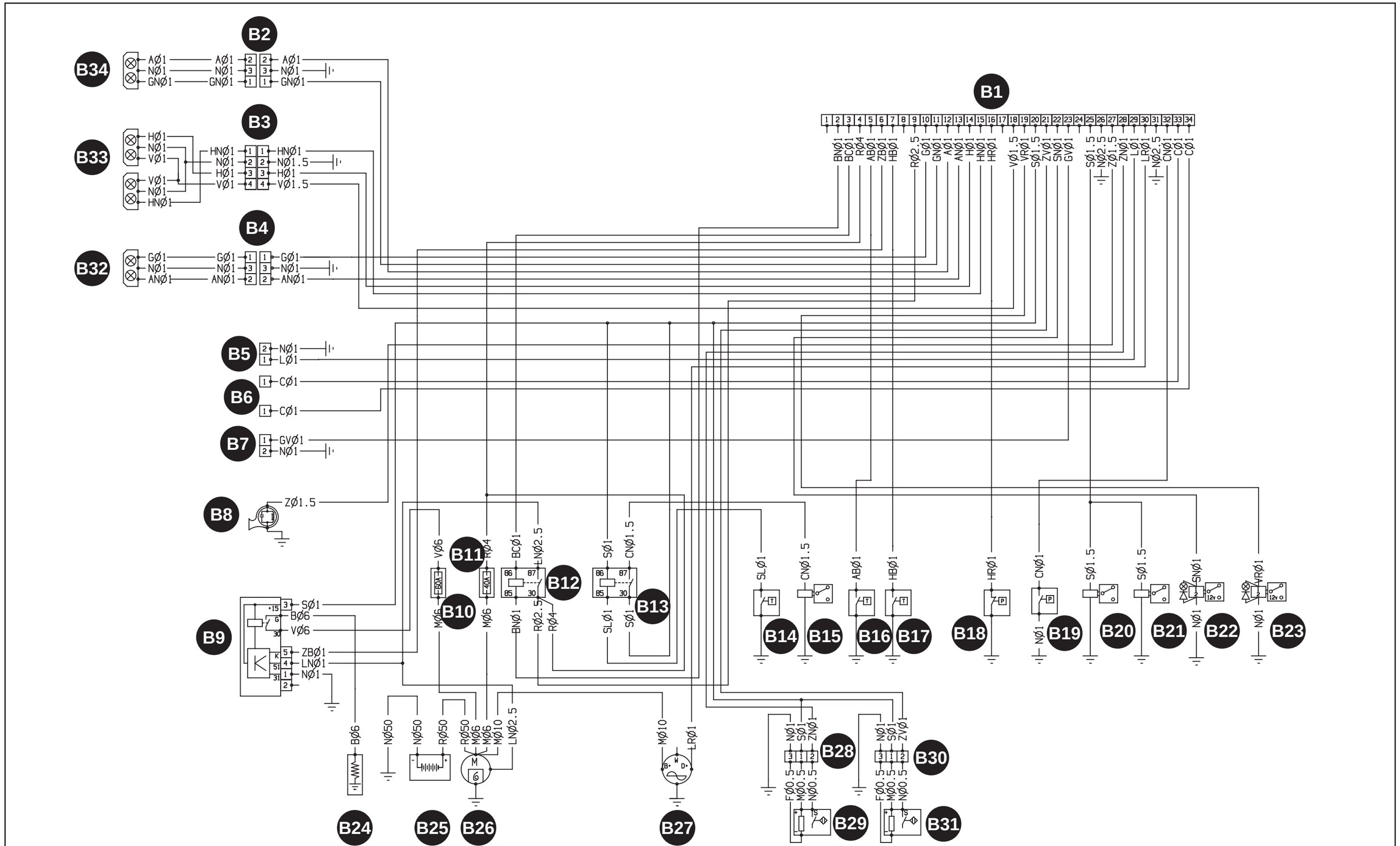

B1
B2
B3
B4
B5
B6
B7
B8
B9
B10
B11
B12
B13
B14
B15
B16
B17
B18
B19
B20
B21
B22
B23
B24
B25
B26
B27
B28
B29
B30
B31
B32
B33
B34

Fig. 17.21

B1 - 34-pin connector for engine line/dashboard line connection
B2 - RH headlight, turn indicator, sidelight extension connector
B3 - 4-pin connector for engine line/headlight line connection
B4 - LH headlight, turn indicator, sidelight extension connector
B5 - Roll Bar limit switch
B6 - Cab power supply pre-engineering
B7 - Revolving beacon connection pre-engineering
B8 - Horn
B9 - Preheater glow plug plant
B10 - Preheater glow plug maxifuse
B11 - Maxifuse for system protection
B12 - Ignition relay
B13 - Cold start relay
B14 - KSB lead variator sensor
B15 - Lead variator solenoid valve
B16 - Variator temperature sensor
B17 - Hydraulic oil temperature sensor
B18 - Engine oil pressure sensor
B19 - Air filter clogged sensor
B20 - Fuel filter solenoid valve
B21 - Motor stop solenoid valve
B22 - Differential lock solenoid valve
B23 - 4WD solenoid valve
B24 - Preheater glow plugs
B25 - 12V battery
B26 - Starter motor
B27 - Alternator
B28 - 3-pole connector for engine rate sensor connection
B29 - Engine rate sensor
B30 - 3-pole connector for speed sensor connection
B31 - Speed sensor
B32 - LH headlight, turn indicator, sidelight
B33 - Front driving beam-dipped beam
B34 - RH headlight, turn indicator, sidelight

4.3 02003654 - Platform

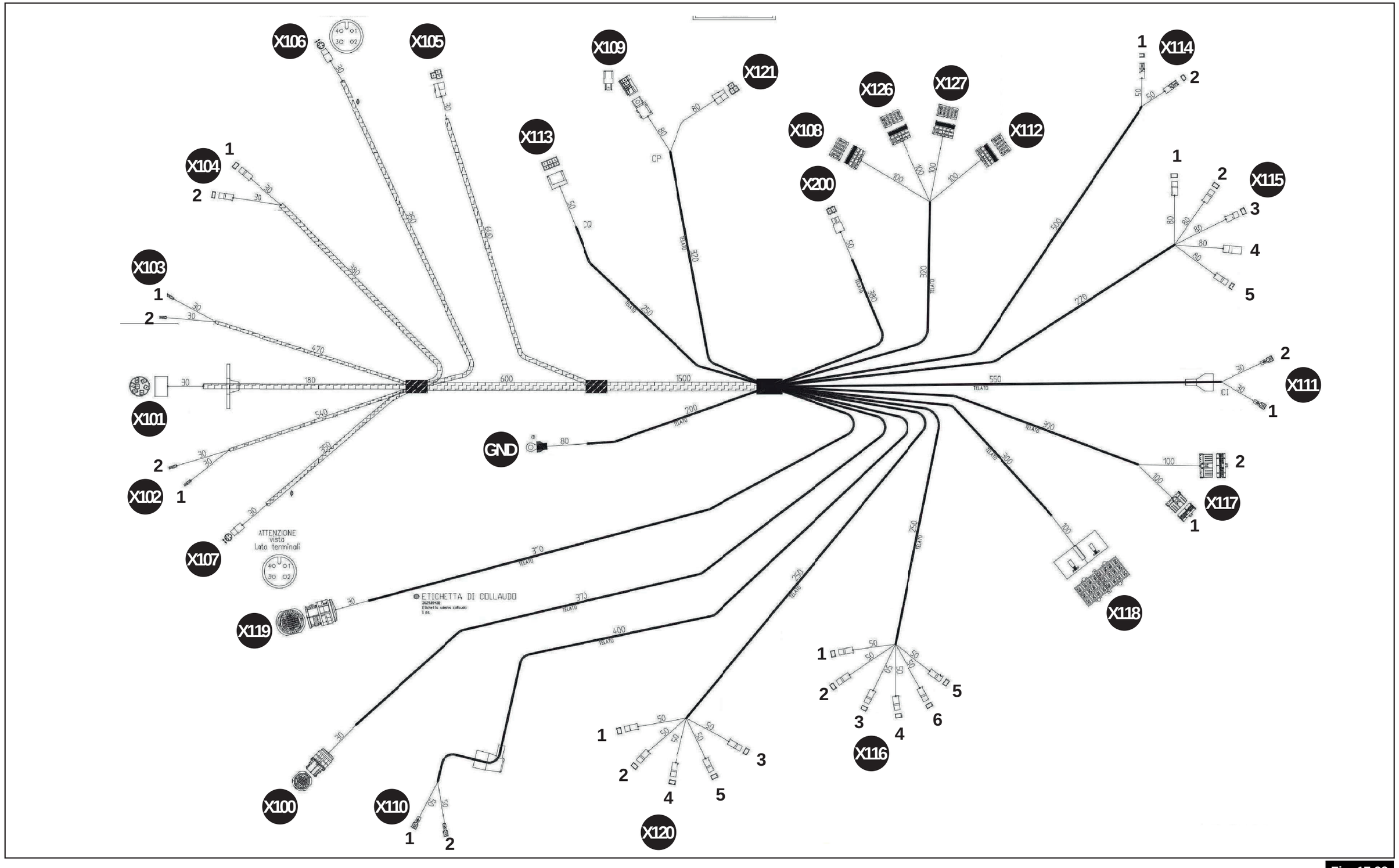


Fig. 17.22

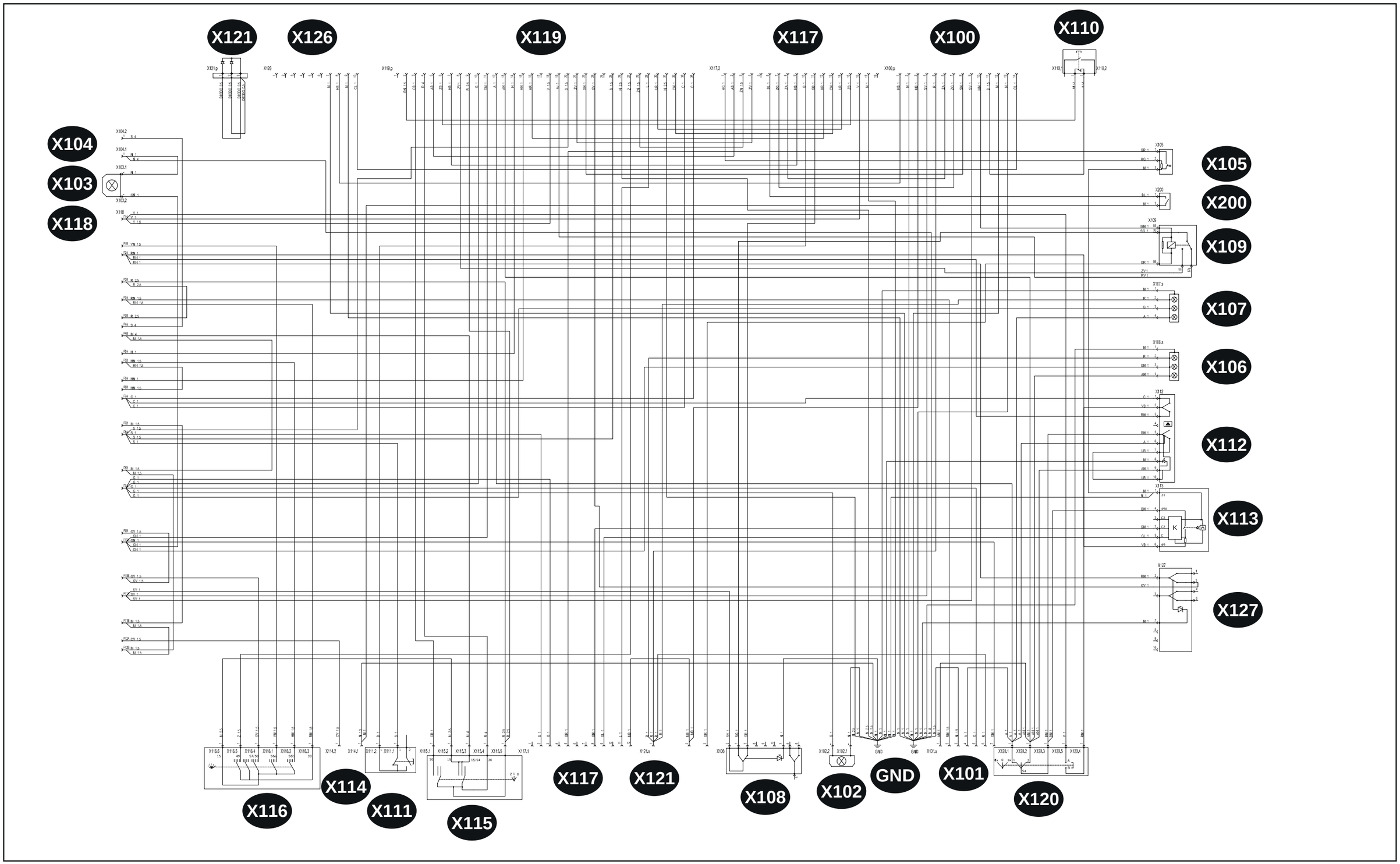

X121
X126
X119
X117
X100
X110
X104
X103
X118
X105
X200
X109
X107
X106
X112
X113
X127
X116
X114
X111
X115
X117
X121
X108
X102
GND
X101
X120

Fig. 17.23

GND - Ground
X100 - Chassis line connector
X101 - 7-pin trailer socket
X102 - Right-hand license plate light
X103 - Left-hand license plate light
X104 - Power socket
X105 - Fuel float
X106 - Left rear field light
X107 - Right rear field light
X108 - 4WD switch
X109 - Four-wheel drive relay
X110 - ignition switch
X111 - PTO clutch
X112 - Hazard light switch
X113 - Turn indicator flasher
X114 - 1-pin socket
X115 - +50 ignition switch
X116 - Light switches
X117 - Instruments
X118 - Fuse box
X119 - Engine line
X120 - Turn indicator switch
X121 - Diodes
X126 - Switch not used
X127 - Rotating beacon switch
X200 - Check button

4.4 GL cab

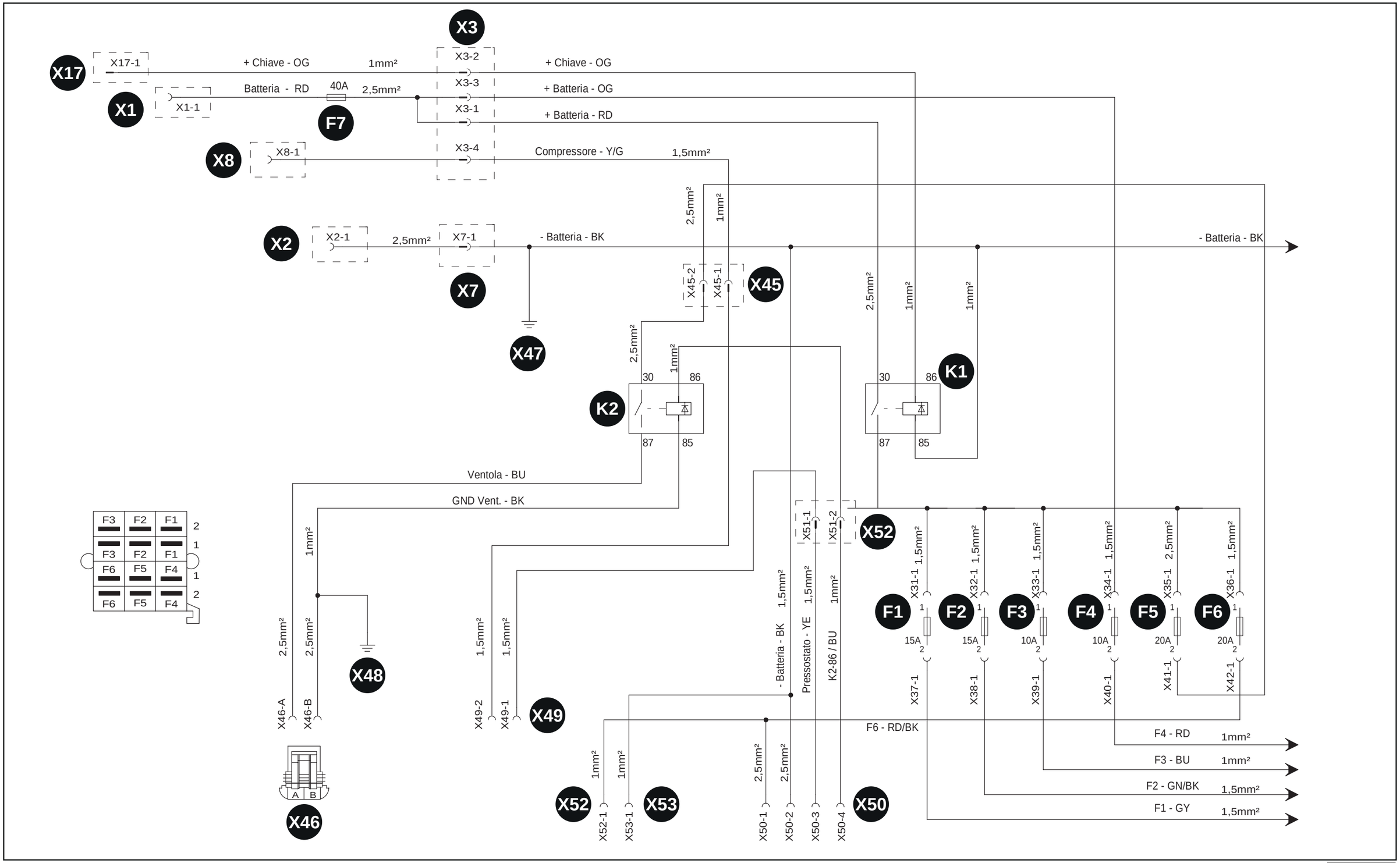


Fig. 17.24

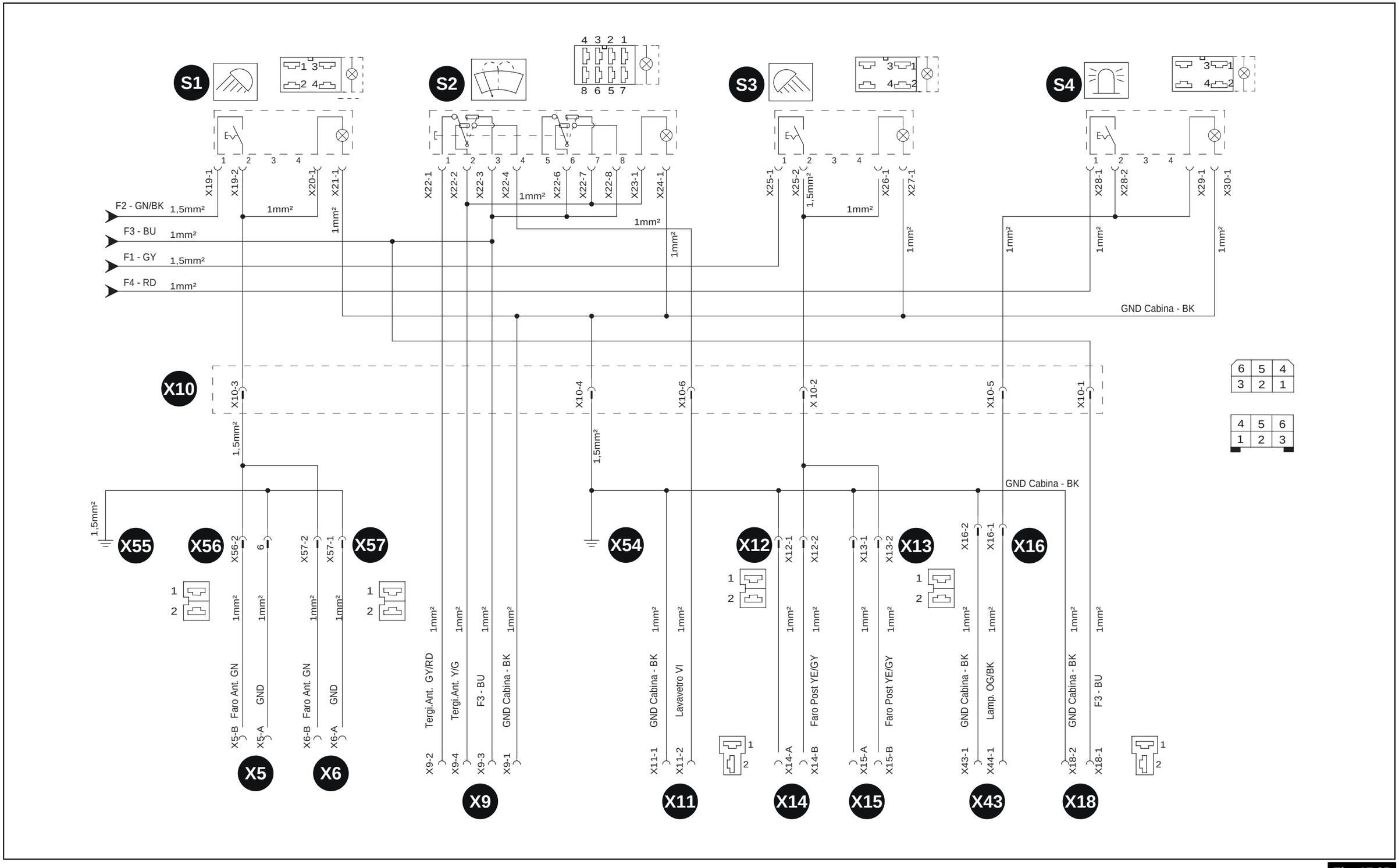

S1
S2
S3
S4
F2 - GN/BK 1,5mm²
F3 - BU 1mm²
F1 - GY 1,5mm²
F4 - RD 1mm²
GND Cabina - BK
X10
X55
X56
X57
X5
X6
X9
X54
X12
X13
X16
X11
X14
X15
X43
X18
Faro Ant. GN
GND
Tergi.Ant. GY/RD
Tergi.Ant. Y/G
F3 - BU
GND Cabina - BK
Lavavetro VI
Faro Post YE/GY
Lamp. OG/BK

Fig. 17.25

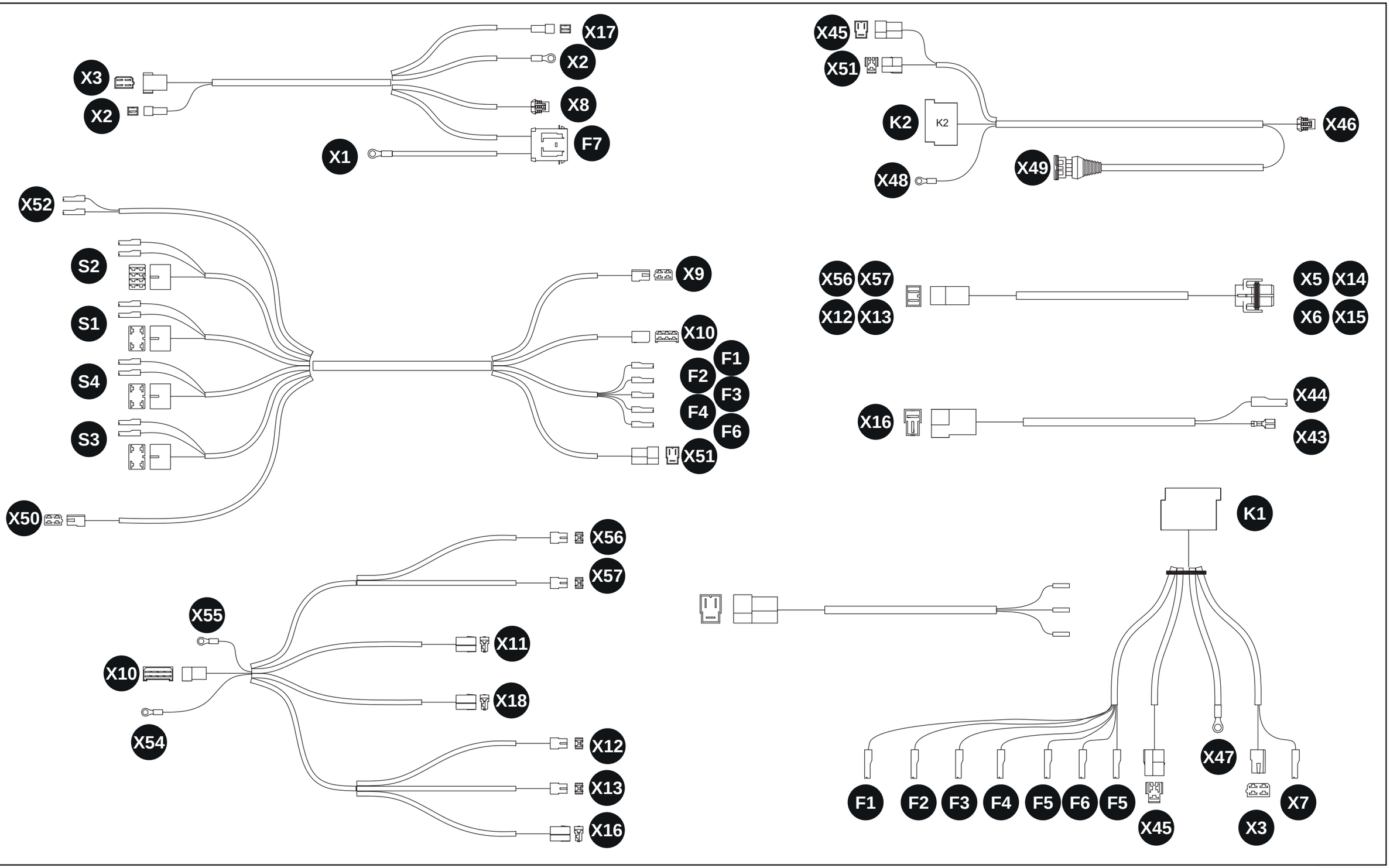

X3
X2
X17
X2
X8
F7
X1
X45
X51
K2
K2
X46
X48
X49
X52
S2
S1
S4
S3
X9
X10
F1
F2
F3
F4
F6
X51
X56
X57
X12
X13
X5
X14
X6
X15
X16
X44
X43
X50
X56
X57
X55
X10
X11
X18
X54
X12
X13
X16
K1
F1
F2
F3
F4
F5
F6
F5
X45
X47
X3
X7

Fig. 17.26

F1 - 15 A fuse
F2 - 15 A fuse
F3 - 10 A fuse
F4 - 10 A fuse
F5 - 20 A fuse
F6 - 20 A fuse
F7 - 40 A fuse
K1 - AC system relay
K2 - Fan relay
S1 - Front field light
S2 - Windscreen wiper/washer
S3 - Rear field light
S4 - Blinker
X1 - Grounding eyelet
X2 - Junction connector
X3 - Junction connector
X5 - Front left field light
X6 - Front right field light
X7 - Junction connector
X8 - Compressor
X9 - Windscreen wiper
X10 - Junction connector
X11 - Window washer
X12 - Junction connector for light extensions
X13 - Junction connector for light extensions
X14 - Left rear field light
X15 - Right rear field light
X16 - Junction connector for light extensions
X17 - + Key
X18 - Rear window wiper
X43 - Blinker
X45 - Junction connector for AC cable
X46 - Fan
X47 - Grounding point on chassis
X48 - Grounding point on chassis
X49 - Pressure switch
X50 - Ventilation/ceiling light
X52 - Radio
X54 - Grounding point on chassis
X55 - Grounding point on chassis
X56 - Junction connector for light extensions
X57 - Junction connector for light extensions

4.5 02003655- Transmission

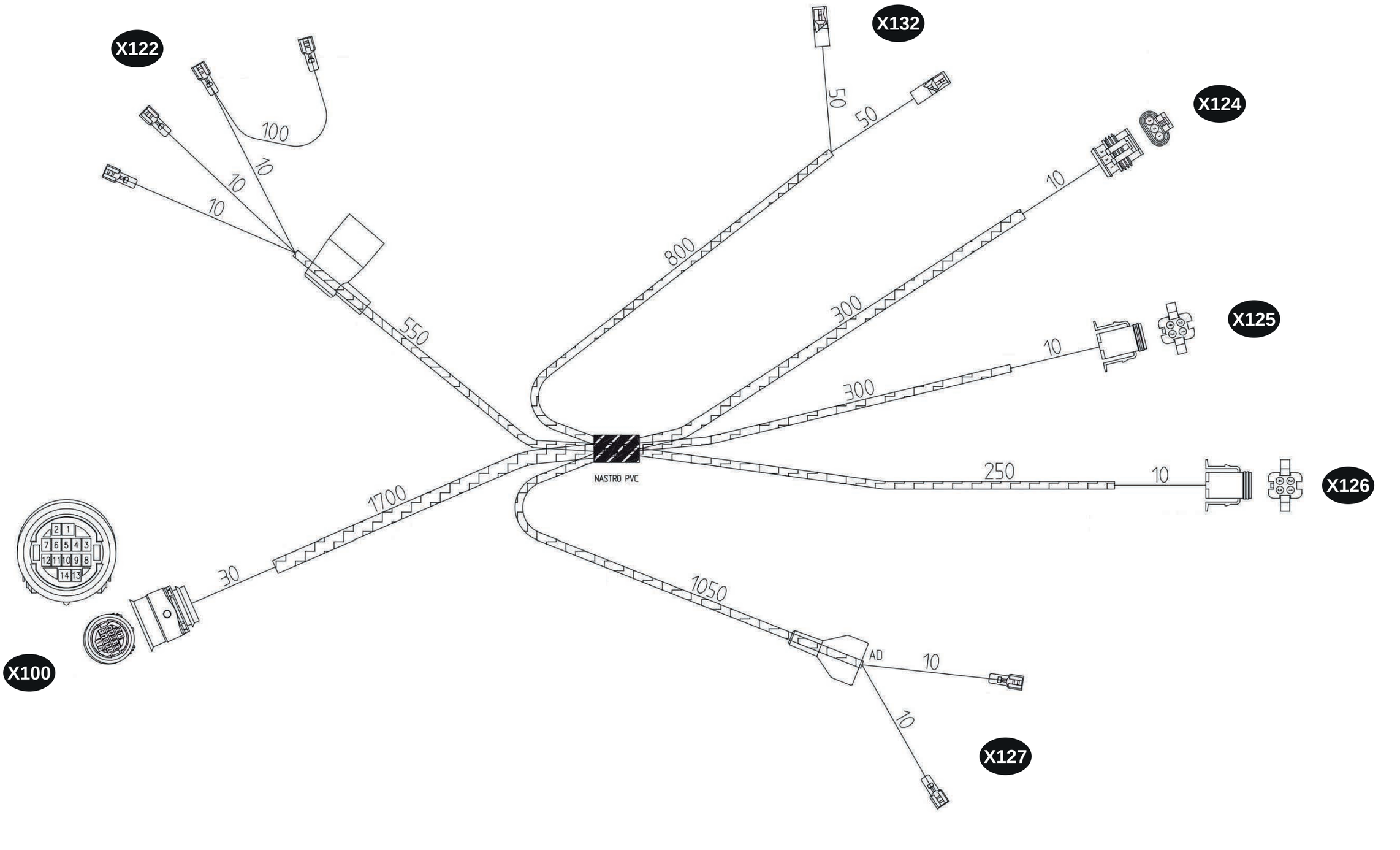


Fig. 17.27

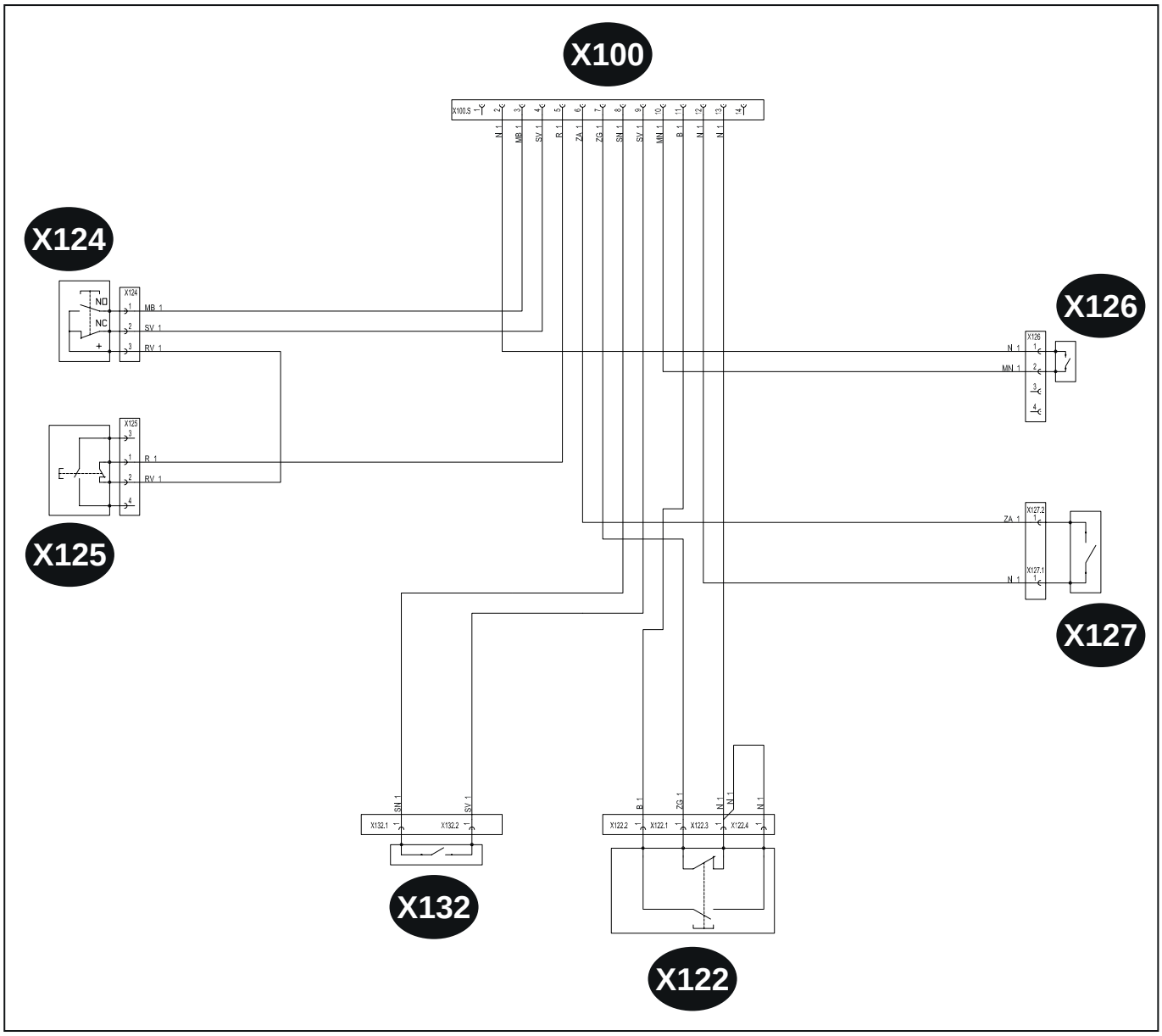


Fig. 17.28

X100 - 14-pin connector for dashboard line-parking and brake light line
X122 - PTO ignition switch
X124 - Parking brake switch
X125 - Brake light switch
X126 - 4WD switch
X127 - Slow/fast PTO switch
X132 - Differential lock

Chapter 18 : Troubleshooting

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Section 1 : Engine

Fault	Possible causes	Remedies
Poor engine performance.	Fuel filter clogged	Replace the filter
	Injector return line partially clogged	2.Remove the obstruction
	Air in the circuit	Make the circuit airtight
	Incorrect injector settings	Overhaul or replace the injectors
	Air filter clogged	Clean the filter and replace the cartridge if necessary
Engine starts badly	Incorrect injection pump setting	Overhaul or replace the pump
	Incorrect injector settings	Overhaul or replace the injectors
	Incorrect operation of KSB or glow plugs	Check operation of glow plugs and KSB system
The engine fails to start	Faulty electrostop	Replace the electrostop
	Fuse blown	Check the fuse box, eliminate the cause that short-circuited the fuse and replace it
	Ignition enabling relay	Replace the relay

Section 2 : Reverse shuttle

Fault	Possible causes	Remedies
The reverse shuttle grinds	Badly adjusted clutch	Adjust the clutch as described
	Worn synchromeshes	Disassemble the gearbox and replace the synchromesh
Reverse shuttle feels stiff when engaged	Make sure the external linkages are properly greased	Grease the external linkages
Reverse shuttle fails to engage	Check linkages	Adjust external linkages and, if necessary, the internal ones

Section 3 : Clutch - Transmission

Fault	Possible causes	Remedies
The clutch slips	Clutch plate dirtied by oil	Eliminate any oil leaks, thoroughly clean the flywheel and replace the clutch plate
	Clutch play incorrect	Adjust the clutch pedal
	Worn clutch plate	Replace the clutch plate
Clutch fails to disengage	Clutch disengaging lever does not move	Replace the spring pins of the clutch disengaging lever
	Pressure plate levers not adjusted properly	Make sure that the levers are not worn. Adjust them if they are not worn
	Clutch plate jammed onto flywheel	Start the machine, block it with the brakes, repeatedly engage and disengage the clutch. If no appreciable result is obtained, disassemble the clutch and clean it
	Clutch with too much play	Adjust external linkages and, if necessary, the internal ones

Section 4 : Gearbox

Fault	Possible causes	Remedies
The gears grind	Worn synchromeshes	Disassemble the gearbox and replace the synchromeshes
	Incorrectly adjusted clutch	Adjust the clutch as described
The gearbox is noisy when operating	Oil level too low	Check the oil level
	Worn bearings	Replace the bearings
	Damaged gears	Open the cover and replace the damaged gears
The speed gears disengage	Pack of synchromeshes and speed selection gears with excessive float	Adjust to the required level of play
	Sliding speed engaging sleeve and selection gear with worn teeth causing the synchromesh to function badly	Replace the complete synchromeshes and selection gears
The speed gears fail to engage	Clutch fails to disengage	Adjust the clutch as described
	Synchromesh with worn brake ring	Replace the brake rings
The final drive - reverse shuttle disengage	Insufficient selection spring load	Increase the load on the selection spring
The final drive - reverse shuttle fails to engage	Clutch fails to disengage	Adjust the clutch as described
	Broken linkage spring pin.	Remove the gearbox cover and replace the spring pin

Section 5 : Rear differential

Fault	Possible causes	Remedies
Noisy axle	Badly adjusted diff lock internal linkage	Adjust the linkages
	Bevel gear pair not adjusted	Adjust the bevel gear pair
	Worn bearings	Replace the bearings
The diff lock fails to engage	Pressure too low	Restore the correct pressure level. Make sure that push-button functions correctly
	Badly adjusted diff lock internal linkage	Adjust the linkages
The diff lock fails to disengage	Solenoid valve locked in the open position	Release the solenoid valve and make sure that push-button functions correctly
	Diff lock ram blocked	Overhaul the differential lock ram

Section 6 : Rear final drives

Fault	Possible causes	Remedies
Noisy wheels	Loose flange and rim fastening screw	Tighten screws to the correct torque value
	Noisy bearings	Replace the bearings

Section 7 : Drive transmission

Fault	Possible causes	Remedies
Drive disengages	Faulty solenoid valves	Check the solenoid valves as described
	Faulty electrical system	Check drive engaging switches. Check relays under fixed bonnet
	Fault in the drive engaging housing	Overhaul the drive engaging unit after having performed the inspections described above
Drive remains engaged	Pressure too low	Restore the correct pressure level
	Faulty cylinder seals	Replace all the seals
	Mechanical fault in drive unit	Overhaul the unit
	Electrical system or solenoid valves are not operating	Check the fuses, check valve supply, check components of electrical system (4WD switch, relays, etc...) as shown on circuit diagram
	4WD solenoid valve defective	Replace 4WD solenoid valve
Noisy drive	Tyre pairing incorrect	Comply with indicated pairing
	Tyre pressure wrong	Inflate tyres to correct pressure
	Worn transmission sleeve	Replace sleeves

Section 8 : Power take-off

Fault	Possible causes	Remedies
The P.T.O. disengages	Independent or synchronized P.T.O. selection control badly adjusted	Adjust as described
	Tractor-trailer load excessive	Make sure that tractor-trailer ratio is correct
The P.T.O. fails to engages	Clutch fails to disengage	Adjust the clutch as described
	Independent or synchronized P.T.O. selection control badly adjusted or blocked	Adjust as described
	Selection pad broken	Replace the pad
Noisy P.T.O.	When implements that turn in an irregular way and require low draft are hitched	There is no remedy for faults concerning interventions on implements
	Selection of 540-750- 1000 rpm rate not proportional to that of the application	Select an appropriate rate
	P.T.O. shaft float	Adjust the shaft as indicated and make sure that the couplings connected to it slide smoothly

Section 9 : Front axle

Fault	Possible causes	Remedies
Noisy axle	Oil level low	Check oil level
	Axle bearing bushes with excessive play	Replace the bushes of the support and the transmission sleeve
	Worn transmission sleeve	Replace the sleeve and check alignment of transmission shaft
	Bevel gear pair not adjusted	Adjust the bevel gear pair - ring gear correctly
	Defective No-Spin system	Check operation and replace if required

Section 10 : Front final drives

Fault	Possible causes	Remedies
Noisy wheels	Loose flange and rim fastening screw	Tighten screws to the correct torque value
	Noisy bearings	Replace the bearings

Section 11 : Brakes

Fault	Possible causes	Remedies
The machine fails to brake	Badly adjusted brakes	Adjust the parking and emergency brakes
	Worn brake discs	Replace the discs
Machine remains braked	Badly adjusted brakes	Adjust the parking and emergency brakes
	Broken return springs	Replace the springs
	Stiff controls because they have not been lubricated	Lubricate them to ensure they function smoothly
Irregular braking action	Badly adjusted brakes	Adjust the main brakes and make sure that they operate contemporaneously

Section 12 : Hydraulic circuit

Fault	Possible causes	Remedies
Pump overheats	Excessive pressure	Reduce pressure to the correct value
	Cavitation	Clean the suction components and check the unions
	Too much back pressure owing to installation of incorrect hydraulic components	Replace the hydraulic components with others of the correct type
	Control valves engaged	Disengage
Pump with zero pressure	Pump plunger broken	Replace the pump
	Sleeve connection ruined	Replace sleeve
	Insufficient oil	Check oil level and suction circuit
Noisy pump	Cavitation	Clean the suction components and check the unions
	Imperfect seal on pump shaft	Replace oil retainer
	Pump casing not tight	Tighten the screws of the pump casing and replace the retention rings
Oil in circuit becomes frothy and increases in volume in an abnormal way	Air in the circuit	Check oil level and prevent air from entering
	Pump cavitation	Clean the suction components and check the unions
	Oil contaminated by water	Replace oil and filters

Section 13 : Steering system

Fault	Possible causes	Remedies
Loss of control when driving the machine	Steering cylinder with worn retention rings	Replace the retention rings on the cylinder
	Power steering system with incorrectly calibrated anti-shock valves	After thoroughly cleaning the valves, make sure that the pressure values are as required. If these values cannot be obtained, replace the power steering system
	Air in the circuit	Check the clamps and unions of the oil intake circuit
Oil leaks from the power steering system	Loosened unions	Tighten the unions
	Worn retention rings	Make the power steering system oil tight
	Outlet from power steering system obstructed	Check condition of discharge pipe and operation of hitch control valve
Steering difficult	Low pressure in power steering system	Check and restore maximum pressure in the circuit
	Air in the circuit	Thoroughly clean the intake circuit and make sure it is tight
	LS priority valve badly adjusted	Clean and carefully reassemble the valve. Check for wear and make sure it functions smoothly
	Poor gear pump efficiency	Overhaul or replace the pump
	Tarnished steering column	Disassemble and lubricate the steering column
	Excessive load on front axle	Check load on front axle

Section 14 : Electrical system

Fault	Possible causes	Remedies
The starter motor fails to turn	Battery low or faulty	Recharge the battery. Replace it if it fails to remain charged
	Starter motor defective	Overhaul the starter motor or replace it
	Ignition switch defective	Replace the switch
	Battery cables tarnished or broken at the terminals	Clean the tarnished terminals or replace them
	Ignition enabling switches on machine badly adjusted	Adjust the ignition enabling switches or replace them if necessary
	Independent PTO engaged	Disengage the power take-off
	Clutch pedal not depressed	Depress the clutch pedal
Generator indicator light fails to go out even at a high engine rate	Regulator inefficient	Replace the alternator
	Alternator fails to charge sufficiently	Replace the alternator
The battery becomes misshapen	Battery has been charged too much	Replace the alternator
Revolution counter fails to function	Supply pulse fails to arrive	Repair the circuit
	Instrument with irregular setting	Adjust the instrument
	Faulty instrument	Adjust the instrument
	Engine speed sensor defective	Replace the engine speed sensor
The solenoid valves of the diff lock or 4WD fail to magnetize	Faulty control switches	Replace the switch
	Faulty solenoid valve coils	Replace the coils
	Electrical system interrupted in some point	Restore the continuity of the electrical system

Section 15 : Platform

Fault	Possible causes	Remedies
Platform vibrates	Contact between bodywork and chassis	Eliminate contact
	Contact between bodywork and hitch	Insert spacers between the bodywork and its supports
	Inefficient Silent-Blocks	Replace the Silent-Blocks

Section 16 : Hitch

Fault	Possible causes	Remedies
The hitch lifts in a jerky way	Hydraulic pump suction filter clogged	Clean the filter and replace it if necessary
	Air in the suction pipe of the hydraulic pump	Tighten the unions of the intake circuit and find out if there are any leaks
	Faulty four-wheel drive circuit (50 l version)	Check operation of 4WD circuit
The hitch fails to function or does not lift very much.	Pilot valve jammed	Remove the valve system and release the pilot valve
The hitch starts to lift but stops as soon as it senses the load, without the overpressure valve having activated	Badly adjusted draft rod	Adjust the draft control
The hitch does not lower to its full extent	Badly adjusted position control lever	Adjust the position control lever
The hitch fails to lower	Hydraulic lock cock closed	Open the cock
The hitch fails to reach the indicated lifting capacity	Worn control valve unit retention rings	Remove the valve unit and replace the external retention rings
	Badly regulated safety and overpressure valves	Calibrate the valves
	Poor gear pump efficiency	Overhaul the pump
	Worn springs and other mechanical components	Overhaul the control valve unit
The hitch has difficulty in supporting the load: it swings rhythmically when the engine is running, while the load lowers when the engine is off.	Worn piston rings	Replace the retention rings on the cylinders if leaks from the cylinders are noted
	Cylinder overpressure valve badly adjusted	Remove the valve system unit and calibrate the valve
	Check valve badly adjusted	Remove the valve system unit and calibrate the valve
	Valve system unit with dirty valves	Remove the valve system unit and clean the valves
When the engine is running, rhythmic swinging occurs with the links at the end of upward travel. The load fails to lower when the engine is off.	Incorrect hitch sensitivity adjustment	Adjust the sensitivity as indicated in the manual
Draft control fails to function: the hitch can only lift and lower by means of the position control lever	Badly adjusted draft control lever	Adjust the draft control lever
	3-point hitch with play	Eliminate the play and restore the lever + link adjustment
Position control fails to function: the hitch can only lift and lower by means of the draft control lever	Position control lever not adjusted	Adjust the position control lever
	Faulty internal linkages	Overhaul the internal linkages

Chapter 19 : Special tools

Index

Section 1 : List of tools 19-2

Section 1 : List of tools

Code:	07000215
Description:	Gearbox - base unit support
Chapter:	Chap.7 Front axle

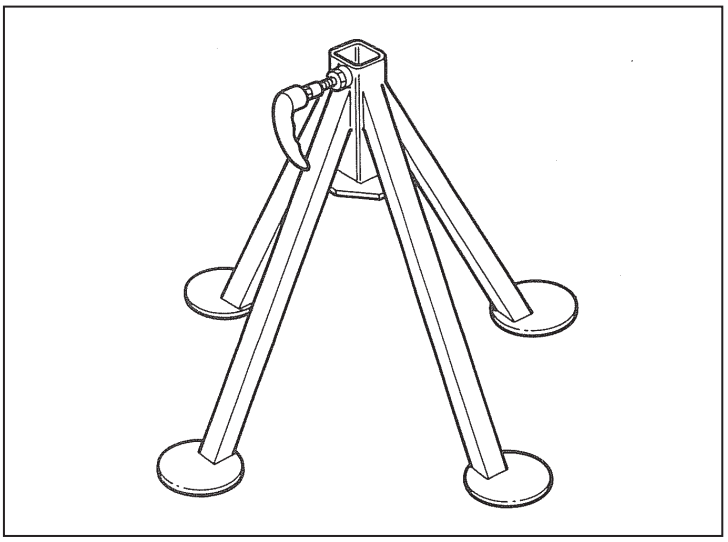


Fig. 19.1

Code:	07000227
Description:	Ring nut wrench
Chapter:	Chap.6 Rear final drives

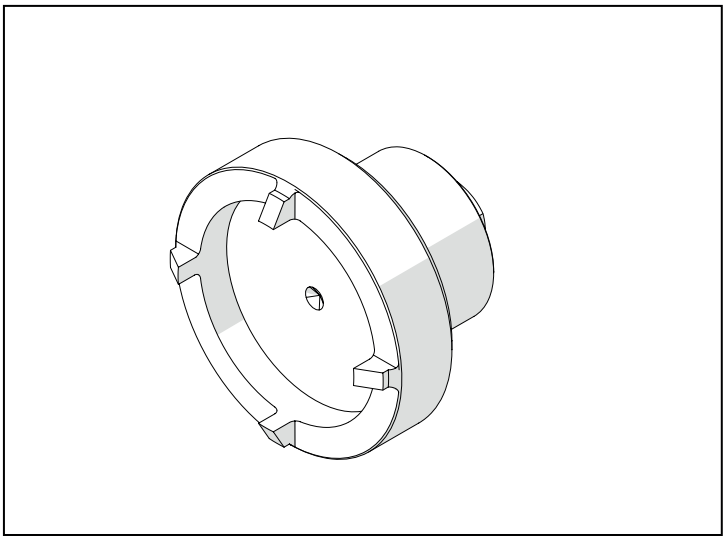


Fig. 19.2

Code:	07000234
Description:	Ring nut wrench 06340273
Chapter:	Chap.7 Front axle

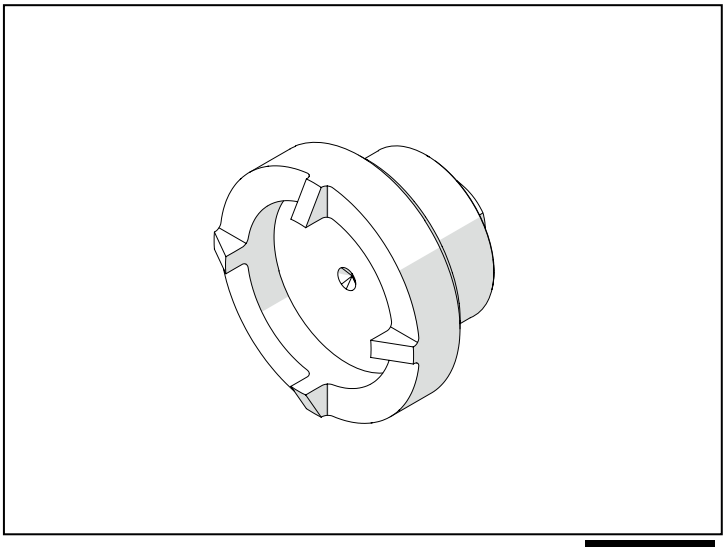


Fig. 19.3

Code:	07000237
Description:	Ring nut wrench - 1363
Chapter:	Chap.5 Rear differential
	Chap.7 Front axle

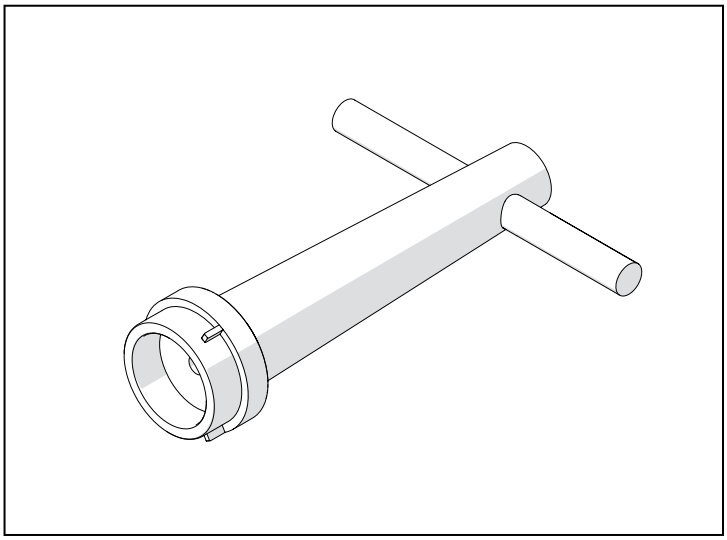


Fig. 19.4

Code:	07000239
Description:	Tool 1363/20 - 1363
Chapter:	Chap.5 Rear differential

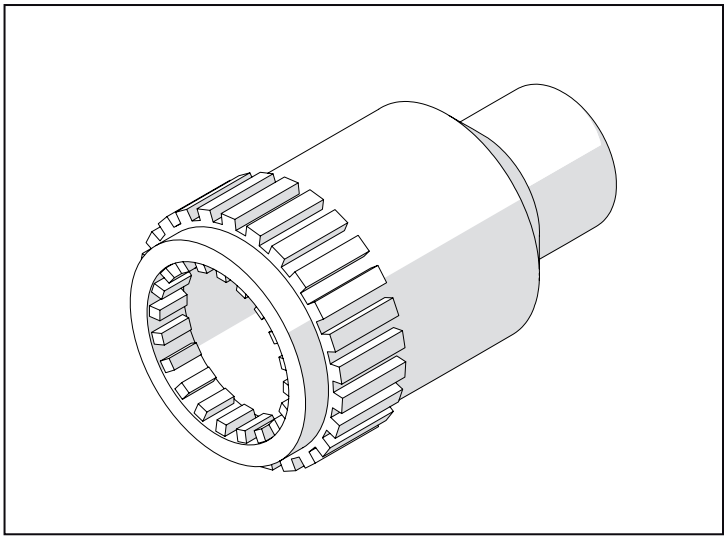


Fig. 19.5

Code:	07000240
Description:	Tool for removing/inserting ring nuts
Chapter:	Chap.4 Gearbox

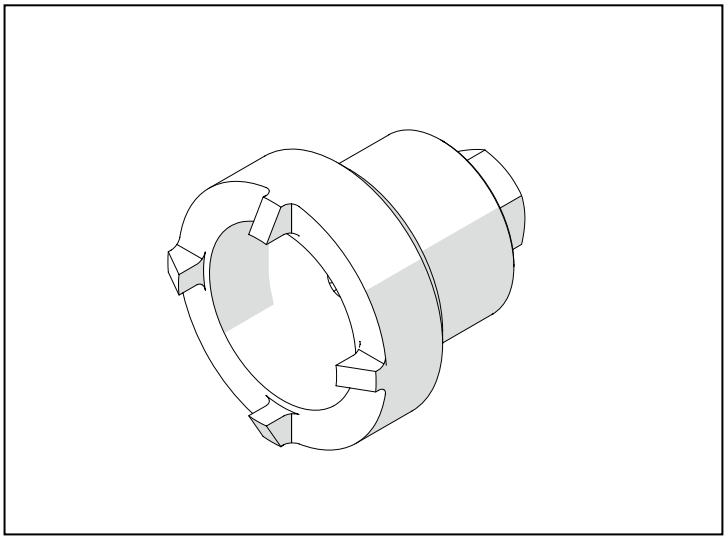


Fig. 19.6

Code:	07000241
Description:	1363 dist. test tool
Chapter:	Chap.12 Hydraulic circuit

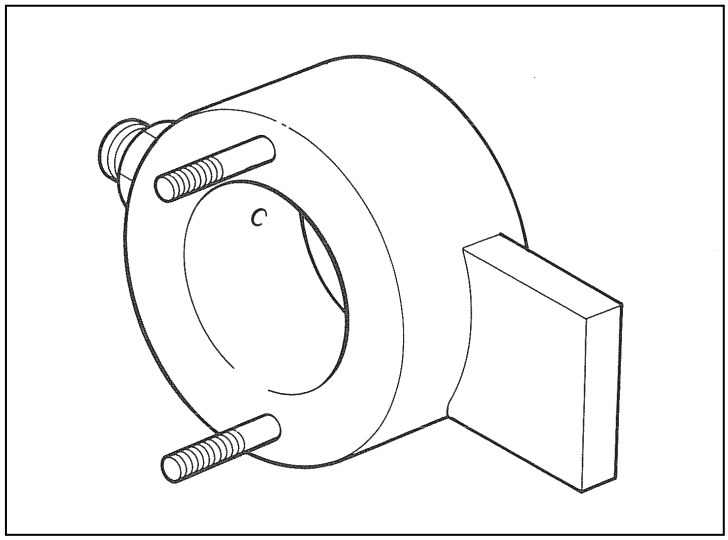


Fig. 19.7

Code:	07000243
Description:	Wrench for NoSPIN ring nut
Chapter:	Chap.7 Front axle

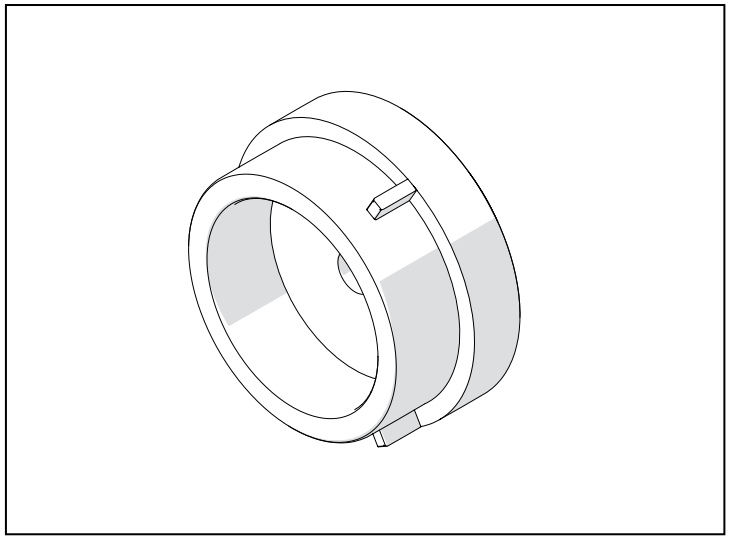


Fig. 19.8

Code:	07000245
Description:	Tractor splitting support
Chapter:	Chap.3 Clutch bowl

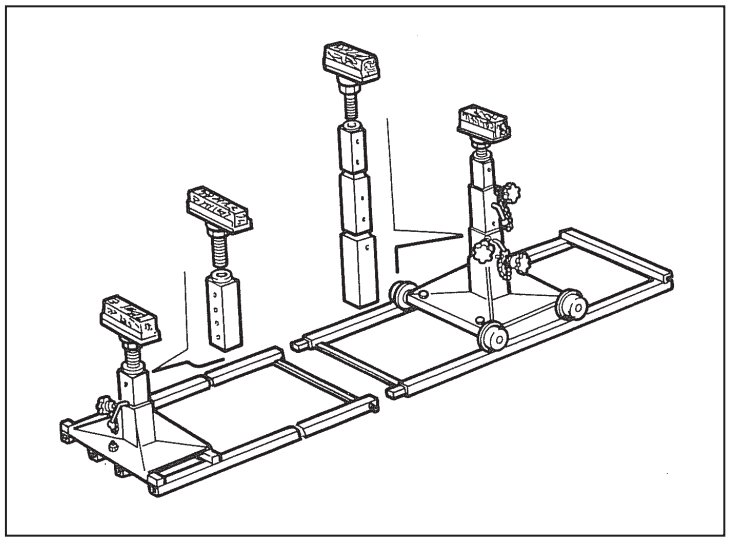


Fig. 19.9

Code:	07000246
Description:	Gearbox housing support
Chapter:	Cap.4 Cambio

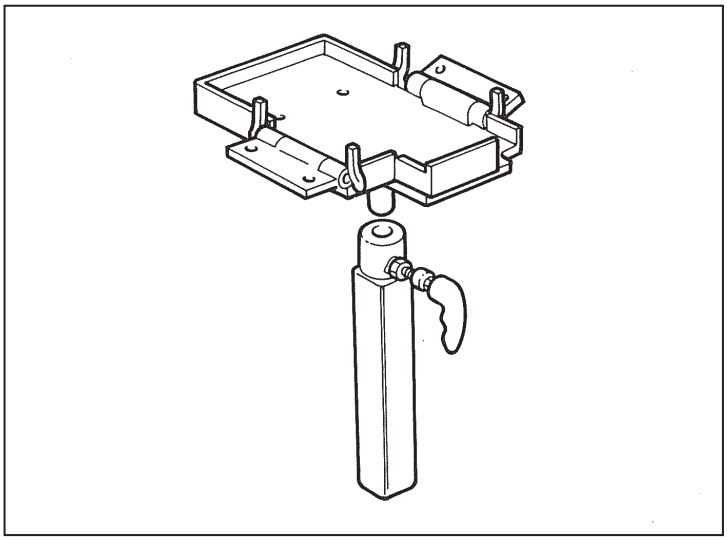


Fig. 19.10

Code:	07000247
Description:	Differential support
Chapter:	Chap.5 Rear differential

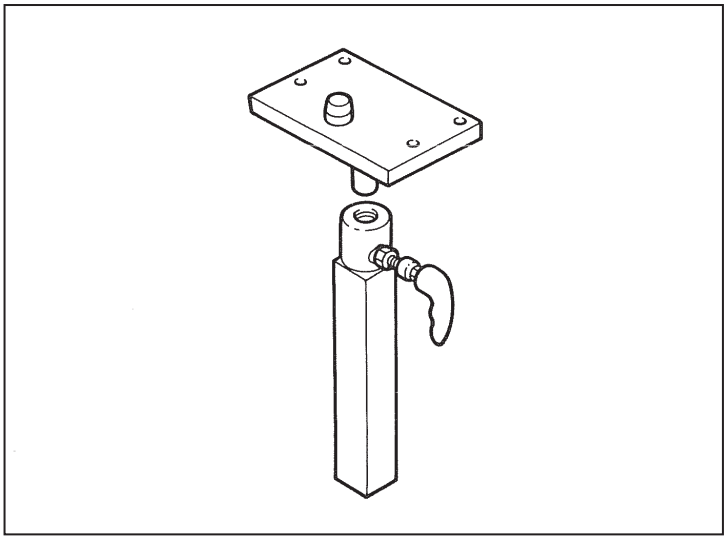


Fig. 19.11

Code:	07000249
Description:	Hitch draft adjuster tool
Chapter:	Chap.12 Hydraulic circuit

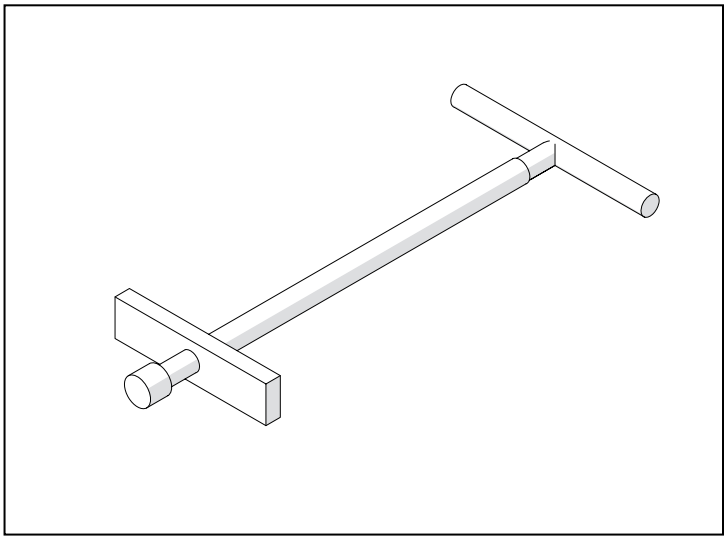


Fig. 19.12

Code:	07000303
Description:	Pressure gauge
Chapter:	Chap.12 Hydraulic circuit

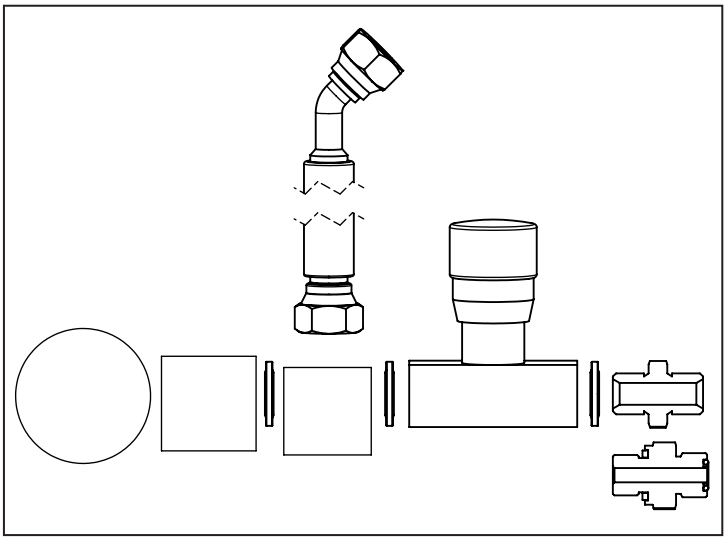


Fig. 19.13

Code:	07000306
Description:	Tool for removing reverse shuttle shaft
Chapter:	Chap.4 Gearbox

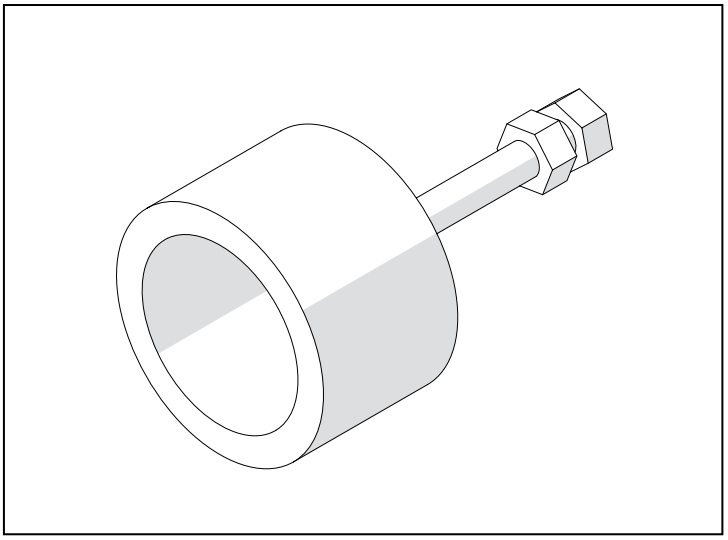


Fig. 19.14

Code:	07001643
Description:	P.T.O. selection lever adjuster tool
Chapter:	Chap.5 Rear differential

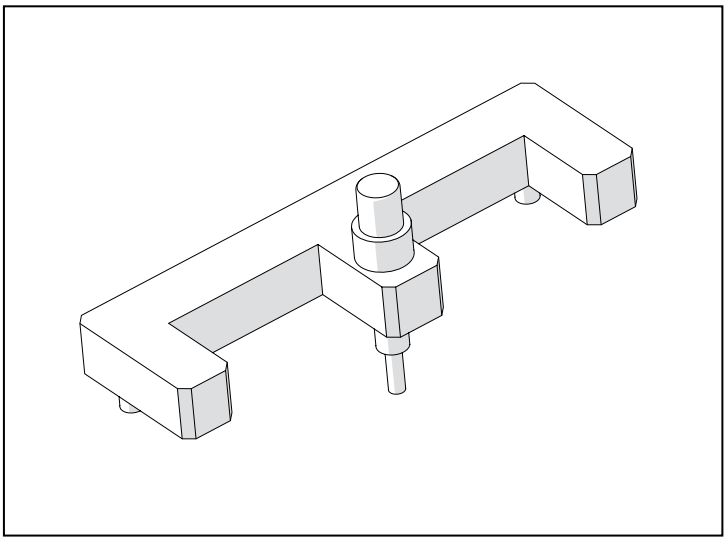


Fig. 19.15

Code:	07002765
Description:	Spacer for bearing assembly
Chapter:	Chap.8 Drive transmission

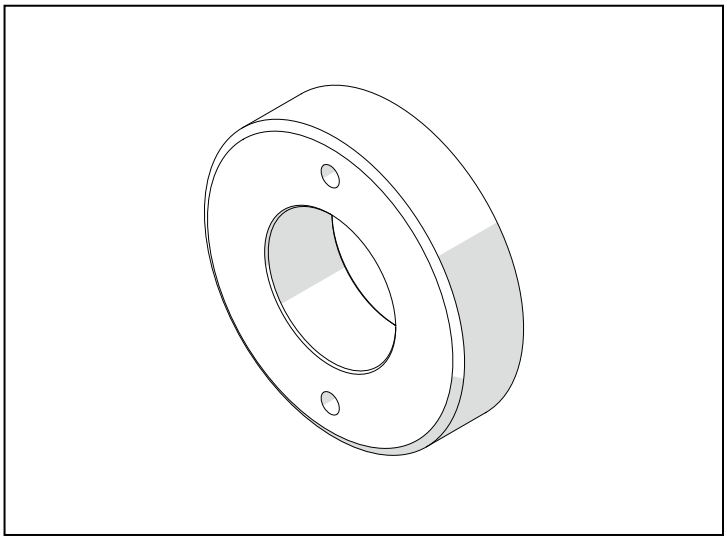


Fig. 19.16

Code:	07003831
Description:	4WD shaft guard
Chapter:	Chap.8 Drive transmission

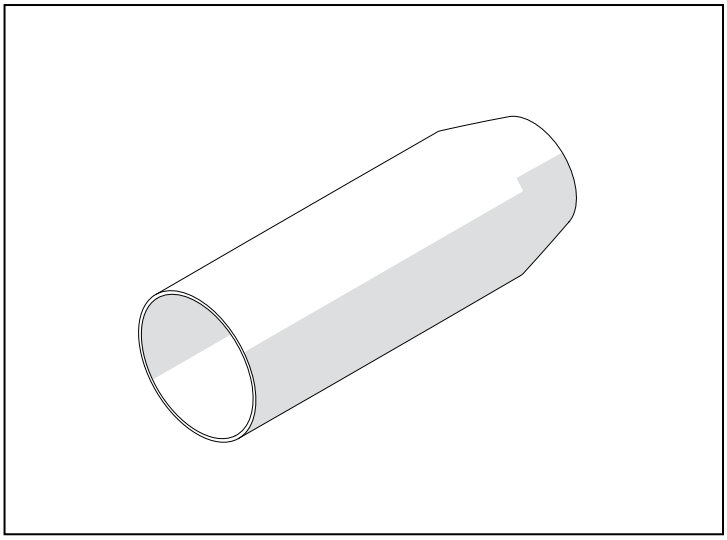


Fig. 19.17

Code:	07006128
Description:	Ring nut wrench
Chapter:	Chap.8 Drive transmission
	Chap.9 Rear power take-off

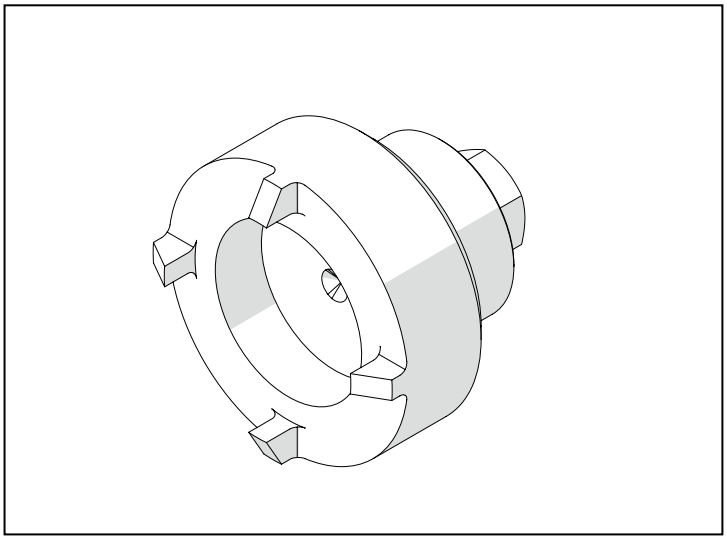


Fig. 19.18

Code:	07006220
Description:	Link retaining too
Chapter:	Chap.12 Hydraulic circuit

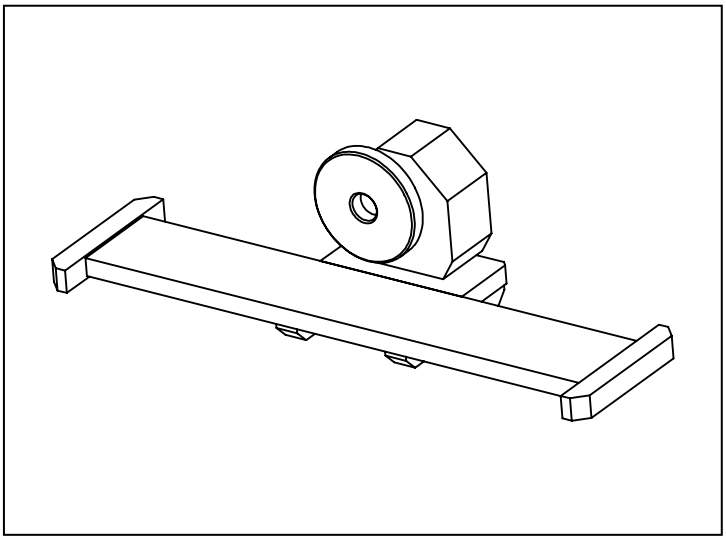


Fig. 19.19

Code:	07006221
Description:	Plug for multiple chiseling of pinion ring nut
Chapter:	Chap.5 Rear differential

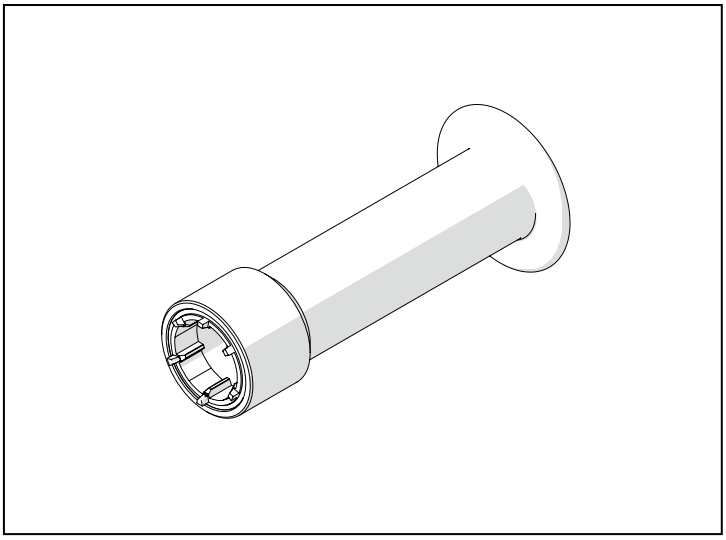


Fig. 19.20

Code:	07006223
Description:	Plug for assembling differential taper bearings
Chapter:	Chap.5 Rear differential

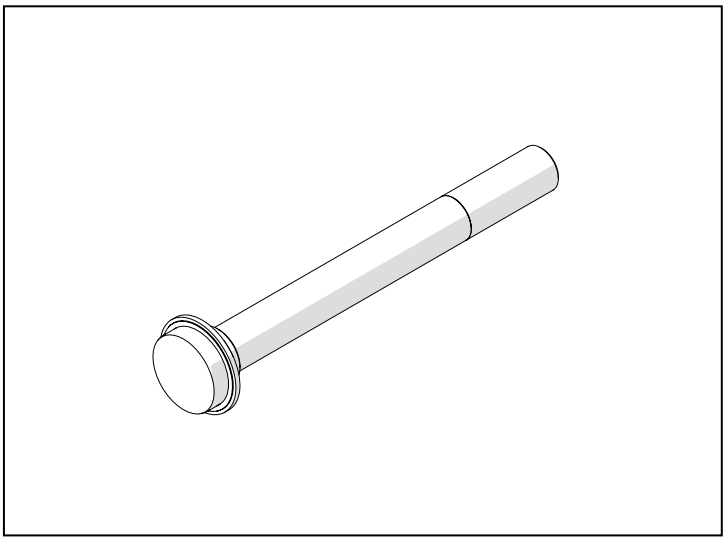


Fig. 19.21

Code:	07006224
Description:	Plug for assembling bevel pinion taper bearings
Chapter:	Chap.5 Rear differential

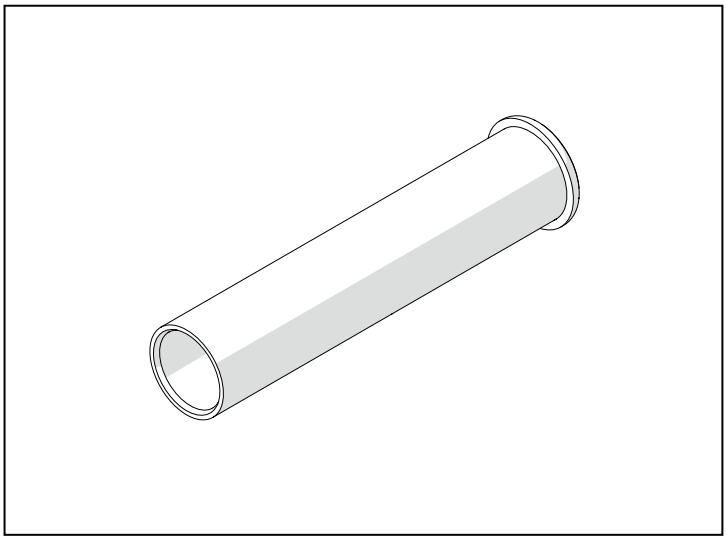


Fig. 19.22

Code:	07006225
Description:	Bevel pinion retainer tool
Chapter:	Chap.5 Rear differential

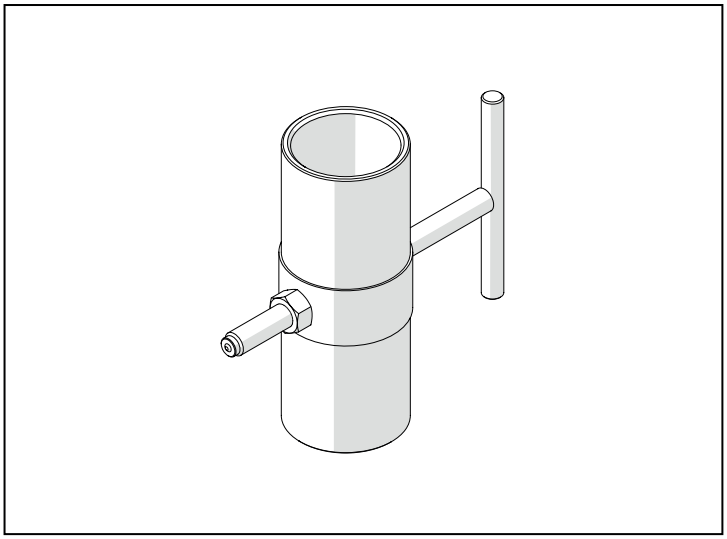


Fig. 19.23

Code:	07006226
Description:	Plug for assembling differential crown wheel bearing
Chapter:	Chap.5 Rear differential

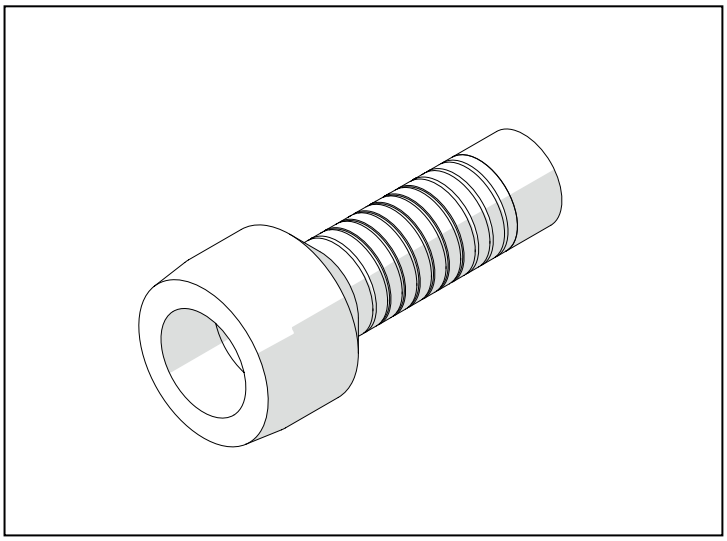


Fig. 19.24

Code:	07006208
Description:	Plug for assembling bearing
Chapter:	Chap.8 Drive transmission

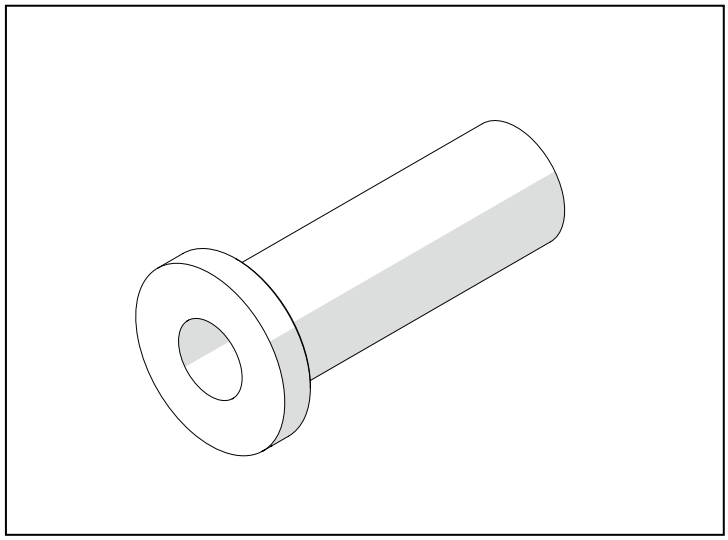


Fig. 19.25

Code:	07006209
Description:	Plug for assembling bearing
Chapter:	Chap.8 Drive transmission

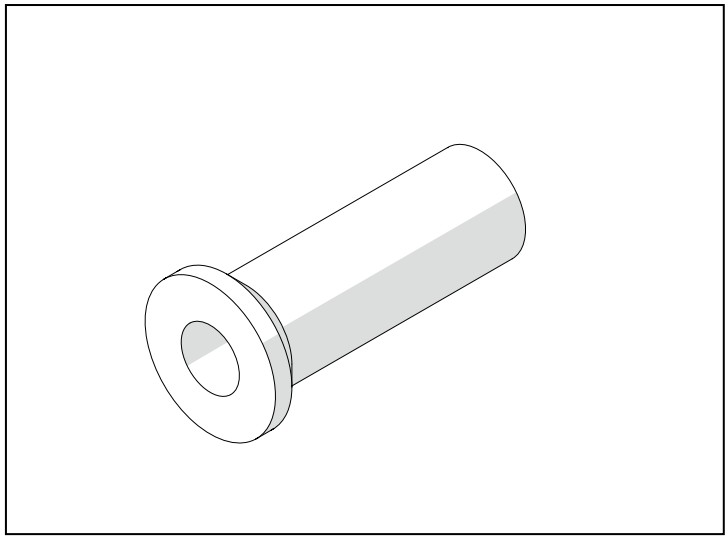


Fig. 19.26

Code:	07006210
Description:	Driver tool for installing flange in spring pack
Chapter:	Chap.8 Drive transmission

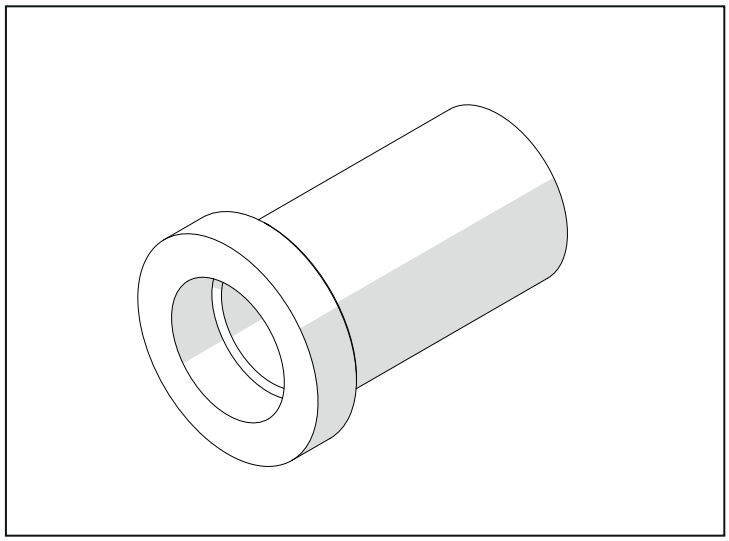


Fig. 19.27

Code:	07006211
Description:	4WD housing support
Chapter:	Chap.8 Drive transmission

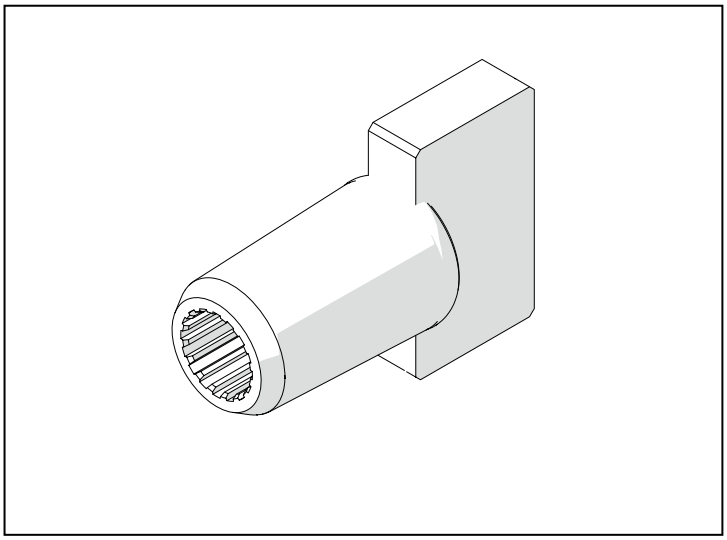


Fig. 19.28

Code:	07006212
Description:	Steering wheel puller
Chapter:	Chap.13 Platform

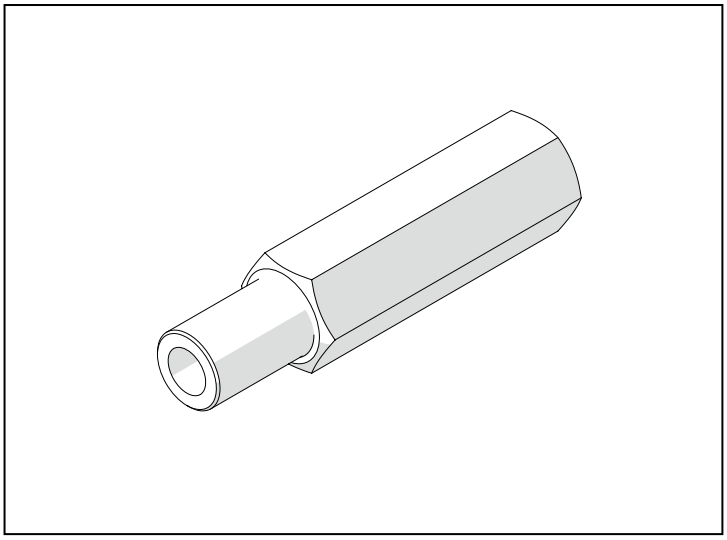


Fig. 19.29

Code:	07007078
Description:	Front bevel pinion retainer tool
Chapter:	Chap.7 Front axle

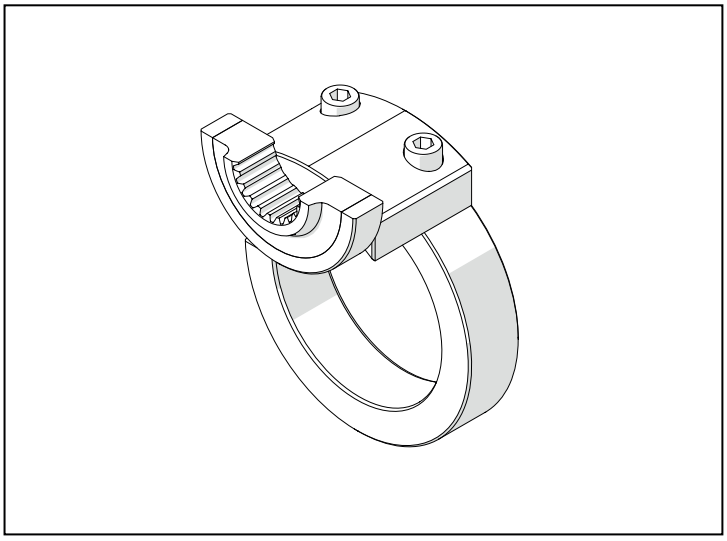


Fig. 19.30

Code:	07007171
Description:	STAR clutch plate dowel pin
Chapter:	Chap.3 Clutch bowl

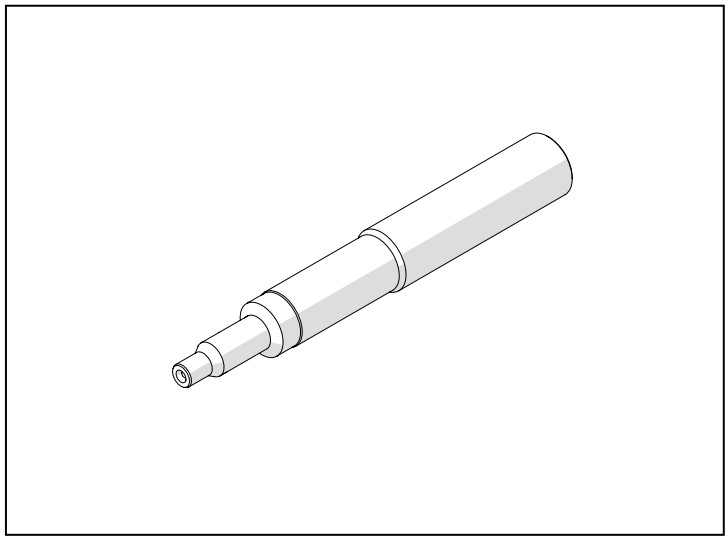


Fig. 19.31

Code:	07007176
Description:	Rear hitch shaft protection
Chapter:	Chap.15 Rear hitch

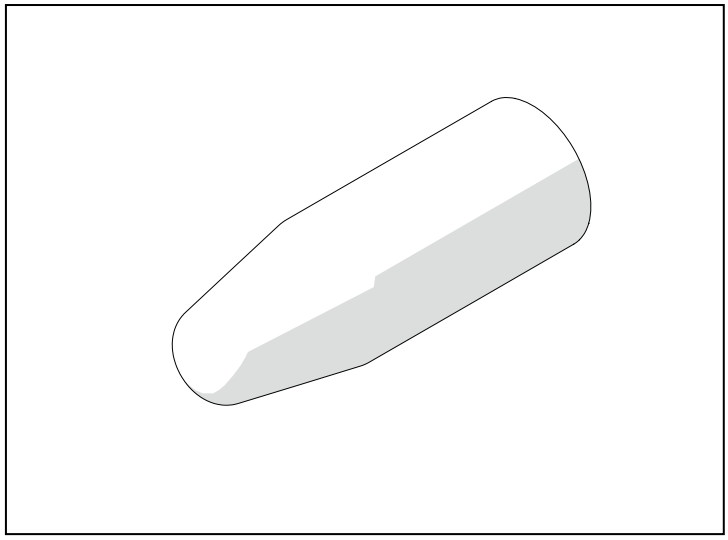


Fig. 19.32

Code:	07007179
Description:	NoSPIN control lever
Chapter:	Chap.7 Front axle

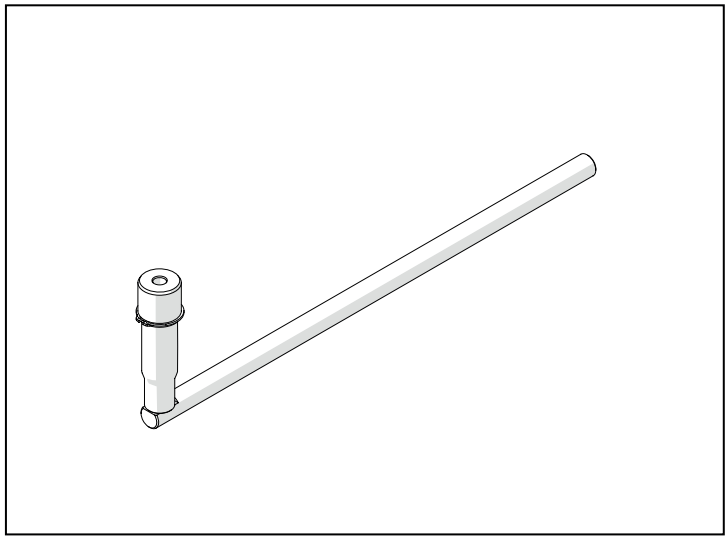


Fig. 19.33

Code:	07007180
Description:	Toe-in testing tool
Chapter:	Chap.7 Front axle

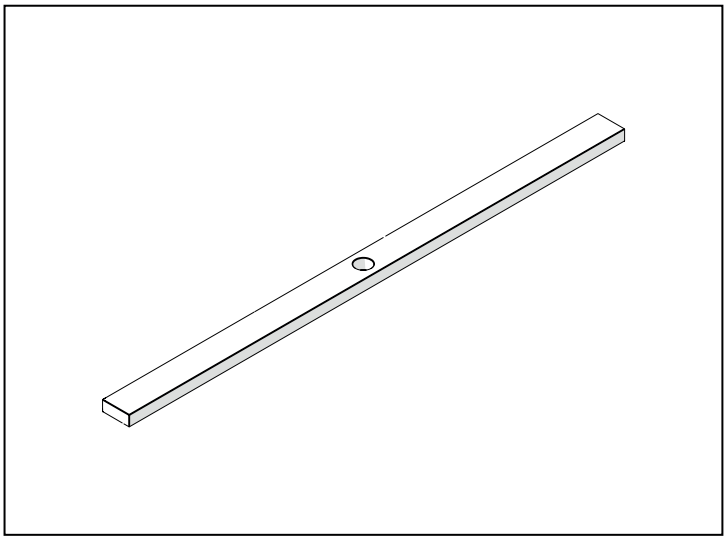


Fig. 19.34

Code:	07007181
Description:	Cab lifting tool
Chapter:	Chap.13 Platform
	Chap.14 Cab

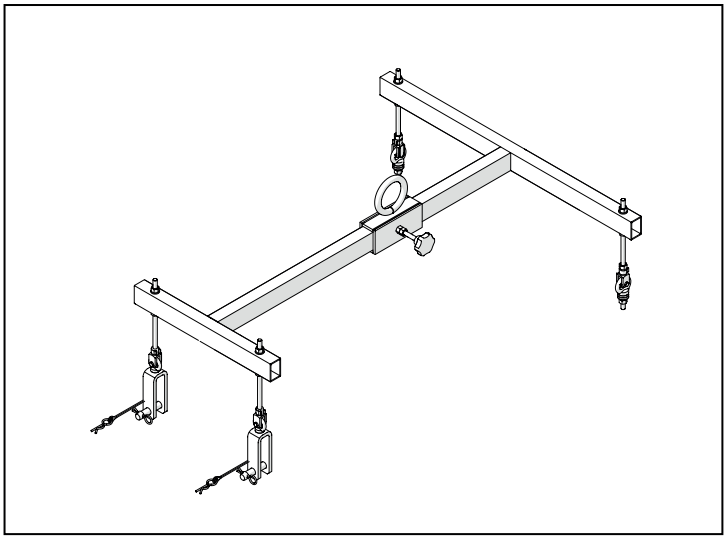


Fig. 19.35

Code:	07007182
Description:	Spring pre-loading tool
Chapter:	Chap.9 Rear power take-off

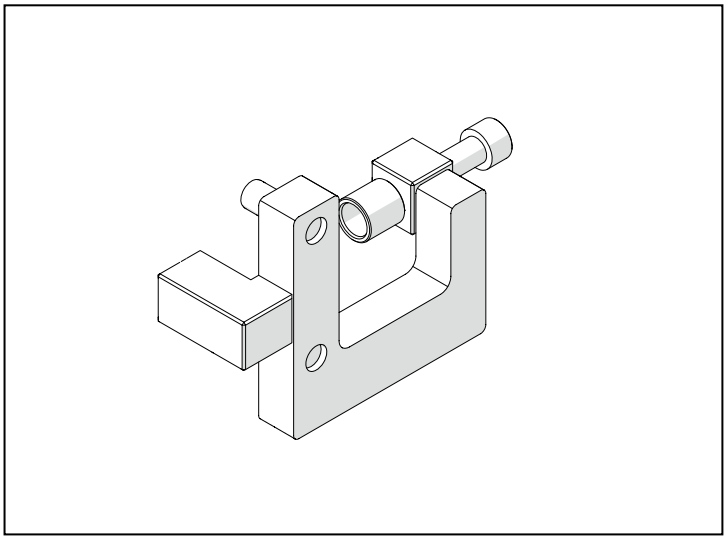


Fig. 19.36

Code:	07007183
Description:	Tool for assembling rear diff lock locking cylinder
Chapter:	Chap.5 Rear differential

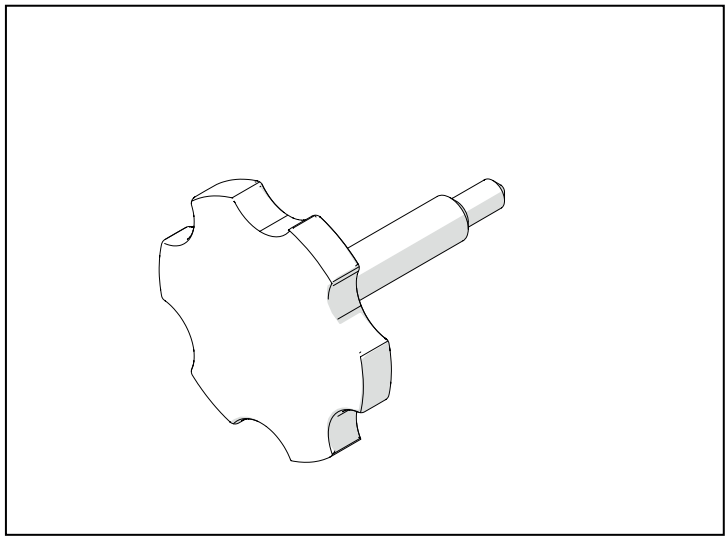


Fig. 19.37

Code:	07007184
Description:	Rear hitch oil retainer plug
Chapter:	Chap.15 Rear hitch

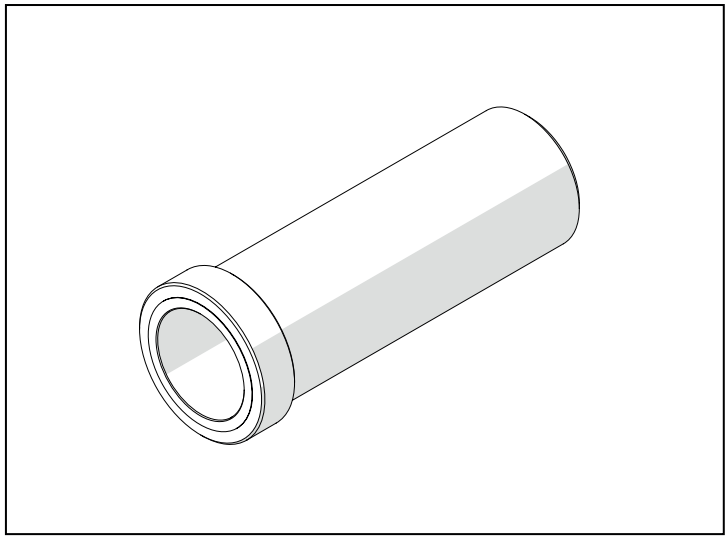


Fig. 19.38

Code:	07007953
Description:	Layshaft spacer tool
Chapter:	Chap.4 Gearbox

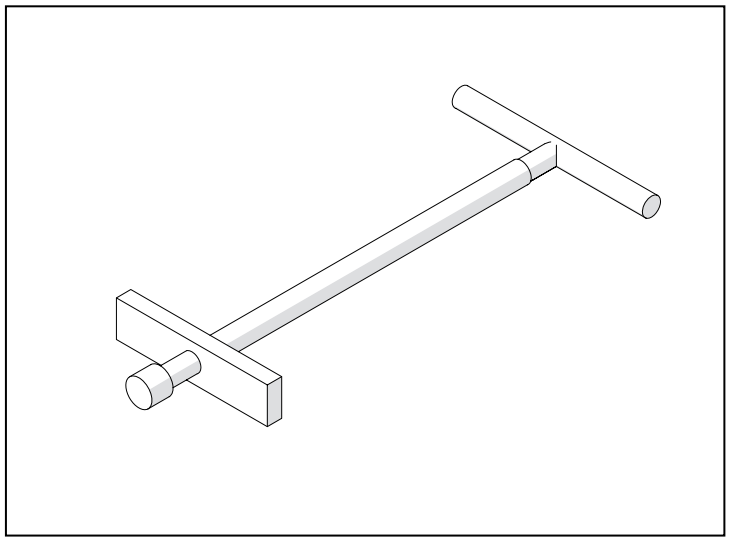


Fig. 19.39

Code:	07007954
Description:	Synchromesh locking tool
Chapter:	Chap.4 Gearbox

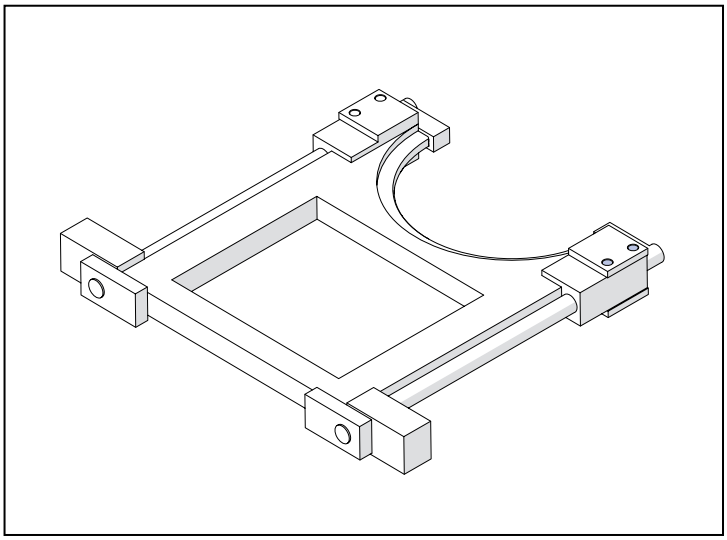


Fig. 19.40

Code:	07007955
Description:	Layshaft locking tool
Chapter:	Chap.4 Gearbox

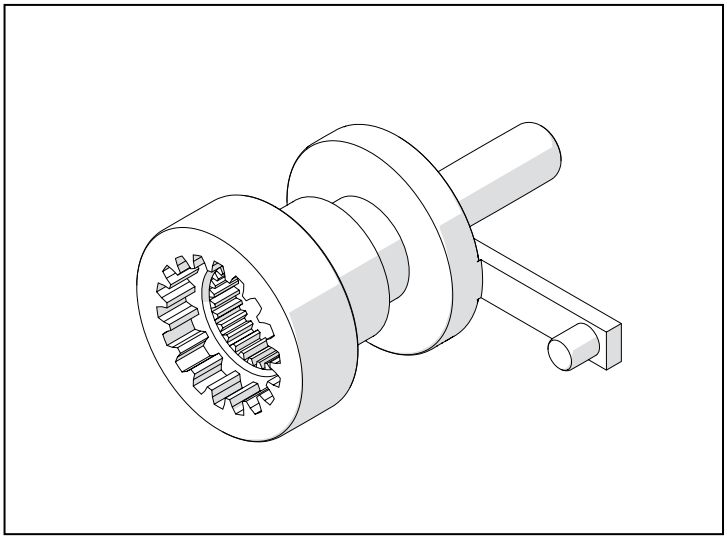


Fig. 19.41

Code:	07007956
Description:	Tool for fitting shaft into gearbox
Chapter:	Chap.4 Gearbox

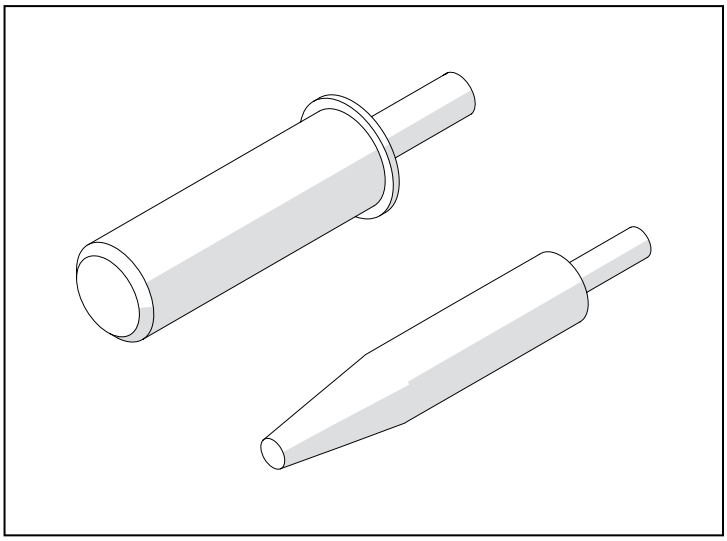


Fig. 19.42

Code:	07007957
Description:	Spacer inserting tool
Chapter:	Chap.4 Gearbox

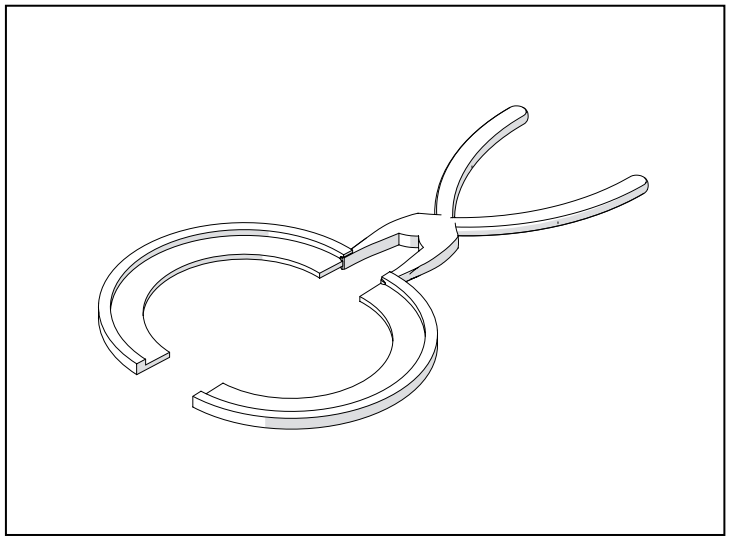


Fig. 19.43

WORKSHOP MANUAL

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